Mute Swan

Cygnus olor

(Britain and Ireland populations) in Britain and Northern Ireland

1960/61 – 2000/01

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SUMMARY

This report aims to describe changes in the abundance and distribution of the Mute Swan Cygnus olor in Britain and Northern Ireland since 1960/61, to compile available historical information, to provide current estimates of population size, to review published data on the ecology and biology of this species, and to describe numbers, trends and site use at the key resorts in Britain and Northern Ireland.

The Mute Swan has the most southerly breeding range of the Eurasian swans. The species has a fragmented distribution, with seven recognised populations. Many birds live in areas that are mild enough for them not to have to migrate to other areas during the non-breeding season. Birds in Britain and Ireland are largely sedentary and are considered to comprise two discrete populations.

The British population remained fairly stable, at around 20,000 birds, from the late 1960s to the mid-1980s. Since the late 1980s there has been a large increase in numbers. A national census during the breeding season in 2002 estimated the population at 31,700, whilst analysis of winter counts from the late 1990s suggested a figure of 37,500. The Irish population increased in size between the 1970s and mid-1980s, since when the population has become more stable. The all-Ireland total is estimated to number 10,000, although some have suggested it may be as high as 19,000-20,000.

A possible reason for the increase in population is the incidence of lead poisoning. In the late 1970s lead poisoning was shown to be the largest single cause of Mute Swan deaths in England. However, since the ban on the use of lead fishing weights in 1987 and the changes imposed on shooting in England and Wales, the number of deaths from lead poisoning has reduced greatly. Mild winters are also likely to have contributed to the general increase in swan numbers. In Ireland, however, lead still remains a problem.

In Britain and Ireland, the Mute Swan is widespread on lowland wetland habitats such as slow-flowing rivers, lakes, ponds and estuaries. It also occurs on man-made wetlands (e.g. gravel pits), and in urban areas. In Britain, the greatest numbers of breeding birds are found in central, eastern and southern counties. They are largely absent from many northerly and westerly areas where high ground predominates although they flourish in the southern Western Isles and Orkney. Here, the highest breeding densities occur in lowland river basins and in isolated areas. In Northern Ireland, the highest numbers of breeding birds are found in the east parts, particularly around Loughs Neagh & Beg.

The pondweeds Potamogeton, Myriophyllum and Chara are important food resources in freshwater habitats. In brackish and saltwater areas, eelgrass Zostera, tasselweeds Ruppia and various green algae are the main sources of food. Agricultural crops (oilseed rape, grasses, cereals and potatoes) are becoming increasingly important in certain areas. The species has a close association with humans, and supplementary feeding has become important in many areas.

During 1996–2000, 19 sites in Britain were internationally important for the Mute Swan, regularly supporting at least 260 birds during the non-breeding season. Four sites in Northern Ireland were internationally important, holding 100 or more birds, during the same period. Information on numbers, trends and site use at these key resorts are provided within this review.

Future monitoring should include the collection of demographic data to generate scientifically-robust assessments of abundance, productivity, survival and movements over a range of spatial scales. Such integrated population monitoring should be developed with the aim of understanding the population dynamics of this species.

Survey during late summer is irregular, and consequently the importance of some sites for moulting birds may not be recognised. The instigation of a regular nationwide survey of Mute Swan moult flocks is recommended.

1 THE MUTE SWAN

1.1 Introduction

It has been suggested that the Mute Swan *Cygnus olor* was introduced to Britain by either the Romans or Richard I (Ticehurst 1957). There is, however, no actual evidence to support this, and Ticehurst (1957) discusses the possibility and puts forward a convincing argument that the species was already well established over a wide area by the time Richard I returned from the Crusades, and that therefore this suggestion can be discounted. Northcote (1980) states that bones of Mute Swans are widespread in East Anglia in deposits from c. 6,000 years ago. The Romans were skilled in domesticating birds and had a taste for taming them. Therefore they may have been the ones who began the domestication of the Mute Swan during their rule in England, as it was used for food and kept in a semi-domesticated state in Britain before the Norman Conquest (Birkhead & Perrins 1986).

During the Middle Ages, large stretches of the English countryside were waterlogged and covered with dense reedbeds and meandering waterways, which were ideal habitats for swans and other waterbirds. Originally, the Mute Swan was shot with arrows or rounded up when flightless and eaten, as were other wild animals. Later the species's potential as a food source was realised, and people began to semi-domesticate the birds (Birkhead & Perrins 1986). Because the birds nested along rivers and waterways, wild cygnets could be caught when they were quite small. They were hand-reared, pinioned before they were fully fledged, and placed on private waters. The young of these birds were treated in a similar way (Ticehurst 1957). Cygnets kept on these private waters were fed and fattened until they were required for their owners' table, for sale or as gifts; such waters have been known as 'swan parks or pits' (Ticehurst 1957).

Swan-keeping became a profitable concern in England in the 13th century. This led to issues of ownership, and at one time the Crown claimed possession of all the Mute Swans in England. As time passed, the Crown gave rights for Mute Swans in certain areas to be owned by the clergy and local noblemen. This led to the marking of the birds' bills with distinct marks depending on the owner; any unmarked birds on open waters belonged to the Crown (Ticehurst 1957). By the mid-18th century, swan-keeping had more or less ceased in most parts of the country and it was kept going by a only few of the largest land owners (Ticehurst 1957). However, swan ownership lasted a little longer than this in one or two places, particularly in the Fens, where the birds were farmed until at least the end of the 18th century (Birkhead & Perrins 1986). By the late 19th century many private owners in the Fens still claimed rights to birds, although most had given up having herds of swans of their own (Birkhead & Perrins 1986). As swan-keeping declined, the wild population increased as a result of escapes from the semi-domestic flock. In Britain, Mute Swans retain much of their semi-domesticated nature, frequenting public waters and seeking food from humans (Spray *et al.* 2002).

Unlike in Britain, little is known about the history of the Mute Swan in Ireland. Introduced birds were known to be present in the 1700s. By the 1800s, the species was reported around Belfast, but it was not known in a wild state, only in collections (O'Donoghue et al. 1992). All authors in the 20th century regarded the species as an introduction, except Collins & Whelan (1990), who questioned this, suggesting that the spread of the species in the 19th and 20th centuries could have been the result of the decline in persecution rather than the spread of the species following an introduction.

Today, Mute Swans are much more common than they were at the beginning of the 20th century, and the species possibly owes its survival to its semi-domestication, as it might otherwise have been exterminated by excessive hunting (Dawnay 1972). For many years the species was taken for granted to such an extent that very few attempts were made in Britain to count the birds, and in the early 1960s very little was known about their life-history and biology (Birkhead & Perrins 1986). The situation began to change in the early 1960s, when people began to realise that the Mute Swan was a good bird to study, especially for looking at certain aspects of life-history and population biology (Birkhead & Perrins 1986). A large number of studies have now been carried out on the Mute Swan in the UK, many of them by amateur groups, and today it is one of our better-known species. In an attempt to collate information for the British population and the Northern Ireland component of the Irish population, this report aims to assess changes in the abundance and distribution of the Mute Swan since 1960/61, provide current estimates of population size and review our knowledge of this species. Only the British and Irish populations are examined as these have been shown to be largely sedentary and are accepted as discrete populations by Wetlands International (Wetlands International 2002).

The report is split into two sections and follows the format of other reviews (e.g. Fox *et al.* 1994). The first section gives a summary of current knowledge on the abundance, distribution and ecology of the Mute Swan in Britain and Northern Ireland. Gaps in our knowledge are highlighted along with the conservation threats facing this species. The second section presents numbers on a regional scale collected between the winters of 1960/61 and 2000/01. Spatial and temporal changes in abundance and distribution are examined. Furthermore, monthly peak counts are illustrated for those sites that regularly support internationally important numbers, to investigate the phenology of movement to and from individual sites.

1.2 Background

The Mute Swan *Cygnus olor* has the most southerly breeding range of the Eurasian swans (Wieloch *et al.* 1997). Many birds live in areas that are mild enough for them not to have to migrate during the non-breeding season. The species is patchily distributed but locally common across temperate regions of the Palearctic, from western Europe to northeast China (Scott & Rose 1996). The species breeds widely in western and central Europe and more locally in southeast Europe, the Black Sea and Caspian regions and central Asia. In winter it occurs south to the Mediterranean Sea and the southern shores of the Caspian Sea (Scott & Rose 1996) (Fig. 1).

Atkinson-Willes (1981) recognised three main groups in western Eurasia: a northwest and central European population, a Black Sea/Sea of Azov population and a Caspian Sea/west-central Asian population. On the basis of ringing data and various national studies, the northwest and central European population of Mute Swans was divided into seven more or less independent groups (Scott & Rose 1996):

i. Scandinavia-Baltic Group – Finland, Baltic Republics, Poland, Sweden, eastern Germany, Schleswig-Holstein and Niedersachsen in western Germany, Denmark and Norway;
ii. Netherlands Group – Netherlands, Nordrhein-Westfalen in Germany, Belgium and northwest France;
iii. Central European Group – Czech Republic, Slovak Republic, Austria, central and southern Germany, Switzerland, southeast France and Italy;
iv. England & Wales Group;
v. Scotland (mainland and Orkneys) Group;
vi. Scotland (Hebrides) Group; and
vii. Irish Group.

The two Scottish groups have since been grouped with England and Wales to form one individual British group (Ruger *et al.* 1986, Monval & Pirot 1989).

Exchange between the northwest and central European population and the Black Sea/Sea of Azov population is becoming increasingly likely as a result of recent increases in numbers and an expansion in the ranges of both populations (Scott & Rose 1996). The birds of the Scandinavian-Baltic group and central European group have expanded their ranges towards the south and east, have established breeding populations in the former Yugoslavia, Hungary and the Ukraine, and have moved closer to the range of the Black Sea population (Scott & Rose 1996).

The increase in numbers and range expansion has been even more marked further east. The Mute Swan now has an almost continuous distribution between the Black Sea and Caspian Sea, and there is ringing evidence to suggest interchange between the Caspian and Black Sea populations (Scott & Rose 1996). It may no longer be possible to sub-divide the northwest and central European population into separate groups on the mainland of Europe as a result of the expansions in range. The results of genetic analysis of birds in Britain and Ireland did not support the hypothesis of reproductive isolation of Irish Mute Swan populations from those in England and Scotland (O'Donoghue *et al.* 1992). Scott & Rose (1996), however, still considered that there were strong grounds for treating the British and Irish populations as separate groups.

As a result of the increase in numbers and expansion of range of Mute Swan populations, the following seven populations are currently recognised by Wetlands International (Wetlands International 2002):

i. Northwest & central European population, which breeds and winters in the northwest mainland and central Europe;
ii. British population, which breeds and winters in Britain;
iii. Irish population, which breeds and winters in Ireland;
iv. Black Sea population, which breeds in the Black Sea region and winters in the Black Sea and southeast Europe;
v. West & Central Asian and Caspian population, which breeds and winters in west and central Asia and the Caspian;

vi. Central Asian population, which breeds in central Asia and winters in southern central Asia; and
vii. East Asian population, which breeds in Lake Baikal (Russia), Mongolia and northwest and northeast China, and winters in west and northeast China and the Korean Peninsula.

As it is the organisation charged with co-ordinating information on waterbird populations on behalf of various international conventions and agreements, Wetlands International's treatment of populations has been adopted for the purposes of this review.

It is the largely sedentary British and Irish populations that are the subject of this review. Seasonal movements occur within Britain and Ireland, particularly in late summer when birds congregate at traditional moulting sites. Movements of Mute Swans between Britain and the continent also occur, but only very occasionally, and a high proportion of these occur during very harsh winters (Spray *et al.* 2002). For example, foreign-ringed birds were recorded in Britain during the severe winters of 1962/63 and 1982. During the 1962/63 winter, British birds were also recorded on the continent (Spray *et al.* 2002). These cross-channel movements appear to be fairly restricted as virtually all foreign birds have been recovered in the southeastern counties from Norfolk to Hampshire. Small numbers of birds ringed at Abbotsbury and Radipole Lake have been recorded in France, particularly in an area roughly centred on Vendee on the Atlantic coast of France (C. Perrins pers. comm.). A small number of Mute Swans are also known to move from the Western Isles of Scotland to Northern Ireland and the Irish Republic, as birds neck collared in the Western Isles have subsequently been reported in Donegal, Antrim and Londonderry (Spray 1981b, O'Halloran & Collins 1985). However, the birds that disperse from the Western Isles are largely immature, and there is no evidence of any return movements (C. Spray pers. obs.). In 2003, a ringing study began in Orkney to try to ascertain the origins of this rapidly expanding Mute Swan population.

The breeding distribution in Britain and Northern Ireland shows that the only area avoided by Mute Swans is land over 300 m above sea level (Delany *et al.* 1992, Ogilvie & Delany 1993). The winter distribution is broadly similar to the breeding distribution, except for localised movements to coastal waters, especially in cold weather, and to freshwater marshes and agricultural fields (Ogilvie 1986a, Kirby *et al.* 1994, Chisholm & Spray 2002).

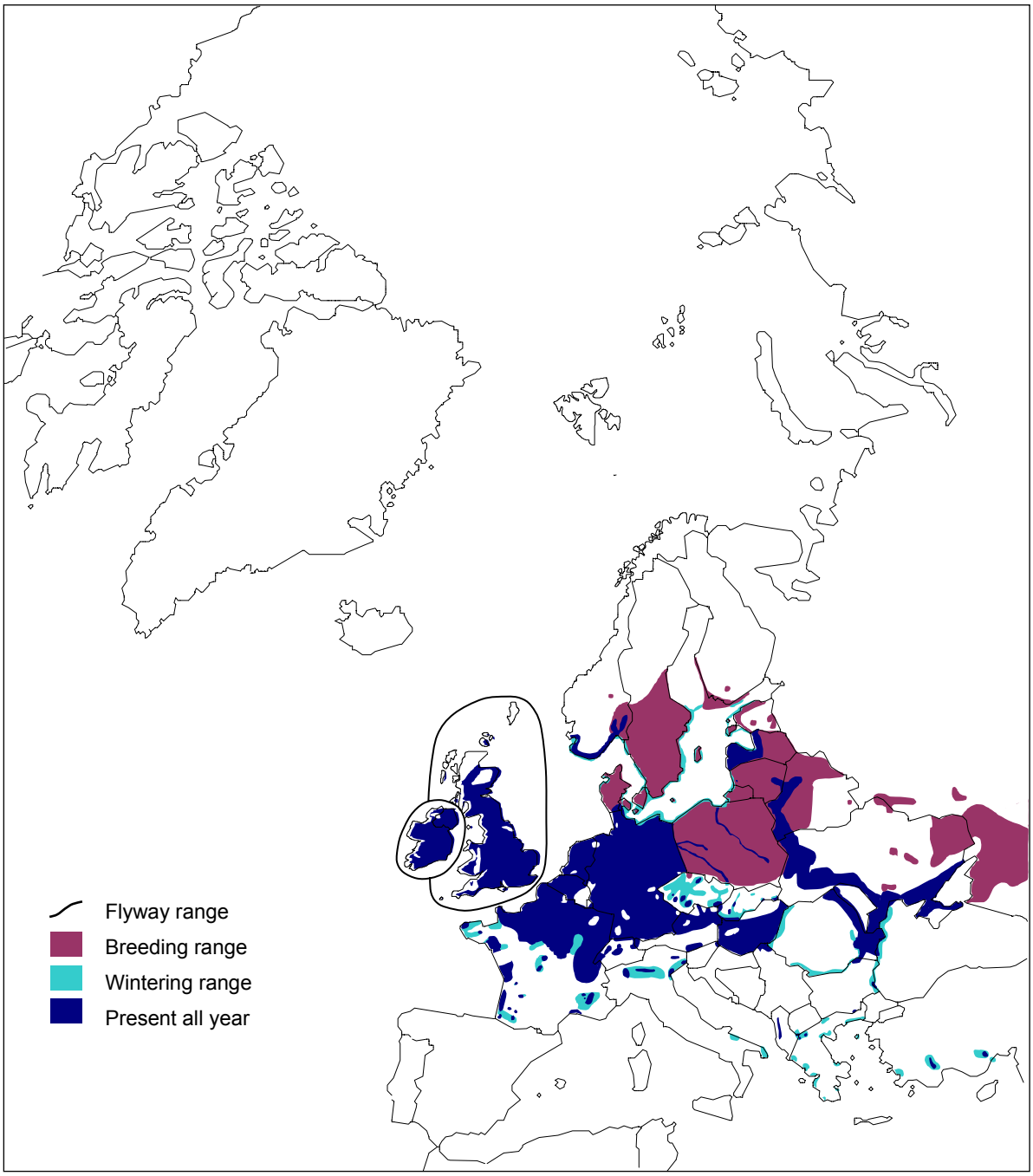
1.3 Monitoring and population assessment

1.3.1 Counts

Mute Swans have been counted at hundreds of wetland sites throughout Great Britain, mainly for the Wetland Bird Survey (WeBS). WeBS counts have been made since 1947, and the scheme was extended to include Northern Ireland from 1986; they are nationally co-ordinated and are made by volunteer ornithologists at a variety of wetland habitats. Counts are made once a month between September and March, usually on the middle Sunday, although other months are also covered at some sites (Atkinson-Willes 1963, Owen *et al.* 1986, Pollitt *et al.* 2003). However, as the Mute Swan population is widely dispersed in winter, the entire population is not recorded by these counts (Kirby *et al.* 1994). As a result, Mute Swan censuses have been carried out in the springs of 1955/56 (Rawcliffe 1958, Campbell 1960), 1978 (Ogilvie 1981), 1983 (Ogilvie 1986b), 1990 (Delany *et al.* 1992), and most recently in 2002. In these censuses, counters were asked to record numbers of pairs of swans and check for signs of breeding by noting the presence of a nest or signs of cygnets. For non-breeding birds, counters were asked to record the size of the flock. In addition to the number of birds, the habitat and precise grid reference of each nest/pair or flock of swans were recorded (Ogilvie 1981). These censuses record the numbers of adult birds and do not include cygnets.

Before the mid-1960s, the counting of Mute Swans in Ireland was sporadic and localised and the results were largely unpublished (Hutchinson 1979). In the winters between 1971 and 1974, the first comprehensive waterbird monitoring project in Ireland took place. The results of this were published in *Ireland's Wetlands and Their Birds* (Hutchinson 1979). A follow-up survey, the Winter Wetlands Survey, was carried out over a decade later and covered the period 1984/85 to 1986/87. The results of this were published in *Ireland's Wetland Wealth* (Sheppard 1993). As a result of the need for a more long-term monitoring programme, the Irish Wetland Bird Survey (I-WeBS) was started in the winter of 1994/95; the methodology for this is identical to that used in WeBS.

Figure 1. Breeding and wintering ranges of Mute Swan *Cygnus olor* and flyway ranges of Britain and Ireland populations (adapted from Scott & Rose 1996 and Snow & Perrins 1998).



Although WeBS monitors a large proportion of most of the UK's waterbird species, there is little understanding of how many waterbirds are present on small waters, streams, flooded fields and ditches. To address this question, a pilot survey, the Dispersed Waterbirds Survey (DWS), was carried out in winter 2000/01, followed by a full survey during January 2003. The results of the full survey have not yet been published, but both surveys involved asking volunteers to count birds within random squares of the UK national grid. The Mute Swan was one of the species covered by the surveys and the results will provide much information on numbers away from large wetlands.

Because of the sedentary nature of the Mute Swan, the species is also monitored in the breeding season in the UK by the Common Birds Census (CBC), the Breeding Bird Survey (BBS), the Waterways Bird Survey (WBS) and the Waterways Breeding Bird Survey (WBBS). All these surveys are organised by the British Trust for Ornithology (BTO).

The CBC ran from 1962 to 2000 and was instigated to provide information on farmland bird populations as changes took place in agricultural practice. Although the original emphasis was on farmland plots, woodland plots and a small number of other habitats, including heathlands and small wetlands, were also surveyed annually (Baillie *et al.* 2002). Fieldwork was carried out by volunteers who visited their plot 8–10 times between late March and early July. A territory-mapping method was used to estimate the number and positions of territories of each species present on each plot during the breeding season. Observers also provided detailed habitat information and maps for their plots (Baillie *et al.* 2002). CBC sites were chosen by the volunteer and tended to be sites that were good for birds. There was also bias towards southeast England, where most census plots were located. To overcome these problems, the BBS was started in 1994 (Baillie *et al.* 2002).

The BBS uses line transects rather than territory mapping. The sampling units are randomly selected (by computer) 1-km squares of the national grid. Fieldwork is carried out by volunteers who visit each survey square three times each year (Baillie *et al.* 2002). In the first visit, habitat details are recorded and the survey route is established. The two count visits are made about four weeks apart between early May and early June. Birds are noted in three distance categories (within 25 m, 25–100 m, or more than 100 m on either side of the line) measured at right angles to the transect line, or as in flight. This allows population densities to be estimated. The total numbers for each species (excluding juveniles) in each 200-m transect section and distance category are recorded on summary forms (Baillie *et al.* 2002). The WBS has monitored bird species on rivers and canals throughout the UK since 1974. As with the CBC, territory mapping is used to estimate the breeding population of waterbirds on each plot and to show each bird's habitat usage in detail. Volunteers, who survey their plot nine times between March and July, again carry out fieldwork. All birds seen or heard are marked onto 1:10,000-scale maps. These data are then transferred onto species maps and analysed to reveal the numbers and positions of territories for each species (Baillie *et al.* 2002).

The WBBS started in 1998 as a pilot project. Sites are chosen randomly and are visited by volunteers three times a year between April and June. Birds are recorded along 500-m transects, which lie along a waterway. Identification of all birds, both seen and heard, is required but territories are not mapped.

1.3.2 Productivity

The breeding performance of Mute Swans in the UK is measured nationally by the BTO's Nest Record Scheme (NRS). The data for this are gathered through a network of volunteer ornithologists, who complete nest record cards for each nest they find. On these cards they record details of the nest site, habitat, contents of the nest at each visit, and evidence for success or failure. Computer programmes developed by the BTO check the data provided for errors and calculate first-egg-date, clutch size and nest loss rates at both egg and chick stages (Baillie *et al.* 2002). The general distribution of Nest Record Cards is patchy at the county scale but is more even over larger regions of the UK. Overall, Northern Ireland, parts of Scotland (the southwest and Western Isles) and parts of England (the West Midlands and southwest) have relatively low coverage, often reflecting observer density (Baillie *et al.* 2002).

Mute Swan productivity has been measured in detail at a local scale, often in the study areas of members of the Swan Study Group. These areas include the English Midlands (e.g. Coleman *et al.* 2001), the Western Isles (e.g. Spray 1991), the northeast of England (e.g. Coleman *et al.* 2002), the Lothians (e.g. Brown & Brown 2002) and Abbotsbury Swannery (e.g. McCleery *et al.* 2002). Methods of studying productivity include collecting data on the numbers of breeding or nesting pairs, clutch size, the number of cygnets hatched per breeding pair, the number of cygnets fledged per breeding pair and the percentage of cygnets surviving to fledging.

However, because of the amateur nature of many of these studies and the high costs involved in large-scale studies, and despite increasing efforts on the part of members of the Swan Study Group to standardise methods and techniques, there remains considerable variation in the range of data that are collected in each study.

Some studies have also been carried out on Irish Mute Swans that have collected data on productivity, such as those looking at birds in Dublin (e.g. Collins 1991) and at birds in southeast Cork (e.g. Smiddy & O'Halloran 1991). These studies have collected data on the number of nests, first egg date, final clutch size and the hatching and fledging success of clutches and broods.

1.3.3 Ringing

Mute Swans are easy to catch in small numbers as they are readily attracted to bait, and as a result many have been ringed. Larger flocks have been caught by herding the birds into confined places or by rounding up flightless birds on their moulting grounds (Owen *et al.* 1986). One of the early very large catches was on the Chesil Fleet in Dorset in 1980, when 831 flightless birds were rounded up using canoes and rowing boats (Perrins & Ogilvie 1981). Another round up in 1982 caught 642 swans. The 2003 round up caught exactly 900 birds (C. Perrins pers. comm.). Catches of over 500 have also been achieved at Berwick-upon-Tweed, with other large catches at Loch of Strathbeg and Montrose Basin (northeast Scotland), Loch Bee (Western Isles), Chichester Harbour and several sites in the English Midlands (Spray *et al.* 2002).

There are several local studies that involve the catching and marking of large numbers of Mute Swans with large, numbered plastic rings, and many of these studies are long-term (Ogilvie 1972b). Studies of local movements and population dynamics have been carried out, for example, in the Midlands (Minton 1968, 1971), the Oxford area (Bacon 1980), the northeast of England (Coleman *et al.* 2002), at Abbotsbury on the Chesil Fleet (Perrins & Ogilvie 1981), and in the Western Isles of Scotland (where birds were marked with neck collars) (Spray & Bayes 1992).

Over 82,000 Mute Swans have been ringed since 1960, with some 19,700 recovered over that period (24%), in addition to numerous re-sightings of colour-marked birds (Spray *et al.* 2002). Minton (1971) reported three quarters of the birds marked in his study in south Staffordshire were recaptured or reported to the BTO ringing scheme. Ringing is very seasonal, and ringers aim to catch birds together with their young before the cygnets fledge and leave their natal territory (Spray *et al.* 2002).

The extensive ringing of Mute Swans has shown that most birds make only short-distance movements and tend to avoid moving over high ground, with the vast majority of flights using river valleys and low-lying areas (Spray *et al.* 2002). Irish Mute Swans have been shown to move more than English birds. A key factor in this is that the distance between flocks is greater in Ireland (Collins & Whelan 1994). In the English Midlands significant movements occur between flocks less than 25 km apart, but this rapidly decreases as distance between flocks increases. Only 3% of all recorded movements in this area were more than 48 km and only 1–2% of birds moved more than 80 km (Minton 1971). In Ireland, Collins and Whelan (1994) reported seeing 55% of birds in two or more flocks, of which 20% were seen in three and 2% in four different flocks. Both studies showed that movements became less frequent with age.

The mean natal dispersal distance derived from 307 British and Irish recoveries is 14 km (Spray *et al.* 2002). Detailed studies have shown that birds move further from their natal sites during their early adult years, but then return to pair and nest closer to them (Coleman & Minton 1979). Once birds are established as breeders their movements tend to become even more restricted, and the median distance for breeding dispersal from 182 recoveries is only 2 km (Spray *et al.* 2002).

In recent years the activities of Swan Rescue Centres have caused problems for the analysis of Mute Swan movements. This is because during the course of the rescue and rehabilitation process, some birds are released at locations different from those where they were caught. Large numbers of birds are released at certain favoured sites, and rings sometimes are removed (Spray *et al.* 2002). It is hard to know the exact numbers of birds involved, and many are handled more than once, but some centres report over 400 birds handled in one year, therefore the figure must be in the thousands (Spray *et al.* 2002). The figures presented in Perrins & Martin (1999) could indicate that as many as 5,500 birds pass through Swan Rescue Centres in England and Wales each year (C. Perrins pers. comm.), therefore it is becoming increasingly difficult to be certain of whether reported longer distance movements are occurring naturally or are assisted (Spray *et al.* 2002).

1.3.4 Population assessment

As mentioned earlier, the presence of the Mute Swan in Britain was taken for granted for a long period of time, resulting in very few attempts being made to estimate the size of the population before the early 1960s (Birkhead & Perrins 1986).

National censuses
The first complete British Mute Swan census was carried out in the summer of 1955, with a partial repeat the following year (Campbell 1960, Rawcliffe 1958). These censuses recorded around 12,000 swans, but the population was estimated to be nearer 19,000–21,600 as some areas were not covered.

A series of complaints from farmers and fishing interests regarding considerable increases in the Mute Swan population in many areas prompted the next census, which was held in the summer of 1961. This was only a partial census, looking at a number of counties in England and Wales that were selected for total cover to provide a basis of comparison with the 1955 results (Eltringham 1963). The population had also been monitored since the first census by the monthly winter wildfowl counts of the then Wildfowl Trust. These counts together with the census results showed that the Mute Swan population may have increased slightly through the late 1950s, reaching a peak of around 21,000–23,000 in 1959 (Ogilvie 1981). A slight drop in numbers was recorded between 1959 and 1961, giving an extrapolated total of around 19,000 in 1961 (Eltringham 1963).

The 1978 census did not cover the whole of the country. This was the first census to count birds in 10-km squares. Birds were counted within a sample of 10-km squares within the National Grid. This method had been the basis of the fieldwork for the The Atlas of Breeding Birds in Britain and Ireland (Sharrock 1976) for the years 1968-72. The method was chosen because the Atlas work had shown that counters worked readily with this unit. Extrapolation from a sample to a national total would be very straightforward, and the overall distribution found by the census could be compared directly with the Atlas map, which only showed distribution and not density. Future comparisons would also be straightforward and would not be affected by county boundary changes (Ogilvie 1981). There was also a major problem with using the counties as a basis for the fieldwork because some major rivers form county boundaries, therefore making it difficult to count in this way (C. Perrins pers. comm.). In this census, a random selection of 50% of those squares with proven or probable breeding, or with birds in suitable habitat in the breeding season (between 1968 and 1972), were surveyed. In addition to the 50% sample, some areas (those counties included in the 1955 and 1961 censuses) were covered in full (Ogilvie 1981). The results suggested a population of 18,400 birds, indicating a possible decline of about 10% since the 1955 census (Ogilvie 1981).

In spring 1983, the next national Mute Swan census was carried out using the same 10-km square method. Full coverage of the country was attempted but was not achieved, and extrapolation of the data was necessary to estimate the population size (Ogilvie 1986b). Comparisons with the 1978 census showed that numbers had remained relatively stable over this period, with a new estimate of 18,750, but that the population had undergone a possible decline of 8% since 1955 (Ogilvie 1986b).

The 1990 census used the same method as the 1978 and 1983 censuses. Complete coverage was not achieved; however, 85% of 10-km squares received coverage or were considered to contain habitat that was unsuitable for Mute Swans. Areas containing high concentrations of the species in England, such as parts of the artificially drained regions of Huntingdonshire, Cambridgeshire and Lincolnshire, and sections of the Somerset Levels and Moors, were not surveyed; similarly neither the Grampian region nor the Western Isles was adequately covered in Scotland (Delany et al. 1992). From this census, the population was estimated to have increased by about 37% since 1983, to 25,750 birds (Delany et al. 1992). Provisional results from the 2002 census suggest 31,700 birds (with 95% confidence limits of 28,600 and 35,200), including 6,150 breeding pairs (WWT unpublished). This compares with an estimate, based on WeBS counts during winter months, of 37,500 for the late 1990s (Kershaw & Cranswick 2003) although, since the British birds are considered to be a separate biogeographical population (Wetlands International 2002), both survey approaches should yield broadly similar results. The results of national censuses of the British Mute Swan population during the breeding season between 1955 and 2002 are shown in Table 1.

Table 1. Changes that have taken place in the size of the British Mute Swan population from 1955 to 1990 (census data collected during the breeding season).

Year	Mute Swan population estimate
1955/56	19,000–21,600
1961	19,000
1978	18,400
1983	18,750
1990	25,750
2002	31,700

A census of breeding Mute Swans in Ireland was carried out in 1976, but unfortunately no data were published (Hutchinson 1979). Ogilvie (1972a) estimated that the Irish population numbered 5,000–6,000 birds. This was seen by Hutchinson (1979) as a reasonable estimate from a review of the numbers of birds concentrated in large flocks in late summer, and the absence of data for many sites where Mute Swans occur. The results of the IWRB International Census 1967-1983 estimated the all-Ireland Mute Swan population to be 7,000 birds (Ruger *et al.* 1986). Sheppard (1993) gives evidence for an increase in the Mute Swan population between 1986/87 and 1990/91 and estimated the Irish population at 10,000 birds in the mid-1980s. The current population estimate remains at 10,000 birds (Wetlands International 2002). However, extrapolation from tetrad counts during the 1988–91 Breeding Birds Atlas project in Britain and Ireland suggests that the Irish population may be much higher (19,000–20,000 birds) than has generally been supposed (Ogilvie & Delany 1993).

WeBS indices
WeBS sites are not always covered every year and therefore population trends cannot be identified simply by comparing the numbers of birds counted. To overcome this, indexing techniques are used (see Underhill & Prys-Jones 1994, Kirby *et al.* 1995) that allow between-year comparisons of numbers even if not all the sites are covered (Pollitt *et al.* 2003). The index values are derived from sites where at least 50% of the maximum possible number of counts, bearing in mind that different months are used for different species, were complete. Where possible the index is based on counts for more than one month. The months chosen for the Mute Swan in Great Britain are September through to March, and in Northern Ireland September through to January (Pollitt *et al.* 2003). WeBS indices for the Mute Swan in Great Britain and Northern Ireland are shown in Fig. 2. The British index shows a similar trend to the census data, with the population remaining fairly constant from the late 1960s to the mid-1980s. Since the late 1980s there has been a large increase in population size. In Northern Ireland, annual index values have generally increased since the mid-1980s, with slight decreases recorded in a few winters (1990/91, 1993/94 and 1996/97). The peak value was reached in winter 1998/99 and since then values have declined slightly.

Common Birds Census (CBC)
Population changes are modelled using a generalised additive model (GAM), a form of log-linear regression model that incorporates a smoothing function (see Fewster *et al.* 2000). Counts are modelled as the product of site and year effects, assuming that between-year changes are homogenous across plots (Baillie *et al.* 2002). 'Smoothing' is used to remove short-term fluctuations, such as those caused by periods of severe weather and measurement error. This, therefore, shows the underlying pattern of population change (Baillie *et al.* 2002). The index series for the Mute Swan on all CBC habitats from 1970 to 2000 shows a similar trend to the census and WeBS data, with the population remaining relatively stable until the mid-1980s. Since then the population has been increasing, with a rapid increase occurring through the 1990s (Baillie *et al.* 2002). The CBC index for the Mute Swan is shown in Fig. 3. As the CBC sample for Mute Swans is relatively small (around 20 plots), it is possible that this is unrepresentative of the population as a whole, as the average abundance of the species in the 10-km squares containing CBC plots may be less than in the other 10-km squares of the species' distribution in the UK (as measured from the new breeding atlas) (Baillie *et al.* 2002).

Breeding Bird Survey (BBS)
Population changes between years are assessed using a log-linear model with Poisson error terms. For each species, the higher count for each square is used (or the single count if the square was visited only once). Counts are modelled as a function of square and year effects. Each observation is weighted by the number of 1-km squares in that region divided by the number of squares counted in that region, to correct for the under- or over-sampling of BBS regions in the UK (Baillie *et al.* 2002). The UK BBS index for the Mute Swan for the period 1994–2000 shows that the population fell slightly between 1994 and 1995 (Fig. 4), but has been steadily increasing since 1995 and increased by 20% between 1994 and 2000 (Baillie *et al.* 2002).

Waterways Bird Survey (WBS)
Population indices are estimated using the methods described for the CBC (see Fewster *et al.* 2000), and

an index series has been created for each species (Baillie *et al.* 2002). The index series for the Mute Swan for the WBS in the UK between 1974 and 2000 shows a slight rise in the population through the 1970s. This is followed by a slight decline during the first part of the 1980s. From 1986 onwards there has been a significant steady increase. The WBS index for Mute Swan increased by 76% between 1975 and 1999 (Fig. 5; Baillie *et al.* 2002). The geographical spread of WBS sites is slightly different from that of the CBC, as a higher proportion of plots are in the north and west of England. However, Wales, Northern Ireland and Scotland are again rather poorly covered (Baillie *et al.* 2002).

Possible causes of population increases

Lead from discarded anglers' weights and from spent gunshot has been a problem for Mute Swans in Britain and Ireland for decades (Simpson *et al.* 1979, Sears 1989a). The lead pellets are mistaken as grit particles and are ingested and ground down in the gizzard before being absorbed into the blood, resulting in lead poisoning (O'Halloran *et al.* 2002). The increase in the British Mute Swan population seen between the 1983 and 1990 censuses can be explained partly by the ban on the use of lead weights in fishing imposed by the Water Authorities in 1987. In the late 1970s lead poisoning was shown to be the largest single cause of death among Mute Swans in England, accounting for the deaths of 3,000–3,500 birds each year at this time (Kirby *et al.* 1994). However, lead was important in different ways in different areas, and its effects depended on how prevalent coarse fishing was. Where only game fishing occurred, lead has never been a major problem (Spray & Milne 1988). Although the situation has greatly improved since the ban on the use of lead fishing weights, lead poisoning remains a problem in some areas because of the persistence of lead in wetland habitats. This is particularly the case on rivers that have been heavily fished in the past, such as the Warwickshire Avon at Stratford, the River Severn at Bewdley in Worcestershire, the River Trent in Nottingham, and the River Thames at Hampton, Reading and Windsor (Perrins *et al.* 2003).

From 1 September 1999 legislation came into force in England that banned the use of lead shot for the purpose of shooting with a shotgun over certain areas and for shooting wild birds listed on Schedule 2 of the regulations. The Mute Swan is included on the list in Schedule 2 (Her Majesty's Stationery Office 1999). Similar legislation came into force in Wales from 1st September 2001 (Her Majesty's Stationery Office 2001).

Lead is still a problem in Ireland as there is no legislation to control its use, and it is widely used in fishing and hunting. O'Halloran and Duggan (1984) showed that birds at a coarse fishing site had increased levels of lead in their blood compared to those at non-fished sites. It may become necessary at some sites to undertake management and mitigation measures to minimise lead poisoning in Mute Swans and other wildfowl. One possible method would be to add grit to the substrate at individual sites. This has been tried at Cork Lough, and the results have shown that blood lead levels and lead poisoning in Mute Swans have reduced since the grit was added (O'Halloran *et al.* 2002).

Winter weather also affects Mute Swan populations, and deaths during the winter due to poor weather are an important cause of mortality in many areas (Spray 1981a, Perrins 1991). The last extensive period of cold weather in Britain was the winter of 1962/63, and this produced a high number of recoveries of dead Mute Swans. Recent years have seen a run of good weather, with particularly mild winters. Mild winters are not only associated with low mortality but are also followed by high reproductive output (Delany *et al.* 1992); this has therefore also contributed to the increase in the Mute Swan population.

Recent years have also seen an increase in the availability of suitable habitats for the species, as the large numbers of gravel pits and ponds that have been created have provided new breeding locations. In addition, improvements to the water quality of rivers and canals, as a result of reduced levels of pollution, may have also helped the species.

The timing and extent of increases in the population resulting from the factors described above will vary from one area to another.

The number and activity of Swan Rescue Centres may also have an effect on the Mute Swan population size (Delany *et al.* 1992, Perrins & Martin 1999).

Productivity

Baillie *et al.* (2002) used Nest Record Scheme data to look at five variables for Mute Swan productivity. These were clutch size, brood size, egg stage nest failure rate, chick stage nest failure rate and laying date. For all these variables except brood size, the mean annual sample is between 10 and 30 and is therefore regarded as a small sample, and this should be taken into account when analysing trends. In the period 1968–1999 Mute Swan clutch size showed a linear decline, with a change of -0.78 eggs (Baillie *et al.* 2002). The egg-stage nest failure rates over the period 1968–1999 showed a curvilinear trend, with a change of 0.0356 nests per day (Baillie *et al.* 2002).

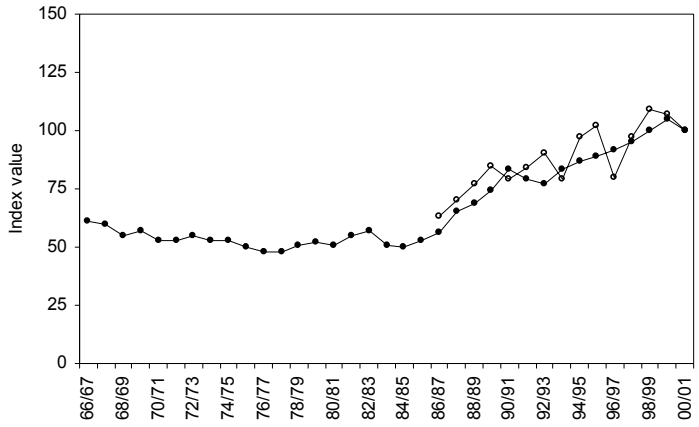


Figure 2. WeBS indices for Mute Swans in Great Britain (●, left axis) and Northern Ireland (○, right axis) (index value set to 100 in 2000/01)

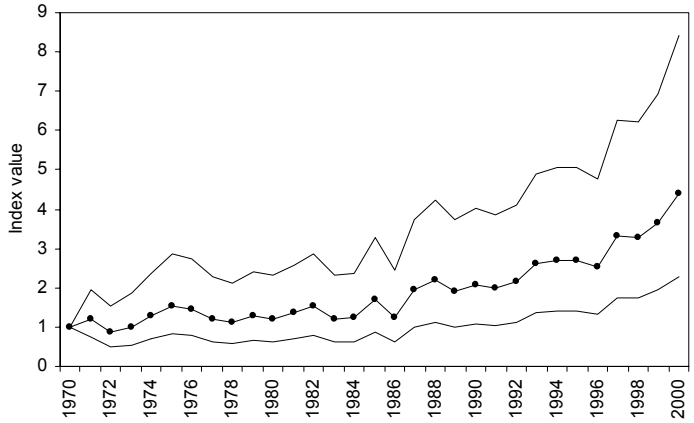


Figure 3. Mute Swan Common Bird Census trend (1970-2000) (the line with the individual data points represents the CBC index; the other two lines represent the upper and lower 95% confidence intervals; index value set to 1 in 1970)

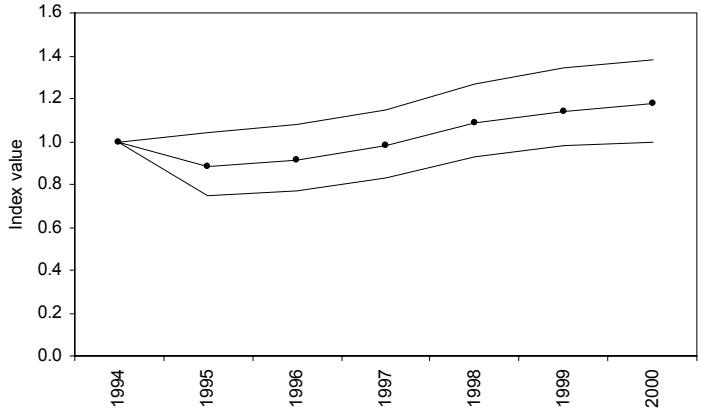


Figure 4. Mute Swan Breeding Bird Survey trend (1994-2000) (the line with the individual data points represents the BBS index; the other two lines represent the upper and lower 95% confidence intervals; index values set to 1 in 1994)

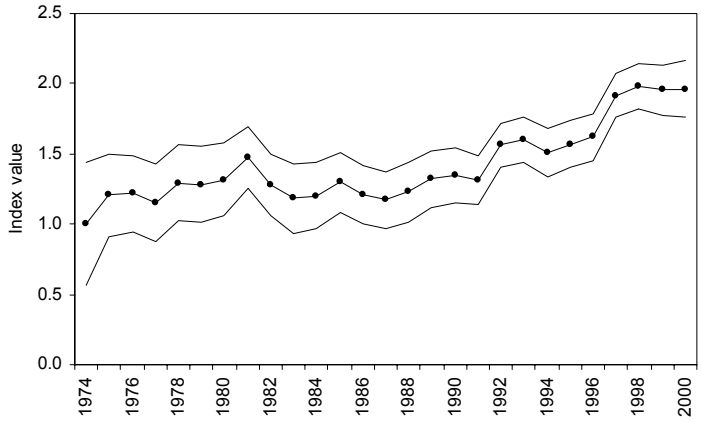


Figure 5. Mute Swan Waterways Bird Survey trend (1974-2000) (the line with the individual data points represents the WBS index; the other two lines represent the upper and lower 95% confidence intervals; index value set to 1 in 1974)

The other three variables (brood size, chick-stage nest failure rate and laying date) showed no trends over the period 1968–1999 (Baillie *et al.* 2002).
The various local studies on Mute Swan populations have shown that the number of cygnets hatched and fledged per breeding pair, the percentage of cygnets surviving to fledging, and hence productivity, vary across the UK. Adult survival rates also vary across the UK.

One of the most detailed studies has been carried out in the English Midlands study area since 1961 (Coleman *et al.* 2001). The number of breeding pairs in this study area between 1961 and 1999 showed a pattern of a decline in numbers to a low point in 1985. This was followed by a marked increase to a peak in 1987. The number of breeding pairs was typically 53–78 in the first 15 years of the study. This fell to only 34 pairs in 1985 before climbing to 120 in 1997 (Coleman *et al.* 2001). Over the period 1961–99 the data on the number of cygnets fledged per breeding pair showed there had been a marked increase in productivity, from an average of 1.75 cygnets fledged per breeding pair in the early 1960s to around 2.70 fledged cygnets per breeding pair in the late 1990s. This increased productivity appears to have occurred mainly since the mid-1970s (Coleman *et al.* 2001).

Data collected in the Oxford study area suggest that breeding numbers around Oxford declined from c. 100 pairs in the early 1960s to 70–80 breeding pairs in 1976–78. However, the declines were localised, occurring mainly in Oxford and on the Lower and Upper Thames (Bacon 1980). In 1977 the number of cygnets fledged per pair in the Oxford area was 2.5, and in 1978 3.1 cygnets were fledged per pair (Bacon 1980).

At Abbotsbury Swannery the number of breeding pairs increased between 1969 and 2000. Studies of the birds at Abbotsbury have shown that this population raises many fewer cygnets per pair to fledging than do territorial Mute Swans elsewhere in the UK (McCleery *et al.* 2002). This is because the large numbers of non-breeding birds that are present harass the cygnets raised outside the pens, and most of the young are lost within one to two weeks (Perrins & Ogilvie 1981). However, it should be taken into consideration that the birds breeding at Abbotsbury are in an artificial, semi-colonial situation, where they do not encounter many of the hazards experienced by most wild swans (McCleery *et al.* 2002).

The Western Isles hold one of the highest densities of breeding Mute Swans in Britain, with 99–140 pairs nesting each year. Productivity here is low, compared to the Midlands and Lothians study areas, at 1.77 cygnets fledged per breeding pair (Spray 1991). However, this level of productivity is quite sufficient to replace the number of adults dying, as adult survival is high (90%) (Birkhead & Perrins 1986). Spray (1991) also showed that Mute Swan productivity levels here are closely related to habitat type. Pairs nesting on eutrophic ('machair') lochs in the Western Isles fledged an average of 2.86 cygnets, compared to only 1.56 and 1.47 cygnets for pairs nesting on mesotrophic and saline lochs (Spray 1991). In addition, the cygnets on the machair lochs were also heavier and survived better than those on other lochs.

In the Lothians study area, the number of breeding pairs increased significantly between 1978 and 1998, with just 15 pairs in 1978 and 69 in 1998. However, there was no overall change in productivity during the study period with 2.6 cygnets fledged per breeding pair (Brown & Brown 2002). This study has also shown that Mute Swan productivity levels are related to habitat type, with pairs nesting on low altitude still waters and rivers fledging on average 2.1 cygnets per breeding pair, compared to 3.6 cygnets for pairs on mid-altitude still waters. The low productivity on rivers was the result of a high proportion of breeding pairs losing complete clutches or broods rather than from low cygnet survival rates, whilst the low productivity on low altitude still waters resulted from low cygnet survival rates (Brown & Brown 2002).

Data from Irish studies showed that for Mute Swans in Dublin about 80% of clutches hatched. The mean brood size was 4.2 per nest at hatching and 2.7 per nest at three months. A shortage of suitable territories in the area seemed to limit recruitment into the breeding population and to encourage the use of unsuitable territories (Collins 1991). The southeast Cork study showed that 71% of clutches hatched successfully; the mean brood size at fledging was 3.8 cygnets per clutch. No significant difference was found in the mean number of cygnets produced per clutch on lakes, rivers, bogs and estuaries in the area (Smiddy & O'Halloran 1991).

1.4 Annual cycle

The British and Irish populations of Mute Swans are largely sedentary. Birds breed, moult and winter in Britain and Ireland, with relatively short-distance movements occurring mainly at specific times of the year. These movements are associated with breeding, moulting or winter weather. A full discussion of Mute Swan movements can be found in the *Migration Atlas* (Spray *et al.* 2002). In severe winters, very

occasional movements of birds into southeast England from the near continent have been recorded (Ogilvie 1986a), and British birds have been noted on the continent (Spray *et al.* 2002). Some movement of birds, often juveniles, also occurs between the Western Isles of Scotland and Northern Ireland and the Irish Republic (Spray 1981b). Minton (1971) showed that most such long distance movements take place during birds' first two years of life.

1.4.1 Breeding season

The Mute Swan is widespread on lowland wetland habitats such as slow-flowing rivers, lakes, ponds and estuaries in Britain and Ireland (Delany *et al.* 1992, Ogilvie & Delany 1993). They also occur on man-made wetlands (e.g. gravel pits) and in urban areas. In Britain, the greatest numbers of breeding birds are found in central, eastern and southern counties. They are largely absent from many northerly and westerly areas where high ground predominates. However, they flourish in the southern Western Isles of Scotland and Orkney (Ogilvie & Delany 1993). Here, the highest breeding densities occur in lowland river basins and isolated areas (Spray *et al.* 2002). In Northern Ireland, the highest numbers of breeding birds are found in the eastern areas, particularly around Loughs Neagh & Beg (Ogilvie & Delany 1993).

Mute Swans normally choose a nest site where there is plenty of vegetation nearby. The pondweeds *Potamogeton, Myriophyllum* and *Chara* are important food resources in freshwater habitats. In brackish and saltwater areas eelgrass *Zostera*, tasselweeds *Ruppia* and various green algae are the main sources of food (Kirby *et al.* 1994). The birds also select sites where there is easy access to and from the water. Nests tend to be in the same site year after year, and sites can be on still waters, canals, rivers, coastal or estuarine shores, grazing marshes and islands or in reedbeds. Choosing a nest site where the cygnets have easy access to food does not appear to be a priority. Parents are often prepared to take newly hatched cygnets some distance to suitable feeding areas (Birkhead & Perrins 1986). Mute Swans do not actually put food into the mouths of their cygnets, but the cygnets are not totally independent of their parents. The adults help to make food more available to their young by foot paddling to stir up food so the cygnets can peck at the surface, picking up small food items. The parents also bring up food from under the water, which the cygnets would otherwise be unable to reach (Kear 1972).

Many of the individual studies of Mute Swans in Britain have collected data on these aspects of the breeding biology of Mute Swans (e.g. Minton 1968, Coleman *et al.* 2001). However, there are little detailed breeding biology data available on Irish Mute Swans (Smiddy & O'Halloran 1991).

Most Mute Swans pair for the first time when between two and four years old. Occasionally birds will find a mate at one year old, but others may not pair until they are five or six years old (Minton 1968). In the English Midlands study area, data from a 39-year study of the Mute Swan showed that birds paired, on average, in their third year (Coleman *et al.* 2001). Most pair bonds are formed initially in the non-breeding flocks, and displays are often seen within these flocks in the spring. Many birds are paired for over a year before they start breeding, and during this year they will probably occupy a territory (Minton 1968). This is shown in the English Midlands study where, on average, birds first bred in their fourth year (Coleman *et al.* 2001).

Mute Swans are highly territorial, and mature birds without a territory do not usually breed. Once a territory has been established, birds defend it rigorously to prevent intruders from trying to set up a territory nearby (Kear 1972). Territory size probably depends on the quality of the habitat, with lower densities in the less favourable parts of their range (Ogilvie & Delany 1993), however there is great variability in territory size. On rivers around Oxford, the average territory size was shown to be 2.5–3 km (Bacon 1980); territories on the best-quality rivers around Oxford were found to be smaller than this. Some pairs on the River Thames can be more than 15-km apart; however, when the birds were more abundant in this area they were much closer together (Bacon 1980). During incubation the birds are less aggressive, but afterwards they defend water-borne territories. In Britain, Mute Swans nest colonially at Abbotsbury in Dorset within metres of each other, although this is the site of a long-established Swannery and the situation is somewhat artificial. By comparison, on Loch of Harray, on Orkney, Mute Swans have recently begun breeding semi-colonially in the wild and a similar high-density nesting attempt has been made in the Western Isles in the past (C. Spray pers. obs.), whilst birds at Radipole Lake near Abbotsbury have also nested in close proximity in dense reeds (Birkhead & Perrins 1986).

Many Mute Swans retain the same territory throughout their breeding lives; however, territory changes can occur. Pairs have been known to change territory after experiencing a season as a non-breeding pair on their original territory or after failing to breed successfully (Coleman *et al.* 2001). Monogamy is the rule for swan species, but

polygamy occurs very occasionally. Divorce occurs among swans, and in the Midlands study area it was responsible for a surprisingly high proportion of occurrences of changes in mate (38% of males and 36% of females) (Coleman *et al.* 2001). Death or the disappearance of the old mate is the other main cause of mate change. A change of mate can also lead to a change of territory for one or both of the pair (Coleman *et al.* 2001).

Mute Swan clutch sizes have been measured in a number of studies. There is very little variation across Britain, and clutches in almost all areas average around 5.5–7 eggs, though this varies between season and habitat (Birkhead & Perrins 1986). An exception to this is the colony at Abbotsbury, where the average clutch size is just under five eggs (Perrins & Ogilvie 1981). Generally, average clutch sizes of Irish birds are also within this range, with a mean of 5.5 eggs recorded in southeast Cork (Smiddy & O'Halloran 1991) and 6.7 recorded in Dublin (Collins 1991). Eggs are usually laid in late March, April or the first half of May, with incubation normally lasting 35.5 days (Kear 1972). The number of cygnets hatched varies quite markedly. This variation is due mainly to the proportion of the nests failing to produce any cygnets at all. The reasons for failure differ from area to area, with the commonest causes being vandalism by humans and flooding of nests. The highest nest failure rates in Britain are seen in the Midlands study area, where about half of the nests fail (Birkhead & Perrins 1986). Mute Swan cygnets take longer than cygnets of some of the other swans to fledge, with cygnets fledging 120–150 days after hatching (Kear 1972).

The pattern of mortality in young Mute Swans in the UK seems to be largely similar across the country (Perrins 1991). As cygnets start to leave their natal area in October, monthly death rates rise sharply. Mortality rates remain high until April, when the birds settle down for the summer and eventually moult. At this time they remain in one location and death rates begin to fall (Perrins 1991). Coleman *et al.* (2001) showed that of 1,647 birds for which exact age was known at time of death, 75% died during their first two years of life. The probability of survival of young birds and immatures improves with time.

Adult survival rates are usually high, and survival rates for birds over four years, most of which are established breeders, can be very high e.g. 85% in the Midlands (Birkhead & Perrins 1986) and 90% on the Western Isles (Spray 1991). Dead birds are easily noticed and this, combined with the detailed nature of regionally focused studies and the species's close association with humans, means that the ringing recovery rate of 24% is among the highest for any species in Britain and Ireland (Spray *et al.* 2002). Around 53% of all Mute Swan ring recoveries are linked to a known cause of death, and exactly half of these are the result of human-related circumstances; a further 14% resulting from pollution and 8% for birds deliberately taken by humans can be added to this figure (Spray *et al.* 2002). Since the reduction in deaths from lead poisoning, the main cause of death in Mute Swans is collision with overhead wires. Perrins & Sears (1991), in a study using all British and Irish ring recoveries, showed that 22% of reported deaths were due to collisions with wires. Other detailed studies have shown similar or higher figures, with wires accounting for 30–40% of all deaths in the Midlands study area (Coleman *et al.* 2001), 25.6% of all deaths in the northeast England study area (J. Coleman pers. comm.) and up to 46% of deaths in the Western Isles (Spray 1991). Other causes of mortality include predation, shooting, oiling, lead poisoning and vandalism (accounting for 6% of deaths for non-breeding birds and 10% for breeding birds in the Midlands) (Coleman *et al.* 2001). Seasonal mortality data show a similar pattern in both Britain and Ireland, with most birds dying in early spring (O'Halloran & Collins 1985). This may be caused by the increased mobility of birds at this time of year, with pairs seeking out territories and the last remaining young of the previous year being displaced from their natal territories (O'Halloran & Collins 1985).

1.4.2 Moult migration

Mute Swans, like other waterfowl, moult all their flight feathers simultaneously and for a period of 4–5 weeks are thus flightless. Individual birds may be in full wing moult from May through to the end of October, but there is a clear difference in the strategy adopted by successful breeding pairs and other birds (Coleman *et al.* 2002). Whilst successful pairs moult on their territories (the adult female first, the male later), failed breeders, non-breeders and immatures gather at traditional moult sites. These areas are large, safe areas where there is an abundant supply of food. Such sites are generally estuaries, lakes or reservoirs.

Minton (1971) reports the movement to these moult sites starting in mid-May through to the end of June, with the return in September. Detailed work on the large moult flock at Berwick (Spray *et al.* 1996, Coleman *et al.* 2002) suggests that birds move to the moult flock at a slightly later date at that site and a gradual dispersion from Berwick in late August and September. Although the exact timing of moult may vary between areas, being apparently slightly later in

the Orkneys and Western Isles than further south (C. Spray pers. obs.), there remains a period of relative non-movement from mid-July to early August.

The exact catchment for each of the British moult flocks is not fully known and as the population has increased new sites have formed (and some later disappeared). However, the ringing and re-sighting of large numbers of birds on moulting grounds has shown that the movement of birds to these areas involves the avoidance of moving over high ground (Spray *et al.* 2002). For example, the birds that moult at Berwick move either along the coastal plain or via the Tweed Valley, rather than moving inland over the hills (Coleman *et al.* 2002). Whilst moult movements probably involve local birds, data from aerial surveys and ringing at the Montrose Basin in east Scotland have shown that an influx of nearly 200 birds occurs during the moulting period, rather than just a redistribution of local Mute Swans. There is little interchange to the north and the birds subsequently disperse from Montrose to the south and southwest (Spray & Atkinson 1991).

1.4.3 Winter distribution

Unlike migratory swans, a large number of British and Irish Mute Swans maintain their territories throughout the year (Kirby *et al.* 1994). Scott (1984) showed that winter temperature and available food supply were the critical factors that cause territorial pairs to abandon a site. Staying on territory is important in preventing other pairs from taking over an apparently empty site. However, territories sometimes become less exclusive in winter, and pairs occasionally share with large flocks of immature birds. Large numbers can also be seen in public parks or on rivers used for public recreation, where they benefit from food provided by the public (Kirby *et al.* 1994).

In the winter months, most aquatic vegetation dies down in British and Irish freshwater habitats. At this time, Mute Swans will graze on emergent plants, grass swards and, in more recent years, agricultural crops (Kirby *et al.* 1994). The species has shown particular preferences for oilseed rape fields in parts of Scotland and northern England (Spray *et al.* 2002) and improved grassland in the Wylye Valley, Wiltshire (Trump *et al.* 1994). This habit has brought the species into conflict with farmers in certain areas because of the alleged damage the birds cause (Trump *et al.* 1994, Spray *et al.* 2002). Birds living in urban areas through the winter may be dependent on the food supplied to them by humans. The birds wintering on Cork Lough in Ireland (Keane & O'Halloran 1992) and in urban areas in the Thames Valley, England (Sears 1989b) were shown to be at least partially dependent on the bread supplied to them by humans. Bread was also shown to be extremely popular amongst Mute Swans in areas where natural food is readily available, such as Blagdon Lake and a gravel pit at Dinton Pastures (Sears 1989b).

1.4.4 Spring dispersal

Early spring is one of the major periods when Mute Swans disperse. The movement occurs from flocks of mainly immature birds aged between one and four years old. Once a pair has established a firm partnership, they fly off and explore suitable territories. Often, the pair will return to the general area where the female was raised. In the 39-year study in the English Midlands, 50% of females and 33% of males took up territories within 5 km of their birthplace (Coleman *et al.* 2001). There is also movement of young from the previous year as they move from their natal grounds, usually into the nearest non-breeding flock, and of 132 first-year birds recovered dead in a Midlands study area only 6% were more than 32 km from their natal site (Minton 1971, Coleman & Minton 1979). By late spring, when territories have been established, the Mute Swan population in Britain and Ireland remains largely sedentary until movements begin in late spring or early summer for the moult period.

1.5 Conservation and management

1.5.1 Legislation and other conservation measures

1.5.1.1 International

Conservation status
The Mute Swan is classed as a Non-SPEC species in Europe, i.e. it has a favourable conservation status (Tucker & Heath 1994). As British Mute Swans are non-migratory, this section of the population is not listed on the African-Eurasian Waterbird Agreement, prepared under the Bonn Convention on Migratory Species.

Habitat protection
The EC Directive on the Conservation of Wild Birds (79/409/EEC) (the 'Birds Directive') requires Member States to classify Special Protection Areas (SPAs) for species listed in Annex I of the Birds Directive and regularly occurring migratory species.

As the Mute Swan population in the UK is non-migratory and does not appear on Annex I of the Directive, there are no SPAs designated for this population. Another means of protection for important wetland habitats is the designation of Ramsar sites. Mute Swans can often be found at Ramsar sites and at SPAs that have been designated for other species and may, therefore, benefit from the protection given to these sites.
Species protection

As a wild bird, the Mute Swan is protected to a degree by the Birds Directive; however, the species is listed on Annex II/2 of the Directive. This means that Mute Swans may be hunted under national legislation in certain Member States, but that Member States are to ensure that any hunting that takes place does not jeopardise conservation efforts. The Mute Swan is listed in Appendix III of the Bern Convention, and therefore exploitation of this species must be regulated in order to maintain the population in a favourable conservation status (Council of Europe 1979). The species cannot be hunted in the UK but is hunted in many areas of the EU; for example, about 2,000 Mute Swans are shot annually in the Netherlands (C. Perrins *pers. comm.*).
Britain and Northern Ireland

1.5.1.2 Great Britain and Northern Ireland

Conservation status
The Mute Swan has recently been moved from the 'Green' list to the 'Amber' list of 'The Population Status of Birds in the UK' (Gregory et al. 2002), as the breeding birds in Britain are now considered to be a discrete population, but this does not reflect changes to the numbers of Mute Swans in Britain.
Habitat protection

The key site designation in Britain is Site of Special Scientific Interest (SSSI) and in Northern Ireland Area of Special Scientific Interest (ASSI). These sites are areas of land notified under the Wildlife and Countryside Act 1981 and the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985 as being of special nature conservation interest (Nature Conservancy Council 1989). The aim of these sites is to safeguard the best examples of habitat types and notable species or groups of species. Attributes used in the selection of sites include: naturalness; diversity; typicalness of the habitat type; size – associated with the ability of the site to sustain a viable population of the characteristic species; and rarity – measured by the scarcity of the species or habitat type. For birds, a site can be selected for notification as an SSSI for a variety of reasons, but principally because it regularly supports 1% or more of the British population in any season. Sites with a good diversity of species in any season can also be selected, either according to the total numbers of species present or for supporting a specific assemblage. In this context, the Mute Swan is a component species of the breeding bird assemblage in lowland open waters and so its presence in such habitats is used in evaluations of overall species diversity. SSSIs can also be notified if the site is designated as a Ramsar site or a Special Protection Area. Mute Swans are found in SSSIs and ASSIs across Britain and Northern Ireland, but the total numbers of birds protected by each of these site networks have not been evaluated.
Many of the best SSSIs have also been designated as National Nature Reserves (NNRs) to increase their importance for conservation. The legislative protection given to NNRs is the same as that given to SSSIs.

Species protection
The Wildlife and Countryside Act 1981 protects Mute Swans in Britain. Under Part 1 of this Act it is illegal to: kill, injure or take any wild bird; take, damage or destroy a nest while it is in use or being built; take or destroy an egg. However, this species is not listed under Schedule 1 of the Act, and therefore does not receive special protection. The same levels of protection are given to the species in Northern Ireland by the Wildlife (Northern Ireland) Order 1985.

There is also the fact that the Mute Swan is a Royal Bird and the Crown has the prerogative right to claim ownership of any unmarked Mute Swan on open waters. Today the Crown normally claims birds only on the River Thames, but has the right to do so elsewhere if it wishes. A man was convicted of damage to Her Majesty's property when he was caught killing two adult Mute Swans at Stroud in Gloucestershire (C. Perrins pers. comm.).

1.5.2 Hunting

The Mute Swan, its nests and eggs are protected in Britain and Northern Ireland from deliberate killing or destruction. However, vandalism has occurred for many years in the form of deliberate shooting and nest destruction. Birkhead and Perrins (1986) showed from ring recoveries that of the 3,783 birds recovered 123 had been shot. Incidents of illegal deliberate shooting still occur, and 8% of Mute Swan ring recoveries are attributed to birds having been deliberately taken by humans (Spray et al. 2002). It is, however, difficult to know exactly how many birds are killed illegally, as some birds may be removed and eaten, therefore leaving no evidence (Birkhead & Perrins 1986).

1.5.3 Agricultural conflict

Mute Swans use agricultural fields and are increasingly coming into conflict with farmers when they, allegedly, cause damage. Most complaints occur between late winter and early spring, which is when the birds' natural foods are scarcest (Owen *et al.* 1986).

Whilst Whooper Swans *Cygnus cygnus* feeding on agricultural land in Britain during the winter are a common sight, the use of such habitats by the Mute Swan is a more recent phenomenon (Kirby *et al.* 1994, Rees *et al.* 1997). Mute Swans will feed on winter cereals, oilseed rape and improved grassland. In Scotland and northern England, particularly in the Tweed Valley and at Montrose, Mute Swans have shown a preference for fields of oilseed rape (Chisholm & Spray 2002). The alleged damage caused by the birds includes reduced crop yields, puddling of fields and trampling of crops with their large feet, soil compaction and the contamination of land from droppings (Spray *et al.* 2002). As a result of concerns regarding damage at Montrose, a Swan Management Demonstration Programme was started in 1998. This involved the provision of an alternative 'sacrificial' oilseed rape field to encourage the birds away from other fields. A 'swan scarer' is also employed temporarily to scare swans from the other fields onto the sacrificial field (Anon 2002, Spray *et al.* 2002).
In the Wylye Valley, Wiltshire, and adjacent catchments there have been complaints from farming and fishing interests regarding damage by Mute Swans, and the frequency of such complaints has increased (Trump *et al.* 1994).

In the Wylye Valley, it has been shown that the birds have a clear preference for feeding on improved/semi-improved/reseeded grassland during winter and early spring. Farmers in the area have expressed concerns regarding the loss of grazing to Mute Swans, the effects of the birds' droppings on grass palatability to stock and on silage fermentation, and the effect of trampling of grass by large flocks of birds (Trump *et al.* 1994). It was found, from studies using enclosures, that Mute Swan grazing on improved grassland in the Wylye Valley led to losses of grass yield averaging 11.4%, and this delayed the turnout of ewes, which as a result needed supplementary food (Trump *et al.* 1994).

There have also been complaints from fishing interests in the Wylye Valley and elsewhere in southern England as overgrazing of aquatic macrophytes, particularly water-crowfoot *Ranunculus* spp., by Mute Swans may reduce Brown Trout *Salmo trutta* territories and interfere with reed management regimes (Trump *et al.* 1994, Watola *et al.* 2003). This damage occurs mainly in the summer when the aquatic plants are growing actively. There have also been complaints that the species is a nuisance to the public in urban parks (Spray *et al.* 2002).

As a result of the alleged damage caused to agriculture and fisheries, birds have been shot illegally and requests have been made to cull large numbers of birds.

2 SURVEY OF AREAS USED DURING THE NON-BREEDING SEASON

The following accounts give a detailed review of the abundance, distribution and phenology of the Mute Swan in Britain and Northern Ireland during the non-breeding season, based on data collected through the various national monitoring schemes. In addition, some counts have been obtained from county bird reports or submitted by regional experts. A similar review of Mute Swans in the Republic of Ireland would be a valuable exercise.

Although every effort has been made to gather data from a wide range of sources, there are concerns about the nature, reliability and completeness of the data. Particular concerns are:

- WeBS concentrates on the period September–March and few counts are made during the moult period in late summer. Therefore the importance of sites that hold large numbers of swans at that time but that are of less importance during the winter may not be identified using WeBS data alone.
- It is not always possible to use data from county bird reports. At larger sites that are split into a number of smaller counting areas, the counts may not have been co-ordinated and therefore cannot be summed with confidence.
- Further, data provided by county reports are often not systematic, and there are considerable variations in the detail of reported data at some sites, particularly with regard to low or zero counts. Few records are provided for non-breeding birds, particularly in older reports. More recent data (1980–2001) are generally more detailed and consistent than older data.
- Members of the Swan Study Group hold a large amount of data on Mute Swans, much of which is as yet not published or generally available.

Geographically discrete regions of importance for Mute Swans are considered separately and each description is split into five sections:

Background
This provides brief information on the distribution of Mute Swans in the region and the types of habitat used.

Historical status
This is based primarily on data collected since 1960/61 and provides an overview of trends in numbers at a site-based and regional level. However, where data or published information are available, the status prior to 1960/61 is also reviewed. This section also highlights those sites that were once important for Mute Swans but where numbers have fallen over the period of the review.

Internationally and nationally important sites
Where a region contains internationally important sites, detailed accounts of these sites are given. In their review of Anatidae populations in Africa and Western Eurasia, Wetlands International classified Mute Swans in Britain and Ireland as being distinct biogeographic populations, separate from each other and from those in mainland Europe (Scott & Rose 1996), thus any site of national importance for Mute Swans in Britain and Ireland is by definition also of international importance. A wetland in Britain is considered internationally important if it regularly holds 1% or more of the estimated British population and in Ireland if it holds 1% or more of the estimated all-Ireland population.

The threshold for international importance chosen to select sites for this review was 260 individuals. This is derived from an estimate of 25,748 individuals obtained during a national census of Mute Swans in Britain in 1990 (Delany et al. 1992), and a figure of 25,750 was consequently adopted as the British estimate (Kirby 1995, Stone et al. 1997). The 1% threshold for national importance in Britain was therefore set at 260 birds (e.g. Pollitt et al. 2003). Scott & Rose (1996), however, adopted a different rounding convention, and gave a 1% threshold of 250 for this population, a figure retained in Wetlands International's second global review of waterbird population sizes (Rose & Scott 1997).

The Mute Swan estimate for Britain has since been revised, and a figure of 37,500 has been adopted as the estimate both nationally (Kershaw & Cranswick 2003) and internationally (Wetlands International 2002). However, in line with accepted practice, the earlier figure of 260 has been retained to select sites for inclusion in this review, and the new threshold has not been applied retrospectively. Clearly, some sites listed in this review as being of international importance may not meet the revised international threshold in future assessments. The all-Ireland 1% threshold used in this review is 100 individuals (Shepherd 1993), which remains unchanged in the most recent revision of international thresholds (Wetlands International 2002).

Five-year peak means during the non-breeding period for each internationally important site in

Britain and Northern Ireland (derived from WeBS data, county bird reports and local experts) are given in Table 2. The locations of each of these sites are illustrated in Fig. 6.

Site accounts contain detailed information on current status and trends, site protection measures, habitats present and site use. For definitions of site safeguards and selection criteria/guidelines mentioned in the text, see www.english-nature.org.uk; www.ehsni.gov.uk for Sites/Areas of Special Scientific Interest and National Nature Reserves in England and Northern Ireland; Stroud *et al.* (2001) for Special Protection Areas (SPAs) in Britain and Northern Ireland; Ramsar (1999) for Ramsar sites; and Heath and Evans (2000) for Important Bird Areas (IBAs).

For each site, figures are presented showing the peak counts recorded in each year since 1960/61. Unless otherwise stated, a circle highlights years in which no counts were made at a site. For sites with adequate data, figures illustrating the phenology of use are presented. Columns represent mean counts made in each month between 1996/97 and 2000/01. Bars represent maximum and minimum counts over this period.

Other sites

This section gives information on sites that have regularly supported flocks of 100 or more Mute Swans in Britain, or 55 or more Mute Swans in Northern Ireland during the non-breeding season and/or that have a long history of occupancy but do not support internationally important numbers according to WeBS data. However, it is recognised that there are numerous sites within the UK that are important for Mute Swans but which hold smaller numbers. These flock sizes have been chosen solely as a cut-off point for this review. As a result of the nature of the data available it is possible that sites that regularly hold over 100 birds in Britain or over 55 in Northern Ireland during the moult season (and smaller numbers in winter) may have been missed. The Mute Swan population is changing rapidly and therefore the importance of the sites that are used is also changing. As a result, there may also be 'new' sites that now hold over 100 birds in Britain and over 55 in Northern Ireland but that did not hold such large numbers during the period of this review.

Table 2. Sites of international importance for Mute Swans in Britain and Northern Ireland (in descending order of importance) based on numbers during the non-breeding period.

	Site name	5-year mean (1996/97–2000/01)
1.	Loughs Neagh & Beg	1,939
2.	Fleet/Wey	1,193
3.	Somerset Levels and Moors	864
4.	Tweed Estuary	598
5.	Ouse Washes	569
6.	Rutland Water	502
7.	Abberton Reservoir	464
8.	Loch of Harray	439
9.	Upper Lough Erne	408
10.	Loch Leven	375
11.	Christchurch Harbour	373
12.	Stour Estuary	342
13.	Montrose Basin	329
14.	Loch Bee (South Uist)	320
15.	Hornsea Mere	301
16.	Tring Reservoirs	298
17.	Morecambe Bay	285
18.	Severn Estuary	285
19	Humber Estuary	275
20.	Avon Valley: Salisbury–Fordingbridge	269
21.	Fen Drayton Gravel Pits	269
22.	Strangford Lough	138
23.	Lough Foyle	114

Figure 6. Internationally important sites for Mute Swans *Cygnus olor* in Britain and Northern Ireland (see Table 2 for key to sites)

Key references
This section gives a comprehensive list of relevant literature and published and unpublished monitoring data on Mute Swans in each region.

It should be noted that the definition of a site varies according to the user. Even for the same general area, for example an estuary, the site boundary as defined by the habitat may be different from the boundary defining the limits of statutory protection and from the 'boundary' used by the birds, because of the different criteria that each use. Furthermore, the definition of a site for waterbird use will vary still further for different species, since some species will be restricted largely to intertidal or saltmarsh areas while others will use inland areas for feeding or roosting. Nevertheless, the concept of a site is interpreted in a broadly similar manner for many wetland habitats, such that lakes, reservoirs, gravel pits and estuaries are generally treated as discrete sites and differences in the boundaries for different uses are generally minor. The treatment of sites in this review adopts this general, intuitive approach.

Large numbers of Mute Swans also occur, however, along rivers, in many cases in high densities over considerable stretches. The limits of a site along a river are far more difficult to define using this general approach because of the geographical extent of the habitat. A number of riverine sites have been included in this review, but in these cases the definition of the site is far more likely to represent the stretch of river for which data have been regularly supplied. This is likely to be a function of both the number of birds and the relative ease of access and coverage of a manageable area for the purposes of the survey; several rivers with known high concentrations of swans and regular coverage are thus included. In many cases, however, it is likely that high bird densities may continue into adjoining stretches of river. It is also likely that stretches of river that support high densities of Mute Swans are not included in this review, primarily because rivers feature relatively little in surveys of waterbirds and there is a resulting paucity of data for this habitat. Consequently, the inclusion of certain river stretches in this review may not represent the most appropriate definition of a site for Mute Swans, and several stretches of river supporting qualifying numbers of birds have probably been overlooked.

2.1 Britain

2.1.1 Northern Scotland (Shetland, Orkney, Highland, Western Isles, Skye, Grampian)

2.1.1.1 Background

Shetland comprises 117 islands, 16 of which are permanently inhabited. The islands are studded throughout with numerous freshwater lochs, many of which are acidic and very bleak. The coast is equally broken, with many voes, or sea lochs, which extend far inland. More than 90% of the land is classified as rough grazing and is suitable only for sheep grazing (O'Dell & Walton 1962). Small numbers of Mute Swans are present on freshwater lochs such as the Loch of Spiggie (HU3716) and the Loch of Brow (HU3815).

Orkney is made up of 90 islands, holms and skerries, only one fifth of which are inhabited by humans. However, only about 70 of these islands could ever be utilised by birds (E. Meek pers. comm.). The islands extend for 74 km from north to south and for 61 km from east to west, and have a total area of 97,250 ha (Owen *et al.* 1986). The climate is cool and equable because of the strong maritime influences. Away from the coastline the topography consists of low rolling hills, with nowhere outside Hoy above 900ft. The predominant habitats are improved grasslands for sheep and cattle grazing, rough pasture and moorland interspersed with lochs, machair and dune systems. The Lochs of Harray and Stenness support a large population of Mute Swans, and numbers here have been well documented (e.g. Meek 1993). The Loch of Harray also supports a large moult flock and many breeding pairs. Orkney now has one of the highest densities of Mute Swans in the UK.

There have been few occurrences of Mute Swans in Lewis and Harris. The population of Mute Swans on the Western Isles is centred on the Uists and Benbecula, and this population was the subject of a detailed study in the late 1970s and early 1980s (Spray 1981a). The two main flocks are found on Loch Bee, South Uist, and a smaller one also occurs on the Loch an Duin complex of sea lochs (NF8974) near Loch Maddy. Movements of birds from these islands to Northern Ireland and the Irish Republic are known to occur (C. Spray pers. obs.). During the moult season, Loch Ollay, South Uist (NF7432), may briefly hold large numbers of birds, and smaller flocks can be seen near Balranald RSPB reserve (NF7169). Elsewhere, the population is widely

dispersed in pairs or small groups, mostly on brackish water or on the rich machair lochs on the west coast.

The coastline of Skye is deeply indented, with long stretches of rock and cliff broken only by a few small patches of saltmarsh at the heads of the sea lochs. The inland waters are generally devoid of food and shelter, except in one or two places where outcrops of limestone have encouraged richer and more varied vegetation (Owen *et al.* 1986). Therefore, as on Harris and Lewis, there are few Mute Swans on Skye.

The birds in the Highland region of Scotland are generally isolated from the populations to the south, although it is probable that some movement occurs along the east coast (C. Spray pers. obs.). They are confined mostly to a narrow lowland belt along the coast (Owen *et al.* 1986). Important sites in this area for Mute Swans include the Cromarty and Dornoch Firths and Loch Eye. Inverness Harbour and the adjacent shoreline are used extensively in the winter, and a regular moult flock can also be seen (C. Spray pers. obs.). Pairs and small flocks can be found on most waters in the area.

The birds of the Grampian region are confined mostly to the lowland areas around the coast. Large flocks of Mute Swans occur on the Loch of Strathbeg and Loch of Skene, while smaller numbers are found on Loch Spynie (NJ2366), the Ythan Estuary (NK0026) and at the Mouth of the Spey (NJ3465).

2.1.1.2 Historical status

The Mute Swan was first recorded in Orkney in the summer of 1869, when four birds appeared on the Loch of Skaill at Sandwick (HY2418) (Booth *et al.* 1985). By 1941, the species had increased significantly and was widely distributed, and breeding had also been recorded. Mute Swans have long been a feature of the Lochs of Harray and Stenness, and during the summer of 1941 82 adult birds were seen on the Loch of Stenness and 92 on the Loch of Harray (Booth *et al.* 1985). In the early 1980s the lochs were known to hold around 50% of Orkney's breeding population of 65 pairs. During the late 1980s numbers of both breeding and wintering birds were increasing. Numbers peaked in the early 1990s, and by the 1990/91 winter over 1,000 Mute Swans were present on the Loch of Harray (Meek 1993). The large increase in numbers was due to the introduced aquatic macrophyte, Canadian Pondweed *Elodea canadensis*, reaching a peak. Canadian Pondweed was first noticed in the loch in 1982. By 1987 it was the most widely distributed plant species in the loch, and it was especially dense in the northern bays (Meek 1993). However, from early in 1991 there were signs that the amount of pondweed available for the birds was declining: dead Mute Swans (around 250 in total) began to be found around the loch shores in late March and mortality continued throughout the rest of the year. A marked decline in wintering birds was apparent by 1991/92 and in breeding birds in 1992. The decline in wintering numbers and the crash in the breeding population coincided closely with observed declines in pondweed abundance (Meek 1993). The large number of deaths was a more complex issue. At first it was believed that the birds may simply have died of starvation. It was possible that the large numbers of young present in spring 1991 may have been prevented from feeding effectively, on what was by then a declining food source, by territorial birds (Meek 1993). In recent years Mute Swan numbers on the Loch of Harray have been increasing, and the site is now of international importance for the species. Large flocks are also seen on the Loch of Stenness.

There are no records of Mute Swans in the Western Isles until the middle of the 19th century. Birds were introduced into Harris at Rodel, and into North Uist at Balelone in 1887 and at Borve in 1893 (Cunningham 1983). Within 50 years, birds were nesting commonly on Benbecula and South Uist, and flocks on Loch Bee were already numbered in 'hundreds' (Owen *et al.* 1986). The Mute Swans of the Uists and Benbecula have been studied in great detail (e.g. Spray 1981a). Large flocks of birds can still be seen on Loch Bee.

In the Scottish Highlands, large flocks of Mute Swans were present on the Cromarty Firth during the 1960s (the 1966/67 flock totalled around 500–600 birds). The birds were attracted to large quantities of spent barley that were being discharged into the Firth from distilleries at Invergordon and Dalmore (Owen *et al.* 1986). Numbers began to fall during the late 1960s and early 1970s, when the amount of grain discharged was reduced; the losses were offset to some extent by an increase in numbers at Loch Eye (NH8379). During the 1970s there were frequent fuel oil spillages in the Cromarty Firth from a naval station at Invergordon (Owen *et al.* 1986); this would also have been a factor in the fall in Mute Swan numbers at this time. Numbers of Mute Swans at Loch Eye have also fallen. In early winter 100–200 birds used to be present at this site through the 1960s and 1970s. A decline through the 1990s has left current numbers at 20–40 birds.
In the Grampian region, a moulting flock of Mute Swans was present in the summer through the 1970s at the Mouth of the Spey. Around 40 birds were counted here in 1976 and 30 in 1979. By 1981 the

flock had dwindled to 18, and by the mid-1980s it had disappeared. However, in 1990 and 1991, a small flock of around 20 birds was once again present (Cook 1992), and small numbers are still present today. In winter the largest numbers used to be present on Loch Spynie. Over 100 birds wintered regularly there in the 1960s and 1970s, with the highest count being 148 in December 1973 (Cook 1992). From the late 1980s numbers began to decline, and 20–40 birds are currently present in most winters. Unless the loch freezes, numbers usually increase from October to a midwinter peak and then decline in March. The Loch of Skene held over 100 birds in the 1950s, but numbers then decreased and the species was very scarce until December 1988, when 80 birds were present (Buckland *et al.* 1990). Numbers then began to rise rapidly, with around 250–300 birds present in the winters of the early 1990s, and the site was then classed as internationally important for Mute Swans. Numbers have since fallen to their present level of 100–150. Mute Swan numbers at the Loch of Strathbeg increased from around 250 in the early 1960s to around 420 in the 1970s and it too was of international importance for the Mute Swan. However, through the 1980s and 1990s numbers declined and 170–200 birds can currently be found on the loch. Around 20–40 Mute Swans could be seen during the winter on the Ythan Estuary in the late 1960s. Numbers increased in the late 1960s to just over 100. From the 1970s onwards numbers have been declining, although for a time in the 1980s numbers increased again because the birds were attracted to waste potatoes that had been dumped on the edge of the estuary (C. Spray pers. obs.). More recent years have seen around 20 birds on the estuary.

2.1.1.3 Internationally important sites

i) Loch of Harray (Orkney)

Five-year mean 96/97–00/01: 439

Site conservation status
SSSI (Lochs of Harray and Stenness)
IBA (Lochs of Harray and Stenness, non-listed species)

Site description
The Loch of Harray (HY2915) is a large water body of 930 ha. It has a mean depth of 3 m and is situated at <10 m above sea level. The Loch drains a shallow basin in the centre of the West Mainland of Orkney, and pours its contents into the Loch of Stenness (which is a brackish lagoon) through a narrow channel at Brodgar.

Numbers and trends
Mute Swan numbers on the Loch of Harray remained fairly stable at 100–200 birds (with slight fluctuations) through the 1960s, 1970s and early 1980s. From 1985 numbers began to increase dramatically to a peak of over 1,000 birds in 1990/91 (Fig. 7). This rapid increase was due to a proliferation of Canadian Pondweed at the site, attracting a huge gathering of birds (Meek 1993). The peak winter count in 1991/92 showed a decline of some 650 birds compared to 1990/91; this decline was due to a reduction in the availability of the Canadian Pondweed. Around 250 birds were found dead, and post mortems showed these birds were emaciated, anaemic and had heavy parasite burdens (Meek 1993). The other 'missing' 400 birds were not located elsewhere within Orkney during National Wildfowl Counts and therefore must have moved out of the islands, presumably to the Scottish mainland, although there is no direct evidence that this occurred (Meek 1993). After this, numbers fell back to around 200 birds. They have, however, begun to increase again steadily since 1997/98 and the site has been classed as internationally important since this time. The numbers of birds on the loch peak during the winter, usually from November to January, and from the New Year numbers begin to decline (Fig. 8).

Site use
During the moult period the Mute Swans on the Loch of Harray move to the northern end of the loch and feed on Canadian Pondweed**.** The main roost sites used by the birds are the islands within the loch. In recent years some of these islands, such as the Ling Holms, have been the location for pairs nesting colonially (E. Meek pers. comm.).

In 2003 a new ringing study was started in Orkney, and a moult catch on the Loch of Harray caught 114 birds.

ii) Loch Bee (South Uist)

Five-year mean 96/97–00/01: 320

Site conservation status
SPA (South Uist Machair & Lochs, non-qualifying species)
Ramsar (South Uist Machair & Lochs, non-qualifying species)
SSSI (Loch Bee)
IBA (South Uist Machair & Lochs, non-listed species)

Site description
Loch Bee (NF7743) is a large, shallow loch located at the northern end of the island of South Uist in the

Western Isles, Scotland. The water is brackish as there is a tidal connection at the northern end of the loch. The SPA, of which Loch Bee is a part, is of outstanding importance for its transition of habitats from acidic moorland to the calcareous coastal plain, and for the transition from freshwater to saltwater habitats. This complex includes outstanding examples of relict woodland, moorland and blanket bog, large oligotrophic lochs, acidic blacklands, wet and dry machair with eutrophic machair lochs, freshwater marsh, saltmarsh, coastal dunes and sandy and rocky shores.

Numbers and trends
The lack of continuous, accurate data for Mute Swans at Loch Bee, combined with the size and complexity of the site, makes it difficult to identify any long-term trends in the population of Mute Swans on the loch. Numbers declined through the late 1970s and early 1980s, but a rapid increase was seen in 1983/84, with the highest recorded number of 516 present in January and February 1984. In 1999/00 and 2000/01, numbers once again increased (Fig. 9), and the site is now classed as internationally important for the Mute Swan. It is also hard to draw conclusions for monthly phenology at the site as, with the exception of the period when detailed studies were made (Spray 1981a), some months are without counts and others have only been surveyed once in the last five years. Mute Swan numbers appear to peak during the moult period and decline slightly during the winter (Fig. 10). Winter mortality and collisions with overhead power lines are features of this population (Spray 1991).

Juveniles from this loch have been known to move to locations on Skye, Tiree, Poolewe and Shetland, and to Northern Ireland and the Irish Republic (Spray 1981b).

Site use
A causeway divides Loch Bee, and the Mute Swans use the part of the loch to the west of the causeway more than that to the east. The main roost sites are located at the northern end of the western part of the loch. The birds feed on the *Potamogeton* reserves on the central islands and on the shallow west side of the loch. When this food resource is depleted, often around November and December, the birds move to a channel at the northern end of the loch that joins the loch to the sea; here, they feed on *Ruppia* and *Zostera* (Spray & Bayes 1992).

2.1.1.4 Other sites

The Loch of Stenness (HY2812) on the West Mainland of Orkney is joined by culverts to the Loch of Harray. This site used to hold over 100 Mute Swans through the winter, but numbers have fallen and the loch currently holds around 50–60 birds during October to March.

During the moult season, a flock of over 100 birds may be seen briefly on the freshwater Loch Ollay, South Uist (NF7432), whilst the Loch an Duin complex (sea lochs on North Uist, NF8974) holds similar numbers.

In the Highlands, the Cromarty Firth (NH7771) covers some 12,500 ha and stretches inland for nearly 30 km. Flocks of around 130 Mute Swans can currently be seen here between December and January. Nearby is the Dornoch Firth (NH7384), which is similar in size but has less extensive food supplies. Despite this, since the 1980s the Dornoch Firth has held over 100 Mute Swans in the winter; many are found on the Skibo Estuary (NH7388) and on the upper reaches of the Firth at the bay between Easter and Wester Fearn.

The Lochs of Strathbeg (NK0758) and Skene (NJ7807) have both held internationally important numbers of Mute Swans in the past. The numbers of birds at both sites have fallen, but they both currently hold reasonably sized flocks. In recent years, around 170–200 birds have used the Loch of Strathbeg as a moult site, and around 120 birds can now be seen during November and December at the Loch of Skene.

2.1.1.5 Key references

O'Dell & Walton (1962), Spray (1981a & b, 1991), Cunningham (1983), Booth *et al.* (1985), Owen *et al.* (1986), Buckland *et al.* (1990), Cook (1992), Meek (1993)

2.1.2 Central Scotland (Tayside, Fife, Central)

2.1.2.1 Background

Tayside is a mainly agricultural region on the southern edge of the highlands. On the east coast a dominant feature is the Montrose Basin (NO7057), which is the almost totally enclosed estuary of the River South Esk. Large numbers of Mute Swans are present here throughout the year and the site holds internationally important numbers during the moult

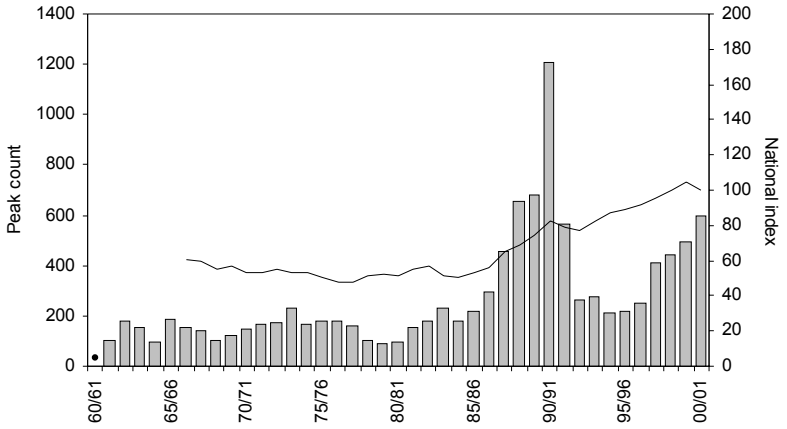


Figure 7. Mute Swans at Loch of Harray, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

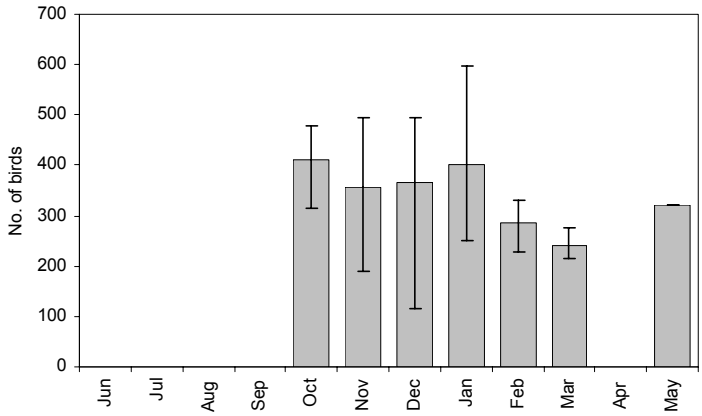


Figure 8. Mute Swans at Loch of Harray, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

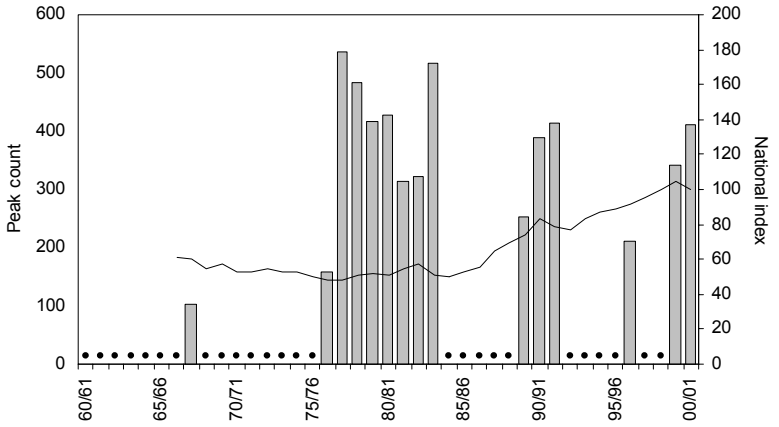


Figure 9. Mute Swans at Loch Bee, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

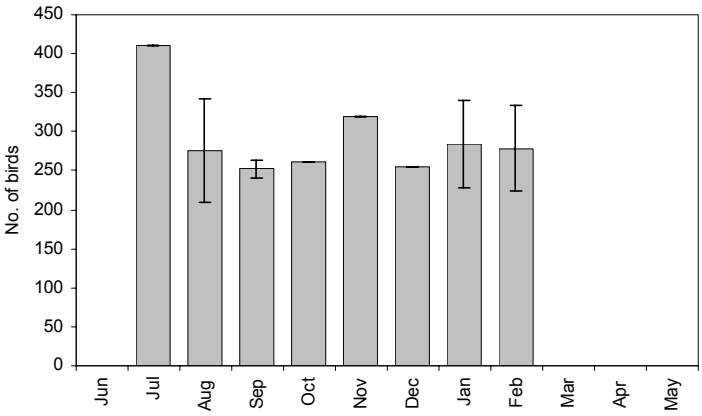


Figure10. Mute Swans at Loch Bee, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

season. The extensive Tay Estuary (NO4828) lies to the south and has supported a large flock of moulting Mute Swans in recent years at Balmossie, Monifieth (NO4831) (A. Reid & D.M. Shepherd pers. comm.) with a smaller flock at Mugdrum Island (NO2319). There are numerous lochs and reservoirs in the area that hold small flocks in winter, but the most notable site is Loch Leven (NO1401), where internationally important numbers of birds have gathered to moult in late summer in recent years and birds are recorded feeding on nearby farmland in winter/early spring.

Fife is a predominantly low-lying, intensively farmed area with a distinct split between arable land in the east and pasture in the west, much of the latter having been subject to extensive mining activity in the past and then restored to agriculture in the 1970s and 1980s. Although there are over 400 standing waters in Fife, few are natural other than the two largest at Loch Ore (NT1695) and Loch Gelly (NT2092). However, there are 45 water bodies of over 2 ha in extent (Corbet 1998) and most of these hold pairs of Mute Swans (Brown & Brown unpubl. 1991–2001). These include reservoirs such as Cameron Reservoir (NO4711), Clatto Reservoir (NO3607) and Craigluscar Reservoirs (NT0690). All these sites can hold substantial wintering and/or moulting flocks. The coastline of Fife extends for 170 km between the Forth and Tay Estuaries and is mostly low and rocky; however, the eastern boundary is dominated by the Eden Estuary (NO4719), a Local Nature Reserve, which holds a regular but fluctuating population of Mute Swans including a moult flock.

The Forth Estuary (in the upper section of the Firth of Forth, and bounded by Central, Fife and Lothian) has been heavily industrialised, with extensive coastal reclamation, but there are still relatively undeveloped areas in the lower estuary. A number of areas are favoured by flocks of Mute Swans, some of which in recent years have held nearly 100 birds in either winter or the moult period, e.g. the mouth of the River Almond at Cramond (NT1876) and the mouth of the River Esk at Musselburgh (NT3473); these are referred to in the section on southeast Scotland. Elsewhere in Central Scotland, small numbers of birds are found at a number of freshwater lochs and reservoirs and at several sites along the Rivers Forth and Teith.

2.1.2.2 Historical status

Amongst the earliest records of the Mute Swan in this region is an observation in 1793 of between 60 and 70 birds on Kilconquhar Loch (NO4801), Fife (Smout 1986). However, early records are generally scarce although it is presumed that the birds were widespread. More systematic recording since the 1950s suggests that a number of small lochs and reservoirs held 10-20 birds in the winter (Smout 1986). There was a decline in the 1960s, probably related to the severe winter of 1961, and numbers remained low through the 1970s and 1980s. However, throughout the 1990s, when an intensive study of the population commenced in Fife, numbers increased to their highest recorded levels (Brown & Brown unpubl. 1991–2001).

The Alloa Inches (Tullibody) (NS8692) in Central, in the inner Forth, held a winter flock of up to 400 birds in the 1960s (Owen *et al.* 1986), when the birds were attracted by waste discharged from the Cambus distillery. This discharge ceased in 1965 and although over 100 birds were still present on occasion during the 1970s numbers had generally fallen to around 35 by that time with no substantial flock present since.

On the Fife side of the Forth Estuary, Torry Bay (NT0184) is the only location where a flock regularly gathers; this flock held up to 40 birds in the 1980s (Smout 1986), with these numbers continuing through the 1990s when up to 80 birds were recorded on occasion. In the Tay Estuary, Tayport Bay (NO4628) and Mugdrum Island (NO2319) periodically held up to 50 or more birds during the 1990s (Brown & Brown unpubl. 1991–2001).

Inland Tayside supported small numbers of birds (up to 30) at sites such as Forfar Loch (NO4450), Loch of Lintrathen (NO2754) and Rescobie Loch (NO5151) during the 1970s and 1980s. Numbers at Forfar Loch increased to 60–80 birds through the 1990s. The 1990s saw a substantial flock become established at Old England Loch, Meiklour, Perthshire (NO1237), where the birds fed on discarded potatoes and numbers peaked at over 300 birds (K. Thomson pers. com.). Drummond Pond (NN8518) and Carsebreck and Rhynd Lochs (NN8609) held 50–100 birds in the 1970s and 1980s, but numbers fell to around 50 in the 1990s. Since the late 1980s a winter flock peaking at over 100 birds by the late 1990s has been recorded in the Easter Rhynd area (NO1918), by the junction of the Rivers Earn and Tay (J. Kirk pers. comm.).

In Fife the main sites holding small flocks of around 30 birds during the 1970s and 1980s were Loch Ore (NT1594), Loch Fitty (NT1291) and Loch Gelly (NT2092) (Owen *et al.* 1986, Smout 1986); however, during the 1990s the peaks at these sites, and a number of other sites such as Cameron Reservoir (NO4611), Birnie and Gaddon Lochs (NO2812) and Kilconquhar Loch (NO4810), were regularly over 50 birds, either in moult, winter or spring. Occasionally

these birds have numbered well over 100 at Loch Gelly and at the Leven Cut (NO2000), which is linked to the Loch Leven population. At the Eden Estuary spring counts of over 50 birds were made in most years during the 1990s, with a peak winter count of over 100 in 1996. The Eden Estuary and Loch Gelly are the only two sites to regularly hold over 50 birds during the moult period (Brown & Brown unpubl. 1991–2001). The detailed study undertaken in Fife since 1990 has indicated that the total population in mid-April (including territorial birds) has risen from around 100 to 250 birds by 2001 (Brown & Brown unpubl. 1991–2001). Colour ringing of cygnets throughout the 1990s showed, in particular, movement south to the Lothians and west into Central (including Perthshire) and the Glasgow area, paralleling the movements already shown by the flock at the Montrose Basin.

One of the main sites in Central during the 1960s to early 1980s was Gartmorn Dam (NS9194), which on occasion held over 50 birds (Owen *et al.* 1986). WeBS data for more recent years has shown that numbers here have occasionally peaked at over 100 birds (e.g. 122 in November 1997).

2.1.2.3 Internationally important sites

i) Montrose Basin

Five-year mean 96/97–00/01: 329

Site conservation status
SPA (Montrose Basin, non-qualifying species)
Ramsar (Montrose Basin, non-qualifying species)
SSSI (various)
IBA (Montrose Basin, non-listed species)

Site description and habitat
The Montrose Basin (NO6958) is the almost totally enclosed estuary of the River South Esk in Angus, Scotland. It is a large expanse of tidal mudflats and saltmarsh. Despite having a port and industry at the mouth, the main basin has been virtually untouched by industrial development and pollution and provides a rich feeding ground for waterbirds. However, the basin was frequently overflown by military aircraft in the past and was then used excessively by wildfowlers. In 1981 a Local Nature Reserve was created that took in virtually the whole basin plus a small amount of land above high water, particularly at the western end, and shooting was restricted to specified areas.

Numbers and trends
Mute Swans are present on the Montrose Basin throughout the year, and over 150 have been seen there in most years since 1962/63. The numbers of birds using the site has generally increased since the late 1980s and early 1990s, with the highest number recorded being 356 in 1996/97 (Fig. 11). Monthly counts, derived mainly from WeBS counts, show a distinct annual pattern, with a peak during the moult period and lower levels in winter (Fig. 12). Results of aerial surveys and detailed ringing show that the peak count in the moult period is due in part to an influx of some 200 birds from outside the local area, from the south and southwest (Spray & Atkinson 1991). The ringing has shown that very little interchange occurs with the Grampian region to the north.

Site use
At low tide most Mute Swans are found along the main river channel and, especially, at the western side of the basin (Cranswick *et al.* 1999; the birds drift up the river with the tide. In the past, large numbers of birds collected on the north side of the estuary where waste from the carrot-processing factory was dumped, and more recently around the old pier as humans have fed them here for some years. When the natural food supply of *Zostera* dies down in the winter, many of the birds now shift to feeding on fields of oilseed rape that are adjacent to the estuary and use the estuary as a roost; this shift is generally seen at the end of December (Anon 2002). This has become a major issue with local farmers and a joint programme of experimental feeding and the provision of sacrificial rape fields has been trialled to try to reduce the problem (Anon 2002, Spray *et al.* 2002).

ii) Loch Leven

Five-year mean 96/97–00/01: 375

Site conservation status
SPA (Loch Leven, non-qualifying species)
Ramsar (Loch Leven, non-qualifying species)
NNR (Loch Leven)
SSSI (Loch Leven)
IBA (Loch Leven, non-listed species)

Site description and habitat
Loch Leven (NO1401) is located in central Scotland, midway between the Forth and Tay Estuaries; it is the largest naturally eutrophic loch in Britain and Ireland. It is relatively shallow and is surrounded by farmland. There is a diverse aquatic flora and shoreline vegetation. The loch also contains several islands, the largest of which is St. Serf's Island, with an area of about 46 ha.

In the past this loch has suffered from high nitrate and phosphate levels from agricultural run-off. This has also lead to problems with blue-green algae blooms.

Numbers and trends
Regular winter wildfowl counts did not start at Loch Leven until 1966, however there is a complete series available since then. Mute Swan numbers remained fairly constant through the 1970s; they then began to increase steadily during the 1980s, but fell in the 1990s. With the exception of 1993/94, numbers remained low until recent years when numbers have increased dramatically, with a peak of 496 birds in 2000/01 (Fig. 13). The site was traditionally a moulting site, and when numbers fell it was thought that this might be because the Montrose Basin was replacing Loch Leven as the region's moult site (Owen *et al.* 1986). Nevertheless, between 1996/97 and 2000/01, numbers have peaked in August (Fig. 14) (the site was not surveyed in June and July during this period). This shows that the site is still an important moult site for Mute Swans in the area. Numbers decline rapidly through the winter months as birds move to other locations for the winter or feed on nearby farmland and use the loch only as a roost (Fig. 14).

Site use
During the moult period the Mute Swans are found predominantly at the east side of the loch, mainly around St. Serf's Island, or along the south side to the west of Vane Farm. Since the mid-1990s a wintering flock of Mute Swans, regularly numbering over 100 birds and associated with Whooper Swans, has frequented the valley of the River Leven (the Leven Cut) to the east between Loch Leven and Auchmuirbridge. These birds are seen feeding mainly on oilseed rape. The birds roost at Loch Leven and can make use of this feeding area from October through to April, when there was a peak of 166 in April 2000 (Brown & Brown unpubl. 1991–2001).

2.1.2.4 Other sites

Within the Tay Estuary a moult flock of 8–90 birds at Balmossie, Monifieth, built up during the 1990s increasing to a peak of 160 birds by 2000 (A. Reid pers. comm.). After the moult some of these birds disperse to the nearby Broughty Ferry and Tayport Bay. Flocks of over 100 birds have been recorded feeding on farmland near Loch Leven in winter/early spring. In Fife, flocks of over 100 birds occur inconsistently at various sites during the moult or in winter; this inconsistent use is apparently related to the availability of natural food supplies (A. & L. Brown pers. obs.). In the Forth Estuary there is a regular flock of up to 90 birds at the mouth of the River Almond, Cramond, Edinburgh, while a substantial moult flock numbering up to 200 birds had formed at the mouth of the River Esk, Musselburgh, by 2001 (Brown & Brown unpubl. 1978–1980, Brown & Brown 1981–2001).

2.1.2.5 Key references

Brown & Brown (unpubl. 1978–1980 & 1991–2001), Brown & Brown (1981–2001), Owen *et al.* (1986), Smout (1986), Corbet (1998)

2.1.3 Southeast Scotland (Lothians, Borders)

2.1.3.1 Background

Southeast Scotland is primarily agricultural with arable land on the richer soils of the lowland areas of East Lothian, the eastern Borders and associated river valleys, and pasture predominating on the poorer soils of the western and upland hills. The principal urban area is Edinburgh, at the centre of the Lothians on the south shore of the Firth of Forth, the coastline extending along the North Sea at the east edge of the Borders down to the English border. Three principal rivers flow into the Firth of Forth from the Lothians, providing distinct estuaries, i.e. the River Almond at Cramond, Edinburgh, the River Esk at Musselburgh and the River Tyne at Tyninghame, near Dunbar, the latter having an almost enclosed estuary. In the Borders all the main rivers (the River Teviot, Ettrick Water and Whiteadder Water) flow into the low-lying and dominant River Tweed basin, which meets the North Sea at Berwick. The river mouths along the shore of the Lothians regularly hold flocks of up to 100 or more birds in winter or during the moulting period (Brown & Brown unpubl. 1978–1980, Brown & Brown 1981–2001, Brown & Brown 1999) and the low-lying sections of the Tweed Valley complex (the Tweed Haughs) can support nearly 300 birds on occasion (Borders Bird Reports, Spray *et al.* 2002) with 40–50 on the lower Teviot Valley (the Teviot Haughs).

In general, waterbodies are uncommon in the region; however, there are over 650 freshwater sites in southeast Scotland (Murray *et al.* 1998), most of the larger ones being man-made reservoirs at upland locations that are less suited to Mute Swans. The smaller lochs tend to occur in the lower lying areas and many of these, in both Lothians and Borders, hold pairs of breeding Mute Swans. In the Lothians some of the larger waterbodies such as Linlithgow Loch (NT0077) and ponds in urban parks such as Inverleith Pond (NT2474) and St. Margaret's Loch (NT2773) attract flocks of over 50 birds throughout

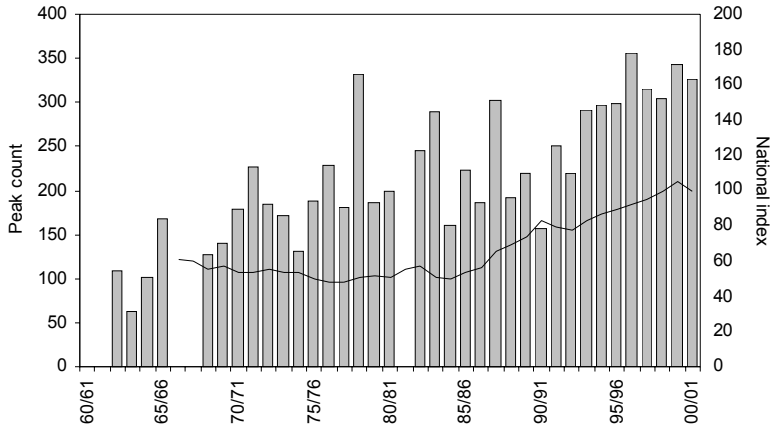


Figure 11. Mute Swans at Montrose Basin, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

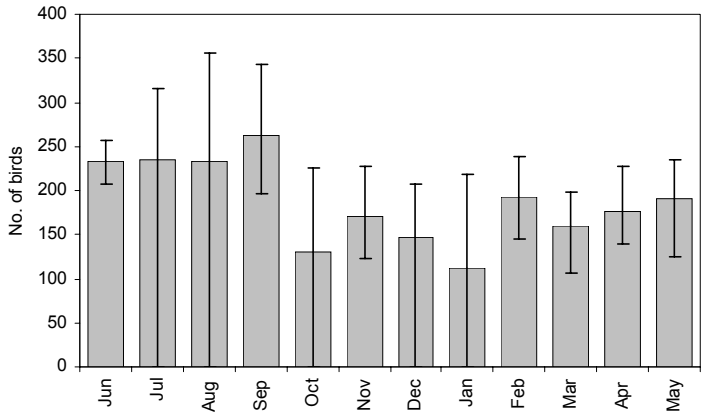


Figure 12. Mute Swans at Montrose Basin, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

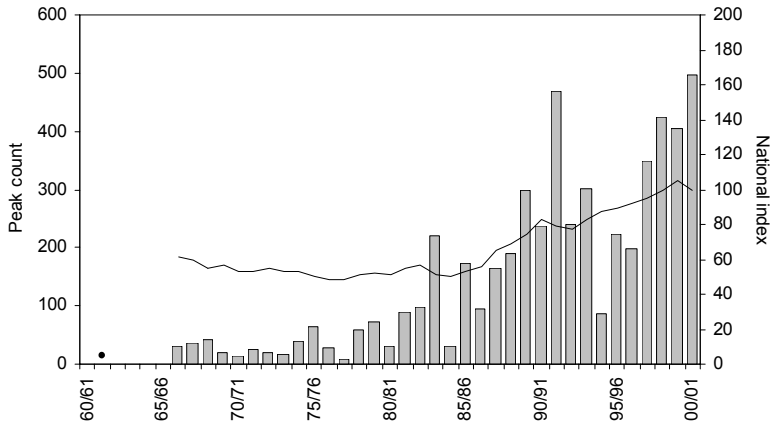


Figure 13. Mute Swans at Loch Leven, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

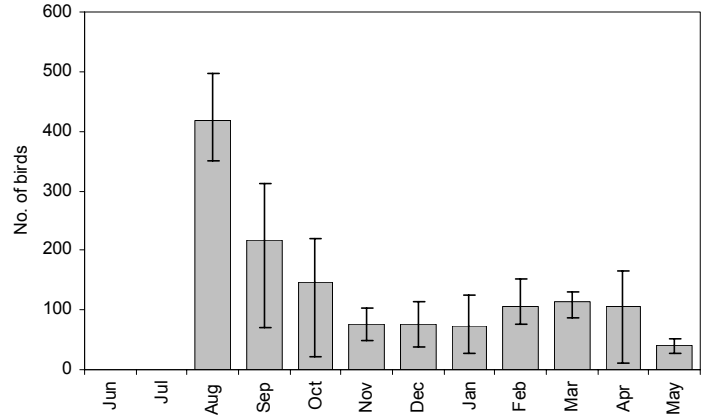


Figure 14. Mute Swans at Loch Leven, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

the year, reflecting the increasing size of the population since the 1980s (Brown & Brown 1978–2001, Brown & Brown 1984, 1999 & 2002). In the Borders, freshwater lochs such as Yetholm Loch (NT8028), Hirsel Lake (NT8420) and Baron's Folly (NT6426) increasingly hold 50 or more birds in winter, at the moult period or at post-moult gatherings, with similar numbers being reported from Ploughlands Pond (NT6826) and Gunknowe Loch, Galashiels (NT5134) (Borders Bird Reports, A. Bramhall pers. comm.).

2.1.3.2 Historical status

Mute Swans were first mentioned in the Lothians as being introduced to Duddingston Loch in 1678. They appear to have been abundant and widespread during the 1930s but numbers have declined considerably since the early 1960s (Andrews 1986, Brown & Brown 1984). Since 1978 a detailed and complete annual census has taken place of both the territorial/breeding and non-territorial numbers and has shown a rapid increase in both these sectors of the population, with territorial birds increasing from 20 pairs in 1978 to 90 pairs by 2001 and non-territorial birds in mid-April from 76 to 380 (Brown & Brown unpubl. 1978–1980, Brown & Brown 1981–2001, Brown & Brown 1999). A midwinter count in January 2000 found a total of 567 birds (Brown & Brown 1981–2001). This increase is thought to be due to a combination of mild winters and resultant high winter survival of juveniles.

One of the principal Mute Swan flock sites in the Firth of Forth during the 1960s was found at the mouth of the Water of Leith, Edinburgh (NT2776), where numbers increased to over 200 birds before the installation of dock gates in 1969 saw a dramatic decline in the use of this site (A. T. Macmillan pers. comm.). Thereafter, the main flock site was based around the Tyne Estuary at Tyninghame, near Dunbar (NT6380), which has on occasion held over 100 birds since the 1960s (the late R.W.J. Smith pers. com.). Since the 1980s this flock has regularly held up to 60 birds, which have tended to feed on oilseed rape fields at various locations to the west of the estuary, using the estuary only as a roost, and often in association with Whooper Swans (E. J. MacGregor pers. comm.).

The increase in the Lothians Mute Swan population has been accompanied by the establishment of a number of significant flock sites (St. Margaret's Loch, Inverleith Pond, Linlithgow Loch, mouth of the River Almond at Cramond and mouth of the River Esk at Musselburgh) that are used by varying numbers of birds, often reaching 100 or more in recent years. Indeed Musselburgh is now a major moulting location holding up to 200 birds by 2001. The establishment of these flocks and their continued presence has been documented (Brown & Brown 1999) and shows a distinct contrast with the flock sites found in Fife as described earlier. In the Lothians, once the flock sites have become established they are used constantly throughout the year, no doubt owing to their being accessible to the public and thus benefiting from public feeding (which also helps the birds survive over the winter) whereas, as stated earlier, the Fife flocks are more dynamic in their use of sites. Extensive ringing of cygnets has shown that birds regularly move around the Lothian flock sites as well as to sites in Fife and west into the Glasgow area, but movement into the Borders and further north is more limited.

There are few references to early records of the Mute Swan in the Borders (Church 1956) but it was certainly regarded as widespread although it had declined considerably by the early 1980s (Murray 1986). As with the Lothians, the Borders have shown a considerable increase in the last 20 years, but part of this increase is undoubtedly to the result of better coverage of certain rivers, e.g. the Whiteadder. In contrast to the Lothians, a higher proportion of the territorial and non-territorial population is associated with the rivers (Brown & Brown 1998), adding to the difficulty of monitoring. However, recent surveys have shown that the territorial population must be around 100 pairs (Murray *et al.* 1996). In the 1950s the Borders held some of the highest-altitude breeding sites in Britain, in the Ettrick Forest area in the southwest of the region (Murray 1986). After a decline into the 1980s many of these sites have been re-occupied as the population increased (A. Bramhall pers. comm., C. Spray pers. obs.).

A principal location for winter flocks is the Tweed and Teviot Valleys, which have been of importance to this species for many years, with flocks of 100 or more birds being common (Owen *et al.* 1986, Murray 1986, Borders Bird Reports). Work in the Tweed Valley in the 1990s showed numbers varying between just over 30 and nearly 300 birds, confirming some of the earlier observations (A. Bramhall pers. comm., H. Chisholm & C. Spray pers. obs.). These birds are found at various locations along the river valley: most are present over the winter months and have a preference for feeding on oilseed rape; the valley may hold flocks of up to 150 from December to March (Spray *et al.* 2002). The Lower Teviot valley regularly holds 30–50 birds in winter.

The lochs associated with the Tweed valley are often frequented by the birds feeding in the nearby fields and a number of these fields have been used for

many years. Hirsel Lake (NT8240), near Coldstream, and Ploughlands Pond (NT6826), near Crailing, regularly held 50–100 birds during the 1980s and continue to do so (Borders Bird Reports). Yetholm Loch (NT8028) has held over 50 birds in winter since at least the 1950s (Church 1956), and numbers have now increased again with up to 80 birds present in the moult period (A. Bramhall & C. Spray pers. obs.). Ringing has shown a close link between the moult flock at Berwick and the birds using both the Tweed Valley and the nearby lochs (C. Spray pers. obs.).

2.1.3.3 Other sites

Many of the sites frequently used by Mute Swans in the Lothians and Borders have been referred to above. The sequential occupation of flock sites in the Lothians as the population has expanded has been fully described (Brown & Brown 1999). Musselburgh developed into the most important moult flock site in the area during the 1990s, recording well over 100 birds, but is now increasing in use with over 50 and 30 birds present in spring and winter, respectively, in recent years.

The River Tweed between Kelso and Coldstream (NT7737) has supported flocks of wintering Mute Swans from at least the 1970s with a total of over 100 birds occasionally recorded at various locations such as Redden (NT7737) and Birgham (NT7938) (Borders Bird Reports). Similarly, the Rivers Tweed and Teviot upstream from Kelso, around the Rutherford (NT6431), Magdalene Hall (NT6232), Roxburgh (NT6930) and Nisbet (NT6725) areas, are well-frequented sites. The numbers wintering here are often up to 70 birds and occasionally more than 100 (Borders Bird Reports). Typically the birds use mainly oilseed rape fields for feeding and then roost or bathe on the rivers or nearby lochs.

2.1.3.4 Key references

Borders Bird Reports, Lothian Bird Reports, Church (1956), Brown & Brown (unpubl. 1978–1980), Brown & Brown (1981–2001, 1984, 1998, 1999, 2002), Andrews (1986), Murray (1986), Murray *et al.* (1996, 1998), Chisholm & Spray (2002), Spray *et al.* (2002)

2.1.4 West/Southwest Scotland (Strathclyde, Dumfries and Galloway)

2.1.4.1 Background

Throughout Strathclyde there is a wide diversity of landscape and habitat. In the south there are large areas of good farmland. Glasgow dominates the central part of the region, but large flocks of Mute Swans are found in the area. The majority of Mute Swans in this region are located in the south and central lowland districts, where food is plentiful and there are numerous reservoirs and lochs around the industrial and urban developments. Many of these lochs and reservoirs hold a pair or small numbers of Mute Swans, but some can hold larger numbers.

The Strathclyde coast has several small river estuaries and outfalls that support Mute Swans, including the Doon Estuary (NS3219) and the Irvine/Garnock Estuary (NS3038), despite its being frequently overflown by aircraft. The majority of the Mute Swans on the Irvine/Garnock Estuary are found on the upper reaches of the River Garnock (Pollitt *et al.* 2000). The main estuary in the region is the Clyde Estuary (NS3576) and large flocks of Mute Swans gather on this estuary both in winter and during the moult season.

Mute Swans are not especially common on the islands of Arran, Bute and the Cumbraes, although a small number of pairs are resident on each of these islands (B. Zonfrillo pers. comm.). Arran is too mountainous and lacking in standing fresh water to be of much interest to Mute Swans. The species is present in small numbers on many freshwater lochs on Islay (NR3560). A moult flock of around 60–80 Mute Swans can be seen on Loch a'Phuill (NL9541) on Tiree. Some of the birds here have come across from the Uist population (C. Spray pers. obs.).

The primary agriculture in Dumfries and Galloway is the rearing of cattle and sheep. There are also large amounts of heavily fertilised silage grasslands. Dumfriesshire is dominated by the Solway Basin, which lies to the south. On the Scottish side of the Inner Solway Firth lies the Caerlaverock National Nature Reserve (NY0464), which takes in all the extensive inter-tidal flats lying between the Rivers Lochar and Nith, together with the merse (Owen *et al.* 1986). There is also the Wildfowl and Wetlands Trust reserve at Eastpark (NY0565), which covers the adjoining farmland and includes artificial pools. Mute Swans can be found here during the winter months (around 60 birds).

Further west, in Galloway, there are a number of lochs lying between the Nith and Cree Valleys and in the Dee Valley. Some of the more important sites for Mute Swans include Loch Ken (NX7168) and Carlingwark Loch (NX7761).

2.1.4.2 Historical status

There is little information on the history of the species in this region of Scotland. However, data have shown that Mute Swan numbers on the estuaries of Strathclyde have increased during the last 40 years. The Inner Firth of Clyde supported 20–50 birds in the winters of the 1970s. During the 1980s numbers began to increase and 80–100 birds have been recorded in recent years. The Doon Estuary held 25–30 birds through the winter in the late 1970s, but numbers decreased in the early 1980s. Since the late 1980s, however, numbers have increased fairly rapidly and flocks of 150–200 birds can now be seen here in late summer. Flocks on the Irvine/Garnock Estuary have also increased slightly, from 10–20 birds in the 1970s and 1980s to 20–50 birds in recent years.

Holy Loch, which is itself an arm of the Firth of Clyde, has seen a decrease in the number of Mute Swans using the site. During the late 1970s, 20–40 birds would be present in September or October. The flocks here began to decline in the mid-1980s and presently there is often no more than a pair of birds present on the loch.

Since the establishment of the Eastpark WWT reserve, the Mute Swan has changed from being a casual visitor in the early 1970s to a regular winter visitor (Owen *et al.* 1986), probably because the birds are being attracted by the grain provided at the reserve. Recent ringing here has shown that some birds move south to Barrow-in-Furness.

2.1.4.3 Other sites

Hogganfield Loch (NS6467), located in the northeast of the City of Glasgow, has seen Mute Swan flocks increase since the 1980s. Moulting flocks of 100–200 (sometimes more) birds have been present on the loch in late summer in recent years. Knightswood Park (NS5369), also in Glasgow, can hold over 100 birds in winter. Loch Lomond (NS4388) has, in recent years, held a moulting flock of up to 100 birds. The majority of the birds here are found around the mouth of the main tributary feeding the loch, the Endrick Water (Owen *et al.* 1986). A large moult flock can be present on Strathclyde Loch (NS7257), and a peak of 129 birds was recorded here in 1999. A moult flock of around 100 birds has also been seen in recent years on the River Leven.

The Doon Estuary (NS3219) supports a moult flock of 150–200 birds in late summer and 70–90 birds during the winter. Flocks of over 100 Mute Swans gather on the Inner Firth of Clyde (NS3576) to moult in July and August, and around 100–130 birds can be seen in the winter, generally in October.

2.1.4.4 Key references

Owen *et al.* (1986)

2.1.5 Northwest England (Cumbria, Isle of Man, Lancashire, Merseyside, Greater Manchester)

2.1.5.1 Background

Mute Swans are resident on many of the larger lakes and lowland tarns in Cumbria, but the numbers at any one site are seldom more than five, or occasionally 10. The only major gathering is the summer moulting flock on the Gretna Road Gravel Pits (NY3768), and that on Lake Windermere (SD3995) throughout the 1990s.

A few Mute Swans are resident on the Isle of Man. There are several large artificial lakes, such as the shallow Foxdale Dams of Eairy (SC2977) and Kionslieu (SC2878), which each support a pair of Mute Swans. Scattered over the northern plain are numerous dubs, which are either naturally occurring kettle holes or flooded marl or clay pits (Cullen & Jennings 1986). Glascoe Dub (SC4498) and the neighbouring fields, when flooded, sometimes attract small flocks of Mute Swans. During the winter a few birds can be seen in Douglas (SC3875) and Castletown (SC2866), and the harbours of Peel (SC2484) and Port St. Mary (SC2167) are occasionally visited in spring (Cullen & Jennings 1986).

Lancashire and Merseyside contain a varied range of habitats. On the coast are the expansive saltmarshes of the Ribble Estuary (SD3825) and Morecambe Bay (SD4070), both of which hold Mute Swans, with Morecambe Bay holding numbers of international importance. Within the fertile coastal strip, much of which is given over to arable and dairy farming, are the remnants of reed fen at Leighton Moss RSPB reserve (SD4875) and lowland wet grassland at the Wildfowl and Wetlands Trust reserve at Martin Mere (SD4214).

Standing water is plentiful in Greater Manchester and comprises park ponds, colliery subsidences and drinking and industrial reservoirs. Many of these waters hold one or more pairs of Mute Swans. Greater Manchester is often perceived as an urban conglomeration, but it actually contains a range of different habitats, including ancient woodland, moorland, peatland and reedbeds. The majority of the reedbeds are found around Wigan, and the Wigan Flashes (SD5803) are an important reedbed resource in Greater Manchester. The Wigan Flashes were formed through subsidence of past mining activities where water has collected in the resulting hollows, and small numbers of Mute Swans are present here.

2.1.5.2 Historical status

Until the mid-1980s only very small numbers of Mute Swans (no more than eight birds) used the Gretna Road Gravel Pits. Since then, a moulting flock has used the site in late summer and the numbers have been gradually increasing. The size of the winter flock at this site has also increased slightly in recent years. Small winter flocks of 20–30 birds used to be seen on the River Eden in the 1970s and 1980s, but numbers have since dwindled. During the 1960s and 1970s a small flock of 20–30 birds was present on Lake Windermere. Numbers here began to increase to around 80 in the 1980s, and they continued to increase through the 1990s to around 150 birds.

The Mute Swan did not appear on a 1901 list of the birds of the Isle of Man. However, there are records of birds having been kept at Kirby, Bishopscourt and Kentraugh, and of a pair having been presented to the Mooragh Park by King Edward VII in 1903. Escapes occurred, and the Kentraugh birds in particular used to use the adjacent bay, straying at times to Castletown Bay (Cullen & Jennings 1986). By 1931 Mute Swans were nesting on the open coast at several places. This has continued, and presently around seven nesting sites are used regularly (Cullen & Jennings 1986). During the 1970s a herd of up to 17 non-breeding birds gathered in Castletown Harbour in early July, moved to Ramsey Harbour in September or early October and remained there until breaking up in January (Cullen & Jennings 1986). Paired birds tend to move to the nearest harbour for the winter. The total Isle of Man Mute Swan population has fluctuated between 20 and 30 birds since about 1940 (Cullen & Jennings 1986).

Mute Swan numbers at many of the main sites in Lancashire and Merseyside have increased. Around 20 birds were present on the Ribble Estuary in the 1980s; this then increased to a regular level of 50–90 during the 1990s. Recently there has been a dramatic increase and 301 birds were recorded in January 2001. Flocks using Morecambe Bay have also increased over the last decade (see below). The numbers of birds at Martin Mere also increased slightly during the 1990s from no more than 10 to 15–25 birds, probably because the birds were making use of the grain provided at the reserve.

In Greater Manchester an increase in numbers has also been seen. In the 1960s around 50–60 birds could be seen during the winter on Pennington Flash; a decline through the 1970s and 1980s saw numbers fall to no more than 20. However, in the 1990s numbers began to increase, and 30–50 birds have been present in recent years. The same is true of the Wigan Flashes, where 10–15 birds were regularly seen in the 1980s, but where numbers have now increased to 30–50. In the winter of 1999, over 100 birds were recorded on the Wigan Flashes.

2.1.5.3 Internationally important sites

i) Morecambe Bay

Five-year mean 96/97–00/01: 285

Site conservation status
SPA (Morecambe Bay, non-qualifying species)
Ramsar (Morecambe Bay, non-qualifying species)
SSSI (various)
IBA (Morecambe Bay, non-listed species)

Site description and habitat
Morecambe Bay (SD4070) is located on the Irish Sea coast of northwest England. It is one of the UK's largest estuarine systems and is fed by five main river channels (the Leven, Kent, Keer, Lune and Wyre), which drain through the intertidal flats of sand and mud. The whole system is dynamic, with shifting channels and phases of erosion and accretion affecting the estuarine deposits and surrounding saltmarshes. Habitats include freshwater wetlands, fringing saltmarshes and saline lagoons.

Numbers and trends
During the early and mid-1960s fewer than 50 Mute Swans used Morecambe Bay. In the late 1960s numbers increased and peaked at around 100, however, numbers then declined in the 1970s to fewer than 50. Flocks began to steadily increase once more in the early and mid-1980s to between 50 and 100 birds. In July 1989, there was a very dramatic increase in the number of birds to 444. After this, numbers fell to around 200 but have since steadily increased and around 270–300 birds regularly use the site (Fig. 15). A non-breeding flock of 100–200 birds is present during the summer months. Flock size

gradually increases as birds arrive to spend the winter on the bay, and the largest numbers of the year are present in February. After this numbers decline to summer levels as wintering birds return to their breeding areas (Fig. 16).

Site use
Around 250 Mute Swans at Morecambe Bay are thought to use the Lune Marshes around Cockerham (J. Sheldon pers. comm.). A flock of moulting birds gathered on Cavendish Dock, where the water was perpetually warm because it was used as a cooling agent in the power station; however, this power station closed in 2001 and since its closure no Mute Swans have used the dock. Some of the birds on Cavendish Dock have been shown by colour-ringing to have come from the WWT Eastpark reserve (W. Halton, J. Sheldon pers. comm.). Birds also often use the marine lakes at Fairhaven and Fleetwood, where they are fed by the public (W. Halton, J. Sheldon pers. comm.).

2.1.5.4 Other sites

WeBS data have shown that throughout the 1990s a flock of over 100 birds was present on Lake Windermere (SD3995) in the Lake District.

The Ribble Estuary (SD3825) generally holds 50–90 birds, but 301 were recorded in January 2001 and this exceeded the threshold for international importance (Pollitt *et al.* 2003). Southport Marina (SD3317) holds a regular moulting flock of over 200 Mute Swans in late summer. Winter flocks are also of reasonable size, with 110–120 birds in many recent years. One of the attractions of this site is the regular handouts of food from the public.

2.1.5.5 Key references

Cullen & Jennings (1986)

2.1.6 Northeast England (Northumberland, Tyne and Wear, Durham, Yorkshire)

2.1.6.1 Background

Northumberland contrasts strongly from west to east. The west is dominated by the uplands of the north Pennines, while the east consists primarily of mixed farmland, with several notable estuaries along the coast. Of particular importance for the Mute Swan is the Tweed Estuary (NT9853): in the south it is more industrialised and many wetlands have been lost, although they have, to some degree, been replaced by disused quarries, subsidence ponds and other habitats. Mute Swans have made use of these waters, and are found in pairs or small flocks on many of them. The Tyne Valley is used by Mute Swans to access the upland lochs to the west of Hexham. These include Broomlee (NY7869), Greenlee (NY7769), Crag (NY7668) and Hindshield (NY8267) Loughs. A mobile non-breeding flock, which in some years is as high as 30 birds, can be found in this area (J. Coleman pers. comm.). Further north are the Druridge Bay Country Park (NU2600) and the East Chevington reserves (NZ2799); a non-breeding flock totalling around 30 birds occurs between both these sites.

The majority of Tyne and Wear is urban and a large part is industrialised. Much of the coastline has been intensively developed, but there are a number of rocky and sandy bays still remaining (Prater 1981). The Tyne Estuary (NZ2464) is very heavily developed, but a flock of birds has been seen all year round in recent years at the South Shields Marine Park on the Tyne shore. Within the urban area there are many good sites that have a history of use by Mute Swans. An example is Killingworth Lake (NZ2771), which holds 20–30 birds during the winter (J. Coleman pers. comm.). Along the River Wear, slightly upstream of Sunderland, lies the Wildfowl and Wetlands Trust's Washington Refuge (NZ3356). This opened in 1975 and created a fragment of artificial wetland in this urban area; however, the site holds only small numbers of Mute Swans.

Located on the Yorkshire coast is the Humber Estuary (TA2020) (it is also on the Lincolnshire coast). This estuary holds internationally important numbers of Mute Swans during the winter. Yorkshire has few natural lakes but many small tarns occur in the Pennines, and there are innumerable reservoirs and other man-made waters. Flooded sand/gravel pits and areas of mining subsidence, such as Fairburn Ings (SE4627), provide open water and can support large numbers of Mute Swans (Dickens & Mitchell 1977). Additionally, areas of floodwater occur in many valleys, mostly in the winter months. For Mute Swans the most important area where this occurs is the Lower Derwent Valley (or Ings) (SE6938). This is a major floodplain system composed of a series of neutral alluvial flood meadows, fens, swamp valley mires, *Alnus* woodlands and other freshwater habitats lying adjacent to the River Derwent, Pocklington Canal and The Beck. Large flocks of non-breeding birds are present here during the winter, and territorial pairs are concentrated along the Pocklington Canal

(largely upstream of Melbourne) and at Wheldrake Ings (C. Ralston pers. comm.).

2.1.6.2 Historical status

North of Seaton Sluice in Northumberland lies the Coquet Estuary (NU2706). During the 1960s, the Coquet Estuary was notable for a flock of up to 47 Mute Swans (Owen *et al.* 1986). Numbers declined through the 1970s and 1980s, and by the early 1990s maximum numbers of no more than six birds were seen. Numbers have since increased and the estuary now holds a regular pre-moult flock (in May and early June) of around 40 birds. The birds gather here prior to moving to Berwick to moult (J. Coleman pers. comm.).

Also on the Northumberland coast is the Lindisfarne National Nature Reserve (NU1041). The reserve, declared in 1964, covers the vast sand and mudflats from Budle Bay to Cheswick, together with the sand dunes of Holy Island (or Lindisfarne) itself (Owen *et al.* 1986). Flocks of up to 400–500 Mute Swans could be seen here during the 1960s (H. Church pers. comm.). However, numbers declined markedly during the 1970s, and numbers currently peak at only around 40 birds usually in November and December. The decline in this area was in line with a decline in many parts of England; it was, however, difficult to pinpoint the reason for the decline.

The Mute Swan has a long history in the Lower Derwent Valley, with the first details of the species being found in the records of Selby Abbey in the 15th century (C. Ralston pers. comm.). In 1844 records of the species were regarded as escapes from people's enclosures, and by 1912 the species was still regarded as domesticated: records were thought to have been of birds that had strayed from private ownership (C. Ralston pers. comm.). The bird remained rather scarce until recent decades, with 10 recorded in the Lower Derwent Valley in March 1974 and eight at Aughton Ings in December 1974. The species has been recorded annually in the Lower Derwent Valley since 1976 (C. Ralston pers. comm.). The numbers of non-breeding birds remained relatively stable during the 1980s, with peaks of 15–25 birds recorded annually. A herd of 35 reported in February 1982 was described at the time as 'exceptional' (C. Ralston pers. comm.). Since 1990 numbers have increased dramatically and now regularly peak at over 100 birds, with the 171 recorded in January 1999 being the highest count yet recorded for the valley (C. Ralston pers. comm.). The opposite has been seen in the Lower Aire Valley, as Swillington Ings (SE3828), a complex of flashes adjacent to the Aire, used to hold 30–40 Mute Swans during the winters of the 1980s. The flocks declined during the 1990s and numbers currently peak at fewer than 10.

2.1.6.3 Internationally important sites

i) Tweed Estuary

Five-year mean 96/97–00/01: 598

Site conservation status
SSSI (various)

Site description and habitat
The Tweed Estuary (NT9853) is located on the Northumberland Coast. It is long and narrow, and largely natural and undisturbed. Compared to other estuaries in northeast England, it supports a wide range of habitats. Habitats present include intertidal mud and sand flats, saltmarshes and salt pastures. Many of the shores are exposed, and species and habitat diversity rise as shelter increases with distance upstream.

Numbers and trends
After an initial rise in the 1950s, Mute Swan numbers on the Tweed remained stable (c. 400) until the mid-1970s. Since then there has been a major increase in numbers, with a peak count of 787 birds in September 1994, and numbers remained high until the mid-1990s (Fig. 17). The huge drop in 1986 was due to the impact of an oil pollution incident on the estuary in early winter. Some 200 birds were affected and many died, while 80 birds were treated and then released, and the numbers crashed temporarily (Spray *et al.* 1996). After this incident numbers increased again but oiling incidents also occurred in 1991 and 1996, and this probably explains the low numbers in these years (C. Spray pers. obs.). In recent years numbers have begun to decline slightly, and this is probably associated with improvements in sewage treatment standards on the estuary (in 1996), and the cessation of polluting discharges from various factories, including the maltings shortly afterwards. At the same time birds began using agricultural fields, particularly rape fields further up the Tweed Valley (C. Spray pers. obs.). Mute Swan numbers peak during the moult season, and are much lower in winter when the birds are on the rape fields or have returned to the Tweed Valley or Northumbrian lowlands to the south (Fig. 18) (Spray *et al.* 2002).

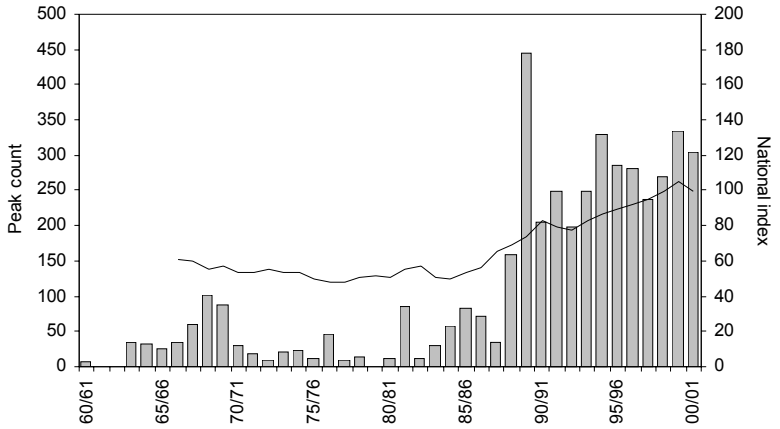


Figure 15. Mute Swans at Morecambe Bay, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

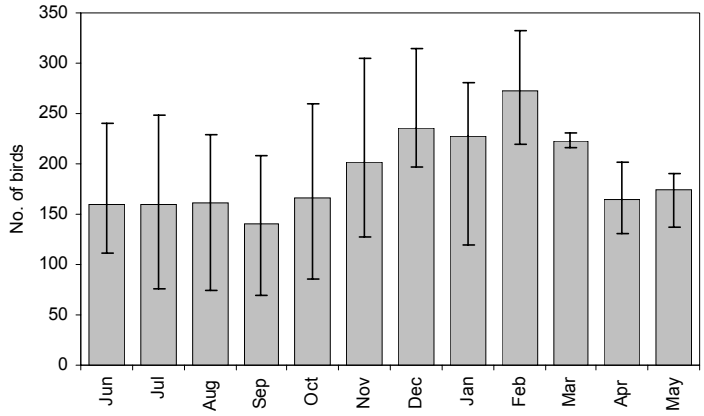


Figure 16. Mute Swans at Morecambe Bay, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

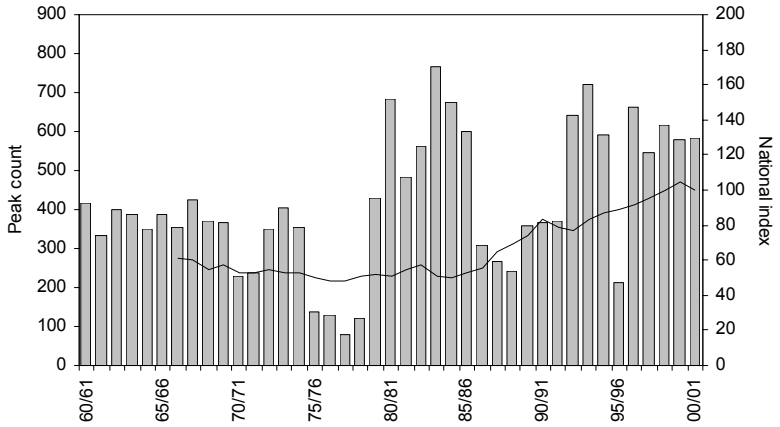


Figure 17. Mute Swans at the Tweed Estuary, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

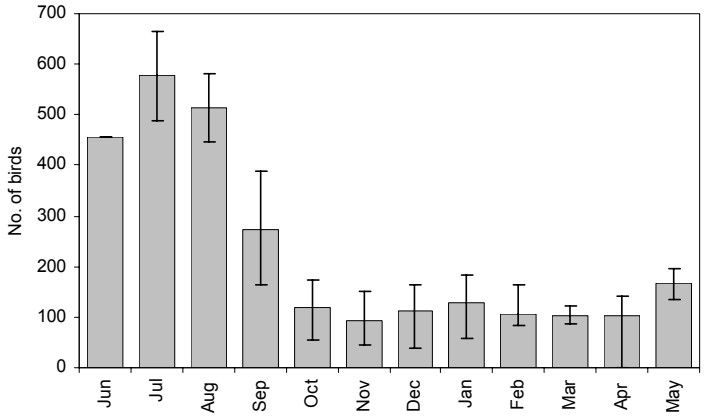


Figure 18. Mute Swans at the Tweed Estuary, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

Site use
The most important area for Mute Swans on the Tweed Estuary is at Berwick-upon-Tweed itself. This site is very important for the species in Britain as it is the only major moulting area in the region and holds up to 4% of the British Mute Swan population during the summer (Coleman *et al.* 2002).

The location and activity of the Mute Swans on the Tweed Estuary are influenced by seasonal, tidal and diurnal factors. Their movements can be explained by their need for food and safe roosting areas (Spray *et al.* 1996). Birds on the lower estuary (below the Royal Border Bridge) feed on *Enteromorpha* and a variety of seaweeds. One of the main feeding grounds is the mudflats at Calot Shad. Further upstream, particularly in the autumn, the birds can be seen feeding on aquatic plants in the river. Groups of over 100 birds can sometimes be seen upstream of the new A1 road bridge (Spray *et al.* 1996). At Yarrow Slake and along New Water Haugh, Mute Swans are commonly seen grazing on the banks. The natural supply of food at the estuary is augmented by regular handouts from the public, and by spillages of grain and other foodstuffs from ships in the docks and waste products from industrial food processing (Spray *et al.* 1996).

As the tide rises birds tend to leave Calot Shad, as the water becomes too deep for them to reach the bottom, and begin to drift upstream. Favoured roost sites are on the banks of the Slake and further upstream at New Water Haugh. Some birds remain in and around the dock at high tide, and they can be seen sleeping or preening during this period (Spray *et al.* 1996).

Berwick has been the site of an intensive ringing and research study for over 15 years, with regular catches of 400–500 birds during the moult period (Coleman *et al.* 2002). The majority of re-sightings have been in the Tweed Valley and throughout Northumbria. However, several young birds have been re-sighted as far afield as Aberdeenshire, Glasgow, Dumfries, Northern Ireland, Northampton, Devon and Denmark (C. Spray pers. obs.).

ii) Hornsea Mere

Five-year mean 96/97–00/01: 301

Site conservation status
SPA (Hornsea Mere, non-qualifying species)
Ramsar (Hornsea Mere, non-qualifying species)
SSSI (Hornsea Mere)
IBA (Hornsea Mere, non-listed species)

Site description and habitat
Hornsea Mere (TA1947) is situated less than 1 km from the sea on the east Yorkshire coast in northern England. It is the largest freshwater lake in Yorkshire and is of glacial origin. It is shallow (1–2 m deep), eutrophic and fringed by reedbeds, fen and carr. The shallowness has led to the development of extensive marginal swamps of Common Reed *Phragmites australis*, Bulrush *Typha latifolia* and Common Club-rush *Schoenoplectus lacustris*; these are most developed at the west end of the mere, where they grade into Alder *Alnus glutinosa* and willow *Salix* spp. carr. There are also fen communities, rich in plant species, as well as aquatic plants of open water such as Canadian Pondweed, Fennel Pondweed *Potamogeton pectinatus*, Spiked Water-milfoil *Myriophyllum spicatum*, Rigid Hornwort *Ceratophyllum demersum* and Yellow Water-lily *Nuphar lutea*. Dense algal blooms occur in summer as a result of eutrophication.

Numbers and trends
Mute Swan numbers remained fairly constant at between 100 and 200 birds through the 1970s and 1980s. The numbers of birds using Hornsea Mere have increased dramatically since the mid-1990s (Fig. 19). The maximum number recorded was 400 in July 1995. Much of this increase is probably due to the ban on the use of lead shot (B. Curtis pers. comm.). Monthly counts show that numbers increase rapidly from June to peak in August as birds gather on the lake to moult. Numbers then decline through the winter and spring to give the lowest counts in February and March (Fig. 20).

Site use
During the summer, the main concentration of Mute Swans on Hornsea Mere can be found to the north of Kirkholme. At times as many as 350–400 birds congregate in this area, probably attracted by visitors who feed them in this location. This part of the Mere is prohibited to boats and therefore there is a general lack of disturbance (B. Curtis pers. comm.). The area to the northwest of Lady Island is a favoured feeding and roosting area. Although boats are allowed in this part, the disturbance caused does not seem to affect the birds greatly, and it is likely that this area is favoured as it is often sheltered from the prevailing weather by the woods on the north side and by Swan Island and Lady Island (B. Curtis pers. comm.). On occasion, when there is a strong southerly wind, some birds (no more than about 30% of the total population) can be found on the southeast and southern parts of the lake. The area of the lake to the west of Lady Island is also prohibited to boats, however only around 20% of the Mute Swan population is found here. If the birds are disturbed from their favoured area near Swan Island, they generally move to the area north of Kirkholme,

rather than to that near Lady Island. Many of the birds that spend the day near Kirkholme then move back to the area near Swan Island when the tourists leave (B. Curtis pers. comm.).

2.1.6.4 Other sites

In Northumberland, the Linton area (NZ2691) has recently attracted large numbers of Mute Swans in winter (more than 100 birds at times) feeding on rape fields in the company of Whooper Swans, as well as utilising the adjacent pools (C. Spray pers. obs.).

Another site whose importance has increased is the South Shields Marine Park. This urban lake has become an important moult site, with up to 120 birds in late summer, and is used in winter by up to 190 (J. Coleman pers. comm.).

Fairburn Ings (SE4627) lies adjacent to the A1 to the northeast of Castleford in North Yorkshire. The site holds a resident core of birds all year round (around 100), and there is an influx of birds during the moulting period. The site seems to be most important for birds in an area extending from Wakefield in the west, down towards Rotherham and Doncaster to the south and across to the Humber and parts of East Yorkshire (J. Coleman pers. comm.).

Between 100 and 170 birds have regularly been present on the Lower Derwent Valley (SE6938) since the mid-1990s. The first non-breeding birds often appear at the site from mid-August after the summer moult. Numbers steadily increase from mid-September and normally peak during January to March, with a reduction thereafter. In wet years large concentrations can build up in May and early June before the birds depart to the moult sites. These herds comprise mainly first, second and third-year birds (C. Ralston pers. comm.). An extensive colour-ringing project, which started in 1992, has shown that birds from the Lower Derwent Valley moult at Berwick-upon-Tweed, Hornsea Mere, New Holland, Fairburn Ings, the Doncaster area and down the Trent Valley (C. Ralston pers. comm.)
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2.1.6.5 Key references

Dickens & Mitchell (1977), Prater (1981), Owen *et al.* (1986), Spray *et al.* (1996), Coleman *et al.* (2002).

2.1.7 Wales

2.1.7.1 Background

Much of Wales is unsuitable for this species, and it is largely absent over most of the Cambrian Mountains and Snowdonia. Elsewhere, it is confined to the larger lakes, ponds, coastal wetlands and canals (Lovegrove *et al.* 1994). Most Mute Swan flocks are small, with few exceeding 100, and there are no sites in Wales that support internationally important numbers of Mute Swans. Breeding and wintering distributions are almost identical, and many breeding pairs remain on their territories throughout the year. Immature and non-breeding birds join flocks at traditional sites. Favoured sites in Wales are low-lying lakes, slow-moving rivers and sheltered estuaries (Lovegrove *et al.* 1994). Many of the river valleys, such as those of the Usk, Wye and Severn, also support small numbers of Mute Swans.

Wintering flocks of between 20 and 50 birds are found along many of the western estuaries, including the Cleaddau Estuary (SN0005) and the Glaslyn Estuary (SH5736) (Lovegrove *et al.* 1994, Welsh Bird Reports). Favoured moult sites include the eastern end of the Menai Strait (Traeth Lafan SH6474), the Dee Estuary (SJ2675), the Cleaddau Estuary and the Glaslyn Estuary (Lovegrove *et al.* 1994, Welsh Bird Reports).

Mute Swans are rare vagrants to the Pembrokeshire islands and Bardsey, and are usually recorded between July and November (Lovegrove *et al.* 1994).

The majority of ringing records of Mute Swans recovered in Wales involve relatively short distances, mainly birds ringed in Cheshire or the English Midlands, with no seasonal trend to the recoveries (Lovegrove *et al.* 1994).

2.1.7.2 Historical status

There are few historical data available regarding the Mute Swan population in Wales. The Welsh Mute Swan population declined between the 1955/56 census and the 1978 census (Campbell 1960, Ogilvie 1981). By the time of the 1983 census the population had increased (Ogilvie 1986b), and the results of the 1990 survey showed that the Welsh population had continued to increase during the 1980s (Delany *et al.* 1992). Wetland creation schemes in the Severn Valley have helped to increase local populations in the area (Welsh Bird Reports). Aquatic vegetation has changed in the long-term in favour of the Mute Swan's food requirements. This, along with the pastoral nature of farming along the Upper Wye and

Upper Severn floodplains, which provide grazing for the species, have helped create conditions favourable to population expansion (Slater *et al.* 1990a)

During the 1950s and 1960s, one of the most important sites for summer flocks of non-breeding birds was Llyn Coron (SH3770) on Anglesey, where the summering flock reached a maximum of 54 in July 1965 (Griffiths 1967). This flock regularly numbered over 40 birds, but after 1970 the birds did not return, possibly because of a change in the food supply (Venables & Venables 1972).

In the 1950s large flocks (max. c. 150) of birds gathered on Roath Park Lake (ST1881) in Cardiff (Lovegrove *et al.* 1994). They used to moult on Llanishen and Lisvane Reservoirs (ST1881) and move to the lake for the winter. However, increased disturbance on the surrounds of the lake meant that numbers gradually declined until they had virtually disappeared by the late 1970s (Owen *et al.* 1986).

In the 1960s the only places where non-breeding flocks of Mute Swans were found to the west of the River Severn and away from the coast were Llangorse Lake (SO1326), Talybont Reservoir (SO0918), on the River Wye along the Powys/Hereford border, and Anglesey (Griffiths 1967). Before 1962 nearly all the non-breeding Mute Swans in Breconshire (40–50 birds) could be found on Talybont Reservoir. In 1962 the flock split, and most birds apparently moved to Llangorse Lake, although there are no ringing data to confirm this (Slater *et al.* 1990b). During the 1980s both breeding and non-breeding Mute Swan numbers at Llangorse Lake declined markedly. This decline was probably the result of increased disturbance from recreational use (particularly power boats), which may have changed the turbidity and aquatic macroflora of the lake (Seddon 1972, Cundale 1980).

In the Wye Valley, the non-breeding numbers between Glasbury (SO1840) and Castleton (SO2846) increased five-fold between the 1960s and 1980s, and this area was where the largest proportion of the River Wye's Mute Swans was found (Slater *et al.* 1990b). Several factors may have contributed to this increase. Initially, at least some of the former Llangorse Lake flock may have moved to the River Wye, as the decline after 1979–1980 in the Llangorse flock was matched by an increase of similar magnitude in the River Wye flock. Movements may have also occurred between the lake and the Wye Valley (Slater *et al.* 1990b), but high counts of around 90–100 birds are still occasionally recorded by WeBS counts in July and August on Llangorse Lake today.

Mute Swans have wintered on the Cleddau Estuary (SN0005) for the past century. Up to 50 birds are recorded each year and the complex holds some 9% of Welsh Mute Swans in winter (Poole 1997). Most birds are seen at Llanstadwell (SM9404) and Pembroke River, although preferred sites change, and large numbers were recorded in Garron Pill (SN0007) in 1993/94 and in Coheston Pill (SM9903) in 1994/95 (Poole 1997). During the colder winters of the 1980s, the numbers of birds on the estuary were greater. The *El Omar* oil spill in December 1988 caused numbers to fall and they subsequently remained low, but appeared to have recovered by 1994–95 (Poole 1997).

2.1.7.3 Other sites

A flock of around 170 Mute Swans has regularly congregated at the eastern end of the Menai Strait (Traeth Lafan, SH6474) during the moult period (Welsh Bird Reports).

2.1.7.4 Key references

Welsh Bird Reports, Griffiths (1967), Seddon (1972), Venables & Venables (1972), Cundale (1980), Slater *et al.* (1990a & b), Lovegrove *et al.* (1994), Poole (1997)

2.1.8 Western England (Cheshire, Shropshire, Hereford & Worcestershire, Gloucestershire)

2.1.8.1 Background

The Mute Swan is resident and widespread in Cheshire, and most sizeable waters hold at least a pair. In the east of Cheshire the land rises towards the Peak District, and this area is largely avoided by Mute Swans. However, the greatest part of Cheshire is level farmland, and there are many inland waters. There are clusters of natural meres close to the Shropshire border, in the Delamere Forest, and in the area between Northwich and Macclesfield (Guest *et al.* 1992). These include Combermere (SJ5844), Pickmere (SJ6877) and Marbury (Great Budworth) (SJ6576), which all hold small numbers of Mute Swans. There are also a number of ornamental lakes in parks, many of which hold at least a pair of birds. Some of these lakes are natural but have been enlarged by damming. One of the more important sites during the winter for Mute Swans in Cheshire is the Dee Estuary (SJ2675, also in Merseyside and Clwyd). Many sand-quarries have also been

excavated in the last 10 years or so, but these have little vegetation and steep banks and are therefore not widely used by Mute Swans (Guest *et al.* 1992).

Much of north Shropshire is occupied by a belt of level farmland, lying at less than 100 m above sea level and extending over 60 km inland (Owen *et al.* 1986). The River Severn winds its way through the county, passing through the towns of Shrewsbury, Ironbridge and Bridgenorth. Mute Swans are found in small numbers at many points along the River Severn, and flocks of around 20 birds can be seen on the river at Shrewsbury (SJ4815). Small numbers are also present on the River Teme between Ludlow and Knighton (SO4073). To the north of Shrewsbury lies a series of mini lakes, or meres, which were formed during the ice age. These natural hollows are not fed from rivers or streams but rely on the surrounding water table to maintain their levels. These provide a good habitat for Mute Swans, and Ellesmere Lakes (SJ4133), which is a consolidation of several meres, supports a flock of Mute Swans during the moult period. Shropshire contains many other lakes and pools, which hold at least a pair of birds and sometimes more.

The River Wye in Herefordshire meanders through a broad low-lying vale of farmland, in which there are numerous pools and ornamental waters (Owen *et al.* 1986). The River Wye itself holds small flocks at many places along its course, including a non-breeding flock from March to September at Castleton (SO2846). The attraction of the region to Mute Swans is enhanced in mid-winter when flooding occurs along the Wye and its tributaries (Owen *et al.* 1986). One of the more important areas is on the River Lugg near Hereford, with the stretch of river between Lugg Bridge and Wergins Bridge (SO5343) being favoured in the winter months. There are also a number of gravel pits that have attracted Mute Swans, such as Bodenham Gravel Pit (SO5251) and Wellington Gravel Pit (SO5047).

In Worcestershire most birds can be found in the valleys of the Severn and Avon. The River Severn holds small flocks along its course through the county, and around 10 birds can be found near Worcester Cathedral (SO8356). There are many lakes, reservoirs and gravel pits in the region that support small numbers of birds.

The Severn Vale in Gloucestershire forms a wide belt of low-lying country flanking the River Severn on both sides from Tewkesbury in the north to the southern county boundary with Avon. It includes the upper part of the Severn Estuary, and separates the hills of the Forest of Dean in the northwest from the Cotswold escarpment to the southeast. The most important area for Mute Swans is the Severn Estuary (ST5058) (also in Avon and Wales), which holds over 200 birds. The WWT reserve at the New Grounds, Slimbridge (SO7206), is a part of the Severn Estuary site. Other sites include Frampton Pools (SO7507) and Coombe Hill Canal (SO8626) (Swaine 1982). In the extreme eastern corner of the county lies the Cotswold Water Park (East-SU1999, also in Oxfordshire, and West-SU0595, also in Wiltshire), where birds congregate during the winter. Other Mute Swan areas are along the valley of the River Frome, along the Cotswold streams and at gravel pits near Bourton-on-the-Water (SP1720). The species is uncommon over the rest of the Cotswolds, the Forest of Dean and in the northwest of the county, where there are few suitable habitats (Swaine 1982).

2.1.8.2 Historical status

In Cheshire in the early 1900s, the Mute Swan was found in a semi-domesticated state on most of the meres and ornamental waters of the county. By the 1930s and 1940s it had been noted that the species seemed to be increasing in number each year (Guest *et al.* 1992). However, from the 1950s through to the early 1980s, both the wintering and breeding populations of the Mute Swan in Cheshire had declined. The reasons for this decline were complicated, but causes included some deterioration of habitat, lead poisoning, vandalism and collisions with overhead power lines (Guest *et al.* 1992). Mute Swan numbers in the region have since improved; for example, numbers on the Dee Estuary have been increasing since the 1980s and have risen from 10–30 in the 1980s to over 100 in the 1990s.

During the late 1970s and 1980s Mute Swan numbers on the Shropshire section of the River Severn were very low. The number of birds gradually increased through the 1990s, and flocks of around 20 can now be seen at some locations. It is also likely that the increase has occurred because of to the ban imposed on the use of lead weights by anglers in 1987. The numbers of birds on Ellesmere Lakes increased during the 1980s and 1990s and flocks of 50–80 birds could be seen during the moulting season. In recent years, however, numbers seem to have declined slightly to 30–60 birds.

The Mute Swan was scarcely mentioned by 19th century writers on the birds of Gloucestershire. It was described in 1902 as a winter straggler to the Severn (Swaine 1982). There was then a steady increase up to the 1950s, with some later declines in numbers, particularly in the 1970s and 1980s. Since the ban on lead weights, numbers in the region have increased, particularly on the Severn Estuary where

numbers were very low through the 1970s and most of the 1980s, but have since increased to levels of international importance. The population of Mute Swans in the area around the New Grounds has increased markedly since the late 1970s. In spring 1978 five non-breeding birds were counted in the 10-km grid square containing Slimbridge and Frampton (Ogilvie 1981). No non-breeding birds were counted in the same grid square in spring 1983 (Ogilvie 1986b), but by spring 1990 a total of 109 birds were counted, putting it amongst the top 30 squares for non-breeding birds in Britain (Delany *et al.* 1992). Initially, Mute Swans were discouraged from residing in WWT's collection at Slimbridge because they would compete with captive birds for both the provisioned grain and breeding territories. Active discouragement was reduced in the mid-1980s, and this, along with the national increase in the Mute Swan population, resulted in increasing numbers of birds at both Slimbridge and the nearby gravel pits at Frampton (Ryley & Bowler 1994). Before 1987, the highest annual counts at Slimbridge typically occurred during the winter months. Numbers would fall in the summer with some birds dispersing in spring to breed, and the remainder leaving between June and August to moult (Ryley & Bowler 1994). During the early 1980s, re-sightings of non-breeding birds ringed at Slimbridge showed that the majority of these birds moulted at Frampton, with only the occasional breeding pair remaining at Slimbridge. However, after 1987 the proportion of birds remaining to moult at Slimbridge began to increase rapidly: by 1992 only two breeding pairs remained at Frampton during the moult period, whilst the remainder moulted at Slimbridge (Ryley & Bowler 1994).

Numbers at the Cotswold Water Park have been steadily increasing since the 1970s on both the East and West sites. However larger flocks of 120–160 birds occur at the West site, compared to 50–70 on the East site.

2.1.8.3 Internationally important sites

i) Severn Estuary
(also falls in Avon, Somerset, Gwent, Mid and South Glamorgan)

Five-year mean 96/97–00/01: 285

Site conservation status
SPA (Severn Estuary, non-qualifying species)
Ramsar (Severn Estuary, non-qualifying species)
SSSI (various)
IBA (Severn Estuary, non-listed species)

Site description and habitat
The Severn Estuary (ST5058) is located between England and Wales in southwest Britain. It is the largest example of a coastal plain estuary in the UK. Eight rivers discharge into it, together producing a marked east-west salinity gradient. It has the second highest tidal range in the world, with a spring range of over 12 metres. There are many different habitats present, including saltmarsh, intertidal and subtidal mud and sand, rock outcrops, and boulder and shingle shores. The estuary holds the largest aggregation of saltmarsh in the south and southwest of the UK. The extreme tidal range has resulted in saltmarsh that is both accreting and eroding (though erosion predominates). The wide salinity gradient has led to a range of transitional habitats, including transitions to freshwater, inundated grasslands and freshwater marshes. The Severn Estuary is one of the more developed estuaries, with over one million people living in the towns and major cities on its shores.

Numbers and trends
Very few Mute Swans were present on the Severn Estuary in the early 1960s. Numbers increased to around 50 in the late 1960s and early 1970s, but they then fell away to very low levels through the rest of the 1970s and first half of the 1980s. Towards the end of the 1980s, following the ban on lead weights, numbers began to increase steadily. A more rapid increase was seen through the 1990s and the highest number recorded was 337 in December 2000 (Fig. 21). Around 100 Mute Swans are present on the estuary during the moult period. Numbers appear to fall slightly in October, but then begin to increase through the winter, with numbers peaking around the New Year. In early spring flocks begin to decrease and the lowest numbers of the year are seen in May (Fig. 22).

Site use
Large numbers of the Mute Swans on the Severn Estuary can be found on the Axe Estuary (Pollitt et al. 2000) and also at the WWT New Grounds reserve at Slimbridge. Here the birds can also be found within the collection, where they are attracted by the feed provided by reserve staff and members of the public. Birds from Frampton Pools come to the New Grounds to moult (Ryley & Bowler 1994). The birds on the Welsh side of the estuary tend to be widely dispersed in small groups (Welsh Bird Reports).
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Figure 19. Mute Swans at Hornsea Mere, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

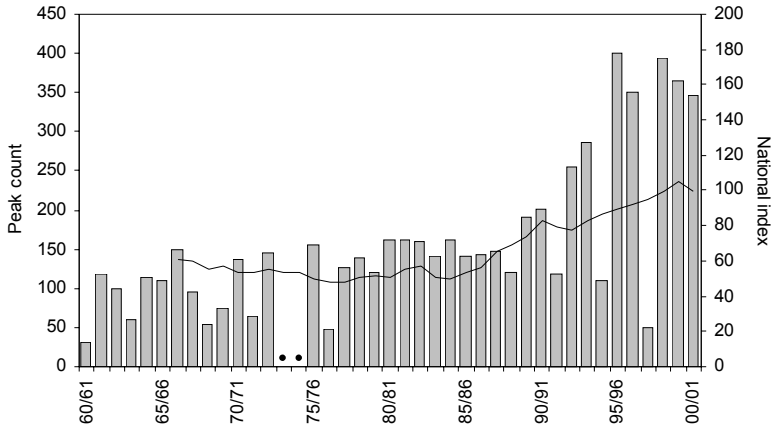


Figure 20. Mute Swans at Hornsea Mere, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

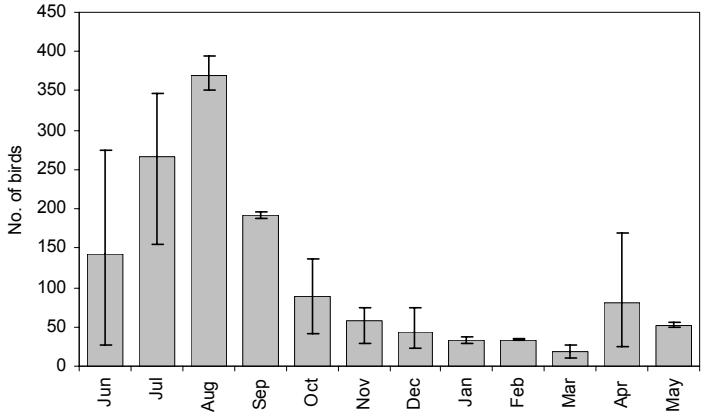


Figure 21. Mute Swans at the Severn Estuary 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

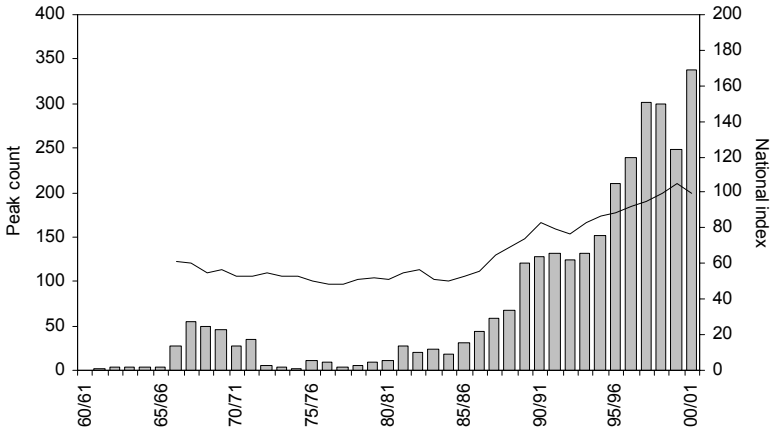
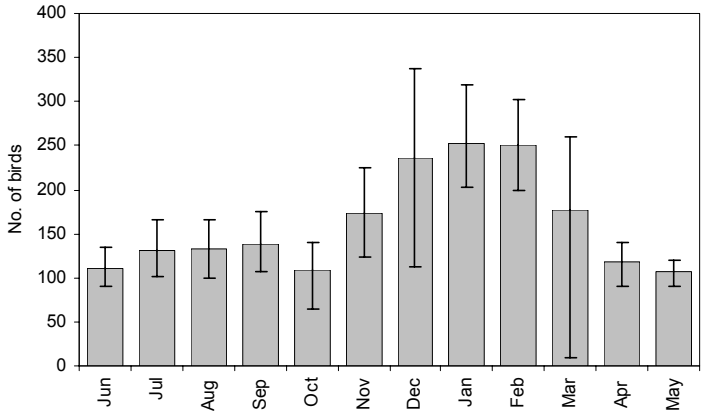


Figure 22. Mute Swans at the Severn Estuary 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)



2.1.8.4 Other sites

Large flocks of Mute Swans use the Cotswold Water Park, particularly during the winter. The numbers here have been steadily increasing over the last 30 years. The Cotswold Water Park (West) (SU0595) appears to be favoured over the East site (SU1999), and 120–160 birds have been recorded on the West site in recent winters. Flocks here tend to peak from October to December, but large moult flocks of around 100 birds can also be seen.

2.1.8.5 Key references

Swaine (1982), Owen *et al.* (1986), Guest *et al.* (1992), Ryley & Bowler (1994)

2.1.9 The Midlands (Staffordshire, West Midlands, Warwickshire, Nottinghamshire, Derbyshire, Leicestershire)

2.1.9.1 Background

This section of the country has seen rapid industrial growth and population expansion through the 20th century. The process of urbanisation has, however, not always been to the detriment or exclusion of birds (Harrison *et al.* 1982). An increased demand for water over the last 50 or 60 years has lead to the creation of several large water-supply reservoirs, such as those at Blithfield (SK0524) in Staffordshire and Draycote (SP4469) in Warwickshire. Both of these waters hold moulting flocks of Mute Swans. The demand for water has been matched by the demand for power, and many power stations have been built in the region. Small numbers of Mute Swans have taken to frequenting the ash lagoons associated with many stations. Another product of urbanisation has been sewage farms with settling lagoons, and some birds have also made use of these. However, many of these are now being closed and replaced by large modern sewage treatment plants, which do not provide a suitable habitat. Over the last 15 years, many additional pools have been created in this region as irrigation ponds for farms and to accommodate leisure pursuits (Coleman *et al.* 2001)

Since the Second World War, and particularly in the 1950s and 1960s, there has been an increase in sand and gravel extraction across this region (Harrison *et al.* 1982). These sites have provided new habitats for the Mute Swan and some, such as those at Fisherwick and Elford (SK1710) in Staffordshire, and those in the Middle Tame Valley (SP2096) in Staffordshire and Warwickshire, support flocks of over 200 birds.

Important coal measures occur in the north and south of Staffordshire and in the east of Warwickshire. Where old workings have been abandoned, such as at Brandon Marsh (SP3875), colliery subsidence has created a flash. Subsequent gravel working here has added considerably to the extent of the aquatic habitat (Harrison *et al.* 1982) and the open lagoons, with their numerous small, vegetated islands, regularly hold small flocks of around 10 Mute Swans.

The rivers of the region, such as the Avon in Warwickshire and the Trent in Staffordshire, hold varying numbers of Mute Swans along their courses, including moult flocks of up to 100 birds at sites in Tamworth.

Mute Swans occur widely in Derbyshire but frequent mainly lowland waters, including reservoirs, lakes, canals, rivers and gravel pits. The species is rare on upland waters, and only a few Mute Swans are present in the Peak District. Lakes, ponds and 'flashes' in eastern and central areas of the county may support a breeding pair. However, most birds are found in the south, especially in the Trent Valley, where there is a greater abundance of suitable aquatic habitat (Frost 1978).

2.1.9.2 Historical status

The Mute Swan population in this region peaked in the late 1950s. Subsequently, and until the 1980s, populations declined, although the decline was more severe in some places than in others. After the mid-1980s there was a marked increase in the region's Mute Swan population, and this followed the national pattern (Delany *et al.* 1992). Whilst the national changes are thought to be closely linked with the ban on the use of lead weights by anglers, the studies carried out on Mute Swan populations in the English Midlands area suggested that locally other factors may also have been involved (Minton 1971, Hardman & Cooper 1980, Coleman *et al.* 2001). The reasons for these declines include pollution, general deterioration of habitat and disturbance (Hardman & Cooper 1980). The decline was also accelerated by three major oil spills, in 1966, 1974 and 1978, as these almost totally wiped out some of the non-breeding flocks, including that at Burton-on-Trent (Minton 1971, Coleman *et al.* 1991). These flocks, which act as a source of recruitment to the breeding population, took some years to recover and therefore the region's population declined (Coleman *et al.* 2001). Vandalism of nests, particularly in the industrialised parts of the region,

may also have contributed to the decline by reducing the breeding success (Coleman *et al.* 1991). The Mute Swan population in the English Midlands study area seems to have stabilised, or even declined slightly, since 1997 (Coleman *et al.* 2001).

Mute Swan numbers on the Warwickshire Avon, particularly around Stratford-upon-Avon, also declined over the period from the 1960s to the 1980s. Between 1974 and 1975 there was a spectacular decline, which was due largely to great mortality from lead poisoning as a result of ingesting fishing weights. However numbers recovered in the spring of 1976, but the number of birds at Stratford soon declined very sharply and has now fallen to often no more than a pair. Hardman and Cooper (1980) put the decline down to more than just lead poisoning, and concluded that birds simply left the area, as some were later recorded in other places. Deterioration in river habitat quality was another possible cause for the decline. The amount of visible weed growth had declined and in some areas where dredging was carried out stretches that were very shallow and carried good growths of macrophytic vegetation were out of reach of feeding birds (Hardman & Cooper 1980).

Although the flock at Stratford has not recovered, Mute Swan numbers on other rivers in this region, such as the River Trent in Staffordshire, have been slowly increasing since the ban on lead fishing weights. The numbers of birds using gravel pits in the region have increased, particularly through the 1990s.

Generally, numbers in Derbyshire seem to have decreased slightly. Winter numbers of 70–80 were recorded at Swarkstone gravel pits (SK3627) in the 1970s (Frost 1978). Numbers here have since declined and only around 10–15 birds are seen today. A large number of birds used to congregate at Sawley Bridge during the late 1950s (Frost 1978), this flock is now virtually non-existent. The numbers on the Trent have also suffered a decline.

2.1.9.3 Internationally important sites

i) Rutland Water

Five-year mean 96/97–00/01: 502

Site conservation status
SPA (Rutland Water, non-qualifying species)
Ramsar (Rutland Water, non-qualifying species)
SSSI (Rutland Water)
IBA (Rutland Water, non-listed species)

Site description and habitat
Rutland Water (SK9207) located in Rutland, east Midlands, is a man-made pump storage reservoir. The reservoir is drawn down in summer and filled in autumn and winter when river levels are high. The main habitats are open water and a mosaic of lagoons, reed swamp, marsh, old meadows, scrub and woodland.

Numbers and trends
Rutland Water has been surveyed since its construction. Mute Swan numbers have generally increased fairly rapidly since the late 1970s. In the early 1980s fewer than 100 birds were present on the reservoir. The greatest increases occurred during the mid to late 1990s, and the highest recorded number was 617 in July 1999 (Fig. 23). The greatest numbers of Mute Swans are present on the reservoir during the moult season, with influxes of birds beginning in May and peaking in July and August (although numbers are often also high in September). Numbers decline throughout the winter and reach their lowest levels in February (Fig. 24).

Site use
The distribution of Mute Swans at Rutland Water depends on the time of year and the amount of disturbance from recreational pursuits (T. Appleton pers. comm.). When the water level is shallow enough for aquatic vegetation to grow in abundance, the birds can be found feeding around the shallows. This coincides with the arrival of non-breeding birds coming to moult. The birds move round the reservoir but tend to keep mainly to the two arms closest to the western end, which are wildlife reserves and provide better feeding habitats and are less disturbed (T. Appleton pers. comm.).

2.1.9.4 Other sites

To the north of Rugeley in Staffordshire lies Blithfield Reservoir (SK0524). The 790-acre reservoir has supported a moulting flock of 120–160 Mute Swans in July and August in recent years.

Since the late 1980s Mute Swan numbers on the Fisherwick and Elford Gravel Pits (SK1710) have increased steadily. At present the site regularly holds between 200 and 250 birds, and in 1999/2000 and 2000/01 the numbers exceeded the threshold level of 260 birds.

The Middle Tame Valley Gravel Pits (SP2096) have supported over 200 birds in recent winters and a moult flock of 100–150 during late summer. The numbers of Mute Swans at this site have increased, particularly during the 1990s.

2.1.9.5 Key references

Minton (1971), Frost (1978), Hardman & Cooper (1980), Harrison *et al.* (1982), Coleman *et al.* (1991, 2001)

2.1.10 Eastern England/East Anglia (Lincolnshire, Norfolk, Suffolk, Cambridgeshire, Northamptonshire)

2.1.10.1 Background

The Mute Swan is a common and widespread resident in this part of the country, and most areas of water hold at least a pair.

There are many reservoirs and gravel/sand pits in Lincolnshire that support very small numbers of Mute Swans, often only around 2–10 birds. The Humber Estuary also lies on the Lincolnshire coast and internationally important numbers of Mute Swans are found here during the winter.

The Wash is a large estuarine expanse of sand/silt flats and saltmarsh. It incorporates the estuaries of the East Anglian Ouse flowing in from a southerly direction, the Nene and the Welland from the southwest, and the Witham from the northwest. Small numbers of Mute Swans are present here throughout the year. A regular flock of Mute Swans can be found further east along the North Norfolk Coast (TF8546), with the greatest numbers occurring on Holkham Lake (Owen *et al.* 1986).

The Fenlands of East Anglia are an important area for Mute Swans. The Fens consist of a network of canals and ditches (known locally as drains) covering some 3,400 km² and the drained part of the Wash basin. The main Fenland rivers are the Great Ouse, Nene, Welland and Witham. The courses of these rivers have been greatly changed and straightened over the centuries so that their original courses are unclear. Drains have been cut through the marshes and water is pumped into them from the adjacent low-lying farmland. To allow for control of winter floods, washlands were created on either side of the Nene and Ouse Washes by enclosing an area between two parallel, high-banked drains. Built in the 17th century, the Ouse Washes are some 34-km long and encompass a series of nature reserves (WWT, RSPB and County Wildlife Trust). In addition to holding thousands of geese and ducks, these seasonally flooded washland meadows have for many years supported internationally important numbers of swans of all three British species.

The Suffolk coast includes shingle banks, wide estuaries, low cliffs, marshland and saltings. Inland it is predominantly arable and is varied by commons and woodland, wide river valleys, patches of fen and, in the northwest, a unique area of sandy heath and conifer forest. The rivers are all comparatively shallow and sluggish, and show great seasonal variation (Payn 1978). There are two main flocks of Mute Swans: on the Rivers Stour and Orwell and their estuaries. Other gatherings have been present on the Alde-Ore Complex, the Deben Estuary and Lake Lothing. Mute Swans have shown a preference for the upper reaches of the Deben Estuary (Pollitt *et al.* 2000).

Mute Swans are resident and recorded on most waters during the year in Northamptonshire. Here many gravel pits can be found along the River Nene valley from west of Northampton to the boundary with Cambridgeshire, and these support reasonable flocks of both moulting and wintering birds, such as at Thrapston Gravel Pits. The latter part of the 20th century has seen a massive expansion of flooded gravel pits in both the Nene and Ouse Valleys, and this has provided more habitats for Mute Swans.

2.1.10.2 Historical status

As a result of the increase in sand and gravel extraction over the last 40 or 50 years, these pits have become an increasingly common feature in parts of Lincolnshire and Northamptonshire, particularly along the Nene valley. During the 1950s and 1960s, several large reservoirs were created on higher ground in this region. The birds have taken advantage of this, and as a result Mute Swan numbers in this area have been increasing steadily. The River Welland in Lincolnshire held nationally important numbers of Mute Swans during the 1980s, particularly on the section from Spalding to Borough Fen. Fairly large gatherings of birds are still seen in this area today.

In the 1950s and 1960s a flock of between 60 and 150 Mute Swans wintered at the mouth of Barton Haven (TA0223) (on the Lincolnshire side of the Humber Estuary). Here they fed on the outfall from the maltings, which were active at that time. By the early 1970s the maltings had closed and the number of birds fell rapidly, but up to 40 were still occasionally present until 1973 (G. Catley pers. comm.). For a number of years in the 1970s a large winter flock of Mute Swans frequented North Killingholme Haven pits (TA1619) (on the north Lincolnshire side of the Humber Estuary). Winter

flocks here at this time totalled 60–70 birds. However, this flock dissipated in the 1980s and the site no longer holds more than 10 birds (G. Catley pers. comm.).

Since 1934, flocks of Mute Swans have regularly gathered in the winter at the Ouse and Nene Washes in Cambridgeshire (Bircham 1989). Non-breeding flocks also occur in late summer, particularly on the Ouse Washes. The Fenlands were some of the areas in the UK worst effected by lead poisoning, and there was a very high percentage of deaths resulting from the birds' ingestion of anglers' lead weights. The River Cam in the city of Cambridge has been surveyed regularly and the winter maxima have shown a marked decline, particularly between 1964 and 1972, possibly as a result of pollution (Bircham 1989). In general, winter numbers in the area seem to be increasing on the larger areas of water.

It is probable that, no more than 100 years ago, the Mute Swan was a very scarce bird throughout Suffolk (Payn 1978). Within the last 50 years, a great increase has taken place and the bird is now found on most rivers and broads, as well as on flooded gravel pits and many lakes and small ponds. In places it is now considered a pest by some, damaging arable crops and grassland and driving off other waterfowl (Payn 1978). During the 1960s and early 1970s large flocks (often around 300 birds) were present at the upstream end of the Orwell Estuary (TM2238): these birds were attracted to the grain wharves at Ipswich Docks (Owen *et al.* 1986). As in many other places, the amount of waste grain released was greatly reduced, and hence the numbers of Mute Swans began to decline. Since the mid-1990s, the numbers of birds on the Orwell Estuary have increased again.

2.1.10.3 Internationally important sites

i) Humber Estuary
(also in Humberside)

Five-year mean 96/97–00/01: 275

Site conservation status
SPA (Humber Flats, Marshes and Coast, non-qualifying species)
Ramsar (Humber Flats, Marshes and Coast, non-qualifying species)
SSSI (various)
IBA (Humber Flats, Marshes and Coast, non-listed species)

Site description and habitat
The Humber Estuary (TA2020) drains a catchment of 24,240 km² and provides the largest single input of freshwater from Britain into the North Sea. It is a long, relatively narrow estuary and has the second highest tidal range in Britain (7.2 m). At low tide approximately one third of the estuary is exposed as mud or sand flats. The inner estuary supports large areas of reedbed with areas of mature and developing saltmarsh backed by grazing marsh in the middle and outer estuary. The saltmarsh on the north Lincolnshire coast is backed by low sand dunes with marshy slacks and brackish pools. Thousands of hectares have been reclaimed from the estuary in its lower reaches.

Numbers and trends
Through the 1960s and much of the 1970s, very few Mute Swans used the Humber Estuary. In the late 1970s there was a slight increase to 100 birds in 1980/81. Numbers then declined until the mid-1990s, when a fairly rapid increase began. Flocks now peak at around 250–300 birds through the winter (Fig. 25). A regular moulting flock of around 100–200 birds is present on the estuary during the summer months. Numbers increase slightly through the winter and tend to peak in January. After this, numbers decline to their lowest levels in early spring (Fig. 26).

Site use
The majority of the Mute Swans recorded on the Humber Estuary are found on the south bank, in Lincolnshire. Many of the birds can be found immediately east and west of New Holland Pier. The concentration of birds here is to the result of the provision of foodstuffs, in the form of spilt grain and animal feeds, from the New Holland Bulk Services complex that operates on the site of the old ferry terminal (Anon 1999). In the New Holland area the birds are able to forage, even on high neap tides, along the shoreline, in the Howarth timber dock and around the pier. However, on very high tides they either gather immediately west of the pier or on the adjacent Fairfield pit at New Holland or drift west up the estuary to Barrow Haven. In some months a proportion of the birds will also move west onto the Barrow Haven and Barton clay pits (G. Catley pers. comm.). In effect, the Mute Swan flock on the Humber Estuary is an artificial result of the inadvertent provision of food as little natural food is available on the estuary (G. Catley pers. comm.).

Observations of colour ringed birds on the Humber Estuary have shown that they originate from areas on the Upper Derwent and Pocklington Canal, and from Northumberland and even southern Scotland (G. Catley pers. comm.).

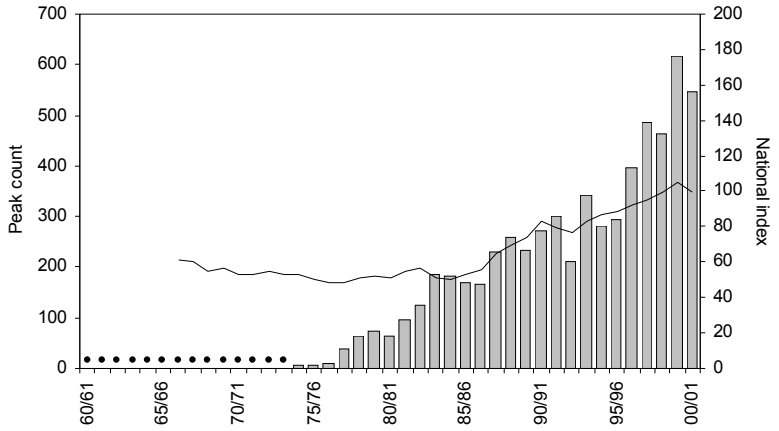


Figure 23. Mute Swans at Rutland Water, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

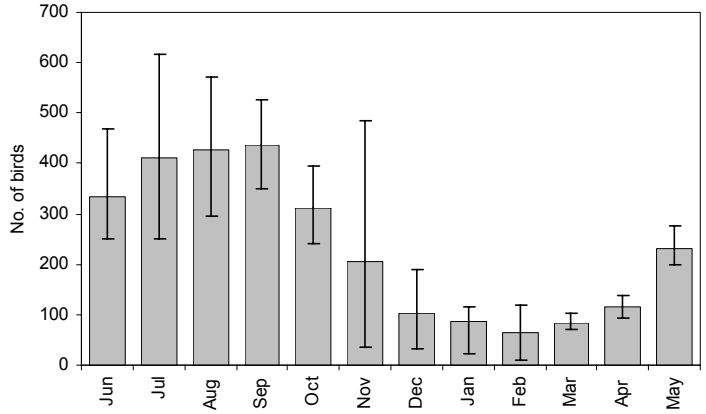


Figure 24. Mute Swans at Rutland Water, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

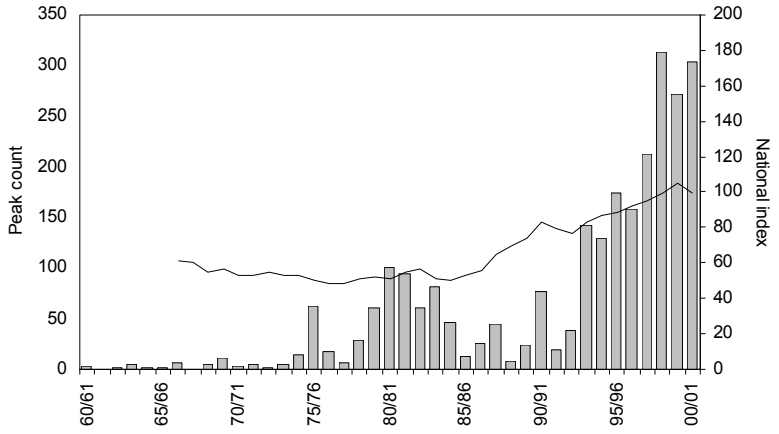


Figure 25. Mute Swans at the Humber Estuary, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

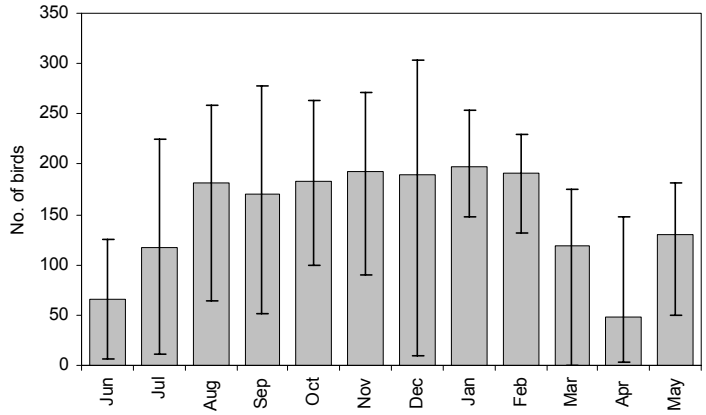


Figure 26. Mute Swans at the Humber Estuary, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

ii) Stour Estuary
(also in Essex)

Five-year mean 96/97–00/01: 342

Site conservation status
SPA (Stour and Orwell Estuaries, non-qualifying species)
Ramsar (Stour and Orwell Estuaries, non-qualifying species)
SSSI (Stour Estuary)
IBA (Stour and Orwell Estuary, non-listed species)

Site description
The Stour Estuary (TM1732) straddles the eastern part of the Suffolk/Essex border in eastern England. The estuary includes extensive mudflats, low cliffs, saltmarsh and small areas of vegetated shingle on the lower reaches. The mudflats hold *Enteromorpha, Zostera* and *Salicornia* spp.

Numbers and trends
In contrast to most estuaries in the south, wildfowl numbers, including numbers of Mute Swans, on the Stour have declined markedly (Owen *et al.* 1986). Winter gatherings of around 800 Mute Swans could be seen on the estuary in the early 1960s. At this time the birds were attracted by waste grain from the Mill at Mistley (Owen *et al.* 1986). Numbers had fallen to around 200 birds by the early 1970s, and have remained relatively stable since, although over 400 birds were present in January 1997 and May 1999 (Fig. 27). A moulting flock of 150+ birds is present in August, and numbers of around this value are likely to be present in June and July as well (the site not having been surveyed in these months). Numbers steadily increase from September, with the highest numbers of the year occurring in January. From February onwards numbers steadily decline and then increase again in May (Fig. 28). The high number of birds in May might be unrepresentative of true numbers present as there is only one count for that month in the last five years.

Site use
In recent years, many of the Mute Swans on the estuary have tended to congregate at the western end of the estuary around Manningtree, with smaller numbers around Harwich (Pollitt *et al.* 2003).

iii) Ouse Washes

Five-year mean 96/97–00/01: 569

Site conservation status
SPA (Ouse Washes, non-qualifying species)
Ramsar (Ouse Washes, non-qualifying species)
SSSI (Ouse Washes)
IBA (Ouse Washes, non-listed species)

Site description
The Ouse Washes (TL5394) is the area of land between the Old and New Bedford Rivers in eastern England. They are located on the River Great Ouse, one of the major tributary rivers of The Wash, and act as a floodwater storage system during the winter months. The cycle of winter storage of floodwaters from the river, followed by traditional summer grazing by cattle, along with hay production, has led to a mosaic of rough grassland and wet pasture.

Numbers and trends
The Ouse Washes and the surrounding fenland have supported large flocks of Mute Swans since the 1930s (Bircham 1989). Numbers increased during the 1960s, but a slight decline occurred in the early 1970s. Over the next 20 years numbers generally increased, with some slight fluctuations in the late 1980s, to peak at 1,020 birds in November 1993 (Fig. 29). There was, however, a subsequent decline to only around 400 birds in the mid-1990s. Since then numbers have begun to increase once again, peaking at over 700 birds in the 2000/01 winter (Fig. 29). Flocks of non-breeding birds are present throughout the summer. The numbers of birds present at the WWT reserve at Welney depend on the amount of spring and summer flooding (D. Stevens pers. comm.). Significant numbers of birds start to gather at the site from September onwards, and the largest numbers are present in November and December. From January numbers begin to decline, but then start to increase again by April (Fig. 30).

Site use
The Earith end of the Ouse Washes has always been popular with Mute Swans. As the Ouse Washes are a flood defence system for the surrounding land, the level and extent of flooding are very unpredictable, varying with the amount of rainfall in the catchment of the Great Ouse. The Mute Swans that use the Ouse Washes for feeding and roosting are also unpredictable as to which areas of the Washes they use, as they are subject to the same flood levels. There seems to be no pattern as to where the birds roost or feed within the Ouse Washes, and at different times of the year and with different flood levels they utilise the full length of the site (R. Humpidge pers. comm.).

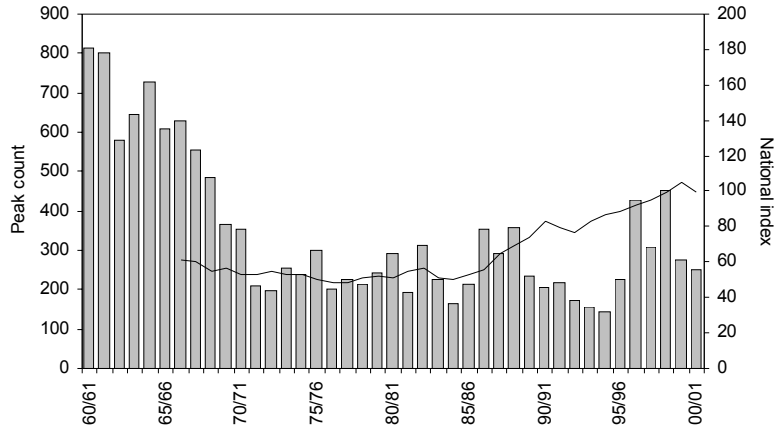


Figure 27. Mute Swans at the Stour Estuary, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

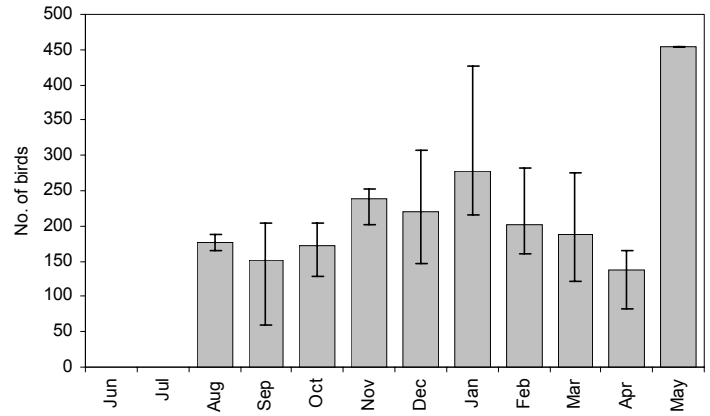


Figure 28. Mute Swans at the Stour Estuary, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

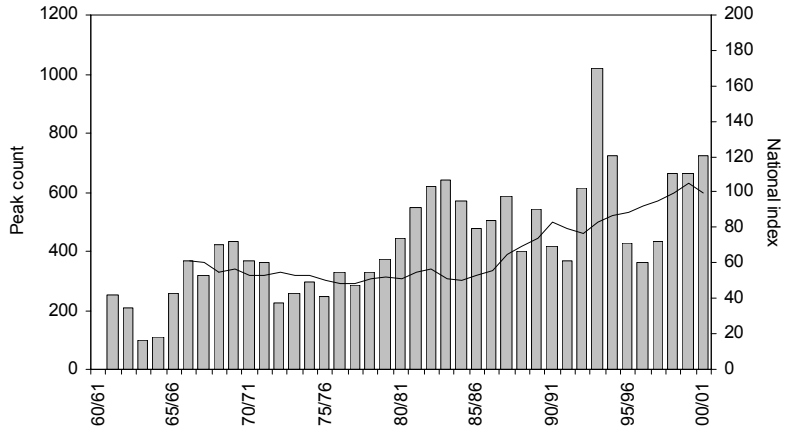


Figure 29. Mute Swans at the Ouse Washes, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

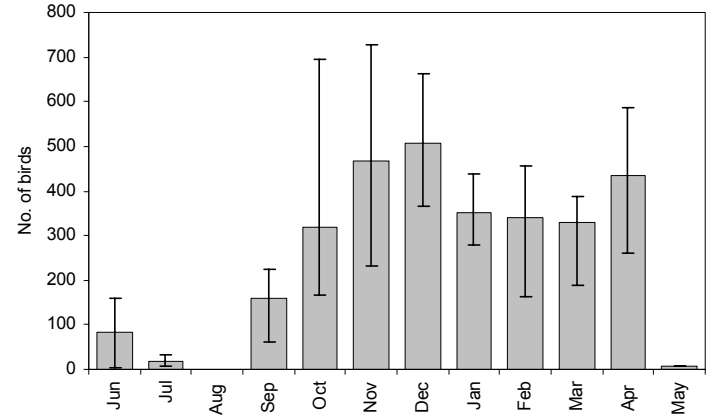


Figure 30. Mute Swans at the Ouse Washes, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

iv) Fen Drayton Gravel Pits

Five-year mean 96/97–00/01: 269

Site conservation status
LNR (Mare Fen)

Site description
Fen Drayton Gravel Pits (TL3470) are located on the banks of the River Great Ouse near the village of Fen Drayton in Cambridgeshire; they are also in close proximity to the Ouse Washes. The extraction of sand and gravel from this area began in 1953 (Allison 1988). Following the extraction, the area was restored and has become an important wildfowl refuge. The success of this site was achieved through careful early planning and by the use of sympathetic working, restoration and landscaping techniques. Habitats include reedbeds, lakes and lagoons. During the winter months the area can become very flooded.

Numbers and trends
Fen Drayton Gravel Pits were not regularly surveyed until 1977. Mute Swan numbers were low through the late 1970s and early 1980s. Numbers gradually increased through the 1980s and early 1990s to around 100–150 birds. Since 1994 numbers have increased again, with a maximum count of 316 birds recorded in 1999/2000 (Fig. 31). This is possibly a result of the designation of part of the complex as a Local Nature Reserve in 1989 and of the ban on the use of lead shot (B. Martin pers. comm.). The five-year mean for 96/97–00/01 exceeded the 260-bird threshold for international importance for the first time. The highest concentrations of Mute Swans are seen during the moult period, with numbers increasing significantly between June and August. From September numbers begin to steadily decrease through the winter and fall to their lowest levels in the spring (Fig. 32).

Site use
Most Mute Swans used to be found on Drayton Lagoon, the largest single pit of the complex. However, windsurfing has become a popular activity on this pit and as a result the numbers of birds have declined (Allison 1988). The birds then switched to using Ferry Lagoon. At present the Mute Swans do not seem to have any preference for any of the eleven pits they use, apart from avoiding Drayton Lagoon (B. Martin pers. comm.).

2.1.10.4 Other sites

Mute Swans can be found along the River Welland in Lincolnshire. They tend to concentrate around the stretch from Spalding to Borough Fen (TF2516). Wintering flocks were large here through the 1980s and numbers regularly totalled 250–300 birds, with the birds exploiting the drained Cowbit Washes (TF2516) alongside the river (Owen *et al.* 1986). In the early 1990s numbers declined, peaking at just over 100 birds. In more recent years numbers have begun to increase and peak at 200 during the winter.

A flock of 130–170 Mute Swans has, in recent years, been present at Breydon Water and Berney Marshes (TG4097) on the east coast of Norfolk. Mute Swans have been present here since the 1960s and numbers began to increase in the 1980s.

Flocks of over 100 Mute Swans can be found on the Alde-Ore Complex and the Orwell Estuary in Suffolk. The Alde-Ore Complex (TM4257) covers the estuaries of the Alde, Butley and Ore rivers, and there are a variety of habitats present. Over 100 Mute Swans are recorded on the complex during most winters. The Orwell Estuary has a deeper channel in its lower reaches than that of the Stour. Mute Swan numbers here currently peak at around 100 birds in October to December. In recent years virtually all the Mute Swans on the Orwell Estuary have been found on the upper part of the estuary, particularly in the vicinity of Ipswich (Pollitt *et al.* 2003).

There are a number of gravel pits along the Ouse Valley where around 100 Mute Swans can be found. The series of pits from Earith to Paxton (which includes those at Fen Drayton) collectively held 530 Mute Swans in November 2000. In recent years, winter flocks of around 200 birds have been seen at Over Fen. This is the area on the south side of the River Ouse between the villages of Over and Earith. On the north shore is what are known locally as Barleycraft Gravel Pits (or Needingworth Quarry Gravel Pits). The birds here spend most of their time feeding in the fields, and it is assumed that they roost on the river floodplain or the gravel pits. It is possible that the birds in this area congregate at Fen Drayton Gravel Pits to moult in July and August (B. Martin pers. comm.)

The Nene Washes (TF3300) lie 20-km northwest of the Ouse Washes. An RSPB reserve was established on these washes in 1983. WeBS data have shown that since then Mute Swan numbers have increased from around 100–150 in the 1970s and early 1980s to a regular wintering number of around 200 birds. Along the River Nene in Northamptonshire are the gravel pits at Thrapston (SP9979). Mute Swans have gradually increased in number here since the mid-1980s, and numbers currently peak at around 200 birds in October and November. In recent years flocks of over 100 birds have also been present

during the moult period. Into the River Nene at Northampton flows a tributary, which, 10 km to the north, is impounded to form the 300-ha Pitsford Reservoir (SP7769) (Owen *et al.* 1986). Since the establishment of a nature reserve in 1970, Mute Swan numbers have increased and currently exceed 100 birds through October and November. As at Thrapston, large flocks (often around 100) also congregate here to moult.

2.1.10.5 Key references

Payn (1978), Owen *et al.* (1986), Allison (1988), Bircham (1989)

2.1.11 Southeast England (Oxfordshire, Berkshire, Buckinghamshire, Hertfordshire, Essex, Greater London)

2.1.11.1 Background

The Mute Swan is a numerous but locally distributed resident in Oxfordshire. The majority of birds can be found on the rivers and streams, particularly around Oxford and Abingdon (Brucker *et al.* 1992). An increasing proportion of birds are also found on gravel pits such as those at the Lower Windrush Valley (SP4004). Winter herds have traditionally congregated on the meadows adjacent to the Thames between Lechlade and Shifford, and between Eynsham and Port Meadow (Brucker *et al.* 1992). In recent years flocks of 60–100 birds have become a feature of the larger gravel pit lakes at Dorchester (SU5795).

The Mute Swan is now a widespread resident on suitable habitats in Berkshire. The species is present on all the river systems in the county, and flocks of non-breeding birds of varying sizes occur both during and outside the breeding season. Considerable numbers are attracted to urban riverside locations, such as at Windsor (SU9677) and Reading, where the public provides the birds with food. Flocks of 20–50 birds often occur on many gravel pits and riverside meadows in the region during the winter. The distribution of birds on these sites often changes as the birds move between sites as the winter progresses (Standley *et al.* 1996). The species's requirement for a sufficiently long 'runway' to enable it to take off appears to limit its use of standing water bodies to those that are relatively large (Standley *et al.* 1996).

There are many lakes, reservoirs and sand/gravel pits in Buckinghamshire that provide suitable habitats for the Mute Swan. Many of these hold only a pair or small numbers of birds. Larger flocks occur on some waters, such as Foxcote Reservoir (SP7136) and Caldecotte Gravel Pits (SP8935).

The Mute Swan is a common resident and non-breeding visitor to Hertfordshire in all seasons. It is present in varying numbers on almost every lake, gravel pit and reservoir of sufficient size in the county. The most important site in the county is the reservoirs at Tring (SP9113), which hold internationally important numbers of Mute Swans. Varying numbers of non-breeding and juvenile birds appear in the county during the breeding season.

Essex is bounded on the east by the North Sea and on the south by the Thames Estuary and tidal river. The county possesses a wide range of habitats including open sea, tidal water, reservoirs, intertidal mudflats, saltings, shingle and shell banks, headland and freshwater grazing marshes and borrow-dykes. The estuaries, including the Colne Estuary (TM0614), the Crouch/Roach Estuary (TQ9496), and the Blackwater Estuary (TL9307), are favoured haunts of Mute Swans. Traditionally, a moulting flock gathers at Abberton Reservoir (TL9818) in the late summer, but many non-breeders remain on tidal waters throughout the year and are joined in winter by a great majority of Essex Mute Swans (Cox 1984). The Essex saltmarshes cover almost the entire length of the Dengie Coast (TM0302), whilst the Hamford Water Complex (TM2225) is also very extensive, and both support small numbers of Mute Swans.

Congregations of Mute Swans can be found throughout the year in Greater London. Favoured sites include the Thames in central London, where reasonably sized flocks can even be seen in April and May. As the breeding season comes to an end, flocks on the river increase in size. Smaller gatherings can be found right through the heart of London and as far east as Dartford. The birds obtain food from the public and from the refuse that finds its way into this stretch of the River Thames (London Natural History Society 1964). Flocks also remain on the river throughout the winter. The increase in gravel digging over the last 30 years, along with the creation of more reservoirs and sewage farms, has increased the area of water in the region considerably. The Mute Swan has made use of these waters and small numbers of birds can be found on many of them. However, many of the sewage farms are being closed and replaced by large modern treatment works, which are not suitable for the birds.

2.1.11.2 Historical status

The species has a long history in Oxfordshire, although formerly as a semi-domesticated bird. Breeding was first known in 1361, and it is also possible that a small proportion of this population was truly wild, having originated from migrant east European birds (Brucker *et al.* 1992). Since the decline in swan ownership two or three centuries ago, the Mute Swan has been in a free state.

The Oxford Mute Swan population increased considerably between 1955 and 1961 (Eltringham 1963), and also between 1961 and 1978 (Ogilvie 1981); this expansion was due largely to the creation of new habitats by gravel extraction. However, between 1978 and 1983 the Oxfordshire population declined by around 27% (Ogilvie 1986b). Whilst this could be explained partly by increased boating activity on the Thames having caused significant habitat deterioration (Bacon 1980), lead poisoning from anglers' weights is the most likely reason for the decline. Between 1979 and 1985, lead poisoning accounted for 44% of the known mortality of birds on the Thames in Oxford (Sears 1989a). Lead poisoning was also largely responsible for the demise of a herd of juvenile birds that occurred between Folly Bridge and Iffley in the 1950s. A total of 132 birds were present here in 1955, but fewer than 10 were recorded in 1985 (Brucker *et al.* 1992). Since 1987, when the ban on lead weights was introduced, there has been a rapid decrease in the number of lead poisoning cases, and the number of birds in Oxfordshire has begun to increase. The fortunes of the Mute Swan in Oxfordshire have been closely linked to human activities, and local fluctuations have occurred as a result of both habitat creation and destruction, and by lead poisoning (Brucker *et al.* 1992).

The Mute Swan was the focus of much attention in Berkshire in the early 1980s as a result of a number of surveys that indicated that many birds were dying from lead poisoning (Standley *et al.* 1996). This was followed by a campaign to ban the use of lead fishing weights, and a swan rescue service, 'Swan Life-Line', was established locally. This service took in sick birds, used a fibre optic endoscope to remove the lead, and then kept and rehabilitated the birds prior to release back into the wild (Standley *et al.* 1996). Analyses carried out after the ban on lead weights in 1987 showed a dramatic decline in lead poisoning deaths on the Thames, from 50–60% of all deaths investigated prior to 1987 to 5% of all adult deaths in 1988 (Sears 1989a). Consequently, numbers of Mute Swans in the county began to increase.

The exact period over which Mute Swans were as domestic stock in Hertfordshire is shrouded in the mists of antiquity. In 1249 there were sufficient numbers of the species in the county for birds to be bought and sold as food (Sage 1959). The species became increasingly common through the 1900s, and small congregations could be seen. Winter flocks of 43 birds were recorded in November 1957 feeding at Rye Mill Sewage Farm (Sage 1959), however these flocks do not occur here today. A winter flock of 24 was also seen in 1957 at Hilfield Park Reservoir (TQ1596) in December. Numbers at this site declined through the 1960s, 1970s and 1980s to not many more than a pair.

In Essex in the 1950s, several hundred Mute Swans overwintered at Abberton. At this time there were records of 50–100 birds at Walthamstow (TQ3589) and Ardleigh (TM0328) Reservoirs in early winter (Cox 1984), but such occurrences are now rare. The flock at Abberton decreased greatly in the late 1950s following the deaths of 50 birds there in the wet summer of 1958 as a result of a parasitic tapeworm infestation and a shortage of natural food (Jennings *et al.* 1961). As mentioned earlier, the decline of the flock at Mistley on the Stour Estuary was due partly to the running down of the maltings there. Grain spillages also used to attract birds to Hythe and Wivenhoe quays on the River Colne, and to Fullbridge and Maldon on the River Blackwater (Cox 1984). As at Mistley, the grain spillages have ceased and few if any Mute Swans are now recorded. Although lead poisoning and river pollution and drainage associated with increased boat traffic have been factors in the decline of the Mute Swan in some parts of Britain (Ogilvie 1981), it is uncertain whether these factors have played a significant part in the overall Essex decline (Cox 1984). However, attention should be drawn to the inner Thames, where, in contrast to the picture over most of the county, numbers increased in the 1968/69 winter after anti-pollution measures were introduced on the river. Numbers rose dramatically to peaks of 420 in January and 616 in June 1973. The main concentration of birds was around the Silvertown grain wharf and in Bow Creek, where birds were observed feeding on the macrophyte *Potamogeton pectinatus* (Cox 1984). Harrison and Grant (1976) thought this represented a downriver shift, although some recruitment from other Essex herds was a possibility. The wharf closed in 1976, and the birds were then drawn more to the Kent shores and were greatly reduced in number (Cox 1984).

The population of Mute Swans on the Thames is the only population in Britain for which there are reliable records of numbers for any length of time. Swan-upping (the catching and marking of birds on the

River Thames) has been carried out by the Vintners' and Dyers' Companies since the late 15th century, and was probably undertaken by the Crown for many years before this (Birkhead & Perrins 1986). There are continuous, but incomplete, records from 1733, with better records available from 1823 onwards. These records give a fairly good indication of how the Mute Swan population on the Thames has changed over the last two and a half centuries, and how the birds were managed (Birkhead & Perrins 1986). For further details of the history of swan upping see Ticehurst (1957) and Birkhead & Perrins (1986).

The national Mute Swan censuses of 1955/56 and 1961 showed that the population on the Greater London stretches of the River Thames had declined from a total of 744 non-breeders in 1956 (Cramp 1957) to only 427 in 1961 (Cramp 1963). This could be explained partly by the sinking of an oil barge at Battersea in December 1956, causing the death of 243 birds (Owen *et al.* 1986). After 1961 numbers on the Thames, particularly above Putney, continued to decline. This decline was thought to have been caused largely by lead poisoning, although some element of the normal fluctuations may have been involved (Cramp 1972, Oliver 1982). The decline in human industrial activities along the river in central London, particularly in the late 1970s and early 1980s, may have contributed to the disappearance of birds from this area, as they had thrived on the scraps provided (Owen *et al.* 1986). Since the ban on the use of lead weights, the numbers of Mute Swans on the Thames have begun to increase.

2.1.11.3 Internationally important sites

i) Tring Reservoirs

Five-year mean 96/97–00/01: 298

Site conservation status
SSSI (Tring Reservoirs)

Site description and habitat
The reservoirs at Tring (SP9113) are fed by natural springs and are set at the foot of the Chiltern Escarpment. The reservoirs are man-made but they are well established and have taken on many features of more natural lakes (Young *et al.* 1996). The water is drawn down from the chalk and is rich in nutrients, which encourages the growth of plants and invertebrates. At Tring there are four adjacent reservoirs and a lagoon at the sewage farm, with a total area of 77 ha, and a maximum depth of around 6 m, though this is subject to considerable drawdown. Farmland and areas of semi-natural marsh and fen surround the reservoirs. Common Reed *Phragmites australis* largely dominates the fen with some areas of Reed Sweetgrass *Glyceria maxima* (Young *et al.* 1996).

The reservoir known as Marsworth Reservoir has suffered from pollution in the past. This has led to this particular reservoir becoming silted-up and less clear, and this has caused the natural succession process to speed up. Here the reedbed has become drier, encouraging the encroachment of willow carr and thus reducing the area of open water as the reeds have spread (Young *et al.* 1996).

Numbers and trends
Mute Swan numbers at Tring Reservoirs remained at a fairly constant level of below 50 birds throughout the 1960s, 1970s and 1980s. Numbers began to increase in the early 1990s and have increased rapidly since 1997, when peak numbers increased from 201 to 329 in 1998/99. The largest recorded flock was 342 birds in December 1999 (Fig. 33). The increase in numbers is probably the result of the ban on the use of lead fishing weights (Young *et al.* 1996). A flock of non-breeding birds generally remains throughout the summer. A significant influx of birds occurs between August and November, resulting in the highest numbers of the year. In the New Year the flock slowly disperses as breeding territories are established (Fig. 34) (Young *et al.* 1996).

Site use
At Wilstone Reservoir and Tringford Reservoir, grain has been put down for ducks at feeding stations in recent years. These feeding stations attract Mute Swans and the birds can be seen feeding and roosting in these areas (J. Taylor pers. comm.). The site is also used regularly as a release site by Swan Rescue Groups and the RSPCA (J. Taylor pers. comm.).

ii) Abberton Reservoir

Five-year mean 96/97–00/01: 464

Site conservation status
SPA (Abberton Reservoir, non-qualifying species)
Ramsar (Abberton Reservoir, non-qualifying species)
SSSI (Abberton Reservoir)
IBA (Abberton Reservoir, non-listed species)

Site description and habitat
Abberton Reservoir (TL9818) is located close to the Essex coast in eastern England. It is a large, shallow, freshwater storage reservoir, built in a long, shallow valley. In some parts, the margins of the reservoir have well developed plant communities that provide important opportunities for feeding, nesting and shelter.

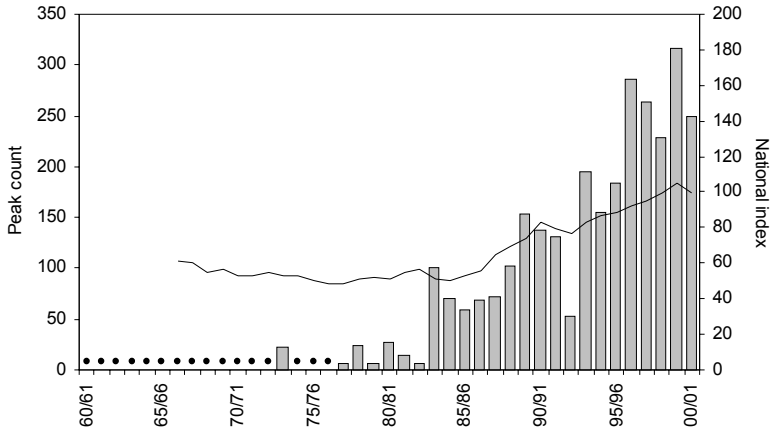


Figure 31. Mute Swans at Fen Drayton Gravel Pits, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

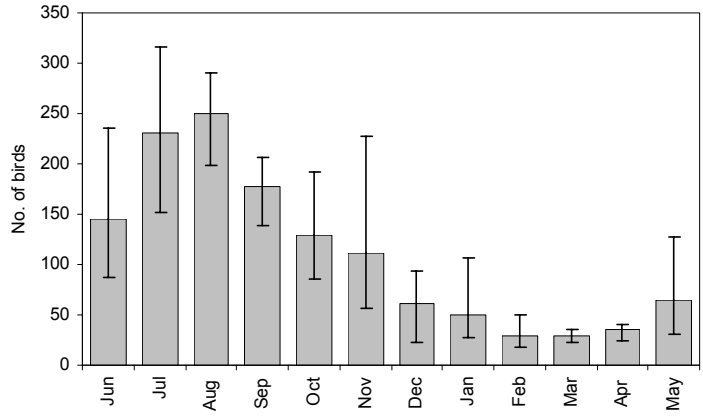


Figure 32. Mute Swans at Fen Drayton Gravel Pits, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

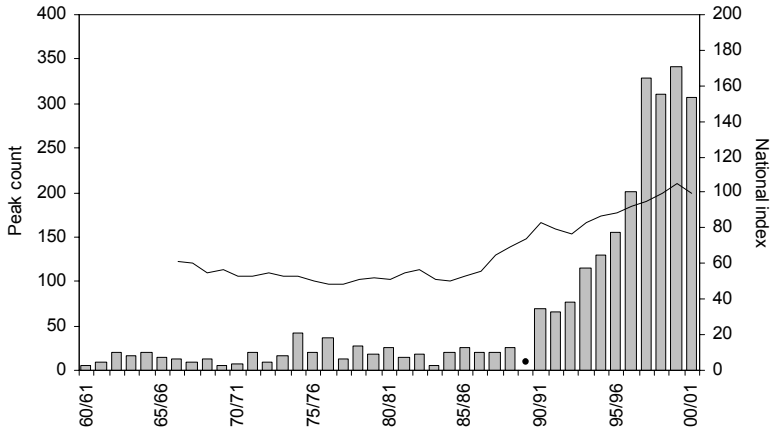


Figure 33. Mute Swans at Tring Reservoirs, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

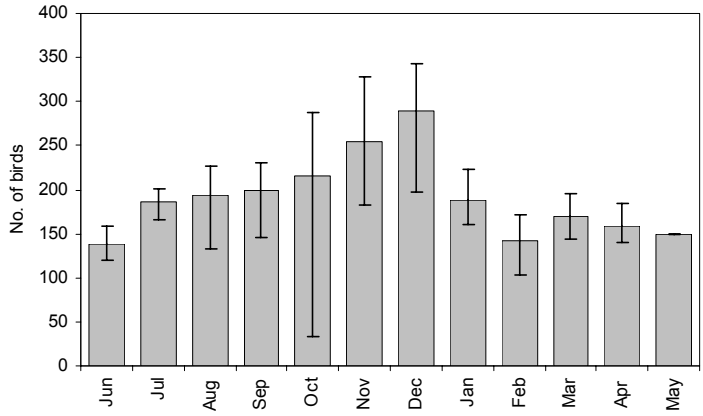


Figure 34. Mute Swans at Tring Reservoirs, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

Numbers and trends
In the 1960s between 200 and 300 Mute Swans were a common sight at Abberton. However, numbers declined markedly in the early 1970s to no more than 100. Numbers began to rise again in the late 1970s, and had risen dramatically by the mid-1980s. Numbers have reached over 600 in some years, but present levels are often around 400–500 birds (Fig. 35). The site is traditionally used as a moulting site with significant numbers of birds moving to the reservoir from May, and numbers continue to increase rapidly until August, when the highest counts of the year are recorded. A rapid decline is seen through the winter, with the lowest numbers occurring in December and January; a steady increase then begins from February (Fig. 36).

Site use
Abberton Reservoir is divided into three sections by two causeways. These sections are known as the main section, the middle section (between the two causeways) and the western section (R. Gardiner pers. comm.). Mute Swans can be found all over the reservoir, but the largest numbers tend to be seen in the Hide Bay area of the main section. The birds feed mainly in the shallower water in this area. Inland feeding also occurs, and this can be seen on the fields bordering the middle section, primarily on the northern side. Mute Swans can also be seen feeding on fields to the northwest and south of the western section (R. Gardiner pers. comm.).

Plans to increase the size of the reservoir may well change this pattern of usage, although indications are that the birds will benefit from the increased area of shallow water that will be created (C. Spray pers. obs.).

2.1.11.4 Other sites

In recent years, WeBS counts have shown that flocks of up to 100 birds have become a feature of the larger gravel pit lakes at Dorchester (SU5795).

Flocks of c. 200 Mute Swans can be found on the River Thames at Windsor and Reading (C. Perrins pers. comm.).

The Thames Estuary (TQ7880), lying in Essex, Greater London and Kent, has supported a large wintering flock of Mute Swans for the last 40 years. There have been fluctuations in flock size, but peak numbers have been over 100 birds in almost every year; numbers currently peak at 150–200 birds during the winter. Another Essex site is the Blackwater Estuary (TL9307), and a wintering flock of around 100–150 Mute Swans can be found here. WeBS data show that Hanningfield Reservoir (TQ7393) in Essex holds a moulting flock of over 100 Mute Swans.

The numbers of Mute Swans at the Colne Valley Gravel Pits (TQ0489) have increased through the 1990s. These gravel pits currently support 120–190 birds in the winter, and moult flocks of around 100 birds can be seen in July.

2.1.11.5 Key references

Cramp (1957, 1963, & 1972), Sage (1959), Jennings *et al.* (1961), Eltringham (1963), London Natural History Society (1964), Harrison & Grant (1976), Bacon (1980), Ogilvie (1981 & 1986b), Oliver (1982), Cox (1984), Owen *et al.* (1986), Sears (1989a), Brucker *et al.* (1992), Standley *et al.* (1996), Young *et al.* (1996)

2.1.12 Southern England (Kent, East Sussex, West Sussex, Isle of Wight, Hampshire, Wiltshire)

2.1.12.1 Background

The Mute Swan is a widespread resident in Kent and Sussex. Much of the wet grassland of the North Kent Marshes (TQ8080) has been lost to arable production and 'improved' by drainage (Taylor *et al.* 1997). As a result only very small numbers of Mute Swans are now present here (often only one or two birds). The Stour Valley extends eastwards from Sturry to Grove Ferry, and comprises one of the few remaining true wetland areas in Kent. It is characterised by extensive reedbeds, shallow lagoons and well-established gravel pits (Taylor *et al.* 1997). Mute Swans are found in small numbers at several locations in the valley. Large flocks of Mute Swans can be found during the winter months on the Thanet Coast (TR2669) and on Walland Marsh (TQ9824). Large moulting congregations can be seen at Dungeness Gravel Pits (TR0619).

A particular feature of Sussex is its river valley systems, which cut south through the South Downs to the coast. These river valleys provide the most important habitat for territorial pairs and non-breeders alike during April and May. Ponds and lakes are also an important breeding habitat, but are of much less significance to non-breeders (Mason 1996). In West Sussex the Adur and, particularly, the Arun have substantial flood plains that provide areas of wet riverside pasture that is subject to shallow winter flooding and supports Mute Swans. These sites, like so many wetland sites in the southeast, have been subjected to drainage and agricultural

improvements (Taylor *et al.* 1997). The species is resident throughout the year at Chichester Harbour (SU7700), and small flocks of birds gather at Thorney Deeps in the harbour to feed or rest during higher water (Taylor *et al.* 1997). Inland, there are several reservoirs and gravel pits, mainly in the east, and these have provided new habitats for Mute Swans.

The Isle of Wight consists mainly of chalkland in the south, with sands and gravels to the north. The main rivers, the Yar, Medina and Newtown, flow from the south to the north and support small numbers of Mute Swans along their courses. The southern coastline is mainly of steep chalk cliffs with sparse vegetation, and the remainder of the chalk is open downland or heather moorland (Cohen 1963). Small flocks of Mute Swans can be found on the estuaries, for example the Newtown Estuary (SZ4292) and the Yar Estuary (SZ3588).

The Mute Swan can be found on lakes, ponds, rivers, gravel pits and canals throughout the county of Hampshire. The largest numbers of Mute Swans are found on the Avon Valley in the west of the county, particularly on the stretch between Fordingbridge and Ringwood (SU1510). When breeding pairs establish their territories in spring, first-summer birds and other non-breeders are forced out of their wintering areas. Most of the birds on the three main river valleys (Avon, Test and Itchen Valleys) move downstream to join moult gatherings at the coast. From August onwards, the summering flocks disperse and many birds return inland (Clark 1993). In the Avon Valley the pattern that has developed since the mid-1980s sees a build up of birds on Blashford Lakes (SU1506) from late summer onwards, where they feed on the profuse growth of Canadian Pondweed. By the New Year most have moved on to the water meadows at nearby Blashford and Ibsley, and other sites in the valley (Clark 1993). Large congregations can be seen at Southampton Water (SU4507) and Langstone Harbour (SU6902) in late summer. Mute Swans are widespread at Portsmouth Harbour (SU6204) (Cranswick *et al.* 1999), and around 50 birds can be seen here in the winter months.

The Mute Swan is found in varying numbers along the main rivers and canals in Wiltshire. There is an almost continuous distribution of the species along the Salisbury Avon and its major tributaries (the Rivers Nadder, Wylye, Bourne and Ebble). The valley of the River Wylye is 1–2 km wide and the fields on either side of the river were managed as a water meadow system until the 1930s. Since then, many of the watercourses have been levelled and most of the land is now agriculturally improved and used for grazing, silage and cereals (Trump *et al.* 1994). There are several large gravel pits at Steeple Langford (SU0437), and these are used as bathing and preening areas by Mute Swans that feed in nearby fields (Trump *et al.* 1994). Large concentrations also occur on the West site of the Cotswold Water Park (SU0595), part of which lies in Wiltshire. Congregations can also be seen on urban lakes in and around Swindon, such as Coate Water, and occasionally on floodwaters along the River Kennet above Marlborough (C. Spray pers. obs.).

2.1.12.2 Historical status

During the 1940s, gatherings of Mute Swans in double figures were the exception on the North Kent Marshes. In late 1946 and early 1947, however, a herd of 18 stayed on the Sheppey marshes for over a month during hard weather (Gillham & Homes 1950). Fair numbers were seen off Sheerness in early 1944. Small flocks were most frequently seen in April, and eight birds were seen in the east of Sheppey and 12 at Port Victoria in April 1947 (Gillham & Homes 1950). Numbers declined, and very few birds are currently seen in this area. Mute Swan numbers in Kent have increased since the 1980s, and flocks at Walland Marsh began to increase during the 1980s to peaks of 150–200 birds. There has, however, been a slight decrease in recent years and flocks now total around 120–150 birds.

The Mute Swan population in Sussex has increased since the 1980s, and this is probably partly a result of the ban on lead fishing weights, and partly more thorough coverage of East Guldeford Level, east of Rye (Mason 1996). Sizeable winter flocks of birds have occurred on suitable localities along the Sussex coast, river valleys, reservoirs and gravel pits since the 1960s (Shrubb 1979). In December 1960, 145 birds were recorded on the Amberley/Pulborough Marshes (TQ0416) (Shrubb 1979). These flocks had declined by the 1970s, and the site has not been surveyed since 1979. About 100 birds regularly wintered in Bosham Creek in the 1970s (Shrubb 1979); this flock also gradually declined and eventually disappeared. The number of Mute Swans on the Pevensey Levels increased during the 1970s to around 150 birds in the winter (peaks often occurred in February). Numbers gradually declined through the late 1980s and 1990s to current levels of 80–100 in winter.

The Medina Estuary (SZ5093) on the Isle of Wight held 50–100 birds in the winters of the 1960s and early 1970s, and a flock of 40–50 birds was seen on the river upstream of Cowes at this time (Owen *et al.* 1986). The numbers here declined during the 1980s and have remained at 20–25 birds in recent years.

The Mute Swan population in Hampshire has been steadily increasing since the 1970s and probably earlier (Clark 1993). Large flocks of Mute Swans could be seen at any time of the year at Southampton Water at the start of the 1900s. The flocks at this time were composed almost entirely of adult birds (Cohen 1963). In 1934 the *Zostera* disappeared at the Swannery at Abbotsbury, and great numbers of birds deserted the Swannery and stayed at Southampton Water all summer without attempting to breed (Cohen 1963). The flocks on Southampton Water had declined by the 1960s to around only 10 birds, and remained at these levels for most of the 1970s. Numbers began to increase from the end of the 1970s, and around 60–100 birds have been present in late summer in recent years. Langstone Harbour held large flocks in the 1950s, and in 1952 about 30 birds remained at the site through the summer and there was a maximum of about 100 in December (Cohen 1963). By the mid-1960s and 1970s winter numbers had fallen to around 20 birds, but numbers began to increase gradually from the late 1980s, and 60–100 birds can currently be seen in late summer.

Ticehurst (1957) gives an interesting quote from John Taylor's record of a voyage along the Avon to Salisbury in 1625, which gave an estimate of at least 2,000 birds. Ticehurst noted that this was plausible, at that time, as the river had a particularly large royal 'game' of Mute Swans belonging to the manor of Clarendon, besides those of some 90 private owners.

Mute Swans in the Wylye Valley have been counted in detail since 1978, when the number of Mute Swans in the valley was low. This was the result of an unlicensed cull of c. 70 birds in the Steeple Langford area, which wiped out the bulk of the non-breeding population (Trump *et al.* 1994). Following the cull, numbers increased linearly, and non-breeding numbers peaked at 146 birds in 1984. The numbers remained at around this level until 1992, when numbers dropped following a temporary substitution of linseed for grass over much of the Steeple Langford to Great Wishford area. In each year, over 90% of the non-breeding birds had concentrated in this area (Trump *et al.* 1994). Numbers at the Wylye Valley have since increased, and non-breeding numbers between Heytesbury and Wilton have reached up to 100 birds in recent years (D. Stone pers. comm.). Counts of birds in the valley between Wishford and Codford in 1985, 1988 and 1989 showed that numbers peaked in winter, with a maximum count of 175 birds recorded in January 1985. From the spring onwards numbers gradually decline to a low point in July/August, by which time the moulting flocks have dispersed throughout the Wylye and Avon river systems (Trump *et al.* 1994).

The birds in the valley graze the meadows from November to April and move onto the river between May and October (D. Stone pers. comm.). There has also been increased conflict from fishing interests in the area as result of concerns that the increased numbers have lead to overgrazing of water-crowfoot (Trump *et al.* 1994).

2.1.12.3 Internationally important sites

i) Avon Valley: Salisbury to Fordingbridge

Five-year mean 96/97–00/01: 269

Site conservation status
SPA (Avon Valley, non-qualifying species)
Ramsar (Avon Valley, non-qualifying species)
IBA (Avon Valley, non-listed species)

Site description
The River Avon between Salisbury and Fordingbridge (SU1721) receives water from the extensive chalk downlands of Salisbury Plain. The river valley is mainly improved grassland and rough grazing, largely on former water meadows. Much of the scientific interest of the Avon Valley depends on high water levels being maintained in the river and regular seasonal flooding of the valley grasslands. Only one area, south of Britford, is actively managed as traditional flowing water meadow. Other areas of the valley are increasingly being incorporated into water level management agreements under DEFRA's Countryside Stewardship Scheme, whereby high summer water levels are maintained in carriers and drains and winter levels allow for seasonal flooding. The rough grazing contains large tussocks of sedges *Carex* spp. and rushes *Juncus* spp. Alder and willows of various species are common trees, and along the margins are many aquatic or semi-aquatic plants including Arrowhead *Sagittaria sagittifolia* and Flowering Rush *Butomus umbellatus.*

Numbers and trends
Mute Swan numbers in the Avon Valley between Salisbury and Fordingbridge have fluctuated in many years since counts began in the late 1970s. In recent years numbers have increased, and there was a dramatic increase in numbers between 1999/2000 and 2000/01, with numbers increasing from 265 to 395 (Fig. 37). About 40 pairs nest or hold territory annually (D. Stone pers. comm.). Birds begin to arrive in the valley in September and numbers peak in October. Flocks decline slightly through November and December, and then increase again through January and February. Although there are some data available on Mute Swan numbers on this stretch of the Avon Valley during the spring and summer months, it seems likely that these data may

be unrepresentative of the numbers present at this time and have therefore not been included in Fig. 38. However, it can be said that numbers begin to fall in the spring and reach their lowest levels during the summer moult period (D. Stone pers. comm.).

Site use

The extensive network of water channels associated with the former and existing water meadows forms ideal habitat for nesting birds, supporting many more territories than possible from the river alone (D. Stone pers. comm.). Wintering and non-breeding flocks graze extensively on the improved grasslands from October to May before moving onto the river as aquatic vegetation develops during the summer. The majority of wintering birds congregate in three distinct flocks, between Britford and Downton, at Charford, and between Breamore and Fordingbridge. Most birds in the Breamore to Fordingbridge stretch move down river to moult further south in the Avon Valley and at Christchurch Harbour, although about 25 remain all year just north of Fordingbridge, where the public at a campsite provides supplementary food. The Charford flock of up to 90 birds remains all year. The Britford to Downton flock is more mobile from year to year, often dividing into three flocks at Britford, the Longford Castle estate, south of Britford and, less regularly, north of Downton (D. Stone pers. comm.). During the moult, a flock of up to 80 birds remain mainly in the Britford and Longford areas, but this number has declined to about 40 birds in the past five years as more birds take advantage of increased public feeding in the Salisbury conurbation (D. Stone pers. comm.).

2.1.12.4 Other sites

Besides the stretch between Salisbury and Fordingbridge, the River Avon also holds flocks of up to 200 birds in the winter on the section from Fordingbridge to Ringwood (SU1510), and flocks of 140–180 on the stretch from Ringwood to Christchurch (SZ1499). Although widely distributed throughout the Avon Valley south of Fordingbridge, the main wintering flocks are found grazing on the wet grasslands in the Ibsley area (SU1410), Somerley Estate (north of Ringwood, SU1407), Westover Farm (south of Ringwood, SU1403), and the Bisterne (SU1300) and Avon Tyrrell (SZ1499) Estates. Flocks on these two stretches of the Avon are highly mobile during the autumn and winter periods as birds disperse northwards following the summer moult in Christchurch Harbour. While most non-breeding birds in the area moult at Christchurch, in years of good aquatic weed growth up to 60 birds have moulted on the Somerley Estate or the Blashford Lakes (D. Stone pers. comm..).

The Swale Estuary (TQ9765) supports flocks of 120–180 Mute Swans during the winter. Mute Swan numbers at the Arun Valley (TQ0314) currently peak at 120–160 birds in both October–November and April–May.

The Thanet Coast (TR2669) has held winter flocks of 160–200 birds in recent years, and around 160–200 birds can be seen in winter on Walland Marsh (TQ9824). The National Nature Reserve at Stodmarsh, along with Collards Lagoon (TR2601), has seen a rapid increase in the number of moulting Mute Swans using the site since the late 1980s. Around 150–200 Mute Swans now use the site regularly, and the peak numbers have, in some recent years (1997/98 and 2000/01), exceeded the 260-bird threshold for international importance. Mute Swan numbers at Dungeness Gravel Pits (TR0619) began to increase in the 1980s, and numbers have peaked at 100–150 in July and August of recent years.

At Chichester Harbour (SU7700), Mute Swan numbers built up during the 1990s and presently reach 120–160 in July and August. Fairly large flocks of around 100 birds can also be seen during the winter. At Chichester, high densities of Mute Swans are found at Emsworth Mill Ponds and at the top ends of the Chichester and Bosham Channels (Pollitt *et al.* 2000). Up to 100 birds can be seen during the moult at Langstone Harbour (SU6902) and Southampton Water (SU4507). The majority of the Mute Swans at Southampton Water can be found on the River Itchen (Pollitt *et al.* 2003).

2.1.12.5 Key references

Gillham & Homes (1950), Cohen (1963), Shrubb (1979), Owen *et al.* (1986), Taylor *et al.* (1997)

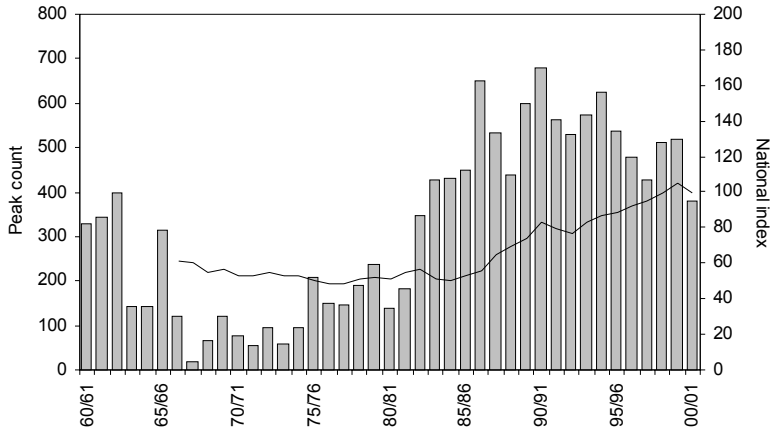


Figure 35. Mute Swans at Abberton Reservoir, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

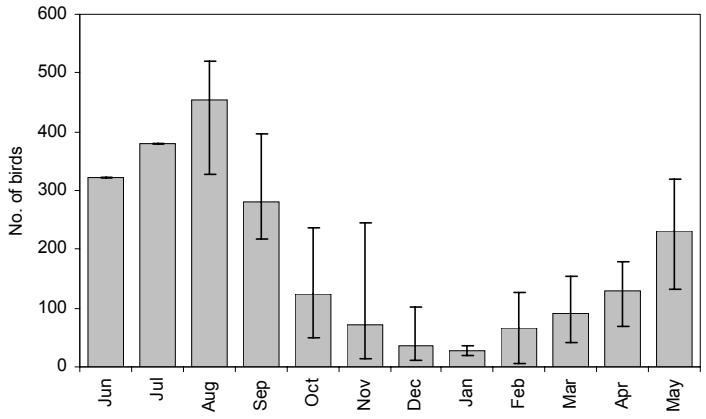


Figure 36. Mute Swans at Abberton Reservoir, 1996/97-2000/01, mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

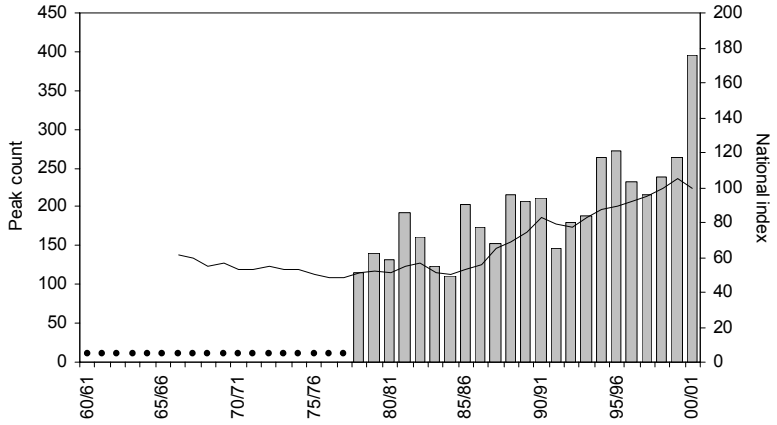


Figure 37. Mute Swans at the Avon Valley: Salisbury to Fordingbridge, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

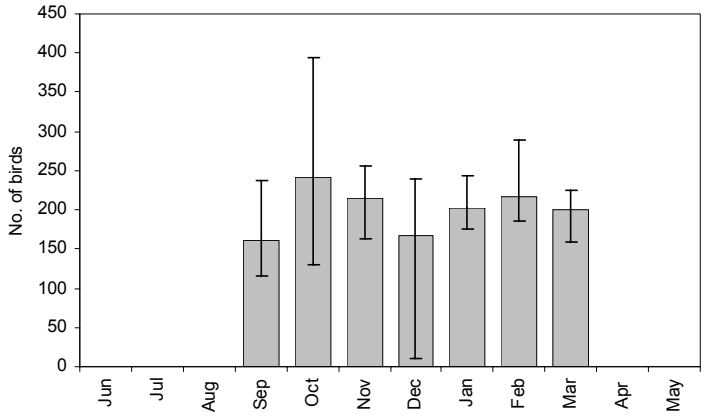


Figure 38. Mute Swans at the Avon Valley: Salisbury to Fordingbridge, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

2.1.13 Southwest England (Dorset, Somerset, Devon, Cornwall)

2.1.13.1 Background

The Mute Swans on the Dorset coast are confined almost exclusively to the Chesil Fleet (including Abbotsbury), and Christchurch and Poole Harbours, as well as a few much smaller sites nearby. A large proportion of Mute Swans in Somerset are found inland on the low-lying flood land (the Somerset Levels) in the centre of the county, and a fairly large number are dispersed over the many small lakes and reservoirs that are to be found (Atkinson-Willes 1963).

Devon and Cornwall are topographically similar, with the coast being cliff-bound for much of its length and the interior being dominated by granite moorland (Owen *et al.* 1986). Inland waters are scarce in many districts; there are a few reservoirs, although these tend to hold only a pair of birds. Mute Swans are found in varying numbers at most of the main estuaries. The estuaries of Devon are, however, more productive than those of Cornwall.

2.1.13.2 Historical status

There have been large numbers of Mute Swans in Dorset for centuries. The Abbotsbury Swannery is believed to have been in existence for about 900 years, but the earliest record appears in the court roles of the Manor of Abbotsbury for 1393 (Arnold 1983). Another document, dated 1591, states that at this date there were 500 birds, including 90 cygnets, on the Fleet (Arnold 1983). Over 1,500 birds were recorded in 1942 (Boys 1983), but after this numbers declined, although they began to increase again in the 1990s. The Abbotsbury Swannery is located at the extreme western end of Chesil Fleet. The history of management here has led to the development of a large breeding colony of Mute Swans (around 150 pairs) in the reedbed of the Swannery. This colony is accompanied by a large flock (approximately 350) of non-breeding birds. In winter, numbers increase to around 1,500 as birds fly in from other areas. The birds at Abbotsbury do not encounter many of the hazards experienced by most wild Mute Swans in Europe, which include the risk of flying into overhead cables (Perrins & Sears 1991), colliding with other objects such as boats and bridges, oiling, getting tangled in fishing tackle and swallowing hooks (Perrins & Martin 1999) and lead poisoning. Most of the birds hatched at the Swannery remain in the vicinity all their lives and therefore never encounter such hazards. The birds have abundant stocks of natural foods, especially *Zostera* spp. and *Ruppia* spp., for much of the year, and are fed supplementary grain, especially in hard weather (McCleery *et al.* 2002). However, the birds live at high densities, and the males frequently fight and spend a significant proportion of their day in milder aggressive interactions with their neighbours (McCleery *et al.* 2002). In bad weather, the colony can be exposed to very windy conditions, and in some years much of the natural food resources may be uprooted, blown ashore and destroyed. Nests may also be raided by Red Foxes (*Vulpes vulpes*) and European Badgers (*Meles meles*), although they pose little threat to the adult birds (McCleery *et al.* 2002).

In Somerset, records of Mute Swans date back to 1247, and before 1900 they bred widely on park lakes and rivers (Somerset Ornithological Society 1988). The increase in suitable waters through the 20th century has been to the birds' advantage, but this has been counterbalanced to some extent by the effects of pollution, particularly by lead, and by collisions with overhead wires (Somerset Ornithological Society 1988). The species has become so widespread in Somerset that hardly any large pond or piece of water in Somerset is without a pair or more of Mute Swans.

There is little information on the history of Mute Swans in Cornwall as no swan marks were registered. During the 19th century some Cornish landowners kept Mute Swans, but the breeding of semi-feral birds was rare and very few birds visited the county in winter at this time (Penhallurick 1969); the same was true of Devon at this time. The species became more common during the 20th century, and birds are now found on many estuaries and inland waters, including reservoirs, across both counties, but often only in small numbers.

As Mute Swan numbers at many of the major sites in the southwest have steadily increased in recent years, it is clear that the numbers in this part of the country are increasing.

2.1.13.3 Internationally important sites

i) Fleet/Wey

Five-year mean 96/97–00/01: 1,193

Site conservation status
SPA (Chesil Beach and the Fleet, non-qualifying species)
Ramsar (Chesil Beach and the Fleet, non-qualifying species)
SSSI (Chesil and the Fleet)
IBA (Chesil Beach and the Fleet, non-listed species)

Site description
The Fleet/Wey (SY6976) is located on the south coast in Dorset. The Fleet is a brackish lagoon enclosed by a long, linear, shingle beach (Chesil Bank). The Fleet is the largest and best example of a barrier-built saline lagoon in the UK. The salinity gradient, peculiar hydrographic regime and varied substrates, together with associated reedbed and intertidal habitats and the relative lack of pollution in comparison to most other lagoons, have resulted in the Fleet's being extraordinarily rich in wildlife. There are outstanding communities of aquatic plants and animals providing feeding areas for waterbirds. The site also includes Radipole Lake (SY6779) and Lodmoor (SY6881): Radipole Lake is made up of an RSPB reserve, open water and a large area of reedbed; Lodmoor is saltmarsh with open pools and large dykes.

Numbers and trends
Large numbers of non-breeding birds are present in the area all the year round. At the start of the breeding season only the resident birds are present (Perrins & Ogilvie 1981). In June and July numbers begin to increase as birds from elsewhere arrive to moult. After the moulting birds have left, there is another influx from September onwards and numbers peak in November. From the New Year numbers begin to decline until only the resident birds are present once again (Fig. 40). Winter numbers have peaked at over 1,000 birds throughout the 1990s. The highest count recorded was 1,313 in November 1997 (Fig. 39).

Site use
During the winter there are plentiful supplies of *Ruppia* and all three species of *Zostera*, and this provides an abundance of food for the large gatherings of birds.

There is a daily exchange of birds between Radipole Lake and the Fleet in both directions (I. & T. Coombs pers. comm.). Some of the visiting birds that arrive here to moult or for the winter are known to have come from local pools and streams inland, and the rest are from a much wider area outside the county boundary (Owen *et al.* 1986). These birds will return to their usual areas after moult or in the spring.

Ringing results have shown a small amount of interchange between the birds on the Fleet and those on the Exe to the west, and with those at Christchurch (about 5–10 birds per year, D. Stone pers. comm.) and Poole Harbours to the east (I. & T. Coombs pers. comm.).

It has been suggested that some of the birds coming to moult on the Fleet may have come from northern France, where they are not ringed. A total of six birds ringed at Abbotsbury and three ringed at Radipole Lake have been recovered on the Continent, with five of these recovered in an area centred roughly on the Vendée (on the Atlantic coast of France, some 450 km from Abbotsbury) (C. Perrins pers. comm.). As the birds were not ringed when they arrived at Abbotsbury and Radipole Lake, their origins are unknown. However, the possibility that they were raised in France, came to Abbotsbury and Radipole Lake to moult and then returned to France seems likely (C. Perrins pers. comm.). There are too few recoveries on the continent to make any serious analysis, but it is of interest that three of the nine birds were ringed at Radipole, where many fewer birds have been ringed overall (C. Perrins pers. comm.).

ii) Christchurch Harbour

Five-year mean 96/97–00/01: 373

Site conservation status
SSSI (Stanpit Marsh, Hengistbury Head and the Harbour down to low water)

Site description and habitat
Christchurch Harbour (SZ1792) is situated on the south coast of England and covers an area of 9 km^2. Christchurch Harbour is a natural harbour formed by the confluence of the Rivers Avon and Stour. The harbour is bordered to the north by the town of Christchurch and is sheltered from the south by Hengistbury Head. Stanpit Marsh provides an effective buffer zone between the harbour and the growing town. The habitat within the harbour is tidal mud around Stanpit Marsh.

Numbers and trends
Mute Swans come to Christchurch Harbour to moult, with numbers building up from April and peaking in July and August at around 350–400 birds (maximum count was 538 in July 1989, see Fig. 41). Ringing has shown that most of the birds are drawn from the upstream areas of the Avon and Stour, from the Isle of Wight, Keyhaven and the Lymington and Beaulieu Rivers to the west, and from Poole Harbour to the east (D. Stone pers. comm.). During the course of the autumn the birds return to their wintering areas, leaving a regular winter level of around 10–50 birds, although over 100 birds have remained in some recent winters (Fig. 42).

Figure 39. Mute Swans at Fleet/Wey, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

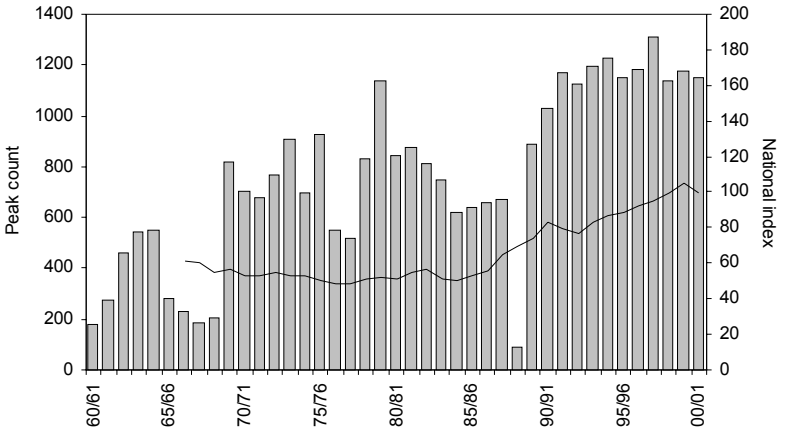


Figure 40. Mute Swans at Fleet/Wey, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

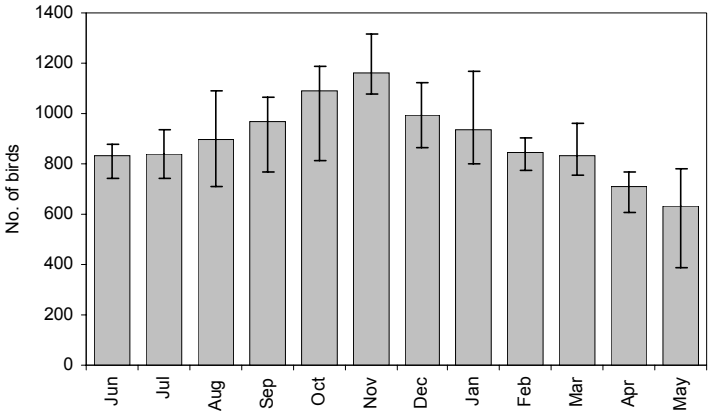


Figure 41. Mute Swans at Christchurch Harbour, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

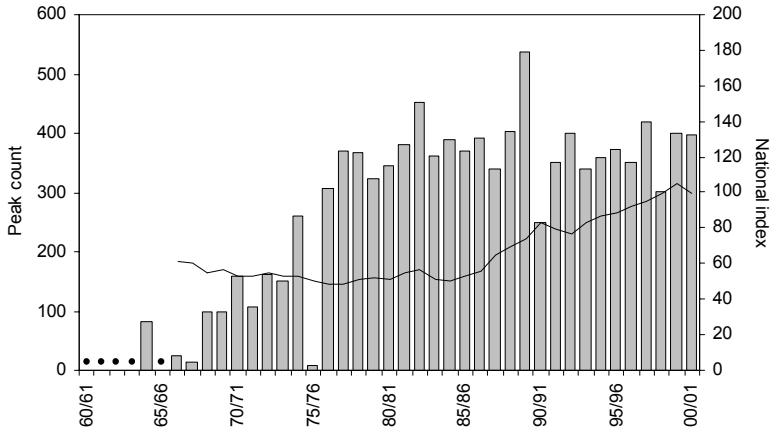
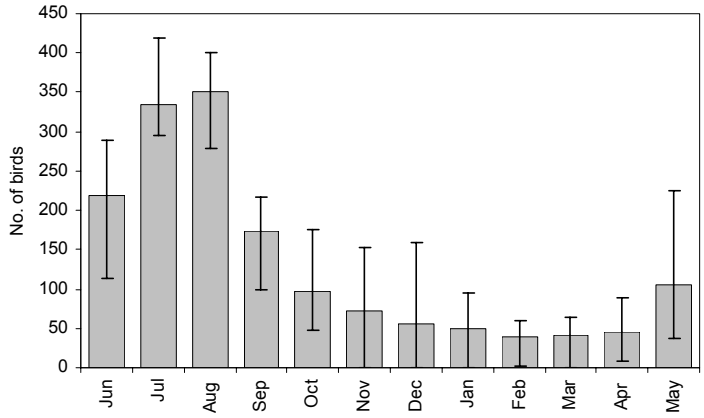


Figure 42. Mute Swans at Christchurch Harbour, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)



Site use
Mute Swans in the Christchurch flock interchange between the harbour and the town quay. Numbers in the town build up during the day (around 10–25% of the flock), which is when the public feeds the birds. In the harbour the birds feed on marine algae over most of the area. Their distribution depends on disturbance from water-based activities, wind and the state of the tide. At high tide most birds stop feeding and congregate in the shallows around the islands off Stanpit Marsh and off the northern shoreline, where there is a freshwater inlet (River Mude). In some years, up to 100 birds have been seen feeding at low water on the shallow sand and gravel banks outside the harbour entrance (D. Stone pers. comm.).

iii) Somerset Levels and Moors

Five-year mean 96/97–00/01: 864

Site conservation status
SPA (Somerset Levels and Moors, non-qualifying species)
Ramsar (Somerset Levels and Moors, non-qualifying species)
NNR (Somerset Levels)
SSSI (various)
IBA (Somerset Levels and Moors, non-qualifying species)

Site description and habitat
The Somerset Levels and Moors (ST4040) are one of the largest and richest areas of traditionally managed wet grassland and associated wetland habitat in lowland UK. The site covers the floodplains of the Rivers Axe, Brue, Parrett, Tone and their tributaries. The majority of the site is only a few metres above sea level and drains through a series of ditches, rhynes, drains and rivers. Flooding may affect large areas in winter, but this depends on rainfall and tidal conditions.

Since 1990 there has been extensive restoration of wetland areas in the former peat production area in the Brue Valley, which is now known as the Avalon Marshes. Since 1992 several areas of the Somerset Levels and Moors have been restored to wet grassland, known as 'Raised Water Level Areas', under the Somerset Levels and Moors Environmentally Sensitive Areas (ESA) scheme (J. Leece pers. comm.).

Numbers and trends
Mute Swan numbers on the Somerset Levels and Moors have been increasing since the 1980s (Fig. 43); the highest count recorded was 1,110 in January 2001. Many birds in the area used to congregate on reservoirs at Cheddar, Durleigh and Sutton Bingham, but numbers have declined since about 1980 (Somerset Ornithological Society 1988). In contrast, numbers on the Levels and Moors have increased since this time. Some birds evidently leave to moult at Abbotsbury in Dorset, and either winter there or return to the Levels after their moult. In mild winters, some birds remain on their breeding waters, but most gather in flocks on the Levels (Somerset Ornithological Society 1988). Significant numbers of Mute Swans begin to arrive on the Levels in October. Numbers increase through the winter, reaching a peak in January. From February onwards flock size decreases, and numbers are lowest during the summer months (Fig. 44).

Site use
The areas on the Levels that the birds frequent vary greatly from year to year, as do their numbers at each location. Flocks of up to 120 used to be found on Tealham Moor and on the South Drain near Catcott on Westhay Moor. Larger numbers often occurred to the south at King's Sedge Moor, West Sedge Moor and the South Levels, with up to 150 birds having been recorded in each area. In most years the flocks are fragmented and move in small groups over the different Moors (Somerset Ornithological Society 1988).

As a result of the extensive restoration of wetland areas in the region, there are now several alternative roost sites available to Mute Swans. The favoured feeding areas are agricultural lands in the floodplains. The old reservoir roost sites are much further away from these feeding areas and are therefore now used less often (J. Leece pers. comm.).

2.1.13.4 Other sites

Poole Harbour (SY9988), 15 km to the west of Christchurch Harbour, is one of the largest, and shallowest, natural harbours in the world. It is a drowned valley with higher land remaining as islands. Poole Harbour has regularly supported over 100 Mute Swans in recent winters, and a flock of around 100–200 birds also congregates here in late summer to moult. Generally, the use made of the various parts of the harbour is governed by the food supply, the amount of disturbance, and the state of the wind and tide (Bromby 1983); however, birds tend to congregate on Wareham and Bestwall Meadows and Poole Park (Dorset Bird Reports).

2.1.13.5 Key references

Penhallurick (1969), Perrins & Ogilvie (1981), Arnold (1983), Bromby (1983), Somerset Ornithological Society (1988), McCleery *et al.* (2002)

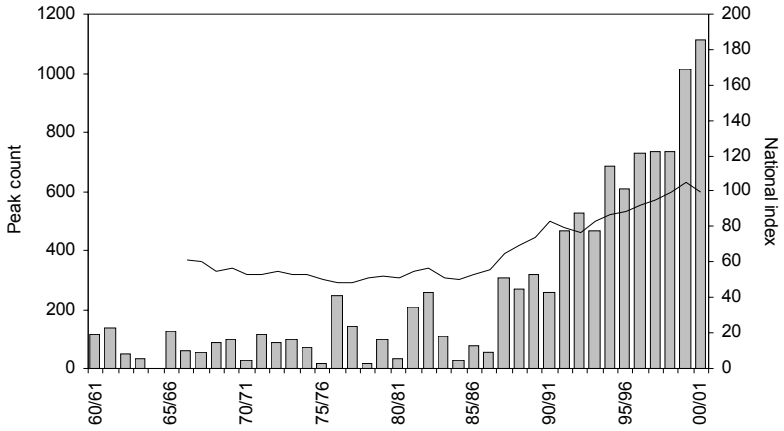


Figure 43. Mute Swans at the Somerset Levels and Moors, 1960/61-2000/01: peak counts (bars) and British index (line) (circles denote years with no known data)

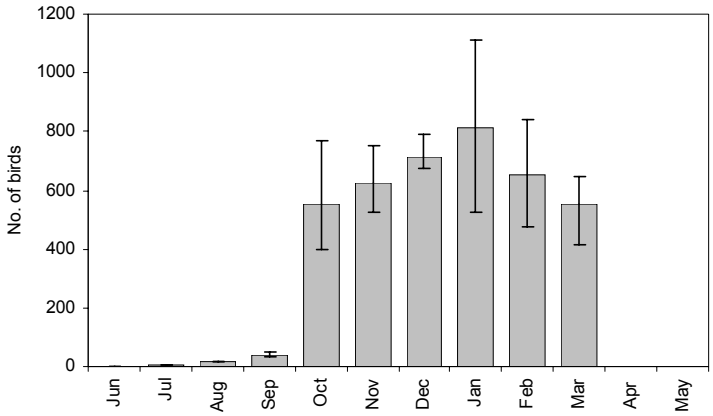


Figure 44. Mute Swans at the Somerset Levels and Moors, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

2.2 Northern Ireland

2.2.1 Background

Antrim is a plateau with few wetlands (Sheppard 1993), but a pair or more of Mute Swans can be found on most of the county's wetlands. It is bordered to the southeast by Belfast Lough (J4083), which holds a flock of Mute Swans. To the southwest lie Loughs Neagh & Beg (J0575), which together hold the greatest numbers of Mute Swans at any site in Northern Ireland.

Londonderry contains a variety of landscapes, ranging from a mountainous core to coastal and inland lowlands (Sheppard 1993). However, there are few major wetlands apart from part of Loughs Neagh & Beg, Lough Foyle (C6025), which holds internationally important numbers of birds in winter, and the Bann Estuary (C7935), which holds a small flock during the moult season.

County Tyrone has a large number of hill lakes that lie between Lough Neagh and the River Foyle, which support small numbers of Mute Swans. The southern part of the county falls within a drumlin belt where there are many small lakes (Sheppard 1993), and these often hold a pair of birds.

Fermanagh is divided by the Erne system. On both sides of the two Loughs Erne (Upper and Lower) there are many drumlin lakes. The southern parts are hillier and contain fewer, but larger, lakes. The difficulty of surveying such a maze of waterways has led to an under-valuation of birds in Fermanagh in the past. However, more recent good counts of Upper Lough Erne (H3231, which regularly holds internationally important numbers) have led to a change. There are still many lakes for which there are no figures available (Sheppard 1993).

The landscape of Armagh is largely drumlin lakes and each of these often holds a pair of Mute Swans. The main wetland interest in the county is its share of Lough Neagh (Sheppard 1993).

County Down is dominated by drumlins, but there are estuaries, sea loughs and rich coastal areas (Sheppard 1993). The main site for Mute Swans is Strangford Lough (J5560), which holds numbers of international importance. There are also many small drumlin lakes that hold a pair or small flocks of Mute Swans. Collectively the County Down Lakes hold large numbers of Mute Swans. These lakes were the subject of a detailed study between 1986/87 and 1990/91, where monthly counts of birds were carried out on 115 lakes in County Down each winter during this period (McElwaine 1991). The results of this study showed that Mute Swans occurred on 91% of the lakes covered in the survey. The peak annual Mute Swan counts appeared to show a pattern of steady increase. The mean annual peak count of Mute Swans from the survey was 461 birds. An additional 300–400 birds were recorded at the Birds of Estuaries Enquiries sites in the county (e.g. Dundrum, Killough Harbour and Strangford Lough), and there was an estimated minimum of 50 birds on riverine sites and un-surveyed ponds, therefore it was likely that the average peak winter total for the county at this time could be nearer 900–1,000 birds (McElwaine 1991). Wells and Foster (1989) suggested that numbers increase on the County Down Lakes in early winter as a result of movement away from Lough Neagh. Data have shown that fluctuations in numbers could be due mainly to the movement of adult birds, presumably non-breeders (McElwaine 1991).

2.2.2 Historical status

The Mute Swan was introduced to Ireland and has since become semi-feral as a resident. By the end of the 19th century the population was increasing. The increase has continued, and today there is hardly a bog lake, lough or river that does not hold a pair of birds or more. The species was first recorded breeding in Tyrone in the early 20th century. During the 19th century Mute Swans ceased to breed in Londonderry, but this has changed since the 1950s (Kennedy *et al.* 1954). Today the species breeds in every county in Northern Ireland (and the Irish Republic).

2.2.3 Internationally important sites

i) Loughs Neagh & Beg

Five-year mean 96/97–00/01: 1,939

Site conservation status
SPA (Lough Neagh and Lough Beg, non-qualifying species)
Ramsar (Lough Neagh and Lough Beg, non-qualifying species)
NNR (Lough Neagh-Oxford Island, Lough Beg)
ASSI (Lough Neagh, Lough Beg, Portmore Lough)
IBA (Lough Neagh and Lough Beg, non-listed species)

Site description
Loughs Neagh & Beg (J0575) are located in the centre of Northern Ireland. Lough Neagh is the largest freshwater lake in the UK, and covers an area

of 383 km². For its size, the lough is very shallow, with a mean depth of 8.9 m (and at its deepest only 34 m). The 125-km long shoreline is mostly exposed, with wave-beaten rocks and stones, but there are also some sheltered, sandy bays with better-developed marginal vegetation including some reedbeds.

Lough Beg covers 1,125 ha to the north, and is essentially a widening of the Lower Bann River downstream of its exit from Lough Neagh. It is very shallow, with a mean depth of 1–2 m. About 200 ha of the west shore is unintensified wet grassland that is largely inundated with floodwater each winter.

Numbers and trends
Mute Swan numbers at Loughs Neagh & Beg increased during the mid to late 1960s. Numbers clearly went through a depression in the late 1970s and early 1980s (Fig. 45). The reasons for this are unknown, but the sudden marked increase between 1985/86 and 1986/87 probably indicates that movements to other sites in Northern Ireland, such as Strangford and Belfast Loughs, were involved (Winfield *et al.* 1989).

Since the late 1980s Mute Swan numbers on the loughs have increased, reaching a peak of 2,422 birds in August 1998 (Fig. 45). Over 1,000 are present on the loughs for most of the year. Numbers are largest in August (Fig. 46), probably a result of the recruitment of juveniles to the population and also an influx of birds during the moult (S. Foster pers. comm.). It has been suggested, however, that the rise in numbers at this time to be too large to be due to arrivals of birds from local waters only (B. Davidson pers. comm.), though there is no information about from where they may have come. A number of colour-ringed birds observed on Lough Neagh had come from Belfast, and one bird originally ringed at Hodbarrow arrived on the lough after spending a year touring the Lancashire/Cumbria coast (S. Foster pers. comm.).

WeBS counts have not taken place in June and July, but the Environment and Heritage Service has conducted occasional surveys of Lough Neagh by boat since 1997. In May/June attempts are made to establish the number of breeding waterfowl, followed by a survey in July/August to locate broods (S. Foster pers. comm.). In 1999, 1,120 Mute Swans were present on Lough Neagh in May (Fig. 46), and this comprised an estimated 175 pairs. By comparison, the most recent data are from 2003, when 987 birds were counted on Lough Neagh, comprising an estimated 150 pairs (S. Foster pers. comm.).

After the August peak, numbers gradually decline through the winter as birds move to other areas and onto agricultural fields (S. Foster pers. comm.). Numbers reach their lowest levels in February (Fig. 46).

Site use
Generally speaking, from November onwards a significant proportion of the wintering Mute Swans at Loughs Neagh & Beg are to be found in flocks scattered around the mainly agriculturally improved grassland fields in the area. They often accompany Whooper Swans but can occur as single-species herds (S. Foster pers. comm.). Although the majority of the birds recorded on the WeBS counts are to be found on the large lakes of Lough Neagh and Lough Beg, other significant concentrations can occur at some of the nearby satellite lakes, such as Craigavon Lakes and Broad Water (S. Foster pers. comm.).

ii) Upper Lough Erne

Five-year mean 96/97–00/01: 408

Site conservation status
SPA (Upper Lough Erne, non-qualifying species)
Ramsar (Upper Lough Erne, non-qualifying species)
ASSI (various)
IBA (Upper Lough Erne, non-listed species)

Site description
Upper Lough Erne (H3231) is a very large and complex freshwater system located in the south of Northern Ireland. It lies within the catchment of the River Erne, a river shared with the Irish Republic. A series of flooded drumlins in the course of the River Erne give rise to a complex of islands, bays and many lakes bordered by damp pastures, fen, reedswamp, Alder**,** willow *Salix* spp. carr, and oak *Quercus* spp. woodland.

Numbers and trends
Mute Swan numbers on Upper Lough Erne increased fairly rapidly between the mid-1980s (200 birds) and the early 1990s (over 400 birds). Numbers then declined slightly, but then increased to a peak count of 590 birds in January 1997. After this, numbers declined to 377 birds and have continued to steadily decline (Fig. 47). Mute Swan numbers are highest on the complex in winter, and peak counts are recorded in December or January (Fig. 48).

Site use
The feeding and roosting areas used by Mute Swans at Upper Lough Erne tend to be adjacent to one another, with the birds simply moving off their feeding areas on wet grassland and onto the

adjoining water areas for roosting (I. Enlander pers. comm.).

The majority of Mute Swans at the complex are seen in small groups (usually pairs, family groups or small herds) throughout the surveyed system, including on the main lough, the satellite loughs and the river sections. The numbers of birds in these groups typically ranges between one and 12 birds (I. Enlander pers. comm.). Notable groups of Mute Swans tend to be seen with flocks of Whooper Swans. The numbers of Mute Swans present in such flocks are generally only small (typically 10–20 birds). These mixed flocks are widely dispersed around the system, but notable concentrations can be seen in the central eastern section, around the Inishroosk area and at the satellite loughs towards Lisnaskea; in the northern area, around Cleenish and Tamlaght; and in the swan fields to the south of the lough at Newtown Butler and Scothouse (I. Enlander pers. comm.). Occasionally, larger flocks of just Mute Swans occur, although generally fewer than 50 birds are present in these flocks. Such flocks are not seen every winter, but when they are present they regularly use flooded grasslands at the northern end of the lough near Cleenish Island, and the central eastern shore of the lough around Kilmore and Trannish (I. Enlander pers. comm.).

iii) Strangford Lough

Five-year mean 96/97–00/01: 138

Site conservation status
SPA (Strangford Lough, non-qualifying species)
Ramsar (Strangford Lough, non-qualifying species)
ASSI (various)
IBA (Strangford Lough, non-listed species)

Site description and habitat
Strangford Lough (J5560) is located on the east coast of Northern Ireland in County Down. It is a shallow sea lough with an indented shoreline and a wide variety of marine and intertidal habitats. The west shore has numerous islands typical of flooded drumlin topography. The lough contains extensive areas of mudflat, saltmarsh and rocky coastline.

Numbers and trends
Generally, Mute Swan numbers on Strangford Lough declined steadily between the mid-1970s and mid-1990s from around 400 birds to fewer than 100. Then, through the late 1990s, numbers increased fairly rapidly and the highest recently recorded number was 225 in September 1999 (Fig. 49). The numbers of Mute Swans on the lough peak in September and then steadily decline through the winter to reach their lowest levels in February. In March numbers start to increase slowly (Fig. 50).

Site use
Most of the Mute Swans on Strangford Lough are found in Ardmillan Bay and along the northeast shore (Pollitt *et al.* 2000). Notable concentrations are also found off Mount Stewart (Musgrove 2003).

iv) Lough Foyle

Five-year mean 96/97–00/01: 114

Site conservation status
SPA (Lough Foyle, non-qualifying species)
Ramsar (Lough Foyle, non-qualifying species)
ASSI (Lough Foyle)
IBA (Lough Foyle and River Foyle, non-listed species)

Site description and habitat
Lough Foyle (C6025) lies on the northwest coast of Northern Ireland and straddles the international border with the Irish Republic. The site comprises a large, shallow sea lough that includes the estuaries of the Rivers Foyle, Faughan and Roe. The site contains extensive intertidal mudflats and sand flats (with Mussel *Mytilus edulis* beds), saltmarsh and associated brackish ditches.

Numbers and trends
Lough Foyle was first surveyed in October 1982. Mute Swan numbers on the lough have remained relatively stable since counts began, with occasional large peaks occurring in some years (Fig. 51). Occasional young birds have been known to arrive at the lough from the Uists in the Western Isles of Scotland (Spray 1981b). A small flock of Mute Swans is present on the lough through the summer months. Significant numbers of birds begin to gather on the lough from September, and numbers steadily increase through the winter, peaking in November. From December numbers begin to decline, and fall to their lowest levels in the summer moult period (Fig. 52).

Site use
The Mute Swans at Lough Foyle use a variety of habitats and locations. They are generally found on the open, tidal water of the lough in small numbers (often family groups). These small groups are usually found close to the shore from Black Braes to north of Balls Point, with no particular favoured sites within this area (M. Tickner pers. comm.).

In the winter months, Whooper and occasionally Bewick's Swans visit the Lough Foyle system and feed on stubbles, potatoes and grass. From October onwards, quite large groups of Mute Swans can be

seen mixed in with these flocks. This occurs regularly on poldered land at Black Brae, Donnybrewer and Myroe, and less regularly at places close to the shore, as well as further inland (i.e. inland of the railway line) at Myroe and Donnybrewer (M. Tickner pers. comm.).

However, the areas most regularly used by Mute Swans are the linear water bodies (borrow-pits/borrow-dykes) inland of the sea wall on all parts of the Northern Irish side of the Foyle system; these are used at all stages of the year. The areas used most are those at Donnybrewer and Myroe. Numbers on any one part of the dyke network may not rival those found feeding on the fields with the Whooper Swans, but the former are the most consistently used areas of Lough Foyle (M. Tickner pers. comm.).

2.2.4 Other sites

The Broadwater Canal (J1462) in County Antrim has regularly held 70–100 Mute Swans in the winters of recent years; numbers tend to peak here in October. Larne Loch (D4200) can hold up to 60 birds during the winter.

Lower Lough Erne (H1060) is a broad, open, triangular-shaped lough downstream of Enniskillen in County Fermanagh. The edge of the lough has been colonised by scrub, which provides breeding habitat (Hutchinson 1994). The site has been very infrequently surveyed during the period of this review. However, 116 Mute Swans were recorded on the lough in December 1997. WeBS counts of Drumgay Lough (H2447) in County Fermanagh recorded 63 birds in December 1998.

There are several sites in County Down that hold reasonably large flocks of Mute Swans. Around 50–100 birds can be seen during the winter on the Upper Quoile River (J4745). However, numbers here have been declining steadily in recent years. Dundrum Bay (J4235) regularly supports 70–80 birds through the winter, and numbers are often highest in October. The Mute Swans at Dundrum Bay are generally found in the southern arm of the inner bay, mostly just south of Dundrum. Small numbers can also be found at the northern end of the bay (Waters *et al.* 1998). Lough Aghery (J2853) supports 50–90 birds, although numbers here have also been steadily declining in recent years. Around 50–90 birds are present on Belfast Lough (J4083) during the winter months. Mute Swans on Belfast Lough favour Victoria Park and, to a lesser extent, the Belfast Pools (Pollitt *et al.* 2000).

2.2.5 Key references

Kennedy *et al.* (1954), McElwaine (1991), Sheppard (1993), Hutchinson (1994)

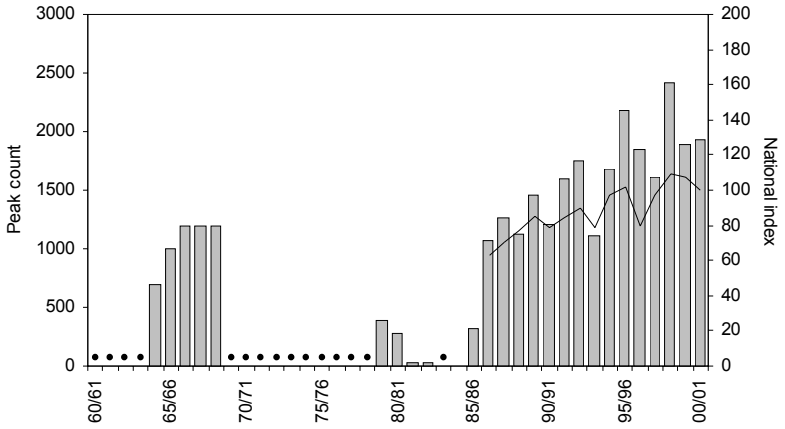


Figure 45. Mute Swans at Loughs Neagh & Beg, 1960/61-2000/01: peak counts (bars) and Northern Ireland index (line) (circles denote years with no known data)

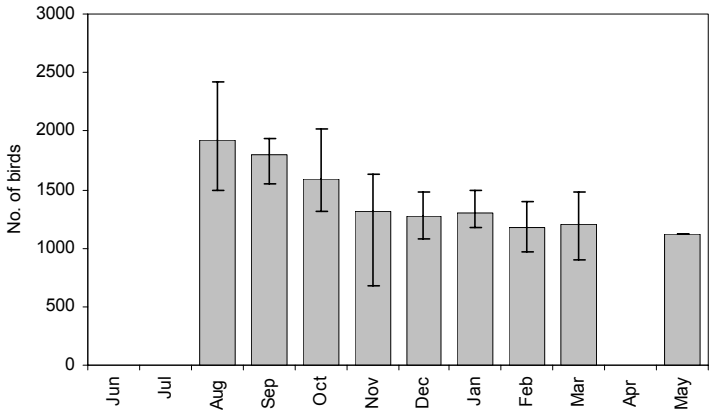


Figure 46. Mute Swans at Loughs Neagh & Beg, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

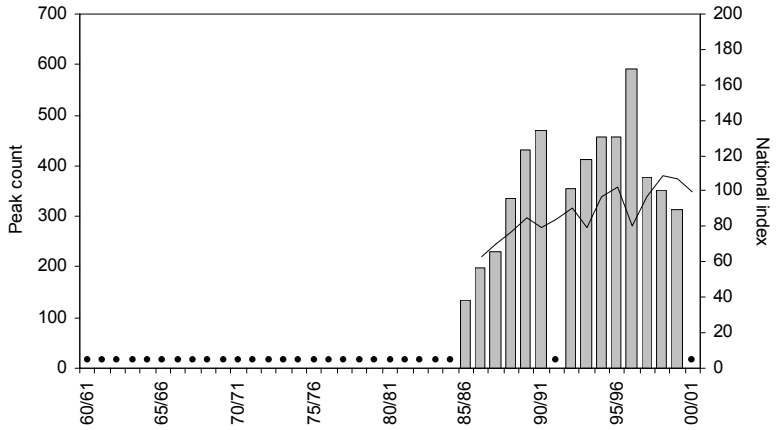


Figure 47. Mute Swans at Upper Lough Erne, 1960/61-2000/01: peak counts (bars) and Northern Ireland index (line) (circles denote years with no known data)

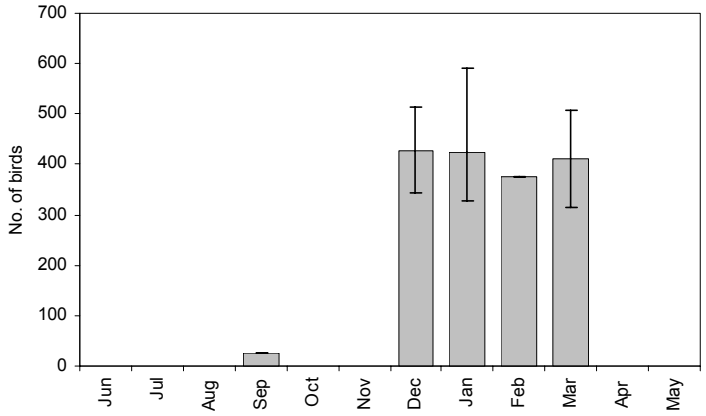


Figure 48. Mute Swans at Upper Lough Erne, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

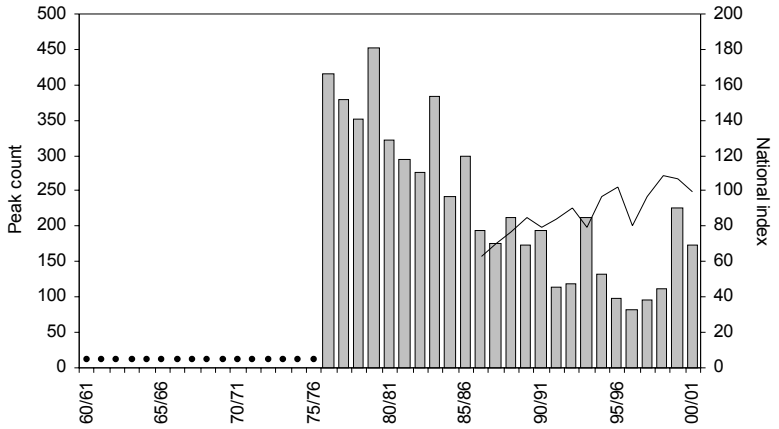


Figure 49. Mute Swans at Strangford Lough, 1960/61-2000/01: peak counts (bars) and Northern Ireland index (line) (circles denote years with no known data)

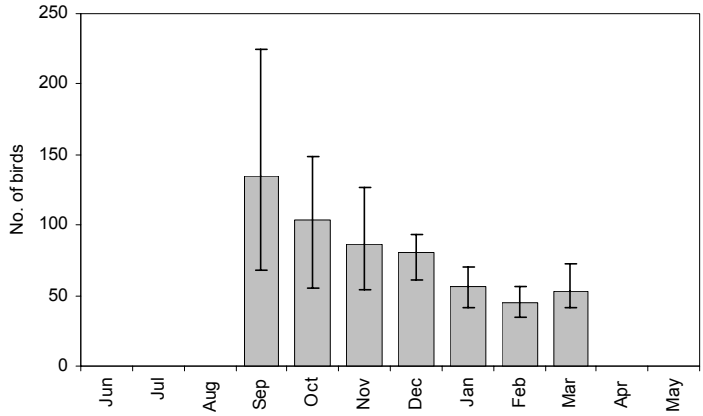


Figure 50. Mute Swans at Strangford Lough, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

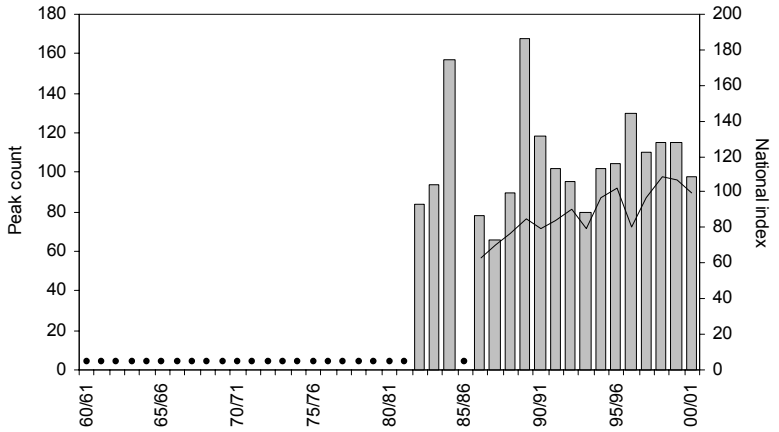


Figure 51. Mute Swans at Lough Foyle, 1960/61-2000/01: peak counts (bars) and Northern Ireland index (line) (circles denote years with no known data)

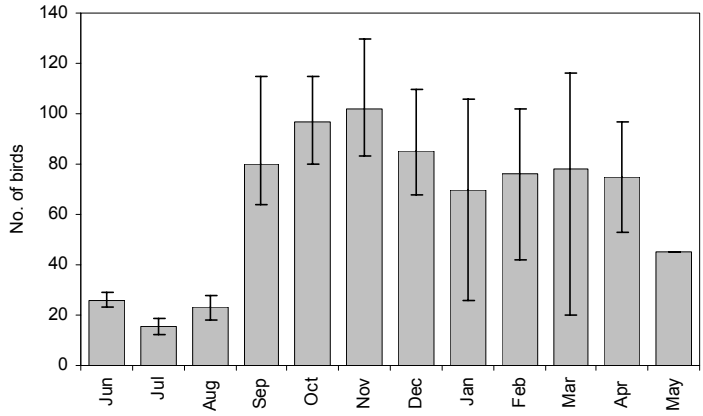


Figure 52. Mute Swans at Lough Foyle, 1996/97-2000/01: mean peak counts by month (error bars denote minimum and maximum peak counts during the period)

3 FUTURE RESEARCH AND MONITORING NEEDS

As the Mute Swan population has risen rapidly over the last decade, the species has come into increased conflict with humans, particularly agricultural and fishing interests. If this continues into the future, as seems probable, there will be a need to present data on population numbers and feeding habits in order to help resolve any conflicts and issues that may arise. Therefore it will be important to maintain and have access to robust and up-to-date data. However, there are problems associated with the data that are currently available:

- Much of the information from specific studies of Mute Swans is unpublished and the data are not readily available; the data that exist and the methodology used for their collection are often variable.
- For the data that are available, there is variation in the periods of the year in which they were collected and the information provided, e.g. whilst WeBS data are commonly available for September to March, much less information is available for April to August.
- There are problems in comparing WeBS data with counts in county bird reports as the sites used may not correspond exactly. Further, data in county bird reports are often presented for sub-sites: it is not known whether counts on these sub-sites were co-ordinated and whether summing these figures to produce a site total will result in double-counting (WeBS counts are co-ordinated and thus can be added together).

There is a clear need to collate the available data and make it accessible, and to keep the records up to date. In this way a more complete picture would be available, and there could be confidence in any data that were used to help resolve conflicts or issues that may arise in the future.

At the Swan Study Group meeting at WWT Welney in November 2002, a group of amateur and professional Mute Swan enthusiasts discussed the possibility of developing an integrated population monitoring programme for the species, focusing the efforts of fieldworkers on collecting demographic data that could be used to generate scientifically-robust assessments of abundance, productivity, survival and movements over a range of spatial scales, from local to national. The group identified the need to assess the current level of activity by fieldworkers across the UK before planning any proposed new activity, and a questionnaire was developed to enable fieldworkers to record their current level of activity.

At a subsequent Swan Study Group Meeting, in 2003, it became apparent that the variability in data collection between studies was greater than previously thought. It is hoped that integrated population monitoring can be developed and implemented in the future with the help of the Swan Study Group, but this will need input – particularly co-ordination – from professional bodies and organisations also.

One need for future research and monitoring that became apparent is the distribution of Mute Swans during the moult period. Because of the timing of the principal counts, the data available on moult flocks are variable and important sites may have been overlooked. Moult flocks are vulnerable to incidents such as oil spills, as large numbers of birds can be killed by one such incident at a site where a large moulting flock gathers. A full survey of moult flocks (repeated every five years) would help to identify important areas, with certain flocks being counted annually. Whilst aimed primarily at identifying key moult sites, such a survey, suitably structured, might also be able to assist in population monitoring. Population changes may also be assessed by designing a sampling method similar to that used by Rehfisch *et al.* (2002) to assess changes in the numbers of Canada Geese *Branta canadensis* and Greylag Geese *Anser anser* in southern Britain.

4 ACKNOWLEDGEMENTS

This review of monitoring information would not have been possible without the efforts of dedicated volunteer and professional ornithologists who monitor and research Mute Swans throughout Britain. We are extremely grateful for their efforts and strongly encourage them to continue their valuable work into the future. We also wish to thank the Swan Study Group, Helen Baker, Stuart Newson, Mark Pollitt, Colette Hall, James Robinson and Peter Cranswick for their support and assistance during the production of this review, and Chris Perrins and John O'Halloran, who reviewed an earlier draft.

The authors have made every effort to include all known data in this review. Given, however, that a number of unpublished reports and databases may have been overlooked, we urge readers to submit new and additional data to the authors, especially where there are apparent gaps in our datasets.

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