

APPROACHES TO A QUANTIFICATION OF THE DECREASE OF DRAGONFLY SPECIES IN INDUSTRIALIZED COUNTRIES*

E. SCHMIDT

Biologie und ihre Didaktik, Pädagogische Hochschule,
Römerstrasse 164, D-5300 Bonn, German Federal Republic

Received November 30, 1978

A quantification of the decrease of dragonfly spp. will be achieved by preparing distribution maps which, by using different symbols, should allow an identification of spatial and temporal distribution of records. Recent records should be further classified and commented with regard to their actual status. Stable populations should be especially denoted in the maps. Criteria for estimating the status of a dragonfly population are given, using *Gomphus vulgatissimus* in Schleswig-Holstein, northern German Federal Republic, as an example.

INTRODUCTION

In all industrialized countries a remarkable decrease of the aquatic invertebrate fauna, including Odonata, can be noticed. A quantification of the decline in odonate species is indispensable before one can prevail upon the authorities to carry out appropriate nature conservation procedures. The "Red Lists" (cf. PRETSCHER, 1978), recording the odonate species into categories with respect to certain degrees of endangerment, have been welcomed, but, as SCHMIDT (1977b) pointed out, they must be considered of only restricted value in so far as they do not comment on single species and their respective classification in the "Red List". For a few confined biotopes the decline in the odonate fauna has been verified by recording changes in habitat conditions and in number and abundance of species through a series of years (SCHMIDT, 1972, 1975b). However, as far as more extended regions

* Presented at the Fourth International Symposium of Odonatology, Gainesville, Florida, United States, August 1-5, 1977.

are concerned, our knowledge of alterations of the fauna composition is still fragmentary, mostly due to a discontinuity in collecting activities. In order to ensure greatest possible efficiency, the methods of processing faunistic data have to be adapted to the intended purpose.

PROCEDURE OF INTERPRETING FAUNISTIC RECORDS

The following four-graded procedure of interpreting the faunistic records has proved effective in analyzing the dragonfly fauna of the county of Schleswig-Holstein in the northern German Federal Republic.

(1) *Scheduling spatial distribution of a species* — Merely enumerating the species is of no value without simultaneously indicating their spatial distribution by means of dot distribution maps, for which the UTM-grid-maps might be adopted as a standard unit suitable for modern data processing. Recording of a species within a grid square is indicated by a symbol, thus summarizing records from more than one locality within a particular grid square. Special rules are needed to avoid multiple recording of habitats which are divided by the intersection of grid lines. Distribution maps like those presented by AAGAARD & DOLMEN (1977) are easily prepared from data stored on punchcards (SCHMIDT, 1973) or other software (HEATH, 1971).

(2) *Scheduling temporal distribution of records* — Changes in fauna composition will be revealed by introducing different symbols into the distribution maps, corresponding to the time of the last record. Recent records should be especially marked. Here the distribution maps prepared by the "European Invertebrate Survey" (cf. SKELTON, 1974), separating records up to 1960 and from 1960 onwards, are to be mentioned. However, maps of this type still need supplementary comments, for temporal and spatial discontinuity in collecting may give a false picture. An example of adequately commented dot distribution maps is given by SCHMIDT (1977a).

(3) *Scheduling the status of recent populations* — The extinction of a stable population, due to the changing character of its habitat, is preceded by a notable decline in abundance (SCHMIDT, 1972, 1975a). Even after the extinction of a population in a particular habitat, occasional immigrants may be recorded, from which overoptimistic notions of the status of a species may arise, unless the singularity of the record is mentioned in particular. Therefore in dot distribution maps those localities, where steady populations are maintained, should be especially noted. A location may be considered as harbouring a steady population, if (1) copulating or egg depositing individuals of the respective species are to be found on any day with suitable weather conditions within the main flight period in any year, or

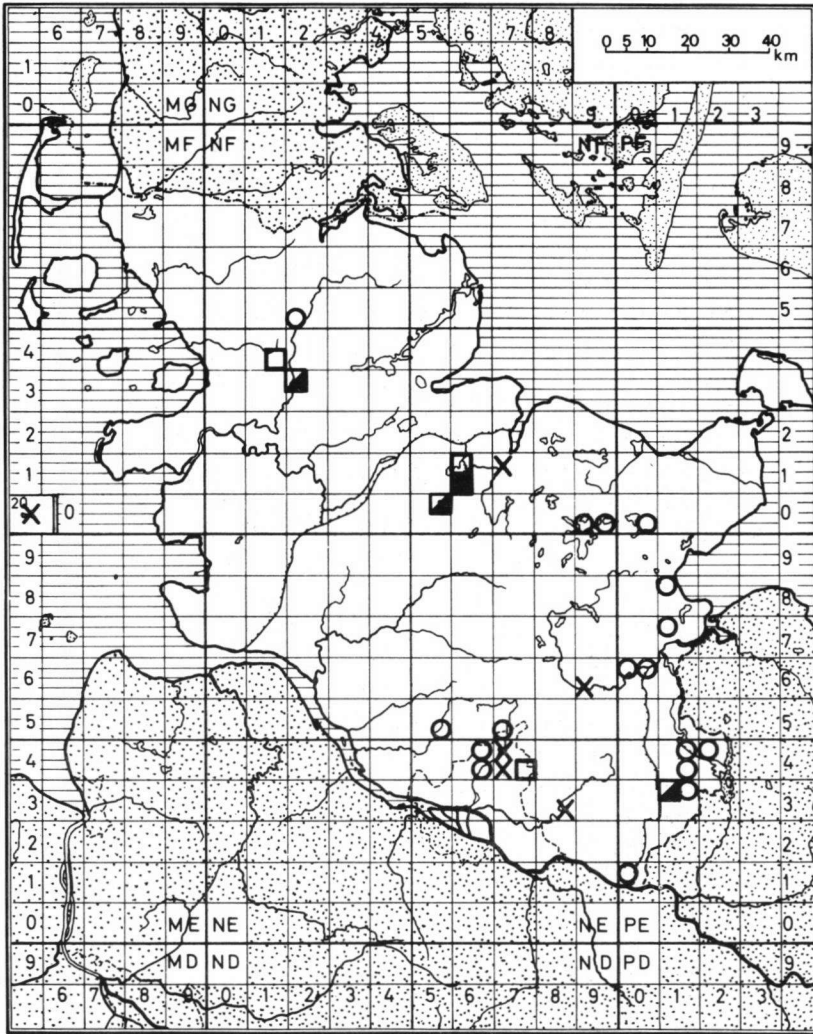


Fig. 1. Records of *Gomphus vulgatissimus* in Schleswig-Holstein. Temporal distribution of records is indicated by three symbols, crosses marking records before 1920, circles denoting records up to and including 1960, and squares denoting records from 1960 onwards. The status of the seven records from 1960 onwards is indicated by threefold variation of the square symbol, open squares marking records of single specimens, half filled squares representing weak populations, and a solid square representing a stable population. Records up to 1960 mainly represent local collecting activity.

if (2) larvae can be found regularly at least in autumn/spring (for spring species) or in spring/early summer (for summer species), or if (3) emerging specimens can be collected in any year. The population density must not be taken into account as a criterion in estimating the status of a population. Locations with non-steady populations may be further classified, denoting records of only single specimens, or records from only one or a few years, and in addition commenting on the abundance.

The distribution map of *Gomphus vulgatissimus* in Schleswig-Holstein is presented here as an example of the mapping of a species with regard to several categories of status (Fig. 1). This species was once common at lakes, streams and ditches, and has been recorded even on the island of Heligoland. The old records of *G. vulgatissimus* mainly represent the centres of collecting activities, concentrated before 1920 around large towns such as Hamburg, Kiel, Oldesloe and on Heligoland, and from 1920 onwards they are restricted to the vicinity of Lübeck, where C. Lunau was a keen collector. Only a few old records by Lunau and other collectors are scattered outside this area. From 1960 onwards thorough investigations covered the whole county of Schleswig-Holstein, except for some areas in the SW. It is remarkable that only two out of 25 old locations could be confirmed as still harbouring the species. Only five new locations were discovered, so that there are seven records from 1960 onwards. Of these only one may be regarded as a steady population, following the above-mentioned criteria. Of the remaining six records, three represent only single specimens, and three represent unstable populations, which may have perished in the meantime.

Using five symbols, this distribution map clearly illustrates the drastic decline in this species as a consequence of pollution and eutrophication of rivers and lakes.

(4) Scheduling localities of suspected occurrence of a species and areas uncovered by collecting activity — Distribution maps specifying recent steady populations of a species should be completed by discussing incoherent distribution patterns and by denoting localities where the species is likely to breed but has not yet been recorded due to a lack of collecting activity. In doing so, an extremely thorough knowledge of the biology of the species and of the ecological conditions of the locality is required to achieve reliable statements.

ACKNOWLEDGEMENT

Many thanks are due to Dr. R. RUDOLPH, Münster, who translated the original German manuscript into English.

REFERENCES

- AAGAARD, K. & D. DOLMEN, 1977. Vann-nymfer i Norge. *Fauna, Oslo* 30: 61-74.
- HEATH, J., 1971. The European Invertebrate Survey. *Acta ent. fenn.* 28: 27-29.
- PRETSCHER, P., 1978. Rote Liste der Libellen (Odonata). In: J. Blab, [Ed.], Rote Liste der gefährdeten Tiere und Pflanzen in der Bundesrepublik Deutschland, pp. 43-44. Kilda Verlag, Greven.
- SCHMIDT, E., 1972. Das Naturschutzgebiet Teufelsbruch in Berlin-Spandau. IX. Die Odonatenfauna des Teufelsbruches und anderer Berliner Moore. *Sber. Ges. naturf. Freunde Berlin* (NF) 12 (1/2): 106-131.
- SCHMIDT, E., 1973. The use of punch cards in the survey of the European odonate fauna. *Odonatologica* 2 (1): 39-43.
- SCHMIDT, E., 1975a. *Aeshna viridis* Eversmann in Schleswig-Holstein, Bundesrepublik Deutschland (Anisoptera: Aeshnidae). *Odonatologica* 4 (2): 81-88.
- SCHMIDT, E., 1975b. Zur Veränderung der Libellenfauna einiger Berliner Moore in den letzten fünf Jahren. *Berl. Naturschutzbl.* 56: 155-158.
- SCHMIDT, E., 1977a. Analyse der Libellenverbreitung in Schleswig-Holstein (Norddeutschland, BRD) am Beispiel der Aeshniden (Odonata). *Verh. 6 Int. Symp. Entomofaunistik Mitteleuropa* (1975), pp. 27-42. Junk, The Hague.
- SCHMIDT, E., 1977b. Ausgestorbene und bedrohte Libellenarten in der Bundesrepublik Deutschland. *Odonatologica* 6 (2): 97-103.
- SKELTON, M., 1974. *Orthoptera, Dictyoptera and Odonata. Preliminary distribution maps.* Biol. Records Cent., Abbots Ripton, Hunt.