Protecting internationally important bird sites

A review of the EEC Special Protection Area network in Great Britain

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"Before setting out on a long and difficult journey we carefully pack those things we think will make the way safe and comfortable. For a species, the nature refuge is also a kind of journey, though it is a journey through time rather than space. It is a journey of millennia. The destination is survival. We humans are the travel agents; we try to anticipate the problems that might arise for our charges, and do our best to prepare them for any probable circumstance. As a general rule, everything needed by these passengers should be stocked in advance because the future is uncertain and there are no supplies along the way."

Soulé & Simberloff (1986)

Foreword

by Sir William Wilkinson
Chairman of the Nature Conservancy Council

Birds are our common heritage. Their popularity with the public of many nations, as well as their often spectacular migrations, have led to international commitments made by governments to conserve their populations throughout their range. Indeed, we should strive to *widen* their distribution for those species which have suffered at the hand of man in the past. It is possibly the increasing rate of habitat loss in recent years which has stimulated the current and worldwide concern, first to stop, and then to reverse that damage.

For most bird species, international co-operation is essential for their conservation. For many, this is because they are migratory and depend on different countries at different times of the year. For certain species (some migratory and others not) their population densities, even when habitat is optimal, are so low that international efforts are essential if the risk of extinction is to be avoided. This stresses the need for coordination of conservation science and policy at as wide a scale as possible. Birds show little respect for country or administrative boundaries, and we need to plan accordingly.

Britain has a particular responsibility in international bird conservation. It lies where the migration paths of waders and wildfowl from arctic Canada, Greenland and Iceland meet those from northern Europe and Siberia. Birds from a vast breeding range in the arctic depend on estuaries and other wetlands in Britain and western Europe. Some stay here to over-winter, whilst others may moult and feed before moving on as far as southern Africa, returning once more in spring.

Seabirds are another group for which Britain has unique responsibility. Our coasts and waters provide the combination of safe nesting sites and rich feeding areas necessary for their breeding. This report includes consideration of internationally important colonies of seabirds. The UK's commitment to protect their marine feeding areas awaits a later review (which we have in hand). This is partly because domestic legislation does not yet readily allow implementation of the UK's international commitments in this regard.

Britain is also responsible for large proportions of the remaining extents of some bird habitats in Europe. These include blanket bog, maritime heath, Hebridean machair, and oceanic woodlands found in the north and west of Britain. The conservation of these, and other habitats, is crucial in ensuring the survival of species throughout their range.

Under the EEC Council Directive on the Conservation of Wild Birds 1979, the United Kingdom is committed to taking *"the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats"* for *"all species of naturally occurring birds in the wild state."* Over and above this, the UK is committed to taking special conservation measures for two groups of birds. These are certain listed vulnerable species as well as all migratory species. Among the measures to be taken is the designation of Special Protection Areas (SPAs).

Although SPAs can provide only part of the conservation measures necessary for many species, they are an important element for many. The UK government has decided that all SPAs will be protected under domestic legislation. This generally means notification first as Sites of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981. This provides the mechanism by which the UK government will be able to fulfil its international commitments. Thus, SPA designation imposes no constraints on owners and occupiers additional to those consequent on SSSI notification. It does, however, emphasise the international importance of the site. Indeed, these areas are the ornithological conservation flagships in Britain. Some of these sites have benefitted from funds from the EEC to aid appropriate management.

The NCC has responsibility for advising government on the implementation of international commitments to nature conservation, including EEC Directive 79/409 on the Conservation of Wild Birds. Amongst the NCC's roles are the selection of appropriate sites and the undertaking of consultations with local interests.

Designations of SPAs should have been made by 1981. However, UK government domestic procedures and resource shortages in the NCC have delayed this. Late in 1988, the Department of the Environment and the Scottish Development Department asked the NCC for a review of the extent to which the proposed suite of sites meets the requirements in Britain for the site safeguard element of the EEC Directive. Subsequent discussion revealed that the level of information requested was substantial. This publication is the result of this request.

The compilation of this report has involved much work by the authors and their colleagues in the Ornithology Branch in the NCC's Chief Scientist Directorate, and on a very tight time schedule. As with much work of this nature, they have drawn heavily on information obtained under contracts

they manage with voluntary conservation organisations, including the British Trust for Ornithology, the Wildfowl and Wetlands Trust, the Seabird Group, the International Waterfowl and Wetlands Bureau, the Wader Study Group, RSPB and the Rare Breeding Birds Panel, amongst others. The data collated by these groups have been collected by a veritable army of amateur ornithologists. Their work (on which this work so heavily draws) is crucial to bird conservation in Britain.

Many other ornithologists have also provided information. In many cases, this involves sensitive data on vulnerable species, and this information is passed to individual NCC officers on a confidential and personal basis. This confidence has, of course, been maintained.

An earlier version of this report was sent to many scientific colleagues, including some in the organisations listed above and others, for their comments. They are thanked elsewhere in the report.

The work has thus involved the co-operation of many people, and we are grateful to them all. This co-ordination of the many valuable sources of information has been one of the strengths of the NCC's long involvement in British ornithological studies, as witnessed in many of our publications.

At the same time as publishing this report, the NCC is also producing a popular information leaflet about sites for international designation. This is designed both to stand alone and to complement site-description leaflets which will be produced progressively.

The information collated by the NCC's Ornithology Branch has already been used to provide the British contribution to the International Council for Bird Preservation's book *Important Bird Areas in Europe*. In the near future, we shall be producing, jointly with RSPB, the British equivalent outlining all the currently proposed sites in UK.

We hope that these publications will help demonstrate the importance of these sites to international bird conservation, and encourage rapid progress towards designation of the full suite of Special Protection Areas.

Sir William Wilkinson
Chairman

Summary

1 International requirements and commitments (see sections 1.1 & 1.2 of main text)

1.1 Birds require international conservation measures. Migrants require a series of essential areas during their annual cycle. Both migrants and residents need networks of protected areas which ensure a wide and linked range. The long-term viability of bird populations depends on wide-spread protection. These conservation needs are reflected in several important international conventions and other legislation.

1.2 The importance of wetlands and the birds dependent on them, as well as the need for international perspectives in encouraging their conservation, was recognised by the Convention on Wetlands of International Importance especially as Waterfowl Habitat, or 'Ramsar', Convention of 1971. This Convention is global in scope and has done much to encourage international wetland conservation.

1.3 The EC Council Directive on the Conservation of Wild Birds (Directive 79/409 of 2 April 1979) also lays emphasis on the need to conserve bird habitats as a means of maintaining populations. Article 3 requires Member States to *"take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in Article 1"*, that is *"all species of naturally occurring birds in the wild state in the European territory of the Member States"*. Over and above the conservation measures for all bird species, Article 4 of the Directive is concerned with applying special measures for the protection of the habitats of two groups of birds. These groups are, first, certain listed vulnerable species to which reference is made in Article 4.1 and which are listed in Annex 1, and secondly, all other migratory bird species (to which reference is made in Article 4.2). In part, such habitat protection is to be achieved by the establishment of a network of protected areas for birds throughout the Community called Special Protection Areas (SPAs).

1.4 However, as well as indicating the need for SPAs, the Directive also indicates that other means of protecting populations are necessary, especially where these are vulnerable and dispersed. These 'wider countryside' conservation measures are a necessary complement to site-based conservation. Such measures include policies for land-uses which may adversely affect dispersed populations of vulnerable species. For example, in the uplands there is a need to avoid the afforestation of the moorland habitats of birds such as merlins and golden plovers; while in lowland areas, the conservation of remaining strongholds of breeding waders could be encouraged by support of low-intensity agriculture such as crofting.

2 Purpose of this review (see section 1.3 of main text)

2.1 The Directive requires conservation measures for all bird species and special measures for certain species. Whilst the overall objective is to maintain and enhance the distributions and numbers of these species, the measures to do this are not specified, except that these should include the establishment of SPAs.

2.2 The emphasis within the Directive is on maintaining both the range of distributions *and* the reproductive success of bird populations. The key objective overall is *"the preservation, maintenance or restoration of a sufficent diversity and area of habitat .... to ensure* [the birds'] *survival and reproduction in their area of distribution"*. The methods required to achieve this aim will differ between species. Indeed, in some areas, different populations of the same species will require different conservation policies.

2.3 The UK Government has requested NCC to examine the extent to which the presently proposed suite of SPAs can fulfil its commitment under the Directive.

2.4 This report presents information on both identified sites of international importance and the rationale for their selection, as well as background information on the populations, status and habitats of Annex 1 and a selection of other migratory species of major conservation importance regularly occurring in Britain. The opportunity has also been taken to include information on wetlands of international importance under the Ramsar Convention, given that the majority of proposed Ramsar sites are also proposed or designated SPAs.

3 Rationale (see section 2 of main text)

3.1 There are fundamental biological reasons to sustain the geographical range of populations as well as their numerical size. Small, fragmented, or relict populations are much more vulnerable to natural and human-induced catastrophes than those that are more widespread, numerous and with a more-or-less continuous range allowing some dispersal between components.

3.2 The present-day distributions of many birds, especially those of wetlands, are now greatly reduced compared with former times. This makes them more vulnerable. Thus the present-day status and distribution of some birds cannot be regarded as a 'natural' *status quo* and certainly not as desirable. As indicated by the Directive, for many species, conservation planning needs to set targets to *increase* already diminished population sizes and ranges. A network of internationally important core areas is one way to ensure that further attrition does not occur, while other policies are devised and promoted to expand these already restricted populations. In wetland areas especially, there is a need for 'wise use' as directed by the Ramsar Convention.

3.3 Birds use sites in many and complex ways. Often birds use a certain area, habitat or site for only a short period of time, yet that short period may be crucial to survival and reproduction. Birds have many ecological requirements at different times of their lives. Thus for effective conservation, sites, or site networks must ensure the preservation of all essential habitats, even if these may be used only for short periods each year. Such needs are taken into account when determining site boundaries of Special Protection Areas.

3.4 Not only do some birds use different areas within a site, but more mobile birds may use different sites at different times. For example, some waders that breed in the far Soviet Arctic and winter in South Africa depend on estuaries in Britain as refuelling areas. Thus, conservation planning needs to be pitched at an international level, with the creation of site networks. The Birds Directive facilitates this.

3.5 Given the wide geographic range of many migratory bird populations, evaluations are required at least at a Great Britain level or, more usually, at an international level. A variety of international data-sources have been of value in this exercise, illustrating the necessity to avoid parochial or nationalistic approaches to conservation. At a time when effective conservation requires coordinated international action, it is crucial to maintain existing international scientific links.

3.6 Information from the NCC's ornithological data-bases have been used to assess the totals of birds contained within the SPA site network. These are presented as proportions of the relevant populations and are used to assess conservation needs.

3.7 The challenge of site selection can be defined as two questions:

3.7.1 Which sites should be selected as internationally important bird areas to provide for protection for the whole suite of species, in so far as site-safeguard mechanisms are appropriate?

3.7.2 What target level of overall protection is required to provide a basis for maintenance of the survival and reproduction of each species population in its area of distribution, where site-safeguard is appropriate?

4 Site selection (see section 2.5 of main text)

4.1 Previously developed criteria for site selection (Appendix 3) give broad outlines which are of value, although in need of further refinement and elaboration. No single criterion is adequate to assess the extremely wide conservation needs of Europe's bird population. All have disadvantages (and advantages) and the paramount aim of any set of criteria must be to ensure that the sites so selected, fulfil (collectively) the aims of the Birds Directive: *..."to ensure their survival and reproduction in their area of distribution"...* (i.e. Question 3.7.2 above). One advantage of the present review exercise is that it prevents discussion becoming side-tracked into assessing criteria for individual site-selection. Instead it addresses the major question of the degree of protection which will be achieved by the designation of a suite of SPAs as a coherent network.

4.2 At the request of Government, the NCC has identified sites of international importance for nature conservation for designation under both the Ramsar Convention and EEC Birds Directive. Identification and evaluation of these areas is a continuing process. To date a total of 218 candidate SPAs[1] and 154 candidate Ramsar sites have been identified (Figure 1.2)[2]. It is the NCC's view that the presently proposed SPA network is the minimum of sites needed to carry through the objectives of this aspect of the Birds Directive. Several other areas have been proposed by various

[1] The reference to the 'SPA network' in the text refers to this network of proposed (and already designated) sites.

[2] Figures include sites already designated.

conservation bodies as being likely to qualify, or have been tentatively identified by NCC to fill gaps in coverage (Table 3.2). As further information is .obtained, either the eligibility of these will be confirmed or they will be deleted from the list.

4.3 In Great Britain, a total of 33 sites covering 127,279.5 ha (Table 1.2) have been designated as Special Protection Areas (SPAs) under the Directive, and a total of 39[1] internationally important wetlands (covering 129,176 ha) have also been designated under the Ramsar Convention (Table 1.3). Many of the sites are designated under both the Directive and the Convention.

5. The suite of sites (see sections 2.6 and 3 of main text)

5.1 The question addressed here, is: "is the proposed suite of sites enough?" (All references in this report to the "suite of sites" includes the proposed list (Table 3.1), not just the few already designated.) In order to answer this question from first principles, we would need to know all the risks to which all species will be subjected in the future. With such powers of prediction, we would all be in better jobs! An alternative approach would be to use modern statistical analyses of population viability, and combine these with further development studies in maintaining desired range. Unfortunately, the work required to do this would be quite prohibitive with current resources.

5.2 Therefore, instead of basing the analysis on viability, we have based it on assessments of vulnerability, and used this to establish conservation priorities.

5.3 Following the work of the EC Technical Groups, we have used an index of vulnerability based on that of Bezzel (1980) to assess international conservation priorities for breeding species. This takes into account the area of distribution, dispersion, size of population and trends in population size. The system gives one good means of simple, easy and objective assessment of priorities for some conservation actions on an international basis. Species rankings can be reviewed easily as more precise information becomes available. It is also uncomplicated and so is applicable even where only broad-scale information is available, as is the case for some countries.

5.4 Bezzel's scheme has been modified to remove some statistical redundancy relating to dispersion and to replace this element appropriately with an approximate weighting to include the proportional importance of British populations to EEC populations.

5.5 The same scheme can be used to assess the vulnerability of wintering birds in the EEC, with the use of similar categories. The European Commission have indicated that such indices should be used as the basis of evaluation. These indices are currently being calculated by the NCC for wintering bird species, and although not available for the present review, they will shortly be used in making similar assessments for these populations.

5.6 Such indices of vulnerability can be used to establish priorities for conservation action. Care is needed because the levels are approximate and relevant only to the scale under consideraton. For example, species that are rare on a world scale, with a distribution limited to the EEC, will not be highlighted by this system. Thus, the scheme requires interpretation by competent ornithologists. However, it is a useful guide, for example in drawing attention to species fairly common on a local scale, but rare or declining in the EEC as a whole.

5.7 By dividing the indices of vulnerability into bands, it is possible to assess whether site protection measures are able to meet the most urgent protection needs. Species with the highest vulnerability indices should have at least 60-80% of their populations within SPAs if site-safeguard is to be an appropriate principal measure. Other species with high vulnerability require at least 40-60% of their populations in SPAs if these are to be the principal special protection measure.

5.8 It is important to stress that these minimum targets are not levels to which populations can be reduced, but minimum levels which must be achieved if Special Protection Areas are to be an appropriate main measure. For all species, general protection measures, and/or protection in the countryside as a whole, will be necessary to maintain and enhance their populations.

5.9 Such protection targets can be derived for *all* migratory bird species in the Community - even abundant and widespread species. This is in accord with the Directive, which concerns all birds, not just those that are rare. However, nearly all the commoner migratory species will occur incidentally on sites designated for other, scarcer, species. The former species therefore do not require Special Protection Areas specifically designated for them alone.

5.10 This approach addresses Question 3.7.2 above. It provides target proportions of

[1] An additional Ramsar site (Lough Neagh/Lough Beg) has been designated in Northern Ireland.

populations which should be included in SPAs if site-safeguard is to be the appropriate principal special protection measure. Those rare and declining species with small populations (with high Bezzel indices) are often those most appropriate to conserve using a site-based approach, although in the case of widely ranging species (such as many raptors) wider conservation measures will also be appropriate. Some species are most appropriately protected mainly by conservation measures in the 'wider countryside', i.e. conservation measures that are not site-based. These species will usually also benefit from or require active management of sites according to their individual conservation needs.

5.11 This approach is helpful in confirming which species require most effort in wider countryside conservation measures. This is demonstrated by examining which species fail to have appropriate proportions of the populations included in sites and for which, because of their ecology, additional sites could not practicably meet this target.

5.12 Appendices 5 and 6 analyse in more detail, by habitats and species, the extent of coverage achieved by the suite of proposed SPAs.

5.13 The aims given in the Directive provide the framework for a series of practical conservation measures that are ecologically based and which directly relate to ways of enhancing survival of bird populations. The many examples given in section 2.4 of the main text show that sustaining healthy populations requires more than just the drawing of restricted boundaries around areas of high bird concentrations. A great variety of considerations need to be taken into account, and these vary, not only with species and habitat but also with time.

5.14 The proposed suite of SPAs represents an irreducible minimum, and will need urgently to be complemented by land-use measures in the wider countryside. Some relevant examples are given. Our trusteeship of the environment will be promoted by the network of Special Protection Areas and presented in this report, together with recommendations for wider countryside actions which will be amplified later.

1 Introduction

1.1 International wildlife treaties

1.1.1 Background

Both migratory and non-migratory birds require international conservation measures. Those birds that are most migratory are also those that are most internationally shared, and for the species to be conserved all countries must contribute.

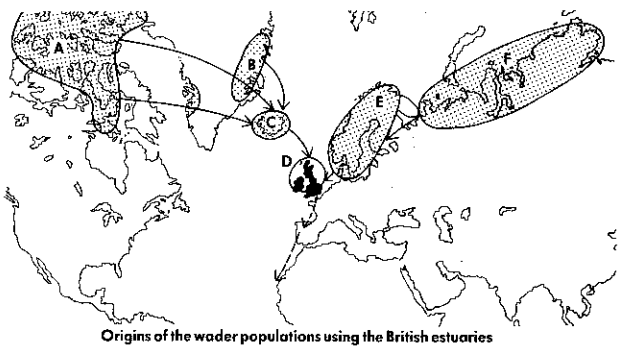
This report explains why wildlife requires protection on an international scale. Migrants require a range of essential areas during their annual cycle. Staging areas used by long-distance migrants act as stepping-stones and re-fuelling stops on flights across ecological barriers such as oceans, forests, and deserts, as well as less obvious barriers where birds are unable to land and feed. Each stopover area is an essential link in the chain of sites. The conservation of such migratory species needs to be co-ordinated at an international level, since major conservation efforts in one country can be rendered totally ineffective by the loss of a critically important area in another (Pearson 1938; Morrison & Ross 1989; Robbins *et al.* 1989).

Networks of protected areas are important in preserving both the size and genetic variability of populations of birds, thus ensuring long-term viability of species (Soulé 1987).

A single migratory bird, such as a wader, may use a large number of different areas in a year. In winter, a variety of sites are visited depending on its age, feeding conditions, weather and a variety of other factors (Pienkowski & Pienkowski 1983; Pienkowski & Evans 1984). Thus, during its lifetime, a single bird will depend on a network of sites, possibly of different habitat types and spread across many countries; the loss of any one of these will potentially reduce the length of its life. The viability of the whole group of birds to which it belongs (the population – section 2.5.2) will potentially also be reduced by the loss of a site.

Even non-migratory populations which are widely distributed can be affected by a variety of adverse anthropogenic effects. These include ecological changes such as those caused by acid precipitation and global warming. While solutions to these wide-scale problems may lie in other policies, core areas where other ecological changes (such as man-made habitat loss or change) can be minimised are of value for scientific research (e.g. Flower *et al.* 1988). They may also maximise the survival chances of existing populations. In examining the effects of acid rain on wildlife, for example, it is valuable to have 'control' areas where scientific research can investigate the effect of pollution alone, unconfused by other interactions which may affect wildlife populations (Eriksson 1984, 1987; Battarbee 1989). Given the major implications of such widespread environmental change this is especially important.

Britain is the wintering area for many birds breeding throughout the far north. Birds visiting Britain come from as far afield at the central Canadian arctic (105° W) and central Siberia (110° E). Most of these wintering birds, especially waders, geese, ducks and swans, nest at low densities over extensive areas of the arctic. The short summers and limited natural productivity



Origins of the wader populations using the British estuaries

	NE Canada A	Greenland B	Iceland C	Britain & Ireland D	Northern Europe E	Northern USSR F
Knot	•	•				
Sanderling	•	•				•
Grey plover						•
Turnstone	•	•			•	
Bar-tailed godwit					•	•
Ringed plover		•	•	•	•	
Whimbrel			•	•		
Dunlin		•	•		•	•
Redshank			•	•	•	
Black-tailed godwit			•			
Oystercatcher			•	•	•	
Curlew				•	•	
Avocet				•		

*Populations use British and Irish estuaries on passage, but mainly winter further south.

Figure 1.1 The east Atlantic flyway, showing the breeding grounds and migration routes of the waders that visit British estuaries (from Moser 1987).

impose constraints on the densities of arctic nesting birds. For instance, in west Greenland, a survey of prime breeding habitat some 750 km² in extent found only 320 Greenland white-fronted geese, with only 16 successful breeding pairs (Stroud 1981). Yet on wintering sites such as Islay and Tiree, such numbers can occur in a single field at certain times of the winter. The same is true for breeding waders which, with few exceptions, nest at very low densities over extensive areas in Siberia, Greenland and arctic Canada (Watson 1963; Meltofte 1985; Fox 1987; Knysautas 1987). Yet in winter exceptionally high densities are found on British estuaries, where flocks of many tens of thousands are common. These represent the breeding birds of vast areas of tundra.

These examples, and many others, indicate the extreme importance of British wintering sites for birds that breed as far afield as the central Canadian arctic islands in the north-west and the central Siberian arctic in the north-east (Figure 1.1).

Small British wintering areas gather waterfowl from an entire hemisphere, and these sites are thus of critical importance.

Britain also holds significant numbers of breeding waders and waterfowl. Some species of wader, in particular, breed at very high densities in Britain (Fuller *et al.* 1986), much higher than the densities for other populations breeding in the arctic (Watson 1963; Meltofte 1985; Fox 1987). However, the extent of such waterfowl habitat is much less in Britain than it is in the arctic.

Britain is also the breeding area for seabirds which visit the Antarctic and Australia, literally circling the globe.

The need for international treaties to protect migratory species is accepted by many countries (IUCN 1986). The first serious attempt in the world at international bird protection took place in Germany in 1868, although it was not for a further 34 years that the 1902 Paris Treaty was agreed (Pearson 1938). In North America, the need for international measures was recognised as long ago as 1916 in the Convention for the Protection of Migratory Birds, agreed between Britain (for Canada) and the United States of America – one of the earliest bilateral conservation treaties (Lyster 1985). In this treaty, the common concerns about, and responsibility for, migratory animal populations have been formalised between the two nation states. The more recent international measures relevant to birds, to which the United Kingdom is a party, are outlined below.

1.1.2 Ramsar Convention

Wetland areas are not only extremely important for their biological value and for the maintenance of systems on which humans depend, but are also intensely threatened throughout the world (Maltby 1986). The importance of wetlands, and the need for international perspectives in encouraging their conservation, was recognised by the **Convention on Wetlands of International Importance especially as Waterfowl Habitat**. This Convention was adopted at a meeting of countries concerned with wetland and waterfowl conservation held at Ramsar, Iran, in 1971 (Carp 1972). The preamble to the Convention refers to the contracting parties' desire *"to stem the progressive encroachment on and loss of wetlands now and in the future"*. The UK Government signed the Convention in 1973 and Parliament ratified it in 1976. The Ramsar Convention has proved extremely successful in focussing attention on the need for wetland conservation, especially as habitat for waterfowl (Smart 1987), and many countries have made important contributions to the international network of protected Ramsar sites (e.g. Statens Naturvårdsverk 1989).

Article 1 of the Convention defines wetlands as *"areas of marsh, fen, peatlands or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"*. Waterfowl are defined as *"birds ecologically dependent on wetlands"*.

Article 2 requires each Contracting Party to designate suitable wetlands within its territory for inclusion in a list of wetlands of international importance. The boundaries of each wetland need to be described precisely and marked on a map, and may incorporate riparian and coastal zones adjacent to the wetlands and islands, or bodies of marine water deeper than 6 m at low tide lying within the wetlands, especially where these have importance as waterfowl habitat.

Article 3 requires Contracting Parties to formulate and implement their planning so as to promote the conservation of wetlands included in the list and also, as far as possible, the 'wise use' of all wetlands in their territory. This article also requires the Contracting Parties to inform the Bureau of the Convention, at the earliest possible time, if the ecological character of any wetland in the list has changed or is changing, or is likely to change as the result of technological developments, pollution, or other human interference.

Article 4 requires Contracting Parties to promote the conservation of wetlands and waterfowl. It also requires that where a Contracting Party, in its own urgent national interest, deletes or restricts the boundaries of wetlands included in the list, it should compensate for any loss of wetland resources. This is to be undertaken in particular by the protection, in the same area or elsewhere, of at least an equal area of the original habitat.

Article 5 requires Contracting Parties to consult with each other about implementation of the Convention. Such consultations should refer to trans-border wetlands, but also to other matters, including North-South consultations on developments and projects affecting wetlands.

Among the other provisions of the Ramsar Convention, Article 6 requires Contracting Parties to convene conferences to consider matters relating to the Convention. The most recent of these was held at Regina in Canada in 1987 (Ramsar Convention Bureau 1988). Amongst other activities this conference, which like others (Carp 1972; Smart 1976; Spagnesi 1982; Ramsar Convention Bureau 1984) was attended by the UK, defined the 'wise use' specified in Article 3 thus: *"The wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem"*. Sustainable utilisation was defined as *"human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations"*. Natural properties of the ecosystem were defined as its *"physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them"*. Conferences also adopted criteria for identifying wetlands of international importance (see section 2.5).

1.1.3 Other international conventions

Other international treaties also recognise the importance of co-ordinated international measures to conserve wildlife.

The 'Berne' **Convention on the Conservation of European Wildlife and Natural Habitats** encourages in particular the promotion of co-operation between countries in their conservation efforts, especially with regard to migratory species. Article 4(3) of the Convention states that Parties should:
"undertake to give special attention to the protection of areas that are of importance for the migratory species specified in Appendices II and III [including most birds] *and which are appropriately situated in relation to migration routes as wintering, staging, feeding, breeding or moulting areas."*

Britain is a party to this convention, having ratified its provisions on 28 May 1982.

The **Convention on the Conservation of Migratory Species of Wild Animals** (the 'Bonn Convention') is specifically concerned with migratory species. It provides for their conservation by giving strict protection to a number of endangered animals listed in its Appendix 1, whilst also providing the framework for a series of 'AGREEMENTS' between Range States for the conservation and management of Appendix II species. Currently, an AGREEMENT on the conservation of migratory populations of Anatidae is being drawn up under the terms of the Convention. Britain is a party to this Convention also, having signed it on 23 June 1979 and ratified its provisions on 23 July 1985.

1.2 Directive on the Conservation of Wild Birds

The European Council of Ministers adopted the **Directive on the Conservation of Wild Birds** (Directive 79/409) on 2 April 1979. The Directive (reproduced in Appendix 1 and hereinafter called the Birds Directive) concerns the urgent need for European co-operation in bird conservation policies. This is because bird populations may move rapidly between different Member States of the Community. Birds which range widely and which require to use habitats and areas in different Member States will clearly benefit from a uniform positive approach to conservation.

Like all such Directives under the Treaty of Rome (which established the EEC), the Birds Directive indicates what needs to be achieved, but the manner in which these objectives are attained is left to individual Member States.

These conservation measures include a wide range of measures for bird protection, including standardisation of seasons in which gamebirds are protected, and restrictions on certain methods of killing. Monitoring of bird populations is also stipulated, so that conservation policies can be revised as and when needed.

Emphasis is laid in the Birds Directive on the need to conserve bird habitats as a means of maintaining populations. In part, such habitat protection is to be achieved by the establishment of a network of protected areas for birds throughout the Community: Special Protection Areas (SPAs). However, as well as stating the need for SPAs, the Birds Directive also indicates that other means of protecting populations are necessary, especially where these populations are vulnerable and dispersed. These 'wider countryside' conservation measures are a necessary complement to site-based conservation.

The relevant part of the preamble to the Directive states that *"whereas the preservation, maintenance or restoration of a sufficent diversity and area of habitats is essential to the conservation of all species of birds; whereas certain species of birds should be the subject of special conservation measures concerning their habitats in order to ensure their survival and reproduction in their area of distribution; whereas such measures must also take account of migratory species and be co-ordinated with a view to setting up a coherant whole....."*

Article 3 requires Member States to take requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in Article 1. This Article refers to all species of birds naturally occurring in the wild state in the European territory of the Member States to which the Treaty applies.

Article 4 is concerned with applying additional special conservation measures, including the

designation of Special Protection Areas, to two groups of birds. These groups are, firstly, certain listed vulnerable species to which reference is made in Article 4.1 and which are listed in Annex 1 (amended with some additions by Directives 81/854/EEC, 85/411/EEC and 86/122/EEC); and secondly, all other migratory bird species (to which reference is made in Article 4.2):

"1. The species mentioned in Annex 1 shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution. In this connection, account shall be taken of:

a. species in danger of extinction;

b. species vulnerable to specific changes in their habitat;

c. species considered rare because of small populations or restricted local distribution;

d. other species requiring particular attention for reasons of the specific nature of their habitat.

Trends and variations in population levels shall be taken into account as a background for evaluations. Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this Directive applies.

2. Member States shall take similar measures for regularly occurring migratory species not listed in Annex 1, bearing in mind their need for protection in the geographical sea and land areas where this Directive applies, as regards their breeding, moulting and wintering areas and staging posts along their migration routes. To this end, Member States shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance.

3. Member States shall send the Commission all relevant information so that it may take appropriate initiatives with a view to the co-ordination necessary to ensure that areas provided for in paragraphs 1 and 2 above form a coherent whole which meets the protection requirements in the geographical sea and land areas where this Directive applies.

4. In respect of the protection areas referred to in paragraphs 1 and 2 above, Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article. Outside these protection areas, Member States shall also strive to avoid pollution or deterioriation of habitats."

A Council Resolution (reproduced in Appendix 2) of 2 April 1979 concerning the Birds Directive also made it clear that the Directive, and Special Protection Areas designated under it, should be used to further the conservation of biotopes wherever possible:

"2. In the designation of these areas, account shall be taken of the need to protect biotopes and flora and fauna without, however, delaying the action of primary importance for bird conservation, particularly in wetlands, to be taken under the programme of Action of the European Communities on the Environment."

The Resolution further called upon Member States to notify the Commission within two years of the Directive (i.e. by 1981) of the list of SPAs to be notified, progress that had been made and progress which was intended.

1.3 The proposed UK network of Special Protection Areas

In Britain, the domestic legislation intended to allow implementation of the Birds Directive is incorporated in the Wildlife and Countryside Act (1981). All sites of international importance are, or will be, designated as Sites of Special Scientific Interest (SSSIs). International designation, whether for SPA or Ramsar site status, makes no further requirements on owners and occupiers of sites beyond those applying to SSSIs. However, a consequence of using SSSIs to designate SPAs has been that it is not possible to designate many of the required SPAs covering inshore or offshore areas important to birds, despite the Government's obligation to do this. This is because the relevant provisions of the Wildlife and Countryside Act do not generally extend below intertidal areas. A review of marine areas qualifying for SPA status is currently being undertaken by NCC's Ornithology Branch on the basis of work in its Seabirds at Sea programme (Tasker *et al.* in prep.). This problem is considered further in section 2.4.6.

Other EEC states have chosen to implement the Birds Directive in other ways in accordance with different domestic legislation or by incorporation of the Birds Directive directly into domestic law. Consequently they have so far designated markedly differing proportions of their territory as SPAs (Table 1.1). Denmark has designated over 22% of its area as Special Protection Areas, and is actively evaluating other sites for SPA status. In contrast, the UK has designated less than 1% of its area as SPAs.

Both previous public statements and internal records give the impression that those involved in drafting the Directive and the Wildlife and Countryside Act thought that the two together would allow a fairly rapid listing of appropriate SSSIs, consequently fulfilling the Directive not much later than the specified date of 1981. Indeed, some

Table 1.1 Numbers and area of Special Protection Areas designated by Member States of EEC pursuant to the Birds Directive as on 6/3/1989.

Member State	Number of SPAs[1]	Total area SPAs (ha)	Mean area SPAs (ha)	Proportion of state area
Belgium	34	368,227	10,830	12.06%
Denmark	111	960,092	8,649	22.29%
Germany	382	298,902	782	1.10%
Greece	26	191,637	7,370	1.45%
Spain	43	670,938	15,603	1.33%
France	37	417,945	11,296	0.77%
Ireland	16	3,664	229	0.05%
Italy	52	271,248	5,216	0.90%
Luxembourg	2	314	157	0.12%
Netherlands	6	8,290	1,382	0.24%
Portugal	19	307,047	16,160	3.55%
United Kingdom	33	127,112	3,857	0.52%

[1] Excluding designated Ramsar sites which have not been designated SPA: i.e. both Ramsar sites designated on non-bird grounds and some sites designated before the Directive and thus not yet classified.

Table 1.2 British sites designated as Special Protection Areas. Sites in italics are also designated, in whole or in part, as Ramsar sites (Table 1.3). Some sites listed here will require boundary modifications, since early designations by government did not always take adequate account of biologically meaningful boundaries, as opposed to patterns of land-tenure.

Name	County/Region	Date designated	Area (ha)
Loch Druidibeg/a'Machair	Western Isles	31 August 1982	1,043
Moor House	Cumbria	31 August 1982	3,894
Orfordness – Havergate	Suffolk	31 August 1982	117
Ribble Estuary	Lancashire	31 August 1982	2,182
Rhum	Highland	31 August 1982	10,684
Skomer	Dyfed	31 August 1982	292
The Swale	Kent	31 August 1982[1]	5,677
Chesil Beach & the Fleet	Dorset	17 July 1985	763
Chew Valley Lake	Avon	17 July 1985	565
Coquet Island	Northumberland	17 July 1985	21
The Dee Estuary	Merseyside/Clwyd & Cheshire	17 July 1985	13,055
Derwent Ings	North Yorkshire & Humberside	17 July 1985	783
Farne Islands	Northumberland	17 July 1985	97
Holburn Moss	Northumberland	17 July 1985	22
Alt Estuary	Merseyside	28 November 1985	1,160
Leighton Moss	Lancashire	28 November 1985	124
Martin Mere	Lancashire	28 November 1985	119
Grassholm	Dyfed	31 January 1986	9
Loch Eye	Highland	1 October 1986	195
Loch of Skene	Grampian	1 October 1986	125
Priest Island	Highland	1 October 1986	138
Rockcliffe Marshes[2]	Cumbria	1 October 1986	1,897
Chichester & Langstone Harbours	West Sussex & Hampshire	28 October 1987	5,764
Upper Severn Estuary[3]	Gloucestershire	5 February 1988	1,357
The Wash	Lincolnshire & Norfolk	30 March 1988	63,135
Pagham Harbour	West Sussex	30 March 1988	616
Gladhouse Reservoir	Lothian	14 July 1988	186.5
Hoselaw Loch	Borders	14 July 1988	46
Gruinart Flats, Islay	Strathclyde	14 July 1988	3,170
Eilean na Muice Duibhe, Islay	Strathclyde	14 July 1988	574
Bridgend Flats, Islay	Strathclyde	14 July 1988	331
Laggan Peninsula, Islay	Strathclyde	14 July 1988	1,270
North Norfolk Coast	Norfolk	20 January 1989	7,701
Total 33 sites			**127,112.5 ha**

[1] Extended 17 July 1985. [2] Part of Upper Solway Flats and Marshes proposed Ramsar site. [3] Part of Severn Estuary proposed Ramsar site.

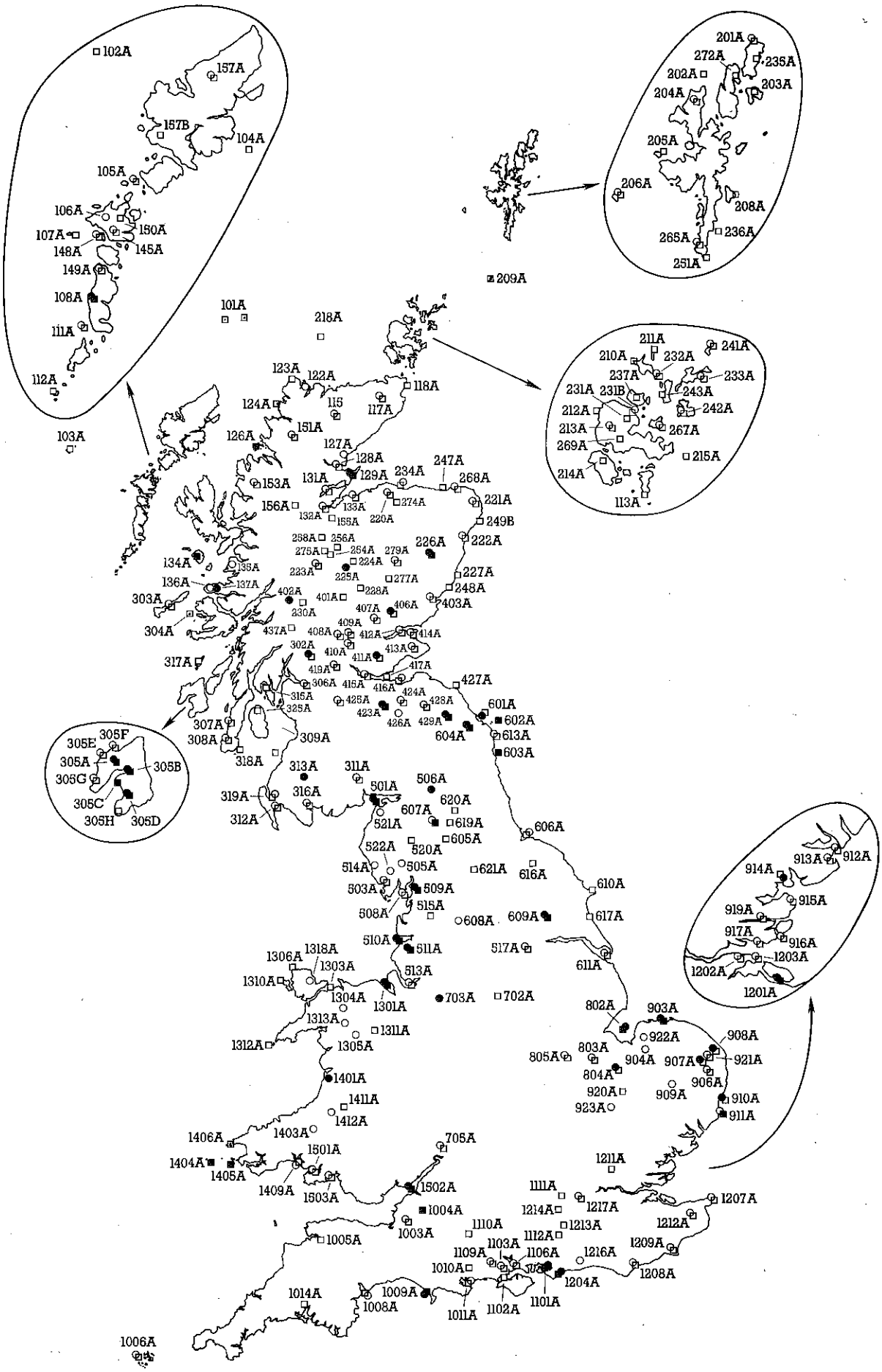


Figure 1.2 The location of Ramsar sites and Special Protection Areas (SPAs) in Britain. Solid symbols indicate sites already designated, whilst open symbols indicate proposed sites. Squares indicate SPAs whilst circles indicate Ramsar sites. Numbers are identifying code numbers as given in Table 3.1.
Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Table 1.3 British sites (excluding Northern Ireland) designated as wetlands of international importance under the Ramsar Convention. Sites in italics are also designated, in whole or in part, as Special Protection Areas (Table 1.2). Some sites listed here will require boundary modifications, since early designations by government did not always take adequate account of biologically meaningful boundaries, as opposed to patterns of land tenure.

Name	County/Region	Date designated	Area (ha)
Bridgwater Bay	Somerset	5 January 1976	2,703
Bure Marshes	Norfolk	5 January 1976	412
Cors Fochno and Dyfi	Dyfed/Gwynedd/Powys	5 January 1976	2,497
Hickling Broad & Horsey Mere	Norfolk	5 January 1976	892
Lindisfarne	Nothumberland	5 January 1976	3,123
Loch Druidibeg, Loch a' Machair & Loch Stilligary	Western Isles	5 January 1976	1,780
Loch Leven	Tayside	5 January 1976	1,597
Loch Lomond	Strathclyde/Central	5 January 1976	253
Minsmere-Walberswick	Suffolk	5 January 1976	1,697
North Norfolk Coast	Norfolk	5 January 1976[1]	7,701
Ouse Washes	Cambridgeshire & Norfolk	5 January 1976	2,276
Rannoch Moor	Tayside	5 January 1976	1,499
Abberton Reservoir	Essex	24 July 1981	1,228
Cairngorm Lochs	Grampian/Highland	24 July 1981	179
Claish Moss	Highland	24 July 1981	563
Loch Lintrathen	Tayside	24 July 1981	218
Rostherne Mere	Cheshire	24 July 1981	79
Silver Flowe	Dumfries/Galloway	24 July 1981	608
Chesil Beach & the Fleet	Dorset	17 July 1985	763
The Dee Estuary	Merseyside/Clwyd & Cheshire	17 July 1985	13,055
Derwent Ings	North Yorkshire & Humberside	17 July 1985	783
Holburn Moss	Northumberland	17 July 1985	22
Irthinghead Mires	Northumberland & Cumbria	17 July 1985	608
The Swale	Kent	17 July 1985	5,790
Alt Estuary	Merseyside	28 November 1985	1,160
Leighton Moss	Lancashire	28 November 1985	125
Martin Mere	Lancashire	28 November 1985	119
Loch Eye	Highland	1 October 1986	195
Loch of Skene	Grampian	1 October 1986	125
Rockcliffe Marshes	Cumbria	1 October 1986	1,897
Chichester & Langstone Harbours	West Sussex & Hampshire	28 October 1987	5,749
Upper Severn Estuary	Gloucestershire	5 February 1988	1,437
The Wash	Lincolnshire & Norfolk	30 March 1988	63,124
Pagham Harbour	West Sussex	30 March 1988	616
Gladhouse Reservoir	Lothian	14 July 1988	186
Hoselaw Loch	Borders	14 July 1988	46
Gruinart Flats, Islay	Strathclyde	14 July 1988	3,170
Eilean na Muice Duibhe, Islay	Strathclyde	14 July 1988	574
Bridgend Flats, Islay	Strathclyde	14 July 1988	331
Total 39 sites			**129,180 ha**

[1] Site extended 20 January 1989.

public statements by HM Government tended to support this view. In practice, the additional consultations which were considered necessary have tended to delay matters. Also, one of the many flaws in the drafting of the Act meant that dealing with international measures within SSSI notifications, as intended, was not legally possible.

At the request of Government, the NCC has identified sites of international importance for nature conservation under both the Ramsar Convention and EEC Birds Directive. Identification and evaluation of these areas is a continuing process. To date a total of 218 candidate SPAs and 154 candidate Ramsar sites have been identified[1] (Figure 1.2). At least 43 other areas have been proposed by various conservation bodies as being likely to qualify. This figure includes some provision for aspects not yet adequately covered. As further information is obtained, either the eligibility of these areas will be confirmed or they will be deleted from the list.

As at 13 October 1989, a total of 33 sites covering 127,112.5 ha (Table 1.2) had been designated as Special Protection Areas (SPAs) under the Directive. A total of 39 internationally important wetlands (covering 129,180 ha) had also been designated under the Ramsar Convention (Table 1.3). (One further Ramsar site, Lough Neagh and Lough Beg, has been designated in Northern Ireland, which is outside the scope of the present report). Many of the sites are designated under both the Directive and the Convention.

The Scottish Development Department and the Department of the Environment have requested from NCC a review of the extent of protection to bird populations which will be afforded by the proposed sites of international importance. This report presents both information on the suite of identified sites and the rationale for their selection, as well as background information on the population, status and habitats of Annex 1 and some other migratory species of major conservation importance regularly occurring in Britain.

Although the British Government is responsible for notification of SPAs in Northern Ireland, NCC does not have responsibility for identification of sites there. This task falls to the Department of Environment (Northern Ireland). The potential coverage achieved by SPAs in Northern Ireland (which are notified as Areas of Special Scientific Interest by domestic legislation) is not considered further in this report, and neither are sites in Dependent Territories (most of which are party to the 'Ramsar' Convention, but only a few of which are within the scope of the Birds Directive).

[1] Figures include already designated sites.

2 Rationale for selection of sites

2.1 Introduction

The general conservation aims of the Directive are set out in its preamble, which makes the following points:

- a large number of species of wild bird naturally occurring in Europe are declining in number, and this represents a serious threat to the biological balance of the natural environment;
- most of these species are migratory and are thus a common heritage which presents trans-frontier challenges to conservation;
- conservation is aimed at the long-term protection and management of natural resources as a integral part of European heritage;
- the preservation, maintenance or restoration of a sufficent diversity and area of habitats is essential to the conservation of all species of birds, although some will require special conservation measures concerning their habitats to ensure their survival and reproduction in their area of distribution; and
- these necessary measures should be coordinated between states, especially in view of the needs of migratory species.

The key conservation objective overall is thus *"the preservation, maintenance or restoration of a sufficent diversity and area of habitat .... to ensure their survival and reproduction in their area of distribution"*. The methods required to achieve this aim will clearly differ between species. However, it is important to note the emphasis laid by the Directive on the term *"area of distribution"* both in the preamble and in the text of Article 4. This clearly implies that the Directive is concerned not only with the maintenance of population numbers, but also with the maintenance of range and with population persistence. This is biologically sensible. Similarly, the reference to reproduction as well as survival stresses the need to allow adequately for areas which will allow for production, rather than just supporting numbers. Clearly, this is essential for population survival.

The Directive is clearly intended at least to maintain current numbers, distributions and performance. Thus we should give some effort to making sure that currently common birds do not become rare, as well as taking steps to improve the situation for those that have already suffered this fate.

The selection of sites for designation as Special Protection Areas provides some challenges. This is because the Directive adopts a practical conservation approach towards achieving adequate measures rather than establishing particular population thresholds (as has been done in the criteria of the Ramsar Convention – section 2.5.1). As is being recognised for the Ramsar criteria, the simple threshold approach does have drawbacks, particularly in allowing for sites of high productivity but where densities may be low (section 2.4.4). The emphasis within the EEC Directive is on maintaining both the range of distributions *and* the reproductive success of the populations. Even for waterfowl, the Directive gives requirements which would not be covered by the Ramsar criteria. One example is the protection of sites on which waterfowl predictively depend in periods of severe weather, but which are used only by low numbers in mild winters. Other areas would include those which have a very high turnover of individuals (section 2.4.1) and are consequently important to a high proportion of a population. Examples would include certain montane gathering grounds for dotterel[1] (section A.6.2.27) and many estuaries.

2.2 Importance of maintaining geographic range

2.2.1 Minimum viable populations and genetic conservation

There are fundamental biological reasons for sustaining the geographical range of populations as well as their numerical size.

Recent research into the size of minimum viable populations has shown the importance of range for the long-term well-being of populations (e.g. Salwasser *et al.* 1983; Gilpin 1987; Marcot & Holthausen 1987). There is a lower probability of chance extinction when a species occurs over a wide geographic range. This is because those environmental fluctuations (including those caused by man) which may be detrimental to populations will not generally occur synchronously across wide areas. Even though environmental variation (such as extreme winter cold) may cause some of a population to suffer depressed productivity, or even lead to local extinctions, this will not occur in all the areas occupied by a wide-ranging population (Goodman 1987). When large

[1] Nomenclature throughout this report follows that of Cramp *et al. The Birds of the Western Palearctic.*

populations occur over wide geographic areas this also leads to better conservation of genetic variation through reduced inbreeding, and hence to enhanced long-term population viability (Salwasser *et al.* 1983; Lande & Barrowclough 1987; Harris 1988).

Indeed, the importance of genetic conservation as a prerequisite for population conservation and the continued evolutionary development of species is directly written into the legislation of some states. For example, the much lauded *Flora and Fauna Guarantee Act 1988* of the State of Victoria, Australia, has the following objectives:

4 a) *to guarantee that all taxa of Victoria's flora and fauna ... can survive, flourish and retain their potential for evolutionary development in the wild; and*
b) *to conserve Victoria's communities of flora and fauna; and ...*
e) *to ensure that the genetic diversity of flora and fauna is maintained...*

Likewise the US *Endangered Species Act 1973* and subsequent legislation directly links population survival to reproduction and distribution:

"Jeopardise the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species[1].

Genetic differences between populations, and the analysis of the degree of past and current inter-breeding between different populations of birds, are becoming increasingly important in taxonomic and evolutionary studies (e.g. Cracroft 1989).

2.2.2 Effects of range reduction and habitat fragmentation

The present day distributions of many bird species are now greatly reduced or fragmented compared with former times. Usually this is due to man-induced habitat changes or other impacts (such as persecution). Thus present distributions can be poorly indicative of 'natural' range.

Species such as red kite and corncrake now occupy a very small part of their former range in Britain owing to persecution and habitat change (intensification of lowland agriculture) respectively. Lowland breeding waders such as ruff, black-tailed godwit, snipe and redshank are now much reduced in distribution and numbers, both in Britain and elsewhere, owing to the loss or modification of their un-intensified, wet grassland habitat (Beinterna 1983; Smith 1983).

Even where overall geographic range is sustained, the fragmentation of prime habitat by land-use or other changes can make isolated populations more vulnerable to chance processes of extinction (Alexandersson 1987; Temple & Cary 1988). In these cases, immigration into isolated populations is increasingly difficult. Although very large populations can sometimes become extinct naturally and without human interference (MacArthur & Wilson 1967), such events are normally redressed by eventual immigration from neighbouring populations. However, as fragmentation of habitats and reduction of population sizes continue, the point is reached where there are no further sources of immigrants to re-colonise an area destroyed by natural catastrophes. Thus species extinction can occur because the remaining population *is* the species (Soulé & Simberloff 1986).

An example is that of the great auk which was persecuted by humans for centuries, resulting in an increasingly restricted and fragmented distribution (Grieve 1885). The last major breeding colony on an island off the south coast of Iceland was destroyed by volcanic eruption, effectively and finally making the species extinct. Centuries previously, such an event would not have been catastrophic to the species because the island (or its remains) would eventually have been recolonised by immigrant great auks from other parts of a range which once extended across the whole north Atlantic to America. Thus human persecution made the great auk population ever more vulnerable to the chance effects of a natural catastrophe.

The Svalbard breeding population of light-bellied brent geese winters in Denmark and on Lindisfarne. With a total of only 3,000 – 4,000 birds, it is one of the smallest and most threatened goose stocks in the world (Madsen 1984a, 1987). Formerly however, it totalled in excess of 50,000 geese and bred in many areas of the Svalbard archipelago, including all along the west coast. However, the population crashed at the beginning of this century due to a combination of factors on both breeding and wintering grounds. Their staple winter food of *Zostera* (eel-grass) died out along most North Atlantic coasts and many geese died of starvation or from over-shooting. In addition, hunting pressure was also excessive in summer.

The present restricted distribution of light-bellied brent geese in summer is centred on a small group of islands in the extreme south of Svalbard. Here breeding productivity is consistently low, with an average proportion of only 12% young in the autumn flocks each year, and with many years of almost complete breeding failure. Recently, it has been established that this is due to nest predation by polar bears, who can reach these islands when there is much pack-ice (Madsen *et al.* 1989; Madsen & Mehlum unpublished).

The population is consequently threatened to a much greater extent by this 'natural' predation than

[1] US Federal Register 51: 19926-19963.

it would formerly have been. When the population was much larger, the geese would also have nested in many places inaccessible to polar bears, and thus production by these other birds in years of dense pack-ice would have offset losses to polar bears elsewhere. In this case a combination of both natural (*Zostera* disease) and human (over-shooting) factors have reduced and restricted the population. Now, even with complete protection, the population is highly vulnerable to extinction owing to chance natural effects (a succession of years in which polar bears or arctic foxes can obtain access to the few nesting islands). Further, the prospect of recolonisation of other areas of Svalbard is poor. The species' low productivity gives poor scope for population expansion, whilst inter-specific competition with an expanding population of the closely related barnacle goose (Prestrud 1989) means that now there may be few alternative areas to colonise. Madsen *et al.* (1989) consider that, as a result of past circumstances, this goose population may now be 'ecologically trapped' in sub-optimal habitat and have poor long-term prospects of survival.

The red kite, a raptor that was once widespread throughout Britain, is now restricted to a limited area in mid-Wales. This non-migratory population has not naturally re-colonised other areas in which it once occurred, because of persecution in closely surrounding areas and generally low productivity. The areas occupied are not ideal habitat but the present distribution has come about as a result of the historical patterns of persecution by man. This relict population is now also much more vulnerable to natural and unnatural catastrophes (such as disease and poisoning) than when it was more widespread and numerous. (For this and other reasons, NCC and RSPB are experimenting to re-establish the red kite in other areas of Britain.)

Dartford warblers have been adversely affected by the fragmentation of heathland habitats in southern England (Moore 1962). Small blocks of heathland hold lower densities of Dartford warblers than more extensive areas (Bibby & Tubbs 1975). Small and isolated groups are more likely to become extinct following high mortality in severe winters. Fragmentation of heathland also increases the impact of adverse edge-effects from neighbouring non-heathland habitats, such as nutrient enrichment from adjacent farmland and vegetation change following grazing by rabbits (Bibby & Tubbs 1975).

The marsh warbler, a species facing imminent extinction in its former main area in Britain, has also been adversely affected by fragmentation of its habitat and population. Although much more common elsewhere in Europe, the imminent British extinction will reduce the species' range. This wetland breeding passerine was restricted by progressive wetland habitat loss to scrubland beside rivers and streams. This habitat was in turn progressively 'tidied-up' by Water Authorities. Eventually Water Authorities became more enlightened regarding conservation needs on water-courses, but by this time the habitat was highly fragmented and the population too small and restricted to take advantage of changed attitudes and policies. Since then, the tiny marsh warbler population has had no buffer against climatic and other random fluctuations (Kelsey *et al.* 1989).

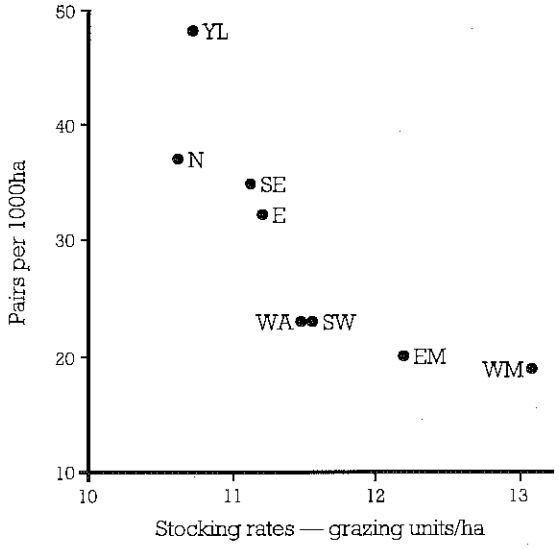
The marsh warbler population was highly fragmented in the late 1960s (Sharrock 1976), and even at that time Sharrock noted that the further loss of traditional wetland breeding areas was likely to result in failure of potential pairs to make contact with each other. Recent evidence from colour-ringing indicates there has indeed been little net immigration to remaining sites (Kelsey *et al.* 1989). Thus the isolated population remnants have declined still further and the species is likely to become extinct in the next few years. Indeed, this has effectively happened since only one male was found in the species' hitherto 'stronghold' in 1989 (G.H. Green pers. comm.).

Populations of birds of prey are extremely vulnerable to sudden, unpredictable changes in the environment. For example, peregrines were wiped out across most of the North American continent (as well as from much of Britain and large parts of the rest of Europe) before the effects of certain agricultural chemicals were realised (Hickey 1969; Lindberg 1985).

It is important to note that, generally, the present day distribution and abundance of bird species and their habitats can be the end result of extensive and long-term human interventions. Only a very few generalist species, for example some common farmland birds such as the yellowhammer have benefited from some of the landscape modifications (Laursen 1980; O'Connor & Shrubb 1986). However, even within agricultural landscapes, change has been occurring with increasing speed with a variety of adverse consequences even for these adaptable populations. Birds such as the lapwing occur in both agricultural and non-agricultural habitats, and although they have benefitted from increased grassland extent in pastoral areas (Figure 2.1) they have declined in agricultural landscapes where cereal production has predominated. In these areas, changing patterns of cereal production have had consequences for both the lapwing's breeding density and its success (O'Connor & Shrubb 1986).

In contrast, where agricultural modification has occurred slowly and over long periods of time, it has sometimes had the effect of interacting with natural and semi-natural habitats to produce areas of considerable value for wildlife. This is in marked contrast to the effects of the rapid change which has been so typical of agriculture in the latter part of this century. Examples of the first group include the crofting landscapes of the Hebrides and northern isles (Fuller *et al.* 1986; Bignal *et al.* 1988; Stroud 1989; Campbell 1989), and lowland wet grasslands (Green & Cadbury 1987). Areas of the country with low-intensity pastoral farmland, particularly where there has been traditional emphasis on extensive stock-rearing with generally

Figure 2.1 The density of nesting lapwings in lowland grassland in each region of England and Wales in relation to average stocking rates.
YL, Yorkshire – Lancaster; N, Northern England; SE, South-east England; E, Eastern England; SW, South-west England; EM, East Midlands; WM; West Midlands; WA, Wales (from O'Connor & Shrubb 1986).



low grazing levels (Figure 2.1), have generally produced habitats of significant conservation value.

However, many birds of other habitats are now much more restricted than formerly. This is particularly the case for a wide variety of wetland birds. Wetlands have been drastically reduced in extent, in turn reducing and fragmenting the bird populations dependent on them. This loss is continuing.

Prater (1981) gives examples of the reduction in extent of estuarine and saltmarsh habitats; saltmarsh habitat on areas such as the Wash has been greatly reduced (Doody & Barnett 1987; Cadbury 1987a; Hill 1988). Lowland grasslands have been severely modified by intensive agriculture, with the loss of their characteristic breeding waders (Smith 1983; Green & Cadbury 1987; Fuller 1987; Williams & Bowers 1987). Freshwater coastal grasslands, in particular, have been lost at a rapid rate as a result of conversion to arable agriculture (Williams & Hall 1987). An NCC study of lowland raised mires has shown that in some areas there has been up to 95% loss of habitat since 1948 (NCC 1984; Lindsay in prep.), and lowland English heaths have been dramatically fragmented and 'reclaimed' (Moore 1962) with adverse consequences for their characteristic birds (Bibby 1978; Tubbs 1985). Upland waders such as golden plovers, dunlin and greenshank have been much reduced by recent afforestation and other land-use changes (Cadbury 1987b; Stroud *et al.* 1987; Thompson *et al.* 1988).

Thus the present-day status and distribution of some birds cannot be regarded as the 'natural' *status quo* and certainly not as desirable. For many species, conservation planning needs to set targets to *increase* their presently diminished population sizes and ranges. A network of internationally important core areas is one way to ensure that further attrition does not occur, while other policies are devised and promoted, both on sites and in the wider countryside, to expand these already restricted populations.

In Denmark, there has been widespread and severe attrition of wildlife habitats, with massive destruction or modification of many bird habitats. This has been addressed by legislation which gives complete protection to natural and semi-natural habitats greater than 5,000 m^2, as well as to water-bodies greater than 500 m^2. Under Paragraph 43 of the Nature Protection Law currently before the Danish Parliament, these existing laws will be strengthened with protection for heaths, bogs, coastal marshes, wet meadows and semi-natural grasslands greater than 2,500 m in extent, and for water bodies greater than 250 m^2 in size. Such control on further attrition has also encouraged a great deal of research on practical re-establishment and re-creation of habitats formerly destroyed (H. Meltofte pers. comm.).

In Britain, the need for conservation measures outside designated sites (to complement site-related actions) is being addressed by the NCC's Chief Scientist Directorate in a variety of research, survey and monitoring programmes (Pienkowski in press). In particular, the integration of information on bird populations in the wider countryside can be used to guide locational strategies for potentially damaging land-uses such as coniferous afforestation (Galbraith & Pienkowski in press). A variety of innovative techniques are also being developed and used. These will gather information on birds and their habitats over very wide areas (Pienkowski in press).

2.2.3 The importance of monitoring

If bird monitoring programmes are well designed, they may be able to give some clue as to the possible underlying causes of change (Järvinen & Väisänen 1979). This is especially important for long-lived bird species, since the buffering effect of the immature component may delay the manifestation in population sizes of changes in productivity or survival rates. For instance, monitoring of arctic tern's productivity in the Shetland Isles identified the breeding failure of terns and the shortage of their food, sand-eels, in the 1980s, several years before the decline was apparent in population numbers, and this allowed more detailed examination concurrent with continuing changes. Similarly, the NCC Seabird Monitoring Programme has been able to examine the geographical context of the change in this and other species. Problems for seabirds were not confined to Shetland, but were not so pronounced elsewhere. Such studies help to point to possible causes, and, in this case, to provide light and remove heat from discussions between the fishing industry and conservationists.

The geographical patterns in changes may also point to the need for further investigation. The Seabird Colony Register, organised by NCC and the Seabird Group, surveyed seabird colonies in 1986-88 and compared the results with earlier work in 1969-70 (Lloyd *et al.* in press). Cormorants have increased along most coasts of Britain and Ireland, but decreased in western and northern Scotland. As the latter areas are those of major developments in marine fish-farming in this period, it seems possible that these features are linked (Lloyd *et al.* in press).

These examples relate to reporting change and investigating why it happened. Lessons learnt may be used to avoid similar problems in the future which would be a clear benefit. However, we would like to move towards an even more positive approach whereby we could aim for actual improvements in the environment. This would allow soundly based advice to be provided to national and local government on the development of countryside policies. Such information can be gained by combining wildlife monitoring with information on relationships between habitats and the land-use practices which influence those habitats. From here, one can move towards setting positive targets for conservation in the countryside and monitoring how well those are achieved, as is outlined further by Pienkowski (in press).

2.3 Importance of site networks for migratory birds

By definition, migratory birds depend on a number of areas which are used at different times of the year. The ecological requirements and the use made of different sites are perhaps best understood for well-studied groups of birds such as waders (e.g. Pienkowski & Pienkowski 1983; Davidson & Pienkowski 1987; Prokosch 1988; Smit & Piersma 1989), and wildfowl (e.g. Owen 1980; Patterson 1982; Prokosch 1984; Owen *et al.* 1986; Pirot *et al.* 1989). Whilst it is beyond the scope of the present report to review such extensive scientific literature, various points are important in planning site networks to conserve migratory populations. Some of these are considered below.

Birds do not use sites randomly. Most have specialised requirements which can best be met at a certain number of locations. Generally, birds tend to use sites at which their chances of survival and future reproduction are greatest. There are advantages to the individual in returning to areas with which they are familiar – in terms of food resources, predation risk, nesting habitat etc. Consequently, such sites are used regularly, with important numbers of birds returning each year, and their loss is likely to have an adverse effect on populations. This strong site fidelity at each season has been found for an increasing number of birds (e.g. Pienkowski & Evans 1985; Hudson 1985; Diefenbach *et al.* 1988; Thompson *et al.* 1988; Wilson *et al.* in press).

However, sites do not have to be of numerical importance in every year, nor at all times of the year, in order to be of crucial importance to the conservation of a population. Certain areas hold mobile populations under some circumstances (e.g. at times of severe winter weather when birds are displaced from 'normal' wintering areas (Baillie 1984)), and at these times such sites can be crucial for population survival (Baillie *et al.* 1986). For example, individual grey plovers each use particular sites on different sides of the North Sea, according to the severity of the winter (Townshend 1982; Pienkowski & Evans 1984), as does the endangered population of light-bellied brent geese. These geese move from Denmark to Lindisfarne NNR according to Danish winter weather conditions (Madsen 1984a; see also section 2.2.1 above). Bewick's swans can make rapid and extensive movements, not only within Britain, but also to sites in Holland, Germany and Denmark, in response to severe winter weather (Evans 1982).

There may also be distinct shifts of habitat associated with cold weather movements. Pochard are ducks of shallow, eutrophic waters in normal winters. However, these habitats are liable to freeze early, and in severe weather conditions there is a pronounced move by pochard onto estuaries which normally hold only minor numbers of this species (Fox & Salmon 1988). Other such habitat shifts occur for different species.

Clearly then, sites which hold populations under these known but irregularly occurring conditions are of key importance for population viability, even if they may not achieve arbitrary numerical criteria of 'importance' in every year. Similar arguments pertain to the use of certain important areas within a 'site', which may not be used regularly (section 2.4.2). Examples would include estuarine areas which are used by roosting waders when exceptional tidal conditions make more usual roosts unavailable. Such areas may be needed only infrequently, although at those times they are of very great importance as refuges.

The loss of sites will force birds to use other areas which may be sub-optimal. The increasing density of birds forced onto smaller areas will adversely affect birds through competition and other interference (Goss-Custard & Moser 1988; Thompson *et al.* 1988).

Whilst networks of protected 'sites' are important in themselves, it is essential not to neglect positive conservation measures in the countryside surrounding the 'sites' protected. For some species, a high proportion of a population will occur within a 'site', whereas for others there will be an interchange of individuals with other areas. Still other species may be concentrated within a site in a certain season, and yet be widespread at other times of the year. For example, many seabirds nest at very high densities in colonies, and yet disperse over wide areas outside the breeding season. Even in one season, different activities may

take place in distinctly different locations for which differing means of conservation are appropriate (e.g. some geese have separate feeding and roosting sites, the former often being widespread).

It is thus not always possible to conserve bird populations using a site-based approach alone, and this is recognised by the Birds Directive (Articles 2 & 3) which requires wider measures *"in accordance with the ecological needs of habitats inside and outside the protected zones"*. Article 4.4 requires *"... appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article"*.

An example of the need for wider measures has been given by Helle (1986) who investigated population trends in birds of protected and exploited boreal forests. Forest bird populations changed with commercial forestry exploitation. However, such change was detectable also within large-scale protected areas. This work indicated that *"... even an area of protected virgin forest as large as 70 km² is not a closed unit for bird populations. The populations of such areas are influenced by large-scale changes in source populations on a regional scale (northern Finland), where the impact of forestry on natural habitats is considerable"*. Similar findings have been made by Järvinen (1978) and Väisänen *et al.* (1986) elsewhere in Finland. Such studies reaffirm Janzen's (1983) paraphrase that "no park is an island". As Soulé & Wilcox (1980) argue, such studies and theoretical considerations indicate the need for many large and dispersed protected areas (Table 2.1) to underpin a conservation strategy for migratory species. This has been accepted by HM Government who are henceforth giving priority to the designation of large SPAs[1].

At the level of site-use by individual species, such needs are considered further in section 2.4.2.

Table 2.1 Components important in consideration of nature reserve planning, summarised from many theoretical and other studies. From Soulé & Wilcox (1980) who give further supporting detail.

Design considerations	RESERVE DESIGN FEATURES		
	Number	Size	Dispersed?
Disease	Many	Large	Yes
Genetics	Many	Large	–
Community ecology	Many	Large	–
Island biogeography	–	Large	(complex[1])
Research potential	Many	–	–
Politics, economics	Many	–	Yes
Recreation	Many	Large	Yes
Summary	**Many**	**Large**	**Dispersed**

[1] See Soulé & Wilcox (1980) and Soulé & Simberloff (1986) for full discussion.

Table 2.1

Components important in consideration of nature reserve planning, summarised from many theoretical and other studies. From Soulé & Wilcox (1980) who give further supporting detail.

2.4 Interpretation of data

In contrast to many other groups of animals, most birds tend to be easy to count. Thus, bird surveys, unlike some types of biological survey (e.g. for most invertebrates), usually generate large amounts of quantitative data. This is most commonly in the form of an estimate of total numbers on a site at a particular time. Such quantitative data are particularly useful in determining the importance of sites to bird populations, especially where information exists from many years.

However, there are a wide variety of potential pitfalls in the interpretation of ornithological survey data. It is possible to be misled in certain circumstances if the methodological systems used are imperfectly understood. A knowledge of bird ecology is also required. All such data require careful interpretation by conservation scientists in the light of the methods used for survey, as well as knowledge of similar habitats and species assemblages elsewhere.

These problems are fully taken into account by the NCC when evaluating data for sites of international importance across the whole of Great Britain. Some of the more usual ones are summarised below.

2.4.1 Turnover

The problem of assessing turnover is particularly acute for migratory birds, since the use of simple count data (even where maximum counts are used) will often severely under-estimate the number of birds using a site (such as a large estuary) over a period of time. Take for example 1,000 dunlin counted on an estuary one spring day. These may all migrate north that night but a further 1,000 may arrive from a more southerly area the following day. Another count of the site would again reveal 1,000 dunlin, even though 2,000 birds had actually used the site. During migration periods, when there may be continual arrivals and departures of birds staggered over a period of weeks, simple count data may greatly under-estimate the importance of a site to a population.

[1] Minutes of Working Party of the Committee for Adaptation to Technical and Scientific Progress of Directive 79/409/EEC: Brussels, 19 October1988.

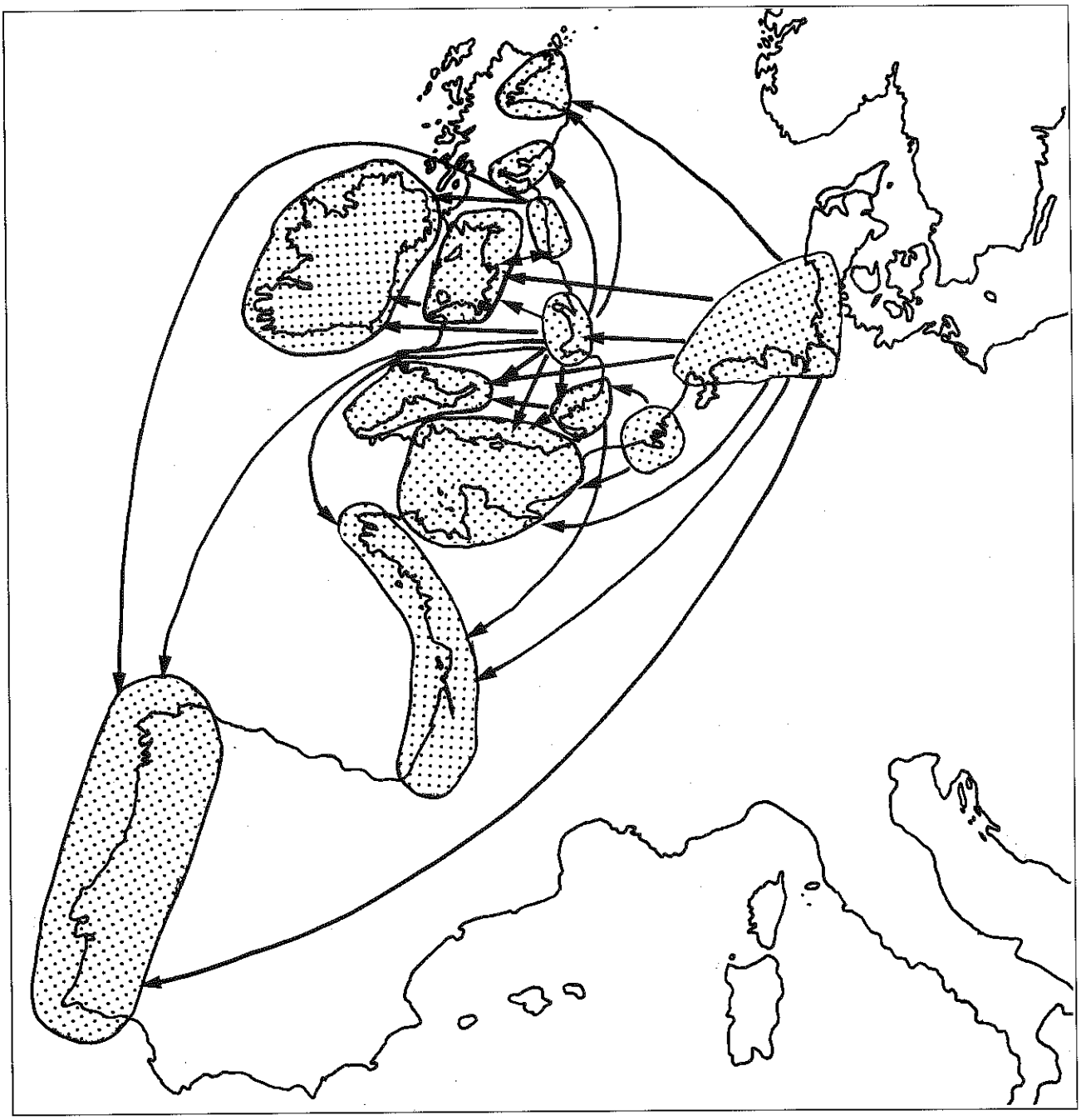


Figure 2.2 Estuaries cannot be considered in isolation since they are linked by a complex web of movements by the many internationally important bird populations. This summary of movements of individually marked dunlin shows movements between many estuaries in Europe during the course of a non-breeding season (from Pienkowski & Pienkowski 1983).

This problem of turnover can best be assessed by studying individually marked birds, which are either repeatedly re-trapped or re-sighted to assess the duration of their stay (Figure 2.2). Unfortunately such studies are complex and lengthy and have been undertaken in only a few areas. Most usually such studies have involved estuarine wintering or migrating waders (Symonds & Langslow 1981; Symonds *et al.* 1984; Moser & Carrier 1983; Pienkowski 1983; Pienkowski & Pienkowski 1983; Symonds & Langslow 1985; Prokosch 1988). Another approach is to use natural markers which occur on birds for defined periods of time, such as observations of moulted, featherless wings in grebes (Piersma 1987). Turnover means that count data for sites have to be interpreted with caution, since in many cases where movements through a site are suspected, 'snapshot' counts may considerably under-estimate the numbers of birds actually dependent on a site.

For instance, by observing marked birds, Moser & Carrier (1983) estimated that the number of individual ringed plovers using the Solway Firth in spring 1983 was twice the number recorded during peak counts. Likewise, Prokosch (1988) estimated that at least twice the number of grey plovers used the estuarine Waddensee compared to peak numbers of birds counted over the same period. Numbers of knot and bar-tailed godwit using the Waddensee were also greater than peak numbers counted.

Kersten & Smit (1984) estimated both peak numbers present and duration of stay of waders at the Sidi Moussa estuary in Morocco in 1981 and 1982. Although counts gave a peak of 7,000 dunlins, turnover studies showed that during the entire spring migration period at least 21,000 dunlins must have used the site. Using the last figure, the Sidi Moussa estuary qualifies as a site of international importance for dunlin, which was not clear from examination of count data only (Smit & Piersma 1989).

Turnover means that even peak counts will always under-estimate the importance of a site to the population concerned. Where turnover data exist for British sites they are taken into account in assessment of 'importance'. However, such cases are few and information on typical turnover gathered at other sites should be used also.

The draft revised criteria for identification of wetlands of international importance (section 2.5.1) indicate the need to take turnover into consideration when identification of such sites is being undertaken: *"Consideration may also be given to turnover of waterfowl at migration periods, so that a cumulative total is reached, if such data are available"*.

2.4.2 Use of sites and functional unit systems

The ways in which birds use areas is of great importance in determining their requirements. An aim of conservation is the long-term maintenance of bird populations. Thus protected sites should include all areas necessary for the survival and reproduction of birds, where such habitats can be effectively influenced through site-based conservation. Some birds have complex 'ecological niches' and conservation needs to take the full range of ecological requirements into consideration.

Clearly, protection of only the nest site of a bird such as a merlin will not be an adequate conservation measure. The wide area of countryside around the nest, in which the merlin hunts for food, needs to be protected from undesirable change. Only this will keep the merlins breeding at that site (Bibby 1986). The same applies for all nesting birds, although the size of the area necessary to ensure successful breeding varies enormously. For a few birds, such as golden eagles, the home range is so large that site-based conservation cannot hope to conserve more than a small proportion of the breeding population. Whilst site-safeguard may form a useful part of a conservation strategy for the species, particularly in 'core' or high density areas, conservation of these species must concentrate on measures taken largely in the 'wider countryside'. In the case of golden eagles, restricting coniferous afforestation in the uplands and reducing currently high levels of persecution are important (Watson *et al.* 1987; Watson *et al.* 1989).

At the other end of the scale, small passerines such as warblers and tits have relatively small territories. Many whole territories and ranges will be encompassed within a site containing suitable habitat.

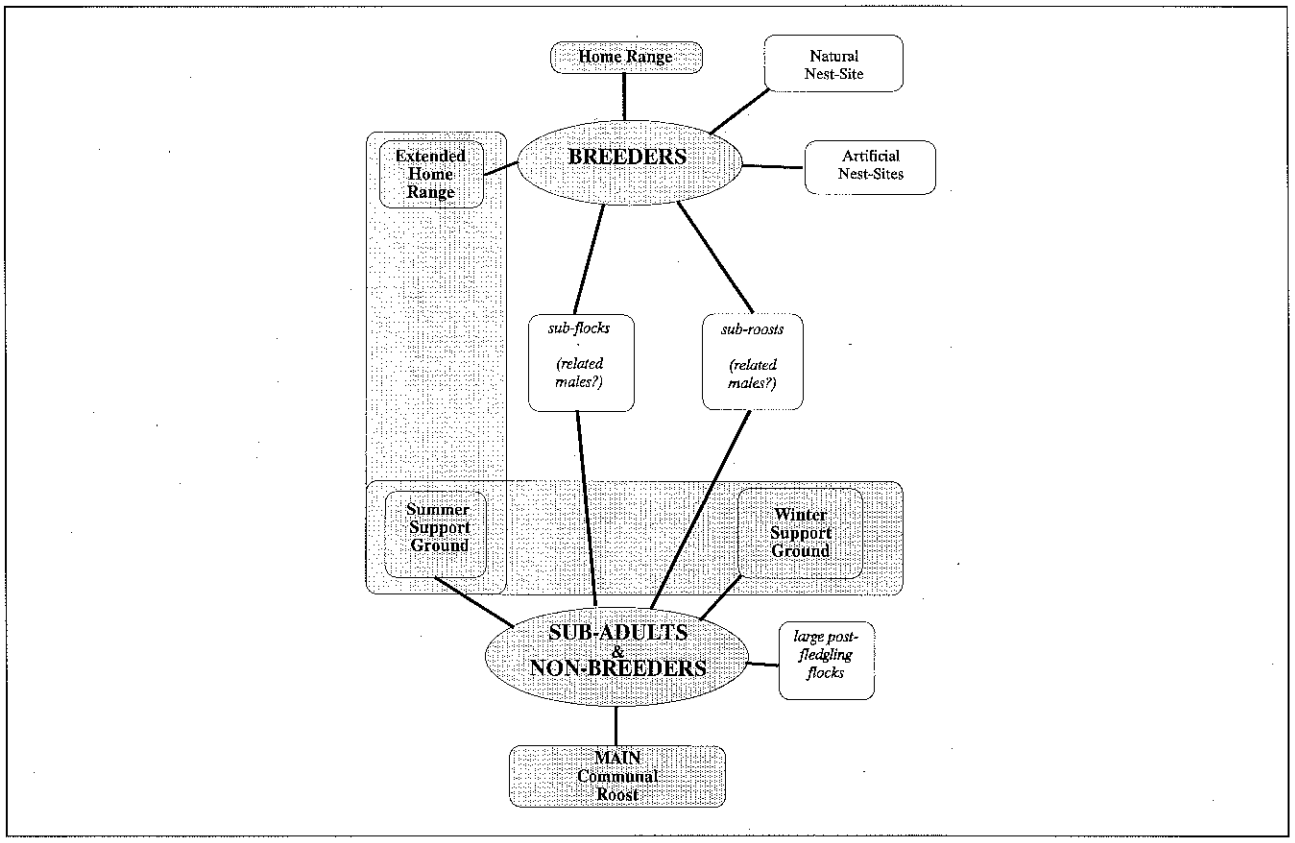
Conservation measures should, therefore, provide for all the needs of bird species, even though the measures used may differ. Site-based conservation may not be able to ensure that all the ecological requirements of widely ranging or dispersed species are met. However, for other species, sites should contain all the areas necessary for the birds under consideration, where this is possible.

Nesting areas and feeding areas are obvious considerations, but other areas, such as refuges to which birds may retreat when highly disturbed, are also important. For example, the viability of some Greenland white-fronted goose flocks has been adversely affected when such retreat areas have been lost either through afforestation or through disturbance following agricultural intensification (Ruttledge & Ogilvie 1979; Norriss & Wilson 1988). Likewise, wider areas are necessary to support populations of a species such as chough. In this case, it is necessary to protect not only areas used by breeding pairs but also the area used for feeding by flocks of sub-adult birds (Bignal *et al.* 1989). Communal roost sites are also important, as they provide an area where birds can exchange information about the location of new feeding areas, and foster other social functions, such as the establishment of dominance hierarchies or 'pecking-orders' (Still *et al.* 1987; Monaghan 1989; Bignal *et al.* 1989). Some of the requirements for choughs are summarised in Figure 2.3 which indicates the complexity of their needs in both space and time. Loss of choughs from parts of their range has usually been preceded by loss of the immature component of the population and its habitat.

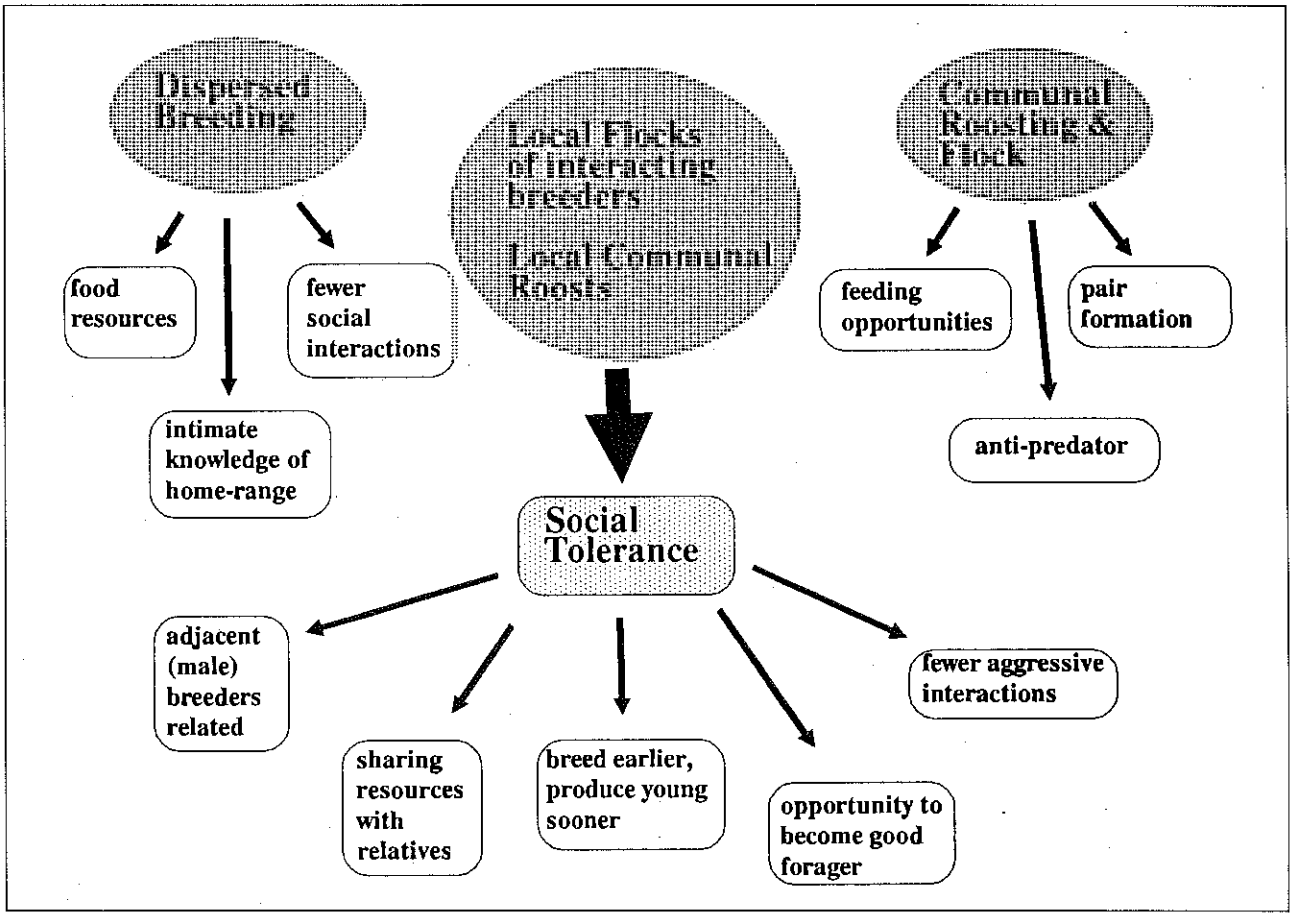
Some birds require different foods in different seasons according to physiological and other needs. Many long-distance migrants require to lay down fat and protein reserves prior to migration as explained further in section 2.4.9. Thus the diet, and hence habitats used, in periods before and during migration may be quite different compared with other times of the year (McLandress & Raveling 1981a, 1981b). For instance, some herbivorous waterfowl consume high proportions of invertebrate food prior to, or during, the nesting season (Serie & Swanson 1976), since this provides an important protein source for egg-formation. Pink-footed geese significantly change their diet and habitat in the month before spring migration. This has been linked directly to changing energy and nutritional needs (Madsen 1985). Similar dietary changes have also been shown for barnacle geese (Prins & Ydenberg 1985), and a great variety of other species.

Birds may also use a range of areas during the summer, taking similar foods but maximising nutrient intake. Some species such as Greenland white-fronted geese move uphill during the course

Figure 2.3 Functional Unit System concept applied to choughs on Islay (from Bignal *et al.* 1989), to show the interacting physical and social requirements of the two main sections of the population – the breeders, and sub-adults and non-breeders.



Summary of the interpretation of the adaptive significance of the chough's functional unit system on Islay: partitioning of feeding and breeding opportunities, whilst minimising predation and intraspecific competition, and maximising population productivity.



of the summer, following the progression of the spring thaw and selecting as food young plants just starting growth. These young plants have high concentrations of nutrients and are highly favoured by the geese (Madsen & Fox 1981; Stroud 1981). Some grouse and ptarmigan species also undertake similar movements, although changing altitudinal feeding zone and diet at different times of the season (Andersen 1986). Such selection processes are complex. They relate not only to differing spatial and temporal availability of foods, but also to the changing dietary needs of both chicks and adult grouse (Andersen 1986).

The effect of differing dietary and habitat needs is that, for effective conservation, sites or site-networks must ensure the preservation of all essential habitats, even if some may be used by birds for only a short period each year. In many cases site-safeguard needs complementing by wider countryside measures.

Some birds have complex mating systems and require areas for social display. In these 'lek' areas, many males display for the attention of unmated females. Leks are traditional and, although used for only a short period each year, can be crucial for successful breeding by social species such as capercaillie, black grouse and ruff (Johnsgard 1983). Leks in one area can be used also by birds (such as ruffs) still on migration to nesting areas further north. These leks are therefore of importance, not only to locally nesting birds, but also to the wider population (van Rhijn 1983).

The concept of the 'functional unit system' was described by Tamisier (1979, 1985) for ducks, although the concept has been developed further in respect of the conservation needs of other birds (Bignal *et al.* 1989; Wilson *et al.* in press). Functional unit systems attempt to describe systematically the differing ecological niches which different species of birds occupy. They are the summation of the often wide range of habitats and areas used by birds for different activities at different times. These are components of the needs for survival (e.g. Figure 2.3). Thus areas on the wintering grounds of ducks are used for communal preening or loafing – behaviour which serves an important social function (Tamisier 1985). The loss of these areas may be as important to the long-term suitability of habitat as the loss of feeding areas. Birds prefer areas where their survival chances are greatest. The loss of such favoured areas will depress their population (e.g. Goss-Custard & Moser 1988).

The identification of feeding and roosting areas is clearly important for wintering birds such as wildfowl and waders. These birds may require a wide range of feeding sites, particularly in estuaries, according to tidal state, disturbance, seasonality etc. Knowledge of such requirements and processes, and the use of different components by birds, allows delimitation of boundaries for SPAs which contain the range of areas necessary to fulfil ecological requirements. However, in addition to such information, detailed site-specific studies can also be of value in determining site use (e.g. Goss-Custard *et al.* 1977; Ferns 1977; Symonds & Langslow 1981, 1985; Symonds *et al.* 1984; Tasker & Milsom 1979; Moser 1984; Howarth & Bryant 1988; Kirby 1987; Kirby *et al.* 1988; Prys-Jones *et al.* 1989).

When considering site boundaries then, it is necessary to be aware of not only *how many* birds are present, but also of *how* and *why* they use an area. In this way ecologically sensible site boundaries can be drawn, and, where necessary, combinations of sites or sub-sites can be identifed. In some situations, it is necessary to provide protected sites for some features, and initiatives in the wider countryside for other features. However, it is obviously not possible to undertake detailed ecological studies on each individual site. Scientific investigation involves the derivation of information on general processes and principles from specific studies. This information can then be applied, within appropriate constraints, more widely to other sites.

In practical terms, because of NCC's severe resource constraints, and the fact that the majority of sites do not have detailed information on use by birds, the boundaries of SPAs follow those of their component SSSIs, where these have been designated on ornithological grounds (unless there is readily available information to indicate otherwise). The only exceptions are sites where component SSSIs clearly have major elements which, although of special interest for other features, do not contribute to the needs of birds. An example might be a composite coastal SSSI containing geological interest in one area and ornithological interest elsewhere.

2.4.3 Nocturnal use of sites

Some sites may be used during the night but only little during the day. Indeed, in some areas, ducks have night-time feeding areas which are distinct geographically and ecologically from the daytime localities (Tamisier 1979, 1985). Because data on bird use are more easily available from the daytime (unless specific studies have been undertaken), the importance of nocturnal sites may not be fully apparent (Jorde & Owen 1988). Examples such as roosts of geese can be assessed by counts of birds arriving at or leaving these areas. However, other situations may be less obvious.

Some estuaries are used at night for feeding by ducks such as teal and wigeon, as well as by waders. Information on this and other such situations may sometimes be collected by using counts of droppings to assess use. Such dropping counts have also been used to assess site usage over longer periods, especially by geese (e.g. Ebbinge *et al.* 1975).

At night, some diving ducks gather in large concentrations to feed. In Switzerland, a stretch of

river draining Lake Constance holds, in winter, up to 23,000 tufted ducks and pochard feeding at night. However daytime counts of the same stretch of river usually reveal only a few hundred birds, since the ducks spend the day on nearby Lake Constance (Frenzel & Kolb in press).

In some areas, such as the Firth of Forth, high-water roosts of waders differ in location between day and night. Day-time roosts probably minimise expensive flights (in terms of time and energy) whilst night-time roosts are probably safer from predators.

There is thus a need to ensure that data on the conservation importance of a site is not unintentionally biased by being collected at a time of day (or night) when the importance for birds is not fully apparent.

2.4.4 Colonies and productivity

Several species of birds nest in colonies or other high density gatherings. Such species include the highly colonial herons and egrets, most seabirds and some wildfowl. The ecology of such colonial nesting has been much studied and interpreted by theoretical biologists (e.g. Krebs 1974; Nelson 1978; Patterson 1965, 1982; Birkhead 1977, 1985; Ward & Zahavi 1973).

A variety of potential advantages may be gained from nesting at such high densities, including reduced predation (Patterson 1965; Birkhead 1977), more social stimulation and better information exchange (e.g. Ward & Zahavi 1973; Krebs 1974). Information exchange may be particularly important for seabirds which feed over wide areas on a patchily distributed food resource. The colony can potentially play an important role in the exchange of information about the ever-changing marine environment (Ward & Zahavi 1973).

For some species, strongly adapted to colonial nesting, productivity is greater in large or densely packed colonies compared with smaller ones. This has been shown for the gannet (Nelson 1978) at some North Sea colonies. In some studies of eider ducks, higher nesting success occurs in large, densely populated colonies compared with areas with lower-density nesting (Belopol'skii 1957 in Choate 1967).

However, a colonial life-style may also bring potential problems such as greater competition for nest sites, food and mates, and an increased risk of disease and parasites (both inter- and intra-specific). Several studies have shown that, for some species, small colonies or dispersed nests produce either more, or better quality, young than large colonies. Gaston (1985) showed that the fledgling weight (and thus probably eventual survival) of some auks was lower at large colonies than at smaller ones. This was probably due to greater competition for food close to large colonies, which meant that parents had to fly further only to catch fewer fish.

Some birds are adapted to breed more successfully at low densities but require to flock together at other seasons. Some of the population may also breed in the latter situation. Dispersed-nesting shelduck have a higher productivity and better duckling survival than colonially-nesting birds in the same general area (Makepeace & Patterson 1980; Pienkowski & Evans 1982).

Clearly it is important to protect large colonies, as very often they will contain a major proportion of a breeding population but, given the requirement of the Birds Directive to consider both productivity and range (see also section 2.5.1), conservation of colonies for some species must not occur at the expense of protection for possibly more productive, but more widely dispersed, breeding birds elsewhere (Fuller & Langslow 1986). The shelduck is a good example of this conservation need, where safeguard of winter and spring wetland flocking areas is important in order to maintain survival, and protection of lower-density nesting areas, in wetlands with adjacent terrestrial nesting habitats, is important to maintain productivity. The same species flocks even more strongly in late summer into a small number of moulting areas in shallow coastal water. This also provides a further example of habitat requirements on the wide (international) scale necessary to conserve a functional unit for this species.

Some birds occur at substantially similar nesting densities in different areas, although their breeding success and productivity may vary. In these cases, numbers of birds may not be the best criterion on which to assess conservation priorities. Such differential productivity has been recorded for golden eagles by Watson *et al.* (1987), who related breeding success to food supply. Eagle nesting density was closely correlated with amounts of carrion available in winter, and was highest in western Scotland. However, breeding performance was related instead to the amounts of 'living' prey available during the summer months and was greatest in eastern Scotland. Thus the factors (mainly dietary) determining nesting *density* are different from those determining eagle nesting *success*. Consequently, it is important to target conservation measures especially towards those areas with the highest total eagle productivity. This will maximise chances of long-term population viability.

Monitoring productivity can give advance warning of problems for bird populations before they start to decline in numbers. A population of long-lived birds can retain high numbers for many years even with poor reproductive success. However, without immigration (which may not be possible), the age-structure of this population will become skewed, with an increasing proportion of older birds. If poor breeding success continues it may be followed by a catastrophic decline as these older individuals reach the end of their natural lifespan. Such was the

case for the Puerto Rican parrot and the dusky seaside sparrow (now extinct) (Harris 1988). Monitoring of productivity, and targeting protection on those areas which sustain highly productive population segments, will allow early warning of such situations. This approach has been developed in NCC's Seabird Monitoring Programme and the NCC-contracted work at the British Trust for Ornithology on integrated monitoring for terrestrial birds (Pienkowski in press).

In conclusion, several types of information can be used to determine the importance of sites for birds. Count information allows assessment of the importance of an area in comparison to other areas. Additional information concerning relative productivity may allow such assessments to be further refined. Finally, information on the small-scale use of a site by birds allows consideration of the management and protection of specific features (such as lekking areas and communal roosts). Not all this information is available for all species, and it is important to incorporate further data as these become available. As ever, our assessments are made on the basis of the best available information. To wait for perfect information would be an abdication of responsibility leading to serious loss of populations and habitats (section 2.6.1).

2.4.5 Contextual information

There is obviously a need for contextual information to establish the importance of individual sites. Indeed, by definition, criteria such as that of using 1% of populations as an assessment level (section 2.5.3), rely on such information. Salyer (1945), in commenting on the need for refuges for waterfowl populations in North America, raised the requirement for contextual information to allow for the full interpretation of count data from sites: *"The preservation* [after the shooting season] *of residual brood stock necessary to populate the nesting grounds is far more important than is generally realised by gunners who have an opportunity to make observations on only isolated sections of the waterfowl habitat. Destruction of waterfowl resorts through industrial and other land-use developments results in the concentration of waterfowl on remaining areas, these giving to the local observers an impression of plenty".*

As well as studies closely focussed on individual sites, a broad awareness of population trends over national and international boundaries is required. Many NCC-supported research programmes supply contextual information used in this review, especially those listed in Table 2.2. These different monitoring schemes were designed to be closely related, both organisationally and conceptually. This allows the maximum use to be made of information collected, and allows NCC not only to monitor populations, but also potentially to set and assess targets related to specific conservation aims (Pienkowski in press).

Such schemes give a level of information which allows the importance of an individual site to be set within the context of national or international bird populations. As Salyer (1945) pointed out, the fact that there may be many birds on a site is not necessarily an indication that the species is common. Indeed, the opposite may be the case. Clearly the use of full survey data, wherever available, is valuable in establishing the conservation importance of a site.

An important example of contextual information for wintering wader populations is the estimation of numbers occurring on rocky shore habitats. Wintering waders on estuaries have been well surveyed in recent years. However, many of the waders occurring on estuaries are found also in significant numbers on other coastlines such as rocky shores and sandy beaches. A full survey of the British coast in January 1985 allowed the revision of national wader population totals to include this population element not counted every year (Moser 1987b). (Previously, numbers on non-

Table 2.2 Some monitoring schemes for British birds. Many of the BTO/NCC monitoring and survey schemes will be further integrated into the forthcoming NCC-funded integrated monitoring programme to be organised by the BTO (Pienkowski in press).

Seabirds

NCC (and others) Seabird Monitoring Programme;
NCC/Seabird Group Seabird Colony Register (Lloyd *et al.* in press);
RSPB Tern monitoring;
RSPB Beached birds surveys.

Breeding land birds

BTO[1]/NCC Common Bird Census;
BTO/IWC[2] breeding birds atlas (Sharrock 1976);
BTO/IWC/SOC[3]/NCC New breeding birds atlas;
BTO/NCC Waterways Birds Survey;
BTO/NCC Ringing Scheme (including constant effort ringing sites);
BTO/NCC Nest Records Scheme;
Raptor monitoring by various bodies and individuals;
NCC/RSPB[4]/Rare Breeding Birds Panel monitoring;
BTO/RSPB/WSG[5]/NCC survey of breeding waders of wet meadows (Smith 1983);
various single species surveys.

Wintering birds

BTO/IWC Winter Birds Atlas (Lack 1986);
BTO/NCC/RSPB Birds of Estuaries Enquiry (Prater 1981; Salmon *et al.* 1988);
NCC/Wildfowl and Wetlands Trust National Wildfowl Counts (Owen *et al.* 1986);
other NCC/Wildfowl and Wetlands Trust monitoring schemes;
NCC/GWGS[6] goose counts on Islay and elsewhere.

[1] British Trust for Ornithology
[2] Irish Wildbird Conservancy
[3] Scottish Ornithologists' Club
[4] Royal Society for the Protection of Birds
[5] Wader Study Group
[6] Greenland White-fronted Goose Study

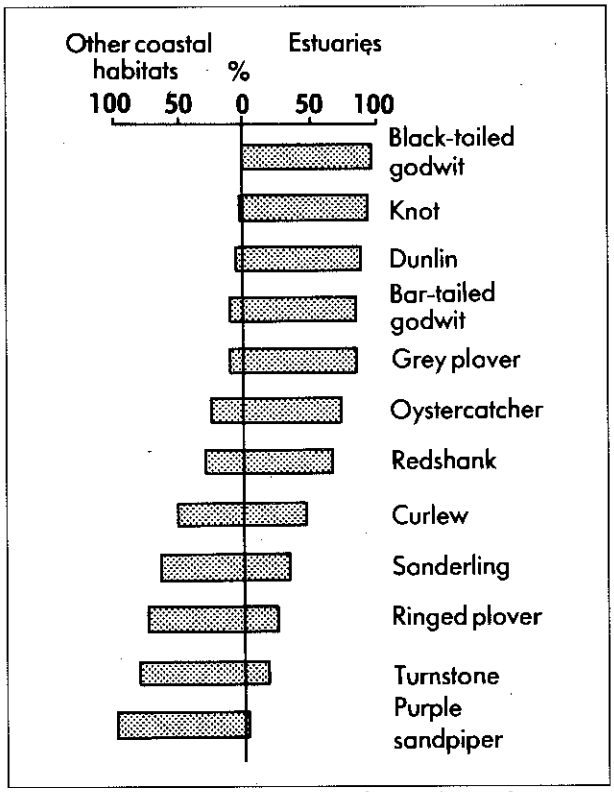


Figure 2.4 Relative importance of estuarine and non-estuarine shores for the principal species of waders wintering in Britain. Such species as the godwits and knot are almost restricted to estuaries, while the majority of turnstones and purple sandpipers frequent rocky shores (from Moser 1987).

estuarine shores could only be guessed on the basis of very limited data.) The results (Figure 2.4) demonstrated that although species such as knot and black-tailed godwit occur almost exclusively on estuaries, and those such as purple sandpipers occur almost exclusively on rocky shores, other waders are found in significant proportions on both types of coast. For these species, it is important to have information on both estuarine and rocky shore numbers to be able to place counted sites in their proper context.

Given the wide geographic range of many migratory bird populations, evaluations are required at a Great Britain, or more usually, an international level. Many sources have been of value in this exercise.

The Wader Study Group's compilation of information on population sizes of European breeding waders (Piersma 1986, published with the support of NCC and the Netherlands conservation authorities), and other national compilations encouraged by the Wader Study Group (Dominguez *et al.* 1987; Hromadkova 1987; Bartovsky *et al.* 1987; Tinarelli & Baccetti 1989; Nankinov 1989) have demonstrated the international importance of Britain as a breeding ground for temperate wader populations. Review of populations of wintering waders has also shown Britain's key importance within the East Atlantic flyway (Smit & Piersma 1989). The International Waterfowl and Wetlands Research Bureau organises an annual international waterfowl census which provides valuable information on European-wide trends and numbers (Rüger *et al.* 1986; Pirot *et al.* 1989).

This wide information exchange illustrates the necessity to avoid a parochial or nationalistic approach to conservation. At a time when effective conservation requires coordinated international action, it is especially important to maintain and extend existing international scientific links. Indeed, the ability to be able to review and interpret information at a Great Britain and international scale is essential for the proper assessment of sites.

2.4.6 Conservation of seabirds in marine areas

The Birds Directive applies to the whole territory of Member States, including sea areas, but currently in Britain SSSIs can be designated normally only above the level of low tides. Thus, the situation has arisen in Britain that there is no domestic legislative mechanism, with the exception of Marine Nature Reserves (which are designed primarily to conserve the sub-littoral interest of areas, and also involve very great bureaucratic effort), to protect areas of international conservation importance for seabirds[1] (including those listed on Annex 1). Since the passing of the 1981 Wildlife and Countryside Act, only one MNR (Lundy) has been designated. Despite this problem, the recently declared Wash SPA does include substantial areas beyond the low-water mark.

The current inability to protect, as SPAs, marine areas of importance for seabirds means that only nesting colonies are safeguarded. Some of the problems that this entails in conservation management are demonstrated in near-shore areas used by seaducks. One of the greatest threats to large numbers of eiders comes from oil pollution on their moulting grounds (where they gather following the breeding season) or on their wintering grounds. An oil spill or other incident in these areas could effectively negate all the protection provided during the limited part of the year that comprises the breeding season. Likewise over-fishing of stocks of fish used by seabirds, or of dredging for scallops and mussels in certain areas, could also have major impacts.

A review of marine areas important for seabirds, under the terms of the Birds Directive, is currently being undertaken at the request of Government (see Prime Minister, Hansard: 19 June 1989) by NCC's Ornithology Branch, based on information gathered by its Seabirds at Sea Team (Tasker *et al.* in prep.). This is not considered in detail here, except to note Government's obligation to protect such areas even though currently this appears not to be possible by means of the SSSI mechanism.

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[1] As well as birds associated with the sea throughout the year, seabirds in this context include groups such as divers, grebes, seaducks etc. whose use of marine areas may occur only at certain times of year.

2.4.7 Hydrological integrity of sites

Section 2.4.2 above considered the need to protect the whole of the area required by birds for survival and reproduction. This is usually significantly larger than the restricted nesting or roosting areas. In determining site boundaries for wetlands, hydrological integrity also requires consideration. Areas such as fens are affected by water input from other areas. Peatlands such as raised and blanket bogs can be damaged by the effects of water-table drawdown following drainage or ditching (see Lindsay *et al.* 1988 for full details).

Some peatland birds such as breeding waterfowl or dunlin occur especially in the very wettest areas close to bog pool complexes. However, protection of these areas alone could prove ineffective since such pools are hydrologically associated or linked with the wider mire expanse. In most such cases on blanket bogs, site boundary determination will need to be linked to mire macrotopes (Lindsay *et al.* 1988) wherever possible. Where this is not possible owing to historical land-use, then the site will need to be as hydrologically sustainable as possible. In these cases, positive conservation management (such as ditch blocking to raise water-tables) will usually also be desirable.

Some wetland sites may also be affected by undesirable influences from other areas, not in the quantity, but rather in the quality, of water received. This is the case for some fen systems receiving nutrient-rich ground water from surrounding agricultural areas. This can result in serious eutrophication. Likewise coniferous afforestation in areas with soils of low buffering capacity can seriously exacerbate effects of acid precipitation with consequences for bird populations (Stoner *et al.* 1984; Stoner & Gee 1985; Eriksson 1987; Ormerod & Tyler 1987; Stroud *et al.* 1987). Such situations may require protection of surrounding areas in order to sustain habitat suitability for some birds.

Some of the hydrological influences on wetlands, such as riverine and estuarine systems, originate from far outwith the site. In these instances, site protection may not be the best solution to the problems. Where such changes may potentially influence a wetland or other area, a full Environmental Impact Assessment is required at an early stage. This will need to address not only immediate effects of development, but also consequential effects on other sites, possibly far removed from a development.

2.4.8 Assemblages

Where a number of species require similar habitat conditions they frequently occur together in the same area. Not only do they interact amongst themselves, but the bird community itself can form food for predatory birds. Reduction in numbers of one species can directly affect others through a variety of complex behavioural and ecological links (e.g. Dyrcz & Witowski 1987; Thompson & Thompson 1985). Such assemblages or communities are of particular scientific and conservation importance and are significant features of a site's interest where they occur. The conservation of plant and animal assemblages as distinct from, and in addition to, individual species or their habitats is explicitly written into legislation in certain countries[1], and is implicit in the Birds Directive and related Council Resolution.

Some examples of important bird assemblages in Britain are given here.

Moorlands sometimes hold important assemblages of breeding waders, which can include golden plover, dunlin, greenshank, whimbrel, curlew and a number of other waders. Often merlins, hen harriers and other birds of prey occur, as well as several waterfowl (including divers, teal, wigeon and other ducks). Such moorland bird communities are described for blanket bogs in section A.5.13. More specific details of moorland breeding birds in the Flow Country have been given elsewhere (Stroud *et al.* 1987; Fox *et al.* 1989a).

Lowland grasslands and machair areas may hold assemblages of breeding waders, with snipe, redshank, curlew and lapwing occurring. More locally, and especially on machair areas, dunlin and ringed plover breed. In some areas, ruff and black-tailed godwit also occur, together with ducks such as shoveler. These areas are described further in sections A.5.6 and A.5.7.

Although some seabirds nest in colonies dominated by a single species, others occur together in spectacular and diverse 'seabird cities'. In particular, guillemots, razorbills and kittiwakes often occur together as described in section A.5.4.

Estuaries and other coastal areas frequently hold important assemblages of waterfowl in winter. Many species occur together over a whole estuary and often roost together in mixed groups. However, most species have particular feeding requirements and occur in different parts of estuarine complexes at different times. Waders occurring together can include knot, grey plover, ringed plover, curlew, dunlin, sanderling, black-tailed godwit, bar-tailed godwit, oystercatcher, greenshank and redshank. Such coastal wader communities in turn support wintering raptors such as hen harriers, peregrines, sparrowhawks, short-eared owls and merlins (Whitfield 1985). These areas can also hold mixed flocks of wintering wildfowl such as brent geese, wigeon, pintail, mallard, shelduck, pochard and others.

The occurrence of such assemblages has a beneficial practical consequence in the attempt to provide an adequate suite of SPAs. Because several

[1] e.g. the Flora and Fauna Guarantee Act 1988 of the State of Victoria, Australia. See section 2.2.1.

species occur together, each site is likely to contribute to the overall level of protection of many species. The development of the suite of proposed SPAs has taken this into account (see section 2.6).

2.4.9 Migratory staging areas

Staging areas play a crucial role in the life of migratory birds.

Some birds need not only need to store 'fuel' for their long migrations, but also, in spring, to carry body reserves of fat and protein. These will be used for egg production and to sustain the incubating bird during a period of low-food availability on arctic breeding grounds (Ankney & MacInnes 1978; Raveling 1979; Ankney 1984; Murphy & Boag 1989; Davidson & Evans 1989). On their arrival in the arctic adequate body reserves are also required to survive periods of extremely hostile arctic weather (Davidson & Evans 1986; Davidson & Morrison 1989). Such birds have therefore evolved traditional migration routes where they can stop to 're-fuel' at various points along the route. These 'staging areas' can be additionally important as areas where large flocks come together for social needs such as pairing.

The importance of staging areas have been especially investigated for migrant wildfowl and waders. Eco-physiological studies of North American geese have shown that the food obtained from spring staging areas is important in determining the size of the clutch laid by female geese on their arrival in the arctic (Ankney & MacInnes 1978; Wypkema & Ankney 1979; Thomas & Prevett 1982; Thomas 1983; Ankney 1984). In Europe, studies of brent geese have also demonstrated the importance of spring feeding on staging areas in the Waddensee for subsequent reproductive success (Ebbinge *et al.* 1982; Prokosch 1984). Geese which fail to reach a certain weight after feeding on spring staging areas have a high probability of failing to return with young the following year. This may be either because fewer eggs are laid, or because the female goose needs to leave the nest more often during incubation, hence exposing the nest to a higher probability of predation by arctic foxes and other predators (c.f. Thompson & Raveling 1987). A feature of the use of spring staging areas by brent geese (and other species) is their high fidelity to particular areas. Flocks of brent geese are not random groups, but are highly structured socially. The loss of traditional staging areas used by these flocks would have profound effects for the population (Prokosch 1984).

During spring staging, migratory species frequently show dietary shifts, selecting food items which at other times are of lesser importance (e.g. Leito & Renno 1983; Leito *et al.* 1986). Selection for important food items relates to the physiological need to lay-down reserves for migration and reproduction (section 2.4.2). However, spring accumulation of fat can differ according to the habitats available within a staging area. In the Gulf of St. Lawrence, Gauthier *et al.* (1984) showed that greater snow geese feeding in traditionally-occupied, freshwater *Scirpus*-dominated marshes gained fat significantly faster than birds feeding in saltwater marshes, newly invaded by *Spartina*. Subtle changes in habitat availability within a staging area can thus have significant effects on the process of spring fat and protein accumulation.

Waders also have long migration routes. Not all have the same migration strategy, and some species may need to stop and re-fuel more often during migration. Additionally, the sequence of staging areas along a route may vary from year-to-year according to such factors as wind-speed and weather (Piersma 1988). Their energetic and other requirements in spring have been subject to intensive research (e.g. Kersten & Piersma 1983; Pienkowski & Evans 1984; Davidson & Evans 1986, 1988; Piersma *et al.* 1987; Prokosch 1988; Davidson & Wilson in press) which has confirmed the key role that staging areas play in the conservation of wader populations.

The conservation of staging areas is of the utmost importance for populations of migrants, even if they may only be used by birds for short periods each year. Arctic breeding birds have a very short potential breeding period, and nesting is critically timed (Green *et al.* 1977; Meltofte 1985). Failure to arrive on the nesting grounds in suitable condition, or at the right time, may mean not only that breeding may not be possible, but also that death may ensue. Thus, timing of migration by arctic birds reflects their need to arrive with adequate reserves at a precisely determined time in spring. Their use of staging areas reflects these needs (e.g. Davidson & Wilson in press).

The high biological productivity of staging areas and generally low disturbance experienced by birds feeding there, enable migrants to gain weight very rapidly (Kersten & Piersma 1983). The use of re-fuelling stops *en route* to the arctic is thus critically timed so that birds arrive in optimum condition. Although perhaps used for very short periods, these 'pit-stops' are essential to the breeding strategy of these migrants.

Autumn staging areas also serve important functions. Substantially the whole world population of Greenland barnacle geese arrive at Loch Gruinart on Islay for a period in October (Easterbee *et al.* 1987). After some weeks feeding here, geese disperse elsewhere throughout their wintering range in the west of Scotland and Ireland. Other species also have autumn staging or gathering areas.

2.5 Criteria for assessing importance: general concepts

2.5.1 Ramsar Convention criteria for identifying sites of international importance

Several of the conferences of Contracting Parties, including the most recent at Regina, have considered guidance upon the criteria for selection of sites of international importance (Carp 1972; Smart 1976; Spagnesi 1982; Ramsar Convention Bureau 1984, 1988). The basic themes running through the criteria have remained fairly constant since an early date. However, modifications have been made, particularly those relating to general wetland types. This is because more information has become available on the assessment of sites on criteria other than those for birds (NCC 1988).

The criteria, as revised and agreed at Regina, are given in Appendix 4. The Regina meeting set up a Working Group of the Contracting Parties which has revised the criteria. The draft revised criteria are to be presented with a view to formal adoption, to the next full meeting of Contracting Parties in Montreux in June 1990, and are given below.

A wetland is identified as being of international importance if it meets at least one of the criteria set out below:

Criteria for representative or unique wetlands.

A wetland should be considered internationally important if:

a) *it is a particularly good representative example of a natural or near-natural wetland characteristic of the appropriate biogeographical region; or*

b) *it is a particularly good representative example of a natural or near-natural wetland, common to more than one biogeographical region; or*

c) *it is a particularly good representative example of a wetland, which plays a substantial hydrological, biological or ecological role in the natural functioning of a major river basin or coastal system, especially where it is located in a trans-border position; or*

d) *it is an example of a specific type of wetland, rare or unusual in the appropriate biogeographical region.*

General criteria based on plants or animals

A wetland should be considered internationally important if -

a) *it supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal, or an appreciable number of individuals of any one or more of these species; or*

b) *it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna; or*

c) *it is of special value as the habitat of plants or animals at a critical stage of their biological cycle; or*

d) *it is of special value for one or more endemic plant or animal species or communities.*

3. Specific criteria for using waterfowl to identify wetlands of importance

A wetland should be considered internationally important if -

a) *it regularly supports 20,000 waterfowl; or*

b) *it regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity; or*

c) *where data on populations are available, it regularly supports 1% of the individuals in a population of one species or subspecies of waterfowl.*

Guidelines

To assist Contracting Parties in assessing the suitability of wetlands for inclusion on the List of Wetlands of International Importance, the Conference of the Contracting Parties has

formulated the following guidelines for application of the Criteria:

a) *A wetland could be considered of international importance under Criterion 1 if, because of its outstanding role in natural biological, ecological or hydrological systems, it is of substantial value in supporting human communities dependent on the wetland. In this context, such support would include:*

- *provision of food, fibre or fuel;*
- *or maintenance of cultural values;*
- *or support of food chains, water quality, flood control, or climatic stability.*

The support, in all its aspects, should remain within the framework of sustainable use and habitat conservation, and should not change the ecological character of the wetland.

or

b) *A wetland could be considered of international importance under Criteria 1, 2 or 3 if it conforms to additional guidelines developed at regional or national level. Elaboration of such regional or national guidelines may be especially appropriate*

- *where particular groups of animals or plants (other than waterfowl) are considered more suitable as a basis for evaluation;*

- *or where waterfowl and other animals do not occur in large concentrations (particularly in northern latitudes);*

- *or where collection of data is difficult (particularly in very large countries).*

or

c) *The "particular groups of waterfowl, indicative of wetland values, productivity or diversity" in Criterion 3b include any of the following:*

- *loons or divers: Gaviidae*
- *grebes: Podicipedidae*
- *herons and bitterns: Ardeidae*
- *storks: Ciconiidae*
- *swans, geese and ducks (wildfowl): Anatidae*
- *shorebirds or waders: Charadrii*
- *terns: Sternidae*

or

d) *The specific criteria based on waterfowl numbers will apply to wetlands of varying size in different Contracting Parties. While it is impossible to give precise guidance on the area in which these numbers may occur, wetlands identified as being of international importance under Criterion 3 should form an ecological unit, and may thus be made up of a group of smaller wetlands. Consideration may also be given to turnover of waterfowl at migration periods, so that a cumulative total is reached, if such data are available.*

Regina criteria 1 and 2 (Appendix 4) relate to the whole range of wetland types and species. The application of these criteria has been considered both internationally and nationally. To date, NCC has proposed few sites for designation under the wetland criteria 1 and 2 while these deliberations are continuing, except for sites of outstanding importance which self-evidently qualify, such as the peatlands of Caithness and Sutherland (Stroud *et al.* 1987: pp. 92-93). However, the revised criteria and guidelines given above clarify the situation further.

The criteria relating solely to birds are now grouped under criterion 3 as these criteria have been renumbered since earlier versions. As with other criteria, it is important to note that the guidance given by these criteria needs to be sufficently broad so as to allow application throughout the world, whatever the level of information available. In most countries such population information is very limited. Other information is even more limited.

Criterion 3a indicates that a wetland should be considered internationally important if it regularly supports 20,000 waterfowl. This is a simplification of earlier criteria which used separate figures for different groups of waterfowl (waders and wildfowl).

Criterion 3b, as amended at Regina, shows an interesting move to a less quantified criterion. This provides some allowance for the features which may be lost if one deals simply in numerical thresholds. For example, it is well established that for certain species of waterfowl, areas of lower nesting density are more productive, in terms of breeding output, than are higher concentrations (see section 2.4).

Criterion 3c indicates that a wetland should be considered internationally important if it regularly supports 1% of the individuals in a biogeographical population of one species or sub-species of waterfowl. The current qualifying 1% levels are given in Table 2.3.

2.5.2 Biogeographical populations

A biogeographical population is normally defined as a more or less discrete group of birds which live in a particular area (or group of areas in the case of a migratory population), interbreed freely within the group and rarely breed or exchange individuals with other groups (Mayr 1970). Several goose species provide good examples of distinct biogeographical populations.

There are three populations of barnacle goose with hardly any exchange between them at any season (Boyd 1961; Ebbinge 1982; Owen *et al.* 1986: section A.6.2.11). Barnacle geese breeding in east Greenland over-winter in western Scotland and Ireland; those from Svalbard winter on the Solway Firth; and those from western Siberia winter in western mainland Europe (Figure 2.5). There are also two discrete populations of pink-footed geese. One nests in Iceland and Greenland (Kerbes *et al.* 1971) and winters in Scotland and England. The other nests in Svalbard and winters principally in

Denmark and some of the Low Countries (Norderhaug 1971; Madsen 1984b; Figure 2.6). In both these examples, the populations are of single species which are morphologically similar, albeit remaining separate throughout their range and throughout the year.

In other cases, particularly where slight physical differences have developed between populations, a species may be divided into one or more sub-species. Such is the case for white-fronted geese *Anser albifrons*, two populations (and sub-species) of which over-winter in the British Isles. The Greenland white-fronted goose *Anser albifrons flavirostris* breeds in west Greenland and winters in the western and northern British Isles, whilst the European white-fronted goose *Anser albifrons albifrons* breeds in Siberia and winters in southern England and Europe. In this case, the sub-species of Greenland white-front consists of a single population (Salomonsen 1967; Kampp *et al.* 1988), whilst the sub-species of European white-front consists of five discrete populations. These winter in north-western, central and eastern Europe (Timmerman *et al.* 1976; Ogilvie 1978; Figure 2.7).

Table 2.3 Qualifying 1% population levels (individual birds) for national and international importance for non-breeding populations of wildfowl and waders.

Species and/or population	National (GB)	International
Great-crested grebe	100	?
Mute swan	180	1,800
Bewick's swan	70	170
Whooper swan	60	170
Bean goose	+ *	800
Pink-footed goose:		
Iceland/Greenland population	1,100	1,100
European white-fronted goose	60	3,000
Greenland white-fronted goose	100	220
Greylag goose: Iceland population	1,000	1,000
Barnacle goose: Greenland population	200	300
Svalbard population	100	100
Dark-bellied brent goose	900	1,700
Light-bellied brent goose		
Canada/Greenland population	+ *	200
Svalbard population	30 *	40
Shelduck	750	2,500
Wigeon	2,500	7,500
Gadwall	50	120
Teal	1,000	4,000
Mallard	5,000	20,000 **
Pintail	250	700
Shoveler	90	400
Pochard	500	3,500
Tufted duck	600	7,500
Scaup	40 *	1,500
Eider	700	20,000 **
Long-tailed duck	200	20,000
Common scoter	350	8,000 **
Velvet scoter	30 *	2,500
Goldeneye	150	3,000
Smew	+ *	150
Red-breasted merganser	100	1,000
Goosander	50	1,250
Coot	1,000	15,000
Oystercatcher	2,800	9,000
Avocet	5 *	700
Ringed plover	230	500
Golden plover	2,000	10,000
Grey plover	210	1,500
Lapwing	10,000	20,000 **
Knot *C.c. islandica*	2,200	3,500
Sanderling	140	1,000
Purple sandpiper	160	500
Dunlin	4,300	
C.a. arctica		150
C.a. schinzii (Icelandic)		8,000
C.a. schinzii (temperate)		200
C.a. alpina		14,000
Ruff	15 *	10,000
Snipe	?	10,000
Black-tailed godwit	50	700
Bar-tailed godwit	610	1,000
Whimbrel	50+	700
Curlew	910	3,500
Spotted redshank	2 *	500
Redshank	750	1,500
Greenshank	4 *	500
Turnstone	450	700

\+ *British population too small for meaningful figure to be obtained.*

* *Where 1% of the British wintering population is less than 50 birds, 50 is normally used as a minimum qualifying level for national importance.*

** *A site regularly holding more than 20,000 waterfowl qualifies as internationally important by virtue of absolute numbers.*

? *Data not available.*

Sources of criteria for international importance: Smit & Piersma (1989); Pirot *et al.* (1989). Sources of criteria for national importance: wildfowl – Owen *et al.* (1986); waders – Prater (1981) as revised by Moser (1987).

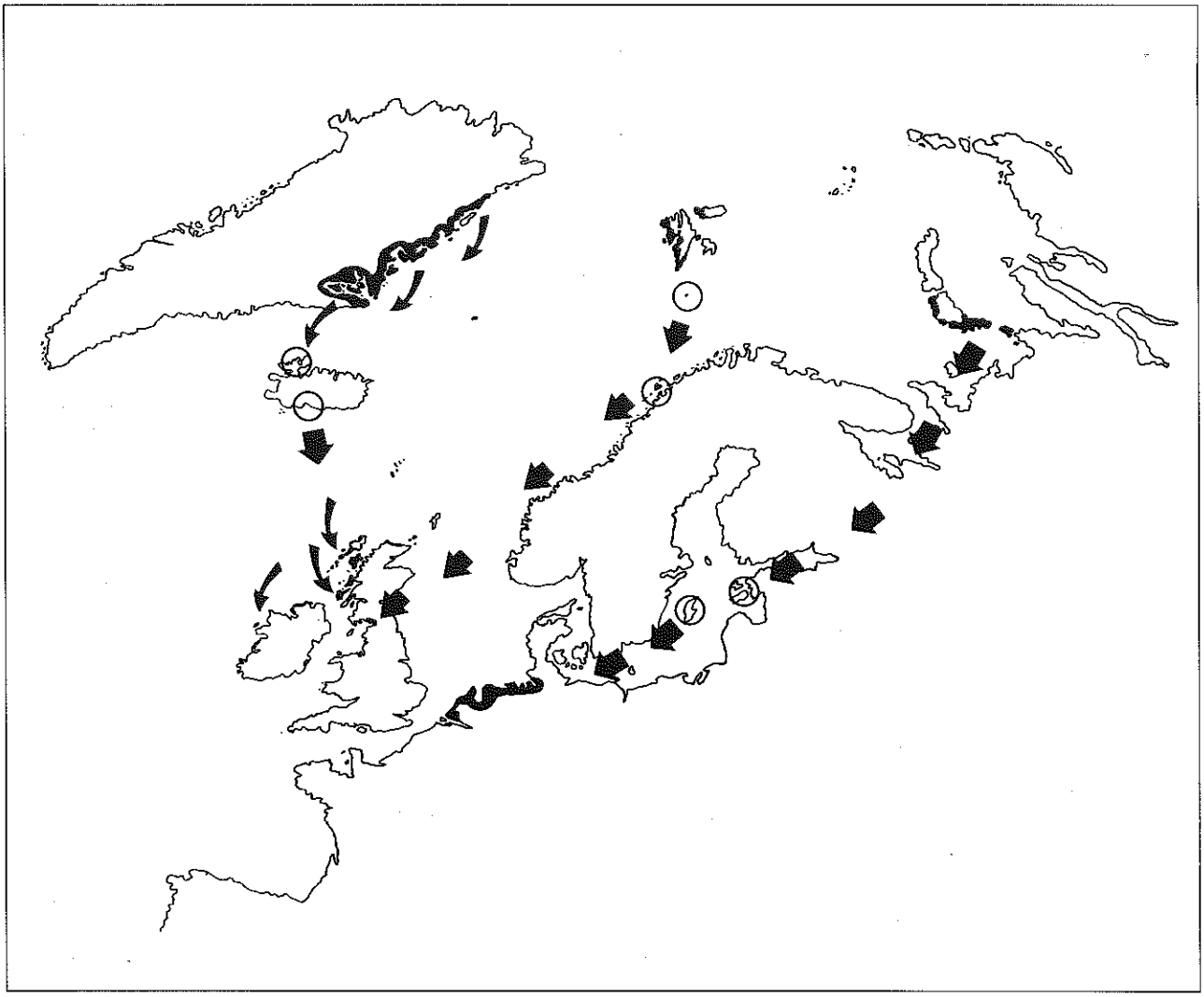

Figure 2.5 One species: three populations.
The three separate biogeographical populations of barnacle geese, showing breeding and wintering ranges (in black) with migration routes and staging areas (circled) (from Owen 1980).

Three other sub-species occur in North America (Table 2.4).

The reason for treating each biogeographic population separately for conservation planning is that these populations will contend with different conditions in the various parts of their range. Consequently, there may also be differences in productivity or mortality between populations. This may make the uniform application of certain conservation or other policies (e.g. hunting regulations) inapplicable at the level of species. Thus, the Greenland sub-species of white-fronted geese has a consistently lower productivity compared with either the European (Siberian breeding) *Anser albifrons albifrons* or American sub-species (*A. a. frontalis*, *A. a. elgasi* or *A. a. gambelli*) (Table 2.4). Hence the population of Greenland white-fronted geese is far less able to recover from periods of severe conditions, whether natural or human-induced (Kampp *et al.* 1988).

Similarly, population characteristics of the Greenland, Svalbard and Siberian populations of barnacle geese are quite different: *"it is clear that the three separate populations of barnacle geese have different strategies of recruitment to suit different circumstances in the wintering and breeding areas"* (Cabot & West 1983).

Populations of waders also have different survival rates. For example, two populations of wintering knot studied by Harrington *et al.* (1988) were not morphologically distinct. Ringing showed there to be no interchange between the two groups, and yet the survival rate of one population was twice that of the other.

Where the range of a species is continuous and there is no obvious separation between groups, the discrete groups described above do not occur. In these species the approach, as approved by intergovernmental meetings, has been to take the number of birds in western Europe as the population for British purposes (where such data are available). Two such species are wigeon and pochard. In subsequent studies, this has been found to be biologically sensible in view of the conditions to which the birds are exposed in comparison with other population sections.

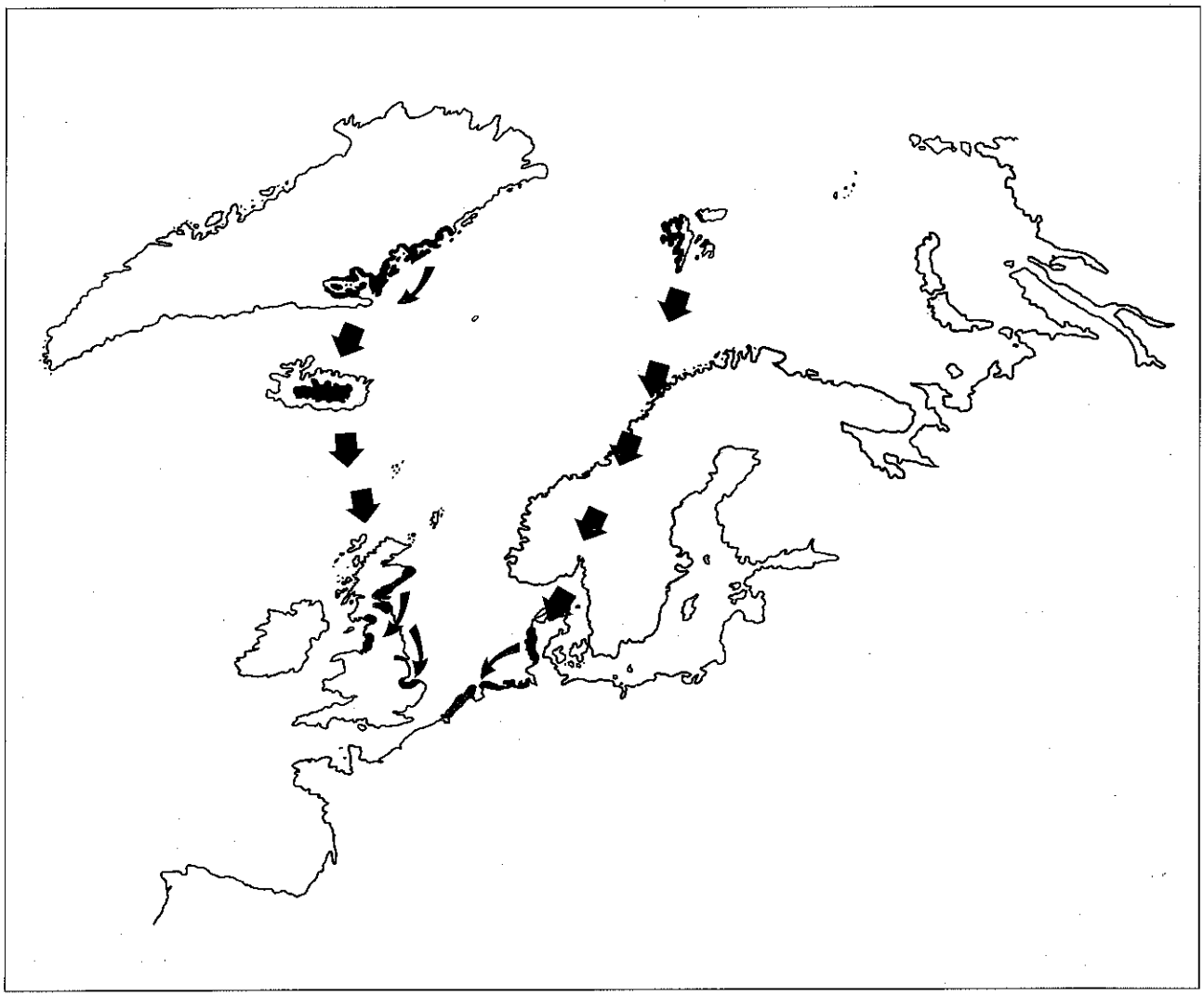

Figure 2.6 One species: two populations.
The two separate biogeographical populations of pink-footed geese, showing breeding and wintering grounds (in black) with migration routes (from Owen 1980).

2.5.3 The 1% criterion

There is no fundamental biological reason to take 1% of a population as the threshold level for establishing international importance of a site. However, this percentage has been found by long experience and evaluation to be useful in giving an appropriate degree of protection to populations, and in the definition of ecologically sensible sites (Szijj 1972; Atkinson-Willes 1976). The criterion has, therefore, gained wide acceptance throughout the world, as well as by the Contracting Parties of the Ramsar Convention (Atkinson-Willes *et al.* 1982). Because of this, the 1% level of national species totals has also been taken as the basis of the assessment of national importance in various countries, including Britain.

This proportional measure is self-adjusting to rarity, which is clearly a necessity for such a method of evaluation. Thus, the scarcer a population, the greater the number of sites occupied by it which should be protected. This increased proportion of sites will be generated using the 1% level.

This measure works only for those populations which tend to concentrate. This is also a desirable feature because those which concentrate will, by definition, be dependent on a relatively small proportion of the total territory and therefore be vulnerable to changes only on that small proportion. However, they will tend to be those with specialised ecological requirements which will usually be met only at a few traditional locations. Examples would include species such as whooper swans, brent geese and avocets (Atkinson-Willes 1982).

For both the national and international assessments the 1% level is fairly conservative. This can be illustrated by applying it to the human species. Human populations are an extreme example of a numerous species which forms dense concentrations, so the assessment is appropriate for use in this context. The British population is approximately 56,000,000 people; therefore 1% is about 560,000. On this basis the only cities in Britain which would qualify as 'nationally important' would be London, Birmingham, Sheffield, Manchester and Liverpool. Glasgow could be included if its adjacent towns such as Paisley were grouped with it. Clearly a policy of conservation for historic

Figure 2.7 One species: two sub-species: five populations.
The breeding and wintering grounds of Western Palearctic white-fronted geese (from Owen 1980).
The sub-species of Greenland white-fronted goose consists of one population. The sub-species of European white-fronted goose consists of four European populations (separated by dotted lines). Other sub-species and populations also occur in North America (from Owen 1980).

Table 2.4 Differing productivity of sub-species and population segments of white- fronted geese *Anser albifrons* as expressed by the mean proportion of young and the mean brood size in autumn flocks.

Sub-species	Breeding area productivity	Mean size	Mean brood	Source
A. a. flavirostris	W. Greenland	14.5% [1]	2.7	Kampp *et al.* 1988
		16.4% [2]	3.6	Kampp *et al.* 1988
A. a. albifrons	Siberia	34 %	2.6	Ogilvie 1978
A. a. frontalis	Alaska	36.1%	2.1	Timm & Dau 1979
A. a. gambelli	Canada/ Alaska	37.5%	2.5	Ogilvie 1978
A. a. elgasi	S. Alaska	30-37%	–	Timm *et al.* 1982

[1] wintering on Islay, Scotland
[2] wintering at the Wexford Slobs, Ireland

buildings (habitats for the human population) based on this criterion would be excessively conservative and probably liable to cause irritation to all the Welsh, most Scots and a considerable proportion of the English, including those from the south-west, north-east and East Anglia! If one used the definition of 'international importance', only London would qualify.

A potential problem with the use of the 1% criterion is that it depends on the availability of good estimates of total population size, whether for biogeographical populations or for national totals. For most parts of the world, detailed data on the status of bird populations do not exist or are extremely incomplete (Parish *et al.* 1987; Summers *et al.* 1987).

In Britain however, the various population monitoring schemes such as the WWT/NCC National Wildfowl Counts and the BTO/NCC/RSPB Birds of Estuaries Enquiry provide a means of obtaining and updating such information. Likewise there is good information on breeding seabirds available from the NCC/Seabird Group's Seabird Colony Register. The totals for the eastern Atlantic wader populations have recently been updated using data from such schemes throughout Europe (Smit & Piersma 1989). The current and recently revised 1% levels for populations of wintering wildfowl and waders are given in Table 2.3.

It is essential to note that the 1% level is ***not*** a level to which sites may be reduced while still fulfilling international obligations. This rather odd view has gained some currency in proposals for development. The view is clearly wrong. If sites holding greater than 1% of a population of birds were to be reduced to "1%", then the total population would decline. This would lead to progressive lowering of the 1% level until population extinction occurs. Such an approach would clearly be nonsense.

2.5.4 Regularity of use

The Conference of Contracting Parties to the Ramsar Convention has also defined the term "regularly" as used in the criteria. A wetland regularly supports a population of a given size if:

a. the requisite number of birds is known to have occurred in at least three quarters of the seasons for which adequate data are available, the total number of seasons being not less than three; or

b. the mean of the seasonal maxima, taken over at least five years, amounts to the required level (means based on three or four years may be quoted in provisional assessments only).

Such requirements indicate the need for long-term monitoring of national populations and site-use by birds. Indeed, such monitoring is a requirement under Article 10 of the Birds Directive.

However, in establishing long-term 'use' of a site by birds, there needs to be a full awareness of the ecological needs of the populations protected at that site. Thus in some of the examples given previously in this section (e.g. cold weather movements), the arithmetical average number of birds using a site over several years may not adequately reflect the importance of the site. In these instances, a site may be of crucial importance at certain times ('ecological bottlenecks'), but hold lesser numbers at other times. Thus, as always, there is a need for interpretion of data by qualified conservation scientists in order to ensure that the importance of sites is fully assessed.

2.5.5 Preference ranking

When a population is increasing, it is possible to infer preference for particular sites from the choices birds make between sites. Thus, at small population sizes, birds use first, those sites which most fully provide for their requirements. As numbers increase, however, birds are obliged to use increasingly less favoured sites. However, the proportion of birds on most preferred sites declines as the overall population increase.

Moser (1988b) has proposed a possible refinement of the 1% criterion to include ranking sites on their

preferedness by species, where such data exist. Such refinement is possible where information is available in addition to the numbers using a site.

The numbers and range of sites used by grey plovers which winter on British estuaries has increased in recent years. However, Moser showed that there seems to be a limit to the numbers that can use any one site. Thus at many preferred sites, where numbers have already reached carrying capacity, numbers are no longer increasing. However, as a consequence of the continuing national increase in numbers, such highly preferred sites apparently decline in *relative* importance with respect to an arbitrary percentage threshold. (It is important to note here that whilst such data are adequate to show that a proportion of sites are filled to capacity, it is not possible to analyse individual sites to predict what numbers they could hold under certain, different, circumstances).

Moser (1988b) pointed out that *"an estuary such as the NW Solent, one of the most preferred sites for grey plover in Britain, would, on present trends, cease to be 'nationally important'* [on the arbitrary definition] *if the national population level rose to 30,000, although it probably held 5% of the national population when there were only 5,000 grey plovers wintering in Britain"*. Factors such as site quality and preferedness are important and, when known, require consideration in determining the selection of sites that will best sustain population productivity and range. This has been undertaken for the present selection of SPAs.
However, even less preferred sites, or those that are not regularly used when populations are low can be of importance. If arctic breeding birds are not closely regulated on their breeding grounds (as is very likely for many species) then there is a need to be able to support populations at high levels, so that there will still be adequate populations after a sequence of poor breeding years.

2.6 Criteria for selection of potential SPAs

The Birds Directive does not state specifically how Special Protection Areas are to be selected. Rather, it adopts a practical approach linked to achieving particular conservation objectives. Different Member States have adopted different policies for the identification and designation of Special Protection Areas, as is evident both from the markedly different total areas designated to date and the different average size of designated sites (Table 1.1). Indeed, Denmark does not consider that its achievement of more than 22% of their area protected as SPA is complete, and active measures are currently being undertaken to evaluate further areas (H. Meltofte pers. comm.). Sizes (projected to horizontal planes) of individual sites range from 0.12 ha in Germany (or approximately 0 ha for two vertical cliffs in Ireland), to 214,300 ha in Spain.

The question of site selection has been considered recently by ICBP who have identified 'important bird areas' throughout Europe (Grimmett & Jones 1989). They used a variety of standard criteria for site selection, formalising those used by NCC and other national conservation bodies. These are based on both absolute and relative proportions of bird populations on sites (in both European and world contexts) (see Appendix 7).
Selection criteria have also been considered for SPAs at the request of the European Commission by a group at ICBP[1]. They considered that the following objectives would need to be met for the successful application of any criteria to meet the requirements of Article 4:

"a) That it ensures the survival and reproduction of Annex 1 species in their area of distribution.

b) That it ensures the survival of the breeding, moulting and wintering areas, and staging posts of regularly occurring migratory species not listed in Annex 1 and particularly the protection of wetlands of international importance.

c) That the areas within the network form a coherent whole which meets the protection requirements of these species.
d) That the areas selected were identified because of their Community importance for the species concerned and excluded sites of lesser (national or regional) importance."

In keeping with the Directive, the EC's Technical Group laid emphasis on the end target, with the identification of individual sites contributing a secondary question supporting this. One can essentially restate the challenge in two questions:

1. What target level of overall protection is required to provide a basis for maintenance for the survival and reproduction of each species' population throughout its area of distribution?

2. Which sites should be selected to provide for this level of protection for the whole suite of species' in so far as site-safeguard mechanisms are appropriate?

We shall return to these questions later, after considering some of the guidance available in the Birds Directive and elsewhere.

Clearly, many sites are so obviously important as to select themselves, but these alone will not be enough to fulfil the requirement of the Directive. The EC Working Group, not surprisingly, came to the conclusion that there was no single or easy-to-apply criterion which could be used to classify the

[1] Draft discussion paper of 14 October 1988 for the Working Group under the Committee for the Adaptation to Technical and Scientific Progress of the Council Directive of 2 April 1979 (EC/79/409).

vast diversity of habitats, species and ecological conditions which are to be found within the European Community.

They also considered that, for some widely dispersed species (such as peregrine), site-based conservation measures would not be adequate in themselves to conserve the health of populations (c.f. section 2.3 above). However, they have proposed ten criteria which could be used throughout the Community. The suggested criteria, and their different shortcomings and strengths are presented in Appendix 3. These criteria would indeed be concerned more with establishing priorities for attention, rather than achieving adequate coverage. They do not, however, address the question of what proportion of a population should be accommodated within SPAs.

However, despite the lack of explicit criteria, the wording of the Birds Directive indicates how guidance for site identification may be obtained. Article 4.2 requires Member States to pay particular attention to the protection of wetlands, and particularly to wetlands of international importance. This is a clear cross-reference to the Ramsar Convention, but indicates also that some sites which do not meet the Ramsar criteria of international importance (section 2.5.1) should, however, qualify for protection as SPAs. This is as we would expect because the Directive relates to a different scale of issues and areas than the Convention. The Ramsar Convention is a worldwide measure, whereas the EEC Directive is far more local, relating essentially to part of Western Europe. One would therefore expect the frames of reference to be different. Furthermore, one would not expect to give less protection to species listed on Annex 1, and to other vulnerable migrants, than one would give to waterfowl.

The requirement to consider range and productivity clearly indicates that it may not be appropriate to apply numerical criteria uniformly across the whole Community. This is especially the case if such uniformity of application conflicts with the need to protect outlying populations or population segments, the conservation of which is important to maintain overall species ranges.

Indeed, the international area is composed of many national areas, and whilst a uniform *framework* within which to work is essential, uniform numeric *criteria* across the whole international area may not be desirable if due account is to be taken of the need to maintain range and productivity. Thus, wider criteria to guide conservation actions for some species may be desirable in some parts of the international area. Due allowance must be made for such needs.

The problem then becomes one of how to assess priorities for action or for site selection at a *national* level. Some birds may be more common at national than international levels. A result of this might be that national information or assessments alone might indicate different priorities, compared with those derived from an international perspective. Conversely, the international perspective might seem to conflict with national priorities, until the need to maintain populations and range is considered. The problem is one of scale, and is analagous to the case of some wintering geese, which appear very 'common' in the limited areas where they occur, but are in fact extremely scarce in a national or international context.

Thus, the direction of *national* conservation action needs to be guided by an awareness of *international* trends in range, distribution, productivity and population numbers. An integration of all these factors has been undertaken by Dr Einhard Bezzel for the European Commission.

2.6.1 Derivation of Bezzel Index

In his paper outlining the derivation of indices of vulnerability, Bezzel (1980) notes that to be useful to guide conservation action, the system needs to be able to address the following points:

- *"It should be easy to use and should, for example, be able to provide information quickly for officials without biological training.*
- *It must give succinct quantitative expression to biological facts.*
- *The quantities in question must not be too narrowly defined if they are to do justice to the varying biological positions of the individual species and the varying level of knowledge acquired in research on a region or a species.*
- *The assessment system must be sufficently flexible for new findings or, for example, the new developments which emerge very quickly today to be taken into account at any time.*
- *The system should be applicable at international, national or regional levels without complications and along the same basic lines."*

The key point is the need for an assessment which will allow priorities and provisional targets to be set now, whilst further concurrent research is undertaken. The Bezzel indices have been used by the European Commission to assess vulnerability on an international scale. We here develop the European Commission's earlier application of the concept (Institut Royal des Sciences Naturelles de Belgique 1989).

Recent studies on viable populations for conservation (Soulé 1980, 1987; Soulé & Wilcox 1980; Salwasser *et al.* 1983; Marcot & Holthausen 1987) have demonstrated the detailed information needs for assessing population viability in conservation terms. There is a need to set provisional targets and priorities *now*, notwithstanding the need for more detailed studies. Indeed, the integrated monitoring programme being undertaken by the British Trust for Ornithology under contract to NCC will provide a

considerable advance in such areas (Pienkowski in press). As and when such detailed information becomes available, it will be incorporated and the provisional targets and priorities presented here will be revised. This revision will be a continuing process.

The situation has been described by Soulé (1980): *"Some biologists will be appalled by the blanket prescriptions for survival suggested here, especially in view of the heterogeneity in population structure, genetic variability and, probably, in genetic load that exists among species – even closely related ones. Indeed, criteria such as those recommended here lack precision. The caveat is that the luxuries of confidence limits and certainty are ones that conservation biologists cannot now afford, given the rate of habitat destruction documented ..... Constructive criticism is welcome, but to embrace the purist's motto of 'insufficient data' is to abandon the bleeding patient on the operating table."*

Bezzel (1980) accordingly has drawn together and summarised information on European breeding birds using four categories. (A more recent modification, which we consider to be less rigorous, added a variety of semi-subjective categories. We have chosen to use the earlier scheme here. In any event, the recent modification is not fully complete or available for all species.) The categories Bezzel used are as follows:

A Estimation of the area occupied by a species (with varying degrees of density or continuity). This equates to the 'range' within which a species currently occurs (although formerly it may have been more widely distributed). The area is expressed as a percentage of the potential area of distribution within the European Community. As has been noted in earlier sections, the smaller the area of distribution, the greater the degree of risk to survival.

B Evenness of distribution within the area of occurrence. A 500 x 500 km grid was laid over the total Community area and occurrence within each grid square was noted. As Bezzel notes, the more evenly or unevenly a species is distributed within an area, the smaller or larger respectively is the potential danger to it.

C Breeding population in pairs.

D Definition or estimation of long-term population dynamics in broad categories such as decreasing, increasing or extinct.

More detailed information on the derivation of each of these categories is presented in Table 2.5.

For each species, an overall score or index value can be calculated as the sum of the scores for A, B, C and D values. In Bezzel's paper he calculates an index as the sum of A, B, C and D values. However, as he notes, there is a strong correlation ($r = 0.877$; $n = 215$) between A and B values (range and

Table 2.5 Derivation of A, B, B*, C and D values used to assess vulnerability of breeding bird species in Europe, after Bezzel (1980): B* is a modification (see text).

A Value
Proportions of the total area occupied by a species or population, and allocation of A values:

Proportion of area	A value
<0.1%	9
<1.0%	8
<5.0%	7
<10.0%	6
<20.0%	5
<30.0%	4
<40.0%	3
<50.0%	2
<75.0%	1
<100.0%	0

B Value
Dispersion of breeding birds within a 500 x 500 km grid laid over Europe:

Number of grid squares occupied	B value
1	9
2	8
3	7
4	6
6	5
8	4
10	3
12	2
14	1
16	0

B* Value
Dispersional international responsibility; proportion of total numbers in EEC occurring in Britain:

% of EC total in GB	B* value
>90.0%	9
80.0-89.9%	8
70.0-79.9%	7
60.0-69.9%	6
50.0-59.9%	5
40.0-49.9%	4
30.0-39.9%	3
20.0-29.9%	2
10.0-19.9%	1
<9.9%	0

C Value
Population categories of breeding birds and C values:

Number of breeding pairs	C value
50	9
100	8
500	7
1,000	6
5,000	5
10,000	4
50,000	3
100,000	2
1,000,000	1
>1,000,000	0

D Value

Population dynamics and D values: trend scores are calculated for each country and the average mean score is converted into the D value as given below.

Trend	Trend score
Species has immigrated since c.1950 and is spreading	+3
A clear long-term increase	+2
Long-term feeble or patchy increase	+1
Long-term trend stationary or no change discernable	0
Long-term feeble or patchy decrease	-1
Long-term clear decrease	-2
Died out in 20th century	-3
Countries for which no information is available	±0

Trend score	D value
< -2	9
< -1	8
< -0.1	7
-0.1 to +0.1	6
> +0.1	5
> +1	4
> +2	3

eveness of distribution). This means that the overall ABCD index value does not give full weighting to those widespread species which may be have either declining or small populations (high C or D values). In effect the ABCD index is biased towards distributional values.

In order to remove this bias, and to reflect adequately the importance of populations of which Britain holds a major part of the EC total, we have revised the index by replacing B by B* (Table 2.5). This value expresses the approximate proportion of the EC population residing in Britain, and is thus an appropriate replacement for the largely redundant B in the present context.

Thus, we have used an index which is the sum of the A, B*, C and D values alone. This better reflects conservation priorities for the species concerned.

The revised indices range from a potential score of 36 to 4. For example:

	A	B*	C	D	Revised index
Red-necked phalarope	9	9	9	8	35
House sparrow	0	0	0	5	5

In these examples, the red-necked phalarope has a very restricted area of distribution (A = 9), the major part (>90%) of the EC population occurs in Britain, (B*= 9), it has a very small population (C = 9) and is decreasing in numbers (D = 8). In contrast, house sparrows are wide-spread throughout the EC, abundant and increasing in numbers; thus they are of low conservation priority in international terms.

The system gives one means of simple, easy and objective assessment of immediate *priorities* for conservation action on an international basis. It has a variety of uses as noted by Bezzel, since species rankings can be easily reviewed as more precise information becomes available. It is also uncomplicated, and so is applicable even where only broad-scale information on species status is available.

The same scheme can be used to assess the vulnerability of wintering birds in the European Community, with the use of similar categories. The European Commission have agreed that such indices should be used as the basis for evaluation[1]. These indices are being calculated for wintering bird species and, although not available for the present review, will be used in making similar assessments for wintering bird populations.

Table 2.6 gives the revised Bezzel indices for British breeding birds (including very rare or irregular breeders), with their Annex 1 status (EC Birds Directive) and Schedule 1 status (Wildlife and Countryside Act) also indicated. Species are grouped in systematic order within five groups.

As well as re-affirming the importance of species known to be at risk in Britain (as indicated, for example, by species listed in Schedule 1 of the Wildlife and Countryside Act 1981), Table 2.6 also highlights species to which possibly less attention would be given in Britain were it not for the requirement to have regard for international distributions. Such birds include dunlin, golden plover, arctic tern, pintail and goosander, amongst others.

The Bezzel data can also be used to generate classifications which indicate groups of species with similar conservation characteristics. In this way, the possibility of common conservation strategies can be investigated. Thus, golden plover, black grouse, red grouse and common sandpiper all have relatively localised distributions (A > 5), are British-centred in the EEC (B* > 5), are relatively numerous (C<4), but are declining (D > 7). Such conservation strategies could involve protection of an essential site-based population core with additional wider-countryside measures elsewhere. This might include protection of important moorland habitats from afforestation (for all species) and promotion of traditional low intensity farming and other appropriate management on moorland edge habitats (for black grouse and golden plover especially). Such classification and further interpretation of the Bezzel data are currently being undertaken by NCC and will be reported elsewhere.

[1] Meeting of the Working Group under the Committee for the Adaptation and Scientific Progress of the Birds Directive: 8 March 1989, Brussels.

Table 2.6 Revised Bezzel indices for British breeding birds (including irregular breeders), with Annex 1 status in EEC Birds Directive (*) and Schedule 1 status in Wildlife and Countryside Act (+) also indicated. Introduced, alien species (e.g. Canada goose and ruddy duck) have been omitted. Species are grouped in systematic order within five bands.

The values A, B*, C and D, and their sum, the revised Bezzel score, are explained in Table 2.5. Target priority for inclusion in SPAs is calculated as a proportion of the maximum Bezzel score (36). To avoid spurious precision (see text), species are grouped into five SPA priority target bands of 20 percentage points each, according to their revised Bezzel scores. The targets are for setting priorities for special protection and are **additional** to ordinary and necessary protection measures which should be sufficent to protect the whole of the populations of vulnerable species. The target for SPAs has been compared against the proportion of the population contained within the proposed British SPA network (penultimate column). The shortfall, or otherwise, of the target against currently proposed protection within British SPAs gives the final column which indicates priority for future conservation action. (This has been calculated by subtracting the proportion within pSPAs from the range figure for priority action to give a range figure in the final column. This indicates the shortfall on target.) This shortfall may be addressed either by identification of further SPAs (where this is feasible), or by undertaking special protection measures in the wider countryside (see Table 2.7 and text for further details).

Where a column is left blank, no information is currently or easily available.
$ = proportion in SPAs reaches target.

Species	Annex 1	Schedule 1	A	B*	C	D	Revised Bezzel index	Priority target for SPAs	%GB population in SPAs	Shortfall on target i.e. action priority
Black-throated diver	*	+	7	9	7	6	29	80-100%	30	50-70
Great northern diver	*	+	9	9	9	3	30	80-100%		
Slavonian grebe	*	+	9	9	8	6	32	80-100%	32	48-68
Whooper swan	*		9	9	9	3	30	80-100%		
Greylag goose (N Scottish)			9	9	6	6	30	80-100%	74	6-26
Wigeon			7	9	7	7	30	80-100%	35	45-65
Scaup			9	9	9	3	30	80-100%	0	80-100
Goldeneye			9	9	9	3	30	80-100%	21	59-79
Sea eagle	*	+	9	5	9	9	32	80-100%		
Osprey	*	+	8	6	8	9	31	80-100%		
Merlin	*	+	7	8	6	8	29	80-100%	26	54-74
Dotterel	*	+	8	9	8	5	30	80-100%	26	54-74
Temminck's stint		+	9	9	9	3	30	80-100%	100	$
Purple sandpiper			9	9	9	3	30	80-100%		
Greenshank		+	7	9	5	8	29	80-100%	43	37-57
Wood sandpiper	*	+	8	6	7	8	29	80-100%		
Turnstone			9	9	9	3	30	80-100%		
Red-necked phalarope	*	+	9	9	9	8	35	80-100%	100	$
Snowy owl	*	+	9	9	9	3	30	80-100%		
Shore lark		+	9	9	9	3	30	80-100%		
Wren (Fair Isle race)	*		9	9	9	6	33	80-100%	100	$
Brambling		+	9	9	9	3	30	80-100%		
Scottish crossbill	*	+	9	9	7	6	31	80-100%	40	40-60
Snow bunting		+	9	9	9	6	33	80-100%	77	3-23
Red-throated diver	*	+	7	9	5	6	27	60-79%	22	38-57
Manx shearwater			7	9	1	5	22	60-79%	60	0-19
Leach's petrel	*	+	9	9	4	6	28	60-79%	100	$
Shag			6	7	3	6	22	60-79%	56	4-23
Pintail			7	1	7	7	22	60-79%	93	$
Common scoter		+	8	4	7	8	27	60-79%	55	5-24
Red-breasted merganser			6	6	5	5	22	60-79%		
Goosander			7	8	5	6	26	60-79%		
Golden eagle	*	+	5	5	7	8	25	60-79%	16	44-63
Red grouse			7	9	1	7	24	60-79%		
Ptarmigan			7	5	5	7	24	60-79%		
Black grouse			5	8	3	8	24	60-79%		
Capercaillie	*		6	5	4	8	23	60-79%		
Golden plover	*		6	9	3	8	26	60-79%	23	37-56
Dunlin			7	9	4	8	28	60-79%	68	0-11
Whimbrel		+	8	9	7	4	28	60-79%	22	38-57
Arctic skua			8	9	5	6	28	60-79%	35	25-44
Great skua			8	9	4	4	25	60-79%	69	0-10
Roseate tern	*	+	8	4	6	9	27	60-79%	97	$

Species	Annex 1	Schedule 1	A	B*	C	D	Revised Bezzel index	Priority target for SPAs	%GB population in SPAs	Shortfall on target i.e. action priority
Arctic tern	*		7	8	2	7	24	60-79%	26	34-53
Razorbill			7	8	1	7	23	60-79%	69	0-10
Black guillemot			7	7	3	6	23	60-79%	17	43-62
Puffin			7	9	1	7	24	60-79%	63	0-16
Short-eared owl	*		5	6	5	7	23	60-79%	14	46-65
Redwing		+	8	9	7	4	28	60-79%		
Red-necked grebe			7	0	6	5	18	40-59%		
Black-necked grebe		+	6	2	5	4	17	40-59%		
Fulmar			7	9	1	4	21	40-59%	52	0-7
Gannet			9	8	1	3	21	40-59%	97	$
Cormorant			7	1	3	7	18	40-59%	36	4-23
Bittern	*	+	5	0	5	9	19	40-59%		
Little bittern		+	4	0	5	7	16	40-59%		
Shelduck			5	6	3	4	18	40-59%	7	33-52
Gadwall			6	0	5	5	16	40-59%	22	18-37
Teal			3	6	4	7	20	40-59%	4	36-55
Garganey		+	4	0	5	8	17	40-59%	26	14-33
Eider			7	6	3	3	19	40-59%	13	27-46
Marsh harrier	*	+	5	0	5	7	17	40-59%	11	29-48
Hen harrier	*	+	5	0	5	7	17	40-59%	33	7-26
Montagu's harrier	*	+	6	0	6	8	20	40-59%	0	40-59
Sparrowhawk			1	5	3	7	16	40-59%		
Peregrine	*	+	7	2	5	7	21	40-59%	11	29-48
Spotted crake	*	+	5	0	3	7	15	40-59%		
Corncrake	*	+	4	1	5	8	18	40-59%	35	5-24
Stone curlew	*	+	5	0	4	8	17	40-59%	14	26-45
Black-winged stilt		+	6	0	5	6	17	40-59%	0	40-59
Ringed plover			5	6	3	6	20	40-59%	29	11-30
Kentish plover		+	6	0	5	7	18	40-59%		
Ruff	*	+	7	0	5	8	20	40-59%	91	$
Common snipe			2	4	1	8	15	40-59%	9	31-50
Curlew			3	6	2	6	17	40-59%	4	36-55
Redshank			4	3	2	8	17	40-59%	12	28-47
Common sandpiper			4	6	3	8	21	40-59%		
Mediterranean gull	*	+	9	0	9	3	21	40-59%		
Common gull			6	4	2	5	17	40-59%	12	28-47
Lesser black-backed gull			6	6	1	4	17	40-59%	50	0-9
Great black-backed gull			6	7	3	4	20	40-59%	39	1-20
Kittiwake			7	9	1	4	21	40-59%	70	$
Sandwich tern	*		7	3	3	7	20	40-59%	88	$
Common tern	*		5	2	3	7	17	40-59%	39	1-20
Little tern	*	+	6	2	3	6	17	40-59%	47	0-12
Black tern	*	+	6	0	3	7	16	40-59%	0	40-59
Guillemot			7	8	0	6	21	40-59%	73	$
Nightjar	*		5	1	3	7	16	40-59%	30	10-29
Kingfisher	*	+	1	4	4	8	17	40-59%		
Rock pipit			5	3	1	6	15	40-59%		
Dipper			2	4	2	7	15	40-59%		
Ring ouzel			5	3	3	5	16	40-59%		
Bearded tit		+	5	1	5	4	15	40-59%		
Chough	*	+	5	2	5	8	20	40-59%	48	0-11
Twite			7	4	3	6	20	40-59%		
Little grebe			1	0	3	7	11	20-39%		
Great-crested grebe			3	1	3	4	11	20-39%		
Red kite	*	+	4	0	5	5	14	20-39%		
Grey heron			3	2	3	5	13	20-39%		
Shoveler			5	0	3	5	13	20-39%	38	0-1
Pochard			5	0	4	3	12	20-39%	23	0-16
Tufted duck			4	2	4	3	13	20-39%	8	12-31

Species	Annex 1	Schedule 1	A	B*	C	D	Revised Bezzel index	Priority target for SPAs	%GB population in SPAs	Shortfall on target i.e. action priority
Goshawk		+	2	0	5	7	14	20-39%		
Buzzard			0	2	3	6	11	20-39%		
Honey buzzard	*	+	2	0	4	6	12	20-39%		
Kestrel			0	3	2	6	11	20-39%		
Hobby		+	2	1	4	7	14	20-39%		
Red-legged partridge			4	1	1	7	13	20-39%		
Grey partridge			1	0	0	8	9	20-39%		
Quail		+	1	0	1	7	9	20-39%		
Water rail			2	0	2	7	11	20-39%		
Oystercatcher			4	2	2	4	12	20-39%	7	13-32
Avocet	*	+	6	0	3	4	13	20-39%	90	$
Little ringed plover		+	3	0	4	5	12	20-39%	2	18-37
Lapwing			1	3	1	5	10	20-39%	3	17-36
Woodcock			3	0	3	7	13	20-39%		
Black-tailed godwit		+	6	0	1	5	12	20-39%	65	$
Black-headed gull			4	3	1	4	12	20-39%	18	2-21
Herring gull			5	3	1	4	13	20-39%	25	9-14
Rock dove/feral pigeon			4	0	1	6	11	20-39%		
Stock dove			1	4	1	6	12	20-39%		
Barn owl		+	1	0	2	7	10	20-39%		
Little owl			1	0	1	6	8	20-39%		
Long-eared owl			2	1	2	6	11	20-39%		
Hoopoe		+	2	0	1	6	9	20-39%		
Wryneck		+	2	0	1	7	10	20-39%		
Green woodpecker			1	0	1	6	8	20-39%		
Lesser spotted woodpecker			2	3	3	6	14	20-39%		
Woodlark	*	+	2	0	1	7	10	20-39%	35	$
Sand martin			1	1	1	7	10	20-39%		
Meadow pipit			2	6	0	6	14	20-39%		
Yellow wagtail			1	1	1	6	9	20-39%		
Grey wagtail			1	2	1	6	10	20-39%		
Redstart			1	0	0	7	8	20-39%		
Whinchat			2	1	1	7	11	20-39%		
Stonechat			1	0	1	6	8	20-39%		
Wheatear			2	3	1	7	13	20-39%		
Fieldfare		+	4	0	1	3	8	20-39%		
Cetti's warbler		+	4	0	1	3	8	20-39%		
Grasshopper warbler			2	0	1	6	9	20-39%		
Savi's warbler		+	5	0	4	4	13	20-39%		
Sedge warbler			2	0	1	6	9	20-39%		
Marsh warbler		+	3	0	1	5	9	20-39%		
Reed warbler			2	0	1	6	9	20-39%		
Dartford warbler	*	+	5	0	1	6	12	20-39%	12	8-27
Wood warbler			3	0	1	6	10	20-39%		
Lesser whitethroat			1	0	1	6	8	20-39%		
Whitethroat			0	0	0	8	8	20-39%		
Goldcrest			2	0	0	6	8	20-39%		
Firecrest		+	3	0	1	6	10	20-39%		
Pied flycatcher			4	1	1	4	10	20-39%		
Marsh tit			1	0	1	6	8	20-39%		
Willow tit			2	0	1	6	9	20-39%		
Crested tit		+	2	0	1	6	9	20-39%		
Treecreeper			2	3	1	5	11	20-39%		
Golden oriole		+	1	0	2	6	9	20-39%		
Red-backed shrike	*	+	1	0	1	7	9	20-39%		
Rook			2	0	0	6	8	20-39%		
Raven			3	1	3	5	12	20-39%		
Siskin			5	0	2	6	13	20-39%		
Redpoll			4	2	1	4	11	20-39%		
Common crossbill		+	4	0	2	6	12	20-39%		
Hawfinch			2	1	2	6	11	20-39%		
Cirl bunting		+	2	0	1	6	9	20-39%		
Corn bunting			1	0	0	7	8	20-39%		

Species	Annex 1	Schedule 1	A	B*	C	D	Revised Bezzel index	Priority target for SPAs	%GB population in SPAs	Shortfall on target i.e. action priority
Mute swan			3	0	1	3	7	<19%	6	0-13
Mallard			0	0	1	6	7	<19%	5	0-14
Pheasant			1	0	0	3	4	<19%		
Moorhen			0	0	1	5	6	<19%		
Coot			0	2	1	4	7	<19%	0	0-19
Wood pigeon			0	0	0	4	4	<19%		
Collared dove			1	0	1	3	5	<19%		
Turtle dove			1	0	0	5	6	<19%		
Cuckoo			0	0	1	6	7	<19%		
Tawny owl			0	1	1	5	7	<19%		
Swift			0	0	1	6	7	<19%		
Great spotted woodpecker			0	0	1	6	7	<19%		
Skylark			0	0	0	6	6	<19%		
Swallow			0	0	0	6	6	<19%		
House martin			0	0	0	6	6	<19%		
Tree pipit			1	0	0	6	7	<19%		
Pied/white wagtail			0	0	0	6	6	<19%		
Wren			0	0	0	6	6	<19%		
Hedge sparrow			1	0	0	6	7	<19%		
Robin			0	0	0	6	6	<19%		
Nightingale			1	0	0	5	6	<19%		
Black redstart		+	1	0	0	5	6	<19%		
Blackbird			0	0	0	4	4	<19%		
Song thrush			1	0	0	4	5	<19%		
Mistle thrush			0	0	0	5	5	<19%		
Garden warbler			1	0	0	6	7	<19%		
Blackcap			1	0	0	4	5	<19%		
Chiffchaf			0	0	0	6	6	<19%		
Willow warbler			1	0	0	6	7	<19%		
Spotted flycatcher			0	0	0	6	6	<19%		
Long-tailed tit			1	0	0	6	7	<19%		
Coal tit			1	0	0	6	7	<19%		
Blue tit			0	0	0	5	5	<19%		
Great tit			0	0	0	5	5	<19%		
Nuthatch			1	0	0	6	7	<19%		
Jay			0	0	1	6	7	<19%		
Magpie			0	0	0	6	6	<19%		
Jackdaw			0	1	0	6	7	<19%		
Carrion/hooded crow			0	0	0	6	6	<19%		
Starling			0	0	0	5	5	<19%		
House sparrow			0	0	0	5	5	<19%		
Tree sparrow			0	0	0	5	5	<19%		
Chaffinch			0	0	0	6	6	<19%		
Serin		+	1	0	0	4	5	<19%		
Greenfinch			0	0	0	5	5	<19%		
Goldfinch			0	0	0	5	5	<19%		
Linnet			0	0	0	6	5	<19%		
Bullfinch			1	0	0	5	6	<19%		
Reed bunting			1	0	0	6	7	<19%		
Yellowhammer			0	1	0	6	7	<19%		

2.6.2 Target setting

The revised Bezzel Indices, and later the complementary indices for wintering populations, can also be used to link objective assessment of vulnerability, (and thus conservation need), directly with target proportions (of provisional nature) of populations to be included in special protection areas, where site-safeguard is an appropriate principal measures.

It is important to note that this approach concerns the provisional targetting of priorities for special protection areas. In all cases, the conservation aim will be to ensure the protection of whole populations of rare or migratory species. This is, not least, because many of these species have already suffered major attrition, and population sizes and distribution are now much reduced and fragmented from that occurring historically (section 2.2). Thus, over and above national requirements to protect whole populations (e.g. of golden eagle),

the Directive imposes a requirement for certain additional, special protection measures. It is the proportion of the population which ought to be targetted for special protection areas that the current exercise identifies.

This approach, which follows that of the European Commission, indicates that those species with the highest possible revised Bezzel Index (36) require the complete population to be the subject of special protection. Thus for any species the provisional target proportion to be included in special protection areas (over and above other conservation measures) can be calculated as: 100/36 x revised Bezzel index. These values are indicated in Table 2.6, where species have been grouped into bands of 20%. This grouping avoids spurious precision as, in many cases, the precise Bezzel values will change with time and further information.

The system used here is, indeed, an approximate guide to setting priorities. Because we are concerned with conservation in an EEC context and Britain's contribution to that, we have followed the European Commission in using distributions, numbers and trends within the EEC for the common currency for this comparision. We do not suggest that this is the only scale at which matters can be considered. Both more local and wider scales also need to be taken into account. Looking at population distributions on a wider scale can lead to both decreases and increases in the priorities to be attached. For example, a vulnerable population limited to the EEC, but occurring throughout it, will tend to be under-valued in our assessment. Different scales of assessment are valid for different reasons, but it is not feasible to detail all here. However, this matter must be borne in mind: continued interpretation by conservation biologists will remain necessary, as will periodic reassessment.

Nevertheless, some setting of priorities is needed urgently now. The rate of habitat destruction, previous damage and current threats to populations have necessitated this urgent review. The quote above from Soulé (1980) is relevent here. In the context of the Birds Directive, Britain's performance in the designation of SPAs has been extremely poor. This has been for various reasons, most recently as a result of government-decided reorganisations and a severe mismatch between the level of information government feels it needs and the resources it has made available to meet this need.

Our analysis is, therefore, far from perfect and we would envisage periodic updating. Relevant to this, NCC has commissioned or is undertaking further surveys, population monitoring and studies of habitat relationships. Monitoring is a key feature of the work, with feedback to policies an essential part of our work as conservation biologists.

Apart from the large work remaining on SPAs, and advice on their management, a major priority is the development of innovative land-use policies in the wider countryside, especially for these requirements. This must be undertaken at a national and international level, and some initiatives are already in progress.

None of this, however, can be allowed to delay conservation action now in respect of SPA designation. Accordingly, we have used the best available common currency in the context of the EEC measures currently under consideration. We amplify this in the species sections (Appendix 6) by making reference to other scales of comparison, especially in respect of biogeographical populations (see section 2.5) where possible.

It is important to stress that the 'targets' based on the modified Bezzel scheme are intended to set approximate priorities for action. They are **not** levels to which populations should be allowed to fall. Such an approach would be highly irresponsible in respect of the vulnerable populations concerned, as well as being contrary to the requirements of the Birds Directive. The populations and distributions of all the species concerned need to be maintained, although in part this will be by measures additional to SPAs, whether this be in other protected sites or in the countryside as a whole. The target setting has an additional feature, in that it helps identify those populations for which site-safeguard can make only a relatively minor contribution. Such populations must be a priority for measures in the wider countryside. We consider this further later, and will address the subject in more detail in other publications.

In a preliminary analysis on the proportions of national populations in SPAs, a European Commission advisor indicated that Belgium's existing SPAs protected 100% of the population of five species listed on Annex 1, over 80% of seven more, over 50% of six, 40% of one, 30% of another and 15% of yet another[1].

It is significant that provisional target special protection areas can be derived for *all* migratory bird species in the Community, even though those abundant and widespread species with low Bezzel indices have very low proportions requiring special protection. This is in accord with the Birds Directive, which concerns all birds, not just those which are rare. The commoner migratory species will occur incidentally on sites designated for other, scarcer, species. The former species therefore require no Special Protection Areas specifically designated for them, although certain special protection measures in the wider countryside may be appropriate. They will, however, be the subject of other general conservation measures.

[1] Dr P Devillers: meeting of the Working Group, 19 October 1988.

We have compared the target for *special* protection areas against the proportion of the population currently contained within the proposed British SPA network (penultimate column of Table 2.6). The shortfall or otherwise of the target against currently proposed protection levels within British SPAs indicates priority for future conservation action. For some species, continuing survey has indicated probable further sites and these will be fully evaluated to enhance levels of site-based protection. Other species may not be amenable to further site-based special protection measures, and a shortfall on the special protection target indicates needs for special protection measures in the wider countryside. Most species will require a mixture of further site-based and wider special protection, the emphasis varying both between species and also geographically. For example, some birds may be very thinly spread at the edge of their range – indicating the need for wider countryside measures to effect protection, but occur at higher densities elsewhere – where further SPAs would be appropriate. This information is summarised in Table 2.7.

One should note that, for many species, the levels of protection achieved by SPAs relate to only parts of their behavioural, ecological or seasonal requirements (see section 2.4.2). Other needs may be met by further SPAs or by other measures. This is addressed further in Appendix 6 and summarised in Table 2.7.

This general approach addresses Question 1 of section 2.6. It provides a provisional target proportion of the population which should be the subject of special protection areas. It is thus valuable in indicating provisional target priorities. Given that conservation resources are always likely to be greatly over-stretched, it gives a means of assessing relative priorities for conservation action. Those rare and declining species with small populations (i.e. with high indices of vulnerability) are often, although not always, those most appropriate to conserve using a site-based approach, although in the case of widely ranging species such as many raptors, wider special protection measures will also be appropriate. Some species are most appropriately protected mainly by conservation measures in the 'wider countryside', i.e. special protection measures that are not site-based.

The Bezzel approach is helpful in confirming which species require most effort in wider special protection measures. This is demonstrated by comparing the proportions of populations protected by site-safeguard with provisional target proportions (Tables 2.6 and 2.7). This information is further elaborated by species in Appendix 6 and is summarised in section 3.3.

2.6.3 Site selection

The Bezzel Indices allow the setting of provisional targets for the proportion of a population which should be included in special protection areas.

However, these provisional targets require to be implemented by selecting a suite of sites (Question 2 of section 2.6). This selection requires account to be taken of the variety of ecological needs identified earlier in section 2 as important for the persistence of populations throughout the geographic range.

The initial suite of sites for the British list of proposed Special Protection Areas were selected using criteria which have subsequently been integrated by the ICBP in their major review of sites of importance to birds throughout Europe (Grimmett & Jones 1989: 13-16; Appendix 7).

The ICBP-EC Working Group draft criteria (Appendix 3) also give broad selection outlines which are of value, although in need of further refinement and elaboration. The important point that the Working Group have stated is that no single criterion is adequate to assess the extremely wide conservation needs of Europe's bird population. All have disadvantages (and advantages) and the paramount aim of any set of criteria must be to ensure that the sites so selected fulfil (collectively) the aims of the Directive: *..."to ensure* [the birds] *survival and reproduction in their area of distribution"....* (i.e. Question 1 of section 2.6). One advantage of the present review excercise is that it prevents discussion becoming side-tracked into paying too much attention to assessing criteria for individual site-selection. Instead it addresses the basic question of the degree of protection which will be achieved by the designation of a suite of SPAs as a coherent network.

In terms of immediate priorities in site-protection, the existing network of proposed Special Protection Areas is a minimum objective. As additional suitable sites are identified which will assist diminishing major shortfalls compared to provisional targets, such sites will progressively be proposed.

2.6.4 Summary and future action

The steps outlined in the sections above are iterative in nature. They have involved the following stages:

- calculation of revised Bezzel indices as a guide to vulnerability,
- setting targets for *special* protection areas (under the Directive) based on these indices,
- assessment of populations within the existing SPA network in Britain,
- assessing the proportion of populations within the SPA network against such targets to measure performance, and
- estimating the degree of shortfall (or otherwise) which gives a measure of priority to future special protection measures.

Table 2.7 Adequacy of the currently proposed British SPA network and the need for further special protection measures for Annex 1 and certain migratory species in Britain.

KEY

A = adequate minimum proportion in proposed network of SPAs (based on current, incomplete knowledge)
X = further SPAs needed
M = marine measures needed
W = additional 'wider countryside' special protection measures needed
O = colonising or very rare species: site-based conservation to be opportunistic
– = does not occur in significant numbers in season indicated
W = **symbol emboldened and underlined indicates major further special protection measures needed for category of action**

SPECIES	Annex 1	BREEDING SEASON			NON-BREEDING SEASON		
		Nesting	Feeding	Other	Feeding	Roosting	Other
Red-throated diver	*	**X,W**	M		M		
Black-throated diver	*	X,**W**	X		M		
Great northern diver	*	O,A	M,W		M		
Slavonian grebe	*	X,**W**	X		M		
Fulmar		A	M		M		
Manx shearwater		A	M		M		
Storm petrel	*	A	M		M		
Leach's petrel	*	A	M		M		
Gannet		A	M		M		
Cormorant		X	X,M		X,M		
Shag		W,X	W,X		X,M		
Bittern	*	X	X				
Mute swan		**W**	X,**W**	W	W		
Bewick's swan	*	–	–	–	W	W,?A	
Whooper swan	*	–	–	–	W	W	
Bean goose		–	–	–	W	X	
Pink-footed goose		–	–	–	W	A	
European white-fronted goose		–	–	–	W	X?,W	
Greenland white-fronted goose	*	–	–	–	X,**W**	**X**,W	
Greylag goose: native popn.		A	W	W	W	A?	
Greylag goose: Icelandic popn.		–	–	–	W	A	
Greenland barnacle goose	*	–	–	–	?	A?	
Svalbard barnacle goose	*	–	–	–	A	A	
Light-bellied brent (Svalbard)		–	–	–	W,A?	A	
Dark-bellied brent goose		–	–	–	W	A?	
Shelduck		X,W	X	W	W	X	
Wigeon		**W**,X	**W**,X		W	W	
Gadwall		X	X		W	W	
Teal		X,**W**	X,**W**		W	W	
Mallard		A,W	A,W	W	W	W	
Pintail		A	A	W	W,?A	W,?A	
Garganey		O,A,W	O,A,W				
Shoveler		A	A	W	X,W	X,W	
Red-crested pochard		–	–	–	W	W	
Pochard		W	W		W	W	
Tufted duck		X,**W**	X,**W**	W	W	W	
Scaup		O	O		M	M	
Eider		X,W	X,W	X	M	M	M
Long-tailed duck		–	–	–	M	M	
Common scoter		A	A		X,**M**	X,**M**	
Velvet scoter		–	–	–	X,**M**	X,**M**	
Goldeneye		O,W	O,W		X,**M**	X,**M**	
Smew		–	–	–	M	M	
Red-breasted merganser		?,W	?,W		W	W	
Goosander		?,W	?,W		W	W	
Coot		X,W	X,W		W	W	
Honey buzzard	*	O,W	O,W		–	–	–

SPECIES	Annex 1	BREEDING SEASON			NON-BREEDING SEASON		
		Nesting	Feeding	Other	Feeding	Roosting	Other
Red kite	*	**X**,W	X,**W**	**X**,W	X,W	X,W	**X**
Sea eagle	*	W	W		W	W	
Marsh harrier	*	X,W	X,W		X,W	X,W	
Hen harrier	*	X,**W**	X,**W**		X,**W**	X,**W**	
Montagu's harrier	*	O,W	O,W		–	–	–
Golden eagle	*	X,**W**	X,**W**		X,**W**	X,**W**	
Osprey	*	X,**W**	X,**W**	–	–	–	
Merlin	*	X,**W**	X,**W**	W			
Hobby		X,W	X,W	W	–	–	–
Peregrine	*	X,**W**	X,**W**		X,**W**	**W**	
Capercaillie	*	X,W	X,W	X	X,W	X,W	
Spotted crake	*	O,W	O,W		–	–	–
Corncrake	*	A,**W**	A,**W**		–	–	–
Oystercatcher		X,**W**	X,**W**		W	W	
Black-winged stilt		O	O	–	–		
Avocet	*	A	A		A?,W	A?,W	
Stone curlew	*	X,**W**	X,**W**		–	–	–
Little ringed plover		X,W	X,W		–	–	–
Ringed plover		X,W	X,W		W	W	
Kentish plover		O	O		–	–	–
Dotterel	*	**X**,**W**	**X**,W		–	–	–
Golden plover	*	**X**,**W**	**X**,**W**		X,**W**	X,**W**	
Grey plover		–	–	–			
Lapwing		X,**W**	X,**W**		X,**W**	X,**W**	
Knot		–	–	–	A	A	
Sanderling		–	–	–	X,W	X,W	
Little stint		–	–	–	O	O	
Temminck's stint		O	O		–	–	–
Purple sandpiper		O	O		X,W	X,W	
Dunlin		X?,**W**	X,**W**		X,W	X,W	
Ruff	*	O,A?	O,A?		W	W	
Jack snipe		–	–	–	W	W	
Common snipe		X,**W**	X,**W**		W	W	
Woodcock		W	W		W	W	
Black-tailed godwit		O,A?	O,A?		A?,W	A?,W	
Bar-tailed godwit		–	–	–	A?,W	A?,W	
Whimbrel		X,O	X,O		–	–	–
Curlew		X,**W**	X,**W**		W	W	
Redshank		X,**W**	X,**W**		W	W	
Spotted redshank		–	–	–	O	O	
Greenshank		**X**,W	**X**,W		X,W	X,W	
Green sandpiper		O	O	O	O		
Wood sandpiper	*	O	O	–	–	–	
Common sandpiper		X,**W**	X,**W**		W	W	
Turnstone		O	O		W	W	
Red-necked phalarope	*	A,O	A,O	–	–	–	
Arctic skua		X,**W**	X,**W**		M		
Great skua		A	A,M		M		
Mediterranean gull	*	O,A	O,W		–	–	–
Little gull		–	–	–	O	O	
Black-headed gull		A,W	A,W		W	W	
Ring-billed gull		–	–	–	O	O	
Common gull		X,**W**	X,**W**		W	W	
Lesser black-backed gull		A,**W**	A,**W**		–	–	–
Herring gull		A,**W**	A,**W**		W	W	
Iceland gull		–	–	–	O,W	O,W	
Glaucous gull		–	–	–	O,W	O,W	
Great black-backed gull		A,**W**	A,**W**,M		M	M	
Kittiwake		A	M		M	M	
Sandwich tern	*	X	X,**M**		–	–	–
Roseate tern	*	X	X,**M**		–	–	–
Common tern	*	X,**W**	X,**M**		–	–	–
Arctic tern	*	X,**W**	X,**M**		–	–	–

SPECIES	Annex 1	BREEDING SEASON			NON-BREEDING SEASON		
		Nesting	Feeding	Other	Feeding	Roosting	Other
Little tern	*	X,**W**	X,**M**		–	–	–
Black tern	*	O	O		–	–	–
Guillemot		A	M		M	M	
Razorbill		A	M		M	M	
Black guillemot		X,W	M		M	M	
Puffin		A	M		–	–	–
Snowy owl	*	O,A	O,A		O,A	O,A	
Short-eared owl	*	W	W		W	W	
Nightjar	*	A?,**W**	A?,**W**		–	–	
Kingfisher	*	A?,**W**	A?,**W**		A?,W	A?,W	
Woodlark	*	W	W		W	W	
Wren (Fair Isle race)	*	A	A		A	A	
Dartford Warbler	*	A?,**W**	A?,**W**		A?,W	A?,W	
Red-backed shrike	*	O,W	O,W		–	–	–
Chough	*	A,**W**	A,**W**		A,**W**	A,**W**	
Scottish crossbill	*	X,W	X,W		X,W	X,W	
Snow bunting		X,**W**	X,**W**		W	W	

Future actions will vary for each species, but all require feedback. If there is considerable difference between the special protection target and the proportion protected within the SPA network, then the priority for further measures is clearly great. If the ecology and degree of dispersion of the species is such that further site-based conservation is appropriate, then further SPAs will be proposed. If further sites are not appropriate (e.g. because the species occurs at very low densities), then special protection measures in the wider countryside will be required most urgently. In many cases, such measures, for example restriction of further upland afforestation or support for low-intensity farming, will benefit more than one species because of the occurrence of assemblages (section 2.4.8).

At all these stages, the information presented here will be continually updated and revised. In this respect the proportions of populations protected, and all the indices and targets presented here should be regarded as provisional since they are the subject of continuous revision. Following from this is a clear need for the *monitoring* of the efficacy of the SPA network across the whole of Great Britain. Such monitoring (a crucial part of all conservation programmes (Pienkowski in press)) will allow the NCC to judge the need for further special measures according to their effectiveness.

By monitoring the implementation of this network and associated measures across the whole of Britain, the NCC can ensure that future conservation actions, in the words of the Directive, *"form a coherent whole which meets the protection requirements of these species"*.

3 The SPA/Ramsar network in Britain – sites, bird habitats and species

3.1 Proposed and designated SPAs/Ramsar sites

Tables 3.1 and 3.2 list proposed and designated SPAs and Ramsar sites. Locations are shown in Figure 1.2.

Table 3.1 (previously given in some publications as 'List A'[1]) includes sites which definitely qualify for either Ramsar and/or SPA status. In some cases the qualification for the other designation is under review.

Table 3.2 (previously given in some publications as 'List B') includes those sites for which information is still being reviewed or gathered and for which neither qualification has yet been confirmed. Sites which have been put forward but have been rejected as not qualifying for either designation, are not listed. The fact that a site qualifies does not necessarily mean that the boundary has yet been finally confirmed. Because of this, it is not currently possible to present information on the areas of each site.

Similarly, further aspects of the interest may still be under investigation for sites listed here. For example, some sites which qualify for their importance to wintering birds, may also have international conservation importance in summer. However, such summer information may not be fully collated or available.

Each proposed or designated international site occupies at least one line on the list. A site may have several additional lines if it crosses boundaries between English and Welsh counties or Scottish districts. The meaning of each column is indicated below.

INDEX

This is a code number given to each site. These code numbers also relate to sites shown in Figure 1.2.

SNAME

This is the name by which the international site is currently known. The name of the international site is not necessarily the same as that of component SSSI(s), especially where the international site includes more than one SSSI.

COUNTY

This indicates the county in England and Wales, or the district and region, or islands area, in the case of Scottish sites.

SPA

If the site qualifies for SPA status, S is printed. If the site does not qualify – is printed. If neither S or R is printed, qualification has not yet been confirmed or rejected.

RAM

If the site qualifies for Ramsar status, R is printed. If the site does not qualify – is printed. If neither S or R is printed, qualification has not yet been confirmed or rejected.

DOEACT

This gives the date on which the papers proposing designation were sent from NCC to the Department of the Environment (or Scottish Development Department). This information is not given for sites designated in early years.

SPADATE

This is the date of designation of a site as a SPA. If only part of a site has so far been designated, P precedes the date and, in some cases, an indication is given (after the date) of the part designated.

RAMDATE

This is the date of designation of the sites under the Ramsar Convention. If only part of the site has so far been designated, P precedes the date and, in some cases, an indication is given (after the date) of the part designated.

Some sites listed here as designated will require boundary modifications. This is because early designations by government did not always take adequate account of biologically meaningful boundaries, as opposed to patterns of land-tenure.

[1] Slightly updated from the list in Commons Hansard, 20 December 1988: columns 187-191.

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
101A	NORTH RONA AND SULA SGEIR	WESTERN ISLES	S	–			
157A	LEWIS PEATLANDS	WESTERN ISLES	S	R			
157B	NORTH HARRIS MOUNTAINS	WESTERN ISLES	S	–			
102A	FLANNAN ISLES	WESTERN ISLES	S	–			
103A	ST KILDA	WESTERN ISLES	S	–			
104A	SHIANT ISLES	WESTERN ISLES	S	–			
105A	WEST SOUND OF HARRIS	WESTERN ISLES	S	R			
106A	LOCH AN DUIN	WESTERN ISLES		R	03/05/1989		
107A	MONACH ISLANDS	WESTERN ISLES	S	–			
145A	BALRANALD	WESTERN ISLES	S	R			
150A	LOCH SCADAVAY	WESTERN ISLES	S				
148A	BALESHARE AND KIRKIBOST	WESTERN ISLES	S	R			
149A	BAGH NAM FOAILEAN TO ARDIVACHAR	WESTERN ISLES	S	R			
108A	SOUTH UIST MACHAIR AND LOCHS	WESTERN ISLES	S	R		P31/08/1982	P5/1/1976 DRUIDIB
111A	WEST SOUND OF BARRA	WESTERN ISLES	S	R			
112A	MINGULAY AND BERNERAY	WESTERN ISLES	S	–			
113A	PENTLAND FIRTH ISLANDS	CAITHNESS, HIGHLAND ORKNEY	S	–			
118A	CAITHNESS CLIFFS	CAITHNESS, HIGHLAND	S	–			
117A	CAITHNESS LOCHS	CAITHNESS, HIGHLAND	S	R			
115	THE PEATLANDS	CAITHNESS, HIGHLAND SUTHERLAND, HIGHLAND	S	R			
123A	CAPE WRATH-AODANN MHOR	SUTHERLAND, HIGHLAND	S	–			
122A	DURNESS LOCHS AND STREAMS	SUTHERLAND, HIGHLAND		R			
124A	HANDA	SUTHERLAND, HIGHLAND	S	–	05/04/1989		
151A	LOCH ASSYNT, LOCH URIGILL AND NEARBY LOCHS	SUTHERLAND, HIGHLAND	S	R			
127A	LOCH FLEET AND THE MOUND	SUTHERLAND, HIGHLAND	–	R			
134A	RHUM	LOCHABER, HIGHLAND	S	–		31/8/1982	
135A	LOCH MORAR	LOCHABER, HIGHLAND	–	R			
136A	KENTRA MOSS	LOCHABER, HIGHLAND	–	R			
137A	CLAISH MOSS	LOCHABER, HIGHLAND	–	R			24/07/1981
126A	PRIEST ISLAND	ROSS & CROMARTY, HIGHLAND	S	–	10/04/1986	1/10/1986	
153A	LOCH MAREE	ROSS & CROMARTY, HIGHLAND	S	R			
128A	LOWER DORNOCH FIRTH	ROSS & CROMARTY, HIGHLAND SUTHERLAND, HIGHLAND	S	R			
129A	LOCH EYE	ROSS & CROMARTY, HIGHLAND	S	R	05/09/1985	1/10/1986	1/10/1986
131A	CROMARTY FIRTH	ROSS & CROMARTY, HIGHLAND	S	R			
156A	AFFRIC-CANNICH HILLS AND GLENS	INVERNESS, HIGHLAND	S	–			
155A	LOCHS ASHIE AND RUTHVEN	INVERNESS, HIGHLAND	S	–			
132A	BEAULY FIRTH	INVERNESS, HIGHLAND	S	R			
133A	MORAY FIRTH: MUNLOCHY BAY TO FINDHORN BAY	MORAY, GRAMPIAN INVERNESS, HIGHLAND	S	R			
201A	HERMANESS & SAXA VORD, UNST	SHETLAND	S	R			
235A	CROUSSA FIELD AND THE HEOGS	SHETLAND	S	–			
203A	FETLAR	SHETLAND	S	–			
272A	BLACKPARK, YELL	SHETLAND	S	–			
202A	RAMNA STACKS AND GRUNEY	SHETLAND	S	–			
204A	NORTH ROE, MAINLAND	SHETLAND	S	R			
205A	PAPA STOUR	SHETLAND	S	–			
206A	FOULA	SHETLAND	S	R			
208A	NOSS	SHETLAND	S	–			
236A	MOUSA (PART)	SHETLAND	S	–			
265A	LOCH SPIGGIE	SHETLAND	S	R			
251A	SUMBURGH HEAD	SHETLAND	S	–			
209A	FAIR ISLE	SHETLAND	S	–			
241A	NORTH RONALDSAY COAST	ORKNEY	S	R			
233A	EAST SANDAY	ORKNEY	S	R			
242A	SOUTH EASTERN STRONSAY	ORKNEY	S	R			
211A	PAPA WESTRAY (NORTH HILL AND HOLM)	ORKNEY	S	–			
210A	WEST WESTRAY	ORKNEY	S	–			

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
232A	SOUTH WESTRAY COAST	ORKNEY	S	R			
243A	EDAY	ORKNEY	S	–			
237A	ROUSAY (PART)	ORKNEY	S	–			
267A	MILL DAM, SHAPINSAY	ORKNEY	S	R			
212A	MARWICK HEAD	ORKNEY	S	–			
231B	NORTH MAINLAND COAST	ORKNEY	S	R			
231A	WEST MAINLAND MOORS	ORKNEY	S	–			
213A	LOCHS OF HARRAY AND STENNESS	ORKNEY	S	R			
269A	ORPHIR AND STENNESS HILLS	ORKNEY	S	–			
214A	HOY	ORKNEY	S	–			
215A	COPINSAY	ORKNEY	S	–			
218A	SULE SKERRY AND STACK	ORKNEY	S	–			
234A	MORAY FIRTH: BURGHEAD & SPEY BAYS	MORAY, GRAMPIAN	S	R			
		INVERNESS, HIGHLAND					
220A	LOCH SPYNIE	MORAY, GRAMPIAN	S	R			
274A	LOCH OIRE	MORAY, GRAMPIAN	S	–			
247A	TROUP, PENNAN & LION HEADS	BANFF & BUCHAN, GRAMPIAN	S	–			
268A	QUARRY HEAD TO FRASERBURGH COAST	BANFF & BUCHAN, GRAMPIAN	S	R			
221A	LOCH OF STRATHBEG	BANFF & BUCHAN, GRAMPIAN	S	R			
249B	BULLERS OF BUCHAN & WHINNYFOLD	BANFF & BUCHAN	S	–			
		GORDON, GRAMPIAN					
222A	YTHAN ESTUARY, SANDS OF FORVIE AND MEIKLE LOCHS	GORDON,GRAMPIAN	S	R			
226A	LOCH OF SKENE	GORDON, GRAMPIAN	S	R	05/09/1986	1/10/1986	1/10/1986
227A	FOWLSHEUGH	KINCARDINE, GRAMPIAN	S	–			
279A	MUIR OF DINNET	KINCARDINE, GRAMPIAN	S	R			
248A	ST CYRUS	KINCARDINE, GRAMPIAN	S	–			
277A	GLEN TANAR	KINCARDINE, GRAMPIAN	S				
228A	LOCHNAGAR	KINCARDINE, GRAMPIAN	S	–			
225A	CAIRNGORM LOCHS	KINCARDINE, GRAMPIAN	–	R			24/07/1981
		BADENOCH & STRATHSPEY,HIG					
224A	CAIRNGORMS	BADENOCH & STRATHSPEY, HI	S	–	01/07/1988		
		KINCARDINE, GRAMPIAN					
256A	ABERNETHY FOREST	BADENOCH & STRATHSPEY, HI	S	–	05/04/1989		
258A	KINVEACHY	BADENOCH & STRATHSPEY, HI	S	–			
275A	LOCH VAA	BADENOCH & STRATHSPEY, HI	S				
254A	LOCH ALVIE	BADENOCH & STRATHSPEY, HI	S	–			
223A	RIVER SPEY - INSH MARSHES	BADENOCH & STRATHSPEY, HI	S	R			
303A	TIREE AND COLL	ARGYLL & BUTE, STRATHCLYDE	S	R			
304A	TRESHNISH ISLES	ARGYLL & BUTE, STRATHCLYDE	S	–			
317A	NORTH COLONSAY AND WESTERN CLIFFS	ARGYLL & BUTE, STRATHCLYDE	S	–			
305G	ISLAY: RINNS	ARGYLL & BUTE, STRATHCLYDE	S	R			
305E	ISLAY: GLAC NA CRICHE	ARGYLL & BUTE, STRATHCLYDE	S	R	09/05/1986		
305F	ISLAY: FEUR LOCHAIN	ARGYLL & BUTE, STRATHCLYDE	S	R	09/05/1986		
305A	ISLAY: LOCH GRUINART	ARGYLL & BUTE, STRATHCLYDE	S	R	09/05/1986	14/07/1988	14/07/1988
305B	ISLAY: BRIDGEND FLATS	ARGYLL & BUTE, STRATHCLYDE	S	R	09/05/1986	14/07/1988	14/07/1988
305C	ISLAY: LAGGAN	ARGYLL & BUTE, STRATHCLYDE	S	–	09/05/1986	14/07/1988	
305D	ISLAY: EILEAN NA MUICE DUBHE (DUICH MOSS)	ARGYLL & BUTE, STRATHCLYDE	S	R	09/05/1986	14/07/1988	14/07/1988
305H	ISLAY: THE OA	ARGYLL & BUTE, STRATHCLYDE	S	–			
307A	RHUNAHAORINE	ARGYLL & BUTE, STRATHCLYDE	S	R			
308A	MACHRIHANISH AND TANGY LOCH	ARGYLL & BUTE, STRATHCLYDE	S	R			
318A	SANDA	ARGYLL & BUTE, STRATHCLYDE	S	–			
315A	NORTH END OF BUTE	ARGYLL & BUTE, STRATHCLYDE	S	–			
325A	NORTH ARRAN MOUNTAINS	CUNNINGHAME, STRATHCLYDE	S	–			
309A	AILSA CRAIG	KYLE & CARRICK, STRATHCLYDE	S	–	03/05/1989		
302A	LOCH LOMOND	DUMBARTON, STRATHCLYDE	S	R			P5/01/1976
		STIRLING, CENTRAL					
306A	INNER CLYDE ESTUARY	DUMBARTON, STRATHCLYDE	S	R			
313A	SILVER FLOWE	WIGTOWN, DUMFRIES AND GAL	–	R			24/07/1981
312A	LOCHINCH & TORRS WARREN	WIGTOWN, DUMFRIES AND GAL	S	R			
316A	WIGTOWN BAY	WIGTOWN, DUMFRIES AND GAL	S	R			

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
319A	CASTLE LOCH DUMFRIES	ANNANDALE & ESKDALE, DUMF	S	R			
311A	LOCH KEN AND DEE MARSHES	STEWARTRY, DUMFRIES AND G	S	R			
401A	CAENLOCHAN	ANGUS, TAYSIDE	S	–	01/07/1988		
		PERTH & KINROSS, TAYSIDE					
		GRAMPIAN					
403A	MONTROSE BASIN	ANGUS, TAYSIDE	S	R			
406A	LOCH OF LINTRATHEN	ANGUS, TAYSIDE	S	R			24/07/1981
407A	TAY-ISLA VALLEY	PERTH & KINROSS, TAYSIDE	S	R			
408A	DUPPLIN LOCHS	PERTH & KINROSS, TAYSIDE	S	R			
409A	DRUMMOND LOCHS	PERTH & KINROSS, TAYSIDE	S	R			
410A	CARSEBRECK AND RHYND LOCHS	PERTH & KINROSS, TAYSIDE	S	R			
411A	LOCH LEVEN	PERTH & KINROSS, TAYSIDE	S	R			5/1/1986
230A	DRUMOCHTER HILLS	BADENOCH & STRATHSPEY, HI	S	–	01/07/1988		
		PERTH & KINROSS, TAYSIDE					
402A	RANNOCH MOOR	PERTH & KINROSS, TAYSIDE		R			5/1/1976
		LOCHABER, HIGHLAND					
		ARGYLL & BUTE, STRATHCLYDE					
437A	BEN DUBHCHRAIG	STIRLING, CENTRAL	S				
419A	FLANDERS MOSS AND LAKE OF MENTEITH	STIRLING, CENTRAL	S	R			
412A	FIRTH OF TAY	PERTH & KINROSS, TAYSIDE	S	R			
		DUNDEE, TAYSIDE					
		NE FIFE, FIFE					
414A	EDEN ESTUARY, TENTSMUIR POINT AND ABERTAY SANDS	NE FIFE, FIFE	S	R			
		ANGUS, TAYSIDE					
413A	CAMERON RESERVOIR	NE FIFE, FIFE	S	R			
415A	INNER FIRTH OF FORTH	FALKIRK, CENTRAL	S	R			
		DUNFERMLINE, FIFE					
416A	OUTER FIRTH OF FORTH	E LOTHIAN, LOTHIAN	S	R			
		EDINBURGH, LOTHIAN					
		NE FIFE, FIFE					
		KIRKCALDY, FIFE					
417A	FORTH ISLANDS	E LOTHIAN, LOTHIAN	S	–			
		KIRKCALDY, FIFE					
		NE FIFE, FIFE					
423A	GLADHOUSE RESERVOIR	MIDLOTHIAN, LOTHIAN	S	R	06/08/1986	14/07/1988	14/07/1988
424A	FALA FLOW	MIDLOTHIAN, LOTHIAN	S	R	03/05/1989		
425A	WESTWATER	TWEEDDALE, BORDERS	S	R			
426A	MOORFOOT HILLS	TWEEDDALE, BORDERS		R			
429A	HOSELAW LOCH	ROXBURGH, BORDERS	S	R	29/08/1986	14/07/1988	14/07/1988
428A	GREENLAW MOOR AND HULE MOSS	BERWICK, BORDERS	S	R			
427A	ST ABB'S HEAD TO FAST CASTLE	BERWICK, BORDERS	S	–			
506A	IRTHINGHEAD MIRES	CUMBRIA	–	R			17/7/1985
		NORTHUMBERLAND					
501A	UPPER SOLWAY FLATS AND MARSS	CUMBRIA	S	R	05/07/1988	P1/10/1986 ROCKL	P1/10/1986 ROCKL
		ANNANDALE & ESKDALE, DUMFR					
		NITHSDALE, DUMFRIES & GALL					
521A	SOLWAY MOSSES	CUMBRIA		R			
520A	SHAP FELLS	CUMBRIA	S				
514A	RAVENGLASS	CUMBRIA	–	R			
505A	ESTHWAITE WATER	CUMBRIA	–	R	31/03/1989		
522A	DUDDON MOSSES	CUMBRIA		R			
503A	DUDDON ESTUARY	CUMBRIA	S	R			
508A	MORECAMBE BAY	CUMBRIA	S	R			
		LANCASHIRE					
509A	LEIGHTON MOSS	LANCASHIRE	S	R		28/11/1985	28/11/1985
515A	BOWLAND FELLS	LANCASHIRE	S	–	30/03/1989		
510A	RIBBLE AND ALT ESTUARIES	LANCASHIRE	S	R		P31/8/1982	P28/11/1985 ALT
		MERSEYSIDE					
511A	MARTIN MERE	LANCASHIRE	S	R		28/11/1985	28/11/1985
517A	THORNE AND HATFIELD MOORS	S. YORKSHIRE	S	R			

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
		HUMBERSIDE					
601A	LINDISFARNE	NORTHUMBERLAND	S	R			P5/1/1976
602A	FARNE ISLANDS	NORTHUMBERLAND	S	–		17/7/1985	
613A	NORTHUMBERLAND COAST	NORTHUMBERLAND	S	R			
603A	COQUET ISLAND	NORTHUMBERLAND	S	–		17/7/1985	
604A	HOLBURN MOSS	NORTHUMBERLAND	S	R		17/7/1985	17/7/1985
620A	MUGGLESWICK, STANHOPE AND WOLSINGHAM COMMONS	DURHAM	S				
619A	BOLLIHOPE AND MIDDLETON COMMONS	DURHAM	S				
607A	UPPER TEESDALE & MOOR HOUSE	DURHAM	S	R		P31/8/1982 MOOR HO	
		N YORKSHIRE					
		CUMBRIA					
605A	BOWES MOOR	DURHAM	S				
606A	TEESMOUTH AND CLEVELAND COAST	CLEVELAND	S	R			
616A	SPAUNTON, WHEELDALE, EGTON & GLAISDALE MOORS	N. YORKSHIRE	S	–			
621A	ABBOTSIDE, ASKRIGG AND MALLERSTANG COMMONS	N YORKSHIRE	S				
		CUMBRIA					
608A	MALHAM TARN	N YORKSHIRE		R			
609A	DERWENT INGS	N YORKSHIRE	S	R		17/7/1985	17/7/1985
		HUMBERSIDE					
610A	FLAMBOROUGH HEAD & BEMPTON CLIFFS	HUMBERSIDE	S	–			
617A	HORNSEA MERE	HUMBERSIDE	S	–			
611A	HUMBER FLATS, MARSHES AND COAST	HUMBERSIDE	S	R			
		LINCOLNSHIRE					
513A	MERSEY ESTUARY	MERSEYSIDE	S	R	28/11/1985		
		CHESHIRE					
703A	MIDLAND MERES AND MOSSES	CHESHIRE	–	R			P24/7/1981 ROSTHER
		SHROPSHIRE					
		STAFFORDSHIRE					
702A	PEAK DISTRICT MOORS	DERBYSHIRE	S				
		S YORKSHIRE					
		STAFFORDSHIRE					
705A	WALMORE COMMON	GLOUCESTERSHIRE	S	R			
805A	RUTLAND WATER	LEICESTERSHIRE	S	R	31/03/1989		
803A	NENE WASHES	CAMBRIDGESHIRE	S	R			
804A	OUSE WASHES	CAMBRIDGESHIRE	S	R	28/04/1989		5/1/1976
		NORFOLK					
802A	THE WASH	LINCOLNSHIRE	S	R	14/03/1984	31/03/1988	31/03/1988
		NORFOLK					
802B	THE WASH - GIBRALTAR POINT	LINCOLNSHIRE	S	R			
903A	NORTH NORFOLK COAST	NORFOLK	S	R	18/11/1987	20/01/1989	20/01/1989
922A	DERSINGHAM BOG	NORFOLK	–	R			
904A	ROYDON COMMON	NORFOLK	–	R			
908A	UPPER THURNE BROADS AND MARSHES	NORFOLK	S	R			P5/1/1976 HICKLING
921A	ANT BROADS AND MARSHES	NORFOLK	S	R			
907A	BURE BROADS AND MARSHES	NORFOLK	S	R			P5/1/1976
906A	YARE BROADS AND MARSHES	NORFOLK	S	R			
909A	REDGRAVE AND LOPHAM FENS	NORFOLK	–	R	31/03/1989		
		SUFFOLK					
920A	BRECKLAND HEATHS	NORFOLK	S	–			
		SUFFOLK					
910A	MINSMERE - WALBERSWICK	SUFFOLK	S	R			P5/1/1976
911A	ORFORDNESS - HAVERGATE	SUFFOLK	S	R		P31/8/1982	
923A	CHIPPENHAM FEN	CAMBRIDGESHIRE	–	R			
912A	STOUR AND ORWELL ESTUARY	SUFFOLK	S	R	16/01/1986		
		ESSEX					
913A	HAMFORD WATER	ESSEX	S	R			
914A	ABBERTON RESERVOIR	ESSEX	S	R			24/7/1981
915A	BLACKWATER, COLNE AND DENGIE	ESSEX	S	R			
919A	RIVER CROUCH MARSHES	ESSEX	S	R			
916A	FOULNESS AND MAPLIN SANDS	ESSEX	S	R			

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
917A	BENFLEET AND SOUTHEND MARSHES	ESSEX	S	R	27/05/1987		
1006A	ISLES OF SCILLY COASTAL HABITATS	CORNWALL	S	R			
1014A	TAMAR COMPLEX	DEVON	S	–			
		CORNWALL					
1008A	EXE ESTUARY	DEVON	S	R	01/11/1989		
1005A	TAW AND TORRIDGE ESTUARY	DEVON	S	–			
1003A	SOMERSET LEVELS AND MOORS	SOMERSET	S	R			
1004A	CHEW VALLEY LAKE	AVON	S	–		17/7/1985	
1014B	BODMIN MOOR	CORNWALL	S	–			
1009A	CHESIL BEACH AND THE FLEET	DORSET	S	R		17/7/1985	17/7/1985
1011A	POOLE BASIN	DORSET	S	R			
1010A	HORTON COMMON AND HOLT HEATH	DORSET	S				
1110A	PORTON DOWN	WILTSHIRE	S	–			
		HAMPSHIRE					
1111A	WINDSOR FOREST & GREAT PARK	BERKSHIRE	S	–			
		SURREY					
1109A	AVON VALLEY	HAMPSHIRE	S	R			
1103A	NEW FOREST	HAMPSHIRE	S	R			
1102A	WEST SOLENT MARSHES	HAMPSHIRE	S	–			
		ISLE OF WIGHT					
1106A	SOUTHAMPTON WATER	HAMPSHIRE	S	R			
1112A	WOOLMER FOREST	HAMPSHIRE	S	–			
1101A	CHICHESTER AND LANGSTONE HARBOURS	HAMPSHIRE	S	R	10/12/1985	28/10/1987	28/10/1987
		WEST SUSSEX					
1217A	SW LONDON RESERVOIRS AND GRAVEL PITS	GREATER LONDON	S	R			
		BERKSHIRE					
		SURREY					
1211A	LEE VALLEY	GREATER LONDON	S				
1214A	CHOBHAM TO YATELEY COMMONS	SURREY	S	–			
		HAMPSHIRE					
		BERKSHIRE					
1213A	THURSLEY, HANKLEY AND FRENSHAM COMMONS	SURREY	S	–			
1216A	AMBERLEY	WEST SUSSEX		R			
1204A	PAGHAM HARBOUR	WEST SUSSEX	S	R	12/11/1987	30/04/1988	30/04/1988
1208A	PEVENSEY LEVELS	EAST SUSSEX	S	R			
1209A	DUNGENESS TO PETT LEVELS	KENT	S	R			
		EAST SUSSEX					
1212A	STODMARSH	KENT	S	R			
1202A	SOUTH THAMES MARSHES	KENT	S	R			
1203A	MEDWAY ESTUARY AND MARSHES	KENT	S	R	01/04/1986		
1201A	THE SWALE AND SOUTH SHEPPEY	KENT	S	R		17/7/1985	17/7/1985
1207A	THANET COAST	KENT	S	R			
1301A	DEE ESTUARY	CLWYD	S	R		17/7/1985	17/7/1985
		CHESHIRE					
		MERSEYSIDE					
1311A	BERWYN	CLWYD	S	–			
		POWYS					
		GWYNEDD					
1304A	LLYN IDWAL	GWYNEDD	–	R	06/05/1987		
1305A	LLYN TEGID	GWYNEDD	–	R	22/04/1987		
1313A	MIGNEINT	GWYNEDD		R			
1303A	TRAETH LAFAN, (LAVAN SANDS), CONWAY BAY	GWYNEDD	S	–			
1318A	ANGLESEY FENS	GWYNEDD		R			
1306A	YNYS FEURIG, CEMLYN BAY AND THE SKERRIES	GWYNEDD	S	–			
1310A	HOLY ISLAND COAST	GWYNEDD	S	–			
1312A	GLANNAU ABERDARAN /YNYS ENLLIOAST	GWYNEDD	S	–	18/08/1989		
1401A	CORS FOCHNO AND DYFI	DYFED		R			5/1/1976
		GWYNEDD					
		POWYS					
1411A	ELENYDD - MALLAEN	POWYS	S				

Table 3.1 Proposed and designated SPA and Ramsar sites in Great Britain (List A).

INDEX	SNAME	COUNTY	SPA	RAM	DOEACT	SPADATE	RAMDATE
1412A	CORS CARON	DYFED		R			
1403A	LLANGLOFFEN	DYFED	–	R			
1406A	PEMBROKESHIRE CLIFFS	DYFED	S	–			
1405A	SKOKHOLM AND SKOMER	DYFED	S	–	27/07/1988	P31/8/1982	
1404A	GRASSHOLM	DYFED	S	–		31/1/1986	
1409A	CARMARTHEN BAY	DYFED	S	R			
1501A	BURRY INLET	DYFED	S	R	11/09/1986		
		WEST GLAMORGAN					
1503A	SWANSEA BAY - BLACKPILL	WEST GLAMORGAN	S	R			
1502A	SEVERN ESTUARY	GLOUCESTERSHIRE	S	R		P5/2/1988 UPPER SE	P5/2/1988
		AVON					
		SOMERSET					P5/1/1976
		S GLAMORGAN					
		GWENT					

Table 3.2 Possible SPA and Rasmar sites in Great Britain under consideration (List B).

INDEX	SNAME	COUNTY	SPA	RAM
144A	LOCH-AN-TOMAIN	WESTERN ISLES		
147A	KILPHEDER TO SMERCLATE	WESTERN ISLES		
121A	ISLES AT THE MOUTH OF KYLE OF TONGUE	SUTHERLAND, HIGHLAND		
125A	INCHNADAMPH	SUTHERLAND, HIGHLAND		
158A	MONTANE AREAS	SUTHERLAND, HIGHLAND		
		ROSS & CROMARTY, HIGHLAND		
143A	CANNA	LOCHABER HIGHLAND		–
154A	FANNICH HILLS	ROSS & CROMARTY, HIGHLAND		
280A	MOORLAND AREAS	SHETLAND		
244A	STRONSAY:ROTHIESHOLM HEAD	ORKNEY		–
238A	AUSKERRY	ORKNEY		–
270A	KEELYLANG HILL - WAULKMILL BAY	ORKNEY		–
271A	LOCH OF ISBISTER	ORKNEY		
266A	LOCH OF BROCHAN	ORKNEY		
239A	FLOTTA	ORKNEY		–
259A	CAWDOR OAKWOODS	NAIRN, HIGHLAND		
281A	MOORLAND AREAS	GRAMPIAN		
264A	HADDO HOUSE LOCH	GORDON, GRAMPIAN		
278A	BALLOCHBUIE	KINCARDINE, GRAMPIAN		
276A	FOREST OF BIRSE	KINCARDINE, GRAMPIAN		
262A	CREAG DUBH	BADENOCH & STRATHSPEY, HIGHLAND		
260A	CRAIGELLACHIE	BADENOCH & STRATHSPEY, HIGHLAND		
253A	MONADHLIATH	BADENOCH & STRATHSPEY, HIGHLAND		–
		INVERNESS, HIGHLAND		
261A	CREAG MEAGAIDH	BADENOCH & STRATHSPEY, HIGHLAND		
255A	BEN ALDER	BADENOCH & STRATHSPEY, HIGHLAND		–
320A	LISMORE/BENDERLOCH	ARGYLL & BUTE, STRATHCLYDE		
327A	BLACKSIDE & MILL RIG	CUMNOCK & DOON VALLEY, STRATHCLYDE		
		KILMARNOCK & LOUDOUN, STRATHCLYDE		
		EAST KILBRIDE, STRATHCLYDE		
326A	MOORLAND SITES	DUMFRIES & GALLOWAY		
		STRATHCLYDE		
406A	LOCH OF KINNORDY	ANGUS, TAYSIDE		
434A	LOCHS LUNDIE LONG AND THRIEPLEY	DUNDEE, TAYSIDE		
439A	MOORLAND SITES	TAYSIDE REGION		
438A	MOORLAND, BORDERS AND LOTHIAN	BORDERS		
		LOTHIAN		
626A	ALLENDALE	NORTHUMBERLAND		
625A	NOOKTON EDGE	NORTHUMBERLAND		
624A	HEXHAMSHIRE COMMON	NORTHUMBERLAND		
618A	KELTON FELL	DURHAM		
622A	BIRKS TARN	N YORKSHIRE		
623A	BARDEN MOOR	N YORKSHIRE		
706A	CANNOCK CHASE	STAFFORDSHIRE		–
708A	WYRE FOREST	WORCESTERSHIRE		–
		SHROPSHIRE		
707A	HIGHBURY WOOD	GLOUCESTERSHIRE		–
709A	FOREST OF DEAN	GLOUCESTERSHIRE		–
807A	SHERWOOD	NOTTINGHAMSHIRE		
806A	CAM WASHES	CAMBRIDGESHIRE		
918A	BREYDON WATER AND HALVERGATE	NORFOLK		
1016A	CORNISH CLIFFS	CORNWALL		
1012A	EAST DEVON HEATHS	DEVON		
1110B	SALISBURY PLAIN	WILTSHIRE		
1114A	THATCHAM REEDBEDS	BERKSHIRE		
1113A	ITCHEN VALLEY	HAMPSHIRE		
1105A	PORTSMOUTH HARBOUR	HAMPSHIRE		
1215A	BLEAN WOODS	KENT		
1316A	RUABON MOUNTAIN	CLWYD		–
1317A	HIRAETHOG	CLWYD		–
1314A	LLYN LLYWENAN AND VALLEY LAKES	GWYNEDD		
1416A	PUMLUMON	DYFED		–
1407A	CORS Y LLYN	DYFED		
1408A	MILFORD HAVEN	DYFED		

3.2 Representation of bird habitats within the SPA/Ramsar network

The Council Resolution of 2 April 1979 (Appendix 2) makes it clear that SPAs designated for bird conservation should also facilitate the conservation of biotopes wherever possible. Information on the representation of different biotopes within the network of proposed internationally important sites (as SPA and/or Ramsar sites) has been gathered and is presented in Appendix 5 as a series of maps.

The habitat accounts of Appendix 5 outline the importance of each of these biotopes as bird habitats, as well as indicating general points which are important when NCC determines the boundaries of sites within such habitats. Finally each section indicates the extent to which these bird habitats are currently represented within the proposed SPA network (Table 3.1).

In the accounts in Appendix 5 (and elsewhere in this report), the term 'SPA network' is taken to include those sites listed in Table 3.1, including sites that have been formally designated (Table 1.2), as well as those that NCC is currently proposing for SPA designation.

3.3 Proportions of species populations protected within SPAs

3.3.1 Introduction and data-sources

Information from NCC ornithological data-bases has been used to assess the current totals of birds contained within the SPA site network[1]. These data have been collated from a wide variety of sources, and most are not wholely owned by NCC. Further, many data are held in confidence and commitments have been given to those supplying such information. Because of this and the obvious sensitivity of presenting locational information on rare breeding bird species, it is not possible to present totals broken down by individual sites. Such individual site assessment as is presently required by Government involves a great deal of work on each site. This is not within the scope of the present document, which gives a review of the protection which will be achieved by the designation of the full suite of sites.

Because of the continuing shortage of resources for this work, exacerbated by increased government demands for site-related information, at present not all proposed sites have definitive boundaries. For many sites, boundaries are more or less self-selecting; however, for others more work is needed to define them. The boundaries are confirmed at the time of citation preparation, in liaison with NCC Regional staff, and using information from a variety of other sources. Therefore, whilst the location of sites is well known and their international importance established, precise details of extent are sometimes not available. For this reason species totals for some sites cannot be determined precisely at this stage. Furthermore, populations of birds are dynamic and, as indicated in the species accounts (Appendix 6), many are either declining or expanding. Thus, assessments of numbers can quickly become out of date and misleading, if a period of time elapses before designation. Therefore, totals are approximate. They are presented as indicative of the numbers present on the whole network of sites, rather than as a precise assessment of numbers present. Greater precision will come when each site in turn is formally prepared for designation.

The grand totals of birds either breeding or wintering within the site network have been assessed and presented as a proportion of the relevant population. Information on migrating numbers is more poorly known, and is, of course, complicated by turnover (section 2.4.1). More detailed information on the number of sites of major international importance for each Annex 1 species (and for some other migratory species) is given in sections A.6.2 and A.6.3 respectively.

For wintering wildfowl and waders, the totals usually used in individual site-assessments are the mean (usually over the past five years) of the peak totals counted during the course of the winter. The five-year mean of peaks gives a good general assessment of numbers at that site. For species that are mobile (i.e. which require several different sites to fulfil their requirements at different times), however, the sum of mean peaks is usually greater than the total population of birds. This is because, as birds move between sites on which they depend, they are counted in different months of the winter on different sites. Thus the overall 'total' is inflated as a result of turnover (section 2.4.1), and the sum of the peak means is inappropriate to use to estimate the proportion of populations protected.

The problem of double counting is greatest with flocking birds that move rapidly between different sites (such as certain wildfowl and waders). Where such situations arise, however, they emphasise the need for a network of sites for population protection, as explained in earlier sections. Clearly, if large numbers move between different sites in different months of the winter, this indicates their differing food, weather or social. needs

In the case of such birds, we have assessed the proportion of populations using the SPA network in January (using mean counts where they are available). January is usually the month when the peak numbers occur in Britain for many wildfowl and waders, (although some populations occur in greater numbers during the migration periods: Salmon *et al.* 1988). It is also the month in which

[1] Figures are for the network of proposed and designated sites (Table 3.1), not just for designated sites.

greatest coverage of sites is achieved on both a national (Salmon *et al.* 1988) and international basis (Rüger *et al.* 1986; Monval & Pirot 1989). Most importantly, it is usually the time of least movement between sites (although there are some exceptions). Where some species are the subject of comprehensive population census at other times, we have used that information. This particularly applies to certain goose species.

In assessing the numeric importance of sites, 1% thresholds (section 2.5.3; Table 2.3) are calculated from a nominal international 'population total' for each species. In order to establish some medium-term stability in assessment, the nominal 'international population' is held fixed for some years, even if the true population differs slightly from the nominal total. For some species which have variable breeding success (such as brent geese), numbers may oscillate around an average value. Other species may show long-term declines or increases in numbers. In these cases, international 'population levels' are adjusted periodically, as has recently been undertaken by Pirot *et al.* (1989) and Smit & Piersma (1989) for wildfowl and waders respectively.

It is important to note, however, that real populations are dynamic and their counts may lag behind or exceed nominal 'population totals'. The same is true of national totals. This presents problems in assessing proportions of populations on the suite of Special Protection Areas. Population fluctuations are also relevant to the needs of arctic breeding populations, which often show extreme fluctuations in breeding success and population size (e.g. brent geese and other high arctic waterfowl: sections 2.3 and 2.4.2). Any network of sites needs to be able adequately to protect populations at their peak sizes, otherwise overall the population will decline (because it will have no buffer against periods of lower breeding success or increased mortality). However, such variation in population numbers makes the assessment of numeric importance (on a site or network basis) at any one instant difficult and of questionable usefulness.

3.3.2 Proportions of populations protected

Allowing for the *caveats* given above, it is possible to assess the proportion of different populations protected within the SPA network. Further information on data sources and the total population sizes use are given in section A.6.1.

Divers and grebes

Table 3.3 shows the proportion of diver and grebe populations which will be protected within the proposed SPA network. The proportions of both red-throated and black-throated divers is generally low compared with their provisional Bezzel target figures of 60-79% and 80-100% respectively. However, the boundaries of a number of moorland pSPAs (including several in Shetland) are still to be determined following recent ornithological survey. It is expected that this will substantially increase the proportion of the breeding population of red-throated divers protected by SPAs, although the marine feeding areas are not covered. Additionally there is the need for major special protection measures for divers and grebes in the wider countryside, such as the protection of moorland habitats from afforestation.

A small number of both species winter within the currently proposed SPA network, but fuller protection measures for divers are being considered by Tasker *et al.* (in prep.).

Breeding wildfowl

A significant proportion of the breeding populations of several wildfowl will be contained within the proposed SPA network (Table 3.4). This is especially the case for some rarer species such as common scoter, pintail and native greylag geese. However, some scarce ducks breeding on moorland areas, such as teal and wigeon, have generally low numbers protected within pSPAs.

Although the numbers of these species, and of other breeding wildfowl, will probably increase following determination of boundaries of some moorland sites, the apparent low degree of protection may also relate to generally poor information. Breeding wildfowl are difficult to census, and, with notable exceptions, there is little wide-scale, site-based information available in Britain. (This is in contrast to some other groups of birds such as wintering waders.) We suspect that higher (and in some cases substantially higher) numbers of wildfowl breed within the network of proposed SPAs than is apparent from the limited data available.

Breeding seabirds

Table 3.5 shows the proportions of breeding seabird populations within the proposed SPA network. For highly colonial species such as Sandwich tern, guillemot, razorbill, Leach's petrel and gannet, a very significant proportion of their populations will be protected. Other species (arctic skua, common gull and arctic tern) will have small proportions of their populations protected, when compared with the provisional Bezzel index target. Both for these species, and for other more dispersed breeders such as cormorant and black guillemots, wider conservation measures can play an important role in sustaining range and size of breeding populations. Marine feeding areas, even inshore, are not protected.

Breeding raptors

For all breeding raptor species (Table 3.6), the proportions of birds occurring on the proposed SPA network is less than the target proportions derived from the revised Bezzel index (Table 2.6). This indicates the great requirement for special protection measures in the wider countryside for these species. This is as expected, since such

Table 3.3 Proportions of breeding divers and grebes protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Red-throated diver	Y	1,350	295	22	NW		
Black-throated diver	Y	150	45	30	NW		
Great northern diver	Y	0			NW		
Red-necked grebe		0			NW		
Slavonian grebe	Y	62	20	32	NW	5,125	1
Black-necked grebe		28			NW		

NW – north-west Europe; Y – yes.

Table 3.4 Proportions of breeding wildfowl protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Mute swan		3,150	200	6	NW		
Whooper swan	Y	2			T		
Greylag goose (N Scottish)		2,000	1,485	74	T	2,000	100
Shelduck		15,000	1,000	7	NW		
Wigeon		400	140	35	NW		
Gadwall		550	120	22	NW		
Teal		4,750	210	4	NW		
Mallard		40,000	2,000	5	NW		
Pintail		40	37	93	NW		
Garganey		50	13	26	NW		
Shoveler		1,250	480	38	NW		
Pochard		380	88	23	NW		
Tufted duck		7,000	560	8	NW		
Scaup		2	0	0	NW		
Eider		20,000	2,500	13	NW		
Common scoter		110	60	55	NW		
Goldeneye		87	18	21	NW		
Red-breasted merganser		1,500			NW		
Goosander		1,100			NW		

T – total population; NW – north-west Europe; Y – yes.

Table 3.5 Proportions of breeding seabirds protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs except for guillemot, razorbill, black guillemot and puffin which are counted as individual birds at breeding sites.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Fulmar		531,400	274,000	52	WE	11,568,000	5
Manx shearwater		235,000	141,000	60	WE		
Storm petrel	Y	60,000	35,000	58	T		
Leach's petrel	Y	10,000	10,000	100	WE		
Gannet		158,700	154,500	97	WE	222,200	71
Cormorant		7,000	2,500	36	WC	40,700	17
Shag		36,100	20,250	56	WE	120,800	30
Arctic skua		3,350	1,170	35	WE	17,300	19
Great skua		7,900	5,430	69	WE	13,500	59
Mediterranean gull	Y	4	2	50	WE		
Common gull		47,000	5,420	12	WC	461,000	10
Lesser black-backed gull*		81,600	41,100	50	WC	108,800	75
Great black-backed gull		17,900	7,000	39	WE	83,600	21
Kittiwake		486,900	340,500	70	WE	2,109,000	23
Sandwich tern	Y	15,000	13,200	88	WE	44,500	34
Roseate tern	Y	300	290	97	WE	750	40
Common tern	Y	12,700	4,900	39	WC	92,500	14
Arctic tern	Y	83,000	21,850	26	WC	270,000	31
Little tern	Y	2,350	1,115	47	WE	12,600	19
Guillemot		1,044,000	760,800	73	WE	3,617,000	29
Razorbill		144,500	99,100	69	WE	1,067,000	14
Black guillemot		35,100	6,100	17	WE	213,900	16
Puffin		720,000	455,400	63	WE	22,613,000	3

T – total population; WE – western Europe; WC – western & central Europe *– *graellsii* race; Y – yes.

Table 3.6 Proportions of breeding raptors protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Honey buzzard	Y	30			NW	19,000	<1
Red kite	Y	47			NW	4,750	1
Sea eagle	Y	10			NW	950	1
Marsh harrier	Y	75	8	11	NW	3,110	2
Hen harrier	Y	400	130	33	NW	6,820	6
Montagu's harrier	Y	4	0	0	NW	585	1
Golden eagle	Y	424	66	16	NW	1,560	27
Osprey	Y	52			NW	2,940	2
Merlin (*aesalon* race)	Y	600	155	26	NW	9,000	7
Hobby		1,000			NW	9,000	11
Peregrine (nominate race)	Y	850	90	11	NW	1,585	54

NW – north-west Europe; Y – yes.

wide-ranging birds nest at low densities and require large areas in which to hunt. The need for non site-based special protection measures in upland areas facing extensive land-use changes (such as afforestation with alien conifers) is particularly urgent and, as this analysis shows, is required to fulfil international conservation obligations.

Annex 1 passerines and others

The proportions of summer and winter populations which will be protected within the proposed SPA network are given in Tables 3.7 and 3.8 respectively. Some populations (e.g. Fair Isle wren), will be well protected within the proposed network; others clearly require a combination of wider conservation measures as well as protection of core areas. This applies especially to the kingfisher population, which is poorly represented within the existing site network, but also to chough, Scottish crossbill, nightjar, Dartford warbler and woodlark. Conservation measures for red-backed shrikes came too late. The species is effectively extinct in Britain.

Breeding and wintering waders

The protection which will be given to waders by the SPA network in summer and winter is shown in Tables 3.9 and 3.10 respectively. Generally, the proposed network will give a high level of protection to those breeding populations with very restricted distributions, such as avocet and black-tailed godwit. However, for moorland breeding species, such as dunlin, greenshank, common sandpiper and golden plover, there is an urgent need for further conservation measures. Some needs can be met by further site designations; this is one of the habitats for which further sites are under survey and consideration. Measures in the wider countryside will also be required. This is especially so in the light of recent population losses caused by afforestation of the moorland habitats with alien conifers. Other populations (e.g. lapwing and curlew) occur in high densities on traditionally managed or low-intensity farmland (e.g. Baines 1989). For these species, and others such as corncrakes, conservation effort can and should be directed at support for traditional forms of low-intensity agriculture, whether within protected sites or in the wider countryside.

In winter, many populations occur in estuarine habitats. Some (grey plover and knot) will be adequately protected by the proposed network of sites. Others occur on other coastal habitats as well as on estuaries, and conservation strategies need to make provision for their protection both in areas where they occur at high density and elsewhere. Some populations which occur on non-estuarine areas (purple sandpiper) have low levels of protection within the SPA network. For these species further measures, both on sites and outside, are required to sustain populations.

Wintering wildfowl

Numbers and proportions of populations of wintering wildfowl which will be protected within the SPA network are shown in Table 3.11. The network provides markedly different levels of protection for different populations. Some of the most endangered populations, such as the Svalbard barnacle geese, Bewick's swans and light-bellied brent geese, are well protected. Other goose populations (such as pink-footed, greylag and Greenland white-fronted geese) have adequate proposed protection of roosting sites, but feed extensively in unprotected areas. Certainly for Greenland white-fronted geese there is a requirement for wider conservation measures directed at these feeding grounds (Bignal *et al.* 1988).

Some duck populations, including pintail and wigeon, will be well protected by the proposed network, yet on the whole, ducks in particular require further measures to protect wintering habitat generally. This is especially the case for those with highly specialised requirements.

Generally, sea-ducks are poorly protected within the proposed SPA network, whose sites extend only to low-water mark. However, conservation requirements for these populations are the subject of another current NCC review (Tasker *et al.* in prep.).

General

The suite of sites has been selected to provide for as many of the populations as possible within a limited number of sites. This means that some populations which tend to occur with several others needing protection will be fairly well covered. However, those with particular requirements tend not to achieve the target levels (Table 2.6). Notable amongst these are certain water birds and seabirds which do not form huge colonies; these may require additional sites. These, and raptors, feeding geese and certain passerines, also require measures in the wider countryside. Seabird feeding areas need to be considered separately.

Table 3.7 Proportions of breeding passerines and other species protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs except for capercaille – individual birds, spotted crake – individual males, corncrake – calling birds, and wren – territory-holding males.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Bittern	Y	28	17	61	WC		
Ptarmigan		10,000			NW		
Capercaillie	Y	1,100			NW		
Spotted crake	Y	7			NW		
Corncrake	Y	575	200	35	WE	5,400	11
Short-eared owl	Y	1,000	140	14	NW		
Nightjar	Y	2,000	600	30	NW		
Kingfisher	Y	5,000			NW		
Woodlark	Y	220	76	35	NW		
Fair Isle wren	Y	33	33	100	T	33	100
Redwing		36			NW		
Dartford warbler	Y	500	60	12	NW		
Red-backed shrike	Y	1	0	0	NW		
Chough	Y	262	125	48	NW		
Brambling		2					
Twite		22,500			NW		
Scottish crossbill	Y	350	140	40	T	350	100
Snow bunting		30	23	77	NW		

T – total population; NW – north-west Europe; WE – western Europe; WC – western & central Europe.
Y – yes.

Table 3.8 Proportions of wintering passerines and other species protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are individual birds.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Bittern	Y	110			NW		
Ptarmigan		12,500			NW		
Capercaillie	Y				NW		
Snowy owl		3			NW		
Short eared owl	Y	22,000			NW		
Kingfisher	Y	8,000			NW		
Woodlark	Y	175	40	23	NW		
Shore lark		900			NW		
Fair Isle wren	Y	80	80	100	T	80	100
Redwing		800,000			NW		
Dartford warbler	Y	1,150	340	30	NW		
Chough	Y	742	400	54	NW		
Brambling		920,000			NW		
Twite		100,000			NW		
Scottish crossbill	Y	1,500	700	47	T	1,500	100
Snow bunting		10,000			NW		

T – total population; NW – north west Europe. Y – yes.

Table 3.9 Proportions of breeding waders protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are pairs except for Temminck's stint – individual birds, and ruff – breeding females.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Oystercatcher		38,000	2,500	7	NW+C	218,000	17
Avocet	Y	385	345	90	NW+C	19,300	2
Stone curlew	Y	145	20	14	NW+C	13,500	1
Little ringed plover		608	10	2	NW+C	22,500	3
Ringed plover (nominate race)		8,400	2,400	29	NW+C	13,100	64
Kentish plover		1	0	0	NW+C	8,000	<1
Dotterel	Y	860	220	26	NW+C	36,500	2
Golden plover	Y	23,000	5,300	23	NW+C	609,000	4
Lapwing		215,000	5,400	3	NW+C	869,000	25
Temminck's stint		6	6	100	NW+C	25,400	<1
Purple sandpiper		2	1	50	NW+C	54,000	<1
Dunlin (temperate *schinzii*)		9,150	6,200	68	T	11,100	82
Ruff	Y	11	10	91	NW+C	247,000	<1
Snipe		30,000	2,600	9	NW+C	841,000	4
Woodcock		21,500			NW+C	347,000	6
Black-tailed godwit		54	35	65	NW+C	133,000	<1
Whimbrel (nominate race)		465	100	22	NW+C	203,000	<1
Curlew (nominate race)		35,500	1,400	4	NW+C	125,000	28
Redshank (nominate race)		32,500	3,900	12	NW+C	268,000	12
Greenshank		1,545	660	43	NW+C	109,000	1
Wood sandpiper	Y	7	3	43	NW+C	577,000	<1
Common sandpiper		18,500	650	4	NW+C	882,000	2
Turnstone		1					
Red-necked phalarope	Y	19			NW+C	150,000	<1

T – total population; NW – north-west Europe; NW+C – north-west & central Europe. Y – yes.

Table 3.10 Proportions of wintering waders protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are individual birds.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Oystercatcher		279,500	211,000	75	EAF	874,000	32
Avocet	Y	500	350	70	EAF	67,000	1
Ringed plover (nominate race)		23,040	11,300	49	EAF	48,000	48
Golden plover	Y	200,000	24,200	12	EAF	1,000,000	20
Grey plover		21,250	19,500	92	EAF	168,000	13
Lapwing		1,000,000	62,200	6	EAF	2,000,000	50
Knot (*islandica* race)		222,830	216,700	97	EAF	345,000	65
Sanderling		13,710	8,400	61	EAF	123,000	11
Little stint		20			EAF	211,000	<1
Purple sandpiper		16,140	5,300	33	EAF	50,000	32
Dunlin (*alpina* race)		433,000	393,000	91	EAF	1,373,000	32
Ruff	Y	1,500	340	23	EAF	1,000,000	<1
Jack snipe		15,000	100	1	EAF		
Snipe			2,100		EAF	1,000,000	<1
Woodcock					EAF		
Black -tailed godwit (*islandica*)		4,770	3,800	80	EAF	66,000	7
Bar-tailed godwit (nominate)		60,810	49,500	81	EAF	115,000	53
Curlew (nominate race)		91,200	47,500	52	EAF	348,000	26
Spotted redshank		200			EAF	6,500	3
Redshank		75,400	48,300	64	EAF	109,000	69
Greenshank		400	90	23	EAF	19,000	2
Green sandpiper		300			EAF		
Common sandpiper		40	27	68	EAF	39,000	<1
Turnstone		44,480	8,000	40	EAF	67,000	66

EAF – east Atlantic flyway. Y – yes.

Table 3.11 Proportions of wintering wildfowl protected within the Great Britain SPA network. Where no information is currently available the cell is left blank. Units are individual birds. For geese, site protection relates mainly to roosts and semi-natural feeding areas. Wider countryside measures are usually more appropriate for protection on their farmland feeding areas.

Species	Annex 1	British population Number	No. in SPAs	% in SPAs	International population Area	Number	% of international population in Britain
Mute swan		18,000	4,300	24	NW+C	180,000	10
Bewick's swan	Y	7,000	5,800	83	WC	17,000	41
Whooper swan	Y	6,000	2,100	35	T	17,000	35
Bean goose		450	0	0	NW	80,000	<1
Pink footed goose		110,000	103,000	94	T	110,000	100
European white-fronted goose		6,000	4,100	68	NW	300,000	2
Greenland white-fronted goose	Y	10,000	8,500	85	T	22,000	45
Greylag goose (N Scottish)		2,000			T	2,000	100
Greylag goose (Icelandic)		100,000	66,100	66	T	100,000	100
Greenland barnacle goose	Y	27,000	21,600	80	T	32,000	63
Svalbard barnacle goose	Y	10,000	10,000	100	T	10,000	100
Light-bellied brent goose		3,000	3,000	100	T	4,000	75
Dark-bellied brent goose		90,000	78,300	87	T	170,000	53
Shelduck		75,000	41,000	55	NW	250,000	30
Wigeon		250,000	185,000	74	NW	750,000	33
Gadwall		6,000	2,500	42	NW	12,000	50
Teal		100,000	44,500	45	NW	400,000	25
Mallard		500,000	50,000	10	NW	5,000,000	10
Pintail		25,000	19,800	79	NW	70,000	36
Shoveler		9,000	3,300	37	NW	40,000	23
Pochard		50,000	8,000	16	NW	350,000	14
Tufted duck		60,000	12,700	21	NW	750,000	8
Scaup		4,000	2,600	65	NW	150,000	3
Eider		50,000	29,000	58	WP	3,000,000	2
Long-tailed duck		20,000	300	2	NW	2,000,000	1
Common scoter		35,000	14,200	41	WP	800,000	4
Velvet scoter		3,000	2,000	67	WP	250,000	1
Goldeneye		15,000	7,200	48	NW	300,000	5
Smew		50			NW	15,000	<1
Red-breasted mergsanser		10,000	4,200	42	NW	100,000	10
Goosander		5,500	2,100	38	NW	125,000	4

T – total population; NW – north west Europe; WC – western & central Europe; NW+C – north west and central Europe; WP – western Palearctic. Y – yes.

4 Conclusions

"Concern over loss of shorebird habitats does not relate simply to the threat to a population of wild birds. Shorebirds concentrate in particular places because such areas are especially biologically productive, and it is the biological productivity of these areas upon which many human activities are based. Shorebirds are, in fact, excellent indicators not only of the productivity of a particular area, but also of its biological health. The continued biological function of ecosystems upon which birds depend is thus of vital concern to human populations. As our world becomes more heavily developed and polluted, shorebirds can serve as a valuable indicator of problems that will certainly also affect mankind. With their long migrations spanning the hemisphere, they draw attention to environmental concerns on an international scale. The challenge of maintaining healthy shorebird populations is directly related to our own future survival." (Morrison & Ross 1989).

Such concerns relate not only to shorebirds. The monitoring of the decline of Peregrines and other birds of prey gave early warning of the build up of persistent toxic chemicals within a food chain culminating in mankind. However, if bird populations are to serve mankind by acting as canaries once did in mines – warning of unseen future threats – then mankind must serve bird populations by ensuring the survival of viable populations throughout their range of distribution. This means that a variety of actions need to be taken now in the full implementation of measures under the EEC Birds Directive.

Some species although very widespread, may occur at low densities. This means that significant proportions of a breeding or wintering population cannot be protected on nature reserves or by other 'site-based' conservation mechanisms alone, even though protected sites will provide a component of a conservation strategy for most species. For populations occurring naturally at low densities, wider countryside policies are needed which will sustain and enhance existing populations. Such needs are being addressed for certain species through several of NCC's research programmes such as that concerning birds of low-intensity agricultural land (e.g. Bignal *et al.* 1988), and other dispersed birds (Galbraith & Pienkowski in press; Pienkowski in press).

Other species occur more patchily or at high densities, and significant proportions of populations can be conserved within a network of protected areas (section 3.3). Protection of 'sites' (breeding, feeding, roosting or other areas), does not mean that no further conservation measures are required for bird populations. Even if the breeding habitat of, for example, a bird of prey is secured, it will still be vulnerable to a great variety of adverse influences, such as build-up of toxic chemicals in food, disturbance at the nest or deliberate persecution. These wider challenges will also need to be addressed. Other species, such as certain geese, may be well protected at roosts where they gather in large numbers, but feed extensively over unprotected areas during the day. Thus each species ultimately needs a strategy designed to provide for its particular ecological needs. One of our aims has been to combine the requirements of diverse assemblages of species in the approach to both site-related and wider countryside conservation, so as to maximise the degree of protection within the sites or by other measures.

The EEC Birds Directive lays strong but reasonable emphasis on the need for effective bird conservation. It stresses practical aims:
"...the preservation, maintenance or restoration of a sufficent diversity and area of habitats is essential to the conservation of all species of birds;
...certain species of birds should be the subject of special conservation measures concerning their habitats in order to ensure their survival and reproduction in their area of distribution,
...such measures must also take account of migratory species and be coordinated with a view to setting up a coherent whole..."

Such aims give the framework for a series of practical conservation measures that are ecologically based and which directly relate to ways of enhancing survival of bird populations. The many examples given in section 2.4 show that sustaining healthy populations requires more than just drawing minimalist boundaries around areas of high bird concentrations. A great variety of considerations need to be taken into account and these vary not only with species and habitat but also with time.

Our trusteeship of nature will be promoted by the network of Special Protection Areas and recommendations for wider countryside actions presented here.

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Appendix 1

25.4.79 Official Journal of the European Communities No L 103/1

II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DIRECTIVE

of 2 April 1979

on the conservation of wild birds

(79/409/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas the Council declaration of 22 November 1973 on the programme of action of the European Communities on the environment (4) calls for specific action to protect birds, supplemented by the resolution of the Council of the European Communities and of the representatives of the Governments of the Member States meeting within the Council of 17 May 1977 on the continuation and implementation of a European Community policy and action programme on the environment (5);

Whereas a large number of species of wild birds naturally occurring in the European territory of the Member States are declining in number, very rapidly in some cases; where as this decline represents a serious threat to the conservation of the natural environment, particularly because of the biological balances threatened thereby;

Whereas the species of wild birds naturally occurring in the European territory of the Member States are mainly migratory species; whereas such species constitute a common heritage and whereas effective bird protection is typically a trans-frontier environment problem entailing common responsibilities;

Whereas the conditions of life for birds in Greenland are fundamentally different from those in the other regions of the European territory of the Member States on account of the general circumstances and in particular the climate, the low density of population and the exceptional size and geographical situation of the island;

Whereas therefore this Directive should not apply to Greenland;

Whereas the conservation of the species of wild birds naturally occurring in the European territory of the Member States is necessary to attain, within the operation of the common market, of the Community's objectives regarding the improvement of living conditions, a harmonious development of economic activities throughout the Community and a continuous and balanced expansion, but the necessary specific powers to act have not been provided for in the Treaty;

Whereas the measures to be taken must apply to the various factors which may affect the numbers of birds, namely the repercussions of man's activities and in particular the destruction and pollution of their habitats, capture and killing by man and the trade resulting from such practices; whereas the stringency of such measures should be adapted to the particular situation of the various species within the framework of a conservation policy;

(1) OJ No C 24, 1.2.1977, p. 3; OJ No C 201, 23.8.1977, p. 2.
(2) OJ No C 163, 11.7.1977, p. 28.
(3) OJ No C 152 29.6.1977, p. 3.
(4) OJ No C 112, 20.12.1973, p. 40.
(5) OJ No C 139, 13.6.1977, p. 1.

Whereas conservation is aimed at the long-term protection and management of natural resources as an integral part of the heritage of the peoples of Europe; whereas it makes it possible to control natural resources and governs their use on the basis of the measures necessary for the maintenance and adjustment of the natural balances between species as far as is reasonably possible;

Whereas the preservation, maintenance or restoration of a sufficient diversity and area of habitats is essential to the conservation of all species of birds; whereas certain species of birds should be the subject of special conservation measures concerning their habitats in order to ensure their survival and reproduction in their area of distribution; whereas such measures must also take account of migratory species and be coordinated with a view to setting up a coherent whole;

Whereas, in order to prevent commercial interests from exerting a possible harmful pressure on exploitation levels it is necessary to impose a general ban on marketing and to restrict all derogation to those species whose biological status so permits, account being taken of the specific conditions obtaining in the different regions;

Whereas, because of their high population level, geographical distribution and reproductive rate in the Community as a whole, certain species may be hunted, which constitutes acceptable exploitation; where certain limits are established and respected, such hunting must be compatible with maintenance of the population of these species at a satisfactory level;

Whereas the various means, devices or methods of large-scale or non-selective capture or killing and hunting with certain forms of transport must be banned because of the excessive pressure which they exert or may exert on the numbers of the species concerned;

Whereas, because of the importance which may be attached to certain specific situations, provision should be made for the possibility of derogations on certain conditions and subject to monitoring by the Commission;

Whereas the conservation of birds and, in particular, migratory birds still presents problems which call for scientific research; whereas such research will also make it possible to assess the effectiveness of the measures taken;

Whereas care should be taken in consultation with the Commission to see that the introduction of any species of wild bird not naturally occurring in the European territory of the Member States does not cause harm to local flora and fauna;

Whereas the Commission will every three years prepare and transmit to the Member States a composite report based on information submitted by the Member States on the application of national provisions introduced pursuant to this Directive;

Whereas it is necessary to adapt certain Annexes rapidly in the light of technical and scientific progress; whereas, to facilitate the implementation of the measures needed for this purpose, provision should be made for a procedure establishing close cooperation between the Member States and the Commission in a Committee for Adaptation to Technical and Scientific Progress,

HAS ADOPTED THIS DIRECTIVE:

Article 1

1. This Directive relates to the conservation of all species of naturally occurring birds in the wild state in the European territory of the Member States to which the Treaty applies. It covers the protection, management and control of these species and lays down rules for their exploitation.

2. It shall apply to birds, their eggs, nests and habitats.

3. This Directive shall not apply to Greenland.

Article 2

Member States shall take the requisite measures to maintain the population of the species referred to in Article 1 at a level which corresponds in particular to ecological, scientific and cultural requirements, while taking account of economic and recreational requirements, or to adapt the population of these species to that level.

Article 3

1. In the light of the requirements referred to in Article 2, Member States shall take the requisite measures to preserve, maintain or re-establish a sufficient diversity and area of habitats for all the species of birds referred to in Article 1.

2. The preservation, maintenance and re-establishment of biotopes and habitats shall include primarily the following measures:

(a) creation of protected areas;

(b) upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones;

(c) re-establishment of destroyed biotopes;

(d) creation of biotopes.

Article 4

1. The species mentioned in Annex I shall be the subject of special conservation measures concerning their habitat in order to ensure their survival and reproduction in their area of distribution.

In this connection, account shall be taken of:

(a) species in danger of extinction;

(b) species vulnerable to specific changes in their habitat;

(c) species considered rare because of small populations or restricted local distribution;

(d) other species requiring particular attention for reasons for the specific nature of their habitat.

Trends and variations in population levels shall be taken into account as a background for evaluations.

Member States shall classify in particular the most suitable territories in number and size as special protection areas for the conservation of these species, taking into account their protection requirements in the geographical sea and land area where this Directive applies.

2. Member States take similar measures for regulary occurring migratory species not listed in Annex I, bearing in mind their need for protection in the geographical sea and land area where this Directive applies, as regards their breeding, moulting and wintering areas and staging posts along their migration routes. To this end, Member States shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance.

3. Member States shall send the Commission all relevant information so that it may take appropriate initiatives with a view to the coordination necessary to ensure that the areas provided for in paragraphs 1 and 2 above form a coherent whole which meets the protection requirements of these species in the geographical sea and land area where this Directive applies.

4. In respect of the protection areas referred to in paragraphs 1 and 2 above, Member States shall take appropriate steps to avoid pollution or deterioration of habitats or any disturbances affecting the birds, in so far as these would be significant having regard to the objectives of this Article. Outside these protection areas, Member States shall also strive to avoid pollution or deterioration of habitats.

Article 5

Without prejudice to Articles 7 and 9, Member States shall take the requisite measures to establish a general system of protection for all species of birds referred to in Article 1, prohibiting in particular:

(a) deliberate killing or capture by any method;

(b) deliberate destruction of, or damage to, their nests and eggs or removal of their nests;

(c) taking their eggs in the wild and keeping these eggs even if empty;

(d) deliberate disturbance of these birds particularly during the period of breeding and rearing, in so far as disturbance would be significant having regard to the objectives of this Directive;

(e) keeping birds of species the hunting and capture of which is prohibited.

Article 6

1. Without prejudice to the provisions of paragraphs 2 and 3, Member States shall prohibit, for all the bird species referred to in Article 1, the sale, transport for sale, keeping for sale and the offering for sale of live or dead birds and of any readily recognizable parts or derivatives of such birds.

2. The activities referred to in paragraph 1 shall not be prohibited in respect of the species referred to in Annex III/1, provided that the birds have been legally killed or captured or otherwise legally acquired.

3. Member States may, for the species listed in Annex III/2, allow within their territory the activities referred to in paragraph 1, making provision for certain restrictions, provided the birds have been legally killed or captured or otherwise legally acquired.

Member States wishing to grant such authorization shall first of all consult the Commission with a view to examining jointly with the latter whether the marketing of specimens of such species would result or could reasonably be expected to result in the population levels, geographical distribution or reproductive rate of the species being endangered throughout the Community. Should this examination prove that the intended authorization will, in the view of the Commission, result in any one of the aforementioned species being thus endangered or in the possibility of their being thus endangered, the Commission shall forward a reasoned recommendation to the Member State concerned stating its opposition to the marketing of the species in question. Should the Commission consider that no such risk exists, it will inform the Member State concerned accordingly.

The Commission's recommendation shall be published in the *Official Journal of the European Communities*.

Member States granting authorization pursuant to this paragraph shall verify at regular intervals that the conditions governing the granting of such authorization continue to be fulfilled.

4. The Commission shall carry out studies on the biological status of the species listed in Annex III/3 and on the effects of marketing on such status.

It shall submit, at the latest four months before the time limit referred to in Article 18 (1) of this Directive, a report and its proposals to the Committee referred to in Article 16, with a view to a decision on the entry of such species in Annex III/2.

Pending this decision, the Member States may apply existing national rules to such species without prejudice to paragraph 3 hereof.

Article 7

1. Owing to their population level, geographical distribution and reproductive rate throughout the Community, the species listed in Annex II may be hunted under national legislation. Member States shall ensure that the hunting of these species does not jeopardize conservation efforts in their distribution area.

2. The species referred to in Annex II/1 may be hunted in the geographical sea and land area where this Directive applies.

3. The species referred to in Annex II/2 may be hunted only in the Member States in respect of which they are indicated.

4. Member States shall ensure that the practice of hunting, including falconry if practised, as carried on in accordance with the national measures in force, complies with the principles of wise use and ecologically balanced control of the species of birds concerned and that this practice is compatible as regards the population of these species, in particular migratory species, with the measures resulting from Article 2. They shall see in particular that the species to which hunting laws apply are not hunted during the rearing season nor during the various stages of reproduction. In the case of migratory species, they shall see in particular that the species to which hunting regulations apply are not hunted during their period of reproduction or during their return to their rearing grounds. Member States shall send the Commission all relevant information on the practical application of their hunting regulations.

Article 8

1. In respect of the hunting, capture or killing of birds under this Directive, Member States shall prohibit the use of all means, arrangements or methods used for the large-scale or non-selective capture or killing of birds or capable of causing the local disappearance of a species, in particular the use of those listed in Annex IV (a).

2. Moreover, Member States shall prohibit any hunting from the modes of transport and under the conditions mentioned in Annex IV (b).

Article 9

1. Member States may derogate from the provisions of Article 5, 6, 7 and 8, where there is no other satisfactory solution, for the following reasons:

(a)—in the interests of public health and safety,

—in the interests of air safety,

—to prevent serious damage to crops, livestock, forests, fisheries and water,

—for the protection of flora and fauna;

(b) for the purposes of research and teaching, of re-population, of re-introduction and for the breeding necessary for these purposes;

(c) to permit, under strictly supervised conditions and on a selective basis, the capture, keeping or other judicious use of, certain birds in small numbers.

2. The derogations must specify:

—the species which are subject to the derogations,

—the means, arrangements or methods authorized for capture or killing,

—the conditions of risk and the circumstances of time and place under which such derogations may be granted,

—the authority empowered to declare that the required conditions obtain and to decide what means, arrangements or methods may be used, within what limits and by whom,

—the controls which will be carried out.

3. Each year the Member States shall send a report to the Commission on the implementation of this Article.

4. On the basis of the information available to it, and in particular the information communicated to it pursuant to paragraph 3, the Commission shall at all times ensure that the consequences of these derogations are not incompatible with this Directive. It shall take appropriate steps to this end.

Article 10

1. Member States shall encourage research and any work required as a basis for the protection, management and use of the population of all species of bird referred to in Article 1.

2. Particular attention shall be paid to research and work on the subjects listed in Annex V. Member States shall send the Commission any information required to enable it to take appropriate measures for the coordination of the research and work referred to in this Article.

Article 11

Member States shall see that any introduction of species of bird which do not occur naturally in the wild state in the European territory of the Member States does not prejudice the local flora and fauna. In this connection they shall consult the Commission.

Article 12

1. Member States shall forward to the Commission every three years, starting from the date of expiry of the time limit referred to in Article 18 (1), a report on the implementation of national provisions taken thereunder.

2. The Commission shall prepare every three years a composite report based on the information referred to in paragraph 1. That part of the draft report covering the information supplied by a Member State shall be forwarded to the authorities of he Member State in question for verification. The final version of the report shall be forwarded to the Member States.

Article 13

Application of the measures taken pursuant to this Directive may not lead to deterioration in the present situation as regards the conservation of species of birds referred to in Article 1.

Article 14

Member States may introduce stricter protective measures than those provided for under this Directive.

Article 15

Such amendments as are necessary for adapting Annexes I to V to this Directive to technical and scientific progress and the amendments referred to in the second paragraph of Article 6 (4) shall be adopted in accordance with the procedure laid down in Article 17.

Article 16

1. For the purposes of the amendments referred to in Article 15 of this Directive, a Committee for the Adaptation to Technical and Scientific Progress (hereinafter called 'the Committee'), consisting of representatives of the Member States and chaired by a representative of the Commission, is hereby set up.

2. The Committee shall draw up its rules of procedure.

Article 17

1. Where the procedure laid down in this Article is to be followed, matters shall be referred to the Committee by its chairman, either on his own initiative or at the request of the representative of a Member State.

2. The Commission representative shall submit to the Committee a draft of the measures to be taken. The Committee shall deliver its opinion on the draft within a time limit set by the chairman having regard to the urgency of the matter. It shall act by a majority of 41 votes, the votes of the Member States being weighted as provided in Article 148 (2) of this Treaty. The chairman shall not vote.

3. (a) The Commission shall adopt the measures envisaged where they are in accordance with the opinion of the Committee.

(b) Where the measures envisaged are not in accordance with the opinion of the Committee, or if no opinion is delivered, the Commission shall without delay submit a proposal to the Council concerning the measures to be adopted. The Council shall act by a qualified majority.

(c) If, within three months of the proposal being submitted to it, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 18

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive within two years of its notification. They shall forthwith inform the Commission thereof.

2. Member States shall communicate to the Commission the texts of the main provisions of national law which they adopt in the field governed by this Directive.

Article 19

This Directive is addressed to the Member States.

Done at Luxembourg, 2 April 1979.

For the Council

The President

J. FRANCOIS-PONCET

BILAG — ANHANG — ΠΑΡΑΡΤΗΜΑ — ANNEX — ANNEXE — ALLEGATO — BIJLAGE

	Dansk	Deutsch	Ἑλληνιχά	English	Francais	Italiano	Nederlands
1. Gavia arctica	Sortstrubet Lom	Prachttaucher	Ααμπροβούτι	Black-throated Diver	Plongeon arctique	Strolaga mezzana	Parelduiker
2. Gavia stellata	Rodstrubet Lom	Sterntaucher	Κμλδοβούσι	Red-throated Diver	Plongeon catmarin	Strolaga minore	Roodkeelduiker
3. Gavia immer	Islom	Eistaucher	Ηαγοβοΐτι	Great Northern Diver	Plongeon imbrin	Stolaga maggiore	IJsduiker
4. Podiceps auritus	Nordisk Lappedykker	Ohrentaucher	Ωτοβοττηχτάρα	Slavonian Grebe	Grébe esclavon	Svasso cornuto	Kuifduiker
5. Calonectris diomedea	Kuhls Skåpe	Gelbschnabelsturmtaucher	Αρτέμιζ	Cory's Shearwater	Puffin cendré	Berta maggiore	Kuhls Pijlstormvogel
6. Hydrobates pelagicus	Lille Stormsvale	Sturmschwalbe	Πετρίλοζ	Storm Petrel	Pétrel tempête	Uccello delle tempeste	Stormvogeltje
7. Oceanodroma leucorhoa	Stores Stormsvale	Wellenläufer	Κυματοβατής	Leach's Storm-petrel	Pêtrel culblanc	Uccello delle tempeste codaforcuta	Vaal Stormvogeltje
8. Phalacrocorax carbo sinensis	Skarv (kontinental underart)	Kormoran (kontinentale Unterart)	Κορμοάνοζ (Ηαετρωτικη φυλη)	Cormorant (continental subspecies)	Grand Cormoran (sous-espéce continentale)	Cormorano (sottospecie continentale)	Aalscholver (continentale ondersoort)
9. Phalacrocorax aristotelis desmarestii	Topskarv (Middelhavs-underart)	Krähenscharbe (Mittelmeer-Unterart)	Θαλασσοκόαρακαζ	Shag (Mediterranean subspecies)	Cormoran huppé (sous-espéce méditerranéenne)	Marangone dal ciuffo (sottospecie del Mediterraneo)	Kuifaalscholver (Middelandse Zee ondersoort)
10. Phalacrocorax pygmeus	Dværgskarv	Zwergscharbe	Ααγγόνα	Pygrmy Cormorant	Cormoran pygmée	Marangone minore	Dwergaalscholver
11. Pelecanus onocrotalus	Almindelig Pelikan	Rosapelikan	Ροδοπελεκάνοζ	White Pelican	Pélican blanc	Pellicano	Pelikaan
12. Pelecanus crispus	Kroltoppet Pelikan	Krauskopfpelikan	Αργυροπελεκάνοζ	Dalmatian Pelican	Pélican frisé	Pellicano riccio	Kroeskoppelikaan
13. Ixobrychus minutus	Dværghejre	Zwergrohrdommel	Ναnομουγκανά	Little Bittern	Blongios nain (Butor blongios)	Tarabusino	Woudaapje
14. Botaurus stellaris	Rordrum	Robrdommel	Τρανομουγκάνα	Bittern	Butor étoilé	Tarabuso	Roedomp
15. Nycticorax nycticorax	Nathejre	Nachtreiher	Νυχτοκόρακαζ	Night Heron	Héron bihoreau	Nitticora	Kwak
16. Ardeola ralloides	Tophejre	Rallenreiher	Κρυπτοτικνιάζ	Squacco Heron	Héron crabier	Sgarza ciuffetto	Ralreiger

	Dansk	Deutsch	Ελληνικά	English	Francais	Italiano	Nederlands
17. Egretta garzetta	Silkehejre	Seidenreiher	Ασυκοτστκνιάζ	Little Egret	Aigrett garzette	Garzetta	Kleine Zilverreiger
18. Egretta alba	Solvehejre	Silberreiher	Αργυροτστκντάζ	Great White Egret	Grande aigrette	Airone bianco maggiore	Grote Zilverreiger
19. Ardea purpurea	Purpurhejre	Purpurreiher	Πορφυροτοικνιάζ	Purple Heron	Héron pourpré	Airone rosso	Purperreiger
20. Ciconia nigra	Sort Stork	Schwarzstorch	Μαυροπελαργός	Black Stork	Cigogne noire	Çicogna nera	Zwarte Ooievaar
21. Ciconia ciconia	Hvid Stork	Weißstorch	Λευκοπελαργός	White Stork	Cigogne blanche	Cicogna bianca	Ooievaar
22. Plegadis falcinellus	Sort Ibis	Sichler	Χαλκόκοτα	Glossy Ibis	Ibis falcinelle	Mignattaio	Zwarte Ibis
23. Platalea leucorodia	Skestork	Löffler	Χουλιαρομυτα	Spoonbill	Spatule blanche	Spatola	Lepelaar
24. Phoenicopterus ruber	Flamingo	Flamingo	Φλαμίγκο	Greater Flamingo	Flamant rose	Fenicottero	Flamingo
25. Cygnus columbianus bewickii (Cygnus bewickii)	Pibesvane	Zwergschwan	Νανόκυκνος	Bewick's Swan	Cygne de Bewick	Cigno minore	Kleine Zwaan
26. Cygnus cygnus	Sangsvane	Singschwan	Αγρόκυκνος	Whooper Swan	Cygne sauvage	Cigno selvatico	Wilde Zwaan
27. Answer albifrons flavirostris	Blisgås (grønlandsk underart)	Blaßgans (Grönland-Unterart)	Ασπρομετωπόχηνα (Φηληης Γριλανδιαζ)	White-fronted Goose (Greenland subspecies)	Oie ricuse (sous-espéce du Groenland)	Oca lombardella (sottospecie di Groenlandia)	Groenlandse Kolghans
28. Anser erythropus	Dværggås	Zwerggans	Νανόχηνα	Lesser White-fronted Goose	Oie naine	Oca lombardella minore	Dwerggans
29. Branta leucopsis	Bramgås	Nonnengans	Λαπρομαγουλόχηνα	Barnacle Goose	Bernache nonnette	Oca facciabianca	Brandgans
30. Branta ruficollis	Rodhalset Gås	Rothalsgans	Κοκκινολαιμόχηνα	Red-breasted Goose	Bernache ä cou roux	Oca collorosso	Roodhalsgans
31. Tadorna ferruginea	Rustand	Rostgans	Καστανόχηνα	Ruddy Shelduck	Tadorne casarca	Casarca	Casarca
32. Aythya nyroca	Hvidojet And	Moorente	Βαλτόπαπια	White-eyed Pochard	Fuligule nyroca	Moretta tabaccata	Witoogeend
33. Oxyura leucocephala	Hvidhovedet And	Weißkopf-Ruderente	Κεφαλούδι	White-headed Duck	Erismature á tête blanche	Gobbo rugginoso	Whitkopeend
34. Pernis apivorus	Hvepsevåge	Wespenbussard	Σφηκοβαρβακίνο	Honey Buzzard	Bondrée apivore	Falco pecchiaiolo	Wespendief
35. Milvus migrans	Sort Glente	Schwarzmilan	Τσίφτης	Black Kite	Milan noir	Nibbio bruno	Zwarte Wouw

	Dansk	Deutsch	Ελληνικά	English	Francais	Italiano	Nederlands
36. Milvus milvus	Rod Glente	Rotmilan	Ψαλιδάρης	Red Kite	Milan royal	Nibbio reale	Rode Wouw
37. Haliacetus albicilla	Havorn	Seeadler	Θαλασαετός	White-tailed Eagle	Pygargue á queue blanche	Aquila di mare	Zeearend
38. Gypactus barbatus	Lammegrib	Bartgeier	Γυπαετός	Bearded Vulture	Gypaéte barbu	Avvoltoio degli agnelli	Lammergier
39. Neophron percnopterus	Ådselgrip	Schmutzgeier	Δσπροπόπης	Egyptian Vulture	Percnoptère d'Egypte	Capovaccaio	Aasgier
40. Gyps fulvus	Gåsegrip	Gänsegeier	Ορυιο	Griffon Vulture	Vautour fauve	Grifone	Vale Gier
41. Aegypius monachu	Munkegrip	Mönchsgeier	Μαυρόγυπαζ	Black Vulture	Vautour moine	Avvoltoio	Monniksgier
42. Circaetus gallicus	Slangeorn	Schlangenadler	Φισαετός	Short-toed Eagle	Circaète jean-le-blanc	Biancone	Slangenarend
43. Circus aeruginosus	Rorhøg	Rohrweihe	Καλαμόκιρκος	Marsh Harrier	Busard des roseaux	Falco di palude	Bruine Kiekendief
44. Circus cyaneus	Blå Kærhøg	Kornweihe	Βαλτόκιρκος	Hen Harrier	Busard saint-martin	Albanella reale	Blauwe Kiekendief
45. Circus macrourus	Steppehog	Steppenweihe	Στεπόκιρκος	Pallid Harrier	Busard Pâle	Albanella pallida	Steppenkickendief
46. Circus pygargus	Hedehøg	Wiesenweihe	Διβαδόκιρκος	Montagu's Harrier	Busard cendré	Albanella minore	Grauwe Kickendief
47. Accipiter brevipes	Kortløbet Spurvehøg	Kurzfangsperber	Σαίνη	Levant Sparrowhawk	Épervier à pieds courts	Sparviere levantino	Balkansperwer
48. Accipiter gentilis arrigonii	Duchøg (Korsikansk-sardinsk underart)	Habieht (Korsika-Sardinien-Unterart)	Διπλοσάλνο (Φυλη της Κορσικής Σαρδυνία)	Goshawk (Corsican-Sardinian subspecies)	Autour des palombes (sous-espèce de Corse-Sardaigne)	Astore (sottospecie di Corsica-Sardegna)	Havik (ondersoort van Corsica-Sardinië)
49. Butco rufinus	Ørnevåge	Adlerbussard	Αετοβαρβαχίυα	Long-legged Buzzard	Buse féroce	Poiana codabianca	Arendbuizerd
50. Aquila pomarina	Lille Skrigeørn	Schreiadler	Κραυγαετός	Lesser Spotted Eagle	Aigle pomarin	Aquila anatraia minore	Schreeuwarend
51. Aquilla clanga	Stor Skrigeørn	Schelladler	Στικταετός	Spotted Eagle	Aigle criard	Aquila anatraia maggiore	Bastaardarend
52. Aquila chrysaetos	Kongeørn	Steinadler	Χρυσαετός	Golden Eagle	Aigle royal	Aquila reale	Steenarend
53. Aquila heliaca	Kejsrørn	Kaiseradler	Βασιλαετός	Imperial Eagle	Aigle impérial	Aquila imperiale	Keizerarend

	Dansk	Deutsch	Εκκζμθά	English	Francais	Italiano	Nederlands
54. Hieraactus pennatus	Dvægorn	Zwergadler	Σταυραετός	Booted Eagle	Aigle botté	Aquila minore	Dwergarend
55. Hieraactus fasciatus	Hogøorn	Habichtsadler	Σπιζαετός	Bonelli's Eagle	Aigle de Bonelli	Aquila del Bonelli	Havikarend
56. Pandion haliactus	Fiskeørn	Fischadler	Ψαραετός	Osprey	Balbuzard pêcheur	Falco pescatore	Visarend
57. Falco naumanni	Lille Tårnfalk	Rötelfalke	Κιρκινέζι	Lesser Kestrel	Faucon crécerellette	Grillaio	Kleine Torenvalk
58. Falco cleonorae	Eleonorfalk	Eleonorenfalke	Μαυροπετρίτης	Eleonora's Falcon	Faucon d'Éléonore	Falco della regina	Eleonora's Valk
59. Falco biarmicus	Lannerfalk	Lanner	Χρυσογέρακας	Lanner Falcon	Faucon lanier	Lanario	Lannervalk
60. Falco peregrinus	Vandrefalk	Wanderfalke	Πετρίτης	Peregrine	Faucon pèlerin	Pellegrino	Slechtvalk
61. Falco columbarius	Dværgfalk	Merlin	Νανογέρακας	Merlin	Faucon émerillon	Smeriglio	Smelleken
62. Bonasa bonasia	Hjerpe	Haselhuhn	Αγριόκοτα	Hazel Grouse	Gélinotte des bois	Francolino di monte	Hazelhoen
63. Tetrao urogallus	Tjur	Auerhuhn	Αγριόκουρκος	Capercaillie	Grand Tétras	Gallo cedrone	Auerhoen
64. Tetrao tetrix tetrix	Urfugl (kontinental underart)	Birkhuhn (kontinentale Unterart)	Αυροπετεινός (Πβειρωτικη φυλη)	Black Grouse (continental subspecies)	Tétras lyre (sous-espèce continentale)	Fagiano di monte (sottospecie continentale)	Korhoen (continentale ondersoort)
65. Lagopus mutus pyrenaicus	Fjeldrype (Pyrenæern underart)	Alpenschneehuhn (Pyrenäen-Unterart)	Βουνοχιονόκοτα (Φυλή των Πυρηναιωνν)	Ptarmigan (Pyrenean subspecies)	Lagopède alpin (sous-espèce des Pyrénées)	Pernice bianca (sottospecie di Pirenei)	Alpensneeuwhoen (Pyreneeën ondersoort)
66. Lagopus mutus helveticus	Fjeldrype (Alperne underart)	Alpenschneehuhn (Alpen-Unterart)	Βουνοχιονόκοτα (Φυλή των Αλπεων)	Ptarmigan (Alpine subspecies)	Lagopède alpin (sous-espèce des Alpes)	Pernice bianca (sottospecie di Alpi)	Alpensneeuwhoen (alpijnse ondersoort)
67. Alectoris barbara	Berberhone	Felsenhuhn	Βρυχοπξρδικα	Barbary Partridge	Perdrix gambra	Pernice sarda	Barbarijse Patrijs
68. Alectoris graeca saxatilis	Stenhone (Alperne underart)	Steinhuhn (Alpen-Unterart)	Πετροπέρδικα (φυλή των Αλπεων)	Rock Partridge (Alpine subspecies)	Perdrix bartavelle (sous-espèce des Alpes)	Coturnice (sottospecie di Alpi)	Europese Steenpatrijs (alpijase ondersoort)
69. Alectoris graeca whitakeri	Stenhone (Sicilien underart)	Steinhuhn (Sizilien-Unterart)	Πετροπέρδικα (φυλή της Σικελίας)	Rock Partridge (Sicilian subspecies)	Perdrix bartavelle (sous-espèce de Sicile)	Coturnice (sottospecie di Sicilia)	Europese Steenpartijs (Siciliaanse ondersoort)

	Dansk	Deutsch	Ἑλληνικά	English	Francais	Italiano	Nederlands
70. Perdix perdix italica	Agerhone (italiensk underart)	Rebhuhn (italienische Unterart)	Ατβαδοπέρδικα (φυλή της Ιταλίας)	Partridge (Italian subspecies)	Perdrix grise (sous-espèce d'Italic)	Starna (sottospecie d'Italia)	Patrijs (Italiaanse ondersoort)
71. Crex crex	Engsnarre	Wachtelkönig	Ορτυγομάνα	Corn Crake	Râle des genêts	Re di quaglie	Kwartelkoning
72. Porzana porzana	Plettet Rorvagtel	Tüpfelsumpfhuhn	Στικτοπουλάδα	Spotted Crake	Marouette ponctuée	Voltolino	Porseleinhoen
73. Porzana parva	Lille Rorvagtel	Kleines Sumpfhuhn	Μικροπουλάδα	Little Crake	Marouette poussin	Schiribilla	Klein Waterhoen
74. Porzana pusilla	Dværgrorvagtel	Zwergsumpfhuhn	Ναποπολξδα	Baillon's Crake	Marouette de Baillon	Schiribilla grigiata	Kleinst Waterhoen
75. Porphyrio porphyrio	Sultanhone	Purpurhuhn	Εουλτανοποτλάδα	Purple Gallinule	Poule sultane	Pollo sultano	Purperkoet
76. Porphyrio porphyrio	Sultanhone	Purpurhuhn	Σουλτανοπουλάδα	Purple Gallinule	Poule sultane	Pollo sultano	Purperkoet
76. Grus grus	Trane	Kranich	Γτρανός	Crane	Grue cendrée	Gru	Kraanvogel
77. Tetrax tetrax (Otis tetrax)	Dværgtrappe	Zwergtrappe	Χαμψτίδα	Little Bustard	Outarde canepetière	Gallina prataiola	Kleine Trap
78. Otis tarda	Stortrappe	Großtrappe	Αγρόγαλοζ	Great Bustard	Outarde barbue	Otarda	Grote Trap
79. Himantopus himantopus	Styltelober	Stelzenläufer	Καλαμξκανζ	Black-winged Stilt	Échasse blanche	Cavaliere d'Italia	Steltkluut
80. Recurvirostra avosetta	Klyde	Säbelschnäbler	Αβοκέτα	Avocet	Avocette élégante	Avocetta	Kluut
81. Burhinus oedienemus	Triel	Triel	Πετροτιλίδα	Stone Curlew	Oedienéme criard	Occhione	Griel
82. Glareola pratincola	Braksvale	Brachschwalbe	Νεροχελίδονο	Collared Pratincole	Glaréole á collier	Pernice di mare	Vorkstaartplevier
83. Charadrius morinellus (Eudromias morinellus)	Pomeransfugl	Mornellregenpfeifer	Βουνοαφυριχτής	Dotterel	Pluvier guignard	Piviere tortolino	Morinelplevier
84. Pluvialis apricaria	Hjejle	Goldregenpfeifer	Βροχοπούλι	Golden Plover	Pluvier doré	Piviere dorato	Goudplevier
85. Hoplopterus spinosus	Sporevibte	Spornkiebitz	Αγκαδοκαλημάνα	Spur-winged Plover	Vanneau éperonné	Pavoncella arinata	Sporenkievi
86. Gallinago media	Tredækker	Doppelschnepfe	Διπλομπεκαταινι	Great Snipe	Bécassine double	Croccolone	Poelsnip

	Dansk	Deutsch	Ἑλληνικά	English	Francais	Italiano	Nederlands
87. Philomachus pugnax	Brushane	Kampfläufer	Ψενιομαχητής	Ruff	Chevalier combattant	Combattente	Kemphaan
88. Naimenius tenuirostris	Tyndnæbbet Spove	Dünnschnabelbrachvogel	Λεπτομυτα	Slender-billed Curlew	Courlis á bee grâle	Chiurlottello	Dunbekwulp
89. Tringa glarcola	Tiuksmed	Bruchwasserläufer	Λασπότρυγγας	Wood Sandpiper	Chevalier sylvain	Piro piro boschereccio	Bosruiter
90. Phalaropus lobatus	Odinshane	Odinshühnchen	Ραβδοκολυμπότρυγγας	Red-necked Phalarope	Phalarope á bec étroit	Falaropo becco sottile	Grauwe Franjepoot
91. Larus genei	Tyndnæbbet Måge	Dünnschnabelmöwe	Λεπτοραμφόγλαρος	Slender-billed Gull	Goéland railleur	Gabbiano rosco	Dunbekmeeuw
92. Larus inelanocephalus	Sorthovedet Måge	Schwarzkopfmöwe	Εκυλοκούταβος	Mediterranean Gull	Mouette mélaocáphale	Gabbiano corallino	Zwartkopmeeuw
93. Larus audouinii	Audouinsmåge	Korallenmöwe	Ατγαιόγλαρος	Audouin's Gull	Goéland d'Audouin	Gabbiano corse	Audouins Moouw
94. Gelochelidon nilotica	Sandterne	Lachseeschwalbe	Γελογλάρονο	Gull-billed Tern	Sterne hansel	Rondine di mare zampenere	Lachstern
95. Sterna caspia	Rovterne	Rabuseeschwalbe	Καρατξάζ	Caspian Tern	Sterne caspienne	Rondine di mare maggiore	Reuzenstern
96. Sterna sandvicensis	Splitterne	Brandseeschwalbe	Χειμωνογλύρονο	Sandwich Tern	Sterne caugek	Beccapesci	Grote Stern
97. Sterna dougallii	Dougallsterne	Rosenseeschwalbe	Ροδογλάρονο	Roseate Tern	Sterne de Dougall	Sterna del Dougall	Dougalls Stern
98. Sterna hirundo	Fjordterne	Flußseeschwalbe	Ποταμογλύρονο	Common Tern	Sterne pierregarin	Sterna comune	Visdief
99. Sterna paradisaea	Havterne	Kustenseeschwalbe	Αρκτικογλάρονο	Artic Tern	Sterne arctique	Sterna codalunga	Noordse Stern
100. Sterua albifrons	Dværgterne	Zwergseeschwalbe	Νανογλάρονο	Little Tern	Sterne naine	Fraticello	Dwergstern
101. Chlidouias hybridus	Hvidskægget Terue	Weißbartseeschwalbe	Μουότακογλάορνο	Whiskered Teru	Guifette moustac	Mignattino piombato	Witwangstern
102. Chlidonias niger	Sortterne	Trauerseeschwalbe	Μαυρογλάρονο	Black Tern	Guifette noire	Mignattino	Zwarte Stern
103. Pterocles alchata	Spidshalet Sandhøne	Spießflughuhn	Στβλοπεριστερόκοτα	Pin-tailed Sandgrouse	Ganga cata	Grandule	Witbuikzandhoen

	Dansk	Deutsch	Ἑλληνικά	English	Francais	Italiano	Nederlands
104. Bubo bubo	Stor Hornugle	Uhu	Μπούφος	Eagle Owl	Grand-duc d'Europe	Gufo reale	Oehoe
105. Nyctea scandiaca	Sneugle	Schnee-Eule	Χιονογλαύκα	Snowy Owl	Harfang des neiges	Gufo delle nevi	Sneeuwuil
106. Glaucidium passerinum	Spurveugle	Sperlingskauz	Επουργιτόγλανκα	Pygmy Owl	Chouette chevêchette (Chevêchette d'Europe)	Civetta nana	Dwerguil
107. Asio flammeus	Moschornugle	Sumpfohreule	Βαλτόμπούφος	Short-eared Owl	Hibou des marais	Gufo di palude	Velduil
108. Aegolius funereus	Perleugle	Rauhfußkauz	Χαροπούλι (Αιγωλιός)	Tengmalm's Owl	Chouette de Tengmalm (Nyctale de Tengmalm)	Civetta capogrosso	Ruigpootuil
109. Caprimulgus europaeus	Natravn	Ziegenmelker	Γιδοβυζάστρα	Nightjar	Engoulevent d'Europe	Succiacapre	Nachtzwaluw
110. Alcedo atthis	Isfugl	Eisvogel	Αλκυόνα	Kingfisher	Martin pêcheur d'Europe	Martin pescatore	IJsvogel
111. Coracias garrulus	Ellekrage	Blauracke	Χαλκοκουρούνα	Roller	Rollier d'Europe	Ghiandaia marina	Scharrelaar
112. Picus canus	Gråspætte	Grauspecht	Σταχτοτοικλιτύρα	Grey-headed Woodpecker	Pic cendré	Picchio cenerino	Grijskopspecht
113. Dryocopus martius	Sortspætte	Schwarzspecht	Μουροτσικλιτάρα	Black Woodpecker	Pic noir	Picchio nero	Zwarte Specht
114. Dendrocopos medius	Mellemflagspætte	Mittelspecht	Μδσοτοικγιτάρα	Middle Spotted Woodpecker	Pic mar	Picchio rosso mezzano	Middelste Bonte Specht
115. Dendrocopos leucotos	Hvidrygget Flagspætte	Weißrückenspecht	Λευχονωτοτσικλι-τάρα	White-backed Woodpecker	Pic à dos blanc	Picchio dorsobianco	Witrugspecht
116. Dendrocopos syriacus	Syrisk Flagspætte	Blutspecht	Βαλκανοτσικλι-τάρα	Syrian Woodpecker	Pic syriaque	Picchio siriaco	Syrische bonte Specht
117. Picoides tridactylus	Tretået Spætte	Dreizehenspecht	Τριδακτυλοτσικλ ιτάπα	Three-toed Woodpecker	Pic tridactyle	Pichio tridattilo	Drieteenspecht
118. Galerida theklae	Kortnæbbet Toplærke	Theklalerche	Κατσοιλρμζ της δέκλας	Thekla Lark	Cochevis de Thékla	Capellaccia spagnola	Thekla Leeuwerik
119. Melanocorypha calandra	Kalanderlærke	Kalanderlerche	Βουνογαλιάταρα	Calandra Lark	Alouette calandre	Calandra	Kalanderleeuwerik
120. Lollula arborea	Hedelærke	Heidelerche	Δεντροσταρήθων	Woodlark	Alouette lulu	Tottavilla	Boomleeuwerik

	Dansk	Deutsch	Ἑλληνιχά	English	Francais	Italiano	Nederlands
121. Calandrella brachydactyla	Korttået Lærke	Kurzzchenlerche	Μικρογαλιάντρα	Short-toed Lark	Alouette calandrelle	Calandrella	Kortteenleeuwerik
122. Anthus campestris	Markpiber	Brachpieper	Ναμοκελάδα	Tawny Pipit	Pipit rousseliae	Calandro	Duinpieper
123. Troglodytes troglodytes fridariensis	Gærdesmutte (Fair Isle underart)	Zaunkönig (Fair Isle-Unterart)	Τουποφράχτης (υποείδος της ν. Φαίρ)	Wren (Fair Isle subspecies)	Troglodyte mignon (sous-espèce de Fair Isle)	Scricciolo (sottospecie delle isole Fair Isle)	Winterkoning (ondersoort van Fair Isle)
124. Luscinia svecica	Blåhals	Blaukehlchen	Γαλαζολαίμης	Bluethroat	Gorgebleue à miroir	Pettazzurro	Blauwborst
125. Oenanthe leucura	Sørgestenpikker	Trauerstein-schmätzer	Μαυροπετρόκλης	Black Wheatear	Traquet ricur	Monachella nera	Zwarte Tapuit
126. Acrocephalus paludicola	Vandsanger	Seggenrohrsänger	Καρηκοποταμίδα	Aquatic Warbler	Phragmite aquatique	Pagliarolo	Waterrietzanger
127. Acrocephalus inclanopogon	Tamarisksanger	Mariskensänger	Μουστακοποταμίδα	Moustached Warbler	Lusciniole à moustaches	Forapaglie castagnole	Zwartkoprietzanger
128. Hippolais olivetorum	Oliveusanger	Olivenspötter	Αιοσιριτοίδα	Olive-tree Warbler	Hypolais des oliviers	Canapino levantino	Grickse Spotvogel
129. Sylvia sarda	Sardinsk Sanger	Sardengrasmücke	Σαρδοτσιροβάκος	Marmora's Warbler	Fauvette sarde	Magnanina sarda	Sardijnse Grasmus
130. Sylvia rueppelli	Sortsrubet Sanger	Maskengrasmücke	Μουτακοτπιτοβάκος	Rüppell's Warbler	Fauvette de Rüppell	Silvia del Rüppell	Rüppells Grasmus
131. Sylvia undata	Provencesanger	Provencegras-mücke	Προβηλκοταιροβάκος	Dartford Warbler	Fauvette pitchou	Magnanina	Provençaalse Grasmus
132. Sylvia nisoria	Hogesanger	Sperbergrasmücke	Ψυλτοτσιροβάκος	Barred Warbler	Fauvette épervière	Bigia padovaua	Sperwergrasmus
133. Sitta whiteheadi	Korsikansk Spætmejse	Korsenkleiber	Κοραικοτσομπανάκος	Corsican Nuthatch	Sittelle corse	Picchio muratore corso	Zwartkopboom-klever
134. Sitta krueperi	Krüper Spætmejse	Krüpers Kleiber	Τουρκοτσομπανάκος	Krüper's Nuthatch	Sittelle de Krüper	Picchio muratore del Krüper	Krüpers Boomklever
135. Ficedula parva	Lille Fluesnapper	Zwergschnäpper	Νανομυλοχάφτης	Red-breasted Flycatcher	Gobemouche nain	Pigliamosche peturosso	Kleine Vliegenvanger
136. Ficedula albicollis	Hvidhalset Fluesnapper	Halsband-schnäpper	Κρικομτγοχάφτης	Collared Flycatcher	Gobemouche à collier	Balia dal collare	Withalsvliegen-vanger

	Dansk	Deutsch	Ἑλληνιχά	English	Francais	Italiano	Nederlands
137. Ficedula semitorquata	Halvkrave Fluesnapper	Halbringschnäpper	Δρυομυγοχάφτης	Semi-collared Flycatcher	Gobemouche á semi-collier	Balia del mezzo collare	Balkanvliegenvanger
138. Lanius minor	Rosenbrystet Tornskade	Schwarstirnwürger	Γατδουροκεφαλάζ	Lesser Grey Shrike	Pie-grièche á poitrine rose	Averla cenerina	Kleine Klapekster
139. Lanius collurio	Rodygget Tornskade	Neuntöter	Αετομάχος	Red-backed Shrike	Pie-grièche écorcheu	Averla piccola	Grauwe Klauwier
140. Emberiza cineracea	Gulgrå Værling	Kleinasiatische Ammer	Σμυρνοτσίχλονο	Cinereous Bunting	Bruant centré	Zigolo cinereo	Smyrna Cors
141. Emberiza hortulana	Hortulan	Ortolan	Βλάχος	Ortolan Bunting	Bruant ortolan	Ortolano	Ortolaan
142. Emberiza caesia	Rustværling	Grauer Ortolan	Σκουροβλίχος	Cretzschmar's Bunting	Bruant cendrillard	Ortolano grigio	Bruinkeelortolaan
143. Loxia scotica	Skotsk Korsnæb	Schottischer Kreuzschnabel	Σταυρομίτης της Σκωτιάζ	Scottish Crossbill	Beccroisé d'Écosse	Scozzese Crociere	Schotse Kruisbek
144. Pyrrhocorax pyrrhocorax	Alpekrage	Alpenkrähe	Κοκκινοκαλιακούδα	Chough	Crave á bec rouge	Gracchio corallino	Alpenkraai

BILAG II/I—ANHANG II/I—ANNEX II/I—ANNEXE II/I—ALLEGATO II/I—BIJLAGE II/I

	Dansk	Deutsch	English	Francais	Italiano	Nederlands
ANSERIFORMES						
1. Anser fabalis	Saedgås	Saatgans	Bean goose	Oie des moissons	Oca granaiola	Rietgans
2. Anser anser	Grågås	Graugans	Greylag goose	Oic cendrée	Oca selvatica	Granwe gans
3. Branta canadensis	Kanadagås	Kanadagans	Canada goose	Bernache du Canada	Oca del Canada	Canadese gans
4. Anas penelope	Pibeand	Pfeifente	Wigeon	Canard siffleur	Fischione	Smicnt
5. Anas strepera	Knarand	Schnatterente	Gadwall	Canard chipeau	Canapiglia	Krakeend
6. Anas crecca	Krikand	Krickente	Teal	Sarcelle d'hiver	Alzavola	Wintertaling
7. Anas platyrhynchus	Gråand	Stockente	Mallard	Canard colvert	Germano reale	Wilde eend
8. Anas acuta	Spidsand	Spießente	Pintail	Canard pilet	Codone	Pijlstaart
9. Anas querquedula	Atlinghand	Knäkente	Garganey	Sarcelle d'été	Marzaiola	Zomertaling
10. Anas clypeata	Skeand	Löffelente	Shoveler	Canard souchet	Mestolone	Slobeend
11. Aythya ferina	Taffeland	Tafelente	Pochard	Fuligule milouin	Moriglione	Tafeleend
12. Aythya fuligula	Troldand	Reiherente	Tufted duck	Fuligule morillon	Moretta	Kuifeend
GALLIFORMES						
13. Lagopus lagopus scoticus et hibernicus	Grouse	Schottisches Moorschneehuhn	Red grouse	Lagopède des saules	Pernice bianca di Scozia	Moerassneeuwhoen
14. Lagopus mutus	Fjeldrype	Alpenschnechuhn	Ptarmigan	Lagopède des Alpes	Pernice bianca	Alpensneeuwhoen
15. Alectoris graeca	Stenhøne	Steinhuhn	Rock partridge	Perdrix bartavelle	Coturnice	Europese steenpatrijs
16. Alectoris rufa	Rødhøne	Rothuhn	Red-legged Partridge	Perdrix rouge	Pernice rossa	Rode patrijs
17. Perdix perdix	Agerhøne	Rebhuhn	Partridge	Perdrix grise	Starna	Patrijs
18. Phasianus colchicus	Fasan	Fasan	Pheasant	Faisan de chasse	Fagiano	Fazant
GRUIFORMES						
19. Fulica atra	Blishøne	Bläßhuhn	Coot	Foulque macroule	Folaga	Meerkoet

	Dansk	Deutsch	English	Francais	Italiano	Nederlands
CHARADRIIFORMES						
20. Lymnocryptes minimus	Enkeltbekkasin	Zwergschnepfe	Jack snipe	Bécassine sourde	Frullino	Bokje
21. Gallinago gallinago	Dobbeltbekkasin	Beckassine	Snipe	Becassine des marias	Beccaccino	Watersnip
22. Scolopax rusticola	Skovsneppe	Waldchnepfe	Woodcock	Bécasse des bois	Beccaccia	Houtsnip
COLUMBIFORMES						
23. Columba livia	Klippedue	Felsentaube	Rock dove	Pigeon biset	Piccione selvatico	Rotsduif
24. Columba palumbus	Ringdue	Ringeltaube	Wood pigeon	Pigeon ramier	Colombaccio	Houtduif

BILAG II/2—ANHANG II/2—ANNEX II/2—ANNEXE II/2—ALLEGATO II/2—BIJLAGE II/2

	Dansk	Deutsch	English	Francais	Italiano	Nederlands
25. Cygnus olor	Knopsvane	Höckerschwan	Mute swan	Cygne muet	Cigno reale	Knobbelzwaan
26. Anser brachyrhynchus	Kortnæbbet gås	Kurzschnabelgans	Pink-footed goose	Oie à bec court	Oca zamperose	Kleine rietgans
27. Anser albifrons	Blisgås	Bläßgans	White-fronted goose	Oie rieuse	Oca lombardella	Kolgans
28. Branta bernicla	Knortegås	Ringelgans	Brent goose	Bernache cravant	Oca colombaccio	Rotgans
29. Netta rufina	Rødhovedet and	Kolbenente	Red-crested pochard	Nette rousse	Fistione turco	Krooneend
30. Aythya marila	Bjergand	Bergente	Scaup	Fuligule milouiuin	Moretta grigia	Toppereend
31. Somateria mollissima	Ederfugl	Eiderente	Eider	Eider à duvet	Edredone	Eidereend
32. Clangula hyemalis	Havlit	Eisente	Long-tailed duck	Harelde de Miquelon	Moretta codona	Ijseend
33. Melanitta nigra	Sortand	Trauerente	Common scoter	Macreuse noire	Orchetto marino	Zwarte zeeëend
34. Melanitta fusca	Fløjlsand	Samtente	Velvet scoter	Macreuse brune	Orco marino	Grote zeeëend
35. Bucephala clangula	Hvinand	Schellente	Golden-eye	Garrot à l'œil d'or	Quattrocchi	Brilduiker
36. Mergus serrator	Toppet skallesluger	Mittelsäger	Red-breasted merganser	Harle huppé	Smergo minore	Middelste zaagbek
37. Mergus merganser	Stor skallesluger	Gänsesäger	Goosander	Harle bièvre	Smergo maggiore	Grote zaagbek
38. Bonasia bonasia (Tetrastes bonasia)	Hjerpe	Haselhuhn	Hazel hen	Gélinotte des bois	Francolino di monte	Hazelhoen
39. Tetrao tetrix (Lyrurus tetrix)	Urfugl	Birkhuhn ♂	Black grouse	Tétras lyre ♂	Fagiano di monte	Korhoen
40. Tetrao urogallus	Tjur	Auerhuhn ♂	Capercaillie	Grand tétras ♂	Gallo cedrone	Auerhoen
41. Alectoris barbara	Berberhøne	Felsenhuhn	Barbary partridge	Perdrix de Barbarie	Pernice di Sardegna	Barbarijse patrijs
42. Coturnix coturnix	Vagtel	Wachtel	Quail	Caille des blés	Quaglia	Kwartel
43. Meleagris gallopavo	Vildkalkun	Wildtruthuhn	Wild Turkey	Dindon/Dinde sauvage	Tacchina selvatico	Wilde kalkoen
44. Rallus aquaticus	Vandrikse	Wasserraile	Water rail	Râle d'eau	Porciglione	Waterral
45. Gallinula chloropus	Grønbenet rørhøne	Teichhuhn	Moorhen	Poule d'eau	Gallinella d'acqua	Waterhoen
46. Haematopus ostralegus	Strandskade	Austernfischer	Oystercatcher	Huîtrier pie	Beccaccia di mare	Scholckster
47. Pluvialis apricaria	Hjejle	Goldregenpfeifer	Golden plover	Pluvier doré	Piviere dorato	Goudplevier
48. Pluvialis squatarola	Strandhjejle	Kiebitzregenpfeifer	Grey plover	Pluvier argenté	Pivieressa	Zilverplevier

	Dansk	Deutsch	English	Français	Italiano	Nederlands
49. Vanellus vanellus	Vibe	Kiebitz	Lapwing	Vanneau huppé	Pavoncella	Kievit
50. Calidris canutus	Islandsk ryle	Knutt	Knot	Bécasseau maubèche	Piovanello maggiore	Kanoetstrandloper
51. Philomachus pugnax	Brushane	Kampfläufer	Ruff ♂ Reeve ♀	Chavalier combattant	Combattente	Kemphaan
52. Limosa limosa	Stor kobbersneppe	Uferschnepfe	Black-tailed godwit	Barge à queue noir	Pittima reale	Grutto
53. Limosa lapponica	Lille kobbersneppe	Pfuhlschnepfe	Bar-tailed godwit	Barge rousse	Pittima minore	Rosse grutto
54. Numenius phaeopus	Lille regnspove	Regenbrachvogel	Whimbrel	Courlis corlieu	Chiurlo piccolo	Regenwulp
66. Numenius arquata	Stor regnspove	Großer Brachvogel	Curlew	Courlis cendré	Chiurlo	Wulp
56. Tringa crythropus	Sortklire	Dunkler Wasserläufer	Spotted redshank	Chavalier arlequin	Totano moro	Zwarte ruiter
67. Tringa totanus	Rødben	Rotschenkel	Redshank	Chevalier gambette	Pettegola	Tureluur
68. Tringa nebularia	Hvidklire	Grünschenkel	Greenshank	Chavalier aboyeur	Pantana	Groenpootruiter
59. Larus ridibundus	Hætemåge	Lachmöwe	Black-headed gull	Mouette rieuse	Gabbiano comune	Kokmeeuw
60. Larus canus	Stormmåge	Sturmmöwe	Common gull	Goéland cendré	Gavina	Stormmeeuw
61. Larus fuscus	Slidemåge	Heringsmöwe	Lesser black-backed gull	Goéland brun	Gabbiano zafferano	Kleine mantelmeeuw
62. Larus argentatus	Sølvmåge	Silbermöwe	Herring gull	Goéland argenté	Gabbiano reale	Zilvermeeuw
63. Larus marinus	Svartbag	Mantelmöwe	Greater black-backed gull	Goéland marin	Mugnaiaccio	Mantelmeeuw
64. Columba oenas	Huldue	Hohltaube	Stock dove	Pigeon colmbien	Colombella	Holenduif
65. Streptopelia decaoctoa	Tyrkerdue	Türkentaube	Collared turtle dove	Tourterelle turque	Tortora dal collare orientale	Turkse tortel
66. Streptopelia turtur	Turteldue	Turteltaube	Turtle dove	Tourterelle des bois	Tortora	Tortelduif
67. Alauda arvensis	Sanglærke	Feldlerche	Skylark	Aloutte des champs	Ludola	Veldleeuwerik
68. Turdus merula	Solsort	Amsel	Blackbird	Merle noire	Merlo	Merel
69. Turdus pilaris	Sjagger	Wacholderdrossel	Fieldfare	Grive litorne	Cesena	Kramsvogel
70. Turdus philomelos	Sangdrossel	Singdrossel	Song-thrush	Grive musicienne	Tordo	Zanglijster
71. Turdas iliacus	Vindrossel	Rotdrossel	Redwing	Grive mauvis	Tordo sassello	Koperwiek
72. Turdus viscivorus	Misteldrossel	Misteldrossel	Mistle-thrush	Grive draine	Tordela	Grote lijster

	Belgique/ België	Danmark	Deutschland	France	Ireland	Italia	Luxembourg	Nederland	United Kingdom
25. Cynus olor			+						
26. Anser brachyrhynchus	+	+			+				+
27. Anser albifrons	+	+	+	+	+			+	+
28. Branta bernicla		+	+						
29. Netta rufina				+					
30. Aythya marila	+	+	+	+	+			+	+
31. Somateria mollissima		+		+	+				
32. Clangula hyemalis		+		+	+				+
33. Melanitta nigra		+	+	+	+				+
34. Melanitta fusca		+	+	+	+				+
35. Bucephala clangula		+		+	+				+
36. Mergus serrator		+			+				
37. Mergus merganser		+			+				
38. Bonasia bonasia (Tetrastes bonasia)				+					
39. Tetrao tetrix (Lyrurus tetrix)	+		+ ♂	+ ♂		+			+
40. Tetrao urogallus			+ ♂	+ ♂		+			+
41. Alectoris barbara						+			
42. Coturnix coturnix				+		+			
43. Meleagris gallopavo			+						
44. Rallus aquaticus				+		+			
45. Gallinula chloropus	+			+		+			+
46. Haematopus astralegus		+		+					
47. Pluvialis apricaria	+	+		+	+	+		+	+
48. Pluvialis squatarola		+		+					+
49. Vanellus vanellus	+	+		+	+	+			
50. Calidris canutus		+		+					
51. Philomachus pugnax				+		+			
52. Limosa limosa		+		+		+			
53. Limosa lapponica		+		+		+			+
54. Numenius phaeopus		+		+					+
55. Numerius arquata		+		+	+	+			+
56. Tringa erythropus		+		+					
57. Tringa totanus		+		+		+			+
58. Tringa nebularia		+		+					
59. Larus ridibundus		+	+						
60. Larus canus		+	+						
61. Larus fuscus		+	+						
62. Larus argentatus		+	+						

	Belgique/ België	Danmark	Deutschland	France	Ireland	Italia	Luxembourg	Nederland	United Kingdom
63. Larus marinus		+	+						
64. Columba oenas				+					
65. Streptopelia decaoctoa		+	+	+					
66. Streptopelia turtur				+		+			
67. Alauda arvensis				+		+			
68. Turdus merula				+		+			
69. Turdus pilaris				+		+			
70. Turdus philomelos				+		+			
71. Turdus iliacus				+		+			
72. Tudus viscirorus				+					

+ = Medlemasstater, som i overensstemmelse med artikel 7, stk. 3, kan gaive tilladelse til jagt på de anførte arter.

+ = Mitgliedstaaten, die nach Artikel 7 Absatz 3 die Bejagung der aufgeführten Arten zulassen können.

+ = Member States which under Article 7 (3) may authorize hunting of the species listed.

+ = États membres pouvant autoriser, conformément à l'article 7 paragraphe 3, la chasse des espèces énumérées.

+ = Stati membri che possono autorizzare, conformemente all'articlolo 7, paragrafo 3, la caccia delle specie elencate.

+ = Lid-Staten die overeenkomstig artikel 7, lid 3, toestemming mogen geven tot het jagen op de genoemde soorten.

BILAG III/1—ANHANG III/1—ANNEX III/1—ANNEXE III/1—ALLEGATO III/1—BIJALGE III/1

	Dansk	Deutsch	English	Français	Italiano	Nederlands
1. Anas platyrhynchus	Gråand	Stockente	Mallard	Canard colvert	Germano reale	Wilde eend
2. Lagopus lagopus scoticus et hibernicus	Grouse	Schottisches Moorschneehuhn	Red grouse	Lagopède des saules	Pernice bianca di Scozia	Moerassneeuwhoen
3. Alectoris rufa	Rødhøne	Rothuhn	Red-legged partridge	Pedrix rouge	Pernice rossa	Rode patrijs
4. Alectoris barbara	Berberhøne	Felsenhuhn	Barbary partridge	Perdrix de Barbarie	Pernice di Sardegna	Barbarijse patrijs
5. Perdix perdix	Agerhøne	Rebhuhn	Partridge	Perdrix grise	Starna	Patrijs
6. Phasianus colchicus	Fasan	Fasan	Pheasant	Faisan de chasse	Fagiano	Fazant
7. Columba palumbus	Ringdue	Ringeltaube	Wood pigeon	Pigeon ramier	Columbaccio	Houtduif

BILAG III/2—ANHANG III/2—ANNEX III/2—ANNEXE III/2—ALLEGATO III/2—BIJALGE III/2

	Dansk	Deutsch	English	Français	Italiano	Nederlands
8. Anser anser	Grågås	Graugans	Greylag goose	Oie cendrée	Oca selvatica	Grauwe gans
9. Anas penelope	Pibeand	Pfeifenente	Wigeon	Canard siffluer	Fischione	Smient
10. Anas crecca	Krikand	Krickente	Teal	Sarcelle d'hiver	Alzavola	Wintertaling
11. Anas acuta	Spidsand	Spießente	Pintail	Canard pilet	Codone	Pijlstaart
12. Aythy ferina	Taffeland	Tafelente	Pochard	Fuligule milouin	Moriglione	Tafeleend
13. Aythya fuligula	Troldand	Reiherente	Tufted duck	Fuligule morillion	Moretta	Kuifeend
14. Somateria mollissima	Ederfugl	Eiderente	Eider	Eider à duvet	Edredone	Eidereend
15. Lagopus mutus	Fjeldrype	Alpenschneehuhn	Ptarmigan	Lagopède des Alpes	Pernice bianca	Alpensneeuwhoen
16. Tetrao urogallus	Tjur	Auerhuhn	Capercaillie	Grand tétras	Gall'o cedrone	Auerhoen
17. Fulica atra	Blishøne	Bläßhuhn	Coot	Foulque macroule	Folaga	Meerkoet

BILAG III/3 — ANHANG III/3 — ANNEX III/3 — ANNEXE III/3 — ALLEGATO III/3 — BIJLAGE III/3

	Dansk	Deutsch	English	Francais	Italiano	Nederlands
18. Anser albifrons	Blisgås	Bläßgans	White-fronted goose	Oie rieuse	Oca lombardella	Kolgans
19. Anas clypeata	Skeand	Löffelente	Shoveler	Canard souchet	Mestolone	Slobeend
20. Aythya marila	Bjergand	Bergente	Scaup	Fuligule milouinin	Moretta grigia	Toppereend
21. Melanitta nigra	Sortland	Trauerente	Common scoter	Macreuse noire	Orchetto marino	Zwarte zeeëend
22. Tetrao tetrix (Lyrurus tetris)	Urfugl	Birkhuhn	Black grouse	Tétras lyre	Fagiano di monte	Korhoen
23. Pluvialis apricaria	Hjejle	Goldregenpfeifer	Golden plover	Pluvier doré	Piviere dorato	Goudplevier
24. Lymnocryptes minimus	Enkeltbekkasin	Zwergschnepfe	Jack snipe	Bécassine sourde	Frullino	Bokje
25. Gallinago gallinago	Dobbeltbekkasin	Bekassine	Snipe	Bécassinne de marais	Beccaccino	Watersnip
26. Scolopax rusticola	Skovsneppe	Waldschnepfe	Woodcock	Bécasse des bois	Beccaccia	Houtsnip

ANNEX IV

(a) — Snares, limes, hooks, live birds which are blind or mutilated used as decoys, tape recorders, eletrocuting devices.

— Artificial light sources, mirror, devices for illuminating targets, sighting devices for night shooting comprising an electronic image magnifier or image converter.

— Explosives.

— Nets, traps, poisoned or anaesthetic bait.

— Semi-automatic or automatic weapons with a magazine capable of holding more than two rounds of ammunition.

(b) — Aircraft, motor vehicles.

— Boats driven at a speed exceeding five kilometres per hour. On the open sea, Member States may, for safety reasons, authorize the use of motor-boats with a maximum speed of 18 kilometres per hour. Member States shall inform the Commission of any authorizations granted.

ANNEX V

(a) National lists of species in danger of extinction or particularly endangered species, taking into account their geographical distribution.

(b) Listing and ecological description of areas particularly important to migratory species on their migratory routes and as wintering and nesting grounds.

(c) Listing of data on the population levels of migratory species as shown by ringing.

(d) Assessing the influence of methods of taking wild birds on population levels.

(e) Developing or refining ecological methods for preventing the type of damage caused by birds.

(f) Determining the role of certain species as indicators of pollution.

(g) Studying the adverse effect of chemical pollution on population levels of bird species.

Appendix 2

COUNCIL RESOLUTION

of 2 April 1979

concerning Directive 79/409/EEC on the conservation of wild birds

I

1 The Council calls upon the Member States to notify the Commission within 24 months following adoption of Directive 79/409/EEC on the conservation of wild birds of:

a) the special protection areas which they have classified under Article 4,
b) the areas which they have or intend to have designated as wetlands of international importance,
c) the areas other than wetlands already classified according to national legislation, similar to those described in Article 4 and subject to comparable protection measures.

2 In the designation of these areas, account shall be taken of the need to protect biotopes and flora and fauna without, however, delaying the action of primary importance for bird conservation, particularly in wetlands, to be taken under the Programme of Action of the European Communities on the Environment.

II

1 The Council requests the Commission to draw up a list of the areas notified by the Member States pursuant to point I above.
2 This list shall be drawn up within six months following the transmission of the information and shall be kept up to date. The Council calls upon the Commission to take the necessary coordinating steps to see that the network thereby established fulfils the objectives of the Directive and can be integrated into a larger network, should the need arise.

III

The Council takes note of the Commission's intention of submitting appropriate proposals regarding the criteria for the determination, selection, organization and methods of administration of the special protection areas, and invites the Commission to take into consideration in particular in those proposals the parts of the areas selected which are to be given intensive protection, a minimum threshold for those parts, which will enable the objectives of Article 4 to be attained, and the measures to be taken to prohibit hunting and to control other specific activities likely to disturb the birds.

Appendix 3 Suggested Community-wide criteria for selection of Special Protection Areas proposed by ICBP-EC working group

The European Commission has set up a working group to evaluate possible Community-wide criteria for the selection of Special Protection Areas required under Article 4 of Directive 79/409. The ten criteria listed in a draft discussion paper of 14 October 1988 are given below. Footnotes have been added where these are useful.

Breeding sites

1) Sites supporting 1% or more of the breeding pairs of the biogeographical population[1].

[The biogeographical population has been defined for the purposes of the Community criteria, as a discrete population where this was identifiable or where it was not, the populations occurring in Europe and North-west Africa (Tunisia, Algeria and Morocco), but excluding for the most part, the USSR and Black Sea States.]

Advantages:

This criterion is objective and certainly points to very important sites for the species concerned. It is derived from the already established Ramsar Criteria[2] to identify wetlands of international importance, which predated Directive 79/409.

Disadvantages:

The most obvious disadvantage is that for the vast majority of species, the population size is unknown and therefore 1% cannot be applied. In addition many sites are difficult to count precisely. Further, many species fail to come together in sufficient numbers to trigger this mechanism.

2) If Criterion 1 is not appropriate (because for example the biogeographical population is not clearly defined, is not known or the 1% criterion is too high to select important sites), criteria for the selection of breeding sites have been based on the specific characteristics of dispersion and habitat preference of the species.

Advantages:

The criterion allows experts to look specifically at the Community population and the ways this population is dispersed and in what numbers, and for the experts to fix a threshold figure which attempts to ensure important sites are identified and unimportant sites excluded.

Disadvantages:

Since the Community is not a biogeographical unit, every time it changes, for example when Greece, Spain or Portugal joined, the Community population changes. Many sites are difficult to count precisely. Further, many species fail to come together in sufficent numbers to trigger even this mechanism.

3) If Criterion 2 also proves impossible to apply, all sites with proved breeding are selected (this Criterion is applied to six very poorly known seabirds only: *Bulweria bulwerii*[1], *Puffinus puffinus mauretanicus*[2], *Puffinus assimilis*[3], *Pelagodroma marina*[4], *Oceanodroma leucorhoa*[5] and *Oceanodroma castro*[6]).

Advantages:

This is probably the only criterion which could be used to identify breeding sites for these species. Since they are colonial it is unlikely to identify unimportant sites.

Disadvantages:

Useful only in the case of very particular species.

4) Sites of particular importance for marginal or isolated breeding populations, with criteria based on specific characteristics of dispersion and habitat preference of the species.

[1] see section 2.5.2.
[2] see section 2.5.1.

[1] Bulwer's petrel
[2] West Mediterranean race of Manx shearwater
[3] Little shearwater
[4] White-faced storm-petrel
[5] Leach's storm-petrel – the only British breeding species of these six
[6] Madeiran storm-petrel

Advantages:

This criterion recognises that the Community is diverse and consequently that application of a single numerical criterion across the entire Community would lead to the exclusion of small marginal populations, whose conservation is of importance to maintain the range of the species[1]. With this criterion, experts fix a threshold figure which attempts to ensure that, recognising the diversity present in the Community, important sites are identified and unimportant sites excluded throughout the range of the species.

Disadvantages:

Many sites are difficult to count precisely. Further, many species fail to come together in sufficent numbers to trigger even this mechanism.

5) All regular breeding sites of rare or endangered species or sub-species; or small and endangered distinct biogeographical populations: *c.* 2,500 pairs or less. For some colonial species a level of five pairs is used to exclude irregular breeding sites.

Advantages:

This is a clear criterion to ensure the conservation of sites important for threatened species.

Disadvantages:

Can only be applied to suitable species.

6) For widely dispersed species, breeding sites are selected on the basis of high densities or good numbers.

Advantages:

This allows experts to conserve sites on the basis of their known biological importance, based on the presence of exceptional numbers or exceptionally high densities.

Disadvantages:

This criterion is subjective to some degree and must only be used in cases of clear importance.

Sites other than breeding sites

7) Sites having 1% (being at least 100 individuals) of the flyway or biogeographical population of one species.

Advantages:

This criterion is objective and certainly points to very important sites for the species concerned. It is derived from the already established Ramsar criteria to identify wetlands of international importance, which predated Directive 79/409.

Disadvantages:

The most obvious disadvantage is that for the vast majority of species, the population size is unknown and therefore 1% cannot be applied. In addition many sites are difficult to count precisely. Further, many species fail to come together in sufficent numbers to trigger this mechanism.

8) Sites having (at least) 500 grebes; 10,000 ducks, geese and swans; 20,000 waders; 5,000 birds of prey on passage during a migration season.

Advantages:

The criterion is objective and certainly points to very important sites for the species concerned. It is derived from the already established Ramsar criteria[1] to identify wetlands of international importance, which predated Directive 79/409. [It also has the advantage of including concentrations of birds (e.g. assemblages of seaducks) where these are not easily identified to separate species. This was the main reason for the introduction of the similar guideline for the Ramsar Convention.]

Disadvantages:

The most obvious disadvantage is that for the vast majority of species this criterion cannot be applied. In addition many sites are difficult to count precisely. Further, many species fail to come together in sufficent numbers to trigger even this mechanism.

9) Sites with particular importance for marginal or isolated populations, with criteria based on specific characteristics of dispersion and habitat preference of the species.

Advantages:

This criterion recognises that the Community is diverse and consequently that application of a single numerical criterion across the entire Community would lead to the exclusion of small marginal populations, whose conservation is of importance to maintain the range of the species[2].

[1] See section 2.2

[1] However, it differs from the Ramsar criteria as explained in section 2.5.1. The Ramsar criterion 3a (as amended at Regina) indicates 20,000 'waterfowl' rather than separate totals for waders and wildfowl.

[2] See section 2.2.

With this criterion, experts fix a threshold figure which attempts to ensure that, recognising the diversity present in the Community, important sites are identified and unimportant sites excluded throughout the range of the species.

Disadvantages:

Many sites are difficult to count precisely. Further, many species fail to come together in sufficent numbers to trigger even this mechanism.

10) Sites which hold 5 (gregarious species 25) individuals of rare and endangered species or sub-species or small and endangered biogeographical populations (less than 10,000 individuals in number).

Advantages:

This is a clear criterion to ensure the conservation of sites important for threatened species.

Disadvantages:
Can only be appled to suitable species.

Appendix 4 Criteria for the identification of wetlands of international importance as agreed at the meeting of Contracting Parties; Regina 1987.

A wetland qualifies as internationally important for one or more of the following reasons:

1. Criteria for assessing the value of representative or unique wetlands.

A wetland should be considered internationally important if it is a particularly good example of a specific type of wetland characteristic of its region.

2. General criteria for using plants or animals to identify wetlands of importance

A wetland should be considered internationally important if -

a) it supports an appreciable assemblage of rare, vulnerable or endangered species or subspecies of plant or animal or an appreciable number of individuals of any one or more of these species; or

b) it is of special value for maintaining the genetic and ecological diversity of a region because of the quality and peculiarities of its flora and fauna; or

c) it is of special value as the habitat of plants or animals at a critical stage of their biological cycles; or

d) it is of special value for its endemic plant or animal species or communities.

3. Specific criteria for using waterfowl to identify wetlands of importance

A wetland should be considered internationally important if -

a) it regularly supports 20,000 waterfowl; or

b) it regularly supports substantial numbers of individuals from particular groups of waterfowl indicative of wetland values, productivity or diversity; or

c) where data on populations are available, it regularly supports 1% of the individuals of a population of one species or subspecies of waterfowl.

Guidelines

A wetland could be considered under Criterion 1 if:

a) it is an example of a type rare or unusual in the appropriate biogeographical region; or

b) it is a particularly good representative example of a wetland characteristic of the appropriate region; or

c) it is a particularly good representative of a common type where the site also qualifies for consideration under criteria 2a, 2b, or 2c; or

d) it is representative of a type by virtue of being part of a complex of high quality wetland habitats. A wetland of national value could be considered of international importance if it has a substantial hydrological, biological or ecological role in the functioning of an international river basin or coastal system; or

e) in developing countries, it is a wetland which, because of its outstanding hydrological, biological or ecological role, is of substantial socio-economic and cultural value within the framework of sustainable use and habitat conservation.

Appendix 5 Representation of bird habitats within the proposed SPA/Ramsar network

A.5.1 Estuarine and soft shores

Estuaries are ecologically highly productive areas of great importance to many migratory birds, especially waders and wildfowl. They are important as both breeding and wintering areas. Estuaries and estuarine ecological processes have been the subject of extensive academic research, considerably beyond the scope of this report to review.

The outstanding importance for wintering wildfowl of British estuaries, and indeed other coastal areas, is a result of several factors (Moser 1987). Our mild winter climate means that there are few prolonged periods of freezing which would make food unavailable. Secondly, British seas have a large tidal amplitude which results in substantial inter-tidal feeding areas. Also there is an interaction between wind and tidal amplitude: in estuaries such as the Waddenzee, westerly gales can cause the tide to exceed the predicted high-water mark three hours before the time of high water. The mudflats thus remain submerged for much of the following low-water period, forcing birds to feed elsewhere. Although gales are just as common in Britain, the larger tidal amplitude means that the effect is much smaller in proportion to the tidal range. Thus exposure times of inter-tidal feeding areas change less (Pienkowski & Evans 1984). Thirdly, Britain lies at the junction of several migration routes or 'flyways' used by millions of waterfowl breeding in northern Canada, Greenland, Iceland, Scandinavia, Svalbard and the Soviet arctic (Figure 1.1). The western European wintering area is the northernmost in the world.

Birds over-wintering on most major estuaries in Britain are counted regularly each winter by participants in the BTO/NCC/RSPB Birds of Estuaries Enquiry (BoEE). This has led to the development of a major database on estuarine birds which has been nsed in the current review. Complementing such work there has been a variety of more detailed studies on individual estuaries, also undertaken under either NCC, BTO or Wildfowl and Wetlands Trust (WWT) auspices.

Prater (1981) reviewed the conservation importance of British estuaries and their bird populations on the basis of BoEE data up until the mid-1970s. Currently the NCC is undertaking a major review of British estuaries (Figure A.5.1) and the conservation importance of their many features (Davidson 1989, in press; Davidson *et al.* in prep.). This work is reviewing all major estuaries in Britain, and will provide important contextual information. It is clear that nearly all major estuaries in Britain are under some threat from land-claim or other developments (Figure A.5.2). This makes integrated conservation measures particularly important and urgent in the light of the importance of these sites to migratory bird populations.

In considering estuaries in respect of bird conservation, it is especially important to ensure that sensible ecological boundaries are proposed. This is because birds are mobile within estuaries and usually use a variety of roosting and feeding sites according to weather, tidal states, food stocks and various other factors (e.g. Symonds *et al.* 1984; Moser 1984; Kirby 1987; Kirby *et al.* 1988; Prys-Jones *et al.* 1989). These detailed studies of certain sites allow general principles to be derived which can then be applied more widely (section 2.4.2).

Studies on the movement of wintering waders (Pienkowski 1983) have demonstrated that, for many populations, British estuaries are one of several essential components of a network of sites used in different seasons and in different years. Thus international coordination of conservation measures is particularly important to ensure protection of populations which may depend on many sites in many countries (Smit & Piersma 1989).

The SPA network contains a number of estuaries, which together are important in providing for migratory populations of wintering wildfowl and waders. These are indicated in Figure A.5.3.

A.5.2 Open shore bird habitats

A variety of open shores are particularly important for wintering birds. However, suitability as habitat is greatly influenced by a number of factors, especially exposure to wave action and winds, the slope of the shore, substrate and bedrock type and a range of other topographic features. Several wader species occur on rocky coasts, although to what extent varies between species and also geographically.

The major part of the wintering populations of

turnstones and purple sandpipers occurs on rocky coasts, whilst oystercatchers, redshank, curlew and ringed plover also occur (Figure 2.4). The local distribution and abundance of these species (and others) is influenced by a number of features. For example, in a survey of the non-estuarine shores of Shetland, Summers *et al.* (1988) found that whilst oystercatchers, turnstones and curlews showed no clear preference for shore type, redshanks and lapwings preferred muddy areas, ringed plovers selected sandy shores, and golden plovers and purple sandpipers preferred shallow-sloping bedrock. All the wader species avoided steep shores and cliffs.

On Coll and Tiree, Madders & Moser (1989) found that waders, especially turnstones, were most numerous where rocky shores either adjoined sandy beaches or occurred as outcrops within them. These areas tended to accumulate drifting, rotting seaweed, the invertebrates of which provided a food source for waders.

In response to a number of local studies of the birds of non-estuarine shore habitats (e.g. da Prato & da Prato 1979; Buxton 1982), the NCC co-funded the BTO to organise a national survey of non-estuarine shores in winter 1984/5 (Moser & Summers 1987). This survey has resulted in a much better understanding of the distribution and abundance of wintering wader populations on non-estuarine shores, and has allowed the revision of the national population estimates for wintering waders (Moser 1987b).

The results showed not only that many stretches of rocky (and sandy) shores are of considerable conservation importance in their own right, but that importance for winter wader populations is considerably enhanced during periods of severe cold weather. Non-estuarine shore habitats freeze less readily than estuarine areas because of greater wave action and higher salinity. Thus, during periods of severe weather, there is evidence of movement by significant numbers of estuarine waders onto open shores (Moser & Summers (1987).

The BTO/WSG Winter Shorebird Count and further surveys have allowed the conservation assessment of a number of stretches of non-estuarine coast important to non-breeding waders. Those which are of known international importance are included within the SPA network (Figure 5.4).

A.5.3 Dunes and coastal formations

Sand dunes are dynamic environments and the structural form dunes take varies geographically according to factors such as the supply of sand and the direction and stength of wind and tidal currents. Actively forming dunes show a variety of successional stages from the seaward to landward sides. Each of these stages – embryo dunes, fore dunes, mobile (yellow) dunes, fixed (grey) dunes and dune slacks – have characteristic vegetation communities. The sequence of plant habitats across, and sometimes along, a dune system is characterised by increasing stability and increasing amount of organic material within the dune. This in turn leads to better water retention properties which influences vegetation. Accordingly, different types of dune systems hold different bird assemblages (Fuller 1982).

In unstable dunes, generally low densities of breeding birds occur, with ringed plover being typical close to the shoreward edge. Other breeding species include reed bunting, grey partridge, stonechat and shelducks (Fuller 1982). The wetter dune slack areas (which flood in winter) can hold breeding mallard, moorhen, common snipe and sedge warbler. However, the densities and species composition of bird communities in these areas is much influenced by the structure of vegetation communities. At sites in the Hebrides, dunes grade into machair systems (section A.5.7) of which they form an integral component.

Many gulls and terns also nest within dune systems, and isolated or remote dune spits or islands tend to hold the largest colonies (section A.5.4). Coastal dune systems are especially important for species such as sandwich terns and black-headed gulls. For example, the second largest black-headed gull colony in Britain used to occur within a dune system at Ravenglass (Gribble 1976), whilst dune areas in the North Norfolk Coast SPA hold internationally important numbers of breeding sandwich terns.

Outside the breeding season, dunes and coastal areas are particularly important for migrating birds (especially passerines), and some of the most important areas for the scientific study of bird migration are centred on dunes and other coastal features (Durman 1976).

Coastal shingle features are of importance to some breeding birds such as ringed plovers and little terns. However, many shingle and dune areas are threatened by industrial uses and, at some sites, high levels of human disturbance threaten sensitive nesting birds such as little terns. Such areas are also naturally dynamic and conditions can change according to current and other changes. Pienkowski & Pienkowski (1989) documented changing conditions for ringed plovers at Lindisfarne NNR. Shingle areas previously holding high nesting densities of ringed plovers were progressively covered by sand over a long period. This adversely affected suitability of nesting habitat and densities declined. Pienkowski & Pienkowski (1989) emphasise that in temperate zones, open ground habitats such as shingle and other coastal features, are often unstable. Therefore these areas tend to be both small in area and variable in location. This provides particular problems for site-based conservation since not all potentially suitable areas may be suitable for use at any one time.

The SPA network contains a number of major dune systems and coastal features (Figure A.5.5), located throughout Britain.

A.5.4 Seabird cliffs and colonies

Terrestrial habitats used by seabirds range from sheer rocky cliffs to beach and sand-dune systems, with many intermediates. Some seabird species nest primarily inland, normally in relatively inaccessible places such as bogs or hilltops. These habitats provide safe nesting grounds within range of adequate food resources in coastal or offshore waters (or inland fields). Given the great inbalance between available breeding habitat and potential foraging area at sea, the vast majority of seabirds worldwide are inevitably colonial breeders. However, there may also be advantages in coloniality for seabirds, and the 'attractiveness' of an individual colony may be partly influenced by socio-physiological factors serving to maintain coloniality (section 2.4.4).

Reflecting the availability of both suitable habitat and food, Britain holds more than half the EC population of fourteen species of seabird[1], and more than half the world population of four of these (Lloyd *et al.* in prep.). Most of these species breed on mainland cliffs or on the cliffs, slopes or plateaux of islands – habitats which are largely confined to the west and north coasts of Britain. The distribution of major seabird colonies follows the same pattern, with most in northern England, Wales and, especially, Scotland (Figure A.5.6).

Seabirds characteristic of sheer rocky cliffs include guillemots and kittiwakes, the latter capable of nesting on narrower ledges or projections than other seabirds. Several other species occupy such cliffs, but tend to be less highly colonial and less specialised and thus more widely distributed on suitable coasts. For example, razorbills and shags make extensive use of boulder slopes at mainland and island sites; their nest-sites on sheer cliffs tend to be rather scattered among isolated ledges and recesses, and often they occupy cliffs away from the main kittiwake/guillemot concentrations.

Four species (Manx shearwater, Leach's petrel, storm petrel and puffin) nest in burrows or rock/scree crevices on islands of the west and north coasts, with the British and Irish population of each being more than 90% of the EC total (Lloyd *et al.* in prep.). There are also many puffin colonies on suitable mainland cliffs, though these are usually small (Harris 1984). The other three (nocturnal species) are confined to a smaller number of colonies on islands, although there are a few mainland colonies of Manx shearwater. Leach's petrel is the rarest of these species in EC terms, with only six known colonies in Britain, and no EC colonies outside Britain and Ireland (section A.6.2.6).

A further broad category of habitat use is shown by the five species of terns, which nest colonially on 'flat' habitats including island plateaux, small rocky islets and beaches. In contrast to cliff and burrow habitats, suitable breeding habitat for terns are widely distributed around Britain, though terns are more dependent on beaches in the south-east than in Scotland. Up to 10% of common, arctic and sandwich terns in Britain breed at inland sites.

Four gull species also nest extensively inland, including more than half the British populations of common and black-headed gulls. Both the latter are ground-nesters, and show some similarities in coastal habitats used. However, few common gulls breed outside north and north-west Britain; black-headed gulls are more widely distributed, in larger colonies. herring and (particularly) lesser black-backed gulls also have large inland populations, but mainly breed in coastal colonies, often on grassy island plateaux. Herring gulls have the wider distribution, including many colonies in the south, reflecting their broader habitat preferences, including sheer cliffs. Great black-backed gulls are more exclusively coastal and are absent from the east coast of England.

Of the remaining seabird species, fulmars show a similar wide distribution to herring gull, occupying even sand dunes on some coasts. However, the main concentrations are in the north and north-west of Scotland, usually on high cliffs. Gannets are confined to about a dozen islands in Scotland and Wales and two mainland sites, one in north-east England, the other in north-east Scotland. Cormorants occupy cliffs and islands throughout north and west Britain, with small colonies often shifting slightly from year to year. Arctic and great skuas have a very restricted distribution in Britain, forming loose colonies on moorland on north Scottish islands and coasts. Both species are at the southern limit of their North Atlantic distribution (Furness 1987) and their conservation in these areas is important to maintain the population range.

Physical threats to typical cliff or island seabird colonies are rather few, although the introduction of ground-predators such as rats or mink can be very damaging to ground-nesting seabirds (Moors & Atkinson 1987). Changes in land-use, or disturbance from large-scale construction work, could damage colonies. Tern colonies on mainland coasts are, however, very vulnerable to disturbance and ground predators, although intensive wardening and other protective measures can be effective.

For most colonies, the main threats operate in the marine environment around the colony. Man's fishing activities are likely to have the greatest anthropogenic impact on seabirds. Overfishing of prey species (such as herring or sandeel) or indirect effects caused by overfishing of potential marine predators of these species could change seabird populations dramatically (Blake 1984; Furness 1987a). Indiscriminate use of nylon fishing nets within important seabird foraging areas,

[1] Birds associated with the sea throughout the year. Other species, such as divers, grebes, seaducks etc. occur in marine areas only during the non-breeding season.

sometimes even directly below large auk colonies, has killed numbers of seabirds. Chemical pollutants, including organochlorines and heavy metals, have caused seabird deaths and reduced breeding success of seabirds in several parts of the world (Cramp *et al.* 1974; Furness 1987b). Large numbers of seabirds, especially auks, have been killed in oil pollution incidents in British waters, and a spill near a large concentration of seabirds could be catastrophic, not only in the vicinity of breeding colonies (Tasker & Pienkowski 1987).

The numbers and breeding output of seabirds at a network of British colonies, including some SPAs, are monitored annually in a scheme coordinated by NCC. This provides a measure of the 'state of health' of those colonies. Any adverse effects of pollutants or reduced food availability are unlikely to be confined to individual colonies, so such monitoring can also provide indications of the condition of the wider marine environment around Great Britain. Thus colonially-nesting seabirds can be used as indicators of the health of extensive marine areas, which would otherwise be extremely difficult and expensive to assess, even if it were possible (Furness 1987b; Gilbertson *et al.* 1987). It follows that any corrective actions arising from such monitoring should apply over broad regions.

Although most of Britain's breeding seabirds are migratory or dispersive to some extent, colonies may nevertheless be occupied for long periods each year. In some cases (e.g. Manx shearwater) this reflects the duration of the breeding season, whilst other species, notably fulmars and guillemots, occupy or visit colonies regularly during the winter.

Britain's seabird colonies are relatively unimportant for other groups of birds. However, small numbers of raptors, notably peregrines, breed at many colonies. Several British breeding areas of choughs, within their currently restricted west-coast distribution, are also important seabird colonies (section A.6.2.47).

The distribution of SPA/Ramsar sites with important breeding populations of seabirds effectively mirrors the distribution of important seabird colonies around Britain. These sites include the island group of St Kilda, the most important seabird breeding station in Europe, with over half a million breeding seabirds (Tasker *et al.* 1988) including the largest British colonies of fulmar, Leach's petrel, gannet and puffin. (This island is also a World Heritage site, a designation of particular significance as it is one of very few designated primarily on ecological grounds.) The island of Rhum, in the Inner Hebrides, holds in the order of 100,000 pairs of the nominate sub-species of Manx shearwaters, the largest colony in the world. Foula in Shetland is the largest great skua colony in the world and holds large numbers of several other species. Virtually all of Britain's gannet colonies are proposed SPAs (section A.6.3.3), often in association with large populations of other species. Skokholm and Skomer islands in south Wales are the most important colonies in the southern half of Britain, with large populations of Manx shearwaters, storm petrels and other species. Skomer holds the largest colony of lesser black-backed gulls in Britain. The Flamborough and Bempton cliffs in north-east England hold a colony of gannets and one of the largest kittiwake and guillemot colonies in Britain. Large tern colonies on Coquet Island, the Farne Islands and the north Norfolk coast are also included in SPAs.

A.5.5 Saltmarsh and coastal grassland

There is a wide range of different types of saltmarsh in Britain, containing many plant communities (Burd 1989). The proposed SPA/Ramsar network includes a good representative selection of different examples.

Saltmarshes are present on coastal sites throughout Britain, although with major representation on sites on the south and east coasts of Britain. Most major estuarine pSPAs include saltmarshes. However, some estuaries have had industrial development to the water's edge, and thus very little of the original saltmarsh area remains. Furthermore, the large majority of estuaries have lost their upper levels as a result of agricultural or other development. Consequently natural transitions through brackish areas, such as occurs at Bridgend Flats SPA, are particularly important.

Significant areas of saltmarsh within the SPA network occur at the Beauly, Cromarty, Dornoch and Solway Firths, the Humber, Wash, and Kent/Essex estuary complexes, the Solent and the Severn estuary, as well as other estuaries shown in Figure A.5.7. The Burry Inlet contains the largest area of saltmarsh in Wales. Saltmarsh also occurs on sheltered coastlines, with areas at Morrich More and Lindisfarne being particularly significant.

Apart from the SPAs at Loch Gruinart and Bridgend Flats on Islay, and some areas in the Uists, there is generally little saltmarsh on coastal sites on the north and west coasts of Scotland. To a large extent this reflects the general distribution of saltmarshes in Britain and the relative absence of this habitat from these north-westerly coastal areas (Burd 1989).

In summer, saltmarshes provide important nesting areas for a variety of breeding waders, especially redshanks (Allport *et al.* 1986; Cadbury *et al.* 1987). Although nesting inland, shelducks use saltmarshes and associated flats as rearing areas for their young (Greenhalgh 1971). Fuller's analysis (1982) of saltmarsh breeding bird data showed that eight species were particularly abundant saltmarsh breeders on a national scale: skylark, redshank, meadow pipit, shelduck, oystercatcher, lapwing, reed bunting and mallard. Colonial gulls such as black-headed gull and common terns occur less frequently. However, on sites where such colonies

are present, gulls tend to outnumber all other breeding species (Greenhalgh 1971; Fuller 1982). In summer, the species of perhaps greatest conservation significance is the redshank, since nesting densities on saltmarshes are generally high, compared to those in other British habitats, and on the Ribble estuary reach over 70 pairs/km^2 (Allport *et al.* 1986; Cadbury *et al.* 1987).

Fuller (1982) noted that, in Britain generally, birds with restricted ranges as saltmarsh breeders tended to occur in the north and west. Of note is the dunlin, which is a characteristic breeder on the upper saltmarsh grasslands of the Solway and Outer Hebrides (Fuller 1981), although also occurring as far south as the Ribble (Greenhalgh 1969, 1971). Other even rarer species also occur, with very limited distributions.

In winter, saltmarshes are particularly important for grazing waterfowl such as wigeon, white-fronted, barnacle and brent geese, as well as for waders such as lapwing, golden plover, snipe and redshank (Owen 1972, 1973, 1976b; Fuller 1982; Prokosch 1984; Owen *et al.* 1986). For many waterfowl, the attractiveness of saltmarsh as a feeding habitat is influenced not only by its botanical composition, but also by management practices. In particular, short-billed grazers such as wigeon, brent and barnacle geese favour marshes that have been closely cropped by grazing livestock, and extensive areas of tall, rank saltmarsh are avoided. Thus the management of such areas is of particular importance for maintaining their conservation importance for birds with such needs (Charman & Macey 1978; Cadwalladr *et al.* 1972; Owen 1973; Scott 1982). However, other species have different needs, and the management of sites requires consideration on an individual basis according the specific nature of the conservation interest.

In winter, saltmarshes are also important for certain passerines, although their occurrence is variable in different parts of Britain. Among the species present are snow bunting, Lapland bunting, reed bunting, twite, meadow pipit, skylark, linnets and greenfinches (Fuller 1982), although not all occur at each site. Twite, in particular, show a dependence on saltmarsh as winter habitat, and occur in larger concentrations on the Wash than anywhere else in Britain (Davies 1988). As a consequence of these passerine numbers, some saltmarshes are of importance for wintering raptors, especially peregrines, merlins, and short-eared owls. In some areas, kingfishers occur within saltmarshes in winter, feeding along creeks and streams.

A.5.6 Seasonally-flooding neutral grasslands

Freshwater, seasonally flooded grasslands and washes are of considerable ornithological importance where they still remain undrained and appropriately managed. In summer, they are used by breeding waders and ducks, whilst in winter such grasslands are used as feeding areas by wintering ducks, geese and swans. Locally they can also be important for wintering birds of prey, such as short-eared owls and hen harriers, because of the often high densities of small mammals associated with traditional grassland management using livestock.

Breeding wader species are usually variable in their nesting density according to site characteristics (principally the structure of the grassland, site wetness and agricultural management). Main species occurring include lapwing, redshank, snipe, curlew and sometimes oystercatcher (Smith 1983; Green & Cadbury 1987). Rare waders with now very restricted distributions in Britain (such as black-tailed godwits and ruffs) also occur locally on some seasonally flooded washlands (Cottier & Lea 1969), although these birds, as well as others, can be adversely affected by flooding during the nesting period (Green *et al.* 1987). The management of water and vegetation is crucial to the successful conservation management of lowland wet grasslands (Thomas 1982).

Conditions on some washes and areas of lowland wet grassland attract a range of breeding ducks, which can include shoveler, pintail, mallard, teal, garganey, shelduck, tufted duck, pochard, gadwall, coot and moorhen. Many of these are highly local, however, occurring on only a few sites (Thomas 1980; Fuller 1982). Breeding ducks, unlike waders, are dependent on the presence of open water, usually in the form of ditches or rhines. Such areas can also support nesting little grebe, sedge warbler, reed warbler and reed bunting (Fuller 1982).

In winter, freshwater grasslands in many areas of Britain provide essential feeding areas for very large numbers of migratory waterfowl (Owen *et al.* 1986). The attractiveness of important sites is usually determined by the degree to which they flood; however, some drier grassland areas are also used to some extent by Bewick's swans, European white-fronted geese and wigeon. Some waterfowl such as geese, swans (Bewick's, whooper and mute) and wigeon directly graze emergent vegetation, whilst others such as gadwall, pochard and coot eat submerged plants in flooded areas. In contrast, teal and shoveler feed by sifting small seeds and other food particles from winter flood waters (Thomas 1976).

Flooded grasslands are also valuable winter feeding areas for some waders such as snipe, dunlin, black-tailed godwits and ruff (Fuller 1982), whilst the damp rough grazings of the Somerset and Gwent Levels are of importance to migrating whimbrels in spring (Ferns *et al.* 1976).

The SPA/Ramsar network contains a number of freshwater wetlands throughout Britain (Figure A.5.8). These include sites such as the Ouse and Nene Washes, Derwent Ings and Somerset Levels.

In determining the boundaries of these sites, consideration is given to defining a sensible hydrological unit. Since so many aspects of conservation importance are affected by water-levels and their fluctuations, it is important to be able to control water regimes (Beintema 1982, 1983; Green *et al.* 1987). This may mean inclusion in a site of areas with lower direct ornithological interest, but which are of critical importance for water management.

There have been major losses of these habitats throughout Britain in recent decades, with conversion of wet grassland either to arable or, through drainage and reseeding, to dry intensively managed leys (Fuller 1987; Williams & Bowers 1987). However, conservation interest can also be damaged by the cessation of traditional agricultural practices. These low-input, low-output forms of farming maintain the grassland ecosystem and prevent succession of wet grassland to scrub and woodland (Nairn *et al.* 1988).

Major losses have also occurred elsewhere in Europe (Beintema 1983; Nairn *et al.* 1988). It is important to protect sites from which birds might re-colonise other areas if conditions in the latter were restored to some extent. For several of these lowland grassland breeding species (common snipe, redshank, ruff, black-tailed godwit), the land-use changes associated with agricultural intensification have resulted in a reduction in survival and reproduction in their areas of distribution within the Community. The protection of key remaining sites is thus of great importance, both to maintain existing (restricted) distributions, and to allow future re-colonisation of former distributions (as indicated under Articles 2 and 3 of the Directive).

A.5.7 Machair

Machair is the Gaelic name for coastal grasslands which develop under a geographically limited range of conditions in Europe. They occur where offshore, calcareous shell-sand is washed and blown ashore to form low coastal landforms. Machair is frequently associated with traditional systems of low-intensity agriculture, usually those which have developed under crofting tenure (Caird 1979). These flat landforms often flood extensively in winter, while some areas remain wet throughout the year. This provides a rich range of breeding and feeding opportunities for wildfowl and waders as well as other scarce birds.

In Europe, machair grasslands occur on the Atlantic seaboard of the British Isles, from isolated areas in Shetland and Orkney in the north, to the extreme west of Ireland. However, they attain their greatest development in the southern islands of the Outer Hebrides (Ritchie 1976). Small areas occur also on some of the Inner Hebridean islands such as Colonsay, Islay and Iona, although the greatest extent in this island group occurs on the islands of Tiree and, to a lesser extent, Coll (Wormell 1989).

In the Outer Hebrides, machair is cultivated in strips on a traditional arable – fallow or potatoes cycle (Caird 1979), whilst on Coll and Tiree it is not generally cultivated for arable crops and is used rather as permanent grazing.

Machair is of importance for the high densities of several species of wader or terns which breed there. These include oystercatcher, ringed plover, lapwing, dunlin, snipe, redshank and red-necked phalarope. Some of these such as dunlin breed in exceptionally high densities (Fuller *et al.* 1986; Shepherd 1989). Fuller *et al.* considered that *"the Southern Isles* [of the Outer Hebrides] *are amongst the most important breeding grounds for waders in the north-west Palearctic. Internationally they represent a particularly important habitat for the southern dunlin and the densities of ringed plover are probably the highest in Europe"*.

Elsewhere, studies on the islands of Coll and Tiree have found these islands to be internationally important for their machair breeding waders (Shepherd 1989; Stroud 1989). However, these waders occur on slightly different, uncultivated machair.

As well as breeding waders, the wettest areas of machair and the lochs set within it are important for a variety of breeding waterfowl, including mute swan, mallard, gadwall, pintail, teal, shoveler and tufted duck (Spray 1981; Reed *et al.* in press). In autumn and winter, machair lochs can also be important areas for mute and whooper swans, and Greenland white-fronted geese (Spray 1981; Newton 1989).

Areas of cultivated machair and other associated areas hold the last remaining strongholds of corncrakes in Britain, and the continued traditional crofting management of these areas is of critical importance for the survival of this species in Britain (Hudson *et al.* 1986; Stowe & Hudson 1988; Cadbury 1989a; Hudson *et al.* in press). These areas also hold important populations of corn buntings, a bird of weedy arable land that has suffered major declines elsewhere in Britain as a consequence of intensification of agriculture (Williams *et al.* 1986; Cadbury 1989a).

The SPA/Ramsar network contains some of the most important areas of machair habitat on the islands of Coll and Tiree, South Uist, North Uist and the Monach Isles (Figure A.5.9). Nearly all the machair in Europe has been surveyed for breeding waders in the last five years (c.f. Nairn & Sheppard 1985). The islands of Tiree and Coll, and the Outer Hebrides hold internationally important populations of breeding waders, and are important in maintaining the breeding distribution of several species of wader, and wildfowl within both the British Isles and the European Communities.

As well as protecting key areas of machair with exceptionally high densities of breeding waders, conservation of these populations elsewhere should also be undertaken, by support for

traditional forms of crofting. Over the past centuries such crofting has created the agricultural landscape of these Hebridean islands (Wilson 1978; Harrison 1989). Support for traditional forms of agriculture (especially through Environmentally Sensitive Area – type designations) which benefits birds would accord with the provision in the EEC Birds Directive for wider protective measures to support site-based conservation (under Articles 2, 3 and 4.4: see section 2.3).

A.5.8 Chalk grassland

Chalk grassland has been profoundly influenced by modern agricultural change. The vast areas of open sheepwalk which historically occurred in southern English counties have now been almost entirely converted to intensive arable agriculture (Blackwood & Tubbs 1970). There has been an 80% loss of or significant damage to chalk grassland, mainly since 1940 (NCC 1984). Remaining areas of chalk grassland occur almost exclusively on either steep escarpments and slopes too difficult to plough, on nature reserves or on military training areas such as Salisbury Plain.

The grasslands have a characteristic breeding bird assemblage, including lapwings, wheatears, meadow pipits and skylarks. Downland remains one of the most important habitats for stone curlews in Britain. Although this species is nesting more frequently on arable land if conditions are favourable, where chalk grassland management is suitable it will nest there at higher densities (Fuller 1982). However, stone curlews require close-cropped grassland and this traditional agricultural management is no longer practised on some important remaining chalk grassland areas such as military training land (Green 1988).

Large populations of small mammals make chalk grassland an important winter feeding habitat for birds of prey such as hen harriers and short-eared owls, and in some areas hobbys and kestrels breed. The remaining chalk grasslands on Salisbury Plain appear to be the main British stronghold for breeding quail in 'normal' (non-irruptive) years.

The SPA/Ramsar network contains only one site with a significant area of chalk grassland: Porton Down (Figure A.5.10). However, information is being gathered as to the probable qualification of larger areas of Salisbury Plain.

A.5.9 Woodland

A great variety of woodland types occur within the proposed SPA network. These range from wind-blasted fragments of native woodland on Orkney to extensive deciduous woodland in southern England. Several woodland types are of special note as habitats for scarce birds, and are considered here.

Caledonian Pine forest

There used to be extensive natural pine woodland in Scotland, but now these areas are much reduced in extent and highly fragmented (Steven & Carlisle 1959). Even now, these areas are being lost by inappropriate management and by conversion to plantations of alien conifers of uniform age (Bain & Bainbridge 1988: Figure A.5.11). Those Scots pine woodlands which still remain have a natural age structure providing a far greater range of feeding and nesting opportunities for a larger number of birds than conifer plantations. Newton & Moss (1977) found that densities of birds in native pine woods were twice as great as in conifer plantations, and that they also had a more diverse bird community.

Native pine woods support a variety of highly restricted birds, including crested tit, capercaillie and Scottish crossbill: Britain's only endemic bird species (Voous 1978). Both Scottish crossbill and capercaillie are listed on Annex 1 of the Directive as requiring special protection measures.

In view of the small national populations of these species (section 3.3), their specialised habitat requirements and the degree of fragmentation of native pine woods, it is particularly important to conserve large remaining tracts of native pine wood. Indeed, some of the largest woods, such as that at Abernethy, are contained within the proposed SPA network.

The conservation importance of Britain's remaining natural pine forests, are considerable, even though the areas are small. Few northern countries have mature natural conifer forest remaining, and that in many Scandinavian countries has been heavily modified or changed by commercial forestry practices. This has had adverse consequences for the birds of these areas (Helle 1986; Väisänen ***et al.*** 1986).

Ancient deciduous woodland

Lowland ancient woodland in England is included in several sites such as Windsor Forest and Great Park, and the New Forest. In these areas, the woodland occurs as one component of the 'forest' area, which also includes commons and heathland. These areas are of importance for such lowland birds as hobby, nightjar, woodlark and, in the past, red-backed shrike.

Such areas continue to be lost either by conversion to coniferous plantations or through grubbing up for agricultural use. There was a decrease of over 46% in the area of ancient semi-natural woodland in England and Wales between 1933 and 1983 (NCC 1984).

Fen carr woodland

Areas of fen carr woodland are included in some mire sites in the Norfolk Broads and elsewhere in East Anglia. These areas provide nesting sites for a

number of scrubland and fen margin birds such as reed bunting and sedge warbler.

A.5.10 Montane

In Britain, the montane zone lies above the upper limits of the tree growth line (i.e. timberline) and covers between 2.5% and 3.0% of Britain's land surface. This zone has not suffered the massive human impacts inflicted on the sub-montane zone (such as tree-felling, burning, intensive grazing and podsolisation) and contains the largest areas of near-natural habitat remaining on land in Britain. British montane habitats are of particular conservation importance in an international context, both for their birds and for other aspects of their fauna and flora. The range of variation in composition and in plant communities has been well described elsewhere (Ratcliffe & Thompson 1988). Plant communities vary widely from both east to west and north to south across Britain. Underlying bed-rock geology has a profound influence on the productivity and composition of mountain vegetation. In recent years the ecology and conservation importance of montane plateaux in Scotland has been the subject of special study by NCC (Thompson *et al.* 1987; Galbraith *et al.* submitted, in prep.).

Characteristic birds of the montane plateaux and corries include nesting dotterel, snow bunting, ptarmigan, golden plover, dunlin and wheatear. Raptors, which feed there, include golden eagles, merlins and peregrines, whilst the crags of many mountainous or montane areas are important nest sites for ravens. Dotterel, snow bunting and ptarmigan are restricted as breeding species to these montane areas, whilst other birds occur also at lower altitudes. In some montane areas, very rare species in Britain such as Lapland bunting and purple sandpiper occur. These, and snow bunting, are on the extreme southern limit of their range. Consequently these species may not nest each year. In view of the EEC Birds Directive's emphasis on maintaining range (sections 1.2 & 2.2), it is particularly important to provide site protection for such species. With the current concern about global warming, it is, furthermore, particularly important to monitor population sizes and breeding distributions of dotterel, ptarmigan, snow bunting and the rarer species, for these may be amongst the first birds to respond to temperature shifts (Williamson 1975; Ratcliffe & Thompson 1988).

Adverse impacts in montane areas are largely the result of sheep and deer-grazing, and, more locally, recreational activities such as ski-development and walking. These have been summarised by Thompson *et al.* (1987).

Grazing-related damage to montane vegetation is a particular problem south of the Scottish Highlands. Food for ptarmigan has been lost resulting in local extinctions in the south of Scotland (Galbraith *et al.* 1988). Damage to *Rhacomitrium* heath by sheep (in terms of modification into grassland) may deter dotterel from breeding south of the Highlands, and poses a major threat *per se* to Britain's largest single near-natural plant community. Acidic deposition is a concern because it increases with cloud cover and so is greatest at high altitude. Ski-developments (there are currently five) pose particular threats to birds for several reasons: a) they facilitate greater access by people onto areas which are sensitive to physical disturbance, b) they add an artificial dimension to a typically wild landscape, and c) they have pylons and snow fences which kill ptarmigan and dotterel. The increase in numbers of people on mountains, and their habit of leaving food scraps, can attract species that are liable to predate nests.

Montane, and upland (see section A.5.13), sites in the proposed SPA/Ramsar network mostly occur in the central Scottish Highlands, although some Scottish islands such as Arran, Rhum, Harris and Shetland also hold important upland sites (Figure A.5.12). The three pSPA montane sites (Cairngorm, Caenlochan and Drumochter) together contain a considerable range of montane birds, plant communities and geomorphological features. Whereas Cairngorm is the highest, composed of grantic bedrock, Drumochter and Caenlochan are predominately schistose and somewhat more oceanic. The dotterel populations in the last two sites are amongst the most dense recorded anywhere in Europe. Cairngorm contains the major outposts of two rare arctic breeding birds, and has the bulk of the snow bunting population (which is unusual by virtue of containing both races of the species as breeders and in winter). The ptarmigan population density in parts of the Cairngorms is amongst the highest recorded anywhere.

A.5.11 Fens and valley bogs

Fens are areas subject to water-logging or impeded drainage, but in contrast to ombrotrophic mire systems such as raised or blanket bogs (sections A.5.12 and A.5.13) they are dependent upon mineral water input derived from surface or sub-surface sources. The category includes a wide range of plant communities including tall emergent vegetation within which tall grasses and bulky species are important, as well as short-sedge and moss-dominated vegetation. The productivity of fen plant communities is variable, though tall herb fen, when generally productive, forms an important habitat for both breeding and wintering birds. Fens are well represented within the SPA/Ramsar network (Figure A.5.13). Valley bogs have affinities to fens and are included here, although not referred to specifically in this account.

Fens have been subject to massive destruction, as a result of drainage and 'reclamation' for agriculture, and, chemical enrichment of drainage water. This is most dramatically illustrated by the East Anglian Fens which suffered a 99.7% reduction in area between 1637 and 1984, whilst between 1934 and 1984 there was a 90% reduction in area (NCC 1984).

Fens within internationally important sites occur from Loch Fleet and Mound Alder woods in north-east Scotland to the New Forest in Hampshire. There is a concentration of rich-fen sites in East Anglia, historically a major centre for this habitat (Rackham 1986; Wheeler 1988). Apart from the proposed SPAs, several of these sites, such as Dersingham Bog, Redgrave and Lopham Fens, Chippenham Fen and Roydon Common, are proposed Ramsar sites only, mainly on the basis of their non-bird interest.

Like bogs, fens are hydrologically sensitive to changes in surrounding areas, especially since they often receive nutrient input from these areas. Thus the conservation of fens requires consideration of land-use and management in an area often much greater than that of the fen habitat alone.

Fen vegetation and structure, and hence bird communities present, depend on the nutrient status of received water. 'Poor fens' have a pH usually less than 5, are base-deficient and generally have low levels of disolved nutrients. Typically they may have a carpet of *Sphagnum* mosses and a variety of sedges. These areas are often found in the north and west of Britain, often on the margins of other peatland areas (such as blanket bogs) from which they receive run-off. There are particularly good examples on the Rhinns of Islay pSPA. In contrast, rich fens are associated with water of a higher pH and base-richness. A number of different fen types are recognised, but those presenting hydroseral succession, illustrated by open water areas grading through to woodland communities, provide particularly varied habitat for birds and are therefore particularly valuable (Fuller 1982).

Large beds of *Phragmites* reed swamp are particularly important for a number of scarce breeding birds (Everett 1989). Indeed, such areas hold the whole British breeding population of some of these species, such as bearded tit, bittern, marsh harrier, Savi's warbler and Cetti's warbler. The majority of the populations of most of these species are currently centered in East Anglia, reflecting the geographic concentration of extensive areas of reedbeds (Bibby & Lunn 1982; Underhill-Day 1984). Other breeding birds associated with such reedbeds include mallard, water rail, moorhen, cuckoo, reed warbler and reed bunting (Fuller 1982). Locally, significant nesting colonies of black-headed gulls occur.

Reedbeds are also important roosting areas for some birds. Hen harriers, for instance, roost communally in some reedbeds and half the 77 winter roosts found in Britain in 1983-84 were in reedbeds or marshes (Everett 1989). Very large numbers of migrant and other passerines also roost in such areas, and Bibby & Lunn (1982) documented the importance of reedbeds for swallows, sand martins, yellow wagtails, pied wagtails, starlings, reed buntings and corn buntings.

Other types of fen vegetation (dominated by *Typha*, *Glyceria* or a mixture of other plants) are important breeding areas for other birds such as coot, teal, shoveler, water rail, grasshopper warbler, sedge warbler and a variety of other passerines (Fuller 1982; Bibby & Lunn 1982).

A.5.12 Lowland raised mires

Raised bogs are a rare and localised habitat and one of high conservation importance owing to the assemblage of specialised animals and plants which occur there.

Raised bogs have been subject to huge losses as a result of exploitation for peat reserves, drainage, conversion to agriculture, coniferous afforestation and other damaging activities. Overall, there has been a 60% reduction in area of lowland raised mire, although local losses have been even greater. In areas such as Lancashire, once famous for its huge Mosses, there has been a 95% reduction in extent between 1948 and 1975 (NCC 1984).

Only a very few raised bogs in Britain have survived more or less intact. Despite these losses, Britain's remaining raised bogs are of particular importance in a European context. Some Member States of the Community have totally destroyed their raised bog systems. The Netherlands are now spending millions of guilders in an attempt to restore their last remaining fragment of raised bog – a tiny site, "de Groote Peel", a few hectares in extent.

In Britain, studies of the birds of raised bogs indicate various common ecological features (Fuller 1982). As would be expected on these nutrient-poor, ombrotrophic systems, both the density and diversity of breeding birds is low, although their occurrence on these areas is of considerable ecological interest. Regularly occurring birds tend to be habitat specialists, and the bird assemblage includes a high proportion of wildfowl and waders, with some raptors. Raised bogs are especially important for wintering and migrating birds. Many contain particularly important roosts of raptors and corvids and these open areas are also important hunting grounds for such predatory birds.

Frequently occurring wildfowl species include teal (although usually in marginal rand areas which are naturally slightly enriched by nutrients: Fox 1986) and mallard. In winter, raised bogs in some parts of Britain and Ireland are important feeding and roosting areas for Greenland white-fronted geese (Pollard & Walters-Davies 1968; Ruttledge & Ogilvie 1979; Fox & Stroud 1986). They are used in winter by a wider range of wildfowl including wigeon.

A wide range of wader species occur on British and Irish raised bogs, including curlews, redshank, snipe and very locally, dunlin. Many sites are also

traditionally important for passage and wintering waders. In the north and west of the British Isles, and particularly in Ireland, raised mires are important breeding areas for red grouse, especially where these mires occur as 'islands' surrounded by agricultural land. Locally, significant numbers of breeding black-headed gulls occur. The principal passerine species nesting on raised mires are meadow pipits and skylarks, with a few other birds such as yellow wagtails, reed buntings and crows occurring on some sites.

Raised mires are important feeding areas for several birds of prey, although some also nest there. Prime amongst these species are hen harrier, merlin, buzzard, short-eared owl and, in winter, peregrine. Of particular significance is the use of bogs as winter roosts by hen harriers and merlin. In many areas of the country, such undisturbed open-ground sites are essential for wintering raptors. Some of these sites occur within the SPA/Ramsar network (Figure A.5.14).

A feature of human impacts on raised mires is that very few systems remain wholly intact; most have been exploited to a greater or lesser extent. However, there is a growing realisation of the conservation importance of cut-over raised mires (Fojt & Meade 1989; Stroud 1989), and some such as Thorne and Hatfield Moors are included within the SPA network because of their importance for bird populations.

A.5.13 Sub-montane blanket bogs and moorland

Upland moorlands and blanket bogs are a biotope for which Britain has a special responsibility, particularly because of the global rarity of these habitats (Cadbury 1987b; Ratcliffe & Thompson 1988). Blanket bog forms under cool conditions with very high rainfall, not only developing on flat areas, but also blanketing slopes in peat.

These moorland areas, which include upland grasslands and a variety of other plant communities occurring on acidic soils or peats, are also important to a number of specialised birds. The assemblage of moorland birds varies across the country, being generally richest in the north and west of Britain where there are significant numbers of breeding wildfowl and waders (Stroud *et al.* 1987; Hudson 1988). In part, this geographic trend in bird assemblages reflects variation in the physiognomy and floristics of blanket bogs across Britain (Lindsay *et al.* 1988). Bogs tend to have more pools and small lochans in the north and west. However, assemblages and species abundance also differ between different moorland types within a geographical area.

There are several common ecological features of moorland bird assemblages. The majority of species are habitat specialists which do not occur in other lowland habitats, and as a consequence many have small national populations. Most are open-ground birds, the larger of which (birds of prey especially) require extensive areas over which to hunt for food. Many are birds which depend on wetlands at some stage of their annual cycle.

These populations have been adversely affected by land-use changes which alter their habitats. Upland coniferous afforestation has had a particularly severe impact on a number of upland birds (Marquiss *et al.* 1978; Watson *et al.* 1987; Stroud 1987; Stroud *et al.* 1987; Thompson *et al.* 1988). The losses of scarce bird species caused by afforestation have not been offset by the increase in commoner birds attracted by some new plantations, since these birds are abundant elsewhere.

As well as afforestation, other changes in moorland management have affected moorland birds. The most widespread has been the effect of over-grazing by sheep. In many areas this has led to the loss of heather-dominated vegetation and its replacement by acidic grasslands, a generally poorer habitat for moorland birds (Woods & Cadbury 1987; Cadbury 1987b, Sydes 1988).

Moorlands hold important breeding populations of waders, including golden plover, dunlin, greenshank, commion snipe, curlew, redshank and common sandpiper, and much more locally, whimbrel and wood sandpiper. A number of wildfowl occur, although their presence in any area depends much (as for other species listed) on the local suitability of moorland or blanket bog areas. Characteristic wildfowl include greylag goose, wigeon, common scoter, red-throated and black-throated divers and teal. Each has specific requirements (Fox *et al.* 1989a). Red grouse, and more locally, black grouse breed on many moorlands.

Birds of prey have a patchy distribution, often directly linked to levels of human persecution, but golden eagle, hen harrier, peregrine and merlin are all characteristic, with short-eared owl also occurring on moorlands. There are a number of moorland passerines such as ring ouzel, wheatear, twite, whinchat and stonechat. Thompson *et al.* (1988) give a fuller list of birds associated with moorlands and upland blanket bogs. A notable point is that a significant number of these species are listed on Annex 1 of the Birds Directive as requiring special habitat protection measures.

The proposed SPA/Ramsar site network contains a number of moorland and blanket bog areas (Figure A.5.15), and these extend south from important moorlands on Shetland, Orkney, Lewis and Islay, through Scotland, to the Pennines and mid-Wales. Some of these sites also contain montane areas, and the mid-altitude moorland/montane boundary is a particularly important zone for some bird species. It is important to ensure that adequate topographic units are deliniated in order to safeguard the full range of ecological variation. The sub-montane

zone is extensive and is of international conservation significance. If often contains, at certain times, many of the species which also feed and breed in the higher montane zone (section A.5.10). Where montane and sub-montane areas meet, the altitudinal continuity of ecological variation is as important as the extent of the montane resource. Thus, the conservation value of sites could be adversely affected if an arbitrary boundary to either montane or sub-montane sites is drawn along the tree-line.

The proportions of the populations of many moorland species contained within existing sites in Table 3.1 is low (section 3.3 & Appendix 6). This is because several areas require further survey and sites from these will need to be added to the list as indicated tentatively in Table 3.2. Survey and assessment of other moorland areas (such as those listed in Table 3.2) is proceeding.

A.5.14 Heaths and brecks

Heathlands are open, treeless areas which generally occur on nutrient-poor or acidic soils. Heaths can be divided into two main types – upland heath (generally wet heath) and lowland heath.

Many lowland heath areas were once natural deciduous woodland, cleared between 2,000 – 4,000 years ago. After forest clearance, high rainfall leached nutrients from the sandy soils, resulting in characteristic vegetation communities. These are principally dominated by a variety of ericoid species and other shrubby undergrowth. Gorse, heather and cross-leaved heath are especially common.

Britain holds a major part (20%: Farrell pers. comm.) of Europe's remaining lowland heathland, and these areas hold not only many nationally rare plant and invertebrate species but also a significant number of rare and restricted birds. However, the lowland heaths of southern England are under intense threat from a variety of development pressures and also because of the results of management changes (Cadbury 1989b). This has been a long-term and persistent threat (Moore 1962), which has resulted in the fragmentation and isolation of heaths – a process which continues to the present. In Dorset, there were 30,000 ha of heathland at the beginning of the 19th century; however, this area has been reduced to less than 5,500 ha in 1989 and the present rate of loss is about 240 ha per year. In Suffolk, three-quarters of the coastal heathland has been lost since 1920 and in north Hampshire a fifth of heathland was destroyed between 1966 and 1980. There was an overall reduction of lowland heathland of 40% between 1950 and 1980 (NCC 1984).

Dartford warblers have their British stronghold in lowland heaths and the protection and appropriate management of these areas is crucial to the long-term survival of this species in Britain (Bibby 1978). Heathlands are also important for populations of hobbies and nightjars (Gribble 1983), and in some regions for woodlarks (Sitters 1986) and stone curlew. The highest breeding densities of hobby in Britain are associated with heathland in Surrey and Hampshire (Parr 1985).

Cadbury (1989b) has recently reviewed the conservation importance of lowland heathland and has noted the international obligation to protect heathland habitats under the Birds Directive. The lowland heathland sites within the network of proposed SPAs (Figure A.5.16) will protect a significant proportion of the populations of rare birds dependent on this scarce and vulnerable habitat. These include the majority of remaining heaths in Dorset and the New Forest.

Upland heath areas have a vegetation more akin to drier moorland. The bird communities present in these areas are also similar to some moorland bird assemblages with waders predominating and species such as black and red grouse being locally common.

A.5.15 Freshwater: lochs, reservoirs and rivers

A great variety of freshwater habitats occur in Britain, although their importance to bird populations varies greatly. It is far beyond the scope of this review adequately to summarise the importance of the many types of freshwater habitat for breeding and wintering birds (especially for wildfowl and waders). Owen *et al.* (1986) have presented much relevant information, and many detailed studies have been undertaken by the Wildfowl and Wetlands Trust under contract to the NCC. Fuller (1982) gives further information on the bird communities of freshwater habitats throughout Britain.

In considering the conservation of these areas for birds, however, great importance must be given to the hydrological systems of which a site (such as a lake) may be a part. It is not possible to isolate lakes and rivers from the wider hydrological systems of which they are components. Thus the management of unprotected water systems outside a site may directly influence wetland birds within a protected area such as an SPA. For example, coniferous afforestation of certain upland areas can increase acidification of watercourses draining these areas. This can have detrimental effects, not only on invertebrates but also on bird populations (Ormerod & Tyler 1987). Many sensitive populations of waterfowl are potentially at risk from such effects (Stroud *et al.* 1987; Fox *et al.* 1989a), and consequently this factor is taken into consideration when assessing boundaries for proposed Special Protection Areas (see also sections 2.4.2 and 2.4.7).

The SPA network contains a number of freshwater sites (Figure A.5.17). These are of importance for a

variety of reasons: as nesting areas for red-throated and black-throated divers; as winter roost sites for geese and swans; as breeding and wintering areas for duck populations or as integral components of wider areas of machair and moorland important for breeding waders and other waterfowl.

Figure A.5.1 Location of British estuaries studied by NCC's Estuaries Review (Davidson *et al.* in prep). Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

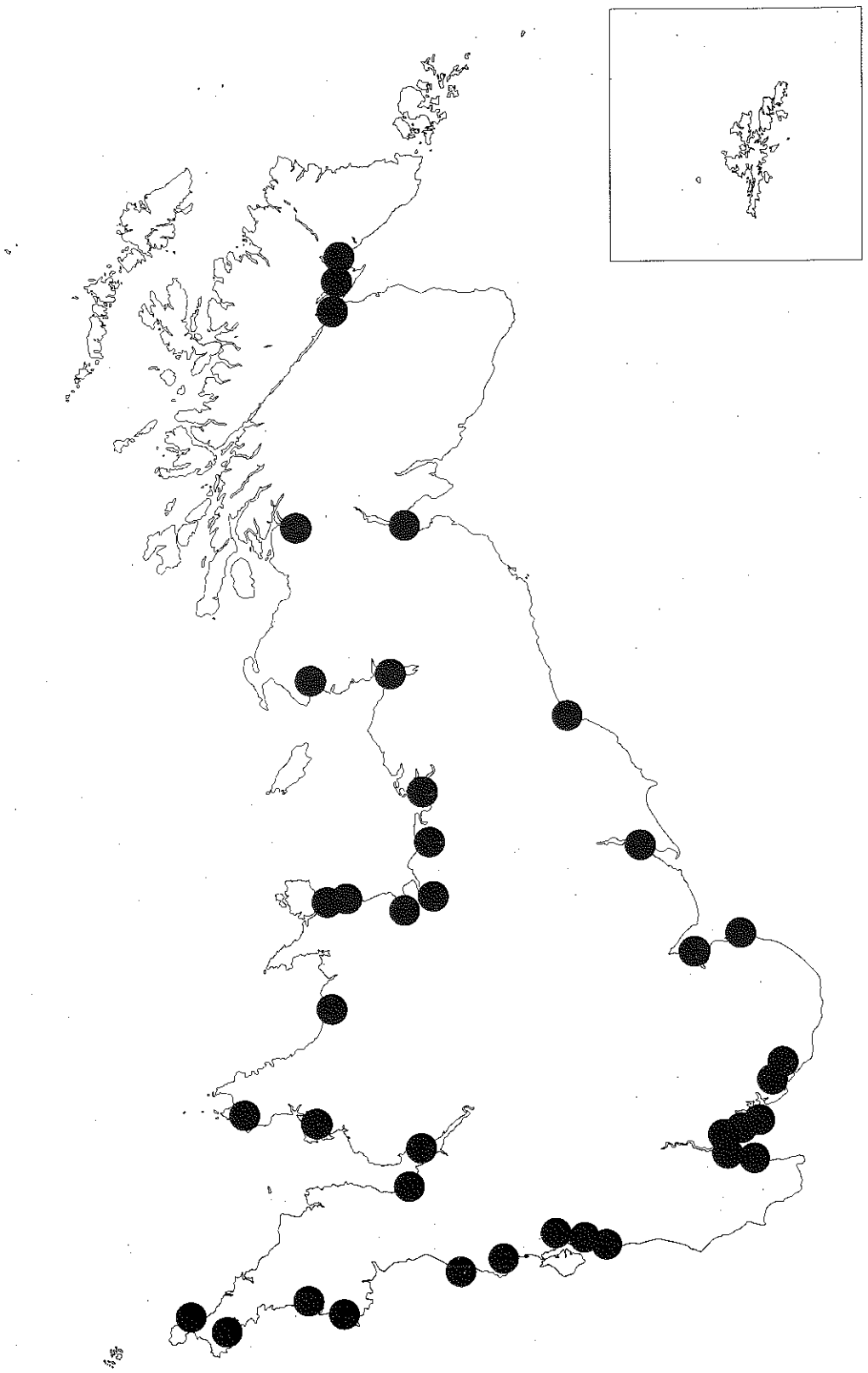


Figure A.5.2 Estuaries of nature conservation importance in Britain on which there are known to be current land-claim schemes involving loss of estuarine habitats (as of 1988). (From Davidson in press). Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Figure A.5.3 Sites within the SPA/Ramsar site network in Britain which contain estuarine bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

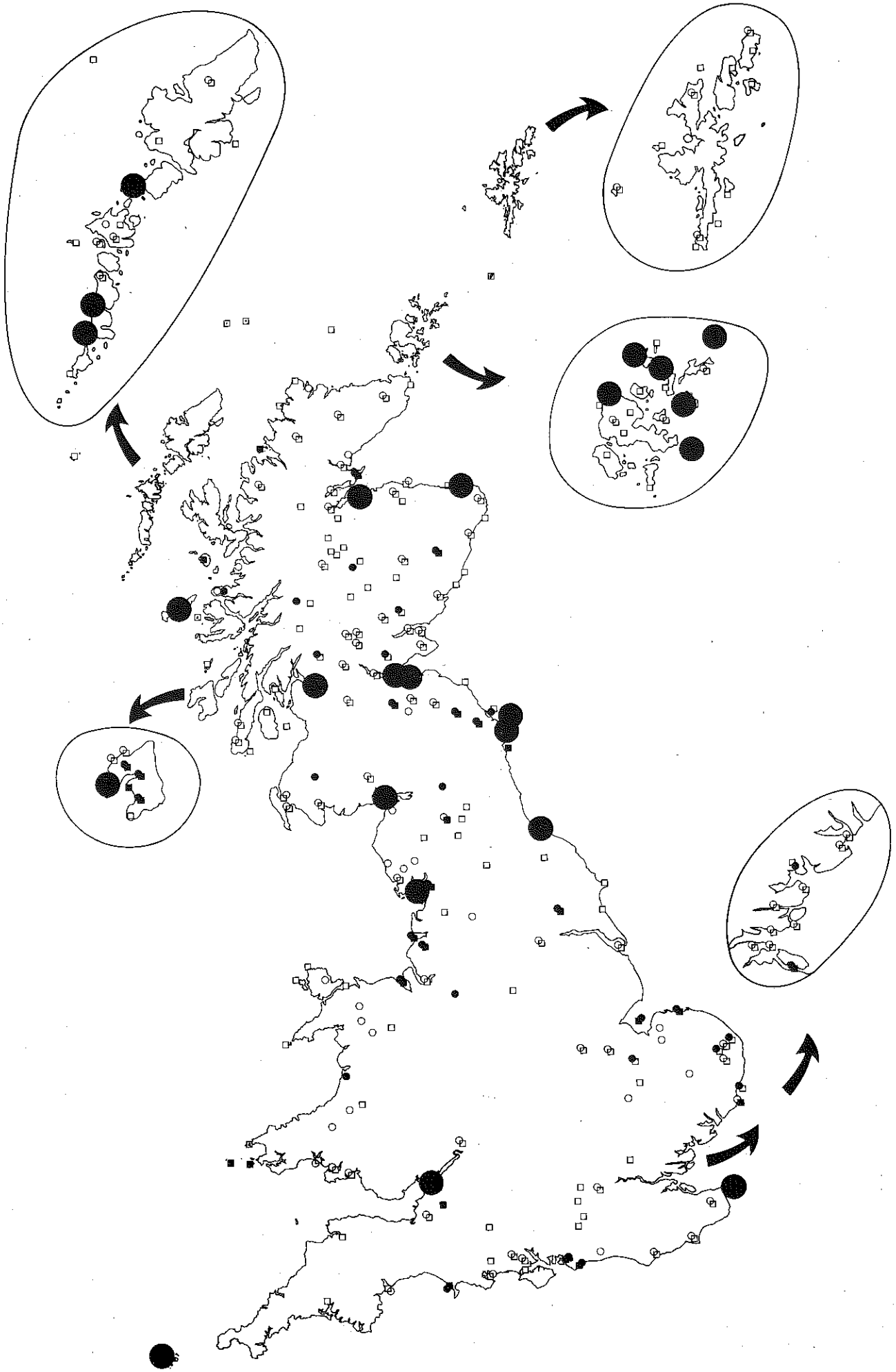


Figure A.5.4 Sites within the SPA/Ramsar site network in Britain which contain open shore bird habitats of importance for shorebirds. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Figure A.5.5 Sites within the SPA/Ramsar site network in Britain which contain sand dunes and other coastal features. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Figure A.5.6 Sites within the SPA/Ramsar site network in Britain which contain major seabird colonies. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Figure A.5.7 Sites within the SPA/Ramsar site network in Britain which contain saltmarsh and other coastal grassland bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

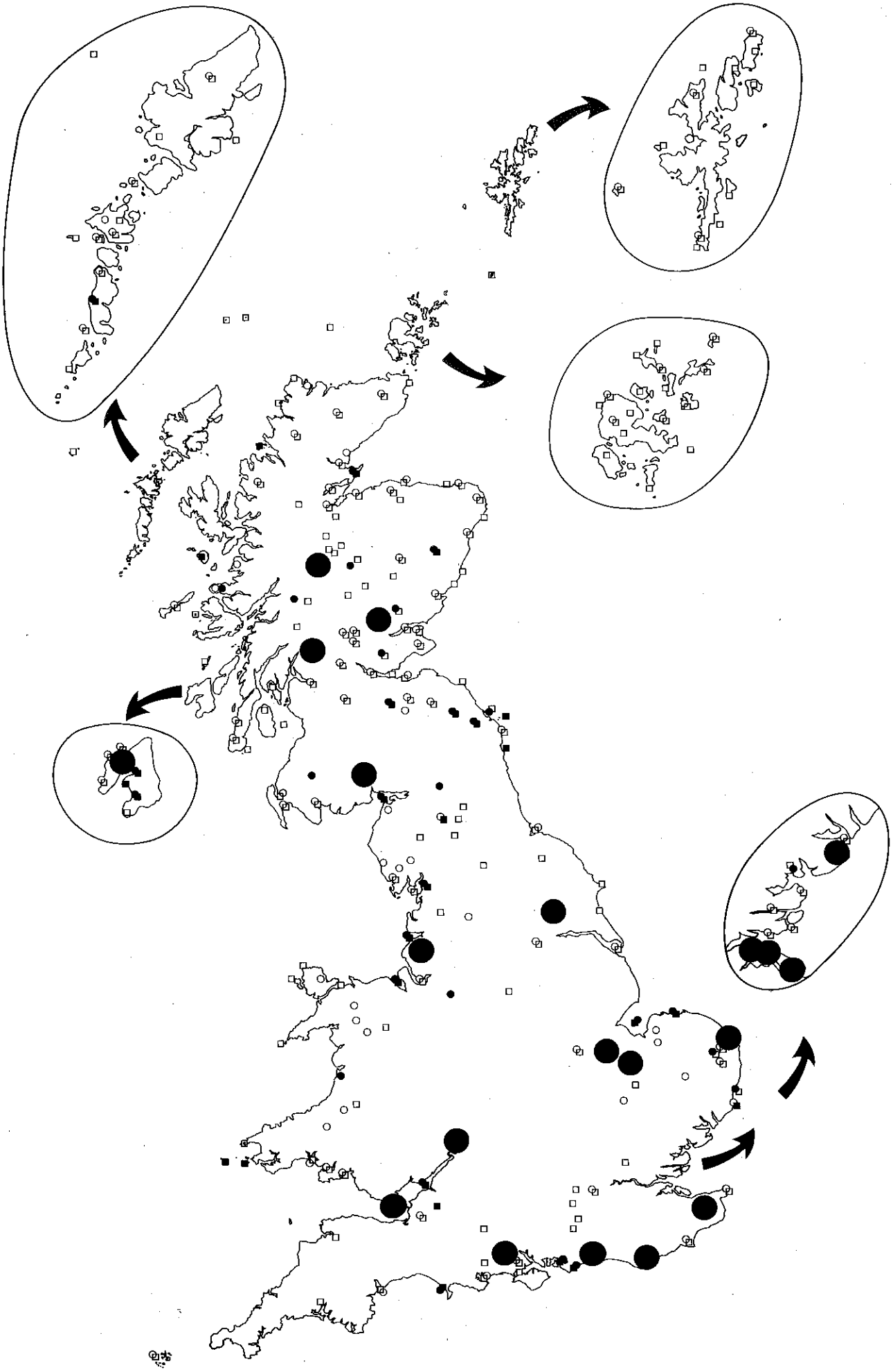


Figure A.5.8 Sites within the SPA/Ramsar site network in Britain which contain seasonally flooding neutral grassland bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

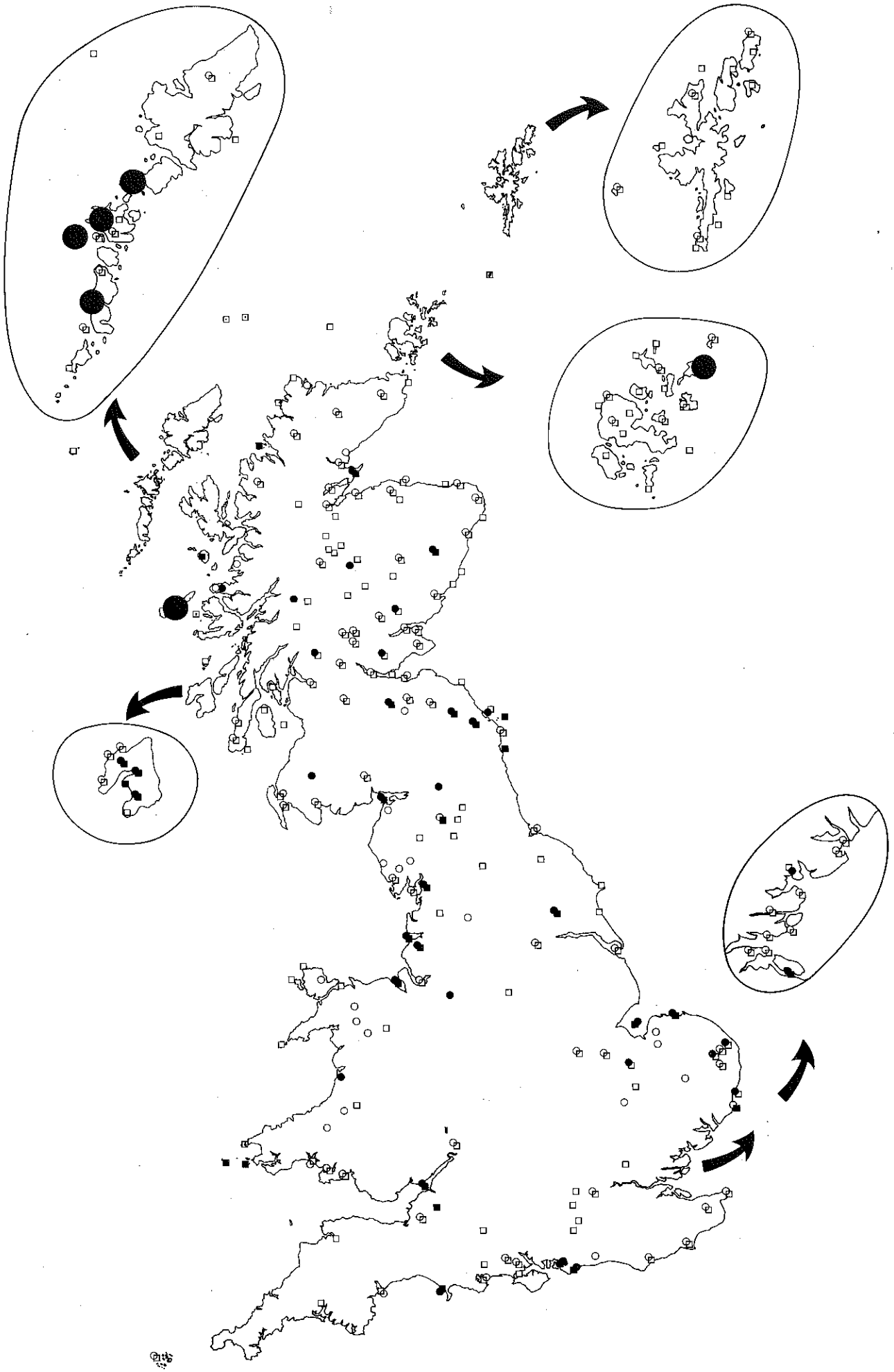


Figure A.5.9 Sites within the SPA/Ramsar site network in Britain which contain machair bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

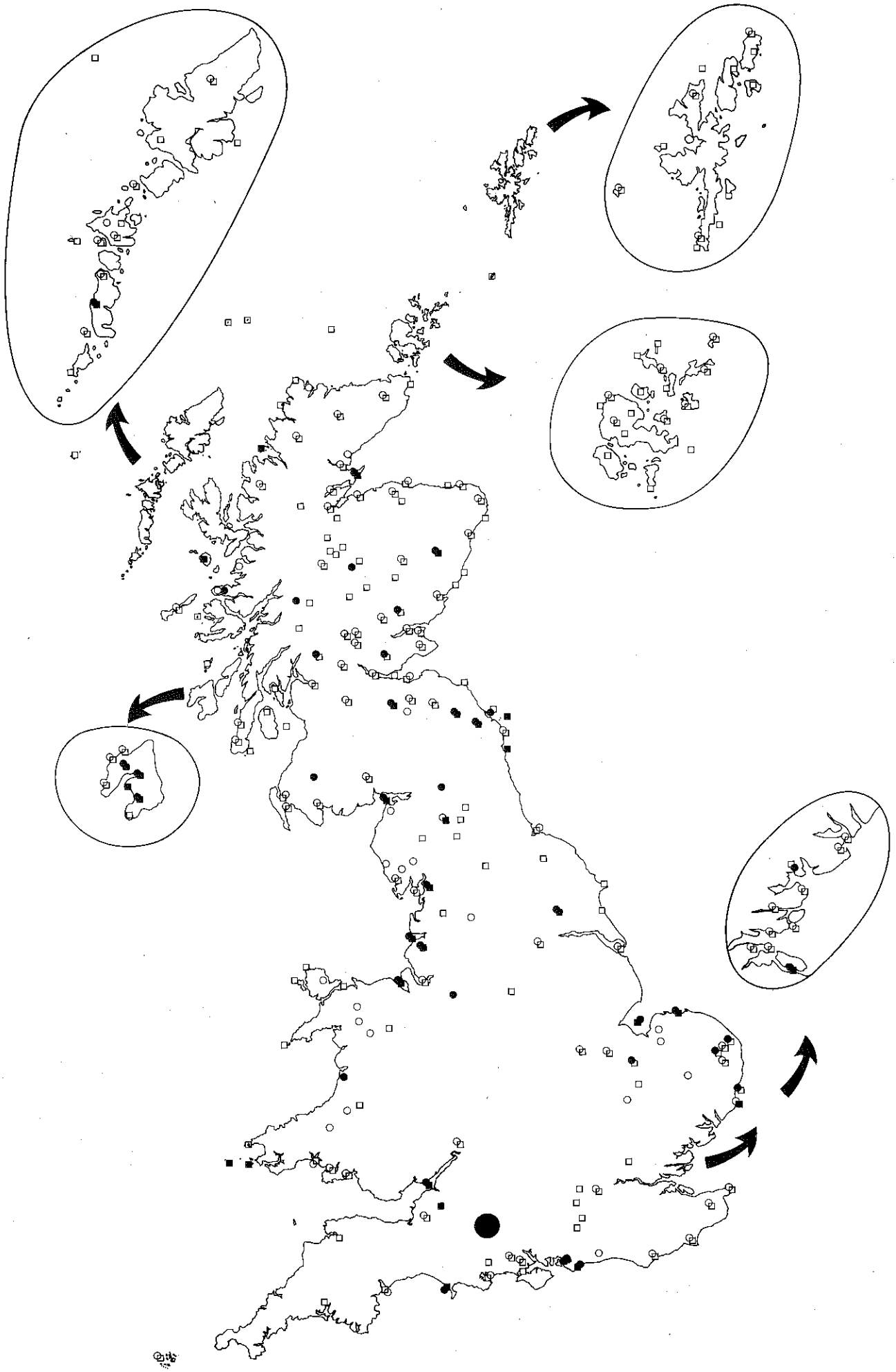
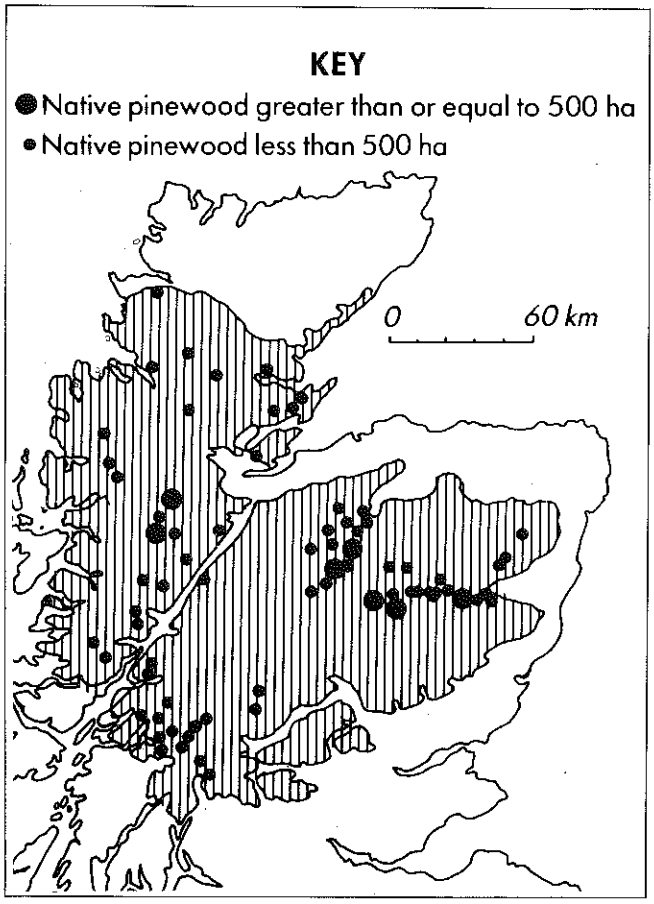
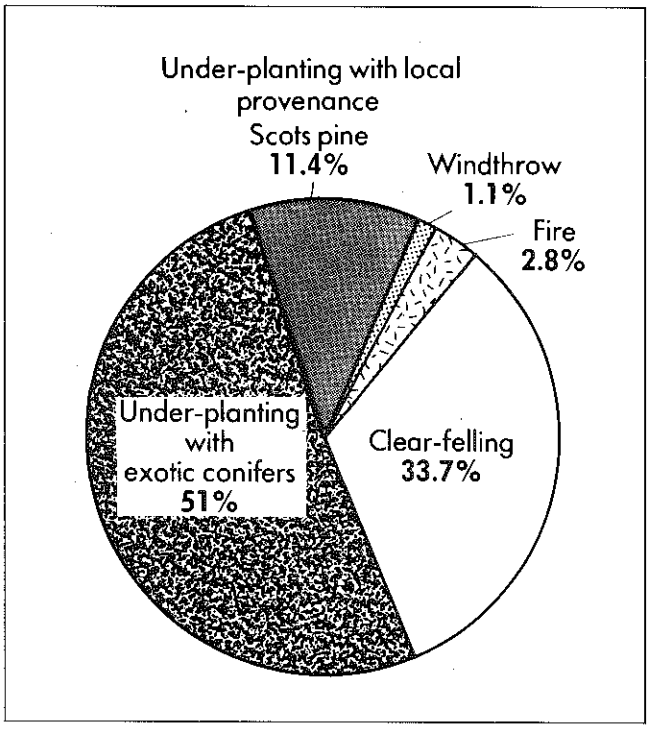


Figure A.5.10 Sites within the SPA/Ramsar site network in Britain which contain chalk grassland bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

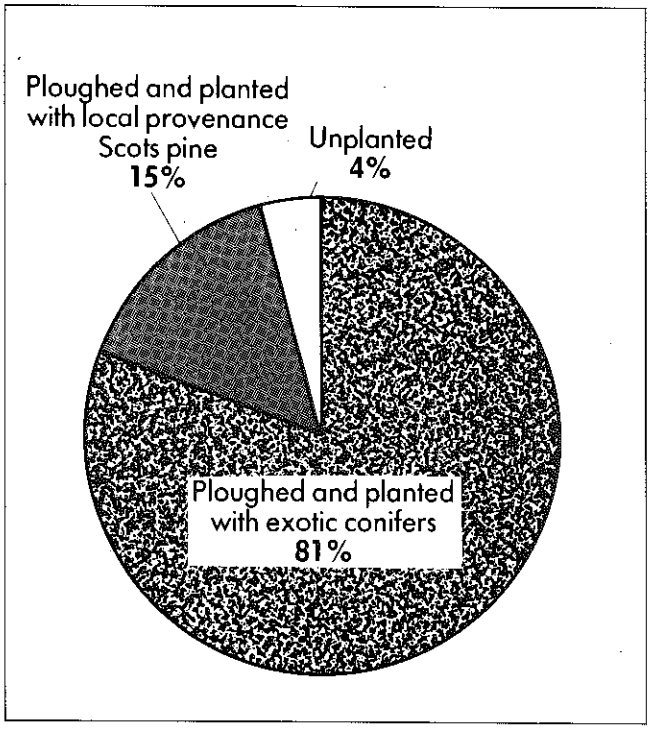
Figure A.5.11 (from Bain and Bainbridge 1988)



a Past and present distribution of native pinewood in the Scottish Highlands (from Bain & Bainbridge 1988). Hatched area indicates suggested distribution of Scots pine/birch forest about 6,000 years ago (redrawn from O'Sullivan 1977). Dots represent present distribution: large dots are woods of 500 ha or more.



b Causes of damage to, and loss of, native pinewoods since 1957 at 35 sites listed by Steven & Carlisle (1959). Total damaged area is 3,887 ha.



c Treatments carried out on areas of native pine woodland clear-felled since 1957. Total area is 1,308 ha.

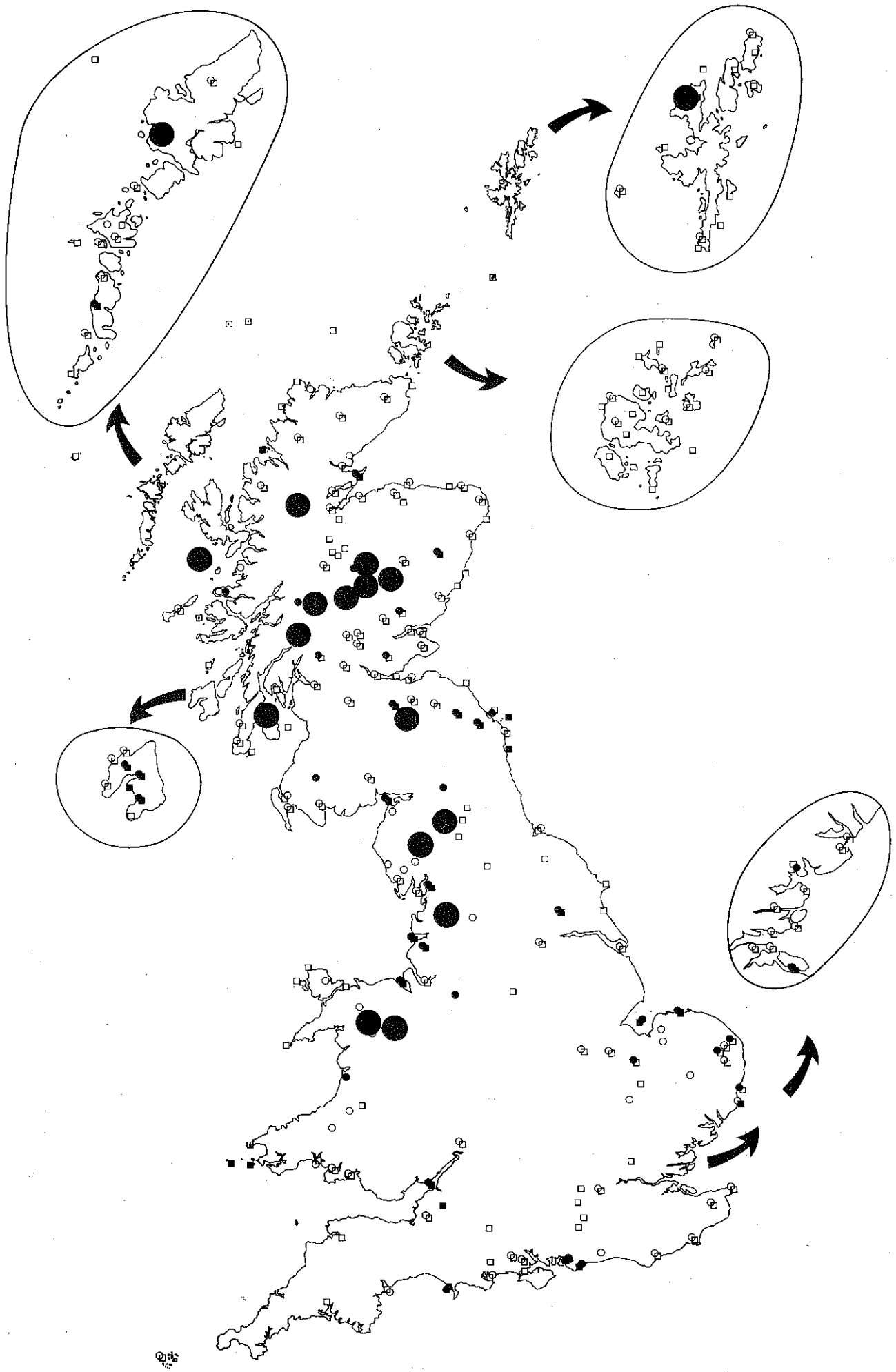


Figure A.5.12 Sites within the SPA/Ramsar site network in Britain which contain montane and upland bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Figure A.5.13 Sites within the SPA/Ramsar site network in Britain which contain lowland fen and valley bog bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

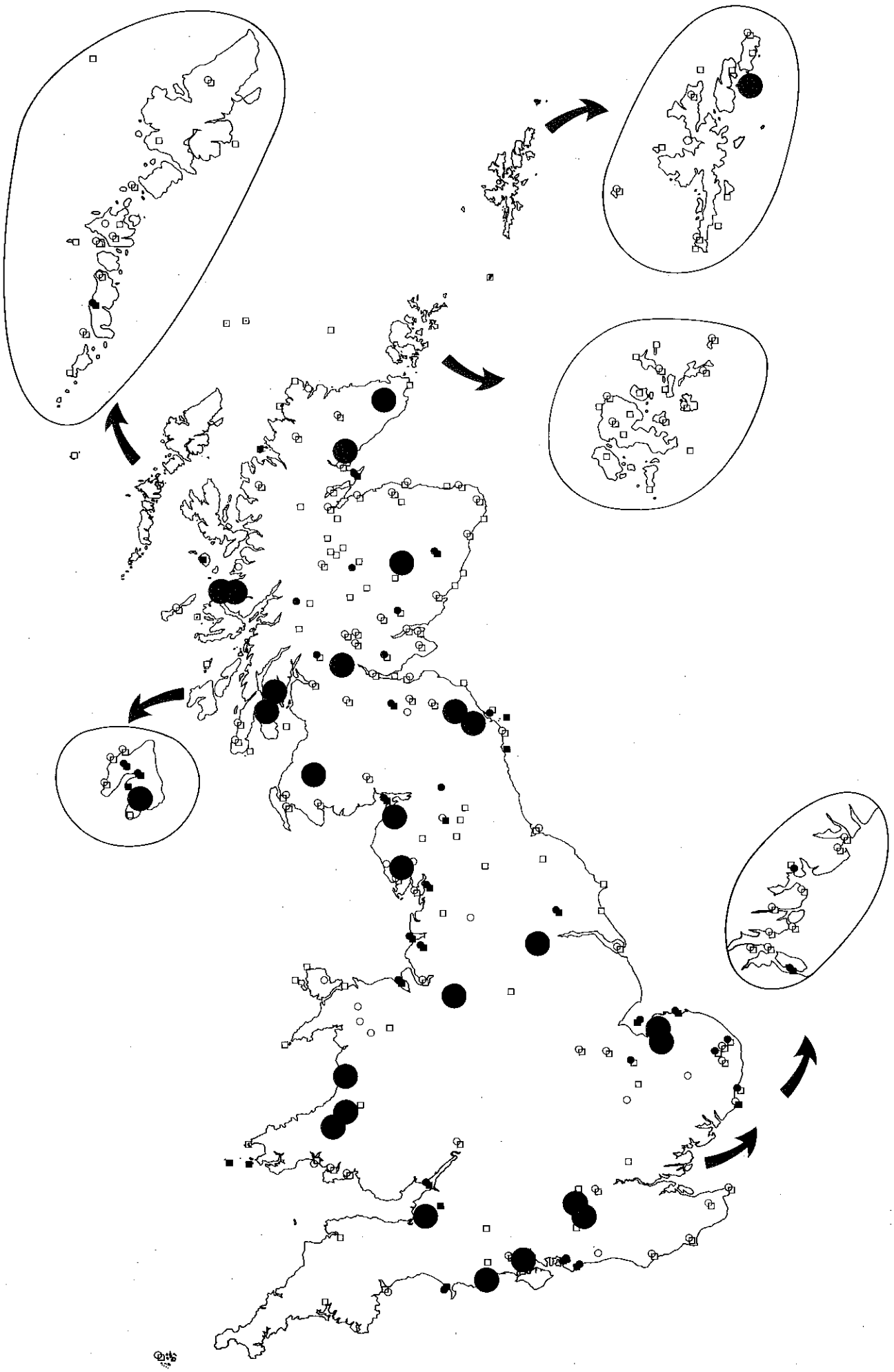


Figure A.5.14 Sites within the SPA/Ramsar site network in Britain which contain lowland raised mire bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

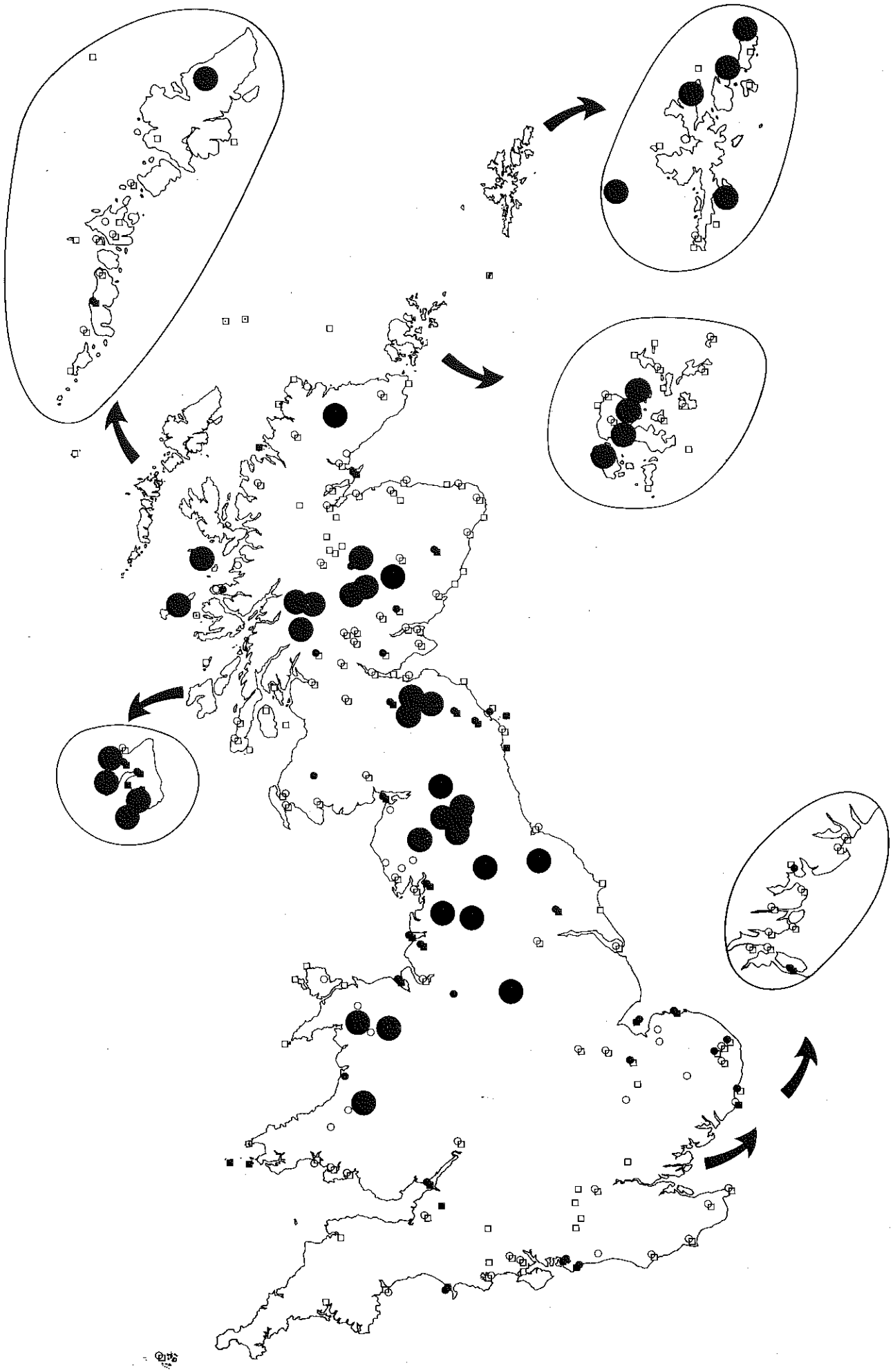


Figure A.5.15 Sites within the SPA/Ramsar site network in Britain which contain soub-montane blanket bog and moorland bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

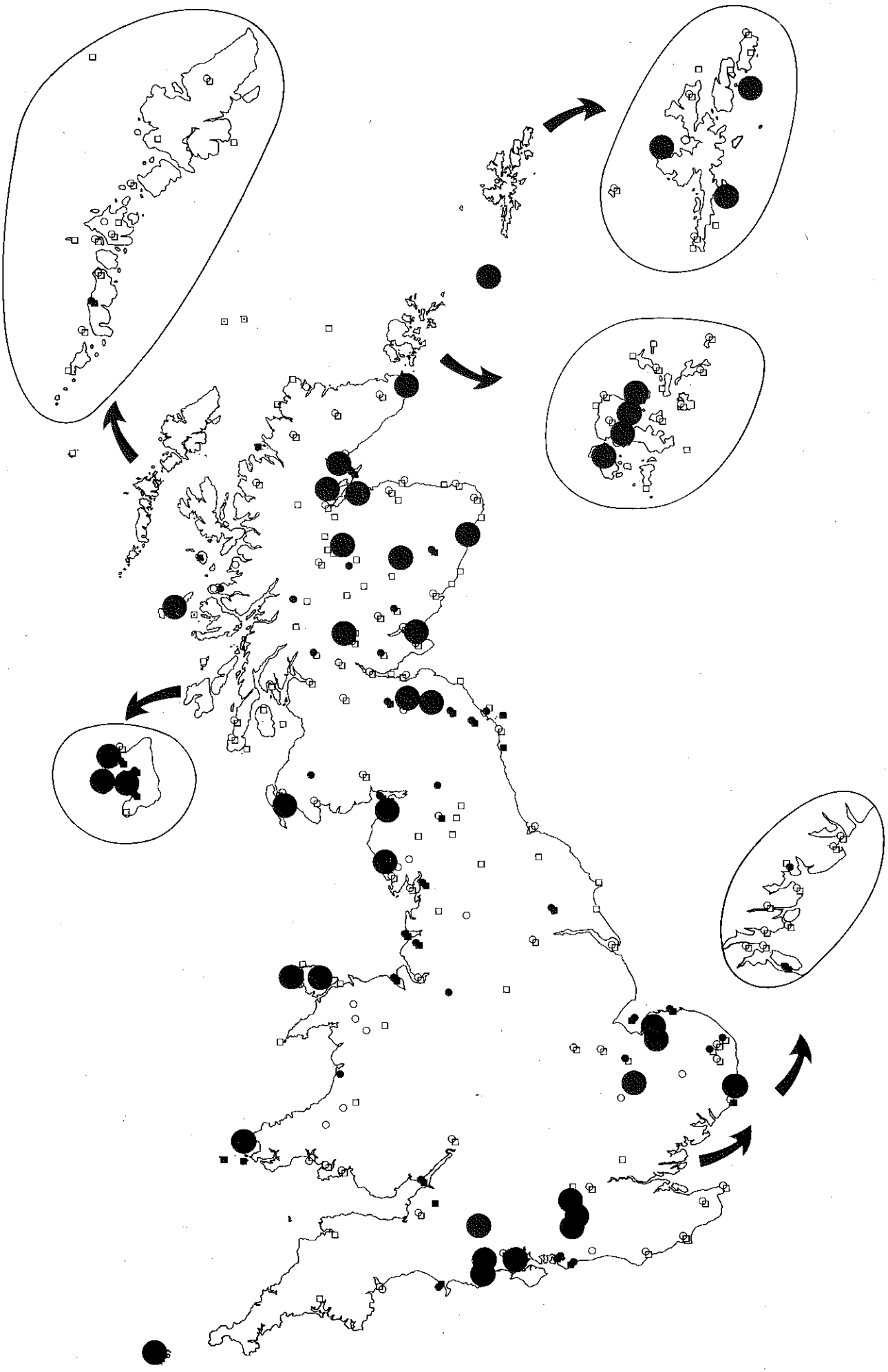


Figure A.5.16 Sites within the SPA/Ramsar site network in Britain which contain heath (both lowland and upland) and breck bird habitats. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

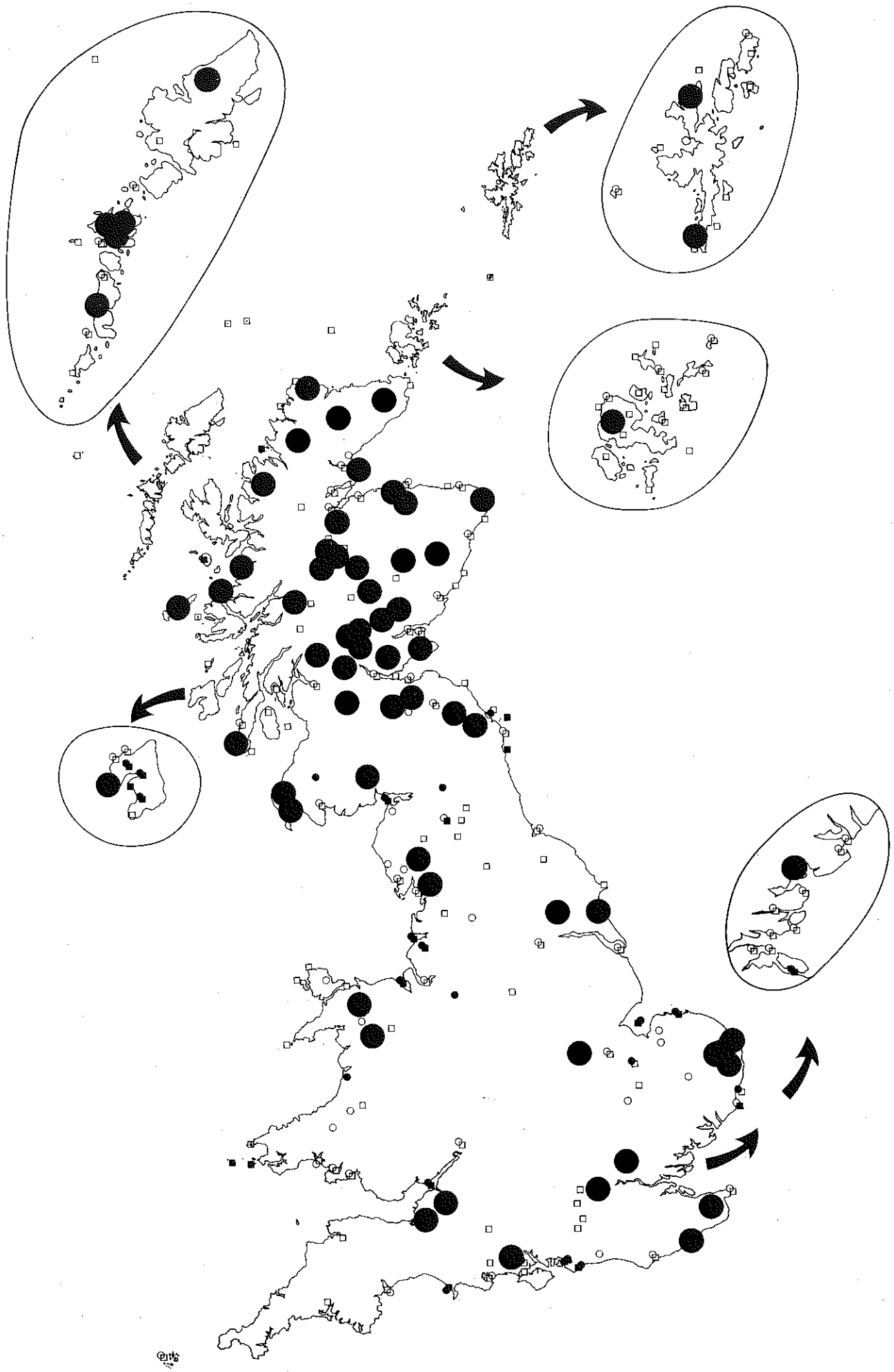


Figure A.5.17 Sites within the SPA/Ramsar site network in Britain which contain freshwater bird habitats, including lochs and rivers. Site identification as given in Figure 1.2 and Table 3.1. Reproduced from the 1975 Ordnance Survey 1:1,250,000 map with the permission of the Controller of Her Majesty's Stationery Office.

Appendix 6 Conservation needs of vulnerable bird species

A.6.1 Introduction

Article 4.1 of the EEC Birds Directive requires special conservation measures to be taken by Member States for 113 species of wild birds (not all of which occur in Great Britain) listed on Annex 1. In addition, Article 4.2 requires similar measures to be taken for regularly occurring migratory species that are not listed in Annex 1 of the Directive (see section 1.2). Section A.6.2 of the current document reviews available information relevant to the conservation of the 48 Annex 1 species that occur regularly in Britain. Section A.6.3 provides similar, but less detailed, information on a selection of Britain's important, threatened or vulnerable migratory species.

For each species the following aspects are addressed:

a Conservation status
A statement on the status of the species within the statutory frameworks of the EEC Bird Directive (79/409) and Britain's Wildlife and Countryside Act 1981, together with its classification within the Berne and Bonn Conventions (see section 1.1.3).

b Population and distribution
Information is given, where available, on the sizes, distributions and numerical trends of British breeding, passage, moulting and wintering populations, together with their importance in the international context.

c Habitat
A general indication is given of the broad habitat characteristics of the species in Britain. In most cases it has not been possible to provide a full assessment of this subject. Further, more detailed sources of information are usually indicated, in addition to the standard texts (below).

d Conservation needs
Information is given on any special conservation requirements of the species within the context of the SPA network, and of any particular threats that need to be safeguarded against. In most cases it has not been possible to provide a thorough assessment of this subject.

e Proportion of British population currently protected within the SPA network.

Country groupings for bird population comparisons

Consideration of British populations is restricted to Great Britain (England, Wales and Scotland). This results in some anomalies between population estimates given here and those in standard texts which often include Northern Ireland, the Isle of Man and sometimes also Eire. Where data are available the sizes of the British breeding and wintering populations are compared with that of the other EEC countries and with a biogeographically-appropriate international grouping of countries. The following are definitions for groupings (based on national populations) that have been used in this review:

1 Great Britain
Includes Scotland (including all islands), Wales, England (including the Scillies). Excludes: Northern Ireland, Isle of Man, Channel Islands.

2 EEC
Includes the twelve Member States of 1989, i.e. United Kingdon, Eire, France, Luxembourg, Belgium, Netherlands, Denmark, West Germany, Italy, Spain, Portugal and Greece. Also includes the Isle of Man and the Channel Isles (although these are not included in the EEC for most other purposes).

3 NW Europe
Includes UK, Isle of Man, Channel Islands, Eire, Iceland, Faroes, Norway, Sweden, Finland, Denmark, Luxembourg, Belgium, Netherlands, West Germany, northern and western France, and north-west Spain.

4 Western Europe
As NW Europe plus Italy, Switzerland, Portugal, south-east France, and the remainder of Spain.

5 Europe
As Western Europe plus USSR west of the Ural Mountains, Poland, East Germany, Czechoslovakia, Austria, Hungary, Yugoslavia, Romania, Bulgaria, Albania and Greece. With the exception of the USSR these listed countries constitute "Central Europe".

6 Western Palearctic
As defined in *Birds of the Western Palearctic* (Cramp & Simmons 1977).

7 East Atlantic Flyway
As defined for waders by Smit & Piersma (1989).

8 Total

The world total for a species, a race or a distinct biogeographical population.

The choice of country groupings for international comparisons of particular species follow convention wherever this has been established, e.g. East Atlantic flyway for wintering waders follow Smit & Piersma (1989), and NW Europe for most wintering wildfowl follow Pirot *et al.* (1989). Some population estimates for NW Europe include the whole of France and/or Spain in cases where the source reference only gives whole-country figures (e.g. for some birds of prey, following Gensbol 1984). Where there is no clearly established convention, or obvious biogeographical population, we have used NW Europe by preference.

Sources of information

Unless otherwise stated the information supplied in the species accounts comes from one of the following standard sources:

All species
Batten, Bibby *et al.* in press; Hudson & Marchant (1984); NCC (1989); Cramp *et al.* (1977, 1980, 1983, 1985, 1988); Sharrock (1976); Lack (1986).

Seabirds
Cramp *et al.* (1974); Tasker *et al.* (1987); Lloyd *et al.* (in prep).

Birds of prey
Gensbol (1984).

Wildfowl
Owen *et al.* (1986); Laursen (1989); Salmon *et al.* (1988); Rüger *et al.* (1986); Pirot *et al.* (1989).

Waders
Reed (1985); Piersma (1986); Moser (1987); Salmon *et al.* (1988); Smit & Piersma (1989).

In the following accounts, the term 'SPA network' is taken to include those sites listed in Table 3.1, including sites that have already been formally designated (Table 1.2), as well as those that NCC are currently proposing for SPA designation.

A.6.2 Information on Annex 1 species

A.6.2.1 Red-throated diver *Gavia stellata*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Nesting in Britain is confined to Scotland, with strongholds in the northern and western isles and the north and west mainland. There has never been a comprehensive survey of the Scottish population but area surveys have found 700 pairs in Shetland in 1983, 39-46 pairs in the Uists in 1982 (Gomersall *et al.* 1984), 90-95 pairs in Orkney (Booth *et al.* 1984), and 68-88 pairs in Argyll in 1985 (Broad *et al.* 1986), and it is estimated that there are 150 pairs on the peatlands of Caithness and Sutherland (Stroud *et al.* 1987). It is likely that the British total is between 1,200-1,500 pairs and the population is thought to have increased in the 20th century following a decline in the 19th century.

Breeding success is generally higher than for black-throated divers. In Shetland a mean of 0.45 chicks were fledged per breeding pair per year. Pairs in Shetland (where there is very high population density) nesting on lochs smaller than 1 ha were more successful than those nesting on larger lochs (Gomersall 1986).

Outside Scotland a few pairs breed in NW Ireland but there is no breeding in any other EEC country. Red-throated divers generally have a boreal – high arctic world breeding distribution occurring through Iceland, Scandinavia, northern USSR and North America.

Autumn:

Following breeding red-throated divers move to the coast where they undergo a complete moult. Large concentrations can occur in autumn, e.g. 1,500 in the Moray Firth in October 1982 (Barrett & Barrett 1985), and during this time they are especially vulnerable to oil pollution.

Winter:

Red-throated divers are found right around the British coast in winter and the population is estimated to be in the order of 6,000 – 7,000 birds. There are no estimates available of the size of international winter populations.

Habitat

Red-throated divers breed on freshwater lochs. In Scotland these are typically small, oligotrophic lochans with the nest located either on a small island or on an undisturbed mainland shore. Feeding during the summer usually occurs away from the breeding loch, most commonly at sea. The proximity of the sea may be a factor limiting the range in some parts of Scotland but long distance feeding flights have been observed and large freshwater lochs are also used. In winter they occur in shallow inshore coastal waters.

Conservation needs

Britain holds nearly all the EEC's breeding red-throated divers and therefore, has a special responsibility for their protection. SPA designation will protect them from land-use changes on the moorland in which their breeding lochans are located. Widespread afforestation is of particular concern because of the associated drainage, the potential increase in predator populations, and the physical intrusion of the growing trees on the flight-lines of divers to the small breeding lochans (see sections A.5.13. and A.5.15.).

The well-being of red-throated divers throughout the year is dependent upon the quality of the marine environment. Oil pollution and entanglement in fishing nets are threats while the birds are at sea, as are fluctuations in the size of fish populations. The latter is currently the subject of concern during the breeding season in waters around Shetland and Orkney (Heubeck 1989). Being at the top of the food chain divers tend to build up concentrations of pollutants and pesticides (Ream 1976; Fox *et al.* 1980; Barr 1986) and are, therefore, vulnerable to the debilitating effects of these chemicals.

Proportion currently protected within the SPA network

An estimated total of 295 pairs of red-throated divers breed on 16 sites in the proposed SPA network (22% of the British total). The majority of these (274: 93%) occur in Shetland, Orkney, Caithness and Sutherland which are the core areas for the species in Britain. Boundaries of a number of moorland pSPA (including several in Shetland) are still to be determined following recent ornithological survey. It is expected that this will substantially increase the proportion of the breeding population protected by proposed SPAs.

A small number winter within the proposed SPA network. Protection measures for this species in the marine environment are being considered by Tasker *et al.* (in prep.).

A.6.2.2 Black-throated diver *Gavia arctica*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The black-throated diver is a rare species in Britain. Its breeding range is restricted to the northern and western parts of Scotland, with strongholds in Sutherland and Wester Ross. The current population size was assessed through a national survey of territorial pairs in 1985 (Campbell & Talbot 1987), and a survey of confirmed breeding sites in 1986-88 (Mudge *et al.* in prep.). These found 151 territories with summering birds and 154 breeding pairs respectively. There has been no previous census and it is, therefore, difficult to be certain about any trends of change in population size. Evidence from the history of occupancy of individual sites (Mudge *et al.* in prep.) and persistent low breeding success (Mudge & Talbot in prep.) point to a current population decline and retraction of range.

Breeding success in Sutherland and Wester Ross in the period 1983-87 has varied between 0.17 and 0.29 chicks per territorial pair per year (Mudge & Talbot in prep.), compared with the 0.4 – 0.5 level that is considered necessary for population stability (Nilsson 1977). Some sites have been consistently more successful than others, at least in the short term, and this variation in productivity needs to be taken into account when considering site protection (section 2.4.4).

Scotland holds the entire breeding population of black-throated divers in the EEC. Elsewhere, the species has a strongly northern distribution through Scandinavia, the Baltic States and the northern USSR.

Winter:

After breeding, black-throated divers move to coastal waters where the wintering population in Britain has been estimated at 1,200 birds (Lack 1986). These are scattered around the British coastline and, although ring recovery data are lacking, probably include many of Scandinavian origin. Adult birds flock together during body moult in autumn and become flightless during a complete moult in late winter (spring/summer for immatures). There is, however, little substantive information available on the locations of moulting areas and their distinctiveness from general wintering areas.

Habitat

Black-throated divers breed on freshwater lochs. In Scotland these are typically oligotrophic, relatively large, at low altitude and contain islands (Mudge & Talbot in prep.). Food (fish and freshwater invertebrates) is normally taken from the breeding loch or other nearby lochs, in contrast to the strategy of the closely related red-throated diver. Therefore, SPAs need to be large enough to encompass these essential feeding areas.

Conservation needs

Britain holds all the EEC's breeding black-throated divers and, therefore, has a special responsibility for their protection. They are very specific in their habitat requirements and, because of their general low breeding success, are highly vulnerable to any adverse changes to their breeding lochs (Götmark *et al.* 1989). Recent research in Sutherland and Wester Ross (Mudge & Talbot in prep.) has identified predation of eggs and loch water level changes as the principal direct causes of breeding failure during incubation. However, chick losses were also high and the reasons for this have not been determined. SPA designation should protect the breeding sites from potentially damaging land-use changes, particularly hydro-electric schemes, fish farming, housing encroachment and some recreational activities (Götmark *et al.* 1989). The quality of water in the loch is potentially influenced by land uses throughout its catchment area, and afforestation or changes in farming practices could be damaging to the diver interest (see sections 2.4.7. and A.5.15.). Therefore, areas considerably wider than the water body itself have necessarily been considered for SPA designation or for other special protection measures for this species.

The well-being of black-throated divers outside the breeding season is dependent upon the quality of the marine environment. The main direct threats in coastal waters are from oil pollution and entanglement in fishing nets. At least 58 black-throated divers were oiled following the Amoco Cadiz incident off the North Brittany coast in March 1978 (Jones *et al.* 1978). Being at the top of the food chain divers tend to build up concentrations of pollutants and pesticides (Ream 1976; Fox *et al.* 1980; Barr 1986) and are, therefore, vulnerable to the debilitating effects of these chemicals.

Proportion currently protected within the SPA network

An estimated total of 45 pairs of black-throated divers breed on sites in the proposed SPA network (30% of the British total). However, the low-density distribution of this species means that their conservation also requires wide-scale special protection measures to curb potentially damaging activities near nesting lochs, as well as measures to minimise disturbance during the nesting season.

A small number winter within the proposed SPA network. Protection measures for this species in the marine environment are being considered by Tasker *et al.* (in prep.).

A.6.2.3 Great northern diver *Gavia immer*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

There is currently a single individual great northern diver known to be breeding in Britain. The bird is probably a female and is paired with a black-throated diver. The species does not breed in other EEC countries. Iceland holds 100-300 breeding pairs and some breed in Greenland, but the bulk of the world population occurs in North America and Canada.

Non breeding:

Immature great northern divers occur in Scottish coastal waters during the summer months, and adults and immatures occur around British coasts during spring and autumn. There is, however, no comprehensive information available on the numbers involved at these times.

Winter:

Wintering great northern divers are found right around the British coast but the main concentrations occur in north and west Scotland and around the Northern and Western Isles. In 1984/85, Moser *et al.* (1986) recorded a total of 464 during a survey of the west and north-west coastline of Scotland and the Inner Hebrides. Between 300-400 are thought to winter around Shetland (Heubeck & Richardson 1980), 450 around Orkney (Lea 1980) and 1,000 in the western North Sea including waters around Shetland and Orkney (Tasker *et al.* 1987). The British wintering population is estimated to be 2,500-3,000 birds, compared with a total of about 5,000 for the entire western Palearctic. These totals are much larger than could be expected from the Icelandic breeding population and it is likely that birds from Greenland, and perhaps also eastern Canada, winter in British waters.

Habitat

Breeding occurs on islands in large freshwater bodies and the birds winter on coastal waters. In the Moray Firth, great northern divers were consistently found to occur further offshore in winter than the other diver species, but nonetheless were usually within 10 km of the shore (Barrett & Barrett 1985). In western Scottish waters most wintering great northern divers occur within 2 km of the shore (A. Webb, pers. comm.).

Conservation needs

The well-being of non-breeding great northern divers in Britain is dependent upon the quality of the marine environment. The main threats in coastal waters are likely to be oil pollution and entanglement in fishing nets. For example 146 great northern divers were known to have died following the Esso Bernicia oiling incident in Shetland in December 1978 (Heubeck & Richardson 1980) and at least 66 were oiled during the Amoco Cadiz incident off the North Brittany coast in March 1978 (Jones *et al.* 1978). Being at the top of the food chain divers tend to build up concentrations of pollutants and pesticides (Ream 1976; Fox *et al.* 1980; Barr 1986) and are, therefore, vulnerable to the debilitating effects of these chemicals.

Proportion currently protected within the SPA network

The single British breeding individual is on a pSPA. A small number winter within the currently proposed SPA network. Protection measures for this species and other birds which use marine areas are being considered by Tasker *et al.* (in prep.).

A.6.2.4 Slavonian grebe *Podiceps auritus*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Nesting in Britain is currently confined to the Highland and Grampian Regions where a survey in 1987 found a population of 61-62 pairs (Crooke *et al.* 1987). Breeding was first recorded in Scotland in 1908 and the population gradually increased to a peak of 81 pairs in 1984, since when numbers have declined. Breeding success has been generally low in recent years, varying between 0.4 – 0.8 chicks fledged per breeding pair per annum, and has also varied markedly between different lochs (Crooke *et al.* 1987). Consequently there is a need to protect especially those sites holding consistently productive pairs as these may be of disproportionate importance to population maintenance.

Scotland holds the entire EEC breeding population. Elsewhere the species has a circumpolar distribution in the boreal climatic zones of Iceland, Scandinavia, USSR and North America. Population

estimates include 500-750 pairs in Iceland, 500 pairs in Norway, 1,000 in Sweden and 3,000 in Finland (Cramp *et al.* 1977).

Autumn:

After breeding the Scottish birds gather on a small number of traditional freshwater lochs where they undergo a complete moult.

Winter:

Slavonian grebes are widely, but thinly, distributed on British coastal waters during the winter. The total population has been estimated at about 400 birds, compared with a European wintering total of perhaps 15,000 birds. The wintering grounds of the Scottish breeding population are unknown.

Habitat

The Scottish breeding sites are typically mesotrophic freshwater lochs, with the nests usually placed among emergent vegetation in a shallow part of the loch. In winter most birds are found on sheltered, inshore, coastal waters, although some do occur on inland freshwater bodies.

Conservation needs

Britain holds all the EEC's breeding slavonian grebes and, therefore, has a special responsibility for their protection. They are very specific in their habitat requirements and, because of their generally low breeding success, are highly vulnerable to any adverse changes to their breeding lochs. As food is gathered from the breeding loch the birds are also vulnerable to factors that may change the ecological balance such as acidification, fish stocking for angling purposes (artificially high densities of fish such as rainbow trout can result in the depletion of invertebrate prey), and land use changes in the water catchment areas (afforestation and agricultural changes may influence loch water quality). Areas larger than the water body itself will, therefore, be proposed for SPA designation for this species (see sections 2.4.7. and A.5.15). Breeding birds are believed to be vulnerable to a wide range of direct threats, including human disturbance, egg collectors, predators and water level fluctuations.

Oil pollution and entanglement in fishing nets are potential threats for wintering birds in coastal areas. Being near the top of the food chain slavonian grebes are likely to build up concentrations of pollutants and pesticides.

Proportion currently protected within the SPA network

A total of *c.*20 pairs of slavonian grebe breed on sites in the proposed SPA network (32% British population). A small number winter within the currently proposed SPA network. Protection measures for this species in marine areas are being considered by Tasker *et al.* (in prep.).

A.6.2.5 Storm petrel *Hydrobates pelagicus*

Conservation status

Annex 1 of EEC Birds Directive; Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Because this species is nocturnal while on land and nests underground on remote off-shore islands, it is very difficult to census. There is no precise figure for the total British population, but it is thought to be between 20,000 and 100,000 pairs. Breeding was confirmed or strongly suspected in the late 1970s and 1980s on 26 islands or island groups in Scotland (around Shetland, Orkney and the Western Isles), 10 islands in the Isles of Scilly and three in west Wales. The largest colonies are on St. Kilda, Priest Island and Foula. There is no reliable information on population trends.

Storm petrels also breed in Eire, the Channel Isles, France, Spain, islands in the west Mediterranean, Iceland (one colony) and the Faeroes. They have bred in the Canary Isles and may breed in Norway. Population sizes in these countries are poorly known, but it is likely that Britain holds over 30% of the world/European population and, therefore, has a special responsibility for the conservation of this species.

Winter:

Outside the breeding season storm petrels have a pelagic existence largely away from British waters. British-ringed birds have been recovered off western and southern Africa.

Habitat

Nests underground in holes and crevices on remote rat-free islands. Storm petrels feed over and beyond the continental shelf when not at the breeding colony.

Conservation needs

It is reasonable to expect storm petrels to be sensitive to changes in the quality of the marine environment, but, being largely aerial, they are less vulnerable to oil pollution than some other seabird species. While breeding they are particularly vulnerable to ground predators, especially cats and rats. Storm petrels in Britain appear to nest only on islands that are free of rats. Extra care needs to be taken to ensure that these predatory species are

not inadvertently introduced to islands holding storm petrels, and control measures actively pursued at sites where this has happened (see section A.5.4.)

Proportion currently protected within the SPA network

Numbers of breeding storm petrels are extremely difficult to determine owing to their secretive and nocturnal habits, and the inaccessibility of most breeding areas. For these reasons, considerable margins of uncertainty are attached both to individual site totals, as well as to national and international population estimates. To the best current knowledge (Lloyd *et al.* in press), between 10,000-60,000 pairs of storm petrels occur on the 14 sites included in the proposed SPA network. This amounts to perhaps 60% of the British population. No feeding or gathering areas for this species are currently included within the proposed SPA network, an aspect currently being reviewed by Tasker *et al.* (in prep.).

A 6.2.6 Leach's petrel *Oceanodroma leucorhoa*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Because this species is nocturnal while on land and nests underground on off-shore islands, it is very difficult to census. The total British population is not accurately known, but is thought to be less than 10,000 pairs. There are seven known British colonies – St. Kilda, the Flannan Isles, North Rona, Sula Sgeir, Foula, Sule Skerry and Ramna Stacks. Other breeding sites have been suspected, but not confirmed.

The species breeds nowhere else in the EEC. The only other known colonies in the eastern Atlantic are on the Westmann Islands and Ingolfshofdi (Iceland), the Lofoten Islands (Norway), and the Faeroes. Britain probably holds over 50% of the eastern Atlantic breeding population.

Winter:

Outside the breeding season Leach's petrels have a pelagic existence largely away from British waters. They are thought to winter in areas of tropical convergences, but some remain in cooler northern waters.

Habitat

Nests underground in holes and crevices on remote rat-free islands. Pelagic, mostly over the edge of the continental shelf by day when not at the breeding colony.

Conservation needs

It is reasonable to expect Leach's petrels to be sensitive to changes in the quality of the marine environment, but, being largely aerial, they are less vulnerable to oil pollution than some other seabird species. While breeding they are particularly vulnerable to ground predators, especially cats and rats. Leach's petrels in Britain appear to nest only on islands that are free of rats. Extra care needs to be taken to ensure that these predatory species are not inadvertently introduced to islands holding Leach's petrels, and that control measures are actively pursued at sites where this has happened (see section A.5.4.)

Proportion currently protected within the SPA network

Numbers of breeding Leach's petrels are extremely difficult to determine owing to their secretive and nocturnal habits and the inaccessibility of most breeding areas. For these reasons, considerable margins of uncertainty are attached both to individual site totals, as well as to national and international population estimates. However, since all seven known breeding sites are included within the proposed SPA network, the entire known breeding British (and majority of the European) population of Leach's petrel is thus protected. No feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.7 Bittern *Botaurus stellaris*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British population is currently estimated at between 25-30 pairs at three main sites in East Anglia and Lancashire. The species had ceased to breed in Britain by about 1886, but recolonised Norfolk in the early 1900s and increased slowly to a peak of 79-83 pairs in 1954 before declining again to the current level (Day & Wilson 1978).

Within the EEC bitterns also breed in France, West Germany, Belgium, Denmark, Greece, Italy, Netherlands, Portugal and Spain, but recent counts

from these countries are not available to this review. A questionnaire survey of all European countries (excluding USSR) in 1976 yielded an estimated population of 2,500-2,700 pairs (Day 1981). Britain's population of 45-47 pairs in that year constituted about 1.8% of the European total.

Winter:

The British wintering population away from breeding areas has varied between 30 and 190 birds, depending upon the severity of the weather (Bibby 1981). Birds are widely scattered through England and Wales, but with the majority (>50%) occurring in the south-east of England. Information on the sizes of wintering populations in other European countries is not available to this review.

Habitat

Breeding birds in Britain are confined to lowland freshwater marshlands and fens dominated by Phragmites communis (section A.5.11). In winter they also occur in other wetland habitats such as gravel pits, sewage farms, cressbeds, reservoirs and rivers.

Conservation needs

Detailed research into the biology and habitat requirements is currently being carried out by the RSPB. The main breeding sites are characterised by large size and wetness, including pools and dykes within reedbeds (Bibby & Lunn 1982). In the Carmargue, bitterns are more numerous where there is plentiful edge with emergent vegetation along canals and open water. Data from 27 British reedbeds support this and also point to the size of reedbeds as important (Byle 1988 in Everett 1989). The availability of suitable habitat probably limits the size of the British population as large reedbeds are scarce (Bibby & Lunn 1982). However, other factors such as weather conditions (harsh winters and dry summers), habitat deterioration, human disturbance, eutrophication, and pesticide and heavy metal pollution have all been suggested as contributory causes to the recent decline. Site protection and sympathetic management (linked to the findings of the current research) are urgently required in order to maintain and enhance the British population. This is important in an international context in terms of maintenance of part of the traditional European breeding range.

Proportion currently protected within the SPA network

A total of *c.*17 pairs of bitterns occur on three sites within the proposed SPA network (61% of the British population).

A.6.2.8 Bewick's swan *Cygnus columbianus bewickii*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Bewick's swans breed in tundra areas of the USSR above latitude 65°N. They do not breed in any of the EEC countries.

Winter:

The NW European wintering population is currently estimated to comprise about 17,000 birds and is considered by Monval & Pirot (1989) to be currently stable. The distribution is restricted, with the major proportion of the population occurring in England, Ireland, the Netherlands, East and West Germany and Denmark. An internationally coordinated census in January 1984 found that only seven areas in Europe held more than 500 birds (Beekman *et al.* 1985), and 56% of the total population was found on 39 sites (Rüger *et al.* 1986). This indicates not only that a small number of sites are particularly important, but also that a wider range of sites form essential components for maintaining the range and size of the population.

The regular maximum British wintering population is estimated to be 7,000 birds and this constitutes 41% of the European total. Numbers in Britain have increased substantially in the last 20 years from just a few hundred in the early 1960s. In the middle and late 1970s the population increased at an annual rate of 16%. Numbers and distribution vary between and within winters, depending on the severity of the weather which influences the movement of birds to and from wintering areas elsewhere in Europe. Largest numbers currently occur on the Ouse Washes which, in the five winters 1983/84 to 1987/88, supported an average peak monthly total of 4,657 birds (Salmon *et al.* 1988). Other sites of major importance include the Nene Washes, Martin Mere/Ribble Estuary, Upper Severn Estuary, Walland Marsh, Hampshire Avon and Walmore Common.

Habitat

Bewick's swans winter on estuaries, lakes and river floods where they roost on water and feed either on submerged vegetation or on surrounding pastures. They show a positive selection for feeding areas with a relatively high biomass of plant material (Rees in press). The wet grassland areas of sites such as the Ouse Washes pSPA are important for feeding, and a range of 'soft' wet meadow grasses,

such as *Agrostis stolonifera*, *Glyceria fluitans* and *Alopecurus geniculatus* are selected (Owen & Cadbury 1975). In recent years, increasing numbers of swans have fed on stubbles and other waste arable fields near sites such as the Ouse Washes. The traditional wet meadow management and general lack of disturbance of many sites are important factors in determining their attractiveness to Bewick's swans. These characteristics allow them to exploit surrounding areas of farmland which would otherwise be unavailable without resort to secure refuges.

Conservation needs

Britain holds a large, but variable, proportion of the international wintering population of Bewick's swans and the majority occur at a relatively small number of sites. Because of this Britain has a special responsibility for the protection of this bird. Artificial feeding of wild birds with grain is carried out by the Wildfowl and Wetlands Trust at Slimbridge, Martin Mere and Welney (Ouse Washes) and this is probably an important factor in maintaining numbers at these internationally important sites particularly during severe winter weather. The wintering ecology of Bewick's swans is thought to have changed in recent years with greater use now being made of arable land in the vicinity of secure roosts. At the same time their traditional wet pastures and floodlands have come under pressure from agricultural developments throughout the wintering range (Cadbury 1975; Owen *et al.* 1986). The maintenance of suitable wet conditions at a large number of undisturbed sites is important.

The swans move between sites in response to changing weather conditions such that the use of individual refuges may vary both between and within winters (Evans 1979); (see section 2.3).

The main threats to these swans are from further habitat losses through improved drainage of seasonally-flooded farmland; from disturbance at their main wintering areas; from illegal shooting (12% of 53 first winter birds were found to be carrying lead shot in their tissues, despite total protection throughout their world range (Evans *et al.* 1973); and from poisoning following ingestion of spent lead pellets which are gathered along with grit (Owen & Cadbury 1975; Mudge 1983).

Proportion currently protected within the SPA network

A total of c.5,800 Bewick's swans winter on sites within the proposed SPA network (83% British wintering total; 34% international total). There is movement of birds between sites within a winter as shown by individual marking and bill recognition (Evans 1982). The species moves extensively and rapidly within its wintering area, not only within Britain but also to and from continental Europe and Ireland (Evans 1982). Thus, as with many other species, an international network of sites is necessary to conserve this small population.

Bewick's swans undertake extensive cold-weather movements, and at these times a greater proportion of the international population is accommodated within Britain.

A.6.2.9 Whooper swan *Cygnus cygnus cygnus*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Whooper swans used to breed in Orkney but this ceased in the 18th century. Since then there has been sporadic breeding in Scotland, usually by single pairs, but up to four pairs nested in 1987. These birds have usually been considered either feral or injured. The main breeding areas are in Iceland, Scandinavia and northern USSR.

Winter:

The vast majority of the whooper swans that winter in Britain belong to the Icelandic breeding population (Black & Rees 1984) and the population is nominally set at 6,000 birds. A co-ordinated international census of the population in January 1986 found a total of 16,742 birds, of which 5,136 (30.7%) were in Britain, 2,363 in Northern Ireland, 7,943 in Eire, and 1,300 in Iceland (Salmon & Black 1986). Within Britain flocks are widely dispersed and occur in the north of England and in southern and eastern Scotland. Internationally important concentrations regularly occur at the Ouse Washes, Loch of Strathbeg, Cromarty Firth/Loch Eye, Martin Mere/Ribble Estuary, River Eden and Caerlaverock (Salmon *et al.* 1988). Population trends within the British wintering population are not easily discerned because of the dispersed nature of flocks, but numbers appear to have increased, particularly during the 1970s (Owen *et al.* 1986; Monval & Pirot 1989).

Passage:

Many Hebridean sites, particularly on Islay, Tiree and the Uists, are regularly important during passage periods for whooper swans moving between Iceland and Ireland (Percival *et al.* 1986). Small numbers also over-winter at some of these sites.

Habitat

Nests on shores or islands of freshwater lochs. In Iceland they nest on islands in marshy pools at altitudes up to 700 m a.s.l.

The traditional winter habitats were shallow lakes, brackish lagoons and coastal bays where the swans fed on underwater vegetation. However, flocks are now increasingly found on pastures and arable fields where they feed on waste vegetables, spilt grain, grass and the shoots of winter cereals (Brazil 1981). These birds are still strongly linked with nearby wetland areas which they require for roosting and as a refuge if disturbed (Black *et al.* in prep.). The existence of the wetland areas allows whooper swans to exploit agricultural land.

Conservation needs

It is likely that breeding could become more regular in Scotland if occupied sites are protected and kept undisturbed. Outwith the breeding season Britain holds a large proportion of the distinct Icelandic population of this species and, therefore, has a special responsibility for its conservation. Artificial feeding of wild birds with grain is carried out by the Wildfowl and Wetlands Trust at Caerlaverock, Martin Mere and Welney (Ouse Washes) and this is probably an important factor in maintaining numbers at these internationally important sites, particularly during severe winter weather. The proposed SPA network will benefit whooper swans by protecting some of the wetland habitats on which they depend. Particular threats to wintering birds in Britain include collisions with power cables, illegal shooting, disturbance of roost areas, and poisoning from ingestion of toxic seed dressings (Badenoch 1980) and spent lead pellets (Mudge 1983; Spray & Milne 1988).

Proportion currently protected within the SPA network

A total of *c.*2,100 whooper swans winter on sites within the proposed SPA network (35% British wintering total; 12% international total). Although 8 sites hold >1% of the international population each, nearly half the total protected (43.0%) are on sites holding lesser numbers, indicating the need for a wide-scale network of sites in attaining high levels of overall protection for this species.

Intermittent breeding has occurred on at least one pSPA.

A.6.2.10 Greenland white-fronted goose *Anser albifrons flavirostris*

Conservation status

Annex 1 of EEC Birds Directive; Schedule 2, part 1 of WCA 1981 (protected in the close season in England and Wales and at all times in Scotland); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The population of Greenland white-fronted geese is small and their world range limited. Breeding occurs in low-arctic west Greenland between 63° and 72° N (Salomonsen 1950).

Wintering:

The winter range of this population falls entirely within the British Isles, with groups in Ireland, the west and north of Scotland and in Wales (Ruttledge & Ogilvie 1979). On autumn and spring passage the population passes through areas of south and west Iceland (Francis & Fox 1987).

In the past, the population appears to have traditionally wintered on lowland peatlands (both raised and blanket bogs). However, in many parts of the range increasing levels of peatland destruction, particularly in Ireland (Ryan & Cross 1984), other drainage and agricultural intensification of wetland feeding areas, together with high shooting mortality and disturbance, led the population to decline. Between the late 1950s and late 1970s, the population declined from a maximum of 23,000 birds to about 14,300 – 16,600 birds. This decline was particularly pronounced in Ireland where an estimated 50% decline in population occurred over the same period (from 12,700-17,300 to 7,500-8,600). Following positive conservation measures and several good breeding seasons the total population in Ireland and Britain has since risen to *c.*26,000, of which *c.*10,000 are in Britain (Stroud *et al.* in press).

The main British wintering areas are on the island of Islay. Peak counts there have risen under current levels of protection from 3,250 (Stroud 1984) to a current total of *c.*6,700. However, numbers on the island had declined from previously higher levels and a count of 4,700 in 1966 (Ogilvie 1983) was not exceeded until 1984. Together with much more thorough census procedures in recent years (Bignal *et al.* 1987), the increase on Islay is not dramatic.

The British population remains small in world terms and numbers on Islay form a most important component of the whole population (Bignal *et al.* in press).

As a consequence of population decline, and continuing habitat loss in some areas, the goose was given enhanced protection in most parts of its world range in the early 1980s (detailed by Stroud *et al.* in press) and separate programmes of research were initiated in Ireland, Scotland, Iceland and Greenland (Fox & Stroud 1981, 1988; Fox *et al.* 1983). Much of this work was aimed at accurate estimation of population size and improved knowledge of distribution (Stroud *et al.* in press), as well as an investigation of some of the factors important in the conservation management of the geese (Norriss & Wilson 1988; Bignal *et al.* in press). Conservation measures have since led to an increase in population size, although it remains small in international terms.

Habitat

The range of Greenland white-fronted geese in the British Isles reflects that of their traditional wintering habitats of patterned mires, especially ombrotrophic raised and blanket bogs (Owen 1976a; Ruttledge & Ogilvie 1979). Whilst the geese still use such habitats as both roost and feeding areas substantially throughout their range, they also feed on a range of semi-improved and improved grasslands (Bignal *et al.* 1988).

On the main British wintering area on Islay, Bignal *et al.* (1988; in prep.) have presented information on land-type and habitat selection and have shown that Greenland white-fronted geese feed in small flocks utilising a range of grasslands including rough pastures, bogs and rushy fields. They roost on peatlands (Stroud 1985) where they also feed in semi-natural plant communities.

Conservation needs

Greenland whitefronts are sensitive to land-use changes (Ruttledge & Ogilvie 1979; Norriss & Wilson 1988; Stroud *et al.* in prep.), and the high levels of within- and between-winter site fidelity shown by studies of individually marked birds (Kampp *et al.* 1988; Wilson *et al.* in press) indicates that population management is particularly important. The main threats remain habitat loss, disturbance at traditional haunts and illegal shooting.

In areas such as Islay, few sites specifically favoured by Greenland whitefronts have been designated as SSSI. The main barnacle goose sanctuaries/SPA there (Gruinart and Laggan SPAs) hold relatively few Greenland white-fronted geese, whilst the peatland SPAs or pSPAs of Feur Lochain, Glac na Criche, Eilean na Muice Dubhe and parts of the Rhinns are either roosts or night-time feeding areas, rather than day-time feeding areas on low-intensity farmland. Greenland white-fronted geese are widely scattered across Islay and an Environmentally Sensitive Area- type designation there, and on other areas such as Coll and Tiree (Fox *et al.* 1989), would be helpful in encouraging farmers to accept regular use by moderate numbers of geese on their land – much of which is not currently subject to SSSI designation. Likewise, drainage and agricultural intensification of small wet fields on Coll, Tiree and other sites could lead to either increased agricultural conflict, and/or adverse effects on wintering flocks (Fox *et al.* 1989). The Wildfowl & Wetlands Trust have recommended that farmers should be able to opt for payments under an ESA-type agreement (Owen in press).

Proportion currently protected within the SPA network

The network provides for a variety of different requirements: including roost sites, staging areas and some feeding areas. In winter, the proposed SPA network holds approximately 8,500 Greenland white-fronted geese (85% of British wintering total and 39% of the world population). Some sites for this species (especially on Islay) are nocturnal roost sites, and do not include daytime feeding areas (which include a range of habitats including low-intensity farmland). Thus additional and complementary conservation measures are required in these areas to sustain the population of wintering Greenland white-fronted geese.

A.6.2.11 Barnacle goose *Branta leucopsis*

Conservation status

Annex 1 of EEC Birds Directive; Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Breeds in three separate localities – Greenland, Svalbard and western Siberia (see section 2.5.2). In addition a small, but increasing, population has recently established itself on the Swedish island of Gotland. There are no wild birds breeding in any EEC country. Populations are generally characterised by low productivity, variable breeding success and occasional non-breeding years. Therefore there is a need to ensure large populations to buffer against adverse conditions.

Winter:

The movements of barnacle geese between their breeding and wintering localities are well understood, following many years of research by the Wildfowl & Wetlands Trust and others (summarised in Owen *et al.* 1986 and Owen & Black 1989).

USSR population.
This population comprises about 70,000 birds which winter in the Netherlands and pass through several other European countries in spring and autumn.

Svalbard population.
The 10,000+ birds that comprise this population winter exclusively in the inner Solway Firth (100% in Britain). Numbers have increased from a low of about 300 birds in 1948 due both to protection on the breeding and wintering grounds, and the establishment of a disturbance free National Nature Reserve at Caerlaverock (Owen et al. 1987). The five-year peak month average to 1987/88 was 10,200 birds, with a peak count of 12,100 in October 1988 (M. Owen, pers. comm.). The birds have distinct staging areas during migration (section 2.3). In the autumn they stop at Bear Island when weather conditions are favourable. In the spring they stop for 2-3 weeks on islands in Helgeland, north Norway. Recent studies have indicated that significant mortality occurs on migration (Owen & Black 1989).

Greenland population
This population currently comprises about 32,000 birds which winter along the west coasts of Scotland (63%) and Ireland (37%). Following an earlier decline in numbers the population has increased since the late 1950s. An aerial survey of the entire wintering range in March/April 1988 found 34,550 geese, of which 26,960 were in Scotland (Fox & Ogilvie 1989) and 7,590 in Ireland (Walsh & Merne 1989). However, some movement between sites occurs throughout the winter (Cabot unpubl.; Newton & Percival 1989), and the Irish and British components of the population do not appear to be totally discrete. The principal sites are on Islay where the five-year peak month average to 1987/88 was 17,900 birds (Salmon *et al.* 1988).

Birds from this population have an autumn staging area in southern Iceland where they stop for about a month, and a spring staging area in the north-west of Iceland where they stay for about three weeks. Recent research has indicated that the condition of birds in spring, as influenced by plant growth and weather conditions in Scotland before departure, in Iceland, and on arrival in Greenland, is a major determinant of breeding success (Fox & Gitay in press).

Substantially the whole Greenland population uses the Loch Gruinart SPA on Islay in October before dispersing to other Irish and Scottish wintering sites (Easterbee *et al.* 1987). The area and its management is of crucial importance for the well-being of the population.

Ringing studies (Percival 1988; Newton & Percival 1989) have shown a high degree of site-fidelity on both Islay and elsewhere. However, interchange occurs between these areas and other sites such as the main Irish wintering site on the Inishkea islands (Cabot unpubl.). The regular use of core areas on Islay by flocks of barnacle geese has implications for conservation management of the geese (Percival 1988).

Habitat

In winter barnacle geese graze on saltmarshes, short-cropped coastal pastures, machair and turf-topped rocky islands. Fox & Ogilvie (1989) have drawn attention to the lack of sheep-grazing on many of the small, traditionally occupied Scottish islands. Without such agricultural management, rank vegetation can develop which is unattractive to barnacle geese. At all such sites, continued grazing management is required. Increasingly, barnacle geese are also using intensively managed, short-cropped cattle pasture on the main winter areas of Islay and at Caerlaverock. The geese roost on uninhabited, fox-free islands and on estuarine sandbanks.

Conservation needs

The world totals for the two biogeographical populations that winter in Britain are very small and they are highly vulnerable to changing circumstances on their breeding, staging and wintering grounds. Oil exploration and potential oil production on breeding and moulting grounds in Greenland may have a significant effect on a high proportion of the Greenland population (Madsen 1984c). The Svalbard population appears to be levelling out in response to density-dependent factors operating on their breeding grounds (Owen & Black 1989).

Britain has a special responsibility for their protection in winter on the Solway Firth, on Islay and elsewhere in the west of Scotland. Parts of Islay and the Solway Firth are now protected and managed for barnacle geese by the NCC, Wildfowl and Wetlands Trust, and RSPB. Threats include illegal shooting at both places, excessive disturbance (especially at roost sites), and licensed shooting of unlimited numbers on Islay (where licenses are issued by DAFS ostensibly to prevent serious agricultural damage). Such shooting is particularly disruptive during the spring.

Proportion currently protected within the SPA network

Svalbard barnacle goose

The entire population of Svalbard barnacle geese is dependent in winter on the proposed Upper Solway Flats and Marshes SPA. This is the sole wintering site for this small population. However, with recent increases of the population following succesful conservation management, flocks are ranging more widely onto arable farmland away from the pSPA. Continued conservation management of core refuge areas within the SPA is required to alleviate possible conflicts with agricultural interests (Owen *et al.* 1987).

Greenland barnacle goose

A significant proportion of the Greenland population of barnacle geese is accommodated within the proposed SPA network in Britain. The network provides for a variety of different requirements, including roost sites, feeding areas and staging areas. Substantially the entire population uses the Loch Gruinart SPA on Islay for a short period in the autumn (Easterbee *et al.* 1987). At the time of the last complete population census (Fox & Ogilvie 1989) there were a total of 21,600 Greenland barnacle geese on sites in the proposed SPA network (80% of the British and 63% of the international populations). Not all these geese are protected all the time: substantial numbers of geese occur outwith the SPA network on Islay, since feeding areas for birds that roost at Bridgend Flats SPA are not included within the site. Thus the adequacy of protection measures on Islay requires review as indicated by Bignal *et al.* (1988).

A.6.2.12 Honey buzzard *Pernis apivorus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

This is a very rare breeding species in Britain, occurring at a small number of scattered localities. The documented population is 10-12 pairs (RBBP), but may be as high as 30 summering pairs (the discrepancy due to data being withheld by amateur observers to maintain confidentiality of sites). Trends in population size in Britain are difficult to determine, but numbers have probably increased following near extinction in the 19th century.

Honey buzzards breed in all EEC countries with the exception of Ireland. Elsewhere they have a wide breeding range extending through Europe, southern Scandinavia and the USSR. The breeding population in NW Europe amounts to about 19,000 pairs and is thought to be in decline.

Winter:

Winters in tropical and southern Africa.

Habitat

Honey buzzards appear to require mature woodland with open areas for feeding.

Conservation needs

The British population is internationally important in terms of retention of the current breeding range and designation of traditionally used sites will protect these areas from further woodland clearance, or other inappropriate management.

Proportion currently protected within the SPA network

A small but significant number of honey buzzards currently breed within the SPA network.

A.6.2.13 Red kite *Milvus milvus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention. The red kite is classified as a **globally threatened** species (Collar & Andrew 1988).

Population and distribution

Breeding:

The wild population in Britain comprises 47 nesting pairs (1988) and is confined to Wales. The species was previously abundant and widespread in Britain, but declined to near extinction following human persecution during the 19th century. Numbers in Wales have gradually increased under protection since the 1940s (Davies & Newton 1981). A joint NCC/RSPB experimental reintroduction programme has recently commenced with young birds released in 1989 at two sites, one in Scotland and one in England.

Red kites breed in all other EEC countries with the exception of Eire and Greece. Elsewhere the world range is restricted to a few other European countries, a small area of Morocco and some small Atlantic islands. The NW European population (excluding Spain) is estimated to be about 4,750 breeding pairs.

Winter:

Welsh breeding birds are largely sedentary, although there are scattered winter sightings of Welsh or continental birds in eastern England and Devon. The British wintering total is estimated to be 110-140 birds.

Habitat

In Wales they breed in mature woodland but range widely throughout the year in both wooded and open country. It is widely recognised, however, that the Welsh locality is not optimal habitat for red kites in terms of food supply in the breeding season.

Conservation needs

The British population is important internationally in terms of retention of the current world breeding range. Red kites are also rare in world terms and are threatened. They will benefit from protection within SPAs, particularly if combined with wider countryside measures in existing and new localities. Breeding success of Welsh birds is usually low because of food shortage and climatic conditions there (Davis & Newton 1981). Other threats that have been identified include egg collecting, human disturbance, poisoning and illegal shooting.

Apart from the Welsh birds, red kites became extinct in Britain largely as a result of former persecution. Suitable habitat and food still exist in many of its former nesting areas. By establishing additional populations in areas where higher productivity could be achieved, the future of the red kite population in Britain could be made less dependent at present on events than in just one area as. In view of the only slight expansion in Wales and its distance from other breeding areas, kites are unlikely to recolonise these other areas naturally. After more than two years of detailed assessment, a joint NCC/RSPB project team determined that red kite fulfilled all the criteria used to assess reintroduction proposals. It is the view of both the NCC and RSPB that the red kite is one of the very few bird species which fulfil these criteria. It is a conservation priority to help spread the population by translocation into its former breeding range.

In 1989, 10 young kites were collected under special licences from nests in Sweden and flown to Britain and reared in Scotland and England at locations being kept secret in order to minimise disturbance to the birds. They were joined by a young kite from Wales. All the young developed well and were duly released. They flew strongly, catching flying insects within a few hours of release.

Proportion currently protected within the SPA network

Only a small proportion of the red kite population currently breed within the SPA network. Whilst site-protection measures may be appropriate for concentrations or core areas, the majority of protection for this species will be achieved through non site-based special protection measures. In this light, there is a need to review sites used for roosting which sustain a significant proportion of the population in the non-breeding season. This is currently being undertaken by the NCC and will probably result in additions to the SPA network at a later date.

A.6.2.14 White-tailed eagle *Haliaeetus albicilla*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix I of the Bonn Convention. The white-tailed eagle is classified as a **globally endangered** species in world terms (Collar & Andrew 1988; Grimmett & Jones 1989).

Population and distribution

Breeding:

White-tailed (or sea) eagles were once common throughout the north and west of Britain with at least 100 known breeding sites in Scotland (Love 1983, 1988). Indeed, they occurred throughout the country in earlier times, but suffered drastically from persecution last century. Its predominantly coastal distribution made the whole population relatively accessible to humans, whereas golden eagles managed to survive in the remote inland mountains. The last pair in Britain bred on the Isle of Skye in 1916. In recent times, populations throughout the species' range, except those in Norway and Greenland, have been much reduced by habitat loss and, especially, by pesticides. Any species whose healthy population is limited to a small part of its range is very vulnerable to extinction. However, birds of this species are highly sedentary, and unlikely to recolonise rehabilitated areas. The coasts of north and west Britain are again suitable for this species due to a more enlightened view of birds of prey. The white-tailed eagle fulfilled all agreed criteria for reintroduction to be appropriate, and, since 1975, the NCC has, in co-operating with the RSPB, the Institute of Terrestrial Ecology and the Scottish Wildlife Trust, run a programme to reintroduce it to Britain.

Each year between 1975 and 1985, the Norwegian government granted licences to take up to 10 eaglets from eyries in northern Norway. They were retained in captivity but in as near natural conditions as possible on Rhum NNR. The young eagles were set free in late summer, after marking with coloured leg-rings and/or wing-tags, as indicated below.

Year:	1975	76	77	78	79	80	81	82	83	84	85	Total
No. released:												
males	0	5	2	4	3	5	3	3	3	6	5	39
females	3	4	2	3	3	3	2	7	7	4	5	43
Total	3	9	4	7	6	8	5	10	10	10	10	82

White-tailed eagles take at least 5 years to reach adulthood, and in 1982 the first courtship and nest-building were seen. In 1983, the first recorded eggs were laid – by a pair of birds 3-4 years old

and by a trio of 2 females and a male. The young pair laid again in 1984 but again no eggs hatched. In 1985 this pair (now fully adult) successfully hatched and reared one chick – the first to have been bred in Britain for 70 years. They repeated their success with two more chicks the following year, by which time several other pairs were laying eggs. They reared another two chicks in 1987, when another pair (part of the earlier trio) also fledged one chick. Both these pairs failed in 1988 (the previously very successful pair losing their nest in a storm), but a third pair succeeded in fledging two eaglets – particularly noteworthy since this pair (6 years old) had never bred before. A total of 10 or 11 pairs had established territories by 1988, and 6 or 7 of them produced eggs. So far, any failures to breed successfully seem due to age and inexperience, and sometimes to bad weather. Nest sites are protected by RSPB and the NCC and, of course, the localities are kept secret to give the eagles every chance of success. 1989 was the best year so far, with three pairs rearing a total of five young.

Sea-eagles bred in the wild

Year: Fledged	1985	1986	1987	1988	1989	Total
males:	1	0	1	0		2
females:	0	2	2	2		6
Total:	1	2	3	2	5	13
Known deaths:			1 female		1 bird	

Within the EEC the species also breeds in Denmark (0-1 pair), West Germany (4 pairs) and Greece (1-3 pairs). The NW European breeding population amounts to about 950 pairs, with Norway holding 800 of these. The reintroduced British population thus forms about 56% of the EEC total and 1% of the NW European total. Elsewhere it breeds in Greenland, East Germany, Poland and the USSR.

Winter:

The breeding population is largely sedentary, and, together with juveniles and immatures, the British wintering population amounts to about 50 birds (from a total of 82 that were released in 1975-85 plus their offspring). These are to be found in coastal and island areas of western Scotland, although birds have ranged more widely.

Habitat

Birds breed and winter in coastal areas and their diet consists of fish, seabirds, rabbits and hares, supplemented in the winter months with carrion.

Conservation needs

In common with all other birds of prey, white-tailed eagles are fully protected by law. Nonetheless, two of the birds reared and released on Rhum have died at poisoned baits illegally laid out for foxes and crows. Six other eagles have died from natural causes. However, the survival rate is very high: between 50% and 75% of the 82 eagles released are thought to be thriving in the wild.
Continued protection and monitoring of the Scottish population is essential to the long term success of the reintroduction programme. The last birds were released in 1985, although the option of further releases is available if necessary. Particular threats include illegal poisoning and shooting, human disturbance, egg collecting, collisions with overhead cables, and oiling by Fulmars. As a top predator the white-tailed eagle is also vulnerable to accumulation of marine pollutants. The British population is important internationally in terms of range retention and in view of the small and fragile nature of the overall population. It will benefit from SPA designation of breeding localities, particularly in conjunction with wider countryside measures.

Proportion currently protected within the SPA network

Whilst site-protection measures may be appropriate for particular concentrations or areas, the majority of protection for this species will be achieved through non site-based special protection measures of which the NCC's re-introduction programme is one initiative.

A.6.2.15 Marsh harrier *Circus aeruginosus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The size of the British breeding population has varied considerably in recent years with a peak of over 75 nests in 1988. The species had become extinct in Britain at the end of the 19th century due to drainage of the wetland habitats on which they depend, and persecution. Breeding recommenced around 1911 and the population increased gradually to 15 nests in 1958, followed by a decline to 1 pair in 1971, then a recovery to present numbers (Day 1984). The population is centered in East Anglia.

Breeding occurs within all other EEC countries with the exception of Eire and Luxembourg. Elsewhere the breeding range includes North Africa, southern Scandinavia, eastern Europe and the USSR. The total NW European population (excluding Spain) is estimated to be about 3,110 pairs.

Winter:

Marsh harriers are migratory and most winter in the Mediterranean and NW Africa, although a few remain in southern counties of Britain.

Habitat

Breeding in Britain usually occurs within extensive reedbeds, while hunting (for birds, rabbits and small mammals) takes place over open marshland or agricultural land (Day 1985).

Conservation needs

The British population is important internationally in terms of retention of the traditional breeding range. The extensive reedbed habitats in which they breed have become very scarce in Britain (Everett 1989) because of drainage and agricultural reclamation (section A.5.11). This may limit the potential for population expansion, although some pairs are now nesting in cereal fields. Protection and sympathetic management of remaining sites is, therefore, of great importance and has been largely responsible for the recent increase. SPA designation will allow the maintenance of the large, unfragmented areas of reedbed required by this species. Other threats that have been identified include pesticides, egg collecting, human disturbance, illegal shooting and poisoning, and predation by foxes.

Proportion currently protected within the SPA network

A total of *c.*8 pairs of marsh harriers breed within the SPA network (11% of the British total).

A.6.2.16 Hen harrier *Circus cyaneus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population is currently estimated to be about 400 pairs. In the early decades of the current century breeding hen harriers were confined to Orkney and the Outer Hebrides. This followed a decline in the 19th century, caused by habitat losses and intense persecution by game-keeping interests. Since the 1930s the population has increased and the breeding range has spread to include much of mainland Scotland and parts of northern England and North Wales. In some areas, e.g. Orkney, a polygynous mating system is practised (Balfour 1957). The current status of this species is under review.

Within the EEC, hen harriers also breed in Denmark (0-1 pair), France (2,800-3,800 pairs), West Germany (15-20 pairs), Netherlands (100-130 pairs), Spain (500 pairs), Portugal (rare) and Ireland (70 pairs). The NW European population is about 6,820 pairs. Thus Britain holds approximately 9% of the EEC and 6% of the NW European breeding total. The full breeding range extends through Eastern Europe, Scandinavia and the USSR.

Winter:

Hen harriers are migratory in parts of their range but an estimated 750 birds spend the winter in Britain, where they are widely distributed.

Habitat

Breeding occurs on open heather moorland (with nests amongst rank heather) and in young conifer plantations. In winter birds do occur on moorland, but are more often associated with coastal lowlands, agricultural lands, marshes, saltmarshes, estuaries and young conifer plantations. Wintering birds traditionally gather to form communal roosts at night, often in reedbeds and marshes (section A.5.11).

Conservation needs

The main current threat is from illegal shooting, nest destruction and illegal poisoning of hen harriers on grouse moors. This continuing illegal persecution is particularly intense in some areas and severely threatens the maintenance of range within the British Isles. Afforestation provides some short term benefits, but, along with agricultural intensification, is harmful to hen harriers in the long term through loss of open moorland habitat (O'Flynn 1983). Site protection requires inclusion of the winter roosting sites and the extensive areas used for foraging in both summer and winter. Effective protection involves SPA designation of core areas coupled with non site-based special protection measures.

Proportion currently protected within the SPA network

A total of *c.*130 pairs of hen harriers breed within the SPA network (33% of the British total; 2% of the international total). Survey information for this species is generally poor, and the proportion occurring on some sites may well be greater than presently known. Even within the SPA network, hen harriers are subject to intense illegal persecution by some game-keeping interests.

In winter, hen harriers leave breeding areas and a significant number, although nationally untotalled, occur on coastal sites within the SPA network.

A.6.2.17 Montagu's harrier *Circus pygargus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Montagu's harriers are a very rare breeding bird in Britain at present, although numbers have fluctuated considerably during the present century. In the 12 year period 1976-87 the total has varied between 2-7 pairs (Elliot 1988). The species was heavily persecuted during the 19th and early 20th centuries and no more than 7 pairs were recorded at any time in the period 1850-1920. Numbers then increased to a maximum of 30 nests in 1953, followed by a decline to 7 pairs in 1962, a recovery to 19 nests in 1967, then another decline to the present. Breeding is currently restricted to East Anglia and south-west England.

Within the EEC, breeding also occurs in Denmark (50 pairs), West Germany (80-90 pairs), Netherlands (25-35 pairs), Belgium (5 pairs), France (300-400), Spain (3,000 pairs), Portugal (1,000 pairs), Italy (200 pairs) and Greece (10-20 pairs). The NW European total (excluding Spain) is about 585 pairs. The full breeding range extends through North Africa, Eastern Europe and the USSR.

Winter:

Montagu's harriers winter in Africa south of the Sahara.

Habitat

Traditionally Montagu's harriers bred in reedbeds, rough grassland, and on heathland and moorland. However, since 1976 virtually all nests in Britain have been located within agricultural crops, particularly autumn sown cereals (Elliot 1988).

Conservation needs

The British population is very small in EEC terms but its protection is important in the context of maintainance of the traditional breeding range. Safeguarding of nests currently requires liaison between conservation bodies and local farmers. Threats that have been identified include accumulation of pesticides within the food chain (which has possibly been involved in past declines), fox predation, human disturbance and nest destruction by agricultural operations.

Proportion currently protected within the SPA network

The British population of Montagu's harrier nests largely in arable areas and on ground that would not normally be considered for site-based protection. Whilst site-protection measures may be appropriate for particular concentrations or areas, the majority of protection for this species will be achieved through special protection measures in the wider countryside. These may include protection from illegal persecution and disturbance during the nesting season, and payments to farmers where nest protection affects the harvesting of part of a crop.

A.6.2.18 Golden eagle *Aquila chrysaetos*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The current British breeding population is estimated to be at least 424 pairs, with almost all of these in Scotland (Dennis *et al.* 1984). The species was formerly more widespread, breeding in mountainous areas of England and Wales as well as Scotland, but was heavily persecuted during the 19th century. Some recolonisation of the former range has taken place this century.

Differential productivity has been recorded by Watson *et al.* (1987), who related breeding success to food supply in different parts of their Scottish range. Golden eagle nesting density was closely correlated with amounts of carrion available in winter, and was highest in western Scotland. However, breeding performance was related instead to the amounts of 'living' prey available during the summer months which was greatest in eastern Scotland.

Within the EEC golden eagles also breed in West Germany (12-25 pairs), France (190-236 pairs), Italy (250 pairs), Spain (400 pairs), Portugal (5 pairs) and Greece (250 pairs). Birds in the Iberian peninsula belong to the North African race *A. c. homeyeri*. Britain holds about 50% of the EEC and 27% of the NW European population of the nominate race (Dennis *et al.* 1984). The full breeding range extends through Scandinavia and the USSR.

Winter:

British golden eagles are highly sedentary and the wintering population is estimated to be 1,000-1,200 birds.

Habitat

Throughout the year they frequent open hill and mountain as well as coastal country and have very large home ranges. The traditional nest sites are usually located on cliff ledges, but sometimes in trees.

Conservation needs

Britain holds 50% of the EEC population of golden eagles and, therefore, has a special responsibility for its protection. The main threat to the species in Scotland is thought to arise from land use changes, particularly afforestation (see below). SPA designation of certain core areas will, therefore, be beneficial but, because of the large size of eagle home ranges it is not possible to protect more than a small proportion of the breeding range in this way. Special protection measures elsewhere will form an integral part of the overall conservation strategy for the British golden eagle population. Because the factors (mainly dietary) determining nesting density are different from those determining eagle nesting success, it is important to target conservation measures especially towards those areas with the highest total eagle productivity. This will maximise chances of long-term population viability.

Afforestation, as well as continuing overgrazing and excessive burning of upland vegetation, is believed to reduce the carrying capacity of upland areas for golden eagles by reducing the abundance of wild prey. More than 20% of the British golden eagle population could be lost as a result of afforestation in the west and extreme north of Scotland (Watson *et al.* 1987). Past fluctuations in numbers in northeast Scotland were linked with patterns of human land use and associated gamekeeping practices (Watson *et al.* 1989).

Proportion currently protected within the SPA network

A total of *c.*66 pairs of golden eagles (16% of the British breeding total; 4% of the international total) nest within the SPA network. However, not all sites hold sufficent ground to sustain the hunting territories of these pairs, whilst other pairs nest outwith SPAs but use ground within them for hunting.

In winter, the SPA network supports an important but unquantified proportion of the population.

A.6.2.19 Osprey *Pandion haliaetus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population is currently 52 pairs (1988), all located in central and northern Scotland. Ospreys were formerly common in Scotland, and probably also in England, but declined in the 18th and 19th centuries due to human persecution. They became extinct in 1916 but recolonised Scotland during the 1950s. Under close protection, the population has gradually increased to its present level.

Within the EEC, ospreys also breed in Denmark (0-1 pair), Spain (10-15 pairs), Portugal (2 pairs) and France (20 pairs). Britain therefore, holds about 68% of the EEC population. Large numbers occur in Sweden and Finland, and Britain holds about 2% of the NW European population. Elsewhere the range extends through the USSR, with smaller numbers in eastern Europe, on Mediterranean and Atlantic islands and in North Africa.

Winter:

British ospreys winter in West Africa.

Habitat

Scottish birds use traditional nest sites in mature Scots pine forests and isolated woods. They feed on fish caught in nearby freshwater lochs, rivers and estuaries.

Conservation needs

Britain holds a large proportion of the EEC breeding population and, therefore, has a special responsibility for their protection. Being fish eaters, ospreys are vulnerable to changes in the quality of freshwater and estuarine environments. Protection, therefore, involves consideration of areas often well away from the locality of the nest site. This is a species that will benefit from a combination of SPA and wider countryside measures. Other threats that have been identified include egg collecting, human disturbance, collision with overhead cables and interaction with fish farm interests. It has been found necessary to organise protection of many of the nest sites and to maintain close liaison with landowners. Provision of artificial eyries in safe locations and maintainance of nesting sites during winter are also involved in the management of the population (Dennis 1987a).

Proportion currently protected within the SPA network

A small proportion of nesting areas are currently protected within the SPA network. Whilst site-protection measures may be appropriate for particular concentrations or areas, the majority of protection for this species will be achieved through wider countryside measures.

A.6.2.20 Merlin *Falco columbarius*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The current British breeding population is estimated to be 550-650 pairs (Bibby & Natrass 1986) and is widely but thinly scattered in moorland areas from south-west England to Wales, northern England and Scotland. Merlins were formerly more numerous throughout the British range but widespread declines throughout the present century accelerated from about 1950 and are still continuing.

The only other EEC country where merlins breed is Ireland, which holds about 100 pairs. Britain thus supports about 85% of the EEC total. The NW European total for the *aesalon* race is in the order of 9,000 pairs, and Britain holds about 7% of these.

Winter:

Merlins are resident in Britain throughout the year, but numbers are augmented in winter by migrants from Iceland, giving an estimated winter population of 1,500-2,500 birds. They are widely, but thinly scattered throughout lowland Britain.

Habitat

Merlins hunt over open ground and are found on heather moorland or grass-dominated sheep walks in summer and on open farmland, estuaries and other coastal habitats in winter. The traditional nest sites are often found in trees but these usually stand within open moorland.

Conservation needs

Britain holds the majority of the EEC breeding population and thus has a special responsibility for its protection, urgently so in the light of the continuing decline in numbers (Bibby & Natrass 1986; Roberts & Green 1983). Like other birds of prey, the merlin has a large foraging range and this has been taken into account in proposals for SPA designation. The main concern is loss of suitable habitat, namely heather moorland, through conversion to grassland or to forestry (Bibby 1986; Haworth & Fielding 1988). This is a species that will benefit from a combination of SPA and wider countryside special protection measures.

Other threats that have been identified include accumulation of toxic pesticides and mercury from food items, human disturbance, illegal egg collecting and taking of eggs or chicks for falconry.

Proportion currently protected within the SPA network

A total of *c.*155 pairs of merlins breed within the SPA network (26% of the British population). Survey information for this species is poor in some areas and the proportion occurring on some sites may well be greater. Even within the SPA network, merlins are subject to persecution by some game-keeping interests. Whilst site-protection measures are appropriate for particular concentrations or areas, the majority of protection for this species will be achieved through wider countryside measures.

In winter, merlins leave breeding areas, and a significant, although nationally uncollated number, occur on coastal sites within the SPA network.

A.6.2.21 Peregrine *Falco peregrinus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population is currently estimated to be about 850 pairs and is widely but thinly distributed in coastal and upland areas from south-west England to Wales, northern England and Scotland. In 1930-39 the population was estimated to be about 900 pairs. This was substantially reduced during the Second World War by a programme of peregrine killing linked with the military use of homing pigeons. A further set-back occurred during the late 1950s and early 1960s, caused by organochlorine pesticides, and resulted in a further decline in population to about 360 pairs in 1963. Following restrictions on the use of these pesticides the population has recovered and increased to the present (Ratcliffe 1963, 1972, 1984).

Within the EEC, peregrines also breed in Ireland (250 pairs), West Germany (115 pairs), France (250 pairs), Italy (300-350 pairs), Spain (2,000 pairs), Portugal (a few) and Greece (150 pairs). Elsewhere in the Western Palearctic, peregrines

breed in North Africa and through Scandinavia and the USSR. British birds belong to the nominate race *Falco p. peregrinus* whose range also includes Ireland, Scandinavia, western USSR and northern central Europe. A second race, *F. p. brookei*, breeds in southern France, Portugal, Spain, Italy, Greece and other parts of southern Europe. Based on estimates in Gensbol (1984) Britain holds about 54% of the north-west European population of the nominate race.

Winter:

Peregrines are resident in Britain throughout the year. The wintering population is estimated at about 3,000 birds. They are widely distributed in both the uplands and lowlands, although largely absent from central and eastern England.

Habitat

Breeding occurs in coastal, moorland or mountain terrain and the nest is usually located on a steep cliff-face ledge. A large foraging area is used. A wide variety of habitats are frequented in winter, but coastal areas and estuaries are particularly important.

Conservation needs

The population is important in international terms and Britain, therefore, has a special responsibility for its protection. It has been necessary to take into account the large size of foraging areas when assessing the SPA network for this species. Peregrines will benefit from a combination of SPA and wider countryside measures. Particular threats that have been identified include pesticides, taking of eggs and young for falconry, egg collecting, human disturbance, illegal persecution on some grouse moors, and paucity of wild prey in some areas due to habitat degradation.

Proportion currently protected within the SPA network

In summer, a total of *c.*90 pairs of peregrines breed within the SPA network (11% of the British population; 6% of the international population). However, not all sites hold sufficient ground to sustain the hunting territories of these pairs, whilst other pairs nest outwith SPAs but use ground within them for hunting. Whilst site-protection measures may be appropriate for particular concentrations or areas, the majority of protection for this species will be achieved through wider countryside measures.

In winter, peregrines leave breeding areas, and a significant, although nationally uncollated total, occur on coastal sites within the SPA network.

A.6.2.22 Capercaillie *Tetrao urogallus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 2, Part 1 of WCA 1981 (may be shot in open season from 1 October to 31 January); Appendix III of the Berne Convention.

Population and distribution

Breeding:

No full census of the British breeding population has been carried out, but it is thought to currently number 1,000-2,000 birds. These are largely confined to the central and eastern highlands of Scotland. The species became extinct in England in the 17th century and in Scotland in the 18th century. It was reintroduced from Scandinavia to several areas in Scotland during the 19th century and spread to recolonise much of its former Scottish range. However, numbers are thought to have declined in recent years. A questionnaire survey of Forestry Commission staff in 1986 (Dennis & Hinde 1987) found that numbers had decreased during the last five years in 80% of the woods which had previously held capercaillies. Within Scotland, their range appears to be limited by climatic factors: breeding success is inversely related to the number of days with rain during and just after hatching (Moss 1986).

Within the EEC, capercaillies also breed in parts of France, Spain, Luxembourg and West Germany. Population sizes are poorly known, but the species is thought to be declining in most areas. The breeding range includes eastern Europe, Scandinavia and the USSR.

Winter:

Capercaillies are highly sedentary and winter in the central and eastern highlands of Scotland.

Habitat

Capercaillies are birds of open mature coniferous forests, especially of Scots pine *Pinus sylvestris*, and are found in this habitat throughout the year. Moss *et al.* (1979) have shown that capercaillies breed better in semi-natural forests than in plantations, and suggested that the greater abundance of the chick's favoured food *Vaccinium myrtillus* in semi-natural forests may improve their survival.

Conservation needs

Britain probably holds a large proportion of the EEC total and is important internationally in terms of retention of the traditional breeding range. Loss of mature pine forests, overshooting and climatic changes are the main factors implicated in recent population declines. The native pinewoods of the Scottish Highlands have been reduced by felling

and fire to now occupy only about 1% of their natural range. There are now just 35 genuine native pinewood sites of any size, covering a total area of about 12,000 ha. In addition numerous small and scattered remnants together contribute a further c.500 ha (Carlisle 1977; Bain 1987; section A.5.9). It is clearly important that the remaining tracts of native pinewoods that still hold capercaillies should be protected within the proposed SPA network. Other threats that have been identified include predation by pine martens and foxes, and human disturbance.

Proportion currently protected within the SPA network

In summer, the proposed SPA network holds a significant but currently unquantified proportion of the British breeding population.

A.6.2.23 Spotted crake *Porzana porzana*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Spotted crakes are a very rare breeding species in Britain. Less than 12 males have been noted in any one year but the species is probably under-recorded because of its secretive nature. Birds have turned up in different years at sites scattered throughout Britain from southern England to the Outer Hebrides. It is thought to have been formerly more numerous, but to have declined during the 18th and early 19th centuries, probably mainly because of extensive drainage of wetland areas.

Spotted crakes breed in scattered localities in most EEC countries as well as in southern Scandinavia, eastern Europe and the USSR. There is, however, very little information available on population sizes.

Winter and passage:

Substantial numbers of spotted crakes pass through Britain in the autumn. They spend the winter in the Mediterranean area, north and east Africa, and south-west Asia.

Habitat

Breeding occurs in wetland habitats ranging from lowland swamps and fens, overgrown edges of lakes and rivers, to upland bogs.

Conservation needs

The British breeding population is very small but is important internationally in terms of retention of the traditional breeding range. As spotted crakes are vulnerable to the drainage and loss of their wetland habitat and to human disturbance they will benefit from the protection afforded by the proposed SPA network. However, protection of specific sites for this species is difficult because of the sporadic nature of its summer occurrence in some areas.

Proportion currently protected within the SPA network

The spotted crake is an extremely rare breeding bird in Britain, and a moderate proportion of the variable British breeding population of the species is accommodated within the proposed SPA network.

A.6.2.24 Corncrake *Crex crex*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention. The corncrake is classified as a **globally endangered** species (Collar & Andrew 1988; Grimmett & Jones 1989).

Population and distribution

Breeding:

The British breeding population in 1988 was estimated to be 551-596 calling birds (equivalent to pairs; Hudson *et al.* in press). Of these, four were in England, one on the Isle of Man and the remainder in Scotland. Of the total 90% were found on the Inner and Outer Hebrides. The 1988 total represents a 15-26% decline from the total of 700-746 calling birds counted in the previous national census of 1978/79 (Cadbury 1980). Corncrakes were once widely distributed in Scotland, England and Wales, but a decline began towards the end of the 19th century and has continued until the present.

Within the EEC, corncrakes also breed in Ireland (900-930 calling birds in 1988, Mayes & Stowe in press), France (1,750-2,450), Luxembourg (<10), Belgium (38), Netherlands (100-300), Denmark (10-30), West Germany (probably in the range 200-1,000) and Italy (scarce). Numbers are declining in nearly all these countries. It also breeds in southern Norway and Sweden, eastern Europe and across the central Ussr. Britain holds about 13% of the EEC total and about 10% of the western European total (Hudson *et al.* in press).

Winter:

Corncrakes winter mainly in south-east Africa.

Habitat

At present corncrakes breed on low intensity agricultural land, particularly crofting land in north and west Scotland. The juxtaposition of hay meadows and areas of rough herbage, such as iris beds, is particularly favoured, as are areas of weedy arable land (Cadbury 1989a). Deep cover, such as iris and *Juncus*, is important to the birds on their arrival in the spring. Nests are positioned on the ground amongst vegetation.

Conservation needs

The British population is very important in an international context both by virtue of its size and for the retention of the species' traditional range. The well documented decline in numbers and range in Britain requires the urgent implementation of effective conservation measures, especially in respect of wider countryside measures of support for traditional agriculture. These have been assessed in the light of recent NCC/RSPB research work (Stowe & Hudson 1988; Bignal *et al.* 1988) and involve maintenance of low intensity farming methods with a crop rotation system and widespread hay production. Hay cutting should be undertaken from the centre of fields outwards in order to minimise corncrake chick casualties.

The precise reasons for the long term decline are not fully understood, but it is highly likely that intensification of farming has played a part. These changes have probably accelerated the decline of the species. A few areas of the breeding range, such as the island of Tiree, have maintained extensive areas of traditional low-intensity crofting agriculture. This pattern of land-use is much favoured by corncrakes and the numbers on Tiree have been sustained in contrast to declines elsewhere (Cadbury 1989a). Corncrakes will benefit from SPA designation of core areas, particularly if combined with widescale support for low intensity agricultural land through designation of SSSIs, Environmentally Sensitive Areas and other such mechanisms.

Proportion currently protected within the SPA network

The British corncrake population is in marked decline and is increasingly restricted to the crofting lands of the Hebrides and north-west Scottish mainland. The conservation of the species requires both the protection of remaining high density areas (such as those sites within the network), and importantly, the support for traditional forms of low-intensity agriculture throughout its former and current area of distribution. The existing network of sites holds about 200 pairs of corncrakes (35% of the British and 4% of the international populations). Elsewhere in Britain, densities are low and conservation is most effectively promoted through encouragement of traditional forms of agriculture.

Several sites, such as Tiree, are of particular importance because a stable population has been maintained in contrast to other areas (Cadbury 1989a). The production in these areas can possibly supply recruits to other areas.

A.6.2.25 Avocet *Recurvirostra avosetta*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population in 1988 was 385 pairs, all in south or east England. Breeding was formerly widespread on the east coast of England from the Humber to south-east Essex, but avocets became extinct in Britain in the 1840s because of largely land-claim and disturbance. Recolonisation of Norfolk, Essex and Suffolk occurred in the 1940s following huge increases in the Low Countries and Denmark. Under protection and habitat management, numbers have increased steadily to the present level (Cadbury & Olney 1978; Hill 1988).

Within the EEC, breeding also occurs in Denmark (3,555 pairs), West Germany (3,200-3,500), Netherlands (8,000), Luxembourg (480), France (1,473-1,633), Spain (1,000) and Portugal (50-100) (Piersma 1986). Elsewhere breeding occurs in southern Scandinavia, Eastern Europe, the eastern Mediterranean and in parts of the southern USSR. Reed (1985) estimated the British population as 175 pairs, which formed just under 1% of the estimated European total of 19,300 pairs (Piersma 1986). The 1988 British total of 385 pairs forms 2% of this European total and 94% of the European population breeds in EEC countries.

Winter:

The British wintering population of avocets is estimated to be about 500 birds, but exceeded 700 in 1988/89 (Cadbury *et al.* 1989). This forms 1% of the East Atlantic flyway population of about 67,000 birds. Avocets resumed regular wintering in Britain in 1947 and now occur on estuaries in south and east England, notably the Tamar/Tavy, Exe, Poole Harbour, Pagham Harbour, Alde, Thames and Hamford Water. Hill (1988), in a detailed study of avocet population dynamics in Britain, showed that the whilst chick loss on breeding colonies can explain most variation in total losses between years, the main regulatory factor for the population is over-winter mortality. This clearly has major implications for the protection of wintering habitat. Since birds do not return to their natal colonies for their first two years, they are dependent on

estuaries during those winters. Thus loss of winter habitat will directly reduce the numbers of birds returning to breed in the colonies in which they were born. Hill (1988) suggests that further increases in avocet productivity in Britain depend to a great extent on the creation of conditions for the founding of new populations. This can be encouraged by habitat protection, creation and management.

Habitat

Avocets breed at shallow, brackish lagoons and saltmarshes, and spend the winter on estuaries. The RSPB has carried out a great deal of work on habitat creation and management for breeding birds and this is summarised by Cadbury *et al.* (1989).

Conservation needs

The breeding and wintering populations of avocets in Britain are important for maintenance of the traditional range of the species. Avocets have highly specialised habitat requirements for breeding. The maintenance of suitable conditions at existing sites, together with the creation of brackish lagoons elsewhere, is important for the future well-being of the species in Britain.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution, are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

About 90% of the British breeding population of avocets is accommodated within the proposed SPA network. Sites of major importance include the North Norfolk Coast, Minsmere – Walberswick, and Orfordness – Havergate.

In winter, most of the British wintering population occurs on sites in the proposed SPA network (*c.*350 on nine sites). Sites of key current importance are Orfordness – Havergate, the Tamar complex (Reay 1988) and the Exe Estuary.

A.6.2.26 Stone curlew *Burhinus oedicnemus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population of stone curlews in the mid-1980s was between 135-155 pairs. Stone curlews were formerly widespread in England but a long-term range contraction and decrease in population has taken place since the mid-19th century. In the 1930s the population was thought to be between 1,000-2,000 pairs. The present breeding range is restricted to southern and south-eastern England, with the vast majority in Breckland (Norfolk-Suffolk border) and Wessex (parts of Wiltshire, Hampshire and Dorset).

Within the EEC, breeding also occurs in France (4,000-5,000 pairs), Spain (1,000-5,000), Portugal (1,000-10,000), Italy and Greece. Elsewhere it breeds in eastern Europe, the southern USSR, North Africa and the Middle East. Britain holds up to 2% of the estimated 13,500 pairs that breed in Europe (Piersma 1986).

Winter:

Stone curlews from Europe winter in Iberia, North Africa and the southern edge of the Sahara.

Habitat

Nesting occurs on bare, or sparsely vegetated, stony or sandy ground. In Britain stone curlews are associated with free-draining sandy soils, mainly overlying chalk. Half the present population nests on downland or breck grassland that has been closely grazed by rabbits or livestock, while the remainder nest on tilled fields. They forage for their invertebrate prey mainly at night on tightly grazed semi-natural and improved grassland, in pig fields, manured arable fields and manure heaps. Feeding areas are usually within 2-3 km of the nest site (Green 1988).

Conservation needs

The British population is important in terms of retention of the traditional breeding range. Conversion of semi-natural chalk grassland to arable farmland has been a major cause of population decline. Also, the reduction in rabbit populations by myxomatosis and reduced grazing with livestock has made much of the remaining grassland too lightly grazed for stone curlews to use for feeding. Maintenance of the remaining

population will depend upon sympathetic habitat management and avoidance of damage to nests and chicks by farm machinery. Detailed information on these aspects has been obtained through recent research and protection work carried out by the RSPB and summarised by Green (1988). This species will benefit from a combination of SPA designation of core areas coupled with wider special protection elsewhere.

Proportion currently protected within the SPA network

In summer, a total of about 20 pairs of stone curlews breed within the proposed SPA network (14% of the British population). Additionally, numbers of other birds use SPAs for feeding, although nesting on nearby arable land.

A.6.2.27 Dotterel *Charadrius morinellus*

Based on material supplied by D.B.A. Thompson.

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population in 1987-89 was estimated to be about 860 pairs, with all but five of these in Scotland, mainly in the NE Highlands (Galbraith *et al.* in prep.a). This figure is substantially higher than past estimates, due mainly to improved survey coverage. Population trends in Scotland are unclear but there has been a marked decline in England and Wales since the mid-19th century when these areas may have held 50-75 pairs (Ratcliffe in Nethersole-Thompson 1973).

Within the EEC dotterel also breed in Italy (5-10 pairs) and NE Spain (1-10 pairs) and used to breed in small numbers in France and the Netherlands. The main European strongholds are in Norway (20-40,000), Sweden (5-10,000) and Finland (800). Britain holds about 97% of the EEC and 2% of the European totals. Some of the British montane populations breed at a higher density than recorded anywhere else in the world (Galbraith *et al.* in prep.a).

Passage:

There is a passage movement of dotterel through Britain (on both pastureland and mountain summits) in late April to mid-May. Mounting evidence indicates that many of these birds move on to breed in the Norwegian mountains (Kålas *et al.* in prep.; Thompson *et al.* in prep.).

Winter:

Dotterel spend the winter in the Mediterranean area and south-west Asia.

Habitat

In Britain dotterels breed in the montane (arctic-alpine) zone with concentrations particularly on the high plateaux over 900 m (Thom 1986), where they are associated with short grassland, and moss and lichen heaths. Watson (1989) found that spring densities were highest on schist mountains and on ground dominated by *Juncus trifidus* or *Carex bigelowii*, especially where there were ridges, terraces, hummocks or boulders.

Conservation needs

With such a large proportion of the EEC population breeding here, Britain has a special responsibility for their protection. The decline in numbers in England and Wales was probably due to habitat damage, notably to *Rhacomitrium* heaths, arising from sheep grazing combined with some local increases in disturbance from people (Thompson *et al.* 1987; Galbraith *et al.* in prep.b). These same factors are seen as the main current threat to the Scottish population. Densities of breeding birds are highest on the largest areas of montane plateaux and it is these same areas that are popular for existing and proposed skiing and recreational developments. Human disturbance associated with these developments, together with the predators/scavengers attracted by the presence of people, pose the main threat to the breeding dotterel (Thompson *et al.* 1987; Watson 1988; section A.5.10). The proposed SPA network, by protecting important breeding and staging areas, will play a vital part in providing a secure future for the Scottish dotterel population.

Proportion currently protected within the SPA network

A total of about 220 pairs of dotterels breed within the proposed SPA network (26% of the British breeding population). Greater numbers use sites within the network at other times, such as during migration and in the pre-breeding period.

A.6.2.28 Golden plover *Pluvialis apricaria*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (can be shot in period 1st September to 31 January); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The current British breeding population is estimated to be about 23,000 pairs, and is scattered in upland areas of Scotland, northern England, and Wales. Numbers are thought to be declining (Ratcliffe 1976), although this has not been fully quantified on a national level.

Within the EEC golden plovers also breed in Denmark (5-10 pairs), West Germany (25-30), Luxembourg (0-1) and Ireland (600). Elsewhere the range extends from Iceland, through Scandinavia and the northern USSR. Britain holds over 90% of the EEC population and 4% of the international population (Piersma 1986). The golden plover is currently regarded as a monotypic species (not split into races), although in the past it has been separated into a northern (Iceland, northern Scandinavia to central USSR) and a southern (Ireland to south Finland) race (Prater 1981).

Winter:

The British wintering population is about 200,000 birds, about 20% of the 1,000,000 birds that make up the East Atlantic Flyway population. Together with maritime France and Ireland, Britain is the major wintering ground for European golden plover. They are widely distributed in coastal and lowland areas of Britain.

Habitat

Breeding occurs on a range of upland blanket bogs, wet heaths, acidic grassland and other sub-montane habitats. Montane moss/lichen heaths, dwarf shrub heath and blanket bogs are also important. The species usually breeds between 240 – 600 m altitude, although down to sea level in the extreme north-west of Scotland. The geographical range in the breeding season reflects very closely the distribution of the major upland blocks throughout Britain, although the breeding density is low on uplands in SW England and S Wales. Breeding occurs at a range of densities. On suitable terrain there is frequently a relationship between breeding density and soil fertility – highest densities being recorded on Pennine limestone grassland: up to 16 pairs/km^2 (Ratcliffe 1976). On the extensive Caithness and Sutherland blanket bogs an average of 1 – 2 (range 1 – 5) pairs/km^2 (Stroud *et al.* 1987). Average density in the montane zone is 0.1 – 0.5 pairs/km^2. Although birds nest in a range of semi-natural or near-natural upland habitats, marginal or low intensity agricultural pastures are of importance for supplementary feeding during the summer (Ratcliffe 1976).

In winter some occur on estuaries, but the majority are found on agricultural land, particularly lowland permanent pasture (Fuller & Youngman 1979; Fuller & Lloyd 1981). Birds use traditional wintering areas on a regular basis (Fuller & Youngman 1979), with feeding occurring mainly on permanent pasture, probably because of greater near-surface earthworm densities (Barnard & Thompson 1985). Roosting occurs on ploughed fields and winter cereals (Fuller & Lloyd 1981). There appears to be some geographical differences in areas and habitats used in winter: East Anglia has relatively few wintering birds, whereas north-west and south England have high concentrations. Birds spend periods of milder weather on winter cereal fields, but of colder weather on pasture. In very harsh conditions they move south and east, often out of Britain (Barnard & Thompson 1985; Lack 1986).

Conservation needs

Britain holds the majority of the EEC breeding population and of the biogeographical wintering population, and thus has a special responsibility for the conservation of golden plovers.

Breeding birds are threatened by habitat changes in the uplands, particularly afforestation and agricultural intensification. They will, therefore, benefit from SPA designation of important upland blocks and from wider countryside measures. There have been major losses of upland breeding habitat due to coniferous afforestation of previously open moors, heaths and blanket bogs. On the blanket bogs of Caithness and Sutherland, an area originally holding at least 18% of the British population, afforestation has resulted in a 19% loss, substantially in the last decade. There have been further losses in Wales, the North York Moors, Cheviots, Southern Uplands and the Eastern Highlands, probably amounting to at least 2,000 pairs (Stroud *et al.* 1987). Grouse moor management provides ideal breeding habitat (Reed 1985) and loss of grouse moors to afforestation is clearly of particular concern, not only for this species. Current afforestation is likely to have greater deleterious effects on the population because of increased predation and competition (see Thompson *et al.* 1988). Studies in Sweden have shown that particular priority needs to be given to the protection of areas with high densities of golden plovers (Alexandersson 1987).

Agricultural changes in the lowlands could have an impact on the wintering population.

Proportion currently protected within the proposed SPA network

A total of about 5,300 pairs of golden plovers (23% of the British total) breed on sites in the proposed SPA network. However, boundaries of a number of moorland pSPA are still to be determined following recent ornithological survey, and it is expected that this will substantially increase the proportion of the breeding population protected by SPAs. It is of significance that, outside the Flow Country, the remaining 1,320 pairs are distributed among 25 sites. This is not surprising in the light of the generally low densities at which the species occurs and indicates the need for a network of sites to support a significant proportion of the population and to maintain its geographic range in the British uplands. Breeding populations are directly affected by agricultural regimes in upland areas. Thus, the conservation of British breeding populations of golden plovers will depend on the adoption of sympathetic agricultural policies that encourage the maintenance of traditional or low-intensity farming methods in upland areas where golden plovers are abundant.

A number of west coast sites are of importance for migrating golden plovers, and the Tiree and Coll pSPA is particularly significant.

A total of *c.*24,200 golden plovers winter on the proposed SPA network (2% of the international flyway population; 12% of British wintering numbers). Two sites of special importance are Bodmin Moor pSPA and Humber Estuary pSPA.

A.6.2.29 Ruff *Philomachus pugnax*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The ruff is currently a very rare breeding bird in Britain, although formerly more widespread. More sites have leks (communal display areas: section 2.4.2) than are known to have breeding females. Since 1963 estimates of the numbers of females suspected of breeding have fluctuated between 0 and 32, but the number of confirmed breeding attempts has usually been less than 10. Breeding is currently restricted to a small number of sites in south-east and northern England, and breeding was proved at one site in northern Scotland in 1980.

Formerly widespread in England, the ruff ceased regular breeding in the 19th century as a result of drainage of marshland and, finally, egg collecting and shooting. Regular breeding began again at the Ouse Washes in the 1950s or 1960s (Cottier & Lea 1969).

Ruffs have a very complex mating system, with copulation occurring on some southerly lekking areas (section 2.4.2) whilst birds are still on migration (van Rhijn 1983). If these areas become less attractive, this will have adverse consequences not only for birds nesting at that site, but also for birds nesting elsewhere but using the site for pairing and copulation.

Within the EEC ruffs also breed in the Netherlands (800-1,100 pairs), Denmark (652), West Germany (500), Luxembourg (0-2) and France (5-13). The western European strongholds are in Norway, Sweden and Finland, and the breeding range extends eastwards through eastern Europe and the northern USSR. The estimated European breeding population is 247,000 pairs (Piersma 1986). During the last few decades, ruffs have almost disappeared from the countries around the North Sea, largely due to agricultural intensification of their lowland grassland breeding habitats (Beintema 1983).

Winter:

The British wintering population is estimated to be about 1,500 birds out of an East Atlantic flyway total of about 1,000,000 birds.

Habitat

Ruffs breed in Britain on inland wet grasslands, coastal grazing marshes and high saltmarshes. Suitable areas have shallow pools and ditches with standing water. Available information indicates that the species is unusually sensitive to small changes in the state of the habitat, a vulnerability intensified by a very complex mating system, which requires adjacent nest sites, lekking and feeding areas (Cramp 1985). After hatching, young are led to areas of shallow water, hayfields and other areas suitable for chick feeding. They winter on estuaries and at inland wetlands.

Conservation needs

The British breeding and wintering populations are small in an international context, but are important in terms of maintenance of traditional ranges. Lowland wet grasslands are important traditional habitats for ruffs, and the species has been affected by the massive loss of these wetland areas to drainage, agricultural intensification and conversion to arable in recent decades (Smith 1983; Green & Cadbury 1987; Williams & Bowers 1987; see section A.5.6). Retention of breeding birds depends upon the protection and sympathetic management (particularly water level control) of the currently used sites. An important part of conservation management is the

continuation of traditional mowing or grazing regimes – features important in determining the attractiveness of sites to ruffs.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages, which would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A maximum of 10 pairs of ruff breed at two sites within the proposed SPA network. This accounts for most of the regularly breeding pairs in Britain. However, the situation is variable, and in recent years breeding success at the major site (Ouse Washes pSPA) has been low owing to spring flooding (Green *et al.* 1987).

A total of c.340 ruff winter at sites within the proposed SPA network (23% British wintering total). The majority of wintering birds occur at two sites, although other sites are important to maintain range. Some sites, such as the Ouse Washes and the Humber Estuary, also hold important numbers of migrating birds in spring and autumn.

A.6.2.30 Wood sandpiper *Tringa glareola*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

This is a very rare breeding species in Britain with less than 12 pairs recorded in recent years. Breeding is confined to a small number of sites in northern Scotland. Regular breeding has occurred in this area since 1959, but in no year have more than six pairs been proved to breed.

The only other EEC countries where breeding is known to occur are West Germany (5 pairs) and Denmark (100 pairs). The main breeding range extends through Scandinavia and the northern USSR. The British population is important in an EEC context (Piersma 1986).

Winter and passage:

Wood sandpipers do not overwinter in Britain but are regular passage migrants at many freshwater sites, particularly in autumn when en route to their African winter quarters.

Habitat

In Scotland wood sandpipers breed in freshwater marshes and bogs, and in boggy clearings in forests and scrub woodland.

Conservation needs

Existing sites should be protected from damaging developments and from human disturbance by inclusion within the proposed SPA network. As with many rare birds, egg collecting is a problem and site confidentiality is, therefore, important.

Proportion currently protected within the SPA network

The wood sandpiper is an extremely rare breeding bird in Britain and about half the current British breeding population (which varies between years) is protected within the proposed SPA in the Flow Country.

A.6.2.31 Red-necked phalarope *Phalaropus lobatus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British population in 1988 was about 19 'pairs'. Sexual roles are reversed in this species with the male taking responsibility for incubating the eggs and rearing the young. Breeding is confined to a small number of sites in Shetland (where the current stronghold is on Fetlar) and in the Hebrides. Red-necked phalaropes were formerly more numerous and widespread, but declined in the 19th century. There was some local recovery in the early 20th century, but a further period of decline from the 1930s (Everett 1971) is still continuing.

Britain is the only EEC country where the species is currently known to breed. They used to occur in western Ireland but are now thought to be extinct there. Elsewhere the breeding range is circumpolar in tundra and sub-arctic climatic zones and includes Greenland (Salomonsen 1950), Iceland, Scandinavia and the northern USSR. The

total west and central European population is estimated to be 150,000 'pairs'.

Winter and passage:

Red-necked phalaropes winter in tropical oceanic waters, but occur at many sites, particularly on the east coast of Britain, as a passage migrant.

Habitat

Breeding currently occurs in Scotland at sites with a mosaic of open water, emergent swamp, and wet and dry mire. Each of these components appears to be important to the breeding ecology of the species. Active habitat management on Fetlar (creating further open water areas) seems to have improved conditions there on sites which had become overgrown by aquatic emergent vegetation in recent years.

Conservation needs

The British population is important within the EEC and also, on a wider scale, in terms of range retention. Collecting of eggs and adult birds is thought to have played a part in the 19th century decline, but is of less importance at present as most breeding sites are now wardened. The main requirement is the maintenance of suitable wetland conditions at the remaining sites and encouragement of any attempts at breeding elsewhere. The species will benefit from inclusion of its main current sites within the proposed SPA network.

Proportion currently protected within the SPA network

Although the red-necked phalarope is an extremely rare breeding bird in Britain, the current breeding distribution of the species is adequately accommodated within the proposed SPA network.

A.6.2.32 Mediterranean gull *Larus melanocephalus*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

This is a very rare breeding species in Britain with less than four pairs nesting in recent years in southern England. Breeding was first recorded as recently as 1968, but did not become regular until 1976. Since then the number of pairs attempting to nest has varied with a maximum of four proven pairs in 1984.

The stronghold for Mediterranean gulls within EEC countries is Greece (where 4+ colonies together hold over 3,000 pairs), but they also breed in small numbers in the Netherlands, Belgium, France and Italy (population estimates not available). The majority of the world population occurs around the Black Sea in the southern USSR where 210,000-300,000 pairs are thought to nest.

Winter and passage:

Mediterranean gulls are scarce passage and winter visitors to Britain with in the order of 100 birds occurring in winter.

Habitat

Breeds in Britain within colonies of black-headed gulls on coastal marshes and islets in brackish lagoons. In Greece, the gulls nest in both saltmarsh and other coastal habitats where they select nest sites in areas of dense vegetation. They avoid open nest sites (Goutner 1987). Mediterranean gulls are coastal in winter.

Conservation needs

The Mediterranean gull has a relatively small world population and a restricted distribution. Any natural attempts by this species to breed in Britain should be encouraged. The main threats to breeding pairs are human disturbance and predation (see sections 2.4.4, 2.4.6 and A.5.3).

Proportion currently protected within the SPA network

The Mediterranean gull is an extremely rare breeding bird in Britain and the current breeding distribution of the species is adequately accommodated within the proposed SPA network in England and Scotland. Very few birds winter in Britain; those that do will not be protected by the proposed SPA network.

A.6.2.33 Sandwich tern *Sterna sandvicensis*

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British breeding population of Sandwich terns in 1985-87 was about 15,000 pairs. During the 1980s, 49 sites are known to have supported at least one breeding pair in at least one year, but over 65% of the population occurs at six main colonies – Sands of Forvie, Coquet Island, Farne

Islands, Blakeney Point, Scolt Head and Foulney (Thomas 1982b; Thomas *et al.* in press; Lloyd *et al.* in prep.). The British population is thought to have declined in the 19th century, but has increased in size during the 20th century from less than 2,000 pairs in 1920.

Within the EEC Sandwich terns also breed in Ireland (5,300 pairs), France (5,300), Spain (<50), Italy (<100), West Germany (7,000), Denmark (4,000) and the Netherlands (7,450). The total population in Europe (excluding the USSR) is currently estimated to be 44,500 pairs (Lloyd *et al.* in prep.). Britain holds about 35% of the EEC and 34% of the Western European populations.

Winter and passage:

Sandwich terns occur in substantial numbers at several coastal sites in Britain in the autumn before moving on to winter on the south and south-west coasts of Africa. A very small number remain in temperate waters.

Habitat

Breeding colonies are located on coastal sand or shingle beaches, and are usually associated with other tern species or gulls. Sandwich terns forage in inshore waters for small surface-dwelling marine fish.

Conservation needs

Britain holds internationally important breeding numbers of this scarce species and, therefore, has a special responsibility for its conservation. Sandwich terns, in common with other terns, will often desert a formerly regular breeding site and move to a new locality. Site designation for this species needs to anticipate this eventuality, but minimise it by preventing excessive human disturbance at established colonies. The fortunes of Sandwich terns are linked to the quality of the marine environment, and particularly to any fluctuations in the availability of sandeels and clupeids. Terns are particularly vulnerable to food shortage as they spend a very high proportion of available time foraging for their young and have a relatively small foraging range. Other threats include human disturbance, predation of eggs and chicks by gulls and ground predators, oil pollution, and trapping by man in its African winter quarters (see sections 2.4.4, 2.4.6 and A.5.3).

Proportion currently protected within the SPA network

A total of about 13,200 pairs of Sandwich terns nest on sites in the proposed SPA network. This amounts to about 88% of the British and 30% of the international breeding totals. No marine feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.34 Roseate tern *Sterna dougallii*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

This is a rare and declining breeding bird in Britain with about 300 pairs present in 1987. Breeding occurs at a small number of colonies (less than 13) located in southern Scotland, northeast England, Isles of Scilly and north Wales. Numbers in Britain are thought to have declined in the 19th century, then increased during the first half of the 20th century to a peak of perhaps 1,000 pairs, but to have declined again from the early 1960s to present (Cramp *et al.* 1974; Lloyd *et al.* 1975; Thomas 1982b; Thomas *et al.* in press; Lloyd *et al.* in prep.).

Within western Europe breeding is confined to Britain, Ireland and Brittany. Numbers have declined in each of these countries between the 1970s and 1987 from 320 to 300 pairs in Britain, 660 to 355 in Ireland and 120 to 90 in Brittany (Thomas 1982b; Lloyd *et al.* in prep.). Britain holds about 40% of the European population. The total world population is estimated to be only about 44,000 pairs, split between western Europe, the Azores, the eastern United States, and in a broad belt from the Indian Ocean to south-east Asia, Australia and some of the Pacific islands (Everett *et al.* 1987).

Winter:

Roseate terns from western Europe winter in coastal west Africa.

Habitat

Breeding usually occurs on offshore islands amongst colonies of common or arctic terns. Roseate terns forage in inshore waters for small surface-dwelling marine fish.

Conservation needs

Britain holds internationally important breeding numbers of this scarce and declining species and, therefore, has a special responsibility for its conservation. Roseate terns require strong protection at all existing breeding sites. A conservation strategy for this species also needs to anticipate movements to new localities. The fortunes of roseate terns are linked to the quality of the marine environment, and particularly to any fluctuations in the availability of sandeels and clupeids. Terns are particularly vulnerable to food shortage as they spend a very high proportion of available time foraging for their young and have a relatively small foraging range. Particular threats

that have been identified include human disturbance, predation of adults by foxes and peregrines, and trapping by man in the birds' African winter quarters (see sections 2.4.4, 2.4.6 and A.5.3).

The RSPB are currently carrying out a research programme designed to assess in more detail the problems and conservation requirements of roseate terns in western Europe, the Azores and West Africa.

Proportion currently protected within the SPA network

A total of about 290 pairs of roseate terns nest on a total of 7 sites in the proposed SPA network. This amounts to about 97% of the national and 40% of the international breeding totals. No marine feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.35 Common tern *Sterna hirundo*

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British breeding population in 1985-87 was estimated to be about 12,700 pairs (Lloyd *et al.* in prep.), with small colonies widely scattered along the coast and inland in Scotland, northern England, south-eastern England and north Wales. About 10% of the total breed in Shetland and Orkney (Bullock & Gomersall 1981). Trends of total population change are not well known due mainly to the widespread distribution of colonies.

Common terns breed widely throughout most of Europe, Asia and North America between 30° and 65°N. Within the EEC they breed in Ireland (3,000 pairs), France (3,000-3,500), Denmark (600-900), West Germany (6,000), Netherlands (10,000+), Belgium (200), Spain (11,500), Italy (2,800) and Greece (1,100). Britain holds about 24% of the EEC and 14% of the western and central European populations.

Winter:

Common terns winter in southern Europe and west Africa.

Habitat

Nests in colonies principally near the coast on islands, sand or shingle banks, sand dunes and saltmarshes, but also inland on islands in lakes and shingle banks in rivers. Forages over shallow waters for small surface-dwelling fish.

Conservation needs

Britain holds internationally important numbers of breeding birds and, therefore, has a special responsibility for their protection. The fortunes of common terns are linked to the quality of the marine environment, and particularly to any fluctuations in the availability of sandeels and clupeids. Terns are particularly vulnerable to food shortage as they spend a very high proportion of available time foraging for their young and have a relatively small foraging range. In common with other terns, common terns will often desert a formerly regular breeding site and move to a new locality. Site designation for this species needs to anticipate this eventuality. Other threats include human disturbance, predation of eggs and chicks by gulls and ground predators, oil pollution, and trapping by man in its African winter quarters (see sections 2.4.4, 2.4.6 and A.5.3).

Proportion currently protected within the SPA network

A total of about 4,900 pairs of common terns nest on sites in the proposed SPA network. This amounts to 41% of the national, and 5% of the international breeding totals. No marine feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.36 Arctic tern *Sterna paradisaea*

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British breeding population in 1985-87 was estimated to be about 83,000 pairs. The majority of these (about 87%) are found in Orkney and Shetland (Bullock & Gomersall 1981; Thomas 1982b; Lloyd *et al.* in prep.). The remainder are widely scattered in coastal localities in mainland Scotland, the Western Isles, northern and south-eastern England, and north Wales. This species has declined from a peak in the early 1980s, largely as a consequence of a recent dramatic fall in numbers breeding on Orkney and Shetland.

Arctic terns have a circumpolar breeding distribution through Greenland, Iceland, northern Europe, the northern USSR and North America. Within the EEC they breed in Ireland (2,700 pairs),

Denmark (6-8,000), West Germany (2,500), Netherlands (1,500) and Belgium (179970s (Thomas 1982b). Britain holds about 86% of the EEC and 31% of the European populations.

Winter:

Arctic terns are believed to spend the northern winter in Antarctic waters and undertake one of the longest known bird migrations.

Habitat

Nesting colonies are usually located near the sea on low rocky skerries, islands, shingle, sand or open ground. However, they also occur inland, particularly in northern Scotland, where heaths, rough pasture, sedge grassland and islets in lochs are used. Forages in inshore waters for small surface-dwelling marine fish.

Conservation needs

Britain holds internationally important numbers of breeding pairs and, therefore, has a special responsibility for their protection. The fortunes of arctic terns are closely linked to the quality of the wider marine environment, and particularly to any fluctuations in the availability of small fish, particularly sandeels and clupeids. Terns are particularly vulnerable to food shortage as they spend a very high proportion of available time foraging for their young and have a relatively small foraging range. Concern has arisen over just this matter in Shetland where the breeding success of arctic terns has been very poor in each year 1984-88 owing to starvation of chicks. This has been due to a shortage of sandeels, possibly the result of local over-exploitation by fishing boats (Heubeck 1989; Monaghan *et al.* 1989). Research commissioned jointly by the NCC and RSPB is being carried out by Glasgow University to examine the causes of these breeding failures. Future research, funded by NERC and a consortium of agencies including NCC, will be examining the overall problem around Shetland in greater detail. Arctic terns, in common with other terns, will often desert a formerly regular breeding site and move to a new locality. Site designation for this species needs to anticipate this eventuality. Other direct threats include human disturbance, predation of eggs and chicks by gulls and ground predators, and oil pollution (see sections 2.4.4, 2.4.6 and A.5.3).

Proportion currently protected within the SPA network

A total of about 21,850 pairs of arctic terns nest on a total of 39 sites in the proposed SPA network. This amounts to 26% of the national and 8% of the international breeding totals. No marine feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.37 Little tern *Sterna albifrons*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British breeding population is estimated to be about 2,350 pairs (Lloyd *et al.* in prep.) with colonies widely scattered around the coastlines of Scotland, northern England, northern Wales, and eastern and southern England. Numbers had declined earlier in the 20th century, but have increased under protection in recent years; e.g. Thomas (1982b) noted a 15% increase during the 1970s.

Little terns have a widespread world breeding distribution extending through Europe, the Mediterranean, West Africa, Asia, Australia and North America. Within the EEC they breed in Ireland (540 pairs), France (700-900), Denmark (400), West Germany (500), Netherlands (700), Spain and Portugal (3,200), Italy (3,200) and Greece (400). The western European population is thought to be about 12,600 pairs (Thomas 1982b; Lloyd *et al.* in prep.). Britain holds about 20% of the EEC and 19% of the European populations.

Winter:

Little terns spend the winter in West Africa.

Habitat

Breeding occurs in small, single-species colonies on coastal sand or shingle substrates. Forages in inshore waters for small surface-dwelling marine fish and invertebrates.

Conservation needs

Britain holds internationally important numbers of breeding birds and, therefore, has a special responsibility for their protection. The fortunes of little terns are probably closely linked to the quality of the marine environment, and particularly to any fluctuations in the availability of small fish and invertebrates. Little terns are particularly vulnerable to food shortage as they spend a very high proportion of available time foraging for their young and have a relatively small foraging range. As many little terns nest on the upper levels of sandy beaches, they are especially vulnerable to human disturbance arising from recreational use of beaches. Such disturbance often facilitates predation by gulls and ground predators. Wardening and other protection schemes are necessary to safeguard breeding little terns at sites where this is a problem (see sections 2.4.4, 2.4.6 and A.5.3).

Proportion currently protected within the SPA network

A total of about 1,115 pairs of little terns nest within the proposed SPA network. This amounts to 47% of the national and 9% of the international breeding totals. Because of the dispersed nesting habits of this species, only one site holds more than 1% of the international breeding population. However, the significant proportion of this species protected within a network of 28 sites demonstrates the advantages of a co-ordinated approach to conservation for species such as little terns. No marine feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.2.38 Black tern *Chlidonias niger*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Black terns breed only occasionally in Britain, with nesting recorded (usually by single pairs) in 1853, 1858, 1966, 1969 (up to 7 pairs), 1970, 1975 and 1978. These attempts have usually been in south-east England. The species formerly nested regularly in south-east and east England north to Yorkshire, particularly in East Anglia, but became extinct before the mid-19th century as a result of extensive draining.

Black terns breed locally over much of continental Europe and central and southern USSR. Within the EEC they breed in France (10,000 pairs), Belgium (20), Netherlands (2-3,000), and also in Denmark and Spain. Numbers are thought to be declining in most localities.

Passage:

Britain's current importance is as a staging post for passage birds.

Winter:

Black terns winter in tropical Africa.

Habitat

Breeding occurs at fresh or brackish pools that are rich in low marginal, floating or emergent aquatic vegetation. Migrating birds occur at wetland sites both on the coast and inland, particularly in eastern Britain.

Conservation needs

If further breeding attempts occur they should be encouraged, through active protection and habitat management, as they would represent a re-establishment of part of the traditional breeding range. Sympathetic management should be maintained at regularly-used passage sites.

Proportion currently protected within the SPA network

Previously, breeding occurred on the Ouse Washes (Cottier & Lea 1969) which is a proposed SPA and largely under direct conservation management.

A.6.2.39 Snowy owl *Nyctea scandiaca*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Snowy owls do not currently breed in Britain, but a single male bred with one or two females on Fetlar in Shetland in each year between 1967 and 1975. Since the loss of the male in the winter of 1975/76, up to four unmated females have remained in Shetland (Robinson & Becker 1986). Elsewhere, since the mid-1960s, single birds and occasional pairs have occurred at various seasons, including the summer, in the central and north-eastern Highlands and the Western Isles. However, none are thought to have bred. Two single females laid infertile eggs in 1982 and one did so in 1983.

The breeding range is holarctic and extends through north Scandinavia, northern Soviet Union, North America, northern Greenland and, rarely, Iceland.

Winter:

Snowy owls are occasional and irregular rare winter visitors, mainly to Scotland.

Habitat

The species normally breeds on open arctic tundra beyond the treeline. On Fetlar breeding occurred on grass/heather moorland with rocky outcrops and boulder-strewn slopes 150 m above sea level.

Conservation needs

The occurrence of snowy owls in Britain is dependent upon climatic trends as well as on the breeding success and irruptive movements of birds from the normal breeding range. There is no

firm evidence that snowy owls were ever regular breeders in Britain. For this reason suggestions that a male should be introduced to Shetland to stimulate further breeding have been rejected and the natural course of events should be allowed to ensue. This is in line with NCC/IUCN policies on reintroductions. If future breeding occurs it will be necessary to take further action to minimise human disturbance and to protect the site from egg collectors.

Proportion currently protected within the SPA network

Breeding took place within the Fetlar pSPA and individual birds currently use other sites within the proposed SPA network.

A.6.2.40 Short-eared owl *Asio flammeus*

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The numbers of this species breeding in Britain are poorly known and the best available estimate is over 1,000 pairs (Sharrock 1976). They are widely but thinly distributed in Scotland, Wales, and northern and eastern England. Trends of population change are difficult to discern due to periodic fluctuations caused by cycles in vole numbers (Village 1987). However, the general trend in recent years is thought to be upwards.

Short-eared owls have a circumpolar breeding range extending though Europe, the Soviet Union, North America, Iceland, and also in South America. Within the EEC breeding occurs in France (10-100 pairs), Netherlands (130-185), West Germany (300-350) and Denmark (5-30), but the species is absent, or irregular, in Ireland, Luxembourg, Belgium, Spain, Portugal, Italy and Greece. The European strongholds are in Sweden and Finland. Britain probably holds over 60% of the EEC population.

Winter:

In winter short-eared owls are generally distributed over most parts of lowland Britain. Numbers are supplemented by continental immigrants and are thought to be in the range 4,000-40,000. Information on the sizes of wintering populations in other EEC and European countries are not available.

Habitat

In the breeding season short-eared owls inhabit moorland, heaths, marshes, bogs, sand dunes and young forestry plantations. They are displaced from forestry plantations as the trees grow and such areas provide only a temporary nesting habitat in contrast to other areas. In winter short-eared owls usually vacate the moors in favour of rough hill grazings, freshwater marshes, arable farmland, lowland heaths, downland, coastal grazings and saltmarshes (Glue 1977). They feed mainly on small mammals and birds, and territory sizes in young plantations in southern Scotland varied between 42-112 ha (Village 1987).

Conservation needs

The British population is of international importance both in terms of its size and for maintenance of part of the traditional breeding range. Short-eared owls in Britain are thought to have benefitted temporarily from the widespread planting of new conifer forests in recent years. In their early stages these plantations provide suitable nesting and feeding habitat, but cease to be used once the canopy closes. The longer-term well-being of the short-eared owl population will depend to a large extent upon maintenance of extensive areas of unafforested moorland and rough grassland habitats. As these areas are threatened by coniferous afforestation the species will benefit from the protection afforded by the proposed SPA network, particularly if coupled with wider countryside measures.

Proportion currently protected within the SPA network

A total of c.140 pairs of short-eared owls nest within the proposed SPA network (14% of the British total). Survey information for this species is generally poor, and the proportion occurring in sites is difficult to determine. In part this is due to great variability in overall population sizes between years as a result of variability in food supply for nesting owls.

In winter, short-eared owls leave breeding areas, and a significant, although nationally uncollated total occurs on coastal sites within the proposed SPA network.

A.6.2.41 Nightjar *Caprimulgus europaeus*

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The British breeding population in 1981 was about 2,000 pairs, scattered widely through England, Wales, and southern Scotland. The largest numbers (>50 singing males) occurred in Sussex, Hampshire, Surrey, Dorset, Devon, Norfolk, Suffolk,

Nottinghamshire and Yorkshire (Gribble 1983). A reduction in numbers and range is believed to have occurred since the turn of the century.

The world breeding range extends from North Africa, through Europe, the central and southern Soviet Union, to China and Mongolia. Nightjars breed in all EEC Member States, although population levels are poorly known in most. Cramp (1985) gives the population in France as 1,000-10,000 pairs, Belgium as 750, Luxembourg 35, Netherlands 500-600, and West Germany 5,000. Numbers are believed to be declining in all these countries. The relative proportions of the EEC and European populations occurring in Britain cannot be precisely assessed in the current poor state of knowledge.

Winter:

Nightjars spend the winter in Africa.

Habitat

In Britain nightjars prefer areas with sparce woodland and/or scrub. These include open ground created by clear-felling, coppicing, grazing or burning, but usually in clear association with open woodland. Early phases of regeneration by birch and Scots pine tend to be especially favoured. The 1981 survey found that conifer plantations, either in their early stages or during the restocking period after felling, were the single most frequently used habitat type, followed by lowland heath, open bracken areas, other woodlands and raised bogs or mosses (Gribble 1983). In southern England and East Anglia the main strongholds are in areas of acidic heathland on sandy or gravelly soils.

Conservation needs

Britain is thought to hold a significant proportion of the nightjars in the EEC, and is also of importance in terms of maintenance of the traditional breeding range of this declining species. Climatic changes and the loss and fragmentation of habitat are considered to be the main reasons for the continuing population declines. Losses of heathland to agriculture, forestry and urban developments have been particularly severe in recent years. There was a 40% overall loss of heathland in southern England between 1950 and 1984, and 85-90% of the heathland in Dorset, Surrey and the Suffolk Sandlings has been lost in the last 20 or so years (NCC 1984; Cadbury 1989b). Sympathetic habitat management is required in order to maintain numbers at protected sites.

Proportion currently protected within the SPA network

The proposed SPA network holds a maximum of 600 pairs of breeding nightjars (30% of the British population).

A.6.2.42 Kingfisher *Alcedo atthis*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

A census of the British breeding population of kingfishers has never been specifically undertaken, but the population is estimated to be between 3,000-7,000 pairs. They are widely distributed at low density throughout England, Wales and southern Scotland. Numbers fluctuate markedly in the short term as a consequence of the species' vulnerability to hard winters. However, the underlying population trend since the mid-1970s has been downwards (Marchant *et al.* in press).

The breeding range extends through North Africa, Europe, the Soviet Union and south-east Asia. It breeds in all EEC Member States, but numbers involved are poorly known in most cases. Cramp (1985) give the population in France as 1,000-10,000 pairs, in Belgium as about 450, Luxembourg 140, Netherlands 90-140, and West Germany 1,200. The relative importance of Britain within the EEC and Europe cannot reasonably be assessed in the current poor state of knowledge.

Winter:

Kingfishers are resident in Britain and the winter population is estimated to be in the order of 6-10,000 birds. Information on the sizes of wintering populations in other EEC and European countries is not readily available.

Habitat

Kingfishers occur only in the vicinity of water, usually slow-flowing rivers, canals, lakes, ponds and flooded gravel pits. The nest is usually located at the end of a tunnel in an exposed bank bordering the water. The diet is principally small freshwater fish caught by plunge-diving.

Conservation needs

Britain is thought to hold a moderate proportion of the kingfishers in the EEC, and is also of importance in terms of maintenance of the traditional breeding range. The well-being of kingfishers is dependent upon the quality of the freshwater environment. They are threatened by the influence of water pollution (including acidification) on prey species, by hard winter weather, particularly a succession of bad winters, by unsympathetic waterway management, and, being at the top of a food chain, are vulnerable to build-up of toxic chemicals (Mead 1968).

Proportion currently protected within the SPA network

This species breeds and winters at low densities on several sites within the proposed SPA network. The proportion of the population breeding on SPAs has not been quantified, but is known to be low. During summer, the protection of this species will depend on the adoption of sympathetic policies by river authorities, as well as maintenance of high levels of water quality.

In winter, kingfishers leave breeding areas, and a significant, although nationally uncollated total occur on coastal sites within the proposed SPA network.

A.6.2.43 Woodlark *Lullula arborea*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention.

Population and distribution

Breeding:

The British breeding population in 1983 was estimated to be 210-230 pairs, concentrated in five areas of southern England (Sitters 1986). Woodlarks were considered to have been widespread and numerous in England and Wales in the 19th century, but to have declined from about 1850. There was some recovery between the 1920s and the 1950s, followed by another decline. Considerable fluctuations were noted in the 1960s, 1970s and early 1980s. The breeding range has contracted substantially since 1968-72 when birds were breeding much more widely in southern England and also in several parts of Wales (Sitters 1986).

The world breeding range extends from North Africa, through southern Europe to the southern Soviet Union. It includes all EEC Member States with the current exception of Ireland. Declines have been noted in most countries. Cramp (1988) gives population estimates of 10,000-100,000 pairs in France, 400 in Belgium, and 800-900 in the Netherlands. The relative importance of Britain within the EEC and Europe cannot reasonably be assessed in the current state of knowledge of population sizes.

Winter:

In Britain, some birds winter near the breeding areas, especially in Hampshire and Surrey, but it is likely that part of the population winters on the continent (Sitters 1986). The wintering total is estimated to be about 150-200 birds.

Habitat

Woodlarks breed in open country with scattered trees and bushes. They prefer areas with bare ground or very short grass intermingled with areas of long grass, bracken or heather. In Britain the main nesting habitats are lowland heaths, recently felled and restocked forestry plantations, rabbit-grazed grass heaths, derelict pasture, and places where scrub has been cleared by fire. During the winter they spend much of the time in fields, sometimes in association with skylarks.

Conservation needs

The British population is internationally important in terms of maintenance of the traditional breeding range. Short-term fluctuations in numbers are linked to hard winters, while the longer-term trend of decline is perhaps partly due to climatic changes, but more importantly to changes in the availability of suitable habitat (Sitters 1986). Afforestation and conversion of heaths to intensive agriculture and the growth of grass and scrub on remaining heaths (after the decline of rabbits due to myxomatosis) are probably the main causes of the recent decline. Because of reductions in other traditional habitats, a substantial part of the current population nests in restocked conifer plantations, but they are excluded from these 3-7 years after planting by the growth of long grass or bracken. The age structure of forests where woodlarks occur indicates that there will be a shortage of plantations of suitable age in the 1990s and 2000s (Sitters 1986). Protected sites require continuing sympathetic management through grazing or burning in order to maintain their suitability for woodlarks.

Proportion currently protected within the SPA network

The proposed SPA network holds a maximum of 76 nesting pairs of woodlarks (35% of the British breeding total). An estimated 40 birds remain in winter (23% of winter total), although information on wintering numbers is less readily available.

A.6.2.44 Wren (Fair Isle race) *Troglodytes troglodytes fridariensis*

Based on material supplied by S. & R. Aspinall.

Conservation status

Annex 1 of EEC Bird Directive; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The Fair Isle sub-species of wren is endemic to Fair Isle, Shetland. Between 1950 and 1987 the

population varied between a minimum of 10 and maximum of 52 territory- holding males. Numbers were largest during the late 1950s and mid 1960s, the maximum being recorded in 1964 and 1965 (Dennis 1966). The lowest population size was recorded in 1981, since when numbers have gradually increased, and in the spring of 1987 there was a maximum of 33 males (Aspinall 1988).

Winter:

The wren is resident on Fair Isle throughout the year and the winter population is about 80 birds.

Habitat

Birds are associated almost exclusively with coastal sites. The subspecies is more common on sheltered than exposed parts of the coast (Williamson 1951) and is less common along the south and west coasts during the nesting season (Dennis 1966). The preferred habitat is afforded by cliffs and geos where there are beaches on which decaying seaweed accumulates, and in which the wrens can feed, possibly on small marine organisms and flies (Williamson 1958). The most regularly used breeding sites also have a supply of fresh water and abundant cliff vegetation. The wren rarely leaves the coast apart from when young disperse in July and August or when forced from beaches and geos onto cliff-top areas by severe winter gales (Stout 1952).

Conservation needs

This biogeographical population is very small and occurs only on Fair Isle. Britain, therefore, has a unique responsibility for its protection. Numbers are positively correlated with the mean temperature in January and winter dryness, suggesting that cold weather and wet conditions limit population size. The number of young produced is positively correlated with population size and mean temperature during July (Aspinall & Aspinall 1987). All known breeding sites fall within the area currently designated as an SSSI and within the boundary of the pSPA. Potential threats to the population would arise from the collection, destruction or removal of seaweed and from the pollution of beaches by oil or other substances. Occasional individuals of the nominate race *T. t. troglodytes* and the Shetland wren *T. t. zetlandicus* are recorded on the island although the impact (in both the competitive and genetic senses) of this immigration on the endemic population is unknown.

Proportion currently protected within the SPA network

The entire population of sedentary Fair Isle wren is located within the Fair Isle pSPA.

A.6.2.45. Dartford warbler *Sylvia undata*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Between 450-550 pairs regularly breed in Britain, but numbers fluctuate considerably as a consequence of mortality in hard winters. A national census in 1984 (Robins & Bibby 1985) located a total of 423 territories, compared with 565 in a previous census in 1974 (Bibby & Tubbs 1975) and 450+ in 1961 (Tubbs 1963). Breeding is confined to southern England with 203 territories located in the New Forest in 1984, 16 in the rest of Hampshire, 127 in Dorset, 69 in Surrey, 2 in Devon and 6 in Cornwall (Robins & Bibby 1985). Dartford warblers were formerly much more widely distributed in southern England and the total population is thought to have been much larger (Bibby & Tubbs 1975).

Elsewhere breeding occurs in Iberia, west and south France, southern Italy, Sicily, Corsica and Sardinia. Information on population sizes in these countries is not readily available, so the relative importance of the British population cannot be assessed.

Winter:

Dartford warblers are largely sedentary but there is some partial migration from Britain in winter (Bibby 1979). The overwintering population is estimated to be between 800-1,500 birds.

Habitat

Throughout the year Dartford warblers are found on dry lowland heaths dominated by heather and with a generous scattering of gorse. In 1974 some territories in the New Forest were in young forestry plantations but there was none in this habitat in 1984 (Bibby & Tubbs 1975; Robins & Bibby 1985). The diet of beetles, spiders, lepidopteran larvae and bugs is mainly gathered from the gorse element of the heathland habitat (Bibby 1979a).

Conservation needs

Dartford warblers are at the extreme northern limit of their range in Britain and their protection is important internationally in terms of maintenance of the traditional area of distribution. The British population is small, occurs in a threatened and fragmented habitat and is highly vulnerable to cold winters. For these reasons there is a real risk of extinction unless vigorous conservation action is taken in remaining strongholds.

The long-term trend of decline is thought to be mainly associated with the fragmentation and loss of lowland heaths, while short-term fluctuations are largely weather-related. The former ultimate factor makes the population more liable to extinction by the latter proximate factor. Inclusion of the remaining Dartford warbler heathland sites within the proposed SPA network will improve the long-term prospects for this fragile population. Losses of heathland to agriculture, forestry and urban developments have been particularly severe in recent years. There was a 40% overall loss of heathland in southern England between 1950 and 1984, and 85-90% of the heathland in Dorset, Surrey and the Suffolk Sandlings have been lost in the last 20 or so years (NCC 1984; Cadbury 1989b). Numbers fall dramatically after cold winters, with 80-90% population declines following those of 1961/62 and 1962/63. Uncontrolled fire is a problem, periodically destroying suitable habitat for several years. More seriously, fire may promote the spread of birches or bracken which, once established, are hard to eradicate. Other threats that have been identified include human disturbance (recreation and military activities), egg collecting, overgrazing and thicket encroachment. Sympathetic habitat management is required in order to maintain numbers at protected sites (Bibby 1978).

Proportion currently protected within the SPA network

The proposed SPA network holds about 60 nesting pairs of Dartford warblers (12% of the British breeding total). An estimated 340 birds remain in Britain in winter, although information on wintering numbers is less readily available.

A.6.2.46 Red-backed shrike *Lanius collurio*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

The red-backed shrike is now extinct as a breeding species in Britain. There were only one or two pairs present in East Anglia in 1987 and 1988, and none in 1989. It was formerly a widespread breeder over much of England and Wales, but has been decreasing continuously since the mid-19th century. The 1952 population of about 300 pairs had declined to 253 pairs by 1960 (Peakall 1962), 80-90 pairs by 1971 (Bibby 1973) and 4 pairs by 1986. A few pairs bred in Scotland during 1977-79 but breeding has not been recorded there since 1980.

Elsewhere it breeds throughout most of Europe except Ireland, northern Scandinavia, the northern Soviet Union, and southern Iberia. Information on population sizes is not available to this review so the relative importance of the British population cannot be assessed.

Winter:

Red-backed shrikes winter mainly in tropical and southern Africa east to the Persian Gulf and north-west India.

Habitat

In Britain red-backed shrikes formerly nested on commons, waste ground, in overgrown hedgerows, young plantations and other scrub, but in recent years they have been restricted to lowland heaths. The principal prey are large flying insects such as grasshoppers, butterflies, moths, bees, dragonflies, damselflies and beetles.

Conservation needs

Britain was once important internationally for red-backed shrikes in terms of retention of the traditional area of distribution. However, the population now appears to have become extinct, possibly as a result of the effects of climatic change (warmer and wetter summers) on their food supply (Bibby 1973). Other factors that may have contributed to the decline include egg collecting, human disturbance, changes in land use and agricultural practices, and the general effects of pesticides on populations of insect prey. Active protection should be given to any sites where breeding is attempted in the future.

Proportion currently protected within the SPA network

This species is now extinct as a breeding bird in Britain and none nest within the proposed SPA network.

A.6.2.47 Chough *Pyrrhocorax pyrrhocorax*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix II of the Berne Convention.

Population and distribution

Breeding:

Choughs were formerly more abundant and widely distributed, extending to north, east and inland Scotland, and coastal cliffs of Cumbria, Yorkshire and Cornwall to Kent and the Channel Isles. There

was a marked decrease and contraction of range in the 18th and 19th centuries although breeding persisted in Devon until about 1910 and in Cornwall to 1952 when the chough became extinct as a breeding species in England (Rolfe 1966; Bullock *et al.* 1983; Bignal & Curtis 1989). A national survey in 1963 found 98 breeding pairs in Wales, 20 in the Isle of Man and 11 in Scotland (Rolfe 1966). These numbers are considered to have been low due to a combination of the impact of the severe winter of 1962/63 as well as poor coverage in some areas (especially Scotland).

The British breeding population in 1982 was 249-274 pairs, with 139-142 in western Wales, 49-60 on the Isle of Man, and 61-72 in the west of Scotland. In addition there was also a substantial number of non-breeding immatures in the population, estimated at 210-235 birds (Bullock *et al.* 1983). These non-breeding birds are an essential component of the population with different requirements from those of breeding adults (Bignal *et al.* 1989). A more recent survey of Scotland in 1986 found 105 pairs, restricted to the islands of Islay, Jura and Colonsay (Monaghan *et al.* 1989). The evidence now is that numbers in the remaining areas may be holding their own or continuing to recover from the earlier declines. Recently, young ringed on Islay have been seen on Tiree and Jura and have bred on Colonsay, indicating the importance of Islay for future development of the currently restricted population.

Within the EEC choughs also breed in Ireland, France, Spain, Portugal, Italy and Greece (see Bignal & Curtis 1989 for further information). Elsewhere the range extends from North Africa through the northern and eastern Mediterranean, southern Soviet Union, Mongolia and China. The breeding population in Ireland is between 567-682 pairs (Bullock *et al.* 1983), in Portugal a continuing decline to 755 birds (1988: Farinha & Teixeira 1989), and in NW France 28-37 pairs (1987/88: Thomas 1989). Information on population sizes in other areas is not readily available.

Winter:

Choughs are not migratory and the British wintering total is estimated to be 726-758 birds.

Habitat

Throughout Europe choughs are associated with pastoral landscapes where there are nesting opportunities in cliffs and artefacts and where a wide range of semi-natural vegetation occurs. They are invariably associated with base-rich soils or limestone. In Britain they are associated with permanent grassland, moorland grassland, marshes, rushy fields, and heather moorland stocked with cattle or sheep (Bullock *et al.* 1983; Warnes & Stroud 1989; Curtis *et al.* 1989; Bignal *et al.* 1989). Their diet consists mainly of invertebrates of soil and dung (Roberts 1989; Warnes & Stroud 1989). Nesting occurs in crevices and deeply sheltered ledges in sea cliffs, sea caves, quarries, mine shafts and ruined buildings. In some areas a significant proportion of the population nest in buildings and sympathetic restoration of these can be important for conservation (Bignal & Bignal 1988).

Conservation needs

Britain holds the most northerly population of choughs in the world and is important internationally in terms of maintenance of the traditional area of distribution. Various factors have been suggested as reasons for the earlier decline, but it seems likely that changes in climate and land-use (through their influence on food availability), coupled with human persecution, were the most important (Owen 1989). The future well-being of British choughs is largely dependent upon maintenance of suitable land use which provides feeding areas of semi-natural vegetation with relatively high (but sustainable) stocking levels particularly of cattle (Bignal *et al.* 1989). Particular threats that have been identified include human disturbance, egg collecting, illegal shooting, severe winter weather, and injection of livestock with anti-parasite drugs (which poison the dung-dwelling insects that are eaten by choughs – McCracken 1989).

Proportion currently protected within the SPA network

In Britain choughs are largely sedentary, with breeders remaining in the same areas all year. Whilst sub-adult birds are more mobile than breeding pairs, these do not have discrete summer and winter areas.

In summer, a total of 125 pairs of chough nest within the proposed network of SPAs (48% of the British breeding population). However, as explained above and by Bignal *et al.* (1989), the non-breeding component of the population is important for overall population survival and the expression of conservation importance of a site for chough on the basis of breeding pairs alone is misleading. Several sites (such as the Rhinns of Islay pSPA and Oa pSPA) are especially important for non-breeding flocks which also range more widely outside the SPAs on Islay. Wider countryside protection measures are particularly important for these birds.

In winter, the proposed SPA network holds an estimated 400 individuals (54% of the estimated British winter population). However, this may slightly over-estimate the total population protected since on Islay some individuals range widely, and thus individual site totals may be greater than the total number of birds using all sites. This is especially true of sites in close proximity such as the Rhinns pSPA, Laggan pSPA and Glac na Criche pSPA on Islay, where there is known to be interchange of individuals (Scottish Chough Study Group unpublished).

A.6.2.48 Scottish crossbill *Loxia scotica*

Conservation status

Annex 1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention.

Population and distribution

Breeding:

The Scottish crossbill is Britain's only endemic bird species (Voous 1978) with a population of at least 300-400 pairs breeding in the central and eastern Highlands of Scotland (Thom 1986). Because of identification difficulties with the closely related common crossbill *L. curvirostra*, and annual fluctuations in numbers, little is known of long term population trends. However, despite a major range and population expansion by common crossbills, there appears to have been no equivalent expansion of the sedentary Scottish crossbill which remains confined to relatively few areas.

Winter:

Scottish crossbills are resident in the central and eastern Highlands throughout the year and the wintering total is thought to be about 1,500 birds.

Habitat

They occur throughout the year in the natural Caledonian pine forests of the Scottish Highlands. The nest is usually located high up in a Scots pine and the tree's seeds make up a large proportion of the diet. The Scottish crossbill species is not found to any extent in the dense plantations of alien conifers now found widely in Scotland.

Conservation needs

Scottish crossbills occur nowhere else in the world. Britain, therefore, has a unique responsibility for their protection. The current distribution is essentially a relict one based on the now fragmented natural Caledonian pine forests. It is reasonable to assume that the species was formerly more abundant and widely distributed. The native pinewoods of the Scottish Highlands have been reduced by felling and fire to occupy at present only about 1% of their natural range. There are now just 35 genuine native pinewood sites of any size, covering a total area of about 12,000 ha. In addition, numerous small and scattered remnants contribute a further *c.*500 ha (Carlisle 1977; Bain 1987; see section A.5.9). The future SPA network will be beneficial to the well-being of the remaining population of Scottish crossbills by maintaining sufficient areas of mature semi-natural Scots pine on which the species is dependent.

Proportion currently protected within the SPA network

In summer, a total of at least 140 pairs of Scottish crossbills nest within the proposed SPA network (40% of the British and international populations). However, the species is poorly known and difficult to distinguish from the common crossbill. Thus there is generally poor knowledge of numbers at sites, and it is possible that the proportion protected could be greater.

Winter numbers on sites are not currently known, but are assumed to be roughly in the same proportion as breeding numbers i.e. *c.*700 birds from an estimated total of *c.*1,500.

A.6.3 Information on some other migratory species

Selection of species for inclusion here was made in line with Article 4.2 of the Birds Directive. This states that special conservation measures should be taken for "regularly occurring migratory species not listed in Annex 1" and that "Member States shall pay particular attention to the protection of wetlands and particularly to wetlands of international importance". We have accordingly selected all wildfowl and waders that regularly occur in Britain, and any other regularly occurring migratory species with a Bezzel score (see section 2.6.2) of 17 or more (i.e. in the top half of scale of indices of vulnerability).

These are dealt with here in less detail than the Annex 1 species. The texts focus on estimates of the sizes of British breeding and wintering populations, and on the relative numeric importance of these in the international context. Information on the ecology of many of these species has been reviewed in other publications. Selected aspects of their habitat characteristics and conservation needs are summarised briefly.

A.6.3.1 Red-necked grebe *Podiceps grisegena*

Conservation status

Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Red-necked grebe is a very rare and sporadic breeder in Britain. Since 1980 breeding is known to have occurred at just one site in Scotland and one in England. Within the EEC it also breeds in Denmark (350-400 pairs) and West Germany (c.120 pairs). The main breeding areas are in Finland and the USSR.

Winter:

The British wintering population is estimated to be 100-170 birds. There are no available estimates of international wintering populations.

Habitat

Breeds on shallow lowland lakes and winters on estuaries and inshore coastal waters.

Conservation needs

Red-necked grebes are dependent upon the quality of freshwater, estuarine and coastal habitats. They are vulnerable to oil pollution when wintering on coastal waters. Protection from human disturbance and other activities is required at breeding sites in Britain.

A.6.3.2 Black-necked grebe *Podiceps nigricollis*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

A very rare breeding species in Britain with a population of 25-30 pairs. Nesting occurs at several localities in England and Scotland and numbers have gradually increased in recent years. Small numbers breed in most other EEC countries with the exception of Eire, Portugal, Italy and now Greece. The main breeding areas are in central Europe and southern USSR.

Winter:

Black-necked grebes regularly occur at inland sites during spring and autumn passage, and small numbers (about 100 birds) overwinter in Britain.

Habitat

In Britain, breeding occurs on lowland eutrophic meres, ponds, lochs and reservoirs with extensive emergent vegetation. Wintering birds are found on sheltered coastal waters and open inland waters.

Conservation needs

Black-necked grebes are dependent upon the quality of freshwater, estuarine and coastal habitats. They are vulnerable to oil pollution when wintering on coastal waters. Protection from human disturbance and other activities is required at breeding sites in Britain and this species will benefit considerably from site-based protection of its breeding localities through SPA designation.

A.6.3.3 Fulmar *Fulmarus glacialis*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population of about 531,400 pairs is of very considerable international importance comprising about 94% of the Western European population and 5% of the western European populations. Breeding fulmars are nowadays widely distributed around the British coastline, having undergone an increase in numbers and range during the present century.

Winter:

Fulmars spend the winter in the North Atlantic and North Sea.

Habitat

Fulmars breed on coastal cliffs and grassy slopes, and during the nesting season they can range widely at sea. When not at their colonies they have a pelagic existence in the waters of the North Atlantic and North Sea.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely aerial species, fulmars are less vulnerable to oil pollution than some other seabirds.

Proportion currently protected within the SPA network

A total of c.274,000 pairs of fulmars breed on 48 sites in the proposed SPA network (52% of the British population; 2% of the international population). Of this total, 90% occur on 11 sites which each hold more than 1% of the international population. No feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.4 Manx shearwater *Puffinus puffinus*

Conservation status

Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Owing to the difficulty of censusing this underground nesting, nocturnal species figures available for the size of the British breeding population are imprecise. The population is, however, thought to exceed 235,000 pairs at about 30 colonies in northern and western Britain. The largest colonies, each thought to hold over 100,000 pairs, are on Skomer and Rhum. British colonies hold over 95% of the European population.

Winter:

Spends the winter at sea.

Habitat

Breeding colonies are located on grassy islands and headlands. Manx shearwaters feed generally in coastal waters and are seldom found beyond the edge of the continental shelf.

Conservation needs

Because of its extensive and varied coastline Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Manx shearwaters are vulnerable to oil pollution and entanglement in fishing nets. Colonial, island-nesting seabirds are especially vulnerable to ground predators, such as cats and rats, and care needs to be taken to ensure that these species are not introduced to islands holding seabird colonies. Control measures may be needed at sites where this has happened (see section A.5.4). Since the species occurs at high densities on a small number of sites, breeding colonies are well suited to site-based protection as provided by SPA designation.

Proportion currently protected within the SPA network

An estimated total of 141,000 pairs of Manx shearwaters breed on nine sites within the proposed SPA network (60% of the British population). No feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.5 Gannet *Sula bassana*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population is now about 158,700 pairs at 15 colonies. These represent about 71% of the European and 61% of the world totals (Wanless 1987). Following decreases in the 19th century, numbers have increased to the present level from only about 30,000 pairs which were present at seven colonies in the first decade of the 20th century.

Winter:

Gannets spend the winter at sea, many flying south out of British waters.

Habitat

Gannets breed in colonies on cliff ledges or cliff top slopes, stacks, headlands and precipitous islands. They feed in waters over the continental shelf (Tasker *et al.* 1985), often in association with fishing vessels.

Conservation needs

Because of its extensive and varied coastline Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. The 19th century decline in gannet numbers is thought to have been due to excessive human exploitation. Gannets are vulnerable to oil pollution and to entanglement in fishing nets. Since the species occurs at high densities on a small number of sites, breeding colonies are well suited to site-based protection as provided by SPA designation.

Proportion currently protected within the SPA network

A total of *c.*154,500 pairs of gannets breed on 13 sites within the proposed SPA network (97% of the British population; 70% of the international population). No feeding or gathering areas for this species are currently included within the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.6 Cormorant *Phalacrocorax carbo*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British coastal breeding population is estimated to be about 6,300 pairs and these constitute 29% of the EEC and 17% of the western and central European population totals. They are widely distributed except in eastern and south-eastern England and have generally increased in numbers since 1969/70.

Winter:

The British wintering population is estimated to be 15-20,000 birds and these are widely distributed in coastal and inland areas.

Habitat

Cormorants breed on broad ledges on sea cliffs and on the flat tops of stacks and islets. They feed in shallow inshore marine waters, estuaries, rivers and large inland freshwater bodies.

Conservation needs

Because of its extensive and varied coastline Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely surface-dwelling species, cormorants are especially vulnerable to oil pollution and to entanglement in fishing nets.

Birds that winter on estuaries are vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites (see section A.5.1). Cormorants are persecuted by fishing interests at their breeding colonies, on inland rivers and lakes, and at fish farms.

Proportion currently protected within the SPA network

A total of *c.*2,500 pairs of cormorants breed on 22 sites within the proposed SPA network (36% of the British population; 6% of the international population).

In winter, only a small proportion (<2%) of the British wintering population is thought to be accommodated by the presently proposed SPA network, although data are poorly collated for this species.

A.6.3.7 Shag *Phalacrocorax aristotelis*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population is estimated to be about 36,100 pairs and these form about 67% of the EEC and 30% of the European populations. They are widely distributed in coastal areas away from eastern and south-eastern England, and have increased in numbers since Operation Seafarer (1969/70).

Winter:

The British wintering population is estimated to be 75,000-120,000 birds and these are widely distributed mainly in coastal areas.

Habitat

Shags breed on sea cliffs and islands and feed throughout the year in inshore marine waters.

Conservation needs

Because of its extensive and varied coastline Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely surface-dwelling species, shags are especially vulnerable to oil pollution and to entanglement in fishing nets.

Proportion currently protected within the SPA network

A total of *c.*20,250 pairs of shags breed on 45 sites within the proposed SPA network (56% of the British population). Only a small number of these sites individually hold more than 1% of the national breeding population. No feeding or gathering areas for this species are currently included within the SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.8 Mute swan *Cygnus olor*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population in 1983 was about 3,150 pairs. In addition there was a non-breeding component amounting to about 12,600 individuals (Ogilvie 1986).

Winter:

The British wintering population is estimated to be about 18,000 birds and these form about 10% of the increasing north-west and central European population (Monval & Pirot 1989).

Habitat

Mute swans occur throughout the year in freshwater and estuarine habitats.

Conservation needs

Although the species is vulnerable to drainage and loss of freshwater habitats and to adverse developments on estuaries, the proposed SPA network will provide security from such threats. Particular threats that have been identified include oil pollution, collision with overhead power cables and poisoning following ingestion of anglers' lead weights. This last factor resulted in a major recent decline in the population in southern and central England. Steps have now been taken to reduce the use of lead for angling. During the moulting period, swans become flightless. Large flocks of swans gather at these times and the proposed SPA network provides protection for several such regular moulting sites. However, at these times swans are obviously more vulnerable to the effects of oil pollution.

Proportion currently protected within the SPA network

A total of *c.*200 pairs of mute swans are known to breed on 19 sites in the proposed SPA network (6% British breeding population). This assessment is likely to under estimate the total number breeding within the site network since nesting usually occurs at low density. Consequently data are poorly collated for this species in summer.

In winter, a total of *c.*4,300 mute swans winter on sites (24% of the British wintering population; 2.4% of the international wintering population). Small numbers winter on a larger number of sites which have not been taken into account; thus the proportion of the population protected is a minimum.

A total of *c.*500 swans of the isolated population of Outer Hebridean mute swans occur on proposed SPA/Ramsar sites in South Uist (*c.*55% of that population: Spray 1981).

A.6.3.9 Bean goose *Anser fabalis*

Conservation status

Annex II/1 of EEC Bird Directive; Appendix III of the Berne Convention. Not a quarry species in Britain; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

This species does not breed in any of the EEC Member States.

Winter:

The British wintering population is estimated to be about 400-500 birds with the Yare Valley in Norfolk as the main site. Birds at the traditional Scottish site near Castle Douglas have shown a long-term decline (Watson 1986) and are no longer present. There is also a regular wintering group of up to 100-120 birds in the Carron Valley, central Scotland. Although the British flocks are a small proportion of the estimated 80,000 birds that winter in NW Europe, they are important in terms of retention of a part of the traditional wintering range. Recent ringing has shown that the Scottish and English bean geese derive from different parts of the breeding range in Scandinavia.

Habitat

In Britain bean geese winter regularly only on grasslands. In the Yare Valley the flock selects cattle-grazed swards for feeding, and the main food plant is the grass *Poa pratensis/trivialis* (Allport 1989). Away from the Yare Valley birds are associated with relatively poor quality grazing marshes and grassland. Small undisturbed waters of about 5 ha, often surrounded by trees, are preferred for roosting.

Conservation needs

The main threats to the small English wintering population are alterations to the habitat in the Yare Valley, human disturbance, and possible competition for resources with wigeon (Allport 1989).

Proportion currently protected within the SPA network

The British wintering population is not currently protected in SPAs.

A.6.3.10 Pink-footed goose *Anser brachyrhynchus*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

In winter Britain holds the entire Iceland and east Greenland breeding population, amounting to about 110,000 birds. The main concentrations are found in eastern and southern Scotland, and north-west and eastern England, although there have been marked annual and seasonal changes in this distribution. The population is currently increasing in size largely as a result of restrictions on shooting in winter (Fox *et al.* in press).

Habitat

In winter pink-footed geese frequent arable fields and pastures within the vicinity of nocturnal roosts which are mainly on estuarine flats and sandbanks, freshwater lakes and reservoirs. In north-east Scotland a recent study found that 82% of all geese foraged within 8 km (median distance 4 km) of traditional roost sites (Bell 1988). Therefore conservation of traditional roosting sites is necessary to enable the population fully to exploit potential feeding habitats.

Conservation needs

The main threats to this population are thought to be potential hydro-electricity schemes at its breeding grounds in central Iceland. It is also vulnerable to potential oil extraction in the vicinity of its moulting grounds in NE Greenland (Madsen 1984c). Its current reliance on farmland for feeding while in Britain means that very large areas of potential habitat are available. However, human disturbance at traditional roosting sites is a persistent problem.

Proportion currently protected within the SPA network

The network provides for a variety of different requirements, including roost sites and staging areas. The proposed SPA network holds approximately 103,000 pink-footed geese (94% of the British and international populations) (assessed using the November WWT grey goose census data). The actual national and international

proportions of populations protected are difficult to calculate precisely owing to major within-winter movements between different parts of the range (Fox *et al.* 1989b). Sites for this species are largely nocturnal roost sites. Feeding areas (which include a range of habitats including farmland) are not significantly represented within the proposed SPA network and require complementary measures such as designation as Environmentally Sensitive Areas.

A.6.3.11 European white-fronted goose *Anser albifrons albifrons*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season in England and Wales only); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

The birds that winter in Britain come from breeding grounds in the north-western USSR. The British wintering population amounts to about 6,000 birds and these form about 2% of the NW European wintering population. They occur mainly in southern England and Wales, with over half of the British total at the New Grounds, Slimbridge. The NW European total has increased substantially in recent decades, but numbers wintering in Britain are currently lower than they were in the 1960s. The numbers occurring in Britain (and thus on British proposed SPAs) in any year are partly dependent on the severity of weather conditions in continental Europe.

Habitat

European whitefronts traditionally winter on coastal grasslands and inland floodplains, but increasingly frequent arable land and stubble fields, especially in autumn. They roost at night on estuarine sandbanks and shallow lakes and usually fly less than 10 km to their daytime feeding grounds. Therefore conservation of traditional roosting sites is necessary to enable the population to exploit potential feeding habitats.

Conservation needs

Appropriate management of sites within the proposed SPA network may encourage reversal of the contraction of wintering range of the European whitefront in Britain which has occurred due to habitat loss (through drainage), and disturbance on many haunts.

Proportion currently protected within the SPA network

The network provides for a variety of different requirements, including roost sites, feeding areas and staging areas. A total of *c.*4,100 European whitefronts winter on the proposed SPA network (68% of the British wintering total and 1.4% of the international flyway population). The only site regularly holding more than 1% of the international population is the Severn Estuary, although some other sites such as the South Thames Marshes, North Norfolk Coast, the Swale and South Sheppey and the Avon Valley, Hampshire are important to maintain the range of the species in Britain. Numbers wintering (and hence numbers on proposed SPAs) vary according to continental weather conditions.

A.6.3.12 Greylag goose *Anser anser*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 1, part II (in the Outer Hebrides, Caithness, Sutherland and Wester Ross) and Schednle 2, part 1 (elsewhere in Britain) of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Two distinct biogeographical populations are occur in Britain:

Icelandic population: The Icelandic breeding population winters almost exclusively in eastern and southern Scotland and northern England. Numbers have increased in recent decades, largely as a result of restrictions on shooting in winter (Fox *et al.* in press), and the population now comprises about 100,000 birds.

North Scottish population: This is a remnant of the formerly widespread native breeding population, now confined to the Western Isles, Wester Ross, Sutherland, Caithness, Tiree and Coll. The population comprises about 2,000 birds and is sedentary.

In addition there is a rapidly increasing feral population in parts of eastern and southern England, and a now more stable one in south-west Scotland, all resulting from re-introductions and escapes from parks and collections. These amount to about 14,000 birds in total (Owen & Salmon 1988; Shimmings *et al.* 1989).

Habitat

Throughout the year the Scottish birds are associated with freshwater lochs, blanket bogs, marshes and moorland habitats. In winter the Icelandic birds feed almost exclusively on arable land and improved pastures, and roost on

estuaries, freshwater lakes and reservoirs. In north-east Scotland a recent study found that 68% of all geese foraged between 8-22 km (median distance 10.7 km) of traditional roost sites (Bell 1988). Therefore conservation of traditional roosting sites is necessary to enable the population fully to exploit potential feeding habitats.

Conservation needs

The Scottish breeding population is vulnerable to land use changes, such as the widescale afforestation of the Caithness and Sutherland peatlands. During the moulting period, the geese loose their wing feathers and become flightless. The geese are particularly vulnerable during this period and the proposed SPA network will protect the population during both the breeding and moulting seasons from the impacts of damaging land-uses.

In winter greylag geese frequent arable fields and pastures close to nocturnal roosts which are mainly on freshwater lakes and reservoirs. Therefore conservation of traditional roosting sites as SPAs is necessary to enable the population to exploit potential feeding habitats.

Proportion currently protected within the SPA network

Overall, the proposed network provides for a variety of different requirements, including roost sites, feeding areas and staging areas (but usually not all the requirements for geese in any one area).

Icelandic population:
The proposed SPA network holds approximately 66,100 Icelandic greylag geese (66% of the British and international populations) (assessed using the November WWT greylag goose census data). The national and international proportions of populations protected are difficult to calculate precisely owing to within-winter movements between different parts of the range. There are also problems with the establishment of long-term nominal population levels in a species that has been increasing in recent years. Sites for this population are largely nocturnal roosts. Feeding areas, which include a range of habitats including farmland, are not significantly represented within the proposed SPA network. These require wider conservation policies such as designation as Environmentally Sensitive Areas.

North Scottish population:
The native greylag goose population of north and west Scotland has been recently shown to be sedentary and clearly distinct (Paterson 1987). About 500 pairs of native greylag breed within the proposed SPA network, largely in the Uists, the Flow Country (Stroud *et al.* 1987; Fox *et al.* 1989a) and on Tiree and Coll (Stroud 1989). The majority of the known wintering population is currently located within the proposed SPA network in the Outer and Inner Hebrides (Newton 1989). The status of greylag geese wintering in Caithness is currently unclear. Some sites for this species are largely nocturnal roost sites. Feeding areas, which cover a range of habitats including farmland, are not significantly represented within every proposed SPA.

A.6.3.13 Dark-bellied brent goose *Branta bernicla bernicla*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; not currently a quarry species in Britain; Appendix II of the Bonn Convention.

Population and distribution

Dark-bellied brent geese breed in North Siberia as far east as the eastern Taymyr Peninsula and winter in western Europe (Prokosch 1984). The population has been re-establishing former numbers in recent years following decades of low numbers after a major population crash in the 1930s. Britain currently supports up to about 90,000 birds (53% of the total) at coastal sites in eastern and southern England.

Habitat

The wintering habitat was formerly restricted to coastal and estuarine mudflats where they fed on *Zostera* and other green seaweeds. However, the huge areas of former estuarine feeding habitat which have been 'claimed' for agriculture in recent years has meant that, since the re-establishment of the population in the 1970s and early 1980s, the geese have also had to feed on coastal arable farmland and pasture when food supplies on the mudflats have been depleted. They roost communally on sheltered coastal and estuarine waters.

Conservation needs

The breeding success of this high arctic nesting goose fluctuates markedly in response to conditions on the breeding grounds, and in many years no young at all are produced by the population (Prokosch 1984). Thus large numbers are required to sustain the population through these non-breeding years. Spring feeding is particularly important for subsequent reproductive success (Ebbinge *et al.* 1982; Prokosch 1984). Geese which fail to reach a certain weight after feeding on spring staging areas have a high probability of failing to return with young the following year. A feature of the use of spring staging areas by brent geese is their high fidelity to particular areas. Flocks of brent geese are not random groups, but are highly structured socially. The loss of traditional staging areas used by these flocks would have profound effects for the population (Prokosch 1984).

The population is vulnerable to the effects of a series of poor breeding seasons, and also to further land-claim and other developments on estuaries, to uncontrolled shooting, and to changes to existing arable land-use in the present coastal feeding areas. Uncontrolled shooting on inter-tidal areas would exacerbate any conflict between geese and agricultural interest on 'claimed' land. The network of proposed SPAs will protect the population from further loss of natural and semi-natural habitats on which the distribution of this goose depends.

Proportion currently protected within the SPA network

In winter a total of *c.*78,300 dark-bellied brent geese are accommodated within the proposed SPA network (January census). This amounts to a major part (87%) of the national and 46% of the international populations. Precise proportions of the population protected are difficult to assess owing to within-winter movements as well as natural variability in long-term population levels due to very variable breeding success in fluctuating high arctic conditions (Madsen 1987). Significant numbers occur outside the proposed SPA network as some feeding areas of birds that roost at coastal or estuarine sites are not included in SPAs.

A.6.3.14 Light-bellied brent goose *Branta bernicla hrota*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; not a quarry species in Britain; Appendix II of the Bonn Convention.

Population and distribution

A distinct biogeographical population of the light-bellied brent goose breeds in Svalbard and winters in Denmark and eastern England. The population suffered a serious decline in the early part of this century (due to excessive shooting, *Zostera* die-off, and human interference in Svalbard) and now numbers just 4,000 birds. An average of about 3,000 of these (75%) occur in Britain, mainly at Lindisfarne NNR, but larger proportions of the population (up to 100%) occur when weather conditions are severe on the Danish wintering grounds (sections 2.2.2 and 2.3).

Habitat

At Lindisfarne NNR they are found on intertidal mudflats where they feed on *Zostera* and other green seaweeds.

Conservation needs

The highly endangered Svalbard population is dependent in winter upon the maintenance of suitable conditions at a small number of currently-used sites in England and Denmark (Madsen 1984a). Lindisfarne NNR is of very special significance and its inclusion within the SPA network will ensure the best possible habitat protection for this population in Britain.

Proportion currently protected within the SPA network

The entire British total of Svalbard light-bellied brent geese use the Lindisfarne pSPA. The numbers wintering in Britain are related to the coldness of winter weather in Denmark and may amount to the whole population in some years.

A.6.3.15 Shelduck *Tadorna tadorna*

Conservation status

Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Shelducks breed near the coast in most areas of Britain and the total is an estimated 15,000 pairs. Numbers have increased this century following declines due to persecution and habitat loss during the 19th century (Marchant *et al.* in press).

Winter:

The British wintering population is about 75,000 birds and this constitutes 30% of the NW European total. They are widely distributed in coastal areas, but the main concentrations are found in the major estuary complexes.

Moulting areas:

Shelducks undertake a moult migration in late summer each year to gather in large concentrations at a small number of traditional moulting grounds. During this time they are highly vulnerable and such concentrations are especially important to the conservation of the population. The largest is in the German Waddensea area and involves 200,000 or more birds. In Britain 3-4,000 gather to moult in Bridgwater Bay (Severn Estuary). Moulting flocks also occur in the Firth of Forth, the Wash, the Humber and the Dee.

Habitat

The feeding habitat throughout the year is intertidal sand and mud flats, where the birds forage for molluscs and other invertebrates. They nest in burrows on coastal marshland, dunes, farmland and other open habitats close to the feeding areas.

Conservation needs

The proposed SPA network will give protection to shelduck populations by restricting further land-claim or other developments affecting the extensive mudflats used for feeding. Such developments, which would disturb or damage the estuaries on which they occur, are detrimental to the population. The network also takes into account differences in productivity between different sections of the population as explained in sections 2.4.2 and 2.4.4. The species is also vulnerable to oiling during the moult period.

Proportion currently protected within the SPA network

In summer, a total of *c.*1,000 pairs of shelduck breed on sites in the proposed SPA network. This is about 7% of the British total. However, data on the breeding status of this species, as with many other breeding waterfowl is extremely poorly collated, and the proportion protected could be significantly higher.

Several major estuarine pSPAs, including the Firth of Forth, Humber and Severn are of great importance to the population as moulting areas in late summer and early autumn.

In winter, a total of *c.*41,000 shelduck occur on sites in the proposed SPA network (55% of the British wintering population and 16% of the international population). The Wash holds significantly greater numbers than other wintering sites with approximately 7% of the international and 25% of the national totals.

A.6.3.16 Wigeon *Anas penelope*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Britain holds a small breeding population of wigeon amounting to 300-500 pairs. These occur in the north Pennines, and east, central and northern Scotland.

Winter:

The British wintering population is about 250,000 birds and is widely distributed at estuarine sites throughout Britain. Britain holds about 27% of the NW European population.

Habitat

During the breeding season, British wigeon frequent freshwater bodies, often in upland areas (Fox *et al.* 1989a). In winter the majority are associated with estuarine mudflats, saltmarshes and nearby pastures. However, about 20% occur at inland sites, mostly on flooded grasslands, and these sites are important for the conservation of the population.

Conservation needs

The proposed SPA network will give protection to wigeon populations by restricting further land-claim or other developments affecting the extensive mudflats used for feeding. Such developments, which would disturb or damage the estuaries on which they occur, are detrimental to the population. As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this.

Proportion currently protected within the SPA network

In summer, breeding wigeon have a scattered distribution, and a total of *c.*140 pairs of occur within the SPA network (35% of British total). Of these, the majority (55%) occur in the Flow Country (Stroud *et al.*1987; Fox *et al.* 1989a). Because of difficulties with census for this secretive species (Thompson & Dougall 1988), the total of birds present may be greater.

In winter, a total of *c.*185,000 wigeon occur within the proposed SPA network (74% of the British wintering total; 25% of the international wintering population). A total of 27 sites each hold >1% of international wintering numbers (using peak mean totals). The majority of these sites are estuarine, but some inland sites of considerable importance (such as the Ouse Washes pSPA) are also included in the network.

A.6.3.17 Gadwall *Anas strepera*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population is currently 500-600 pairs, having arisen largely from introductions. They currently breed in scattered localities in south-east England, the Isles of Scilly,

Gloucestershire, north Lancashire, the Lake District, Yorkshire and south-east Scotland (Fox 1988).

Winter:

The British wintering population is about 6,000 birds, widely distributed in central, eastern and southern England (Fox & Salmon 1989). They constitute up to half of the increasing NW European total.

Habitat

Gadwalls are associated with freshwater lakes, slow rivers, marshes and flooded areas. Feeding occurs with other species such as coot, and gadwall frequently occur as part of an assemblage of duck species.

Conservation needs

Gadwalls are dependent upon the extent and quality of freshwater wetland habitats and are potentially vulnerable to excessive human disturbance from recreational activities. As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this. Gadwalls have a relatively high incidence of lead pellet ingestion (12% – Mudge 1983), and thus are vulnerable to lead poisioning in areas with high levels of shooting.

Proportion currently protected within the SPA network

In summer, a small proportion of the population of breeding gadwalls occur on proposed SPAs. However, owing to the difficulty of obtaining extensive survey information on breeding ducks, including this species, it is not currently possible to quantify this total.

In winter, a total of *c.*2,500 gadwall occur within the proposed SPA network (42% of the British wintering total; 21% of the international wintering population). Numbers are currently expanding rapidly (Fox & Salmon 1989), and thus the population base-line is currently in flux.

A.6.3.18 Teal *Anas crecca*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Teal are a widely, although thinly, distributed breeding species in Britain with an estimated population of only 3,500-6,000 pairs. Population trends are not well known.

Winter:

In winter, teal are widely distributed in coastal and lowland areas of Britain. The population is in the order of 100,000 birds and comprises about 25% of the NW European total. Numbers in Britain have been slowly increasing since the early 1960s, although the NW European population as a whole is considered to be stable (Monval & Pirot 1989).

Habitat

In the breeding season teal favour rushy moorland and heath pools, bogs and peat mosses (e.g. Fox 1986), but also nest at lowland lakes, rivers, streams and marshes. In winter they frequent areas of shallow water on estuaries, coastal lagoons, coastal and inland marshes, flood meadows and ponds.

Conservation needs

Teal are dependent upon the quality of freshwater and estuarine habitats. They are vulnerable to land-claim and other developments on estuaries, and to drainage of freshwater sites. As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this.

Proportion currently protected within the SPA network

In summer, an estimated total of 210 pairs of teal breed on sites in the proposed SPA network (4% of the British total). This assessment is, however likely to be significantly less than the true number in many moorland areas, owing to the extremely secretive nature of these ducks during the breeding season and the lack of extensive survey information from most uplands. There are relatively few sites where reliable information on the breeding status of this species exists (e.g. Fox 1986; Fox *et al.* 1989a).

In winter, a total of *c.*44,500 teal winter on the proposed SPA network (45% of the British population; 11% of the international population).

A.6.3.19 Mallard *Anas platyrhynchos*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Mallard are very widely dispersed as a breeding species in Britain, with a total population in excess of 40,000 pairs.

Winter:

Wintering mallard are dispersed throughout Britain, with a total population of about 500,000 birds. These form about 10% of the NW European total.

Habitat

Mallard occur in a wide variety of freshwater and estuarine habitats.

Conservation needs

Mallard are dependent upon the quality of freshwater and estuarine habitats. They are vulnerable to land-claim and other developments on estuaries, and to drainage of freshwater sites. Thus the proposed SPA network will protect the most important sites from such damaging land-uses.

As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this. It has been estimated that 2-3% of the British population of wild mallard may die each winter from ingested lead poisoning after swallowing spent shotgun pellets (Mudge 1983).

Proportion currently protected within the SPA network

In summer, a total of at least 2,000 pairs of mallard are known to breed on sites within the proposed SPA network (5% of the British breeding population). This total is most probably a significant under-estimate, however, owing to the difficulty of obtaining extensive survey information on breeding duck species.

In winter, a total of *c.*50,000 mallard winter on sites within the proposed SPA network (10% of the British wintering population; 1% of the international flyway population). There are no sites that individually hold more than 1% of the international wintering population, and mallard are widely but thinly distributed across most wetland sites.

A.6.3.20 Pintail *Anas acuta*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Pintail is a rare breeding species in Britain, with a total of about 40 pairs currently breeding in scattered localities in Scotland and northern and south-eastern England.

Winter:

The British wintering population has increased in recent years and is currently about 25,000 birds, 36% of the NW European total. It has a highly clumped distribution in Britain with over half the counted total at only six sites: the Mersey Estuary, the Dee Estuary, the Wash, Morecambe Bay, Burry Inlet, Martin Mere, the Ouse Washes and Duddon Estuary.

Habitat

Pintails breed close to water at shallow lowland lakes, marshes, upland lochs and moorland pools. In winter they occur mainly on estuaries, but also on inland flood meadows.

Conservation needs

Pintail are heavily dependent in winter upon estuarine habitats. The proposed SPA network will protect the population since it is especially vulnerable to land-claim and other developments at these sites. As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this.

Proportion currently protected within the SPA network

In summer, a total of up to *c.*37 pairs of pintail breed on sites within the proposed SPA network, amounting to a major proportion of the variable British breeding population. Most of these are on the Ouse Washes.

In winter, a total of *c.*19,800 occur on sites (79% of the British wintering population; 28% of the international population).

A.6.3.21. Garganey *Anas querquedula*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Britain supports a small breeding population of about 50 pairs, largely confined to East Anglia and south-east England. Numbers fluctuate from year to year but have generally declined since the early 1950s. Britain lies on the north-western edge of the garganey's breeding range.

Winter:

Garganey winter in north tropical Africa and southern Asia.

Habitat

Breeding occurs in water meadows, grasslands with intersecting ditches, rushy marshes, and other shallow freshwaters edged with reeds.

Conservation needs

The small and declining population breeding in Britain is important internationally in terms of retention of part of the traditional area of distribution. The species is especially vulnerable to drainage and any further habitat losses at its remaining breeding sites. Protection and sympathetic habitat management of inland shallow wetlands is crucial in order to maintain a nucleus of breeding pairs in Britain.

Proportion currently protected within the SPA network

In summer, garganey only occur in small numbers (*c.*13 pairs: 26% of the British population) on six sites.

A.6.3.22. Shoveler *Anas clypeata*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The British breeding population is estimated to be between only 1,000-1,500 pairs, thinly distributed in lowland areas of England and southern Scotland. Largest numbers occur in central and eastern counties of England and the two most important sites are the Ouse and Nene Washes. Breeding population trends are not well known.

Winter:

About 9,000 shovelers winter in Britain and these form about 23% of the declining NW European total of *c.*40,000 birds (Monval & Pirot 1989). They are widely distributed at inland sites in lowland England and southern Scotland, but over 50% of the population occurs at less than 10 sites.

Habitat

Shovelers usually breed in marshland adjacent to shallow open water. In winter they frequent shallow water areas on marshes, flooded pasture, reservoirs and lakes with plentiful marginal reeds or emergent vegetation.

Conservation needs

Shovelers require areas of shallow freshwater for both breeding and wintering and are thus vulnerable to losses of this habitat through drainage and changes in land use. The proposed SPA network will protect the population through protection and sympathetic habitat management at the main breeding sites. As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this.

Proportion currently protected within the SPA network

In summer, a total of *c.*480 pairs of shovelers breed on sites within the proposed SPA network, amounting to about 38% of the British breeding population. Most of these are on the Ouse Washes and the Derwent Ings.

In winter, a total of *c.*3,300 occur on sites (37% of the British wintering population; 8% of the international population). There are no sites that currently hold more than 1% of the international wintering population.

A.6.3.23 Pochard *Aythya ferina*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

In Britain, pochard breed in scattered localities from the southern counties of England to northern Scotland, with some concentrations in south-east England. In 1986 there were 370-395 pairs nesting in Britain (Fox in press).

Autumn moult

Considerable numbers of pochard traditionally gather at several sites in south-east England to moult in late summer and early autumn. For example, Abberton Reservoir pSPA regularly holds 2,000-3,000 birds.

Winter:

The British wintering population is about 50,000 birds, and this constitutes about 14% of the NW European total. Pochard are widely distributed in inland lowland areas of England, Wales and southern Scotland (Fox & Salmon 1988).

Habitat

Pochard breed on large pools, lakes or slow moving streams. In winter they occur by day on lowland freshwater reservoirs, lakes, ponds and gravel pits. During periods of sustained cold weather, large numbers move onto estuaries and other ice-free coastal areas (Fox & Salmon 1988).

Conservation needs

Pochard are one of the few species of wildfowl whose numbers are declining on an international scale (Monval & Pirot 1989). They occur on large freshwater bodies throughout the year and, since their well-being is dependent upon the quality of these environments, the population will benefit from the protection resulting from SPA designation of these sites in Britain. They are vulnerable to disturbance from human recreational activities (Tuite *et al.* 1984) and to lead poisoning resulting from the ingestion of spent shotgun pellets (Mudge 1983). As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this. Protection and sympathetic habitat management may be required to safeguard the more important breeding sites.

Proportion currently protected within the SPA network

In summer a very small number of pochard breed on a few sites within the proposed SPA network.

In winter, a total of *c.*8,000 occur on sites in the proposed SPA network (16% of the British wintering population; 2% of the international population). There are currently no sites holding more than 1% of the international wintering numbers of pochard.

A.6.3.24 Tufted duck *Aythya fuligula*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The tufted duck is a widely distributed breeding species in lowland areas of Britain with a current population of about 7,000 pairs. Numbers have increased substantially in recent years, partly due to their use of the expanding number of gravel pits in lowland England.

Autumn moult

Considerable numbers of tufted ducks, like pochard, traditionally gather at several sites in south east England to moult in late summer and early autumn. For example, Abberton Reservoir pSPA regularly holds 2,000-3,000 birds, and large numbers also occur in the London area and on Loch Leven pSPA.

Winter:

The wintering population is widely distributed in inland lowland Britain and numbers about 60,000 birds, 8% of the NW European total. Numbers in Britain have almost doubled since the early 1960s although the overall NW European wintering population is considered to be stable (Monval & Pirot 1989).

Habitat

Tufted ducks are found throughout the year predominantly on large, inland bodies of freshwater where they obtain their food by diving.

Conservation needs

Since the well-being of tufted ducks is dependent upon the quality of the freshwater bodies on which they occur, the population will benefit from the protection of important areas within the proposed SPA network. They are potentially vulnerable to disturbance from human recreational activities (Tuite *et al.* 1984) and to lead poisoning resulting from the ingestion of spent shotgun pellets (Mudge 1983). As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges is the most appropriate mechanism for achieving this.

Proportion currently protected within the SPA network

In summer, a total of at least 560 pairs of tufted ducks are known to breed on sites within the proposed SPA network (8% of the British breeding population). This total is possibly an under-estimate, however, owing to the difficulty of obtaining extensive survey information on breeding duck species.

In winter, a total of *c.*12,700 tufted ducks winter on sites within the proposed SPA network (21% of the British wintering population; 2% of the NW European population). There are no sites that individually hold more than 1% of the international wintering population.

A.6.3.25 Scaup *Aythya marila*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

A total of 1-3 pairs have bred at irregular intervals in Britain since the first recorded nesting in 1897. All but one of these attempts have been in Scotland, most frequently in the Western Isles and Orkney.

Winter:

The British wintering population is currently about 4,000 birds and this constitutes about 3% of the NW European total. The majority are concentrated at three localities: Upper Solway Firth, the Firth of Forth and Loch Indaal, Islay. The numbers currently wintering in Britain are much lower than in the 1960s and early 1970s when 20,000-30,000 birds were regularly present in the Firth of Forth. The decline there was mainly a result of a change in the regime of sewage disposal (Campbell 1984).

Habitat

Scaup breed on islets or shores of moorland lochs and rivers, often in association with gull colonies. In winter they occur mainly in coastal or estuarine areas and show a strong attraction to sewage outfalls or other areas with high benthic productivity.

Conservation needs

Wintering birds are closely associated with estuaries and are likely to be affected by land-claim and other developments that would disturb or damage these sites. Thus the population will benefit from the protection of these sites as Special Protection Areas. They are vulnerable to oil pollution (Campbell *et al.* 1978), to commercial exploitation of mussel beds, and to changes in coastal disposal of domestic sewage (Campbell 1984).

Proportion currently protected within the SPA network

In winter, a total of *c.*2,600 occur on proposed SPAs (65% of the British wintering population; 2% of the international population). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within currently proposed SPA boundaries. This includes areas adjacent to currently identified sites. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.26 Eider *Somateria mollissima*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The eider is widely distributed as a breeding species throughout coastal areas of Scotland, extending into north-east England. The population is estimated to be 15-25,000 pairs. Numbers have risen considerably and the breeding range has expanded during the current century.

Autumn moult:

The Scottish eider population is largely sedentary but undertakes short migrations to traditional moulting grounds around the Scottish coast.

Winter:

The British wintering population is about 50,000 birds, 2% of the Western Palearctic total. The majority are concentrated at a relatively small number of sites. Those which hold the greatest numbers are the Firth of Tay; Walney Island, Cumbria; Firth of Forth; Lindisfarne; Inner Firth of Clyde and Montrose Basin (Salmon *et al.* 1988).

Habitat

Throughout the year eiders inhabit coastal and estuarine waters where they feed mainly on mussels and other molluscs.

Conservation needs

The well-being of eiders is dependent upon the quality of the marine and estuarine environments. Since they are vulnerable to land-claim and other developments on estuaries, the network of proposed SPAs will benefit the population. They are also vulnerable to commercial exploitation of mussel beds, to illegal persecution by mussel farming interests, to oil pollution, and in some areas to recreational disturbance. The NCC is working with mussel-farming interests to produce agreement on how to manage farms to minimise conflict.

Proportion currently protected within the SPA network

In summer, a total of at least 2,500 pairs of eiders are known to breed on sites within the proposed SPA network (13% of the British breeding population). This total is possibly an under-estimate, however, owing to the difficulty of obtaining extensive survey information on breeding duck species. The breeding areas are scattered widely along coastal areas, and there are probably few areas where site-based conservation could sustain significant proportions of the breeding population.

In winter, a total of *c.*29,000 eiders are found for part of the season on sites within the proposed SPA network (58% of the British wintering population; 1% of the international flyway population). There are no sites that individually hold more than 1% of the international wintering population. At some sites, this species occurs as an important component of an assemblage of wintering seaducks. Many marine areas used by this seaduck lie just offshore and cannot be included within proposed SPAs. For the majority of the time in winter, depending on tides and weather, eiders occur outside the boundaries of currently proposed SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.27 Long-tailed duck *Clangula hyemalis*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Long-tailed ducks have bred in Scotland in very small numbers in the past, but not since 1926.

Winter:

The British wintering population is thought to be about 20,000 birds (1% of the NW European total), but this figure is likely to be an under-estimate due to the difficulties involved in locating and counting flocks. The major British site is the Moray Firth, which in recent years has regularly held peak numbers of between 10,000-20,000 birds in several discrete groups (Mudge & Allen 1980; Campbell *et al.* 1986). Other large concentrations occur around Shetland, Orkney and the Western Isles, and along the east Grampian coast, St. Andrews Bay and the Firth of Forth.

Habitat

Most wintering flocks of long-tailed ducks are found on open coastal waters, often several kilometres offshore. Within the Moray Firth they feed by day in sandy bays and over shallow offshore banks, and typically gather to roost at night in areas distinct from the daytime feeding localities (Mudge & Allen 1980; Campbell *et al.* 1986). A similar strategy has been recorded in Scapa Flow, Orkney (Jones 1979).

Conservation needs

Wintering long-tailed ducks are dependent for their well-being on the quality of the marine environment. The main direct threats are from oil pollution and commercial exploitation of mussel beds and other invertebrate resources.

Proportion currently protected within the SPA network

In winter, a total of 300 long-tailed ducks occur on sites (2% of the British). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within

currently proposed SPAs. For the majority of the time in winter, depending on tides and weather, long-tailed ducks occur outside the boundaries of proposed SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.28 Common scoter *Melanitta nigra*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

A small population of 100-114 pairs currently breeds in northern and western Scotland, with the main strongholds in Caithness and Sutherland (*c.* 50 pairs) and Inverness-shire (30 pairs) (Partridge 1987). Although probably longer established, breeding was first proved in 1855 in Sutherland. There is inadequate information currently available to judge population trends.

Autumn moult:

Late summer moulting flocks, consisting mostly of males, regularly occur off sandy coastal areas along the east coasts of Scotland. For example, a flock of 1,000 or more birds is regularly present in July off the Morrich More in the Moray Firth.

Winter:

The British wintering population is estimated to be about 35,000 birds, and these form about 4% of the Western Palearctic total. Flocks are widely distributed in coastal areas of Britain with major, regular concentrations in the Moray Firth, St. Andrews Bay, the Firth of Forth, Lindisfarne and Carmarthen Bay. The relative importance of wintering sites typically varies between years.

Habitat

Common scoters breed on moorland lochs where certain rather specific conditions are found (Fox *et al.* 1989a). They winter on inshore coastal waters.

Conservation needs

The Scottish breeding population is small but is important internationally in terms of retention of the traditional area of distribution.

The quality of water in the loch is potentially influenced by land uses throughout its catchment. Since the breeding lochs are vulnerable to land-use changes, (particularly hydro-electric schemes, fish farming and recreational activities), the population will benefit from the protection of important sites within the proposed SPA network. Recent large-scale afforestation in the vicinity of the Caithness and Sutherland breeding areas is of particular concern in this context and the Flow Country pSPA will benefit the remaining population there, although further measures are also necessary.

Wintering common scoters are dependent for their well-being on the quality of the marine environment. The main direct threats here are from oil pollution and commercial exploitation of mussel beds and other invertebrate resources.

Proportion currently protected within the SPA network

In summer, a total of *c.*60 pairs of common scoters breed on sites within the SPA network (55% of the British total). The vast majority of these occur on the peatland of Caithness and Sutherland where they are threatened by further afforestation of their peatland habitat (Stroud *et al.* 1987; Fox *et al.* 1989a).

In winter, a total of *c.*14,200 common scoters winter on, or close to, sites within the proposed SPA network (41% of the British total; 2% of the international total). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within proposed SPAs. For the majority of the time in winter, depending on tides and weather, common scoters occur outside the boundaries of proposed SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.29 Velvet scoter *Melanitta fusca*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Velvet scoters have never been proved to breed in Britain.

Winter:

The British wintering population is estimated to be *c.*3,000 birds (1% of the Western Palearctic total, but this number has occasionally been exceeded in late winter in the Moray Firth. This is the most important locality for this species, with smaller

concentrations regularly occurring in Orkney, St. Andrews Bay and in the Firth of Forth.

Habitat

Wintering velvet scoters occur on open, inshore coastal waters, usually in association with common scoters.

Conservation needs

Wintering velvet scoters are dependent for their well-being on the quality of the marine environment. The main direct threats are from oil pollution and commercial exploitation of mussel beds and other invertebrate resources.

Proportion currently protected within the SPA network

In winter, a total of *c.*2,000 velvet scoters winter on, or close to, sites within the proposed SPA network (67% of the British total; 1% of the international total). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within currently proposed SPAs. For the majority of the time in winter, depending on tides and weather, velvet scoter occur outside the boundaries of proposed SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.30 Goldeneye *Bucephala clangula*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Goldeneyes became established as a breeding species in Scotland during the 1970s. Encouraged by the provision of nest boxes, numbers increased rapidly to a total of at least 87 occupied nests in 1988. The breeding range is currently restricted to the central Highlands of Scotland (Dennis 1987b).

Winter:

The British wintering population is estimated to be *c.*15,000 birds, and these constitute about 5% of the NW European total. The species occurs throughout Britain, but the main concentrations are in coastal areas, particularly the Firth of Forth, Firth of Clyde, Inverness Firth, Blackwater Estuary, Cromarty Firth and Morecambe Bay.

Habitat

In Scotland, goldeneyes breed in coniferous forests close to water. In winter they occur on coastal, estuarine and inland waters, and show a special attraction to waste outfalls and other areas with high benthic productivity.

Conservation needs

The breeding population is limited by a shortage of natural nesting holes in modern plantations of alien conifers, and is largely supported by the provision of nest boxes. Predators (pine martins and jackdaws) and egg collectors are direct threats to breeding birds. Goldeneyes are dependent upon good quality freshwater, estuarine and coastal environments, and are vulnerable to damaging activities at any of these. Particular threats that have been identified include oil pollution, human recreational disturbance, and heavy stocking of lochs with rainbow trout which may deplete the invertebrates on which the goldeneyes feed.

Proportion currently protected within the SPA network

In summer, a total of *c.*18 pairs of goldeneye breed on sites within the proposed SPA network (21% of the British total). The breeding population is currently very restricted, having only recently re-established itself.

In winter, a total of *c.*7,200 goldeneye winter on, or close to, sites within the proposed SPA network (48% of the British total; 2% of the international total). No site individually holds more than 1% of the international wintering population, but the significant proportion of the national wintering population protected on pSPAs indicates the value of a network of sites. At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within currently proposed SPAs. For much of the time in winter, depending on tides and weather, goldeneye occur outside the boundaries of SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.31 Smew *Mergus albellus*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Smew do not breed in Britain.

Winter:

The smew is a rare winter visitor in Britain with a population of about 50 birds (less than 1% of the NW European total). They are mainly found in south-east England with only a few elsewhere. Numbers wintering in Britain have declined in recent years, despite an increase in the wider European population.

Habitat

Smew occur in winter on fresh or slightly brackish water.

Conservation needs

Wintering smew are dependent upon the quality of freshwater and estuarine environments. Internationally the main threat is industrial pollution, particularly of the major rivers.

Proportion currently protected within the SPA network

A small number of smew occur in winter at sites within the SPA network.

A.6.3.32 Red-breasted merganser *Mergus serrator*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Red-breasted mergansers breed widely, but thinly, in northern Scotland. They have increased in numbers and extended their breeding range into southern Scotland, north-west England and north Wales during the present century. However, the total British breeding population is estimated to be only 1-2,000 pairs.

Winter:

The British wintering population is estimated to be about 10,000 birds, forming about 10% of the NW European total. Numbers are increasing and birds are widely distributed around the British coastline, with particular concentrations in north-west Scotland, the Moray Firth and the Firth of Forth.

Habitat

Red-breasted mergansers breed in freshwater loch and riverine habitats, and winter largely in coastal/estuarine areas.

Conservation needs

Red-breasted mergansers are dependent upon the quality of freshwater, estuarine and marine habitats. They are vulnerable to oil pollution, overfishing, persecution by game fishery interests and land use changes in the catchment areas of the freshwater breeding habitats. Thus the population would benefit from protection of major sites as SPAs.

Proportion currently protected within the SPA network

In summer, an unknown (but probably low) proportion of the British population of red-breasted mergansers breeds within the proposed SPA network. This is because of under-representation of riverine sites within the network.

In winter, a total of c.4,200 red-breasted merganser winter on sites within the proposed SPA network (42% of the British total; 4% of the international total). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl. Many marine areas used by this seaduck lie just offshore and cannot be included within existing SPAs. For the majority of the time in winter, depending on tides and weather, red-breasted mergansers occur outside the boundaries of proposed SPAs and thus many of the birds numbered above receive only partial protection. This question is being considered further by Tasker *et al.* (in prep.).

A.6.3.33 Goosander *Mergus merganser*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Breeding in Britain was first proved in 1871, since when goosanders have increased in numbers and gradually extended their breeding range through Scotland, and more recently into Northumberland, Cumbria and Wales. However, the population in 1975 was estimated to be only 914-1,245 pairs (Meek & Little 1977).

Winter:

The British wintering population is estimated to be about 5,500 birds (4% of the NW European total). They are widely distributed and occur mainly on inland freshwaters, but the most important site, the Beauly Firth, is an estuary. This site regularly holds over 2,000 goosanders (Aspinall & Dennis 1988).

Habitat

Goosanders breed along clear, fast-flowing rivers, and winter on freshwater and estuarine habitats.

Conservation needs

Goosanders are dependent upon the quality of freshwater and estuarine habitats. They are vulnerable to oil pollution, overfishing, persecution by game fishery interests and land use changes in the catchment areas of the freshwater breeding habitats. Thus the population would benefit from protection of major sites as SPAs.

Proportion currently protected within the SPA network

In summer, an unknown proportion of the British population of goosanders breeds within the proposed SPA network.

In winter, a total of *c.*2,100 goosander winter on 14 sites within the proposed SPA network (38% of the British total; 2% of the international total). At some sites, this species occurs as an important component of an assemblage of wintering seaducks and other wildfowl.

A.6.3.34 Hobby *Falco subbuteo*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population numbers approximately 1,000 pairs, largely confined to southern England. Breeding occurs in all other EEC countries with the exception of Eire. Britain holds about 11% of the *c.*9,000 pairs that breed in NW Europe.

Winter:

Hobbies overwinter in tropical Africa.

Habitat

Breeding in Britain typically occurs on the dry heaths and downlands of southern England, where hobbies require areas of open country for hunting, combined with isolated clumps, shelter-belts or tall trees in hedgerows for nest sites (Parr 1985).

Conservation needs

Hobbies are vulnerable to changes in the lowland areas they inhabit, particularly agricultural intensification and conversion of heaths and downs to arable cultivation.

Proportion currently protected within the SPA network

A small proportion of the breeding population of hobbies currently nests within the proposed SPA network in southern England. This species forms part of an assemblage of heathland bird species and requires both site-based protection and wider countryside measures.

A.6.3.35 Ptarmigan *Lagopus mutus*

Conservation status

Annex II/1 and Annex III/2 of EEC Birds Directive; Appendix III of the Berne Convention. May be shot in Scotland from 12 August to 10 December each year.

Population and distribution

Breeding:

The British breeding population is thought to be in the order of 10,000 pairs, but shows marked annual fluctuations. The range is restricted to northern and central Scotland, although it was formerly more widely distributed in mountainous areas in Britain (Galbraith *et al.* 1988). Within the EEC breeding also occurs in the Pyrenees (France/Spain) and in northern Italy. Elsewhere ptarmigan are widely distributed in arctic regions.

Winter:

Ptarmigan are resident in Britain with a winter population of 10-15,000 birds.

Habitat

Ptarmigan are found throughout most of the year on the arctic-alpine heaths of montane plateau and corries.

Conservation needs

Galbraith *et al.* (1988) considered that the main historical and potential current threat to ptarmigan populations is from overgrazing by sheep. Ptarmigan feed mainly on the shoots, leaves and berries of dwarf-shrubs and these habitats have been severely damaged by sheep in many areas in Britain where ptarmigan no longer occur. In localised areas they are also vulnerable to overshooting and to problems associated with ski developments. On Cairngorm one consequence of the summer operation of the chair lifts has been to enable large numbers of people to reach the montane plateau areas. Food scraps left by these people have attracted scavengers/predators such as gulls and crows on to the high ground and a consequence of this has been increased predation on ptarmigan eggs and chicks. Breeding success in the area of ski development on Cairngorm was substantially lower than on adjacent hills (Watson 1979; Nethersole-Thompson & Watson 1981). In addition many ptarmigan are killed each winter by colliding with the wires of the chair lifts and tows (Watson 1979).

Proportion currently protected within the SPA network

A small but nationally uncollated proportion of the breeding and wintering population occurs on proposed SPAs. Ptarmigan form part of an assemblage of arctic/alpine species of very restricted current distribution in Britain.

A.6.3.36 Oystercatcher *Haematopus ostralegus*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 38,000 oystercatcher pairs breed in Britain and these constitute about 17% of the NW and Central European population. They are widely distributed in northern England and Scotland and in coastal areas of southern England and Wales. Numbers have increased during this century (Marchant *et al.* in press).

Winter:

The British wintering population is estimated to be 279,500 birds, forming about 32% of the Eastern Atlantic Flyway population. They are widely distributed mainly in coastal areas of Britain.

Habitat

Oystercatchers breed in coastal habitats, and also inland along river valleys in northern Britain. They winter in sandy estuaries and along rocky coasts where cockles and mussels form the staple diet.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1). Oystercatchers have in the past been persecuted by shell-fishery interests.

Proportion currently protected within the SPA network

A total of c.2,500 pairs of breeding oystercatchers occur within the proposed SPA network (7% British total population; 1% of the international breeding population).

A total of c.211,000 oystercatchers winter on sites in the proposed SPA network (75% of the British population; 24% of the international population).

A.6.3.37 Little ringed plover *Charadrius dubius*

Conservation status

Appendix II of the Berne Convention; Schedule 1 of WCA 1981; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

At least 608 pairs of of little ringed plovers breed in Britain (Parrinder 1989), and these constitute 3% of the NW and Central European population. Numbers have increased and the breeding range has spread through central and eastern England since initial colonisation in 1938.

Winter:

Little ringed plovers do not overwinter in Britain.

Habitat

In Britain most breeding has taken place at gravel pits and, to a lesser extent, at other man-made sites such as industrial tips and waste ground, sewage farms and reservoirs.

Conservation needs

The main threats to the breeding population are from egg collectors, mammalian predators, and disturbance from birdwatchers.

Proportion currently protected within the SPA network

A total of c.10 little ringed plover are known to breed within the proposed SPA network (2% British total population).

A.6.3.38. Ringed plover *Charadrius hiaticula*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 8,400 pairs breed in Britain, and these constitute 64% of the NW and Central European population of *C. h. hiaticula*. Ringed plovers breed throughout Britain, but the most important areas are the machair of the Western Isles (Fuller *et al.* 1986), Coll and Tiree, and on other areas in Shetland, Orkney, the Inner Hebrides and Norfolk (Prater 1989).

Winter:

The British wintering population is estimated to be 23,040 birds, and these form about 48% of the Eastern Atlantic Flyway population. They are widely distributed in coastal areas of Britain.

Habitat

Ringed plovers breed on the machair of the Hebrides and largely on sandy or shingle beaches elsewhere. They winter mainly in sandy coastal areas and in estuaries.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1). Breeding birds are vulnerable to human disturbance and to land use changes (such as changes in the traditional farming system on the Hebridean machair – see section A.5.7), and to the introduction of alien predators such as mink and hedgehog.

Proportion currently protected within the SPA network

A total of c.2,400 pairs of breeding ringed plover occur within the proposed SPA network (29% British total population; 18% international breeding population). The species is characteristic of a variety of bare or sparsely vegetatated habitats and, with the exception of machair areas of the Inner and Outer Hebrides and certain other coastal areas, usually occurs at low densities (Pienkowski & Pienkowski 1989).

Large numbers of ringed plovers occur at several sites within the network during the spring and autumn migration periods. Up to 4,000 occur on sites such as the Ribble and Ali Estuaries. Many other estuaries sustain higher numbers during the migration periods than they do during the rest of the winter.

A total of c.11,300 ringed plover winter on 51 sites in the proposed SPA network (49% of the British population; 24% of the international population).

A.6.3.39 Kentish plover *Charadrius alexandrinus*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

The Kentish plover was formerly a regular breeder in south-east England, but numbers declined in the 1920s and there has only been one documented breeding attempt since 1956.

Winter:

Kentish plovers do not overwinter in Britain.

Habitat

In Britain Kentish plovers used to breed along sea coasts on shell banks, or on sand/mud by estuaries and salt or brackish lagoons.

Conservation needs

The main reason for the decline in Britain, and elsewhere in NW Europe, is believed to be disturbance resulting from increased human usage of coastal areas.

Proportion currently protected within the SPA network

The recent breeding sites fall within the proposed SPA network.

A.6.3.40 Grey plover *Pluvialis squatarola*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Grey plovers do not breed in Britain.

Winter:

The British wintering population is estimated to be 21,250 birds, and these form about 13% of the Eastern Atlantic Flyway population. They occur widely in coastal areas of England, Wales and southern Scotland, and numbers have increased substantially in recent years.

Habitat

Over 90% of wintering grey plovers occur on estuaries.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

In winter a total of c.19,500 grey plovers are accommodated within the proposed SPA network. This amounts to 92% of the national and 12% of the international populations. Only four sites hold greater than 1% of the international total. It is significant that over half the total protected by the network (57.3%) occurs on sites which individually hold less than 1% of the international total. This also demonstrates the need for a network of sites to sustain populations of this species.

A.6.3.41 Lapwing *Vanellus vanellus*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 215,000 pairs of lapwings breed in Britain, and these constitute 25% of the NW and Central European population. They are very widely distributed throughout Britain, but have declined in numbers in recent years in southern England and probably elsewhere (Marchant *et al.* in press).

Winter:

The British wintering population is estimated to be 1 million birds, and these form about 50% of the Eastern Atlantic Flyway population. It is widely distributed in lowland areas.

Habitat

Lapwings are found on agricultural land throughout the year, most frequently on permanent pastures, ploughed arable fields and lowland wet grasslands. Other areas, including moorlands, are used in parts of the breeding range (Galbraith 1989), and in these areas lapwings form an important part of an assemblage of breeding waders. Baines (1989) found that nesting densities and breeding success were higher on low-intensity grassland compared with highly intensified leys in northern England.

Conservation needs

Lowland wet grasslands are important, traditional habitats for lapwings, particularly in southern and eastern Britain, and the species has been affected by the massive loss of these wetland areas to drainage, agricultural intensification and conversion to arable in recent decades (Smith 1983; Green & Cadbury 1987; Williams & Bowers 1987; see section A.5.6).

Proportion currently protected within the SPA network

A total of *c.*6,000 pairs of breeding lapwing occur within the proposed SPA network (3% British total population). The species is characteristic of low-intensity farmland (often at the margins of moorland) that would not normally be protected using site-based conservation measures. Since breeding populations are directly affected by agricultural regimes (O'Connor & Shrubb 1986; Baines 1989), the conservation of British breeding populations of lapwings will depend to a very great extent on the adoption of sympathetic agricultural policies that encourage the maintenance of traditional or low-intensity farming methods in areas where lapwings remain abundant.

A total of *c.*62,200 lapwings winter on sites within the proposed SPA network (6% of the British wintering total; 3% of the international flyway population). The use of particular sites is very dependent of weather conditions. Some coastal and estuarine sites sustain large numbers of birds in mild winters, although these birds leave and move inland in response to severe weather. There are no sites which individually hold more than 1% of the international population.

A.6.3.42 Knot *Calidris canutus*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Knots do not breed in Britain.

Winter:

The British wintering population is estimated to be 222,830 birds, and these form about 65% of the east Atlantic flyway population of the *islandica* race. They are widely distributed in coastal areas, with regular major concentrations (>10,000 birds simultaneously present[1] on the following estuaries: Wash, Alt, Humber, Ribble, Morecambe Bay, Thames and Dee. Numbers have shown a recent decline both in Britain and elsewhere in the Eastern Atlantic. The *islandica* race have a complex migration system, but in winter they occur in the British Isles, the Waddensee, the Dutch delta and as far south as western France (Davidson & Wilson in press).

Habitat

Of the British total of wintering knots, 98% are found on estuaries (Moser 1987).

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance,

[1] but see comments on turnover in section 2.4.1

commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of 216,700 knots use sites within the proposed SPA network in winter (97% of the wintering British total; 63% of the international flyway population). The use of sites in the non-breeding season is complex with birds showing rapid movements between different sites and parts of the wintering range (Davidson & Wilson in press).

A relatively small number of sites are used, and all 14 sites in the proposed SPA network individually hold more than 1% of the international total. This is a function of the traditional use of a few sites and the highly gregarious nature of this species in winter, and clearly demonstrates the need for a network of sites to sustain populations of this mobile and vulnerable species. Requirements for this species are very exacting, and probably not all sites reach them in all years, so additional sites are necessary.

A.6.3.43 Sanderling *Calidris alba*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Sanderlings breed in the arctic.

Winter:

The British wintering population is estimated to be 13,710 birds, and these form about 11% of the east Atlantic flyway population. They are widely dispersed in flocks of 200 – 300, but major concentrations (more than 1,000 birds present simultaneously) occur on the west coast of the Uists and on the Ribble Estuary (Prater & Davies 1978; Salmon *et al.* 1988).

Habitat

Wintering sanderlings are found on sandy estuarine and open-sea coasts.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of *c.*8,400 sanderlings winter within the proposed SPA network (61% of the British wintering total; 7% of the international flyway population). Sanderlings do not occur in very large aggregations and are scattered amongst many sites. Consequently, it is significant that only one site individually holds more than 1% of the international total (Ribble & Alt: 16.9% British, 2.4% international numbers). Yet the remaining sites within the network hold a significant proportion of the total international numbers. This demonstrates the need for a network of sites to sustain populations of this species.

Very large numbers of birds pass through British estuaries during migration, and peak passage numbers exceed 20,000. At some estuaries, such as the Wash, Morecambe Bay, Solway, Duddon, Humber and others, the peak numbers counted during spring or autumn migration are significantly greater than peak wintering numbers. Allowing for turnover (section 2.4.1), the importance for the population of these sites will be even greater than instantaneous counts suggest.

A.6.3.44 Little stint *Calidris minuta*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Little stints do not breed in Britain.

Passage and winter:

Within Britain the little stint occurs typically as a passage migrant. Small numbers winter in scattered localities in southern Britain.

Habitat

Migrating birds use fresh and brackish water habitats near estuaries, such as feeder streams and adjacent pools and scrapes. Wintering birds show a preference for muddy estuarine habitats.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages, that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

A.6.3.45 Temminck's stint *Calidris temminckii*

Conservation status

Appendix II of the Berne Convention; Schedule 1 of WCA 1981; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Temminck's stint is a very rare and localised breeding species in Britain. Breeding was first proved in 1934 and has been recorded since then at six widely separated localities, all but one in Scotland. Since 1971 up to nine birds have been present each year at one or other of two Scottish sites, and breeding has probably occurred each year. Only one of these sites was occupied in 1987-89, with up to six adults present.

Winter:

Temminck's stints do not overwinter in Britain.

Habitat

In Scotland breeding has occurred in open, dry, sparsely-vegetated terrain situated close to river deltas and their extensive marshy habitats.

Conservation needs

Temminck's stints have rather specific habitat requirements for breeding, and the right combination of features is rather rare in Britain. The only known currently-occupied site is seriously threatened by agricultural activities. Strong protection measures and sympathetic habitat management are required if this species is to maintain its tenuous toe-hold as a breeding species in Britain. As such the species will benefit from the designation of breeding sites as Special Protection Areas.

Proportion currently protected within the SPA network

The British breeding population of Temminck's stint is wholly contained in a pSPA.

A.6.3.46 Purple sandpiper *Calidris maritima*

Conservation status

Appendix II of the Berne Convention; Schedule 1 of WCA 1981; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

This is a very rare breeding species with 1-3 nests recorded between 1978-88 at one Scottish locality.

Winter:

The British wintering population is estimated to be 16,140 birds, and these form about 32% of the east Atlantic flyway population. They are widely distributed in coastal areas of Britain, especially on rocky shores. Nicoll *et al.* (1988) suggest that at least three different populations may winter in Britain, although the situation remains unclear. In eastern Scotland and north-eastern England, wintering birds (morphologically distinct from those elsewhere in Britain) appear to come from Norway. Small numbers of wintering birds in south-east England, however, may come from the USSR, whilst larger numbers in northern and western Scotland and Wales may derive from Canada, Greenland and/or Iceland.

Habitat

Purple sandpipers breed on open ground on hillsides, mountains and arctic tundra. Wintering birds are found on rocky coasts.

Conservation needs

The main threats to breeding birds in Britain are human disturbance and egg collecting.

Proportion currently protected within the SPA network

The purple sandpiper is an extremely rare breeding bird in Britain and the current breeding distribution of the species is accommodated within the proposed SPA network.

In winter, a total of *c.*5,300 purple sandpipers winter on sites within the proposed SPA network (33% British wintering total; 11% international flyway population). A clearer distinction between the different wintering populations is important for their conservation and they may require separate numerical criteria in the long-term.

A.6.3.47 Dunlin *Calidris alpina*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 9,150 pairs of dunlin breed in Britain, and these constitute 82% of the *schinzii* race breeding in temperate Europe, which has been dramatically reduced in range and numbers elsewhere in western Europe. They are widely distributed in upland areas of Scotland, England and Wales, but the main concentrations are found among the peatlands of Caithness and Sutherland, the peatlands of Lewis and the machair of the Hebrides (Fuller *et al.* 1986; Stroud *et al.* 1987; Shepherd 1989).

Passage:

Individuals of the Icelandic *schinzii* and the *arctica* races pass through Britain during spring and autumn passage periods.

Winter:

The British wintering population is estimated to be 433,000 birds, and these form about 32% of the east Atlantic flyway populations of *alpina* dunlin. They are distributed in coastal areas of Britain, with the following estuarine sites regularly holding over 15,000 birds simultaneously: Severn, Morecambe Bay, Wash, Langstone Harbour, Thames, Humber, Chichester Harbour, Mersey, Medway, Stour, Blackwater, Dee and Swale. Wintering numbers have shown a substantial decline in Britain over the last 15 years (Goss-Custard & Moser 1988), attributed to loss of estuarine habitat.

Habitat

In Britain dunlin breed generally in wet upland moorland habitats, and also in wet areas in the machair of the Hebrides. Over 95% of wintering birds are found in estuaries.

Conservation needs

Since breeding dunlin are dependent upon the maintenance of suitable areas of wet moorland and machair habitats, the population will benefit from the designation of these areas as SPAs. Moorland habitats are threatened by extensive blanket afforestation with alien conifers, particularly in the important peatlands of Caithness and Sutherland, and on Lewis (Stroud *et al.* 1987; see section A.5.13). Birds breeding on the Hebridean machair is vulnerable to land use changes, particularly changes to the traditional farming system (see section A.5.7) and to the introduction of alien predators such as mink and hedgehog.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of about 6,200 pairs of dunlin (68% of the British total; 56% of the international total) breed on the currently proposed SPA network. Boundaries of a number of moorland pSPA are still to be determined following recent ornithological survey, and this may increase the proportion of the breeding population protected by SPAs. Of significance is that outside the Flow Country, the remaining 2,357 pairs (38%) are distributed among 27 sites. This indicates the need for a network of sites to support a significant proportion of the population as well as to maintain its geographic range in the British uplands.

A total of *c.*393,000 dunlin winter within the proposed SPA network (91% of British wintering population; 29% of the international flyway population). However, with long-term declines of dunlin linked to habitat loss (Goss-Custard & Moser 1988), the situation is in a state of flux.

A.6.3.48 Jack snipe *Lymnocryptes minimus*

Conservation status

Annex II/1 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Jack snipe do not breed in Britain.

Winter:

The British wintering population is estimated to be 15,000 birds. There are no estimates available of the sizes of international populations with which to compare this figure. In Britain jack snipe occur widely in lowland areas, with no major concentrations.

Habitat

Wintering birds occur in wet and muddy habitats with shallow water.

Conservation needs

Jack snipe are vulnerable to losses of wetland habitats through drainage and land use changes. Of particular importance is the massive loss of lowland wet grasslands due to drainage, agricultural intensification and conversion to arable in recent decades (Smith 1983; Green & Cadbury 1987; Williams & Bowers 1987; see section A.5.6).

Proportion currently protected within the SPA network

It is particularly difficult to undertake accurate counts of this species, and reliable quantitative information is not currently available for most sites. Therefore it is not currently possible to give a reliable estimation of the proportion of the wintering population protected by the proposed SPA network. However, because of its selection of wetland habitats in winter, this proportion is thought to be significant.

A.6.3.49 Common snipe *Gallinago gallinago*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

About 30,000 pairs of common snipe breed in Britain, and these constitute 4% of the NW and Central European population. They are widely, but thinly, distributed throughout Britain, and numbers in lowland England and Wales have shown a major decline in recent years. Birds breeding in Orkney and Shetland are considered to belong to the *faeroeensis* race, while those elsewhere belong to the nominate race.

Winter:

The British wintering population is considered to be many hundreds of thousands of birds, but a more precise estimate is not available. They occur widely in lowland areas of Britain.

Habitat

Common snipe are found throughout the year in shallow wetlands, moorlands and damp Juncus-dominated meadows.

Conservation needs

Common snipe are widely scattered on sites including moorland, marshes and lowland wet grassland (particularly in southern and eastern Britain). In the lowlands they have been subject to major declines in numbers and range attributed to habitat change (Smith 1983; see section A.5.6). The species is particularly characteristic of low intensity agricultural land (often at the margins of moorland) that would not normally be protected using site-based conservation measures. They are nearly always the first species to be lost following drainage of wet grasslands. Thus, the conservation of British breeding populations of this species will depend to a very great extent on the adoption of sympathetic agricultural policies that encourage the maintenance of traditional farming methods in areas where common snipe remain abundant and their re-establishment elsewhere.

Moorland habitats of common snipe are threatened by extensive blanket afforestation with alien conifers, particularly in the important peatlands of Caithness and Sutherland, and on Lewis (Stroud *et al.* 1987; see section A.5.13). The Hebridean machair is vulnerable to land use changes,

particularly changes to the traditional farming system (see section A.6.7). The population will thus benefit from the protection of the most important remaining sites in all these habitats as SPAs.

Being a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges will contribute to this.

Proportion currently protected within the SPA network

A total of *c.*2,600 pairs of breeding common snipe occur within the proposed SPA network (9% British total population).

In winter, common snipe congregate more densely at fewer, usually coastal, sites. A total of *c.*2,100 occur within the proposed SPA network. This is less than 1% of the estimated British wintering population. In cold weather, major movements of common snipe occur, with birds arriving from continental areas, as well as the redistribution of British birds.

A.6.3.50 Woodcock *Scolopax rusticola*

Conservation status

Annex II/1 of EEC Bird Directive; Schedule 2, part 1 of WCA 1981 (may be shot outside the close season); Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

About 21,500 pairs of woodcock breed in Britain, and these constitute 6% of the NW and Central European population. They are distributed throughout Britain.

Winter:

The British wintering population is certainly large, but, because of its cryptic and secretive nature, there is no reliable estimate of population size available. Woodcocks are generally distributed over much of Britain with the notable exception of high ground in Scotland and the north of England.

Habitat

Throughout the year woodcocks inhabit woodlands by day and feed in nearby fields by night.

Conservation needs

As it is a quarry species it is important that harvest levels and the degree of shooting disturbance are not excessive. Ensuring that there is an effective network of refuges will contribute to this.

Proportion currently protected within the SPA network

It is particularly difficult to undertake accurate counts of this species, and reliable quantitative information is not currently available for most sites. Therefore it is not currently possible to give a reliable estimation of the proportion of the breeding and wintering population protected by the proposed SPA network. There are occasional substantial influxes of woodcocks as a result of severe winter weather in continental Europe.

A.6.3.51 Black-tailed godwit *Limosa limosa*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Breeding black-tailed godwits are rare and localised in Britain with a current population of about 54 pairs. Most of these are in south-east England, but a few pairs breed annually in Somerset, northern England and Shetland. It was formerly a widespread breeding bird in wetlands in eastern England, but became extinct early in the 19th century. After sporadic breeding in the 1930s and 1940s, East Anglia was recolonised in 1952. Most belong to the nominate race, but those in northern Britain probably belong to the *islandica* race.

Winter:

The British wintering population is estimated to be 4,770 birds, and these form about 7% of the east Atlantic flyway population of the *islandica* race. They occur on a restricted number of estuarine sites, with the following regularly holding more than 400 birds simultaneously: Ribble, Stour, Langstone Harbour, Poole Harbour, Hamford Water, Dee, Exe, Chichester Harbour and Southampton Water. Numbers have declined since the mid 1970s.

Habitat

Black-tailed godwits breed in wet meadows, coastal grazing marshes and moorland bogs. In winter they occur on estuaries.

Conservation needs

Lowland wet grasslands are important traditional habitats for black-tailed godwits in southern and eastern Britain, yet this habitat is now much restricted because of drainage, agricultural

intensification and conversion to arable in recent decades (Smith 1983; Green & Cadbury 1987; Williams & Bowers 1987; see section A.5.6). The population will thus benefit from the protection of the most important remaining sites as SPAs. Summer flooding has been an important cause of breeding failure in recent years at the Ouse Washes, the godwit's most important breeding site (Green *et al.* 1987).

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, black-tailed godwits will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

In summer, a total of *c.*35 pairs of black-tailed godwit breed on sites within the proposed SPA network (*c.*65% of the British population). The site of greatest numeric importance is the Ouse Washes but breeding also occurs at at least three other sites widely spread throughout Britain.

Several sites are of particular importance during the spring and autumn migration periods, with the Ouse Washes regularly supporting significant numbers.

In winter, a total of *c.*3,800 black-tailed godwit are accommodated within the proposed SPA network. This amounts to 80% of the national and 6% of the international populations. Only 3 sites individually hold more than 1% of the international total. It is significant that over half the total protected by the network (60.9%) occurs on sites which individually hold less than 1% of the international total. This also demonstrates the need for a network of sites to sustain populations of this species.

A.6.3.52 Bar-tailed godwit *Limosa lapponica*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Bar-tailed godwits do not breed in Britain.

Winter:

The British wintering population is estimated to be 60,810 birds, and these form about 53% of the European component of the east Atlantic flyway population. It is widely distributed at estuarine sites around Britain, with major concentrations (more than 2,000 birds simultaneously) on the Ribble, Wash, Alt, Lindisfarne, Thames, Forth, Morecambe Bay and Solway.

Habitat

The majority of wintering birds (92%) are found within estuaries, where they prefer relatively sandy areas.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, bar-tailed godwits will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

In winter, a total of *c.*49,500 bar-tailed godwit are accommodated on sites within the proposed SPA network. This amounts to 81% of the national and 43% of the international populations.

A.6.3.53 Whimbrel *Numenius phaeopus*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Breeding whimbrels are scarce and restricted in Britain with a current population of about 465 pairs. The majority of these are in Shetland, with smaller numbers in Orkney, the Outer Hebrides and the Highlands (Richardson in prep.). Whimbrel were formerly much more abundant, but declined in the late 19th and early 20th centuries. However, numbers have recovered to some extent since the 1950s.

Passage:

Whimbrels winter in Africa, but occur regularly at certain estuarine and lowland grassland sites during autumn and spring passage periods. These sites constitute important traditional staging posts in the migration system of this species. The Severn Estuary is particularly important during spring passage when 2,000 or more whimbrel may be present at any one time (turnover rates are not known, but totals are almost certainly much greater), feeding inland on the Somerset and Gwent Levels and roosting on the estuary (Ferns 1977).

Habitat

In Britain breeding usually occurs on moorland and maritime heaths dominated by heather, cotton-grass or other long grasses. On passage, whimbrels are associated with estuaries and with traditionally managed lowland wet grasslands.

Conservation needs

The breeding localities are vulnerable to land use changes, particularly agricultural developments and afforestation. The agricultural intensification of moorland in Shetland by fertilisation and seeding with grass destroys breeding areas as whimbrel do not nest in the newly created fields (Grant 1989). The population will thus benefit from the protection of important moorland breeding areas within the proposed SPA network. Egg collectors and human disturbance are additional threats to the breeding birds.

Lowland wet grasslands are important as feeding areas for passage birds, yet this habitat is now much restricted because of drainage, agricultural intensification and conversion to arable in recent decades (see section A.5.6).

Since waders that use estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, whimbrel will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

In summer, a total of *c.*100 pairs of whimbrel are located within the proposed SPA network (22% of the British total). These proportions are expected to increase significantly with the determining of boundaries of further sites on Shetland following recent moorland bird surveys there. Although the majority of this total is on Shetland, where the major proportion of the population in Britain is located, other sites in northern Scotland are of importance in maintaining the range of this species in Britain.

A.6.3.54 Curlew *Numenius arquata*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 35,500 pairs of curlews breed in Britain, and these constitute 28% of the NW and Central European population. They are widely distributed in northern and western Britain.

Winter:

The British wintering population is estimated to be 91,200 birds, and these form about 26% of the east Atlantic flyway population. Curlews are widely distributed in coastal areas of Britain.

Habitat

Curlews typically breed in upland areas, favouring moist, poorly-drained moors and heaths, and also grasslands farmed in a traditional low-intensity manner. In winter they occur on both estuarine and non-estuarine coasts and on adjacent farmland.

Conservation needs

Breeding birds are vulnerable to land use changes, particularly agricultural intensification and afforestation of moorland and rough grassland habitats.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, curlews will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of about 1,400 pairs of curlew (4% of the British total; 1% of the international breeding population) breed on sites in the proposed SPA network. Boundaries of a number of moorland pSPA are, however, still to be determined following recent ornithological survey and this may increase the proportion of the breeding population

protected by SPAs. The species is particularly characteristic of low intensity agricultural land (often at the margins of moorland) that would not normally be protected using site-based conservation measures. Thus the conservation of British breeding populations will depend to a very great extent on the adoption of sympathetic agricultural policies that encourage the maintenance of traditional farming methods, in areas where curlew are abundant, and their re-establishment elsewhere.

In winter, a total of *c.*47,500 curlew occur on sites within the proposed SPA network (52% of the British total; 14% of the international population). It is significant that only three sites individually hold greater than 1% of the international total. Yet the remainder of sites within the network hold over 66% of the total protected. This demonstrates the need for a network of sites to sustain wintering populations of this species.

A.6.3.55 Redshank *Tringa totanus*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 32,500 pairs of redshank breed in Britain, and these constitute 12% of the NW and Central European population. They are widely distributed in Britain at coastal and inland locations. Numbers breeding inland declined during the 19th century and again since the 1940s. British breeding birds belong to the nominate race.

Winter:

The British wintering population is estimated to be 75,400 birds, and these form about 69% of the NW European component of the east Atlantic flyway population. They are thinly distributed, mainly in coastal areas of Britain. There has been a substantial decline in numbers overwintering in Britain in recent years. Wintering birds are a mixture of individuals from the nominate and *robusta* races.

Habitat

Redshanks breed mainly in coastal areas on the mid and upper parts of saltmarshes, on coastal grazing marshes, and on damp machair (where very high densities occur: Fuller *et al.* 1986; Shepherd 1989). Inland they breed in damp pastures, in lowland river valleys, and on rough grazing land in upland valleys. Outside the breeding season they mainly frequent coastal habitats, with 75% of the wintering birds associated with estuaries.

Conservation needs

Past declines in the numbers of inland breeding redshank have been linked with losses of lowland wet grassland habitats because of drainage, agricultural intensification and conversion to arable (Smith 1983; see section A.5.6). Thus the population will benefit from the protection of remaining sites of importance as SPAs.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, redshanks will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1). Saltmarshes are used extensively by redshanks throughout the year but are severely reduced in area on many estuaries particularly on the landward side owing to agricultural and industrial encroachment (see section A.5.5).

Proportion currently protected within the SPA network

A total of *c.*3,900 pairs of breeding redshank occur within the proposed SPA network (12% of the British total population; 1.5% of the international breeding population). Redshanks are widely scattered on sites including peat-bogs, salt-marshes, machair and lowland wet grassland. In the lowlands they have been subject to major declines in numbers and range attributed to habitat change (Smith 1983). The species is particularly characteristic of low intensity farmland (often at the margins of moorland) that would not normally be protected using site-based conservation measures. Thus, the conservation of British breeding population of this species will depend to a very great extent on the adoption of sympathetic agricultural policies that encourage the maintenance of traditional farming methods, in areas where redshanks remain abundant, and their re-establishment elsewhere (e.g. Stroud & Pienkowski 1989).

In winter, redshank congregate more densely at fewer, coastal sites. A total of *c.*48,300 occur within the proposed SPA network (64% of the British wintering population; 44% of the international population).

A.6.3.56 Spotted redshank *Tringa erythropus*

Conservation status

Annex II/2 of EEC Bird Directive; Appendix III of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Spotted redshanks do not breed in Britain.

Passage and winter:

A small number of spotted redshanks, about 200 birds, overwinter in Britain, but they mainly occur as spring and autumn passage migrants. Wintering birds occur mainly at estuarine sites in southern and south-western England, while passage birds are found at coastal and inland sites throughout southern Britain, especially in eastern England.

Habitat

Wintering birds are associated with estuaries where they also use adjacent fresh or brackish lakes, pools and streams. Passage birds also occur inland at reservoirs, gravel pits and sewage farms.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, spotted redshanks will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

A.6.3.57 Greenshank *Tringa nebularia*

Conservation status

Annex II/2 of EEC Bird Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

About 1,545 pairs of greenshanks breed in Britain, and these constitute 1% of the NW and Central European population. Britain is, however, the only EEC Member State in which they breed. Within Britain breeding is confined to central and north-western Scotland, including Lewis and Harris. Numbers are have declined in Caithness and Sutherland in recent years because of afforestation of traditional habitats with alien conifers.

Winter:

A small number of greenshanks, about 400 birds, overwinter in Britain and these form about 2% of the east Atlantic flyway population. They occur in scattered coastal localities mainly in western and south-western Britain.

Habitat

Greenshanks breed in the open peatlands of the northern and western Scottish Highlands. In winter they occur mainly on estuaries.

Conservation needs

Breeding greenshanks are currently severely threatened by widespread afforestation of the Scottish peatlands, particularly in Caithness and Sutherland where in the order of 130 pairs have already been lost (Stroud *et al.* 1987; see section A.5.13). Thus the population will benefit from the protection of remaining sites of importance as SPAs. Additional threats to breeding birds include egg collecting and human disturbance.

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, greenshanks will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of *c.*660 pairs of greenshanks breed within the proposed SPA network, principally on two sites: the peatlands of Caithness and Sutherland, and the Lewis peatlands. This amounts to 43% of the estimated British breeding population.

A number of pSPAs are important during the migration period, although peak numbers there vary considerably between years. These sites include the Wash, Langstone Harbour, and the Medway and Thames estuaries.

In winter, numbers are also variable between years but an estimated total of *c.*90 greenshanks occur within the network. This is 23% of the British wintering total.

A.6.3.58 Green sandpiper *Tringa ochropus*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; Appendix II of the Bonn Convention.

Population and distribution

Breeding:

Does not currently breed in Britain although there have been two proven cases this century: in Westmorland in 1917 and in Inverness-shire in 1959.

Passage and winter:

Small numbers of green sandpipers, about 300 birds, overwinter in southern Britain, but the species is most commonly encountered as a spring and autumn passage migrant, particularly in south-eastern England.

Habitat

While some passage and wintering birds frequent estuaries, the majority occur inland on the margins of streams, ditches, farm ponds, gravel pits and sewage works.

Conservation needs

Since waders that use estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, green sandpipers will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

A.6.3.59 Common sandpiper *Actitis hypoleucos*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

About 18,500 pairs of common sandpipers breed in Britain, and these constitute 2% of the NW and Central European population. They are widely distributed in upland and northern areas of Britain.

Passage and winter:

The main wintering areas of common sandpipers are in Africa, but a small number, about 40 birds, do remain to overwinter in southern Britain where the species is also a common autumn passage migrant.

Habitat

Common sandpipers breed alongside upland streams, rivers and clear lakes. The majority of passage birds occur at inland water bodies, while wintering birds frequent both inland and estuarine sites.

Conservation needs

The well-being of breeding birds is dependent upon the quality of upland freshwater environments. These are vulnerable to the effects of acidification arising from airborne pollution and run-off from conifer plantations (see section A.5.15). Thus the population will benefit from the protection of sites of major importance as SPAs.

Since waders that use estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, common sandpipers will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of about 650 pairs of common sandpipers (4% of the British total) breed on sites in the proposed SPA network. However, boundaries of a number of moorland pSPAs are still to be determined following recent ornithological survey, and this may increase the proportion of the breeding population protected by SPAs. However, the species occurs widely in moorland and upland areas at low density. Thus the conservation of British breeding populations of this species will depend to a great extent on the adoption of sympathetic policies in these areas (for instance the discouragment of ecologically damaging activities such as blanket afforestation by alien conifers).

Small numbers regularly occur on migration on sites such as the Wash, but no birds winter in significant numbers.

A.6.3.60 Turnstone *Arenaria interpres*

Conservation status

Appendix II of the Berne Convention; Appendix II of the Bonn Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Breeding has been suspected in Scotland in recent years, but not proven.

Winter:

The British wintering population is estimated to be 44,480 birds, and these form about 66% of the European component of the east Atlantic flyway population. They occur widely in coastal areas of Britain.

Habitat

Wintering birds occur on estuaries, sandy beaches and, particularly, rocky shores.

Conservation needs

Since waders that winter on estuaries are particularly vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these sites, they will benefit from the protection afforded by the proposed SPA network. Other human influences such as recreational disturbance, commercial exploitation of shellfish and worms, and oil and industrial pollution are also potentially damaging to the conservation interest of estuaries (see section A.5.1).

Proportion currently protected within the SPA network

A total of c.18,000 turnstones winter on the proposed SPA network (40% of the British wintering total; 27% of the international flyway population). Only 9 sites individually hold more than 1% of the international total. It is significant that nearly half the total protected by the network (45.1%) occurs on sites which individually hold less than 1% of the international total. This demonstrates the need for a network of sites to sustain populations of this species.

A.6.3.61 Arctic skua *Stercorarius parasiticus*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

In Britain breeding is confined to north and west Scotland, with the main concentrations in Shetland and Orkney. The population in 1985-87 was about 3,350 pairs and has increased substantially since 1969/70. Arctic skuas do not breed in any other EEC country. Britain holds about 19% of the western European breeding total which is estimated to be about 17,300 pairs.

Winter:

Arctic skuas spend the winter in the southern hemisphere.

Habitat

Arctic skuas breed on moorlands, varying from blanket bogs to drier heather moors. They feed at sea usually by forcing other seabirds to drop or disgorge their food.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species including arctic skuas, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely aerial species, arctic skuas are less vulnerable to oil pollution than some other seabirds. Some persecution of skuas occurs in Shetland and Orkney arising from alleged damage to agricultural interests (Furness 1986; Ewins *et al.* 1988).

Proportion currently protected within the SPA network

A total of c.1,170 pairs of arctic skuas nest within the proposed SPA network in summer (35% of the British total; 7% of the international total). These proportions are expected to increase with the determining of boundaries of further sites on Shetland following recent surveys there. Although the majority of this total is on Shetland (62.7%: 690 on 10 sites) and Orkney (30.9%: 340 on 7 sites) where the population is centred, in Britain, other sites in the west of Scotland are of great importance for maintaining the range of this species in Britain (and indeed in the world). The non-breeding

component is important for population survival and the expression of conservation importance of sites on the basis of arctic skua pairs alone can be misleading. Feeding areas for this skua are currently poorly catered for by the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.62 Great skua *Stercorarius skua*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population in 1985-87 was about 7,900 pairs with the majority (97%) on Shetland and Orkney. Great skuas do not breed in any other EEC country, and Britain holds about 59% of the world population of the nominate race.

Winter:

Great skuas spend the winter in the Mediterranean, off west Africa and in the South Atlantic.

Habitat

Breeding occurs in loose colonies on coastal grassy moors. Food is obtained naturally at sea and also by scavenging at trawlers or by forcing other seabirds to drop or disgorge their food.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species including great skuas, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely aerial species, great skuas are less vulnerable to oil pollution than some other seabirds. Some persecution of skuas occurs in Shetland and Orkney arising from alleged damage to agricultural interests (Furness 1986; Ewins *et al.* 1988).

Proportion currently protected within the SPA network

A total of c.5,430 pairs of great skuas nest within the proposed SPA network in summer (69% of the British total; 40% of the internation total). Although the majority of this total is on Shetland (78.6%: 4,270 on 9 sites) and Orkney (18.5%: 1,000 on four sites) other sites in the north and west of Scotland are of great importance in maintaining the range of this species in Britain. The non-breeding component is important for population survival and the expression of conservation importance of sites on the basis of great skua pairs alone can be misleading. Feeding areas for this skua are currently poorly catered for by the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.63 Common gull *Larus canus*

Conservation status

Annex II/2 of EEC Birds Directive; Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population is in the order of 47,000 pairs of which about 15,000 breed in coastal areas. They are widely distributed in Scotland and parts of northern England. Elsewhere breeding occurs across Scandinavia and the northern USSR.

Winter:

Britain is an important overwintering area for common gulls and supports in the order of 635,000 birds.

Habitat

Breeding and wintering birds occur both on inland hills and moors and in coastal areas. In many areas, breeding common gulls are an important component of the moorland bird assemblage (Stroud *et al.* 1987). In winter the preferred feeding areas are well-grazed grasslands, particularly on well-drained limestone soils, and often above 100 m in altitude (Vernon 1970). Large, traditional winter night-roosts occur on estuaries and inland reservoirs.

Conservation needs

Breeding and wintering birds are vulnerable to wide-scale changes in land use, such as blanket afforestation of heather moorland and agricultural intensification. On a scale relevant to most common gulls these are matters best addressed through special protection measures in the wider countryside.

Proportion currently protected within the SPA network

A total of c.5,420 pairs of common gull nest on sites within the proposed SPA network (12% of the British population; 1% of the international population). At several sites, common gulls occur as part of an assemblage of other gull species.

A.6.3.64 Lesser black-backed gull *Larus fuscus*

Conservation status

Annex II/2 of EEC Birds Directive; Schedule 2 part II of WCA 1981 (may be killed by authorised persons at all times).

Population and distribution

Breeding:

Britain holds about 81,600 pairs of breeding lesser black-backed gulls and these are widely distributed in coastal and inland areas. British breeding birds are of the *graellsii* race which breeds also in Iceland, Ireland, France and NW Spain. Britain supports about 75% of the total breeding population of this race. Numbers have generally increased between 1969-70 and 1985-87.

Winter:

Over the last 40 years increasing numbers of lesser black-backed gulls have overwintered in southern Britain. The total amounts to about 60,000 birds.

Habitat

Nesting occurs on grassy slopes of undisturbed coasts and offshore islands, as well as on inland moorlands. Wintering birds occur both on the coast and inland. Favoured feeding areas are refuse tips, fields and at sea.

Conservation needs

The main requirement is to protect breeding colonies from disturbance and damage. Such sites will, therefore, benefit from SPA designation.

Proportion currently protected within the SPA network

A total of *c.*41,100 pairs of lesser black-backed gulls nest on 25 sites within the proposed SPA network (50% of the British population; 38% of the international population). At several sites, lesser black-backed gulls occur as part of an assemblage of other gull species, and seven sites individually hold more than 1% of the international breeding population.

A.6.3.65 Great black-backed gull *Larus marinus*

Conservation status

Annex II/2 of EEC Birds Directive; Schedule 2 part II of WCA 1981 (may be killed by authorised persons at all times).

Population and distribution

Breeding:

The British breeding population is about 17,900 pairs, widely distributed in northern and western coastal areas. Elsewhere in western Europe breeding occurs in Iceland, Scandinavia, Denmark and NW France. Britain holds about 21% of the western European population.

Winter:

Large numbers of great black-backed gulls overwinter in both coastal and inland areas of Britain. No reliable estimate is available of the total numbers involved.

Habitat

Breeding occurs on coastal cliffs and islands. Throughout the year food is obtained largely from the sea (particularly by scavenging from fishing boats) but refuse tips are also important feeding sites.

Conservation needs

The main requirement is to protect breeding colonies from disturbance and damage. Such sites will, therefore, benefit from SPA designation.

Proportion currently protected within the SPA network

A total of *c.*7,000 pairs of great black-backed gulls nest on 25 sites throughout Britain within the proposed SPA network (39% of the British population; 8% of the international population). At several sites, great black-backed gulls occur as part of an assemblage of other gull species. Feeding areas for this gull are currently poorly catered for by the proposed SPA network. These aspects are currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.66 Kittiwake *Rissa tridactyla*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population is about 486,900 pairs with colonies widely scattered around the coastline. Numbers increased by about 20% between 1969-70 and 1985-87. Other breeding concentrations in the Western Palearctic occur in Iceland, Ireland, Norway and the northern USSR. Britain holds 90% of the EEC breeding population and about 23% of that of western Europe.

Winter:

Kittiwakes are the most oceanic of Britain's gulls and spend the winter largely at sea.

Habitat

Breeding takes place on coastal cliffs and food is collected from the sea.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely aerial species, kittiwakes are less vulnerable to oil pollution and entanglement in fishing nets than some other seabirds.

Proportion currently protected within the SPA network

A total of *c.*340,500 pairs of kittiwakes nest on 44 sites within the proposed SPA network (70% of the British population; 16% of the international population). No marine feeding or gathering areas for this species are currently included within the proposed SPA network. The necessary protection for this species is currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.67 Guillemot *Uria aalge*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population comprises about 1,044,000 individual birds on breeding ledges (the standard census unit), with the majority located around the Scottish coastline. Numbers have more than doubled since 1969/70. Britain holds about 87% of the breeding population of the EEC, and 29% of that of western Europe (including Iceland and the Faroes).

Autumn:

Adult and juvenile guillemots typically gather in large concentrations in coastal waters in July and August each year (Tasker *et al.* 1987). For part of this time the birds are flightless as adults moult their wing feathers and juveniles grow theirs. These concentrations are highly vulnerable to oil pollution.

Winter:

Guillemots spend the winter at sea.

Habitat

Guillemots nest on coastal cliffs and on rock stacks. When not at the colonies they frequent coastal and offshore waters.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species such as guillemots, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely sea surface-dwelling species, guillemots are especially vulnerable to oil pollution. In some parts of the world auks are frequently caught and killed in monofilament fishing nets. Sensible controls on the use of such nets in British coastal waters are to be recommended.

Proportion currently protected within the SPA network

A total of *c.*760,800 individual adult guillemots nest at 42 colonies within the proposed SPA network (73% of the British population; 21% of the international population). At several sites, guillemots occur as part of an assemblage of other auk species (see section 2.4.8). No feeding or

gathering areas for this species are currently included within the proposed SPA network. The necessary protection for this species is currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.68 Razorbill *Alca torda*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population comprises about 144,500 individual birds on breeding ledges (the standard census unit), with the majority located around the Scottish coastline. Numbers have increased substantially since 1969/70. Britain holds about 80% of the breeding population of the EEC and 14% of that of western Europe (including Iceland and the Faroes).

Autumn:

Adult and juvenile razorbills typically gather in large concentrations in coastal waters in July and August each year. For part of this time the birds are flightless as adults moult their wing feathers and juveniles grow theirs. These concentrations are highly vulnerable to oil pollution.

Winter:

Razorbills winter at sea around the North Sea and eastern Atlantic south to the Mediterranean.

Habitat

Razorbills nest on coastal cliffs and on rock stacks. When not at the colonies they frequent coastal and offshore waters.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species such as razorbills, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely surface-dwelling species, razorbills are especially vulnerable to oil pollution. In some parts of the world auks are frequently caught and killed in monofilament fishing nets. Sensible controls on the use of such nets in British coastal waters are to be recommended.

Proportion currently protected within the SPA network

A total of *c.*99,100 individual adult razorbills nest at 41 colonies within the proposed SPA network (69% of the British population; 9% of the international population). At several sites, razorbills occur as part of an assemblage of other auk species (see section 2.4.8). No feeding or gathering areas for this species are currently included within the proposed SPA network. The necessary protection for this species is currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.69 Black guillemot *Cepphus grylle*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British population comprises in excess of 35,000 birds (the usual census unit for this species is birds at the breeding localities in April – Ewins 1985), with the majority located around the Scottish coastline. Numbers have probably increased since 1969/70. Britain holds about 93% of the breeding population of the EEC and 16% of that of western Europe (including Iceland and the Faroes).

Winter:

Black guillemots overwinter in coastal waters around the British Isles.

Habitat

Nesting occurs in holes and crevices on rocky and boulder-strewn coasts. Birds are resident in inshore waters along these coasts throughout the year.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species such as black guillemots, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely surface-dwelling species, black guillemots are particularly vulnerable to oil pollution. Colonial, island-nesting seabirds are especially vulnerable to ground predators, such as cats and rats, and care needs to be taken to ensure that these species are not introduced to islands holding seabird colonies. Control measures may be needed at sites where this has happened (see section A.5.4). In some parts of the world auks are

frequently caught and killed in monofilament fishing nets. Sensible controls on the use of such nets in British coastal waters are to be recommended.

Proportion currently protected within the SPA network

A total of c.6,100 individual adult black guillemots nest on 28 sites within the proposed SPA network (17% of the British population; 3% of the international population). No feeding or gathering areas for this species are currently included within the proposed SPA network. The necessary protection for this species is currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.70 Puffin *Fratercula arctica*

Conservation status

Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

The British breeding population comprises about 720,000 individual birds at colonies. The vast majority of these are in Scotland and numbers have increased in recent years. Britain holds about 94% of the breeding population in the EEC and 3% of western Europe (including Iceland and the Faroes).

Winter:

Puffins spend the winter at sea.

Habitat

Nesting takes place in burrows and crevices on offshore islands and mainland cliffs. When not at the colonies they frequent coastal and offshore waters.

Conservation needs

Because of its extensive and varied coastline, Britain holds internationally important populations of most seabird species such as puffins, and, therefore, has a special responsibility for their protection. Seabirds are sensitive to changes in the quality of the marine environment, particularly to changes in fish stocks and human fishing activities. Being a largely surface-dwelling species, puffins are especially vulnerable to oil pollution. Colonial, island-nesting seabirds are especially vulnerable to ground predators, such as cats and rats, and care needs to be taken to ensure that these species are not introduced to islands holding seabird colonies. Control measures may be needed at sites where this has happened (see section A.5.4). In some parts of the world auks are frequently caught and killed in monofilament fishing nets. Sensible controls on the use of such nets in British coastal waters are to be recommended.

Proportion currently protected within the SPA network

A total of c.455,400 pairs of puffins nest on sites within the proposed SPA network (63% of the British population; 2% of the international population). At several sites, puffins occur as part of an assemblage of other auk species (see section 2.4.8). No feeding or gathering areas for this species are currently included within the proposed SPA network. The necessary protection for this species is currently being reviewed by Tasker *et al.* (in prep.).

A.6.3.71 Shore lark *Eremophila alpestris*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Breeding in Britain has been confirmed just once at a Scottish site in 1977. Summering birds were also recorded in 1972-73 and 1976. The main breeding range is in northern Scandinavia and the USSR.

Winter:

Shore larks are regular winter visitors to Britain with numbers in the order 300-1,500 birds.

Habitat

Nesting usually occurs in open tundra and montane uplands. Wintering birds are found in coastal habitats where they feed among saltmarsh and sand dune vegetation.

Conservation needs

No special conservation measures specifically directed at shore larks are appropriate at present. Should further breeding attempts occur then protection of nest sites from human disturbance and egg collectors will be required.

A.6.3.72. Redwing *Turdus iliacus*

Conservation status

Annex II/2 of EEC Birds Directive; Schedule 1 of WCA 1981; Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

A rare breeding bird in Britain with 20-52 pairs recorded in recent years, mostly in the Scottish Highlands. Elsewhere it breeds in Iceland, Faeroes, Scandinavia, north and central Russia, NE Germany and Poland.

Winter:

Redwings are regular and abundant winter visitors to most parts of Britain. Numbers are highly variable but are in the order of 800,000 birds.

Habitat

Breeding birds in Scotland are usually associated with hillside birch woods, oak woods, or grassy areas with alders and gorse. Wintering birds are usually associated with hedgerows (where they feed on fruits and berries) and with open fields.

Conservation needs

The breeding population is small and, therefore, is vulnerable to such factors as human disturbance and local habitat changes. Early cutting of hedgerows removes much potential food, such as hawthorn berries, before redwings arrive in the autumn. Encouragement of later cutting would be a useful wider countryside measure to help this species as well as other migrant thrushes.

Proportion currently protected within the SPA network

In winter a highly variable and nationally uncollated proportion of the British total occurs on pSPAs.

A.6.3.73 Brambling *Fringilla montifringilla*

Conservation status

Schedule 1 of WCA 1981; Appendix III of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Sporadic breeding by up to four pairs has occurred in Scotland since 1920. The main breeding areas are in northern Europe and the USSR.

Winter:

Bramblings are regular passage and winter visitors to Britain, but numbers are highly variable and may be in the order of 40,000 – 1,800,000 birds.

Habitat

Bramblings breed in coniferous and birch forests, mixed woodland or birch scrub across northern Europe and Asia. Passage and wintering birds are usually associated with beech trees as beechmast forms their staple diet.

Conservation needs

Should breeding become more regular in Britain then SPA designation of breeding areas would be desirable together with wider maintenance of the birch woodland habitat which they use. Wintering birds would benefit from the encouragement of planting of lowland broadleaf woodland with a high beech content.

A.6.3.74 Twite *Carduelis flavirostris*

Conservation status

Schedule 3 of WCA 1981; Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Accurate population estimates are not available, but Britain probably has a breeding population of 15-30,000 pairs. The main concentrations are in north and west mainland Scotland, Orkney, Shetland, the Hebrides and the west of Ireland.

There is an isolated breeding population in the Pennines (Davies 1988). Britain holds the entire NW European population of the *pipilans* race. Elsewhere, individuals of the nominate race breed in Norway and Finland.

Winter:

The British wintering population is probably in the order of 80,000-120,000 birds. Pennine breeders overwinter on the saltmarshes of Essex, The Wash and in the Low Countries, while Scottish and Irish birds appear to be mainly sedentary (Davies 1988).

Habitat

In the Pennines twite breed on heather moorland but commute to areas of pasture and re-seeded upland grassland nearby to feed (Orford 1973). In northern and western Scotland and in Ireland they also breed on heather moorland but in addition can be found in coastal areas where they feed on short grassy turf and around farms and crofts (Davies 1988). In winter twite in England are mainly associated with saltmarshes.

Conservation needs

Upland breeding twite are one of an assemblage of species that are threatened by afforestation and agricultural developments on heather moorland. They are also vulnerable to agricultural change in traditional low intensity farming areas where they breed and winter in northern Britain. Twite that winter on saltmarshes are vulnerable to land-claim and other developments, such as the construction of barrages that would disturb or damage the existing ecology of these estuarine areas. In all these localities twite will benefit from the protection that SPA designation would bring.

Proportion currently protected within the SPA network

In winter, a total of about 15,000 twites occur on sites within the proposed SPA network (15% 0f the British wintering population). These are mainly coastal areas such as the Wash (Davies 1988).

A.6.3.75 Snow bunting *Plectrophenax nivalis*

Conservation status

Schedule 1 of WCA 1981; Appendix II of the Berne Convention; not a quarry species in Britain.

Population and distribution

Breeding:

Snow buntings have nested in Scotland in very small and fluctuating numbers since the late 19th century (Nethersole-Thompson 1966; Milsom & Watson 1984). In recent years the numbers recorded breeding have normally varied between 6-20 pairs, but may have reached up to 50 pairs. Elsewhere in the Western Palearctic snow buntings also breed in Iceland, Scandinavia and arctic USSR. Britain holds the whole EEC breeding population.

Winter:

Snow buntings are regular winter visitors to Britain with an estimated population of 8-12,000 birds.

Habitat

Breeding is confined to a very few of the highest mountains in Scotland where suitable arctic conditions occur. Nesting usually occurs above 900 m in areas with arctic types of vegetation. Both solitary pairs and small groups of pairs occur. Males frequently use rocky outcrops as singing posts. Wintering flocks are usually found in coastal habitats but some do occur in upland areas.

Conservation needs

The British breeding population is of importance for maintaining the range in Europe and will benefit from the protection provided by SPA designation. Breeding birds are vulnerable to human disturbance and associated impacts, especially where access to mountain tops is facilitated by ski lifts. Snow buntings are part of an assemblage of arctic/alpine bird species nesting in montane areas of Scotland.

Proportion currently protected within the SPA network

A substantial, but currently unquantified proportion of the British breeding and wintering population of snow buntings occurs on sites within the proposed SPA network.

Appendix 7 Criteria used to select important bird areas in Europe by ICBP.

Criteria used to select sites (taken from Grimmett & Jones 1989).

The following categories of sites have been selected, using criteria which are outlined below. Each criterion has supplementary explanatory notes which are not reproduced in full here but are given by Grimmett & Jones (1989) pp. 11-34.

Category 1: Sites for migratory species which congregate (either when breeding, or on passage, or in winter) in important numbers.

Criteria:
1. The site regularly holds 1% of a species's world population; or
2. the site regularly holds 1% of a species European population (or EEC population for EEC Member States only); or
3. the site regularly holds 1% of a species biogeographical population; or
4. it is a 'bottleneck site' where over 5,000 storks *(Ciconiidae)* or over 3,000 raptors *(Accipitridae)* regularly pass through on spring or autumn migration.

See notes 1, 2 and 3, and Appendices 1a and 1b given by Grimmett & Jones (1989).

Category 2: Sites for globally threatened species.

Criterion:
1. The site regularly holds significant numbers of the species.

See note 4[1] and Appendix 2 given by Grimmett & Jones (1989).

Category 3: Sites for species and subspecies which are threatened throughout all or large parts of their range in Europe (but are not globally threatened).

Criteria:
1. The site is one of the five most important in the European region in question for the species or subspecies, or one of the ten most important in the European region in question for the species or subspecies (if the region is particularly large and is divided into comparatively small political units; the regions used when applying the criteria are given in Appendix 5); or
2. the site is one of the 100 most important in Europe for the species or subspecies; or
3. the site is one of the 100 most important for the species or subspecies in the European Community.

See notes 5, 6, 7, 8, 9 and 10, and Appendices 3 and 5 given by Grimmett & Jones (1989).

Category 4. Sites for species which have relatively small total world ranges with important populations in Europe.

Criteria:
1. The site is one of the five most important in the European region in question for the species, or one of the ten most important in the European region in question for the species (if the region is particularly large and is divided into comparatively small political units; the regions used when applying the criteria are given in Appendix 5); or
2. The site is one of the 100 most important in Europe for the species.

See notes 5, 6, 11 and 12, and Appendices 4 and 5 given by Grimmett & Jones (1989).

[1] Those occurring in Britain include: lesser white-fronted goose, red kite, sea eagle and corncrake.