

Migration and seasonal distribution of Gadwall from Britain and Ireland: a preliminary assessment

A.D. FOX and CARL MITCHELL

Introduction

The Gadwall *Anas strepera* has shown considerable range extension in the western Palearctic this century partly due to climatic amelioration and to artificial introduction (Cramp and Simmons 1977). The species has also gained from the increase in suitable habitat, such as flooded mineral extraction pits and reservoirs (Fox and Salmon 1988). This was the suggested cause of the eastward spread of the species in North America (Henny and Holgerson 1974). The species is highly migratory in the north and east of its Palearctic range; breeders from the Baltic countries and west-central USSR winter around the North Sea, whilst French and Dutch breeding birds appear to be resident (Cramp and Simmons 1977). Gadwall breeding in south-central USSR and adjacent parts of eastern Europe, through to western parts of Siberia, winter in the Black and Caspian Sea areas, with some moving to the Nile Delta, East Africa and south-west Asia (Dementiev and Gladkov 1952; Treus 1957).

The numbers of breeding pairs in Britain have increased by 4.5% per annum since 1960 (Fox 1988) and the wintering population has grown by 15% per annum in parallel with a similar expansion in the Low

Countries (Rüger *et al.* 1986; Fox and Salmon 1988). In spite of increasing breeding numbers here, the expansion in the wintering population cannot be explained simply in terms of the resident population. The present paper therefore analyses ringing recoveries of Gadwall to establish migration patterns and suggest reasons for the expansion in wintering numbers.

Methods

All recoveries of birds ringed in Britain and Ireland, and those foreign ringed birds recovered therein, are processed by the British Trust for Ornithology (BTO). Gadwall data were obtained from the BTO up to the end of 1983, and subsequent recoveries were added at Slimbridge by the Wildfowl Trust – up to and including a recovery dated 29 January 1988. Manipulation of this database enables analysis by sex and age class, ringing site and recovery location, time and distance between ringing and recovery and the finding circumstances. Up to 31st December 1986, 3,123 Gadwall had been ringed in Britain and Ireland, of which 472 had been recovered, including 2 controls, before February 1988.

Table 1. County and month of ringing of all Gadwall ringed in Britain and Ireland and recovered before February 1988.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Bedford	1	5										6	12
Cambs	9	7	1					2		4	5	7	35
Dorset		1											1
Essex	26	11	3	4	11	9	21	44	33	6	10	13	191
Glos	33	18	11				1	6	18	14	16	29	146
Lincs	2	2						3	4	2	1	2	16
Norfolk				1			4	8	6	1	4	7	31
Northumb								2					2
Staffs								1					1
Suffolk					1	2	9	4	4	3			23
Wilts								2					2
Tayside				4	6								10
Co. Down								2					2
Total	71	44	15	5	16	17	35	74	65	30	36	64	472

Of the recovered Gadwall, 80% were ringed by the Wildfowl Trust at its ringing stations at Abberton Reservoir (Essex), Nacton (Suffolk) and Slimbridge (Gloucestershire). Gadwall first bred at Abberton in 1950, although the reservoir held a few wintering birds before then; numbers of Gadwall using the reservoir have been relatively stable at 50–100 birds (December) in recent years. At Nacton, Gadwall were rare late summer visitors in the 1950s, but had begun wintering by the late 1960s. The feral population at Slimbridge was established in the late 1950s from free-flying off-spring of captive parents and hence is essentially an artificially introduced colony. This has given rise to the breeding population in much of the south-west of Britain, currently expanding at 9% per annum. These differences should be borne in mind in considering the movement of ducks ringed at these sites. A full breakdown of location and time of ringing of all Gadwall ringed in Britain and Ireland is shown in Table 1.

Results

Recovery circumstances

Perdeck and Clason (1980) pointed out that different recovery patterns emerge from differences in recovery circumstances—shot birds in particular, bias recovery by being confined to an open season, the timing, length and magnitude of which varies greatly between countries. In France, Gadwall can be shot from late July until March, while in Britain (except on the coast), Ireland and the Netherlands, the season closes on 1st February. Further east, the open season is even shorter, generally running from August through to the end of November (Lampio 1982). Similarly, the chances of a ringed bird being found dead are greatly enhanced in the south and west of Europe where human population and activity are greatest. This source of bias must be considered in all interpretations of the recovery picture. A breakdown of recovery circumstances is shown in Table

Table 2. Finding circumstances of recovered Gadwall.

Reported cause of death or recovery	Number
Shot or otherwise intentionally killed	418
Accidentally killed by humans or their materials	5
Trapped by other ringers and released ('controlled')	2
Other predators	1
Disease or starvation	2
No positive information	44
Total	472

Table 3. Recovery country and month of recovery of Gadwall ringed in Britain and Ireland and recovered before February 1988.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
USSR (Europe)				1	1			2		1			5
Poland								4					4
Ger Dem Rep						1		1		2			4
Fed Rep Ger					2				1	1		1	5
Sweden								2	1				3
Denmark								2		1			3
Netherlands								1	11	11	6	4	33
Ireland	1									2	1	3	7
Great Britain	57	10	5	2	3	5	2	3	28	36	51	48	250
France	24	22	1	1		1	3	4	5	14	43	27	145
Spain	3	1	1							2	2	1	10
Italy			1										1
Algeria	1												1
Malta								1					1
Total	86	33	8	4	6	7	5	20	46	70	103	84	472

2; of these 408 (86%) were shot and a further 12 (2.5%) otherwise hunted or trapped by man.

Breeding origin of British and Irish Gadwall

The distribution of recoveries of Gadwall ringed in Britain and Ireland in all months is shown in Table 3. Although the sample size is small the pattern during May, June and July (when on their breeding grounds) shows a wide distribution, including two from the USSR well east of most other recoveries. Birds recovered on passage lend further support to the hypothesis that some of our wintering Gadwall derive from eastern Europe, with records from Germany, Denmark, Poland, European USSR and Sweden during August–October when the species is known to move to milder western European areas (Figure 1). The ratio of recoveries from eastern Europe v. Britain and France during September and October is 3:1 ($n=114$) compared with 1:1 ($n=24$) in July and August before the onset of the shooting season in some parts. If these

values bear any relationship to the actual overlap of the populations and assuming reporting rates are equivalent throughout eastern and western Europe, it would appear that at least 33–50% of Gadwall wintering in Britain and Ireland derive from eastern European populations. There have been 28 recoveries during May–August of birds captured in winter at Slimbridge and Abberton. Intriguingly, 64% of the Abberton birds were recovered in Britain, compared with 21% of the Slimbridge-ringed birds; conversely 57% of the latter were recovered on the Continent, east of the British Isles as far as 21°E, compared to 28% of those ringed in Essex.

Birds ringed as pulli overseas recovered in Britain and Ireland

Of 15 pulli ringed abroad, 6 were caught in Iceland, 5 of which were recovered in Ireland, the other in Sussex during the autumn after ringing. One bird found in Co. Down in the winter after ringing had hatched from the small Danish breeding



Figure 1. Distribution of British-ringed Gadwall recovered during August – October inclusive, when birds can be expected to be migrating between breeding and wintering areas. ● = Male ($n = 67$), ▲ = Female ($n = 53$). Area A = 27 Male, 24 Female. Area B = 16 Male, 8 Female.

population and two recovered as adults in Essex and Sussex had been ringed in the Netherlands.

There have been six recoveries of Gadwall ringed as pulli in Czechoslovakia and the USSR, the three Czech birds all after one migration ("direct recoveries") to eastern Britain. Two Estonian birds were shot in the winter after ringing, one in Clwyd (away from regular wintering haunts in autumn, possibly *en route* to Ireland) and the other in Essex, where the only Latvian ringed pullus Gadwall has been recovered.

Other overseas birds recovered in Britain and Ireland

A further 21 Gadwall ringed overseas have been recovered in Britain and Ireland. In addition to the Gadwall ringed as ducklings in Iceland, 5 breeding females and 2 first-year birds ringed at Myvatn have been recovered in Ireland.

The majority of the remaining records relate to birds caught in the Low Countries, with 11 caught in the Netherlands between July and November, mostly recovered in eastern Britain, five in the winter following ringing. A juvenile ringed in Belgium was recovered the following October in Essex.

Most remarkable are the three recoveries of Spanish-ringed Gadwall: first-year birds ringed in June in the Guadalquivir Delta have turned up in Powys (October) and the Ouse Washes Cambridgeshire/Norfolk (January), both within the year of ringing, while another bird caught in the Ciudad Real, central Spain, during March 1983 was recovered in Dorset one year later.

Two breeding females ringed at the Matsalu Reserve in Estonia have been recovered shot in Lancashire and Kent, while a single bird caught at Ottenby, Sweden in May was subsequently recovered in the following November in Kent. The remaining two foreign recoveries relate to a bird caught in Munchen, Federal Republic of Germany in September and recovered at Strangford Lough, Co. Down the following December, and a summering bird caught in Rostock, German Democratic Republic recovered in Lincolnshire after four winters.

Birds ringed as pulli in Britain

Of the 37 recovered Gadwall ringed as pulli in Britain, 20 were ringed at Abberton, and

14 at Nacton. Singles captured in Norfolk, Northumberland and Gloucestershire were all recovered at or near the site of ringing. Of the Essex birds, 11 were recovered overseas, all in the autumn or winter of the year of capture, six in France, two in the Netherlands, one in Italy and two in Denmark. Of the Suffolk-ringed pulli, eight were recovered abroad, three in the autumn/winter of capture (one each in France, the Netherlands and Spain). Three further birds were recovered in France, two more in the Netherlands and one in Ireland in subsequent seasons; four birds were local recoveries within England, the other controlled in Essex.

Autumn recoveries of Gadwall ringed in Britain and Ireland

The IJsselmeer in the Netherlands is known to be an important moulting area for Gadwall (Salomonsen 1968) and there are post-breeding recoveries of British- and Irish-ringed birds from this area in autumn (Figure 1). These include five pulli recovered in their first autumn, but also seven adults ringed in late summer/early autumn in eastern England which have been recovered in the same autumn from northern Netherlands. In addition, 25 other birds have been recovered in the Netherlands during August–December. In one instance, a bird ringed in Cambridgeshire on 12 November 1984 was recovered 17 days later in the Netherlands, suggesting that not all movement is necessarily linked to a moult migration.

Other winter recoveries of Gadwall ringed in Britain and Ireland

An earlier analysis suggested that there is no significant difference between the recoveries of Gadwall ringed at Abberton and Slimbridge during the winter in either the proportion of overseas recoveries (27%) or in their distribution (Owen *et al.* 1986). Since then, additional recent data shows an increase in foreign recoveries and that significantly (X^2 4.89 $P < 0.05$) more Gadwall ringed at Slimbridge have been recovered abroad (59%, $n = 121$) than those ringed at Abberton (42%, $n = 69$). Eighteen percent of the Slimbridge sample were found in eastern areas (Denmark, Germany, Poland and European USSR) compared to 9% of the Abberton birds. Of the

Table 4. Percentage of Gadwall recovered in Britain and Ireland by age at ringing, based on recoveries reported up to Feb 1987. Birds of unknown age are excluded from analysis.

	Males	Females	Sex Unknown	Total
Juveniles	52.3%	56.3%	59.8%	55.9% (n=281)
Adults	45.1%	49.3%	58.8%	52.1% (n=167)
Total	49.8%	57.3%	59.1%	54.4% (n=448)

remainder, nine females ringed at Loch Leven, Tayside have been recovered, four locally in the same or subsequent years, four in Ireland and one in Spain.

Sixty percent of all Gadwall were ringed in their first winter, one third of which were recovered in the same year in Britain and Ireland, the majority being local movements. Older birds recovered in the same season as ringing showed a 63% recovery rate in Britain and Ireland, the majority close to the site of ringing. Male Gadwall of all ages are more likely to disperse overseas than females, while adult birds are

less likely to be recovered in Britain and Ireland than juveniles of either sex (Table 4), although none of the differences shown attain statistical significance. The suggestion of Owen *et al.* (1986) that part of this difference is explained by abmigration is further supported in the present analysis by the fact that 69% of recoveries in France and Spain are male birds, compared to a sex ratio not significantly different from unity amongst all other recoveries overseas. There is no difference in range between the sexes (Figure 2) in their winter recoveries.

In an attempt to assess turnover amongst

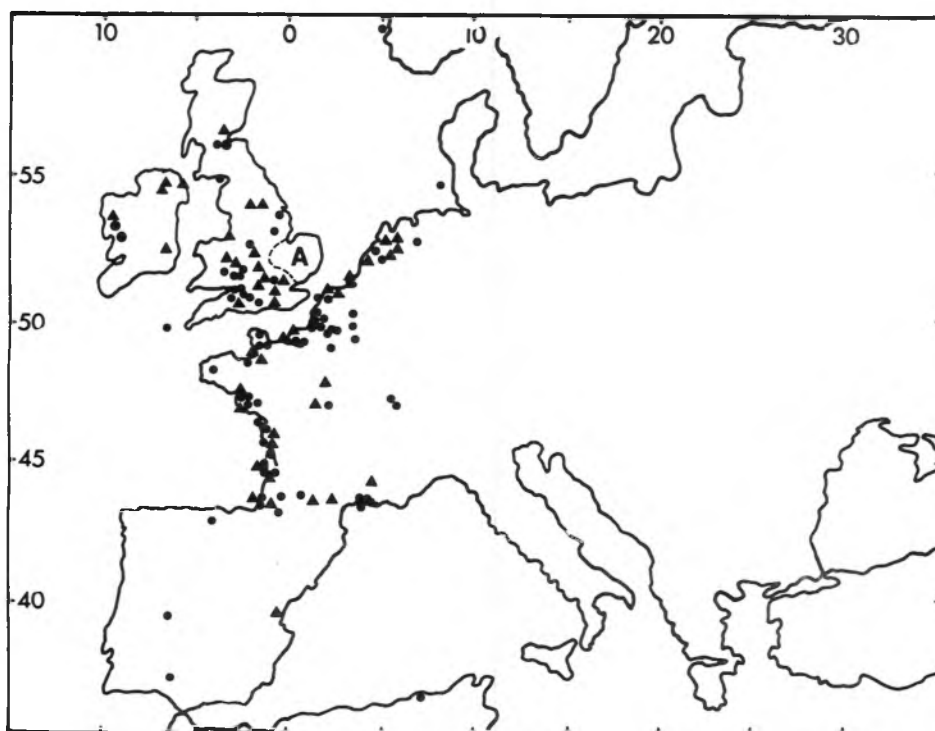


Figure 2. Distribution of British-ringed Gadwall recovered during November – January inclusive, when birds can be expected to be on their wintering grounds. ● = Male (n = 151), ▲ = Female (n = 106). Area A = 60 Male, 52 Female.

birds wintering in Britain, Table 5 shows the breakdown of direct recoveries of Gadwall recovered in Britain and overseas. These data suggest that birds ringed in July/August/September are more likely to be recovered overseas than those ringed later in the season, although the preponderance of birds ringed in autumn rather than later in the season complicates the interpretation. Further analysis of all direct recoveries shows that between 33% (amongst males) and 42% (amongst females) are recovered overseas, with a mean of 13% of recoveries in the vicinity of their autumn capture site throughout the winter (Table 6). These data contradict the overall pattern described above since females are apparently more likely to move overseas and are less likely to be recovered locally within Britain than males during the winter following capture, although the small sample size precludes the attachment of great significance to this trend.

Discussion

The Gadwall is highly migratory in the north and east of its western Palearctic range; this is hardly surprising considering its preference for shallow eutrophic freshwaters which would be the first to freeze in northern and continental areas during normal winter conditions. It would appear that the Icelandic population moves south to Ireland and perhaps Britain as well, and the Scottish population also moves chiefly to Ireland. The English population has probably largely descended from introduced stock, and although described as "rather sedentary" (Cramp and Simmons 1977), ringing evidence demonstrates that up to 46% of all birds ringed in Britain move south to winter, and of these 54% of ducklings ringed at natal sites in Britain have been recovered on the Continent. Whilst this may overstate the movement from our shores due to the heavier shooting pressure

Table 5. Direct recoveries of British-ringed Gadwall recovered before the February following capture, showing month of ringing and recovery.

	British recoveries				Overseas recoveries			
	males		females		males		females	
	ringed	recovered	ringed	recovered	ringed	recovered	ringed	recovered
July	1	0	1	0	2	0	0	0
August	5	0	8	0	3	2	9	1
September	8	3	6	2	3	0	4	0
October	4	4	0	2	3	1	3	3
November	4	4	3	5	0	1	3	6
December	5	9	3	8	0	3	0	3
January	1	7	3	6	1	2	1	3
February	0	1	0	1	0	3	0	4
Totals	28		24		12		20	

Table 6. Recoveries of Gadwall ringed in Britain and Ireland during April-September inclusive and recovered before the following March.

		Males	Females
Recovered locally (<100 km)	(i) before January	8	8
	(ii) in January/February	0	0
Recovered elsewhere in Britain	(i) before January	5	2
	(ii) in January/February	3	4
Overseas		8	17
Gadwall recovered "locally" before February		3	4
Percentage of recovered birds "remaining" in Britain until late February		12.5%	12.9%

across the Channel (Scott 1982), the supposition that at least 25% of the breeding population may leave Britain during the winter (Owen *et al.* 1986) is probably supported by these data. If the assessment of the September population in Britain and Ireland of c.4,200 (Fox 1988) is reasonably accurate this would mean that 3,150 would remain, just over half of the estimated winter population (Fox and Salmon 1988). This fits well with the suggestion from ringing recoveries that up to 50% of the wintering population derives from overseas.

The Gadwall breeding in northern Germany, Czechoslovakia, Poland and west central Russia winter around the North Sea coasts, particularly in the Netherlands (Cramp and Simmons 1977), and it is presumably increases in this element of the population which have boosted the numbers of migrants wintering in Britain and Ireland in recent years. Breeding numbers in the Federal Republic of Germany amounted to c.730 pairs in the early 1970s (Szijj 1973), the total of breeding Gadwall in Bavaria increasing from two pairs in 1930 to 230 pairs by 1965 (Bauer and Glutz von Blotzheim 1968). Ringing recoveries show that birds from this nesting area winter in France, Italy and Spain, with a few recoveries from North Africa (Kohler 1980). German Democratic Republic numbers had similarly expanded to c.210 pairs by 1970 (Isakov 1970). The Czechoslovakian Gadwall had also increased dramatically (Hudec 1970), so it would appear that the breeding population of central Europe was then increasing, although the present magnitude of the spread is unknown. In Spain Gadwall nesting numbers are also known to be expanding in response to the increase in water impoundments (Bernis 1972). While it would seem improbable that these birds would migrate north to winter in Britain and Ireland, three recoveries of birds ringed in the breeding season indicate that at least these did.

Whilst it has been assumed that the small French and Dutch nesting populations are sedentary, the recovery in Britain of two Dutch bred birds indicates that interchange occurs. There is also a suggestion of a moult migration to the Netherlands of birds

breeding and hatched in eastern Britain.

Britain and Ireland are thus at the crossroads of Gadwall migration, accepting Continental breeding birds from the east, some of which doubtless continue to France, Spain and North Africa, as well as contributing breeding birds which are either sedentary or go south for the winter. Much more ringing is required to identify the relative importance of these different components at a time of increases in Gadwall numbers.

Acknowledgements

Wildfowl Trust ringing activities have received funds from the Nature Conservancy Council (NCC) and this analysis has been prepared under contract to them; this support is gratefully acknowledged. Thanks go to all ringers who have caught and ringed Gadwall, but particular thanks must go to Roy King and Don Revett for their efforts at Abberton and Nacton respectively. Thanks to Dr Myrfyn Owen, Professor Geoffrey Matthews and David Salmon for their help in preparing this paper and to them and Dr Mike Pienkowski for improving earlier drafts. Stephan Brager kindly suggested literature sources, and our thanks go to the BTO Ringing and Migration Office for supplying details of ringing recoveries.

Summary

Analysis of 472 recoveries of Gadwall ringed in Britain and Ireland and of 36 foreign-ringed birds recovered in Britain and Ireland was carried out to determine the breeding origin of wintering birds and the wintering areas used by the summering population. Results are based on recoveries, where hunting accounts for 89% of known mortality. Between 33% and 50% of British wintering Gadwall derive from eastern Europe. Birds nesting in Iceland winter in Ireland and Scottish-breeding Gadwall also tend to move there to winter. Fifty-two percent of English-ringed pulli have been recovered in the Low Countries, France and Spain, which appear to represent the main wintering area for British and Irish-ringed Gadwall recovered abroad. Overall, 46% of British-ringed Gadwall recoveries come from overseas, with males more likely to disperse across the Channel than females, and adults less likely to be recovered in Britain and Ireland than juveniles of either sex. The high proportion of males recovered in France and Spain in winter suggests abmigration may be involved.

References

- Bauer K.M. and Glutz von Blotzheim, U.N. 1968. *Handbuch der Vogel Mitteleuropas*. Band 2. Frankfurt am Main.
- Bernis, F. 1972. Status of the wetlands of international importance in Spain and the new Spanish hunting law. Pp. 239-245. In: Carp E. (Ed.) *Proc. Int. Conf. Conserv. Wetlands and Waterfowl, Ramsar 1971*. Slimbridge, IWRB.
- Cramp, S. and Simmons, K.E.L. 1977. *Birds of the Western Palearctic*. Vol.1. Oxford, The University Press.
- Dementiev, G.P. and Gladkov, N.A. 1966. *Birds of the Soviet Union*. Israeli Program for Scientific Translations, Jerusalem.
- Fox, A.D. 1988. Breeding status of Gadwall in Britain and Ireland. *British Birds* 81:51-66.
- Fox, A.D. and Salmon, D.G. 1988. Winter status and distribution of Gadwall in Britain and Ireland. *Bird Study*.
- Henny, C.J. and Holgerson, N.E. 1974. Range expansion and population increase of the Gadwall in eastern North America. *Wildfowl* 25:95-101.
- Hudec, K. 1970. Status of the species of wildfowl occurring in the CSSR. Pp. 135-138. In: Isakov, Yu. A. (Ed.) *Proc. Int. Reg. Meet. Cons. Wildfowl Res. Leningrad 1968*. Slimbridge, IWRB.
- Isakov, Yu. A. 1970. Distribution and Number of Waterfowl Populations on their Breeding Grounds in Europe and West Asia. Pp. 19-23. In: Isakov Yu. A. (Ed.) *Proc. Int. Reg. Meet. Cons. Wildfowl Res. Leningrad 1968*. Moscow, IWRB.
- Kohler, P. 1980. Ringfunde in Suddeutchnland beringter Schnatterenten *Anas strepera*. *Auspicium* 7:25-28.
- Lampio, T. 1982. National and local requirements for regulation of waterfowl shooting pressure. Pp. 239-301. In: Scott, D.A. (Ed.) *Managing Wetlands and their Birds*. Slimbridge, IWRB.
- Owen, M., Atkinson-Willes, G.L. and Salmon, D.G. 1986. *Wildfowl in Great Britain*. 2nd Edition. The University Press, Cambridge.
- Perdeck, A.C. and Clason, C. 1980. Some results of waterfowl ringing in Europe. *IWRB Special Publication No.1*. Slimbridge, IWRB.
- Rüger, A., Prentice, C. and Owen, M. 1986. Results of the IWRB International Waterfowl Census 1967-1983. *IWRB Special Publication No.6*. Slimbridge, IWRB.
- Salomonsen, F. 1968. The moult migration. *Wildfowl* 19:5-24.
- Scott, D.A. 1982. Problems in the management of waterfowl populations. *Proc. 2nd Tech. Mtng. Western Palearctic Migratory Bird Management, Paris 1979*:89-106.
- Szijj, J. 1973. Breeding populations of Anatidae in the Federal Republic of Germany. *IWRB Bulletin* 35:14-15.
- Treus, V.D. 1957. (Seasonal distribution and migration of the Gadwall (*Anas strepera*) according to data obtained by banding.) *Trudy Byuro Kol'tsevaniya IX*:162-186.

A.D. Fox and Carl Mitchell, The Wildfowl Trust, Slimbridge, Gloucester GL7 2BT.

