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The decline of the Ring Ouzel *Turdus torquatus* in Britain: evidence from bird observatory data

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Analysis of British and Irish bird observatory data from 1970-1998 shows that the number of Ring Ouzel *Turdus torquatus* bird days has declined significantly in spring at western observatories through which British-breeding birds pass, but not at east coast observatories through which Fennoscandian breeders pass. The extent of decline corresponds roughly to the decline in numbers of British breeders as assessed on the breeding grounds. While these results could indicate that the decline in British Ring Ouzels is caused by problems on the breeding grounds, we also highlight the possibility that differences in the timing and routing of British and Fennoscandian birds when migrating across continental Europe could expose the former to greater risks from hunting.

When a species is in decline, various routes can be followed to diagnose the causes. One approach is to examine regional variation in the extent of decline and ask whether possible drivers of decline act more or less strongly in different parts of the range in a manner that correlates with the extent of decline. This approach has been followed successfully, for example, by Green & Stowe (1993) and by Weimerskirch *et al* (1997), and underpins our study on the Ring Ouzel *Turdus torquatus* in Britain.

Several lines of evidence suggest that the Ring Ouzel declined in Britain in the twentieth century. Substantial decline was noted in Scotland in the first half of the last century (Baxter & Rintoul 1953). Then Sharrock (1976), reporting the findings of the first nationwide atlas survey (1968-1972), painted a picture of widespread decline and estimated a national population of 8,000-16,000 pairs. Between then and the second atlas survey (1988-1991), the Ring Ouzel's range contracted by a further 27% (Gibbons *et al* 1993). This contraction was most evident at the periphery of the species' British range (eg southwest England). Following these indications of decline, the first species-specific nationwide survey was undertaken in 1999, and suggested a total of around 6,000-7,500 occupied territories (Wotton *et al* 2002).

Since these broad-scale surveys were consistent in suggesting that British Ring Ouzels declined in number and range during the twentieth century, several authors have postulated reasons for the decline. These reasons include changes in agricultural practice (Thompson *et al* 1995), upland afforestation (Avery & Leslie 1990) and recreational disturbance (Appleyard 1994). In general, these authors have focused on causes that may be acting on the breeding grounds. This focus is probably partly due to the relative difficulty of establishing what factors might be impinging adversely on Ring Ouzels on migration or on their wintering grounds in southern Spain and northwest Africa (Burfield 2002a). A corollary of this focus is that any drivers of decline on migration or on the wintering grounds may be perceived as relatively unimportant. This perception needs scrutiny.

One way it might be tested is by comparing the population trends of British Ring Ouzels and any other populations with which they share wintering grounds. The obvious candidate population is that in Fennoscandia, where Ring Ouzels are around five times more numerous than in Great Britain (BirdLife International 2004). If British Ring Ouzels - which winter alongside those from Fennoscandia (Burfield 2001) - are in decline while those from Fennoscandia are not, then wintering impacts are unlikely to be causing the decline. The problem is that breeding data from Fennoscandia itself are sparse and, although those that are available suggest a stable population, data quality is generally poor (Tucker & Heath 1994, BirdLife International 2004). However, the migration route of Fennoscandian breeders includes the east coast of Britain (Durman 1976, Riddiford & Findley 1981), and this offers an alternative means of comparing the population trends of British and Fennoscandian birds, which we exploit in this paper.

British and Irish bird observatories are situated coastally (Fig 1). Those on the west coast record Ring Ouzels on passage to and from the species' upland

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nesting grounds within Great Britain (Durman 1976, Riddiford & Findley 1981). In contrast, east coast observatories record some British breeders, but a substantial proportion of records are of Fennoscandian migrants. This leads to the prediction that, while a decline in Ring Ouzel abundance will be evident at west coast observatories over past decades, no such trend will be evident at east coast sites, assuming that Fennoscandian populations have remained roughly stable. The primary aim of our analysis was to test this prediction. A subsidiary aim was to investigate whether the extent of any decline in numbers at west coast observatories matched that recorded from breeding surveys.

METHODS

Data were analysed from the observatories shown in Fig 1, which divide conveniently into two groups. Those in the west consist of Calf of Man, Walney, Bardsey, Cape Clear, Skomer, Skokholm and Portland Bill. The timing of the Ouzel spring migration at Portland Bill, the easternmost of the western observatories, matches that at other western observatories (Durman 1976) and provides the reason, supplementing geography, why we place this station in the western group. The east coast observatories are Spurn Point, Sandwich Bay and Dungeness, plus Fair

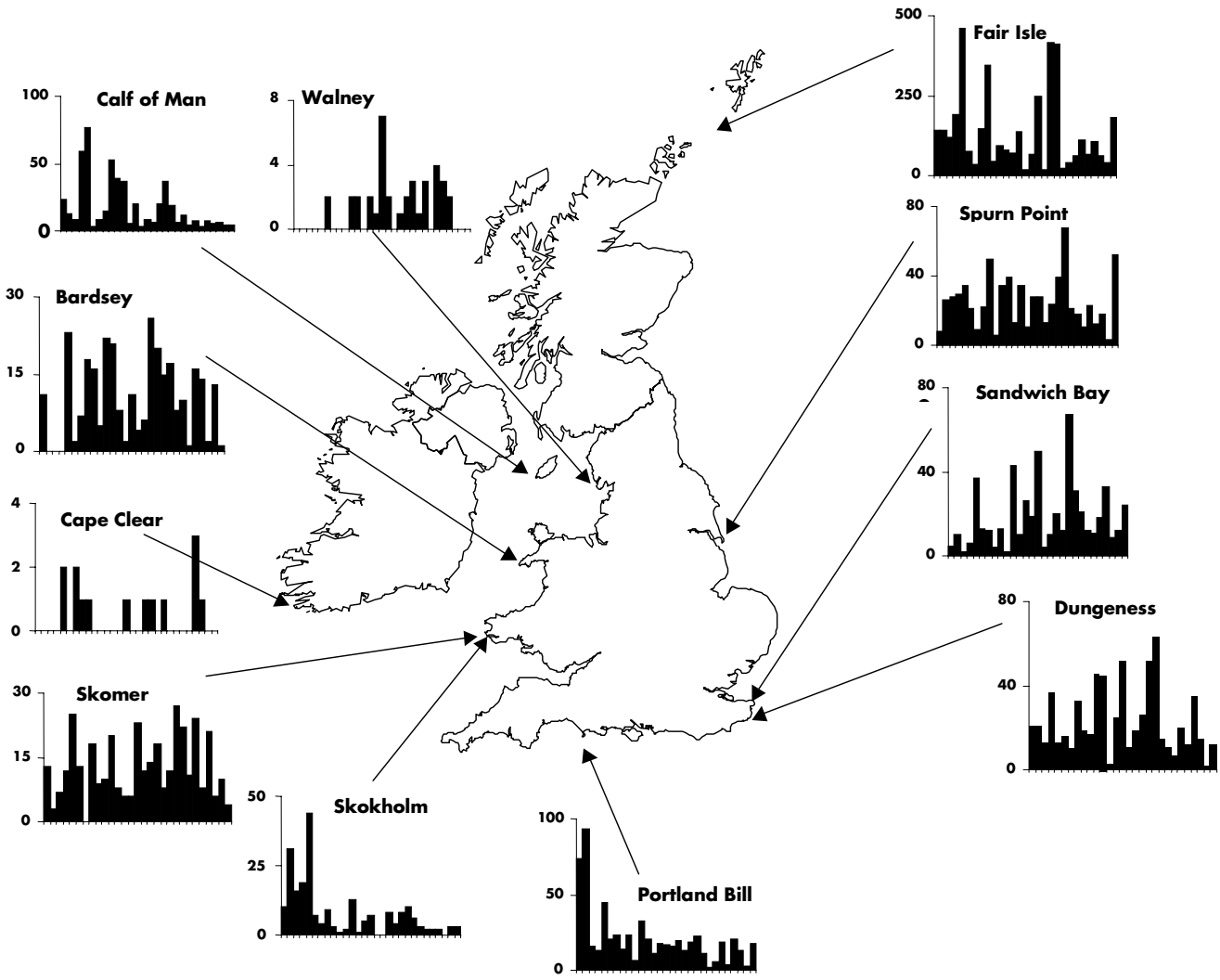

Figure 1. The 11 British and Irish bird observatories that provided data for this study. For each observatory, the histogram shows the number of spring bird days registered in each of the 29 years, 1970-1998. Note that the vertical scale differs substantially between plots.

Isle, Shetland. Fair Isle data were analysed separately because the timing of passage there in both spring and autumn is different to that at other east coast observatories (Durman 1976, Burfield 2002a), and because the number of birds observed there in most springs exceeds the number seen at all other west or east coast observatories combined.

Years for which data were available inevitably varied between observatories. Consequently, the analysis was restricted to the 29-year period 1970-1998, when all observatories were able to provide an uninterrupted run of data. This period also coincided well with the interval between the first atlas (fieldwork 1968-1972) and the national breeding survey in 1999 (Wotton *et al* 2002). The data were in the form of bird days at each site, one bird day being registered when one Ring Ouzel was recorded in the observatory's daily log on one day. Since the observatories census birds in a fixed area, for example an island, the number of birds recorded is assumed not to be influenced by observer effort. While this assumption is probably not strictly true, we have no reason to believe there have been significant trends in observer effort over the 29 study years. The data were divided into spring (before 1 July) and autumn (after 31 July) of the relevant calendar year.

In the statistical analysis of Ring Ouzel numbers by calendar year, the squared correlation coefficient (r) indicates the proportion of the variation that is explained by calendar year; these r^2 values are expressed as percentages in the text of the Results section and in the Tables. The probabilities (*P*) associated with the r^2 values refer to the statistical significance of r at the relevant sample size.

RESULTS

Spring

During the 29-year period, the total number of birds seen each year in spring declined at the west coast observatories but showed no significant trend at the east coast observatories (Fig 2). When spring data for individual observatories were examined, there was no temporal trend at any east coast site or at Fair Isle, but three west coast observatories (Calf of Man, Skokholm and Portland) showed significant declines (Table 1, Fig 1). The other four west coast sites showed no trends, although sample sizes at two of these, Cape Clear and Walney, were so small that trends would have been unlikely to be detected.

The overall extent of the spring decline at the west coast sites was, if calculated simply from the regression, a fall from 108 bird days in 1970 to 30 in 1998. This decline of 73% is greater than would be anticipated from Sharrock's (1976) estimate of 8,000-16,000 pairs around 1970 and Wotton *et al*'s (2002) figure of 6,000-7,500 pairs in 1999. Taking the mid-point of those two estimates suggests a decline of 44%, from 12,000 to 6,750. However, if the minimum rate of observatory decline is calculated using the 95% confidence intervals for slope and intercept, a value of 39% emerges (from 84 bird-days in 1970 to 52 in 1998), according more closely with the breeding survey data.

Autumn

When the autumn data were considered, there were no discernible trends in Ring Ouzel numbers at the individual west coast observatories (Table 2), and this

Table 1. The percentage of year-to-year variation (r^2) in spring Ring Ouzel bird days explained by year for seven west coast and three east coast observatories (and Fair Isle). The probability associated with the value of the correlation coefficient r is shown. All three sites with a significant trend (Calf, Skokholm and Portland) are on the west coast and all showed declines.

	West coast			East coast	
	r^2	*P*		r^2	*P*
Calf of Man	22.7	0.009	Spurn Point	0.0	0.938
Walney	6.8	0.173	Sandwich Bay	5.7	0.213
Bardsey	0.7	0.681	Dungeness	0.8	0.648
Cape Clear	0.2	0.804	Fair Isle	3.1	0.365
Skomer	0.5	0.718			
Skokholm	30.4	0.002			
Portland Bill	31.5	0.002			

Table 2. The percentage of year-to-year variation (r^2) in autumn Ring Ouzel bird days explained by year for seven west coast and three east coast observatories (and Fair Isle). The probability associated with the value of r is shown.

	West coast			East coast	
	r^2	*P*		r^2	*P*
Calf of Man	1.2	0.257	Spurn Point	17.6	0.023
Walney	9.0	0.063	Sandwich Bay	16.0	0.031
Bardsey	0.5	0.732	Dungeness	10.3	0.089
Cape Clear	3.6	0.327	Fair Isle	2.3	0.429
Skomer	1.8	0.485			
Skokholm	0.3	0.783			
Portland Bill	0.0	0.959			

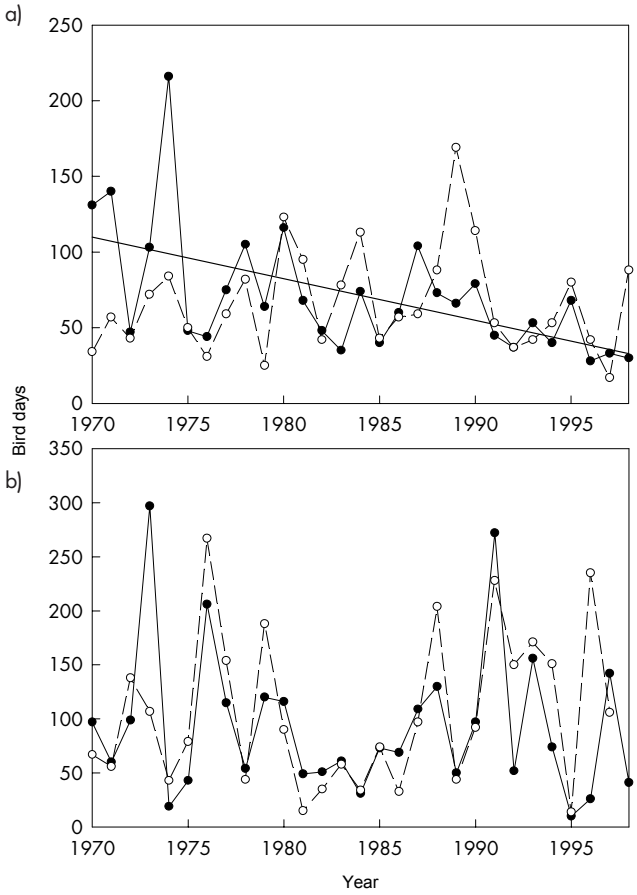

Figure 2. The annual totals of Ring Ouzel bird days registered at British and Irish bird observatories in the spring a) and autumn b) from 1970-1998. The data are aggregated from seven observatories on the west coast (filled circles, solid lines) and three on the east (open circles, dotted lines; see text). However, the east coast autumn data cover only the years 1970-1997 (see text). The single trend line in the upper plot (number of bird days = 5525-2.75*year) shows the overall significant spring decline (r^2 = 32.2%; r is significant at P = 0.001) at west coast sites. For east coast sites in the spring and both east and west coast sites in the autumn, the relationship between number of bird days and year was non-significant ($r^2 \leq 1.7\%$, $P > 0.05$).

pattern was confirmed when data from all seven observatories were aggregated (Fig 2). The three east coast observatories all showed an increasing trend over the 29 autumns (Table 2). However, this trend was largely due to exceptionally high numbers recorded in 1998. If that year was removed from the analysis, none of the three observatories showed a significant trend over time. Similarly, when data from the three observatories were aggregated, total autumn numbers in 1998 (1,019) were over three times higher than in other years and, including this year, there was a slight upward trend over time (r^2 = 13.2%, n = 29, $P < 0.05$). If 1998 was excluded from the analysis, there was no significant trend (Fig 2).

DISCUSSION

This analysis shows that, over a 29-year period, the number of Ring Ouzels recorded on spring passage declined at west coast observatories, but not in the east. The extent of decline in the west is comparable with that recorded by breeding surveys in Britain. This can be explained if most of the birds recorded on the west coast in spring are British breeders, as seems likely given the timing of the spring migration there (Durman 1976, Riddiford & Findley 1981), and if the east coast sites (including Fair Isle) are visited mainly by Fennoscandian birds, for which there is little evidence of decline (Tucker & Heath 1994, BirdLife International 2004). The lack of change on either the east or west coast in autumn presumably reflects a greater tendency for Fennoscandian birds to wander westward at that season and be recorded at both east and west coast observatories (Durman 1976).

At first sight, these findings suggest that the cause of the decline of British Ring Ouzels is most likely to be found on the breeding grounds, because they and Fennoscandian birds share overlapping wintering areas (see earlier). This emphatically remains a possibility, although identifying the cause(s) of the decline has proved elusive (Burfield 2002b, Buchanan *et al* 2003). However, it is also possible that the different migration routes and timings followed by birds of the two populations expose them to different risks. In particular, while the hunting season ends on 31 January in most western European countries, it ends on 28 February in France (CEC 2002). This raises the possibility that some British Ouzels, travelling through France in late February prior to reaching Britain in early March, may experience higher mortality on spring migration than later migrating Fennoscandian birds. Alternatively or additionally, in autumn, British Ouzels probably migrate through France on a more westerly route than Fennoscandian birds (Burfield 2001), and thus may be at greater risk from the hunters of southwest France, a region where hunting pressure is particularly intense (Bernard Deceuninck, pers comm).

Since Burfield (2002a) reported that 97% of British-ringed Ouzels recovered were found dead, with deliberate killing responsible for 77% of those deaths, there is little doubt that hunting is an important cause of Ring Ouzel

mortality. Indeed this proportion of recoveries of British-ringed birds attributed to deliberate killing is higher for the Ring Ouzel than for any other British *Turdus* species (Wernham *et al* 2002). The impact may be especially severe in France and Spain. Of the 70 recovered British-ringed Ring Ouzels whose circumstances of death were documented, 97% (34/35) were deliberately taken by man in France and 100% (13/13) in Spain, but only 32% (7/22) in all other countries (χ^2 = 37.4, 2 df, $P < 0.001$). Moreover, there is no evidence that hunting pressure in the 1980s in France and Spain was less intense than in earlier decades (McCulloch *et al* 1992). Thus, it seems possible that the decline of British Ouzels may be driven partly by hunting mortality during migration, caused by the more westerly route and/or the earlier spring passage of British birds.

Several analyses have shown that migrant birds, particularly shorter distance migrants, have been arriving on their Holarctic breeding grounds at earlier dates in spring in recent decades as temperatures have risen (Butler 2003, Cotton 2003). It is therefore intriguing that an analysis of the first spring arrival date of the Ring Ouzel at four west coast British bird observatories (Portland, Skokholm, Bardsey, Calf of Man) showed a tendency towards later arrival in the period 1959-1998 at all four, and that the trend was significant at Skokholm (Loxton & Sparks 1999). These authors suggested that this phenomenon may be a statistical artefact arising from a declining number of birds on passage. This idea is supported by the west coast declines documented here.

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REFERENCES

Appleyard, I. (1994) *Ring Ouzels of the Yorkshire Dales*. W.S. Maney & Sons Ltd, Leeds.

Avery, M. & Leslie, R. (1990) *Birds and Forestry*. T. & A.D. Poyser, Calton.

Baxter, E.V. & Rintoul, L.J. (1953) *The Birds of Scotland*. Oliver & Boyd, Edinburgh.

BirdLife International (2004) *Birds in Europe: population estimates, trends and conservation status*. BirdLife International, Cambridge, UK (BirdLife Conservation Series No 12).

Buchanan, G.M., Pearce-Higgins, J.W., Wotton, S.R., Grant, M.C. & Whitfield, D.P. (2003) Correlates of the change in Ring Ouzel *Turdus torquatus* abundance in Scotland from 1988-91 to 1999. *Bird Study* **50**, 97-105.

Burfield, I. (2001) Ringed ouzels: where do they go in winter? *Ringers' Bulletin* **10**, 58.

Burfield, I. (2002a) Ring Ouzel *Turdus torquatus*. In *The Migration Atlas: movements of the birds of Britain and Ireland* (eds Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R.) pp 518-520. T. & A.D. Poyser, London.

Burfield, I.J. (2002b) *The breeding ecology and conservation of the Ring Ouzel* Turdus torquatus *in Britain*. PhD thesis, University of Cambridge.

Butler, C.J. (2003) The disproportionate effect of global warming on the arrival dates of short-distance migratory birds in North America. *Ibis* **145**, 484-495.

CEC (2002) *Report from the Commission on the Application of Directive 79/409/EEC on the Conservation of Wild Birds: Update for 1996-1998*. Commission of the European Communities, Brussels.

Cotton, P.A. (2003) Avian migration phenology and climate change. *Proceedings of the National Academy of Sciences USA* **100**, 12219-12222.

Durman, R.E. (1976) Ring Ouzel migration. *Bird Study* **23**, 197-205.

Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993) *The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991*. T. & A.D. Poyser, London.

Green, R.E. & Stowe, T.J. (1993) The decline of the corncrake *Crex crex* in Britain and Ireland in relation to habitat change. *Journal of Applied Ecology* **30**, 689-695.

Loxton, R.G. & Sparks, T.H. (1999) Arrival of spring migrants at Portland, Skokholm, Bardsey and Calf of Man. *Bardsey Observatory Report* **42**, 105-143.

McCulloch, M.N., Tucker, G.M. & Baillie, S.R. (1992) The hunting of migratory birds in Europe: a ringing recovery analysis. *Ibis* **134** Suppl, 55-65.

Riddiford, N. & Findley, P. (1981) *Seasonal movements of summer migrants*. BTO Guide 18. BTO, Tring.

Sharrock, J.T.R. (1976) *The Atlas of Breeding Birds in Britain and Ireland*. T. & A.D. Poyser, Calton.

Thompson, D.B.A., Hester, A.J. & Usher, M.B. (1995) *Heaths and moorland: cultural landscapes*. Her Majesty's Stationery Office, Edinburgh.

Tucker, G.M. & Heath, M.F. (1994) *Birds in Europe: their conservation status*. BirdLife International, Cambridge, UK (BirdLife Conservation Series No 3).

Weimerskirch, H., Brothers, N. & Jouventin, P. (1997) Population dynamics of Wandering Albatross *Diomedea exulans* and Amsterdam Albatross *D. amsterdamensis* in the Indian Ocean and their relationships with long-line fisheries: conservation implications. *Biological Conservation* **79**, 257-270.

Wernham, C.V., Toms, M.P., Marchant, J.H., Clark, J.A., Siriwardena, G.M. & Baillie, S.R. (eds) (2002). *The Migration Atlas: movements of the birds of Britain and Ireland*. T. & A.D. Poyser, London.

Wotton S.R., Langston, R.H.W. & Gregory, R.D. (2002) The breeding status of the Ring Ouzel *Turdus torquatus* in the UK in 1999. *Bird Study* **49**, 26-34.

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