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18450. Bössneck, U.; Sparmberg, H. (2011): Die Schutzgebiete der Landeshauptstadt Erfurt (Thüringen). Teil XVIII: Flora und Fauna des GLB „Ermstedter Holz“ bei Ermstedt. *Vernate* 30: 117-142. (in German, with English summary) ["The nature reserves of the urban area of Erfurt (Thuringia) . Part XVIII: Flora and fauna of the reserve „Ermstedter Holz“ near Ermstedt The paper presents the results of floristic and faunistic surveys within the reserve „Ermstedter Holz“ near Ermstedt carried out in 2004 and 2005. In total, 668 species of plants and animals were recorded." (Authors), among them only two odonate species: *Aeshna cyanea* and *Sympetrum sanguineum*] Address: Bößneck, U., Stadtverwaltung Erfurt, Umwelt. und Naturschutzamt, Stauffenbergallee 18, D-99085 Erfurt, Germany. E-mail: ulrich.boessneck@erfurt.de

18451. Buczynski, P.; Mikolajczuk, P.; Tonczyk, G. (2011): New records of Norfolk Damselfly *Coenagrion armatum* (Charpentier, 1840) (Odonata: Coenagrionidae) on the south-western edge of its distribution area (Central and Eastern Poland). *Odonatrix* 7(2): 41-47. (in Polish, with English summary) ["*C. armatum* is a Siberian species whose south-western boundary of its distribution area goes through Poland. Formerly, it passed through the western part of the country. In the last 30–40 years it moped back ca. 300 km due to climatic and anthropogenic environmental changes. Currently, it runs through eastern regions – its putative form is shown on Fig. 1. The authors give five new sites of the species (Fig. 1). Breeding populations are probably at sites 1–3 (good habitat conditions, usually the large numbers of imagines) and less likely at site 5 (a water body partially dries out). In Pulawy (site 4) a single imago was recorded in an unusual environment (a river slope), however, the complexes of water bodies in the valleys of the River Kurówka and Wisla are located nearby. The sites 4 and 5 are the first known from over 10 years in Poland which are located to the west of 22°N. They confirm the hypothesis of Bernard et al. (2009) about the existence of scattered relict populations outside this line. Probably there are more of them but a short

and early flight period of *C. armatum* is the cause of its overlooking in faunistic studies. Nevertheless, the sites 1–3 are important because they confirm the form of the current species distribution area which was determined approximately due to the lack of precise data. The authors suggest the evaluation program as well as passive and active protection of *C. armatum*. It would be particularly important due to the regress and strong threats of the species in the neighbouring countries of Poland from the west and south – Poland is an important refugium of this species in Central Europe." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska University, Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

18452. Conze, K.-J.; Menke, N.; Olthoff, M. (2011): Libellen und Klimawandel in Nordrhein-Westfalen. Ergebnisse einer Studie zu Folgen des Klimawandels am Beispiel der Gestreiften Quelljungfer und der Arktischen Smaragdlibelle. *Natur in NRW* 4/11: 20-26. (in German) ["Within the framework of the study ... on the consequences of climate consequences of climate change, an analysis of possible effects of effects of climate change on the dragonfly fauna. Due to the broad data base that the Dragonfly The broad data base compiled by the Dragonfly Working Group NRW in recent years made it possible to conduct a state-specific analysis of the impacts of climate change. As the results of the sensitivity analysis show, a very dynamic development can be expected for this highly mobile species group, which is also bound to suitable water bodies. The examples of *Cordulegaster bidentata* and *Somatochlora arctica* are used to illustrate how climate change could affect and which measures can preserve and promote these highly vulnerable species. Rapid implementation and monitoring of these measures are just as important as continuous monitoring of the population development of all species in the sense of an early warning system. A species training programme is suggested for the particularly endangered damselfly." (Authors, DeepL)] Address: Conze, K.-J., Listerstr. 13, 45147 Essen, Germany. E-mail: Klaus-Juergen.Conze@t-online.de

18453. Cywinska, A.; Davies, R.W. (2011): Predation on the erpobdellid leech *Nepheleopsis obscura* in the laboratory.

Can. J. Zool. 67: 2689-2693. (in English) ["Six size classes of *Nephelopsis obscura* ranging from cocoons through hatchlings (2-4 mg) to mature individuals (150 mg) were exposed to a range of potential predators and also tested for cannibalism. Neither cannibalism nor interspecific leech predation was found, but nine species of Coleoptera, Amphipoda, Hemiptera, and Zygoptera (*Enallagma boreale*) consumed one or more size classes of *N. obscura*. In general, predation rates were highest on individuals < 10 mg and declined with increasing size of *N. obscura*. Larger predators (intra- and inter-specifically) usually had higher consumption rates than smaller ones. Because of the high abundance of the nine species of predators in prairie pothole lakes during the summer, it is speculated that predation on *N. obscura* hatchlings and cocoons is directly related to the recorded reductions in these size classes in the macrophyte zones during the summer." (Authors)] Address: Cywinska, A.; Division of Ecology (Aquatic Ecology Group), Dept Biological Sciences, Univ. of Calgary, Calgary, Alta., Canada T2N 1N4

18454. De Knijf, G. (2011): Massale aantallen van de Noordse witsnuitlibel. Libellenvereniging Vlaanderen . nieuwsbrief 5(2): 8. (in Dutch) [Massive numbers of Northern white-faced darter (*Leucorrhinia rubicunda*): In recent weeks, *L. rubicunda* was observed in different places in Belgium. Outside the traditional sites in the Kempen region, this was the case in the Ghent canal zone at St-Kruis-Winkel on May 8, 2011 (Ward Vercruysse), in the Hainaut sand region at Stamburges on May 18, 2011 (Luc & Dirk Verroken) and also in May in a limestone quarry near Tournai (Benoît Gauquie). From the same period, there is a sighting from the centre of Lille, Northern France (Cédric Vanappelghem). This is all the more remarkable as there are no populations of the species in France. The question of where these animals could have come from was always raised. In the Netherlands, very large numbers of *L. rubicunda* have been observed in recent weeks on several locations. Witness a few photos from the northern part of the Netherlands. Whether such numbers were also observed in the south of the Netherlands or in the Belgian Kempen is not known to me at the moment. It is to be expected that at least part of those numbers of animals do not stay at the breeding site, but start swarming out. These numbers combined with persistent dry, warm weather with predominantly winds from the east to north-east have apparently led to the sighting of the Northern whitefly in many places where it was never observed before. This phenomenon probably also occurred in 2001, when *L. rubicunda* was observed in the Kraaibos at Moen in South-West Flanders (De Knijf 2001). And who knows, maybe on some suitable locations females have ended up laying eggs and allowing the larvae to develop. We'll have to wait and see in the years to come whether the Northern white-beaked dragonfly will eventually be able to establish itself there or not. google translator: In recent weeks at various locations in Belgium Nordic white-faced darter (*Leucorrhinia rubicunda*) were observed. Beyond the traditional sites in the Kempen, this was particularly the case in the Ghent Canal to St-Kruis-Store on May 8, 2011 (Ward Vercruysse), sand in the Hainaut region Stamburges on May 18, 2011 (L. & Dirk Verroken)

and also in May in a limestone quarry near Tournai (Benoît Gauquie). From the same period was an observation from the center of Lille, northern France (Med. Cedric Vanappelghem). That is all the more remarkable because no populations of the species present in France. This was always the question of where that animals could come. In the Netherlands the last week in different locations very large numbers of white-faced darter Nordic observed. Witnessed by a few pictures from the north of the Netherlands. Whether any such numbers were observed in the south of the Netherlands or in Belgium Kempen me at this moment unknown. It is expected that at least some of the numbers of animals location on reproduction remain, but begin to swarms. These numbers combined with continued dry, warm weather with mostly wind from the east to Northeast has apparently led to the perception of *L. rubicunda* in many places where they previously was never observed. This phenomenon has probably occurred in 2001, when *L. rubicunda* was observed in the Kraaibos to Moen in southwest Flanders (De Knijf 2001). And who knows, there are a number of suitable locations also landed females who take eggs and larvae which can develop. But look out next year white-faced darter or the Norse are finally able to establish or not.] Address: Knijf, G. de, Instituut voor Natuurbehoud, Kliniekstraat 25, B-1070 Brussel, Belgium. E-mail: geert.deknijf@inbo.be

18455. Dévai, G.; Miskolczi, M. (2011): Data on the dragonfly (Odonata) fauna of the landscape Hortobágy. *Studia odonotol. hung.* 12: 55-64. (in Hungarian, with English summary) ["This is the 18th paper of a series directed at communicating faunistical data of Hungary which had been unpublished until December 31, 1987 (cf. DÉVAI et al. 1993). The authors present faunistical data from 19 localities in 10 10×10 km UTM grid map cell (DT 95, 96, 97; ET 07, 08, 16, 17, 18, 26, 27) of the geographical microregion Hortobágy in the plain Tiszai-Alföld. The sampling sites are located in the area of the Hortobágy National Park. Collections were made in 6 years between 1982–1987 on 28 days, with the participation of 10 specialists. In the report information on 1809 adults (1156 males and 653 females) is given in detail, representing 378 faunistical data. In this study 40 species (16 Zygoptera and 24 Anisoptera) were found to occur in the area, out of which 1 belongs to the very frequent, 19 to the frequent, 12 to the less frequent, 4 to the rare and 4 to the sporadic class of country-wide occurrence frequency." (Authors)] Address: Dévai, G.Y., Dept Hydrobiology, Faculty of Science & Technology, University of Debrecen, Egyetem tér 1, H-4032 Debrecen, Hungary

18456. Devai, G.; Miskolczi, M. (2011): Adatok Bátorliget szitakötő-faunájához (Odonata) [Data on the dragonfly (Odonata) fauna in the surroundings of the settlement Bátorliget (NE-Hungary)]. *Studia odonotol. hung.* 13: 81-88. (in Hungarian, with English summary) [This is the 23th paper of a series directed at communicating faunistical data of Hungary which had been unpublished until December 31, 1987 (cf. DÉVAI, GY. et al. 1993). The authors present faunistical data from two sampling areas (the marshland Bátorligeti-láp and the canalized stream Pilis–Piricsei-folyás) in

the geographical region Nyírség in NE-Hungary, over the administrative area of the settlement Bátorliget. Collections were made in one year (1985), with the participation of 3 specialists on 4 days, in one 10×10 km UTM grid map cell (ET 99). In the report information on 256 adults (141 males and 115 females) is given in detail, representing 69 faunistic data. In this study 25 species (13 Zygoptera and 12 Anisoptera) were found to occur in the area, out of which 1 belongs to the very frequent, 15 to the frequent, 4 to the less frequent, 4 to the rare and 1 to the sporadic class of country-wide occurrence frequency." (Authors)] Address: Miskolczi, Margit, Dept Hydrobiology, Fac. Science & Technology, Univ. Debrecen, Egyetem tér 1, 4032 Debrecen, Hungary

18457. Devai, G.; Miskolczi, M. (2011): Adatok a Bereg–Szatmári-síkság szitakötő-faunájához (Odonata) [Data on the dragonfly (Odonata) fauna of the landscape Bereg–Szatmári-síkság (NE-Hungary)]. *Studia odonotol. hung.* 13: 55-61. (in Hungarian, with English summary) ["This is the 20th paper of a series directed at communicating faunistic data of Hungary which had been unpublished until December 31, 1987 (cf. DÉVAI, GY. et al. 1993). The authors present faunistic data from the geographical microregion-group Bereg–Szatmári-síkság in NE-Hungary, over the administrative area of 8 settlements (Csaroda, Gelénes, Kisar, Márokpapi, Nagyar, Szatmárcseke, Tivadar, Tiszakerecseny). Collections were made in 5 years between 1983–1987, with the participation of 5 specialists on 13 days and 11 localities, in 4 of the 10×10 km UTM grid map cells (FU 03, 04, 12, 13). In the report information on 473 adults (324 males and 149 females) is given in detail, representing 110 faunistic data. In this study 25 species (11 Zygoptera and 14 Anisoptera) were found to occur in the area, out of which 17 belong to the frequent, 6 to the less frequent, 1 to the rare and 1 to the sporadic class of country-wide occurrence frequency." (Authors)] Address: Miskolczi, Margit, Dept Hydrobiol., Fac. Science & Tech., Univ. Debrecen, Egyetem tér 1, 4032 Debrecen, Hungary

18458. Do, M.C.; Nguyen, V.K.; Bui, H.M. (2011): Dragonfly *Coellicia mingxiensis* Xu, 2006 (Odonata: Platynemiidae) from Tam Dao National Park, with additional notes on its morphology. *Proceedings of the 4th National Scientific Conference on Ecology and Biological Resources*, Hanoi, 21 October 2011: 68-69. (in English, with Vietnamese summary) [10 ♂, Vietnam, Vinh Phuc, Tam Dao National Park, Thac Bac Stream, 25.IV.2009 alt. 800m a.s.l.] Address: Do, M.C., Military Institute of Hygiene and Epidemiology, Vietnam

18459. Fernández-Bellon, D.; Luxby, J. (2011): The feeding ecology of Merlin Falco columbarius during the breeding season in Ireland, and an assessment of current diet analysis methods. *Irish Birds* 9: 159-164. (in English) [Prey items during the breeding season of 2010.: Odonata sp.: Number of specimens: 4; Percentage occurrence: 1.0; Percentage biomass: <0.1] Address: Luxby, J., BirdWatch Ireland, Midlands Office, Crank House, Banagher, Co. Offaly, Ireland. E-mail: dfernandezbellon@gmail.com

18460. Ficsor, M. (2011): Contribution to the occurrence of

riverine dragonfly species (Odonata: Gomphidae) in the north-eastern part of Hungary based on larval study. *Acta Biol. Debr. Oecol. Hung.* 26: 67-74. (in Hungarian, with English summary) [*Stylurus flavipes*, *Gomphus vulgatissimus*, *Ophiogomphus cecilia* and *Onychogomphus forcipatus* are documented from 63 sampling sites] Address: Ficsor, M., North Hungarian Regional Environmental, Nature Conservation & Water Management Inspectorate, Laboratory, 4. Mindszent tér, 3530, Miskolc, Hungary. E-mail: ficsor.mark@emikofe.kvvm.hu

18461. Höpstein, G. (2011): Der Südliche Blaupfeil (*Orthetrum brunneum*) in der Sandgrube bei Remschütz. *Landchaftspflege und Naturschutz in Thüringen* 48(2): 95-98. (in German, with English summary) ["*O. brunneum*) could be observed in the sand pit near Remschuetz during 2008 and 2010. It is a rare species in Thuringia, The reproduction was recorded via exuviae in July 2010." (Author)] Address: Höpstein, G., Flecke 17, D-07422 Bad Blankenburg, Germany

18462. Hunger, H. (2011): Nachweise der Asiatischen Keiljungfer (*Gomphus flavipes*) am Restrhein unterhalb der Staustufe Markt/Kembs. *Mercuriale* 11: 31-34. (in German) [Baden-Württemberg, Germany. On 24.06.2011, a *G. flavipes* exuvium was found on the southern test stretch directly above the former Kander mouth (Rhine-km 175.2) and a just-hatched animal at the exuvium shortly below the former Kander mouth (Rhine-km 175.4). On 03.08.2011, another exuvium was found at Rhine-km 175.4. Both sites are located on the Messtischblatt-Quadrant (MTBQ) 8311 SW. This is the first record of *G. flavipes*) for the Restrhein between Basel and the cultural weir Breisach. In terms of substrate and bank morphology, the hatching sites did not show any clear differences to other areas of the test stretch. In 2010, a total of four exuviae of *O. cecilia* but none of *Gomphus flavipes* had been collected on the southern sample stretch. Address: Hunger, H. E-mail: holger.hunger@inula.de

18463. Johnston, T. (2011): Comparison of riparian willows and riprap as habitat for fish and invertebrates in the Waikato River. MSc thesis. University of Waikato: XI + 145 pp. (in English) ["Willows (*Salix* spp.) are an abundant alien tree and have been the mainstay of river bank protection throughout New Zealand. Riprap is another method of bank stabilisation consisting of rocks used to armour shorelines to protect against erosion. There is a trend for increasing use of riprap to replace willow along the banks of large rivers in New Zealand, but there is limited information on the ecological roles of these different bank types to support management. The objectives of this research were to determine the effects of different bank habitats on nearshore fish and invertebrate communities in the Waikato River as it passes through Hamilton city. The study involves three sites situated along the river. Each site has four bank types consisting of willow, riprap, a mixture of willow and riprap, and beach. Invertebrate sampling was carried out on three occasions to assess if there was a seasonal effect on community composition. Fish were sampled bimonthly determine differences in

community composition. Assessment of fish populations was carried out with using boat electrofishing, Gee minnow trapping and spotlighting, while invertebrate populations were sampled by kick netting. Few significant differences were detected in invertebrate diversity between willow, riprap and willow/riprap habitats. However, community composition based on relative abundance was different among contrasting habitats in most seasons and Pielou's evenness was greater for the more homogenous beach and riprap habitats. Riprap had consistently high alpha diversity but had lower species accumulation on two out of three dates suggesting there was a limited pool of taxa colonising the riprap compared to other habitats. Pairwise dissimilarity coefficients and PERMANOVA comparisons indicated that, although low in alpha diversity, beach habitats contributed significantly to macroinvertebrate beta diversity, and that willow and riprap habitats also supported different combinations of taxa due to different physical conditions. The combination of beach and willow habitats gave the highest gamma diversity. Willow habitats supported the highest number of both introduced and native fish, mainly reflecting abundances of common smelt, likely due to provision of cover, complex aquatic habitat, and riparian vegetation supplying detritus and invertebrate food resources. Riprap habitats supported the highest number of common bully. Common bully were also significantly larger in this habitat. Variations in water temperature, amount of shade, and river levels were possible factors contributing to temporal influences on biological patterns. The findings of this study indicate that, if all banks habitats in Hamilton City were composed of a single type, invertebrate biodiversity would be reduced. While the combination of beach and willow habitats may sustain high diversity for invertebrates and fish, the novel habitat provided by riprap may also favour some native fish and invertebrates over others. Therefore, a balance of different bank habitat types would perhaps be best to sustain present-day biodiversity levels in near shore macroinvertebrate and fish communities." (Author) The list of taxa includes *Aeshna*, *Hemicordulia australiae*, *Procordulia*, *Xanthocnemis zealandica*, and *Zygoptera* indet.] Address: not stated

18464. Kim, D.E. (2011): The study on the habitat change of *Nannophya pygmaea* Rambur in the abandoned paddy field Ulsan city and its management. *Korea Journal of Ecology* 25(6): 867-877. (in Korean, with English summary) [In order to provide basic data for the conservation and restoration of *N. pygmaea* habitat, habitat changes and insect fauna inhabiting the fallow land were examined for 4 years from June 2008 to July 2011 in Daun-dong, Jung-gu, Ulsan Metropolitan City. The flora was investigated. As a result, a total of 10 orders, 32 families, and 53 species were investigated, and the order Dragonflies, Hemiptera, and Coleoptera were dominant with a total of 18.9%. A total of 23 orders, 30 families, and 60 species of plants were investigated, and Cyperaceae (13.3%) and the Gramineae (11.7%) were dominant. As woody plants are introduced into the survey area, the transition is progressing rapidly, and the habitats of aquatic plants are encroached and turned into land. In addition, phytophagous insects and mountainous insects

are increasing in this area. As a result, the habitat of *N. pygmaea* was maintained at a constant depth of 2.5 to 9.5 cm and moved to a place where the water surface was open. Therefore, long-term monitoring and appropriate management are required to identify ecological characteristics for the continuous conservation and maintenance of *C. dragonfly* habitat in this area.] Address: Kim, D.E., Environmental Resources Research Department, National Institute of Environmental Research, Incheon (404-708), Korea. E-mail: un19781978@korea.kr

18465. Kosík, M.; Cadkova, Z.; Prikryl, I.; Seda, J.; Pechar, L.; Pecharová, E. (2011): Initial succession of zooplankton and zoobenthos assemblages in newly formed quarry lake medard (Sokolov, Czech Republic). "Mine Water – Managing the Challenges" IMWA 2011 (International Mine Water Association): 517-522. (in English) ["This paper gives the results of the initial observation period of the development of zooplankton and zoobenthos (including *Enallagma cyathigerum*, *Ischnura elegans*, *I. pumilio*, *Lestes sponsa*, *Chalcolestes viridis*, *Anax imperator*) during flooding of the residual brown coal mine pit Medard. Changes in the quantity and quality of water, flowing from different sources, and development of stratification in the lake water affect the composition of zooplankton and zoobenthos. Original sources of zooplankton inoculum, which are the reservoirs in the Lake Medard own catchment area, are monitored too. Another important source, that will significantly affect the formation of the newly formed lake, is the river Ohre (Eger), which will contribute with the greatest volume of water. At the same time, the hydrochemical water quality parameters and their influence on the formation of zooplankton and zoobentos communities are monitored." (Authors)] Address: Pecharova, Emile, Czech Univ. Life Science Prague, Fac. Environmental Sciences, Dept of Landscape Ecology, Czech Republic

18466. Loureiro, N. S. (2011): *Libélulas e Libelinhas (Odonata) no Algarve*. *Guias Digitais Biodiversidade e Natureza* nº 1: 134 pp. (in Portuguese, with English, Spanish and German summaries) ["This ebook is the first publication focused on the Algarve's Odonata Order. It shouldn't, however, be perceived as the definitive edition on the subject, published only after exhausting all knowledge about. In fact, there still will be much to add in future editions. At this moment, its divulgation is aiming to contribute to the satisfaction of a recognized demand and, simultaneously, to fill in a blank mentioned on the European Red List of Dragonflies (p. 17). Therefore, this Digital Guide not only synthesizes, in Portuguese, a large amount of data already available though scattered, but also adds new one. As main results of our efforts: i. The number of records was duplicated, providing new data to significantly improved cartographies on the regional distribution of the 51 species; ii. Six new species were added to the Algarve's most recent checklist. The large number of photographs in this ebook also contributes to the fact that it can be easily used by those who are not, neither wish to be, experts on the subject. This Digital Guide has been prepared to be used as an independent source of information. It can, however, be consulted in parallel with some European

field guides, such as the Field Guide to the Dragonflies of Britain and Europe, by K-D B Dijkstra & R Lewington, and/or The Dragonflies of Europe, by R R Askew. In the other hand, this ebook can be easily consulted by non Portuguese speakers, because the indispensable technical terms are translated to English, allowing the comprehension of fundamental contents. In this way, it is assumed that the international community interested in the Algarve's Odonata fauna will find this Digital Guide to be a reference work of great importance. At last, it is presented in this Abstract a new contribute, equally enriching for those who wish to discover the Algarve' Odonata fauna: the 10 hotspots to observe and photograph dragonflies and damselflies at Algarve. Fully enjoy this natural resource, respecting it carefully and avoiding its degradation and extinction.] Address: not stated

18467. McGeoch, M.A., Sithole, H., Samways, M.J., Simaika, J.P., Pryke, J.S., Picker, M.; Uys, C.; Armstrong, A.J.; Dippenaar-Schoeman, A.S.; Engelbrecht, I.A.; Braschler, B.; Hamer, M. (2011): Conservation and monitoring of invertebrates in terrestrial protected areas. *Koedoe* 53(2), Art. #1000; doi:10.4102/koedoe.v53i2.1000: 13 pp. (in English) ["Invertebrates constitute a substantial proportion of terrestrial and freshwater biodiversity and are critical to ecosystem function. However, their inclusion in biodiversity monitoring and conservation planning and management has lagged behind better-known, more widely appreciated taxa. Significant progress in invertebrate surveys, systematics and bioindication, both globally and locally, means that their use in biodiversity monitoring and conservation is becoming increasingly feasible. Here we outline challenges and solutions to the integration of invertebrates into biodiversity management objectives and monitoring in protected areas in South Africa. We show that such integration is relevant and possible, and assess the relative suitability of seven key taxa in this context. Finally, we outline a series of recommendations for mainstreaming invertebrates in conservation planning, surveys and monitoring in and around protected areas. Conservation implications: Invertebrates constitute a substantial and functionally significant component of terrestrial biodiversity and are valuable indicators of environmental condition. Although consideration of invertebrates has historically been neglected in conservation planning and management, substantial progress with surveys, systematics and bioindication means that it is now both feasible and advisable to incorporate them into protected area monitoring activities.... Odonata: Several freshwater monitoring schemes involving macroinvertebrates are well developed with a long history, for example the River Invertebrate Prediction Classification System used in the UK to monitor the pollution status of water courses (Wright et al. 2000) and the South African Scoring System (SASS) (Revenga et al. 2005). Good taxonomic and biological information, along with knowledge of species conservation status and responses to habitat quality are amongst the key suitability criteria in invertebrate monitoring (Table 3). The Odonata in South Africa perhaps best exemplify this with existing Red Data information and comprehensive field guides that make working with the group broadly accessible to biologists, the public and citizen

scientists (Samways 2006, 2008). South Africa's freshwater systems are under intense pressure (Nel et al. 2007) and the Odonata are sensitive indicators of the quality of these systems. This includes their response to pollution and invasive alien species impacts (Chovanec 2000), as well as their recovery after alien plant removal in rivers in PAs in South Africa (Samways & Sharratt 2010). In addition to the well-known and widely used SASS system (Dallas & Day 1993; Revenga et al. 2005), the Dragonfly Biotic Index (DBI) provides a measure of ecological integrity for freshwater systems. The DBI is a weighted index (see Table 4) based on the quantitative assessment of three subindices of species distribution, threat status and sensitivity to disturbance (Simaika & Samways 2008, 2009a). The total DBI of a water body (stream, river or pool) reflects the total odonate assemblage, thus allowing for water bodies to be compared and restoration success to be monitored (Simaika & Samways 2008). Every South African odonate species has been assigned a score (Samways 2008). The DBI has been tested and applied in biomonitoring (Simaika & Samways 2009a), 2011 to measure habitat recovery (Simaika & Samways 2008) and select sites for conservation (Simaika & Samways 2009b). Previous work has shown a strong correlation between adult dragonfly scores and macroinvertebrate scores (Simaika & Samways 2011; Smith, Samways & Taylor 2007). An advantage of the DBI over conventional macroinvertebrate indices is that it operates at the species level and is therefore highly sensitive to habitat condition. It, therefore, has good potential for environmental assessment and monitoring freshwater biodiversity and quality, alongside SASS (Simaika & Samways 2011). The low field effort required to obtain a DBI score for a site also makes this a low-cost and readily applied method. Odonata are therefore particularly useful for monitoring freshwater quality and landscape physiognomy around riverine and other aquatic habitats in South Africa's PAs (Samways 1993b)." (Authors)] Address: McGeoch, Melodie, PO Box 216, Steenberg 7947, South Africa. E-mail: melodiem@sanparks.org

18468. Neff, M.R. (2011): Abiotic conditions in contrasting environments: An examination of Precambrian Shield lotic communities. PhD thesis, Ecology and Evolutionary Biology, University of Toronto: XX, 175 pp. (in English) ["the inherent complexity of the natural world has long been a central theme in ecological research, as the patterns and processes that govern ecosystems can operate at multiple spatial and temporal scales. It is clear that to develop general ecological frameworks, we must consider many different factors at different scales, and incorporate ideas from other disciplines. This thesis touches on several of these ideas, first through an analysis of literature, and then with field research examining the role of broad-scale abiotic factors on lotic systems. To determine how integrated aquatic science is currently understood among different researchers, I provide an analysis on communication and exchange of ideas among various subfields in aquatic science. I show that there are clear divisions within the aquatic science literature, suggesting that there is progress to be made on the integration of methods and ideas. Next, I examine the impact of a

large-scale geological feature, the Canadian Precambrian Shield, on abiotic conditions in lotic systems, and how these conditions in turn influence the species assemblages of aquatic organisms. This is addressed with both historical survey data, as well as contemporary data, and as a whole, incorporates ideas concerning the relative influence of regional versus local factors, the importance of historical factors on species distributions, and the relationship between the abiotic environment and biological communities. These analyses show that there are distinct fish and macroinvertebrate communities in Shield lotic systems compared to those found in nearby off-Shield sites, indicating that the Shield is an important broad-scale factor influencing local biological communities. This finding, in conjunction with previous knowledge on the influence of historical factors, provides further insight on the structuring of lotic fish and macroinvertebrate communities in Ontario." (Author) Odonata are treated at family level.] Address: not stated

18469. Petzold, F.; Zimmermann, W. (2011): Rote Liste der Libellen (Insecta: Odonata) Thüringens 4. Fassung, Stand: 11/2009. Naturschutzreport 26: 74-78. (in German) [Annotated and commented Red List of 26 species in Thuringia (Germany)] Address: Petzold, F., Pappelallee 73, 10437 Berlin, Germany. E-Mail: petzold.falk@googlemail.com

18470. Pilon, J.-G. (2011): Phylogénie des Odonates: aperçu et réflexion. *Le naturaliste canadien* 135(2): 26-29. (in French) [There are several taxonomic problems in the Odonata that classical methods have not been able to solve. Molecular methods offer new avenues of investigation that, while taking into account classical methods, allow a better understanding of phylogeny in this group of insects. The author presents a few examples and some of their repercussions on the classification of the Quebec fauna.] Address: Pilon, J.-G. E-mail: pilon.jeanguy@videotron.ca

18471. Raio, C.B.; Espinoza, A.A.; Bennemann, S.T. (2011): Diversidade e similaridade entre populações de insetos aquáticos em riachos de primeira e segunda ordem, sul do Brasil similarity and diversity between aquatic insect populations in streams of first and second order, south of Brazil. *Semina: Ciências Biológicas e da Saúde, Londrina* 32(1): 69-76. (in Portuguese, with English summary) ["Aquatic communities of macroinvertebrates are influenced by rapid velocity, habitat heterogeneity and other characteristics. This study examined a relationship between aquatic insects diversity with hydrologic order of two streams. We tested following hypothesis: diversity of insects associated with the same substrate in equal parts of streams, classified in different orders, are similar. Samples of litter were collected in middle stretches of stream Cascatinha (first order) and stream João Pinheiro (second order), Tibagi river basin, Telêmaco Borba, Paraná, Brazil. Diversity of each stream was obtained by Shannon index. Diversity values were low for both streams (0.8 for the first order stream and 0.89 for the second order stream) with no statistical difference ($t = -1.12$; $p = 0.27$). Similarity between the streams was 0.51. These results allowed us to verify that, to studied streams,

hydrological order has no effect on aquatic insects diversity ($F = 0.14$, $p = 0.71$), so the hypothesis was accepted. The most abundant taxon in both streams was Chironomidae (Diptera), representing 82.7% of total collected. However when Chironomidae was removed from analysis, the hypothesis was refused. An high abundance of Chironomidae individuals had influenced values of local diversity." (Authors) Odonata are treated at the family level.] Address: Raio, Cibele, Aluna do Programa de Pós-Graduação em Ciências Biológicas (Zoologia) da Universidade Estadual de Londrina. Laboratório de Ecologia Trófica, Departamento de Ciências Animal e Vegetal, Centro de Ciências Biológicas, Brazil. E-mail: cibeles_bio@hotmail.com

18472. Rehm, P.; Borner, J.; Meusemann, K.; von Reumont, B.M.; Simon, S.; Hadrys, H.; Misof, B.; Burmester, T. (2011): Dating the arthropod tree based on large-scale transcriptome data. *Molecular Phylogenetics and Evolution* 61(3): 880-887. (in English) ["Molecular sequences do not only allow the reconstruction of phylogenetic relationships among species, but also provide information on the approximate divergence times. Whereas the fossil record dates the origin of most multicellular animal phyla during the Cambrian explosion less than 540 million years ago (mya), molecular clock calculations usually suggest much older dates. Here we used a large multiple sequence alignment derived from Expressed Sequence Tags and genomes comprising 129 genes (37,476 amino acid positions) and 117 taxa, including 101 arthropods. We obtained consistent divergence time estimates applying relaxed Bayesian clock models with different priors and multiple calibration points. While the influence of substitution rates, missing data, and model priors were negligible, the clock model had significant effect. A log-normal autocorrelated model was selected on basis of cross-validation. We calculated that arthropods emerged ~600 mya. Onychophorans (velvet worms) and euarthropods split ~590 mya, Pancrustacea and Myriochelata ~560 mya, Myriapoda and Chelicerata ~555 mya, and 'Crustacea' and Hexapoda ~510 mya. Endopterygote insects appeared ~390 mya. These dates are considerably younger than most previous molecular clock estimates and in better agreement with the fossil record. Nevertheless, a Precambrian origin of arthropods and other metazoan phyla is still supported. Our results also demonstrate the applicability of large datasets of random nuclear sequences for approximating the timing of multicellular animal evolution... (1988). *Paleoptera–Neoptera* *, 419, 325 (Archaeorthoptera), Béthoux and Nel (2005). *Odonata–Ephemeroptera*, 388, 318 (Odonata), (Brauckmann and Schneider (1996). *Hemiptera–other neopterans*, 397, 284 (Paleorrhyncha), Shcherbakov (2000). ... " (Authors)] Address: Burmester, T., Institute of Zoology & Zoological Museum, Biocenter Grindelmann Univ. of Hamburg, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany. E-mail: thorsten.burmester@uni-hamburg.de

18473. Rodríguez-Martínez, S.; Outomuro, D.; Ocharan, F.J. (2011): Odonatos de la cuenca baja del Porcia y alrededores (Asturias, norte de España). *Boletín de la S.E.A.* 48(1): 484-486. (in Spanish, with English summary) [22 odonate

species including *Coenagrion mercuriale* are documented from the lower basin of the river Porcía and adjoining localities is presented. Sampling and observations were carried out during July and August 2009.] Address: Outomuro, D., Depto de Biología de Organismos y Sistemas, Univ. de Oviedo. 33071 Oviedo, Spain. E-mail: outomuro.david@gmail.com

18474. Rozner, G. (2011): Adatok Magyarország szitakötő-faunájához (Odonata) az 1987. december 31-ig végzett szórványgyűjtéseim alapján [Data on the dragonfly (Odonata) fauna of Hungary according to my scatter-collections by December 31, 1987]. *Studia odonotol. hung.* 13: 49-54. (in Hungarian, with English summary) ["This is the 24th paper of a series directed at communicating faunistical data of Hungary which had been unpublished until December 31, 1987 (cf. DÉVAI, GY. et al. 1993). The author presents 58 faunistical data, results of a survey based on his own scatter-collections and other specimens collected by 3 colleagues. The adult dragonfly series is from 27 localities throughout the country, but mostly from the sampling sites of Transdanubia. The localities are situated in 24 cells according to the 10×10 km UTM grid map. Collections were made on 29 days in 5 years between 1977 and 1981. In all cases it was possible to provide the number of individuals as well, thus the paper is based on the study of 177 presented specimens (21 males, 17 females and 139 specimens with undecided sex). In conclusion, 35 species (14 Zygoptera and 21 Anisoptera) were recorded throughout the country, out of which 1 belongs to the very frequent, 16 to the frequent, 13 to the less frequent, 3 to the rare and 2 to the sporadic class of country-wide occurrence frequency." (Author)] Address: Rozner, G., Vasút u. 25, 8648 Balatonkeresztúr, Hungary

18475. Seifert, C. (2011): 10 Jahre Libellenmonitoring im FND „Kuhbergbruch“. *Landschaftspflege und Naturschutz in Thüringen* 48(2): 70-81. (in German, with English summary) ["Ten years of monitoring dragonflies at the nature protected site FND "Kuhbergbruch". Between 2002 and 2011 a monitoring program of true dragonflies (Anisoptera) was realized at a complex of small anthropogenous ponds in the administrative district of Greiz. Based on collecting exuviae on a regular basis, it was possible to provide evidence of reproduction of 16 indigenous species. Due to additional observations of imagines, including damselflies (Zygoptera), the number of species increased to 32 since 1992. Amongst indigenous Anisoptera *Leucorrhinia pectoralis* and *L. rubicunda* are two species of the category 1 in the Red List of Thuringia, furthermore *Aeshna juncea* and *L. dubia* are in category 3. This four important species were described in detail in view of nature conservation by means of phenology, colonization and population development." (Author)] Address: Seifert, C.L., Hafengasse 9, 1030 Wien, Austria. E-Mail: carlo_seifert@web.de

18476. Stauer, M.; Schulze, C.H. (2011): Diversität und Struktur von Libellengemeinschaften an Augewässern in den March-Auen. *Wiss. Mitt. Niederösterreich. Landesmuseum* 22: 171-202. (in German, with English and Slovak summaries)

["Hydrological dynamics at the Morava underwent dramatic changes in the first half of the 20th century due to river regulations that prevented the formation of new backwaters and simultaneously supported silting up processes. Nevertheless, the Morava floodplains are still characterised by a wide range of water bodies providing important habitats for a rich dragonfly fauna. The Austrian part of the Morava floodplains is home to 48 species of dragonflies and damselflies. Within the whole trilateral area (including the Czech and Slovakian parts) of the Morava floodplains, a total of 54 species have been recorded. The Odonata fauna at backwaters from Hohenau to Marchegg was surveyed in 2008 and 2009. A total of 7,056 adult dragonflies belonging to 34 species were observed along 24 transects, each with a length of 50 meters. 29 species with 6,748 individuals were classified as autochthonous at any of the survey sites. Species richness of individual sites varied between three and 18 species and differed between water body types. Lowest species numbers were recorded for water bodies completely embedded in forest whilst sunny parts of larger, permanent water bodies showed the highest species richness. Our data indicate a tendency towards an increasing percentage of endangered species with increasing species richness at backwaters. Species assemblages proved to be significantly nested, although a clear deviation from maximum nestedness was evident. From all tested parameters, the water body type and the degree of desiccation had the strongest effect on species composition. A considerable proportion of all Odonata species and endangered species was represented by dragonflies and damselflies that favour standing waterbodies or ephemeral conditions, indicating that the entire species assemblage is strongly affected by the reduced hydrodynamic conditions within the floodplain system." (Authors)] Address: Stauer, Martina, Dep. für Biodiversität der Tiere, Fakultät für Lebenswissenschaften, Universität Wien, Rennweg 14, 1030 Wien, Austria. E-mail: m_stauer@web.de

18477. Thomas, M. (2011): Untersuchungen zum Vorkommen der Helm-Azurjungfer *Coenagrion mercuriale* in einem Kalkflachmoor bei Köln (NRW) als Grundlage für Pflege und Entwicklung. Thesis, Bachelor of Engineering (B. Eng.). Hochschule Osnabrück: 92 pp + Anhänge. (in German) [Nordrhein-Westfalen, Germany. "The calcareous low moor bog Katharinenkammer is presumably the last primary habitat of *C. mercuriale* in NRW. The studies in 2011 found *C. mercuriale* flying from May 3rd to August 1st, 2011. In the main flight season between May 20th and June 17th more than 35 individuals were observed at each survey. The highest number of imagines was recorded on June 2nd, 2011 at 60 individuals. Using vegetation and water mapping of the area and GPS based localities of capture of imagines and exuviae the species' land use in the annual phenological progress was analyzed. Additionally three daily phenological studies during the main flight season were implemented. Analysis of the land use has shown that the species in the Katharinenkammer mainly populated the southern areas of the tall sedge meadows. A preference for moister areas containing small streamlets with varying vegetation structures, a

vegetation height of 40 to 80 cm and a dominance of 40 to 80 % was noticed. Areas with dense and high mantle of vegetation and shade were avoided. In the other parts of the investigation area there was a considerably lower concentration of individuals. However they could be observed occasionally on sun exposed areas of the purple moor grass meadows which border the tall sedge meadows. In addition to *C. mercuriale* the study has provided evidence for 16 other dragonfly species in the Katharinenkammer, including autochthonous appearances of the rare species *Ceriagrion tenellum*, *Orthetrum coerulescens* and *Cordulegaster boltonii*." (Author)] Address: Thomas, Manuela, Bauerbankstr. 4, 50969 Köln, Germany

18478. Toth, S.; Csiby, M.; Ambrus, A. (2011): Adatok a Nyugat-magyarországi-peremvidék szitakötő-faunájához (Odonata) [Data on the dragonfly (Odonata) fauna of the landscape Nyugat-magyarországi-peremvidék (W-Hungary)]. *Studia odonatol. hung.* 13: 27-48. (in Hungarian, with English summary) ["This is the 19th paper of a series directed at communicating faunistical data of Hungary which had been unpublished until December 31, 1987 (cf. DÉVAI, GY. et al. 1993). The authors present faunistical data from 74 localities in 29 10×10 km UTM grid map cells (XM 07, 08, 09, 18, 19, 25, 37, 56; XN 10, 12, 14, 15, 17, 18, 21, 23, 24, 25, 27, 28, 34, 35, 36, 37, 41, 50, 51, 55; WM 99) of the geographical region Nyugat-magyarországi-peremvidék (W-Hungary), over the administrative area of 45 settlements. Collections were made in 16 years between 1971-1987 on 117 days, with the participation of 3 specialists. In the report information on 9406 adults (5399 males and 4007 females) is given in detail, representing 1589 faunistical data. In this study 55 species (20 Zygoptera and 35 Anisoptera) were found to occur in the area, out of which 1 belongs to the very frequent, 19 to the frequent, 16 to the less frequent, 8 to the rare and 11 to the sporadic class of country-wide occurrence frequency." (Authors)] Address: Tóth, S., Széchenyi u. 2, 8420 Zirc, Hungary – °Fertő –Hanság National Park Directorate, P.O.Box 4, H-9435 Sarród, Hungary

18479. Walia, G.K.; Kaur, J. (2011): Karyological study on ten odonate species from Mangalore (Karnataka), India. *Hislopia journal* 4(1): 83-88. (in English) ["Karyological investigations have been done on ten species belonging to six families of two suborders . Zygoptera and Anisoptera of order Odonata. These includes *Vestalis apicalis* of family Calopterygidae, *Ceriagrion cerinorubellum* and *Ischnura aurora* of family Coenagrionidae, *Lestes dorothea* of family Lestidae, *Copera annulata* of family Platycnemididae, *Gynacantha milliardi* of family Aeshnidae and *Diplacodes nebulosa*, *Diplacodes trivialis*, *Orthetrum sabina* and *Trithemis pallidinervis* of family Libellulidae. Majority of the species possess the type number of the families, 2n = 25m in Calopterygidae, Lestidae, Platycnemididae and Libellulidae, while 2n = 27m in Coenagrionidae and Aeshnidae. Three species show variations in chromosome number i.e. in *Ischnura aurora* 2n=25 (m chromosomes are lacking), *Lestes dorothea* (n=10-12m) and *Gynacantha milliardi* (2n=27m and 2n=25). *Vestalis apicalis* with 2n=25m of family Calopterygidae has

been reported for the first time in India." (Authors.)] Address: Walia, Miss Dr. G.K., Dept of Zoology, Punjabi University, Patiala . 147002, India

18480. Willigalla, C.; Fartmann, T. (2011): Einfluss der Bebauung auf die Libellendiversität (Odonata) in Städten. *Treffpunkt Biologische Vielfalt* 10: 145-149. (in German) [At 12 rainwater retention basins in the city of Mainz (Rheinland-Pfalz, Germany), 32 species were detected between 2006 and 2008, 84% of the 38 species known in the urban area of Mainz. The number of species depended on the size of the water body and its location in different urban zones. Significantly more species were found on the outskirts of the city than in the inner city area. The abundance of damselflies correlated negatively with the degree of development. Only low densities were found from a development level of 40 % and more within a radius of 200 m around the water body.] Address: Willigalla, C., Annastr. 1, 55124 Mainz, Germany. E-mail: christoph@willigalla.de

2012

18481. Huang, J.-s. (2012): Behavioural habits and habitat selection of adult odonates in Ban-ping lake. MSc thesis: IX + 117 pp. (in Chinese, with English summary) ["A total of 24 Odonata species (2 Zygoptera and 22 Anisoptera) under 19 genera and 5 families was identified in Ban-ping Lake during May 2010 to December 2011, and there are a total of 10 species (1 Zygoptera and 9 Anisoptera) under 9 genera and 5 families founded with exuviae. The activity patterns of these ten species were examined during June to December 2011. In territorial perch, 3 perchers (*Ischnura senegalensis* and *Brachythemis contaminata*) preferred area of marsh (55.6% of Variance; 66.7%); *Diplacodes trivialis* in Cement embankment; But one Flier (*Pantala flavescens*) preferred that pool of forest area (45.1%). In seeking flight, *Diplacodes trivialis* and *Pantala flavescens* preferred that open water side (90.8%; 32.7%). 4 fliers (*Anax panybeus*, *Anax parthenope julius*, *Ictinogomphus rapax* and *Tholymis tillarga*) were patrolling flight, preferred that open water side (55.5%). In parallel flying, *Pantala flavescens* and *Tholymis tillarga* preferred mudflat near open water side (70.4%). *Pantala flavescens* behaved mating, picked on marsh (39.4%). Otherwise, Scatter of pool or basin (Deep<0.3m, Water area is nearly 12m²) were important biotope in Ban-ping Lake, not only finding exuviae of *Ischnura senegalensis*, *Pantala flavescens*, *Tholymis tillarga* and *Zyxomma petiolatum*, but also male Odonates Adults of at least 9 species (*Ischnura senegalensis*, *Brachythemis contaminata*, *Crocothemis servilia servilia*, *Diplacodes trivialis*, *Neurothemis ramburii ramburii*, *Orthetrum pruinosum neglectum*, *Orthetrum sabina sabina*, *Tramea transmarina euryale* and *Trithemis aurora*) behaved territorial perch and seeking flight." (Author)] Address: Not stated

18482. Kipping, J. (2012): Southern African Regional Environmental Program (SAREP). First Biodiversity Field Survey. Upper Cubango (Okavango) catchment, Angola May 2012. Dragonflies & Damselflies (Insecta: Odonata). Expert

Report. December 2012: 108 pp. (in English) ["Conclusion and outlook: From the perspective of the Odonata expert the first SAREP biodiversity survey in May 2012 was very successful and gave a first insight in the Odonata fauna of the region, their habitats and potential threats. On Angolan territory altogether 30 sites were sampled for Odonata, 28 within the Okavango catchment, 2 outside in the Cuanza catchment. The first survey focused in the middle and upper sections of the tributaries. Altogether 88 dragonfly species could be recorded on the survey in May 2012. More than 600 specimens of Odonata were collected and DNA samples of all recorded species. The survey led to the discovery of 4 undescribed species. One *Chlorocypha* sp. nov. near aphrodite is close to the tropical *Chlorocypha* aphrodite but differs in some characters. A *Pseudagrion* sp. nov. is near the Zambian *Pseudagrion* fisheri but unique in morphological features and colour markings. *Mesocnemis* sp. nov. and *Zygonyx* sp. nov. nr. *flavicosta* were recorded before in neighbouring countries but are still undescribed. 20 of the species were recorded for the first time in Angola (incl. the undescribed four), 27 are new for the whole Okavango catchment and 54 species are new for the Angolan part of the Okavango catchment. This survey brings the total number of Odonata known from the Okavango catchment to 160 species. A complete preliminary checklist of this catchment is provided (see Table 3 on page 74). The number of Odonata species known from Angola increases from 164 to 184, an updated preliminary checklist of the Odonata of Angola is provided in Table 4 on page 82. The single sampling sites are characterized by their habitat and the species that they inhabit. Observed and potential threats to freshwater diversity and Odonata in special are discussed. For the forthcoming surveys there are the following recommendations. As shown in the map of the Okavango catchment in Fig. 7 there are large gaps that were not covered by any research yet. Especially the headwaters of the Cuchi might be highly diverse in Odonata species. It forms the watershed of Okavango, Cuanza, Zambezi and Congo which promises very diverse habitats and a species rich dragonfly fauna with highly specialized taxa and even undescribed species. Also worth to sample are the middle section of the Cuito and also the Kwando. As known from own surveys and those from partners the rainy season, especially the beginning rainy season in late November is the period with the most species to be found. Next surveys should orientate on this fact and be conducted in November or shortly after the rain in March." (Author)] Address: Kipping, J., BioCart Ökologische Gutachten, Taucha/Leipzig, Germany. E-mail: biocartkippping@email.de

2018

18483. Abbott, K.K.; Abbott, J.C.; Lozier, J.D.; Beasley, R.R. (2018): Development of polymorphic microsatellite markers for a rare dragonfly, *Cordulegaster sarracenia* (Odonata: Cordulegasteridae), with notes on population structure and genetic diversity. *International Journal of Odonatology* 21(3-4): 165-171. (in English) ["We isolated and characterized a total of 13 microsatellite loci from *C. sarracenia*. Loci were screened in 24 individuals from Louisiana and Texas. Within

C. sarracenia, the number of alleles per locus ranged from 0 to 5, and observed and expected heterozygosities ranged from 0.000 to 0.556 and 0.000 to 0.613, respectively. Overall differentiation among study populations was very high ($F_{ST} = 0.423$), suggesting significant geographic population structure with low diversity within populations. Twelve of the 13 primers amplified in *C. sayi*, *C. diastatops*, *C. maculata*, and *C. obliqua* and polymorphism levels are reported. These new genetic markers will provide tools for addressing a number of population genetic and demographic questions relating to conservation of this rare dragonfly species." (Authors)] Address: Abbott, J.C., Alabama Mus. Natural History, Univ. of Alabama, Tuscaloosa, AL, USA. Email: jabbott1@ua.edu

18484. Agembe, S.; Yongo, E.; Masese, F.; Njiru, J.; Manjala, J.; Ojwang, W. (2018): Shifts in the food of Nile perch (*Lates niloticus*) in Lake Victoria. *Lakes & Reserv.* 2018;1-5. wileyonlinelibrary.com/journal/lre © 2018 John Wiley & Sons Australia, Ltd | 1: 5 pp. (in English) ["The study investigated diet of Nile perch in Lake Victoria and compared results with past data from the same lake in order to analyse diet shifts over time. Fish samples (2020) were collected by seining and trawling from 2012 to 2016. In overall, *Caridina nilotica* (59%) was the dominant food item in the diet, while *Rastrineobola argentea* (5%) contributed the least. The diet of Nile perch of 1 cm was copepods, cladocerans and rotifers. The diet changed to only copepods and cladocerans at 2 cm. The proportion of the relatively large calanoids increased with Nile perch size in 1988/89, comprising between 35 and 80% of the diet of fishes of 3-4 cm. Nile perch of 6-25 cm TL fed more on *C. nilotica* in 2012/2016, compared to 1988/1989 and 2006/08. Haplochromines were fed on more in 2006/2008 than in 2012/2016 by Nile perch of 6-30 cm TL as fish size increased. The frequencies of occurrence of *R. argentea* in the diet were highest in 1988/1989, and lowest in 2006/2008, for fish size of up to 30 cm TL. The proportion of Odonata in the diet of size class 16-20 and 21-30 cm TL were highest in 2012/2016 and 1988/1989, respectively. Thus, shifts in Nile perch diet was observed from zooplankton to *C. nilotica*, then to haplochromines and finally to fish prey as size increased. Nile perch preferred haplochromines with *C. nilotica* as the substitute food. Cannibalism was observed to have decreased, only being evidenced in Nile perch above 35 cm TL, which could actually have a positive impact on the Nile perch fishery. The information on shifts in diet of Nile perch in Lake Victoria is of considerable ecological importance." (Authors)] Address: Agembe, S., Dept of Fisheries & Aquatic, Sci., Univ. of Eldoret, Eldoret, Kenya. Email: agembesimon@yahoo.com

18485. Amrullah, S.H. (2018): [Odonata diversity index (Insecta: Odonata) as measurement of environmental quality of river in the area of Taman Nasional Bantimurung Bulusaraung]. *Prosiding Seminar Hasil Penelitian (SNP2M) 2018*: 86-91. (in Indonesian, with English summary) ["Dragonflies (Insecta: Odonata) has important roles in the ecosystem. They act as a predator, control population, and indicator of environmental pollution. The research objectives are to inventory and calculate the species diversity of dragonflies in

Bantimurung Bulusaraung National Park (Babul NP) region and also measure the environment quality of rivers according to the Species Diversity Index (SDI). The study was conducted through exploration in the six resorts. Dragonflies specimens will be identified and confirmed to LIPI Cibinong, Bogor, West Java. SDI calculated by the Shannon-Wiener formula. The results showed that there are 27 species of Odonata (17 of Anisoptera and 10 of Zygoptera) in Babul NP region. SDI shows >2.41 means that environmental quality is in very good category. The conclusion of this research was that dragonflies in the Babul NP is very diverse with the discovery of 27 species in six working area resort." (Author)] Address: Amrullah, S.H., Dosen Program Studi Biologi Fakultas Sains, Universitas Cokroaminoto Palopo

18486. Anjos-Santos, D.; Neiss, U.G.; Pessacq, P. (2018): Chapter 14.4 . Superfamily Calopterygoidea. Thorp and Covich's Freshwater Invertebrates (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 449-468. (in English) ["The superfamily Calopterygoidea has worldwide distribution, with 111 genera and 782 species known. Neotropical region has approximately 30 genera and 290 species, distributed in the families Amphipterygidae, Calopterygidae, Dicteriidae, Megapodagrionidae and Polythoridae. Several ordinal level keys exist that include larvae of Calopterygoidea, but they are limited to certain regions or countries. At generic level, the larvae knowledge of low diversity families is relatively good, but only a small portion of its species have been described. For the speciose and widely distributed genera Hetaerina and Mnesarete (Calopterygidae) separation of larvae is impossible. Larvae of Heteragrion and Oxystigma (Megapodagrionidae) and Euthore and Polythore (Polythoridae) are also very difficult to separate morphologically. Here we present a key to families and genera of Calopterygoidea." (Authors)] Address: Pessacq, P., Lab. de Investigaciones en Ecología y Sistemática Animal (LIESA), Univ. Nac. de la Patagonia San Juan Bosco, Sarmiento 849, 9200 Esquel, Chubut, Argentina. E-mail: pablopessacq@yahoo.com.ar

18487. Arrowsmith, J.; Nagaraju Shivaprakash, K.; Larrivé, M.; Turgeon, J.; Lessard, J.-P. (2018): Environmental filtering along a broad-scale acidity gradient shapes the structure of odonate communities. *Ecosphere* 9(12) . Article e02473: 16 pp. (in English) ["Historical, evolutionary, and ecological processes jointly shape the structure of communities, and the relative influence of such process may vary from one region to another. Nevertheless, much of community ecology focuses on one or several communities in a given region. To assess the relative importance and the context-dependency of processes shaping communities, studies in community ecology must be conducted across regions and along broad-scale environmental gradients. Regionally, historical colonization and extinction events, as well as diversification, can influence community structure by shaping the pool of potential community members (i.e., the regional species pool). Locally, a suite of deterministic and stochastic processes can influence community structure. We constructed a large time-calibrated phylogenetic tree for North American odonates and used analyses of phylogenetic community

structure with explicit species pool definitions to assess the predominant processes structuring assemblages along a north-south environmental gradient spanning two biomes and 8° of latitude in eastern Canada. Phylogenetic analyses of 39 lentic (i.e., lake) odonate communities revealed that co-occurring species were on average more closely related than expected by chance, but only in the temperate biome. In addition, site-to-site variation in phylogenetic structure across the temperate and boreal biomes was most strongly related to variation in water pH. The most alkaline lakes were in the temperate biome and were also the most phylogenetically clustered, suggesting that water pH acts as a main environmental filter of odonate communities. An alternative explanation was that the recent radiation of damselflies increased the diversity of this group relative to that of dragonflies in the temperate species pool, thereby leaving a signature of clustering in that biome. However, our comparative null model analyses with explicit species pool definitions at least partially ruled out this explanation. Somewhat contrary to previous hypotheses regarding the assembly of odonate communities, our results suggest that stochastic processes alone cannot account for community structure in odonates and that deterministic, niche-based processes have a strong influence." (Authors)] Address: Lessard, J.-P., Dept of Biology, Concordia University, Montreal, Qu ebec H4B 1R6 Canada. E-mail: jp.lessard@concordia.ca

18488. Aziz, M.A.A.A.; Mohamed, M. (2018): Diversity and species composition of odonates (Insecta: Odonata) of Hutan Lipur Soga Perdana, Batu Pahat, Johor, Malaysia: A green lung. *Journal of Science and Technology* 10(2): 1-9. (in English) ["In Malaysia, Odonates have been used widely in the assessment of water quality. This study is part of an effort to prepare a baseline data for the state of Johor, where development is happening at a fast rate which in turn could affect the water quality. Hutan Lipur Bukit Soga Perdana is a green lung for Batu Pahat which is considered as the second largest industrial town in Malaysia. Opportunistic sampling using sweep nets along 1 km line transect was conducted for a total of six days. 22 species of Odonata belonging to 17 genera and seven families were recorded. Among the seven families, the most species-rich were Libellulidae (12 species) followed by Coenagrionidae and Platycnemididae (3 species) while Gomphidae, Platystictidae, Devadattidae and Euphaeidae represented by single species. *Drepanosticta fontinalis*, a damselfly endemic to Peninsular Malaysia was collected. The abundance of the endemic *D. fontinalis* was 10.3% from a total of 126 individuals. *Tyriobapta torrida* (15.9%) was found to be the most abundant species found followed by *Prodasineura notostigma* (12.7%) and *Neurothemis fluctuans* (11.9%). The data were further analysed by using Shannon-Wiener Species Diversity Index giving a value of 2.63 indicating a moderate diversity. Simpson's Evenness is 0.91 indicating a high evenness in the distribution of Odonates. Since the forest gains high public interest in Batu Pahat and Odonates are visible and useful insects, more studies could be done, and the data could be transferred to the public as a model for biodiversity and conservation." (Authors)] Address: Mohamed, Maryati, Centre of Research for Sustainable Uses

of Natural Resources, Fac. Appl. Sci. & Tech., Universiti Tun Hussein Onn Malaysia, Bandar Universiti, 84500, Pagoh, Johor, Malaysia. E-mail: maryati@uthm.edu.my

18489. Babu, R.; Subramanian, K.A. (2018): Twenty-two new records of Odonata for Andhra Pradesh state, India (Lestidae, Calopterygidae, Coenagrionidae, Platycnemididae, Gomphidae, Libellulidae). *Notulae odonatologicae* 9(2): 67-71. (in English) ["Field surveys were carried out during 2011–2014 in the State of Andhra Pradesh by scientists of Zoological Survey of India, Southern Regional Centre, Chennai. Collected specimens deposited in the National Zoological Collections of Zoological Survey of India, Chennai, were studied and yielded 22 species new to the state of Andhra Pradesh. These new records increase the number of odonate taxa known from Andhra Pradesh to 69." (Authors)] Address: Babu, R., South. Regional Centre, Zool. Survey of India, Chennai-600028, India. E-mail: baburzi@gmail.com

18490. Balazs, A.; Holusa, O. (2018): Contribution to the knowledge on the dragonfly fauna (Insecta: Odonata) of Islamic Republic of Iran. *MendelNet* 25(1): 190-195. (in English) ["Intensive fieldworks were undertaken in northern parts of Islamic Republic of Iran during midsummer seasons in 2017 and 2018. Overall species richness reached 35 species at 21 visited localities. 13 species from 5 families from Zygoptera and 22 species from 4 families from Anisoptera were recorded in our study. The most valuable species caught were e. g., *Epallage fatime*, *Coenagrion pulchellum*, *C. lunulatum*, *Aeshna vercanica*, *Callaieschna microstigma*, *Cordulegaster vanbrinkae*, *C. nobilis*, *Sympetrum flaveolum*, *S. vulgatum decoloratum* or *Selysiothemis nigra*. First time *Aeshna vercanica* is documented from Gilan Province and *Cordulegaster nobilis* for Ardabil Province. Its habitat in this province is discussed." (Authors)] Address: Balazs, A., Dept of Zoology, Fisheries, Hydrobiology & Apiculture, Mendel University in Brno, Zemedelska 1, 613 00 Brno. Czech Republic. E-mail: balazsaeko@gmail.com

18491. Bode-Oke, A.T.; Zeyghami, S.; Dong, H. (2018): Flying in reverse: kinematics and aerodynamics of a dragonfly in backward free flight. *J. R. Soc. Interface* 15: 20180102. <http://dx.doi.org/10.1098/rsif.2018.0102>: 14 pp. (in English) ["In this study, we investigated the backward free flight of a dragonfly, accelerating in a flight path inclined to the horizontal. The wing and body kinematics were reconstructed from the output of three high-speed cameras using a template-based subdivision surface reconstruction method, and numerical simulations using an immersed boundary flow solver were conducted to compute the forces and visualize the flow features. During backward flight, the dragonfly maintained an upright body posture of approximately 90° relative to the horizon. The upright body posture was used to reorient the stroke plane and the flight force in the global frame; a mechanism known as 'force vectoring' which was previously observed in manoeuvres of other flying animals. In addition to force vectoring, we found that while flying backward, the dragonfly flaps its wings with larger angles of attack in the upstroke (US) when compared with forward

flight. Also, the backward velocity of the body in the upright position enhances the wings' net velocity in the US. The combined effect of the angle of attack and wing net velocity yields large aerodynamic force generation in the US, with the average magnitude of the force reaching values as high as two to three times the body weight. Corresponding to these large forces was the presence of a strong leading edge vortex (LEV) at the onset of US which remained attached up until wing reversal. Finally, wing–wing interaction was found to enhance the aerodynamic performance of the hindwings (HW) during backward flight. Vorticity from the forewings' trailing edge fed directly into the HW LEV to increase its circulation and enhance force production." (Authors)] Address: Bode-Oke, A.T., Mechanical & Aerospace Engineering, Univ. of Virginia, Charlottesville, VA 22903, USA

18492. Bowman, R.M.; Schmidt, S.; Weeks, C.; Clark, H.; Brown, C.; Latta IV, L.C.; Edgehouse, M. (2018): Phenotypic plasticity in a population of odonates. *Scientific Reports* 8, Article number: 8442: 6 pp. (in English) ["The maintenance of phenotypic plasticity within a species ensures survival through environmental flux. Plastic strategies are increasingly important given the number and magnitude of modern anthropogenic threats to the environment. We tested for phenotypic plasticity in the odonate *Argia vivida* in response to resource limitation. By limiting food availability, effectively inducing hunger, we were able to quantify shifts in agonistic behavior during intraspecific interactions. Scoring behavior in one-on-one combat trials after 1 and 4 days without food revealed phenotypic plasticity. Three classes of genotypes were identified, genotypes exhibiting either increased aggression, decreased aggression, or no phenotypic plasticity, in response to resource limitation. The variable plastic strategies in this population of odonates likely aids in maintaining fitness in fluctuating environments." (Authors)] Address: Edgehouse, M., Division of Natural Sciences & Mathematics, Lewis-Clark State College, Lewiston, Idaho, USA

18493. Bucciarelli, G.M.; Suh, D.; Davis, A.; Roberts, D.; Sharpton, D.; Shaffer, H.B.; Fisher, R.N.; Kats, L.B. (2018): Assessing effects of non-native crayfish on mosquito survival. *Conservation Biology* 33(1): 122-131. (in English) ["The introductions of non-native predators often reduce biodiversity and affect natural predator-prey relationships. However, non-native predators may increase the abundance of potential disease vectors (e.g. mosquitoes) indirectly through competition or predation cascades. The Santa Monica Mountains, situated in a global biodiversity hotspot, is an area of conservation concern due to climate change, urbanization, and the introduction of non-native species. We examined the effect that non-native crayfish (*Procambarus clarkii*) have on an existing native predator, dragonfly nymphs (*Aeshna* sp.) and their mosquito larvae (*Anopheles* sp.) prey. We used laboratory experiments to compare the predation efficiency of both predators, separately and together, and field data on counts of dragonfly nymphs and mosquito larvae sampled from 13 local streams. We predicted a lower predation efficiency of crayfish compared to native dragonfly nymphs as well as a reduced efficiency of dragonfly nymphs in the presence

of crayfish. Dragonfly nymphs were an order of magnitude more efficient mosquito predators compared to crayfish and dragonfly nymphs suffered reduced efficiency in the presence of crayfish. Analyses of field count data showed that populations of dragonfly nymphs and mosquito larvae were strongly correlated with crayfish presence in streams, such that sites with crayfish tended to have fewer dragonfly nymphs and more mosquito larvae. Under natural conditions, it is likely that crayfish reduce the abundance of dragonfly nymphs and their predation efficiency, and thereby, directly and indirectly, lead to higher mosquito populations and a loss of ecosystem services related to disease vector control." (Authors)] Address: Bucciarelli, G.M., UCLA La Kretz Center for California Conservation Science, Institute of the Environment and Sustainability, Los Angeles, CA, 90095 U.S.A. Email garyb@ucla.edu

18494. Cabaret, P. (2018): Présentation de la Réserve naturelle régionale de la haute vallée de la Vézère. *Annales Scientifiques du Limousin* 27: 72-81. (in French, with English summary) ["The Conservatoire d'espaces naturels du Limousin (CEN Limousin) was designated as responsible for managing the regional nature reserve (RNR) "Haute vallée de la Vézère" following his gazettement in November 2015. The site is located in the headwaters of the Vézère river, at the heart of Millevaches Plateau, on the communes of Saint-Merd-les-Oussines and Tarnac in the department of Corrèze. It covers a surface of 196 hectares. It is one of the last extensive and unspoilt network of heaths, dry grasslands and peatland in Limousin. The CEN Limousin has been involved in this space with local stock farmers for twenty years. The perimeter includes the pond of Chabannes with a quaking mire of exceptional vegetal diversity, and the pond of Oussines which is a local historical heritage. According to what we know, the large density of remarkable species (plants, birds, odonates in particular) as well as the substantial surface of habitats of community interest in good condition and the quality of aquatic environments, are the major conservation issues. The diagnostic of the management plan for the nature reserve is being currently written. It will clear this challenges issues and should set out the targets to be achieved. They will be the topic of dialogue and validation within the advisory committee of the RNR chaired by the President of Region "Nouvelle Aquitaine". Besides recognition of ecological and landscape site quality at regional level, the gazettement as RNR is a new action framework for experimental measures and pedagogical recovery of heritage." (Author) "The Odonata assemblage is the richest in Limousin, with 45 species recorded, i.e. 66% of the regional assemblage (75% of the known species in Corrèze). Amongst these species, 7 are included in the red list of threatened Odonata in Limousin (SLO, 2006): *Leucorrhinia dubia* is "critically endangered"; *Aeschna juncea*, *Coenagrion hastulatum*, *Somatochlora arctica*, *S. flavomaculata* and *Sympetrum flaveolum* are "endangered"; *Sympetrum danae* is "vulnerable". This exceptional diversity is largely attributed to the habitats of the Chabannes peat bog and its hydraulic annexes, the Oussines peat delta, and the Marcy stream, which is in very good ecological condition." Translated

with www.DeepL.com/Translator (free version)] Address: not stated

18495. Cabezas Castillo, M.B.; Grether, G.F. (2018): Why are female color polymorphisms rare in territorial damselflies? *Ethology* 124(9): 667-673. (in English) [Costa Rica "In nonterritorial damselflies, females often come in multiple color morphs, perhaps because females with rare colors experience reduced sexual harassment, and thus have a frequency-dependent fitness advantage, compared to females of the most common color morph, but such polymorphisms are rare in territorial species. We consider three hypotheses to explain the rarity of female color polymorphisms in territorial species: (a) misdirected male aggression, (b) poor male mate recognition, and (c) low mating harassment rates. The first hypothesis has some empirical support, and can account for the absence of andromorphs (i.e., females that resemble males), but does not explain the absence of multiple heteromorphs. We tested the second hypothesis by presenting females of two novel color morphs (green. or red-banded abdomens) to territorial male *Hetaerina capitalis*. Females of both novel color morphs elicited fewer sexual responses than control females, and the red morph occasionally elicited aggressive responses. These results indicate that novel female color morphs would experience reduced mating harassment in this species, contradicting the hypothesis that male mate recognition is too poorly developed to reduce harassment of novel female morphs. By process of elimination, the third hypothesis, that harassment rates are too low in territorial species to provide rare female morphs a fitness advantage, is favored, but remains untested. Our findings also suggest that the common practice of color-marking odonates for behavioral research is likely to interfere with mate choice, as has long been known to be the case in birds." (Authors)] Address: Grether, G.F., Dept Ecology & Evolutionary Biology, University of California Los Angeles, Los Angeles, CA, USA. Email: ggrether@ucla.edu

18496. Cao, L.Z.; Yuan, Y.G. (2018): Development of SSR markers based on the head transcriptome of *Pantala flavescens* (Fabricius, 1798) (Odonata: Libellulidae). *International Journal of Odonatology* 21(3-4): 1-7. (in English) ["*P. flavescens* is one of the most common species of dragonflies and has been found throughout from tropic to temperate zones worldwide. In this study, RNA-seq of *P. flavescens* was carried out through Illumina high-throughput sequencing technology. Approximately 37,868 unigenes and 47,188 transcripts were obtained. The average length of the assembled unigenes was 908.59 bp. We identified 1442 cDNA simple sequence repeats (SSRs) among the 37,868 unigenes, with 864 (59.91%) di-nucleotide repeats, 537 (37.32%) tri-nucleotide repeats, 32 (2.22%) complex-nucleotide repeats, and 9 (0.62%) with tetra-nucleotide repeats. Sixty microsatellite molecular markers were randomly selected to test amplification. Of the 60 markers, 32 (53.33%) produced clear amplicons of the expected size, 10 (16.67%) amplified nonspecific products, and 18 (30%) failed to amplify the DNA products. In order to assess their applicability, genetic diversity of the 32 SSR loci was tested

in 32 individuals from Nanchang in China. Of these loci, 14 markers were highly polymorphic, with the observed (H_o) and expected (H_e) heterozygosities ranged 0.69 to 0.88 and from 0.96 to 0.98 respectively. PIC ranged from 0.52 to 0.83. These highly polymorphic loci will be valuable for the genetic analysis of distinct populations of *P. flavescens*." (Authors)] Address: Cao, L.Z., College of Life Science, Jiangxi Normal University, Nanchang, PR China. Email: clzclz1011-@163.com

18497. Carvalho, A.; Pessacq, P. (2018): Chapter 14.1 . Superfamily Aeshnoidea. Thorp and Covich's Freshwater Invertebrates (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 367-376. (in English) ["A new key to the identification of mature larvae of the 17 neotropical genera of Aeshnoidea (Insecta: Odonata), including in the families Aeshnidae (15) and Austroptelliidae (2), are proposed. High-resolution photographs are added for illustrate the characters used in all the steps." (Authors)] Address: Pessacq, P., Laboratorio de Investigaciones en Ecología y Sistemática Animal (LIESA), Universidad Nacional de la Patagonia San Juan Bosco, Sarmiento 849, 9200 Esquel, Chubut, Argentina. E-mail: pablopessacq@yahoo.com.ar

18498. Carvalho, A.L. (2018): The larval ontogeny of *Coryphaeschna perrensi* (McLachlan, 1887): Supporting monophyletic groups in Aeshnidae dragonflies (Insecta: Odonata: Anisoptera). *Journal of Morphology* 279(9): 1321-1335. (in English) ["The development of the larval external morphology of *C. perrensi* is reported based primarily on a comparison of successive exuviae of reared specimens, with the second stadium larvae first described separately. Accentuated changes observable throughout successive moltings occur in some structures, such as the head capsule, labium, and anal appendages, allowing for the definition of characters with naturally ordered, polarized, and linear states (transformation series) by ontogenetic evidence. The terminal (less general) and nonterminal (more general) states of the described transformation series correspond by primary homology to the conditions found in larvae of other dragonfly species. Consequently, as the result of a parsimony analysis and subsequently ontogenetic rooting, the disposition of the states of 17 characters in a sample of final-stadium larvae of 23 species, representatives of the six Aeshnidae tribes (21) and Austroptelliidae (2), results in a hierarchical network comprising six distinct taxonomic levels of inclusion of *C. perrensi*. The levels correspond to Aeshnidae, Aeshninae, Aeshnini (part) + Gynacanthini, *Coryphaeschna*?+?-*Remartinia*, *Coryphaeschna*, and *Coryphaeschna* except *C. adnexa*, which are groups previously recognized as monophyletic resulting from analyses considering adult morphology. Immature insect morphology coupled with ontogenetic observation presenting great potential to hypothesize phylogenetic relationships and investigate heterochronic events." (Authors)] Address: Carvalho, A.L., Departamento de Entomologia, Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil.

18499. Cavallaro, M.C. (2018): Assessing the effects of

chronic neonicotinoid insecticide exposure on aquatic insects using multiple experimental approaches. PhD thesis. School of Environment and Sustainability, University of Saskatchewan, Saskatoon: XIV + 148 pp. (in English) ["Neonicotinoid insecticides are among the most widely used plant protection products in industrialized agriculture, and are hypothesized to be contributing to losses in non-target insect biodiversity. The lack of toxicological data evaluating the effects of neonicotinoids restricts the ability of regulators to adequately protect sensitive insects particularly those with aquatic larval stages. Many Prairie wetlands are in regions of intensive agriculture and are directly at risk of neonicotinoid contamination and require special considerations to best protect these ecologically important areas. Under laboratory conditions, I compared the effects of imidacloprid, clothianidin, thiamethoxam on the model aquatic insect, *Chironomus dilutus*. Reduced emergence success, advanced emergence timing, and male-biased sex ratios were observed across all compounds tested. Imidacloprid and clothianidin reduced emergence success at similar concentrations whereas thiamethoxam required a concentration an order of magnitude greater to observe similar toxicity. Normalizing the clothianidin and thiamethoxam toxic responses to imidacloprid, I calculated acute (lethality) 14-day toxic equivalency factors (TEFs) for imidacloprid, clothianidin and thiamethoxam as 1.00, 1.05 and 0.14, respectively, and chronic (emergence inhibition) 40-day TEFs as 1.00, 1.62 and 0.11, respectively. To expand upon these single-species laboratory assessments, in situ limnocorral were used to determine the chronic effects of the three neonicotinoids to emerging aquatic insect communities in a Prairie wetland. Imidacloprid and clothianidin treatments had similar community responses and non-biting midge (Diptera: Chironomidae) and damselfly emerged significantly earlier than the controls (18 to 25 days earlier). An additional limnocorral study with clothianidin was inconclusive. While laboratory and limnocorral studies were useful to isolate neonicotinoid effects, multiple anthropogenic stressors were hypothesized to cumulatively influence insect emergence from natural Prairie wetlands surrounded by neonicotinoid-treated canola fields. Multivariate analysis showed neonicotinoid concentration, turbidity, vegetation disturbance and continuity of grasses were significant factors modifying the abundance and composition of emerging insects. Total insect abundance was negatively affected by neonicotinoids ($\beta \pm S.E. = -0.61 \pm 0.14$, $P < 0.001$) but positively affected by vegetation disturbance ($\beta \pm S.E. = 0.34 \pm 0.11$, $P < 0.001$). Collectively, these data suggest more rigorous water quality guidelines and agricultural management strategies are needed to protect aquatic insects and the higher trophic organisms that rely on this important food source. ... *Lestes disjunctus* was the most negatively affected taxon with a species score of -0.34; the remaining odonate taxa species scores were negligible (range from *Enallagma annexum* - 0.02 to *Aeshna interrupta* 0.001)." (Author)] Address: not stated

18500. Chari, L.D.; Moyo, S.; Richoux, N.B.; (2018): Trophic ecology of adult male Odonata. II. Dietary contributions

of aquatic food sources. *Ecological Entomology* 43: 15-27. (in English) ["1. Insects that emerge from rivers provide nutritional subsidies to local riparian predators. Adult damselflies and dragonflies often benefit from aquatic resources, but their high mobility and evasiveness have made it difficult to monitor their diets. 2. A dual fatty acid and stable isotope analysis approach was used to investigate the links between Odonata size and behaviour with proportions of their aquatically derived nutritional sources. Additionally, the study investigated the variation in dietary contributions of aquatic food sources to Odonata between two sections of a river, each with different aquatic productivity rates. 3. Variations in body size and foraging method of Odonata in the Kowie River (South Africa) contributed to differences in the contributions of aquatic food sources to their diets. Large Odonata that consumed prey in flight had smaller proportions of aquatic indicator fatty acids and stable isotope-generated proportions of aquatic food sources than did the smaller Odonata that consumed prey from perches. 4. There was a considerable amount of interspecific variation in indicators of aquatic feeding, but Odonata at an upstream site had smaller proportions of aquatic indicators than those at a downstream site which had higher insect emergence rates. 5. The findings of this study contribute information on the dynamics of feeding ecology among adult Odonata, and the substantial contributions of aquatic prey (>80% of total diet in some cases) indicated that cross-boundary trophic linkages via odonates are strong in the Kowie River." (Authors)] Address: Chari, L.D., Dept of Zoology & Entomology, Rhodes University, African Street, Grahamstown, South Africa. E-mail: lenychari@gmail.com

18501. Chavez, M.Y. (2018): Wisconsin cranberry marshes support diverse communities of odonate biocontrol agents. MSc. thesis, Entomology and Agroecology, University of Wisconsin-Madison: III, 100 pp. (in English) ["Odonata are abundant generalist predators observed all summer on Wisconsin cranberry marshes and represent a potentially important group of biocontrol agents for a major moth pest of cranberries, *Acrobasis vaccinii*. The success of dragonflies as bio-control agents may be supported by on-site marsh habitats and the composition of the surrounding landscape. This landscape is composed of four major characteristics: cultivated cranberry marshes, forested areas, water bodies, and other (any non-cranberry agriculture, developed land, and wild marshes). We hypothesize that landscape patterns will vary by site, distance from field sites, and in composition of landscape characteristics. Given interspecific variation among odonate taxa, we hypothesize that dragonfly diversity will vary by month, site, and habitat type. We also expect that dragonfly abundance and diversity will be significantly influenced by on-marsh habitat types (cultivated cranberry beds, forest edges, or waterfront areas). Eight cranberry marshes were established as replicate tests of how landscape features may be influencing odonate abundance and diversity. Each marsh was characterized with USDA NASS cropland data layers at radii of 1 and 2 km from the marsh midpoint. Transects were established in each habitat type (i.e., bed, forest, waterfront) within these

sites during the summers of 2016 and 2017. Odonate populations were sampled within each habitat type. The eight surveyed marshes did not vary significantly in their respective proportions of surrounding landscape characteristics, but at both 1 and 2 km radii from the marshes, there was more forest and water habitat than cultivated cranberry acreage. On-site, dragonfly abundance and diversity were highest near water habitats. Dragonfly abundance was highest in June. A total of 6,577 dragonflies were observed, representing 11 taxa. The most common taxa were the following five species: *Epithea spinigera*, *Leucorrhinia frigida*, *L. intacta*, *Ladona julia*, and *Libellula quadrimaculata*. There appears to be no relationship between the surrounding landscape (at 1 or 2 km) and on-site odonate communities. To assess whether the five most abundant odonate species were consuming *A. vaccinii*, gutcontent analyses were conducted using real-time PCR. Consumption of *A. vaccinii* was consistently observed across all sites, sample dates, and among the five most abundant odonates. Thus, the dragonfly communities of Wisconsin cranberries appear to represent biocontrol agents for a major cranberry pest. Growers may benefit from this knowledge by promoting their land stewardship and sustainability practices in an environmentally conscious market." (Author)] Address: not stated

18502. Chovanec, A. (2018): Bewertung von Restrukturierungsmaßnahmen an der Ache (Oberösterreich) anhand von Libellen (Odonata) – Anwendung des Konzeptes der biozönotischen Regionen. *Libellula* 37(3/4): 135-160. (in German, with English summary) ["Assessment of regeneration measures at the river Ache (Upper Austria) based on Odonata – application of the Rhithron-Potamon-Concept – The Rhithron-Potamon-Concept explains the changes in species composition along a river's length. These longitudinal zonation patterns are described by biocoenotic regions. In the present paper, this concept is applied to the Austrian dragonfly fauna. Species-specific preferences for the biocoenotic regions are expressed by the allocation of ten valency points per species. A scheme for the assessment of the ecological status of rhithron sections was developed focusing on the definition of rivertype-specific reference Odonata species. In 2017, this method was applied at both a metarhithron stretch and a stretch in the transition zone of metarhithron and hyporhithron of the Ache, a river in Upper Austria. The methodological approach revealed as sensitive – also on a small scale – to detect and evaluate the impacts of regulation and rehabilitation measures as well as potamalisation effects due to impoundment." (Authors)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-Mail: andreas.chovanec@bmnt.gv.at

18503. Cordero-Rivera, A.; Vieira, V.; Utzeri, C. (2018): Clonal damselflies (*Ischnura hastata*) are not significantly affected by mite parasitism. *Entomologia Experimentalis et Applicata* 166(7): 583-591. (in English) ["We studied parasitism rate by the terrestrial mite *Leptus killingtoni* Turk (Acari: Erythraeidae) on asexual parthenogenetic damselflies, *Ischnura hastata*, and sexual *Ischnura pumilio* on Pico island (Azores, Portugal). We sampled 52 water bodies on the island

and recorded whether *Ischnura* specimens were parasitized. Half of the water bodies had either dried up or were almost dry or did not have *Ischnura* populations. In the remaining 23 ponds, mite parasitism was extremely low, with only 3.6% of *I. hastata* females bearing one or more mites. *Ischnura pumilio* was rare on the island (61 specimens examined) and had also very few parasites (9.8% parasitism). We examined the biology of the mite and its effects on the host, by studying mite attachment behavior and seasonal abundance, in an intensive study of one pond (Lagoa do Landroal). At this pond, mite prevalence peaked at the start of the sampling period, with 32% of females of *I. hastata* parasitized and decreased continuously until the end of the study, when only 2% were parasitized. The analysis of mark-recapture histories of 1 748 females of *I. hastata* indicates that mites did not affect female survival or recapture rate. Our results suggest that *L. killingtoni* is unlikely to represent a significant selective factor for odonates on the island of Pico, if its density is as low as during the period of our study, although it could be relevant when it is locally abundant or during periods of outbreak." (Authors)] Address: Cordero Rivera, A., Departamento de Ecología e Biología Animal, Univ. de Vigo, E.U.E.T. Forestal, Campus Universitario, 36005 Pontevedra, Spain. E-mail: acordero@uvigo.es

18504. Díaz Flórez, B.; García, M.P.; Altamiranda-Saavedra, M.; Martínez-Hernández, N. (2018): Estructura poblacional de *Mecistogaster ornata* Rambur 1842 (Odonata: Pseudostigmatidae) en dos fragmentos de bosque seco tropical en el departamento del Atlántico, Colombia. *Bol. cient. mus. hist. nat.* 22(2): 107-131. (in Spanish, with English summary) ["Objective: The variation of the population structure of *M. ornata* was evaluated in two fragments (La Montana and Sarmiento) of Tropical Dry Forest in the Department of Atlántico, Colombia. Scope: To determinate the spatial and temporal variations of *M. ornata* abundance and its relationship with environmental variables, as well as the availability of phytotelmata and the structure of the vegetation. Methodology: 26 samplings were taken (13 per fragment) every 8 days between 8:00 a.m. and 5:00 p.m. (9 hours/man/fragment). A 600 m long and 30 m large area was established per fragment, where 10 points were marked 50 m apart from each other and in this way, 10 stretches with equal length were obtained. Odonata were captured with entomologic nets using a mark and recapture method. On the other hand, environmental temperature, relative moisture, and light intensity were measured in each stretch, as well as the number of phytotelmata and some of their characteristics (height, density, volume) and the structure of the vegetation (density of trees, vegetal cover, basal area and average height). Main results: A total of 90 individuals were captured in La Montana and released (35 ♂, 55 ♀), 40 of which were recaptured (15 ♂, 25 ♀) once or more times. The highest number of captures (19) occurred in sampling 2 carried out in March (7 ♂, 12 ♀). In Sarmiento, 31 individuals were captured and released (14 ♂, 17 ♀). In this fragment, the major number of captures was registered in event 1 carried out in March. Taking into account the sex proportions, in La Montana it was 2:1 (80 ♂, 50 ♀) with significant differences (X²=

23.403, p=0.02449), whereas in Sarmiento it was 27 ♂ and 29 ♀ (proportion 1:1) and without differences. With the principal component analysis (PCA), it was determined that the variation in the number of individuals between the places and fragments of sampling, can be explained in 59.76% because of vegetation variables as well as phytotelmata variables. Conclusions: it was established that temperature and light intensity are abiotic factors playing an important role in the temporal dynamics of the abundance of this species in the area of study. Additionally, the non random disposition of plant species and vegetation cover, as well as the height of phytotelmata influence the spatial variation of *M. ornata* in the area." (Authors)] Address: Martínez-Hernández, N., Estudiante de Doctorado en Ciencias-Biología, Univ. Nac. de Colombia-Sede Bogotá. Grupo de Investigación Biodiversidad del Caribe colombiano. Programa de Biología, Fac. de Ciencias Básicas, Univ. del Atlántico. Apartado 1890 Barranquilla, Colombia. E-mail: neyjoosemartinez@gmail.com

18505. Dorrington, G.E. (2018): On the scaling of dragonflies. 10th International Micro-Air Vehicles Conference, 22nd-23rd November 2018. Melbourne, Australia: 1-7. (in English) ["Anisopteran dragonfly allometry is discussed. Induced power during hover is found to scale with body mass raised to the ~7/6 power. The possible existence of an upper body mass limit is suggested and a scenario where the maximum load factor for flight manoeuvres decreases with size. Some brief comments are also made about Meganisoptera, bats and birds." (Author)] Address: Dorrington, G.E., School of Engineering, Royal Melbourne Inst. Tech., Bundoora, Australia. E-mail: graham.dorrington@rmit.edu.au

18506. Dudaniec, R.Y.; Yong, C.J.; Lancaster, L.T.; Svensson, E.I.; Hansson, B. (2018): Signatures of local adaptation along environmental gradients in a range-expanding damselfly (*Ischnura elegans*). *Molecular Ecology* 27: 2576-2593. (in English) ["Insect distributions are shifting rapidly in response to climate change and are undergoing rapid evolutionary change. We investigate the molecular signatures underlying local adaptation in the range-expanding damselfly, *Ischnura elegans*. Using a landscape genomic approach combined with generalized dissimilarity modelling (GDM), we detect selection signatures on loci via allelic frequency change along environmental gradients. We analyse 13,612 Single Nucleotide Polymorphisms (SNPs), derived from Restriction site-Associated DNA sequencing (RADseq), in 426 individuals from 25 sites spanning the *I. elegans* distribution in Sweden, including its expanding northern range edge. Environmental association analysis (EAA) and the magnitude of allele frequency change along the range expansion gradient revealed significant signatures of selection in relation to high maximum summer temperature, high mean annual precipitation, and low wind speeds at the range edge. SNP annotations with significant signatures of selection revealed gene functions associated with ongoing range expansion, including heat shock proteins (HSP40 and HSP70), ion transport (V-ATPase) and visual processes (long wavelength-sensitive opsin), which have implications for thermal stress response, salinity tolerance and mate discrimination,

respectively. We also identified environmental thresholds where climate-mediated selection is likely to be strong, and indicate that *I. elegans* is rapidly adapting to the climatic environment during its ongoing range expansion. Our findings empirically validate an integrative approach for detecting spatially explicit signatures of local adaptation along environmental gradients." (Authors)] Address: Dudaniec, Rachael, Dept of Biological Sciences, Macquarie Univ., Sydney, NSW, Australia. Email: rachael.dudaniec@mq.edu.au

18507. Dwari, S.; Mondal, A.K. (2018): Odonata (Dragonfly and Damselfly) diversity of Howrah District, West Bengal, India. *Advances in BioResearch* 9(5): 54-65. (in English) ["Continuous survey was carried out on order Odonata of Howrah District, West Bengal, India as no previous exclusive study of District was available. We present a list of 54 Odonata species from this District which contains 35 species of Anisoptera from 4 families and 19 species of Zygoptera from 3 families. ... four species are newly recorded from the area, viz., *Macrogomphus annulatus*, *Orthetrum luzonicum*, *Mortonagrion aborense*, and *Lestes viridulus*. The most dominant family is Libellulidae followed by Coenagrionidae, Aeshnidae and Gomphidae, Lestidae, Platycnemididae and Macromiidae." (Authors)] Address: Dwari, S., Vidyasagar Univ., Plant Taxonomy, Biosystematics & Molecular Taxonomy Lab., Dept of Botany & Forestry, Midnapore-721 102, West Bengal, India. E-mail: saurav.dwari@gmail.com

18508. Evangelio Pinach, J.M.; Notario Maroto, C.; Alcaide Gil, M.I. (2018): Nueva localidad de *Oxygastra curtisii* (Dale, 1834) en Castilla-La Mancha (España). *Boletín Rola* n° 12, segundo semestre 2018: 13-18. (in Spanish, with English summary) ["A new locality of the endangered *O. curtisii* is presented from the region of Castilla-La Mancha, the second for the province of Cuenca (Spain)." (Authors)] Address: Evangelio Pinach, J.M., Parotets . Sociedad Odonatológica de la Comunitat Valenciana (Parotets-SOCV). C/ Padre Vicente Cabanes, 5, esc. 2, pta. 12 -46900 Torrent (Valencia), Spain. E-mail: jjevanach@hotmail.com

18509. Fischer, I.; Sittenthaler, M.; Traugott, M.; Thauger, B.; Zangl, L.; Koblmüller, S.; Kunz, G.; Chovanec, A.; Sattmann, H.; Randolf, S.; Haring, E. (2018): Extended Abstract: Monitoring and DNA barcoding of dragonflies (Insecta: Odonata) in Vienna, Austria. *Acta ZooBot Austria* 155/2: 39-42. (in bilingual in English and German) [Verbatim: Surveys of dragonfly communities have become an important instrument for characterizing aquatic systems and assessing their ecological state (Samways 1993» Bulankova 1997, Chovanec & Wvrincer 2001, Oertli 2008, McGeoch et al. 2011). »Although dragonflies colonize a wide range of aquatic habitats, many species have specific habitat requirements concerning the morphology, hydrological dynamics and plant communities of their breeding waters and the riparian zones (CORBET 1999, SCHINDLER et al. 2003, Kadoya et al. 2004). In addition to their role as bioindicators, dragonflies are of conservation concern; 56 % of the 78 »Austrian dragonfly species are classified as vulnerable, endangered or critically endangered (Raab 2006). On a Europe-wide scale,

11 of them are listed in the Fauna-Flora-Habitat (FFH) directive by the European Union (KALKMAN et al. 2010). Hence, knowledge on distribution and abundance of these species is of relevance for both water management and conservation issues. Molecular genetic methods have found their way into the field of biomonitoring: Environmental DNA (eDNA) for either single-species detection or for surveying whole species communities (metabarcoding) has proven to be a useful tool in biodiversity research to monitor aquatic organisms, e. g. fish and amphibians (THOMSEN et al. 2012, Valentini et al. 2016, Deiner et al. 2017). However, before setting up standardized protocols for the specific taxonomic group of interest, it is indispensable to evaluate the potential of such methods first (Goldberg et al. 2016). Moreover, the availability of extensive DNA reference databases based on correctly identified voucher specimens is crucial for the successful application of eDNA metabarcoding (TABERLET et al. 2018). In the light of this, a current study titled 'Dragonflies in Vienna; DNA barcoding and survey, with focus on FFH species' includes a combination of traditional fieldwork via observation of imagines and molecular methods. The overall objective of the project is a complete dragonfly species inventory in the rural areas of Vienna with a special focus on two FFH species: *Cordulegaster heros* and *Leucorrhinia pectoralis*. Within the project, species-specific DNA barcodes are generated of collected dragonflies. Further, collecting and barcoding of dragonflies is extended to whole »Austria, to setup a complete DNA reference database or »Austrian dragonfly species within the .Austrian Barcode of Life (.ABOL) initiative. All voucher specimens are stored at the Natural History Museum Vienna. Based on this reference database, a pilot study on eDNA using filtered water samples from four running and six standing water bodies will be carried out. Both, protocols of single-species detection for rare species as well as metabarcoding approaches will be set up. The combination of traditional field surveys and DNA-based methods will allow a direct comparison between species inventories obtained by observation of imagines and detected via eDNA. Within the first project year (2017), 47 species have been recorded in Vienna by observation so far, including both FFH species. »Additionally, the first record of *Leucorrhinia albifrons*, also listed as FFH species, was obtained for Vienna (Fischer et al. 2018). In total, 342 individuals of 51 »Austrian dragonfly species have been collected during the field season in 2017 by sampling in Vienna, Styria and Burgenland. For amplifying the whole DNA barcoding region of the mitochondrial cytochrome c oxidase subunit 1 (COI) gene as well as shorter sections of the gene a new set of Odonata primers has been designed. By now, 162 DNA barcodes have been generated for the .Austrian dragonfly DNA database and the subsequent pilot study on eDNA metabarcoding. The results of this study will contribute to the development and evaluation of eDNA approaches and will reveal their potential as an additional tool for monitoring aquatic macroinvertebrates in modern biodiversity research and habitat quality assessment.] Address: Fischer, Iris, Central Research Laboratories, Museum of Natural History Vienna, Burgring 7,1010 Vienna, Austria. E-mail: iris.fischer@nhm-wien.ac.at

18510. Girardin, V. (2018): Source origin of Polycyclic Aromatic Hydrocarbons (PAHs) in sediment, and fate of organic contaminants in dragonfly larvae (Aeshnidae) from highway sedimentation ponds and natural ponds. Master thesis in toxicology. University of Oslo. Department of Biosciences. Faculty of Mathematics and Natural Sciences: X + 87 pp. (in English) ["Road and tunnel wash runoff contain a mixture of organic and inorganic contaminants that threatens the quality of natural water bodies, and the health of the organisms dependent on these waters. A variety of treatment solutions can be established to reduce potential runoff impact. The most common mitigation adopted in Norway is the installation of nature-based sedimentation ponds. A variety of organisms migrate to these ponds over time, and are thus at risk of exposure to high levels of traffic-related contaminants. Dragonflies, with their aquatic life stage, can potentially transfer these substances back to the terrestrial environment. This aim of this study was to assess the source origin and fate of polycyclic aromatic hydrocarbons (PAHs), and two types of organobromine compounds used as flame retardants, polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCD) in three natural and seven highway sedimentation ponds in Norway. Sediment samples were used to determine source origin of PAHs. The concentrations of organic contaminants were analyzed in dragonfly larvae to investigate their potential role as pollutant vectors across ecosystems. Parent and alkylated PAHs in sediment were measured, and the results were used to characterize the source of PAHs. Distribution patterns of selected PAHs showed similar patterns in all sedimentation ponds, and distinct patterns in natural ponds. Specific PAH ratios indicated that sedimentation ponds are dominated by petrogenic PAHs, whereas natural ponds showed pyrogenic dominance. Moreover, the addition of alkylated PAHs resulted in significant changes in the environmental quality standard values related to sediment pollution. PAHs, PBDEs and HBCD were quantified in sediment, and larval exuvia and tissue. Haemolymph was also analyzed for PAH metabolites. The results indicated that dragonfly larvae accumulate PAHs in the exuvia, but not sufficiently enough to avoid bioaccumulation. 1-hydroxypyrene was detected only in some of the samples and at very low concentrations, and thus it is not clear whether larvae are able to metabolize PAHs at low levels or if the metabolite has come from others sources. Nevertheless, the results suggest that metabolites are not suitable biomarkers for PAH exposure in dragonfly larvae. Levels of BFRs were detected at very low concentrations, and the results were qualified. Overall, there was no indication of bioaccumulation of BFRs." (Author)] Address: not stated

18511. Golfieri, B.; Surian, N.; Hardersen, S. (2018): Towards a more comprehensive assessment of river corridor conditions: A comparison between the Morphological Quality Index and three biotic indices. *Ecological Indicators* 84: 525-534. (in English) ["River management and planning of restoration actions require a detailed analysis of stream conditions. However, most biotic and hydromorphological indices that have been developed for implementing the European Water Framework Directive (WFD) are characterized

by limited spatial and temporal scales of application. In addition, the indices based on the biological quality elements defined by the WFD are sensitive to water quality but not to hydromorphological alterations. To overcome these limitations, alternative hydromorphological and biotic indices have recently been developed. In this study we compared the results obtained with the Morphological Quality Index (MQI) to those of three biotic indices, the Odonate River Index (ORI) and two BQE-based indices, in seven rivers of northern Italy. MQI and ORI resulted highly and significantly correlated, and alterations of river functionality and continuity were the most relevant impacts affecting dragonfly assemblages. Conversely, no significant relationships were found between the MQI and both BQE-based indices and assemblages. The significant correlation between MQI and ORI can be explained by the correspondence of the spatial scale of application (i.e. the whole river corridor). In contrast, the lack of correlation between the BQE-based indices and MQI can probably be attributed to the different spatial scales at which the indices work. The results of this study underline the importance of evaluating the lateral dimension of the river corridor and the need to apply reach-scale indices to achieve a comprehensive evaluation of river corridor conditions and to define appropriate management actions." (Authors)] Address: Golfieri, B., Dept Geosci., Univ. Padova, Via Gradenigo 6, 35131 Padova, Italy. E-mail: bruno.golfieri@unipd.it

18512. Grotz, N.; Roß-Nickoll, M.; Schneider, S. (2018): Der Einfluss von Alter, Struktur und Umweltparametern auf Stillgewässer und ihre Besiedlung durch Amphibien und Libellen im Westen und Südwesten Luxemburgs. *Bulletin de la Société des naturalistes luxembourgeois* 120: 77-106. (in German, with English summary) ["Amphibians are among the most endangered animal classes worldwide. One of the major causes for their decline, besides various diseases, is the disappearance and deterioration of their aquatic habitats. To replace at least some of the lost habitats and to maintain and increase amphibian populations, nature conservation organisations create new semi natural ponds in Luxembourg. The aim of the following study was to evaluate the colonization process of ponds of various ages by amphibians as well as other species and to test for a number of variables that may influence colonization and could be important factors to help improve the design and choice of future ponds. The 36 study ponds were situated in the south-western and western parts of Luxembourg. At each site, a survey of the vegetation, amphibians and dragonflies was undertaken. Furthermore, a number of environmental parameters (e.g. age, shape, distance to nearest watercourse or forest, ...) and water analysis (pH, O₂, temperature, conductivity) were recorded and statistically tested in order to determine the parameters with the most significant influence on the colonization process of the ponds. The study shows that pond age has an effect on a number of the environmental factors. Pond age also directly influences the colonization by dragonflies. Colonization by amphibians, however, was not explained by pond age alone, which in this case seems to be only one of many factors influencing the process. For plants, a clear succession from pioneer communities to more specialized

reed communities was observed. Overall, the study shows a great heterogeneity of the ponds. The heterogeneity is reflected by the colonisation of the ponds. Because of this it is important to create new ponds of different types and especially in groups so that different succession stages are available for the various species during the time." (Authors)] Address: Grotz, Nathalie, 12, rue du puits, L-7475 Schoos, Luxembourg. E-mail: grotz.n@gmail.com

18513. Günther, A.; Heise, S.; Held, M.; Jäger, N.; Kipping, J.; Moritz, R.; Schnabel, H.; Voigt, H.; Brockhaus, T. (2018): Neue Nachweise der Zierlichen Moosjungfer *Leucorrhinia caudalis* (Charpentier 1840) in Sachsen und einige Bemerkungen zur Ökologie der Art (Odonata: Libellulidae). Entomologische Nachrichten und Berichte 62(1): 19-25. (in German, with English summary) ["New records of the Dainty White-faced Darter *Leucorrhinia caudalis* (Charpentier 1840) in Saxony with some remarks on the ecology of the species (Odonata: Libellulidae). *Leucorrhinia caudalis* was recorded in Saxony (Germany) since 2005 to 2017 at 11 locations. Most of the records are from pits and ponds in the lower parts of Northern Saxony. The presence of winter green submerged vegetation is most likely essential for successful reproduction and continuous occurrence of the species at a site. The state of submerged vegetation should therefore be considered a relevant factor during the selection of monitoring areas for the species strictly protected under the Habitats Directive." (Authors)] Address: Kipping, J., BioCart Ökologische Gutachten, Taucha/Leipzig, Germany. E-mail: biocartkipping@email.de

18514. Hajdukiewicz, H.; Wyzga, B.; Amirowicz, A.; Oglecki, P.; Radecki-Pawlik, A.; Zawiejska, J.; Mikus, P. (2018): Ecological state of a mountain river before and after a large flood: Implications for river status assessment. *Science of the Total Environment* 610–611: 244-257. (in English) ["Assessment of the ecological status of rivers is key to monitoring the achievement of the environmental goal of the EU-Water Framework Directive and the success of restoration projects. In summer of 2009 and 2010, repeated assessments of physical habitat conditions and of fish and benthic invertebrate communities were performed at low-flow conditions in 10 unmanaged and 10 channelized cross-sections of the Bia³a River, Polish Carpathians. Between the two surveys, an 80-year flood occurred, significantly affecting habitat characteristics and river communities. In unmanaged cross-sections, active channel width increased, whereas the degree of cross-sectional variation of flow velocity decreased. In channelized cross-sections, the increase in active channel width and the cross-sectional variation of flow velocity was accompanied by a decrease in bed-material grain size. Before the flood, the unmanaged cross-sections hosted 2.3 times more benthic invertebrate taxa than the channelized ones, whereas after the flood, the number of taxa they supported was so reduced that the taxonomic richness of benthic invertebrate assemblages in both cross-section types became similar. In comparison to pre-flood conditions, the abundance of fish juveniles (YOY) in unmanaged cross-sections was reduced nearly by half;

before the flood they hosted 5 times more juvenile individuals than channelized cross-sections and only twice as many after the flood. Finally, a differing assessment of flood impact on the ecological river quality was obtained with the invertebrate-based BMWP-PL index and the European Fish Index, with the former indicating a significant reduction of the quality in unmanaged cross-sections and the latter pointing to no such change. The results indicate that assessments performed before or after a major flood may yield significantly different results for the quality of abiotic and biotic elements of the river ecosystem. Final assessment should thus be based on repeated surveys to balance the effect of extreme hydrological events." (Authors) *Calopteryx*, sp., *Aeshna* sp., *Cordulegaster* sp., *Corduliidae*, *Platycnemis pennipes*] Address: Hajdukiewicz, Hanna, Inst. Nature Conservation, Polish Acad. Sciences, al. Mickiewicza 33, 32-120 Kraków, Poland. E-mail address: hajdukiewicz@iop.krakow.pl

18515. Halverson, T.G.; Gill, D.E. (2018): Annual patterns of production in a dragonfly community in western Virginia. *Banisteria* 51: 3-11. (in English) ["The number of dragonflies emerging from five mountain ponds over a four-year period was highly variable and independent for six species. Levels of adult activity were accurate indicators of relative reproductive input to the individual ponds. There was a general lack of concordance between reproductive input and subsequent adult emergence at a pond for three of four species studied, demonstrating the existence of differential egg or larval survival among ponds and years. Emergence and subsequent adult activity were not correlated for two of four species, indicating the existence of among-pond variability in factors affecting adult distributions. *Plathemis lydia* exhibited spatially and temporally stable populations and significant correlations between reproductive input and emergence, and between emergence and subsequent adult activity." (Authors)] Address: Halverson, T.G., Dept Zoology, Univ. of Maryland, College Park, Maryland 20742, USA

18516. Haubrock, P.J.; Balzani, P.; Johovic, I.; Inghilesi, A.F.; Nocita, A.; Tricarico, E. (2018): The diet of the alien channel catfish *Ictalurus punctatus* in the River Arno (Central Italy). *Aquatic Invasions* 13(4): 575-585. (in English) ["The North American channel catfish *Ictalurus punctatus* has been widely introduced to Europe, but no in-depth studies on its ecology and potential impacts in the introduced European range have been carried out. In 2016, 248 specimens of *I. punctatus* were collected from the Arno river, Florence (Central Italy), and analysed for their length, weight, size, sex, and stomach contents to assess their diet. Specimens < 30 cm total length (TL) represented the majority of the sampled population. Detritus and phytoplankton dominated the diet, while in larger fish (≥ 30 cm TL) two invasive alien species, the topmouth gudgeon *Pseudorasbora parva* and the red swamp crayfish *Procambarus clarkii*, were dominant prey items. Diet composition of *I. punctatus* significantly varied among size classes, but not between sexes. The results indicate an opportunistic but gape size limited feeding behaviour, suggesting an intra-specific competition avoidance mechanism." (Authors) The diet includes "Odonata".]

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18517. Hefler, C.; Qiu, H.; Shyy, W. (2018): Aerodynamic characteristics along the wing span of a dragonfly *Pantala flavescens*. *Journal of Experimental Biology* 221 (19): jeb-171199: 14 pp. (in English) ["We investigate the characteristics of inter-wing aerodynamic interactions across the span of the high-aspect-ratio, flexible wings of dragonflies under tethered and free-flying conditions. The effects of the interactions on the hindwings vary across four spanwise regions. (I) Close to the wing root, a trailing-edge vortex (TEV) is formed by each stroke, while the formation of a leading-edge vortex (LEV) is limited by the short translational distance of the hindwing and suppressed by the forewing-induced flow. (II) In the region away from the wing root but not quite up to midspan, the formation of the hindwing LEV is influenced by that of the forewing LEV. This vortex synergy can increase the circulation of the hindwing LEV in the corresponding cross-section by 22% versus that the hindwing in isolation. (III) The region about half way between the wing root and wing tip is there is a transition dominated by downwash from the forewing resulting in flow attached to the hindwing. (IV) An LEV is developed in the remaining, outer region of the wing at the end of a stroke when the hindwing captures the vortex shed by the forewing. The interaction effects depend not only on the wing phasing, but also the flapping offset and flight direction. The aerodynamics of the hindwings vary substantially from the wing root to the wing tip. For a given phasing, this spanwise variation in the aerodynamics can be exploited in the design of artificial wings to achieve greater agility and higher efficiency." (Authors)] Address: Qiu, H., Dept of Mechanical & Aerospace Engineering, The Hong Kong Univ. Science & Technology, Clear Water Bay, Kowloon, Hong Kong SAR, China. E-mail: meqiu@ust.hk

18518. Heinloth, T.; Uhlhorn, J.; Wernet, M.F. (2018): Insect responses to linearly polarized reflections: Orphan behaviors without neural circuits. *Front. Cell. Neurosci.* | doi: 10.3389/fncel.2018.00050 : 13 pp. (in English) ["The e-vector orientation of linearly polarized light represents an important visual stimulus for many insects. Especially the detection of polarized skylight by a growing number of many navigating insect species is known to improve their orientation skills. While great progress has been made towards describing both the anatomy and function of neural circuit elements mediating behaviors related to navigation, relatively little is known about how insects perceive non-celestial polarized light stimuli, like reflections off water, leaves, or shiny body surfaces. Work on different species suggests that these behaviors are not mediated by the 'Dorsal Rim Area', a specialized region in the dorsal periphery of the adult compound eye, where ommatidia contain highly polarization-sensitive photoreceptor cells whose receptive fields point towards the sky. So far, only few cases of polarization-sensitive photoreceptors have been described in the ventral periphery of the insect retina. Furthermore, both the structure and function of those neural circuits connecting to these

photoreceptor inputs remain largely uncharacterized. Here we review the known data on non-celestial polarization vision from different insect species (dragonflies, butterflies, beetles, bugs, and flies) and present three well-characterized examples for functionally specialized non-DRA detectors from different insects that seem perfectly suited for mediating such behaviors. Finally, using recent advances from circuit dissection in *Drosophila melanogaster*, we discuss what types of potential candidate neurons could be involved in forming the underlying neural circuitry mediating non-celestial polarization vision." (Authors)] Address: Wernet, M.F.; Freie Universität Berlin, Biology, Fachbereich Biologie, Chemie & Pharmazie, Koenigin-Luise Str. 1-3, Berlin, 14195, Berlin, Germany. E-mail: mathias.wernet@fu-berlin.de

18519. Holtmann, L.; Juchem, M.; Brüggeshemke, J.; Möhlmeier, A.; Fartmann, T. (2018): Stormwater ponds promote dragonfly (Odonata) species richness and density in urban areas. *Ecological Engineering* 118: 1-11. (in English) ["Highlights: •Determine the importance of stormwater ponds for dragonflies in urban areas. •Strong differences in environmental conditions between stormwater and control ponds. •Overall species richness greater at stormwater ponds than at control ponds. •Higher species richness and densities of threatened species. •High habitat quality of stormwater ponds compensated for low landscape quality. Abstract: The loss of global biodiversity is one of the major challenges of our time and urbanisation is seen as a main cause of this. The aim of this study was to determine whether artificial stormwater ponds, designed to control water flow, can act as refuges for Odonata in urban areas. Moreover, we analysed the influence of habitat and landscape quality on dragonfly species richness and density of 35 stormwater ponds (STOPON) in comparison to 35 control ponds (CONTROL). Our study revealed significant differences in environmental conditions between STOPON and CONTROL. At the habitat level, STOPON were larger, had a warmer microclimate, and lower concentrations of phosphate. STOPON were predominantly situated in suburbs, while CONTROL occurred mostly in rural areas. Accordingly, at the landscape level, STOPON had greater cover of built-up area as well as a lower cover of arable land and woodland. In line with this, the dragonfly assemblages at STOPON and CONTROL differed. Overall species richness was greater at STOPON than at CONTROL, and indicator species were only identified for STOPON. Especially threatened species benefited from STOPON, having higher species richness as well as higher adult and exuviae densities than CONTROL. In conclusion, our study shows that stormwater ponds in urban areas play an important role in the conservation of dragonflies in general and threatened species in particular. At STOPON, as a result of regular management, the habitat quality was high and compensated for the low landscape quality stemming from significant urbanisation effects." (Authors)] Address: Joltmann, Lisa, Dept Biodiversity & Landscape Ecology, Osnabrück Univ., Barbarastr. 11, 49076 Osnabrück, Germany. E-mail address: liholtmann@uni-osnabrueck.de

18520. Honckar, H. Yu.; Verves, Yu. G.; Gaponova, L. P.;

Dubrovskiy, Yu. V.; Koniakiu, S. M.; Kostenko, O. G.; Kotenko, A. G.; Kumpanenko, O. S.; Stukaliuk, S. V. (2018): Preliminary list of invertebrates of the local landscape 'Theophania'. The Kharkov Entomol. Soc. 26(1): 11-49. (in Ukrainian, with Russian and English summaries) ["An annotated list of the 509 species of invertebrates known to occur on territory of the local landscape 'Theophania' and its park zone is provided. The list includes 9 species of ciliate (Ciliophora), 20 species of flatworms (Platyhelminthes), 10 species of mollusks (Mollusca), and 470 species of arthropods, of them 29 species of crustaceans and 441 species of insects. The most species-rich insect orders of the boundary are Hymenoptera (214 species), Diptera (117 species), Lepidoptera (54 species), and Coleoptera (32 species). Some characteristics (habitat, area of distribution within the local landscape boundaries) are given for each species. For the territory of the local landscape 'Theophania' 12 species of insects, included in the 'Red Book of Ukraine', were recorded: *Calopteryx virgo*, *Anax imperator*, ..."] (Authors)] Address: not stated

18521. Hossie, T.J.; MacFarlane, S.; Clement, A.; Murray, D.L. (2018): Threat of predation alters aggressive interactions among spotted salamander (*Ambystoma maculatum*) larvae. *Ecology and Evolution* 8(6): 3131-3138. (in English) ["Intraspecific aggression represents a major source of mortality for many animals and is often experienced alongside the threat of predation. The presence of predators can strongly influence ecological systems both directly by consuming prey and indirectly by altering prey behavior or habitat use. As such, the threat of attack by higher level predators may strongly influence agonistic interactions among conspecifics via non-consumptive (e.g., behaviorally mediated) predator effects. We sought to investigate these interactions experimentally using larval salamanders (*Ambystoma maculatum*) as prey and dragonfly nymphs (*Anax junius*) as predators. Specifically, we quantified salamander behavioral responses to perceived predation risk (PPR) from dragonfly nymphs and determined the degree to which PPR influenced intraspecific aggression (i.e., intraspecific biting and cannibalism) among prey. This included examining the effects of predator exposure on the magnitude of intraspecific biting (i.e., extent of tail damage) and the resulting change in performance (i.e., burst swim speed). Salamander larvae responded to PPR by reducing activity and feeding, but did not increase refuge use. Predator exposure did not significantly influence overall survival; however, the pattern of survival differed among treatments. Larvae exposed to PPR experienced less tail damage from conspecifics, and maximum burst swim speed declined as tail damage became more extensive. Thus, escape ability was more strongly compromised by intraspecific aggression occurring in the absence of predation risk. We conclude that multitrophic indirect effects may importantly modulate intraspecific aggression and should be considered when evaluating the effects of intraspecific competition."] (Authors)] Address: Hossie, T.J., Dept Biol., Trent Univ., Peterborough, ON, Canada. Email: thossie@trentu.ca

18522. Huang, D.; Cai, C.; Nel, A. (2018): New damsel-

dragonflies with "calopterygid"-like wing shape from the Middle Jurassic of China (Odonata: Isophlebioidea: Camptero-phlebiidae). *Geobios* 51(3): 181-186. (in English) ["The new damsel-dragonflies *Zygokaratawia incompleta* nov. sp. and *Parazygokaratawia azari* nov. gen., nov. sp., closely related to the camptero-phlebiid genus *Zygokaratawia*, are described from the Middle Jurassic locality of the Daohugou and Chentaizi villages, respectively (Ningcheng County, Inner Mongolia, NE China). *Parazygokaratawia* nov. gen. and *Zygokaratawia* share a narrowly reduced cubito-anal area, unique synapomorphy in the Isophlebioptera. Camptero-phlebiids with this character are only known from the Daohugou biota."] (Authors)] Address: Nel, A., Lab. Ent. Mus. Natn. Hist. Nat., 45 rue Buffon, 75005 Paris, France. Email: anel@cimrs1.mnhn.fr

18523. Husson, S.J.; Limin, S.H.; Adul, Boyd, N.S.; Brousseau, J.J.; Collier, S.; Cheyne, S.M.; D'Arcy, L.J.; Dow, R.A.; Dowds, N.W.; Dragiewicz, M.L.; Ehlers Smith, D.A.; Iwan, Hendri; Houlihan, P.R.; Jeffers, K.A.; Jarrett, B.J.M.; Kulu, I.P.; Morrogh-Bernard, H.C.; Page, S.E.; Perlett, E.D.; Purwanto, A.; Ripoll Capilla, B.; Salahuddin; Santiano; Schreven, S.J.J.; Struebig, M.J.; Thornton, S.A.; Tremlett, C.; Yeen, Z.; Harrison, M.E. (2018): Biodiversity of the Sebangau tropical peat swamp forest, Indonesian Borneo. *Mires and Peat* 22, Article 05: 1-50. (in English) ["The importance of Southeast Asia's tropical peat swamp forests for biodiversity is becoming increasingly recognised. Information on species presence within peatland areas is scant, however, limiting our ability to develop species conservation strategies and monitor responses to human activities. We compile species presence records for the Sebangau forest in Indonesian Borneo since 1993 and present the most complete Bornean PSF biodiversity inventory yet published. Including morpho-species that are likely to represent true species, this list comprises 215 tree, 92 non-tree flora, 73 ant, 66 butterfly, 297 spider, 41 Odonata, 55 fish, 11 amphibian, 46 reptile, 172 bird and 65 mammal taxa. Of these, 46 species are globally threatened and 59 are currently protected in Indonesia; 22 vertebrate species are Borneo endemics. Because our sampling is both biased and incomplete, the true number of species found at this site is likely to be much higher. Little is known about many of these taxa in Sebangau and peat swamp forests elsewhere. Many of these species are considered forest dependent, and the entire community is expected to be important for maintaining the resilience of the peat swamp forest ecosystem and the environmental services that it provides. This highlights the need for urgent conservation of Sebangau and its diverse biological community."] (Authors)] Address: Dow, R.A., 6 Bramley Av., Coulsdon, Surrey, CR5 2DP, UK. E-mail: rory.dow@virgin.net

18524. Ilich Mauseth, M (2018): Designs for dragonflies: Odonata diversity in Oslo, Norway. M.Sc. thesis, Science in Ecology, Environmental Sciences and Natural Resource Management, Norwegian University of Life Sciences, Ås : 94 pp. (in English) ["This study establishes that Odonata breed in freshwater habitats in the Oslo urban region. It also identifies elements that could be adjusted to support greater Odonata diversity in the municipality. This was grounded in

an awareness of the species conservation potential of cities, the "flagship" status of dragonflies as a species group, and a desire to enhance the quality of wildlife experiences of urban dwellers. It includes both pond habitat variables and human behaviour. An index tool was developed to evaluate the habitat variables of the surveyed ponds, and statistical analysis was conducted to ascertain if there was a correlation between habitat quality scores, and the presence of Odonata larvae." (Author)] Address: not stated

18525. Islam, S.U.; Qasim, M.; Ali, H.; Islam, W.; Arif, M.; Dash, C.K.; Lin, W.; Du, Z.; Wu, Z. (2018): Genetic diversity of the families Aeshnidae, Gomphidae and Libellulidae through COI gene from South China. *Acta Tropica* 185: 273-279. (in English) ["Highlights: • The present study had covered the region of South-China, which presented 16 species from three families. • Cytochrome oxidase subunit I (COI) was used to identify all species. • Trithemis genus presented maximum genetic divergence (18.69%) from all collected samples. • Maximum diversity was recorded from the sequences of Orthetrum genus. • Trithemis genus was dominated in the entire collection, with 28 sequences. Abstract: Adult dragonflies (Anisoptera) were collected from different localities of South China covering eight provinces. Representative sequences were sixty-one, including 16 species, 11 genera and three families (Aeshnidae, Gomphidae and Libellulidae), under cytochrome oxidase subunit I (COI) gene. After alignment of sequences by BioEdit v6, genetic interaction and divergence were computed by MEGA 7 whereas all the indices of genetic diversity were calculated by DnaSP v5 software. Phylogenetic trees were constructed through Neighbor-Joining method under Jukes-Cantor model, and all species of respective families were assembled with each other into individual groups. Maximum divergence was observed by Trithemis genus (18.69%), followed by Orthetrum genus (18.16%), whereas a minimum value of divergence was noted for Pantala genus (0.31%). On the other hand, maximum genetic diversity was recorded for Orthetrum genus up to 142 mutations, followed by Trithemis genus (126 mutations), while the minimum value (two mutations) was observed for Pantala genus. Genetic diversity for overall and Libellulidae family sequences was much higher, up to 404 mutations and 344 mutations, respectively. Current results suggest a high diversity of odonates in the South China region and results are valuable in gaining a total obligation of the diversity of Asian odonates and conservation measures of this insect group." (Authors)] Address: Islam, S.U., State Key Lab. of Ecol. Pest Control for Fujian & Taiwan Crops, Fuzhou, China

18526. Jankowska, B. (2018): Pierwsze stwierdzenie *Somatochlora alpestris* (Selys, 1840) (Odonata: Corduliidae) w Pieninach - First record of *S. alpestris* in Pieniny Mountains. *Odonatrix* 144 (2018): 2 pp. (in Polish, with English summary) ["One hunting imago of *S. alpestris* was observed on 10.07.2016 in the Szopczański Ravine (S Poland, Pieniny Mts., Pieniński National Park, UTM: DV57). It is the first record of this sp. in this mountain range. There are no habitats suitable for *S. alpestris* in this region that is why the observed specimen probably came from another area. Tatra Mts.

and their foot-hills are the most likely sources of the population of that species." (Author)] Address: Jankowska, Bogusława, ul. Przyjemna 8/1, 40-470 Katowice, Poland. E-mail: berta01@interia.pl

18527. Jinguji, H.; Ohtsu, K.; Ueda, T.; Goka, K. (2018): Effects of short-term, sublethal fipronil and its metabolite on dragonfly feeding activity. *PLoS ONE* 13(7): e0200299. 22 pp. (in English) ["Dragonflies, *Sympetrum* spp., are indispensable to agriculture and are a central element of culture in Japan. However, *S. frequens* populations in rice paddy fields have declined in recent decades. Dragonfly larvae are predatory aquatic insects that feed on other organisms found in habitats with slow-moving or standing water. The increasing use of fipronil and neonicotinoid insecticides in agriculture is also increasing exposure to *Sympetrum* spp. in larval stages through paddy soil and water. The role of fipronil insecticides in the decline of dragonflies is of concern, and we here examine the sublethal effects of this insecticide on the feeding behaviors of two *Sympetrum* spp. Based on the quantity of prey items consumed and the time to capture prey items, feeding inhibition was determined to be a potential mechanism of the decline of *Sympetrum* spp. following 48-h exposure to fipronil and fipronil sulfone. Prey consumption by *S. infuscatum* was significantly reduced for fipronil sulfone at all concentrations (0.01–1000 µg/L). *S. frequens* exposed to 1, 10, 100 and 1000 µg/L fipronil sulfone had significantly longer prey capture times. Fipronil sulfone was 2.8, 9.7 and 10.5 times more toxic to *S. infuscatum* than fipronil in terms of acute toxicity, feeding inhibition and delayed toxicity, respectively. In addition, fipronil sulfone was 6.6, 2.9 and 9.1 times more toxic, respectively, to *S. frequens* than fipronil. Our findings suggest that sublethal effects on feeding inhibition lead to severe mortality at realistic paddy soil and water concentrations. Our results provide the first demonstration that short-term exposure to fipronil and fipronil sulfone can consequently cause significant harm to dragonfly larvae survival due to feeding inhibition. These findings have implications for current pesticide risk assessment and dragonfly protection." (Authors)] Address: Jinguji, H., School of Food, Agricultural and Environmental Sciences, Miyagi University, Sendai, Miyagi, Japan. E-mail: Jinguji@myu.ac.jp

18528. Karlsson, T. (2018): Grön flodtrollsända *Ophiogomphus cecilia* i Pite älv – inventering inom biogeografisk uppföljning 2018. Länsstyrelsen Östergötland, rapport 2018:13: 30 pp. (in Swedish, with English summary) ["The member countries in the European Union are obliged to report the conservation status for species listed in the Habitat directive every 6th year. To gather information about population sizes and trends for the species in Sweden, the County Administrative Board of Östergötland has been assigned by the Swedish Environmental Protection Agency to coordinate monitoring of dragonflies (Odonata) and diving beetles (Dytiscidae) listed in the Habitat directive in Sweden. This report presents a survey of *O. cecilia* in the river Piteälven. *O. cecilia* is in Sweden restricted to a few rivers in the very northeastern part. It is red listed as "Near threatened" in Sweden due to small distribution area. *O. cecilia* was searched

for as exuviae and imago at 17 localities in Piteälven from the river mouth and 100 km upstream. The survey was performed during the period 1-2 August 2018. The species could for the first time ever be found in Piteälven. Exuviae of the species were observed at five localities between Sikfors in the south and Vidsel in the north. No imago were observed despite sunny and very warm weather. The survey demonstrates that searching for exuviae is the best method for detecting the species in Sweden. The difficulty to observe imagos of the species indicates that it has a wider distribution in Sweden than previously known. Some of the surveyed localities in Piteälven should be monitored continuously. The distribution in northern Sweden of other species in the family Gomphidae was studied. *Gomphus vulgatissimus* is not recorded in this area, while there are five records of *Onychogomphus forcipatus* as larvae. Furthermore, *O. forcipatus* is reported from the province Norrbotten in some literature. Four of records have been checked out, but showed to be misidentified larvae. The occurrence of *O. forcipatus* in Norrbotten could neither be confirmed nor denied." (Author)] Address: Karlsson, T., Opphems-gatan 2, 58237 Linköping, Sweden. E-mail: tommy.karlsson@e.lst.se

18529. Karlsson, T. (2018): Biogeografisk uppföljning av grön mosaikslända *Aeshna viridis* – inventering och metodiktest 2017. Report, Swedish Environmental Protection Agency: 14 pp. (in Swedish, with English summary) ["The member countries in the European Union are obliged to report the conservation status for species listed in the Habitat directive every 6th year. To gather information about population sizes and trends for the species in Sweden, the Swedish Environmental Protection Agency funds "Biogeographical monitoring". The County Administrative Board of Östergötland has been assigned to coordinate the biogeographical monitoring of Odonata and diving beetles (Dytiscidae) listed in the Habitat directive in Sweden. This report aims to function as a basis document for a national monitoring programme for the dragonfly *Aeshna viridis*. The species is mainly restricted to waters with the plant *Stratiotes aloides*, where it lays its eggs and where the larvae lives. It is red listed as "Near threatened" at the European and EU-level, and listed in the annex 4 in the Habitat directive. In Sweden it is red listed as "Least concerned", but is considered to have unfavourable conservation status. During 2017 a survey was performed which aimed to test netting for larvae as survey method and to search for the species at new potential sites. The species was surveyed at 20 sites with *S. aloides* along the northern Baltic coast and in the middle east Sweden. *A. viridis* was found at nine localities of which five were previously unknown. One of these is of special interest since it together with other recent observations indicates that the species have a wider distribution in northern Sweden than previously known. The survey shows that netting for larvae is an appropriate method for monitoring *A. viridis* in Sweden. The larva is quite easy to identify and big advantages with surveying larvae compared to adults is that it is not dependent of the weather and that records of larvae confirm reproduction of the species. A suitable sample design for biogeographical monitoring of *A. viridis* in Sweden would be to

select a number of localities from a previous study of the species (Anderson et. al. 2016) and survey these once every 6 year-period." (Author)] Address: Karlsson, T., Opphems-gatan 2, 58237 Linköping, Sweden. E-mail: tommy.karlsson@e.lst.se

18530. Kassner, Z.; Ribak, G. (2018): Role of side-slip flight in target pursuit: blue-tailed damselflies (*Ischnura elegans*) avoid body rotation while approaching a moving perch. *Journal of Comparative Physiology A* 204(6): 561-577. (in English) ["Visually guided flight control requires processing changes in the visual panorama (optic-flow) resulting from self-movement relative to stationary objects, as well as from moving objects passing through the field of view. We studied the ability of the blue-tailed damselfly, *Ischnura elegans*, to successfully land on a perch moving unpredictably. We tracked the insects landing on a vertical pole moved linearly 6 cm back and forth with sinusoidal changes in velocity. When the moving perch changed direction at frequencies higher than 1 Hz, the damselflies engaged in manoeuvres that typically involved sideways flight, with minimal changes in body orientation relative to the stationary environment. We show that these flight manoeuvres attempted to fix the target in the centre of the field of view when flying in any direction while keeping body rotation changes about the yaw axis to the minimum. We propose that this pursuit strategy allows the insect to obtain reliable information on self and target motion relative to the stationary environment from the translational optic-flow, while minimizing interference from the rotational optic-flow. The ability of damselflies to fly in any direction, irrespective of body orientation, underlines the superb flight control of these aerial predators." (Authors)] Address: Ribak, Gal, 2. Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

18531. Khelifa, R.; Zebba, R. (2018): Rediscovery of the regionally critically endangered dragonfly *Lindenia tetraphylla* in Northeast Algeria after 170 years of apparent absence (Odonata: Gomphidae). *Notulae odonatologicae* 9(2): 50-54. (in English) ["In 2018 we rediscovered *L. tetraphylla* in the El Kala National Park, Northeast Algeria, after 170 years with no record. A total of ten individuals were observed in the Ramsar listed Lac Noir along with dense populations of the regionally threatened *Urothemis edwardsii* and *Acisoma inflatum*. These findings suggest that Lac Noir, which suffered from major fire almost 30 years ago, has relatively recovered." (Authors)] Address: Rassim Khelifa, R. Dept of Evolutionary Biology & Environmental Studies, University of Zürich, Winterthurerstr. 190, 8057 Zürich, Switzerland. E-Mail: rassimkhefifa@gmail.com

18532. Kipping, J.; Petzold, f., Ngoulou, C. (2018): Dragonfly and damselfly (Insects: Odonata) inventory of the Réserve Naturelle des Gorilles de Lésio-Louna (RNGLL) on the Bataké Plateau in the Republic of Congo. *International Dragonfly Fund-Report* 126: 1-36. (in English, with French summary) [We present records of 99 Odonata species from the Réserve Naturelle des Gorilles de Lésio-Louna (RNGLL) in the Republic of Congo (Congo-Brazzaville) collected during

a short survey from 14 January to 01 February 2017. It is the first systematic Odonata inventory for the RNgLL and for the Congolese part of the species-rich Batéké Plateau. A short introduction is given about the existing knowledge of dragonflies and damselflies from the country. Amongst the recorded species eight are new for the country list, raising it to at least 208 species. Some of the recorded species are endemic and characteristic for sandy streams and rivers of the Batéké Plateau. The potential diversity of the plateau in comparison to other regions of the country is discussed." (Authors)] Address: Kipping, J., BioCart Ökologische Gutachten, Albrecht-Dürer-Weg 8, 04425 Taucha/Leipzig, Germany. E-mail: biocartkippping@web.de

18533. Kisa Mencütekýn, Y.; Hacet, N. (2018): Diversity and distribution of Odonates of the Meriç delta wetland in Turkish Thrace, with a new record for the region. *J. Entomol. Res. Soc.* 20(3): 105-115. (in English) ["This study was performed in the Meriç Delta located in the Edirne province of the Turkish Thrace Region in order to reveal the diversity and distributions of odonates in the delta wetlands. Samplings were performed from spring to autumn in 2014 and 2015 in different wetland localities represented by lagoons, lakes and a river. A total of 30 Odonata species were recorded during the study, of which *Libellula quadrimaculata* is a new record for both the study area and Turkish Thrace. In addition, *Calopteryx splendens*, *Lestes dryas*, *L. macrostigma*, *Coenagrion puella*, *C. pulchellum*, *C. scitulum*, *Enallagma cyathigerum*, *Ischnura pumilio*, *Aeshna affinis*, *A. isocetes*, *Anax imperator*, *Lindenia tetraphylla*, *Libellula depressa*, *L. fulva*, *Orthetrum brunneum* and *Sympetrum meridionale* are the species determined to be new records for the Meriç Delta wetland. While the Odonata fauna of the Meriç Delta was represented so far by 14 species, this number increased to 31 with the addition of 17 new species during this study. The diversity of the Odonata species recorded in the delta and their conservation categories according to the Red List criteria of the World Conservation Union (IUCN) are also considered." (Authors)] Address: Kisa Mencütekýn, Yurdagül, Dept of Biology, Fac. Science, Trakya Univ., 22030 Edirne, Turkey. E-mail: yurda_gul52@hotmail.com

18534. Klostermann, L. (2018): Kartierung von Libellen und Entwicklung eines Pflegekonzeptes zur optimalen Lebensraumentwicklung der neu angelegten Gewässer auf der Fläche der Deichrückverlegung Langenlonsheim. Mapping of dragonflies and elaboration of a management concept for optimal habitat development of the new created water bodies on the area of the dike relocating Langenlonsheim. BSc. thesis, Department 1 – Life Sciences & Engineering, Univ. of Applied Sciences Bingen: 92 pp. (in German, with English summary) ["In the course of flood protection on the Nahe river, a retention area was created 3 years ago on a former arable land as part of the dike relocating Langenlonsheim. New water bodies were created in order to promote habitat connectivity. The paper presented deals with the dragonfly colonisation of these waters. Small waters were completely scanned for dragonflies and their exuvias while larger ones were mapped by transects. The occurring dragonfly species and

their number of individuals were gathered by abundance classes. The investigations showed that all water bodies were populated by dragonflies. Silt up waters showed less numbers of individuals as waters of earlier successional stages. A high diversity of differently structured water bodies benefits a high diversity of dragonfly species, including species classified as near-threatened. Based on the habitat requirements of the occurring endangered dragonfly species, a management concept was developed for all water bodies. This includes the restoration of earlier successional stages as well as the creation of periodically water-bearing areas." (Author)] Address: Klostermann, Lisa, Rheinstr. 16, 55424 Münster-Sarmsheim, German

18535. Kömer, A.; Rieckh, C.; Holzinger, W.E. (2018): Die Vogelazurjungfer (*Coenagrion ornatum*) am Laabach (Grazer Feld, Steiermark): Bestandsgröße und Biologie einer EU-geschützten Libellenart. *Entomologica Austriaca* 25: 145-155. (in German) [The Laabach is an approx. 9.4 km long stream in the southern Graz field. It is the site of what is probably Austria's most important occurrence of the protected European species *C. ornatum*. As part of a Master's thesis, data on the biology of the species was collected at this water body in early summer 2017 and the population size was estimated. For this purpose, selected stretches of the watercourse were walked in a two-day rhythm from 11 May to 17 July and all individuals of *C. ornatum* encountered were individually marked and recorded. In addition, data on diurnal activity at the watercourse were recorded. In total, about 1,800 individuals were observed on 35 days and 732 individuals (538 males, 194 females) were marked. The total population amounts to several thousand individuals, although only relatively short sections of the stream are more densely populated. The occurrence of the species depends largely on the water flow of the stream and the presence of submerged vegetation. The phenomena known from the literature of the very short diurnal occurrence at the breeding site and the equally short flight time of the species could be confirmed. Translated with www.DeepL.com/Translator (free version)] Address: Rieckh, Christina, Institut für Zoologie der Karl-Franzens-Univ. Graz, Universitätsplatz 2, 8010 Graz, Austria. E-Mail: christina.rieckh@edu.uni-graz.at

18536. Korkeamäki, E.; Elo, M.; Sahlén, G.; Salmela, J. (2018): Regional variations in occupancy frequency distributions patterns between odonate assemblages in Fennoscandia. *Ecosphere* 9(4) e02192. doi:10.1002/ecs2.2192: 15 pp. (in English) ["Odonate (damselfly and dragonfly) species richness and species occupancy frequency distributions (SOFD) were analysed in relation to geographical location in standing waters (lakes and ponds) in Fennoscandia, from southern Sweden to central Finland. In total, 46 dragonfly and damselfly species were recorded from 292 waterbodies. Species richness decreased to the north and increased with waterbody area in central Finland, but not in southern Finland or in Sweden. Species occupancy ranged from 1 up to 209 lakes and ponds. Over 50% of the species occurred in < 10% of the waterbodies, although this proportion decreased to the north. In the southern lakes and ponds,

none of the species occurred in all lakes, whereas in the north many species were present in all of the studied waterbodies. The dispersal ability of the species did not explain the observed species occupancy frequencies, but generalist species with a large geographical range occurred in a higher percentage of the waterbodies. At Fennoscandian scale, we found that the unimodal satellite pattern was predominant. However, at smaller scale, we found geographical variations in odonate species SOFD patterns. The most southern communities followed the unimodal satellite-dominant pattern, whereas in other regions communities fitted best with the bimodal core- satellite patterns. It seems that the richer species pool in the southern locations, and the larger distribution range of the northern species, skewed the unimodal pattern into a bimodal satellite dominant pattern." (Authors)] Address: Korkeamäki, E., Karkunkatu 18 a 4 b, FIN-48600 Karhula, Finland.

18537. Kosterin, O.E.; Chartier, G. (2018): More Odonata found at the Cardamonean foothills in Koh Kong Province of Cambodia in 2014-2018. IDF-Report 123: 1-21. (in English) ["Still unpublished data on Odonata of the coastal foothills of the Cardamom Mts. in Koh Kong Province, SW Cambodia obtained in 2014-2018 are provided. *Tetrathemis flavescens* Kirby, 1889 is for the first time reported for Cambodia and *Risiphlebia guentheri* Kosterin, 2015 for SW Cambodia. The photographic records from this area of *Gynacantha basiguttata* Selys, 1882, *Gynacantha demeter* Ris, 1911, *Heliaeschna crassa* Krüger, 1899, *Amphithemis curvistyla* Selys, 1891 and *Pomothemis serrata* Krüger, 1902 have been confirmed by specimens. The known local faunas of two neighbouring rivulets in Koh Kong Province, rich in Odonata, are updated and summarised." (Authors)] Address: Chartier, G., Koh Andet Village, Tatai Commune, Koh Kong Province, Cambodia. Email: gee@tataiwildlife.info

18538. Langbroek, M. (2018): A new record of the damselfly *Palaiargia ernstmayri* (Odonata: Platycnemididae) in the Arfak mountains of New Guinea. *Notulae odonatologicae* 9(1): 1-5. (in English) ["This contribution reports and photographically documents a sighting of the little known damselfly *Palaiargia ernstmayri*. A mature male was seen and photographed by the author on 31-vii-2016 in the Arfak Mountains of Western New Guinea, Indonesia. To the author's knowledge this is only the fourth reported sighting of the species, and the second since its formal description by Lieftinck in 1972. All four reports since 1928 come from a 50 by 25 km area in the northeastern part of the Arfak mountains." (Author)] Address: Langbroek, M., Zusterhof 12, 2311 RK Leiden, the Netherlands; libellen@langbroek.org

18539. Lhundup, K.; Dorji, U. (2018): Macro-invertebrate diversity and its relationship with environmental variables in Adha Lake between monsoon and post-monsoon seasons. *Bhutan Journal of Natural Resources & Development* 5(1): 13-24. (in English) ["Lentic water bodies are amongst the most threatened wetland habitat types as anthropogenic disturbances have significantly influenced the structure and function of aquatic ecosystems. This study compared the

seasonal variations of macro-invertebrate diversity and analysed the physiochemical parameters to study the influence of surrounding land use on the lentic ecosystem of Adha Lake. Macro-invertebrate abundance in the lake was used as an indicator to assess the effect of surrounding land use. The lake was categorised into four major zones namely agriculture zone, forest east zone, catchment zone, and forest west zone. Sampling was carried out along the littoral zone of the lake. Physio-chemical variables were collected for both the seasons. Chironomidae and Baetidae families were the most dominant macro-invertebrates in the lake. The least families encountered were Acrididae, Aeshnidae, Tabanidae, Hydrophilidae, and Libellulidae during monsoon season, and Simuliidae and Culicidae for post-monsoon season. There was no significant difference in Shannon Wiener's Diversity Index for monsoon and post-monsoon seasons, $p > .05$. pH, salinity, conductivity, total dissolved solid, and water temperature had negative correlation with diversity and richness; however, total dissolved solid, water temperature, and pH had positive association with taxon evenness. The HKH-bios index and NHBL index indicated that the lake is polluted which could be attributed to discharge from the paddy fields. Restoration and protection of Adha Lake as White-bellied heron's habitat may need significant conservation and advocacy measures." (Author)] Address: Dorji, U., Dept Forestry, College of Natural Resources, Royal Univ. of Bhutan, Lobesa, Bhutan. E-mail: ugendojee@cnr.edu.bt

18540. Lin, C.-P.; Yang, I.H. (2018): Correlation between larger body mass, smaller wing and alternative reproductive tactics in *Psolodesmus mandarinus* damselflies. MSc. thesis, Faculty of Science, Dept of Life Sciences, Biological Agriculture, Biological Science, National Taiwan Normal University: 96 pp. (in English, with Chinese summary) ["Males of the many animal species use alternative reproductive tactics (ARTs) to obtain mating opportunity and reproductive success. In odonate species, adult males employ various genetically or conditionally based mating tactics (territoriality, non-territoriality/wandering/sneaking, or switching between the two). The evolution of different ARTs via sexual selection in recently diverged odonate species may have facilitated their speciation process. However, the relative effects of the ARTs between closely related but phenotypically divergent odonate species is poorly known. This study investigated the causes and consequences of the ARTs in two parapatrically distributed subspecies of Taiwanese *Psolodesmus mandarinus*, *P. m. mandarinus* and *P. m. dorothea*. The observations indicate that the males of both subspecies employ the same three mating tactics, including territorial, switching, and non-territorial. In *P. m. mandarinus* population of Fusan, an increase in body mass and decrease in hindwing area is associated with an increase in territoriality. Compared to non-territorial males, territorial and switching *P. m. mandarinus* males have higher mating opportunity (i.e. to engage in at least one mating). However, only switching but not territorial *P. m. mandarinus* males have higher mating success than non-territorial males. In contrast, none of the body size indicators are associated with territoriality in *P. m. dorothea* population of Lianhuachi. Only the switching

but not territorial *P. m. dorothea* males had higher mating opportunity than non-territorial males. The mating tactics of *P. m. dorothea* males had no significant effect on their mating success. In both *P. mandarinus* subspecies, the switching males instead of territorial males, appear to have the highest fitness. These results suggest that the ARTs of the two *P. mandarinus* subspecies were different in their associations of morphological traits and fitness consequences, which may be due to habitat differences or observer effects." (Author)] Address: not stated

18541. Lozano, F.; Muzón, J.; Anjos-Santos, D.; Pessacq, P. (2018): Chapter 14.6. Superfamily Coenagrionoidea. Thorp and Covich's Freshwater Invertebrates (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 475-494. (in English) ["The superfamily Coenagrionoidea with approximately 170 genera and more than 1,700 species is the largest superfamily within the Zygoptera. Recent molecular studies and classificatory schemes suggest that it is composed of three families: Isostictidae, Platycnemididae, and Coenagrionidae; from these only the Coenagrionidae is represented within the Neotropics. Besides, these proposals imply the non monophyly of long recognized families such as Protoneuridae and Pseudostigmatidae which are now included within Coenagrionidae. The knowledge on Neotropical coenagrionid larvae is still very incomplete, currently it is restricted to 34 genera (48.57%) and approximately 210 species (31.81%). Few ordinal level keys exist that include larvae of Coenagrionoidea, and they are limited to certain regions or countries; this together with the fact that larval morphology is strikingly uniform makes larval identification very difficult. Here we present a key to the genera of final instar larvae of Coenagrionidae." (Authors)] Address: Pessacq, P., Laboratorio de Investigaciones en Ecología y Sistemática Animal (LIESA), Universidad Nacional de la Patagonia San Juan Bosco, Sarmiento 849, 9200 Esquel, Chubut, Argentina. E-mail: pablopessacq@yahoo.com.ar

18542. Maloney, E.M.; Liber, K.; Headley, J.V.; Peru, K.M.; Morrissey, C.A. (2018): Neonicotinoid insecticide mixtures: Evaluation of laboratory-based toxicity predictions under semi-controlled field conditions? *Environmental Pollution* 243, Part B: 1727-1739. (in English) ["Highlights: •Chronic toxicity of neonicotinoids and mixtures was evaluated for wetland insects. •Contrary to predictions, mixtures were not more toxic than single neonicotinoids. •Some neonicotinoids/mixtures had greater-than-predicted effects on emergence and biomass. •Lab-derived mixture models did not adequately predict field-based mixture effects. Abstract: Neonicotinoid insecticide mixtures are frequently detected in aquatic environments in agricultural regions. Recent laboratory studies have indicated that neonicotinoid mixtures can elicit greater-than-additive toxicity in sensitive aquatic insects (e.g. *Chironomus dilutus*). However, this has yet to be validated under field conditions. In this study, we compared the chronic (28. and 56-d) toxicity of three neonicotinoids (imidacloprid, clothianidin, and thiamethoxam) and their mixtures to natural aquatic insect communities. Using experimental in-situ enclosures (limnocorrals), we exposed wetland insects to

single-compounds and binary mixtures at equitoxic concentrations (1 Toxic Unit under the principle of Concentration Addition). We assessed the composition of all emerged insect taxa and cumulative Chironomidae emergence and biomass over time. In all treated limnocorrals there were subtle shifts in community composition, with greater proportions of emerged Trichoptera and Odonata. Cumulative emergence and biomass increased over time and there was a significant interaction between time and treatment. At 28 days, cumulative Chironomidae emergence and biomass were not significantly different between neonicotinoid treatments and controls. However, cumulative emergences in imidacloprid, clothianidin, and clothianidin-thiamethoxam treatments were 42%, 20%, and 44% lower than predicted from applied doses. At 56 days, imidacloprid, clothianidin, and the clothianidin-thiamethoxam mixture elicited significant declines in cumulative emergence and biomass. However, contrary to laboratory predictions, greater-than-additive mixture toxicity was not observed under semi-controlled field settings. Furthermore, only clothianidin significantly shifted sex-ratios towards female-dominated populations. Results showed that the responses of natural Chironomidae populations to neonicotinoids and their mixtures cannot be adequately predicted from laboratory-derived single-species models, and that reductions in Chironomidae emergence and biomass can occur at neonicotinoid concentrations below some current water quality guidelines (albeit effects may have been attenuated by occasional overdosing). Therefore, these neonicotinoid guidelines should be reviewed and amended to ensure that Chironomidae and other sensitive aquatic insects inhabiting agricultural wetlands are adequately protected." (Authors)] Address: Morrissey, C.A., School of Environment & Sustainability, Univ. of Saskatchewan, Saskatoon, Saskatchewan. Canada. E-mail: christy.morrissey@usask.ca

18543. Marques Pires, M.; Périco, E.; Renner, S.; Sahlén, G. (2018): Predicting the effects of future climate change on the distribution of an endemic damselfly (Odonata, Coenagrionidae) in subtropical South American grasslands. *Journal of Insect Conservation* 22: 303-319. (in English) ["Climate change is predicted to affect the distribution of freshwater taxa, and stronger impacts are expected on endemic species. However, the effects of future climates on freshwater insects from the Neotropical region have been generally overlooked. In this study, the distribution of *Cyanallagma bonariense* endemic to the subtropical South American grasslands (Pampa) was modelled in relation to future scenarios of high greenhouse gas emissions (RCP 8.5) for 2050 and 2070. For this purpose, ecological niche models were developed based on assumptions of limited dispersal and niche conservatism, and the projected distribution of *C. bonariense* was contrasted with the location of current protected areas (PAs) in the Pampa. A broad potential distribution of *C. bonariense* was indicated throughout the Pampa, and projections predicted a predominance of range contractions rather than range shifts in climatically suitable areas for *C. bonariense* in 2050 and 2070. Projections of suitable areas overlapped in central Argentina and southernmost Uruguay

in these periods. Our results indicated a potential resilience of *C. bonariense* to future climate change, which is likely related to the low restrictions in habitat use of *C. bonariense*. In every projection, however, most PAs were expected to lose effectiveness, as by 2070 most PAs fall outside the range of the predicted distribution of *C. bonariense*. Thus, the creation or enlargement of PAs in these areas is recommended and these results represent an important information for the conservation of endemic freshwater insects under global warming scenarios in an overlooked Neotropical landscape." (Authors)] Address: Sahlén, G., Systematic Zoology, Evolutionary Biol. Centre, Uppsala Univ., Norbyvägen 18D, 752 36 Uppsala, Sweden. E-mail: goran.sahlen@set.hh.se

18544. Marques Pires, M.M.; Stenert, C.; Maltchik, L. (2018): Drivers of beta diversity of Odonata along a forest–grassland transition in southern Brazilian coastal ponds. *Freshwater Science* 37(2): 357-366. (in English) ["Assessment of β diversity patterns in relation to environmental and spatial drivers can provide useful insights into the underlying mechanisms structuring communities (deterministic and dispersal limitation). However, the relative importance of each mechanism and driver of β diversity patterns in freshwater communities is assumed to change with ecosystem type, scale of observation, and among groups with different dispersal abilities. We assessed β diversity patterns of assemblages of odonate larvae in relation to geographical distances and scale-specific environmental drivers in southern Brazilian coastal ponds along a latitudinal gradient. We expected to find similar contributions of deterministic and dispersal limitation mechanisms to odonate assemblages and distinct patterns of β diversity between suborders Anisoptera and Zygoptera. We found low values of β diversity (probably related to distribution of generalist taxa and environmental conditions constituted by temporary ponds). Mantel and partial Mantel tests detected distinct relationships between dissimilarity in scale-specific drivers and geographical distances with β diversity of Odonata. Zygoptera was influenced by dissimilarity in local. (presence of riparian vegetation and connectivity) and regional-level (climate) variables, whereas Anisoptera was influenced by geographical distances. Our results supported our hypothesis that changes in the composition of assemblages of odonate larvae in temporary ponds were jointly driven by deterministic and dispersal limitation mechanisms. Furthermore, the similar contributions of nestedness and replacement components and the differing responses of Anisoptera and Zygoptera to local. and regional-level environmental drivers and geographical distances indicate that the relative importance of environmental and spatial drivers to β diversity patterns in ponds is scale-specific." (Authors)] Address: Marques Pires, M., Lab. Ecology & Conservation of Aquatic Ecosystems, Unisinos, Av. Unisinos, 950, 93.022-750 São Leopoldo, Rio Grande do Sul, Brazil. E-mail: marquespiresm@gmail.com

18545. Martínez-López, J.I.; Villeda-Callejas, M.; Lara-Vázquez, J.A.; Guedea-Fernandez, D.; Cervantes-Zamudio, O. (2018): Histology of the compound eyes of *Sympetrum illotum* (Hages, 1861) (Anisoptera: Libellulidae). *Entomologia*

mexicana 5: 552-558. (in Spanish, with English summary) ["The odonates are great air-ground predators, their vision presents a high spatial resolution due to their compound eyes which are highly developed, formed by approximately 30,000 ommatidia; these photoreceptors are able to adjust the changes in the visual scene. The objective of the present work was to describe the compound eyes of *Sympetrum illotum* at histological level. Histological technique was performed staining with hematoxylin-eosin and silver; for its observation phase contrast microscope was used with green and blue filters. Histologically it was found that the compound eyes have a wide cornea, the crystalline cones are of similar size and homogeneous arrangement, broad basal membrane and under this one tracheas of different diameter are observed. The use of the blue filter in phase contrast microscopy highlights the hematoxylin-eosin stain better." (Authors)] Address: Villeda-Callejas, Maria, Laboratorio de Microscopía. FES Iztacala UNAM. Av. de los Barrios #1, Los Reyes Iztacala, Tlalnepantla, Edo. de México. México C.P. 54090. E-mail: mapili_villeda@yahoo.com.mx

18546. Maynou, X.; Martín, R. (2018): Timing of adult emergence and flight periods of the Odonata of the Gallecs Rural Area (Barcelona, Catalonia, NE Spain). *Boletín de la Sociedad Entomológica Aragonesa (S.E.A.)* 62: 235-242. (in English, with Spanish summary) ["This article presents the results of a field study carried out in the Gallecs Rural Area (Barcelona, Catalonia, NE Spain) in 2015 in order to determine the emergence and flight periods of the dragonflies inhabiting a group of four small permanent and temporary man-made ponds set up through an amphibian breeding habitat project. In total fifteen taxa were recorded, most of which are common and well distributed throughout the Iberian territory. Exuviae collection provided valuable information on their life cycle, voltinism and sex ratios at emergence. In general, biotope characteristics influenced the timing of emergence and the composition of larval and adult communities, which differed between ponds, although less markedly in the case of the latter. There were also within-pond differences between larval and adult assemblages. While exuviae collection provided accurate information on the taxa breeding at each pond, records of adults reflected the diversity and composition of species at a broader landscape level due to dispersal movements between ponds." (Authors)] Address: Martín, R., Martí Julià, 19-23, 08911 Badalona, Spain. ricardo.martin@cllicenciats.cat

18547. Mendonça, F.Z.; Bernardy, J.V.; Oliveira, C.E.K.; Oliveira, P.B.G.; De Marco, P. (2018): Temperature effect on the development of tropical dragonfly eggs. *Neotropical Entomology* 47: 484-491. (in English) ["Physiological constraints in insects are related to several large-scale processes such as species distribution and thermal adaptation. Here, we fill an important gap in ecophysiology knowledge by accessing the relationship between temperature and embryonic development time in four dragonfly species. We evaluated two questions (1) what is the effect of temperature on the development time of Odonata eggs, and (2) considering a degree-day relationship, could a simple linear model

describe the dependence of embryonic development time on temperature or it is better described by a more complex non-linear relation. Egg development time of *Erythrodiplax fusca*, *Micrathya hesperis*, *Perithemis mooma*, and *Micrathya simplex* were evaluated. We put the eggs at different temperatures (15, 20, 25, and 30°C) and counted the number of hatched larvae daily. A nonlinear response of the development to the temperature was found, differing from the expected pattern for standard degree-day analysis. Furthermore, we observed that there is a similar process in the development time and hatching synchronization between species, with all species presenting faster egg development at high temperatures. Species-specific differences are more evident at lower temperatures (15°C), with no egg development in *M. simplex*. Only *E. fusca* was relatively insensitive to temperature changes with similar hatching rates in all treatments." (Authors)] Address: De Marco, P., Lab de Teoria, Metacomunidades e Ecologia de Paisagens, Depto de Ecologia, ICB, Campus Samambaia, Univ Federal de Goiás, Goiânia, Brasil

18548. Mitchell, F.L.; Lasswell, J.L. (2018): Population characteristics of the dragonfly *Pantala flavescens* (F.). colonizing small constructed ponds. *Southwestern Entomologist* 43(4): 833-839. (in English) ["A series of small ponds was constructed to determine whether dragonflies would oviposit in them. Four pond sizes . 0.3, 0.6, 0.9, and 1.2 m² . were replicated and randomized in each of six blocks. Ponds in three of the blocks were planted with cattail (*Typha* sp.) and three with spike rush (*Juncus* sp.). Sampling revealed that of 273 nymphs collected, 267 were *P. flavescens* and six were *Orthemis ferruginea*, although adults of 15 other dragonfly species were seen in the study area. Dragonfly nymphs were not found in any of the smallest size of pond. Significantly more nymphs were found in ponds planted with cattail than rush (215 vs 52), but the nymphs grew larger in ponds with rushes. The mean number of nymphs was larger in the 1.2-m² ponds (21.8) than in the 0.6-m² ponds (8.7), while 0.9 m² was intermediate (15.0). However, when the number of nymphs per unit area was compared, there were no differences between any of the pond sizes within a vegetation class -. cattail or rush. Between classes, more nymphs per unit area were in ponds planted with cattails. Because the one species of dominant dragonfly was not representative of distribution of dragonfly species in normal-sized ponds and probably was the only dragonfly found in any similar experiment, use of small reference ponds of these sizes was not feasible for assessing dragonfly diversity and abundance." (Authors)] Address: Mitchell, F.L., Texas A&M AgriLife Res., 1229 North Highway 281, Stephenville, TX 76401, USA

18549. Mitchell, Z. (2018): Dragonfly locomotion: Ecology, form and function. PhD thesis, Faculty of Biological Sciences, School of Biology, University of Leeds: XIX, 166 pp. (in English) ["The Odonata is a charismatic insect order remarked for their flight ability. They are a useful model system for ecological and evolutionary processes, but in particular their strong and unique flight abilities make them a model taxon

to study the biomechanics of flight. Movement is fundamental to a range of processes in biology, including population spatial dynamics. With increasingly urgent demands to understand and predict the impacts of climate change, uncovering the processes driving the movement of populations is paramount. Currently the macroecological patterns caused by climate change are reasonably well documented – particularly for the Odonata. However the mechanisms driving population movements are less clear. Despite considerable advances in our knowledge of the biomechanics of insect flight, little of this has been applied in an ecological context. This thesis aims to identify the gaps in our knowledge of macroecological processes and how biomechanical techniques can advance the field. I have set out a number of methods demonstrating how the biomechanics of flight in Odonata impacts ecological patterns. Range shifts are perhaps one of the best detailed impacts of climate change. At some level they must be driven by the movements of individuals, yet many studies have found little evidence to correlate flight ability and dispersal in insects. Using laboratory measures of flight performance I show that climate induced range shifts in the Odonata are limited by flight efficiency. This has important implications for conservation, as knowing how flight ability is able to restrict a species' range shift will aid reserve design and future ecosystem predictions. The possible reason behind the lack of evidence linking flight ability and dispersal is the use of proxies for flight performance, and the assumptions of the relationship between these measures and actual flight performance. Indeed, in the literature there are a host of different often mutually exclusive assumptions regarding the role of morphology in shaping flight ability. I provide empirical evidence of how wing morphology affects flight performance, showing that a large proportion of assumptions made within the literature are not supported, or are only weakly supported. This calls into question how prevalent the effects of flight performance on dispersal are, given the use of misleading assumptions. In many systems the state of adult organisms is strongly dependent on the experience of juveniles. For the Odonata, a number of mass and size carry-over effects exist between larva and adult forms, but whether locomotory performance is linked in this way is as yet unknown. Here I show that there is no correlation between larval and adult locomotory performance, suggesting that muscle development mechanisms are different for larvae and adults. Except for existing mass and size effects, flight performance should not be strongly affected by larval conditions. Finally, various behaviours have the capacity to affect dispersal in a species. One of the behaviours recently empirically confirmed in the Odonata is that of reversible polarotaxis: initial repulsion from polarised light sources as immature adults and the attraction back to polarised light as mature adults. I predicted that reversible polarotaxis would help aid dispersal, repelling insects from natal habitats and encouraging them to find new ones. However, the individual-based model of dispersal that I developed shows that reversible polarotaxis is more important in speeding up the progression through life stages, reducing the time taken to reach feeding habitats and to return to breeding sites. Individuals without polarotaxis would experience

higher mortality and lower rates of energy uptake (taking longer to find food) and also higher mortality rates taking longer to return to breeding sites (including lower reproductive success from potentially spending less time at breeding sites). All the work here is then synthesised to create a comprehensive description of Odonata flight morphology (form), its effects on flight performance (function) and the ecological patterns it generates (ecology). I demonstrate that biomechanics can provide important insights into ecological processes – in this case, that flight performance is an important limiting factor for range expansions, where other limitations are perhaps not present. In addition flight morphology is strongly linked with flight performance, suggesting that up to 74% of studies have used incorrect assumptions regarding the links between morphology and performance." (Author) 1.6 Thesis Outline: The purpose of this thesis is to provide a much-needed evidence base to link form, function, and ecology in a model insect taxon. In the following chapters I demonstrate methods to build this body of evidence and demonstrate how it advances our mechanistic understanding of species' movements: 1.6.1 – Chapter 2: In this chapter I measure quantitatively the flight mechanics of a range of UK Odonata species, comparing flight mechanics data to observed range shifts during a period of warming. This comparison will help to demonstrate that population level movements are affected by the flight ability of the species, and to ascertain what specific aspect of flight performance drives macroecological patterns. Alongside providing baseline descriptions of flight performance for several Odonata species, I demonstrate the function of flight performance in influencing ecological movements. 1.6.2 – Chapter 3: Our theoretical understanding of how wing morphology affects flight performance is good, but empirical evidence is lacking. Further, a host of often mutually exclusive assumptions regarding links between morphology and flight performance have been made in the literature. Here I demonstrate empirically the effect of different wing shapes across the same range of Odonata species as in chapter 2, on their flight performance. From describing the detailed form of wing morphology I can demonstrate its function in driving flight performance and following back up through chapter 2, driving ecological range shifts. 1.6.3 – Chapter 4: Odonata like many insects have a complex life cycle, so the adult is very much dependent on the larval stage. Several previous studies have found 'carry-over' effects from larva to adult, but few have looked for an effect in locomotory performance. In this chapter I look for 'carry-over' effects of locomotory performance in Odonata from larva to adult by measuring swimming performance and subsequent flight performance when the larva emerges. It is still not known exactly how the form of flight morphology is produced, so here I demonstrate the potential function of larval form in affecting adult flight morphology, and the ecological basis of larval variation in swimming performance. 1.6.4 – Chapter 5: The previous chapters aim to establish a mechanistic understanding of locomotory performance, relating form to function and understanding its effects on Odonata ecology. They do not take into account how behaviour might modulate this process. In this chapter I provide a spatially explicit individual based

model of Odonata movement to investigate the potential impact of reversible polarotaxis, a behaviour seen in Odonata, on dispersal. Through my work, I aim to demonstrate the emergent macroecological effects from individual behaviours, informed in part from the dispersal mechanisms outlined in the previous chapters. 1.6.5 – Chapter 6: Here I describe how the preceding chapters link to form a comprehensive explanation of the form and function of Odonata biomechanics and its effects on individual and population level ecological patterns, starting from potential larval influences through to adult flight morphology. I then compare the work here to our current understanding of biomechanics and ecology and how it amends or adds to current theory. Finally I suggest the best direction for future work, looking to improve and expand on the work I have carried out here. 1.7 Conclusion: The flight biomechanics and ecological patterns in the Odonata are well described within those two respective fields. However, the underlying processes are still unclear in some cases and links between the two areas of work are few and often tenuous, due to conflicting evidence and potentially poor proxies of the properties involved being used. In the following chapters I attempt to bring together biomechanics and macroecology to explain underlying processes. I will first look at the links between quantitative flight performance data and climate induced range shifts across a range of Odonata species, followed by an empirical demonstration of the effects of wing morphology on flight performance in the Odonata. I will also look for ontogenetic carry-over effects of biomechanical performance across the odonate life cycle, to see if larval performance has an impact on macroecological patterns seen in the adults. Finally using an individual based dispersal model I test the effect that certain behaviours might have on odonate dispersal. I will give a brief discussion in each of these chapters on the results obtained, followed by an in depth discussion and synthesis in chapter 6.] Address: not stated

18550. Moore, M.P.; Martin, R.A. (2018): Trade-offs between larval survival and adult ornament development depend on predator regime in a territorial dragonfly. *Oecologia* 188(1): 97-106. (in English) ["Trade-offs between juvenile survival and the development of sexually selected traits can cause ontogenetic conflict between life stages that constrains adaptive evolution. However, the potential for ecological interactions to alter the presence or strength of these trade-offs remains largely unexplored. Antagonistic selection over the accumulation and storage of resources could be one common cause of environment-specific trade-offs between life stages: higher condition may simultaneously enhance adult ornament development and increase juvenile vulnerability to predators. We tested this hypothesis in an ornamented dragonfly (*Pachydiplax longipennis*). Higher larval body condition indeed enhanced the initial development of its intrasexually selected wing coloration, but was opposed by viability selection in the presence of large aeshnid predators. In contrast, viability selection did not oppose larval body condition in pools when aeshnids were absent, and was not affected when we manipulated cannibalism risk. Trade-offs between larval survival and ornament

development, mediated through the conflicting effects of body condition, therefore occurred only under high predation risk. We additionally characterized how body condition influences several traits associated with predator avoidance. Although body condition did not affect burst distance, it did increase larval abdomen size, potentially making larvae easier targets for aeshnid predators. As high body condition similarly increases vulnerability to predators in many other animals, predator-mediated costs of juvenile resource accumulation could be a common, environment-specific limitation on the elaboration of sexually selected traits." (Authors)] Address: Moore, M.P., Dept of Biology, Case Western Reserve University, Cleveland, USA

18551. Móra, A.; Boda, P.; Mauchart, P.; Perneckner, B.; Csabai, Z. (2018): Hydrobiological state of Fehér-tó near Kardoskút based on the physico-chemical characteristics and the aquatic macroinvertebrate assemblages in 2015. *Crisicum* 10: 143-167. (in Hungarian, with English summary) [The Fehér-tó is one of the most important astatic soda pans in the Carpathian basin. The pond is separated by a dam to eastern and western basins, which are different in hydrological regime and extension of macrovegetation. In 2015 physico-chemical parameters were measured and quantitative and faunistic samplings of aquatic macroinvertebrate assemblages were carried out to reveal the potential differences in the hydrobiological state of the two basins. The chemical parameters (Na⁺, K⁺, Ca²⁺ ions, pH, conductivity, total dissolved solid) show that both basins are polyhalobous soda pans. Based on nutrient contents (N and P forms) the whole Fehér-tó is hypertrophic, especially the western basin. Altogether 6937 specimens belonging 60 aquatic macroinvertebrate taxa [including *Lestes macrostigma*] were collected. In the eastern basin 45, in the western basin 25 taxa were found, the number of taxa occurring in both basins was 20. Significantly higher number of species and specimens were found in the assemblages of the riparian zone (with vegetation cover) than in the open water areas in both basins. The differences between the basins were less obvious; although more species and specimens were collected in the eastern basin and the assemblages were more diverse here, the differences were not statistically significant. These results were confirmed by multivariate analyses (ANOSIM, NMDS) too. In both basins the chironomid *Cricotopus ornatus* was the dominant species, while the number of subdominant species were different (7 in the eastern and 3 in the western basin). The species composition (fewer species and specimens with the dominance of tolerant species) in the western basin suggests heavy organic matter load (the influence of aquatic birds) and regular dry periods. The more diverse macroinvertebrate fauna in the eastern basin might be due to the higher habitat heterogeneity, the more stable hydrological regime and the lower nutrient load." (Authors)] Address: Móra, A., Pécsi Tudományegyetem, TTK Hidrobiológiai Tanszék, H-7624 Pécs Ifjúság útja 6, Hungary. Email: mamold@gamma.ttk.pte.hu

18552. Moreno-Benítez, J.M. (2018): Odonatos de las lagunas del Lagar de Oliveros (Málaga, España). *Boletín*

Rola n° 12, segundo semestre 2018: 19-28. (in Spanish, with English summary) [The paper presents the results of an Odonata survey carried out at Lagar de Oliveros Lagoons (Málaga, Spain) during the years 2017 and 2018. A total of 21 species have been recorded and the reproduction of *Anax ephippiger* is confirmed for the first time in the province." (Author)] Address: Moreno-Benítez, J.M., C/ Larga del Palmar 34 . 29650 Mijas (Málaga), Spain. E-mail: cono-cenaturaeco@gmail.com

18553. Muzon, J. (2018): Chapter 14.5. Superfamily Lestoidea. Thorp and Covich's *Freshwater Invertebrates* (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 469-473. (in English) [The Lestoidea, known also as Lestinoidea (Bybee et al., 2008; Rehn, 2003), is a small taxon composed of medium to large damselflies encompassing approximately 21 genera and 210 species distributed worldwide (Dijkstra et al., 2013). It includes four families: the monotypic and Australian endemic Hemiphlebidae, the speciose and cosmopolitan Lestidae and Synlestidae, and the Neotropical endemic Perilestidae (Dijkstra et al., 2014). In the Neotropical region three families, five genera, and 62 species are reported, but this number is very likely to increase (Garrison et al., 2010). The Lestoidea has been proposed as the sister group of all the remaining Zygoptera (Bybee et al., 2008; Carle et al., 2008; Dumont et al., 2010; Davis et al., 2011). In this group, larval caudal appendages are lamellate and held in a vertical plane. Most species occupy fast to moderate streams, except *Lestes*, which prefer temporary lentic environments." (Author)] Address: Muzón, X., Lab. Biodiversidad y Genética Ambiental (BioGeA), Univ. Nac. Avelaneda (UNDAV), Buenos Aires, Buenos Aires, Argentina

18554. Neiss, U.G.; Fleck, G.; Pessacq, P.; Tennessen, K.J. (2018): Chapter 14.3 . Odonata: Superfamily Libelluloidea. Thorp and Covich's *Freshwater Invertebrates* (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 399-447. (in English) [Libelluloidea is the second most diverse and speciose group of Odonata just behind the Coenagrionoidea. It includes almost 1,500 species in 195 genera, of which approximately 450 species and 58 genera are represented in the Neotropical region. The Libelluloidea have a cosmopolitan distribution and are present in all kind of environments. The monophyly of the superfamily is strongly supported but inner arrangement is still unresolved. In this work, four families are acknowledged: Synthemistidae (one genus in the Neotropical region: Gomphomacromia); Macromiidae (a broad genus not considered generally neotropical but present in northern Mexico: Macromia); Corduliidae (sensu stricto with six genera in the Neotropical region, but including also here for practical reasons the probable closely related incertae sedis *Lauromacromia* and *Neocordulia*), and Libellulidae (48 genera in the Neotropical region). Except for Libellulidae, with 40 genera with known larvae, all remaining genera larva are known. Here, we present a key to the families and genera of ultimate stadium larvae of Libelluloidea." (Authors)] Address: Neiss, U.G., Instituto de Criminalística, Departamento de Polícia Técnica-Científica, Manaus, Amazonas, Brazil. E-mail:ulisses.neiss@gmail

18555. Norling, U. (2018): Constant and shifting photoperiods as seasonal cues during larval development of the univoltine damselfly *Lestes sponsa* (Odonata: Lestidae). *International Journal of Odonatology* 21(2): 129 -150. (in English) ["Larvae were reared at 21.5°C from eggs from southernmost Sweden, and fed ad libitum to emergence in four different photoperiodic treatments, intended to represent increasing levels of time stress: constant LD 16:8, corresponding to late April (or August) conditions, a shift after about two weeks from LD 16:8 to 19.5:4.5, coarsely simulating late spring, constant LD 19.5:4.5, corresponding to the summer solstice, and a shift from LD 19.5:4.5 to 16:8, coarsely simulating late summer. Mean larval development time significantly decreased in this series: 47.5, 45.2, 43.0 and 39 days (n = 11–13 larvae), respectively. This suggests an ecologically relevant integration of absolute photoperiods and changes in photoperiod, allowing larvae to distinguish if LD 16:8 represented spring or late summer, depending on earlier experience. Thus, rapid development, a long day response during spring conditions, is further speeded up by shorter days during late summer. In early stadia, moulting intervals were uniform, but long days may to some extent have programmed young larvae to develop with fewer moults, thereby increasing development rate. In the last four stadia the principal effect was variation in moulting intervals. Adult size was little affected. Homogeneous conditions and low genetic diversity produced a remarkably synchronous development within treatments, with an emergence span of 5–10 days. Due to low numbers of larvae, derived from a single female, and problems with a switch, the generality of these results would need confirmation." (Author)] Address: Norling, N., Spårnsögatan 53, 22652 Lund, Sweden. Email: ulf.norling@comhem.se

18556. Novelo-Gutiérrez, R.; Ramírez, A.; González-Soriano, E. (2018): Chapter 14.2. Superfamily Gomphoidea. Thorp and Covich's *Freshwater Invertebrates* (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 377-397. (in English) ["An illustrated key to the larvae of 27 out of 29 genera of Gomphidae of the Neotropical region is provided. Additional information on microhabitats and notes on the larval habits is also included. Larvae of *Brasiliogomphus* and *Cyanogomphus* are still unknown, and larva of *Diaphlebia* is keyed by supposition. Gomphidae represents between 34–35% of all known Neotropical anisopterans. Most Gomphidae species inhabit running waters and many of their larvae behave as shallow burrowers. Larvae of Gomphidae are characterized mainly by body abundantly setose; antennae 4-articulated with the third antennal article the largest, and the fourth segment minute or vestigial; prementum flat, ligula without median cleft, apical margin with piliform setae; molar crest of mandible movable; legs scarcely opposable, short, and setose, and female larva gonapophyses rudimentary or vestigial." (Authors)] Address: Novelo-Gutiérrez, R., Depto Entomología, Instituto de Ecología A.C., Km 2.5. antigua carretera a Coatepec, Aparatdo Postal 63, 91000 Xalapa, Veracruz, Mexico. E-mail: rodolfo.novelo@inecol.edu.mx

18557. Paillat, R.; Tabut, C. (2018): Cordulie à taches jaunes et Cordulie métallique à l'honneur en Eure-et-Loir. *Recherches*

naturalistes 6 N.S.: 7-14. (in French, with English summary) ["During field work involving a population census of dragonflies at the Moronville wetlands, Eure-et-Loir department, two Corduliidae species were observed: *Somatochlora metallica* and *S. flavomaculata*. Further research into the presence of the two species in July of the same year revealed 10 adults and 16 exuviae of *S. metallica*, which means that Moronville the only site where this species is known to breed in the department. However, only two adult *S. flavomaculata* were seen and no exuvia found. As far as is known this is the first time the species has been recorded in Eure-et-Loir. To date 28 dragonfly species have been recorded at Moronville." (Authors)] Address: Tabut, C., 39 rue des Huguenots 28320 Bailleau Armenonville, France. E-mail: cyril.tabut@gmx.fr

18558. Pessacq, P.; Muzón, J.; Neiss, U.G. (2018): Chapter 14. Order Odonata. Thorp and Covich's *Freshwater Invertebrates* (Fourth Edition). Volume 3: Keys to Neotropical Hexapoda: 355-366. (in English) ["Odonata is a cosmopolitan and ubiquitous order of insects, represented in most aquatic environments by approximately 6,000 species, of which more than 1,700 occur in the Neotropical region. It is considered a monophyletic group, but higher relationships within the order are not fully resolved yet. The larvae of only about 75% genera and 40% of the species are known, many larval descriptions are too brief or out of date, and the existing keys only involves certain regions or countries. Here, we present a glossary with morphological terms and a key to the families." (Authors)] Address: Pessacq, P., Centro de Investigaciones Esquel de Montana y Estepa Patagónicas (CIEMEP), Esquel, Chubut, Argentina

18559. Pestana, G.C.; Caromano, T.G.; Guillermo Ferreira, R. (2018): Sexual ornamentation triggers rival aggressiveness in the Neotropical damselfly *Hetaerina longipes* (Odonata: Calopterygidae). *Odonatologica* 47(1/2): 121-132. (in English) ["Coloration is associated with male quality in various animal species. These secondary sexual characters are a result of selective pressures that favor males able to cope with the physiological costs of production and maintenance of the ornament. Males of the Neotropical damselfly *Hetaerina longipes* exhibit red wing pigmentation, which is considered a sexual ornament. We tested the hypothesis that territorial males assess the quality of sexual ornamentation of rival males and respond with aggressive or neutral behaviors according to the quality of the opponent. Since wing pigmentation is an indicator of male quality, influencing contest outcome and territory acquisition, we expected that territorial males would decrease their aggressiveness when facing opponents with experimentally enhanced wing pigmentation, assuming that males should avoid conflicts with stronger males. The results suggest that territorial males are in fact more aggressive against rivals with increased pigmentation, contrary to our initial hypothesis. We discuss the cognitive ability of odonates in the assessment of opponents and suggest three hypotheses to explain the observed patterns." (Authors)] Address: Guillermo Ferreira, R., Laboratory of Ecological Studies on Ethology and Evolution (LES-TES), Department of Hydrobiology, Federal University of

São Carlos – UFSCar, São Carlos – Rodovia Washington Luís, km235, São Carlos, SP, 13565-905, Brazil. E-mail: rhainerguillermo@gmail.com

18560. Plan, L.; Stöger, T.; Draganits, E.; Gier, S. (2018): A Pleistocene landslide-dammed lake indicated by karren features (Eastern Alps, Austria). *Geomorphology* 321: 60-71. (in English) ["Highlights: •Documentation and morphometric measurements of rare röhrenkarren. •These karst features have formed due to water table fluctuation of a palaeolake. •A previously unknown palaeo-landslide body is identified. •A landslide dammed lake is reconstructed. Abstract: Numerous enigmatic tube-shaped holes in the limestone ceilings of overhangs and small caves in a restricted area north of the village St. Aegydt am Neuwalde (Lower Austria) have been known at least since 1933, but so far, no detailed study concerning their origin has been conducted. The vertical holes occur in Middle Triassic limestone and they are almost perfect cylinders tapering gently to a rounded apex. Their diameters are up to 5.5 cm and their depths reach 45 cm. They occur on both sides of the Unrechtraisen valley located in the north-eastern part of the Northern Calcareous Alps. Almost identical features were described from the shores of lakes in western Ireland and termed röhrenkarren or tube karren (Simms, 2002). According to Simms' model, they have formed by condensation corrosion within air pockets trapped in limestone overhangs by rising water levels during floods. The occurrence of these features is surprising, because presently, there is no lake and so far, no palaeolake has been known from this area. Based on high-resolution airborne laser scanning data and detailed field observations, a landslide deposit was identified in a narrow section of the valley, downstream of the röhrenkarren sites. Fine-grained, partly laminated sediments with abundant Anisoptera or flatworm (*Turbellaria*) eggs, indicative of lacustrine sediments, up to ca. 100 m above present river bed. These data indicate that a landslide had dammed the Unrechtraisen River resulting in a ca. 100 m deep lake. The röhrenkarren have formed due to fluctuations of the lake level, resulting from differences in river run-off and seepage through the landslide dam. Since ²³⁰Th/U-dating of calcite crusts covering some röhrenkarren was not successful, the age is not well constrained." (Authors)] Address: Plan, L., Natural History Museum Vienna, Karst & Cave Group, Museumsplatz 1/10, 1070 Vienna, Austria. E-mail: lukas.plan@nhm-wien.ac.at

18561. Priyadarshana, T.S.; Wijewardhane, I.H.; Peabotuwage, I.; Jayasooriya, A.; Herath, B.E. (2018): A new species of *Ceylonosticta* Fraser, 1931 (Odonata: Zygoptera: Platystictidae) from Sri Lanka. *International Journal of Odonatology* 21(2): 105-114. (in English) [A new species of *Ceylonosticta* from the wet zone of Sri Lanka is described and illustrated, namely *Ceylonosticta goodalei* sp. nov. (Kuruwita-Erathana foot path, Seethagangula, Adam's Peak, Samanala Nature Reserve, Ratnapura, 6.8196°N, 80.4615°E, 1109 m asl). The species is described from male specimens only and the genital ligula is described and illustrated. Females are as yet unknown. A brief review of *Ceylonosticta*

"species-groups" is provided, provisionally incorporating three recently described species (*C. nancyae*, *C. rupasinghe*, *C. alwisi*) as well as *C. goodalei*. A determination key is updated by addition of these four newly described *Ceylonosticta* species and now covers 22 endemic species of the genus hereto known from the island." (Authors)] Address: Priyadarshana, T.S., College of Forestry, Guangxi Univ., Nanning, PR China. Email: tharakas.priyadarshana@gmail.com

18562. Purba, W.C.; Yulminarti (2018): Komposisi dan ke-*limpahan* capung (Ordo: Odonata) pada tiga tipe habitat di Desa Buluh Cina Kecamatan Siak Hulu Kabupaten Kampar Provinsi Riau. *Jurnal Riau Biologia* 3(1): 17-22. (in Indonesian, with English summary) ["This study aims to determine the level of abundance and diversity of Odonata in Buluh Cina village, Kampar District, Riau. This study was conducted from March to May 2017, using a sweeping technique applied to each habitat type (settlement, forest and forest). The result obtained are 671 individuals Odonata representing ...16 species. The six families found among them, Libellulidae (8 species), Gomphidae (1 species), Aeshnidae (1 species), Coenagrionidae (4 species), Chlorocyphidae (1 species) and Platycnemididae (1 species). The highest number Odonata were collected from the Libellulidae family with 340 individuals." (Authors)] Address: Purba, W.C., Jurusan Biol. Fak. Matematika dan Ilmu Pengetahuan Alam Kampus Bina Widya Pekanbaru 28293, Indonesia. E-mail: williamcowper.purba@yahoo.com

18563. Ramírez, Y.P.; Giraldo, L.P.; Zúñiga, M.; Ramos, B.C.; Chará, J. (2018): Influencia de la ganadería en la comunidad de macroinvertebrados acuáticos en microcuencas de los Andes centrales de Colombia. *Revista de Biología Tropical* 66(3): 1244-1257. (in Spanish, with English summary) ["Influence of cattle ranching on the community of aquatic macroinvertebrates in watersheds of central Andes, Colombia. In order to measure the impact of cattle ranching and riparian corridors on the composition and diversity of benthic macroinvertebrates in Andean watersheds, nine headwater streams were selected in the municipality of Villamaría (Caldas, Colombia), five of them with riparian corridors and four without protection. In July (2013) in each stream, macroinvertebrate samples were collected using D and Surber nets, and streams were characterized according to water quality, channel metrics and habitat quality score. In total 98 934 individuals were collected, distributed in nine classes, 17 orders, 56 families and 92 genera. Veneroidea was the most abundant order followed by Trichoptera, Diptera, Tubificida and Ephemeroptera. Coleoptera was the order with highest richness with 28 genera, followed by Diptera with 18, Trichoptera with 11, Ephemeroptera with 10 and Odonata with 8. Streams with riparian corridors were deeper, had higher proportion of coarse substrates and Habitat Quality Score and presented higher genus diversity than those unprotected ($p < 0.05$). The genera *Ferrisia*, *Eurygerris*, *Heleobia* and *Pisidium*, total nitrogen, ammonia nitrogen and silt proportion on the streambed were correlated with unprotected streams, whilst the genus *Rhagovelia*, the subfamily Chironominae, the Habitat Quality Score and the proportion

of coarse substrates were correlated with streams with riparian corridors. This information confirms that riparian corridors help reducing the negative impact generated by cattle ranching practices and improve the provision of environmental services, and therefore it is recommended to maintain the strip of riparian vegetation in streams that possess it and allow the establishment of this in streams devoid of forest on its slopes." (Author)] Address: Ramírez, Yuly Paulina, Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria -CIPAV, Carrera 25 No. 6-62, Cali, Colombia. E-mail: yulypaulinaramirez@gmail.com

18564. Rangel-Sánchez, L.; Nava-Bolaños, A.; Palacino-Rodríguez, F.; Córdoba-Aguilar, A. (2018): Estimating distribution area in six *Argia* damselflies (Insecta: Odonata: Coenagrionidae) including *A. garrisoni*, a threatened species. *Revista Mexicana de Biodiversidad* 89: 921-926. ["Odonata are currently facing a number of threats. One tool to provide a straightforward assessment of risk is distribution area. Here we have used ecological niche modeling to estimate distribution range for 6 species of *Argia* damselflies distributed in North America: *A. cuprea*, *A. funcki*, *A. garrisoni*, *A. harknessi*, *A. munda*, and *A. rhoadsi*. These species are not included in the International Union for the Conservation of Nature (IUCN) Red List, except for *A. garrisoni* which has been categorized as Least Concern. Our results indicated large distribution areas for all species, except for *A. garrisoni*, (8,038 km² after a refinement analysis looking for suitable habitat). Large distribution can be explained by similar niche properties shared by all study species. This is not the case for *A. garrisoni* whose situation seems worrying. This species was found in the Mexican state of San Luis Potosí in 1999 and there have been no further observations so it deserves further inspection to see whether populations are at risk. In the meantime, and according to the IUCN criteria, *A. garrisoni* should be placed under a vulnerable category." (Authors)] Address: Rangel-Sánchez, Laura, Grupo de Investigación en Odonatos de Colombia-Grupo de Investigación en Biología, Depto Biol., Univ. El Bosque, Av. Cra 9 No. 131A-02 Bogotá, Colombia

18565. Rathod, D.M.; Parasharya, B.M. (2018): Odonate diversity of Nalsarovar Bird Sanctuary - a Ramsar site in Gujarat, India. *Journal of Threatened Taxa* 10(8): 12117-12122. (in English) ["Odonate diversity of Nalsarovar Bird Sanctuary, a Ramsar site in Gujarat, was studied between January 2015 and July 2017. A total of 46 species belonging to six families, and 27 genera were recorded, which included 14 species of Zygoptera and 32 species of Anisoptera. Out of the 46 species, 40 species are new records for the Nalsarovar Bird Sanctuary. The record of *Enallagma cyathigerum* in Gujarat needs verification. Need to monitor changes taking place in Odonata species composition after influx from Narmada canal at Nalsarovar is emphasized." (Authors)] Address: Rathod, Darshana, AINP on Agricultural Ornithology, Anand Agricult. Univ., Anand, Gujarat 388110, India. E-mail: darshanarathod500@gmail.com

18566. Relyea, R.A. (2018): The interactive effects of predator stress, predation, and the herbicide Roundup. *Ecosphere*

9(11):e02476. 16 pp. (in English) ["As the number of studies examining the effects of contaminants grows, ecologists are becoming increasingly aware that contaminants can interact with natural stressors (e.g., competition and predator cues) in their effects on nontarget animals. In amphibians, predator cues can make contaminants more lethal under laboratory conditions, but the opposite outcome has been observed under more natural conditions with stratified water columns; stratification causes more pesticide to be present near the surface while predator cues scare spring-breeding amphibians down to the benthos. I examined whether this phenomenon also occurs in three species of summer-breeding amphibians (*Hyla versicolor*, *Rana clamitans*, and *Rana catesbeiana*) that were raised in outdoor mesocosms. Specifically, I asked how amphibian survival was affected by multiple concentrations of a common herbicide (glyphosate; commercial name: Roundup), the herbicide combined with chemical cues from predators (caged larval *Anax junius*), and the herbicide combined with lethal predators. Environmentally relevant concentrations of the herbicide caused high rates of tadpole mortality, but this outcome was substantially reversed by the addition of predator cues. With lethal predators, the tadpoles experienced such high mortality that the herbicide caused no additional effect. Roundup also induced morphological changes in *Hyla versicolor*, and the induced traits were different from those induced by predators. Collectively, these results suggest that while predator cues can make pesticides less lethal when thermal stratification occurs, highly lethal predators can overwhelm these effects. Thus, the impacts of such contaminants can be dramatically different in environments that do or do not contain high-risk predators." (Author)] Address: Relyea, R.A., Dept Biol. Sci., Darrin Fresh Water Inst., Rensselaer Polytechnic Inst., Troy, New York 12980 USA. E-mail: relyer@rpi.edu

18567. Remm, L.; Sushko, G. (2018): Dragonfly fauna in rewetted mires in Belarus: diverse but different from natural sites. *Wetlands Ecology and Management* 26(6): 1173-1180. (in English) ["Mire specialist species are under strong anthropogenic pressure. In areas where the exploitation of their habitat has been temporary or unsuccessful, restoration frequently has risen as an objective. The results of the restoration activities for habitat specialists, however, are unclear. In this work we investigated whether raising the water level ca. 10 years ago in degraded bogs has brought back a characteristic group of fauna, and mire specialists therein. Dip-netting for Odonata larvae, together with habitat description, was carried out in restored, unrestored, and natural sites. We found almost no larvae at unrestored sites. The restored sites provided habitat for diverse Odonata fauna, including lagg zone species. Bog specialists only occurred at a former pit-mining site. Based on the study, we suggest three means to support the biodiversity of mire Odonata: (i) protecting the remaining natural mires, (ii) using pit-mining instead of milling for peat extraction, and (iii) creating special pools in former milled sites that have been designated for mire restoration." (Authors)] Address: Remm, Liina, Department of Zoology, Institute of Ecology and Earth Sciences, University of Tartu, Tartu, Estonia

18568. Reyes-Hernández, J.L.; Escoto-Moreno, J.A.; González-Martínez, E.; Márquez, J.; Ocampo, G.; Rodríguez, J.C. (2018): Riqueza de Especies de Odonatos en el Área Natural Protegida Sierra del Laurel, Calvillo, Aguascalientes, México. Richness of Odonata Species in the Sierra del Laurel Natural Protected Area, Calvillo, Aguascalientes, Mexico. *South-western Entomologist* 43(4): 995-1002. ["Richness of odonate in the Sierra del Laurel Natural Protected Area, municipality of Calvillo, Aguascalientes, Mexico is reported here. In total, 31 species in 21 genera and six families were collected at 13 localities, representing approximately 50% of the species registered in Aguascalientes. *Rhionaeschna jalapensis* and *Dythemis nigrescens* are new records for the State of Aguascalientes, and eight species are new records for the municipality of Calvillo. The list of Odonata from Aguascalientes now includes 61 species, and the Sierra del Laurel is one of the richest sites of odonates in the state." (Authors)] Address: Márquez, J., Lab. de Sistemática Animal, Centro de Investigaciones Biológicas, Univ. Autó. del Estado de Hidalgo, km 4.5 carretera Pachuca-Tulancingo s/n, Ciudad del Conocimiento, Col. Carboneras, 42184 Mineral de la Reforma, Hidalgo, México. E-mail: marquezorum@gmail.com

18569. Riaz, M.A.; Riaz, A.; Ijaz, B.; Rasool, M.S.; Rahat, S.; Un Nisa, Z. (2018): Environment friendly management of mosquito: a short review. *Bangladesh Journal of Scientific and Industrial Research* 53(3): 169-178. (in English) ["Despite the large scale use of insecticides, capacity building, municipality, community and metropolis awareness, and preventive measures to counter vector borne diseases which are mounting day-by-day, new tools are now being introduced to prevent the spread of mosquito transmitted diseases. The low efficacy status of chemical pesticides have led to the interest of researchers in search of fresh and even more practicable vector control methodologies to be applied. In this regards, multiple alternatives have been monitoring to develop control practice measures for the eradication, observation and control of mosquitoes at larval level by the use of a sustainable biological monitoring and control by an ordinary constructive predator, to exercise monitoring and practical control measures over parasites at larval stages in environmental and eco-friendly techniques. In particular, bio-control measures to monitor and control practical practices, context predatory larvivorous fish, dragonfly nymph, frogs, copepods, turtle, Entomopathogenic bacillus, *Bacillus sphaericus* and *Bacillus thuringiensis israelensis* are being tried in different regions of world. The available research on the subject recommends that there exist multiple direct and indirect growth factors that could play a dynamic role in prey and predator's survival. Species controphic that have an impact on concerned eco-relation reflect significant effect. In addition to this, certain eco-relations represent positive stimuli for the control of vector borne viral diseases. As a bio-control achieving feasible agent for vector monitoring, pointing, management and control predatory larvivorous fish, dragonfly nymph, frogs, copepods, turtle, Entomopathogenic bacillus, *Bacillus sphaericus* and *Bacillus thuringiensis israelensis* are not only considered as a liberated intervention for disease vector control of practices and mechanical

control cost deterrents as well. Further research has been suggested on the subject so as to find out even more practicable and effective mosquito monitoring and practical control practices." (Authors)] Address: Riaz, M.A., Dept Environmental Sciences & Engineering, Government College Univ. Faisalabad, Pakistan. E-mail: ahsanenv38@gmail.com

18570. Rieckh, C. (2018): Die Libellenfauna des Laabachs im Grazer Feld (Insecta: Odonata). MSc. thesis, Ökologie und Evolutionsbiologie, Karl-Franzens-Universität Graz: VIII, 121 pp. (in German, with English summary) [Austria; "For this Master's thesis, the Odonata fauna of the rivulet "Laabach" in the "Grazer Feld" south of Graz (Styria) was examined. The small stream has a length of 9,2 km and runs through predominantly agricultural landscape, but also partly through residential areas. For the survey of Odonata fauna it was divided in 59 widely homogeneous sections. All sections of the Laabach were surveyed at least four times in 2017, during the flying period of Odonata from May to September. In addition, in 2016 data were collected in some of the sections in August and September. Data collection was carried out on a semiquantitative basis, by observation of adult dragonflies and damselflies. To verify the impact of the surrounding habitat the rivulet sections were characterized by their morphology and by mapping the surrounding habitat at a distance of up to 30 m on both sides. Some sections of the Laabach were rich in structure, others were strongly anthropogenically affected (channelled) and/or dried out at least temporarily. A total of 27 Odonata species were identified, from which 14 species were considered autochthonous. 6 species showed a mass occurrence, among them the critically *Coenagrion ornatum*. The occurrence of *Somatochlora meridionalis* and *Lestes barbarus* are also remarkable records regarding nature conservation. Dried sections were significantly poorer in species diversity and population densities than sections with permanent water. The presence/absence of some species showed a significant dependence on the character of the surrounding landscape." (Author)] Address: Rieckh, Christina, Institut für Zoologie der Karl-Franzens-Universität Graz, Universitätsplatz 2, 8010 Graz, Austria. E-Mail: christina.rieckh@edu.uni-graz.at

18571. Ries, L.; Neupane, N.; Baum, K.A.; Zipkin, E.F. (2018): Flying through hurricane central: impacts of hurricanes on migrants with a focus on monarch butterflies. *Animal Migration* 5(1): 94-103. (in English) ["Hurricanes are becoming more frequent and intense, so understanding the consequences for biodiversity, including migratory species, has become critical. Studies suggest that migrants may avoid most of the direct harm of hurricanes by shifting their flight trajectories to less-impacted regions, but the majority of this research has focused on birds. We review the literature on migratory bird responses to hurricanes and also describe other taxa likely to be affected. We then focus on the monarch butterfly (*Danaus plexippus*), whose fall migratory pathway goes through Texas during hurricane season. Like birds, monarchs may be able to avoid direct damage from hurricanes. However, it may be more important to determine how they respond to shifts in availability of critical resources during migration. In

fall, when a storm-triggered flush of out-of-season vegetation growth is especially likely, hurricanes could reasonably cause indirect impacts that could be positive (increased nectar) or negative (out-of-season host plants that could disrupt migration), or both. The monarch butterfly is an especially good target for this research because of its distinct migratory phases, the importance of hurricane-impacted zones to its annual cycle, and the large quantity of data available through an extensive network of citizen science programs. ... There are also five species of migratory dragonflies (*Anax junius*, *Tramae lacerata*, *Sympetrum corruptum*, *Pantala flavescens*, and *P. hymenea*), which have both solely residential and solely migratory populations throughout their ranges [24]. Although little is known about their migration, the migratory timing of these species through Texas also coincides with peak hurricane season so there is potential for both direct and indirect effects." (Authors)] Address: Ries, Leslie, Georgetown Univ., Dept of Biology, USA. E-mail: leslie.ries@georgetown.edu

18572. Román-Heracleo, J.; Springer, M.; Ramírez, A. (2018): The larva of *Perissolestes remotus* (Williamson & Williamson, 1924) (Zygoptera: Perilestidae). *International Journal of Odonatology* 21(3-4): 173-179. (in English) ["The larva of *P. remotus* is described for the first time based on Costa Rican specimens collected in forested streams with abundant organic matter. It is characterized by a slender, elongated body, with lateral keels on abdominal segments 1–9, and a middorsal row of spines on segments 4–10. We also provide additional notes on the larvae of *P. magdalenae* using material from Panama. The larva is similar to the only other species of *Perissolestes* present in Mexico and Central America, *P. magdalenae*, but can be separated by the articulation of the prementum-postmentum reaching the metacoxa (reaching the mesocoxa in *P. magdalenae*) and the female gonapophyses exceeding past the posterior margin of S10 (just reaching posterior margin in *P. magdalenae*). At the generic level, *Perissolestes* can be differentiated from *Perilestes* by the presence of abdominal keels on segments 1–9 (from 4–9 in *Perilestes*) and by having caudal gills with small spines along the medial trachea (spines absent in *Perilestes*)."] (Authors)] Address: Ramírez, A., Dept Applied Ecology, North Carolina State Univ., Raleigh, NC 27603, USA. Email: aramirez@ramirezlab.net

18573. Rudolf, V.H.W.; Roman, A. (2018): Trophic structure alters consequences of environmental warming. *Oikos* 127(11): 1646-1656. (in English) ["Climate warming can directly affect traits and demographic rates of organisms. However, individuals are embedded in complex networks of ecological interactions with other members of the community, allowing for a range of direct and indirect effects that depend on the trophic structure of the community. Here we show that effects of warming (i.e. increase in mean temperature) on a given species can strongly depend on the community context and trophic complexity of the system. Specifically, we manipulated the presence/ absence of two competing tadpole species and their dragonfly predators to simulate different food webs of increasing complexity that

were exposed to ambient or warmed conditions. We found that warming dramatically reduced herbivore (tadpole) survival in the absence of strong interspecific competition and predation, but it had no measureable effect on demographic rates on the dominant competitor in more complex communities where it was exposed to interspecific competition and predation. Conversely, our results also indicate that warming reduced the strength of interspecific competition and predation in our system. These results suggest that trophic complexity could potentially buffer climate change effects on populations and emphasize that we often cannot predict the effects of changes in abiotic conditions on a given population without accounting for the community context." (Authors)] Address: Rudolf, V.H.W., Program in Ecology and Evolutionary Biology, Rice Univ., BioSciences, Houston, TX, USA. E-mail: volker.rudolf@rice.edu

18574. Rumrill, C.T.; Scott, D.E.; Lance, S.L. (2018): Delayed effects and complex life cycles: How the larval aquatic environment influences terrestrial performance and survival. *Environmental Toxicology and Chemistry* 37(10): 2660-2669. (in English) ["Species with complex life cycles are susceptible to environmental stressors across life stages, but the carryover and latent effects between stages remain understudied. For species with biphasic life histories, such as pond-breeding amphibians, delayed effects of aquatic conditions can influence terrestrial juveniles and adults directly or indirectly, usually mediated through fitness correlates such as body size. We collected adult southern toads (*Anaxyrus terrestris*) from two source populations – a natural reference wetland and a metal-contaminated industrial wetland – and exposed their offspring to two aquatic stressors – a metal contaminant, copper (Cu), and a dragonfly predator cue – in outdoor mesocosms (n = 24). We then reared metamorphs in terraria for five months to examine delayed effects of early life stage environmental conditions on juvenile performance, growth, and survival. Larval exposure to Cu, as well as having parents from a contaminated wetland, resulted in smaller size at metamorphosis – a response later negated by compensatory growth. Although Cu exposure and parental source did not affect larval survival, we observed latent effects of these stressors on juvenile survival, with elevated Cu conditions and metal-contaminated parents reducing post-metamorphic survival. Parental source and larval Cu exposure affected performance at metamorphosis through carryover effects on body size but, one month later, latent effects of parental source and larval predator exposure directly (i.e., not via body size) influenced performance. The carryover and latent effects of parental source population and aquatic Cu level on post-metamorphic survival and juvenile performance highlight the importance of conducting studies across life stages and generations." (Authors)] Address: Rumrill, C.T., Savannah River Ecol. Lab., Univ. of Georgia, Aiken, South Carolina, USA. E-mail: crumrill@gmail.com

18575. Rushbrook, B. (2018): Habitat enhancement opportunities for southern damselfly. Itchen Valley Country Park. Arcadian Ecology & Consulting Ltd, Curdridge.: 50 pp. (in English) ["Executive Summary: Arcadian Ecology was

appointed by Eastleigh Borough Council to conduct a walk over visit of Itchen Valley Country Park and, based on this and information provided by Kevin Young (formerly of Eastleigh Borough Council and who has an in-depth knowledge of the species at this site), identify habitat enhancement and creation opportunities for southern damselfly (*Coenagrion mercuriale*) at the site. The historic water meadow network at Itchen Valley Country Park forms part of the River Itchen Site of Special Scientific Interest (SSSI) / Special Area of Conservation (SAC), and supports a population of *C. mercuriale* considered to be of national importance. However, recent studies have indicated a potential decline in the strength of the population at Itchen Valley Country Park, and it is considered that urgent conservation action for this species is required at this site. It is therefore the specific intention of this report to outline habitat enhancement and creation opportunities identified at Itchen Valley Country Park and assess them in terms of their: a. relative or site-specific value in increasing the distribution, robustness and resilience of the *C. mercuriale* population at Itchen Valley Country Park, and b. habitat enhancement and creation potential in the context of the wider Itchen Valley metapopulation as set out in the recently published strategic conservation plan for *C. mercuriale* with in and adjacent to Eastleigh Borough boundary. Habitat enhancement opportunities were identified for 16 of the 26 watercourses assessed, with a further two infrastructure improvement opportunities identified, considered to provide benefits for both *C. mercuriale* and for the management / ecology of the wider Itchen Valley Country Park. It was not considered appropriate to make recommendations for habitat creation at Itchen Valley Country Park, due to the complexity of the historic network of floodplain meadow carrier streams and ditches. It is therefore considered that a detailed hydrological study would be necessary before any notable alterations are made to water level management at the site such as the re-connection of paleo-channels or defunct elements of the historic water meadow network. It was considered more appropriate and valuable to base the recommendations of potential implementation options on the results of the site-specific prioritisation assessment (rather than strategic assessment) since: * there is no evidence of an imminent delivery of the recently published strategic conservation plan for southern damselfly with in and adjacent to Eastleigh Borough boundary; and * there was limited variability between options in the strategic assessment with 16 of the 18 assessed to have a high current potential of being delivered. Four different options for the suite of opportunities that should be included in the future management of Itchen Valley Country Park are provided below, representing the preferred option, preferred (within site) option, an alternative sub-optimal option, and a strongly recommended 'minimum' option. It is emphasised that these recommendations are provided on the basis that they are delivered in parallel with the general management recommendations provided. Furthermore, irrespective of what programme of works is selected, its delivery must not be unduly rigid, but be subject to continual assessment and responsive to the current habitat characteristics of the relevant watercourse(s). Specifically, where cattle grazing is already creating suitable conditions, it is not

recommended that rotational clearance is undertaken, and could instead be re-assigned to another (sections of) watercourse where it is required at that time. Finally, it is considered that there would be three distinct, but not disconnected, elements of any programme of habitat enhancement and infrastructure improvement works in order to maximise the resulting increase in the distribution, robustness and resilience of the *C. mercuriale* population at Itchen Valley Country Park. Specifically this will include measures that: 1. maintain and strengthen *C. mercuriale* numbers in the important hub in the north of site; 2. provide two-fold benefits for the wider population through works in the centre of the site; and 3. maintain and strengthen *C. mercuriale* numbers supported in the south of the site. In conclusion, it is strongly recommended that any future programme of works is designed to encompass all three elements outlined above (i.e. as included within the two preferred options outlined in Section 4.2.1). However, where there are insufficient resources and / or it is not feasible to deliver a programme of works that meets all three of these criteria, the programme should be designed to include works that deliver in line with the three elements as prioritised above." (Author)] Address: Published by: Arcadian Ecology & Consulting Ltd., Beechcroft House, Vicarage Lane, Curdridge, Hampshire, SO32 2DP, UK

18576. Samanmali, C.; Udayanga, L.; Ranathunge, T.; Perera, S.J.; Hapugoda, M.; Welivitiya, C. (2018): Larvicidal potential of five selected dragonfly nymphs in Sri Lanka over *Aedes aegypti* (Linnaeus) larvae under laboratory settings. *BioMed Research International* Volume 2018, Article ID 8759459: 10 pp. (in English) ["Introduction. Limitations in breeding source reduction practices, development of insecticide resistance in mosquitoes, and ill effects of chemical controlling methods on human and ecosystem health have motivated Sri Lankan authorities working for dengue control to seek for alternative, ecofriendly, and sustainable approaches for controlling of *Aedes* vectors, to manage dengue epidemics. The present study attempted to investigate the predation efficiency of locally available dragonfly nymphs over *Aedes aegypti* under laboratory conditions, aiming to evaluate the potential of using dragonflies as biocontrol agents against dengue. Methods. Nymphal stages of five locally abundant dragonfly species were collected from different stagnated water bodies in Belihuloya area. After morphological identification, a well grown individual of each species was starved for 12 hours and introduced into a glass tank containing 1L of pond water with 200 larvae (4th instar) of *Aedes aegypti*. Number of larvae survived in the tank was enumerated hourly up to 48 hours. In case where >75% of larvae are consumed by dragonfly nymphs, additional *Ae. aegypti* larvae were introduced into such tanks. Experiment was repeated for five times. Same procedure was followed with different stages of growth of the dragonfly nymphs characterized by the highest predation rate. General Linear Model followed by Tukey's pairwise comparison was used for statistical analysis. Results. The predation rates of different dragonfly species varied significantly ($p < 0.05$), whereby *Anax indicus* (110 ± 7.14 per day) indicated the highest, followed by *Pantala flavescens* (54.07 ± 5.15) and *Gynacantha*

dravida (49.00±11.89), while *Tholymis tillarga* (23.47±2.48) had the lowest. Further, significant variations in the larval predation were found among different maturity stages (10–20; 25–35; and 35–45 mm in body length) of *Ana. indicus* ($p < 0.05$). Regardless of statistical significance, a relatively higher larvicidal activity was observed at dusk than in dawn. Conclusion. *Ana. indicus*, which is characterized by the highest predation rate, and *P. flavescens* that has the widest geographical distribution within Sri Lanka along with a notable predation efficacy could be recommended as potential candidates for field trials in biological control of dengue outbreaks via suppression of *Ae. aegypti* larvae." (Authors)] Address: Ranathunge, T., Dept of Biosystems Engineering, Fac. Agriculture & Plantation Management, Wayamba Univ. of Sri Lanka, Sri Lanka. E-mail: tharaka.ranathunge@gmail.com

18577. Sánchez Estrada, D.M. (2018): Odonatos (Insecta: Odonata) en dos localidades del Valle de Tulancingo-Acaxochitlán, Hidalgo, México. Tesis, Licenciada en Biología, Área Académica de Biología, Instituto de Ciencias Básicas e Ingeniería, Universidad autónoma del Estado de Hidalgo: 64 pp. (in Spanish) ["This thesis describes a list of the order Odonata, which was carried out from June 2015 to April 2016, in two localities of Acaxochitlán of the Tulancingo Valley in the state of Hidalgo, Mexico; in a lentic and lentic environment. In addition, the occurrence of the different species was related to the following physical-chemical variables of the water: temperature, pH, dissolved oxygen and turbidity. They were collected and/or censused by the 50-meter transect method. A total of 313 individuals from 20 species. The most common species for adults and naiads were those of the family Coenagrionidae. The species accumulation curves describe an almost complete sampling for both ages. The results indicated a low correlation of the occurrence of species with the variables physical-chemical properties of water. This study pays for the lack of faunistic works for the and for the state of Hidalgo. More samples are required at the local level to understand the total number of species, as well as their link with environmental variables. Translated with www.DeepL.com/Translator]] Address: not stated

18578. Schiesari, L.; Sgambatti Monteiro, A.; Ilha, P.; Pope, N.; Tadeu Corrêa, D. (2018): The ecology of a system of natural mesocosms: Rock pools in the Atlantic Forest. *Freshwater Biology* 63(9): 1077-1087. (in English) ["1. The methodological trade-off between the realism of natural systems and the tractability of artificial systems has led ecologists to praise the qualities of natural micro. and mesocosms as an ideal means for investigating the processes that organise biological communities. Among the different types of naturally occurring micro. and mesocosms, clusters of rock pools combine a global distribution with the simplicity, replicability, tractability and structural homogeneity that are desirable in model experimental systems. However, critical geographical data gaps in the study of rock pools must be filled if ecologists are to use these as global model systems in community ecology. 2. In a year-long study of a cluster of 181 rock pools in the Atlantic Forest of eastern Brazil, we conducted the first study on the ecology of freshwater rock

pool communities in the entire Neotropical region, to the best of our knowledge. Building on published descriptions of the factors that drive community assembly within rock pools, we tested the hypotheses (1) that the effects of environmental factors prevail over those of spatial factors and (2) that pool volume and secondarily species interactions between consumers (anuran larvae), resources (leaf litter) and predators (dragonfly larvae) have a dominant role in driving species patterns of occurrence and abundance. 3. Our hypotheses were generally supported as community structure was clearly influenced by the environmental characteristics of individual pools, and not to the spatial relations among them. Pool volume had a consistent, positive influence on the probability of occurrence of dragonflies and tadpoles of three anuran species, possibly through the influence of volume on hydroperiod. However, the species most strongly associated with larger pools were not those with longer times until metamorphosis, but those with larger egg clutches. In addition, species occurrences were positively associated with resource availability as measured by leaf litter mass (significantly so for *Rhinella* and dragonflies). These observations suggest that within these severely confined freshwater systems, indicators of environmental stability and reduced intraspecific competition could be important ultimate criteria for oviposition site selection. 4. The ease of sampling and manipulating the rock pools at our Atlantic Forest site combined with the observation that these pools are governed by some of the same factors influencing community organisation in other rock pool systems around the world reinforces the merit of the system as a means to conduct global comparative studies of the ecology of communities and meta-communities." (Authors)] Address: Schiesari, L., Escola de Artes, Ciências e Humanidades, Universidade de São Paulo, São Paulo, Brazil. Email: lschiesari@usp.br

18579. Schmidt Dalzochio, M.; Périco, E.; Renner, S.; Sah-lén, G. (2018): Effect of tree plantations on the functional composition of Odonata species in the highlands of southern Brazil. *Hydrobiologia* 808: 283-300. (in English) ["Changes in biodiversity have mainly been assessed using taxonomical diversity indices. Although these approaches contribute to the scientific understanding of species richness and composition patterns, trait-based metrics may be more useful for detecting responses to land use change. We used odonates as a model system to compare traits composition in mixed ombrophilous forest (MOF) and tree plantations: exotic species (*Pinus* sp.) and native species (*Araucaria angustifolia*). Our goal was to understand and compare how each vegetation type affects the selection of species traits, and which factors are responsible for the presence of the species in the environment. We recorded 36 Odonata species distributed across 14 functional groups. The functional composition varied between MOF and exotic tree plantations and was similar between these two habitats and native tree plantations. Native forest favoured specialist traits. Our results suggest that the conversion of MOF to tree plantations, especially exotic ones, results in a shift to less specialized Odonata communities with altered functional group composition. This result highlights the negative impact

associated with the conversion of native forests into exotic plantations. Our results show that odonates with specialist traits are limited to natural forest sites, which makes the conservation of such areas crucial." (Authors)] Address: Schmidt Dalzochio, Marina, Ecology and Evolution, University of Vale do Taquari, UNIVATES, Lajeado, Brazil

18580. Schmidt-Jeffris, R.A.; Nelson, J.C. (2018): Gotta Catch 'Em All!: Communicating Entomology with Pokémon? *American Entomologist* 64(3): 159-164. (in English) ["In 2012, an article was published in *American Entomologist* regarding the influence of rhinoceros beetles on Akihabara culture (Hoshina and Takada 2012). However, one critical game was missing from their discussion: Pokémon. With the advent of Pokémon GO, an augmented reality-based cell phone app released in the U.S. on 6 July 2016, the Pokémon craze is once again in the limelight, and this presents a unique opportunity for entomologists and science educators to increase student interest in natural history." (Authors)] Address: Schmidt-Jeffris, R.A., Coastal Research & Education Center, Clemson Univ., Charleston, SC 29414-5329, USA

18581. Schröder, R.; Linkem, C.N.; Rivera, J.A.; Butler, M.A. (2018): Should I stay or should I go? Perching damselfly use simple colour and size cues to trigger flight. *Animal Behaviour* 145: 29-37. (in English) ["Highlights: •We examined how flying insects respond to visual stimuli in a natural environment. •*Megalagrion xanthomelas* damselflies used colour and size cues to trigger pursuit. •They attacked small beads of socially relevant colours and avoided large beads. •The retina spatial resolution is 0.82° , but the object detection threshold is 0.34° . •The damselfly's stereopsis range is estimated to be ~ 17.5 cm. Abstract: How do flying insects correctly respond to visual stimuli in complex natural environments? The spectacular coloration of some orders suggests that colour cues are important. Size may contain useful information as well, but insects are limited in resolving fine spatial detail due to the structure of their compound eyes. Although there have been many studies of experimentally altered body colour and pattern, we know surprisingly little about simple, isolated cues that insects use to take off after objects. Specifically, whether it is colour, size or some combination that triggers pursuit. We presented artificial bead stimuli of varying colours and sizes to perching males of the Hawaiian orangeblack damselfly *Megalagrion xanthomelas* in their natural forested stream habitat. Damselflies were most vigorously responsive to conspecific colours – attacking red (males) and tracking brown (females). Other colours with lesser biological relevance inspired lower response rates. Interestingly, size strongly modulated responses, whereby attack responses towards the smallest bead sizes transitioned to tracking or avoidance at the larger bead sizes. Although small beads are inherently more difficult to see, they triggered responses from greatest distances, even beyond the calculated stereopsis range of 17.5 cm. Damselflies had an object detection threshold of 0.34° within a high-resolution frontally directed acute zone with an interommatidial angle of 0.82° . We found evidence that size and colour serve as discrimination filters to efficiently identify

objects of interest while ignoring visual noise. Simple schemes for object discrimination may help to explain how insects can differentiate among prey and conspecifics, and why multiple species can exist in the same community despite being similar in colour. We discuss implications for visual capabilities, and how visual systems that can readily discriminate size and colour can contribute to extraordinary phenotypic diversity." (Authors)] Address: Butler, M.A., Dept of Biology, Univ. of Hawaii, 2538 McCarthy Mall, Honolulu, HI 96822, U.S.A. E-mail address: mbutler@hawaii.edu

18582. Seehausen, M. (2018): On collections of Odonata from the Lao People's Democratic Republic, with three new records. *Notulae odonatologicae* 9(2): 37-49. (in English) ["Collections of Odonata from the Lao PDR held at the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany, the Museum Wiesbaden, Germany, and the Oberösterreichisches Landesmuseum Linz, Austria, were examined. Altogether 143 specimens of 47 species (26 Zygoptera, 21 Anisoptera) were examined. *Lestes dorothea*, *Nychogomphus lui* and *Tramea basilaris* are reported from the Lao PDR for the first time and their characters are briefly discussed. Records of *Caliphaea thailandica*, *Asiagomphus xanthenatus*, *Leptogomphus baolocensis* and *Macromia pinratani* are briefly discussed. Illustrations of the male appendages of *L. dorothea*, of the male appendages, secondary genitalia as well as the penis of *N. lui*, of the male secondary genitalia of *T. basilaris* and of the female valvula vulvae of *Macromia pinratani* are provided." (Author)] Address: Seehausen, M., Museum Wiesbaden, Naturhistorische Sammlungen, Friedrich-Ebert-Allee 2, 65185 Wiesbaden, Germany. E-mail: malte.seehausen@museum-wiesbaden.de

18583. Seehausen, M. (2018): Ergebnisse der Costa Rica-Expedition des Übersee-Museums Bremen im Jahr 1971. *Libellen (Insecta: Odonata). TenDenZen 2014 (2018), Jahrbuch XXII, Übersee-Museum Bremen*: 98-102. (in English) ["The Odonata collected during the expedition of the Übersee-Museum Bremen to Costa Rica in 1971 was just now determined and catalogued. Altogether 42 specimens could be assigned to 20 species. All of them are well known from Central America. *Ischnura capreolus*, *Cannaphila insularis* and two specimens of *Erythodiplax umbrata* at Barra del Colorado were collected during a light-trap sampling." (Author)] Address: Seehausen, M., Boddenweg 12, 18439 Stralsund, Germany. E-mail: m.seehausen@gmx.de

18584. Seehausen, M.; Pinto, R.M.; Trainor, C.R.; Potenzo Lopes, J. (2018): Further records of Odonata from Timor Island, with the first photographs of living *Nososticta impercepta* (Odonata: Platycnemididae) and additional records from Rote and Romang Islands. *Faunistic Studies in Southeast Asian and Pacific Island Odonata* 25: 1-73. (in English) ["We present an annotated list of 28 Odonata species (19 Anisoptera, 9 Zygoptera) from Timor Island based on 464 records via photographs and 56 specimens held in collections at the Museum and Art Gallery of the Northern Territory, Darwin, Australia and the Museum Wiesbaden, Germany. Additionally 43 records of eight species (7 Anisoptera,

1 Zygoptera) from Rote Island and one record from Romang were reported. Most Timorese records are from Oecusse Special Administrative Region/Timor-Leste, a region which to date was "terra incognita". Further records from Timor-Leste are predominantly from Lautem Municipality and Baucau Municipality as well as from the Indonesian Kupang Regency. Four species are new records for Timor Island increasing the checklist to 40 species: *Brachythemis contaminata* (Fabricius, 1793), *Tholymis tillarga* (Fabricius, 1798), *Gynacantha* sp. cf. *dobsoni* Fraser, 1951 and *Ischnura aurora* (Brauer, 1865). We provide the first photographs of live *Nososticta impercepta* Seehausen & Theischinger, 2017 as well as some descriptions of habitats in Oecusse. At Rote Island five species were reported for the first time as well: *B. contaminata*, *Crocothemis servilia* (Drury, 1773), *Rhyothemis phyllis* (Sulzer, 1776), *Macrodiplax cora* (Brauer, 1867) and *Potamarcha* congener (Rambur, 1842). The record of *Orthetrum testaceum* (Burmeister, 1839) from Romang Island appears to be the first Odonata documented from this island. The status of *Rhyothemis phyllis* is discussed with regard to the ssp. *ixias* Lieftinck, 1953 from the islands of Sumba and Flores. We provide distribution maps of each species as well as suggestions for targeted field research in the future. All historical records of *Nososticta selysii* (Förster, 1896) from Timor are now assigned to *N. impercepta*." (Authors)] Address: Seehausen, M., Museum Wiesbaden, Naturhistorische Sammlungen, Friedrich-Ebert-Allee 2, 65185 Wiesbaden, Germany. E-mail: malte.seehausen@museum-wiesbaden.de

18585. Shaikh, J.; Baloch, N.; Bughio, B.A.; Ahmed, A.A.; Muntha, S. (2018): Morphometric study of Dragonflies inhabiting in district Matiari Sindh. University of Sindh Journal of Animal Sciences 2(4): 20-25. (in English) ["Research article should aim to observed morphometric study of dragonflies which inhabited in district Matiari. During study period many surveys were conducted from 02 talukas included (Saeedabad and Hala) district Matiari is an extravagant amount of minute district of Sindh that's why it is withal included in taluka as well. Survey were commenced from monsoon season which is commences from August up to mid of September. During survey total 381 specimens comprising 213 males and 168 females were amassed. All specimens exhibiting some key transmutations in their morphological description." (Authors)] Address: Shaikh, J., Dept of Zoology, University of Sindh, Jamshoro, Pakistan

18586. Shkëmbi, E.; Gerken, B.; Pepa, B.; Këqaj, H.; Misja, K.; Paparisto, A. (2018): Contribution to the knowledge of Odonata from Vjosa catchment. Acta Zoo.Bot. Austria 155: 239-250. (in English, with German summary) ["The Vjosa River in Albania carries pan-European and global significance. It represents one of the last intact large river systems in Europe, hosting many different types of ecosystems, from the narrow gorges in the upper part, to the wide, braided river sections in the middle part, to the near natural delta in the Adriatic Sea. These ecosystems include aquatic, semi-aquatic and semi-terrestrial habitats, and also include vital terrestrial foraging habitats near the river, in the still predominantly traditionally cultivated landscape. Imagines of

Odonata act as ecosystemconnecting faunal elements – a fact which enhances their meaning as bioindicators. Very few studies for the area exist so far, but these few underscore the importance of the river valley as Albania's biodiversity hotspot, providing ideal aquatic habitats for numerous species. Here, we will discuss the Odonata species based on the analysis of existing research data and on the results of our expeditions to the Vjosa habitats during 2015–2017. In total, 22 Odonata species were found, 9 belonging to the Zygoptera and 13 to the Anisoptera. The species were recorded both as imagines and partly as exuviae. 10 species (*Pyrrhosoma nymphula*, *Ceriagrion tenellum*, *Coenagrion ornatum*, *Sympecma fusca*, *Sympetrum fonscolombii*, *S. vulgatum*, *S. striolatum*, *Aeshna mixta*, *Crocothemis erythraea*, *Libellula quadrimaculata*) are reported for the first time in this area. Based also on data reported in the literature, the total checklist now increases to 28 species known for the Vjosa watershed so far; all 28 species belong to Annex II (IUCN, 2010); *Cordulegaster heros* is classified as NT (Near Threatened) according to the IUCN, the EU27 red list and the European red list, and as VU (Vulnerable) according to the Mediterranean red list. *Caliaeschna microstigma* and *C. ornatum* are classified as very rare and endangered at all current sites (according to Annex II they are considered strictly protected faunal elements, are listed as LC (Least Concern) according to the IUCN, but as NT according to the EU27 red list, European red list, and the Mediterranean red list. *Calopteryx splendens* is classified as VU according to Mediterranean red list and as LC according to the others. The total number of species recorded for the Vjosa watershed is nearly half of the Odonata species found in Albania (70 species based on our data). The Vjosa floodplain system is therefore one of the richest ecosystems regarding Odonata of Albania and the Balkan region." (Authors)] Address: Shkëmbi, Enilda, Tirana Univ., Fac. Nat. Sci., Dept of Biology, Albania. E-mail: enilda07@gmail.com

18587. Siepielski, A.M.; McPeck, S.J.; McPeck, M.A. (2018): Female mate preferences on high dimensional shape variation for male species recognition traits. Journal of Evolutionary Biology 31(8): 1239-1250. (in English) ["Females in many animal species must discriminate between conspecific and heterospecific males when choosing mates. Such mating preferences that discriminate against heterospecifics may inadvertently also affect the mating success of conspecific males, particularly those with more extreme phenotypes. From this expectation, we hypothesized that female mate choice should cause *Enallagma* females (Odonata: Coenagrionidae) to discriminate against conspecific males with more extreme phenotypes of the claspers males use to grasp females while mating – the main feature of species mate recognition in these species. To test this, we compared cerci sizes and shapes between males that were captured while mating with females to males that were captured at the same time but not mating in three *Enallagma* species. In contrast to our hypothesis, we found only one of forty comparisons of shape variation that was consistent with females discriminating against males with more extreme cerci shapes. Instead, differences in cerci shape

between mating and single males suggested that females displayed directional preferences on 1-4 aspects of cerci shape in two of the species in our samples. These results suggest that while some directional biases in mating based on cerci shape occur, the intraspecific phenotypic variation in male cerci size and shape is likely not large enough for females to express any significant incidental discrimination among conspecifics with more extreme shapes." (Authors) *Enallagma ebrium*, *E. geminatum*, *E. hagenij* Address: Mc-Peek, M.A., Dept Biol. Sci., Dartmouth College, Hanover, NH 03755, USA. E-mail: mark.mcpeek@dartmouth.edu

18588. Sigutova, H.; Sigut, M.; Dolny, A (2018): Phenotypic plasticity in specialists: How longspined larval *Sympetrum depressiusculum* (Odonata: Libellulidae) responds to combined predator cues. *PLoS ONE* 13(8): e0201406. 15 pp. (in English) ["Phenotypic plasticity is a common defensive strategy in species experiencing variable predation risk, such as habitat generalists. Larvae of generalist dragonflies can elongate their abdominal spines in environments with fish, but long spines render larvae susceptible to invertebrate predators. Long-spined specialists adapted to fish-heavy habitats are not expected to have phenotypic plasticity in this defence trait, but no empirical studies have been undertaken. Moreover, in comparison to prey responding to multiple predators that induce similar phenotypes, relatively little is known regarding how species react to combinations of predators that favour opposing traits. We examined plasticity of larval dragonfly *Sympetrum depressiusculum*, a long-spined habitat specialist. In a rearing experiment, larvae were exposed to four environments: (i) no predator control, (ii) fish cues (*Carassius auratus*), (iii) invertebrate cues (*Anax imperator*), as well as (iv) a combination of (ii) and (iii). Compared with the control, fish but not invertebrate cues resulted in longer spines for two (one lateral, one dorsal) of the six spines measured. Interestingly, the combined-cue treatment led to the elongation of all four dorsal spines compared with the fish treatment alone, whereas lateral spines showed no response. Our experiment provided evidence of morphological plasticity in a long-spined specialist dragonfly. We showed that nearly all spines can elongate, but also react differently under specific predator settings. Therefore, while spine plasticity evolved in direct response to a single predator type (fish), plasticity was maintained against invertebrate predators as long as fish were also present. Selective spine induction under the combined condition suggests that *S. depressiusculum* can successfully survive in environments with both predators. Therefore, phenotypic plasticity may be an effective strategy for habitat generalists and specialists. Although more studies are necessary to fully understand how selection shapes the evolution of phenotypic plasticity, we demonstrated that in dragonflies, presence or absence of a specific predator is not the only factor that determines plastic defence responses." (Authors)] Address: Sigutova, Hana, Institute of Environmental Technologies, Faculty of Science, Univ. of Ostrava, Ostrava, Czech Republic. E-mail: hana.sigutova@osu.cz

18589. Silva, L.; Machado, F.; Resede, D.; Neiss, U.G.

(2018): Immature Odonata community in streams: diversity, season variation and habitat preference in different levels of degradation. *North-Western Journal of Zoology* 14(2): 232-236. (in English) ["The immature Odonata community is used to diagnose and monitor impacts on aquatic environments. Degraded environments, with a wide range of environmental variables, usually present highly resilient species. Here we present a highly diverse immature Odonata community, collect with great sample effort. In doing so, we were able to show that these altered and natural environments have similar immature Odonata communities, and pH was the only abiotic variable affecting the system and the community. The community also changes with seasonal variation, because rains modify the river flow. Furthermore, the ecological integrity of the streams was influenced by anthropogenic activities, changing the dynamics of the Odonata communities. Two genera, *Brechmorhoga* and "Unidentified genus 1", are indicators of altered environments, so they can be used as bioindicator in others monitoring environmental evaluations." (Authors)] Address: Silva Larissa, Depto de Biol., Univ. Fed. de Lavras, Campus Universitário, Cep: 37.-200.000, MG, Brasil. E-mail: larissamg05@hotmail.com

18590. Silva Mendonça, S.; Alcântara Santos, A.C.; Marques Martins, M.; Gerson Araújo, F. (2018): Size-related and seasonal changes in the diet of the non-native *Cichla kelberi* Kullander & Ferreira, 2006 in a lowland reservoir in the southeastern Brazil. *Biota Neotropica* 18(3): 8pp. (in English, with Portuguese summary) ["We examined size-related and seasonal changes in the diet of the peacock bass *Cichla kelberi* in a tropical lowland reservoir in southeastern Brazil over three hydro-climatic seasons: summer (high rainfall and temperature), winter (low rainfall and temperature), and late spring (increasing rainfall and temperature) during two years (2006-2007). The tested hypothesis is that this non-native predator fish changes diet during the subadult and adult phases and among seasons to adapt in new colonized environment. Fishes of the families Clupeidae (*Platanichthys platana*), Characidae (*Astyanax* spp.) and Cichlidae (*Cichla kelberi*) were the most important food items, followed by insects of the order Odonata. Cannibalism was also recorded for the largest individuals. A significant size-related change in diet was found with the smallest individuals (Total Length, TL < 20 cm) preying mainly on fishes, whereas the larger individuals (TL > 30 cm) preyed mainly on Odonata. The niche breadth increased during growth, with the largest individuals having a diet more evenly distributed among the available resources. No significant seasonal differences in diet composition were found, but stomachs with higher degree of volume occupied by food were more frequent in late spring than in summer. Conversely, the highest niche breadth was found during the summer compared to the other seasons. Together, these observations suggest an efficient use of the available resources by this top predator in this new colonized system." (Authors)] Address: Alcântara Santos, A.C., Univ. Fed.I Rural do Rio de Janeiro, Rodovia BR 465, Km 07, Campus Universitário, 23890-000, Seropédica, RJ, Brasil

18591. Siregar, A.Z.; (2018): Ecological studies of Odonata

population in northern Sumatra, Indonesia. Conference Series: Agricultural & Natural Resources (ANR) 1(2): 34-41. (in English) ["Ten ha rice field plot in three sites in Manik Rambung Rice Field (MRRF), Simalungun District, North of Sumatera (latitude: 2°53' 52.8"N and longitude: 99° 00'24.4"E, about 90 km from Medan City at 594 . 602 masl) were recorded of Odonata population. The farmers have rice culture practices, combine with fish farming during season paddy planting. The comparison was conducted which nine stations of green Campus areas with purposive random sampling in a month (1. - 28. XI. 2011) using sweep net (400 im mesh, 60cm x 90cm) which six swings started from 0900 to 1200 for collection of Odonata. The results were collected 445 individuals from Zygopteran and 892 individuals from Anisoperan, 3 families, and 19 species of adults Odonata ... Coenagrionidae were dominant by *Agriocnemis femina*, *A. pygmaea*, and *Ischnura senegalensis*. Only *Ictinogomphus decoratus* recorded from Gomphidae and 11 species from Libellulidae. While two suborder, 4 families, 26 genera, 31 species and 436 individuals of Odonata identified in green campus, USU, Sumatera Utara, Indonesia. In MRRF, the ecological indices were calculated with score H' (0.88 . 2.50), Index Simpson (1-D) recorded were 0.49 until 0.99, while index Jaccard with 0.60-1.00. While Diversities indices Shannon and Evenness Pilon of Odonata in Campus USU was lower recorded in Station 7 and Station 1, while the highest were collected in Station 3 and Station 6. The diversities and evenness Odonata species were varied (H' =2.20-3.42 and E =0.55-0.78). Comparison to the evenness and richness of Odonata species in each stations were differences, which effected by natural habitat, heterogenous vegetations of plants, time and weather while taken sampling, biotic, physics, and chemicals factors in environmental system are varied." (Author)] Address: Siregar, Ameilia, Fac. Agrocotec., Univ. Sumatera Utara, Medan-20155, Indonesia. E-mail: zuliyanti@yahoo.com

18592. Starr, S.M. (2018): The effects of land use and climate change on Playa wetlands and their invertebrate communities. Ph.D.thesis, Biology, Dept Biological Sciences, Texas Tech University: XIII + 129 pp. (in English) ["Climate and land-use changes are the primary threats to playa wetlands and their invertebrate communities. Playas are ephemeral, depressional wetlands that are the primary form of surface water in the Southern High Plains of North America, an area that has experienced recent land-use changes that may affect playas. I used remotely sensed imagery to assess changes in land use in five categories (agriculture, rangeland/grassland, fallow, developed, and water) and playa inundation in Texas on six dates during the late growing season over 23 years. A decrease in the number of wet playas was observed over that span, and significant differences among land uses were found between and within years around dry and wet playas. Mean patch size and overall area of rangeland/grassland increased over time, possibly due in part to conservation efforts in the area. Other land-use types consequently decreased, but agriculture remained one of the dominant land-use types throughout. Because playas are crucial habitats, these changes have likely

affected regional biodiversity. Playa-associated biodiversity is largely comprised of birds, amphibians, and invertebrates. *Enallagma civile* was selected as a model organism to study the effects of environmental changes on playa invertebrates. Odonates are good model organisms to study ecological and evolutionary concepts because of their amphibious life history, which makes them sensitive to both aquatic and terrestrial environmental changes. *Enallagma civile* is a habitat generalist with a widespread distribution throughout the New World that has been underutilized in research. I summarized its life history and described lab husbandry techniques in an overview of the species as a potential model organism for studies on environmental subjects like climate change effects on elevated water temperature. Current climate change predictions estimate increased air temperatures across the Southern High Plains, putting many organisms at risk from environmental changes affecting nymph and adult life stages. Increased air temperatures can lead to elevated water temperatures, but experiments are lacking on responses in terms of development or survival. *Enallagma civile* was used to examine these effects. Eggs were collected and reared under four water temperature regimes (26, 32, 38, and 41°C). Nymph body measurements after molts, development rate, and deaths were recorded daily. Nymphs in the two hotter treatments were smaller and had lower survivorship whereas individuals in the cooler temperatures generally survived to adulthood and were larger. Individuals reared at 32°C emerged the quickest, going from egg to adult in 26 days. Elevated temperatures can thus be both advantageous and detrimental, causing concern for aquatic invertebrates in the future. In conclusion, these studies have demonstrated how land-use and climate changes are threats to playa wetlands and biota. With rangeland/grassland increasing over time, the frequency of playa wetland inundation may continue to decrease due to interactions between land use and overland water flow during precipitation events. With decreases in playa inundation frequencies and effects of climate change, playa invertebrate communities are threatened due to infrequent standing water and elevated water temperatures. By understanding how land-use and projected climate changes are currently effecting playa wetlands, it will allow for better comprehension and management of current and future alterations." (Author)] Address: Starr, S.M., Dept of Biological Sciences, Texas Tech University, Lubbock, TX 79409-3131, USA

18593. Start, D.; McCauley, S.; Gilbert, B. (2018): Physiology underlies the assembly of ecological communities. Proceedings of the National Academy of Sciences 115(23): 6016-6021. (in English) ["Significance: Ecology aims to understand the distribution of species and the processes that assemble communities. One common strategy is to use species traits to predict interaction with the abiotic and biotic environment, thus gaining an understanding of ecological communities. Here, we show that considering causal relationships among physiological and behavioral traits can help elucidate patterns of species distribution and community assembly in larval dragonflies across ponds differing in predation risk. Beyond a conceptual understanding of trait causality,

we also show a striking ecological pattern: the activity of two biomolecules accounts for >80% of the variation in community composition. Together, our conceptual framework and demonstration of a strong ecological pattern suggest that causal relationships are key to advancing trait-based community ecology. Abstract: Trait-based community ecology promises an understanding of the factors that determine species abundances and distributions across habitats. However, ecologists are often faced with large suites of potentially important traits, making generalizations across ecosystems and species difficult or even impossible. Here, we hypothesize that key traits structuring ecological communities may be causally dependent on common physiological mechanisms and that elucidating these mechanisms can help us understand the distributions of traits and species across habitats. We test this hypothesis by investigating putatively causal relationships between physiological and behavioral traits at the species and community levels in larvae of 17 species of dragonfly that co-occur at the landscape scale but segregate among lakes. We use tools borrowed from phenotypic selection analyses to show that physiological traits underlie activity rate, which has opposing effects on foraging and predator avoidance behaviors. The effect of activity on these behaviors ultimately shapes species distributions and community composition in habitats with either large-bodied fish or invertebrates as top predators. Remarkably, despite the inherent complexity of ecological communities, the expression of just two biomolecules accounts for a high proportion of the variation in behavioral traits and hence, dragonfly community composition between habitats. We suggest that causal relationships among traits can drive species distributions and community assembly." (Authors)] Address: Start, D., Dept of Ecology & Evolutionary Biology, University of Toronto, Toronto, ON, M5S3B2, Canada

18594. Stauer, M.; Pöchlacker-Florian, H. (2018): Erste aktuelle Reproduktionsnachweise der Östlichen Moosjungfer (*Leucorrhinia albifrons*) und der Zierlichen Moosjungfer (*Leucorrhinia caudalis*) aus Wien mit Beiträgen zur Phänologie in Ostösterreich (Odonata: Libellulidae). Beiträge zur Entomofaunistik 19: 95-110. (in German, with English summary) ["Since the turn of the millennium there have been single records of adult males of the Dark Whiteface *Leucorrhinia albifrons* (Burmeister, 1839) and the Lilypad Whiteface *Leucorrhinia caudalis* (Charpentier, 1840) in Eastern Austria. In May 2018 the reproduction of both species could be proved at an oxbow in the Lobau, the Viennese part of the Donau-Auen National Park (Natura 2000 Danube Floodplains). Earlier findings indicate that the first population of *L. caudalis* throughout Austria for about hundred years already colonized the Lobau in 2015. For *L. albifrons* the Mühl. and Tischwasser complex currently represents the only breeding site outside Carinthia. Furthermore the Yellow-spotted Whiteface *Leucorrhinia pectoralis* (Charpentier, 1825) has spread significantly in the area in recent years. From May 8th to June 23rd 2018, 97 exuviae of *L. albifrons*, two of *L. caudalis* and one of *L. pectoralis* were collected on a shore length of about 15 meters. Within the emergence of *L. albifrons* the sex ratio was female dominated with only 42.1 %

male exuviae. First adult imagines of *L. caudalis* and *L. pectoralis* appeared already on May 6th and May 7th, respectively, followed by *L. albifrons* from May 12th onwards at the reproduction site. The phenology of these species in Eastern Austria, possible migration routes and potential threats are discussed." (Authors)] Address: Pöchlacker-Florian, Helga, Arnehtgasse 85, 1160 Wien, Austria. E-Mail: helga_florian@hotmail.com

18595. Stewart, S.S. (2018): Phenotypic plasticity: temporal, spatial, and behavioral effects on wing morphology of damselflies in Central Texas. Ph.D. thesis, Baylor University. Dept. of Biology: XIV, 90 pp. (in English) ["In winged animals, flight morphology must be adapted for optimum behavioral efficiency. Behaviors such as foraging, predator avoidance, and mating are strongly influenced by wing morphology and influenced by environmental conditions in many species. Geometric morphometric methods analyze and visualize subtle variations in wing shape. This study examined environmental and behavioral effects on wing shape and wing size in both sexes of multiple damselfly species over several flight seasons in central Texas. Wing size is a proxy for body size of damselflies. For *Argia sedula*, comparisons were made 1) between adults collected early in the season versus those collected late in the season, 2) between adults collected at different locations, and 3) among adults collected during several flight seasons at the same locations. Significant differences in wing shape and size occurred between seasons and between years, but not between locations. Using these findings, I broadened this study to examine temporal effects on wing size and wing shape of both sexes in eight damselfly species. Analyses indicated significant differences in wing shape and wing size between early and late flight seasons in every comparison, including seven populations of four species. Damselflies emerging early in the flight season were significantly larger than those emerging later in the flight season. In contrast, significant shape and size differences between years occurred in only one of six species. Finally, I examined wing morphology associated with gender by comparing 1) mated and unmated damselflies of both sexes from three species, and 2) males and females from ten species. Significant differences in wing shape and size occurred between mated and unmated damselflies in one of nine populations sampled. As expected, significant differences in wing shape and wing size occurred between males and females in nineteen of the twenty comparisons made from ten species. These results suggest that differences in seasonal and annual environmental conditions frequently influence wing shape and body size in both sexes of multiple damselfly species. This work presents an original, comprehensive study of environmental and behavioral effects on wing morphology using geometric morphometric techniques." (Authors) *Hetaerina americana*, *Argia moesta*, *A. nahuana*, *A. sedula*, *Enallagma basidens*, *E. civile*, *Ischnura hastata*, *I. posita*] Address: not stated

18596. Stewart S.S.; Vodopich, D.S. (2018): Environmental effects on wing shape and wing size of *Argia sedula* (Odonata: Coenagrionidae). International Journal of Odonatology

21(3-4): 189-203. (in English) ["Well-adapted flight morphology must allow for efficient behavioral activities. Wing shape has been shown in a variety of species to be influenced by environmental conditions. Analysis of wing shape using geometric morphometrics provides a visualization of wing shape variations. This study examined the effects of varied environments on wing shape and wing size of the damselfly *Argia sedula* in central Texas. Comparisons were made (1) between populations collected early in the flight season versus those collected late in the flight season; (2) between populations collected at different locations, and (3) among populations collected from the same locations during several annual flight seasons. We found widespread differences in both wing shape and body size in males and females among most environments examined. Male and female damselflies collected early varied significantly from those collected late in the flight season for all locations and years sampled. Damselflies emerging early in the flight season were significantly larger than those emerging late in the season. Significant differences in wing shape and size occurred in comparisons of male and female damselflies collected in different years at the same location. In comparing damselflies collected at different locations, neither females nor males varied significantly in wing shape. Size varied in only one male comparison between locations. Our results suggest that differences in seasonal and year-to-year environmental conditions, but not geographical location, frequently influence wing shape and wing size in *A. sedula*, and quite possibly in other damselfly species." (Authors)] Address: Stewart, Sherry, Department of Biology, Baylor University, Waco, Texas 76798-7388, USA. E-mail: Sherry_Stewart@baylor.edu

18597. Sugita, N.; Agemori, H.; Goka, K. (2018): Acute toxicity of neonicotinoids and some insecticides to first instar nymphs of a non-target damselfly, *Ischnura senegalensis* (Odonata: Coenagrionidae), in Japanese paddy fields. *Applied Entomology and Zoology* 53: 519-524. (in English) ["Systemic insecticides such as neonicotinoids and fipronil are widely applied in rice production. These insecticides have been suspected of reducing biodiversity in paddy ecosystems and reducing wild dragonfly populations in Japan. Conventional ecotoxicological risk assessment could not confirm this, as it has not considered interspecific variation in sensitivity to insecticides. We estimated the median effect concentration (EC50) of 15 systemic insecticides to first instar nymphs of a Japanese damselfly, *Ischnura senegalensis*, commonly found in rice paddy fields. Damselflies were found to be highly sensitive to pyrethroid pesticides, less so to phenylpyrazole, organophosphates, and carbamates, and least sensitive to neonicotinoids, nereistoxin, and diamide. Given the acute toxicity data, the sensitivity of the damselfly to neonicotinoids was considered to be lower than that of other aquatic insects, whereas the EC50 values of the damselfly were 2–3 orders lower than that of *Daphnia magna* Straus (Diplostraca: Daphniidae), which is a standard test species. These results indicate that the conventional ecological risk assessment based on acute toxicity data of *D. magna* would underestimate the impact of neonicotinoids on Odonata diversity in paddy ecosystems. We

therefore recommend using the paddy-dwelling damselfly as a new test species for insecticide bioassay." (Authors)] Address: Sugita, N., Center for Environmental Biology and Ecosystem Studies, National Institute for Environmental Studies, Tsukuba, Japan

18598. Sun, Z.; Brittain, J.E.; Sokolova, E.; Thygesen, H.; Saltveit, S.J.; Rauch, S.; Meland, S. (2018): Aquatic biodiversity in sedimentation ponds receiving road runoff – What are the key drivers? *Science of the Total Environment* 610–611: 1527-1535. (in English) ["Highlights: • Investigated the impact of environmental factors on aquatic biodiversity in ponds. • Used multivariate statistical methods on data collected in twelve ponds over a year • The most important factors were metals, chloride, phosphorus, and pond size. • Larger sedimentation ponds host more taxa than smaller ponds. • Sedimentation ponds have the potential to contribute to aquatic biodiversity. Abstract: Recently, increased attention has been paid to biodiversity conservation provided by blue-green solutions such as engineered ponds that are primarily established for water treatment and flood control. However, little research has been done to analyse the factors that affect biodiversity in such ponds. The purpose of this study was to evaluate the influence of environmental factors on aquatic biodiversity, mainly macroinvertebrate communities, in road sedimentation ponds in order to provide a foundation for recommendations on aquatic biodiversity conservation. Multivariate statistical methods, including unconstrained and constrained analysis, were applied to examine the relationships between organisms and the water quality as well as physical factors (including plant cover). Stepwise multiple regressions indicated that the most important variables governing the variation in the biological community composition were pond size, average annual daily traffic, metals, chloride, distance to the closest pond from study pond, dissolved oxygen, hydrocarbons, and phosphorus. The presence of most taxa was positively correlated with pond size and negatively correlated with metals. Small ponds with high pollutant loadings were associated with a low diversity and dominated by a few pollution tolerant taxa such as oligochaetes. A comprehensive understanding of impacts of various environmental factors on aquatic biodiversity is important to effectively promote and conserve aquatic biodiversity in such sedimentation ponds. Our results indicate that road sedimentation ponds should be designed large enough, because large ponds are likely to provide a more heterogeneous habitat and thus contain a species rich fauna. In addition, larger ponds seem to be less contaminated due to dilution compared to smaller ponds, thereby maintaining a higher biodiversity. Finally creating some additional ponds in the vicinity of the sedimentation ponds in areas with few water bodies would increase the connectivity that facilitates the movement of invertebrates between ponds." (Authors) Odonata were identified to family level.] Address: Meland, S., Norwegian Institute for Water Research (NIVA), Gaustadalléen 21, 0349 Oslo, Norway

18599. Takaki, Y. (2018): Influence on the organism forms cognition grade in early childhood course students by the

insectphobia. Research Bulletin of Kindai University Kyushu Junior College 48: 65-76. (in Japanese, with English summary) ["Influence on the grade of organism form cognition by the insectphobia was investigated in early childhood course students. The definite decline of the organism form cognition grade in the three insects (ant, dragonfly, spider) was not seen in five years. On the other hand, in same five years, the ratio of students of the insectphobia increased. The organism form cognition grades of the students of the insectphobia tended to lower, and it was shown that the grades of organism form cognition became higher so that the kinds of the insect to touch increased. To train childminders being able to do appropriate correspondences when a child met an insect, it is necessary to change the negative consciousness for the insect of the students and to let students acquire the power of observation to notice small points.] Address: not stated

18600. Tennesen, K. (2018): Dragonfly nymphs of North America . An identification guide. Springer: 816 pp. (in English) ["This monograph is the first of its kind devoted entirely to the dragonfly nymphs of North America north of Mexico, the focus being accurate identification of the 330 species of Anisoptera that occur in the region. Nymphal external morphology is described and illustrated in detail, and all terms needed to navigate the dichotomous keys are defined. Species are tabulated with references that provide the most detailed, accurate descriptions for each; species that are inadequately described are so indicated. The key separating the seven families in the region contains several new characters. The families are then covered separately: Aeshnidae (13 genera), Gomphidae (17 genera), Petaluridae (2 genera), Cordulegastridae (2 genera), Macromiidae (2 genera), Corduliidae (7 genera), and Libellulidae (29 genera). Each family is further characterized, followed by a generic key. A drawing of the habitus and diagnostic details for each genus are provided, along with additional diagnostic remarks and notes on habitat and life cycle; for each genus, a map shows its geographic distribution in North America. Full-grown nymphs of all known species of each genus are keyed and diagnosed; characters that apply to earlier instars are noted. Morphological variation in character states was analyzed in order to assess the reliability of previously utilized characters and to discover new characters. Most of the characters used to distinguish all levels of taxa are illustrated; a total of 702 figures, comprising 1,800 original drawings, along with selected photographs where necessary for clarity, accompany the keys. Measurements of total length, head width, and other variables for each species are provided in tables. Difficulties with past keys and descriptions, including errors, omissions and other shortcomings, are addressed. The importance of nymph characters in helping solve generic and specific distinctions and their role in phylogenetic studies is emphasized. Methods for collecting, rearing, and preserving dragonfly nymphs and exuviae are presented. The final chapter discusses research opportunities on North American Anisoptera nymphs, including taxonomic needs, studies on structure and function, life history and microhabitat, water quality indices and conservation efforts. The habitus

drawings of all genera are arranged according to family in five plates (Appendix I); although the book is intended as a lab manual, these plates conveniently allow for comparison based on nymph shape making field identification to genus possible in many cases. Appendix II contains a brief history of dragonfly nymph studies in North America. A glossary and an index to scientific names are included." (Publisher)] Address: Tennesen, K.J., Research Associate, Florida State Collection of Arthropods, PO Box 585, Wautoma, WI 54982, USA. E-mail: ktennesen@centurytel.net

18601. Thompson, A.L.; Strauss, A.L.; Oberhauser, K.S.; Koomen, M.H.; Andicoechea, J.; Blair, R.B. (2018): Driven to discover: Citizen Science Curriculum Guide: Dragonflies and Odonata Central. University of Minnesota Extension: Saint Paul, Minnesota: 140 pp. (in English) [Manual: <https://conservancy.umn.edu/handle/11299/198622>] Address: not stated

18602. Tippler, C.; Wright, I.A.; Davies, P.J.; Evans, C.R. (2018): Are Odonata nymph adversely affected by impaired water quality in urban streams. *Austral Ecology* 43(8): 890-902. (in English) ["Globally 10% of all dragonfly species are threatened by extinction that can be primarily attributed to a loss of natural habitat. Urban expansion and the associated urban stream syndrome has established that the extent and intensity of urban development is directly linked to a range of adverse physical, chemical and ecological changes. Urban waterways typically experience degraded water quality and are occupied by impaired communities of aquatic invertebrates which are mostly dominated by rapid colonizing insects. Odonata are a diverse insect group and their tolerance or sensitivity to urban waterway degradation is unclear. This research examined the response of aquatic macroinvertebrate communities and specifically the Odonata nymph community to impaired water quality and degraded riparian vegetation condition in streams of the Georges River catchment, Sydney, across an urban development gradient. Unlike the overall macroinvertebrate community, Odonata nymph species assemblages were not strongly linked to the urban development gradient nor the degree of degradation in water quality. This result diverges from many aquatic macroinvertebrate studies that have reported a correlation between the response of Odonata taxa to degraded water quality. Our findings conclude that Odonata nymph community alone are not a suitable indicator of urban stream degradation as measured by water quality or catchment imperviousness and that the conservation of urban dragonflies should place a greater focus on the conservation and creation of suitable habitats." (Authors)] Address: Tippler, C., Dept Environ. Sci., Fac. Science & Engineering, Macquarie Univ., Macquarie Park, NSW 2109, Australia. Email: carl-john.tippler@students.mq.edu.au

18603. Tumilovich, O.A. (2018): Formation of odonata-fauna in a pond of the Kaliningrad region. *Scientific journal "News of KSTU"* 51: 35-42. (in Russian, with English summary) ["Dragonflies are amphibiotic insects. Their existence is closely connected with waterbodies suitable for their

reproduction. Newly created artificial ponds serve as new habitats for hydrobiontic and amphibiotic organisms that allow exploring their development dynamics. Dragonflies belong to those insects, which species diversity and abundance strongly depend on the appearance of new waterbodies. Dynamics of dragonflies' colonization in ponds can be considered in both faunistic and ecological aspects. In this way it becomes apparent that formation of the dragonfly fauna of this pond goes through three stages. The first stage is a pioneer. The second stage is stabilization. The third stage is the reduction of the fauna. By the frequency of occurrence within first two years the following three species dominate: *Enallagma cyathigerum*, *Erythromma najas* and *Lestes virens*. Within the third year, the occurrence of *E. cyathigerum* and *L. virens* declines with simultaneous appearance in waterbodies of *Libellula* dragonfly larvae. In addition, the frequency of occurrence of *Aeshna* dragonflies was increasing. Eight years later, we again found a sharp increase in the occurrence of dragonfly larvae *E. cyathigerum*, *L. quadrimaculata*, *Ae. cyanea* and *Ae. grandis* against the background of the phytocenosis that was greatly changed in the direction of simplifying the composition and an increase in aquatic vegetation coverage." (Authors)] Address: Tumilovich 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", Russia. E-mail: Levente@rambler.ru

18604. Ubhi, R.; Matthews, P.G.D. (2018): The transition from water to air in aeshnid dragonflies is associated with a change in ventilatory responses to hypoxia and hypercapnia. *Journal of Insect Physiology* 106(3): 172-178. (in English) ["Highlights: •Dragonflies transition from breathing water as nymphs to breathing air as imagoes. •Nymph ventilation is insensitive to aquatic hypercapnia up to 10% CO₂. •Aquatic hypoxia elicits hyperventilation. •Air-breathing adults show ventilatory responses to both hypoxia and hypercapnia. Abstract: Dragonflies are amphibiotic, spending most of their lives as aquatic nymphs before metamorphosing into terrestrial, winged imagoes. Both the nymph and the adult use rhythmic abdominal pumping movements to ventilate their gas exchange systems: the nymph tidally ventilates its rectal gill with water, while the imago pumps air into its tracheal system through its abdominal spiracles. The transition from water to air is known to be associated with changes in both respiratory chemosensitivity and ventilatory control in vertebrates and crustaceans, but the changes experienced by amphibiotic insects have been poorly explored. In this study, dragonfly nymphs (*Anax junius*) and imagoes (*Anax junius* and *Aeshna multicolor*) were exposed to hypoxia and hypercapnia while their abdominal ventilation frequency and amplitude was recorded. Water-breathing nymphs showed a significant increase in abdominal pumping frequency when breathing hypoxic water (< 10 kPa O₂), but no strong response to CO₂, even in severe hypercapnia (up to 10 kPa CO₂). In contrast, both species of air-breathing imago increased their abdominal pumping amplitude when exposed to either hypoxia or hypercapnia,

but did not show any significant increase in frequency. These results demonstrate that aquatic dragonfly nymphs possess a respiratory sensitivity that is more like other water breathing animals, being sensitive to hypoxia but not hypercapnia, while their air-breathing adult form responds to both respiratory challenges, like other terrestrial insects. Shifting from ventilating a rectal gill with water to ventilating a tracheal system with air is also associated with a change in how abdominal ventilation is controlled; nymphs regulate gas exchange by varying frequency while imagoes respond by varying amplitude." (Authors)] Address: Ubhi, Ramandeep, Department of Zoology, University of British Columbia, Vancouver, B.C., V6T 1Z4, Canada

18605. Underhill, L.; Lofie-Eaton, M.; Navarro, R. (2018): Odonata of the Kruger National Park. *Biodiversity Observations* 9.11: 1-16. (in English) ["The number of species of Odonata recorded in the Kruger National, South Africa, was 103 in April 2018. This figure was based on a database containing 2,817 records of Odonata, made since 1980, from the 52 quarter degree grid cells which intersect with the Kruger National Park. Records were available for 41 of the 52 grid cells. The most frequently recorded species were *Trithemis arteriosa* (167 records) and *T. kirbyi* (144 records), both recorded in 33 grid cells, and *Brachythemis leucosticta* (175 records) and *Broad Scarlet* (141 records) both in 29 grid cells. Based on records up to April 2018, the median date of the most recent record for species was September 2017, so that half of the 103 species had been recorded during summer 2017/18. This report could be used to motivate the proclamation of the river and wetland systems of the Kruger National Park as a "Wetland of International Importance" in terms of the Ramsar Convention. Two-thirds of the Odonata of South Africa, and one-eighth of the Odonata of Africa, have been recorded in the Kruger National Park." (Authors)] Address: Les G. Underhill Animal Demography Unit, Department of Biological Sciences, University of Cape Town, Rondebosch, 7701 South Africa

18606. Vajda, C.; Szabó, L.J.; Cserhádi, C.; Dévai, G. (2018): Analysing the European genera of family Lestidae (Odonata: Zygoptera) with special emphasis on the status of *Chalcolestes* based on the morphological characteristics of male adults. *International Journal of Odonatology* 21(3/4): 241-259. (in English) ["Lestidae is a heterogeneous family with more than 150 species worldwide. There are many debates concerning its resolution. One of them is whether the genus *Chalcolestes* should be recognized as a genus or considered as a synonym of *Lestes*. We compared male characteristics of eight Hungarian species of three genera (*Lestes*, *Chalcolestes* and *Sympecma*) of the family Lestidae to get closer to the answer. We analysed the morphometry of genital and non-genital characteristics and the morphology of the secondary genitalia, especially the ligula. The morphometric analyses showed that two *Chalcolestes* species were the biggest in the most of the cases while *Sympecma fusca* (Vander Linden, 1820) and *Lestes virens* (Charpentier, 1825) were the smallest. The genera were separated mainly by the genitalic traits in the morphometric analyses.

The differences in the secondary genitalia strengthen the generic status of *Chalcolestes*." (Authors)] Address: Vajda, Csilla, Department of Hydrobiology, Institute of Biology and Ecology, Faculty of Science and Technology, University of Debrecen, Egyetem tér 1, H-4032 Debrecen, Hungary. Email: vajda.csilla@science.unideb.hu

18607. Valente-Neto, F.; Rodrigues, M.E.; Roque, F. (2018): Selecting indicators based on biodiversity surrogacy and environmental response in a riverine network: Bringing operationality to biomonitoring. *Ecological Indicators* 94(1): 198-206. (in English) ["Highlights: •We assessed cross-taxon congruence between adult dragonflies and groups of aquatic insects. •We evaluated groups responses to environmental and spatial predictors. •We developed a set of criteria that avoid arbitrariness in the selection of the best indicator group. •EPT was selected as the best indicator group for monitoring the effects of riparian vegetation loss. Abstract: An efficient indicator group should fulfill operational and performance-related criteria, including reasonable taxonomic knowledge, costs, response to environmental changes and strong proxy-capacity for biodiversity groups. However, in the real world many trade-offs are involved in the selection of an indicator group, and a single group rarely satisfies all criteria. We investigated cross-taxon congruence of assemblage composition patterns using both quantitative and qualitative data between adult dragonflies and aquatic insects (midges, Ephemeroptera-Plecoptera-Trichoptera (EPT), beetles and entire aquatic insects assemblage). Also, we tested whether environmental and spatial variables were important drivers for cross-taxon congruence. Finally, we developed a set of guiding criteria that avoid arbitrariness in the selection of the best indicator group. We sampled adult dragonflies and aquatic insects in 41 streams and rivers along a riparian vegetation loss gradient in a Neotropical riverine network. We used Procrustes analyses to verify surrogacy between groups and the association of each group with environmental and spatial predictors. The criteria used involves both operational and performance aspects to select an indicator group. Our results showed that adult dragonflies were weakly congruent with the entire aquatic insects assemblage and aquatic insect subgroups were moderate (beetles) to strongly (EPT and midges) congruent with the entire assemblage. Comparisons between EPT, midges and beetles were also weakly congruent, with the exception of midges-EPT. The association between assemblage patterns and overall environmental predictors was significant for all groups, while with spatial patterns, only midges and entire assemblage showed significant results. Numerical resolution slightly improved the congruence results. Incidence data could be used instead of abundance, due to higher congruence values compared to abundance data. Based on cost-benefit, EPT was selected as the best indicator group for monitoring the effects of riparian vegetation loss on aquatic biodiversity, and its use could be viable in biomonitoring programs." (Authors)] Address: Valente-Neto, F., Programa de Pós-Graduação em Ecologia e Conservação, Univ. Federal de Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul CP 549, CEP 79070-900, Brazil. E-mail: fvalenteneto@gmail.com

18608. Van Swaay, C.A.M.; Bos-Groenendijk, G.I.; Deijk, J.R. van; Grunsven, R.H.A.; van, Kok, J.M.; Huskens, K.; Poot, M. (2018): Handleiding landelijke meetnetten vlinders, libellen en nachtvlinders. Rapport VS2018.011, De Vlinderstichting, Wageningen: 32 pp. (in Dutch) [Manual for national monitoring networks for butterflies, dragonflies and moths. Odonata are treated in chapters 4 and 5.] Address: De Vlinderstichting, Mennonietenweg 10, Postbus 506, 6700 AM Wageningen, The Netherlands. E-mail: info@vlinderstichting.nl

18609. Vanacker, M.; Wezel, A.; Oertli, B.; Robin, J. (2018): Water quality parameters and tipping points of dragonfly diversity and abundance in fishponds. *Limnology* 19(3): 321-333. (in English) ["Fishponds are often enriched with nutrients in order to increase phytoplankton and zooplankton populations to support fish production. This eutrophication often leads to a global decrease of biodiversity. This biodiversity shift may be identified by a tipping point, the value of an environmental parameter above which a significant change of species richness and abundance occurs. A total of 110 eutrophic to highly eutrophic fishponds were studied in two areas in France to investigate parameters governing dragonfly species richness and species abundance by determining tipping points. Parameters investigated were chlorophyll a (CHL), water transparency, total N (TN), total P (TP), aquatic plant richness and coverage, adult dragonfly richness and abundance, and fish harvest. A high species richness of dragonflies was found in fishponds, with a total of 34 species, including six species of conservation concern. Dragonfly richness and abundance was shown to be negatively influenced by higher degrees of eutrophication. A high diversity of dragonflies occurred in the fishponds with CHL concentrations below 127 µg/l, water transparency above 67 cm, TN concentrations below 2.30 mg/l, and a fish harvest smaller than 253 kg/ha. A minimum of 5% of aquatic plant cover and the presence of a minimum 9 aquatic plant species seem to promote the richness and abundance of dragonflies. According to tipping points, 19 dragonfly species could be determined as indicator species for water quality in fishponds." (Authors)] Address: Oertli, B., Hepia Geneva Technology, Architecture & Landscape, Univ. of Applied Sciences Western Switzerland, Jussy, Switzerland

18610. Velasco-Villanueva, T.; Campos, F.; Norling, U.; Ferreras-Romero, M. (2018): The life cycles of *Boyeria irene* and *Onychogomphus uncatus* (Odonata: Aeshnidae, Gomphidae) in western Spain: A biometric study. *Eur. J. Entomol.* 115: 684-696. (in English) ["Co-occurrence of species with similar trophic requirements, such as odonates, seems to depend both on them occupying different microhabitats and differing in their life-cycles. The life cycles of the dragonflies *Boyeria irene* and *Onychogomphus uncatus* were studied in two consecutive years, mainly by systematic sampling of larvae in seven permanent head courses that constitute the upper basin of the River Águeda, western Spain, in the central part of the ranges of these two species. The size ranges of the last five larval stadia of both species were established based on biometric data. The eggs of the egg-overwintering aeshnid hatched in late spring and early

summer and for the gomphid hatching peaked in middle-late summer. Both species showed mixed voltinism with "cohort splitting". *B. irene* had a dominant three-year development (partivoltinism), with some developing in two years (semivoltinism). *O. uncatus* requires four, sometimes three years to complete development (all partivoltine). *B. irene* larvae spent the winter before emergence in the last three, maybe four stadia, as a "summer species". *O. uncatus* mainly behaved as a "spring species", most larvae spending the last winter in the final larval stadium." (Authors)] Address: Velasco-Villanueva, Tatiana, Depto de Ciencias Experimentales, Universidad Europea Miguel de Cervantes, Calle Padre Julio Chevalier, 2, 47012 Valladolid, Spain. E-mail: tvelascovillanueva@gmail.com

18611. Villalobos-Jiménez, G.; Dunn, A.M.; Hassall, C. (2018): Environmental noise reduces predation rate in an aquatic invertebrate. *Journal of Insect Conservation* 21: 839–847. (in English) ["Noise is one of a wide range of disturbances associated with human activities that have been shown to have detrimental impacts on a wide range of species, from montane regions to the deep marine environment. Noise may also have community-level impacts via predator–prey interactions, thus jeopardising the stability of trophic networks. However, the impact of noise on freshwater ecosystems is largely unknown. Even more so is the case of insects, despite their crucial role in trophic networks. Here, we study the impact of underwater noise on the predatory functional response of damselfly larvae. We compared the feeding rates of larvae under anthropogenic noise, natural noise, and silent conditions. Our results suggest that underwater noise (pooling the effects of anthropogenic noise and natural noise) decreases the feeding rate of damselflies significantly compared to relatively silent conditions. In particular, natural noise increased the handling time significantly compared to the silent treatment, thus reducing the feeding rate. Unexpectedly, feeding rates under anthropogenic noise were not reduced significantly compared to silent conditions. This study suggests that noise per se may not necessarily have negative impacts on trophic interactions. Instead, the impact of noise on feeding rates may be explained by the presence of nonlinearities in acoustic signals, which may be more abundant in natural compared to anthropogenic noise. We conclude by highlighting the importance of studying a diversity of types of acoustic pollution, and encourage further work regarding trophic interactions with insects using a functional response approach." (Authors)] Address: Villalobos.Jimenez, Giovanna, School Biol., Univ. of Leeds, Woodhouse Lane, Leeds LS2 9JT, UK. E-mail: bsgdjv@leeds.ac.uk

18612. Villanueva, R.J.T.; Cahilog, H.; Jose, E.; van Beijnen, J. (2018): A brief odonatological survey in Palawan and in Cuyo Island, the Philippines. *International Dragonfly Fund . Report 119:* 1-12. (in English) ["An odonatological survey, based on sighting and photographic documenting, was conducted in Palawan and in Cuyo Island. Ten species were found in Cuyo Island raising the number of known species from five to eleven. There are six additions to the Cuyo

Island fauna: *Agriocnemis f. femina*, *Ischnura senegalensis*, *Pseudagrion microcephalum*, *Brachydiplax c. chalybea*, *Neurothemis fluctuans* and *Neurothemis t. terminata*. The occurrence of *Coeliccia boettcheri*, known from Cuyo, but not recorded during this survey, is discussed in some detail. Forty species were recorded in Palawan. Four new additions to the Palawan fauna were recorded: *Lestes p. praemorsus*, *Pseudagrion microcephalum*, *Xiphiagrion cyanomelas*, and *Anax guttatus*. *Neurobasis daviesi*, a rare calopterygid damselfly endemic in Palawan, was encountered at the northern side of Cleopatra Needle during the survey." (Authors)] Address: Villanueva, R.J.T., Forestal Healing Homes & Therapeutic Milieu, Forestal Road, Cabantian, Davao City, 8000 Philippines. E-mail: rjtvillanueva@gmail.com

18613. Walia, G.K.; Devi, M. (2018): Distribution of constitutive heterochromatin in four species of genus *Copera* of family Platycnemididae (Odonata: Zygoptera) from India. *Int. J. of Life Sciences* 6(2): 457-461. (in English) ["C-heterochromatin distribution in four species of genus *Copera* of family Platycnemididae have been described. *C. marginipes* and *C. vittata assamensis* were collected from Bilaspur and Renuka lake (Sirmour, Himachal Pradesh), respectively, while *C. annulata* and *C. vittata* were collected from Nongkhyllam (Meghalaya), India. All the species possess $n=13m$ as haploid chromosome number, which is the type number of the family and X0-XX sex determining mechanism. In all the species, autosomal bivalents show dark/light terminal C-bands on chiasmatic/nonchiasmatic ends, while *m* bivalent and X chromosome possess variation in distribution of C-heterochromatin. *m* bivalent is C-negative in *C. marginipes*, while shows terminal C-bands in *C. annulata*, *C. vittata* and *C. vittata assamensis*. X chromosome possesses less amount of C-heterochromatin in *C. marginipes*, *C. annulata* and *C. vittata*, whereas X chromosome is bipartite and entirely C-negative in *C. vittata assamensis*. Chromosome complement of *C. vittata assamensis* has been studied for the first time." (Authors)] Address: Walia, Gurinder Kaur, Dept of Zoology & Environmental Sciences, Punjabi University, Patiala 147002, Punjab, India

18614. Wildermuth, H.; Borkenstein, A.; Jödicke, R. (2018): Verhaltensgesteuerte Thermoregulation bei *Leucorrhinia pectoralis* und *L. rubicunda* (Odonata: Libellulidae). *Libellula* 37(3/4): 97-134. (in German, with English summary) ["Behavioural thermoregulation in *Leucorrhinia pectoralis* and *L. rubicunda* (Odonata: Libellulidae). Libellulids are perchers that control their body temperature. in contrast to the endothermic fliers. during their activity periods at sunny sites mainly by perch selection and body posture. Hitherto, thermoregulation in Libellulidae was studied only in a few species applying an experimental-invasive method to measure the thoracic temperature. As to *Leucorrhinia* spp. nothing has been published in this respect. Aiming to learn more about the behavioural thermoadaptation of this cool and cold temperate Holarctic genus, we studied *Leucorrhinia pectoralis* and *L. rubicunda* in peat bogs of the Swiss Plateau and Lower Saxony in northwestern Germany. All data were collected by Observation, photo documentation and measures of

temperature without capture and Intervention. The breeding water and its terrestrial environment turned out to be a richly structured thermal landscape with vast differences varying up to 25°C between diverse sites, which were preferred or avoided by the dragonflies depending on the given Situation. For a spontaneous takeoff from a shaded roost, *L. rubicunda* needed a minimum temperature of ca 17°C. In the morning and after cloudy periods both species first flew to a sunlit site where they pressed their body with spread legs and wings against the Substrate ('dorsally exposed warm-up posture') and thus assimilated the direct and indirect radial heat as well as most probably also heat conduction from the Substrate. A 'warm-up obelisk posture' was seen rarely and only in *L. rubicunda*. The insects preferred light bark and deadwood but also flat parts from green herbs and bushes for basking. *L. rubicunda* preferentially basked directly on the ground in wind-sheltered grooves. With rising temperatures they gave up their close link to the ground but remained within the ground Vegetation. On sunny days mature males of *L. pectoralis* arrived at ca 17°C at the water, those of *L. rubicunda* at ca 14°C. Both species sat there at ambient temperatures between 20 and 30°C in a horizontal or oblique body posture on an elevated, sunlit perch above the water or on the water's edge, always with free view of the open water. From time to time they took off for a patrol flight and occasionally they flew ashore for basking. On hot days with an ambient temperature above 30°C most individuals left their sunlit sites to seek out shade, which was especially obvious in *L. rubicunda*. All males remaining at the water changed their posture and sun exposure for heat avoidance: They either directly faced the sun ('sun-facing heat posture') or they adopted the 'heat Obelisk posture', the abdominal tip pointing to the sun, the wings holded V-shaped and the legs stretched. In both postures the sunlit body surface was reduced to a minimum. For fine adjustment of the body temperature they controlled the heat input by turning the abdomen or the whole body in all three spatial axes. Heat release by convection resulted from wind effects on elevated, wind-exposed perches. In hot conditions *L. rubicunda* preferred frontal exposure to the sun and adopted the obelisk posture only in extremely hot periods when there was no compensating cooling by wind. All forms of behavioural thermoregulation are of great adaptive importance. The effective warm-up enables young *L. rubicunda* individuals optimal use of the hours of sunshine that may be scarce during cold April days. Thus, the species is able to feed, escape and disperse at low air temperatures. During hot conditions mature males of both species use behavioural heat avoidance to remain at water for reproductive activities instead of withdrawal into the shade of the terrestrial habitat. It remained unclear to what extent wing whirring and flapping played a role in warming up. Both *Leucorrhinia* species have demonstrated that they are able to apply it in extreme situations but we have never observed this to be performed systematically during diurnal hours." (Authors)] Address: Wildermuth, H., Haltbergstr. 43, CH-8630 Rütli, Switzerland. E-mail: hansruedi@wildermuth.ch

18615. Willink Castro, B. (2018): The descent of damselflies and variation in relation to sex. PhD. Thesis, Evolutionary Biology, Lund University, Faculty of Science, Department of Biology: 84 pp. (in English) ["Sexual conflict over mating shapes the interactions between males and females in many animals and is also responsible for dramatic adaptations in both sexes. In some species of pond damselflies (Odonata: Coeangrionidae), sexual conflict maintains discrete female-limited colour morphs over multiple generations and within populations. One of the female morphs is typically male-coloured and considered a male mimic. This is because their male-like appearance provides a frequency-dependent advantage against excessive male mating attempts. In this thesis, I investigate three major questions regarding the evolutionary consequences of this pervasive sexual conflict. First, how is phenotypic variation in ecological traits distributed among heritable female colour morphs? Second, how does sexual conflict shape phenotypic variation within the lifespan of females? Finally, how, where and why do female-limited morphs arise in the first place? In *Ischnura elegans*, female morphs differ in multiple phenotypic traits. My results uncover further phenotypic associations between the two most common morphs of the Common Bluetail in Sweden. One morph is more resistant to infections by parasitic mites, whereas the other is instead more tolerant. These morphs also differ in their developmental sensitivity to temperature, which in turn influences how morph frequencies are distributed across European populations. Moreover, my findings provide some insights as to how these profound phenotypic differences are produced over the course of adult development, and suggest that male mimics and non-mimics differ in the regulation of important developmental processes. Females of the Common Bluetail undergo dramatic colour changes as they become sexually mature. My thesis shows that immature colour patterns in non-mimic female morphs reduce male pre-mating harassment, and may have evolved by co-opting male colour signals to be expressed as immature signals of reproductive unsuitability. These results suggest that female colour patterns might be highly evolutionarily labile. Yet, a large-scale phylogenetic framework is required to gain a full understanding of the macroevolutionary consequences of sexual conflict on the evolution of female-limited colour variation. I inferred a multi-locus phylogeny for the damselfly superfamily Coeangrionoidea. I then used this phylogeny to show that female-limited colour polymorphisms have arisen repeatedly in this clade, and in association with ecological conditions that foster sexual conflict over mating. Finally, my results uncover a stark contrast between the consequences of sexual conflict at micro and macroevolutionary scales. While sexual conflict promotes diversity within populations by maintaining alternative female morphs, the presence of these morphs is also associated with increased extinction risk and a fast lineage turnover. Together, my results reveal how sexual conflict can influence the origin, distribution and loss of diversity." (Author)] Address: Willink, Beatriz, Dept of Biology, Evolutionary Ecology Unit, Ecology Building, Lund University, Lund 223-62, Sweden. E-mail: beatriz.willink@ucr.ac.cr

18616. Worthen, W.B. (2018): Differences in male-male tandem formation in two species of *Micrathyria* (Odonata: Libellulidae). *Notulae odonatologicae* 9(2): 60-66. (in English) ["Male-male tandem formation in odonates is typically described as a mistaken sexual advance by one male on another. If so, male-male tandem formation should be less frequent in more sexually dimorphic species. In a small experiment designed to describe patterns of intra- and interspecific aggression by *Micrathyria atra* and *M. mengeri*, I placed live tethered male decoys of these species in the territories of territorial males. In the less sexually dimorphic *M. mengeri*, nine of 21 intraspecific interactions by three different males resulted in male-male tandem attempts. In the more sexually dimorphic *M. atra*, only one of 25 intraspecific interactions resulted in a male-male tandem attempt. The higher incidence of male-male tandem formation in *M. mengeri* may reflect a greater mistake rate by males in this less dimorphic species." (Author)] Address: Worthen, W.B., Biology Dept, Furman Univ., Greenville, SC, USA, 29613. E-Mail: wade.worthen@furman.edu

18617. Worthen, W.B. (2018): Confirming the relationship between body size and perch height in tropical odonates (Odonata: Libellulidae): wet-season contrasts and experimental tests. *International Journal of Odonatology* 21(3/4): 229-239. (in English) ["In a previous study conducted during the dry season at La Selva Biological Station, Costa Rica, mean perch height of libellulid dragonfly species (Odonata: Libellulidae) correlated with male body size, and interactions between species suggested a size-dependent competitive hierarchy. Here, I report on a wet-season study that examined whether seasonal changes in community composition affect these patterns. Males were captured, photographed, and marked, perch heights among individuals and species on natural and artificial perches (25, 50, and 100 cm) were compared, and the frequencies of aggressive interactions between species were analyzed. I also examined the responses of *Micrathyria atra* and *Micrathyria mengeri* males to decoys of these species placed in their territory at different heights (50 or 100 cm). Although the wet season community differed from the dry season community (Jaccard dissimilarity = 0.778), there was still a significant correlation between species perch height and body size, on both natural and artificial perches. Interspecific interactions supported the size-dependent competitive hierarchy hypothesis: smaller species that perched low avoided attacks by larger species. These patterns were confirmed in the decoy experiment. The larger *M. atra*, which perches at ~100 cm, attacked decoys at 100 cm almost exclusively, and attacked decoys of the smaller *M. mengeri* more than conspecifics. In contrast, *M. mengeri* (which perches at 50 cm) only attacked decoys placed at 50 cm. Although community membership changed, the correlation between body size and perch height was maintained by a size-dependent competitive hierarchy in both dry and rainy seasons." (Author)] Address: Worthen, W.B., Biology Dept, Furman Univ., Greenville, SC, USA. Email: wade.worthen@furman.edu

18618. Worthen, W.B.; Hoke, L. (2018): Pseudoreplication in species comparisons: do individual differences matter?

Notulae odonatologicae 9(1): 18-25. (in English) ["Pseudoreplication occurs in many behavioral studies of odonates, because a few unmarked individuals are sampled repeatedly and are used as estimators of the species' behavior. This can confound individual differences with species differences. Here, we tallied perches of marked and unmarked male libellulids on artificial perches of seven heights (10–120 cm). We estimated the effect of pseudoreplication on species-level contrasts of mean male perch height by comparing the results of four different analyses: 1) a nested ANOVA (analysis of variance) evaluating individual and species effects on perches by marked individuals; 2) a one-way ANOVA comparing species using mean perch heights of the same marked individuals; 3) a one-way ANOVA comparing species without regard to individuals (pseudoreplication of these marked individuals); and 4) a one-way ANOVA using perches by unmarked individuals observed at the same time (pooling across pseudoreplicated individuals in a larger independent data set). Species differences were qualitatively similar across all analyses, and mean perch heights computed on individual means, pooled (pseudoreplicated) data on marked individuals, and data on unmarked individuals were highly correlated. Pseudoreplication altered patterns slightly, but these effects were overcome in the larger data set on unmarked individuals." (Authors)] Address: Worthen, W.B., Biology Department, Furman University, Greenville, SC 29613, USA. E-mail: wade.worthen@furman.edu

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18619. Alves-Martins, F.; Brasil, L.S.; Juen, L.; De Marco Jr, P.; Stropp, J.; Hortal, J. (2019): Metacommunity patterns of Amazonian Odonata: the role of environmental gradients and major rivers. *PeerJ* 7:e6472. 26 pp. (in English) ["Background. We identified and classified Zygoptera and Anisoptera metacommunities in Brazilian Amazonia, relating species distribution patterns to known biological gradients and biogeographical history. We expected a random distribution of both Zygoptera and Anisoptera within interfluves. At the Amazonian scale, we expected Anisoptera metacommunities to be randomly distributed due to their higher dispersal ability and large environmental tolerance. In contrast, we expected Zygoptera communities to exhibit a Clementsian pattern, limited by the large Amazonia rivers due to their low dispersal ability. Methods. We used a dataset of 58 first-to-third order well-sampled streamlets in four Amazonian interfluves and applied an extension of the Elements of Metacommunity Structure (EMS) framework, in which we order Zygoptera and Anisoptera metacommunities by known spatial and biogeographic predictors. Results. At the Amazonian scale, both Zygoptera and Anisoptera presented a Clementsian pattern, driven by the same environmental and biogeographical predictors, namely biogeographic region (interfluve), annual mean temperature, habitat integrity and annual precipitation. At the interfluve scale, results were less consistent and only partially support our hypothesis. Zygoptera metacommunities at Guiana and Anisoptera metacommunities at Tapajós were classified as random, sugges-

ting that neutral processes gain importance at smaller spatial scales. Discussion. Our findings were consistent with previous studies showing that environmental gradients and major rivers limit the distribution of Odonata communities, supporting that larger Amazonian rivers act as barriers for the dispersal of this group. In addition, the importance of habitat integrity indicates that intactness of riparian vegetation is an important filter shaping metacommunity structure of Amazonian stream Odonata." (Authors)] Address: Alves-Martins, Fernanda, Dept Biogeography & Global Change, Museo Nacional de Ciencias Naturales (MNCN-CSIC), Madrid, Madrid, Spain

18620. Cherpitel, T.; Filipe, M. (2019): Observations de pontes de *Sympetrum striolatum* sur un estran rocheux atlantique (Odonata: Libellulidae). *Martinia* 34(1/2): 57-58. (in French) [Verbatim: *S. striolatum* is a eurytopean species whose larvae live in fresh, permanent, stagnant to slightly flowing water but can also live in temporary or brackish water (e.g. HEIDEMANN H. & SEIDENBUSCH R., 2002: Larvae and exuviae of dragonflies from France and Germany (except Corsica). *Société française d'odonatologie*, Bois-d'Arcy, 416 pp.) When laying eggs, the eggs of this species are deposited freely in the water or sometimes on the exposed banks (GRAND D. & BOUDOT J.-P., 2006: *Les Libellules de France, Belgique et Luxembourg*. Biotope [Coll. Parthénope], Mèze, 480 pp). During a low-water tide on 28 -IX-2018, during a survey in search of continental invertebrates taking refuge in the diaclases of the rocky foreshore of the Pointe de Penchâteau (Le Pouliguen [44]), our attention was drawn to the presence of numerous tandems of *S. striolatum*. We then observed, on about 15 occasions, spawning in the numerous tidal pools of the mediolittoral. Up to three tandems were noted laying eggs in one of them (Fig. 1). Spawning took place in open water, sometimes in the algal clusters that were outcropping on the surface (*Fucus* sp., *Ulva* sp., etc.). No copulatory hearts were observed that day. As this was seawater, these observations seem atypical. Most Odonata live in fresh to brackish water and their larvae are unable to perform hypo-osmotic regulation and thus to survive in water with too much salt. The only counter-example is the American Libellulidae *Erythrodiplax berenice* (Drury, 1773) whose larvae are able to live in water saltier than sea water, i.e. over 35 g/L (CORBET P.S., 2004: *Dragonflies: behaviour and ecology of Odonata* (Revised Edition). Harley books, Colchester, 829 pp.). The larvae of *S. striolatum* tolerate a salinity of 2 to 3 g/L (AGUESSE P., 1968: *Les Odonates de l'Europe Occidentale, du Nord de l'Afrique et des Îles Atlantiques*. Faune de l'Europe et du Bassin méditerranéen, 4. Masson, Paris, 258 pp.). These spawning sites observed in sea water therefore have no chance of allowing the larvae that might hatch to develop properly. However, this type of egg-laying behaviour, and others whose reproductive success is just as predictable, have already been cited for this species, notably at the level of "puddles of sea water at low tide, car windscreens or bonnets, paths, roads or tarmac car parks, puddles of diesel fuel in a petrol station, dog bowls or metal sheets" (JOURDE P. & MONTENOT J.-P., 2009.

Sympetrum striolatum (Charpentier, 1840). In: Poitou-Charentes Nature (ed.). *Libellules du Poitou-Charentes*. Poitou-Charentes Nature, Fontaine-le-Comte: 198-199). Many other examples are known, involving various species in egg-laying behaviour in a woollen jumper, a rubber boot, a carpet in a house, etc. (CORBET, 2004: op. cit.). The choice of an oviposition site in a tidal pool, like several other cases cited above, is probably due to the species' polarotaxis. Indeed, to find their oviposition sites, many Odonata are guided by horizontally polarised light (e.g. WILDERMUTH H., 1998: Dragonflies recognize the water of rendezvous and oviposition sites by horizontally polarized light: a behavioural field test. *Naturwissenschaften*, 85: 297-302). This visual response of species with exophytic oviposition is also assumed to be universal by CORBET (2004: op. cit.). Here, the ecological trap represented by oviposition in sea water is linked to the chemical properties of the water, which the females of *S. striolatum* do not seem to have detected. Odonates with endophytic oviposition have taste sensilla on the ovipositor (e.g. REBORA M. et al., 2013: The gustatory sensilla on the endophytic ovipositor of Odonata. *Arthropod Structure & Development*, 42: 127-134). If *S. striolatum* also possesses them, this would tend to show that these sensilla are totally inoperative in assessing the salinity of the water when the apex of the abdomen is in contact with it. However, it should be remembered that Libellulidae laying eggs at random in all potentially favourable areas are the Odonata with the widest distribution on the planet, while presenting important numbers (AGUESSE, 1968: op. cit.); an efficient strategy that accommodates some ecological traps. Acknowledgements: Thanks to Philippe Lambret for his suggestions and bibliographical help. Translated with www.DeepL.com/Translator (free version)] Address: Cherpitel, T., 1 Groupe d'Étude des Invertébrés Armoricaïns, 5, rue du Général Leclerc, 44390 Nort-sur-Erdre, France. E-mail: t.cherpitel@gretia.org

18621. de Vries, R.; Buesink, R.; Kloen, J.-F.; Achterkamp, J. (2019): Interesting observations of Odonata in Limburg, the Netherlands during the summer of 2018. *Brachytron* 20(1): 32-37. (in Dutch, with English summary) ["In July 2018, the Dutch youth nature organisations NJN and JNM investigated the region around Roermond in the province of Limburg, the Netherlands. Due to its large diversity of aquatic habitats, this region harbours a very high diversity of Odonata. Here we present the observations of scarce and rare species for the Netherlands that were observed by the nature camps in four areas: the Meinweg, the valleys of the rivers Roer and Swalm and the Vlootbeek. Of particular interest were the observations of 3 individuals of *Onychogomphus forcipatus* at the river Roer, and 10 individuals of *Aeshna affinis* at three locations in the Meinweg. These are two very rare species in the Netherlands, of which reproduction in this areas is plausible respectively possible." (Authors)] Address: de Vries, R.: E-mail: vries.reinier@gmail.com

18622. Ehlert, J.; Pinto, A.P. (2019): Additions to the dragonfly genus *Lauromacromia*, with description of the female of *Lauromacromia luismoojeni* and new distributional re-

cords (Odonata: Corduliidae s.l.). *International Journal of Odonatology* 23(2) (issued: 2020): 79-91. (in English) ["Taxonomic, morphological and distributional data on three species of the rare South American corduliid genus *Lauromacromia* Geijskes, 1970 are updated based on specimens collected recently and old specimens deposited in natural history collections. The female of the poorly known *Lauromacromia luismoojeni* (Santos, 1967), an endemic species from the Brazilian Cerrado, is illustrated, described and diagnosed for the first time, based on a single specimen from the municipality of Mineiros, state of Goiás. This species was previously known from two males from two different localities: the original description from Distrito Federal, and an additional record from the state of Mato Grosso do Sul. New state records to Brazil are given for *L. dubitalis* (Fraser, 1939) (Amazonia domain of the state of Amapá), *L. luismoojeni* (Cerrado domain of the state of Goiás), and for *L. pinguaba* Carvalho et al., 2004 (Atlantic Forest domain of the state of Paraná). Finally, the current knowledge about the genus is discussed." (Authors)] Address: Ehlert, Julia, Biological Sciences, Universidade Federal do Paraná, Curitiba, Paraná, Brazil. Email: juliana.ehlert@ufpr.br

18623. Gainzarain, J.A. (2019): Fauna de odonatos (Insecta: Odonata) en los ríos del norte de Burgos (Castilla y León, España). *Boletín de la Sociedad Entomológica Aragonesa* 65: 207-217. (in Spanish, with English summary) ["In 2019, rivers in northern Burgos province were surveyed in search of adult odonata by means of 52 points prospected twice in June-July and August-September. 31 species (15 Zygoptera and 16 Anisoptera) were registered. The number of odonate species was negatively related to river slope, and positively to the presence of helophytes and submerged/floating vegetation. These relationships were basically due to the variation in generalist species richness, as the number of river specialists was only related to the presence of submerged/floating vegetation. *Ischnura pumilio* and *Gomphus vulgatissimus* were added as new species for Burgos, and the first records of *Coenagrion caerulescens* in the current century were obtained as well." (Authors)] Address: Gainzarain, J.A., Inst. Alavés de la Naturaleza. Apdo. de correos 2092 01080 Vitoria-Gasteiz, Spain. E-mail: j.gainzarain@gmail.com

18624. Gorb, S.N. (2019): Body temperatures in *Sympetma paedisca* (Zygoptera, Lestidae) in the autumn in the Central Ukraine. *International Journal of Odonatology* 22(2): 95-100. (in English) ["This short communication reports on the warming ability of the damselfly *S. paedisca*, which is known for its winter hibernation and tolerance to low temperatures. The data were collected using an infrared camera in late September on two sunny days (air temperature 15–17°C) in the vicinity of Kyiv, Central Ukraine. The obtained data show that the thorax was almost always the warmest part of the body (up to 21°C in comparison to 17–18°C of the substrates damselflies were resting on and surrounding living plants). This indicates that the animals, in addition to sun, use their thoracic musculature to warm their bodies up. There was a clear correlation between thorax temperature

and the temperature of both the head and abdomen, which means the warmed up thorax can transport part of its heat to other parts of the body by using their circulatory system." (Author)] Address: Gorb, S.N., Functional Morphology and Biomechanics, Zoological Institute, Christian-Albrecht Univ. of Kiel, 24098 Kiel, Germany. E-mail: sgorb@zoologie.uni-kiel.de

18625. Krieg-Jacquier, R.; Baux, V.; Cornuel-Willermoz, A. (2019): Mortalité importante à l'émergence chez *Libellula depressa*: impact du pâturage sur une pozzine de Corse (Odonata: Libellulidae). *Martinia* 34(1-2)(2020): 26-28. (in French) [Verbatim: The pozzine is a flat acidic peat bog dotted with water holes connected by channels and owes its name to the term pozzini (plural of pozzo) which means "well" in Corsica (BRIQUET J., 1910: *Prodrome de la flore corse: comprenant les résultats botaniques de six voyages exécutés en Corse sous les auspices de M. Emile Burnat*, tome I. Georg, Geneva, 656 + LVI pp). More precisely, it is a "set of hygrophilous or mesohygrophilous grasslands developed around glacial lakes or water holes which result from their fragmentation" (GAMISANS J., 2010. *Le paysage végétal de la Corse*. Albiana, 348 pp). The observation was made on 27 May 2017 at about 3 pm on a pozzo in the commune of Casamaccioli (42.25806°N | 8.93667°E [WGS84]) at an altitude of 1,745 m, on the Ninu pozzine in the immediate vicinity of the eponymous lake. This water body is vaguely kidney-shaped and its surface area is about 135 m² (20 × 10 m in its maximum dimensions). Like various pozzies on the site, it is not directly connected to the main stream, which flows 6 m from the nearest bank, but gives rise to a small tributary circulation that feeds 6-7 smaller pozzies. The depth was not probed, but the visible bottom areas did not appear to support macrophytes. Unlike other pozzos at the site, this pozzo did not have a steep bank and the water came into direct contact with the bank vegetation which is mainly Poaceae like the surrounding grassland. As the water levels and the connection between the different pozzini can fluctuate rapidly (Cyril Berquier, pers. com.), the configuration we describe here is variable over time, particularly according to the seasons. When we arrived at the edge of the pond, we spotted numerous *Libellula depressa* Linnaeus, 1758 teneral floating on the surface; they were in various stages of decomposition, indicating that some individuals had been dying for several days. Other specimens were observed completing their emergence, wings and abdomen in the water. About ten individuals managed to complete their emergence during our observation but sometimes had poorly developed wings. We estimate that we saw about 100 individuals (emergent, dead, exuviae) and it is likely that less than 5% of the emergences allowed an imago to fly. The only other odonate species we observed on the site today was an agonising female of *Sympetrum fonscolombii* (Selys, 1840). Three types of impact of grazing on emergence can be identified (THOMPSON D.J. et al. 1985. Horses as a major cause of mortality in *Coenagrion puella* (L.) (Zygoptera: Coenagrionidae). *Notul. Odonatol.* 2(6), pp. 104–105): (i) accidental consumption of emerging larvae and

adults during grazing or their eventual fall; excessive mowing of vegetation which (ii) reduces the number of supports on which larvae can climb to emerge (larvae then attempt to emerge on insufficiently high plant supports and fail to complete emergence) and (iii) allows greater accessibility of the emergence site to birds, predators of emerging larvae and individuals. In the case of the observation area under consideration, cattle and horses share the meadow and after prolonged grazing of the bank, there is no longer enough support on which the larvae can climb to emerge. As a result, emergence takes place on insufficiently high vegetation (about 10 cm). A significant number of individuals fail to complete emergence, either because they are exposed to wind-generated ripples, or because they remain partly in the water, or because they fall. It is possible that avian predation is also facilitated here, but we have not observed it. It seems to be negligible on the site, frequented only by a few *Spioncelle* Pipits *Anthus spinoletta*, Clumped Wheatears *Oenanthe oenanthe* and various passerines, mainly granivorous, such as the Corsican Venturon *Carduelis corsicana* or the Tree Finch *Fringilla coelebs* (Cyril Berquier, in litt. 29 November 2018). The presence of vegetation that is not very appealing to livestock, which generally surrounds water bodies (rushes, sedges, reeds), often preserves a ring of riparian vegetation that allows for emergence with less risk. Here, the absence of this ring encourages grazing right up to the water's edge. At some distance from the pozzo studied, Lake Ninu offers a more varied vegetation on its banks (helophytes and hydrophytes) which preserves more areas suitable for the emergence of Odonata. The consequences of pastoral practices on the pozzines of Corsica should be studied in greater depth and the mortality of other Odonata species should be assessed (the observation reported here being fairly early). These studies would make it possible to envisage measures for the conservation of Odonata that are consistent with traditional activities and respect for the landscape characteristics of pozzines. One of these measures could be the enclosure of part of their banks, which would maintain a riverine vegetation of sufficient height and structure that the larvae could select during emergence (e.g. WORTHEN W. B., 2010: Emergence-site selection by the dragonfly *Epitheca spinosa* (Hagen). *Southeastern Naturalist*, 9 (2): 251-258; GROF-TISZA P. et al., 2017: Plant structural complexity and mechanical defences mediate predator-prey interactions in an odonate-bird system. *Ecology and Evolution*, 7(5): 1650-1659) without prohibiting livestock access to drinking water. Acknowledgements: We would like to thank Cyril Berquier from the Office de l'Environnement de la Corse for his proofreading and additions.] Address: Krieg-Jacquier, R., 628 route de Marboz 01440 Viriat, France. E-mail: regis.krieg.jacquier@gmail.com

18626. Patten, M.A.; Barnard, A.A.; Smith, B.D. (2019): Geographic variation in a restricted-range endemic dragonfly *Gomphurus ozarkensis* (Odonata: Gomphidae), with description of a new subspecies. *Journal of Insect Biodiversity* 13(2): 15-26. (in English) ["The geographic distribution of *G. ozarkensis*, a species described to science only four de-

caes ago, is confined to a four-state area in the central United States: southeastern Kansas, eastern Oklahoma, western and northern Arkansas, and southern Missouri. Its small range has led some to classify it a species of conservation concern. We examined geographic variation in the species, which despite its small range exists in three distinct subpopulations: one in the Ouachita Mountains of western Arkansas and southeastern Oklahoma; one on the Ozark Plateau of northeastern Oklahoma, southeastern-most Kansas, southern Missouri, and northern Arkansas; and one in the Osage/Flint hills of southeastern Kansas and northeastern Oklahoma. Clinal variation is evident in the extent of yellow on the terminal abdominal segments and the extent to which certain thoracic stripes are fused. A population in a separate watershed basin in the southern Osage Hills of Oklahoma is taxonomically distinct, with some phenotypic characters tending toward *G. externus* (Hagen, 1858). We describe this population as a new subspecies of *G. ozarkensis*." (Authors)] Address: Patten, M.A., Oklahoma Biological Survey, Univ. Oklahoma, Norman, Oklahoma 73019, USA

18627. Payette, W.I.; Sullivan, A.M. (2019): The effect of predator kairomones on caudal regeneration by Allegheny Mountain dusky salamanders (*Desmognathus ochrophaeus*). *Canadian Journal of Zoology* 97(6): 502-509. (in English) ["Many prey utilize autotomy as an antipredator mechanism. Rapid regeneration of autotomized appendages is beneficial because forfeited tissues may serve as organs for energy storage, accessories for locomotion, or indicators of social status. We monitored levels of caudal regeneration by Allegheny Mountain dusky salamanders, *D. ochrophaeus* (Cope, 1859) exposed to kairomones from predatory eastern garter snakes, *Thamnophis sirtalis* (L., 1758). After the induction of autotomy, salamanders were exposed to one of three treatment regimens: blank (water), or an acute (30 min per week) or chronic (constant) exposure to predator kairomones during a 12-week study period. Overall, the average volume of regenerated tissue, as a percentage of original tail volume, was highest for individuals exposed to the blank versus predator kairomones. When the combined effects of time elapsed since the induction of caudal autotomy and the different treatment regimens were considered, we found that the average volume of regenerated tissue was significantly greater for control salamanders beginning eight weeks after autotomy. The mechanism contributing to the differential rates of regeneration among individuals in our treatment groups is unknown, but previous work suggests that elevated stress related to predation threat can have detrimental effects on wound healing and growth in amphibians." (Authors) The paper includes references to Odonata.] Address: Sullivan, A.M., Dept Biol., Houghton Coll., Houghton, NY 14744, USA. E-mail: aaron.sullivan@houghton.edu

18628. Rahaman, M.M.; Stout, M.J. (2019): Comparative efficacies of next-generation insecticides against yellow stem borer and their effects on natural enemies in a rice ecosystem. *Rice Science* 26(3): 157-166. (in English) ["The efficacies of some next-generation insecticides against the rice yellow stem borer (YSB), *Scirpophaga incertulas*

(Walk.), and their compatibilities with natural enemies were investigated during 2014 and 2015. Three newer insecticides, chlorantraniliprole 0.4%G, dinotefuran 20% SG, and methoxyfenozide 24% SC, and two older, commonly used insecticides, carbufuran 5G and quinalphos 25 EC, were evaluated in the field for their efficacies against YSB and their non-target effects on natural enemies. Application of chlorantraniliprole 0.4%G at 10.96 kg/ha resulted in the greatest reduction in YSB infestation (deadhearts and whiteheads) and greatest increase of yield over control, followed by methoxyfenozide 24% SC at 0.41L/ha, dinotefuran 20% SG at 0.15 kg/ha, carbufuran 5G at 10.96 kg/ha, and quinalphos 25EC at 1.5 L/ha. All the insecticides reduced the numbers of predators' viz., lady bird beetles, wolf spiders, carabid beetles, earwigs, green mirid bugs, damselflies. Numbers of adults of the egg parasitoids *Trichogramma* sp., *Telenomus* sp., and *Tetrastichus* sp. were significantly reduced in insecticide-treated plots compared to untreated control plots. In all field trials, chlorantraniliprole 0.4%G was found to be least harmful and quinalphos 25EC was found most harmful to natural enemies, with their harmful effects in the following rank order (least harmful to most harmful): chlorantraniliprole 0.4% G <carbufuran5G <dinotefuran 20% SG <methoxyfenozide 24% SC <quinalphos 25EC. On the basis of reduction in YSB infestation, increase in grain yield, and compatibility with natural enemies, chlorantraniliprole 0.4% G proved the best of all the insecticides for the YSB management system, although the study suggested minimizing its retail price for enhancement of cost effectiveness in farmers' fields." (Authors)] Address: Rahaman, M.M., Dept Agriculture, Pakutia College, Ghatail, Tangail-1982, Bangladesh

18629. Ryazanova, G.I. (2019): Odonata and anthropogenic salinization of inland waters. *Moscow University Biological Sciences Bulletin* 74(1): 33-39. (in English) ["The anthropogenic salinization of inland waters and its effect on freshwater biota are current environmental problems. This salinization leads to changes in the natural environment that are ecologically undesirable and not indifferent to humans. The widespread use of agents for road deicing has become one of the three most important factors of anthropogenic salinization of fresh water (along with agricultural activities and mining) in countries with temperate and cold climate. Today, the main components of these agents are Na and Ca chlorides—cheap and easily available natural materials. Their mixture with sand, used in deicing practice, is usually stored in bulk in special open-air areas all year round. The impact of atmospheric precipitation makes this mixture a source of salinization of the surrounding soils and waters. In 2015, 2016, and 2018, the salinity of inland waters was recorded near the long-term open storage of antiicing agents in Kaluga oblast. The anthropogenic nature of salinization of the investigated water bodies is established. The main components of salinization of water bodies in the study area are Na and Ca chlorides. The maximum degree of salinization in the studied conditions is 4‰ (ppm); the degree of salinity depends on the distance of the water body from the road-salt storage. The influence of anthropogenic salinity on dragonflies, mainly of the species *Coenagrion puella* L., is studied. It is found

that the negative effect of high water salinity is expressed only in the slowdown of the development of individuals with a high level of fluctuating asymmetry, the number of which in the population is not determined by water salinity. High water salinity leads to changes only in the timing of emergence of imagoes with high FA. It is assumed that dragonflies as a mass object of freshwater biota are obviously not significantly exposed to anthropogenic salinization. Russian Text © The Author(s), 2019, published in *Vestnik Moskovskogo Universiteta, Seriya 16: Biologiya*, 2019, Vol. 74, No. 1, pp. 42–49.] Address: Ryazanova, G.I., Dept of Biology, Moscow State University, Moscow, Russia. E-mail: ryazanovagi@mail.ru

18630. Serrano-Meneses, M.A.; López-García, K.; Carrillo-Muñoz, A.I. (2019): Assortative mating by size in the American Rubyspot Damselfly (*Hetaerina americana*). *Journal of Insect Behavior* 31(6): 585-598. (in English) ["Assortative mating refers to the non-random nature of mating patterns between certain males and females. Thus, males and females may associate negative. or positively, based on different traits. Amongst these associations, assortative mating by size is one of the most common patterns found in natural populations of animals. Two main hypotheses have been proposed to account for the occurrence of assortative mating by size. First, it may be the result of mechanical, temporal, or physiological constraints. Second, it may occur in response to direct or indirect selection on mating preferences. Here we investigate whether the American rubyspot damselfly exhibits true assortative mating by size. Males of this species exhibit high levels of male-male competition, as they compete over territories, to which females are attracted for copulation. There is a documented large male body size advantage: the largest males are better able to hold their territories and thus secure more copulations. Our major results show that i) mated males are more likely to be larger than unmated males, whereas mated and unmated females tend to have similar body sizes; ii) *H. americana* exhibits true assortative mating by size; as such, this pattern is not driven by seasonal changes in the body sizes of males and females. We suggest that this mating pattern occurs in this species given the advantages of large male size, and the advantages of large female body size (i.e. higher fecundity). We believe that males may be able to evaluate a female's reproductive value and exert mate choice." (Authors)] Address: Serrano-Meneses, M.A., Depto de Ciencias Químico-Biológicas, Univ. de las Américas Puebla, Puebla, Mexico

18631. Sniegula, S.; Golab, M.J.; Johansson, F. (2019): Size-mediated priority and temperature effects on intra-cohort competition and cannibalism in a damselfly. *Journal of animal ecology* 88(4): 637-648. (in English) ["1. A shift in the relative arrival of offspring, e.g., a shift in hatching time, can affect competition at the intraspecific level through size-mediated priority effects, where the larger individuals gain more resources. These priority effects are likely to be affected by climate warming and the rate of intraspecific predation, i.e., cannibalism. 2. In a laboratory experiment, we exa-

mined size-mediated priority effects in larvae of the univoltine damselfly, *Lestes sponsa*, at two different temperatures (21°C and 23°C). We created three size groups of larvae by manipulating hatching time: early hatched with a large size (extra-advanced), intermediate hatched with an intermediate size (advanced) and late hatched with a small size (non-advanced). Thereafter we reared the larvae from these groups in non-mixed and mixed groups of 12 larvae. 3. We found strong priority and temperature effects. First, extra-advanced larvae most often had higher survival, growth and development rates than non-advanced larvae in mixed groups, compared to groups that consisted of only extra-advanced larvae. Second, temperature increased growth and development rates and cannibalism. 4. However, the strength of priority effects did not differ between the two experimental temperatures, because there was no statistical interaction between temperature and treatments. That is, the mixed and non-mixed groups of non-advanced, advanced and extra-advanced larvae showed the same relative change in life history traits across the two temperatures. 5. Non-advanced and advanced larvae had similar or higher growth rate and mass in mixed groups compared to non-mixed groups, suggesting that predation from advanced larvae in the mixed group released resources for the non-advanced and advanced larvae that survived despite cannibalism risk. Thus, a thinning effect occurred due to cannibalism caused by priority effects. 6. The results suggest that a shift in the relative arrival of offspring can cause temperature-dependent priority effects, mediated through cannibalism, growth and development, which may change the size distribution and abundance of emerging aquatic insects." (Authors)] Address: Sniegula, S., Dept Ecosystem Conservation, Inst. Nature Conservation, Polish Acad. of Sciences, Krakow, Poland. E-mail: szymon.sniegula@gmail.com

18632. Trueman, J.W.H.; Rowe, R.J. (2019): The wing venation of Odonata. *International Journal of Odonatology* 22(1): 1-16. (in English) ["Existing nomenclatures for the venation of the odonate wing are inconsistent and inaccurate. We offer a new scheme, based on the evolution and ontogeny of the insect wing and on the physical structure of wing veins, in which the veins of dragonflies and damselflies are fully reconciled with those of the other winged orders. Our starting point is the body of evidence that the insect pleuron and sternum are foreshortened leg segments and that wings evolved from leg appendages. We find that all expected longitudinal veins are present. The costa is a short vein, extending only to the nodus, and the entire costal field is sclerotised. The so-called double radial stem of Odonatoidea is a triple vein comprising the radial stem, the medial stem and the anterior cubitus, the radial and medial fields from the base of the wing to the arculus having closed when the basal sclerites fused to form a single axillary plate. In the distal part of the wing the medial and cubital fields are secondarily expanded. In Anisoptera the remnant anal field also is expanded. The dense crossvenation of Odonata, interpreted by some as an archdictyon, is secondary venation to support these expanded fields. The evolution of the odonate wing from the palaeopteran ancestor – first to the odonatoid condition, from

there to the zygopteran wing in which a paddle-shaped blade is worked by two strong levers, and from there through grade Anisozygoptera to the anisopteran condition – can be simply explained." (Authors)] Address: Trueman, J., Res. School Biol., Australian National Univ., Canberra, Australia

18633. Veselý, L.; Boukal, D.S.; Buric, M.; Kuklina, I.; Fort, M.; Yazicioglu, B.; Prchal, M.; Kozák, P.; Kouba, A.; Sentis, A. (2019): Temperature and prey density jointly influence trophic and non-trophic interactions in multiple predator communities. *Freshwater Biology* 64(11): 1984-1993. (in English) ["Environmental changes such as global warming can affect ecological communities by altering individual life histories and species interactions. Recent studies focusing on the consequences of environmental change on species interactions highlighted the need for a wider, multi-species context including both trophic and non-trophic interactions (e.g. predator interference). However, the effects of biotic and abiotic factors on trophic and non-trophic interactions remain largely unexplored. To fill this gap, we combined laboratory experiments and functional response modelling to investigate how temperature and prey density influence trophic and non-trophic interactions in multiple predator communities. The system under study consisted of predatory dragonfly larvae (*Aeshna cyanea*) and omnivorous marbled crayfish (*Procambarus virginalis*) preying on common carp fry (*Cyprinus carpio*). We estimated the functional response of each predator in single-predator experiments and used this information to disentangle the trophic and non-trophic interactions and their dependence on environmental conditions in multiple predator trials. We found that consumer identity, prey density, and temperature all affect the magnitude of trophic and non-trophic interactions. Non-trophic interactions mostly decreased predator feeding rates, corroborating previous observations that interference prevails in aquatic communities. Moreover, trophic interactions depended primarily on the environmental variables whereas non-trophic interactions depended mainly on consumer identity. Our results indicate that non-trophic interactions among true predators and omnivores can be substantial and that biotic and abiotic conditions further modify the magnitude and direction of these interactions, which can affect food web dynamics and stability." (Authors)] Address: Veselý, L., Fac. Fishery & Protection of Waters, South Bohemian Research Centre of Aquaculture & Biodiversity of Hydrocenoses, Univ. of South Bohemia in České Budejovice, Zátíší 728/II, 389 25, Vodňany, Czech Republic. E-mail: Email: veselyl@frov.jcu.cz

2020

18634. Hedlund, J.; Ehrnsten, E.; Hayward, C.; Lehmann, P.; Hayward, A. (2020): New records of the Paleotropical migrant *Hemianax ephippiger* in the Caribbean and a review of its status in the Neotropics. *International Journal of Odonatology* 23(4): 315-325. (in English) ["Tropical America is currently experiencing the establishment of a new apex insect predator, the Paleotropical dragonfly *H. ephippiger*. *H. ephippiger* is migratory and is suggested to have colo-

nised the eastern Neotropics by chance Trans-Atlantic displacement. We report the discovery of *H. ephippiger* at three new locations in the Caribbean, the islands of Bonaire, Isla de Coche (Venezuela), and Martinique, and we review its reported distribution across the Neotropics. We discuss the establishment of *H. ephippiger* as a new apex insect predator in the Americas, both in terms of ecological implications and the possible provision of ecosystem services. We also provide an additional new species record for Bonaire, *Pantala hymenaea* (Odonata: Libellulidae)." (Authors)] Address: Hedlung, Johanna, Dept of Biology, Centre for Animal Movement Research (CANMove), Lund University, Lund, Sweden. E-mail: johanna.hedlund@biol.lu.se

18635. Mendes, T.P.; Amado, L.L.; Barbosa Ribeiro, R.A.; Juen, L. (2020): Morphological diversity of Odonata larvae (Insecta) and abiotic variables in oil palm plantation areas in the Eastern Amazon. *Hydrobiologia* 847: 161-175. (in English) ["Our aim was to investigate whether there is a relationship between abiotic factors and the morphological diversity (MD) of Odonata larvae by building an ecomorphological index in oil palm plantation areas with riparian vegetation in the Eastern Amazon. We hypothesised that the MD of Odonata larvae might be affected by oil palm plantation since changes in the landscape might cause the loss of microhabitats that are essential for the larval life cycle. A total of 950 Odonata larvae were collected in 11 streams located in a continuous forest area (inside the legal reserve) and 18 streams located in oil palm streams surrounded by riparian vegetation. There was a significant difference in the MD of the larvae between the oil palm and forest areas. When we compared the results obtained using traditional measures of biodiversity (estimated species richness) with those obtained using the measure of MD, MD was more efficient. The RLQ tests showed a significant relationship between genus abundance and environmental variables, and between genera and morphological traits. We believe that the suppression or change in riparian vegetation might increase the sediment load input and decrease the amount of plant substrate available in the system, leading to the simplification of morphological traits. Therefore, such traits might be used as indicators of environmental impact." (Authors)] Address: Juen, L., Programa de Pós-graduação em Zoologia/Instituto de Ciências Biológicas –Universidade Federal do Pará, Rua Augusto Correia, Belém, Brazil. E-mail: leandrojuen@ufpa.br

18636. Pinto, A.P.; de Araujo, B.R. (2020): A new damselfly of the genus *Forcepsioneura* from the Atlantic Forest of south-eastern Brazil (Odonata: Coenagrionidae). *Odonatologica* 49(1/2): 107-123. (in English) ["A new Brazilian Protoneurinae damselfly, *Forcepsioneura lopii* sp. nov. (holotype male deposited in DZUP: Brazil, São Paulo State, Cananéia, Ilha do Cardoso State Park) is described, and diagnosed based on two males and one female. This small dark yellow-orange *Forcepsioneura* Lencioni, 1999, inhabits typical restinga-like formations in southern Brazil. The coloration and short ventrobasal process of the male cercus of *Forcepsioneura lopii* sp. nov. make it similar to the larger

montane species of the orange-black group, i.e., *F. grossiorum* Machado, 2005, *F. itatiaiae* (Santos, 1970), *F. janeae* Pimenta et al., 2019, *F. lucia* Machado, 2000, and *F. serabonita* Pinto & Kompier, 2018. However it occurs in lowlands and the cercus is slender as in the light blue group, i.e., *F. gabriela* Pimenta et al., 2019, *F. garrisoni* Lencioni, 1999, *F. haerteli* Machado, 2001, *F. regua* Pinto & Kompier, 2018, and *F. sancta* (Hagen in Selys, 1860). The very acute, spur-like process on the mediobasal process of male cercus is unique. This is only one of several undescribed species recently discovered in *Forcepsioneura*, and it reaffirms the necessity for additional investigations to understand the richness and diversification of this genus." (Authors)] Address: Pinto, A.P., Lab. Systematics on Aquatic Insects (LABSIA), Depto de Zoologia, Universidade Federal do Paraná, P. O. Box 19020, 81531-980, Curitiba, PR, Brazil

18637. Schröder, N.M.; Rippel, C.G.; Walantus, L.H.; Zapata, P.D.; Pessacq, P. (2020): Odonata assemblages as indicators of stream condition – a test from northern Argentina. *North-Western Journal of Zoology* 16(2): 117-124. (in English) ["The increasing consumption of natural resources due to population growth, and the expansion of agricultural activity have a major impact on freshwater ecosystems. The aim of this study was to verify if possible changes in habitat condition and physical-chemical variables due to different land uses are reflected by changes in Odonata assemblages. In order to do that, we evaluated the conservation status of the riparian zone and the physicochemical parameters of stream waters affected by different degrees of anthropogenic impact, and assessed richness and variation in species composition, testing for potential indicator species of habitat quality. The riparian index allowed the differentiation of three habitat condition categories: conserved, intermediate and degraded. No significant differences were found in species richness between the three conservation states, but it was possible to discriminate between the communities present. Four species showed potential as habitat quality indicators that can serve as biomonitors in future strategies of stream management and conservation." (Authors)] Address: Schröder, Noelia, Molecular Biotechnology Laboratory, Institute of Biotechnology Misiones, FCEQyN, UNaM. Ruta 12 km 7.5. Posadas, Misiones, CP 3300, Argentina. E-mail: noeliaschroder@gmail.com

18638. Starr, S.M.; McIntyre, N.E. (2020): Effects of water temperature under projected climate change on the development and survival of *Enallagma civile* (Odonata: Coenagrionidae). *Environmental Entomology* 49(1): 230-237. (in English) ["Current climate projections for the Great Plains of North America indicate markedly increased air temperatures by the end of the current century. Because the Great Plains contains >80,000 intermittent wetlands that serve as irreplaceable wildlife habitat, this projected warming may have profound effects throughout a continental-scale trophic network. However, little research has been done to determine how projected warming may affect the growth, development, or survival of even common species in this region. We conducted laboratory warming experiments, using

an abundant amphibious predatory insect, *Enallagma civile* (Hagen, 1861), as a model organism, to determine whether projected warming may affect development or survival. Eggs were collected and reared under four water temperature regimes representing current (26°C) and projected future conditions (32, 38, and 41°C). Nymph body size after each molt, development rate, and deaths were recorded. Elevated water temperatures were found to significantly affect the survivorship of *E. civile* eggs and nymphs as well as adult body size at emergence: an increase in temperature incurred a decrease in survival and size. Nymphs in the two hotter treatments were smaller and had low survivorship whereas individuals in the cooler temperatures generally survived to adulthood and were larger. Nymphs reared at 32°C experienced accelerated ontogenetic development compared with the other temperatures, going from egg to adult in 26 d. Projected elevated temperatures may, thus, be both advantageous and detrimental, causing concern for aquatic invertebrates in this region in the future." (Authors)] Address: McIntyre, Nancy, Dept Biological Sciences, Texas Tech University, Lubbock, TX 79409-3131, USA. E-mail: nancy.mcintyre@ttu.edu

2021

18639. Agnes Deepa, A.; Selvarasu, P.; Gunasekaran, C.; Shobana, G. (2021): Odonata fauna in adjoining areas of Amirthi Zoological Park in Vellore District, Tamilnadu, India. *Acta Entomology and Zoology* 2(1): 12-18. (in English) ["The objective of the present study is to explore the diversity of Odonata in Amirthi Forest Division, Vellore District. Dragonfly watching and recording has been done in each line transect during a week. A total of 37 species belonging to 29 genera and 6 families viz. Lestidae, Platycnemididae, Coenagrionidae and Libellulidae were recorded. The maximum number of Odonates were found in Libellulidae (n=20 species), followed by Coenagrionidae (n=11), Aeshnidae (n=2), Lestidae (n=3), Platycnemididae (n=1) and Gomphidae (n=1). Out of the Site -1 Urban areas, Site -2 Agricultural areas, Site -3 wet land areas and Site. 4 Amirthi park areas are selected study sites, the highest number of Odonate species (28) was recorded in S3 and S2 ranked second with 24 species. Species richness was comparatively low in the remaining Study sites: S4 with 21 species and S1 with 18 species. The result of high species richness in the particular study sites (S3 and S2) may be due to the intensity and duration of longer surveys, rather than true ecological species richness. Among the selected Sites the diversity of dragonflies was high in Agricultural areas and wet land areas. Out of the 37 Odonates recorded from the district, 35 species come under the IUCN Red List of Threatened Category. Among them 37 species comes under Least Concern (LC) Category, one species under Data Deficient (DD) and three species is not evaluated. The present study is to encourages the wide range conservation of dragonfly species in the study area." (Authors)] Address: Agnes Deepa A., Unit Conserv. Biol., Dept Zool., Bharathiyar Univ., Coimbatore, Tamil Nadu, India

18640. Archibald, S.B.; Cannings, R.A. (2021): The head

of Cephalozygoptera (Odonata). *Zootaxa* 5047(1): 97-100. (in English) ["Conclusions: We know of no force acting before or during diagenesis that might change the conservative zygoteran head shape to the diagnostic Cephalozygoptera shape. We conclude that the evidence from the specimens discussed by Nel & Zheng (2021), and those further examined and discussed here and by Archibald et al. (2021) supports the proposal that the head shape ascribed to the Cephalozygoptera by Archibald et al. (2021) is their actual shape, and that the Cephalozygoptera is a valid taxon. Note: We maintain that the Cretaceous genera *Palaeodysagrion* Zheng et al., *Electrodysagrion* Zheng et al., and *Burmadyagrion* Zheng et al. are not members of the Dysagrionidae and that the Paleocene genus *Valerea* Garrouste et al. is tentatively a member of the Dysagrionidae for reasons given by Archibald et al. (2021, pages 20 and 42)." (Authors)] Address: Archibald, S.B., Dept of Biological Sciences, Simon Fraser Univ., 8888 University Drive, Burnaby, British Columbia, V5A 1S6, Canada. E-mail: sba48@sfu.ca

18641. Busmachi, G. (2021): New record of *Leucorrhinia pectoralis* (Charpentier, 1825) (Insecta: Libellulidae) in the Republic of Moldova. Sustainable use and protection of animal world in the context of climate change. *Editia 10, 2021 Conferința "Sustainable use and protection of animal world in the context of climate change"*. Chisinau, Moldova, 16-17 septembrie 2021: 161-163. (in English) ["The paper includes new record of rare and protected species of Odonata – *L. pectoralis* in the Republic of Moldova. The species was cited firstly in 2009 from the Cioburciu village. In June, 2021 one adult male was identified on the palustral vegetation in the Plaiul Fagului Reserve. This is the second record of this species in the Republic of Moldova." (Author)] Address: Busmachi, Galina, Institute of Zoology, Chisinau, Republic of Moldova. E-mail: bushmakiu@yahoo.com

18642. Curtean-Bănăduc, A.; Burcea, A.; Mihub, C.-M.; Bănăduc, D. (2021): The benthic trophic corner stone compartment in POPs transfer from abiotic environment to higher trophic levels — Trichoptera and Ephemeroptera pre-alert indicator role. *Water* 2021, 13, 1778. 17 pp. (in English) ["Persistent organic pollutants (POPs) have been at the forefront of environmental contamination research even before their ban in 2001 at the Stockholm Convention. Their relation to different compartments of the environment (biotic and abiotic) has been thoroughly investigated. This article aims to identify whether the benthos could represent a reliable indicator of environmental contamination with POPs and to highlight its potential transfer role between abiotic and upper trophic compartments—benthos feeders. In this regard, we determined that the Ephemeroptera samples have higher concentrations ($p < 0.05$) of Σ PCB, Σ HCH, and Σ DDT than sediment samples while Trichoptera samples have higher concentrations ($p < 0.05$) only in the case of Σ PCB and Σ DDT. This, along with the fact that the frequency of detection for POPs is similar between the sample types (sediments, Trichoptera, and Ephemeroptera), makes the benthos samples valuable indicators of contamination with sediment samples working as complementary information about how recent the

contamination is." (Authors) At sampling point M14, Odonata contributed with 10,31% to the benthic macroinvertebrate community.] Address: Curtean-Bănăduc, Angela, Applied Ecology Res. Center, Lucian Blaga Univ. of Sibiu, 550012 Sibiu, Romania. E-mail: angela.banaduc@ulbsibiu.ro

18643. Dasrat, C.M.; Maharaj, G. (2021): Biological control of mosquitoes with odonates: A case study in Guyana. *Nusantara Bioscience* 13: 163-170. (in English) ["Mosquitoes have plagued the lives of tropical residents as pests. However, due to their role as vectors of life-threatening diseases, controlling their population is necessary, especially in areas of prevalence – the Caribbean and Equatorial regions. In Guyana, we employ chemical treatments sub-regionally to eradicate mosquitoes. However, this treatment has limited success and is harmful to the environment. Therefore, our study focused on an environmentally friendly method such as biological control. This study was conducted at the University of Guyana, Turkeyen campus, where we exploited Odonata; Anisoptera, and Zygoptera as natural predators of mosquitoes of the genus *Culex*. The feeding efficiency and behaviors of naiads from the families of Libellulidae and Coenagrionidae were assessed during April – May of 2018. Each naiad was fed three *Culex* pupae and larvae, then observed for 60 minutes. We found that both groups pursue soft-bodied larvae and Libellulidae naiads are more efficient predators due to the higher feeding rate than Coenagrionidae. This finding is related to a behavioral study where we observed Libellulidae as active hunters that masticate and consume faster than Coenagrionidae, which are lay and wait, opportunistic predators that swallow their prey. We concluded that Libellulidae is an efficient predator for mosquito larvae of the *Culex* genus, and we found that there is a link between morphologic characteristics and feeding behaviors. We hope to use these results as a baseline study to develop mosquito biological control in Guyana. These can be used to reduce mosquito populations and the occurrence of vector diseases as well as improve integrated pest and vector management." (Authors)] Address: Dasrat, Cindy, Dept Biol., Univ. Guyana. Turkeyen Campus, Turkeyen, Georgetown, Guyana. Email: cindrina@gmail.com

18644. De Almeida, M.V.O.; Pinto, Â.P.; Carvalho, A.L. (2021): Digitizing Primary Data on Biodiversity to Protect Natural History Collections Against Catastrophic Events: The type material of dragonflies (Insecta: Odonata) from Museu Nacional of Brazil. *Biodiversity Information Science and Standards* 5: e75284: 3 pp. (in English) ["Conference Abstract: Natural history collections (NHC) are guardians of biodiversity (Lane 1996) and essential to understand the natural world and its evolutionary processes. They hold samples of morphological and genetic heritages of living and extinct biotas, helping to reconstruct the timeline of life over the centuries (Gardner 2014). Primary data from specimens in NHC are crucial elements for research in many areas of biological sciences, considered the "bricks" of systematics and therefore one of the pillars for evolutionary studies (Troudet

2018). For this reason, studies carried out in NHC are essential for the development of the scientific knowledge and are pivotal for the scientific-technological progress of a nation (Camargo 2015). The digitization and availability of primary data on biodiversity from NHC represents a inexpensive, practical and secure means of exchanging information, allowing collaboration between institutions and researchers. In this sense, initiatives such as the Sistema de Informação sobre a Biodiversidade Brasileira (SiBBR), a country-level branch of the Global Biodiversity Information Facility (GBIF) platform, aim to encourage and establish ways for the informatization of biological collections and their type specimens. Known for housing one of the largest and oldest collections of insects in the world focused on Neotropical fauna, the Entomological Collection of the Museu Nacional of Federal University of Rio de Janeiro (MNRJ) had more than 3,000 primary types and approximately 12,005,000 specimens, of which about 96% were lost in the tragic fire occurred at the institution on September 2, 2018. The SiBBR project was active in that collection from 2016 to 2019 and enabled the digitization and preservation of data from the type material of many insect orders, including the charismatic order Odonata. Due to the end of the agreement between SiBBR and the Museu Nacional, most of the obtained primary data are pending full curation and, therefore, are not yet available to the public and researchers. The MNRJ housed the biggest and most important collection of dragonflies among all Central and South American institutions. It assembled most of the physical records of neotropical dragonfly fauna gathered over the last 80 years, many of which are of undescribed taxa. Unfortunately, almost all material was permanently lost. This study aims to gather, analyze and publicize primary data of the type material of dragonflies housed in the MNRJ, ensuring the preservation of its history, as well as providing data on the taxonomy and diversity of this marvelous group of insects. A total of 11 families, 50 genera and 131 species were recorded, belonging to the suborders Anisoptera and Zygoptera with distributional records widespread in South America. The MNRJ housed 105 holotypes of dragonflies' nomina representing 11.7% of the richness of the Brazilian Odonata fauna (901 spp.), a country with the highest number of species of the biosphere. The impact of the loss of this collection to studies of these insects is unprecedented, since some enigmatic and monotypic genera such as *Brasiliogomphus*, *Fluminagrion* and *Roppaneura* lost 100% of their type series, while others most diverse such as *Lauromacromia*, *Oxyagrion* and *Necordulia* lost 50%, 35% and 31% of their holotypes. Therefore, due to the registration and preservation of primary biodiversity data, this work reiterates the importance of curating and digitizing biological scientific collections. Furthermore, it shows extreme relevance for preserving information on existing biodiversity permanently and providing support for future research. Digitization and interconnecting digital extended specimen data proves to be one of the main and most effective ways to protect NHC heritage and their primary data against catastrophic events." (Authors)] Address: Pinto, Â.P. Lab. Systematics on Aquatic Insects, Depto de Zoologia, Univ. Federal do Paraná, Curitiba, Paraná, Brazil

18645. Ekpah, O.; Kemabonta, K.A.; Dijkstra, K-d.B.; Ogbogu, S.S.; Fomekong-Lontchi, J.; Omonun, C. (2021): Odonata from two western Nigeria rainforests, with a record of the rare *Ceriagrion citrinum* Campion, 1914. International Dragonfly Fund - Report 162: 1-17. (in English) ["A survey of Odonata was carried out in two tropical rainforest habitats, in Omo Forest Reserve (OMO) and Igele Sunmoge village (ISV) in Ogun State, Nigeria with focus on the endangered damselfly *Ceriagrion citrinum* Campion, 1914. A total of 163 individuals of Odonata representing 37 species and 5 families were recorded, including 12 individuals of *C. citrinum* at ISV. A brief note on the conservation status and ecology of the endangered *C. citrinum* in Nigeria is given. OMO is a protected forest managed by the government while ISV is heavily impacted by human activities. Conservation education focusing on the iconic *C. citrinum* was therefore provided to local residents. Dragonfly perception by the residents of Sunmoge village is briefly outlined." (Authors)] Address: Ekpah, O., Nigerian Conserv. Foundation, Km 19, Lekki-Epe Expressway, Lagos State, Nigeria. Email: davisugwa@gmail.com

18646. Ensaldo-Cárdenas, A.S.; Rocha-Ortega, M.; Schneider, D.; Robertson, B.A.; Córdoba-Aguilar, A. (2021): Ultraviolet polarized light and individual condition drive habitat selection in tropical damselflies and dragonflies. *Animal Behaviour* 180: 229-238. (in English) ["Highlights: • We examined effects of ultraviolet polarized light (UVPL) on aquatic insects. • We measured odonates' preference for UVPL vs visible range polarized light. • Sexual behaviours were performed in association with the UVPL. • UVPL-associated insects had reduced lipid reserves and body size. • UVPL is both a cue that animals use for habitat selection and an evolutionary trap. Abstract: Artificial objects can polarize ultraviolet light sources to a higher degree than natural objects like water bodies. This can induce a strong attraction response by insects that use such cues as proxies of habitat suitable for reproduction. Visible range polarized light (VRPL) can create evolutionary traps for aquatic insects, but it remains unclear whether insects can use ultraviolet polarized light (UVPL) as a habitat selection cue or if UVPL pollution can create evolutionary traps for aquatic insects like VRPL can. Odonate insects require an aquatic habitat to perform their mating and egg-laying behaviours yet they also perform such behaviours on artificial surfaces (i.e. metal pieces). We measured the preference for UVPL versus VRPL via exposing three species of odonates (*Enallagma praevarum*, *Ischnura denticollis* and *Sympetrum illotum*) to experimental test surfaces differing in these visual cues and assessing behavioural preference via differences in mating behaviour, body condition (i.e. lipid and protein content and body size) and visual acuity (based on eye width size). *Ischnura denticollis* performed more diverse mating behaviours in association with the VRPL treatment, while *S. illotum* preferentially exhibited these behaviours in association with the UVPL. *Ischnura denticollis* individuals associated with the preferred habitat had lower lipid reserves, smaller body size and larger eyes, while habitat preference was unrelated to individual condition and morphology in *E. praevarum* and *S. illotum*. These results suggest intra- and interspecific variation

in trap preferences, which are related to individual condition. They also show that UVPL is a cue that odonates use in habitat selection that has the potential to create evolutionary traps, suggesting conservation problems for aquatic insects that rely upon it to locate water bodies." (Authors)] Address: Córdoba-Aguilar, A., Depto de Ecología Evolutiva, Instituto de Ecología, Universidad Nacional Autónoma de México, Apdo. Postal 70-275, Ciudad Univ., 04510, México, D. F., México. E-mail: acordoba@ecologia.unam.mx

18647. Felker, A.; Vasilenko, D. (2021): A new species of the 'protozygopteran' damselfly (Odonata: Permagrionidae) from the Lower-Middle Permian of Russia. *Palaeoentomology* 4(5): 462-467. (in English) ["The small Paleozoic protozygopteran family Permagrionidae comprises 11 described species in 5 genera from the Lower Permian Chekarda and Solikamsk localities in Russia (Zalesky, 1948; Nel et al., 2012) and Salagou Formation in France (Nel et al., 1999; Fate et al., 2013), the Middle Permian Soyana and Kargala localities in Russia (Martynov, 1932; Martynov, 1937; Nel et al., 2012), and the Upper Permian Bodie Creek Head locality in Malvinas Tillyard (1928). Here we describe the new species, *Epilestes rasnitsyni* sp. nov. from the Ufimian of Perm Territory, which is characterized by specific arrangement of veins in the petiole and the unique preservation of body structures." (Authors)] Address: Felker, Anastasia, Borissiak Paleontol. Inst., Russian Acad. Sciences, Moscow, Russia

18648. Guliyeva, S.A. (2021): Generalized condition of dragonfly (Odonata) larvae of lakes around Kura. *Advances in Biology & Earth Sciences* 6(2): 184-190. (in English) ["The article provides information on the species composition and distribution of dragonfly larvae inhabiting the inland water basins of Azerbaijan (Aggol, Mehman, Nakhalkhchala, Hajigabul, Garaoglan, Yetim Kur, Marzli, Garkhun, Aynali). The article describes the species composition and distribution of dragonfly larvae inhabiting the inland water basins (Aggol, Mehman, Nakhalkhchala, Hajigabul lakes and Garaoglan, Yetim Kur, Marzli, Garkhun, Aynali) of Azerbaijan by seasons. Larvae are considered one of the most important tools for malaria prevention. At the same time, the larvae of dragonflies form the basis of the feed of fish and other aquatic animals." (Author) Regrettably, many of the records (e.g. *Coenagrion mercuriale*, *C. johanssoni*) are unlikely, and must be misidentifications.] Address: Guliyeva, Senuber, Azerbaijan State University of Economics (UNEC), Istiglaliyyat str 6, Baku, Azerbaijan. E-mail: sama2013@bk.ru

18649. Kosterin, O.E. (2021): *Burmagomphus williamsoni eddiei* subsp. nov. (Odonata, Gomphidae) from northern Cambodia. International Dragonfly Fund Report 161: 1-15. (in English) ["*B. williamsoni eddiei* is described from northern (holotype: Cambodia, Siem Reap Province, Sway Leu District, Phnom Kulen Mts, the waterfall 600 m NNW of Preah Ang Thom, 13.569°N, 104.108°E, 270 m a.s.l., 17.06.2018, RMNH), also occurring in Preah Vihear Province. The new subspecies differs from the nominotypical one by a very prominent subapical cercal tooth, the convex inner margin of the para-

proct arms and a trapezoid incision between them, the antehumeral stripe finely separated from that on the metinfraepisternum in males and strong singular spines at the sides of the occipital plate in females." (Author)] Address: Kosterin, O.E., Inst. Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia

18650. McLoughlin, S.; Prevec, R.; Slater, B. (2021): Arthropod interactions with the Permian Glossopteris flora. *Journal of Palaeosciences / The Palaeobotanist* 70: 43-133. (in English) ["An extensive survey of literature on the Permian floras of Gondwana reveals over 500 discrete arthropod–herbivory–damage/plant–taxon/stratigraphic–unit associations spanning all regions of the supercontinent from the earliest Asselian to the latest Changhsingian. Margin– and apex–feeding damage is the most common style of herbivory but hole– and surface–feeding, galling, and oviposition damage are locally well represented. Evidence for skeletonization and mucivory is sparse and that for leaf mining is equivocal. Wood and root boring is recognized widely but only where depositional conditions were conducive to the permineralization of plant axes. Wood boring and detritivory may have been especially favoured arthropod feeding strategies in Permian high latitudes where living foliage was scarce during the polar winters. Herbivory damage is most strongly apparent on glossopterid remains; other groups of broad–leafed gymnosperms and sphenopsids host moderate levels of damage. Damage features are under–represented on lycophytes, ferns and spine– and scale–leafed conifers. A survey of insect body fossils from the Gondwanan Permian reveals that most records are from a small number of rich assemblages that are dominated by Blattodea, Hemiptera, Grylloblattida, Mecoptera and Protelytroptera, accompanied by significant representations of Coleoptera, Glosselytrodeia, Miomoptera, Neuroptera, Odonata, Protorthoptera, Palaeodictyopteroidea, Paoliida, Paraplecoptera, Plecoptera, Psocoptera, Thysanoptera and Trichoptera, which collectively adopted a broad range of feeding styles. Oribatid mites and collembolans appear to have been important components of the wood–boring and detritivorous communities. Although temporal trends in herbivory styles and diversity are difficult to resolve from mostly incidental observations and illustrations of plant damage across Gondwana, the results of this study provide a baseline of qualitative data for future studies that should adopt a quantitative approach to the analysis of herbivory, spanning the shift from icehouse to hothouse conditions through the Permian of the Southern Hemisphere." (Authors)] Address: McLoughlin, S., Dept of Palaeobiology, Swedish Museum of Natural History, Stockholm, Sweden

18651. Outomuro, D.; Golab, M.J.; Johansson, F.; Sniegula, S. (2021): Body and wing size, but not wing shape, vary along a large-scale latitudinal gradient in a damselfly. *Scientific Reports* volume 11, Article number: 18642 (2021): 11pp. (in English) ["Large-scale latitudinal studies that include both north and south edge populations and address sex differences are needed to understand how selection has shaped trait variation. We quantified the variation of flight-related morphological traits (body size, wing size, ratio between

wing size and body size, and wing shape) along the whole latitudinal distribution of the damselfly *Lestes sponsa*, spanning over 2700 km. We tested predictions of geographic variation in the flight-related traits as a signature of: (1) stronger natural selection to improve dispersal in males and females at edge populations; (2) stronger sexual selection to improve reproduction (fecundity in females and sexual behaviors in males) at edge populations. We found that body size and wing size showed a U-shaped latitudinal pattern, while wing ratio showed the inverse shape. However, wing shape varied very little along the latitudinal gradient. We also detected sex-differences in the latitudinal patterns of variation. We discuss how latitudinal differences in natural and sexual selection regimes can lead to the observed quadratic patterns of variation in body and wing morphology via direct or indirect selection. We also discuss the lack of latitudinal variation in wing shape, possibly due to aerodynamic constraints." (Authors)] Address: Outomuro, D., Dept of Biol. Sciences, Univ. Cincinnati, Rieveschl Hall, Cincinnati, OH 45221, USA. Email: outomuro.david@gmail.com

18652. Pahari, P.R.; Jana, G.C.; Mandal, S., Maiti, S.; Bhattacharya, T. (2021): A study on the impact of brick embankment on aquatic entomofauna. *Uttar Pradesh Journal of Zoology* 42(19): 59-68. (in English) ["Shrinkage of the littoral zone due to brick embankment around a pond caused an adverse effect on the floral & faunal composition. A brick embanked pond (BEP) had lower number of macrophytes and entomofauna as compared to a natural pond (NP). Index of similarity suggests that both the ponds were strongly dissimilar in their floral and entomofaunal composition. Hemiptera was the most predominating insect order (96.73%) in BEP while Odonata (41.14%) and Coleoptera (39.02%) were the common orders in NP. Lower diversity, equitability, signal, ASPT, BMWP indices/scores and higher dominance & FBI indices in BEP as compared to NP indicates that BEP provided a less equitable habitat with poor quality of water for the existence of lower diversity of entomofauna." (Authors)] Address: Jana, G.C., PG Dept of Zoology, Tamralipta Mahavidyalaya, Tamluk, 721636, West Bengal, India

18653. Paulson, D.R.; Dunkle, W.W. (2021): A checklist of North American Odonata. Including English name, etymology, type Locality, and distribution. Originally published as Occasional Paper No. 56, Slater Museum of Natural History, University of Puget Sound, June 1999; completely revised March 2009; updated February 2011, February 2012, October 2016, November 2018, and February 2021: 92 pp. (in English) ["The checklist includes all 470 species of North American Odonata (Canada and the continental United States) considered valid at this time. For each species the original citation, English name, type locality, etymology of both scientific and English names, and approximate distribution are given. Literature citations for original descriptions of all species are given in the appended list of references." (Authors)] Address: Paulson, D.R., 1724 NE 98th Street, Seattle, WA 98115, USA. E-mail: dennispaulson@comcast.net

18654. Polizeli, L.; Pinto, A.P. (2021): Taxonomy and conservation concerns of the critically endangered *Roppaneura beckeri*, a phytotelm-breeding damselfly in the southern Brazilian Atlantic Forest. *Bulletin of Insectology* 74(1): 91-101. (in English) ["Phytotelm-breeding Odonata are rare: from the 6,300 known species of these charismatic freshwater organisms, only a small number of about 50 develop in phytotelmata habitats. Mainly members of the Zygoptera are dependent on this special type of environment. The small coenagrionid *R. beckeri*, a damselfly endemic to the Brazilian Atlantic Forest, is the only known Odonata breeding in the terrestrial umbellifers of *Eryngium floribundum* (Cham. et Schltdl.). This is a species-specific association with a host-plant unparalleled in the order. It also is the only species within the subfamily Protoneurinae to occupy phytotelmata habitats. Here, we report on a population of *R. beckeri* re-discovered after 42 years and recorded for the first time from the southern Atlantic Forest from the state of Paraná. The morphology and the distribution of this species is reviewed and based on these primary data future conservation strategies are discussed. We suggest including *R. beckeri* as a priority species for dragonfly conservation policies due to its exclusive biological characteristics, evolutionary relevance, and occurrence in urban to peri-urban landscapes." (Authors)] Address: Polizeli, L., Undergraduate course of Ciências Biológicas, Univ. Fed. Paraná, Curitiba, Paraná, Brazil

18655. Sabeder, N. (2021): Popis kačjih pastirjev in dvoživk ob avtocestnem odseku Šentjakob–Blagovica - Inventory of dragonflies and amphibians by the motorway section Šentjakob–Blagovica. M.Sc. thesis (Master Study Programmes – Ecology and Biodiversity, Biotechnical Faculty, Ecology and biodiversity studies, University of Ljubljana. VIII, 52 pp. (in Slovenian, with English summary) ["The primary objective of the thesis was to gather data on the presence of dragonflies (Odonata) and amphibians (Amphibia) along the highway section between Šentjakob and Blagovica on the A1 Šentilj-Koper. We compared the species richness of dragonflies and amphibians between the sampling sites with a direct influence of the highway and those without. We registered 33 species of dragonflies and 9 species of amphibians. We found that water bodies with the direct impact of the highway had a lower diversity of dragonflies and amphibians compared to those without direct impact, however the difference was not statistically significant. On the other hand, we recorded significantly more dragonfly species that completed their life cycle on water bodies without direct impact of the highway than on sites impacted by highway. We also found a positive correlation between the size of the water body and extent of riparian vegetation on the number of recorded dragonflies on sampling sites. We could not confirm the impact of closeness to the highway on dragonfly species richness. The role of water bodies with the direct impact of highways is not yet completely known. In any case, they likely perform an important connecting function between better preserved habitats and therefore require proper management." (Author)] Address: Šabeder, N., Biotechnical Faculty, Ecology & biodiversity studies, University of Ljubljana, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

18656. Šigutová, H.; Harabiš, F.; Šigut, M.; Jiří Vojar, J.; Choleva, L.; Dolný, A. (2021): Specialization directs habitat selection responses to a top predator in semiaquatic but not aquatic taxa. *Scientific Reports* | (2021) 11:18928. 11pp. (in English) ["Habitat selectivity has become an increasingly acknowledged mechanism shaping the structure of freshwater communities; however, most studies have focused on the effect of predators and competitors, neglecting habitat complexity and specialization. In this study, we examined the habitat selection of semiaquatic (amphibians: Bufonidae; Libellulidae) and aquatic organisms (true bugs: Notonectidae; diving beetles: Dytiscidae). From each family, we selected one habitat generalist species able to coexist with fish (*Bufo bufo*, *Sympetrum sanguineum*, *Notonecta glauca*, *Dytiscus marginalis*) and one species specialized in fishless habitats (*Bufotes viridis*, *Sympetrum danae*, *Notonecta obliqua*, *Acilius sulcatus*). In a mesocosm experiment, we quantified habitat selection decisions in response to the non-consumptive presence of fish (*Carassius auratus*) and vegetation structure mimicking different successional stages of aquatic habitats (no macrophytes; submerged and floating macrophytes; submerged, floating, and littoral-emergent macrophytes). No congruence between habitat specialists and generalists was observed, but a similar response to fish and vegetation structure defined both semiaquatic and aquatic organisms. While semiaquatic generalists did not distinguish between fish and fishless pools, specialists avoided fish-occupied pools and had a preferred vegetation structure. In aquatic taxa, predator presence affected habitat selection only in combination with vegetation structure, and all species preferred fishless pools with floating and submerged macrophytes. Fish presence triggered avoidance only in the generalist bug *N. glauca*. Our results highlight the significance of habitat selectivity for structuring freshwater ecosystems and illustrate how habitat selection responses to a top predator are dictated by specialization and life history." (Authors)] Address: Šigutová, Hana, Dept Biol. & Ecol., Fac. Science, Univ. Ostrava, 71000 Ostrava, Czech Republic. Email: hana.sigutova@osu.cz

18657. Willink, B.; Blow, R.; Sparrow, D.J.; Sparrow, R.; Svensson, E.I. (2021): Population biology and phenology of the colour polymorphic damselfly *Ischnura elegans* at its southern range limit in Cyprus. *Ecological Entomology* 46(3): 601-613. (in English) ["1. Geographically widespread species provide excellent opportunities to investigate how phenotypes change across large-scale environmental gradients. Temperature is a fundamental environmental variable and an important determinant of insect fitness. However, field research is often geographically restricted, and typically concentrated in northern latitudes. Basic population biology and phenotypic clines in relation to temperature therefore remain poorly known across the entire geographic range, even in otherwise well-studied taxa. 2. We surveyed populations of the trimorphic damselfly *Ischnura elegans* in Cyprus, which is the southern range limit in Europe of this widespread insect species. Females of *I. elegans* occur in three discrete and heritable colour morphs, which vary in suites of phenotypic traits. One of these female morphs is a male-mimic that avoids excessive male-mating harassment

by its male-like appearance, and which is more cold-tolerant than the two other morphs. 3. In contrast to the situation in northern Europe, these male-mimicking females are the minority morph in Cyprus, representing only about 5% of all females. Male mimics also have lower mating rates than alternative female morphs. 4. Individuals in Cyprus are relatively small in comparison to the reported European range for body size, consistent with Bergman's rule. 5. Finally, populations of *I. elegans* on the island have the longest flight period known in Europe, and there is only partial evidence for seasonality in flight activity. 6. These results underscore the benefits of considering the entire range of environmental conditions encountered by insect species when conducting evolutionary ecology research." (Authors)] Address: Svensson, E., Evolutionary Ecology Unit, Dept of Biology, Lund Univ., 223 62 Lund, Sweden. E-mail: erik.svensson@biol.lu.se

18658. Wu, G.; Tang, S.; Han, J.; Li, C.; Liu, L.; Xu, X.; Xu, Z.; Chen, Z.; Wang, Y.; Qiu, G (2021): Distributions of total mercury and methylmercury in dragonflies from a large abandoned mercury mining region in China. *Archives of Environmental Contamination and Toxicology* 81: 25-35. (in English) ["Odonata are often considered to be biosentinels of environmental contamination. Dragonflies (n = 439) belonging to 15 species of eight genera were collected from an abandoned mercury (Hg) mining region in China to investigate the bioaccumulation of total Hg (THg) and methylmercury (MeHg). The THg and MeHg concentrations in dragonflies varied widely within ranges of 0.06–19 mg/kg and 0.02–5.7 mg/kg, respectively. THg and MeHg were positively correlated with bodyweight (THg: $r^2 = 0.10$, $P = 0.000$; MeHg: $r^2 = 0.09$, $P = 0.000$). Significant variations were observed among species, with the highest MeHg value (in *Orthetrum triangulare*) being 5-fold higher than the lowest (in *Pantala flavescens*). These variations were consistent with those of nitrogen isotope ($\delta^{15}N$) values. A health risk assessment found hazard quotients for specialist dragonfly-consuming birds of up to 7.2, which is 2.4 times greater than the permissible limit of 3, suggesting a potential health risk of exposure." (Authors)] Address: Qiu, G., State Key Lab. Environmental Geochemistry, Inst. of Geochemistry, Chinese Acad. of Sci., Guiyang, 550081, China. E-mail: qiuguangle@vip.skleg.cn

18659. Zatkos, L.; Ivan Arismendi, William J. Gerth (2021): Diet of *Octogomphus specularis* (Hagen in Selys, 1859) (Odonata: Gomphidae) nymphs in western Oregon, U.S.A. with incidental information on the diet of *Cordulegaster dorsalis* Hagen in Selys, 1858 (Odonata: Cordulegastridae) nymphs. *The Pan-Pacific Entomologist* 97(2): 75-79. (in English) ["Of the 84 *O. specularis* specimens collected, 39 had empty guts or contained unidentifiable remains of prey and debris. However, stomachs of the remaining 45 contained a diverse composition of prey items. Because the prey in *O. specularis* guts were often damaged or partially digested, insects were mainly identified to order or family (53% identified to order, 45% to family, 2% to genus); non-insects were identified to order or coarser levels. Dipterans were the most common prey found in these specimens. In fall and spring, almost 90% and 70% of the stomachs contained Diptera, respectively

(and 30% in winter). Ephemeroptera (20% and 8%) and Trichoptera. Frequency of occurrence (%F) of prey items by season for *O. specularis* and *C. dorsalis*. (10% and 14%) were also common prey in winter and spring, respectively, whereas Coleoptera made up only 12% of diet contents in the fall. Incidental prey items occurred only in spring and included Coleoptera, Plecoptera, Acariformes, Ostracoda, Oligochaeta, and Psocodea. No statistically significant differences in the composition of individual diets existed among seasons. The results of the PERMANOVA support the null hypothesis that the stomach contents of these opportunistic predators do not vary significantly by season ($p = 0.13$). Nevertheless, this is a relatively small p value, and a larger analysis with more specimens may illuminate seasonal trends not observed here. Because only three *C. dorsalis* specimens were collected, analyses could not be conducted." (Authors)] Address: Arismendi, I., Dept of Fisheries, Wildlife, and Conservation Sciences, Oregon State University, 104 Nash Hall, Corvallis, Oregon 97331, U.S.A. E-mail: ivan.arismendi@oregonstate.edu

18660. Zhang, H.; Ning, X.; Yu, X.; Bu, W.-J. (2021): Integrative species delimitation based on COI, ITS, and morphological evidence illustrates a unique evolutionary history of the genus *Paracercion* (Odonata: Coenagrionidae). *PeerJ* 9:e11459. DOI 10.7717/peerj.11459: 22 pp. (in English) ["*Paracercion* are common 'blue and black' colored damselflies. We explore the species boundaries of *Paracercion* (Odonata: Coenagrionidae) using ABGD, bPTP, GMYC and Distance-based clustering. We finally got the molecular data of all nine species of *Paracercion*. *P. hieroglyphicum* and *P. melanotum* were combined into one putative species based on cytochrome c oxidase I (COI). However, they were separated into two putative species based on the nuclear segment including ITS1-5.8S-ITS2 (ITS). This suggests the introgression of mtDNA in *Paracercion*. *Paracercion barbatum* and *Paracercion melanotum* can be separated into two species based on COI, whereas they were combined into one putative species based on ITS, which suggests a hybridization event between them. The lower interspecific divergence (COI: 0.49%) between *P. barbatum* and *Paracercion v-nigrum* indicates a recent speciation event in *Paracercion*. *Paracercion sieboldii* and *P. v-nigrum* can be separated into two putative species based on COI, while they were frequently merged into the same putative species based on ITS. This can be explained by incomplete lineage sorting in nDNA. Besides, *P. pendulum* and *P. malayanum* were synonymized as junior synonyms of *P. melanotum*. *P. luzonicum* was confirmed not to belong to *Paracercion*. The possibility of introgression, hybridization, recent speciation and incomplete lineage sorting makes species delimitation, based on molecular data, difficult and complicates understanding of the evolutionary history of *Paracercion*. The discordance in COI and ITS also indicates the value of using markers from different sources in species delimitation studies." (Authors)] Address: Yu, X., College of Life Sciences, Chongqing Normal University, Chongqing, China. E-mail: lannysummer@163.com