BTO Research Report No. 362

Timing of Breeding of Moorland Birds

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A report to Scottish Natural Heritage
and
Department for Environment, Food and Rural Affairs

April 2005

British Trust for Ornithology, The Nunnery, Thetford, Norfolk, IP24 2PU
Registered Charity No. 216652

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ISBN 1-904870-31-7

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EXECUTIVE SUMMARY

1. The permitted periods over which the controlled burning of vegetation on moorland is legally allowed in Scotland (muirburn) is from 1st October until 15th April for altitudes below 450m (1500 ft) above sea level (asl) and until 30th April above 450m (1500 ft). This period may be extended from 15th April to 30th April below 1500 ft and from 30th April to 15th May above 1500 ft. In England and Wales burning is permitted from 1st November to 31st March in lowland areas and from 1st October to 15th April in upland areas, defined as Severely Disadvantaged in the Less Favoured Areas.

2 This report provides information on the current breeding periods for upland moorland breeding bird species in Great Britain and on any changes in timing of breeding in moorland birds over recent years. It uses four key datasets: the Game Conservancy Trust's long-term dataset on Red Grouse (*Lagopus lagopus*) in Scotland; nest records for Hen Harrier (*Circus cyaneus*) collected mainly in Scotland during 1988-1995as part of the RSPB's Hen Harrier project; BTO's Nest Record Scheme (NRS) and BTO data on the ringing dates of pulli from the Ringing Scheme. The aim is to improve the assessment of the potential vulnerabilities of moorland bird populations to current burning practices.

3. The species chosen for detailed study were heather moorland specialists or those which breed in rough grassland / moorland edge. Less detailed information was collated for species that breed along upland lakes, rivers and streams and for species that commonly breed in uplands but are widespread in other habitats. All species included are listed in Appendix 1.

Game Conservancy Trust's dataset on Red Grouse

4. Records of hatching dates in Red Grouse were restricted to Scotland; (1) 318 nests were obtained from monitoring radio-tracked hens in Strathspey between 1992 and 2003 and (2) hatch dates were predicted from chick weights in 1149 broods recorded throughout Scotland from 24 individual estates between 1985 and 2003. There was large variation from year to year in the proportions of Red Grouse nesting attempts that had started breeding within the burning season for the two altitude bands. At low altitudes (<1500ft) only a small proportion of nests had started nesting by 15th April, but approximately 40% of nesting attempts had started breeding before 30th April at altitudes >1500ft. The potential risk from burning increases further if the season is extended to 15th May as approximately 95% had started breeding (>1500ft). For altitudes <1500ft, 50% of the nesting attempts would have started breeding by 30th April (extended permissions).

5. There was no evidence of any trend of altitude with hatching dates, but in Strathspey a generalised linear model showed hatching dates of Red Grouse had become earlier over the last 12 years; being approximately seven days earlier than it was in 1992. However this was not substantiated using the longer time series of data from 1983 throughout Scotland; there was no evidence of earlier nesting. Despite this the trend observed in Strathspey over the last 12 years agrees with that throughout Scotland for the same time period, which may represent either the start of a new trend or perhaps a short-term fluctuation within a more stable longer-term trend.

RSPB Hen Harrier nest records

6. These data, collected over an eight-year period mostly in Scotland, were used to calculate proportions of nests with first egg dates before the specified burning cut-off dates, and to examine annual differences and trends associated with altitude, latitude and longitude.

7. 30% of Hen Harrier clutches had begun by 30th April and 75% by 15th May. These proportions varied between years, with a range in annual means of 9 days. Laying started earlier with distance east and later with distance north.

BTO datasets on nest records and ringed pulli.

8. Using Nest Record Card (NRC) data, the proportions of nests in which egg laying had started by the specified burning cut-off dates in England, Wales, Scotland and GB as a whole, and for the two altitude bands, were calculated. Trends in first egg laying dates with altitude, latitude, longitude and year were explored using multiple linear regression. Similar analyses were undertaken for data from ringed pulli (nestlings), which lacked altitudes but gave larger sample sizes.

9. Twenty-one species were analysed using NRCs, and twenty-three species using ringed pulli. Sample sizes from NRCs exceeded 50 for all but three species, and from ringed pulli for all but one. Sample sizes in uplands below 250m altitude in England & Wales, and above 450m in Scotland were very small for several species.

10. There was generally good agreement between data from ringed pulli and from NRCs for potential risk from burning, with any differences likely to be due to the assumptions used for the estimation of laying dates from ringed pulli data.

11. Table 1 gives the proportions of the nests with estimated first egg laying by key dates for the cessation of burning in Great Britain, and the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests. By 31st March only Peregrine and Lapwing had laid in >10% of all nests in the NRC data, while the ringed pulli sample shows Golden Eagle and Short-eared Owl in this category. By 15th April seven species (NRC data) and five (ringed pulli) exceeded 10% of clutches begun. By 30th April the majority of Golden Plover, Lapwing, Peregrine, Redshank and Snipe had laid (NRC data), as was also the case for Golden Eagle, Golden Plover, Lapwing, Peregrine, Short-eared Owl and Stonechat (ringed pulli).

12. The NRC and ringed pulli data showed that laying dates were generally later in Scotland than in England & Wales. The differences were less than the 15 days' difference in burning regulation dates between the countries. Thus, although laying dates were generally later at higher latitudes, and were later for a small number of species at higher altitudes, the scatter in the data suggests that there may be little reason for there to be differences in burning cut-off dates between different altitudes or countries.

13. Regression analysis showed that a number of species are nesting earlier now than at the start of data collection, although a small number were also laying later. The former changes may reflect generally earlier breeding seasons attributed in other studies to global warming.

14. Both the NRC and ringed pulli datasets may be affected by certain biases, particularly that the proportion of nests found may decline through the season due to changes in search effort and nest detectability. Assessment of this bias, suggests that the results for most species in this study (particularly single-brooded species) are unlikely to be affected. For a small number, the proportions of nests occurring early in the season may be over-estimated, but the size of such effect is only likely to be small. This is supported by the good agreement between the NRC/ringed pulli results for Hen Harrier and those from the intensive RSPB dataset.

Pre-laying occupancy of breeding grounds

15. It was difficult to find information on the lengths of time that birds occupy breeding grounds before egg laying, and during which they would potentially be liable to disturbance from burning operations. Resident species, several waders, Hen Harrier and early-returning migrants such as Ring Ouzel and Wheatear might all be affected during this period, particularly in March.

16. Although these results can be used to indicate the vulnerability of moorland birds to the potentially damaging effects of burning during the approved periods, they do not show what proportion of nests are actually affected. The actual vulnerability will also depend on the frequency and timing of burning, total extent of moorland affected, and possibility for birds to re-nest. This 'true' vulnerability may depend on aspects such as the choice of nest sites in relation to the types of vegetation, especially heather, that are burnt.

Seasonal variation in breeding performance

17. Nest record card data were used to investigate trends with laying date in clutch and brood sizes, hatching success and nest losses during the egg and nestling periods. Six of 13 species showed trends of declining clutch size through the nesting season and two showed trends of increase followed by decrease. Four species showed seasonal declines in brood size, and as above two species increased then decreased. There were no significant trends in hatching success, and only one species showed an increase in chick-stage failure rates. These results suggested that losses of nests during April could have impacts on the productivity of Oystercatcher, Peregrine and Wheatear nesting in burned areas and less so for Hen Harrier, Stonechat and possibly Ring Ouzel, even if the birds could relay.

Table 1 Estimates using BTO data for the proportions of the nests in Great Britain with first egg laying by key dates, and the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests. Note that nidifugous species were assumed to have been ringed aged 1 day, nidicolous species mid-way through the nestling period.

		% of clutches started by:				date by which X% have started laying				
	N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
(a) Nest Record Card analysis										
Common Sandpiper	97	0%	0%	1%	36%	05-May	08-May	11-May	12-May	14-May
Curlew	107	0%	2%	44%	85%	22-Apr	24-Apr	26-Apr	26-Apr	27-Apr
Dunlin	114	1%	1%	3%	35%	03-May	07-May	09-May	11-May	13-May
Golden Plover	133	4%	23%	61%	81%	03-Apr	06-Apr	10-Apr	14-Apr	17-Apr
Hen Harrier	118	0%	2%	26%	69%	19-Apr	23-Apr	28-Apr	29-Apr	30-Apr
Lapwing	204	13%	45%	69%	89%	27-Mar	31-Mar	01-Apr	03-Apr	05-Apr
Meadow Pipit	388	0%	0%	15%	62%	27-Apr	29-Apr	30-Apr	02-May	04-May
Merlin	280	0%	0%	21%	79%	25-Apr	27-Apr	29-Apr	30-Apr	01-May
Oystercatcher	157	1%	1%	29%	71%	21-Apr	23-Apr	27-Apr	28-Apr	29-Apr
Peregrine	128	30%	83%	94%	99%	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar
Redshank	43	0%	12%	72%	95%	11-Apr	14-Apr	18-Apr	20-Apr	20-Apr
Ring Ouzel	781	0%	1%	35%	62%	19-Apr	22-Apr	24-Apr	26-Apr	27-Apr
Ringed Plover	28	0%	4%	25%	54%	22-Apr	25-Apr	29-Apr	30-Apr	02-May
Short-eared Owl	19	0%	16%	37%	68%	05-Apr	08-Apr	11-Apr	16-Apr	23-Apr
Skylark	55	0%	2%	27%	47%	23-Apr	25-Apr	26-Apr	29-Apr	30-Apr
Snipe	87	9%	31%	64%	78%	30-Mar	01-Apr	07-Apr	08-Apr	12-Apr
Stonechat	170	6%	24%	41%	59%	30-Mar	03-Apr	08-Apr	11-Apr	18-Apr
Twite	316	0%	0%	0%	14%	10-May	14-May	16-May	18-May	20-May
Wheatear	364	0%	0%	5%	57%	01-May	04-May	06-May	07-May	09-May
Whinchat	518	0%	0%	0%	11%	13-May	15-May	17-May	18-May	20-May
Wren	177	0%	1%	14%	50%	25-Apr	27-Apr	01-May	03-May	04-May
(b) Ringed pulli analysis										
Common Gull	10908	0%	0%	1%	31%	06-May	08-May	10-May	12-May	14-May
Common Sandpiper	319	0%	0%	0%	34%	06-May	08-May	10-May	12-May	13-May
Curlew	1042	0%	1%	22%	64%	21-Apr	25-Apr	27-Apr	29-Apr	02-May
Dunlin	168	0%	0%	0%	4%	15-May	18-May	19-May	20-May	21-May
Golden Eagle	131	52%	94%	100%	100%	11-Mar	15-Mar	18-Mar	22-Mar	23-Mar
Golden Plover	145	0%	6%	51%	85%	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr
Hen Harrier	680	0%	0%	11%	58%	24-Apr	29-Apr	01-May	03-May	05-May
Lapwing	5345	2%	22%	59%	86%	04-Apr	08-Apr	12-Apr	15-Apr	17-Apr
Meadow Pipit	541	0%	1%	7%	60%	28-Apr	02-May	04-May	06-May	07-May
Merlin	1180	0%	0%	9%	80%	27-Apr	30-Apr	02-May	03-May	04-May
Oystercatcher	2080	0%	0%	4%	31%	02-May	06-May	08-May	10-May	12-May
Peregrine	602	4%	54%	91%	98%	01-Apr	04-Apr	06-Apr	08-Apr	09-Apr
Redshank	350	0%	1%	20%	64%	22-Apr	26-Apr	28-Apr	02-May	02-May
Ring Ouzel	531	0%	3%	41%	61%	17-Apr	21-Apr	23-Apr	24-Apr	26-Apr
Ringed Plover	329	0%	0%	7%	30%	28-Apr	04-May	08-May	10-May	12-May
Short-eared Owl	124	11%	32%	57%	81%	27-Mar	30-Mar	02-Apr	04-Apr	09-Apr
Skylark	116	0%	0%	4%	34%	02-May	05-May	07-May	10-May	11-May
Snipe	163	0%	2%	18%	49%	19-Apr	25-Apr	29-Apr	01-May	02-May
Stonechat	296	7%	40%	66%	74%	31-Mar	03-Apr	06-Apr	07-Apr	10-Apr
Twite	245	0%	0%	3%	41%	02-May	06-May	06-May	10-May	10-May
Wheatear	526	0%	0%	9%	82%	30-Apr	02-May	02-May	04-May	04-May
Whinchat	184	0%	0%	0%	8%	13-May	16-May	17-May	18-May	20-May
Wren	38	0%	3%	16%	61%	21-Apr	27-Apr	29-Apr	02-May	03-May

1. INTRODUCTION

Moorland, whether dominated by heather or grass, has been subjected to burning by man from time immemorial (Ratcliffe 1990). Heather burning has been a traditional tool, especially for grouse moor managers, to promote the growth of young shoots and plants and to reduce the cover of mature heather. But on grassland, shepherds and crofters have also traditionally used burning as a tool for promoting new grass growth and for controlling scrub encroachment. While such burns may generally be quite well controlled by grouse moor managers, burning by shepherds, graziers and crofters can be less well controlled and can result in larger areas being affected than intended. The timing and intensity (how hot the burns are) of burning and habitats burnt may influence the degree of detriment to other wildlife, particularly ground-nesting birds, and there are restrictions on how late controlled burning can occur to avoid such problems.

Information on bird breeding periods is often obtained by reference to the available published literature (for example *Birds of the Western Palaearctic* (e.g. Cramp 1977)), but this approach has several potential limitations, especially when considering data on a regional basis. Generally it only gives ranges for timing and does not enable the proportion of nest attempts by certain dates to be determined. Breeding periods for birds in northern latitudes of the UK are likely to be later than for those breeding further south and, with climatic changes as a result of global warming, breeding periods for many species may now be earlier than they were at the time when standard reference texts were produced (Crick 2004). Such differences may be important if certain activities or developments that are detrimental or potentially damaging to breeding birds are permitted, based on the premise that they occur outside the published breeding periods. This has particular relevance to the current burning legislation in Great Britain, and the permitted periods over which the controlled burning of vegetation of moorland and other habitats is legally allowed.

In Scotland, muirburn is permitted from 1st October onwards with the end period being delimited by altitude; below 1500 feet (450m) above sea level (asl) the cut off point is 15th April and above 1500 feet (450m) this is extended to 30th April. Under certain circumstances the Scottish Executive Environment and Rural Affairs Department (SEERAD) and the proprietor can allow this period to be extended from 15th April to 30th April below 1500 feet and from 30th April to 15th May at 1500 feet or above. In England and Wales burning is permitted from 1 November until 31st March in ‘lowland’ areas and from 1 October 15th April in upland areas, defined as Severely Disadvantaged in the Less Favoured Areas. There is anecdotal evidence that moorland ground nesting birds are breeding earlier as a result of climate change and that burning may affect moorland-nesting birds. Furthermore, there is already strong evidence of trends towards earlier laying among UK birds in general, and that these trends are a result of climate change (Crick *et al*. 1997, Crick & Sparks 1999).

Scotland’s Moorland Forum (through its Policy Working Group) is currently undertaking a review of muirburn legislation and the Scottish Executive’s *Muirburn Code*, and for England, Defra are currently reviewing the burning regulations and the *Heather and Grass Burning Code*. A similar review is understood to be under consideration in Wales where currently the same regulations and code apply as in England.[2]

This report aims to analyse the major available datasets to provide information on the breeding periods for upland moorland breeding bird species in Great Britain (GB) and the three constituent countries, and to provide objective information on any changes in timing of breeding in moorland birds over the last few decades. The three key datasets used in this report consist of Game Conservancy Trust’s (GCT) long-term dataset on Red Grouse (*Lagopus lagopus*) in Scotland, a

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[2] Further details of the muirburn legislation and the muirburn code in Scotland can be found at www.scotland.gov.uk/library3/environment/mbcd.pdf and on the Defra Heather and Grass Burning Code at http://www.defra.gov.uk/rds/hgbc.pdf. Further information on burning, including the regulations, will be available at http://www.defra.gov.uk/rural/uplands/burning.htm in April 2005.

dataset of records of nests of Hen Harrier (*Circus cyaneus*) between 1988 and 1995 collected as part of the RSPB's Hen Harrier project and compiled by Brian Etheridge, nesting records from the BTO's Nest Record Scheme (NRS), and the bird ringing and recoveries from the BTO's Ringing Scheme. The GCT also holds similar data on Red Grouse and Black Grouse in England but it was not possible to include analysis of this in the time available for the present report.

These datasets are used to assess the proportion of upland birds that have started nesting (by estimating first egg laying dates) before the end of the specified burning periods. In addition, temporal changes in the start of breeding are examined with reference to the role of altitude, latitude and longitude. The species analysed ranged from those that breed only in montane or sub-montane habitats to those with at least a foothold in the uplands.

2. METHODS

The species analysed (Appendix 1) were selected as priority species with respect to the potential impact of burning, due to their habitat use and niche in the uplands, in particular on moorland. The species were chosen with respect to the habitat associations identified in Thompson *et* al. (1988) and in consultation with the project's steering group. They were:

Heather moorland: Black Grouse, Dunlin, Golden Eagle, Golden Plover, Greenshank, Hen Harrier, Meadow Pipit, Merlin, Peregrine, Red Grouse, Ring Ouzel, Short-eared Owl, Stonechat and Whinchat.

Rough grassland / moorland edge: Common Gull, Common Sandpiper, Curlew, Lapwing, Oystercatcher, Redshank, Ringed Plover, Skylark, (Common) Snipe, Twite and Wheatear.

Subsidiary species that, although common in the uplands, are not sufficiently dependent on moorland to be included in the main body of the report, including species that breed along upland lakes, rivers and streams and others that commonly breed in uplands but are widespread in other habitats: Black-headed Gull, Buzzard, Cuckoo, Dipper, Grey Wagtail, Kestrel, Lesser Black-backed Gull, Linnet, Ptarmigan, Raven, Reed Bunting, Tree Pipit, Whitethroat, Willow Warbler and Wren[3].

2.1 Scottish Red Grouse data

2.1.1 Hatching dates of Red Grouse over time

Two methods were used to identify hatch date: (1) monitoring clutches of radio-tagged hens in Strathspey and (2) predicting hatch dates from chick weights recorded from broods across Scotland.

2.1.2 Nest location and monitoring in Strathspey

Nests were found on five intensively studied contiguous grouse moors by locating radio-tagged incubating hens (n = 301) or with trained pointing dogs (n = 17). The way in which nests were located was entered into the analysis to account for any possible bias. Nests were marked and visited every other day giving a hatch date accurate to 24 hours. Frequency distributions of nest hatch date were constructed to show any bimodal distribution that would have indicated replacement clutches. No secondary peaks were evident on any moor indicating all clutches were the first laid and data from all moors were grouped for analysis. Hatch dates are given as days from 1st May as day one.

The grid reference of each nest was determined by global positioning system (GPS; 1997 onwards) or by compass bearing triangulation. Altitudes for each individual nest were derived from 1:25000 OS maps, the altitude being read from the nearest contour. Latitude was included although the north/south distance between the two nests that were furthest apart was only 17 km. A number (n = 108) of the hens monitored received a dose of an anthelminthic to clear infections of the gut parasite *Trichostrongylus tenuis*. A two level factor (treated / untreated) was used to control for any effects medication may have on the timing of breeding. A three level factor for age of hens (unknown, old or young being determined by looking for shedding marks on the claws at capture) was used to control for possible age-related reproductive effects in the model.

2.1.3 Chick growth curves and chick weight data from across Scotland

In addition to known hatch dates, hatch time was back-calculated from weights of chicks captured on moors across Scotland using chick growth curves. The growth curves were derived from the 304 broods associated with the 318 known hatch times described above. Broods were caught between day

[3] Detailed data are for Wren are included.

4 and 50 (the majority being between 4 and 15). Weight was averaged across brood. The relationship between chick weight and age was investigated with a non-linear regression and an algorithm describing chick growth in relation to age was derived.

2.1.4 The proportion of records for which breeding had started by 15th April, 30th April and 15th May

To determine the start of the breeding season, it was first necessary to back-calculate the clutch initiation date from the hatching dates; this was done by subtracting the time of incubation and the time it takes to lay a full clutch from the hatching dates (equivalent to 30 days in all). The proportion of hens that had started breeding by 15th April (up to 1500 feet), 30th April (1500 feet or above) and 15th May where extended burning permission had been granted was calculated for each year. This was for done separately for Strathspey from years 1992 to 2003 and for the rest of Scotland from 1985 to 2003.

2.1.5 Frequency distribution of clutch initiation dates

A frequency distribution was plotted to show the distribution of the clutch initiation dates (expressed as days – May 1st as day one) for the two altitude bands separately. This was done separately for Strathspey and the larger dataset from the rest of Scotland. As the predicted hatching dates/clutch initiation dates worked out from the growth curves were earlier than those of monitored nests in the same years (approximately five days earlier), histograms are plotted for unaltered predicted clutch initiation dates and also predicted clutch initiation dates with five days added.

2.2 RSPB Hen Harrier nest records

2.2.1 Data

Records of Hen Harrier nests were supplied for this study by Brian Etheridge from the RSPB Hen Harrier Study (Etheridge *et al* (1997). These comprised 1235 nests for the period 1988-1995, of which 1156 were in Scotland, 62 in Wales and 17 in England. Grid references were available for 1085 nests, and altitude (metres above sea level) for 760. First egg dates were available for all nests. These were calculated using one of the following methods (given in order of accuracy) and back dated:

(i) Laying date: nest found during laying of clutch (300 nests)
(ii) Egg development: based on known weight loss of measured eggs over entire incubation period and estimated from a table produced from these weights (33 nests)
(iii) Hatching date: hatching date known (189 nests)
(iv) Age of young: based on mass and wing-length of eldest chick and estimated from a graph produced from 5 broods which were measured at frequent intervals during their development (705 nests).

The following assumptions were used:

Egg laying: one egg laid every 2 days, incubation commences on the third egg laid in clutch sizes 3-5 and fourth egg in clutches 6 or more.
Incubation period: 30 days for last 2 eggs laid; pipping at 28 days.

The dataset was cross-checked on the bases of year and grid reference against the BTO NRC and BTO ringed pulli datasets analysed elsewhere in this report in order to estimate overlaps and consequent loss of independence. Although it was not possible to be certain that the records in pairs of datasets originated from the same nests, this cross-referencing indicated that there were only 11 potential overlaps of the RSPB dataset with the BTO NRC dataset and 4 with the BTO ringed pulli dataset.

2.2.2 Analysis

Since there were no records in England and Wales below 250m above sea level, and only 46 (7% of those of known altitude) in Scotland above 450m, percentages of clutches begun by the key dates and percentiles for laying dates were calculated irrespective of altitude classes. There were sufficiently large samples (94 or more) in every year 1988-1995 to treat the years separately and so examine individual year effects rather than treat year as a continuous variable. Analysis of variance was run for this purpose. Generalised linear multiple regression was run for first egg data on linear and quadratic terms for easting, northing, altitude and year effects. Eastings, northings and altitude were centred as for the other regression analyses (see below). The regression was run including all variables, and then sequentially eliminating the least significant until all variables were significant with probability $<$ 0.15.

2.3 Nest Record Cards

The BTO Nest Record Scheme (NRS) has gathered records of individual nesting attempts from volunteer birdwatchers and others since 1939. Observers record species, county, year, place name, six-figure grid reference, altitude, and on each visit the date, numbers of eggs or young, and standardised codes to describe the development stage of nests, eggs, young, activity of the parents. The outcome of the nest (giving cause of any failure if known) completes the record. Currently around 30000 Nest Record Cards (NRCs) are submitted each year from a network of 600 individuals and groups. For a full description of the NRS see Crick *et al*. (2003). Data were available from 1966 onwards as this was the start date of computerised records for the majority of species.

2.3.1 Selection of NRCs

Data from the NRCs were used to identify breeding periods for all the priority study species, with the exception of Black-headed and Common Gulls, Golden Eagle, Greenshank, Red and Black Grouse, for which there were inadequate numbers of NRCs available. Breeding periods were estimated from the first egg laying date estimated from the NRCs. Laying dates are generally not recorded on NRCs and have to be estimated by back-calculation, using information on the nest contents at each visit with reference to standard information on the timing of events within the nesting cycle (e.g. length of incubation and egg-laying periods, see Crick *et al*. 2003 for details). For each nest a range of possible laying dates was calculated and the mid-point used when the range was less than 10 days. Records were excluded where the range was greater than 10 days.

Only NRCs from the appropriate habitat and region were used in the analysis. For species that are found only in moorland habitat (Dunlin, Golden Plover, Greenshank, Hen Harrier, Merlin, Ring Ouzel, Short-eared Owl, and Twite), all records from the NRS that have estimable first egg laying dates and altitude details were included in the analysis. For other species only records from upland habitats or upland areas were selected, as follows. NRCs which had a four-figure grid reference within one of the three upland Environmental Zones in the UK (see below) were selected. As Zones Three and Five include marginal upland areas, this will have meant that some records from non-moorland areas will have been included. Where there was no grid reference (a small number of cards prior to 1990), habitat data from the NRCs were used for the selection of NRCs for rough grassland/moorland edge species. The habitats selected from the classification used until 1990 for these NRCs were: upland heather moor, upland grassland, bog, wet heath, cliff or crag (not coastal), scree slope (not coastal), fast flowing river/stream, moorland (unspecified).

The three upland Environmental Zones (Figure 2.3.1) form part of the six broad environmental zones that were categorised in the UK using data from the Countryside Survey 2000 (CS2000) (Haines-Young *et al*. 2000). **Environmental Zone Three** comprises the uplands of England and Wales. The Zone occurs mostly in Wales and the north of England, but also includes high ground in the southwest. Marginal areas, which represent the transition between the lowlands and the uplands proper, are also included. This zone is broadly comparable to the Severely Disadvantaged Less Favoured Areas in England. **Environmental Zone Five** covers marginal land at sea level and intermediate altitudes, mostly in the west and including the Scottish islands from Shetland to Kintyre. **Environmental Zone Six** includes all of the 'true' uplands in Scotland, occurring mainly in the north central areas, with high relief.

Altitude is routinely recorded on NRCs by observers and can be considered to be within a reasonable degree of accuracy. The altitude data were checked by tabulating maximum altitude per county, resulting in the correction of a few erroneous values (chiefly where altitudes in feet had been recorded as metres). So as to analyse laying dates in the different altitude zones relevant to burning, nests in England and Wales were differentiated as up to or above 250m above sea level. This dividing line was used as a substitute for Severely Disadvantaged Less Favoured Areas, since data on these areas were not available. Thus, the category up to 250m comprises a narrow zone of lower-lying moorland and marginal upland and consequently has relatively few records. Nests in Scotland were similarly divided at the 1500ft level (approximately 450m), so as to distinguish nests subject to the different cut-off dates in the muirburn legislation.

For analyses involving latitude and longitude, grid references were used as a surrogate. These were recorded at least to 1 km accuracy, and usually to 100m (i.e. 6-figure grid references). Incomplete grid references in the raw data were completed using online maps and by reference to recorded altitude and county. Grid references were available for 3721 (86.9%) of the 4284 NRCs dating between 1966 and 2002 used in the analyses. These were used to derive two variables, easting and northing, i.e. distances in kilometres east and north respectively of the origin of the National Grid of Great Britain.

2.3.2 Analysis

In order to assess percentages of nests potentially at risk from burning, the proportions of nests of each species where the first egg was laid by the relevant cut-off dates were calculated. These proportions were calculated separately for nests in England, Wales and Scotland above and below the burning altitude limits and for all altitudes; and for Great Britain as a whole. As an alternative view of the distributions of laying dates, percentiles were calculated at 5% intervals from 5% to 100% for the same categories of nests. This analysis was made for all species listed in Appendix 1 with sufficient samples.

The remaining analyses were made for each heather moorland and rough grassland/moorland edge species. Summary statistics were calculated: number of records, mean, standard deviation, range and median of first egg date, altitude, easting, northing and year. Analysis of variance was used to estimate differences in laying dates between nests in England, Wales and Scotland. The statistical significances of the overall difference between the three countries, and of pairwise differences were calculated using F and t tests.

Least squares multiple linear regression was used to investigate possible relationships of the continuous variables altitude, easting, northing and year with first egg laying date for each species. Linear and curvilinear relationships were explored. So as to avoid numerical problems, the four variables were approximately centred prior to calculating the regressions, by subtracting 1988 from year, 310m from altitude, 335.3 km from easting, and 544.6 km from northing. All four variables and their quadratic terms were entered into the model as continuous variables; year was not considered a categorical variable so as to be able to detect trends with time. However this does not allow for the relationship with year to show effects of different years due for example to weather conditions, and this should be borne in mind when considering the results of the analysis. For a proportion of species, these analyses should be treated with caution due to the small sample sizes and often disjunct distributions of records with altitude and year.

Models were fitted using a stepwise procedure: predictors were entered into the model in order according to the percentage of remaining variance in first egg laying date they explained, but also were removed if their significance level fell below 0.15. The procedure stopped when no more variables could be added with significance less than 0.15, and all those remaining had significance below 0.15. For some species none of the predictors had a significant relationship with first egg laying date. For each regression the overall significance (F value), and predictors with their coefficients and significance was tabulated.

2.4 Ringed pulli

The BTO Ringing Scheme provides information on the dates of ringing of pulli (nestlings) which can be used to estimate nesting dates. The scheme covers Britain and Ireland, and approximately 2000 trained volunteers ring around three-quarters of a million birds of a wide variety of species each year, with a total to the end of 2003 of almost 32 million ringed (Clark *et al*. 2004). Annually there are over 11,000 subsequent reports of ringed birds (recoveries) that have either been found dead or have been recaptured at least 5km from their original capture site. Over 600,000 such recoveries had been received by the end of 2003 (Clark *et al*. 2004). Ring-recovery data in this report refers to the ringing of birds at one point in space and time with later recapturing, resighting or finding. All records of dead birds have been computerised, regardless of the distance moved from ringing to later recovery. In contrast, live recoveries (recaptures & resightings) have only been computerised for those records that meet certain criteria or have travelled more than 5km from the original ringing site (Clark *et al*. 2004). All recoveries of birds ringed in Britain and Ireland since the start of the Ringing Scheme in 1909 have been computerised. However, this is not the case for ringing records, as the routine computerisation of records by ringers only started from 1995 onwards. Since that date a rapidly increasing proportion of records of all birds ringed have been computerised, and individual ringers and ringing groups are now also submitting computerised back-data from before 1995. In this analysis, ringing data from both the recoveries and ringing data sources were combined.

2.4.1 Derivation of a set of independent records

When a bird is ringed, the species, age, sex, date and place of ringing are recorded. All available ringing records for the study species were extracted. No data were available for Red Grouse or Black Grouse, as only very few are ringed as part of the BTO Ringing Scheme. It was not possible to distinguish records derived from the ringing of birds that had subsequently been recovered, which spanned 1909 to 2004, from records derived from the routine computerisation of ringing information by ringers, mainly from 1995 to 2004. Records of the first type were considered to be statistically independent, since there was a very low probability that more than one member of a ringed brood would be recovered. However, records from ringing included all members of each brood ringed, and therefore the data would have been biased if every brood member were to be included in the analysis. The ringing records do not specifically identify members of individual broods, but they do record the number of pulli ringed in each brood. It was possible to detect the numbers of broods with identical combinations of species, grid reference, year, ringing date and brood size, and to enter just one record from each such brood. For example if there were three records with brood size three which were identical apart from the ring numbers, one of these records was retained; if there were 20 identical records with brood size four, these were assumed to derive from five distinct broods, so five copies of the record were retained.

For a number of rare species or species vulnerable to persecution, the exact coordinates for grid reference were not provided and records for these species were included if the ringing location accuracy is within at least half a degree of latitude and longitude (Wernham & Siriwardena 2002).

The availability of records of ringed pulli varies between species and to some extent year, dependent on the ease of finding the nests or chicks for that species, and whether ringers were involved in intensive studies, which may have lasted for several years but have been localised to certain areas. For example, Common Gull has the largest sample sizes relative to other species: a large number of gulls can be ringed easily at colonies, and they are also more likely than smaller species to be found dead by members of the public. By contrast there are very few data for Skylark, the nests of which are difficult to find, or for moorland Wrens, which generally are not ringed as pulli.

2.4.2 Selection of pulli ringed in upland areas

Pulli ringed in upland areas were selected using the three upland Environmental Zones in the UK (see above and Figure 2.3.1). Records with an accuracy of grid reference to within 1km and records with ringing date accuracy to within a day were included in the analysis. As for NRCs, eastings and northings (km east and north of the origin of the National Grid) were calculated from grid references.

2.4.3 Estimation of first egg laying date

To enable the back calculation of the first egg laying date from the date of ringing, Harrison (1975) or other references were used to obtain the species-specific clutch size, egg laying frequency, length of the incubation and length of the nestling period. See Appendix 2 for details. The average value was taken for the clutch size where a range was given, and similarly the average length of the stated range was taken for the incubation period. As there was no information available regarding the age at which the majority of pulli are ringed, it was assumed for the purposes of this study that pulli were ringed mid-way through the nestling period. Again if a range of values was given, the average value was used for the nestling period. Therefore, the first egg laying date was back-calculated from the date at which the pulli were ringed by subtracting the sum of the following (in days): (1) length of the mid-way stage of the nestling period; (2) length of the incubation period; (3) length of the period from the laying of the first egg until incubation begins, i.e. egg frequency period multiplied by the average number of eggs laid before incubation begins. For passerines that lay one egg per day and begin incubating on laying the last egg, item (3) was equal to average clutch size minus one, while for Short-eared Owl, which begins incubation on laying the first egg, it was zero.

For nidifugous species, i.e. those whose chicks leave the nest very soon after hatching, an alternative assumption that the chicks were ringed the day after hatching was also used. This may be more likely since such chicks become dispersed and more difficult to find by the middle of the nestling period. This assumption was tested for gulls and waders alongside the mid-fledge estimates.

2.4.4 Altitude data for ringing records

As altitude is not recorded on ringing records, it could have been obtained from two sources; (1) the ITE *Land Characteristics Data Bank for Great Britain* (Ball *et al.* 1983) at a resolution of 10km and (2) a topographic map for Scotland provided by Scottish Natural Heritage in the form of a Geographical Information System (GIS) database. Due to the coarseness of these data, especially in uplands, it was thought that any estimate of altitude would be unreliable. Altitude data and height classes were therefore not analysed for the pulli data.

2.4.5 Analysis

The same procedures as for NRCs (see 2.3.2) were used for analysis of ringed pulli, with most attention again being given to priority species (i.e. those of moorland and rough grassland / moorland edge). (1) The proportions of pulli that resulted from nests where laying had started by the specified dates relevant to burning were calculated for each country and for Great Britain for all species. Percentiles were calculated at 5% intervals. For the 12 nidifugous species, the two assumptions for ringing age were both analysed. For priority species (2) Summary statistics were calculated; (3) analysis of variance was used to test differences between countries; (4) multiple linear regression was used to assess the possible relationship of first egg laying date with linear and quadratic variables for easting, northing and year. Initial results included many outliers due to the long 'tail' of the distribution of the variable year. These were due to the few records dating between 1909 and 1949. 590 such records were excluded from the data, leaving 25448 records used for the regression analyses, and 26043 records for the other analyses. Variables were centred by subtracting 1995 from year, 302.1 km from easting, and 800.5 km from northing.

2.5 Pre-nesting periods

Birds listed under Annex 1 of the EC Birds Directive need to be protected during the period when pre-nesting/nuptial behaviour occurs. Information on the likely duration of such behaviour prior to laying of these and other priority species in this study was collated from published sources and used to estimate time periods over which pre-nesting behaviour occurs on the breeding grounds.

2.6 Seasonal variation in breeding performance

Nest record card data were analysed to investigate seasonal variation in breeding performance. The following variables were used:

- First egg date – the date on which the first egg in the clutch is likely to have been laid – as analysed elsewhere in this report (see 2.3.1 above).
- Clutch size – the maximum number of eggs found in a nest. Clutch size data were rejected if egg laying could have continued after the last visit of the recorder.
- Brood size – the maximum number of young found in a nest. This is likely to overestimate the brood size at fledging, but will approach it if mortality early in nestling life (when chicks are often most vulnerable) is the most significant form of partial brood loss.
- Hatching success – the ratio of brood size to clutch size, where the whole nest did not fail. This incorporates early losses of chicks, as well as hatching success (the proportion of eggs that hatch successfully).
- Daily nest failure rates before and after hatching (see below).

The number and timing of visits recorded on each NRC, relative to nest progress, determined which of the above variables could be calculated, so the sample sizes of the analyses differed between variables.

The variation in each nest record variable with respect to laying date was investigated using generalised linear models in the GENMOD procedure of SAS (SAS Institute 1996). Daily nest failure rates were estimated using a formulation of Mayfield's (1961, 1975) method as a logistic model with a binomial error term. Success or failure over a given number of days (as a binary variable) was modelled with the number of days over which the nest was exposed during the egg or nestling periods as the binomial denominator (Crawley 1993, Etheridge *et al.* 1997, Aebischer 1999). The numbers of exposure days during egg and nestling periods were calculated as the mid-points between the maxima and minima possible, given the timing of nest visits recorded on each NRC. (Note that exposure days refer only to the time span for which data were recorded for each nest and do not represent the full length of the egg or nestling periods). Hatching success was also modelled using a logit link and binomial errors, brood size forming the numerator and clutch size the binomial denominator. Individually, clutch and brood sizes were modelled with identity links and normal errors, as were first egg dates. In each model, both linear and quadratic terms were included and only the significant terms reported. Modelling was only undertaken when sample sizes were greater than 50.

In order to reveal the net effects of variation in each variable, the category-specific estimates of clutch size, hatching success and daily nest failure rates were combined to estimate seasonal trends in the number of fledglings produced per nesting attempt. This was done according to the formula (after Hensler 1985, Siriwardena *et al.* 2000):

$$FPA = CS \times HS \times (1\text{-}EFR)^{EP} \times (1\text{-}NFR)^{NP}$$

where FPA is the number of fledglings produced per breeding attempt, CS is clutch size, HS is hatching success, EFR and NFR are the egg and nestling period daily nest failure rates, respectively, and EP and NP are the lengths of the egg and nestling period in days. EP and NP were taken from Harrison (1975). Confidence intervals for FPA values were calculated following the methods used in Siriwardena *et al*. (2000).

3. RESULTS

3.1 Results for Scottish Red Grouse

3.1.1 Changes in hatching dates over time in Strathspey

Between the start of April 1992 and the end of May 2003, 318 nests were located in Strathspey. The median hatch day of all grouse clutches in these years was 29th May (range 13th May – 19th June). The mean clutch size was 8.4 eggs (se ±0.08) and this suggests that the median date of first laying over all years was 1st May, given one egg is laid per day and that Red Grouse have an incubation period of 21 days.

In order to investigate variation in hatch date across years a generalised linear model was constructed with Poisson errors. The minimal model was achieved by stepwise deletion tests. The generalised linear model suggests that hatch date was earlier in 2003 than it was in 1992, see Table 3.1.1 for details. No other explanatory variables had a significant effect in the model, this included altitude.

A linear trend line fitted to all the data suggests that hatch date is now approximately seven days earlier in 2003 than it was in 1992 (Figure 3.1.1a). Date of first laying will therefore have been in the first week of May in 1992 and the last week of April in Strathspey in 2003. However there is considerable annual variation in mean hatch date during the period studied. For example, the mean hatch date in 2001 was later than the mean hatch date in 1992 (Figure 3.1.1b).

3.1.2 Changes in hatching dates over time in Scotland

3.1.2.1 Growth curve

Between 1992 and 2003, chicks from 304 broods in Strathspey with known hatch dates were weighed. The equation derived was: Chick weight = (2.77*Age)/(1 - (0.01*Age)). This relationship accounted for 89.8% of the variance in the data set.

3.1.2.2 Predicted hatch

Excluding the broods used to construct the growth curve, hatch dates were derived from a further 1149 broods using this algorithm. These records came from 24 individual estates throughout Scotland between 1985 and 2003. Plotting the derived hatch dates suggests there is no trend towards earlier laying in Red Grouse over this longer data series (Figure 3.1.2). The predicted hatch dates were strongly correlated with the known hatch dates from Strathspey, over the same period. There was a significant positive correlation between the two sets of dates when the outlier (data in the year 2000) was omitted (correlation coefficient = 0.73).

3.1.2.3 Distribution of the clutch initiation dates

Frequency distributions of the clutch initiation dates are shown in Figures 3.1.3a and 3.1.3b for Strathspey and the rest of Scotland respectively. The proportion of hens that had started laying by 15th April (<1500 ft asl), 30th April (>1500 ft) and 15th May where extended burning permission had been granted for each year and both of the altitude bands are shown in Table 3.1.2a for Strathspey from years 1992 to 2003 and Table 3.1.2b for the rest of Scotland from 1985 to 2003. There was only a small proportion of birds which had started nesting by the permitted burn season at altitudes <1500ft; this is the case for Strathspey and the rest of Scotland. However, at altitudes >1500ft a larger proportion of birds had started breeding within the permitted muirburn season. In terms of proportions, at >1500ft approximately 40% of the nesting attempts had started breeding within the permitted muirburn season (30th April) and this was increased to approximately 95% if the season was extended to 15th May. If the muirburn season was extended until 30th April for altitudes <1500ft, then approximately 50% of birds would have laid within the burn period. This suggests that there is a greater risk from burning at altitudes >1500ft, and that this is increased greatly if the permissions are extended to 15th May. There was however large variation from year to year in the proportions that had started laying within the muirburn season.

3.2 Hen Harrier results

Numbers of Hen Harrier nest records with laying dates, altitude and coordinates, and summary statistics for laying date, altitude, easting and northing by year and in total are given in Table 3.2.1. Table 3.2.2 gives the proportions of Hen Harrier nest records for which laying is estimated to have started (first egg laying date) by 15th April, 30th April and 15th May in each year 1988-1995, GB total, and in England, Wales and Scotland separately. These cut-off dates were selected as relevant to the muirburn regulations in Scotland. Over all years, 30% of clutches had begun by 30th April, except in Wales (8%). Between years, this proportion varied between 18% and 56%. By 15th May, 75% of clutches had begun (47% in Wales), with a range between years of 71% to 89%. The dates for 5% to 25% percentiles in Table 3.2.2 are alternative views of the distributions of laying dates. The full arrays of percentiles from 5% to 100% are given in Appendix 3.

Mean first egg dates varied between years by nine days (Table 3.2.3), with the extremes being the first two years, 1988 and 1989. There was no systematic trend. The multiple linear regression on all predictors (Table 3.2.4) explained 8% of the variation; when the non-significant altitude and northing (linear) predictors were omitted, 7% of the variation was explained, with laying becoming earlier with distance east (linear and quadratic) and later with distance north (quadratic).

3.3 Results for NRCs and ringed pulli

3.3.1 Sample sizes and summary statistics

A total of 4284 Nest Records Cards of 21 species are included in the NRC data used for detailed analyses; there were no cards for Black-headed and Common Gulls, Golden Eagle, Black and Red Grouse. Location data (easting and northings) were available for 3721 (86.9%) of the records. Numbers of Nest Record Cards with estimable laying dates for each species, and summary statistics for laying date, altitude, easting, northing and year are given in Table 3.3.1a. Corresponding data for ringed pulli are in Table 3.3.1b. Sample sizes for subsets of data by country and altitude zone are included in Tables 3.3.2a and 3.3.2b. A total of 26043 records of ringed pulli of 23 species were analysed in detail, there being no records for Greenshank, Black and Red Grouse. All ringing data included eastings and northings. Redshank, Ringed Plover and Short-eared Owl NRC sample sizes were <50, and therefore unsuitable for regression analysis, and the same applied to ringed pulli of Wren.

The species with the earliest mean first egg date from NRCs was Peregrine (8 April) and the latest was Twite (1 June). For ringed pulli, the additional species Golden Eagle was earliest (26 March), and Twite remained the latest (28 May). Ignoring Short-eared Owl, due to the small NRC sample, the difference between mean first egg dates from the two datasets ranged from 11 days earlier from ringed pulli (Stonechat) to 10 days earlier from NRCs (Skylark), with a mean across species of two days earlier from pulli. For the nine nidifugous species with data from both sources for which there were laying date estimates from ringed pulli based on ringing at day 1, Common Sandpiper, Golden Plover, Lapwing and Curlew mean dates from pulli were closer to NRCs using the day 1 assumption, but for Dunlin, Redshank, Snipe, Ringed Plover and Oystercatcher the mid-nestling period assumption was closer to NRCs. These differences may be indicative of the ease of locating pulli of these species at different growth stages in order to ring them.

3.3.2 The proportion of nests for which laying had started by specified burning cut-off dates

Table 3.3.2a gives the proportions of nests for which laying is estimated to have started (first egg laying date) categorised by country, altitude zone and the four cut-off dates 31st March, 15th April, 30th April and 15th May. These cut-off dates were selected as relevant to the burning regulations in the different countries. Table 3.3.2b gives the corresponding proportions of the nests derived from ringed pulli records Great Britain, and each country by the four dates (a) when ringing of pulli was assumed to be mid-way through the nestling period and (b) for nidifugous species, ringing at age one day. Appendices 6 and 7 give equivalent results for the subsidiary upland species.

The following summaries are based on samples of >=20 nest records or ringed pulli. Results based on fewer than 20 records are included in the tables but not the discussion below.

3.3.2.1 Moorland and rough grassland/moorland edge species

The NRC analysis shows that by 31st March in the upland Environmental Zone 3 below 250m in England and Wales, Stonechat (9%, England) has begun laying. By 15th April in upland England (E) and Wales (W) above 250m, Peregrine (82%, both countries), Lapwing (55% E, 30% W), Snipe (39%, E), Stonechat (39% E, 25% W), Golden Plover (23%, E) and Redshank (23%, E), have >5% pairs laying. By 15th April in lowland Scotland the percentages are Peregrine (84%) Lapwing (29%), Stonechat (25%) and Golden Plover (19%). When this date is extended to 30th April, those percentages are increased to 95%, 71%, 58% and 39% respectively, while Curlew (53%), Ring Ouzel (40%), Oystercatcher (31%), Wren (25%), Merlin (24%), Hen Harrier (18%), Ringed Plover (17%), Skylark (12%) and Meadow Pipit (11%) have all begun laying. In upland Scotland sample size exceeds 20 only for Ring Ouzel, with 30% of pairs laying by 30th April and 65% by the extension date 15th May.

The ringed pulli do not allow analysis in separate altitude zones, but sample sizes are much larger. In England and Wales by 31st March Lapwing (24%, E, ringing assumed at mid-nestling), Short-eared Owl (11%, E) and Peregrine (5% E, 10% W) exceed 5%. By 15th April in England and Wales Peregrine (53% E, 60% W), Lapwing (59% E, mid; 22% E, 1-day), Short-eared Owl (24%, E), Golden Plover (44%, E, mid), Stonechat (41%, E), Curlew (28% E, 67% W, mid), Oystercatcher (23%, mid), Redshank (18%, E), Snipe (15%, E) and Ring Ouzel (6%, E) exceed 5%. In Scotland by 15th April >5% of Golden Eagle (94%), Peregrine (53%), Lapwing (60%, mid; 22%, 1-day), Stonechat (44%), Short-eared Owl (38%), Golden Plover (35%, mid), Curlew (20%, mid), Redshank (15%, mid), Snipe (7%, mid) have begun laying. By 30th April more than 50% of Golden Eagle (100%), Peregrine (91%), Lapwing (87%, mid; 60%, 1-day), Stonechat (61%), Short-eared Owl (59%), Golden Plover (65%, mid; 43%, 1-day) and Curlew (62%, mid; 19% 1-day) have begun. By 15th May only Whinchat, Twite and Skylark amongst the nidicolous species do not reach the 50% level, but of the nidifugous species several (Common Gull, Common Sandpiper, Curlew, Dunlin, Golden Plover, Oystercatcher, Redshank, Ringed Plover, Snipe) have not yet reached 50% clutches begun if the ringing on day 1 assumption is used.

The dates for 5% to 25% percentiles in Tables 3.3.2a and 3.3.2b are alternative views of the distributions of laying dates. The full arrays of percentiles from 5% to 100% are given in Appendices 4 and 5.

3.3.2.2 Subsidiary upland species

Appendix 6 gives results from NRCs for subsidiary upland species. By 31st March of the species in the Upland Environmental Zone 3, but below 250m, Dipper (32%, E; 35%, W) is well into the breeding season. By 15th April in upland England and Wales above 250m, Raven (100% all categories), Dipper (36%, E; 50%, W), Grey Wagtail (5%, E; 9%, W) have begun laying. In lowland Scotland (below 450m) by 15th April Raven (100%), Dipper (47%), Buzzard (43%) and Grey Wagtail (8%) have laid. These percentages increase to (100%), 73%, 90% and 45% by 30th April, while

Kestrel (39%) and Linnet (13%) have also begun laying by that date. There were hardly any nest records for Scotland above 450m.

The ringed pulli data (Appendix 7) show that in England and Wales by 31st March Raven (97%, E; 96%, W) and Dipper (37%, E; 43%, W) have begun laying in more than 5% of nests. By 15th April in England and Wales in addition to all Ravens, Dipper (67%, E; 70%, W), Buzzard (61%, E; 58% W), Grey Wagtail (18%, E; 29%, W) and Kestrel (5%, E; 7%, W) have started clutches. In Scotland by 15th April Raven (100%), Buzzard (68%), Dipper (62%), Grey Wagtail (8%) and Kestrel (5%) have begun laying. By 30th April more than 50% of Raven (100%), Buzzard (98%) and Dipper (79%) in Scotland have begun laying. By 15th May of the species with sufficient samples in Scotland only Black-headed and Lesser Black-backed Gulls, Linnet and Willow Warbler have not yet laid in 50% of nests.

3.3.3 Differences in laying dates between countries

Mean first egg laying dates for England, Wales and Scotland from NRCs are given in Table 3.3.3a and from ringed pulli in Table 3.3.3b. The NRC and ringed pulli data showed that generally laying dates were later in Scotland than in England & Wales. The differences were less than the 15 days' difference in burning regulation dates between the countries.

The largest and most significant difference using NRC data was for Hen Harrier, laying 15 days earlier in England than Scotland, while in Wales the mean date was 7 days later than in Scotland. However the sample sizes in England and Wales were each <20 so this may be a spurious finding, although the same trends were found in the specialist Hen Harrier dataset (Table 3.2.2). Laying dates were also latest in Wales for Ring Ouzel, with differences in means of 5-6 days. The significant differences for Whinchat were in the opposite direction, up to 4 days. All these differences may be confounded with altitude, easting, northing and year, for which see the multiple linear regression results.

Data from ringed pulli confirmed the highly significant differences for Hen Harrier between the three countries, with nests in England 10 days earlier than in Scotland, and in Wales 6 days behind Scotland. Curlew, Oystercatcher, Snipe, Meadow Pipit and Twite all nested significantly earlier in England than Scotland. There were also major differences for Wren but sample sizes were very small.

3.3.4 Relationships of first egg laying date with altitude, easting, northing and year

Table 3.3.4a gives the results of the multiple linear regression for NRC data of first egg laying date with altitude, easting, northing and year for species which showed a significant effect with one or more of the predictors. Linear and quadratic terms were used. All predictors are centred around their overall mean values. Table 3.3.4b gives the corresponding results for ringed pulli data, excluding altitude, which was not available for this dataset. As there were few data for pulli ringed before 1950, they were also excluded from the dataset so as to reduce skew in variable year. Summaries of the regression results, showing only the significance levels of the coefficients, are given in Table 3.3.5.

In the NRC analyses the following species showed no significant effect of any of the predictors on first egg laying date: Merlin, Oystercatcher, Short-eared Owl, Twite and Wren; sample size was very low for Redshank, Ringed Plover and Short-eared Owl. Using ringed pulli data the following showed no significant effect of any of the predictors on first egg laying date: Short-eared Owl, and Whinchat; sample size was very low for Wren.

Statistical significance does not always imply biological significance, and the strength of the association of first egg laying date with the predictors is often weak, suggesting other factors are important in explaining first egg laying date. The percentage of total variance in first laying date explained by the NRC regression models was Dunlin 40%, Skylark 35%, Hen Harrier 26%, Snipe 21%, Curlew 13%, Golden Plover, Ringed Plover and Peregrine 12%, Lapwing and Wheatear 11%

and other species <10%. Using pulli data, the highest R-squared values were Golden Eagle (27%), Dunlin, Ringed Plover and Snipe (24%), Curlew (15%), Wheatear and Hen Harrier (13%), Oystercatcher (12%), other species <10%. The remaining variation was due to factors which could not easily be assessed, and were not available for these data, for example: year-to-year variations in weather, food supplies, fitness of breeding birds, habitat quality and density dependence.

Using NRCs, five species showed earlier first egg dates with increasing year, but Dunlin became later (quadratic term). Hen Harrier and Lapwing laying dates were becoming earlier by more than 1 day per year, although for Lapwing the non-significant quadratic term for year reduced this effect to zero by 2002. Using pulli data, seven species showed earlier first egg dates with increasing year, but two, Common Gull and Oystercatcher, suggested later dates for both linear and quadratic terms. Golden Eagle, Twite and Ring Ouzel all estimated laying dates becoming earlier by more than 0.3 days per year. For Meadow Pipit the two datasets gave contrary relationships with year.

Five species laid later and none earlier with increasing altitude (NRC data only). For Wheatear this amounted to 3.7 days per 100m increase in altitude, and for Peregrine, 2.8 days per 100m. As expected from the earlier results comparing countries, there were many significant relationships between increasing laying dates and distance north, for linear, quadratic or both terms. Most of these relationships were observed for the pulli data where samples were larger. Exceptions were Golden Eagle (pulli), Ring Ouzel (NRCs) and Whinchat (NRCs). The trends with distance east were mixed, with almost as many relationships of either sign. Lapwing were earlier with distance east using NRCs, but later using pulli data.

3.4 Pre-nesting periods

Information gathered from the literature review is given in Table 3.4. Published information about the length of time moorland species spend on their breeding grounds before egg-laying is scanty, and most factual data concerns timing of egg-laying, already the subject of the major part of this study. Table 3.4 indicates the periods during which migrant or partially migrant species generally return to the breeding grounds, and which species are resident. This shows that the resident Black and Red Grouse, Golden Eagle and Peregrine, and also parts of the populations of Skylark, Wren, and possibly Golden Plover are likely to be affected by burning at any time of the winter. By the end of March the additional species likely to be on territory are Curlew, Hen Harrier, Lapwing, Oystercatcher, Redshank, Ring Ouzel, Ringed Plover, Stonechat, Wheatear and some Twite.

3.5 Trends in breeding performance

Analysis of trends in breeding performance are detailed in Appendix 8 and summarised in Table 3.5.

The commonest patterns of trend were for declines in clutch and brood size through the breeding season and for non-significant trends in the other variables. Six of 13 species showed trends of declining clutch size through the nesting season and Stonechat and Twite showed trends of increase followed by decrease. Brood size trends were estimable for fewer species (n=9) because NRC information for nidifugous waders is unreliable after hatching. Thus four species showed seasonal declines in brood size and again Stonechat and Twite showed trends of increase then decrease. All seven species for which hatching success was analysed showed non-significant trends. Out of thirteen species, two showed declines in failure rates at the egg stage and one showed an increase. Of seven species for which seasonal trends in chick-stage failure rates were estimable, only Wheatear showed a significant trend: a linear increase through the season.

Trends in overall productivity per nesting attempt (*FPA*) were only investigated for species for which there were sufficient sample sizes for each component of breeding performance. Overall, Wheatear and Whinchat showed trends of decline in *FPA*, Twite showed a trend of increase followed by decrease, as expected from its trends in clutch and brood size, and Peregrine and Ring Ouzel showed only minor changes through the season (see Figure 3.5.1). The trend for Meadow Pipit was not considered reliable due to small samples sizes for egg failure rates at certain points during the nesting season.

4. DISCUSSION

4.1 Scottish Red Grouse data

There is large variation from year to year in the proportions of Red Grouse that have started breeding within the muirburn season for the two altitude bands. Despite this, at lower altitudes (<1500ft) only a small proportion of clutches have initiated within the permitted burn season. However this is not the case at higher altitudes (>1500ft); approximately 40% of nesting attempts have started before 30th April and this is increased to approximately 95% if the season is extended to 15th May. For altitudes <1500ft, 50% of the clutches started by 30th April (extended permissions). There is evidence that grouse can and do re-nest following both clutch and early brood loss (Kirby & Smith 2005).

There was no evidence of any trend of altitude with hatching dates, but in Strathspey hatch dates of Red Grouse appear to have become earlier over the last 12 years. However, using a longer data series derived from patterns of chick weight gain data this trend is not evident. Although this predictive method assumes growth rates are similar across Scotland it does question whether the relatively short run of nest data is robust enough to base a conclusion on. The 1992-2003 predicted hatch dates from across Scotland and known hatch dates from Strathspey were significantly positively correlated. This suggests that Strathspey is representative of moors across Scotland and that the trend observed in the last 12 years may represent either the start of a new trend or a short-term fluctuation within a more stable longer term trend. Further work is needed in order to ascertain whether the earlier hatch dates observed in the nest data are a strong relationship or a passing trend. There was considerable variation about the trends and it is unclear if the data showed any evidence of cyclicity or whether the trends or variations around the trend could be explained by intrinsic factors such as parasite burdens or extrinsic factors such as climate or weather.

4.2 Hen Harrier dataset

The RSPB Hen Harrier dataset is more than 10 times larger than the BTO NRC Hen Harrier sample, but more concentrated in time and space, spanning only 8 years and with over 90% of the records from Scotland. The small numbers of overlaps between the datasets were not thought likely to compromise independence between the samples.

Overall, the mean first egg date is latest in the ringed pulli dataset (Table 3.2.5a), but it must be remembered that first egg date was estimated here according to an assumption that chicks were ringed mid-way through the nestling period. This may in fact be an under-estimate of the age of ringing, as it is not possible to sex the pulli until about 21 days (c. 3.5 days after the assumption used in the ringed pulli analysis, B.Etheridge, pers. comm.), thus ringers may actually time their visits to be later in the nestling period than assumed. If a further 3.5 days had been subtracted from the ringed pulli first egg dates, the discrepancy from the other two datasets would be reduced to less than 1 day. Of the two nest records datasets, the BTO's estimated mean first egg date is under two days later than that based on the much larger sample from the RSPB dataset. This might be due to the relatively high proportion of records from early years from Orkney (Crick 1998), where birds tend to lay later and the high incidence of polygyny will tend to make average laying dates later (B.Etheridge, pers. comm.).

Comparing the Scottish results between RSPB's and the BTO's nest record datasets (Table 3.2.5b), the RSPB data suggest that 10% more clutches are at risk to burning taking place until 30th April and 7% more until 15th May. The ringed pulli data show 11% and 10% fewer clutches begun by these two key dates than the BTO's nest record dataset, but the above comment about the usual age at which pulli are ringed also applies here.

The regression results for all three datasets (Table 3.2.5c) suggest that Hen Harriers lay earlier further east and later further north. In the RSPB and BTO NRC datasets, linear and quadratic terms for easting are significant, and for BTO NRCs, only the linear term.

4.3 Analyses of NRCs and ringed pulli

There are more species for which all or virtually all records occur after the specified burn dates compared to those which have all or virtually all records occurring within the burning season. Golden Eagle is the only species which has all first egg laying dates within the permitted burning season, but it nests on cliffs, so is vulnerable only if burning is carried out close to cliffs. Peregrine is also highly vulnerable as regards laying dates, with 80-90% of clutches begun within the burning season, and is also a cliff-nester. Although burning may not affect nests directly, the effect on surrounding habitats and food availability may be deleterious to these raptors. If burning is carried out up to the extreme cut-off dates of 15th May in Scotland, at least 50% of nests of the ground-nesting moorland specialists Golden Plover, Short-eared Owl and possibly Stonechat are vulnerable. Of the rough grassland / moorland edge species, Lapwing and Curlew reach similar levels of vulnerability, although since these species (and Stonechat) are not restricted to moorland, the risk of burning would not apply to the whole populations.

Out of 21 species, 10 showed significant relationships of nesting earlier over time (ringed pulli or NRCs), two showed mixed responses and three showed a relationship of nesting later over the study period. If these trends of nesting earlier continue there is the potential for more species and a greater proportion of each species' nesting attempts to have started within the permitted burning season. However another potential consequence of global warming is that for some species a larger proportion of each species nesting attempts may occur at higher altitudes (Crick 2004).

Many species also nested earlier at lower latitudes, a finding also demonstrated by differences between Scotland and England & Wales. However, except for Hen Harrier, the differences were less than the 15 days' additional burning allowed in the spring in Scotland. In a previous review of breeding periods for selected bird species in England using similar methods (Joys & Crick 2004), 75% of the 64 species selected showed significant differences in fledging date between Government Office Regions. Despite this, the large scatter in data with respect to latitude and altitude, as shown by the relatively small R^2 values for the regressions, suggest that there is little reason for there to be differences in burning cut-off dates between different altitudes or countries. However it should be noted that this study generally had relatively sparse data available from low latitudes (south-west England) and high altitudes.

4.3.1 Limitations of the results

One of the major biases of NRCs is the potential for seasonal variation in the proportion of nests found due to changes in search effort and nest detectability (Crick *et al.* 2003). The majority of the nest records are collected between March and October, with the peak occurring during April to June. Thus for those species for which their breeding season falls largely within this period, particularly single-brooded species, there is little to suggest that NRCs will be biased with respect to season. Furthermore, the breeding season in upland areas is likely to be shorter generally than in lowland areas, due to climatic conditions, also making the problem of reduced late season recording effort less of an issue. Crick *et al.* (2003) assessed this problem by comparing recorded search effort with the nesting seasons for UK species provided diagrammatically by Campbell & Ferguson-Lees (1972) and adding on the length of the stage of nesting at which 75% of nests are found by nest recorders. Species in the current study, for which seasonal variation in search effort might compromise estimates of the distribution of laying dates because their egg-laying can extend into August are: Meadow Pipit, Skylark, Short-eared Owl, Stonechat, Twite, Wheatear, Whinchat; and among the subsidiary species: Linnet, Reed Bunting, Tree Pipit, Whitethroat and Wren. Similar factors may influence the ringed pulli data. The effect will be to truncate the later end of the laying date distributions, making the proportions of nests slightly higher in the early part of the season for these species. Given that the bulk of the nesting activity for these species occurs within the period of peak activity by volunteer nest recorders and ringers, it is unlikely that the under-recording of the diminishing tail of the distribution of late nests will exert a major effect on the results presented here. However, without knowing the true proportions of nests that occur during the latter part of the season, it is hard to quantify the extent of this potential problem. In this respect, it is reassuring to note that the results from the analysis of the intensive RSPB Hen Harrier dataset are in good agreement with those from the NRC and ringed pulli datasets.

Although the detectability of nests tends to decrease through the season, due to vegetation growth (Dwernychuk & Boag 1972, Yahner & Cypher 1987), this is unlikely to be a major factor in upland habitats where growth rates tend to be restricted due to the harsher conditions experienced than in lowland areas. Thus, although there might be a tendency for the later nests of multi-brooded species to be under-recorded in the uplands, as elsewhere, this is unlikely to be a major bias in the results presented here.

Although the results for some species showed good concordance between NRC and ringed pulli datasets, for other species there were differences which were likely to be related to the assumptions used for age at ringing. For some, the NRC estimates fell between ringed pulli estimates based on ringing on day 1 or mid-way through the nestling period. Broods of species such as Golden Plover and Lapwing appear to be more usually ringed soon after hatching, whereas those of Redshank and Oystercatcher are more likely to be ringed later. For raptors, even the mid-way assumption is too early, because they tend to be ringed later when it is possible for chicks to be sexed. The analyses of ringed pulli could be enhanced by obtaining information on the age at ringing recorded on NRCs.

4.4 Seasonal trends in breeding performance

Seasonal patterns in breeding performance among birds have long been known to occur and have been ascribed to a range of different factors (Lack 1968, O'Connor 1984, Clutton-Brock 1991). For example, younger, relatively inexperienced birds tend to be less efficient at breeding than older, more experienced individuals, thus they tend to start laying later and lay smaller clutches (e.g. Coulson & White 1961, Newton 1976, Perrins & Moss 1974; see review in Saether 1990). Birds nesting in poorer quality habitats may also be constrained to lay smaller and later clutches, due to poor food supplies (Boutin 1990). Species that rely on short periods of food abundance, following closely after the date on which laying becomes energetically possible (usually single-brooded species), start laying at a time when the adapted clutch size is already declining, so that any delay will result in a decline in clutch size (Perrins 1970). Early breeding may be an advantage because it allows parents to re-nest after successful breeding or after failure, for example climate warming has permitted some European populations of Great Tits to increase the proportion of second broods raised, as birds have been able to start breeding early (Visser *et al.* 2003).

Crick *et al*. (1993) analysed BTO nest record data to show that seasonal declines in clutch size were the norm for single-brooded species, as well as for multi-brooded long-distance migrants. They also demonstrated that multi-brooded residents were more likely to show patterns of seasonal increase to a peak followed by decline. The trends revealed here, using data for birds breeding in upland habitats also followed these patterns. Single-brooded Hen Harrier, Peregrine and Oystercatcher all showed declines in clutch size, as did migrant Ring Ouzel, Wheatear and Whinchat. Multi-brooded Stonechat and Twite showed increases early in the season followed by decreases in clutch and brood size.

Hatching success showed no trends through the season, which probably indicates that once eggs have been laid, the factors affecting hatching failure do not change substantially. Partial losses, due to failure to hatch of a portion of the clutch, are relatively small. Losses of whole nests during the egg and nestling stages showed few trends through the season. Losses of nests of Golden Plover and Meadow Pipit at the egg stage tended to decline through the season, although the latter trend was not considered reliable due to small samples at certain points through the season. Nests of Wheatear tended to fail more at both egg and nestling stages as the nesting season progresses. No other seasonal trends of nest failure rates were detected.

If we consider species that nest during the period from 1st to 30th April, when burning can occur, we can gauge the scale of change, in aspects of breeding performance that could occur over the period by using the results of the GLMs in Appendix 8. Thus for Oystercatcher, clutch size is predicted to decline by 0.49 egg; Peregrine clutch size will decline by 0.62 egg; Stonechat clutch size by 0.15 egg and brood size by 0.11 young; and egg-stage failure rates of Golden Plover would decline by a negligible amount. For species that only start nesting half way through April, the average predicted changes from 15th to 30th April are: a decline of 0.29 egg for Hen Harrier; <0.02 egg or young for Ring Ouzel; <0.01 egg for Twite; but 0.48 egg and 0.51 young for Wheatear. So, losses of nests during April could have impacts on the productivity of Oystercatcher, Peregrine and Wheatear nesting in burned areas and less so for Hen Harrier and Stonechat, even if the birds could relay.

Looking at trends in overall breeding productivity in terms of fledglings per nesting attempt (FPA) over the course of April, Peregrine shows an estimated decline from 2.76 fledglings to 1.75 fledglings on average. Thus interference with early nesting attempts can have important repercussions for productivity of Peregrines nesting in an area affected by burning, given that over 80% will have started nesting by mid-April. Of course, some of this decline may be due to declines in the experience of birds breeding later in the season (Ratcliffe 1993), so that displaced birds may not incur such a large reduction in breeding performance if they do relay. It may also reflect declines in the availability of important resources for breeding or declines in the reproductive effort as a result of declines in the "value" of the chicks to the parents (Trivers 1972, 1974). For Ring Ouzel, the decline in FPA over the last half of April is relatively small: a decline from 3.12 to 3.02 fledglings from the 16th to 30th April. This only affects a small proportion of the population. For the Wheatear, estimated productivity changes very little and, anyway this affects an even smaller proportion of the population than for Ring Ouzel, as only 8% have started nesting by 30th April. Whinchat and Twite do not start breeding until after April.

In conclusion, it appears that burning in late March and April may not only destroy a certain proportion of nests of some species, but it may also destroy or affect the more productive nests than occur later on, particularly for Peregrine, Oystercatcher, but also for Hen Harrier, Stonechat and possibly Ring Ouzel.

4.5 Other potential data sources and further research

This report has utilised the two major multi-species datasets (NRCs and ringed pulli) available for GB, as well as two datasets for individual species derived from intensive studies. However, there are a range of other datasets that would be useful to explore, with the aim of expanding on and corroborating the findings from the BTO datasets. Examples of such long-term intensive local-area datasets are:

a) Hen Harrier: Richard Saunders/EN (England); Joint Raptor Study; Orkney studies.
b) Merlin: specialists, such as Alan Heavisides, Graham Rebecca and others within the Scottish Raptor Study Groups and English Ringing Groups may be willing to provide information from their intensive long-term studies.
c) Golden Plover: Mark Whittingham (N Pennines), James Pearce-Higgins (S Pennines), Ray Parr (Highlands).
d) Curlew: Glen Robson (N Pennines), Murray Grant (N Pennines).
e) Twite: Henry McGhie, Sean Read, Andre Raines, Andy Brown (S Pennines); Nick Wilkinson (Uists).
f) Golden Eagle: Jeff Watson, Paul Howarth, Phil Whitfield (Scotland).
g) Lapwing: Pat Thompson, Dave Baines (N Pennines).

h) Black Grouse: Dave Baines (Game Conservancy Trust), N England Recovery Project, SNH/RSPB (Tayside).
i) Red Grouse in northern England: David Baines (Game Conservancy Trust).
i) Ring Ouzel: Ian Appleyard (N Pennines), Innes Sim (Glen Clunie).

The data holders may be willing to undertake the analyses themselves or be willing to provide the information in a format that will allow analysis by a third party, but this may require some negotiation to arrange. What would be needed for each record would be: estimated laying date (with information on how this was estimated); altitude; and region. If possible, broad habitat type would be useful and any information on whether burning ever caused any nest losses. Precise location information would not be necessary, although it may be advantageous.

In addition to exploring other datasets, this study highlights the lack of information available on the pre-nesting stage of moorland birds. In particular, it would be useful to have more information on when migrants (whether long- or short-distance) arrive back on their breeding grounds, and on the impact of burning on site fidelity in the short- and longer-term. In addition, there is a lack of information on how birds respond if they lose a nest to burning – do they attempt to renest? Are they able to move elsewhere to renest? How successful is re-nesting after burning? How does renesting after burning affect the survival of adults? It would be a valuable exercise to see whether any information on nest loss due to burning can be gleaned from the NRC data, as such losses are likely to be recorded by observers.

Finally, this analysis has revealed that the sample sizes for NRCs and ringed pulli in the uplands are often relatively small. There is a need to promote more volunteer effort in these areas by raising the profile of the conservation importance of the habitats and the issues concerning them. Increased effort in the areas would help in the monitoring of the impacts of burning in these areas in the future.

4.6 Risk analysis

Although these results can be used to indicate the vulnerability of moorland birds to the potentially damaging effects of burning during the approved periods, they do not show what proportion of nests are actually affected. This ‘true’ vulnerability may depend on aspects such as the choice of nest sites in relation to the types of heather that are burnt, which may in turn vary depending on the objectives of burning. For example, Golden Plover tend not to nest in stands of mature heather that are ready for burning as part of grouse moor management (though they do nest in shorter and fragmented heaths, e.g. Ratcliffe 1976), but may be affected if a fire spreads into other more suitable habitats. They may also be affected by burning (swaling) on grass moorland and blanket bog.

A number of additional factors must be taken into account to assess that risk:

(1) The proportion of suitable habitat subject to management through burning;
(2) The frequency with which a managed moor is burned;
(3) The effect of burning operations on the species’ nesting attempt .

A number of potential approaches to creating a vulnerability index are possible:

One approach would be to assess the proportions of the populations of each species that occur in areas likely to be subject to burning. Advice from Country Agencies would be needed to define such areas. or, alternatively, the Defra Moorland Line could be used. A cruder approach would be to use data from the 1988-1991 Breeding Bird Atlas (BBA; Gibbons *et al.* 1993) to assess the proportions of each population that occurs above and below certain altitude levels within the areas covered by the CS2000 upland Environmental Zones (see above). Relative abundance in the BBA is not a direct measure but is estimated from the frequency of occurrence of species in the tetrads surveyed in each 10-km square: the assumption being that frequency of occurrence is related to relative abundance.

Another approach would be to use the BTO/JNCC/RSPB Breeding Bird Survey (BBS) data to undertake a similar analysis. BBS data would be available for recent years and the information on relative abundance would be based on count data instead of presence/absence data. This would require the Kriging of BBS abundance data to produce a smoothed map of abundance for each species that could then be overlaid against the altitude and Environmental Zone information to estimate the proportion of each population within the potential burning areas.

A third approach would be to use BBS data to estimate the proportions of each species occurring in the key burning habitats within each country. BBS surveyors record bird densities and habitat for each of the ten 200 m transect sections within their 1-km survey squares. These data could then be used to estimate habitat-specific densities and the extent of each habitat within a country to provide total population estimates for that habitat. A further refinement would be to consider low and high altitude squares separately to estimate the proportions of each population in these altitude bands.

Other factors associated with each species' natural history could also be included, as qualitative measures to scale the vulnerability indices estimated from the proportions of each population at risk. For example ground-nesting species that tend to nest in tall rank heather would have a higher risk factor than a species that tended to use recently burnt areas or trees for nesting. The development of a risk analysis method would benefit from comment with stakeholders and experts in the field, followed by revision and potentially a further round of comment, before the production of a final index.

Some evidence on (1) and (2), above, is available from a recent study (Thomas *et al.* in prep.) which used aerial photographs to assess the extent of burning in a random sample of 1km squares covering upland habitats in England. They were unable to identify evidence of the often extensive burning of grass moorland and bog habitats due at least partly to limitations of the method. In dwarf shrub heath (which probably included wet heath and bog dominated by *Calluna*), which covered 24% of their study area, 71% of samples showed visible evidence of burning. Of this total, the average proportion of the *Calluna* area showing new or recent burning (up to 12 years old) was 38%. Frequency of burning of any given area was also estimated, with a modal return time of 16-20 years. Combining these estimates, we would conclude that the probability of burning a random sample area in upland heather moor in a given year could be 4-5%. Thomas *et al.* (in prep.) found that the typical area of individual heath burns ranged between 0.12ha and 0.55ha with a median value between 0.25 to 0.28ha.

Tucker (2003) included a literature review of the potential impacts of upland burning management, rather than the burning event itself, on some birds of conservation concern in England. Of these species, Hen Harrier, Merlin and Short-eared Owl were likely to suffer detrimental effects from heather burning due to loss of cover for nesting or for their prey. Black Grouse, Golden Plover, Skylark and Twite might gain some benefits due to regeneration of short swards or encouragement of grassland. Peregrine and Golden Eagle were considered not likely to suffer or benefit since they are cliff nesting. Certainly Rebecca & Cosnette (2003) reported a temporary decline in a Merlin population on Donside as a result of extensive burning, including on some steep heather banks. They noted that much of the burning was carried out into April, when Merlins would have been established on territory.

The study by Thomas *et al.* (in prep.) does not include any information on the timing of burning within the permitted periods. Tucker (2003) reports that most burning takes place over a relatively short period in spring when weather conditions and daylight are most favourable. This would suggest that burning is most likely near the cut-off dates which have been the focus of this study. We have found that substantial proportions of several priority species begin nesting during the permitted burning seasons, particularly in Scotland where burning can extend into late April or early May. The results presented in this study should enable policy makers to assess the potential effects on the birds of moorlands of any future legislative change in the burning season. For example, bringing the 15th April cut-off date back to 31st March would remove the earliest breeding species from significant risk. The data in Tables 3.3.2a and 3.3.2b provide a ready assessment of this for each country.

5. ACKNOWLEDGEMENTS

We are particularly grateful to the thousands of volunteer nest recorders and ringers who, over the years, have contributed their records, all those who have reported a ringed bird, and to all the landowners and managers who allowed ringing and nest recording to take place on their land. The NRS is funded under the JNCC/BTO partnership that the JNCC undertakes on behalf of English Nature, Scottish Natural Heritage, Countryside Council for Wales and the Environment & Heritage Service in Northern Ireland. The BTO Ringing Scheme is funded by a partnership of the British Trust for Ornithology, the Joint Nature Conservation Committee (on behalf of English Nature, Scottish Natural Heritage and the Countryside Council for Wales, and also on behalf of the Environment and Heritage Service in Northern Ireland), The National Parks and Wildlife Service (Ireland) and the ringers themselves. Thanks to Dave Leech for providing habitat datasets for the NRCs, Sue Adams for extracting ringing and recovery data, and to Rachel Coombes for extracting literature on pre-nesting periods.. All records for Red Grouse were taken from data sets collected by past or present Game Conservancy Trust staff or students on projects managed and funded by The Game Conservancy Trust. We are also very grateful to Brian Etheridge for the provision of data from the RSPB Hen Harrier dataset and to RSPB for granting access to these data; this key dataset would not have been available without the large efforts put in by the many contributors to the RSPB's Hen Harrier Project. We are grateful to Susan Waghorn and Angela Rickard for their expertise in formatting and presenting the report. The project was funded by Defra, Scottish Natural Heritage, the Joint Nature Conservation Committee and the BTO and we are grateful to the members of the project's Steering Group for their help and advice with the project: Des Thompson and Mike Thornton of SNH; David Glaves of Defra Rural Development Service; and Mick Rebane of English Nature as well as to Andy Brown and Alistair Crowle of English Nature. We are also grateful to Jerry Wilson, Sue O'Brien, Jim Younger (Defra), Simon Thorp and The Heather Trust for comments on an earlier draft.

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Table 3.1.1 Coefficients, Chi square and P values of terms in the Generalised Linear Model with hatching date for the 'minimal model' for Red Grouse.

Term	df	Coeff	χ^2	P value
Year	1	0.02	41.30	<0.001**

Table 3.1.2a Proportion of Red Grouse nesting attempts where breeding had started (clutch initiation) by 15th April (up to 1500 feet), 30th April (1500 feet or above) and 15th May where extended burning permission had been granted for each year for Strathspey (*known* hatching dates).

Year	By 15th April		By 30th April		By 15th May	
	<1500ft	>1500ft	<1500ft	>1500ft	<1500ft	>1500ft
1992	0%	0%	50%	0%	94%	100%
1993	0%	0%	21%	NA	100%	100%
1994	0%	0%	10%	0%	100%	100%
1995	0%	0%	42%	0%	100%	100%
1996	0%	0%	44%	25%	100%	100%
1997	0%	0%	75%	58%	94%	100%
1998	0%	0%	50%	100%	100%	100%
1999	3%	0%	64%	0%	100%	100%
2000	0%	0%	78%	67%	100%	100%
2001	0%	0%	23%	40%	100%	100%
2002	0%	0%	52%	100%	97%	100%
2003	0%	0%	88%	NA	100%	100%

Note clutch initiation dates are estimated as 30 days before *known* hatching dates.

Table 3.1.2b Proportion of Red Grouse nesting attempts that had started breeding (clutch initiation) by either 15th April (up to 1500 feet), 30th April (1500 feet or above) and 15th May where extended burning permission had been granted for each year for Scotland (*predicted* hatching dates).

Year	By 15th April		By 30th April		By 15th May	
	<1500ft	>1500ft	<1500ft	>1500ft	<1500ft	>1500ft
1985	6%	0%	82%	52%	100%	96%
1986	0%	0%	42%	20%	100%	100%
1987	0%	0%	44%	56%	100%	100%
1988	1%	8%	75%	77%	100%	77%
1989	3%	0%	48%	13%	100%	100%
1992	0%	0%	45%	25%	97%	83%
1993	2%	0%	49%	20%	95%	90%
1994	0%	0%	49%	0%	98%	58%
1995	2%	0%	57%	42%	96%	100%
1996	9%	0%	70%	14%	98%	91%
1997	0%	0%	73%	58%	100%	96%
1998	0%	0%	33%	31%	100%	94%
1999	5%	0%	59%	71%	85%	100%
2000	0%	0%	20%	0%	100%	100%
2002	0%	0%	75%	80%	100%	80%
2003	0%	0%	65%	83%	100%	100%

Note clutch initiation dates are estimated as 30 days before *predicted* hatching dates. To correct for the discrepancies seen between the true hatching dates and predicted hatching dates five days have been added to the predicted hatching dates.

Table 3.2.1 Numbers of Hen Harrier nest records in the RSPB dataset for each year and overall with estimable laying dates, and summary statistics for laying date, altitude, easting and northing.

				First egg date				Altitude (m)				Easting (km)				Northing (km)			
Year	N (total)	N (co-ordinates)	N (altitude)	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median
1988	94	92	92	121.65	11.11	104 - 163	120	225	119	10 - 450	225	229.1	69.1	121 - 355	243	734.4	92.4	578 - 911	723
1989	129	129	26	130.94	11.39	109 - 168	130	363	48	280 - 480	350	268.5	73.7	121 - 362	284	800.9	142.8	615 - 1030	765
1990	144	119	2	129.74	12.04	107 - 165	127	270	184	140 - 400	270	236.3	75.6	118 - 362	267	736.8	92.1	575 - 950	751
1991	187	149	146	128.94	14.66	103 - 175	127	237	146	5 - 520	220	228.5	70.5	119 - 362	260	723.5	82.4	575 - 911	722
1992	208	175	142	128.52	11.17	105 - 175	125	329	126	35 - 550	350	242.0	74.2	119 - 371	267	730.1	91.7	464 - 961	741
1993	166	145	109	129.14	13.31	107 - 171	128	304	160	5 - 650	340	243.9	73.0	119 - 357	269	736.1	99.4	571 - 956	744
1994	171	153	119	129.36	12.24	107 - 169	127	323	122	10 - 600	340	261.7	67.8	119 - 366	275	730.8	120.9	551 - 1029	706
1995	136	123	124	127.33	12.07	105 - 170	126	295	140	5 - 570	320	272.2	58.7	125 - 368	277	763.7	129.9	571 - 1022	758
Total	1235	1085	760	128.52	12.56	103 - 175	127	290	140	5 - 650	310	248.0	72.2	118 - 371	269	743.4	110.2	464 - 1030	742

Table 3.2.2 The proportions of Hen Harrier nest records for which estimated first egg laying date for (a) each year 1988-1995 and (b) Great Britain, England, Wales and Scotland were by 15th April, 30th April and 15th May. For the same categories, the dates by which laying began in the first 5%, 10%, 15%, 20% and 25% of nests.

		% of clutches started by:			date by which X% have started laying				
Year	N	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
1988	94	2%	56%	89%	17-Apr	20-Apr	21-Apr	23-Apr	24-Apr
1989	129	0%	18%	74%	25-Apr	28-Apr	30-Apr	02-May	04-May
1990	144	0%	23%	75%	24-Apr	26-Apr	28-Apr	29-Apr	01-May
1991	187	2%	35%	72%	20-Apr	22-Apr	24-Apr	26-Apr	27-Apr
1992	208	0%	24%	72%	24-Apr	26-Apr	27-Apr	29-Apr	01-May
1993	166	0%	27%	71%	20-Apr	23-Apr	25-Apr	28-Apr	29-Apr
1994	171	0%	27%	74%	24-Apr	26-Apr	28-Apr	29-Apr	30-Apr
1995	136	1%	30%	80%	19-Apr	23-Apr	26-Apr	28-Apr	29-Apr
Country									
GB Total	1235	1%	29%	75%	21-Apr	24-Apr	26-Apr	28-Apr	30-Apr
England	17	0%	29%	76%	16-Apr	17-Apr	27-Apr	28-Apr	29-Apr
Wales	62	0%	8%	47%	27-Apr	02-May	03-May	06-May	08-May
Scotland	1156	1%	30%	76%	21-Apr	24-Apr	26-Apr	28-Apr	29-Apr

Table 3.2.3 Mean Hen Harrier first egg dates and standard errors for each year, 1988-1995, and results of analysis of variance between years.

Year	N	Mean Date (1=1st Jan)	Mean Calendar date	Std Err	R-square	F Value	Prob F
1988	94	121.65	02-May	11.11	0.0298	5.39	4.19E-06
1989	129	130.94	11-May	11.39			
1990	144	129.74	10-May	12.04			
1991	187	128.94	09-May	14.66			
1992	208	128.52	09-May	11.17			
1993	166	129.14	09-May	13.31			
1994	171	129.36	09-May	12.24			
1995	136	127.33	07-May	12.07			

Table 3.2.4 Results of the multiple linear regression for Hen Harrier nest records of first egg laying date with altitude, easting, northing and year. Linear and quadratic terms were used, hence altm1 = altitude, altm2 = altitude * altitude, etc. All predictors are centred around their overall mean values. Two models are shown: all predictors, and subtraction model in which non-significant predictors were removed.

	R-square	F value	DF model	DF error	Prob F	Variable		Estimate	Std err	t	Prob t
GLM, subtraction model	0.0669	7.69	10	1074	<0.0001	Intercept		126.9441	1.163839	109.07	
						east1		-0.02187	0.006085	-3.59	0.0003
						east2		-0.00036	7.9E-05	-4.59	<0.0001
						north2		7.65E-05	2.32E-05	3.30	0.0010
						Year	1988	-5.1007	1.61801	-3.15	0.0017
						Year	1989	4.642687	1.473049	3.15	0.0017
						Year	1990	2.470066	1.509747	1.64	0.1021
						Year	1991	-0.68998	1.439379	-0.48	0.6318
						Year	1992	1.469491	1.382218	1.06	0.2880
						Year	1993	2.081488	1.434027	1.45	0.1469
						Year	1994	2.422489	1.405159	1.72	0.0850
						Year	1995	0			
GLM, all predictors	0.0836	4.51	13	642	<0.0001	Intercept		126.5222	1.393233	90.81	
						east1		-0.03467	0.014501	-2.39	0.0171
						east2		-0.00035	0.00014	-2.51	0.0124
						north1		-0.00417	0.005163	-0.81	0.4200
						north2		0.000157	4.22E-05	3.71	0.0002
						altm1		0.008855	0.006602	1.34	0.1803
						altm2		-2.90E-05	3.14E-05	-0.92	0.3555
						Year	1988	-4.47898	1.736319	-2.58	0.0101
						Year	1989	1.963446	2.618447	0.75	0.4536
						Year	1990	18.82983	8.447004	2.23	0.0261
						Year	1991	0.00479	1.642831	0.00	0.9977
						Year	1992	1.56941	1.590403	0.99	0.3241
						Year	1993	2.829421	1.693735	1.67	0.0953
						Year	1994	0.376484	1.585309	0.24	0.8124
						Year	1995	0			

Table 3.2.5 Summary, comparing three datasets, of (a) mean, standard deviation, range and median first egg laying dates; (b) estimates of the proportions of Hen Harrier nests in Scotland for which laying is estimated to have started by the key dates; and (c) results of the multiple linear regression for Hen Harrier nests in Great Britain of first egg laying date with altitude[4], easting, northing and year. Full results are in sections 3.2, 3.3 and 3.4.

(a) First egg date statistics

Dataset	N	Mean	Std dev	Range	Median
RSPB	1235	128.52	12.56	103 - 175	127
BTO NRCs	118	130.25	13.94	101 - 167	129
BTO ringing	680	133.26	12.23	76 - 186	132

(b) Key dates and percentiles

		% of clutches started by:			date by which X% have started laying				
Dataset	N	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
RSPB	1156	1%	30%	76%	21-Apr	24-Apr	26-Apr	28-Apr	29-Apr
BTO NRCs	85	0%	20%	69%	25-Apr	29-Apr	30-Apr	30-Apr	03-May
BTO ringing	562	0%	9%	59%	26-Apr	30-Apr	01-May	03-may	05-May

(c) Multiple linear regression

Dataset	R-square	F value	DF model	DF error	Prob F	Variable	Estimate	Stderr	t	Prob t
RSPB	0.0669	7.69	10	1074	<0.0001	Intercept	126.9441	1.163839	109.07	
						east1	-0.02187	0.006085	-3.59	0.0003
						east2	-0.00036	7.9E-05	-4.59	<0.0001
						north2	7.65E-05	2.32E-05	3.30	0.0010
BTO NRCs	0.2630	8.33	3	70	<0.0001	Intercept	130.4623	2.397112	54.42	
						east1	-0.08411	0.02844	-2.96	0.0042
						north1	0.011818	0.006076	1.94	0.0558
						year1	-1.06792	0.292022	-3.66	0.0005
BTO ringing	0.1254	18.95	5	661	<0.0001	Intercept	129.1424	0.841875	143.90	
						east1	-0.0561	0.013748	-4.08	0.0001
						north1	0.019712	0.003164	6.23	<0.0001
						year1	-0.06693	0.031023	-2.16	0.0313
						east2	-0.00038	8.93E-05	-4.30	<0.0001
						north2	8.53E-05	1.11E-05	7.67	<0.0001

[4] Altitude data not available for BTO ringing dataset.

Table 3.3.1a Numbers of Nest Record Cards with estimable laying dates for each species, and summary statistics for laying date, altitude, easting, northing and year.

Species which are italicised have <50 records and therefore insufficient samples for regression analyses. There were no NRCs available for Black-headed and Common Gulls, Golden Eagle, Black and Red Grouse.

			First egg date				Altitude (m)				Easting (km)				Northing (km)				Year			
Species name	N (total)	N (coordinates)	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median
Common Sandpiper	97	97	139.21	10.26	113 - 170	138	194	126	0 - 900	210	321.8	77.5	135 - 467	323	598.5	196.4	214 - 1031	587	1989.87	7.78	1970 - 2002	1990
Curlew	107	94	124.21	10.53	104 - 156	121	182	157	2 - 530	210	346.5	46.1	236 - 478	334	759.0	282.2	271 - 1201	900	1989.27	8.01	1966 - 2000	1991
Dunlin	114	62	139.90	12.32	89 - 178	139	156	199	0 - 975	46	256.8	162.5	69 - 492	250	751.6	267.3	215 - 1215	870	1983.20	8.99	1966 - 1998	1983
Golden Plover	133	81	119.23	19.66	59 - 174	116	392	159	6 - 701	440	381.8	65.3	84 - 479	405	483.9	180.5	233 - 1154	414	1982.90	8.47	1966 - 2002	1984
Hen Harrier	118	74	130.25	13.94	101 - 167	129	245	162	20 - 549	163	313.6	53.5	82 - 474	330	768.8	255.5	310 - 1030	832	1992.25	6.98	1968 - 2002	1993
Lapwing	204	204	111.11	18.86	79 - 158	108	264	101	0 - 500	291	345.8	90.9	69 - 479	383	524.4	200.5	199 - 1028	487	1989.84	5.73	1981 - 2002	1992
Meadow Pipit	388	388	135.73	16.81	101 - 199	131	264	151	0 - 900	280	337.7	69.3	73 - 520	326	552.2	259.7	64 - 1216	515	1990.87	7.13	1972 - 2002	1992
Merlin	280	178	127.88	10.09	94 - 170	126	333	126	15 - 650	360	367.6	60.7	139 - 490	371	552.1	207.3	197 - 1191	501	1989.72	7.66	1968 - 2002	1991
Oystercatcher	157	153	128.62	12.82	83 - 159	127	130	124	0 - 360	80	297.2	91.7	79 - 466	297	784.6	186.9	323 - 1191	800	1993.99	3.97	1973 - 2002	1994
Peregrine	128	128	97.83	10.71	80 - 139	97	352	117	37 - 580	380	316.4	40.9	200 - 426	319	471.6	180.2	199 - 964	399	1993.80	5.08	1968 - 2002	1995
Redshank	*43*	*36*	*116.28*	*9.64*	*91 - 141*	*116*	*247*	*110*	*0 - 457*	*270*	*349.3*	*95.5*	*72 - 478*	*392*	*586.0*	*141.5*	*211 - 877*	*523*	*1992.14*	*9.53*	*1966 - 2000*	*1997*
Ring Ouzel	781	779	131.49	17.15	102 - 184	127	410	106	67 - 683	410	345.8	43.5	205 - 487	336	540.4	189.9	66 - 994	546	1982.29	8.74	1966 - 2002	1982
Ringed Plover	*28*	*26*	*137.18*	*19.55*	*97 - 171*	*131.5*	*113*	*130*	*0 - 351*	*33*	*325.5*	*109.0*	*83 - 623*	*354*	*854.8*	*226.7*	*218 - 1119*	*894*	*1992.68*	*5.48*	*1972 - 2002*	*1993*
Short-eared Owl	*19*	*12*	*123.00*	*15.62*	*95 - 149*	*122*	*266*	*132*	*37 - 427*	*229*	*308.8*	*107.2*	*121 - 417*	*353*	*560.8*	*240.8*	*209 - 1006*	*468*	*1984.32*	*7.80*	*1966 - 1998*	*1984*
Skylark	55	54	136.96	18.17	105 - 182	136	134	143	0 - 530	61	365.3	93.1	71 - 462	376	815.1	301.2	199 - 1217	972	1985.78	8.54	1970 - 2002	1990
Snipe	87	72	117.76	21.84	73 - 185	117	245	108	0 - 427	270	361.6	85.3	71 - 466	394	589.6	168.5	211 - 1190	525	1992.07	8.83	1966 - 1999	1996
Stonechat	170	170	129.95	28.39	83 - 201	129	279	131	0 - 460	350	304.7	45.0	80 - 418	313	521.6	204.4	142 - 1007	528	1995.41	6.96	1972 - 2002	1998
Twite	316	56	152.37	17.64	120 - 199	148	314	116	0 - 610	332	337.0	93.7	74 - 476	372	656.9	274.2	350 - 1155	441	1974.92	7.54	1966 - 1999	1974
Wheatear	364	364	136.46	11.59	104 - 175	135	364	87	5 - 1120	375	330.1	17.3	270 - 422	330	614.0	134.0	202 - 1072	650	1990.39	6.38	1977 - 2002	1992
Whinchat	518	518	146.84	10.50	124 - 193	145	325	85	5 - 549	350	317.5	36.3	138 - 429	317	371.6	210.1	76 - 1020	229	1993.80	7.41	1969 - 2002	1997
Wren	177	177	142.97	23.49	100 - 213	136	173	81	2 - 400	183	339.9	53.3	155 - 484	326	421.0	188.7	198 - 1014	433	1986.87	9.57	1967 - 2002	1989

Table 3.3.1b Numbers of independent records of ringed pulli with estimable laying dates for each species, and summary statistics for laying date, estimated from ringing at mid-nestling or day 1, easting, northing and year.

Species which are italicised have <50 records and therefore insufficient samples for regression analyses. There were no data for Greenshank, Black and Red Grouse.

		First egg date: pulli ringed mid-nestling period				First egg date: pulli ringed aged 1 day				Easting (km)				Northing (km)				Year			
Species name	N	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median	Mean	Std dev	Range	Median
Common Gull	10908	127.86	9.93	104 - 180	128	140.93	9.91	116 - 192	140	280.6	79.6	75 - 468	279	890.0	129.2	588 - 1216	870	1998.56	6.81	1910 - 2004	2000
Common Sandpiper	319	136.25	11.62	113 - 176	134.5	141.75	11.62	118 - 181	140	307.4	71.5	74 - 419	332	685.1	137.8	213 - 962	648	1997.03	10.17	1923 - 2004	2000
Curlew	1042	114.88	13.67	76 - 162	114	131.37	13.68	92 - 179	130	367.3	60.4	124 - 479	361	733.7	246.3	74 - 1213	657	1990.57	19.12	1909 - 2004	1998
Dunlin	168	134.11	7.37	115 - 166	133	145.61	7.37	127 - 178	144.5	273.1	112.3	70 - 466	324	969.9	90.9	408 - 1216	994	1996.42	9.60	1913 - 2004	1999
Golden Eagle	131	89.13	10.18	63 - 116	90					210.7	77.0	70 - 357	219	811.8	93.9	512 - 962	822	1995.29	11.36	1956 - 2004	2000
Golden Plover	145	109.58	13.93	84 - 157	107	122.59	13.93	97 - 170	120	396.2	95.1	82 - 479	409	607.9	194.8	389 - 1216	510	1991.96	15.90	1918 - 2004	1999
Hen Harrier	680	133.26	12.23	76 - 186	132					302.3	57.7	80 - 376	326	822.6	233.2	307 - 1032	898	1990.28	16.23	1938 - 2004	1998
Lapwing	5345	102.65	15.93	64 - 166	102	118.16	15.93	80 - 182	117	316.7	100.4	70 - 485	335	725.4	208.8	74 - 1214	798	1989.67	20.23	1910 - 2004	1998
Meadow Pipit	541	138.16	17.29	72 - 218	133					313.0	79.2	70 - 479	336	691.0	234.9	141 - 1164	710	1997.88	11.48	1911 - 2004	2002
Merlin	1180	129.34	8.06	103 - 189	129					356.3	59.4	80 - 482	361	670.6	247.0	69 - 1208	594	1990.70	15.04	1912 - 2004	1995
Oystercatcher	2080	125.71	13.22	58 - 196	125	142.20	13.23	74 - 212	142	314.7	97.7	57 - 468	334	915.0	179.1	336 - 1216	965	1992.13	12.93	1910 - 2004	1998
Peregrine	602	105.01	10.06	60 - 148	104					309.5	53.5	80 - 452	319	601.0	187.1	87 - 1180	592	1990.06	12.01	1923 - 2004	1991
Redshank	350	116.48	11.64	74 - 150	116	130.51	11.64	88 - 164	130	252.2	133.5	70 - 477	297	790.5	192.4	212 - 1212	853	1991.45	15.65	1911 - 2004	1998
Ring Ouzel	531	130.87	18.32	99 - 184	125					338.6	34.8	144 - 471	340	683.3	164.4	141 - 930	779	1998.40	10.18	1925 - 2004	2001
Ringed Plover	329	134.80	19.00	83 - 195	134	146.24	18.96	94 - 206	146	269.6	128.0	70 - 463	279	930.9	156.5	464 - 1203	934	1995.96	11.42	1911 - 2004	1999
Short-eared Owl	124	116.16	22.36	63 - 182	116					326.0	78.4	77 - 447	337	665.4	214.4	340 - 1027	597	1986.11	19.01	1912 - 2004	1995
Skylark	116	146.55	19.69	116 - 206	142					289.7	127.6	70 - 462	337	804.2	250.9	142 - 1203	869	1997.53	6.84	1960 - 2004	2000
Snipe	163	131.27	22.64	92 - 201	127	140.27	22.64	101 - 210	136	309.5	120.7	70 - 470	336	799.3	233.9	376 - 1196	805	1982.88	28.82	1910 - 2004	1998
Stonechat	296	118.57	26.62	85 - 201	108					326.5	52.0	201 - 427	359	406.5	233.4	63 - 1001	277	2000.19	7.73	1923 - 2004	2002
Twite	245	147.81	21.87	116 - 202	140					203.9	156.1	70 - 422	77	684.4	204.7	367 - 1072	833	2001.07	8.70	1954 - 2004	2004
Wheatear	526	129.86	9.24	112 - 172	128					317.8	68.4	70 - 468	357	567.8	308.7	65 - 1203	440	1996.37	11.56	1924 - 2004	2000
Whinchat	184	147.21	11.38	128 - 178	144					308.7	48.3	74 - 465	316	319.8	227.4	65 - 957	211	1994.17	15.22	1912 - 2004	1998
Wren	*38*	*137.82*	*23.28*	*101 - 210*	*130*					*337.6*	*58.8*	*236 - 451*	*324*	*591.9*	*300.2*	*210 - 1193*	*494*	*1997.92*	*12.01*	*1932 - 2004*	*2001*

Table 3.3.2a The proportions of first egg laying dates before key dates estimated from nest record cards. (a) All altitudes by 31st March, 15th April, 30th April and 15th May (Great Britain, England, Wales and Scotland); (b) altitudes <=250m above sea level (England & Wales) by 31st March; (c) altitudes >250m (England & Wales) by 15th April; (d) altitudes <=450m (Scotland) by 15th April and 30th April; (e) altitudes >450m (Scotland) by 30th April and 15th May. For the same categories, the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests.

Note that country/altitude classes which are not relevant to burning regulations have been greyed out for greater clarity, and that percentiles are omitted for country/altitude classes with samples below 20.

Country	Altitude	% of clutches started by:					date by which X% have started laying				
		N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Common Sandpiper											
GB	All	97	0%	0%	1%	36%	05-May	08-May	11-May	12-May	14-May
England	All	40	0%	0%	0%	28%	05-May	08-May	12-May	13-May	14-May
England	<=250m	28	0%				05-May	06-May	09-May	12-May	14-May
England	>250m	12		0%							
Wales	All	6	0%	0%	17%	33%	23-Apr	23-Apr	23-Apr	08-May	08-May
Wales	<=250m	4	0%								
Wales	>250m	2		0%							
Scotland	All	51	0%	0%	0%	43%	06-May	08-May	11-May	12-May	13-May
Scotland	<=450m	50		0%	0%		06-May	08-May	11-May	11-May	13-May
Scotland	>450m	0									
Curlew											
GB	All	107	0%	2%	44%	85%	22-Apr	24-Apr	26-Apr	26-Apr	27-Apr
England	All	37	0%	0%	27%	84%	24-Apr	26-Apr	28-Apr	29-Apr	30-Apr
England	<=250m	9	0%								
England	>250m	28		0%			24-Apr	26-Apr	28-Apr	29-Apr	30-Apr
Wales	All	10	0%	0%	50%	90%	22-Apr	23-Apr	25-Apr	25-Apr	26-Apr
Wales	<=250m	0									
Wales	>250m	10		0%							
Scotland	All	60	0%	3%	53%	85%	20-Apr	23-Apr	24-Apr	25-Apr	26-Apr
Scotland	<=450m	60		3%	53%		20-Apr	23-Apr	24-Apr	25-Apr	26-Apr
Scotland	>450m	0									
Dunlin											
GB	All	114	1%	1%	3%	35%	03-May	07-May	09-May	11-May	13-May
England	All	31	3%	3%	10%	55%	29-Apr	03-May	04-May	07-May	08-May
England	<=250m	1	0%								
England	>250m	26		4%			29-Apr	30-Apr	03-May	05-May	07-May
Wales	All	1	0%	0%	0%	0%	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Wales	>250m	1		0%							
Scotland	All	82	0%	0%	0%	28%	06-May	12-May	13-May	13-May	15-May
Scotland	<=450m	80		0%	0%		05-May	11-May	13-May	13-May	15-May
Scotland	>450m	1			0%	0%					

Country	Altitude	N	% of clutches started by: 31-Mar	15-Apr	30-Apr	15-May	date by which X% have started laying: 5%	10%	15%	20%	25%
Golden Plover											
GB	All	133	4%	23%	61%	81%	03-Apr	06-Apr	10-Apr	14-Apr	17-Apr
England	All	98	4%	24%	61%	80%	01-Apr	06-Apr	10-Apr	12-Apr	16-Apr
England	<=250m	6	33%								
England	>250m	92		23%			05-Apr	09-Apr	11-Apr	15-Apr	16-Apr
Wales	All	8	0%	13%	63%	88%	06-Apr	06-Apr	17-Apr	17-Apr	17-Apr
Wales	<=250m	0									
Wales	>250m	8		13%							
Scotland	All	27	4%	19%	59%	85%	03-Apr	08-Apr	14-Apr	17-Apr	18-Apr
Scotland	<=450m	26		19%	58%		03-Apr	08-Apr	09-Apr	17-Apr	18-Apr
Scotland	>450m	1			100%	100%					
Greenshank											
GB	All	24	0%	0%	25%	88%	27-Apr	28-Apr	29-Apr	29-Apr	01-May
Scotland	<=450m	24	0%	0%	25%	88%	27-Apr	28-Apr	29-Apr	29-Apr	01-May
Hen Harrier											
GB	All	118	0%	2%	26%	69%	19-Apr	23-Apr	28-Apr	29-Apr	30-Apr
England	All	16	0%	6%	75%	100%	13-Apr	16-Apr	19-Apr	19-Apr	19-Apr
England	<=250m	2	0%								
England	>250m	14		7%							
Wales	All	17	0%	6%	12%	41%	11-Apr	28-Apr	01-May	03-May	11-May
Wales	<=250m	0									
Wales	>250m	17		6%							
Scotland	All	85	0%	0%	20%	69%	25-Apr	29-Apr	30-Apr	30-Apr	03-May
Scotland	<=450m	79		0%	18%		25-Apr	29-Apr	30-Apr	02-May	03-May
Scotland	>450m	6			50%	67%					
Lapwing											
GB	All	204	13%	45%	69%	89%	27-Mar	31-Mar	01-Apr	03-Apr	05-Apr
England	All	117	17%	56%	70%	91%	25-Mar	28-Mar	31-Mar	02-Apr	03-Apr
England	<=250m	15	7%								
England	>250m	102		55%			26-Mar	28-Mar	31-Mar	01-Apr	03-Apr
Wales	All	31	6%	29%	61%	84%	30-Mar	01-Apr	02-Apr	06-Apr	09-Apr
Wales	<=250m	4	0%								
Wales	>250m	27		30%			30-Mar	01-Apr	02-Apr	03-Apr	06-Apr
Scotland	All	56	9%	29%	71%	89%	28-Mar	01-Apr	07-Apr	10-Apr	14-Apr
Scotland	<=450m	56		29%	71%		28-Mar	01-Apr	07-Apr	10-Apr	14-Apr
Scotland	>450m	0									

Country	Altitude	N	% of clutches started by:				date by which X% have started laying				
		N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Meadow Pipit											
GB	All	388	0%	0%	15%	62%	27-Apr	29-Apr	30-Apr	02-May	04-May
England	All	147	0%	0%	15%	64%	26-Apr	30-Apr	01-May	02-May	03-May
England	<=250m	37	0%				25-Apr	26-Apr	29-Apr	01-May	02-May
England	>250m	110		0%			27-Apr	30-Apr	02-May	02-May	04-May
Wales	All	93	0%	1%	24%	65%	23-Apr	27-Apr	28-Apr	30-Apr	01-May
Wales	<=250m	4	0%								
Wales	>250m	89		0%			25-Apr	27-Apr	28-Apr	30-Apr	01-May
Scotland	All	148	0%	0%	11%	58%	28-Apr	30-Apr	04-May	05-May	07-May
Scotland	<=450m	146		0%	11%		28-Apr	30-Apr	04-May	05-May	07-May
Scotland	>450m	2			0%	50%					
Merlin											
GB	All	280	0%	0%	21%	79%	25-Apr	27-Apr	29-Apr	30-Apr	01-May
England	All	142	0%	0%	17%	80%	27-Apr	28-Apr	30-Apr	01-May	02-May
England	<=250m	18	0%								
England	>250m	124		0%			26-Apr	28-Apr	29-Apr	01-May	02-May
Wales	All	45	0%	0%	20%	80%	27-Apr	27-Apr	29-Apr	30-Apr	01-May
Wales	<=250m	3	0%								
Wales	>250m	42		0%			27-Apr	29-Apr	30-Apr	01-May	01-May
Scotland	All	93	0%	1%	27%	76%	25-Apr	26-Apr	28-Apr	29-Apr	30-Apr
Scotland	<=450m	86		1%	24%		25-Apr	27-Apr	28-Apr	30-Apr	01-May
Scotland	>450m	7			57%	100%					
Oystercatcher											
GB	All	157	1%	1%	29%	71%	21-Apr	23-Apr	27-Apr	28-Apr	29-Apr
England	All	26	0%	4%	23%	62%	25-Apr	27-Apr	27-Apr	28-Apr	01-May
England	<=250m	13	0%								
England	>250m	13		8%							
Wales	All	1	0%	0%	0%	0%	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Wales	<=250m	1	0%								
Wales	>250m	0									
Scotland	All	130	1%	1%	31%	73%	21-Apr	23-Apr	26-Apr	28-Apr	29-Apr
Scotland	<=450m	130		1%	31%		21-Apr	23-Apr	26-Apr	28-Apr	29-Apr
Scotland	>450m	0									
Peregrine											
GB	All	128	30%	83%	94%	99%	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar
England	All	24	33%	83%	92%	96%	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar
England	<=250m	2	50%								
England	>250m	22		82%			26-Mar	27-Mar	28-Mar	30-Mar	31-Mar
Wales	All	60	30%	82%	93%	100%	26-Mar	28-Mar	29-Mar	30-Mar	31-Mar
Wales	<=250m	5	60%								
Wales	>250m	55		82%			27-Mar	28-Mar	29-Mar	30-Mar	31-Mar
Scotland	All	44	30%	84%	95%	100%	26-Mar	27-Mar	27-Mar	28-Mar	31-Mar
Scotland	<=450m	38		84%	95%		25-Mar	26-Mar	27-Mar	28-Mar	31-Mar
Scotland	>450m	6			100%	100%					

Country	Altitude		% of clutches started by:				date by which X% have started laying				
		N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Redshank											
GB	All	43	0%	12%	72%	95%	11-Apr	14-Apr	18-Apr	20-Apr	20-Apr
England	All	28	0%	18%	75%	93%	11-Apr	11-Apr	14-Apr	16-Apr	18-Apr
England	<=250m	6	0%								
England	>250m	22		23%			11-Apr	11-Apr	14-Apr	14-Apr	18-Apr
Wales	All	1	0%	0%	100%	100%	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
Wales	<=250m	0									
Wales	>250m	1		0%							
Scotland	All	14	0%	0%	64%	100%	20-Apr	21-Apr	21-Apr	21-Apr	24-Apr
Scotland	<=450m	14		0%	64%						
Scotland	>450m	0									
Ring Ouzel											
GB	All	781	0%	1%	35%	62%	19-Apr	22-Apr	24-Apr	26-Apr	27-Apr
England	All	314	0%	1%	37%	61%	20-Apr	22-Apr	24-Apr	25-Apr	27-Apr
England	<=250m	18	0%								
England	>250m	296		1%			19-Apr	21-Apr	23-Apr	25-Apr	26-Apr
Wales	All	107	0%	1%	27%	53%	21-Apr	24-Apr	27-Apr	28-Apr	30-Apr
Wales	<=250m	3	0%								
Wales	>250m	104		1%			21-Apr	24-Apr	26-Apr	28-Apr	30-Apr
Scotland	All	360	0%	1%	37%	65%	19-Apr	22-Apr	24-Apr	26-Apr	27-Apr
Scotland	<=450m	252		1%	40%		18-Apr	21-Apr	23-Apr	25-Apr	26-Apr
Scotland	>450m	108			30%	65%	22-Apr	24-Apr	26-Apr	27-Apr	28-Apr
Ringed Plover											
GB	All	28	0%	4%	25%	54%	22-Apr	25-Apr	29-Apr	30-Apr	02-May
England	All	5	0%	20%	60%	60%	07-Apr	07-Apr	07-Apr	14-Apr	22-Apr
England	<=250m	2	0%								
England	>250m	3		0%							
Wales	All	0									
Wales	<=250m	0									
Wales	>250m	0									
Scotland	All	23	0%	0%	17%	52%	29-Apr	30-Apr	30-Apr	05-May	05-May
Scotland	<=450m	23		0%	17%		29-Apr	30-Apr	30-Apr	05-May	05-May
Scotland	>450m	0									
Short-eared Owl											
GB	All	19	0%	16%	37%	68%	05-Apr	08-Apr	11-Apr	16-Apr	23-Apr
England	All	10	0%	20%	40%	70%	08-Apr	09-Apr	11-Apr	17-Apr	23-Apr
England	<=250m	2	0%								
England	>250m	8		25%							
Wales	All	1	0%	100%	100%	100%	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr
Wales	<=250m	1	0%								
Wales	>250m	0									
Scotland	All	8	0%	0%	25%	63%	16-Apr	16-Apr	29-Apr	29-Apr	30-Apr
Scotland	<=450m	8		0%	25%						
Scotland	>450m	0									

Country	Altitude	N	% of clutches started by:				date by which X% have started laying				
		N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Skylark											
GB	All	55	0%	2%	27%	47%	23-Apr	25-Apr	26-Apr	29-Apr	30-Apr
England	All	17	0%	6%	59%	71%	15-Apr	23-Apr	24-Apr	25-Apr	26-Apr
England	<=250m	3	0%								
England	>250m	14		7%							
Wales	All	4	0%	0%	25%	25%	29-Apr	29-Apr	29-Apr	29-Apr	15-May
Wales	<=250m	0									
Wales	>250m	4		0%							
Scotland	All	34	0%	0%	12%	38%	25-Apr	30-Apr	03-May	08-May	11-May
Scotland	<=450m	34		0%	12%		25-Apr	30-Apr	03-May	08-May	11-May
Scotland	>450m	0									
Snipe											
GB	All	87	9%	31%	64%	78%	30-Mar	01-Apr	07-Apr	08-Apr	12-Apr
England	All	67	12%	39%	69%	81%	28-Mar	31-Mar	03-Apr	07-Apr	08-Apr
England	<=250m	11	9%								
England	>250m	56		39%			24-Mar	31-Mar	01-Apr	07-Apr	08-Apr
Wales	All	1	0%	0%	100%	100%	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr
Wales	<=250m										
Wales	>250m	1		0%							
Scotland	All	19	0%	5%	47%	68%	09-Apr	20-Apr	23-Apr	25-Apr	27-Apr
Scotland	<=450m	19		5%	47%						
Scotland	>450m	0									
Stonechat											
GB	All	170	6%	24%	41%	59%	30-Mar	03-Apr	08-Apr	11-Apr	18-Apr
England	All	97	9%	26%	39%	55%	25-Mar	02-Apr	03-Apr	08-Apr	15-Apr
England	<=250m	22	9%				31-Mar	03-Apr	08-Apr	14-Apr	15-Apr
England	>250m	75		25%			25-Mar	02-Apr	03-Apr	06-Apr	13-Apr
Wales	All	37	3%	19%	46%	68%	03-Apr	08-Apr	10-Apr	17-Apr	18-Apr
Wales	<=250m	0									
Wales	>250m	37		19%			03-Apr	08-Apr	10-Apr	17-Apr	18-Apr
Scotland	All	36	0%	25%	39%	64%	05-Apr	09-Apr	10-Apr	13-Apr	16-Apr
Scotland	<=450m	36		25%	39%		05-Apr	09-Apr	10-Apr	13-Apr	16-Apr
Scotland	>450m	0									
Twite											
GB	All	316	0%	0%	0%	14%	10-May	14-May	16-May	18-May	20-May
England	All	273	0%	0%	0%	12%	12-May	14-May	16-May	18-May	20-May
England	<=250m	10	0%								
England	>250m	263		0%			13-May	15-May	17-May	19-May	20-May
Wales	All	2	0%	0%	0%	100%	07-May	07-May	07-May	07-May	07-May
Wales	<=250m	1	0%								
Wales	>250m	1		0%							
Scotland	All	41	0%	0%	2%	24%	07-May	09-May	11-May	14-May	16-May
Scotland	<=450m	37		0%	3%		01-May	08-May	09-May	12-May	14-May
Scotland	>450m	4			0%	0%					

Country	Altitude	N	% of clutches started by: 31-Mar	15-Apr	30-Apr	15-May	date by which X% have started laying 5%	10%	15%	20%	25%
Wheatear											
GB	All	364	0%	0%	5%	57%	01-May	04-May	06-May	07-May	09-May
England	All	42	0%	0%	17%	74%	27-Apr	28-Apr	29-Apr	01-May	03-May
England	<=250m	12	0%								
England	>250m	30		0%			01-May	02-May	06-May	07-May	11-May
Wales	All	22	0%	5%	18%	68%	23-Apr	25-Apr	26-Apr	02-May	03-May
Wales	<=250m	1	0%								
Wales	>250m	21		5%			23-Apr	25-Apr	26-Apr	02-May	03-May
Scotland	All	300	0%	0%	2%	54%	03-May	05-May	07-May	09-May	11-May
Scotland	<=450m	285		0%	2%		03-May	05-May	07-May	09-May	11-May
Scotland	>450m	15			0%	40%					
Whinchat											
GB	All	518	0%	0%	0%	11%	13-May	15-May	17-May	18-May	20-May
England	All	114	0%	0%	0%	5%	15-May	17-May	18-May	20-May	21-May
England	<=250m	24	0%				17-May	19-May	19-May	20-May	22-May
England	>250m	90		0%			15-May	17-May	18-May	20-May	21-May
Wales	All	286	0%	0%	0%	17%	12-May	14-May	15-May	16-May	17-May
Wales	<=250m	18	0%								
Wales	>250m	268		0%			12-May	14-May	15-May	16-May	17-May
Scotland	All	118	0%	0%	0%	3%	17-May	20-May	21-May	22-May	24-May
Scotland	<=450m	116		0%	0%		17-May	20-May	21-May	22-May	24-May
Scotland	>450m	2			0%	0%					
Wren											
GB	All	177	0%	1%	14%	50%	25-Apr	27-Apr	01-May	03-May	04-May
England	All	83	0%	0%	8%	49%	28-Apr	02-May	03-May	05-May	06-May
England	<=250m	78	0%				27-Apr	01-May	03-May	05-May	06-May
England	>250m	5		0%							
Wales	All	62	0%	3%	15%	48%	22-Apr	27-Apr	01-May	03-May	03-May
Wales	<=250m	43	0%				27-Apr	01-May	03-May	04-May	08-May
Wales	>250m	19		11%							
Scotland	All	32	0%	0%	25%	53%	25-Apr	26-Apr	27-Apr	28-Apr	30-Apr
Scotland	<=450m	32		0%	25%		25-Apr	26-Apr	27-Apr	28-Apr	30-Apr
Scotland	>450m	0									

Table 3.3.2b The proportions of estimated first egg laying dates before key dates, derived from ringed pulli records. Results for Great Britain, England, Wales and Scotland by 31st March, 15th April, 30th April and 15th May (a) when ringing of pulli was assumed to be mid-way through the nestling period ("mid"); (b) for nidifugous species, ringing at age one day ("1 day"). For the same categories, the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests.

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Common Gull											
GB	Mid	10908	0%	0%	26%	74%	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr
Scotland	Mid	10908	0%	0%	26%	74%	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr
GB	1 day	10908	0%	0%	1%	31%	06-May	08-May	10-May	12-May	14-May
Scotland	1 day	10908	0%	0%	1%	31%	06-May	08-May	10-May	12-May	14-May
Common Sandpiper											
GB	Mid	319	0%	0%	4%	53%	30-Apr	02-May	04-May	06-May	07-May
England	Mid	35	0%	0%	0%	37%	02-May	08-May	10-May	11-May	12-May
Wales	Mid	2	0%	0%	0%	100%	10-May	10-May	10-May	10-May	10-May
Scotland	Mid	282	0%	0%	5%	54%	30-Apr	02-May	04-May	05-May	07-May
GB	1 day	319	0%	0%	0%	34%	06-May	08-May	10-May	12-May	13-May
England	1 day	35	0%	0%	0%	14%	08-May	14-May	16-May	16-May	18-May
Wales	1 day	2	0%	0%	0%	0%	16-May	16-May	16-May	16-May	16-May
Scotland	1 day	282	0%	0%	0%	37%	06-May	08-May	10-May	11-May	13-May
Curlew											
GB	Mid	1042	2%	24%	69%	92%	04-Apr	08-Apr	10-Apr	12-Apr	16-Apr
England	Mid	454	3%	28%	78%	96%	02-Apr	06-Apr	08-Apr	12-Apr	14-Apr
Wales	Mid	3	0%	67%	100%	100%	08-Apr	08-Apr	08-Apr	08-Apr	08-Apr
Scotland	Mid	585	1%	20%	62%	89%	08-Apr	10-Apr	12-Apr	14-Apr	16-Apr
GB	1 day	1042	0%	1%	22%	64%	21-Apr	25-Apr	27-Apr	29-Apr	02-May
England	1 day	454	0%	1%	26%	74%	19-Apr	22-Apr	25-Apr	28-Apr	30-Apr
Wales	1 day	3	0%	0%	67%	100%	25-Apr	25-Apr	25-Apr	25-Apr	25-Apr
Scotland	1 day	585	0%	1%	19%	57%	24-Apr	26-Apr	29-Apr	01-May	03-May
Dunlin											
GB	Mid	168	0%	0%	2%	68%	04-May	07-May	08-May	09-May	10-May
England	Mid	1	0%	0%	100%	100%	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr
Scotland	Mid	167	0%	0%	2%	68%	05-May	07-May	08-May	09-May	10-May
GB	1 day	168	0%	0%	0%	4%	15-May	18-May	19-May	20-May	21-May
England	1 day	1	0%	0%	0%	100%	10-May	10-May	10-May	10-May	10-May
Scotland	1 day	167	0%	0%	0%	4%	16-May	18-May	19-May	20-May	21-May
Golden Eagle											
GB	Mid	131	52%	94%	100%	100%	11-Mar	15-Mar	18-Mar	22-Mar	23-Mar
England	Mid	1	0%	100%	100%	100%	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Scotland	Mid	130	52%	94%	100%	100%	11-Mar	15-Mar	18-Mar	22-Mar	23-Mar

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Golden Plover											
GB	Mid	145	3%	41%	85%	94%	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr
England	Mid	108	2%	44%	92%	97%	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr
Scotland	Mid	37	5%	35%	65%	84%	30-Mar	06-Apr	06-Apr	08-Apr	11-Apr
GB	1 day	145	0%	6%	51%	85%	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr
England	1 day	108	0%	6%	54%	93%	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr
Scotland	1 day	37	0%	5%	43%	65%	12-Apr	19-Apr	19-Apr	21-Apr	24-Apr
Hen Harrier											
GB	Mid	680	0%	0%	11%	58%	24-Apr	29-Apr	01-May	03-May	05-May
England	Mid	41	0%	2%	54%	83%	17-Apr	19-Apr	21-Apr	22-Apr	23-Apr
Wales	Mid	77	0%	1%	3%	39%	02-May	03-May	07-May	09-May	12-May
Scotland	Mid	562	0%	0%	9%	59%	26-Apr	30-Apr	01-May	03-May	05-May
Lapwing											
GB	Mid	5345	24%	59%	87%	97%	19-Mar	23-Mar	27-Mar	31-Mar	02-Apr
England	Mid	1873	24%	59%	87%	97%	17-Mar	23-Mar	27-Mar	31-Mar	02-Apr
Wales	Mid	11	55%	91%	100%	100%	15-Mar	17-Mar	17-Mar	19-Mar	19-Mar
Scotland	Mid	3461	23%	60%	87%	97%	19-Mar	25-Mar	27-Mar	31-Mar	02-Apr
GB	1 day	5345	2%	22%	59%	86%	04-Apr	08-Apr	12-Apr	15-Apr	17-Apr
England	1 day	1873	4%	22%	59%	86%	02-Apr	08-Apr	11-Apr	15-Apr	17-Apr
Wales	1 day	11	9%	55%	91%	100%	31-Mar	02-Apr	02-Apr	03-Apr	03-Apr
Scotland	1 day	3461	2%	22%	60%	86%	04-Apr	09-Apr	12-Apr	15-Apr	17-Apr
Meadow Pipit											
GB	Mid	541	0%	1%	7%	60%	28-Apr	02-May	04-May	06-May	07-May
England	Mid	123	2%	2%	18%	67%	18-Apr	28-Apr	29-Apr	01-May	02-May
Wales	Mid	15	0%	0%	7%	67%	24-Apr	06-May	07-May	07-May	07-May
Scotland	Mid	403	0%	0%	4%	57%	01-May	04-May	06-May	08-May	09-May
Merlin											
GB	Mid	1180	0%	0%	9%	80%	27-Apr	30-Apr	02-May	03-May	04-May
England	Mid	530	0%	0%	12%	80%	27-Apr	29-Apr	30-Apr	02-May	03-May
Wales	Mid	84	0%	0%	10%	86%	26-Apr	01-May	02-May	04-May	04-May
Scotland	Mid	566	0%	0%	6%	80%	29-Apr	01-May	02-May	04-May	05-May
Oystercatcher											
GB	Mid	2080	0%	5%	37%	77%	16-Apr	19-Apr	22-Apr	24-Apr	26-Apr
England	Mid	73	0%	23%	73%	95%	06-Apr	12-Apr	13-Apr	15-Apr	17-Apr
Wales	Mid	2	0%	0%	0%	100%	04-May	04-May	04-May	04-May	04-May
Scotland	Mid	2005	0%	4%	36%	76%	16-Apr	20-Apr	22-Apr	25-Apr	26-Apr
GB	1 day	2080	0%	0%	4%	31%	02-May	06-May	08-May	10-May	12-May
England	1 day	73	0%	0%	19%	67%	22-Apr	28-Apr	30-Apr	02-May	04-May
Wales	1 day	2	0%	0%	0%	0%	20-May	20-May	20-May	20-May	20-May
Scotland	1 day	2005	0%	0%	3%	30%	02-May	06-May	08-May	12-May	12-May

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Peregrine											
GB	Mid	602	4%	54%	91%	98%	01-Apr	04-Apr	06-Apr	08-Apr	09-Apr
England	Mid	236	5%	53%	92%	99%	31-Mar	04-Apr	05-Apr	07-Apr	08-Apr
Wales	Mid	72	10%	60%	92%	99%	27-Mar	01-Apr	03-Apr	05-Apr	07-Apr
Scotland	Mid	294	2%	53%	91%	98%	02-Apr	05-Apr	08-Apr	08-Apr	09-Apr
Redshank											
GB	Mid	350	1%	16%	64%	94%	08-Apr	12-Apr	14-Apr	18-Apr	18-Apr
England	Mid	74	1%	18%	80%	99%	04-Apr	10-Apr	14-Apr	16-Apr	16-Apr
Wales	Mid	1	0%	0%	100%	100%	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr
Scotland	Mid	275	0%	15%	60%	92%	10-Apr	12-Apr	14-Apr	18-Apr	20-Apr
GB	1 day	350	0%	1%	20%	64%	22-Apr	26-Apr	28-Apr	02-May	02-May
England	1 day	74	1%	1%	30%	80%	18-Apr	24-Apr	28-Apr	30-Apr	30-Apr
Wales	1 day	1	0%	0%	0%	100%	12-May	12-May	12-May	12-May	12-May
Scotland	1 day	275	0%	0%	17%	60%	24-Apr	26-Apr	28-Apr	02-May	04-May
Ring Ouzel											
GB	Mid	531	0%	3%	41%	61%	17-Apr	21-Apr	23-Apr	24-Apr	26-Apr
England	Mid	109	0%	6%	44%	69%	15-Apr	18-Apr	20-Apr	23-Apr	25-Apr
Wales	Mid	3	0%	0%	67%	67%	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr
Scotland	Mid	419	0%	2%	40%	59%	18-Apr	21-Apr	24-Apr	24-Apr	26-Apr
Ringed Plover											
GB	Mid	329	0%	3%	26%	57%	17-Apr	22-Apr	26-Apr	28-Apr	30-Apr
England	Mid	9	11%	44%	89%	100%	24-Mar	24-Mar	04-Apr	04-Apr	06-Apr
Scotland	Mid	320	0%	2%	24%	56%	19-Apr	24-Apr	27-Apr	29-Apr	01-May
GB	1 day	329	0%	0%	7%	30%	28-Apr	04-May	08-May	10-May	12-May
England	1 day	9	0%	11%	44%	100%	04-Apr	04-Apr	16-Apr	16-Apr	18-Apr
Scotland	1 day	320	0%	0%	6%	28%	30-Apr	06-May	08-May	10-May	12-May
Short-eared Owl											
GB	Mid	124	11%	32%	57%	81%	27-Mar	30-Mar	02-Apr	04-Apr	09-Apr
England	Mid	46	11%	24%	52%	80%	09-Mar	28-Mar	03-Apr	05-Apr	15-Apr
Wales	Mid	2	0%	0%	100%	100%	18-Apr	18-Apr	18-Apr	18-Apr	18-Apr
Scotland	Mid	76	12%	38%	59%	82%	29-Mar	30-Mar	01-Apr	04-Apr	08-Apr
Skylark											
GB	Mid	116	0%	0%	4%	34%	02-May	05-May	07-May	10-May	11-May
England	Mid	17	0%	0%	18%	35%	28-Apr	28-Apr	29-Apr	04-May	10-May
Scotland	Mid	99	0%	0%	2%	33%	04-May	06-May	07-May	10-May	11-May

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Snipe											
GB	Mid	163	0%	9%	37%	63%	10-Apr	16-Apr	20-Apr	22-Apr	23-Apr
England	Mid	39	0%	15%	62%	85%	10-Apr	13-Apr	14-Apr	18-Apr	19-Apr
Scotland	Mid	124	0%	7%	30%	56%	10-Apr	18-Apr	22-Apr	24-Apr	27-Apr
GB	1 day	163	0%	2%	18%	49%	19-Apr	25-Apr	29-Apr	01-May	02-May
England	1 day	39	0%	3%	33%	74%	19-Apr	22-Apr	23-Apr	27-Apr	28-Apr
Scotland	1 day	124	0%	2%	14%	41%	19-Apr	27-Apr	01-May	03-May	06-May
Stonechat											
GB	Mid	296	7%	40%	66%	74%	31-Mar	03-Apr	06-Apr	07-Apr	10-Apr
England	Mid	207	4%	41%	70%	75%	02-Apr	04-Apr	07-Apr	09-Apr	10-Apr
Wales	Mid	14	0%	14%	36%	50%	02-Apr	05-Apr	19-Apr	19-Apr	24-Apr
Scotland	Mid	75	15%	44%	61%	75%	30-Mar	31-Mar	01-Apr	04-Apr	07-Apr
Twite											
GB	Mid	245	0%	0%	3%	41%	02-May	06-May	06-May	10-May	10-May
England	Mid	91	0%	0%	0%	52%	06-May	06-May	06-May	08-May	10-May
Scotland	Mid	154	0%	0%	5%	35%	30-Apr	04-May	06-May	10-May	12-May
Wheatear											
GB	Mid	526	0%	0%	9%	82%	30-Apr	02-May	02-May	04-May	04-May
England	Mid	248	0%	0%	16%	83%	28-Apr	30-Apr	30-Apr	02-May	02-May
Wales	Mid	47	0%	0%	4%	79%	02-May	04-May	04-May	04-May	06-May
Scotland	Mid	231	0%	0%	3%	81%	02-May	02-May	04-May	04-May	06-May
Whinchat											
GB	Mid	184	0%	0%	0%	8%	13-May	16-May	17-May	18-May	20-May
England	Mid	98	0%	0%	0%	7%	13-May	16-May	17-May	18-May	20-May
Wales	Mid	55	0%	0%	0%	7%	10-May	16-May	19-May	19-May	20-May
Scotland	Mid	31	0%	0%	0%	13%	09-May	15-May	16-May	17-May	17-May
Wren											
GB	Mid	38	0%	3%	16%	61%	21-Apr	27-Apr	29-Apr	02-May	03-May
England	Mid	12	0%	0%	25%	75%	27-Apr	27-Apr	27-Apr	29-Apr	29-Apr
Wales	Mid	10	0%	10%	30%	100%	11-Apr	21-Apr	21-Apr	22-Apr	22-Apr
Scotland	Mid	16	0%	0%	0%	25%	07-May	10-May	11-May	12-May	12-May

Table 3.3.3a Sample sizes and mean first egg laying dates from nest record cards for each country; comparisons of these means by overall analysis of variance and pairwise t-tests.

	England		Wales		Scotland		ANOVA		England - Scotland			Wales - Scotland			England - Wales		
	N	Mean	N	Mean	N	Mean	F Value	Prob F	Difference	t	Prob t	Difference	t	Prob t	Difference	t	Prob t
Common Sandpiper	40	21-May	6	12-May	51	18-May	2.64	0.0768	3.24	1.52	0.1319	-5.90	-1.36	0.1786	9.14	2.07	0.0413
Curlew	37	07-May	10	02-May	60	02-May	3.18	0.0455	5.33	2.47	0.0152	0.25	0.07	0.9436	5.08	1.38	0.1706
Dunlin	31	15-May	1	07-Jun	82	21-May	4.05	0.0201	-6.09	-2.41	0.0177	16.59	1.37	0.1721	-22.68	-1.86	0.0654
Golden Plover	98	28-Apr	8	01-May	27	30-Apr	0.16	0.8520	-2.16	-0.50	0.6160	0.19	0.02	0.9815	-2.35	-0.32	0.7475
Hen Harrier	16	25-Apr	17	18-May	85	11-May	14.92	<0.0001	-15.42	-4.52	<0.0001	7.65	2.30	0.0234	-23.07	-5.29	<0.0001
Lapwing	117	18-Apr	31	25-Apr	56	23-Apr	2.73	0.0679	-5.31	-1.75	0.0822	2.06	0.49	0.6226	-7.37	-1.95	0.0524
Meadow Pipit	147	15-May	93	13-May	148	17-May	1.53	0.2177	-1.08	-0.55	0.5805	-3.85	-1.73	0.0836	2.77	1.25	0.2135
Merlin	142	08-May	45	07-May	93	07-May	0.20	0.8185	0.84	0.62	0.5351	0.30	0.16	0.8693	0.54	0.31	0.7573
Oystercatcher	26	10-May	1	07-Jun	130	08-May	3.02	0.0515	2.15	0.79	0.4295	29.92	2.36	0.0198	-27.77	-2.15	0.0329
Peregrine	24	08-Apr	60	07-Apr	44	07-Apr	0.02	0.9786	0.37	0.13	0.8935	-0.17	-0.08	0.9353	0.54	0.21	0.8357
Redshank	28	25-Apr	1	20-Apr	14	28-Apr	0.73	0.4899	-3.21	-1.01	0.3176	-8.57	-0.85	0.3985	5.36	0.54	0.5905
Ring Ouzel	314	11-May	107	16-May	360	10-May	5.12	0.0062	0.94	0.71	0.4767	5.98	3.18	0.0015	-5.04	-2.64	0.0085
Ringed Plover	5	04-May	0	n/a	23	19-May	2.58	0.1200	-15.07	-1.61	0.1200	n/a			n/a		
Short-eared Owl	10	01-May	1	05-Apr	8	07-May	2.32	0.1307	-5.98	-0.86	0.4007	-32.88	-2.12	0.0496	26.90	1.76	0.0979
Skylark	17	07-May	4	27-May	34	20-May	4.11	0.0221	-13.21	-2.58	0.0126	6.69	0.74	0.4653	-19.90	-2.08	0.0424
Snipe	67	24-Apr	1	17-Apr	19	11-May	5.20	0.0074	-17.24	-3.18	0.0020	-24.32	-1.14	0.2587	7.07	0.34	0.7370
Stonechat	97	12-May	37	07-May	36	06-May	0.71	0.4908	5.75	1.04	0.3016	1.04	0.16	0.8758	4.71	0.86	0.3927
Twite	273	01-Jun	2	09-May	41	01-Jun	1.78	0.1709	-0.18	-0.06	0.9501	-23.68	-1.86	0.0641	23.50	1.88	0.0609
Wheatear	42	12-May	22	12-May	300	17-May	4.48	0.0120	-4.62	-2.45	0.0150	-4.93	-1.94	0.0527	0.30	0.10	0.9201
Whinchat	114	27-May	286	26-May	118	29-May	5.55	0.0041	-1.83	-1.15	0.2492	-3.60	-3.16	0.0017	1.77	1.66	0.0968
Wren	83	25-May	62	21-May	32	17-May	1.45	0.2372	7.89	1.62	0.1075	3.72	0.73	0.4661	4.16	1.06	0.2913

Table 3.3.3b Sample sizes and mean first egg laying dates from ringed pulli for each country; comparisons of these means by overall analysis of variance and pairwise t-tests.

	England		Wales		Scotland		ANOVA		England - Scotland			Wales - Scotland			England - Wales		
	N	Mean	N	Mean	N	Mean	F Value	Prob F	Difference	t	Prob t	Difference	t	Prob t	Difference	t	Prob t
Common Gull					10908	07-May											
Common Sandpiper	35	19-May	2	11-May	282	15-May	1.30	0.2749	-3.07	-1.48	0.1406	4.94	0.60	0.5493	-8.01	-0.95	0.3432
Curlew	454	21-Apr	3	14-Apr	585	27-Apr	22.53	<0.0001	5.50	6.56	<0.0001	13.31	1.72	0.0862	-7.81	-1.01	0.3140
Dunlin	1	29-Apr	0	n/a	167	14-May	4.32	0.0392	15.20	2.08	0.0392	n/a			n/a		
Golden Eagle	1	01-Apr	0	n/a	130	30-Mar	0.03	0.8739	-1.63	-0.16	0.8739	n/a			n/a		
Golden Plover	108	17-Apr	0	n/a	37	25-Apr	7.96	0.0055	7.31	2.82	0.0055	n/a			n/a		
Hen Harrier	41	03-May	77	20-May	562	13-May	26.08	<0.0001	9.86	5.18	<0.0001	-6.50	-4.55	<0.0001	16.37	7.19	<0.0001
Lapwing	1873	12-Apr	11	30-Mar	3461	12-Apr	3.87	0.0210	0.19	0.41	0.6796	13.29	2.76	0.0058	-13.10	-2.72	0.0066
Meadow Pipit	123	12-May	15	19-May	403	19-May	8.67	0.0002	7.30	4.16	<0.0001	0.77	0.17	0.8633	6.53	1.40	0.1619
Merlin	530	09-May	84	09-May	566	10-May	2.25	0.1054	1.03	2.12	0.0339	0.48	0.51	0.6067	0.55	0.58	0.5619
Oystercatcher	73	25-Apr	2	05-May	2005	06-May	22.02	<0.0001	10.35	6.64	<0.0001	1.07	0.12	0.9076	9.27	0.99	0.3230
Peregrine	236	15-Apr	72	13-Apr	294	16-Apr	2.08	0.1252	0.83	0.95	0.3449	2.65	2.01	0.0450	-1.82	-1.35	0.1781
Redshank	74	22-Apr	1	28-Apr	275	27-Apr	4.84	0.0085	4.69	3.11	0.0020	-0.53	-0.05	0.9633	5.22	0.45	0.6530
Ring Ouzel	109	07-May	3	12-May	419	11-May	2.69	0.0691	4.55	2.32	0.0210	-0.20	-0.02	0.9853	4.74	0.44	0.6574
Ringed Plover	9	15-Apr	0	n/a	320	15-May	23.99	<0.0001	30.41	4.90	<0.0001	n/a			n/a		
Short-eared Owl	46	26-Apr	2	22-Apr	76	26-Apr	0.04	0.9641	-0.21	-0.05	0.9607	4.18	0.26	0.7954	-4.39	-0.27	0.7872
Skylark	17	20-May	0	n/a	99	27-May	2.19	0.1419	7.61	1.48	0.1419	n/a			n/a		
Snipe	39	29-Apr	0	n/a	124	14-May	14.67	0.0002	15.29	3.83	<0.0001	n/a			n/a		
Stonechat	207	28-Apr	14	19-May	75	25-Apr	4.84	0.0086	-3.02	-0.85	0.3946	-23.74	-3.10	0.0021	20.72	2.86	0.0046
Twite	91	20-May	0		154	01-Jun	17.02	<0.0001	11.55	4.13	<0.0001	n/a			n/a		
Wheatear	248	08-May	47	10-May	231	11-May	4.45	0.0121	2.49	2.96	0.0032	0.81	0.55	0.5814	1.68	1.15	0.2513
Whinchat	98	25-May	55	30-May	31	27-May	4.17	0.0170	1.78	0.77	0.4415	-3.66	-1.46	0.1468	5.44	2.89	0.0044
Wren	12	17-May	10	30-Apr	16	29-May	6.06	0.0055	12.31	1.56	0.1271	28.91	3.48	0.0014	-16.60	-1.88	0.0686

Table 3.3.4a Results of the multiple linear regression for nest record card data of first egg laying date with altitude, easting, northing and year for species which showed a significant effect with one or more of the predictors. Linear and quadratic terms were used, hence altm1 = altitude, altm2 = altitude * altitude, etc. All predictors are centred around their overall mean values. Note the following showed no significant effect of any of the predictors on first egg laying date; Merlin, Oystercatcher, Short-eared Owl, Twite and Wren; sample size was very low for Redshank, Ringed Plover and Short-eared Owl (shown in italics).

Species name	R-square	Adjusted R-square	F value	DF model	DF error	Prob F	Variable	Estimate	Std err	t	Prob t
Common Sandpiper	0.0709	0.0509	3.55	2	93	0.0327	Intercept	138.8750	1.06729	130.12	
							east1	0.02208	0.01375	1.61	0.1117
							year1	0.22947	0.13402	1.71	0.0902
Curlew	0.1310	0.1119	6.86	2	91	0.0017	Intercept	119.6381	1.328275	90.07	
							east2	0.000446	0.000223	2.00	0.0489
							year2	0.076187	0.025123	3.03	0.0032
Dunlin	0.4021	0.3487	7.53	5	56	<0.0001	Intercept	133.57028	3.17275	42.10	
							east1	-0.12019	0.02721	-4.42	<0.0001
							north1	-0.04301	0.01500	-2.87	0.0058
							east2	-0.000441	0.0001143	-3.85	0.0003
							north2	0.0001398	0.00003489	4.01	0.0002
							year2	0.12231	0.03171	3.86	0.0003
Golden Plover	0.1201	0.0976	5.32	2	78	0.0068	Intercept	111.7638	3.270099	34.18	
							year1	-0.78292	0.296096	-2.64	0.0099
							altm2	0.000155	7.49E-05	2.08	0.0411
Hen Harrier	0.2630	0.2314	8.33	3	70	<0.0001	Intercept	130.4623	2.397112	54.42	
							east1	-0.08411	0.02844	-2.96	0.0042
							north1	0.011818	0.006076	1.94	0.0558
							year1	-1.06792	0.292022	-3.66	0.0005
Lapwing	0.1050	0.0870	5.84	4	199	0.0002	Intercept	115.3921	2.105123	54.81	
							east1	-0.07063	0.020194	-3.50	0.0006
							year1	-1.13761	0.286181	-3.98	<0.0001
							east2	-0.00049	0.000128	-3.84	0.0002
							year2	0.073214	0.045953	1.59	0.1127

Species name	R-square	Adjusted R-square	F value	DF model	DF error	Prob F	Variable	Estimate	Std err	t	Prob t
Meadow Pipit	0.0293	0.0243	5.81	2	385	0.0033	Intercept	138.9859	1.313545	105.81	
							year1	-0.25727	0.118374	-2.17	0.0304
							year2	-0.04263	0.01598	-2.67	0.0080
Merlin	0	0		0	177		Intercept	127.8708	0.723196	176.81	
Oystercatcher	0	0		0	152		Intercept	128.7255	1.045336	123.14	
Peregrine	0.1164	0.1022	8.23	2	125	0.0004	Intercept	94.86656	1.157175	81.98	
							altm1	0.027715	0.008434	3.29	0.0013
							east2	0.000893	0.000254	3.52	0.0006
Redshank	*0.0909*	*0.0642*	*3.40*	*1*	*34*	*0.0739*	*Intercept*	*115.0303*	*1.530162*	*75.18*	
							north1	*0.019386*	*0.010514*	*1.84*	*0.0739*
Ring Ouzel	0.0575	0.0502	7.85	6	772	<0.0001	Intercept	132.8198	1.379932	96.25	
							altm1	-0.01592	0.00934	-1.70	0.0887
							east1	-0.0634	0.017986	-3.53	0.0004
							north1	-0.01301	0.003957	-3.29	0.0011
							year1	-0.13957	0.076597	-1.82	0.0688
							altm2	0.000123	3.8E-05	3.24	0.0013
							north2	-7E-05	2E-05	-3.51	0.0005
Ringed Plover	*0.1189*	*0.0822*	*3.24*	*1*	*24*	*0.0845*	*Intercept*	*140.2691*	*3.958623*	*35.43*	
							east2	*-0.0003*	*0.000165*	*-1.80*	*0.0845*
Short-eared Owl	*0*	*0*		*0*	*11*		*Intercept*	*120.0833*	*4.347515*	*27.62*	
Skylark	0.3480	0.2948	6.54	4	49	0.0003	Intercept	127.6567	3.682982	34.66	
							altm1	0.098983	0.026315	3.76	0.0005
							altm2	0.000203	0.000109	1.85	0.0700
							east2	0.000342	0.000154	2.22	0.0314
							north2	8.03E-05	2.57E-05	3.12	0.0030
Snipe	0.2073	0.1959	18.30	1	70	<0.0001	Intercept	112.3004	2.428044	46.25	
							north2	0.000136	3.18E-05	4.28	<0.0001
Stonechat	0.0573	0.0402	3.36	3	166	0.0202	Intercept	142.3413	4.719018	30.16	
							altm2	-0.00013	8.14E-05	-1.64	0.1036
							north2	-6.2E-05	3.97E-05	-1.55	0.1237

Species name	R-square	Adjusted R-square	F value	DF model	DF error	Prob F	Variable	Estimate	Std err	t	Prob t
							year2	-0.07182	0.034281	-2.10	0.0377
Twite	0	0		0	55		Intercept	151.375	2.642751	57.28	
Wheatear	0.1050	0.0950	10.53	4	359	<0.0001	Intercept	133.4002	0.891962	149.56	
							altm1	0.037197	0.007092	5.24	<0.0001
							north1	0.012585	0.004384	2.87	0.0043
							year1	-0.22365	0.091507	-2.44	0.0150
							east2	0.002199	0.000698	3.15	0.0018
Whinchat	0.0191	0.0172	10.06	1	516	0.0016	Intercept	148.9199	0.799074	186.37	
							north2	-2.8E-05	8.85E-06	-3.17	0.0016
Wren	0	0		0	176		Intercept	142.9718	1.765249	80.99	

Table 3.3.4b Results of the multiple linear regression for ringed pulli data of first egg laying date with easting, northing and year for species which showed a significant effect with one or more of the predictors. Linear and quadratic terms were used, hence east1 = easting, east2 = easting * easting, etc. All predictors are centred around their overall mean values. Note the following showed no significant effect of any of the predictors on first egg laying date: Short-eared Owl, and Whinchat; sample size was very low for Wren (shown in italics).

Species name	R-square	Adjusted R-square	DF model	DF error	F value	Prob F	Variable	Estimate	Std err	t	Prob t
Common Gull	0.0470	0.0465	6	10875	89.49	5.2E-110	Intercept	124.7383	0.205902	605.81	
							east1	-0.00898	0.002761	-3.25	0.0011
							north1	-0.00492	0.001281	-3.84	0.0001
							year1	0.153982	0.020557	7.49	<0.0001
							east2	4.52E-05	1.59E-05	2.85	0.0044
							north2	7.28E-05	6.52E-06	11.17	<0.0001
							year2	0.014464	0.001082	13.37	<0.0001
Common Sandpiper	0.0294	0.0232	2	312	4.73	0.0095	Intercept	134.2307	0.984477	136.35	
							north1	-0.0081	0.004894	-1.66	0.0988
							east2	0.000209	7.16E-05	2.92	0.0038
Curlew	0.1501	0.1457	5	978	34.54	1.41E-32	Intercept	111.6695	0.705257	158.34	
							east1	0.056659	0.013613	4.16	<0.0001
							north1	0.021296	0.001815	11.73	<0.0001
							year1	-0.07413	0.032691	-2.27	0.0236
							east2	-0.00033	8.15E-05	-4.01	0.0001
							north2	4.84E-05	1.12E-05	4.32	<0.0001
Dunlin	0.2375	0.2234	3	163	16.92	1.29E-09	Intercept	116.7867	3.505558	33.31	
							east1	-0.07461	0.023852	-3.13	0.0021
							north1	0.103636	0.020836	4.97	<0.0001
							east2	-0.0002	7.81E-05	-2.59	0.0104

Species name	R-square	Adjusted R-square	DF model	DF error	F value	Prob F	Variable	Estimate	Std err	t	Prob t
Golden Eagle	0.2723	0.2371	6	124	7.73	4.48E-07	Intercept	97.20776	1.615797	57.99	
							east1	0.063557	0.025261	2.52	0.0131
							north1	-0.02315	0.010105	-2.29	0.0237
							year1	-0.30577	0.140863	-2.17	0.0319
							east2	0.000224	0.00012	1.87	0.0642
							north2	-0.00036	6.83E-05	-5.22	<0.0001
							year2	-0.01509	0.005664	-2.66	0.0087
Golden Plover	0.0989	0.0859	2	139	7.62	0.0007	Intercept	111.2114	2.176945	51.09	
							north1	0.021503	0.005784	3.72	0.0003
							east2	0.000153	9.21E-05	1.66	0.0983
Hen Harrier	0.1254	0.1188	5	661	18.95	1.23E-17	Intercept	129.1424	0.841875	143.90	
							east1	-0.0561	0.013748	-4.08	0.0001
							north1	0.019712	0.003164	6.23	<0.0001
							year1	-0.06693	0.031023	-2.16	0.0313
							east2	-0.00038	8.93E-05	-4.30	<0.0001
							north2	8.53E-05	1.11E-05	7.67	<0.0001
Lapwing	0.0190	0.0180	5	4972	19.29	4.6E-19	Intercept	100.9001	0.36541	276.13	
							east1	0.02679	0.003956	6.77	<0.0001
							north1	0.006473	0.001378	4.70	<0.0001
							east2	0.000147	2.11E-05	7.00	<0.0001
							north2	-1.8E-05	7.29E-06	-2.44	0.0149
							year2	0.003545	0.000545	6.50	<0.0001
Meadow Pipit	0.0694	0.0624	4	532	9.92	9.49E-08	Intercept	135.5293	1.285566	105.42	
							east1	-0.02843	0.00949	-3.00	0.0029
							north1	0.004637	0.003166	1.46	0.1436
							year1	0.294507	0.140312	2.10	0.0363
							year2	0.023635	0.005248	4.50	<0.0001

Species name	R-square	Adjusted R-square	DF model	DF error	F value	Prob F	Variable	Estimate	Std err	t	Prob t
Merlin	0.0516	0.0482	4	1135	15.42	2.72E-12	Intercept	128.6419	0.364993	346.97	
							east1	0.009858	0.004091	2.41	0.0161
							north1	0.006764	0.001099	6.15	<0.0001
							year1	-0.04175	0.023758	-1.76	0.0792
							north2	0.0000	0.0000	3.36	0.0008
Oystercatcher	0.1162	0.1137	6	2064	45.25	3.01E-52	Intercept	120.4037	0.519904	231.59	
							east1	-0.03049	0.007386	-4.13	<0.0001
							north1	0.020768	0.00192	10.82	<0.0001
							year1	0.208632	0.043635	4.78	<0.0001
							east2	-7.6E-05	3.54E-05	-2.15	0.0319
							north2	7.73E-05	1.41E-05	5.47	<0.0001
							year2	0.005236	0.001518	3.45	0.0006
Peregrine	0.0198	0.0165	2	590	5.97	0.0027	Intercept	105.7186	0.613137	170.38	
							north1	0.005495	0.002148	2.56	0.0108
							year1	-0.08697	0.039629	-2.19	0.0286
Redshank	*0.0488*	*0.0432*	*2*	*341*	*8.75*	*0.0002*	*Intercept*	*115.3417*	*0.808753*	*142.62*	
							north1	*0.014086*	*0.003406*	*4.14*	*<0.0001*
							north2	*3.16E-05*	*1.47E-05*	*2.15*	*0.0323*
Ring Ouzel	0.0503	0.0430	4	522	6.91	1.99E-05	Intercept	137.643	1.616197	85.16	
							east1	-0.12806	0.036578	-3.50	0.0005
							year1	-0.35538	0.180208	-1.97	0.0491
							east2	0.000496	0.000278	1.79	0.0746
							year2	-0.01887	0.006695	-2.82	0.0050
Ringed Plover	0.2442	0.2299	6	317	17.07	4.23E-17	Intercept	122.6357	2.384261	51.44	
							east1	-0.19914	0.029081	-6.85	<0.0001
							north1	0.060483	0.007626	7.93	<0.0001
							year1	0.444477	0.17471	2.54	0.0114
							east2	-0.00085	0.000133	-6.40	<0.0001
							north2	0.000255	5.6E-05	4.55	<0.0001
							year2	0.016839	0.008319	2.02	0.0438

Species name	R-square	Adjusted R-square	DF model	DF error	F value	Prob F	Variable	Estimate	Std err	t	Prob t
Short-eared Owl	0.0000	0.0000	0	118			Intercept	116.5756	2.024637	50.17	
Skylark	0.0962	0.0802	2	113	6.01	0.0033	Intercept	138.6827	2.869797	48.32	
							east1	0.067142	0.025335	2.65	0.0092
							east2	0.000534	0.000155	3.44	0.0008
Snipe	0.2389	0.2213	3	130	13.60	9.04E-08	Intercept	125.1374	3.130519	39.97	
							east1	-0.03344	0.022118	-1.51	0.1330
							north1	0.042066	0.007783	5.40	<0.0001
							north2	0.000144	5.41E-05	2.67	0.0087
Stonechat	0.0463	0.0364	3	291	4.71	0.0032	Intercept	111.2899	3.192076	34.86	
							east1	-0.08731	0.036193	-2.41	0.0165
							north2	4.78E-05	1.47E-05	3.25	0.0013
							year2	-0.01217	0.007802	-1.56	0.1199
Twite	0.0815	0.0739	2	242	10.73	3.43E-05	Intercept	139.5943	2.532794	55.11	
							year1	-0.32105	0.162525	-1.98	0.0494
							east2	0.000305	6.64E-05	4.59	<0.0001
Wheatear	0.1275	0.1191	5	514	15.03	8.75E-14	Intercept	129.0886	0.745217	173.22	
							east1	0.026006	0.00702	3.70	0.0002
							north1	0.015497	0.002851	5.43	<0.0001
							year1	-0.17898	0.040541	-4.41	<0.0001
							east2	0.000102	5.15E-05	1.98	0.0483
							north2	2.42E-05	7.4E-06	3.28	0.0011
Whinchat	0.0000	0.0000	0	179			Intercept	146.7833	0.841059	174.52	
Wren	*0.3961*	*0.3606*	*2*	*34*	*11.15*	*0.0002*	*Intercept*	*162.7948*	*6.448936*	*25.24*	
							year1	*-1.41242*	*0.652683*	*-2.16*	*0.0376*
							north2	*-0.00014*	*3.16E-05*	*-4.57*	*0.0001*

Table 3.3.5 Summary of multiple regression analyses for BTO NRC and ringed pulli datasets. Significance and direction of the regression coefficients for the predictor variables.

Species name	Dataset	year1	year2	east1	east2	north1	north2	altm1	altm2
Common Gull	Pulli	***	***	-**	**	-***	***		
Common Sandpiper	NRCs	ns		ns					
Common Sandpiper	Pulli				**	-ns			
Curlew	NRCs		**		*				
Curlew	Pulli	-*		***	-***	***	***		
Dunlin	NRCs		***	-***	-***	-**	***		
Dunlin	Pulli			-**	-*	***			
Golden Eagle	Pulli	-*	-**	*	ns	-*	-***		
Golden Plover	NRCs	-**							*
Golden Plover	Pulli				ns	***			
Hen Harrier	NRCs	-***		-**		ns			
Hen Harrier	Pulli	-*		-***	-***	***	***		
Lapwing	NRCs	-***	ns	-***	-***				
Lapwing	Pulli		***	***	***	***	-*		
Meadow Pipit	NRCs	-*	-**						
Meadow Pipit	Pulli	*	***	-**		ns			
Merlin	Pulli	-ns		*		***	***		
Oystercatcher	Pulli	***	***	-***	-*	***	***		
Peregrine	NRCs				***			**	
Peregrine	Pulli	-*				*			
Redshank	*NRCs*					*ns*			
Redshank	*Pulli*					***	*		
Ring Ouzel	NRCs	-ns		-***		-**	-***	-ns	**
Ring Ouzel	Pulli	-*	-**	-***	ns				
Ringed Plover	*NRCs*				*-ns*				
Ringed Plover	Pulli	*	*	-***	-***	***	***		
Skylark	NRCs				*		**	***	ns
Skylark	Pulli			**	***				
Snipe	NRCs						***		
Snipe	Pulli			ns		***	**		
Stonechat	NRCs		-*				-ns		-ns
Stonechat	Pulli		-ns	-*			**		
Twite	Pulli	-*			***				
Wheatear	NRCs	-*			**	**		***	
Wheatear	Pulli	-***		***	*	***	**		
Whinchat	NRCs						-**		
Wren	*Pulli*	-*					-***		

Table 3.4 Timing of return to breeding grounds and pre-nesting behaviour. Species names in bold are listed on Annex I of the EU Birds Directive (European Commission, 1979).

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
		Key to symbols: ? Unknown; ↑ increasing during period; √ present								
Black Grouse	Mainly resident								Mainly resident, even sedentary	Cramp *et al.* (1977-1994)
Common Gull		?	?	?	?	?	?	?	Passage begins mid-February but chief spring movements of adults in March (might not be British breeders)	Cramp *et al.* (1977-1994)
Common Sandpiper									The breeding season in Britain begins with establishment of territories in the last week of April.	Wernham *et al.* (2002)
Common Sandpiper	Late April							√	In temperate Europe, breeding grounds re-occupied in second half April.	Cramp *et al.* (1977-1994)
Common Sandpiper									The weather generally determines the dates on which sandpipers return to their breeding grounds. "In 1975 we watched pairs copulate on 4&5 May; but in 1976 we only located a single bird on 1 May and did not hear one singing until the 5th. Pairs were calling noisily on 30 April 1977. After the cold and wet April of 1979 no sandpipers had arrived by 5 May. However birds returned early after the dry April of 1980; we saw a small trip of three - possibly males - on 3 May. On 4th May the males were in full song and song-dancing over the river."	Nethersole Thompson (1986)
Common Sandpiper									More southerly breeding areas are reoccupied from mid-April but not until mid-May, or even June, by Northern Scandinavian and Russian birds.	Colston & Burton (1988)
Common Snipe									Males return up to a fortnight ahead of females	Nethersole Thompson (1986)
Common Snipe					begin	?	?	?	Return during late March and April to reach breeding grounds in May	Wernham *et al.* (2002)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Curlew		many	√	√	√	√	√	√	Returning migrants may reappear inland as early as late January, and many southern breeding sites are reoccupied during February	Wernham *et al.* (2002)
Curlew	Mid February - early March								On the moor, where territories were about 300-400m asl, single curlews sometimes arrived in mid-February, but the trips, possibly consisting largely of males, usually returned in the last week in February or in early March	Nethersole Thompson (1986)
Curlew	February -March								Curlew often come and go from the uplands according to vagaries of the weather during February and March. Heavy snow or hard frost will send them down to the upper farms, or even back to the low country beyond, there to reform flocks	Ratcliffe (1990)
Dunlin	Mid-April						√	√	As Dunlin breed at a wide range of latitudes, the first birds may arrive on their British & Irish breeding in April	Wernham *et al.* (2002)
Dunlin									British and continental *schinzii* arrive on their breeding grounds from early to mid April.	Colston & Burton (1988)
Dunlin									British and Continental *schinzii* are on their breeding grounds rather earlier than Icelandic birds; Britain mid April	Cramp *et al.* (1977-1994)
Golden Eagle	Resident	√	√	√	√	√	√	√	Adult pairs resident all year	Cramp *et al.* (1977-1994)
Golden Plover	Some birds wintering nearby may visit them throughout the winter	most	√	√	√	√	√	√	If weather is not too severe	Cramp *et al.* (1977-1994)
Golden Plover	Late February									Wernham *et al.* (2002)
Golden Plover	Mid February or even earlier								A big snowstorm in late February or March upsets the rhythm of courtship and territory establishment. All the birds re-assemble in packs and retire to the valley until sun and thaw enable courtship again to proceed.	Nethersole Thompson (1986)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Golden Plover									Often come and go from the uplands according to vagaries of the weather during February and March. Heavy snow or hard frost will send them down to the upper farms, or even back to the low country beyond, there to reform flocks	Ratcliffe (1990)
Golden Plover	Mid February								Although timing is greatly affected by weather conditions	Thom (1986)
Greenshank	Males return in mid to late March, females returning roughly a week after males				√	√	√	√		Des Thompson (SNH) *pers. comm.*
Hen Harrier	Late March	some	some	some	√	√	√	√	Breeding areas of west and central Europe re-occupied by late March. Males arrive c.3 weeks before female but pairs may also be first seen over breeding territories together	Cramp *et al.* (1977-1994)
Hen Harrier	From February								In Scotland Males visiting breeding areas increasingly on fine days in February & March. About mid March a pair may be seen together.	Watson (1977)
Lapwing	March - April	?	↑	↑	↑	√	√	√	Breeding grounds reoccupied March - April, averaging later in north and east	Cramp *et al.* (1977-1994)
Lapwing									A few males are usually the first to appear; on isolated territories they may come back fully a week before the earliest mixed sexes.	Nethersole Thompson (1986)
Lapwing	From mid February								Lapwing often come and go from the uplands according to vagaries of the weather during February and March. Heavy snow or hard frost will send them down to the upper farms, or even back to the low country beyond, there to reform flocks	Ratcliffe (1990)
Lapwing									May be back on territory in February	Galbraith (1989) in Wernham *et al.* (2002)
Meadow Pipit	Second half of March				√	√	√	√	In Snowdonia	Walton 1979 in Cramp *et al.* (1977-1994)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Meadow Pipit									Spring migration occurs from late February to mid-May, in Europe generally mainly March and April	Alstrom & Mild (2003)
Meadow Pipit									Since conditions in winter moors and hills can be sever these are largely deserted by Meadow Pipit. Small parties of birds can be found in a number of lowland sites and these may include areas along the coast similar to those on which the birds have bred.	Simms (1992)
Meadow Pipit	Late March								When adults return to their mountain breeding grounds in Snowdonia in late March they fed mainly on the larvae of a moth. The start of the breeding season is affected by the temperature in late March and becomes later with increasing altitude and latitude	Simms (1992)
Merlin	Late April							√		Cramp *et al.* (1977-1994)
Merlin									Males arrive on breeding grounds before females	Ratcliffe (1990)
Oystercatcher	Late January to April	?	↑	↑	↑	√	√	√		Cramp *et al.* (1977-1994)
Peregrine	Mid or late February	?	√	√	√	√	√	√	Or later in the North	Cramp *et al.* (1977-1994)
Peregrine	Largely resident								Many established breeders are virtually sedentary.	Wernham *et al.* (2002)
Peregrine	March and April								Migrants head back to their place of origin during March and April	Ratcliffe (1993)
Red Grouse	Almost entirely sedentary	√	√	√	√	√	√	√	Males sedentary and female mostly so	Cramp *et al.* (1977-1994)
Red Grouse									In heavy snow and prolonged frost will often congregate on the moorland edge	Ratcliffe (1990)
Redshank	March and April		↑	↑	↑	↑	↑	↑		Wernham *et al.* (2002)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Redshank									Males normally arrived first but also known to turn up in pairs and small trips together	Nethersole Thompson (1986)
Ring Ouzel	Late March			↑	√	√	√	√		Wernham *et al.* (2002)
Ring Ouzel									Arrival in England begins from second week of March	Cramp *et al.* (1977-1994)
Ringed Plover	February -May, mainly March - April	?	↑	↑	↑	↑	↑	↑		Cramp *et al.* (1977-1994)
Ringed Plover	February									Wernham *et al.* (2002)
Ringed Plover									Usually return singly, but occasionally in pairs	Nethersole Thompson (1986)
Short-eared Owl		?	?	?	?	?	?	?	In winter move to coastal marshes and dunes, farmland and downland.	Lack (1986)
Short-eared owl									Migratory, only tied to one area by their nest when they are nesting	Mikkola (1983)
Skylark	Largely resident	?	?	?	?	?	?	?	In the UK, breeding populations appear to be largely resident, although at least part of the population of the Northern Isles migrates to Southern England. Many upland habitats become abandoned and there is evidence of a movement in many regions to warmer coastal areas. Movement is related to weather patterns	Donald (2004)
Stonechat	February - April	√	√	√	√	√	√	√	The return movements of birds to their breeding territories that have wintered within the UK commences very early, often from February onwards. Immigrants that have wintered outside of the UK also arrive comparatively early from late February onwards, reaching a peak in March and continuing on into April, with stragglers into May. Many birds even in the northern most limits of their breeding range have returned by March.	Urquhart (2002)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Stonechat	Resident at lower altitudes								In the UK a large proportion of the population remains to winter, often with others from northern parts of the range. Moving South or westwards towards more temperate coastal areas. Many inland breeding areas are vacated during winter and some winter territories are often in areas where no breeding occurs, whilst other territories that have been vacated by breeding birds are occupied by different wintering birds	Urquhart (2002)
Twite	March, some birds resident			√	√	√	√	√	Some birds remain in vicinity of breeding grounds year-round. Those which winter elsewhere can return any time and birds will certainly be in their breeding area in March. We rarely find Twite on the open moor – i.e. the area subject to burning - much before nest building and egg laying. At a wild guess, these would be unlikely more than two weeks prior to first egg date	Andy Brown (EN), *pers. comm.*
Twite									Has a spread out breeding season, with birds still returning to their nesting grounds during June, though many pairs have eggs in May	Ratcliffe (1990)
Twite	March - early April								Start returning in numbers to their south Pennines breeding grounds towards the end of this month - a few may return at the beginning of March, but the majority start coming in from late March to early April. They start breeding at the end of April.	Andre Raine (PhD researcher), *pers. comm.*
Wheatear	March		↑	↑	√	√	√	√	They are usually the first migrant to return to British & Irish shores in March, thus heralding the start of spring. Males migrate on average a week or two before females.	Wernham *et al.* (2002)
Wheatear									The first arrivals to the British & Irish Shores are in early March on the south coast (exceptionally late February) and the first returns to the Northern Isles are at the end of March.	Wernham *et al.* (2002)

Species	Month birds return to upland breeding grounds	Present on breeding grounds in: late Feb.	early March	mid March	late March	early April	mid April	late April	Notes	Reference
Wheatear									Often the first passerine to reach Britain where sometimes recorded early March (exceptionally late February) but more usually from mid-march with peak in early April. Usually c1-2 weeks later in north than the south, arrival peaks variable, usually related to calm anticyclonic weather with clear nights in Iberia & France. Males arrive on breeding grounds before females.	Cramp *et al.* (1977-1994)
Whinchat	Late April - early May						↑	↑	Whinchats start arriving in Britain & Ireland in Mid- or late April. Arrivals on the breeding grounds in Ayrshire were generally between 25 April and 10 May, with males preceding females by three to eight days.	Gray 1974 in Wernham *et al.* (2002)
Whinchat									Return passage begins February - March continuing into early May	Cramp *et al.* (1977-1994)
Wren	Mostly sedentary, migratory birds return end of April	√	√	√	√	√	√	√		Wernham *et al.* (2002)

Key to symbols: ? Unknown; ↑ increasing during period; √ present

Table 3.5 Summary of results of seasonal trends in breeding performance. A dash (-) indicates that there were insufficient data for that variable ($n < 50$). *L* and *Q* indicate a significant linear or quadratic trend respectively, *neg* and *pos* indicate negative or positive trends respectively, ∩ indicates a significant positive linear coefficient and a significant negative quadratic coefficient, *NS* indicates a non-significant trend.

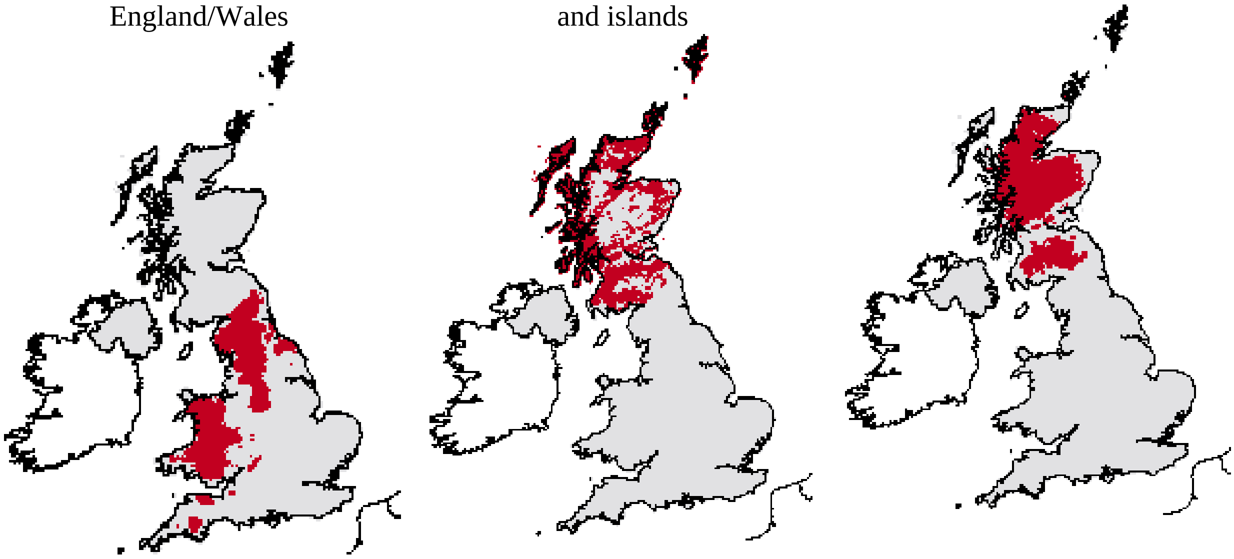
Species	Clutch Size	Brood Size	Hatching Success	Egg Stage Failure Rates	Chick Stage Failure Rates
Curlew	NS	-	-	NS	-
Golden Plover	NS	L neg	-	Q neg	-
Hen Harrier	L neg	NS	-	NS	NS
Lapwing	NS	-	-	NS	-
Meadow Pipit	NS	NS	NS	Q neg	NS
Oystercatcher	L neg	-	-	NS	-
Peregrine	L neg	NS	NS	NS	NS
Ring Ouzel	Q neg	Q neg	NS	NS	NS
Skylark	-	-	-	NS	-
Snipe	NS	-	-	NS	-
Stonechat	∩	∩	NS	-	-
Twite	∩	∩	NS	NS	NS
Wheatear	Q neg	Q neg	NS	L pos	L pos
Whinchat	Q neg	Q neg	NS	NS	NS

Figure 2.2.1 The three separate upland zones in the UK which form part of the six Environmental Zones in the UK.

1. Easterly lowlands (England/ Wales)
2. Westerly lowlands (England/ Wales)
3. Uplands (England/ Wales)
4. Lowlands (Scotland)
5. Intermediate uplands and islands (Scotland)
6. True uplands (Scotland)

(coverage of each zone is indicated by the darker shading on the map)

(i) Zone 3: Uplands England/Wales | **(ii)** Zone 5: Intermediate upland and islands | **(iii)** Zone 6: True uplands



Source: http://www.defra.gov.uk/wildlife-countryside/cs2000/01/04.htm

Figure 3.1.1a The hatch date (May 1st = 1) of Red Grouse between 1992 and 2003. The data plotted are the raw values and the relationship is a simple line of best fit.

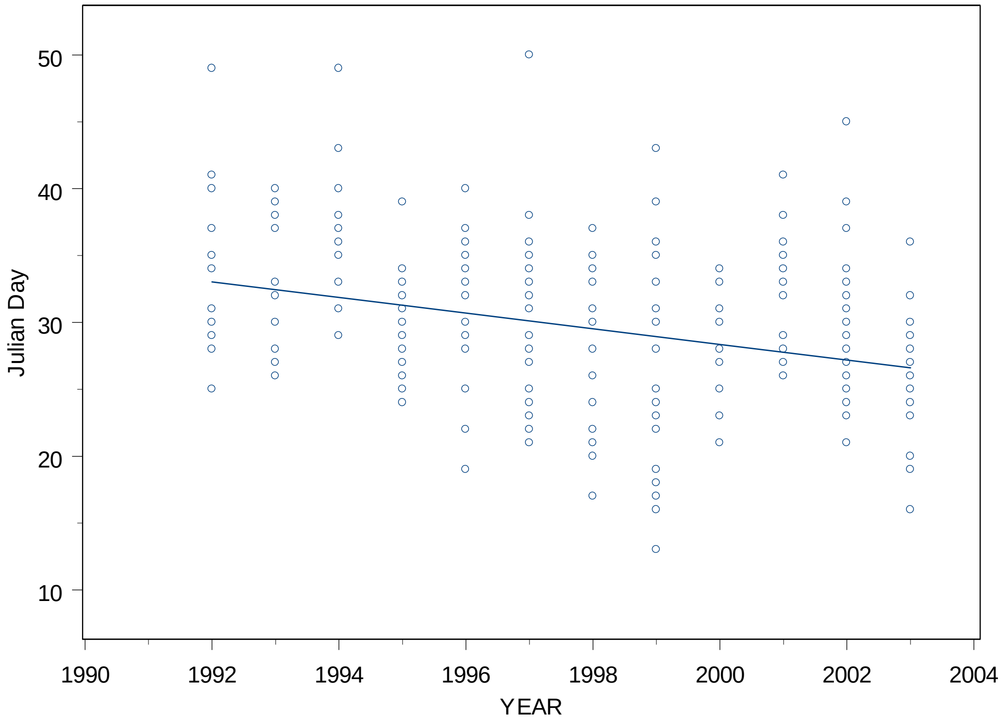


Figure 3.1.1b The mean (±se) hatch date (May 1st = 1) of Red Grouse from 1992 to 2003.

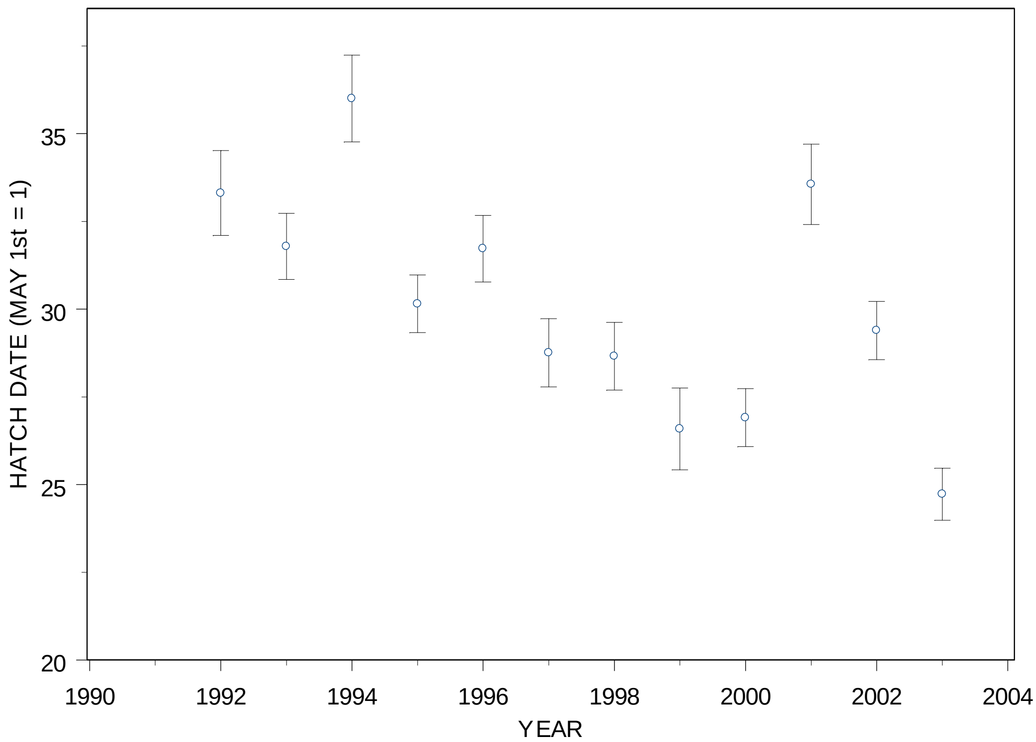


Figure 3.1.2 Mean (±se) hatching date of Red Grouse *predicted* from growth curve data between 1985 and 2003.

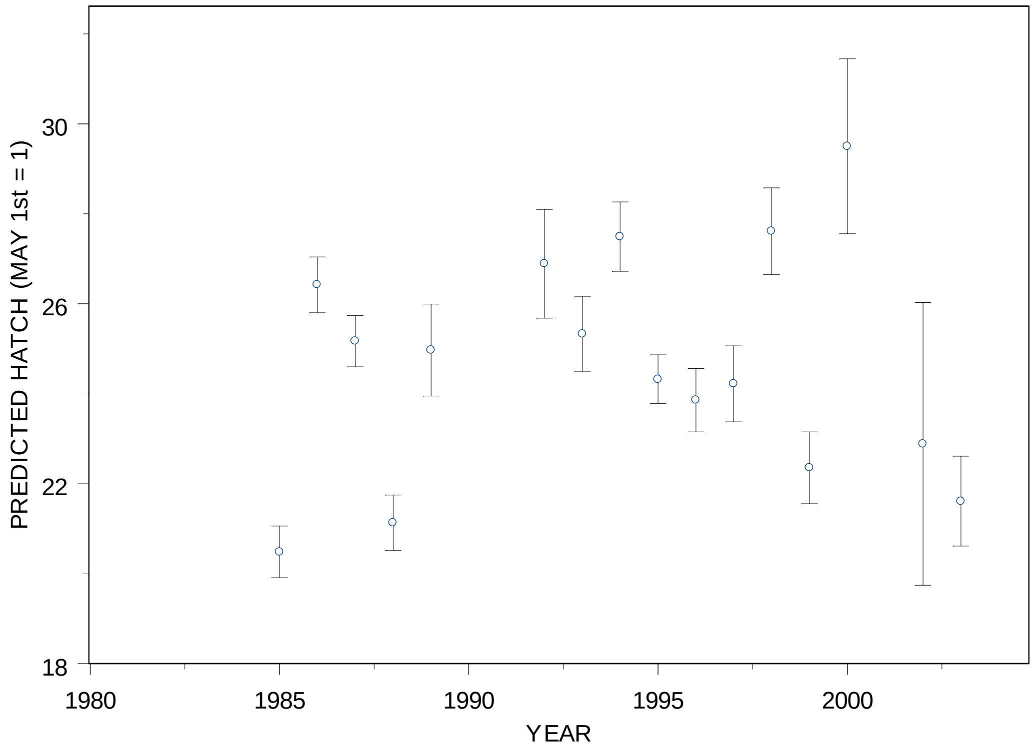
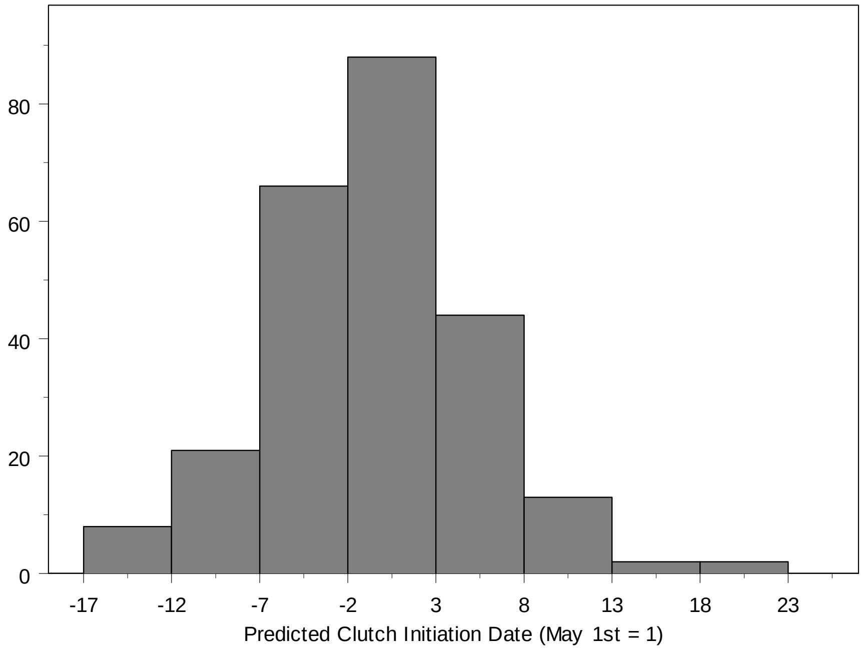


Figure 3.1.3a Frequency distributions of Red grouse clutch initiation dates for Strathspey

i) <1500ft



ii) >1500ft

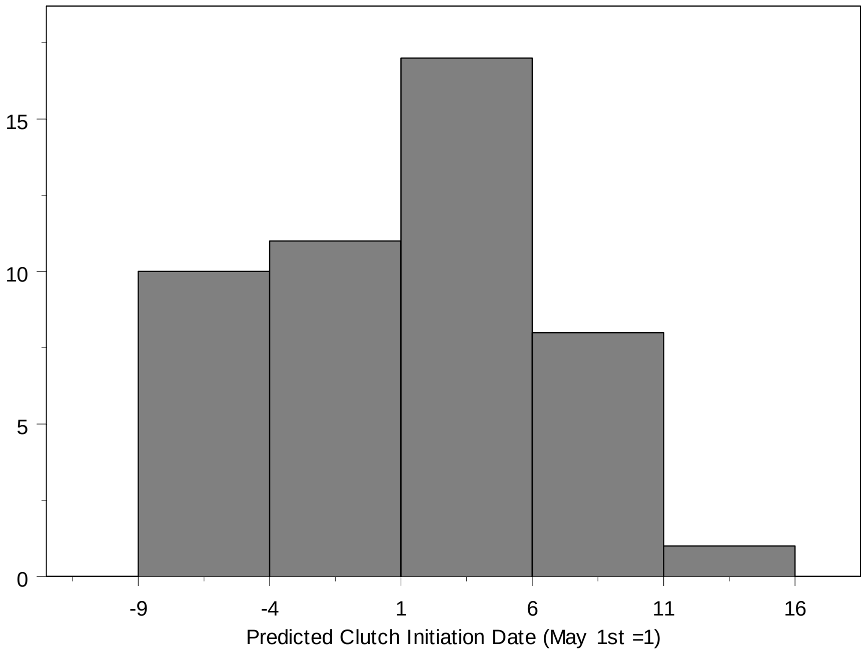
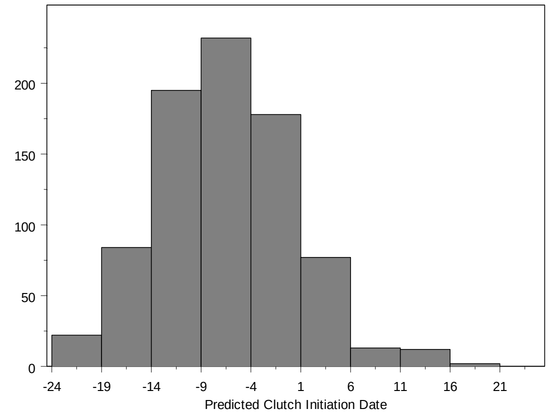


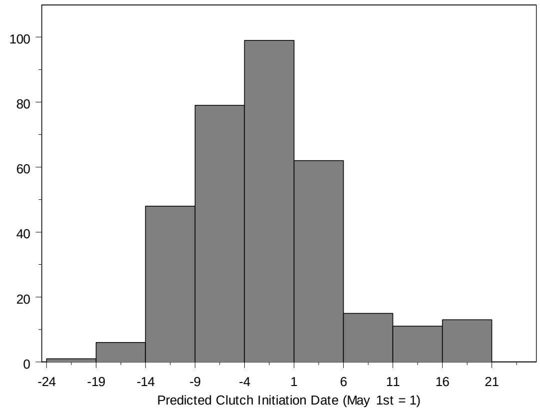
Figure 3.1.3b Frequency distributions of predicted Red Grouse clutch initiation dates for rest of Scotland

i) predicted clutch initiation dates

<1500ft

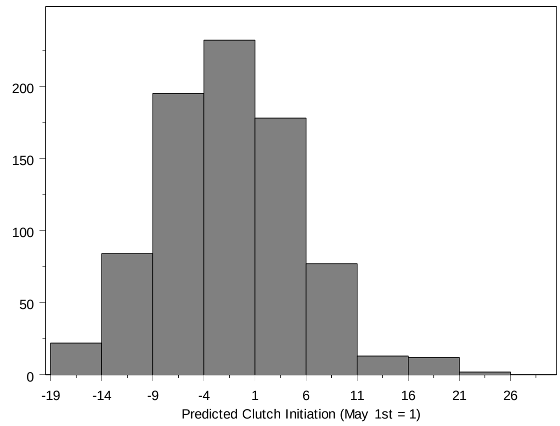


>1500ft



ii) adjusted predicted clutch initiation dates (to correct for the discrepancies seen between the true hatching dates and predicted dates 5 days has been added)

<1500ft



>1500ft

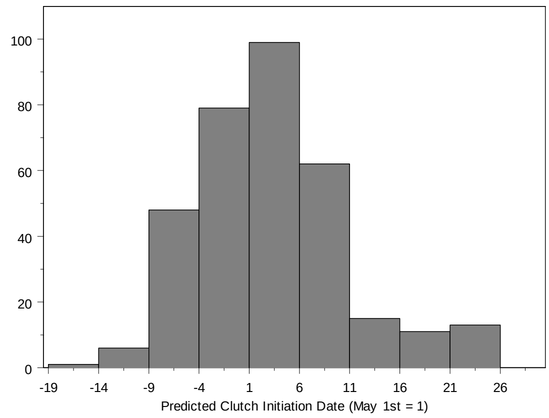
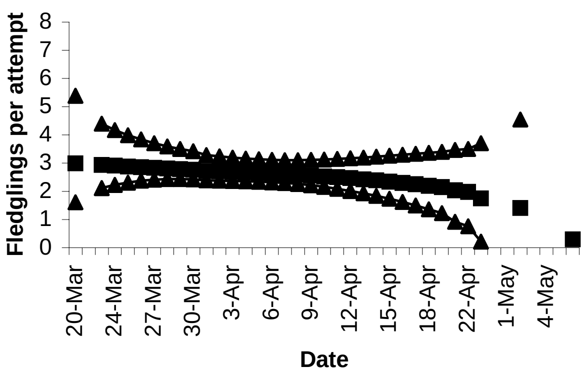
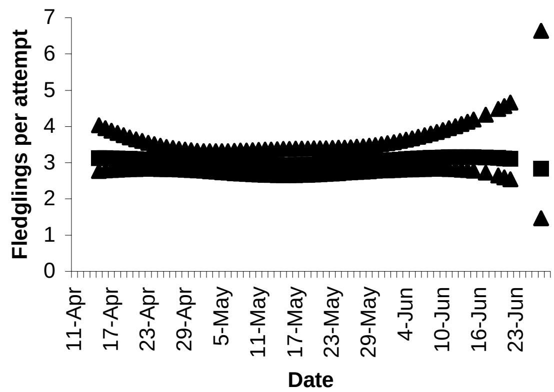


Figure 3.5.1 Seasonal trends in breeding performance per nesting attempt for (a) Peregrine, (b) Ring Ouzel, (c) Twite, (d) Wheatear and (e) Whinchat. Trends and the 95% confidence limits of the trends are shown in each case.

(a)

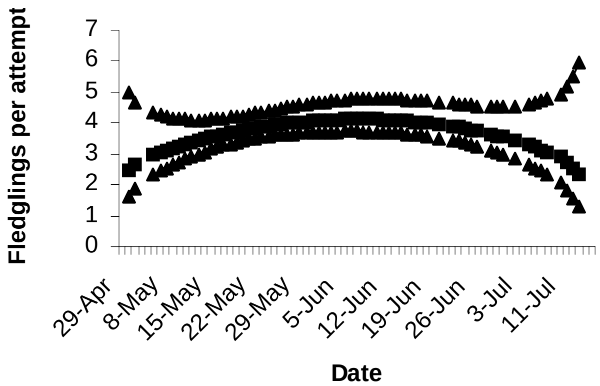


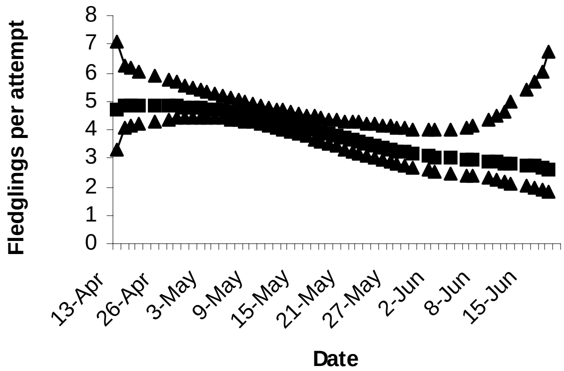
(b)



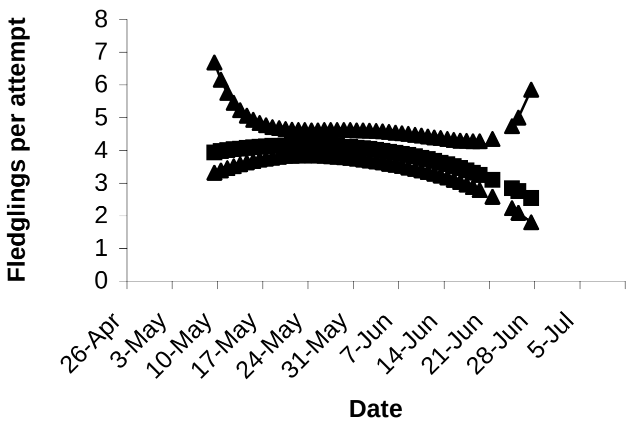
(c)

d (d) (d)





(e)



Appendix 1 List of species considered for analysis according to their upland habitat use. Category A: all NRCs used as these species are predominantly upland; Category B: only 'upland' NRCs are selected using Environmental Zones (see methods).

Breed mainly in heather moorland	Category	Rough grassland / moorland edge species	Category	Subsidiary upland species	Category
Black grouse (*Tetrao tetrix*)	B	Common Gull (*Larus canus*)	B	Black-headed Gull (*Larus ridibundus*)	B
Dunlin (*Calidris alpina)*	A	Common Sandpiper (*Actitis hypoleucos*)	B	Buzzard (*Buteo buteo*)	B
Golden Eagle (*Aquila chrysaetos*)	A	Curlew (*Numenius arquata*)	B	Cuckoo (*Cuculus canorus*)	B
Golden Plover (*Pluvalis apricaria*)	A	Lapwing *(Vanellus vanellus*)	B	Dipper (*Cinclus cinclus*)	B
Greenshank (*Tringa nebularia*)	A	Oystercatcher (*Haematopus ostralegus*)	B	Grey Wagtail (*Motacilla cinerea*)	B
Hen Harrier (*Circus cyaneus*)	A	Redshank (*Tringa totanus*)	B	Kestrel (*Falco tinnunculus*)	B
Meadow Pipit (*Anthus pratensis)*	B	Ringed Plover (*Charadrius hiaticula*)	B	Lesser Black-backed Gull (*Larus fuscus*)	B
Merlin (*Falco columbarius*)	A	Skylark (*Alauda arvensis*)	B	Linnet *(Acanthis cannabina)*	B
Peregrine Falcon (*Falco peregrinus*)	B	(Common) Snipe *(Gallinago gallinago*)	B	Ptarmigan *(Lagopus mutus)*	A
Red Grouse (*Lagopus lagopus scoticus)*	A	Twite (*Acanthis flavirostris*)	A	Raven (*Corvus corax*)	B
Ring Ouzel (*Turdus torquatus*)	A	Wheatear (*Oenanthe oenanthe*)	B	Reed Bunting *(Emberiza schoeniclus)*	B
Short-eared Owl (*Asio flammeus*)	A			Tree Pipit (*Anthus trivalis*)	B
Stonechat (*Saxicola torquata*)	B			Whitethroat (*Sylvia communis*)	B
Whinchat *(Saxicola rubetra*)	B			Willow Warbler (*Phylloscopus trochilus*)	B
				Wren (*Troglodytes troglodytes*)	B

Appendix 2 Values for back-calculation of first egg laying dates for ringed pulli.

Species	Incubation starts on egg	Mean laying interval	Mean incubation period	Mean nestling period	Subtraction for ringing at mid-nestling period	Subtraction for ringing at day 1	Reference[5]
Black-headed Gull	1	1	24	35	41.5	25	Cramp *et al.* (1977-1994)
Buzzard	1	2.5	42	42.5	63.25		
Common Gull	3	2	24.5	28	42.5	29.5	
Common Sandpiper	4	1	21	13	30.5	25	
Curlew	4	2	28	35	51.5	35	
Dipper	5	1	16.5	22	31.5		
Dunlin	4	1	21.5	25	37	25.5	
Golden Eagle	1	3.5	44	66.5	77.25		
Golden Plover	4	2.5	27.5	28	49	36	
Grey Wagtail	5	1	12.5	15	24		
Hen Harrier	3	2	30	37	52.5		
Kestrel	3	2.5	28	31.5	48.75		Village (1990)
Lapwing	4	1.5	26.5	33	47.5	32	
Lesser Black-backed Gull	1	2	27	37.5	45.75	28	Cramp *et al.* (1977-1994)
Linnet	5	1	12	15.5	23.75		
Meadow Pipit	4	1	13	12	22		
Merlin	4.5	2	30	27.5	50.75		Cramp *et al.* (1977-1994)
Oystercatcher	3	1	25.5	35.5	45.25	28.5	
Peregrine	3	2.5	28.5	38.5	52.75		Cramp *et al.* (1977-1994)
Raven	4	2	20.5	42	47.5		Ratcliffe (1997)
Redshank	4	1	23.5	30	41.5	27.5	
Reed Bunting	4.5	1	13	11.5	22.25		
Ring Ouzel	4.5	1	13.5	13.5	23.75		
Ringed Plover	4	1	24.5	25	40	28.5	
Short-eared Owl	1	3	26	27	39.5		
Skylark	3.5	1	11	15	21		
Snipe	4	1	19	19.5	31.75	23	
Stonechat	5.5	1	14.5	12.5	25.25		
Tree Pipit	5	1	13	12.5	23.25		
Twite	5.5	1	12.5	15	24.5		
Wheatear	5	1	14	15	25.5		
Whinchat	6	1	13.5	13.5	25.25		
Whitethroat	4.5	1	12	11	21		
Willow Warbler	6.5	1	13	14.5	25.75		
Wren	7	1	15.5	17.5	30.25		

[5] Harrison (1977) unless otherwise stated.

Appendix 3 Full list of percentiles for first egg laying dates derived from Hen Harrier Nest Records

	N	date by which X% have started laying																			
Year		5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
1988	94	17-Apr	20-Apr	21-Apr	23-Apr	24-Apr	26-Apr	27-Apr	29-Apr	30-Apr	30-Apr	30-Apr	01-May	03-May	04-May	06-May	07-May	12-May	17-May	22-May	12-Jun
1989	129	25-Apr	28-Apr	30-Apr	02-May	04-May	05-May	07-May	07-May	09-May	10-May	11-May	12-May	13-May	14-May	16-May	18-May	21-May	25-May	03-Jun	17-Jun
1990	144	24-Apr	26-Apr	28-Apr	29-Apr	01-May	04-May	04-May	05-May	06-May	07-May	09-May	10-May	12-May	13-May	15-May	18-May	24-May	28-May	04-Jun	14-Jun
1991	187	20-Apr	22-Apr	24-Apr	26-Apr	27-Apr	29-Apr	01-May	02-May	05-May	07-May	09-May	11-May	13-May	15-May	18-May	21-May	25-May	30-May	04-Jun	24-Jun
1992	208	24-Apr	26-Apr	27-Apr	29-Apr	01-May	02-May	03-May	04-May	04-May	05-May	07-May	10-May	11-May	14-May	17-May	18-May	20-May	26-May	27-May	24-Jun
1993	166	20-Apr	23-Apr	25-Apr	28-Apr	29-Apr	01-May	02-May	05-May	06-May	08-May	10-May	11-May	13-May	15-May	16-May	19-May	23-May	25-May	04-Jun	20-Jun
1994	171	24-Apr	26-Apr	28-Apr	29-Apr	30-Apr	02-May	03-May	05-May	06-May	07-May	08-May	10-May	13-May	14-May	16-May	20-May	23-May	25-May	03-Jun	18-Jun
1995	136	19-Apr	23-Apr	26-Apr	28-Apr	29-Apr	30-Apr	02-May	04-May	05-May	06-May	07-May	08-May	11-May	12-May	14-May	15-May	20-May	23-May	01-Jun	19-Jun
Total	1235	21-Apr	24-Apr	26-Apr	28-Apr	30-Apr	01-May	02-May	04-May	05-May	07-May	08-May	10-May	11-May	13-May	16-May	18-May	22-May	26-May	01-Jun	24-Jun
Country																					
England	17	16-Apr	17-Apr	27-Apr	28-Apr	29-Apr	08-May	08-May	09-May	09-May	10-May	11-May	11-May	14-May	14-May	14-May	20-May	06-Jun	08-Jun	15-Jun	15-Jun
Wales	62	27-Apr	02-May	03-May	06-May	08-May	09-May	12-May	13-May	14-May	17-May	18-May	20-May	22-May	23-May	24-May	27-May	31-May	01-Jun	07-Jun	16-Jun
Scotland	1156	21-Apr	24-Apr	26-Apr	28-Apr	29-Apr	01-May	02-May	03-May	05-May	06-May	07-May	09-May	11-May	13-May	15-May	17-May	21-May	25-May	01-Jun	24-Jun

Appendix 4 Full list of percentiles for first egg laying dates derived from Nest Record Cards

		N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Common Sandpiper																						
GB	All	97	05-May	08-May	11-May	12-May	14-May	14-May	15-May	16-May	17-May	18-May	18-May	19-May	20-May	22-May	23-May	25-May	29-May	03-Jun	11-Jun	19-Jun
England	All	40	05-May	08-May	12-May	13-May	14-May	16-May	18-May	18-May	19-May	19-May	20-May	21-May	22-May	23-May	25-May	26-May	03-Jun	09-Jun	16-Jun	19-Jun
England	<=250m	28	05-May	06-May	09-May	12-May	14-May	16-May	19-May	19-May	20-May	21-May	22-May	22-May	25-May	25-May	29-May	06-Jun	06-Jun	14-Jun	18-Jun	19-Jun
England	>250m	12	12-May	13-May	13-May	14-May	15-May	17-May	18-May	18-May	18-May	18-May	18-May	18-May	18-May	20-May	20-May	20-May	23-May	23-May	24-May	24-May
Wales	All	6	23-Apr	23-Apr	23-Apr	08-May	08-May	08-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	22-May	22-May	22-May	22-May
Wales	<=250m	4	23-Apr	23-Apr	23-Apr	23-Apr	30-Apr	08-May	08-May	08-May	08-May	12-May	17-May	17-May	17-May	17-May	19-May	22-May	22-May	22-May	22-May	22-May
Wales	>250m	2	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May
Scotland	All	51	06-May	08-May	11-May	12-May	13-May	14-May	14-May	15-May	16-May	17-May	17-May	18-May	18-May	20-May	23-May	26-May	29-May	31-May	07-Jun	11-Jun
Scotland	<=450m	50	06-May	08-May	11-May	11-May	13-May	14-May	14-May	14-May	16-May	16-May	17-May	18-May	18-May	19-May	22-May	25-May	27-May	30-May	07-Jun	11-Jun
Scotland	>450m	0																				
Curlew																						
GB	All	107	22-Apr	24-Apr	26-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	01-May	01-May	02-May	03-May	06-May	08-May	10-May	13-May	15-May	22-May	27-May	05-Jun
England	All	37	24-Apr	26-Apr	28-Apr	29-Apr	30-Apr	01-May	01-May	02-May	03-May	06-May	08-May	10-May	11-May	11-May	13-May	14-May	18-May	25-May	28-May	05-Jun
England	<=250m	9	26-Apr	26-Apr	29-Apr	29-Apr	01-May	01-May	01-May	01-May	02-May	02-May	02-May	13-May	13-May	13-May	13-May	14-May	14-May	14-May	14-May	14-May
England	>250m	28	24-Apr	26-Apr	28-Apr	29-Apr	30-Apr	01-May	01-May	03-May	04-May	06-May	08-May	09-May	11-May	11-May	12-May	18-May	23-May	28-May	28-May	05-Jun
Wales	All	10	22-Apr	23-Apr	25-Apr	25-Apr	26-Apr	27-Apr	28-Apr	28-Apr	29-Apr	30-Apr	02-May	02-May	03-May	03-May	04-May	04-May	04-May	18-May	02-Jun	02-Jun
Wales	<=250m	0																				
Wales	>250m	10	22-Apr	23-Apr	25-Apr	25-Apr	26-Apr	27-Apr	28-Apr	28-Apr	29-Apr	30-Apr	02-May	02-May	03-May	03-May	04-May	04-May	04-May	18-May	02-Jun	02-Jun
Scotland	All	60	20-Apr	23-Apr	24-Apr	25-Apr	26-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	01-May	01-May	02-May	05-May	07-May	10-May	15-May	17-May	23-May	29-May
Scotland	<=450m	60	20-Apr	23-Apr	24-Apr	25-Apr	26-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	01-May	01-May	02-May	05-May	07-May	10-May	15-May	17-May	23-May	29-May
Scotland	>450m	0																				

		N	date by which X% have started laying																		
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Dunlin																						
GB	All	114	03-May	07-May	09-May	11-May	13-May	14-May	15-May	17-May	18-May	19-May	19-May	21-May	23-May	24-May	26-May	29-May	03-Jun	05-Jun	10-Jun	27-Jun
England	All	31	29-Apr	03-May	04-May	07-May	08-May	09-May	09-May	10-May	11-May	12-May	17-May	18-May	22-May	23-May	24-May	25-May	29-May	30-May	16-Jun	18-Jun
England	<=250m	1	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May	28-May
England	>250m	26	29-Apr	30-Apr	03-May	05-May	07-May	08-May	09-May	09-May	09-May	10-May	12-May	12-May	17-May	21-May	23-May	24-May	29-May	30-May	02-Jun	18-Jun
Wales	All	1	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Wales	>250m	1	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Scotland	All	82	06-May	12-May	13-May	13-May	15-May	16-May	17-May	17-May	18-May	19-May	20-May	21-May	24-May	24-May	26-May	29-May	03-Jun	05-Jun	09-Jun	27-Jun
Scotland	<=450m	80	05-May	11-May	13-May	13-May	15-May	16-May	16-May	17-May	18-May	19-May	19-May	20-May	22-May	24-May	26-May	29-May	03-Jun	04-Jun	08-Jun	27-Jun
Scotland	>450m	1	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May	24-May
GB	All	114	03-May	07-May	09-May	11-May	13-May	14-May	15-May	17-May	18-May	19-May	19-May	21-May	23-May	24-May	26-May	29-May	03-Jun	05-Jun	10-Jun	27-Jun
England	All	31	29-Apr	03-May	04-May	07-May	08-May	09-May	09-May	10-May	11-May	12-May	17-May	18-May	22-May	23-May	24-May	25-May	29-May	30-May	16-Jun	18-Jun
Golden Plover																						
GB	All	133	03-Apr	06-Apr	10-Apr	14-Apr	17-Apr	18-Apr	20-Apr	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	03-May	08-May	10-May	15-May	21-May	29-May	06-Jun	23-Jun
England	All	98	01-Apr	06-Apr	10-Apr	12-Apr	16-Apr	18-Apr	19-Apr	21-Apr	24-Apr	25-Apr	28-Apr	29-Apr	03-May	07-May	09-May	17-May	22-May	29-May	06-Jun	15-Jun
England	<=250m	6	29-Mar	29-Mar	29-Mar	31-Mar	31-Mar	31-Mar	03-Apr	03-Apr	03-Apr	10-Apr	18-Apr	18-Apr	18-Apr	22-Apr	22-Apr	22-Apr	22-May	22-May	22-May	22-May
England	>250m	92	05-Apr	09-Apr	11-Apr	15-Apr	16-Apr	19-Apr	20-Apr	21-Apr	24-Apr	26-Apr	28-Apr	01-May	05-May	08-May	10-May	17-May	23-May	29-May	06-Jun	15-Jun
Wales	All	8	06-Apr	06-Apr	17-Apr	17-Apr	17-Apr	18-Apr	18-Apr	25-Apr	25-Apr	25-Apr	26-Apr	26-Apr	02-May	02-May	08-May	14-May	14-May	19-Jun	19-Jun	19-Jun
Wales	<=250m	0																				
Wales	>250m	8	06-Apr	06-Apr	17-Apr	17-Apr	17-Apr	18-Apr	18-Apr	25-Apr	25-Apr	25-Apr	26-Apr	26-Apr	02-May	02-May	08-May	14-May	14-May	19-Jun	19-Jun	19-Jun
Scotland	All	27	03-Apr	08-Apr	14-Apr	17-Apr	18-Apr	23-Apr	24-Apr	25-Apr	29-Apr	29-Apr	29-Apr	02-May	03-May	08-May	11-May	12-May	15-May	27-May	05-Jun	23-Jun
Scotland	<=450m	26	03-Apr	08-Apr	09-Apr	17-Apr	18-Apr	20-Apr	24-Apr	25-Apr	28-Apr	29-Apr	30-Apr	02-May	03-May	10-May	11-May	12-May	19-May	27-May	05-Jun	23-Jun
Scotland	>450m	1	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr

		N	date by which X% have started laying																		
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Hen Harrier																						
GB	All	118	19-Apr	23-Apr	28-Apr	29-Apr	30-Apr	03-May	04-May	07-May	07-May	09-May	11-May	11-May	12-May	16-May	17-May	22-May	24-May	30-May	09-Jun	16-Jun
England	All	16	13-Apr	16-Apr	19-Apr	19-Apr	19-Apr	20-Apr	20-Apr	21-Apr	21-Apr	21-Apr	22-Apr	25-Apr	27-Apr	28-Apr	01-May	04-May	11-May	13-May	14-May	14-May
England	<=250m	2	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	01-May	13-May	13-May	13-May	13-May	13-May	13-May	13-May	13-May	13-May	13-May
England	>250m	14	13-Apr	16-Apr	19-Apr	19-Apr	19-Apr	20-Apr	20-Apr	21-Apr	21-Apr	21-Apr	22-Apr	25-Apr	27-Apr	27-Apr	28-Apr	04-May	04-May	11-May	14-May	14-May
Wales	All	17	11-Apr	28-Apr	01-May	03-May	11-May	11-May	11-May	12-May	16-May	22-May	23-May	24-May	28-May	28-May	30-May	07-Jun	08-Jun	10-Jun	12-Jun	12-Jun
Wales	<=250m	0																				
Wales	>250m	17	11-Apr	28-Apr	01-May	03-May	11-May	11-May	11-May	12-May	16-May	22-May	23-May	24-May	28-May	28-May	30-May	07-Jun	08-Jun	10-Jun	12-Jun	12-Jun
Scotland	All	85	25-Apr	29-Apr	30-Apr	30-Apr	03-May	05-May	06-May	07-May	08-May	09-May	11-May	11-May	12-May	16-May	16-May	19-May	23-May	28-May	09-Jun	16-Jun
Scotland	<=450m	79	25-Apr	29-Apr	30-Apr	02-May	03-May	05-May	07-May	07-May	08-May	09-May	11-May	11-May	12-May	16-May	17-May	20-May	23-May	28-May	09-Jun	16-Jun
Scotland	>450m	6	23-Apr	23-Apr	23-Apr	28-Apr	28-Apr	28-Apr	30-Apr	30-Apr	30-Apr	06-May	12-May	12-May	12-May	16-May	16-May	16-May	29-May	29-May	29-May	29-May
Lapwing																						
GB	All	204	27-Mar	31-Mar	01-Apr	03-Apr	05-Apr	07-Apr	10-Apr	14-Apr	16-Apr	18-Apr	21-Apr	25-Apr	28-Apr	01-May	05-May	08-May	11-May	19-May	26-May	07-Jun
England	All	117	25-Mar	28-Mar	31-Mar	02-Apr	03-Apr	05-Apr	06-Apr	07-Apr	09-Apr	13-Apr	15-Apr	20-Apr	25-Apr	30-Apr	05-May	08-May	09-May	15-May	29-May	07-Jun
England	<=250m	15	24-Mar	03-Apr	07-Apr	07-Apr	07-Apr	07-Apr	08-Apr	08-Apr	08-Apr	09-Apr	10-Apr	10-Apr	11-Apr	20-Apr	08-May	10-May	12-May	15-May	02-Jun	02-Jun
England	>250m	102	26-Mar	28-Mar	31-Mar	01-Apr	03-Apr	03-Apr	05-Apr	07-Apr	11-Apr	14-Apr	17-Apr	21-Apr	26-Apr	01-May	05-May	07-May	09-May	14-May	26-May	07-Jun
Wales	All	31	30-Mar	01-Apr	02-Apr	06-Apr	09-Apr	16-Apr	16-Apr	20-Apr	21-Apr	22-Apr	27-Apr	28-Apr	04-May	07-May	11-May	12-May	23-May	25-May	26-May	02-Jun
Wales	<=250m	4	09-Apr	09-Apr	09-Apr	09-Apr	18-Apr	28-Apr	28-Apr	28-Apr	28-Apr	10-May	23-May	23-May	23-May	23-May	28-May	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun
Wales	>250m	27	30-Mar	01-Apr	02-Apr	03-Apr	06-Apr	16-Apr	16-Apr	18-Apr	21-Apr	22-Apr	22-Apr	27-Apr	02-May	04-May	11-May	11-May	12-May	25-May	26-May	26-May
Scotland	All	56	28-Mar	01-Apr	07-Apr	10-Apr	14-Apr	16-Apr	17-Apr	18-Apr	19-Apr	23-Apr	26-Apr	27-Apr	29-Apr	30-Apr	03-May	04-May	10-May	19-May	27-May	02-Jun
Scotland	<=450m	56	28-Mar	01-Apr	07-Apr	10-Apr	14-Apr	16-Apr	17-Apr	18-Apr	19-Apr	23-Apr	26-Apr	27-Apr	29-Apr	30-Apr	03-May	04-May	10-May	19-May	27-May	02-Jun
Scotland	>450m	0																				

		N	date by which X% have started laying																		
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Meadow Pipit																						
GB	All	388	27-Apr	29-Apr	30-Apr	02-May	04-May	05-May	07-May	08-May	10-May	11-May	13-May	15-May	17-May	20-May	23-May	29-May	05-Jun	12-Jun	18-Jun	18-Jul
England	All	147	26-Apr	30-Apr	01-May	02-May	03-May	04-May	05-May	07-May	08-May	10-May	11-May	13-May	16-May	20-May	25-May	03-Jun	09-Jun	17-Jun	20-Jun	18-Jul
England	<=250m	37	25-Apr	26-Apr	29-Apr	01-May	02-May	02-May	03-May	03-May	04-May	05-May	06-May	08-May	10-May	10-May	14-May	18-May	02-Jun	09-Jun	21-Jun	18-Jul
England	>250m	110	27-Apr	30-Apr	02-May	02-May	04-May	04-May	07-May	08-May	10-May	11-May	13-May	15-May	19-May	22-May	26-May	06-Jun	11-Jun	17-Jun	20-Jun	30-Jun
Wales	All	93	23-Apr	27-Apr	28-Apr	30-Apr	01-May	02-May	03-May	05-May	07-May	09-May	12-May	14-May	17-May	18-May	20-May	27-May	04-Jun	09-Jun	13-Jun	18-Jul
Wales	<=250m	4	11-Apr	11-Apr	11-Apr	11-Apr	24-Apr	08-May	08-May	08-May	08-May	26-May	13-Jun	13-Jun	13-Jun	13-Jun	14-Jun	15-Jun	15-Jun	15-Jun	15-Jun	15-Jun
Wales	>250m	89	25-Apr	27-Apr	28-Apr	30-Apr	01-May	02-May	03-May	05-May	07-May	09-May	10-May	14-May	15-May	18-May	20-May	27-May	30-May	09-Jun	12-Jun	18-Jul
Scotland	All	148	28-Apr	30-Apr	04-May	05-May	07-May	08-May	10-May	11-May	12-May	13-May	15-May	16-May	18-May	20-May	24-May	28-May	02-Jun	11-Jun	17-Jun	01-Jul
Scotland	<=450m	146	28-Apr	30-Apr	04-May	05-May	07-May	08-May	10-May	11-May	12-May	13-May	15-May	16-May	18-May	20-May	25-May	28-May	03-Jun	11-Jun	17-Jun	01-Jul
Scotland	>450m	2	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	14-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May

Merlin																						
GB	All	280	25-Apr	27-Apr	29-Apr	30-Apr	01-May	02-May	03-May	04-May	05-May	06-May	07-May	08-May	10-May	11-May	13-May	16-May	18-May	20-May	27-May	19-Jun
England	All	142	27-Apr	28-Apr	30-Apr	01-May	02-May	03-May	04-May	04-May	05-May	06-May	07-May	08-May	09-May	11-May	13-May	16-May	17-May	20-May	28-May	11-Jun
England	<=250m	18	28-Apr	29-Apr	01-May	01-May	02-May	07-May	08-May	09-May	10-May	10-May	11-May	13-May	16-May	17-May	17-May	18-May	19-May	29-May	09-Jun	09-Jun
England	>250m	124	26-Apr	28-Apr	29-Apr	01-May	02-May	03-May	04-May	04-May	05-May	06-May	07-May	08-May	09-May	10-May	12-May	15-May	16-May	20-May	27-May	11-Jun
Wales	All	45	27-Apr	27-Apr	29-Apr	30-Apr	01-May	02-May	03-May	04-May	05-May	05-May	06-May	08-May	10-May	11-May	12-May	15-May	18-May	18-May	21-May	11-Jun
Wales	<=250m	3	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	02-May	02-May	02-May	02-May	02-May	02-May	02-May	21-May	21-May	21-May	21-May	21-May	21-May	21-May
Wales	>250m	42	27-Apr	29-Apr	30-Apr	01-May	01-May	03-May	03-May	04-May	05-May	05-May	07-May	08-May	10-May	11-May	12-May	14-May	17-May	18-May	21-May	11-Jun
Scotland	All	93	25-Apr	26-Apr	28-Apr	29-Apr	30-Apr	01-May	02-May	02-May	03-May	05-May	07-May	08-May	10-May	13-May	13-May	17-May	18-May	19-May	26-May	19-Jun
Scotland	<=450m	86	25-Apr	27-Apr	28-Apr	30-Apr	01-May	01-May	02-May	02-May	04-May	06-May	07-May	09-May	11-May	13-May	16-May	18-May	19-May	20-May	26-May	19-Jun
Scotland	>450m	7	25-Apr	25-Apr	26-Apr	26-Apr	26-Apr	30-Apr	30-Apr	30-Apr	30-Apr	30-Apr	30-Apr	03-May	03-May	03-May	04-May	04-May	04-May	13-May	13-May	13-May

		N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Oystercatcher																						
GB	All	157	21-Apr	23-Apr	27-Apr	28-Apr	29-Apr	01-May	02-May	03-May	05-May	07-May	10-May	11-May	14-May	15-May	18-May	21-May	22-May	26-May	30-May	08-Jun
England	All	26	25-Apr	27-Apr	27-Apr	28-Apr	01-May	02-May	02-May	03-May	04-May	09-May	11-May	11-May	18-May	21-May	22-May	23-May	25-May	26-May	28-May	07-Jun
England	<=250m	13	28-Apr	01-May	01-May	02-May	02-May	02-May	02-May	03-May	03-May	04-May	11-May	11-May	18-May	21-May	21-May	22-May	24-May	24-May	07-Jun	07-Jun
England	>250m	13	13-Apr	25-Apr	25-Apr	27-Apr	27-Apr	27-Apr	28-Apr	09-May	09-May	10-May	11-May	11-May	18-May	23-May	23-May	25-May	26-May	26-May	28-May	28-May
Wales	All	1	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Wales	<=250m	1	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun	07-Jun
Wales	>250m	0																				
Scotland	All	130	21-Apr	23-Apr	26-Apr	28-Apr	29-Apr	30-Apr	02-May	03-May	05-May	06-May	09-May	11-May	13-May	15-May	16-May	19-May	21-May	25-May	29-May	08-Jun
Scotland	<=450m	130	21-Apr	23-Apr	26-Apr	28-Apr	29-Apr	30-Apr	02-May	03-May	05-May	06-May	09-May	11-May	13-May	15-May	16-May	19-May	21-May	25-May	29-May	08-Jun
Scotland	>450m	0																				
Peregrine																						
GB	All	128	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar	31-Mar	02-Apr	04-Apr	05-Apr	07-Apr	08-Apr	09-Apr	10-Apr	11-Apr	13-Apr	15-Apr	17-Apr	20-Apr	02-May	19-May
England	All	24	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar	31-Mar	02-Apr	02-Apr	07-Apr	07-Apr	08-Apr	10-Apr	11-Apr	11-Apr	11-Apr	14-Apr	16-Apr	17-Apr	02-May	19-May
England	<=250m	2	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	01-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr	02-Apr
England	>250m	22	26-Mar	27-Mar	28-Mar	30-Mar	31-Mar	31-Mar	02-Apr	07-Apr	07-Apr	08-Apr	10-Apr	11-Apr	11-Apr	11-Apr	12-Apr	14-Apr	16-Apr	17-Apr	02-May	19-May
Wales	All	60	26-Mar	28-Mar	29-Mar	30-Mar	31-Mar	01-Apr	03-Apr	03-Apr	04-Apr	05-Apr	06-Apr	07-Apr	09-Apr	10-Apr	12-Apr	15-Apr	18-Apr	22-Apr	03-May	05-May
Wales	<=250m	5	25-Mar	25-Mar	25-Mar	27-Mar	30-Mar	30-Mar	30-Mar	30-Mar	31-Mar	31-Mar	31-Mar	02-Apr	05-Apr	05-Apr	05-Apr	13-Apr	21-Apr	21-Apr	21-Apr	21-Apr
Wales	>250m	55	27-Mar	28-Mar	29-Mar	30-Mar	31-Mar	02-Apr	03-Apr	04-Apr	05-Apr	06-Apr	07-Apr	08-Apr	09-Apr	10-Apr	12-Apr	15-Apr	18-Apr	23-Apr	03-May	05-May
Scotland	All	44	26-Mar	27-Mar	27-Mar	28-Mar	31-Mar	02-Apr	02-Apr	05-Apr	07-Apr	07-Apr	10-Apr	11-Apr	11-Apr	14-Apr	14-Apr	15-Apr	16-Apr	18-Apr	22-Apr	14-May
Scotland	<=450m	38	25-Mar	26-Mar	27-Mar	28-Mar	31-Mar	02-Apr	05-Apr	06-Apr	07-Apr	08-Apr	10-Apr	11-Apr	11-Apr	14-Apr	14-Apr	15-Apr	17-Apr	19-Apr	01-May	14-May
Scotland	>450m	6	27-Mar	27-Mar	27-Mar	31-Mar	31-Mar	31-Mar	02-Apr	02-Apr	02-Apr	04-Apr	07-Apr	07-Apr	07-Apr	14-Apr	14-Apr	14-Apr	16-Apr	16-Apr	16-Apr	16-Apr

		N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Redshank																						
GB	All	43	11-Apr	14-Apr	18-Apr	20-Apr	20-Apr	21-Apr	23-Apr	24-Apr	24-Apr	26-Apr	29-Apr	30-Apr	30-Apr	30-Apr	01-May	02-May	05-May	06-May	13-May	21-May
England	All	28	11-Apr	11-Apr	14-Apr	16-Apr	18-Apr	20-Apr	21-Apr	23-Apr	24-Apr	24-Apr	25-Apr	26-Apr	29-Apr	30-Apr	30-Apr	02-May	06-May	13-May	18-May	21-May
England	<=250m	6	16-Apr	16-Apr	16-Apr	23-Apr	23-Apr	23-Apr	24-Apr	24-Apr	24-Apr	26-Apr	28-Apr	28-Apr	28-Apr	30-Apr	30-Apr	30-Apr	13-May	13-May	13-May	13-May
England	>250m	22	11-Apr	11-Apr	14-Apr	14-Apr	18-Apr	19-Apr	20-Apr	21-Apr	22-Apr	24-Apr	25-Apr	26-Apr	29-Apr	30-Apr	01-May	02-May	06-May	09-May	18-May	21-May
Wales	All	1	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
Wales	<=250m	0																				
Wales	>250m	1	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
Scotland	All	14	20-Apr	21-Apr	21-Apr	21-Apr	24-Apr	29-Apr	29-Apr	30-Apr	30-Apr	30-Apr	30-Apr	30-Apr	01-May	01-May	02-May	02-May	02-May	05-May	05-May	05-May
Scotland	<=450m	14	20-Apr	21-Apr	21-Apr	21-Apr	24-Apr	29-Apr	29-Apr	30-Apr	30-Apr	30-Apr	30-Apr	30-Apr	01-May	01-May	02-May	02-May	02-May	05-May	05-May	05-May
Scotland	>450m	0																				
Ring Ouzel																						
GB	All	781	19-Apr	22-Apr	24-Apr	26-Apr	27-Apr	29-Apr	30-Apr	03-May	06-May	07-May	10-May	14-May	18-May	21-May	24-May	28-May	01-Jun	06-Jun	12-Jun	03-Jul
England	All	314	20-Apr	22-Apr	24-Apr	25-Apr	27-Apr	28-Apr	30-Apr	03-May	06-May	08-May	11-May	15-May	18-May	20-May	24-May	27-May	31-May	06-Jun	11-Jun	28-Jun
England	<=250m	18	21-Apr	27-Apr	29-Apr	30-Apr	02-May	06-May	07-May	08-May	11-May	13-May	15-May	19-May	21-May	22-May	25-May	01-Jun	04-Jun	09-Jun	17-Jun	17-Jun
England	>250m	296	19-Apr	21-Apr	23-Apr	25-Apr	26-Apr	28-Apr	29-Apr	02-May	05-May	07-May	11-May	14-May	18-May	20-May	24-May	26-May	31-May	06-Jun	11-Jun	28-Jun
Wales	All	107	21-Apr	24-Apr	27-Apr	28-Apr	30-Apr	03-May	05-May	06-May	09-May	11-May	18-May	22-May	26-May	28-May	31-May	04-Jun	08-Jun	13-Jun	18-Jun	03-Jul
Wales	<=250m	3	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	12-Jun	12-Jun	12-Jun	12-Jun	12-Jun	12-Jun	12-Jun	24-Jun	24-Jun	24-Jun	24-Jun	24-Jun	24-Jun	24-Jun
Wales	>250m	104	21-Apr	24-Apr	26-Apr	28-Apr	30-Apr	03-May	05-May	06-May	09-May	10-May	18-May	22-May	24-May	28-May	29-May	04-Jun	08-Jun	12-Jun	15-Jun	03-Jul
Scotland	All	360	19-Apr	22-Apr	24-Apr	26-Apr	27-Apr	28-Apr	30-Apr	02-May	05-May	07-May	08-May	11-May	15-May	19-May	23-May	25-May	30-May	04-Jun	11-Jun	29-Jun
Scotland	<=450m	252	18-Apr	21-Apr	23-Apr	25-Apr	26-Apr	28-Apr	29-Apr	01-May	03-May	06-May	08-May	10-May	15-May	18-May	21-May	24-May	27-May	01-Jun	08-Jun	29-Jun
Scotland	>450m	109	22-Apr	24-Apr	26-Apr	27-Apr	28-Apr	01-May	02-May	04-May	06-May	08-May	10-May	11-May	16-May	23-May	27-May	02-Jun	05-Jun	11-Jun	14-Jun	22-Jun

		N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Ringed Plover																						
GB	All	28	22-Apr	25-Apr	29-Apr	30-Apr	02-May	05-May	05-May	08-May	08-May	11-May	20-May	24-May	29-May	31-May	02-Jun	05-Jun	06-Jun	15-Jun	17-Jun	20-Jun
England	All	5	07-Apr	07-Apr	07-Apr	14-Apr	22-Apr	22-Apr	22-Apr	23-Apr	25-Apr	25-Apr	25-Apr	12-May	29-May	29-May	29-May	30-May	31-May	31-May	31-May	31-May
England	<=250m	2	07-Apr	07-Apr	07-Apr	07-Apr	07-Apr	07-Apr	07-Apr	07-Apr	07-Apr	14-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr
England	>250m	3	25-Apr	25-Apr	25-Apr	25-Apr	25-Apr	25-Apr	29-May	29-May	29-May	29-May	29-May	29-May	29-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May
Wales	All	0																				
Wales	<=250m	0																				
Wales	>250m	0																				
Scotland	All	23	29-Apr	30-Apr	30-Apr	05-May	05-May	05-May	08-May	08-May	09-May	14-May	20-May	24-May	26-May	05-Jun	05-Jun	06-Jun	14-Jun	15-Jun	17-Jun	20-Jun
Scotland	<=450m	23	29-Apr	30-Apr	30-Apr	05-May	05-May	05-May	08-May	08-May	09-May	14-May	20-May	24-May	26-May	05-Jun	05-Jun	06-Jun	14-Jun	15-Jun	17-Jun	20-Jun
Scotland	>450m	0																				
Short-eared Owl																						
GB	All	19	05-Apr	08-Apr	11-Apr	16-Apr	23-Apr	26-Apr	29-Apr	01-May	01-May	02-May	02-May	11-May	11-May	16-May	16-May	17-May	19-May	24-May	29-May	29-May
England	All	10	08-Apr	09-Apr	11-Apr	17-Apr	23-Apr	24-Apr	26-Apr	28-Apr	01-May	01-May	02-May	06-May	11-May	13-May	16-May	16-May	17-May	20-May	24-May	24-May
England	<=250m	2	01-May	01-May	01-May	01-May	01-May	01-May	01-May	01-May	01-May	09-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May
England	>250m	8	08-Apr	08-Apr	11-Apr	11-Apr	17-Apr	23-Apr	23-Apr	26-Apr	26-Apr	29-Apr	02-May	02-May	11-May	11-May	13-May	16-May	16-May	24-May	24-May	24-May
Wales	All	1	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr
Wales	<=250m	1	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr	05-Apr
Wales	>250m	0																				
Scotland	All	8	16-Apr	16-Apr	29-Apr	29-Apr	30-Apr	01-May	01-May	02-May	02-May	06-May	11-May	11-May	16-May	16-May	17-May	19-May	19-May	29-May	29-May	29-May
Scotland	<=450m	8	16-Apr	16-Apr	29-Apr	29-Apr	30-Apr	01-May	01-May	02-May	02-May	06-May	11-May	11-May	16-May	16-May	17-May	19-May	19-May	29-May	29-May	29-May
Scotland	>450m	0																				

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			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Skylark																						
GB	All	55	23-Apr	25-Apr	26-Apr	29-Apr	30-Apr	03-May	08-May	13-May	15-May	16-May	18-May	19-May	22-May	26-May	27-May	31-May	05-Jun	09-Jun	22-Jun	01-Jul
England	All	17	15-Apr	23-Apr	24-Apr	25-Apr	26-Apr	26-Apr	26-Apr	26-Apr	29-Apr	30-Apr	30-Apr	04-May	13-May	13-May	17-May	20-May	27-May	04-Jun	24-Jun	24-Jun
England	<=250m	3	13-May	13-May	13-May	13-May	13-May	13-May	20-May	20-May	20-May	20-May	20-May	20-May	20-May	27-May	27-May	27-May	27-May	27-May	27-May	27-May
England	>250m	14	15-Apr	23-Apr	24-Apr	24-Apr	25-Apr	26-Apr	26-Apr	26-Apr	26-Apr	27-Apr	29-Apr	30-Apr	30-Apr	30-Apr	04-May	17-May	17-May	04-Jun	24-Jun	24-Jun
Wales	All	4	29-Apr	29-Apr	29-Apr	29-Apr	15-May	31-May	31-May	31-May	31-May	04-Jun	08-Jun	08-Jun	08-Jun	08-Jun	08-Jun	09-Jun	09-Jun	09-Jun	09-Jun	09-Jun
Wales	<=250m	0																				
Wales	>250m	4	29-Apr	29-Apr	29-Apr	29-Apr	15-May	31-May	31-May	31-May	31-May	04-Jun	08-Jun	08-Jun	08-Jun	08-Jun	08-Jun	09-Jun	09-Jun	09-Jun	09-Jun	09-Jun
Scotland	All	34	25-Apr	30-Apr	03-May	08-May	11-May	14-May	15-May	16-May	18-May	18-May	19-May	22-May	25-May	26-May	27-May	01-Jun	05-Jun	18-Jun	22-Jun	01-Jul
Scotland	<=450m	34	25-Apr	30-Apr	03-May	08-May	11-May	14-May	15-May	16-May	18-May	18-May	19-May	22-May	25-May	26-May	27-May	01-Jun	05-Jun	18-Jun	22-Jun	01-Jul
Scotland	>450m	0																				
Snipe																						
GB	All	87	30-Mar	01-Apr	07-Apr	08-Apr	12-Apr	15-Apr	17-Apr	21-Apr	24-Apr	27-Apr	27-Apr	29-Apr	01-May	06-May	12-May	18-May	22-May	27-May	07-Jun	04-Jul
England	All	67	28-Mar	31-Mar	03-Apr	07-Apr	08-Apr	12-Apr	14-Apr	16-Apr	17-Apr	21-Apr	25-Apr	28-Apr	29-Apr	01-May	08-May	12-May	18-May	23-May	27-May	18-Jun
England	<=250m	11	28-Mar	03-Apr	03-Apr	05-Apr	05-Apr	12-Apr	12-Apr	16-Apr	16-Apr	04-May	16-May	16-May	18-May	18-May	19-May	19-May	25-May	25-May	26-May	26-May
England	>250m	56	24-Mar	31-Mar	01-Apr	07-Apr	08-Apr	12-Apr	14-Apr	16-Apr	17-Apr	21-Apr	24-Apr	27-Apr	29-Apr	29-Apr	01-May	08-May	12-May	22-May	01-Jun	18-Jun
Wales	All	1	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr
Wales	<=250m																					
Wales	>250m	1	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr	17-Apr
Scotland	All	19	09-Apr	20-Apr	23-Apr	25-Apr	27-Apr	27-Apr	27-Apr	28-Apr	29-Apr	05-May	10-May	13-May	15-May	26-May	29-May	29-May	07-Jun	09-Jun	04-Jul	04-Jul
Scotland	<=450m	19	09-Apr	20-Apr	23-Apr	25-Apr	27-Apr	27-Apr	27-Apr	28-Apr	29-Apr	05-May	10-May	13-May	15-May	26-May	29-May	29-May	07-Jun	09-Jun	04-Jul	04-Jul
Scotland	>450m	0																				

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			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Stonechat																						
GB	All	170	30-Mar	03-Apr	08-Apr	11-Apr	18-Apr	19-Apr	24-Apr	30-Apr	04-May	09-May	14-May	16-May	20-May	24-May	27-May	06-Jun	13-Jun	19-Jun	30-Jun	20-Jul
England	All	97	25-Mar	02-Apr	03-Apr	08-Apr	15-Apr	19-Apr	26-Apr	02-May	08-May	14-May	16-May	18-May	24-May	29-May	07-Jun	12-Jun	20-Jun	26-Jun	05-Jul	20-Jul
England	<=250m	22	31-Mar	03-Apr	08-Apr	14-Apr	15-Apr	19-Apr	24-Apr	26-Apr	29-Apr	04-May	18-May	20-May	24-May	25-May	12-Jun	15-Jun	25-Jun	26-Jun	30-Jun	12-Jul
England	>250m	75	25-Mar	02-Apr	03-Apr	06-Apr	13-Apr	19-Apr	30-Apr	04-May	11-May	15-May	16-May	18-May	23-May	29-May	07-Jun	11-Jun	16-Jun	26-Jun	05-Jul	20-Jul
Wales	All	37	03-Apr	08-Apr	10-Apr	17-Apr	18-Apr	23-Apr	23-Apr	27-Apr	29-Apr	02-May	03-May	07-May	14-May	18-May	27-May	05-Jun	13-Jun	18-Jun	19-Jun	20-Jun
Wales	<=250m	0																				
Wales	>250m	37	03-Apr	08-Apr	10-Apr	17-Apr	18-Apr	23-Apr	23-Apr	27-Apr	29-Apr	02-May	03-May	07-May	14-May	18-May	27-May	05-Jun	13-Jun	18-Jun	19-Jun	20-Jun
Scotland	All	36	05-Apr	09-Apr	10-Apr	13-Apr	16-Apr	18-Apr	22-Apr	02-May	06-May	09-May	14-May	14-May	17-May	20-May	21-May	23-May	25-May	27-May	12-Jun	08-Jul
Scotland	<=450m	36	05-Apr	09-Apr	10-Apr	13-Apr	16-Apr	18-Apr	22-Apr	02-May	06-May	09-May	14-May	14-May	17-May	20-May	21-May	23-May	25-May	27-May	12-Jun	08-Jul
Scotland	>450m	0																				
Twite																						
GB	All	316	10-May	14-May	16-May	18-May	20-May	21-May	23-May	25-May	26-May	28-May	29-May	31-May	03-Jun	06-Jun	11-Jun	17-Jun	24-Jun	30-Jun	07-Jul	18-Jul
England	All	273	12-May	14-May	16-May	18-May	20-May	22-May	23-May	25-May	26-May	28-May	30-May	31-May	03-Jun	06-Jun	11-Jun	16-Jun	23-Jun	29-Jun	07-Jul	18-Jul
England	<=250m	10	05-May	06-May	07-May	07-May	08-May	11-May	14-May	18-May	22-May	22-May	23-May	25-May	27-May	29-May	31-May	05-Jun	10-Jun	19-Jun	28-Jun	28-Jun
England	>250m	263	13-May	15-May	17-May	19-May	20-May	22-May	23-May	25-May	26-May	28-May	30-May	01-Jun	03-Jun	06-Jun	11-Jun	17-Jun	23-Jun	30-Jun	07-Jul	18-Jul
Wales	All	2	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	09-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May
Wales	<=250m	1	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May
Wales	>250m	1	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May	07-May
Scotland	All	41	07-May	09-May	11-May	14-May	16-May	16-May	23-May	27-May	28-May	29-May	30-May	01-Jun	03-Jun	11-Jun	12-Jun	29-Jun	30-Jun	03-Jul	07-Jul	14-Jul
Scotland	<=450m	37	01-May	08-May	09-May	12-May	14-May	16-May	16-May	24-May	28-May	29-May	30-May	02-Jun	05-Jun	11-Jun	26-Jun	29-Jun	01-Jul	05-Jul	12-Jul	14-Jul
Scotland	>450m	4	23-May	23-May	23-May	23-May	25-May	27-May	27-May	27-May	27-May	28-May	30-May	30-May	30-May	30-May	05-Jun	11-Jun	11-Jun	11-Jun	11-Jun	11-Jun

		N	date by which X% have started laying																		
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Wheatear																					
GB	All	364	01-May	04-May	06-May	07-May	09-May	11-May	12-May	13-May	14-May	15-May	15-May	17-May	18-May	19-May	21-May	25-May	29-May	03-Jun	09-Jun	24-Jun
England	All	42	27-Apr	28-Apr	29-Apr	01-May	03-May	05-May	06-May	07-May	11-May	12-May	12-May	12-May	13-May	15-May	17-May	19-May	29-May	04-Jun	06-Jun	24-Jun
England	<=250m	12	22-Apr	24-Apr	24-Apr	27-Apr	27-Apr	28-Apr	29-Apr	29-Apr	29-Apr	30-Apr	01-May	03-May	03-May	05-May	05-May	06-May	07-May	07-May	15-May	15-May
England	>250m	30	01-May	02-May	06-May	07-May	11-May	11-May	12-May	12-May	12-May	12-May	13-May	14-May	17-May	18-May	29-May	30-May	04-Jun	05-Jun	07-Jun	24-Jun
Wales	All	22	23-Apr	25-Apr	26-Apr	02-May	03-May	04-May	04-May	05-May	13-May	14-May	14-May	15-May	15-May	20-May	20-May	22-May	25-May	01-Jun	03-Jun	17-Jun
Wales	<=250m	1	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May	15-May
Wales	>250m	21	23-Apr	25-Apr	26-Apr	02-May	03-May	04-May	04-May	05-May	13-May	14-May	14-May	14-May	15-May	20-May	20-May	22-May	25-May	01-Jun	03-Jun	17-Jun
Scotland	All	300	03-May	05-May	07-May	09-May	11-May	12-May	13-May	14-May	14-May	15-May	16-May	17-May	18-May	19-May	21-May	25-May	27-May	03-Jun	10-Jun	20-Jun
Scotland	<=450m	285	03-May	05-May	07-May	09-May	11-May	12-May	13-May	14-May	14-May	15-May	16-May	17-May	18-May	19-May	21-May	24-May	27-May	03-Jun	10-Jun	20-Jun
Scotland	>450m	15	08-May	09-May	10-May	10-May	11-May	15-May	15-May	16-May	17-May	18-May	19-May	21-May	24-May	25-May	29-May	30-May	31-May	08-Jun	08-Jun	08-Jun
Whinchat																					
GB	All	518	13-May	15-May	17-May	18-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	29-May	30-May	01-Jun	03-Jun	07-Jun	11-Jun	16-Jun	12-Jul
England	All	114	15-May	17-May	18-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	26-May	27-May	28-May	29-May	31-May	02-Jun	04-Jun	10-Jun	18-Jun	12-Jul
England	<=250m	24	17-May	19-May	19-May	20-May	22-May	24-May	24-May	25-May	25-May	25-May	26-May	26-May	26-May	26-May	26-May	31-May	03-Jun	03-Jun	10-Jun	12-Jul
England	>250m	90	15-May	17-May	18-May	20-May	21-May	22-May	22-May	23-May	25-May	26-May	27-May	28-May	29-May	30-May	01-Jun	02-Jun	05-Jun	11-Jun	18-Jun	01-Jul
Wales	All	286	12-May	14-May	15-May	16-May	17-May	18-May	20-May	20-May	21-May	23-May	24-May	26-May	28-May	29-May	31-May	03-Jun	08-Jun	11-Jun	17-Jun	03-Jul
Wales	<=250m	18	16-May	16-May	17-May	18-May	19-May	20-May	26-May	28-May	30-May	30-May	30-May	31-May	01-Jun	01-Jun	02-Jun	04-Jun	10-Jun	11-Jun	18-Jun	18-Jun
Wales	>250m	268	12-May	14-May	15-May	16-May	17-May	18-May	20-May	20-May	21-May	23-May	24-May	25-May	27-May	29-May	30-May	02-Jun	08-Jun	11-Jun	17-Jun	03-Jul
Scotland	All	118	17-May	20-May	21-May	22-May	24-May	24-May	26-May	27-May	27-May	28-May	29-May	30-May	01-Jun	02-Jun	03-Jun	05-Jun	06-Jun	10-Jun	15-Jun	25-Jun
Scotland	<=450m	116	17-May	20-May	21-May	22-May	24-May	24-May	26-May	26-May	27-May	28-May	29-May	30-May	01-Jun	02-Jun	03-Jun	05-Jun	06-Jun	10-Jun	15-Jun	25-Jun
Scotland	>450m	2	27-May	27-May	27-May	27-May	27-May	27-May	27-May	27-May	27-May	30-May	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun	02-Jun

		N	date by which X% have started laying																		
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Wren																						
GB	All	177	25-Apr	27-Apr	01-May	03-May	04-May	06-May	08-May	11-May	12-May	16-May	17-May	25-May	31-May	05-Jun	10-Jun	17-Jun	20-Jun	24-Jun	03-Jul	01-Aug
England	All	83	28-Apr	02-May	03-May	05-May	06-May	08-May	09-May	11-May	14-May	16-May	22-May	28-May	31-May	10-Jun	17-Jun	20-Jun	24-Jun	29-Jun	04-Jul	01-Aug
England	<=250m	78	27-Apr	01-May	03-May	05-May	06-May	08-May	09-May	12-May	15-May	16-May	23-May	29-May	02-Jun	10-Jun	17-Jun	20-Jun	24-Jun	01-Jul	13-Jul	01-Aug
England	>250m	5	03-May	03-May	03-May	06-May	09-May	09-May	09-May	10-May	11-May	11-May	11-May	11-May	12-May	12-May	12-May	27-May	11-Jun	11-Jun	11-Jun	11-Jun
Wales	All	62	22-Apr	27-Apr	01-May	03-May	03-May	06-May	11-May	11-May	12-May	16-May	17-May	23-May	27-May	05-Jun	09-Jun	15-Jun	17-Jun	22-Jun	02-Jul	13-Jul
Wales	<=250m	43	27-Apr	01-May	03-May	04-May	08-May	11-May	12-May	13-May	16-May	17-May	18-May	02-Jun	07-Jun	09-Jun	15-Jun	17-Jun	22-Jun	29-Jun	10-Jul	13-Jul
Wales	>250m	19	10-Apr	15-Apr	21-Apr	23-Apr	27-Apr	01-May	03-May	03-May	05-May	11-May	11-May	17-May	19-May	23-May	23-May	27-May	05-Jun	21-Jun	25-Jun	25-Jun
Scotland	All	32	25-Apr	26-Apr	27-Apr	28-Apr	30-Apr	01-May	03-May	03-May	08-May	14-May	16-May	21-May	26-May	03-Jun	05-Jun	06-Jun	17-Jun	18-Jun	21-Jun	22-Jun
Scotland	<=450m	32	25-Apr	26-Apr	27-Apr	28-Apr	30-Apr	01-May	03-May	03-May	08-May	14-May	16-May	21-May	26-May	03-Jun	05-Jun	06-Jun	17-Jun	18-Jun	21-Jun	22-Jun
Scotland	>450m	0																				

Appendix 5 Full list of percentiles for first egg laying dates derived from ringed pulli

date by which X% have started laying

Country	Ringing age	N	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Common Gull												
GB /	Mid	10908	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	02-May	04-May	04-May	06-May	08-May
Scotland	1 day	10908	06-May	08-May	10-May	12-May	14-May	14-May	16-May	18-May	20-May	20-May
Common Sandpiper												
GB	Mid	319	30-Apr	02-May	04-May	06-May	07-May	09-May	10-May	11-May	12-May	14-May
England	Mid	35	02-May	08-May	10-May	11-May	12-May	13-May	14-May	15-May	15-May	16-May
Wales	Mid	2	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	11-May
Scotland	Mid	282	30-Apr	02-May	04-May	05-May	07-May	08-May	09-May	10-May	12-May	13-May
GB	1 day	319	06-May	08-May	10-May	12-May	13-May	15-May	16-May	17-May	18-May	20-May
England	1 day	35	08-May	14-May	16-May	16-May	18-May	19-May	20-May	21-May	21-May	22-May
Wales	1 day	2	16-May	16-May	16-May	16-May	16-May	16-May	16-May	16-May	16-May	17-May
Scotland	1 day	282	06-May	08-May	10-May	11-May	13-May	14-May	15-May	16-May	18-May	19-May
Curlew												
GB	Mid	1042	04-Apr	08-Apr	10-Apr	12-Apr	16-Apr	16-Apr	18-Apr	20-Apr	22-Apr	24-Apr
England	Mid	454	02-Apr	06-Apr	08-Apr	12-Apr	14-Apr	16-Apr	16-Apr	18-Apr	20-Apr	20-Apr
Wales	Mid	3	08-Apr	08-Apr	08-Apr	08-Apr	08-Apr	08-Apr	14-Apr	14-Apr	14-Apr	14-Apr
Scotland	Mid	585	08-Apr	10-Apr	12-Apr	14-Apr	16-Apr	18-Apr	20-Apr	24-Apr	24-Apr	28-Apr
GB	1 day	1042	21-Apr	25-Apr	27-Apr	29-Apr	02-May	03-May	05-May	06-May	08-May	10-May
England	1 day	454	19-Apr	22-Apr	25-Apr	28-Apr	30-Apr	02-May	03-May	04-May	06-May	07-May
Wales	1 day	3	25-Apr	25-Apr	25-Apr	25-Apr	25-Apr	25-Apr	30-Apr	30-Apr	30-Apr	30-Apr
Scotland	1 day	585	24-Apr	26-Apr	29-Apr	01-May	03-May	05-May	07-May	10-May	11-May	14-May
Dunlin												
GB	Mid	168	04-May	07-May	08-May	09-May	10-May	12-May	12-May	13-May	13-May	13-May
England	Mid	1	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr
Scotland	Mid	167	05-May	07-May	08-May	09-May	10-May	12-May	12-May	13-May	13-May	13-May
GB	1 day	168	15-May	18-May	19-May	20-May	21-May	23-May	23-May	24-May	24-May	24-May
England	1 day	1	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May
Scotland	1 day	167	16-May	18-May	19-May	20-May	21-May	23-May	23-May	24-May	24-May	24-May

Country	Ringing age	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Common Gull											
GB /	Mid	08-May	10-May	12-May	12-May	16-May	18-May	20-May	20-May	24-May	29-Jun
Scotland	1 day	22-May	24-May	24-May	26-May	28-May	30-May	01-Jun	03-Jun	05-Jun	11-Jul
Common Sandpiper											
GB	Mid	15-May	17-May	19-May	21-May	23-May	26-May	28-May	01-Jun	09-Jun	24-Jun
England	Mid	16-May	17-May	18-May	21-May	27-May	29-May	30-May	03-Jun	07-Jun	10-Jun
Wales	Mid	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May	11-May
Scotland	Mid	15-May	17-May	19-May	21-May	23-May	25-May	28-May	01-Jun	09-Jun	24-Jun
GB	1 day	21-May	23-May	25-May	27-May	29-May	01-Jun	03-Jun	07-Jun	15-Jun	30-Jun
England	1 day	22-May	22-May	24-May	27-May	02-Jun	04-Jun	05-Jun	09-Jun	13-Jun	16-Jun
Wales	1 day	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May	17-May
Scotland	1 day	21-May	23-May	25-May	27-May	29-May	31-May	03-Jun	07-Jun	15-Jun	30-Jun
Curlew											
GB	Mid	26-Apr	28-Apr	30-Apr	02-May	04-May	06-May	08-May	12-May	20-May	11-Jun
England	Mid	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	02-May	04-May	08-May	14-May	07-Jun
Wales	Mid	14-Apr	14-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr	20-Apr
Scotland	Mid	28-Apr	30-Apr	02-May	04-May	06-May	08-May	12-May	16-May	22-May	11-Jun
GB	1 day	12-May	14-May	16-May	18-May	20-May	22-May	25-May	29-May	05-Jun	28-Jun
England	1 day	09-May	10-May	12-May	14-May	16-May	19-May	21-May	25-May	30-May	23-Jun
Wales	1 day	30-Apr	30-Apr	30-Apr	06-May	06-May	06-May	06-May	06-May	06-May	06-May
Scotland	1 day	15-May	17-May	18-May	20-May	23-May	25-May	28-May	02-Jun	07-Jun	28-Jun
Dunlin											
GB	Mid	14-May	15-May	15-May	16-May	16-May	17-May	18-May	24-May	29-May	15-Jun
England	Mid	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr
Scotland	Mid	14-May	15-May	15-May	16-May	16-May	17-May	18-May	24-May	29-May	15-Jun
GB	1 day	25-May	26-May	26-May	27-May	27-May	28-May	29-May	04-Jun	09-Jun	26-Jun
England	1 day	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May	10-May
Scotland	1 day	25-May	26-May	26-May	27-May	27-May	28-May	29-May	04-Jun	09-Jun	26-Jun

Country	Ringing age	N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Golden Eagle																						
GB	Mid	131	11-Mar	15-Mar	18-Mar	22-Mar	23-Mar	24-Mar	26-Mar	27-Mar	29-Mar	30-Mar	31-Mar	01-Apr	02-Apr	03-Apr	04-Apr	05-Apr	09-Apr	12-Apr	16-Apr	25-Apr
England	Mid	1	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Scotland	Mid	130	11-Mar	15-Mar	18-Mar	22-Mar	23-Mar	24-Mar	26-Mar	27-Mar	29-Mar	30-Mar	31-Mar	01-Apr	02-Apr	03-Apr	04-Apr	06-Apr	09-Apr	12-Apr	16-Apr	25-Apr
Golden Plover																						
GB	Mid	145	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr	12-Apr	13-Apr	14-Apr	16-Apr	17-Apr	18-Apr	22-Apr	23-Apr	24-Apr	27-Apr	28-Apr	01-May	07-May	19-May	06-Jun
England	Mid	108	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr	12-Apr	12-Apr	14-Apr	16-Apr	16-Apr	18-Apr	21-Apr	22-Apr	23-Apr	25-Apr	27-Apr	28-Apr	29-Apr	07-May	23-May
Scotland	Mid	37	30-Mar	06-Apr	06-Apr	08-Apr	11-Apr	15-Apr	15-Apr	16-Apr	18-Apr	18-Apr	22-Apr	26-Apr	04-May	04-May	06-May	11-May	19-May	27-May	02-Jun	06-Jun
GB	1 day	145	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr	25-Apr	26-Apr	27-Apr	29-Apr	30-Apr	01-May	05-May	06-May	07-May	10-May	11-May	14-May	20-May	01-Jun	19-Jun
England	1 day	108	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr	25-Apr	25-Apr	27-Apr	29-Apr	29-Apr	01-May	04-May	05-May	06-May	08-May	10-May	11-May	12-May	20-May	05-Jun
Scotland	1 day	37	12-Apr	19-Apr	19-Apr	21-Apr	24-Apr	28-Apr	28-Apr	29-Apr	01-May	01-May	05-May	09-May	17-May	17-May	19-May	24-May	01-Jun	09-Jun	15-Jun	19-Jun
Hen Harrier																						
GB	Mid	680	24-Apr	29-Apr	01-May	03-May	05-May	06-May	08-May	09-May	10-May	12-May	13-May	16-May	17-May	18-May	20-May	22-May	24-May	28-May	03-Jun	05-Jul
England	Mid	41	17-Apr	19-Apr	21-Apr	22-Apr	23-Apr	24-Apr	25-Apr	26-Apr	28-Apr	28-Apr	30-Apr	01-May	02-May	02-May	07-May	10-May	15-May	24-May	28-May	05-Jul
Wales	Mid	77	02-May	03-May	07-May	09-May	12-May	12-May	13-May	15-May	17-May	19-May	20-May	22-May	23-May	25-May	29-May	31-May	01-Jun	02-Jun	10-Jun	20-Jun
Scotland	Mid	562	26-Apr	30-Apr	01-May	03-May	05-May	06-May	08-May	09-May	10-May	12-May	13-May	15-May	17-May	18-May	19-May	22-May	23-May	26-May	01-Jun	21-Jun
Lapwing																						
GB	Mid	5345	19-Mar	23-Mar	27-Mar	31-Mar	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr	12-Apr	14-Apr	16-Apr	18-Apr	20-Apr	22-Apr	26-Apr	30-Apr	04-May	10-May	15-Jun
England	Mid	1873	17-Mar	23-Mar	27-Mar	31-Mar	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr	12-Apr	14-Apr	16-Apr	18-Apr	20-Apr	24-Apr	26-Apr	30-Apr	04-May	10-May	15-Jun
Wales	Mid	11	15-Mar	17-Mar	17-Mar	19-Mar	19-Mar	23-Mar	23-Mar	23-Mar	23-Mar	27-Mar	08-Apr	08-Apr	08-Apr	08-Apr	10-Apr	10-Apr	12-Apr	12-Apr	18-Apr	18-Apr
Scotland	Mid	3461	19-Mar	25-Mar	27-Mar	31-Mar	02-Apr	04-Apr	06-Apr	08-Apr	10-Apr	12-Apr	12-Apr	16-Apr	18-Apr	20-Apr	22-Apr	26-Apr	28-Apr	04-May	10-May	13-Jun
GB	1 day	5345	04-Apr	08-Apr	12-Apr	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr	25-Apr	27-Apr	29-Apr	01-May	03-May	05-May	08-May	11-May	15-May	19-May	26-May	01-Jul
England	1 day	1873	02-Apr	08-Apr	11-Apr	15-Apr	17-Apr	19-Apr	21-Apr	23-Apr	25-Apr	27-Apr	29-Apr	01-May	04-May	06-May	09-May	11-May	15-May	19-May	26-May	01-Jul
Wales	1 day	11	31-Mar	02-Apr	02-Apr	03-Apr	03-Apr	07-Apr	07-Apr	07-Apr	07-Apr	12-Apr	23-Apr	23-Apr	23-Apr	23-Apr	25-Apr	25-Apr	27-Apr	27-Apr	03-May	03-May
Scotland	1 day	3461	04-Apr	09-Apr	12-Apr	15-Apr	17-Apr	19-Apr	22-Apr	23-Apr	25-Apr	27-Apr	28-Apr	01-May	03-May	05-May	08-May	11-May	14-May	20-May	26-May	28-Jun
Meadow Pipit																						
GB	Mid	541	28-Apr	02-May	04-May	06-May	07-May	09-May	10-May	11-May	12-May	13-May	14-May	16-May	19-May	22-May	27-May	01-Jun	10-Jun	13-Jun	20-Jun	06-Aug
England	Mid	123	18-Apr	28-Apr	29-Apr	01-May	02-May	03-May	05-May	06-May	07-May	08-May	09-May	11-May	14-May	18-May	22-May	24-May	30-May	09-Jun	20-Jun	05-Jul
Wales	Mid	15	24-Apr	06-May	07-May	07-May	07-May	09-May	09-May	09-May	09-May	10-May	10-May	14-May	14-May	02-Jun	09-Jun	10-Jun	10-Jun	12-Jun	23-Jun	23-Jun
Scotland	Mid	403	01-May	04-May	06-May	08-May	09-May	10-May	11-May	12-May	13-May	14-May	15-May	18-May	21-May	24-May	28-May	05-Jun	10-Jun	15-Jun	20-Jun	06-Aug

Country	Ringing age	N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Merlin																						
GB	Mid	1180	27-Apr	30-Apr	02-May	03-May	04-May	05-May	06-May	07-May	08-May	09-May	09-May	10-May	11-May	12-May	13-May	14-May	16-May	18-May	23-May	08-Jul
England	Mid	530	27-Apr	29-Apr	30-Apr	02-May	03-May	04-May	05-May	06-May	07-May	08-May	09-May	10-May	11-May	12-May	13-May	14-May	16-May	18-May	22-May	08-Jul
Wales	Mid	84	26-Apr	01-May	02-May	04-May	04-May	06-May	07-May	08-May	09-May	09-May	10-May	10-May	11-May	12-May	13-May	13-May	14-May	18-May	23-May	01-Jun
Scotland	Mid	566	29-Apr	01-May	02-May	04-May	05-May	05-May	06-May	07-May	08-May	09-May	10-May	10-May	11-May	12-May	13-May	15-May	17-May	19-May	23-May	12-Jun
Oystercatcher																						
GB	Mid	2080	16-Apr	19-Apr	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	02-May	04-May	05-May	07-May	09-May	11-May	13-May	15-May	16-May	18-May	22-May	28-May	15-Jul
England	Mid	73	06-Apr	12-Apr	13-Apr	15-Apr	17-Apr	18-Apr	22-Apr	23-Apr	24-Apr	24-Apr	25-Apr	26-Apr	28-Apr	30-Apr	03-May	06-May	09-May	11-May	20-May	04-Jun
Wales	Mid	2	04-May	04-May	04-May	04-May	04-May	04-May	04-May	04-May	04-May	05-May	06-May	06-May	06-May	06-May	06-May	06-May	06-May	06-May	06-May	06-May
Scotland	Mid	2005	16-Apr	20-Apr	22-Apr	25-Apr	26-Apr	29-Apr	30-Apr	02-May	04-May	06-May	08-May	09-May	11-May	13-May	15-May	16-May	18-May	23-May	28-May	15-Jul
GB	1 day	2076	02-May	06-May	08-May	10-May	12-May	14-May	16-May	18-May	20-May	22-May	24-May	26-May	28-May	30-May	01-Jun	01-Jun	03-Jun	07-Jun	13-Jun	31-Jul
England	1 day	73	22-Apr	28-Apr	30-Apr	02-May	04-May	04-May	08-May	10-May	10-May	10-May	12-May	12-May	14-May	16-May	20-May	22-May	26-May	28-May	05-Jun	21-Jun
Wales	1 day	2	20-May	20-May	20-May	20-May	20-May	20-May	20-May	20-May	20-May	21-May	22-May	22-May	22-May	22-May	22-May	22-May	22-May	22-May	22-May	22-May
Scotland	1 day	2005	02-May	06-May	08-May	12-May	12-May	16-May	16-May	18-May	20-May	22-May	24-May	26-May	28-May	30-May	01-Jun	01-Jun	03-Jun	09-Jun	13-Jun	31-Jul
Peregrine																						
GB	Mid	602	01-Apr	04-Apr	06-Apr	08-Apr	09-Apr	09-Apr	11-Apr	12-Apr	13-Apr	13-Apr	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	21-Apr	23-Apr	28-Apr	03-May	28-May
England	Mid	236	31-Mar	04-Apr	05-Apr	07-Apr	08-Apr	09-Apr	10-Apr	11-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	22-Apr	24-Apr	28-Apr	02-May	23-May
Wales	Mid	72	27-Mar	01-Apr	03-Apr	05-Apr	07-Apr	08-Apr	10-Apr	10-Apr	11-Apr	11-Apr	13-Apr	15-Apr	15-Apr	16-Apr	17-Apr	18-Apr	21-Apr	27-Apr	04-May	15-May
Scotland	Mid	294	02-Apr	05-Apr	08-Apr	08-Apr	09-Apr	10-Apr	11-Apr	12-Apr	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	21-Apr	23-Apr	28-Apr	05-May	28-May
Redshank																						
GB	Mid	350	08-Apr	12-Apr	14-Apr	18-Apr	18-Apr	20-Apr	22-Apr	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	02-May	04-May	04-May	06-May	08-May	10-May	18-May	30-May
England	Mid	74	04-Apr	10-Apr	14-Apr	16-Apr	16-Apr	18-Apr	20-Apr	22-Apr	22-Apr	23-Apr	24-Apr	26-Apr	26-Apr	26-Apr	28-Apr	02-May	04-May	06-May	10-May	26-May
Wales	Mid	1	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr	28-Apr
Scotland	Mid	275	10-Apr	12-Apr	14-Apr	18-Apr	20-Apr	20-Apr	22-Apr	24-Apr	26-Apr	28-Apr	30-Apr	02-May	02-May	04-May	04-May	06-May	08-May	12-May	18-May	30-May
GB	1 day	350	22-Apr	26-Apr	28-Apr	02-May	02-May	04-May	06-May	06-May	08-May	10-May	12-May	14-May	16-May	18-May	18-May	20-May	22-May	24-May	01-Jun	13-Jun
England	1 day	74	18-Apr	24-Apr	28-Apr	30-Apr	30-Apr	02-May	04-May	06-May	06-May	07-May	08-May	10-May	10-May	10-May	12-May	16-May	18-May	20-May	24-May	09-Jun
Wales	1 day	1	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May	12-May
Scotland	1 day	275	24-Apr	26-Apr	28-Apr	02-May	04-May	04-May	06-May	08-May	10-May	12-May	14-May	16-May	16-May	18-May	18-May	20-May	22-May	26-May	01-Jun	13-Jun

Country	Ringing age	N	date by which X% have started laying																			
			5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Ring Ouzel																						
GB	Mid	531	17-Apr	21-Apr	23-Apr	24-Apr	26-Apr	27-Apr	29-Apr	30-Apr	02-May	05-May	08-May	14-May	20-May	24-May	28-May	30-May	02-Jun	06-Jun	11-Jun	03-Jul
England	Mid	109	15-Apr	18-Apr	20-Apr	23-Apr	25-Apr	26-Apr	28-Apr	29-Apr	01-May	02-May	03-May	06-May	13-May	20-May	22-May	25-May	28-May	31-May	11-Jun	21-Jun
Wales	Mid	3	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	27-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	29-Apr	09-Jun	09-Jun	09-Jun	09-Jun	09-Jun	09-Jun	09-Jun
Scotland	Mid	419	18-Apr	21-Apr	24-Apr	24-Apr	26-Apr	28-Apr	29-Apr	01-May	02-May	06-May	10-May	17-May	22-May	26-May	29-May	01-Jun	03-Jun	06-Jun	11-Jun	03-Jul
Ringed Plover																						
GB	Mid	329	17-Apr	22-Apr	26-Apr	28-Apr	30-Apr	03-May	05-May	09-May	11-May	14-May	15-May	18-May	20-May	23-May	26-May	01-Jun	04-Jun	07-Jun	18-Jun	14-Jul
England	Mid	9	24-Mar	24-Mar	04-Apr	04-Apr	06-Apr	06-Apr	09-Apr	09-Apr	21-Apr	21-Apr	21-Apr	21-Apr	21-Apr	24-Apr	24-Apr	28-Apr	28-Apr	01-May	01-May	01-May
Scotland	Mid	320	19-Apr	24-Apr	27-Apr	29-Apr	01-May	04-May	06-May	10-May	12-May	14-May	15-May	18-May	20-May	23-May	27-May	02-Jun	04-Jun	07-Jun	18-Jun	14-Jul
GB	1 day	329	28-Apr	04-May	08-May	10-May	12-May	14-May	16-May	20-May	22-May	26-May	26-May	30-May	01-Jun	03-Jun	07-Jun	13-Jun	15-Jun	19-Jun	29-Jun	25-Jul
England	1 day	9	04-Apr	04-Apr	16-Apr	16-Apr	18-Apr	18-Apr	20-Apr	20-Apr	02-May	02-May	02-May	02-May	02-May	06-May	06-May	10-May	10-May	12-May	12-May	12-May
Scotland	1 day	320	30-Apr	06-May	08-May	10-May	12-May	16-May	18-May	22-May	24-May	26-May	26-May	30-May	01-Jun	03-Jun	07-Jun	13-Jun	15-Jun	19-Jun	29-Jun	25-Jul
Short-eared Owl																						
GB	Mid	124	27-Mar	30-Mar	02-Apr	04-Apr	09-Apr	14-Apr	16-Apr	18-Apr	21-Apr	26-Apr	29-Apr	01-May	03-May	07-May	11-May	14-May	18-May	26-May	29-May	30-Jun
England	Mid	46	09-Mar	28-Mar	03-Apr	05-Apr	15-Apr	16-Apr	20-Apr	25-Apr	27-Apr	29-Apr	30-Apr	01-May	01-May	05-May	07-May	11-May	25-May	27-May	29-May	15-Jun
Wales	Mid	2	18-Apr	18-Apr	18-Apr	18-Apr	18-Apr	18-Apr	18-Apr	18-Apr	21-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr	24-Apr
Scotland	Mid	76	29-Mar	30-Mar	01-Apr	04-Apr	08-Apr	12-Apr	14-Apr	16-Apr	20-Apr	22-Apr	26-Apr	30-Apr	05-May	10-May	13-May	14-May	17-May	26-May	07-Jun	30-Jun
Skylark																						
GB	Mid	116	02-May	05-May	07-May	10-May	11-May	15-May	16-May	18-May	20-May	22-May	26-May	26-May	28-May	01-Jun	11-Jun	15-Jun	20-Jun	24-Jun	03-Jul	25-Jul
England	Mid	17	28-Apr	28-Apr	29-Apr	04-May	10-May	10-May	10-May	16-May	18-May	20-May	24-May	24-May	26-May	26-May	01-Jun	05-Jun	05-Jun	13-Jun	15-Jun	15-Jun
Scotland	Mid	99	04-May	06-May	07-May	10-May	11-May	15-May	16-May	18-May	20-May	22-May	26-May	27-May	28-May	01-Jun	14-Jun	18-Jun	21-Jun	25-Jun	03-Jul	25-Jul
Snipe																						
GB	Mid	163	10-Apr	16-Apr	20-Apr	22-Apr	23-Apr	26-Apr	29-Apr	02-May	05-May	07-May	10-May	13-May	17-May	19-May	28-May	02-Jun	07-Jun	11-Jun	20-Jun	20-Jul
England	Mid	39	10-Apr	13-Apr	14-Apr	18-Apr	19-Apr	21-Apr	22-Apr	23-Apr	23-Apr	27-Apr	29-Apr	29-Apr	02-May	04-May	07-May	10-May	16-May	28-May	06-Jun	07-Jun
Scotland	Mid	124	10-Apr	18-Apr	22-Apr	24-Apr	27-Apr	01-May	03-May	05-May	09-May	12-May	15-May	18-May	21-May	28-May	02-Jun	05-Jun	10-Jun	17-Jun	24-Jun	20-Jul
GB	1 day	163	19-Apr	25-Apr	29-Apr	01-May	02-May	05-May	08-May	11-May	14-May	16-May	19-May	22-May	26-May	28-May	06-Jun	11-Jun	16-Jun	20-Jun	29-Jun	29-Jul
England	1 day	39	19-Apr	22-Apr	23-Apr	27-Apr	28-Apr	30-Apr	01-May	02-May	02-May	06-May	08-May	08-May	11-May	13-May	16-May	19-May	25-May	06-Jun	15-Jun	16-Jun
Scotland	1 day	124	19-Apr	27-Apr	01-May	03-May	06-May	10-May	12-May	14-May	18-May	21-May	24-May	27-May	30-May	06-Jun	11-Jun	14-Jun	19-Jun	26-Jun	03-Jul	29-Jul

Country	Ringing age	N	date by which X% have started laying 5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
Stonechat																						
GB	Mid	296	31-Mar	03-Apr	06-Apr	07-Apr	10-Apr	11-Apr	13-Apr	15-Apr	18-Apr	18-Apr	19-Apr	23-Apr	29-Apr	08-May	16-May	20-May	28-May	08-Jun	18-Jun	20-Jul
England	Mid	207	02-Apr	04-Apr	07-Apr	09-Apr	10-Apr	12-Apr	14-Apr	15-Apr	17-Apr	18-Apr	18-Apr	22-Apr	23-Apr	01-May	15-May	23-May	02-Jun	08-Jun	18-Jun	20-Jul
Wales	Mid	14	02-Apr	05-Apr	19-Apr	19-Apr	24-Apr	30-Apr	30-Apr	01-May	14-May	17-May	17-May	06-Jun	13-Jun	13-Jun	13-Jun	14-Jun	14-Jun	29-Jun	14-Jul	14-Jul
Scotland	Mid	75	30-Mar	31-Mar	01-Apr	04-Apr	07-Apr	08-Apr	10-Apr	13-Apr	17-Apr	18-Apr	19-Apr	28-Apr	05-May	10-May	16-May	16-May	18-May	24-May	08-Jun	11-Jul
Twite																						
GB	Mid	245	02-May	06-May	06-May	10-May	10-May	12-May	14-May	14-May	18-May	20-May	22-May	28-May	03-Jun	09-Jun	13-Jun	19-Jun	25-Jun	01-Jul	09-Jul	21-Jul
England	Mid	91	06-May	06-May	06-May	08-May	10-May	12-May	12-May	14-May	14-May	14-May	16-May	18-May	20-May	24-May	28-May	01-Jun	07-Jun	11-Jun	23-Jun	11-Jul
Scotland	Mid	154	30-Apr	04-May	06-May	10-May	12-May	14-May	14-May	18-May	22-May	28-May	01-Jun	09-Jun	11-Jun	19-Jun	21-Jun	25-Jun	29-Jun	07-Jul	13-Jul	21-Jul
Wheatear																						
GB	Mid	526	30-Apr	02-May	02-May	04-May	04-May	04-May	06-May	06-May	08-May	08-May	10-May	10-May	10-May	12-May	12-May	14-May	16-May	20-May	30-May	21-Jun
England	Mid	248	28-Apr	30-Apr	30-Apr	02-May	02-May	04-May	04-May	04-May	06-May	06-May	06-May	08-May	10-May	10-May	12-May	14-May	16-May	20-May	30-May	21-Jun
Wales	Mid	47	02-May	04-May	04-May	04-May	06-May	06-May	08-May	08-May	10-May	10-May	12-May	12-May	12-May	14-May	14-May	16-May	16-May	20-May	20-May	28-May
Scotland	Mid	231	02-May	02-May	04-May	04-May	06-May	06-May	08-May	08-May	08-May	10-May	10-May	10-May	12-May	12-May	14-May	14-May	18-May	20-May	30-May	21-Jun
Whinchat																						
GB	Mid	184	13-May	16-May	17-May	18-May	20-May	20-May	22-May	22-May	23-May	24-May	26-May	27-May	29-May	29-May	01-Jun	03-Jun	13-Jun	15-Jun	21-Jun	27-Jun
England	Mid	98	13-May	16-May	17-May	18-May	20-May	20-May	22-May	22-May	24-May	24-May	25-May	26-May	27-May	28-May	29-May	01-Jun	02-Jun	04-Jun	13-Jun	25-Jun
Wales	Mid	55	10-May	16-May	19-May	19-May	20-May	21-May	22-May	22-May	23-May	26-May	28-May	29-May	30-May	14-Jun	14-Jun	16-Jun	19-Jun	21-Jun	23-Jun	27-Jun
Scotland	Mid	31	09-May	15-May	16-May	17-May	17-May	20-May	22-May	22-May	23-May	23-May	26-May	28-May	29-May	31-May	31-May	01-Jun	14-Jun	20-Jun	23-Jun	27-Jun
Wren																						
GB	Mid	38	21-Apr	27-Apr	29-Apr	02-May	03-May	06-May	07-May	08-May	09-May	09-May	10-May	12-May	17-May	23-May	28-May	29-May	18-Jun	25-Jun	05-Jul	29-Jul
England	Mid	12	27-Apr	27-Apr	27-Apr	29-Apr	29-Apr	01-May	03-May	03-May	08-May	08-May	08-May	09-May	09-May	09-May	09-May	17-May	05-Jul	05-Jul	29-Jul	29-Jul
Wales	Mid	10	11-Apr	21-Apr	21-Apr	22-Apr	22-Apr	22-Apr	02-May	02-May	03-May	05-May	05-May	06-May	06-May	07-May	07-May	07-May	07-May	10-May	10-May	10-May
Scotland	Mid	16	07-May	10-May	11-May	12-May	12-May	17-May	19-May	23-May	23-May	23-May	28-May	29-May	29-May	18-Jun	18-Jun	18-Jun	19-Jun	25-Jun	26-Jun	26-Jun

Appendix 6 Subsidiary upland species.
The proportions of first egg laying dates before key dates estimated from nest record cards for Great Britain; for all altitudes and nests <=250m or >250m above sea level (England & Wales); for all altitudes and nests <=450m or >450m above sea level (Scotland). For the same categories, the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests.

Country	Altitude		% of clutches started by:				date by which X% have started laying				
		N	31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Buzzard											
GB	All	52	8%	42%	83%	96%	30-Mar	05-Apr	06-Apr	10-Apr	11-Apr
England	All / >250m	3	33%	67%	67%	100%	30-Mar	30-Mar	30-Mar	30-Mar	30-Mar
Wales	All	28	4%	39%	79%	93%	03-Apr	05-Apr	09-Apr	09-Apr	10-Apr
Wales	<=250m	13	8%	38%	62%	92%	31-Mar	05-Apr	05-Apr	06-Apr	10-Apr
Wales	>250m	15	0%	40%	93%	93%	03-Apr	09-Apr	09-Apr	10-Apr	11-Apr
Scotland	All / <=450m	21	10%	43%	90%	100%	28-Mar	06-Apr	10-Apr	12-Apr	13-Apr
Dipper											
GB	All	375	27%	52%	75%	95%	17-Mar	23-Mar	26-Mar	29-Mar	31-Mar
England	All	135	24%	48%	72%	95%	17-Mar	22-Mar	27-Mar	31-Mar	01-Apr
England	<=250m	79	32%	57%	80%	96%	15-Mar	21-Mar	25-Mar	26-Mar	30-Mar
England	>250m	56	13%	36%	61%	93%	19-Mar	29-Mar	01-Apr	02-Apr	06-Apr
Wales	All	166	30%	57%	79%	96%	20-Mar	23-Mar	25-Mar	28-Mar	30-Mar
Wales	<=250m	98	35%	61%	82%	96%	16-Mar	21-Mar	24-Mar	26-Mar	28-Mar
Wales	>250m	68	24%	50%	75%	96%	22-Mar	26-Mar	29-Mar	31-Mar	01-Apr
Scotland	All / <=450m	74	27%	47%	73%	92%	11-Mar	25-Mar	27-Mar	29-Mar	31-Mar
Grey Wagtail											
GB	All	460	1%	16%	45%	62%	06-Apr	10-Apr	15-Apr	18-Apr	20-Apr
England	All	79	0%	13%	48%	59%	04-Apr	12-Apr	16-Apr	18-Apr	20-Apr
England	<=250m	57	0%	16%	54%	65%	03-Apr	08-Apr	15-Apr	18-Apr	19-Apr
England	>250m	22	0%	5%	32%	45%	16-Apr	17-Apr	20-Apr	20-Apr	27-Apr
Wales	All	292	2%	20%	45%	60%	05-Apr	09-Apr	13-Apr	16-Apr	19-Apr
Wales	<=250m	133	2%	32%	64%	73%	03-Apr	07-Apr	09-Apr	10-Apr	13-Apr
Wales	>250m	159	1%	9%	28%	50%	08-Apr	16-Apr	22-Apr	25-Apr	27-Apr
Scotland	All / <=450m	89	0%	8%	45%	72%	13-Apr	16-Apr	20-Apr	22-Apr	24-Apr
Kestrel											
GB	All	74	0%	3%	32%	89%	22-Apr	23-Apr	25-Apr	27-Apr	29-Apr
England	All	22	0%	9%	36%	95%	08-Apr	17-Apr	22-Apr	24-Apr	27-Apr
England	<=250m	6	0%	17%	17%	100%	03-Apr	03-Apr	03-Apr	02-May	02-May
England	>250m	16	0%	6%	44%	94%	08-Apr	17-Apr	22-Apr	24-Apr	25-Apr
Wales	All	12	0%	0%	8%	75%	30-Apr	01-May	01-May	02-May	02-May
Wales	<=250m	6	0%	0%	0%	83%	01-May	01-May	01-May	03-May	03-May
Wales	>250m	6	0%	0%	17%	67%	30-Apr	30-Apr	30-Apr	02-May	02-May
Scotland	All	40	0%	0%	38%	90%	23-Apr	23-Apr	24-Apr	25-Apr	28-Apr
Scotland	<=450m	38	0%	0%	39%	92%	23-Apr	23-Apr	24-Apr	25-Apr	28-Apr
Scotland	>450m	2	0%	0%	0%	50%	06-May	06-May	06-May	06-May	06-May

Linnet											
GB	All	88	0%	0%	6%	40%	27-Apr	04-May	07-May	09-May	10-May
England	All	41	0%	0%	2%	32%	03-May	09-May	10-May	11-May	12-May
England	<=250m	31	0%	0%	3%	32%	03-May	06-May	09-May	12-May	12-May
England	>250m	10	0%	0%	0%	30%	10-May	10-May	10-May	10-May	11-May
Wales	All	17	0%	0%	0%	29%	07-May	08-May	10-May	12-May	15-May
Wales	<=250m	1	0%	0%	0%	100%	12-May	12-May	12-May	12-May	12-May
Wales	>250m	16	0%	0%	0%	25%	07-May	08-May	10-May	15-May	15-May
Scotland	All / <=450m	30	0%	0%	13%	57%	22-Apr	26-Apr	03-May	04-May	07-May
Raven											
GB	All	144	96%	100%	100%	100%	23-Feb	24-Feb	25-Feb	27-Feb	28-Feb
England	All / >250m	9	100%	100%	100%	100%	24-Feb	24-Feb	25-Feb	25-Feb	26-Feb
Wales	All	122	98%	100%	100%	100%	23-Feb	25-Feb	26-Feb	27-Feb	01-Mar
Wales	<=250m	15	100%	100%	100%	100%	14-Feb	22-Feb	23-Feb	23-Feb	24-Feb
Wales	>250m	107	97%	100%	100%	100%	24-Feb	25-Feb	27-Feb	28-Feb	01-Mar
Scotland	All	13	77%	100%	100%	100%	12-Feb	18-Feb	18-Feb	20-Feb	25-Feb
Scotland	<=450m	12	75%	100%	100%	100%	12-Feb	18-Feb	18-Feb	20-Feb	22-Feb
Scotland	>450m	1	100%	100%	100%	100%	04-Mar	04-Mar	04-Mar	04-Mar	04-Mar
Reed Bunting											
GB	All	30	0%	0%	3%	47%	03-May	04-May	05-May	08-May	09-May
England	All	12	0%	0%	0%	42%	03-May	05-May	05-May	08-May	08-May
England	<=250m	10	0%	0%	0%	40%	03-May	04-May	05-May	06-May	08-May
England	>250m	2	0%	0%	0%	50%	10-May	10-May	10-May	10-May	10-May
Wales	All	9	0%	0%	11%	44%	27-Apr	27-Apr	04-May	04-May	10-May
Wales	<=250m	4	0%	0%	25%	50%	27-Apr	27-Apr	27-Apr	27-Apr	05-May
Wales	>250m	5	0%	0%	0%	40%	04-May	04-May	04-May	07-May	10-May
Scotland	All / <=450m	9	0%	0%	0%	56%	05-May	05-May	08-May	08-May	11-May
Tree Pipit											
GB	All	39	0%	0%	0%	38%	07-May	08-May	09-May	10-May	11-May
England	All	14	0%	0%	0%	43%	07-May	07-May	09-May	09-May	10-May
England	<=250m	10	0%	0%	0%	40%	07-May	07-May	07-May	08-May	09-May
England	>250m	4	0%	0%	0%	50%	10-May	10-May	10-May	10-May	11-May
Wales	All	15	0%	0%	0%	33%	02-May	10-May	11-May	12-May	14-May
Wales	<=250m	7	0%	0%	0%	29%	11-May	11-May	15-May	15-May	15-May
Wales	>250m	8	0%	0%	0%	38%	02-May	02-May	10-May	10-May	12-May
Scotland	All / <=450m	10	0%	0%	0%	40%	08-May	08-May	08-May	09-May	10-May
Whitethroat											
GB	All	2	0%	0%	0%	0%	19-May	19-May	19-May	19-May	19-May
England	All / <=250m	1	0%	0%	0%	0%	28-May	28-May	28-May	28-May	28-May
Scotland	All / <=450m	1	0%	0%	0%	0%	19-May	19-May	19-May	19-May	19-May

Willow Warbler

GB	All	151	0%	0%	1%	40%	06-May	08-May	09-May	11-May	12-May
England	All	76	0%	0%	1%	53%	06-May	08-May	09-May	09-May	10-May
England	<=250m	56	0%	0%	2%	50%	06-May	08-May	09-May	09-May	10-May
England	>250m	20	0%	0%	0%	60%	06-May	07-May	08-May	09-May	10-May
Wales	All	27	0%	0%	4%	41%	03-May	04-May	10-May	11-May	12-May
Wales	<=250m	10	0%	0%	10%	70%	16-Apr	24-Apr	03-May	03-May	04-May
Wales	>250m	17	0%	0%	0%	24%	06-May	11-May	12-May	14-May	17-May
Scotland	All / <=450m	48	0%	0%	0%	21%	08-May	08-May	14-May	15-May	17-May

Ptarmigan *No NRCs*

Appendix 7 Subsidiary upland species.
The proportions of estimated first egg laying dates before key dates, derived from ringed pulli records. Results for Great Britain, England, Wales and Scotland by 31st March, 15th April, 30th April and 15th May (a) when ringing of pulli was assumed to be mid-way through the nestling period ("mid"); (b) for nidifugous species, ringing at age one day ("1 day"). For the same categories, the dates by which laying has begun in the first 5%, 10%, 15%, 20% and 25% of nests.

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Black-headed Gull											
GB	Mid	10172	0%	2%	24%	81%	18-Apr	23-Apr	26-Apr	27-Apr	01-May
England	Mid	5438	0%	1%	16%	87%	18-Apr	27-Apr	29-Apr	02-May	02-May
Wales	Mid	404	0%	0%	9%	80%	27-Apr	01-May	01-May	03-May	06-May
Scotland	Mid	4330	0%	3%	35%	74%	19-Apr	21-Apr	24-Apr	25-Apr	26-Apr
GB	1 day	10172	0%	0%	1%	23%	05-May	10-May	13-May	14-May	18-May
England	1 day	5438	0%	0%	1%	15%	05-May	14-May	16-May	19-May	19-May
Wales	1 day	404	0%	0%	0%	8%	14-May	18-May	18-May	20-May	23-May
Scotland	1 day	4330	0%	0%	2%	34%	06-May	08-May	11-May	12-May	13-May
Buzzard											
GB	Mid	988	7%	64%	97%	100%	28-Mar	01-Apr	03-Apr	05-Apr	06-Apr
England	Mid	168	4%	61%	96%	99%	31-Mar	04-Apr	05-Apr	06-Apr	07-Apr
Wales	Mid	179	1%	54%	92%	100%	03-Apr	05-Apr	06-Apr	08-Apr	09-Apr
Scotland	Mid	641	10%	68%	98%	100%	27-Mar	31-Mar	02-Apr	04-Apr	05-Apr
Dipper											
GB	Mid	978	41%	66%	82%	96%	09-Mar	14-Mar	17-Mar	20-Mar	22-Mar
England	Mid	347	37%	67%	82%	95%	14-Mar	16-Mar	19-Mar	22-Mar	25-Mar
Wales	Mid	307	43%	70%	86%	98%	12-Mar	15-Mar	17-Mar	19-Mar	23-Mar
Scotland	Mid	324	43%	62%	79%	94%	04-Mar	11-Mar	16-Mar	18-Mar	20-Mar
Grey Wagtail											
GB	Mid	226	2%	18%	46%	65%	05-Apr	10-Apr	11-Apr	17-Apr	20-Apr
England	Mid	61	2%	18%	46%	62%	08-Apr	10-Apr	14-Apr	21-Apr	23-Apr
Wales	Mid	79	4%	29%	48%	67%	01-Apr	03-Apr	06-Apr	10-Apr	10-Apr
Scotland	Mid	86	0%	8%	43%	66%	12-Apr	16-Apr	17-Apr	19-Apr	22-Apr
Kestrel											
GB	Mid	1434	0%	5%	36%	84%	14-Apr	18-Apr	22-Apr	24-Apr	26-Apr
England	Mid	850	0%	5%	31%	83%	14-Apr	20-Apr	23-Apr	25-Apr	28-Apr
Wales	Mid	73	0%	7%	22%	86%	13-Apr	23-Apr	27-Apr	29-Apr	01-May
Scotland	Mid	511	0%	5%	46%	86%	14-Apr	17-Apr	19-Apr	22-Apr	24-Apr

Country	Ringing age	N	% of clutches started by:				date by which X% have started laying				
			31-Mar	15-Apr	30-Apr	15-May	5%	10%	15%	20%	25%
Lesser Black-backed Gull											
GB	Mid	5154	0%	0%	2%	18%	08-May	10-May	13-May	15-May	15-May
England	Mid	3167	0%	0%	0%	3%	15-May	15-May	15-May	16-May	17-May
Wales	Mid	643	0%	0%	0%	46%	07-May	08-May	09-May	09-May	13-May
Scotland	Mid	1344	0%	0%	9%	39%	29-Apr	02-May	09-May	09-May	10-May
GB	1 day	5154	0%	0%	0%	0%	26-May	28-May	31-May	02-Jun	02-Jun
England	1 day	3167	0%	0%	0%	0%	02-Jun	02-Jun	02-Jun	03-Jun	04-Jun
Wales	1 day	643	0%	0%	0%	0%	25-May	26-May	27-May	27-May	31-May
Scotland	1 day	1344	0%	0%	0%	0%	17-May	20-May	27-May	27-May	28-May
Linnet											
GB	Mid	292	0%	0%	2%	19%	08-May	10-May	13-May	16-May	16-May
England	Mid	12	0%	0%	0%	25%	01-May	06-May	06-May	14-May	15-May
Wales	Mid	3	0%	0%	0%	33%	08-May	08-May	08-May	08-May	08-May
Scotland	Mid	277	0%	0%	2%	19%	08-May	12-May	13-May	16-May	16-May
Raven											
GB	Mid	1022	97%	100%	100%	100%	22-Feb	24-Feb	26-Feb	28-Feb	01-Mar
England	Mid	291	97%	100%	100%	100%	22-Feb	24-Feb	25-Feb	27-Feb	28-Feb
Wales	Mid	522	96%	100%	100%	100%	23-Feb	25-Feb	28-Feb	03-Mar	05-Mar
Scotland	Mid	209	96%	100%	100%	100%	21-Feb	22-Feb	24-Feb	26-Feb	27-Feb
Reed Bunting											
GB	Mid	17	0%	0%	0%	59%	04-May	05-May	05-May	08-May	09-May
England	Mid	5	0%	0%	0%	60%	05-May	05-May	05-May	05-May	05-May
Wales	Mid	1	0%	0%	0%	100%	09-May	09-May	09-May	09-May	09-May
Scotland	Mid	11	0%	0%	0%	55%	04-May	08-May	08-May	09-May	09-May
Tree Pipit											
GB	Mid	21	0%	0%	19%	48%	18-Apr	27-Apr	27-Apr	06-May	10-May
England	Mid	10	0%	0%	40%	60%	18-Apr	18-Apr	18-Apr	23-Apr	27-Apr
Wales	Mid	2	0%	0%	0%	50%	12-May	12-May	12-May	12-May	12-May
Scotland	Mid	9	0%	0%	0%	33%	10-May	10-May	13-May	13-May	13-May
Whitethroat											
GB	Mid	24	0%	0%	0%	8%	10-May	17-May	17-May	17-May	17-May
England	Mid	7	0%	0%	0%	14%	08-May	08-May	17-May	17-May	17-May
Scotland	Mid	17	0%	0%	0%	6%	10-May	17-May	17-May	17-May	18-May
Willow Warbler											
GB	Mid	241	0%	0%	0%	53%	05-May	05-May	07-May	08-May	08-May
England	Mid	149	0%	0%	0%	67%	03-May	05-May	05-May	06-May	08-May
Wales	Mid	19	0%	0%	0%	42%	07-May	10-May	10-May	12-May	12-May
Scotland	Mid	73	0%	0%	0%	26%	07-May	10-May	11-May	14-May	14-May

Appendix 8. Results of Generalized Linear Modelling of aspects of breeding performance in relation to laying date. Terms that were significant at the P<0.05 level are highlighted in bold.

Species	Breeding variable	Parameter	Estimate	S.E.	Chi Square	P	df
Curlew	Clutch Size	Intercept	4.888375	0.694841			78
	Clutch Size	Laying Date	-0.008514	0.005781	2.140	0.143	78
	Clutch Size	Laying Date Squared	0.000197	0.000410	0.231	0.631	78
	Egg Failure	Intercept	-6.474433	2.985922			92
	Egg Failure	Laying Date	0.011985	0.024684	0.246	0.620	92
	Egg Failure	Laying Date Squared	0.002261	0.001330	2.543	0.111	92
Golden Plover	Brood Size	Intercept	4.738265	0.574887			56
	Brood Size	**Laying Date**	**-0.011755**	**0.004757**	**5.810**	**0.016**	**56**
	Brood Size	Laying Date Squared	0.000190	0.000139	1.847	0.174	56
	Clutch Size	Intercept	4.242922	0.199736			120
	Clutch Size	Laying Date	-0.002970	0.001708	2.986	0.084	120
	Clutch Size	Laying Date Squared	-0.000007	0.000056	0.017	0.896	120
	Egg Failure	Intercept	-12.025128	5.543416			104
	Egg Failure	Laying Date	0.058285	0.046372	2.123	0.145	104
	Egg Failure	**Laying Date Squared**	**-0.003316**	**0.002282**	**4.084**	**0.043**	**104**
Hen Harrier	Brood Size	Intercept	3.616850	1.181681			55
	Brood Size	Laying Date	0.001230	0.009226	0.018	0.894	55
	Brood Size	Laying Date Squared	-0.000175	0.000557	0.099	0.753	55
	Clutch Size	Intercept	7.313657	1.053501			73
	Clutch Size	**Laying Date**	**-0.019147**	**0.008094**	**5.400**	**0.020**	**73**
	Clutch Size	Laying Date Squared	-0.000133	0.000438	0.092	0.761	73
	Egg Failure	Intercept	-8.655937	5.135521			67
	Egg Failure	Laying Date	0.027287	0.039057	0.490	0.484	67
	Egg Failure	Laying Date Squared	-0.003412	0.002682	2.566	0.109	67
	Young Failure	Intercept	-1.975860	8.413819			54
	Young Failure	Laying Date	-0.025748	0.064525	0.185	0.668	54
	Young Failure	Laying Date Squared	-0.003171	0.004160	0.833	0.361	54
Lapwing	Clutch Size	Intercept	3.723609	0.212329			157
	Clutch Size	Laying Date	0.001011	0.001982	0.260	0.610	157
	Clutch Size	Laying Date Squared	-0.000030	0.000090	0.111	0.739	157
	Egg Failure	Intercept	-4.908691	0.768215			187
	Egg Failure	Laying Date	0.007941	0.007136	1.274	0.259	187
	Egg Failure	Laying Date Squared	0.000121	0.000310	0.148	0.700	187

Species	Breeding variable	Parameter	Estimate	S.E.	Chi Square	P	df
Meadow Pipit	Brood Size	Intercept	3.640968	0.468098			286
	Brood Size	Laying Date	0.003760	0.003596	1.091	0.296	286
	Brood Size	Laying Date Squared	-0.000203	0.000122	2.730	0.098	286
	Clutch Size	Intercept	3.950255	0.361245			306
	Clutch Size	Laying Date	0.002716	0.002773	0.958	0.328	306
	Clutch Size	Laying Date Squared	-0.000176	0.000093	3.535	0.060	306
	Egg Failure	Intercept	18.424287	16.710258			340
	Egg Failure	Laying Date	-0.174798	0.125353	3.764	0.052	340
	Egg Failure	**Laying Date Squared**	**-0.015268**	**0.008908**	**8.621**	**0.003**	**340**
	Hatch success	Intercept	4.373263	1.555172			226
	Hatch success	Laying Date	-0.010895	0.011786	0.887	0.346	226
	Hatch success	Laying Date Squared	0.000214	0.000410	0.293	0.588	226
	Young Failure	Intercept	-3.051968	1.803381			267
	Young Failure	Laying Date	-0.007786	0.013957	0.306	0.580	267
	Young Failure	Laying Date Squared	-0.000209	0.000575	0.142	0.707	267
Oystercatcher	Clutch Size	Intercept	4.920608	0.549388			141
	Clutch Size	**Laying Date**	**-0.016280**	**0.004351**	**13.361**	**0.000**	**141**
	Clutch Size	Laying Date Squared	0.000588	0.000300	3.801	0.051	141
	Egg Failure	Intercept	-9.387522	2.898274			158
	Egg Failure	Laying Date	0.032171	0.022617	2.542	0.111	158
	Egg Failure	Laying Date Squared	0.000845	0.001196	0.457	0.499	158
Peregrine	Brood Size	Intercept	4.177845	0.973563			81
	Brood Size	Laying Date	-0.011723	0.010299	1.286	0.257	81
	Brood Size	Laying Date Squared	-0.000371	0.000472	0.617	0.432	81
	Clutch Size	Intercept	5.402854	0.885017			75
	Clutch Size	**Laying Date**	**-0.020544**	**0.009311**	**4.722**	**0.030**	**75**
	Clutch Size	Laying Date Squared	-0.000547	0.000395	1.892	0.169	75
	Egg Failure	Intercept	-7.052996	3.738537			107
	Egg Failure	Laying Date	0.008024	0.039070	0.043	0.836	107
	Egg Failure	Laying Date Squared	0.001774	0.001436	1.359	0.244	107
	Hatch success	Intercept	-6.830648	7.807948			51
	Hatch success	Laying Date	0.093231	0.080532	2.320	0.128	51
	Hatch success	Laying Date Squared	0.005578	0.006900	0.916	0.339	51
	Young Failure	Intercept	-14.757114	6.412837			73
	Young Failure	Laying Date	0.091202	0.064319	2.582	0.108	73
	Young Failure	Laying Date Squared	-0.001707	0.002466	0.619	0.431	73

Species	Breeding variable	Parameter	Estimate	S.E.	Chi Square	P	df
Ring Ouzel	Brood Size	Intercept	3.526492	0.199604			681
	Brood Size	Laying Date	0.002759	0.001567	3.094	0.079	681
	Brood Size	**Laying Date Squared**	**-0.000180**	**0.000055**	**10.446**	**0.001**	**681**
	Clutch Size	Intercept	3.606548	0.263399			284
	Clutch Size	Laying Date	0.003708	0.002057	3.233	0.072	284
	Clutch Size	**Laying Date Squared**	**-0.000308**	**0.000095**	**10.394**	**0.001**	**284**
	Egg Failure	Intercept	-6.227169	2.992778			335
	Egg Failure	Laying Date	0.007281	0.023249	0.101	0.751	335
	Egg Failure	Laying Date Squared	-0.000838	0.001159	0.588	0.443	335
	Hatch success	Intercept	2.947713	1.315474			212
	Hatch success	Laying Date	0.001218	0.010356	0.014	0.907	212
	Hatch success	Laying Date Squared	-0.000523	0.000485	1.080	0.299	212
	Young Failure	Intercept	-5.028984	1.488196			475
	Young Failure	Laying Date	0.006976	0.011661	0.363	0.547	475
	Young Failure	Laying Date Squared	-0.000942	0.000701	2.028	0.154	475
Skylark	Egg Failure	Intercept	-1.665855	4.848218			50
	Egg Failure	Laying Date	-0.016667	0.035156	0.249	0.618	50
	Egg Failure	Laying Date Squared	-0.001823	0.002061	1.161	0.281	50
Snipe	Clutch Size	Intercept	4.114935	0.237014			67
	Clutch Size	Laying Date	-0.001670	0.002113	0.622	0.430	67
	Clutch Size	Laying Date Squared	0.000015	0.000063	0.054	0.817	67
	Egg Failure	Intercept	-7.504880	3.217581			75
	Egg Failure	Laying Date	0.019060	0.027744	0.526	0.468	75
	Egg Failure	Laying Date Squared	-0.000098	0.000648	0.024	0.878	75
Stonechat	Brood Size	Intercept	3.983426	0.331813			150
	Brood Size	**Laying Date**	**0.008865**	**0.002688**	**10.507**	**0.001**	**150**
	Brood Size	**Laying Date Squared**	**-0.000258**	**0.000085**	**8.913**	**0.003**	**150**
	Clutch Size	Intercept	4.277995	0.239253			125
	Clutch Size	**Laying Date**	**0.009346**	**0.001964**	**20.844**	**0.000**	**125**
	Clutch Size	**Laying Date Squared**	**-0.000311**	**0.000060**	**24.785**	**0.000**	**125**
	Hatch success	Intercept	2.804499	0.935679			92
	Hatch success	Laying Date	-0.000377	0.007566	0.002	0.960	92
	Hatch success	Laying Date Squared	0.000108	0.000236	0.220	0.639	92

Species	Breeding variable	Parameter	Estimate	S.E.	Chi Square	P	df
Twite	Brood Size	Intercept	4.071703	0.591957			235
	Brood Size	**Laying Date**	**0.008921**	**0.004063**	**4.773**	**0.029**	**235**
	Brood Size	**Laying Date Squared**	**-0.000573**	**0.000178**	**10.129**	**0.001**	**235**
	Clutch Size	Intercept	3.927804	0.601998			223
	Clutch Size	**Laying Date**	**0.012077**	**0.004136**	**8.368**	**0.004**	**223**
	Clutch Size	**Laying Date Squared**	**-0.000745**	**0.000168**	**18.865**	**0.000**	**223**
	Egg Failure	Intercept	-3.916503	1.934954			259
	Egg Failure	Laying Date	-0.003515	0.013290	0.069	0.793	259
	Egg Failure	Laying Date Squared	0.000131	0.000532	0.060	0.807	259
	Hatch success	Intercept	2.466065	1.596776			157
	Hatch success	Laying Date	0.002224	0.010916	0.041	0.839	157
	Hatch success	Laying Date Squared	0.000157	0.000483	0.108	0.743	157
	Young Failure	Intercept	-3.431074	1.680389			236
	Young Failure	Laying Date	-0.007927	0.011779	0.441	0.507	236
	Young Failure	Laying Date Squared	0.000826	0.000512	2.389	0.122	236
Wheatear	Brood Size	Intercept	8.838807	0.882870			277
	Brood Size	**Laying Date**	**-0.027527**	**0.006605**	**16.852**	**0.000**	**277**
	Brood Size	Laying Date Squared	-0.000565	0.000342	2.719	0.099	277
	Clutch Size	Intercept	8.345113	0.665325			270
	Clutch Size	**Laying Date**	**-0.019827**	**0.004957**	**15.546**	**0.000**	**270**
	Clutch Size	**Laying Date Squared**	**-0.000885**	**0.000252**	**12.045**	**0.001**	**270**
	Egg Failure	Intercept	-22.139050	8.714513			317
	Egg Failure	**Laying Date**	**0.121903**	**0.062952**	**5.989**	**0.014**	**317**
	Egg Failure	**Laying Date Squared**	**-0.004285**	**0.002882**	**3.191**	**0.074**	**317**
	Hatch success	Intercept	2.312473	1.453793			213
	Hatch success	Laying Date	-0.001061	0.010874	0.010	0.922	213
	Hatch success	Laying Date Squared	-0.000035	0.000575	0.004	0.951	213
	Young Failure	Intercept	-10.480822	3.094762			296
	Young Failure	**Laying Date**	**0.043365**	**0.023043**	**4.249**	**0.039**	**296**
	Young Failure	Laying Date Squared	-0.000844	0.001166	0.577	0.447	296
Whinchat	Brood Size	Intercept	8.797390	0.569677			446
	Brood Size	**Laying Date**	**-0.022300**	**0.003919**	**31.261**	**0.000**	**446**
	Brood Size	**Laying Date Squared**	**-0.000533**	**0.000169**	**9.882**	**0.002**	**446**
	Clutch Size	Intercept	8.590189	0.826296			203
	Clutch Size	**Laying Date**	**-0.018500**	**0.005703**	**10.262**	**0.001**	**203**
	Clutch Size	**Laying Date Squared**	**-0.001267**	**0.000301**	**17.035**	**0.000**	**203**
	Egg Failure	Intercept	-4.378472	6.172554			227
	Egg Failure	Laying Date	-0.007942	0.042734	0.034	0.854	227
	Egg Failure	Laying Date Squared	0.001478	0.002040	0.491	0.483	227
	Hatch success	Intercept	7.227178	2.948783			152
	Hatch success	Laying Date	-0.030392	0.020237	2.435	0.119	152
	Hatch success	Laying Date Squared	0.000202	0.001019	0.040	0.842	152
	Young Failure	Intercept	-2.185430	2.056594			404
	Young Failure	Laying Date	-0.012679	0.014237	0.767	0.381	404
	Young Failure	Laying Date Squared	-0.000278	0.000573	0.914	0.339	404