

The migration of the Goldeneye in north-west Europe

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Introduction

For many years, wildfowl counts have been performed in some European countries in order to increase our understanding of the movements and fluctuations of wildfowl populations (for example Atkinson-Willes 1963, Burckhardt 1958, Leuzinger 1964, Nilsson 1967a, 1967b, 1968, Requate 1954). In the ringing schemes of various countries large numbers of ducks have been ringed or marked with wing-tags and a few reports on the movements of European sea ducks have been published (Boyd 1959, Paludan 1962). However, no attempts at a combined analysis have been made.

The present paper seeks to outline the general pattern of the European Goldeneye *Bucephala clangula* migration in north-western Europe on the basis of the Swedish and Finnish ringing programmes, and of the wildfowl counts in Sweden, Britain and the Netherlands in 1961-62 to 1964-65. Sex ratio data were also collected.

General winter distribution in Europe

In winter, in Sweden, Goldeneye are mainly distributed around the coasts of the southern parts of the country, the January population probably not exceeding 20,000 (Nilsson 1967b, and unpublished). The species is widespread in Denmark, where 64,000 were actually counted in a survey covering the whole country in January 1968 (Joensen 1968). In Norway the species is widely distributed along the southern coasts but details are lacking (H. Holgersen *in litt.*).

The number wintering in the Netherlands is estimated to be about 50,000 but details are lacking (J. A. Eygenraam *in litt.*). The species is also common in Belgium during the winter (Lippens 1954), whereas the winter population of France is estimated at only 3,000 (F. Roux *in litt.*).

Atkinson-Willes (1963) summarises wildfowl counts from Britain and considers the winter population to be about 10,000. The species is common during the winter in Ireland with up to 5,000 on Lough Neagh alone.

In Germany up to 22,000 were counted along the coast of the Baltic in January 1967 (H. W. Nehls and G. A. J. Schmidt *in litt.*) and the species is also fairly common in inland Germany (Bezzel 1959, Requate 1954). Up to 1,000 are regularly

counted on the Lake of Constance (Sziij 1963). The Goldeneye is also a common winter visitor to Switzerland (Burckhardt 1958, Geroudet 1963, Leuzinger 1964), where up to 5,500 were counted in January 1967 (I.W.R.B. unpublished report).

Information is scarce from other parts of Europe but small numbers occur in winter in Austria, Czechoslovakia, Yugoslavia and the Balkan countries (Donner 1959; I. Tutman, B. Urbanek *in litt.*).

Analysis of ringing recoveries

Many Goldeneye have been marked with rings or wing-tags in Sweden and Finland, whereas in Norway and Denmark only a few have been ringed, yielding no recoveries showing any movement (H. Holgersen, N. O. Preuss *in litt.*).

Erz (1965) mentions two recoveries of Goldeneye marked in northern Germany and later found near Genoa, Italy, and in Bavaria. The ringing activities in Britain (Spencer 1966) have yielded four foreign recoveries, all of birds marked at Newburgh, Aberdeenshire, Scotland. Two were recovered in the following spring at the breeding places near Luleå in northern Sweden and one on the west coast the following autumn. One British-ringed Goldeneye was shot in SW. Finland in the autumn four years later.

All published and unpublished recoveries (except controls) from the ringing offices in Sweden and Finland up to August 1967 are tabulated according to country and month of recovery in Tables I and II (see also Figures 1 and 2). Goldeneye marked as young birds and as adult females in the breeding boxes are treated together as no differences were found between the two groups.

Goldeneye from the woodland area of northern Sweden (Figure 1) scatter over the countries bordering the North Sea to winter in Denmark and in the British Isles. Autumn recoveries were obtained from the west coast of Norway.

A large number of Goldeneye have been marked in a rather restricted area in central Sweden (Jämtland, southern part of area I) with recoveries mainly from Norway, Denmark and the British Isles. These Goldeneye thus either migrate over Norway, following the coast, to cross to Scotland, or pass inland through Norway and/or Sweden, crossing the Skagerack to Denmark, and, in smaller numbers, to Holland and France.

Table I. Recoveries of Swedish Goldeneye. Controls and recoveries on the breeding-places during the summer months of juveniles marked in the same year not included.

Country	Sept./Oct.	Nov./Dec.	Jan./Feb.	March-May	Total
Sweden	35	4	2	21	62
Finland	1	—	—	—	1
Norway	4	6	4	—	14
Denmark	7	22	9	2	40
Germany	—	3	2	1	6
The Netherlands	—	2	—	—	2
British Isles	1	8	9	2	20
France	—	1	3	—	4
Total	48	46	29	26	149

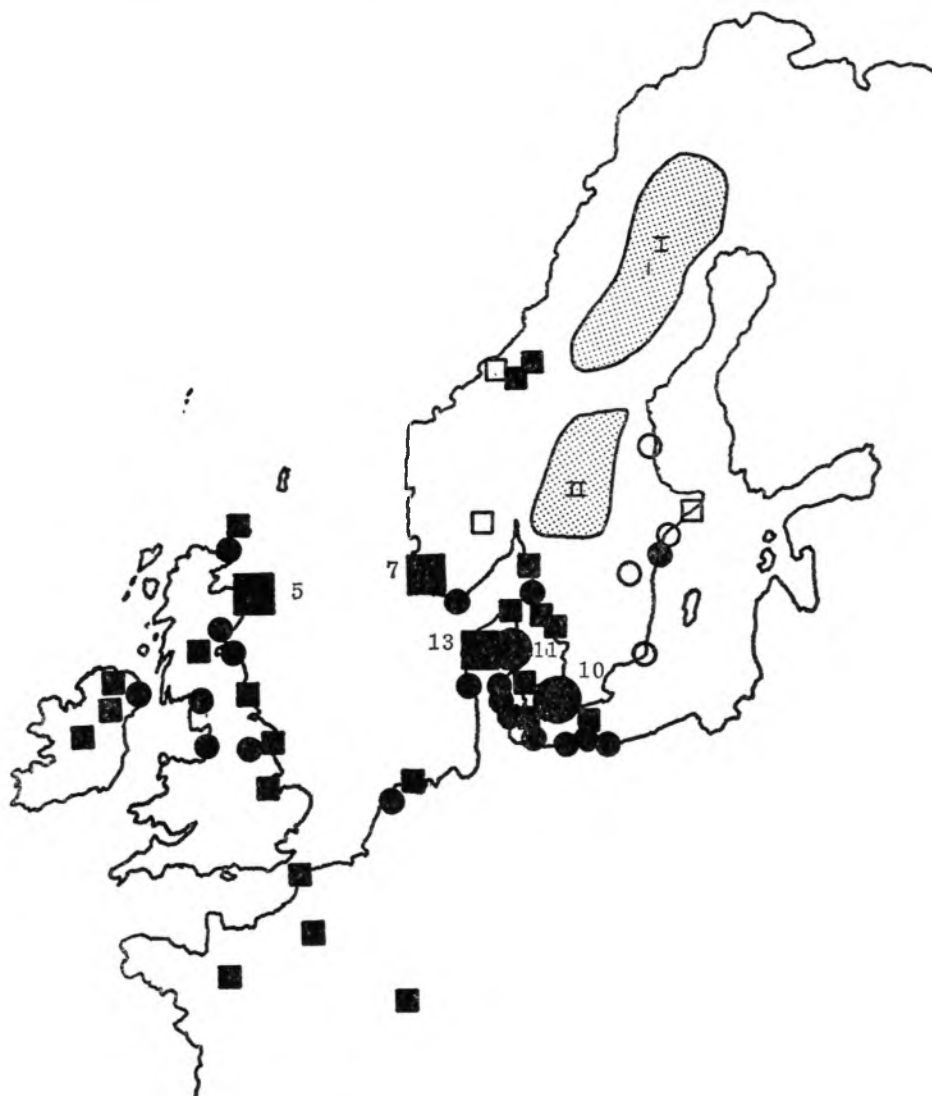


Figure 1. Recoveries of Goldeneye marked in north Sweden (I) (solid squares) and central Sweden (II) (solid circles). Open symbols denote recoveries from Norway and Sweden in September/October and March/April (recoveries from the winter areas in these months not separated on the map). Recoveries within 100 km. from the place of marking excluded.

Table II. Recoveries of Finnish Goldeneye. Control and recoveries on the breeding-places during the summer months of juveniles marked in the same year not included.

<i>Country</i>	<i>Sept./Oct.</i>	<i>Nov./Dec.</i>	<i>Jan./Feb.</i>	<i>March-May</i>	<i>Total</i>
Finland	6	—	—	—	6
Sweden	—	4	1	4	9
Norway	1	—	—	—	1
Denmark	—	8	13	2	23
Germany	—	3	3	—	6
The Netherlands	—	1	—	—	1
British Isles	—	—	1	—	1
Others	—	—	6	—	6
Total	7	16	24	6	53



Figure 2. Recoveries of Goldeneye marked in Finland. Open circles denote recoveries in September/October and March/April. Recoveries within 100 km. from the place of marking excluded.

The Goldeneye from more southerly parts of Sweden (Figure 1, area II) winter mainly in Denmark although seven recoveries were made in the British Isles and one in Holland. There are clear indications that they do not move as far to the south-west as do birds from area I. Three autumn recoveries show that some individuals follow the Baltic coast during the migration.

The great importance of Danish waters for Swedish Goldeneye is apparent from the map. Two areas are especially frequented: Goldeneye from northern Sweden stay mainly in the Limfjord area of Jutland, whereas Goldeneye from the southern parts of the country are common around the Danish islands. Swedish Goldeneye overwintering in the British Isles are mainly from the western and northern parts of Sweden. The British winter population is probably mainly of Scandinavian origin as there is only one Finnish recovery there. It is rather unlikely that Goldeneye from further east would be commoner than Finnish birds.

The scarcity of Scandinavian recoveries from the Netherlands is striking when the large winter population of the country is considered. The majority of the Goldeneye in this country may come from areas further to the east than Sweden (and Finland). When discussing the geographical distribution of recoveries it must be remembered that such data are undoubtedly biased due to different shooting seasons and different intensities of shooting.

The Goldeneye from Finland (Figure 2) mainly take a south-westerly course and arrive in Denmark after having traversed southern Sweden. The majority

stay for the winter in this country, equally divided between the Limfjord area and the Danish islands (including neighbouring areas of the south-western Baltic). Several, however, have been recovered in central Europe and down to the Mediterranean and Black Seas.

Seasonal fluctuations as revealed by wildfowl counts

The organisation of wildfowl counts is described in the papers cited in the introduction. Of the countries in which large numbers of Goldeneye winter, Britain, the Netherlands and Sweden have sufficient monthly counts to examine changes within the season. The Swedish data are restricted to the four seasons 1961-62 to 1964-65, so the comparative discussion is likewise limited. The British data are treated in three regions, England and Wales, East Scotland and West Scotland.

The number of places on which Goldeneye were counted and the peak numbers recorded (Table III) varied widely between regions. To render the data more comparable, the following procedure was adopted. For each region and for each season the number present in the peak month was taken as 100. The numbers present in the other months were then expressed as percentages of this peak. A mean index for each month over the four seasons can then be calculated, the maximum value being restored to 100 and the other means adjusted accordingly. Although not very respectable, statistically speaking, this method produces a fairly good picture of the fluctuations and obviates the need to present massive tabular information. The original data

Table III. Number of count points and the peak numbers of Goldeneye counted thereat in four seasons.

	1961-62	1962-63	1963-64	1964-65
Inland Sweden				
Counts	61	68	54	42
Peak	904	1697	722	743
Coast Sweden				
Counts	17	22	17	16
Peak	653	2201	1552	2103
The Netherlands				
Counts	61	86	121	117
Peak	7422	2939	789	2051
East Scotland				
Counts	39	40	49	46
Peak	855	2180	1456	2834
West Scotland				
Counts	24	25	27	27
Peak	647	502	390	501
England & Wales				
Counts	138	141	152	135
Peak	1195	1145	1236	983

are deposited at the Wildfowl Trust, Slimbridge.

Of the four seasons studied, 1962-63 was characterised by a very severe winter with almost no open water in Sweden in January whereas the other winters were more normal.

The wildfowl counts in Sweden give the following picture of the seasonal changes (Figure 3, see also Nilsson 1967b). In September there are only few birds on the waters in southern Sweden. In October autumnal maxima are noted at most inland resting places other than the extreme south (Scania) and some Goldeneye arrive at the coasts. By mid-November Goldeneye are still common in inland Sweden but the birds have moved in large numbers to the coasts. By December Goldeneye are generally scarce in inland Sweden and numbers north of Scania are at the winter level. The coastal localities have a peak in this month. During January and February numbers are low inland whereas numbers at the coasts vary mainly with the ice conditions; in the extremely hard winter of 1963 only a few were left in January. During March a heavy build up occurred at the coasts in all years followed by inland migration during April. Regional differences in southern Sweden north of Scania are negligible.

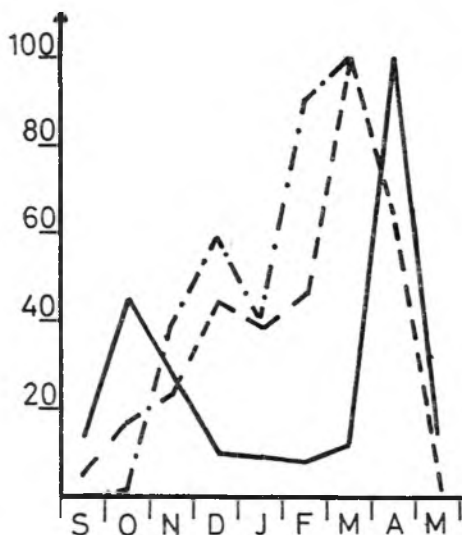


Figure 3. Mean seasonal indices for Goldeneye from wildfowl counts in inland Sweden (—), coastal Sweden (---) and the Netherlands (-.-.-) in 1961-62 to 1964-65. The means were recalculated to obtain a peak index of 100 for each area.

Data from the Netherlands (Figure 3) shows that Goldeneye arrive here in small numbers during October with greater numbers arriving in November followed by a peak in December and a decrease to a minimum in January. Numbers then increase again to a peak in February or early March depending on weather conditions. In the hard winter of 1962-63 January numbers were rather low, still lower numbers in February, but a marked spring peak occurred in March.

In Britain the general picture varied little in the four years. In all regions a marked increase occurred between the counts in October and December (Figure 4). In eastern Scotland the seasonal maximum was reached in the latter month, followed by a decrease during January and February and a new influx of migrants in March. In western Scotland the increase after the autumn migration continued slowly so that maximum numbers did not occur until later in the winter. In England and Wales the increase during autumn was about the same as in eastern Scotland but the peak was

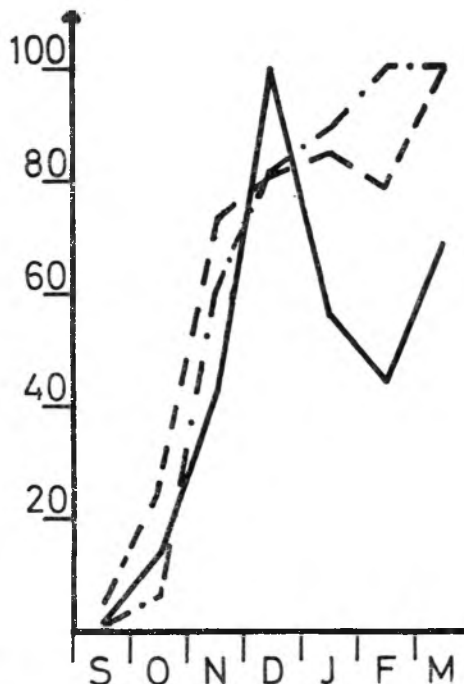


Figure 4. Mean seasonal indices for Goldeneye from the wildfowl counts in east Scotland (—), west Scotland (---) and England and Wales (-.-.-) in 1961-62 to 1964-65. The means were recalculated to obtain a peak index of 100 for each area.

not reached until February or March, just before spring migration started.

In the hard winter of 1962-63 a decrease was noted in western Scotland during January whereas the numbers normally increase in this month. In eastern Scotland that winter, the decrease from December to January was more marked than in the other years. The counts in England and Wales, however, showed the normal seasonal pattern, with no complementary increase. The Goldeneye which left western Scotland in greater numbers than normal therefore probably continued to Ireland.

A comparison between the wildfowl counts from the three countries show that the main influx begins in November in all areas except inland Sweden, where it starts in October. In normal years the majority of the Goldeneye arrive almost simultaneously in the British Isles and on the coast of south Sweden. This and the regional differences in the timing of peaks in Britain is consistent with migration of the British winter birds through Norway, where there are few suitable resting places. During the winter the most marked variation occurred in southern Sweden that is the most northerly of the winter areas examined. In the hard winter of 1962-63 all areas except England and Wales experienced some emigration of Goldeneye during the coldest period. In spring peak numbers occur in both Scotland and southern Sweden in March, whereas the peak was generally earlier in England and Wales and in the Netherlands.

The proportion of adult males among wintering Goldeneye

The sex ratio counts of Goldeneye in Sweden (Nilsson 1967b) show marked seasonal variation in the percentage of adult males indicating differential migration between the adult males and the first winter males plus females. The pattern is, however, complicated by local variations and differences in flocking tendencies between the sexes (Nilsson in prep.). Differences in other regions might also be suspected. For this reason data on the proportion of adult males have been collected from other parts of Europe (Table IV).

The counts for this purpose are restricted to the months December-March. The Swedish data are grouped according to whether they are from inland, or from coastal waters of the southern tip (Scania). The latter are further divided into those from the Öresund (on the west coast between Sweden and Denmark) and those from the south coast. The data are mean values from counts of all Goldeneye resting in the respective areas, to even out local variations. The proportion of adult males in the whole population is given, as some first winter males are similar to the females and have not generally been separated.

From the table a clear trend can be seen in the percentage of adult males in the Goldeneye when proceeding from the breeding grounds towards the winter areas, i.e. in a south-westerly direction. Adult males dominate the populations only in Sweden north of Scania and the lowest values in western Europe are found in

Table IV. Percentage of adult males among Goldeneye in different regions.

Region	Years	December		January		February		March		Source
		Sample	%	Sample	%	Sample	%	Sample	%	
Sweden (inland)	1959-67	1795	45	2851	59	2363	55	9630	61	(a)
Scania (Öresund)	1962-67	5472	28	10362	39	9972	44	27488	43	(b)
Scania (S. coast)	1964-67	5715	49	12584	51	12027	47	8308	38	(b)
S-Holstein (coast)	1963-67	—	—	5855	40	—	—	3100	51	(c)
N. Germany (inland)	1955-61	546	47	554	48	754	35	985	45	(d)(e)
S. Bavaria	1955-58	1219	38	1714	36	833	42	947	46	(f)
Scotland	1950-63	454	35	1374	33	—	—	1013	33	(a)
England	1950-63	611	22	725	19	775	20	663	30	(a)
N. Switzerland	1958-61	1599	23	2392	27	3151	30	934	24	(g)
L. Constance	1959-61	612	11	407	21	—	—	620	16	(h)

Sources. (a) National Wildfowl Counts; (b) Nilsson in prep.; (c) G. A. J. Schmidt; (d) Erlich (1963); (e) S. Dittmann, H. Hasse, A. Hinsche, K. Puchstein, K. Tuscherer; (f) Bezzel (1959); (g) H. Leuzinger; (h) R. Kuhk.

England, Switzerland and Lake Constance. It may be noticed that the Goldeneye in the two latter areas come mainly from more easterly breeding populations than the Swedish.

While the regional differences in the percentage of adult males among wintering Goldeneye to be expected from the seasonal changes in sex ratio in Sweden is apparent in the data presented here, sex ratio counts from southern Norway, Denmark, the Netherlands, and Ireland are badly needed.

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Summary

An analysis of the recoveries of Goldeneye *Bucephala clangula* up to August 1967 show that Goldeneye from Sweden winter in the countries bordering the North Sea, with the majority of recoveries in Danish waters. Finnish Goldeneye were mainly recovered in Denmark but some were found scattered over the continent.

According to wildfowl count data from Sweden, the Netherlands and Britain in 1961-62 to 1964-65, the first main arrivals occurred in November simultaneously at the coasts of southern Sweden, in Britain and the Netherlands. In spring, peak numbers at the coasts of southern Sweden and Scotland occurred in March but it was generally earlier in England and the Netherlands.

Adult males dominated among the Goldeneye in Sweden north of Scania, whereas females and immatures predominated in all other areas from which data were obtained.

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