

# Fifty years of goose research and conservation by The Wildfowl & Wetlands Trust

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*The Wildfowl & Wetlands Trust (WWT) pioneered goose counting and research in the UK and has contributed to the conservation of goose species by establishing reserves for the birds in winter. This paper describes the development of the goose monitoring schemes, largely carried out by volunteer counters, that underpin our understanding of the distribution, abundance and dynamics of our goose populations. The diverse range of investigations WWT has undertaken on geese in the last 50 years is described, and the value of long-term population studies discussed. The importance of international collaboration for the effective conservation of migratory wildfowl is emphasised.*

At its inauguration in November 1946, Peter Scott announced that the work of The Wildfowl & Wetlands Trust (WWT), then called the Severn Wildfowl Trust, had two primary aims “...*part educational and part scientific....a practical aspect of the scientific studies is to provide data which will help to arrest the decline in the world’s wildfowl....*”. There had been considerable concern, raised during the 1930s in North America, at real declines in the numbers of geese reported and, in Europe, a dramatic decline in the Brent Goose *Branta bernicla* population prompted cause for concern. In Britain and Ireland, the status of goose populations was based largely on local knowledge with little co ordination. Certainly there were, for example, records that Bean Geese *Anser fabalis* were formerly very common, but their status in the 1930s was largely unknown. In *The status and distribution of wild geese and duck in Scotland* by John Berry (1939), the author pointed to the wholesale drainage and reclamation work of the 17th-19th centuries, combined with the wanton exploitation, mostly through over-hunting that led to the population’s increasing vulnerability. Interestingly, in

the foreword to the book, Percy Lowe suggests that the introduction of the breech loader, the steam engine and the internal combustion engine (motor-car) were the three fundamental inventions which helped reduce goose numbers. Berry, however, suggested that the trough of the reduction was reached at different periods in different areas for different species and, by the 1930s, only two of the seven species of geese were being shot excessively, since the Greylag *Anser anser*, White-fronted *Anser albifrons* and Pink-footed Geese *Anser brachyrhynchus* were actually recovering from low points reported in the previous 50 years.

## Population monitoring

The Wildfowl Count network, set up in 1947 by the International Wildfowl Enquiry Committee, aimed to cover as many waterbodies (or wetlands) as possible, once in each winter month (September to March) and, in 1954, WWT took over responsibility for its organisation (see Cranswick, P.A. *et al.* 1996. *Wildfowl* this issue). In order to

provide a basis for conservation planning following the 1954 Protection of Birds Act and the formation by the then Nature Conservancy of the Wildfowl Conservation Committee, the results of the first 14 years of counts were published in *Wildfowl in Great Britain* by George Atkinson-Willes; this proved to be the first comprehensive survey into wildfowl habitats, stocks and prospects in Britain. Two decades later, the results of the intervening years (up to 1980) were published in *Wildfowl in Great Britain* (Second Edition, Owen *et al.* 1986).

However, because of their nature, the Wildfowl Counts picked up only a fraction of the total number of geese present. Except perhaps for the Brent Geese, which could be adequately monitored on estuaries, counting of the other geese wintering in the UK needed a different approach. Geese fly from estuaries or inland water roosts to their feeding grounds at first light, and counters often need to be in position before dawn. The count dates need to avoid periods of full moon, when geese tend to feed at night. Equally important is count coordination; the counters in different parts of the country need to be active on the same weekend in order to avoid double counting as flocks move between roosts.

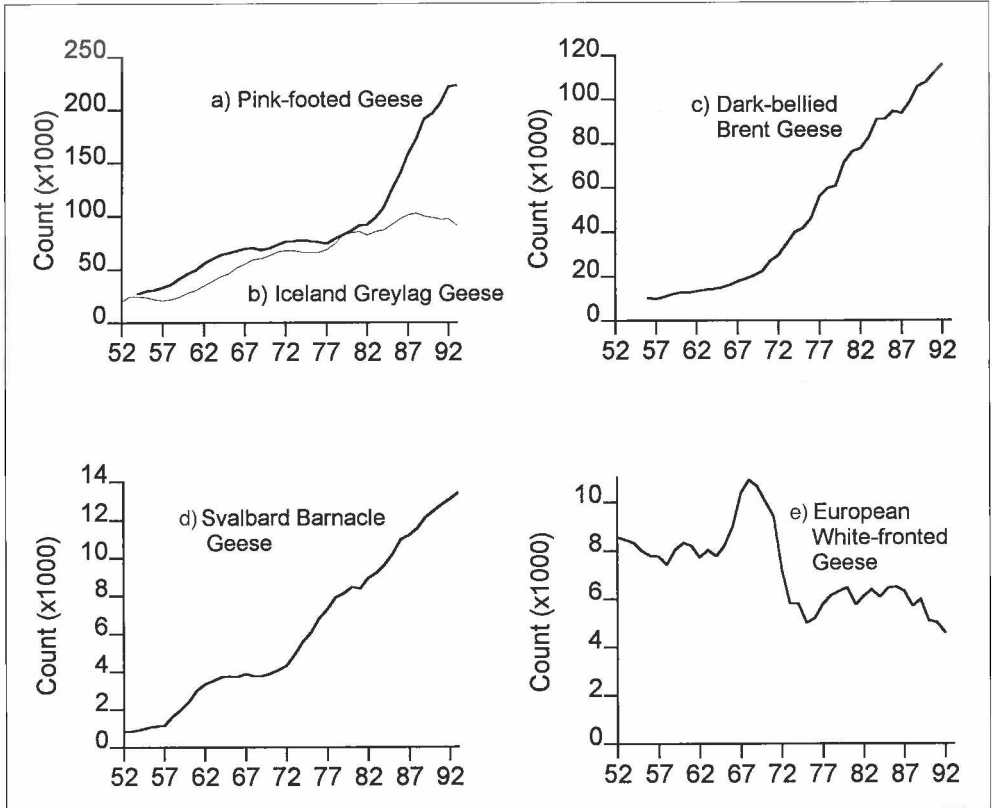
WWT are fortunate and have benefitted considerably from the efforts of a large number of dedicated volunteer goose counters. The population estimates derived from monitoring over the last 50 years have largely been gathered by volunteer counters and their efforts have been rewarded with a far better understanding of the distribution and abundance of geese in Britain. Goose counting can often involve arriving at a roost an hour before dawn; no mean feat when this involves travelling along snowy roads during mid-winter to a remote Scottish hill loch. Some independent goose groups have been established (e.g. the Central Scotland Goose Group) and their local detailed monitoring is invaluable in assessing counts and movements at a finer level than the national monitoring can achieve. It is fair to say that the success of the whole monitoring scheme is due in great part to

the involvement of the volunteer counters.

In its very earliest days, WWT's interest in goose numbers was primarily based on the flock of European White-fronted Geese wintering on the Severn Estuary at Slimbridge. Much pioneering work on goose biology was founded at Slimbridge by Hugh Boyd and Peter Scott (see Research below) and the monthly counts of this species have continued to this day. The British wintering birds represent the westernmost limit of this population and, in comparison with the flocks wintering just across the sea in Germany and the low countries, the numbers are very small (**Figure 1**), particularly as the overall population size has increased tremendously in the last 30 years. The proportion of the population and the total number of birds wintering in Britain are declining and the species is now restricted to only a handful of sites.

One of the very earliest censuses of a total goose population was initiated in the 1950s in response to the interest of WWT in the Pink-footed Goose. This population breeds in Iceland and Greenland, and Britain supports the entire population in winter (e.g. Boyd & Ogilvie 1969). The counting techniques developed over several years, particularly with the emphasis on roost counting were pioneered by Hugh Boyd and others at WWT and have been used for other goose monitoring schemes throughout the northern hemisphere.

Traditionally, the counts were organised over a single weekend in November. Since 1990, however, the counts have switched to October. It became apparent that peak numbers of Pink-footed Geese were gathering at several key sites in Scotland in this month, rather than November, and we were able to establish that a better population estimate was obtained earlier in the autumn. There was a gradual increase in numbers through the 1970s with a more rapid rate of increase in the 1980s that continues today (**Figure 1**). There have been changes in the winter distribution of the population too, with Norfolk now supporting a greater proportion in mid-winter than in former years.



**Figure 1.** Total numbers of a) Pink-footed Geese, b) Iceland Greylag Geese, c) Dark-bellied Brent Geese, d) Svalbard Barnacle Geese, e) European White-fronted Geese, recorded in Britain, 1950-1995. Expressed as 5-year running means (mean at 1960 is of 1958-1962 etc.)

Up to 160 estuaries, inland lakes or reservoirs are checked, either at first light or at dusk flight. The geese are much more concentrated in autumn, with flocks frequently exceeding 50,000 now being recorded. Some sites are very important indeed; for example, the top five or six sites in Britain in autumn can support over 60% of the population. In 1993, one such site, Dupplin Loch, an inland lake measuring 500 m by 400 m, held 62,000 Pink-footed Geese (a quarter of the population total).

Greylag Geese, which breed in Iceland and winter in northern Britain and Ireland, are counted at the same time as Pink-footed Geese although, since they tend to arrive later than Pink-footed Geese, November counts have provided the most accurate (i.e. largest) population

estimates (Boyd & Ogilvie 1972). However, counts in Ireland, a country which may support up to 5% of the winter population, are infrequent. This situation should improve, as a new wildfowl monitoring scheme (Irish Wetland Bird Survey, I-WeBS) is now in operation. The Greylag population has also increased over the last 30 years, but not at such a fast rate as the Pink-footed Geese. In fact, the population has been approximately 80,000 to 100,000 for the last ten years (Figure 1), in stark contrast to the continued rise of the Pink-footed Geese, although the underlying mechanisms for this difference are poorly understood. They are thought to be the effect of a much greater hunting kill in Iceland during the autumn and this is under current study.

Two of the world's populations of Barnacle Geese *Branta leucopsis* winter in Britain and Ireland. Those breeding in Svalbard winter exclusively on the Solway estuary and have been the focus of one of the longest running goose population studies in the world (see Research below). WWT own and/or manage a large proportion of the wintering area. Counts are undertaken each autumn when the population is located primarily on the WWT Caerlaverock Reserve. The population has increased steadily since regular counts began in the 1950s, the current estimate being over 13,000 (**Figure 1**).

Greenland Barnacle Geese, by contrast, are much more of a problem to monitor adequately (e.g. Boyd 1968). They frequent inhabited and uninhabited islands, as well as remote parts of the Irish and Scottish mainland. The bulk of the population winters on the inner Hebridean Island of Islay, and these birds have been the subject of a special study for many years (e.g. Percival 1991). Complete coverage of the birds' winter range (both in Ireland by Oscar Merne and in Scotland by WWT) has been attempted using aerial counts started in the early 1960s by Hugh Boyd, and undertaken approximately every five years (Delany & Ogilvie 1994). These show a steady increase in the overall population with a slight dip in the early 1980s caused by shooting pressure on Islay. There has been an increase in the proportion wintering on Islay with an apparent reduction in the number of the smaller flocks, and number of geese found in them, on some of the west coast islands off Scotland (Delany & Ogilvie 1994).

We are fortunate that enthusiasts, both professional and especially, voluntary, often take great interest in a single species. The Greenland White-fronted Goose is found over much of Ireland and on the westernmost fringes of Scotland, quite often in small discrete winter flocks, but with principal concentrations on Islay and at Wexford (Fox *et al.* 1994). Population counts were attempted periodically in the 1960s and 1970s but met with limited success. In the late 1970s, an historical analysis of the distribution

and abundance of the subspecies showed that the numbers had fallen to perhaps as low as 13,400 (Ruttledge & Ogilvie 1979). More regular counts, particularly on Islay and at Wexford, were undertaken, but annual monitoring of most, if not all, of the principal sites did not become established until the early 1980s. This has been largely as a result of the enthusiasm of the people undertaking the Greenland White-fronted Goose Study, especially Tony Fox and David Stroud, in close collaboration with WWT and government departments. There has undoubtedly been a genuine increase in the numbers counted in Britain, the bulk of which winter on Islay, and we are now in a fortunate position of being able to examine changes in the populations at a site and regional level (e.g. Pettifor *et al.* 1996).

Brent Geese are largely estuary dwellers and we are fortunate that the WeBS count scheme can monitor adequately these birds with few of the problems associated with counting other species. The focus of several detailed studies (e.g. St Joseph 1979) and international collaboration, the Dark-bellied Brent Goose population of northwest Europe has been monitored for well over 30 years. The overall trend is increasing (**Figure 1**), yet the proportion recorded in Britain is probably declining, though this may be influenced by the absence in recent years of any major cold weather periods (Mitchell *et al.* 1994). The current British population estimate is 125,000.

Virtually all the Canadian/Greenland Light-bellied Brent Geese wintering in northwest Europe occur along the coast of Ireland, at least 75% passing through Strangford Lough, County Down, during the autumn. Total population estimates have been rather sporadic, but included aerial counts in the 1960s by WWT, and regular counts have been undertaken at Strangford Lough since the late 1960s. There has undoubtedly been an increase in numbers since the 1960s although, interestingly, the peak numbers on Strangford have remained similar since 1970 at about 14,000. We are hopeful that renewed interest in this population, together with the advent of I-WeBS, will

lead to at least one census every year starting in 1996-97.

Also of interest are the smaller populations. Bean Geese winter in very small numbers in the UK in comparison to central Europe. Two regular flocks are restricted to the Yare Valley, Norfolk, numbering approximately 400, and the Slammanan plateau, central Scotland, with just over 100 birds. These are regularly monitored by local enthusiasts.

Svalbard Light-bellied Brent Geese are restricted to one site in northeast England at Lindisfarne. This is one of the most important flocks in an international context since the population is small and has a very limited world range. It is well monitored at Lindisfarne and the subject of several recent studies (e.g. Clausen & Percival 1994).

Native Greylag Geese number some 7,000 (Mitchell 1995; WWT data) and are restricted to the very north of Scotland and some Hebridean Islands and are, by and large, sedentary. The three principal gatherings at Uists, Sutherland and Coll & Tiree, are all now counted regularly. Feral geese, especially Canada Geese *Branta canadensis* and reintroduced Greylags, are subject to periodic censuses carried out post-breeding in the late summer. The most recent estimate for Canada Geese is 63,500 (they may still be increasing) and that for reintroduced Greylags is 19,500 (Delany 1993).

## Research

Fluctuations in goose numbers, and the factors affecting them, have been the subject of exhaustive studies both in Europe and North America. The number of birds in a population at any time depends on the recruitment level (the number of young produced to fledging) and mortality (the number of fully grown geese that die). We have seen how reliable estimates of the number of geese in any population or species are essential to the conservationist anxious to maintain viable breeding units, and to the wildfowler or hunting manager who wants to know the proportion of individuals that can be

harvested without harming future breeding potential and hunting opportunities.

Because in most goose species young of the year are distinguishable from adults in the field, at least until early winter, an estimate of the proportion of young in the population can be obtained and, if the total number of birds is known, total recruitment can be calculated. Hugh Boyd began to obtain and collate annual estimates of productivity, a tradition that has not only continued for all goose populations in the UK today, but throughout most of Europe and North America.

In Europe, age ratios and total counts of relatively small and well counted populations are often used to calculate annual mortality. By subtracting birds of the year from the total, the number returning (of the previous year's total) can be calculated and this figure used to suggest mortality between counts. The annual population counts and estimates of productivity underpin our knowledge of the dynamics of goose populations in the UK (e.g. Fox *et al.* 1989). The ringing of geese is fundamental to our understanding of movements and migrations. WWT pioneered many of the catching techniques used for geese and these are documented more fully in Mitchell & Ogilvie (*Wildfowl* this issue). The ringing and recovery data can also be used to provide independent assessments of mortality using statistical models (e.g. Boyd 1956; Gitay *et al.* 1990).

Catching and ringing of geese provides the opportunity for other data to be collected. The age and sex composition of the sample can be determined, and it is usual for the caught birds to be weighed and measured before release. Body weight is a useful measure, especially for energetic studies, and to some extent for taxonomic purposes. Body measurements are useful as indicators of size in studies of body condition (e.g. Owen *et al.* 1992). The standard measurements are wing (length of flattened chord), the length of the head including the bill, and tarsus (the length of the tarso-metatarsal bone). Caught geese have also been fluoroscoped

to indicate the proportion carrying lead shot in their tissues, an indication of shooting intensity (Elder 1955), and the same technique can be used to estimate the proportion carrying lead in the gizzard, an indication of the prevalence of lead poisoning.

### *Population studies*

Whereas counts and ringing provide valuable information on numbers and distribution, more detailed research is necessary to determine how changes in numbers are brought about. WWT's study of the Solway/Svalbard population of Barnacle Geese began in 1957, and, in 1963, WWT established the population's breeding provenance (Boyd 1964). A more intensive approach to studying the population involving individual marking was established in 1970. Considerable effort in following the ringed birds enabled the mortality rates of birds of different ages to be measured (e.g. Owen 1982). There is competition for resources during the breeding season and only a small proportion of the pairs are successful in rearing young. Breeding success of individuals is affected by environmental conditions and by their own performance in relation to other members of the population, which in turn is influenced by age and breeding experience. The geese travel 2,700 km from their wintering grounds to Svalbard, stopping to refuel in Norway. Observers from WWT have visited Norway and Svalbard regularly since 1977, keeping track of marked birds. Many birds have been recorded over more than 15 seasons; some are known to have reached 25 years of age. The population is protected (although illegal shooting still accounts for some deaths) but the detailed population data will help in the management of other species through a fuller understanding of the processes influencing mortality and breeding success. Wildfowl are long-lived and such investigations are necessarily long-term. The Svalbard Barnacle Goose research is one of the world's longest running population studies, and yet has not

proceeded as long as the maximum lifespan of an individual goose. The research has resulted in over 100 scientific papers and contributions to several books.

Intensive population studies have also been carried out on Dark-bellied Brent Geese (St Joseph 1982), the Hawaiian Goose *Branta sandvicensis* (Black 1990) and, recently, attention is now focused on Red-breasted Geese *Branta ruficollis* (Quinn *et al.* 1995).

### *Feeding studies*

Achieving an adequate food supply is the major preoccupation of wintering geese, and determining the requirements of each species is a key to any understanding of distribution and conservation needs. WWT focused on the diet of ducks in the early 1960s, but later detailed observation studies on geese related the diet to food availability and numbers and movements to ecological factors such as disturbance, weather, food quality and quantity. Experiments were carried out both in captivity, and on a large scale, on reserves to determine feeding preferences and the effects of management activities (Owen 1972).

### *WWT reserves*

WWT also contributes to the conservation of migratory geese through three of its reserves which now host internationally important numbers of geese: Slimbridge, Gloucestershire (European White-fronted Geese), Caerlaverock, Dumfriesshire (Barnacle Geese), and Martin Mere, Lancashire (Pink-footed Geese).

#### *i) European White-fronted Geese at Slimbridge*

As well as the grazing by sheep and cattle to produce a good sward, and the wardening to prevent disturbance, WWT developed a system of observation hides and towers whose approaches were hidden in earth banks and other forms of screening. The flock has declined somewhat in the 50 years since WWT was

formed to c.4,000 today, although the total population has increased during that time.

*ii) Barnacle Geese at Caerlaverock*

In February 1970, WWT leased Eastpark Farm at Caerlaverock, on the north shore of the Solway Firth, when it was already famous as the favourite wintering ground for the Svalbard population of Barnacle Geese. A system of screens and hides was constructed and, in 1971, it was opened to the public. The northern boundaries of the reserve were secured, and a buffer zone created, by the purchase of Stanhope and Powhillon farms in 1975 and of the important parts of the Nether Lochardwoods smallholdings in 1981/82. All the farmland at Eastpark is now managed, being let for grass in the summer, which has resulted in greatly improved grazing management for the Barnacle Geese and less disturbance through farming operations in winter. The only manipulation required is grazing to provide an abundance of short nutritional grasses for the geese between September and April. Protection from shooting and disturbance, management measures undertaken with the creation of the Caerlaverock National Nature Reserve by the Nature Conservancy in the late 1950s, helped the numbers of geese rise from 300 to 3,000 in 1970, and the flock has increased, with WWT's involvement, to over 13,000 in the early 1990s.

*iii) Pink-footed Geese at Martin Mere*

On the Lancashire moorlands near Ormskirk lies the site of Martin Mere which was once the largest lake in Lancashire. It was once teeming with wildlife and set in the midst of hostile mossy wetlands. Drainage to allow cultivation of its rich peat soil started in 1692 and eventually nothing remained but a patch of damp farmland. The surrounding area was, however, important because of the numbers of feeding Pink-footed Geese in winter. In 1973, 147 ha of land was purchased and, in 1975, a new centre opened there. WWT proceeded to excavate a new 6 ha lake and improvement to the reserve and sound

habitat management soon attracted significant numbers of wildfowl and waders. In 1985, Martin Mere achieved international recognition as a site of outstanding importance and was designated under the Ramsar Convention. Today up to 25,000 Pink-footed Geese use the site as a roost during the winter months.

### **Conservation and management**

Wild geese, and to some extent swans and ducks, are in conflict with farmers at certain times of the year and WWT has been involved in trying to reduce this conflict as far as possible. As well as carrying out experimental work to assess damage (Kear 1970), studies have also tested scaring devices and assessed various other means of reducing damage. The use of reserves to lure birds away from conflict situations is a method that has been tried little in Britain, but experience at several WWT reserves indicates that this provides a long-term solution in some cases. WWT has advocated this method of resolving conflict for decades (Owen 1977) but it is only now that the technique is being considered seriously and implemented.

Apart from the direct contribution to the conservation of wildfowl and wetlands made by its own reserves, WWT has many indirect inputs to goose conservation. Through the continual monitoring of wildfowl numbers and distribution, WWT indicates to the Joint Nature Conservation Committee, the Royal Society for the Protection of Birds and county naturalists trusts those wetlands areas most worthy of special conservation effort. The counts collated by WWT are used by many conservation organisations setting up reserves or opposing developments, as well as by planners and developers themselves.

The value of long-term studies of this type is immense. Site safeguard is based on knowledge of the numbers of geese using a particular roost and the goose censuses provide those data. The dissemination of techniques for wetland

management has been practised not only within Britain but in other parts of the world too.

The aims of WWT's waterfowl collection were scientific from the start. Konrad Lorenz wrote in the 4th Annual Report on its value. The collection serves both as a scientific resource and genetic bank. The restoration of the Hawaiian Goose to the wild, for example, has become a classic story. Many behavioural and morphological studies, particularly on geese, used extensively the close observation facilities offered by the WWT collection in the 1950s and 1960s (e.g. Johnsgard 1962).

Only one goose on the British list gave cause for concern in the late 1970s. This was a particular favourite of Sir Peter Scott, since he 'discovered' it in 1939 and named it in 1948, the Greenland White-fronted Goose. This race had declined in the 1950s and was only to be found in very small numbers; the world population was estimated at barely 15,000. In 1978, WWT began to urge the governments of the UK and Ireland to give it protection, so that it could increase its numbers. WWT put forward a successful case which led to complete protection in Britain in 1981, in Eire in 1982 (though only sporadically), in

Northern Ireland in 1984 and in Greenland in 1985. The result of this was to enable numbers to increase to 32,000 in 1995-96 (Fox & Francis 1995; Norriss & Walsh 1995).

Wildfowl conservation depends on international co-operation. Geese do not recognise international boundaries and WWT has been instrumental in developing censuses and research programmes both within Britain and beyond. An international flyway plan has been developed for the Greenland White-fronted Goose, with input from WWT, and one is being prepared currently by WWT for the Svalbard Barnacle Goose. Collaborative research is undertaken currently in Iceland, Greenland, Norway (including Svalbard), Russia and North America. Techniques investigating population viability analyses are being developed and may be applied to goose populations outside Britain. WWT's contribution to goose conservation owes a lot to the pioneering work of Peter Scott and Hugh Boyd in the 1950s; the next 50 years may see huge changes in the populations of the wild geese that visit Britain, and WWT will continue to play a role in the challenges that these bring.

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