A revised estimate of the breeding population of Common Sandpipers *Actitis hypoleucos* in Great Britain and Ireland

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Breeding densities of Common Sandpipers in Great Britain (there are no density estimates for Ireland) are summarised, along with surveys of their national and local distribution, to produce new estimates of the total national populations. Extrapolating from linear densities to the populations of areas is problematical, and a range of population estimates from 11,500 to 51,500 can be justified. Reasons for believing estimates of about 24,000 for Great Britain (and about 30,600 for the British Isles) are presented.

INTRODUCTION

Sharrock (1976) considered that Common Sandpipers occurred at densities of 10–30 pairs per occupied 10 × 10 km square, giving bounds to an estimate of the combined British and Irish population during 1968–72 of 15,800–47,300 pairs (in 1,581 hectads). Reed (1985), who presented revised estimates for population size of all waders in Britain and Ireland, included a range of 22,000–25,000 pairs for Common Sandpipers, without explaining the basis of the revised figures. In the *New Breeding Atlas of Breeding Birds in Britain and Ireland: 1988–1991*, it was estimated that Common Sandpipers occurred at 15 pairs per occupied hectad, equating to breeding populations of 15,855 pairs in Great Britain and 2,445 pairs in Ireland (Yalden 1993). In attempting to revise the estimates for Scotland, for a forthcoming revision of Thom (1986) *Birds in Scotland*, we have revisited the problem of estimating population sizes for this species. There are now more estimates for breeding density along stretches of river and lake shore, and also more tetrad atlases that allow a better estimate of how much of the countryside is actually occupied by the species. We present and evaluate this more extensive data-base, produce a number of rather disparate estimates, and discuss the discrepancies between them.

POPULATION ESTIMATION

Sample breeding population surveys of Common Sandpipers in the British Isles have been carried out using two rather different types of recording unit: linear surveys, along rivers or around the perimeter of water-bodies such as lakes and reservoirs, and area surveys based on national grid squares, either 10 × 10 km (hectads), or 2 × 2 km (tetrads) or 1 × 1 km (monads). Therefore any attempt to estimate the whole population involves complex and problematic extrapolations, especially from observed linear densities to areas. Moreover study areas are often chosen for their high abundance and it is vital that this is taken into account in estimating the population of much larger and probably less favourable areas.

Linear densities

It is reasonably easy to record the territories of this species, mapping them as pairs when they establish territories in early May, as single birds occupying territories while their mates are incubating in May/June, or as anxious parents loudly guarding chicks in June/July. By late in the breeding cycle, one mate, usually the female, has left, but the remaining one stays with the older chicks up to and well beyond fledging. Jenkins & Bell (1984) recorded birds, rather than pairs/territories, but since their survey was in this late period, it is assumed that their count of birds equated to territories.

Area surveys

In summarizing breeding distributions from published atlases, we have ignored those squares in which birds were recorded only as "present in possible nesting habitat" during the breeding season, since these are likely to have been birds still on passage, or failed breeders already moving back southwards, and this is an easy species for which to demonstrate at least probable breeding. Records of probable and proven breeding in recording squares (hectads, tetrads or monads) are therefore combined (Table 2).

Estimation

Two population counts over large survey areas in England (Holland *et al.* 1982, Pyefinch & Golborn 2001) suggest average densities of 9–11 pairs/hectad. On this basis, Yalden (1993) argued for an overall density of 15 pairs per occupied hectad across the whole of Britain and Ireland, assuming that the density in Scotland, which supports most of the population, is higher than in England, which is closer to the edge of the species' range. This gave estimates of 15,855 pairs for Great Britain and 2,445 for Ireland.

In relation to linear densities, Harris *et al.* (1995, their Table 4) quote aggregate lengths of rivers, streams, canals and lake shores in each water authority area. Anglian, South

West, Southern, Thames and Wessex Water Authority areas can be discounted, as breeding Common Sandpipers are essentially absent from these regions, and canals can similarly be ignored. For the rest of Great Britain, there are 28,697 km of rivers and 8,591 km of lake shores potentially inhabitable by Common Sandpipers. Taking a low density of 0.2 pairs/km, from two extensive surveys which included uninhabited as well as occupied rivers (Cowper 1953, Vickery 1991), and 0.7 pairs/km of shore from a similar reservoir survey (Holland et al. 1982), suggests a population of 11,506 pairs. An analysis by Vickery (1988) suggested that streams narrower than 8 m would have no Common Sandpipers, and others have also remarked that stream width is a constraint on Common Sandpiper density or presence (Jones 1983, Yalden 1986), because narrow streams usually lack the shingle banks favoured by this species. If streams were to be inhabited at the same density as rivers, the population might be as large as 51,589 pairs (Table 3), but this seems unlikely.

Note that streams in the context of this paper are defined as initial tributaries, the order 1 streams of geographers, as shown on the old 1:63,360 maps of Great Britain. Smith & Lyle (1979) suggest that order 1 streams, at this scale, would be 75% of the total river network, and order 1 plus order 2 streams would be 93%. The figures in Harris et al. (1995) imply that streams are 87% of the total river network, so probably correspond largely to order 1 streams. Order 2

Table 1. Estimates of linear densities for Common Sandpipers in Great Britain (where surveys covered more than one year, the average density and number of pairs is given).

Published data					
Density (pairs/km)	No. of pairs	Length of river or shore surveyed (km)	River/site	Year(s)	Source
1.05	101	96	R. Lune & tributaries, Lancashire, England	1951	Cuthbertson et al. 1952
0.13	41–52	400	R. Esk catchment, Lothian, Scotland, including reservoirs	1961–1966	Cowper 1973
0.73	13	17.9	R. Noe & R. Derwent, England	1977–1980	Holland et al. 1982
0.74	14	18.8	Longdendale reservoirs, England	1977–1980	Holland et al. 1982
1.27	24	18.9	Ladybower reservoir, Derbyshire, England	1977–1980	Holland et al. 1982
1.49	10	6.7	Derwent reservoir, England	1977–1980	Holland et al. 1982
1.97	15	7.6	Goyt valley reservoirs, England	1977–1980	Holland et al. 1982
2.39	24	10.05	R. Ashop & R. Alport, England	1977–1980	Holland et al. 1982
0.57	78	136	Peak District rivers, England	1977–1980	Holland et al. 1982
0.73	128	175	Peak District reservoir shores, England	1977–1980	Holland et al. 1982
0.45	107	223	R. Wye, Wales	1977	Round & Moss 1984
0.26	36	138	R. Severn, Wales	1978	Round & Moss 1984
0.27	18	67	R. Vrynwy, Wales	1978	Round & Moss 1984
1.54 birds[a]	145 birds[a]	94.3	R. Dee & tributaries, Aberdeenshire, Scotland	1984	Jenkins & Bell 1984[a]
0.28[b]	39	112	18 streams, Dumfries & Galloway, Scotland (species only present on 10 streams)	1987	Vickery 1991
1.5–2.2	7–10	4.5	NW Sutherland, Scotland	1975–1980	Nethersole-Thompsons 1986
6	30+	4.6	shore of Loch Morlich, Inverness, Scotland	1934–1956	Nethersole-Thompsons 1986
4.2–5.6	6–8	1.4	R. Dorback, Inverness, Scotland	1938–1942	Nethersole-Thompsons 1986
3.0	31	10.4	part Ladybower reservoir, Derbyshire, England	1989	Yalden 1992a
2.5	26	10.4	part Ladybower reservoir, Derbyshire, England	1990	Yalden 1992a
1.8	60	33.3	Ladybower-Derwent-Howden reservoir system, Derbyshire & Yorkshire, England	1991	Yalden 1992b
1.67	55	32.9	R. Lune, Lancashire, England (downstream of the site of Cuthbertson et al. 1952)	1976–1995	Harrison 1995
2.47[c]	21–31	10.13	streams in Moorfoot Hills, Scotland	1993–1998	Dougall et al. 1999
Unpublished studies					
0.84	62	73.6	Resurvey of R. Lune & tributaries, Lancashire, England (most of area studied by Cuthbertson et al. (1952))	1990	P.K. Holland
1.36[d]	97.75	71.7	R. Tees, Co. Durham, England	1977–1980	Jones 1983
4.67	28	6	Stream in Moorfoot Hills, Scotland (cf. Dougall et al. 1999)	1998	Mee 2001
2.41	35	14.5	Stream in Moorfoot Hills, Scotland (cf. Dougall et al. 1999)	1999	Mee 2001
0.18 (0.13)	27.1	153.1	31 'positive plots' (i.e. those with Common Sandpipers) of the Waterways Bird Survey in Scotland (including negative plots)	1977–2002	British Trust for Ornithology per J.H. Marchant
5.0	7	1.4	R. Dee at Inverey, Aberdeenshire, Scotland	2002	D.W. Yalden

[a] Although Jenkins & Bell counted birds rather than pairs or territories, it is thought that the number of birds would have equated to the number of pairs for the reason explained in the text.
[b] Range 0.21–1.12 on 10 streams.
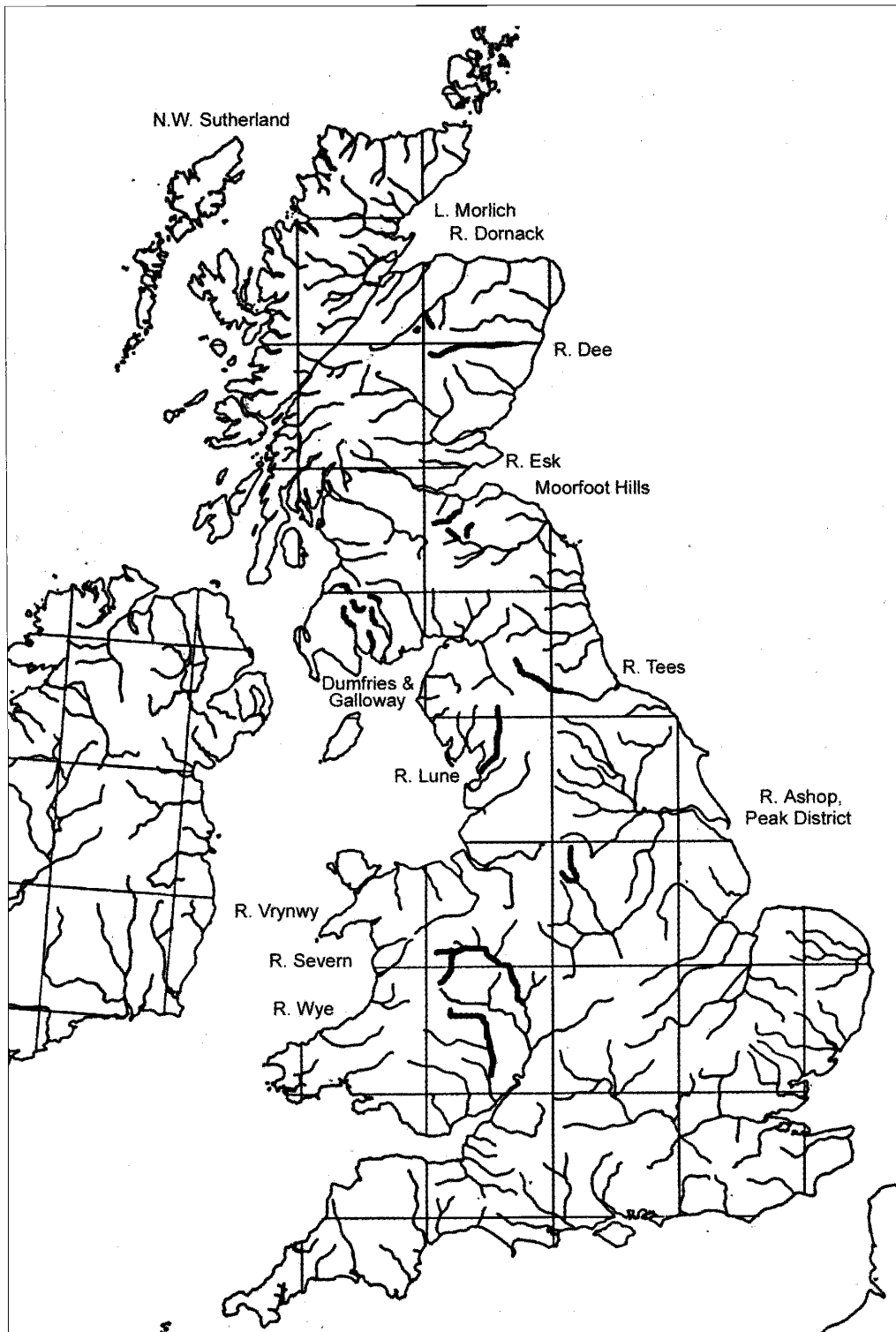[c] Range 2.07–3.06
[d] Range 0.30–2.31

Fig. 1. Distribution of linear surveys for breeding Common Sandpipers in Great Britain, as listed in Table 1. The various rivers and reservoirs surveyed by Holland *et al.* (1982) are all in the Peak District.

streams are constituted by the junction of two order 1 streams, while order 3 streams are formed by the junction of two order 2 streams. In the Peak District, at least, only rivers of order 3 and higher are occupied by Common Sandpipers, though we have seen them on order 1 streams in the Scottish Highlands.

In attempting to estimate the population size from the number of hectads or tetrads occupied, the difficulty is to allow for the proportion of unoccupied habitat, by selecting an appropriate density per unit area. The greater number of tetrad atlases now published facilitates a better understanding of this relationship. Breeding sandpipers were found in

11.8% (Greater Manchester) to 29.5% (SE Scotland) of the tetrads in occupied hectads (Table 2). Even occupied tetrads would contain only limited lengths of riparian habitat, and analysis of data for the Moorfoot Hills study area in the Scottish Borders (TD, pers. obs.) suggests that an average of 2.5 pairs per occupied tetrad would be a reasonable basis for extrapolation.

The *New Atlas of Breeding Birds in Britain and Ireland: 1988–1991* (Gibbons *et al.* 1993) includes a colour-contoured 'abundance map' that depicts not actual abundance but the proportion of tetrads within each hectad in which the species was found during a single 2-hour, or two separate 1-hour, visits. Given the time limit and the fact that observers had to find as many species as possible, not just Common Sandpipers, it is possible that these data underestimate the actual proportion of tetrads per hectad that contained Common Sandpipers. Nevertheless this is the most extensive dataset available, and the only one available for Ireland.

The distribution by decile of *New Atlas* data cannot be deduced from the published map, but S. Gillings (pers. comm.) has kindly extracted them from British Trust for Ornithology files, enabling us to make estimates for the British Isles as a whole and for each country separately. This suggests a total population of 26,247 pairs with by far the majority (71%) in Scotland (Table 4).

It should be noted that the total number of hectads in which Common Sandpipers were found during the timed-visit survey is 185 more than the number in which breeding was confirmed or probable during the whole *New Atlas* project (1,405 hectads as opposed to 1,220 as published in the atlas). This reflects the fact that the timed-visit survey only recorded presence/absence and, in some of the hectads in which Common Sandpipers were found during timed visits, breeding was neither proved nor even found to be probable. Thus, although the time limit may have led to some underestimation, this seems to have been offset by recording birds that were not actually breeding.

Table 2. Area surveys for breeding Common Sandpipers in the British Isles.

(a) National atlases

Hectads in which breeding probable or confirmed	Hectads covered	Area covered	Years	Source
1,581	3,858	The British Isles	1968–1972	Sharrock 1976
1,231	2,816	England, Wales & Scotland	1968–1972	Sharrock 1976
1	14	Isle of Man	1968–1972	Sharrock 1976
349	1,014	Ireland	1968–1972	Sharrock 1976
1,220	3,858	The British Isles	1988–1991	Gibbons *et al.* 1993
1,056 (101 Wales, 228 England, 726 Scotland)	2,816	England, Wales & Scotland	1988–1991	Gibbons *et al.* 1993
1	14	Isle of Man	1988–1991	Gibbons *et al.* 1993
163	1,014	Ireland	1988–1991	Gibbons *et al.* 1993

(b) Local atlases

| Squares in which breeding probable or confirmed	Area covered	Common Sandpiper pairs/density	Location	Years	Source
126 monads	18 hectads	206 pairs, 11 pairs/hectad	Peak District, England	1977–1980	Holland *et al.* 1982
34 tetrads (11.8% of tetrads covered)	288 tetrads in 15 hectads		Greater Manchester, England	1979–1983	Holland *et al.* 1984
		19–34 pairs in 32.5 km², 0.58–1.04 pairs/km²	NW Sutherland, Scotland	1975–1980	Nethersole-Thompsons 1986
22 tetrads (21.3% of tetrads covered)	103 tetrads in 12 hectads		Cheshire, England	1978–1984	Guest *et al.* 1992
182 tetrads (18.2% of tetrads covered)	1,001 tetrads in 45 hectads	342 pairs, 1.88 pairs/tetrad, 7.6 pairs/hectad	Northumbria, England	1988–1992	Cadwallender 1995
489 tetrads (29.5% of tetrads covered)	1,660 tetrads in 72 hectads		SE Scotland	1988–1994	Murray *et al.* 1998
102 tetrads (18.9% of tetrads covered)	540 tetrads in 27 hectads	250 pairs[a], 2.45 pairs/occupied tetrad, 9.3 pairs/hectad	Lancashire, England	1997–2000	Pyefinch & Golborn 2001
296 tetrads (21.9% of tetrads covered)	1,362 tetrads in 66 hectads		Cumbria, England	1997–2001	Barron 2002
50 tetrads (17.9% of tetrads covered)	280 tetrads in 15 hectads		Derbyshire, England	1995–2001	Frost *et al.* in prep.

[a] Estimate (211 counted)
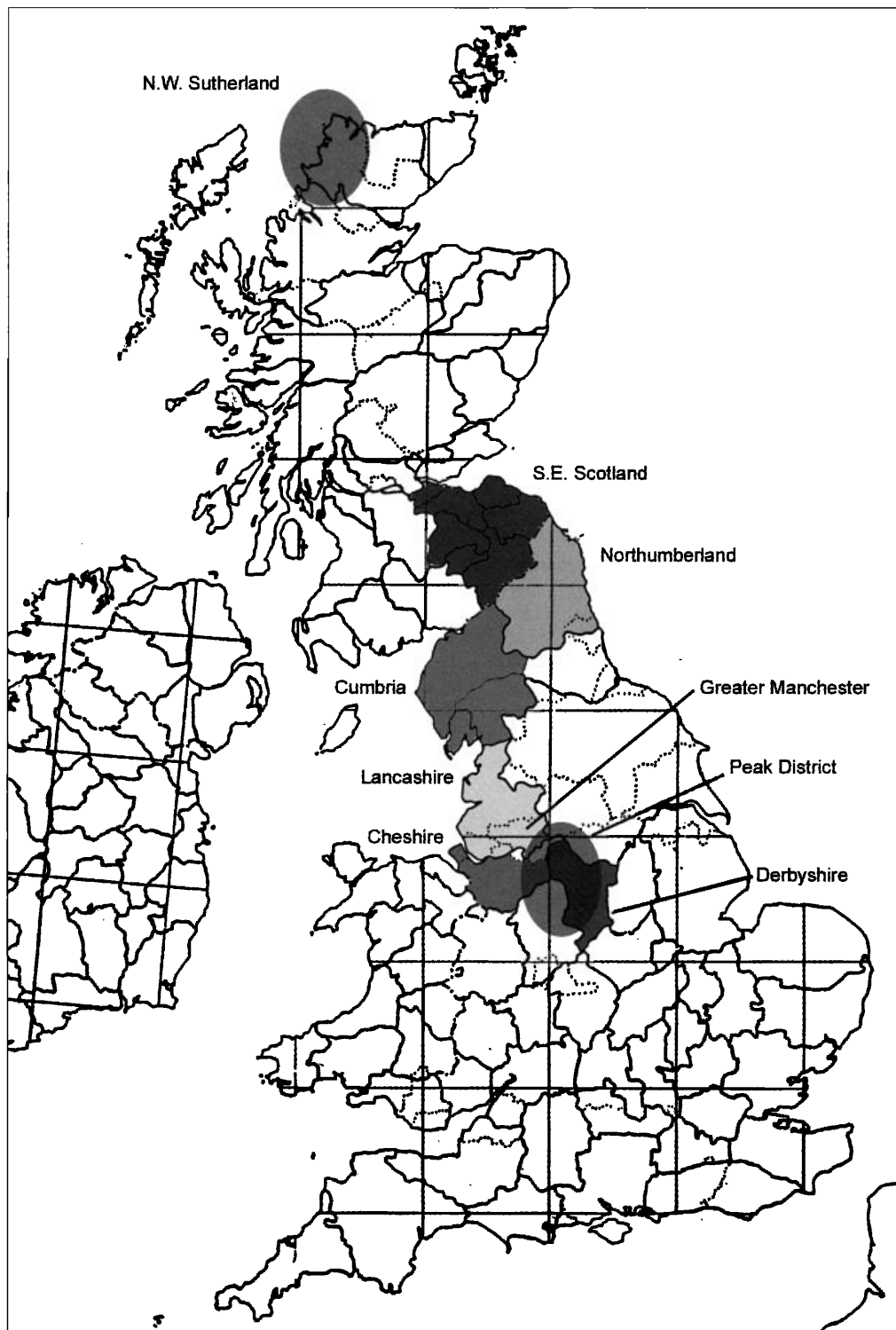
Fig. 2. Distribution of local areas surveyed (for county atlases and others) for breeding Common Sandpipers in Great Britain, as listed in Table 2. The Peak District, as surveyed in 1977–1980, partially overlaps later surveys for Greater Manchester, Cheshire and Derbyshire.

A converse error might be the extent to which the *New Atlas* maps show Common Sandpipers as proved to breed in at least some hectads in which the species was not found during the timed-visit surveys. However, this is likely to be less important in terms of total numbers because, if no Common Sandpipers were found during the timed visits, they cannot have been very abundant.

Of these three factors, the only one that is relatively easy to evaluate is the recording of Common Sandpipers in hectads where breeding was neither proved nor probable. These records presumably relate to hectads where Common Sandpipers were found in the lowest proportion of tetrads during the timed visits (because if they were found in a high proportion, proof of breeding would have been more readily

Table 3. Lengths of riparian habitat in NW Britain (from Harris *et al.* 1995) and population estimates (in bold) for these lengths, assuming linear densities of 0.2 (rivers) and 0.7 (lakes) pairs/km. The total available habitat might be estimated as either the sum of the river and lake shore (R + L) or the sum of river, lake and stream (R + L + S).

Water Authority area	River		Lake		Stream		Estimated pop. (pairs)	
	(km)	pairs	(km)	pairs	(km)	pairs	R + L	R + L + S
North West	1,091	**218**	373	**261**	10,907	**2,181**	**479**	**2,660**
Northumbria	983	**197**	457	**320**	10,771	**2,154**	**517**	**2,671**
Severn-Trent	1,115	**223**	375	**262**	23,048	**4,610**	**485**	**5,095**
Yorkshire	874	**175**	257	**180**	14,751	**2,950**	**355**	**3,305**
NW England	4,063	**813**	1,462	**1,023**	59,477	**11,895**	**1,836**	**13,731**
Scotland	20,761	**4,152**	6,373	**4,461**	117,231	**23,446**	**8,613**	**32,059**
Wales	3,873	**774**	403	**282**	23,708	**4,742**	**1,056**	**5,798**
NW Britain	28,697	**5,739**	8,238	**5,767**	200,416	**40,083**	**11,506**	**51,589**

Table 4. Estimation of separate populations for each country from "abundance map" in Gibbons *et al.* (1993). Figures are the number of hectads in each decile (per S. Gillings, pers. comm.), the number of tetrads (out of the total of 25) assumed occupied in each hectad at each density, and the population estimate (at 2.5 pairs per occupied tetrad).

Decile (proportion of tetrads occupied in hectad)	Number of hectads					No. of tetrads occupied out of 25	Number of pairs					Pairs/ hectad
	England	Wales	Scotland	Ireland	Total		England	Wales	Scotland	Ireland	Total	
>0.624	1	1	139	14	152	18	45	45	6,120	630	6,840	45
0.500–0.624	1	0	117	14	132	14	35	0	4,095	490	4,620	35
0.375–0.499	15	5	115	23	158	11	413	138	3,163	633	4,347	27.5
0.280–0.374	36	4	78	4	122	8	720	80	1,560	80	2,440	20
0.250–0.279	7	7	100	35	149	6.5	114	114	1,625	569	2,422	16.25
0.167–0.249	47	9	60	10	126	5.5	646	124	825	138	1,733	13.75
0.125–0.166	52	26	90	92	260	4	520	260	900	920	2,600	10
0.111–0.124	20	9	13	15	57	3	150	68	98	113	429	7.5
0.077–0.110	44	17	25	13	99	2	220	85	125	65	495	5
0.040–0.076	84	16	15	13	128	1	210	40	38	33	321	2.5
<0.040	16	6	0	0	22	0	0	0	0	0	0	0
TOTAL	323	100	749	233	1,405		3,073	954	18,549	3,671	26,247	18.25

obtained). On this basis, if the 185 hectads with the fewest tetrads containing Common Sandpipers were discounted, the estimate for the British Isles would be reduced by 1,087 pairs, from 26,247 to 25,160. This discount, however, is likely to be more than offset by underestimation arising from the time limit. Therefore in our opinion the best estimate of the population that is possible with these data is that set out in Table 4, but it is possibly still on the low side.

A similar approach, also giving separate estimates for each country, is offered by counting (approximately, because hectads, tetrads and monads straddle national boundaries) the number of occupied hectads in each country, combining the results of local tetrad surveys and the occupancy rates from Table 4 to estimate the likely occupancy in each hectad, and applying the same assumed density of 2.5 pairs/tetrad. In England and Wales, it is likely that about 15% of the tetrads are occupied in each occupied hectad (observed range in six English studies, 11.8–21.9%, mean of 18.3%, see Table 2; mean rate nationally from data in Table 4, 15%). There is only one local Scottish atlas in Table 2, suggesting a higher occupancy rate of 29.5%, but the analysis of Table 4 suggests

Table 5. Population estimates for the British Isles, based on likely proportion of tetrads occupied (at 2.5 pairs/tetrad) in hectads in which breeding was confirmed or probable according to the *New Atlas of Breeding Birds in Britain and Ireland: 1988–1991* (Gibbons *et al.* 1993).

Country	Hectads occupied	% tetrads occupied	N tetrads occupied	Population estimate
England	228	15	855	**2,138**
Wales	101	15	379	**948**
Scotland	726	38	6,897	**17,243**
Great Britain	1,056		8,131	**20,329**
Ireland	163	23	937	**2,342**
Man	1	10	3	**8**
British Isles	1,220		9,071	**22,679**

on average 38% of Scottish tetrads were occupied and 23% of those in Irish hectads. This gives an overall population estimate of 23,000 (Table 5); this is slightly lower than the estimate from Table 4 in part because fewer hectads are recognised as having breeding pairs.

The best stratified sample of breeding Common Sandpipers in the British countryside is the BTO's Breeding Birds Survey (BBS). Mead (2001) reported that this found Common Sandpipers in only 3.4% of the monads surveyed overall in Great Britain, but in Scotland M. Raven (pers. comm.) reports that the simple average over 9 years was 12.9%. To clarify these proportions, S. Gillings and S. Newson (pers. comm.) have reviewed the BTO data for 9 years of the BBS. They calculated weighted averages for each country, allowing for the different density of coverage in different regions. Based on 1,558 squares in England and 174 squares in Wales, only 2% were occupied by Common Sandpipers, contrasting with 15% from 273 squares in Scotland. No squares in Northern Ireland or the Isle of Man were occupied, and there are no equivalent data for Eire, for which a proportion of 5% was rather arbitrarily assumed (scaled up from England and Wales, down from Scotland, cf. Table 4). There seems to be only one published survey of an extensive area at the monad scale: Holland *et al.* (1982) found 206 pairs in 126 monads, at a mean of 1.63 (s.d. 1.09, range 1–8, median and mode both 1). Our two study areas, selected for their high populations, contained means of 2.56 (T.D., pers. obs., Scottish Borders) and 2.35 pairs per monad (DWY, pers. obs., Ladybower/Derwent/Howden Reservoirs) in 2003. It seems likely that the average per occupied monad is nearer 2 than 1 pair (since totally unsuitable habitat has, at this scale, already been excluded), and using 1.6 per monad gives estimates of 24,000 pairs for Great Britain and 30,600 pairs for the British Isles (Table 6).

DISCUSSION

This exercise has generated a large range of population estimates, of variable reliability. At least, however, the assumptions on which they are based are clarified.

Underlying the variability of the estimates, there are two central problems:

1. What proportion of habitat is suitable?
2. At what density is it occupied?

It is crucial to assess correctly the number of pairs per occupied hectad, tetrad or monad. More confidence in the assumptions of 2.5 pairs per occupied tetrad or 1.6 pairs per occupied monad would come from more atlas surveys in which pairs/territories are counted; the latter must be at least one pair, giving a minimum population estimate for Great Britain of 15,300 pairs if the occupancy rates are correctly estimated by the Breeding Bird Survey. The population of the British Isles would then be at least 19,500 pairs. Because it is based on presence in this stratified sample of the countryside, the best supported figure seems to be the estimate, using a density of 1.6 pairs/monad, of 24,000 pairs for Great Britain (including 19,000 pairs for Scotland), 30,600 for the whole of the British Isles (Table 6), and it is reassuring that the estimates in Table 4 – which we expected to be on the low side – are similar. The exercise emphasises the importance of the Scottish population, not previously made explicit. It also reflects the availability of freshwater in Great Britain described by Smith & Lyle (1979) who show that 66.7% of the lake area and 52.9% of the rivers and streams are in Scotland which supports 79.7% of the Common Sandpiper population (from Table 6). There are no BBS data for Ireland, so the Irish estimate must be taken cautiously. Moreover that for the Isle of Man is clearly excessive, since it is rarely recorded breeding there. The estimate of 30,600 implies a density of 25.1 pairs per hectad, which might be on the high side (Table 4), and is substantially more than the 15 pairs per hectad assumed by Yalden (1993).

In so far as this analysis is based on the 1988–1991 hectad distribution, the population estimated is essentially that of about 15 years ago. During 1968–72, the population must have been about 39,600 pairs in the British Isles (30,900 pairs in Great Britain, 8,700 in Ireland), assuming the same density across the wider distribution. The population apparently declined by 23% between the two national atlas surveys, and continues to decline. Analysis of the BTO's Waterways Bird Survey also suggests a decline of 23%, between 1989 and 1999 (Baillie *et al.* 2002).

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Table 6. Estimates of the populations based on the proportion of 1-km squares (monads) reported occupied by the British Trust for Ornithology's Breeding Bird Survey in England, Wales and Scotland, applied to the areas of each country at presumed densities of 1.6 or 2 pairs/monad.

Country	Area (km²)	% monads occupied	N monads occupied	Population estimates at 1.6 prs/md	at 2prs/md
England	130,298	2	2,606	4,170	5,212
Wales	20,824	2	416	666	832
Scotland	79,245	15	11,887	19,019	23,774
Great Britain	230,367	7	15,361	23,855	2,818
Ireland	84,364	5	4,218	6,749	8,436
Man	563	2	11	18	36
British Isles	315,294	6	19,590	30,622	38,290

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