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The Dartford Warbler in the United Kingdom in 1994

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ABSTRACT A survey of breeding Dartford Warblers *Sylvia undata* in the UK in 1994 recorded a total of 1,600-1,670 territories, though it is likely that the actual population was slightly higher (1,800-1,890 territories). This represents a near four-fold increase in population since an earlier survey in 1984. Although recorded in nine counties, more than three-quarters of the population was restricted to two (Dorset and Hampshire), with most of the rest in Devon and Surrey. The most likely cause of the population increase is the recent run of mild winters, though habitat change may have played a part. Despite such a marked increase in numbers, the species' range is still much reduced compared with that of earlier centuries, and 75% of its current population is still restricted to only 24 sites.

In the United Kingdom, Dartford Warblers *Sylvia undata* are confined largely to the remaining fragments of lowland heathland and, as a consequence of the interest in the flora and fauna of this much-threatened habitat, their populations and ecology have been well studied (Tubbs 1963, 1967; Bibby & Tubbs 1975; Bibby 1979a & b; Robins & Bibby 1985a; Westerhoff & Tubbs 1991; Catchpole & Phillips 1992). Historically, the Dartford Warbler had a much wider distribution, and was presumably more abundant, than in recent years. In the nineteenth century, its breeding range extended from Suffolk in the east to Cornwall in the

west, and northwards to Shropshire and possibly even Staffordshire. During that century, however, its population went into steep decline (Alexander & Lack 1944; Parslow 1973) and by the middle of the twentieth century it had become largely restricted to the counties of Devon, Dorset, Hampshire, Surrey, Sussex and the Isle of Wight. Though the precise cause of this decline is uncertain, at least part of the species' demise was probably due to habitat loss and fragmentation (Tubbs 1963; Sharrock 1976), with the United Kingdom having lost over 70% of its lowland heathland since the early 1800s (Farrell 1989). Much of this loss was as a consequence of reclamation for agriculture and forestry, and urban and industrial development. Though such losses have now largely ceased as a result of improved site protection, the remaining areas are still vulnerable to degradation through scrub encroachment, particularly by birch *Betula* and Scots Pine *Pinus sylvestris*, following the demise of traditional methods of pastoral land management (Tubbs 1963; Webb & Haskins 1980).

Though Alexander & Lack (1944) considered that egg-collection may have played a part in the historical contraction of range of this species, more noticeable have been the periodic population crashes due to severe winter weather. An estimated national population of 460 pairs in 1960-61 was reduced to no more than a dozen pairs in 1963 as a result of the two harsh winters of 1961/62 and 1962/63 (Tubbs 1963, 1967). Since 1850, similar population crashes are thought to have occurred during the winters of 1860/61, 1880/81, 1886/87, 1916/17, the late 1930s/early 1940s and 1946/47 (Tubbs 1963). Dartford Warblers have a comparatively high nesting success, with about 80% of nests producing some young, and early-starting pairs can rear two broods in a good summer (Bibby 1979a); thus, breeding populations can build up again swiftly following such crashes. Despite this, however, as the species is a year-round resident at the northern limit of its World breeding range (Tucker & Heath 1994), it is highly likely that it will always suffer from harsh winter weather.

The UK population, all of which is in England, has been well monitored, with annual population figures published in county bird reports and, since 1974, in the reports of the Rare Breeding Birds Panel. By 1993, the population in the UK was estimated at just over 1,150 pairs (Ogilvie *et al.* 1996). Tubbs (1963, 1967) collated the county-bird-report data for the early 1960s, and national surveys were undertaken in 1974 (Bibby & Tubbs 1975) and 1984 (Robins & Bibby 1985a), and the third in this series was organised by the RSPB and English Nature in 1994. This paper reports the results of this most recent survey.

Though the population of Dartford Warblers in the UK is small compared with that in southern and western France and Spain, the species is considered to be of conservation concern in Europe because of losses in some of the most valuable habitats in Spain, including the Mediterranean maquis (de Juana *et al.* 1988; Tucker & Heath 1994).

Methods

Sites covered

Since the Dartford Warbler is restricted largely to lowland heathland, the distribution of which is reasonably well known, the 1994 survey was, as for the earlier ones, based largely on visits to all possible sites. A full list of such sites for the counties of Cornwall, Devon, Somerset, Dorset, Hampshire, Surrey, Sussex,

Berkshire and the Isle of Wight was compiled from the reports of the two earlier national surveys (Robins & Bibby 1985b), from the RSPB/EN Heathland Inventory (Evans *et al.* 1994) and from local knowledge. Dartford Warblers have been recorded from some areas, for example the Purbeck Ridge, which are not considered lowland heath, so all additional non-heathland sites from which Dartford Warblers have been recorded were included in the survey. Because 'sites' in the New Forest, Hampshire, are rather ill-defined, the survey there was based on visits to all 1-km squares within the Forest's boundary, rather than to individual sites. Though the Dartford Warbler breeds in the Channel Islands, this survey did not cover those islands.

The definition of what constituted a site was largely arbitrary. We have generally treated each distinct fragment of habitat which could be referred to by a particular name as a site, as this was the approach used in the earlier surveys (Robins & Bibby 1985b). In some cases, these individual sites are themselves simply a small part of a larger 'site', for example a Site of Special Scientific Interest (SSSI). We chose not to use such larger sites as our sampling unit for two reasons. First, field-workers may well have been unaware of the boundary of such sites. Secondly, whilst it would be straightforward to calculate the total number of Dartford Warbler territories on a particular SSSI by adding up the counts for each of its constituent fragments, it would have been much more difficult to do the reverse if the data had been collected simply in terms of the number of territories per SSSI.

One of the disadvantages of using sites rather than grid squares for survey purposes is that many sites have the same name. For instance, there are at least four lowland-heathland sites known as Pirbright, and different observers use the same name to refer to different sites or similar sites with different boundaries, which makes comparisons between surveys difficult. It is sites, however, not grid squares, that are protected for their nature-conservation interests and this is essentially the rationale behind collecting the data on a site-by-site basis.

Organisation

Much of the fieldwork was undertaken by volunteer ornithologists working through county or regional co-ordinators to a national organiser (SW). In addition, substantial amounts of fieldwork were undertaken by staff from the RSPB and EN.

Field methods

Observers were asked to visit each site (or 1-km square in the New Forest) at least twice, once during April to mid May, and once during mid May to the end of June. They were asked to record the number of singing males and other contacts (for example, calling individuals and adults carrying nesting material or food) separately, to estimate the total number of territories recorded on each visit and to provide their 'best estimate' of the number of Dartford Warbler territories on that site (or 1-km square) during the 1994 breeding season. All numeric estimates were cross-referenced to maps showing the locations of bird registrations. This crude form of territory-mapping allowed the total number of territories to be more readily estimated, and gave a more precise grid reference for each territory than that of the central grid reference of the site, which was also supplied by the observer.

Problems of multiple visits

Though observers were asked to visit each site at least twice, some observers visited a site only once, and others visited each site many times. This was shown to influence the number of Dartford Warbler territories recorded (see Results), as the more visits that were made to a site the more territories were found. In this paper, correction has been made for any underestimation of population size caused by insufficient visits to locate all of the territories. To do this, the cumulative number of territories recorded over one, two, three and four visits to each of 28 sites (or 1-km squares) was determined from the site maps. On the assumption that four visits located all territories present, the cumulative proportion of territories found on one, two and three visits was calculated and used to correct the estimate for each site (or 1-km square) depending on the number of visits made to each. These 28 sites and 1-km squares were those to which four visits were made, on which Dartford Warblers were present and for which sufficient mapped information was supplied to determine the cumulative number of territories recorded on successive visits. One further complication was that the number of visits to a site was not always recorded; for these sites, it was assumed that they were visited as often, on average, as those sites for which the number of visits was known. As none of the previous national population estimates for the Dartford Warbler have been corrected in this manner, the actual, uncorrected number of territories recorded is presented for comparison. One assumption of this method is that four visits were sufficient to record all territories present. Though the validity of this assumption is unknown, the additional number of territories recorded on the fourth visit was small (see Results). Similar corrections for survey efficiency have been used for other species, for example Red-throated *Gavia stellata* and Black-throated Divers *G. arctica* (Gomersall *et al.* 1984; Campbell & Talbot 1987) and Cirl Buntings *Emberiza cirius* (Evans 1992).

A related problem was that of different individuals visiting the same site (or 1-km square) independently so that two (and in some cases three) recording forms, and thus two (or three) estimates of the total number of territories, were submitted for some sites or 1-km squares. There were several potential ways of resolving this problem: decide which estimate was most likely to be correct, based, for example, on observer experience; use the maximum of the two or three values on the basis that this would most likely approximate the 'true' value; compare the territory maps for each card to obtain a sum of unique (to each card) plus shared (between cards) territories; or use both values and quote a range. In this paper we have adopted the last of these options, as we believe this to be the most objective method.

Population trends of the Dartford Warbler since 1961

Population estimates for each of the years 1961 to 1993 were taken from the literature for comparison with the 1994 estimate. The following sources were used: 1961-62, Tubbs (1963); 1963-66, Tubbs (1967); 1967-73, County Bird Reports for Devon, Dorset, Hampshire, Surrey and Sussex; 1974, Bibby & Tubbs (1975); 1975-83, RBBP; 1984, Robins & Bibby (1985a); 1985-1993, RBBP. The population of the New Forest in 1981 is unknown and has been

calculated here as the mean of the 1980 and 1982 figures. Grid references of territories for 1963 were taken from Follett (1964) and Tubbs (*in litt.*), and for 1974 and 1984 from Robins & Bibby (1985b). Some grid references for the 1963, 1974 and 1984 surveys were unavailable.

Results

Table 1a shows the number of sites (or 1-km squares) that were visited during the survey. Most of these were visited by a single observer (or team), though a few were covered independently, and probably unknowingly, by independent observers. Table 1b documents the number of successive visits made to each site (or 1-km square) and shows that there was great variation in this, some sites being visited only once, yet others being visited up to ten times. Also shown is the mean cumulative proportion of territories that were recorded on each successive visit to the 28 four-visit sites and 1-km squares. On average, the first visit to a site found 60% of Dartford Warbler territories, the first three visits 94%. The small proportion of additional territories found on a fourth visit suggests that further visits would have yielded only a few extra territories.

Table 1a. Number of sites (and 1-km squares in the New Forest) visited during 1994.

Number of independent observers covering site (or 1-km square) is given; this is equivalent to the number of population estimates made for each (see text for explanation).

	No. of independent observers			Total no. of sites or 1-km squares
	1	2	3	
Number of sites	261	13	1	275
Number of 1-km squares	166	24	1	191
Total	427	37	2	466

Table 1b. Number of successive visits made to each site (or 1-km square) and mean cumulative proportion of total territories of Dartford Warblers *Sylvia undata* found on each visit.

Mean proportions are based on those 28 four-visit sites and 1-km squares with sufficient information (see text for explanation).

	No. of successive visits made					
	1	2	3	4	>4	unknown
No. of sites	26	76	56	36	5	91
No. of 1-km squares	35	118	28	10	0	26
Mean cumulative % of territories located	59.7	86.9	94.3	100	100	

Table 2 lists the number of Dartford Warbler territories recorded in each county, along with an estimate for the national population. Corrected values are also given. During the 1994 survey, some 1,600-1,670 Dartford Warbler territories were located in ten counties: Cornwall, Devon, Somerset, Dorset, Hampshire, Isle of Wight, Sussex (East and West), Surrey and Berkshire. Three-quarters (76%) of the population was, however, restricted to the counties of Dorset and Hampshire, with most of the rest (a further 20%) in Devon and Surrey. Correcting for variation in the number of visits to each site suggested that the actual population may have been slightly higher (1,800-1,890 territories).

Table 2. Number of Dartford Warbler *Sylvia undata* territories in the UK in 1994.

Actual numbers recorded, and numbers estimated following correction (in parentheses), are given for each county. Manners in which ranges were calculated and recorded numbers corrected are given in the text. Corrected figures have been rounded to the nearest whole number. Percentage figures are based on maximum values.

	No. of territories				% UK population	
	Act.	Min. (Est.)	Act.	Max. (Est.)	Act.	(Est.)
Cornwall	7	(8)	7	(8)	0.4	(0.4)
Devon	156	(167)	165	(177)	9.9	(9.4)
Somerset	7	(7)	7	(7)	0.4	(0.4)
Dorset	652	(733)	653	(734)	39.1	(38.9)
Hampshire						
New Forest	479	(567)	524	(619)	31.3	(32.8)
Elsewhere	98	(106)	98	(106)	5.9	(5.6)
Whole county	577	(673)	622	(725)	37.3	(38.4)
Isle of Wight	5	(6)	9	(11)	0.5	(0.6)
Sussex						
East Sussex	29	(29)	29	(29)	1.7	(1.5)
West Sussex	5	(5)	5	(5)	0.3	(0.3)
Surrey	155	(169)	173	(190)	10.3	(10.1)
Berkshire	2	(2)	2	(2)	0.1	(0.1)
UK total	1,595	(1,799)	1,672	(1,889)		

National and county estimates from earlier surveys and selected years are given in table 3 for comparison, and national estimates for each year during 1961-94 are plotted in fig. 1. Following the population crash after the cold winters of 1961/62 and 1962/63, the population built up slowly but steadily to a maximum in 1974 and 1975. Thereafter followed three apparent years of decline, with a further population low in 1979. From 1980, the population size gradually increased, though with setbacks, until 1994. The RBBP acknowledges that the 1983, and possibly the 1976, figures may be unreliable and are probably minima.

Table 3. Trends in Dartford Warbler *Sylvia undata* numbers over the last 35 years.

Data taken from Tubbs (1963, 1967), Bibby & Tubbs (1975), Robins & Bibby (1985a & b), Bibby in Gibbons *et al.* (1993), Ogilvie *et al.* (1995) and this survey. Estimates of the total UK population are rounded. The 1994 figures are the number of territories recorded and have not been corrected, thus allowing direct comparison with other years.

County	1960-61	1963	1974	1984	1990	1992	1994
Cornwall	0	0	0	6	1	2	7
Devon	0	0	3	2	16	73	156-165
Somerset	0	0	0		0	0	7
Dorset	63	4	286	127	334	266	652-653
Wiltshire	0	0	0	0	1	0	0
Hampshire	350	6	255	219	441	530	577-622
Isle of Wight	0	0	0	0	7	8	5-9
Sussex (East and West)	4	1	15	0	8	7	34
Surrey	40	0	1	69	120	37	155-173
Berkshire	0	0	0	0	0	3	2
Approx. UK total	460	11	560	420	930	930	1,600-1,670

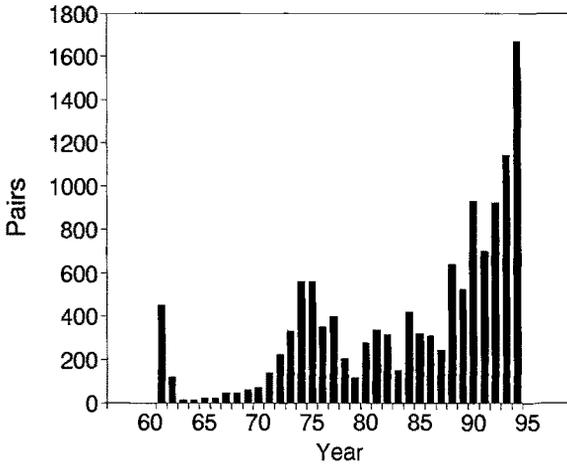


Fig. 1. Population trend of the Dartford Warbler *Sylvia undata* in the UK (all in England), 1961-94. Data sources are given in the text. For 1994, the uncorrected population maximum is used. Estimates for 1976 and 1983 are considered by the RBBP to be minima. Mean winter (December-February) temperature dropped below 2°C in 1962/63 and 1978/79.

The distribution and geographical patterns of abundance of Dartford Warblers in the UK during 1963, 1974, 1984 and 1994 are given in figs. 2a-d. The expansion in range over the 30-year period is striking.

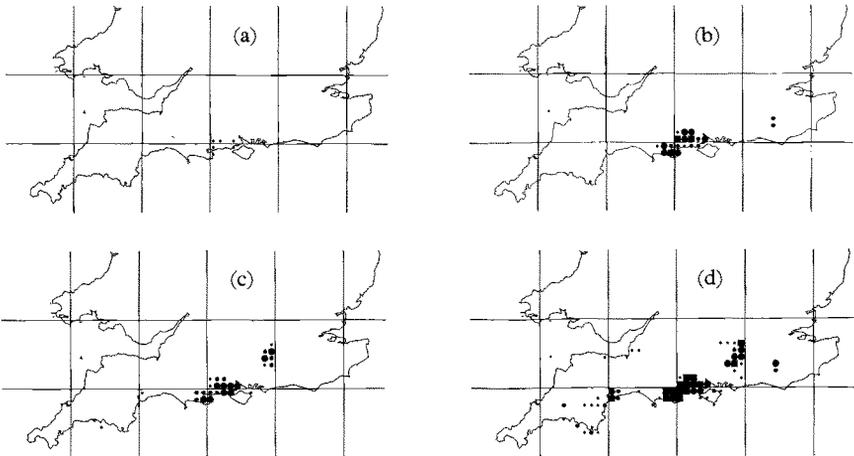


Fig. 2. The distribution and geographical pattern of abundance of the Dartford Warbler *Sylvia undata* in the UK in (a) 1963, (b) 1974, (c) 1984 and (d) 1994. Increasing symbol sizes refer to increasing numbers of Dartford Warbler territories; these are, from the smallest to the largest, 1-4, 5-14, 15-49 and 50+ territories. For 1994, uncorrected population maxima are used. Symbols are placed conventionally at the centre of each 10-km square; thus, for some coastal squares, the symbols may fall in the sea. The following grid references were missing or unavailable: one Sussex territory in 1963; all Sussex territories in 1974 (it has been assumed that they occurred in the same two 10-km squares as in 1994); 40+ New Forest territories in 1974 which were not found but whose existence was surmised from the proportion of the Forest searched in that year; a few territories in 1984.

Table 4. Dartford Warbler *Sylvia undata* sites with 1% or more of the UK population in 1994. The 1994 figures are uncorrected to allow direct comparison with the 1974 and 1984 figures, which are also given. The 1994 figures, and the percentage of the UK population that these represent, are based on maxima.

Site name	County	Number of territories			(% UK)
		1974	1984	1994	
New Forest	Hampshire	250	194	524	(31.3)
Studland Heath (E&W) & Godlingston	Dorset	39	35	57	(3.4)
Holt Heath (N&S)	Dorset	30	4	45	(2.7)
Canford Heath	Dorset	5	5	41	(2.5)
Arne (all heaths)	Dorset	30	18	40	(2.4)
Hankley Common	Surrey	0	10	36	(2.2)
Thursley & Ockley Common	Surrey	0	17	36	(2.2)
Colaton Raleigh Common	Devon	0	0	36	(2.2)
Chobham Common (N&S)	Surrey	0	1	35	(2.1)
Pirbright & Cleygate Common	Surrey	0	23	34	(2.0)
Povington & West Holme Heath	Dorset	0	-2	34	(2.0)
Parley Common	Dorset	4	1	32	(1.9)
Harpford Common	Devon	0	1	32	(1.9)
Woodbury Common	Devon	0	0	29	(1.7)
Town Common & St Catherine's Hill	Dorset	2	6	29	(1.7)
Ashdown Forest	E. Sussex	?	?	29	(1.7)
Ludshott Common	Hampshire	0	0	28	(1.7)
Hartland Moor	Dorset	17	14	26	(1.6)
Avon Forest Park (N&S)	Dorset	0	0	25	(1.5)
Woolmer Forest	Hampshire	0	0	23	(1.4)
Gore Heath (N&W) & Great Ovens	Dorset	5	4	22	(1.3)
Upton Heath	Dorset	2	1	21	(1.3)
Barnsfield Heath	Dorset	3	1	19	(1.1)
Wareham Forest	Dorset	5	1	19	(1.1)

Finally, table 4 lists the most important sites for Dartford Warblers in the UK in 1994. On a site-by-site basis, 75% (=1,252 territories) of the UK population was recorded on only 24 sites (Pritchard *et al.* 1992).

Discussion

Populations of Dartford Warblers in the UK are at their highest recorded levels in recent decades. The national population has nearly quadrupled in size since the last survey in 1984. Fears that habitat loss would ensure that the population high of nearly 600 pairs in the mid 1970s would never be reached again (Bibby in Lack 1986) have proved unfounded (Bibby in Gibbons *et al.* 1993). Unfortunately, despite population sizes during the first half of the twentieth and earlier centuries being poorly known, it is probable that the Dartford Warbler has still not regained its former historical range (Burton 1995; Holloway 1995). Despite occasional records from Suffolk in recent years, the last recorded breeding there was nearly 80 years ago, with the last in Essex in 1948 (Sharrock 1976). Apparently suitable habitat exists in some of these more northern and eastern counties, though the species has not yet spread farther north than Berkshire.

The Meteorological Office's Central England Temperature Record shows that the mean winter (December-February) temperature has dropped below 2°C on only two occasions since 1960, in the winters of 1962/63 and 1978/79. The population in the breeding seasons following both of these winters was very low (fig. 1), and the population trend of this species since 1961 can be seen as two separate phases of recovery, one following each of these extreme winters (Westerhoff & Tubbs 1991). A continuation of the run of current mild winters might see yet further expansion of range and numbers, possibly into East Anglia, though that region's relatively hard winters, the fragmented nature of its heathland and its dominance by grasses may limit expansion there. During 1994, there were up to 11 Dartford Warbler territories at altitudes of over 300 m, six in Cornwall, four in the Mendips and one on Dartmoor, so the possibility exists that this species might expand into upland heathland in southern Britain.

More than three-quarters of the UK population of Dartford Warblers was recorded in two counties, Dorset and Hampshire, with most of the rest in Devon and Surrey. With 75% of the UK population concentrated at only 24 sites, the species' distribution is still markedly restricted.

Although firm evidence is lacking, it is likely that the current expansion in numbers and range of the Dartford Warbler is mainly a consequence of a long run of mild winters. Improved management of the habitat, particularly the removal of Bracken *Pteridium aquilinum* and invasive conifers by staff working on the current county heathland projects in Dorset, northeast Hampshire, Surrey and West Sussex, will also have played a part. The extensive heathland fires of 1976 may also have been significant in the recovery, as by the late 1980s and early 1990s much of the Dartford Warbler's heathland habitat would have reached its 'optimal quality' (*sensu* Westerhoff & Tubbs 1991). The same fires may have been partly responsible for some of the population decline from 1976 to 1979.

Much of England's lowland heathland is currently dominated by mature dry heath and is thus suitable for Dartford Warblers. Inevitably, this heath will degenerate as it ages, and may become less suitable. Ideally, heathland management should aim to create a dynamic mosaic of heather age structures, ensuring that there is always suitable Dartford Warbler habitat even if in the short term this would lead to a reduction in the carrying capacity of the habitat.

Though population sizes in the years in which national surveys were undertaken were generally high, they were not markedly so. Thus, population sizes in 1974 and 1994 were approximately what might have been predicted from the trends of the preceding decades. This suggests that, with the exception of some years of inadequate coverage (e.g. 1976 and 1983), reports of county bird societies and more recently the RBBP have monitored this species successfully for the past three decades. It also questions whether national surveys are needed at all. If the population keeps expanding, however, it may become increasingly difficult for the RBBP to monitor the species successfully, and the need for a further national survey in 2004 should therefore be kept under review.

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