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LIFE Waders for Real

D.1 Wader breeding monitoring report - Annual monitoring of wader numbers and breeding success

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Abstract

In order to document the effects of management techniques during the course of the LIFE Waders for Real project on breeding waders detailed monitoring was required. This document outlines the results of the detailed monitoring of breeding lapwing along the Avon Valley on hotspot and non-hotspot sites. A stabilisation of lapwing pairs was observed along with an increase in productivity during the project years. An increase in breeding pairs of redshank was observed and observations of snipe breeding behaviour.

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Introduction

Monitoring of lapwing breeding success in the Avon Valley 2007-2014 showed that productivity was too low to maintain a stable breeding population. To halt the decline of lapwing and redshank, we urgently needed to intervene to improve breeding success. Higher breeding success can, depending on overwinter survival, lead to an increase in adults returning to breed and consequently, to increases in breeding population density.

Therefore, from 2015 to 2019 habitat and predator management has been put in place to improve wader breeding success in the Avon Valley. In order to document how this management affected breeding wader numbers and breeding success we have conducted detailed monitoring each year (2015-2019). Lapwing breeding success was monitored through pair surveys, nest and brood monitoring and other breeding waders were monitored through pair counts.

Monitoring protocols

Breeding wader surveys

Surveys commence in mid-March, each site was visited every two weeks until the end of the breeding season in early July. These visits do not need to be made in the early morning. The surveys yield information on site occupancy and overall productivity per site.

On all visits to occupied fields a visit sheet should be completed, and the surveyor should:

1. Note time of arrival at the field. Record numbers and species of all corvids, gulls, raptors and herons on arrival. Distinguish birds on the field or on the field boundary from those flying over.

2. Make careful observations from several vantage points at the edge of the field to ensure that the whole of the field is scanned. Record the total number of adult lapwings (where possible, distinguish males from females), number of sitting adults, number of alarm-calling females and number of young. Where possible record the brood sizes and the age class of any chicks observed. Mark the positions of birds, nests and broods on large scale (1:10,000) maps.

If it is not possible to make an accurate count of the number of birds by scanning from the field edge, the field should be walked until all areas can be seen. If this is the case walk to within 100 m of every point in all fields so that no waders are missed (although take care not to cause undue disturbance to nesting lapwings). If unable to see birds sitting due to vegetation after the field is walked return to a vantage point, watch carefully for birds walking back to nests.

3. Note any raptors flying over or stopping in the field during observations.

4. The time the surveyor leaves the field is recorded.

Nest finding and monitoring

On each visit to a field nests should be located using the method detailed below. To minimize disturbance, nests should only be approached when first located and when clutches are estimated to have failed or hatched. Care should be taken to avoid drawing the attention of potential egg predators to nest sites.

All nest monitoring is done under Natural England Nest disturbance permit, under the Wildlife and Countryside Act 1981, assigned to each individual researcher.

Nest are found by scanning for incubating birds from the edge of the field. Once an incubating bird is spotted pick an obvious point in the horizon directly in line with the nest. The nest is located by walking towards this point across the field until the nest is found. Once the nest is found, the location is recorded using a GPS and the date and time are noted. The length and breadth of the eggs is measured using callipers and the eggs are weighed. Using these measurements, it is possible to calculate an approximate egg density which is used to predict a hatch date for each clutch. A temperature logger is placed in the centre of the nest under the eggs.

Record vegetation height (to nearest cm) on the edge of the nest cup and at 4 points at 1 m around the nest. Estimate the % bare ground and the % composition of vegetation within a 1 m square quadrat over the nest (grass, sedge, rush, dicot and herb) in a 1 m square quadrat around the nest. No more than about 5 mins should be spent at the nest. Try to minimize disturbance to soil/vegetation around nests.

First clutches tend to be fairly synchronous in late March/early April, but as nests fail birds will start re-nesting. Lapwing typically take about 8 days to re-nest after losing a clutch. Birds may re-nest twice in a season, i.e. have up to 3 nesting attempts. Hence birds may be nesting into June.

Temperature loggers provide data on time of nest failure or hatching, avoiding the need to make frequent visits to nests to obtain survival data. As far as possible, the nests should be re-visited within a day or two of the estimated hatch date. However, there are many occasions where sites are re-visited for other reasons before this hatch date, in these cases nests are not visited but it may be possible to check the status of nests by observing sitting females from the field edge.

Nests are checked at the predicted hatch date. If there is no bird sitting, the nest site is approached and checked for signs of predation or hatching. The temperature logger is retrieved, the time that it is removed from the nest is noted and the data is downloaded the same day. If the temperature logger cannot be located in the nest cup, carefully search up to a 10 m radius around the nest.

At some predated nests it is possible to identify the nest predator from signs left at the nest. Eggs predated by corvids have a hole punched in the side. Those taken by foxes or badgers tend to be crushed to small pieces. Those taken by small mustelids tend to have tooth marks in the shell. Badgers will completely destroy the nest, whereas foxes and corvids lift the eggs cleanly, leaving the nest lining intact. Mammals may leave footprints or scats.

Successful nests always have small eggshell fragments, c.1-2 mm in size, in the nest lining (the adults remove the eggshells, but these chippings are from where the chicks break out of the shell). Always search the nest lining carefully.

If there is doubt, detailed notes should be made and, if possible, photos of the nest and any egg remains taken.

When a nesting attempt has finished, record the 5 vegetation height measures as before, % bare ground and the % composition of vegetation within a 1 m quadrat over the nest (grass, sedge, rush, dicot and herb). At the same time record these measures at a paired random point within the same field 100 m from the nest. To do this take a random compass direction, pace 100 m and then take the measurements.

Monitoring lapwing brood survival

During visits from late April to July, careful observation of adult behaviour should be made to determine whether or not each pair of lapwings has managed to hatch a clutch of eggs and whether they fledge a brood.

Females have a distinctive alarm-call when they have chicks. This call can be used to estimate the period for which broods survive. By carefully noting the combination of pair location, alarm-calling behaviour and any chick observations on each visit, it is possible to estimate brood survival. Ideally, broods should not be disturbed more than once a week. For any broods seen, attempt to count the number of chicks and estimate their age to the nearest week. Chicks fledge at around 35 days but can fly short distances soon after 20 days (Figure 1).

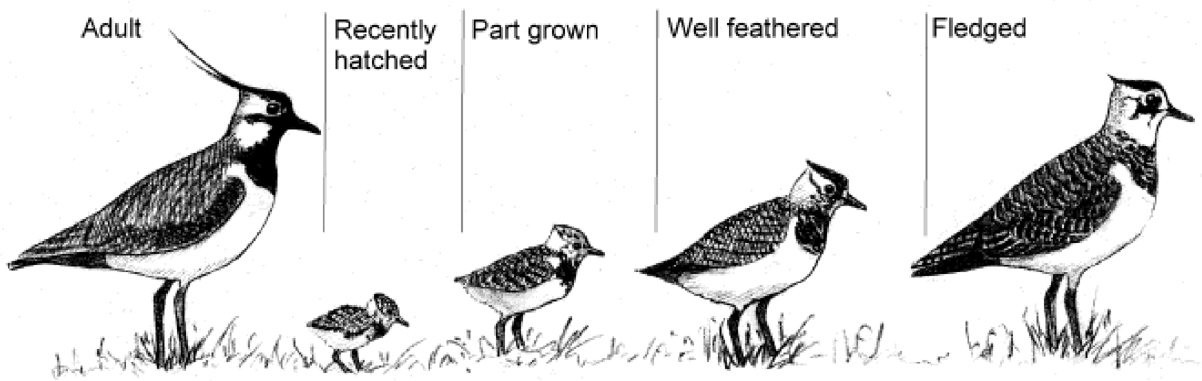

Figure 1 Guide to ageing lapwing chicks. Recently hatched, part grown, well feathered and fledged equate roughly to less than 1 week, 2 weeks old, 3 weeks old and 28-35 days respectively.

Catching, ringing and tagging of chicks is done under BTO license, held by each researcher with specific endorsements to colour ring and radio-tag.

If chicks are not found at point of hatching in the nest cup, they can be caught using a similar method as nest finding. Once a brood is observed, the area where the chicks have been seen can be approached with great care as chicks have good camouflage. Once caught, chicks are fitted with a metal BTO ring with a unique code to the individual. Chicks can be ringed with a BTO metal ring from the day they hatch. Chicks can be colour-ringed from 20 days therefore where possible chicks should be recaptured at or after 20 days old in order to fit a set of uniquely coded colour rings. Re-sighting colour-ringed birds will allow us to better understand survival and dispersal.

Biometrics are taken from all chicks caught - bill and tarsus length (to 0.1 mm), weight to 0.1 g. For chicks older than 20 days, the wing length is measured and the extent of primary growth noted (third, two-thirds, fully grown).

A sample of lapwing chicks are radio-tagged to obtain more accurate data on brood movements and on fate of chicks that perish. One chick randomly selected from each brood is radio-tagged shortly after hatching with a 0.4 g, 30-day life, transmitter, glue mounted to the chicks back. Chicks are radio-tracked twice a week, where possible, by triangulation from field edges and only approached closely where death is suspected; if tags indicate a static signal or no movement or a very large movement since the previous day. Fixes are recorded on 1:10,000 scale maps with the time of the fix, enabling average distances travelled and time spent in different habitats to be calculated subsequently using a GIS.

Breeding wader results

Lapwing Pairs

Over the project we have begun to see a stabilisation in the number of lapwing breeding pairs in the Avon Valley at around 70-80 pairs (Figure 2). Prior to the project the population had been in decline since the 1980s, a low of 41 pairs was counted in 2012. Pair numbers in 2019 reached 105, the highest pair count since 2010, we also had lapwing successfully breeding north of Fordingbridge, showing a possible expansion of territories.

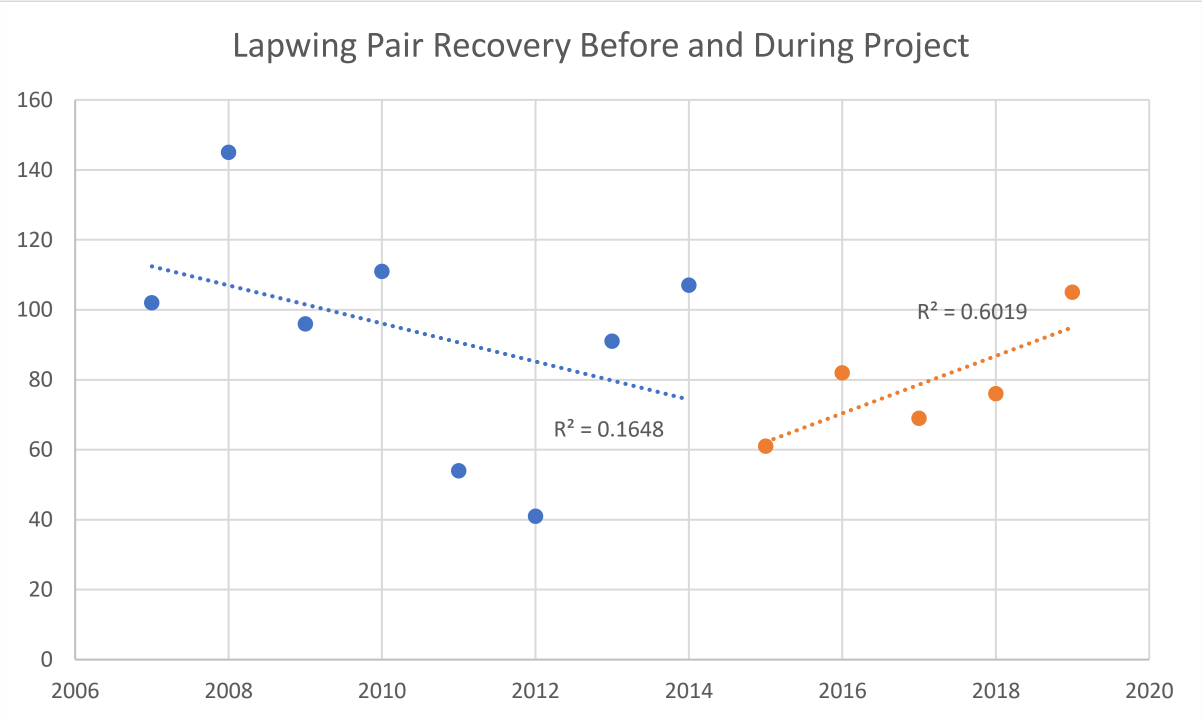

Figure 2: Count of Lapwing pairs in the Avon Valley in the years before and during the Waders 4 Real project

Over the five years of the project, the majority of lapwing pairs have been observed on the hotspot sites. Surprisingly, the proportion of the total pairs observed on hotspot sites has remained relatively constant at around 65% (Figure 3).

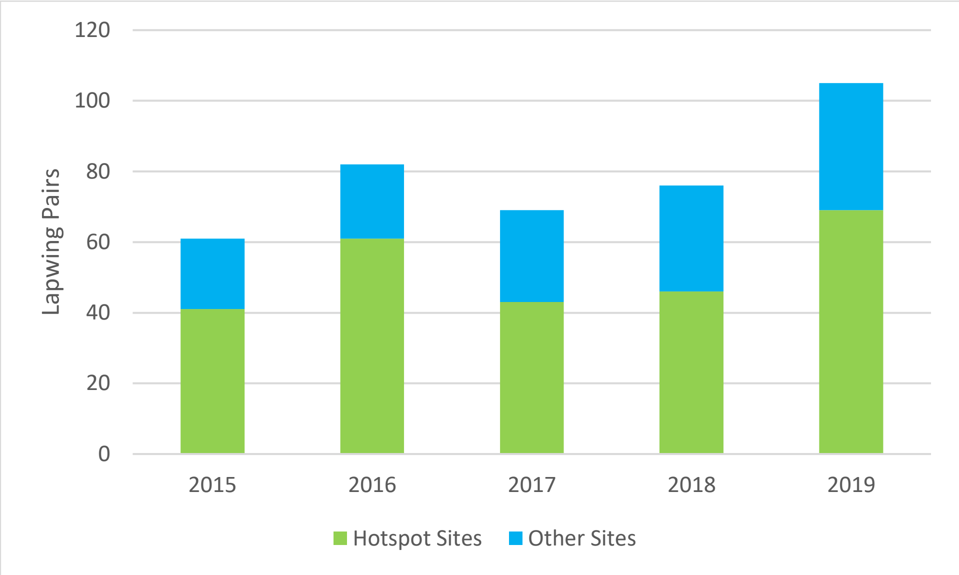

Figure 3: Lapwing pairs counted in hotspot and non-hotspot sites in the Avon Valley

Lapwing nesting success

Nesting success before the start of the project (2007-2011) averaged 44.9%, this increased by an average of 11% during the years of the project (2015-2019) (See Table 1). Between 2015 and 2019 251 nests were monitored and nesting success averaged 55.3%. There was some variation in nesting success between years but in 2019 nesting success was at an all-time high of 76%.

Table 1 Lapwing hatching success across project monitoring

Year	*Hatched*	*Unknown*	*Failed*	*Total*
2015	31 (55 %)		25	56
2016	28 (43 %)		36	64
2017	20 (39 %)	5	26	51
2018	15 (52%)	4	10	29
2019	39 (76%)	1	11	51

Of nests which were known to have failed, predation was the main cause of nest failure (Table 1). It was not surprising that this was the most common cause of failure as other causes of nest loss, such as livestock trampling or insensitive farming practices, were minimised. Due to the low intensity of farming practices and conscientious grazing regimes we only recorded 8 nest failures due to farming practices or livestock throughout the project.

Table 2 Lapwing nest fates across project monitoring.

Year	Predated	Abandoned	Flooded	Trampled	Unknown Failed
2015	18	3		3	1
2016	19	2	1	3	11
2017	16	1			9
2018	8	1	1		
2019	7	3			1

During the project it was possible to estimate the timing of nest predation using temperature loggers in the nest. This timing can be used to provide insight into nest predator identity; in general, the majority of nocturnal predation is thought to be due to mammalian predators whereas diurnal predation could be due to a variety of different predators including birds (Table 2).

Over the course of the project we have seen a change in proportion of night and daytime predation events. In 2015 62.5% of known nest predation timings were at night, this was also 62.5% in 2016, 33.3% in 2017, 25.0% in 2018 and 27.3% in 2019. Although this is based on a relatively small sample size, of 52 nests over the 5 years, this still shows a possible shift in predator types in the Avon Valley. It could be that nocturnal mammalian predation has declined. This could possibly be linked with to the increased use of temporary electric fences to exclude mammalian predators and increased lethal control effort (on foxes), however at this stage we are unable to distinguish between these possibilities.

Lapwing chick survival

Radio tracking was used as a method to investigate lapwing chick survival. Lapwing chicks were tagged as close to hatching as possible, preferably on day one while still in the nest. 133 lapwing chicks were tagged during the project. We report here on chick from 2015-2018 as analysis of 2019 chicks has not been possibly yet. The main cause of failure in chick survival is predation, however we were unable to determine the main causes of predation (Table3).

Table3 The fate of ninety-eight chicks radio-tracked over four years (24 in 2015; 31 in 2016; 19 in 2017; 24 in 2018).

Outcome	Cause	Number of chicks
Fledged		28
Failed	Assumed predated	22
	Known predated	20
	Trampled	1
	Drowned	1
	Unknown	9
Unknown		17

Lapwing chick survival differed considerable between years, leading to the differences seen in productivity year to year (Figure 4). Influences of lapwing chick survival in regard to habitat use and home range will be further explored in the upcoming Deliverable E1 Scientific paper on the importance of wet in-field features for increasing lapwing chick survival (in writing).

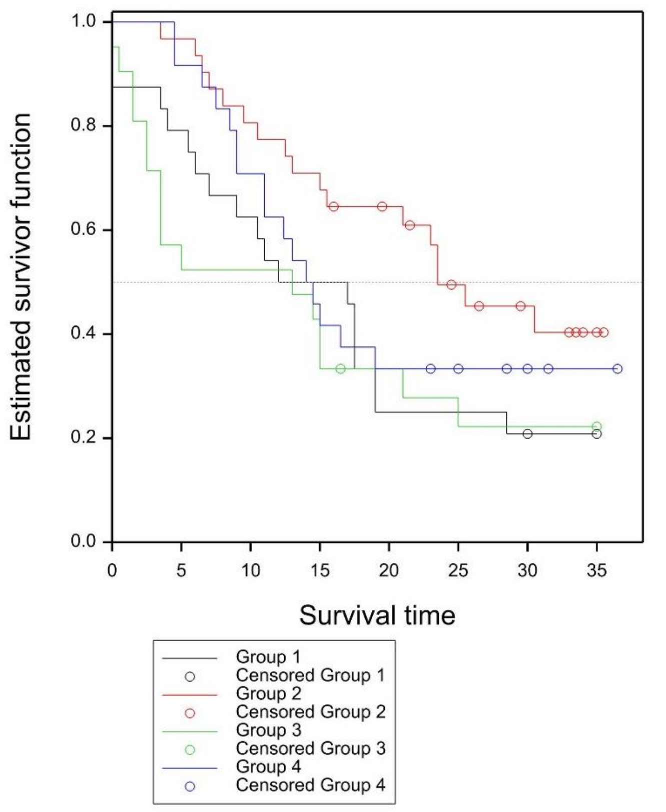

Figure 4 Kaplan-Meier estimate of daily chick survival.

Lapwing productivity

We monitored wader productivity as chicks fledged per pair per year. Lapwing need to fledge an average of 0.7 chicks per pair each year in order to maintain a stable population. Out of the five years of the project we were successful in reaching this 0.7 threshold in three of the years. On average productivity was higher on hotspot sites compared to other sites, 2018 being the outlier, where one of our other sites had a particularly successful season (Table 4).

Table 4 Lapwing productivity over the project.

Year	*Productivity overall*	*Productivity – hotspot sites*	*Productivity – other sites*
2015	0.49	0.49	0.50
2016	0.71	0.87	0.23
2017	0.34	0.38	0.28
2018	0.77	0.58	1.03
2019	0.96	1.17	0.58

There has been a large increase in productivity on hotspot sites during the course of the project. We have chosen to include 2015, the first year of the project as 'before project' as there was no habitat work or predator reduction techniques used before the spring of 2015 (see Deliverable E1 Technical publication on the direct and indirect predator control techniques for wader population stabilisation and increase, including implementation and efficacy of indirect measures).

An increase in lapwing productivity of 0.22 chicks per pair was seen across all sites during the course of the LIFE Waders for Real project, bringing the average productivity on hotspot sites to 0.7, the value required to maintain a stable population. This increase in productivity was predominantly seen on hotspot sites where most management techniques were used. An increase in productivity on hotspot sites of 0.24 was observed compared to 0.06 on other sites (Table 5).

Table 5 Lapwing productivity change on hotspot sites vs other sites across the project.

	Productivity – hotspot sites	Increase in productivity	***Productivity – non-hotspot sites***	Increase in productivity	***All sites productivity***	*Increase*
Before project (2007 - 2015)	*0.51*		0.47		0.48	
During project (2016 - 2019)	0.75	0.237	0.53	0.058	0.70	0.22

Due to a number of external factors, such as variation in weather and water-levels, wader productivity is notoriously variable from year to year, so it is important to look at this as a 5-year average. We are pleased to report a steady increase in 5-year average productivity since the beginning of the project. When the project began in 2015 the average productivity of the previous 5 years was 0.5, this has now increased to 0.66 in 2019 (Figure 5). The changes in pair numbers and productivity before and during the project will be further explored in the upcoming Deliverable E1 Scientific paper on lapwing breeding success in the Avon Valley before and during the LIFE project and contributing factors (in writing).

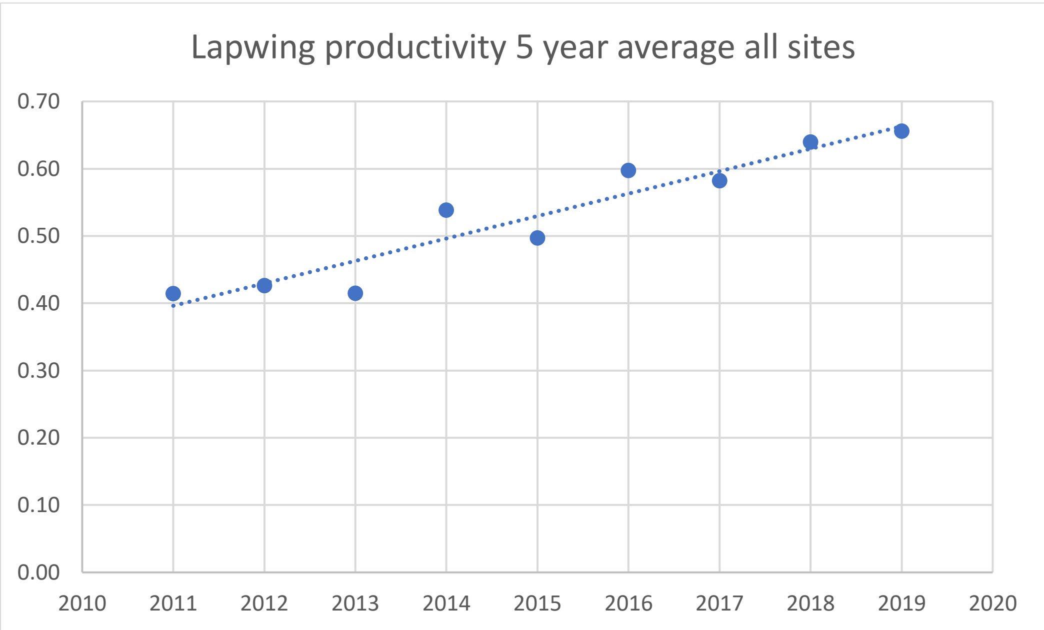

Figure 5 A rolling five-year average of Lapwing productivity in the Avon Valley

Redshank pairs

We have seen an encouraging increase in Redshank pair numbers over the course of the project and are happy to report 35 pairs were surveyed during the 2019 field season, a significant increase from 19 pairs at the beginning of the project in 2015 (Figure 6).

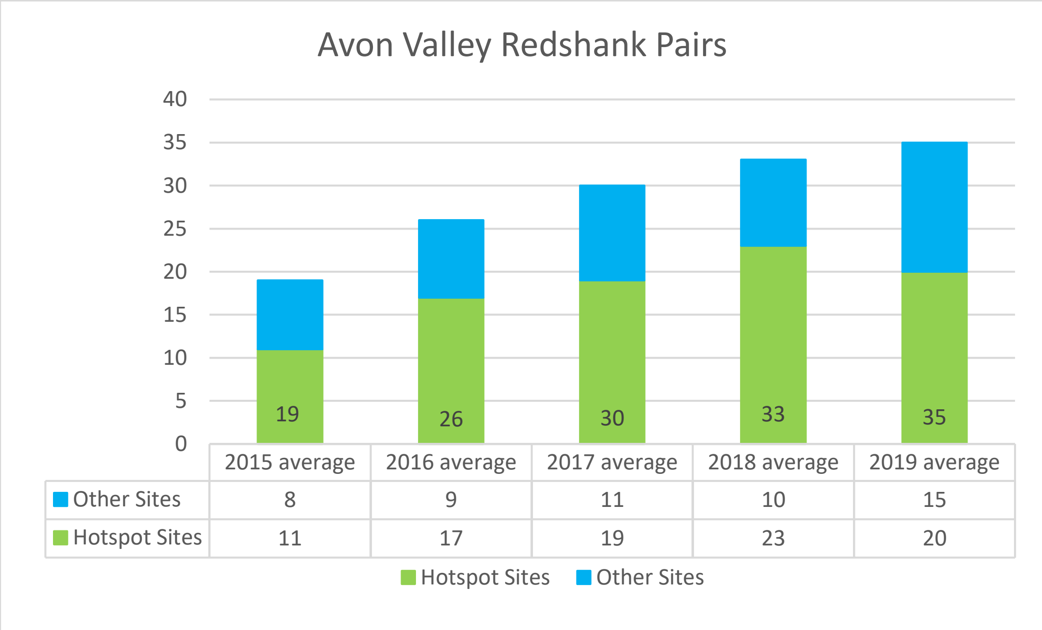

Figure 6: Redshank pairs counted in hotspot and non-hotspot sites in the Avon Valley

As with lapwing, the split of pairs occupying hotspot site compared to other sites is very consistent over the 5 years despite the increase in pair numbers, on average 62% of redshank pairs are on hotspot sites.

Redshank nesting success

Although not our focal species, we were able to monitor a sample of redshank nests over the course of the project, particularly in 2019. We only monitored a small sample of nests, but of nests where the outcome was known the hatching success was 42%. However, outcome was unknown for 26% of nests, so it could be that this hatching success is an underestimate (Table 6).

Table 6 Redshank nest fates over project monitoring.

Year	***Hatched***	***Abandoned***	***Predated***	***Unknown Fail***	***Unknown***	***Total***
2016	1		1		3	5
2017	2				1	3
2018		1			1	2
2019	5		2	2		9
Total	8	1	3	2	5	19

We did not actively to monitor redshank productivity but based on our field observations, and knowledge of the species, we assume they followed a similar pattern of breeding success to the lapwing population over the course of the project. In some sites in the Avon Valley an increase in redshank pairs was extremely noticeable in 2019. One field in particular on the Watton's Ford hotspot site saw an increase in redshank pairs from 2 in 2015 to 6 in 2019. This increase could indicate improved habitat suitability. Redshank are highly site faithful so this population increase could show improved breeding success. Looking forward we would like to explore their productivity and site fidelity further and hope this can be done through a future project.

Snipe

There have been possible signs of snipe returning to breed in the Avon Valley over the course of the project. Two drumming snipe (drumming is part of a courtship display) were heard on hotspot sites in 2018 and one chipping snipe (another display call) in 2019. We do not have direct evidence of breeding in the form of nests or chicks, but at low densities these are hard to find. These sightings of breeding behaviour show the potential for birds to move back to breed in the Avon Valley.

Conclusion

The detailed monitoring of lapwing breeding success described above indicates a stabilisation of the lapwing population decline across the Avon Valley. Productivity on hotspot sites in years after the implementation of habitat and predator management has crossed the 0.7 threshold required to maintain a stable population. Productivity across all sites (hotspot and non-hotspot) within the Avon Valley is improving and the 5-year average reached 0.7. The project has been very successful, with targets for habitat creation exceeded and a greater number of wader pairs achieved than expected: lapwing 105 pairs (target 80-90 pairs), redshank 35 pairs (target 30 pairs). Snipe have started to reappear in the valley in summer. This is a great achievement over the 5 years of the project and highlights the work not only put in by the Waders for Real team, but the land managers and farmers who were responsible for altering management practices and increasing awareness of how to farm alongside breeding waders.

In future years, as monitoring continues, we suggest that redshank may be a better indicator species for the condition of the Avon Valley than lapwing. Redshank are more restricted in their habitat requirements than lapwing so may be likely to be more dependent on the wet grassland in the Avon Valley. Lapwing can utilise other habitats for breeding; as we have seen through our colour ring observations, lapwing fledged from the Avon Valley can go and breed on adjacent arable farmland or the New Forest.

For more information on the causes of this management success see Deliverable E1 Technical publication on the direct and indirect predator management techniques for wader population stabilisation and increase, including implementation and efficacy of indirect measures.