Monitoring butterflies in the Netherlands and Flanders: the first results

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Butterfly monitoring started in the Netherlands in 1990 and in Flanders in 1991. During the last few years butterflies have been counted at nearly 300 sites. This high number of transects makes it possible to calculate not only national, but also regional and habitat-indices for many species. Special attention is paid to Red list species in the Netherlands. In the near future the number of sites per species on this list is to be increased to at least 20. This can be achieved by a 'Red list monitoring scheme', in which monitoring is restricted to the flight period of the species.

Keywords: butterflies; monitoring; Flanders; the Netherlands; Red list,

Introduction

In 1990 De Vlinderstichting (Dutch Butterfly Conservation) and CBS (Statistics Netherlands) started a butterfl monitoring scheme in the Netherlands. This scheme was based on the British Monitoring Scheme, which began in 1976. In 1991 the Vlaamse Vlinderwerkgroep (Flemish Butterfly Working group) started to use the same method in Flanders (North-Belgium).

In this paper we present the fi results and discuss ways to improve the quality of the monitoring scheme.

Method

To a large extent, the method is based on the British Butterfly Monitoring Scheme (Pollard and Yates, 1993). Only a few minor changes have been made. The most important is that all transects have been divided into sections with a fi length of 50 m. Such a section must have a homogeneous vegetation structure. The maximum length of a transect is 1 km (20 sections), but may be shorter. All butterflies 2.5 m to the left and right of the recorder and 5 m in front and above have to be counted. The method is described in detail in van Swaay (1996). Indices were calculated using the computer program TRIM. TRIM is an index program for the analysis of time series of counts with missing data. The program can be used to estimate indices and trends and to assess the effects of covariates on the indices and trends. Monitoring data often contain many missing values. The idea is to estimate a model using the observed counts and then to use this model to predict the missing counts. Indices can then be calculated on the basis of a completed data set with the predicted counts replacing the missing counts. TRIM can distinguish between several loglinear models for this purpose. The models are based on the assumption of independent Poisson distributions for the counts, many low counts and few high counts, resulting in a log-linear regression model. In this method corrections can be made for deviations on this distribution and weights can be used countering the effects of over- and under-sampling of particular areas (Pannekoek and Van Strien, 1994, 1996). In our project, the model with parameters is chosen which tests for the effects of every year separately and calculates a linear trend over all the years. As the number of sites in Flanders in the first year was too low for the calculation of reliable indices, only the last four of the fi years were used.

TRIM is a free-ware program, designed to run in a DOS-environment (3.0 or later) or Windows DOS-box.

It was written by Jeroen Pannekoek of Statistics Netherlands. TRIM can be downloaded from the WWW-site of Statistics Netherlands:

http://www.cbs.nl/temp/lmi/tri001p1.htm.

Results

Number of transects and coverage

Figure 1 shows the number of transects in the Netherlands and Flanders. The fi three years show a rapid growth in the number of sites. Since 1992 the number has become more or less stable, with transects well distributed over the country. Nevertheless, Fig. 2 shows that there are a few areas, especially in the north of the Netherlands, where extra transects are needed.

Number of butterflies

In the fi six years (1990–1995) of the Dutch monitoring scheme, a total of 720 000 butterflies for 65 species were counted. In Flanders the total number was almost 90 000 butterflies of 40 species in fi years (1991–1995).

In the Netherlands *Maniola jurtina* was by far the most numerous butterfly and *Pieris napi, Pieris rapae* and *Thymelicus lineola* were very common. In Flanders *Pyronia tithonus* was also seen in high numbers.

Indices

It was not possible to calculate indices for every species that was reported in the monitoring scheme. Some species were seen in very low numbers or on just one or two sites. For all the resident species for which it was possible to calculate reliable indices, Fig. 3 gives the proportion of the species which had a significant positive, significant negative or no significant trend.

Red list species

Originally, the monitoring schemes of the Netherlands and Flanders were designed to calculate reliable trends for all butterfly species. Since the publication of the Red lists in both countries (Wynhoff and van Swaay, 1995; Maes and Van Dyck, 1996), the species in these lists have become very important for nature conservation purposes. Table 1 gives the trends per category of the Red list in the Netherlands. This table shows that it is not possible to calculate indices for 14 of the 30 species in this list. Of those species for which a reliable index could be calculated, a relatively large proportion (50%) is still declining.

Regional trends

In Flanders, *Pyronia tithonus* is the most common species on the monitoring sites. This is also the case in the

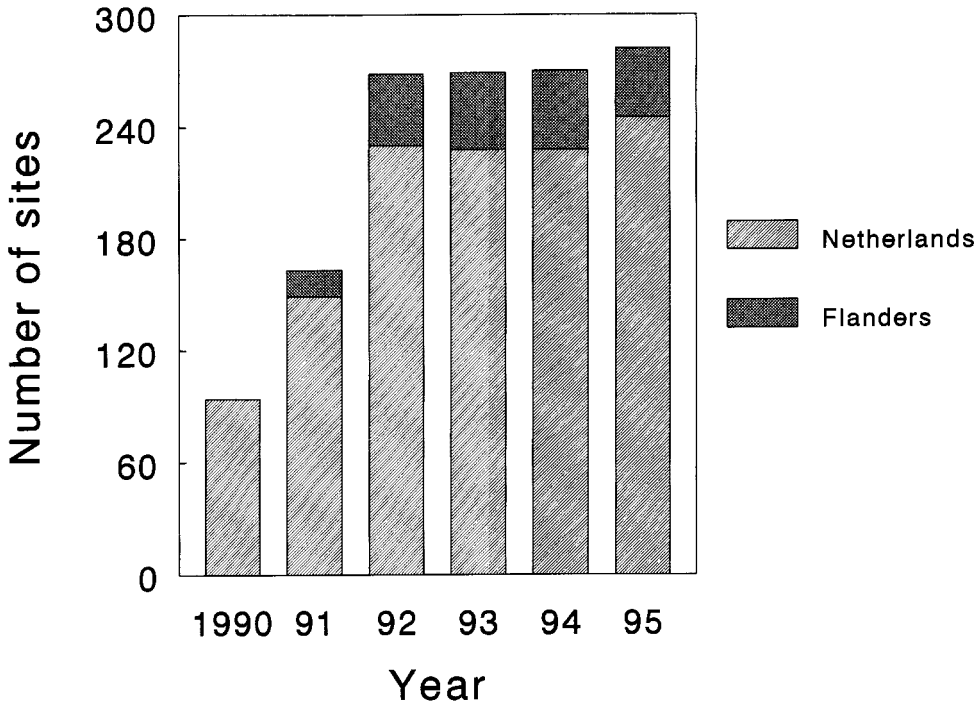

Figure 1. The number of butterfly monitoring sites in the Netherlands and Flanders.

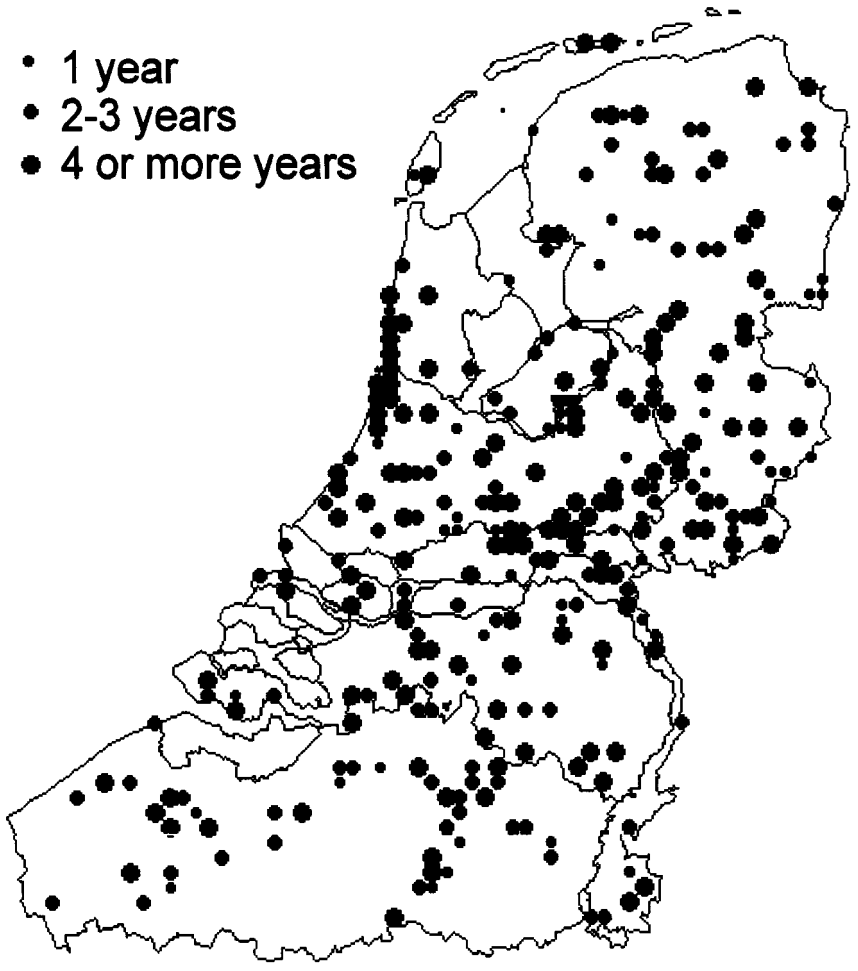

Figure 2. Distribution of butterfly monitoring sites in the Netherlands and Flanders. The size of each dot indicates the number of years a site has been monitored.

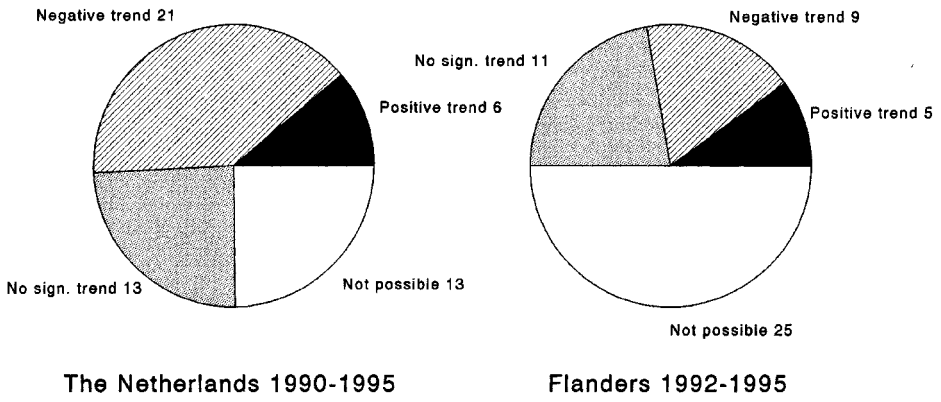

Figure 3. Proportion of species with a significant positive, significant negative or no significant trend and the proportion of those whose trend is not possible to determine.

Table 1. Trends per category of the Red list in the Netherlands

Red list category	positive trend	no significant trend	negative trend	not possible to determine
Critical	-	-	-	7
Endangered	1	3	2	5
Vulnerable	1	3	5	1
Susceptible	-	-	1	1

southern part of the Netherlands, but in the rest of the country *Maniola jurtina* is much more common. Figure 4 shows the indices for the former species. Although the direction of changes in the indices are very much the same in all three regions, the fl seem to be much larger in the northern part of the Netherlands than in the south and in Flanders. Since *P. tithonus* reaches the northern edge of its range in the north of the Netherlands, we assume that this is the main reason for this effect. Similar increases in variability of butterfly populations in the north of their ranges have been described for Great Britain (Thomas *et al*., 1994).

Trends per habitat

In the Netherlands there were enough transects to enable us to calculate separate indices for different types of habitat. Figure 5 shows the indices for *Anthocharis cardamines* on its main habitats: grasslands and woodlands. On woodland sites this species has a significant negative trend, on grasslands no significant trend could be detected. The reason for this habitat difference is not known.

In 1990, *Coenonympha pamphilus* was a widespread and common species. During the next few years it showed a marked decline. Figure 6 clearly illustrates that this butterfly recovered quickly in the dunes but is still decreasing on the grassland sites. Again, more detailed ecological research is needed to fi a reason for this difference.

Colonization

One of the results of the monitoring scheme is that colonization and extinction of species can be followed in detail. Figure 7 shows the distribution of *Polygonia c-*

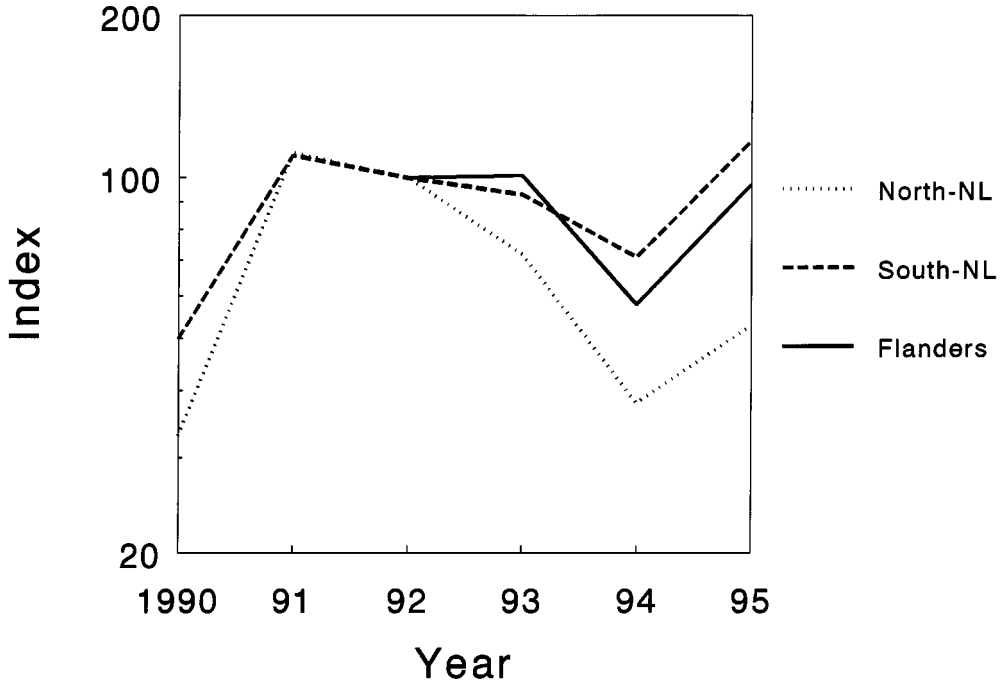

Figure 4. Indices of *Pyronia tithonus* in the northern and southern part of the Netherlands and in Flanders.

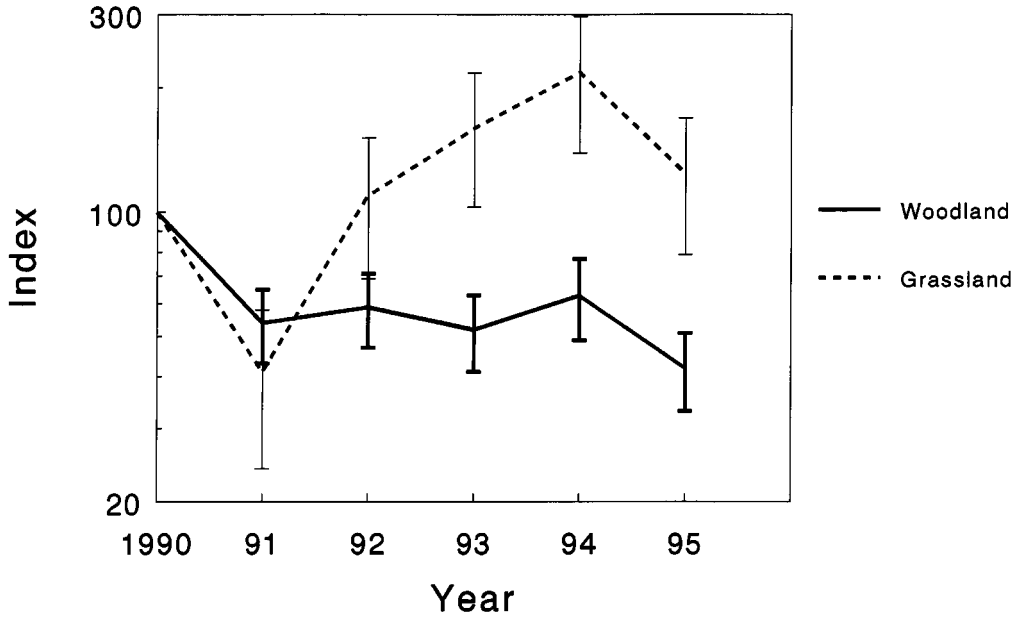

Figure 5. Habitat-indices and standard error for *Anthocharis cardamines* on grassland and woodland sites in the Netherlands.

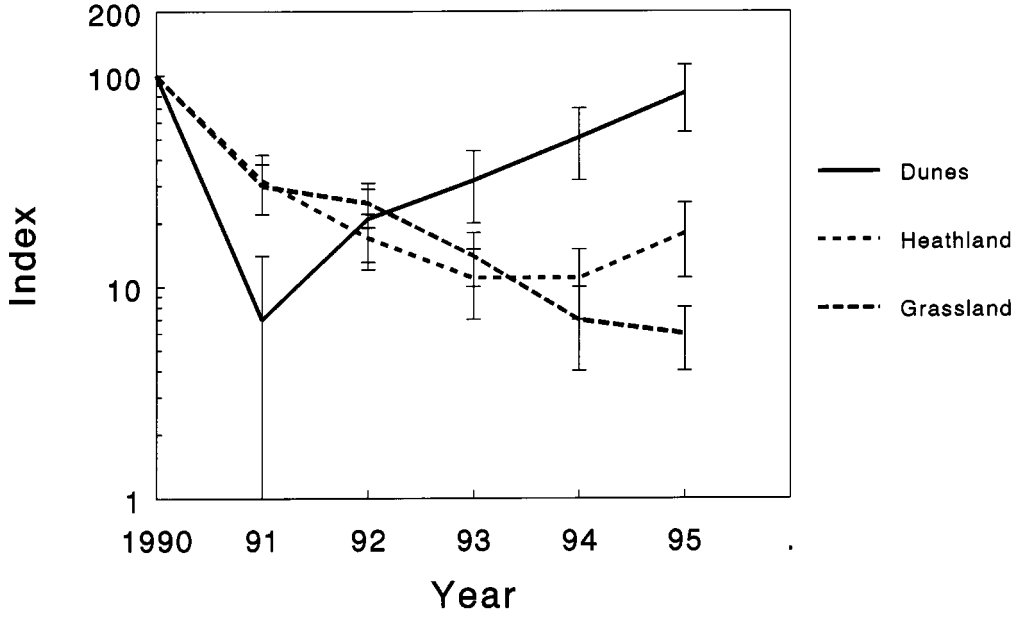

Figure 6. Indices and standard error of *Coenonympha pamphilus* in different habitats in the Netherlands.

album on the monitoring sites. Between 1990 and 1992 this species rapidly expanded its range in a northern and western direction and during the last few years it seems to have established itself in a large part of this area. In the past, *P. c-album* has regularly undergone strong fl in distribution. In the Netherlands this species reaches the edge of its range and small changes in climate may cause the species to expand or contract its range quickly.

Discussion

This paper gives only a brief overview of some of the fi results of butterfly monitoring in the low countries (the Netherlands and Flanders). Compared to the Brit-

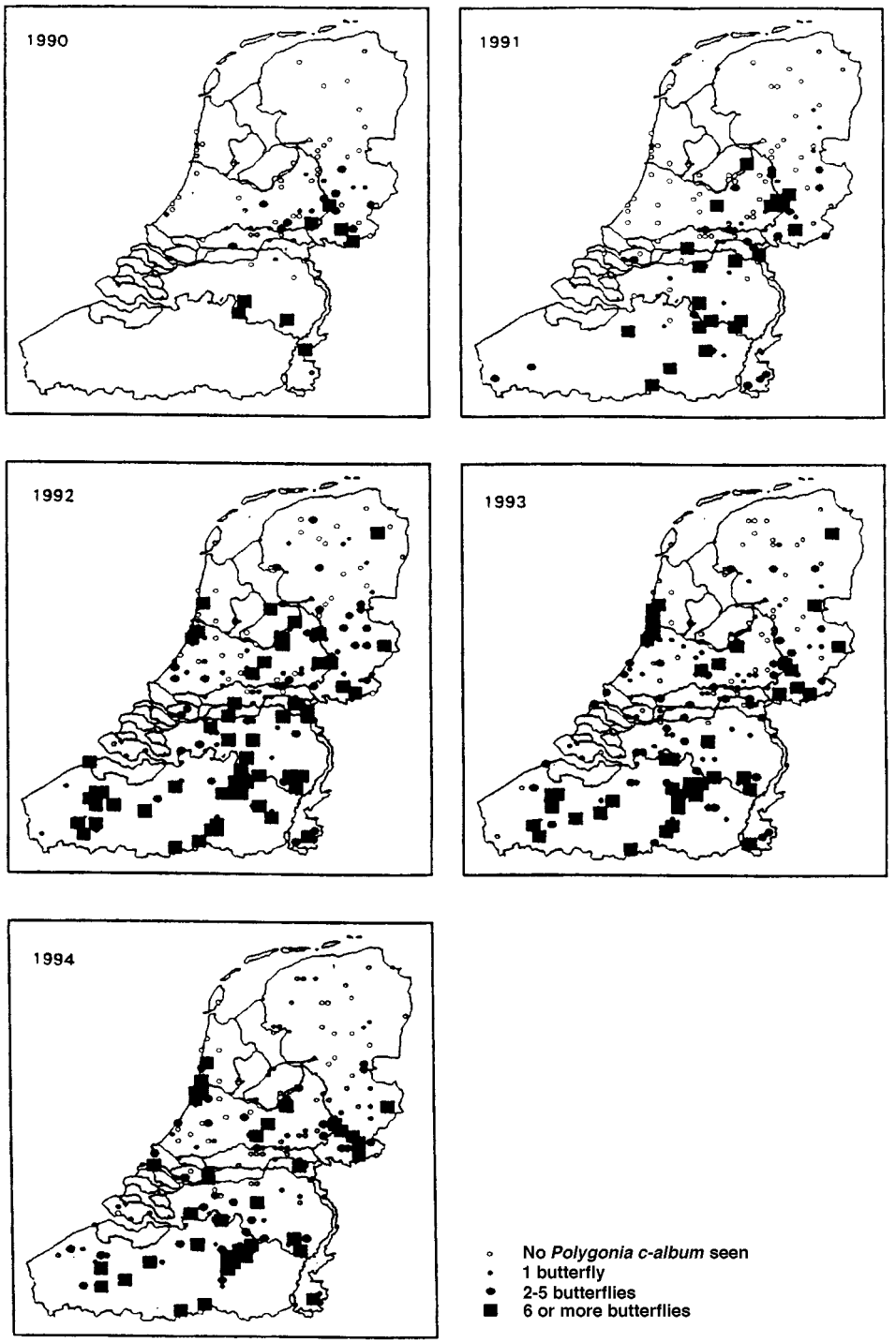

Figure 7. Distribution of *Polygonia c-album* on monitoring sites in the Netherlands and Flanders in the period 1990–1994.

ish monitoring scheme, which started in 1976, ours is still very recent and there is only a short time period to study. This means that we have to be very cautious in drawing conclusions.

The Dutch and Flemish butterfly monitoring projects are very successful schemes. There are enough transects to obtain a good impression of the trends for most common butterflies. For these species there is a clear resemblance between the trends of species in the Netherlands and Flanders. This is not surprising, as the Netherlands and Flanders have a similar landscape and the butterflies have to face the same environmental

problems. Pollard *et al*. (1993) also demonstrated a close similarity in the changes in abundance of butterflies in Britain and the Netherlands. It would be very interesting to compare British, Flemish and Dutch results. Synchronous population changes in different areas in Northwestern Europe could teach us more about the effects of weather. This knowledge would also help us to distinguish between trends caused by local and environmental factors and large scale factors, such as weather. Monitoring schemes in other European countries or areas could enlarge our knowledge still further.

Species of the Red list are much harder to monitor than common butterflies. The main reason is the simple fact that these species are rare. The more transects you have for a species, the more reliable are the calculated indices. One of the main objectives of our monitoring scheme is to follow these Red list species in detail and, in the near future, this means that we will have to focus much more on special transects for these species. We hope to get at least 20 sites for every species. For some species there are fewer than 20 populations left, but in these cases we hope to be able to count the butterflies on all remaining sites. This causes some extra problems, since almost all Red list species occur on remote nature reserves which often have only restricted access. To make it possible for wardens, who usually have a very busy time schedule, to count these butterflies, we developed a 'Red list monitoring scheme'. Red list species can be monitored on special transects which are only counted in the fl period of each species. This means the recorder only has to walk the transect four or fi times in the peak fl period of the species. Here, of course, precise timing is essential. To achieve this we have developed a simple computer program that predicts the fl period of a species corrected for weather data.

The fi results of this 'Red list monitoring scheme' are promising. For some of the Red list species we have managed to increase the number of transects considerably, e.g. *Boloria selene* from four sites in 1990–1993, to 11 sites in 1995. Nevertheless, for some Red list species this will not be enough, particularly for species like *Apatura iris, Lycaena dispar* and *Maculinea alcon* which occur in very low densities. This means that it is not possible to calculate reliable indices. For *Lycaena dispar* and *Maculinea alcon* we hope to start counting eggs or larvae which are much easier to fi and count than the adult butterflies.

Acknowledgements

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References

Maes, D. and Dyck, H. van (1996) *A documented Red List of the butterflies in Flanders* [in Dutch with English summary]. Brussels: Communications of the Institute of Nature Conservation.

Pannekoek, J. and Van Strien, A.J. (1994) Developments in wildlife statistics; new methods for meeting new demands. *Netherlands Official Statistics* **9**(4), 42–5.

Pannekoek, J. and Van Strien, A.J. (1996) *TRIM (Trends & Indices for Monitoring data)*. Voorburg: Statistics Netherlands.

Pollard, E. and Yates, T.J. (1993) *Monitoring Butterflies for Ecology and Conservation*. London: Chapman & Hall.

Pollard, E., van Swaay, C.A.M. and Yates T.J. (1993) Changes in butterfly numbers in Britain and The Netherlands, 1990–91. *Ecol. Entomol.* **18**, 93–4.

Swaay, C.A.M. van (1996) *Handleiding Dagvlindermonitoring*. Wageningen: De Vlinderstichting.

Thomas, J.A., Moss, D. and Pollard, E. (1994) Increased fluctuations of butterfly populations towards the northern edges of species' ranges. *Ecography* **17**, 215–20.

Wynhoff, I. and van Swaay, C.A.M (1995) *Threatened and vulnerable butterflies in The Netherlands: Basic report and proposal for the Red list*. Wageningen: De Vlinderstichting.