Arrival and departure patterns of Eurasian Curlew *Numenius a. arquata* wintering on the River Severn estuary, Gloucestershire, southwest England

JOHN D. SANDERS[1,*] & EILEEN C. REES[2]

[1]18b Cleevelands Drive, Cheltenham, Gloucestershire GL50 4QF, UK.
[2]Wildfowl & Wetlands Trust, Martin Mere, Fish Lane, Burscough, Lancashire L40 0TA, UK.
Correspondence author. E-mail: john.sanders1@btinternet.com

Abstract

Regular spring and autumn observations of colour-ringed Eurasian Curlew *Numenius a. arquata* wintering on the River Severn estuary in Gloucestershire, UK, marked during 2010–2013 inclusive, were used to locate surviving ringed individuals (n = 147 birds resighted) and describe the timing of their annual arrivals and departures. Breeding locations reported for 18 birds were from Fennoscandia (5), the Netherlands or Germany (6) and Britain (7). Fennoscandian birds remained significantly later on the estuary each year than the 13 individuals known to breed in Britain, the Netherlands or Germany. Departure dates recorded for 109 Curlew during a more intensive survey in 2016 similarly found that onset of spring migration was significantly later for birds known (or thought because they remained on the estuary until April) to be of Fennoscandian origin. Curlew returned from breeding grounds to the Severn estuary from the first week of June onwards, sooner than reported in previous studies, but with limited evidence for differences in return dates for Curlew breeding in different parts of Europe. Whether early arrival is associated with a failed breeding attempt could not be determined.

Key words: breeding distribution, colour-marked individuals, movements, winter arrival dates, winter departure dates.

Eurasian Curlew *Numenius a. arquata* have been counted on the lower reaches of the River Severn estuary in Gloucestershire, UK, since 1963, where up to 1,400–1,800 birds were recorded during the late 1970s to early 1980s. More recently, numbers on this part of the estuary have declined to annual maxima of *c.* 1,000 in 2013 and *c.* 800 in 2017–2018 (Gloucestershire Naturalists' Society, P. Hazelwood and J. Sanders, unpubl. data). This concurs with counts made during the UK's mid-monthly Wetland Bird Surveys (WeBS), which reported declining numbers wintering across a larger part of the estuary from *c.* 4,500 birds in winter 1992/93 to *c.* 3,000 by winter

2008/09 (Waters & Cranswick 1993; Calbrade *et al.* 2010). Curlew migrate to British wintering sites from breeding areas across Europe, including from other parts of Britain, the Netherlands, Germany and Fennoscandia (Bainbridge & Minton 1978; Brown 2015). The distribution of the British-breeding population contracted (Balmer *et al.* 2013), and numbers declined by 48% between 1995 and 2014 (Baillie *et al.* 2010; Harris *et al.* 2016), most likely because of factors such as intensification of agriculture, forestry and increased egg and chick predation (Grant *et al.* 1999; Brown *et al.* 2015; Franks *et al.* 2017). Numbers breeding in Belarus, Belgium, Denmark, France and Germany have been stable or increasing during the 1990s–2000s (Brown 2015), in contrast to other common waders such as Northern Lapwing *Vanellus vanellus*, Redshank *Tringa totanus* and Common Snipe *Gallinago gallinago* (Heldbjerg & Eskildsen 2009; Calbrade *et al.* 2010; BirdLife International 2018). Given the variation in trends noted for the species across Europe, data on the breeding distribution and migration phenology of individuals observed on the wintering grounds may provide insight into any differences in trends in numbers recorded for Curlew at wintering sites within the UK.

Although relatively little is known about the timing of Curlew movements to and from their wintering sites in Britain, adult Curlew which remain at British coastal sites as late as April are considered to be of Fennoscandian origin (Evans 1966; Bainbridge 2002), whereas British-breeding Curlew disperse to their breeding areas earlier, such that many breeding areas in southern Britain are reoccupied during February (Bainbridge 2002). Radar studies by Lack (1962) of waders returning to their wintering grounds reported that early migration of Curlew from mainland Europe into East Anglia occurred in late June to early July, and more recently Bainbridge and Minton (1978) found that although most movements of Curlew breeding in Britain and Ireland begin in August, early movements of failed northern breeders and females occur in July. Although both sexes care for and brood the young post-hatching (Cramp & Simmons 1983), British-breeding males remain a little later to tend the chicks in late June and July, whilst the young are learning to fly (Bainbridge 2002; M. Smart *in litt.*). The review by Cramp and Simmons (1983) additionally suggested that Fennoscandian Curlew begin to arrive in North Sea estuaries to moult in July–August. Overall, the studies therefore indicated that the majority of adult birds from the different breeding areas are probably at their wintering sites in Britain by the end of September.

During the 1960s–1970s, small numbers of Curlew on the Severn estuary were caught by members of the former Severn Vale Ringing Group and fitted with metal rings, yet little is known about the timing of movements and breeding distribution for birds wintering at the site. More recently, eight years of observations (August 2011–April 2018) of 165 Curlew colour-ringed at a high tide roost near Wibdon (51.664°N, 2.620°W) during 2010–2013 inclusive indicated high levels of winter site fidelity (Sanders 2017). From over 10,000 resightings of 147 colour-ringed birds at or near the ringing site in at least one winter after ringing (Sanders 2017; J. Sanders, unpubl.

data), only one is known to have moved to another estuary, in Cornwall (M. Grantham, pers. comm.). That the same marked birds return to the estuary each year provides an excellent opportunity for analysing the timing of their movements, and (for individuals identified on the breeding grounds) to determine whether arrival and departure patterns vary with breeding distribution. Adult Curlew remaining in Britain into April are thought to be of Fennoscandian origin (Evans 1966; Bainbridge 2002), so the presence of over 505 Curlew counted on the Gloucestershire sections of the Severn estuary between 8–10 April 2015 (out of about 900 present earlier in the winter; J. Sanders pers. obs.) suggests that just over half of the birds wintering in Gloucestershire migrate to Fennoscandia.

This paper analyses the sightings of colour-marked Curlew on the Severn Estuary from 2011 onwards, to describe arrival and departure patterns for comparison with the earlier studies of the species' migration phenology. As adult female Curlew depart from their breeding grounds first, leaving males to tend the young (Bainbridge & Minton 1978; Bainbridge 2002), whether females returned to their winter quarters earlier than males was investigated. Sightings in the breeding range are also reported, with an analysis of the arrival and departure dates recorded for these individuals, to relate timing of spring and autumn migration to their breeding distribution.

Methods

Following the colour-ringing of 165 Curlew caught at Wibdon on the Severn Estuary in September 2010, attempts were made each spring and autumn to find and identify every marked bird in the Gloucestershire section of the estuary between the harbour at Lydney (51.710°N, 2.508°W) and the first road crossing of the River Severn (51.609°N, 2.638°W). Individual identification was not straightforward; birds were marked with different colour rings on both the left and right tibiae, so observations of both legs were essential to confirm identity. Mudflat-feeding birds were usually observed *c.* 0.5 km away, making ring identification difficult, and when closer on the high tide roosts the Curlew usually stood on one leg. Optimum ring reading time was during first arrival at the roost when both legs were still visible. Close viewing was essential to ensure correct colour ring identification, confirmed by digiscope images, made from behind a screen set before the first birds arrived (at least 3 h before each high tide) to minimise disturbance. Observation periods at Wibdon and at five other high tide roosts in the study area were governed both by the timing of the tides and weather conditions, clustering sightings at two-week intervals. Guscar Rocks (51.682°N, 2.586°W) and Littleton Warth (51.621°N, 2.593°W) were best viewed on spring tides which push the birds further up the shore, while Aylburton Warth (51.692°N, 2.554°W), Wibdon, Pillhead Gout (51.629°N, 2.584°W) and Shepperdine (51.656°N, 2.568°W) were best observed on neap tides.

Determination of Curlew departure in late winter and early spring was confounded by the dispersal of birds over wide areas on both sides of the estuary and field-feeding, rather than being concentrated at high tide

roosts. Recording became easier in late March and April, when birds returned to feed on the estuary and daylight hours were longer, making it possible to record the number and identity of colour-ringed individuals that stayed into April. A more intensive study was carried out during 2016, particularly during February–April (n = 41 visits; average = 13.7 visits/month) and June–August (n = 32 visits; average = 10.7 visits/month), focussing on sites known from previous years to be best for identifying individual Curlew, to determine as accurately as possible the colour-ringed birds' departure and return dates. Observations were made in all months from August 2011 except for June–July 2015, with the total number of site visits made annually ranging from 58–199 during 2012–2017 inclusive. A single observer cannot cover all six roost sites simultaneously, so it was impossible to find all of the ringed birds present in the study area on a single day, but all colour-ringed individuals were searched for each week in spring and autumn, so that there was a high degree of certainty that movement to or from the estuary could be assigned to a particular week especially in 2016. Given observation frequency, the week after 1 January in which an individual was last seen in late winter or spring therefore was used as the point at which it embarked upon spring migration, with the week after 1 January in which it was first seen back on the estuary in summer/autumn similarly used to describe its timing of return.

Sightings of 18 colour-marked Curlew identified at their breeding sites were used to determine whether an individual bred in Britain or elsewhere in Europe. These birds were grouped into three breeding locations, based on the assumption that they would be philopatric in the breeding range: Fennoscandia, England and the Netherlands/Germany. As some Curlew were seen over several years, the average departure week and average return week was calculated for each bird to control for repeat observations of the same individuals in the data. General linear models (GLM) with Gaussian error distribution and identity link functions in Program R version 3.5.1 (R Core Team 2018) analysed whether the birds' sex and breeding area had a significant effect on the timing of their migration from and to the Severn Estuary, with average departure week and average return week included as the response variables. Inspection of the data and residuals confirmed normality and the absence of outliers, indicating that the data met the assumptions of the model. Tukey's *post-hoc* tests were then used to determine which of the breeding populations differed significantly from each other. Given the relatively small sample of individuals whose breeding location was known, unpaired t-tests further assessed whether birds from a larger sample of individuals known (or presumed) to be from Fennoscandia (*i.e.* last seen on the estuary during April in at least two years, as indicated in the Results below) differed significantly from those not classed as Fennoscanian for the detailed observations made in 2016. An unpaired t-test also tested whether a larger sample of males differed significantly from females in the weeks during which they were first and last seen on the estuary. Sex was determined from bill

length measures taken of the birds when the Curlew were caught for ringing (*e.g.* Summers *et al.* 2013). Those with bill lengths of 130mm and below were considered to be males, those at 140mm and above were classed as females, and sex was not allocated for several individuals with intermediate bill lengths.

Results

Departure in spring

During 2016, of 109 Curlew identified from June–November 2015, 14 (12.8%) were not seen after the end of February, 27 (24.8%) were last seen in March, and 35 (32.1%) remained on the estuary until the end of the third week of April before departing. No colour-ringed birds were sighted in the last week of April (Fig. 1). Of 41 birds last seen in the study area in February–March 2016, 10 (24%) were known to have nested in England, the Netherlands or Germany in at least one year, whereas none was recorded in Fennoscandia. In contrast 5 (7.4%) of the 68 birds departing in April 2016 were identified in Finland or Sweden during the study, whereas none was reported breeding elsewhere (Fig. 1).

Analysis of the mean departure weeks recorded for 18 colour-ringed Curlew seen on the Severn Estuary and reported at their breeding sites (Appendix 1 and Supporting Materials Table S1) found that birds breeding in different parts of Europe differed significantly in the week in which

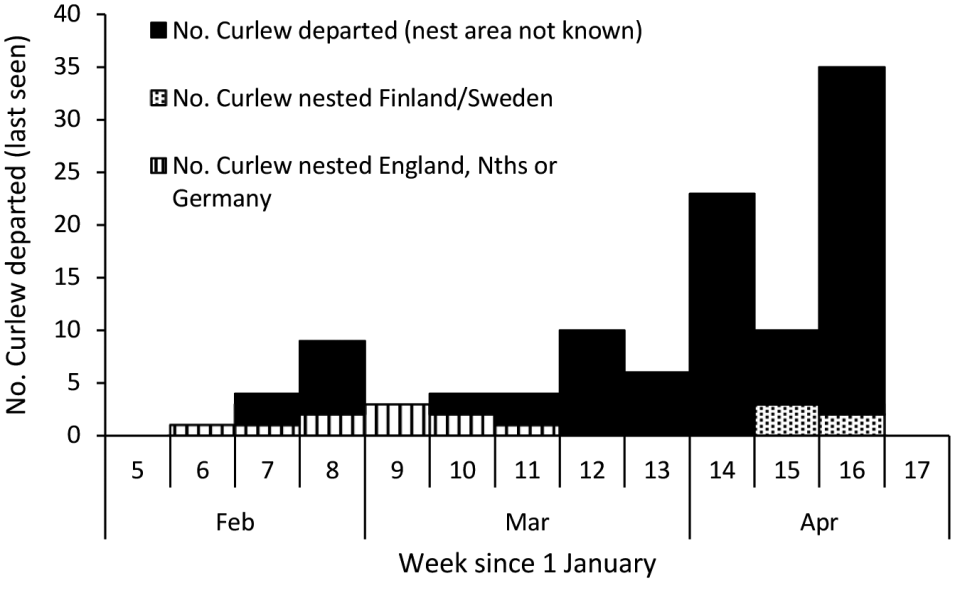

Figure 1. Last weeks recorded for colour-ringed Curlew prior to their departure from the Severn Estuary in spring 2016 (n = 109). The records of ten birds, known to breed in England, the Netherlands and Germany (n = 10), are marked with vertical lines, while five birds known to nest in Fennoscandia (n = 5) are stippled.

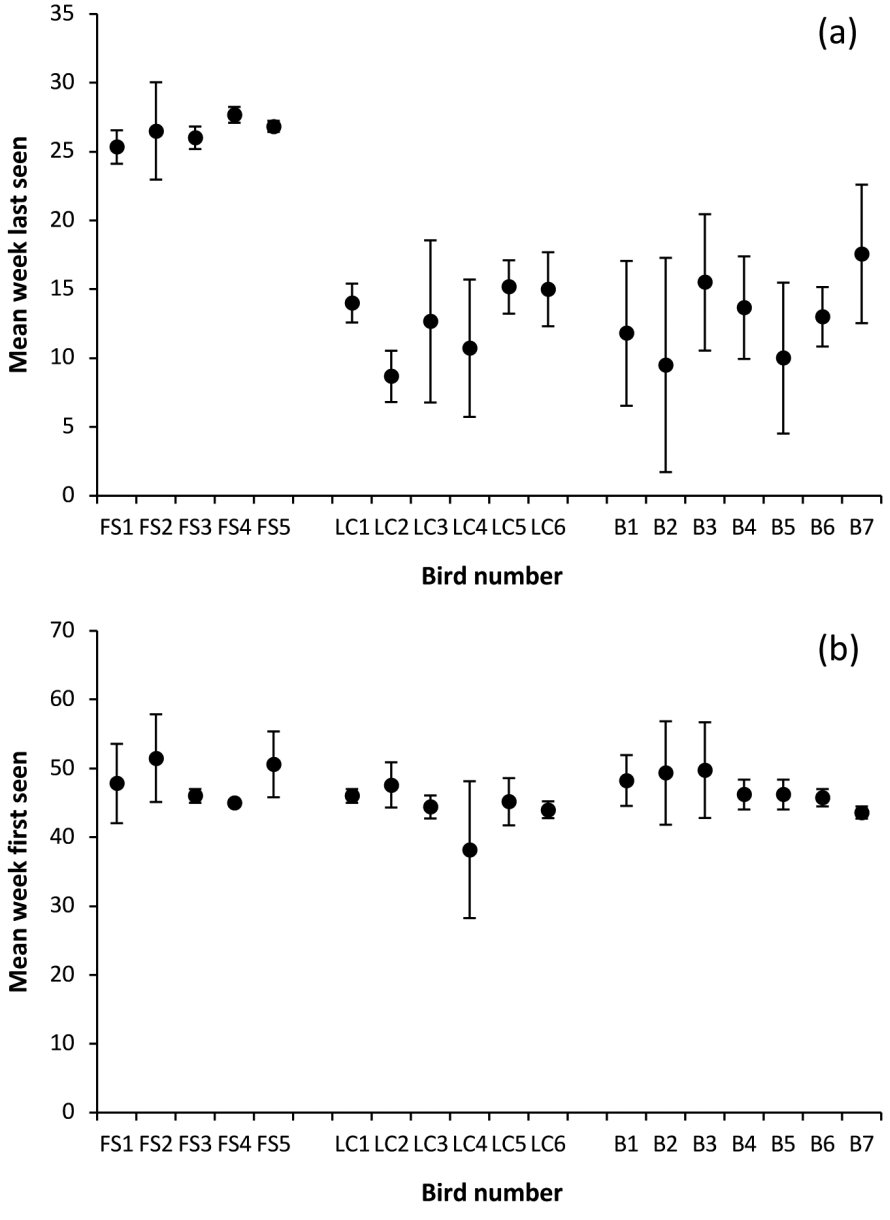

Figure 2. Mean week (± s.d., recorded as number of weeks after 1 January) on which 18 Curlew of known breeding location were (a) last seen, and (b) first resighted on their wintering grounds at the Severn Estuary each year. Birds FS1–FS5 bred in Fennoscandia, birds LC1–LC6 bred in the Netherlands/Germany, and birds B1–B7 bred in Britain. Dates on which each individual was first and last seen each year are presented in the Supporting Materials (online).

they were last identified on the Severn Estuary in spring (GLM: $F_{17,1}$ = 24.98, P = 0.00016), whereas sex did not affect the timing of the birds' departure (GLM: $F_{17,1}$ = 1.09, P = 0.313, n.s.). Tukey *post-hoc* tests found that Curlew migrating to Fennoscandia migrated significantly later than those breeding in England (P < 0.001) and also than those breeding in the Netherlands or Germany (P < 0.001), but that the Dutch/German-breeding Curlew and the English-breeding Curlew did not differ in their mean departure weeks (P = 0.891, n.s.; Fig. 2a). The median weeks on which these individuals were last sighted on the estuary each year (considering data from all years) was week 27 (range = weeks 24–29, n = 21 bird-years) for the Fennoscandian Curlew, week 13 (range = weeks 1–18, n = 32 bird-years) for those breeding in the Netherlands or Germany, and week 14 (range = weeks 3–24, n = 33 bird-years) for those breeding in England (Appendix 1).

Return in mid-summer and autumn

The first colour-ringed bird to return in summer 2016 arrived on 6 June (week 23), an individual know to have migrated to the Netherlands in previous and subsequent years (WBkY in Appendix 1). Three more appeared by 17 June (in week 24). The main influx occurred from 18 June–22 July (weeks 25–29 inclusive; Fig. 3), when 89 (86.4%) of 103 colour-ringed Curlew returning to the estuary in summer–autumn 2016 were first

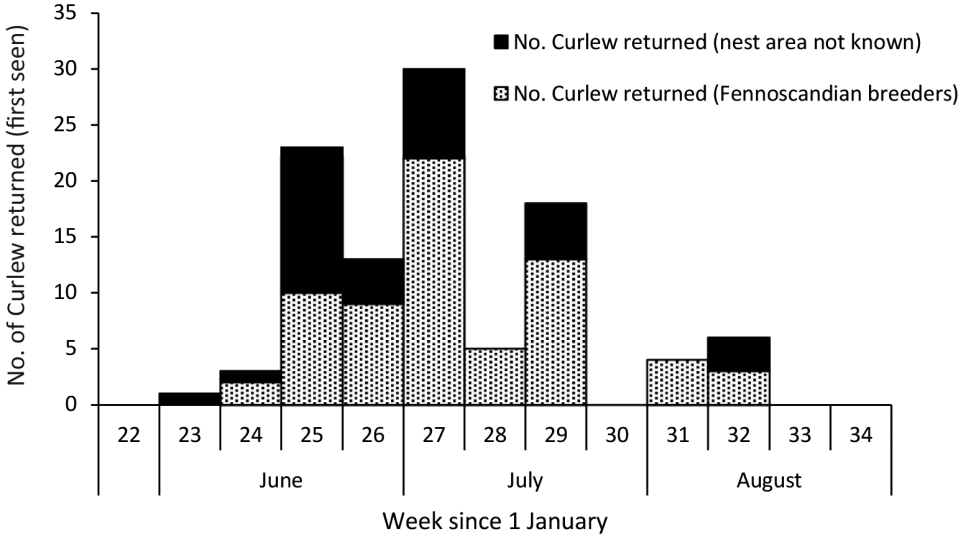

Figure 3. First resightings weeks recorded for 103 colour-ringed Curlew returning to winter on the Severn Estuary in 2016. Stippled shading = return dates for 68 Curlew known (from sightings) or believed (from the timing of their departure in spring) to breed in Fennoscandia. Three more birds were first seen later in the year, on 10 and 25 October (weeks 41 and 43, with the latter thought to be a Fennoscandian bird), and 8 November (week 45, also thought to be a Fennoscandian bird). Birds were presumed to migrate to Fennoscandia if they were last seen on the estuary in April in at least two years.

recorded. Just ten were first seen between 2–10 August (weeks 31–32; Fig. 3), with the last birds sighted on 10 and 25 October (weeks 41 and 43) and 8 November (week 45) respectively. The timing of return was similar for 130 colour-ringed Curlew seen back on the estuary in 2014, with the first 12 birds (9.2%) first sighted in week 24, a further 97 (74.5%) recorded between weeks 25–29, and all but four of the surviving colour-ringed birds had been identified by the second week of August in that year. There was no statistical difference between 2014 and 2016 in the number of individuals returning to the estuary in each week (unpaired *t*-test: $t_{229} = 0.32$, $P = 0.75$, n.s.).

Analysis of the mean return weeks for the 18 colour-ringed Curlew whose breeding areas were known found that neither breeding location (*i.e.* Fennoscandia, the Netherlands/Germany, or England) nor the sex of the individual had a significant influence on the week in which the birds were first seen back on the River Severn (GLM: $F_{2,17} = 2.32$, $P = 0.13$ and $F_{1,17} = 0.021$, $P = 0.89$, respectively, n.s. in each case; Fig. 2b). When return dates in 2016 for the larger sample of individuals comprising known and presumed Fennoscandian birds (*i.e.* those last seen on the estuary during April in at least two years) were considered, two were first sighted on the estuary on 14 and 16 June (week 24), 10 on 23 and 24 June (week 25), 49 between 27 June and 20 July (weeks 26–29), and seven from 2–8 August (weeks 31–32; Fig. 3). Two others were first seen on 25 October (week 43) and 8 November (week 45). Median return dates of weeks 26 and 27 respectively for Curlew classed as non-Fennoscandian and Fennoscandian did not differ significantly (unpaired *t*-test: $t_{57} = 1.52$, $P = 0.13$, n.s., when the three late first sightings were omitted; Fig. 3).

Based on observation data from 32 male and 56 female Curlew during 2016, median return week did not differ significantly between sexes (week 27; *i.e.* first week of July, unpaired *t*-test: $t_{59} = -0.30$, $P = 0.77$, n.s.; Fig. 4).

Individual movements

Data for 18 colour-ringed Severn Estuary wintering Curlew reported from their breeding grounds (five in Fennoscandia, six in the Netherlands or Germany, and seven in England) are illustrated in Appendix 1, with further details provided in the Supporting Materials available online. The five Fennoscandian birds remained on the River Severn into April each year with the exception of BOB in 2012 (Appendix 1a), whereas those breeding in the Netherlands or Germany were last seen during February or March (Appendix 1b,c). The earliest sighting in Fennoscandia was of BOB, seen in Finland on 24 April 2011 and back at Guscar Rocks by 12 August. RRY (in Sweden on 16 May 2014) and LRL (in Finland, behaving as if with young, on 1–26 June 2015), were recorded a little later in the breeding season. Curlew RRY was resighted in Gloucestershire on 28 June 2014, confirming that the northern birds may return early. Indeed, most were first seen back on the estuary during the second half of June or the first half of July each year (13 of 16 bird-years; Appendix 1a).

Sightings from the breeding grounds for six birds which migrated to Germany or the

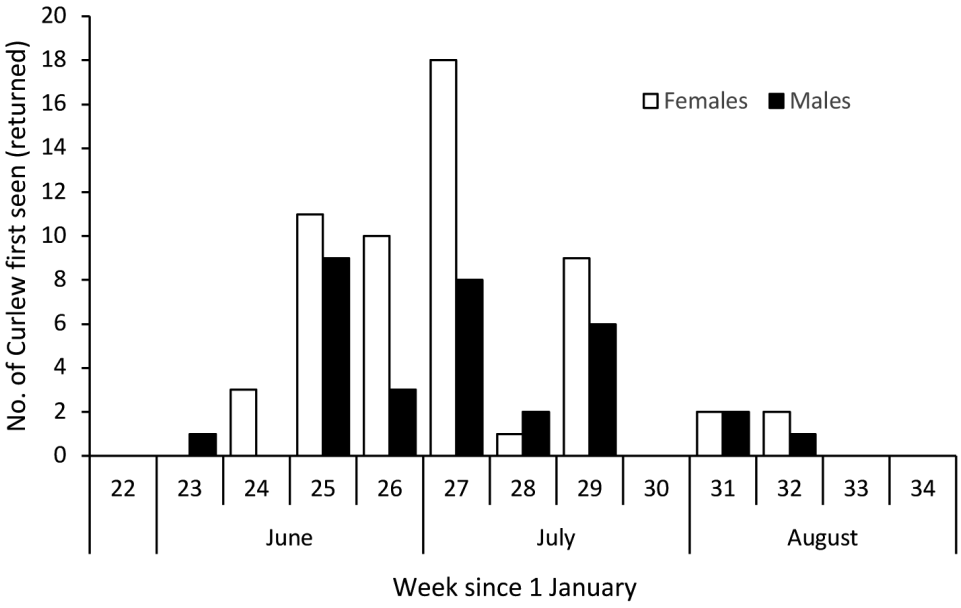

Figure 4. Return dates in 2016 for female (n = 56) and male (n = 32) colour-ringed Curlew wintering on the estuary of the River Severn.

Netherlands found that several had reached their breeding range by the second half of February. The earliest was Curlew colour-ringed BGW (recorded in the Netherlands in the 5 years from 2011 to 2015 inclusive), seen at its nest site on 14 February 2014, though in some other years it was not reported until the end of the first week of March. It bred in 2011, when it was seen with a female and two young on 16 June. This bird fed on grassland on the east bank of the River Severn in South Gloucestershire during the winter, where it was difficult to observe and identify rings; hence the lack of records for winters of 2013/14 and 2014/15 (Appendix 1b). Curlew LOG, migrated to the Netherlands for seven consecutive years (from 2012–2018) and was seen at its nest site in the second half of February each year except in 2018, when it was not recorded until the second half of March. In 2015 it was last seen on the Severn Estuary on 14 February and was at its breeding site 13 days later on 27 February. BkYY, last seen on the Severn on 14 March 2013, was at its nest site in Germany on the following day. Annual variation in the last observation dates of BkYY on the wintering grounds (Appendix 1b), and its early arrival in Germany on 28 February 2012, suggests individual spring migration can vary by two weeks or more. Dutch/German breeding Curlew mostly returned to the Severn Estuary in the second half of June or the first half of July each year (Appendix 1b), although WBkY returned on 6 June 2016, the earliest of all colour-ringed Curlew

resighted there (Supporting Materials: Table S1).

The seven colour-ringed Curlew seen breeding in England were reported from Gloucestershire (2), North Yorkshire (2), and one each in Worcestershire, Oxfordshire and Suffolk. Annual last sightings on the estuary were mainly in the second half of February to the first half of March, although Curlew WBR (reported in North Yorkshire on 15 March 2017) remained until early April in 2012 and 2013 (Appendix 1c). Curlew BBW, metal-ringed as a juvenile near Harrogate, North Yorkshire (54.083°N, 1.717°W) on 31 May 1994 (last seen aged 23 years on 2 March 2017) is the oldest known colour-ringed bird recorded during the study. Its return dates of 12 July in both 2012 and 2014 are the only records to date of a female Curlew breeding in England arriving at the wintering site following a successful breeding attempt. Curlew BRR frequents the well-watched Coombe Hill (51.943°N, 2.186°W) and Ashleworth Ham (51.936°N, 2.248°W) Nature Reserves area, on the Severn flood plain north of Gloucester, to which Curlew return from early February onwards, so first sightings of BRR in March (18 April in 2014) each year are relatively late for this site. It feeds in fields in the Oldbury-on-Severn area (51.638°N, 2.572°W) in late winter, where recording is difficult, so the latest dates on the estuary are not accurate. BYR, found nesting by the River Severn at Ripple, upstream from Tewkesbury, in Worcestershire (52.027°N, 2.190°W) in April 2014, also feeds in fields in late winter, so departures from the estuary again were not accurately recorded, although the sighting of 19 March 2013 indicates that it left relatively late in some years. Departure dates of early–mid March for LOB (Appendix 1c), reported breeding near Banbury in Oxfordshire (52.086°N, 1.461°W) during 5 April–16 May 2012, are also quite late for a bird that nests a relatively short distance from its winter quarters. WBY, which nested in the same field at Upham Meadow on the River Avon north of Twyning (52.038°N, 2.123°W) each year from 2015 to 2018 inclusive, was unusual in moving upstream from the study area in some winters. In January 2012 it was near Rodley (51.796°N, 2.376°W); in early 2013 it remained in the Aylburton Warth roost, but from December 2013 to February 2014 it was seen at the Wildfowl and Wetlands Trust at Slimbridge (51.745°N, 2.416°W), and from November 2014 to January 2015 it was back at Rodley.

Discussion

The study has provided new insights into Curlew movements between their Severn Estuary wintering quarters and breeding areas in different parts of Europe. Fennoscandian birds remained until April, including the third week of this month. Three Dutch birds departed between mid-February and the first week of March, while two from Germany stayed a little later, sometimes until mid-March. Those from England showed considerable variation in the timing of their movements; some were back on their nesting sites in mid-February, while in other years they were still on the estuary in March and one remained until early April on two occasions. More detailed monitoring of Curlew departure patterns in

2016, which indicated that birds from the Fennoscandian population remained on the estuary until the third week of April, confirmed observations made in Sweden two years earlier in 2014, when most Curlew arrived in Västerbotten Province (63.90°–65.97°N) between 22–29 April and by about 5 May all territories in the lowlands were occupied, whereas more northerly birds passed through until *c.* 10–15 May (N. Lindberg Alseryd, *in litt.*). Although the birds may have wintered elsewhere, the dates correspond with the late departure times from the Severn estuary, and with the observations that Curlew BOB was in Finland by 24 April in 2011 and RRY in Sweden by 16 May in 2014. More coordinated information from both the wintering and breeding grounds, or perhaps tracking data for Severn Estuary Curlew, are however required to confirm the timing of migratory flight and whether the birds make a rapid and direct migration back to their breeding grounds.

Curlew were found to return to the estuary sooner than had been anticipated at the start of the project, given that earlier studies found that the birds returned to the UK from late June onwards during the mid-20th century (*e.g.* Lack 1962; Bainbridge & Minton 1978). The first colour-ringed birds were identified on the estuary at the end of the first week of June in 2016, and almost all had arrived by the second week of August. The previous studies were made in different study areas, and used different techniques (radar in southeast England in Lack 1962; ring recoveries across Britain in Bainbridge & Minton 1978), so it is difficult to assess whether the earlier returns to the Severn estuary reflect a change in timing of the Curlews' migration. Studies at other sites would however help to determine whether there is regional variation in arrival and departure patterns within Britain, perhaps attributable to the proportion of birds from different breeding areas wintering at the site.

Given the migration distances involved, and presumably later breeding, it might be expected that birds from Fennoscandia would return later to the Severn estuary than those from England, the Netherlands and Germany. However, the weeks in which five birds known to have migrated to Fennoscandia in at least one year were recorded back on the estuary each summer–autumn did not differ significantly from those recorded for birds known to have bred elsewhere. Moreover, birds thought to be of Fennoscandian origin on the basis of their late departure in spring did not return to the estuary any later than the other colour-ringed Curlew identified during the detailed 2016 study. Indeed, two "Fennoscandian" birds were among the first four Curlew to be identified (during week 24) in June 2016. Information from northern Sweden in 2014 indicated that Curlew generally depart from that region in mid–late June, which would coincide with the timing of their arrival in Britain if the birds migrate directly from the breeding to the wintering sites. Niklas Lindberg Alseryd (*in litt.*) reported that: "as usual, observations of gathering flocks of Curlew were reported around here from about 13 June, and during 23–27 June many flocks of Curlew were observed leaving, or passing through, heading southwest".

The 2016 observations also found no significant differences in the timing of return to the estuary recorded for males and females, despite females reported as migrating a little ahead of males when the males are involved in raising the young (Bainbridge 2002; M. Smart *in litt.*). This may be a result of poor breeding success, however, as the highest count of first-summer birds on the estuary in May 2017 was of just 19 individuals, indicating that productivity during the 2016 breeding season had been low. Further information on the breeding success of ringed individuals is required for a robust assessment of sex differences in migration phenology, to determine the extent to which it influences the timing of their movements to and from the wintering site each year. Information from more years therefore is required to test for sex differences in the return dates for Curlew wintering on the estuary of the River Severn.

In conclusion, the Severn Estuary represents an important wintering site for Curlew which breed in different parts of Europe, some from areas where the breeding population is in decline (*e.g.* England) and also from countries (*e.g.* Germany) where it is stable or increasing. Whilst conditions on the wintering grounds have not to our knowledge been linked to the decrease in the Eurasian Curlew, nonetheless the habitat and food resources on the estuary underpin the over-winter survival of adults and juveniles from different subpopulations. A good understanding of the factors affecting site-use and survival of Curlew wintering on the River Severn, and any changes in conditions at the site which may be detrimental to the birds, therefore would benefit conservation efforts for the species not only at the site but at a regional level.

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Appendix 1. Dates, presented here by half-month, for Curlew seen wintering on the Severn Estuary (dark grey shading) and also sighted at their breeding areas (light grey shading). Intermediate shading indicates individuals seen on their wintering and breeding grounds in the same month.

(a) Curlew breeding in Fennoscandia: F = Finland, S = Sweden.

Bird	Year	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
BWBk	1997											F													
	2010																								
	2011																								
	2012																								
	2013																								
	2014																								
	2015																								
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BOB	2010																								
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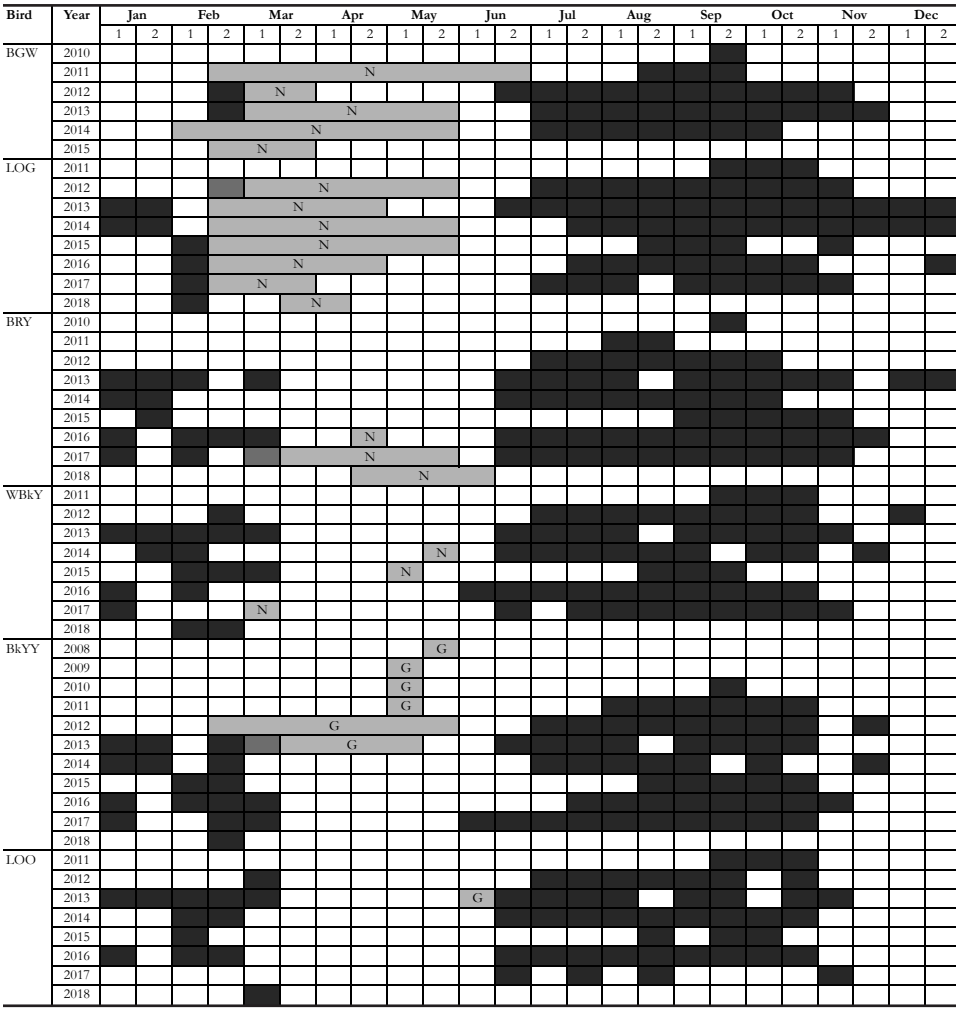
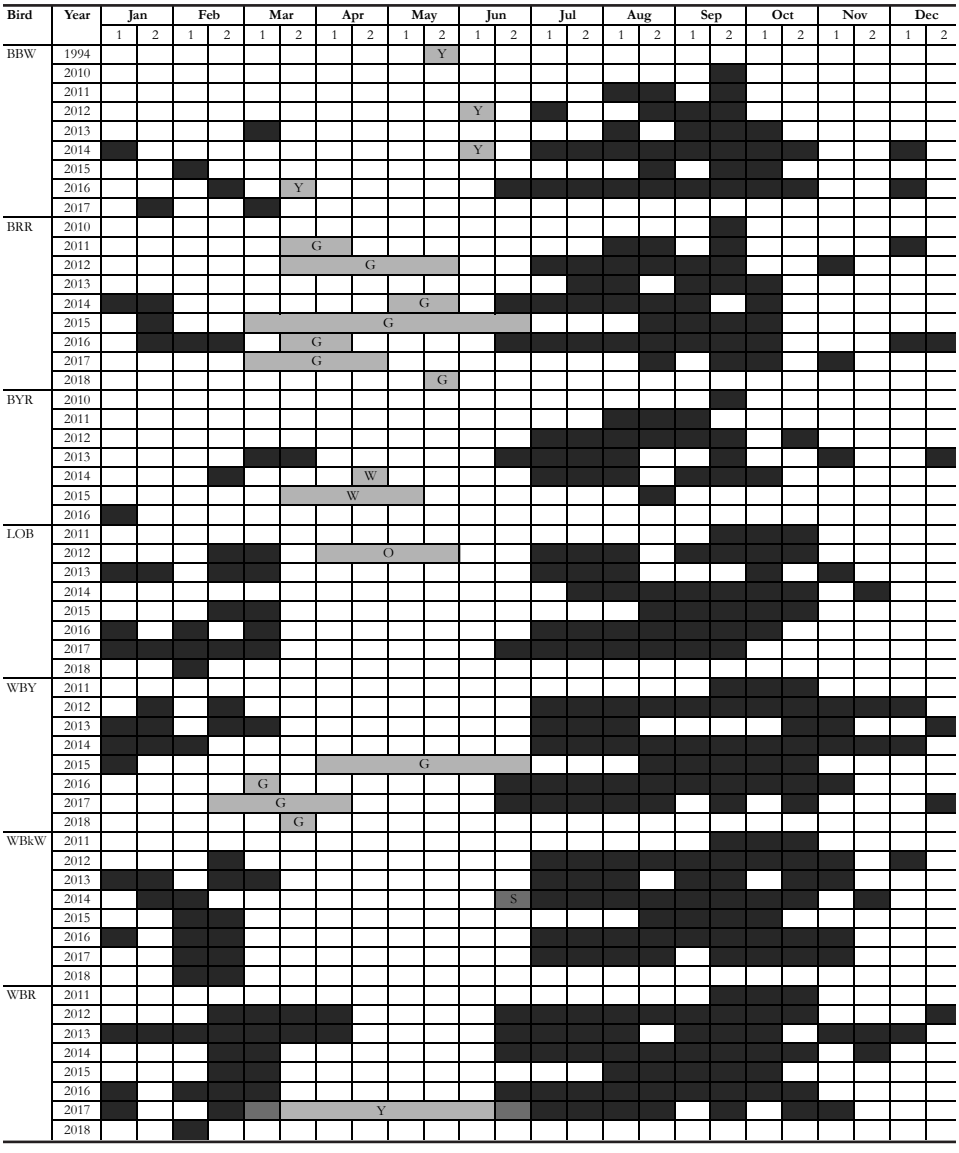
	2012																								
	2013																								
LRL	2013																								
	2014																								
	2015											F													
	2016																								
	2017																								
RRY	2013																								
	2014										S														
	2015																								
	2016																								
BLY	2010																								
	2011																								
	2012																								
	2013																								
	2014																								
	2015																								
	2016																								
	2017											F													

(b) Curlew breeding in the Netherlands/Germany: N = Netherlands, G = Germany.



(c) Curlew breeding in England: Y = Yorkshire, G = Gloucestershire, O = Oxfordshire, S = Suffolk, W = Worcestershire.



Photograph: Curlew ringed RWR (Red, White, Red), which was identified at Guscar Rocks, Severn Estuary, Gloucestershire (by JDS) on 16 April 2018, at Ärväänkylä, Sotkamo, Oulu, Finland (64.12°N 28.23°E; by Jyrki Lukkari) on 6–7 May 2018, and back at Guscar Rocks on 28 June 2018. Here seen at Aylburton Warth on 30 September 2018, by John Sanders.

Photograph: Curlew arriving in the Aylburton Warth high tide roost on 19 October 2011, by John Sanders.

