Reintroducing the Cirl Bunting to Cornwall

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Abstract A pioneering project to reintroduce the Cirl Bunting *Emberiza cirlus* was carried out on the Roseland Peninsula in southern Cornwall between 2006 and 2011. It involved the captive rearing and release of 376 young birds, taken from nests in south Devon. A breeding population is now established in the release area and at least 52 pairs were present in 2015. With further targeted habitat management through agri-environment schemes it is hoped that the population will continue to increase and spread into the surrounding landscape. This paper describes the development of the work, from the initial planning stages, through to the adaptive management required to help to ensure that it was ultimately successful. Working with a small passerine requires a rather different approach from that for the larger, more robust, species that are more familiar as subjects for reintroduction. The lessons learnt may be useful for future projects involving the translocation of small passerines in Britain or farther afield.

Introduction

The Cirl Bunting *Emberiza cirlus* was once widespread and locally numerous in farmland habitats across southern England but the population declined markedly in the twentieth century. Only 118 pairs were recorded in a complete survey in 1989, nearly all of which were in south Devon (Evans 1992).

Since then, a species recovery project has resulted in a substantial turnaround and the most recent survey, in 2009, estimated that there were 862 pairs of Cirl Buntings (Stanbury *et al.* 2010). This recovery has been hugely encouraging, in terms of both an increase in numbers and a modest expansion and consolidation of the breeding range. However, owing to the species' sedentary nature and a barrier of unsuitable habitat around its south Devon stronghold, significant range recovery into formerly occupied areas of southern Britain seemed unlikely to occur unaided, or at least would be extremely slow. This led to concerns over the potential impact of an unexpected event, such as a spell of severe winter weather, on such a localised population. To improve the conservation status of the species it was felt that establishing a geographically separate population was desirable. Consequently, RSPB and Natural England assessed the feasibility of establishing another self-sustaining population of Cirl Buntings through translocation to a new area.

Assessment of potentially suitable release sites began in 1997 and release techniques were trialled. After several years of planning, the Cirl Bunting Reintroduction Project began in earnest and, in 2006, the first of six years of releases were undertaken on the Roseland Peninsula in Cornwall. Post-release monitoring has shown that the project has been successful with over 50 pairs recorded in 2015. Breeding productivity has been good and winter survival rates are high, suggesting that the population has a good chance of continued increase in the coming years.

This paper describes the approach taken during this pioneering reintroduction project, the first successful reintroduction of a small passerine in Europe. It summarises the methods used and some of the key lessons learnt.

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208. The rolling landscape and mixed farming habitats of the Roseland Peninsula, Cornwall, July 2014.

Historical status and reasons for decline

The Cirl Bunting population in Britain has undergone significant changes over the past 200 years. It was first described by Montagu near Kingsbridge in Devon in the winter of 1800 and he found it breeding nearby the following summer (Montagu 1833). Southern England was colonised gradually during the nineteenth century, with the bird spreading into many English and Welsh counties; occasional breeders were reported as far north as Cumbria (Brown & Grice 2005). The population was at its peak between the late 1800s and the 1930s, but Cirl Buntings were at best only locally numerous and tended to be most abundant in coastal areas (Brown & Grice 2005). However, Cirl Buntings were reportedly more common than Yellowhammers *E. citrinella* in parts of Gloucestershire (Mellersh 1902) and the North Downs (Ticehurst 1909). The species was often recorded around farmsteads and in villages where suitable feeding and nesting habitats were available in close proximity (Wilson *et al.* 2009).

The Cirl Bunting went into steady decline sometime after the 1930s, and by the mid 1960s numbers had collapsed across the majority of its British range (Parslow 1968; Sitters 1982). This trend continued, leaving small groups and isolated pairs throughout the former range. There were just 250–300 pairs recorded in 20 counties during 1968–72 (Sitters 1982) and by 1989 the 118 pairs were found in just three counties with over 96% of the population concentrated in south Devon (Evans 1992). The last remaining breeding pairs in Cornwall and Somerset were lost in the 1990s leaving the entire British population restricted to a strip of coastal farmland between Plymouth and Exeter.

Research conducted during the late 1980s and early 1990s indicated that this decline was associated with changes in the farmed landscape that resulted in the loss of essential feeding and breeding habitat. The following broad factors were implicated:

- **Lack of winter food** The shift from spring-sown to autumn-sown cereals from the 1960s onwards, together with an increased use of herbicides, resulted in far fewer weedy arable fields being left as stubble during the winter (Wilson *et al.* 2009). This created a significant food shortage at a crucial time of year for Cirl Buntings and many other granivorous birds (Evans & Smith 1994).
- **Lack of summer food** In summer, grasshoppers are an important food source for chicks, especially later in the season, and breeding success is closely linked to their availability (Evans *et al.* 1997). Grassland intensification, including reseeding of pastures, the use of inorganic

fertilisers and the switch from hay to silage, has dramatically reduced grasshopper abundance.

- **Nesting sites** During this period hedgerows were often removed or mismanaged, which led to a reduction in scrubby, bushy hedges essential for nesting sites and winter cover (Evans 1997).

These factors were exacerbated by the essentially sedentary nature of the Cirl Bunting. The species could thrive only if all the habitats required to meet its needs throughout the year were available within a small area, essentially at the farm scale. The trend for farms to specialise resulted in a reduction in mixed arable and livestock farms and a greater uniformity in local landscapes, which would have affected breeding success and/or winter survival rates in many areas.

The road to recovery

As a result of the research carried out in the late 1980s, trial management agreements were arranged with a number of key farmers within the core range in south Devon. These provided financial incentives to retain weedy overwinter stubbles. At around the same time, 'set-aside' became part of the EU Common Agricultural Policy as an arable production control mechanism, and effectively became compulsory from 1992, with the resulting fallows providing vital foraging areas for Cirl Buntings in winter (Buckingham *et al.* 1999). In 1991, Countryside Stewardship (CS) was introduced to improve the environmental value of targeted areas of England's farmed landscapes. As part of this measure the Countryside Commission championed a new option called *The Cirl Bunting Special Project*, which was to prove vital in the species' recovery. Together with prescriptions already available (such as tussocky grass margins around arable crops, cattle-grazed grassland, and hedgerow and scrub management), this allowed optimum land management for Cirl Buntings. Farmers were encouraged to enter into the ten-year agreements for this option, guided by advice from a dedicated RSPB Project Officer.

This targeted habitat provision produced spectacular results. Between 1992 and 1998, Cirl Buntings increased by 83% on land under management agreements, compared with a 2% increase on land outside agreements (Peach *et al.* 2001). Subsequent

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209. Winter stubble is a critical resource for Cirl Buntings *Emberiza cirlus*; Cornwall, March 2014.

surveys showed that the population recovered to an estimated 450 pairs in 1998 (Wotton *et al.* 2000), 697 pairs in 2003 (Wotton *et al.* 2004) and 862 pairs in 2009 (Stanbury *et al.* 2010). The Countryside Stewardship agreements targeted at Cirl Buntings also had benefits for other wildlife, including other birds, insects and plants (Lock 1999; Bradbury *et al.* 2008; MacDonald *et al.* 2012).

Andy Hay/rspb-images.com

210. Cirl Bunting *Emberiza cirlus* chick at around seven days old.

Developing plans for reintroduction

Planning

Despite the population increase, by the early 2000s there was little corresponding expansion in range with the population consolidating within its existing range rather than expanding into new areas. This was due in part to the bird's sedentary nature but it was also thought that a barrier of unsuitable habitat around its south Devon stronghold would limit expansion and make recolonisation of the former range unlikely.

RSPB and Natural England first discussed the idea of translocation in the mid 1990s. As the plans progressed, other organisations became involved. Paignton Zoo Environmental Park was well placed to become the avicultural specialist, being at the heart of the Cirl Bunting's range in Devon. The National Trust, as the owners of land supporting around 18% of the Cirl Bunting population, and with land holdings across the former range, was also regarded as a key partner. The Zoological Society of London had expertise in health and disease monitoring of other reintroductions, and carried out a disease risk analysis for the proposed translocation.

Population source

There were a number of suggestions for the source of the birds to be released. One potential source was New Zealand, where Cirl Buntings were introduced with early human settlers, but the cost and logistics of transportation, not to mention concerns about genetic isolation, meant that this option was quickly discounted. Another possibility was France, although the species has declined in Normandy and moving birds between countries, even just across the English Channel, would have been logistically challenging and costly. The best option appeared to be the increasingly secure and robust population in Devon, provided that translocation would not affect the recovering population.

Reintroduction techniques

Three different approaches were considered: 1) capture-and-release of adult birds; 2) removal of chicks from nests to be reared then released after fledging (rear-and-release); and 3) establishment of a captive breeding population to provide birds for release.

Cirl Buntings are known to be sensitive birds to handle and there have been cases where capture for ringing has led to unexpected mortality (Andy Evans pers. comm.). The stress involved in capturing adult birds was felt to be unacceptable on both welfare and conservation grounds so this option was discounted at an early stage.

Establishing a captive population using wild-caught founder stock from Devon was initially appealing, since this would have a negligible impact on the wild population. However, there was little information available about keeping Cirl Buntings in captivity and none were known in existing collections. Indeed, rather ominously, they were described by early aviculturalists as somewhat delicate birds with a tendency to die in captivity (Bradburn 1891). In order to trial

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211. The brooders for nestling chicks. Chicks that were taken from nests in Devon were kept warm in a brooder like this for about a week, until they were ready to fledge.

this technique, nine broods (25 chicks) were brought into captivity at Paignton Zoo Environmental Park in 2003. The survival of chicks to the fledging stage was high but there was subsequently high mortality of the juveniles and adults, with only 16 survivors by spring 2004. Failure of breeding attempts also indicated that the birds were not adapting well to captivity, and it was the view of avicultural staff that suitable breeding techniques would take a long time to develop before they could be used for a full reintroduction.

This left 'rear-and-release' as the remaining option, with chicks being removed from nests, hand-reared and then released after fledging. This had been initially discounted, due to concerns about the impact on the recovering Devon population. However, by 2003 it was felt that numbers – around 700 pairs – were sufficient to allow the collection of chicks. The Cirl Bunting is typically double-brooded throughout its range, and occasionally triple-brooded (*BWP*), readily relaying if a nest is lost. It was considered reasonable to take young from up to 20 nests a year (across several sites). This represented <1.5% of the total nest productivity, assuming those pairs went on to relay. Trials began in 2004 to examine this new approach and to develop hand-rearing techniques; test methods of release; assess survival rates of captive-reared birds; and determine whether hand-reared chicks can survive and recruit into a wild population. The trial also carefully assessed the impact of removing broods on the source population. Following the success of this work it was adopted as the preferred approach for the reintroduction (Jeffs 2005).

Receptor site assessment

The initial site assessment (Lock & St Pierre 1997) involved visiting a number of areas across southern Britain to assess their suitability as potential translocation sites. Selection was based upon the following criteria:

- Recent history (early 1970s or later) of Cirl Buntings.
- Environmental criteria should include mild winter weather but also predominant weather patterns different from those in south Devon – so that in the event of severe weather in south Devon, the release site would hopefully not be affected to the same degree.
- A minimum of five contiguous tetrads (2 km × 2 km) of suitable habitat.
- Suitable farming systems, with sufficient areas of low-intensity mixed farming.
- Sympathetic land ownership and the availability of incentives for habitat improvement and management.

Using these criteria, 17 potential release areas were assessed, of which the areas considered most favourable for translocation were east Devon, south Cornwall, the Tamar valley (coastal area only), the Isle of Wight, and the Mendips and the Polden Hills in Somerset. Most of the former range in south-east England was no longer considered suitable for Cirl Buntings as a result of major land-use changes. Climate change was felt likely to benefit Cirl Buntings at any of the sites across southern England but, at the time, there was no way of modelling its potential effects, so this was not one of the parameters considered.

Refining the initial analysis of potential

release areas, and disregarding sites adjacent to the existing Cirl Bunting range, the Isle of Wight was identified as a good potential candidate, with favourable conditions in the winter being a significant benefit there (Donald & Evans 2001). Following the rear-and-release trials in Devon, a final stage of site assessments took place in 2005. Seven release localities in four counties were shortlisted: the Roseland Peninsula and Looe in southern Cornwall; the Polden and Mendip Hills in Somerset; the Isle of Purbeck in Dorset; and the southwest and southeast portions of the Isle of Wight. Each of these was considered in more detail, including an exercise to map the extent of suitable habitat (current and potential) in each locality, based on features of occupied territories in south Devon. On this basis of habitat, only three areas could be expected to support sustainable populations – the Roseland Peninsula, the Isle of Purbeck and the southwest part of the Isle of Wight. Concerns about the ability to influence land management on a long-term basis led us to rule out the Isle of Wight at this stage while Purbeck had limited high-quality wintering habitat.

Cris Sellarés

212. Three Cirl Bunting *Emberiza cirlus* chicks in a brooder.

Eventually, the Roseland Peninsula was selected as the final release area, with the best prospects for supporting a sustainable population of Cirl Buntings in the longer term. Indeed, because the species had been recorded there in the 1990s, several farmers in the area already managed land to provide the full range of breeding and wintering habitat, including the vital winter stubbles. Although this came too late to prevent the loss of Cirl Buntings here, it turned out to be a significant benefit for the reintroduction project.

The release phase 2006–11

Having found a suitable release location on the Roseland (owned by the National Trust), and with a local farmer happy to host the release aviaries, the Cornish reintroduction project began in earnest in 2006.

A population model based on demographic parameters from the Devon population predicted that releasing 60 young birds each year over four years would result in a self-sustaining population of around 30 breeding pairs. This model was subsequently revisited when the population had not grown as expected by year four and, as a result, the release project was extended by a further two years. To ensure that 60 birds could be released, it was estimated that 75 chicks would need to be taken from the wild each year (to allow for pre-release mortality). This translated to 20 broods out of a conservative estimate of 1,400 produced annually at that time.

Disease risk analysis is a requirement of any reintroduction project (IUCN 2013) and in 2005 veterinary staff from the Zoological Society of London (ZSL) carried out this work for the Cirl Bunting project (McGill *et al.* 2005). The assessment concluded that hand-rearing should be carried out away from an existing zoo and that any staff involved in captive-rearing should not be in contact with exotic species. As a result, a dedicated facility was set up near to the release site, which also meant that the birds undertook their longest journeys as nestlings and at an age where stress was less likely to be an issue.

There were three main stages in the rearing process, as described below.

Stage 1: Chick removal

Three fieldworkers worked in ten donor areas with healthy Cirl Bunting populations and supportive landowners. The support of land managers was essential and if there were any concerns, these sites were not used. The nest-finders monitored territories across these sites and took chicks from selected nests when they were six days old. The whole brood was removed, to encourage the pair to relay. Only one brood was taken per pair and, where possible, pairs were monitored to assess whether they went on to breed again that season. Over half of all monitored pairs went on to breed successfully after their first brood was removed and at all the donor sites fledged broods outnumbered broods removed. Subsequent monitoring indicated that chick removal did not adversely affect breeding populations at the sites targeted, apart from two sites, where it was considered that habitat changes were a contributory factor – these sites were no longer used once a problem had been established.

Most broods were removed around midday or in the early afternoon, to ensure that they had already been fed by the adults that day. Before being transported they were usually ringed, with a BTO metal ring and a unique combination of three colour rings. Measurements, including weights, were also taken. In 2009, midway through one of the wettest summers on record, it was decided that only broods with chicks over 10 g would be removed, a policy that was continued in subsequent years. The aviculturalists found that chicks lighter than 10 g were more difficult to hand-rear, and subsequent analysis of release data found that chicks under 13 g (when removed) were statistically more likely to die after release than those over 13 g (Fountain *et al.* 2016). There may be a case for increasing the weight of chicks removed in any subsequent projects, though this could affect the number of chicks available for removal. The mean weight of chicks removed was 14.5 g (range 6.5–20.1 g before the 10 g minimum was introduced). In periods of wet weather, chicks were observed to grow more slowly and tended to look younger than they actually were, so they were not collected under such conditions. Slow growth during wet spells is well known in Cirl Buntings and is thought to reflect the increased difficulty of

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213. Fledgling Cirl Buntings *Emberiza cirlus* being fed by Carl Laven, senior aviculturalist. When the chicks were old enough to be moved from the brooders (plates 211 & 212), they were housed in a canary cage. Individual broods were kept separate at all stages.

finding insect prey (Evans *et al.* 1997). Chicks were transported to the rearing facilities in Cornwall in an artificial nest within a small pet carrier. Travelling times were usually no more than 2–4 hours.

Stage 2: Rearing

Two aviculturalists were employed throughout the season and lived on site so that the birds were under 24-hour supervision. The facilities were housed in a National Trust property with one room given over to chick rearing and a barn for the older birds. Detailed husbandry guidelines were developed from experience during the trial and were further refined throughout the project (Sellarés & Maggs 2011). Rearing consisted of three stages: nestling, fledgling and pre-release. At each stage of the process, broods remained together and separate from other broods, with strict hygiene protocols and density limits as specified in the disease risk management protocol for the project. In the first two years, faecal samples were monitored intensively to provide baseline information on health and parasites. Post-mortem examinations were carried out on all birds that died. Nestlings were reared in brooders until they were around 15 days old. At this age they were increasingly active and ready to be moved to canary cages. Moving was considered stressful for birds and the hand-rearers were extra vigilant to identify any health issues. The young birds continued to be hand-fed in the canary cages but once they were feeding themselves and bathing (usually at about 21 days) they were moved to large aviaries at the release site.

Stage 3: Release

The release aviaries were the final stage of the rearing process. The aviaries were sited within suitable Cirl Bunting habitat in a sheltered position so that the young birds were afforded some protection from inclement weather. Branches were added to provide some structure.

As in the earlier stages, broods remained separate. Each aviary had one enclosed end with a shelf for a canary cage. The brood was transferred into these cages, where they remained for a day while they settled before being released into the main compartment of the aviary. The hand-reared birds were found to react to predators which, although desirable to aid learning, made it essential to provide good cover both within the aviary and on top of the roof to help the birds to feel secure and avoid injuries arising from panicked flight.

Although the hand-reared birds did not become imprinted on humans, once in the release aviaries, human contact was kept to a minimum and birds became increasingly 'wild'. At around 28 days old they were ready to be 'soft' released. A hatch on the front of the aviary was opened and remained open for a few days to allow birds to come and go from the aviary. Mesh netting was placed across the opening to allow the Cirl Buntings free access but to exclude larger predators. After release, food was provided in and near the aviaries for a period until the birds had learnt to forage for themselves in suitable habitat nearby.

Initially, the release aviaries were all at the same site in an effort to ensure that there were enough Cirl Buntings in one area to provide a focal point for a re-established population. However, Eurasian Sparrowhawks *Accipiter nisus* began to visit the release field regularly and it was felt that this might be having an impact on the survival chances of naïve, newly released birds. During 2009, various techniques to keep Sparrowhawks away were trialled, including the use of bird-scaring devices and increased human presence at the release site. These were not wholly effective, since the Sparrowhawks soon habituated to them. Providing a diversionary food supply to a local breeding pair of Sparrowhawks was also trialled in 2010, with some success. However, the most effective and practical measure proved to be changing release sites, both between and within years, as this ensured that the local Sparrowhawks did not become habituated to a source of freshly released young Cirl Buntings. All the release sites were within 2 km of each other, which is within the normal range of movements for Cirl Buntings.

Monitoring

All the released birds had unique colour-ring combinations so that information on survival rates, dispersal patterns and breeding

Andy Hay/RSPB

214. Once the Cirl Bunting *Emberiza cirlus* chicks were able to feed themselves, they were moved to outdoor aviaries where, after a night in the canary cage, they were allowed free rein of the aviary. After at least a week, a panel at the front of the aviary was removed and a cage attached to cover a release hatch that allowed the young buntings to leave but prevented predators from entering the aviary. Food was placed on top of the aviary, under the cage, to encourage birds to leave, and food was provided around aviaries throughout the release period. Here, Stuart Croft is checking on recently released birds in the vicinity; all sightings were used to build up a complete history of each bird.

success could be gathered. Since Cirl Buntings normally move 2 km or less between breeding and wintering areas (Evans 1992), the expectation was that the released birds would stay fairly local to the release site. A full-time RSPB field officer was employed during 2006–15, assisted by many volunteers, which allowed all suitable habitat around the release site to be regularly checked for colour-ringed birds.

Over the course of the project and as the population established, monitoring protocols were refined and standardised. During the summer the main aim was to locate and monitor all breeding pairs and non-breeding individuals by surveying all suitable, accessible sites within 500 m of known records. Breeding productivity was recorded where possible, while keeping disturbance to an absolute minimum. The decision was taken not to colour-ring chicks bred in the wild owing to previous problems with adults attacking rings placed on nestlings (Andy Evans pers. comm.).

In winter, all accessible winter foraging habitats (barley stubble, wild bird seed mix, supplementary feed areas (see later), horse/cattle feed areas, allotments/vegetable plots and farmyards), as well as known nesting territories, were mapped and grouped into discrete areas that could be monitored by a single, experienced surveyor in about half a day. All suitable areas within 2 km of the release site were surveyed at least once a week, while all other areas were covered once a fortnight (weather permitting). Additionally, a 'constant effort resighting' survey was undertaken based on reading colour-ring combinations in the areas within 2 km of the release site. These were surveyed every month, usually in a single day.

Table 1. Survival of released Cirl Buntings *Emberiza cirlus* in Cornwall, 2006–11.
Key: [1] released birds surviving 30 days following release; [2] number of birds surviving from 1st October to 1st April in the year following release; [3] total number of released birds surviving until 1st April in the year following release.

	no. released	no. alive after one month	no. alive on 1st October	no. alive on 1st April	% post-release survival[1]	% 1st-winter survival[2]	% overall 1st-year survival[3]
2006	72	57	47	29	79.2	61.7	40.3
2007	47	16	11	11	34.0	100	23.4
2008	68	25	24	17	36.8	70.8	25.0
2009	67	39	23	7	58.2	30.4	10.4
2010	70	40	31	18	57.1	58.1	25.7
2011	52	43	38	25	82.7	65.8	48.1
2006–11	**376**	**220**	**174**	**107**	**58.5**	**61.5**	**28.5**

Habitat management

Project staff worked alongside the local Natural England adviser to ensure that agri-environment schemes in the release area and beyond were tailored to the needs of Cirl Buntings. By the end of 2014, approximately 1,200 ha of land across ten farms were under sympathetic management.

To ensure that birds were not limited by food availability, supplementary feeding sites were set up in key areas. These provided a reliable additional source of seed throughout the year. They also provided a focal point for birds, which helped with the monitoring effort. Feeding sites were monitored carefully and moved if it was felt they had become a focus for avian predators. In addition, strict hygiene protocols were adhered to, in order to minimise the risk of disease transmission.

Results

During the six years of releases (2006–11), 376 chicks were reared and released successfully (83% of those taken from the wild). Mortality was at its highest during the first few weeks following release, which mirrors the situation among passerines in the wild (Cox *et al.* 2014). Over the six years of the project, post-release survival to at least 30 days averaged 58.5%, which compares favourably with the 55% predicted (based on data from the Devon population). However, this has varied considerably, from a low of 34.0% to a high of 82.7% (see table 1). Overwinter survival was relatively high and if birds survived until January/February of their first winter, they usually survived to the following summer and attempted to breed. This meant that winter stubble surveys undertaken between December and February provided a good estimate of the expected breeding population for the following season. Overall survival rates to May in the year following release were roughly as predicted before the reintroduction began.

Once released birds had survived their first year, survival rates tended to increase significantly. This was the case in all years apart from 2012 and 2013, when there were high levels of adult mortality in autumn. Following exceptionally poor weather during the 2012 breeding season, mortality among adult females was significantly higher than for adult males. This may have been the result of fatigue and stress during difficult breeding conditions, since females are responsible for a far greater share of breeding duties than males. The life expectancy of released birds that survived the initial post-release period was one year and four months, so the majority of these individuals live through only one breeding season. However, a handful of the most successful birds have lived for over five years and have bred in all five seasons (see table 2).

Table 2. Survival rates of released Cirl Buntings *Emberiza cirlus* with age.

	no. birds in breeding population (%)
1st season after release	87 (50%)
2nd season after release	46 (26.4%)
3rd season after release	18 (10.3%)
4th season after release	8 (4.6%)
5th season after release	1–3 (0.6–1.7%)

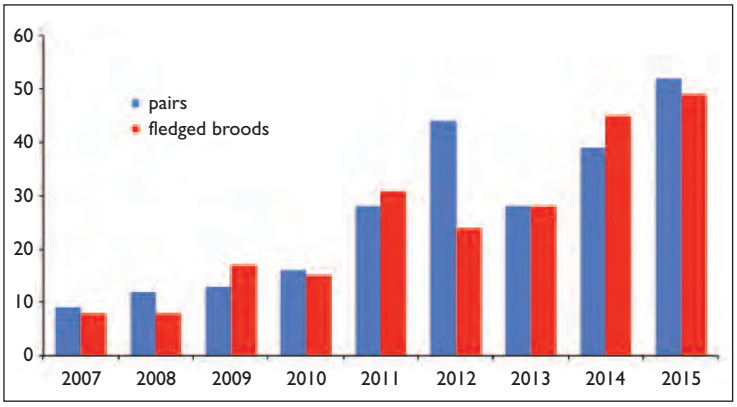

Fig. 1. Numbers of breeding pairs and fledged broods of Cirl Buntings *Emberiza cirlus* in Cornwall, 2007–15.

The first breeding in the wild occurred in the 2007 season when nine pairs fledged a minimum of 11 young. This represented an average of at least 1.2 fledglings per pair, well below the 4.6 fledglings predicted in the model based on data from the Devon population. Productivity, as measured by minimum number of fledglings observed, was again low in 2008 but then increased markedly in 2009 (table 3). Productivity levels recorded during the project must be regarded as minimum estimates, because in order to reduce disturbance, nest visits were not undertaken routinely. Productivity became harder to monitor as the number of pairs grew and occupied a much larger area. For this reason it is probably most useful to use the percentage of successful nests as a comparison with other areas. In Devon, Evans *et al.* (1997) found that 54% of nests produced fledglings, while in an area of orange groves in Spain the equivalent figure was 61% (Barba & Lopez 1990; Ponz *et al.* 1996). Using this statistic, the Cornish Cirl Buntings have done well, exceeding the Devon average in seven of the nine years monitored (table 3).

It is well known that Cirl Bunting breeding success is adversely affected by poor weather, with periods of prolonged rain being particularly detrimental (Evans *et al.* 1997). This has had a noticeable effect on the Cornish population with summers when rainfall was above average and temperature below average (such as 2007 and 2012) resulting in lower than average productivity. With every successful nest being crucial to the success of the project in the early stages, supplementary food in the form of live mealworms was provided near known active nests during periods of wet weather. During 2009–14, over 70 pairs were provisioned, from a high of 19 pairs in 2011 to only three pairs in 2015. In most cases this was for a short period, but feeding was carried out for up to a week in particularly poor weather.

Table 3 and fig. 1 show that the population has increased steadily. However, during the early years, growth was slow. In 2009, there were only 13 pairs, well below the 30 pairs predicted by the model. As a result, it was decided to continue with two more years of releases. The final year of releases was in 2011 and by 2012 the population had increased to 44 pairs, when it was felt that no further releases were necessary. In 2013 the population dropped to 28 pairs; some decline was anticipated, since this was the first year with no boost to the population from birds released in the previous year. In addition, breeding success in 2012 was poor (table 3) so recruitment from wild-bred birds was limited. Since then the population has increased to 52 pairs in 2015.

There was some evidence that hand-

Table 3. Breeding population and productivity of Cirl Buntings *Emberiza cirlus* in Cornwall, 2007–15.

	2007	2008	2009	2010	2011	2012	2013	2014	2015
no. pairs	9	12	13	16	28	44	28	39	52
min. successful fledglings per pair	1.22	1.25	3.23	2.44	2.46	1.09	2.36	2.62	1.88
percentage of successful nests	66	40	71	65	63	32	58	79	73

Table 4. Productivity of hand-reared and wild-bred pairs of Cirl Buntings *Emberiza cirlus* in Cornwall in 2011.

pair composition	no. pairs	no. nests	no. successful nests	no. fledglings per pair
both wild-bred	9	18	13 (72%)	3.44–4.44
one wild-bred; one hand-reared	13	22	14 (64%)	2.42–3.08
both hand-reared	6	10	4 (40%)	1.5–1.83

reared birds were less productive than their wild-bred counterparts. This was especially evident during 2011 (table 4), and may be partially responsible for the slow growth of the population. Again, this is perhaps not surprising as wild-bred birds benefit from a natural upbringing as opposed to those that are hand-reared in captivity. However, once hand-reared birds gain experience in the wild this difference diminishes and some went on to be extremely productive.

Discussion

This reintroduction project appears to have established a sustainable population of Cirl Buntings in the Cornish release area. Further monitoring, albeit at a less intensive level, will be required to confirm that the population continues to grow and expand. Experience with the recovery of the Cirl Bunting population in Devon is that once habitat issues are addressed the birds respond favourably, with the potential for fairly rapid and sustained increases. It is also clear that given good breeding conditions they can be very productive, something that is helped by their long breeding season (April to September) and the fact that they can have up to three broods in a season. Winter mortality does not appear to be a limiting factor though there have been no prolonged periods of snow cover since the project started, something that is known to be an issue for this species (Evans 1997). In the event of a hard winter in future, the established feeding sites will hopefully help to minimise any adverse effects on the population. Poor summer weather, in particular prolonged cold and wet conditions, reduces breeding performance and hence slows population growth but there is little that can be done to offset this. Supplementary feeding

Paul Keene

215. Colour-ringed Cirl Bunting *Emberiza cirlus*; a full-grown bird from the release scheme in Cornwall in March 2007, colour-ringed when taken from the nest in Devon the preceding summer.

Box 1. Summary of key success factors and lessons learnt.

- Establishing and maintaining good relationships with landowners and managers at both the donor and the release sites was essential to ensure their support for the project.
- Partnership working was crucial to ensure the full range of expertise required to complete such a complex project.
- Trialling hand-rearing and husbandry techniques was extremely beneficial before undertaking the full-scale project.
- Adaptive management was vital, with monitoring of the success of specific interventions feeding back into management decisions.
- Funding should be considered at the earliest stages of the project, taking into account the full lifetime of the project, including contingency and the post-release monitoring and intervention stages.
- Continuity of staff throughout the project was extremely beneficial, although clear protocols and guidelines can help to provide this continuity.

near nest sites was undertaken during such conditions and was felt to have been beneficial with the adults readily feeding their chicks the live mealworms provided. This is not likely to be necessary in the long term but was considered to be a useful temporary measure while the population was still becoming established.

The project has evolved as it has progressed with valuable lessons learnt in the early stages and changes implemented when necessary. Early in the project, modifications were made to both the selected release area and the preferred avicultural techniques. During the release phase, a fundamental change was the decision to undertake two further years of releases, without which the project would have had a far lower chance of success. Although the model used to predict population growth was invaluable for planning, it did not take into account the lower productivity due to a predominance of first-year birds, the effects of hand-rearing or the adverse impact of poor weather. Future models should seek to include such factors where possible. Based on our experience, we suggest that any future Cirl Bunting reintroduction projects should plan for a minimum of six years of releases. The same is likely to apply to other small passerines with similar demography. Another important change made during the project was to have multiple release sites, in response to predators habituating to the presence of young birds as described above; again, this seems a sensible guideline for any future projects.

Since the availability of sufficient suitable habitat is key to the long-term success of this project, environmental schemes and the promotion of Cirl Bunting habitat options by farmland advisers are important considerations for the future. Agri-environment schemes can deliver all the habitat needs of this species and good wintering habitat is especially important in facilitating population increase and spread (Evans 1997). Cereal stubble (particularly following spring barley) is therefore a vital component of any Cirl Bunting agreement. Farmers within the Roseland Peninsula have been receptive to these agri-environment schemes and in 2015 all the breeding pairs nested within 200 m of an area under such management. It will be important to maintain this focus on habitat management if we are to see Cirl Buntings continue to increase and expand their range in Cornwall.

Conclusions

After six years of releases, the Cirl Bunting has been re-established as a breeding species in Cornwall. Within Britain, this is one of only a handful of bird species to have been subject to a successful reintroduction programme – and the only passerine.

Indeed, it is thought that this is the only successful passerine reintroduction to have been undertaken in Europe. Farther afield, of the 63 bird reintroduction projects in 2008–16 documented by the IUCN, only 19

Stuart Croft/RSPB

216. A hand-reared male Cirl Bunting *Emberiza cirlus* (individually recognisable by the unique colour-ring combination) feeding its own chick in the wild; Cornwall, June 2014.

involved passerines and not all of these were considered to have been successful. The success of this project therefore represents a significant contribution to reintroduction biology with many lessons that will be applicable to other passerines considered as reintroduction candidates.

Over the next decade, the existence of suitable low-intensity mixed farming within southern Cornwall will be essential to the survival of this newly established population. If this can be achieved through the implementation of appropriately targeted environmental stewardship schemes, then the future prospects for this species look bright. Indeed, models suggest that the Cirl Bunting may be one of the species to benefit from changes in climate (e.g. Huntley *et al.* 2008) and when combined with the availability of low-intensity mixed farming this could facilitate its spread to other parts of southwest England and perhaps even farther afield.

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References

Barba, E., & Lopez, J. A. 1990. Breeding season, clutch size and breeding success in the Cirl Bunting *Emberiza cirlus*. *Mediter. Ser. Biol.* 12: 79–88. [In Spanish with English summary]

Bradburn, J. D. 1891. *British Birds: their successful management in captivity with other allied information for fanciers*. 3rd edn. The Feathered World, London.

Bradbury, R. B., Bailey, C. M., Wright, D., & Evans, A. D. 2008. Wintering Cirl Buntings *Emberiza cirlus* in southwest England select cereal stubbles that follow

a low-input herbicide regime. *Bird Study* 55: 23–31.
Brown, A., & Grice, P. 2005. *Birds in England*. Poyser, London.
Buckingham, D. L., Evans, A. D., Morris, A. J., Orsman, C. J., & Yaxley, R. 1999. Use of set-aside in winter by declining farmland bird species in the UK. *Bird Study* 46: 157–169.
Cox, W. A., Thompson, F. R., Cox, A. S., & Faaborg, J. 2014. Post-fledging survival in passerine birds and the value of post-fledging studies to conservation. *J. Wildlife Management* 78: 183–193. doi:10.1002/jwmg.670
Donald, P. F., & Evans, A. D. 2001. Identification of suitable sites for Cirl Bunting *Emberiza cirlus* translocation in the UK. Unpublished RSPB report, Sandy.
Evans, A. D. 1992. The numbers and distribution of Cirl Buntings *Emberiza cirlus* breeding in Britain in 1989. *Bird Study* 39: 17–22.
— 1997. Cirl Buntings in Britain. *Brit. Birds* 90: 267–282.
— & Smith, K. W. 1994. Habitat selection of Cirl Buntings wintering in Britain. *Bird Study* 41: 81–87.
—, —, Buckingham, D. L., & Evans, J. 1997. Seasonal variation in breeding performance and nestling diet of Cirl Buntings in England. *Bird Study* 44: 66–79.
Fountain, K., Jeffs, C., Croft, S., Gregson, J., Lister, J., Evans, A., Carter, I., Chang, Y. M., & Sainsbury, A. W. 2016. The influence of risk factors associated with captive rearing on post-release survival in translocated Cirl Buntings *Emberiza cirlus* in the UK. *Oryx* doi:10.1017/S0030605315001313
Huntley, B., Collingham, Y. C., Willis, S. G., & Green, R. E. 2008. Potential impacts of climatic change on European breeding birds. *PLoS ONE* 3(1): e1439. doi:10.1371/journal.pone.0001439
IUCN. 2013. *Guidelines for Reintroductions and Other Conservation Translocations*. Version 1.0. IUCN Species Survival Commission, Gland, Switzerland.
Jeffs, C. 2005. Cirl Bunting rear and release trial 2004/5. Unpublished RSPB report, Exeter.
Lock, L. 1999. Saving the Cirl Bunting... and lots more. *British Wildlife* 11: 17–21.
— & St Pierre, P. 1997. Cirl Bunting site review. Unpublished RSPB report, Exeter.
MacDonald, M. A., Cobbold, G., Mathews, F., Denny, M. J. H., Walker, L. K., Grice, P. V., & Anderson, G. Q. A. 2012. Effects of agri-environment management for Cirl Buntings on other biodiversity. *Biodiversity & Conservation* 21: 1477–1492.
McGill, I., & Sainsbury, A. W. 2005. The Cirl Bunting (*Emberiza cirlus*) disease risk analysis. Unpublished Zoological Society of London report, London.
Mellersh, W. L. 1902. *A Treatise on the Birds of Gloucestershire*. John Bellows, Gloucester.
Montagu, G. 1833. *Ornithological Dictionary of British Birds*. Orr & Smith, London.
Parslow, J. L. F. 1968. Changes in status among breeding birds in Britain and Ireland. Status change amongst British birds. *Brit. Birds* 61: 61–62.
Peach, W. J., Lovett, L. J., Wotton, S. R., & Jeffs, C. 2001. Countryside stewardship delivers Cirl Buntings (*Emberiza cirlus*) in Devon, UK. *Biological Conservation* 101: 361–371.
Ponz, A., Barba, E., & Gil-Degado, J. A. 1996. Population changes and breeding ecology of the Cirl Bunting *Emberiza cirlus* in eastern Spain. *Bird Study* 43: 38–47.
Sellarés, C., & Maggs, G. 2011. Cirl Bunting (*Emberiza cirlus*) husbandry guidelines for the Cirl Bunting Reintroduction Project. Internal Project Report.
Sitters, H. P. 1982. The decline of the Cirl Bunting in Britain, 1968–80. *Brit. Birds* 75: 105–108.
Stanbury, A., Davies, M., Grice, P., Gregory, R., & Wotton, S. 2010. The status of the Cirl Bunting in the UK in 2009. *Brit. Birds* 103: 702–711.
Ticehurst, N. F. 1909. *A History of the Birds of Kent*. Witherby, London.
Wilson, J. D., Evans, A. D., & Grice, P. V. 2009. *Bird Conservation and Agriculture*. Cambridge University Press, Cambridge.
Wotton, S. R., Langston, R. H. W., Gibbons, D. W., & Pierce, A. J. 2000. The status of the Cirl Bunting *Emberiza cirlus* in the UK and the Channel Islands in 1998. *Bird Study* 47: 138–146.
—, Rylands, K., Grice, P., Smallshire, D., & Gregory, R. 2004. The status of the Cirl Bunting in Britain and the Channel Islands in 2003. *Brit. Birds* 97: 376–384.

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