

The number of adult Eiders in the Baltic Sea

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The Eider *Somateria mollissima* is the most common breeding duck in the Baltic and also the most important game species in Swedish and Danish coastal areas. The size of the Baltic Eider population has varied drastically during the twentieth century, but since the 1940s it has increased and still no levelling out is noted. The Eider of the Baltic Sea is now studied from several aspects. The results of those studies may clarify the dynamics of the Eider in the Baltic, give a basis for management and provide informa-

tion to marine biologists studying the Baltic ecosystem.

The aim of the present investigation was to census the numbers of adult Eiders in the Baltic. An additional purpose was to study the possibilities of monitoring the population trends. Earlier counts have been conducted in winter quarters and along migration routes but proved to be not very reliable. The method of examining premoulting gatherings of males was developed during introductory investigations in 1971 (Almkvist

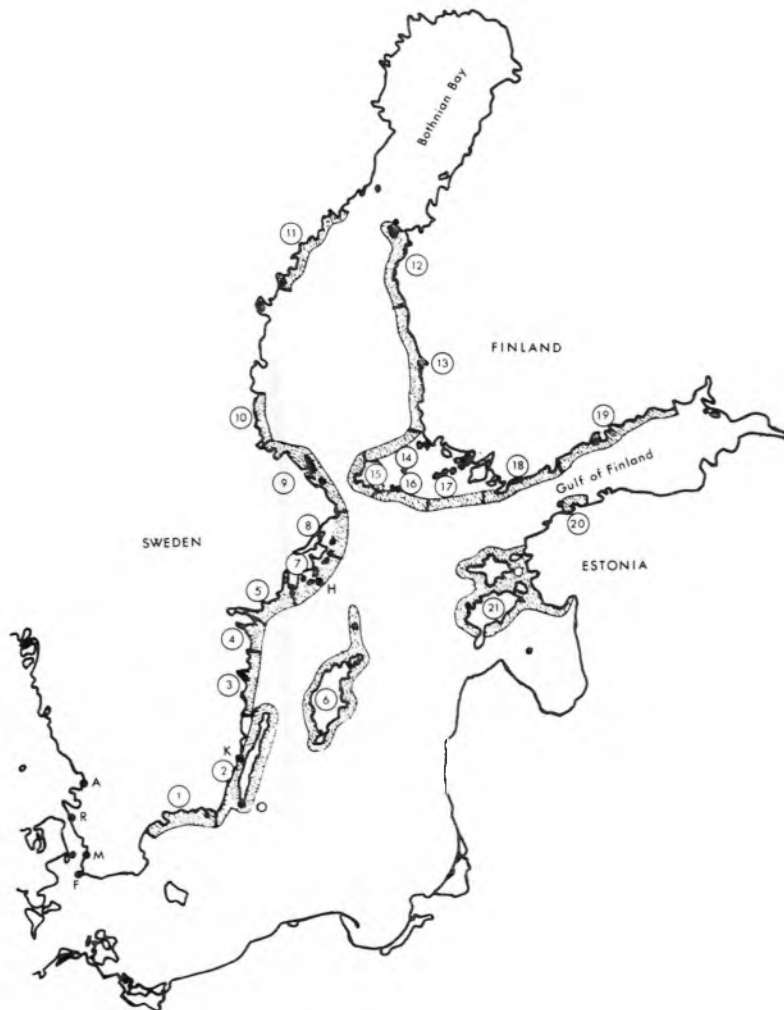


Figure 1. The Baltic Sea. Areas where Eider males were censused on 29 May–5 June, 1973, are numbered 1–21 and shaded. Number of Eider males for each area is given in Table 1. A=Laholm, R=Laröd, M=Lomma, F=Falsterbo, O=Ottenby, K=Kalmarsund, H=Huvudskär.

& Andersson, 1972) and 1972. In Finland a pilot survey was conducted in 1972.

The study has been carried out as a joint project between scientists from Estonia, Finland and Sweden coordinated by Almkvist and Andersson.

Chronology

From the main wintering grounds in the Danish waters, the Eiders migrate to their breeding areas during April. They nest on islands, in all the archipelago zones of central Sweden and southwestern Finland (areas 4–9, 14–19 in Figure 1), but also on islands off straight coastlines.

Shortly after the females have started to incubate, the males gather in small flocks (less than ten birds) close to the breeding grounds. In the archipelago areas these small flocks move to the outermost islets and form larger flocks (100–1,000 birds). Finally, most of these gather in traditional sites and form large aggregations of several thousands.

The migration of males to moulting areas in Danish waters starts in the beginning of June, or end of May. This first contingent is small and consists mainly of males probably from the southernmost populations. From the large aggregations, birds leave in the middle of June to the beginning of July for moulting quarters in Denmark. Those males which have moulted in the Baltic migrate south during late summer and autumn to their winter quarters.

Method

The census was made when the postbreeding males were aggregated at traditional areas, but not yet migrated south. These easily detected flocks afford an ideal opportunity to count Eider populations from large areas.

The field-work was undertaken from light aeroplanes and from a helicopter (area 13, Figure 1) on 29 May–5 June 1973, during thirteen flights. The concentration of flights to this short period was to avoid double counting, or ignorance, of flocks eventually moving between different areas. The areas censused are shown in Figure 1. The larger flocks (usually more than 100 birds) were photographed and the Eiders counted on enlargements. Flight altitude was usually 100–150 m and flight speed about 150 km/h. The weather during the flight period was mostly ideal for censusing Eiders, sunny and calm but sometimes with a slight sea-breeze in the afternoon. In the Gulf of Finland part

of the flight was made in light rain. Further discussions on the method is given by Almkvist & Andersson (1972).

The number of adult males

Table 1 summarizes the number of adult Eider males found in different regions marked on Figure 1.

Table 1. Number of Eider males counted on 29 May–5 June 1973 in different areas of the Baltic Sea (all figures to nearest hundred). Numbers 1–21 refer to areas on Figure 1

1 Åhus–Torhamn	300
2 Kalmarsund and Öland	2,100
3 Oskarshamn–Östergötland	2,800
4 Östergötland	14,600
5 Östergötland–Landsort	12,900
6 Gotland	10,900
7 Landsort–Sandhamn	24,100
8 Sandhamn–Björkö	29,500
9 Björkö–Gävle	400
10 Gävle–Söderhamn	200
11 Ångermanland	0
12 Valsörarna–Sideby	100
13 Merikarvia–Kustavi	3,200
14 Åland, Brändö–N. Geta	2,400
15 Åland, W. Geta–Mariehamn	7,800
16 Åland, Mariehamn–Kökar	47,300
17 Korpo–Hitis	108,800
18 Bengtskär–Helsinki	2,900
19 Helsinki–Haapasaari	100
20 Koipse	100
21 Ösel and Dagö	500
Total	271,000

A total of 271,000 Eider males was counted. This number is, however, not equal to the number of males in the Baltic. Four main sources of error will be discussed below.

First, scattered males could still be left in breeding areas. Due to differences in breeding time between southern Sweden and Finland some males in the northern and eastern archipelagoes had not gathered in the outermost areas but were still on breeding areas in the inner archipelagoes which were not censused. These areas were visited just before and after the flights to estimate the number of males there. In area 4 (Figure 1) no such scattered males were present. In areas 7 and 8 about 3% of the total male population was still scattered and not seen during flights. This makes approximately 1,700 males. The Archipelago Sea in southwestern Finland was only censused in its outermost parts

(areas 14–18, Figure 1) but several flights across the inner archipelago gave the approximate figure of 2,000 Eider males still there. Similarly about 300 males in the Gulf of Finland (area 19, Figure 1) were estimated to stay north of the censused area. This gives a total of approximately 4,000 males not seen during the flights.

Second, flocks could be in areas not visited. No Eider flocks are known to stay far from the coast since the birds usually sleep ashore. The Swedish Coast Guard visited some remote banks during the census period, but no Eider males were seen. The northern coast of Estonia was not surveyed, but concentrations of Eider males are not known from that area. On a visit by boat to a group of suitable small islands (area 20, Figure 1) only 100 males were seen. In the Bothnian Bay and along the Baltic coast south of Estonia not covered in this census few Eiders breed and flocks of males are not known to stay there.

Third, some males may have migrated out of the area before the census. Regularly there is a south migration in June (see Chronology). Observations at Kalmarsund and Ottenby (Figure 1) from 22 May to 4 June showed low migratory activity with a maximum of 500 Eider males per day. No more than 5,000 males could have passed south before the surveys. This figure corresponds well with results from the regular countings in Kalmarsund (Almkvist & Andersson, 1972). South-western Baltic (west of Kalmarsund) was

censused at a time when the majority of males already had gone westwards, or was not at all covered by flights. In this area the approximate breeding population is about 3,400 pairs (= males, see below), made up of 1,700 in Denmark (Joensen, 1973), 500 pairs in Scania, Sweden (Andersson, Kristersson & Schönbeck, personal communication) and about 1,200 pairs in Blekinge, Sweden (Gerell & Swahn, personal communication). Of these 300 were seen during the census (area 1, Table 1). In the eastern Baltic we have the Estonian population consisting of 6,500 breeding pairs (= males), where only small postbreeding gatherings of males were found in 1973. It is more likely, however, that the Estonian males had entered concentrations in Finland or around Gotland than that they had migrated to moulting areas in Danish waters.

Fourth, males seen could have been incorrectly counted. The Eider male flock in Figure 2 shows how easily a flock is discovered and how difficult it is to estimate the number of birds in it. We are convinced that all flocks, perhaps except a few minor ones, in the censused areas have been discovered. The major problem is to count the numbers in the flocks. Earlier experiences have shown the importance of counting the birds on photographs. For detailed information see Almkvist & Andersson (1972). The diving activity of the males is generally low at the time of day when the census was made

Figure 2. A premoulting flock of Eider males in Östergötland, Sweden, 1 June 1971. The photo shows that the flock is easy to discover, but also the difficulty of estimating numbers. About 2,535 adult Eider males can be seen on this photo.

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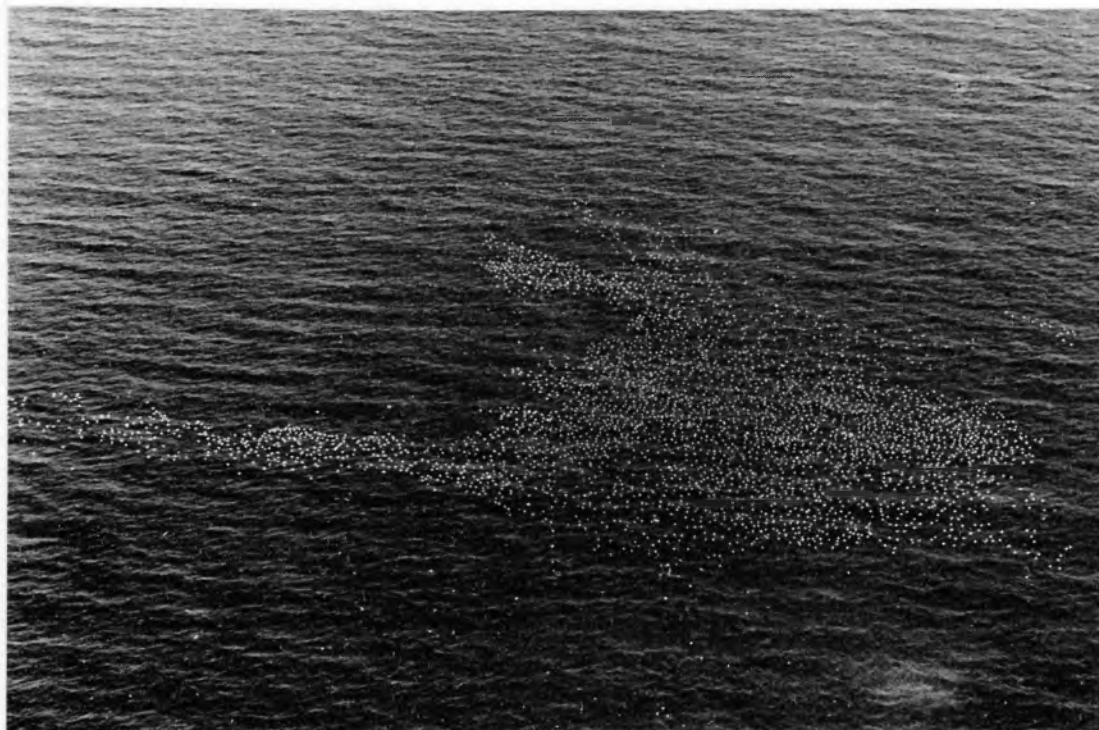


Table 2. Sex ratio (♀:♂) from Eider counts in the Baltic in 1972 and 1973. Sites are given with numbers in accordance with areas in Figure 1

Site	Date	Sample size	Sex ratio
On different breeding grounds			
	April 1973		
14 Archipelago sea	1	1475	1.00†
14 Archipelago sea	4-8	674	0.88†
19 Porvoo	13	217	1.13*
14 Archipelago Sea	15	1690	1.00*†
17 SW Archipelago	12	815	0.96*†
4 Östergötland	8	385	0.99
7 Stockholm arch	10	249	1.06*
On north migration			
	April 1972		
2 K Kalmarsund	5-18	1477	0.97
7 H Huvudskär	9-22	1813	0.97

* A few females had started laying and even incubating.

† Possibly influenced by spring shooting of males.

(09.00-16.00 hours) and since the normal reaction on the approaching aeroplane was to stay alert, ready to fly, no birds were seen diving. The error in counting the birds on photographs is difficult to estimate.

Some photographs were not good enough to count birds from and sometimes when several flocks were close together and several photos were taken it was difficult to cover all birds. Also sometimes the farthest parts of some large flocks was vague. We believe that we can have underestimated the number of males seen, 271,600, in this way by 5%.

In consideration of the errors discussed above, the 271,600 males seen should be corrected to approximately 297,000 adult Eider males in the Baltic population (including 4,000 left in breeding areas, 5,000 + 3,100 migrated south before census, 13,600 underestimation of flocks seen).

Sex ratio

Before the number of adult males can be used as a measure of the total adult population

the sex ratio must be known. For this purpose, counts were carried out during spring migration and on breeding grounds.

Samples of migrating flocks were counted on two sites on the Swedish east coast during the peak and the terminating phases of the spring migration in 1972 (Table 2, Figure 1). Adult males, 1-year-old males and dark-coloured birds were separated. The sex ratio (adult males: all females) was 0.97. The deviation from 1:1 is probably due to occurrence of 1-year-old females (compare frequency of 1-year-old males in Table 3).

The counts of Eiders on breeding grounds were made in 1973 by boat or aeroplane during the prebreeding time, and mainly included pairs more or less attached to breeding sites. The sex ratio varied between 0.88 and 1.13 with a sample average of 1.00. The relatively large variation presumably is caused by commencement of egg laying and possibly also by local influences of spring shooting of males, which is permitted from 1 April in Finland.

Even if the counts in 1972 did not cover the whole migration period and the figures

Table 3. Percentage of 1-year-old Eider males in migrating flocks at different observation sites along the Swedish coast (Figure 1) in April 1972. Figures in brackets are numbers counted

Site	Date			
	5-8	9-13	14-18	19-22
A Laholm	3.6 (1,377)	4.2 (1,511)	6.7 (640)	
R Laröd	2.9 (544)	5.1 (527)	15.7 (198)	
M Lomma	1.2 (607)	1.5 (342)		
F Falsterbo	0.4 (1,339)	1.6 (498)		
K Kalmarsund	0.4 (1,144)	0.0 (188)	3.8 (156)	
H Huvudskär		0.2 (1,185)	0.9 (463)	5.5 (181)

from the breeding grounds in 1973 are somewhat biased, we conclude that the number of females approximately equals the number of males.

The number of adult Eiders in the Baltic

From the results of the aerial census of the flocked males and the sex ratio we thus can calculate that within the Baltic the number of adult Eiders was about 594,000 specimens.

The size of the Baltic Eider population or countrywide parts of it has been estimated or at least elucidated with different techniques. The breeding population in Finland was estimated by Bergman to be 90,000 pairs (Alerstam, Bauer & Roos, 1974). The Estonian population was 6,500 pairs, and parts of the Swedish population (area 3–8 in Figure 1) to be 80,000 pairs (Almkvist & Andersson, 1972). This makes a minimum figure of 176,500 breeding pairs in the Baltic, but large areas were not surveyed.

In Danish waters, which are the main wintering area and where relatively few Eiders from other populations intermingle, Paludan (1962) on the basis of bag statistics, hunting pressure and Eider distribution, presupposed a minimum winter population of 600,000 Eiders, and extensive aerial censuses in January 1969–1971 revealed 450,000 individuals (Joensen, 1972). Because of incompleteness in cover the latter value has been presented as a minimum figure by the author himself. Of course the winter figures also include the yearlings.

The most serious attempt to calculate the size of the Eider population in the Baltic has been made by Alerstam *et al.* (1974). The result of their study was a spring population of 700,000–800,000 Eiders in the Baltic, or allowing for roughly 20% nonbreeders (=immature birds after Paludan, 1962), about 600,000 breeding adults. Their result can not, however, be directly compared with ours.

Alerstam *et al.* concludes that 20% of the birds passing Kalmarsund (K in area 2, Figure 1) are nonbreeders. From studies of the age composition of migrating flocks (Table 3) it is clear that 1-year-old males at Kalmarsund made up an insignificant fraction (0.0–0.4%) during the peak of the spring migration. But their frequency also increased as migration progressed. Young males were more frequent in southwest Sweden than further northeast. On the basis of the seasonal distribution of the migration (appendix 2 in Alerstam *et al.*) we conclude that 92% of the northward migration in Kalmarsund 1972

occurred during 20 March–15 April and 8% during 16 April–20 May. The frequency of 1-year-old females and 2-year-old males (usually considered nonbreeders) is not known. But if we assume that each constituted similar shares as 1-year-old males it is reasonable to believe that the frequency of juveniles/immatures during the whole spring migration at Kalmarsund is definitely less than 10%, probably not more than roughly 5%. In the calculations below the later figure is used.

A correct comparison with Alerstam *et al.* thus involves a reduction of their total of 700,000–800,000 Eiders with 5% immatures, to 660,000–765,000 adult Eiders or about 350,000 pairs, instead of 300,000 breeding pairs as they suggested. The discrepancy between the two investigations, approximately 50,000 pairs, is not great. Alerstam *et al.*, however, have to base their calculations on several assumptions and extrapolations, which are exemplarily described and explained. The main objection in our opinion is that they transfer the experiences from the size of the nocturnal migration over Scania, southern Sweden, to the situation in Kalmarsund, where the indications of such a large night migration are very small (see 'Diel periodicity' in Alerstam *et al.*). Also the large variation concerning the proportion of the migration falling during the standard hours of observation (see Alerstam *et al.*, appendix 2) may be an important source of error.

Monitoring of the Baltic Eider population

In wintering areas and on breeding grounds the Baltic Eiders are so dispersed that it is very laborious to count them and the figures received may also be inexact. The concentrations necessary for convenient and accurate censuses are provided on the spring migration along southeast Sweden and when the males gather in postbreeding flocks. Alerstam *et al.* (1974) demonstrated how traditional migration counts and radar observations can be combined and used also for estimations of population size. In our opinion the present investigation also turned out very successfully. Either of these two methods can be used for monitoring the Baltic Eiders. Beside economic advantages, the male counts offer the possibility of localizing parts of the population and following their changes. Since the Eider in many areas of the Baltic is still increasing it would be valuable to repeat the census after a few years and thus try to follow overall population trends in the Baltic simultaneously with counts on breeding grounds.

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Summary

An aerial census of adult male Eiders *Somateria mollissima* gathered in postbreeding flocks was made in the Baltic Sea on 29 May–5 June 1973. The dense flocks gather at traditional sites soon after the females start to incubate. 271,000 males were counted, mostly from photographs. This figure was corrected to approximately 297,000, including males still in the breeding areas, males migrating south out of the Baltic to Danish moulting areas and underestimations of numbers in flocks seen. The sex ratio was approximately 1:1, both in counts during spring-migration and on the breeding grounds. Thus the number of adult Eiders was about 594,000 specimens, or 297,000 pairs. This figure corresponds roughly with estimates from winter counts and radar studies of north-migration. The method of censusing Eider males in the Baltic, with male counts in postbreeding flocks, is suggested for monitoring purposes.

References

- Alerstam, T., Bauer, C.-A., & Roos, G. 1974. Spring migration of the Eiders *Somateria mollissima* in Southern Scandinavia. *Ibis*, 116:194–210.
- Almkvist, B. & Andersson, Å. 1972. Aerial census of flocked eider males *Somateria mollissima*—a method for estimating breeding populations. (In Swedish, with English summary.) *Vår Fågelvärld*, 31:237–240.
- Joensen, A. H. 1972. Studies on oil pollution and seabirds in Denmark 1968–1971. *Dan. Rev. Game Biol.* 6 no. 9.
- Joensen, A. H. 1973. The breeding of the Eider *Somateria mollissima* in Denmark. (In Danish with English summary.) *Danske Viltunders* 20.
- Paludan, K. 1962. Eider-ducks *Somateria mollissima* in Danish waters. (In Danish with English summary.) *Danske Viltunders* 10.
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