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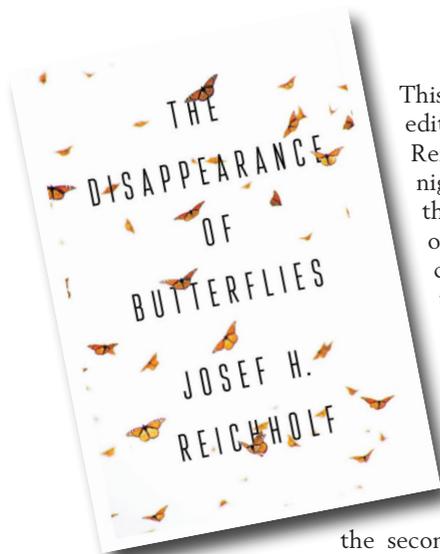
The Disappearance of Butterflies

Joseph H. Reichholf (translated by Gwen Clayton)

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This is an important book and the publishers are to be congratulated on producing an English edition following the original German publication in 2018. The significance of Joseph Reichholf's observations and comments should not be detracted from by two immediate niggles regarding first impressions of the book. Firstly, the dust jacket uses multiple images of the Monarch butterfly *Danaus plexippus* which initially made me wonder if it would focus on butterflies of North America, as the decline of the iconic Monarch has been often commented upon recently. Secondly, the title is a little misleading as it is so much more than just a treatise about the decline of butterflies. It does mainly use butterfly examples but there is much of interest to the moth specialist, and the general message around declines needs to be read by anyone concerned about the loss of biodiversity.

The Disappearance of Butterflies is a summary of a lifetime's work, study and enjoyment of the Lepidoptera of Germany and Bavaria in particular. Reichholf began recording his observations on nature as a boy in the late 1950s, an interest which led to a distinguished career as an entomologist, notably at the Bavarian State Collection of Zoology, Munich.

His book is divided into two halves, the first entitled *The Biodiversity of Lepidoptera* and the second *The Disappearance of Lepidoptera*. Be reassured, these are no dull textbook style descriptions, but fascinating accounts of these two topics, full of personal observations on particular species and groups of species, shedding new light on the ecology of species you probably thought you knew but in fact have only scratched the surface.

The China-mark moths are a familiar sub-family of five native species in the UK, regularly recorded at light-traps or disturbed from waterside vegetation by day. They are noted for their aquatic larvae and were the subject of Reichholf's PhD studies, especially the life-history of the Brown China-mark *Elophila nymphaea*. The description of the adaptations of this group of moths will be of interest to many readers and reinforce admiration for the subtlety of ecological adaptation that exists under our noses. Further examples of familiar species looked at in a new light include our nettle feeding butterflies, white butterflies and that perennial favourite, the Purple Emperor *Apatura iris* (supplemented in Bavaria by the Lesser Purple Emperor *A. ilia*). In these chapters, the impacts of biotic and abiotic factors on population numbers are examined. The years in which the Painted Lady butterfly *Vanessa cardui* appears in great numbers in Europe are now very well known – largely controlled by climatic factors in North Africa, but this is contrasted with the swarming migratory nature of the Large White *Pieris brassicae*, where the controlling factor is considered to be parasitism. In looking at these examples, the role of both Mullerian and Batesian mimicry is touched upon as well as pointing out facts such as that only a proportion of the Small Tortoiseshell butterfly *Aglais urticae* population actually hibernates (at least in Germany) and that migration is an important factor in understanding population numbers in that species too.

The intriguing nuggets of information keep coming thick and fast. An examination of the small ermine moths, and especially the Bird Cherry Ermine *Yponomeuta evonymella*, reveals the suspected altruistic actions of late-hatching larvae. These moths can be the cause of massive silken webs of larvae defoliating the Bird Cherry trees, as the larvae are one of the few insects able to tolerate the toxins in the leaves. The webs help protect against the actions of parasitoid wasps, but did you know that late hatching larvae (an insurance against poor spring weather) in a normal year will probably not successfully pupate? What they do though, is spin their silk specifically over the pupal cocoons of those larvae which have already pupated and so help to create an even greater defence against the parasitoids for this first hatching, before they die themselves. If, like me, you find this level of detail absorbing then I will leave you to read this book and find out more facts about familiar species such as the Brimstone butterfly *Gonepteryx rhamni*.

Part two brings together some of the references in the first half to the declines observed and studied by the author over his long career with those which first hit international headlines when the Entomological Society Krefeld study revealed a shocking decline of butterflies on German nature reserves of over 70% in the 20 years leading up to 2016. In Reichholf's case, the declines he documents includes much data from light-trapping of moth populations but also of other species such as the Cockchafer *Melolontha melolontha*. His research reveals an 80% decline in nocturnal Lepidoptera since the 1970s but

potentially an even greater drop of other nocturnal insects of perhaps 96% over a 50-year period. Butterflies, too, are shown to have declined in cases where the impact of migration can be removed from the results, e.g., the less-mobile species of grassland habitats.

In providing evidence of these declines in insect abundance, Reichholf then pulls no punches when it comes to assigning the cause. He points out that in Western Europe post-World War II, agricultural policy has clearly aimed to create a mechanised, industrialised and efficient farming machine. Consequently, why are we surprised that the result is a countryside that may look green and pleasant but in which creatures which eat plants are ruthlessly eradicated, and so is no longer populated by butterflies or other insects, nor by insect-eating birds? Rachel Carson's *Silent Spring* may have been a seminal work which helped lead to the banning of DDT, but we have still allowed that silence to arrive, and the countryside of Western Europe and the USA is testament to that. Although the role of pesticides and the agrochemical industry in this decline of invertebrates and the food web they support has been highlighted often, the author places even greater emphasis on the over-fertilisation of our environment. Application of fertilisers directly onto farmland leads to poor plant diversity and a subsequent knock-on effect to surrounding areas, but also the more subtle effect of our nitrogen-laden air in fertilising other habitats is highlighted. In woodlands, for example, the impact of this nitrogen settling out is more luxuriant plant growth which at ground level can give a wetter and cooler micro-environment which many insects fail to tolerate. As such, Reichholf's argument is that eutrophication, a term we usually think of in terms of wet habitats, should also be applied to terrestrial habitats. Coupling that with monocultures of crops which reduce the structural diversity of vegetation and are then sprayed with toxins, results in the collapse we see in our biodiversity.

Finally, this book compares the urban to the rural environment. The main premise is that prior to the application of industrial agricultural techniques our rural habitats were much more biodiverse than urban habitats. However, as that biodiversity has been destroyed, the urban environment has proven to hold its own and is now a really important reservoir for many species. Reichholf holds out little hope that the countryside can be restored to a pre-industrialised state and so his plea is that we protect and develop our urban environment for the continued benefit of those species which still can be found there. He points out that nature conservation legislation in Germany is more often restricting the activities of nature lovers whilst allowing farmers to carry out activities which can cause large-scale damage. Consequently, he suggests that society in general, and the nature conservation movement in particular, should drop the ingrained attitude that urban is bad, countryside is good. Instead of now building over brown field sites in cities, in order to protect the nature found in the countryside, we should be planning for more nature-friendly spaces and management practices in our urban areas. To achieve this, he suggests that a grass-roots movement by local people to generate a butterfly meadow for every municipality is required, building on the intrinsic beauty and pleasure we all obtain from seeing these insects.

In conclusion, although Reichholf suggests that Germany is probably in a much worse place than other countries, such as the UK, is it really? Should we throw in the towel on our own agricultural deserts or fight back? The declines of invertebrate populations in the UK are as dramatic as in Germany. Conservationists and planners would do well to read this book and take on board some of its lessons. Reversing the decline in invertebrates is a crucial challenge to our society and this book not only ably demonstrates the problem but also offers possible hope and guidance.

Ray Barnett