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2010

18661. Dow, R.A. (2010): Revision of the genus *Coeliccia* (Zygoptera: Platycnemididae) in Borneo. Part I: The borneensis group of species. *Zool. Med. Leiden* 84(7): 117-157. (in English) ["A revision of the borneensis-group of *Coeliccia* species from the SE Asian island of Borneo is presented. The group is characterised based on the form of the penis, the form of the posterior lobe of the female pronotum and the mesostigmal plates of the female. Six species are recognised as occurring in Borneo, of which one is described as new: *C. kenyah* spec. nov. *Coeliccia campioni*, often considered a junior synonym of *C. borneensis*, is shown to be a valid species and new records are provided. *C. coomansi* is shown to be a junior synonym of *C. flavostriata*. Redescriptions based on fresh material are provided for the female of *C. borneensis* and the male of *C. campioni*. The male of *C. borneensis* and the female of *C. campioni* are described for the first time. Variation in *C. arcuata* and *C. flavostriata* is discussed. Keys to both sexes and illustrations of important characters for all named species are given." (Author)] Address: Rory A. Dow, Netherlands Centre for Biodiversity Naturalis, P.O. Box 9517, 2300 RA Leiden, The Netherlands. E-mail: rory.dow230@yahoo.co.uk

18662. Gainzarain, J.A. (2010): Primeras citas de *Hemianax ephippiger* (Burmeister, 1839) (Odonata: Aeshnidae) y *Onychogomphus costae* (Selys, 1885) (Odonata: Gomphidae) para el País Vasco (norte de España). *Boletín de la S.E.A.* 46(1): 525-526. (in Spanish, with English summary) [The first records of *H. ephippiger* and *O. costae* from the Basque Country (Spain) are reported, including observations of reproductive activity by the first species.] Address: Gainzarain, J.A., Instituto Alavés de la Naturaleza Apdo. de Correos 2092 01080 Vitoria-Gasteiz, Spain. E-mail: j.a.gainzarain@euskalnet.net

18663. Huang, B.-y.; Liang, X.-f.; Shi, Y.-w.; Zan, Q.-t.; Xu, J.-c. (2010): Damselflies and its habitat selection in South China Botanical Garden. *Ecological Science* 29(5) : 444-450. (in Chinese, with English summary) ["The preliminary

studies on biological characteristics and unique habitat selection of damselflies in South China Botanical Garden is here reported. At the same time, we cultivated damselfly larvae under the conditions in the Laboratory. Through the research about water conditions, aquatic vegetation habitat, the distribution of different seasons of various types of damselflies, it found that as its sensitive habitat conditions, some damselflies can play the role in ecological indicators for wetland aquatic community structure changes and water quality pollution. This study has great significances for the biological monitoring of water pollution, damselflies habitat protection and the construction and transformation of wetlands in the city." (Authors)] Address: Huang, B.-y., Dept of Biotechnology, Jinnan Univ., Guangzhou 510632, China

18664. Sendra Perez, I.; Marin Palomares, G.; Lopez Alabau, A. (2010): De Monstruos y Prodigios (31): Deformacion abdominal en *Sympetrum striolatum* (Charpentier, 1840) (Odonata: Libellulidae). *Boletín de la S.E.A.* 47: 467-468. (in Spanish, with English summary) ["A *S. striolatum* teratological female is showed; the specimen presents a deformed, twisted abdomen. Individual was captured in the surrounding areas of the Cabriel River, in the province of Valencia (Spain)." (Authors)] Address: Sendra Pérez, I., C/Camino 14, 2º, 3ª. 46.300, Utiel (Valencia), Spain. E-mail: sendra_ign@gva.es

18665. Shugart, M.M. (2010): In pursuit of dragonflies: protein sources in Balinese rice fields. MSc thesis, University of Colorado, Boulder, CO, USA: 98 pp. (in English) ["Agricultural systems can provide more to the farmers and their communities than simply the production of domesticated plants. This project considers how rice farms can also support a variety of edible insects and small wild animals that can be harvested for protein. In this thesis, I analyze the farmer knowledge, capturing techniques, and cooking methods for small animals and insects from organic rice fields in Bali, Indonesia. Information was gathered from formal surveys with farmers and participant observation. Considering the rich source of protein and fats found in these insects and animals, I argue that production and harvesting of small protein resources may provide a more sustainable approach

to dealing with global food shortages, particularly in places such as Africa, where livestock husbandry is not practical." (Author)] Address: not stated

18666. Stübing, S.; Hill, B.T.; Roland, H.-J. (2010): Jahresbericht Hessen 2009. Libellen in Hessen 3: 4-36. (in German) ["The Hessian dragonfly year 2009 was marked by several "records": Never before was the flight season so long, were so many data reported to us and were so many informative photos and manuscripts available as in 2009. For the third annual report on dragonflies, 11,191 data sets were reported by 83 observers from all Hessian districts. 7,924 reports were for the year 2009, which is an increase of about 60 % compared to the previous year's data collection, which was by far the most comprehensive to date. The other data is made up of highly welcome follow-up reports as well as miscellaneous registrations. All in all, the total data stock in Hesse has thus been increased by one third! For reasons of space, the reports of the more common species are therefore presented in tabular form. 26 new first and 24 last observation records are not only due to increased observer activity, but also a result of the climatic conditions in 2009. After the occasionally unusually cold winter of 2008/09 with lows around -26 °C, March and April were remarkably warm and sunny. Already on 1.4. the first winter dragonflies *Sympetma fusca* appeared at the water body and on 5.4. the first early *Pyrrhosoma nymphula* hatched. October and November were very mild, so that on 25.11. *Sympetrum striolatum*, *S. vulgatum* were still on the move. Unusually late flying were *Libellula depressa* and *Crocothemis erythraea*. Remarkable observations were made of the following species, among others: *Leucorrhinia caudalis* (proof of ground-level occurrences of nationwide importance), *Sympetrum meridionale* (large ground-level population for the first time), *Ophiogomphus cecilia* (numerous new water bodies, also among the other gomphids), *Somatochlora arctica*. (confirmation of both occurrences), *S. flavomaculata* (new discovery at two sites) and *Aeshna isocetes* as well as *Libellula fulva* (both remarkably frequent, as last year). *Brachytron pratense* also appeared remarkably often. On the other hand, *Erythromma viridulum* and *Ischnura pumilio* were conspicuously rare, as was probably also *Orthetrum brunneum*. The other southern species did not show any effects of the cold winter." (Authors; DeepL)] Address: Stübing, S., Im Feldchen 1a, 61209 Echzell, Germany. E-mail: stefan.stuebing@gmx.de

2014

18667. Afsar, A. (2014): Scanning Electron Microscopy (SEM) study of the caudal gills of *Ceriagrion coromandelianum* (Fabricius) of zygopteran larvae (Odonata: Zygoptera). International Journal of Technical Research and Applications 2(6): 159-165. (in English) [SEM study of the caudal gills of larvae of *C. coromandelianum* „greatly clarifies the orientation, structures and arrangement of trachea, its ramification, tracheoles, and chloride cells apart with the arrangement of complex cuticular components because of its depth of field and high resolving power." (Author)] Address: Afsar, A., Guest Fac., Dept of Zoology, J. R. S. College Jamalpur Munger,

T. M. B. Univ. Bhagalpur, Bhagalpur, Bihar, India

18668. Al-Asady, H.S.; Al-Hashmi, A.H. (2014): External morphological study of *Coenagrion* [sic] *lindenii* (Selys, 1840) (Odonata: Zygoptera: Coenagrionidae) in Iraq. Ibn Al-Haitham Jour. for Pure & Appl. Sci. 27(1): 14-23. (in Arabian, with English summary) ["The present study introduces detailed description of *erythromma lindenii*. External morphological characters of the three body region were used included male genitalia. Such characters were supported by illustration. Date and place of collection were recorded." (Authors)] Address: Al-Asady, H.S., Dept. Biology / College Education for Pure Science (Ibn Al-Haitham), Univ. of Baghdad, Iraq

18669. Bakhshi, Y.; Sadeghi, S. (2014): Odonata fauna of Khuzestan province (Iran) with a note on an Oriental species *Trithemis aurora* (Burmeister, 1839) as a new record for the south-west of Iran. Zoology in the Middle East 60(4): 372-374. (in English) ["We carried out our survey from 2010 to 2012. ... In total, 616 specimens have been collected belonging to 33 species. Nine species belong to Zygoptera and the remaining 24 species to Anisoptera (Table 1). This is about 30% of all dragonflies found so far in Iran. We could thus add 18 species to the previous list for Khuzestan which comprised 21 species (Sadeghi & Dumont, 2004; Heidari & Dumont, 2002). ... *Trithemis aurora* was collected in 3 ♂ and 1 ♀ from three sites in Khuzestan during July and August 2011 and August 2012." (Authors)] Address: Sadeghi, S., Biolology Dept, Shiraz University, Shiraz, Iran

18670. Blaho, M.; Herczeg, T.; Kriska, G.; Egri, A.; Szaz, D.; Farkas, A.; Tarjanyi, N.; Czinke, L.; Barta, A.; Horvath, G. (2014): Unexpected attraction of polarotactic water-leaving insects to matt black car surfaces: Mattness of paintwork cannot eliminate the polarized light pollution of black cars. PLoS ONE 9(7): e103339. doi:10.1371/journal.pone.0103339: 12 pp. (in English) ["The horizontally polarizing surface parts of shiny black cars (the reflection-polarization characteristics of which are similar to those of water surfaces) attract water-leaving polarotactic insects. Thus, shiny black cars are typical sources of polarized light pollution endangering water-leaving insects. A new fashion fad is to make car-bodies matt black or grey. Since rough (matt) surfaces depolarize the reflected light, one of the ways of reducing polarized light pollution is to make matt the concerned surface. Consequently, matt black/grey cars may not induce polarized light pollution, which would be an advantageous feature for environmental protection. To test this idea, we performed field experiments with horizontal shiny and matt black car-body surfaces laid on the ground. Using imaging polarimetry, in multiple-choice field experiments we investigated the attractiveness of these test surfaces to various water-leaving polarotactic insects and obtained the following results: (i) The attractiveness of black car-bodies to polarotactic insects depends in complex manner on the surface roughness (shiny, matt) and species (mayflies, dolichopodids, tabanids). (ii) Non-expectedly, the matt dark grey car finish is much more attractive to mayflies (being endangered and protected in many countries) than matt black finish. (iii) The

polarized light pollution of shiny black cars usually cannot be reduced with the use of matt painting. On the basis of these, our two novel findings are that (a) matt car-paints are highly polarization reflecting, and (b) these matt paints are not suitable to repel polarotactic insects. Hence, the recent technology used to make matt the car-bodies cannot eliminate or even can enhance the attractiveness of black/grey cars to water-leaving insects. Thus, changing shiny black car painting to matt one is a disadvantageous fashion fad concerning the reduction of polarized light pollution of black vehicles." (Authors) The paper includes references to Odonata.] Address: Horvath, G., Environmental Optics Laboratory, Dept of Biological Physics, Physical Institute, Eötvös Univ., Budapest, Hungary. E-mail: gh@arago.elte.hu

18671. Boda, P.; Horváth, G.; Kriska, G.; Blahó, M.; Csabai, Z. (2014): Phototaxis and polarotaxis hand in hand: night dispersal flight of aquatic insects distracted synergistically by light intensity and reflection polarization. *Naturwissenschaften* 101: 385-395. (in English) ["Based on an earlier observation in the field, we hypothesized that light intensity and horizontally polarized reflected light may strongly influence the flight behaviour of night-active aquatic insects. We assumed that phototaxis and polarotaxis together have a more harmful effect on the dispersal flight of these insects than they would have separately. We tested this hypothesis in a multiple-choice field experiment using horizontal test surfaces laid on the ground. We offered simultaneously the following visual stimuli for aerial aquatic insects: (1) lamplit matte black canvas inducing phototaxis alone, (2) unlit shiny black plastic sheet eliciting polarotaxis alone, (3) lamplit shiny black plastic sheet inducing simultaneously phototaxis and polarotaxis, and (4) unlit matte black canvas as a visually unattractive control. The unlit matte black canvas trapped only a negligible number (13) of water insects. The sum (16,432) of the total numbers of water beetles and bugs captured on the lamplit matte black canvas (7,922) and the unlit shiny black plastic sheet (8,510) was much smaller than the total catch (29,682) caught on the lamplit shiny black plastic sheet. This provides experimental evidence for the synergistic interaction of phototaxis (elicited by the unpolarized direct lamplight) and polarotaxis (induced by the strongly and horizontally polarized plastic-reflected light) in the investigated aquatic insects. Thus, horizontally polarizing artificial lamplit surfaces can function as an effective ecological trap due to this synergism of optical cues, especially in the urban environment." (Authors) The paper includes references to Odonata.] Address: Horvath, G., Environmental Optics Lab., Dept of Biological Physics, Physical Inst., Eötvös Univ., Budapest, Hungary. E-mail: gh@arago.elte.hu

18672. Catil, J.-M. (2014): Une femelle de *Gomphus pulchellus* morte empalée sur une tige de *Juncus inflexus* (Odonata: Gomphidae). *Martinia* 30(2): 46. (in French) [Verbatim: On 14 June 2013, an odonate caught my attention at the edge of a small pond in the commune of Monfort (Gers [32]). This one, a female of *G. pulchellus*, was impaled on the top part of a stem of *Juncus inflexus* L., 1753 by the left forewing. The individual had obviously been dead for a relatively short

time, its relatively intact body not having been damaged by weather conditions or predators. Several cases of accidental capture by plants have been reported, one of which is quite similar (Lambret, P., 2010: Un mâle de *Lestes macrostigma* prisonnier de *Juncus maritimus*. *Martinia*, 26 (1): 49-51). Various hypotheses were put forward at the time. Amongst these, the influence of the wind is plausible, as there had been strong gusts of wind on the previous days (11 and 12 June). In addition, the individual in question had crumpled and still relatively shiny wings, suggesting that it had emerged shortly before the incident and that the wings were fragile. This factor, whether or not combined with the windy episode, could explain a flight accident. However, we cannot exclude other causes, although less likely, such as flight from a predator or from fellow birds (Lambret, op. cit.) and only direct observations, although unlikely, could shed light on this very unusual mortality. I would like to thank Pierre-Olivier Cochard for his help in determining *J. inflexus*. (DeepL)] Address: Catil, J.-M., CPIE Pays Gersois, Au Château, 32300 L'Isle-de-Noé, France. E-mail: jmcatil@yahoo.fr

18673. Cerny, M. (2014): First records for Czechia of *Forcipomyia paludis* (Diptera: Ceratopogonidae), a midge parasitizing dragonfly imagines (Odonata: Coenagrionidae, Aeshnidae). *Libellula* 33(3/4): 157-162. (in English, with German and Czech summaries) ["Three findings of *F. paludis* are reported, representing the first records of this biting midge for Czechia. On 23-VI-2013 one female attached to the wings of a female *Coenagrion puella* was photographically documented near Lysá nad Labem ca 30 km northeast of Prague. Two further specimens were discovered in the author's photographic archive, both attached to wings of male *Aeshna isocetes*. These records originated from West and South Bohemia on 3 June and 6 June 2011, respectively." (Author)] Address: Cerny, M., Dept Ecol., Charles Univ. in Prague, Viničná 7, Prague, 128 44, Czech Republic. E-mail: cerny@natur.cuni.cz

18674. Charashika, Z. (2014): An assessment of infestation by parasitic water mites on dragonflies at Marsh along Mwenje dam, Mazowe district, Zimbabwe. BSc. thesis, Bindura University of Science Education: 30 pp. (in English) ["This study was done to determine the infestation levels by water mites (Hydrachnidae) on dragonflies (Anisoptera) that are found at a marsh along Mwenje Dam in Mazowe District, Zimbabwe. A total of 111 dragonflies comprising Aeshnidae (31.5%) and Libellulidae (68.5%) were collected over a period of four months (January to April 2014). The total length and gender of each individual was recorded, as well as number and attachment sites of the parasitic mites. Overall, a total of 28.8% insects were infected. Among the Aeshnidae, the proportion of males that were infected were significantly greater than the females (Chisquare, x^2 , $p < 0.05$). However, for Libellulidae there was no significant difference in the proportions of infected males and females (Chi-square, x^2 , $p > 0.05$). A significantly greater proportion of Aeshnidae was parasitized as compared to Libellulidae (Chi-square, x^2 , $p < 0.05$). For both taxa, the parasites were attached on either the thorax or abdomen, with no significant

difference in the number of parasites between the two attachment sites (ANOVA, $p > 0.05$). (Author) Regrettably, all odonate taxa are misidentified.] Address: not stated

18675. Chovanec, A.; Waringer, J.; Wimmer, R.; Schindler, M. (2014): DRAGONFLY ASSOCIATION INDEX: Bewertung der Morphologie von Fließgewässern der Bioregion Östliche Flach- und Hügelländer durch libellenkundliche Untersuchungen. Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft Stubenring 1, 1010 Wien: 43 pp. (in German) ["The aim of this dragonfly study was to develop a water type-specific, index-based approach to assess the hydromorphology of small and medium-sized watercourses in the Eastern Plains and Hills bioregion. Based on the ecological requirements of 57 dragonfly species (potentially) occurring in the bioregion, seven dragonfly associations were described. The ecological requirements of these associations were correlated with the water typological characteristics. The result is the definition of water body type-specific associations. In the Dragonfly Association Index, any deviation of the respective status quo from these reference states is calculated and expressed in one of the five classes of ecological status according to the Water Act (WRG). The method is to be applied in particular to those water bodies and water body types where the informative value of the standard methods according to the WRG is limited or not given due to the water body typological characteristics. Furthermore, the use of the method is recommended for the evaluation of local hydraulic engineering interventions, in particular reconstruction measures." (Authors; DeepL) Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-mail: andreas.chovanec@bmlfuw.gv.at

18676. Chovanec, A.; Schindler, M.; Rubey, W. (2014): Assessing the success of lowland river restoration using dragonfly assemblages (Insecta: Odonata). *Acta ZooBot Austria* 150/151: 1-16. (in English, with German summary) ["The ecological status of straightened and restored stretches of a small river system ("Weidenbach") in the lowland areas of eastern Austria was assessed based on dragonfly surveys. Restoration measures were carried out to varying extent, ranging from measures aimed at the main channel (increasing sinuosity and in-stream habitat heterogeneity) to river-type-specific restoration (RTSR) focusing also on the lateral connectivity of the system (e.g., by river widening and constructing backwaters). The assessment, which is in compliance with the EU Water Framework Directive (WFD), is based on a comparison between the current situation ("status quo") and a river-type-specific reference condition. The key elements of the assessment are species composition and the Odonata Habitat Index (OHI). Stretches of the Weidenbach subjected to RTSR were characterised by higher species numbers and a broader range of OHIs than in the other areas of the same river, indicating a wider spectrum of relevant habitats. In RTSR areas, autochthonous populations of sensitive and threatened species such as *Coenagrion scitulum* and *Aeshna isosceles* were found. These areas were ranked as class II ("good dragonfly-related ecological status"), which represents the second best class and the quality

target in the 5-tiered WFD classification scheme." (Authors)] Address: Chovanec, A., Krotenbachgasse 68, 2345 Brunn am Gebirge, Austria. E-mail: andreas.chovanec@bmlfuw.gv.at

18677. Coy, R. (2014): *Synlestes weyersii*: Observations of mating and oviposition. *Victorian Entomologist* 44(4) August 2014: 74-79. (in English) [Deer Vale, NSW, Australia, 6-1-2014] Address: not stated

18678. Deliry, C. (2014): Les libellules du marais de Lavours. *Bulletin mensuel de la Société linnéenne de Lyon, hors-série numéro 3*, 2014. Bilan de 30 ans d'études scientifiques dans le marais de Lavours (1984-2014): 219-228. (in French, with English summary) ["The dragonflies of the Lavours marsh. - Dragonflies are studied in the Lavours marsh since thirty years, leading to 44 species identified now. This high specific richness makes Lavours marsh one of the major odonatological area for Rhône-Alpes region. However, populations are often at low level even if several interesting places are still needing investigations. Some habitats deteriorated with likely loss of two species: *Leucorrhinia caudalis* and *Coenagrion pulchellum*. The evolution of other species populations and their heritage value are analyzed." (Author)] Address: Deliry, C., 1, place de la Poste, F-38200 Villefontaine, France. E-mail: cyrille@deliry.com

18679. Denis, A. (2014): Evaluation de l'état de conservation de la population de Gomphes à pattes jaunes *Gomphus flavipes* (Charpentier, 1825) sur le fleuve Adour. Rapport de stage de Master 2, Université de Toulouse: 38 pp, app. (in French) [*G. flavipes* is a relatively rare species of Odonate that is restricted to slow, undeveloped streams in the alluvial valleys of the plains. This species, protected in France and Europe, is classified as "Least Concern" on the Red List of European Odonates and "Endangered" on the provisional Red List of French Odonates. A priority species of the Regional Action Plan for Odonates (PRAO) in Aquitaine, effective since 2013, *Gomphus flavipes*, mainly present on the Adour river, benefits from an action dedicated to it. Indeed, the objective of action A.7 of the PRAO is to improve knowledge on the distribution and ecology of *G. flavipes* in order to assess the conservation status of the regional population. The results of this study made it possible to identify certain basic characteristics of the habitat favourable to larval emergence on the banks of the Adour, namely a wooded riparian vegetation and a rather steep slope. The presence of grass beds in beach areas seems to be a limiting factor for the emergence of this species on these sectors. The study also showed that the majority of emergences took place between 0 and 50 centimetres above the water level and that the most commonly used emergence supports are root hairs and roots plunging into the water. As the study took place under particular meteorological and hydrological conditions, only partial conclusions could be drawn as to the conservation status of the population of *G. stylurus* on the Adour River. However, the study did highlight the difficulties and limitations of the proposed protocol. Proposals for improving the protocol and suggestions for future studies were therefore submitted. In addition to these recommendations, this report highlights

the fact that the Adour River is a favourable environment for the species in ecological conditions that are poorly documented in the bibliography. Finally, the pressures and threats weighing on the population appear to be low. The regional population therefore does not seem to be threatened in the medium term. Translated with www.DeepL.com/Translator (free version)] Address: not stated

18680. Dunk, von der K. (2014): Untersuchungen zur entomologischen Vielfalt in der Brucker Lache, einem seit über 50 Jahren geschützten besonderen Lebensraum in unmittelbarer Nähe zur Großstadt Erlangen. *galathea* 30: 5-48. (in German, with English summary) ["In 2012 and additional in 2013 members of the "Kreis Nürnberger Entomologen" investigated the insect fauna of the "Brucker Lache". The name of the area derives from a small suburb of the city of Erlangen (Middle Frankonia, Northern Bavaria) and the nearby growing wet forest. This kind of wood was drained by mankind so hard, that one must speak from an exception, that this forest still exists. As one of the first objects it was set under protection in 1964. The elder-grove (*Alnus glutinosa* with stilt roots) offers different life conditions compared with the ordinary pinetree forests, which grow all around. So it was exciting to look for specific insect species. We were able to discover 625 different insects. Among them 19 are mentioned in the Bavarian Red Data Book, and 11 in the new German Red Data Book. ..."] (Authors) *Aeshna cyanea*, *Ischnura elegans*, *Pyrhosoma nymphula*, *Sympecma fusca*, *Libellula depressa*, *Sympetrum danae*, *S. sanguineum*, *Platycnemis pennipes*] Address: v.d. Dunk, K., Ringstr. 62, 91334 Hemhofen, Germany. E-mail: k.v.d.dunk@t-online.de

18681. Evangelio Pinach, J.M.; Sendra Pérez, P.; Díaz Martínez, C. (2014): Primera cita de *Libellula quadrimaculata* Linnaeus, 1758 (Odonata: Libellulidae) y *Lestes sponsa* (Hansemann, 1823) (Odonata: Lestidae) para la provincia de Cuenca (este de España). *Boletín de la Sociedad Entomológica Aragonesa* 54: 425-426. (in Spanish, with English summary) [The first records of *L. quadrimaculata* [14-V-2011, laguna de Talayuelas (Serranía baja, Cuenca) (ETRS89, UTM 30SXX5008, 895 m a.s.l.) and *L. sponsa* [15-VII-2013, ETRS89, UTM 30TXK3141, 1340 m.a.s.l.] from Cuenca province (eastern Spain) are reported.] Address: Jesús M. Evangelio Pinach, J.M., Agente Medioambiental. Servicios Periféricos de la Consejería de Agricultura en Cuenca. Junta de Comunidades de Castilla-La Mancha, Spain. E-mail: jjevanach@hotmail.com

18682. Folz, H.-G. (2014): Positive Entwicklung von Vogel- und Libellenfauna durch Bachrenaturierungen im rheinhesischen Hügelland. *Fauna und Flora in Rheinland-Pfalz* 12(4): 1287-1313. (in German, with English summary) ["After their restoration, four stream sections have been surveyed for birds and dragonflies. The results are compared with data from before the restoration projects. It is shown that the measures to restore the habitat have resulted in a dramatic improvement for the birds and dragonflies of Rhineland, a region tradition-ally sparse of bodies of water. The surveyed Stretches show a considerable improvement regarding

areas to breed or rest for water-dependent bird species. ... The number of dragonfly species has grown to at least 37, which means an increase of more than 120% in certain areas." (Authors)] Address: Folz, H.-G., Hausener Str. 8, 55270 Engelstadt, Germany. E-Mail: folz-engelstadt@gmx.de

18683. Friebe, G. (2014): Libellen-Beobachtungen (Einzel-funde) aus Vorarlberg (Odonata / Österreich – Austria occ.). *inatura – Forschung online*, Nr. 9: 13 pp. (in German) [Austria "This paper lists observations by chance of dragonflies in recent years and at the same time continues the observations at the water garden in the inatura area in Dornbirn. At this artificial concrete basin in the city area, the number of reliably identified and documented species increased to 27 last year. From the Rhine delta, the first finding for Vorarlberg of *Aeshna affinis* from 2004 is published. The oviposition and thus the attempted reproduction of this species was documented in Lustenau in 2010. *Crocothemis erythraea*, which also likes warmth, was sighted several times in the Rhine Valley, with a freshly hatched animal documenting successful reproduction. With the occurrence of *Sympetrum fonscolombii* in the inatura area, another species flying in from the south is discussed. For some rarer dragonfly species, new locations in Vorarlberg are mentioned." (Author; DeepL)] Address: Friebe, G., inatura - Erlebnis Naturschau GmbH, Jahngasse 9, 6850 Dornbirn, Austria. E-Mail: georg.friebe@inatura.at

18684. Haritonov, A.Yu.; Popova, O.N.; Lagunov, A.V. (2014): Zoological analysis of dragonflies (Odonata) of the Southern Urals. *Eurasian Entomological Journal* 13(4): 301-314. (in Russian, with English summary) ["For the first time one of methods of the zoological analysis, namely Saksonov-Rosenberg's matrix is applied to estimate of the current nature protection status of dragonflies and to form the list of protected species. The estimated matrix included 65 species of dragonflies authentically revealed for the Southern Urals. As a result of the analysis of this matrix it is revealed 25 species being under the threat of disappearance and also very rare species which were taken as a basis by drawing up the general recommendatory lists of protected species of dragonflies as a part of Red Lists of the Republic of Bashkortostan (21 spp.), the Chelyabinsk (23) and Orenburg (3) Provinces, and also in structure «red lists» of the Bashkir (6) and Ilmen (6) State Reserve, certain areas, the cities, etc." (Authors)] Address: Popova, Olga, Inst. of Systematics & Ecology of Animals, Russian Academy of Sciences, Siberian Branch, Frunze str. 11, Novosibirsk 630091, Russia. E-mail: popova-2012@yandex.ru

18685. Hunger, H.; Schiel, F.-J. (2014): *Sympetrum paedisca* am westlichen Bodensee – neue Beobachtungen zu Bestandsschwankungen und Fortpflanzungshabitaten (Odonata: Lestidae). *Libellula* 33(3/4): 195-209. (in German, with English summary) ["*S. paedisca* at the westerly Lake Constance: new findings on population fluctuations and reproduction habitats – Data from surveys carried out in seven years during the period from 2004 to 2013 indicate a correlation between the water level fluctuations of Lake

Constance between April and September, the period of oviposition, larval development and emergence, and the population sizes of the summer generation of *S. paedisca*. It can be assumed that falling water levels during the summer lead to the death of many larvae in their shallow water habitats. Knowledge regarding the larval habitats of *S. paedisca* is still insufficient. We observed reproductive activities at nearly natural shallow shore zones of Lake Constance within the nature reserve "Wollmatinger-Ried-Untersee-Gnadensee" and at an artificially created pond on the Mettnau peninsula. Only at the latter location *S. fusca* occurred syntopically." (Authors)] Address: Hunger, H., INULA, Wilhelmstr. 8, 79098 Freiburg, Germany. E-mail: holger.hunger@inula.de

18686. Jeanmougin, M.; Leprieur, F.; Loïs, G.; Clergeau, P. (2014): Fine-scale urbanization affects Odonata species diversity in ponds of a megacity (Paris, France). *Acta Oecologica* 59: 26-34. (in English) ["Highlights: •There was no influence of pond localization along the urban gradient on Odonata assemblages. •There was no influence of pond localization along the urban gradient on Odonata α -diversity. •Fine-scale urbanization has negative effects on Odonata α -diversity. •The environmental conditions were similar among the studied ponds. •Exuviae are important for understanding the response of Odonata to urbanization. Abstract: Current developments in urban ecology include very few studies focused on pond ecosystems, though ponds are recognized as biodiversity hotspots. Using Odonata as an indicator model, we explored changes in species composition in ponds localized along an urban gradient of a megacity (Paris, France). We then assessed the relative importance of local- and landscape-scale variables in shaping Odonata α -diversity patterns using a model-averaging approach. Analyses were performed for adult (A) and adult plus exuviae (AE) census data. At 26 ponds, we recorded 657 adults and 815 exuviae belonging to 17 Odonata species. The results showed that the Odonata species assemblage composition was not determined by pond localization along the urban gradient. Similarly, pond characteristics were found to be similar among urban, suburban and periurban ponds. The analyses of AE census data revealed that fine-scale urbanization (i.e., increased density of buildings surrounding ponds) negatively affects Odonata α -diversity. In contrast, pond localization along the urban gradient weakly explained the α -diversity patterns. Several local-scale variables, such as the coverage of submerged macrophytes, were found to be significant drivers of Odonata α -diversity. Together, these results show that the degree of urbanization around ponds must be considered instead of pond localization along the urban gradient when assessing the potential impacts of urbanization on Odonata species diversity. This work also indicates the importance of exuviae sampling in understanding the response of Odonata to urbanization." (Authors)] Address: Jeanmougin, M., MR 7204 (MNHN-CNRS-UPMC), Laboratoire Centre d'Ecologie et des Sciences de la Conservation, Muséum National d'Histoire Naturelle, CP 51, 55 rue Buffon, 75005 Paris, France

18687. Leuthold, W.; Wildermuth, H. (2014): Erstnachweis der an Libellen parasitierenden Gnitze *Forcipomyia paludis*

in Litauen (Diptera: Ceratopogonidae; Odonata: Coenagrionidae). *Libellula* 33(3/4): 153-155. (in German, with English summary) ["First record of *F. paludis* as a parasite of Odonata in Lithuania – On 15 June 2014, in the Aukštaitija National Park W of Ignalina, Utena district, a female of *F. paludis* was photographically documented attached to the wing of a male *Coenagrion hastulatum*. This is the first record of this biting midge in the Baltic States." (Authors)] Address: Leuthold, W., Kinkelstr. 61, 8006 Zürich, Switzerland. E-mail: wleuthold@bluewin.ch

18688. Mansoreha, S.; Doosti, S.; Bazrafkan, S.; Hosseini-Vasoukolaei, N.; Vatandoost, H. (2014): Prevalence of aquatic entomofauna, the predators of mosquitoes, in the Zayandeh River of Central Iran. *Asian Pacific Journal of Tropical Disease* 4, Supplement 1: S240-S245. ["Objective: To determine the fauna of aquatic insects in Zayandeh River of Isfahan carried out in Tehran University of Medical Sciences in 2011. Methods: This study was performed in Isfahan, central of Iran in Zayandeh River. This was a descriptive study. Having fulfilled sampling for several times, we collected nearly 76 samples from different parts of river. Then they were sealed in an individual jars containing some water obtained from their habitat. Next, the insects were put in jars containing 70% ethylic alcohol. Results: A total of 76 matured samples of aquatic insects from the Zayandeh River were obtained. Among them, the order of Hemiptera which were the most prevalent order including two families: Gerridae (n=27, 35.52%), and Notonectidae (n=11, 14.47%). Other order were found belonging to Odonata from the family of Coenagrionidae (n=12, 15.78%), Coleoptera from the family of Carabidae (n=15, 19.73%) and Prostigmata from the family of Hydrachnidae (n=11, 14.47%). This was the first faunistic study carried out in Zayandeh River of Isfahan of Iran. Conclusions: The results are appropriate for future researches to detect more ecological aspects of aquatic arthropods and their role for biological control of vectors which transmit disease to human and animals." (Authors)] Address: Corresponding author: Dr. Hassan Vatandoost, Dept of Medical Entomology & Vector Control, School of Public Health, Tehran University of Medical Science, Tehran, Iran. E-mail: hvatandoost1@yahoo.com

18689. Marques Pires, M.; Bender Kotzian, C.; Spies, M.R. (2014): Diversity and spatiotemporal distribution of larval odonate assemblages in temperate Neotropical farm ponds. *J. Insect Sci.* 14(275): 2014; DOI: 10.1093/jisesa/ieu137: 9 pp. (in English) ["Farm ponds help maintain diversity in altered landscapes. However, studies on the features that drive this type of property in the Neotropics are still lacking, especially for the insect fauna. We analyzed the spatial and temporal distribution of odonate larval assemblages in farm ponds. Odonates were sampled monthly at four farm ponds from March 2008 to February 2009 in a temperate montane region of southern Brazil. A small number of genera were frequent and accounted for most of the dominant fauna. The dominant genera composition differed among ponds. Local spatial drivers such as area, hydroperiod, and margin vegetation structure likely explain these results more than spatial

predictors due to the small size of the study area. Circular analysis detected seasonal effect on assemblage abundance but not on richness. Seasonality in abundance was related to the life cycles of a few dominant genera. This result was explained by temperature and not rainfall due to the temperate climate of the region studied. The persistence of dominant genera and the sparse occurrence of many taxa over time probably led to a lack in a seasonal pattern in assemblage richness." (Authors) Odonata are treated a genus level.] Address: Mateus Marques Pires, M., Programa de Pós-graduação em Biologia, Escola Politécnica, Universidade do Vale do Rio dos Sinos, Avenida Unisinos, 950, CEP 93022-000, Sao Leopoldo, Rio Grande do Sul, Brazil. E-mail: marquespiresm@gmail.com

18690. Mazzanco, ; Paulson, D.; Abbott, J. (2014): Backyard ponds. Guidelines for creating and managing habitat for dragonflies and damselflies. Portland, OR. Migratory dragonfly partnership: 22 pp. (in English) [http://www.xerces.org/wp-content/uploads/2014/07/Pond_Habitat_Guidelines_Odonates_Final_Websec.pdf] Address: Paulson, D.R., Slater Museum, Univ. of Puget Sound, Tacoma, WA 98416, USA. E-mail: dpaulson@pugetsound.edu

18691. Mercer, E.; Mercer, T.; Sayok, A.K. (2014): Effects of forest conversions to oil palm plantations on freshwater macroinvertebrates: A case study from Sarawak, Malaysia. *Journal of Land Use Science* 9(3): 260-277. (in English) ["Oil palm plantations in Malaysia are expanding rapidly due to global oil and biofuel demand. This is of particular concern, as the conversion process of forested land to oil palm plantations and the maintenance of a plantation can significantly alter freshwater ecosystems. This is a result of the initial loss of a forested catchment, particularly the riparian vegetation, changes to the bed and banks of streams, sedimentation and changes to detrital inputs. In addition, various chemicals used on the plantations leach into the nearest waterways and can potentially affect freshwater macroinvertebrates. In the Malaysian region, these are largely endemic and generally incompletely known. This study assesses the impact of oil palm plantations on stream macroinvertebrates, by comparing four streams flowing through undisturbed rainforest and four streams flowing through oil palm plantations in Sarawak, Malaysia. Freshwater macroinvertebrates were sampled using the standard three minute kick sample method with accompanying chemical measurements. Although there were no distinct differences between the control and oil palm streams in the chemical data, the invertebrate communities provided a different interpretation of stream quality. Invertebrates were more abundant, species rich and diverse in rainforest streams than in oil palm ones. Most noticeably, two whole orders of insects, Coleoptera and Hemiptera, were absent from the oil palm streams. This may be the result of the disappearance of natural bank habitats, the sensitivity to the pesticides targeted at the Rhinoceros beetle (*Oryctes rhinoceros*), or a combination of both." (Authors) Odonata are treated at family level.] Address: Mercer, Edwina, School of Applied Sciences, Cranfield Water Science Inst., Cranfield Univ. UK

18692. Mousseau, T.A.; Møller, A.P. (2014): Genetic and ecological studies of animals in Chernobyl and Fukushima. *Journal of Heredity* 105(5): 704-709. (in English) ["Recent advances in genetic and ecological studies of wild animal populations in Chernobyl and Fukushima have demonstrated significant genetic, physiological, developmental, and fitness effects stemming from exposure to radioactive contaminants. The few genetic studies that have been conducted in Chernobyl generally show elevated rates of genetic damage and mutation rates. All major taxonomic groups investigated (i.e., birds, bees, butterflies, grasshoppers, dragonflies, spiders, mammals) displayed reduced population sizes in highly radioactive parts of the Chernobyl Exclusion Zone. In Fukushima, population censuses of birds, butterflies, and cicadas suggested that abundances were negatively impacted by exposure to radioactive contaminants, while other groups (e.g., dragonflies, grasshoppers, bees, spiders) showed no significant declines, at least during the first summer following the disaster. Insufficient information exists for groups other than insects and birds to assess effects on life history at this time. The differences observed between Fukushima and Chernobyl may reflect the different times of exposure and the significance of multigenerational mutation accumulation in Chernobyl compared to Fukushima. There was considerable variation among taxa in their apparent sensitivity to radiation and this reflects in part life history, physiology, behavior, and evolutionary history. Interestingly, for birds, population declines in Chernobyl can be predicted by historical mitochondrial DNA base-pair substitution rates that may reflect intrinsic DNA repair ability." (Authors)] Address: Mousseau, T.A., Dept Biol. Sciences & the Environment & Sustainability Program, Univ. of South Carolina, Columbia, SC 29208, USA. E-mail: mousseau@sc.edu

18693. Mugwenhi, E. (2014): The impact of gold panning to macroinvertebrate communities along the Nyazvidzi river. BSc. thesis, Dept of Biological Science, Fac. Science of Education, Bindura University of Science Education: 28 pp. (in English) ["Gold panning have affected negatively the diversity of macroinvertebrates along the Nyazvidzi river as evidenced by the results. The main objective of this research was to assess the impact of gold panning on the diversity of macroinvertebrates along the Nyazvidzi river. Site1 was up the stream and at this site panning was less because 3 to 5 were seen on daily basis. Site 2 was 2 kilometres down from Site 1 and panning at this site was medium. Site 3 was 2.5 kilometres from Site 2 and panning was more as 30 to 40 panners were seen on daily basis. Species richness was computed using the Shannon Weiner index and abundance was calculated using one way analysis of variance (ANOVA) and determine aquatic macroinvertebrates diversity. Results show that diversity decreased down the stream as more macroinvertebrates were seen at site 1 than site 3. A total of 26 families from 9 orders were recorded. The three main orders were the Odonata (40.8%), Ephemeroptera (26.3%) and the Trichoptera (14.8%). The order Odonata of class Hexapoda had the highest abundance (40.8% of total) and highest richness (9 families). Baetidae (9.8%) was the most persistent and the most abundant macroinvertebrate taxa

followed by Libellulidae (8.4%). Almost all taxa were represented in upper stations, except for Potamidae, which were limited to downstream station. Macroinvertebrate taxa richness, total abundance and diversity were significantly higher at Sites 1 and 2 compared to Site 3. Results show that gold panning have some negative impacts on the diversity, taxa richness and abundance of macroinvertebrates communities." (Author)] Address: not stated

18694. Myint, W.W. (2014): A study on some Odonate species in Hinthada University Campus. Hinthada University Research Journal 5(1): 38-47. (in English) ["This study was to identify the some Odonates and to add more information on damselflies and dragonflies. A total of 14 species of odonates from Hinthada University Campus, Myanmar were collected and identified. The study period lasted from September, 2011 to October, 2013. Zygoptera and Anisoptera, four families, 12 genera and 14 species of odonates were recorded. Among these 10 species of family Libellulidae is the large family in this study period. Detail morphological structures such as head, thorax, abdomen, body colour and measurements of high wings and abdomen length had also been described. The percentages of recorded odonate species were 71.42% family Libellulidae, 14.28% family Coenagrionidae and 7.15% of families Platynemididae and Aeshnidae. The Odonate species are beneficial to man as biological control agents and as food and traditional medicine in some countries." (Authors)] Address: Dept Zool., Hinthada University, Myanmar

18695. Onishko, V.V. (2014): The dragonflies (Odonata) species new to different regions of the Russia. Bulletin of the Moscow Society of Naturalists. Biological Division 119(5): 66-68. (in Russian, with English summary) ["The article provides information about the 24 new discoveries 22 species of dragonflies in the territory of European Russia, made from 1998 to 2011 and in six regions, Astrakhan, Moscow, Murmansk, Tver, Vladimir and Voronezh oblasts. (Author)] Address: E-mail: wervolf999@yandex.ru

18696. Parr, A. (2014): The Southern Darter *Sympetrum meridionale* (Selys) and its potential occurrence in Britain. *Atropos* 52: 49-52. (in English) ["*S. meridionale* has expanded its range well to the north over recent years, and its occurrence in Britain is to be anticipated in the near future. Observers are thus encouraged to be on the lookout for the species. Indeed, given its close similarity to resident species, it is conceivable that it has already occurred but gone unnoticed; perhaps further scrutiny of recent photographs of 'unusual' Common Darter individuals might prove enlightening." (Author)] Address: Parr, A.J., 10 Orchard Way, Barrow, Bury St. Edmunds, Suffolk IP29 5BX, UK. E-mail: Adrian.parr@bbsrc.ac.uk

18697. Pinach, J.M.; Ramos, J.M.; Perez, I.S.; Anton, V.B. (2014): Primeras citas de *Libellula quadrimaculata* Linnaeus, 1758 (Odonata, Libellulidae) para la provincia de Valencia (este de España). *Boln. Asoc. esp. Ent.*, 38(3-4): 351-355. (in Spanish, with English summary) [First records of L.

quadrimaculata from Valencia province (eastern Spain): 4-VI-2014, Castielfabib (Rincón de Ademuz, ETRS89 30T-XK4141, 1125 m a.s.l.) and 15-VI-2014, Parque Natural de la Puebla de San Miguel (Rincón de Ademuz, ETRS89 30TXK-5635, 1123 m a.s.l.) Address: Pinach, J.M., Junta de Comunidades de Castilla-La Mancha. Servicios Periféricos de la Consejería de Agricultura en Cuenca. C/ Colón, 2. 16071, Cuenca, Spain. E-mail: jjevanach@hotmail.com

18698. Renner, S. (2014): Composição de Libélulas (Odonata) em diferentes ambientes da floresta nacional de São Francisco de Paula, Rio Grande do Sul, Brasil. Dissertação (Mestrado) – Curso de Ambiente e Desenvolvimento, Centro Universitário Univates, Lajeado: 59 pp. (in Portuguese, with English summary) ["The human development brings several consequences to the environment, being the most remarkable the fragmentation of natural systems, resulting in ecological imbalance, biodiversity loss and degradation of the watershed. One of the richest biomes of this planet is the Atlantic Forest, which still poorly known in many animal groups, one example is the Odonata order. Actually this biome remains, under pressure in a fragmented mosaic. The forest formation occurring in the South of Brazil is the Mixed Ombrophilous Forest (MOF), a subtype of the Atlantic Forest. In the state of Rio Grande do Sul, this biome covered the high regions and the slopes of the Atlantic Ocean, occurring mostly in the northern half of the state. The MOF is remarkable by the presence of the Brazilian Pine (*Araucaria angustifolia*). Nowadays the remnants of the MOF are disperse in open fields, agriculture or urban matrix. In this context, the species inventory can play a key role in the conservation of these forest remnants. The present study was developed in a big forest fragment, in which exists an ecologic reserve: the Floresta Nacional de São Francisco de Paula, RS. The dragonfly species inventory was performed by sampling 30 aquatic sources distributed in 4 vegetation types and 3 types of aquatic systems. Were registered 47 species scattered in eight families. The Odonata assemblages found in all the types of water (rivers, lakes and swamps) and vegetation types (MOF, araucaria forest, pinus forest and open fields) were statistically compared. In the pinus areas was found the richest assemblage, being composed mainly by generalist species. Was applied and adapted a known methodology for the selection of potential indicator species. The poor knowledge of the Odonata order was improved in the Atlantic Forest/MOF, contributing for future conservation measures and definition of priority protection areas." (Author)] Address: Renner, S., Laboratório de Ecologia e Evolução, Universidade do Vale do Taquari – UNIVATES, Rua Avelino Tallini, 171 Bairro, Universitário, Lajeado RS 95900-00, Brazil. E-mail: samuelrenner@hotmail.com

18699. Sanyal, A.K.; Chattapadhyay, S.K.; Pal, T.K.; Karmakar, A.K. (2014): Faunal resources and assessment of the impact of mining activities on fauna of Chhotonagpur Coalfield Areas, Jharkhand. *Rec. zool. Surv. of India, Occasional Paper No. 361*: 1-47. (in English) [A total of 35 different localities were studied, resulting in 35 odonate taxa.] Address: not stated

18700. Schiel, F.-J. (2014): Eine Fang-Wiederfang-Studie an *Sympetrum depressiusculum* in Mittelbaden (Odonata: Libellulidae). *Libellula* 33(3/4): 217-231. (in German, with English summary) ["A mark-recapture study of *Sympetrum depressiusculum* in the Upper Rhine Valley, Germany (Odonata: Libellulidae) – In a mark-recapture-study conducted in 2007 at two surveyareas in the central part of the upper Rhine Valley (119-129 m a.s.l., MTB 7214, 7313, German federal state of Baden-Württemberg) all in all 713 specimens of *S. depressiusculum* were individually marked to find out if there is an exchange between the two selected survey areas and between the different breeding sites within each area. With 69 recaptures, the recapture rate amounted to 9.7 %. Both, recapture rates from males (14.4 %) and females (4.4 %) and those of mature (10.3 %) and immature marked (6.9 %) individuals differed significantly. 13 individuals (1.8 %) were recaptured on two dates, three on three dates and one on four dates. The median time span between marking and recapture was 14 days. Seven males and two females were recaptured 28-42 days after marking. Altogether 23 individuals (3.2 %) were recaptured 30-550 m away from the marking sites. 14 of these were movements between reproduction sites and foraging sites or resting sites, respectively. The results suggest a small activity range and a metapopulation structure in both survey areas. Even though an exchange between the two study areas, which are separated by a 14 km gap without records of *S. depressiusculum*, could not be evidenced by recapture dates, an exchange is nevertheless very probable. This may be assumed by own accidental observations of *S. depressiusculum* at unsuitable reproduction sites at distances up to 6 km away from the next known breeding site and by records in literature with observations at distances up to 40 km around reproduction sites.] Address: Schiel, F.J., INULA, Turenneweg 9, 77880 Sasbach, Germany. E-mail: Franz-Josef.Schiel@inula.de

18701. Stalder, G. (2014): Ein außergewöhnlich warmer Winter 2013/2014 mit den beiden Winterlibellen *Sympetma fusca* und *S. paedisca*. *Mercuriale* 14: 43-60. (in German, with English summary) ["Residence and activity patterns during hibernation of 27 adults of *S. fusca* were observed and controlled 62 times from late autumn, 2013, until late winter, 2014. Whereas autumn temperatures were near average, the winter was characterised by exceptionally high temperatures. The study was carried out in the nature reserve "Lengwiler Weiher" in the vicinity of the southern shore of Lake Constance, Switzerland. Five specimen of *S. fusca* were captured, marked and released in November, 2013. Three out of these five individuals could be recorded several times until mid-March, 2014. On 23 February 2014, a remarkable observation was done: under cloudy conditions a specimen undertook a short flight although the current temperature was only 6.6° C. After midday the same day an individual could be observed feeding. Furthermore, in the end of February, 2014, few specimens of *S. paedisca* could be recorded, partly in the same habitat." (Author)] Address: Stalder, G., Hueb 6, 8580 Sommeri, Switzerland. E-mail: gesta@gmx.ch

18702. Svensson, E.I.; Runemark, A.; Verzijden, M.N.;

Wellenreuther, M. (2014): Sex differences in developmental plasticity and canalization shape population divergence in mate preferences. *Proceedings of the Royal Society B: Biological Sciences* 281: 9 pp. (in English) ["Sexual selection of high-quality mates can conflict with species recognition if traits that govern intraspecific mate preferences also influence interspecific recognition. This conflict might be resolved by developmental plasticity and learned mate preferences, which could drive preference divergence in populations that differ in local species composition. We integrate field and laboratory experiments on two calopterygid damselfly species with population genetic data to investigate how sex differences in developmental plasticity affect population divergence in the face of gene flow. Whereas male species recognition is fixed at emergence, females instead learn to recognize heterospecifics. Females are therefore more plastic in their mate preferences than males. We suggest that this results from sex differences in the balance between sexual selection for high-quality mates and selection for species recognition. As a result of these sex differences, females develop more pronounced population divergence in their mate preferences compared with males. Local ecological community context and presence of heterospecifics in combination with sex differences in plasticity and canalization therefore shape population divergence in mate preferences. As ongoing environmental change and habitat fragmentation bring formerly allopatric species into secondary contact, developmental plasticity of mate preferences in either or both sexes might facilitate coexistence and prevent local species extinction." (Authors)] Address: Anna Runemark: E-mail: anna.runemark@biol.lu.se

18703. White, E.L.; Hunt, P.D.; Schlesinger, M.D.; Corser, J.D.; deMaynadier, P.G. (2014): A conservation status assessment of Odonata for the Northeastern United States. *New York Natural Heritage Program, Albany, NY: VI + 44 pp.* (in English) ["Executive Summary: Odonates are valuable biological indicators of freshwater ecosystem integrity and climate change. Approximately 18% of odonates in the US are considered rare and vulnerable to extirpation or extinction. Northeastern North America hosts a rich and ancient odonate fauna, especially for a temperate region. Recognition of northeastern North America as both a hotspot of odonate diversity, and a region of historical and growing threats to freshwater ecosystems, highlights the urgency of developing a comprehensive conservation assessment of the Northeast's resident odonate species. Here, we develop and apply a prioritization framework for 228 species of Odonata occurring in the northeastern US (Virginia to Maine). Specifically, we offer a modified version of NatureServe's methodology for assessing conservation status ranks by assigning a single, regional vulnerability metric (R-rank) reflecting each species' degree of relative extinction risk in the northeastern US. We combine this newly formulated vulnerability assessment with an updated analysis of the degree of endemism (% of the species' US and Canada range within the Northeast) as a proxy for regional responsibility, thereby deriving a list of species of combined vulnerability and regional management responsibility. In so doing our goals are two-fold:

a) to develop a credible list of odonate species of conservation concern in northeastern North America, and more generally, b) to invite scrutiny of a science-based species prioritization methodology that might be applied to assess other diverse taxa that have not yet received adequate conservation attention. We compiled all confirmed, county-level odonate data from all years. This dataset contained 248,059 records, with data from all NEAFWA states. We calculated a single vulnerability rank (R-rank) based on five factors: three rarity factors (range extent, area of occupancy, and habitat specificity), one threat factor (vulnerability of occupied habitats), and one trend factor (relative change in range size). This yielded a regional vulnerability rank (R-rank) for each species, ranging from R1 (most vulnerable) to R5 (least vulnerable). We calculated regional responsibility as the proportion of the US & Canadian range occurring within the Northeast US. Odonate species fell into three categories based on their responsibility calculation: „Primary“ responsibility species were those for which $\geq 50\%$ of their range fell in the Northeast; „Significant“ responsibility species were those for which 25-50% of their range fell in the Northeast; and „Shared“ responsibility species were those for which $< 25\%$ of their range fell in the Northeast. We created a matrix of species in three vulnerability categories (High: R1 and R2, Medium: R3, and Low: R4 and R5) and three responsibility categories (Primary, Significant, and Shared). We also present results on habitat associations for northeastern Odonata along with all metric components of our conservation assessment. Overall, 18% of our region's odonate fauna is imperiled (R1 and R2) and peatlands, low gradient streams and seeps, high gradient headwaters, and larger rivers that harbor a disproportionate number of these species should be considered as priority habitat types for conservation, monitoring, and management. We recommend that our assessment be used to inform the strategic allocation of limited state and federal conservation resources and help foster collaborations across state lines to implement similar goals for conserving regionally at-risk Odonata. We also anticipate our products will help guide and standardize conservation assessments of Odonata, and potentially other invertebrate taxa, at the statewide level in the Northeast. Finally, we recommend that a regional Odonata conservation working group be formed to help guide protocols for surveys, monitoring, research, habitat protection, and education, and thereby develop a framework for a coordinated comprehensive conservation plan for northeastern Odonata." (Authors)] Address: White, E.L., New York Natural Heritage Program, SUNY College of Environmental Science & Forestry, 625 Broadway 5th Floor, Albany, NY, US 12233-4757

18704. Wildermuth, H.; Schneider, B. (2014): Der Eisvogel *Alcedo atthis* als Libellenjäger (Aves: Alcedinidae; Odonata). *Libellula* 33(3/4): 127-148. (in German, with English summary) ["The Kingfisher *Alcedo atthis* as dragonfly hunter – The Common Kingfisher mainly feeds on small fish and to a lesser extent on aquatic arthropods caught by plunge-diving. As little is known about the Kingfisher's insect nutrition we investigated the captured prey on photos and video films and analysed the contents of pellets collected between March

and May in the years 2010-2014 at four riverine breeding sites along a 20 km stretch of the River Töss in the Swiss Plateau. Altogether we identified 273 insect prey items from more than 1,000 small cuticle fragments, comprising water bugs (Notonecta spp. and *Iliocoris cimicoides*, 62 %), Anisoptera (38.5 %) and Zygoptera (1.5 %). *Anax imperator* (mainly F0-stadia) constituted 49 %, *Orthetrum cancellatum* 31 % (mainly F1-stadia) and *Aeshna cyanea* 11.5 % (mainly F1-stadia) of the odonate prey, while *Calopteryx* sp., *Brachytron pratense*, *Onychogomphus forcipatus*, *Cordulegaster boltonii*, and *Libellula depressa* were only sporadically found. The number of odonate species and prey items differed greatly between the four sites, due to the availability of prey in the surroundings of the breeding burrows. The recorded insects mainly originated from ponds near the river (water bugs, five odonate spp.) and to a lesser extent from the river itself (*Calopteryx* sp., *O. forcipatus*, *C. boltonii*). The results are discussed with respect to the applied methods and identification problems as well as to the season and the local availability of food, the prey recognition of the Kingfisher, and the behaviour of the odonate larvae preyed on." (Authors)] Address: Wildermuth, H., Haltbergstr. 43, 8630 Rüti, Switzerland. E-mail: hansruedi@wildermuth.ch

18705. Yen, A.L. (2014): Insects as food and feed in the Asia Pacific region: current perspectives and future directions. *Journal of Insects as Food and Feed* 1(1): 33-55. (in English) ["Western cultures currently struggle to have insects accepted as a human food. This barrier is not as high in many parts of the Asia Pacific region because entomophagy is (or was until recent times) a part of their accepted diets. The region is comprised of many different cultural groups and the degree to which they embraced entomophagy has been determined by dietary needs, cultural considerations, and the availability of insects. While entomophagy has decreased in westernised societies, the demand for edible insects has increased in parts of Asia in association with rising standards of living. An assessment of the use of insects as food and feed in the Asia Pacific region is provided and important knowledge gaps are identified. Edible insects are sourced by three main strategies: wild harvesting, semi-domestication of insects in the wild, and farming. Semi-domestication and farming have the potential to provide a more sustainable food supply, but globally 92% of species are wild harvested. The harvested insects come from all trophic levels, although most of the terrestrial edible insect species are herbivores and most species of edible aquatic species are predators. The increased demand for edible insects puts pressure on the source populations because new technologies are now used to harvest insects more efficiently and to store them safely for longer periods, facilitating the harvesting of greater amounts of insects. This, in combination with either loss of natural habitats or changes to the environment, puts even more pressure on insect populations. The over harvesting of edible insects from different trophic levels could have long term adverse implications for ecosystem processes in Asia Pacific and other regions. ... For example, fish can indirectly facilitate terrestrial plant reproduction by reducing larval dragonfly abundances in ponds, leading to

fewer adult dragonflies nearby. Adult dragonflies consume insect pollinators and alter their foraging behaviour. As a result, plants near ponds with fish have more pollinators than plants near fish-free ponds. There could also be subtle ecological interactions between human and wildlife use of insects. In Thailand," (Author)] Address: Yen, A.L., Dept Economic Development, Jobs, Transport & Resources, Biosciences Research Division, AgriBio, 5 Ring Road, Bundoora, Victoria 3083, Australia. E-mail: alan.yen@ecodev.vic.gov.au

2015

18706. Allen, B.T. (2015): Proximate behavioral and morphological mechanisms that may mediate intraguild predation stability in the Anisoptera. Ph.D., University of Texas at Arlington: 189 pp. (in English) ["Intraguild Predation (IGP) is a form of interference competition characterized by an intraguild predator consuming interspecific competitors, the intraguild prey. This interaction is extremely common in nature, but mechanistic and descriptive models usually predict that it is unstable with either the IG prey or IG predator becoming locally extinct, dependent on initial conditions. Only intermediate shared prey availability leads to IGP stability in these models, and this condition is not common. In this work, I used dragonfly nymphs to examine behavioural and morphological aspects of consumptive competition and predator avoidance that may act to stabilize IGP, particularly in systems with more than two predators. There are two primary hypotheses in this treatment. The first is that prey capture is morphologically mediated and that this leads to differences in diet composition that can promote IGP stability by allowing prey specialization. The second is that there is a behavioural tradeoff that leads to disproportionate feeding on competitively superior IG prey by an IG predator that may lead to IGP stability. This tradeoff was hypothesized to exist in terms of direct prey capture as well as movement and space use patterns. Both of these mechanisms were found to exist, with species variation in mortality being explained by their behaviour, in spite of morphological defenses compensating for the lack of behavioural defenses in some species. While effect of this possible mechanism on IGP stability was not directly examined, further long-term study should elucidate it." (Author) *Anax junius*, *Erythemis simplicicollis*, *Libellula lydia*, *Pachydiplax longipennis*, *Tamea lacerata*, *Sympetrum corruptum*, *Enallagma civile*; <https://rc.library.uta.edu/uta-ir/handle/10106/26728>] Address: not stated

18707. Andem, A.B.; Esenowo, I.K.; Bassey, D.O. (2015): Application of biotic indices and pollution Tolerance Index in assessing macro-invertebrate assemblage of Ediba River, Cross River State, Nigeria. *Environmental & Analytical Toxicology S7*: 007. doi:10.4172/2161-0525.S7-007: 5 pp. (in English) ["The study of the macro-invertebrates community of Ediba River in Cross River State was carried out from October to December, 2014 using Pollution Tolerance Index (PTI). Macro-invertebrate fauna were sampled with sweeping net using kick sampling methods. 16 genera, belonging to 9 orders and a total of 289 individuals were encountered. The dominant groups in the order were Oligochaeta

(29.1%)>Diptera (24.62%)>Odonata (20.3%), showing insignificant difference between the three stations at $p>0.05$. Taxa richness was highest in Station 1 (2.985) and least in Station 3 (1.008) showing insignificant differences across station ($p>0.05$). Evenness ranges from 0.337 to 0.369 showing significant difference across stations ($p<0.05$). Station 1 had a PTI value of 39 indicating good quality water status, while Stations 2 and Station 3 had PTI values of 6 and 4 respectively indicating poor quality water status. The abundance of pollution tolerance species of the orders, Odonata Zygoptera, Oligochaeta, Diptera and the absence of pollution sensitive species of the orders, Ephemeroptera and Trichoptera in Stations 2 and 3 indicated the poor waters quality, coupled with the low PTI values in both stations, hence need for proper management of the river." (Authors)] Address: Esenowo, I.K., Dept Zoology, Univ. of Uyo, Akwa Ibom State, Nigeria. E-mail: imehesenowo@yahoo.com

18708. Beadle, J.M.; Brown, L.E.; Holden, J. (2015): Biodiversity and ecosystem functioning in natural bog pools and those created by rewetting schemes. *WIREs Water* 2015. doi: 10.1002/wat2.1063: 20 pp. (in English) ["Anthropogenic drainage and cutting over of peatlands have historically occurred worldwide leading to erosion, issues with water quality, loss of biodiversity, and reduced rates of carbon accumulation. In recent years, rewetting measures have attempted to address these issues. Creating dams to block drainage ditches on peatlands is a common restoration tool, yet the ecological consequences of such management interventions are poorly understood. In particular, knowledge about the ecology of the thousands of pools created by drain blocking is limited even though they potentially provide valuable new habitat for aquatic species and food and water sources for terrestrial organisms. More research is needed to assess the suitability of these artificial pools as surrogates for naturally occurring peat pools with regard to the flora (e.g., bryophytes, algae, and macrophytes) and fauna (e.g., invertebrates and amphibians), which utilize them. Evidence suggests that (1) to maximize benefits to aquatic biota, land managers should consider creating an array of differently sized pools behind the dams as a broader size range would facilitate colonization by a wider range of taxa, (2) prioritizing landscapes close to existing water bodies would encourage faster colonization, and (3) even newly created pools with low macrophyte cover may be able to sustain substantial populations of larger fauna via algal primary production, consumption of detritus, and microbial processing of humic substances and methane. Ongoing programs of peatland restoration worldwide also afford unique opportunities to study how pool communities assemble and change over time." (Authors) The study includes references to Odonata.] Address: Beadle, Jeannie, School of Geography, University of Leeds, Leeds, UK, School of Geography, University of Leeds, Leeds, UK. e-mail: ill2jmb@leeds.ac.uk

18709. Bechly, G. (2015): Fossile Libellennachweise aus Deutschland (Odonoptera). *Libellula Supplement* 14: 423-464. (in German, with English summary) ["Fossil odonate records from Germany (Odonoptera) – A historical

sketch of the research on fossil dragonflies from Germany is provided, together with a commented list of all localities and discovered taxa, supplemented by a complete bibliography. The deposition of the fossil material is specified as well. The oldest fossils stem from the Carboniferous, and the youngest ones from the Pleistocene. The largest number of fossil dragonflies was found in Jurassic and Tertiary sediments. Only from the Cretaceous and the Paleocene have no fossils yet been discovered." (Author)] Address: Bechly, G., Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, 70191 Stuttgart, Germany. E-mail: guenter.bechly@smns-bw.de

18710. Biodrawersity (2015): Relicensing Study 3.3.10. Assess operational impacts on emergence of state-listed odonates in the Connecticut River. Interim Study Report. Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889). Prepared for: FirstLight: 26 pp. [3.1 Odonate Survey Results: 3.1.1 Species Assemblage: Table 3.1.1-1 lists the genera and species collected at each site. *Epithea princeps*, a species common in lentic habitats, was the most common species collected at Sites 1-3. These sites in the lowermost portion of the Turners Falls Impoundment (Barton Cove) contain mostly lentic habitat with submerged and emergent vegetation. Sites 4-8 were generally more lotic; dominant taxa in these samples included *Gomphus* sp. (mostly *G. vastus*), *Ophiogomphus* (mostly *G. rupinsulensis*), *N. yamaskenensis*, *Boyeria vinosa*, and *Macromia illinoensis*. There was very little variation in the odonate assemblage among sites 4-8. Species-level identification of some of the Gomphidae, especially *Gomphus* sp. and *Ophiogomphus* sp., is incomplete; this interim report will be updated when these data become available. Most of the target state-listed species for Sites 4-8 were in the genus *Gomphus*. Based on historic survey data, which were generally more complete for the Turners. 3.1.2 Emergence and Eclosure: Approximately 250 exuviae were collected across the eight survey sites. These were found on emergent aquatic vegetation only at sites 1 and 3, as this type of emergence substrate was not available at the other sites. Elsewhere, exuviae were found primarily on terrestrial herbaceous vegetation, soil, trees, coarse fallen wood, and rock (Table 3.1.2-1). They were found as high as nine feet above the water's surface (mean = 4.4) and as far as 42 ft from the edge of the water (mean = 12.7). Since these surveys were qualitative and only occurred during the month of June, these distances above the water and from the water's edge are biased, but do provide a range to consider in the next phase of work. 3.2 Habitat Characterization: Habitat parameters recorded at each site are provided in Table 3.2-1, and representative photographs are provided in Appendix A. The most common habitat feature of nearshore areas and streambanks was a muddy slope of varying steepness, with lesser and variable amounts of sand, gravel, or cobble. Upslope, this mud transitioned into the riparian zone that was typically vegetated with trees (especially silver maple), low terrestrial herbaceous vegetation, moss, and vines, and contained varying amounts of large woody debris and detritus. The odonate surveys were typically done during periods of low flow, therefore relatively large amounts of the

muddy bank were exposed and the distance from the water line to the interface between aquatic and terrestrial habitat was relatively great. Less common nearshore habitat types included aquatic emergent vegetation and rock. Aquatic emergent vegetation was prevalent only in the more lentic habitats of Barton Cove (Site 1) and on the other side of Campground Point (Site 3). Elsewhere, aquatic emergent vegetation was either absent, or existed as a very sparse fringe of species that can tolerate daily exposure. Submerged aquatic vegetation, especially *Vallisneria*, was common in some areas but typically only as a narrow band in deeper waters. Bare rock, an emergence substrate for odonates, is uncommon in the Connecticut River between the Deerfield River confluence and Route 116 Bridge. There are some isolated ledge outcrops, and the bridge abutments and areas near bridges often contained higher amounts of "unnatural" rock. The most "natural" rock is located in the Turners Falls bypass reach." (Author)] Address: not stated

18711. Blanckenhagen, B. von (2015): Die Arktische Smaragdlibelle *Somatochlora arctica* (Zetterstedt, 1840) im Burgwald: Verbreitung und Anmerkungen zur Ökologie. Libellen in Hessen 8: 39-52. (in German) [The distribution of *S. arctica* in the Burgwald (Hessen, Germany) was mapped in summer 2014 with the help of exuviae collections and supplementary larval surveys. The survey focused on six FFH sites and adjacent areas with fens and transitional bogs as well as dystrophic ponds and their siltation zones. Ten subpopulations were documented with a total of 125 exuviae. The Lange Grund, the Franzosenwiesen and the Christenberger Talgrund are the distribution centres of *S. arctica* in the Burgwald. In addition, the habitats occupied, the association with other dragonfly species and possible predators are described. The occurrence has a nationwide significance and a high value in the context of the disjunct Central European occurrences north of the Alps." (Author; DeepL)] Address: von Blanckenhagen, B., Kaffweg 8, 35039 Marburg, Germany. E-mail: benno.v.blanckenhagen@web.de

18712. Boudot, J.-P.; Kalkman, V. (2015): Atlas of the dragonflies and damselflies of Europe. KNNV uitgeverij, Netherlands: 384 pp. (in English) [This is the first detailed and complete overview of the distribution of the dragonflies and damselflies of Europe. An important reference work for professionals and amateurs alike. * Covers the distribution and habitat selection of all 143 European species of dragonflies and damselflies. * Gives a complete description of their global and European distribution, illustrated using over 200 distribution maps. * Gives per species information on taxonomy, range, population trends, flight season-, and habitat. * Includes unique photos and flight season diagrams for virtually all European dragonflies. * Contains extensive background information on taxonomy, conservation, and for each country an overview of the history of odonatological studies." (Publishers)

18713. Burmester, T. (2015): Evolution of respiratory proteins across the Pancrustacea. *Integrative and Comparative Biology* 55(5): 792-801. (in English) [Respiratory proteins enhance the capacity of the blood for oxygen transport and

support intracellular storage and delivery of oxygen. Hemocyanin and hemoglobin are the respiratory proteins that occur in the Pancrustacea. The copper-containing hemocyanins evolved from phenoloxidases in the stem lineage of arthropods. For a long time, hemocyanins had only been known from the malacostracan crustaceans but recent studies identified hemocyanin also in Remipedia, Ostracoda, and Branchiura. Hemoglobins are common in the Branchiopoda but have also been sporadically found in other crustacean classes (Malacostraca, Copepoda, Thecostraca). Respiratory proteins had long been considered unnecessary in the hexapods because of the tracheal system. Only chironomids, some backswimmers, and the horse botfly, which all live under hypoxic conditions, were known exceptions and possess hemoglobins. However, recent data suggest that hemocyanins occur in most ametabolous and hemimetabolous insects. Phylogenetic analysis showed the hemocyanins of insects and Remipedia to be similar, suggesting a close relationship of these taxa. Hemocyanin has been lost in dragonflies, mayflies, and Eumetabola (Hemiptera + Holometabola). In cockroaches and grasshoppers, hemocyanin expression is restricted to the developing embryo while in adults oxygen is supplied solely by the tracheal system. This pattern suggests that hemocyanin was the oxygen-transport protein in the hemolymph of the last common ancestor of the pancrustaceans. The loss was probably associated with miniaturization, a period of restricted availability of oxygen, a change in life-style, or morphological changes. Once lost, hemocyanin was not regained. Some pancrustaceans also possess cellular globin genes with uncertain functions, which are expressed at low levels. When a respiratory protein was again required, hemoglobins evolved several times independently from cellular globins. ... Hemocyanin has been lost in dragonflies, mayflies, and Eumetabola (Hemiptera + Holometabola). ... 2). No Hc was found in Protura, Diplura, Ephemeroptera (mayflies), Odonata (dragonflies and damselflies), or Eumetabola (Hemiptera and Holometabola)" (Author)] Address: Burmester, T., Inst. Zool., Biocenter Grindel, Univ. Hamburg, Martin-Luther-King-Platz 3, 20146 Hamburg, Germany. E-mail: thorsten.burmester@uni-hamburg.de

18714. Chavez, M.Y.; Mabry, K.E.; McCauley, S.J.; Hammond, J.I. (2015): Differential larval responses of two ecologically similar insects (Odonata) to temperature and resource variation. *International Journal of Odonatology* 18(4): 297-304. (in English) ["How species respond to shifting environmental conditions is a central question in ecology, especially because ecosystems are experiencing rapidly changing climatic conditions. However, predicting the responses of species interactions and community composition to changing conditions is often difficult. We examined the effects of rearing temperature and resource level on larval survival of two ecologically similar dragonflies, *Erythemis collocata* and *Pachydiplax longipennis*. Within high and low (26 and 21°C) temperatures, we crossed species and resource level and reared larvae individually. We predicted that warmer temperatures would reduce survival and increase growth rate, that higher resource availability would increase survival and growth rate, and that the two species would respond similarly. We

found that increased temperature reduced survival for both species. There was also an interaction between temperature and species: *E. collocata* had higher survival at the lower temperature, but lower survival at the higher temperature when compared to *P. longipennis*. Resource level did not affect survival. In general, *P. longipennis* grew more than *E. collocata*, with no effects of temperature or resource level. These results suggest that these species respond dissimilarly to changing thermal conditions, that increased food availability cannot always compensate for the negative effects of higher temperatures, and that climate change may affect interactions between these two sympatric, ecologically similar species, with potential consequences for community composition." (Authors)] Address: Hammond, J.I., Dept of Biology, University of New Mexico, Albuquerque, NM, USAEmail: jhammo02@unm.edu

18715. Chovanec, A. (2015): Bewertung der Renaturierungsmaßnahmen in den Mündungsbereichen von Leitenbach und Sandbach sowie an der Aschach (Oberösterreich) aus libellenkundlicher Sicht. Im Auftrag des Amtes der Oberösterreichischen Landesregierung, Abt. Oberflächengewässerswirtschaft: 73 pp. (in English) ["In the present study, the ecological status of the renaturalised estuary sections of the Leitenbach and Sandbach as well as the Aschach in this area was assessed from a dragonfly point of view, with special consideration of the morphological conditions. This was done on the basis of the Dragonfly Association Index and was based - in accordance with the requirements of the Water Framework Directive and the Water Act - on a comparison between a water body type-specific reference condition and the status quo. A total of 25 species were detected in the study area, which corresponds to 32 % of the spectrum of 78 species occurring in Austria; 21 species were native to the soil. On the Leitenbach 23 species were found (20 of them native), on the Sandbach 16 (14) and on the Aschach also 16 (11). The high number of rheobiont and rheophilous species (*Calopteryx splendens*, *Calopteryx virgo*, *Platycnemis pennipes*, *Gomphus vulgatissimus*, *Ophiogomphus cecilia*, *Onychogomphus forcipatus*, *Orthetrum brunneum*) should be emphasised. *G. vulgatissimus*, *O. cecilia* and *O. forcipatus* are "endangered" according to the Red List for Austria. *O. cecilia* is listed in Annexes II and IV of the EU Habitats Directive. All three stretches of water were classified in class 1 "very good dragonfly ecological status". (Author) Translated with www.DeepL.com/Translator (free version)] Address: Chovanec, A., Umweltbundesamt, Abt. Oberflächengewässer, Spittelauer Lände 5, 1090 Wien, Austria

18716. Coccia, C. (2015): Invasion biology of *Trichocorixa verticalis* in Doñana, SW Spain . PhD dissertation, Univ. of Seville: 208 pp. (in English, with Spanish summary) ["Biological invasions are one of the top threats to biodiversity and ecosystem functioning worldwide, and fresh waters are among the most invaded ecosystems in the world. To be successful, an invader must possess qualities that allow invasion in the new habitat, but besides these qualities its success also depends on the interactions between its traits, the traits of the invaded community, and many other contingent

factors. A recent addition to the list of alien invertebrate species in European fresh waters is the North American *Trichocorixa verticalis* (Hemiptera: Corixidae). To date, *T. verticalis* is the only established alien waterbug in these ecosystems. In the 18 years since its first detection in the Iberian Peninsula, *T. verticalis* has increased its area of distribution in and around Doñana, in the Guadalquivir delta, and also in other areas of conservation interest including Ramsar wetlands and Nature Reserves in Andalucía. In general, it is highly dominant and abundant in permanent saline waters, where native Corixidae are rare, but it is rare in fresh waters, where native Corixidae dominate. This thesis focuses on four main determinants of successful invasions (plasticity, resource competition, parasites and facilitative interactions among invaders) to investigate why *T. verticalis* dominates in saline waters while it is rare in fresh waters. In addition, we explored the success of a restoration project for macroinvertebrates in new ponds where *T. verticalis* is known to be an abundant breeder. In addressing these topics, we apply an invasive-native comparative approach to both experimental and field data collected in Doñana. In Chapter 1 we show experimentally that *T. verticalis* possesses broader physiological plasticity than native corixids when exposed to different conditions of temperature and salinity, and its physiological tolerance to both heat and freezing increases following exposure to high conductivities. In Chapter 2 we investigate the niche partitioning between native and invasive corixids from different ecosystems by means of carbon (C) and nitrogen (N) stable isotopes. We reveal strong resource partitioning between species in permanent ponds, but also some degree of niche overlap in unstable temporary sites. In Chapter 3 we describe the role of parasite infections during the invasion. *T. verticalis* show higher total parasite (water mite) prevalence, mean total abundance infection and mean infection than native corixids in low salinity waters, whereas mites are not present in saline waters. In Chapter 4 we examine experimentally the role of facilitative interactions among invaders. *T. verticalis* invasion does not seem to be promoted by a lower predation rate by alien predators compared to native corixids. In contrast, owing its smaller size it suffers higher predation rates by Odonata larvae. Finally, in Chapter 5 we investigate the value of the Caracoles restoration project in supporting aquatic macroinvertebrates. *T. verticalis* is known to be an abundant breeder in these ponds. We find that, although new ponds differ from reference sites in abiotic conditions, they become representative and even surpass the levels of local invertebrate richness, diversity and abundance 6-7 years after restoration. However, differences in the abundance and distribution of invasive species between waterbody types and inundation periods may have strong effects on the patterns of species composition, especially for the Hemiptera. The integration of these results sheds light on the role of salinity for the invasion success of *T. verticalis*, and helps to elucidate why it is still rare in fresh waters. In addition, we also provide important insights on the potential impacts that *T. verticalis* may have on native Corixids in the future. ... Using laboratory experiments, we compared the predation rates by the two exotic fish and native Odonata larvae on *Trichocorixa* and the native *Sigara*

lateralis. We found no evidence to suggest that *T. verticalis* suffers lower predation rates. However, when both corixids were mixed together, predation of *T. verticalis* by Odonata larvae was higher. Odonata larvae were size-limited predators and the proportion of corixids ingested was positively correlated with mask length. Since *T. verticalis* is smaller than its native competitors, this may explain their higher susceptibility to predation by Odonata. This may be one of various factors explaining why *T. verticalis* is particularly dominant in saline habitats where Odonata are rare, while it is still scarce in fresh waters." (Author)] Address: not stated

18717. Crucitti, P.; Brocchieri, D.; Bubbico, F.; Castelluccio, P.; Emiliani, F.; Francioni, G.; Tringali, L. (2015): Check-list di gruppi selezionati dell'entomofauna dell'area "Arcipelago Mentanese-Comicolano" (Lazio). Bollettino della Società Entomologica Italiana 147(1): 3-29. (in Italian, with English summary) ["A check-list of the species of certain groups of insects - Odonata [26 species, including *Trithemis annulata*, *Sympetrum meridionale*, *Somatochlora meridionalis*, *Coenagrion castellani*], Mantodea, Orthopteroidea, Coleoptera and Lepidoptera - observed in the so called "Mentanese-Comicolano Archipelago" a district of the Roman Campagna, north-east from Rome city area (Latium, Central Italy), a relic of mesoxerophilous woods with cultivated land, urban and suburban areas penetrated by infrastructures, is presented. Typical physiographical aspects of the landscape are hilly areas with small valleys of clayey volcanic terrains or limestone rocks with karstic features. Notwithstanding conservation measures - two protected areas administered by the Province of Rome, the Natural Reserve "Nomentum" and the Natural Reserve "Macchia di Gattaceca and Macchia del Barco", exist - little is known about its invertebrate fauna, especially insects. Irregular observations lasted for over ten years followed by intensive researches between 2009 and 2013 with the utilization of many, direct and indirect, collecting tools - nets, aspirators, pitfall and aerial traps, light sheets - together with bibliographical data, allowed the authors to survey 422 species. Biogeographical analysis has been limited to Odonata and Coleoptera Carabidae well represented in the samples, especially in comparison with the insect fauna of the Rome city area restricted by the Grande Raccordo Anulare ring freeway. Species of particular interest from conservational viewpoints are discussed. This check-list is necessarily incomplete and lacking of quantitative analysis, notwithstanding the results of collecting efforts suggest that species richness has been strongly reduced in recent time. From conservational viewpoint, the situation of the Natural Reserve "Nomentum" may be considered middling while the situation of the Natural Reserve "Macchia di Gattaceca and Macchia del Barco" may be considered moderate (Macchia di Gattaceca) or fairly good (Macchia del Barco). The current inadequacy of protection measures is critical, considering the relevant entomological importance of some patches of this landscape." (Authors)] Address: Crucitti, P., Soc. Romana Scienze Naturali, Roma, Italia. davidebrocchieri@hotmail.com

18718. Davies, T. (2015): Dragonflies of Lundy – A summary of occurrence during the LFS years. Lundy Field

Society Annual Report 2015: 91-97. (in English) ["To date, 15 species (including *Sympetrum fonscolombii* and *Anax ephippiger* new to Lundy in 2015) have been recorded on the island, as summarised below, collated from LFS Annual Reports. In many instances the available information is at best sparse, but dates, locations and observers' names are included wherever they have been given in past reports." (Author)] Address: Davis, T., Harpers Mill, Berrynarbor, Ilfracombe, Devon EX34 9TB, UK. E-mail: gen@birdsoflundy.org.uk

18719. Flamant, N.; Sibley, S. (2015): Peuplement odonologique d'une mare pionnière en Bassée seine-et-marnaise en 2013 (Seine-et-Marne). *Bull. Ass. Natur. Vallée Loing*, 88(4) (2012): 164-171. (in French) ["The authors report on the results of an odonological survey carried out in 2013 on a pioneer pond of artificial origin in the commune of Bazoches-lès-Bray located in the heart of the Seine valley of the Seine-et-Marnaise called "la Bassée". The monitoring was based on a systematic collection of Anisoptera exuviae. The odonological diversity appears remarkable. Specific phenologies adapted to the pioneer context of the pond were observed, with particularly early emergence of certain species. The odonological interactions of the pond are briefly analysed. Finally, the prospects for monitoring to better understand the odonological dynamics of pioneer aquatic environments are specified. ... 19 species were recorded, 18 of which were breeding. 1,699 Anisoptera exuviae were collected between 15 May and 25 September 2013. The "productivity" at emergence of Anisoptera therefore reached a minimum of 113 exuviae/m². The daily productivity of the pond for Anisoptera averages 11 exuviae/day. It reaches up to 38 exu/d in July." (Authors) Translated with www.DeepL.com/Translator (free version)] Address: Flamant, N., 6, Allée Frédégonde 77250 Écuellles, France. E-mail: flamant.nico@gmail.com

18720. Fulan, J.; Rodrigues dos Anjos, M. (2015): Predation by *Erythemis* nymphs (Odonata) on Chironomidae (Diptera) and Elmidae (Coleoptera) in different conditions of habitat complexity. *Acta Limnologica Brasiliensia* 27(4): 454-458. ["Aim: The goal of this study was to analyze the effects of predation by nymphs of *Erythemis* Hagen, 1861 on Elmidae and Chironomidae and to check if the presence and the architecture of aquatic macrophytes may mediate this interaction. Methods: All prey as well as nymphs were captured near macrophytes in a small lagoon alongside a highway near Humaitá, Amazonas, Brazil. Twelve buckets were used in three different treatments: with *Pistia stratiotes* Linnaeus, 1753, with *Salvinia auriculata* Aublet and without macrophytes. Results: We found a mortality rate of 100% of Chironomidae and Elmidae larvae in the treatment without macrophytes. There was a greater survival of Elmidae compared to Chironomidae in the treatments with *P. stratiotes* and *S. auriculata*; however, there was a greater survival of both preys on treatment with *P. stratiotes*. Conclusions: We conclude that the presence of macrophytes decreased the efficiency of predation of *Erythemis* nymphs under experimental conditions. The architecture of macrophytes affected

predation as macrophytes with longer roots and with greater habitat complexity promoted a greater survival of prey." (Authors)] Address: Fulan, J.A., Universidade Federal do Amazonas – UFAM, Rua 29 de agosto, 786, CEP 69800-000, Humaitá, AM, Brazil. E-mail: joaofulan@hotmail.com

18721. Girish, V.P.; Hegde, M.G.; Balikai, R.A. (2015): Population dynamics of insect predators under different planting methods of paddy ecosystem. *Journal of Experimental Zoology, India* 18(1): 249-251. (in English) ["The population of insect predators, Odonata, coccinellids, spiders and carabids were recorded on paddy under different planting methods viz., drill sowing, transplanting and aerobic cultivation during kharif 2010 at the Agricultural Research Station, Mugad, Karnataka, India. The average high population of Odonata was recorded in aerobic rice throughout the cropping period. However, their peak activity varied across the different rice planting methods. And found insignificant difference among the planting methods. There was significant coccinellid population difference in drill sown v/s aerobic, but no significant difference in drill v/s transplanting and transplanting v/s aerobic rice planting methods. The predatory spiders population increased slowly from the beginning up to reproductive phase of the crop in drill sown and transplanted rice. The predatory spider's population differed significantly when compared in transplanted v/s aerobic and aerobic v/s drill sowed planting methods. The population of carabid predator was noticed meagerly throughout the cropping period. The peak carabid population noticed in drill sown, transplanted and aerobic rice planting methods respectively. The mean carabid population recorded in different planting methods not differed statistically when compared between, using t test." (Authors)] Address: Girish, V.P., Dept of Agril. Entomology, Univ. Agricultural Sciences, Dharwad-580 005, India. E-mail: girishsomaraddy@gmail.com

18722. Gliwa, B.; Švitra, G. (2015): Lietuvos laumžirgiai - Odonata of Lithuania. ISBN 978-609-8135-05-3: 352 pp. (in Lithuanian, with English summary) ["The book describes all species of Odonata that have been observed in Lithuania or in the neighbouring regions – a total of 71. Except for a booklet with an identification key only, this is the first book on Odonata written in Lithuanian, thus serving as an introduction of the matter to the larger audience. For the international reader summaries of most chapters, including specific regional peculiarities, occurrence, habitats, flight period and conservation regularities are provided in English." (Authors)]

18723. Gomez-Anaya, J.A.; Novelo-Gutierrez, R. (2015): A case of successful restoration of a tropical wetland evaluated through its Odonata (Insecta) larval assemblage. *Rev. Biol. Trop.* 63(4): 1043-1058. (in English, with Spanish summary) ["Wetlands are important wildlife habitats that also provide vital services for human societies. Unfortunately, they have been disappearing due to human activities such as conversion to farmland, pollution, habitat fragmentation, invasion of alien species, and inappropriate management, resulting in declines in species diversity, wildlife habitat quality, and ecosystem functions and services. In some countries,

many programs and actions have been undertaken to reverse the rate of wetland loss by restoring, creating and constructing new wetlands. We report on the assessment of Odonata larvae from a tropical and putatively restored wetland located in the La Mancha Biological Station, CÍCOLMA (LM, Ramsar site #1336), Veracruz, Mexico. Larval surveys were performed during the 2010 and 2011 dry and rainy seasons in both LM and a reference site, Cansaburro (CB), located approximately 2 km South of LM. Twelve samples were collected during each survey using a D-frame aquatic net (0.2 mm mesh size), sweeping 1 m² areas along shorelines using a random design. The effect of site, season and year on Odonata larval abundance was explored and diversity and abundance patterns of the assemblages were compared. A total of 3 718 larvae from 25 species (five Zygoptera and 20 Anisoptera) in 14 genera and three families were collected from both wetlands. Species number was equal in both wetlands although abundance was significantly higher in LM. Renyi's diversity profiles and species abundance patterns (rank abundance curves) in both sites were similar, suggesting an apparent recovery at LM. Differences in species composition (sites shared 13 species), and species dominance between both assemblages were observed and were related to differences in the aquatic plant structure between both wetlands as a result of extensive plant management in LM and cattle grazing in CB. Most evidence derived from this work shows that the LM wetland may be recovered." (Authors)] Address: Novelo-Gutiérrez, R., Departamento de Entomología, Instituto de Ecología A.C., Km 2.5. antigua carretera a Coatepec, Apartado Postal 63, 91000 Xalapa, Veracruz, Mexico. E-mail: rodolfo.novelo@inecol.edu.mx

18724. Happel, A.; Lafountain, J.; Creque, S.; Rinchar, J.; Höök, T.; Bootsma, H.; Janssen, J.; Jude, D.; Czesny, S. (2015): Spatio-temporal description of spottail shiner (*Notropis hudsonius*) fatty acid profiles in Lake Michigan's southern basin Austin. *Journal of Great Lakes Research* 41: 179-184. (in English) ["On-going ecosystem alterations within Lake Michigan have drastically transformed species interactions and food-web assembly. Description of trophic interactions across broad spatial regions is likely necessary to fully appreciate the structure of this emerging food web. Spottail shiners, *Notropis hudsonius*, are numerically abundant in the nearshore zone of Lake Michigan, but their trophic interactions are under-described. To that end, we described fatty acid profiles of spottail shiner through spring, summer, and fall across western and eastern shorelines of Lake Michigan's southern basin. Fatty acids, used as dietary tracers, suggested a shift from benthic-based diets in spring to more pelagic-associated diets in summer and a reversal in fall. When time lag of fatty acid accumulation is accounted for in interpretations, diets likely follow spring plankton and summer/fall benthic invertebrate maxima. Fatty acid profiles also indicated differences in diet composition based on geographic location, with benthic tracers more prevalent among spottail shiner inhabiting the western shoreline. These interpretations were generally supported by stomach content data, with high Chironomidae consumption in spottail shiners

from western waters. The presence of Coleoptera, Hymenoptera, and Odonata in spottail shiner stomach contents throughout the lake highlights its reliance on nearshore and potentially inshore areas. This study offers one of the most spatially broad depiction of spottail shiner foraging habits in Lake Michigan." (Authors)] Address: Happel, A., Illinois Natural History Survey, University of Illinois, 1816 South Oak Street, MC-652, Champaign, IL 61820, USA. E-mail: Happel2@illinois.edu

18725. Henel, A.; Taylor, J.R.E.; Krasjewski, N. (2015): First records of *Coenagrion armatum* (Charpentier, 1840) (Odonata: Coenagrionidae) in the Biebrza Valley. *Wiad Entomologiczne* 34(2): 59-60. [FE02 Osowiec-Twierdza; FE00 Szorce (N. (53°18'20"N / 22°38'41"E); FE00 Szorce: (53°18'20"N / 22°38'41"E); FEOO Bagno Lawki N. (53°17'8"N / 22°36'19"E – 53°17'13"N / 22°36'32"E); FE00 Krynica, (53°16'43"N / 22°38,31"E)

18726. Hou, D.; Yin, Y.; Zhong, Z.; Zhao, H. (2015): A new torsion control mechanism induced by blood circulation in dragonfly wings. *Bioinspiration & Biomimetics* 10 016020. doi:10.1088/1748-3190/10/1/016020: 10 pp. (in English) ["A new mechanism to generate the torque of flapping dragonfly wings is disclosed in this paper. The concept is inspired by blood circulation in insect wings. The blood flowing in veins induces Coriolis forces in the flapping wings. The Coriolis forces acting on veins are of opposite directions when blood flows in and out. The opposite Coriolis forces generate torsional moment to the wing, especially in the leading-edge part. To estimate the time-varying torque induced by the blood circulation, a simplified U-tube model is designed. A three-dimensional finite element model of the wing is developed to analyze the dynamic behaviors under this torque. The dragonfly wing is in favor of torsional deformation because the corrugated structure is of high flexural rigidity in the spanwise direction but is of low torsional rigidity in the chordwise direction. In both the downstroke and upstroke, the twist of the leading-edge part causes the sections to camber spontaneously. Such a kind of deformation is found to be of great importance to improve aerodynamic efficiency. In addition, it also compensates for the disadvantageous bending deformation caused by air pressure in flapping flight. These results are important for better understanding of the multifunctional structures of dragonfly wings and may give some inspiration to the bionics of flapping-wing micro air vehicles (FMAVs)." (Authors)] Address: Hou, D., School of Aerospace Engineering and Applied Mechanics, Tongji University, Shanghai 200092, People's Republic of China

18727. Ichter, J. (2015): *Paragomphus genei*, especie nueva para Avila y Castilla y León. *Boletín Rola*: 85-86. (in Spanish, with English translation of title) ["*Paragomphus genei*, species new to the province of Avila and to Castilla y León region: An adult female *P. genei* was photographed on 21-VIII-2015 at the municipal observatory "Las Tejoneras" at the Rosarito reservoir (T.M. Candeleda, Ávila). UTM coordinates: zone=30S; x=305300; y=4442850. Altitude: 330 m a.s.l.. Habitat: thickets of *Cistus ladanifer* and *Quercus*

ilex near a reservoir on the river Tiétar. The species is new for the province of Avila and the autonomous community of Castilla y León (Victor Salvador Vilaríño, personal communication).] Address: jean.ichter@gmail.com

18728. Iorio, E.; Mouquet, C. (2015): Déclinaison régionale du Plan National d'Actions en faveur des Odonates en Basse-Normandie. Bilan final des années 2012 à 2015. Rapport GREZIA pour la DREAL Basse-Normandie, l'Europe et l'Agence de l'Eau Seine-Normandie: 66 pp. (in French) [For a full version of the publication see: http://odonates.pnaopie.fr/wp-content/uploads/2010/12/IORIO_PNA_Odonates_bilan_final_2012-2015.pdf] Address: Etienne IORIO & Claire MOUQUET, chargé d'études & directrice, animateurs de la déclinaison régionale du PNA odonates en Basse-Normandie au Groupe d'Etude des Invertébrés Armoricaïns (GREZIA) – Antenne Basse-Normandie – Entrée A, 4e étage – 320 quartier Le Val – 14 120 Hérouville-Saint-Clair.

18729. Jisha Krishnan, E.K.; Sebastian, C.D. (2015): Evolutionary divergence and phylogenetic relationships of selected dragonflies using cytochrome oxidase I gene. Proceedings of International Conference on Biodiversity & Evaluation: Perspectives and Paradigm shifts 2015: 227-229. (in English) ["Dragonflies are candidates among ancient flying insects existed in the carboniferous period. Libellulidae is the largest and cosmopolitan dragonfly family of the order Odonata. Here we assessed the phylogenetic relationships of 5 dragonfly members (*Rhyothemis variegata*, *Acisoma panorpoides*, *Orthetrum sabina*, *Anaciaeschna jaspidea* and *Trithemis pallidinervis*) using cytochrome oxidase I (COI) marker. The partial PCR product of this gene yielded 450bp, 479bp, 500bp, 591bp and 580bp DNA respectively. The nucleotide BLAST analysis confirmed the taxonomic identity of these entire species. Phylogenetic tree constructed by Neighbour joining method showed that Libellulidae members are having a monophyletic ancestry due to the divergence from a common ancestor. Among these members, *Orthetrum sabina* is sharing a sister clade relationship with *T. pallidinervis* which remained in the same clade and *R. variegata* with *A. jaspidea* in another clade. The average A+T content of all these species is 66.26% while G+C content is 33.74% showing a strong A+T bias. The nucleotide substitution analysis states that *A. panorpoides*, has the highest substitution rate followed by *R. variegata*, *A. jaspidea*, *O. sabina* and *T. pallidinervis*. The high A+T content along with second codon change reflects evolutionary divergence of all these species. Thus the present study concluded that cytochrome oxidase I is an effective tool for predicting phylogenetic relationships and evolutionary divergence of closely related species." (Authors)] Address: Sebastian, C.D., Molecular Biology Laboratory, Dept of Zoology, Univ. of Calicut, Kerala 673 635 India. E-mail: drcdsebastian@gmail.com

18730. Korichi, R.; Bouzid, A.; Zehani, A.; Hammadi, Z.; Korichi-Almi, A. (2015): La diversité de l'odonatofaune dans deux biotopes sahariens. 2eme Seminaire International sur la Biodiversite Faunistique en Zones Semi arides Et Arides, 29 & 30 Novembre 2015: 29-30. (in French) [Verbatim

translated to English: "The objective of research on biotic indicators is to provide tools that allow the characterisation of the evolution of the ecological state of ecosystems over time. At the ecosystem level, we can examine the structure of communities or look at processes, structures and the landscape. These are known as ecological indicators. Odonates are useful and usually protected ecological indicators and any attempt to address them should take this special status into account and therefore only take from nature what is strictly needed in a rational approach. However, few studies have taken this group of predatory insects into account, even fewer have taken the trouble to establish temporal monitoring in Saharan regions and in all seasons. The objective of the present study is to characterise the population of odonates (Insecta) in some Saharan biotopes. The draft addresses the specific inventory in a spatio-temporal context through several stations, disturbed or not, reflecting the wetland but especially the palm grove in two regions, Djamaa and Ouargla (northern Sahara) known for these two particular ecosystems. The survey and inventory continued for 11 months at a monthly rate in 6 stations including 2 wetlands (Chott d'Ain Beida in Ouargla and Lake Ayata in Djamaa), 4 palm groves (Chemora, Ain Choucha, Chriâa in Djemâa and the I.T.A.S. palm grove in Ouargla). The trapping of adults or imagos is done with a mowing net and similar tools, whereas the trapping of larvae is done with a net. In addition, the diet is analysed by recovering the faeces when the individuals are captured. Finally, some bioecological aspects are discussed. The inventory reveals the presence of 22 species of odonates in the two biotopes, the majority of which are found in the palm grove. The species inventoried are divided into two suborders: 15 Anisoptera (dragonflies) and 7 Zygoptera. The values of the Shannon-Weaver diversity index fluctuate between 1.52 bits and 2.58 bits and those of the equitability are close to 1. With regard to diet, it should be noted that the total richness of the prey species examined shows the presence of 14 orders of insects." (Authors; DeepL)] Address: Korichi, R., Dép. Agro., Faculté SNV, Univ. Ouargla, Algeria. E-mail: Korichkov@hotmail.fr

18731. Kovács, T.; Horváth, R.; Juhász, P. (2015): Study of dragonflies and caddisflies (Insecta: Odonata, Trichoptera) on Batanta Island (Indonesia, West Papua). *Annls Mus. hist.-nat. hung.* 107: 269-288. (in Bilingual in Hungarian and English) ["Research of water insects on Batanta Island of the Raja Ampat archipelago in Indonesia started in 2010 with UV light trapping of caddisflies. Soon it turned out that the fauna of the island is extremely rich and many species are still need to be described. In 2014 the research continued with new methods and the scope had been widened to mayflies and dragonflies. In this article the authors summarize their experience and results. The data confirm that Batanta Island is a unique area of freshwater endemism." (Authors)] Address: Kovács, T., Mátra Museum of the Hungarian Natural History Museum, Kossuth Lajos u. 40, 3200 Gyöngyös, Hungary, E-mail: koati@t-online.hu

18732. Lewis, T.L.; Lindberg, M.S.; Schmutz, J.A.; Bertram, M.R.; Dubour, A.J. (2015): Species richness and distributions

of boreal waterbird broods in relation to nesting and brood-rearing habitats. *The Journal of Wildlife Management* 79(2): 296-310. (in English) ["Identification of ecological factors that drive animal distributions allows us to understand why distributions vary temporally and spatially, and to develop models to predict future changes to populations—vital tools for effective wildlife management and conservation. For waterbird broods in the boreal forest, distributions are likely driven by factors affecting quality of nesting and brood-rearing habitats, and the influence of these factors may extend beyond single species, affecting the entire waterbird community. We used occupancy models to assess factors influencing species richness of waterbird broods on 72 boreal lakes, along with brood distributions of 3 species of conservation concern: lesser scaup (*Aythya affinis*), white-winged scoters (*Melanitta fusca*), and horned grebe (*Podiceps auritus*). Factors examined included abundance of invertebrate foods (Amphipoda, Diptera, Gastropoda, Hemiptera, Odonata), physical lake attributes (lake area, emergent vegetation), water chemistry (nitrogen, phosphorus, chlorophyll a concentrations), and nesting habitats (water edge, non-forest cover). Of the 5 invertebrates, only amphipod density was related to richness and occupancy, consistently having a large and positive relationship. Despite this importance to waterbirds, amphipods were the most patchily distributed invertebrate, with 17% of the study lakes containing 70% of collected amphipods. Lake area was the only other covariate that strongly and positively influenced species richness and occupancy of scaup, scoters, and grebes. All 3 water chemistry covariates, which provided alternative measures of lake productivity, were positively related to species richness but had little effect on scaup, scoter, and grebe occupancy. Conversely, emergent vegetation was negatively related to richness, reflecting avoidance of overgrown lakes by broods. Finally, nesting habitats had no influence on richness and occupancy, indicating that, at a broad spatial scale, brood distributions are largely driven by the presence of quality brood-rearing lakes, not nesting habitats. Our findings are relevant to generating conservation plans or management goals; specifically, boreal lakes with abundant amphipods and surface areas >25 ha are important habitat for waterbird broods and merit conservation, especially given the patchy distribution of amphipods. Moreover, these high quality brood-rearing lakes are much rarer, and thus more constraining, than are quality nesting habitats, which are likely abundant in the boreal." (Authors)] Address: Lewis, T.L., Dept of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK, USA. E-mail: tlewis@alaska.edu

18733. Li, Y.-y.; Zhang, D.-z. (2015): The species diversity and fauna of Odonata in Ningxia Lingwu Baijitan National Nature Reserve. *Journal of Environmental Entomology* 37(3): 492-497. (in Chinese, with English summary) ["From 2010 to 2013, the Odonata diversity were surveyed in Ningxia Lingwu Baijitan National Nature Reserve. A total of 305 specimens were collected. 13 species of 9 genera in 3 families were identified. 9 species of 6 genera in 2 families were belonged to Anisoptera and 4 species of 3 genera in one family were belonged to Zygoptera. Coenagrionidae (3 genera and

4 species) and Libellulidae (5 genera and 7 species) were dominant families. *Ischnura elegans*, *Sympetrum frequens* and *Pantala flavescens* were dominant species. The ratio of total genera and species was 0.692, monotypic genus accounted for 66.67% of total genera. Most species markedly presented the characters of Palaearctic Region in world geographical distribution. Palaearctic Region species accounted for 46.15% of total species and Polytopic species accounted for 30.77%. In the zoogeographic of China, the fauna can be divided into 8 distribution patterns. The seven type distribution was predominant type (accounted for 38.46%), followed by the four type distribution and five type distribution. The six type distribution had only one. The single type distribution, two type distribution and three type distribution were absent. It was showed that the relationship and composition of fauna of Odonata were more complicated in Ningxia Lingwu Baijitan National Nature Reserve." (Authors) *Anax nigrofasciatus*, *A. parthenope julius*, *Crocothemis servilia*, *Deielia phaon*, *Orthetrum albistylum*, *Pantala flavescens*, *Sympetrum frequens*, *S. uniforme*, *S. imitans*, *Coenagrion dyeri*, *Enallagma cyathigerum*, *Ischnura elegans*, *I. senegalensis*] Address: Li, Y.-y., School of Life Science, Ningxia University, Yinchuan 750021, China

18734. Lukashanets, D.A.; & Novik, I.V. (2015): Influence of Common Carp *Cyprinus carpio* Linnaeus, 1758 stocking on the macroinvertebrate community in lake ecosystems. *Doklady of the National Academy of Sciences of Belarus* 59(6): 79-85. (in Russian, with English summary) ["The article contains the research results of the common carp influence on macrozoobenthos in lake ecosystems. The reduction of the benthos abundance and its biomass in the littoral of the fish-stocking reservoir is established. It is found that the benthos structure – the increase in a relative abundance of Diptera (*Chironomidae* sp.) larvae changes due to the grazing of large larvae of Odonata [*Epitheca bimaculata*], Ephemeroptera, Megaloptera and Trichoptera by big carp." (Authors)] Address: Novik, I.V., Scientific and Practical Center for Bioresources of the National Academy of Sciences of Belarus, Minsk, Belarus. E-Mail: lukashanetsdm@rambler.ru; novik_igor@rambler.ru

18735. Merckx, V.S.F.T.; Hendriks, K.P.; Beentjes, K.K.; Mennes, C.B.; Becking, L.E.; Peijnenburg, K.T.C.A.; Afendy, A.; Arumugam, N.; de Boer, H.; Biun, A.; Buang, M.M.; Chen, P.-p.; Chung, A.Y.C.; Dow, R.A.; Feijen, F.A.A.; Feijen, H.; Feijen-van Soest, C.; Geml, J.; Geurts, R.; Graven-deel, B.; Hovenkamp, P.; Imbun, P.; Ipor, I.; Janssens, S.B.; Jocque, M.J.; Kappes, H.; Khoo, E.; Koomen, P.; Lens, F.; Majapun, R.J.; Morgado, L.N.; Neupane, S.; Nieser, N.; Pereira, J.T.; Rahman, H.; Sabran, S.; Sawang, A.; Schwallier, R.M.; Shim, P.-s.; Smit, H.; Sol., N.; Spait, M.; Stech, M.; Stokvis, F.; Sugau, J.B.; Suleiman, M.; Sumail, S.; Thomas, D.C.; van Tol, J.; Tuh, F.Y.Y.; Yahya, B.E.; Nais, J.; Repin, R.; Lakim, M.; Schilthuizen, M. (2015): Evolution of endemism on a young tropical mountain. *Nature* 524: 347-350, Suppl.. (in English) ["Tropical mountains are hot spots of biodiversity and endemism1–3, but the evolutionary origins of their unique biotas are poorly understood4. In varying degrees,

local and regional extinction, long-distance colonization, and local recruitment may all contribute to the exceptional character of these communities⁵. Also, it is debated whether mountain endemics mostly originate from local lowland taxa, or from lineages that reach the mountain by longrange dispersal from cool localities elsewhere⁶. Here we investigate the evolutionary routes to endemism by sampling an entire tropical mountain biota on the 4,095-metre-high Mount Kinabalu in Sabah, East Malaysia. We discover that most of its unique biodiversity is younger than the mountain itself (6 million years), and comprises a mix of immigrant pre-adapted lineages and descendants from local lowland ancestors, although substantial shifts from lower to higher vegetation zones in this latter group were rare. These insights could improve forecasts of the likelihood of extinction and 'evolutionary rescue'⁷ in montane biodiversity hot spots under climate change scenarios." (Authors) Figure 4 demonstrates a phylogenetic reconstructions for *Coelicia*.] Address: Dow, R.A., 6 Bramley Avenue, Coulsdon, Surrey, CR5 2DP, UK. E-mail: rory.dow@virgin.net

18736. Mikolajczuk, P. (2015): The next new sites and ecological data of *Nehalennia speciosa* (Charpentier, 1840) (Odonata: Coenagrionidae) from Central Eastern Poland. *Odonatrix* 11(1): 1-20. (in Polish, with English summary) ["The paper discusses the records of 10 new sites of *Nehalennia speciosa* in east-central Poland. Sites 4–6 and 7 are located in the landscape more or less agriculturally transformed converted and do not have continuous forest buffering zone. In Poland, the habitat of *N. speciosa* without the typical continuous forest buffering zone have been previously known only from a few sites so far. Data in this study indicates that their number is probably higher in Poland than previously thought. A relatively low trophy of peat bog and pools despite the agricultural use of their catchment area probably results from the presence of aeolian/poor fluvioglacial sands in the ground. Identified habitats of *N. speciosa* mostly refer to acidic fens with abundant *Sphagnum* (sites 1–3, 5, 7, 10), and acidic fens without or small amount of *Sphagnum* (sites 4, 6, 8, 9). Particular fragments of habitats occupied by *N. speciosa* were situated near open surface of water bodies (sites 1, 3, 4, and probably a few more) as well as far from the influence of water bodies, as a shallow flooded peat bog (sites 2, 5, 6–10 and probably at others at some places). Water bodies at sites 1–3, 6, 7 and probably 5 had peat excavation origins. Formations of helophytes inhabited by *N. speciosa* (with probable or confirmed larval development) can be divided into two groups – monospecies formations: *Juncus effusus* (sites 3, 4, 5, 10), *Carex rostrata* (sites 1, 4), *Carex elata* (sites 6, 9), *Carex lasiocarpa* (site 6), *Carex vesicaria* (site 9); and mixed ones (where space structure is formed by two helophyte species): *J. effusus* + *C. rostrata* (sites 2, 4), *J. effusus* + *C. vesicaria* (site 10), *C. elata* + *C. lasiocarpa* (sites 6, 9), *C. lasiocarpa* + *J. effusus* (site 7), *C. rostrata* + *C. lasiocarpa* (site 2), *C. lasiocarpa* + *Eriophorum angustifolium* (site 8). The formation of *J. effusus* with larval development has been found for the first time in Poland. *C. elata* as the leading plant element was known so far only from two sites discovered after 2009 as well as *C. vesicaria*.

Data in this paper and other recent records of *N. speciosa* in old glacial areas show that the elements different than *Carex limosa/lasiocarpa* are more often inhabited in Poland than it was given in older data. Secondary habitats as well seem to be inhabited more often. The occurrence of imagines was also found within shallow and temporarily flooded marginal zones of peat bogs; at site 3 also at land. Larval development was not found in those zones. Vegetation used by imagines at the discussed marginal zones consisted of *J. effusus*, *Eriophorum vaginatum*, *Carex canescens*, however, mainly: *Molinia caerulea*, *Glyceria fluitans* as well as short grass unidentified to the species level. At sites 1–3, 4, 9, imagines at marginal zones occurred at higher densities than in the zones of larval development (maximum: up to 20 individuals per 1 m² at site 3). Perhaps it is caused by favourable microclimatic conditions at temporarily flooded marginal zones as well as the presence of suitable structure of vegetation. Dispersion of imagines towards the marginal zones is in several cases certainly enhanced by the increase in water level, which causes thinning of vegetation on the actual surface of the peat bog (where larval development takes place) and shallow flooding of vegetation in the marginal zone. It is possible that the dispersion towards the marginal zones may be increased at sites 3 and 4 by not entirely suitable spatial structure of swamps of *J. effusus* in the development zones. Existence of imagines aside of larval habitats may occur more frequently than it was suggested by previous data, especially in habitats with greater fluctuations of water level." (Author)] Address: Mikolajczuk, P., ul. Partyzantów 59c/26, 21-560 Międzyrzec Podlaski, Poland. E-mail: gugapm@wp.pl

18737. Miriglu, A.; Demirtas, A. (2015): Situation of the genus *Cordulegaster* (Insecta: Odonata) in Turkey and variations in *Cordulegaster picta*. *Ordu Üniv. Bil. Tek. Derg. / Ordu Univ. J. Sci. Tech.* 5(1): 50-55. (in Turkish, with English summary) ["In this study, studies on the distribution and systematic status of the genus *Cordulegaster* in Turkey were discussed and *C. picta* samples from various localities were examined and their variations were revealed. In Turkey, this genus is represented by 3 species (*C. insignis*, *C. myzmtae* and *C. picta*). *C. picta* differs from that given in the original definition, especially in the patterning of the abdominal segment, and may lead to different definitions. Therefore, the detection of these variations is very important from a taxonomic point of view."] Address: Miriglu, A., Ordu Üniversitesi, Fatsa Deniz Bilimleri Fakültesi, Fatsa/Ordu, Turkey. E-mail: alimiroglu@odu.edu.tr

18738. Nico, L.G.; Englund, R.A.; Jelks, H.L. (2015): Evaluating the piscicide rotenone as an option for eradication of invasive Mozambique tilapia in a Hawaiian brackish-water wetland complex. *Management of Biological Invasions* 6: 83-104. (in English) ["Mozambique tilapia *Oreochromis mossambicus* were recently discovered in 'Aimakap. Fishpond, a 12-hectare brackish-water wetland complex in Kaloko-Honokohau National Historical Park, on the Island of Hawaii'. As a possible eradication method, we evaluated rotenone, a natural piscicide used in fish management and the active

ingredient in plants traditionally used by indigenous Hawaiians for capturing fish. To assess rotenone's efficacy in killing tilapia and effects on non-target species, laboratory toxicity tests involved exposing organisms to various concentrations of liquid CFT Legumine (5% rotenone) in static trials of 48-h to 72-h duration. Test organisms included: Mozambique tilapia, non-native guppy *Poecilia reticulata*, the non-native odonate *Ischnura ramburii*, native feeble shrimp *Palaemon debilis*, and native *ōpae'ula* shrimp *Halocaridina rubra*. All organisms and water used in tests were obtained from 'Aimakap. (12.6 - 12.7 ppt salinity), or, for *H. rubra*, an anchialine pool (15.0 - 15.2 ppt salinity). Survival analyses indicated CFT Legumine concentrations ≥ 3 ppm (> 0.15 mg/L rotenone) achieved 100% mortality of tilapia and 93% of guppies within 24 h, with most tilapia killed by 6 h and most guppies by 2 h. Little or no mortality was observed among invertebrate exposed to 1 to 5 mg/L CFT Legumine: 0% mortality for *ōpae'ula* shrimp, 4% for feeble shrimp; and 16% for odonate larvae. The 48 h LC50 values for Mozambique tilapia and guppy were 0.06 and 0.11 mg/L rotenone, respectively. Results demonstrate rotenone's potential for non-native fish eradication in brackish-water habitats, with benefit of low mortality to certain macro-invertebrates. High rotenone tolerance displayed by *ōpae'ula* shrimp is noteworthy. Invasive fish are common in anchialine pools, threatening existence of shrimp and other invertebrate fauna. Although rotenone's effects on freshwater organisms have been well studied, our research represents one of only a few controlled laboratory experiments quantitatively assessing rotenone tolerance of brackish or marine fauna." (Authors)] Address: Nico, L.G., US Geological Survey, Southeast Ecological Science Center, 7920 NW 71st Street, Gainesville, Florida 32653 USA. E-mail: lnico@usgs.gov

18739. Pamungkas, D.W.; Ridwan, M. (2015): Diversity of dragonfly and damselfly (Odonata) in some water springs in Magetan, East Java. *Pros. Sem. Nas. Masy. Biodiv. Indon.* 1: 1295-1301. (in Indonesian, with English summary) ["This study aims to determine the diversity of Odonata in some water springs of Panekan sub-District, Magetan, East Java, ... 19 species of Odonata was found including 10 species of Anisoptera and 9 species of Zygoptera. Diversity index (H') of Odonata obtained 2,28 and relative abundance (KR) species *Orthetrum sabina* was the highest (29.4%), while the lowest was *Orthetrum pruinosum* (0.3%). Odonata including aggregated distribution, except for *Diplacodes trivialis* and *O. pruinosum* that had regular distribution." (Authors)] Address: Pamungkas, D.W., Kelompok Studi Biodiversitas (KS Biodiv), Jurusan Biologi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Sebelas Maret Surakarta. Jl. Ir. Sutami 36A Surakarta 57126, Jawa Tengah, Indonesia. E-mail: diagal.wisnu@gmail.com

18740. Pessacq, P.; Lozano, F.; Muzón, J. (2015): A checklist of the dragonflies from the North-Western of Isiboro-Sécre Indian Country and National Park, Bolivia. *Agrion* 20(2): 64-66. (in English) [Isiboro-Sécre Indian Country and National Park, located in central-western Bolivia, in the departments of Beni and Cochabamba (Figure 1). The Park

includes about 12,363 km² of Yunga rainforest in the Bolivian Amazon.] 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

18741. Popova, O.N.; Matafonov, D.V. (2015): Materials on biology, ecology and systematics of larvae of some species of Odonata from water bodies of Buryatia (East Transbaikalia, Russia). *Proceedings of the Irkutsk State University* 13: 27-50. (in Russian, with English summary) ["Larvae of 9 species of Odonata from 12 water bodies of Buryatia are observed: *Enallagma cyathigerum*, *Coenagrion lunulatum*, *Erythromma najas*, *Aeshna crenata*, *Somatochlora exuberata*, *S. graeseri*, *S. sahlbergi*, *Epitheca bimaculata* and *Leucorrhinia orientalis*. All of founded species are not new to fauna of Buryatia, but the geography of their findings has significantly extended. The analysis of literary and our data has allowed to reveal the terms of flying of the studied species which are in general in range from the beginning of June to the end of August. It is established that the egg phase of *C. lunulatum*, *E. cyathigerum*, *E. najas* and *E. bimaculata* can have two parallel ways of development – with winter diapause and without it that, perhaps, is important adaptation to winter frost penetration in reservoirs. The analysis of seasonal age dynamics of larvae of *E. cyathigerum* has shown that the cycle of development of species in the Chivyrkuysky Bay of Baikal is one-year and implement in two independent generations – spring and summer. On the basis of the elicited new facts was confirmed that populations of *Erythromma najas* in Baikalian region belong to subspecies of *E. n. baicalensis* (Belyshev, 1964), but not to Far East one *E. n. humerale* (to Selys, 1887). The literary and original data, and also collection materials are allowed to form the list of 37 species of Odonata known so far for the territory of Buryatia." (Authors)] Address: Popova, Olga, Institute of Systematics & Ecology of Animals, Russian Acad. of Sciences, Siberian Branch, Frunze str. 11, Novosibirsk 630091, Russia. E-mail: popova-2012@yandex.ru

18742. Rivas, A. (2015): Co-existence of calopterygid damselfly species: neutrality or negative frequency dependence? MSc. thesis, Department of Biology, Lund University. (in English) ["Closely related species often share the same local environment and use similar resources. Local diversity could then be maintained through some frequency-dependent species maintenance mechanism, fulfilling the inviability criterion. Alternatively, and according to the neutral theory of biodiversity, different species should randomly go extinct over time. Here, I studied two closely related and congeneric damselfly species (*Calopteryx splendens* and *C. virgo*) to investigate if, how and why species with similar ecology could coexist. Through an experimental investigation in large outdoor cages, I investigated if there was any evidence for either species neutrality or coexistence via negative frequency dependent survival advantages of rare species. I quantified the longevity of both species under several different density and frequency treatments, where the

number and species composition in the cages was manipulated in a fully factorial experimental design. My results suggest that longevity of these two species was similar over a large range of densities and frequency treatments, except when total male density was low and the frequency of *C. splendens* males was high. In this situation, *C. virgo* males showed evidence of a negative frequency-dependent survival advantage. I also present data on species-specific territoriality and discuss how territorial plasticity might contribute to coexistence between the two species. I found that *C. virgo* was significantly more likely to be territorial in two out of six density -and frequency treatments than was *C. splendens*. Overall, my results are consistent with species neutrality across most density and frequency-environments, although there is also evidence for negative frequency dependent fitness advantage of *C. virgo* at low density and when *C. splendens* was common. Therefore, different outcomes would be expected when these two ecologically similar and congeneric damselflies come in to contact with each other in nature, depending on environmental context." Popular Abstract: How two similar damselfly species can co-exist? Nowadays, one can not a priori assume that each and every species found together in a local community need to coexist in the long run. Instead, local community composition might follow a neutral community dynamics, whereby species are expected to randomly go to extinct. However, ecologically equivalent species cannot coexist infinitely, so there needs to exist some coexistence mechanism (-s) if two or more species are going to continue to coexist locally. The aim of my project was experimentally investigate and search for potential co-existence mechanisms between two ecologically similar damselfly species within the same genus (*C. splendens*, *C. virgo*). In particular, I investigated the importance of neutrality or coexistence through negative frequency dependence mechanisms (i.e. that a species does better when it is rare than when it is common). In addition, I also investigated how territoriality behaviour of these two species changed in relation to local community composition in the form of density and frequency of interacting species. In order to examine the coexistence mechanism (-s) I estimated longevity of individually marked damselflies of these two species in different density and frequency-environments in large outdoor cages, where the total number of individuals and damselfly species composition was experimentally manipulated. My study demonstrate experimental data suggesting that a mixture of neutrality and negative frequency dependent shape the coexistence of these two ecologically similar damselflies. These results also suggest that these two damselfly species use different degree of territoriality (i.e. more probability to holding a territory or less probability to holding a territory) depending on the other species territorial behavior. This study is one of few experimental studies of this kind, where species composition (frequency) and density (total number of individuals) are simultaneously manipulated with the aim to understand the roles of species neutrality vs. negative frequency-dependent coexistence mechanisms. To understand local species composition, these results can help us to get a better understanding about the ecological causes of global species distributions." (Author)] Available

at (<http://lup.lub.lu.se/student-papers/record/5152954>). Address: Rivas Torres, Anais, ECOEVO Lab, Univ. de Vigo, Escola de Enxeñaría Forestal, Campus A Xunqueira, 36005 Pontevedra, Spain

18743. Rodrigues, I.; 1, Reis Raposo Maciel, C.M.; Maciel Junior, A.; Almeida Diniz, A.; Neres Barbosa de Souza, L. (2015): Odonatas registered in Catolé Grande river, No Itapetinga county, BA. Enciclopédia Biospera, Centro Científico Conhecer - Goiânia 11(21): 2352-2364. (in Portuguese, with English summary) ["This study aimed to identify odonatas collected in the Catolé Grande river, in the urban area of Itapetinga, Bahia, in 2012. Samples were collected at four different points of the river, considering aspects of preservation and environmental deterioration. Specific keys were used to identify the copies until the last possible taxonomic level [genus]. Identified himself two suborders, Zygoptera and Anisoptera, six families and 10 genera. The distribution of Odonata differ between the collection points in the river and some species were more tolerant to environmental degradation. It can be inferred that the Catolé Grande river presents a significant diversity of insect species of Odonata order, but more studies are needed for a more detailed survey of this order, as well as the distribution of species in the river, for the preservation of habitats and, therefore, the retention of these species." (Authors)] Address: Silva Rodrigues, Ingrid Silva, UESB, Laboratório de Biologia. Universidade Estadual do Sudoeste da Bahia - UESB, Itapetinga, Bahia, Brazil. E-mail: ingridbels@hotmail.com

18744. Rychla, A.; Sniegula, S.; Karasek, T.; Golab, M.J.; Zurek, R. (2015): Distribution and habitat characteristics of *Sympecma fusca* (Vander Linden, 1820) and *Sympecma paedisca* (Brauer, 1877) in oxbows of the upper Vistula River. *Odonatrix* 11(1): 21-30. (in Polish, with English summary) ["*Sympecma fusca* and *S. paedisca* occur in a wide spectrum of habitats within standing waters. However, the knowledge of these species distribution in oxbows is poor in Poland. In this study, new sites of *S. fusca* and *S. paedisca* along the Vistula River valley, between Jawiszowice and Otałęż in the Małopolska Region (the Lesser Poland), are presented and the importance of oxbows for the species distribution is discussed. Habitat conditions concerning hydrological and physico-chemical (12 parameters) water properties are analysed with a focus on nutrient contents (phosphate – PO_4^{3-} , ammonium – NH_4^+ , and nitrate – NO_3^-). A total of 22 UTM 10x10 km squares were investigated and *S. fusca* was recorded in 17, while *S. paedisca* in 11 UTM squares. In total, 51 and 25 new sites of *S. fusca* and *S. paedisca*, respectively, were recorded. The species coexisted at 22 (43%) sites. The reproductive behaviour was observed at 29 sites for *S. fusca* and at 16 ones for *S. paedisca*. Both species preferred oxbows that during high water periods were temporarily connected with the river, i.e. those situated inside rather than outside of the levees. Specifically, 63% sites of *S. fusca* and 76% sites of *S. paedisca* were located between the levees of the Vistula River. With respect to hydrochemical conditions, both species occurred in habitats with wide ranges of all measured water parameters and there

was no significant difference between their preferences in this matter. Regarding nutrients, both species were found at concentrations reaching $1,5 \text{ mg L}^{-1} \text{ PO}_4^{3-}$ and $1,6 \text{ mg L}^{-1} \text{ NH}_4^+$. Nevertheless, a comparison between inhabited and uninhabited waters revealed preferences of both species to relatively low contents of phosphate and ammonium. With respect to nitrate, *S. paedisca* occurred at their low concentrations, whereas *S. fusca* did not show any pattern. We conclude that oxbows, particularly those seasonally flooded due to the river proximity, are important habitats for *S. fusca* and *S. paedisca*. Thus, special attention should be paid on biotopes situated in great river valleys in Poland. Although both species tolerate broad ranges of physico-chemical water parameters, oxbows with relatively low nutrient concentrations are preferred." (Authors)] Address: Rychla, Anna, ul. Osiedlowa 12, Płoty, 66-016 Czerwieńsk, Poland. E-mail: an.rychla@gmail.com

18745. Salazar Cespedes, S.A.; Castrillon Andrade, G.; Valenzuela-Rojas, J.C.; Amortegui Cedeno, E.F. (2015): Dragonfly (Insecta - Odonata) diversity in the Center for Environmental Research and Education "La Tribuna", Vereda Tamarindo (Neiva-Huila-Colombia). *Entomologia Mexicana* 2: 619-627. (in Spanish, with English summary) ["The main objective of this work was to analyse the composition of dragonflies in the Centro de Investigación y Educación Ambiental (CIEA) "La Tribuna" Vereda Tamarindo (Neiva-Huila-Colombia), in terms of richness and abundance of local communities, by lotic and lentic environment, in the dry and rainy seasons; in a sampling between 2013 and 2014. In total, 543 individuals were collected, including 57 Anisoptera and 486 Zygoptera; distributed in seven families and 19 genera. In Anisoptera, the only family collected was Libellulidae, while in the suborder Zygoptera, the most abundant family was Calopterygidae with 178 individuals. Sampling effort was 73.5%, a value that represents a valid sample of odonate biodiversity in the IARC; alpha diversity (α) was low, with dominance in the rainy season of 0.2274 and in the dry season of 0.1933, based on the Shannon-Wiener index which indicates that regardless of the season, the species are constant; for beta diversity (β), the Jaccard Similarity index was used, this value was 41% which means that the two seasons are similar in terms of species richness." (Authors) Translated with www.DeepL.com/Translator (free version).] Address: Salazar Cespedes, S.A., Universidad Surcolombiana (USCO), Facultad de Educacion, Programa Licenciatura en Ciencias Naturales: Fisica, Quimica y Biologia. Avenida Pastrana Borrero - Carrera 1, Neiva-Huila, Colombia. E-mail: checho8805@hotmail.com

18746. Sharma, G. (2015): Pictorial handbook on damselflies and dragonflies (Odonata: Insecta) of Rajasthan. *Zoological Survey of India*: 266 pp. [This monograph introduces the dragon- and damselflies of the Indian state of Rajasthan, and contain a sizeable introduction the study area, as well as an extensive selection of chapters on odonate biology. Contents: I. Study Area: Rajasthan. 1. Introduction. 2. Thar Desert or Great Indian Desert. 3. Aravalli hill ranges. 4. Geology. 5. River valley catchments. 6. Rainfall pattern.

7. Temperature regimes. 8. Forests. 9. Tropical thorn forests. 10. Tropical dry deciduous forests. 11. Central Indian Sub-tropical hill forests. 12. National parks and wildlife sanctuaries. References. II. Odonata. 1. Introduction. 2. Habitat. 3. Life cycle. 4. Aquatic stage. 5. Terrestrial stage. 6. Historical resume. 7. Behavioral patterns. 8. Feeding behaviour. 9. Reproductive behaviour. 10. Emergence. 11. Life history study. 12. Species diversity. 13. Discussion. 14. Role as biological control agent. 15. Need for conservation. 16. Economic value of odonates. 17. Summary. Some frequently asked questions (FAQs). Odonata Associations and Societies globally. Odonata information websites. Glossary. Bibliography. Photoplates.]

18747. Soler Monzo, E. (2015): Estructura de comunidades de Odonata en sistemas mediterráneos. Dissertation, Universitat de València: 193 pp. (in Spanish) ["In ecology, a community is an assemblage of species coexisting at the same time and place (Mittelbach 2012) but the way ecological communities have been conceptualised has changed over time. In the early 20th century, the community was seen as a discrete entity primarily regulated by environmental factors, leading to the debate between Clementsian and Gleasonian views of communities. Later, the debate focused on the mechanisms that allowed species to coexist depending on the way in which different species exploited available resources. This was the time when Hutchinson (1957) enunciated his niche theory. Along these lines, Diamond (1975) described the formation of a community as an "assemblage of species" that follows a series of rules, mainly determined by interspecific relationships (competition for resources), the differential response of species to exploit those resources and their respective dispersal rates. The community was considered a closed entity until McArthur & Wilson (1967) enunciated their Theory of Island Biogeography in which, in addition to possible interactions between species and environmental effect, they outlined the possibility that extinction and colonisation events were also involved in the formation of a community. In this new context in which a community is neither isolated nor closed, Ricklefs (1987) stressed the importance of explicitly recognising a regional scale and a local scale, in which different processes are at work in the assembly of a local community. A local community is now recognised as the result of the interaction of local and regional processes. Local processes are related to abiotic and biotic factors while regional processes are related to species dispersal capacity and their demographic processes. Consequently, the concept of metacommunity (communities that interact through the dispersal of at least part of the species that form them) has become the new scenario for approaching the study of communities and in the literature local processes are called deterministic processes while regional processes are assimilated to spatial processes. There are basically two approaches to the study of metacommunity structure. The first one focuses on the description of patterns while the second approach tries to unravel the processes underlying these patterns. In addition, communities change in their composition and/or structure. Discerning whether these patterns or changes in composition and structure

occur randomly or are driven by specific mechanisms is one of the current challenges in ecology. The underlying processes have been classified into two broad groups: deterministic processes and stochastic processes. Deterministic processes are those related to niche theory and act at the local level. Stochastic processes relate to mechanisms that are regional in scope and can be intrinsic to the organism (dispersal capacity, size, trophic position) or extrinsic (landscape configuration, extinction or colonisation phenomena). Within the study of metacommunities, freshwater ecosystems have received considerable attention. On the one hand, the hydroperiod represents a wide abiotic gradient which, in turn, conditions the biotic component of the sites. On the other hand, they provide an ideal framework for establishing the role of regional processes in the assembly of communities of organisms with different dispersal capacities. Furthermore, elucidating the mechanisms underlying their structure is no longer of mere theoretical interest, but of vital importance for their proper management and conservation, as these systems are among the most threatened by anthropogenic action. This is especially true in Mediterranean freshwater ecosystems, which not only have a great variety of endemic species, but some of these habitats are considered to be of priority protection. Odonata are an important group in inland water communities, as they need these ecosystems to complete their life cycle. They are a suitable group for the study of community assemblages, as many aspects of their distribution, biology and habitat requirements are known, and not all species have the same dispersal capacity. Due to the interest in restoring aquatic habitats, it has been used to assess the consequences of anthropogenic disturbances. Dragonfly communities have also been studied in a metacommunity context, although work in which this conceptual framework prevails is scarce. Moreover, larvae and adults have received uneven attention and this makes it difficult to agree on the prevailing patterns and dynamics. In Mediterranean ecosystems, despite being a well-studied group, Odonata communities have only been described in terms of the main abiotic factors influencing their assemblage structure. There is some knowledge of their dynamism but the only works in which they are studied from a metacommunity point of view are those in which they have been included as part of macroinvertebrate communities. Consequently, it is convenient to establish the metacommunity as a conceptual framework for Odonata communities, especially if we take into account that in the Mediterranean area, one out of five species is threatened with extinction at regional level. Thus, this PhD thesis aims to contribute to this change of perspective and to increase the knowledge of the patterns and dynamics associated with Odonata communities. This general objective is specified in four specific objectives: (1) to establish the factors that determine dragonfly species richness in temporary wetlands, (2) to establish the structure observed in dragonfly metacommunities and their stability over time, (3) to assess what is the temporal beta diversity of dragonfly communities and (4) to analyse how dragonfly community assembly occurs in newly created habitats. To achieve each objective, fieldwork was carried out in two very different study areas, the island

of Menorca (within the Balearic Islands archipelago) and the Banyoles wetland (Girona, Catalonia). In Menorca, the fieldwork included, on the one hand, the monitoring of adult communities in temporary pools and, on the other hand, the monitoring of larval communities in different types of habitats. In the Banyoles wetland, only adult communities linked to permanent and semi-permanent habitats were studied. The methodology used to monitor larvae included the capture, conservation and identification of specimens according to their size. Two different methodologies were used to monitor adults in Menorca (adaptive sampling) and in Banyoles (SLIC). In neither of them was the capture of individuals included, except in cases of doubtful identification. For fieldwork with adult communities, surveys consisted of sightings of adults (males and females) at or near water points. These surveys are carried out weekly or fortnightly in the central hours of preferably sunny and not too windy days in the period between approximately March and November. For the sampling carried out in temporary ponds, the observer walked along transects or used count points and for each new species recorded, an additional 20 minutes of survey time was added. This work was carried out in 2008. To survey the newly created ponds, the SLIC method (*Seguiment de Libèl·lues de Catalunya*), developed by the naturalist group *Oxygastra*, was used. In this case, observers make weekly counts of adult insects along a linear transect and when it is impossible to access some of the lake habitats, counting points consisting of 5-minute sessions from a fixed point are added. Counts of adults in the Banyoles wetland were made over seven years. For larval sampling, each site was visited twice to ensure that larvae of both spring and summer species were captured in their most advanced stages of development, so the sampling period began in late winter and ended in early summer. A methodology similar to that described by other authors was followed in which larvae are captured with a 1 mm light net for at least 3 minutes, trying to cover all existing mesohabitats. The larval sampling was a replica of the work carried out by García-Avilés et al. (1995) 22 years earlier. The environmental characterisation of the sites studied was done by including the variables most commonly measured in this type of study, i.e. physico-chemical parameters of the water, vegetation, connectivity or characteristics of the environment of the sites. The analysis methods used in this thesis included descriptive statistics, hypothesis testing and multivariate statistics. Specific programmes were also used to quantify beta diversity, establish metacommunity patterns and analyse community rarity and dynamics. In addition, the DBI (Dragonfly Biotic Index) was used to test whether the measure of creating new lagoons had improved the odonatological diversity of the Banyoles wetland. The most important results of this doctoral thesis can be grouped according to each objective. In the case of the adult communities of temporary ponds (Objective 1) it was found that regional factors such as area and connectivity played a relevant role in the species richness of the communities. These assemblages, consisting of generalist and rare species, contribute significantly to regional diversity despite the fact that only a low percentage (around 20%) have specific mechanisms to resist desiccation. Larval

communities showed a quasi-nested metacommunity pattern in 1988 and a random pattern in 2010 (Objective 2). These patterns could be caused by differences in dispersal ability and degree of habitat specialisation. Larval communities showed a high variability in composition in both 1988 and 2010 (Objective 3) and, although no direct relationship could be established, it was found that the different habitats included in the study represented an important environmental heterogeneity. In fact, together with distance to the sea and temperature, habitat type was the most influential variable in the differentiation of assemblages in both 1988 and 2010 (Objective 3). Odonata larval communities are highly dynamic and after 22 years, a variability in their composition of about 75% was recorded. This dynamism could not be related to the degree of environmental change and was negatively correlated with the species recorded at each station in 1988. Despite this, the number of species recorded at each locality remained more or less constant after this time period (Objective 3). In newly created habitats the adult Odonata communities did not follow successional but rather stochastic dynamics (Objective 4). This type of dynamics was also observed in assemblages of more mature habitats. In both types of assemblages, a spatial variability close to 50% was recorded. This percentage was very similar to their inter-annual variability, although species richness remained more or less constant (Objective 4). According to the DBI values, the newly created ponds seem to have improved the odonatological diversity of the area. The main conclusions of this PhD thesis show that Odonada communities can be influenced by both local and regional factors, especially in the case of highly fluctuating habitats. In larval communities, the observed metacommunity pattern may be related to the trade-off between dispersal ability and degree of habitat specialisation and is not stable over time. There is great variability in the composition of Odonata communities (adult and larval) at both local and regional scales, especially when different habitat types are taken into account. Odonata communities are highly dynamic at both the adult and larval stages, but the number of species within them remains stable. The mechanisms underlying these dynamics seem to have a strong stochastic component." (Author; DeepL)] Address: not stated

18748. Suhling, F.; Sahlén, G.; Gorb, S.; Kalkman, V.J.; Dijkstra, K-D.B.; van Tol, J., (2015): Order Odonata. In: Thorp, J., Rogers, D.C. (Eds.), *Ecology and General Biology: Thorp and Covich's Freshwater Invertebrates*, Academic Press. ISBN: 9780123850263: 893-932. (in English) [This handbook introduces in most aspects of Odonata biology as Chapter Outline; Introduction 894; Systematic and Phylogenetic Relationships 894; Zygoptera 894; Anisozygoptera 896; Anisoptera 896; Species Numbers 897; General Biology 899; External Features of the Larva 899; External Features of the Imago 900; Size 902; Egg Structure 902; Ultrastructures 903; Wing Structures 903; Coloration 904; Cuticula 904; Head Arrestor System 904; Genitalia 905; Perception: The Sensory Organs and Neural System 905; Compound Eyes and Ocelli 906; Tactile Sensory Organs 907; Respiration 908; Larval Gill Systems 908; Oxygen Demands 909;

Tracheal System of the Imago 909; Physical-Gill Respiration 909; Thermoregulation 910; Flight 910; Reproduction 911; Sexual Dimorphism 911; Mating Systems 911; The Mating Process 911; Oviposition 911; Life Cycle 913; Egg Development 913; Larval Development 913; Metamorphosis and Emergence 914; Seasonal Patterns 915; Pre-reproductive Period 915; Adult Life Span 915; Life Cycle Types and Voltinism 916; General Ecology and Behavior 917; Foraging 917; Larval Foraging 917; Adult Foraging Behavior 918; Dispersal and Migration 918; Habitats 918; Generalists versus Specialists 918; Habitat Selection 919; Microhabitat Occupancy by Larvae 919; Lotic Waters 921; Temporary Habitats: Coping with or Avoiding Drought 921; Acidic Ponds and Lakes 922; Saline Waters 922; Forest and Shade Habitats 922; Very Small Habitats 922; Terrestrial Habitats 922; Biotic Interactions 922; Predation 923; Intraspecific Interactions 924; Abiotic Limitations and Biotic Interactions 924; Parasitism and Other Interactions 925; Distribution and Diversity 925; Diversity Patterns 925; Range Shifts due to Climate Change 926; Conservation Status and Biotic Indicators 927; Collecting, Culturing, and Specimen Preparation 928; Collecting and Sampling 928; Culturing 929; Preservation 929; Acknowledgments 930; References 930] Address: Suhling F., Inst. Geoökologie, TU Braunschweig, Langer Kamp 19c, 38102 Braunschweig, Germany. E-mail: f.suhling@tu-bs.de

18749. Takhelmayum, K.; Gupta, S. (2015): Aquatic insect diversity of a protected area, Keibul Lamjao National Park in Manipur, North East India. *Journal of Asia-Pacific Entomology* 18(2): 335-341. (in English) ["Highlights: •Presence of tolerant orders like Odonata, Hemiptera and Coleoptera. •Absence of sensitive orders of aquatic insects in all the sites of the floating park. •Shannon H' values are less than 1 in all the sites. •Very low DO concentration in water of the park. •Lead and mercury concentrations were found beyond the desirable level of WHO and BIS. Abstract: Keibul Lamjao National Park, only home of Brow-Antler Deer, (*Rucervus eldii eldii*) is the unique floating park of the world. It is a part of the Loktak Lake, Manipur (Ramsar site). The lake gets major share of water from seven feeder rivers. In this paper an attempt has been made to study aquatic insect diversity of the five sites of the national park area which will indicate the health of the unique but deteriorating ecosystem and at the same time reduce aquatic insect data deficiency of the area. The study recorded 3 orders, 12 families and 23 species of aquatic insects. Besides inventorying the aquatic insect taxa, their relationships with several environmental variables including heavy metals were also investigated. The low Shannon Weiner Diversity Index values of aquatic insects (Shannon H' less than 1 in all the sites) indicated perturbed condition of the water of the National Park area. The study revealed very low dissolved oxygen (DO) in all the sites. All the three heavy metals in most of the sites were found beyond the desirable level of BIS (IS 10500: 1991). Different biological monitoring scores and Canonical correspondence analysis (CCA) have been used for discussion and interpretation. This study found that although protected areas are meant for protecting biodiversity,

management of outside protected area particularly catchment area should be given priority for minimizing land use disturbance, altered hydrology and other related factors." (Authors) The following taxa (including probable misidentifications) are listed: *Sympetrum* sp., *Tramea* sp., *Rhodothemis* sp., *Orthetrum* sp., *Crocothemis servilia servilia*, *Potomarcha* sp., *Zyxomma petiolatum*, *Leucorrhinia* sp. [sic] (Libellulidae), *Aeshna* sp., *Anax* sp., (Aeshnidae); *Pseudagrion* sp., *Ischnura* sp., *Ceriagrion* sp. (Coenagriidae); *Neurobasis chinensis* (Calopterygidae), *Lestes* sp., (Lestidae)] Address: Gupta, Susmita, Department of Ecology and Environmental Science, Assam University, Silchar 788 011, India. E-mail: susmita.au@gmail.com

18750. Vilariño, V.S.; Rodríguez, M.S.R.; Flechoso del Cueto, M.F. (2015): Primeras citas de *Oxygastra curtisii* (Dale, 1834) (Odonata: Corduliidae) y de *Aeshna juncea* (Linnaeus, 1758) (Odonata: Aeshnidae) para la provincia de Segovia en el Parque Nacional de la Sierra de Guadarrama (España). Boletín de la Sociedad Entomológica Aragonesa 57: 425-428. (in Spanish, with English summary) ["We present the first records from Segovia province of *O. curtisii* [8-VII-2015, UTM 30TVL12, 1154 m.a.s.l.] and *A. juncea* [16-VII-2015, UTM 30TVL12, 1867 m.a.s.l.; 21-VII-2015, UTM 30TVL24, 1928 m.a.s.l.]. Also, we have confirmed the reproduction of *A. juncea* in the Sierra de Guadarrama National Park in the provinces of Segovia and Madrid. [20-VII-2015, UTM 30TVL-22, 2151 m.a.s.l.]"] (Authors)] Address: Salvador Vilariño, V.S., C/ San Francisco nº 57 5ºA. 09400 Aranda de Duero (Burgos), Spain. E-mail: visalvia@yahoo.es

18751. White, S.; Smith, S.P.H. (2015): Dragonflies of Lancashire and North Merseyside. Lancashire & Cheshire Fauna Society 118: 104 pp. (in English) ["Just published in full colour, the Dragonflies of Lancashire and North Merseyside provides a comprehensive of all 24 species seen there. The distribution and breeding status of each species are mapped and details of flight periods illustrated, with particular emphasis on changes brought about by climate change. Lancashire lies on the north-western edge of the breeding range of several British dragonflies but, presumably driven largely by climate change, it has been colonised by six new species within the past 20 years during which period the ranges of several established species have also shown dramatic northward shifts. Of the 24 species recorded (8 damselflies and 16 dragonflies), 19 now breed annually with one other, Red-veined Darter, now apparently lost after breeding successfully for several years. The current distribution and breeding status of each species is mapped together with the progression of colonisation by the recently-arrived species. In contrast to most other species groups in Lancashire, the county's dragonflies appear to be thriving, in part due to the creation of a number of large wetlands by the conservation bodies, but other environmental factors have also played a part. Climatic amelioration is undoubtedly the most important of these but improvements in water quality, due especially to the clean-up of industrial pollution, has also figured. The most dramatic example of this is the exponential spread of *Calopteryx splendens* which expanded its breeding range

from a single site in the mid-1990s to its present range covering 25% of the county; like several other species *C. splendens* have moved northwards but their main range change has been to the east along the previously polluted waterbodies of Lancashire's historic cotton-mill towns. Dates of annual first and last sightings have also changed significantly during the past 30 years with the flight period of several species increasing by three or more weeks. This is partly simply a result of the increased number of dragonfly recorders but there is little doubt that major changes in phenology have taken place. For example, the date when the first 25% of annual sightings of Common Darters have been recorded has advanced by a fortnight or more, while there is no evidence of a similar change at the other end of the year. Interestingly, these phenological changes appear to be confined to the lowlands - the flight periods of Lancashire's three predominantly upland species, Golden-ringed Dragonfly, Common Hawker and Black Darter have remained stable. The county supports a wide range of dragonfly habitats which are summarised in the book's introduction - from the sand dunes of the Sefton Coast in Merseyside, the swathe of arable land in the south-west and pastures in the centre of the county, to the uplands of the Pennines and the Forest of Bowland. All contain important dragonfly sites, some perhaps warranting SSSI status, but, perhaps surprisingly, the county's premier site is located on the ex-industrial land of Heysham and Middleton near Lancaster, where all but three of the county's 24 species have been recorded with 16 breeding in recent years."] Address: <https://www.northwestinvertebrates.org.uk/document/the-dragonflies-of-lancashire-and-north-merseyside/>

2016

18752. BioDrawversity (2016): Assess operational impacts on emergence of state-listed odonates in the Connecticut River: 2014–2016. Study report. Northfield Mountain Pumped Storage, Project No. 2485 and Turners Falls Hydroelectric Project No. 1889. Leverett, MA. 118 pp. (in English) ["Pumped Storage Project (Northfield Mountain Project, FERC No. 2485) and the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889). FirstLight has initiated with the Federal Energy Regulatory Commission (FERC, the Commission) the process of relicensing the Northfield Mountain and Turners Falls Projects using FERC's Integrated Licensing Process (ILP). The current licenses for the Northfield Mountain and Turners Falls Projects were issued on May 14, 1968 and May 5, 1980, respectively, with both set to expire on April 30, 2018. This report documents the results of Study No. 3.3.10: Assess Operational Impacts on Emergence of State-Listed Odonates in the Connecticut River. The study goal was to assess potential effects of Project operations on emerging dragonflies (Insecta: Odonata; hereafter called "odonates") in the Connecticut River. To meet this goal, field surveys were conducted to characterize the habitat, assemblage structure, and emergence and eclosure behavior of odonates in the Project area. This information was compared with existing data on odonates and water surface elevation (WSEL) collected throughout the Project

area. Three phases of fieldwork were completed. Phase 1, completed in 2014, included qualitative surveys of odonate larvae and exuviae at eight sites in the Connecticut River to determine species assemblage structure and to collect habitat data. For teneral or exuviae, biologists recorded the vertical and lateral distance from the water's edge, and the substrate that each was collected on. Phase 2, completed in 2015, included quantitative odonate surveys, observations of emergence and eclosure behavior, and concurrent collection of WSEL and water temperature data. Surveys for emerging larvae, exuviae, and teneral were conducted at five sites, with six transects per site, during eight biweekly sampling periods from late May to early September. Biologists looked for larvae exiting the water or crawling on land, and attempted to track and record the time it took for individuals to complete eclosure and fly away. For each exuvia and teneral, the vertical height above the water's surface, the distance from the water's edge, and its eclosure substrate was recorded. Phase 3, completed in 2016, was intended to increase sample sizes for eclosure duration for state-listed odonates and to collect additional data on the vertical heights and horizontal distances traveled prior to eclosure. The speed for all or part of the eclosure process was recorded for 180 specimens, with nearly 90% of these observed in 2016. Surveys for emerging and eclosing larvae were conducted at eight sites in the Turners Falls Impoundment (TFI) and downstream from the Turners Falls Dam, on warm sunny days during peak emergence from late May through mid-July. A total of 17 species were collected from 2014 to 2016, including the state-listed *Gomphus abbreviatus*, *Gomphus vastus*, *Gomphus ventricosus*, *Neurocordulia yamaskanensis*, and *Stylurus amnicola*. Species found most frequently in the riverine environments in the bypass reach and downstream from Cabot Station in the Connecticut River included *Gomphus vastus*, *Boyeria vinosa*, *Stylurus spiniceps*, *Ophiogomphus rupinsulensis*, *Neurocordulia yamaskanensis*, *Dromogomphus spinosus*, *Gomphus abbreviatus*, and *Macromia illinoensis*. The lower TFI (Barton Cove) was inhabited by several species more tolerant of lentic conditions, such as *Epithea princeps*, *Perithemis tenera*, and *Libellula* sp. For all species combined, larvae crawled a median vertical height of 5.5 ft from the water's surface, and a median distance of 12.5 ft from the water's edge. Among the riverine species, crawl height was greatest for *Macromia illinoensis*, *Gomphus abbreviatus*, and *Gomphus vastus*; each of these species crawled a median height of near or above 7 ft. Riverine species that crawled the shortest height from the water's surface included *Stylurus amnicola* (median = 2.2 ft), *Stylurus spiniceps* (median = 3.4 ft), and *Ophiogomphus rupinsulensis* (median = 3.5 ft). The more lentic species collected in Barton Cove crawled shorter distances from the water's surface than the riverine species. Average horizontal crawl distance was usually 10-15 ft for most species, with maximum distances often 3-4 times greater than the average. Shortest crawl distance was for *Perithemis tenera* (a lentic species that prefers to emerge on aquatic vegetation) and *Stylurus amnicola*. Considering crawl height and crawl distance together, the riverine species that tended to

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

18753. Kaya, M.; Sargin, I.; Al-jafa, I.; Erdogan, S.; Arslan, G. (2016): Characteristics of corneal lens chitin in dragonfly compound eyes. *International Journal of Biological Macromolecules* 89: 54-61. (in English) [Highlights: •Chitin in the

corneal (ommatidial) lenses of dragonfly compound eyes was isolated. •The chitin content of the corneal lenses was determined to be quite high ($0.85 \pm 20.3\%$). •The FT-IR analysis showed that corneal lens chitin was in the α -form. •The maximum degradation temperature of the lens chitin was observed at 369.2°C . •Corneal lens chitin consist of nanofibrils. Abstract: Chitin in the compound eyes of arthropods serves as a part of the visual system. The quality of chitin in such highly specialised body parts deserves more detailed examination. Chitin in the corneal (ommatidial) lenses of dragonfly (*Sympetrum fonscolombii*) compound eyes was isolated by using the classical chemical method. The chitin content of the corneal lenses was determined to be quite high ($20.3 \pm 0.85\%$). The FT-IR analysis showed that corneal lens chitin was in the α -form as found in all arthropod species where mechanical strength is required. The surface morphology analysis by scanning electron microscopy revealed that the outer part of corneal lenses consisted of long chitin fibrils with regular arrays of papillary structures while the smoother inner part had concentric lamellated chitin formation with shorter chitin nanofibrils. Chitinase enzymatic digestion studies, elemental analysis results and the degree of acetylation value showed the purity of chitin samples from corneal lens. The maximum degradation temperature value of the corneal lens chitin was observed at 369.2°C . X-ray analysis revealed that corneal lens chitin has high crystallinity index; 96.4%. Identification of chitin found in ommatidia of insect compound eyes can provide insights into insect vision and chitin-based optical material design studies." (Authors)] Address: Kaya, M., Dept Biotechnology & Molecular Biology, Faculty of Science & Letters, Aksaray Univ., 68100, Aksaray, Turkey. E-mail: muratkaya3806@yahoo.com

18754. Kaya, M.; Baublys, V.; Sargin, I.; Šatkauskienė, I.; Paulauskas, A.; Akyuz, B.; Bulut, E.; Tubelyte, V.; Baran, T.; Seyyar, O.; Kabalak, M.; Yurtmen, H. (2016): How taxonomic relations affect the physicochemical properties of chitin. *Food Biophysics* 11: 10-19. (in English) ["Chitin specimens from 16 arthropod species (13 of Insecta and 3 of Arachnida) were isolated for the first time using the same method. Fourier Transform Infrared Spectrometry (FTIR), Thermogravimetric Analysis (TGA), X-ray diffraction (XRD), Scanning Electron Microscope (SEM) and elemental analysis have been applied to determine how physicochemical properties of chitin specimens are affected by taxonomic relationship. The characterisation studies revealed that physicochemical nature of the chitin specimens differed greatly and were found partially specific to taxa. Significant differences in the surface morphologies of chitin specimens were observed even in the same order. However, the chitin contents were recorded to be specific to the order in the class Insecta. The highest chitin content was observed in Coleoptera (18.2–25.2 %) followed by Hemiptera (10.6–14.5 %), Odonata (9.5–10.1 %), Hymenoptera (7.8–9.3 %), Diptera (8.1 %), Blattodea (4.7 %). In addition, the crystalline index (Crl) values of chitin specimens from Coleoptera were found to be higher than the other orders in Insecta. This study revealed that the chitin contents and Crl values can be related

to taxonomical relationships." (Authors) *Cordulia aenea*, *Libellula quadrimaculata* Village Puvoėiai (Dzukija national park, Lithuania) 15/17.05.2012] Address: Kaya, M., Department of Biotechnology and Molecular Biology, Faculty of Science and Letters, Aksaray University, 68100, Aksaray, Turkey. E-mail: muratkaya3806@gmail.com

18755. Tsubaki, Y.; Okuyama, H. (2016): Adaptive loss of color polymorphism and character displacements in sympatric *Mnais damselflies*. *Evolutionary Ecology* 30(5): 811-824. (in English) ["A geographical survey of two *Mnais damselfly* species in the Kinki area of Japan showed evidence for character displacements when the two species were found in sympatry. *Mnais costalis*, a species that has polymorphic male mating types of orange-winged territorial and clear-winged non-territorial morphs (hereafter abbreviated to orange and clear morphs respectively) in allopatry often shifted to having monomorphic orange morphs in sympatry. The mean body size of orange morphs was consistently larger than that of clear morph in allopatry. The mean body size of the sympatric orange morphs was even larger than that of allopatric orange morphs. By contrast, *Mnais pruinosa*, a species that also has two morphs of large orange and small clear morphs in allopatry, shifted to having monomorphic clear morphs in sympatry. The mean body size of the sympatric clear morphs was smaller than that of allopatric clear morphs. Divergence was also detected in the preference for habitat insolation conditions between sympatric *Mnais damselflies*. Both species in allopatric regions prefer half-light forest habitats, while in sympatric regions they showed diversified habitat preference: *M. costalis* preferred sunny habitats while *M. pruinosa* preferred shady habitats. Multiple character displacements in signal traits and habitat preference emerged in heterogeneous forest light environments are likely to have synergistic effects on the reproductive isolation of the two species." (Authors)] Address: Tsubaki, Y., Center Ecological Research, Kyoto Univ., Hirano 2-509-3, Otsu 520-2113, Japan. E-mail: mnais.pruinosa@me.com

2018

18756. Gomez-Llano, M.A.; Bensch, H.M.; Svensson, E.I. (2018): Sexual conflict and ecology: Species composition and male density interact to reduce male mating harassment and increase female survival. *Evolution* 72(4): 906-915. (in English) ["Sexual conflict is a pervasive evolutionary force that can reduce female fitness. Experimental evolution studies in the laboratory might overestimate the importance of sexual conflict because the ecological conditions in such settings typically include only a single species. Here, we experimentally manipulated conspecific male density (high or low) and species composition (sympatric or allopatric) to investigate how ecological conditions affect female survival in a sexually dimorphic insect, the banded demoiselle (*Calopteryx splendens*). Female survival was strongly influenced by an interaction between male density and species composition. Specifically, at low conspecific male density, female survival increased in the presence of heterospecific males

(*C. virgo*). Behavioral mating experiments showed that interspecific interference competition reduced conspecific male mating success with large females. These findings suggest that reproductive interference competition between con- and heterospecific males might indirectly facilitate female survival by reducing mating harassment from conspecific males. Hence, interspecific competitors can show contrasting effects on the two sexes thereby influencing sexual conflict dynamics. Our results call for incorporation of more ecological realism in sexual conflict research, particularly how local community context and reproductive interference competition between heterospecific males can affect female fitness." (Authors)] Address: Gomez-Llano, M.A., Evolutionary Ecology Unit, Dept of Biology, Lund University, Sweden. E-mail: miguel.gomez@biol.lu.se

18757. Svensson, E.I.; Gómez-Llano, M.A.; Torres, A.R.; Bensch, H.M. (2018): Frequency dependence and ecological drift shape coexistence of species with similar niches. *The American Naturalist* 191(6): 691-703. (in English) ["The coexistence of ecologically similar species might be counteracted by ecological drift and demographic stochasticity, both of which erode local diversity. With niche differentiation, species can be maintained through performance trade-offs between environments, but trade-offs are difficult to invoke for species with similar ecological niches. Such similar species might then go locally extinct due to stochastic ecological drift, but there is little empirical evidence for such processes. Previous studies have relied on biogeographical surveys and inferred process from pattern, while experimental field investigations of ecological drift are rare. Mechanisms preserving local species diversity, such as frequency dependence (e.g., rare-species advantages), can oppose local ecological drift, but the combined effects of ecological drift and such counteracting forces have seldom been investigated. Here, we investigate mechanisms between coexistence of ecologically similar but strongly sexually differentiated damselfly species (*Calopteryx virgo*, *C. splendens*). Combining field surveys, behavioral observations, experimental manipulations of species frequencies and densities, and simulation modeling, we demonstrate that species coexistence is shaped by the opposing forces of ecological drift and negative frequency dependence (rare-species advantage), generated by interference competition. Stochastic and deterministic processes therefore jointly shape coexistence. The role of negative frequency dependence in delaying the loss of ecologically similar species, such as those formed by sexual selection, should therefore be considered in community assembly, macroecology, macroevolution, and biogeography." (Authors)] Address: Svensson, E.I., Dept Biol, Lund Univ, 223 62 Lund, Sweden. E-mail: erik.svensson@biol.lu.se

2019

18758. Papazian, M.; Filippi, G. (2019): Contribution a la connaissance des odonates de l'archipel de Sao Tome-et-Principe 1. Presence de *Zygonyx torridus* (Kirby, 1889) (Odonata Libellulidae). *L'Entomologiste* 75(5): 265. (in French, with

English and Portuguese summaries) ["During a first expedition, carried out in February 2019 as part of the São Tomé-et-Príncipe «Archipel de la Biodiversité» project, *Z. torridus* was collected on the island of São Tomé, bringing to 16 the number of Odonates known to the archipelago." (Authors)] Address: Papazian, M., Opie Provence-Alpes-du-Sud, Muséum d'histoire naturelle de Marseille, palais Longchamp, 13233 Marseille cedex 20, France. E-mail: papazianmcm@wanadoo.fr

2020

18759. Acquah-Lampsey, D.; Brändle, M.; Brandl, R.; Pinkert, S. (2020): Temperature-driven color lightness and body size variation scale to local assemblages of European Odonata but are modified by propensity for dispersal. *Ecology and Evolution* 10(16): 8936-8948. (in English) ["Previous macrophysiological studies suggested that temperature-driven color lightness and body size variations strongly influence biogeographical patterns in ectotherms. However, these trait–environment relationships scale to local assemblages and the extent to which they can be modified by dispersal remains largely unexplored. We test whether the predictions of the thermal melanism hypothesis and the Bergmann's rule hold for local assemblages. We also assess whether these trait–environment relationships are more important for species adapted to less stable (lentic) habitats, due to their greater dispersal propensity compared to those adapted to stable (lotic) habitats. We quantified the color lightness and body volume of 99 European Odonata and combined these trait information with survey data for 518 local assemblages across Europe. Based on this continent-wide yet spatially explicit dataset, we tested for effects temperature and precipitation on the color lightness and body volume of local assemblages and assessed differences in their relative importance and strength between lentic and lotic assemblages, while accounting for spatial and phylogenetic autocorrelation. The color lightness of assemblages of odonates increased, and body size decreased with increasing temperature. Trait–environment relationships in the average and phylogenetic predicted component were equally important for assemblages of both habitat types but were stronger in lentic assemblages when accounting for phylogenetic autocorrelation. Our results show that the mechanism underlying color lightness and body size variations scale to local assemblages, indicating their general importance. These mechanisms were of equal evolutionary significance for lentic and lotic species, but higher dispersal ability seems to enable lentic species to cope better with historical climatic changes. The documented differences between lentic and lotic assemblages also highlight the importance of integrating interactions of thermal adaptations with proxies of the dispersal ability of species into trait-based models, for improving our understanding of climate-driven biological responses." (Authors)] Address: Acquah-Lampsey, D., Faculty of Biology, Dept of Ecology – Animal Ecology, Philipps-Universität Marburg, Karl-von-Frisch-Str. 8, 35043 Marburg, Germany. E-mail: dacquahlampsey@gmail.com

18760. Amann, G.; Puchta, A.; Burtscher, B. (2020): Monitoring im Hochmoor. Das Götzner Moos vor und nach seiner Renaturierung. *inatura – Forschung online* 75: 42 pp. (in German, with English summary) ["A drained and therefore partially disturbed bog with *Pinus uncinata* at the edge of the Rhine Valley in Vorarlberg (Austria), called Götzner Moos, was renaturalised in 2013. In the following six years we monitored the water balance and vegetation as well as selected insects (dragonflies, butterflies) in the bog and adjacent fens to evaluate the restoration measures (clearing shrubs and trees, installing plank dams and clay bunds, restart of the autumnal haymaking in the fens). The water table varied from near the surface to 20 cm under normal weather condition in summer, but fell well beyond 20 cm in dry periods. Cleared but otherwise undisturbed vegetation showed positive effects on special bog plants (e. g. *Vaccinium oxycoccus*), but also contrary effects on wetter and dryer places (e. g. increase or decrease of *Sphagnum magellanicum*, thinning or thickening of heath vegetation). *Molinia caerulea* increased and thereby reflects the still partially unfavorable water balance. As a result of restoration activities, open peat was densely overgrown within two years mainly by *Juncus effusus*, in little ponds mainly by *Carex rostrata*, where also rarer moss species (e. g. *Sphagnum cuspidatum*) flourished. Conspicuous mats of *S. magellanicum* developed later in the period on wet peat, or as small hummocks at the edge of the ponds. The moss flora as well as the vegetation as a whole today still points to a bog forest rather than to a raised bog with current peat growth. Yet it is unclear if *Pinus uncinata*, conveniently a protected property, or *Picea abies* will be the winner of this hypothetic competition. Compared with the studies before the restoration, the number of species of dragonflies has increased. After the restoration 15 species of dragonflies were registered. 6 species reproduced in the investigated area using the new ponds as reproduction site. Whereas most of the detected species are common, *Somatochlora arctica* is endangered and associated with bogs. 41 species of butterflies were found, none of them is especially associated with bogs. However, the adjacent fens and wet grassland are important habitats for butterflies - the clearing and the restart of the autumnal haymaking were a contribution to their conservation. It could be interesting to continue the monitoring to keep an eye on the development of the area, especially in view of climate change and the increase of unusual warm and dry periods." (Authors)] Address: Burtscher, Bianca, Naturschutzbund Vorarlberg, Schulgasse 7, 6850 Dornbirn, Austria. E-Mail: vorarlberg@naturschutzbund.at

18761. Ananian, V.; Schröter, A. (2020): *Aeshna juncea* (Odonata: Aeshnidae) new to Armenia. *Notulae odonatologicae* 9(5): 218-228. (in English) ["*Aeshna juncea* is reported from Armenia for the first time on the basis of voucher specimens and photographic records. On 30-vii-2018 a putative pair was photographed, and on 3- and 4-viii-2019 several specimens were photographed and examined in the hand. The occurrence of *A. juncea* in the Caucasus region as well as its puzzling regional distribution in relation to its congener *A. serrata* is summarized and discussed." (Authors)] Address: Ananian, V., 179 Bashinjaghyan St., apt. 23,

0078, Yerevan, Armenia. E-mail: gomphus@gmx.com

18762. Bakker, G. (2020): Zadellibellen in Rotterdam. *Stratgras* 32(1): 16-17. (in Dutch) [*Anax ephippiger*: "Back to Rotterdam After the sighting by Schrijvershof and Hak in 2013, it remained quiet for five years as far as saddle dragonflies in Rotterdam are concerned. Following the spectacular developments elsewhere in the Netherlands, Paul Schrijvershof travelled to Hoek van Holland on 10-X- 2018 and found and photographed Rotterdam's second saddle dragonfly. That was all that remained that year. On 14-VI- 2019, both Johan van 't Bosch and Jaap Engberts saw a male saddle dragonfly in - not entirely coincidentally - the dunes of Hoek van Holland. Johan managed to take photos. Because the observations were made at two different pools, the suspicion arose that there must be more specimens present. In the following days this proved to be the case. At a quickly drying pool, several dozen people reported up to six specimens at the same time. Mating and egg deposition were often observed. On 18 June the pool had almost dried up and only one specimen was seen. Until 25 June a few specimens were seen at the nearby dune pond. Meanwhile, elsewhere in the municipality of Rotterdam, some sightings were also made: on 17-VI- 2019, les Goedbloed saw one along the Schiedamseweg in Oud-Mathenesse ("While running, suddenly a saddle dragonfly!") and on 20 June Merijn Loeve saw one at the Veilingterrein in Crooswijk. Translated with www.DeepL.com/Translator (free version)] Address: Garry Bakker [ecoloog, Bureau Stadsnatuur; bakker@bureaustadsnatuur.nl]

18763. Batista Calvão, L.; Paiva, C.K.; Brito, J.; Fares, A.L.; Maia, C.; Michelan, T.S.; Montag, L.; Juen, L. (2020): Influence of biotic and abiotic factors on adult Odonata (Insecta) in Amazon streams. *Animal Biology* 71(1): 67-84. (in English) ["Abiotic and biotic factors play an essential role in the structuring of natural communities. Aquatic ecosystems have complex interaction networks, encompassing predator/prey relationships and structural support. Among aquatic organisms, the order Odonata is a model group for understanding those relationships since they can be both predators and prey. Our hypotheses were that Zygoptera are (i) influenced positively by Ephemeroptera, Plecoptera and Trichoptera (EPT) and the Habitat Integrity Index (HII), and negatively by fish and macrophytes; and (ii) Anisoptera are affected positively by EPT and macrophytes, and negatively by fish and HII. We found that Zygoptera were affected by the fish functional trophic groups, while Anisoptera were affected by macrophytes, EPT, fish and HII. Macrophytes affected anisopterans positively because they provide perching sites for adults. The results for EPT and HII may be related since these organisms are also sensitive to environmental changes. More open areas have lower HII values and the negative relationship with Anisoptera may be explained by physiological constraints. The negative relationship between EPT and Anisoptera could be explained by the low occurrence of EPT in open sites, which are the sites that were highly rich in Anisoptera. Finally, the dominance of specific functional trophic groups of fish influences Odonata

suborders in different ways. In conclusion, the results show the importance of ecological interactions for Odonata in Amazonian streams in both direct and indirect ways." (Authors)] Address: Juen, L., Programa de Pós-graduação em Ecologia, Universidade Federal do Pará-Ufpa, Rua Augusto Correia, No Bairro Guamá, Belém 66075-110, Brazil. E-mail: leandrojuen@ufpa.br

18764. Brockhaus, T.; Müller, O.; Nel, A.; Poschmann, M.J.; Wappler, T. (2020): Fossil dragonflies (Odonata: Anisoptera) from the late Oligocene Fossil-Lagerstätte Enspel (Rhine-land-Palatinate, SW Germany). *Palaeoentomology* 3(3): 284-300. (in English) ["Fossils of Anisoptera, three larvae and one isolated hind wing, are described from the late Oligocene crater lake of Enspel (Westerwald, Germany). The larvae are interpreted to belong to one species, although representing three different ontogenetic stages. Comparison to extant taxa shows that the larvae are to be assigned to the clubtails (Gomphidae), namely to the genera Gomphidia or Ictinogomphus, or, more unlikely, Diastomma in the subfamily Lindeniinae, and thus constitute the first record of larvae of this subfamily in the Oligocene. The venation pattern of the hind wing clearly shows that it belongs to a species in the family Macromiidae and thus constitutes the oldest record of this family." (Authors)] Address: Brockhaus, T., An der Morgensonne 5, D-09387 Jahnsdorf, Germany. E-mail: T.Brockhaus@t-online.de

18765. Buffagni, A. (2020): The lentic and lotic characteristics of habitats determine the distribution of benthic macroinvertebrates in Mediterranean rivers. *Freshwater Biology* 66: 13-34. (in English) ["(1) The importance of flow-related factors to benthic organisms, as well as the role of habitat conditions in shaping aquatic communities during low-flow periods, have been recognised. Despite this, the preferences of macroinvertebrates to the ratio of lentic to lotic habitats at the reach scale have not been accurately quantified in most instances. (2) Aquatic invertebrates and habitat features in a range of temporary rivers in Sardinia were investigated. The investigation focused on the flow-related characteristics that contribute to defining the lentic-lotic condition of the river reaches. The relation of habitat features to benthic taxa distributions was assessed using multidimensional scaling. The main aim of the paper was to quantify the responses of taxa to the different lentic and lotic habitat conditions by applying hierarchical logistic regressions. Finally, taxon optima were aligned along the lentic-lotic gradient and the responses of different taxonomic groups compared. (3) Unbroken waves and imperceptible flow were correlated with benthic taxa variability, suggesting local hydraulics and turbulence have a major role in regulating community composition. The overall lentic-lotic character of the river reaches was also clearly related to the benthic taxa distribution. More than 80% of taxa were significantly related to the lentic-lotic gradient, and an asymmetrical response curve was the predominant model. (4) Benthic groups showed taxon optima clustered in different ranges of the lentic-lotic gradient. Odonata, Coleoptera, Hemiptera, and Mollusca preferred clearly lentic con-

ditions. Diptera mainly ranged on the lotic side of the gradient, while Trichoptera were relatively uniformly distributed across the gradient. Ephemeroptera taxa clustered in intermediate lentic-lotic conditions, with two species preferring extremely lentic habitats. In general, optima converged at intermediate and extremely lentic conditions, presumably due, respectively, to the coexistence of different lentic and lotic features and to the highly diverse environmental characteristics under extremely lentic situations. (5) These results support the conclusion that dissimilar ecological factors act on benthic taxa along the lentic-lotic range and species favouring different lentic-lotic conditions are subjected to pressures of different nature. This should not be ignored when defining species preferences and studying community structure or relationships between species in Mediterranean rivers, which cyclically vary their habitat composition. In addition, the uneven distribution of optima of different groups along the lentic-lotic gradient might affect macroinvertebrate metrics when assessing ecological status or establishing reference conditions under variable climatic conditions." (Author) Taxa are treated at family level.] Address: Buffagni, A., Water Res. Inst., Nat. Res. Council (CNR-IRSA), Via del Mullno, 19,1-20861, Brugherio (MB), Italy. Email: huffagnl@Irsa.cnr.it

18766. Chelli, A.; Moulai, R.; Djemai, A. (2020): Does the Tichi Haf dam construction affect dragonfly and damselfly (Odonata: Insecta) assemblages of the Boussellam watercourse (central north Algeria)? A preliminary study. *Zoology and Ecology* 30(1): 37-47. (in English) ["This paper reports a pioneer study dealing with the impact of dam construction on Odonata communities, because no similar study has been undertaken in Algeria and the consequences of this artificialization on the Odonata assemblages have rarely been studied elsewhere. The main purpose of this study was to determine if the Tichi Haf dam is really having a negative effect on the Odonata communities living on the Boussellam watercourse, as there has hitherto been a lack of knowledge about its odonatofauna and aquatic microinvertebrates. This study showed that changes due to the construction of this dam, involving riparian vegetation, bank aspect and water parameters, affected the Odonata assemblages inhabiting both sides of the dam wall. The richness and abundance of Odonata found upstream from the dam is quite different from those found downstream from the dam. The survey also identified four new species for the Bejaia region. Among these, we report on the rediscovery of the critically endangered (EN) *Calopteryx exul* in Algeria, recorded in the nineteenth century and deemed to have been extinct after an absence of more than a century. The presence of an extant population *C. exul* in this location does not correspond to any historical locality reported for this species." (Authors)] Address: Chelli, A., Lab. de Zoologie Appliquée et d'Ecophysiologie Animale, Fac. Sciences Nature et Vie, Univ. de Bejaia, 06000 Bejaia, Algeria. Email: mchelli70@yahoo.fr

18767. Chung, H.-Y.; Yeom, C.-M.; Kim, J.H.; Park, S.; Lee, Y.-W.; Pyo, G.; Kim, S.H. (2020): Species diversity and com-

munity characteristics of benthic macroinvertebrates from irrigation ponds in the western CCZ area, Korea. *Korean Journal of Ecology and Environment* 53(2): 173-184. (in Korean, with English summary) ["Irrigation ponds, 'dumbeong', which are artificially constructed water resources for traditional farming, serve as a biological shelter connecting seasonally created rice paddy fields to local freshwater ecosystems. This 2018 study surveyed 143 irrigation ponds in the western Civilian Control Zone (CCZ) area from August to September, revealing species diversity and community characteristics of benthic macroinvertebrates. A total of 13,454 individuals of macroinvertebrates were captured and classified into 3 phyla, 5 classes, 17 orders, 59 families, 192 species. Among Insecta, the most frequently recorded order was Odonata, 55 spp. (33.7%), followed by Coleoptera, 52 spp. (31.9%), Hemiptera, 34 spp. (20.8%), Diptera, 17 spp. (9.8%), Ephemeroptera, 3 spp. (2.4%), Trichoptera, 1 spp. (0.6%) and Lepidoptera, 1 spp. (0.6%). Taxon of non-Insecta consisted of Mollusca, 14 spp. (48.2%), Annelida, 11 spp. (37.9%) and Arthropoda, 4 spp. (3.4%). The analysis of Diversity Index (H'), Species Richness Index (RI), Dominance Index (DI) and Evenness Index (J') revealed the general stability of communities in the study sites. A total of 28 rare species were found in 98 study sites, including three endangered species designated by the Ministry of Environment. These results showed that the species diversity and rarity of macroinvertebrates in the study area were greater than those of previous research on lentic wetlands (lake, etc.) and national conserved wetlands (Upo-swamp, etc.) in Korea. A conservation planning of aquatic ecosystems in the western CCZ area, therefore, should focus on conservation of irrigation ponds." (Authors)] Address: Kim, S.H., DMZ Ecology Res. Inst., Paju 10881, Rep. Korea. E-mail: ecodmz@dmz.or.kr

18768. Dias de Oliveira, F. (2020): Impact du castor sur les populations d'odonates en Ardenne belge. MSc. thesis, Faculté des sciences, Université catholique de Louvain: 103 pp. (in French, with English summary) ["The beaver is back in Belgium for a few years and today it is an integral part of the Belgian biodiversity. Many studies highlight the positive influence that the beaver can have on other groups of organisms, including dragonflies, by creating a dam that creates heterogeneity in the environment. Dragonflies are known to be insects that are highly dependent on aquatic environments. Consequently, a few studies have already linked the creation of a water retention by the dam to an increase in dragonfly populations. And that's what my work is based on. Throughout this work, I have tried to assess whether there is an apparent change in dragonfly populations since the appearance of the beaver in Wallonia. The first part of the work consisted of finding the year of construction of each dam in order to know the approximate time when a change in dragonflies could have been measured. In the second part I tried to evaluate a change in dragonfly richness and community by comparing dragonfly observations at two periods, namely before and after the appearance of the dam. This work has thus shown that the response of dragonflies is not obvious and that it depends strongly on the influence of the dam on the environment. In other words, not all dams seem

to impact dragonflies in the same way, which has an impact on the results of the analysis. In addition, the size of the impoundments created by the dams appears to be correlated with the size of the standing water present at the sites, which further complicates the assessment of dragonfly responses. Nevertheless, the positive effects of the beaver continue to make it a very useful organism in improving habitat for various organisms, and as a result, we must continue to pay attention to this rodent and its influence on the biodiversity. ... Conclusion: Unfortunately, this thesis could not show a clear-cut response of dragonfly populations to the appearance of dams in the Walloon territory. Nevertheless, I do not believe that this result is due to the fact that dams have no effect on dragonflies but rather to the limitations of the data and the methodology used. Nevertheless, it should be borne in mind that the presence of a beaver or even a dam at a site does not in all cases equate to an increase in the number of dragonfly species or the abundance of a specific species. The dam must clearly have special characteristics and above all have a fairly large effect on the environment (large water reservoir, abundant vegetation, abundant substrates, sunlight, etc.). In this case, not only dragonflies can benefit from the presence of this rodent but also many other species. Over the last 20 years, the beaver has managed to conquer a large part of Wallonia and has drastically changed the waterways. Whether we like it or not, the beaver has clearly become an integral part of Belgian biodiversity once again and I think we should accept this and try to make the most of the benefits to biodiversity. Indeed, it has been clearly proven that the beaver is very beneficial through its ability to create heterogeneity. However, in order to really benefit a large number of organisms, the various natural environments must always be present in the right quantity and distribution, which is unfortunately no longer the case in Wallonia. So I think that if we continue to create wetlands thanks to the various Life projects and if we let the beaver do what it does best, namely create wetlands, we may be able to see a reduction in the decline of dragonflies in certain regions of Belgium, and I hope so." (Author)] Address: not stated

18769. Dietrich, S.E. (2020): Habitat, diet, and foraging ecology of Willow Flycatcher in Sierra Nevada Meadows. M.Sc. thesis, Utah State University: XI + 60 pp. (in English) ["The last stronghold of the California Willow Flycatcher (*Empidonax traillii*) population, which exists in the Sierra Nevada, continues to decline, necessitating a clearer understanding of how meadows provide habitat for the species. To gain this understanding, we assessed vegetation type, saturation levels, and invertebrate species at 51 different sites within four meadows located in the Little Truckee River drainage. 17 of these sites were occupied by nesting Willow Flycatcher during the time of the study, 17 sites had been occupied by nesting Willow Flycatcher in annual surveys between 1997 and 2010 but are no longer used, and 17 sites had never been used by nesting Willow Flycatcher. We found that occupied sites were generally far wetter than unused sites. Total saturation varied from 88% to 100% and total inundation varied from 20% to 52%. Sedge vegetation coverage was also

much higher in occupied sites than unused sites and varied from 62% to 90%. Abandoned sites were found to not be suitable for breeding Willow Flycatcher because they were either too dry (low food abundance) or they were too wet (decreased shrub quality). Food items desired by Willow Flycatcher were found to be higher in abundance within wetter occupied sites compared to drier unused sites. In addition to evaluating vegetation coverage, saturation levels, and invertebrates, we examined Willow Flycatcher diet, foraging behavior, and food/habitat relationships by using video footage of nestlings being fed and field observations. Over 75% of the Willow Flycatcher diet was represented by Lepidoptera, Raphidioptera, Ephemeroptera, Odonata, and Hemiptera. Aquatic invertebrate food items composed 42% of the diet and aquatic habitat features such as stream channels and oxbow ponds were found to be important. Overall, gleaning and hawking foraging methods were used relatively equally, 49% and 51% of the time, respectively. Foraging often took place outside of territory boundaries and some food items, such as Raphidioptera, were caught outside of meadow boundaries. Diets and foraging behavior also varied throughout the day with some food items, such as Ephemeroptera and Lepidoptera, being targeted only during certain times of the day." (Author)] Address: not stated

18770. Dimitrov, D.; Bechev, D. (2020): Odonata (Zygoptera and Anisoptera) of the Samena Sredna Gora Mts. Zoo-Notes Supplement 9: 115-121. (in English) [Bulgaria "Checklist of the dragonflies (Order Odonata) of the Samena Sredna Gora and its adjacent areas contains 26 species from 7 families: Calopterygidae (2 sp.), Coenagrionidae (7 sp.), Lestidae (1 sp.), Platycnemididae (1 sp.), Aeshnidae (1 sp.), Gomphidae (4 sp.) and Libellulidae (10 sp.)." (Authors)] Address: Dimitrov, D., University of Plovdiv "Paisii Hilendarski", Department of Zoology, 24 Tzar Assen Str., BG-4000 Plovdiv, Bulgaria. E-mail: d.dymytrow@gmail.com

18771. Eagles-Smith, C.A.; Willacker, J.J.; Nelson, S.J.; Flanagan Pritz, C.M.; Krabbenhoft, D.P.; Chen, C.Y.; Ackerman, J.T. Campbell Grant, E.H.; Pilliod, D.S. (2020): A national-scale assessment of mercury bioaccumulation in United States National Parks using dragonfly larvae as biosentinels through a Citizen-Science Framework. *Environmental Science & Technology* 54(14): 8778-8790. (in English) ["We conducted a national-scale assessment of mercury (Hg) bioaccumulation in aquatic ecosystems, using dragonfly larvae as biosentinels, by developing a citizen-science network to facilitate biological sampling. Implementing a carefully designed sampling methodology for citizen scientists, we developed an effective framework for a landscape-level inquiry that might otherwise be resource limited. We assessed the variation in dragonfly Hg concentrations across >450 sites spanning 100 United States National Park Service units and examined intrinsic and extrinsic factors associated with the variation in Hg concentrations. Mercury concentrations ranged between 10.4 and 1411 ng/g dry weight across sites and varied among habitat types. Dragonfly total Hg (THg) concentrations were up to 1.8-fold higher in lotic

habitats than in lentic habitats and 37% higher in waterbodies with abundant wetlands along their margins than those without wetlands. Mercury concentrations in dragonflies differed among families but were correlated ($r^2 > 0.80$) with each other, enabling adjustment to a consistent family to facilitate spatial comparisons among sampling units. Dragonfly THg concentrations were positively correlated with THg concentrations in both fish and amphibians from the same locations, indicating that dragonfly larvae are effective indicators of Hg bioavailability in aquatic food webs. We used these relationships to develop an integrated impairment index of Hg risk to aquatic ecosystems and found that 12% of site-years exceeded high or severe benchmarks of fish, wildlife, or human health risk. Collectively, this continental-scale study demonstrates the utility of dragonfly larvae for estimating the potential mercury risk to fish and wildlife in aquatic ecosystems and provides a framework for engaging citizen science as a component of landscape Hg monitoring programs." (Authors)] Address: Eagles-Smith, C.A., United States Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, Oregon 97330, United States. E-mail: ceagles-smith@usgs.gov

18772. Ekvall, M.T.; Sha, Y.; Palmér, T.; Bianco, G.; Bäckman, J.; Åström, K.; Hansson, L.-A. (2020): Behavioural responses to co-occurring threats of predation and ultraviolet radiation in *Daphnia*. *Freshwater Biology* 65(9): 1509-1517. (in English) ["(1) Organisms in the wild are faced with multiple threats and a common response is a change in behaviour. To disentangle responses to several threats, we exposed two differently sized species of the freshwater invertebrate *Daphnia* to solar ultraviolet radiation (UVR) and predation from either moving pelagic or benthic ambush predators. (2) Using an advanced nanotechnology-based method, we tracked the three-dimensional movements of those mm-sized animals at the individual level. Each behavioural trial was performed both under conditions resembling night (no UVR) and day (UVR) and we examined patterns of the depth distribution and swimming speed by *Daphnia* across three treatments: no predator (control); bottom-dwelling damselfly (*Calopteryx* sp.); and fish (stickleback, *Pungitius pungitius*) predators. We also quantified the actual predation rate by the two predators on the two *Daphnia* species, *D. magna* and *D. pulex*. (3) We show that individual *Daphnia* are able to identify predators with different feeding habitats, rank multiple and simultaneously occurring risks and respond in accordance with the actual threat; complex responses that are generally associated with larger animals. (4) In a broader context, our results highlight and quantify how a cocktail of everyday threats is perceived and handled by invertebrates, which advances our understanding of species distribution in space and time, and thereby of population dynamics and ecosystem function in natural ecosystems." (Authors)] Address: Hansson, L.-A., Aquatic Ecology, Dept of Biology, Ecology Building, Lund University SE-223 62 Lund, Sweden. Email: lars-anders.hansson@biol.lu.se

18773. Emiliyamma, K.G.; Palot, M.J.; Charesh, C. (2020): A new species of *Platylestes* Selys (Odonata: Zygoptera):

Lestidae) from the coastal area of Kannur District, Kerala, India. *Journal of Threatened Taxa* 12(13): 16854-16860. (in English) ["The genus *Platylestes* Selys, 1862 is known from India, by only one species, *P. platystylus* from eastern India, West Bengal, and recently from Kerala. Here, we describe a new species *Platylestes kirani* from the coastal tracts of the northern part of Kerala, southern India. The new species differs from all other known species of the genus by its unique coloration, distinct marking on synthorax, and the shape of anal appendages." (Authors)] Address: Emiliyamma, K.G., Zoological Survey of India, M- Block, New Alipore, Kolkata, West Bengal 700053, India. E-mail: kgemily@gmail.com

18774. Epp, L.J. (2020): Assessing the effect of *Bacillus thuringiensis* var. *israelensis* on nontarget Chironomidae emergence. MSc. thesis, Department of Biology, Faculty of Science, University of Ottawa: xvi + 220pp. (in English) ["*Bacillus*-derived larvicides, which selectively target mosquito (Diptera: Nematocera: Culicidae) populations to reduce nuisance and health risks, were applied in the South March Highlands Conservation Forest near residential neighbourhoods in Ottawa, Ontario. The objective was to assess effects of application on the nontarget mosquito relative, Chironomidae (Diptera: Nematocera: Chironomidae), and other nontarget aquatic taxa captured using emergence traps. A secondary objective was to assess physicochemical variables that influence Chironomidae emergence. Study ponds received an application of *Bacillus thuringiensis* var. *israelensis*, a subset also received an application of *Bacillus sphaericus*, and a group of control ponds were left untreated over 3 years (2016-2018). Weekly sampling included trap collections and measurements of water temperature, pH, water depth, conductivity, dissolved oxygen, ammonia, nitrate, and sulphate. Drought in 2016, high precipitation throughout 2017, and seasonal precipitation in 2018 influenced variable physicochemical conditions. Principal component analyses identified differences between sampling groups and between years. Redundancy analyses correlated insect emergence with pond pH, average water depth and water temperature and indicated a strong relationship between Chironomidae emergence and average water depth. Although significantly less Chironomidae annual emergence was observed at treated sites in 2017 and 2018, zero-inflated negative binomial generalized linear mixed modelling failed to detect a significant Bti treatment effect when controlling for within group variation. Rather, variations in pH, mean water depth and water temperature were identified as drivers of Chironomidae emergence. Culicidae emergence was reduced to zero briefly following treatment in 2017 and 2018. The model detected a marginal negative treatment effect on Culicidae in 2017 only, and a positive treatment effect in 2018 at the onset of a secondary hydroperiod, in the absence of treatment. Variations in pH and water temperature were also identified to be drivers of Culicidae emergence. Modelling failed to detect treatment effects on any of the nontarget taxa abundance, including Diptera, Lepidoptera, Ephemeroptera, Odonata, Coleoptera, Hymen-

optera, and Arachnida. An inverse relationship between insectivore and prey taxa abundance was observed. In 2018, taxa richness increased between years and trended higher at treated sites and a positive relationship between insectivore and prey taxa richness was observed. In 2017, Shannon-Weiner index and Simpson's index of diversity were higher at untreated sites, and in 2018 diversity indices were higher at treated sites, with taxa richness increasing between years and higher evenness trending at treated sites. Our data suggest that treatment effects were potentially shrouded by natural variability of physicochemical variables, especially due to the varying hydroperiod observed over the three years of sampling. Additional work is needed to capture average conditions and separate confounding variables from treatment effects. This study provides an inventory of the current wetland insect community in the South March Highlands Conservation Forest landscape that offers a reference for ongoing mosquito management." (Author)] Address: not stated

18775. Geary, M.; von Hardenberg, A. (2020): White-faced Darter distribution is associated with coniferous forests in Great Britain. *Insect Conservation and Diversity* 14(1): 15-25. (in English) ["Understanding of dragonfly distributions is often geographically comprehensive but less so in ecological terms. 2) White-faced darter (*Leucorrhinia dubia*) is a lowland peatbog specialist dragonfly which has experienced population declines in Great Britain. *L. dubia* are thought to rely on peat-rich pool complexes within woodland but this has not yet been empirically tested. 3) We used dragonfly recording data collected by volunteers of the British Dragonfly Society from 2005 to 2018 to model habitat preference for *L. dubia* using species distribution models across Great Britain and, with a more detailed landcover dataset, specifically in the North of Scotland. 4) Across the whole of Great Britain our models used the proportion of coniferous forest within 1km as the most important predictor of habitat suitability but were not able to predict all current populations in England. 5) In the North of Scotland our models were more successful and suggest that habitats characterised by native coniferous forest and areas high potential evapotranspiration represent the most suitable habitat for *L. dubia*. 6) We recommend that future *L. dubia* monitoring should be expanded to include areas currently poorly surveyed but with high suitability in the North of Scotland. 7) Our results also suggest that *L. dubia* management should concentrate on maintaining Sphagnum rich pool complexes and the maintenance and restoration of native forests in which these pool complexes occur." (Authors)] Address: Geary, M., Conservation Biology Research Group, Dept of Biological Sciences, Univ. of Chester, Chester, CH1 4BJ, UK. E-mail: m.geary@chester.ac.uk

18776. Gomes Viana, C.; Reis Campos, I.; Santana Lustosa, G.; Silas Veras, D. (2020): Environmental gradients as filters on the composition of aquatic insect of the Cerrado Caatinga, Brazil. *Acta Brasiliensis* 4(3): 142-148. (in English, with Portuguese summary) ["The patterns of aquatic in-

sect diversity are influenced by landscape structure and environmental gradients that can be altered significantly through changes in land use. The aim of the present study was to verify if the patterns of diversity of the orders Odonata and Trichoptera vary significantly between preserved and altered sites, along a gradient of environmental impact. Data were collected on the structural and environmental characteristics of the stream, and the assemblages of aquatic insects at seven sampling points in a Cerrado-Caatinga ecotone of northeastern Brazil, in the dry seasons of 2018 and 2019. The results indicated that altered streams had higher electrical conductivity and lowest HII (habitat integrity index) values in comparison with the preserved ones, being determinant in the distribution of genera, and low pH values increased genera richness, informations that can guide management strategies for biodiversity conservation. Which supports the conclusion that the diversity of aquatic insects is determined by the influence of environmental filters in the streams." (Authors)] Address: Gomes Viana, Carolina, Instituto Federal de Educagao, Ciencia e Tecnologia do Maranhao, Caxias, 65609-899, Maranhao, Brasil. E-mail: carolina.viana@acad.ifma.edu.br

18777. Hoffmann U (2020): Ein Leben im Verborgenen – Nachweise der Gestreiften Quelljungfer (*Cordulegaster bidentata*) im Kreis Lippe, NRW. Berichte des Naturwissenschaftlichen Verein für Bielefeld und Umgegend 57: 58-80. (in German) ["With the present work, an essential gap in the state of knowledge on the distribution and population situation of *C. bidentata* at the northern border of its European range could be closed by means of a targeted search from 2017 to 2019. The study shows that the northern Hessian and southern Lower Saxon occurrences find their northern continuation in the district of Lippe and represent a common settlement area. A colonisation via the Weser region can be assumed as very probable for the eastern Lippe source areas, whereas the western occurrences along the Osning chain could be associated with a colonisation from the Rhine catchment area. The well-founded assumption that two different populations meet in the Lippe district would have to be substantiated by genetic tests. Only 20 % of the 201 mapped, potentially suitable spring sites and spring streams were found. Despite the 62 individual sightings, the occurrences in the district must be considered rather poor in individuals. *C. bidentata* remains a rare species whose conservation status of RL 2 (critically endangered) is still justified, especially in view of the high responsibility we bear in Europe for this endemic species. According to various forecasts and observations, the influence that climate change will have on the habitat of springs and spring creeks must be assessed as quite serious (LANUV 2010, 2016). This concerns on the one hand the increase in average temperatures and on the other hand the changing precipitation amounts and their seasonal distribution. In addition, the forced forest conversion will change many of the spring habitats and thus their suitability for colonisation by *C. bidentata* in the future." (Authors; DeepL)] Address: Hoffmann, Ulrike, Prof.-Schacht-Str. 2, 32657 Lemgo, Germany. E-Mail: mahpa@web.de

18778. Holzinger, W.E.; Kerschbaumsteiner, H.; Brunner, H.; Komposch, B. (2020): Neue Nachweise des Zweifelflecks (*Epithea bimaculata* Charpentier, 1825) aus der Steiermark (Insecta: Odonata). *Joansea Zoologie* 18: 215-222. (in German, with English summary) ["New records of the Eurasian Dragonfly *E. bimaculata* from Styria. – Records of *E. bimaculata* from two sites in southern Styria, a protected ditch and swamp near Zwaring and a pond called „Neuteich“ near Wundschuh, protected as Natura-2000-site, represent first findings of this species in Styria after almost 50 years. A mass emergence of about 4,000 dragonflies was documented by extrapolation of exuviae numbers at the Neuteich end of April/beginning of May 2019. The ditch near Zwaring hosts at least 12 Odonata species, the Neuteich (including an adjacent creek called Poniglbach) at least 22, among them *Somatochlora meridionalis* and *S. metallica*." (Authors)] Address: Holzinger, W., Ökoteam, Bergmannsgasse 22, 8010 Graz, Austria. E-Mail: holzinger@oekoteam.at,

18779. Huber, E.; Sandra Aurenhammer, S.; Bauer, H.; Becker, J.; Borovsky, R.; Brugggraber, N.; Degasper, G.; Elsasser, H.; Frieß, T.; Fröhlich, D.; Gladitsch, J.; Gorfer, B.; Gunczy, J.; Gunczy, L.W.; Heimbürg, H.; Holzer, E.; Kirchmair, G.; Komposch, C.; Körner, A.; Kunz, G.; Lorber, L.; Moser, A.; Paill, W.; Schattaneck, P.; Volkmer, J.; Wagner, H.C.; Wiesmair, B.; Wolf, A.; Zangl, L.; Zechmeister, T.; Zweidick, O. (2020): Bericht über das sechste ÖEG-Insektencamp: Wirbellose Artenvielfalt rund um Güssing (Südburgenland). *Entomologica Austriaca* 27: 137-210. (in German, with English summary) ["Abstract: Report on the sixth "insect camp" of the Austrian Entomological Society: invertebrate diversity all around Güssing (Southern Burgenland, Austria): The sixth insect camp of the Austrian Entomological Society took place in the vicinity of Güssing ... from May 16th to May 19th, 2019. In total, 24 participants from Tyrol, Vienna, and Styria attended the field course and were accompanied and supported by 23 specialists for various taxonomic groups during the camp and/or at the postprocessing. During those four days, the participants studied and applied different trapping and preparation approaches, trained determination, gathered knowledge on various groups of arthropods and gastropods and were able to network with taxonomists. Five localities were investigated and in total 788 species were detected: 11 Odonata, ..." (Authors)] Address: Huber, Elisabeth, ÖKOTEAM, Bergmannsgasse 22, 8010 Graz, Austria. E-Mail: jugend@entomologie.org

18780. Ilahi, I.; Yousafzai, A.M.; Ul Haq, T.; Rahim, A.; Attaullah, M.; Naz, D. (2020): Toxicity to lead, cadmium and copper in nymphs of three odonate species. *Bioscience Research* 17(4): 2448-2464. (in English) ["The present research aimed to investigate the effect of seven days exposure to lead (Pb), cadmium (Cd) and copper (Cu) on survival and feeding rate of nymphs of three odonate species i.e., *Ischnura elegans*, *Trithemis aurora* and *Pantala flavescens*. During this study, the nymphs of all the three odonate species survived when exposed separately to 40 ppm each of Pb and Cd, and 10 ppm of Cu. Cu appeared most toxic. The

LC50 values of Cu against *I. elegans*, *T. aurora* and *P. flavescens* was 148.2, 101.8 and 173.6 ppm, respectively. The feeding rate of *I. elegans* and *T. aurora* nymphs when separately exposed to sublethal concentration of Pb and Cd (40 ppm each) was not different significantly ($P > 0.05$) from control nymphs. However, the feeding rate of *I. elegans* and *T. aurora* nymphs exposed to the sublethal concentration of Cu (10 ppm) was significantly lower ($P < 0.05$) from the control nymphs. The feeding rate of *P. flavescens* nymphs when exposure to the sublethal concentration of any of the three metals was significant lower ($P < 0.05$) than control nymphs. It is concluded that among Pb, Cd and Cu, the Cu is most toxic to *I. elegans*, *T. aurora* and *P. flavescens* nymphs. It is further concluded that among Pb, Cd and Cu, the sublethal concentration of Cu significantly reduces the feeding rate of *I. elegans*, *T. aurora* and *P. flavescens* nymphs." (Authors)] Address: Ilahi, I., Dept of Zoology, Univ. of Malakand, Chakdara, Dir Lower, Khyber Pakhtunkhwa, Pakistan. E-mail: ikramilahi@uom.edu.pk

18781. Jain, A.; Rasmussen, A.K.; Milla, K.A.; Richard, B.A.; Pescador, M.L. (2020): Water chemistry and aquatic insect assemblages of ephemeral ponds in the Munson Sand Hills region of the Apalachicola National Forest, Florida. *Southeastern Naturalist* 19(2): 205-232. (in English) ["Ephemeral ponds in the Munson Sand Hills region (MSH) of Apalachicola National Forest (ANF) are an essential resource in the life cycles of a variety of amphibian species, a number of which are threatened or endangered. Various types of human activities have disturbed some of these ponds threatening their survival. Although extensive research has been done on the biology of amphibians in the ponds, little is known of the invertebrates and to what extent the water quality may be affected by human impacts. We monitored 4 ponds, representing a spectrum of sizes, natural settings, and anthropogenic disturbance, in terms of water chemistry and aquatic insect assemblages seasonally for 2 years. Pond waters were characterized by acidic pH, low ionic strength, low buffering capacity, low nutrient concentrations, and phosphorus-limiting conditions. The water quality of studied ponds was similar to those reported for natural wetlands in west-central Florida. The chemistry, as compared to a nearby sinkhole, indicated that these ponds were mainly recharged with rain and had no connectivity to groundwater. Aquatic beetles (Coleoptera), Odonata, and aquatic bugs (Heteroptera) were the most diverse groups of aquatic insects recorded. Species collected included many common, predatory species adapted to exploit resources in fishless, temporary ponds. Water chemistry and aquatic insect composition showed minor spatial-temporal variations among ponds. The results of this study indicate that human disturbances have not had a significant effect on pond water quality, posing no threat to amphibian and other wildlife species, and the sampled ponds had abundant and diverse aquatic insect fauna. The aquatic insect assemblages documented in this study provide evidence that pond type and the top-down effects of aquatic insects as predators are important determinants of community structure, which is a common theme observed in temporary ponds found in other regions

within temperate biomes." (Authors)] Address: Jain, Amita, Center for Water Resources, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL 32307, USA. E-mail: amita.jain@famou.edu

18782. Janra, M.N.; Herwina, H.; Gusman, D. (2020): Rumble in the stream: mating site preference in endemic *Euphaea aspasia* (Zygoptera: Euphaeidae). *Agrion* 24(3): 179-183. (in English) [Biological Research and Educational Forest, Andalas University, West Sumatra, Indonesia; "Euphaea aspasia, as with most of other members of the Oriental genus *Euphaea*, has poorly known reproductive biology. Here we report on the possible mating site for this species through observations of protracted agitation between two males over a prospective area, in addition to the subsequent guarding act from a male over the same area. The physical and environmental aspects of the prospective mating site are described." (Authors)] Address: Janra, M.N., The Biology Department, Andalas University, Jalan Kampus Unand Limau Manis Pauh, Padang, West Sumatra 25163, Indonesia. E-mail: mnjanra@sci.unand.ac.id

18783. Kawashima, I. (2020): The order Odonata illustrated in Heikuro (Takanori, Jyakuso-an) Yoshida's "Yoshida-O-Chifu (Part 1)" deposited in the Nagoya City Museum. *Tombo* 62: 77-90. (in English, with Japanese summary) ["The author investigated the Odonata illustrated in a manuscript by Goro Oshio (1830-1894) of Heikuro (Takanori, Jyakuso-an) Yoshida (1805—1869)'s "Yoshida-O-Chifu (Part 1)" housed in the Nagoya City Museum. Out of 65 figures, 27 species in 40 figures were identified as follows: Lestidae: *Lestes sponsa*; Calopterygidae: *Calopteryx Comelia*, *Atrocalopteryx atrata*; Coenagrionidae: *Ceriagrion melanurum*, *C. nipponicum*; Aeshnidae: *Boyeria maclachlani*, *Aeschnophlebia longistigma*, *A. anisoptera*, *Gynacantha japonica*, *Polycanthygyna melanictera*, *Anax parthenope*, *A. nigrofasciatus*; Gomphidae: *Sinictinogomphus clavatus*; Corduliidae: *Epithea marginata*; Macromiidae: *Epophthalmia elegans*; Libellulidae: *Rhyothemis fuliginosa*, *Sympetrum darwinianum*, *S. maculatum*, *S. risi*, *S. croceolum*, *Pseudothemis zonata*, *Deielia phaon*, *Nannophya pygmaea*, *Crocothemis servilia*, *Pantala flavescens*, *Lyriothemis pachygastra* and *Orthetrum albistylum*. Of the remaining 25 figures the author could not be certain of the species identification as follows: Lestidae: *Sympecma paedisca* ?; *Lestes* spp. (*sponsa*, *temporalis* or *japonica*); Calopterygidae: *Mnais* spp. (*costalis* or *pruinosa* ?); Platycnemididae: *Pseudocoptera annulata* ?; Coenagrionidae: gen. et sp. (*Ischnura asiatica* ?); Aeshnidae: *Gynacantha* sp. (*japonica* ?) or *Anax* sp. (*nigrofasciatus* ?); Gomphidae: *Asiagomphus* sp. (*melaenops* or *pryeri* ?); *Davidius fujijama* ?; *Trigomphus* sp. (*ogumai* ?); *Shoagomphus postocularis* ?; Macromiidae: *E. elegans* or *Macromia* spp. (*amphigena* or *daimoji* ?); Libellulidae: *Sympetrum* spp. (*parvulum*, *eroticum* or *kunckeli* ?); *Sympetrum* sp. (*risi*, *baccha*, or *eroticum* ?); *Sympetrum* sp. (*risi* ?); *Sympetrum* sp. (*frequens* ?). Many figures are of a quality that makes identification to generic or specific levels possible to be precise. On the other hand, the arrangement was not intended to be carried out from a phylogenetic viewpoint

which was how Western natural history was done at that time." (Author)] Address: Kawashima, I., Nagasawa 1-50-9, Yokosuka-shi, Kanagawa, 239-0842 Japan. Email: itsurok29@jcom.home.ne.jp

18784. Kita, A.; Nakahara, M.; Tokuda, M. (2020): Changes in Odonata abundance between 2000 and 2015–2016 in Saga Plain, northern Kyushu, Japan. *Journal of Insect Conservation* 24: 575-583. (in English) ["The impacts of systemic pesticides on biodiversity are a major ecological concern. Rapid population declines of *Sympetrum* species (Odonata: Libellulidae) have been reported in various localities in Japan beginning in the 2000s. Several studies suggested that nursery box use of fipronil in paddy fields to prevent insect feeding on rice seedlings negatively impacts *Sympetrum* larvae. Although several other Odonata species are suspected to have declined significantly in recent decades, accurate evaluations of their population declines and identification of the causes are difficult due to limited data on population density prior to the declines. In addition, a recent study revealed that herbicide use negatively affects phytophilous species, but positively impacts benthic populations of lentic Odonata by reducing the prevalence of macrophytes. To evaluate the changes in the abundance of Odonata during recent decades, we conducted line transect observation of Odonata populations at one site along the Tafusegawa River in Saga Plain, northern Kyushu, Japan in 2000 and 2015–2016, before and after the use of fipronil in paddy fields in this area. We identified that *Sympetrum eroticum eroticum* (Selys) populations have significantly decreased in recent years. In addition, prevalence of a lotic benthic species, *Asiagomphus pryeri* (Selys), has significantly decreased in this time period. Other lotic benthic species have also declined in this area, suggesting that benthic environments might have degraded in recent years. In contrast to the decrease of the abovementioned species, prevalence of the lentic and benthic species *Orthetrum melania melania* (Selys) and *Rhyothemis fuliginosa* Selys significantly increased. The densities of lentic phytophilous species appear to have decreased, suggesting that reduction of macrophytes in surrounding lentic environments could be involved in these changes." (Authors)] Address: Tokuda, M., Lab. Systems Ecology, Fac. Agriculture, Saga Univ., Honjo 1, Saga 840.8502, Japan. E-mail: tokudam@cc.saga.u.ac.jp

18785. Kosterin, O.E. (2020): Odonata of the great Lake Tonle Sap of Cambodia, as examined in 2017/2019. *International Dragonfly Fund - Report 129*: 29-98. (in English) ["Lake Tonle Sap in NW Cambodia is the largest freshwater lake in Southeast Asia and one of the most productive freshwater ecosystems in the world, so its banks are a home for ca 1,5 million people. It serves as a natural reservoir of the excess water of the Mekong River and cyclically changes its area from 2,500 km² in May to 16,000 km² in October. Its banks are naturally occupied by temporarily inundated forest and scrub, at present mostly replaced by rice fields. The present day semiaquatic vegetation of the lake is to a large extent formed by invasive plant species. The hitherto existing data on Odonata of the lake are very scarce. The

author briefly examined the bank and floodplain at the NW part of the lake in February/March 2017, June and November 2018 and December 2019. Five main localities studied are described and illustrated in detail. In total 41 odonate species of four families (22 in Libellulidae) were found. Most of them are common and widespread lentic species but *Macrogomphus phalantus* is a species hitherto known only by few specimens from swamped forests of Borneo and Sumatra; its Tonle Sap population was earlier described by the author as the subspecies *M. phalantus jayavarman* Kosterin, 2019. The earlier published report by Seehausen et al. (2016) of *Sinictinogomphus clavatus* (not found by the author) was a considerable extension of the known species' range to the south. Six species were found in all main examined localities and ten only in one of them. At any season at the lake immediate bank (that is water front at the lowest level), *Brachythemis contaminata* predominates overwhelmingly, *Orthetrum sabina* and *Crocothemis servilia* are numerous, two damselfly species, *Pseudagrion microcephalum* and *P. rubriceps*, invariably occur at floating vegetation (mostly water hyacinth), and *Trithemis pallidinervis*, *Urothemis signata*, *Rhyothemis phyllis*, *R. variegata* and *Tholymis tillarga* are common at bushes. *Agriocnemis nana*, *Ceragrion praetermissum*, *Ischnura senegalensis*, *Macrogomphus phalantus*, and *Aethriamanta aethra* were occasionally met at the lake bank. Other 26 species were found, with different occurrence and quantity, on the lake floodplain. Variation of the male occiput coloration of *Amphiallagma parvum* is commented." (Author)] Address: Oleg E. Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia; Novosibirsk State University, Pirogova str. 2, Novosibirsk, 630090, Russia. Email: kosterin@bionet.nsc.ru

18786. Kosterin, O.E.; Smith, E. (2020): Odonata of Phnom Kulen Mts, Cambodia: a preliminary checklist. *International Dragonfly Fund - Report 129*: 99-183. (in English) ["Phnom Kulen is a small and low plateau in the northern Cambodia still partly covered with evergreen forests and isolated from similar habitats by the Cambodian Lowland at least for 60 km. A preliminary checklist of its Odonata is provided, including 97 species. *Burmagomphus* sp. cf. *willamsoni* and *Macromia callisto* are for the first time reported for Cambodia." (Authors)] Address: Oleg E. Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia; Novosibirsk State University, Pirogova str. 2, Novosibirsk, 630090, Russia. Email: kosterin@bionet.nsc.ru

18787. Kosterin, O.E. (2020): Miscellaneous faunal data on Odonata of Cambodia. *International Dragonfly Fund - Report 154*: 185-223. (in English) ["Miscellaneous faunal data on Odonata are presented from four parts of Cambodia: the Cambodian Plain around Siem Reap (2017/2019), a Phnom Tbeng foothill in Preah Vihear Province (19.06.2018), Monduliri Province (June 2018) and the O'Som village environs in Pursat Province (March 2019). *Macromia flavocolorata* is for the first time reported for Cambodia. Some remarks and interesting observations are provided." (Authors)] Address:

Oleg E. Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Acad. Lavrentyev ave. 10, Novosibirsk, 630090, Russia; Novosibirsk State University, Pirogova str. 2, Novosibirsk, 630090, Russia. Email: kosterin@bionet.nsc.ru

18788. Kosterin, O.E. (2020): First data on Odonata of Prey Long Forest in Cambodian Lowland. International Dragonfly Fund - Report 129: 1-28. (in English) ["Prey Long (Prey Lang) Forest is the largest remaining lowland rainforest in Indochina, shared by Stung Treng, Preah Vihear, Kampong Thom and Kratie Provinces of Cambodia, which has been persisted until present because of the lack of roads. It includes patches of unique evergreen swamp forests. Odonata of Prey Long forest, including Cheum Takong forest swamp, was briefly examined in December 2019, while the already deforested area was examined in June 2018. The former examination resulted in 40 species, the latter in 34 species, 60 species in total. Two species, *Copera chantaburii* Asahina, 1984 and *Burmagomphus williamsoni* Förster, 1914, are for the first time reported for Cambodia from the deforested area (Chey Saen District of Preah Vihear Province). The swamped forest of Cheum Takong provided 17 species, 5 of which were not found elsewhere in the considered area, 3 are rare and 4 generally Sondaic. Prey Long Forest should be reexamined in the rainy season soon after the road to Spong village is constructed." (Author)] Address: Kosterin, O.E., Institute of Cytology & Genetics, Siberian Branch, Russian Acad. Sciences, Lavrentiev Ave 10, 630090 Novosibirsk, Russia. E-mail: kosterin@bionet.nsc.ru

18789. Kosuke, N.; Dai, K.; Hiroyuki, Y.; Taku, K.; Takehiko, I.H. (2020): Investigating effect of climate warming on the population declines of *Sympetrum frequens* during the 1990s in three regions in Japan. Scientific Reports 10(1): 9 pp. (in English) ["Climate warming is of concern as a key factor in the worldwide decline in insect populations. In Japan, numbers of a common dragonfly in rice paddy fields, *S. frequens*, decreased sharply in the 1990s. Because *S. frequens* migrates to cooler mountains in summer, climate warming has been suggested as one of the main causes of the population decline in addition to agronomic factors. Here, we analysed the relation between summer temperatures and population densities of *S. frequens* and the related *S. infuscatum*, which does not migrate to mountains in summer, using published population monitoring data and temperature data from three regions (Toyama, Ishikawa, and Shizuoka) in Japan. Decadal differences in summer temperatures lay within the range of fluctuations among years, suggesting that an increase in summer temperatures cannot explain the past sharp population declines. However, regression analyses using monitoring data from Toyama showed that the population dynamics of both species in autumn are negatively correlated with summer temperatures in the same year. These results suggest that high temperatures in summer directly affect adult mortality to an extent that results in a decrease in population growth." (Authors)] Address: Kosuke, N., National Institute for Environmental Studies, Onogawa 16.2, Tsukuba, Ibaraki 305.8506, Japan. E-mail: nakanishi.kosuke@nies.go.jp

18790. Krause, M.A.; Koster, T.; MacNeill, B.N.; Zydek, D.J.; Ogburn, N.T.; Sharpin, J.; Shell, R.; Lajeunesse, M.J. (2020): Diversity and abundance of dragonflies and damselflies in Tampa Bay, Florida. Florida Entomologist, 103(3): 392-396. (in English) ["Little is known about the community of Odonata in Tampa Bay, Florida, USA. To address this gap, we conducted 2 longitudinal surveys of adult odonates in a natural floodplain of the Hillsborough River in 2013 and 2017. Along with abundance and species diversity, we also measured intraspecific variation in body size, sexual dimorphism, wing-cell asymmetry, and water mite ectoparasitism. Our first weekly survey from Oct 2013 to Oct 2014 sampled 327 adults (230 female, 97 male) from 8 dragonfly species, with *Erythemis simplicicollis* Say representing 79% of captures, followed by the second most abundant (14%), the Florida non-native and neotropical *Miathyria marcella* Selys. Our second weekly survey from Sept to Dec 2017, which focused on both damselflies and dragonflies and captured 205 adults from 8 species, with *Ischnura posita* Hagen being the most abundant with 70% of captures. Female-biased sexual size dimorphism was found in both *E. simplicicollis* and *I. posita*; however, both sexes were equally variable in size and symmetric in a meristic trait. Female and male *M. marcella* were equally variable, monomorphic, and symmetric. Combining symmetry data from each sex, only *I. posita* damselflies were asymmetric overall. Finally, we did not observe any parasitism by larval water mites in either survey. We aim to continue surveys to track seasonal and climate-driven changes in dragonfly diversity and phenology in this region." (Authors)] Address: Krause, Meredith, University of South Florida, Department of Integrative biology, Tampa, Florida 33620, USA; E-mail: meredithk@mail.usf.edu

18791. La Porta, G.; Goretti, E. (2020): Movement and demography of Southern damselfly (*Coenagrion mercuriale*, Odonata) in a Mediterranean lotic ecosystem. Ethology Ecology & Evolution 32(2): 107-121. (in English) [*Coenagrion castellani*; "Home range, routine movement, and dispersal are key factors affecting the population distribution, thus playing a crucial role in spatial dynamics and gene flow. In this regard, detailed investigations on insects require the capture of the specimens and subsequent manipulation. The movement and the abundance of a population of the damselfly *Coenagrion mercuriale* were monitored using the mark-recapture method at a breeding site located in a Mediterranean watercourse in Central Italy. The study area was a transect of 250 m along a ditch, subdivided into five stretches varying from 40 to 70 m each. A total of 849 adults was captured and 210 specimens of them were recaptured on a 17-day survey (from mid-June to early July 2018), corresponding to an estimation of population size of 5,600 specimens. Recapture and survival probabilities revealed no significant effect ensuing from handling and marking with different colours. Specimens of different stretches showed different sedentary rate. The recaptured individuals had a low vagility, with a high proportion of individuals which are incline to philopatry." (Authors)] Address: La Porta, G., Dipto di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Via dell'Elce di Sotto 8, 06123 Perugia, Italy. E-mail:

18792. Lewis, J.H. (2020): Black Beach—not for the birds: The significance of Black Beach, New Brunswick, Canada, as a feeding and stopover site for migratory dragonflies. *Northeastern Naturalist* 27(3): N48-N52. (in English) ["Feeding swarms of dragonflies generally form during prey-accumulation events and can be very large (1000+ individuals), dense, composed of multiple species and both sexes, and persist for hours. In the first published account of such a site from Atlantic Canada, I report the regular, yearly occurrence of large, diverse dragonfly feeding swarms at Black Beach, NB, Canada, in September 2014, 2015, and 2019, and also present the species, sex, and relative ages of specimens collected in swarm surveys. I discuss the significance of Black Beach not only as a feeding site during prey-accumulation events, but also secondarily as a stopover site for migratory species." (Author) *Aeshna canadensis*, *A. clepsydra*, *A. constricta*, *A. interrupta*, *A. sitchensis*, *A. subarctica*, *A. tuberculifera*, *A. umbrosa*, *A. verticalis*, *Anax junius*, *Libellula pulchella*, *Pantala flavescens*, *Somatochlora incurvata*, *S. tenebrosa*, *S. walshii*] Address: Lewis, J.H., Canadian Museum of Nature, 1740 Pink Road, Gatineau, QC J9J 3N7, Canada, and New Brunswick Museum, 277 Douglas Avenue, Saint John, NB E2K 1E5, Canada. E-mail: jlewis3@unb.ca

18793. McLachlan, J.R.; Greig, H.S. (2020): The ecology and distribution of *Stylurus spiniceps* (Walsh, 1862) (Odonata: Gomphidae). *Northeastern Naturalist* 27(3): 434-445. (in English) ["Herein we synthesize the current understanding of the ecology and distribution of a rarely encountered but broadly distributed dragonfly, *S. spiniceps* (Arrow Clubtail), and provide new larval records for Maine. Using published and unpublished sources, we construct an account of the distribution, life history, reproductive ecology, and trophic ecology of the Arrow Clubtail, as well as review conservation concerns for the species. We provide new records for the Arrow Clubtail from an atypical habitat—tidal freshwater wetlands—and discuss the importance of these areas for the species. We highlight gaps in our basic natural history knowledge and provide suggestions for future enquiry that could inform conservation measures for this enigmatic dragonfly." (Authors)] Address: McLachlan, J.R., School Biol. & Ecol., Univ. Maine, ME, 04469, USA. E-mail: jack.mclachlan@maine.edu.

18794. Márquez-Rodríguez, J. (2020): Successful reproduction of dragonflies in an artistic water fountain in Versailles, France. *Revista Chilena de Entomología* 46(2): 329-332. (in English, with Spanish summary) ["Exuvian records of *Aeshna cyanea* and *Sympetrum striolatum* are presented in an urban setting of a megacity, Paris. This is the first record of successful breeding in standing water from a small, untreated fountain in the gardens of the Palace of Versailles (France)." (Author)] Address: Márquez-Rodríguez, J., Zoology. Dept of Physical, Chemical and Natural Systems, Faculty of Experimental Sciences, University of Pablo de Olavide, A-376, Km 1, 41013 Seville, Spain. E-mail: jmarrod1@upo.es

18795. Martynov, A.V. (2020): Some rare damselflies and

dragonflies (Odonata: Zygoptera and Anisoptera) in Ukraine: new records, notes on distribution, and habitat preferences. *Journal of Threatened Taxa* 12(10): 16279-16294. (in English) ["*Coenagrion scitulum*, *Ophiogomphus cecilia*, *Lindenia tetraphylla*, *Cordulegaster boltonii*, *Somatochlora arctica*, *Leucorrhinia albifrons*, *L. caudalis*, and *Selysiothemis nigra* within Ukraine are given. Habitats and distribution of species within the country are briefly discussed. Breeding sites of *C. boltonii* within Ukraine is found for the first time and confirmed with larval material. *S. arctica* is recommended for inclusion in the next edition of the Red Data Book of Ukraine." (Author)] Address: Martynov, A.V., National Museum of Natural History, National Academy of Sciences of Ukraine, B. Khmelnytsky Str., 15, 01601, Kyiv, Ukraine. E-mail: martynov_av@ukr.net, centroptilium@gmail.com

18796. Mogali, S.M.; Saidapur, S.K.; Shanbhag, B.A. (2020): Behavioral responses of tadpoles of *Duttaphrynus melanostictus* (Anura: Bufonidae) to cues of starved and fed dragonfly larvae. *Phyllomedusa* 19(1): 93-98. (in Defense behavior, dietary cues, kairomones, *Pantala flavescens*, predator-prey interactions, tadpoles, Wandering Glider.) ["Tadpoles of *Duttaphrynus melanostictus* use chemoreception to detect kairomonal cues and excretory metabolites from predatory anuran tadpoles (*Hoplobatrachus tigerinus*) that consume them. We describe here the behavioral responses of tadpoles of *D. melanostictus* to predatory dragonfly larvae (*Pantala flavescens*). The predator's kairomones (water conditioned by the starved predator) or its diet-derived metabolites released in excreta of predator after consumption of conspecific prey tadpoles were used to simulate predation risk. The tadpoles of *D. melanostictus* had no behavioral response to predator kairomones. However, the larvae reduced swimming movements and overall time spent in swimming, and had a higher burst speed/swimming velocity in response to water borne cues released from the excreta of predators fed conspecific prey. Thus, just the presence of dragonfly larvae does not elicit defense behaviors in tadpoles of *D. melanostictus*, but when predation risk is recognized as real (i.e., when tadpoles are exposed to excretory metabolites of predators fed conspecific tadpoles), defense behaviors are activated." (Authors)] Address: Mogali, S.M., Department of Zoology, Karnatak University, Dharwad-580 003, Karnataka State, India. E-mail: santoshmogali@rediffmail.com.

18797. Moon, M.Y.; Chang, W.J.; Lee, D.-S.; Lee, D.-Y.; Hwang, S.J.; Noh, S.-Y.; Kwak, I.-S.; Park, Y.-S. (2020): Characterizing responses of biological trait and functional diversity of benthic macroinvertebrates to environmental variables to develop aquatic ecosystem health assessment index. *Korean Journal of Ecology and Environment* 53(1): 31-45. (in Korean, with English summary) ["The biological indices based on the community structure with species richness and/or abundance are commonly used to assess aquatic ecosystem health. Meanwhile, recently functional traits-based approach is considered in ecosystem health assessment to reflect ecosystem functioning. In this study, we

developed a database of biological traits for 136 taxa consisting of major stream insects (Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, and Odonata) collected at Korean streams on the nationwide scale. In addition, we obtained environmental variables in five categories (geography, climate, land use, hydrology and physicochemistry) measured at each sampling site. We evaluated the relationships between community indices based on taxonomic diversity and functional diversity estimated from biological traits. We classified sampling sites based on similarities of their environmental variables and evaluated relations between clusters of sampling sites and diversity indices and biological traits. Our results showed that functional diversity was highly correlated with Shannon diversity index and species richness. The six clusters of sampling sites defined by a hierarchical cluster analysis reflected differences of their environmental variables. Samples in cluster 1 were mostly from high altitude areas, whereas samples in cluster 6 were from lowland areas. Non-metric multidimensional scaling (NMDS) displayed similar patterns with cluster analysis and presented variation of taxonomic diversity and functional diversity. Based on NMDS and community-weighted mean trait value matrix, species in clusters 1-3 displayed the resistance strategy in the life history strategy to the environmental variables whereas species in clusters 4-6 presented the resilience strategy. These results suggest that functional diversity can complement the biological monitoring assessment based on taxonomic diversity and can be used as biological monitoring assessment tool reflecting changes of ecosystem functioning responding to environmental changes." (Authors)] Address: Park, Y.-S., Dept Life & Nanopharmaceutical Sciences, Kyung Hee University, Dongdaemun-gu, Seoul 02447, Republic of Korea

18798. Moroz, M.D.; Lipinskaya, T.P. (2020): Aboriginal and alien species of macrozoobenthos in watercourses of the Belarusian part of the Central European Invasive Corridor. *Hydrobiological Journal* 56(4): 19-32. (in English) ["The watercourses of the Central European Invasive Corridor were studied in 2016-2017. On the whole, 166 LIT (the lowest identified taxa) of macrozoobenthos of three types were found in the studied watercourses. Annelida were represented by 9 LIT, Mollusca - 34, whereas Arthropoda - by 123 LIT. Among them, 13 alien species included 3 representatives of Mollusca, 8 species of Amphipoda, 1 species of Mysidacea, and 1 species of Decapoda. The largest number of alien species was registered in the lower reaches of the Pripyat River, where they were most abundant. New localities of *Faxonius limosus* (Rafinesque, 1817), and also of *Anax imperator* Leach, 1815 and *Brachytron pratense* (Müller, 1764), belonging to the protected species within the territory of Belarus were found in the studied watercourses." (Authors)] Address: Moroz, M.D., Scientific & Practical Center on Bioresources National Academy of Sciences of Belarus Minsk, Belarus

18799. Motta, L.; Barrios-Garcia, M.N.; Ballari, S.A.; Rodriguez-Cabal, M.A. (2020): Cross-ecosystem impacts of non-

native ungulates on wetland communities. *Biological Invasions* 22: 3283-3291. (in English) ["Herbivory by non-native species can create strong direct and indirect effects on plant and arthropods communities that can potentially cross ecosystem boundaries. Yet, the cross-ecosystems impacts of non-native species are poorly understood. We took advantage of ongoing invasions by non-native ungulates in Patagonia, Argentina, to examine their cross-ecosystem impacts on water parameters, littoral vegetation and aquatic macroinvertebrate assemblages in wetlands. We found a gradient of invasion by non-native ungulates from intact (non-invaded) to highly invaded wetlands. These highly invaded wetlands had ~ 24% less vegetation cover, which was 72% shorter in height than vegetation in intact wetlands. As a result, the abundance of predatory macroinvertebrates such as Odonata was reduced by ~ 90%; while Diptera were ~ 170% more abundant, and Oligochaeta were recorded mostly at invaded sites. In contrast, we did not find evidence that non-native ungulates altered water parameters. Understanding the indirect consequences of invasive non-native species is crucial for quantifying the real impacts of global change. Our results show strong cross-ecosystem impacts of non-native ungulates on macroinvertebrate wetland communities, highlighting the importance of indirect interactions beyond ecosystem boundaries." (Authors)] Address: Motta, Luciana, Grupo de Ecología de Invasiones, INIBIOMA – CONICET, Universidad Nacional del Comahue, Av. de los Pioneros 2350, CP. 8400, Bariloche, Rio Negro, Argentina

18800. Mujumdar, N.; Sawant, D.; Sumanapala, A.; Rangnekar, P.; Koparde, P. (2020): Rapid multi-taxa assessment around Dhamapur Lake (Sindhudurg, Maharashtra, India) using citizen science reveals significant odonate records. *Journal of Threatened Taxa* 12(13): 16795-16818. (in English) ["In the present work, we discuss the results of a four-day long rapid survey around Dhamapur Lake and surrounding freshwater habitats in the Sindhudurg District of Maharashtra through public participation. In total, 61 odonates, 51 butterflies, 17 species of amphibians and reptiles, 90 birds, and four mammals are documented. Our observations taken over a brief time reflect the importance of citizen science in documenting local biodiversity. We report involvement of citizen scientists in recovering significant odonate records for the state." (Authors) The following taxa are discussed in detail: *Lestes praemorsus decipiens* Kirby, 1894, *Platylestes cf. platystylus* (Rambur, 1842), *Pseudagrion malabaricum* Fraser, 1924, *Gynacantha cf. khasiaca* and *Indothemis limbata* ssp. *nov.* Campion, 1923.] Address: Mujumdar, N., Bombay Natural History Society, Hornbill House, Opp. Lion Gate, Shaheed Bhagat Singh Road, Colaba, Mumbai, Maharashtra 400001, India. E-mail: n.mujumdar@bnhs.org

18801. Ngo, C.D.; Le, P.L.T.; Nguyen, H.D.; Truong, P.B.; Hoang, N.T.; Ngo B.V. (2020): Diet of the Bronze Skink *Eutropis macularius* (Reptilia: Squamata: Scincidae) from Thua Thien Hue Province, Central Vietnam. *Russian Journal of Herpetology* 27(4): 209-216. (in English) ["In this study, we examined the diet of 149 males and 147 females of *Eutropis macularius* from Thua Thien Hue Province, central Vietnam

using a nonlethal stomach-flushing technique. The prey items of *E. macularius* composed of Araneae, Insecta (Blattodea, Coleoptera, Hymenoptera, Isoptera, Odonata, and Orthoptera), Mollusca (Philomycidae), and plant materials. The most important prey items were insect larvae, hymenopterans (including ants), grasshoppers, and termites, for both sexes in three populations. Plant materials were also found in the stomach of *E. macularius* with an index of relative importance of 7.19%, suggesting that *E. macularius* is an omnivorous species. However, the dominant prey categories of *E. macularius* were insects, including insect larvae, hymenopterans, grasshoppers, and termites, with many small, sedentary, clumped prey items. Simpson's heterogeneity index of skinks from three populations from Bach Ma National Park as well as from Aluoi and Huong Tra districts were 10.07, 7.85, 3.94, respectively. *Eutropis macularius* showed significant positive correlations between mouth width (MW) and prey width ($P = 0.001$) and between MW and prey volume ($P < 0.0001$). There are significant positive correlations between snout-vent length (SVL) and prey sizes consumed: between SVL and prey length, $P < 0.0001$; SVL and prey width, $P < 0.0001$; and between SVL and prey volume, $P < 0.0001$. These results indicated that SVL and MW are the limiting factors on the size of prey consumed in this skink." (Authors)] Address: Ngo B.V., Dept of Biology, University of Education, Hue University, 34 Le Loi Road, Hue, Vietnam. E-mail: ngovanbinh@dhsphue.edu.vn

18802. Okude, G.; Fukatsu, T.; Futahashi, R. (2020): Interspecific crossing between blue-tailed damselflies *Ischnura elegans* and *I. senegalensis* in the laboratory. *Entomological Science* 23: 165-172. (in English) ["*Ischnura* species are among the most common damselflies in the world, which often exhibit female color polymorphisms. One morph, called androchrome, is similar to males in its color pattern, whereas the other morphs, generally referred to as gynochromes, exhibit female-specific colors. In several *Ischnura* species, the female polymorphism is heritable, although molecular and genetic mechanisms remain largely unknown. The dominant-recessive patterns of the female color morphs may differ between species. For example, androchromic females are dominant to gynochromic females in *Ischnura elegans*, whereas androchromic females are recessive in *Ischnura senegalensis*. Here we report a case of interspecific hybridization between a gynochrome female of *I. elegans* and a male of *I. senegalensis* in the laboratory. We obtained 61 hybrid adult offspring, of which all 31 females were of gynochrome morph. DNA analyses of the hybrids confirmed that nuclear DNA sequences were derived from both parent species, whereas mitochondrial DNA sequences were maternally inherited. In the hybrids, the post-ocular spots of female heads, the shape of male appendages, and the color of female's cerci resembled those of *I. elegans*, whereas the size of abdominal blue spots was similar to that of *I. senegalensis*. The shape of prothorax and basal abdominal markings were intermediate in females. The larval developmental traits and the morphological changes in the final larval instar of the hybrids were similar to those of *I. senegalensis*. To our knowledge, this is the first

report of hybrids between two damselfly species with different dominant-recessive patterns of female color morphs." (Authors)] Address: Futahashi, R., Bioproduction Res. Inst., National Institute of Advanced Industrial Science and Technology (AIST), Central building 6th, 1-1-1 Higashi, Tsukuba, Ibaraki 305-8566, Japan. Email: ryo-futahashi@aist.go.jp

18803. Okur, Y. & Salur, A. (2020): A study on Odonata larvae inhabiting Burdur and Isparta provinces. *Munis Entomology & Zoology* 15(2): 565-571. (in English) ["In this study, 200 larvae samples collected from different localities and habitats in the provinces of Burdur and Isparta (Turkey) between 2000 and 2002 were identified. These specimens belonging to 7 families, 14 genera and 17 species and 3 subspecies. In addition, characteristic and habitat information of the identified species are given in the text." (Authors)] Address: Salur, A., Hitit University, Faculty of Arts and Sciences, Biology, Çorum, Turkey. E-mail: alisalur@hitit.edu.tr

18804. Palacino-Rodríguez, F.; Altamiranda-Saavedra, M.; Palacino, D.A.; Penagos, A.C. (2020): Ecology of *Mesamphiagrion laterale* (Odonata: Coenagrionidae): abundance, reproduction and interactions with co-occurring species. *International Journal of Odonatology* 23(2): 165-182. (in English) ["The behavior of *M. laterale* (Selys, 1876) is described based upon 2430 hours of observation. A total of 2820 individuals were observed for 270 days from 2014 to 2015 using mark-recapture. Probabilities of resight, highest reproductive activity, time-perch and time of perch-temperature were statistically analyzed. *Mesamphiagrion laterale* is not a territorial species, the individuals perch on grass, trees, garbage, ground, and rocks, they feed on hemipterans, mosquitoes, spiders and other damselflies, and are prey to spiders and birds. Conspecific siege and interspecific interactions by perch were observed. No courtship was observed. During tandem, which lasted for 3–90 min, the ventral side of the male's abdominal segment 2 was in contact with the female's abdominal segments 8–10 until a wheel was formed. We observed three tandem pair combinations: sexually mature males and females, immature males with mature females, and immature males and females. While copulation lasted from 7 to 20 min, oviposition lasted from 12 to 15 min. Irrespective of male presence, oviposition occurred in submerged or emerged areas of *Eichornia crassipes*. We recorded the highest reproductive activity between 12:00 and 12:35 (Colombia Time-COT, UTC-5). Above 20°C, a larger perching area close to the water allows more reproductive events. However, a more extensive canopy cover impedes achieving optimal reproductive temperatures. Species interactions within this community may be explained by temporal and spatial niche partitioning." (Authors)] Address: Palacino-Rodríguez, F., Biology Research Group (GRIB), Dept of Biology, Universidad El Bosque, Bogotá, Colombia. Email: palazinofredy@unbosque.edu.co

18805. Pawlak, S. (2020): Records of dragonflies (Odonata) in the vicinity of Wieruszów (Łódź Province) in 2017-2020. *Odonatrix* 1616 (2020): 34 pp. (in Polish, with English summary) ["The present report provides information on 53

species of dragonflies recorded in 2017-2020 at 69 sites near Wieruszów (Łódź Province). They include protected and/or endangered species such as *Nehalennia speciosa*, *Ophiogomphus cecilia*, *Aeshna viridis*, *Orthetrum coerulescens*, *Leucorrhinia dubia*, *L. pectoralis* and *Sympetrum depressiusculum*. Southern species were also recorded: *Aeshna affinis*, *Anax ephippiger*, *Orthetrum albistylum*, *Sympetrum fonscolombii*, *S. meridionale* and *Crocothemis erythraea*." (Author)] Address: Pawlak, S., ul. Konopnickiej 15, 98-400 Wieruszów, Poland. E-mail: slawieru@interia.pl

18806. Pierce, A.J.; Makbun, N. (2020): First record of *Gynacantha limbalis* Karsch, 1892 from Thailand (Odonata: Anisoptera: Aeshnidae). *Songklanakarin J. Sci. Technol.* 42(5): 965-966. (in English) ["*G. limbalis* is reported for the first time (7-IV- 2019) from Thailand based on photographs taken at San Kala Khiri National Park, Songkhla province. This extends the northern limit of the species and increases the number of *Gynacantha* species recorded in Thailand to nine." (Authors)] Address: Makbun, N., 211/5 Moo 4, Takhli, Nakhon Sawan, 60140 Thailand. E-mail: noppadon.makbun@gmail.com

18807. Pinkert, S.; Zeuss, D.; Dijkstra, K.-D. B.; Kipping, J.; Clausnitzer, V.; Brunzel, S.; Brandl, R. (2020): Climate–diversity relationships underlying cross-taxon diversity of the African fauna and their implications for conservation. *Diversity and Distributions* 26(10): 1330-1342. (in English) ["Many taxa show remarkable similarities in their diversity patterns, and these similarities are commonly used to define large-scale conservation priorities. Here, we investigated the relative importance of contemporary climate and climate change since the Last Glacial Maximum for determining the species richness and rarity patterns of four animal taxa. We assessed the extent to which diversity patterns are congruent across taxa because of similar responses to these climatic aspects, and we identify regions that are disproportionately diverse due to their palaeoclimatic stability. Location: Sub-Saharan Africa. Time period: LGM–contemporary. Major taxa studied: Mammal, bird, amphibian and dragonfly species. Methods: Diversity patterns were predicted based on their relationships with contemporary climate and Quaternary climate change, respectively. Climate–diversity relationships were modelled with and without accounting for spatial autocorrelation. For raw and predicted diversity patterns, cross-taxon congruence and the coverage of diversity hotspots by protected areas were determined. Results: Species richness and rarity of all taxa increased with increasing temperature and precipitation, but also with increasing palaeoclimatic stability. Cross-taxon congruence was higher for predictions based on contemporary climate than for predictions based on Quaternary climate change. Protected areas covered 17%–37% of the species richness and rarity hotspots and approximately 6% fewer hotspots of the underlying signatures of Quaternary climate change (i.e. biodiversity refugia). Main conclusions: Both contemporary climate and past climatic changes strongly affect species richness and rarity patterns. However, whereas contemporary climate–diversity relationships are largely congruent across

taxa, signatures of Quaternary climate change differ among taxa. Furthermore, protected areas emphasize regions with high species richness and rarity but fewer biodiversity refugia—even less than expected by random placement (<21%). Our results highlight the importance of historical factors for shaping large-scale diversity patterns and the potential of using palaeoclimatic stability–diversity relationships for identifying important conservation areas at the global scale." (Authors)] Address: Kipping, J., BioCart Ökologische Gutachten, Taucha/Leipzig, Germany. E-mail: biocartkippping@email.de

18808. Pires, A.; Drumm Müller, N.F.; Stenert, C.; Maltchik, L. (2020): Influence of different riparian vegetation widths and substrate types on the communities of larval Odonata (Insecta) in southern Brazilian streams. *Acta Limnologica Brasiliensia* 32 e301: 16 pp. (in English, with Portuguese summary) ["Aim: We assessed the influence of substrate type and categories of riparian vegetation widths on the community structure of Odonata (Insecta) in southern Brazilian streams. Methods: Sampling took place in twelve stream reaches differing in their riparian vegetation widths (from more than 40 m up to less than 5 m). Larval odonates were collected in inorganic (stone and gravel) and organic (leaf litter) substrates at each stream reach. Differences in Odonata composition among substrates and categories of riparian vegetation width were tested using PERMANOVA and visualized with ordination diagrams. In addition, we assessed the influence of riparian vegetation width taking into account two levels of resolutions: fine (four categories: > 40 m, 30-15 m, 15-5 m and < 5 m) and coarse (narrower and broader than 15 m). Results: Odonata composition differed more strongly according to substrate type regardless of the level of resolution. Organic substrate (litter) had different composition and higher richness than inorganic ones. Odonata composition significantly differed between riparian vegetation widths at the coarser level of resolution (narrower and broader than 15 m); at the coarser level, the interaction between substrate and riparian widths was significant, with the composition from litter substrate in broader widths differing from stone and gravel in narrower widths. Conclusions: The composition of odonate larvae responded to the major reductions in riparian widths (above > 15 m), indicating that reductions above this level are enough to affect the community structure of Odonata. Additionally, the different composition of Odonata in organic substrates in broader riparian vegetation widths compared to inorganic substrates in narrower widths indicate a complex relationship between riparian vegetation and substrate in the assembly of insect communities in southern Brazilian forest streams. The interaction between riparian vegetation widths and substrate suggests that the effects of reductions in riparian widths on Odonata composition are not similar across substrate types." (Authors)] Address: Pires, M.M., Laboratório de Ecologia e Conservação de Ecossistemas Aquáticos, Universidade do Vale do Rio dos Sinos – UNISINOS, Av. Unisinos, 950, CEP 93022-750, São Leopoldo, RS, Brasil

18809. Potapov, G.S.; Kolosova, Y.S.; Gofarov, M.Y.; Bolotov, I.N. (2020): Dragonflies and damselflies (Odonata) from Flores Island, Lesser Sunda Archipelago: New occurrences in extreme environments and an island-level checklist of this group. *Ecologica Montenegrina* 35: 5-25. (in English) ["Although the Odonata are common inhabitants of various extreme environments such as geothermal springs, brackish wetlands, mangroves, and volcanic lakes, the assemblages of this group associated with extreme habitats in Australasia are rather poorly known. Here, we combine museum collection data and published reports on Odonata from extreme habitats on Flores Island, Lesser Sunda Archipelago. The highly acidic Sano Nggoang Crater Lake (mean pH = 3.17) on Flores houses seven species as follows: *Agriocnemis pygmaea*, *Xiphiagrion cyanomelas*, *Neurothemis ramburii*, *Orthetrum pruinatum pruinatum*, *O. sabina*, *O. testaceum soembanum*, and *Anax gibbosulus*. A coastal marsh site with slightly brackish water on Flores harbors at least five dragonfly species as follows: *Diplacodes trivialis*, *Neurothemis intermedia excelsa*, *N. terminata*, *Pantala flavescens*, and *Rhyothemis phyllis ixias*. The migratory dragonfly *Pantala flavescens* was a single species recorded on the waterless Kanawa Island near the western edge of Flores. Our findings suggest that extreme habitats in eastern Indonesia primarily colonized by widespread generalist Odonata species. Finally, an updated checklist of Odonata species recorded from Flores Island was compiled. Our survey of museum specimens recovered two species not found on existing species lists for Flores: *N. intermedia excelsa* and *P. flavescens*." (Authors)] Address: Potapov, G.S., N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences Russian Federation

18810. Pouillon, J.-M.; Nel, A. (2020): The oldest representative of the modern clade Aeshnodea from the Lower Cretaceous Crato Formation, Araripe Basin, NE Brazil (Odonata: Anisoptera). *Cretaceous Research* 116, 104580: (in English) ["The hawker dragonfly *Primumaeshna britta* gen. et sp. nov., type genus and species of the new family *Primumaeshnidae*, is described from the Lower Cretaceous Crato Formation in Brazil, corresponding to the oldest record of the clade Aeshnodea. The previously described representatives of the Aeshnoptera from this formation belonged to extinct families or to the *Gomphaeschnidae*. Otherwise the oldest Aeshnodea were previously only known from the Cenomanian. This new discovery confirms that the diversification of the modern lineages of hawker dragonflies occurred during the Early Cretaceous." (Authors)] Address: Nel, A., Lab. Ent., Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@cimrs1.mnhn.fr

18811. Pramual, P.; Thane, I.; Uttaruk, Y.; Thajjarern, J.; & Wongpakam, K. (2020): Efficiency of DNA barcodes for identification and documenting aquatic insect diversity in rice fields. *Tropical Natural History* 20(2): 169-181. (in English) ["Rapid and accurate identifications are crucial for biodiversity assessment. Yet, traditional methods for species identification have some limitations. In this study, we tested

the efficiency of mitochondrial cytochrome c oxidase I barcoding sequences for species identification and documenting diversity of aquatic insects in the rice fields of Thailand. Considerable success rate (80%) for species identification was found among the species of the order Odonata. Unidentifiable specimens of immatures were successfully associated with conspecific adults or by matching with reference sequences in the public DNA barcoding library. However, some specimens were ambiguous, possibly due to incomplete lineage sorting of closely related species or erroneous identification of the sequences in the public database. The technique was less successful for other insect orders because a lack of reference sequences in the DNA barcode library limits the utility of DNA barcoding. The Poisson tree process and Automatic Barcode Gap Discovery species delimitations revealed that the number of species recognized is more than twice that based on morphological identification. Therefore, DNA barcoding has potential for use in species identification and biodiversity assessment of the aquatic insects in the rice field ecosystem." (Authors)] Address: Pramual, P., Department of Biology, Faculty of Science, Mahasarakham University, Maha Sarakham 44150, Thailand

18812. Prasad, P.K.; Shinad, K.; Sherin, C.; Arusha, K. (2020): Studies on the life cycle of *Pleurogenoides wayanadensis* Shinad & Prasad, 2018 (Digenea: Pleurogenidae) from the Western Ghats, India. *Journal of Helminthology* 94 e196: 10 pp. (in English) ["The life cycle of *Pleurogenoides wayanadensis* Shinad & Prasad, 2018, infecting the frogs *Hoplobatrachus tigerinus* and *Euphlyctis cyanophlyctis*, is elucidated in this study. All the life cycle stages from egg to egg-producing adults were elucidated under natural conditions and successfully established in the laboratory. The life cycle took about 58 to 65 days for completion. Miracidia were released by teasing the eggs with fine needles. Sporocysts were found in the freshwater snail, *Bithynia (Digoniostoma) pulchella*, collected from paddy fields at Payode, Western Ghats, Wayanad region, in the months of October and November 2019. Cercariae were of the virgulate xiphidiocercous type. Metacercariae were recovered from the eyes of the damselfly naiads of the species *Ischnura* sp. and *Copera* sp., and the thorax and abdomen of the dragonfly naiads, *Orthetrum* sp. The metacercariae showed progenetic development. The growth and development of the metacercariae in the naiads that were exposed to cercariae, and development of the trematode in frogs that were force-fed with encysted metacercariae, have been studied at regular intervals. The prepatent period is 14–19 days. The present life cycle study of a *Pleurogenoides* spp. forms the seventh report from the world, fourth report from India and the third from Kerala." (Authors)] Address: P.K. Prasad, E-mail: prasadpank@kannuruniv.ac.in

18813. Rafael, J.A.; Limeira-de-Oliveira, F.; Hutchings, R.W.; (74 authors) (2020): Insect (Hexapoda) diversity in the oceanic archipelago of Fernando de Noronha, Brazil: updated taxonomic checklist and new records. *Revista Brasileira de Entomologia* 64(3):e20200052, 2020: 27 pp. (in English) ["Hexapods, commonly known as insects, are a neglected

taxonomic group in the Fernando de Noronha archipelago, with unanswered questions about their species richness and the ecological processes in which they are involved (e.g., colonization, introduction, establishment, and extinction). Herein, we provide an updated Hexapod checklist with current nomenclatural combinations. The entomofauna of the Fernando de Noronha archipelago is currently composed of 453 species in 21 orders. The orders, and their respective number of species, are: Blattaria (9), Coleoptera (118), Collembola (29), Dermaptera (3), Diplura (1), Diptera (134), Embioptera (1), Hemiptera (29), Hymenoptera (59), Isoptera (2), Lepidoptera (25), Mantodea (1), Neuroptera (3), Odonata (5), Orthoptera (11), Phasmatodea (1), Phthiraptera (6), Psocoptera (3), Siphonaptera (1), Thysanoptera (10), and Zygentoma (2). The archipelago has 263 new taxon records (family + genera + species). Thirty-eight species (3.39%) were described from local specimens and most of them are likely endemic species. This study more than doubles our knowledge (from the previous 190 records) of the entomofauna in this large Brazilian archipelago. This study also provides a baseline for studies on its conservation status and for implementing future environmental management programs." (Authors) Odonata [Responsible: A.P. Pinto] are represented by *Ischnura capreolus* (Hagen, 1861), *Erythemis vesiculosa* (Fabricius, 1775), *Miathyria marcella* (Selys in Sagra, 1857), *Pantala flavescens* (Fabricius, 1798), *Tremea basalis* (Burmeister, 1839). "Remarks. *Libellula basalis* Burmeister, 1839 is currently considered a synonym of *Tremea abdominalis* (Rambur, 1842). The identity of the species cited by Kirby (1890) as *Tremea basalis* (Burmeister, 1839) and transcribed by Alvarenga (1962) cannot be ascertained without examination of specimens from Ridley's expedition housed in the NHMUK, due to nomenclatural confusion and ambiguities about the identity of at least three current valid species, i.e., *T. abdominalis*, *T. binotata* (Rambur, 1842) and *T. cophysa* Hagen, 1867 (Calvert, 1906a; Ris, 1913). They are all widespread species in the Western Hemisphere. Furthermore, a species described in the 19th century, *Libellula basalis* Burmeister, 1839, was a homonym of two other species, and later on *L. basalis* Burmeister was synonymized with *T. cophysa* (Calvert, 1906a; but see Calvert, 1906b). In his revision of Libellulidae, Ris (1913) synonymized *Libellula basalis* Burmeister with *T. abdominalis* and mentioned the material from Fernando de Noronha as a synonym for *T. cophysa* (due to a misidentification by W. Kirby) based on the study by Kirby (1897). Decades later, De Marmels and Racenis (1982) included Kirby's (1897) *T. basalis* in the synonymy of *Tremea calverti* Muttkowski, 1910. Therefore, because neither Ris (1913) or De Marmels and Racenis (1982) cited Kirby's (1890) original study, and it is unclear if they examined those specimens, this Fernando de Noronha record is left identified only to genus level until the original material can be studied." Address: Rafael, J.A., Instituto Nacional de Pesquisas da Amazônia, Coordenação de Biodiversidade, Manaus, AM, Brazil. E-mail: jarafael@inpa.gov.br

18814. Rehman, A.; Ahmad, S.; Zia, A.; Ali, A.; Shahjeer, K.; Latif, A.; Khan, T. (2020): Dragonflies (Anisoptera: Odonata)

fauna of district Swabi Khyber Pakhtunkhwa, Pakistan. *Sarhad Journal of Agriculture* 36(2): 675-684. (in English) ["Current study was conducted in order to explore the dragonflies fauna in District Swabi of Khyber Pakhtunkhwa, Pakistan. A comprehensive field survey was conducted to collect dragonfly adults using aerial nets. 19 sites of District Swabi were surveyed during summer seasons of 2015 and 2016. The study revealed 23 species from 15 genera under 3 families. Libellulidae comprised of 19 species belonging to 11 genera, Gomphidae included 3 species belonging to 3 genera and Aeshnidae included one species. Detailed description of each species, valid scientific names, their habitat, ecological observation, collection date and distributional range for all recorded species are provided. ... *Ictinogomphus angulosus*, *Burmogomphus sivalikensis*, *Zygomma petiolatum* were recorded for the first time from district Swabi as well as Khyber Pakhtunkhwa" (Authors)] Address: Rehman, A., Department of Entomology, Faculty of Crop Protection Sciences, Univ. of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan

18815. Reis dos Santos, M.; Saito, V.S.; Zaitune Pamplin, P.A.; Pereira, A.A.; Fonseca-Gessner, A.A. (2020): Pollution tolerance, flight capacity and natural history explain meta-community structure in high-altitude stream insects. *Acta Limnologica Brasiliensia* 32: 14 pp. (in English, with Portuguese summary) ["Aim: To test how different taxonomic and functional groups of aquatic insects from high-altitude streams respond to environmental and spatial gradients at multiple scales in Southeast of Brazil. Methods: Specimens were collected in 26 high-altitude streams distributed over a gradient of previously defined environmental quality. The taxonomic identification was made at the genus level and the functional classification was based on traits of flight capacity and pollution tolerance compiled from specific literature. We obtained local in situ data (limnological, sediments, and organic matter), as well as calculated land use at the riparian and drainage basin scale. A variation partitioning approach was used to explain species composition based on different response matrices deconstructed by both taxonomic groups and functional traits. The explanatory matrices encompassed environmental variables at three spatial scales and spatial variables extracted from Principal Components of Neighbor Matrices analysis. A linear model was applied to verify the possible correlation between spatial and environmental components." (Authors)] Address: Reis dos Santos, Mireile, Programa de Pós-graduação em Ecologia e Recursos – PPGERN, Laboratório de Ecologia de Insetos Aquáticos, Universidade Federal de São Carlos – UFSCar, Rod. Washington Luís, Km 235, SP-310, CEP 13565-905, São Carlos, SP, Brasil

18816. Renjith, R.V.; Chandran, V. (2020): A record of gynandromorphism in the libellulid dragonfly *Crocothemis servilia* (Insecta: Odonata) from India. *Journal of Threatened Taxa* 12(9): 16183-16186. (in English) ["At Puzhakkal region of the Kole wetlands (10.5400N & 76.1720E), an individual of *Crocothemis servilia* that looked part male and part

female was photographed during the survey." (Authors)] Address: Chandran, V., Dept of Geology & Environmental Science, Christ College, Irinjalakuda, Thrissur, Kerala 680125, India. E-mail: avivekchandran@gmail.com

18817. Renner, S.; Schmidt Dalzochio, M.; Périco, E.; Sah-lén, G.; Suhonen, J. (2020): Odonate species occupancy frequency distribution and abundance–occupancy relationship patterns in temporal and permanent water bodies in a subtropical area. *Ecology & Evolution* 10(14): 7525-7536. (in English) ["This paper investigates species richness and species occupancy frequency distributions (SOFD) as well as patterns of abundance–occupancy relationship (SAOR) in Odonata (dragonflies and damselflies) in a subtropical area. A total of 82 species and 1983 individuals were noted from 73 permanent and temporal water bodies (lakes and ponds) in the Pampa biome in southern Brazil. Odonate species occupancy ranged from 1 to 54. There were few widely distributed generalist species and several specialist species with a restricted distribution. About 70% of the species occurred in <10% of the water bodies, yielding a surprisingly high number of rare species, often making up the majority of the communities. No difference in species richness was found between temporal and permanent water bodies. Both temporal and permanent water bodies had odonate assemblages that fitted best with the unimodal satellite SOFD pattern. It seems that unimodal satellite SOFD pattern frequently occurred in the aquatic habitats. The SAOR pattern was positive and did not differ between permanent and temporal water bodies. Our results are consistent with a niche-based model rather than a metapopulation dynamic model." (Authors)] Address: Renner, S., Lab. Ecol. e Evol., Univ. do Vale do Taquari – UNIVATES, Rua Avelino Tallini, 171 Bairro, Universitário, Lajeado RS 95900-00, Brazil. E-mail: samuelrenner@hotmail.com

18818. Rewicz, T.; Móra, A.; Tonczyk, G.; Szymczak, A.; Grabowski, M.; Calleja, E.J.; Perneckner, B.; Csabai, Z. (2020): First records raise questions: DNA barcoding of Odonata in the middle of the Mediterranean. *Genome* 64(3): 196-206. (in English, with French summary) ["We present the results of the first-ever DNA barcoding study of odonates from the Maltese Islands. In total, ten morphologically identified species were collected during a two-week long expedition in 2018. 80 cytochrome c oxidase subunit I (COI) barcodes were obtained from the collected specimens. Intra- and interspecific distances ranged from 0% to 2.24% and 0.48% to 17.62%, respectively. Successful species identification based on ascribing a single morphological species to a single Barcode Index Number (BIN) was achieved for eight species (80%). In the case of two species, *Ischnura genei* and *Anax parthenope*, BINs were shared with other closely related species. The taxonomic status of *I. genei* is questionable and the phylogenetic relationship between *A. imperator*/*parthenope* is not clear. Further studies involving a series of adult specimens collected in a wide spatial range and nuclear markers are necessary to resolve these cases. Therefore, this dataset serves as an initial DNA barcode reference library

for Maltese odonates, within a larger project: Aquatic Macro-invertebrates DNA Barcode Library of Malta." (Authors)] Address: Rewicz, T., Univ. Guelph, Centre Biodiv. Genomics, Guelph, Ontario, Canada

18819. Riefani, M.K.; Badruzsaufari; Dharmono (2020): The practicality of Odonata handout in invertebrate zoology course. *Journal of Physics: Conf. Series* 1422: 9 pp. (in English) ["Wetlands around the University of Lambung Mangkurat (ULM) Banjarmasin has been the habitat for Odonata. It has the potential to be utilized as a learning resource. A handout is one of the effective learning resources to achieve learning goals. Researchers created a handout to facilitate students to learn about the diversity and activities of Odonata at the wetlands around ULM Banjarmasin. This study aims to describe practicality of the Odonata handout. Research and development of handouts are based on Borg and Gall development model. This research was conducted in ULM Banjarmasin. The research subjects included three expert validation, nine students for small readability tests, and 18 students for small-scale field trials. Data analysis uses descriptive categorical techniques. The practicality of handout is indicated by students' activity and students' responses after they use handouts. The handouts based on students' activity showed very high activity and showed a very strong positive response." (Authors)] Address: Riefani, M.K. Biology Education Dept, Fac. of Teacher & Training Education, Univ. Lambung Mangkurat, Jl. Brigjen Hasan Basry 87 Banjarmasin, South Kalimantan, Indonesia. E-mail: maulanakhalidriefani@gmail.com

18820. Rison, K.J.; Chandran, A.V. (2020): Observations of the damselfly *Platylestes cf. platystylus* Rambur, 1842 (Insecta: Odonata: Zygoptera: Lestidae) from peninsular India. *Journal of Threatened Taxa* 12(10): 16392-16395. (in English) [India, Thommana region (10.342°N & 76.250°E) of the Kole wetlands and Thumboor (10.297°N & 76.256°E) & Uppungal region (10.692°N & 75.997°E); morphological descriptions of male and female are given.] Address: Rison, K.J., Konkoth House, Thumboor P.O, Thrissur District, Kerala 680662, India. E-mail: risonkj@gmail.com

18821. Rohman, A.; Sulistyono, S.; Nuryati, W.; Arifandy, A.; Setiyanto, A. (2020): Dragonflies in Bawean Island Nature Reserve, Indonesia. *Borneo Journal of Resource Science and Technology* 10(1): 45-50. (in English) ["Bawean Island is known for its endemic Bawa deer and other vertebrate species of mammals, avians and reptiles. However, little is known about the invertebrates, especially the Odonata (dragonflies) group. The aim of this study was to examine the variety of dragonflies on the Bawean Island. The observation method was employed for data collection while the Shannon-Weinner Diversity Index was used for data analysis. A total of 23 dragonflies' species consisting of four families were collected throughout the study. These include Coenagrionidae (6 species), Libellulidae (13 species), Platycnemididae (2 species) and Aeshnidae (1 species). *Ischnura senegalensis* is the most dominant species. The diversity index (absolute H index) shows a moderate level of diversity in Bawean Island, with a value of 1,007." (Authors)] Address:

Rohman, A., Biology Education, Faculty of Teacher Training and Education, University of Jember, 68121, Indonesia. E-mail: abdu.fkip@unej.ac.id

18822. Ruiter, E.; Mulder-Milderij, G.; Bunskoek, M.; Huijzinga, A. (2020): *Libellen in Overijssel*. ISBN: 9789050117739. Uitgeverij Knv: 348 pp. (in Dutch) [Bohre, P. (2021): *Prachtig boek over libellen in Overijssel*. <https://www.rootsmagazine.nl/blog/dieren/prachtig-boek-over-libellen-in-overijssel/>: "Already in 2005 an overview of the dragonflies in Overijssel was published with preliminary distribution maps up to 2003. The prelude to the enormous book of 30×30 centimetres that is now before us. Evert Ruiter, main author of *Libellen van Overijssel*: "One of the reasons that this book was not published earlier, was the fact that almost every year a new species of dragonfly was discovered in Overijssel. *Erythromma lindenii*, *Leucorrhinia caudalis*, *Sympetrum depressiusculum*, *Leucorrhinia albifrons*, to name but a few. And of course, they had to be included in the book. In the end, we cut the Gordian knot and started writing. By now, 65 species have been identified within the provincial borders, from extremely rare to very common. "And that puts us in second place as a province behind Limburg. The species richness in Overijssel is mainly due to the exceptionally large diversity of wetlands," says Ruiter. "There are small streams here, but also large rivers, bogs, low moors, a range of other wetlands such as canals, ditches, fens, pools and sand drifts. And not forgetting the local height differences, such as the Salland Ridge and the lateral moraines in north-east Twente. They provide seepage-rich environments on the flanks. All ideal factors for a very diverse dragonfly fauna. Another important factor is the increased interest in observing dragonflies. "I remember well that about twenty years ago I first came to the Woldlake forest to make an inventory. I walked around all alone, the area was still totally undiscovered. And I was pleasantly surprised by the surprisingly large number of species that could be found here. Now thousands of dragonflies fly around here on a beautiful day and you come across photographers everywhere who want to capture these flying gems. The interest in dragonflies has grown enormously in the last twenty years. This is also thanks to *Waarneming.nl*, where dragonfly enthusiasts are increasingly posting their sightings and photos. Naturally, the Woldlake forest is therefore included in the book as a walking route." Critical species Dragonflies occupy an important place in wetland ecosystems. Their presence or absence says a lot about the quality of the biotope and the water in which they occur. This preference is therefore determined to a very large extent by the larvae, as they live in the water. "Some species only thrive in nutrient-poor water and disappear when acidification or enrichment occurs. Other, less critical species appear and are thus a direct indication of deteriorating water quality", explains Ruiter. Industrial discharges in the previous century had heavily polluted the Vecht and the Regge. Thanks to water purification and nature development, many vulnerable species such as the meadow creek juggernaut, blue broad-headed damselfly and brook hawk have fortunately returned. However, dragonflies also appreciate favourable conditions

around the water, such as shelter provided by riparian vegetation, upright trees and shrubs. All of this has led to the exceptionally rich dragonfly population in Overijssel. Magnificent book *Libellen in Overijssel* is a beautiful publication for every nature lover who wants to discover the dragonflies and the landscape while walking. This book, richly illustrated with brilliant photographs, highlights and describes all of the dragonfly species found in the 'garden of the Netherlands'. Distribution maps show where they occur. And by means of 8 special dragonfly routes, you can also find all that beauty yourself while walking. The book is intended for both beginners and experienced dragonfly lovers." (Author; DeepL)]

18823. Salami, E.; Ward, T.A.; Montazer, E.; Nik Ghazali, N.N. (2020): Nanoindentation analysis comparing dragonfly-inspired biomimetic micro-aerial vehicle (BMAV) wings. *International Journal of Bio-Inspired Computation* 16(2): 111-120. (in English) ["Biomimetic micro-aerial vehicle (BMAV) are micro-scaled, unmanned aircraft based on flying biological organisms, generating thrust and lift by flapping their wings. This study investigates and compares the nano mechanical mechanical properties of four sets of fabricated, dragonfly inspired BMAV wings and compares them to actual dragonfly wings used as a baseline reference. The BMAV wings were fabricated using a 3D printer, based on these simplified models. Different 3D printer filament materials were used for each of the four wing sets: acrylonitrile butadiene styrene (or ABS), polylactic acid (or PLA), high impact polystyrene (or HIPS) as well as Ultrat. Nanoindentation tests of the actual dragonfly wings and the BMAV wings were conducted to measure their hardness and Young's modulus. The test result demonstrates the feasibility solution in the development of strong, practical and low cost BMAV wings, this work is a stepping-stone on the path to flying robotic dragonfly." (Authors)] Address: Salami, E., Dept Mech. Engineering, Univ. of Malaya, Kuala Lumpur, KL 50603, Malaysia

18824. Sánchez-Herrera, M.; Beatty, C.D.; Nunes, R.; Salazar, C.; Ware, J.L. (2020): An exploration of the complex biogeographical history of the Neotropical banner-wing damselflies (Odonata: Polythoridae). *BMC Evolutionary Biology* 20(74) (2020): 14 pp. (in English) ["Background: The New World Tropics has experienced a dynamic landscape across evolutionary history and harbors a high diversity of flora and fauna. While there are some studies addressing diversification in Neotropical vertebrates and plants, there is still a lack of knowledge in arthropods. Here we examine temporal and spatial diversification patterns in the Polythoridae, which comprises seven genera with a total of 58 species distributed across much of Central and South America. Results: Our time-calibrated phylogeny for 48 species suggests that this family radiated during the late Eocene (~ 33 Ma), diversifying during the Miocene. As with other neotropical groups, the Most Recent Common Ancestor (MRCA) of most of the Polythoridae genera has a primary origin in the Northern Andes though the MRCA of at least one genus may have appeared in the Amazon Basin. Our molecular clock suggests correlations with some major geographical events, and our biogeographical modeling (with BioGeoBEARS and RASP)

found a significant influence of the formation of the Pebas and Acre systems on the early diversification of these damselflies, though evidence for the influence of the rise of the different Andean ranges was mixed. Diversification rates have been uniform in all genera except one—Polythore—where a significant increase in the late Pliocene (~ 3 mya) may have been influenced by recent Andean uplift. Conclusion: The biogeographical models implemented here suggest that the Pebas and Acre Systems were significant geological events associated with the diversification of this damselfly family; while diversification in the tree shows some correlation with mountain building events, it is possible that other abiotic and biotic changes during our study period have influenced diversification as well. The high diversification rate observed in Polythore could be explained by the late uplift of the Northern Andes. However, it is possible that other intrinsic factors like sexual and natural selection acting on color patterns could be involved in the diversification of this genus." (Authors)] Address: Sánchez-Herrera, Melissa, Dept Biology, Faculty of Natural Sciences, Univ. del Rosario, Bogotá, DC, Colombia; Fed. Dept of Biol. Sciences. Rutgers, The State University of New Jersey, Newark, NJ, USA

18825. Santos, J.C.; Vilela, D.S.; Rejane de Almeida, W.; Santos, B. dos; Santos, A.E.; Bezerra, L.M.; Santos, L. dos; Neto, A.M.; Venâncio, H.; Cameiro, M.A.A. (2020): A rapid survey of dragonflies and damselflies (Insecta: Odonata) reveals 29 new records to Sergipe State, Brazil. *Heterocerina* 2(2): 29-34. (in English, with Spanish summary) ["The knowledge about the richness and composition of odonate species is still relatively scarce for Northeastern Brazil. Here we present the results from a rapid survey of Odonata species that was carried out in Sergipe State, Brazil. We provide 29 new species records, from a total of 182 collected specimens, belonging to 20 different genera. Thus, the Sergipe State has 34 species and 23 genera recorded at the present. Now, these species have their geographical distribution expanded from the southeastern to the northeastern Brazil in the Atlantic Forest." (Authors)] Address: Santos, J.C., Depto de Ecologia, Univ. Federal de Sergipe, São Cristóvão, Sergipe, Brazil. E-mail: jcsantosbio@gmail.com

18826. Sasamoto, A.; Lien, V.V. (2020): Description of a new species of *Periaeschna* (Odonata: Aeshnidae) from northern Vietnam. *Tombo* 62: 57-62. (in English, with Japanese summary) ["*Periaeschna yashiroi* sp. nov. from northern Vietnam (holotype ♂ from Ta Phin, Sapa, Lao Cai Province, N. Vietnam and a paratype ♀ from Hoang Lien NP, Lai Chau Province, N. Vietnam), is described and illustrated for both sexes. This species seems closely related to *Periaeschna zhangzhouensis* Xu, 2017 from southern China, but differs by body maculation and the morphology of the male anal appendages." (Authors)] Address: Sasamoto, A., Tawaramoto-cho, Shiki-gun, Nara Pref., Japan. E-mail: akssmt@sea.plala.or.jp

18827. Schmidt, K.J. (2020): Developing eDNA techniques for the endangered Hine's Emerald Dragonfly (*Somatochlora hineana*) and its symbiont the Devil Crayfish (Camba-

rus [=Lacunicambarus] diogenes): Mesocosm and field studies. M.Sc. thesis, Department of Biology, University of South Dakota: V, 18 pp. (in English) ["Detection of environmental DNA (eDNA) has become a commonly used surveillance method for threatened or invasive vertebrates in both aquatic and terrestrial environments. However, use of eDNA methodologies for the detection of aquatic invertebrates (e.g., crayfish and insects) has been limited. Environmental DNA protocols can be especially useful for endangered invertebrates such as *S. hineana* where conservation efforts have been greatly hindered by the training, time, overall costs, and environmental impacts associated with conducting surveys in the calcareous fens occupied by this species. An essential step in developing such a protocol is to evaluate the dynamics of eDNA concentration under controlled and field conditions. In this study we examined the persistence and accumulation of eDNA from captive *S. hineana* larvae in experimental mesocosms at temperatures (5.0°C and 16.0°C) that reflect seasonal variation in their natural habitat, and we evaluated the usefulness of eDNA protocols for studying the distribution and abundance of invertebrates by assessing patterns of eDNA distribution for the Hine's emerald dragonfly and its symbiont the devil crayfish, in the field over several months. In mesocosms, *S. hineana* eDNA persisted longer at 5.0°C but accumulated more readily at 16.0°C. In the field, life-history events affected seasonal variations in eDNA more significantly and consistently than temperature for both species. These data can be used to aid in conservation efforts for *S. hineana* and similar aquatic invertebrates." (Author)] Address: Schmidt, Kristie, Univ. of South Dakota, Vermillion, SD, USA. Email: Kristie.Schmidt@uky.edu

18828. Schmidt Dalzochio, M.; Périco, E.; Dametto, N.; Sahlén, G. (2020): Rapid functional traits turnover in boreal dragonfly communities (Odonata). *Scientific Reports* 10, (15411) (2020): 12 pp. (in English) ["All natural populations show fluctuations in space or time. This is fundamental for the maintenance of biodiversity, as it allows species to coexist. Long-term ecological studies are rare, mainly due to logistics, but studies like the one presented below recognize the dimensionality of temporal change and the ecological processes that lead to shifts in community composition over time. Here, we used three sampling occasions from a dataset spanning 20 years where dragonflies in central Sweden were monitored. Our aim was to investigate how the prevalence of ecological and biological species traits varied over time measured as Community-level Weighted Means of trait values (CWM). Most CWM values varied significantly between years. Most of the traits changed between the second and the last sampling occasion, but not between the two first ones. These changes could be linked to major changes in species abundance. Our work indicates that fundamental shifts in community structure can occur over a short time, providing environmental drivers act on species turnover. In our case, Climate change and pH levels in lakes are most likely the most important factors." (Authors)] Address: Sahlén, G., Rydberg Laboratory for Applied Sciences, RLAS, Halmstad University, P.O. Box 823, 30118 Halmstad, Sweden. Email: goran.sahlen@hh.se

18829. Shrimali, S.; Rathore, A.S. (2020): Efficacy of neem oil for the eradication of aquatic insects in fish nurseries. *Uttar Pradesh Journal of Zoology* 41(8): 104-112. (in English) ["Generally, the survival rate of carp spawn during the nursery phase is very low due to the presence of harmful aquatic insects in fish nursery pond, which prey heavily upon the spawn and early stages of fry. Insects usually found in large numbers in ponds over the greater part of the year especially during and after rains. They injure the spawn and some of them prey upon spawn. Insects should be eradicated prior to stocking to ensure maximum survival of the spawn. Aquatic insects and their larvae compete for food with the young fish and also cause large scale destruction of hatchlings in nurseries. A study was carried out by the authors to investigating the possible use of natural chemical Neem Oil for the control of aquatic insects in nursery ponds. Bioassay studies were conducted in 5 glass aquaria and using four concentration 0.003, 0.004, 0.005, 0.006 ppm of Neem Oil (natural chemical) on four experimental insects Notonecta (Backswimmer), Dragonfly nymph, Eretes (Small beetle), Nepa (Water Scorpion). The LC50 value of Neem Oil for the experimental insects ... ranged 0.0033 ppm for Eretes and Nepa at 6 hrs and 0.0040 for Notonecta at 5 hrs. Further, the results on toll rate showed that Backswimmer, Small beetle, Water Scorpion killed within 6hrs when exposed to a concentration of 0.004 ppm Neem oil. This was the lowest dose of Neem oil which killed the predatory insects within the desired period of 6 hrs and the death rate of fish seed at this dose is zero. Therefore, the use of Neem oil @0.004 ppm is recommended for the eradication of predatory insects from fish nursery ponds." (Authors)] Address: Shrimali, S., Wildlife Research Laboratory, Dept of Zoology, Bhupal Nobles' University, Udaipur, India

18830. Silva-Hurtado, J.D.; Márquez, J.; Escoto-Moreno, J.A.; Martínez-Falcónx, A.P. (2020): Odonate fauna (Insecta: Odonata) from a locality in San Marcos River in the Sierra Norte of Puebla, Mexico. *International Journal of Odonatology* 23(4): 327-336. (in English) ["Odonates have been recognized as an important group for evaluating ecosystems since they are used as bioindicators of the conservation status of the habitat they occupy, in addition to being generalist predators feeding on invertebrates and small vertebrates. In this work, the biodiversity of adult odonates from a locality near the San Marcos River, in Puebla, Mexico, is analyzed through systematic sampling performed during 2018. Species richness and composition patterns were analyzed and compared between the rainy and dry seasons; the results were also compared with those of similar studies at the regional level. There were six families, 21 genera and 37 species that represent about 40% of the 95 species registered in Puebla. Coenagrionidae, with *Argia*, was the best representative of the Zygoptera, and Libellulidae was the best for the Anisoptera. Three of the species collected in the San Marcos River increased the species number from 95 to 98 for Puebla, making it currently placed 14th of 32 Mexican states in terms of the species richness of odonates nationwide. According to the Chao2 and Bootstrap estimators, the completeness of the inventory varied from 61% to 67% in the

dry season, from 73% to 83% in the rainy season, and from 74% to 86% for the annual completeness. There were no significant differences in species richness and composition between the rainy and dry seasons. The species richness of odonates in this locality is the second highest known for Puebla and can still provide important data for this group." (Authors)] Address: Márquez, J., Laboratorio de Sistemática Animal, Centro de Investigaciones Biológicas, Univ. Autónoma del Estado de Hidalgo, Mineral de la Reforma, Hidalgo, Mexico. Email: marquezorum@gmail.com

18831. Simonsen, T.J.; Olsen, K.; Djernæs, M. (2020): The African-Iberian connection in Odonata: mtDNA and ncDNA based phylogeography of *Aeshna cyanea* (Müller, 1764) (Odonata: Aeshnidae) in Western Palaearctic. *Arthropod Structure & Development* 78(2): 309-320. (in English) ["We explore the phylogeography and inter-population relationships of *A. cyanea* in the Western Palaearctic region based on 603 bp Cytochrome Oxidase Subunit 1 (COI) mtDNA and 732 bp Internal Transcribed Spacer region (Internal Transcribed Spacer 1, 5.8S ribosomal RNA gene and Internal Transcribed Spacer 2, ITS region) ncDNA with an increased sampling from Europe compared to a previous study. Both DNA fragments recover a remarkable and compatible pattern: the recently described *Aeshna vercanica* Schneider et al. is the sister group of *A. cyanea*, which in turn comprises three distinct populations. These populations are: a population in the Caucasus region; a North African population; and a European population. When analysed alone, the ITS fragment recovered *A. vercanica* and the Caucasus *A. cyanea* population as separate units, but the North African and European *A. cyanea* populations were recovered as intermixed. FST population genetic analyses of COI data revealed high degrees of isolation between all populations as all inter-population values were between 0.818 (North Africa – Europe) and 0.944 (Europe – *A. vercanica*). Average pairwise distance in COI (uncorrected p) between populations followed this pattern and was lowest between Europe and North Africa and highest between North Africa and *A. vercanica*, and between Europe and *A. vercanica*. Within population pairwise distance values were approximately an order of magnitude lower. Pairwise distance values between populations for the ITS region were much lower than for COI, but followed the same pattern. Our results therefore support the full species status for *A. vercanica*, and clearly indicate that the current Western European *A. cyanea* population originated from a North African glacial refugium and dispersed to Europe (the Iberian Peninsula) prior to the Holsteinian interglacial period. While the North African and European populations likely remained in contact initially, the European population was probably isolated in the Iberian Peninsula during the Holsteinian interglacial period, and subsequently spread throughout Europe in late Pleistocene – early Holocene." (Authors)] Address: Simonsen, T.J., Natural History Museum Aarhus, Wilhelm Meyers Allé 10, DK-8000 Aarhus, Denmark. E-mail: t.simonsen@nathist.dk

18832. Sivaruban, T.; Barathy, S.; Srinivasan, P.; Isack, R. (2020): Diversity and distribution of odonates in Alagar Hills

of Southern India. *Indian Journal of Ecology* 47(3): 869-871. (in English) ["Order Odonata includes important aquatic insect groups such as dragonflies and damselflies. They help to assess the ecosystem health and serves as pollution indicators. Studies of Odonata were conducted in Alagar hills of South India state of Tamilnadu from August 2018 to January 2019. Odonate species abundance was high in October to November (7 to 8 species) and their abundance was low in the January and December (6 species.) Among all months, the abundance of libellulid species was comparatively high. Shannon index values were between 1.6094-1.9792 and it shows that these sites had critical position and they might have sensitive habitat status. The results of Simpson index complement with the results of Shannon index. Higher air and water temperature was in August and causes less diversity of organisms. DO was low in January (1.65) and it directly influences the abundance. This study interpreted that diversity of Odonates was directly and indirectly influenced by climatic change and anthropogenic impacts." (Authors)] Address: Sivaruban, T., Dept of Zoology, The American College (Autonomous), Madurai-625 002, India. E-mail: sivaruban270@gmail.com

18833. Svensson, E.I.; Willink, B.; Duryea, M.C.; Lancaster, L.T. (2020): Temperature drives pre-reproductive selection and shapes the biogeography of a female polymorphism. *Ecology Letters* 23(1): 149-159. (in English) ["Conflicts of interests between males and females over reproduction is a universal feature of sexually reproducing organisms and has driven the evolution of intersexual mimicry, mating behaviours and reproductive polymorphisms. Here, we show how temperature drives pre-reproductive selection in a female colour polymorphic insect that is subject to strong sexual conflict. These species have three female colour morphs, one of which is a male mimic. This polymorphism is maintained by frequency-dependent sexual conflict caused by male mating harassment. The frequency of female morphs varies geographically, with higher frequency of the male mimic at higher latitudes. We show that differential temperature sensitivity of the female morphs and faster sexual maturation of the male mimic increases the frequency of this morph in the north. These results suggest that sexual conflict during the adult stage is shaped by abiotic factors and frequency-independent pre-reproductive selection that operate earlier during ontogeny of these female morphs." (Authors)] Address: Willink, Beatriz, Dept of Biology, Evolutionary Ecology Unit, Ecology Building, Lund University, Lund 223-62, Sweden. E-mail: beatriz.willink@ucr.ac.cr

18834. Swaegers, J.; Spanier, K.I.; Stoks, R. (2020): Genetic compensation rather than genetic assimilation drives the evolution of plasticity in response to mild warming across latitudes in a damselfly. *Molecular ecology* 29(4): 4823-4834. (in English) ["Global warming is causing plastic and evolutionary changes in the phenotypes of ectotherms. Yet, we have limited knowledge on how the interplay between plasticity and evolution shapes thermal responses and underlying gene expression patterns. We assessed thermal

reaction norm patterns across the transcriptome and identified associated molecular pathways in northern and southern populations of *Ischnura elegans*. Larvae were reared in a common garden experiment at the mean summer water temperatures experienced at the northern (20°C) and southern (24°C) latitudes. This allowed a space-for-time substitution where the current gene expression levels at 24°C in southern larvae are a proxy for the expected responses of northern larvae under gradual thermal evolution to the predicted 4°C warming. Most differentially expressed genes showed fixed differences across temperatures between latitudes, suggesting that thermal genetic adaptation will mainly evolve through changes in constitutive gene expression. Northern populations also frequently showed plastic responses in gene expression to mild warming, while southern populations were much less responsive to temperature. Thermal responsive genes in northern populations showed to a large extent a pattern of genetic compensation, i.e. gene expression that was induced at 24°C in northern populations remained at a lower constant level in southern populations, and were associated with metabolic and translation pathways. There was instead little evidence for genetic assimilation of an initial plastic response to mild warming. Our data therefore suggest that genetic compensation rather than genetic assimilation may drive the evolution of plasticity in response to mild warming in this damselfly species." (Authors)] Address: Swaegers, J., Lab. of Evolutionary Stress Ecology and Ecotoxicology, University of Leuven, Leuven, Belgium. Email: janne.swaegers@kuleuven.be

18835. Tanczuk, A. (2020): Dragonflies (Odonata) observed at the small pond in Lędziny (Poland, Opole Region). *Odonatrix* 1613: 5 pp. (in Polish, with English summary) ["The observations were conducted at the small reservoir near Lędziny village in 2017-2019. In total, 35 dragonfly species were recorded. Among them, six southern species *Anax ephippiger*, *Orthetrum brunneum*, *O. coerulescens*, *Sympetrum meridionale*, (*S. fonscolombii* and *Crocothemis erythraea*) were observed. Further, some phenological data concerning the occurrence of imagines in late September, October and November were presented." (Author)] Address: Tanczuk, Agnieszka, ul. Przasniedzki 2/40, 20-838 Lublin, Poland. E-mail: atanczuk@gmail.com

18836. Triyanti, M.; Arisandy, D.A. (2020): Fauna Capung Di Bukit Cogong Kabupaten Musi Rawas. *Quagga: Jurnal Pendidikan dan Biologi* 12(2): 181-187. (in Indonesian, with English summary) ["This study was to determine the diversity index of dragonflies in Bukit Cogong Musi Rawas. This study uses exploratory methods and descriptions using techniques to explore transects. The observation station was determined to be 3 stations with 5 systematic transects with an area of 100m X 100m transect. Catching using net nets, identifying by observing dragonfly morphological characteristics. Based on the research, data obtained from 111 dragonfly individuals from 10 dragonfly species from Libellulidae, Aeshnidae, Euphaeidae, Protoneuridae, Platycnemididae and Lestidae. The lowest relative abundance were *Gynacantha bayadera* and *Nososticta insignis* at 1.8%,

while the highest relative abundance was *Orthetrum sabina* as big as 34.23%. The diversity index of dragonflies in Bukit Cogong, Musi Rawas was categorized as low with a value of 1.96. the uniformity index for all high-categorized stations, stable communities and dominance index (C) in all stations are categorized as low." (Authors) *Orthetrum sabina*, *Neurothemis fluctuans*, *Brachythemis contaminata*, *Rhodothemis rufa*, *Onychothemis culminicola*, *Gynacantha bayadera*, *Euphaea variegata*, *Nososticta insignis*, *Coeliccia membranipes*, *Lestes concinnus*] Address: Triyanti, M., Program Studi Pendidikan Biologi, STKIP PGRI Lubuklinggau, Lubuklinggau, Indonesia. Email: mertitriyanti28@gmail.com

18837. Twardochleb, L.A.; Treacle, T.C.; Zametske, P.L. (2020): Foraging strategy mediates ectotherm predator–prey responses to climate warming. *Ecology* 101(11). e03146: (in English) ["Climate warming and species traits interact to influence predator performance, including individual feeding and growth rates. However, the effects of an important trait—predator foraging strategy—are largely unknown. We investigated the interactions between predator foraging strategy and temperature on two ectotherm predators: an active predator, the backswimmer *Notonecta undulata*, and a sit-and-wait predator, the damselfly *Enallagma annexum*. In a series of predator–prey experiments across a temperature gradient, we measured predator feeding rates on an active prey species, zooplankton *Daphnia pulex*, predator growth rates, and mechanisms that influence predator feeding: body speed of predators and prey (here measured as swimming speed), prey encounter rates, capture success, attack rates, and handling time. Overall, warming led to increased feeding rates for both predators through changes to each component of the predator's functional response. We found that prey swimming speed strongly increased with temperature. The active predator's swimming speed also increased with temperature, and together, the increase in predator and prey swimming speed resulted in two-fold higher prey encounter rates for the active predator at warmer temperatures. By contrast, prey encounter rates of the sit-and-wait predator increased four-fold with rising temperatures as a result of increased prey swimming speed. Concurrently, increased prey swimming speed was associated with a decline in the active predator's capture success at high temperatures, whereas the sit-and-wait predator's capture success slightly increased with temperature. We provide some of the first evidence that foraging traits mediate the indirect effects of warming on predator performance. Understanding how traits influence species' responses to warming could clarify how climate change will affect entire functional groups of species." (Authors)] Address: Twardochleb, Laura, Dept of Fisheries & Wildlife, Michigan State Univ., East Lansing, MI, USA. E-mail: laura.twardochleb@water.ca.gov

18838. Udayanath, S.; Yashaswi, N. (2020): Impact of mining activities on odonates diversity in adjacent villages of Balaram open cast project, Talcher, Angul, Odisha, India. *Journal of Entomological Research* 44(3): 449-454. (in English) ["In the present study an attempt has been made to

study the regimen of Odonates in peripheral villages of Balaram Open Cast Project (OCP), Talcher, Angul, Odisha. A total number of 1604 Odonates belonging to 6 families and 34 species under two sub-orders (Anisoptera and Zygoptera) were recorded during the entire study period. Shannon -Weiner index (H') was 2.65 in Bhalugadia village, followed by 2.73 in Malibandha village, 2.62 in Natada village and 2.68 in Nakeipasi village. Margalef's richness (D_{mg}) index found to be 3.62 in Bhalugadia, 3.52 in Malibandha, 4.43 in Natada and 2.68 in Nakeipasi village. The presence of Odonates is easily perceived from this study that shows that ecosystem health is proportionate to Odonate diversity. Swap nets and dragonfly traps were used for sampling in the revegetation and un-mined area, but the variation in abundance and diversity among the four areas was statistically insignificant. Hence revegetation can restore the biodiversity and also the population of Odonates belonging to various families. In toto, mined areas should be ecologically restored, so that rich diversity of these elegant insects can be conserved." (Authors)] Address: Yashaswi, N., Dept Zool., Centurion Univ. of Technology and Management, Khurda - 751 009, Odisha, India. E-mail: yashaswi@cutm.ac.in

18839. Vega-Sánchez, Y.M.; Lorenzo-Carballa. M.O.; Vilela, D.S.; Guillermo-Ferreira, R.; Koroiva, R. (2020): Comment on Islam et al. (2020) "Molecular identification of seven new Zygopteran genera from South China through partial cytochrome oxidase subunit I (COI) gene". *Meta Gene* 25, September 2020, 100759: (in English) ["This letter to the editor aims to address the issues that we have found in an article recently published in *Meta Gene* by Islam et al. (2020) on the molecular identification of Odonata specimens from eight provinces of southern China. We conducted a review on the literature regarding the distribution of *Hetaerina* (Calopterygidae) and *Nesobasis* (Coenagrionidae), and analyzed the genetic sequences deposited by Islam et al. (2020) in molecular data repositories. *Hetaerina* is a genus endemic to the New World, with most species confined to the Neotropical region. Islam et al. (2020) reported *H. vulnerata* Hagen in Selys, 1853, *H. titia* Drury, 1773 and *H. capitalis* Selys, 1873 for southern China. The genus *Nesobasis* is endemic to the Fiji Islands. The referred authors reported *N. longistyla* also in southern China. All these species had never been registered before by any other study conducted in Asia. The sequences of these species deposited by Islam et al. were analyzed by us and identified as dipteran DNA, fitting cytochrome oxidase I sequences of the Ephydriidae, Chironomidae and Drosophilidae families. Furthermore, few sequences deposited in data repositories matched with the molecular analyses made by Islam et al. (2020). We suggest that the authors must reassess the morphological and molecular identification of the specimens collected for their study. There might be morphological misidentifications of voucher specimens and/or sequences deposited as *Hetaerina* and *Nesobasis*. Aiming to clarify the results, we recommend the authors to include photographs of the species and redo their analyses. Considering the aforementioned problems, we strongly suggest the authors a review of their other results, which may also present flaws that we are not aware of at

the moment." (Authors)] Address: Vega-Sánchez, Yesenia Margarita, Inst. de Investigaciones en Ecosistemas y Sustentabilidad, Universidad Nacional Autónoma de México, Antigua carretera a Pátzcuaro #8701, Morelia, Michoacán 58190, Mexico. E-mail: yvega@cieco.unam.mx

18840. Veras, D.S.; Lustosa, G.S.; Moura, L.P.; Ribeiro Ferreira, M.F.; Juen, L. (2020): Differences in land use modify Odonata assemblages in the Cerrado-Caatinga ecotone. *Acta Limnologica Brasiliensia* 32, e15: 11 pp. (in English, with Portuguese summary) ["Aim: The present study tested the hypothesis that the composition of the odonate assemblages in environments with greater habitat integrity is significantly different from that of areas with reduced habitat integrity. Methods: The samples were collected between April 2017 and November 2017 in eight streams in Caxias, in the Brazilian state of Maranhao. The habitat integrity index was used to quantify habitat integrity. The odonate specimens were collected by the fixed area scanning method. Results: The habitat integrity index ranged from 0.265 to 0.915 at the different localities. A total of 229 specimens were collected, representing 19 odonate species. Species composition varied among streams that presented different degrees of conservation, with some species being typical of specific habitats. However, this variation had no effect on the number of taxa or the abundance of odonates, which may reflect the local substitution of extinct specialist species by generalists. Conclusions: Evidence indicates that the reduction of habitat integrity is an important predictor of changes in the biodiversity of aquatic insects in streams such as those of the Cerrado-Caatinga ecotone." (Authors)] Address: Veras, D.S., Lab. de Ecologia de Comunidades, Inst. Fed. do Maranhao, Campus Caxias, Rodovia MA-340, Km 02, Gleba Buriti do Paraíso, Povoado Lamego, Zona Rural, CEP 65600-000, Caxias, MA, Brasil. E-mail: daniel.veras@ifma.edu.br

18841. Wang, Y.; Yin, Y.; Zheng, G.; Yao, H. (2020): Driving mechanism of dragonfly's wing flapping pattern for liquid circulation inside wing. *Animal Biology* 71(1): 85-101. (in English) ["Flying animals can inspire practical approaches to a more advanced way of flying. Dragonflies demonstrate a special flapping pattern in which their wings perform torsional movement while flapping, which is different from that of birds. This flapping pattern is referred to as nonsynchronous flapping in this article. We present a hypothesis that nonsynchronous flapping provides a driving force for enhancing the haemolymph circulation inside dragonfly wings. To support this hypothesis, a controlled experiment was designed and conducted with living dragonflies. By observing the liquid motion inside the vein within free flapping wings and restricted wings of living dragonflies, this hypothesis was supported. A mathematical model of the flapping wing was built and numerically studied to further support the function of the nonsynchronous flapping pattern in driving the circulation. With these studies, a theoretical explanation for the mechanism of enhancing the haemolymph circulation by nonsynchronous flapping was provided." (Authors)] Address: Wang, Y., School of Aerospace Engineering, Tsinghua University, Beijing 100084, China

18842. Wildermuth, H. (2020): Als Larvenhabitate von *Orthemtrum coerulescens* (Odonata: Libellulidae) im Hinblick auf sporadische Sommertrockenheit optimierte Flachmoorgräben. *Entomo Helvetica* 13: 107-116. (in German, with English and French summaries) ["Larval habitats of *Orthemtrum coerulescens* (Fabricius, 1798) optimized in fenland ditches by counteracting sporadic aestival desiccation (Odonata: Libellulidae). - In 1981–82, 1.5 ha of overgrown fenland were cleared in a nature reserve on the eastern Swiss plateau. The drainage ditches at the site were rebuilt, thus converting the fenland back into a traditional litter meadow. In order to retain water, six controllable weirs were installed, slowing desiccation of the ditches during hot periods with low or no precipitation. Maintenance of ditches was staggered in both space and time. During systematic success monitoring from 2006 to 2019, a total of 26 species of Odonata were recorded, eleven of which were either permanently or temporally indigenous. The study focused specifically on *O. coerulescens*. Up to 150 territorial males were located simultaneously at the ditches and successful reproductions were recorded every year. Due to water retention by the weirs, the ditches did not dry out even during long, dry summer periods. In extreme cases, larvae survived in the moist layer of the peat mud." (Authors)] Address: Wildermuth, H., Haltbergstr. 43, 8630 Rütli, Switzerland. E-mail: hansruedi@wildermuth.ch

18843. Worthen, W.B.; Chamlee, M.G. (2020): Determinants of adult odonate community structure at several spatial scales: effects of habitat type and landscape context. *International Journal of Odonatology* 23(4): 365-379. (in English) ["Odonata use both aquatic and terrestrial ecosystems, and the abundance and diversity of odonates should be good indicators of habitat integrity. To determine which environmental variables affect odonates, we sampled adult dragonflies three times at 12 sites in Pickens and Greenville Counties, SC, USA, in different habitats, at different spatial scales, across a landscape gradient from intact forest to urban locations. At each site, we established two 2 m × 20 m plots along the shoreline of each aquatic habitat. We sampled dragonflies in ten 2 m × 2 m subplots/plot, described the vegetation and substrate in these subplots and adjacent aquatic subplots, and measured the percent cover of different landforms within 500 m of each plot center. Using nested ANOVA and Akaike information criteria models, habitat type and correlating environmental variables (substrate type and bank vegetation) were the best predictors of community structure at all spatial scales. Streams and rivers had fewer individuals and species than lakes, and had a nested subset of species found in lake communities. Landscape elements were also important, with indices declining as barren land and grasslands increased. At the largest scale, anthropogenic changes to the landscape had mixed effects. Small habitats isolated in urban areas had a significantly depauperate, nested subset of species found in communities inhabiting larger natural areas. However, odonate abundance and diversity was highest at human-made lakes and ponds, suggesting that these anthropogenic features help maintain odonate communities." (Authors)] Address:

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18844. Alves, N.P.; Andrade da Silva, R.; Calvão Santos, L.B.; Barbosa de Oliveira Junior, J.M. (2021): Variação morfológica de caracteres em *Oligoclada walkeri* Geijskes, 1931 (Anisoptera: Libellulidae) em relação a integridade ambiental de Igarapés da Amazônia oriental. Tópicos Integrados de Zoologia 3: 58-70. (in Portuguese, with English summary). ["Morphological variation of characters in *O. walkeri* in relation to the environmental integrity of eastern Amazonian streams: This work aims to evaluate the effect of environmental integrity on morphological characteristics in population samples of *O. walkeri*. The collections were carried out in the municipalities of Santarém, Mojuí dos Campos and Belterra, in the state of Pará, between 10 and 14 h, in 48 streams with 150 m sections, subdivided into 10 sections of 15 m, separated by margin to margin transections. The adult individuals of *O. walkeri* were collected with an entomological network (40 cm in diameter, 65 cm in depth and 90 cm in length) and 50 specimens were selected (25 of preserved areas and 25 of altered areas) to obtain the measures of the characters. With the use of digital caliper, the morphological characters CT (total length), CTA (anterior wing length), LAA (anterior wing width), CAP (anterior wing length), LAP (posterior wing width), LAPB posterior wing at the base), CA (abdomen length), CTO (chest length), LT (chest width) were measured and P (weight) was measured by means of an analytical balance with an accuracy of 0.00005g. To evaluate the effect of environmental integrity on the total length of the *O. walkeri* specimens, simple linear regression was performed. Among the morphological variables, only the posterior wing width at base height was affected by environmental integrity ($r^2 = 0.075$; $p = 0.050$), the result suggests that the more preserved the stream, the greater the Wing Width at Base Height. With the increase of 0.01 in integrity there is an increase of approximately 0.06 mm in the Rear Wing at Base Height. Odonata wing size may be affected by a combination of factors such as: sexual selection, agonistic interactions, intersex cut-offs, migration, and reproductive behavior. In addition, the increase in the width of the posterior wing at base height in *O. walkeri* specimens in the preserved environment may have been due to the main activities carried out by the species in these places, where they do not have to travel long distances to find food. corroborates with the study, because in preserved places the species tend to spend less energy, facilitating the maintenance of a flight with less energy expenditure." (Authors)] Address: Pinto Alves, N., Universidade Federal do Oeste do Pará (UFOPA), Santarém –PA, Brazil

18845. Batucan Jr, L.S.; Hsu, Y.-H.; Maliszewski, J.W.; Wang, L.-J.; Lin, C.-P. (2021): Novel wing display and divergent agonistic behaviors of two incipient *Psolodermus* damselflies. The Science of Nature 108, 49. (in English) [„Sexual selection via male competition is a strong evolutionary force

that can drive rapid changes in competitive traits and subsequently lead to population divergence and speciation. Territorial males of many odonates are known to use their colorful wings as visual signals and to perform agonistic displays toward intruders. *P. mandarinus dorothea* and *P. mandarinus mandarinus* are two parapatrically distributed sister damselflies that share similar ecological characteristics but differ markedly in wing coloration. The wings of *P. m. dorothea* are mostly clear, whereas those of *P. m. mandarinus* have a large area of black pigmentation and a central white patch. We investigated whether territorial males of the two damselflies at breeding sites display distinct agonistic behaviors associated with their respective wing colors. Behavioral interactions between territorial and intruder males and their wing kinematics were filmed and analyzed for *P. m. dorothea* in Lienhuachih of central Taiwan, and *P. m. mandarinus* in Tianxiyuan and Fusan of northern Taiwan. We observed that the *P. m. mandarinus* males exhibited a novel set of perched wing displays, which was not only absent in its sister *P. m. dorothea* but also previously unknown in Odonata. At breeding sites, perched rival males of *P. m. mandarinus* with pigmented wings exhibited escalating agonistic wing-flapping and wing-hitting displays toward each other. In contrast, territorial males of *P. m. dorothea* with clear wings engaged only in aerial chase or face-to-face hovering when intruder males approached from the air. These results indicate that the two sister *P. mandarinus* damselflies diverged behaviorally in territorial contests and support the hypothesis of coadaptation on the basis of wing colors and types of wing movement in Odonata. Our findings further suggest that divergent agonistic wing displays may play a pivotal role in the speciation mechanism of *P. mandarinus* damselflies. The sequential analyses of behavioral characteristics and progression suggest that *P. m. mandarinus* damselflies likely use mutual assessment of rivals in territorial contests." (Authors)] Address: Lin, C.-P., Dept of Life Science, National Taiwan Normal Univ., No. 88, Section 4, Tingzhou Road, Taipei, 11677, Taiwan

18846. Bobrek, R. (2021): Odonate phenology recorded in a Central European location in an extremely warm season. Biologia 76(6): 2957-2964. (in English) [“Life history of ectothermic organisms, including odonates, is greatly influenced by environmental temperature. Current increase in temperatures in many areas connected with global climate change may therefore affect many traits of natural populations, especially their phenology. In odonates, this includes, the timing of emergence, flight period and reproductive behaviour of adults. This study describes the phenology of odonates in a single, extremely warm year (2018) at a site located in a Central European city (Kraków, Poland), and compares it with the past data on odonate phenology across the country. 36 species were recorded in the studied site. Comparison with literature revealed that for a quarter of species, the dates of first records were 1–2 ten-day periods earlier than documented in the previous phenological data for the country. In contrast to existing data, in the current study there were summer, not spring species that showed an advanced

phenological pattern of occurrence. This study demonstrates that contemporary data on odonate phenology obtained in a single, extremely warm season, deviates from comparative long-term data from more than a decade ago, potentially as a result of rising temperatures brought on by climate change." (Author)] Address: Bobrek, R., Polish Society for the Protection of Birds, Odrowaza 24, 05–270, Marki, Poland

18847. Boudot, J.P.; Borisov, S.; De Knijf, G.; van Grunsven, R.H.A.; Schröter, A.; Kalkman, V.J. (2021): Atlas of the dragonflies and damselflies of West and Central Asia. *Brachytron* 22, Supplement: 3-248. (in English) ["This atlas presents, for the first time, a detailed overview of the distribution of the damselflies and dragonflies (Odonata) of West and Central Asia, an area covering nearly 8 million km². The region is not only characterized by the presence of several vast arid deserts such as the Arabian desert, Syrian desert and the Karakum but also harbors extensive mountain chains rich in streams, rivers, marshes and lakes including the Caucasus, Zagros and Hindu Kush. These combination of strong geographic differences in combination with its position between the Afrotropical, Oriental and Palearctic realm result in an interesting and diverse odonate fauna. Dragonflies and damselflies are good indicators of the quality of freshwater habitats and are colorful ambassadors for the preservation of freshwater ecosystems. In West and Central Asia the combination of climate change and an ever increasing demand for freshwater for drinking and agriculture will result in increased desertification and habitat degradation. The future of some of the species occurring in the area is therefore gloomy and some might not make it to the end of the century. This Atlas deals with no less than 175 (sub)species, many of which are endemic to the region or occur just marginally outside the region. For each species a distribution map is presented showing its occurrence in the region and adjacent areas. Texts for each species give basic information on the distribution, habitat preferences and, in some cases, taxonomical information. Although this atlas is not an identification guide, it will definitely help to identify most of the species in the region as it contains images of nearly all species, many of which have seldom been depicted in books before. We hope that this book will help to raise local awareness about this group of freshwater species and will contribute in a better protection and management of freshwater ecosystems." (Authors)] Address: Knijf, G. de, Instituut voor Natuurbehoud, Kliniekstraat 25, B-1070 Brussel, Belgium. E-mail: geert.deknijf@inbo.be

18848. Gaenzle Schilling, E.; Kardynal, K.J.; Kundel, H.; Crews-Erjaveck, Z.; Zobitz, J.M.; Hobson, K.A. (2021): Phenological and isotopic evidence for migration as a life history strategy in *Aeshna canadensis* (family: Aeshnidae) dragonflies. *Ecological Entomology* 46(2): 209-219. (in English) ["1. Investigating dragonfly migration is important for understanding species' life history strategies, migratory connectivity, terrestrial-aquatic linkages, and for successful species conservation. While migration patterns are well-documented for some species (e.g., *Anax junius*), questions remain

about potential migratory behaviour of others. 2. We investigated the potential for migration of *Aeshna canadensis* (Walker, 1908; Canada damer) using phenological observations in three study ponds in central Minnesota, 2017–2019. We also conducted probabilistic assignment to natal origins by measuring stable hydrogen isotope values of wing tissue ($\delta^2\text{H}_w$) of dragonflies collected in Minnesota and acquired through Canadian museum collections. 3. This species emerged May–June from study ponds in central Minnesota, with a 10–15 week lag after onset of emergence before mature adults were observed flying and ovipositing in late summer. The probabilistic assignment depictions of emerging teneral overlapped with the sampling location, confirming accuracy of isotopic assignments of natal origin. 4. Late-flying mature adults collected at our study ponds likely originated from southern Manitoba, suggesting a north–south migration pathway. We found further evidence for migration by analysing $\delta^2\text{H}_w$ of adult dragonflies collected in northern Minnesota and south-central Canada. Their likely origins were farther north in central Canada (Manitoba/Quebec) or the northeastern reaches of this species' range in eastern Canada. 5. We provide the first conclusive evidence of *Aeshna* migration in North America and demonstrate a robust approach, combining field observations with probabilistic assignment to origin using stable isotope analysis, which can test for migration in other dragonfly populations." (Authors)] Address: Gaenzle Schilling, Emily, Dept Biology, Augsburg Univ., Riverside Ave., Minneapolis, Minnesota, 55454, USA. E-mail: schillin@augsb.org

18849. Kamarajan, B.P.; Ananthasubramanian, M.; Sriramajayam, L.; Boppe, A. (2021): Behavior of *Pseudomonas aeruginosa* strains on the nanopillar topography of dragonfly (*Pantala flavescens*) wing under flow conditions. *Biointerphases* 16, 051002: 9 pp. (in English) ["Bacterial associated infection is a threat in the medical field. *Pseudomonas aeruginosa*, one of the major causative agents for nosocomial infection, has developed resistance to almost all the classes of antibiotics. Recently, nanopillar-like structures were identified on the wings of insects such as cicada and dragonfly. Nanopillars both on natural surfaces and those mimicked on artificial surfaces were reported to possess bactericidal activity against a wide range of bacteria. An earlier study reported strain specific variation in the viability of *P. aeruginosa* on the nanopillar topography of a dragonfly wing under static condition. Here, we report the behavior of *P. aeruginosa* strains on a dragonfly wing under hydrodynamic conditions. The results of the study indicated that, under hydrodynamic conditions, *P. aeruginosa* PAO1 was attached in higher numbers to the wing surface than *P. aeruginosa* ATCC 9027 but killed in lower numbers. The plausible reason was identified to be the masking of nanopillars by the secreted extracellular polysaccharide. The shear rate of 1.0 s⁻¹ showed a relatively higher bactericidal effect among the three tested shear rates." (Authors)] Address: Ananthasubramanian, M., Dept of Biotechnology, PSG College of Technology, Coimbatore 641004, India. E-mail: biosubramanian@gmail.com

18850. Kawabe, H.; Aoki, Y.; Nakamura, T. (2021): Cross-

longitudinal reinforcement structure inspired by dragonfly wing. Proceedings of the American Society for Composites — 36th Technical Conference on Composite Materials, DOI 10.12783/asc36/35748. (in English) ["The aim of this study is to establish a novel aircraft design approach replacing the conventional airframe by utilizing biomimetics. This design approach particularly focused on the dragonfly wing, whose reinforcement structures are composed of cross- veins and longitudinal veins. The cross-veins have been emulated by weighted Centroidal Voronoi Tessellation (WCVT) following the out-of-plane displacement on the skin, while the longitudinal veins have been emulated by extracting a centerline from the topology optimization result on the skin to be reinforced, through image analysis of binarization and skeletonization. The longitudinal layout can reduce the compliance distributing the inner load with only essential reinforcement on the skin without increasing the mass. The weighted CVT layout can improve the effectiveness of the reinforced skin against buckling drastically. Thus, the skin reinforced along the cross- longitudinal layout by the topology optimization and weighted CVT pattern increased buckling load 2.7 times higher even with less mass than the conventional layout. (Authors)] Address: not stated

18851. Kosterin, O.E.; Onishko, V.V. (2021): Two newly recorded dragonfly species (Odonata: Libellulidae) for the Novosibirskaya Oblast of Russia. Eurasian Entomological Journal 20(4): 221-228. (in English, with Russian summary) ["In 2020, *Orthetrum brunneum* and *Sympetrum depressiusculum* were first recorded for Novosibirskaya Oblast as photographic observations in the iNaturalist internet platform. Their populations and habitats were examined in situ. The habitat of *O. brunneum* at the Eltsovka Vtoraya River in Zeltsovskiy Park in Novosibirsk lacked other lotic Odonata as a result of pollution. Supposedly the river inside the city limits is warm enough during winter to make possible its colonisation by *O. brunneum* far to the north of its main range. The record of *S. depressiusculum* at the Obskoe Water Reservoir is the northernmost in Siberia. A list of 57 Odonata species currently known from Novosibirskaya Oblast is also provided." (Authors)] Address: Kosterin, O.E., Institute of Cytology & Genetics SB RAS, Academica Lavrentyeva Ave. 10, Novosibirsk 630090 Russia; Novosibirsk State University, Pirogova Str. 2, Novosibirsk 630090 Russia. E-mail: kosterin@bionet.nsc.ru.

18852. Madhukar, G.S. (2021): Faunal diversity of Odonata at Rankala Lake, Kolhapur, Maharashtra. Indian Journal of Entomology 83(1): 54-56. (in English) ["Odonates are excellent habitat indicators of present and past environmental conditions in aquatic habitats. The objective of the present study was to check out the diversity and abundance of Odonates around the lentic habitat, Rankala Lake. A total of 81 individuals was recorded from four localities around the Rankala Lake comprising of ten species (1 unidentified) of dragonflies and three species of damselflies. Family Libellulidae was the most represented (nine species) while family Coenagrionidae was represented by three species. Among

four selected sites, Choupati site has shown maximum diversity ($H=2.187$); however, species abundance was found to be more at Padpath Udyan site. This latter site has plenty of aquatic vegetation dominated by *Sacciolepis indica* and *Alternanthera paronychioides* and shallow water. The Shannon-Weiner index (H) was 2.187 at Rankala Choupati, followed by 1.858 at Tambat Kaman and Fish Seed Centre and 1.588 at Padpath Udyan. Margalef's richness (D_{mg}) index was found to be 3.246, 1.443, 2.148 and 1.406 at localities 1, 2, 3 and 4 respectively. The present study indicates that the aquatic habitat with good vegetation is most suitable for Odonata life and open area is having the high species richness and H index than in a water body." (Author)] Address: Madhukar, G.S., Dept Zool., Shivaji Univ., Kolhapur 416004, Maharashtra, India. Email: smg_zoo@unishivaji.ac.in

18853. Malikova, E.I.; Chistyakov, Yu.A. (2021): First record of *Anax nigrofasciatus* Oguma, 1915 (Odonata: Aeshnidae) from Russia. Far Eastern Entomologist 439: 24-28. (in English, with Russian summary) ["*A. nigrofasciatus* was collected on a small pond in the vicinity of Vityaz settlement, Gamov Peninsula, Primorsky Krai in 2021. It is the first record of this East Asian species from Russia. *A. nigrofasciatus* clearly differs from *A. parthenope julius* Brauer, 1865, more common in the south of the Russian Far East, by body coloration and by details of morphology." (Authors)] Address: Malikova, Elena, Blagoveshchensk State Pedagogical University, Blagoveshchensk, 675000, Russia. E-mail: e_malikova@inbox.ru

18854. Mehmood, S.A.; Zia, A.; Ahmed, S.; Panhwar, W.A.; Khan, W.; Shah, M.; Ullah, I. (2021): Seasonal abundance and distribution of dragonflies in upper Siran valley of District Mansehra Pakistan. Brazilian Journal of Biology 81(3): 785-791. (in English, with Portuguese summary) ["Present study was conducted to study seasonal abundance and distribution of dragonflies in upper Siran valley district Mansehra Pakistan. To collect data, eleven localities were visited for three consecutive years (2016-2018). Results come up with a sum of 300 specimens identified under three families, eight genera and twenty species. Highest seasonal abundance recorded during summer and spring were 80.67% and 13.33% respectively while minimum 6.00% was recorded during early autumn. Dominant species observed were, *Orthetrum chrysis* (14.00%), followed by *O. glaucum* (12.00%), *Palpopleura sexmaculata sexmaculata* (11.33%) and *O. cancellatum cancellatum* (8.00%). However the highest population of dragonflies was found in Munda Gucha with a percentage of 11.33 followed by Jabbar (11.00%) and Sachan (9.67%). The lowest populations were recorded in Suham (6.00%), Dadar (7.67%) and Jabori (7.67%). The surveyed valley showed diverse anisopterous fauna and thus further extensive surveys are recommended that can come up with more important species from the area." (Authors)] Address: Mehmood, S.A., Hazara University Mansehra, Department of Zoology, Pakistan

18855. Miroglu, A. (2021): A suprising dragonfly record:

Selysiothemis nigra (Insecta: Odonata) from Black Sea Region of Turkey. Turkish Journal of Biodiversity 4(2): 66-68. (in Turkish, with English summary) ["In this study, it was given regionally interesting record of *Selysiothemis nigra* that its distribution known from Turkey. Two females were collected and observed many males and females from Samsun province in the Middle Black Sea Region of Turkey. This species is new record for the Black Sea Region. In addition, the present record are to provide new data on known distribution of the species in Turkey and to its migration route in the region." (Author)] Address: Miroglu, A., Ordu Üniversitesi, Fatsa Deniz Bilimleri Fakültesi, Balıkcıyık Teknolojisi Mühendisliği Bölümü, Ordu, Turkey. E-mail: alimiroglu@gmail.com

18856. Mocq, J.; Soukup, P.R.; Näslund, J.; Boukal, D.S. (2021): Disentangling the nonlinear effects of habitat complexity on functional responses. Journal of animal ecology 90(6): 1525-1537. (in English) ["1. Structural complexity of habitats modifies trophic interactions by providing refuges and altering predator and prey behaviour. Nonlinear effects on trophic interaction strengths driven by these mechanisms may alter food web dynamics and community structure in response to habitat modifications. However, changes in functional response, the relationship between prey density and feeding rate, along habitat complexity (HC) gradients are little understood. 2. We quantified functional responses along a HC gradient from an entirely unstructured to highly structured habitat in a freshwater system, using dragonfly larvae (*Aeshna cyanea*) preying on *Chaoborus obscuripes* larvae. To disentangle mechanisms by which changes in HC affect functional responses, we used two different approaches – a population-level and a behavioural experiment–, applied an information theoretic approach to identify plausible links between HC and functional response parameters, and compared our results to previous studies. 3. Functional response shape did not change, but we found strong evidence for nonlinear dependence of attack rate and handling time on HC in our study. Combined results from both experiments imply that attack rate increased stepwise between the unstructured and structured habitats in line with the threshold hypothesis, because the predators gained better access to the prey. Handling time was lowest at an intermediate HC level in the population-level experiment, while the direct estimate of handling time did not vary with HC in the behavioural experiment. These differences point toward HC-driven changes in foraging activity and other predator and prey behaviour. 4. Most previous studies reported stepwise decrease in attack rate in line with the threshold hypothesis or no change with increasing HC. Moreover, changes in the handling time parameter with HC appear to be relatively common but not conforming to the threshold hypothesis. Overall, increased HC appears to respectively weaken and strengthen trophic links in 2D and 3D predator-prey interactions. 5. We conclude that detailed understanding of HC effects on food webs requires complementary experimental approaches across HC gradients that consider predator foraging strategies and predator and

prey behaviour. Such studies can also help guide conservation efforts as addition of structural elements is frequently used for restoration of degraded aquatic habitats." (Authors)] Address: Mocq, J., Univ. of South Bohemia, Fac. of Science, Dept of Ecosystem Biology & Soil & Water Research Infrastructure, Branišovská, 1760, 37005 České Budějovice, Czech Republic. E-mail: julien.mocq@gmail.com

18857. Nava-Bolaños, A.; Vrech, D.E.; Peretti, A.V.; Córdoba-Aguilar, A. (2021): Argentinian odonates (dragonflies and damselflies): current and future distribution and discussion of their conservation. Journal of Threatened Taxa 13(11): 19448-19465. (in English, with Spanish summary) ["In terms of conservation, Argentinian odonates have not been assessed using a quantitative approach. One way to achieve this is by modelling their distribution to gather the extent of occurrence. Thus, we modelled the current and future (projected year, 2050) potential distribution of 44 odonate species that occur in Argentina as well as in neighboring countries. Our models of current times indicate a fairly wide distribution for most species but one exception is relevant for conservation purposes: *Lestes dichrostigma* has less than 30,000 km² and falls in the 'Near Threatened' category according to the IUCN Red List. Another seven species have less than or close to 100,000 km²: *Elasmothemis cannacrioides*, *Erythemis credula*, *E. paraguayensis*, *Heteragrion angustipenne*, *H. inca*, *Lestes forcifera*, and *Mecistogaster linearis*. Future distribution estimates suggest that: a) 12 species will lose or gain around 10%, four species will increase their distribution beyond 10% (up to 2,346%), and 28 species will lose more than 10% (up to 99%). Although current protected areas embrace most odonate species in Argentina, it is still premature to conclude whether this situation will remain in the future given the physiological tolerance and dispersal abilities of the study species among other drivers of distribution." (Authors)] Address: Vrech, D.E., Instituto de Diversidad y Ecología Animal, CONICET - Universidad Nacional de Córdoba, Vélez Sarsfield 299 (5000), Córdoba, Argentina. E-mail: dvrech@unc.edu.ar

18858. Nowak, M.; Weihrauch, F. (2021): *Orthetrum ransonnetii* has gained a foothold in the Canary Islands (Odonata: Libellulidae). Notulae odonologicae 9(7): 291-295. (in English) ["*Orthetrum ransonnetii* is a recent addition to the fauna of Fuerteventura, Canary Islands, but its status on the island has remained unclear. In this study evidence is provided that in the past few years the species has established a resident population there. Further expansion of the species in the Canarian archipelago can be expected." (Authors)] Address: Nowak, M., Fuchseckstr. 16/1, 73114 Schlat, Germany. E-mail: Nowak-Schlat@t-online.de

18859. Santos, A.A.; Sender, L.M.; Wappler, T.; Engel, M.S.; Diez, J.B. (2021): A Robinson Crusoe story in the fossil record: Plant-insect interactions from a Middle Jurassic ephemeral volcanic island (Eastern Spain). Palaeogeography, Palaeoclimatology, Palaeoecology 583: 12 pp. (in English) [Highlights: • First study of plant-insect interactions from the Ju-

Jurassic of the Iberian Peninsula. • Comparison with other mid– Jurassic plant-insect interactions. • Identification of possible culprits for the different damages. • Discussion on colonization strategies by insects during the Jurassic. Abstract: We present here the first record of plant-insect interactions from an ephemeral volcanic island that was placed 150 km away from the nearest continental mass. The island was formed and destroyed during the Aalenian (Middle Jurassic) in a shallow sea of the southwestern Tethyan realm corresponding today to a place located in eastern Spain. These plant-insect interactions were mainly documented in leaves of Cycadophytes (comprising both Cycads and Bennettitales), and they have been described and classified into different Damage Types (DTs) and Functional Feeding Groups (FFGs). The interactions were assigned to 11 different DTs including different types of hole feeding, margin feeding, surface feeding, piercing and sucking, mining(?), and some putative ovipositional scars. The presence of these interactions implies that the island was colonized by different groups of insects, including orders such as Coleoptera, Hemiptera, Odonata, or Lepidoptera. The low variety and incidence of interactions comparing with other Middle Jurassic plant-insect interactions assemblages indicate that the diversity of insects was not high, possibly due to the difficulty of reaching this island by various lineages, the small size of the landmass of the island, and the limited food availability (mainly Cycadophytes). Possible colonization strategies could be by atmospheric dispersion, using floating remains of plants or pterosaurs as vectors, by active flight for Lepidoptera, or by rafting and floating in marine currents for flightless or other insects." (Authors)] Address: Santos, A., Depto de Xeociencias Mariñas e Ordenación do Territorio, Facultade de Ciencias do Mar, Universidade de Vigo, 36310 Vigo, Spain. E-mail: asantos@uvigo.es

18860. Sanz Sanz, T.; Montoya Jiménez, M. (2021): Primera cita de *Anax parthenope* (Selys, 1839) (Odonata, Aeshnidae) en la provincia de León (NO de España). *Archivos Entomológicos* 24: 99-101. (in Spanish, with English summary) [First record of *A. parthenope* from the province of León (NW Spain). The first record of *A. parthenope* from the province of León (NW Spain) is documented, which remained as the only one in the Castilla y León Autonomous Community from where its occurrence had not been so far reported: Embalse de Villameca, en Quintana del Castillo (León) el 26-VII-2019.] Address: Sanz Sanz, T., 1 c/ El Esguilo, 4. E-24878 Fresnedo de Valdellorma (León), Spain. E-mail: donquillos@hotmail.com

18861. Schmidt, K.J.; Soluk, D.A.; Mays Maestas, S.E.; Britten, H.B. (2021): Persistence and accumulation of environmental DNA from an endangered dragonfly. *Scientific Reports* 11(18987) (2021): 8 pp. (in English) ["Detection of environmental DNA (eDNA) has become a commonly used surveillance method for threatened or invasive vertebrates in both aquatic and terrestrial environments. However, most studies in this field favor vertebrate target species. Environmental DNA protocols can be especially useful for endangered invertebrates such as *Somatochlora hineana* where

conservation efforts have been greatly hindered by training, time, overall costs, and environmental impacts associated with conducting surveys in the calcareous fens occupied by this species. An essential step in developing such a protocol is to evaluate the dynamics of eDNA concentration under controlled conditions. We used the quantitative polymerase chain reaction (qPCR) to examine seasonal shifts in the persistence and net-accumulation of eDNA from captive *S. hineana* larvae in experimental mesocosms at temperatures corresponding with their overwintering (5.0 °C) and active (16.0 °C) seasons. Environmental DNA persisted longer at 5.0 °C but accumulated more readily at 16.0 °C. Differences in the accumulation and persistence of eDNA reflect differences in the longevity of eDNA at different temperatures and seasonal differences in larval *S. hineana* behavior. This study highlights the importance of considering how seasonal changes in temperature influence not only the speed of eDNA degradation but also the target species' eDNA shedding rates." (Authors)] Address: Schmidt, Kristie, Univ. South Dakota, Vermillion, SD, USA. Email: Kristie.Schmidt@uky.edu

18862. Sergio, C.; Luca, R.; Olivier, F. (2021): Plasticity and flexibility in the anti-predator responses of treefrog tadpoles. *Behavioral Ecology and Sociobiology* (2021) 75:142: 14 pp. (in English) ["Tadpoles can respond to perceived predation risk by adjusting their life history, morphology, and behavior in an adaptive way. Adaptive phenotypic plasticity can evolve by natural selection only if there is variation in reaction norms and if this variation is, at least in part, heritable. To provide insights into the evolution of adaptive phenotypic plasticity, we analyzed the environmental and parental components of variation in predator-induced life history (age and size at metamorphosis), morphology (tail depth), and behavior of Italian treefrog tadpoles (*Hyla intermedia*). Using an incomplete factorial design, we raised tadpoles either with or without caged predators (dragonfly larvae, gen. *Aeshna*) and, successively, we tested them in experimental arenas either with or without caged predators. Results provided strong evidence for an environmental effect on all three sets of characters. Tadpoles raised with caged predators (dragonfly larvae, gen. *Aeshna*) metamorphosed earlier (but at a similar body size) and developed deeper tails than their fullsib siblings raised without predators. In the experimental arenas, all tadpoles, independent of their experience, flexibly changed their activity and position, depending on whether the cage was empty or contained the predator. Tadpoles of the two experimental groups, however, showed different responses: those raised with predators were always less active than their predator-naive siblings and differences slightly increased in the presence of predators. Besides this strong environmental component of phenotypic variation, results provided evidence also for parental and parental-by-environment effects, which were strong on life-history, but weak on morphology and behavior. Interestingly, additive parental effects were explained mainly by dams. This supports the hypothesis that phenotypic plasticity might mainly depend on maternal effects and that it might be the expression of condition-dependent mechanisms." (Authors)] Address: Ser-

gio, C., Dept of Life Science and Systems Biology, University of Turin, Via Accademia Albertina 13, 10123 Turin, Italy. E-mail: sergio.castellano@unito.it

18863. Skevington, J.H.; Buck, M. (2021): The first documented migration of a potter wasp, *Ancistrocerus adiabatus* (Hymenoptera: Vespidae: Eumeninae). *The Canadian Field-Naturalist* 135(2): 117-119. (in English) ["Eumenine wasps are not known to be migratory and have never been proposed as migrants, let alone documented as such. We document a large-scale migration of a common eumenine, *Ancistrocerus adiabatus*, during which 44 000–68 000 wasps moved through a known migration corridor in southwestern Ontario, Canada, in less than an hour. Evidence for migration of another eumenine, *Pachodynerus erynnis*, six species of flower flies (Diptera, Syrphidae), and two Odonata is also provided. ... Other apparent insect migrants (all moving east to west), noted at Zion Road on 13 September, included: ... *Tramea lacerata* and *Anax junius*." (Authors)] Address: Skevington, J.H., Canadian National Collection of Insects, Arachnids and Nematodes, Agriculture & Agri-Food Canada, 960 Carling Avenue, Ottawa, Ontario K1A 0C6 Canada. E-mail: jhskevington@gmail.com

18864. Swain, P.K.; Dora, S.P.; Battula, S.M.; Barik, A.K. (2021): Numerical investigation of wing–wing interaction and its effect on the aerodynamic force of a hovering dragonfly. *Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering* 235(12): 1648-1663. (in English) ["The present research focuses on the timing of wing–wing interaction that benefits the aerodynamic force of a dragonfly in hovering flight at Reynolds number 1350. A 3-D numerical simulation method, called the system coupling, was utilised by implementing a two-way coupling between the transient structural and flow analysis. We further explore the aerodynamic forces produced at different phase angles on the forewing and hindwing during the hovering flight condition of a dragonfly. A pair of dragonfly wings is simulated to obtain the force generated during flapping at a 60° inclination stroke plane angle with respect to the horizontal. The hovering flight is simulated by varying the phase angle and the inter-distance between the two wings. We observe a significant enhancement in the lift (16%) of the hindwing when it flaps in-phase with the forewing and closer to the forewing, maintaining an inter-wing distance of 1.2 cm (where centimetre is the mean chord length). However, for the same condition, the lift of the hindwing reduces by 9% when the wings are out of phase/counterstroke flapping. These benefits and drawbacks are dependent on the timing of the interactions between the forewing and hindwing. The time of interaction of wake capture, wing–wing interaction, dipole structure and development of root vortex are examined by 2-D vorticity of the flow field and isosurface of the 3-D model dragonfly. From the isosurface, we found that the root vortex elicited at the root of the hindwing in counterflapping creates an obstacle for the shedding of wake vortices, which results in reduction of vertical lift during the upstroke of flapping. Hence, at the supination stage, a dragonfly uses a high rotation angle for the hovering flight mode. It

is observed that the system coupling method was found to be more efficient and exhibited better performance. The present numerical methodology shows a very close match to the previously reported results." (Authors)] Address: Swain, P.K., Dept of Mechanical Engineering, GIT, GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India

18865. Takemura, M.; Maoka, T.; Koyanagi, T.; Kawase, N.; Nishida, R.; Tsuchida, T.; Hironaka, M.; Ueda, T.; Misawa, N. (2021): Elucidation of the whole carotenoid biosynthetic pathway of aphids at the gene level and arthropodal food chain involving aphids and the red dragonfly. *BMC Zoology* 6(19). 13 pp. (in English) ["Background: Aphids can be positioned as robust pest insects in farming and as ones of the model organisms for arthropods in molecular biology. Carotenoids are pigments that protect organisms from photooxidative damage caused by excessive light. Aphids were shown to possess genes of fungal origin for carotenoid biosynthesis, whereas a little knowledge was available about the functions of the genes and the biosynthetic pathway. Even carotenoid species contained in aphids were not enough understood. Main purpose of this study is to clarify these insufficient findings. Results: The whole carotenoid biosynthetic pathway of the pea aphid (*Acyrtosiphon pisum*) was elucidated at the gene level, through comprehensive functional analysis of its carotenogenic genes, using *Escherichia coli* that synthesized carotenoid substrates, along with structural and quantitative analysis of carotenoids from various aphid species. Four genes were needed to synthesize all carotenoids accumulated in aphids from geranylgeranyl diphosphate. The *tor* gene mediated desaturation reaction from phytoene to 3,4-didehydrolycopene. It was revealed that a gene designated *ApCrYB3*, which was considered to have functionally evolved in aphids, can convert lycopene into uncommon carotenoids with the γ -ring such as (6'S)- β,γ -carotene and γ,γ -carotene. We further demonstrated that the atypical carotenoids work as ecological indicators for estimating the food chain from aphids to predatory arthropods, and showed that aphids contributed with significant levels to the food chain from insect herbivores to several predatory arthropods, i.e., *Sympetrum frequens* (adults), seven-spotted ladybird (*Coccinella septempunctata*), and two spiders, *Oxyopes sertatus* and *Nephila clavata*. Gut microflora of the dragonfly (mature adults) was also found to include endosymbiotic bacteria such as *Serratia symbiotica* specific to the black bean aphid (*Aphis fabae*). Conclusions: We revealed the whole carotenoid biosynthetic pathway of aphids, including functional identification of the corresponding genes. Subsequently, we showed that arthropodal food chain can be estimated using the uncommon carotenoids of aphids as ecological indicators. This result indicated that aphids made significant contributions to the food chain of several predatory arthropods including the red-dragonfly adults. Aphids are likely to be positioned as an important "phytochemicals" source for some predatory insects and arachnids, which are often active under bright sunlight." (Authors)] Address: Misawa, N., Research Institute for Bioresources & Biotechnology, Ishikawa Prefectural Univ., 1-308 Suematsu, Nonouchi-shi, Ishikawa

18866. Thongprem, P. (2021): *Torix Rickettsia*: aspects of diversity, host range and symbiont-host interaction. PhD thesis, University of Liverpool. VII + 185pp. (in English) ["*Rickettsia* bacteria have traditionally been considered as the aetiologic agent of deadly arthropod-borne diseases in humans and livestock. However, more recent studies have discovered *Rickettsia* as non-vertebrate pathogens that are actually important to invertebrate evolution as symbionts. Recently, *Rickettsia* in the 'torix' clade were described from glossiphoniid leeches. This clade has since been observed to infect a wide range of invertebrate species and is thought to be most common in host species associated with freshwater habitats. This leads to a general hypothesis that torix *Rickettsia* are a common endosymbiont of freshwater taxa. However, this hypothesis is yet to be formally tested. To assess this hypothesis, I firstly investigated in-depth a freshwater-associated insect order, the Odonata, in which torix *Rickettsia* had not been previously recorded. This study revealed the first incidence of torix *Rickettsia* in odonates, present in roughly 10% of the screened species. Maternal transmission of this endosymbiont was observed in *Coenagrion puella*, and this strain has likely driven mtDNA introgression between the insect and its sister species (*C. pulchellum*). Then, I expanded the screen to test for torix *Rickettsia* in other invertebrate taxa and compared the infection frequency between freshwater and terrestrial communities. Fisher's exact test indicated that the proportions of infected species from freshwater community is significantly higher than the terrestrial group in three representative insect orders. In addition to this broad screen, torix *Rickettsia* in a few blood-feeding insects are recorded for the first time, including mosquitos (*Anopheles plumbeus*), black flies (*Simulium aureum*) and the common bed bug (*Cimex lectularius*). Bed bugs were then established as a model system to study biological impacts of torix *Rickettsia* carriage. Symbionts in the bed bug were transmitted via matriline only. There were no signs of reproductive parasitism, sex ratio distortion or cytoplasmic incompatibility phenotypes. *Torix Rickettsia* only express mild parasitic impacts on *C. lectularius* biology by slowing development time and reducing fecundity. Finally, this thesis raises three questions for onward study; i) why torix *Rickettsia* are abundant in freshwater biomes, ii) how do torix strains transition into terrestrial species and iii) how torix *Rickettsia* are associated with broad spectrum of eukaryotic hosts. Possible scenarios for these three questions are discussed for future study." (Author) Address: Thongprem, P., University of Liverpool Faculty of Health and Life Sciences, UK

18867. Triyanti, M.; Arisandy, D.A. (2021): Keanekaragaman Jenis Capung Famili Libellulidae di Bukit Cogong Kabupaten Musi Rawas - Diversity species of dragonflies family of Libellulidae in Bukit Cogong Musi Rawas. *Biota: Jurnal Ilmiah Ilmu-Ilmu Hayati* 6(1): 44-51. (in Indonesian, with English summary) ["There are many species of dragonflies in Cogong Hill, Musi Rawas Regency, but not yet well recor-

ded, so it is necessary to collect data on species of dragonflies and studies on diversity. Therefore, the research was conducted to study the diversity of dragonflies of the Libellulidae family in Cogong Hill, Musi Rawas Regency. This research uses the technique of exploring transects by determining 3 observation stations. Each station consists of 5 transects with a transect area of 100x100 m. The capture of the Libellulidae family in Bukit Cogong, Musi Rawas Regency using a net net, was identified by observing the morphological characteristics of the dragonflies of the libellulidae family. Five species of dragonflies from the Libellulidae family were found, namely: *Orthetrum sabina*, *Neurothemis fluctuans*, *Bracythemis contaminata*, *Rhodothemis rufa*, and *Onychothemis culminicola*. The highest species composition is *Orthetrum sabina* by 46.34%, while the lowest is *Onychothemis culminicola* by 6.09%. Uniformity index at all stations in high category, stable community, dominance index (C) in low category, and diversity index is low with a value is 1.61." (Authors) [Triyanti, M., Program Studi Pendidikan Biologi, STKIP PGRI Lubuklinggau Jl Mayor Toha, Kel. Air Kuti, Kec. Lubuk Linggau Timur I, Kota Lubuk Linggau, Sumatera Selatan, Indonesia. E-mail: mertitriyanti28@gmail.com

18868. Trong, K.H.; Thi, N.D.; Thi Nhu, Y.N.; Thi, H.V.; Thanh Ho, V.T. (2021): Impacts of climate change to the growth and development of the dragonflies of Tram Chim National Park, Tam Nong – Dong Thap, Vietnam. IOP Conference Series: Materials Science and Engineering, Volume 1092, The 2nd International Conference on Innovative Technology, Engineering and Sciences (iCITES 2020) 22nd-23rd December 2020, Pekan Pahang, Malaysia Citation K H Trong et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1092 012090. 8 pp. (in English) ["Dragonflies are insects that have an association with wetland ecosystems and sensitive to changes in environmental factors. Therefore, under the increasingly strong impacts of climate change, they exhibit quite pronounced responses. Assessing the growth and development process of dragonflies can contribute positively to assessing and making strategies to cope with the impacts of climate change which is becoming increasingly complicated. The results of the current study showed that the Dragonfly species composition in Tram Chim National Park was remarkably diverse, including 11 species (2008) and 12 species (2019) of larvae belonging to 6 families in Zygoptera and Anisoptera. Based on information from field surveys, the results showed that the presence of dragonflies tended to be earlier than those recorded in the past, and it was often difficult to find them along the survey route, especially nearer to noon. Range, flight speed, and altitude were somewhat reduced, especially for Zygoptera. These environmental factors fluctuated greatly, which might cause pressing impacts on the growth and development of Dragonflies in the Tram Chim National Park area." (Authors) Address: Van Thi Thanh Ho, Hochiminh City Univ. of Natural Resources & Environment (HCMUMRE), Vietnam. E-mail: httvan@hcmunre.edu.vn

18869. Uyizeye, E.; Clausnitzer, V.; Kipping, J.; Dijkstra, K.-D.B.; Willey, L.; Kaplin, B.A. (2021): Developing an odonate-

based index for prioritizing conservation sites and monitoring restoration of freshwater ecosystems in Rwanda. *Ecological Indicators* 125 (2021) 107586. 18 pp. (in English) ["Land use changes and the ways that natural resources are extracted and used pose severe threats to freshwater ecosystems globally. This is particularly pronounced in developing and densely populated countries, such as Rwanda. In-depth understanding of how ecosystems respond to threats could guide their restoration, conservation, and better management. The advancement of ecological monitoring tools is crucial for freshwater conservation. We developed and implemented an odonate-based tool, the Rwanda Dragonfly Biotic Index (RDBI), tailored to freshwater ecosystems in Rwanda as a metric to identify conservation priority sites and to monitor their restoration. The RDBI is determined based on three sub-indices: Distribution-Based Score (DBS), Threat-Based Score (TBS) and Sensitivity-Based Score (SBS). Species level-DBS increases from those that are widespread across all ecological zones to those that are restricted to only one ecological zone; TBS for a species ranges from those that are of least concern to those that are critically endangered, as per IUCN Red List; Species' SBS increases from those thriving in a highly disturbed habitat to those occurring only in a relatively intact habitat. Using RDBI, we identified hotspot habitats for odonates in Rwanda and benchmark sites for restoration. Hotspots are defined based on species richness, presence of unique species, and RDBI scores. Benchmark sites for restoration are habitats with the highest RDBI in each ecological zone. The value of using RDBI in ecosystem monitoring rests on the fact that it can help identify priority sites for conservation, and it uses organisms that are charismatic and relatively easy to identify. This is essential for citizen engagement and drawing a long-term link between policymaking, on-the-ground practices, and impacts on freshwater ecosystems." (Authors)] Address: Uyiz-eye, E., Keene State College, 115 Winchester St, Keene, NH 03431, USA

18870. Vitasse, Y.; Ursenbacher, S.; Klein, G.; Bohnenstengel, T.; Chittaro, Y.; Delestrade, A.; Monnerat, C.; Rebetez, M.; Rixen, C.; Strebel, N.; Schmidt, B.R.; Wipf, S.; Wohlgenuth, T.; Yoccoz, N.G.; Lenoir, J. (2021): Phenological and elevational shifts of plants, animals and fungi under climate change in the European Alps. *Biological Reviews of the Cambridge Philosophical Society* 96(5): 1816-1835. (in English) ["Mountain areas are biodiversity hotspots and provide a multitude of ecosystem services of irreplaceable socio-economic value. In the European Alps, air temperature has increased at a rate of about $0.36^{\circ}\text{C decade}^{-1}$ since 1970, leading to glacier retreat and significant snowpack reduction. Due to these rapid environmental changes, this mountainous region is undergoing marked changes in spring phenology and elevational distribution of animals, plants and fungi. Long-term monitoring in the European Alps offers an excellent natural laboratory to synthesize climate-related changes in spring phenology and elevational distribution for a large array of taxonomic groups. This review assesses the climatic changes that have occurred across the European Alps during recent decades, spring phenological changes and

upslope shifts of plants, animals and fungi from evidence in published papers and previously unpublished data. Our review provides evidence that spring phenology has been shifting earlier during the past four decades and distribution ranges show an upwards trend for most of the taxonomic groups for which there are sufficient data. The first observed activity of reptiles and terrestrial insects (e.g. butterflies) in spring has shifted significantly earlier, at an average rate of -5.7 and -6.0 days decade^{-1} , respectively. By contrast, the first observed spring activity of semi-aquatic insects (e.g. dragonflies and damselflies) and amphibians, as well as the singing activity or laying dates of resident birds, show smaller non-significant trends ranging from -1.0 to $+1.3$ days decade^{-1} . Leaf-out and flowering of woody and herbaceous plants showed intermediate trends with mean values of -2.4 and -2.8 days decade^{-1} , respectively. Regarding species distribution, plants, animals and fungi ($N = 2133$ species) shifted the elevation of maximum abundance (optimum elevation) upslope at a similar pace (on average between $+18$ and $+25$ m decade^{-1}) but with substantial differences among taxa. For example, the optimum elevation shifted upward by $+36.2$ m decade^{-1} for terrestrial insects and $+32.7$ m decade^{-1} for woody plants, whereas it was estimated to range between -1.0 and $+11$ m decade^{-1} for semi-aquatic insects, ferns, birds and wood-decaying fungi. The upper range limit (leading edge) of most species also shifted upslope with a rate clearly higher for animals (from $+47$ to $+91$ m decade^{-1}) than for plants (from $+17$ to $+40$ m decade^{-1}), except for semi-aquatic insects (-4.7 m decade^{-1}). Although regional land-use changes could partly explain some trends, the consistent upward shift found in almost all taxa all over the Alps is likely reflecting the strong warming and the receding of snow cover that has taken place across the European Alps over recent decades. However, with the possible exception of terrestrial insects, the upward shift of organisms seems currently too slow to track the pace of isotherm shifts induced by climate warming, estimated at about $+62$ to $+71$ m decade^{-1} since 1970. In the light of these results, species interactions are likely to change over multiple trophic levels through phenological and spatial mismatches. This nascent research field deserves greater attention to allow us to anticipate structural and functional changes better at the ecosystem level." (Authors)] Address: Vitasse, Y., WSL Swiss Federal Institute for Forest, Snow & Landscape Research, Zürcherstr. 111, 8903 Birmensdorf, Switzerland. E-mail: yann.vitasse@wsl.ch

18871. Walia, G.K.; Katnoria, N. (2021): Chromosome characterization of four calopterygid damselflies with cytogenetic review of family Calopterygidae (Odonata: Zygoptera). *J. Adv. Zool.* 42(1): 107-117. (in English) ["Taxonomically, in family Calopterygidae, 183 species under 21 genera have been reported worldwide. Out of these, cytogenetic data pertains to only 22 species which is only 12% of the known species. In India, 9 species under 6 genera are present, while only 2 species has been studied cytogenetically. The present study has been conducted to linearly characterize the chromosomes of 4 species (*Matrona nigripictus*, *Neurobasis chinensis*, *Vestalis apicalis* and *Vestalis gracilis*) of

family Calopterygidae by conventional staining, C-banding, silver nitrate staining and sequence-specific staining and also compiled the cytogenetic data of the family. The species were collected from Meghalaya, Goa, Kerala, Himachal Pradesh states of India. All the species possess $2n=25m$ as the diploid chromosome number with XO-XX sex determination except *Neurobasis chinensis* with $2n=23$, characterized by the presence of two equal sized large autosomal bivalents originated by the autosome fusion. C-banding and silver nitrate staining results depict the presence of C-bands and NOR's on the terminal positions of autosomal bivalents, while X chromosome and m bivalent show variation in distribution of C-heterochromatin and NOR's. Sequence-specific staining represents the complement of all the species as AT-rich due to more DAPI bright signals. All the cytogenetically studied species have been catalogued including the presently studied species and the list has been updated to 23 species." (Authors)] Address: Walia, Gurinder Kaur, Dept of Zoology and Environmental Sciences, Punjabi University, Patiala 147002, Punjab, India

18872. Wallis de Vries, M.F.; Manger, R.; van Grunsven, R. (2021): Trends van Dagvlinders en Libellen in het Drentsche Aa-gebied. Rapport VS2021.010. De Vlinderstichting, Wageningen. 29 pp. (in Dutch) ["Discussion and conclusion: For the dragonflies, only changes after 1990 could be analysed. As with the butterflies, the number of species increased (13) and decreased (15). The decline was particularly marked for species from fens and cooler climates, which are also under pressure elsewhere in the region. The increase was mainly for species from running water and species that have benefited from climate warming. These trends are in line with nationally observed developments. This is also expected for dragonflies as they are generally much more mobile than butterflies and their populations show similar dynamics on a large spatial scale. Nevertheless, these changes also reflect the development in habitat quality within the Drentsche Aa area, where nutrient-poor environments are under pressure, but the oxygen richness of the flowing water seems to have increased (which does not necessarily mean that the water has become less nutrient-rich)." (Authors, DeepL)] Address: De Vlinderstichting, Mennonietenweg 10, Postbus 506, 6700 AM Wageningen, The Netherlands. Email: info@vlinderstichting.nl

18873. Wang, Y.; Liu, J.-j.; Li, B.-l.; Liu, W.; Zuo, Y.-f.; Kong, D.-x.; Zhu, J.-l. (2021): Relationships between characteristics of macrobenthic assemblages and environmental variables in the Heihe River Basin, China. *AQUA — Water Infrastructure, Ecosystems and Society* 70(5): 710-729. (in English) ["To clarify the characteristics of macrobenthic assemblages and their response to the aquatic environment in the upper and middle reaches of the Heihe River, water quality, sediments and macrobenthos measurements were conducted in the summers of 2018 and 2019. The results showed that 50 species of macrobenthos were identified [including 8 odonate taxa not further detailed], belonging to 3 phyla, 7 classes, 15 orders and 32 families, mainly arthropods (37 species) and mollusks (11 species). *Argyroneta*

aquatica, *Chlaznius* sp., dragonfly nymphs, *Palaemon modestus*, *Radix auricularia*, *Cyraululus albus* and *Suecinea* sp. were the dominant species in the whole study region; most of these are pollution-tolerant and moderately tolerant species. The macrobenthos density and biomass ranged from 10 to 577 ind./m² and from 0.0907 to 50.0562 g/m², respectively, showing high spatial heterogeneity. Predators were the main functional feeding group. One-way analysis of variance clarified that Margalef's index and the Shannon–Wiener index differed significantly among the spatial areas ($P<0.05$). Canonical correspondence analysis showed that the spatial heterogeneity of the macrobenthos was affected by the water temperature and the total nitrogen and total phosphorus in sediments ($P<0.05$). Highlights: • The spatial variation community structures and species diversity of microbenthic in the Heihe River Basin (HRB) of China were investigated. • Analyzed the intensive fluctuations along the way of macrobenthic assemblages and their response relationship with environmental parameters in the HRB. • Natural environment factors and anthropogenic activities maintained the diversity and stability of macrobenthic communities of the HRB." (Authors)] Address: Wang, Y., College of Energy & Power Engineering, Lanzhou Univ. of Technology, Lanzhou 730050, China. E-mail: wangyu-mike@163.com

18874. Wang, Y.-J.; Sentis, A.; Tüzün, N.; Stoks, R. (2021): Thermal evolution ameliorates the long-term plastic effects of warming, temperature fluctuations and heat waves on predator-prey interaction strength. *Functional Ecology* 35(7): 1538- 1549. (in English) ["(1) How thermal evolution may affect trophic interactions and its implications for trophic system stability remains unstudied. To advance insights in how global warming shapes trophic interactions, we need to consider besides increases in mean temperatures, also daily thermal fluctuations (DTF) and heat waves (HW), and how their effects are modulated by thermal evolution. (2) Using a common-garden approach we tested how each thermal factor affected predator metabolic rate and functional response parameters, and used these responses to predict long-term predator-prey interaction strength between larvae of the damselfly *Ischnura elegans* and the water flea *Daphnia magna*. By using high- and low-latitude predator populations with the latter being exposed to higher mean temperatures, higher DTF and more frequent HW, we assessed the potential impact of thermal evolution at the high latitude using a space-for-time substitution. (3) In line with thermal adaptation, growth rates were faster and handling times shorter in low-latitude compared to high-latitude larvae at 24°C, while the opposite was true at 20°C. Warming weakened the long-term interaction strength, except for the high-latitude trophic system at DTF and HW where plastic responses therefore may not stabilize the high-latitude system. This extends the emerging insight that temperature variation may make ectotherms more vulnerable to warming. The contributions of metabolic rate, search rate and handling time in shaping thermal effects on interaction strength differed between latitudes. A key finding was that thermal evolution may further weaken the long-term interaction strength of the high-latitude trophic system under increases

in mean temperatures, even at DTF and potentially also at HW. (4) Our results underscore the importance of daily thermal fluctuations and heat waves in shaping predator-prey interactions, and may suggest an overall stabilizing contribution of predator thermal evolution ameliorating thermal plastic effects on food web stability." (Authors)) Address: Wang, Ying-Jie, Evol. Stress Ecology & Ecotoxicology, Univ. Leuven, Leuven, Belgium. Email: yingjie.wang@kuleuven.be

18875. Wildermuth, H. (2021): Auswirkungen des trockenheissen Sommers 2018 auf die Libellenfauna eines Wiesenweihers im östlichen Schweizer Mittelland. *Entomo Helvetica* 14: 33-44. (in German, with English and French summaries) ["Impact of the hot, dry summer of 2018 on the Odonata fauna of a meadow pond in the eastern Swiss Midlands. - Dragonflies rely on freshwater for their development. If a pond goes dry for several weeks during hot summer periods, the larvae will die. This was the case in 2018 at numerous small bodies of water in the Swiss Midlands. Questions were raised regarding the impact of pond desiccation on the local dragonfly fauna. The problem was studied at a small meadow pond that was created in 2010. In 2017, 28 odonate species were recorded, 16 of them with observed reproduction activities and 10 with successful development. In 2018 there were 19, 9 and 8 species, respectively, and in the following year 28, 16 and 4 species. In the second year after the hot and dry summer, the values were 25, 13 and 12 species, respectively. Unexpectedly, 4 species successfully developed in 2019: *Ischnura elegans*, *Sympetrum fonscolombii*, *S. sanguineum*, and *S. striolatum*. Their success is explained by their species-specific life histories. Only two years after the extreme weather event, the local odonate community had more or less recovered. Thanks to the species present in adjacent water bodies, the pond was rapidly recolonized. The importance of metapopulations based on dense limnological networks for both conservation and the promotion of local dragonfly fauna is underlined." (Author)] Address: Wildermuth, H., Haltbergstrasse 43, 8630 Rüti, Switzerland. E-mail: hansruedi@wilderdmuth.ch

18876. Wonglersak, R. (2021): Insect size and shape responses to temperature: a case study of British Odonata and Chironomidae (Diptera). PhD thesis, University of Southampton. 169pp. (in English) ["This PhD project investigated the response of wing length (as a proxy of body size) of Odonata and Chironomidae, and wing shape of Odonata to temperature and latitude. Three complementary data sources were used: natural history collections, field data, and mesocosm experiments. While natural history collections are valuable resources of specimens collected over long historical time scales, field data provides a modern perspective and mesocosm experiments provide a window on the future, under a predicted climate warming scenario. This PhD project used 5,331 museum specimens of 14 British Odonata species representing different life cycle types to examine the potential drivers of body size and wing shape responses to latitude and temperature (Chapter II and V). To control for latitude a field survey was performed during

the summer of 2018 at Edington, Somerset to compare modern wing length of three species with historical data based on museum specimens of the same species collected at the same locality (Chapter III). Furthermore, to investigate body size responses of chironomids under a future temperature scenario, 1,976 adult specimens of six chironomid species were collected from mesocosm experiments which comprised ponds at ambient temperature and ponds maintained at 4°C higher than ambient (Chapter IV). The results of Chapters II, III and IV showed that species and suborder (within Odonata) were significant factors affecting the magnitude of the temperature-size responses in Odonata and Chironomidae. Wing lengths of Zygoptera and Chironomidae are more sensitive to temperature and collection date than Anisoptera. Zygoptera and Chironomidae tend to get smaller with increasing temperature, likely due to higher temperatures disproportionately increasing developmental rate, resulting in smaller adults. Anisoptera showed no significant correlation with temperature, possibly due to selection for larger individuals in Anisoptera which are strongly territorial species. Adults of Zygoptera and Chironomidae emerging towards the end of the summer tend to be smaller than those emerging earlier in the season, likely due to larval development being time-constrained later in the season and as a result, larvae accelerate their developmental rate which comes at the cost of a smaller adult body size. The results of Chapter V indicated non-significant correlations between environment and wing shape in Anisoptera, while there were significant influences of latitude and mean seasonal temperature on wing shape in Zygoptera species, with broader and shorter wings found at lower latitudes with warmer temperatures. This finding corresponds well with a result of Chapter II which found shorter wing length with increasing temperature in all zygopteran species in the study. Overall, the results of this PhD project show that there are different factors influencing the temperature-size responses of insects, including phylogenetic relationships, sex, behaviour and life cycle types. Although this study found no universal temperature size responses in the focal taxa, Zygoptera and Chironomidae tend to have stronger negative body size responses to warming temperature and emergence date than Anisoptera. In addition, the study shows that wing shape variation in Zygoptera is more sensitive and adaptive to latitude and temperature than in Anisoptera." (Author) *Brachytron pratense*, *Aeshna cyanea*, *A. grandis*, *A. mixta*, *Anax imperator*, *Libellula quadrimaculata*, *Somatochlora metallica*, *Sympetrum striolatum*, *Calopteryx splendens*, *C. virgo*, *Coenagrion puella*, *Ischnura elegans*, *Lestes sponsa*, *Pyrrhosoma nymphula*. Address: Wonglersak, Rungtip: not stated