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The breeding biology of the Common Sandpiper *Actitis hypoleucos* in the Peak District

by P. K. Holland, J. E. Robson and D. W. Yalden

This Common Sandpiper study shows what colour ringing can reveal about a species not otherwise amenable to detailed fieldwork.

THE POPULATION OF Common Sandpipers *Actitis hypoleucos* which breeds in the English Peak District is almost isolated from other breeding populations, and occupies the south-eastern edge of the species' breeding range in this country (Sharrock 1976). A survey of its status and distribution (Holland *et al.* 1982) suggests that 190-200 pairs breed in the Peak District, mainly in the gritstone areas and especially on the reservoirs. No attempt to follow population biology, using colour-ringing, has previously been reported. This paper reports our findings on the breeding biology and gives some indication of population dynamics.

METHODS

Common Sandpipers have a short breeding season; most do not arrive until mid-April, and they leave by mid-July. They are settled in their territories, and available for study, only during May and June. During the breeding seasons of 1977-1980, members of the South Pennine Ringing Group (including P. K. H. and J. E. R.) undertook an intensive study of the breeding population in the valleys of the Rivers Alport and Ashop. This included mapping the territories, locating nests, colour-ringing as many birds as possible (both by mist-netting adults and catching chicks) and, in the later stages, observing the occupancy and recurrence of marked adults. Ringing activity was extended, albeit less intensively, to other breeding sites, particularly Longdendale, and indeed sporadic ringing began in 1967. During 1977 and 1978, most effort was devoted to catching as many birds as possible; in 1979 and 1980, more effort was devoted to observing the marked individuals.

TABLE 1. WINGLENGTH (MM) OF BREEDING COMMON SANDPIPERS

	Mean	S.D.	Range	Sample
Males	111.5	2.96	105-117	24
Females	115.7	2.47	111-112	16

($t = 4.86$, $P < 0.001$)

RESULTS

Biometry

Adults. Common Sandpipers show no obvious sexual dimorphism, but trapping and colour-ringing have enabled some birds to be sexed by their subsequent behaviour or, in the case of females, by their much greater weight as they develop their eggs. Females prove to have a significantly larger winglength, but there is considerable overlap (Table 1).

Adult male Common Sandpipers on their breeding grounds weigh on average 51.6g ($n = 42$, s.d. = 3.3) (Figure 1). It is difficult to calculate a meaningful average weight for females, since they increase by 20-30 g as they develop their eggs; the average for all the points shown in Figure 1 is 67.4 g ($n = 33$), but the large standard deviation (11.0) emphasises the greater variability. Simple inspection of Figure 1 suggests that females weighing more than 62 g are carrying developing eggs. If these females are omitted, the remainder average 57.5 g ($n = 15$, s.d. = 3.0); the similarity of the standard deviation to that for the males' weight suggests that this average is an appropriate figure. There is some suggestion of a slight decrease in adult weights during the breeding season, these being lowest in late June. This is when the young have just hatched and are gaining weight rapidly, so that it is difficult to believe that the adults are suffering from a shortage of food. It seems more probable that they concentrate on protecting their young and reduce the amount of time they themselves spend feeding.

The weights of full grown Sandpipers (mostly adults, but possibly including some wrongly-aged young of the year) caught at passage sites away from the breeding area are

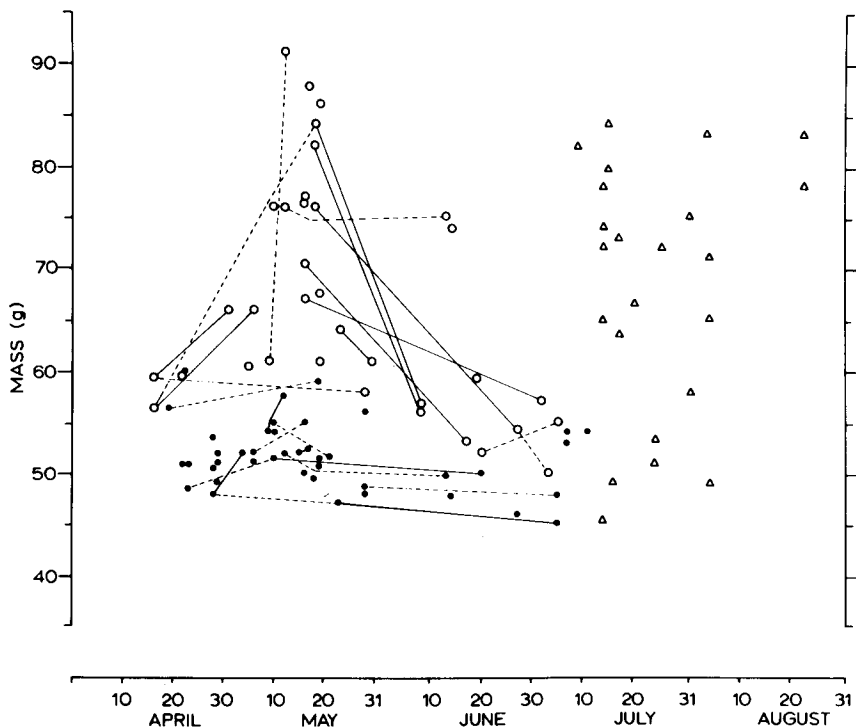


Figure 1. Weights of adult male (●) and adult female (○) Common Sandpipers caught in the study area during the breeding season, and of post-breeding adults (△) caught at feeding sites 10-20 km away.

Solid lines join records for an individual within the same breeding season; broken lines join records for an individual in different breeding seasons.

TABLE II. MEASUREMENTS OF FOUR YOUNG COMMON SANDPIPERS (RINGED WHEN NEWLY HATCHED) AT AROUND FLEDGING TIME, WITH ADULT MALE FIGURES FOR COMPARISON.

	Age (days)	Bill length (mm)	Wing length (mm)	Weight (g)	Remarks
A	18-19	21	82	35	Could not fly
B	18-19	19	93	41	Just flying
C	18-19	22	86	42	Just flying
D	19-20	20	88	39	Flying well
Adult male		25	111.5	50	(n = 10)

also shown in Figure 1. It is evident that weight increase may be very rapid, and that at least 30 g of fat may be deposited. The average figure for these birds is not very meaningful, and has a large standard deviation (\bar{x} = 69.2 g, n = 22, s.d. = 11.7).

Eggs. Four clutches, each of four eggs, were weighed; they totalled 42, 45, 46, and 54 g, giving a mean egg weight of 11.8 g; this is very close to the mean of 12.0 g (n = 34) given by the Nethersole-Thompsons (1979).

Chicks. Two broods of newly-hatched young were weighed; four chicks in one brood were 8.6, 8.6, 8.2 and 8.2 g, while three in the other were 6.5, 7.0 and 7.5 g. Bill lengths were 10-11 mm.

Fledglings. Four juvenile birds which had been ringed as newly-hatched chicks were reweighed 18-20 days later (Table II). Each came from a different brood. Evidently they first fly at about 40 g body-weight, and with bill lengths of 19-22 mm.

Breeding biology

Breeding season. The earliest birds arrive on the breeding grounds in mid-April; in our study area, the confluence of the Alport and Ashop rivers seems to be the favoured feeding ground for these first arrivals. The start of incubation was calculated back from the observed date of hatching; the incubation period of 21 days (Witherby *et al.* 1940) was confirmed by our own observations in two cases where nests were followed in detail from laying through to hatching. For a sample of 49 nests (Figure 2), the modal period for the start of incubation was 15-20 May. Extremes were 6 May and 24 June, but for only two clutches did incubation start later than 5 June (ie. 19 and 24 June) and presumably they were replacement clutches. Certainly replacements are sometimes laid when the first nesting attempt fails; we observed this on two occasions, and the replacement nests were successful.

The modal period for hatching was 6-11 June and, as the young fledge in a further 18-20 days, most young fly in the last week of June. The last clutch hatched on 15 July and the young, if they survived, would have fledged about 4 August. Common Sandpipers seem to abandon their breeding areas as soon as the young can fly, and it is unusual to see birds in the Peak District after mid-July (cf. Figure 1). The latest sighting was of a single colour-ringed juvenile on 4 August 1977; in later years the last sightings have been 14 July 1978 (4 birds), 21 July 1979 (2 families with late broods and 4 other birds) and 9 July 1980 (about 6 birds).

Nest sites. Nests were sought in two areas: the river valley system of the Ashop and Alport, and the reservoir system of Longdendale (the valley of the Etherow). The sample of 98 nests was fairly equally divided between these two areas: 52 and 46 respectively. The mean altitude of the nest sites was approximately 637 ft (193 m) but the distribution was

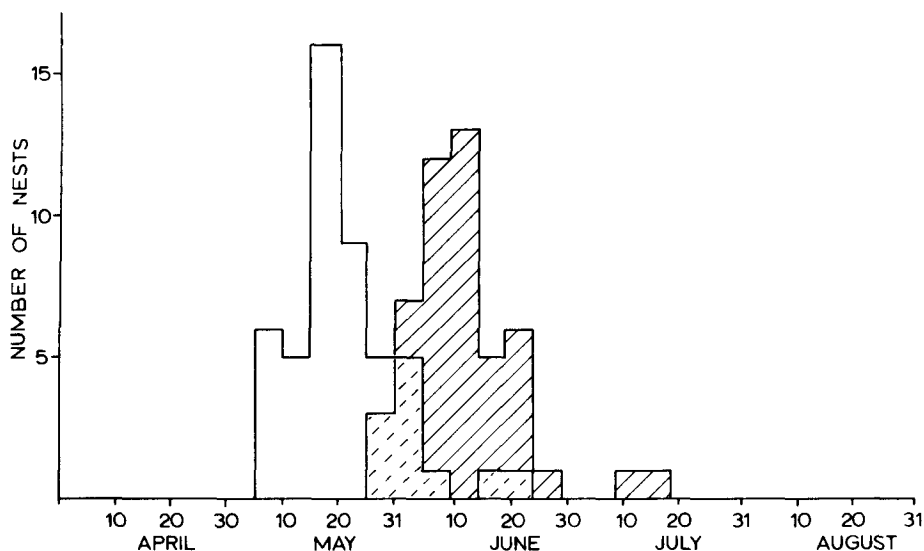


Figure 2. Histogram of hatching dates (grouped in 5-day periods) observed for 49 nests (hatched) and calculated dates of commencement of incubation.

bimodal, reflecting the difference between the two areas; Longdendale is generally lower than the Ashop valley study area. Given the more limited sampling on which it is based, this figure compares well with the figure from the distribution survey (756 ft = 230 m) for the average altitude of a Common Sandpiper territory in the Peak District (Holland *et al.* 1982).

Nests were always on the ground, generally in sparse vegetation. In Longdendale they were usually on the top of reservoir banks on flat ground, but occasionally were on the steep banks of artificial water courses or the natural inflow and outflow streams. In the Ashop and Alport valleys nests were usually on the steep banks, with nearly all nests more than 4 m above water-level, and exceptional nests 20 m or more up the banks. Just two nests were lower than 4 m; these were on islands in the river, and both failed. In both study areas, all the nests which we located were within 50 m (horizontally) of the water's edge, but as our searching was concentrated in this band, the figure may be biased. The fact that we caught unringed juveniles later in the season suggests that we missed some nests; these could have been further from the water. In 1979, two territories at the Ladybower Reservoir were apparently centered 70 m back from the water's edge in conifer plantation; the shore-line there was much disturbed by anglers (Holland *et al.* 1982).

The nests on steep banks had some protection on one side from the bank itself. On flatter ground, nests were usually placed against a clump of rushes or tuft of grass. The vegetation in the area of the nest was noted in 58 cases; 40 were in a mixture of short grass and rushes, 15 in bracken, two in heather and one in nettles. Nests in taller vegetation — bracken or heather — were always near the edge of the patch, rather than in the middle of the thicket.

TABLE III. SIZE OF 98 COMPLETED CLUTCHES OF COMMON SANDPIPER IN THE PEAK DISTRICT

Clutch size	1	2	3	4
Number of clutches	1	3	16	78
% of clutches	1.0	3.1	16.3	79.6

Clutch size. We were able to confirm the completed clutch size, by repeat visits, in 98 cases. Clutches ranged from 1 to 4 eggs, but 80% had 4 eggs and the mean clutch size was 3.74 (Table III). On only two occasions did we note depletion of the clutch during incubation; one clutch declined from 4 to 3, the other from 3 to 2 eggs.

Hatching success. Of the 98 nests, the immediate outcome was known for 88 (Table IV); 78 (89%) hatched and 10 failed. Of 367 eggs laid, 297 hatched, 34 failed, and the outcome for 36 was unknown. Failures were evenly distributed between reservoir and river territories; three clutches disappeared, presumably taken by humans, one was deserted prior to the nest being flooded, and two more were deserted due (probably) to human disturbance. Just four clutches suffered natural predation, with egg remains found in or near the nest. Cuthbertson *et al.* (1952) recorded a rather similar pattern for their 30 nests, with 24 hatching, one flooded, two predated by crows and three lost to 'unknown' causes.

Fledging success. It is very difficult to document fledging success of nidifugous birds. If family parties stay together (as in Red Grouse *Lagopus lagopus*: Jenkins *et al.* 1963) then young: adult ratios may be counted. This does not happen for Common Sandpipers, and since they leave their breeding territories so soon after fledging even general counts of young and adults are impossible. A minimum figure for fledging success is the number of young ringed as chicks which are retrapped as juveniles later in the season or seen in subsequent years. Combining the results from 1979 and 1980, 74 chicks were ringed; 17 of these were caught again later in the same season, and another one was seen a year later. This suggests a minimum fledging success of only 24%. A slightly better estimate of minimum fledging success can be derived from a combination of these retraps, sightings of flying young and observations of alarmed parents during the latter part of the chick's growth period. This suggests that 26 chicks of the 74 ringed probably survived, a fledging success of 35%.

TABLE IV. CLUTCH SIZE AND HATCHING SUCCESS FOR 98 NESTS OF COMMON SANDPIPER IN THE PEAK DISTRICT.

Year	No. nests	Mean clutch size	Territory type:		Outcome			% hatched (excl. unknown)
			Reservoir	River	Hatched	Failed	Unknown	
1967-1973	16	4.00	10	6	16	—	—	100
1974	9	3.88	5	4	8	1	—	88.8
1975	11	3.18	5	6	10	—	1	100
1977	16	3.75	6	10	14	1	1	93.3
1978	23	3.69	12	11	16	1	6	94.1
1979	11	3.90	2	9	7	3	1	70.0
1980	12	3.75	4	8	7	4	1	63.6
Total	98	3.74	44	54	78	10	10	88.6

In practice, not all nests were found, and not all broods were located and ringed. Of 28 recently-fledged young which were caught in mist-nests on the breeding streams, 17 had been ringed as chicks and 11 were new; hence we may have missed up to 40% of the local chicks. Alternatively, these 'new' fledglings may have been moving through our study area after fledging in adjacent areas. In fact, two of the 11 'new' juveniles were known to have come from local broods but had been missed by our earlier ringing efforts.

Overall, combining broods which were ringed and those which were missed, we estimated that 23 young were fledged in 1979. In 1980, estimated production was much lower, at 13 young, and breeding streams were deserted a week earlier. The very dry weather in May could have led to increased recreational disturbances, or may have reduced the food supply.

If 23 young were produced by 24 pairs in 1979, and that was a typical breeding season, it suggests a young:adult ratio of only 0.5 in the post-breeding population. The data tabulated by Brown (1974), for various sites in Britain where Common Sandpipers are caught after the breeding season, suggest a ratio of 1.63 young per adult. This figure is biased because young birds stay longer at passage sites, but even allowance for that suggests a ratio of 1.25:1. Either young birds are much more susceptible to trapping, or our figure for productivity is not typical.

Population biology

Numbers colour-banded. During 1977 and 1978, considerable efforts were made to mark both breeding adults and chicks with colour rings; during 1979 and 1980, less effort was devoted to colour-ringing and more time was spent observing the marked birds. The numbers of adults which received colour rings in 1977-80 were 29, 19, 5 and 4 respectively. In 1979 there were apparently 21 breeding pairs, ie. 42 birds; of these 32 were colour-ringed, and we believed there were eight unringed, which left two birds unaccounted for. In 1980 there were 23 territories, ie. 46 birds, of which 30 were colour-ringed, 13 unringed and three unaccounted for. Obviously we could have confused unringed birds with one another (which might explain the unaccounted birds), some territorial birds might not have found mates, or we failed to get good views of birds which failed early in their breeding attempt.

Survival. Of 32 colour-ringed breeding birds present in 1979, 26 were present again in 1980, an annual survival of 81% (Table V). Of the large sample (29) marked as adults in 1977, 13 were still present as breeding adults in 1980, an annual survival of 76%. Because many birds were caught as breeding adults, we cannot determine the age structure of the population; those of known age (ie. ringed as chicks) are shown in Table VI.

TABLE V. SURVIVAL OF COLOUR-RINGED COMMON SANDPIPERS.

<i>Ringed in</i>	<i>No. ringed</i>	<i>Breeding birds in</i>	
		<i>1979</i>	<i>1980</i>
1977	29	16	13
1978	19	11	10
1979	5	4	3
1980	4	—	4
Total	57	31	30

TABLE VI. COMMON SANDPIPERS OF KNOWN AGE IN THE 1979 AND 1980 BREEDING POPULATION ON THE ASHOP/ALPORT STUDY AREA.

<i>Breeding in:</i>	<i>Ringed as chicks in:</i>			
	1974	1976	1977	1979
1979	2	1	1	—
1980	2	1	—	1

The recorded longevity of the species in Britain is just under 9 years (3277 days: Mead and Hudson 1973); in addition to retrapping two birds ringed as chicks when 6-year old adults, we have had two adults 8 years after ringing as adults, and therefore at least 9 years old. The 1978 breeding population included one male ringed as an adult in 1970 and another adult ringed in 1973; the latter did not return to the Ashop in 1979, but was found dead on 14 April 1979 at Combs Reservoir, only 15 km away to the south-west.

Recruitment. During 1977-1979 we ringed 150 chicks in the Peak District and an additional 20 juveniles. During 1978-1980, nine birds which had been colour-ringed as chicks and five which had been ringed as juveniles were present as breeding adults. (Nine survivors from 150 chicks suggests 94% mortality, though this includes emigration.) Four of these were back as successful breeding adults at one year old, so that delayed recruitment probably is not operating, or at least is not regular. The origin and adult abodes of these 14 individuals are shown on Figure 3. Many of the adult sites are in what seem to us poorer areas for Sandpipers, and this may reflect the intense competition in such favoured sites as the Ashop valley.

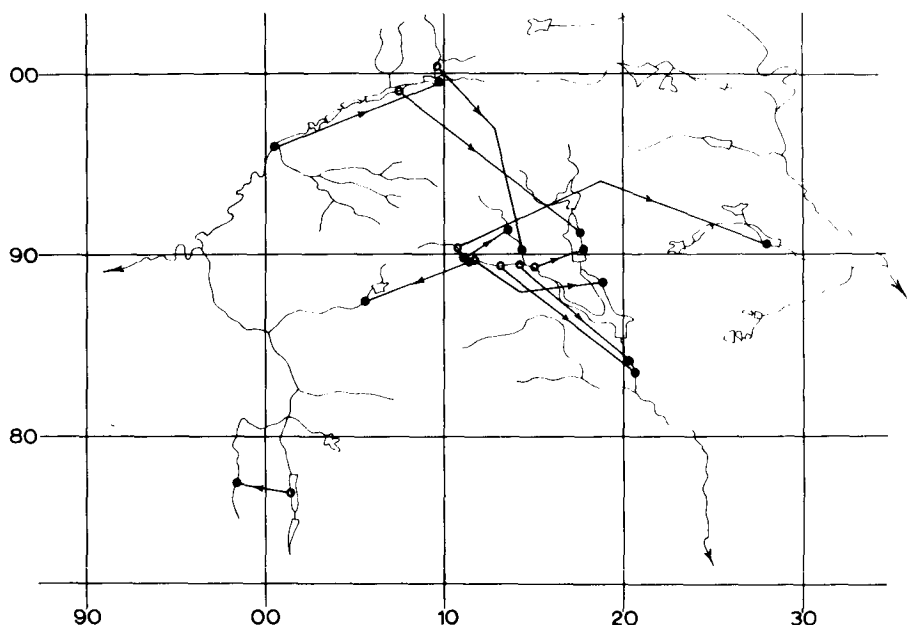


Figure 3. Sites of return as breeding adults (●) for Common Sandpipers ringed as chicks (O, $n = 8$) or as fledglings (⊙, $n = 3$). The graticule shows 10 km squares of the National Grid.

If the breeding population of the Peak District is 400 birds (200 pairs) with an annual survival of 81%, 76 recruits are needed each year. Over the three years when we were ringing chicks, 228 recruits would be needed. If the pairs lay (on average) clutches of 3.74, with a hatching success of 88%, they should produce 658 chicks per year, or 1,974 over three years. The 170 which we ringed in 1977-1979 is then 8.6% of the putative chick production, and the 14 recruits which we saw were 6.1% of the 228 which were required. These percentages are sufficiently close as to suggest that the Peak District population is essentially self-maintaining. However, it is not a closed population. One female found breeding at Hayfield in 1978 had been ringed as a non-breeding adult at West Burton, Yorkshire (97 km north) the previous year. Conversely, one of our chicks, colour-ringed in 1978, was seen during the 1980 breeding season near Bethesda in Snowdonia (155 km WSW).

Site and mate fidelity. Many migrant birds are known to return in subsequent years to territories where they have nested successfully. Given that we cannot be sure what boundaries the birds themselves recognise, we have scored Common Sandpipers as returning to the 'same' territory when they reappeared in either the identical area to a previous year or in its immediate neighbours.

Of 55 'returns' which could be scored (Table VII), 47 birds were back in the 'same' territory, and only eight had changed territories. There is a suggestion that females are more likely to move than males, but the numbers involved are too few for the difference to be statistically significant.

TABLE VII. SITE FIDELITY OF COMMON SANDPIPERS IN SUCCESSIVE BREEDING SEASONS.

		♂	♀	Total
1977-1978	"same"	4	4	8
	moved	1	1	2
1978-1979	"same"	12	6	18
	moved	2	3	5
1979-1980	"same"	14	7	21
	moved	0	1	1
Total	"same"	30	17	47
	moved	3	5	8

The new home sites of birds which moved are presumably in what the Sandpipers find to be more favourable areas. They suggest a favoured stretch of the River Ashop near its confluence with the Alport (Figure 4); this is also the first stretch to be populated each spring, and is where the earliest chicks hatch.

Although many pairs re-appear in their old territories, there is also some exchange of mates. Two pairs breeding in 1979 were paired again in 1980; on the other hand three males, present in their old territory, had different mates in 1980, though their 1979 females were still present in the breeding population. The birds in two 1978 pairs had split between four different pairs in 1979. One particular female which had raised young in both 1978 and 1979 along the River Alport (where her male was present again in 1980) turned up in May 1980 high up the river, but finished with a late brood downstream of the Ashop/Alport confluence in June 1980.

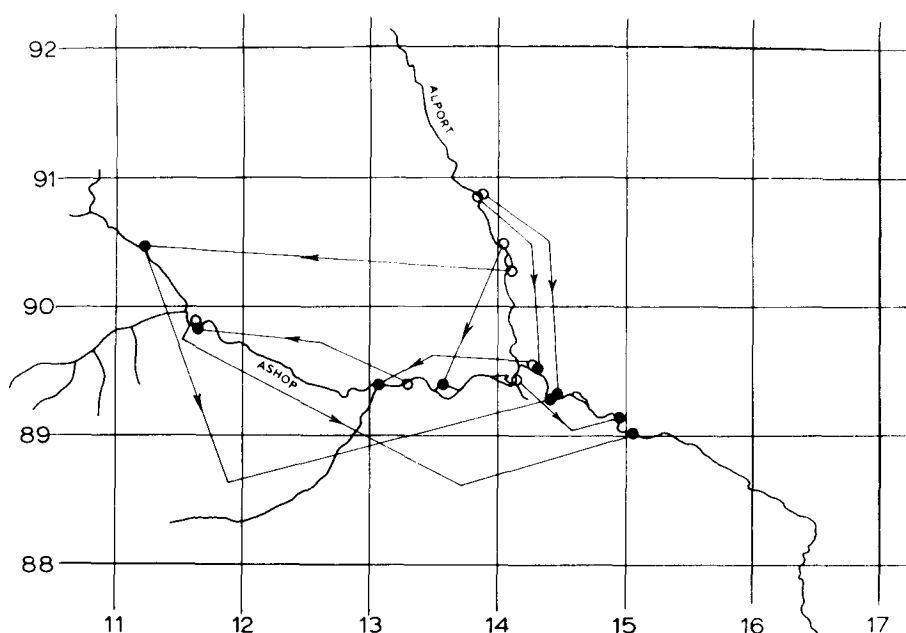


Figure 4. Earlier (○) and later (●) territories of 8 breeding Common Sandpipers which changed their territory within the study area from one year to another.

One bird changed territory again within one season. The graticule shows 1 km squares of the National Grid.

Dispersal. As indicated above, the breeding streams are generally abandoned by mid-July. Almost as soon as they can fly the juveniles move off downstream, and often one parent has departed well before fledging. In former years many Sandpipers were caught at the Glossop Sewage Farm in July, and some were retraps of Peak District breeding birds. A few birds are still trapped at similar sites (eg. Greenfield and Denton Sewage Farms) within 10 km of the breeding areas (and their weights are shown in Figure 3). Other birds seem to feed-up, prior to migration, further afield than this; sightings of colour-ringed birds have been reported to us from Sandbach flashes, Cheshire. The precise wintering areas of British breeding Common Sandpipers are not known, but are presumed to be in West Africa. Ringing recoveries in autumn under the BTO ringing scheme have come from France and Belgium (11), Iberia (5), Morocco (2) and Guinea (1); these were not necessarily British breeding birds, as some will have been ringed while on passage through Britain. One of our birds, ringed as a breeding adult on the River Ashop in 1977 and which successfully reared young in 1978, was seen back in a territory in May 1979 but apparently failed to breed successfully, and was recovered in Morocco (2029 km south) on 15 June 1979 (Spencer and Hudson 1980).

DISCUSSION

The information on breeding biology needs comparison with studies on other waders, notably its close relative the North American Spotted Sandpiper *Actitis macularia*, and the strengths and shortcomings of our own results require some examination.

Significant results and outstanding problems

As expected, most Common Sandpipers laid clutches of 4, and mean clutch size (for 98 nests) was 3.74; hatching success was high (88%) and adult survival in the colour-ringed population was also high (81%). As in most studies of nidifugous birds, our estimate of fledging success is only approximate, a range of 24-35% being inferred. Moreover, these are figures for minimum fledging success. Site fidelity is quite marked, with 85% of returning birds being back in the same territory as in the previous year, but mate faithfulness seems slight. Another problematic area concerns the post-breeding dispersal and migration; the breeding streams are vacated very quickly, and it seems that Common Sandpipers fatten up in favourable feeding areas elsewhere before migrating (cf. Brown 1974). We do not know precisely where these are for our breeding population, neither do we know how quickly the birds leave for (presumably) West Africa. Their precise wintering grounds are unknown.

Comparisons with other wader studies

The fact that Common Sandpipers normally lay clutches of 4 and have a high hatching success accords well with results for several other wader studies (Table VIII). The high adult survival, 81% per annum, is a little higher than revealed by other colour-banding

TABLE VIII. BREEDING SUCCESS AND SURVIVAL OF EUROPEAN WADERS
(ARRANGED BY BODY SIZE)

<i>Species</i>	<i>Clutch size</i>	<i>Hatching success</i> (% eggs laid)	<i>Fledging success (%)</i>	<i>Adult mortality</i> (% p.a.)	<i>Reference</i>
<i>Calidris alpina</i>	3.91	69	22*	27	Soikkeli 1967
<i>Actitis hypoleucos</i>	3.74	90	c.35	19	this study
<i>Tringa nebularia</i> †	3.92	77	32?	26‡	Nethersole-Thompsons 1979
<i>Eudromias morinellus</i>	2.91	92	c.21	—	Nethersole-Thompson 1973
<i>Pluvialis apricaria</i>	3.86	62	—	—	Ratcliffe 1976
<i>Vanellus vanellus</i>	3.75	78	23	—	Jackson & Jackson (1980)
<i>Gallinago gallinago</i>	3.89	56	?	—	Mason and Macdonald 1976
<i>Haematopus ostralegus</i>	3.0	64	48	11	Harris 1967

*survival to one year old; † first clutches only; ‡ "females breed 3.3 years on average".

studies of small waders, eg. 73% for Dunlin *Calidris alpina* (Soikkeli 1967), 74% for ♀ Greenshank *Tringa nebularia* (Nethersole-Thompson and Nethersole-Thompson 1979), but given the necessarily small sample sizes of all these studies is probably quite close to the true value. The longevity shown by at least some individuals in our and other studies accords with these survival rates. Ecologically, it is to be expected that either fledgling or first-year mortality would therefore be high (since this is essentially a stable and self-contained population). While our estimate of fledgling mortality was not especially reliable, and was a maximum, a failure rate of 65% and a calculated overall first year mortality (from hatching to return to the breeding site at one-year old) of 94%, do in fact correspond quite well to the 90% overall first year mortality which we can calculate as allowing sufficient recruits to maintain our population, given the observed adult mortality. Hale (1980) quotes various figures for fledging success of 30%–86% for different waders, and remarks that these are probably underestimates because some surviving young will be overlooked; he also quotes one figure of only 4.6% fledgling survival for German Oystercatchers *Haematopus ostralegus*. However, low chick survival rates would not be unexpected; in their careful study of Lapwing *Vanellus vanellus*, Jackson and Jackson (1980) found that fledgling mortality was 77% in the good breeding years (1971–74), and rose to 100% in 1978.

Boyd (1962) calculated an adult annual mortality of 48% but regarded this as an unreliable estimate; a high rate of ring wear and loss, or a biased sampling which included perhaps non-breeding adults, seem likely explanations of the discrepancy. Our estimate of 19%, though based on a small sample, seems likely to be a more reliable statistic for established breeding birds.

Two studies of the Spotted Sandpiper (Hays 1972, Oring and Knudson 1972) have found that it frequently shows serial polyandry. We found no evidence of females consorting with two successive males within one breeding season; both parents are usually present during the early stages of fledging. It would be impossible to prove that *A. hypoleucos* never shows serial polyandry, but clearly it is not the norm. The Nethersole-Thompsons (1979) have pointed out that while the clutch in *A. hypoleucos* is around 100% of the female's weight, in *A. macularia* it is around 70% (their Table 22); they argue that the smaller proportion in *A. macularia* is an adaptation to laying two clutches in quick succession.

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SUMMARY

The breeding biology of the Common Sandpiper has been studied in the Peak District by finding nests and by colour-ringing both chicks and adults. A sample of 98 nests produced a mean clutch size of 3.74, and a hatching success of 89%. Fledging success was difficult to estimate, but our results suggested a minimum of 24–35%; fledging took about 19 days, and occurred at a weight of about 40 g. Annual survival of the ringed adults was apparently 81%, and site fidelity from year to year was 85%. Although our estimate of fledging success was minimal and perhaps unreliable, a simple modelling of the population (using our calculated clutch size, hatching success and adult survival) suggested that it would suffice to maintain the breeding population.

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