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Timing and seasonal changes in Eider *Somateria mollissima* spring migration in the northern Öresund, south Sweden, 1975–2001

MATS PETERZ

Abstract

This paper describes the spring migration of Eiders *Somateria mollissima* through the Öresund, south Sweden, during the years 1975 to 2001. The birds are leaving their wintering grounds in the Kattegat to breed in the Baltic. The passage takes place in the second half of March and the first half of April with the major migration period between 22 March and 13 April (median date 4 April). Over the study years, there is a significant trend that the migration takes place earlier in the season. This is both in terms of median date and onset of the migration period. The change in the timing of the migration appears to be related to milder winter weather and earlier springs during the end of the 20th century. It is shown that the spring passage of Eiders for individual years is significantly correlated with the ice indices for Swedish seas the preceding winter.

Mats Peterz, Hyllevägen 76, 260 40 Viken
mats.peterz@telia.com

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Introduction

The Eider *Somateria mollissima* is a common bird in many coastal areas of north-western Europe (Cramp & Simmons 1977). A significant part of the population breeds in the Baltic Sea. In the early 1970s this population was estimated at 300,000–350,000 pairs (Almkvist 1974, Alerstam et al. 1974 a). Some ten years later, the Baltic population had increased and was estimated at approx. 400,000 pairs (Koskimies 1993). Out of these, 270,000 pairs bred in Sweden and 130,000–170,000 pairs in Finland.

The main wintering grounds of the Baltic Eider population are located in the south-western Baltic, the Danish straits and in the south-western Kattegat (Figure 1; Durinck et al. 1993, Skov et al. 1995, Fransson & Pettersson 2001). The wintering population in the Kattegat was estimated to be close to 400,000 birds in the mid eighties (Skov et al. 1995). In 1992, 205,000 birds were recorded wintering in the Gulf of Kiel and western Fehman Belt between January and March (Durinck et al. 1993). Recoveries of Eiders ringed in Sweden show that the birds are fairly stationary in their wintering grounds from at least December up to March (Fransson & Pettersson 2001).

In southern Scandinavia the spectacular spring migration of Eiders is taking place during March and April. A detailed combined radar and field study showed that Eiders wintering in the Kattegat are heading mainly in a NE–SE direction (Figure 1) (Alerstam et al. 1974a, b). When the birds reach the west coast of Sweden the majority crosses overland at high altitudes, mostly without being noticed by field observers (Swegen 1972, SOF 2002). To some extent this is because an important part of the Eiders (20 % of registered radar echoes) are migrating during the night (Alerstam et al. 1974a, b). Significant numbers of Eiders are, however, still observed heading south along the Swedish west coast and in the Öresund (Wirdheim 1988, Jönsson et al. 1990), crossing south Sweden at a later stage (Swegen 1972, Alerstam et al. 1974a, b). The majority of Eiders migrating along the south coast of Sweden mostly originate from more southerly wintering grounds, i.e. in the south-western Baltic and the Danish straits (Alerstam et al. 1974a, b).

Although the geographical pattern of the spring migration of Eiders in south Sweden has been

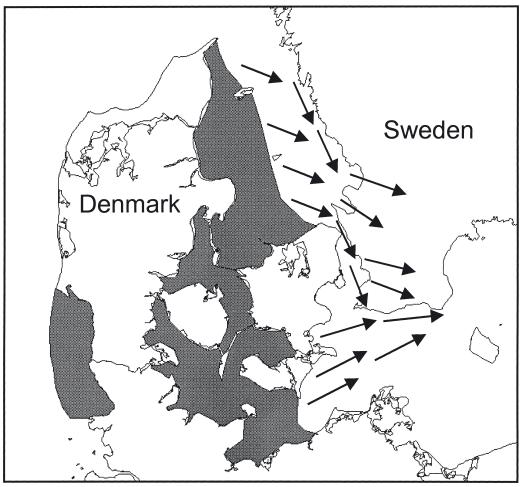

Figure 1. Wintering areas of Eiders *Somateria mollissima* in southern Scandinavia and their principal spring migration pattern over south Sweden.
Ejderns övervintringsområden i södra Skandinavien samt det principiella sträckmönstret över södra Sverige.

described earlier, no detailed analysis of the timing has been published. Here, the seasonal distribution of the Eider spring migration in the northern Öresund, south Sweden, during the years 1975–2001 is described and possible explanations for observed changes in the timing of the passage is discussed.

Materials and methods

This study is based on field observations of the Eider migration in the northern Öresund, along the Swedish coast between Helsingborg and Höganäs during the years 1975 to 2001 (Figure 2). In this area the Öresund is at its narrowest width (approx. 5 km between Sweden and Denmark) and an observer standing at the beach can easily cover the whole southbound migration. Days when more than 1000 Eiders were observed on migration are considered in this study. When observations were carried out at more than one place the same day, only the highest count was taken into account.

Observations of the migration were carried out on a voluntary basis by members of the Ornithological Society of Kullabygden. This means that data were not collected in a strict systematic way. Therefore, to avoid influences of single days with very high numbers of Eiders or differences in observer efforts, statistical analyses are based on number of days with migration, rather than the actual number of birds counted.

Significant changes in the timing of the migration over the study period were analysed by calculating the Spearman's Rank correlation coefficient (r_s) for the time distribution of days with more than 1000 birds over the years studied. Differences in the timing of the migration between three nine-year periods, respectively, were analysed using Kruskal-Wallis rank sum test.

In this study the major migration period is defined as the period during which 80 % of the birds were observed, i.e. excluding the 10% earliest and 10% latest birds during the migration period. The median date is the day when 50% of the birds have passed.

Results

In total there were reports of 139 days with more than 1000 Eiders migrating south through the northern Öresund during the years 1975–2001. The yearly number of days ranged between 1 and 11, with a median of 5 days per year. The total number of Eiders observed was ca. 790,000. The highest count in one day was 67,800 on 12 April 1986. This year was also highest in the yearly total (90,500 birds) and was followed by 1997 (50,500 birds). In three seasons less than 5000 birds were recorded, but this is probably rather a result of poor reporting or coverage of the Eider migration than a true low yearly total.

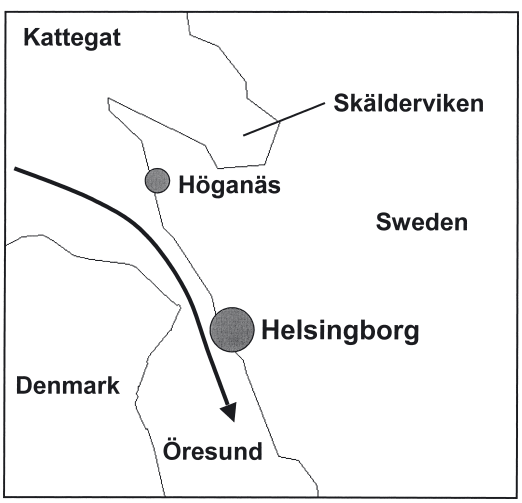

Figure 2. Map showing northern Öresund and geographical names mentioned in the text.
Närbild över norra Öresund visande platser nämnda i texten.

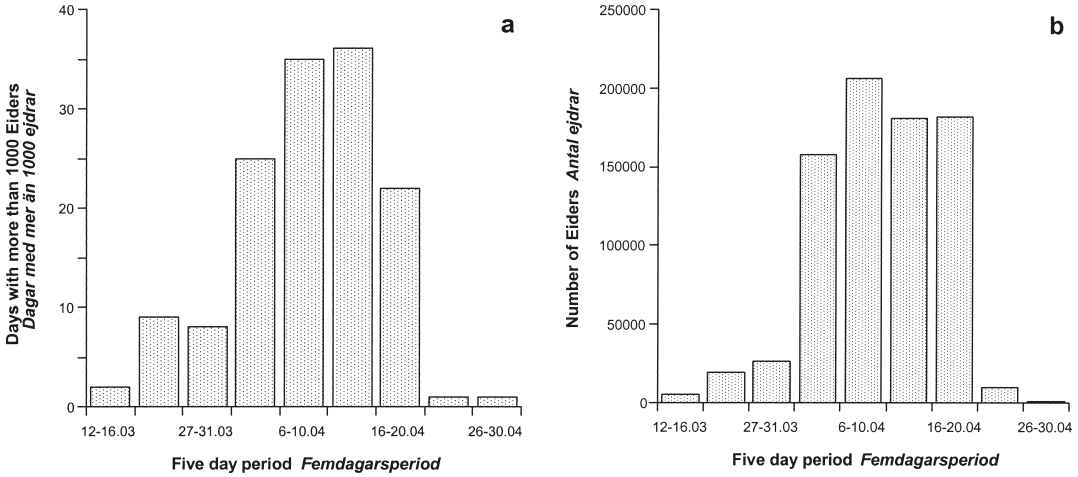

Figure 3. Eider *Somateria mollissima* spring migration in northern Öresund, south Sweden, grouped into five-day periods (Berthold 1973). a: Number of days with more than 1000 birds, b: Number of birds.
Ejdersträckets tidsmässiga förlopp i norra Öresund, fördelat på femdagarsperioder (Berthold 1973). a: antal dagar med mer än 1000 fåglar, b: antal fåglar.

The migration of Eiders in the northern Öresund peaks in the beginning of April (Figure 3a and 3b). The earliest date with more than 1000 birds was on 15 March 1998 and the latest on 22 April 1979. Based on number of days with more than 1000 birds on migration, the major migration period falls between 22 March and 13 April (Table 1) and the median date on 4 April. If instead the actual number of birds observed are considered, the major migration period falls between 28 March and 13 April, with the median date on 5 April.

The seasonal timing of the Eider spring migration has changed during the years covered in this study. Looking at the full data set there is a significant trend that days with more than 1000 migrating Eiders fall earlier ($r_s = -0.357$, $n = 139$, $p<0.001$) in the season towards the end of the analysed time period (Figure 4).

When grouping the data into three nine-year periods it can be seen that the median migration date during the latest period, 1993–2001, falls 5 days earlier ($\chi^2 = 17.8$, $p < 0.001$) than during the two preceding periods 1975–1983 and 1984–1992 (Table 1). In addition, there is also a trend that migration is initiated and terminated earlier in recent years. A test looking at the relation between the earliest and latest day with more than 1000 migrating birds each year (only years with at least three days of migration reported are included) shows a significant correlation with the earliest day ($r_s = -0.549$, $n = 22$, $p<0.01$) but not with the latest ($r_s = -0.124$, $n = 22$, $p>0.05$).

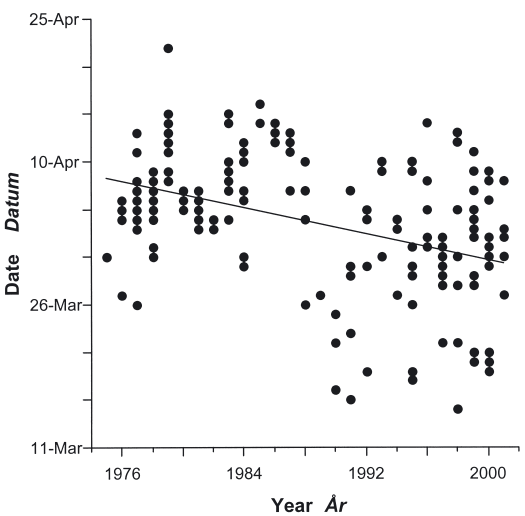

Figure 4. Days with more than 1000 Eiders *Somateria mollissima* on spring migration in northern Öresund, south Sweden, during different years.
Dagar med mer än 1000 ejdrar på vårsträck i norra Öresund under olika år.

Table 1. Earliest and latest record, major migration period (P 10%–P 90%), and median date of days with more than 1000 Eiders *Somateria mollissima* on spring migration in northern Öresund, south Sweden, during different years
Tidigaste och senaste observation, huvudsträckperiod (P 10%–P 90%) och mediandatum för dagar med mer än 1000 ejder på vårsträck i norra Öresund under olika år

Years *År*	Days *Dagar*	Earliest *Tidigaste*	P_{10} P_{10}	Median *Median*	P_{90} P_{90}	Latest *Senaste*
1975–1983	47	26 Mar	1 Apr	6 Apr	14 Apr	22 Apr
1984–1992	33	16 Mar	20 Mar	6 Apr	14 Apr	16 Apr
1993–2001	59	15 Mar	20 Mar	1 Apr	10 Apr	14 Apr
All *Alla*	139	15 Mar	22 Mar	4 Apr	13 Apr	22 Apr

Discussion

This study shows that the spring migration of Eiders wintering in the Kattegat is now taking place earlier than some twenty years ago. There may be several reasons for this change and in the following, I will discuss two possible alternatives.

Population increase

During the last decades of the 20th century the Baltic Eider population has increased considerably (Roos 1978, 2001, Stjernberg 1982, Koskimies 1993, Lyngs 2000). When a population is growing, competition for breeding grounds will increase and it will be advantageous to arrive early in the breeding season to occupy the most favourable territories. In this case an early initiation of the migration would enable early arrival to the breeding grounds and could explain the observed change in the timing of the migration period.

Climate changes

Earlier studies have shown that that warm, westerly winds coincide with high intensity in the Eider migration both in the Kattegat (Alerstam et al. 1974a, b, Karlsson 1976, Malling Olsen 1992) and in the Baltic (Pettersson 1981). Therefore, the seasonal change in the migration period could also be a response to recent climate changes with milder winters and earlier springs (SMHI 1999). A reasonable indicator of winter severity and spring arrival is the ice indices of Swedish seas as calculated by SMHI (1999). Comparison of the time distribution of days with Eider migration in the northern Öresund each spring and the ice indices the preceding winter (Figure 5) shows that these are significantly correlated ($r_s = –0.515$, n = 134, $p<0.001$). This indicates that climate change has had an influence on the timing of migration.

The Eider migration through the Kalmarsund, south-east Sweden, was extensively studied during the years 1963–1972 (Pettersson 1981). Based on data presented by Pettersson (1981), the median date

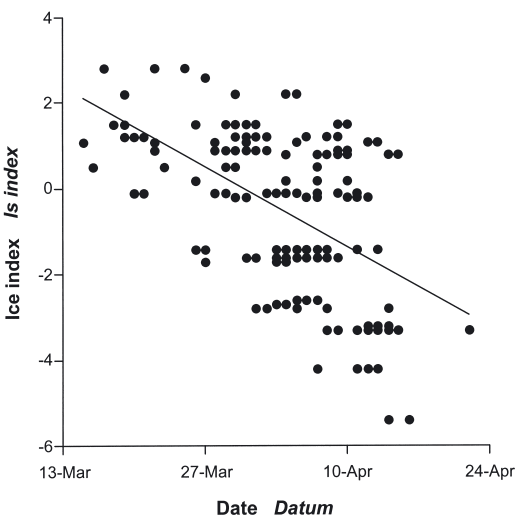

Figure 5. Relation between days with more than 1000 Eiders *Somateria mollissima* on spring migration in northern Öresund, south Sweden, and the ice indices of Swedish seas the preceding winter.
Förhållandet mellan dagar med mer än 1000 ejdrar på vårsträck i norra Öresund och föregående vinters is-index i svenska farvatten.

can be estimated to fall on 11 April, which is five days later than in the northern Öresund during the years 1975–1983 (Table 1). Although it is reasonable to assume that the migration takes place earlier closer to the wintering grounds, the difference between median dates is surprisingly large. The distance between the Kattegat and the Baltic, across land, is around 250 km and with a flight speed of approx. 70 km/h (Rydén & Källander 1964), Eiders would reach the southern Baltic within a few hours depending on wind conditions. This is supported by field observations showing that days with Eider peak migration often coincide at several observation spots in south Sweden (Blomdahl et al. 2001, Elleström et al. 2002).

Looking at the ice indices for the years covered in the Kalmarsund study, the winters during this period were overall colder than normal and there were also several winters with severe, or very severe, ice situations (SMHI 1999). Thus the timing of the Eider migration in Kalmarsund also seems to correlate well with the ice indices, which supports the explanation that the earlier migration in recent years is primarily a reflection of climate changes, i.e. milder winters and earlier springs.

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Sammanfattning

Tidpunkt och säsongsförändring för vårsträcket av ejder Somateria mollissima i norra Öresund, södra Sverige, 1975–2001

En betydande del av det europeiska ejderbeståndet häckar i Östersjön. Den totala populationen här har uppskattats till ca 400.000 par (Koskimies 1993). Östersjöejdrarna har sina viktigaste övervintringsområden i sydvästra Östersjön, i Bälten samt längs den danska Kattegattkusten (Figur 1). Man har beräknat att ungefär 400.000 ejdrar övervintrar i Kattegatt (Skov et al. 1995). I mars–april sträcker dessa mot NE–SE till sina häckplatser i Östersjön (Figur 1). Kombinerade radar- och fältstudier har visat att

ejdrarna när de når den svenska västkusten till stor del sträcker in över land på hög höjd utom synhåll från marken (Swegen 1972, Alerstam et al. 1974a, b). Betydande antal ejdrar sträcker emellertid även söderut längs Västkusten och genom Öresund (Jönsson et al. 1990, Wirdheim 1988) för att korsa Sydsverige längre söderut (Swegen 1972, Alerstam et al. 1974a, b). Majoriteten av de ejdrar som på våren ses sträcka längs Skånes sydkust härstammar från övervintringsplatser i sydvästra Östersjön och i de danska Bälten (Alerstam et al. 1974a, b).

Även om ejdersträckets geografiska mönster i södra Sverige är välbeskrivet har inte mycket publicerats om dess tidsmässiga förlopp. Baserat på fältobservationer under åren 1975–2001 beskrivs här ejderns vårflyttning genom norra Öresund, särskilt med avseende på dess tidsmässiga förlopp samt på de förändringar som skett under senare år.

Material och metoder

Denna sammanställning bygger på observationer av sydsträckande ejdrar i norra Öresund längs kuststräckan mellan Helsingborg och Höganäs (Figur 2). Dagar med minst 1000 observerade ejdrar under åren 1975–2001 har tagits med i studien. Om observationer skett på flera platser samtidigt har endast det högst registrerade antalet beaktats.

Observationerna har utförts av medlemmar i Kullabygdens Ornitologiska Förening på frivillig basis, vilket medfört att data inte samlats in på ett strikt systematiskt sätt. För att undvika att enstaka dagar med många sträckare eller olikheter i observationstid skall påverka resultatet av denna studie, baseras statistiska analyser på antal dagar med minst 1000 flyttande ejdrar, istället för antal inräknade fåglar.

Trender under de behandlade åren har analyserats med hjälp av Spearman's Rank korrelation (r_s). Skillnader i sträcket tidsmässiga förlopp under tre nioårsperioder 1975–1983, 1984–1992 and 1993–2001 har undersökts med Kruskal-Wallis ranksummme-test.

I analysen definieras huvudsträckperioden som den period under vilken 80% av fåglarna observerats, d.v.s. de tidigaste resp. senaste 10 % av sträckarna har uteslutits. Mediandatum är den dag då 50% av fåglarna har passerat.

Resultat

Under åren 1975 till 2001 räknades mer än 1000 sträckande ejdrar per dag i norra Öresund vid 139 tillfällen. Antalet rapporterade dagar per år varierar mellan 1 och 11. Det totala antalet räknade ejdrar uppgick till ca 790.000. Högsta dagssiffra var 67.800 den 12 april 1986. Samma år noterades även den högsta årssumman (90.500) följt av 1997 (50.500). Tre vårar rapporterades färre än 5000 ejdrar totalt, men detta beror snarare på bristande rapportering eller bevakning än att sträcket var dåligt dessa år.

Ejderns vårsträck i norra Öresund kulminerar första halvan av april (Figur 3a och 3b). Tidigaste observationsdag med mer än 1000 sträckande ejdrar inföll 15 mars 1998 och senaste 22 april 1979. Tittar man på dagar med minst 1000 ejdrar inföll huvudsträckperioden mellan 22 mars och 3 april (Tabell 1) med mediandatum 4 april. Om man istället tittar på antalet fåglar infaller huvudsträckperioden mellan 28 mars och 13 april, med mediandatum 5 april.

Ejdersträckets tidsmässiga förlopp har förändrats under den studerade tidsperioden. Det föreligger en signifikant trend att dagar med mer än 1000 sträckande ejdrar inträffar allt tidigare på våren (Figur 4, $r_s = -0.357$, $n = 139$, $p < 0.001$). Om materialet grupperas i tre nioårsperioder kan man konstatera att mediandatum infaller fem dagar tidigare under åren 1993–2001 (Kruskal-Wallis ranksummetest, $\chi^2 = 17.8$, $p < 0.001$), jämfört med de två tidigare perioderna (Tabell 1). Även inledningen av vårsträcket sker tidigare ($r_s = -0.549$, $n = 22$, $p < 0.01$). Däremot ser man ingen sådan trend när det gäller sträckperiodens avslutning ($r_s = -0.124$, $n = 22$, $p > 0.05$).

Diskussion

Denna studie visar att vårflyttningen hos ejdrar övervintrande i Kattegatt sker tidigare under säsongen numera än för ett tjugotal år sedan. Det kan finnas flera förklaringar till detta av vilka två diskuteras i det följande.

Under senare delen av 1900-talet har den häckande ejderpopulationen i Östersjön ökat markant (Roos 1978, 2001, Stjernberg 1982, Koskimies 1993, Lyngs 2000). I en växande population kommer konkurrensen om häckplatser att öka. Det är då en fördel att anlända tidigt på våren och lägga beslag på de bästa reviren, vilket i så fall skulle kunna förklara varför vårsträcket sker tidigare numera.

En viktig sträckutlösande faktor för ejdern är västliga vindar i kombination med varmluftsinbrott (Alerstam et al. 1974a, b, Karlsson 1976, Malling Olsen 1992, Pettersson 1981). Därför skulle en annan förklaring till det tidigare ejdersträcket kunna vara

de senare årens klimatförändringar med allt mildare vintrar och tidigare vårar (SMHI 1999). En indikator på den kombinerade effekten av vinterväder och vårens meteorologiska ankomst är det is-index som beräknats för svenska farvatten (SMHI 1999). När detta jämförs med ejdersträckets tidsmässiga förlopp den efterföljande våren (Figur 5) finns ett signifikant samband (r_s = –0.515, n = 134, $p<0.001$), vilket indikerar att klimatförändringar kan förklara de observerade förändringarna. Detta antagande stöds även av studier av ejdersträcket i Kalmarsund åren 1963–1972 (Pettersson 1981). Enligt SMHIs is-index var flertalet vintrar under denna period stränga eller mycket stränga samtidigt som sträckets mediandatum inföll 11 april, d.v.s. betydligt senare än vad som var fallet i denna studie.