

Long-term trends in the number of Whooper Swans *Cygnus cygnus* breeding and wintering in Sweden

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Abstract

The Whooper Swan *Cygnus cygnus* was a rare breeding species in Sweden during the early years of the 20th century, when total numbers likely consisted of only 20 pairs. Recent decades have however seen a marked increase in numbers and a spread in the swans' distribution, with the number of pairs breeding in the two northernmost provinces rising from 310 to 2,700 pairs between two main surveys, in 1972–75 and 1997. This paper documents continued long-term (1967–2014) increases in numbers of Whooper Swans breeding and wintering in Sweden, based on data collected by the Swedish Bird Monitoring Programme and during the mid-winter International Waterbird Counts (IWC). Most recent estimates for the country indicate that there are now 5,400 breeding pairs during the summer and close to 10,000 individuals present in normal or mild winters.

Key words: breeding, *Cygnus cygnus*, field feeding, population trends, Whooper Swan, wintering.

During the first decades of the 20th century the Whooper Swan *Cygnus cygnus* was considered to be a rare breeding species in Sweden, with about 20 pairs restricted to large but isolated mires in the northernmost part of the country (Nilsson *et al.* 1998). The species was a widespread breeding bird in Sweden during the early 19th century, but was heavily hunted to the brink of extinction during the latter part of the century (Fjeldså 1972; Nilsson *et al.* 1998).

In 1927 the Whooper Swan was protected

from hunting in Sweden, which led to a slow reoccupation of its former breeding distribution as it spread to nesting sites in the inner parts of Swedish Lapland. After 1950, the rate of dispersal increased and the species was even found breeding in the southern parts of the country. It was not until 1972–1975, however, that large-scale counts of the species were undertaken for the first time, when the main breeding areas of northern Sweden (provinces of Västerbotten and Norrbotten) were covered

by aerial surveys during the North Calot survey (Haapanen & Nilsson 1979). In 1985, Birdlife Sweden organised the first nationwide survey of breeding Whooper Swans (Arvidsson 1987) which was followed by a second national survey in 1997. During the latter census, aerial surveys were once more made in the two northernmost provinces of the country (Nilsson *et al.* 1998). Between 1972–75 and 1997, the number of Whooper Swans recorded in the two northern provinces Västerbotten and Norrbotten increased from 310 to 2,775 breeding pairs, and the species became more widely distributed across these provinces.

Sweden is also important for the species in winter, with 14% of the Northwest Mainland European Whooper Swans present during the international census of January 1995 (Laubek *et al.* 1999). Moreover, large numbers of Whooper Swans stage in the country during migration. The status of the Northwest Mainland Europe population, which includes swans breeding and wintering in Sweden, has been monitored since 1967 through the annual mid-winter International Waterfowl Counts (IWC) coordinated by Wetlands International (see Nilsson 1997, 2002, 2008). A marked increase in this wintering population has been recorded during the second half of the 20th century (Monval & Pirot 1989; Rose & Scott 1994), and this is thought to have continued into the 21st century (Wetlands International 2014).

This paper provides an update on the current status and long-term trends for Whooper Swans in Sweden since the last national review of the species in 2001

(Nilsson 2002). The number and distribution of swans breeding in the country is described and the swans' winter distribution is also considered in relation to habitat and winter weather conditions.

Materials and methods

Counts have been undertaken in Sweden in January on an annual basis since the start of the IWC in January 1967. In most years, counts were made at a set number of sites across the southern part of the country in order to provide data for calculating annual population indices (Nilsson 2008). The sites were grouped into a number of reference areas counted in the same way every year. Counts were also provided from a number of sites selected by the counters, which were covered to a varying degree between years (for details see Nilsson 2008). In addition to these annual counts at IWC sites, country-wide mid-winter surveys under the auspices of the IWC were undertaken in January 1971–73, 1987–89 and 2004. These larger surveys were thought sufficiently representative to reflect changes in the total numbers of Whooper Swans wintering in Sweden and can be compared with the specific swan count programmes started in 1995 (see below). Over the years, it was increasingly the case that Whooper Swans were using terrestrial areas which were less well covered than wetland or coastal areas by the IWC site network. More comprehensive surveys of wintering Whooper Swans across Europe therefore were organised by the Wetlands International/IUCN-SSC Swan Specialist Group, and these have been conducted at five-year intervals from 1995 onwards (Laubek *et al.* 1999). During these

coordinated international censuses, all potential Whooper Swan sites were covered together with sites covered by the national goose counts. Many observations were also obtained through an information campaign in the local press in these years. As well as recording total numbers, observers were asked to count the number of swans present on different field types, to describe any changes in habitat use over time. Other data on wintering Whooper Swans were available from winter counts submitted to the Swedish Bird Monitoring programme, recorded during annual point counts made along selected routes in the country, which aims to produce annual national indices for different species (Green & Lindström 2014). The analyses presented here use only the mid-winter Whooper Swan data from this programme.

In addition, national waterbird counts have also been organised in Sweden in September since 1973. These counts are used here for a separate analysis of trends in swan numbers recorded during the autumn migration period.

Information on the expansion in numbers of Whooper Swans breeding in Sweden was obtained from the Swedish Breeding Bird Monitoring Programme (Green & Lindström 2014). Within this programme a system of summer point counts has been conducted along routes selected by the observers since 1975. The same routes were covered each year. In 1996, a system of fixed count routes systematically distributed over the country was introduced to get better and more consistent coverage. The observer walked a distance of 8 km stopping to make point counts eight times (at 1 km intervals)

along the route, and observations of swans during line transects between the points were also recorded (for details see Green & Lindström 2014). A combination of the transect counts and point counts are included in the analyses.

Trends in numbers were calculated using TRIM (“TRends and Indices for Monitoring data”) software (Green & Lindström 2014). The method has a GLM approach that fits log-linear regression models to individual counts data with Poisson error terms, accounting for overdispersion and autocorrelation where these are detected, and accounts for missing values in the time series. The TRIM analyses give the percentage change along with significance levels for these changes over the duration of the monitoring programme.

Results

Breeding population

The breeding bird surveys (Fig. 1) show significantly increasing trends both for data recorded during the summer point counts (1987–2012: mean annual change = 8.3%, $P < 0.001$) and for the fixed route counts (1998–2012: mean annual change = 2.6%, $P < 0.01$). Unfortunately it was not possible to split the data into regions, to determine trends in the number of breeding pairs for different parts of Sweden.

Counts made in the main autumn staging areas in south-central Sweden (*i.e.* the arrival sites for swans migrating to Sweden from areas further east) indicate that wintering Whooper Swans have not yet reached Sweden from more easterly breeding areas by September. There has however been a

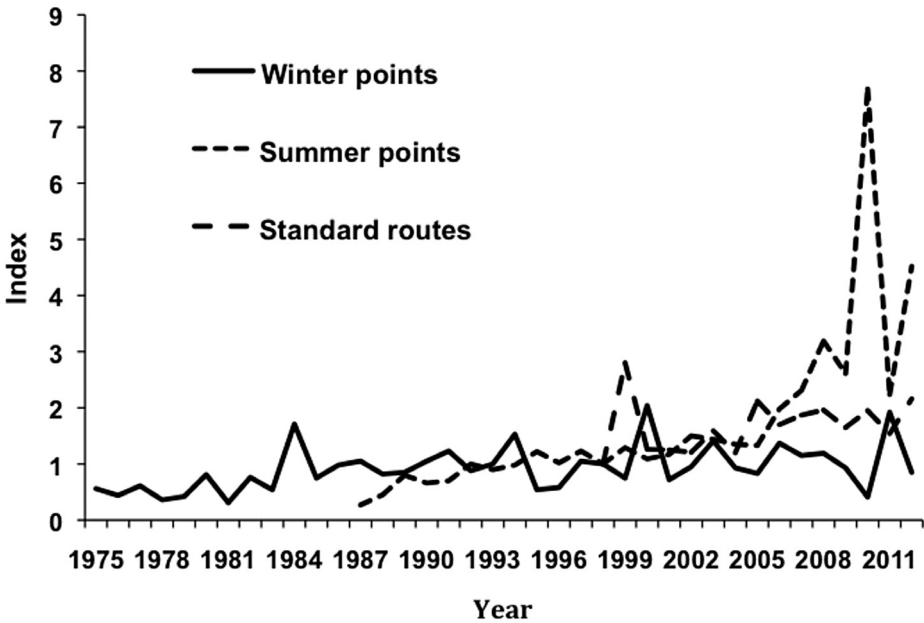


Figure 1. TRIM indices for Whooper Swans from the Swedish Bird Monitoring Programme (Green & Lindström 2014).

marked increase in the numbers of birds counted in Sweden in September since the late 1980s (1973–2013: mean annual change = 9.9%, $P < 0.001$; Fig. 2). The rate of increase in the September counts and the summer point counts are very similar, as might have been expected given that they both largely reflect numbers breeding in Sweden, although there are some annual differences as the September counts also reflect breeding success (*i.e.* they include young produced in that year).

In 1985, the number of Whooper Swans breeding in Sweden was estimated at 490 pairs (Arvidsson 1986). There has been no national survey of the breeding population since 1997, when the total for the country was estimated at 3,780 birds (Axbrink 1999).

A compilation of local and regional estimates, and updates of older surveys in line with the trend estimates, suggested that there were 5,400 pairs of Whooper Swans breeding in the country by 2010 (Ottosson *et al.* 2012). This compilation also showed the species to be well distributed across the entire country with an important proportion of the increase taking place in southern Sweden compared with little recent change in numbers in the former core breeding areas in the north.

Wintering population

Numbers wintering in south Sweden have increased significantly over the full series of mid-winter counts, but there is no clear trend for the last ten years of the series (for

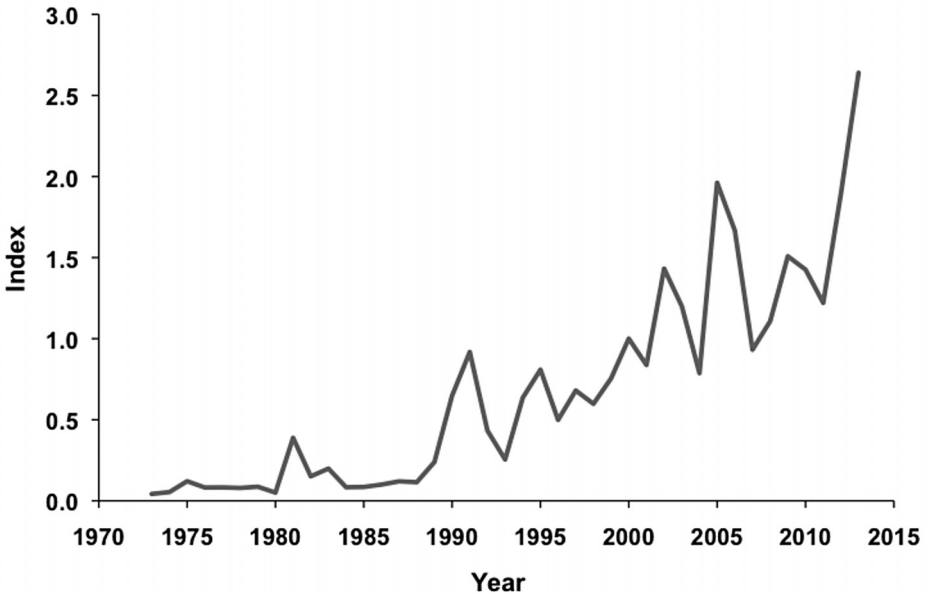


Figure 2. TRIM indices for Whooper Swans from the September counts of waterbirds in Sweden 1973–2013.

the whole series, 1967–2014: mean annual change = 1.3%, $P < 0.001$; for the last ten years, 2005–2014: mean annual change = 1.1%, n.s.; Fig. 3). The winter point counts from the Swedish Bird Monitoring also show an increasing trend over the years (1975–2012: mean annual change = 1.9%, $P < 0.001$; Fig. 1).

As the IWC do not cover key terrestrial areas used by wintering Whooper Swans in Sweden, data from these counts do not reflect the true status of the population within Sweden or trends for the population as a whole (Laubek *et al.* 1999; Nilsson 1997). However, the proportion of Whooper Swans feeding on fields in Sweden was low in the early 1970s, and thus the countrywide surveys undertaken for the IWC are likely to have reflected the total

numbers of wintering birds in the country during this period. There were estimated to be around 2,000 Whooper Swans occurring in Sweden at this time (Fig. 4). When the first coordinated international count of Whooper Swans was made in 1995, between 7,000–8,000 birds were found in the country, increasing to 9,000–10,000 recorded during the 2005 census. In 2010, much smaller numbers were counted in the country due to a very hard winter as there was a substantial emigration from Sweden to countries to the southwest, *e.g.* Denmark.

The Whooper Swans were found wintering over most of the southern third of Sweden, both during mild and cold winters (Fig. 5a,b). However, swans were concentrated into the west and southwest parts of the country during the cold 2010

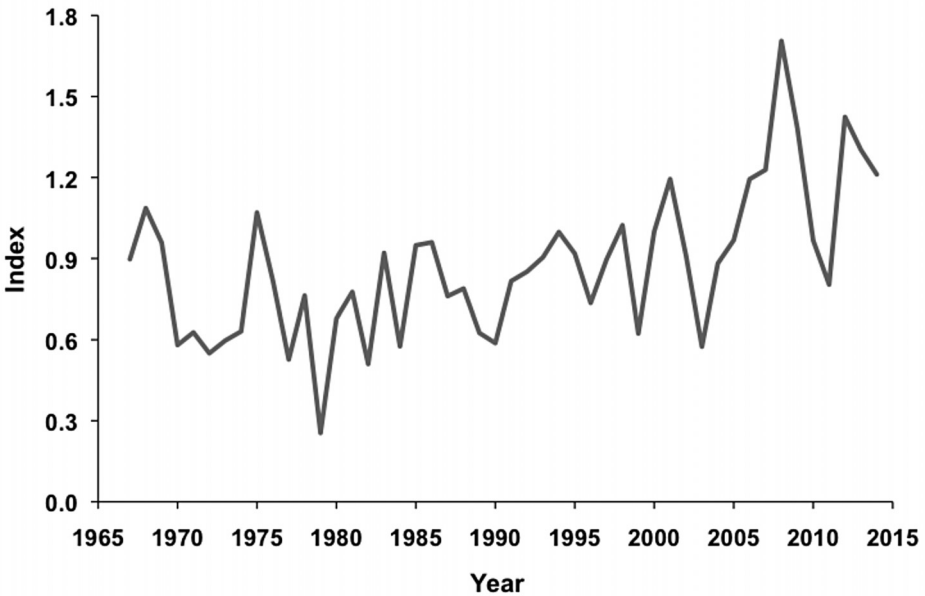


Figure 3. TRIM indices for Whooper Swans from the January counts (IWC) of waterbirds in Sweden, 1967–2014.

winter, when feeding conditions were more favourable there due to less snow. Most sites in inland and eastern Sweden also had wintering Whooper Swans in the cold winter, but numbers at these sites were much smaller.

Field choice in winter

When Nilsson (1997) analysed the results from the first International Whooper Swan Count in 1995, *c.* 70% of the swans were still found on wetlands, predominantly on water, both in coastal and inland areas. There were also marked regional differences with < 40% on water in Scania, the southernmost province of the country.

The proportion of swans feeding on fields increased markedly between the two international Whooper Swan surveys in

1995 and 2000 with *c.* 40% found on water during the latter survey (Fig. 6), this proportion being even less in 2005 (*c.* 35%). No habitat data are available for 2010 as most areas were covered by snow and thus the field types used by the flocks could not be established.

The main field types used by the Whooper Swans during the three surveys presented in Fig. 6 were grasslands, autumn-sown cereals, stubble and rape. On arrival in Scania, southern Sweden, the majority of Whooper Swans, along with staging geese, fed on the remains of the sugar beet harvest. These fields were generally ploughed before the mid-winter counts, although it is likely that many fields classified as “ploughed” were harvested sugar beet fields with some beet remaining on the land.

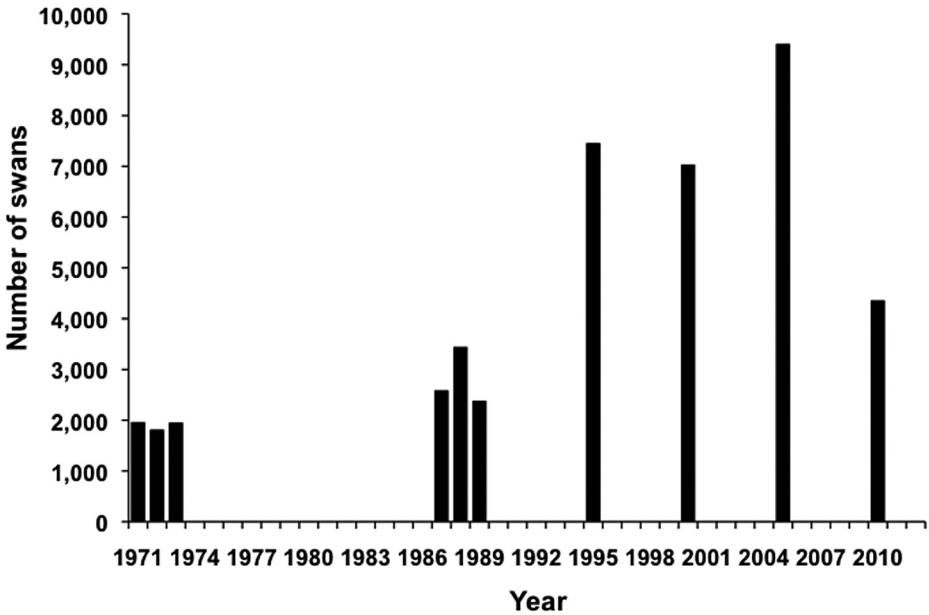


Figure 4. Number of Whooper Swans counted at the country-wide surveys in Sweden during 1971–2010.

Discussion

The breeding population of Whooper Swans in Sweden has increased exponentially during the last century from an estimate of about 20 pairs in the 1920s to about 5,400 pairs in recent years. The main reason for the marked increase was the protection afforded to the species in 1927. Initially the rate of increase was slow and in the early 1970s, Haapanen & Nilsson (1979) estimated the population for the two northernmost provinces in Sweden to about 300 pairs. However a few pairs were also found in the southern part of the country (Arvidsson 1987). After the 1970s, there was a marked increase and spread of the species and the population in the two northern provinces increased to 2,700 pairs (Nilsson *et al.* 1998). The rate of increase in

the north levelled off during the 2000s and a survey of part of the northern provinces in 2009 found only small changes compared to the 1997 survey (Nilsson & Nilsson 2012).

There is a clear parallel with the Greylag Goose *Anser anser* breeding in Sweden, which also increased after protection from a few hundred pairs in the 1960s to about 41,000 pairs in recent years (Ottosson *et al.* 2012). For both the Whooper Swan and the Greylag Geese, changes in agriculture was most probably an important factor behind the increase in addition to the protection from hunting, providing much larger food resources on the staging and wintering areas than before. Additionally, the distribution of staging and wintering geese has been studied in relation to changes in agriculture in the late 20th and early 21st centuries (Nilsson &

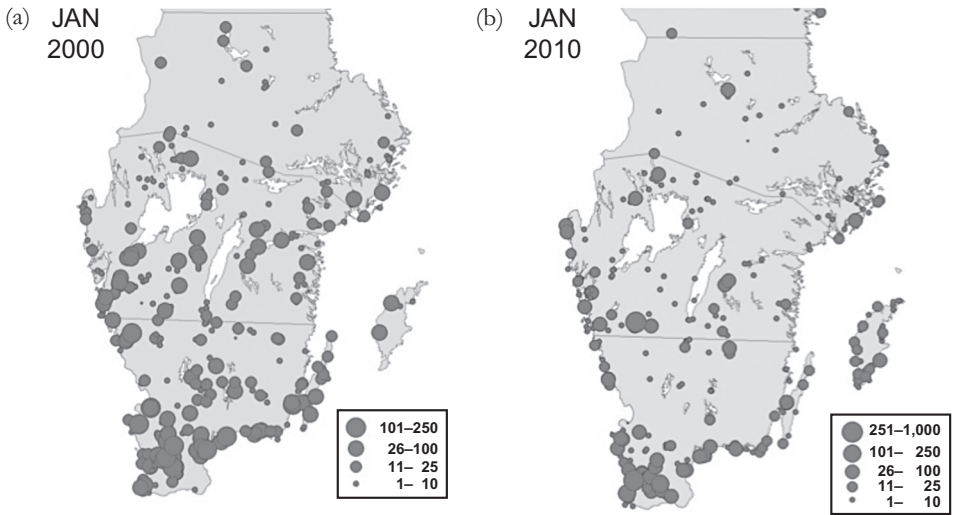


Figure 5. Distribution of wintering Whooper Swans at country-wide surveys during a mild (January 2000) and a cold (January 2010) winter.

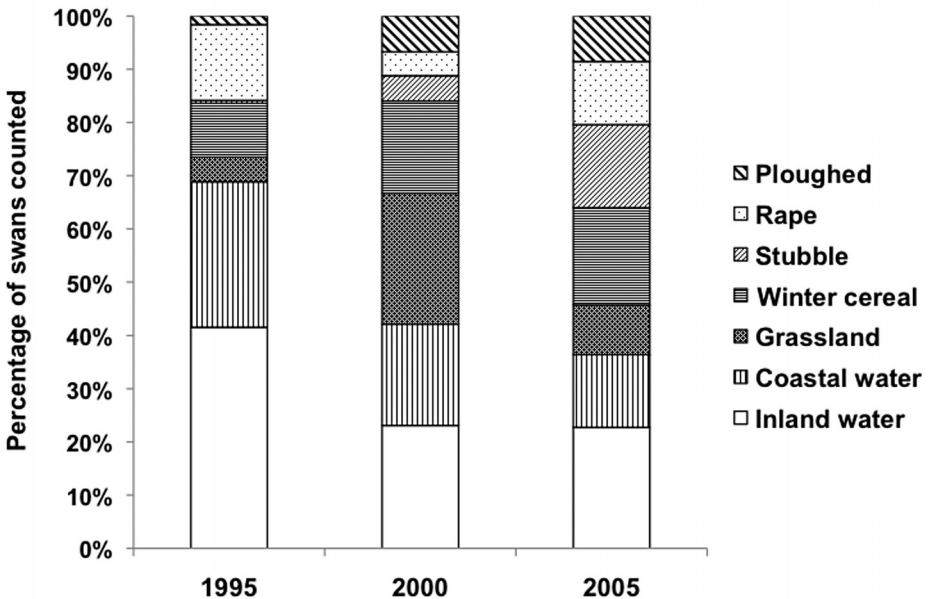


Figure 6. Field choice by Whooper Swans in January recorded during three country-wide surveys, in 1995, 2000 and 2005.

Kampe-Persson 2013), and results indicate shifts in habitat use in relation both to changes in crops grown and in harvesting methods (which may leave variable amounts of harvest waste as food for the birds) over the decades. The main changes in agriculture which are of importance both for Whooper Swans and for geese are the increases in the area of autumn-sown cereals. Moreover, there has been a change in the variety of oilseed rape grown, making the rape more palatable to wildlife since many of the alkaloids present in tissues have been removed. Over the years, geese have increasingly exploited waste left behind after the harvest of sugar beet (and potatoes) for food (Nilsson & Kampe-Persson 2013). Field use by Whooper Swans in Sweden has only been studied during the winter (present study) but it is clear from observations made in connection with the goose studies that waste sugar beet is also an important food source for Whooper Swans in south Sweden in autumn.

A large proportion of the Whooper Swans wintering in Sweden emanate from Finland and/or Russia, whereas many Swedish-breeding birds winter along the Norwegian coast. The increase in wintering numbers in southern Sweden therefore probably reflects general increases in breeding populations not only in the south of Sweden but also further east, with the mild winters in recent years likely also resulting in higher numbers wintering in the country.

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Photograph: Whooper Swan breeding pair at Dalarna, Sweden, by Bernd Zoller/Imagebroker/FLPA.