Movements of Tufted Duck ringed in Britain: a preliminary assessment

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Introduction

The Tufted Duck *Aythya fuligula* is the commonest and most widespread diving duck in Britain. It only arrived as a breeding species in the middle of the last century, but has increased steadily to its present estimated population of around 7,000 breeding pairs. These birds and their offspring are partially migratory, those in the southern half of the country normally resident, while those breeding in Scotland appear to move south and west for the winter. Winter visitors from northern Scandinavia and the USSR join the residents to produce mid-winter totals of around 60,000 (Owen *et al.* 1986).

No analysis of all the British ringing recoveries has hitherto been published for this species, though Boyd (1957) reported on recoveries then available for the summer months, which revealed the northern breeding grounds of the winter visitors, and Owen *et al.* (1986) included a more up-to-date map of the summer recoveries.

Ogilvie (1982) and Baillie *et al.* (1986) both analysed Tufted Duck recoveries in relation to periods of severe winter weather, detecting some movement southwards into France and southern Europe in the winters 1978–79 and 1981–82.

Because so much of the ringing is very recent (see below), with recoveries still accruing, the picture presented here should be regarded as a preliminary one, undertaken to assess the knowledge gained thus far, and to help in deciding on future levels of Tufted Duck ringing.

Tufted Duck ringing in Britain

The first Tufted Duck ringed in Britain were three in 1909. In the period from then until the end of 1984, the total had reached 16,985. The number of recoveries that this ringing has generated stands at 1,996, though the omission of controls (locally retrapped birds) and those recoveries with incomplete or vague information reduces the total to 1,674.

Table 1 sets out the ringing and recovery totals in five and ten year periods, demonstrating how very recent is much of the ringing, and therefore the recoveries. The total ringed has actually doubled in the last six years, and quadrupled in the last 13, with the recovery total doing so even more quickly. Taking just birds ringed up to the end of 1970, all of which can be assumed to be dead, the final recovery rate is about 17.5% (629/3603). Thus there are about another 1,300 recoveries still to accrue from the ringing since 1970.

This great upsurge in the catching of Tufted Duck has come about largely

Table 1. Ringing and recovery totals for Tufted Ducks ringed in Britain, 1909–1984.

Period	No. ringed	Number recovered from that ringing		Number recovered in period
		No.	%	
1909–20	65	9	13.8	8
1921–20	5	0	0.0	1
1931–40	107	24	22.4	23
1941–50	201	43	21.4	20
1951–55	187	43	23.1	50
1956–60	357	65	18.3	68
1961–65	339	45	13.3	29
1966–70	2342	400	17.1	265
1971–75	2712	325	12.0	303
1976–80	4912	436	8.9	407
1981–84	5758	284	4.9	500
Total	16985	1674	9.9	1674

through the activities of the Wildfowl Trust ringing stations. Over 75% of all the Tufted Duck ringing in Britain has been by the Wildfowl Trust, while in recent years the proportion has been well over 80%. The traditional duck decoys operated by the Wildfowl Trust over many years since the late 1940s rarely catch diving ducks. However, the major trapping station at Abberton Reservoir, Essex, has caught considerable numbers in its cage traps, since its establishment in 1949, while even more successful has been cage-trapping at gravel pits, one of the favoured habitats of this species.

Tufted Duck were caught at the Deeping pits, near Stamford, Lincs, steadily through the 1960s and 1970s, but the more recent commencement of trapping at pits near Fakenham, Norfolk, and especially near Sandy, Beds, has been responsible for the bulk of the increase in numbers caught. In addition, nearly 300 nesting female Tufted Duck and just under 1,000 well-grown young were ringed between 1965 and 1970 at Loch Leven, Kinross, the single most important nesting site in the country. Finally, a specially-constructed swan trap at Slimbridge, Glos, has caught several hundred Tufted Duck. The remaining Tufted Duck ringed in Britain have been in scattered small numbers at several different localities.

Distribution of ringing

Table 2 sets out the geographical distribution of the available recoveries, by county or region of ringing. The very considerable uneveness in the distribution of the main ringing sites, predominantly in south-east and eastern England, plus a single site in eastern Scotland, must be taken into account in considering the recovery patterns. In particular, the recoveries of the ducks ringed at Loch Leven, all of which were known to be breeding birds or their young, will be treated separately.

Table 2. Ringing location of 1674 Tufted Duck recoveries.

County	No.	Area	No.
Gloucester	37	Other SW England	6
Essex	676		
London	94		
Bedford	88	Other SE England	46
Lincoln	321	Other E England	90
Cheshire	51	Other cent. & N England	24
Kinross	202	Other Scotland	23
Ireland	10		
Unknown	6		

Age and sex of recovered birds

Table 3 shows the breakdown of the recoveries according to the age and sex of the birds at ringing. The proportion of birds not sexed (7%) is quite small, not unexpectedly forming the largest component of those ringed as ducklings. If the unknown sex birds are omitted, the percentages of males (57%) and females (43%) represents a ratio of 133 males/100 females. Owen and Dix (1986) have recently analysed sex ratio information for the Tufted Duck, obtained from counts in the field in Britain and elsewhere in north-west Europe, and from shooting bag records. Allowing for problems with sexing birds early in the winter, they concluded that the ratio from counts in Britain was 149M/100F, that from shooting between 113M and 132M/100F, and in north-west Europe between 125 and 132M/100F.

Table 3. Age and sex at ringing of Tufted Duck recoveries.

Age category	Male	Female	Unknown	Total
1 = unfledged young	14	7	24	45
2 = age unknown	57	65	15	137
3 = in 1st calendar year	245	261	33	539
4 = older than 1 year	323	242	25	590
5 = in 2nd calendar year	186	88	6	280
6 = older than 2 years	74	9	0	83
Total	889	672	113	1674
%	53	40	7	
% (Omitting unknowns)	57	43		

Table 4. Ageing and sexing of Tufted Duck recoveries, 1911–1986.

Period of ringing	Aged & sexed No.	%	Unknown age	Unknown sex	Unknown age or sex	Total recoveries
1911–20	2	22	0	7	0	9
1921–30	0	–	0	0	0	0
1931–40	19	79	1	3	1	24
1941–50	25	58	7	10	1	43
1951–55	21	49	16	4	2	43
1956–60	46	71	13	3	3	65
1961–65	38	84	4	3	0	45
1966–70	378	94	9	13	0	400
1971–75	307	94	9	5	4	325
1976–80	367	84	26	39	4	436
1981–84	236	83	37	11	0	284
Totals	1439	86	122	98	15	1674

There are so many biases in the information obtained from ringing recoveries, including variation in the trappability of birds and in their vulnerability to being recovered, that the level of agreement in sex ratios between the available recoveries and the figures obtained from counts and shooting bags must be regarded as reasonably encouraging.

The distribution of age at ringing among the recovered birds shown in Table 3 indicates that the ringers are positively ageing the majority of the birds. Just 8% were put in category 2, which essentially means that the ringer was unable to ascribe any age to them. Techniques for ageing Tufted Duck have been improving in recent years, following the pioneering work of Boyd *et al.* (1975), but there are still variations in the way that different ringers apply them.

Table 4 sets out the number of birds aged and sexed, together with those which were not, divided into five and ten year periods of ringing. Predictably, the proportion of birds aged and sexed in the early years of ringing was quite low, but it is disappointing that the great improvement shown in the late 1960s and early 1970s was not maintained in the last ten years. Of the 54 birds not sexed in the last two periods, 23 were ringed as pulli, when sexing depends on cloacal examination, a technique outside the experience of all but a relatively small number of wildfowl experts. The lack of age or sex details for the remainder of the recently-ringed birds may perhaps be ascribed at least in part to the start-up of new trapping stations manned by ringers with limited

Table 5. Month of ringing of Tufted Duck subsequently recovered.

Month of ringing	Males		Females		Unknown		Total
	Adult	Young	Adult	Young	Adult	Young	
January	54	46	29	43	10	4	186
February	72	38	28	25	4	3	170
March	52	28	13	17	4	0	114
April	42	28	4	9	1	0	84
May	48	42	17	5	1	0	113
June	49	19	70	3	1	0	142
July	8	8	24	4	0	9	53
August	8	49	15	31	0	33	136
September	15	48	15	59	4	11	152
October	17	43	23	45	6	4	138
November	40	49	29	71	3	5	197
December	49	37	49	44	6	4	189
Totals	454	435	316	356	40	73	1674

Adult = age categories 2, 4, 6
Young = age categories 3, 5

knowledge, as well as to the accidental capture of birds by ringers unprepared with the necessary information. In the subsequent analyses, unsexed birds are treated separately, while unaged birds are lumped with adults as being the more probable category to which they belong.

Timing of ringing

As Table 5 reveals, the recovered Tufted Duck have been ringed fairly evenly throughout the year. Indeed, the spread of ringing compares very favourably with that for dabbling ducks, which show a very considerable bias towards the autumn months when they are easier to trap, especially in duck decoys. Tufted Ducks seem to be trappable throughout the winter, while useful numbers have been caught in spring and summer, either in traps or, in the case of the majority of the adult females, in May and June on their nests at Loch Leven, Kinross. The latter site is also responsible for a high proportion of the young ducks caught in July and August.

Methods of recovery

The Tufted Duck is a quarry species throughout its range and so, as Table 6 shows, the great majority of recoveries where the cause of death is given arise from shooting, with accidental death accounting for virtually all the remainder. There is a highly significant difference ($X^2=13.23$, $P<0.001$) between the causes of death of males and females, with the latter apparently more vulnerable to shooting. The majority of the accidental deaths arise from birds becoming entangled in fishing nest, or caught in traps set for muskrats and other mammals, when a sex difference would not be expected.

Origins of winter visitors

Table 7 sets out all the available recoveries divided by month and country of recovery, while Figure 1 shows the median recovery positions for each month of the year. Both give the broad-brush picture of the origins

Table 6. Causes of death of Tufted Duck. Birds caught and released alive are omitted. Percentages are of total for which cause of death reported, omitting unknowns.

Reported cause of death	Males		Females		Total	
	No.	%	No.	%	No.	%
Shooting or other deliberate killing	588	81.9	503	89.3	1091	85.2
Accidental death	125	17.4	51	9.1	176	13.7
Predation	4	0.6	6	1.1	10	0.8
Disease	1	0.1	3	0.5	4	0.3
No cause given	127		88		215	
Totals	845		591		1496	

Table 7. Distribution of all Tufted Duck recoveries, 1911–1984.

Month of recovery	Ice	Nor	Swe	Fin	USR	Cze	Pol	GDR	FRG	Den	Net	GBr	Eir	Fra	Spa	Por	Ita	Swi	Totals
January	–	–	1	–	–	–	–	–	4	3	20	321	25	13	4	–	–	–	382
February	–	–	–	–	1	–	–	–	1	1	6	43	5	3	–	–	–	–	60
March	–	–	1	–	–	–	–	–	1	1	9	30	–	2	–	–	–	–	44
April	–	–	5	4	3	–	3	1	1	1	3	20	–	–	–	–	–	–	42
May	1	1	3	42	81	–	–	2	1	1	1	23	1	–	–	–	–	–	157
June	2	2	1	3	9	1	–	–	1	–	1	15	1	–	–	–	–	–	36
July	1	1	1	4	5	–	–	1	1	–	2	23	–	5	–	–	–	–	44
August	1	5	3	21	15	2	6	1	3	1	16	11	–	7	–	–	–	–	92
September	2	3	11	16	31	1	1	–	2	–	16	86	5	4	–	–	1	–	169
October	–	1	7	4	19	–	2	2	–	16	11	126	6	4	1	–	–	–	199
November	–	–	4	–	–	1	–	1	4	5	23	150	10	10	1	1	–	1	211
December	–	2	–	–	–	–	–	–	3	1	25	172	21	12	1	–	1	–	238
Totals	7	15	37	84	164	5	12	8	22	30	133	1011	74	60	7	1	2	1	1674

Countries involved – Iceland, Norway, Sweden, Finland, USSR, Czechoslovakia, Poland, German Democratic Republic, Federal Republic of Germany, Denmark, Netherlands, Great Britain, Eire, France, Spain, Portugal, Switzerland. The April total includes one recovery in Pakistan.

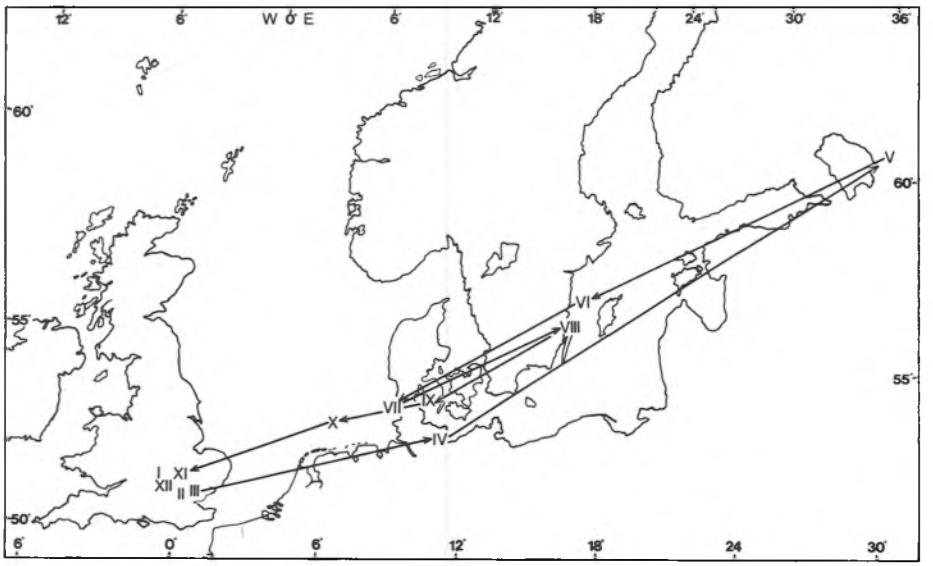

Figure 1. Median recovery positions for each month of recovery. Monthly totals see Table 7.

and destinations of Tufted Ducks ringed in Britain. The number of recoveries does not allow for a very detailed breakdown by age or sex, though there were, in fact, no significant differences in the median recovery positions for males and females. Recovery tables and maps of this nature for quarry species should always be viewed in the context of shooting seasons, which vary considerably across the range, as well as during the long period under condsideration.

Two examples may be given. Firstly, the early start to the shooting season in France (in July) gives rise to a large number of recoveries in that country compared with the Netherlands, Denmark and other countries further east, and so produces an anomalous median recovery position for that month. Such considerations make proper interpretation of autumn movements especially difficult. Secondly, the pattern of recoveries in the USSR reflects the existence over many years of a spring shooting season there, though this is supposed to have been stopped in recent years. However, it probably biasses the May recoveries compared with northern Scandinavia.

It is clear from Table 7 that we receive wintering or passage birds from Iceland, northern Scandinavia and the Soviet Union. The number of recoveries in Iceland does not adequately represent the population of Tufted Duck from that country which winters in Britain, because, naturally, the number of recoveries from that sparsely populated country is always going to be low. In addition it seems likely that Icelandic Tufted Duck may winter in Scotland and Ireland in preference to England, where the bulk of the ringing has been carried out. All seven recoveries were ringed during the winter (November–March), two in Aberdeenshire during the January 1963 cold weather, and one each in Wexford, Cheshire, Gloucestershire, Lincolnshire and Essex, so rather little can be deduced from this scatter. Interestingly, though, all were males, and were mainly caught in mink traps or fish nets.

Almost all of the recoveries in the USSR are north of about 55°N with a concentration bounded by 60–70°N and by 50–70°E. This takes in both a considerable area of tundra as well as the great river valleys of the Ob and the Pechora. This together with Finland can be regarded as the principal breeding area for British wintering Tufted Duck.

The months of ringing of the 248 Tufted Duck recovered in Finland and the USSR are set out in Table 8. This shows that by no means all the birds were caught during the winter months, suggesting a small degree of abmigration by British Tufted Ducks, with both adult birds ringed in the summer and juveniles in the very early autumn sub-

Table 8. Ringing months and age and sex at ringing of Tufted Ducks recovered in Finland and the USSR.

Month of ringing	Adult males	Adult females	Adult unknown	Young males	Young females	Young unknown	Totals
January	13	7	3	9	11	1	44
February	18	5	1	5	6	1	36
March	14	4	2	9	3	0	32
April	10	1	0	1	0	0	12
May	11	2	0	5	1	0	19
June	6	5	0	2	0	0	13
July	1	2	0	3	0	0	6
August	3	1	0	4	0	1	9
September	2	0	1	5	3	2	13
October	1	1	0	2	2	0	6
November	5	3	0	4	13	0	25
December	6	10	2	8	7	0	33
Totals	90	41	9	57	46	5	248

sequently migrating to these northern breeding grounds.

Changes in recovery distribution with time

With the recent increase and spread of the Tufted Duck in Britain over recent decades, it might be expected that changes in the distribution of recoveries would have occurred. Unfortunately, as Table 1 revealed, most ringing of Tufted Duck is very recent, allowing rather little opportunity for comparing recoveries in different periods.

A number of possibilities have been examined but only one significant difference in recovery distribution with time has become apparent. Table 9 shows the distribution of recoveries made before and after 31st December 1970. Chi-squared significance tests performed on various individual and grouped countries show that there has been a highly significant increase in the proportion of recoveries in the group comprising Czechoslavakia, Poland, East and West Germany, Denmark and the Netherlands ($X^2=34.7$, $P<0.001$), with the last-named country contributing the greatest increase (9 v. 124). There appears to be no change in shooting seasons that can account for this, with approximately 65% of recoveries in both periods occurring in the months of September to January.

Table 9. Distribution of Tufted Duck recoveries before (I) and after (II) 31st December 1970.

Area	Period I No.	Period I %	Period II No.	Period II %
Ice	3		4	
Nor. Swe. Fin. USR.	96	20.7	204	16.9
Cze. Pol. GDR. FRG. Den. Net.	22	4.7	188	15.5
GBr.	303	65.3	708	58.5
Eir. Fra. Spa. Por. Ital. Swi.	40	8.6	105	8.7
Pak.	0		1	
Total	464		1210	

Comparisons between the recoveries in the other parts of the range for the two periods show no significant differences for the remainder of western Europe, nor for the summer recoveries in Scandinavia and the USSR. Indeed, there is a striking similarity between the median recovery position for recoveries in the USSR, that for the period prior to 1971 being 61.9°N, 49.4°E (n=56) and for the period after 1970 being 61.6°N, 49.9°E (n=108).

Summer moult movements

There are no less than 60 recoveries of adult and first summer male Tufted Duck ringed during June, all of them caught at Abberton Reservoir, Essex, while undergoing their annual moult. Table 10 sets out the distribution of these recoveries. Of note are the subsequent summer recoveries in the USSR, up to 11 years later. Recoveries still

Table 10. Distribution of recoveries of adult and first summer male Tufted Ducks ringed in June at Abberton Reservoir, Essex. Period I – May to August. Period II – September to April.

Country of recovery	Years from June of ringing										Totals
	Same	1		2		3		4		5 to 11	
	II	I	II	I	II	I	II	I	II	years	
Britain	9	2	4	2	2	1	2	4	–	4	30
Ireland	–	1	–	–	–	–	1	–	–	–	2
France	3	–	1	–	–	–	2	–	1	–	7
Netherlands	2	–	2	–	1	–	–	–	1	3	9
Denmark	1	–	–	–	1	–	–	–	–	–	2
West Germany	1	–	–	–	–	–	–	–	–	–	1
East Germany	–	–	–	1	–	–	–	–	–	–	1
USSR	–	–	–	1	–	2	1	1	–	3	8
Totals	18	3	9	4	6	3	6	1	6	10	60

in Britain in following summers may indicate that some of the birds are of British origin, though equally they could be continuing to moult in Britain whilst attached to breeding grounds elsewhere.

The single recovery of a Tufted Duck in Pakistan (included as a footnote to Table 7) would have been included in Table 10 had it been ringed three days later. It was caught on 28th May 1969, and recovered in Pakistan in April 1971.

Onward movements in winter

Hard weather

Hard weather movements by Tufted Duck from north to south Britain, and from Britain south into southern Europe, have already been examined by Ogilvie (1982) and Baillie *et al.* (1986). They found significant differences between the recovery patterns in mild winters and those in hard winters, with pronounced exoduses in 1978–79 and, particularly, 1981–82.

What these authors did not comment on was the age of the birds involved. Table 11 breaks down the recoveries in France and Spain in the months of December to March, further indicating whether the birds moved in the same winter season as they were ringed. It is clear from this, firstly that a higher than expected proportion of young birds have shown onward movement, bearing in mind that overall only some 35% of recoveries related to birds ringed as juveniles in their first calendar year (see Table 3), and secondly, that the young males, in particular, seem to be more prone to move than the females, or perhaps are more vulnerable having done so.

Table 11. Recoveries of Tufted Duck in France and Spain, December to March, indicating influence of hard weather.

Age and sex at ringing	Recovered same season	Recovered later season	Totals
Adult male	1	8	9
Adult female	3	4	7
Adult unknown	0	0	0
Juvenile male	8	5	13
Juvenile female	1	3	4
Juvenile unknown	1	1	2
Totals	14	21	35

British-bred birds

It has already been seen how at least some of the Tufted Duck present in Britain in the summer months may belong to distant breeding grounds, and it is therefore not possible to look at subsequent movements of summer-ringed birds in order to detect whether British-bred Tufted Duck migrate, other than in hard weather. However, those Tufted Duck ringed as breeding females on the nest, or as fledging young, at Loch Leven, Kinross, are undoubtedly British stock and there are sufficient recoveries to examine these separately.

Table 12 sets out the distribution of the recoveries of Tufted Duck ringed at Loch Leven. All the ringing was done during the period 1966 to 1973. There is a very marked movement of these Scottish birds to Ireland, with the nesting adult females moving as well as the juveniles of both sexes. Abmigration of British Tufted Duck has already been mentioned, and is shown as including a small percentage of the Scottish

Table 12. Recoveries of Tufted Ducks ringed at Loch Leven, Kinross.

Age and sex at ringing	Sco	Eng	Ire	Fra	Spa	Net	Den	FRG	Nor	Fin	USSR	Total
Adult male	1	2	–	–	–	–	–	–	–	1	–	4
Adult female	29	8	35	2	1	–	–	–	–	3	2	80
Adult unknown	–	1	1	–	–	–	–	–	–	–	–	2
Juv male	12	6	30	4	–	2	–	–	2	4	1	62
Juv female	21	4	20	2	1	–	1	1	–	–	–	50
Juv unknown	1	1	2	–	–	–	–	–	–	–	–	4
Totals	64	22	88	8	2	2	1	1	2	8	3	202

birds, both adult females, and both adult and juvenile males, though there is no record of a juvenile female straying further than Denmark. The movement of Scottish Tufted Duck south into England is clearly much less significant than the movement south-west into Ireland.

Conclusions

It must be emphasised again that with so much of the Tufted Duck ringing so recent, with very many recoveries still to be made of birds already ringed, any results from analysing the present recoveries must in many ways be regarded as tentative. Only the Loch Leven ringing of the late 1960s and early 1970s can be treated as a complete set of data, with probably no more recoveries likely.

The number of birds with no record of age or sex is disappointingly high, particularly because birds lacking this basic information are clearly still being ringed and released. Everyone expecting to trap ducks should make themselves familiar with the principles of cloacal examination, which as well as accurately sexing ducklings is also a help in ageing males, and with the available techniques for ageing based on plumage.

The present distribution of ringing in Britain is heavily biassed towards south-east England, though the Loch Leven ringing did provide a useful counterbalance whilst it lasted. Equally this latter ringing helped to produce the relatively even distribution of ringing through the year, though this is still possible if the capture of summer moulting birds continues. The ability to catch Tufted Duck in cage traps set in quite small gravel pits provides a technique that it should be possible to introduce to other areas of the country relatively cheaply. In particular, more trapping in Northern Ireland and the Republic of Ireland would usefully include birds of Scottish as well as Icelandic origin.

Changes in the distribution of recoveries with time could only be examined rather superficially with the data available, but there should be more scope for this in future, both with the recoveries due from the ringing to date, and especially if the ringing continues at its present level. It should be possible to compare, for example, the results of ringing in the 1970s with those in the 1980s. The Tufted Duck populations have been in such a dynamic state in Britain and much of Europe in recent decades, spreading and increasing as a breeding and wintering species, that it is entirely possible that recoveries may reflect and possibly help to monitor this growth.

It can be concluded that there are three separate populations of Tufted Duck using Britain at some time during the year. Wintering and some moulting birds come from breeding grounds in Iceland, and from northern Scandinavia to northern USSR, to join a large indigenous breeding population. The latter is not homogenous, however, with the Scottish breeders moving south-west for the winter into Ireland, while it seems probable that the Tufted Duck breeding in the southern half of Britain are normally sedentary. They do move under the influence of very severe weather, heading south and south-west to France and Iberia. There is no evidence of a movement west into Ireland, however. Both Scottish and southern British stock have produced small numbers of abmigrants.

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Summary

A total of 1,674 recoveries of Tufted Duck *Aythya fuligula* ringed in Britain since 1911 were analysed. Ringing of this species has increased greatly in the last ten years, though mainly in south-east England. The ratio of 133 males to 100 females in the recovered birds closely parallels that found in counts and shooting bags. Ringing has been well spread through the year, including that of breeding birds and their young.

Tufted Duck from breeding grounds in Iceland and from northern Scandinavia to northern USSR winter in Britain, and adult males from the latter area also moult in Britain. British breeding birds show a degree of abmigration. Breeding females and their young ringed at Loch Leven, Kinross, migrate south-west to Ireland for the winter, but those ringed further south in Britain are mainly sedentary except in hard weather when there is a southward movement, particularly by young males, to France and Iberia.

Further ringing of Tufted Duck should be done in areas away from south-east England, and standards of ageing and sexing should be improved.

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