

# Odonatological Abstract Service

published by the INTERNATIONAL DRAGONFLY FUND (IDF)

## Editor:

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Published in Zerf, Germany

ISSN 1438-0269

## 2008

**20300.** Carron, G. (2008): Espèces particulièrement menacées de la région genevoise. Plans d'actions pour la conservation (phase 3). Agrion de Mercure *Coenagrion mercuriale* (Odonata: Coenagrionidae). Etat de Genève, Domaine Nature & Paysage: 55 pp. (in French) [*C. mercuriale* is the 8th insect species considered particularly threatened in the Geneva region (Switzerland) and is the subject of a specific regional action plan. Discovered only in 2006, after several decades of absence in the canton, this dragonfly has its only population on the Creuson, in the Geneva and especially the Vaud sectors, on both sides of the border. Doubts remain as to whether this is a recent colonisation or whether the species has gone unnoticed. There is no other known population within a 40 km radius, there is no other population in the canton of Vaud. *C. mercuriale* is threatened with extinction throughout the country and is protected at the Swiss and European levels. The agrionis requires very sunny and well oxygenated running water and is therefore very sensitive to organic pollution. The present study shows that the population (daily maximum of 700-800 individuals over 3 km) is concentrated in the Vaud sector of the Creuson, between the Bois des Dailles and the Bois de Portes. The Creuson is located in an open landscape, in a sunny situation, and the pollution is marked but not excessive since it is located upstream of the outlet of the Chavannes-Bois WWTP. The optimal habitat is composed of a clear runoff bordered by water cress (*Nasturtium officinale*) and beccabunga speedwell (*Veronica beccabunga*), plants in which the female agrion lays her eggs. The actions must be based on good information / consultation of the different services concerned (as well as the partners involved in the management of the site), on both sides of the border. This will involve limiting the arrival of chemical pollutants (nitrates and biocides from agriculture; copper, organic matter, etc. from the WWTP), modifying the maintenance of the grassy banks, and increasing the amount of sunlight in certain heavily overgrown sections." (Authors/DeepL)] Address: Bureau Gilles Carron, Bioindication\*Gestion\*Monitoring, CP90, 2002 Neuchâtel, Switzerland. E-mail: carron.bureau@vtx.ch

**20301.** Cheung, K.-w. (2008): Spatial and seasonal variations of freshwater macroinvertebrates, Odonata and waterbirds in Luk Keng marshland, Hong Kong. MSc. thesis, The Univ. of Hong Kong (Pokfulam, Hong Kong): V + 125 pp. (in English) [<sup>1</sup>1. The temporal and spatial distribution of macroinvertebrates, adult odonates and waterbirds in 26-ha Luk Keng marsh, the largest freshwater wetland in Hong Kong, were investigated between February 2005 and April 2006 to

provide information relevant to management of the marsh for biodiversity conservation. 2. A salinity gradient has been created in Luk Keng as a result of the presence of a sluice gate which allows sea water to intrude the marsh. Ten habitat zones were identified: a stand of mangroves (*Kandelia obovata*: Rhizophoraceae; M) on the seaward side, and – progressing landward – a reed bed (*Phragmites australis*: Poaceae) situated towards the western (WP) and north-eastern side (NEP) of Luk Keng; a tidal mudflat area on the western (WMudflat) and southern side (SMudflat) of Luk Keng; a portion of the marsh (W) dominated by water chestnut (*Eleocharis dulcis* and *E. spiralis*: Cyperaceae); two grass-dominated freshwater marshland zones (SS and ST); a stream flowing into Luk Keng with an associated marshy area (Ri); and, the junction between the stream and the marsh (H). 3. A total of 75 aquatic macroinvertebrate taxa in 38 families were recorded in 112 samples collected during the dry and wet seasons in the two freshwater marshland zones SS and ST, and is the highest thus far reported from such habitats in Hong Kong. Assemblage composition and richness at SS and ST were broadly similar. Diptera dominated in terms of richness and relative abundance, although Coleoptera and larval odonates were also important. In terms of functional organization, macroinvertebrate assemblages were dominated by predators while collector-gatherers were also numerous. 4. Significant seasonal variation of macroinvertebrate assemblage structure was detected in both SS and ST with odonates more abundant in the wet season and oligochaetes more numerous during the dry season. The proportion of predators was the highest during the wet season when similarity between areas was the greatest. Seasonal variations were more marked at SS due to the greater range of salinity recorded in that area. 5. Forty-two odonate species (15 Zygoptera and 27 Anisoptera) representing 38% of odonate species in Hong Kong, including the globally-vulnerable *Mortonagrion hirosei* and 10 species of local conservation concern, were recorded in M, WP, W, SS, ST and H during biweekly transect counts. The odonate assemblage was dominated by Libellulidae and Coenagrionidae, and *Agriocnemis femina*, *Ceragrion auranticum* and *Orthetrum luzonicum* were the most common species. 6. There was an obvious seasonal change in abundance and species richness of odonates with an increase from March until July then a decline through August to October and followed by a dry-season low. 7. Species richness of adult odonates decreased from the freshwater zones to the mangrove zone, although *M. hirosei* was mainly confined to reed bed, and salinity appeared to have an important influence on odonate assemblage structures, possibly by way of an effect on vegetation structure. 8. Thirty waterbird species, mainly Scolopacidae and Ardeidae were recorded in M, WP, NEP, WMudflat, SMudflat, W, SS, ST and Ri during monthly

point counts and transect counts. [...] 10. It is recommended that populations of globally-vulnerable *Mortonagrion hirosei* be monitored in Luk Keng each year by the Agriculture, Fisheries and Conservation Dept using line transects in reed beds; censuses should be made from April to June. Biweekly odonate surveys during the wet season, especially in July and August, are also recommended to monitor the ecological conditions at Luk Keng. Biweekly point counts should also be undertaken to record the abundance of globally-endangered Black-faced Spoonbills from November to May. Counts of Common Snipe, Pintail Snipe, Swinhoe's Snipe and Greater Painted Snipe which are threatened by the degradation of wet agricultural lands in Hong Kong should also be made. 11. A sluice gate which can be closed during spring tides should be built by the Home Affairs Dept to replace the present faulty gate so as to manage salinity levels in the marsh and prevent excessive saline intrusion. While some intrusion will be needed to maintain the reed bed and mangroves as habitats for *M. hirosei* and the Black-faced Spoonbill, investigation of the consequences of salinity intrusion should be initiated by AFCD. Designation of Luk Keng marsh as a Country Park or Special Area to protect the biodiversity it supports should be undertaken as a matter of urgency." (Author)] Address: not stated

**20302.** Cremona, F. (2008): Transfert de méthylmercure et structure des réseaux trophiques chez les macroinvertébrés littoraux. Thèse universitaire, Université du Québec à Montréal: XIV + 159 pp. (in French or English) ["In the context of the COMERN St. Lawrence River case study, the overall objective of the thesis was to determine the role of littoral macroinvertebrates in the transfer of methylmercury (MeHg) in the Lake St. Pierre ecosystem. The first chapter was devoted to the quantitative contribution of non-consumptive invertebrates ("trophic impasses") to the transfer of MeHg to fish. For this purpose, total mercury (THg) and MeHg concentrations in four functional groups of littoral macroinvertebrates (grazers, detritivores, consumable predators, non-consumable predators) were measured. The results showed that non-consumptive predators had the highest THg, MeHg and MeHg/THg concentrations of all functional groups. The MeHg load (concentration x biomass) of non-consumptive predators represented 10-36% of the MeHg pool of phytophilic invertebrates. This high proportion of MeHg sequestered in trophic impasses could help explain the low Hg concentrations measured in fish in Lake St Pierre. Our results show that non-consumptive organisms must be taken into account in predictive models of Hg contamination of ecosystems in order to avoid overestimating the quantities of MeHg bioavailable to fish. In the second chapter, the objective was to determine the links between the source of organic matter (OM) and MeHg contamination in primary consuming littoral macroinvertebrates. An isotope approach was applied to meet this objective. Indigenous sources (epiphytes and macrophytes) dominated the OM assimilated by primary consumers, with a lower proportion of allochthonous OM (suspended particulate matter in particular). MeHg/THg in macroinvertebrates was positively correlated with epiphyte proportions, whereas the latter were negatively correlated with the inorganic Hg fraction. This finding may suggest that the main pathway of MeHg into nearshore food webs is through epiphytes. Primary consumers could then modulate the transfer of MeHg to higher trophic levels depending on whether they feed on OM sources with high or low MeHg concentrations. The third chapter dealt with the influence of functional group (grazer, collector, fragmenter, omnivore, predator, predator-haematophagous, biting-sucking) and spatiotemporal variables

(year, month, sampling station) on the  $\delta^{15}\text{N}$  signature of littoral macroinvertebrates in Lake St Pierre. Station was the most important factor in explaining  $\delta^{15}\text{N}$  variations, followed by sampling month and functional group. Organisms from the south shore, which is heavily influenced by agricultural inorganic nitrogen inputs, had higher  $\delta^{15}\text{N}$  values than those from the north shore which receives inputs from the Canadian Shield. The  $\delta^{15}\text{N}$  signature of the organisms increased by about 3‰ during the sampling period from May to September, equivalent to one trophic level. The enrichment of  $\delta^{15}\text{N}$  from herbivores to predators averaged 1.6‰, which is lower than the 3.4‰ generally considered in pelagic organisms. Since isotopic fractionation is not homogeneous throughout the food web, we recommend using fractionation values specific to the trophic levels considered, in order to better reconstruct nearshore food webs. In the last chapter, the roles of macrophyte habitat and architecture on the biomass and abundance of phytophilic invertebrates were investigated. We also calculated a lake-wide estimate of the macroinvertebrate biomass associated with different macrophytic habitat types in order to estimate the quantitative effects of vegetation changes on macroinvertebrate communities. Biomass, abundance and richness of invertebrate communities were higher in submerged macrophyte habitats than in floating and emergent macrophyte habitats. Macrophytes with complex architecture did not harbour significantly more macroinvertebrate biomass than those with simpler architecture. In the case of a decrease in water level in Lake St. Pierre we predicted that the total biomass of phytophilic invertebrates would decrease by 16% at the lake scale. In nearshore food webs, it appears that energy and MeHg flows are not perfectly superimposed. Firstly, the lower trophic levels constituted by primary consumer macroinvertebrates are capable of modulating MeHg fluxes according to the nature of their OM sources. Secondly, among secondary consumers a significant proportion of the MeHg pool will be available for transfer to fish only to a limited extent or not at all. The small difference in  $\delta^{15}\text{N}$  between primary and secondary consumers makes us doubt the usefulness of this tool as a tracer of the trophic level of an organism in the littoral zone compared to  $\delta^{13}\text{C}$ ." (Author/DeepL)] Address: Not stated

**20303.** Ruppell, G.; Hilfert-Ruppell, D. (2008): Fliegende Spinnennetze: Erfolgsmodell Libelle. Biologie in unserer Zeit 38: 116-125. (in German) ["The thermal adaptations of damselflies, damselflies and damselflies are presented. *Ischnura* specimens are extremely successful and aggressive. They prey other dragonflies of the same size and even conspecifics. Damselflies fly with the greatest accelerations and are extremely agile. They specialise in small prey. In them, reproduction is largely ordered by a territorial system. Some large dragonflies also manage to become active at cool temperatures despite their highly developed flight apparatus. Thus, studies on dragonflies allow interesting insights into the mechanisms of evolution." (Authors/DeepL)] Address: Hilfert-Ruppell Dagmar, Zool. Inst. TU Braunschweig, Fasanenstr. 3, 38092 Braunschweig, Germany. E-mail: d.hilfert@tu-bs.de

## 2010

**20304.** Achoura, A.; Bellhamra, M. (2010): Aperçu sur la faune arthropodologique des palmeraies d'El-Kantara. *Courrier du Savoir* 10: 93-101. (in French, with English summary) [To study the arthropods in the area of Biskra, Algeria, two study plots in the zone of El-Kantara were chosen dif-

fering by two types of palm plantations, modern and traditional. "Our inventory reveals the presence of 48 species invertebrates, same ones observed in each site but with different manpower, always let us announce that the traditional palm plantation is most dominant with a total rate of 67,87%. The class of the insects is populated by 46 species, that is to say 95,84% of totality. It is followed by that of crustacean and that of Arachnida by only one species and a percentage of 2,08% each one. According to the systematic order the Orthoptera are classified in first position with a rate of 18,75 %, followed by the Coleoptera 16,67%, the Lepidoptera and the Hymenoptera with 14,58 % each one. According to the food mode we noted five groups whose phytophagous ones are represented with a rate of 56,25 %, followed by the predatory ones with 20,83 %, the saprophagous with 18,78 % and finally the parasites and the polyphagous ones with a rate of 2,08 % each one." (Authors)] Address: Achoura, A., Dépt d'Agronomie, Univ. Mohamed Khider Biskra, Algeria. E-mail: achouraammar@yahoo.fr

**20305.** Endersby, I. (2010): A revised, annotated checklist of Victorian dragonflies (Insecta: Odonata). *Proceedings of the Royal Society of Victoria* 122(1): 9-27. (in English) ["Seventy-six species of Odonata are known from Victoria (26 Zygoptera; 50 Anisoptera). In the last ten years one new species *Austroaeschna ingrid* Theischinger, 2008 has been described from the State; *Austroepigomphus praeruptus* (Selys, 1857) and *Pseudagrion microcephalum* (Rambur, 1842) have now been recorded; and records of *Rhadinosticta banksi* (Tillyard, 1913) and *Labidiosticta vallisii* (Fraser, 1955) are judged to be erroneous. Generic names of *Aeshna*, and *Trapezostigma* have been changed. Some changes in higher level names and relationships, based on recent phylogenetic analyses, have been incorporated. Distribution maps for all species, based on museum collections, are provided." (Authors)] Address: Endersby, I., 56 Looker Rd, Montgomery, Victoria 3094, Australia. E-mail: endersby@pacific.net.au

## 2011

**20306.** Hilfert-Rüppell, D.; Rüppell, G. (2011): Mit Fangmaske und Stechrüssel - den Beutefang von Wasserjägern erforschen. *Praxis der Naturwissenschaften, Biologie in der Schule* 7/ 60: 13-21. (in German) ["Aquatic insects [including Odonata] offer very good opportunities for research and to work out facts in a new way. Unlike many land insects, they are easily visible and easy to keep. Simple observations and experiments, but also research with the slow-motion camera, should increase the pupils' motivation for independent, biological work and deepen their knowledge. Media competence is taught and the process-related competence communication is strengthened through group work." (Authors) Translated with [www.DeepL.com/Translator](http://www.DeepL.com/Translator) (free version)] Address: Hilfert-Rüppell Dagmar, Zool. Inst. TU Braunschweig, Fasanenstr. 3, 38092 Braunschweig, Germany. E-mail: d.hilfert@tu-bs.de

**20307.** van der Tol, M. (2011): Onderzoek naar de geschiktheid voor libellen van de duinpoelen Zuid-Kennemerland en de invloed van grote grazers hierop - [Study of the suitability for dragonflies of dune pools South-Kennemerland and the influence of large grazers on this]. BSc. thesis, Bos- en Natuurbeheer, Hogeschool Van Hall - Larenstein: 91 pp. (in Dutch) ["Zuid-kennemerland contains a large number of dune pools. The area is integrally grazed by Scottish Highlanders, Shetland ponies and Konik horses, in order to prevent grassification and encroachment and to

promote varied vegetation structures. The dune pools provide grazing and drinking opportunities for these animals. They are also important breeding grounds for dragonflies, among other things. Management company PWN wants to monitor the effect of the large grazers on the pools in general and on the dragonfly fauna in particular. The aim is to adapt the management for the benefit of the dragonflies if necessary. The assignment was carried out within the graduation phase of the course Forestry and Nature Management, Nature and Landscape Technology at the Van Hall - Larenstein Univ. of Applied Sciences in Velp (Gelderland). The research question is as follows: What is the suitability for the dragonfly fauna of the dune pools in South-Kennemerland, and what is the influence of the large grazers on this? Existing inventory data of various dune pool characteristics and of dragonflies were used for the analysis and converted into a usable dataset. The data were statistically processed with SPSS. The inventory data are not complete; important data of both dune pool characteristics and dragonflies are missing. This fact and the very limited time available for the research have led to research results that partially answer the research question. Moreover, the reliability of the results is limited. In the analysis, relationships between large grazers, dune pools and dragonflies were sought by determining Pearson correlations and by means of the Mann-Whitney U test, a distribution-free significance test. A negative relationship between the use of the pools by large grazers and the total number of reproducing species was found, but it is not a strong relationship. One species, the Flat-bellied Dragon, has been shown to benefit from trampled banks. The most important key factor for dragonfly reproduction in general in the dune pools is the presence of flab in summer. Further research, improvement and extension of inventory methods for dragonflies and dune pool characteristics are necessary in order to arrive at reliable results and useful management advice." (Author) Translated with [www.DeepL.com/Translator](http://www.DeepL.com/Translator) (free version)] Address: not stated

## 2012

**20308.** Hilfert-Rüppell, D.; Rüppell, G. (2012): Blaue Luftkrobaten: Prachtlibellen als Modellorganismen für Verhaltensbeobachtungen. *PdN Biologie in der Schule* 61(6): 8-12. (in German) ["Behavioural observation; Secondary school I; Secondary school II; Courtship; Biology lessons; Flowing water; Wing beat; Dragonfly; Mating; Territorial behaviour; Animal behaviour; Germany. Abstract: Damselflies (*Calopteryx*) are typical inhabitants of flowing water. The blue males are immediately noticeable when they flutter around each other or approach the camouflaged females in buzzing flight. After only a short observation of the animals, it becomes clear that the males occupy certain areas, so-called territories, and drive other males out of them. They do this with very different flights: They fly side by side or behind each other in arcs up and down or back and forth. They circle each other or chase each other at top speed. The winner gets the reward later, usually in the midday and afternoon hours, mating with females. However, when a lot of males gather on the shore, chaos breaks out. Now the males can no longer defend territories and they all pounce on rivals and females. Pupils are given instructions on how to observe, but also how to film with a slow-motion camera to see the behaviour in detail. In doing so, they get to know the animals and their behaviour and thus gain the ability to independently draw conclusions about the order of behaviour, adaptation and evolution. The topic offers both material and content at entry level as well as for more demanding

processing in secondary school. It is possible to advance into modern areas such as genecology, female choice or integrative models by combining physiological (e.g. dual function of flight), ecological (e.g. qualities of the habitat) and evolutionary (e.g. sexual conflict) elements. The behaviour of damselflies is one of the model systems for the study of animal communication." (Authors)] Address: Hilfert-Rüppell, Dagmar, Technische Universität Braunschweig, Institut für Fachdidaktik der Naturwissenschaften, Abteilung Biologie & Biologiedidaktik, Bienroder Weg 82, 38106 Braunschweig, E-Mail: d.hilfert-ruempel@tu-bs.de

## 2013

**20309.** Kosterin, O.E. (2013): 20. New data on dragonfly (Odonata) of Akademgorodok and its surroundings. In: Dynamics of ecosystems of the Novosibirsk Akademgorodok / Ed. ed. I. F. Zhimulev; Ros. acad. Sciences, Sib. Dept, Institute of Molecular and Cellular Biology [and others]. - Novosibirsk: Publishing House of the Siberian Branch of the Russian Academy of Sciences, 2013. - 438 p. + 30 c. insert. : 204-208. (in Russian) [So, in 2008-2012. In the vicinity of Akademgorodok, three previously unrecorded species of dragonflies were found - *Coenagrion johannsoni*, *Ischnura pumilio* and *Somatochlora arctica*, and *Gomphus vulgatissimus* was added according to earlier collections, the find of the second of them is also the first in the Novosibirsk region. At the moment, 41 species of dragonflies are known from the vicinity of Akademgorodok. ] Address: Kosterin, O.E., Institute of Cytology and Genetics, Siberian Branch, Russian Academy of Sciences, Lavrentiev Ave 10, RUS-630090 Novosibirsk, Russia. E-mail: kosterin@bionet.nsc.ru

## 2016

**20310.** Kaelin, K.; Altermatt, F. (2016): Landscape-level predictions of diversity in river networks reveal opposing patterns for different groups of macroinvertebrates. *Aquatic Ecology* 50(2): 283-295. (in English) ["Aquatic biodiversity in rivers and streams is threatened in many regions worldwide. As biodiversity loss has severe consequences on ecosystem functioning, it is important to understand the causes of decline and to predict biodiversity in space and time. In order to achieve this, the identification of the driving factors and the appropriate choice of indicator groups are needed. We developed a spatially explicit habitat distribution model for aquatic macroinvertebrates in Swiss watercourse networks using national biodiversity monitoring data from 410 randomly selected sampling sites. We specifically looked at two worldwide frequently used macroinvertebrate indicator groups. Using generalized linear models, we related firstly species richness of mayfly, stonefly and caddisfly (Ephemeroptera, Plecoptera, Trichoptera; EPT) and secondly richness of all macroinvertebrate families and higher-order taxa (macroinvertebrate family richness) to 38 nationwide available environmental variables. We then predicted richness of both indicator groups at the landscape scale, providing the first nationwide prediction of EPT species and macroinvertebrate family richness. Consistent with previous work, we found that variables describing land use and topology were most important for explaining richness at the landscape level. However, the two indicator groups showed opposing patterns of richness and a different sensitivity to land-use variables. This indicates that the sole use of one of these groups may be misleading with respect to water quality assessments and to the identification of overall diversity hotspots. We conclude that commonly used richness patterns derived from aggregated groups, such as

family-level macroinvertebrate richness, may be less appropriate for conservation strategies." (Authors)] Address: Altermatt, F., Dept of Aquatic Ecology, Eawag, Swiss Federal Inst. of Aquatic Science & Technology, Überlandstr. 133, 8600, Dübendorf, Switzerland. Email: Florian.Altermatt@eawag.ch

**20311.** Liebhold, A.M.; Yamanaka, T.; Roques, A.; Augustin, S.; Chown, S.L.; Brockerhoff, E.G.; Pysek, P. (2016): Global compositional variation among native and non-native regional insect assemblages emphasizes the importance of pathways. *Biological Invasions* 18: 893-905. (in English) ["Insects are among the world's most ecologically and economically important invasive species. Here we assemble inventories of native and non-native species from 20 world regions and contrast relative numbers among these species assemblages. Multivariate ordination indicates that the distribution of species among insect orders is completely different between native and non-native assemblages. Some orders, such as the Psocoptera, Dictyoptera, Siphonaptera, Thysanoptera, and Hemiptera, are always over-represented in the non-native compared to native assemblages. Other orders, such as the Plecoptera, Trichoptera, Ephemeroptera, Odonata, Mecoptera and Microcoryphila, are consistently under-represented in non-native assemblages. These patterns most likely arise both as a result of variation among taxa in their association with invasion pathways responsible for transporting species among world regions, as well as variation in life-history traits that affect establishment potential. However, our results indicate that species compositions associated with invasiveness are fundamentally different from compositions related to insularity, indicating that colonization of islands selects for a different group of insect taxa than does selection for successful invaders. Native and non-native assemblage compositions were also related, to a lesser extent, to latitude of the region sampled. Together, these results illustrate the dominant role of invasion pathways in shaping the composition of non-native insect assemblages. They also emphasize the difference between natural background colonization of islands and anthropogenic colonization events, and imply that biological invasions are not a simple subset of a long-standing ecological process." (Authors)] Address: Liebhold, A.M., US Forest Service Northern Res. Station, 180, Canfield St., Morgantown, WV 26505, USA. E-mail: aliebhold@fs.fed.us

## 2018

**20312.** Alvarez Fidalgo, M.; Miralles-Niunez, A.; Domech Fernandez, M. (2018): Primeros registros de *Symptetrum sinaiticum* Dumont, 1977 (Odonata, Libellulidae) en la provincia de Albacete (Castilla-La Mancha, SE España) y actualización de su distribución en España. *Boln. Asoc. esp. Ent.* 42(3-4): 333-349. (in Spanish, with English summary) ["First records of *S. sinaiticum* in the province of Albacete (Castilla-La Mancha, SE Spain) and an update of its distribution in Spain. The first records of *S. sinaiticum* in the province of Albacete are presented, which are among the few data of the species in the Autonomous Community of Castilla-La Mancha. Furthermore, its distribution in Spain is updated, using information extracted from public databases and citizen science platforms, thus increasing by 35,2 % the previously known distribution of the species, based on UTM squares of 10 x 10 km." (Authors)] Address: Alvarez Fidalgo, Marin, Depto de Química Orgánica e Inorgánica/IU-QOEM, Universidad de Oviedo, 33006 Oviedo, Asturias, Spain. E-mail: madamcoolpix@gmail.com

**20313.** Amundrud, S.L.; Videla, M.; Srivastava, D.S. (2018): Dispersal barriers and climate determine the geographic distribution of the helicopter damselfly *Mecistogaster modesta*. *Freshwater Biology* 63(2): 214-223. (in English) ["1. Species' ranges are typically constrained by the interplay of physical barriers to dispersal, environmental requirements such as suitable climatic conditions and biotic constraints such as from predation or competition. However, teasing apart the relative importance of these constraints in determining species distributions still represents a major challenge for ecologists. 2. The Neotropical damselfly *M. modesta* inhabits wet and moist forests in mainland Central America and north-western South America. This habitat specialist spends its larval development exclusively in tank bromeliads, where it acts as a keystone predator within the aquatic food web. Although tank-forming bromeliads occur from the southern United States throughout most of South America, *M. modesta* is absent from the Caribbean islands and South America south-east of the Andes mountain chain. 3. We employed species distribution models to explore the relative importance of physical barriers (Andes mountain range and oceanic barriers), climate (mean annual temperature and annual precipitation) and biotic interactions (competition from other bromeliad-dwelling odonates) in limiting the geographic distribution of *M. modesta*. 4. We found that dispersal barriers strongly limit the geographic distribution of *M. modesta*. In addition, its range is restricted by low temperatures and low precipitation. Competition from other bromeliad-dwelling odonates was not important in limiting the damselfly's range. Because of the physical barriers to dispersal, *M. modesta* does not occupy its full potential geographic range. Specifically, our model predicted suitable habitat on the Caribbean islands and throughout most of South America, where the species is currently absent. 5. These findings have important conservation implications, particularly as the aridification of rainforests and subsequent localised extinctions due to climate change continue. On the other hand, the species may respond to warming temperatures by tracking climate to higher elevations, with subsequent effects on naïve high-elevation bromeliad food webs. An upwards migration could also increase the probability of *M. modesta* overcoming the dispersal barrier presented by the Andes, enabling the damselfly to invade large areas of suitable habitat in South America." (Authors)] Address: Amundrud, Sarah, Dept Zool., Biodiversity Res. Centre, Univ. of British Columbia, Vancouver, BC, Canada. Email: amundrud@zoology.ubc.ca

**20314.** Andrew, R.J.; Thomas, S. (2018): Egg chorion of *Paragomphus lineatus* (Odonata: Gomphidae). *Odonatologica* 47(1/2): 133-144. (in English) ["The egg chorion of the exophytic dragonfly *Paragomphus lineatus* was examined using light and scanning electron microscopy. The egg is sub-spherical and possesses a very large conical but flat-top micropylar apparatus. The outer surface of the chorion is uniformly sculptured with strong hexagonal reticulations formed by the fusion of tiny low nodules on the chorion (3–4µm). The area lying inside the hexagonal reticulation is filled with 7–10 nodules. The chorion is formed of a uniformly thin endochorion and a multi-layered exochorion. The micropylar apparatus is composed of a central, tubular micropylar projection which terminates as a flat circular disc. This plate bears a central elevated knob around which 6–7 micropylar orifices are arranged in a circle. The micropylar projection is surrounded by a thick mass of sticky jelly. Development of the micropylar apparatus takes place during the late vitellogenic and choriogenic stages of egg maturation. The jelly mass is exochorionic in origin and is deposited

by the follicular epithelial cells of the oocyte. The micropylar projection is formed by the evagination and morphogenetic movement of the endochorion. The egg chorionic architecture of *P. lineatus* is discussed with respect to phylogeny and oviposition behaviour of the female." (Authors)] Address: Andrew, R.J., Centre for Higher Learning and Research in Zoology, Hislop College, Civil lines, Nagpur- 440 001 (MS), India. E-mail: rajandrew@yahoo.com

**20315.** Aziz, M.A.A.; Mohamed, M.; Tokiman, M.L. (2018): Faunistic studies of odonates (Insecta: Odonata) in Johor, Peninsular Malaysia. *Serangga* 23(2): 14-35. (in English, with Malay summary) ["The purpose of this research is to study the diversity and distribution of odonates in Johor, Peninsular Malaysia. The method used for odonate sampling was manual collection along 1 km line transect using aerial net. Overall, a total of 2222 individuals under 84 species from 13 families and 58 genera were recorded. Family Libellulidae was the most well-represented family. Shannon Diversity Index (H') and Evenness Index (E) were highest in Endau-Rompin Johor National Park (H'= 3.155; E= 0.733) and lowest in Soga Perdana Recreational Forest (H'= 2.444; E= 0.501). To determine the site with highest conservation priority, the ecological data and entomotourism criteria was further analyzed using grid analysis. The site with highest priority was Endau-Rompin Johor National Park with a score value of 52 while the lowest priority was recorded in Sungai Sayong with a score value of 35. All these data will be helpful in assisting towards a better management of the conservation areas in Johor." (Authors)] Address: Mohamed, M., Centre of Research for Sustainable Uses of Natural Resources Faculty of Applied Science and Technology Universiti Tun Hussein Onn Malaysia. Email: maryati@uthm.edu.my

**20316.** Bäumlér, F.; Gorb, S.N.; Büsse, S. (2018): Comparative morphology of the thorax musculature of adult Anisoptera (Insecta: Odonata): Functional aspects of the flight apparatus. *Arthropod Structure & Development* 47(4): 430-441. (in English) ["Due to their unique flight mechanism including a direct flight musculature, Odonata show impressive flight skills. Several publications addressed the details of this flight apparatus like: sclerites, wings, musculature, and flight aerodynamics. However, 3D-analysis of the thorax musculature of adult dragonflies was not studied before and this paper allows for a detailed insight. We therefore, focused on the thorax musculature of adult Anisoptera using micro-computed tomography. Herewith, we present a comparative morphological approach to identify differences within Anisoptera: Aeshnidae, Corduliidae, Gomphidae, and Libellulidae. In total, 54 muscles were identified: 16 prothoracic, 19 mesothoracic, and 19 metathoracic. Recorded differences were for example, the reduction of muscle Idlm4 and an additional muscle Ildm1 in *Aeshna cyanea*, previously described as rudimentary or missing. Muscle Iscm1, which was previously reported missing in all Odonata, was found in all investigated species. The attachment of muscle Ipcm2 in *Pantala flavescens* is interpreted as a probable adaptation to its long-distance migration behaviour. Furthermore, we present a review of functions of the odonatan flight muscles, considering previous publications. The data herein set a basis for functional and biomechanical studies of the flight apparatus and will therefore lay the foundation for a better understanding of the odonatan flight. ] Address: Bäumlér, F., Dept of Functional Morphology and Biomechanics Institute of Zoology, Kiel Univ., Am Botanischen Garten 9, 24118, Kiel, Germany

**20317.** Barnard, A. (2018): The role of divergent genital morphologies in reproductive isolation. PhD. thesis, Univ. of Oklahoma: XV + 145 pp. (in English) ["How a single ancestral species can give rise to new, separate species remains a major outstanding question in evolutionary biology. Understanding speciation requires identifying how reproductive isolation (RI) is initiated and maintained in the early stages of population divergence. External male reproductive structures have received considerable attention as an early-acting cause of RI, because the morphology of these structures often evolves rapidly between populations. My dissertation research used a pair of recently diverged damselfly species in the genus *Enallagma* (Odonata: Coenagrionidae) to understand the role of divergent genital morphologies in causing RI at early stages of the speciation process. Specifically, I investigated the mechanisms by which species-specific morphologies limit gene flow between species, and then explored the relationships between morphological differentiation and overall genomic differentiation between species. My research focused on *Enallagma anna* and *E. carunculatum*, two damselfly species that diverged within the past ~250,000 years and differ conspicuously in their reproductive structure morphology, yet currently hybridize in at least one sympatric region. In chapter 1, I tested the importance of mechanical and tactile incompatibilities in RI between *E. anna* and *E. carunculatum* by quantifying 19 potential prezygotic and postzygotic RI barriers, using both naturally occurring and lab-reared damselflies. I found that mechanical incompatibilities between heterospecific male and female reproductive structures limit but do not completely prevent heterospecific mating attempts. However, females were significantly less likely to mate with hybrid or heterospecific males compared to conspecific males, which suggests that tactile incompatibility between male and female morphologies forms an additional mechanism to limit gene flow between these species. Postmating RI barriers appeared weak or nonexistent, which indicates that premating isolation, mediated by divergence in genital morphologies, was the first type of reproductive barrier to evolve in this group. These results highlight the potential for rapidly evolving genitalia to cause RI via tactile mechanisms, which may be a more widespread RI mechanism than we are currently aware of. In chapter 2, I more closely examined the female structures presumed to be important in evaluating male tactile signals during premating contact and influencing *Enallagma* female mating decisions. I quantified and compared several mechanosensory sensilla phenotypes on the female thorax among multiple sympatric and allopatric populations to test for evidence of reproductive character displacement, which would indicate that sensilla phenotypes are important in species recognition. My results suggest that species-specific placement of female mechanoreceptors is sufficient for species recognition, but mechanosensor variation among females within species may be important for mate choice within species. This hypothesis requires additional study to test the relationships between female sensilla phenotypes and behavior. This experiment reveals *Enallagma*'s potential as a study system for elucidating the neurobiological basis of female mating decisions. In chapter 3, I explored the relationships between morphological divergence and genomic differentiation during speciation. Persistent gene flow between species as they diverge can homogenize some regions of the genome and make differentiated regions stand out in comparison. Some of these highly divergent loci are predicted to harbor genes responsible for reproductive isolation. However, patterns of genome diversification at this stage remain poorly understood, such as how such loci are arranged across the ge-

nome and whether such loci commonly contribute to reproductive isolation or are simply less subject to recombination. I generated a set of genome-wide variant loci in a large collection of samples from multiple populations, including both natural and lab-reared hybrids. I used these loci to quantify introgression patterns in nature, identify divergent loci, and test for associations between genomic ancestry and species-specific phenotypic variation. The results suggest ongoing gene flow between *E. anna* and *E. carunculatum* in nature, but also demonstrate the challenge of differentiating shared ancestral polymorphism from recent admixture when studying young species. Additionally, the results revealed that estimated ancestry proportions in hybrids were a reliable predictor of hybrid reproductive structure phenotype in most cases – but some individuals appeared to have a genome that mostly resembled one parental species, yet morphology more similar to that of the other parental species. Clarifying the relationships between genotypes and phenotypes will likely require more fine-scale genomic sequencing efforts than this study obtained. My dissertation research integrated behavioral studies in the field and lab with quantitative trait comparisons and genomics to investigate the importance of rapid evolution of reproductive structures in reproductive isolation. This work enhances our understanding of how morphological divergence affects mating behavior to cause RI, and in turn how RI and behavior shape differentiation of genomes. Together, these experiments contribute to our understanding of how biodiversity is generated and strengthen the role of damselflies as models for understanding evolution." (Author) <https://shareok.org/handle/11244/299884> Address: not stated

**20318.** Benchalel, W.; Bouziane, A.; Bouslama, Z.; Ramdani, M.; Elmsellem, H.; Flower, R.; Ramdani, M. (2018): Odonata of Wadi Bouarroug (northeastern Algeria) and environmental determinants of their distribution. Moroccan Journal of Chemistry 6(1): 78-91. (in English, with French summary) ["The present paper describes odonates recorded over an extended period at wadi Bouarroug, south of lake Mellah, in the national reserve of Brabtia (North-east Algeria). In all, 42 weekly visits were made to four stations at wadi Bouarroug between March 2015 and February 2016. 19 species of odonates comprising seven families was recorded. Among the 19 species, autochthonous status was confirmed for 12 species. Two Maghrebian endemics species, *Platycnemis subdilata*, *Gomphus lucasi* ("Data Deficient" species in the Mediterranean IUCN Red-List) were recorded. In the latest check-list of the odonates fauna of wadi Bouarroug, 11 species were reported, during 1993 and 1994. Eight species have been recently added of which *Paragomphus genei* was recorded for the first time in the reserve of Brabtia in 2014 and its autochthonous status is confirmed at wadi Bouarroug from June 2015. Species richness along the wadi Bouarroug is positively correlated with density of riverine vegetation and with weak to moderate water flow during all the year. By contrast, species richness varies negatively with habitat fragmentation and the destruction caused by urbanization and pollution. As a result of this study, we do not propose any change of the "Red List of the IUCN" classification of the recorded species recorded at wadi Bouarroug. However, the presence of some taxa like *Calopteryx haemorrhoidalis* and *Paragomphus genei* at wadi Bouarroug, testifies to the persistence of high-quality natural environments, which are able to still support an important diversity of aquatic species." (Authors) A total of 1810 individuals was counted during the sampling period. The total number of species was 19, assigned to nine families : *Calopterygidae* (*Calopteryx haemorrhoidalis*), *Lestidae*

(*Lestes virens*, *L. viridis*), Platycnemidae (*Platycnemis subdilatata*), Coenagrionidae (*Ischnura graellsii*, *Coenagrion puella*, *Erythromma lindinii*, *E. viridulum* and *Ceriagrion tenellum*), Aeshnidae (*Anax imperator*, *Boyeria irene*), Gomphidae (*Gomphus lucasii*, *Paragomphus geneii*, and *Onychogomphus uncatatus*), Libellulidae (*Orthetrum cancellatum anceps*, *Sympetrum striolatum*, *Crocothemis erythraea*, *Trithemis arteriosa* and *T. annulata*). Nine species belong to the suborder of willing zygoptera and 10 in Anisoptera. Autochthony is confirmed for 12 species out of the 19 inventoried species (*Calopteryx haemorrhoidalis*, *Lestes viridis*, *Platycnemis subdilatata*, *Ischnura graellsii*, *Coenagrion puella*, *Ceriagrion tenellum*, *Anax imperator*, *Boyeria irene*, *Gomphus lucasii*, *Paragomphus geneii*, *Onychogomphus uncatatus* and *Orthetrum cancellatum*) (Tab. II).] Address: Elmsellem, H., Lab. de chimie analytique appliquée, matériaux et environnement (LC2AME), Faculté des Sciences, B.P. 717, 60000 Oujda, Morocco. E-mail: h.elmsellem@gmail.com

**20319.** Berenbaum, M. (2018): Damsel flies in Distress? *American Entomologist* 64(1): 3-6. (in English) ["Whatever its other shortcomings might have been, 2017 was certainly a year for female empowerment—from the Women's March on Washington in January to "the Silence Breakers" as Time Magazine's People of the Year in December, it was a year of upending norms in interactions between the sexes. Although sexual harassment may have finally received long-overdue public attention in just about every dimension of human endeavor, it has been a focus for entomological research for decades, and the entomological literature in 2017 illustrated the point nicely. A Web of Science search revealed 484 citations in 2017 for articles with "insect" and "sexual harassment" as topics. That number is 484 times higher than the number of citations in 1965, the first year for publication of any articles on those topics ("Sexual aggressiveness of male...") Address: Berenbaum, May, Dept of Entomology, Univ. of Illinois, 320 Morrill Hall, 505 South Goodwin Avenue, Urbana, IL 61801, USA.

**20320.** Bergsten, J.; Göthberg, A.; Johansson, K.; Pettersson, A.; Burkart, W.; Burkart G. (2018): Entomologmötet på Gotland 2017: temaexkursion med fokus på vattenlevande skalbaggar, skinnbaggar och trollsländor i Åskåkersvät. [Entomology meeting on Gotland 2017: thematic excursion on aquatic beetles, bugs and dragonflies to the locality Åskåkersvät.]. *Entomologisk Tidskrift* 139(1): 39-49. (in Swedish, with English summary) ["The yearly Swedish entomology meeting 2017 was organized by the local entomology society of Gotland, on the northern part of the Baltic island Gotland near Bunge, 4-6 August. One thematic excursion was focused on aquatic insects, especially aquatic beetles, bugs and dragonflies. A shallow pond, Åskåkersvät, with Characeae in an open grazed landscape with high natural values was studied. Åskåkersvät lies just adjacent to the larger area around Lake Bästeträsk which is the focus of a pilot study evaluating its potential as a future national park. The pilot study is undertaken by Gotland County Administrative Board, the Swedish Environmental Protection Agency, Region Gotland and the Swedish Agency for Marine and Water Management. Here we give an annotated report of the 103 species found: 69 species of water beetles (out of which 34 were Dytiscidae), 20 species of aquatic or semiaquatic bugs (out of which 10 were Corixidae), and 14 species of dragonflies. [*Lestes sponsa*, *L. virens*, *Sympecma fusca*, *Enallagma cyathigerum*, *Coenagrion pulchellum*, *C. hastulatum*, *Ischnura elegans*, *Orthetrum cancellatum*, *Sympetrum sanguineum*, *Libellula quadrimaculata*, *Cordulia aenea*, *Anax imperator*, *Aeshna isosceles*, *A. sp.*] These

include *Hydrophilus piceus* and *H. aterrimus* redlisted in Sweden (both as NT), and *Dytiscus latissimus*, globally redlisted (VU). We also noted the noble crayfish, *Astacus astacus* (redlisted as CR in Sweden) and the European medicinal leech *Hirudo medicinalis* (redlisted as NT globally). *Anax imperator* was noted, a species first recorded from Gotland in 2002 and we present a graph on its increase and spreading on the island since. The number of species found in spite of a relatively modest collecting effort at a suboptimal time when many species may be in pupal stage out of water as witnessed by many general individuals, indicates a species rich locality with high natural value. The stoneworts (Characeae) vegetation certainly contributes to this, for instance vouchered for by the occurrence of specialists as *Halipilus confinis* and *H. obliquus* whose larvae feed on stoneworts." (Authors)] Address: Bergsten, J., Naturhistoriska riksmuseet, Box 50007, 104 05 Stockholm, Sweden. E-mail: johannes.bergsten@nrm.se

**20321.** Bernard, R.; Daraz, B. (2018): New records of dragonflies (Odonata) in Zambia. *African Invertebrates* 52(9): 165-193. (in English) ["Zoogeographically important data on the occurrence of 22 dragonfly species in Zambia are presented, including at least seven species for the first time recorded or unambiguously confirmed in the country. They filled gaps in the previously known distribution ranges and showed that some of them reach further, especially to the south, but also west or north. Zoogeographical considerations are completed with some remarks on species' morphological traits and habitat selection and activity." (Authors)] *Lestes ictericus* Gerstäcker, 1869; *Allocnemis marshalli* (Ris, 1921); *Aciagrion africanum* Martin, 1908; *Africallagma pallidulum* Dijkstra, 2007; *Ceriagrion banditum* Kipping & Dijkstra, 2015; *Ceriagrion kordofanicum* Ris, 1924; *Pseudagrion commoniae* (Förster, 1902); *Gynacantha vesiculata* Karsch, 1891; *Gynacantha villosa* Grünberg, 1902; *Gynacantha immaculifrons* Fraser, 1956; *Heliaeschna fuliginosa* Selys, 1883; *Heliaeschna trinervulata* Fraser, 1955; *Mastigogomphus cf. dissimilis* (Cammaerts, 2004); *Notogomphus cf. zernyi* (St. Quentin, 1942); *Phyllomacromia monoceros* (Förster, 1906); *Notiothemis jonesi* Ris, 1919; *Tetrathemis poleni* (Selys, 1869); *Tramea limbata* (Desjardins, 1832); *Trithemis donaldsoni* (Calvert, 1899); *T. nuptialis* Karsch, 1894; *T. weneri* Ris, 1912] Address: Bernard, R., Dept of Nature Education and Conservation, Faculty of Biology, Adam Mickiewicz Univ. in Poznań, Umultowska 89, PL-61-614 Poznań, Poland. E-mail: rbernard@amu.edu.pl

**20322.** Blanke, A.; Pinheiro, M.; Watson, P.J.; Fagan, M.J. (2018): A biomechanical analysis of prognathous and orthognathous insect head capsules: Evidence for a many to one mapping of ridge strain to head strain. *Evolutionary Biology* 31(5): 665-674. (in English) ["Insect head shapes are remarkably variable but the influences of these changes on biomechanical performance are unclear. Among "basal" winged insects, such as dragonflies, mayflies, earwigs, and stoneflies, some of the most prominent anatomical changes are the general mouthpart orientation, eye size and the connection of the endoskeleton to the head. Here, we assess these variations as well as differing ridge and sclerite configurations using modern engineering methods including multibody dynamics modelling and finite element analysis in order to quantify and compare the influence of anatomical changes on strain in particular head regions and the whole head. We show that a range of peculiar structures such as the genal/subgenal, epistomal, and circumocular areas are consistently highly loaded in all species, despite drastically differing morphologies in species with forward projecting

(prognathous) and downwards projecting (orthognathous) mouthparts. Sensitivity analyses show that the presence of eyes has a negligible influence on head capsule strain if a circumocular ridge is present. In contrast, the connection of the dorsal endoskeletal arms to the head capsule especially affects overall head loading in species with downward projecting mouthparts. Analysis of the relative strains between species for each head region reveals that concerted changes in head substructures such as the subgenal area, the endoskeleton and the epistomal area lead to a consistent relative loading for the whole head capsule and vulnerable structures such as the eyes in prognathous and orthognathous insects. It appears that biting-chewing loads are managed by a system of strengthening ridges on the head capsule irrespective of the general mouthpart and head orientation. Concerted changes in ridge and endoskeleton configuration allow for more radical anatomical changes such as the general mouthpart orientation which could be an explanation for the variability of this trait among insects. In an evolutionary context, many to one mapping of strain patterns onto a relatively similar overall head loading indeed could have fostered the dynamic diversification processes seen in insects." (Authors)] Address: Blanke, A., Institute of Zoology, Biocenter Cologne, Univ. of Cologne, Cologne, Germany

**20323.** Boda, P.; Móra, A.; Várbiro, G.; Csabai, Z. (2018): Livin' on the edge: the importance of adjacent intermittent habitats in maintaining macroinvertebrate diversity of permanent freshwater marsh systems. *Inland Waters* 8(3): 312-321. (in English) ["Taxonomic and functional patterns of macroinvertebrate communities were investigated to reveal the importance of different habitat units within a marsh system in maintaining its macroinvertebrate diversity. Hydrogeomorphic units based on their functional characteristics were used to distinguish 3 types of aquatic habitats within the marsh system: (1) Core Unit (CU), a permanent inundation of a wetland in the central position of a marsh system; (2) Transitional Unit (TU), a seasonal to intermittent inundation of a wetland, with seasonal saturation; and (3) Satellite Unit (SU), seasonal depression wetlands with ephemeral to intermittent saturation. We hypothesized that communities in each Unit would have specific taxonomic and functional features. Species richness was highest in the TU, with unique community composition in the SU, and moderately high species richness characterized by a stable community with high taxonomic distinctness in the CU. The meta-community of the entire marsh was nearly random with a substantial equilibrium between beta-diversity features: replacement and dissimilarity. Our results suggest that the combination of directly connected or isolated waterbodies in close proximity to a large core waterbody is likely to maintain the highest level of diversity. Each Unit has unique characteristics and provides habitats for species with different ecological traits; thus, different aquatic habitats of a marsh system should be considered together as one meaningful ecological entity." (Authors)] Address: Boda, P., MTA Centre for Ecol. Res., Danube Res. Inst., Dept Tisza River Res., Debrecen, Hungary. Email: boda.pal@okologia.mta.hu

**20324.** Bota-Sierra, C.A.; Corso, A.; Janni, O.; Sandoval-H., J.; Viganò, M. (2018): Seventeen new dragonfly records from Colombia and the synonymy of the synonymy of *Philogenia monotis* and *P. tinalandia* (Insecta: Odonata). *International Journal of Odonatology* 21(2): 115-127. (in English) ["During 2.5 months of intensive fieldwork in Colombia (Depts of Cauca, Nariño, and Putumayo, South America) from January to March 2017, we visited 13 localities and

collected 291 specimens of 68 species of Odonata, including 17 new records for the country. We report range expansions for several species assessed as data deficient or under some degree of threat by the IUCN Red List. Furthermore, we confirmed that *Philogenia tinalandia* is a junior synonym of *P. monotis*, thus solving a longstanding enigma. We also report the rediscovery, after many decades, of *Philogenia raphaella*, *P. sucra* and *Stenocora percornuta*. The data we collected are an important contribution to the knowledge of the dragonfly diversity of the Colombian Andean region and its surroundings, including the nearby areas in Ecuador and Peru, countries with which the Depts visited share boundaries." (Authors)] Address: Bota-Sierra, C.A., Red de Biodiversidad y Sistemática, Inst. de Ecología, A.C. Xalapa, Mexico Email: corneliobota@gmail.com

**20325.** Boucenna, N.; Kahalerras, A.; Boukhemza-Zemmouri, N.; Houhamdi, M.; Khelifa, R. (2018): Niche partitioning at emergence of two sympatric top-predator dragonflies, *Anax imperator* and *A. parthenope* (Odonata: Aeshnidae). *Annales de la Société entomologique de France* (N.S.) 54(2): 1-8. (in English) ["In natural communities, closely related species are phenotypically similar but usually spatially and/or temporally isolated. In odonates, interspecific competition occurs not only at the larval or adult stage but also during emergence. We investigated the emergence of two sympatric *Anax* species, focusing on the temporal pattern, vertical stratification, and body size trend over time. *Anax imperator* started to emerge two weeks earlier than *A. parthenope* but most of the emergence season overlapped. Both species showed an asynchronous emergence and the median emergence date was 10.3 days earlier in *A. imperator*. Sex ratio at emergence was not significantly different from 1:1. Body size of both species increased significantly over time, which contrasts many previous studies. The height of exuvia fixation was not significantly different between species but the larger species *A. parthenope* selected longer supports." (Authors)] Address: Khelifa, R., Biodiversity Res. Center, Univ. British Columbia, 2212 Main Mall, Vancouver, B.C. V6T1Z4, Canada. Email: rassimkhalifa@gmail.com

**20326.** Bray, J.P.; Reich, J.; Nichols, S.J.; King, G.K.K.; Mac Nally, R.; Thompson, R.; O'Reilly-Nugent, A.; Kefford, B.J. (2018): Biological interactions mediate context and species-specific sensitivities to salinity. *Phil. Trans. R. Soc. B* 374: 20180020. <http://dx.doi.org/10.1098/rstb.2018.0020>: 10 pp. (in English) ["Toxicants have both sub-lethal and lethal effects on aquatic biota, influencing organism fitness and community composition. However, toxicant effects within ecosystems may be altered by interactions with abiotic and biotic ecosystem components, including biological interactions. Collectively, this generates the potential for toxicant sensitivity to be highly context dependent, with significantly different outcomes in ecosystems than laboratory toxicity tests predict. We experimentally manipulated stream macroinvertebrate communities in 32 mesocosms to examine how communities from a low-salinity site were influenced by interactions with those from a high-salinity site along a gradient of salinity. Relative to those from the low-salinity site, organisms from the high-salinity site were expected to have greater tolerance and fitness at higher salinities. This created the potential for both salinity and tolerant-sensitive organism interactions to influence communities. We found that community composition was influenced by both direct toxicity and tolerant-sensitive organism interactions. Taxon and context-dependent responses included: (i) direct toxicity effects, irrespective of biotic interactions; (ii)



effects that were owing to the addition of tolerant taxa, irrespective of salinity; (iii) toxicity dependent on sensitive-tolerant taxa interactions; and (iv) toxic effects that were increased by interactions. Our results reinforce that ecological processes require consideration when examining toxicant effects within ecosystems." (Authors) The paper includes a reference to "Gomphidae spp".] Address: Bray, J.P., Institute for Applied Ecology, Univ. of Canberra, Canberra, Australia. Email: jon.bray12@gmail.com

**20327.** Brito, G.G.; Martins, R.T.; Oliveira, V.C.; Hamada, N.; Nessimian, J.L.; Hughes, R.M.; Ferraz, S.F.B.; de Paula, F.R. (2018): Biological indicators of diversity in tropical streams: Congruence in the similarity of invertebrate assemblages. *Ecological Indicators* 85: 85-92. (in English) ["Highlights: •Trichoptera, EPT or families are surrogates for Amazon stream macroinvertebrate assemblage. •Functional and taxonomic groups congruence was lower than among only taxonomic groups. •Macroinvertebrate groups responded similarly to riparian forest loss and channel substrate. Abstract: Surrogate indicators are important alternatives to overcome the shortage of total biodiversity data for planning and implementing conservation measures. The most important premise of this approach is congruence among surrogate candidates and among different assemblages. The aim of this study was to evaluate abundance and incidence congruence between invertebrate assemblages at two taxonomic resolutions (genus and family), and between invertebrate assemblage (genus) and three groups of taxa (EPT, Odonata, and Trichoptera). We also evaluated the congruence between functional groups of EPT and the taxonomic groups listed above. Data were collected from 51 stream sites distributed along a disturbance gradient in the rural area of the Paragominas municipality of the state of Pará, Brazil. We used Procrustes analysis to test congruence between invertebrate assemblages at the multiple taxonomic resolutions listed previously. Family taxonomic level was a good substitute for similarity patterns measured at the genera level. EPT genus also were highly congruent with whole invertebrate assemblage (genus level) variation. Trichoptera had greater congruence with all macroinvertebrate genera than did Odonata. The congruence between EPT functional groups and groups of taxa was greater than  $r = 0.70$ . In general, taxonomic and functional metrics responded similarly to environmental conditions (water quality, channel morphology, substrate, riparian vegetation cover). Trichoptera (abundance), EPT (genera and functional groups), or invertebrate families appear to be reasonable surrogates for Amazon stream invertebrate assemblage as biological indicators for assessing and conserving streams influenced by agriculture." (Authors)] Address: Brito, Janaina, Coordenação de Biodiversidade, Instituto Nacional de Pesquisas da Amazônia – INPA, Av. André Araújo, 2936, Manaus, Amazonas, Brazil

**20328.** Brydegaard, M.; Jansson, S.; Schulz, M.; Runemark, A. (2018): Can the narrow red bands of dragonflies be used to perceive wing interference patterns?. *Ecology and Evolution* 8: 5369-5384. (in English) ["Despite numerous studies of selection on position and number of spectral vision bands, explanations to the function of narrow spectral bands are lacking. We investigate dragonflies (Odonata), which have the narrowest spectral bands reported, in order to investigate what features these narrow spectral bands may be used to perceive. We address whether it is likely that narrow red bands can be used to identify conspecifics by the optical signature from wing interference patterns (WIPs). We investigate the optical signatures of Odonata

wings using hyperspectral imaging, laser profiling, ellipsometry, polarimetric modulation spectroscopy, and laser radar experiments. Based on results, we estimate the prospects for Odonata perception of WIPs to identify conspecifics in the spectral, spatial, intensity, polarization, angular, and temporal domains. We find six lines of evidence consistent with an ability to perceive WIPs. First, the wing membrane thickness of the studied Odonata is 2.3  $\mu\text{m}$ , coinciding with the maximal thickness perceivable by the reported bandwidth. Second, flat wings imply that WIPs persist from whole wings, which can be seen at a distance. Third, WIPs constitute a major brightness in the visual environment only second after the solar disk. Fourth, WIPs exhibit high degree of polarization and polarization vision coincides with frontal narrow red bands in Odonata. Fifth, the angular light incidence on the Odonata composite eye provides all prerequisites for direct assessment of the refractive index which is associated with age. Sixth, WIPs from conspecifics in flight make a significant contribution even to the fundamental wingbeat frequency within the flicker fusion bandwidth of Odonata vision. We conclude that it is likely that WIPs can be perceived by the narrow red bands found in some Odonata species and propose future behavioral and electrophysiological tests of this hypothesis." (Authors)] Address: Brydegaard, M., Depts Physics & Biology, Lund Univ., Lund, Sweden. Email: Mikkel.brydegaard@fysik.lth.se

**20329.** Buden, D.W. (2018): Dragonflies and damselflies (Insecta: Odonata) of the Republic of the Marshall Islands. *Pacific Science* 72(3): 373-387. (in English) ["Seven species of Odonata are recorded from among the numerous atolls and mid-ocean reef islands that make up the Republic of the Marshall Islands (RMI). They include two Zygoptera (*Tanymecosticta* sp. and *Ischnura aurora*) and five Anisoptera (*Anax guttatus*, *Diplacodes bipunctata*, *Pantala flavescens*, *Tholymis tillarga*, and *Tamea transmarina*). *Tanymecosticta* sp. is known only from a single WW II-era extralimital record reported here for the first time. Breeding is confirmed for the six other species, which are widely distributed in the Pacific and often further afield. The frequently cited record of *Pantala flavescens* as being the first odonate and one of the first insects to colonize Bikini Atoll after cessation of nuclear testing requires verification. Additional surveys on many of the Marshall Islands not yet sampled for odonates will doubtless result in many new locality records. However, small island size, limited habitat diversity and water resources for breeding, and large distances from potential source populations contribute to an impoverished odonate fauna, and few, if any, species are likely to be added to the list. The six species known to inhabit the Marshall Islands make up the entire known odonate faunas of many other low, coralline islands in the west-central Pacific." (Author)] Address: Buden, D.W.; E-mail: don\_buden@comfsm.fm

**20330.** Cai, Y.; Ng, C.Y.; Ngiam, R.W.J. (2018): Diversity, distribution and habitat characteristics of dragonflies in Nee Soon freshwater swamp forest, Singapore. *Gardens' Bulletin Singapore* 70 (Suppl. 1): 123-153. (in English) ["Biodiversity baselines were established for dragonflies of Nee Soon freshwater swamp forest based on quantitative sampling across the eight sub-catchments. Surveys were conducted from December 2014 to April 2016. Hydrological, physiochemical parameters and habitats were analysed to identify the main drivers structuring the dragonfly community. A total of 1706 odonate specimens were recorded, comprising 49 species of 34 genera in 11 families. The species diversity in each sub-catchment was compared using the Shannon-Wiener Index ( $H'$ ). Hierarchical clustering and Detrended

Correspondence Analysis (DCA) indicated that three main groupings of sites existed, each with a distinct community of associated species. Further analysis by Canonical Correspondence Analysis (CCA) with 12 significant environmental variables showed that these groups were significantly associated with respective environmental variables. Principal Components Analysis (PCA) was performed to analyse the full 23 environmental variables. The first four principal components of the PCA explained 63% of the variation in all the environmental variables. These four axes were input as independent variables into an Ordinary Least Square (OLS) model to test the significance of the link between habitat characteristics and diversity of the dragonfly community. Threats to the odonate fauna of the freshwater swamp forest are identified and conservation management measures are discussed." (Authors)] Address: Cai, Y., Nat. Biodiversity Centre, National Parks Board, 1 Cluny Road, 259569 Singapore. E-mail: cai\_yixiong@nparks.gov.sg

**20331.** Carter, S.K.; Vodopich, D.; Crumrine, P.W. (2018): Heterogeneity in body size and habitat complexity influence community structure. *Journal of Freshwater Ecology* 33(1): 239-249. (in English) ["Food web studies commonly ignore individual variation within a population and variation in the environment and assume these factors have insignificant effects on community dynamics relative to interspecific interactions. However, variation in body sizes within a population (size structure) and the physical structure of habitats (habitat complexity) can both affect interspecific interactions independently, with possible interactive effects. Using experimental mesocosms, we examined effects of predator size structure and habitat complexity on predation by two common predators in fishless ponds: larval aquatic beetles (*Cybister fimbriolatus*) and larval dragonflies (*Anax junius*). Cannibalism, intraguild predation, and predation on shared prey were measured at two levels of habitat complexity crossed with six size-structured pairs of predators. We found that highly complex habitats sustain a higher prey density because prey can take refuge from predators. Additionally, size structure had direct (size better predicted predation rate than did species identity) and indirect (IGP and cannibalism lowered predation rates) effects on consumptive interactions, which changed the composition and density of the predator guild. The identified size- and habitat-mediated mechanisms can change the frequencies of intra-guild vs. interguild predation (a balance important in determining top-down control of predators), and therefore we argue that these sources of heterogeneity should be included in community ecology studies where possible." (Authors)] Address: Carter, Shannon, Dept of BioSciences, Program in Ecology and Evolutionary Biology, Rice Univ., Houston, TX, USA. E-mail: shannon.k.carter@rice.edu

**20332.** Chung, A.Y.C. (2018): A note on insect diversity of northern Gunung Rara forest in Sabah, with special reference to some Bornean endemic and iconic species. *Sabah Society Journal* 34: 39-54. (in English) ["An insect diversity survey was carried out from 9th to 14th of March, 2015 in the Northern Gunung Rara-Sustainable Forest Management (NGR-SFM) project area in south central Sabah. As there is no insect survey in the past in the NGRSFM project area, this pioneer data will serve as baseline information for other research work in future. Insect data recorded during the survey provides salient information to enhance the biodiversity conservation and for formulation of the forest management plan of this area. At least 12 Bornean endemic species were recorded from NGR during this survey. The endemics include beetle, moth, cicada, odonate species.

This information provides input towards recommendations on High Conservation Value Forest (HCVF) of the area. A few iconic and rare species were also recorded. The nocturnal insect species richness and abundance were moderate. This is not surprising because NGR was logged in the past and some of the surveyed sites were degraded. On average, 58 species and 70 individuals were recorded within a one-square-metre. The mean Shannon Index was 3.94 while Simpson Index was 128.81 and Fisher Alpha Index was 191.70. Monitoring, as well as enforcement according to the management plan in this area at a regular basis is important in ensuring that this project area is protected and conserved accordingly.... At least 20 Odonata species were recorded during the survey. Four damselfly and one dragonfly species are endemic to Borneo. There could be more because some of the damselflies were only identified up to the genus level, e.g. *Vestalis*. Most of the Odonata species were sampled along Sg. Imbok, Sg. Lanap, Sg. Katak in PSP1 and a river adjacent to the Batu Timbang F.R." (Authors) The following species are figured: *Heliocypha biseriata*, *Rhinocypha cucullata*, *R. aurofulgens*, *Rhinagrion elopuriae*, *Macromia corycia*.] Address: Chung, A.Y.C., Forest Research Centre, Sabah Forestry Dept, P.O. Box 1407, 90715 Sandakan, Sabah, Malaysia. E-mail: aycchung@gmail.com

**20333.** Claeson, S.M.; Crisafulli, C.M.; Gerth, W.J. (2018): Diversity of large-bodied macroinvertebrates in ponds created on the Debris-Avalanche Deposit following the 1980 eruption of Mount St. Helens. *Ecological Responses at Mount St. Helens: Revisited 35 years after the 1980 Eruption*: 235-249. (in English) ["The numerous ponds formed in the weeks following the 1980 eruption of Mount St. Helens provided a unique opportunity to investigate macroinvertebrate communities in young (23- to 25-year-old) fishless ponds following a large natural disturbance. Over a 3-year period, Large-bodied macroinvertebrates were sampled from 97 ponds with a range of hydroperiods and biophysical characteristics. Macroinvertebrate communities from these ponds were spatially and temporally variable in spite of their close geographical proximity, shared regional species pool, and similar creation history. We identified 110 taxa, many of which were observed at only one pond or in only one year. Community differences appeared to be influenced more by pond size and riparian tree development rather than by hydroperiod alone, and stochastic colonization events were likely an important factor determining community composition." (Authors) Odonata spp., Aeshnidae spp., Aeshna sp., Aeshna palmata, Anax junius, Coenagrionidae, Enallagma spp., Ischnura spp., I. cervula, I. perparva, Corduliidae, Somatochlora minor, Lestidae, Lestes spp., L. dryas, Libellulidae spp., Libellula forensis, Sympetrum spp.] Address: Claeson, Shannon, U.S. Dept of Agriculture, Forest Service, Pacific Northwest Research Station, Wenatchee Forestry Sciences Lab., 1133 North Western Avenue, Wenatchee, WA, 98801, USA

**20334.** Cordero Rivera, A.; Zhang, H. (2018): Ethological uniqueness of a damselfly with no near relatives: the relevance of behaviour as part of biodiversity. *Animal biodiversity and conservation* 41(1): 161-174. (in English) ["Taxonomically isolated species may contribute unique characters to biological diversity, particularly at the level of ethodiversity. To test this idea, we analysed the territorial and reproductive behaviour of *Pseudolestes mirabilis* (Zygoptera, Pseudolestidae), an endemic damselfly from Hainan Island, China, and the only representative of its family. Our hypothesis was that the uniqueness of this taxon would be evident

in its behaviour. We found that the agonistic encounters between males were usually very short (less than 2 min) and consisted of a face-to-face display with both males maintaining a close distance while flying using only the forewings. No other odonate flies with only two wings in territorial contests. Furthermore, a small proportion of fights were escalated and lasted about one hour, with clear exhibition of the coloured hindwings. Males also confronted wasps (*Eustenogaster nigra*) that used the same microhabitat in a similar way, albeit for short time. Females were found in low numbers. This limited copulatory frequency and most males did not mate in the whole day. Unexpectedly for a damselfly with coloured wings, precopulatory courtship was almost absent, suggesting that intrasexual selection is behind the evolution of coloured wings in this species. Copulation lasted an average of seven minutes, with a first stage of rivals' sperm removal (64% of sperm removed) and a second stage of insemination. In agreement with our initial hypothesis, copulatory behaviour was unique: males did not translocate sperm to their vesicle before each mating but translocated sperm after copulation, a behaviour that cannot be easily explained. These exclusive characteristics point to the relevance of this species as an exceptional taxon that merits high conservation priority." (Authors)] Address: Cordero Rivera, A., Depto de Ecología e Biología Animal, Univ. de Vigo, E.U.E.T. Forestal, Campus Universitario, 36005 Pontevedra, Spain. E-mail: acordero@uvigo.es

**20335.** Cowan, E.M.; Cowan, P.J. (2018): The Odonata (Insecta) of Dhofar, southern Oman. *Journal of Threatened Taxa* 10(11): 12499-12514. (in English) ["The Dhofar governorate of Oman ('Dhofar') is largely desert with a mainly arid climate. It contains an Afrotropical escarpment region influenced by monsoon precipitation. We summarise published records of odonates for Dhofar, organised by four natural regions, present our unpublished photographic records for 23 sites according to these regions and produce a Dhofar apparent-status statement for most odonate species. Records for the regionally Endangered *Urothemis thomasi* and regionally Endangered *Acisoma variegatum* and regionally Least Concern *Paragomphus sinaiticus* are discussed." (Authors)] Address: Cowan, Elaine, School of Education, Univ. of Aberdeen, AB24 3FX, Scotland, UK. Email: desertlarksgirl@hotmail.com

**20336.** Dann, T.J. (2018): Fast versus slow: differing life history strategies of two New Zealand damselfly (Odonata: Zygoptera) species. Thesis, Master of Science, Univ. of Otago: XIII, 86pp. (in English) ["Life history strategies are important for all organisms and are studied in large part to understand how an individual, population or species reacts to/lives in/survives in its environment and how it/they adapt to changes within that environment. No single strategy is optimal because environmental, morphological and physiological constraints lead to trade-offs between different traits, and how a species responds to these constraints determines their life history. Two variations of life history strategies are slow and fast, which are characterised by differences in activity, development, metabolism, behaviour and their environment. These differences can result in species divergent preference for different habitats, influencing species distribution. Around 90% of New Zealand's insects are endemic and most are not well represented in the literature. Their life histories often lack synchronicity, seasonality, and winter diapause, when compared to their Northern Hemisphere counterparts, traits which are often associated with a mild, maritime climate. Odonata are model insects for life history studies but their diversity in New Zealand is low. Two

species of damselfly are present in the South Island: *Austrolestes colenisonis* and *Xanthocnemis zealandica*. Both of these species were selected to study because they are easy to locate, abundant and widely distributed. They are well described, taxonomically distinct, and are easy to collect, and maintain in the lab. These two species also permit the study of two closely related, cohabitating, predator species that potentially differ in their life history strategies. The primary objective of this thesis was to determine if a fast-slow life history strategy dichotomy exists between *A. colenisonis* and *X. zealandica* by investigating aspects of their life history and distribution. A long term (two year) field study was used to investigate differences in life history characteristics between both species in six different populations over an altitudinal gradient. A survey of the lower half of the country was conducted to create a distribution map for each species and investigate any species-specific habitat preferences. Laboratory studies were conducted to investigate differences in metabolism, by measuring movement behaviour and ability to withstand starvation, as well as the likelihood of winter diapause occurring. *A. colenisonis* naiads were found to grow larger, move more, have a decreased starvation tolerance, and a preference for lower altitude. These characteristics are consistent with a life history at the fast end of the continuum. *X. zealandica*, on the other hand, display characteristics more in alignment with a slow life history, because naiads of this species are smaller, move less, and can survive longer periods of starvation. *X. zealandica* require permanent habitats; however, they can take advantage of low quality habitats, particularly those at high altitudes, which don't suit *A. colenisonis*. Therefore, a fast/slow life history strategy dichotomy is confirmed to be present and may influence how these species interact with the environment and each other. Additionally, like many other endemic New Zealand invertebrates, *A. colenisonis* and *X. zealandica* undergo quiescence rather than diapause when overwintering. This allows these species to opportunistically take advantage of a mild changeable climate and hence the periods when suitable conditions for growth prevail." (Author)] Address: Dann, Tanya; no further details

**20337.** Davidovich, H.; Ribak, G. (2018): Loaded flight in male *Ischnura elegans* and its relationship to copulatory flight. *Journal of Insect Physiology* 110: 44-56. (in English) ["Copulation in *Ischnura elegans* can last several hours, during which the pair may fly together in the 'wheel position' with both insects flapping their wings. Previous studies have suggested that during flight in copula, the male increases its power output while the female decreases it. Consequently, the male must support some of the female's body weight in the air. We tested the hypothesis that female body mass places a biomechanical constraint on the ability of smaller males to mate with larger females by attaching weights to male damselflies and analyzing their wing motion and force exerted using high-speed cameras. Males flying with an added load exerted extra forces equivalent to 157% of their body weight. Males flying in the mating wheel position with females whose wings were clipped bore a similar weight and were barely able to fly. To fly with an added load, males increased their wing-flapping frequency and amplitude, reaching values of mean wing tip flapping speed that were 1.9-fold higher than that in solitary flight. Our experiments indicate that although males would be able to fly briefly with the added weight of a non-responsive female, the flight performance of the pair would be severely compromised without the female contributing effort to the joint flight." (Authors)] Address: Davidovich, Hilla, School Zool., Fac. Life Sc., Tel Aviv Univ., POB 39040, Tel Aviv 6997801, Israel

**20338.** de Rezende, R.R.; Mar, T.B.; Páez, L.M.C.; Silva Xavier, A.D.; Xavier, C.A.D.; Navas-Castillo, J.; Zerbini, F.M.; Alfnas-Zerbini, P. (2018): Complete genome sequences of two gemycircularviruses associated with non-cultivated plants in Brazil. *Archives of Virology* 163(11): 3163-3166. (in English) ["Gemycircularviruses (genus Gemycircularvirus, family Genomoviridae) are single-stranded DNA viruses that are spread around the world in association with several organisms and environments. In this work, we identified two gemycircularviruses associated with two non-cultivated plants in Brazil, *Momordica charantia* and *Euphorbia heterophylla*. Both viruses display the general genome structure of gemycircularviruses. The virus isolated from *M. charantia* showed the highest nucleotide sequence identity with Pteropus associated gemycircularvirus 5, and an atypical structure consisting of a hairpin embedded in the major stem-loop was observed in the intergenic region. The virus from *E. heterophylla* showed the highest nucleotide sequence identity with Odonata associated gemycircularvirus 1. Phylogenetic analysis groups the two new viruses together with other genomoviruses of the genus Gemycircularvirus." (Authors)] Address: de Rezende, R.R., Depto Microbiologia, Inst. de Biotecnologia Aplicada à Agropecuária (BIOAGRO), Univ. Federal de Viçosa, Viçosa, Brazil

**20339.** Deacon, C.; Samways, M.J.; Pryke, J.S. (2018): Artificial reservoirs complement natural ponds to improve pondscape resilience in conservation corridors in a biodiversity hotspot. *PLoS ONE* 13(9): e0204148. <https://doi.org/10.1371/journal.pone.0204148>: 17 pp. (in English) ["Natural ponds are rich in biodiversity, contributing greatly to regional aquatic biodiversity. Artificial reservoirs used for irrigation can be significant additional features of the landscape. They infill the local natural pondscape, and are attractors for aquatic insects. Here, we determine the extent to which artificial reservoirs represent the local natural pond biota, and how they contribute to the pondscape in conservation corridors used to mitigate the impact of plantation forestry in a global biodiversity hotspot. We did this by: 1) identifying the environmental factors, including plants, that drive dragonfly, water beetle, and water bug species richness, diversity and composition, and 2) determining the value of natural ponds vs. artificial reservoirs for maintaining the population size and expanding the area of occupancy for dragonflies, beetles and bugs in conservation corridors. While vegetation cover was central for maintaining species richness and composition of the assemblages in general, many other environmental variables are necessary to encourage the full suite of local diversity. Artificial reservoirs are attractive habitats to many species, overall increasing area of occupancy for 75% of them (ranging from 62–84% for different taxa). These reservoirs provide complementary alternative habitats to natural ponds, leading to improved ecological resilience across the pondscape. We conclude that maintaining a diverse and heterogeneous pondscape is important for conserving local aquatic insect diversity, and that artificial reservoirs increase the local area of occupancy for a range of pond insects in conservation corridors, and improve the biodiversity value of these pondscales." (Authors)] Address: Samways, M.J., Dept Entomol. & Nematol., Univ. Stellenbosch, Private Bag X1, ZA-7602, Matieland, South Africa. E-mail: samways@sun.ac.za

**20340.** Díaz-Martínez, C.; Cardo-Maeso, N.; Toledo-Sevilla, B.; Simarro-Tórtola, J.; Brotóns-Padilla, M. (2018): Catálogo provisional de los odonatos (Insecta: Odonata) de Castilla-La Mancha (Centro de España). *Boln. S.E.A.* 63: 325-335. (in Spanish, with English summary) ["Provisional

checklist (Insecta: Odonata) of the Odonata of Castilla-La Mancha (central Spain) Abstract: The key intention of this paper is to gather all of the available information on Odonata in Castilla-La Mancha, as a starting point for future studies in this administrative region. A dataset of 8439 records of adults, larvae and exuviae from published (44.9%) and unpublished data (55.1%) were gathered, providing information about 34% of the regional territory, with large differences in data coverage between provinces. We present a provisional checklist with 64 species for Castilla-La Mancha, a region with a mainly Mediterranean fauna. It includes the first records of five species from Albacete, three from Toledo, two from Cuenca and two from Ciudad Real; some are threatened taxa, like *Lestes macrostigma* and *Gomphus similimus*." (Authors)] Address: Soc. Entomológica y Ambiental de Castilla-La Mancha (SEACAM), C/ Londres, 7. 45003 Toledo (España). Email: cdiaz.cuenca@gmail.com

**20341.** Dow, R.A.; Stokvis, F.A. (2018): Odonata from Gunung Melatai and two other locations in Kapit Division, Sarawak, with a review of the genus *Heliogomphus* in Borneo, Peninsular Malaysia and Singapore. *IDF-Report* 122: 1-25. (in English) ["Records of Odonata from Gunung Melatai, Nanga Gaat and the Kastima Logging area, all in Sarawak's Kapit Division, are presented. The most notable records are of *Matronoides cyaneipennis* Förster, 1897 and *Heliogomphus blandulus* Lieftinck, 1929. A distribution map for *Matronoides cyaneipennis* and updated distribution maps for three species from the *Coeliccia borneensis*-group are given. Tentative identifications to species of previously published records of *Idionyx* females are given. The genus *Heliogomphus* in Borneo, Peninsular Malaysia and Singapore is reviewed and a simple one marker molecular analysis is presented for the genus in this region. Based on reexamination of specimens from the genus and the molecular results, an additional member of the genus is reported from Borneo: *H. sp. cf. olivaceus* Lieftinck, 1961. Although both morphological and molecular results remain incomplete, it does appear likely that there is at least one more species of *Heliogomphus* present in Borneo than has been recognised until now, and that *H. borneensis* Lieftinck, 1964 may be a junior synonym of *H. kelantanensis* (Laidlaw, 1902)." (Authors)] Address: Dow, R.A., Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands. Email: rory.dow230@yahoo.co.uk

**20342.** Dumont, H.J.; Borisov, S.N.; Schröter, A. (2018): On the nature and distribution of *Sympetrum tibiale*, a rare Central Asian species spilling over into Europe (Odonata: Libellulidae). *Odonatologica* 47(1/2): 23-42. (in English) ["Literature data, museum collections as well as fieldwork were used to produce an up-to-date distribution map and a list of records of *Sympetrum tibiale*, a species restricted to the semi-deserts of Russia, Kazakhstan, Uzbekistan, Mongolia and western China. The type locality is in Xinjiang province, China, and the type specimens are preserved in the Zoological Museum of Hamburg, Germany (ZMUH). Language barriers, publication in obscure journals and poor data exchange meant *S. tibiale* was little-known to non-Russian speaking odonatologists for a long time. Yet, it has been confirmed to breed in the steppes of the Kuma-Manych Depression on the western shore of the Caspian Sea, situated in the southern part of European Russia, making the species a genuine member of the European fauna. This article addresses these European sites, hitherto neglected in non-Russian language literature, and establishes the correct westernmost limit of the species' range. In addition, all currently certified records are mapped. Available

knowledge on the species' ecology – a summer species with a larval preference for brackish water – is summarized. Identification characters of adults and larvae are provided; its closest relative is identified as *Sympetrum depressiusculum*." (Authors)] Address: Dumont, H.J., Dept of Biology, Univ. of Gent, 9000 Gent, Belgium. E-mail: Henri.Dumont@UGent.be

**20343.** Frances, D.N.; McCauley, S.J. (2018): Warming drives higher rates of prey consumption and increases rates of intraguild predation. *Oecologia* 187(3): 585-596. (in English) ["Warming due to climate change is expected to alter species interactions. These interactions are shaped by components of individual behavior, particularly foraging behaviors. However, few studies consider species' behavioral responses to warming to predict how species interactions will be affected by warming. We chose two complementary approaches to examine how climate warming may affect the behavior and interactions of aquatic intraguild predators. First, we measured behavioral responses to warming in six larval dragonfly species, expecting that feeding rate and activity would increase with temperature. Secondly, we conducted intraguild predation (IGP) trials with three species to understand how temperature affects IGP, and if species' behavioral responses to warming are indicative of the outcome of IGP interactions. Warming increased feeding rates by 42% on average across species but had no effect on activity rate. The magnitude of change in feeding rate was positively correlated with the maximum temperatures species experience across their ranges. Lastly, warming increased rates of IGP twofold, however, species' behavioral responses alone were not predictive of their susceptibility to become IG prey of other larvae at warmer temperatures. Our results provide evidence that IGP interactions may be greatly affected by future increases in temperature; however, activity responses to warming alone are weak predictors of the outcomes of these interactions. Future studies should consider other species' traits when forecasting the effects of climate change on species interactions.... We used the following species in our experiments: *Erythemis simplicicollis*, *Epitheca canis*, *Libellula pulchella*, *Sympetrum vicinum*, *Leucorrhinia intacta*, and *Plathemis lydia*." (Authors)] Address: Frances, Dachin, Dept of Biology, Univ. of Toronto Mississauga, 3359 Mississauga Road, Mississauga, ON, L5L 1C6, Canada. dachin.frances@mail.utoronto.ca

**20344.** Goldyn, R.; Szapowska, B.; Swierk, D.; Domek, P.; Buxakowski, J.; Dondajewska, R.; Baralkiewicz, D.; Sajnog, A. (2018): Influence of stormwater runoff on macroinvertebrates in a small urban river and a reservoir. *Science of the Total Environment* 625: 743-751. (in English) ["Highlights: • Stormwater caused marked transformation of benthic macroinvertebrates composition. • Abundance and biomass of benthic organisms were also strongly influenced. • Particularly sensitive were Ephemeroptera, Trichoptera and Mollusca. • Impact on macroinvertebrates in the reservoir was more pronounced than in the river. • Reservoirs improve water quality and composition of organisms in outflowing river. The impact of stormwater on benthic macroinvertebrates was studied in two annual cycles. Five small catchments drained by stormwater sewers to a small urban river and a small and shallow reservoir situated in its course were selected. These catchments were located in residential areas with single-family houses or blocks of flats as well as industrial areas, i.e., a car factory, a glassworks and showroom as well as the parking lots of a car dealer and servicing company. In addition to the five stations situated in the vicinity of the stormwater outlets, three stations not directly influenced

by stormwater were also established. Macroinvertebrates were sampled in every season, four times per year. Both abundance and biomass were assessed. Stormwater from industrial areas associated with cars, whose catchments showed a high percentage of impervious areas, had the greatest impact on benthic macroinvertebrates. This was due to a large amount of stormwater and its contamination, including heavy metals. Stormwater outflow from residential multi-family houses exerted the least influence. Macroinvertebrates in the water reservoir were found to undergo more extensive changes than those in the river. The cascade of four reservoirs resulted in a marked improvement of water quality in the river, which was confirmed by species composition, abundance and biomass of macroinvertebrates and indicators calculated on their basis for the stations below the cascade in comparison to the stations above and in the first reservoir. These reservoirs replaced constructed wetlands or other measures, which should be undertaken for stormwater management prior to its discharge into urban rivers and other water bodies. ... High concentrations of Zn, Ni and Al in water contributed to an increase in the biomass of Odonata (Fig. 5C)." (Authors)] Address: Goldyn, R., Dept of Water Protection, Faculty of Biology, Adam Mickiewicz Univ., Poland

**20345.** Guillemot, A.; Krieg-Jacquier, R. (2018): *Aeshna caerulea* en France, une espèce en limite d'aire et menacée par le changement climatique (Odonata: Aeshnidae). *Bourgogne-Franche-Comté Nature* 27: 265-272. (in French, with English summary) ["Extremely rare in France, *Aeshna caerulea* is a boreo-alpine species which trend is considered decreasing in Europe and is currently known from only 10 sites between 1,600 and 2,300 meters high in Haute-Savoie. Since its discovery in 1994, very little attention was paid to the species in the Dept. Its inclusion in the National plan of action on Odonates has encouraged the *Sympetrum* Group to carry out annual research since 2015 on propitious sites. No new breeding locations have been identified and autochthony has only been found on three wetlands of the surveyed area. The natural evolution of environments, human activities and climate change are the most obvious threats to French populations. The species is found on very small wetlands which increases the threat due to the lack of inventory on these environments and the lack of protection status of *A. caerulea* in France." (Authors)] Address: Guillemot, A., Asters, Conservatoire d'espaces naturels de Haute-Savoie / Groupe de recherches et de protection des libellules *Sympetrum*, 150 route de Chez Diannay - 74570 Groisy - alexandre.guillemot@asters.asso.fr

**20346.** Harisha, M.N.; Hosetti, B.B. (2018): Species richness, diversity and conservation threats of odonates in Dyamannana Lake (Kere), Bhadravathi Taluk, Shivamogga district, Karnataka, India. *International Journal of Zoology Studies* 3(1): 197-200. (in English) ["The study was conducted to find out the status, diversity and conservation threats of Odonata at Dyamannana Lake, Shivamogga District during October 2015 to September 2016. Sampling was done by direct counts method and collected data were statistically analyzed to work out the magnitude of Odonate diversity. A total of 470 individuals of odonates belonging to 41 species in 29 genera under 6 families were recorded. The order- Anisoptera was found to be the most dominant with 76% (n=31) species, belonging to 3 families, followed by order- Zygoptera with 24% (n=10) species, under 3 families respectively. Among the order- Anisoptera, the family wise, abundance, richness, diversity and evenness indices was found to be maximum in Libellulidae (340, 4.1, 2.9,

0.72) followed by the Aeshnidae (38, 0.8, 1.3, 0.93) and minimum in Gomphidae (26, 0.3, 0.7, 1.0) respectively (Table 2). Similarly, among the order: Zygoptera, it was found to be maximum in Coenagrionidae (42, 1.6, 1.9, 0.92) and minimum in Platynemididae (12, 0.5, 0.6, 0.94), however, it was least in Lestidae (12, but showed no significant indices value with only single species) respectively. The study revealed that, odonates and their habitats were under threat due to intensive anthropogenic activities, which are attributed to encroachment and loss of habitat. Also, addition of fertilizers and insecticides from the surrounding arecanut plantation lead to pollution and eutrophication of the lake, which not only affect the assemblage of Odonata population but also cause local extinctions." (Authors)] Address: Harisha, M.N., Dept of Post Graduate Studies and Research in Wildlife & Management, Kuvempu Univ., Jnana Sahyadri, Shankaraghatta, Shivamogga, Karnataka, India

**20347.** Herrmann, A.; Schnabler, A.; Martens, A. (2018): Phenology of overland dispersal in the invasive crayfish *Faxonius immunis* (Hagen) at the Upper Rhine River area. Knowledge and Management of Aquatic Ecosystems 2018, 419, 30: 6 pp. (in English, with French summary) ["The non-indigenous crayfish *Faxonius immunis* (Hagen) is the dominant crayfish species at the Upper Rhine River system since his detection in 1993. As an invasive alien species, it is one of the biggest threats to aquatic biodiversity in the area. By dispersing over land, the species has a high potential to colonize small ponds created for threatened amphibians and dragonflies. Shortly after invasion, the fast growing population of *F. immunis* is changing the habitat drastically. In June 2016, our team started a local information campaign including citizen science project where the local people south of Karlsruhe, Baden-Wuerttemberg, Germany, could contact us when they spot a crayfish migrating over land to assess the activity of overland dispersal on a regional scale. Until January 2018, we got a total of 98 responses. Thirty-nine include suitable information including 33 records of overland dispersal of *F. immunis*. The species was recorded on land throughout the year, except February and July. Additionally, single observations of overland dispersal of other invasive crayfish species, naming *Procambarus clarkii* (Girard), *Pacifastacus leniusculus* (Dana), *Procambarus virginalis* (Lyko) and *Faxonius limosus* (Rafinesque), were recorded." (Authors)] Address: Herrmann, A., Institute of Biology, Univ. of Education Karlsruhe, Bismarckstraße 10, 76133 Karlsruhe, Germany. E-mail: alexander.herrmann@ph-karlsruhe.de

**20348.** Hoffmann, J.; Donoughe, S.; Li, K.K.; Salcedo, M.K.; Rycroft, C.H. (2018): A simple developmental model recapitulates complex insect wing venation patterns. PNAS published ahead of print September 17, 2018 <https://doi.org/10.1073/pnas.1721248115>: 6 pp, App. 42 pp. (in English) ["Significance: The wing veins of the fruit fly *Drosophila melanogaster* have long been studied as an example of how signaling gradients in a growing tissue can generate precise, reproducible patterns. However, fruit fly wings represent only a small slice of wing diversity. In many insect species, wings are like human fingerprints: even the left and right wings of the same individual have unique vein patterns. We analyze wing geometry in many species and then present a minimal developmental model for how vein patterns can be formed. This model will serve as a hypothesis for future empirical work. Abstract: Insect wings are typically supported by thickened struts called veins. These veins form diverse geometric patterns across insects. For many insect species, even the left and right wings from the same

individual have veins with unique topological arrangements, and little is known about how these patterns form. We present a large-scale quantitative study of the fingerprint-like "secondary veins." We compile a dataset of wings from 232 species and 17 families from the order Odonata, a group with particularly elaborate vein patterns. We characterize the geometric arrangements of veins and develop a simple model of secondary vein patterning. We show that our model is capable of recapitulating the vein geometries of species from other, distantly related winged insect clades." (Authors)] Address: Hoffmann, J., Paulson School of Engineering & Appl. Sc., Harvard Univ., Cambridge, MA 02138, USA

**20349.** Houard, X.; Itrac-Bruneau, R.; Sueur, A. (2018): Partage du bilan concernant le premier Plan national d'actions (PNA) en faveur des Odonates menacés. Revue scientifique Bourgogne-Franche-Comté Nature 27: 149-164. (in French, with English summary) ["The first French National Action Plan (NAP) for Odonata was officially ended in December 2015. The year 2016 was devoted to the drafting of the balance sheet. For five years, the various stakeholders in the metropolitan area involved in the program – naturalists, wildlife managers and public services – have worked together to bring about numerous actions aimed at improving or consolidating the conservation status of the 18 "target species" and of their habitats. A national network has been created, with the sole objective of sustainable conservation of this group of insects well known for being emblematic of wetlands. This article is a review of the steps stone of the implementation of the NAP. It proposes some examples considered like good achievement then synthesizes technical and financial elements which prove the success of this conservation program." (Authors)] Address: Office pour les insectes et leur environnement - La Minière - BP30 - 78041 Guyancourt Cedex, France. Email: pna@insectes.org

**20350.** Ilhamdi, M.L. (2018): Pola penyebaran capung (Odonata) di kawasan taman wisata alam Suranadi Lombok Barat. Jurnal Biologi Tropis 18(1): 19-25. (in Indonesian, with English summary) ["The aim of this research is to analyze the distribution pattern of the dragonflies (Odonata) in the Area of Nature Park Suranadi. This is an explorative descriptive study conducted in May 2017. The method used in data collection is survey method with sweeping net technique following observation path (Left Edge, Right Edge, Central Line and Water Line). Data retrieval is done 2 times repetition within 1 month in the morning at 08.00 - 11.00 pm and afternoon at 15.00-17.00 pm. The pattern analysis of the distribution of dragonflies using the formula variance value of Southwood. The results showed that (1) the number of species of dragonflies found in Suranadi Nature Park Area consists of 19 species belonging to 5 families (2) distribution pattern of dragonflies are distributed in groups (15 species) and uniform distribution pattern (4 species)." (Authors)] Address: Ilhamdi, M.L., Dosen Pendidikan Biologi FKIP Universitas Mataram, Indonesia. E-mail: liwa\_ilhamdi@unram.ac.id

**20351.** Ilvonen, J.J. (2018): A comparative study of parasitism in insects: why some Odonata species have parasites and others do not? Annales Universitatis Turkuensis Ser. A. II, 344: 34 pp. (in English, with Finnish summary) ["Parasites are one of the most diverse groups of animals, capable of infecting virtually all other organisms on the planet. They are a strong evolutionary force, influencing genetic diversity and thereby affecting individuals, populations and entire species. Studies of host-parasite interactions have frequently examined how host individuals and their parasites interact,

but this focus on the host individual offers a very narrow perspective on the general dynamics of hosts and their parasites. To understand the dynamics of hosts and their parasites on an evolutionary scale, examination has to be moved beyond the individual, to include multiple host species, multiple parasites, and various host species traits. To this end, I decided to expand our knowledge by studying the host-parasite interactions of a large number of damselfly and dragonfly species and their endo- and ectoparasites. I evaluated specific physical, behavioral and distributional traits of the host species along with their parasitism in order to understand what traits affect parasitism. In addition, I examined these associations using the known evolutionary tree of the different damselfly and dragonfly hosts. Using this method I was able to get a deeper understanding on the co-evolution between Odonata and their endo- and ectoparasites. In paper I, I confirmed that there is huge variation in endo- and ectoparasitism between different damselfly and dragonfly species. I also found that damselfly females had more ectoparasites than males did, but there was no difference between sexes in dragonflies. In paper II, I found that there is significant variation between different damselfly and dragonfly species in their strength of immune response and body mass. Using the evolutionary tree of these host species I also discovered that closely related species are more similar in their parasitism and in their two evaluated traits than would be expected if the species were drawn at random. In paper III, I discovered that both endo- and ectoparasites tend to infect the same host species which are relative small, live in high density and are common. Paper IV continued my investigation and I found that territorial or large species have fewer ectoparasites than non-territorial or small species and I also found that northern species have more ectoparasites than southern ones. It seems that the larger size of odonate species lowers their susceptibility to parasitism. However, whether this is the cause of the host's physical traits or due to the infection mechanism and/or preference of the parasite, remains unknown. Further studies are required to understand how the size of the host influences other traits and subsequently co-evolution between damselflies, dragonflies and their endo- and ectoparasites." (Author) Address: Ilvonen, J.J., Dept of Biology, FI-20014 Univ. of Turku, Turku, Finland. E-mail: jjiivo@utu.fi

**20352.** Jaffe, B.D.; Ketterer, M.E.; Smith, D.S. (2018): An arsenic hyperaccumulating fern, *Pteris vittata* L. (Pteridaceae) broadly affects terrestrial invertebrate abundance. *Ecological Entomology* 43: 76-84. (in English) [Florida, USA "1. The Chinese brake fern (*Pteris vittata* L.; Pteridaceae) can accumulate up to 27 000 mg kg<sup>-1</sup> dry wt. of arsenic (As) from the soil into its above-ground biomass. They may use this As to deter invertebrate threats. 2. This study explored how As concentrations [As] in the fern, and in soil associated with the fern, influenced the abundance and composition of various invertebrates. 3. Populations of *P. vittata* were identified in the field. Soils from the base of the fern and from 3 m away of each plant were collected and pitfall traps were installed. Soil and fern arsenic concentrations ([As]) were measured via inductively coupled plasma mass spectrometry and invertebrates were identified to order and classified by feeding guild. 4. Increased [As] did not affect all feeding guilds and orders equally. For example, individual herbivore abundance did not decrease as [As] increased, but predator abundance did. In many cases, the impact of soil [As] on invertebrates depended on the distance from the fern. Fern [As] also influenced components of the community, but only at 3 m away from the fern. Furthermore, the abundances of many invertebrate groups

were higher beneath the fern, where [As] was higher. 5. These results suggest that hyperaccumulated As can impact the invertebrate community, but the defensive benefits of hyperaccumulation are more complex than have been previously described. The authors advocate that future studies examining the potential defensive benefits of hyperaccumulation should do so in a natural setting that incorporates this complexity and invertebrate richness." (Authors) "We collected invertebrates via pitfall traps for 10 consecutive days during two sampling periods in mid-June and late August of 2009": Odonata: Calopterygidae, Corduliidae] Address: Jaffe, B.D., Dept of Biol. Sciences, Northern Arizona Univ., Flagstaff, Arizona, USA. E-mail: jaffebd@gmail.com

**20353.** Janra, M.N. (2018): Inventory of dragonflies and damselflies (Odonata) in Andalas Univ.'s Limau Manis campus complex, Padang: Using photographic approach. *Jurnal Natural* 18(2): 89-96. (in English) ["Odonata, which consists of true dragonflies and damselflies, is considerably understudied in Sumatra, especially in West Sumatra region. While the campus area of Andalas Univ. in Limau Manis provides many suitable habitats for dragonflies and damselflies, the least has been done in learning these organisms. In this paper, we intend to conduct the inventory of Odonata in Limau Manis area by using photography approach (by taking decent pictures only, without sampling the animal). After spending 14 days of data collection which spanned from October 2017 until February 2018), we listed 27 Odonata species. [...] Libellulidae is a family under Anisoptera that was found with most species members. Photography approach promises an immense help in doing species inventory for this animal group for its reliability in determining species identification without harming species' population." (Author)] Address: Muhammad Nazri Janra, M.N., Biology Dept, Faculty of Mathematics and Natural Sciences, Andalas Univ.. Jalan Kampus Unand Limau Manis Pauh Padang, West Sumatra 25163 Indonesia. Email: mnjanra@gmail.com

**20354.** Janssens, L.; Verberk, W.; Stoks, R. (2018): A widespread morphological antipredator mechanism reduces the sensitivity to pesticides and increases the susceptibility to warming. *Science of the Total Environment* 626: 1230-1235. (in English) ["Pollution and predation are two omnipresent stressors in aquatic systems that can interact in multiple ways, thereby challenging accurate assessment of the effects of pollutants in natural systems. Despite the widespread occurrence of morphological antipredator mechanisms, no studies have tested how these can affect the sensitivity of prey to pesticides. Sensitivity to pesticides is typically measured via reductions in growth rates and survival, but also reductions in heat tolerance are to be expected and are becoming increasingly important in a warming world. We investigated how autotomy, a widespread morphological antipredator mechanism where animals sacrifice a body part (here the caudal lamellae) to escape when attacked by a predator, modified the sensitivity to the insecticide chlorpyrifos in larvae of *Coenagrion puella*. Exposure to chlorpyrifos reduced the growth rate and heat tolerance (measured as CTmax). A key finding was that the pesticide had a greater impact on growth rates of intact animals, i.e. those that retained their lamellae. This reduced sensitivity to chlorpyrifos in animals without lamellae can be explained by the reduced outer surface area which is expected to result in a lower uptake of the pesticide. Larvae that underwent autotomy exhibited a lower heat tolerance, which may also be explained by the reduced surface area and the associated reduction in oxygen uptake. There is a wide diversity

of morphological antipredator mechanisms, suggesting that there will be more examples where these mechanisms affect the vulnerability to pollutants. Given the importance of pollution and predation as structuring forces in aquatic food webs, exploring the potential interactions between morphological antipredator mechanisms and sensitivity to pollutants will be crucial for risk assessment of pollutants in aquatic systems." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. Email: [robby.stoks@bio.kuleuven.ac.be](mailto:robby.stoks@bio.kuleuven.ac.be)

**20355.** Janssens, L.; Stoks, R. (2018): Rapid larval development under time stress reduces adult life span through increasing oxidative damage. *Functional Ecology* 32(4): 1036-1045. (in English) ["1. While a trade-off between larval development and adult life span is key to understand why not all animals develop at their maximum rate and why life histories align along a fast-slow continuum, it has been rarely studied. More general, the physiological mechanisms underlying life-history trade-offs are poorly understood and there is ongoing debate about the mediatory role of oxidative stress. 2. We explicitly investigated the role of oxidative stress in mediating the trade-off between larval development and adult life span in the damselfly *Lestes viridis*. We exposed larvae to time stress (by manipulating photoperiods) and manipulated oxidative stress levels using the mitochondrial uncoupler 2,4-dinitrophenol (DNP) that causes a reduced production of reactive oxygen species. In addition, we considered other costs of an accelerated development in terms of reductions in immune function (the activity of phenoloxidase [PO]) and energy storage (fat content). 3. Larvae accelerated their development but not growth under time stress, allowing to identify costs of rapid development without confounding effects of rapid growth. Rapid development came at the cost of a much shorter life span, which was associated with an increase in oxidative damage to lipids, proteins and DNA. Other costs in the adult stage of a rapid larval development included a lower body mass and reduced immune function, while the fat and protein contents were not reduced. 4. Time-stressed animals exposed to DNP developed even faster and did not show the increase in oxidative damage. Notably, they did not suffer the costs of rapid development: they had no shorter life span, lower body mass or reduced PO activity. 5. Our results provide strong experimental support for a trade-off between rapid development and life span and for the mediatory role of oxidative stress in shaping this life-history trade-off. Our study highlights that manipulation of mitochondrial uncoupling may be a powerful method to study the mechanistic underpinnings of life-history trade-offs." (Authors)] Address: Stoks, R., Lab. voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, 3000 Leuven, Belgium. E-mail: [robby.stoks@bio.kuleuven.ac.be](mailto:robby.stoks@bio.kuleuven.ac.be)

**20356.** Jiang, B.; Mikolajewski, D.J. (2018): Shift in predation regime mediates diversification of foraging behaviour in a dragonfly genus. *Ecological Entomology* 43: 525-533. (in English) ["1. Behavioural adaptations to avoid and evade predators are common. Many studies have investigated population divergence in response to changes in predation regime within species, but studies exploring interspecific patterns are scant. Studies on interspecific divergence can infer common outcomes from evolutionary processes and highlight the role of environmental constraints in shaping species traits. 2. Species of the dragonfly genus *Leucorrhinia* underwent well-studied shifts from habitats being dominated by predatory fish (fish lakes) to habitat being dominated by predatory invertebrates (dragonfly lakes).

This change in top predators resulted in a set of adaptive trait modifications in response to the different hunting styles of both predator types: whereas predatory fish actively search and pursue prey, invertebrate predator follow a sit-and-wait strategy, not pursuing prey. 3. Here it is shown that the habitat shift-related change in selection regime on larval *Leucorrhinia* caused species in dragonfly lakes to evolve increased larval foraging and activity, and results suggest that they lost the ability to recognise predatory fish. 4. The results of the present study highlight the impact of predators on behavioural trait diversification with habitat-specific predation regimes selecting for distinct behavioural expression." (Authors)] Address: Jiang, B., Institut für Biologie, Freie Universität Berlin, Königin-Luise-Street 1–3, 14195 Berlin, Germany. E-mail: [bin.jiang@fu-berlin.de](mailto:bin.jiang@fu-berlin.de)

**20357.** Julaika, W.; Junardi; Kustiati (2018): Spesies capung (Ordo: Odonata) di Taman Nasional Gunung Palung Kalimantan Barat. *Protobiont* 7(2): 37-42. ["Dragonflies are one of the Odonata order insects used as predators and bioindicators. The existence of a dragonfly is influenced by various types of habitat. Cabang Panti Research Station is a research station located in area of Gunung Palung National Park which has an area of 2,100 ha and has different type of habitat. This research is to know types of dragonfly at Cabang Panti Research Station. This research was conducted in four habitat types is freshwater swamp, alluvial, lowland sandstone and lowland granite. The catching of samples was done by using insect net. Dragonflies found in Cabang Panti Research Station is 787 individuals, two sub-orders, eight families, 10 genera and 15 species. Two sub-orders found is Zygoptera and Anisoptera, the eight families is Aeshnidae, Calopterygidae, Coenagrionidae, Chlorocyphidae, Euphaeidae, Libellulidae, Megapodagrionidae, and Platycnemididae. The most commonly species found of dragonflies are *Euphaea subcostalis* (275 individuals or 34.94%), *Euphaea impar* (160 individuals or 20.33%) and *Rhinagrion borneense* (78 individuals or 9.91%) whereas species found are *Amphicnemis gracilis* (1 individual or 0.12%) and *Elatoneura analis* (2 individuals or 0.25%)."] (Authors)] Address: Weni Julaika, Program Studi Biologi, Fakultas MIPA, Univ. Tanjungpura, Prof. Dr. H. Hadari Nawawi, Pontianak, Indonesia. E-mail [kostiati@fmipa.untan.ac.id](mailto:kostiati@fmipa.untan.ac.id)

**20358.** Kalkman, V.J.; Dijkstra, K.-D.B.; Dow, R.A.; Stokvis, F.R.; van Tol, J. (2018): Out of Australia: the Argiolestidae reveal the Melanesian Arc System and East Papua Composite Terrane as possible ancient dispersal routes to the Indo-Australian Archipelago (Odonata: Argiolestidae)? *International Journal of Odonatology* 21(1): 1-14. (in English) ["Information on the origin of distribution patterns shown by freshwater invertebrates in the Indo-Australian Archipelago is poor. Here we present a molecular based hypothesis of the phylogenetic relationships of Argiolestidae, a family of damselflies found throughout the tropical parts of the Eastern Hemisphere. We use this to address the following questions: (1) did Argiolestidae colonize Wallacea and the Philippines from the Eurasian or from the Australian continent? (2) Is the presence of Argiolestidae in New Guinea the result of a single colonization event, i.e. are the Argiolestidae found in New Guinea monophyletic? The results show that clades occurring in the Philippines, Wallacea and New Guinea all originate from Australian ancestors. Representatives in Sundaland are most closely related to African genera and failed to reach the Philippines and Wallacea. The presence of Argiolestidae north of Australia is the result of at least



three colonization events from Australia to areas that presently compose New Guinea and probably a fourth from Australia to Sulawesi. The two most diverse lineages found north of Australia show different distribution patterns. One reaching north as far as Luzon, presumably facilitated by Late Oligocene to Miocene islands arcs (Melanesian Arc System). The other clade shows a diversification of two genera and numerous species in the eastern tail of New Guinea, an area largely corresponding with the East Papuan Composite Terrane (EPCT) followed by the expansion of one genus into the rest of New Guinea. The EPCT's importance as source area for the New Guinean fauna has been suggested on the basis of distribution patterns, but we present the first evidence based on phylogeny reconstruction of strong diversification on this formerly isolated land-mass." (Authors)] Address: Kalkman, V.J., Natural Biodiversity Center, naturalis, Postbus 9517, 2300 RA Leiden, The Netherlands. E-mail: kalkman@naturalis.nl

**20359.** Kikuhara, N.; Tanaka, Y. (2018): Study on the life cycle of *Anax nigrofasciatus nigrofasciatus* in the biotope. Proceedings of the Japan Society of Civil Engineers G (Environment) 74(6): 151-156. (in Japanese, with English summary) ["*A. n. nigrofasciatus* is a common species of dragonflies that appear even on the urban waterside. This dragonfly is considered as the index species for developing of waterside biotopes. However, the life cycle such as eclosion period and frequency of visiting has not been well studied yet. For the purpose of utilizing the understanding about the life cycle of the dragonfly to the planning of fixture waterside biotope, we carried out the surveys on eclosion and frequency of visiting of *Anax nigrofasciatus nigrofasciatus* in the biotope of PENTA-OCEAN OBSTRUCTION Institute of Technology. The live camera is also utilized for the investigation of the frequency of visiting. As the result, it was possible to understand the eclosion population and visiting frequency of the dragonfly." (Authors) [https://www.jstage.jst.go.jp/article/jscej/74/6/74\\_IL\\_151/\\_pdf/-char/en](https://www.jstage.jst.go.jp/article/jscej/74/6/74_IL_151/_pdf/-char/en)] Address: Email: noriko.iyoda@mail.penta-ocean.co.jp

**20360.** Kolev, N.; Boudot, J.-P. (2018): Evidence of reproduction of *Lindenia tetrphylla* in Bulgaria (Odonata: Gomphidae). *Notulae odonatologicae* 9(1): 11-17. (in English) ["*L. tetrphylla* was found reproducing in a warm man-made lake strongly influenced by one of the nearby lignite-fired Maritsa Iztok thermoelectric power stations in the Thracian Bulgarian plain. The records included a great number of imagines and some exuviae. A significant number of adult individuals were also found in various smaller ponds around, part of them considered as individuals in search of new breeding habitats. The reasons for the species' establishment in this highly disturbed area are discussed." (Authors)] Address: Kolev, N., Zornitsa St, 6260 Radnevo, Bulgaria. E-mail: neochrom@abv.bg

**20361.** Kompier, T. (2018): *Protosticta curiosa* Fraser, 1934 and its synonyms in Vietnam and China (Odonata: Platystictidae). *Zootaxa* 4434(2): 373-376. (in English) ["*Protosticta zhengi* Yu & Bu, 2009 and *Protosticta albifrons* Kompier, 2016 are shown to be synonyms of *P. curiosa* Fraser, 1934. The general distribution of *P. curiosa* is discussed and the key to the *P. curiosa*-group of *Protosticta* species for Vietnam is updated." (Author) For more details on the taxonomic status of this taxon see Phan et al. (2022): Taxonomic and faunistic notes on the genus *Protosticta* Selys, 1885 in Laos (Odonata: Zygoptera: Platystictidae). *Aquatic Insects* 43(3): 36-45. *P. curiosa* is considered a synonym of *P. trilobata* Fraser, 1933.] Address: Kompier, T., Schoutenstraat

69, 2596 SK Den Haag, the Netherlands. Email [kompiertokyo@yahoo.com](mailto:kompiertokyo@yahoo.com)

**20362.** Koparde, P.; Dawn, P.; Sumanapala, A (2018): Islands are calling: short Expedition to the Andaman Islands reveals five new spatial records and research gaps. *Agrion* 22(1): 37-41. (in English) ["During our seven day visit (14-21 August 2017), we opportunistically sampled 23 localities in North and one locality in Middle and South Andaman Islands each.... Our intense sampling resulted in documenting 27 of 52 species (>50%) recorded from the Andaman Islands and adding five species, namely *Tetrathemis platyptera*, IUCN red-listed 'Endangered' *Libellago balus*, *Acia-grion occidentale*, *Mortonagrion aborense*, and *Ceriagrion auranticum* as new spatial records for the Andaman Islands." (Authors)] Address: Koparde, P., Indian Institute of Science, Education and Research, Tirupati, Andhra Pradesh, India. E-mail: [pankajkoparde@gmail.com](mailto:pankajkoparde@gmail.com)

**20363.** Kosewska, O.; Buczynski, P. (2018): New record of an autochthonic population of *Sympetrum depressiusculum* (SELYS, 1841) (Odonata: Libellulidae) in the north-eastern Poland. *Odonatrix* 149: 6 pp. (in Polish, with English summary) ["The autochthonic population of *Sympetrum depressiusculum* was found in the Che<sup>3</sup>mno-Dobrzyń Lake District in north-eastern Poland, in fish ponds in the village of Koszelewy near Lidzbark (53°19'N, 19°57'E, UTM: DE30). Juvenile imagines were caught here on July 2 and July 4, 2018. The new site, together with other sites in northern Poland located to a maximum of 54°18'N, form the northernmost belt in Central and Eastern Europe, where the regular development of this species is found, which determines the limits of the generative range. They are also probably the source of individuals colonizing the Baltic countries. The authors also discuss the vegetative range of the species, now reaching Latvia, and point to the role of the area of Poland as a refugium of *S. depressiusculum* in Central and Eastern Europe: in most neighbouring countries this species is endangered and in the regression, also in the whole Europe and the EU it was classified as VU threat category, while in Poland it is not threatened and in the southern regions and locally in central regions it is widespread. The habitats occupied by the species are varied in Poland, however, in the northern part of the country fish ponds are still predominant, whose change in management methods is one of the main factors threatening the species in other countries." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska Univ., Akademicka 19, PL-20-033 Lublin, Poland. E-mail: [pawbucz@gmail.com](mailto:pawbucz@gmail.com)

**20364.** Le Gall, M.; Fournier, M.; Chaput-Bardy, A.; Husté, A. (2018): Determinant landscape-scale factors on pond odonate assemblages. *Freshwater Biology* 63(3): 306-317. (in English) ["1. Species assemblages are related to environmental factors acting at different landscape scales. Local habitat heterogeneity also contributes to maintain the regional species pool. Understanding factors determining species presence is therefore crucial for formulation of successful conservation and management strategies. 2. Odonates can reveal much about patterns of species assemblages since their presence at a site reflects both their dispersal ability and life cycle constraints. Odonate assemblages were studied at 31 ponds located in three different landscapes: forest, urban and field. The impact of pond geographical distribution and their local characteristics (i.e., vegetation, suspended matter, freshwater macroinvertebrates, pond area and temporariness) on odonate composition, species richness and larval presence were studied. 3. According to their

intrinsic requirements, Odonata presence on ponds depended on local characteristics. Some species of the two orders were only detected in field or forest ponds. Moreover, some species were never detected in urban ponds. Differences in odonate assemblages were mainly related to vegetation, freshwater macroinvertebrates and pond area. Species richness was related to predator abundance and pond area, especially for dragonflies. The presence and abundance of odonate larvae were both related to aquatic vegetation, and to contrasted aquatic variables of ponds. Therefore, this study confirms that vegetation within and around ponds determines odonate presence. Interestingly, in a pond, species detected at the adult stage were not always detected at the larval stage, highlighting the need to really consider both parts of the lifecycle when studying odonate assemblages. 4. Diversity of local habitats within and around ponds depends strongly on the surrounding landscape and influences the assembly of odonates. Forest and field ponds presented particularly dissimilar species assemblages. Urban ponds had no specific environmental habitats compared to the other contexts. Species present on these ponds are rather generalist and able to support human disturbances. Overall, this study confirms that pond heterogeneity may be a key factor in maintaining the regional pool of odonate species." (Authors)] Address: Husté, Aurélie, ECODIV URA/EA 1293, IRSTEA, FR CNRS 3730 SCALE, UFR Sciences et Techniques, Normandie Université, Université de Rouen, Mont-Saint-Aignan Cedex, France. E-mail: aurelie.huste@univ-rouen.fr

**20365.** Lecaplain, B. (2018): Seconde année de suivi de la Grande Aeshne *Aeshna grandis* (L., 1758) dans deux étangs du Perche (Orne). Rapport GRETIA réalisé grâce aux financements de l'Europe (fonds FEADER), de l'Agence de l'eau Loire-Bretagne et de l'Agence de l'eau Seine-Normandie, dans le cadre de la déclinaison régionale du PNAO: 9 pp. (in French) ["This report presents the results of the second year of monitoring the exuviae of *Aeshna grandis* in the Cachot and Gré ponds (Brésolettes, Orne), carried out by means of three passages made on foot/by boat along the banks from the inside, on 10, 25 August and 11 September 2017. Despite the presence of the species on the Gré pond, no exuviae were found." (Author/DeepL)] Address: not stated

**20366.** Leclerc, D. (2018): Ecosystèmes aquatiques du Salève. Enjeux écologiques et mesures en faveur de leurs espèces remarquables. Archives des Sciences 70: 171-180. (in French) ["Three years of inventories (from 2011 to 2013) have made it possible to draw up an ecological assessment of most of the aquatic ecosystems present on the Salève massif [Département Haute-Savoie, France]. Alpine pasture or forest ponds, marshes or even forest streams were investigated in order to record the diversity of odonates [n=21 species] and macrophytes present in these particular biotopes. This work has made it possible to identify remarkable species for the Salève; some ecosystems even host species that are almost absent from the Geneva basin. These inventories have also made it possible to highlight the ecological challenges and threats facing these fragile ecosystems. Conservation measures were thus proposed in order to maintain or restore them. A hierarchy of interventions was also proposed in order to intervene in the most degraded environments. Finally, only regular monitoring of the restored environments will make it possible to assess the positive or negative effects of the various works carried out in recent years and thus to review the management guidelines if necessary." (Author/DeepL)] Address:

Leclerc, D., 2130, route des Monts, 74560 La Muraz, France. E-mail: davidleclerc74930@gmail.com

**20367.** Liu, H.; He, G.; Ma, C.; Wang, Q.; Luo, Y. (2018): A computational study of the aerodynamic performance of a dragonfly forewing in gliding flight. MATEC Web Conf. Volume 151, 2018: 4 pp. (in English) ["Gliding flight is a common mode of flight for dragonfly, the objective of the current research is to use numerical simulations to explore whether the corrugations have positive effect on aerodynamic performance of the dragonfly wings in gliding flight. In order to compare aerodynamic performance of the dragonfly wing and flat plate, a three-dimensional model of the dragonfly forewing and a three-dimensional flat plate with the same shape of the dragonfly forewing are established. The flow fields around three-dimensional dragonfly forewing and flat plate are simulated for  $Re=10000$  and angles of attack changing from  $0^\circ$  to  $25^\circ$  (with an interval of  $5^\circ$ ), numerical simulation indicate that aerodynamic performance of the dragonfly wing is slightly better than the flat plate over the entire range of parameters tested, especially the effect of the corrugations on the flow is more evident at large angle of attack." (Authors)] Address: Liu, H., Nanchang Hangkong Univ. School of Aircraft Engineering, student, 2017, China

**20368.** Loftie-Eaton, M.; Underhill, L.; Navarro, R. (2018): OdonataMAP: Progress report on the Atlas of the Dragonflies and Damselflies of Africa: 2016/17 and 2017/18. Biodiversity Observations 9.13: 1-10. (in English) ["This paper reports progress with OdonataMAP, the Atlas of Dragonflies and Damselflies of Africa, for the two-year period 1 July 2016 to 30 June 2018. During the two-year review period, the database for the project grew by 30,423 records to 52,257, starting from 22,809 records collected between 2010 and June 2016. Submissions were made from 25 African countries. In six of the nine provinces of South Africa, the number of OdonataMAP records for the province more than doubled. The provinces in which the number of records were not doubled were Gauteng (44% of records made during reporting period), Free State and North West (both 46%). Five observers contributed more than 1000 records over the two-year period, and a further 10 between 500 and 999 records. The total number of observers for the two-year period was 529, compared with 295 in the 2010–16 period. One of the important success of OdonataMAP during the review period was to increase the number of observers, and to reduce the project's dependence on a small number of citizen scientists." (Authors)] Address: Loftie-Eaton, Megan, Animal Demography Unit, Dept Biological Sciences, Univ. of Cape Town, Rondebosch, 7701 South Africa; Biodiversity and Development Institute, 25 Old Farm Road, Rondebosch, 7700 South Africa

**20369.** Luna-León, C.; Domínguez-Márquez, V.M.; Catalán-Heverástico, C.; Pérez-Vargas, J.M. (2018): Dragons (Insecta: Odonata) of Tuxpan, Northern Region of the Guerrero State. Entomología mexicana 5: 587-592. (in Spanish, with English summary) ["This investigation was carried out in the locality of Tuxpan, Iguala de la Independencia, Guerrero, Mexico, with the purpose of knowing the odonatofauna and its seasonal fluctuation. The catches were made on the shores of the Tuxpan lagoon with entomological nets from February to April 2017. 319 specimens were captured, belonging to three families, 11 genera and 16 species. The most abundant family was Libellulidae with eleven species, and the species with the most specimens was *Orthemis feruginea* (Fabricius, 1775). The highest value of abundance

occurred in the third week of March 2017." (Authors)] Address: Luna-León, C., Integrantes del Cuerpo Académico Sistemas de Producción Agropecuaria de la Facultad de Ciencias Agropecuarias y Ambientales, Universidad Autónoma de Guerrero, Periférico Poniente S/N, Colonia Villa de Guadalupe, Iguala de la Independencia, C. P. 40010, Guerrero, México. Email: cluna63@hotmail.com

**20370.** Marthelot, J.; Schleifer, J.; Brun, P.-T. (2018): Dragonfly wings-inspired deployable structures. *Bulletin of the American Physical Society Abstract: APS March Meeting 2018, Monday–Friday, March 5–9, 2018; Los Angeles, California H47.00005*: (in English) [Verbatim: Maintaining the overall shape of a flat structure while increasing its surface area is a nontrivial challenge when designing soft structures. When the wing of an emerging dragonfly deploys in a couple of minutes, the expansion is guided by a network of veins, in which hemolymph is injected and subsequently solidifies to generate rigidity. During the deployment stage, the looping patterns of the edge of the wings are characteristic of differential growth. Inspired by this insect, we build a model experiment of the inflatable deployable structure composed of a tubular network of the veins. We first characterize the response of a unique looping tubular structure under pressure. We then characterize the in-plane expansion of the structure and study its correlation to the network geometry and the pressure applied in the system. A systematic variation of the geometric and elastic parameters allows us to search for an optimal design and operational conditions for maximal extension, while minimizing the input pressure.] Address: not stated

**20371.** Mashkova, I.V.; Krupnova, T.G.; Kostryukova, A.M.; Vlasov, N.E. (2018): Distribution of dragonflies (Odonata: Insecta) in South Ural lakes, Russia. *Biodiversitas* 19: 202-207. (in English) ["This paper studies the diversity and distribution of Odonata (Insecta) in the South Urals region lakes such as Lake Large Miassovo, Lake Small Miassovo, Lake Ilmenskoe, Lake Savelkul and Lake Baraus. We revised dragonflies in five lakes during May–September 2014–2016. Dragonflies and larvae were identified up to the species. As results, 36 species (12 Zygoptera and 22 Anisoptera) belonging to 15 genera were recorded. To compare the similarities of dragonfly communities of different lakes we used the Canonical Correspondence Analysis (CCA) according the Jaccard index. Comparing the number of records of odonate species for selected lakes in our study, we found that the small richness of species was typical for lakes Savelkul and Baraus (22% and 25% of the total number of species, respectively) and the large values of the species richness was obtained for lakes Small Miassovo, Ilmenskoe and Large Miassovo (50%, 72% and 80% of the total number of species, respectively)." (Authors)] Address: Mashkova, Irina, Dept of Chemistry, South Ural State Univ.. 76 Lenin Prospect, 454080, Chelyabinsk, Russia

**20372.** Masterson, R. (2018): A survey of microplastics in invertebrates in the Lake Champlain basin. Poster; <https://soar.suny.edu/handle/20.500.12648/847>: (in English) ["The goal of this research was to determine whether microplastics (MP) were ingested by aquatic macroinvertebrates resident to Lake Champlain. We did so by quantifying and characterizing (e.g., fragment, fiber, film, foam, pellet) microplastic particulate. In more recent samples, we have dried and weighed invertebrates to better assess uptake. Preliminary wet peroxide oxidation digests were performed on aquatic invertebrates (n = 301). Invertebrate specimens were collected across two classes (Insecta, Malacostr)

and 7 orders including Coleoptera, Ephemeroptera, Hemiptera, Odonata, Trichoptera, Mysida, and Amphipoda. These representative organisms are an important part of the lake food web, serving as preferred food for higher vertebrates including fish and waterfowl. Aquatic macroinvertebrates in our sample possess unique feeding methods, such as filter feeding, scraping, piercing, shredding, scavenging, collecting/gathering, and predation. Our research indicated that fibers were the most common microplastic type uptaken by invertebrates. Preliminary results suggest that, *Hydropsyche*, a filter-feeding insect digested, the greatest mean number of MP's (n=3). Lake Champlain macroinvertebrates contained on average 0.36 microplastic particles. There are limited reports of microplastics uptaken in aquatic invertebrates and this research provides baseline information for a guild that will be involved in trophic transfer. Results from this research serve to inform residents of the Lake Champlain watershed, anglers, non-profit lake organizations, as well as public health and government officials of the risks microplastics pose to aquatic biota and ultimately humans." (Author)] Address: Center for Earth & Environmental Science, SUNY Plattsburgh, Plattsburgh, NY 12901

**20373.** Mayer, G. (2018): Die Kleine Zangenlibelle *Onychogomphus forcipatus* (L. 1758); Neue Funde im Paartal und an Seen im Lechtal. *Berichte des Naturwissenschaftlichen Vereins für Schwaben* 122: 56-59. (in German, with English summary) [Bavaria, Germany; "Since 2004-2005, the 110 km long stretch of the Paar River between the Aichach-Friedberg Rural District and its confluence with the Danube has been under protection according to European law. *Ophogomphus cecilia*, a guarantor of clean water, is also the reference species for the dragonfly fauna of the Paar valley. A first record of the *O. forcipatus* in the summer of 2017 confirms the significance of the Paar valley. Additional finds are reported for lakes in the Lech valley. *O. forcipatus* is increasing its range." (Author)] Address: Mayer, G., Am Harfenacker 10, 86316 Friedberg, Germany. Email: mayerfdb@t-online.de

**20374.** McDevitt-Galles, T.; Calhoun, D.M.; Johnson, P.T.J. (2018): Parasite richness and abundance within aquatic macroinvertebrates: testing the roles of host- and habitat-level factors. *Ecosphere* 9(4): 1-16. (in English) ["The importance of parasites as both members of biological communities and structuring agents of host communities has been increasingly emphasized. Yet parasites of aquatic macroinvertebrates and the environmental factors regulating their richness and abundance remain poorly studied. Here, we quantified parasite richness and abundance within 12 genera of odonate naiads and opportunistically sampled four additional orders of aquatic macroinvertebrates from 35 freshwater ponds in the San Francisco Bay Area of California, U.S.A. We also tested the relative contributions of host- and habitat-level factors in driving patterns of infection abundance for the most commonly encountered parasite (the trematode *Haematoloechus* sp.) in nymphal damselflies and dragonflies using hierarchical generalized linear mixed models. Over the course of two years, we quantified the presence and intensity of parasites from 1612 individuals. We identified six parasite taxa: two digenetic trematodes, one larval nematode, one larval acanthocephalan, one gregarine, and a mite, for which the highest infection prevalence (39%) occurred in the damselfly genus, *Ischnura* sp. Based on the hierarchical analysis of *Haematoloechus* sp. occurrence, infection prevalence and abundance were associated predominantly with site-level factors, including definitive host (frog) presence, nymphal odonate

density, water pH, and conductivity. In addition, host suborder interacted with the presence of fishes, such that damselflies had higher infection rates in sites with fish relative to those without, whereas the opposite was true for dragonfly nymphs. These findings offer insights into the potential interaction between host- and site-level factors in shaping parasite populations within macroinvertebrate taxa." (Authors) Odonata are treated at genus level.] Address: McDevitt-Galles, T., Ecology and Evolutionary Biology, Univ. of Colorado, Boulder, Colorado 80309 USA

**20375.** Melendez Quinto, J.M. (2018): Odonatofauna larval de ríos, humedales y otros sistemas acuáticos en Lima Metropolitana, Perú. Tesis para optar el título profesional de biólogo, Universidad Nacional Agraria la Molina, Facultad de Ciencias, Lima – Perú: X + 174 pp. (in Spanish, with English summary) ["Odonata (dragonflies and damselflies) is a little known taxon in South America, especially its larvae. I set out to complete this information for the Lima metropolitan area because the species level offers advantages in ecology. Larvae (almost always close to the last instar) were caught in the Lurin, Rimac and Chillón rivers, the Villa and Ventanilla wetlands, and in the UNALM. I reared these specimens to obtain imago and nominate their exuviae. I also checked the museum material from the main collections in Lima. Twenty-one species were recorded in the study area, six of them for the first time (two new species), three ones only as imago and two others known just by literature. I deleted three species (*Argia fissa*, *Ischnura ramburii* and *Phyllocyba uniflora*) from the record. I made identification keys for 20 species of all recorded ones (*Argia* spec. nov. larva is hitherto unknown) and for their mandibles. Here was included figures (illustrations and photographs) of all species too. In the taxonomic treatment, I described each species the most detailly possible and, as the case may be, I did comments about the differences among their phylogenetically closest congeneric ones in America and their conspecific ones which were described in other countries of the New World. In addition I included information regard to their bionomics (aquatic habitat and emergence time), distribution and conservation status. For all taxa, I put a diagnosis to local (species) and national (supraspecific taxa) scale. *Argia inculta*, l. aff. *ramburii*, *Rhionaeschna brevifrons* and *Erythrodiplax cleopatra* have been described for the first time; while my description of *Progomphus joergenseni* was noticeably different from the same species in Argentina." (Author) <https://docslib.org/doc/59-79760/odonatofauna-larval-de-r%C3%ADos-humedales-y-otros-sistemas-acu%C3%A1ticos-en-lima-metropolitana-per%C3%BA>] Address: not stated

**20376.** Mellal, M.K.; Zebba, R.; Bensouilah, M.; Houhamdi, M.; Khelifa, R. (2018): Aspects of the emergence ecology of the regionally endangered *Coenagrion mercuriale* (Odonata: Coenagrionidae) in Northeast Algeria. *Zoology and Ecology* 28(3): 224-230. (in English) ["Emergence is a critical phase in the life cycle of odonates because then they are highly susceptible to predation and damage. Thus the ecological understanding of this phenomenon is crucial, particularly for the conservation and management of threatened species. We studied the emergence ecology of the regionally endangered *C. mercuriale* in Northeast Algeria where the species produces two generations per year (spring and autumnal), focusing on the temporal emergence pattern, body size and vertical stratification of exuviae of the autumnal population. Emergence was synchronous with 50% of the population emerging within eight days. Sex ratio at emergence was slightly female biased. A seasonal decline

was observed in the body size of the autumnal population like in that of the spring population. Vertical stratification of exuviae at ecdysis depended on the height of the support and vegetation density. These data are expected to be important for the management and conservation of this threatened species in Northeast Algeria and elsewhere within the distribution range." (Authors)] Address: Khelifa, R., Institute of Evolutionary Biology and Environmental Studies, Univ. of Zürich, Winterthurerstr. 190, CH-8057, Zürich, Switzerland. E-mail: [rassimkhelifa@gmail.com](mailto:rassimkhelifa@gmail.com)

**20377.** Michelson, C.I.; Clark, R.G.; Morrissey, C.A. (2018): Agricultural land cover does not affect the diet of Tree Swallows in wetland-dominated habitats. *The Condor* 120(4): 751-764. (in English) ["Agricultural practices have intensified during the past 50 yr, increasing crop production and altering the Canadian prairie landscape by removing or degrading uncropped habitats, including wetlands. We predicted that agricultural practices would alter invertebrate communities and the diets of consumers such as insectivorous birds. Using stable isotope analysis ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ), we tested for differences in the assimilated diets and isotopic niche widths of adult and nestling Tree Swallows (*Tachycineta bicolor*) in grassland and cropland sites with similar wetland densities in Saskatchewan, Canada. We also assessed relationships between swallow diet and body size, mass, and condition. Dietary composition and niche width differed between years and age classes but were not consistently related to agricultural land cover. Aquatic insect prey (Diptera and Odonata) made up 75% of all swallow diets, but nestlings consumed a larger proportion of terrestrial Diptera, resulting in broader isotopic niche widths compared with adults. Age-specific dietary differences could have been related to temporal shifts in the insect community or distinct foraging by adults when feeding nestlings. The body mass and condition of adult and nestling swallows were unrelated to diet, but were higher on average in grassland than cropland habitat. Overall, Tree Swallows specialized in feeding on aquatic insects, regardless of agricultural land cover, at least in wetland-dominated habitats. Food resources originating from wetlands may play a critical role in supporting insectivorous bird populations in agricultural landscapes." (Authors)] Address: Morrissey, Christy, Dept Oceanography & Coastal Sciences, Louisiana State Univ., Baton Rouge, Louisiana, USA. Email: [christy.morrissey@usask.ca](mailto:christy.morrissey@usask.ca)

**20378.** Mocq, J.; Hare, L. (2018): Influence of acid mine drainage, and its remediation, on lakewater quality and benthic invertebrate communities. *Water, Air, & Soil Pollution* 229(2), <https://doi.org/10.1007/s11270-017-3671-3>: (in English) ["The abandoned Aldermac Mine in Québec, Canada, has been a source of acid mine drainage to Lake Arnoux since 1946. Restoration of the site was undertaken in 2008 and completed in 2010. We compared lakewater chemistry and benthic invertebrate communities in the spring of 2010, prior to complete restoration, and in spring 2011, when acid mine drainage was no longer entering the lake. Between these years, lakewater pH increased by about one unit and the concentrations of many trace metals declined substantially. In 2010, benthic taxonomic richness increased significantly with distance from the source of contamination, whereas after restoration, there was no longer a clear trend. Communities in highly contaminated stations tended to be dominated by burrowing taxa such as larvae of *Chironomus* (Chironomidae) and *Oligochaeta*, whereas less contaminated stations had taxonomic and functional communities that were more diverse. In the year following recovery, some new taxa appeared (Trichoptera, Odonata,

and the Ceratopogonidae Bezzia), whereas the populations of an acid-tolerant Chironomus species declined. However, only larger individuals exhibited a significant response to pH and metal contamination." (Authors) Taxa are treated at genus level: Somatochlora, Sympetrum, Leucorrhinia, Coenagrion/Enallagma] Address: Mocq, J., Fac. of Science, Dept of Ecosystems Ecology, Univ. of South Bohemia, České Budejovice, Czech Republic

**20379.** Mor, J.-R.; Ruhí, A.; Tornés, E.; Valcárcel, H.; Muñoz, I.; Sabater, S. (2018): Dam regulation and riverine food-web structure in a Mediterranean river. *Science of the Total Environment* 625: 301-310. (in English) ["Highlights: • Flow regulation increased flow stability in a highly-variable Mediterranean river. • The detritus-based food web shifted into an algae-based food web. • Changes in consumers and their interactions widened and lengthened the food chain. • Flow regime alteration may impact river food webs beyond their individual components. Flow regimes are a major driver of community composition and structure in riverine ecosystems, and flow regulation by dams often induces artificially-stable flow regimes downstream. This represents a major source of hydrological alteration, particularly in regions where biota is adapted to strong seasonal and interannual flow variability. We hypothesized that dam-induced hydrological stability should increase the availability of autochthonous resources at the base of the food web. This, in turn, should favour herbivorous over detritivorous strategies, increasing the diversity of primary consumers, and the food-web width and length. We tested this hypothesis by studying the longitudinal variation in food-web structure in a highly-seasonal Mediterranean river affected by an irrigation dam. We compared an unregulated reach to several reaches downstream of the dam. Hydrological and sedimentological stability increased downstream of the dam, and altered the type and quantity of available resources downstream, prompting a change from a detritus-based to an algae-based food web. The fraction of links between top and intermediate species also increased, and the food web became longer and wider at the intermediate trophic levels. Food-web structure did not recover 14 km downstream of the dam, despite a partial restitution of the flow regime. Our results advance the notion that hydrologic alteration affects riverine food webs via additions/deletions of taxa and variation in the strength and distribution of food-web interactions. Thus, flow regulation by dams may not only impact individual facets of biodiversity, but also food-web level properties across river networks." (Authors) The paper includes a reference to Odonata.] Address: Mor, J.-R., Dept of Evolutionary Biology, Ecology and Environmental Sciences, Universitat de Barcelona, Av. Diagonal, 643, 08028 Barcelona, Spain. Email: jrmor@icra.cat

**20380.** Muktitama, S.R.; Hari prayogo, Yulianti indrayani (2018): Species diversity of dragonflies in Univ. campus area of Tanjungpura in Pontianak. *Jurnal Hutan Lestari* 6(4): 752-764. ["Dragonfly is an indicator to environment and ecosystem in a particular area. It is also known as a balancing predator to another insects' population. Various types of dragonfly are affected by some factors such as habitat conditions and the foods. Various types of dragonfly can be found in swamland, rice fields, flooded area, and also some locations around Universitas Tanjungpura. This research aims to convey information about various types of dragonfly in the area of universitas tanjungpura and also to define the index of variety of dragonfly types (H), equalization index (e), domination index (D), and species similarity (IS). This research took two weeks of fieldwork by applying purposive

sampling, which was started from 5th – 15 th April, 2018. Where the researcher is free to down each location seen from the large number of dragonflies are found. Then each location specified each plot with a distance of 15 meters each point of view of forming a circle pattern diameter 30 meters. The researcher found that 16 type of dragonfly consist of 13 type categorized as Subordo Anisoptera and 3 type categorized as Subordo Zygoptera. The 13 Anisoptera consist of 12 in Libellulidae family and 1 in Gomphidae family. The other 3 Zygoptera are in the the category of Coenagrionidae. This research shows that the role of dragonfly as a bioindicator and the predator of particular environment. Ecologically, Universitas Tanjungpura is indicated to have deficient environment in terms of the population growth of dragonfly in ecological ecosystem." (Authors)] Address: Muktitama, S.R., Fakultas Kehutanan Universitas Tanjungpura Pontianak. Jl. Daya Nasional Pontianak 78124, Indonesia. E-mail: senja.rimbawan@gmail.com

**20381.** Mutlu, O.; Páleníček, T.; Pinterová, N.; Šíchová, K.; Horáček, J.; Kristina Holubová, K.; Höschl, C.; Stuchlík, A.; Erden, F.; Valeš, K. (2018): Effects of the adipokinetic hormone/red pigment-concentrating hormone (AKH/RPCH) family of peptides on MK-801-induced schizophrenia models. *Fundamental and Clinical Pharmacology* 32(6): 589-602. (in English) ["The adipokinetic and red pigment-concentrating hormone (AKH/RPCH) family of peptides controls fat, carbohydrate and protein metabolism in insects. In our previous study, we showed that AKH possesses antidepressant, anxiolytic, and analgesic effects, causes hyperlocomotion and exerts neuroprotective effects and increased brain neurotrophic factors in mice. The aim of this study is to investigate the effects of Anax imperator AKH (Ani-AKH), Libellula auripennis AKH (Lia-AKH) and Phormia-Terra hypertrehalosemic hormone (Pht-HrTH) on MK-801-induced memory deterioration in the active allothetic place avoidance test (AAPA) and MK-801-induced sensorimotor gating deficit in the prepulse inhibition test (PPI). In the AAPA task, Long Evans rats were treated with Ani-AKH (2 mg/kg), Lia-AKH (2 mg/kg), Pht-HrTH (2 mg/kg), MK-801 (0.15 mg/kg) and the combination of MK-801 with the hormones subchronically. In the prepulse inhibition test, Wistar-albino rats were treated with Ani-AKH (1 mg/kg), Lia-AKH (1 mg/kg), Pht-HrTH (1 mg/kg), MK-801 (0.1 mg/kg) or the combination of MK-801 with hormones acutely before the test. In our study, Ani-AKH (2 mg/kg), Lia-AKH (2 mg/kg) and Pht-HrTH (2 mg/kg) reversed MK-801 (0.15 mg/kg)-induced cognitive memory impairment effects in the AAPA task. Lia-AKH (1 mg/kg) significantly potentiated the MK-801-induced PPI disruption, while Ani-AKH (1 mg/kg) partially potentiated the impairment caused by MK-801, and Pht-HrTH did not modify the effect of MK-801. In conclusion, AKH had no effect in sensorimotor gating deficits in the PPI test in schizophrenia model while AKH improved memory in the schizophrenia model of MK-801." (Authors)] Address: Mutlu, O., Kocaeli Univ. Medical Faculty, Dept of Pharmacology, 41380, Kocaeli, Turkey

**20382.** Nasiruddin, M.; Barua, A. (2018): Odonate abundance and diversity in four selective spots of Chittagong Univ. campus. *J. biodivers. conserv. bioresour. manag.* 4(1): 55-62. (in English) ["The abundance and diversity of odonate fauna were studied in four selective spots of Chittagong Univ. Campus, Chittagong, Bangladesh from August 2016 to July 2017. A total of 928 individuals of odonates under three families was collected during the study period from the four sampling sites. Out of 25 species identified one belonged to Gomphidae, 13 belonged to Libellulidae and 11

belonged to Coenagriidae. The abundance of odonate species was highest in July'17 (13.04%) and was lowest in December'16 (4.96%). Spot 2 was a hotspot for odonates as highest number (370) was collected from this spot. A total of 196, 188 and 174 individuals were collected from Spot 4, Spot 3 and Spot 1, respectively. The members of Libellulidae (472) were dominant followed by Coenagrionidae (406) and lastly Gomphidae (50). Highest species richness (SR), species diversity (H') and species evenness (J') values were observed in the months of May'17 (1.56±0.08), May'17 (1.29±0.08) and December'16 (0.96±0.03), respectively. But lowest such values were observed in December'16 (0.96±0.05), November'16 (0.90±0.02) and May'17 (0.81±0.05), respectively. Amongst the spots, highest SR, H' and J', values were observed in Spot 4 (1.40±0.10), Spot 2 (1.22±0.05) and Spot 1 (0.93±0.02), respectively, whereas, lowest such values were observed in Spot 1 (1.02±0.08), Spot 1 (1.01±0.04) and Spot 4 (0.82±0.02), respectively. Ecological conditions and seasonal fluctuation had great impact on the abundance and diversity of odonates." (Authors)] Address: Barua, A., Dept of Zoology, Univ. of Chittagong, Chittagong 4331, Bangladesh

**20383.** Neto, M.V.B.; Campos Júnior, O.; Rodrigues, G.G. (2018): Influence of the reproductive behavior of *Neoneura sylvatica* (Odonata: Protoneuridae) on spermatid morphology. *MOJ Anat & Physiol.* 5(3): 192-193. (in English) ["The present study aimed to verify the behavioral effects on the spermatid morphology of *Neoneura sylvatica* Hagen in Selys, 1886. For this, males were analyzed behaviorally for intra-sexual competition and for morphology of spermatozoa. With the observation of the five labelled individuals it was possible to observe agonistic relationships between resident males and intruders. When an intruding male attempted to invade the territory of the resident male, there were aggressive contacts. In the reproductive behavior it was possible to observe mating and oviposition with guard after copula in all the couples and attempts of interruption of oviposition by the male intruder. Through the histological analysis individual spermatozoa were observed and not found in bundles. Spermatozoa dimorphism was found for *N. sylvatica* being the first record for Odonata. This dimorphism is presented as follows: morphotype 1 has a total length of 99µm, undifferentiated head of the flagellum, spiral body. Morphotype 2 has a total length of 118µm, and it is possible to differentiate the head (31µm) from the flagellum (86µm). The head showed a shape of hook and ripples in the flagellum. We conclude that the behavioral attributes of male intra-sexual competition of *N. sylvatica* can influence the morphological characteristics of spermatozoa generating dimorphism." (Authors)] Address: Neto, Millena Vieira Barbosa, Depto Embriologia e Histologia, Univ. Federal de Pernambuco, Brazil. Email: millenavieira16@gmail.com

**20384.** Nilén, S. (2018): Effects of frequency-dependence in maintaining diversity in coexisting ecologically similar species. BSc. thesis, Dept of Biology, Lund Univ.: (in English) ["Niche theory predicts that cooccurring species must differ in their use of environments in order to coexist, thereby diversity can be maintained in a community. However, ecologically similar species do frequently occur in nature, hence species inhabit similar physical environs and share single underlying resources. In coexisting species with a similar niche, ecological drift is thought to eventually cause all but one species to go extinct, assuming drift acts alone. As drift is likely to be present in a community, contracting forces are expected to be found. One of those forces could be selec-

tion where frequency-dependence that can maintain diversity through e.g. rare species advantages and is thus capable of maintaining stable coexistence. Here we investigate mechanisms that can maintain diversity in ecologically similar but evolutionary separated species *I. elegans* and *E. cyathigerum*. We regulated frequencies of both species in mesocosm experiments and mating trials and were able to experimentally demonstrate the importance of negative frequency-dependence (rare-species advantages) in maintaining diversity in ecologically similar species. The maintenance of diversity in a community have long been explained by how species differ in their use of their environment. However, there are many examples in nature where similar species do cooccur in nature. For example, in Barro Colorado Island approximately 300 tree species were found in only 50 ha. This inevitably raises the question: How can so many closely related species coexist? Interestingly, closely related species of damselflies inhabit similar physical environments and often share single underlying resources. The minor differences of damselflies challenge traditional models of species coexistence. Methods: We wanted to know how closely related species can be maintained in a community without outcompeting each other. As study organisms we used the two, co-occurring species of damselflies: *Ischnura elegans* and *Enallagma cyathigerum*. The two species were kept in big outdoor cages simulating natural conditions where we wanted to understand how survival were affected by interference competition within and between species. We also used smaller cages where we looked at how mating affected both species. In both experiments we manipulated the frequencies of both species in experiments in three frequencies, (Rare: 25 %, Common: 75 % and Allopatric: 100 %) for the Blue-tailed damselfly and the common blue damselfly. Results: We found that the Blue-tailed damselfly survived longer in all treatments compared to the common blue damselfly. As this species does better in all the treatments one would expect that this species will outcompete the common blue damselfly in their natural community. However, we also found that the Blue-tailed damselfly regulates its own abundance. When common the Blue-tailed damselfly will interact with itself more through interference competition which decreases its survival. When rare this species both survives longer and have a higher proportion of matings, which can affect population growth. I suggest that the combination of interference competition that can regulate the species abundance and through rare-species advantages, diversity can be maintained, even if differences between species are small." (Author)] Address: not stated

**20385.** Noorhidayah, M. (2018): Bio-ecological studies of Malaysian odonates and an integrated taxonomic study on the genus *Rhinocypha*. PhD thesis, Faculty of Science, Univ. of Malaya: XXIII + 218 pp. (in English) ["Studies on Odonata have gained worldwide attention as well as here, locally in Malaysia. Although there is a wealth of data available to be utilized for solving taxonomic problems but ecological and behavioural research areas are more favoured in contrast to taxonomy and systematics. Thus, there are existing confusions for correct identifications in closely related and sympatric species, especially in female odonates. One such example is in the genus *Rhinocypha*, in which one of the objectives of this study is to fill in this gap. Consequently, the research aims and study techniques were; to illuminate the nationwide distribution and diversity of Odonata from Peninsular Malaysia forest reserves and relate these to the environmental parameters. Secondly, applying the molecular technique to elucidate the phyloge-

graphic pattern of *Rhinocypha fenestrella* which a predominant species in this study. Thirdly, a focused taxonomic work was conducted on *Rhinocypha*, employing multi-approaches, in the form of morphological procedures (Field Emission Scanning Electron Microscope, FESEM and geometric morphometric analysis); bio-material property investigations by using Laser Scanning Confocal Microscopy (LSCM), Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM). Overall, 1193 individuals from 70 species were collected from the 22 sampling localities. Chlorocyphidae was the dominant family and *R. fenestrella*, *R. biforata*, and *Euphaea ochracea* were the most abundant species. The PCA analysis confirmed that higher species richness was associated with the lower water chemical characteristics (compositions of sulphate, ammonia, iron and nitrite). The genetic diversity, expressed by CO1 and 16S rRNA genes for *R. fenestrella* was high, with 26 and 10 unique haplotypes, while 33 haplotypes were recovered by both combined datasets. The TCS analysis revealed the common ancestor of *R. fenestrella* was from the state of Negeri Sembilan. For the taxonomic study, 17 morphological characteristics were created to differentiate between the females of *Rhinocypha* spp. The FESEM on the female's ovipositor was done to focus on the anal appendages and sheathing valve (V3). Also, the phylogenetic patterns and canonical variate analysis for the wing geomorphometry revealed three clusters that supported the distinction of the *Rhinocypha* group. Exploration on bio-material, illustrate a general widespread distribution of resilin patches and cuticular spikes along the longitudinal veins of the wings. A novel technique applied in this study, was on nanoindentation (AFM) clarified the presence of varying size of nanostructures for all sample sections (membranes, mobile and immobile joints), and the elasticity values differed between sections. In summary, this study had effectively developed an integrated approach of classic morphological and trendy molecular as well as biomaterial studies, combined with different microscopy techniques, LSCM, SEM and AFM which provided corroborative evidence in resolving taxonomic uncertainties." (Author)] Address: not stated

**20386.** Ohba, S.-y.; Honki, K. (2018): Note on odonates in artificial ponds around the Faculty of Education, Nagasaki Univ.. *Bulletin of Faculty of Education, Nagasaki Univ.* 4: 19-26. [In addition to the odonates reported previously, we have newly identified two aeshnids, one macromiid, and three libellulids, in the vicinity of the Faculty of Education building at Nagasaki Univ.. Of these, *Rhyothemis fuliginosa* is placed in the 'Red List' of Nagasaki City in Nagasaki Prefecture. Students who attended a Biological Experiment I program from ,Q,O,P,R to ,Q,O,P,V evaluated the abundance of damselfly nymphs among three ponds. As a result, the abundance of damselfly nymphs in the artificial pond situated between the Faculty of Environmental Science and Faculty of Education buildings was found to be the least among the three ponds evaluated. The mosquitofish, *Gambusia affinis*, in the pond feeds on all kinds of Odonata nymphs. These results confirm the presence of invasive species in our Univ. ponds, and managing the invasive species is important for conservation of the odonates." (Authors)] Address: Ohba, S.-y., Fac. Education, Biology Education, Nagasaki Univ., Japan

**20387.** Ousterhout, B.H.; Graham, S.R.; Hasik, A.Z.; Serano, M.; Siepielski, A.M. (2018): Past selection impacts the strength of an aquatic trophic cascade. *Functional Ecology* 32: 1554-1562. (in English) [1. In complex food webs, in-

teractions among species in different trophic levels can generate cascading indirect effects that couple top predators with primary producers, thereby affecting ecosystem functioning. Natural selection imposed by top predators on intermediate predators may play a role in shaping the strength of these trophic cascades, but this conjecture remains largely untested. 2. To determine the effects of natural selection on the strength of trophic cascades, we conducted a two-part experiment in a four-level aquatic trophic system involving a top predator (fish), an intermediate predator (damselflies [*Enallagma* sp.]), herbivores (zooplankton) and primary producers (algae). We first quantified how predation by fish generated selection on damselfly activity levels after controlling for phenotypic plasticity. We then measured the indirect effects of this selection on primary production (phytoplankton biomass). In both experiments, we varied the density of predators, allowing us to elucidate both trait-mediated and density-mediated indirect effects. 3. We found that as fish density increased, damselfly survivorship declined, which generated natural selection favouring less active damselflies. These results are robust after taking into account latent effects of plasticity in response to fish predator cues. The surviving damselflies likely foraged less, freeing herbivores from predation, which in turn reduced primary production. This selection-driven trait-mediated indirect effect was only apparent at low damselfly densities, because the consumptive effect of damselflies at high densities overwhelmed the effects of past selection. 4. These results demonstrate how the past action of natural selection imposed by predators affects the phenotypes of prey that consume herbivores, which ultimately influences primary productivity—a selective trophic cascade. Natural selection can therefore act as a mechanism coupling ecological dynamics across trophic levels, which ultimately influences ecosystem functioning." (Authors)] Address: Siepielski, A.M., Dept of Biological Sciences, Univ. of Arkansas, Fayetteville, AR, USA. E-mail: amsiepie@uark.edu

**20388.** Pander, J.; Mueller, M.; Geist, J. (2018): Habitat diversity and connectivity govern the conservation value of restored aquatic floodplain habitats. *Biological Conservation* 217: 1-10. (in English) [Floodplains have been strongly altered by human activities such as channelization and other river regulations. Globally, there is a growing interest in their restoration because of an increasing understanding of the ecological importance of these habitats for feeding, spawning, nursery or overwintering of aquatic species. In this study, a large floodplain restoration project of the upper Danube River was used to investigate colonization and succession patterns of fish, macroinvertebrates, macrophytes and periphyton in relation to abiotic habitat variables that can be restored through ecosystem management. Highest species diversity was detected near the contact zones of the floodplain channel to the main stem of the Danube, and in the transition zones of river sections (RS) and oxbow lakes (OS). The highest proportions of all taxa (82%) and of distinctive species (22%) were detected in RS, followed by OS (66% of all taxa, 8% distinctive species) and floodplain ponds (FP, 47% of all taxa, 5% distinctive species). The habitat types RS, OS and FP significantly differed in overall community composition and their colonization processes comprising fast colonization of current-adapted specialists in RS, and mostly generalist species in OS and FP. Our results indicate that restoration of floodplain habitats should not only consider the re-establishment of maximum connectivity, but also provide a mosaic of distinct habitat types with different degrees of connectivity and disturbance. Each habitat type in the floodplain supported a unique assemblage

of species, which suggests that such habitat mosaics can facilitate exceptionally diverse ecosystems." (Authors) *Orthetrum cancellatum*, *Libellula depressa*] Address: Geist, J., Aquatic Systems Biology Unit, School of Life & Food Sciences, Technical Univ. of Munich, Muehlenweg 22, D-85350 Freising, Germany. E-mail: geist@wzw.tum.de

**20389.** Patrick, B. (2018): Moths, butterflies, and other insects of the Christchurch Botanic Gardens. Prepared for: Christchurch Botanic Gardens and Friends of the Christchurch Botanic Gardens. Wildland Consultants Ltd. Contract Report No. 4482: 25 pp. (in English) ["Christchurch Botanic Gardens were established in 1863 and occupy a 120 hectare site in a central and prominent position within the South Island's largest and New Zealand's second largest city. For this reason, Otautahi/Christchurch is often called the garden city." The list of taxa includes *Xanthocnemis zealandicus* and *Austrolestes colenisonis*.] Address: Wildland Consultants, 99 Sala Street, PO Box 7137. TeNgae, Rotorua 3042, New Zealand-

**20390.** Phillips, P.; Swanson, B.J. (2018): A genetic analysis of dragonfly population structure. *Ecology and Evolution* 8: 7206-7215. (in English) ["Dragonflies reside in both aquatic and terrestrial environments, depending on their life stage, necessitating the conservation of drastically different habitats; however, little is understood about how nymph and adult dragonflies function as metapopulations within connected habitat. We used genetic techniques to examine nymphs and adults within a single metapopulation both spatially and temporally to better understand metapopulation structure and the processes that might influence said structure. We sampled 97 nymphs and 149 adult *Sympetrum obtrusum* from eight locations, four aquatic, and four terrestrial, at the Pierce Cedar Creek Institute in Southwest Michigan over two summers. We performed AFLP genetic analysis and used the Bayesian analysis program STRUCTURE to detect genetic clusters from sampled individuals. STRUCTURE detected  $k = 4$  populations, in which nymphs and adults from the same locations collected in different years did not necessarily fall into the same clusters. We also evaluated grouping using the statistical clustering analyses NMDS and MRPP. The results of these confirmed findings from STRUCTURE and emphasized differences between adults collected in 2012 and all other generations. These results suggest that both dispersal and a temporal cycle of emergence of nymphs from unique clusters every other year could be influential in structuring dragonfly populations, although our methods were not able to fully distinguish the influences of either force. This study provides a better understanding of local dragonfly metapopulation structure and provides a starting point for future studies to investigate the spatial and temporal mechanisms controlling metapopulation structure. The results of the study should prove informative for managers working to preserve genetic diversity in connected dragonfly metapopulations, especially in the face of increasing anthropogenic landscape changes." (Authors)] Address: Payton P., Dept of Biology, Central Michigan Univ., Mt. Pleasant, MI 48859, USA. E-mail: phill3pm@cmich.edu

**20391.** Pirela Pérez, R.E. (2018): Libélulas (Insecta) como indicadores da qualidade do habitat de riachos de lavrado em Roraima, Brasil. Programa de Pós-Graduação em Recursos Naturais, Universidade Federal de Roraima, Boa Vista, R.R., Brazil: 43 pp. (in Portuguese, with English summary) ["Human activities can cause great changes in the

Landscape, affecting hydrological cycles and causing habitat degradation, which results in habitat homogenization. Bioindicator species can be used to assess change in ecosystems biological integrity, as they vary their composition and incidence on disturbed aquatic ecosystems. This study aims to evaluate the environmental integrity of Lavrado streams in Roraima using Odonates, in which we stipulated the following hypothesis: Odonata richness and abundance are positively associated with the best rate of environmental stream quality because of their thermoregulatory capacity, their capacity of dispersal and habitat specialization. We sampled 10 Lavrado Streams in Roraima, Brazil, searching for the biggest variation across the savannahs of the region, in the months of October, November, and December of 2017, and March of 2018, the dry season. For each stream, we calculated the Habitat Integrity Index (HII), and we also determined adult Odonata richness, physicochemical variables, and the streamflow. In Lavrado areas there was no relation between the HII and Odonata richness. However, some species were nested in areas with intermediate values of integrity close to 0.5, and we believe that it is necessary to adapt the index, by including variables that can determinate the rate of disturbance of riparian savannah ecosystems. Zygoptera richness and stream's environmental temperature were related negatively. This response in Zygoptera is explained by the fact that they are species with a low capacity of dispersal due to their small size, and therefore are specialists." (Author)] Address: not stated

**20392.** Pires, M.M.; Stenert, C.; Maltchik, L. (2018): Effects of wetland hydroperiod length on the functional structure of assemblages of Odonata. *Austral Entomology* 58(2): 354-360. (in English) ["The role of hydroperiod as an environmental filter in structuring wetland assemblages is usually associated with trait selection in invertebrates. However, the effects of changes in the hydroperiod of non-permanent wetlands on invertebrate assemblages are still unclear, and few studies have assessed the functional structure of insect assemblages along the hydroperiod gradient. In this study, we investigated the effects of different hydroperiod lengths on the functional structure of Odonata assemblages in non-permanent wetlands (posteriorly classified as 'short-', 'medium-' and 'long-hydroperiod') in southern Brazil in 2013 and 2014. Biological traits related to life-history strategies in temporary waters were assessed according to seasonal patterns of occurrence of nymphal and adult stages of odonates. Following the rationale of an environmental filter produced by hydroperiod, we expected to find (1) higher functional diversity in longer hydroperiods and (2) trait-convergence patterns in odonate assemblages in shorter hydroperiods. Patterns of functional diversity were detected along the hydroperiod gradient. More specifically, higher functional dispersion was found in long-hydroperiod wetlands and trait-convergence patterns occurred in wetlands with shorter hydroperiods, supporting our general hypothesis. Odonate taxa with life-history traits associated with shorter life cycles predominated in medium- and short-hydroperiod wetlands. Our results thus suggest that more pronounced reductions in wetland hydroperiod length should produce odonate assemblages functionally more similar, and these results gain special importance as climate change scenarios indicate that the hydrology of wetlands will be affected by variation in rainfall regimes." (Authors)] Address: Pires, M., Lab. Ecol. & Evolution, Vale do Taquari Univ., Lajeado, RS, Brazil. Email: marquespiresm@gmail.com

**20393.** Popova, O.N.; Haritonov, A.Yu.; Erdakov, L.N.



(2018): Cyclicity of long-term population dynamics in dragonflies of the genus *Sympetrum* (Odonata, Anisoptera) in the basin of Lake Chany. *Contemporary Problems of Ecology* 11(6): 551-562. (in English) ["This work is directed at continuous studies of cyclicity of long-term (1980–2010) population dynamics of odonates in the basin of Lake Chany (in the south of Western Siberia). 4 sympatric species of the genus *Sympetrum* [*S. danae*, *S. flaveolum*, *S. sanguineum*, *S. vulgatum*] have been investigated by spectral analysis method. The cycle spectra of population dynamics have been constructed for each species; the basic parameters of these cycles (period, phase, and power) have been calculated. Special number cycles have been found for each species. Interspecies differences increased in the direction from high to low frequencies of the spectrum. In the cases of similar cycles, interspecies differences have been shown in the ratio of cycle powers and/or phases: identical phases can indicate the ability of species to increase their number synchronously with any of close species; different phases can indicate the possibility of a small-numbered species to reach its maximum number against the minimum number of numerous species. A comparison of sympatric species spectra of the genera *Coenagrion* and *Sympetrum* has led to the conclusion that, the more similarity there is in environmental standards among species inside a genus (as for *Sympetrum*), the more specific the species frequency spectra are. All species of the genus *Sympetrum* can synchronize their number fluctuations with 2- to 3 and 4- to 5-year fluctuations of the local climate. Also specific synchronization with important nature-climatic rhythms was found for each species: for *S. danae*, with an 18-year rhythm of the level of Lake Chany and with a 16-year rhythm of June temperatures; for *S. flaveolum*, with a 24-year Brickner cycle, with an 8-year cycle of rainfall, and with a 28-year cycle of April and May temperatures; for *S. vulgatum*, with a 40- to 42-year cycle of the level of Lake Chany, with 12-year cycle of rainfall, and with a 7-year cycle of April and June temperatures; and for *S. sanguineum*, with a 7-year cycle of April and June temperatures. Perhaps the adaptation mechanism of species to each other and to environments is enclosed in the cyclicity of long-term fluctuations of species number." (Authors)] Address: Popova, Olga, Institute of Systematics and Ecology of Animals, Siberian Branch, Russian Academy of Sciences, Novosibirsk, Russia

**20394.** Prunier, F. (2018): *Onychogomphus costae* in Andalusia, southern Spain – mapping an overlooked species (Odonata: Gomphidae). *Odonatologica* 47(1/2): 1-22. (in English) ["*O. costae* is an Ibero-Maghrebian endemic, which is rare in the Iberian Peninsula. This study updates its distribution in Andalusia, southern Spain, based on a targeted survey carried out in 2015–2017 and the compilation of all available records. The species appears to be more widespread than previously documented, with a core distribution along the river Guadalquivir and its tributaries in the province of Córdoba. The altitudinal distribution of *O. costae* reflects its general preferences for permanent, seasonally flooding, lowland rivers. The period of most observations of adults stretches over two months from mid-May to mid-July. Factors likely to explain why the species has been overlooked in past decades are discussed. These include recording effort, habitat features, adult behaviour, larval ecology and general water quality." (Author)] Address: Prunier, F., Benarrabá Field Station, 29490 Benarrabá, Spain. E-mail: aaelbosqueanimado.info@gmail.com

**20395.** Pulok, M.K.H.; Chakravarty, U.K. (2018): Experimental analysis of aerodynamic performances of dragonfly

wings. *AIP Conference Proceedings* 1980(1), 10.1063/1.5044311: (in English) ["Nature-inspired flying robots are beneficial than other multi-rotor or fixed wing analogs, in many aspects. As wings play the key role on the hovering and maneuvering conditions of flying insects, structural functions and aerodynamic performances of the insect wings are needed to be analyzed for designing more effective wings for insect-sized flying robots. This study describes the method for experimental analysis of aerodynamic and vibration characteristics of dragonfly (*Erythemis simplicicollis*) forewings and hindwings. Vibration testing of the dragonfly wings has been conducted to obtain natural frequencies and mode shapes of the wings. The wings have also been examined in a suction wind tunnel having pistol-grip sting balance to illustrate the vibration and aerodynamic characteristics. The structural aerodynamic response of the wing has been determined at different freestream velocities and at different angles of attack. From the experimental results, the deformation response and the coefficients of drag and lift of the insect wings have been obtained for different Reynolds numbers and angles of attack. The coefficient of lift of the wings increases with the Reynolds number and angle of attack. The coefficient of drag of the wings also increases with the Reynolds number and angle of attack." (Authors)] Address: Pulok, M.K.H., Univ. of New Orleans, 2000 Lakeshore Drive, New Orleans, Louisiana 70148, USA. E-mail: mpulok@uno.edu

**20396.** Quenta Herrera, E.; Casas, J.; Dangles, O.; Pincebourde, S. (2018): Temperature effects on ballistic prey capture by a dragonfly larva. *Ecology and Evolution* 8(8): 4303-4311. (in English) ["Understanding the effects of temperature on prey–predator interactions is a key issue to predict the response of natural communities to climate change. Higher temperatures are expected to induce an increase in predation rates. However, little is known on how temperature influences close-range encounter of prey–predator interactions, such as predator's attack velocities. Based on the speed–accuracy trade-off concept, we hypothesized that the increase in predator attack velocity by increasing temperature reduces the accuracy of the attack, leading to a lower probability of capture. We tested this hypothesis on the dragonfly larvae *Anax imperator* and the zooplankton prey *Daphnia magna*. The prey–predator encounters were video-recorded at high speed, and at three different temperatures. Overall, we found that (1) temperature had a strong effect on predator's attack velocities, (2) prey did not have the opportunity to move and/or escape due to the high velocity of the predator during the attack, and (3) neither velocity nor temperature had significant effects on the capture success. By contrast, the capture success mainly depended on the accuracy of the predator in capturing the prey. We found that (4) some 40% of mistakes were under-shooting and some 60% aimed below or above the target. No lateral mistake was observed. These results did not support the speed–accuracy trade-off hypothesis. Further studies on dragonfly larvae with different morphological labial masks and speeds of attacks, as well as on prey with different escape strategies, would provide new insights into the response to environmental changes in prey–predator interactions." (Authors)] Address: Quenta Herrera, Estefania, 1Institut de Recherche sur la Biologie de l'Insecte, UMR 7261, CNRS, Université de Tours, Tours, France

**20397.** Raby, M.; Nowierski, M.; Perlov, D.; Zhao, X.; Hao, C.; Poirier, D.G.; Sibley, P.K. (2018): Acute toxicity of six neonicotinoid insecticides to freshwater invertebrates. *Environmental Toxicology and Chemistry* 37(5): 1430-1445. (in

English) ["Neonicotinoids are a group of insecticides commonly used in agriculture. Due to their high water solubility, neonicotinoids can be transported to surface waters and have the potential to be toxic to aquatic life. The present study assessed and compared the acute (48 or 96h) toxicity of 6 neonicotinoids (acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, and thiamethoxam) to 21 laboratory-cultured and field-collected aquatic invertebrates spanning 10 aquatic arthropod orders. Test conditions mimicked species' habitat, with lentic taxa exposed under static conditions, and lotic taxa using recirculating exposure systems. Lethal (LC50) and effective (immobility, EC50) concentrations were calculated and used to construct separate lethal and immobilization-derived species sensitivity distributions (SSDs) for each neonicotinoid, from which 5th percentile hazard concentrations (HC5s) were calculated. Results showed the most sensitive invertebrates were insects from the orders Ephemeroptera (e.g. *Neocloeon triangulifer*) and Diptera (*Chironomus dilutus*), while cladocerans (e.g. *Daphnia magna*, *Ceriodaphnia dubia*) were the least sensitive. HC5s were compared to neonicotinoid environmental concentrations from Ontario monitoring studies. For all neonicotinoids except imidacloprid, the resulting hazard quotients indicated little to no hazard in terms of acute toxicity to aquatic communities in Ontario freshwater streams. For the neonicotinoid imidacloprid, a moderate hazard was found when only invertebrate immobilization, and not lethality, data was considered." (Authors) Test organisms include "*Coenagrion* sp.".] Address: Raby, Melanie, School of Environmental Sciences, Univ. of Guelph, Guelph, Ontario, Canada. Email: mraby@uoguelph.ca

**20398.** Ramadan, D.M.; Katbeh-Bader, A. (2018): Diversity of aquatic and semi-aquatic insects in Wadi Al-Walah in Jordan. *Zoology and Ecology* 28(2): 117-138. (in English) ["The aquatic and semi-aquatic insects of Wadi Al-Walah, Jordan were collected biweekly from five sites from August 2015 to August 2016. A total of 24,176 specimens of aquatic and semi-aquatic insects representing at least 75 identified or putative species of 33 families and seven insect orders were collected. The most abundant insect order was the Ephemeroptera of the family Caenidae. The Diptera was the most diverse (43 species in 13 families), followed by Coleoptera (10 species in 3 families), Hemiptera (7 species in 6 families), Odonata (7 species in 5 families), Ephemeroptera (4 species in 3 families) and Trichoptera (3 species in 2 families). A total of 22 species were recorded for the first time from Jordan; 8 were identified to the species level. Larvae of all collected species are briefly described and color images are provided illustrating morphological structures useful for future identification, especially for the Diptera. The results of our study indicated an urgent need for identification manuals for aquatic insects to support freshwater quality assessments in developing regions of Jordan and other eastern Mediterranean countries." (Authors)] Address: Katbeh-Bader, A., Dept Plant Protection, Fac. Agriculture, the Univ. Jordan, Amman, Jordan. Email: Ahmadk@ju.edu.jo

**20399.** Reborá, M.; Frati, F.; Piersanti, S.; Salerno, G.; Selvaggini, R.; Fincke, O.M. (2018): Field tests of multiple sensory cues in sex recognition and harassment of a colour polymorphic damselfly. *Animal Behaviour* 136: 127-136. (in English) ["Highlights: •We examined whether free-flying male damselflies detect sex and morph via odour. •Male responses to nonvisual cues of live conspecifics and controls did not differ. •Males showed no preference for andromorphic or heteromorphic females. •Marked female morphs

were equally successful in resisting mating attempts. •Harassment responses of *Ischnura elegans* and *Enallagma* females appear similar. The use of multiple sensory modalities in mating decisions has prompted a reassessment of sexual selection in many species. Odonate males have long been assumed to use only visual cues in mate recognition. Using only airborne cues in the laboratory, a previous study of *Ischnura elegans* found that males discriminate between the sexes and exhibit an odour preference for male-like female colour morphs. In a field experiment that required free-flying males to detect and recognize potential mates, we scored nonsexual and sexual reactions of free-flying males to live conspecifics (andromorphic females, which mimic male body colour and pattern; heteromorphic females, which differ from males in body colour and pattern; and males) and empty control dowels positioned at ponds. 'Non-visual' treatments concealed under a muslin bag offered only olfactory cues, whereas the unbagged 'visual' treatments offered visual plus odour cues. Live conspecifics in the nonvisual treatments did not elicit more sexual reactions than control dowels. In contrast, live individuals in the visual treatment elicited more sexual responses than did controls, suggesting that odour alone was insufficient for detection of conspecifics. However, even with visual cues, males reacted sexually towards other males as often as they did towards either female morph, indicating a failure to discriminate between sex or morph. A second, more realistic visual treatment away from water, where 77% of the solitary mature individuals were males, produced similar results. Thus, we measured natural harassment rates of marked, free-flying females. Both female colour types used similar behaviours to evade males. We found no difference in harassment or mating rates between colour morphs. Our results suggest that visual cues of female *I. elegans* act similarly to the context-dependent signal apparency of *Enallagma* colour morphs, and emphasize the need for laboratory results to be validated by comparison of sensory abilities under natural conditions." (Authors)] Address: Fincke, Ola, Ecology & Evolutionary Biol. Graduate Program, Dept Biol., Univ. Oklahoma, Norman, OK 73019, USA. Email: fincke@ou.edu

**20400.** Renner, S.; Périco, E.; Schmidt Dalzochio, M.; Sahlén, G. (2018): Water body type and land cover shape the dragonfly communities (Odonata) in the Pampa biome, Rio Grande do Sul, Brazil. *Journal of Insect Conservation* 22(1): 113-125. (in English) ["The biogeographical region known as the Pampa biome in southern Brazil, was originally mainly covered with open fields or grassland, with areas of riparian forest surrounding the water bodies. Today this landscape appears highly fragmented due to agricultural activities such as rice cultivation, extensive cattle farming, and forest plantations. Studies have shown that the Pampa biome has high levels of biodiversity and endemism, but with regard to invertebrates, this biome is still one of the least known in Brazil. We therefore designed a study comparing the Odonata communities to environmental and landscape features in this area, measuring diversity by species richness, relative abundance and Shannon index. Our results showed that the Pampa is a biome very rich in odonates, and that the species communities are highly dependent on the environmental conditions of the area. Habitats such as Rivers/Streams, bordered by native grasslands and riparian forests, were shown to harbour communities that were ecologically more complex and sensitive than other habitat types. Man-made lakes and agricultural areas displayed lower levels of biodiversity and odonate communities dominated by generalist species. By combining data

on the communities of Odonata and other taxa, our analyses may be instrumental in determining priority areas for future conservation measures within the area." (Authors)] Address: Renner, S., Laboratório de Ecologia e Evolução, Univde do Vale do Taquari - UNIVATES, Lajeado, Brazil

**20401.** Rieckh, C.; Körner, A.; Holzinger, W.E. (2018): Die Libellenfauna des Laabachs im Grazer Feld. *Entomologica Austriaca* 25: 151- (in German) [Verbatim: In this study, the dragonfly fauna along the Laabach in the Graz field south of the Styrian capital was investigated. The stream, which is about 9.4 km long, runs partly through village and settlement areas, but mostly through agricultural land and is therefore mainly surrounded by fields. It was divided into 59 largely homogeneous sections from its source to its mouth in the Poniglach. Each section was walked at least four times during the flight season from May to September 2017 and the dragonfly fauna was recorded semi-quantitatively. In addition, data from random surveys in 2016 are available. In order to be able to record the influence of the habitat features of the surrounding area on the dragonfly fauna, the surrounding area was mapped up to a distance of 30 metres on both sides of the bank. A total of at least 25 species were recorded. While some sections of the stream were richly structured and had a high dragonfly diversity, other sections were heavily anthropogenically impaired (canalised) and/or temporarily dry. These sections were colonised by only a few species in low densities. Particularly noteworthy from a nature conservation point of view are the occurrences of *Coenagrion ornatum*, *Somatochlora meridionalis* and *Lestes barbarus* on the Laabach."] Address: Rieckh, Christina, Institut für Zoologie der Karl-Franzens-Universität Graz, Universitätsplatz 2, 8010 Graz, Austria. E-Mail: christina.rieckh@edu.uni-graz.at

**20402.** Rodrigues, A.C.M.; Bordalo, M.D.; Golovko, O.; Koba, O.; Barata, C.; Soares, A.M.V.M.; Pestana, J.L.T. (2018): Combined effects of insecticide exposure and predation risk on freshwater detritivores. *Ecotoxicology* 27: 794-802. (in English) ["Insecticides usually present in low concentrations in streams are known to impair behaviour and development of non-target freshwater invertebrates. Moreover, there is growing awareness that the presence of natural stressors, such as predation risk may magnify the negative effects of pesticides. This is because perception of predation risk can by itself lead to changes on behaviour and physiology of prey species. To evaluate the potential combined effects of both stressors on freshwater detritivores we studied the behavioural and developmental responses of *Chironomus riparius* to chlorantraniliprole (CAP) exposure under predation risk. Also, we tested whether the presence of a shredder species would alter collector responses under stress. Trials were conducted using a simplified trophic chain: *Alnus glutinosa* leaves as food resource, the shredder *Sericostoma vittatum* and the collector *C. riparius*. CAP toxicity was thus tested under two conditions, presence/absence of the predator *Cordulegaster boltonii*. CAP exposure decreased leaf decomposition. Despite the lack of significance for interactive effects, predation risk marginally modified shredder effect on leaf decomposition, decreasing this ecosystem process. Shredders presence increased leaf decomposition, but impaired chironomids performance, suggesting interspecific competition rather than facilitation. *C. riparius* growth rate was decreased independently by CAP exposure, presence of predator and shredder species. A marginal interaction between CAP and predation risk was observed regarding chironomids development. To better un-

derstand the effects of chemical pollution to natural freshwater populations, natural stressors and species interactions must be taken into consideration, since both vertical and horizontal species interactions play their role on response to stress." (authors)] Address: Pestana, J., Dept of Biology & CESAM, Univ. of Aveiro, Aveiro, Portugal. E-mail: jpestana@ua.pt

**20403.** Sasamoto, A.; Kawashima, I.; Kompier, T.; Futahashi, R. (2018): Consideration of the taxonomical relationship of *Sympetrum speciosum* and its subspecies *haematoneura* based on adult and larval morphology and genetic analyses, with a first record of *speciosum* from Vietnam and larval description of *haematoneura* (Anisoptera: Libellulidae). *Tombo* 60: 79-89. (in English) ["External morphology of adult and larva are compared among the populations of *S. speciosum* from Japan, Taiwan, continental China, Vietnam, Nepal (subsp. *haematoneura*), and their genetic analyses are performed. The record of Vietnamese *speciosum* and the larval morphology of *haematoneura* are described for the first time. Although the size of orange patch at the base of wings is diversified among the populations, the differences of other adult and larval external morphology are very small and genetic differences are also subtle, suggesting that they belong to the single species *S. speciosum*." (Authors)] Address: Sasamoto, A., Tawaramoto-cho, Shiki-gun, Nara Pref., Japan. E-mail: akssmt@sea.plala.or.jp

**20404.** Schlemmer, L. (2018): Padrões de diversidade e suas implicações para a conservação de Odonata (Insecta) em igarapés amazônicos. Belém,: X + 144 pp. (in Portuguese, with English summary) ["The distribution of species within a landscape and the mechanisms that determine this distribution are fundamental questions for the understanding of the ecology of biological communities. The understanding of these phenomena is essential for the management of ecosystems and decision-making on the conservation of biodiversity, environmental conditions, and ecosystem resources. In this dissertation, we focused on the communities of Zygoptera, found in streams in the Brazilian Amazon region to investigate their alpha diversity (Chapter 1), beta diversity (Chapter 2), and the elements that structure metacommunities (Chapters 3), as well as the spatial priorities for the conservation of Amazonian odonates (Chapter 4). We used environmental, biogeographic, and spatial predictors to investigate the mechanisms that structure the distribution of the communities analyzed in this dissertation. In the case of alpha diversity (Chapter 1), environmental heterogeneity (climate) and primary productivity were the most important determinants of zygopteran species richness. For beta diversity (Chapter 2), turnover was the most important component of changes in species composition within the landscape, together with the spatial distance between sites, and the biogeographic region (centers of endemism), which were the most important predictors of zygopteran beta diversity. In our analysis of metacommunity patterns (Chapter 3), we found a Clementsian pattern in well-preserved streams, with a major change in the configuration of the communities in streams with environmental alterations, which represented subsets of the better preserved areas. In Chapter 4, we show that the spatial distribution of the conservation units in the Amazon region is relatively ineffective for the conservation of most of the beta diversity of the region's odonates. As the priority areas are located predominantly in southern Amazonia, and most of these areas have already been deforested, given that they lie within the arc of deforestation, the priority areas were displaced toward the

forested environments located nearer the center of the Amazon region. Based on this analysis, we suggest the creation of new conservation units or the implementation of incentives for the establishment of activities that cause reduced environmental impacts in more central, priority areas, which are still forested, as well as the restoration of priority areas that have already been deforested. One possibility here would be the implementation of programs that pay for ecosystem services, such as carbon credits obtained through reforestation and/or the development of activities with a reduced impact on biodiversity, such as agroforestry. This study also makes a major contribution to the reduction of the Wallacean and Hutchinsonian shortfalls on the zygoptera of the Brazilian Amazon region." (Author)] Address: Schlemmer Brasil, L., Programa de Pós Graduação em Ecol. e Conservação, Univde do Estado de Mato Grosso – UNEMAT, CEP 78690-000, Nova Xavantina, MT, Brazil. E-mail: brasil\_biologia@hotmail.com

**20405.** Schmidt Dalzochio, M.; Périco, E.; Renner, S.; Sahlén, G. (2018): Description of the final stadium larva of *Erythrodiplax media* (Odonata: Libellulidae) with preliminary key to known South American larvae in the genus. *International Journal of Odonatology* 21(2): 93-104. (in English) ["The larva of *E. media* is described and illustrated based on two exuviae of reared larvae and one final stadium larva collected in Xangri-lá, State of Rio Grande do Sul, Brazil. The larva of *E. media* can be distinguished from other species of *Erythrodiplax* by the presence of lateral spines on S8 and S9, the number of premental setae ( $n = 22$ ), palpal setae ( $n = 7$ ) and by the mandibular formula. We also provide a preliminary key to known South American larvae in the genus." (Authors)] Address: Schmidt Dalzochio, Marina, Lab. Ecol. e Evol., Unive do Vale do Taquari – UNIVATES, Lajeado, RS, Brazil. Email: mahsdalzochio@gmail.com

**20406.** Schneider, T.; Ikemeyer, D.; Müller, O.; Dumont, H.J. (2018): Checklist of the dragonflies (Odonata) of Iran with new records and notes on distribution and taxonomy. *Zootaxa* 4394(1): 1-40. (in English) ["Iran has a complex dragonfly fauna influenced by contacts and overlaps of different geographical zones. Its fauna is dominated by Eurosiberian taxa. However, the SE Province Sistân-va-Baluchestân is rich in oriental species, many of which having their western distribution limit in Iran. In NE-Iran, Irano-Turanian elements live and in the S- and SW-Iran African species are found. The Iranian Odonata fauna seems well studied, however, a closer look reveals many uncertainties and confusion, some records coming clearly from misidentification whereas other, which were missing proofs of correct identification remains to be confirmed. Even today, every new collecting trip reveals species new for Iran whereas species new for science are still detected, although rarely. In this checklist we include seven taxa new for Iran: *Stylurus ubadschii* (although a male of uncertain origin is recorded in Schmidt (1954)), *Ischnura senegalensis* (although two uncertain records were published by Martin (1912) and Schmidt (1954)), *Coenagrion ponticum*, *C. lunulatum*, *C. pulchellum*, *Lestes macrostigma*, and *Calopteryx splendens tschaldirica*. We critically checked all available data, including all published records. Fourteen taxa have been rejected, or placed in the category for need of confirmation. Till the end of 2017, 100 autochthonous taxa of dragonflies and two migratory species could be confirmed to be or have been present in Iran. We provide distribution maps, created after evaluation of published data and containing our own data from 12 trips to Iran, travelling over 35000 km in the country. Over 200 new localities are integrated. Taxonomic confusion is reduced by

rejecting the following taxa for Iran: *C. splendens mingrellica*, *C. hyalina*, *Erythromma najas*, *Aeshna cyanea*, *Gomphus davidi*, and *Sympetrum sinaiticum*. We regard the taxa *Gomphus amseli* and *G. schneiderii transcaspicus* as synonyms of *G. schneiderii*, and *Onychogomphus forcipatus lucidostriatus* as a synonym of *O. f. albotibialis*." (Authors)] Address: Schneider, T., Arnold-Knoblach-Ring 76, 14109 Berlin-Wannsee, Germany. E-mail: thomas.rs@gmx.de

**20407.** Seehausen, M. (2018): Hessische Libellenfunde (Odonata) aus der Sammlung Alfred Schöttner. *Libellen in Hessen* 11: 49-55. (in German) ["178 Hessian specimens from the Alfred Schöttner collection were found in the State Zoological Collection in Munich. The animals were collected between 1946 and 1972 in the districts of Darmstadt-Dieburg, Fulda, Groß-Gerau and the Lahn-Dill district. The specimens from the LDK are currently the earliest known records from this region. A record of *Somatochlora arctica* from the Rote Moor/FD is currently the earliest known record for Hesse. *Gomphus vulgatissimus* and *Orthetrum coerulescens* have not yet been recorded from MTB 5316 (LDK), where they have now been found by Schöttner. There are records of the following species from previously unoccupied MTB quarters (all LDK): *Chalcolestes viridis* (MTB 5315/4), *Lestes barbarus* (MTB 5315/4), *Sympecma fusca* (MTB 5316/3), *Gomphus pulchellus* (5316/3), *Cordulegaster boltonii* (MTB 5316/3), *Somatochlora metallica* (MTB 5415/4) and *Sympetrum flaveolum* (MTB 5316/3). The potential and importance of scientific dragonfly collections for faunistics are explained, and the processing of further collections is recommended." (Author/DeepL)] Address: Seehausen, M., Museum Wiesbaden, Naturhistorische Sammlungen, Friedrich-Ebert-Allee 2, 65185 Wiesbaden, Germany. Email: malte.seehausen@museum-wiesbaden.de

**20408.** Shapoval, A.P. (2018): Results of the 11 years monitoring of the dragonflies (Insecta: Odonata) in the Courish Spit in the Baltic Sea. Problems of explore and conservation natural and cultural heritage of the national park «Kurshskaya kosa» 14: 58-71. (in Russian, with English summary) ["The present study summarizes personal observations data of Odonata gathered in 2007-2017 of the Courish Spit in the Baltic Sea. In total, 57 dragonfly species were recorded (15 species belonging to Zygoptera and 42 species belonging to Anisoptera). The most numerous dragonflies were: 4 *Aeshna* species (*A. grandis*, *A. juncea*, *A. mixta*, *A. viridis*), *Somatochlora flavomaculata*, *Libellula quadrimaculata* and 4 *Sympetrum* species (*S. danae*, *S. flaveolum*, *S. sanguineum*, *S. vulgatum*). The most common species annually collected in Rybachy-type ornithological traps in large numbers (2001)-75000 specimens per year) was *L. quadrimaculata*." (Author) The paper includes also rare species as *Aeshna subarctica*, *Stylurus flavipes*, *Ophiogomphus cecilia*, *Epithea bimaculata*, *Somatochlora arctica*, *Crocothemis erythraea*, *Leucorrhinia albifrons*, *L. caudalis*, *L. pectoralis*, *Pantala flavescens*, *Orthetrum brunneum*, *O. coerulescens*, *Sympetrum pedemontanum*, *S. meridionale*, *Aeshna affinis* and *Sympecma paedisca*.] Address: Shapoval, A.P., Biological Station Rybachy, Russian Academy of Sciences, Zoological Institute, St. Petersburg, 199034 Russia. E-mail: apshap@mail.ru

**20409.** Shumway, N.; Gabryszuk, M.; Laurence, S.J. (2018): Flapping tandem-wing aerodynamics: dragonflies in steady forward flight. 2018 AIAA Aerospace Sciences Meeting, AIAA SciTech Forum, (AIAA 2018-1290): 15 pp. (in English) ["The study of tandem flapping wing aerodynamics of dragonflies in steady forward flight is presented here.

CFD simulations of one forewing-hindwing pair are run using wing kinematics measured in experiments with free flying dragonflies. Wing kinematics were acquired from tests of dragonflies flying through a confined space using multiple high speed cameras, placed such that they could record the dragonfly's motion. The test results contain videos of dragonflies flying inverted as well as upright, and wing kinematics have been extracted for three inverted and two upright flights. In the inverted flights the upstroke is longer than the downstroke and the pitch angle of the forewing is lower during the downstroke than similar upright flights. Three simulations were run based on this kinematic information: one simulating upright flight, one simulating inverted flight, and one looking at the effect of changing relative downstroke duration. The simulation results indicate that the dragonflies are controlling the orientation of their wing such that they have a similar orientation relative to their velocity during the halfstroke when the wing is flapping down in the lab reference frame. In addition, decreasing relative downstroke duration increases peak and average lift, making it unclear why dragonflies use a longer downstroke than upstroke while flying upright." (Authors)] Address: Shumway, N., Univ. of Maryland, College Park, MD, 20742, USA

**20410.** Simon, S.; Blanke, A.; Meusemann, K. (2018): Re-analyzing the Palaeoptera problem - The origin of insect flight remains obscure. *Arthropod Structure & Development* 47(4): 328-338. ["The phylogenetic relationships of the winged insect lineages - mayflies (Ephemeroptera), damselflies and dragonflies (Odonata), and all other winged insects (Neoptera) - are still controversial, with three hypotheses supported by different datasets: Palaeoptera, Metapterygota and Chiasmomyaria. Here, we reanalyze available phylogenomic data with a focus on detecting confounding and alternative signal. In this context, we provide a framework to quantitatively evaluate and assess incongruent molecular phylogenetic signal inherent in phylogenomic datasets. Despite overall support for the Palaeoptera hypothesis, we also found considerable signal for Chiasmomyaria, which is not easily detectable by standardized tree inference approaches. Analyses of the accumulation of signal across gene partitions showed that signal accumulates gradually. However, even in case signal only slightly supported one over the other hypothesis, topologies inferred from large datasets switch from statistically strongly supported Palaeoptera to strongly supported Chiasmomyaria. From a morphological point of view, Palaeoptera currently appears to be the best-supported hypothesis, however, recent analyses were restricted to head characters. Phylogenetic approaches covering all organ systems including analyses of potential functional or developmental convergence are still pending so that the Palaeoptera problem has to be considered an open question in insect systematics." (Authors)] Address: Email: ablanke@evolution.uni-bonn.de

**20411.** Smith, D.R. (2018): The aquatic ecology of Lake Rotokare. M.Sc. thesis, The Univ. of Waikato, Hamilton, New Zealand: 220 pp. (in English) ["The biology of three endemic and one exotic species of fish (banded kokopu, *Galaxias fasciatus*; shortfin eel, *Anguilla australis*; longfin eel, *Anguilla dieffenbachii*; and the European perch, *Perca fluviatilis*) was investigated in Lake Rotokare. Little is currently known regarding the local ecology of the lake. This study improves the understanding of the biological processes in Lake Rotokare and investigates the characteristics of the lake's water quality. Fish sampling occurred in the lake using a combination of boat electrofishing, gill netting, and fyke netting. The tributary was sampled using night time spotlighting. Fish

taken from the lake were used to determine length-weight relationships, size frequencies, CPUE, abundance estimations, fish biomass, stable isotope analyses, trophic levels, and perch diet. Water quality sampling was also undertaken to further build upon data from previous studies. The majority of fish sampled in Lake Rotokare were perch, with a mixture of size classes, but dominated by a large juvenile size class. Perch density was high (16.55 fish 100 m<sup>2</sup>). Longfin eels showed a cohort of large individuals with no evidence of recruitment occurring; while shortfin eels exhibited a distribution of size ranges with evidence of juvenile recruitment occurring. Electrofishing showed evidence of banded kokopu inhabiting the lake, even at distance from the tributary outlet, suggesting the possibility of a lake fringe population of kokopu. Spotlight sampling in June and December revealed a stable kokopu and koura population residing in the lakes' main tributary. Water quality data showed an overall decrease in total nitrogen and phosphorous loads within the lake since 1979. However, the lake has shown strong thermal stratification over summer over multiple years (1977, 2013, February 2017 and December 2017), and remains in poor condition, with a eutrophic TLI 4 rating of 4.1. Frequent cyanobacterial blooms continue to occur during the summer season, resulting in closure of the lake for contact recreation. Both dietary and stable isotope analyses showed indications that chironomid larvae and *Daphnia* sp. constituted the bulk of the primary production of the food web [also including "Odonata"]; juvenile perch were found to be the predominant food source of the three resident fish species. A three-end member mixing model was created to duplicate the theoretical food-web within the lake with chironomid larvae, dragonfly larvae, and juvenile perch at the base. Lipid treatment techniques were examined in this study for eel fin and muscle tissue. The results indicate that lipid treatment is needed for <sup>13</sup>C isotope values for both longfin and shortfin muscle, and longfin fin tissue for accurate results. Mathematical equations were constructed to correct untreated fin tissue values into treated muscle values for <sup>13</sup>C and <sup>15</sup>N; avoiding the necessity for future lethal sampling methods." (Author)] Address: not stated

**20412.** Staentzel, C.; Arnaud, F.; Combroux, I.; Schmitt, L.; Tremolieres, M.; Grac, C.; Piegay, H.; Barillier, A.; Chardon, V.; Beisel, J.-N. (2018): How do instream flow increase and gravel augmentation impact biological communities in large rivers: A case study on the Upper Rhine River. *River Research and Applications* 34(2): 153-164. (in English) ["Actions are being developed to address the adverse consequences of engineering works on large European rivers by developing and implementing restoration activities in order to enhance the functionality and biodiversity of fluvial hydrosystems. However, as has frequently been mentioned in the scientific literature, quantitative and qualitative evaluation of the project benefits, if any, and their sustainability are hindered by the difficulty in assessing the responses of aquatic and riparian communities to the methods employed. A case study was conducted on a by-passed section of the Upper Rhine River (France and Germany) to investigate the effects of instream flow increase and gravel augmentation on selected aquatic and riparian communities (macroinvertebrates, macrophytes, and riparian plants). This paper presents the results of a 6-year interdisciplinary, before-after control-impact design monitoring study. The complexity of the study lies in carrying out a separate assessment of the cumulative effects on a site-based, project-specific basis. The results showed that (a) the instream flow increase resulted in greater richness of macrophyte species in the newly created backwaters, (b) the artificial gravel bar favoured the

recruitment of pioneer species, including invasive species, although gravel redistribution by floods prevented their development, and (c) gravel augmentation tended to promote the taxonomic richness of macroinvertebrate communities with the appearance of species adapted to the new substrate areas. These findings should help to fill the knowledge gaps in large-scale restoration and contribute key responses to the most frequently arising issues in this area, especially those concerning the efficiency and sustainability of river restoration projects." (Authors) Odonata species included *Gomphus vulgatissimus*, *Coenagrionidae*, *Cordulia aenea*, *Platycnemis* sp., and *Calopteryx* sp.] Address: Staentzel, Cybill, CNRS, LIVE UMR 7362, Univ. de Strasbourg, 67000 Strasbourg, France. E-mail: cybill.staentzel@live-cnrs.unistra.fr

**20413.** Stuhr, S.; Khanh, V.T.; Vongsivut, J.; Senkbeil, T.M.; Yang, Y.; Al Kobaisi, M.; Baulin, V.A.; Werner, M.; Rubanov, S.; Tobin, M.J.; Cloetens, P.; Rosenhahn, A.; Lamb, R.N.; Luque, P.; Marchant, R.; Ivanova, E.P. (2018): Structure and chemical organization in damselfly *Calopteryx haemorrhoidalis* wings: A spatially resolved FTIR and XRF analysis with Synchrotron Radiation. *Scientific Reports* 8, Article number: 8413: 9 pp. (in English) ["Insects represent the majority of known animal species and exploit a variety of fascinating nanotechnological concepts. We investigated the wings of the damselfly *Calopteryx haemorrhoidalis*, whose males have dark pigmented wings and females have slightly pigmented wings. We used scanning electron microscopy (SEM) and nanoscale synchrotron X-ray fluorescence (XRF) microscopy analysis for characterizing the nanostructure and the elemental distribution of the wings, respectively. The spatially resolved distribution of the organic constituents was examined by synchrotron Fourier transform infrared (s-FTIR) microspectroscopy and subsequently analyzed using hierarchical cluster analysis. The chemical distribution across the wing was rather uniform with no evidence of melanin in female wings, but with a high content of melanin in male wings. Our data revealed a fiber-like structure of the hairs and confirmed the presence of voids close to its base connecting the hairs to the damselfly wings. Within these voids, all detected elements were found to be locally depleted. Structure and elemental contents varied between wing membranes, hairs and veins. The elemental distribution across the membrane was rather uniform, with higher Ca, Cu and Zn levels in the male damselfly wing membranes." (Authors)] Address: Ivanova, Elena, School of Science, RMIT Univ., Melbourne, Victoria, 3001, Australia. Email: elena.ivanova@rmit.edu.au

**20414.** Tamm, J. (2018): Zur Populationsökologie und Ethologie von *Cordulegaster bidentata* an einem Bach im Kaufunger Wald - eine Fallstudie (Odonata: Cordulegastridae). *Libellula* 37(3/4): 23-54. (in German, with English summary) ["About population ecology and ethology of *C. bidentata* living on a forest stream in Kaufunger Wald, Germany - A small forest stream in Kaufunger Wald, Central Germany, on Bunter Sandstone Substrate was populated by imagines of *C. bidentata* four months after removing a long solid layer of branch waste. One year after this removal 17 males were colour marked and both marked and unmarked individuals were counted during several days when passing the counting Station. Moreover, two unmarked males were observed simultaneously. Females were present too. Forty exuviae found in 2018 verified that the indigenous population is on this scale. In contrast to this result, only five larvae of *C. bidentata* could be found in this stream. In the surrounding forests no streams were found where other

large populations occurred. Individual flight behaviour of marked males was recorded both during season and days. One half of males could not be observed after marking any more. Among the other males few individuals dominated, others only occurred sporadically. One male belonging to the sporadic group occurred twice, in both cases just when a female was present along the stream. It happened to copulate in both cases. These copulations have been the only ones observed during this counting season." (Author)] Address: Tamm, J., Elgershäuser Straße 12, D-34131 Kassel, Germany. E-mail: jochen.tamm@t-online.de

**20415.** Torralba-Burrial, A. (2018): Comunidad Virtual de Aprendizaje (CVA) informal sobre los odonatos ibéricos: análisis de la lista de correo Odo-GIO (Odonata). *Boln. S.E.A.* 63: 357-361. (in Spanish, with English summary) ["The informal Virtual Learning Community (VLC) on Iberian Odonata: an analysis of the Odo-GIO mailing list Abstract: Virtual Learning Communities (VLC) are a reference for informal learning. The Odo-GIO mailing list, hosted by Rediris and linked to the Grupo Ibérico de Odonatología (GIO), is analysed according to the subject and aims of the messages shared by its members. Virtual learning community members' perceptions are evaluated through a questionnaire on both past and future developments of the mailing list. Community members who responded to the questionnaire manifested a high interest in dragonflies, and commented on positive learning experiences within the virtual community. The evaluation of its potential as a learning tool, issues related to odonate distribution, conservation or behaviour were highlighted." (Author)] Address: Torralba Burrial, A., Departamento de Biología de Organismos y Sistemas, Univ. de Oviedo, E-33071 Oviedo, Spain. Email: antoniob@hotmail.com

**20416.** Tsui, M.T.; Adams, E.M.; Jackson, A.K.; Evers, D.C.; Blum, J.D.; Balog, S.J. (2018): Understanding sources of Methylmercury in songbirds with stable mercury isotopes: Challenges and future directions. *Environmental Toxicology and Chemistry* 37(1): 166-174. (in English) ["Mercury (Hg) stable isotope analysis is an emerging technique that has contributed to a better understanding of many aspects of the biogeochemical cycling of Hg in the environment. However, no study has yet evaluated its usefulness in elucidating the sources of methylmercury (MeHg) in songbird species, a common organism for biomonitoring of Hg in forested ecosystems. In the present pilot study, we examined stable mercury isotope ratios in blood of 4 species of songbirds and the invertebrates they are likely foraging on in multiple habitats in a small watershed of mixed forest and wetlands in Acadia National Park in Maine (USA). We found distinct isotopic signatures of MeHg in invertebrates (both mass-dependent fractionation [as  $\delta^{202}\text{Hg}$ ] and mass-independent fractionation [as  $\Delta^{199}\text{Hg}$ ]) among 3 interconnected aquatic habitats. It appears that the Hg isotopic compositions in bird blood cannot be fully accounted for by the isotopic compositions of MeHg in lower trophic levels in each of the habitats examined. Furthermore, the bird blood isotope results cannot be simply explained by an isotopic offset as a result of metabolic fractionation of  $\delta^{202}\text{Hg}$  (e.g., internal demethylation). Our results suggest that many of the birds sampled obtain MeHg from sources outside the habitat they were captured in. Our findings also indicate that mass-independent fractionation is a more reliable and conservative tracer than mass-dependent fractionation for identifying sources of MeHg in bird blood. The results demonstrate the feasibility of Hg isotope studies of songbirds but suggest that larger numbers of samples and an expanded

geographic area of study may be required for conclusive interpretation." (Authors)] Address: Tsui, M., Dept of Biology, Univ. of North Carolina at Greensboro, Greensboro, North Carolina, USA

**20417.** Tüzün, N.; Stoks, R. (2018): Pathways to fitness: carry-over effects of late hatching and urbanisation on lifetime mating success. *Oikos* 127(7): 949-959. (in English) ["Life history theory and most empirical studies assume carry-over effects of larval conditions to shape adult fitness through their impact on metamorphic traits (age and mass at metamorphosis). Yet, very few formal tests of this connection across metamorphosis exist, because this entails longitudinal studies from the egg stage and requires measuring fitness in (semi)natural conditions. In a longitudinal one-year common-garden rearing experiment consisting of an outdoor microcosm part for the larval stage and a large outdoor insectary part for the adult stage, we studied the effects of two factors related to time constraints in the larval stage (egg hatching period and urbanisation) on life history traits and lifetime mating success in the males of the damselfly *Coenagrion puella*. We reared early- and late-hatched larvae from each of three rural and three urban populations from the egg stage throughout their adult life. Key findings were that both the hatching period and urbanisation shaped adult fitness, yet through different pathways. As expected, the more time-constrained late-hatched individuals accelerated their larval life history and this was associated with a lower lifetime mating success. A path analysis revealed this carry-over effect was mediated by the changes in the two metamorphic traits (reduced age and lower mass at emergence). Notably, urban males had a 50% lower lifetime mating success, which was not mediated by age and mass at emergence, and possibly driven by their shorter lifespan. Our results point to long-term carry-over effects of the usually ignored natural variation in egg hatching dates, and further contribute to the limited evidence showing fitness costs of adjusting to an urban lifestyle." (Authors)] Address: Tüzün, N., Evolutionary Stress Ecology & Ecotoxicology, Univ. of Leuven, Deberiotstraat 32, B-3000 Leuven, Belgium. E-mail: nedim.tuzun@kuleuven.be

**20418.** Turiault, M. (2018): A catalogue of the types of Protoneturinae and Disparoneurinae deposited in the Museum für Naturkunde in Berlin (Odonata). *International Dragonfly Fund - Report 118*: 1-10. (in English) ["A catalogue of all types of subfamilies Protoneturinae and Disparoneurinae currently housed in the entomological collection of the Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science in Berlin (Germany) is presented. It includes current status of the familygroup, genusgroup and speciesgroup names, transcriptions of data labels and references to the original descriptions." (Author)] Address: Turiault, Mélanie, Uhlenhorster Str. 23, 12555 Berlin, Germany. Email: melanieturiault@msn.com

**20419.** Turra, B.L.; Raimundi, E.R.; de Souza-Franco, G.M. (2018): Influência de variáveis ambientais em ambientes lóticos de Mata de Araucária sobre a taxocenose de Odonata. *Revista Ibero-Americana de Ciências Ambientais* 9(3): 289-305. (in Portuguese, with English summary) ["Influence of environmental variables in Araucaria Forest lotic environments on taxocenosis of Odonata - The size of the water bodies can be considered the main controller of the physical and chemical characteristics of the lotic environments. Therefore, the substrate type, river flow, organic and inorganic composition, and habitat heterogeneity are directly related to the size of the lotic environment. In turn,

these characteristics are determinant in the distribution and diversity of the immature fauna of Odonata. In this context, we test the hypothesis that different dimensions of lotic environments support similar diversity of Odonata immatures, however, differ in their composition. Thus, we evaluated the influence of water body size on abiotic factors and Odonata immature body taxocenosis. We carried out five seasonal samplings between 2011 and 2012, in the Araucarias National Park, Santa Catarina, in eight environments, through quantitative and qualitative methods. There were 520 Odonata individuals, distributed in eight families and 41 genera. The environments were evidently separated by the classification of the rivers. The highest values of diversity, richness and equitability were recorded in small streams, environments with greater habitat heterogeneity, higher percentage of organic matter and protected by ciliary forest. It was confirmed by this study that the high habitat heterogeneity in low order lotic environments influences the diversity, the abundance and the richness of the Odonata fauna. Another determining factor for the high indexes was the integrity of the study site, favoring the protection and cycling of nutrients in water bodies." (Authors)] Address: Turra, B.L., Universidade Comunitária da Região de Chapecó, Brasil. E-mail: bruninha.lais@gmail.com

**20420.** Walia, K.G.; Devi, M. (2018): Distribution of constitutive heterochromatin in four species of genus *Copera* of family Platycnemididae (Odonata: Zygoptera) from India. *Int. J. of. Life Sciences* 6(2): 457-461. (in English) ["C-heterochromatin distribution in four species of genus *Copera* of family Platycnemididae have been described. *Copera marginipes* and *Copera vittata assamensis* were collected from Bilaspur and Renuka lake (Sirmour, Himachal Pradesh), respectively, while *Copera annulata* and *Copera vittata* were collected from Nongkhyllam (Meghalaya), India. All the species possess  $n=13m$  as haploid chromosome number, which is the type number of the family and X0-XX sex determining mechanism. In all the species, autosomal bivalents show dark/light terminal C-bands on chiasmatic/non-chiasmatic ends, while m bivalent and X chromosome possess variation in distribution of C-heterochromatin. m bivalent is C-negative in *Copera marginipes*, while shows terminal C-bands in *Copera annulata*, *Copera vittata* and *Copera vittata assamensis*. X chromosome possesses less amount of C-heterochromatin in *Copera marginipes*, *Copera annulata* and *Copera vittata*, whereas X chromosome is bipartite and entirely C-negative in *Copera vittata assamensis*. Chromosome complement of *Copera vittata assamensis* has been studied for the first time." (Authors)] Address: Walia, Walia Gurinder, Dept of Zoology and Environmental Sciences, Punjabi Univ., Patiala- 147002. Punjab, India. Email: gurinderkaur\_walia@yahoo.co.in

**20421.** Wang, C.; Zhao, M.; Wang, J.; Jiang, Y.; He, Z.; Feng, Y. (2018): Molecular identification of a new species of edible dragonfly. *Biotic Resources* 40(2): 164-169. (in Chinese, with English summary) ["Some dragonflies are nutrient-rich edible insects with the value of health care. Currently, there are 12 species of edible dragonflies in the domestic market (*Crocothemis servilia*, *Orthetrum albistylum*, *O. triangulare melania*, *Pantala flavescens*, *Sympetrum uniforme*, *O. pruinatum neglectum*, *Epophthalmia elegans*, *Icetinogomphus rapax*, *Sinictinogomphus clavatus*, *Anax parthenope julius*, *Gomphus cuneatus*, *Lestes praemorsa*). We found a smaller species of edible dragonfly nymphs at Daping Township, Yuanyang County, Honghe State in Yunnan Province. This species of dragonfly does not belong to the

above 12 species based on the morphological characteristics. This edible dragonfly was identified with DNA barcoding method as *Sympetrum speciosum*." (Authors)] Address: Wang, C.; Email: cywang11@126.com

**20422.** Wang, J.; Han, P.; Zhu, R.; Liu, C.; Deng, X.; Dong, H. (2018): Wake capture and aerodynamics of passively pitching tandem flapping plates. 2018 Fluid Dynamics Conference. DOI: 10.2514/6.2018-3236: 13 pp. (in English) ["The passive pitching mechanism of insect wings during unsteady flapping flight is commonly observed in nature and has been extensively studied using single wing models. However, passive pitching in ipsilateral wings, which will be inevitably affected by the wing-wing interactions, remains unexplored. In this paper, the wake capture and aerodynamic performances of two passively pitching tandem flapping plates ( $AR = 3.0$ ) is numerically investigated with a torsional spring model. The computations are conducted using an immersed boundary method (IBM) based direct numerical simulation (DNS) solver. A constant incoming flow is introduced to model the flow condition of dragonfly takeoff flight. A parametric study on the phase difference ( $A\langle p$ ) between the downstream and upstream plate is performed at  $Aq\rangle$  between  $-90^\circ$  and  $+90^\circ$ . The simulation results show significant changes in the passive pitching of both plates, especially the plate in downstream, due to wing-wing interactions. Significant wake capture by the leading edge of the downstream plate is found at positive  $A\langle p$ , which helps the downstream plate maintain high passive pitching angle and results in high lift force generation. Wake capture by the trailing edge of the downstream plate is found at negative  $A\langle p$ , which suppresses the passive pitching of the downstream plate and leads to deterioration of its aerodynamic performance." (Authors)] Address: Wang, J., Dept of Mechanical & Aerospace Engineering, Univ. of Virginia Charlottesville, VA 22904, USA

**20423.** Wang, M.; Shi, G.; Zhu, Y.; Wang, Y.; Ma, W. (2018): Au-decorated dragonfly wing bioscaffold arrays as flexible Surface-Enhanced Raman Scattering (SERS) substrate for simultaneous determination of pesticide residues. *Nanomaterials* 2018, 8, 289: 14 pp. (in English) ["Rapid sampling and multicomponent analysis are vital in pesticide residue detection. In this work, we proposed a SERS platform to detect three kinds of pesticides on apple peels simultaneously by a straightforward "press and peel off" method. The flexible Au/dragonfly wing (Au/DW) substrate was obtained from sputtering Au nanoislands on DW bioscaffold arrays by a simple direct current (DC) magnetron sputtering system. The high-performance substrate exhibited a low limit of detection (LOD) to 4-aminothiophenol (4-ATP) ( $10.9 \text{ M}$ ), outstanding reproducibility (less than 12.15%), good stability and suitability in multifold pesticide residues detection. Considering its excellent sample collection efficiency, the Au/DW substrate was employed to solve critical pesticide residue problems for detection of acephate (APT), cypermethrin (CPT), tsumacide (MTMC) and their multiple components on apple peels. The results show that the LOD was  $10.3 \text{ ng/cm}^2$  for APT obtained on the apple surface with a calculation equation of  $y = 0.26x + 6.68$  and a determination coefficient ( $R^2$ ) of 0.970. Additionally, the LOD values for CPT and MTMC were  $10.3 \text{ ng/cm}^2$  and  $10.4 \text{ ng/cm}^2$ , respectively. The finding in this work may provide a promising biomimetic SERS platform for on-spot detection of other organic pollutants in the food industry and environmental protection." (Authors)] Address: Wang, M., Key Lab. Microstructural Material Physics of Hebei Province, School of Science, Yanshan Univ., Qinhuangdao, Hebei 066004, China. Email: wml@ysu.edu.cn

**20424.** Wellenreuther, M.; Muñoz, J.; Chávez-Ríos, J.R.; Hansson, B.; Cordero-Rivera, A.; Sánchez-Guillén, R.A. (2018): Molecular and ecological signatures of an expanding hybrid zone. *Ecology and Evolution* 8(10): 4793-4806. (in English) ["Many species are currently changing their distributions and subsequently form sympatric zones with hybridization between formerly allopatric species as one possible consequence. The damselfly *Ischnura elegans* has recently expanded south into the range of its ecologically and morphologically similar sister species *Ischnura graellsii*. Molecular work shows ongoing introgression between these species, but the extent to which this species mixing is modulated by ecological niche use is not known. Here, we (1) conduct a detailed population genetic analysis based on molecular markers and (2) model the ecological niche use of both species in allopatric and sympatric regions. Population genetic analyses showed chronic introgression between *I. elegans* and *I. graellsii* across a wide part of Spain, and admixture analysis corroborated this, showing that the majority of *I. elegans* from the sympatric zone could not be assigned to either the *I. elegans* or *I. graellsii* species cluster. Niche modeling demonstrated that *I. elegans* has modified its environmental niche following hybridization and genetic introgression with *I. graellsii*, making niche space of introgressed *I. elegans* populations more similar to *I. graellsii*. Taken together, this corroborates the view that adaptive introgression has moved genes from *I. graellsii* into *I. elegans* and that this process is enabling Spanish *I. elegans* to occupy a novel niche, further facilitating its expansion. Our results add to the growing evidence that hybridization can play an important and creative role in the adaptive evolution of animals." (Authors)] Address: Wellenreuther, Maren, Dept Biol., Lund Univ., Lund, Sweden. Email: maren.wellenreuther@plantandfood.co.nz

**20425.** Wiczorek, M.V.; Bakanov, N.; Bilancia, D.; Szöcs, E.; Stehle, S.; Bundschuh, M.; Schulz, R. (2018): Structural and functional effects of a short-term pyrethroid pulse exposure on invertebrates in outdoor stream mesocosms. *Science of the Total Environment* 610–611: 810-819. (in English) ["Agricultural land-use frequently results in short pulse exposures of insecticides such as pyrethroids in river systems, adversely affecting local invertebrate communities. In order to assess insecticide-induced effects, stream mesocosms are used within higher tier aquatic risk assessment. Regulatory acceptable concentrations (RACs) derived from those studies are often higher compared with tier 1 RACs. Hence, the present mesocosm study evaluates this aspect using a pulse exposure scenario typical for streams and the pyrethroid insecticide etofenprox. A 6-h pulse exposure with measured concentrations of  $0.04$ ,  $0.3$  and  $5.3 \mu\text{g L}^{-1}$  etofenprox was used. We considered abundance, drift and emergence of invertebrates as structural endpoints and the in situ-measured feeding rates of the isopod *Asellus aquaticus* as functional endpoint. Most prominent effects were visible at  $5.3 \mu\text{g L}^{-1}$  etofenprox which caused adverse effects of up to 100% at the individual and population level, as well as community structure alterations. Transient effects were observed for invertebrate drift (effect duration .24 h) and for the invertebrate community (9 days after exposure) at  $0.3 \mu\text{g L}^{-1}$  etofenprox. Furthermore,  $0.04 \mu\text{g L}^{-1}$  etofenprox affected the abundance of the mayfly *Cloeon simile* (decrease by 66%) and the feeding rate of *A. aquaticus* (decrease by 44%). Thus, implications for the functional endpoint leaf litter breakdown in heterotrophic ecosystems may be expected. A hypothetical RAC derived from the present mesocosm study ( $0.004 \mu\text{g L}^{-1}$ ) is in line with the official tier 1 RAC ( $0.0044 \mu\text{g L}^{-1}$ ) and thus shows that the



present mesocosm study did not result in a higher RAC." (Authors)] Address: Wieczorek, M., Inst. Environmental Sciences, Univ. of Koblenz-Landau, Fortstr. 7, 76829 Landau, Germany. Email: wieczorekm@uni-landau.de

**20426.** Wolfe, J.D.; Lane, O.P.; Brigham, R.M.; Hall, B.D. (2018): Mercury exposure to red-winged blackbirds (*Agelaius phoeniceus*) and dragonfly (Odonata: Aeshnidae) nymphs in Prairie Pothole wetlands. *FACETS* 3: 174-191. (in English) ["The Prairie Pothole Region (PPR) in the northern Great Plains is an area of ecological significance, serving as an important breeding site for avian wildlife. However, organisms feeding within the PPR may be at risk of mercury (Hg) exposure due to deposition of anthropogenic emissions and the high Hg methylation potential of PPR wetlands. We quantified Hg concentrations in red-winged blackbirds'; RWBLs) blood, feathers, and eggs in the spring and summer breeding season and compared our values with those from RWBLs sampled from ecoregions across North America. Hg concentrations in whole water, aeshnid dragonfly nymphs, and RWBL tissues varied by wetland and were below those considered to elicit acute effects in wildlife, and egg total Hg (THg) concentrations were significantly related to spring whole water methylmercury concentrations. Only RWBL blood THg concentrations showed a clear increase in summer compared with spring, resulting in decoupling of summer blood and feather THg concentrations. Moreover, blood THg concentrations varied by ecoregion, with those impacted by an industrial point source exhibiting high Hg levels. Our study emphasizes that tissue renewal time as well as ecological factors such as competition and diet shifts are important considerations when using RWBLs to assess biological Hg exposure." (Authors)] Address: Wolfe, J.D., Dept Biol., Univ. of Regina, 3737 Wascana Parkway, Regina, SK S4S 0A2, Canada. E-mail: jared.wolfe76@gmail.com

**20427.** Zia, Z.; Amad-Ud-Din; Azam, I.; Munir, A.; Afsheen, S. (2018): Effect of salinity gradients on species composition of Odonata naiads. *Arthropods* 7(1): 11-25. (in English) ["In present study the relationship between salinity gradients of various water bodies and inhabiting Odonata naiads was studied. Naiads, being a popular group of water pollution indicators, were studied. Totally 35 sites were surveyed for collection of naiads and water samples were taken from each positive site. Eight factors viz. Electrical Conductivity (Ec), Calcium +Magnesium (Ca+Mg), Sodium (Na+), Carbonates (Carb), Bicarbonates (Bc), Sodium Absorption Ratio (SAR) and Residual Sodium Carbonate (RSC) were studied for each water sample. Interesting results were obtained both for Anisoptera and Zygoptera species. Among dragonflies, genus *Crocothemis* of family Libellulidae appeared to be resistant while Genus *Gomphidia* and *Sympetrum* of families Gomphidae and Libellulidae were observed to be affected by variations in salinity gradients of waters of different sites. However in case of damselflies Genus *Ischnura* of family Ceonagrionidae and genus *Pseudagrion* of family Ceonagrionidae were observed to be adaptive followed by genus *Ceriagrion* of same family. As an overall conclusion, Anisopterous naiads were found more susceptible to salinity gradients than Zygoptera and thus can be better used in water salinity diagnoses studies." (Authors) *Libellula fulva*, *Ceriagrion pulchellum*] Address: Azam, Iqra, Dept of Zoology, Univ. of Gujrat, Pakistan. E-mail: iqra.azam@uog.edu.pk

**20428.** Zsoldos, A. (2018): Study on biomass in semiaquatic insects (Odonata) over a 20-year period in central, Sweden. B.Sc. thesis, Halmstad Univ., School of Business,

Engineering and Science: 11 pp. (in English) ["This study is about how biomass of dragonfly insects have changed over the past 20-years in a forested area of central Sweden. This was done by analysing previously collected Odonata larvae stored in ethanol where sampling effort corrects the weight per locality. The results display a small but significant biomass increase over past decades, going against the recently observed trend of biomass decline in insects. However, this biomass gain was not even between the families, the ones that increased the most was Aeshnidae and Libellulidae. The reasons for the observed increase are discussed, some possible suggestions are less disturbance in their environments and their ability to adapt due to their long evolution giving them a phenotypical advantage." (Author)] Address: not stated

**20429.** Šigutová, H.; Šigut, M.; Dolný, A. (2018): Phenotypic plasticity in specialists: How long-spined larval *Sympetrum depressiusculum* (Odonata: Libellulidae) responds to combined predator cues. *PLoS ONE* 13(8): e0201406: 15 pp. (in English) ["Phenotypic plasticity is a common defensive strategy in species experiencing variable predation risk, such as habitat generalists. Larvae of generalist dragonflies can elongate their abdominal spines in environments with fish, but long spines render larvae susceptible to invertebrate predators. Long-spined specialists adapted to fish-heavy habitats are not expected to have phenotypic plasticity in this defence trait, but no empirical studies have been undertaken. Moreover, in comparison to prey responding to multiple predators that induce similar phenotypes, relatively little is known regarding how species react to combinations of predators that favour opposing traits. We examined plasticity of larval dragonfly *Sympetrum depressiusculum*, a long-spined habitat specialist. In a rearing experiment, larvae were exposed to four environments: (i) no predator control, (ii) fish cues (*Carassius auratus*), (iii) invertebrate cues (*Anax imperator*), as well as (iv) a combination of (ii) and (iii). Compared with the control, fish but not invertebrate cues resulted in longer spines for two (one lateral, one dorsal) of the six spines measured. Interestingly, the combined-cue treatment led to the elongation of all four dorsal spines compared with the fish treatment alone, whereas lateral spines showed no response. Our experiment provided evidence of morphological plasticity in a long-spined specialist dragonfly. We showed that nearly all spines can elongate, but also react differently under specific predator settings. Therefore, while spine plasticity evolved in direct response to a single predator type (fish), plasticity was maintained against invertebrate predators as long as fish were also present. Selective spine induction under the combined condition suggests that *S. depressiusculum* can successfully survive in environments with both predators. Therefore, phenotypic plasticity may be an effective strategy for habitat generalists and specialists. Although more studies are necessary to fully understand how selection shapes the evolution of phenotypic plasticity, we demonstrated that in dragonflies, presence or absence of a specific predator is not the only factor that determines plastic defence responses] Address: Šigutová, Hana, Institute of Environmental Technologies, Faculty of Science, Univ. of Ostrava, Ostrava, Czech Republic. E-mail: hana.sigutova@osu.cz

## 2019

**20430.** Abdul Aziz, M.A.A.; Mohamed, M. (2019): Annotated checklist of odonates (Insecta: Odonata) in Sungai Bantang Recreational Forest, Bekok, Johor, Malaysia. *IOP Conference Series: Earth and Environmental Science* 269

012002: 15 pp. (in English) ["A total of 34 species of odonates, including 17 species of Anisoptera belonging to 2 families, and 15 species of Zygoptera belonging to 8 families were collected and recorded from Hutan Lipur Sungai Bantang in January, May and July 2017. Libellulidae is the most dominant family with 15 species and in Zygoptera, Chlorocyphidae, Euphaeidae and Platycnemididae, each with three species are represented. A detailed list of odonates [...] is presented. The result forms a baseline data of odonate fauna in this forest reserve useful in the monitoring of water quality of rivers found in the forest reserves in the future." (Authors)] Address: Mohamed, M., Centre of Research Sustainable Uses of Natural Resources, Faculty of Applied Sciences & Technology, Universiti Tun Hussein Onn Malaysia, Kampus Pagoh, Jalan Panchor, 84000, Muar, Johor, Malaysia. E-mail: maryati@uthm.edu.my

**20431.** Adelman, J. (2019): Seltene Segmentanomalie bei einer Imago von *Libellula depressa* (Odonata: Libellulidae). *Libellula* 38(1/2): 93-96. (in German, with English summary) ["Rare anomaly of segmentation in an adult *L. depressa* – A female of *L. depressa* photographed at a stream near Dillshofen [Hessen, Germany] on 29-IV-2018, showed an unusual segmentation of the abdomen. The helical anomaly has been extended over two segments and is to be classified as helicomorphism." (Author)] Address: Adelman, J., Potsdamer Str. 70, 64372 Ober-Ramstadt, Germany. Email: jadelmann@web.de

**20432.** Adu, B.W.; Oyeniyi, E.A. (2019): Water quality parameters and aquatic insect diversity in Aahoo stream, southwestern Nigeria. *The Journal of Basic and Applied Zoology* (2019) 80:15. <https://doi.org/10.1186/s41936-019-0085-3>: 9 pp. (in English) ["Background: The role of water in the maintenance of an aquatic ecosystem is indispensable. In this study, aquatic insect biodiversity and the physico-chemical parameters of Aahoo stream, in southwestern Nigeria, were investigated from March to August 2017. Seven physico-chemical parameters were examined in six study sites. Results: There were significant effects ( $p < 0.0001$ ) of flow rate (F5, 12 = 2221.9), electrical conductivity (F5, 12 = 276.3), air temperature (F5, 12 = 110.3), water temperature (F5, 12 = 55.5) and pH (F5, 12 = 31.45) on the quantity of aquatic insects at the study sites in Aahoo stream. Dissolved oxygen (F2, 12 = 7.82) also had a significant impact ( $p = 0.002$ ) on the quantity of aquatic insects at the stream. Three aquatic insect orders, Diptera (most dominant), Odonata (median dominant) and Hemiptera (least dominant), nine families and 12 genera were found occurring in the stream. Chironomus sp. (Chironomidae, 55.29%), *Brachythemis* sp. and *Orthetrum* sp. (Libellulidae, 21.84%) which are usually associated with polluted water showed the highest occurrence in the stream. Low values of diversity indices were observed across the six study sites, which suggest that the six sites were in unstable conditions. Site 5 has the richest (Simpson 1-D 0.77, Shannon H 1.81, Margalef 1.91) and best taxa distribution (Equitability J: 0.73), while site 3 was the poorest (Simpson 1-D 0.52 and Shannon H 1.31) and the least in taxa distribution (Equitability J 0.55). Conclusion: This study has provided information on the assemblage and copiousness of various aquatic insects as well as the physico-chemical parameters of Aahoo stream. It could therefore be concluded that the stream could be somewhat polluted and unsafe for human consumption without being properly treated." (Authors) *Lestiniogomphus*, *Brachythemis*, *Orthetrum*, *Ceriagrion*, *Pseudagrion*] Address: Adu, B.W., Dept of Biology, Federal Univ. of Technology, Akure, Nigeria

**20433.** Amari, H.; Zebsa, R.; Lazli, A.; Bensouilah, S.; Melal, M.K.; Mahdjoub, H.; Houhamdi, M.; Khelifa, R. (2019): Differential elevational cline in the phenology and demography of two temporally isolated populations of a damselfly: Not two but one taxon? *Ecological Entomology* 44(1): 93-104. (in English) ["1. Temporal isolation by cohort splitting is a life-history mechanism that has been reported in many temperate insects, including those inhabiting freshwater habitats. Although the cohorts seem to maintain separate temporal niches in a specific location, the temporal isolation may be disrupted across a geographic gradient due to constraints imposed by seasonality. 2. This prediction was tested on two temporally isolated populations of the obligatory univoltine *Lestes virens* in north-east Algeria. Although the two cohorts emerge at the same time in spring, one cohort reproduces in summer, while the second cohort estivates in summer and reproduces in autumn. A survey assessing the phenology and abundance was conducted on eight ponds across an elevational gradient (5–1012 m a.s.l.) using capture–mark–recapture and adult density sampling. 3. In all sites from low to high elevation, the species showed cohort splitting. The phenology of reproduction of both cohorts showed a delay with elevation, but the cline was 2.2 days for the summer cohort and 0.7 days for the autumn cohort per 100 m of elevation. Moreover, the density of adults in the autumn cohort was higher than that of summer cohort across the entire elevational range, and the difference increased with elevation. 4. These findings regarding the differential elevational cline in the phenology show that the temporal isolation of the two cohorts becomes narrower at high elevation, suggesting potential inter-cohort temporal overlap at higher elevations. 5. The claim that the two cohorts of *L. virens* are true temporally isolated species needs further investigation." (Authors)] Address: Khelifa, R., Biodiversity Research Center, Univ. of British Columbia, 2212 Main Mall, Vancouver. B.C. V6T1Z4, Canada. Email: rasimkhelifa@gmail.com

**20434.** Anjos-Santos, D. (2019): Colecciones científicas en Latinoamérica: Brasil La odonatología brasileña después del incendio del Museo Nacional. ¿Quiénes son y dónde están los odonatólogos de Brasil? *Hetaerina* 1(2): 8-11. (in Spanish) ["In 2018, Brazilian odontology suffered the loss of its most illustrious collection, which was housed in the Dept of Entomology of the National Museum of the Federal Univ. of Rio de Janeiro (MNRJ). This fateful fire also consumed other important collections, as well as historical holdings and exhibitions open to the general public. At present, the National Museum is carrying out an arduous search of the debris in search of pieces that may have survived the tragedy. The Odonata Collection of the MNRJ was the legacy of Dr. Newton Dias dos Santos (1916-1989). Many of the specimens were the fruit of his innumerable campaigns throughout Brazil and South America. Other researchers contemporary to Santos and after him also contributed to the growth of the collection. Of the thousands of specimens deposited in the collection, there were, in addition to the primary types, specimens from various Brazilian regions, which had not even been studied and which, perhaps, will never be found in the wild again. The few specimens of Odonata that escaped the fire were outside the institution and will be returned to the Museum as soon as possible. The good news is that, in recent months, the MNRJ's Entomology Dept has been receiving donations of insects of different orders and its researchers continue to work in the unaffected areas of the Museum. In addition to the MNRJ, there are other collections in Brazil (described below) that contain specimens of Odonata, mainly from the

Neotropics, and some even have primary types. In recent years, Brazilian odonatology has been growing and a new generation of researchers is focusing on the study of neotropical odonates, with collaborations in taxonomy, phylogeny, behaviour and ecology. To aid interaction between Latin American researchers, the following is a list of contact and basic data for the main research groups and collections in the country. The information was provided by their leaders or by members of the laboratories (Table 1)." (Author/DeepL)] Address: Anjos-Santos, Danielle, Laboratorio de Investigaciones en Sistemática y Ecología Animal (LIESA), Sarmiento 849, 9200, Esquel, Chubut, Argentina. E-mail: danielleanhos2@yahoo.com.br

**20435.** Ansari, M.I.; Siddique, M.H.; Samad, A.; Anwer, S.F. (2019): On the optimal morphology and performance of a modeled dragonfly airfoil in gliding mode. *Physics of Fluids* 31(5): 23 pp. (in English) ["Numerical investigation on the effect of wing morphology of the dragonfly *Aeshna cyanea* is carried out to understand its influence on the aerodynamic performance. The two-dimensional wing section has corrugation all over the surface along the chord length on both upper (suction side) and lower (pressure side) surfaces. By considering each corrugation separately on different airfoils at their different positions, 10 single corrugated airfoils were generated. Simulations are performed on these different airfoils to determine the effect of each corrugation on aerodynamic performance. The flow is modelled as incompressible, Newtonian, homogeneous, and unsteady. The angle of attack was varied from 0° to 20°, and the Reynolds number (Re) was varied from 150 to 10 000. The optimum morphology and angle of attack were predicted by using the surrogate-based optimization technique for a maximum gliding ratio at different Re. A fully corrugated pressure side gives the best performance at angles of attack of 9.79° and 14.83° at low Re. At high Re, corrugations on the pressure side which are in the middle and those near the trailing edge give a maximum gliding ratio at angles of attack 9.22° and 5.276°. The spatiotemporal dynamics indicate that corrugations near the leading edge on the upper surface and corrugations near the trailing edge for the lower surface and which are in the middle are beneficial. It is also found that shear drag due to corrugation decreases but pressure drag increases; therefore, the overall drag coefficient for a fully corrugated airfoil increases. Corrugations on the suction side have little influence, while those on the pressure side causes lift enhancement." (Authors)] Address: Anwer, S.F., Computational Aerodynamics Lab, Dept of Mechanical Engineering, ZHCET, Aligarh Muslim Univ., Aligarh 202002, India. Email: sfahadanwer@zhcet.ac.in

**20436.** Aromaa, S.; Ilvonen, J.J.; Suhonen, J. (2019): Body mass and territorial defence strategy affect the territory size of odonate species. *Proc. R. Soc. B* 286: 20192398: 8 pp. (in English) ["The territory is a distinct mating place that a male defends against intruding conspecific males. The size of a territory varies between species and most of the variation between species has been found to scale allometrically with body mass. The variation that could not be explained by body mass has been explained with several variables such as habitat productivity, trophic level, locomotion strategy and thermoregulation. All previous interspecific comparative studies have been done on vertebrate species such as birds, mammals, reptiles and fishes, meaning that studies using invertebrate species are missing. Here, we studied the relationship of a species's territory size with its fresh body mass (FBM) in addition to other ecologically relevant traits using 86 Odonata species. We found that territory size is strongly

affected by species FBM, following an allometric relationship similar to vertebrates. We also found that the territory size of a species was affected by its territorial defence strategy, constantly flying species having larger territories than species that mostly perch. Breeding habitat or the presence of sexual characters did not affect territory sizes, but lotic species and species without wing spots had steeper allometric slopes. It seems that an increase in a species's body mass increases its territory size and may force the species to shift its territory defence strategy from a perch to a flier." (Authors)] Address: Suhonen, J., Dept Biology, Univ. Turku, FI-20014 Turku, Finland. E-mail: juksuh@utu.fi

**20437.** Bach, A.E.T. (2019): Estudio de los Odonata (Insecta) de los edoststemas altoandinos de la región del Cusco. MSc thesis, Facultad de Ciencias, Escuela Profesional de Biología, Universidad Nacional de San Antonio Abad del Cusco: 152 pp. (in Spanish) ["Odonates from the high Andean ecosystems of the Cusco region were studied. Material previously collected and deposited in the Entomology Laboratory of the National Univ. of San Antonio Abad del Cusco and the Museum of Natural History of the Universidad Nacional Mayor de San Marcos was reviewed. Additionally, between January 2017 and October 2018, collections were made in 12 provinces of the Cusco Region, prioritising provincial capitals and localities where water bodies such as rivers, streams and lakes above 2800 m above sea level are found. The high Andean ecosystems are located from 3700 m above sea level and form a zoogeographic district located within the biogeographic province of the Yungas. In the high Andean ecosystems of the Cusco region, 6 species were identified: *Rhionaeschna fassifrons*, *R. machali*, *R. peralta*, *R. absoluta*, *Sympetrum gilvum* and *Protallagma titicacae*. In the Yungas biogeographic province, the species *Rhionaeschna obscura*, *R. diffinis* and *R. cornigera* were recorded. Finally, the highest species richness was found between the provinces of Calca, Urubamba and Cusco." (Author/DeepL)] Address: not stated

**20438.** Bäumlér, F.; Büsse, S. (2019): Resilin in the flight apparatus of Odonata (Insecta) — cap tendons and their biomechanical importance for flight. *Biol. Lett.* 15: 201901-27. <http://dx.doi.org/10.1098/rsbl.2019.0127>: 7 pp. (in English) ["In Odonata, a direct flight mechanism with specialized tendons evolved. One particular adaptation, the implementation of the rubber-like protein resilin in these cap tendons, might be of major importance. Although resilin was first described in one tendon of Odonata, to our knowledge no comprehensive study about the presence of resilin in the thorax exists yet. We investigated various species of Odonata, using  $\mu$ CT, dissection and fluorescence microscopy. Here we show a complete mapping of the odonatan pterothorax, regarding the presence of tendons and their properties. Thus, 20–21 cap tendons in the pterothorax of Odonata show the presence of resilin. While performing outstanding and often-aggressive flight manoeuvres, resilin can provide shock absorption against mechanical damage from strong impacts. It may further improve the wear and fatigue resistance owing to resilin's damping behaviour. Additionally, resilin in tendons can absorb and return kinetic energy to restore muscles to their original shape after contracting and help in maintaining self-oscillation of the flight muscles. Here, the material distribution within the direct flight system of Odonata and the biomechanical importance and possible function of resilin are discussed. These results are an important step towards the understanding of the complex form–material–function interplay of the insect cuticle." (Authors)] Adult Odonata studied: *Sympetrum striolatum*, *Anax*

imperator, *Calopteryx splendens*, *Lestes sponsa*, *Epiophlebia superstes*] Address: Büsse, S., Dept of Functional Morphology & Biomechanics, Institute of Zoology, Kiel Univ., Am Botanischen Garten 9, 24118 Kiel, Germany. Email: sbuesse@zoologie.uni-kiel.de

**20439.** Bailleux, G.; Duval, A.; Darblade, S.; Ducout, B. (2019): Émergence de *Stylurus flavipes* en milieu lentique. *Martinia* 34 (1/2): 59-60. (in French) [Emergence of *S. flavipes* in Bédorède Lake (city of Biarrotte, Landes Dept, France), 7-VI-2019.] Address: Bailleux, G., CEN Aquitaine, 45 rue Louis Barthou F-64110 Gelos, France. Email: bailleux-gilles@gmail.com

**20440.** Baird, I.R.C. (2019): Establishment of larval pits by *Tachopteryx thoreyi* (Odonata: Petaluridae): habitat modification by a non-burrowing petalurid. *International Journal of Odonatology* 22(2): 135-146. (in English) ["*Tachopteryx thoreyi* is one of only two species of petalurid dragonflies with a non-fossorial larval stage. In the context of questions related to the phylogenetics, historical biogeography and current distribution of the Petaluridae, the evolution of a burrowing larval stage in petalurids, which is unique in the Odonata, is of considerable interest. This paper reports observation of crypts, or shallow pits or depressions, established by some larvae of *Tachopteryx thoreyi*, and briefly discusses these observations in the context of the more typical burrowing habit in petalurids." (Author)] Address: Baird, R.C., 3 Waimea St, Katoomba, NSW 2780, Australia. Email: petalurids@gmail.com

**20441.** Bastos, R.C.; Schlemmer Brasil, L.; Carvalho, F.G.; Calvão, L.B.; Silva, J.O. (2019): Odonata of the state of Maranhão, Brazil: Wallacean shortfall and priority areas for faunistic inventories. - Odonata do estado do Maranhão, Brasil: Déficit wallaceano e áreas prioritárias para inventários faunísticos. *Biota Neotropica* 19(4): e20190734. <http://dx.doi.org/10.1590/1676-0611-BN-2019-0734>: 11 pp. (in English, with Portuguese summary) ["Environmental changes are worrying in a scenario with large knowledge gaps on species diversity and distribution. Many species may become extinct before they are known to science. Considering this scenario, the present study aims to evaluate the known distribution of the species recorded for Maranhão state in Brazilian northeast region and discuss knowledge gaps about Odonata indicating the priority areas for faunistic inventories. Using primary and secondary data together, we present convex minimum polygons of the distribution of all the species registered for the state. In addition, we created maps with the richness of species and number of records of Odonata in the Maranhão state. In primary data sample 269 specimens, represented by 17 genera and 30 species were collected. Of the 30 species collected, 17 are new records for the state of Maranhão; of these, 35.29% are geographically widespread species, occurring in practically all regions of Brazil. Considering the records in the literature, there was a 68% increase in the number of Odonata species known for Maranhão. The most unexplored region is the Cerrado of the state of Maranhão. Furthermore, the transition regions between Cerrado and Amazônia and between Cerrado and Caatinga are also unknown. All these areas are a priority for faunistic inventories." (Authors)] Address: Bastos, R.C., Univ. Federal do Pará, Programa de Pós-Graduação em Ecologia, Belém, PA, Brasil

**20442.** Bergmann, T. (2019): Character-based barcoding, a symbiosis and potential successor of traditional taxonomy

and modern DNA barcoding. Dissertation, Naturwissenschaftlichen Fakultät der Gottfried Wilhelm Leibniz Universität Hannover: VII + 155 pp. (in English) ["Classic taxonomy is a powerful tool for identifying animals based on morphology but has shown to be problematic on similar looking, cryptic species. A solution to this problem has been found within the bauplan of life, the DNA (deoxyribonucleic acid). DNA is used to create and regulate proteins. The structure of DNA has highly unique sections that are conserved within species, but diverse between species. One particular section, a 648 bp long fragment of the mitochondrial cytochrome c oxidase subunit 1 (CO1) gene, has become a popular barcode for species identification. Here, a new barcoding technique, character-based barcoding more similar to traditional approaches is tested. This thesis investigates whether CO1 is suitable as a single marker (a) or should be complemented by others (b). Performance of distance- and character-based barcoding (c) is evaluated and it is tested whether character-based barcoding can be used to identify cryptic species (d). In the first manuscript, CO1 sequences of endangered turtle species are compared (a). Having a reliable tool for species identification is an important asset in species protection surveillance. Variability within the barcode region is assessed and the utility of both distance- and character-based methods for species identification are evaluated (c). Odonata is an old order rich in species. As many species have evolved in a short time, it was observed that intra- and interspecific variety is overlapping in some sister groups. This observation made Odonata the ideal candidate for testing CO1 (a), ND1 (b), as well as distance- and character-based barcoding (c) in the second manuscript. Ants are prime examples for high degrees of cryptic biodiversity due to complex population differentiation, hybridization and speciation processes. As combinations of multiple marker regions seemed to be a better approach to barcoding, three markers (CO1, 28S rDNA, rhodopsin) are tested (b) in the third manuscript. A combined, layered approach to character-based barcoding is evaluated and unique diagnostics specific to geolocations are identified (d). The results of all three studies show that combining multiple markers improves identification success. The character-based approach provides better identification in the tested animal groups. This method can be used to estimate presence, absence or frequency of cryptic species." (Author)] Address: Bergmann, T., Untere Hauptallee 3, 31812 Bad Pyrmont, Germany

**20443.** Bernard, R.; Felska, M.; Makol, J. (2019): Erythraeid larvae parasitizing dragonflies in Zambia—description of *Leptus* (*Leptus*) *chingombensis* sp. nov. with data on biology and ecology of host-parasite interactions. *Systematic & Applied Acarology* 24(5): 790-813. (in English) ["A survey of odonate fauna in Zambia (Central Province, Luano District) resulted in discovery of ectoparasitic larvae of *Leptus* (*L.*) *chingombensis* sp. nov. (Trombidiformes: Parasitengona, Erythraeidae) on four species of dragonflies (Odonata) representing four different families assigned to Zygoptera and Anisoptera. The morphological characteristics of the new species is supported with DNA barcode sequence. Despite some intra-group variation related to relatively large sample, the morphological and genetic consistence confirm the common specific identity of the material. A brief comparison of *Leptus* spp. hitherto known from the Afrotropic as larvae is given. Supplementary data to the descriptions of *Leptus* (*L.*) *bicristatus* Fain et Elsen, 1987, *Leptus* (*L.*) *aldonae* Haitlinger, 1987 and *Leptus* (*L.*) *soddagus* Haitlinger, 1990, based on examination of type material, are provided. In the case of *L.* (*L.*) *chingombensis* sp. nov., the parasite load

reached high, previously not recorded for Odonata–terrestrial Parasitengona association values, attaining at 44 and 49 larvae. Clear topic preferences towards the ventral side of the host's body were recorded, with an additional tendency to distal parts of synthorax and the ventral depression of the abdomen. We hypothesize that the infestation did not take place synchronously at dragonflies emergence, but consisted in repeated infestation events during the recurrent appearance of dragonflies in the contact microhabitat occupied by *Leptus*. The very local character of the finding along with the regular appearance of larvae parasitizing dragonflies, obviously favoured by specific habitat conditions, no doubts confirms the non-accidental nature of the phenomenon." (Authors) *Pseudagrion spermatum* Selys 1881; *Heliaeschna fuliginosa* Karsch, 1893; *Paragomphus cognatus* (Rambur 1842); *Orthetrum julia* Kirby 1900.] Address: Bernard, R., Dept Nature Education and Conservation, Adam Mickiewicz Univ., Umultowska 89, 61-614 Pozna, Poland. E-mail: rbernard@amu.edu.pl

**20444.** Berquier, C.; Andrei-Ruiz, M.-C. (2019): Synthèse des connaissances et évaluation de l'état de conservation de *Lestes macrostigma* en Corse (Odonata: Lestidae). *Martinia* 34(1-2): 1-16. (in French, with English summary) ["State of knowledge and assessment of the conservation status of *L. macrostigma* in Corsica – Corsica hosts in France a large number of reproductive stations for *L. macrostigma*. During these last decades, the number of studies and data concerning this damselfly in the island has considerably increased. They allow a completion and an update of the knowledge provided in 2004 in the atlas of Odonata from Corsica. The purpose of our study was to do so focusing on *L. macrostigma* regional population in order to assess its conservation status and to identify the regional conservation management issues in relation to this species, as recommended by the National Action Plan for Odonata. The gathered data were analysed using baseline methodology, especially recommended by the European Habitats directive. Today, *L. macrostigma* appears widely distributed all along the island coastline, especially in the natural protected and managed sites network. In Corsica, *L. macrostigma* larvae can develop every year in different types of temporary waters ranging from brackish to fresh and mainly of natural origin. Among the types of wetlands in which reproduction is successful, the Mediterranean freshwater temporary ponds appear to be unusual for the species. In this strong conservation value habitat, the monitoring which has been carried out since 2014 highlights the great inter-annual variability in the phenology and the abundance of the species. Our assessment reveals an "Unfavourable-inadequate" conservation status for the species in Corsica, mostly because of the recent destruction of reproduction stations close to main island conurbations. Our analysis also demonstrates that the island has a major heritage responsibility for this specie relative to the national territory. Hence, with respect to these challenges, we strongly encourage to carry out ambitious regional conservation and management policies." (Authors)] Address: Berquier, C., Office de l'Environnement de la Corse, Observatoire - Conservatoire des Insectes de Corse, Avenue Jean Nicoli, 20250 Corte, France. Email: cyril.berquier@oec.fr

**20445.** Bried, J.T.; Siepielski, A.M. (2019): Predator driven niches vary spatially among co-occurring damselfly species. *Evolutionary Ecology* 33(2): 243-256. (in English) ["Determining how niche differences contribute to local species coexistence is a vexing problem. Previous work has shown that the ecological and evolutionary processes shaping niche

differentiation can vary among populations, suggesting that the strength of niche differences among species should likewise vary geographically. Most tests of this idea compare different species in different locations, not the same species in different locations. Thus, it is unclear whether niche differences vary spatially because of variation in community composition or because populations of the same species experience differences in the strength of niche effects. To test this latter hypothesis, we used field experiments to manipulate the relative abundances of the same pair of *Enallagma* damselfly species at two lakes. Manipulating relative abundances allowed us to quantify the demographic signature of niche differences that could stabilize coexistence, because if species are niche differentiated, they should experience lower mortality in response to their shared fish predator, and higher growth in the face of resource competition, when rare. We found that both species experienced lower mortality when rare in one location but not the other. No differences in growth were detected, indicating that competition for prey resources may not be a key factor affecting coexistence. These results suggest the species are ecologically differentiated among populations in ways shaping survivorship in response to a shared predator, which should promote their coexistence. We discuss several factors that could contribute to the differences we observed, focusing on the ideas that either (1) niche differentiation between species evolves locally, or that (2) spatial variation in environmental factors affects the manifestation of species niche differences. We therefore argue that the problem of 'species coexistence' is not a problem of species, but rather is one of understanding if species' populations coexist. Such results imply a role for microevolutionary processes in structuring communities." (Authors)] Address: Bried, J.T., Dept of Biological Sciences, Univ. of Arkansas, Fayetteville, USA

**20446.** Brown, T.A.; Fraker, M.E.; Ludsin, S.A. (2019): Space use of predatory larval dragonflies and tadpole prey in response to chemical cues of predation. *The American Midland Naturalist* 181(1): 53-62. (in English) ["Chemical cues are frequently a key source of information to aquatic organisms. Both predators (kairomones digestive metabolites) and prey (alarm and damage-released cues) may generate chemical cues during their interactions, and different cue types can have different informational values. How predators and prey use the information from chemical cues to make spatial movement decisions influences both their direct interaction rates and their interactions with other species. We measured the spatial response of predatory larval *Anax junius* and predator-naïve green frog (*Lithobates clamitans*) tadpoles exposed to several types of chemical cues using experimental mesocosms. We found tadpoles only responded with spatial avoidance when exposed to both *Anax* kairomones and conspecific alarm cues together, whereas *Anax* did not exhibit consistent spatial responses to any cue type. Our results suggest tadpole prey selectively respond to environmental information from chemical cues (possibly to minimize costly antipredator behavior due to responding to insufficient information or reflecting a need for associative learning). They also show predatory dragonflies may use nonchemical information to make space use decisions (possibly due to inability to detect the same chemical cues as tadpoles)." (Authors)] Address: Fraker, M. Email: mfraker2@gmail.com

**20447.** Buczynski, P.; Tonczyk, G. (2019): Polish and dedicated to Poland odonatological papers. 17. The year 2018. *Odonatrix* 157 (2019): 6 pp. (in Polish, with English summary) ["The authors present a list of Polish and dedicated

to Poland odonatalogical papers that were published in the year 2018. In the reported time period, 42 works of various kind were published, and one Ph.D. thesis was created. In addition, the list of publications from 2017 has been supplemented by three positions." (Authors)] Address: Tonczyk, G., Katedra Zoologii Bezkręgowców i Hydrobiologii, Uniwersytet Łódzki, ul. Banacha 12/16, 90-237 Łódź. E-mail: tonczyk.grzegorz@gmail.com

**20448.** Cavallaro, M.S.; Main, A.R.; Liber, K.; Phillips, I.D.; Headley, J.V.; Peru, K.,M.; Morrissey, C.A. (2019): Neonicotinoids and agricultural stressors collectively modify aquatic insect communities. *Chemosphere* 226: 945-955. (in English) ["Highlights: • Few field studies investigate how neonicotinoids interact with agricultural stressors. • Wetlands and aquatic insect emergence were monitored over 2 growing seasons. • Community affected by neonicotinoids, turbidity, vegetative variables. • Neonicotinoids associated with lower abundance and more tolerant insect taxa. • Intensive agricultural practices collectively degrade insect communities and abundance. Abstract; Threats to wetland water quality and aquatic insect secondary production in agricultural landscapes are multifaceted and are known to vary spatially and temporally. We designed this study with the aim to disentangle the effects of multiple stressors on emerging aquatic insects from wetlands impacted by intensive agricultural practices and receiving runoff from neonicotinoid-treated canola. In 2013, 2015, 22 semi-permanent wetlands were monitored over two growing seasons (11 different wetlands per year) in central Saskatchewan, Canada. Over the two sampling years, dipterans from the families Chironomidae (60–67%), Muscidae (13–15%) and Ceratopogonidae (7–13%) made up the majority of emergent taxa, representing 80–95% of the total emergence. Multivariate ordination analyses of eight water quality and nine wetland habitat variables revealed that neonicotinoid concentration, turbidity, vegetation disturbance, and continuity of a vegetative grass buffer zone were significant factors influencing the aquatic insect taxa composition. Generalized linear mixed effects models indicated that total insect emergence over time was significantly predicted by neonicotinoid concentrations (imidacloprid toxic equivalency, TEQ) and vegetation disturbance. Higher neonicotinoid concentrations negatively affected insect emergence over time, whereas vegetation disturbance increased total emergence, likely due to the abundance of taxa tolerant to habitat disturbance. Overall, we observed community-level responses driven by multiple indicators of wetland degradation (insecticides, turbidity, and vegetation disturbance). Collectively, these multivariate field data provide an in-depth understanding of how agricultural management practices, including neonicotinoid use, interact to shape wetland aquatic insect communities." (Authors) Lestidae, Coenagrionidae] Address: Cavallaro, M.S., School of Environment & Sustainability, Univ. of Saskatchewan, Saskatoon, Saskatchewan, Canada

**20449.** Cendrawati, M.A.; Rahmadhani, T.P.; Meilita, N.; Pujiastuti, Y. (2019): Identifikasi capung odonata pada vegetasi perairan, rerumputan dan tanaman perdu di kampus Indralaya Universitas Sriwijaya. In: Herlinda S et al. (Eds.), *Prosiding Seminar Nasional Lahan Suboptimal 2018*, Palembang 18-19 Oktober 2018. pp. 402-409. Palembang: Unsri Press: 402-409. (in English) ["Dragonflies (Odonata) play an important role of the food chain. Dragonflies are effective predators in the ecosystem, play a role as natural enemies that can reduce the population of food crop pests. This indicates the important position of the existence of dragonflies in ecological balance. Dragonflies can also act

as bioindicator in the ecosystem. Changes in dragonfly populations are a sign of the early stages of water pollution in addition to other signs in the form of water turbidity. This study aimed to determine the types and the behavior of Odonata on several traps in fresh water, grass and herbaceous vegetations in Indralaya Campus of Sriwijaya Univ.. This research was conducted at the Unsri Indralaya Campus area, on December 2016. The study was arranged in a completely Randomized Completed Block Design (RCBD) consisted of two observation time, morning and afternoon, and 3 types of trap, unbranched trap (P1), two branched trap (P2), and three branched trap (P3) with 5 replications. Each branch was used as a trap which smeared by jackfruit sap. The results showed that unbranched trap (P1) on 3 different vegetations were preferred by dragonflies to perch and dragonflies in the Libellulidae family, namely *Brachythemis contaminata* were easy and most common found in each research location." (Authors) Leimrute] Address: Pujiastuti, Y., Jurusan Hama dan Penyakit Tumbuhan, Fakultas Pertanian, Universitas Sriwijaya, Indralaya 30662. Email: ypujiastuti@unsri.ac.id

**20450.** Chance, F.S. (2019): Dragonfly-inspired algorithms for intercept trajectory planning. SANDIA Report SAND-2019-11695: 28 pp. (in English) ["Autonomous real-time trajectory calculations "inside the basket", or within "sight" of the target, remain a critical but unsolved problem. This LDRD was performed in support of the Autonomy for Hypersonics Mission Campaign, specifically to address challenges associated with engagements involving high-speed, highly-maneuverable vehicles with limited sensing capabilities. Algorithms that can dynamically and autonomously adjust intercept trajectories in response to a maneuvering target are critically needed to support our national security missions. Current state-of-the-art solutions rely upon proportional navigation, which requires an overmatch of speed and maneuverability to ensure success. The objective of this project was to develop a model of dragonfly interception, testing a specific hypothesis of how dragonflies use visual information to implement proportional navigation, with the longer-term goal of developing a novel neural-inspired interception algorithm that would decrease or eliminate the required overmatch for successful interception. Dragonflies are known to be highly successful hunters (achieving 90-95% success rate in nature) that implement a guidance law like proportional navigation to intercept their prey. This project tested the hypothesis that dragonflies implement proportional navigation using prey-image translation across their eyes. The model dragonfly presented here calculates changes in pitch and yaw to maintain the prey's image at a designated location (the fovea) on a two-dimensional screen (the model's eyes). When the model also uses self-knowledge of its own maneuvers as an error signal to correct the fovea's location, the resulting interception trajectory becomes guided by proportional navigation (verified using range vector correlation as a metric of proportional navigation). The fovea-adjustment and resulting modifications to interception trajectory can be performed in realtime and in response to prey maneuvers. While further work is required to evaluate the viability of this model for implementation on a manmade system, my results provide a proof-of-concept demonstration of the potential of using the dragonfly nervous system to design a robust interception algorithm for implementation on a manmade system." (Author)] Address: Chance, Frances, Sandia National Laboratories, Albuquerque, New Mexico, 87185 and Livermore, California 94550, USA

**20451.** Cheeseman, S.; Truong, V.K.; Walter, V.; Thalmann,

F.; Marques, C.M.; Hanssen, E.; Vongsvivut, J.; Tobin, M.; Baulin, V.A.; Juodkazis, S.; MacLaughlin, S.; Bryant, G.; Crawford, R.J.; Ivanova, E.P. (2019): The interaction of Giant Unilamellar Vesicles (GUVs) with the surface nanostructures on dragonfly wings. *Langmuir* 35(6): 2422-2430. (in English) ["The waxy epicuticle of dragonfly wings contains a unique nanostructured pattern that exhibits bactericidal properties. In light of emerging concerns of antibiotic resistance, these mechano-bactericidal surfaces represent a particularly novel solution by which bacterial colonization and the formation of biofilms on biomedical devices can be prevented. Pathogenic bacterial biofilms on medical implant surfaces cause a significant number of human deaths every year. The proposed mechanism of bactericidal activity is through mechanical cell rupture, however this is not yet well understood and has not been well characterized. In this study we used giant unilamellar vesicles (GUVs) as a simplified cell membrane model to investigate the nature of their interaction with the surface of the wings of two dragonfly species, *Austrothemis nigrescens* and *Trithemis annulata*, sourced from Victoria, Australia and the Baix Ebre and Terra Alta regions of Catalonia, Spain. Confocal laser scanning microscopy (CLSM) and cryo-scanning electron microscopy (Cryo-SEM) techniques were used to visualize the interactions between the GUVs and the wing surfaces. When exposed to both natural and gold-coated wing surfaces, the GUVs adsorbed on the surface, exhibiting significant deformation, in the process of membrane rupture. Differences between the tensile rupture limit of GUVs composed of DOPC and the isotropic tension generated from the internal osmotic pressure, were used to indirectly determine the membrane tensions, generated by the nanostructures present on the wing surfaces. These were estimated as being in excess of 6.75 mN m<sup>-1</sup>, the first experimental estimate of such mechano-bactericidal surfaces. This simple model provides a convenient bottom-up approach towards understanding and characterizing the bactericidal properties of nanostructured surfaces." (Authors)] Address: Cheeseman, S., School of Science, College of Science, Engineering & Health, RMIT Univ., GPO Box 2476, Melbourne, Victoria 3001, Australia

**20452.** Cunningham-Minnick, M.J.; Meyer, T.B.; Crist, T.O. (2019): Shifts in dragonfly community structure across aquatic ecotones. *International Journal of Odonatology* 22(2): 121-133. (in English) ["Anisoptera are often used as indicators of habitat type and quality due to their varied use of aquatic and terrestrial habitats. Species differ in their preferences for lotic and lentic waters, but community changes across ecotones, or transitional zones between distinct habitats (e.g. lotic and lentic), are not well understood. We quantified dragonfly species richness, abundance, and composition along a gradient of habitat types, including streams, stream mouths (ecotones), and open waters (lakes and ponds). We tested if dragonfly assemblages in aquatic ecotones differ from adjacent stream and open water habitats, and how species respond to riparian forest cover across these habitat types. Adult dragonflies were sampled in all habitat types at four sites in southwest Ohio during the summer of 2016. Riparian canopy cover and relative densities of algal mats and emergent vegetation were recorded. We sampled 157 individuals of 12 dragonfly species [*Pachydiplax longipennis*, *Libellula luctuosa*, *Plathemis lydia*, *Perithemis tenera*, *Epitheca princeps*, *Dromogomphus spoliatus*, *Libellula pulchella*, *Pantala flavescens*, *Tamea lacerata*, *Anax longipes*, *Anax junius*] and found significant differences in community composition between stream and ecotone habitats, both forming subsets of the open water community. Canopy

cover explained 55% and 75% of abundance and species richness variance across habitat types, respectively, but these relationships were strongest at ecotones. Finally, the Odonata Index of Wetland Integrity (OIWI), which uses sensitivities of adult odonates to habitat disturbances to evaluate wetland conditions, showed that species composition at ecotones uniquely represents the ecological integrity of the entire wetland system. Thus, transition zones may provide an effective and more efficient alternative to rapidly assess wetland quality for conservation monitoring than sampling the entire wetland." (Authors)] Address: Cunningham-Minnick, M.J., Dept of Biology, Miami Univ., Oxford, OH, USA. Email: minnicmj@miamiOH.edu

**20453.** Dewan, S.; Darnal, N.; Acharya, B.K.; Subramanian, K.A.; Chettri, B.; Jins, V.J. (2019): Effectiveness of organic terrace rice cultivation in conservation of odonates in Sikkim, Eastern Himalaya, India. *International Journal of Odonatology* 22(3-4): 207-222. (in English) ["Conversion of natural habitat into agricultural landscape has been identified as one of the major drivers of habitat loss. Human-modified ecosystems, such as agricultural land, have gained significant attention in terms of the conservation of their native biodiversity. We studied the effectiveness of organic agroecosystems in conserving odonate diversity by comparing organic terrace rice cultivation with a nearby natural forest system with streams in Sikkim, Eastern Himalaya, India. We sampled adult odonates using a transect count method (laying six permanent transects) covering two villages (Lingmoo in South Sikkim and Dzongu in North Sikkim), making a total of 48 transect counts. A total of 881 individual odonates representing 31 species under two suborders (16 Anisoptera and 15 Zygoptera) and seven families were recorded during this study. Of these, 20 species representing three families and 18 species representing seven families were observed in terrace rice cultivation and the natural forest system, respectively. Beta diversity estimates showed that the community composition of the odonates differed qualitatively (incidence measure) and quantitatively (abundance measure) between the two land use types. Turnover component (abundance balance in case of abundance based beta diversity measure) had higher contribution in the overall beta diversity, suggesting that one assemblage of species is being replaced by another due to environmental sorting. The variation in community composition between the two habitats was statistically significant. Our results suggest that organic wetland habitats are important for conservation of odonates and associated biodiversity (especially herpetofauna) in the Himalaya and require urgent conservation attention." (Authors)] Address: Dewan, S., Dept Zool., School of Life Sciences, Sikkim Univ., Gangtok, Sikkim, India

**20454.** do Prado, A.V.; Rodrigues, M.E.; Aoki, C. (2019): Odonate fauna (INSECT: Odonata) of two ponds in the Cerrado-Pantanal ecotone, Aquidauana, MS. *Oecologia Australis* 23(4): 979-988. (in English) ["Knowing the biodiversity of a given site is the first step in establishing strategies for its conservation, monitoring and sustainable use. The objective of the present study was to catalogue the Odonata community of two ponds in the Cerrado-Pantanal ecotone area. Collections were carried out between October 2012 and September 2013, encompassing different hydrological seasons. This study presents the first systematized survey of Odonata for lentic environments in the region. A total of 347 individuals were recorded, distributed in 41 species, 22 genera and three families. The suborder Zygoptera was represented by the Coenagrionidae and Lestidae families,

while the suborder Anisoptera was represented by the Libellulidae family. The Acanthagrion, Erythemis and Erythrodiplax genera were the most representative. The results indicate that there is seasonality in the occurrence of the species. The wide diversity found in lentic environments emphasizes the importance of long-term monitoring of these ecosystems, in order to understand the effect of seasonality and of anthropic alterations to the surrounding environment on the Odonata community." (Authors)] Address: Rodrigues, M.E., Univde Estadual de Santa Cruz, Depto de Ciências Biológicas, Programa de Pós-graduação em Sistemas Aquáticos Tropicais, Lab. de Organismos Aquáticos, Rod. Jorge Amado, Km 16, CEP 45662-900, Ilhéus, BA, Brazil. E-mail: rodrigues.mbio@gmail.com

**20455.** Duangjit, S.; Aimraksa, S.; Khoomsab, K. (2019): Species diversity of odonates in Nong Naree Park, Amphoe Muang, Phetchabun province. PSRU Journal of Science and Technology 4(1): 61-72. (in Thai, with English summary) ["This research was mainly aimed to study the species diversity of odonates in Nong Naree Park, Amphoe Muang, Phetchabun province, Thailand. The odonate larvae and adults were investigated from study station during October to December 2018. The odonate samples were conducted for 2 times per month. The result found that 12 species from 11 genera under 3 odonate families including family Libellulidae (10 species), family Gomphidae (1 species) and family Aeshnidae (1 species) were observed. Additionally, four species of odonate larvae including Brachydiplax chalybea, Brachythemis contaminata, Crocothemis servilia and Urothemis signata could be linked with adults from rearing." (Authors)] Address: e-mail: sasithorn4521@gmail.com

**20456.** Frantz, B. (2019): Haematoloechus lung flukes in American Bullfrogs: Prevalence and associations of infection. Univ. Honors Theses. Paper 716. <https://pdxscholar.library.pdx.edu/honorstheses/716>: 25 pp. (in English) ["The prevalence and intensity of infection by lung flukes (Haematoloechus sp.) was examined by dissecting 1,590 American bullfrogs (Rana catesbeiana) collected between 2013 and 2018, from Conboy Lake National Wildlife Refuge, Washington. Overall infection, across all age classes, was 59.7% (n=1,580) and mean intensity was 17 (n=169; SD=19.3, range=1-166). A logistic regression model showed a significant relationship between infection and frog snout-to-vent length, gape, and collection year. Sex had a significant relationship to infection ( $\chi^2=7.31$ , df=1, P=0.007). Presence of odonates in the stomach was also significantly related to infection ( $\chi^2=22.49$ , df=1, P<0.001). This study expands on the current breadth of knowledge on this taxon in anurans into a previously unstudied region of the USA and emphasizes the use of odonates as secondary intermediate hosts....The aquatic cercariae are shed from the snail and proceed to enter the second intermediate host: principally Odonata." (Author)] Address: not stated

**20457.** Friesen, O.C.; Goellner, S.; Poulin, R.; Lagrue, C. (2019): Parasite infection reduces predation risk by dragonfly larvae in crustacean prey. Hydrobiologia 835: 63-70. (in English) [New Zealand, "Parasites can modify the phenotype of their hosts, altering host vulnerability to predation. Tropically-transmitted parasites often use host manipulation to increase their probability of transmission to the next host or reduce their chances of being consumed by the wrong species. However, phenotypic changes may actually increase the host's vulnerability to other predators that are 'dead-ends' for the parasite, reducing parasite fitness while

potentially impacting host populations. The isopod Austrodotea annectens serves as intermediate host to Maritrema poulini (trematode) and display behavioural changes when infected that may increase parasite transmission. We tested the role of parasite infection on predation risk of isopods by a dragonfly nymph [Hemicordulia australiae (Rambur 1842)], a 'dead-end' parasite host. Size-matched isopod pairs were exposed to nymphs and observed until one was captured; subsequently isopod parasite abundance was determined. Isopods with lower parasite abundance were significantly more likely to be caught. Several mechanisms may explain this; behavioural modification by the parasites may be altering isopod behaviour to avoid predation by dead-end hosts, or, alternatively, increased activity may allow heavily infected isopods to avoid predation by sit and wait predators. Assessing the effects of parasites on their host's ability to avoid predation is crucial in understanding how parasites may affect ecosystem dynamics and structure." (Authors)] Address: Friesen, O.C., Dept Zool., Univ. Otago, Dunedin, New Zealand. Email: olwynfriesen@gmail.com

**20458.** Fuentes, A. (2019): Effects of pH, dissolved O<sub>2</sub> and temperature of pond water on the richness of odonates at Indiana Dunes National Lakeshore. <https://opus.govst.edu/researchday/2019/posters/12/>: (in not stated) ["Odonates are valuable indicators for assessing impacts of human activities on aquatic habitats. The few studies that have examined the relationship between water quality and Odonate diversity have demonstrated a positive linear relationship between richness and the three water quality parameters: pH, dissolved oxygen and temperature. Previous research has mostly excluded the Odonate nymphs, which according to our hypothesis should be impacted the most by the water quality. To conduct this survey, DNA barcoding and sequence alignments were used to identify samples of nymph and adult Odonates from six different ponds at Indiana Dunes National Lakeshore. After the samples were identified, the total species richness for each location was correlated with three water quality parameters, pH, dissolved oxygen and temperature. Out of the 48 nymph samples identified, there were 16 unique species. The preliminary results show a positive linear relationship between pH, temperature, dissolved O<sub>2</sub> and adult richness, but no significant relationships have been found between any of these water quality variables and nymph richness. The sample size was small for the nymphs compared to the adults because only half of the nymph samples of that year have been identified so far. If further laboratory analysis demonstrates that there is a relationship between nymph richness and the water quality measures above, species indices could provide a more efficient means to determine the presence of particular species as well as overall species richness. This information could then be used to assess the overall health of aquatic habitats." (Authors)] Address: Governors State Univ.

**20459.** Gallardo, L.I.; Coronel, J.M.; Guadalupe Poi, A.S. (2019): Urban rain-fed lakes: macro-invertebrate assemblages associated with Egeria najas as indicators of biological integrity in wetlands of Corrientes Province (Argentina). Biodiversity and Conservation 28: 1549-1568. (in English) ["In northeast Corrientes Province, there are more than 50,000 semi-rounded shallow rain-fed lakes. Several lakes have been disturbed mainly because urbanization causes eutrophication due to the illegal discharge of wastewater. We compared 22 metrics based on the structural attributes of macro-invertebrates associated with Egeria najas across seasons between five lakes with different human disturbance levels. Sixty-six samples of E. najas and associated



invertebrates were collected seasonally using a net with an area of 962 cm<sup>2</sup>. A total of 17,737 macro-invertebrates of eight major groups, 35 families and 30 genera were recorded. The total macro-invertebrate abundance (number of individuals per plant dry weight) and the family richness were significantly higher in less disturbed lakes than those under human disturbance, but the differences between seasons were not significant. Non-metric multidimensional scaling analysis differentiated the macro-invertebrate abundances between the more and less disturbed lakes; instead, the diversity indices were not useful for measuring the changes in the studied lakes. Besides, total number of taxa, number of EOT (Ephemeroptera, Odonata, Trichoptera) taxa, abundance and proportion of Trichoptera and abundance of Chironomidae reflected significant differences between the more and less disturbed lakes. Our results suggest that 7 invertebrate metrics respond to urbanization, and they could be used to assess biological integrity of the studied lakes in complement of chemical monitoring of water quality. Management efforts should focus on the maintenance of macrophyte stands that provide high invertebrate diversity, which serve as food for a wide variety of fish." (Authors)] Address: Gallardo, Luciana, Centro de Ecología Aplicada del Litoral - CECOAL (CCT Nordeste - CONICET-UNNE) Corrientes, Argentina. E-mail: lucianaigallardo@gmail.com

**20460.** Garcia Junior, M.D.N.; Rakes, M.; Pazini, J.; Pasini, R.A.; Garcia, F.R.M.; Grützmacher, A.D. (2019): The diversity of Odonata adults's at Pampa Biome from Brazil. *Revista de Biología Tropical* 67(1): 107-117. (in English) ["The growth of humankind has brought with it several environmental problems that have worsened over time, including the loss of insect biodiversity. The Odonata order have been indicated by several authors as relevant bioindicators for assessing and monitoring environmental conditions of specific locations. The main objective of this study was to conduct an inventory of the Odonata diversity in the Pampa Biome, of the Southern region of the state of Rio Grande do Sul, Brazil. The species survey was conducted between November 2014 and October 2015. Adult insects were collected in Capão do Leão, Pelotas and Rio Grande cities. Each location was visited nine times, totalizing 54 samplings. Entomological nets were used for capturing adult insects, which were then kept in entomological envelopes. The identification of the specimens was carried out with taxonomic keys of Lencioni and Heckman. In addition, Chao-1, the Shannon-Wiener and Jackknife indexes were associated with the sampling areas. During the species survey a total of 2 680 Odonata specimens were collected, representing 45 species encompassed in 22 genera and six families. The Libellulidae and Coenagrionidae families were registered in 60 and 30 % of the specimens sampled, followed of the Aeshnidae, Calopterygidae, Gomphidae and Lestidae, of reduced occurrence. The genera Erythrodiplax, Micrathyrina and Ischnura were found at least once in all the visited sites. The study resulted in the registration for the first time of the following species: Progomphus complicatus Selys, Lestes minutus Selys, Homeoura ambigua Ris, and Tauriphila xiphea Ris. These species were not previously reported in any Odonata study of the Brazilian state of Rio Grande do Sul. In regard to Odonata diversity in the Southern region of Rio Grande do Sul, Libellulidae and Coenagrionidae are the families more abundants. Erythrodiplax and Micrathyrina are the most common genera. Miathyrina marcella represented 9.6 % of all collected libellulidae and was the most abundant specie. Capão do Leão has the largest species diversity (wealth), the largest number of collected specimens and more diversity than Pelotas and Rio Grande.

However, the results showed that the Odonatofauna in the State are still little known, and new studies are needed to better describe this group in other regions." (Authors)] Address: Rakes, M., Dept Plant Protection, Fac. Agronomy "Eliseu Maciel" (FAEM), Federal Univ. of Pelotas, postcode 96010-900, Pelotas, Rio Grande do Sul, Brazil. Email: ma-theusrakes@hotmail.com

**20461.** Guan, D.-L.; Qian, Z.-Q.; Ma, L.-B.; Bai, Y.; Xu, S.-Q. (2019): Different mitogenomic codon usage patterns between damselflies and dragonflies and nine complete mitogenomes for odonates. *Scientific Reports* 9, Article number: 678: 9 pp. (in English) ["Odonata have distinct body plans and predatory abilities. Knowledge of their various evolutionary histories will allow for an understanding of the genetic and phenotypic evolution of insects. Mitogenomes are suitable materials to elucidate this, but the mitogenome of only a few odonates have been annotated. Herein, we report the complete mitogenome of nine odonates, including seven dragonflies and two damselflies, and a comprehensive analysis of the codon usage in 31 Odonata mitogenomes with the aim to estimate their evolutionary characteristics. Overall, a weak codon bias exists among odonate mitogenomes, although this favours AT-ending codons. Damselflies have a weaker codon usage bias than dragonflies, and 37 codons have significantly different usages. Both directional mutation and purifying selection shape damselfly and dragonfly mitogenomes. Although inevitable, directional mutation bias plays a minor role, whereas purifying selection pressure is the dominant evolutionary force. A higher selection pressure is observed in dragonflies than in damselflies, but it mainly acts on codon usage patterns rather than amino acid translation. Our findings suggest that dragonflies might have more efficient mitochondrial gene expression levels than damselflies, producing more proteins that support their locomotion and predatory abilities.... In the present study, we examined the mitogenome of nine odonates by next-generation sequencing. Furthermore, we reconstructed the complete mitogenome of seven Anisoptera dragonflies (*Tramea virginia*, *Orthetrum testaceum*, *O. sabinia*, *O. melania*, *Deielia phaon*, *Acisoma panorpoides*, *Trigomphus carus*, *Atrocalopteryx atratum* and *Platycnemis foliacea*. The mitogenome features of these two species have been described. The codon usage bias in protein coding genes within the mitogenome of dragonflies and damselflies was examined to reveal the evolutionary forces that contributed the most in shaping the mitogenomes and their codon usage patterns in dragonflies and damselflies." (Authors)] Address: Xu, S.-Q., College of life science, Shaanxi Normal Univ., Xi'an, 710119, P. R. China. Email: xushengquan@snnu.edu.cn)

**20462.** Hidayat, S.; Husnia, F.; Rohmah, E.; Mukhlisoh, S. (2019): Study on diversity of dragonfly (Odonata) as a bio-indicator of water quality in Mount Muria area, Central Java. *J. Nat. Scien. & Math. Res.* 5(2): 53-61. (in English) ["Water in the Mount Muria area is needed by the surrounding community to fulfill life. An indicator is needed to determine water quality. Dragonfly (Odonata) is one of the organisms as ecosystem controllers and bioindicators. This study aims to determine the diversity of dragonflies, determine water quality and describe the role of dragonflies as a bioindicator of water quality in the Mount Muria area. This type of research is descriptive quantitative research. The data collection technique used direct observation at 3 stations, namely the Colo Flower River, the Monthel Waterfall River and the River in the Rejenu Area. The results showed that there were 10 species of dragonflies consisting of 6 suborders

Anisoptera and 4 suborders Zygoptera with the highest abundance value being *Euphaea variegata* (51.39%), *Enallagma signatum* (28.47%), *Trithemis festiva* (6.94%), *Orthetrum glaucum* (5.56%), *O. chrysis* (2.78%), *O. pruinatum* (2.08%), *O. testaceum* (0.69%), *O. sabina* (0.69%), *Prodasineura autumnalis* (0.69%), and *Drepanosticta fontinalis* (0.69%). Based on water quality analysis and according to government regulation no. 82 of 2001, the water in the Muria river belongs to category 2. According to the analysis of the family biotic index, it can be seen that the FBI value of the river in the Muria area is 5.60 which means the condition of the river is fair with moderate pollution levels." (Authors)] Address: Hidayat, S., Dept Biology Education, Fac. Science and Technology, Univ. Islam Negeri Walisongo Semarang, Indonesia. Email: [hidayatsaifullah@walisongo.ac.id](mailto:hidayatsaifullah@walisongo.ac.id)

**20463.** Jacmenev, V. (2019): Importance of UV perception for dragonflies (Odonata). Faculty of Science, Ecological and Evolutionary Biology, Dept of Ecology, Karlova Univ., Praha: 24 pp. (in Czech, with English summary) ["It has long been known that some animals are able to perceive radiation at other wavelengths than perceive we humans. In dragonflies, UV sensitivity has been demonstrated in the 1974, however a recent study has unveiled an extraordinary diversity of genes of specific photoreceptor proteins known as opsins, including UV-sensitive opsin. In addition some dragonflies have coloration on their body and wings, which can reflect UV radiation at unchanged wavelength – UV reflectance. Very little is known about the use of UV in dragonfly life. My thesis summarizes the current knowledge of the importance of UV for dragonflies, focusing on interspecific and intraspecific communication." (Author)] Address: not stated

**20464.** Jäger, N. (2019): *Coenagrion mercuriale* am nordöstlichen Arealrand bei Leipzig, Sachsen (Odonata: Coenagrionidae). *Libellula* 38(3/4): 179-203. (in German, with English summary) ["Between May and September 2017, ten sections of streams and ditches west of Leipzig were studied on the abundance of *C. mercuriale* as well as the syntopic odonatan species. Furthermore, various habitat parameters were recorded and a mark-recapture study on *C. mercuriale* was carried out on four days. With the exception of one population, the study sections cover the sites with the highest abundance of all known occurrences in Saxony. The study sections correspond in many ways to the habitat spectrum known from literature. These are mostly perennial streams and ditches, which are narrow, shallow, sunny, do not freeze in winter and show occurrence of marsh plants (helophytes). Submerged herbs that are characteristic of the habitats of *C. mercuriale* are found in only one of the ten study sections with significant coverage. The hydrology seems to be less influenced by groundwater than by diverse discharges. This results in comparatively low water quality, with which the species apparently copes in many places. During the study, a total of 3,427 specimens of *C. mercuriale* were recorded. The highest abundance was 156.9 adults per 100 meters. The longest documented flight period lasted twelve weeks. During the mark-recapture study, a total of 372 specimens were marked at eleven sections. The median of the recapture rate was 18.0% (0.0–40.0%) two days after the markings, and 2.0% (0.0–11.1%) after five days. Outside the study sections no marked specimen were detected. The frequencies determined by the Petersen method are 2.5 to 50.0 times, on average 10.0 times higher than the number of adults counted." (Author)] Address: Jäger, N., Waldstr. 64, 04105 Leipzig, Germany. Email: [nicolasjaeger@hotmail.com](mailto:nicolasjaeger@hotmail.com)

**20465.** Jiang, B.; Johansson, F.; Stoks, R.; Mauersberger, R.; Mikolajewski, D.J. (2019): Predator species related adaptive changes in larval growth and digestive physiology. *Journal of Insect Physiology* 114: 23-29. (in English) ["Prey species are often non-randomly distributed along predator gradients but according to how they trade off growth against predation risk. The foraging-mediated growth/predation risk trade-off is well established, with increased foraging accelerating growth but also increasing predator induced mortality. While adaptations in digestive physiology may partly modify the relationship between foraging and growth in response to predation risk, studies exploring the impact of digestive physiology on growth in prey subjected to predation risk are still scarce. Larvae of the dragonfly genus *Leucorrhinia* segregate at the species level between lakes either being dominated by predatory fish (fish-lakes) or predatory invertebrates (dragonfly-lakes). Predators of these two lake types differ dramatically in their hunting style like searching and pursuing mode causing different selection pressure on prey traits including foraging. In a laboratory experiment we estimated growth rate, digestive physiology (ingested food, growth efficiency, assimilation efficiency, conversion efficiency) and metabolic rate (oxygen consumption) in the presence and absence of predator cues. Whereas fish-lake and dragonfly-lake *Leucorrhinia* species did not differ in growth rate, they evolved different pathways of digestive physiology to achieve similar growth rate. Because fish-lake species expressed a higher metabolic rate than dragonfly-lake species, we assume energy to be differently allocated and used for metabolic demands between species of both predator environments. Further, growth rate, but not digestive physiology was plastic in response to the presence of predator cues. Our results highlight the impact of digestive physiology in shaping the foraging-mediated growth/predation risk trade-off, with digestive physiology contributing to species distribution patterns along predator gradients." (Authors)] Address: Stoks, R., Laboratorium voor Aquatische Ecologie, K.U.Leuven, De Beriotstraat 32, B-3000 Leuven, Belgium. E-mail: [robby.stoks@bio.kuleuven.ac.be](mailto:robby.stoks@bio.kuleuven.ac.be)

**20466.** Kemalok, J.; Mohamed, M.; Rahman, A.A.A.; Ashikin Ismail, N. (2019): Biodiversity across boundary: Ethnoentomology among the Jakun of Kampung Peta, Mersing and the Malay, Chinese and Indian of Kahang, Kluang, Johor. *IOP Conference Series: Earth and Environmental Science* 269 012024: 9 pp. (in English) ["An ethnoentomological survey was carried out on the usage of insects in the culture of several ethnics: Orang Asli Jakun in Kampung Peta, Mersing; the Malay, Chinese and Indian in Kahang, Kluang. Responses from these four communities were compared to understand the uses of insects in their life as well as gauged their views on ethnoentomology. Insects were either part of their spiritual beliefs or used as food, medicine, and entertainment. Four groups of insects were considered, namely Lepidoptera, Homoptera, Odonata and Orthoptera. For example, *Dundubia vaginata* is used by Orang Asli as a source of food, by Malay as entertainment, by Chinese as medicine and by Indian as part of their beliefs. In terms of percentage of insect recognized per ethnicity, Orang Asli accounts for 44.44%, Malay 22.22%, Chinese 16.67% and Indian 16.67%. It was discovered that among the four communities, Orang Asli Jakun were more knowledgeable and open about using insects traditionally. Many insects were integrated in their folklore and myths. Orang Asli Jakun also had more variety of uses for insects in their day to day life compared to the other three communities. Based on this study, it indicated that much of the Malaysian diversity are known and familiar to Orang Asli. Throughout history, Orang

Asli plays important roles in maintaining and managing natural resources through traditional systems. The frequency of human interaction with insects has created a close culture between humans and insects." (Authors)] Address: Mohamed, M., Centre of Res. Sustainable Uses of Nat. Resources, Fac. Applied Sciences & Technology, Univ. Tun Hussein Onn Malaysia, Kampus Pagoh, Jalan Panchor, 84000, Muar, Johor, Malaysia. E-mail: maryati@uthm.edu.my

**20467.** La Porta, G.; Goretti, E. (2019): Investigation on the declining Southern Damselfly (*Coenagrion mercuriale*, Odonata) in a Mediterranean population: survival rate and population size. *Journal of Insect Conservation* 23: 667-675. (in English) [*C. mercuriale* classified as 'Near Threatened' by the Global IUCN Red List and as 'Endangered' in some parts of its range. The species is characterized by fragmented and declining populations with their core in the western Mediterranean and parts of western Europe. This study reported the first estimates of survival rate and population size for a southern European population of *C. mercuriale* living in central Italy. Surveys were carried out in 2017 in the peak of the flight period applying capture-recapture models. More than 1200 specimens were captured on 11 occasions and the sex ratio observed was male-biased (2.8:1). Daily survival probabilities ranged from  $0.662 \pm 0.059$  to  $0.868 \pm 0.045$ . Maximum longevity was 14 days for males. The maximum number of estimated individuals on any day was  $507.2 \pm 49.6$  for males, and  $219.8 \pm 27.7$  for females in mid-June. The estimate of the cumulative population size was about 4000 specimens, with a mean density of 1.2 individuals/m<sup>2</sup> at the breeding site. Our results pointed out that population ecology of *C. mercuriale* in central Italy is similar to that of the populations living in the northern limit of its range. The present study also indicated that monitoring plans, with seven marking occasions at least, can provide consistent estimations of population size, useful for evaluating the viability of populations and for assessing the species conservation status." (Authors) The species considered is *Coenagrion castellani* Robert, 1948 and not *C. mercuriale*.] Address: Goretti, E., Dipartimento di Chimica, Biologia e Biotecnologie, Università degli Studi di Perugia, Perugia, Italy

**20468.** Lee, D.J.; Matthews, P.G.D. (2019): Quantifying the acid-base status of dragonflies across their transition from breathing water to breathing air. *Journal of Experimental Biology* 222, jeb210294. doi:10.1242/jeb.210294: 9 pp. (in English) [*Amphibiotic* dragonflies show a significant increase in hemolymph total CO<sub>2</sub> (T<sub>CO2</sub>) as they transition from water-breathing to air-breathing. This study examines the hemolymph acid-base status of dragonflies from two families [*Anax junius*, *Rhionaeschna multicolor*, *Libellula forensis*, *L. quadrimaculata*] as they transition from water to air. CO<sub>2</sub> solubility (aCO<sub>2</sub>) and the apparent carbonic acid dissociation constant (pK<sub>app</sub>) were determined in vitro, and pH/bicarbonate [HCO<sub>3</sub><sup>-</sup>] plots were produced by equilibrating hemolymph samples with P<sub>CO2</sub> between 0.5-5 kPa in custom-built rotating microtonometers. Hemolymph aCO<sub>2</sub> varied little between families and across development (mean  $0.355 \pm 0.005$  mmol l<sup>-1</sup> kPa<sup>-1</sup>) while the pK<sub>app</sub> was between 6.23 to 6.27, similar to values determined for grasshopper hemolymph. However, the non-HCO<sub>3</sub><sup>-</sup> buffer capacity for dragonfly hemolymph was uniformly low relative to other insects (3.6 to 5.4 mmol l<sup>-1</sup> pH<sup>-1</sup>). While aeshnid dragonflies maintained this level as bimodally-breathing late-final instars and air-breathing adults, the buffer capacity of bimodally-breathing late-final instar *Libellula* nymphs increased substantially to 9.9 mmol l<sup>-1</sup> pH<sup>-1</sup>. Using the pH/[HCO<sub>3</sub><sup>-</sup>] plots and in vivo measurements of TCO<sub>2</sub> and PCO<sub>2</sub> from early-

final instar nymphs, it was calculated that the in vivo hemolymph pH was 7.8 for an aeshnid nymph and 7.9 for a libellulid nymph, respectively. The pH/[HCO<sub>3</sub><sup>-</sup>] plots show that the changes in acid-base status experienced by dragonflies across their development are more moderate than those seen in vertebrate amphibians. Whether these differences are due to dragonflies being secondarily aquatic, or arise from intrinsic differences between insect and vertebrate gas exchange and acid-base regulatory mechanisms, remains an open question." (Authors)] Address: Lee, D.J., Dept of Zoology, Univ. of British Columbia, Vancouver, BC, Canada V6T 1Z4. Email: danlee@zoology.ubc.ca

**20469.** Marinho, R.; Barbosa de Oliveira Junior, J.M.; Silva da Rocha, T.; Cruz da Silva, E.; Souza, L. (2019): Efeito da integridade ambiental sobre a abundância e riqueza de espécies de Zygoptera (Insecta: Odonata) em Igarapés no município de Santarém, Pará, Brasil. *Debate e Reflexão das Novas Tendências da Biologia*. Atena Editora: 1-8. (in Portuguese, with English summary) [*Effect of environmental integrity on the abundance and wealth of Zygoptera species (Insecta: Odonata) in Igarapés in the municipality of Santarém, Pará, Brasil. The monitoring of aquatic ecosystems with the use of dragonflies is indicated by the fact that these organisms inhabit all types of aquatic habitats; the stage larval of each species is specific, able to tolerate environmental disturbances; the males mature they are easily notable while patrolling near the habitat larval, thus facilitating their collection and observation in the field. The suborder Zygoptera is constituted by species that tend to be more sensitive to environmental changes and with it, suffer negative effects on their communities. About addition, this study aims to perform a survey of the diversity of Zygoptera in small creeks preserved and changed in the municipality of Santarém-PA, and to compare the abundance and richness of species of Zygoptera between creeks, preserved and changed. The study was developed in eight creeks in the municipality of Santarém, state of Pará, Brazil, being four located in urban area and four in the preserved areas. Were collected 606 specimens of Zygoptera, distributed in six families, 11 genera and 22 species. The streams classified as preserved were the environments with the greatest richness estimated species of Zygoptera, as this suborder is associated with the most integrity, with riparian vegetation preserved due to the biological requirements more specific. The creeks changed showed a lower species richness of Zygoptera. An explanation for the lower species richness of Zygoptera in environments that have changed is due to changes in riparian forests that have allowed greater entry of light and heat in the systems." (Authors)] Address: Souza, L., Univ. de Fed. do Oeste do Pará, Santarém – Pará, Brasil*

**20470.** Masbou, A.; Goret, T. (2019): Etude de la qualité de l'habitat et monitoring de la population d'Agrion de Mercure (*Coenagrion mercuriale*) dans la plaine de Focant (Beaurain) entre 2013 et 2019. *Natagora*: 32pp. (in French) [*General conclusion: C. mercuriale* is a critically endangered species in Wallonia. In the Focant plain, the population decreased from 696 to 357 individuals between 2013 and 2018. For conservation purposes, it was necessary to confirm our knowledge of the biological requirements of the species. At the end of this study, we can conclude that the abundance of *C. mercuriale* is positively correlated to the presence of headlands and the cover of the ditch by herbaceous vegetation (especially when the latter is higher than 80%). Conversely, factors such as the presence of continuous hedges and the covering of watercourses by bushes are unfavourable factors for the presence of the species. The summer of 2019 was

particularly hot: the average temperature for the months of June, July and August was 19.1°C compared to the normal seasonal temperature of 17.5°C\*. Although there was a surplus in June, the average rainfall was lower in quantity and frequency than the seasonal norms (33 days of rainfall instead of 43.8). Drought is therefore a factor to be taken into account in the results, particularly for the habitat quality maps. Finally, as the data were collected over several years and by multiple operators, it is preferable to remain cautious with regard to our results, particularly for comparative analyses. Management advice in favour of *C. mercuriale*: The management of watercourses and ditches on the Focant plain is a delicate issue. LIFE Bocageous Meadows can only make recommendations to the regional and communal authorities (Beauraing) who are in charge of the management of this biotope: 1) To fight against eutrophication by developing agricultural practices using a minimum of inputs (in particular: fertilisers and pesticides) as well as by restructuring the wastewater treatment system from the surrounding villages. 2) Removing the various logjams that impede the proper flow of water (Annex 6). 3) Planting of alders or other trees should be avoided along the drains, ditches and watercourses in the Focant Valley. Established plantations should ideally be thinned to limit shading of the stream bed. 4) Carry out light dredging in small sections and in rotation over several years as part of a new action plan to avoid the risk of destroying all larval populations of Mercury's Agrion. 5) Do not mow the edges of ditches between 1 April and 31 July. 6) Inform farmers about the Agro-environmental and Climatic Methods, in particular the MAEC "grassed headland", which provides a subsidy of €24 per 20 m long section (12 m wide), i.e. €1,000/ha. 7) Continue to search for other populations in the most favourable regions (Fagne-Famenne and Lorraine)." (Authors/DeepL)] Address: Goret, T., Natagora, Traverse des Muses 1, 5000 Namur, Belgium

**20471.** Messlinger, U.; Burbach, K.; Faltin, I.; Frobel, K.; Schloemer, S. (2019): Zum Einfluss des Europäischen Biber *Castor fiber* auf den Larvallebensraum von *Cordulegaster boltonii* (Odonata: Cordulegastridae). *Libellula* 38(3/4): 157-178. (in German, with English summary) ["In 2016 the effects of beaver activities on habitat quality of *C. boltonii* were studied in various regions of Bavaria and the northern Eifel. In almost all of the study sites the larvae of *C. boltonii* were found in sections influenced by beavers. The larvae also inhabited structures which only arise through beaver activities like dams; water filled cavities on the side and base of dams; beaver ponds and secondary streams with appropriate sandy sediments. In a fast-flowing stream in the Spessart region (Kalter Grund) every location with suitable sediments on a 200 m long stretch of the stream was surveyed. This study revealed, that well populated larval environments were principally provided by beaver damming activities. In stream sections influenced by beavers the density of *C. boltonii* larvae was more than six times higher as in sections not influenced by beavers. The results indicate that *C. boltonii* is both able to survive and benefit from the structures and micro-habitats that beavers typically provide. This applies particularly to streams which are anthropogenically poor in structures. The return of the beaver and the structures which result from their complex behavioural activity is of clear benefit to dragonflies which utilise running waters. It is apparent from our study that these species are from an evolutionary perspective well adapted to beavers and that beaver activities should where practicable be tolerated and supported in the habitat of *C. boltonii*. The prevention of beaver activity in these artificially modified water bodies is therefore a hindrance to their renaturation." (Authors)]

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**20472.** Nattawut Sareein; Chitchol Phalaraksh; Panida Rahong; Chotiwiut Techakijve; Sangwoo Seok; Yeon Jae Bae (2019): Relationships between predatory aquatic insects and mosquito larvae in residential areas in northern Thailand. *Journal of Vector Ecology* 44(3): 223-232. (in English) ["In order to elucidate the poorly understood relationships between mosquito larvae and their predatory aquatic insects in urban and suburban areas of tropical Southeast Asia, where vector-borne diseases are prevalent, aquatic insects were sampled from 14 aquatic habitats in residential areas of Chiang Mai, northern Thailand, during the rainy season (July to November) in 2016. Correlations among biological variables, densities of major predatory aquatic insect groups (i.e., Odonata, Coleoptera, and Hemiptera: OCH group) in wetlands and artificial lentic habitats, and the density of mosquito larvae were analyzed. Among the sampled mosquito larvae, *Culex* spp. were the most abundant, and both OCH density and water quality were major determinants of *Culex* spp. density ( $r_s = -0.302$  and  $-0.396$ , respectively). Logistic regression analyses indicated that the probability of *Culex* spp. occurrence was significantly and negatively correlated with OCH density. Furthermore, high macrophyte abundance was associated with higher predator density, potentially reducing mosquito density. Hemipteran predators were most negatively correlated with *Culex* spp. density, regardless of whether macrophyte abundance was high or low ( $r_s = -0.547$  and  $-0.533$ , respectively). Therefore, hemipteran predators were the most important aquatic insect predators in the urban and suburban residential areas of Chiang Mai, Thailand, and OCH species, such as the hemipteran *Micronecta scutellaris*, could be used as biological control agents against mosquitoes in the region." (Authors)] Address: Yeon, J.B., Dept of Environmental Science & Ecological Engineering, Graduate School, Korea Univ., Seoul, South Korea. Email: yjbae@korea.ac.kr

**20473.** Nava-Bolaños, A.; Sánchez-Guillén, R.A.; Wellenreuther, M.; Muñoz, J.; Torres-Pachón, M.; Novelo-Gutiérrez, R.; Córdoba-Aguilar, A. (2019): Predicting hybridisation as a consequence of climate change in damselflies. *Insect Conservation and Diversity* 12: 427-436. (in English) ["(1) Climate change is a key stressor for species. Two major consequences of climate-induced range shifts are the formation of new areas of geographic overlap (i.e. sympatry) and an increased probability of hybridisation in the de novo created contact zones. (2) One method to effectively quantify the potential of hybridisation is to integrate ecological niche modelling and the propensity to hybridisation based on genetic divergence. In this paper, we have applied this methodology to predict hybridisation outcomes following different scenarios of climate change in 30 species of *Argia* damselflies. (3) We (i) investigated how climate change may affect species' distributions; (ii) quantified if changed distributions generate new areas of sympatry between species; (iii) calculated the propensity to hybridise based on genetic divergence between species; and (iv) integrated these data to predict the future potential of species to hybridise. (4) We found that the distribution of 29 of the 30 species was affected by a change in climate which led to a general increase in sympatric overlap among species. The degree of genetic divergence among the 108 species' combinations ranged from 0.06% to 0.36%. Based on the sympatric overlap and genetic divergence, it can be predicted that 97 of the species pairs are likely to hybridise in the future. (5) Our results are useful to forecast how highly diverse and closely

related groups, such as *Argia* damselflies, may respond to a change in climate and how this can impact the potential of species mixing under a scenario of increased global warming." (Authors)] Address: Sanchez-Guillen, Rosa, Instituto de Ecología A. C., Xalapa 91070, Veracruz, Mexico. E-mail: rosa.sanchez@inecol.mx

**20474.** Nel, A.; Garrouste, R.; Schubnel, T. (2019): Response to Trueman and Rowe (2019) 'The wing venation of Odonata. International Journal of Odonatology'. International Journal of Odonatology 22(2): 115-119. (in English) ["Trueman & Rowe (2019) claimed that they have finally solved the wing venation homologies for the Odonoptera, refuting the previous models, and especially that of Riek & Kukalová-Peck (1984). Nevertheless, their proposal has several failures, viz. nature of the distal part of their "anal vein", nature of the "MA", and incongruence with recent results obtained by Jacquelin et al. (2018) on the morphology of the extreme wing base. Currently the only pattern of venation in total accordance with the known data is that of Riek & Kukalová-Peck (1984), as modified in Nel et al. (1993) and Jacquelin et al. (2018)."] (Authors)] Address: Nel, A., Lab. Ent. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: anel@mnhn.fr

**20475.** Nel, A. (2019): A glance at the deep past history of insects. *Comptes Rendus Biologies* 342(7-8): 253-254. (in English) [Verbatim: With more than 1,100,000 described species, the insects are the most diverse clade of extant animals, far before all other groups. Nevertheless, they undergo a drastic decrease of their populations, due to the sixth extinction of human origin. Thus it is important to define when and how they became so diverse and if they were impacted by the major crises of biodiversity in the deep past to estimate the importance of the current one. Insects are generally among the best preserved terrestrial fossil organisms, much more complete than the vertebrates. They are also much more frequent. Thousands can be found in Konservat-Lagerstätten since the Carboniferous. They are preserved either in lacustrine sediments as compression fossils, or embedded in amber (fossil resins) (Fig. 1). The Hexapoda (or six-legged arthropods, viz., wingless Collembola, Diplura, Protura; wingless and winged Insecta) are among the oldest known terrestrial organisms, with first records dated from the Middle Devonian of Rhynie in Scotland. Recent molecular phylogenetic dating suggests that they appeared during the Silurian or even the Ordovician, with the first terrestrial plants. The Devonian hexapodan record is very scarce and disappointing, with less than six described fossils, all wingless [1]. The early Carboniferous one is even worse, without any fossil insects. But at the very end of this period and during the late Carboniferous, the insect diversity exploded, with a 'sudden appearance' of winged insects with very diverse feeding resources, e.g., carnivorous, plant suckers, leaf eaters, detritivorous, gall-makers, etc. The wingless clades remained a minority and the high diversification of the Carboniferous Hexapoda clearly concerned the winged forms. Wings and flight were probably the first crucial structures and function that allowed the first burst of diversification of the insects. Flight allows them to escape predators, find new resources, sexual partners, and travel to new environments. The most popular fossil insects are the Paleozoic 'giant' dragonflies Meganeuridae. These flying insects with very large wingspans (ca. 70 cm wide) had large bodies but comparable to those of some extant beetles. In fact, the unique really giant Carboniferous terrestrial arthropod was *Arthropleura*, a myriapod that was more than 1 m long. It is supposed that the great increase of oxygen

proportion in the air during the Late Carboniferous favored the gigantism among the terrestrial arthropods, due to their breathing via trachea. The question is in fact more complex, because the winged insects knew a unique situation during the late Paleozoic, as they had no flying vertebrates as predators. As they were the only flying animals, they probably knew a phenomenon of parallel increases of sizes of predators (the Meganeuridae) and preys, the Palaeodictyoptera that also became larger and larger [2]. At the end of the middle Permian, both clades are very diverse, with still very large taxa, while the oxygen proportion began to decrease. The first gliding 'lizard-like' vertebrates are also recorded at the same time, and certainly began to predate these giant insects, which became rarer during the late Permian and no longer existed in the Triassic. The late Carboniferous was also the time of the oldest known holometabolous insects, with complete metamorphosis (wasps, beetles, scorpionflies), and of the oldest bugs (Hemiptera). These were discovered very recently because they were very small insects [3]. They are now the most diverse animal clades, with the 'big five' (Hemiptera, Hymenoptera, Diptera, Lepidoptera, and Coleoptera). But during all the Paleozoic, these insects were clearly very few. Holometaboly in itself was not 'sufficient' to cause their diversification and each of these orders 'separately' diversified during the last 220 Ma. The exact impact on the insects of the most important Permian-Triassic crisis of diversity remains difficult to estimate because there are very few latest Permian and earliest Triassic outcrops with insects. Thus if we know that the Triassic entomofaunas are very different from the Permian ones, we cannot establish that the great changes that occurred between the two periods happened during this crisis or before, during the late Permian or even at the end of the middle Permian. Nevertheless, the Palaeodictyoptera and the Meganisoptera are no longer present in the Triassic, while all the Triassic entomofaunas are clearly 'dominated' by the beetles and other Holometabola. Beetles were still minority during all the Permian in the fossil record. The 'true' flies (Diptera) and crown group of Hymenoptera are also dated from the Middle Triassic. At the end of this period, all the extant orders were present, except, maybe the parasite groups such as fleas (Siphonaptera), whose oldest fossils are middle Jurassic. The 'modern' entomofauna is thus much older than the extant mammal orders. During the Jurassic, the insects continued their diversification, with the first parasitoid wasps (there is no record of parasitoid insects before). The Cretaceous was the second crucial period for the insect (especially the Holometabola) diversification, with the oldest eusocial taxa (termites, wasps, bees, ants). The Albian-Cenomanian (ca. 100 Ma.) was the time of replacement of the gymnosperms by the angiosperms in all the terrestrial biotas, and the time of appearance of nearly all the extant insect families (even some extant genera have this age). It is also an important time of extinctions of several older Jurassic clades, replaced by extant taxa. Only the insects that adapted to the new environments related to flowering plants could diversify. The modern insect-plant relationships were established during the late Cretaceous. The recent new studies of the extraordinarily rich and diverse entomofauna of the 'mid' Cretaceous Burmese amber allowed one to discover that the Cretaceous insect world was as complex, rich and diverse as the extant one. The Cretaceous-Cenozoic (K-T) crisis had clearly a very weak impact on insect diversity, at least at the family level [4]. In fact, there were more extinctions and appearances of new families during the Paleocene-early Eocene than during the K-T crisis. These were periods of global warming followed by global cooling. The entomofaunas suffered the successive periods of cool-

ing of the Oligocene, Miocene, and the Pliocene–Pleistocene glaciations, causing the extinctions of numerous widespread families that survived in small areas (the Australian mastotermitid termites or the Tasmanian hairy cicadid Tetigarctidae are the most spectacular examples). The deep past history of insects is unique, with bursts of diversification ca. 330 Ma, 220 Ma, and 100 Ma ago. The causes of the first one remain poorly known, those of the second one are probably linked to the renewal of the ecosystems during the early Triassic, and the third one to the great floristic change. At least the K–T crisis did not affect much insect diversity. Thus the current crisis of biodiversity that begins to greatly affect the insect biomass, is extremely alarming. It may be more important than the K–T one.] Address: Nel, A., Lab. Ent. Mus. Natn. Hist. Nat., 45 rue Buffon, F-75005 Paris, France. E-mail: [anel@cimr1.mnhn.fr](mailto:anel@cimr1.mnhn.fr)

**20476.** Nur Hikmah, A.; Subchan, W.; Prihatin, J. (2019): Diversity of Odonata species in the Wonoasri resort Meru Betiri National Park. *International Journal of Advanced Research* 7(1): 1183-1188. (in English) ["Meru Betiri National Park is part of Blambangan Biosphere located in East Java Indonesia that consisting of several zone, including core zone, wilderness zone, marine protection zone, utilization zone, traditional zone, rehabilitation zone, and special zone. Wonoasri Resort area included into the rehabilitation zone which consist of a converting forest land to agricultural land. This change of land function will effect on biodiversity included dragonfly. The level of biodiversity of dragonfly, Odonata orders can be used as indicator of quality of the environment. This research needs to be done to know the diversity of dragonfly in the rehabilitation area of Meru Betiri National Park. The results of this research revealed that the order of Odonata consist of 9 species that has been found, which consist of 4 species from Libellulidae, 1 species from Aeshnidae, 1 species from Platycnemididae, 1 species from Euphaeidae, and 1 species from Calopterygidae. The result of the research are expected to be preliminary data for the conservation of biodiversity in Meru Betiri National Park." (Authors)] Address: Nur Hikmah, A., Biology Education Study Program, Faculty of Teacher Training and Education, Univ. of Jember, Indonesia

**20477.** Pelli, A.; Pimenta, P.C. (2019): The life of dragonflies: order Odonata. *Ciencia e Natura*, Santa Maria 41, e43: 1-7. (in English) ["The Odonata Order has a wide geographical distribution. The life cycle is complex, with stage of aquatic nymph, the naiad and winged adults. The research was carried out in peer-reviewed journals at the PubMed and Capes databases, with the keyword Odonata "and" ecology, when the text was complete and available. The used books were researched with insects theme, entomology, available in the collection of the library of the Federal Univ. of the Triângulo Mineiro or private collection. The theoretical framework deals with biology, life cycle, sexual behavior and biodiversity. The Odonata order needs preserved places to reproduce and develop. Some authors mention that certain species of dragonflies can be considered good bioindicators of preserved environment, since they are sensitive to environmental changes. Finally, there is a need for further studies on taxonomy, physiology, and ethology to use this group as a bioindicator in quick works." (Authors)] Address: Pelli, A., Pós-doutora em Ecologia e Recursos Naturais; professora aposentada do Departamento de Biologia e Zootecnia da Universidade Estadual Paulista Júlio de Mesquita Filho. pesquisadora na Faculdade de Engenharia de Ilha Solteira, Brasil. Email: [elizete.lima@unesp.br](mailto:elizete.lima@unesp.br)

**20478.** Pimenta, A.L.A.; Pinto, A.P.; Takiya, D.M. (2019): Integrative taxonomy and phylogeny of the damselfly genus *Forcepsioneura* Lencioni, 1999 (Odonata: Coenagrionidae: Protoneurinae) with description of two new species from the Brazilian Atlantic Forest. *Arthropod systematics & phylogeny* 77(3): 397-414. ["*Forcepsioneura* Lencioni, 1999 is a small genus of eight forest-dependent damselfly species endemic to the Brazilian Atlantic Forest domain. Some of its species are difficult to identify due to their strong morphological similarities. Thus, the use of DNA sequences for taxonomic purposes is warranted. This study examined the diversity among mitochondrial COI and 16S and nuclear PRMT markers in *Forcepsioneura*, identified discrete evolutionary units based on morphological and molecular characters, and described two new species using an integrative approach to propose species-level hypotheses. The first molecular phylogeny of *Forcepsioneura* species, including seven of the 10 valid species, is presented. *Forcepsioneura gabriela* sp.n. and *Forcepsioneura janeae* sp.n. are described and illustrated based on males. *Forcepsioneura gabriela* sp.n. is closely related to *F. garrisoni* Lencioni, 1999 and *F. regua* Pinto & Kompier, 2018 and was included in the light blue group, but was recovered with high K2P COI divergence values relative to *F. garrisoni*. PRMT and ribosomal 16S rDNA sequences were too conservative to distinguish this new species from others of the light blue group. Nevertheless, *F. gabriela* sp.n. can be distinguished from other *Forcepsioneura* by its coloration and shape and length of the ventrobasal process of cercus and MP vein. On the other hand, we were unable to get COI sequences for *F. janeae* sp.n., but morphological diagnostic characters, such as, coloration and shape of the posterior lobe of the prothorax and ventrobasal process of cercus supported its proposal as a new species. A concatenated Bayesian analysis of all markers supported the monophyly of both *Forcepsioneura* and the light blue group of species. This study affirmed the value of COI sequence variation for species-level studies but did not support the use of PRMT and 16S for this group of damselflies, as there was very little interspecific variation between some closely related species." (Authors)] Address: Pinto, A.P., Laboratório de Sistemática de Insetos Aquáticos (LABSIA), Departamento de Zoologia, Universidade Federal do Paraná, P.O. Box 19020, 81531-980 Curitiba, PR, Brazil. Email: [appinto@ufpr.br](mailto:appinto@ufpr.br)

**20479.** Ramamonjisoa, N.; Oiiere, C.; Zheng, X.J.; Kimura, S. (2019): Predation decreases cohort foraging activity and growth, yet increases individual size variation in prey. *Evolutionary Ecology* 33(2): 233-242. (in English) ["There is increasing evidence that size variability within a cohort can have important consequences on community ecology and evolution. It is commonly assumed that the threat of predation can influence cohort size variability by homogenizing foraging behavior among members. We combined predictions of growth–defense models with those from models of genesis of size variation to test the non-lethal effects of size-selective newt and gape-unconstrained aeshnid dragonfly larva predators [*Anax* sp.] on the size structure of *Rhacophorus arboreus* tadpoles in a controlled laboratory experiment. We hypothesized that the predators would induce differential growth and behavioral responses in the tadpoles, and would decrease cohort size variation. The tadpoles reduced activity levels in the presence of the predators, but the responses were generally stronger in the presence of dragonfly larvae. Growth costs were commensurate with the levels of behavioral defense investments in the tadpoles. Despite strong reductions in activity levels and growth, cohort size variation increased in the presence of predators,

contrasting current models on relationship between foraging rates, growth, and cohort size variation in prey. The underlying mechanisms are unclear, but it is possible that reduced rates of movement limited access to food for some cohort members or that predation risk enhanced the expression of behavioral variation among individuals." (Authors)] Address: Ramamonjisoa, N., Ecology Group, Graduate School of Environmental Studies, Nagoya Univ., Nagoya, Japan. Email: noelikanto@d.mbox.nagoya.u.ac.jp

**20480.** Renner, S.; Périco, E.; Dalzochio, M.S.; Sahlén, G. (2019): Ecoregions within the Brazilian Pampa biome reflected in Odonata species assemblies. *Austral Ecology* 44(3): 461-472. (in English) ["Based on vegetation composition, previous studies of the Pampa biome in southern Brazil have defined seven ecoregions within the area. Here, we test this ecoregion approach studying the semi-aquatic insect group Odonata in five of these regions, aiming at comparing the ecoregions to the more traditional environmental predictors of water quality and land cover. Based on a data set of occupancy comprising 99 species distributed between 131 localities, a one-way Permutational Multivariate Analysis of Variance was used to compare differences in the species composition between the ecoregions, followed by a Principal Component Analysis to visualize the variation. The composition varied significantly between all groups tested, and the ordination explained 61.8% of the variance. A partial redundancy analysis of ecoregions, land cover and water quality variables explained 71% of the variance in Odonata community structure. Ecoregion was the most important predictor, followed by water quality and land cover. Within these species assemblies, we could select certain species that were representative of a given ecoregion, to which their distribution within the Pampa biome was entirely or mainly confined. Of 24 representative species 41.7% were rare, while the rest were more abundant and, hence, easier to detect. We suspect that the differences found between the Pampa ecoregions might be due to geology, as such factors may be strong determinants of biodiversity. Specific ecological requirements at the family and genus levels also seemed to act selectively on the species compositions within the ecoregions. Today, the Pampa is highly fragmented due to agricultural activities such as rice cultivation, extensive cattle farming and forest plantations. We suggest that an ecoregion-based approach to the implementation of conservation measures may be the best way to help these distinct species assemblies survive." (Authors)] 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

**20481.** Roman-Heracleo, J.; Novelo-Gutiérrez, R. (2019): Description of the final stadium larva of *Anisagrion allopteron* (Odonata: Coenagrionidae). *International Journal of Odonatology* 22(2): 147-154. (in English) ["The final stadium larva of *Anisagrion allopteron* is described for the first time for Middle America, based upon specimens reared and emerging in the field, from Cartago, Province, Costa Rica. Detailed illustrations are also provided. The larva of this species is characterized by a slender yellow body, premental setae 4+1, five palpal setae, male cerci globose, and caudal lamellae densely tracheate." (Authors)] Address: Novelo-Gutiérrez, R., Instituto de Ecología, A.C. Red de Biodiversidad y Sistemática. Carretera antigua a Coatepec 351, El Haya 91073 Xalapa, Veracruz, Mexico. E-mail: rodolfo.novelo@inecol.edu.mx

**20482.** Rüppell, G.; Hilfert-Rüppell, D. (2019): Touching water by males of *Calopteryx virgo* L. (Insecta: Odonata) in threatening display. *International Journal of Odonatology* 22(1): 31-36. (in English) ["For the first time water dipping behaviour of *Calopteryx* during threatening flight is reported. Four males of *C. virgo* in a small rivulet coming from a spring pool in SW France involved in threatening flights near an opponent dipped a wing into the water, producing conspicuous water rings. One male did this twice and additionally hit the water with its legs, splashing water drops forward. Possible interpretations are discussed." (Authors)] Address: Hilfert-Rüppell Dagmar, Zool. Inst. TU Braunschweig, Fasanenstr. 3, 38092 Braunschweig, Germany. E-mail: d.hilfert@tu-bs.de

**20483.** Russell, S. (2019): Variations in the dragonfly microbiome through life stages and its ability to harbor antibiotic resistant bacteria. M.Sc. thesis, Biological Science, Univ. of Mississippi: V + 45 pp. (in English) ["Juvenile dragonflies (nymphs) may possess the ability to pass their microbiome to the adult life stage through metamorphosis. If this is so, the environment in which the nymph develops may have an effect on the adult microbiome. In this study, the gut microbiomes of 13 species of dragonfly were compared across life stages and when collected from environments at different levels of urbanization. The gut of each dragonfly was removed, DNA extracted, and a portion of the bacterial 16S rRNA gene amplified and sequenced. Gut suspensions were also plated on antibiotic amended plates to determine the potential for dragonflies to contain antibiotic resistant bacteria. Gut microbiomes of dragonflies mainly separated by life stage, with nymphs further separating by the environment from which they were collected from. Dragonfly species was not a significant factor in the separation of either nymph or adult microbiomes. The microbiomes of nymphs and adults differed in levels of their dominant bacterial phyla, with Proteobacteria being dominant in adults, while nymphs showed a higher proportion of Acidobacteria and Bacteroidetes compared to adults. Nymphs also contained bacteria phyla that were not present in the adult microbiome. Both life stages contained antibiotic resistant bacteria, with the guts of dragonfly adults having higher counts of resistant bacteria than nymphs. The environment from which the dragonflies were collected had a significant influence on the counts of resistant bacteria for multiple antibiotics, as did dragonfly species. These results suggest that the gut microbiomes of dragonfly nymphs and adults are fundamentally different, and that both life stages have the potential to contain antibiotic resistant bacteria. The local environment influences both the numbers of these antibiotic resistant bacteria and the composition of the gut microbiome in general." (Author) *Libellula luctuosa*, *Erythemis simplicicollis*, *Pachydiplax longipennis*, *Anax junius*, *Celithemis elisa*, *Orthetrum glaucum*, *Plathemis lydia*, *L. quadrimaculata*, *Celithemis elisa*, *C. eponina*, *Tetragoneuria cynosura*, *Ladona deplanata*, *Sympetrum corruptum*, *Anax imperator*, *Neodythemis preussi*, *S. obtrusum*] Address: Russell, Sarah, Univ. Mississippi, USA. Email: Smruss3913@gmail.com

**20484.** Senn, P. (2019): New localities of southern darter *Sympetrum meridionale* (SELYS, 1841) and banded darter *S. pedemontanum* (MÜLLER in ALLIONI, 1766) (Odonata: Libellulidae) in northern Poland. *Odonatrix* 153: 6 pp. (in English, with Polish summary) [*Sympetrum meridionale*, 28.08.2018 at a pond in Gdynia Dabrowa (UTM: CF33) and two males and one female of *S. pedemontanum* from 14 to 29.09.2018 in three districts (and UTM squares: CF32, CF33, CF42) of Gdansk, Poland. *S. meridionale* is a Ponto-

Caspian/Ponto-Mediterranean species with a Palaearctic distribution extending from north-eastern China and Mongolia, across central Asia, and the Caspian and Black Seas, to Europe, where it is common in France, northern Italy, the Balkans and Greece (KALKMAN et al. 2015). There are increasing reports of sightings from Belgium and The Netherlands, where short-lived populations have been established: in 2018 nearly 400 individuals were sighted in Belgium (<https://waarnemingen.be>) and over 860 in The Netherlands (<https://waarneming.nl>). The species has been found in all of the German states except Schleswig-Holstein, Bremen and Berlin (ROLAND & STÜBING 2014). Although the southern darter is very likely to have reached the U.K. in the last few years, there have not yet been any definitive reports of it from there, probably because of the difficulty in distinguishing it in the field from other darter species (D. HEPPER (quoting from A. PARR), pers. comm.). In the eastern part of Europe, obviously migrating individuals of *S. meridionale* have been trapped on the Curonian Spit on the Baltic coast over a number of years (SHAPOVAL and SHAPOVAL 2017), but the species has not been found in the interior of the Kaliningrad region of Russia or in neighbouring Lithuania (GLIWA and ŠVITRA 2016) or Latvia (KALNINŠ 2017). In Poland, *S. meridionale* has a stable distribution in the south and south-east of the country (BERNARD et al. 2009), but this region lies at the northernmost edge of its known contiguous breeding range in eastern Europe. The species has been sighted in some numbers further north – in the province of Wielkopolska (URAWLEW et al. 2010, URAWLEW 2013) and in the province of Łódź (URAWLEW 2011). But further north still, on the Baltic coast, any southern darters encountered, like this one in Gdynia, must surely be vagrants or migrants, especially in the light of the data from the Curonian Spit (SHAPOVAL and SHAPOVAL 2017), which is only 160 km or so from Gdynia as the crow flies.] Address: Senn, P., ul. Kańskiego 7D/9,81-603 Gdynia, Poland. E-mail: [petersenn47@gmail.com](mailto:petersenn47@gmail.com)

**20485.** Shepard, D. (2019): Pretty Little Predators. Dragonflies are lovely to look at. Unless you're a mosquito or other prey. Montana Outdoors May–June 2019: 17–21. (in English) [<https://fwp.mt.gov/binaries/content/assets/fwpmontana-outdoors/dragonflies.pdf>] Address: not stated

**20486.** Soustelle, C.; Moisset, F.; Lereec le Bricquair, M.-L. (2019): Première mention documentée de *Pantala flavescens* en France métropolitaine (Odonata: Libellulidae). *Martinia* 34(1-2): 61–67. (in French, with English summary) ["First documented record of *P. flavescens* in metropolitan France. – We captured and photographed *P. flavescens* on 12-VIII-2019 in the Gard Dept. This is the first documented record of this migratory species in metropolitan France. We put this observation into the European context in 2019 and discuss the possible origin of the individual." (Authors)] Address: Soustelle, C., Département du Gard, 3 rue Guillemette, F-30044 Nîmes, France. Email: [cyril.soustelle@gard.fr](mailto:cyril.soustelle@gard.fr)

**20487.** Tarwotjo, U.; Rahadian, R.; Hadi, M. (2019): Abundance and diversity of insects on apple water tree during fruit season using different colours and different height placement of sticky trap. *Journal of Physics: Conference Series*, Volume 1217, conference 1: 5 pp. (in English) ["The objective of this research were to determine the abundance and diversity of insects on apple water tree and to measure the effectiveness of several colours and height placement of sticky trap on fruit flies and other insects on apple water tree during fruit season. Sampling of insects was conduct-

ing in an apple water field during fruit season in Demak Central Java Indonesia using sticky trap with methyl eugenol attractant. There were three different sticky trap colours i.e., yellow, white, and blue; and two height of trap placement i.e., one meter and three meter, were used. Parameters observed included the number of fruit flies in each colour, height placement of sticky trap, and the taxon of insects. The data was analysed into Shannon-Wiener diversity and abundances of insects on each colours and height placement of sticky traps. The results showed that the insects found consist of 5 orders (Diptera, Hymenoptera, Coleoptera, Lepidoptera, and Odonata), and 21 families. Most families are found in the order Diptera (8 families), Hymenoptera (4 families), and Coleoptera (3 families). The Diptera family consists of Tephritidae, Culicidae, Agromyzidae, Muscidae, Asilidae, Mycetophyllide, Drosophyllidae, Bombyllidae. In short, the insects on apple water tree were more abundant in 3 meter height and they tend to be attracted on yellow sticky trap." (Authors) Four Calopterygidae were captured at blue sticky traps at a height of three meters.] Address: Rahadian, R., Dept of Biology, Fac. of Sciences & Mathematics, Diponegoro Univ., Jl. Prof. Soedarto, SH, Tembalang, Semarang 50275, Indonesia. Email: [rully.rahadian@live.undip.aci.id](mailto:rully.rahadian@live.undip.aci.id)

**20488.** Taybi, A.F.; Mabrouki, Y.; Berrahou, A.; Sbaa, M.; Brochard, C. (2019): New data on the dragonfly fauna (Odonata) of the Moulouya River Basin and the Oriental Region, Morocco. *Arxius de Miscel·lània Zoològica* 17: 85–108. (in English, with Spanish and Portuguese summaries) ["New data on the dragonfly fauna (Odonata) of the Moulouya River Basin and the Oriental Region, Morocco. We present new faunistic and distributional data on dragonflies (Odonata) from the east of Morocco, comprising the administrative Oriental Region and the Moulouya River Basin and covering an area of 119,268 km<sup>2</sup>. A checklist of 47 species belonging to 19 genera and 7 families is provided. *Pseudagrion s. sublacteum* (Coenagrionidae), *Aeshna mixta* (Aeshnidae), *Sympetrum sinaicum* and *S. meridionale* (Libellulidae) are new for Eastern Morocco, while *Paragomphus genei* (Gomphidae) is new for the Moulouya watershed. Our surveys yield evidence of breeding of *Zygonyx torridus* in the Moulouya River, of *Sympetrum sinaicum* in the Oriental province, and also of *Boyeria Irene*, which remained unrecorded for more than three decades. We confirm the occurrence of *Brachythemis impartita* in the study area, by providing new sightings. Our results also revealed the range expansion of several other species whereas some previously known species in the region were not found. We found a clear dominance of the Palearctic elements, mainly Mediterranean, with a high proportion of Ibero–Maghrebian endemic species. This chorotype pattern is similar to patterns observed for other macroinvertebrate groups in the same study area." (Authors)] Address: Brochard, C., Marsstraat 77, 9742EL Groningen, The Netherlands. E-mail: [info@cbrochard.com](mailto:info@cbrochard.com)

**20489.** Wagner, H.C.; Wiesmair, B.; Paill, W.; Degasperi, G.; Komposch, C.; Schattaneck, P.; Schneider, M.; Aurenhammer, S.; Gunczy, L.W.; Rabitsch, W.; Heimburg, H.; Zweidick, O.; Volkmer, J.; Frei, B.; Kerschbaumsteiner, H.; Huber, E.; Netzberger, R.; Borovsky, R.; Kunz, G.; Zechmeister, T.; Ockermüller, E.; Preiml, S.; Papenberg, E.; Kirchmair, G.; Fröhlich, D.; Allspach, A.; Zittra, C.; Svetnik, I.; Bodner, M.; Vogtenhuber, P.; Körner, A.; Thieme, T.; Christian, E.; Seeber, J.; Baumann, J.; Gross, H.; Hittorf, M.; Rausch, H.; Burckhardt, D.; Graf, W.; Baumgartner, C. (2019): Be-



richt über das fünfte ÖEG-Insektencamp: Biodiversitätsforschung im Nationalpark Donau-Auen (Wien, Niederösterreich). *Entomologica Austriaca* 26: 25-113. (in German, with English summary) ["The fifth insect camp of the Entomological Society of Austria (ESA) was conducted from April 27 to May 2, 2018. Many of the 39 participants were recognized experts on different arthropod groups. Fifty-seven localities within and nearby the Donau-Auen National Park were investigated, and a total of 1265 invertebrate species identified: [...] 19 Odonata, [...]."] (Authors) *Aeshna isocetes*, *Brachytron pratense*, *Coenagrion puella*, *C. pulchellum*, *Erythromma najas*, *Ischnura elegans*, *Pyrrhosoma nymphula*, *Cordulia aenea*, *Epiteca bimaculata*, *Gomphus vulgatissimus*, *Sympecma fusca*, *Leucorrhinia caudalis*, *L. pectoralis*, *Libellula depressa*, *L. fulva*, *L. quadrimaculata*, *Orthetrum albistylum*, *O. cancellatum*, *Platycnemis pennipes*] Address: Borovsky, R., Krobathgasse 2, 9020 Klagenfurt, Austria. E-Mail: borovskyroman@gmail.com

**20490.** Wrynn, T.E.; Gall, B.G. (2019): Palatability and defense of Eastern Newt (*Notophthalmus viridescens*) larvae and metamorphic juveniles against predatory dragonfly nymphs. *Northeastern Naturalist* 26(4): 849-857. (in English) ["We examined the predator-prey relationship between nymphs of the predatory dragonfly *Anax junius* (Common Green Darner) and larval and metamorphic *Notophthalmus viridescens* (Eastern Newt), some of which may contain the potent neurotoxin, tetrodotoxin. First, we conducted a palatability study to determine which life-history stages were palatable to dragonflies. We also tested the metamorphosis and survival rates of larval newts when exposed to predatory dragonflies in small microcosms. Finally, we tested the predator avoidance behavior of larval newts in response to chemical cues from a control, food stimulus, and predatory dragonflies. All life-history stages (small and large larvae, and recent metamorphs) were palatable to dragonflies. In microcosm trials, we found that newt larvae had a lower chance of surviving and transforming when dragonflies were present compared to a control. Finally, newt larvae decreased movement significantly when exposed to predatory dragonfly stimulus compared to either a control or food stimulus. These results suggest dragonflies are effective predators of newts from hatching through metamorphosis. However, the larvae do possess behavioral avoidance mechanisms that likely reduce the risk of predation by dragonflies." (Authors)] Address: Gall, B.G., Hanover College, Hanover, IN 47243, USA

**20491.** Yamada, S.; Tsujino, R.; Takemon, Y.; Urabe, J. (2019): The role of spatial and temporal variations in habitat uses and food habits of larvae in persistent occurrence of multiple odonate species in Mizorogaike Pond, Kyoto, Japan. *Limnology* 20: 181-190. (in English) ["Larvae of many odonate species commonly appear within the same freshwater ecosystem. However, it remains unknown whether there is a dietary separation among the larvae of different species. In this study, we collected different species of odonate larvae in different seasons at various sites on the floating mat of Mizorogaike Pond in Kyoto, Japan, and examined the abundance and gut contents of the dominant species. Our analyses showed that habitat and seasonal abundance of the odonate larvae did not significantly overlap between most pairs of the dominant species. Moreover, the degree of dietary overlap was not related to larval biomass in microhabitats. These results suggest that, although larval food habits were similar among species, the existence of various vegetation types on the floating mat allowed many odonate species to inhabit Mizorogaike Pond." (Authors)]

*Ceriagrion melanurum*, *Libellula quadrimaculata*, *Nannophya pygmaea*, *Sympetrum darwinianum*] Address: Yamada, S., Graduate School of Life Sciences, Tohoku Univ., 6-3 Aramaki Ji Aoba, Sendai 980.8578, Japan. E-mail: sayumi.yamada127@gmail.com

**20492.** Zenteno Clemente, L.; Makoto Nakagaki, J.; Lima-Junior, S.E. (2019): Benthic macroinvertebrates as bioindicators of environmental quality in three streams of the Amambai River basin, Upper Paraná River, Brazil. *Oecologia Australis* 23(4): 951-960. (in English) ["The objective of this study was to evaluate the environmental integrity of three streams (along 13 sampling sites) of the Upper Paraná River Basin using the benthic macroinvertebrate fauna as bioindicators and to answer the following question: Is there spatial variation, related to environmental quality, in the composition of these taxa in the streams? The invertebrates were sampled with a surber collector and for habitat analysis were determined characteristics as stream depth and width, water velocity, dissolved oxygen, pH, temperature, turbidity, and electrical conductivity. The environmental variables were analyzed by Principal Component Analysis in order to synthesize the data and identify the most important variables for ordering the collection sites. For biological analysis, the BMWP index was used. A Canonical Correlation Analysis of the environmental and biotic data was also performed in order to identify correlations between these two sets of variables. The collected macroinvertebrates belonged to four phyla (Nematoda, Annelida, Mollusca and Arthropoda), with Arthropoda being the most representative (54.93%), with the predominance of the order Diptera (30.29%). The most sensitive orders (Ephemeroptera, Plecoptera and Trichoptera) occurred in four sampling sites, corresponding to less impacted ones. Tolerant organisms, mainly chironomids, were found in all streams, including the most impacted places. These results indicate a spatial variation in the composition of the macroinvertebrates taxa in the streams, in response to variation of environmental quality." (Authors) Taxa - including Odonata - are treated at family level.] Address: Zenteno Clemente, Leyzinara, Univ. Estadual de Mato Grosso do Sul, Centro de Estudos em Recursos Naturais, Lab. Ecol., Programa de Pós-Graduação em Recursos Naturais, Rod. Dourados-Itahum, km 12, CEP 79804-970, Dourados, MS, Brazil. Email: leyzinara@gmail.com

**20493.** Zhang, S.; Ochiai, M.; Sunami, Y.; Hashimoto, H. (2019): Influence of microstructures on aerodynamic characteristics for dragonfly wing in gliding flight. *Journal of Biomechanical Engineering* 16(3): 423-431. (in English) ["In this paper, the functionalities of microstructures for dragonfly wing during gliding flight are investigated. Three dragonfly-mimic airfoil-shaped wings with hybrid structures were designed and fabricated as: flat wing, zigzag-edged wing and zigzag-edged wing with pillar structure. Based on the wind tunnel experiments, the zigzag-edged wing structure significantly reduces the drag force in the gliding flight. Moreover, the drag reduction is more effective on the combination of the surface pillar and zigzag-edged structure. In addition, the zigzag-edged wing structure has less influence of Karman vortex street, and the surface pillars reduce the frictional drag and stabilized the streamline in the lower vortex region. Overall, the microstructure of the dragonfly wing is an important element in the aerodynamic study. These findings can enhance the knowledge of insect-mimic wing structure and facilitate the application of Micro Air Vehicle (MAV) in the gliding flight." (Authors)] Address: Sunami, Y., Micro/Nano Technology Center, Tokai Univ., 4-1-1 Kitakaname, Hiratsuka-city, Kanagawa, 259-1292, Japan

**20494.** Šigutová, H.; Šipoš, J.; Dolný, A. (2019): A novel approach involving the use of Odonata as indicators of tropical forest degradation: When family matters. *Ecological Indicators* 104: 229-236. (in English) ["Highlights: •Odonata can be effective and cost-efficient indicators of habitat status. • Coenagrionidae and Libellulidae as indicator groups. • Odonata adult-based bioassessment method is reliable. • The method may be easily applied in any tropical forest habitat worldwide. Abstract: Odonata have proven to be good indicators of freshwater as well as terrestrial habitat conditions. Several studies have shown changes in odonate species richness and/or community composition in response to deforestation, suggesting their potential as bioassessment tools in the tropics. However, former approaches using Odonata as an indicator group required comparative samples from differently disturbed sites and/or knowledge of the focal species environmental specificity. Here, we tested a robust, adult-based bioassessment method assuming that the level of tropical forest degradation reflects the proportional representation of the taxa above species. Based on Web of Science, ScienceDirect, and Scopus databases, we used data from previously published studies linking odonate assemblages to human-mediated disturbances in tropical forests. We hypothesized that along a disturbance gradient (from primary forest to non-forest), (i) the proportion of the suborder Zygoptera (mostly habitat specialists sensitive to deforestation) will decrease in favor of the suborder Anisoptera (high proportion of generalists); and (ii) the proportions of largely generalist families Coenagrionidae and Libellulidae will increase at the expense of other Zygoptera and Anisoptera, respectively. Our results revealed that a ratio of Zygoptera/Anisoptera is a poor indicator of tropical forest conditions, probably because of ecological diversity within these groups. However, the proportions of Coenagrionidae/other Zygoptera and Libellulidae/other Anisoptera significantly increased along a disturbance gradient, suggesting their potential to be a good indicator of well-preserved, altered, and heavily degraded forest habitats. Therefore, our results are in line with studies presenting the usefulness of adult Odonata as versatile indicators for assessing human-mediated changes in tropical forest environments, supporting the practical use of this group in biological monitoring." (Authors)] Address: Dolný, A., Dept of Biology & Ecology/Institute of Environmental Technologies, Faculty of Science, Univ. of Ostrava, Chittussiho 10, 71000 Ostrava, Czech Republic. Email: ales.dolny@osu.cz

**20495.** Adu, B.W.; Ogbogu, S.S. (2020): Odonata assemblages in Akure Forest Reserve, southwestern Nigeria. *Agrion* 24(3): 202-207. (in English) ["A survey of adult dragonflies and damselflies of Rivers Alatori, Aponmu and Owena in Akure Forest Reserve was undertaken with the aim of determining the species assemblage patterns in them. A total of 517 individuals of dragonflies (339) and damselflies (178) was collected, representing 48 species in three families of dragonfly and five families of damselfly. *Trithemis arteriosa* was the dominant dragonfly and well represented in the rivers. *Chlorocypha curta* dominated the damselflies with 21 individuals. Species diversity in River Owena was the richest (Margalef index  $d = 6.267$ , Simpson's dominance index  $— 0.7419$ , and Shannon Wiener IF  $— 2.446$ ). The distribution of species was best in River Alatori (Evenness  $E = 0.3511$  and Equitability  $= 0.6787$ ). Simpson diversity t-test indicated that there was no significant difference in the species diversity among the three rivers studied in Akure Forest Reserve at  $p < 0.05$  (P1: p-value 0.89592, P 2: p-value 0.89497, P 3: p-value 0.99972). Although the forest is under considerable human disturbance the ecosystem is

still conducive for a fairly large number of species of Odonata. Species of some interesting genera such as *Gynacantha*, *Sapho*, *Umma* and *Chlorocypha* were also encountered in the forest. However, a large percentage of species sampled at the forest are ubiquitous, indicating the effect of disturbed environment with altered ecosystem integrity." (Authors)] Address: Adu, B.W., Dept of Biology, Federal Univ. of Technology, Akure, Ondo State, Nigeria. E-mail: williamsadubabs@yahoo.com

## 2020

**20496.** Arenhövel, C.; Lüth, E.; Maul, L.C. (2020): Die Schutzgebiete der Stadt Weimar. Teil XI: Die Geschützten Landschaftsbestandteile "Papierbach - Erlengrund- Herzquelle" und "Wäldchen - Der neue Hof". *Thüringer Faunistische Abhandlungen* 25: 9-34. (in German) [Thüringen, Germany, records of the following taxa are noted: *Chalcolestes viridis*, *Orthetrum coerulescens*, *Libellula depressa*, *Sympetrum* sp.] Address: Arenhövel, C., Martin-Luther-Str. 17, 99425 Weimar, Germany

**20497.** Buczynski, P.; Karasek, T. (2020): Dragonflies (Odonata) of the peat bog Wielkie Bloto (Eastern Poland). *Rocznik Muzeum Górnoskalskiego w bytomiu Przyroda* 26: 1-13. (in Polish, with English summary) ["In 2009 and 2011, the Wielkie Bloto high and transitional peat bog in Zawieprzycze Kolonia was researched (51°22'26"N, 22°47'10"E, UTM: FB29, 13.5 km NE of Lublin). The peat bog with an area of 25.9 ha lies in a depression surrounded mainly by arable fields and buildings of the village of Zawieprzycze Kolonia. There are about 30 peat excavations on it, some of which are used as fish ponds or for fishing. 12 sites representing undisturbed peat bog and peat excavations of various types of usage were examined. 31 dragonfly species were found, including a number of peat bog specialists, some of which were very numerous (*Lestes virens*, *Coenagrion hastulatum*, *Nehalennia speciosa*, *Sympetrum danae*, *Leucorrhinia pectoralis*). Of key importance for their occurrence were: water reaction, its mineralization, water body morphology, the distance between the site and the peat bog border and the occurrence of some plant structures. The immediate vicinity of agrocenoses and the lack of a buffer zone caused that the outer part of the bog had partially transformed fauna, but the central part was well preserved. Particular attention was paid to the occurrence of *Nehalennia speciosa*, which was found in 9 sites. Its number on them was estimated at about 1000 individuals in general and on the entire peat bog – several thousand. The Wielkie Bloto marks the western border of a distribution island of this species, which includes mainly the Łęczna-Włodawa Plain. It is isolated (50-100 km from the nearest sites). At least four populations in this area are very large (several thousand individuals)." (Authors)] Address: Buczynski, P., Dept of Zool., Maria Curie-Skłodowska Univ., Akademicka 19, PL-20-033 Lublin, Poland. E-mail: pawbucz@gmail.com

**20498.** Burwell, C.J.; Hobson, R.G.; Hines, H.B.; Jefferies, M.G.; Power, N.P.; White, D. (2020): Dragonflies and damselflies (Odonata) of the Granite Belt Region, South-Eastern Queensland, Australia. *Australian Entomologist* 47(1): 1-24. (in English) ["Records of species of dragonflies and damselflies were collated from the Granite Belt region (more or less equivalent to the IBRA subregion of the Stant-horpe Plateau) in southeastern Queensland. The Granite Belt is the most northerly extent of the New England Tablelands bioregion and is an elevated region (mostly above

800 m) characterised by adamellite domes and tors. Records of odonate species were collated from our own observations, photographs and collecting activities, specimens in the Queensland Museum, and specimens from other Australian museum collections and observational records from the Atlas of Living Australia. To date, a total of 58 species of Odonata have been recorded from the Granite Belt, 19 species of damselflies from seven families and 39 species of dragonflies from six families. The odonate fauna of the Granite Belt has strong southern affinities with almost all of the region's species occurring in the southern half of the continent. In terms of their distributions in Queensland, a little over half the species recorded from the Granite Belt are widespread extending north into the tropics. Most of the remaining species are restricted to south-eastern Queensland with 13 species potentially restricted within Queensland to the Granite Belt which is the northernmost extent of their national ranges. Some of these restricted species are associated with riverine habitats but more are associated with swamps and wet heaths in the south-eastern parts of Girraween National Park. The long-term persistence of these species in Queensland is at risk due to rising temperatures, more severe and prolonged droughts and more severe and frequent fires due to climate change." (Authors)] Address: Burwell, C.J., Biodiversity Program, Queensland Museum, P.O. Box 3300, South Brisbane, Queensland 4101, Australia. E-mail: [chris.burwell@qm.qld.gov.au](mailto:chris.burwell@qm.qld.gov.au)

**20499.** Cheri, C.R. (2020): Dragonflies and damselflies (Insecta: Odonata) as indicators for riparian condition in Ozark Spring Streams. M.Sc. thesis, Missouri State Univ.: 97 pp. (in English) ["Odonata are often ineffectively sampled during standard stream bioassessments in North America. Subsequently, odonates are not frequently regarded as informative taxa for stream assessment, particularly when monitoring the ecological impacts of organic pollution. I hypothesized that stream-dwelling odonates should be more useful bioindicators for the assessment of riparian conditions surrounding streams because vegetation associated with streams is used for oviposition, roosting and to establish breeding territories. I selected 12 Ozark spring streams that satisfied a broad array of riparian conditions for study. I sampled each stream's odonate and total benthic community along with both instream and vegetation-specific environmental variables. Odonate and total benthic communities were compared across study sites to identify differences in community structure and identify sensitivity to different environmental variables. Odonate community structure alone was highly correlated with riparian-specific vegetation variables. Meanwhile, standard water-quality assessment metrics used by the Missouri Dept of Natural Resources were not useful to indicate riparian habitat condition, based on the total benthic community. I developed tolerance values for use in an odonate-oriented biotic index as a more appropriate metric for assessment of Ozark spring stream riparian conditions. I additionally examined two abundant damselfly species using occupancy modeling associated with riparian habitat. The two species showed different occupancy patterns in relation with the level of riparian impactedness around study sites. Overall, odonates showed greater sensitivity to riparian conditions than did total benthic communities, supporting the idea that this taxon alone is useful for biomonitoring associated with riparian structure around Ozark spring streams. The sensitivity of odonates to riparian conditions in stream ecosystems found in other Nearctic regions should be further studied to identify regional and species differences. Future studies can help land managers make informed decisions concerning riparian conservation

efforts around streams by employing biomonitoring practices that incorporate this apparently riparian-sensitive taxon." (Author) <https://bearworks.missouristate.edu/cgi/viewcontent.cgi?article=4515&context=theses>] Address: Cameron, R.C., Dept of Biology, Missouri State Univ., 901 South National Avenue, Springfield Missouri, 65897, USA. Email: [Cameron205@live.missouristate.edu](mailto:Cameron205@live.missouristate.edu)

**20500.** Cho, S. (2020): Taxonomic and biological notes of the South Korean Odonata revised since 2000. *Odonatologica* 49(1/2): 155-175.["This study provides annotated descriptions of six anisopteran species that were either recently recorded from South Korea or that were subject to taxonomic revision since 2000: (i) Details of *Boyeria karubei* specimens from South Korea are provided for the first time and they are compared with the congeneric *B. maclachlani*. The name *Boyeria jamjari* Jung, 2011, is an unavailable name and the same as *B. karubei*. (ii) *Nihonogomphus minor* Doi, 1943, is for the first time designated a junior synonym of *N. ruptus* (Selys, 1858). (iii) Anal appendages of *Stylurus annulatus* from Korea are compared with those of the Japanese population. (iv) A slight structural difference between *Orthetrum internum* from Korean Peninsula and Japan is highlighted. (v) New records of *Sarasaeschna pryeri* from Jeju Island are detailed and its habitat environment and behavioural ecology are described. (vi) *Brachydiplax chalybea*, a tropical/subtropical immigrant, has successfully colonised Jeju Island, expanding its range to the south-western region of the mainland." (Authors)] Address: Cho, S., Sogang Univ., MA605, 35 Baekbeom-ro, Mapo-gu, Seoul 04107, S. Korea. E-mail: [sungbincho@sogang.ac.kr](mailto:sungbincho@sogang.ac.kr)

**20501.** Choi, J.-Y.; Kim, S.-K.; Kim, J.-C.; Kwon, S.-J. (2020): Habitat preferences and trophic position of *Brachydiplax chalybea flavovittata* Ris, 1911 (Insecta: Odonata) larvae in Yeongsan River wetlands of South Korea. *Insects* 2020, 11, 273; doi:10.3390/insects11050273: 18 pp. (in English) ["In freshwater ecosystems, habitat heterogeneity supports high invertebrate density and diversity, and it contributes to the introduction and settlement of non-native species. In the present study, we identified the habitat preferences and trophic level of *Brachydiplax chalybea flavovittata* larvae, which were distributed in four of the 17 wetlands we examined in the Yeongsan River basin, South Korea. Larval density varied across four microhabitat types: open water area, and microhabitats dominated by *Myriophyllum aquaticum*, *Paspalum distichum*, and *Zizania latifolia*. Microhabitats dominated by *M. aquaticum* had the highest larval density, followed by those dominated by *P. distichum*. The larvae were more prevalent in silt sediments than in plant debris or sand. Stable isotope analysis showed that *B. chalybea flavovittata* is likely to consume, as a food source, other species of Odonata larvae. We conclude that successful settlement of *B. chalybea flavovittata* can be attributed to their habitat preferences. As temperature increases due to climate change, the likelihood of *B. chalybea flavovittata* spreading throughout South Korea increases. We, therefore, recommend continued monitoring of the spread and ecological impacts of *B. chalybea flavovittata*." (Authors)] Address: Choi, J.-Y., National Institute of Ecology, Seo-Cheon Gun 325-813, Chungcheongnam Province, Korea. E-mail: [jyc311@naver.com](mailto:jyc311@naver.com)

**20502.** Cordero-Rivera, A.; Rivas-Torres, A.; Yu, X. (2020): Who eats who: predation events involving *Boyeria irene* (Odonata: Aeshnidae), *Calopteryx haemorrhoidalis asturica* (Odonata: Calopterygidae) and *Vespa velutina* (Hymenop-

tera: Vespidae). *Boletín de la Sociedad Entomológica Aragonesa* 67: 415-417. (in English, with Spanish summary) ["During an intensive behavioural study of a population of the damselfly *Calopteryx haemorrhoidalis asturica*, we observed nine predation events by male *B. irene* on females and males of the damselfly. These cases are described, together with a case of predation of a male *B. irene* by the exotic invasive wasp *Vespa velutina*. The wasp was repeatedly attacking territorial males of *C. h. asturica*, but no case of effective predation was recorded." (Authors)] Address: Cordero Rivera, A., Depto de Ecología e Biología Animal, Univ. de Vigo, E.U.E.T. Forestal, Campus Universitario, 36005 Pontevedra, Spain. E-mail: [acordero@uvigo.es](mailto:acordero@uvigo.es)

**20503.** Cudera, R.B.; Razon, B.C.; Millondaga, K.J.I. (2020): Cultural and ecological significance of Odonata (Insecta) to the T'boli of Lake Sebu, Mindanao, Philippines. *Biodiversitas* 21: 2536-2554. (in English) ["Lake Sebu in Mindanao, Philippines, covered by the Allah Valley Protected Landscape, is home to the T'boli ethnolinguistic group. This study focuses on the cultural and ecological significance of the Odonata (insect order of dragonflies and damselflies) to the T'boli people who are known to have a close connection to their natural environment. According to the T'boli who participated in-depth interviews and focus group discussions, the Odonate larvae of Family Libellulidae and Aeshnidae known as Kmimi and Ogong El respectively are handpicked by the village members as a food source shared in the community when resources are scarce. The Odonata larvae are also used to cure illnesses and are locally believed to be important components for a love potion. In agriculture, T'boli farmers utilize the adult form of Odonata known as Klowong as natural biocontrol agents. Moreover, the Odonata larvae are prominent images in T'boli oral literature, specifically folklore and lullabies, teaching the children the importance of maintaining a harmonious relationship with nature. The results show that the presence of endemic species of Odonata indicates a healthy freshwater environment in the area; thus, studies on the sustainable use and conservation measures of the Odonata should be conducted." (Authors)] Address: Cudera, R.B., Sultan Kudarat State Univ. EJC Montilla, 9800 City of Tacurong, Sultan Kudarat, Mindanao, Philippines. E-mail: [rizalyn\\_borra@umindanao.edu.ph](mailto:rizalyn_borra@umindanao.edu.ph)

**20504.** Deacon, C. (2020): Abiotic and biotic drivers of African aquatic insect distribution. PhD thesis, Stellenbosch Univ.: XIII, 170 pp. (in English, with Dutch summary) ["Freshwater habitats are disproportionately rich in biodiversity, and are among the most threatened, yet poorly protected ecosystems. Aquatic insects make up much of the total freshwater fauna and contribute greatly to ecosystem functioning. At the broad-scale, aquatic insect distribution is driven by combinations of traits, as well as regional climate gradients and historical landscape context. Locally, both aquatic insect species richness and diversity are driven by various aspects related to vegetation and to physiochemical environments. Effective conservation requires thorough understanding of species distribution patterns at various spatial scales. My overall aim here is to combine broad-scale, theoretical biogeography, and local-scale empirical ecology to investigate drivers of aquatic insect distribution across Africa. Species are often binarily classified as 'widespread generalists' or 'narrow-range specialists' based on their ecological traits. Results in Chapter 2 show that ecological and biological traits are highly interactive among dragonflies, and inferring geographical range size based on ecological preference and/or biotope specialization alone should be

approached with caution. Biological traits related to phenology and mobility were also strong drivers of dragonfly range size, indicating that conservation efforts should include multiple species across all habitat types. Regional climates show considerable variation across latitudinal and longitudinal gradients, and determine areas of high species richness and diversity. In Chapter 3, I show strong latitudinal and longitudinal gradients for South-African dragonfly species richness and endemism. Dragonfly assemblage-turnover boundaries coincided with significant geographical features and/or areas where contemporary climate changed from one condition to another. However, these dragonfly assemblage turnover-boundaries were gradual rather than discrete throughout South Africa. At the local scale, natural and artificial ponds contribute greatly to overall biodiversity, especially when they are of high quality and occur in networks across the landscape. I show that ponds characterized by high heterogeneity support diverse aquatic insect assemblages (Chapters 4 and 5). Chapter 4 showed artificial reservoirs, occurring alongside natural ponds in ecological networks, to expand the area of occupancy for most widespread dragonflies, aquatic beetles and true bugs. Some species with specific habitat requirements were confined to natural ponds, suggesting the significance of natural ponds for conserving the full range of insects. Dragonflies, aquatic beetles and true bugs occupy low-quality artificial reservoirs at low abundance to survive the adverse effects of drought (Chapter 5). However, many insects exclusively occupied natural ponds, emphasizing the overall importance of naturalness, and suggests that there is merit in improving artificial reservoirs. This would most likely be by having macrophytes and vegetated banks similar to those of natural ponds. Investigating aquatic insect distribution patterns is important for conservation, and here, I demonstrate the value of dragonflies as model organisms for investigating the drivers of broad-scale distribution patterns. Studying other taxa is also appropriate, as I have demonstrated at the local scale, but not always possible due to limited distribution knowledge. I recommend broad-scale investigations of other complementary taxa to determine their added value for elucidating the drivers of overall insect distribution patterns, and so address our current shortfalls to improve insect conservation." (Author)] Address: Deacon, C., Dept of Conservation Ecology and Entomology, Stellenbosch Univ., South Africa. E-mail: [charldeacon@sun.ac.za](mailto:charldeacon@sun.ac.za)

**20505.** Deliry, C. (2020): Essai sur le genre *Somatochlora* dans le Paléarctique. *Histoires Naturelles* 64: 38 pp. (in French) [<http://deliry.net/pdf/hn64.pdf>]. The following *Somatochlora* taxa are treated: *alpestris*, *arctica*, *clavata*, *daviesi*, *dido*, *exuberata*, *flavomaculata*, *graeseri*, *lingyinensis*, *meridionalis*, *metallica*, *nepalensis*, *sahlbergi*, *shanxiensis*, *shennong*, *taiwana*, *uchidai*, *viridiaenae*] Address: Deliry, C.; Email [cyrille.deliry@orange.fr](mailto:cyrille.deliry@orange.fr)

**20506.** Dorji, T.; Nidup, T. (2020): Study of nymphs of Odonata (Anisoptera & Zygoptera) as a bio-indicator for aquatic ecosystem: A case study in Trashigang District. *Sherub Doenme: The Research Journal of Sherubtse College* 13(1): 16 pp. (in English) ["Nymphs of Odonata are useful indicator of ecosystem functioning and environmental impact in the aquatic system. In this study a total of 222 nymphs belonging to seven Odonata families were collected from four (2 lentic and 2 lotic) study sites. Family Coenagrionidae, Libellulidae and Lestidae were associated with lentic, while Gomphidae, Euphaeidae and Epiophlebiidae were associated with lotic habitat. Aeshnidae is found in both lentic and

lotic habitat but showed strong affinity to lentic habitat. Diversity (H), abundance and richness were compared between and within lentic and lotic habitats. Yonphula Lake is heavily affected by anthropogenic activity and had less abundance and diversity of Odonata Family. Bray-Curtis cluster dendrogram of four study sites based on physicochemical parameters grouped Yonphula Lake, Chiya Lake and two lotic streams (Bamridrang and Gomchu) in separate clades. PCA scatter plot revealed conductivity, total dissolved solids and turbidity as the three physicochemical parameters that characterized Yonphula Lake. A high abundance of Lestidae nymph were found in Yonphula Lake. Aeshnidae, Coenagrionidae and Libellulidae were found in Chiya Lake. Epiophlebia laidlawi and Euphaeidae were found in Gomchu and Bamridrang respectively. Gomphidae was found in both streams. Presence of Epiophlebia laidlawi, Euphaeidae and Gomphidae indicates that they are restricted to pristine streams. As revealed by this study the need for protection and conservation of Lakes and streams to prevent the global decline of Odonata fauna is highlighted." (Authors)] Address: Nidup, T., Dept of Environment and Life Sciences, Sherubtse College, Royal Univ. of Bhutan. E-mail: tsheringnidup.sherubtse@rub.edu.bt

**20507.** Fiebrich & Medinger, V. (2020): Nachweise der Schabracken-Königslibelle (*Anax ephippiger*) am Westlichen Bodensee 2019. *Mercuriale* 20: 33-41. (in German, with English summary) ["In 2019, a strong immigration of *Anax ephippiger* into central Europe was observed. At western Lake Constance, the species occurred in the nature conservation areas "Wollmatinger Ried", "Mettnau" and "Göldern" (Germany) as well as in Gottlieben (Switzerland). *Anax ephippiger* was observed mainly in June and July. A high number (over 50 specimens) were counted at the Wollmatinger Ried. These observations as well as evidence of reproduction in Baden-Württemberg are presented." (Authors)] Address: Fiebrich, M., Liggeringerstr. 15, 78315 Radolfzell, Germany. Email: fiebrich@posteo.de

**20508.** Gänßler, R. (2020): Versuchte Eiablage von *Aeshna cyanea* auf einem Lederschuh (Odonata: Aeshnidae). *Mercuriale* 20: 71-72. (in German) [The author reports an attempt of a female *A. cyanea* to oviposit in a leather shoe; 16-VIII-2020, former Grube Sophia, Baiersbronn-Friedrichstal, Baden-Württemberg, Germany.] Address: Gänßler, R., Talstraße 231, 72250 Freudenstadt, Germany. Email: roland@roland-gaenssler.de

**20509.** Gyeltshen, T. (2020): Eight new additional records of Odonata from Bhutan. *Covid-19 Special Issue Agrion* 24(2) - May 2020: 97-103. ["Findings of the Odonata expedition made between 20-v-2017 and 9-vi-2017 in the eastern districts of Bhutan are presented. Additional collections made by the author are also reported. Eight species: *Anisopleura* sp., *Bayadera longicauda*, *Agriocnemis lacteola*, *Ceragrion azureum*, *Nychogomphus duaricus*, *Idionyx stenseni*, *Sympetrum haematoneura* and *Tramea limbata* are new records for Bhutan." (Author)] Address: Gyeltshen, T., Dept of Environment and Life Sciences, Sherubtse College, Kanglung, Bhutan. Email: thinleytshen@gmail.com

**20510.** Hefler, C.; Noda, R.; Qiu, H.H.; Shyy, W. (2020): Aerodynamic performance of a free-flying dragonfly — A span-resolved investigation featured. *Physics of Fluids* 32(4): 18 pp. (in English) ["We present a quantitative characterization of the unsteady aerodynamic features of a live, free-flying dragonfly under a well-established flight condition. In particular, our investigations cover the span-wise

features of vortex interactions between the fore- and hind-pairs of wings that could be a distinctive feature of a high aspect ratio tandem flapping wing pair. Flapping kinematics and dynamic wing-shape deformation of a dragonfly were measured by tracking painted landmarks on the wings. Using it as the input, computational fluid dynamics analyses were conducted, complemented with time-resolved particle image velocimetry flow measurements to better understand the aerodynamics associated with a dragonfly. The results show that the flow structures around hindwing's inner region are influenced by forewing's leading edge vortex, while those around hindwing's outer region are more influenced by forewing's shed trailing edge vortex. Using a span-resolved approach, we found that the forewing-hindwing interactions affect the horizontal force (thrust) generation of the hindwing most prominently and the modulation of the force generation is distributed evenly around the midspan. Compared to operating in isolation, the thrust of the hindwing is largely increased during upstroke, albeit the drag is also slightly increased during the downstroke. The vertical force generation is moderately affected by the forewing-hindwing interactions and the modulation takes place in the outer 40% of the hindwing span during the downstroke and in the inner 60% of the span during the upstroke." (Authors)] Address: Qiu, H.H., Dept of Mechanical & Aerospace Engineering, The Hong Kong Univ. of Science & Tech., Clear Water Bay, Kowloon, Hong Kong. Email: meqiu@ust.hk.

**20511.** Henningsen, M.; Peitzner, G.; Peitzner, P.; Husemann, M. (2020): An updated checklist of type material of dragonflies and damselflies (Odonata) housed in the Zoological Museum Hamburg (ZMH), Germany. *Evolutionary Systematics* 4: 53-60. (in English) ["We present an updated checklist of type specimens of Anisoptera and Zygoptera housed in the collection of the Zoological Museum of Hamburg (ZMH), part of the Centrum für Naturkunde (CeNak), Germany. We list all types currently housed in the dry and wet collections of the museum and compare the current holdings to the previous catalogues provided by Weidner (1962, 1977). In total, the collection of the ZMH currently houses 84 type specimens belonging to 44 species (38 of which are still valid species); these include 17 holotypes, 7 syntypes, 4 lectotypes, 33 paratypes, and 23 paralectotypes. We here provide an updated list, which includes any changes in taxonomy and the holdings of the museum, but also corrects mistakes of previous catalogues." (Authors)] Address: Husemann, M., Centrum für Naturkunde (CeNak), Hamburg Univ., Martin-Luther-King-Platz 3, 20146, Hamburg, Germany. E-mail: martin.husemann@uni-hamburg.de

**20512.** Hooijmans, F. (2020): Libellen in Meijndel: aantalsverloop tussen 2010 en 2020 langs drie telroutes. *Holland's Duinen* 77: 56-74. (in Dutch) ["In early 2010, three dragonfly routes were set out in the outer dunes of Meijndel. During the period 2010-2020, the dragonflies along these routes were counted ten times a year in the months of May through September. In total, 26 species have been observed. For each species, the number of dragonflies along the three routes is compared to the national index that is derived from the counting results of a few hundred dragonfly routes throughout the Netherlands." (Author) <https://www.dunea.nl/duinen/-/media/bestanden/duinen/hollands-duinen/dunea---hollands-duinen-nummer-77.a.shx>] Address: not stated

**20513.** Hunger, H.; Wildermuth, H. (2020): Kleine Räuber mit großer Beute - *Calopteryx splendens* als Opfer zweier kleiner Spinnen-Arten. *Mercuriale* 20: 1-7. (in German, with

English summary) ["Two anecdotic observations are described where a female crab spider *Misumena vatia* and a female running crab spider *Tibellus oblongus* preyed upon a male *C. splendens*. These events are discussed with respect to camouflage of both ambush hunters, to the body part where they bit the victim and to their ability to hold on to the relatively large, freely hanging prey without falling from their perch." (Authors)] Address: Hunger, H., Institut für Naturschutz & Landschaftsanalyse, Wilhelmstr. 8, 79098 Freiburg, Germany. E-mail: holger.hunger@inula.de

**20514.** Ikemeyer, D.; Schneider, T. (2020): *Anormogomphus kiritshenkoi* Bartenev, 1913 (Odonata: Gomphidae) in Iran: some remarks on its biology, ecology and distribution. *Entomologist's Monthly Magazine* 156(2): 69-78. (in English) ["*A. kiritshenkoi* was found in Iran in 2019, with more than 20 individuals observed at the Karkheh and Shadegan rivers, Khuzestan Province in SW Iran. In 2019 the first floods for decades occurred in this region with high water levels in the floodplains of the lower Karkheh and Shadegan rivers. We believe that this flooding of the lowland plains promoted the appearance of *A. kiritshenkoi*, because the species had not been seen for decades in the region. Most of the specimens were resting on plants of *Suaeda aegyptiaca* growing on small dams close to the riverside, probably creating a favourable microclimate in this saline and hot environment. The region covered by the Karkheh and Shadegan rivers is geographically part of the Mesopotamian Marshes, and *A. kiritshenkoi* was recorded from the Iraqi part of the marshes in the 1920s." (Authors)] Address: Ikemeyer, D., Billerbecker Str. 6, 48329 Havixbeck, Germany; email: DKJlkemeyer@t-online.de

**20515.** Johansson, F.; Berger, D.; Höglund, J.; Meyer-Lucht, Y.; Rödin-Mörch, P.; Sniegula, S.; Watts, P.C. (2020): High variation in last male sperm precedence and genital morphology in the emerald damselfly, *Lestes sponsa*. *Biological Journal of the Linnean Society* 130(3): 497-506. (in English) ["In organisms in which individuals mate multiply, knowledge of the proportion of offspring sired by the last male to mate (P2) under field conditions is important for a thorough understanding of how sexual selection works in nature. In many insect groups, pronounced intraspecific variation in P2 is commonplace. Interestingly, however, in stark contrast to these observations, compilation of P2 data in dragonflies and damselflies (Odonata) indicates that a high P2, seldom below 0.95, is a feature of this taxon. Here we used double digest restriction-site associated DNA sequencing to generate a panel of single nucleotide polymorphisms (SNPs) with which we could determine paternity and estimate values of P2 in the offspring of 19 field-collected pairs of the emerald damselfly *Lestes sponsa*. We also estimated the relationship between P2 and male genital shape of 16 males using geometric morphometric analysis. P2 was variable (range = 0.0–1.0; mean = 0.5), and there was a marginally non-significant ( $P = 0.069$ ) relationship between genital shape and P2, suggesting that males with a high P2 had an aedeagus with a broader tip. We suggest that the high P2-values reported in past studies in Odonata are partly due to the methods used to infer paternity. Use of SNPs to determine patterns of paternity and P2 in odonates is needed for a better appraisal of fitness in odonates, and would open many future avenues for use of odonates as models of sexual selection." (Authors)] Address: Johansson, F., Dept Ecology & Genetics, Animal Ecology, Uppsala Univ., Uppsala, Sweden

**20516.** Kastner, F.; Buchwald, R. (2020): Die Sommerlibelle *Aeshna viridis* – Emergenzverlauf in Nordwest-Deutschland

(Odonata: Aeshnidae). *Libellula* 39(1/2): 63-78. (in German, with English summary) ["The summer dragonfly *A. viridis* – emergence patterns in northwestern Germany – Collecting exuviae from breeding sites is an important method of quantifying emergence patterns, the sex ratio and the approximate population size. In this study the emergence patterns of *A. viridis* in northwestern Germany are described for the three years 2011, 2012 and 2013. *A. viridis* is proved to be a typical summer species with an emergence beginning in the last ten days of June and peaking between the beginning and middle of July. The emergence period lasted six to nine weeks. Differences in the start of emergence between males and females were not detected, but EM50 (the time, when 50% of the population emerged) was not in the same week in 2012 and in 2013. Furthermore, it was possible to determine protandry. The detected sex ratio of *A. viridis* was significantly biased towards the female in all three years. Overall, our results matched existing data for *A. viridis* from other regions in the western distribution area." (Authors)] Address: Kastner, Friederike, AG Vegetationskunde & Naturschutz, IBU, Carl von Ossietzky Universität Oldenburg, 26111 Oldenburg, Germany. E-Mail: Friederike.Kastner@uni-oldenburg.de

**20517.** Kohli, M.K. (2020): Insect micro- and macroevolution through space and time. Rutgers, The State Univ. of New Jersey: VIII + 162 pp. (in English) ["This dissertation uses computational molecular phylogenetic methods to study macro- and micro-evolutionary processes that give rise to biodiversity. Insects, the most diverse group of organisms on earth, are an excellent group for studying and testing various evolutionary hypothesis. I used molecular phylogenetic methods to study the population structure of the northern most Arctic dragonfly species *Somatochlora sahlbergi*. Our results show that this species doesn't follow a common trend seen in evolutionary biology that is, large geographic distances and geographic barriers lead to increased genetic variation. Not only does *S. sahlbergi* appears to interbreed across its entire Holarctic range, there also seems to be almost no variation among European and North American populations in their COI gene fragment (the barcode gene), which is usually extremely variable. These findings seem to be unique to this particular species as none other Arctic dragonflies show such genetic patterns. Upon examining four other distantly related dragonfly species, *Aeshna juncea*, *A. subarctica*, *Sympetrum danae* and *Libellula quadrimaculata*, that have similar Holarctic distribution as *S. sahlbergi*, we find that these species indeed show a geographic structure across their range unlike *S. sahlbergi*. We find that North American and European populations show clear genetic distinction, and this split occurred ~ 400,000 ago, during the Quaternary Period. Lastly, I use the popular divergence time estimation methodology to study the evolutionary past of the Insects and explore how our use of fossil record can influence the outcome of such methods. The results show that fossils can be extremely influential depending on the age of the node (i.e. origin to two lineages). Deep nodes, that represent very old relationships in the evolutionary history, tend to be heavily impacted by the fossil calibrations compared to younger nodes. Older nodes suffer more in their age estimates and the precision around these age estimates in the absence of a fossil. Further, we find that certain groups of insects like flies and butterflies evolve at a much faster rate than most of the other groups of insects." (Author)] Address: Kohli, M., Dept of Invertebrate Zoology, American Museum of Natural History, New York, New York, USA. Email: mkohli@amnh.org

**20518.** Kruger, A.; Morin, P.J. (2020): Predators induce morphological changes in tadpoles of *Hyla andersonii*. *Copeia* 108(2): 316-325. (in English) ["Predators can affect the development, fitness, and behavior of prey species in myriad ways. In response to the threat of predation, tadpoles can alter growth rate, morphology, and foraging behavior. Changes to tadpole development have the potential to alter life history characteristics and are therefore of interest in species of conservation concern. Using experimental mesocosms, we explored how non-lethal predators affected the larval development of the Pine Barrens Treefrog, *Hyla andersonii*, a near-threatened species in the United States. We found that caged dragonflies (*Anax junius*) induced darker tail coloration and deeper tail fins in tadpoles of *H. andersonii*, but the dragonflies did not affect tadpole behavior, survival, or size at metamorphosis. Non-lethal predator presence also induced greater within population variation in the tail color trait compared to populations without predators. This result suggests that there may be underlying genetic variation in the ability to express phenotypically plastic traits, a concept that should be explored further because it has implications for the evolution of inducible defenses. These findings support the existence of an adaptive syndrome among hylid tadpoles, where tadpoles develop conspicuous tail morphology in response to larval dragonfly predators." (Authors)] Address: Kruger, A., Dept of Ecology, Evolution, and Natural Resources, Rutgers Univ., 14 College Farm Road, New Brunswick, New Jersey 08901, USA. E-mail: akruger90@gmail.com

**20519.** Kumar, D.; Shandilya, S.; Khare, V.; Kamle, S.; Chiang, C.-H. (2020): Insect-inspired micro air vehicle with nanocomposite flapping wings and flexure joints. *Proceedings of the SPIE* 11376, id. 1137616: 14 pp.- (in English) ["The biomimicking and understanding of the dynamics of insect flyers is important in developing agile and efficient MAVs. The present study is based on the development of dragonfly inspired MAV and investigation of its motion characteristics. Initially, a tethered two-winged MAV model is constructed, composing of two flapping wings, a flapping mechanism, a chassis, and an external power supply with a function generator. The wings are fabricated with composite stiffeners and membrane. The material of the wings consists of carbon nanotubes (CNTs)/polypropylene (PP) nanocomposite and low density polyethylene (LDPE). The wings are thus lightweight, thin, flexible, and can generate large amplitude bending-twisting motion. The flapping mechanism is constructed with a cantilever type piezoelectric actuator, a mediator mechanism having CNTs/PP nanocomposite flexure joints, and carbon fiber/epoxy composite linkages. The assembled two-winged MAV model has a total mass, body length, wingspan, and aspect ratio of 0.61g, 60.46mm, 90.14mm, and 10.06, respectively. The characteristic flapping frequency of the model is 20Hz, as compared to the wingbeats (or characteristic frequency) of 27.53Hz of an actual dragonfly species, i.e., the *Anax Parthenope* Julius. Measured via digital image correlation (DIC) technique, the fabricated wings exhibit a bending dominated motion during downstroke as well as upstroke. The combined design of flapping wings and flexure joint mechanism is also computationally studied for their structural dynamic characteristics (performed using ANSYS). The first resonance mode or the characteristic frequency, at which the wings have highest deflections, is 17.25Hz. The flexure mechanism is able to generate very large wing deflections (maximum deflection 22.7mm at wing tip) with a sinusoidal heaving input excitation of very small amplitude (0.1mm given at the actuator attachment location). This is useful to

generate higher aerodynamic forces and improve efficiency. The maximum stresses and strains are found at flexure-rigid link and wing stiffener attachment, respectively. Finally, a dragonfly-inspired four-winged MAV is developed. It consists of two pairs of nanocomposite wings with independently actuated flapping mechanisms. Like a natural dragonfly, the forewing and hindwing pairs can be controlled independently and operated at different characteristic frequencies as well as relative phase angles." (Authors)] Address: Kumar, D., Indian Institute of Technology, Kanpur, India

**20520.** Medinger, V.; Fiebrich, M. (2020): Wiederentdeckung der Östlichen Moosjungfer (*Leucorhina albifrons*) im westlichen Bodenseegebiet/Hegau 2019 und 2020. *Mercuriale* 20: 43-51. (in German, with English summary) ["In the Hegau Region, close to Lake Constance, one male individual of *L. albifrons* was observed on July 5 and another two males on July 7, 2019 in the Nature Conservation Area "Ehinger Ried". No further observations (females, couples) were made in 2019. On June 3, 2020, one single male of the species was recorded at the same pond, but was not observed in the following weeks. The last previous record of *L. albifrons* in the region dates back to 1994. The observations indicate that the species has not, as supposed, become extinct in Baden-Württemberg (southwestern Germany). Another possibility is that the observed individuals migrated from populations in Switzerland." (Authors)] Address: Medinger, Verena, Forsteistr.4, 78315 Radolfzell, Germany. Email: VerenaMedinger@gmx.net

**20521.** Palacino-Rodríguez, F.; Palacino-Penagos, D.A.; González-Neitha, A.A. (2020): Odonata from Bahia Solano, Colombian Pacific Region. *Check List* 16(6): 1561-1573. (in English) ["We present a checklist of Odonata species from Bahia Solano Municipality in the Pacific Region of Colombia. Sampling effort included 715 h between December 2018 and January 2020. We recorded 51 species in 27 genera and seven families. The most representative families were Libellulidae with 14 genera and 29 species and Coenagrionidae with 10 genera and 16 species. *Argia fulgida* Navás, 1934 and *Erythrodiplax funerea* (Hagen, 1861) are newly recorded from Chocó Dept. The richer localities in terms of species numbers are conservation areas which are little impacted by indigenous traditional agriculture." (Authors)] Address: Palacino-Rodríguez, F., Grupo de Investigación en Biología (GRIB), Depto de Biología, Universidad El Bosque Av. Cra. 9 No. 131A-02, Bogotá, Colombia. E-mail: odonata17@hotmail.com

**20522.** Palacino-Rodríguez, F. (2020): Larval development and foraging behavior of *Erythrodiplax abjecta* (Rambur) (Anisoptera: Libellulidae) in captivity. *Journal of Asia-Pacific Entomology* 23(4): 1030-1040. (in English) ["Highlights: • *Erythrodiplax abjecta* is univoltine and has a slow lifestyle. • Head width, metathoracic leg length, and total length serve to separate instars. • Total development time was 316 (SD  $\pm 6.6$ ) days, with 13 instars. • Foraging behavior of this species includes active and sit-and-wait strategies. • Foraging strategies were not affected by time of the day or detritus cover. Abstract: Understanding the life cycle of Neotropical odonate species is essential given our scant knowledge of this region. In this paper, we examine growth ratio between instars, development patterns, and active/passive feeding behavior of the Andean dragonfly *Erythrodiplax abjecta* (Rambur, 1842). Larvae were obtained from eggs laid by two females in the laboratory and were maintained at 12–34 °C in individual containers until either their emergence or their death. Larvae hatched 26–57 days after laying, and

the total development time was determined as being 316 (SD  $\pm 6.6$ ) days, including 13 instars. Larval instars were characterized using six morphometric variables. The foraging behavior was analyzed considering the time of day and the percentage of the background covered by detritus. The growth ratios between successive instars averaged 1.9 for FW pad length, 1.6 for HW pad length and 1.2 for head width, head length, metathoracic leg length, and total length. Neither the active foraging nor the sit-and-wait foraging behavior were affected by either time of the day or the percentage of background covered by detritus. *Erythrodiplax abjecta* is univoltine and has a slow lifestyle associated with lentic perennial waters, where larval development and growth rates are low. We provide an equation to estimate the *E. abjecta* larval instars from field specimens." (Authors)] Address: Palacino-Rodríguez, F., Grupo de Investigación en Biología (GRIB), Departamento de Biología, Universidad El Bosque Av, Cra. 9 No, Bogotá 131A-02, Colombia. E-mail: palaznofredy@unbosque.edu.co

**20523.** Payra, A.; Subramanian, K.A.; Chandra, K.; Tripathy, B. (2020): A first record of *Camacinia harterti* Karsch, 1890 (Odonata: Libellulidae) from Arunachal Pradesh, India. *Journal of Threatened Taxa* 12(8): 15922-15926. (in English) ["The large forest dwelling libellulid dragonfly *Camacinia harterti* Karsch, 1890 is recorded from Arunachal Pradesh and India for the first time in 115 years. The present record is based on a single male specimen collected from Namdapha Tiger Reserve, Arunachal Pradesh, India. We provide detailed diagnostic characters in photographs and information on the global distribution of the species." (Authors)] Address: Payra, A., Zoological Survey of India, M Block, New Alipore, Kolkata, West Bengal, 700053 India. E-mail: arajushpayra@gmail.com

**20524.** Piney, B. (2020): Première mention de *Leucorrhinia caudalis* en Loire-Atlantique (Odonata: Libellulidae). *Martinia* 34 (1/2): 29-32. (in French, with English summary) ["First observation of *L. caudalis* in the Loire-Atlantique Dept – The first record of *L. caudalis* in the Loire-Atlantique Dept, as well as an overview of the observations of the species in a few Depts of western France, are mentioned." (Author)] Address: Piney, B., 3 rue de la Frégate, 44470 Thouaré-sur-Loire, France. Email: bertrand.piney@gmail.com

**20525.** Post, M. (2020): Beobachtungen an *Sympecma fusca* im Herbst (Odonata: Lestidae). *Mercuriale* 20: 9-13. (in German) ["In autumn 2020, *S. fusca* was observed near Heidelberg (Germany, Baden-Württemberg). Two females exhibited unusual behavior. A female sitting on a bent stem flexed its abdomen so that it followed the course of the stem. Another female sunbathing on a beech trunk, lifted and lowered single legs alternately. Possible reasons for this behaviour are discussed." (Author)] Address: Post, M., Baden-Badener Str. 5, 69126 Heidelberg, Germany. Email: mjphd@posteo.de

**20526.** Rocha-Ortega, M.; Rodríguez, P.; Bried, J.; Abbott, J.; Córdoba-Aguilar, A. (2020): Why do bugs perish? Range size and local vulnerability traits as surrogates of Odonata extinction risk. *Proc. R. Soc. B* 287: 20192645. <http://dx.doi.org/10.1098/rspb.2019.2645>: 9 pp. (in English) ["Despite claims of an insect decline worldwide, our understanding of extinction risk in insects is incomplete. Using bionomic data of all odonate (603 dragonflies and damselflies) North American species, we assessed (i) regional extinction risk and whether this is related to local extirpation; (ii) whether these two patterns are similar altitudinally and latitudinally;

and (iii) the areas of conservation concern. We used geographic range size as a predictor of regional extinction risk and body size, thermal limits and habitat association as predictors of local extirpation. We found that (i) greater regional extinction risk is related to narrow thermal limits, lotic habitat use and large body size (this in damselflies but not dragonflies); (ii) southern species are more climate tolerant but with more limited geographic range size than northern species; and (iii) two priority areas for odonate conservation are the cold temperate to sub-boreal northeastern USA and the transversal neo-volcanic system. Our approach can be used to estimate insect extinction risk as it compensates for the lack of abundance data." (Authors)] Address: Rodríguez, Pilar, Depto de Ecología Evolutiva, Instituto de Ecología, Universidad Nacional Autónoma de México, Apdo. P. 70-275, Circuito Exterior, Ciudad Universitaria, 04510 Coyoacán, Distrito Federal, Mexico. Email: prodrig@conabio.gob.mx

**20527.** Simonsen, T.J.; Archibald, S.B.; Rasmussen, J.A.; Sylvestersen, R.L.; Olsen, K.; Ware, J.L. (2020): *Danowhetaksa* gen. nov. with two species from the early Eocene Ølst Formation from Denmark, the first Palearctic Whetwhetaksidae (Odonata: Cephalozygoptera). *Zootaxa* 5099(5): 586-592. (in English) ["We propose *Danowhetaksa* n. gen. (Odonata: Whetwhetaksidae) with two new species: *D. birgitteae* n. gen. et sp. and *D. rusti* n. gen. et sp. from the earliest Ypresian Stolleklint clay of the Ølst Formation in northwestern Denmark. Whetwhetaksidae has previously been known only from the Ypresian Okanagan Highlands of far-western North America, the new records are, therefore, the first from the Palearctic Region." (Authors)] Address: Archibald, S.B., Dept of Biological Sciences, Simon Fraser Univ., 8888 Univ. Drive, Burnaby, British Columbia, V5A 1S6, Canada. Email: sba48@sfu.ca

**20528.** Tamm, J.; Dressler, B. (2020): Zur Populationsökologie und Ethologie der Imagines von *Cordulegaster bidentata* an einem Waldbach im Taunus (Odonata: Cordulegastriidae). *Libellula* 39(1/2): 1-25. (in German, with English summary) ["At a small forest stream in the Taunus mountains, Hesse, Central Germany, 16 adult males of *Cordulegaster bidentata* were colour marked and both marked and unmarked individuals were counted during five days when passing the counting station. 69% of the marked males were observed again after the day of capture. Appearing males – marked and unmarked ones – carried out 193 passing flights along the stream, 27% of them were done by marked individuals. One can conclude that the population size was remarkable for this tiny stream. Flight activities were strongest in late morning and late afternoon. Among the patrolling males few individuals were frequently observed, others only occurred sporadically. On the nearby forest streams some more populations of *C. bidentata* were present, but no marked individuals could be found there. Single males of *C. boltonii* occurred along the flight way of *C. bidentata*. This uncommon phenomenon is described and discussed. Moreover, methodological questions of marking and population size calculation are discussed." (Authors)] Address: Tamm, J., 34131 Kassel, Germany. E-Mail: jochen.tamm@t-online.de

**20529.** Tung, T.T.; Dung, L.T. (2020): Food components of the *Brachytarsophrys feae* (Boulenger, 1887) and *Megophrys major* (Boulenger, 1908) in Xuan Son National Park, Phu Tho province. *TNU Journal of Science and Technology* 225(08): 286-291. ["*B. feae* and *M. major* are two useful amphibian species in terrestrial and aquatic ecosystems. However, information on the nutritional characteristics of this



species in Vietnam is currently limited. We have used the method of gastric lavage to collect food samples from 62 stomachs, while simultaneously describing the morphological characteristics of these 2 species. The results showed that the snout-vent length (SVL) of the mature individual *Brachytarsophrys feae* (83 – 89 mm), *Megophrys major* (67.5 – 81 mm), the new distributional records of *Brachytarsophrys feae*. We have identified 18 types of food, in which *Brachytarsophrys feae* has 14 types, accounting for 77.77%; *Megophrys major* has 16 categories, accounting for 88.88%. The most important prey species of *Brachytarsophrys feae* include 5 types of food: (18.48%) of the Phasmatodea; Araneae (17.64%); Insect larvae (15.96%); Coleoptera (12.60%); Hemiptera (10.08%). *Megophrys major* has 4 types of food: Hemiptera (17.21%); Hymenoptera (15.89%); Opiliones (14.56%); Odonata (11.25%). In which, the halfwing set Hemiptera is used by both species." (Authors)] Address: Tung, T.T., Vinh Phuc College, Vietnam. Email: tungbiology3@gmail.com

**20530.** Villanueva, R.J.T.; Dow, R.A. (2020): Review of the Philippine taxa formerly assigned to the Genus *Amphicnemis* Selys. Part III. Genus *Pericnemis*: Bonita- and *Incallida*-groups with descriptions of four new species (Odonata: Coenagrionidae). *Philippine Journal of Systematic Biology* 13(1) (2019): 51-70. (in English) ["The species formerly assigned to the genus *Amphicnemis* Selys, 1863 in the Philippines are reviewed. The present paper is the third of a series and deals with the species transferred to the genus *Pericnemis* Hagen in Selys, 1863. Specimens used in the study are all deposited in museums collections. The bonita- and *incallida*-groups of *Pericnemis* from the Philippines are characterized. A key to species groups within *Pericnemis* is given, and also a key to the males of the bonita- and *incallida*-groups. The bonita-group includes five species: *P. bonita* Needham & Gyger, 1939, *P. flavicornis* Needham & Gyger, 1939, *P. bisaya* spec. nov., *P. gili* spec. nov. and *P. muragbonita* spec. nov. The *incallida*-group includes two species: *P. incallida* Needham & Gyger, 1939 and *P. yakal* spec. nov. Descriptions and illustrations are provided of both sexes of all species." (Authors)] Address: Villanueva, R.J.T., Coll. of Arts & Sciences Education, Univ. Mindanao, Matina, Davao City, 8000 Philippines. E-mail: rjtvillanueva@gmail.com

**20531.** Zuyderduyn, C. (2020): Dagvlinders, libellen en sprinkhanen in Nationaal Park Hollandse Duinen. *Holland's Duinen* 75: 32-37. (in Dutch) ["Butterflies, dragonflies and grasshoppers are among the best known and best studied insect groups in the Netherlands. This article provides an overview of more notable representatives from these species groups observed in Nationaal Park Hollandse Duinen during the 2018 "5000-species year", with a special focus on the status of Red List species." (Author/DeepL) The following odonate species are briefly treated: *Anax ephippiger*, *Cordulia aenea*, *Leucorrhinia caudalis*, *L. dubia*, and *L. pectoralis*.] Address: Casper Zuyderduyn. Email: c.zuyderduyn@staatsbosbeheer.nl

## 2021

**20532.** Álvarez Fidalgo, M.; Miralles-Núñez, A.; Cabanillas, D. (2021): Lista preliminar de los odonatos (Insecta, Odonata) de las Lagunas de Ambroz, un espacio amenazado en el término municipal de Madrid (España). *Boln. Asoc. esp. Ent.* 45(3-4): 229-236. (in Spanish, with English summary) ["Given the need to make known the biodiversity of the Lagunas de Ambroz and its environment due to imminent threats compromising their conservation, a preliminary

checklist of Odonata species is provided. A total of 11 species are recorded, amongst which *Coenagrion scitulum* (Rambur, 1842) is remarkable for being classified as Vulnerable in the Atlas and Red Book of the Threatened Invertebrates of Spain and *Paragomphus genei* (Selys, 1841) for being a rare species in the Community of Madrid. Additionally, comments and proposals for the conservation of the aquatic macroinvertebrate fauna, which depends on the survival of this urban environment in the municipality of Madrid, are included." (Authors) *Anax imperator*, *C. scitulum*, *Enallagma cyathigerum*, *Ischnura graellsii*, *Paragomphus genei*, *Lestes virens*, *Crocothemis erythraea*, *Orthetrum cancellatum*, *Sympetrum fonscolombii*, *Sympetrum striolatum*, *Trithemis annulata*.] Address: Dpto. de Química Orgánica e Inorgánica, Universidad de Oviedo, Avda. Julián Clavería, 8. 33006 Oviedo, Asturias (España). <http://orcid.org/0000-0002-3313-1467>; [madamcoolpix@gmail.com](mailto:madamcoolpix@gmail.com)

**20533.** Basel, A.M.; Simaika, J.P.; Samways, M.J.; Midgeley, G.F.; MacFadyen, S.; Hui, C. (2021): Assemblage reorganization of South African dragonflies due to climate change. *Diversity and Distributions* 27(12): 2542-2558. (in English) ["Aim: Climate change is expected to cause large shifts in species assemblages such as Odonata. Here, we assess the influence of environmental drivers of turnover on Odonata assemblages. Secondly, we map the predicted spatial variation in species composition, first as a gradient of assemblage similarity, and then as discrete bioregions delineating major areas of odonate endemism. Finally, we map the magnitude of expected change in species turnover in response to climate change under two emission scenarios. Location: South Africa. Methods: We used a spatial database comprising of 164 species of odonates and 20 covariates, to explore changes in compositional turnover using generalized dissimilarity models. Bioregions were compiled through various clustering techniques. Results: Present-day odonate bioregions correspond to climatic zones and are clearly separated by transitional zones with rapid spatial turnover. Present odonate bioregions are projected to undergo extensive reorganization by 2050 and 2070. Temporal turnover in species composition is expected to reach up to 80% in the large arid interior and 64% along the coast. Half of all South Africa's protected areas are likely to experience climate induced changes to dragonfly bioregions in the near future. Main conclusions: Species assemblages are rapidly changing. This work highlights future shifts in climate will result in complex and nonlinear responses in Odonata communities. With ongoing climate change, current odonate bioregions are predicted to expand while others will contract considerably in size within the next 30 years. The current demarcated protected areas may be inadequate to protect dragonflies as climates change. Odonata can be used to track forefronts of climate change, which will likely affect a larger array of taxa as well." (Authors)] Address: Basel, Ashleigh, Biodiversity Informatics Unit, Dept Mathematical Sciences, Stellenbosch Univ., Matieland 7602, South Africa. Email: A.Basel@cgiar.org

**20534.** Bastos, R.C.; Brasil, L.S.; Oliveira-Junior, J.M.B.; Carvalho, F.G.; Lennox, D.D.; Barlow, J.; Juen, L. (2021): Morphological and phylogenetic factors structure the distribution of damselfly and dragonfly species (Odonata) along an environmental gradient in Amazonian streams. *Ecological Indicators* 122, March 2021, 107257: 13 pp. (in English) [oas 65: "Highlights: • Odonata order contains distinct species groups that share similar responses to environmental change. • Response patterns were related to phylogeny structure and morphology similarity. • The mentioned above

relationship appears to be complex and no clear. • We believe that other factors as land use historical can effect these Odonata. • Despite this the response patterns had presented some differences between the areas. Abstract: A range of factors may determine the structure of ecological communities in time and space, in particular niches, dispersal limits, and the evolutionary history of the species. In the last decades, the traditional focus of community ecology on species diversity and composition have been supplemented by approaches incorporating functional traits and phylogeny. Following this perspective, we evaluated the response pattern of adult damselflies and dragonflies (Odonata) along a gradient of environmental disturbance in Brazilian Amazonia, with the objective of identifying subgroups of species that respond in a similar manner to environmental filters. The study tested the hypothesis that the subgroups of species with similar responses to the environmental gradient are structured phylogenetically and will be morphologically more similar to one another than they are to the other species. Adult odonates were sampled in 98 Amazonian streams, 48 in the region of Santarém and Belterra and 50 in the municipality of Paragominas, both located in the Brazilian state of Pará. The study was based on an ecological niche modeling approach and statistical significance testing methods to identify groups of species. These species groups (latent classes) were then associated with their morphological characteristics (Abdomen Length and Thorax Length) and phylogenetic relationships. Four latent classes, containing 34 species, were generated for each region. The latent classes of the Odonata formed along the gradient of anthropogenic impact had effects of phylogenetic proximity and the species' morphological similarity. Therefore, species belonging to the same latent class are more morphologically similar and have greater similarities in evolutionary history. It seems likely, however, that other processes may be important for the understanding of the structuring of the latent classes, such as intra- and interspecific relationships, environmental plasticity, and the history of land use. Both morphology and phylogeny are important for understanding species' responses to environmental gradients." (Authors) *Argia tinctipennis* Selys, 1865, *Argyrothemis argentea* Ris, 1909, *Mnesarete aenea* Selys, 1853, *Psaironeura tenuissima* Selys, 1886, *Argia infumata* Selys, 1865, *Chalcopteryx rutilans* Rambur, 1842, *Epipleoneura capilliformis* Selys, 1886, *Perithemis lais* Perty, 1833, *Diastatops obscura* Fabricius, 1775, *Erythrodiplax basalis* Kirby, 1897, *Erythrodiplax fusca* Rambur, 1842, *Orthemis discolor* Burmeister, 1839, *Chalcopteryx radians* Ris, 1914, *Epipleoneura haroldoi* Santos, 1964, *Erythemis vesiculosa* Fabricius, 1775, *Hetaerina indepressa* (Garrison, 1990), *Micrathyria romani* Sjoestedt, 1918, *Mnesarete smaragdina* Selys, 1869, *Phasmonera exigua* Selys, 1886, *Dasythemis esmeralda* Ris, 1910, *Neoneura luzmarina* De Marmels, 1989, *Epipleoneura spatulata* Racenis, 1960, *Erythrodiplax nigricans* Rambur, 1842, *Micrathyria artemis* Ris, 1911, *Gynacantha membranalis* Karsch, 1891, *Heteragrion aurantiacum* Selys, 1862, *Perilestes kahli* Williamson & Williamson, 1924, *Protoneura tenuis* Selys, 1860, *Epipleoneura westfalli* Machado, 1986, *Tigriagrion aurantinigrum* Calvert, 1909, *Argia smithiana* Calvert, 1909, *Heliocharis amazona* Selys, 1853, *Acanthagrion adustum* Williamson, 1916, *Rhodopygia cardinalis* (Erichson in Schomburgk, 1848)] Address: Brasil, L.S., Av. Perimetral, n 1901/1907 - Terra Firme, Belém, Pará, CEP 66017-970, Brazil. E-mail: brasil\_biologia@hotmail.com

**20535.** Beaune, D.; Sellier, Y. (2021): Stream restorations with meanders increase dragonfly and damselfly diversity and abundance, including an endangered species. *Journal*

for Nature Conservation 60 (2021) 125950: 10 pp. (in English) ["Highlights: • Many streams were artificially linearized for human usage, but with probable negative effect on biodiversity. • Two streams were restored with meanders and diggings allowing water to run again. • On both restored streams, diversity and abundance of Odonata (dragonflies & damselflies) significantly increased. • The endangered southern damselfly (*Coenagrion mercurial*) colonized both streams after restorations. Abstract: This study presents examples of successful restoration projects for biodiversity conservation. In West France, the Pinail National Nature Reserve is a protected wetland interspersed with more than 6000 ponds. This wetland is inhabited by 50 species of Odonata and thus is a key biodiversity area for damselflies and dragonflies conservation. In the past, when the limestone was exploited, the streams of the plateau were artificially channeled rectilinearly, running to the Vienne River. Eventually streams were blocked by biomass and sediments resulting in water flowing mainly underground. In 2011, two restoration projects dug and recreated lost habitats such as running streams and meanders by openly reconnecting bodies of standing water (two sites: Rivau (207m) and Hutte (400m) streams). The Odonata species diversity and abundance are annually monitored following transect inventories since 1995 and still ongoing. Diversity and abundance were compared before and after the restoration. The abundance and species diversity increased at both sites due to the addition of lotic habitats and consequently additional new species. The number of observed species almost doubled on the Rivau (from 5.4 observed species to 9.9 spp). By extrapolation the total species number on site increased from 15-18 spp to 29-37 spp. The abundance also greatly increased with 770% more individuals on the Rivau. Similarly, on the 400m Hutte stream, the extrapolated diversity increased from 31-38 spp to 35-43 spp; as well as the abundance with 475% more individuals. These restoration projects created new habitats leading to local biodiversity enrichment and conservation success. More specifically, *Coenagrion mercuriale* (Odonata: Zygoptera), one of Europe's most threatened damselflies and listed in the European Habitats directive, successfully recolonized the Rivau stream and colonized the Hutte stream." (Authors)] Address: Beaune, D., UMR CNRS/uB 6282 Biogéosciences Université de Bourgogne, 6 bd Gabriel, 21 000 Dijon, France. E-mail: david.beaune@u-bourgogne.fr

**20536.** Bekkouche, B. (2021): The neural mechanisms of selective attention. Investigation of insect selective attention during visual object tracking using neurophysiology, neuroanatomy, computational modelling. PhD thesis, Faculty Science, Lund Univ., Sweden: 101 pp. (in English) ["The brain simulates the world around us using sensory information and provides an estimation of reality in which actions can be executed. This estimation of reality is controlled by attention which decides which information is accepted, further processed and ignored. The process of attending a certain part of the sensory information while ignoring other parts is called selective attention. I have studied visual selective attention on a neuronal level in hoverflies and dragonflies. These insects are highly skilled at object tracking in behaviors related to defending territories, mating or hunting prey. They have very small brains with few neurons compared to mammals and yet execute object tracking tasks with impressive accuracy. In Paper 1 we compare insect brain tissue preparation techniques for optimizing the amount of neuronal morphology details that can be captured during microscopy imaging. We then use these techniques to acquire a highly detailed neuron morphology and further apply

the techniques in the other papers. In Paper 2 we captured the morphology of a hoverfly target-tracking neuron using techniques from Paper 1. I measured a type of short-term memory called response facilitation in a population of these hoverfly target-tracking neurons. This was measured by comparing the response of long (primed) versus short (unprimed) target traveling paths. In the next experiment I measured the neuronal response while distracting the neuron with another target moving outside the part of the visual field in which that neuron responds. Both primed and unprimed distractors reduced the response, indicating that the attention was sometimes moved to the distractor. This phenomenon could potentially be implemented using long range inhibition as part of an attention mechanism. Paper 3 & 4 involved computational modeling of target tracking neurons using a neuronal morphology from the dragonfly. We show that a receptor (N-methyl-D-aspartate receptor), known for its involvement in short term memory processing, have some of the properties required to generate facilitation. Altogether, the results of this thesis have improved our knowledge and understanding of the neural mechanisms of selective attention in hoverflies and dragonflies. It has also paved the way for future studies to further expand on this knowledge and understanding." (Author)] Address: not stated

**20537.** Benken, T.; Schwandner, J. (2021): Landesweite Artenkartierung Libellen – Aktueller Zwischenstand. *Mercuriale* 20: 13-22. (in German, with English summary) ["Species mapping of dragonflies in Baden-Württemberg, current interim status - The existing occurrences of the FFH-species [Coenagrion mercuriale, Stylurus flavipes, Ophiogomphus cecilia, Leucorrhinia pectoralis, Sympecma paedisca] are being checked for the current reporting period. For long-term monitoring, permanent areas in eight natural areas of the country are also designated. The current status of these programmes is presented." (Authors)] Address: Schwandner, Julia, LUBW – Landesanstalt für Umwelt Baden-Württemberg, Griesbachstr. 1-3, 76185 Karlsruhe, Germany. Email: julia.schwandner@lubw.bwl.de

**20538.** Benken, T. (2021): Vierzig Jahre SGL, zwanzig Jahre SGL e.V. – Ein Ausblick auf den nächsten Sammelbericht. *Mercuriale* 20: 1-11. (in German, with English summary) ["Forty years of SGL, twenty years of SGL e.V. - An outlook on the next status report. – In times of climate change it becomes more and more important to document the changes of fauna and flora. For the dragonflies of Baden-Württemberg, the data stock has doubled in the last 15 years, therefore the SGL plans to publish a new status report. The presentation will cover three periods with comparable data. Thereby, the aspects phenology, altitudinal distribution, and proof of development will be particularly considered." (Author)] Address: Benken, T., Lindenstr. 86, 77855 Achern, Germany. Email: theodor@benkenhome.de

**20539.** Bernal Sánchez, A.; Conesa García, M.A. (2021): First record of *Pantala flavescens* (Fabricius, 1789) (Odonata, Libellulidae) in the Iberian Peninsula. *Boln. Asoc. esp. Ent.* 45(3-4): 321-323. (in Spanish, with English title) ["On 29 August 2021, at 11:00 h (official time two hours ahead of UTC time, ROA), a male imago was sighted flying in a broom (*Retama sphaerocarpa* L.) (Fig. 1), UTM 30S 235639.4/4008713.6, datum WGS89, and it was seen again at 20:00 h. On 30 August, at 10:00 h. another specimen could be seen in the same area (it is possible that it was the same one observed in previous days). On this last occasion the imago perched and could be photographed in its natural position on the dry branches of a broom (Fig. 2)."

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**20540.** Chacko, S.; Kandambeth, P.P. (2021): Studies on trematode metacercariae infecting libellulid larvae from the Western Ghats, Wayanad region. *Journal of Parasitic Diseases* 46: 159-165. (in English) ["Understanding the host specificity of trematode larvae is vital in predicting the mode of trophic level transfer of trematode parasites and their evolution. In this study, six species of trematode metacercariae, *Eumegacetes* sp., *Orthotremata monostomum*, *Ganeo tigrinus*, *Mehraorchis* sp., *Pleurogenoides* sp. and *Phyllodistomum* sp. infecting the larvae of the odonate family Libellulidae from the water bodies in the Wayanad region of the Western Ghats are recorded. The prevalence of infection of these metacercariae was 5.8%, 2.0%, 10.4%, 9.1%, 2.6% & 1.3%, respectively. Further, the mean intensity of infection was estimated to be 4.44, 1.67, 5.38, 6.21, 6.0 & 17.5 and the mean abundance 0.26, 0.03, 0.56, 0.56, 0.16 & 0.23 respectively." (Authors)] Address: Kandambeth, P.P., Ecological Parasitology and Tropical Biodiversity Laboratory, Dept of Zoology, Kannur Univ., Mananthavady Campus, Wayanad, Kerala, 670645, India

**20541.** Chovanec, A. (2021): Dokumentation der Eiablage von *Anax imperator* (Odonata: Aeshnidae) in einem strömenden Bereich. *Mercuriale* 21: 75-79. (in German, with English summary) ["Documentation of oviposition of *A. imperator* in a streaming area. – *A. imperator* was observed when depositing eggs in a small dead twig of *Fraxinus excelsior* situated in the current (25 cm/s) of a lowland river in Eastern Austria. The female preferred this sunny place in the middle of the river for egg deposition compared to shaded lentic riverbank areas." (Author)] Address: Chovanec, A., Krottenbachgasse 68, A-2345 Brunn am Gebirge, Austria. Email: andreas.chovanec@bmlrt.gv.at

**20542.** Collantes González, R.; Jerkovic, M.; Arteaga, A.B. (2021): Insectos y arañas asociados a plantas ornamentales en David, Chiriquí, Panamá. *Insects and spiders associated with ornamental plants in David, Chiriqui, Panama. Aporte Santiaguino* 14(1): 9-20. (in Spanish, with English summary) ["The purpose of this work was to know the insects and spiders associated with ornamental plants in David, Chiriquí, Panama. For this, five random samplings were carried out in four locations, randomly selecting 35 plants which belong to 15 families and 20 species. The soil, branches and foliage levels were reviewed, manually collecting the arthropods found. The identification of the specimens was made by consulting specialized documentation and a photographic record was kept. The results obtained indicated that three species of spiders and 15 species of insects were associated with nine plant species. The predominant spiders were *Argiope argentata* (Araneidae) and *Leucauge venusta* (Tetragnathidae). About defoliating insects, the Family Diapheromeridae (Phasmatodea) and *Oiketicus kirbyi* (Lepidoptera: Psychidae), were found in *Arecaceae*; three species of Orthoptera associated with Toro grass, of which *Taeniopoda varipennis* (Romaleidae) stood out; Scarabaeidae and Chrysomelidae (Coleoptera) in *schefflera*. The biting-sucking species were represented by nymphs of *Blissus* sp. (Hemiptera: Blissidae) on Toro grass; *Aphis* sp. (Hemiptera: Aphididae) and *Coccus* sp. (Hemiptera: Coccidae), associated with ants (Hymenoptera: Formicidae); nymphs and adults of *Membracis mexicana* (Hemiptera: Membracidae), in *schefflera* shoots and damage by *Gynai-kothrips uzeli* (Thysanoptera: Phlaeothripidae) in *Ficus*. The predatory insects were represented by eggs and larvae of

Chrysopidae (Neuroptera), found in *schefflera* and adults of *Orthemis ferruginea* in water surfaces. The absence of parasitoids, pollinators and the low number of taxa found could be due to the use of synthetic pesticides, which breaks the trophic balance; although the surrounding wild vegetation can serve as a biological corridor for the species survival." (Authors)] Address: Collantes González, R., Universidad de Panamá. Facultad de Ciencias Agropecuarias, Chiriquí, Panamá. Email: rdcg31@hotmail.com

**20543.** Costa Bastos, R.; Schlemmer Brasil, L.; Oliveira-Junior, J.M.B.; Geraldo Carvalho, F.; Lennox, G.D.; Barlow, J.; Juen, L. (2021): Morphological and phylogenetic factors structure the distribution of damselfly and dragonfly species (Odonata) along an environmental gradient in Amazonian streams. *Ecological Indicators*, 122: 13 pp. (in English) ["A range of factors may determine the structure of ecological communities in time and space, in particular niches, dispersal limits, and the evolutionary history of the species. In the last decades, the traditional focus of community ecology on species diversity and composition have been supplemented by approaches incorporating functional traits and phylogeny. Following this perspective, we evaluated the response pattern of adult damselflies and dragonflies (Odonata) along a gradient of environmental disturbance in Brazilian Amazonia, with the objective of identifying subgroups of species that respond in a similar manner to environmental filters. The study tested the hypothesis that the subgroups of species with similar responses to the environmental gradient are structured phylogenetically and will be morphologically more similar to one another than they are to the other species. Adult odonates were sampled in 98 Amazonian streams, 48 in the region of Santarém and Belterra and 50 in the municipality of Paragominas, both located in the Brazilian state of Pará. The study was based on an ecological niche modeling approach and statistical significance testing methods to identify groups of species. These species groups (latent classes) were then associated with their morphological characteristics (Abdomen Length and Thorax Length) and phylogenetic relationships. Four latent classes, containing 34 species, were generated for each region. The latent classes of the Odonata formed along the gradient of anthropogenic impact had effects of phylogenetic proximity and the species' morphological similarity. Therefore, species belonging to the same latent class are more morphologically similar and have greater similarities in evolutionary history. It seems likely, however, that other processes may be important for the understanding of the structuring of the latent classes, such as intra- and interspecific relationships, environmental plasticity, and the history of land use. Both morphology and phylogeny are important for understanding species' responses to environmental gradients." (Authors)] Address: Costa Bastos, R., Graduate Program in Ecology, Universidade Federal do Pará, Belém, Pará, Brazil. Email: bastosrc.bio@gmail.com

**20544.** de Resende, B.O.; Ferreira, V.R.S.; Brasil, L.S.; Calvão, L.B.; Mendes, T.P.; de Carvalho, F.G.; Mendoza-Penagos, C.C.; Bastos, R.C.; Brito, J.S.; Oliveira-Junior, J.M.B.; Dias-Silva, K.; Luiza-Andrade, A.; Guillermo, R.; Cordero-Rivera, A.; Juen, L. (2021): Impact of environmental changes on the behavioral diversity of the Odonata (Insecta) in the Amazon. *Scientific Reports* 11(1): 9742 (2021): 12 pp. (in English) ["The odonates are insects that have a wide range of reproductive, ritualized territorial, and aggressive behaviors. Changes in behavior are the first response of most odonate species to environmental alterations. In this con-

text, the primary objective of the present study was to assess the effects of environmental alterations resulting from shifts in land use on different aspects of the behavioral diversity of adult odonates. Fieldwork was conducted at 92 low-order streams in two different regions of the Brazilian Amazon. To address our main objective, we measured 29 abiotic variables at each stream, together with five morphological and five behavioral traits of the resident odonates. The results indicate a loss of behaviors at sites impacted by anthropogenic changes, as well as variation in some morphological/behavioral traits under specific environmental conditions. We highlight the importance of considering behavioral traits in the development of conservation strategies, given that species with a unique behavioral repertoire may suffer specific types of extinction pressure." (Authors)] Address: de Resende, Bethania, Lab. de Ecologia e Conservação, Instituto de Ciências Biológicas, Universidade Federal do Pará, Belém, Brazil. Eemail: bethania-nx@hotmail.com

**20545.** Dirisu, R.; El Surtasi, E.I. (2021): Bioindicators of lotic and lentic ecosystems in Agbede wetlands (Southern Nigeria), using macroinvertebrate tools. *Scientific African* 14, November 2021, e01000: 15 pp. (in English) ["Macroinvertebrates are globally acclaimed as essential tools for biological monitoring in freshwater ecosystems. The essence of this study was to establish bioindicators for Agbede wetlands located in Edo- North in southern Nigeria. Both lotic (stations 1 to 3) and lentic (stations 4 to 7) water bodies were sampled between December, 2012 and May, 2014. Standard methods were applied for macroinvertebrates collection from the littoral habitats. The results of physicochemical parameters indicated that; flow velocity influenced the lotic environments, while temperature, electrical conductivity and turbidity mostly influenced the lentic water bodies. Three major pollution indicator groups were realised across the ecotypes and they are; the pollution sensitive (Ephemeroptera, Coleoptera and Trichoptera), the facultative (Anisoptera, Zygoptera and Decapoda) and the pollution tolerant groups (aquatic snail, Oligochaete and Leech). Pollution tolerant group was preponderance across the study stations but was significantly predominant in the lentic stations, especially during the dry seasons (November to March). The performance of pollution tolerance index (PTI) model, biodiversity indices and Multivariate analyses; all showed high taxa abundance, species composition and diversity across the stations. Similarly, PTI model revealed moderate water quality particularly in the lentic stations (values between 17 and 18) indicating healthy ecosystems, which was also proven by the biodiversity indices. The implication of this work is that, it will remain a comprehensive guide on biomonitoring programmes of the water bodies and the catchment areas as the water bodies are not in a bad quality." (Authors) All odonate taxa are misidentified because they represent European or American taxa.] Address: Dirisu, R. Dept of Animal and Environmental Biology, Faculty of Life Sciences, Univ. of Benin, Benin City, Edo State, P.M.B. 1154, Nigeria. E-mail: dedonrahman10@yahoo.com