

Increased salinity of inland waters directly or indirectly has an effect on benthic communities, by influencing the behaviour as well as the physiology of the organisms. In a comparative study, we investigated traits and adaptations of the freshwater shrimp *Gammarus pulex* from two confluent streams with different salinity levels, situated in undulating lowland of northwest Germany - Central Europe (Saltwater Creek SWC: 6.0 to 7.5 g/L NaCl, Freshwater Creek FCW: approx. 0.3 g/L NaCl). In the SWC, *G. pulex* lives in the fringe range of physiological tolerance described for the species. The study targeted the mechanism that allows *G. pulex*, using with salinity as a case example, for extension of its distribution range along an environmental gradient and outlasting of extreme physiological conditions.

Between 2012 and 2015, macrozoobenthic communities were sampled semi-quantitatively (based on area-time-reference), and abiotic environmental variables were recorded during each sampling campaign. In laboratory analyses, *G. pulex* populations were tested for morphological parameters and age structure, physical performance, glycogen contents, and as a measure of stress response for hsp70-expression at a 27°C heat shock.

G. pulex dominates in both benthic communities with SWC harbouring a significantly poorer and uneven taxa diversity compared to FWC. Contrarily thereto, *G. pulex* found in SWC represents a stable population. Morphological and experimental analyses revealed that *G. pulex* from the SWC showed a complex combination of ecological and physiological traits, with differences to FWC individuals being predominantly significant: females have a lower body weight, yet physical activity of both sexes is higher in saltwater gammarids, but also decreases faster during keeping time of one month. At the same time, mortality raises notably. Short-term energy storage, determined by glycogen content, is greater, and base level of hsp70 as well as intensity of expression following heat induced stress is markedly more intense. Based on these findings, we conclude that *G. pulex* tolerates elevated salinity levels by boosting metabolic turnover which apparently only can be maintained under natural conditions of relative system steadiness and availability of resources.

Questions to what extent these mechanisms explain specific salinity tolerance of *G. pulex*, or whether the response pattern found mirrors a general potential of euryoeciousness and thus invasiveness, should motivate further specific investigations.

26-O The productivity of the macroinvertebrate prey of the platypus in the upper Shoalhaven River, New South Wales, Australia. *Richard Marchant*¹ - *Tom Grant*²

*Department of Entomology, Museum Victoria, Melbourne, Australia*¹ - *School of Biological, Earth and Environmental Sciences, University of New South Wales, Sydney, Australia*²

The platypus, *Ornithorhynchus anatinus*, feeds almost exclusively on benthic macroinvertebrates, yet no attempt has been made to link its energy demands with the productivity of its benthic macroinvertebrate prey. In the upper Shoalhaven River, southern New South Wales, we estimated macroinvertebrate production (in 2009 and 2011) from benthic samples and recorded platypus diet (2009 only) from cheek pouch samples. Ephemeroptera, Trichoptera and Chironomidae were the most numerous of 6 major groups in both the cheek pouches and the benthic samples. Three other groups (Odonata, Coleoptera, Sphaeriidae) were much less abundant in the benthos, but Odonata were common in the cheek pouches. In both years the Ephemeroptera, Trichoptera and Chironomidae had levels of production that were an order of magnitude higher than those of the three other groups. Rank correlation indicated that the most productive taxa were those most likely to occur in the cheek pouches, indicating the platypus did not select its prey. Total macroinvertebrate production for the six groups varied from 7.8 (in 2009) to 13.1 (in 2011) g dry weight per square meter per year. Previous estimates of field metabolic demand of the platypus enabled calculation of the number that could be supported by a given level of production. The observed levels of production were sufficient to support 13-27 platypuses in 2009 and 22-45 in 2011 along a 1.5km reach of the river. Despite considerable landscape change, productive foraging habitat for the platypus persists in rivers of southern New South Wales.

26-O Status quo of knowledges on Italian high altitude lacustrine macroinvertebrates. *Matteo Ruocco*¹ - *Ivano Ansaloni*¹ - *Daniela Prevedelli*¹ - *Silvia Zaupa*² - *Angela Boggero*²

*Department of Life Sciences, University of Modena and Reggio Emilia, Modena, Italy*¹ - *Institute of Ecosystem Study, ISE CNR, Verbania, Italy*²

High altitude lakes and their fauna are one of the most threatened and less investigated ecosystems in Italy. Alpine lakes are highly influenced by climate harshness and by air pollution, and because of their small dimensions are extremely vulnerable to global climate warming. Italy, in addition to the Alps, hosts another mountain range: the Apennines, reaching in some cases comparable altitudes, and therefore subject to the same risks. Moreover, the gentler slope of the Apennines makes them extremely vulnerable even to direct human impacts. In the present work, for the first time, high altitude lakes belonging to the Alps and to the Apennines are compared to highlight which meteo-climatic or chemical characteristics could be considered key drivers for their macroinvertebrate structure. The study area was explicitly focused on natural lakes placed above 1300 m of altitude and above the 44° parallel, thus in the alpine area and subject to a continental climate. 25 lakes were chosen (19 in the central-western Alps and 6 in the Modenese Apennines) with surface areas lower than 1 km² and with maximum depths lower than 15 m. Physico-chemical parameters and macroinvertebrates were studied and compared. Samples were taken through the use of a hand-net (250 µm mesh size) along the littorals on different substrates following standardised methodologies during the richer-fauna season to allow an easier identification of species. Parallel to that, water samples were collected and analysed. Species richness and the Taxonomic Distinctness Indices were applied to underline the different complexity of the community structure of the two areas. Results showed different macroinvertebrates communities with peculiar characteristics and highlighted a more structured and diverse composition on the Apennines. Predictive models on the future climate scenarios show how the peninsular portion of Italy will be even more affected by the increase in temperatures than the Alpine area. Thus, this work could be highly informative, mainly for central Italy, where proximity to towns encourage tourists to reach these type of lakes, even if placed in protected areas or parks. Therefore, protection and management plans, and conservation efforts of high altitudes cannot overlook a thorough understanding of the biological diversity of these environments, which still appears fragmented and limited to some sector of the Alps. Furthermore, the fundamental role of high altitude lakes as water resource needs a specific management regime, as they are not included under the monitoring programs of the Water Framework Directive legislation.

26-P Life strategies of stoneflies (Insecta, Plecoptera) inhabiting temporary streams of Sierra Morena (Southern Spain). Ten years of studies. [José Manuel Tierno de Figueroa](#)¹ - [Ezequiel Antorán-Pilar](#)¹ - [Pilar Delgado-Juan](#)¹ - [Julio Miguel Luzón-Ortega](#)¹ - [Manuel Jesús López-Rodríguez](#)²

*Departamento de Zoología, Universidad de Granada, Granada, Spain*¹ - *Departamento de Ecología, Universidad de Granada, Granada, Spain*²

The Mediterranean region is characterized by a marked climatic seasonality with a cold, wet season followed by a warm, dry season. Thus, temporary streams appear conspicuously in this area, which follow a sequence of regular flooding and drying periods. Our studies made during the last ten years on life histories of stoneflies from Sierra Morena (Southern Iberian Peninsula) have shown the existence of particular adaptations to cope with the characteristic of these Mediterranean, temporary streams. We have selected some examples, several of them previously published and some yet unpublished, for underlining many of these biological traits: 1) nymphs of some species show exceptional feeding habits not common for their families (demonstrated both by the study of gut contents and by analyses of digestive enzymatic activities). Thus, due to resource limited availability in temporary streams some stoneflies that usually acts as predators can behave as mainly phytophagous (e.g. *Isoperla morenica*); 2) flight periods are particularly short (for spring species, e.g. *Hemimelaena flaviventris*) or long (for autumn/winter taxa, e.g. *Tyrrhenoleuctra minuta*), almost lacking species with mid-duration flight periods, which are the most common in permanent streams from Southern Iberian Peninsula. This fact can be considered as an adaptation to the limited time in which streams have water; 3) for the same reason, nymphal development is particularly fast, sometimes lasting only a few months (e.g. *Capnioneura gelesae*, *T. minuta*), and resting stages (quiescence or diapause, both in the egg or nymphal stage) can be present during the periods when streams are dry (e.g. *Guadalgenus franzi*); 4) likewise, egg development can be very fast, even the eggs of one taxa, *T. minuta*, are fully developed when laid and hatch rapidly after laying, indicating a certain degree of ovoviviparism; 5) asynchronous nymphal and egg development are usual (e.g. *C. gelesae*, *T. minuta*), which is reflected in several cohorts coexisting at the same time. This ensures the survival of at least part of the population when delays or advancements in the period of drought happen; 6) stoneflies with a spring flight period use to have high secondary production (e.g. *G. franzi*, *H. flaviventris*) reaching relatively big size in a short period of time; 7) nymphs of species inhabiting temporary streams (e.g. *G. franzi*, *I. morenica*) show an important enzymatic antioxidant potential, consistent with data on high population densities and secondary production values. On the basis of these characteristics, it seems