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Waterbird dynamics at the shallow Lake Krankesjön, southern Sweden: a long-term study

Beståndsvariationer i Krankesjöns simfågelfauna: en långtidsstudie

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Abstract

This paper reports the within-year and between-year variations in the number of waterbirds at Lake Krankesjön, southern Sweden based on counts carried out during 1985 to 2007. The background to these counts was a dramatic decrease in the number of Great Crested Grebe *Podiceps cristatus*, Mute Swan *Cygnus olor* and Common Coot *Fulica atra* from 1974 to 1976, concurrent with a deterioration of water transparency and a nearly total disappearance of submerged vegetation. In 1985, when the regular counts of waterbirds started, the lake had just begun to recover. Numbers of moulting and staging waterbirds increased rapidly as the conditions improved. Numbers of grebes, swans and coots over the two decades correlated with limnological variables, and it is concluded that their numbers depend on the amount of submerged vegetation, in turn determined by water transparency.

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Introduction

Lake Krankesjön in southern Sweden (55°42' N, 13°28') got its reputation as a first class bird-lake through Swanberg's (1931) book on its bird fauna and, in particular, by his discovery of a colony of Black-necked Grebes *Podiceps nigricollis*, the first breeding record of the species in Sweden. The Black-necked Grebes seem to have disappeared from the lake some time during the latter part of the 1930s, but the lake's popularity among bird watchers has remained to the present day. However, in the years 1974–1976 a drastic decline in the populations of some waterbirds was recorded (Karlsson et al. 1976). Although the observations on which this conclusion was drawn were made without a spottingscope (only binoculars were used) and some of the figures therefore may be on the low side, there is no doubt that the decline in waterbird numbers was both real and dramatic. Thus, the mean number of Great Crested Grebes *Podiceps cristatus* observed in July fell from 50 in 1974 to only 3.5 in 1976; the number of Mute Swans *Cygnus olor* during July–September from a mean of 40.6 to 0.5; and those of Common Coots *Fulica atra* during the same period from c. 1000 to a single bird (calculated from Karlsson et al. 1976). That these changes were a local phenomenon is shown by data from the Swedish Waterbird Counts: the 1976 index figures for both Common Coot and Mute Swan were very high, for the Coot the highest during the period 1963–2006 (Nilsson 2007). Concurrent with the decrease in bird numbers a change occurred in the transparency of the lake's water. From having been relatively clear, the water became highly turbid, and this change seems to have taken place very rapidly. This had the effect that practically all submerged vegetation, which had been dominated by *Chara* spp., disappeared. Interestingly, the same change took place simultaneously at another shallow lake, Lake Björkesåkrasjön, 19 km to the south of Lake Krankesjön (Karlsson et al. 1976). Unfortunately, few limnological data exist for the period immediately after the drastic deterioration of the lake in the mid-1970s, but those few that exist show that the poor state of the lake remained for more than ten years (Andersson et al. 1990). Thus, in 1982 water turbidity was very high and transparency correspondingly low.

To study the relationship between bird numbers and various limnological variables, the late G. Andersson started regular counts of the lake's water-

bird community in summer 1985. With two gaps, in 1997 and in 2000, these counts have continued to the present day. As will be shown below, the waterbird counts started at about the same time as the lake began to recover (also cf. Andersson et al. 1990). The aim of the present paper is to present the results of the first 21 years of the study. We first describe, for the majority of the waterbird species, their seasonal pattern of occurrence and then their population fluctuations. However, we do not treat grebes other than the Great Crested Grebe, geese, herons, rails (other than the Common Coot), gulls and terns, nor any of the various rare birds that have visited the lake only occasionally. Finally we discuss possible causes for the numerical fluctuations of the waterbird community, with an emphasis on those few species that seem to be good indicators of the limnological status of the lake.

Methods

Study area

Lake Krankesjön, 3.4 km^2 in area, is very shallow, with large parts less than a metre deep. In a restricted area, the water depth reaches 3 m, but most of the lake is much shallower and has a mean depth of c. 1.5 m. During periods with clear water about half of the lake's bottom area is covered with submerged plants, especially charophytes, which dominate the bottom vegetation of most of the lake. Smaller areas with *Potamogeton pectinatus* also occur. The lake is fringed by reeds *Phragmites australis* that form more extensive beds in the west and in the southeast. In the eastern part there are also a few small, isolated clumps of reeds as well as low, island-like stands of *Acorus calamus*, *Sparganium*, etc. Two very small streams enter the lake, one from the southwest, one from the southeast, while the outflow is towards the north. The lake is surrounded by the permanent grasslands of a military training area, so the small streams bring only small amounts of nitrogen and phosphorus from agriculture to the lake.

Bird counts

The waterbirds were counted from two bird observation towers, one on the southern shore, one in the east. During the early years, supplementary observations were sometimes also made from a gap in the vegetation on the northern shore. From summer 1985, when the monitoring of the waterbirds started, until 2003, birds were normally counted twice a month. In most years counts started in mid-April and continued until mid-October, but in some years they also included the winter months. After 2003, counts have been more frequent and have been carried out year-round. A few gaps exist in the data series. As mentioned above, no counts were carried out in 1997 and 2000, and in 2001 they did not start until July. The number of counts is given in Table 1. It is important to note that, during the last four years, not all waterbird species were counted during each visit; sometimes only the individuals of some of the more important species (e.g. Mute Swan, Common Pochard *Aythya ferina*, Common Coot) were counted or, more often, most but not all species.

Observations were made with binoculars and (mainly) with spottingscopes. With the better optics available during the last four years, observations were quite frequently made only from the eastern observation tower, from which all of the lake can be viewed. In conditions of good visibility, it is possible to find and identify birds also in the westernmost part of the lake (which usually accommodates fewer birds than the central and eastern parts). However, during counts from the eastern tower only, it is likely that a few birds have been missed sometimes, for instance single female Tufted Ducks *Aythya fuligula* and, in winter, female Smews *Mergus albellus*. Such misses, however, fall within the error margins of the counts and are totally unimportant for the main aim of the study.

Sometimes numbers for a particular species varied markedly between adjacent counts, even on a day-to-day basis. Such variation can have two causes: a turnover of individuals or counting errors. Often it was obvious that the first applied, for instance for some species of dabbling duck in autumn, when flocks sometimes were seen arriving at the lake, or leaving, during a count. In other cases counting errors seem more likely. The precision of counts of Coot depends strongly on the birds' dispersion on the lake; when Coots packed tightly together in response to the appearance of a White-tailed Eagle *Haliaeetus albicilla*, they were impossible to count altogether. Also when ice had concentrated them to small areas of open water, counting was difficult, but also in more normal conditions, the form of the flocks influenced the accuracy of the counts. For one species in particular, the Great Crested Grebe, the number detected was strongly dependent on wind speed. As soon as there was some wave action, grebes became difficult to detect. Also their diving activity and long under-water stays influenced the chances of detecting them.

To test for possible trends in the material and to look for correlations between bird numbers and year,

Table 1. Number of days per month and year that waterbirds were counted at Lake Krankesjön during 1985–2007. Note that the bi-monthly counts in 2003 have been supplemented with additional data and that, in the period 2004–2007, not all species were counted on every visit.
Antal dagar per månad och år som simfåglar räknades i Krankesjön 1985–2007. Under åren 2004–2007 räknades inte alltid samtliga arter vid varje besök. Räkningarna 2003 har kompletterats med en del räkningar utanför de ordinarie räkningarna.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1985	-	-	-	-	-	1	1	1	3	2	1	1	10
1986	-	-	-	2	3	2	2	2	2	3	-	1	17
1987	-	-	-	2	1	2	2	2	4	4	1	1	19
1988	1	1	2	2	1	3	2	1	2	1	2	-	18
1089	1	2	1	3	2	1	2	3	2	1	2	1	21
1990	1	1	3	2	1	2	2	2	4	1	2	1	22
1991	-	-	2	2	2	2	2	1	2	2	2	-	17
1992	1	-	1	2	2	2	3	1	4	2	1	1	20
1993	1	-	1	2	1	2	3	1	2	2	-	-	15
1994	1	-	-	2	1	2	3	1	2	2	-	-	14
1995	-	-	-	2	2	1	3	2	2	2	1	-	15
1996	-	-	-	3	2	2	2	2	2	2	1	-	16
1997	-	-	-	-	-	-	-	-	-	-	-	-	0
1998	-	.	-	2	2	2	2	1	2	2	-	-	13
1999	-	-	-	1	2	3	2	2	2	1	-	-	13
2000	-	-	-	-	-	-	-	-	-	-	-	-	0
2001	-	-	-	-	-	-	1	2	2	1	1	-	7
2002	-	-	-	3	2	1	2	2	2	3	-	-	15
2003	-	-	3	9	4	3	2	2	5	3	-	-	31
2004	3	6	13	8	10	3	7	3	7	12	6	3	81
2005	3	3	6	14	9	3	4	5	7	11	4	1	70
2006	3	1	3	11	2	2	4	8	11	14	5	6	70
2007	2	4	9	10	8	2	6	8	11	16	10	6	92
Total	17	18	44	82	57	41	57	52	80	87	39	22	596

we used the non-parametric Spearman rank correlation, for correlations between bird numbers and environmental variables we used Pearson correlations. Calculations were made in SYSTAT (Wilkinson 1990); 2-tailed P-values are given throughout.

Results

The annual cycle

Here we describe the seasonal occurrence of a number of waterbird species at Lake Krankesjön, mainly in the form of a series of diagrams. For two reasons, the presentation is restricted to the years 2004 to 2007. First, and most important, in the earlier material counts are often lacking for the winter months (November to March) and, second, in most years too few counts were carried out to provide a good characterization of the birds' seasonal presence on the lake. The diagrams are intended to show the general seasonal pattern of occurrence of the species but also to reflect differences in timing and numbers between the four years. For six species, Great Crested Grebe, Great Cormorant *Phalacrocorax carbo*, Mallard *Anas platyrhynchos*, Northern Pintail *Anas acuta*, Smew and Goosander *Mergus merganser*, the four years have been combined to provide a clearer picture of their seasonal presence on the lake despite the fact that this obscures differences between years. The diagrams are accompanied by commenting texts; some species that occur in low numbers or very erratically are treated in text only.

Not all species were counted on each visit to the lake, and since zero occurrence (i.e. no individual detected) is not indicated in the diagrams, gaps can be the result of the species either not being counted or not being seen. Moreover, as pointed out above, variation in numbers between adjacent days can have different causes. Where appropriate, the reasons for such variation are mentioned in the treatment of the respective species.

In the diagrams, time of year is given as day

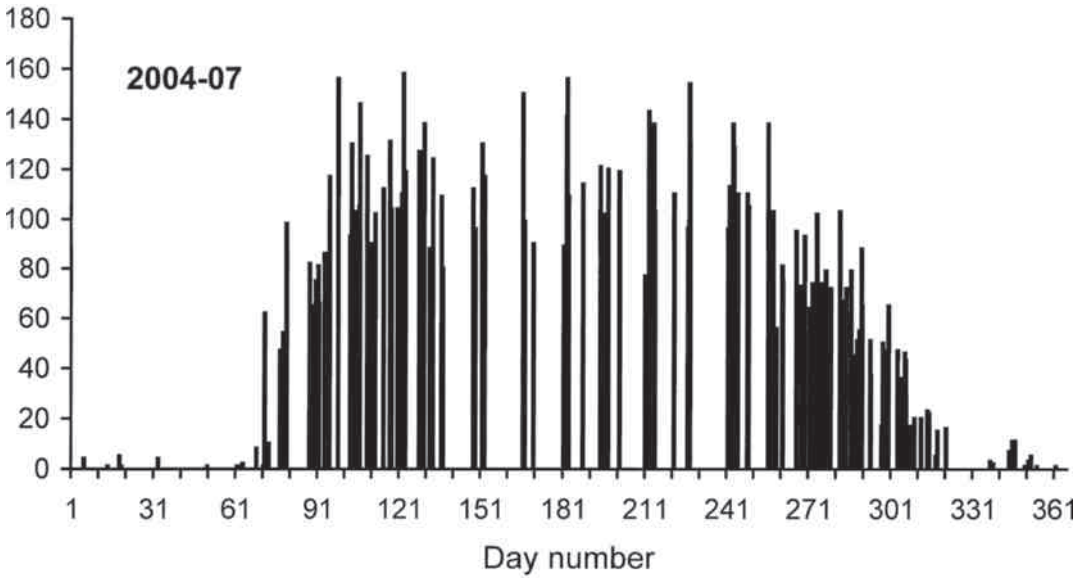

Figure 1. The seasonal occurrence of Great Crested Grebe at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av skäggdopping i Krankesjön. Kombinerade data för åren 2004–2007.

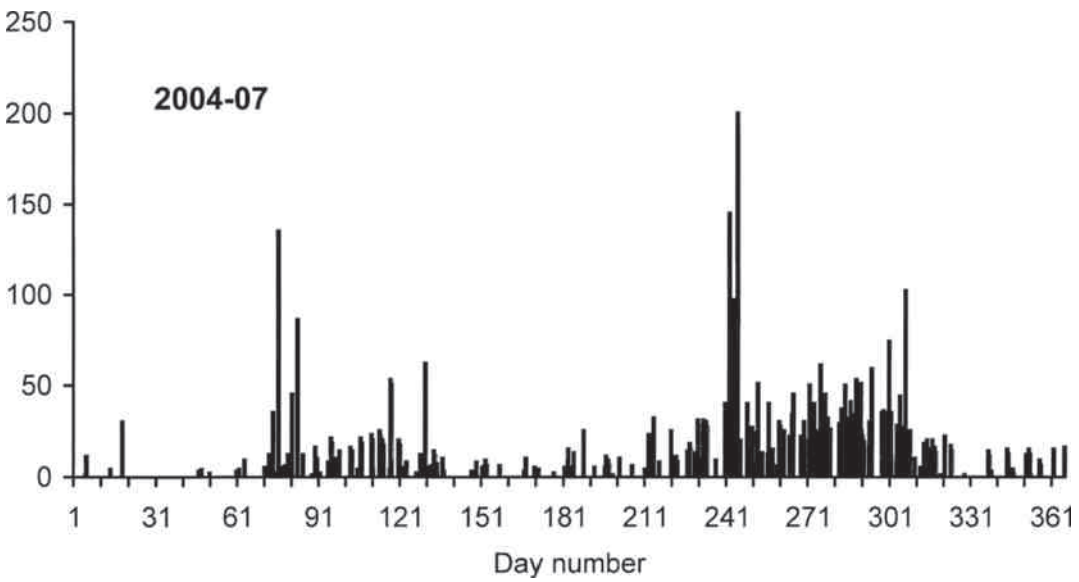

Figure 2. The seasonal occurrence of Great Cormorant at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av storskarv i Krankesjön. Kombinerade data för åren 2004-07.

Great Crested Grebe Skäggdopping *(all photos: Hans Källander)*

Great Cormorant Phalacrocorax carbo

number, Day 1 = 1 January and Day 365 = 31 December. Thus, disregarding the leap-year, 1 July is Day 182. With one important exception, the scale of the Y-axes has been kept identical within (but not between) species to facilitate comparison between years. The exception is the Figure for the European Teal *Anas crecca*, in which scales differ considerably. Throughout, the Y-axis shows the number of individuals; the labelling has been omitted for technical reasons.

Great Crested Grebe *Podiceps cristatus* (Figure 1). Five Great Crested Grebes apparently wintered on the lake in 2006/07 (birds were seen in both December and January, and later in winter). Normally the species arrived at the lake when the ice broke up or, after ice-free winters, at about the same time, viz. during the first half of March. Numbers then increased rapidly. Spring 2006 was an exception in so far that the lake froze late and ice remained until the end of March. However, once the ice was gone, grebes immediately arrived, 24 grebes on 1 April and no less than 117 four days later. In all four years numbers remained high over summer, with some 130–150 birds until mid-September, after which there was a steady decrease. After mid-November very few Great Crested Grebes remained on the lake, in contrast to the situation at the much larger Lake Vombsjön (c. 12 km^2), where the number of staging grebes peaks at that time (Källander 2006). This pattern of occurrence of Great Crested Grebes seems to be typical for Lake Krankesjön and is reflected also in the material collected prior to 2004. Two additional remarks should be added. First, until August, Figure 1 is based on number of adult grebes observed. Thereafter also juveniles were included. The date this was done differed between years but, interestingly, this is not reflected in the diagrams in the form of a sudden increase in numbers. The second point is, as mentioned above, that the Great Crested Grebes are difficult to count accurately in windy conditions, even moderate winds making them difficult to detect. This is without doubt the main reason for the relatively large variation in numbers between counts, but also the level of diving activity has a strong influence on detectability (cf. Källander 2008).

Great Cormorant *Phalacrocorax carbo* (Figure 2). During 2004–2007 Cormorants were seen at the lake almost year-round, except during periods when the lake was frozen. Numbers were generally lower during spring and summer than during autumn. The highest numbers (e.g., 135 on 17 March 2004, 145 on 30 August 2004, 200 on 2 September 2004) are an effect of temporary visits by migrating flocks that landed on the lake and foraged there for a few hours before departing in a northeasterly (spring) or southwesterly direction (autumn). The large number (102) on 2 November (in 2007) is the result of counting the birds going to roost in willow trees *Salix* sp. at the mouth of the small stream that enters the lake from the southeast. Although most birds at the roost came from the lake, birds also arrived from other directions. The figure therefore includes birds that had spent the day elsewhere. Although flock-fishing cormorants are easy to detect, birds fishing alone are much more difficult to spot. For this reason, it is likely that counts during the day to some extent have underestimated the true number present. It seems fairly safe to say, however, that during the last few years some 25–30 cormorants have used the lake regularly during spring, while about 40–50 have used it during autumn.

Whooper Swan *Cygnus cygnus*. On the whole, Whooper Swans are not very common at Lake Krankesjön, but small numbers are seen in winter. There was a small peak during March, but numbers were very low (max 11 birds). At that time, migrating flocks were often seen passing the lake without landing. Birds on autumn migration started arriving in October and up to 30 individuals were recorded on a few occasions at the end of October and during the first half of November.

Mute Swan *Cygnus olor* (Figure 3). Even disregarding the long period of ice in January–March 2006, the Mute Swan's seasonal population pattern varied between the four years (Figure 3 only refers to adult, all-white birds). In 2004, winter numbers decreased gradually until early April, whereas in 2005 this decrease was abrupt. After this spring low, the pattern was roughly similar in the two years until the end of the year, however with slightly lower numbers in October–November in 2004. In 2006 numbers were generally lower than in the three other years, with only a small peak in late July–August, after which numbers, with a few exceptions, remained low until the end of the year. These low numbers then prevailed until early April 2007 despite the winter being extremely mild (compare the November–December numbers in the other three years with those in 2006). In 2007 numbers increased steadily from late October (and reached over 200 adults in early January 2008).

European Wigeon *Anas penelope* (Figure 4). As for most of the other dabbling ducks, Wigeon numbers showed two peaks, one in spring and the other in autumn. The spring peaks differed greatly in size. Thus, in 2006, when the lake did not become ice-free until the end of March, the highest spring

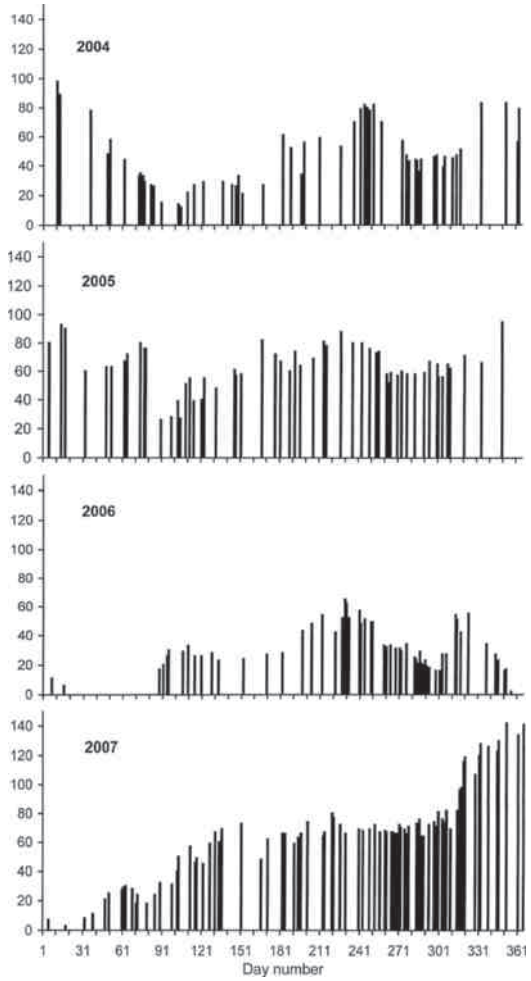

Figure 3. The seasonal occurrence of Mute Swan at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av knölsvan i Krankesjön åren 2004–2007.

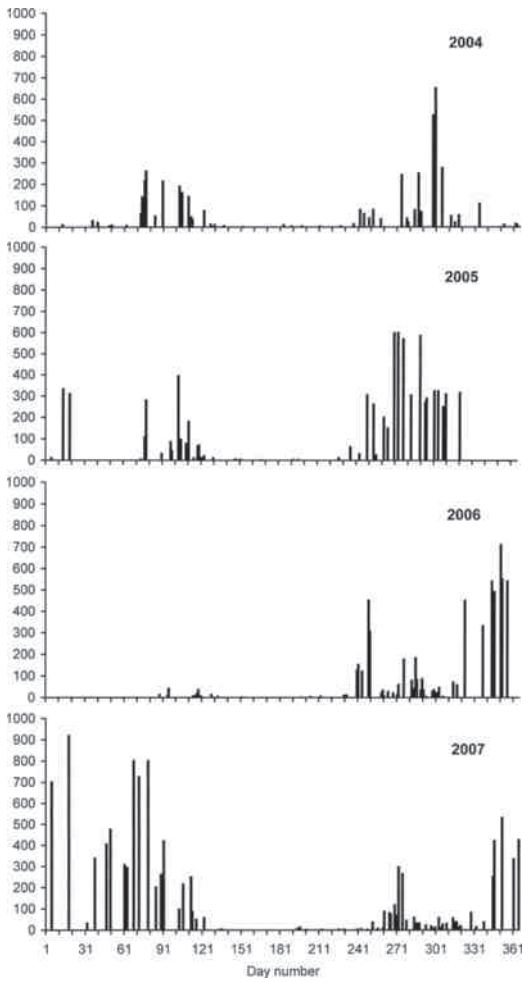

Figure 4. The seasonal occurrence of European Wigeon at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av bläsand i Krankesjön åren 2004–2007.

number recorded was only 41 birds vs 300–400 in the two preceding years. Both 2005 and 2007 were a bit exceptional (compared with those years in the period 1985–2003 from which winter data exist) in that large numbers of Wigeon were present in January (>900 in 2007). In both years the Wigeon disappeared when the lake froze, only to return as soon as the ice melted. Both this temporary absence and the influx of Wigeon in early winter in 2006 and 2007, after the normal migration period (Edelstam 1972, Ulfstrand et al. 1974), suggest that the birds arrived from near areas, such as the coast of the sound between Sweden and Denmark, where large numbers of Wigeon have recently started to winter (Nilsson 2007). During the migration period in autumn, peak numbers in both these years were only half of those in 2004 and 2005.

Mallard *Anas platyrhychos* (Figure 5). During much of the year, Mallards were difficult to count because they tended to loaf in the shelter of reed beds during the day. This was sometimes demonstrated very clearly when White-tailed Eagles vis-

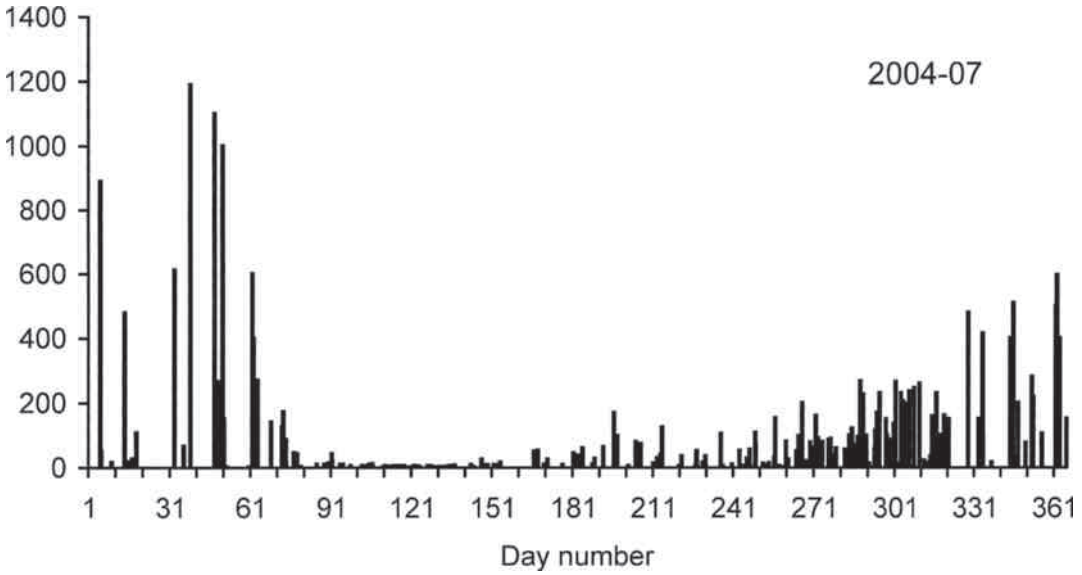

Figure 5. The seasonal occurrence of Mallard at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av gräsand i Krankesjön. Kombinerade data för åren 2004–2007.

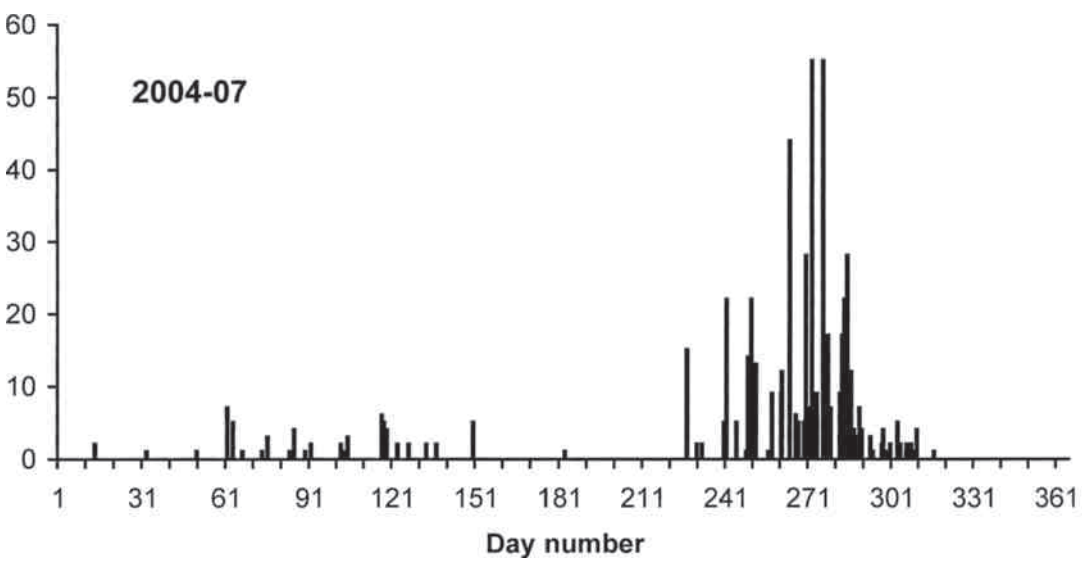

Figure 6. The seasonal occurrence of Northern Pintail at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av stjärtand i Krankesjön. Kombinerade data för åren 2004–2007.

ited the lake, which in recent years they did year-round. Before the appearance of an eagle, a few tens of Mallards would have been counted; when they took flight in response to the eagle they sometimes turned out to be more than five times as many. Even so, Figure 5 gives a reasonably correct picture of the Mallard's presence at the lake. From April until June, i.e. the incubation and brood-rearing periods, very few Mallards were seen. Somewhat more birds were seen during the period of summer moult, and especially from about mid-September. The highest numbers occurred in winter, as long as at least some open water remained, a pattern also reflected in data from the earlier years of the study. The highly variable figures for January to March, both within and between years, are strongly related to the ice situation.

Northern Pintail *Anas acuta* (Figure 6). Spring numbers were always low, only once during 1985–2007 reaching 20 individuals, while autumn numbers were higher, but mostly below 50. The autumn peak fell at the end of September.

Gadwall *Anas strepera* (Figure 7). Gadwall numbers showed a fairly consistent pattern across the four years, with low numbers at least until mid-June, and a peak in the first half of September. As for the Mute Swan and Coot (see below), numbers in 2006 were lower than in the other three years.

Northern Shoveler *Anas clyepata* (Figure 8). As for the other dabbling ducks, numbers were lower in spring than in autumn, with (low) peaks in the second half of April (in 2005 the largest number was seen on 1 May). Numbers were very low in summer, but started to increase by mid-August. While the autumn peak occurred in October and November in 2004 and 2005, respectively, it was much earlier in both 2006 and 2007. Numbers also varied considerably between the four years; only in 2006 did they exceed 100 on any count.

Common Teal *Anas crecca* (Figure 9). The Teal showed a very variable pattern (notice the different scales in the diagrams), both with respect to seasonal occurrence during the four years and numbers observed. There was also considerable day-to-day variation in numbers, probably reflecting a high turnover of individuals but partly also variation in detectability. During autumn in particular, Teal, in common with Mallard, tended to loaf in shelter and only became visible after disturbance. As for Wigeon, extremely high numbers were present during the winter 2006/2007, with 2000 individuals being present by mid-January 2007.

Garganey *Anas querquedula*. The Garganey is the rarest of the dabbling ducks and was normally seen in just a few individuals mainly during April and May, with a peak around 1 May. The very few autumn observations were in August and the first half of September.

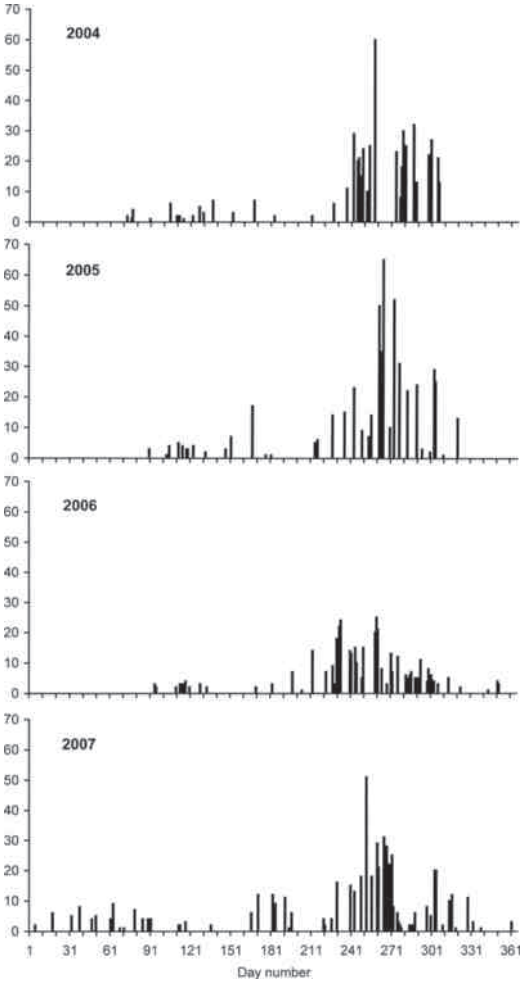

Figure 7. The seasonal occurrence of Gadwall at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av snatterand i Krankesjön åren 2004–2007.

Common Pochard *Aythya ferina* (Figure 10). Disregarding birds counted in December and January, i.e. wintering birds, the Pochard's seasonal pattern of occurrence at Lake Krankesjön was fairly consistent across the four years, albeit with some variation in numbers. Thus, numbers in autumn 2004 were higher than those in the other three years,

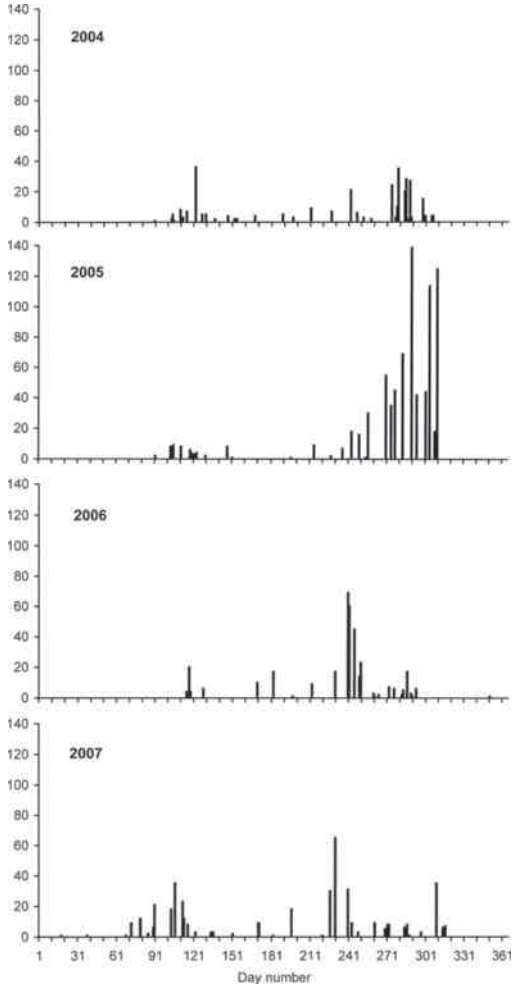

Figure 8. The seasonal occurrence of Northern Shoveler at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av skedand i Krankesjön åren 2004–2007.

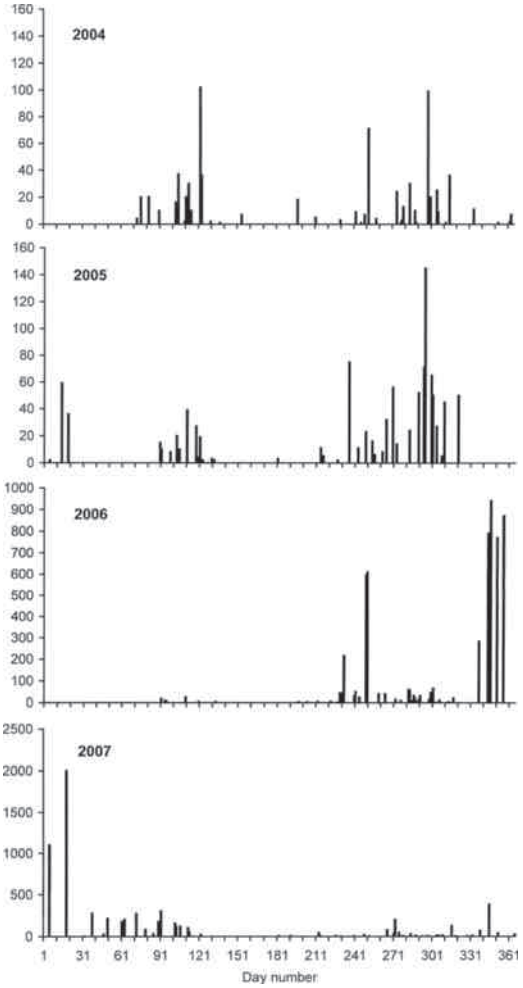

Figure 9. The seasonal occurrence of Common Teal at Lake Krankesjön in 2004 to 2007. Note the widely varying scales in the different diagrams.
Den årstidsmässiga förekomsten av kricka i Krankesjön åren 2004–2007. Observera att delfigurernas skalor skiljer sig åt markant.

while low spring numbers in 2006 may have been an effect of the late ice break-up and subsequent fast migration from the wintering areas. In contrast to several other species, notably some of the dabbling ducks, Pochard numbers often remained quite constant for relatively long periods, suggesting a low turnover of individuals.

Tufted Duck *Aythya fuligula* (Figure 11). The Tufted Duck's seasonal presence at the lake showed similarities to that of the Common Pochard. Autumn numbers were lower in 2006, and both spring and autumn numbers were lower in 2007 than in 2004 and 2005. Winter numbers were high in 2004/2005 and also in 2005/2006 until the lake froze in the first week of January. During the mild winter of 2006/2007, when the lake remained open, relatively few Tufted Ducks were recorded.

Common Goldeneye *Bucephala clanga* (Figure 12). Goldeneyes were present at the lake yearround but their number in summer never exceeded 15 individuals. Birds in summer were immature. The species starts spring migration early, tracking

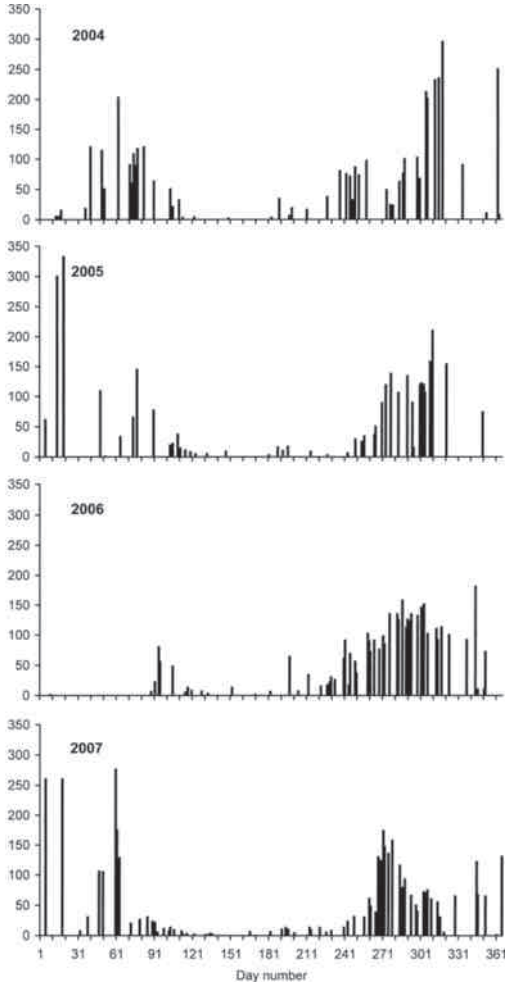

Figure 10. The seasonal occurrence of Common Pochard at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av brunand i Krankesjön åren 2004–2007.

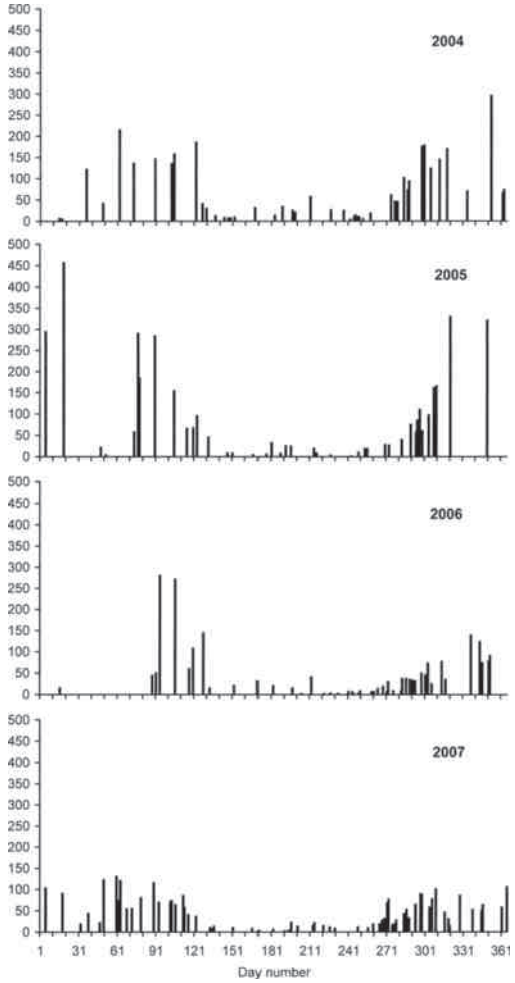

Figure 11. The seasonal occurrence of Tufted Duck at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av vigg i Krankesjön åren 2004–2007.

ice break-up as this advances northward, and peak numbers occurred in February–March. Numbers in autumn started a gradual build-up at the beginning of October and reached more than 300 by mid-December in 2004 and 2005. Numbers remained high over the winter 2004/2005 until the lake froze in the last week of January (a pattern shared with Mute Swan, Pochard and Tufted Duck).

Smew *Mergus albellus* (Figure 13). Smew occurrence showed a pattern similar to that of Goldeneye, with the highest number in February to the first week of April, but numbers never exceeded 100 individuals during the four years. Autumn numbers started to increase somewhat later in Smew than in Goldeneye.

Goosander *Mergus merganser* (Figure 14). Goosander showed a picture almost identical to that of Smew, with a peak from February to the first week of April and an autumn build-up of numbers from about mid-October. Numbers often fluctuated widely between counts (and often also during counts) as flocks entered or left the lake.

Common Coot *Fulica atra* (Figure 15). The general pattern of Coot numbers was relatively similar during three of the four years, with a spring peak by mid-March and low numbers during May and June (breeding season). The date when juveniles were included in the totals varied somewhat between the four years but had no appreciable effect on the curve of gradual build-up of numbers; this normally took place from July to late October. The year 2006 deviates from this pattern. The normal spring peak may have failed to appear because of the late ice break-up, but also numbers in autumn were much lower than in the other three years (see below).

Between-year population fluctuations

In this section we present the inter-annual variations in the numbers of the different waterbird species recorded during the whole study period from summer 1985 to December 2007, with the main focus on the autumn, for which most data are available.

Great Crested Grebe (Figure 16). During the first census years, the number of adult Great Crested Grebes was extremely low but then showed a steady increase to a peak during the first half of the 1990s. This period was followed by slightly lower numbers during the following years. However, the latter period contains the two gaps in the census series, so the exact form of the population curve is unknown. Since then, peak numbers in summer have been relatively high, with some variation between years. Non-breeding adults have most likely occurred in some of the earlier years, but this cannot be established with certainty from available maps and notes. During the last few years, however, up to 90, probably partly non-breeding, adult grebes have formed fishing-flocks roaming widely over the lake in summer (Källander 2008).

Great Cormorant (Figure 17). As in Sweden as a whole and in much of continental Europe (Bregnballe et al. 2003), the number of Great Cormorants observed at Lake Krankesjön increased during the study period ($r_s = 0.893$, N = 21, $P<0.001$). During the first five years, less than 10 cormorants were recorded during September–October each year and almost none in spring. By 2007, some 40–50 Cormorants were present daily at the lake during autumn, and smaller numbers were also present throughout spring and summer. During the last few years Cormorants also took to roosting at night in willow trees at the mouth of the small stream that enters the lake from the southeast. As mentioned above, this roost was, at least sometimes, also used by birds that arrived from other areas. The highest total observed at the roost (102 individuals), as well as exceptional numbers caused by temporarily staging flocks (see above) have not been included in Figure 17 or the analysis of the population trend.

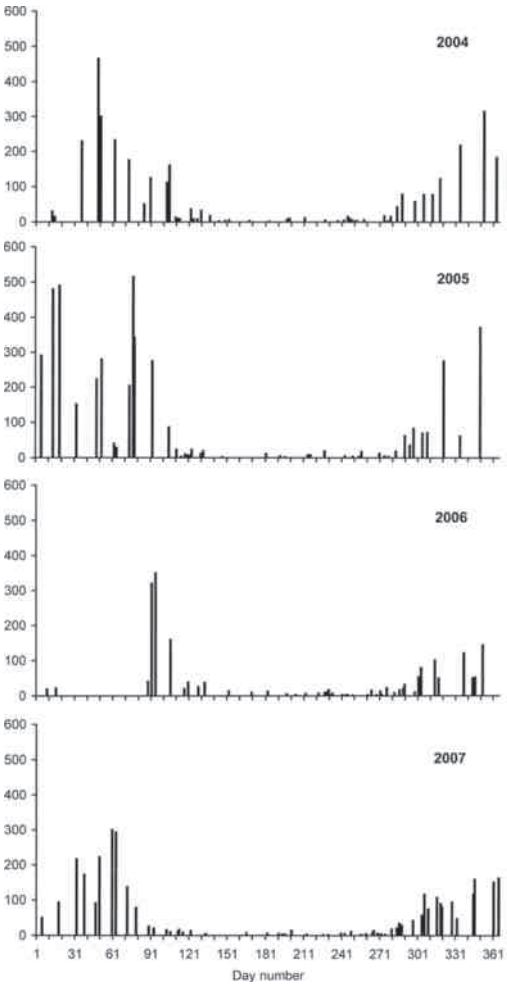

Figure 12. The seasonal occurrence of Common Goldeneye at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av knipa i Krankesjön åren 2004–2007.

Whooper Swan. During the first ten or so years of the study, single pairs of Whooper Swan bred in the vicinity of the lake, and 2–4 birds were sometimes seen on the lake during summer. This has since changed. Thus, during 1985–1999 Whooper

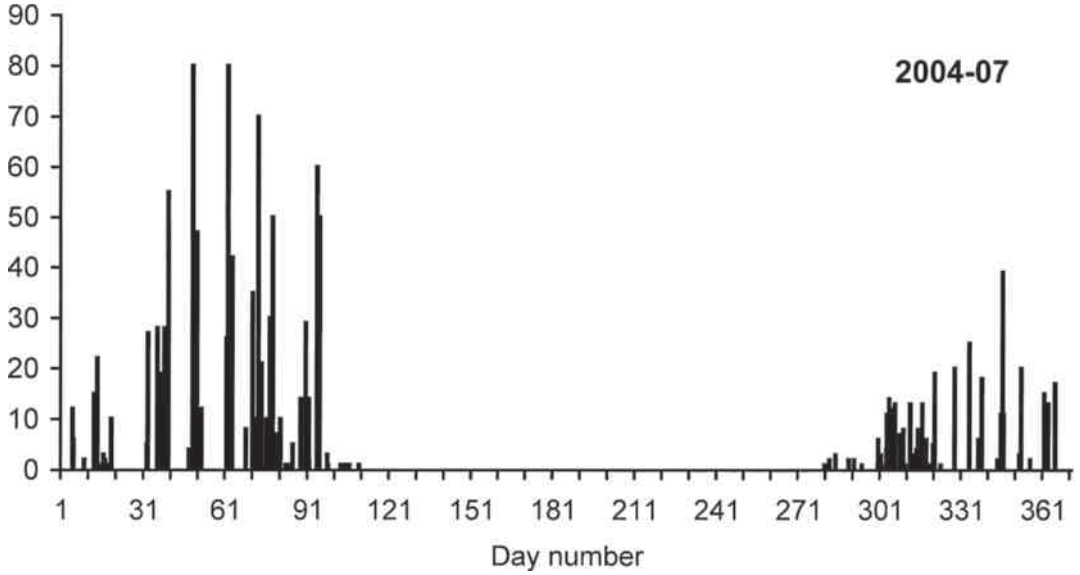

Figure 13. The seasonal occurrence of Smew at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av salskrake i Krankesjön. Kombinerade data för åren 2004–2007.

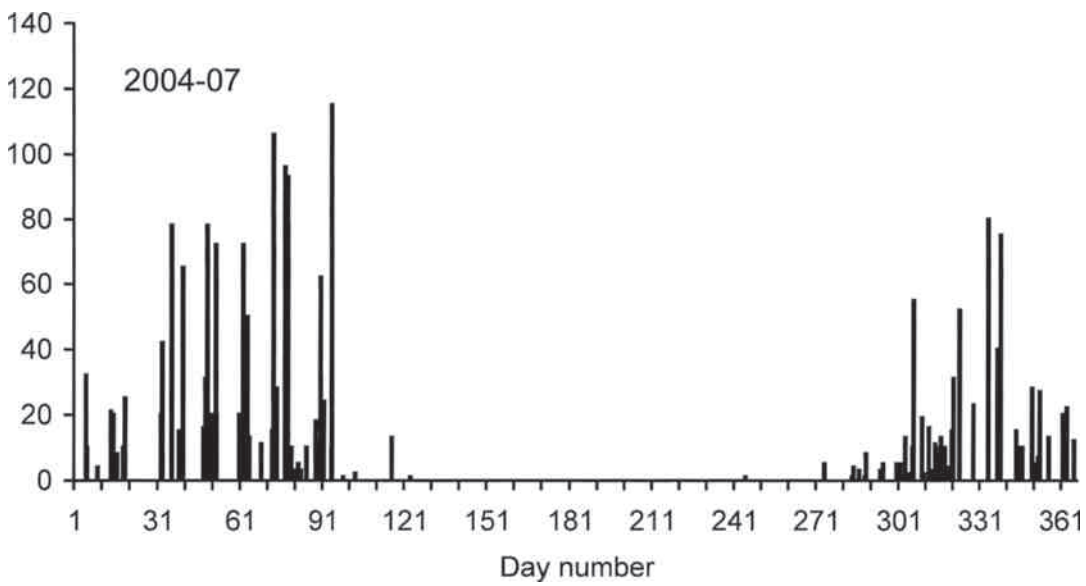

Figure 14. The seasonal occurrence of Goosander at Lake Krankesjön. Combined data for 2004 to 2007.
Den årstidsmässiga förekomsten av storskrake i Krankesjön. Kombinerade data för åren 2004–2007.

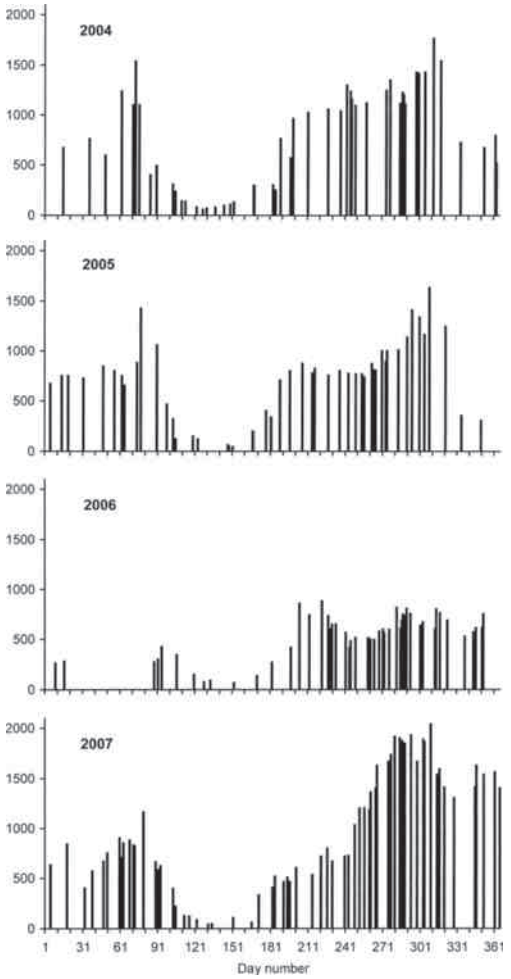

Figure 15. The seasonal occurrence of Common Coot at Lake Krankesjön in 2004 to 2007.
Den årstidsmässiga förekomsten av sothöna i Krankesjön åren 2004–2007.

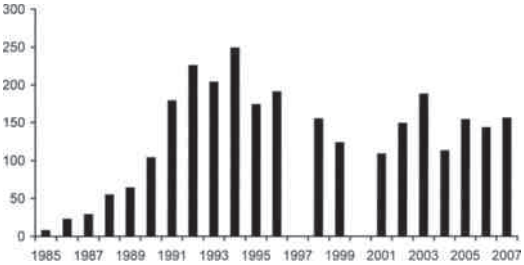

Figure 16. The highest number of Great Crested Grebe recorded in July at Lake Krankesjön in each of the study years 1985–2007. Note the very low numbers during the first years.
Högsta registrerade antal skäggdoppingar i Krankesjön i juli under vart och ett av åren 1985–2007. Notera de mycket låga antalen i periodens början.

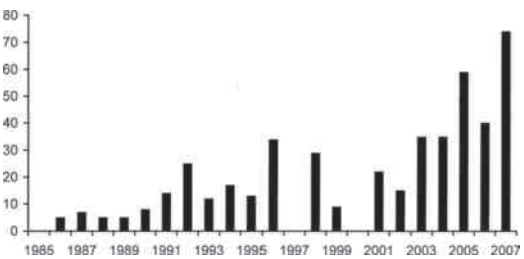

Figure 17. The highest number of Great Cormorants recorded during September–October at Lake Krankesjön in each year 1985–2007. Brief visits by migrating flocks are not included.
Högsta antalet skarvar i Krankesjön under september–oktober under vart och ett av åren 1985–2007. Tillfälliga besök av flyttande skarvar har uteslutits.

Swans were observed on the lake on 18 out of 75 census days (24%) during June–August. During the same months in 2003–2007, Whooper Swans were only seen on 3 out of 59 days (5%). In October during the first two years, from 20 to almost 50 Whooper Swans were feeding at the lake, and at least in 1986 some of them probably were staging there for weeks. Although Whooper Swans have been seen on the lake in October and November during the last four years, their visits have been short. In fact, on a couple of occasions flocks have arrived from the east, landed on the lake only to leave within an hour or two. In autumn 1986, Whooper Swans fed on the tubers of *Potamogeton pectinatus*, which was the first of the submerged plants to recolonize and which in 1986 covered about half of the lake's bottom in sparse stands (Andersson et al. 1990, Hargeby et al. 1994). Subsequently, this plant was largely replaced with charophytes. *Potamogeton pectinatus* tubers are an important food of both Whooper and Bewick's swans *Cygnus columbianus* (Schneider-Jacoby et al. 1991, Beekman

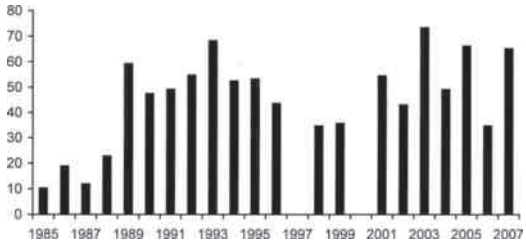

Figure 18. The mean number of Mute Swans at Lake Krankesjön during May to October in 1985–2007. To account for differences in census frequency, the figures are means of the mean for each of the six months.
Medelantal knölsvanar på Krankesjön för månaderna maj–oktober åren 1985–2007. För att ta hänsyn till skillnader i besöksfrekvens är värdena medeltal av månadsmedelvärdena.

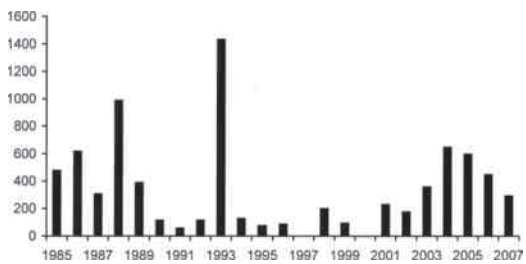

Figure 19. The highest number of European Wigeon recorded during September–October at Lake Krankesjön in each year 1985–2007.
Högsta registrerade antal bläsänder i Krankesjön under september–oktober under vart och ett av åren 1985–2007.

et al. 1991), so the near disappearance of this food resource can no doubt explain the lower numbers of Whooper Swan on the lake in recent years.

Mute Swan (Figure 18). The number of breeding pairs of Mute Swan during the period seems never to have exceeded eleven, so the majority of swans recorded on the lake have been non-breeders. The Figure shows adult and almost adult (all-white) swans during May through October. The pattern is rather similar to that for the Great Crested Grebe, i.e. very low numbers in the early years rising to a peak around 1993, then falling off only to increase again after 2000, however with low numbers in 2006 (see below). The peak in 2003 was caused by exceptionally high numbers of swans being present during the whole of May, with a maximum of 230 on the 24th.

European Wigeon (Figure 19). The maximum number of Wigeon varied much in September and October from 1985 to 2007. There was a peak in 1993 followed by several years with low numbers until 2001. The pattern is very similar if mean counts are used.

Mallard. Mallard numbers were highest in winter, November–February, a period from which counts are quite few before 2004. The highest number, 1700, was recorded in mid-January 1993, but 700 birds or more were seen in an additional eleven winters. However, the data do not allow any conclusion about either fluctuations or trends in number. Mallards do not seem to feed much at the lake, at least not during the day, but use reed edges

Mute Swan Knölsvan

Pochard Brunand

and, when the lake is ice-covered, the ice next to open parts as loafing sites. Probably they feed in agricultural fields at night.

Gadwall (Figure 20). A few Gadwalls were seen in the period April to June in all but three years, but the highest numbers were recorded in September and October (cf. Figure 7). Although there was much variation among years, Gadwall numbers show a positive trend over the study period (r_s = 0.658, N = 21, P<0.02).

Northern Pintail. Although Pintails were recorded in all years, numbers were low, particularly in spring (highest spring number 21; normally just a few). Numbers in autumn were somewhat higher, with top records of 121 and 55, but flocks of more than half a dozen birds were highly fortuitous. For this reason nothing can be said about either trends or fluctuations in number.

Northern Shoveler (Figure 21). The maximum spring number varied from no Shoveler observed in spring 1998 to 35 (in three years), while the corresponding autumn figures ranged from two (1991) to 140 (2005). Both spring and autumn numbers thus show considerable variation. Relatively high numbers were present in autumn during 1987–1990, but generally there is no discernable pattern in Shoveler occurrence at the lake during the study period.

Common Teal (Figure 22). The highest spring numbers of Teal were always found in April, but since counts in many years did not start until mid-April, the peak occurrence may well have been missed in some phenologically early years. For that reason it is doubtful whether the recorded peak numbers before 2004 (varying from eight in 1998

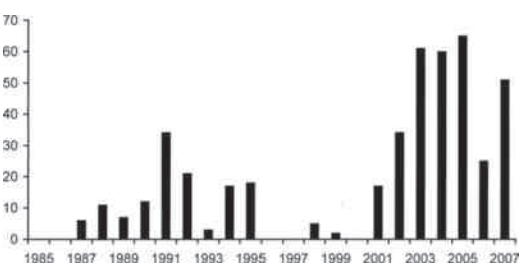

Figure 20. The highest number of Gadwall recorded during August–October at Lake Krankesjön in each year 1985–2007.
Högsta registrerade antal snatteränder i Krankesjön under augusti–oktober under vart och ett av åren 1985–2007.

Coot Sothöna

to 96 in 1988) mirror the species' true presence on the lake. Also autumn numbers show a good deal of variation, with peaks in 1993 and 2006. Means for August through October in these two years were about 100 and 80 birds, and peak numbers 300 and 610.

Garganey. The Garganey is the rarest of the dabbling ducks breeding in Sweden, and its numbers are said to vary strongly between years (Svensson et al. 1999). The highest numbers during the study period were recorded in 1990, when nine individuals were seen on 26 April, six on 1 June, and four on 12 July. In autumn, the species was seen in only six of the years.

Common Pochard (Figure 23). Autumn numbers of Pochard on the lake show a statistically significant negative trend. This holds regardless of whether maximum autumn numbers (r_s = 0.562, N = 21, P<0.02) or weighted means for the autumn months are used (r_s = 0.652, N = 21, P<0.02). How-

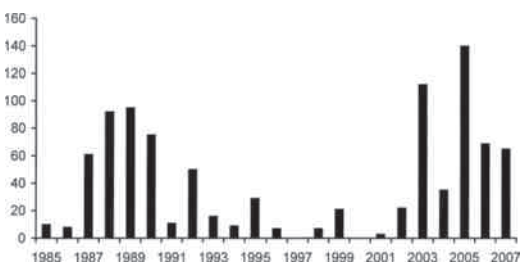

Figure 21. The highest number of Northern Shoveler recorded during August–October at Lake Krankesjön in each year 1985–2007.
Högsta registrerade antal skedänder i Krankesjön under augusti–oktober under vart och ett av åren 1985–2007.

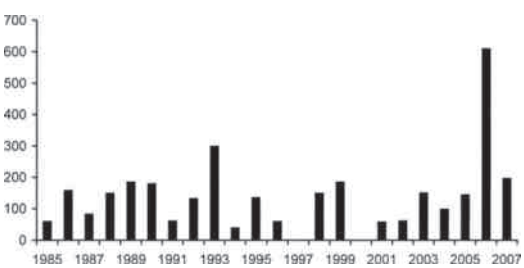

Figure 22. The highest number of Common Teal recorded during August–October at Lake Krankesjön in each year 1985–2007.
Högsta registrerade antal krickor i Krankesjön under augusti–oktober under vart och ett av åren 1985–2007.

ever, as seen in the diagram, the trend was caused by a decrease that took place during the first ten years, after which numbers have remained fairly stable. In most years, counts were started too late in spring to cover the period when numbers peak, which occurs in March (cf. Figure 10).

Tufted Duck. As seen from Figure 11, the highest numbers of Tufted Duck occur during November through March when no counts were carried out in most years, which precludes analysis of population trends and fluctuations. In those earlier years from which data are available, numbers were more than three times higher in February–March than in November–December (highest number 970 on 15 February 1990).

Common Goldeneye. The same problem as for the Tufted Duck applies to the data for Goldeneye, viz. that too few counts were carried out during the winter months. However, the number of Goldeneye seems to have increased during the study period in line with the positive trend shown for wintering birds (Nilsson 2008). Thus, peak numbers in March in 1988–1991 were only a fifth of those in 2004–2007.

Smew. As for the previous two species, the material does not permit any conclusions regarding either trends or fluctuations because of the scarcity of winter data in most years. Numbers in February–March (Figure 13) reached 80 individuals in 2004 and were higher in late winter than in autumn in all but one year for which these two periods could be compared.

Goosander. Goosanders visit the lake almost exclusively during October to early April (Figure 14) and useful data therefore only exist for the last four years. The highest count during the study period was 256 individuals on 14 April 1986; numbers just exceeded 100 twice.

Common Coot (Figure 24). During the whole study period, the Common Coot was the most numerous waterbird on the lake almost year-round, with nearly 2500 individuals in autumn 1993. Numbers were very low in the first years but increased rather quickly to reach a peak in 1993 after which they again fell. From 2001 onwards numbers have been comparable to those in the early 1990s, with the exception of 2006, when the population in autumn was only about half that of the preceding years. The dynamics of the Coot population thus shows strong similarities to that of the Mute Swan (and to some extent to that of the Wigeon and Great Crested Grebe).

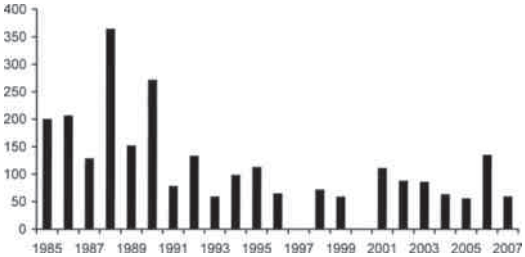

Figure 23. Mean number of Common Pochard recorded during August–October at Lake Krankesjön in each year 1985–2007.
Medelantal brunänder på Krankesjön under perioden augusti-oktoberunder vart och ett av åren 1985–2007.

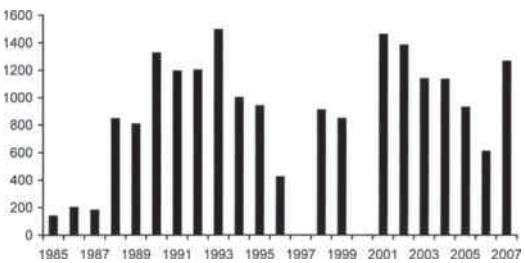

Figure 24. The highest number of Common Coot recorded during August–November at Lake Krankesjön in each year 1985–2007.
Högsta registrerade antal sothöns i Krankesjön under augusti–oktober under vart och ett av åren 1985–2007.

Discussion

Lake Krankesjön as a moult and stop-over site

Figures 1–15 clearly show that the species treated in this paper are most numerous during the migration periods or, for some of the species, during winter. For Coot and Mute Swan, high numbers are also present during moult. From a conservation perspective, the lake is important because of its small breeding colony of Black Terns *Chlidonias niger* beside a few other relatively sparse species (Bittern *Botaurus stellaris*, Penduline Tit *Remiz pendulinus*, etc.). However, few species of waterbird breed at the lake, and those that do so breed in low or moderate numbers. The most common breeding waterbirds, apart from a (re-established) colony of Black-headed Gull *Larus ridibundus*, are Coot, Great Crested Grebe, Mute Swan, Greylag Goose *Anser anser* and Common Tern *Sterna hirundo*. In recent years, a single Tufted Duck brood has been

seen in two seasons and in each year one or two Mallard broods, but there are only a few breeding records for other dabbling ducks (Gadwall, Garganey). So, clearly the lake's main importance is as a moulting and staging area. The number of Coot at Lake Krankesjön in summer and autumn, for instance, is among the highest for any lake in Sweden, with the exception of Lakes Tåkern and Hornborgasjön (Nilsson 2007, L. Nilsson, pers. comm.).

To get some reference against which Lake Krankesjön's importance as a stop-over site in autumn could be compared, we searched the Swedish bird database, Svalan (http://artportalen.se/birds/), restricting our search to observations made in South Sweden (Götaland) during the period 1 August to 31 October in 2004–2008. For each species, we specified a minimum number that should be exceeded for an observation to be included (e.g. 1000 for Wigeon, 100 for Gadwall). A number of localities were identified from which high autumn numbers of one or more waterbird species had been reported consistently. These were, however, predominantly sheltered bays along the coast. Among inland sites, Lakes Tåkern and Hornborgasjön stood out from all the others by holding numbers several times higher than any other South Swedish lake (also cf. Nilsson 2007). For single species, higher numbers than those recorded at Lake Krankesjön had been reported from a few lakes. While, on the whole, the exercise failed to establish Lake Krankesjön's exact position among South Swedish lakes based on its importance as a moulting and staging site, it is probably safe to conclude that Lake Krankesjön is one of the more important ones, especially considering the scarcity of shallow, vegetation-rich and productive lakes in Sweden south of Lakes Tåkern and Hornborgasjön.

Causes of fluctuations in the lake's waterbird numbers

An unknown part of the between-year fluctuations in numbers depends on deficiencies in the counts themselves (individual birds or even flocks having gone undetected, or birds being counted twice). Another factor that may have had some influence on the reliability of the data is that counts were carried out only twice a month for most of the period, with a few gaps here and there. Most likely neither of these two sources of error is particularly important, however, at least for those species that show the most regular occurrence on the lake, such as Great Crested Grebe, Mute Swan, Pochard and Coot. We therefore focus here on the dynamics of these species, although some comments are made also on the occurrence of a few others.

Another factor that might cause variation in the number of staging birds at a locality is if the availability of suitable areas in the surroundings varies between years. To some extent this has been the case during the present study. In autumn 2006, for instance, the nearby Vombs ängar Nature Reserve, only about 3 km distant, was flooded and attracted large numbers of dabbling ducks, particularly Teal, Shoveler and Wigeon. An exchange of individuals between this locality and Lake Krankesjön was documented and may at least explain some of the day-to-day variations in numbers on the lake. Ducks have also been seen travelling between Lake Krankesjön and other locations in its neighbourhood.

Fluctuations in water level could potentially be an important factor affecting the number of dabbling ducks staging on the lake, because high water levels could make the submerged vegetation unavailable to species feeding by up-ending. However, probably this would mainly affect Gadwall, Pintail and Shoveler, perhaps also to some extent Wigeon. Mallard were sometimes seen foraging by up-ending in shallow parts of the lake close to their loafing sites during daytime, but their main feeding probably took place in terrestrial habitats at night. Gadwall was the species most regularly seen feeding (by up-ending) during autumn. Also Wigeon were sometimes seen using up-ending as a foraging method, but in autumn and winter Wigeon appeared not to forage much during the light hours. Sometimes, however, they associated with flocks of Coot, but this was much more pronounced in spring. Coots dive and bring plant material to the surface that would otherwise be unavailable to the Wigeon, and Wigeon use material that the Coots drop while feeding. This commensal association was very frequent in spring and sometimes practically all of up to 200 Wigeon were using Coots in this way (HK unpubl. data).

One cause of numerical fluctuations and trends can be searched on a 'global' level, i.e. population changes involving large portions of a species' total population. The trend in number of Great Cormorants that used Lake Krankesjön no doubt is best explained by this species' general increase practically everywhere in Europe, including Sweden (Engström 2001, Bregnballe et al. 2003). Among the other species treated here, the Gadwall showed a statistically significant positive trend over the study period. This reflects a well-documented general in-

crease and an expansion of the species' breeding area in Sweden during the last 60 years. In 1944, the breeding population in Sweden was estimated at 60–70 pairs (SOF 1962) and in 2003 at 675–725 pairs (SOF 2004). In autumn 2005, a total of 2300 Gadwall were counted while staging on three shallow lakes in South and South Central Sweden (SOF 2006). In contrast, autumn numbers of Pochard at Lake Krankesjön showed a negative trend during the first ten years but have since remained relatively constant. Unfortunately, Swedish September data from the international waterbird counts (Nilsson 2007) do not permit a calculation of an index with which the data from Lake Krankesjön could be compared.

The fluctuation patterns of Great Crested Grebe, Mute Swan and Coot were mutually rather similar, despite the fact that the grebe is piscivorous and the other two feed almost entirely on submerged plants (Cramp 1977, 1980). In fact, there were statistically significant correlations between numbers of grebes and swans ($r = 0.703$, df 19, $P<0.001$), swans and coots ($r = 0.795$, df 19, $P<0.001$) and also numbers of grebes and coots varied in parallel ($r = 0.461$, df 19, $P<0.01$).

The winter survival of Coots has been shown to be affected negatively by the severity of the winter, expressed as number of days with ice (Cavé & Visser 1985). The number of Coots at Lake Krankesjön during 1985–2007 correlated positively with January temperatures measured at Malmö ($r = 0.710$, $P<0.001$), as did the number of Mute Swans ($r = 0.602$, $P<0.01$), whereas the correlation for Great Crested Grebe was low ($r = 0.228$) and non-significant. The question is whether winter temperatures influence the numbers of these waterbird species directly or via effects on their food supply.

By using an ordination method, Milberg et al. (2002) analysed the relationship between biomass of submerged plants and numbers of birds staging on Lake Tåkern, southern Sweden, in mid-September. They found a negative relationship between plant biomass and numbers of the piscivorous Cormorant and Goosander, but not with the likewise piscivorous Great Crested Grebe, which showed a clear positive relationship with plant biomass. For some predominantly herbivorous species (Coot, Pochard, Mute Swan, Mallard and Wigeon in particular) there was a very strong positive association between numbers and the amount of submerged plants.

Unfortunately, measurements of the extent of submerged vegetation at Lake Krankesjön exist for only 11 of the 21 years that its waterbird populations were monitored. For the three species, Great Crested Grebe, Mute Swan and Coot, the correlations between submerged vegetation and population size are nonetheless statistically significant (Great Crested Grebe, $r = 0.897$, $P<0.001$; Mute Swan, $r = 0.794$, $P<0.05$; Coot, $r = 0.949$, $P<0.001$) demonstrating that the same relationship as found at Lake Tåkern existed also at Lake Krankesjön. The relationships between biomass of submerged plants and other (inter-correlated) limnological variables, such as transparency (Secchi depth) and chlorophyll (a measure of the amount of micro-algae), which likely influence the growth of submerged vegetation, will be treated elsewhere. However, it is worth noticing that the population fluctuations of all three of the above-mentioned waterbird species show statistically significant correlations with measures of transparency and algal mass (for which respectively 20 and 19 years of data exist). In agreement with Milberg et al. (2002) we therefore conclude that waterbird numbers at Lake Krankesjön were strongly influenced by water quality via its effects on the submerged vegetation.

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Sammanfattning

Krankesjön c.20 km öster om Lund blev känd genom boken Krankesjön – ett fåglarnas paradis (Swanberg 1931) och inte minst genom den koloni av svarthalsade doppingar *Podiceps nigricollis* som Swanberg fann där. Kolonin tycks ha försvunnit under andra hälften av 1930-talet, men sjön fortfor att vara en god fågelsjö. Under åren 1974–1976 inträffade emellertid en dramatisk minskning i flera fågelarters numerär, t.ex. skäggdopping *Podiceps cristatus*, knölsvan *Cygnus olor* och sothöna *Fulica atra*. Parallellt härmed skedde stora förändringar i sjöns vegetation och vattenkvalitet. Från att ha varit förhållandevis klart blev vattnet grumligt samtidigt som bottenvegetationen försvann nästan helt (Karlsson m.fl. 1976). Detta tillstånd tycks ha varat ungefär till 1985, då en återgång till tidigare förhållanden inleddes (Andersson m.fl. 1990). Samma år, 1985, startade framlidne Gunnar Andersson regelbundna räkningar av Krankesjöns simfåglar. Räkningarna, vilka fortfarande pågår, syftade till att finna samband mellan fågelförekomsterna och olika limnologiska variabler. Resultaten av dessa räkningar presenteras i denna uppsats.

Metod och studieområde

Krankesjön är c. 3,4 km^2 och mycket grund. Medeldjupet är ungefär 1,5 m, det djupaste partiet når 3 m, men stora områden har ett djup betydligt mindre än 1 m. Undervattensvegetationen domineras helt av kransalger *Chara* sp.; några mindre områden hyser borstnate *Potamogeton pectinatus*. Sjön kantas av en bård av vass *Phragmites australis*, som i väster bildar bredare fält och i sjöns sydöstra hörn större sammanhängande områden. Sjön saknar öar, men har i sin östra del ett antal isolerade vassruggar och partier av annan vegetation (kalmus *Acorus calamus*, igelknopp *Sparganium* sp., m.m.). Två fågeltorn finns vid sjön, ett på den södra sidan (det s.k. Almentornet) och ett i öster (Silvåkratornet). Sjön har två små tillflöden, Silvåkrabäcken i sydost och Länsmansbäcken i sydväst och avvattnas till Kävlingeån via Ålabäcken på sjöns nordsida.

Räkningarna av sjöns simfåglar utfördes från de båda fågeltornen med hjälp av tubkikare. Under åren 1985–2003 genomfördes i allmänhet två räkningar per månad, begränsade till perioden mitten av april–mitten av oktober, men vissa år utfördes räkningar också övriga månader. Två luckor finns i detta material, nämligen för åren 1997 och 2000. Från och med 2004 har räkningar genomförts under hela året och betydligt oftare än tidigare (Tabell 1). Under dessa fyra år räknades dock inte alltid samtliga arter vid varje besök (dock oftast flertalet). Parallellt med räkningarna av simfågel har olika limnologiska undersökningar genomförts i sjön.

Givetvis är de siffror som erhållits under simfågelräkningarna behäftade med viss osäkerhet. Vissa arter, t.ex. skäggdopping, underskattas lätt under blåsiga förhållanden, gräsänder *Anas platyrhynchos* ligger under dagtid ofta inne i vass och annan vegetation och blir ofta synliga först då de skräms ut på öppet vatten av exempelvis havsörn *Haliaaetus albicilla*. Speciellt under flyttningstider sker också en viss omsättning av fågel i sjön, vilket kan leda till ganska stora variationer från en dag till en annan. Vi är dock övertygade om att de resultat som redovisas här ger en rättvisande bild av såväl de säsongsmässiga som de årliga fluktuationerna i sjöns simfågelfauna. Inte minst torde detta gälla de arter, som är närvarande i sjön under långa perioder och i ganska konstanta antal, främst skäggdopping, knölsvan och sothöna.

Redovisningen omfattar inte samtliga arter som

räknats; exempelvis ingår inte hägrar, gäss och måsfåglar och inte heller de olika mer eller mindre sällsynta arter som uppträtt under perioden.

De vunna resultaten redovisas under två rubriker, årscykeln respektive beståndsvariationerna. Den förra avser att spegla de olika arternas säsongsmässiga förekomst vid Krankesjön, vilket i huvudsak sker i form av en serie diagram med tillhörande kommentarer. Denna del är uteslutande baserad på de senaste fyra årens räkningar, vilka utförts tillräckligt frekvent för att en bild skall framträda. Under den andra rubriken visas beståndsutvecklingen för de olika simfågelarterna under hela perioden 1985–2007.

Årscykeln

För flertalet arter visas det säsongsmässiga uppträdandet i sjön i figurer, med separata diagram för vart och ett av de fyra åren. Härvid har eftersträvats att ha samma skala på de olika delfigurerna, men för en art, krickan *Anas crecca*, har detta inte följts. Vidare har de fyra åren slagits samman för sex arter. På tidsaxeln (x) anges dagnummer, dvs den 1 januari = 1, 31 december = 365 (ingen hänsyn till skottår) och 1 juli således = 182. Y-axeln saknar av tekniska skäl etikett, men anger antalet individer. För ytterligare några få arter ges bara en kort presentation i texten.

Skäggdopping *Podiceps cristatus* (Figur 1). Den milda vintern 2006/2007 övervintrade några få skäggdoppingar, men normalt anlände de första skäggdoppingarna i samband med islossningen eller, isfria år, vid ungefär samma tid (första halvan av mars) för att därefter snabbt öka i antal. Antalet var högt över sommaren, c. 130–150 ex., varav en troligen ganska hög andel utgjordes av icke-häckande, och minskade sedan successivt från mitten av september. Efter mitten av november var ytterst få doppingar kvar i sjön – i stark kontrast till förhållandena på den närbelägna Vombsjön, där antalet ökar i november för att årligen uppgå till c. 2000.

Storskarv *Phalacrocorax carbo* (Figur 2). Antalet skarvar var normalt lägre under våren–sommaren än under hösten. De tre högsta siffrorna avser flyttande flockar, vilka högst tillfälligt landat på sjön och fiskat innan de dragit vidare. Den höga siffran (102) den 2 november (2007) är fåglar som uppsökt sovplatsen i pilträd vid Silvåkrabäckens mynning och inkluderar även fåglar, som anlände från andra håll än själva sjön.

Sångsvan *Cygnus cygnus*. Arten ses inte särskilt ofta i sjön, men rastar tillfälligt framför allt i mars och slutet av oktober–början av november, då upp till 30 fåglar setts. Också vintertid ses en del sångsvanar, men arten söker då sin föda huvudsakligen i åkermarken, på raps eller ung stråsäd.

Knölsvan *Cygnus olor* (Figur 3). Figuren visar endast antalet utfärgade knölsvanar (vilka alltid kraftigt dominerar antalsmässigt). Antalet häckande par tycks aldrig ha överstigit 11 (och var under de fyra åren ännu lägre), varför det i huvudsak handlar om icke-häckande fåglar. Som synes är mönstret de olika åren ganska olikartat. Den totala avsaknaden av knölsvanar från januari till slutet av mars 2006 beror på en sen, men total isläggning av sjön, men noterbart är de låga antalen även under resten av året (se nedan). År 2007 ökade antalet knölsvanar mycket starkt under senhösten, en ökning som fortsatte in i januari 2008 (220 ex den 21).

Bläsand *Anas penelope* (Figur 4). Bläsanden visar ganska tydliga toppar under artens sträcktider, men dessutom registrerades mycket höga antal i december och januari under ett par av åren. Således skedde under november–december 2006 och 2007, dvs efter artens normala sträcktid, en stark inflyttning av bläsänder till sjön, vilken i januari 2007 resulterade i att över 900 ex. noterades. Isläggning i senare delen av januari detta år tvingade bläsänderna att tillfälligt lämna sjön. Notera också den nästan totala avsaknaden av bläsänder våren 2006 också efter det att isen gått upp i slutet av mars.

Gräsand *Anas platyrhynchos* (Figur 5). Figuren sammanfattar förekomsten under de fyra åren. Normalt sågs de högsta antalen gräsänder under senhöst och vinter, medan ytterst få gräsänder sågs under häckningstid. Antalen ökade sedan sakta under sommaren med en del ruggande fåglar och därefter ganska gradvis under hösten.

Stjärtand *Anas acuta* (Figur 6). Stjärtanden är normalt så sporadisk och fåtalig i Krankesjön, speciellt om våren, att de fyra årens data lagts samman i figuren. Hösttoppen sammanfaller väl med artens sträckperiod.

Snatterand *Anas strepera* (Figur 7). De milda vintrarna 2006/2007 och 2007/2008 sågs enstaka snatteränder. Under våren var antalen ganska blygsamma, varefter antalen ökade under sommaren och oftast nådde en topp en vecka in i september. Liksom för knölsvan och bläsand var antalet snatteränder något lägre 2006 än de andra tre åren.

Skedand *Anas clypeata* (Figur 8). Liksom för övriga simänder var antalen om våren avsevärt lägre än under hösten. De högsta vårsiffrorna noterades under den andra halvan av april. Mönstret för höstförekomsten skiljer sig ganska markant åt mellan åren med en tidigare topp 2006 och 2007 än de båda föregående åren.

Kricka *Anas crecca* (Figur 9). Lägg märke till att skalorna i de två nedre delfigurerna skiljer sig markant från skalan i de båda övre. Den helt uteblivna vårtoppen 2006 kan möjligen tillskrivas det faktum att sjön inte blev helt isfri förrän en bit in i den första aprilveckan. Liksom för bläsand skedde i december 2006 en stark inflyttning av kricka till sjön och antalet kulminerade i januari 2007 med c. 2000 ex., vilka låg tillsammans med bläsänderna ute på öppet vatten.

Årta *Anas querquedula*. Årtan är sjöns sällsyntaste simand och sågs normalt blott med några få exemplar i april och maj, med en liten topp kring 1 maj. De mycket få höstobservationerna gjordes i augusti och september.

Brunand *Aythya ferina* (Figur 10). Bortsett från övervintrande fåglar vissa år, var mönstret för brunandens uppträdande ganska likartat mellan åren. De låga vårsiffrorna 2006 kan troligen hänföras till den sena islossningen. Högstaantalen var något högre hösten 2004 än de andra tre åren, då de låg kring 150 ex. Brunänderna låg oftast inom ett begränsat område utanför den norra stranden.

Vigg *Aythya fuligula* (Figur 11). Viggens uppträdande uppvisade ganska stora likheter med brunandens, inklusive januariförekomsten 2005, men uppgången i antal om hösten inträffade senare än för brunanden. De registrerade antalen under 2007 ligger av okänd anledning något lägre än de andra årens.

Knipa *Bucephala clanga* (Figur 12). Sommartid var antalet knipor i Krankesjön mycket lågt och utgjordes av yngre, icke-häckande fåglar. Antalen ökade normalt ungefär från början av oktober. I vilken utsträckning knipor övervintrade bestämdes av issituationen; antalen uppgick, som framgår av figuren, under januari och februari under två av åren till c. 500. Vårsträcket var i allmänhet avslutat kring mitten av april.

Salskrake *Mergus albellus* (Figur 13). Salskrakens uppträdande i sjön liknar knipans om man bortser från att arten saknades helt under sommarhalvåret. Antalen var högre under årets tre första månader än under de två sista, med en viss topp i slutet av mars med upp till 80 ex.

Storskrake *Mergus merganser* (Figur 14). Bilden för storskraken är nästan identisk med den för salskraken, dvs med förekomst från början av oktober till början av april. Antalen växlade ofta ganska starkt mellan räknetillfällena och grupper sågs både lämna sjön och anlända till den.

Sothöna *Fulica atra* (Figur 15). Det allmänna mönstret var ganska likartat åtminstone för tre av åren: ganska betydande antal övervintrande fåglar, ökande antal till mitten av mars och därpå en minskning ungefär till mitten av juni. Därefter ökade antalen för att nå en topp i början av november. 2006 avviker så till vida att sothöns saknades från mitten av januari till slutet av mars, då sjön var helt istäckt, och genom att hösttoppen i stort sett uteblev.

Beståndsfluktuationer

Här redovisas artvis de förändringar i simfågelbeståndet som registrerats under perioden 1985–2007. Tonvikten ligger på hösten, från vilken flest data föreligger och antalet fåglar varit högst.

Skäggdopping (Figur 16). Under studiens första år var antalet skäggdoppingar extremt lågt men ökade stadigt för att nå en topp under de första åren på 90-talet. Därpå följde en viss nedgång, men beklagligtvis saknas data för åren 1997 och 2000. De senaste 6–7 åren har beståndet varierat något kring en relativt hög nivå. Figuren visar högsta antal adulta fåglar i juli månad och inkluderar åtminstone de senaste åren uppenbarligen ett betydande antal icke-häckare.

Storskarv (Figur 17). I Krankesjön (liksom i Sverige i övrigt och stora delar av kontinenten) visar storskarven en statistiskt signifikant ökning under perioden (r_s = 0,605, N = 21, P<0.02). Under de första åren sågs skarvar praktiskt taget aldrig under våren och höstsiffrorna nådde inte 10 ex. Numera uppehåller sig regelbundet 15–20 skarvar i sjön under vår och sommar och 40–50 under hösten.

Sångsvan. Under de första cirka 10 åren häckade sångsvan i sjöns omgivningar och 2–4 fåglar sågs ibland sommartid på sjön. Här har emellertid en förändring skett. Medan sångsvan under perioden 1985–1999 sågs under 18 av 75 räkningsdagar under juni–augusti (24%), sågs arten endast 3 av 59 dagar (5%) under motsvarande tid åren 2003–2007. Under de första två åren sågs i oktober från 20 till 50 sångsvanar, vilka födosökte i sjön och vilka tycks ha stannat under en längre period. Dessa svanar livnärde sig på borstnatens rotknölar. Borstnaten var den första arten att återkolonisera de kala bottnarna och täckte 1986 ungefär hälften av sjöns bottnar, men ersattes senare av kransalger. Eftersom borstnatens rotknölar är en viktig föda för sångsvan (och mindre sångsvan *Cygnus columbianus bewickii*) är det troligt att den minskade förekomsten av rastande sångsvanar hänger samman med att borstnaten senare ersatts av kransalger.

Knölsvan (Figur 18). Medelantalet adulta (vita) svanar under månaderna maj–oktober (medeltalet vägt för att korrigera för olika räkningsintensitet

olika månader) var mycket lågt under de första åren men steg sedan till en topp i början av 1990-talet för att sedan minska en aning igen. Under de senaste sju åren har antalet växlat en del, med lågt antal speciellt 2006, men i övrigt höga totalantal. Toppen 2003 orsakas av mycket höga antal (upp till 230 fåglar) i maj detta år.

Bläsand (Figur 19). Arten visar ett mycket oregelbundet uppträdande under åren. En kraftig topp 1993 följdes av låga siffror ända till 2003.

Gräsand. Som nämnts ovan var gräsandsiffrorna högst under senhöst och vinter, en period varifrån det är sparsamt med räkningar före 2004. Det högsta registrerade antalet utgörs av 1700 i mitten av januari 1993, men under ytterligare 11 vintrar noterades 700 eller fler gräsänder.

Snatterand (Figur 20). Några få snatteränder sågs alla år utom tre under perioden april–juni, men de högsta antalen noterades alltid i september eller oktober. Trots ganska stor variation mellan åren kan en klar ökning noteras (r_s = 0,658, N = 21, P<0,02).

Stjärtand. Som mest noterades 21 (vår) och 121 exemplar (höst), men förekomsten var mycket oregelbunden och inget mönster kan utläsas ur data.

Skedand (Figur 21). Högsta antal på våren varierade från noll 1998 till 35 (tre olika år) medan höstsiffrorna varierade mellan 2 (1991) och 140 (2005), utan synbart mönster.

Kricka (Figur 22). Möjligen startade räkningarna under flera år för sent på våren för att få med toppen i krickans rastning, varför det är osäkert om vårsiffrorna speglar förekomsten (från max 8 ex. 1998 till 96 ex.1988). Höstsiffrorna varierar likaledes kraftigt, med toppar 1993 och 2006. Medelvärdena för augusti–oktober dessa år var mycket lägre, 100 respektive 80, vilket också visar den stora variationen i siffrorna för denna art.

Årta. Det högsta antal som noterades var 9 ex. den 26 april 1990. På hösten sågs arten endast under sex av de 21 åren.

Brunand (Figur 23). Arten visar en statistiskt signifikant minskning under perioden (r_s = 0,652, N = 21, P<0,02), men denna beror helt och hållet på höga siffror under ett antal år i början. Senare har höstsiffrorna varierat ungefär mellan 100 och 200.

Vigg (Figur 11). Antalet viggar är högst under november t.o.m. mars, en period med få räkningar. De räkningar som finns visar mer än tre gånger så många viggar i februari–mars som i november–december (högsta antal 970 den 15 februari 1990).

Knipa. Liksom för viggen föreligger få räkningar under vintermånaderna. Möjligen har antalet knipor i sjön emellertid ökat. För perioden februari–första veckan i april var de högsta noterade antalen fyra gånger högre 2004–2007 än 1986–2003 (data från 10 av åren).

Salskrake. Också för salskraken saknas tillräckligt med vintersiffror för att säga något om eventuella förändringar i antalet fåglar som besökt sjön.

Storskrake. Samma sak gäller storskraken som för föregående art. Det högsta antal som noterades under perioden var 256 ex. den 14 april 1986; två gånger har antalet överskridit 100.

Sothöna (Figur 24). Under hela perioden var sothönan året runt sjöns vanligaste simfågel (med undantag av den högst tillfälliga toppnoteringen för kricka i januari 2007) med nästan 2500 ex. hösten 1993. Antalet sothöns var emellertid mycket lågt under de första åren men ökade stadigt till 1993, varefter det på nytt minskade, dock utan att nå de första årens bottennivåer. Därefter har antalet sothöns på nytt ökat till mellan 1500 och 2000 höstetid. Ett markant undantag utgör hösten 2006, då antalet endast var ungefär hälften av närliggande höstars.

Krankesjön som ruggnings- och rastningslokal

Från ett fågelskyddsperspektiv är Krankesjön som häckningslokal viktig framför allt på grund av dess koloni av svarttärna *Chlidonias niger*, men sjön hyser också en ett antal mindre talrika arter som rördrom *Botaurus stellaris*, pungmes *Remiz pendulinus*, m.fl. Däremot är antalet häckande andfåglar mycket lågt och utgörs, förutom av grågås *Anser anser*, av knölsvan (max 11 par), gräsand (en eller ett par kullar brukar ses) och vigg (en kull noterad vid vardera två tillfällen under den senaste 5-årsperioden). Till dessa kan läggas några andra vattenfåglar: skäggdopping, sothöna, skrattmås *Larus ridibundus* och fisktärna *Sterna hirundo*, samtliga i låga till måttliga antal. Någon enstaka häckning har konstaterats för snatterand och årta. Sjön har således sitt värde huvudsakligen som ruggnings- och rastningslokal. Undantaget Tåkern och Hornborgasjön, är exempelvis antalet sothöns bland de högsta som noterats för insjöar i Götaland och samma sak gäller för knölsvan. Båda arterna drar givetvis nytta av att sjön är grund och rik på undervattensvegetation. Även om Krankesjön inte på långa vägar kan tävla med Tåkern och Hornborgasjön måste den ändå betraktas som en viktig översomrings- och rastlokal för simfåglar, i synnerhet om man beaktar avsaknaden av liknande sjöar i stora delar av Sydsverige.

Orsaker till variationerna i antalet rastande simfåglar

Vilka är då orsakerna till de variationer i simfågelantalen som redovisas i Figurerna 16–24? En sådan kan vara att andra lokaler i sjöns närhet, som Vombs ängar, vissa år varit mera attraktiva som rastlokal än Krankesjön. Detta gäller dock bara under senare år och bara för några av simandsarterna. En annan faktor kan vara sjöns vattendjup, vilket varierat mellan höstarna. Effekterna härav har inte undersökts, men flera av de simandsarter som höstetid rastar i sjön födosöker inte där, åtminstone inte under dagtid. Beståndsförändringar över större områden är ytterligare en faktor som kan ha gett upphov till variationen. Det ökande antalet storskarvar i sjön, t.ex., är uppenbart endast en spegling av artens allmänna ökning i Sverige och större delen av Europa. Samma sak torde gälla för snatteranden, som också ökat markant i Sverige under den aktuella perioden.

De viktigaste orsakerna till ökningen av antalet skäggdoppingar, knölsvanar och sothöns under perioden (Figurerna 16, 18 och 24) torde dock vara att söka i sjön själv. Som nämndes inledningsvis kännetecknades Krankesjön från mitten av 1970-talet till mitten av 1980-talet av grumligt vatten och kala bottnar. Därefter skedde en snabb förbättring av förhållandena, bottnarna återkoloniserades, till en början av borstnate, senare av kransalger, och siktdjupet ökade. Parallellt härmed ökade de nämnda tre arterna för att alla nå en topp de första åren på 1990-talet. Intressant nog råder statistiskt signifikanta korrelationer mellan antalet skäggdoppingar och antalet knölsvanar, mellan antalet knölsvanar och sothöns, samt mellan antalet skäggdoppingar och sothöns, trots att skäggdoppingen är fiskätare, medan knölsvan och sothöna nästan uteslutande livnär sig av vegetabilier.

Milberg m.fl. (2002) analyserade sambandet mellan mängden undervattensvegetation och antalet rastande simfåglar höstetid i Tåkern och fann ett positivt samband mellan mängden vegetation och både växtätare som knölsvan, sothöna, m.fl. och den fiskätande skäggdoppingen. Tyvärr finns mätningar av Krankesjöns bottenvegetation endast för 11 av de 21 åren. Lika fullt är sambandet mellan bottenvegetation och fågelantal statistiskt signifikant för skäggdopping, knölsvan och sothöna. De tre korrelationerna är alla positiva. För siktdjup och mängden mikroalger (mätt som mängden klorofyll i vattnet), faktorer som kan förväntas ha en stark påverkan på bottenvegetationen, existerar data för 20 respektive 19 av åren. Mellan dessa variabler och de tre fågelarterna föreligger också starka negativa, statistiskt signifikanta samband. Slutsatsen från de båda undersökningarna, den i Tåkern och denna i Krankesjön, blir att en grund slättsjös kvalitet som ruggnings- och rastningslokal för simfåglar beror på tillgången på undervattensvegetation, vilken i sin tur hänger samman med algförekomst och siktdjup.