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THE EXPANSION OF MEDITERRANEAN DRAGONFLIES IN EUROPE AS AN INDICATOR OF CLIMATIC CHANGES — EFFECTS ON PROTECTED SPECIES AND POSSIBLE CONSEQUENCES FOR THE NATURA 2000 WEB

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INTRODUCTION

Dragonflies are good indicators for the quality of aquatic environments and also for environmental changes (Corbet 1999). Consequently they are also used recently as monitoring organisms to demonstrate the effects of climatic changes, e.g. via the range expansion of southern species to the north or via the shifts within communities (Ott 2001, Ott 2007 a, b, Hassel et al., 2007). As Mediterranean species move more and more to the north, they increase in these northern countries the biodiversity. But this may have consequences for other species, which prefer other — the former — environmental conditions. Here the first results of a study carried out during the last two years — and still ongoing for the next two years — in the transboundary biosphere reserve “Pfälzerwald-Vosges du Nord” are presented, where the effects on NATURA 2000 biotopes are investigated. These studies may serve as an example for future and similar processes of biotope changes and the endangerment of species and protected areas in Germany and Europe.

SPECIES, BIOTOPES AND CLIMATE

The dragonfly fauna and the environmental conditions of more than 20 waters — mainly dystrophic lakes (NATURA 2000-code 3160, see also Roweck et al., 1988) — were monitored in 2005 and 2006 and compared with previous investigations of these waters (e.g. Niehuis 1984). The dragonflies were investigated during the entire vegetation periods while visiting the waters in minimum at 3 good days and by observing and/or catching the adults and by collecting exuviae to proof autochthony. During these visits also the abiotic conditions of the waters and in the surrounding were registered and information on the use in the catchment area were collected (e.g. groundwater extraction). Climatic data were obtained from official climatic stations (e.g. www.agrarinfo-rlp.de). Nearly all of these waters are part of the national NATURA 2000 network and / or they are protected by the federal nature conservation law.

EFFECTS ON DRAGONFLIES AND BIOTOPES OF THE WEB NATURA 2000

The climatic data of several climatic stations in the investigated area show a clear trend to warmer temperatures — in comparison to the long-term mean ca. 1-1,5 ° C. — and to more extremes in precipitation in the last years. In particular the dry summer of 2003 is remarkable: after years with higher precipitation in comparison to the mean, this year had a precipitation about 30-40 % lower than the mean. These data are in concordance with recent studies (Zebisch et al., 2005, UBA 2007).

As a consequence of the conditions in 2003 the water level in the waters dropped down about 1 – 2 meters, depending on the local situation (e.g. geology and size of the catchment area, biotopes in the surrounding) and also the nearby situated wetland biotopes dried out. This lack of water could not be filled up in the following 3 years and the water table sank even more (see Fig. 1). This led to a much smaller water body having no more contact to the vegetation at the shoreline and also wide open areas around these waters came into existence.

As a consequence of these abiotic changes and in some cases also because of synergistic effects (e.g. ground water extraction) the ecological quality of these vulnerable waters changed dramatically and so their value for the different dragonfly species. Within very short time most of the stenoecious and endangered moorland species, which are characteristic for the dystrophic waters (sensu Ssymanck et al., 1998), could not anymore be registered from most of the waters (e.g. *Somatochlora arctica*, *Aeshna juncea*, *Leucorrhinia dubia*, *Coeangrion hastulatum*). They are now also nearly extinct for the German part of the biosphere reserve: e.g. for *Somatochlora arctica* only one population is left, being highly isolated. On the other hand these waters were colonised in the same time by euryoecious and ubiquitous species, which are now dominating the coenosis (e.g. *Anax imperator*, *Orthetrum cancellatum*, *Libellula depressa*) and indicating the strong disturbance. Some of these waters were colonised by protected species, such as *Lestes barbarus*, but also this fact is more an indicator for the little ecological value of the waters, as this species is typical for astatic waters (Ott 2007 c). Some of the waters even dried out completely and so lost totally their value for any aquatic fauna, not only for the dragonflies.

If no changes of the climatic conditions will occur, what could be expected (Zebisch et al, 2005, UBA 2007), in the future the waters and so the NATURA 2000 network will lose its value completely.

The invasion of southern and eurytopic species becomes obviously a general process in Germany and Middle and Northern European countries indicating the disturbance of the waters (Ott 2007 b), as well as the lack of water in many countries and regions (Italy, Spain – Germany: e.g. the federal state of Brandenburg). Consequently strong changes within the European dragonfly fauna could be expected. Especially the species of moorland biotopes, springs, small brooks and alpine regions will face a strong decrease and in some regions also extinction.

In the longer term this process will lead more to a decrease of biodiversity then to an increase and to a devaluation of the web NATURA 2000.

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FIGURE 1: The “Kolbenwoog”: a dystrophic water nearly dried out between 2003 and 2006: typical moorland species left and euryoecious species invaded this biotope, being part of the NATURA 2000 web (NATURA 2000-code 3160).



FIGURE 2: *Crocothemis erythraea*: a mediterranean species, which colonised Germany in the last 3-4 decades from south to north. It indicates the climatic effects on the waters, as well as their disturbance. This process could also be observed in many other middle and northern European countries, and meanwhile several other southern species are following, leading to changes in the whole coenosis of the waters.



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