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THE CONSERVATION OF ODONATA IN GREAT BRITAIN

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Recent unprecedented changes in agricultural practices have caused the loss of numerous aquatic habitats throughout the British lowlands. On the other hand, water supply schemes and increased gravel and clay extraction have produced many new water bodies. The effects of these activities on the British odonate fauna are discussed. Since 1950, *Coenagrion scitulum* (Ramb.), *C. armatum* (Charp.) and *Oxygastra curtisi* (Dale) have almost certainly become extinct. Populations of *Lestes dryas* Kirby, *Aeshna isosceles* (Müll.) and *Sympetrum sanguineum* (Müll.) have become much reduced; the first two are now very rare insects. *Orthetrum cancellatum* (L.) and *Aeshna mixta* Latr. appear to be increasing. – National Nature Reserves in Britain are selected as representatives of habitat types rather than to protect particular species, nevertheless 32 out of the 41 species breeding regularly in 1950 now occur in these reserves. 3 other species are protected in reserves managed by voluntary conservation bodies and 2 others in the state-owned New Forest. – The scheduling of the Hampshire locality of *O. curtisi* as a "Site of Special Scientific Interest" failed to prevent its extinction through the pollution of its habitat. – The value of several nature reserves for dragonflies has been increased by making new ponds. Populations of local species such as *Leucorrhinia dubia* (Vander L.), and *S. sanguineum* have been increased, and *Coenagrion mercuriale* (Charp.) was encouraged to colonise a reserve where it was previously absent by these means. – The Nature Conservancy Council is undertaking experiments with the aim of reintroducing species into the Fens which have become extinct there in recent years.

INTRODUCTION

Great Britain has an impoverished odonate fauna. In 1950 it consisted of 44 species, of which three, *Sympetrum vulgatum* (L.), *S. flaveolum* (L.) and *S. fonscolombei* (Selys) were only occasional immigrants and did not maintain

regular breeding populations in the country (CORBET et al., 1960). Nevertheless active steps are being taken to conserve the fauna for scientific and aesthetic reasons.

In this paper changes in land use which affect odonate habitat are described, together with effects which these appear to be having on dragonflies; and finally conservation measures are outlined.

LAND USE CHANGES

The last quarter of a century has witnessed changes in British agriculture, which are more fundamental than any which have occurred before. Greatly increased agricultural productivity has been achieved by the use of artificial fertilisers and pesticides, by improvements in land drainage, by new cultural techniques and by plant and animal breeding. Parallel to these developments industrialisation has increased throughout the country; new towns and motorways have been built. The building programmes have required vast quantities of chalk, clay and gravel, which have been dug in many parts of lowland England; many of the pits have filled with water. New reservoirs have been made. Thus old Odonate habitats have been destroyed and new ones created. No comprehensive studies have been made on the changes in odonate habitat, but several detailed studies give some indication of the scale of the changes.

Reclamation schemes and improved drainage have greatly reduced the number of marshes and bogs containing permanent water. For example, the bogs and ponds of the heathlands of Dorset support a rich dragonfly fauna (MOORE, 1964) including *Ceriagrion tenellum* (Vill.), *Coenagrion mercuriale* (Charp.) and *Ischnura pumilio* (Charp.). The total area of heathland was reduced from 18,000 ha in 1934 to 10,000 ha in 1960 and to 6,000 in 1975 (MOORE, 1962; BIBBY & TUBBS, 1975). The marshlands of East Sussex which supported good populations of *Lestes dryas* Kirby in 1940 had declined by at least 40% by 1974 (unpublished data).

The change-over from mixed farming to purely arable farming in much of eastern England and the provision of piped water for farm animals has caused a great reduction in farm ponds. For example RELTON (1972) records a 35% loss of ponds in Kimbolton parish Huntingdonshire between 1950 and 1969, and JONES (1971) a loss of 26% of 1402 ponds studied in NE Leicestershire between 1930 and 1970. Twenty-eight new towns are in various stages of development in England, Wales and Scotland, and 1770 km of new motorway have been built in England and Wales since 1945, mostly on lowland country. Many ponds and watercourses have been made unsuitable for Odonata as the result of pollution with industrial and agricultural chemicals. Others have lost all their dragonflies except for a few very resilient species such as *Ischnura elegans* (Vander L.). Herbicides such as dalapon, diquat and dichlobenil are used increas-

ingly instead of mechanical means to keep drainage ditches free of water plants. The loss of waterlilies (*Nuphar* and *Nymphaea*) due to herbicides results in the loss of *Erythromma najas* (Hans). On the other hand numerous new waterbodies have been created as the result of gravel and clay extraction. Of 730 pits in 1954 40% were flooded. At that time about 360 ha were excavated each year, but about half this area was filled in (ATKINSON-WILLES, 1963). Gravel pits are particularly suitable for *Orthetrum cancellatum* (L.) and *Enallagma cyathigerum* (Charp.). In addition there are over 500 reservoirs in England and Wales covering an area of over 15,000 ha (ATKINSON-WILLES, 1961). Some are unsuitable for Odonata.

THE EFFECTS OF THE LAND USE CHANGES ON THE ODONATA FAUNA

The following statements are based on the author's largely unpublished observations made from 1939 onwards and from discussions with other odonatists with experience over the same length of time. During the 25 years since 1950 it appears that Britain has lost three species:

(1) *Coenagrion scitulum* (Ramb.) due to the inundation of its one locality in Essex by the North Sea floods in 1953.

(2) *Coenagrion armatum* (Charp.) due to the lowering of the water table and hence alteration of its habitat in the Norfolk Broads. A thorough but unsuccessful attempt to discover the species was made by a group of odonatists in 1975.

(3) *Oxygastra curtisi* (Dale) due to pollution in the West Moors River caused by the installation of a sewage works upstream of the dragonfly's locality. It has not been seen there for several years. This species has occasionally been recorded from Devonshire where suitable habitat appears to exist. A survey of all six principal rivers there was made by the author in 1975 under ideal weather conditions, but the insect was not observed.

In addition three species have shown notable declines.

(1) *Lestes dryas* Kirby no longer occurs in many of the Fenland and Romney Marsh/East Sussex localities where it was found thirty years ago. This is due to the disappearance of suitable marshes caused by lowering of the water-tables.

(2) *Aeshna isosceles* (Müll.) which became extinct in the Fens in the nineteenth century, appears to have declined in the Broads district of Norfolk. Many other organisms have also declined in this district; the reasons appear to be lowering the watertable and eutrophication of the broads and rivers.

(3) *Sympetrum sanguineum* (Müll.) is notably less common in the Fens and Romney Marsh than it was thirty years ago, doubtless due to the disappearance of suitable habitat caused by lowering the watertable. The extensive

use of herbicides to control waterweed may have been a contributory cause.

On the other hand *Orthetrum cancellatum* appears to be more abundant. In some areas this must be due to the great increase in gravel pits and reservoirs which provide very suitable habitats for this species. They are also extensively colonised by common species such as *Enallagma cyathigerum*, and in the south by *Anax imperator* Leach. *Aeshna mixta* Latr., which was called The Scarce *Aeshna* by Miss Cynthia Longfield in the thirties (LONGFIELD, 1937), is now much the commonest *Aeshna* in much of south east England, though what proportion breed in this country is not known. There is no obvious reason for the increase in this species. Doubtless the habitat changes mentioned in this paper have affected the abundance of many other species, but the effects are not obvious.

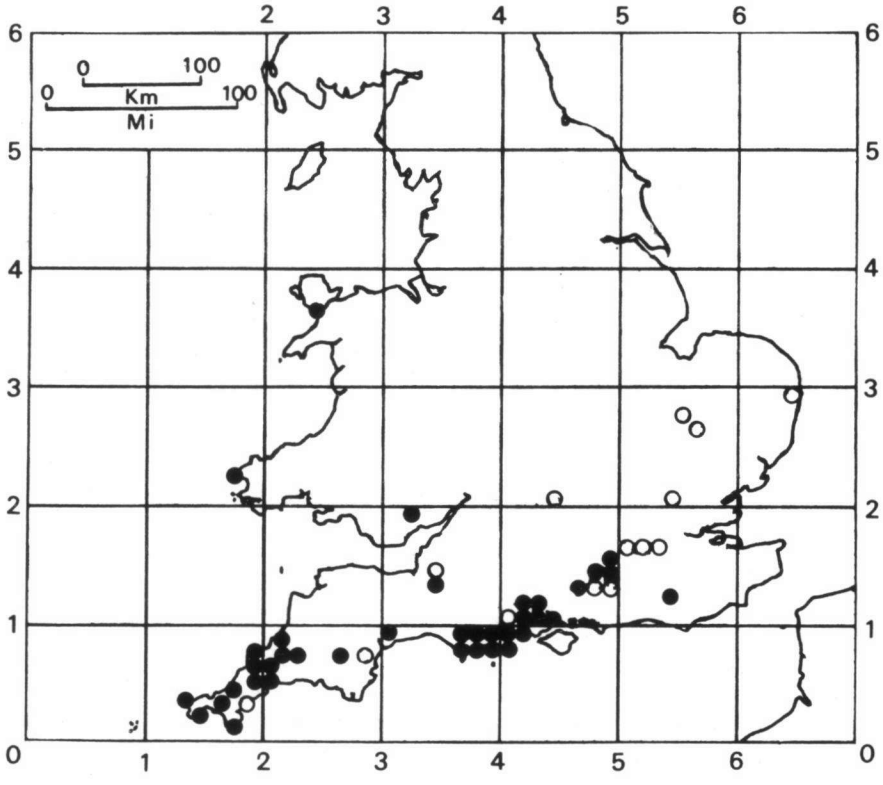

Fig. 1. The distribution of *Ceriagrion tenellum* (Vill.) in Great Britain. Circles include records up to and including 1960. Dots denote subsequent records (SKELTON, 1974).

Thanks to the Insect Distribution maps scheme organised by the Biological Records Centre at Monks Wood Experimental Station much is being learnt about the past and present distribution of British Odonata. Soon the maps will be accurate enough to alert conservation entomologists to major changes in the status of all Odonata species. The preliminary map of the distribution of *Ceriagrion tenellum* is shown in Figure 1. Though not complete it gives a clear indication of the recent decline of the species in the eastern part of its range.

CONSERVATION OF ODONATA IN NATURE RESERVES

Official conservation in Great Britain is the responsibility of the Nature Conservancy Council, which operates by establishing, maintaining and managing National Nature Reserves (NNRs) (In 1975 there were 140 totalling c. 121,000 ha) and by giving advice about conservation matters to both government and non-governmental departments and organisations. The NNRs are reinforced by Local Nature Reserves maintained by Local Authorities and by numerous nature reserves belonging to or managed by voluntary conservation organisations, notably the County Naturalist Trusts, the Royal Society for the Protection of Birds and the National Trust.

No reserve has been set up specifically to conserve Odonata. The NNR system is intended to represent all the main habitat types found in Britain. It is interesting to discover the extent to which this method of selecting reserves has been successful in conserving Odonata. At present no fewer than 32 species of the 41 species which were breeding regularly in Britain in 1950 occur in NNRs. In addition two other species are protected in the New Forest in Hampshire, which is Crown land and where the Nature Conservancy Council advises the Forestry Commission on wildlife management. Another three species are protected in nature reserves run by County Naturalist Trusts. Only four species (*Coenagrion scitulum, C. hastulatum* (Charp.), *Oxygastra curtisi* and *Somatochlora metallica* (Vander L.) have received no protection on nature reserves. This suggests that a system of reserve selection based on protecting a wide range of habitats has been effective in conserving the majority of British dragonfly species.

S. metallica and *O. curtisi* were given some protection by scheduling their habitats as "Sites of Special Scientific Interest" (S.S.S.I.). Thus the Planning Officers concerned were informed about the sites and had to consult the Nature Conservancy Council when development was proposed on them. The S.S.S.I. procedure has saved some sites, but owing to the narrow legal definition of "development", which does not include drainage, it is an inadequate safeguard. As stated above, it did not prevent the pollution of the West Moors river and hence the extinction of *O. curtisi* in its only certain British locality.

CONSERVATION OF ODONATA BY MANAGEMENT IN NATURE RESERVES

Nature reserves provide refuges, whose conservation value increases as habitats outside them become less suitable for dragonflies. More should be established; however existing reserves can be made much more suitable for dragonflies for a very small cost. Some progress has been made already. In 1961 the author arranged for 20 circular ponds, each of 7 m in diameter, to be created in the Wood Walton National Nature Reserve in Huntingdonshire. First a careful survey of the area was undertaken to make sure that nothing of biological interest would be destroyed by the operation. Information was obtained about the watertable to ensure that the ponds would hold permanent water. Then the ponds were dug out by a power operated dragline. The total cost was £70. Since that date the imagines of 15 species of Odonata have been observed by the ponds and 11 species have bred in them including *Brachytron pratense* (Müll.) and *Sympetrum sanguineum*, which are becoming rare in the country surrounding the nature reserve. (A full account of the colonisation of the ponds is being prepared for publication). The Hartland Moor National Nature Reserve in Dorset supports good populations of most of the British acidophilic Odonata, but *Coenagrion mercuriale*, which occurs in three localities nearby, was absent. By enlarging a small stream to form a pond the warden of the reserve, Mr. M.V. Tuck, made a habitat suitable for *C. mercuriale* which soon colonised the reserve.

The Surrey Naturalists' Trust manages a heathland nature reserve in their county which supports an isolated population of *Leucorrhinia dubia* (Vander L.). There was some danger of the bogs on the reserve drying out and so they asked the Army to blow a large hole in the middle of one of the bogs with high explosive. *L. dubia* has colonised the new pond which resulted, and so the chance of survival of *L. dubia* on the reserve has been greatly increased. Incidentally, this species, which is very local in Britain, is also protected on one Scottish and one English National Nature Reserve.

Originally the Fens contained a few acid waterbodies and some dragonfly species dependent on them. For example *Ceriagrion tenellum, Sympetrum danae* (Sulz,) and *Orthetrum coerulescens* (Fabr.) all occurred at Wicken Fen, now a National Trust reserve. These acid waters depended for their existence on peat cutting and disappeared about 50 years ago when peat digging was no longer practised; the acidophilic dragonflies disappeared with them. Attempts are now being made to recreate acid water ponds in two fenland NNRs and carefully controlled experiments are being conducted to determine whether it is feasible to introduce the lost fenland species. Previous experimental work (MOORE, 1964) showed how easy it is to transfer imaginal Zygoptera from one pond to another; so introductions should not be too difficult. A more serious problem is

posed by the necessarily small area of the new waterbodies. However, despite territorial behaviour which produces very low population densities of reproductive males (MOORE, 1964), very restricted isolated habitats have been known to support populations of Odonata for many years. For example there was probably never room for more than 100 territories of *O. curtisi* in the West Moors locality (often much less), and that population survived for at least 140 years.

Some biologists may doubt the propriety of providing man-made habitats for dragonflies. However it must be remembered that the vast majority of ponds and lakes already inhabited by dragonflies in lowland England today are man-made. The only difference is that they were not created for dragonflies, while those described above were made on purpose for them.

Species confined to flowing water cannot be conserved by digging ponds. Fortunately upland rivers and streams, and hence the habitat of species such as *Cordulegaster boltoni* (Don.), are valuable for water supply and salmon and trout fishing and so generally receive good protection from pollution. Species such as *Libellula fulva* Müll. which are virtually confined to slow moving rivers are much more difficult to conserve, since their habitat is easily polluted and the forces working against its pollution are less powerful. However, *L. fulva* is holding its own in England, and since pollution is being gradually reduced in British rivers, thanks to the efforts of the Water Authorities, its survival and that of other species with similar requirements should be assured.

CONCLUSIONS

Habitat is being destroyed or damaged on such a scale in Great Britain that the survival of the odonate fauna cannot be taken for granted. Therefore conservation by means of nature reserves is becoming increasingly important. Much progress has been made already but the value of many nature reserves could be further enhanced by creating new habitats on them. Pilot studies are most encouraging in this respect. More rigorous pollution control is essential for the protection of species confined to rivers.

Finally the effectiveness of conservation measures depends upon research. There is an urgent need to learn more about the exact requirements of threatened species, and more must be learnt about the minimal areas of habitat necessary to protect viable populations.

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