



Odonata as indicator species of freshwater ecosystem health

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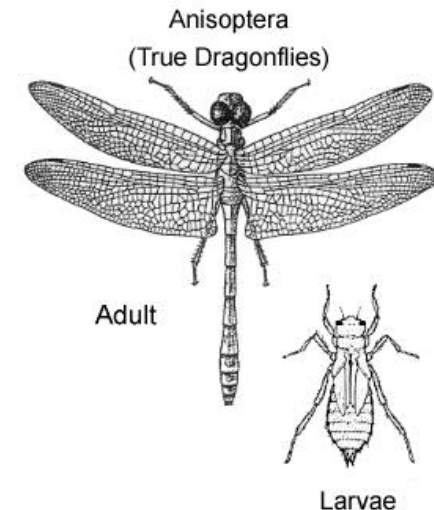
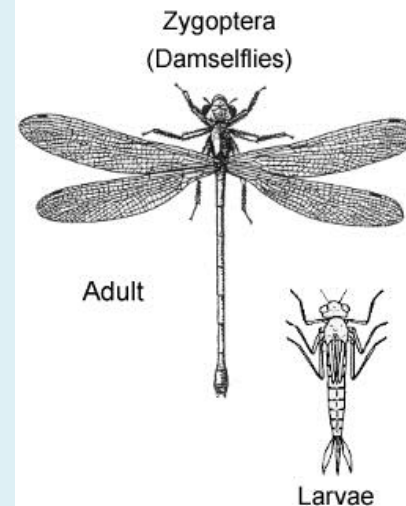
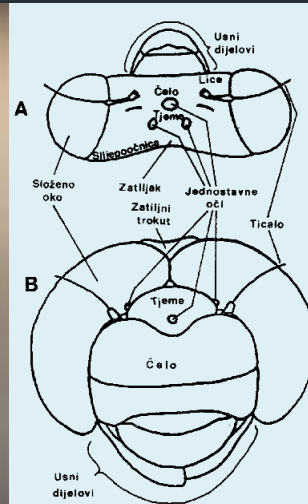
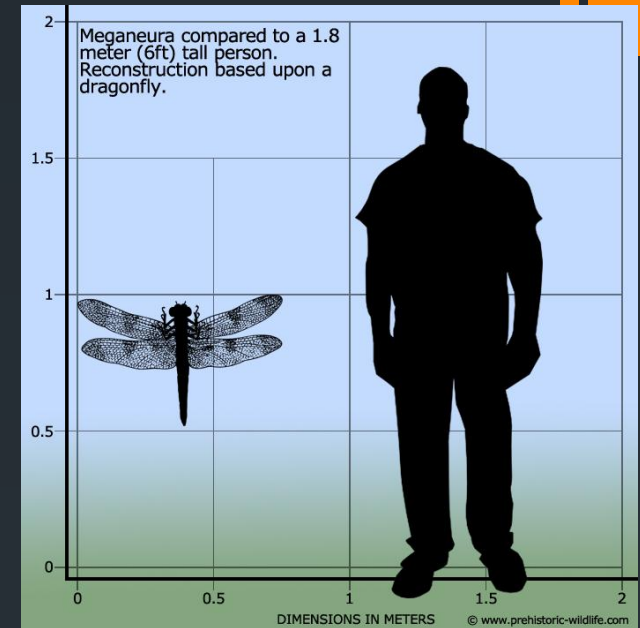
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Odonata

Dragonflies and damselflies

- Small order of insects - 6000 (7000) species
- Two „main“ suborders – Zygoptera and Anisoptera
- Ancient order
- Incomplete metamorphosis (egg – nymph – adult)



Odonata as bioindicators - why Odonata?



- Biological indicators (or bioindicators) can provide reliable, quantitative characterizations of ecological condition.
- Most of macroinvertebrates have long been recognized as useful bioindicators for aquatic and wetland ecosystems, but the impracticalities of collecting, sorting, and identifying aquatic stages limit their use in rapid assessments. It is therefore worthwhile to evaluate taxa and life stages that are both **ecologically important and logistically feasible** for bioassessment.
- Aerial stages of aquatic macroinvertebrates are important for species dispersal and the transfer of energy across aquatic and upland systems and among trophic levels, and are more sensitive than the aquatic stages to land use practices around wetlands.
- From a global perspective, dragonflies are among the best known insect groups with respect to taxonomy and distribution, and, apart from butterflies, probably no other group of insects receives so much attention from the general public.

Odonata as bioindicators - why Odonata?



- Odonata species are sensitive to conditions at the breeding site and surrounding terrestrial area, can react quickly to changes in environmental quality via active dispersal, and contain a tractable number of species for practical use.
- Adult dragonflies are conspicuous over water and relatively easy to identify at the species level, and may be especially well suited for broad and integrative assessments of the wetland breeding site and surrounding landscape. Adults are therefore well-suited for rapid assessment methods and addressing the increased focus on wetland quality and not just quantity.
- In Europe, dragonflies have a moderate number of species, their ecology is mostly well known, and they are easy to identify, thus they are perfect indicators. This is in particular true – as shown here – for the effects of climatic changes on different levels (single waters, landscape or national / European level).

Odonata as bioindicators - why Odonata?

- Contrary to other taxa they depend only on waters, which are more or less omnipresent, and their expansion is only due to their dispersal and migration behavior. This makes dragonflies some kind of unique as climate change indicators.
- The effects – most of them negative – for the waters and (dragonfly) communities have a consequence also for future strategies in nature conservation, as e.g. one of the most important concepts to protect biodiversity in Europe – the Natura-2000-network might not work anymore, as these biotopes are increasingly deteriorated and lose their function. To follow these processes and to identify the effects of global change phenomena, it is of crucial importance to establish and maintain European wide data collections and monitoring schemes.

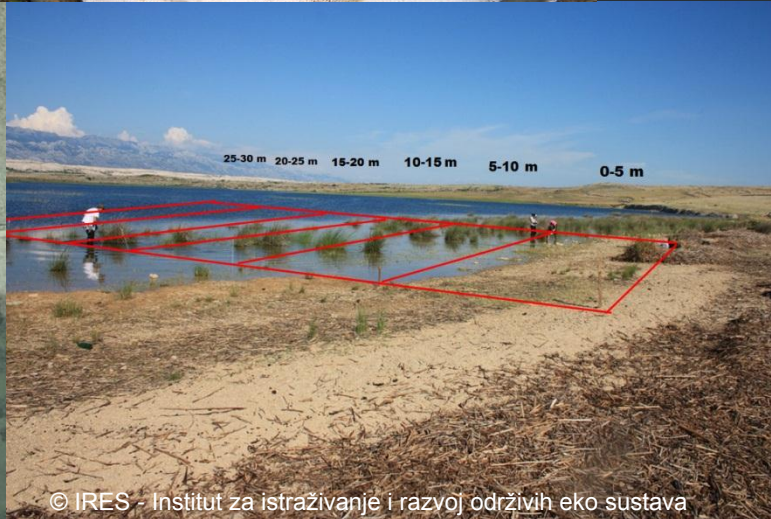
Dragonflies and climatic change

- Dragonflies can be regarded as a good indicator group for climatic change.
- General expansion of many species to the north: Mediterranean species expanded to Central and Northern Europe, whereas some African species expanded to Southern Europe, some are even new to the continent.
- The tendency for expansion is in particular notable in warm years like 2003.
- Northern range shift, more generations
- Moving to higher altitudes
- The best example of the expansion of a dragonfly is the Scarlet Darter (*Crocothemis erythraea*)



Sampling:

- Larvae
- Exuviae
- Adults

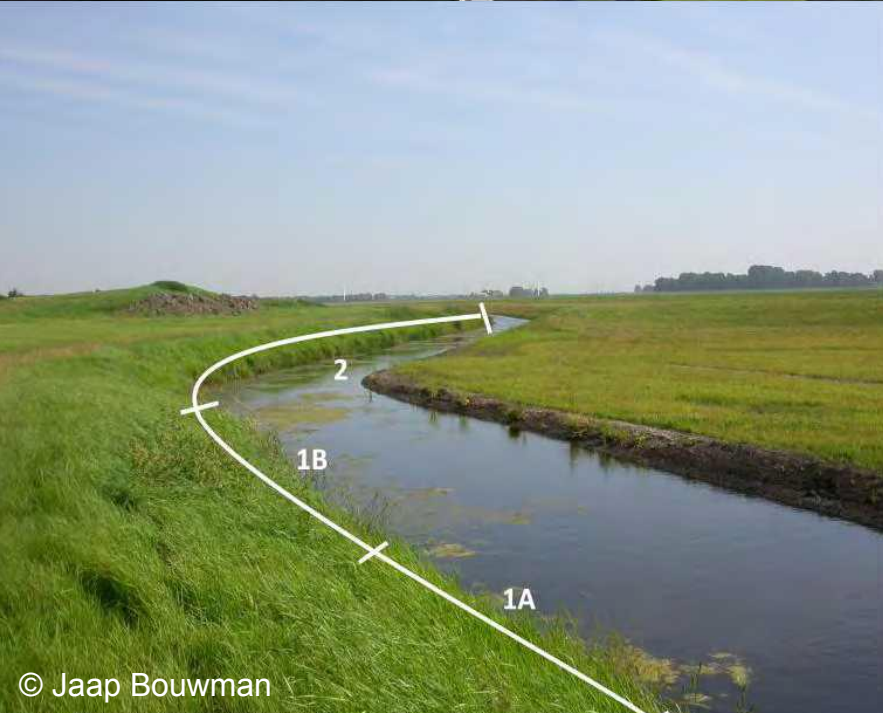




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The Balkan Peninsula

- The Balkan Peninsula is one of the least odonatologically explored parts of the European continent.
- Some of the most threatened dragonflies in Europe are almost completely confined to the southern Balkans (e.g. *Pyrrhosoma elisabethae*, *Cordulegaster helladica* ssp. and *Somatochlora borisi*)



No	Country	No. of species
1	Albania	57
3	Croatia	68
4	Greece	79
5	Macedonia	62
6	Montenegro	67
7	Serbia	63

Important = Taxon with most European records
situated in the region of the Balkan Peninsula

or

Taxon included in the Global/Regional **Red List** and/or
Annex(es) to EU Habitats Directive

Important taxa included:

Calopteryx splendens balcanica

Epallage fatime

Platycemis pennipes nitidula

Gomphus schneiderii

Caliaeschna microstigma

Cordulegaster heros

Cordulegaster insignis

Cordulegaster picta

Somatochlora borisi

Pantala flavescens

Important taxa (expected) to be included:

Coenagrion intermedium

Ceriagrion georgifreyi

Pyrrhosoma elisabethae

Boyeria cretensis

Cordulagaster helladica

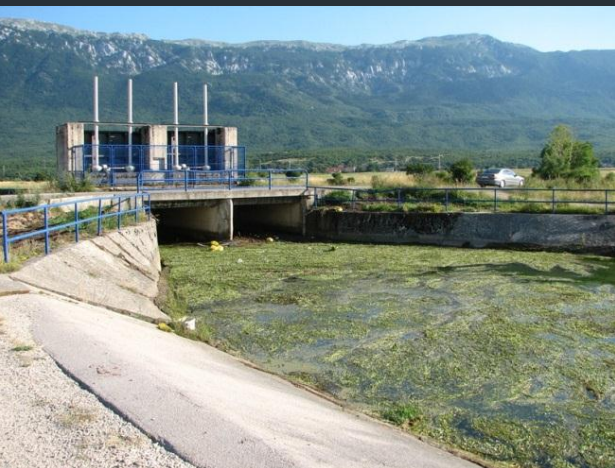
Orthetrum sabina

Orthetrum taeniolatum



Major threats

- Destruction of habitats as a consequence of water flow regulation, dam and reservoir building for hydropower plants Water use for the generation of hydro-electricity.
- Climate change effects? It will particularly affect the species in the Mediterranean region and the high mountain lake habitats.
- Introduction of alien species, especially fish species in high mountain lakes
- Water pollution, waste water from industry, agriculture and human settlements





- „Upper horizons“ – major project for the energy production in the Herzegovina region

- Large system of concrete reservoirs and tens of kilometers of concrete canal connecting the accumulations.



How to protect the threatened species ?

- Distribution, population status and trends are almost unknown. It is crucial to continue research in order to establish solid ground for long term protection of the species and habitats
- Identify key dragonfly areas on which the conservation efforts should focus on in order to protect the most endangered species
- Develop a monitoring program for the target species
- Improve the collaboration of the scientists with government institutions and local community

Balkan Odonatological Meeting (BOOM)

- The Balkan Odonatological Meeting represents regional research and educational program developed and lead by young researchers and students from West Balkan region with the main goal of the establishment of regional cooperation in research and protection of dragonflies and freshwater habitats and the education of future conservation leaders of the country and the region.
- The Meeting is particularly focused on gathering young scientists and students from the Balkan region. So far five successful Meetings were held (In Slovenia 2011, Serbia 2012, Croatia 2013, Bosnia and Herzegovina 2014, Macedonia 2015).
- Previous meetings were attended by an average of about 20 participants from Bosnia and Herzegovina, Croatian, Italy, Hungary, Macedonia, Netheralnds, Germany, Slovakia, Slovenia and Serbia.





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