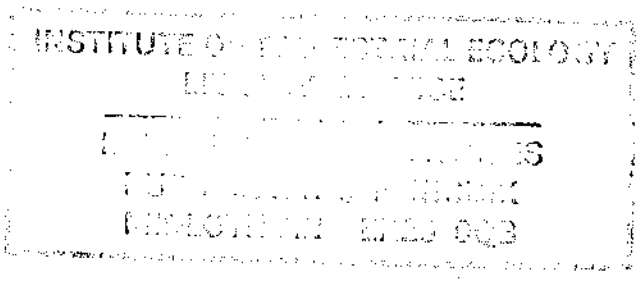
Institute of Terrestrial Ecology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Biological Records Centre

John Heath and Franklyn Perring



Institute of Terrestrial Ecology
Monks Wood Experimental Station
Huntingdon

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The cover shows clockwise from top:
common frog. Photograph A. S. Cooke
early spider orchid. Photograph B. Dickerson
snakeshead fritillary. Photograph L. Farrell
chequered skipper butterfly. Photograph M. Skelton

The Institute of Terrestrial Ecology (*ITE*) was established in 1973, from the former Nature Conservancy's research stations and staff, joined later by the Institute of Tree Biology and the Culture Centre of Algae and Protozoa. ITE contributes to and draws upon the collective knowledge of the fourteen sister institutes which make up the *National Environment Research Council*, spanning all the environmental sciences.

The Institute studies the factors determining the structure, composition and processes of land and freshwater systems, and of individual plant and animal species. It is developing a sounder scientific basis for predicting and modelling environmental trends arising from natural or man-made change. The results of this research are available to those responsible for the protection, management and wise use of our natural resources.

Nearly half of ITE's work is research commissioned by customers, such as the Nature Conservancy Council who require information for wildlife conservation, the Forestry Commission and the Department of the Environment. The remainder is fundamental research supported by NERC.

ITE's expertise is widely used by international organisations in overseas projects and programmes of research.

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Biological Records Centre

The Biological Records Centre (BRC) was set up at Monks Wood Experimental Station in 1964 following the completion of the Botanical Society of the British Isles' *Atlas of the British Flora*. Its main function is to utilise the immense wealth of knowledge of our flora and fauna possessed by the thousands of amateur naturalists in the British Isles to produce scientific information which could not be economically gathered by professional scientists alone. This booklet describes the methods which are used and the results which can be achieved by these means.

The information that amateur naturalists can easily provide is that a particular species was seen at a place or in an area, at a date, or within a date period. In addition, they may record features such as habitat, abundance, reproductive capacity and a list of associated species—information based on observations in the field rather than on experiment.

From this simple information, a number of objectives can be achieved.

The first objective, and the one foremost in the minds of the pioneers who set out to survey the British flora in 1954, was to produce distribution maps as an accurate base for the study of the history of the flora and its biogeographical relationships. In addition, an accurate distribution map is valuable as part of the basic equipment required for autecological research on any species. There was soon a demand, not only for maps, but also for the data on which they were based.

The second objective must therefore be to maintain a data bank for the supply of information by species, by area or by site, either to naturalists wishing to know as exactly as possible where to find the species they are working on, or to writers of Floras and Faunas who wish to assemble all the available information on their species in a defined area. As an extension of these requirements, there is a growing interest in the association between species as in host/parasite relationships or food plant studies.

A third objective, which has now assumed greater immediate importance than the other two, lies in the field of wildlife conservation. Completed surveys of our flora and fauna make it possible to discover which species are rare and possibly endangered. If the surveys are repeated at regular intervals, changes in the distribution of species can be detected.

These, then, are the three major objectives of biological recording: map making, data supply, and conservation. How are they achieved?

MAP MAKING

If meaningful maps are to be prepared, and they are to be comparable with maps prepared in the future, there must be an organisation behind every mapping project which ensures that the whole territory is surveyed as evenly as possible. In most cases, the mapping of a group of plants or animals is co-ordinated by a national biological society or a group of leading national experts in collaboration with the Records Centre, but, in some cases, where there is no appropriate Society or group to organise the data collection, the Records Centre undertakes this co-ordination.

The organisation of data collecting for a scheme by a society or group is usually done voluntarily: as is the collection of the data in the field. This is not to say that some of the organisers and field workers are not being paid from other sources: many are professional scientists from universities or museums who regard recording as ancillary, or additional, to their other research work. However, the BRC does not itself pay them for their work or their records.

The BRC was set up to meet the data handling and processing needs of any organisation collecting distribution data. It was felt that specialists should spend as much time as possible doing what they are good at—namely identifying organisms—and that the routine work of map-making from their data should be left to the Centre. In exchange for this service, it is understood that the data become part of a national data bank.

The Centre does not make its sole contribution by handling data at the end of a Scheme. Assistance is given in a number of ways throughout the Scheme's existence. First, the Centre supplies general instructions for recording

applicable to all plants and animals—terrestrial, freshwater, or marine—found around or within the British Isles (Heath & Scott, 1978). Organisers then have only to prepare a further leaflet of particular instructions for their group.

Second, the Centre has produced a wide selection of general-purpose recording cards suitable for all groups (fig 1). It also prepares for the scheme organisers a special recording card for their particular scheme and supplies these in quantity (fig 2).

Third, the Centre has produced a standard base map of the British Isles (see fig 3) which is considered in detail below. It can be used throughout the scheme to prepare preliminary maps to show progress, to give publicity to the scheme and to encourage the voluntary helpers to further activity.

Provision of these services enables the Centre to have considerable influence on schemes throughout their existence. Nearly all field recording in Britain is done on record cards of the same size (8 in × 5 in), so that all the information available about an area can be stored together in the same filing drawer, and all distributions are plotted on the same base map, so that patterns are readily comparable (fig 3).

A final service is publication. Some atlases, for example *The Atlas of the British Flora* (Perring & Walters, 1962) and *The Atlas of Breeding Birds of Britain and Ireland* (Sharrock, 1976), are commercial publications with sales of 5,000 upwards. Such sales are not likely, however, with an atlas of a little-known invertebrate group. The BRC has published many of these atlases, and copies can be made available to volunteer recorders and organisers free of charge, though they are also sold to the general public.

In Britain, we have used the 10km squares of the National Grid as the basic recording unit since mapping began in 1954, partly because these squares are marked on all Ordnance Survey maps, and partly because they are the same size irrespective of latitude. Indeed, one series (1 : 25,000) provides a single map for each square defining clearly the area to be covered by the observer. An advantage of the grid system in recording is that it is repeatable: grid squares can be regarded as large quadrats. It is intended to repeat national

	SPECIES	GEN & SPEC NUM
RECORDER	COL /REF	

Grid Ref.	V.C.	Collector	Loc	Date	

Fig 1 One species card

	LOCALITY		NEUROPTERA 6440 MECOPTERA 6443	
			Date	V.C. No.
	HABITAT	RECORDER'S NAME	V.C.	
Grid Ref.			Alt.	Code No.

MEGALOPTERA 6438

101 Raphidia cognata
102 maculicollis
103 notata
104 xanthostigma
201 Sialis fuliginosa
202 lutaria
203 nigripes

PLANIPENNIA 6439

101 Aleuropteryx juniperi
201 Chrysopa abbreviata
202 albolineata
203 carnea
204 ciliata
205 commata
206 dorsalis
207 flava
208 flavifrons
209 perla
210 phyllochroma
211 septempunctata
212 ventralis
2121 ventralis prasina
213 vittata
301 Coniopteryx borealis
302 parthenia
303 tineiformis
401 Conwentzia pineticola
402 psociformis
501 Drepanepteryx phalaenoides
601 Helicoconis lutea
701 Hemerobius atrifrons
702 contumax
703 humulinus
704 lutescens
705 marginatus
706 micans
707 Hemerobius nitidulus
708 perelegans
709 pini
710 simulans
711 stigma
801 Megalomus hirtus
901 Micromus angulatus
902 paganus
903 variegatus
1001 Nothochrysa capitata
1002 fulviceps
1101 Osmylus fulvicephalus
1201 Parasemidalis fuscipennis
1301 Psectra diptera
1401 Semidalis aleyrodiformis
1501 Sisyra dalii
1502 fuscata
1503 terminalis
1601 Sympherobius elegans
1602 fuscescens
1603 pellucidus
1604 pygmaeus
1701 Wesmaelius balticus
1702 betulinus
1703 concinnus
1704 malladai
1705 mortoni
1706 quadrifasciatus
1707 ravus
1708 subnebulosus

MECOPTERA 6443

101 Boreus hyemalis
201 Panorpa cognata
202 communis
203 germanica

OTHER SPECIES

BIOLOGICAL RECORDS CENTRE AUG.1977 RA 32

Fig 2 Species–list card

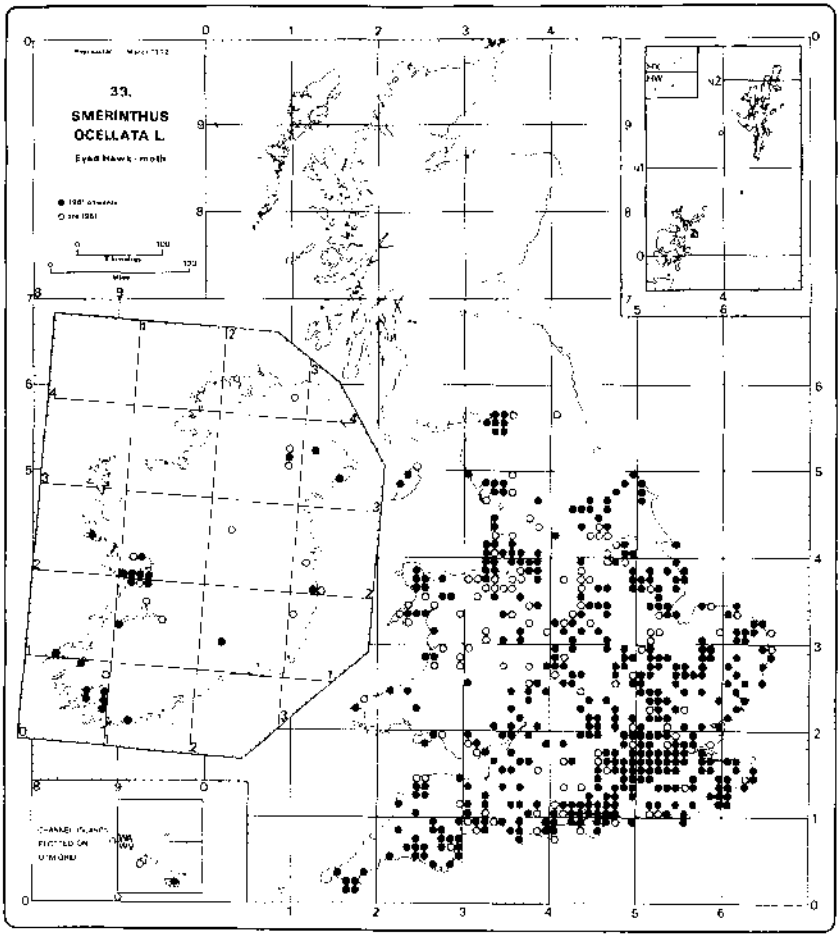


Fig 3 British Isles distribution map

surveys every 20–25 years at the 10km square level, at least for the major groups, for which a large team of observers is available. The British Trust for Ornithology is already planning to resurvey the breeding birds in the five-year period 1985–89—only 17 years after their 1968–72 survey.

Over the last ten years or so, we have seen a unified metric grid become increasingly used on maps in other countries. This grid, the Universal Transverse Mercator (UTM), is now being adopted as the basis of distribution maps in many parts of the world; the flora of Europe, for example, is being mapped using the 50km squares of the UTM grid (Jalas & Suominen, 1972, 1973, 1975). The advantages of this grid are both technical and practical.

First, the UTM grid provides units of equal area throughout the range of latitude from 0 –80° North and South. This equality of area is not true of a latitude/longitude graticule where the size per unit decreases and the number of units increases, towards the poles, over-emphasising the frequency of species in polar regions compared with their occurrence near the equator. Second, the UTM grid provides a system of squares of different scales: data collected on one scale can readily be used for mapping on any smaller scale. In Europe, a 3-tier system has developed. For small areas, say about the size of an English county, the unit is the 2 × 2km square, *c.* 1½ square miles in area. At this scale, one is able to interpret distributions in relation to habitat factors, soils, urbanisation, and so on. For most European countries, the most convenient unit is the 10km square, which covers *c.*36 square miles. Maps made on this scale provide broad correlation to climatic and edaphic factors and enable limits of distribution to be plotted with comparable accuracy to the available environmental data.

In future, most naturalists in Britain will be making their contribution to plant and animal mapping by recording in 2 × 2km squares ('Tetrads') or in particular sites at the county level. During the last ten years or so, many projects have begun to record in detail the biological wealth of the countryside, and, in many cases, species and habitat data have been published as a result (see Cadbury *et al*, 1971, figs 4a and 4b). Data from these surveys are increasingly being

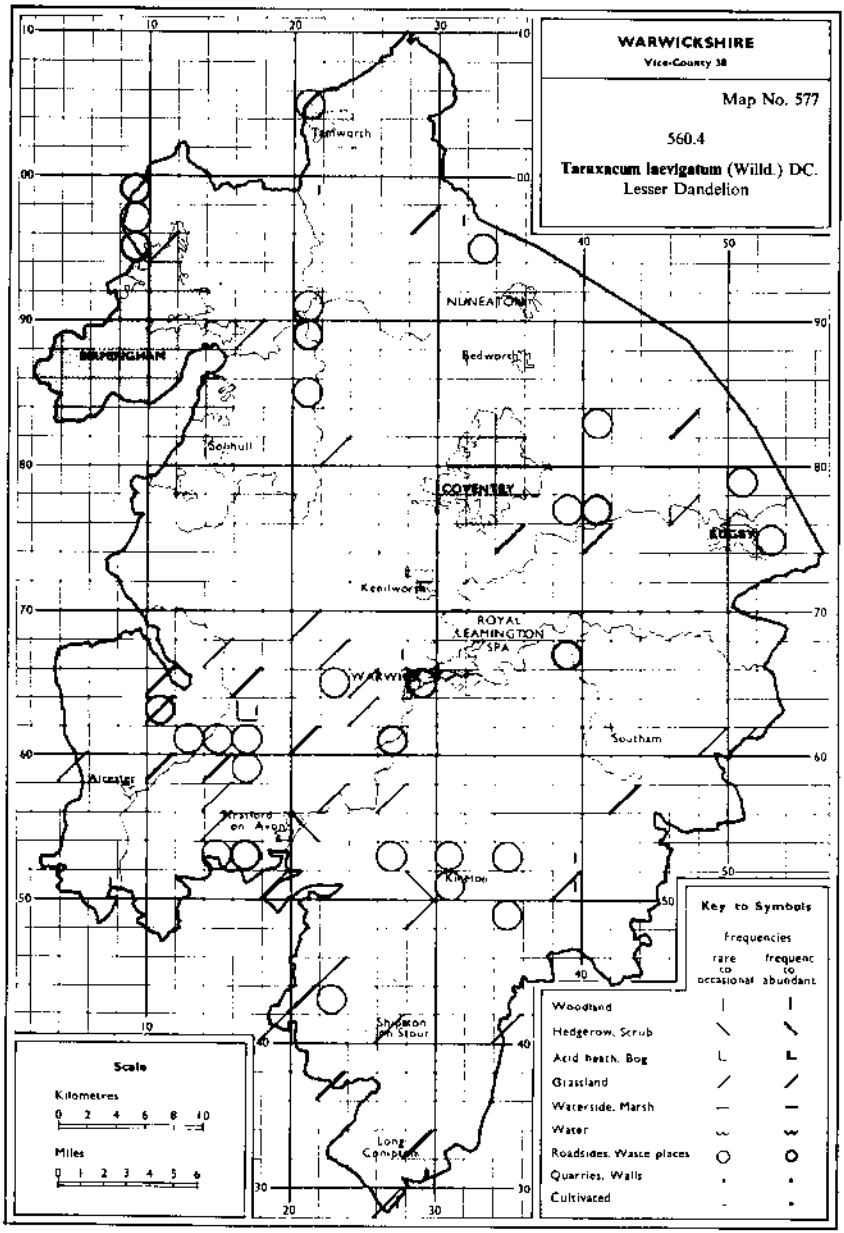
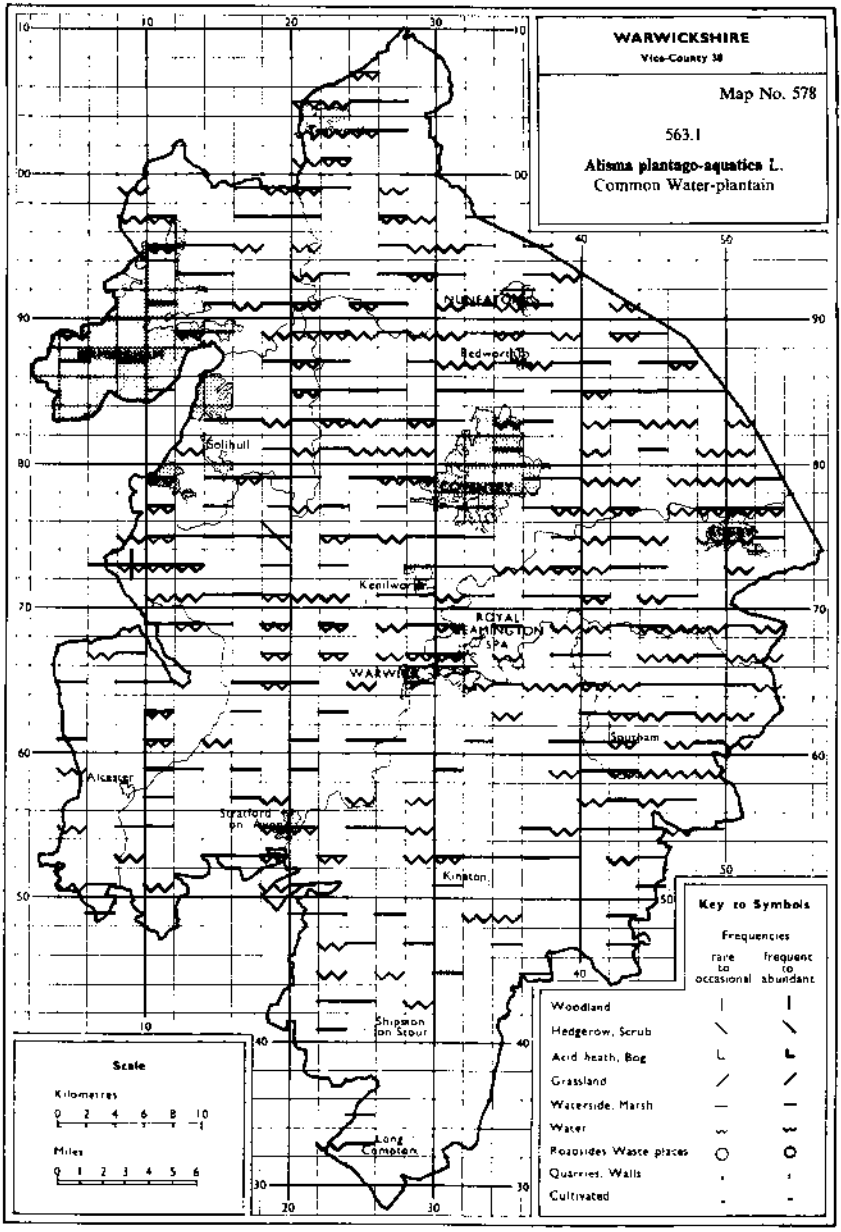


Fig 4 Maps from A Computer-Mapped Flora [of Warwickshire]


WARWICKSHIRE
Vice-County 38
Map No. 578
563.1
Alisma plantago-aquatica L.
Common Water-plantain
NUNEATON
Bedworth
Solihull
COVENTRY
Kenilworth
ROYAL LEAMINGTON SPA
WARWICK
Southam
Alcester
Stratford upon Avon
Kineton
Shipston on Stour
Long Compton
Scale
Kilometres
0 2 4 6 8 10
Miles
0 1 2 3 4 5 6
Key to Symbols
Frequencies
rare to occasional
frequent to abundant
Woodland
Hedgerow, Scrub
Acid heath, Bog
Grassland
Waterside, Marsh
Water
Roadsides Waste places
Quarries, Walls
Cultivated

gathered together at County Records Centres which directly or indirectly ensure that the records necessary for national projects are forwarded to the appropriate organiser. Similarly at the national level, data are assembled in the form required by the appropriate international centres for the production of continental maps (fig 5).

For the western Palaearctic region 50km squares are being used, but, for some other continents, the 100km square may be more practicable.

DATA SUPPLY

The technique of data capture described so far depends entirely upon the use of field observers, and the resulting maps are based on records which are localised only to the 10km square in which they were made. This was the method adopted by the British Trust for Ornithology in the production of their *Breeding Bird Atlas*.

However, for most other schemes, it seems desirable to ask for additional data about some of the species—either because they are rare or because they are of taxonomic interest. Observers are given a list of species or criteria so that they will know when extra information is needed—and they are supplied with individual record cards with space to record all the necessary details (figs 6a and 6b). The main card is designed to cover all terrestrial and freshwater organisms, the other is for marine species.

For the botanical project, individual record cards (IRCs) were used extensively from the beginning, as a means of acquiring data on rare and taxonomically critical species from herbaria and from the literature. As a result, BRC has acquired a more or less complete historical and bibliographical account of these taxa. The cards can be used as a basis for map making, but they also have a more permanent function as an information store. The main data storage and exchange system will be based on microfilm which reduces the space required for storage while providing the user with a facsimile of the original data, including the description of the habitat and any other notes. In addition, the user has the original handwritten record which can be misinterpreted if prepared for computer storage by operators with no geographical or biological training.

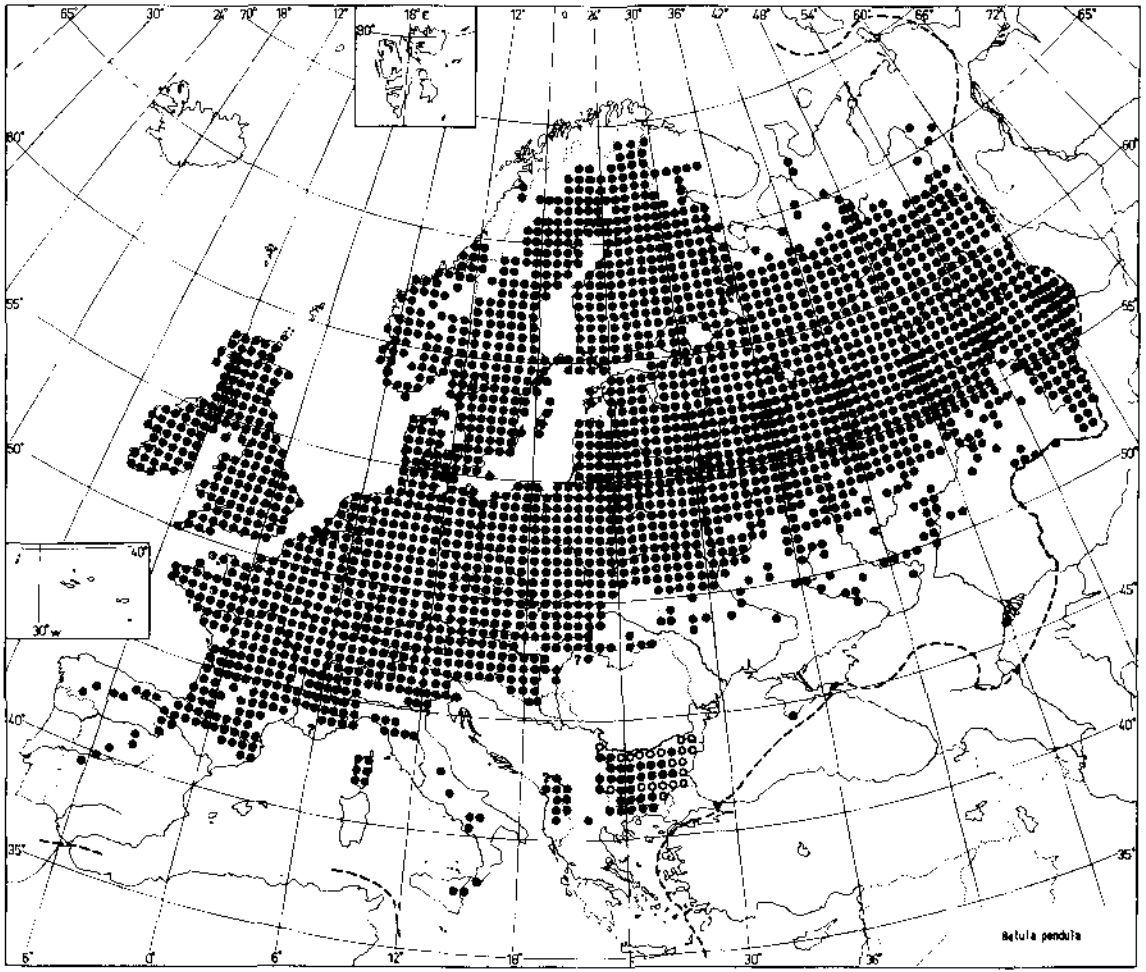


Fig 5 European distribution map

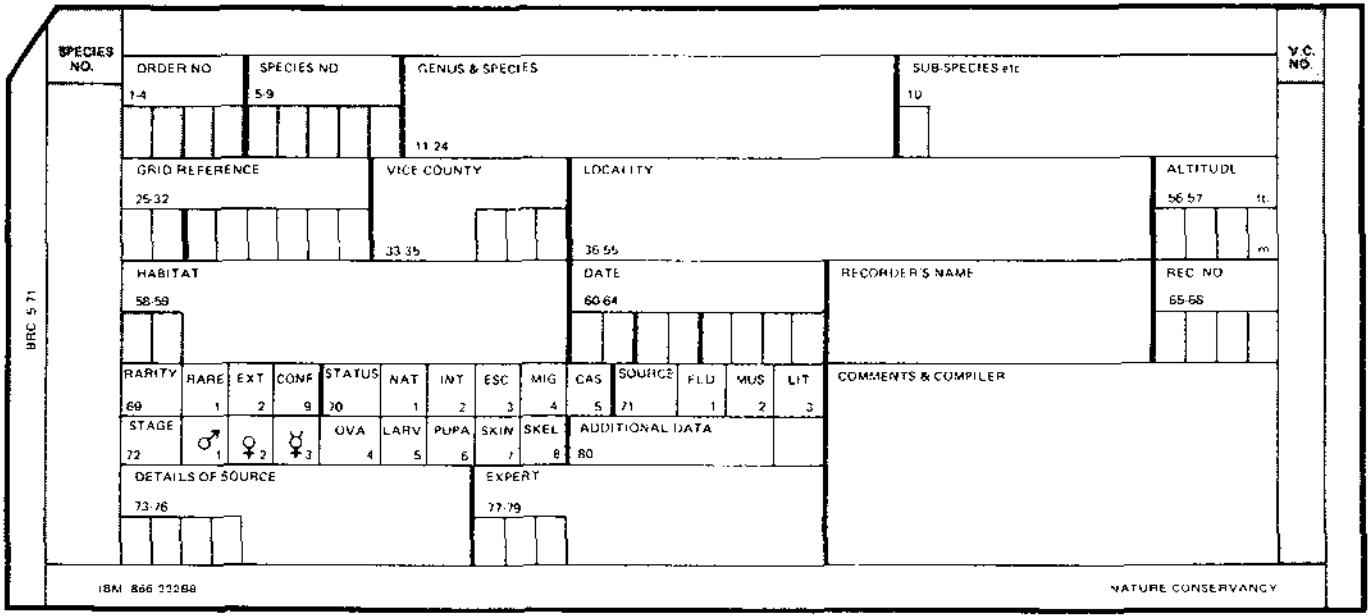


Fig 6a Individual record card: terrestrial

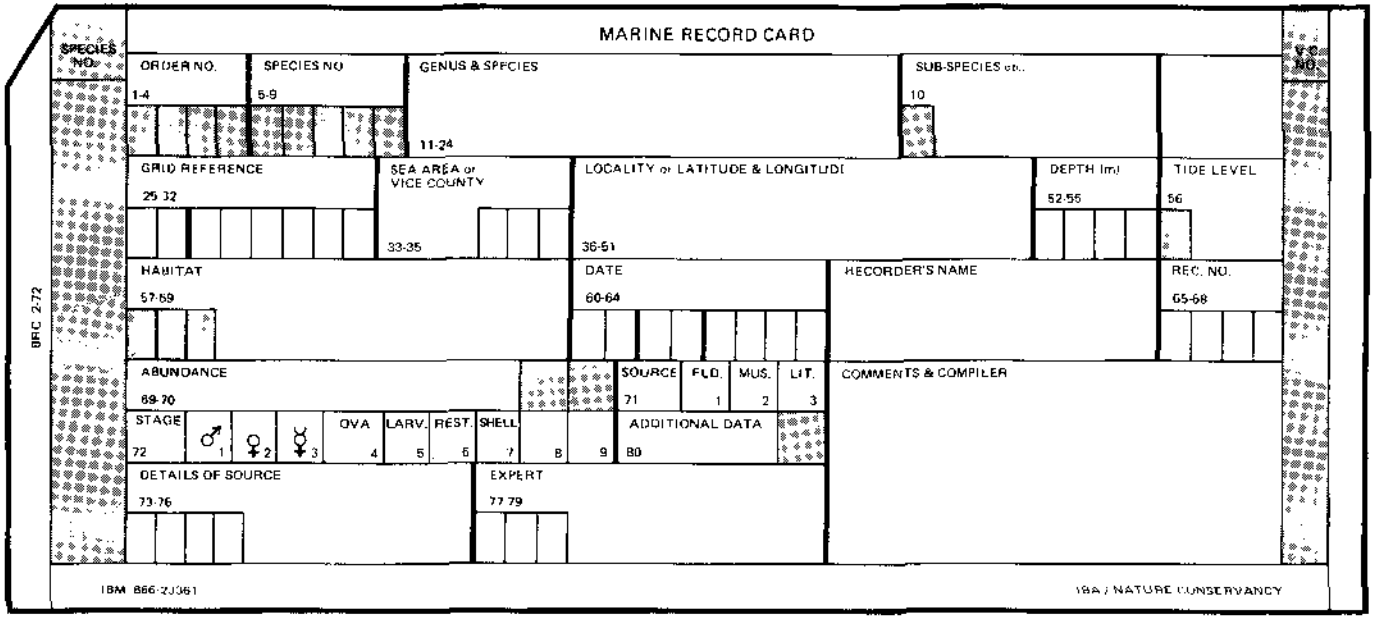


Fig 6b Individual record card: marine

If users require all the data available about a species, they can receive microfiche copies of all the IRCs, plus a listing of grid squares from the computer. However, this listing is not much more informative than the map on which data are normally presented; a new map is usually prepared, based on the latest information available.

If users require all the data available about an area, they can receive microfiche copies of the appropriate 10km square card or cards. Any area can be defined reasonably satisfactorily by this means, at least on a national scale. The aim is to present the user with all the data available on a species or an area. If he wishes to analyse these data statistically, the whole record can be prepared for computer storage and analysis at this time. Data are currently being assembled for over 10,000 species and only 1 per cent of these species are likely to be looked at in detail in any one year; it would not be economic to hold all data in the computer store for such a low demand.

CONSERVATION

One of the major advantages of collecting and mapping data, as described above, is that the results give an objective indication of the relative abundance nationally of a species in the group being studied and make it possible to determine which species are rare. The maps in the *Atlas of the British Flora*, for example, have been used to select all those species recorded from 15 or fewer 10km squares for special and more detailed study. An attempt has been made to record at least every 1km square in which these species occur and, wherever possible, to acquire the exact boundary of each population and/or a count of the population if that is feasible. Experts in each county have been asked to co-ordinate collection of the information on standard population forms which ask for information on the reproduction of the species at the site, any known threats to its survival, as well as a sketch map of the exact location and information on the conservation status of the site. This information is used for the following two purposes:

(i) to assess nationally the degree to which each species is endangered. This information, in summary form, has now been published as a Red Data Book (Perring & Farrell, 1977).

(ii) to alert the conservation organisations in the area concerned, and give them accurate maps of the locations of the populations.

These developments are based on the results of the primary survey, followed by a more detailed survey of the selected rare species. The procedure assumes, however, that only rare species change, mostly by declining, and that we are not concerned with common or expanding species. We should, however, be equally concerned about these other changes.

Repeated surveys at long time intervals may be regarded as part of a programme of biological monitoring, in the broad sense. Within the range of groups and species being surveyed in Britain, some have been selected for more detailed and more frequent survey because there is reason to believe they are more sensitive to such environmental factors as sulphur dioxide.

These surveys are not now restricted to Britain. The ultimate hope is to collect information concurrently for the whole of Europe. Collection of records on this scale may be impossible for most groups, but there is a plan for every country to map the distribution of their breeding birds by 10km squares in the period from 1985–89. This plan will provide a Breeding Bird Atlas for Europe, which will be the basis for further surveys in the future. Such an ambitious plan is quite impossible for vascular plants. It will take 65 years to complete the comprehensive mapping of the flora of Europe, even if the present rate is maintained. However, each country has been asked to draw up a list of extinct, endemic, rare and endangered or rapidly declining plant species, and we now have a provisional list for the continent (Lucas & Walters, 1976).

Data from the surveys being carried out in Britain are made available to the Atlas Florae Europaeae secretariat in Helsinki for inclusion on the maps of the vascular plants of Europe. Similarly distributional data from the various invertebrate schemes is available for the mapping projects sponsored by the European Invertebrate Survey (EIS). This organisation is one of the constituent 'Surveys' of the International Commission for Invertebrate Survey (ICIS), one of the Commissions in the Division of Zoology of the International

Union of Biological Sciences. At present the secretariats of both EIS and ICIS are in BRC.

We look forward in the next ten years to the completion of a network of county records centres in Great Britain. At the same time, we must hope for the strengthening and expansion of the European mapping projects, which would be accelerated if there were at least one national centre in each country. If this strengthening could be achieved, we could have an information network capable of providing rapidly all the available data on every plant or animal anywhere in Europe, and the enthusiastic field naturalist's role in recording accurately the distributions of organisms he knows would be more important than ever before.

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ACKNOWLEDGEMENT

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Up-to-date lists of:

- Atlases of distribution maps
- Schemes in operation
- Record cards

and Regional records centres
are available from the Biological Records Centre.

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