Changes in numbers and habitat utilization of wintering Whooper Swans *Cygnus cygnus* in Sweden 1964–1997

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Abstract

A country-wide survey of wintering Whooper Swans *Cygnus cygnus* was undertaken in south Sweden in January 1995 as part of an international census of the species. The paper reports on this census and analyses Whooper Swan counts from earlier International Waterfowl Census data to elucidate changes in numbers and habitat utilization of the swans. A marked increase in the number of Whooper Swans was found between the first country-wide surveys in the early 1970s and 1995, when the winter population was estimated to be at least 8,000. The increase is not reflected in the midwinter indices, calculated from the International Waterfowl Census data, due to an increasing tendency of the Whooper Swans to feed on land in the southernmost part of the country. In January 1995, nearly 60% of the Whooper Swans in Scania were found on fields, mainly rape and winter wheat, whereas in the other parts of the country the majority of swans still utilised water areas. Earlier in the season the Whooper Swans in Scania also used sugar beet spill for feeding. The field-feeding habit started in the 1970s.


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Introduction

The Whooper Swan *Cygnus cygnus* is a regular winter visitor in south Sweden and is covered by the International Waterfowl Census (IWC), coordinated by Wetlands International (formerly IWRB), in mid-January. Information from the breeding grounds in Fennoscandia has shown marked changes in recent years with a substantial increase in numbers and a spread to new breeding areas, the distribution now covering the major part of Sweden and Finland (Haapanen & Nilsson 1979, Arvidsson 1987, Ohtonen 1992). The indices for continental Northwest Europe, based on the IWC, do suggest an increasing trend (Rose 1995, cf. also Nilsson 1975, 1991, 1996a for national indices) but the counts are not thought to be an adequate reflection of population changes due to Whooper Swans being widely dispersed in the winter quarters (Rose 1995).

To overcome these problems and to obtain an adequate population estimate for the Northwest European winter population of the species, a special survey was organised in January 1995 (Laubek et al. in prep), made at the same time as a census of the Icelandic-British population, which had already been surveyed in this way in 1986 and 1991 (Salmon & Black 1986, Kirby et al. 1992).

This paper presents the Swedish results from the special Whooper Swan census, compares them with former country-wide midwinter counts and considers the population development as illustrated by the midwinter indices. Moreover, data on the habitat selection of swans are analysed to elucidate the change to a higher degree of field feeding that was noted in south Sweden.

Material and methods

The methods used in the IWC have been described in several earlier reports (cf. Nilsson 1975, 1991). In the early years, following the development of the IWC in January 1967, country-wide surveys were attempted (Nilsson 1975) and more or less complete coverage of the swan sites was obtained in 1971–1973. In subsequent years, coverage was not complete for Whooper Swans (only for the main duck species), but from 1987 to 1989 country-wide coverage was once again attempted. For coastal areas a complete coverage in the Baltic was also
obtained in 1993 in connection with a special survey of waterfowl in the entire Baltic (Durinck et al 1994).

Indices presented here have been calculated according to the standard method of the IWC, i.e. by pair-wise comparisons of the totals for sites counted in two consecutive years (Rüger et al 1986, see also Nilsson 1975). The primary indices so obtained have then been recalculated in relation to the index of the base-year (1973) being set to 100. To avoid the influence of extreme years indices have then been recalculated once more so that the mean index for the years 1969–78 = 100. Separate indices for inland and coastal sites have also been calculated.

In the 1995 survey the aim was to obtain complete coverage of Whooper Swans in Sweden, as part of the International Whooper Swan Census. To achieve this goal, all former counters from the midwinter counts were contacted as were a large number of other ornithologists, bird clubs, report committees etc. Contacts with observers were established in all areas where swans had been found over the years of duck and goose counts. For each flock observed data on numbers, ages, habitat choice, etc. were registered. The counts were undertaken at the same time as the IWC in mid January.

Besides the field choice data obtained in January 1995, observations on habitat selection by Whooper Swans in Scania had been collected mainly by the author during more or less monthly goose surveys over a number of years covering the entire winter period, mostly in the south-western and central parts of the province. The counts were made during mid-day and thus covers feeding areas.
Table 1. Regional totals of Whooper Swans *Cygnus cygnus* in Sweden in January 1995. Letters in brackets denote the different counties and refer to the map in Figure 1.

<table>
<thead>
<tr>
<th>County Län</th>
<th>Total Antal</th>
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<tr>
<td>Skåne (L,M)</td>
<td>2303</td>
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<tr>
<td>Blekinge (K)</td>
<td>341</td>
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<tr>
<td>Öland (J)</td>
<td>131</td>
</tr>
<tr>
<td>Gotland (I)</td>
<td>513</td>
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<td>Kalmar län (mainland, H)</td>
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<tr>
<td>Kronoberg (G)</td>
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<td>Jönköping (F)</td>
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<td>Halland (N)</td>
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<tr>
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<td>Älvsborg (P)</td>
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<td>Östergötland (E)</td>
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<td>Örebro (T)</td>
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<td>Jämtland (Z)</td>
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</tr>
<tr>
<td>Total Summa</td>
<td>7439</td>
</tr>
</tbody>
</table>

**Results**

**Numbers and distribution in 1995**

In all, 7439 Whooper Swans were counted during the 1995 survey in Sweden, 2240 of which in the southernmost province of Scania. The species was well spread over the southern part of the country but with a concentration to the west coast and Scania (Figure 1, Table 1).

The coverage in most provinces was good, especially around the coasts, where all areas of importance for the species were covered with the exception of small parts on Öland and in Bohuslän. The missing parts on Öland are not known to be of any great importance for the Whooper Swan, but the areas in Bohuslän can be more important. For instance, two weeks before the count, 1000 swans were present around the island of Orust (also covered at the count) compared to 877 reported from the entire province at the time of the census. As some areas could not be covered (others were frozen in between), it is uncertain how many left the province and how many were redistributed. It is possible that up to 300–400 were present in uncounted parts of Bohuslän. Smaller numbers also may have been overlooked elsewhere, so it is highly probable that the total number of Whooper Swans in the country in January 1995 exceeded 8000 but it is unlikely that there were more than 9000 Whooper Swans in the country.

**Population changes**

Annual indices, based on the IWC mid-winter counts in Sweden 1967–1997 (Figure 2), did not show any clear trend but only fluctuations between different years (Regression Index vs. Year for the whole series: R=0.32, P=0.07). A regression analysis indicates an increasing trend from 1979 or 1980 onwards, which reaches significance if starting with 1979 (a low during a cold winter, R=0.57, P=0.011) but not if starting with 1980 (R=0.45, P=0.061).

The information from country-wide midwinter counts made during the more comprehensive surveys in Sweden in January 1971–1973, 1987–1989 and the special survey in 1995 (Table 2), on the other hand, does show a recent increase. Comparing 1995 with the two earlier periods, there was probably a slight increase in coverage for the 1995 census since special surveys for swans feeding in fields were undertaken. The two earlier periods in which country-wide midwinter counts were undertaken had similar coverage. During 1971–1973 the habit of field feeding was not so wide-spread and the totals in Table 2 are probably fairly close to the real numbers present. In 1988 and 1989 the coverage of water areas was adequate and similar to 1995 but field


Figure 3. Separate midwinter indices for Whooper Swans *Cygnus cygnus* on coastal (triangles and broken line) and inland (squares and whole line) sites in Sweden 1967–1997.


Figure 4. Regional indices for Scania (curve) and actual numbers counted (bars) of Whooper Swans *Cygnus cygnus* in the southern part of the Öresund in Scania (coastal area) at mid-January counts in 1964–1997.

Regionala index för Skåne (kurva) och antalet inträknade (staplar) sångsvanar *Cygnus cygnus* i södra delen av Öresund (kust) vid inventeringar i mitten av januari 1964–1997.
Field feeding

Traditionally, Whooper Swans used areas of open water for both resting and feeding. Even though many Whooper Swans now feed on land, about 70% of all Whooper Swans counted in January 1995 were still found on water-bodies, many on quite small streams. Overall, 30% of the 7440 Whooper Swans recorded in January 1995 were counted on coastal waters, 40% on fresh water and 30% on land (Figure 5).

There are marked regional differences in the distribution of swans across different habitats. In Scania, 63% (n=2414) of the swans seen in January 1995 were feeding on arable fields and grassland, whereas this proportion was about 35% (n=1172) in the south-eastern part of the country and 12-13% (n=1215, 2665, respectively) in the two other regions (Figure 5). The frequency of field feeding is related to the availability of fields without too much snow and is thus restricted to the southernmost part of the country. Aquatic vegetation is available at least in streaming water all over the part of Sweden covered in the census.

In Scania, more than one third of the swans were clear from the counts along the coasts of SW Öresund during 1964–1997, where the numbers in coastal flocks is much lower in the eighties and nineties than in the sixties and early seventies (Figure 4). The regional midwinter indices for Scania (inland and coastal sites together) show an increase to 1986 followed by markedly lower indices in later years (relating to the spread of the field feeding habit, see below).

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In Scania, more than one third of the swans were
seen on fields of winter rape, with winter wheat used by more swans than grasslands. In the other parts of the country, swans using fields were seen mainly on winter wheat and grasslands, but most were recorded on inland or coastal waters (Figure 5).

Seasonal variation in the swan’s use of different field types in SW Scania is shown in Figure 6. Fields of winter rape and winter wheat attracted the largest numbers of swans throughout the winter. Few were seen on grassland, but this habitat is restricted in this part of Scania compared to arable land. During January and February the predominant use of rape was very marked with about 70% of the swans seen on this crop and most of the other swans being seen on winter wheat. During November and December about 30% of the swans seen feeding on fields in Scania were on harvested sugar beet fields feeding on spill. From late December practically all sugar beet fields were ploughed, however, or otherwise unavailable to the swans due to freezing conditions, which changed to other crops as the sugar beets were not possible to dig out.

As the waterfowl counts over the years have concentrated on sites with open water there are no clear data to show when the tradition of field feeding started among the Whooper Swans wintering in southern Sweden. Some ideas can be obtained, however, by comparing the graph showing the annual national indices (Figure 2) with the changes in numbers in the Öresund study area (Figure 4).

Figure 4 shows marked fluctuations in the number of Whooper Swans in the southern part of Öresund during the sixties, the fluctuations following changes in the indices covering the entire province (both inland and coastal sites). Some field feeding by Whooper Swan flocks were seen in the sixties, but the observations were few and mostly restricted to special occasions, such as the very cold winter of 1963 when almost no open water was available.

During the mild winters of the seventies, Whooper Swans decreased in the coastal Öresund area at the same time as they increased inland, as illustrated by the overall indices for Scania in Figure 4. Between the seventies and the country-wide survey in 1987, the increase in the Scanian index agreed with expectations, given the change in the national totals (Table 2, Figure 4). After the cold winter of 1987 indices for Scania showed a marked decrease, perhaps related to a movement of feeding Whooper Swans to feeding areas away from the sites included in the waterfowl counts. The indices may then show a decrease when the population actually is increasing. Indices were somewhat higher again during the recent colder winters. Regional totals for Scania increased from 1987–1989 to 1995 as in the rest of the country. The total counts in 1987–1989 were 1088, 875 and 767 Whooper Swans in Scania compared to 2414 in January 1995.

Discussion

The country wide surveys in Sweden clearly show that the population of Whooper Swans wintering in the country has risen in line with the general increase in the breeding population. The increase in the winter population is not as marked as the increase in the Swedish breeding population (Arvidsson 1987), where the estimated population in the two northernmost provinces Västerbotten and Norrbotten (130,000 square kilometres or about one third of the country) increased from about 310 pairs (120 nests) in 1973–1975 to about 2800 pairs (1800 nests) in 1997 (Haapanen & Nilsson 1979, Nilsson et al., in prep.). However, a large proportion of the Whooper Swans of northernmost Sweden probably winter at the Norwegian coast, whereas the winter population in southern Sweden includes swans both from Sweden and from more easterly breeding areas (Mathiasson 1991, Preuss 1981). Indices from the midwinter counts (IWC) did not show a significant change in the wintering population between 1967 and 1994, although there were some indications of an increasing trend from 1979 onwards. Differing trends were found for coastal and inland sites, however, with indices increasing inland and decreasing for coastal waters. This lack of agreement between the country-wide surveys and the midwinter indices may be related to a change in habitat selection in part of the winter area, with Whooper Swans in South Sweden, especially in Scania, to a large extent feeding in fields far away from the wetlands covered by the IWC.

The indices from the IWC presented by Rose (1995) indicate a doubling of the Continental West European wintering population since 1974. Even if the breeding population of northern Sweden (and also other parts of Fennoscandia) has increased at a higher rate since then (Nilsson et al., in prep., Ohtonen 1992), there are no census data from more easterly breeding areas. Addressing the situation on the European level would be premature, in advance of an analysis of the 1995 survey (Laubek et al., in prep.), but separate reports indicate that Whooper Swans to a large extent feed in fields (Cranswick et al. 1996, Laubek 1995, Rees et al. 1997).

Field feeding by Whooper Swans now seems to be
feeding on winter cereals close to their normal hard winter of 1963, when some flocks were seen in the most provinces where the lighter snow coverage allows the swans to reach the crops. Data on the start of the field feeding habit are scarce. The first observations recorded in Sweden were made during the hard winter of 1963, when some flocks were seen feeding on winter cereals close to their normal aquatic feeding areas during icy periods. Brazil (1984) mention that the first field-feeding Whooper Swans in Scotland were seen in relation to the hard winters of the 1940s, when a proportion of the swans took up the habit of flying inland to feed returning to roost at night on the water. The change in feeding habits may have been triggered by food shortage in periods when aquatic vegetation could not be reached due to freezing conditions, but when snow free fields were available, leading to the swans detecting new feeding opportunities.

Similarly marked changes in feeding habits have been noticed for Bewick’s Swans wintering in the Netherlands, which up to the late sixties fed mainly on aquatic vegetation before switching to arable land and grassland (Dirksen et al. 1991). The Bewick’s still prefer Potamogeton tubers, but since 1975 this food source is depleted by the birds in just one or two months, after which the swans change to other habitats.

Whereas there are clear indications that the shift from feeding in aquatic areas to field feeding in the Bewick’s Swans in the Netherlands (Dirksen et al. 1991) is associated with food depletion, the situation is less clear for the Whooper Swan in mild winters. Even though there are no data to show that the same applies to them, it is quite possible that the change to field feeding is due to food depletion in the aquatic habitats in southernmost Sweden, which in turn is due to the increasing population. The eutrophication of many lakes has also led to a shift from macrophytes to planctonic production, leading to a decrease in the available food resources for swans in some lakes. There are, however, no indications of such influences for the shallow coastal areas in Scania, where extensive meadows of submerged vegetation of extensive Zostera beds and Ruppia are available for Whooper Swans and Mute Swans during all but the very coldest winters (Nilsson 1996).

The most important factor behind the field feeding of Whooper Swans in recent years is probably also changes in agriculture. Sugar beet were hardly ever available for swans and geese feeding in south Sweden in the 1950s, being an important food item in the autumn from the 1960s onwards, after the introduction of mechanical harvesting methods (Nilsson & Persson 1991). The larger acreage of autumn sown cereals is probably also important as is the introduction of new varieties of some crops, such as the new more tasty variety of oilseed rape used in recent years.
References


Sammanfattning


Mot denna bakgrund organiserade Wetlands International en speciell inventering i januari 1995 avsedd att täcka alla sångsvanlokaler av betydelse i de länder som utnyttjas av den Fennoskandisk-Ryska häckpopulationen. I denna uppsats analyseras data från den internationella inventeringen och jämförs med resultaten från sjöfågelinventeringarna för att belysa långtidsförändringar i det övervintrande sångsvanbeståndet.

Material och metoder

Antal och utbredning 1995


Beståndsförändringar


Analyseras index för kust och inlandslokalser separat finner man en signifikant upptågande trend för inlandslokalerna (R=0,64, P<0,001), medan en nedgång antyds för kustlokalerna (Figur 3). Förändringarna kan tydas som en minskad tendens att vistas vid kustlokalerna i sydligaste Sverige under senare år, vilket framgår av inventeringsresultaten från Skåne, där antalet övervitrare i Öresund minskat kraftigt sedan 1960-talet, medan totalindex för Skåne visat en ökning fram till senare delen av 1980-talet följt av minskande Skåneindex för den senaste perioden med milda vintrar (Figur 4).

Fältval

Vid inventeringen i januari 1995 återfanns 70% av sångsvanarna på vattenbiotoper, medan 30% noterades på olika fält, ibland långt från vatten. Markanta skillnader föreligger mellan olika delar av landet, så noterades t.ex. 63% av sångsvanarna i Skåne på olika fält, medan motsvarande andel i SE Sverige var 35% och i övriga Sverige 12–13% (Figur 5). Under vintern var raps den dominerande fälttypen för de födosökande sångsvanarna i Skåne följt av höstsädd.

Underväder säsongen är raps och höstsädd de dominerande fälttyperna för de födosökande sångsvanarna i SV Skåne, men under november och december återfinns också många av sångsvanarna på resterna efter sockerbetskörd. Under hösten utnyttjas också om än i mindre grad, skördade fält med andra grödor, t.ex. potatis.


Diskussion

De landsomfattande inventeringarna i Sverige visar tydligt en ökning i vinterbeståndet parallellt med den ökning som noterats för det häckande beståndet, även om den inte är lika stor. Ökningen återfinns emellertid inte i det nationella sångsvanindex även om en viss ökning antyds och de internationella inventeringarna visar en ökande trend. Bristen på överensstämmelse mellan de landsomfattande inventeringarna och de årliga index förklaras av sångsvanarnas ändrade furageringsvanor med fler och fler sångsvanar sökande fält på fält långt från vatten jämfört med tidigare.


Sångsvanarnas födosök på land är en relativt sen vana och i Sverige begränsad till de sydligaste delarna där snöjudet inte är för högt. Första iakttagel­serna gjordes i samband med en hård isvinter 1963,