Table 4.4 Important birds of lowland wet grasslands in England

Species	EN priority	Annex I	Schedule 1	Population trend
Bewick's Swan	High (1)	*	(1)	Stable
Whooper Swan	High (2)	*	(1)	Increasing
Bean Goose	High (1)			Stable
Barnacle Goose	High (2)	*		Increasing
Wigeon	High (2)			Increasing
Gadwall*	High (1)			Increasing
Teal*	High (2)			Uncertain
Pintail	High (2)			Stable or increasing
Garganey*	High (1)		1	Declining
Shoveler*	High (2)			Uncertain
Pochard*	High (1)			Stable^
Spotted Crake*	High (2)	*	1	Fluctuating
Corncrake*	High (2)	*	1	Declining
Golden Plover	High (2)	*	(1)	Declining
Lapwing*	High (2)			Declining
Ruff*	High (1)	*	1	Fluctuating
Snipe*	Medium			Declining
Black-tailed Godwit*	High (1)		1	Declining
Curlew*	High (2)			Increasing?
Redshank*	High (2)			Declining
Barn Owl*	High (2)		1	Declining
Short-eared Owl*	Medium	*		Increasing?
Yellow Wagtail*	Medium			Declining
Whinchat*	Medium			Declining

* denotes birds that breed on lowland wet grasslands.
^ the European wintering population of the Pochard is thought to be declining.

Threats and opportunities: The principal threat to the birds of lowland wet grasslands continues to be agricultural intensification. Drainage, increased stocking rates and a shift from hay to silage production can reduce the ornithological interest. Habitat loss through incentive-driven conversion to arable farmland no longer poses the threat it did up to the mid-1980s. Lack of management also poses a threat to lowland wet grasslands, which are dependent on grazing and/or cutting to maintain their habitat structure, as is the inability to control water levels (for one reason or another) at critical times of the year.

Agricultural intensification usually relies upon draining grasslands to reduce the frequency of flooding and to lower the water table. Many drainage schemes have been promoted in the past with the aim of increasing food production, and were funded by public money. Although the need to increase production no longer exists, the control structures that remain continue to favour agricultural interests over those of nature conservation. Therefore, despite guidance from MAFF, the Internal Drainage Boards in particular have failed to take account of the ornithological interest

of several important sites in lowland England when exercising their duties (Williams & Bowers 1987). The forthcoming reforms of the EC Common Agricultural Policy may provide an opportunity to re-create or restore lowland wet grasslands.

Knowledge of status and population trends: Our knowledge of the distribution, numbers and population trends of bird species on lowland wet grasslands is generally very good. In 1982, BTO, RSPB and NCC organised the first major survey of the breeding waders of lowland wet grasslands in England and Wales (Smith 1983). This determined the numbers and distribution of five species: Lapwing, Snipe, Curlew, Redshank and Oystercatcher. A repeat survey of a sample of sites was also undertaken in 1989 (O'Brien & Smith 1992). A number of site-specific breeding wader surveys have also been carried out by RSPB (see, for example, Robbins & Green 1988).

The population trends of a number of species breeding on lowland wet grasslands are monitored by the long-term census projects organised by BTO; the Common Birds Census and the Waterways Bird Survey. These allow population indices to be calculated for Oystercatcher, Lapwing, Snipe, Curlew, Redshank and Yellow Wagtail. Several rare species including Garganey, Ruff and Black-tailed Godwit are monitored annually by the Rare Breeding Birds Panel.

Our knowledge of wintering waterfowl on lowland wet grasslands is similarly good, with most important winter sites included in the National Waterfowl Counts network and reported annually in the 'Wildfowl and Wader Counts' report. There is, however, a need to extend the NWC site network to include more winter floodlands.

Ecological requirements: In recent years, a large amount of research into the ecological requirements and, therefore, management needs of waders breeding on lowland wet grasslands has been undertaken (Green 1986 & 1988; Burgess & Hirons 1990; Tickner & Evans 1991). This work concludes that a combination of factors are important in determining the quality of the habitat and therefore the breeding success of wet grassland waders. The most important factors appear to be the hydrology and substrate of the grassland and the management of the grazing and cutting regimes. During the breeding season it is important that a high water level is maintained, creating a scattering of shallow surface pools and an extensive area where the water table is within 15-30 cm of the surface (Green 1986). This provides conditions suitable for Redshank, which feed in the surface pools, Snipe, which require a moist soil for probing, and Lapwing which prefer bare ground and short turf areas for foraging. Suitable breeding conditions should be maintained for as long as possible to allow waders to compensate for predation and trampling losses by laying replacement clutches. Waders also make use of ditch margins when feeding conditions in the grasslands are unsuitable, so these should be managed to maximise their value to birds and other wildlife (Newbold *et al* 1989). This might include damming ditches to retain water (which will also percolate back into the fields) and creating sloping ditch sides and berms to increase the available feeding area.

Grazing and/or cutting are essential for the maintenance of the habitat structure of lowland wet grassland. However, studies of 'meadowbirds' in the Netherlands have shown that excessive nest losses can occur if livestock densities are too high or grazing begins too early in the year (Beintema 1982). Stocking rates should be less than two cattle per hectare and should not commence until late May or early June (Green 1986). It is, however, essential that sufficient grazing intensities are applied in order to produce a suitable habitat structure for breeding waders in the following

year (usually between 120-300 livestock unit days/hectare - Tickner & Evans 1991). Similarly, cutting in July and even August can cause chick losses for Snipe, Black-tailed Godwit and Yellow Wagtail, whose young remain in the tall grass for some time after hatching. This is a particular problem for second broods. Cutting should be undertaken from the middle of the field to the ends, or in strips to avoid trapping wader chicks.

Variation in the grazing/cutting regimes and water level management throughout the year within large lowland wet grassland sites can favour a range of breeding and wintering waterfowl with differing nesting and feeding requirements. For example, breeding waders require different sward height for nesting. Black-tailed Godwit (2-10 cm) and Lapwing (10-15 cm) require short grass whereas Redshank and Snipe will nest in vegetation up to 50 cm and 80 cm tall respectively (Tickner & Evans 1991). Different species of wintering wildfowl favour a variety of water depths from shallows with small pools (Teal and Shoveler), newly flooded shallow water up to 30 cm depth (Pintail and Wigeon), to deeper water (Bewick's Swan, up to 1 m; and Pochard, 1-3 m).

The provision of suitably high water tables in the breeding season is usually achieved by flooding grasslands in winter. This creates ideal feeding conditions for wintering wildfowl and some waders. Flooding in late spring or early summer can, however, be detrimental to breeding waders, and this is thought to be a major reason for the recent decline in Black-tailed Godwits nesting on the Ouse Washes (Green *et al* 1987).

Important sites:

Derwent Ings SPA
Martin Mere SPA
Walmore Common SPA
Nene Washes SPA
Ouse Washes SPA
Broadland pSPA
North Norfolk Coast SPA
Somerset Levels and Moors pSPA
Avon Valley pSPA
Pevensey Levels pSPA
Amberley pSPA

Other sites requiring further investigation include the Cam Washes and the Itchen Valley (Buisson & Williams 1991).

Implementation: Urgent action is required to secure the future of lowland wet grasslands in England. Firstly, it is essential that the ornithological interest of existing wet grassland sites is maintained and, where appropriate, enhanced. This will involve sympathetic management of water levels and farming practices. This is especially important since a large proportion of the populations of several wet grassland species are supported by a very small number of sites. Secondly, it is essential to encourage the creation and correct management of new wet grassland areas outside of the protected sites network. Suitable schemes to encourage these objectives may be available through ESAs, the Wildlife Enhancement Scheme and the reforms of the CAP. In addition, the Countryside Stewardship Scheme targets 'Waterside

Landscapes'. Internationally important sites will continue to be submitted to Government as proposed Special Protection Areas and Ramsar Sites as appropriate.

Key bibliography: Buisson & Williams (1991), Burgess & Hirons (1989), Green (1986), Green (1988), Green & Cadbury (1987), O'Brien & Smith (1992), Shrubb & Lack (1991), Smith (1983), Tickner & Evans (1991), Williams & Bowers (1987).

4.6 Lowland freshwaters and their margins

Definition: This category consists of a diverse range of bird habitats associated with still and running waters in lowland areas. It includes lakes, rivers and all man-made watercourses, together with associated marginal habitats such as reedswamp, fens and carr. It does not include lowland wet grasslands and grazing marsh or upland lakes and rivers. These are dealt with in other sections. Many lakes and watercourses are man-made and owe their existence to a variety of activities, including mineral extraction (gravel and brick pits), water supply (reservoirs and aquaducts), drainage (drains and relief channels) and transport (canals and navigation channels). This does not, however, detract from their nature conservation value.

Significance: Lowland freshwaters and their margins support possibly the richest assemblage of breeding and wintering birds in England. This includes a number of *Red Data Birds*. In winter, they support huge numbers of wildfowl, contributing to Britain's international importance for Bewick's and Whooper Swan, Wigeon, Gadwall, Teal and Pochard. The diverse range and scarcity of certain habitats means that a number of rare and often highly specialised breeding species are supported, such as those dependent on reedbeds (Bibby & Lunn 1982; Everett 1989). These include Black-necked Grebe, Bittern, Garganey, Pochard, Marsh Harrier, Crane, Cetti's Warbler, Savi's Warbler, Marsh Warbler and Bearded Tit.

Lowland freshwaters and their margins also support a wide range of more common breeding waterbirds, including grebes, Grey Heron, Gadwall, Teal, Shoveler, Tufted Duck, Little Ringed Plover, Redshank, Coot, Moorhen, Common Tern, Kingfisher and Reed and Sedge Warbler. Many of these species are highly specialised and depend on the maintenance of habitat diversity in lowland freshwater wetlands. In addition, these habitats form an important inland network of migration stop-over sites for wildfowl, waders, terns, Swifts and hirundines during spring and autumn. Reedbeds provide important winter roosts for Hen Harrier.

Special protection: A total of 21 *Red Data Birds* and four candidate *Red Data Birds* are supported in significant numbers by lowland freshwater habitats (Table 4.5). Seventeen breeding species are of high priority, of which no fewer than ten are included on 'List 1'. Nine breeding species are of medium priority, including four candidate *Red Data Birds*. Seven of these breeding species are also listed on 'Annex I' of the EC Birds Directive and ten species are listed on Schedule 1 of the 1981 Act. An additional three high and two medium priority species, including one 'List 1' species (Bewick's Swan) are supported by freshwater wetlands in winter. The numbers of resident waterbirds are swollen greatly by winter visitors from elsewhere.

Table 4.5 Important freshwater wetland birds in England

Species	EN priority	Annex I	Schedule 1	Population trends
Red-necked Grebe	Medium			Occasional breeder
Black-necked Grebe	High (2)		1	Stable
Bittern	High (1)	*	1	Declining
Bewick's Swan	High (1)	*	(1)	Stable
Whooper Swan	High (2)	*	(1)	Increasing
Greylag Goose	High (2)			Increasing
Shelduck	High (2)			Increasing
Wigeon	High (2)			Increasing
Gadwall	High (1)			Increasing
Teal	High (2)			? / Increasing
Garganey	High (1)		1	Declining
Shoveler	High (2)			? / Increasing
Pochard	High (1)			Stable
Goldeneye	Low			Stable
Smew	Medium			Fluctuating
Marsh Harrier	High (1)	*	1	Increasing
Montagu's Harrier	High (1)	*	1	Declining
Spotted Crake	High (2)	*		Fluctuating
Crane	Medium	*		Stable
Little Ringed Plover	Medium		1	Increasing
Ringed Plover	High (2)			Increasing
Snipe	Medium			Increasing
Green Sandpiper	Medium			Stable
Redshank	High (2)			Declining
Common Tern	Medium	*		Stable
Kingfisher	Medium	*		Declining
Sand Martin	Medium			Decline followed by increase
Cetti's Warbler	High (1)		1	Fluctuating
Savi's Warbler	High (1)		1	Fluctuating
Sedge Warbler	Medium			Decline followed by increase
Reed Warbler	Medium			Uncertain
Marsh Warbler	High (1)		1	Declining
Bearded Tit	High (1)		1	Stable

Threats and opportunities: Water is the driving force behind all wetland habitats. The main threats to birds in freshwater habitats therefore come from changes to both water quality and water quantity, over space and time, as a result of human activities. These include abstraction and the manipulation of hydrological regimes for agriculture and domestic water supply, and pollution from agricultural, industrial and domestic sources. This may result in the degradation and, ultimately, the loss of freshwater habitats. For example, many wetlands now exist as habitat islands faced with severe hydrological problems as water levels continue to fall all around (José in prep). This is a common feature where wetlands continue to be managed in isolation from the surrounding catchment. In such cases, successional habitats such as shallow waters, reedbeds and fen are lost, together with their specialised birds. In addition, deterioration in water quality can reduce the carrying capacity for birds, such as on the Norfolk Broads. Direct habitat loss also continues as freshwater wetlands are drained or infilled for agriculture or built developments.

An additional and growing threat to open water bodies, both still and running, comes from a variety of water-based recreational pursuits. These include the various forms of sailing, rowing and water-skiing, angling and bankside holiday developments. All these activites disturb birds during both the breeding and non-breeding season and can lower the carrying capacity of individual sites (NCC/RSPB 1988). Recreation is a particular problem on freshwater wetlands near to centres of populations, such as gravel pits and reservoirs. The stocking of fish over the carrying capacity of the freshwater system can also reduce the numbers of birds that can be supported (Phillips 1992).

In view of the considerable losses that have occurred, we are fortunate that many lowland freshwater habitats can be readily (re-)created and soon become suitable for colonisation by a range of bird species. The opportunities for wetland creation in lowland areas are legion. The extraction of aggregates should, on the whole, be welcomed on farmland of low existing wildlife interest, with the agreed after-use being conservation.

In coastal areas, freshwater habitats face both a threat and an opportunity from coastal retreat. Significant losses to both habitats and species could occur in a number of areas if the coastline is to retreat at a faster rate than new wetlands can be created, and if no provision for freshwater habitats is made inland of new high water marks. Conversely, there could be major gains from coastal retreat for many bird species if this is managed sympathetically and new freshwater habitats are created.

Knowledge of status and population trends: Our knowledge of the numbers, distribution and population trends of species in this habitat category is generally good. Most information is available for rare or easily counted breeding birds and those species which tend to concentrate during the non-breeding season, such as wildfowl.

Our present high level of knowledge regarding the status and population trends of wildfowl owes much to the work of the Wildfowl and Wetlands Trust, who have organised wildfowl counts under contract from the statutory conservation bodies since 1954. The National Waterfowl Counts systematically monitors wildfowl (and more recently waders at inland wetlands) during the non-breeding season. WWT also periodically carry out surveys of individual breeding wildfowl species. The results of work conducted up until the early 1980s was summarised by Owen *et al* (1986). Since then, the results of the NWC have been published annually in 'Wildfowl and Wader Counts' reports (together with the results of the 'Birds of Estuaries Enquiry').

Work on individual breeding wildfowl species is also published regularly (see, for example, Fox 1988: Linton & Fox 1991; Fox 1991), as well as more in depth analysis of wildfowl during the non-breeding season (Fox & Salmon 1988; Fox & Salmon 1989).

A number of rare breeding species are monitored annually by the Rare Breeding Birds Panel, including Black-necked Grebe, Bittern, Garganey, Pochard, Marsh Harrier, Cetti's Warbler, Savi's Warbler, Marsh Warbler and Bearded Tit, with some periodic reviews (see, for example, Day 1988; Kelsey *et al* 1989). Other species have also been surveyed in recent years, notably Little Ringed Plover (Parrinder 1989) and Ringed Plover (Prater 1989). Information on other species is limited to the BTO atlasses of breeding and wintering birds, which provide limited information on population numbers or trends. The breeding birds of rivers and other linear watercourses are monitored annually by the BTO Waterways Bird Survey. This enables population indices for a number of waterbirds and riparian bird species to be calculated, including Tufted Duck, Coot, Moorhen and Kingfisher.

Ecological requirements: Our knowledge of the habitat requirements of the birds of freshwater wetlands is generally very good. This results from a variety of autecological research and reserve-based management experiments. We can therefore offer quite precise management prescriptions for the maintenance, enhancement, restoration and creation of bird habitats in freshwater environments.

The development of techniques for managing freshwater wetlands for birds has a long tradition, both in Europe and North America (see, for example, Scott 1982: Kusler & Daly 1989). Much of the detailed knowledge gained in Britain has resulted from both research and reviews by RSPB on, for example, the management of reedbeds (Burgess & Evans 1988), the restoration and enhancement of wetland habitats (Burgess & Becker 1988: Andrews & Kinsmann 1991: Tickner *et al* 1991), and the management of rivers for wildlife (Lewis & Williams 1984).

The key principle is the management of both water quality and water quantity, over space and time, to maximise the habitat diversity (in terms of both structure and composition) of freshwater systems, whilst appreciating the varied ecological functions performed by still and running water bodies. This often involves active management to arrest succession and to preserve seral stages such as shallow water, reedswamp and fen.

A number of site-based studies have documented the disturbance to waterbirds resulting from a variety of water-based recreation (for example, Tuite *et al* 1984; the most recent reviews are NCC/RSPB 1988 and Hockin *et al* 1992). However, few have investigated the impacts on waterbird populations or employed experimental management to lessen the effects of disturbance incurred by waterbirds. We therefore remain unclear as to the overall significance of disturbance.

Important sites:

Leighton Moss SPA
Martin Mere SPA
Holburn Lake and Moss SPA
Hornsea Mere pSPA
Rutland Water SPA
North Norfolk Coast SPA
Broadland pSPA
Abberton Reservoir SPA
Minsmere-Walberswick SPA
Chew Valley Lake SPA
Lee Valley pSPA
Stodmarsh pSPA
South-west London Reservoirs and Gravel Pits pSPA

Implementation: Five out of the thirteen pSPAs with a major freshwater wetland component have yet to be notified by Government, and we will continue our work on the submission documents. However, the bulk of the freshwater wetland wildife resource lies outside of the protected sites network and requires integrated conservation mechanisms for its protection and, where appropriate, its enhancement. These should be based on the whole drainage basin, involving sympathetic river corridor and wetland management that recognises the varied ecological functions performed by both still and running water bodies. Within the present legislative and organisational structures, this can only be achieved through co-operation with several key outside bodies, notably the National Rivers Authority, the Regional Water Companies and MAFF. A pre-requisite for greater involvement with such bodies is the preparation of an English Nature strategy for freshwater wetlands. This will set out objectives, targets and actions for all priority areas effecting freshwater wetland habitats and species in England, including liaison with other bodies.

Key parts of the strategy will include the development of a policy on water-based recreation and integration with English Nature's existing coastal policies. Further work is required in both these areas. At the regional level, strategies involving key partners should be prepared for gravel pit and reservoir complexes (many of which are approaching redundancy) which have existing or potentially high conservation significance.

Key bibliography: Andrews (1991), Andrews & Kinsmann (1991), Andrews & Williams (1988), Andrews (1990), Bibby & Lunn (1992), Burgess & Evans (1989), Day (1988), Elliot (1988), Everett (1989), Fox (1988), Fox (1991), Fox & Salmon (1989), Gardiner (1991), Hockin *et al* (1992), Kelsey *et al* (1989), Kirby *et al* (1991), Lewis & Williams (1984), Linton & Fox (1991), Marchant & Hyde (1980), NCC/RSPB (1988), Owen *et al* (1986), Parrinder (1989), Phillips (1992), Prater (1989), Smith *et al* (1992), Ward (1990), Ward (1992).

4.7 Farmland

Definition: This habitat category consists of all 'improved' pastures and leys, arable land and other agricultural habitats such as hedges and ditches. It does not include semi-natural habitats that form part of the farming landscape, such as lowland heaths, unimproved wet and dry grasslands, or moorlands. Many of the breeding birds of these semi-natural habitats do, however, feed or breed at lower densities on intensive farmland, and are affected by adjacent agricultural practices, such as the effects of spray drift and the lowering of water tables.

Significance: Intensively managed farmland is generally of low ornithological interest compared to most semi-natural bird habitats in England. The high ornithological significance of certain elements of the greater farming landscape is often maintained by 'traditional' agricultural systems. These form distinct semi-natural habitats, such as lowland heaths, unimproved wet grassland and moorland, which support some of our rarest and most vulnerable bird species, and are considered elsewhere. There are, however, some notable exceptions to this generalisation. For example, several rare breeding birds are supported by farmland in England. These include Cirl Bunting and Montagu's Harrier, as well as several species that are more numerous in semi-natural habitats, such as Marsh Harrier and Stone Curlew. In addition, a number of vulnerable wintering waterfowl species feed extensively on farmland. These include Bewick's and Whooper Swans, Pink-footed, Brent and Barnacle Beese, Wigeon and Golden Plover.

Farmland supports large numbers of the more ubiquitous bird species, in particular, seed-eating passerines, many of which are essentially dependent on farmland for food. For some of these species, farmland represents their principle habitat. Several are of particular interest in England, and indeed, farmland is perhaps most important for these vulnerable and dispersed bird species due to the extent of farmland in England (It covers around 80% of the land area). Many species breed at low densities or are highly localised. Examples of resident species include the declining Grey Partridge, Lapwing, Barn Owl, Skylark, Linnet and Corn Bunting. Summer migrants include Hobby, Turtle Dove, Yellow Wagtail and Whitethroat. Wintering species include Fieldfare and Redwing, as well as other thrushes and Lapwing, which add to the numbers of resident individuals. Many farmland bird species appear to be valuable indicators of environmental change (Brenchley 1984; Marchant *et al* 1990).

Special protection: A total of 19 *Red Data Birds* are supported by farmland in England (Table 4.6). Nine *Red Data Birds* breed on farmland, of which six species are listed on Schedule 1 of the 1981 Act, in addition to Hobby. Five of these species are resident. A further 12 *Red Data Birds* also occur in winter. Of these *Red Data Birds*, seven are high priority 'List 1' species and 12 are high priority 'List 2' species, including Lapwing (a candidate *Red Data Bird*). Nine are listed on 'Annex I' of the EC Birds Directive. A further 13 species are of medium priority including 10 candidate *Red Data Birds*.

Table 4.6 Important birds occurring on farmland in England

Species	EN priority	Annex I	Schedule 1	Population trend
Bewick's Swan	High (1)	*	(1)	Stable
Whooper Swan	High (2)	*	(1)	Increasing
Bean Goose	High (1)			Stable
Pink-footed Goose	High (2)			Increasing
Greylag Goose	High (2)			Increasing
Barnacle Goose	High (2)	•		Increasing
Brent Goose (both races)	High (1)			Increasing
Wigeon	High (2)			Increasing
Teal	High (2)			Uncertain
Red Kite	High (2)	*	1	Increasing
Marsh Harrier	High (1)	*	1	Increasing
Hen Harrier	High (2)	*	(1)	Declining
Montagu's Harrier	High (1)	*	1	Stable following decline
Buzzard	Medium			Stable or increasing
Hobby	Medium		1	Increasing
Grey Partridge	High (2)			Declining
Quail	High (2)			Declining
Stone Curlew	High (1)	*	1	Stable following decline
Golden Plover	High (2)	*		Declining
Lapwing	High (2)			Declining
Snipe	Medium			Declining
Turtle Dove	Medium			Declining
Barn Owl	High (2)		1	Declining
Lesser Spotted Woodpecker	Medium			Declining
Swallow	Medium			Declining
Yellow Wagtail	Medium			Declining
Lesser Whitethroat	Medium			Fluctuating
Whitethroat	Medium			Fluctuating following crash
Spotted Flycatcher	Medium			Declining
Tree Sparrow	Medium			Declining
Linnet	Medium			Declining
Cirl Bunting	High (1)		1	Declining
Corn Bunting	Medium			Declining

(1) = listed on Schedule 1 but occurs in winter only.

Threats and opportunities: Farmland birds continue to be threatened by agricultural practices. These include the effects of continuing changes to and intensification of farming systems, and pollution by agrochemicals, which has impacts on freshwater systems as well as on farmland. There are, however, also great opportunities for the enhancement of bird populations on farmland. Reforms to the EC Common Agricultural Policy and the designation of additional Environmentally Sensitive Areas could provide major gains for bird conservation given the large areas that could be involved (Mathers & Woods 1989; Osbourne 1989). Other schemes which have promoted farming sympathetic to wildlife include the Countryside Stewardship and Countryside Premium Schemes.

Knowledge of status and population trends: The distribution of birds on farmland in England is well known. Our knowledge of the population trends of breeding birds on farmland is also good. The BTO's Common Bird Census has monitored bird populations on around 100 farmland plots since the early 1960s and provides excellent information on the population trends of the commoner farmland species. In contrast, our knowledge of the population sizes of individual species on farmland is poor, with few exceptions. Rare breeders are monitored annually by the Rare Breeding Birds Panel, and several uncommon species, including Lapwing, Barn Owl and Cirl Bunting, have been periodically surveyed (Shrubb & Lack 1991; Shawyer 1987; Evans 1992) with a Corn Bunting survey in progress. For the very abundant species, we are aware of population sizes to the nearest order of magnitude.

Ecological knowledge: On-going research by BTO and a number of other organisations, such as the Game Conservancy, has provided a wealth of information on the nature of farmland bird communities and the features of farmland which are of importance to birds. This has resulted in one major text concerning farming and birds (O'Connor & Shrubb 1986) and numerous other publications which deal with the benefits to birds of managing farmland in a more sympathetic manner, most notably, the recent book by Lack (1992). From these studies we can conclude:

- Farmland bird communities usually consist of a small number of very abundant and widespread species and around 20 less numerous but nonetheless widespread species. Blackbird, Chaffinch and Skylark are most numerous, with Rook and Woodpigeon particularly important in terms of biomass. Rarer species are present incidentally in patches of suitable habitat. Winter bird communities have been poorly studied. The highest densities of birds in winter are supported in areas of mixed farming (Fuller & Lloyd 1981; Tucker 1992).

- Breeding success on farmland varies regionally and, for several species, is closely linked to the timing and extent of agricultural practises.

- Four main food resources are available to birds on farmland: the green vegetation of the crop and naturally occuring plants; grain, seeds and hedgerow fruits; the invertebrates which feed on these foods; and the vertebrates that feed on all the above, including the birds themselves. Feeding behaviour varies regionally and seasonally, according to changes in food availability. The presence of livestock provides valuable sources of food and water, particularly for songbirds in winter.

- The increasing specialisation of agriculture since the war has had major impacts on farmland bird populations, associated with the loss of habitat diversity. The most important factors have been habitat loss and the intensification of crop and livestock management, such as the timing and extent of agricultural practises and the use agricultural chemicals. Perhaps the most significant changes have occured on grasslands where specialised birds have suffered from habitat loss (conversion to arable) and widespread management changes.

- The maintenance of habitat features associated with the crop or livestock is a particularly important factor determining both the abundance and richness of bird assemblages on farmland. Features of value include field margins, hedges, ditches, ponds, areas of scrub or unmanaged vegetation and even farm buildings. Expanding field margins, for example, can benefit Grey Partridge, Barn Owl and seed-eating passerine populations if widely adopted within an area. Likewise, the sympathetic management of hedgerows can benefit many species (Arnold 1983; Rands 1987).

Although we have a reasonable understanding of bird-habitat associations for a number of farmland species (for example, Fuller & Lloyd 1981, Osbourne 1984, Cayford 1992; Tucker 1992), there is still much research needed into the autecology of farmland birds, in particular, passerine species such as skylarks, finches and buntings and how their food resources are effected by agricultural practice. We also need to know more about the indirect effects of pesticides on farmland birds (for example, on food availability), the effects of less crop rotations and undersowing, and the most beneficial ways to manage both rotational and non-rotational set-aside land.

Important sites: No SPAs have been classified or are proposed on the basis of farmland bird populations, with one notable exception; the Breckland Heaths pSPA, where a significant proportion of the breeding Stone Curlews occur on the adjacent arable land. Farmland, as defined here, does however form a significant part of most ESAs.

Implementation: There are four main priorities for the management of farmland and the wider countryside as a whole for birds and other wildlife (NCC 1990): maintain and, where appropriate enhance the remaining semi-natural habitats within the farming landscape; retain and enhance other areas of good wildlife habitat such as hedgerows, ditches, ponds, areas of scrub and unmanaged vegetation, and farm buildings; create new wildlife habitat on intensively farmed land of low existing nature conservation value, including expanding field margins, planting new farm woods, creating new wetlands and re-creating areas of permanent pasture; and reduce agricultural pollution.

Key bibliographies: Evans (1992), Fuller & Lloyd (1981), Lack (1992), Marchant *et al* (1990), Mathers & Woods (1987), Osbourne (1989), O'Connor & Shrubb (1986), Shawyer (1987), Shrubb & Lack (1991), Smith *et al* (1992), Tucker (1992).

4.8 Estuaries

Definition: Estuaries are partially enclosed areas of water and soft tidal shore, which are open to sea water and receive fresh water from rivers, land run-off or seepage. It includes saltmarshes and other areas of importance for estuary birds.

Significance: Estuaries are arguably the most important bird habitat in England. The 81 estuaries in England have a total area of 389,479 ha. They are of national and international importance for wintering and passage waterfowl; 22 estuaries support over 10,000 wildfowl and 19 support over 20,000 waders in winter, as shown in Table 4.8. Of these 25 estuaries, two are shared with Wales (Severn and Dee) and one with Scotland (Solway). They support internationally important populations of a number of waterfowl species, including Oystercatcher, Knot, Dunlin, Bar-tailed Godwit, Redshank and Shelduck, and over half the world population of Dark-bellied Brent Goose.

England's estuaries support wintering populations of several waders that occur here on the northern edge of their winter range. These include Black-tailed Godwit and small numbers of Spotted Redshank and Common Sandpiper. In contrast, Pink-footed Goose occurs at the southern edge of its winter range. English estuaries are also important for a number of non-waterfowl species in autumn, winter and spring. These include divers, grebes, gulls, birds of prey (notably Hen Harrier, Peregrine, Merlin and Short-eared Owl) and passerines (for example, Twite and Lapland Bunting).

Saltmarshes are intimately associated with estuaries, and together they form some of the last remaining natural habitats in England. Saltmarsh provides crucial high-tide roost sites for the wintering and passage waterfowl which feed on the extensive intertidal mud and sand flats of estuaries. Several bird species breed at high densities on saltmarsh (see section 4.9 for birds which breed in other coastal habitats). Redshank is the most widely distributed and abundant wader breeding on saltmarsh, followed by Oystercatcher and Lapwing. Saltmarsh is also an important breeding habitat for Shelduck and several gull species. They provide enormous food resources for large numbers of both breeding and non-breeding passerines. Several estuaries also support important Sandwich and Little Tern colonies.

Special protection: Estuaries in England support the majority of the populations of 22 *Red Data Birds* and 2 candidate *Red Data Birds* (Table 4.7). Two of these species are listed on 'Annex I' of the EC Birds Directive (Barnacle Goose and Golden Plover) and five have been identified as high priority 'List 1' species; Brent Goose (both races), Avocet, Grey Plover, Knot, Dunlin and Black-tailed Godwit. These five species are almost entirely dependent on English estuaries in winter. Several other *Red Data Birds* are also largely dependent on estuaries in winter, including Pink-footed Goose, Barnacle Goose, Shelduck, Oystercatcher, Bar-tailed Godwit, Redshank and Twite. Other species are less dependent on estuaries in winter, but are nonetheless supported in numbers which are crucial in maintaining their populations. These include waterfowl such as Wigeon, Teal, Ringed Plover, Golden Plover, Lapwing, Snipe, Curlew and Turnstone, as well as divers, grebes, birds of prey and passerines.

Saltmarsh supports significant breeding populations of one high priority 'List 2' species (Redshank) and two medium priority species (Mediterannean Gull and Herring Gull).

Table 4.7 Important estuarine bird species in England

Species	EN priority	Annex I	Schedule 1	Population trend
Pink-footed Goose	High (2)			Increasing
Barnacle Goose	High (2)	*		Increasing
Brent Goose (both races)	High (1)			Increasing/ Stable
Shelduck	High (2)			Increasing
Wigeon	High (2)			Increasing
Teal	High (2)			Increasing
Pintail	High (2)			Stable or increasing
Oystercatcher	High (2)			Increasing
Avocet	High (1)		1	Increasing
Ringed Plover	High (2)			Increasing
Grey Plover	High (1)			Increasing
Golden Plover	High (2)	*		Uncertain
Lapwing	High (2)			Uncertain
Knot	High (1)			Uncertain
Sanderling	High (2)			Fluctuating
Dunlin	High (1)			Increasing or stable
Snipe	Medium			Uncertain
Black-tailed Godwit	High (1)			Increasing
Bar-tailed Godwit	High (2)			Stable
Curlew	High (2)			Increasing
Redshank	High (2)			Increasing
Turnstone	High (2)			Increasing
Mediterannean Gull	Medium		1	Colonising
Herring Gull	Medium			Declining
Sandwich Tern	High (1)	*		Increasing
Little Tern	High (1)	*	1	Increasing
Twite	High (2)			Uncertain

Threats and opportunities: England's estuaries are under long-term and continuous threat of damage and destruction, largely resulting from human activities. This includes the threat from relative sea-level rise. Losses of estuarine habitat have been extensive, and in some estuaries all, or almost all, the intertidal wildlife habitats have been degraded or destroyed. The biggest continuing threat to estuaries is coastal squeeze, which combines the effects of erosion and land-claim for urban and industrial developments and marinas, and their associated infrastructure (together with the resulting indirect effects from recreation and dredging). Barrages remain as a potential threat on many estuaries, with only one major scheme, the Tees Barrage, having gone ahead. Local but nonetheless widespread and significant threats include pollution, commercial shellfish exploitation, 'natural' succession and changes to hydrological regimes.

A major opportunity for the conservation of England's estuaries and their birds is available through the development of integrated management plans which aim to prevent any net loss in intertidal habitat and look at potential for habitat enhancement, for example, the possibilities for habitat re-creation resulting from managed coastal retreat and soft engineering schemes.

Knowledge of status and population trends: Our knowledge of the distribution, numbers and population trends of wintering waterfowl on estuaries is excellent. The Birds of Estuaries Enquiry (BoEE), organised by the British Trust for Ornithology, was begun in 1969. This provides information on the numbers of non-breeding waders and wildfowl using estuaries through systematic monthly counts. Some sites not counted by the BoEE are included in the National Waterfowl Counts (NWC), organised by the Wildfowl and Wetlands Trust since 1949. Together, they form a long-term and comprehensive picture of estuarine bird populations which is probably unparalleled anywhere else in the world. Other important monitoring work relating to estuary birds includes the WWT goose censuses. These provide annual or biennial assessments of the numbers and breeding success of Pink-footed, Icelandic Greylag and Dark-bellied Brent Geese (see, for example, Kirby 1991).

The results of the first five years of the BoEE were described in detail by Prater (1981). More recently, the results have been summarised in the annually produced *Wildfowl and Wader Counts*, which also provides a summary of the NWC counts.

Our knowledge of the breeding birds of saltmarsh is good, resulting from a sample survey of breeding birds on saltmarsh in 1985 carried out by RSPB under contract to NCC (Allport *et al* 1986, summarised in Cadbury *et al* 1987). In contrast, our understanding of the numbers and distribution of birds wintering on saltmarsh is much more fragmented, apart from the use of saltmarsh as a high-tide or nocturnal roost by waterfowl.

Ecological knowledge: A great deal is known about the distribution, behaviour and ecology of wintering and passage waterfowl populations across English estuaries. Our knowledge of individual sites is, however, less than perfect. For example, we have little detailed knowledge of the low tide (feeding) distribution of waders on most of our estuaries, although this is set to change with the new BTO low-tide counts programme. We know the origins and destinations of all waterfowl species as a result of extensive ringing programmes. The use of colour-marked birds has helped us elucidate many aspects of the ecology of estuary birds, which is of considerable value to conservation. From this research, we can conclude that estuaries in England are of major national and international importance for the wintering and passage waterfowl assemblages that they support; many waterfowl are almost entirely dependent on estuaries in winter and/or on migration; estuaries provide crucial late-spring staging areas which provide both energy and nutrient reserves for waterfowl on long-distance migration and for survival on their breeding grounds; estuaries in England play an additional crucial role as both cold weather refuges and moulting sites; movements and population turnover, especially during migration, mean that much larger waterfowl populations are supported by each estuary and England as a whole than is shown by periodic counts; estuaries in England, Britain and the East Atlantic Flyway as a whole are used as a network, and different constituents of the network are important for different species and populations, and at different times.