

Long-term monitoring of British bird populations

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This paper outlines the organizational arrangements in Britain for maintaining long-term surveillance of British bird populations. The UK Nature Conservancy Council is the statutory body responsible for nature conservation work in Britain, including the organization of any monitoring thought necessary. In the case of birds much of this is achieved by commissioning the necessary fieldwork through voluntary organizations, notably the British Trust for Ornithology. Other specialist studies are commissioned from other organizations. Much of the fieldwork involved is conducted on a voluntary unpaid basis by the members of these organizations, with the results subsequently collated and analyzed by professional staff supported by the NCC contract and by membership subscriptions.

A wide range of bird population surveillance is conducted in Britain. Specialised counts of wildfowl are organized through the Wildfowl Trust, operating in conjunction with the BTO's Birds of Estuaries Enquiry for coastal wildfowl. Population levels of game-birds are surveyed by the National Game Census organized by the Game Conservancy. Surveys of the incidence of oiled birds along Britain's coast are conducted by the RSPB's Beached Birds Survey. The bulk of the general bird population monitoring is conducted by the British Trust for Ornithology. Schemes conducted include the Common Birds Census, to determine population levels of many common species nesting on farmland and in woodland; the Nest Records Scheme, which monitors the reproductive success of birds found breeding, and the Ringing Scheme, which provides data on survivorship and movement patterns. A number of additional surveys provide information on winter feeding behaviour. A number of habitat-oriented schemes are also conducted, most notably the Birds of Estuaries Enquiry which monitors the status of shore birds in Britain.

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What is monitoring?

Monitoring is often regarded as the routine counting of population densities. However, such purely numerical information is rather un-informative, since it provides no clue as to the causes of observed population changes. Hence a comprehensive monitoring programme would seek to meet a number of criteria: (1) the establishment of a "base-line" of distribution and abundance, such that later changes can be identified, (2) annual (or at least periodic) recording of population densities, either by a total census or by a sample programme. At a national level it is important to have adequate geographical spread of such monitoring work since changes may occur on a regional basis in response to relatively localised environmental changes (below). (3) Since population changes are due to environmental effects on particular population processes, one would like to identify those which are involved in any particular recorded change. In the case of birds this involves the recording of numbers and success of nesting birds, the mortality of juveniles and adults, and the monitoring of movements of individuals from the population. (4) Finally, not all bird populations are distributed uniformly across the available habitats and particular habitats are more vulnerable to man-made activities than are others. A thorough surveillance programme

may not be possible for all habitats and it may therefore be necessary to devise specialist techniques for surveillance of critically fragile habitats.

The monitoring organizations

In Britain a variety of organizations are involved with birds and for historic reasons particular organizations have taken on responsibility for particular kinds of surveillance activities. Since 1973 the Nature Conservancy Council (NCC) has been the statutory body responsible for nature conservation in Great Britain and is responsible for implementing various provisions of the 1981 Wildlife and Countryside Act that relate to birds. These provisions reflect the long-standing public interest in birds in Britain that began with the campaign at the start of the century to suppress the killing of seabirds for the plume trade and for sport. The volume of ornithological work of potential usefulness in Britain is such that it would be quite impractical to conduct it using professional workers. The NCC therefore commissions the bulk of the routine bird monitoring programme from three organizations, the British Trust for Ornithology (BTO), the Wildfowl Trust, and the Institute of Terrestrial Ecology (ITE). The first two bodies are organizations largely of amateur, volunteer workers

Table 1. Population of the Peregrine Falcon *Falco peregrinus* in Great Britain 1930–1981 as revealed by monitoring surveys. Data from Ratcliffe (1963, 1965, 1972, 1984).

Date	Number of occupied territories	Survey
1930–39	874+	Estimate (Ratcliffe 1984)
1962	357	Full census
1963	270	Sample census
1971	341	Full census
1981	808	Full census

who take part in their organization's monitoring programmes on an unpaid voluntary basis and the NCC support provides the core scientific staff needed to organize the programmes concerned and to collate the results.

In addition to commissioning these long-term programmes, the NCC itself conducts a programme of short-term work relevant to the health of British bird populations, concentrating on those areas where amateur help is not readily available. Thus the NCC has conducted surveys of breeding waders throughout the uplands of Britain and has undertaken studies of wintering waders on areas of specifically high conservation interest, such as the Firth of Forth and the Moray Firth. Similarly, the NCC Seabirds at Sea Team has surveyed the inshore and off-shore waters of Britain, particularly in the North Sea, to establish the distribution of seabirds in these areas, with concurrent work on diet and behaviour to determine the reasons for the observed patterns (Blake et al. 1983). Some of these studies, although originating in very specific problems, have developed with repetition into what are effectively monitoring exercises.

The British Trust for Ornithology. The BTO is the most concerned with long-term monitoring of bird populations in Britain. The BTO's primary aim is to promote an understanding of bird populations by means of co-operative

fieldwork by its 7000 members. To this end the Trust maintains a number of so-called Standing Enquiries which monitor various features of the population ecology of birds in Britain, such as the National Ringing Scheme and the Common Birds Census. In addition, the Trust organises occasional surveys of other features of British bird populations, most typically by evaluating the status of species too scarce in numbers or too difficult in census methodology to survey on an annual basis. In many cases these occasional surveys are designed to provide "base-lines" against which to record subsequent changes in distribution or in population level. Table 1 illustrates the results of surveys of the Peregrine Falcon *Falco peregrinus* as revealed in the surveys organized by Ratcliffe (see 1984).

The most ambitious of the Trust's "base-line" studies has been the Atlas of Breeding Birds in Britain and Ireland (Sharrock 1976) which plotted on the basis of the 10-km squares of the national Ordnance Survey grid the breeding distribution of all species breeding in Britain. Similar information as to the distribution of birds in Britain and Ireland during the winter has been virtually unobtainable from existing studies and the BTO has therefore recently (1980–84) conducted a companion survey — the Winter Atlas — to record the winter distribution of birds. This survey is based on measures of the relative abundance of each species, obtained from timed counts in each 10-km Ordnance Survey square. Such atlases provide substantive documentation of the distribution of birds in Britain and Ireland at key seasons of the year. Subsequent changes in range — which for many species probably occur on a time scale of some decades — can be documented by repetition of these surveys in future years.

These base-line surveys do not directly measure the changing population levels of birds. The BTO therefore maintains six annual surveys designed to measure particular aspects of population biology (Hickling 1983). These surveys include (1) the Common Birds Census which monitors the numbers of the more numerous farmland and woodland species, (2) the Waterways Bird Survey which monitors the breeding density of riparian species, (3) the Nest Record Scheme which monitors the reproductive performance of many species, (4) the Ringing Scheme which collects data on the movement, migration, and survival of birds in Britain and Ireland, (5) the Garden Bird Feeding Survey which looks at the use made of artificial feeders by birds throughout the winter and (6) the Birds of Estuaries Enquiry which monitors the numbers of shorebirds and wildfowl wintering along Britain's coastline.

The Wildfowl Trust. Specialist surveys of wildfowl numbers in Great Britain and Ireland is undertaken by the Wildfowl Trust. The principal aims of the Wildfowl Trust are education of the general public in relation to wildfowl and their habitats, and research into wildfowl biology (both through field studies and through studies of captive birds). In support of this work the Wildfowl Trust undertakes the monitoring of wildfowl numbers in Britain and Ireland once a month from September to March. Each January a special effort is made for the International mid-winter counts, organised throughout the western Palearctic by the International Waterfowl Research Bureau. The information for coastal and estuarine areas is greatly increased by the results of the BTO's Birds of Estuaries Enquiry (see below) and the full data are used to identify population trends in British wildfowl. Fig. 1 illustrates the trend in the post-breeding (September) population for the Tufted Duck *Aythya fuligula* over the last 25 years: the British breeding population has approximately trebled during this time, partly reflecting the westward expansion of this species in Europe (Brandl & Schmidtke 1983). The increase may have been assisted by the long series of mild winters which occurred between 1963 and 1978 but also reflects the increase in breeding and wintering habitat provided by newly-created gravel pits and reservoirs in Britain.

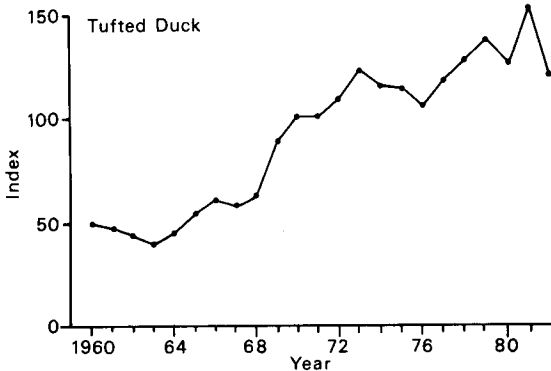


Fig. 1. Increase in the September (= post-breeding) population of Tufted Ducks *Aythya fuligula* in Britain between 1960 and 1982. The index was arbitrarily set to 100 in 1970.

The Royal Society for the Protection of Birds. The RSPB is concerned with bird protection in all its various aspects, including habitat protection and conservation, and with education of the British public in relation to birds. The Society's success in these fields have given it a leading role in the public and political arenas but the Society's own research is directed principally towards applied problems requiring an immediate answer and monitoring work is a smaller part of its activities. The RSPB cooperates with the BTO and the Wildfowl Trust in supporting the Estuaries Enquiry (see below) but is independently involved in monitoring work through its Beached Birds Survey (BBS) and through its surveillance of threatened breeding species.

Since 1971 the Beached Birds Survey has provided one of the few long-term biological programmes attempting assessment of the effects on birds of chronic oil pollution. In this scheme participants regularly (on four occasions each winter) walk defined stretches of shoreline and note the incidence of oiling on the plumages of birds washed ashore. Approximately 2000 km of shore are checked by the 750 participants in the survey and their observations provide information on the regional and temporal pattern of oiling in Britain. The February count coincides with surveys in six other West European countries to provide a wider perspective of the problem. The existence of this scheme also ensures the availability of a network of observers, most of them volunteers, who can be called out at short notice to survey shores in areas involved in major bird mortality incidents. Comparisons of the BBS results on the proportions of birds oiled with those obtained from the analyses of ringed birds reported as oiled to the BTO show very similar results, thus strengthening the evidence from either scheme alone. The RSPB also undertakes some monitoring of breeding seabirds, with the aim of detecting major trends in population levels of Fulmar *Fulmaris glacialis*, Kittiwake *Rissa tridactyla*, Razorbill *Alca torda* and Guillemot *Uria aalge* (Stowe 1982). Counts have been made since 1971 at defined sites selected at colonies representative of the breeding distribution of these species, principally by volunteers able to make five June counts under prescribed conditions. The RSPB also monitors the breeding populations of other species, particularly those scarce species a large proportion of whose numbers breed on or near RSPB reserves. In the case of the Osprey *Pandion haliaetus* such censuses have been conducted from as far back as 1954.

The Game Conservancy. The National Game Census organised by the Game Conservancy provides useful information on the abundance of a variety of species regularly subjected to shooting in Britain. The scheme is based on the recording of game bags by landowners and shooting managers from various estates. Because the game bag on any given estate depends on the intensity of the shooting and on the marksmanship of the shooters, the bags themselves need not be directly related to the population of game species present. Nevertheless, with large enough numbers of contributors (and there are nearly 500 in this scheme) this variation can be reduced to a point where general trends can be identified. In the case of the Grey Partridge *Perdix perdix* censuses have also been made on 50 to 100 farms each spring since 1933 (excepting 1940–1946) with sample counts on the same areas in August to measure brood production and chick survival (Potts 1980). Fig. 2 illustrates the situation for Grey Partridges, for which both the National Game Census and the Common Birds Census figures show a fairly steep decrease in average population density in Britain over the last 30 years. The broad agreement between the results of the two schemes increases the confidence that can be put into either of them. In the case of the Grey Partridge it has been possible to identify the origins of the decline. Approximately one third of the reduction through 1977 has been due to reduced availability of insects for Partridge chicks, due to the application of agro-chemicals to cereal crops (Potts 1980). Another third has been due to habitat loss as

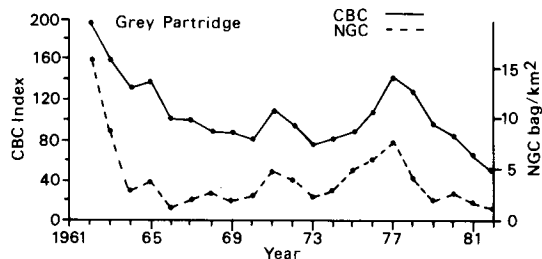


Fig. 2. Population trends in the Grey Partridge *Perdix perdix* in Britain, 1962–1982, according to the Common Birds Census index (solid line) and the National Game Census bag (hatched line).

a result of hedgerow removal and the consequent reduction in safe nesting places for Partridges (Rands 1982). The remaining third has been due to a relative increase in the frequency of predation due in turn to a decrease in the intensity of keeping on British estates. The results of the National Game Census thus provide a crude but effective monitor of gamebird numbers in Britain. The extensive computer modelling of Partridge populations by Potts (1980) constitutes one of the really good examples of British work in exploiting the information provided by monitoring schemes to address the underlying ecological problems responsible for population changes.

Monitoring schemes

We now turn to a more detailed description of the more important monitoring schemes conducted in Britain by the BTO, with some examples of how their results have been used.

Heronries Census. The Heronries Census is the longest running of the surveys organised by the BTO, with some counts begun as early as 1909, some 24 years before the birth of BTO itself (see Lack 1954). This survey aims to census at least a sample, and in some years the whole, of the heronries in England and Wales.

Common Birds Census. The largest of the BTO's population monitoring schemes is the Common Birds Census (CBC). This was begun in 1962 at the request of the then Nature Conservancy, following the detection of mass mortalities of birds due to poisoning by their eating of seeds dressed with organo-chlorines. At that time the notion of pesticide concentration along the sequences of species forming food chains was not fully understood and the finding of large kills of common farmland birds was the first indication of a major environmental problem. Given this background to its inception, the original aim of the CBC was to monitor bird populations on farmland so as to provide an early warning system of any adverse consequences of new agricultural practices (Bailey 1967). In 1964, however, the scheme was extended to include the woodland species (Bailey 1968)

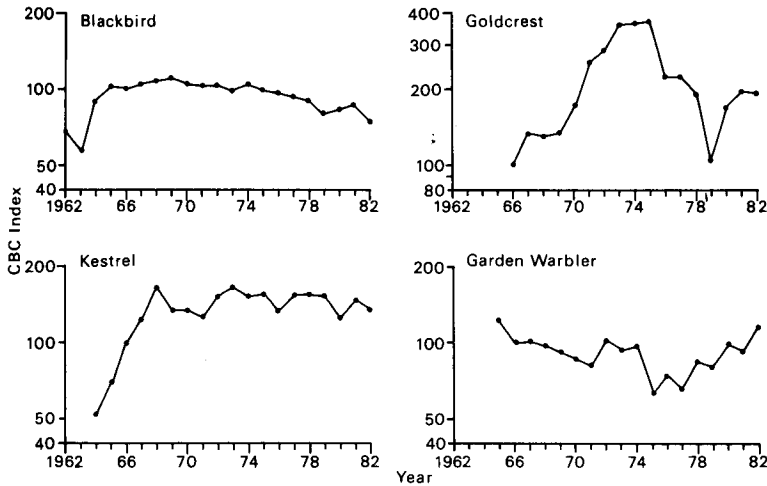


Fig. 3. Trends in the Common Birds Census for the Blackbird *Turdus merula*, Goldcrest *Regulus regulus*, Kestrel *Falco tinnunculus* and Garden Warbler *Sylvia borin*. In each case the index for 1966 was set arbitrarily to a value of 100.

and has developed an additional function as a source of information on habitat management in relation to birds. The Waterways Bird Survey is very similar in aims and methods to the CBC scheme but concentrated into linear habitat of waterways and their banks.

The CBC scheme has about 350 contributors each year, each of whom visits a census plot with agreed boundaries, doing so some 8–12 times over the course of the breeding season. On each field visit the observer records on a large-scale map supplied by the BTO the location of all territorial birds and of any additional registrations relevant to breeding (e.g. sightings of family parties, females with food, etc.). At the end of the breeding season the data for each species on these "visit" maps are collated to provide a single "species map" for each species in turn, with the registrations typically falling into discrete "clusters" which approximately correspond to territories held by the species concerned. In practice some subjectivity in interpretation of the registration patterns is present and the data are therefore interpreted by trained analysts working to rules very similar to those of the International Birds Census Committee (Anon. 1983). O'Connor & Marchant (1980) have shown that there is a strong correlation between the number of territories established on the census plot using the mapping method and those determined by other studies, such as intensive nest finding or delineation of territories using colour-marked birds. Hence the data provide a good index of the numbers of birds breeding in the census plots.

Fig. 3 presents some examples of population trends revealed by the CBC. The winter of 1962–63 in Britain was extremely severe, so that the numbers of many resident species were greatly reduced and breeding populations in 1963 were therefore extremely low. The winters of 1978–79 and of 1981–82 were also unusually severe, and these points are reflected in the data for resident species. Thus the data for Blackbird *Turdus merula* indicate how this species recovered very quickly from the population crash brought about by the cold weather of 1962–63 and thereafter remained extremely constant in density. This implies a high degree of population regulation by density-dependent processes (Lack 1954 1966, Batten 1977). In contrast, the data for Goldcrest *Regulus regulus* indicate that considerably longer time was needed for the population to recover from the 1962–63 induced depression, and that the species responds sharply to any instances of cold weather. A third species,

the Kestrel *Falco tinnunculus*, also decreased in 1962–63, probably because snow cover prevented it from getting at the small mammals and insects that constitute much of its prey. Once recovered to its normal level, however, numbers thereafter fluctuated on an approximately four-year cycle, fairly typical of many small mammal specialists (Snow 1968). In contrast, the data for the migrant Garden Warbler *Sylvia borin* shows a decrease during the early years of the CBC, followed by a subsequent recovery. The causes of this are not known.

Participants in the CBC scheme are requested to submit maps showing the distribution of habitat over their census plot when they first commence work there and to update the habitat records on an annual basis so as to show changes in habitat. These maps and their changes provide much material for study of habitat correlates. Such material is particularly valuable in relation to monitoring because it identifies key elements of habitat on which the various species depend. Population changes detected for these species can then be related to any identifiable changes in the abundance of the habitat elements concerned, whilst changes that are not consistent with known habitat alteration require some other explanation, such as the presence of a previously undetected environmental change. The longer term recording of habitat changes in the CBC scheme also provides a convenient source of case histories on the ornithological consequences of habitat alterations.

Birds of Estuaries Enquiry. Another major population survey conducted by the BTO is the Birds of Estuaries Enquiry. This began in 1969 and was designed to monitor the population of shorebirds and wildfowl using Britain's estuaries. At that time considerable interest existed in developing estuaries for industrial purposes, with the variety of threats to the natural state of these estuaries including proposals for straightforward land reclamation, for the construction of bunded freshwater reservoirs within the estuary, for electricity generation using wave power, and for impoundment for recreational facilities. Although the economic recession in Britain has to some extent alleviated the immediacy of such threats they still continue. Many of Britain's estuaries are of international importance. The BTO therefore joined

with the Royal Society for the Protection of Birds and with the Wildfowl Trust to acquire the necessary information on seasonal and annual variations in use of these estuaries by birds. Between 1969 and 1975 the Enquiry organized monthly counts of the birds on British estuaries, with the counts co-ordinated on a national basis. The subsequent report on the enquiry (Prater 1981) documented the basic information needed for assessing the conservation importance of these estuaries. Four of these monthly counts — those for September, December, January and February — are co-ordinated with international counts conducted elsewhere in Europe, under the auspices of the International Waterfowl Research Bureau. These have continued since the end of the main Enquiry and provide the basis for an annual index of populations using the estuaries.

One of the difficulties in interpreting the results of these counts, co-ordinated though they may be, is the possibility of population turnover between counts. Thus whilst the figure of an average of, say, 5000 birds on an estuary provides a minimum assessment of its importance, one does not know whether these 5000 birds were the same 5000 on each count or whether in fact they consisted of different groups of 5000 birds, each of them dependent upon that estuary for a particular part of the year. In this latter case, the importance of the estuary is considerably greater than suggested by the 5000-bird figure. In practice, the size of this effect seems to differ between species, with some — such as the Ringed Plover *Charadrius hiaticula* — turning over rapidly between visits whilst others, such as the Turnstone *Arenaria interpres*, are much more stable in the composition of the flocks counted. The BTO is therefore currently conducting a special survey of spring passage through estuaries on the west coast of Britain. In this survey co-ordinated programmes of catching and colour-marking and of searching for colour marks at other estuaries have been devised to provide the data needed to document the full extent of spring passage along the west coast.

The estuary counts conducted by BTO members include censusing the wildfowl present. These data are supplied to the Wildfowl Trust, who are responsible for the annual monitoring of wildfowl numbers in Great Britain (see above). The results of the wader and wildfowl counts are published in an annual report on the two schemes (e.g. Marchant 1982, Salmon 1983).

Nest Record Scheme. The Nest Record Scheme run by the BTO is designed to monitor reproductive performance, particularly with a view to identifying causes of observed population changes. The scheme functions by collecting nest histories for nests found by observers. The nest record consists of observations of nest site and habitat, geographical location, and dates of observations (one or more). Where the nest contents are recorded over a series of visits, it is possible to establish such breeding parameters as laying date, clutch size, egg and chick success, and rates of nest loss and its causes. The Nest Record Scheme has a current annual intake of between 20 000–30 000 for all species combined, with substantial annual totals for many of the commoner species in Britain. As a result, it is possible to relate breeding success to population level in a variety of ways.

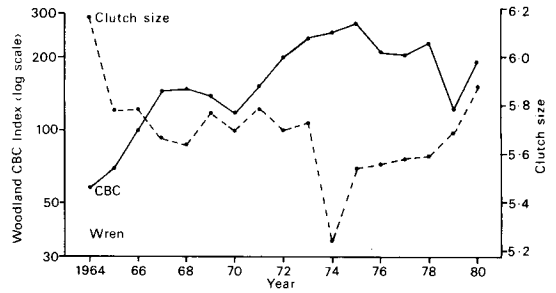


Fig. 4. Annual variation in clutch size (hatched line) and Common Birds Census index (solid line) for the Wren *Troglodytes troglodytes*.

Fig. 4 illustrates the situation for the Wren *Troglodytes troglodytes* in relation to Common Birds Census data for the same years. The figure shows that clutch size and population density are inversely related, with birds producing more eggs in years of low density and fewer eggs in years of high density. Such relationships exemplify the density dependence necessary for a population to be regulated about some equilibrium density (Lack 1966). The relationship goes some way towards explaining the finding of the classic study by Williamson (1969) who found that Wrens preferentially colonised certain habitats during their population recovery from the crash brought about by the 1962–63 cold winter.

Fig. 5 illustrates similar data in the case of the Spotted Flycatcher *Muscicapa striata*. This species has decreased markedly through the early 1960's and, at a slower rate, through the 1970's, very much in line with a concomitant decrease in clutch size. Over the 19 years studied these trends have been associated also with the tendency for the Spotted Flycatcher to breed somewhat later (about a fortnight) in Britain than it used to. Two explanations are

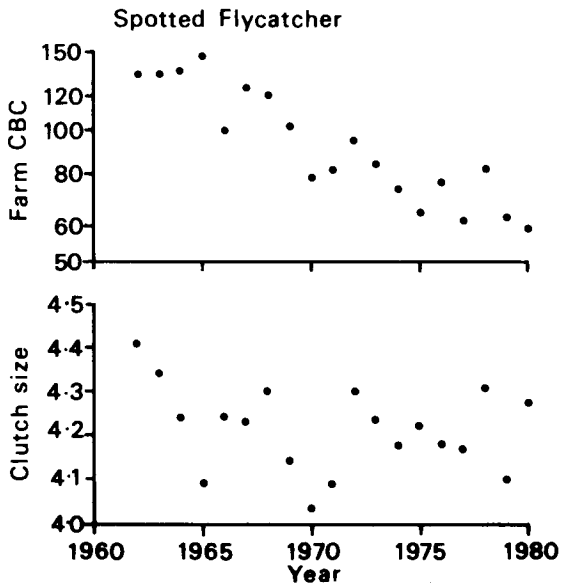


Fig. 5. Trends in Common Birds Census index (top) and clutch size (bottom) for the Spotted Flycatcher *Muscicapa striata* in Britain 1962–1980.

therefore possible. First, the cooler weather that has characterised the British summers in recent years may make it more difficult for the bird to start breeding each year, by reducing the food supply for the females for egg formation. Alternatively, conditions on the wintering grounds may be influenced by the Sahelian drought (see Svensson, this issue), such that it has become more difficult for the birds to migrate early enough to breed optimally. Spotted Flycatchers in Britain show a pronounced seasonal decline in clutch size, a feature usually interpreted as indicating seasonally deteriorating conditions for breeding (Lack 1966, Perrins 1970). Further research is necessary to distinguish between these two explanations.

A third, and final, example of the value of routine surveillance of breeding performance is provided by a study of the Lapwing *Vanellus vanellus* in relation to intensive cereal production (O'Connor & Shrubbs 1985). In this study we found that Lapwing densities in areas of intensive cereal production had fallen by some 40%. During the same period their average breeding success as revealed by the nest record cards decreased by one-third; in control areas no corresponding changes in breeding success took place. These observations go some way towards explaining the recent pronounced change in regional distribution of Lapwings in Britain, where numbers in the east and south — the areas of intensive arable production — have been declining whilst numbers in the west and especially in the north — areas given over to pastoral farming — have increased.

Ringling Scheme. The Ringling Scheme is not intended primarily as a monitoring scheme but as a source of data on movement patterns and survivorship in birds. However, these features of bird populations are potentially affected by the kind of environmental setbacks that most monitoring programmes are designed to address and may therefore provide useful information for surveillance purposes.

Oil pollution is one of the major worries for the huge seabird populations present around Britain's coast and analysis of the ringling recoveries can provide some information on the populations at risk. The pattern of recoveries of auks from Britain that were subsequently reported dead through oiling shows that birds spending time in the North Sea or along the English Channel are more vulnerable whilst birds wintering off the coast of Norway, along the west coast of Britain or the east coast of Ireland or down in the Bay of Biscay, are substantially less at risk. This pattern, of course, reflects the intensity of shipping movements in these areas. This type of analysis, however, also points to another conclusion, for the majority of the birds reported oiled were affected by chronic pollution — the regular occurrence of oil discharge at sea by ships going about their normal business. Acute pollution — through mishaps such as tanker collisions — was rather less important a mortality source (S.R. Baillie, unpubl.). Thus the programme of analysis of ringling recoveries identifies areas over which political action in the form of appropriate governmental regulations will be most effective in the interests of bird conservation.

In a ringling scheme such as that in Britain in which many thousands (718 203 in 1982) of birds are ringed each year one feels that the annual ringling totals offer potential for monitoring population levels. In practice a variety of factors significantly influence the numbers of birds caught. However, given the existence of more systematic monitoring techniques, such as the Common Birds Census scheme, it is possible to use ringling totals as a yardstick with which to measure population health during periods or in areas not otherwise monitored.

Thus O'Connor & Mead (1984) used as an index of population the ratio formed by dividing annual Stock Dove *Columba oenas* totals by the total number of birds ringed in

Britain in that year and used this index to follow the fortunes of the species through the organo-chlorine era of the 1950's. By calibrating this index against the CBC index for an 18-year period we were able to show that this index adequately tracks population level and were thus able to investigate the historic behaviour of Stock Dove populations in Britain at a time when they were not being systematically censused. The results showed a striking decrease in the fortunes of the species with the introduction of dieldrin, with a subsequent recovery when this organo-chlorine compound was prohibited from general use. By analysing the nest record data for the Stock Dove we were able to show that breeding success had fallen sharply as a result of the chemical's introduction. Ringling recoveries indicated a major fall in adult survivorship during the same period. Finally, by examining the pattern of ringling recoveries for this very sedentary species we were able to show that many fewer birds were ringed in the central Midlands, the areas of intensive organo-chlorine use, as compared with more coastal regions where the chemical was less intensively used. These uses of the ringling recoveries were, to some extent, fortuitous, in that the Stock Dove met all of the criteria necessary for their effective use as indirect monitors of population level and distribution and, in any event, were here used only to obtain a historic overview of the species. For an effective monitoring programme, however, one needs to know the current situation in time to deal with the problems coming to the front as new technology and new agricultural and other environmental practices are brought into play.

Overview

A variety of other monitoring schemes are operated for birds in Britain but their detailed consideration adds little to the overall picture. The schemes already considered illustrate the key points of importance. First, the monitoring programmes are not confined to the mere recording of population levels but extend to recording the components of population change. Second, the key schemes are financed centrally by the NCC as the statutory conservation agency but build on the enthusiasm and work of amateur volunteers, supported where necessary by professional workers. Third, specialist groups work closely together in maintaining schemes of mutual interest, such as the Estuaries Enquiry. Fourth, adequate base-lines, especially for distribution, have been determined. Finally, efforts are made (and with increasing frequency) to relate observed population changes to changes in reproductive performance, survivorship or movement patterns to identify more closely the cause of population changes. These features, coupled with the presence of an enthusiastic body of amateur ornithologists willing to devote time and effort to the necessary data collection, have resulted in a very strong programme of long-term monitoring of British bird populations.

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Selostus: Linnuston pitkäaikaisseuranta Englannissa

Kirjoituksessa esitellään Englannin linnuston pitkäaikaisseurannasta vastaavat järjestöt ja seurannan tärkeimmät työmuodot. Maastotyöt ovat paljolti suuren, vapaaehtoisen harrastajajoukon harteilla ammattilaisten vastatessa aineiston käsittelystä ja tulostuksesta. Linnuston vuotuinen seuranta kattaa monipuolisesti eri ympäristötyypit ja linturyhmät. Tärkeimpiä seurantaohjelmia ovat maatalous- ja metsäympäristöjen yleisten lintujen laskenta kartoitusmenetelmällä, ranta-, vesi- ja riistalintujen laskennat, lintujen pesimätuloksen seuranta ja rengastus. Esimerkkeinä seuranta-tutkimusten tuloksista esitetään mm. tukkasotkan (kuva 1), peltopyyn (kuva 2), mustarastaa, hippiaisen, tuulihaukan ja lehtokertun (kuva 3) viimeaikainen kannankehitys sekä peukaloisen (kuva 4) ja harmaasiepon (kuva 5) kannan suuruuden ja pesyekoon vaihtelu.

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