Watching Out for Waders: The Working for Waders Nest Camera Project

Report of partnership work coordinated by Working for Waders (WfW), results presented by the British Trust for Ornithology (BTO)

Noyes, P., Laurie, P., Wetherhill, A. & Wilson, M.

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Contents

Executive summary

Introduction

1. Low rates of nest and chick survival have driven large declines in breeding wader populations across Scotland (and in the UK and Europe).

2. Whilst habitat availability and quality, primarily driven by shifts in agriculture, have played an important role in wader population trends over the longer-term, the most common direct cause of wader nest and chick failure is predation.

3. Furthermore, there is evidence that overall predator abundance has increased in recent decades, exacerbating other drivers of declines. Remaining strongholds of wader breeding success are generally found in areas where rates of nest and chick predation are relatively low, such as on islands, near intensively-managed grouse moors, and in nature reserves managed for breeding waders.

4. and managers can become frustrated when conclusions reached by scientists and policy-makers, particularly on contentious issues such as the impacts or management of predators, run counter to their own understanding and experience.

5. Using cameras to monitor the outcome of wader nesting attempts can help to make the information gathered accessible to a wide range of stakeholders. Also, camera footage can provide more definitive information on predator identities than data generated by most other kinds of monitoring.

6. We trialled the use of trail cameras by land managers and other wader conservation stakeholders to monitor the outcome of wader nesting attempts. We present the results of this trial and assess the potential for the project to improve wader conservation knowledge and management.

Methods

7. We developed guidance, data collection protocols, and data submission options, and provided these, along with 33 trail cameras, to 16 individuals drawn from a range of stakeholder groups across Scotland.

Results

8. During 2022 and 2023, 87 nest records (61 in 2022 and 26 in 2023) based on nest camera monitoring were collected and sent to us by 11 individuals from various parts of mainland Scotland.

9. Participants submitted nest records for Curlew *Numenius arquata* (n = 29), Lapwing *Vanellus vanellus* (n = 31), Oystercatcher *Haematopus ostralegus* (n = 25) and Golden Plover *Pluvialis apricaria* (n = 1). Overall hatching success was 59% (36 out of 60 nests) in 2022 and 85% (22 out of 26) in 2023. Hatching rates for Curlew were 61% in 2022 and 73% in 2023; for Lapwing they were 72% in 2022 and 100% in 2023; and for Oystercatcher they were 48% in 2022 and 50% in 2023.

10. Of the 24 nesting attempts that failed in 2022, 20 (83%) failed due to predation, two (8%) due to deer trampling, and two (8%) due to disturbance (one caused by livestock the other by humans). Of the 20 nests reported as predated, six (30%) were predated by Domestic Sheep *Ovis aries*, four (20%) by Badger *Meles meles*, four (20%) by Fox *Vulpes vulpes*, three (15%) by Pine Marten *Martes martes*, one by Carrion Crow *Corvus corone*, one (5%) by Hedgehog *Erinaceus europaeus*, and one (5%) by Raven *Corvus corax*. Of the three nest records recorded as failed in 2023, two were predated (by Domestic Sheep and an unidentifiable predator) and one was trampled by cattle.

11. Outcomes (hatching success, causes of failure, and predator identities) of nest records reported by different stakeholder groups were similar to one another.

Conclusions

12. Land managers are well-placed to contribute wader nest camera records that can be usefully combined with those of individuals from environmental non-governmental organisations (ENGOs) or academic backgrounds.

13. The approach outlined in this report can deliver cost-effective, inclusive monitoring and robust, co-produced datasets. However, this depends on there being funding to cover effective coordination and support of participants, as well as equipment, analysis, and reporting.

14. Several aspects of the project could be improved, including training opportunities, guidance for participants, and mechanisms for data entry and submission.

Key recommendations

15. Continue the project in future years and secure funding for its costs (including input from staff to support and coordinate participants).

16. In consultation with land managers, decide how best to deploy available management and monitoring resources to benefit breeding wader populations.

17. Engage with ENGOs to discuss sharing of existing wader nest monitoring data.

18. Ensure data collected by participants are regularly discussed with and made easily accessible to them, with findings and progress also communicated to the wider group of stakeholders.

19. Be prepared to adapt and improve nest camera deployment protocols in the light of evidence arising from this or other projects to ensure that the right balance is struck between bird welfare, data quality, and engaging stakeholders.

20. Develop robust protocols for interpreting nest camera footage (and other nest monitoring evidence) to assign outcomes accurately and transparently (ensuring we are interpreting the relevant evidence consistently).

1. Introduction

1.1. Breeding wader declines

Breeding wader populations have undergone large declines in the UK over the last four decades (Heywood et al. 2024, Stanbury et al. 2021). Although adult and first-year juvenile survival rates remain high enough to maintain stable populations, the number of young produced each year is unsustainably low (Cook et al. 2021). Most waders nest on the ground in open habitats such as grassland and moorland, incubating clutches of about 3–5 eggs for a period of 3–4 weeks, depending on the species. Wader chicks are precocial, meaning they can walk and feed independently within hours of hatching. However, they remain flightless for 4–5 weeks, during which time they remain near the nest site being cared for by one or both parents (BTO 2024a, Nethersole-Thompson & Nethersole-Thompson 1986). Wader eggs and unfledged young are vulnerable to a range of threats including predation (Parr 1993, MacDonald & Bolton 2008, Malpas et al. 2013), livestock and farm operations, adverse weather, and starvation (Pearce-Higgins & Yaldon 2002). These factors can reduce rates of egg and chick survival, limiting the number of birds available to recruit into the breeding population. When the rate of recruitment falls below the rate at which adults are lost from the breeding population, this results in population declines (Cook et al. 2021).

Declines have been most severe in wader populations breeding in lowland farmland on the UK mainland (Silva-Monteiro et al. 2021). Waders in these areas are now largely dependent on nature reserves and other sympathetically managed areas (Calladine et al. 2022). A large proportion of the breeding waders remaining in the UK are on islands or in upland landscapes with intensively managed grouse moors, where the impacts of predation on egg and chick survival tend to be less severe than in most lowland situations (Fletcher et al. 2010; Franks et al. 2017, Calladine et al. 2022, Baines et al. 2023). However, changes in land use and management, including agricultural intensification, woodland creation and reductions in predator control effort, can reduce wader breeding productivity in these landscapes (Reed et al. 2009, Douglas et al. 2014, Crowle et al. 2022). Understanding how wader breeding success is affected by these, and other factors will help to inform conservation of breeding waders in Scotland, and the wider UK.

1.2. Research and policy

Conservation funding is limited, so it is vital that conservation interventions for breeding wader populations are joined-up and effective. To this end, collaborations between land managers, scientists, and agricultural and environmental policymakers have the potential to result in more impactful action than any of these groups could achieve on their own. Attitudes on the value of research outputs may vary widely between different groups of stakeholders (Lawrence 2005), but there is widespread acceptance of the need for conservation actions that are based on sound evidence and are robustly evaluated (Sutherland et al. 2004). Most of the evidence underpinning UK conservation policy is collected by a small number of paid researchers alongside a much larger number of volunteers (JNCC 2023). Most of this information is collated, analysed and reported on by academic institutions and environmental non-governmental organisations (ENGOs), primarily in academic journals and reports.

1.3. Landowner and manager engagement

Most of the recent and ongoing research on breeding waders in the UK offers limited scope for input from the relevant land managers, many of whom have extensive understanding and experience about breeding wader landscapes and their management. As well as failing to engage with useful information, leaving land managers out of this process can lead to frustration and lack of trust if research outcomes and the policies they inform disagree with the understanding of local stakeholders. Many UK land managers are keen to demonstrate the value of their land management for wildlife, including waders and other ground-nesting birds, which are increasingly regarded as 'flagship species' for farmland and moorland in the UK (Goodall et al. 2023, Nidderdale Moorland Group 2024). Many land managers are also happy to support work to evaluate impacts on waders and other ground-nesting birds of factors that can also impact on their own livelihoods, such as egg and chick predation or human-caused disturbance (Ainsworth et al. 2016).

Monitoring methods and research pathways that are broadly inclusive are likely to be more robust, yielding shared datasets that are widely trusted and reaching conclusions that are generally well-understood and accepted. Given that many land managers have knowledge and skills that lend themselves to doing ecological research, one way to increase inclusivity is to directly involve land managers in the collection of scientific evidence.

1.4. Wader nest cameras

Monitoring wader nests using trail cameras is well suited to developing inclusive datasets and research outputs on wader breeding success. One advantage of this approach is that information about nest outcomes derived from camera footage is often more detailed, less ambiguous, and more straightforward to interpret than data generated by other nest-monitoring methods. Many land managers have a good understanding of where waders are likely to be nesting on their land and can locate nests during or around their work activities with little or no additional time and effort. Situations where land managers contribute to valuable datasets on wader nest outcomes and, consequently, have more understanding of and trust in these datasets, can be win-wins for both wader conservation and local stakeholders. This kind of involvement with nest monitoring can also increase the engagement of land managers with the conservation interventions and policies that are developed using the data they helped to collect (Jordan et al. 2011, Dickinson et al. 2012), as well as improving their ability to evaluate the environmental consequences of their own management.

Figure 1. A typical wader nest camera set-up, using a trail camera and wooden stake, 3 m away from the nest. The nest in the picture is an Oystercatcher nest in hay meadow. Photo credits: Paul Noyes / BTO.

1.5. Working for Waders Nest Camera Project 2022 and 2023

Working For Waders (WfW) (Working for Waders 2023a) is a partnership formed in 2017 to address the population declines of wading birds in Scotland. The initiative welcomes the involvement of anyone with an interest in waders and is supported by a wide range of organisations and stakeholders, including farmers, gamekeepers, conservationists, and birdwatchers.

Here, we present the findings from two successive trial years (2022 and 2023) of the WfW Nest Camera Project (hereafter referred to as the project). We trialled the use of trail cameras by land managers and other wader conservation stakeholders to monitor the outcome of wader nesting attempts across Scotland. We present the results of this trial, assess the potential for this approach to improve wader conservation knowledge and management, and recommend changes that could be implemented to improve monitoring outcomes.

2. Methods

2.1. Project coordination

A single coordinator managed the project between March and July in both 2022 and 2023, with the support of a data-lead (British Trust for Ornithology, BTO), and a supervisory 'Nest Camera Group'. The coordinator distributed 33 trail cameras (BolyGuard SG2060-K and BolyGuard BG584 4G models), plus external batteries and chargers where these were required, to prospective project participants. These comprised 16 individuals drawn from different stakeholder groups and distributed across Scotland, all of whom were already involved with WfW in some capacity. We also put out a request to WfW partner organisations and interested stakeholders to submit wader nest records based on their own nest camera data to the project. We hereafter refer to all individuals who deployed project cameras or submitted their own camera-based nest records to the project as participants.

During 2022, funding enabled the coordinator to spend time on this project to provide encouragement, support and progress updates to participants. Communication preferences and abilities varied between participants, so five communications platforms were used:

1. Email and telephone support on nest camera set up and data collection, as and when needed.
2. Guidance documents on technical set up of nest cameras and data collection (Appendix 1).
3. Email summaries of progress to the entire group once a week from April to July.
4. A mobile phone messaging app (WhatsApp) group that the coordinator invited all participants to join.
5. Online videoconference (Zoom) meetings in the form of 12 weekly, week-night evening 'drop-in sessions'. Guest speakers helped to give each night a theme, and the coordinator encouraged people to join if they could for as long as they chose.

In 2023, a much smaller amount of coordinator time was funded, so the level and effectiveness of communication with participants across all five of these channels was greatly reduced.

2.2. Data return

We developed a data collection protocol and accompanying guidance for the project, which aimed to minimise the time and effort spent by participants. We did this by asking for only the core information, allowing us to assess wader nest survival and outcomes (Appendix 1). We asked participants to submit data for each wader nesting attempt monitored by using an online data entry form called the **Wader Nest Record Form** (Appendix 2). We built this bespoke data entry form using freely available online software (Google Forms), which stored participants' answers to the questions in the form (Appendix 2) as a Comma Separated Values (CSV) file. The form allowed relevant media (nest camera images, photos of nests and eggshell fragments) to be uploaded by participants to online shared drives (Google Drive) from which they could be accessed by the data-lead.

Due to participant requests, in 2023 we provided two additional forms of data return:

- A spreadsheet (the **Wader Nest Record Spreadsheet**, Microsoft Excel), to facilitate bulk upload of nest records (where participants had many nest records to submit).
- A paper **Wader Nest Record Form** (available as a downloadable PDF, or posted as a paper copy upon request), to facilitate return of nest records from individuals who did not want to use an online form or spreadsheet.

We also ensured that project data were compatible with those held by the Nest Record Scheme (NRS) (**www.bto.org/nrs**). Founded in 1933, the NRS is the largest citizen science bird nest monitoring scheme in the UK. Each year, around 750 NRS participants monitor over 35,000 nests of different bird species (including several species of wader) in a variety of landscapes and habitats (Crick et al. 2003, Walker et al. 2023).

2.3. Data quality assurance

After the deadline for nest record submission (30 November in both years) had passed, we downloaded all the records in the online data entry form, along with any supporting images or videos that had been uploaded by participants.

We manually checked these records for:

- Any clearly anomalous dates (e.g., outside of the wader breeding season, or in a different year).
- Timelines that contradicted wader breeding phenology (e.g., too short an interval between egg-laying and hatching).
- Any notes, camera footage or other supplementary information provided by participants that conflicted with information contained in their nest records.

We emailed each participant to thank them for their submissions, resolve any queries arising from our manual checks, and ask them to send us any outstanding nest records, along with any relevant media that could support or illustrate the information in their nest records.

2.4. Descriptive analyses

We summarised nest record information according to primary stakeholder identity, species, duration of monitoring, nest outcomes, and causes of nest failure (including predator identity, where predation occurred and the predator was identifiable).

2.5. Nest camera evidence

We classified nest records as conclusive if the nest outcome (and predator species, where the nest was predated and the participant did not report predator species as unidentifiable) could be determined by the media (usually nest camera images) provided, and as 'inconclusive' otherwise.

2.6. Nest site habitat

For records that included accurate locational data we assigned a primary habitat using the Scotland Habitat and Land Cover Map — 2020 (Space Intelligence & NatureScot 2021). This was determined as the habitat class with the greatest percentage cover within 30 m of the nest's location using geographic information system software (QGIS). We also tabulated a proportional breakdown of all habitat types within 500 m of each nest.

3. Results

3.1. Wader nest records

3.1.1. Nest records and camera deployments

Across 2022 and 2023, we received 87 nest records (61 in 2022 and 26 in 2023) from 11 individuals (five individuals did not return nest records). Twenty-five of the 26 nest records from 2023 were submitted by two individuals from adjoining sites in Perth and Kinross. The number of nest records individuals submitted across both years ranged from one to 39 (mean = 7.91, ± 3.39 s.e.). All nest cameras were deployed on mainland Scotland (Figure 2). For the 59 nest records where distance of camera from nest was reported, nest cameras were deployed at a mean distance of 2.31 m (± 0.11 s.e.) from the nest.

For the 59 nest records where camera deployment date was recorded, the earliest deployment date was 20 April (in 2022), and the latest deployment date was 22 June (in 2022). The mean date of camera deployment was 6 May (± 2.22 days s.e.). Across all 87 nest records, the mean number of days between nest find date and the known or estimated nest outcome date was 19.89 (± 2.44 s.e.), which was 23.41 (± 3.50 s.e.) for successful nests and 12.66 (± 1.63 s.e.) for failed nests (Table 1).

Most nest cameras were deployed by individuals whose primary stakeholder identity was 'farmer', with 46 records in total (Table 2). Fourteen nests recorded were submitted by one landowner, 12 by two ENGO employees, 10 by a researcher undertaking PhD research, and five by two gamekeepers (Table 2; Figure 3). Fourteen (16%) of the 87 nest records were received by individuals who had not received WfW trail cameras.

Participants monitored nests of four wader species: Curlew *Numenius arquata*, Golden Plover *Pluvialis apricaria*, Lapwing *Vanellus vanellus*, and Oystercatcher *Haematopus ostralegus* (Figure 2). We received 31 Lapwing nest records, 30 Curlew nest records, 25 Oystercatcher nest records, and a single Golden Plover nest record.

Figure 2. Distribution of wader nest records for each of the four species monitored in 2022 and 2023.

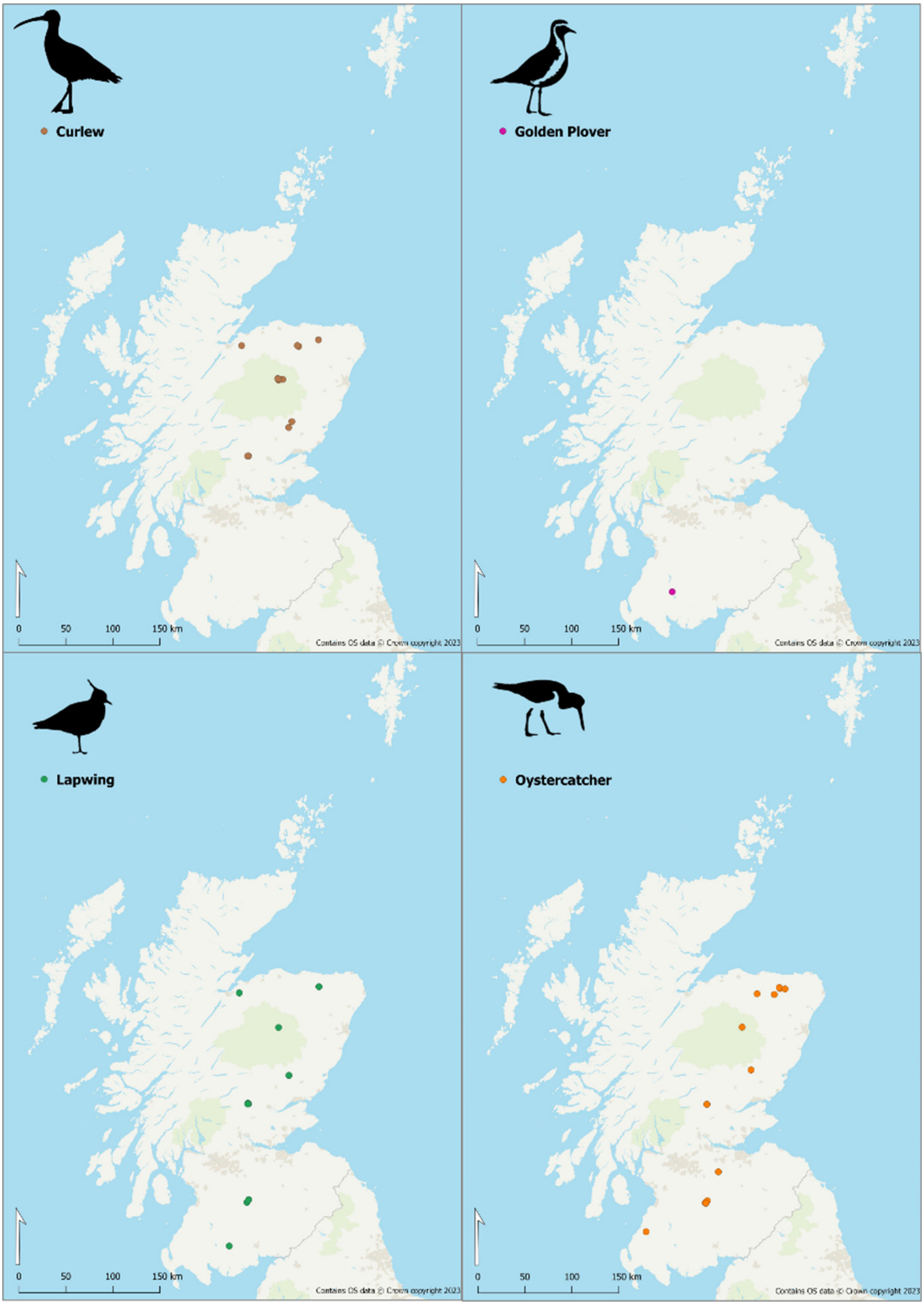


Figure 3. Map of wader nests monitored in 2022 and 2023, colour-differentiated by stakeholder type.

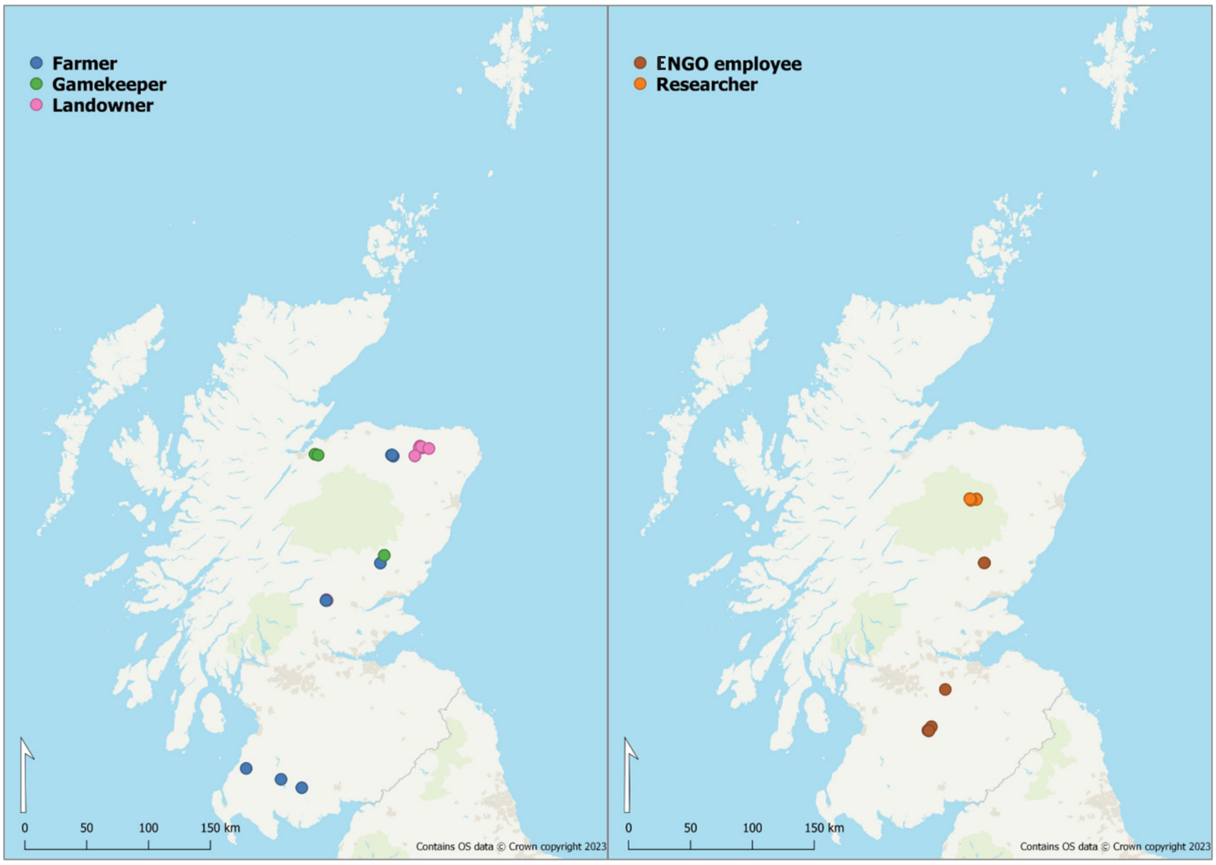


Table 1. Mean (± s.e.) number of days between nest find date and the known or estimated nest outcome date for successful and failed nest attempts, by species (summary excludes one unknown nest outcome, and the single Golden Plover nest record not included in species breakdown).

Species	2022		2023	
	Successful	Failed	Successful	Failed
All	23.23 (± 1.89) n = 35	13.35 (± 1.78) n = 24	15.74 (± 1.87) n = 23	8.50 (± 3.93) n = 4
Curlew	27.41 (± 4.96) n = 11	8.79 (± 2.24) n = 7	18.13 (± 2.03) n = 8	9.00 (± 5.51) n = 3
Lapwing	20.42 (± 1.87) n = 13	11.30 (± 3.31) n = 5	14.38 (± 2.68) n = 13	n = 0
Oystercatcher	22.36 (± 2.52) n = 11	16.88 (± 2.75) n = 12	28.00 n = 1	7.00 n = 1

Table 2. Primary stakeholder identity (identified by report authors), and outcomes reported by each stakeholder type.

Stakeholder type	Success	Failure	Total	Hatching success
Farmer	32	14	46	70%
Gamekeeper	4	1	5	80%
Landowner	8	6	14	57%
ENGO employee	7	5	12	58%
Researcher	7	3	10	70%
Total	**58**	**29**	**87**	**67%**

Of the 87 nests monitored, 58 (67%) hatched, 28 (32%) failed, and one (1%) was unknown (Table 3 summarises nests with known outcomes by species). Of the 61 nests monitored in 2022, 36 (59%) hatched, 24 (39%) failed, and one (2%) was unknown. Of the 26 nests monitored in 2023, 22 (85%) hatched, and four (15%) failed.

3.1.2. Nest camera evidence

Participants uploaded media evidencing reported outcomes for 32 (52%) of the 61 nest records from 2022. Of the 32 nest record outcomes evidenced by media, we deemed 26 (81%) of them to be conclusive, and six (19%) to be inconclusive. Participants more commonly uploaded media evidencing the reported outcome for failed nests (15 (63%) out of 24) than for successful nests (11 (31%) out of 36) (Table 4). No media was provided with any of the nest records submitted in 2023.

Table 3. The number of hatched (at least one chick hatched from the nest) and failed nests, and the resulting hatch rate for monitored nests with known outcomes in 2022 and 2023.

Species	2022			2023		
	Hatch	Failure	Hatch rate	Hatch	Failure	Hatch rate
Curlew	11	7	61%	8	3	73%
Golden Plover	1	0	100%	0	0	–
Lapwing	13	5	72%	13	0	100%
Oystercatcher	11	12	48%	1	1	50%
Total	**36**	**24**	**60%**	**23**	**4**	**85%**

Table 4. Number of 2022 nest records with no media, inconclusive media, and conclusive media uploaded to support success and failure reported outcomes (summary excludes one unknown nest outcome as not applicable).

Nest outcome	No media	Inconclusive media	Conclusive media
Success	25	0	11
Failure	4	5	15

3.1.3. Causes of nest failure

In 2022, the cause of failure for 20 (83%) of the 24 nest records reported as unsuccessful were assigned to predation, two (8%) due to deer trampling, one (4%) due to persistent livestock disturbance and possible trampling, and one due to human disturbance (4%). Of the 20 nests participants reported as predated, six (30%) were predated by Domestic Sheep, including three Curlew nests, three Oystercatcher nests, and one Lapwing nests (Table 5; Figure 4; Figure 5). A single participant reported five of the Domestic Sheep predation events. Badger and Fox each predated four (20%) nests, Pine martes predated three (15%), while Raven, Carrion Crow, and Hedgehog each predated one (5%) nest each (Table 5; Figure 4). Raven also predated a nest with an unknown outcome. Eighteen nests (86%) were predated by mammals, and three (14%) by birds. However, of the 15 predation events from wild animals (i.e. excluding livestock predation), 12 were predated by mammals (80%) and three (20%) by birds.

In the 2023 nest records, cause of nest failure was not reported, although predator identity was included for three of the nests reported as failed, of which one was predated by Domestic Sheep, one by Domestic Cattle *Bos taurus* (indicating trampling rather than predation), and one by an unidentified predator (Table 5; Figure 4).

Table 5. Reported predators by primary stakeholder identity.

Farmer	**Total records of predation: 9**
Badger	1
Hedgehog	1
Pine Marten	1
Domestic Sheep	6
Gamekeeper	**Total records of predation: 1**
Raven	1
Landowner	**Total records of predation: 6**
Badger	2
Carrion Crow	1
Fox	1
Raven	
Unidentifiable	1
1	
ENGO employee	**Total records of predation: 4**
Badger	1
Fox	3
Researcher	**Total records of predation: 3**
Pine Marten	2
Domestic Sheep	1

Figure 4. Reported nest predators, represented as proportions of the total number of reported predation events for each wader species across 2022 (21 predation events, including one predation of nest with unknown outcome (Raven predating a Curlew nest) and 2023 (two predation events). Photo credits: Badger and Hedgehog: Sarah Kelman / BTO, Carrion Crow and Raven: Edmund Fellowes / BTO, Fox and Pine Marten: Liz Cutting / BTO, and Domestic Sheep: Mike Toms / BTO.

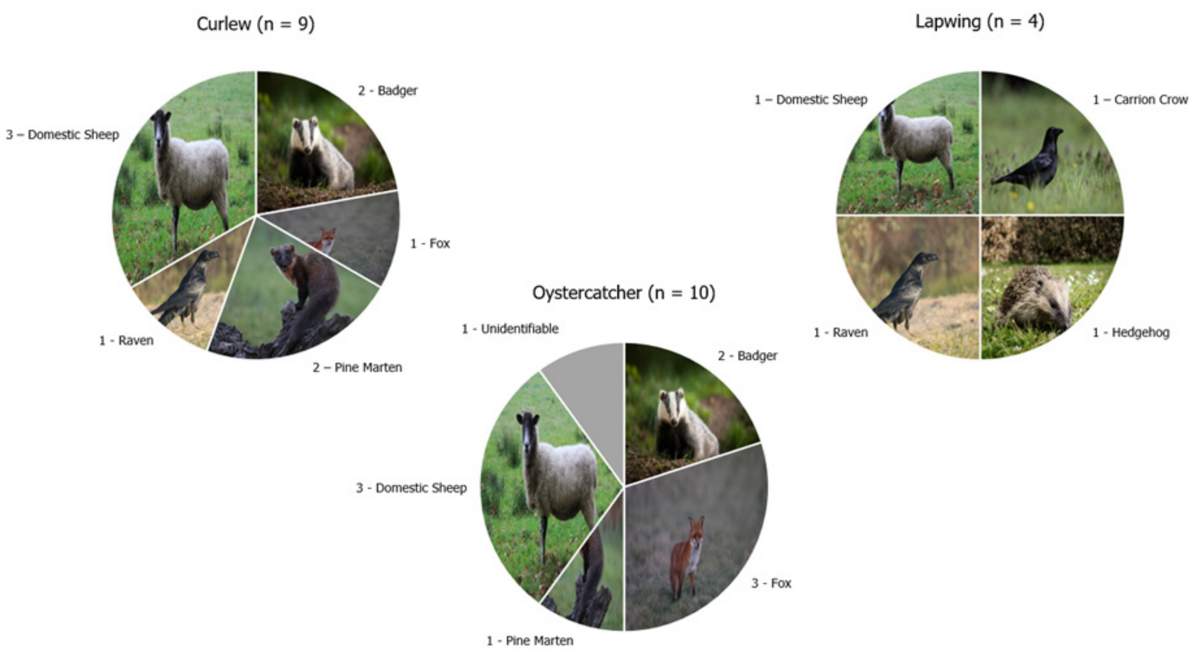


Figure 5. Top-left: Curlew sitting on nest before predation, top-right: Domestic Sheep predating Curlew nest, bottom-left: Domestic Sheep predating Oystercatcher nest, bottom-right: Domestic Sheep predating Lapwing nest (photo credits: David Jarrett, Luise Janniche and Innes Smith, and Aylwin Pillai).

3.1.4. Nest site habitat

Only 44 of 87 nest records provided accurate enough locational information to allow habitat assessment, of which all were from 2022. We found seven European Nature Information System (EUNIS) habitat types where nests were located, three of which were grassland classifications.

Most Curlew nest records were from raised and blanket bogs (six) and temperate shrub heathland (five), with one from arable land, mesic grassland, and wet grassland, respectively (Table 6). The predominant habitat type 500 m around the Curlew nest records submitted to the project was temperate shrub heathland (45%), with secondary habitat types of mesic grasslands (16%), dry grasslands (11%), and raised bog and blanket bogs (8%) (Figure 6).

Table 6. A breakdown of species' nests monitored in 2022 by habitat classification within 30 m of each nest (based on Scotland Habitat and Land Cover Map – 2020 classification).

Habitat	Curlew	Golden Plover	Lapwing	Oystercatcher	Total
D1 Raised and blanket bogs	6	1	0	0	7
E1 Dry grasslands	0	0	7	3	10
E2 Mesic grasslands	1	0	6	6	13
E3 Seasonally wet and wet grasslands	1	0	0	3	4
F4 Temperate shrub heathland	5	0	0	0	5
I1 Arable land	1	0	1	2	4
J Built-up	0	0	0	1	1

The single Golden Plover nest record was from raised and blanket bog. The predominant habitat type 500 m around the Golden Plover nest record was alpine and subalpine grasslands (43%), with secondary habitat types of raised bog and blanket bogs (16%), temperate shrub and heathland (9%), and dry grasslands (3%) (Figure 7).

Most Lapwing nests records were from dry grasslands (seven) and mesic grasslands (six), with one from arable land. The predominant habitat type around the Lapwing nest records submitted to the project was mesic grasslands (34%), with secondary habitat types of dry grasslands (25%), seasonally wet and wet grasslands (13%), and broadleaf deciduous woodlands (6%) (Figure 8).

Most Oystercatcher nests records were from mesic grasslands (six), dry grasslands (three), and wet grasslands (three), with two from arable land, and one from built-up (human) sites. The predominant habitat type around the Oystercatcher nest records submitted to the project was mesic grasslands (45%), with secondary habitat types of seasonally wet and wet grasslands (15%), arable land (15%), and dry grasslands (14%) (Figure 9).

3.2. Project coordination and engagement

3.2.1. Project coordination

Twelve of the 16 participants provided with trail cameras engaged with the project coordinator and/or other participants via one or more of the four communication channels during the project field seasons. The remaining four did not use or respond to attempts to contact them via any of the communication channels. Participation in the online videoconference meetings varied from three to 15 people. A small number of participants shared messages and media (169 images and 45 videos in total during the project) within the mobile phone messaging app group.

3.2.2. Camera deployment

Participants deployed 26 of the 33 cameras sent out to them 87 wader nesting attempts. One camera was deployed at a wader scrape instead of at a nest, and the remaining six cameras were (as far as we are aware) unused. The first camera was deployed on 4 April 2022, and last camera was removed from deployment on 13 June 2023. The period when the greatest number of cameras were running simultaneously was during the last week of May and the first week of June 2022. Twenty-five external batteries were sent out to participants. A minority of participants expressed concerns about the potential for monitoring with nest cameras to cause disturbance to breeding waders, and two participants thought that disturbance resulting from their attempts to deploy cameras at nests resulted in failure of nesting attempts through abandonment or predation.

Eight additional participants took part in the project using their own nest cameras engaged via one or more of the communication channels. A small number of participants deployed and shared images or video footage from their deployment on social media but did not contact the coordinator or submit any nest records.

3.2.3. Data return

A total of 87 online nest records were submitted across 2022 and 2023. Records based on project camera footage accounted for 56 of these, with the remainder submitted by participants using their own cameras. Some participants who did not submit nest records instead provided verbal updates, camera footage, or summaries, but unfortunately these did not convey sufficient information to allow nest records to be based on them. Many records included mistypes and other errors, but most of these were resolved with the help of participants through email correspondence.

3.2.4. Public communications

WfW shared posts containing images and videos from the project nest cameras via social media communications channels during spring 2022. These included images and videos of nesting Curlew, Lapwing, and Oystercatcher along with simple explanations and captions to raise awareness of wading birds, and their conservation. In addition, some participants in the project posted their findings and footage directly online on a range of social media platforms. These posts were successful in raising the profile of the project and its aims, being widely shared and reposted, and many reactions to them were positive. However, they also attracted some criticism, particularly from some land managers external to the project who thought of the WfW posts as overly simplistic, or that they failed to convey the severity of particular threats (e.g., specific nest predators). The wide resharing of footage from the project, especially by non-participants, meant that the project was, on occasion, portrayed as taking sides on more contentious issues (such as impacts of livestock disturbance or predation by protected species like Badgers and Pine Martens).

A basic summary of the 2022 findings was published as a blog (Working for Waders 2023b). This article was written at the end of the 2023 breeding season before relevant data coordination and analysis was complete, and so did not report any data from the 2023 season but acknowledged the valuable contributions of all participants over the two years. This article elicited several positive responses from readers.

4. Discussion

4.1. Nest outcomes

Wader hatching success can vary widely between different landscapes as well as between years (MacDonald & Bolton 2008, Laidlaw et al. 2015). Nevertheless, the overall levels of hatching success reported by project participants (59% in 2022 and 85% in 2023) are high compared those reported by other studies. A review of published and 'grey' literature on wader hatching success and nest predation from nest camera evidence in Europe (MacDonald & Bolton 2008) found that more than 50% of nests were predated in 55.3% of site-years or studies reviewed (n = 544), while a recent analysis of 510 Curlew NRS records found that overall hatching success was just 28%. One potential explanation for this is that participants in the project were recruited mostly from areas with higher-than-average levels of wader hatching success. However, it is also possible that nests found and monitored by participants were biased towards successfully hatching nests due to some breeding pairs failing before participants could find their nests. This fits with the higher levels of hatching success reported for Curlew and Lapwing in 2023, when the stage at which nests were found (inferred from the time between finding and hatching for successful nests) was more than a week later than in 2022.

Predation accounted for all but four nest failures, with the remaining failures being causes by deer trampling, and disturbance by livestock or humans. It is possible that at least some of the failures reportedly caused by predation or disturbance were contributed to by responses of the breeding adults to camera deployment. However, as discussed, rates of hatching success experienced at nests with cameras in this study were high compared to those reported elsewhere, which does not suggest a strong negative impact of camera deployment on nesting outcomes.

Figure 6. The mean percentage of land cover classifications in the 500 m buffers around Curlew nest records submitted to the project.

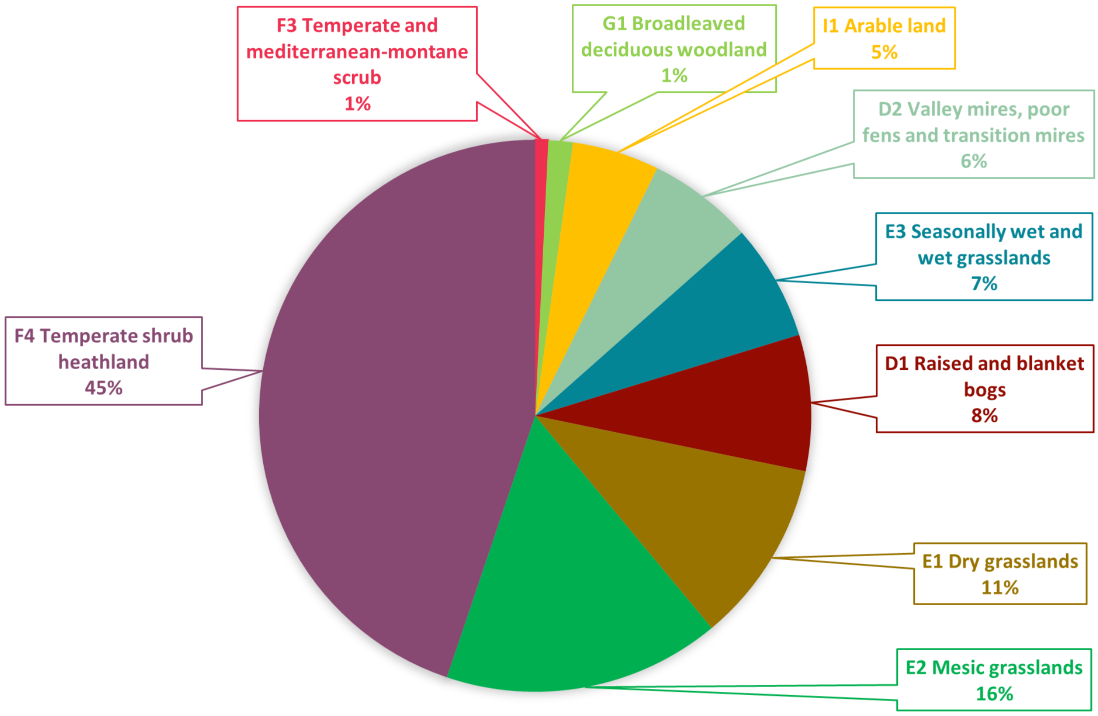


Figure 7. The mean percentage of land cover classifications in the 500 m buffers around the Golden Plover nest record submitted to the project.

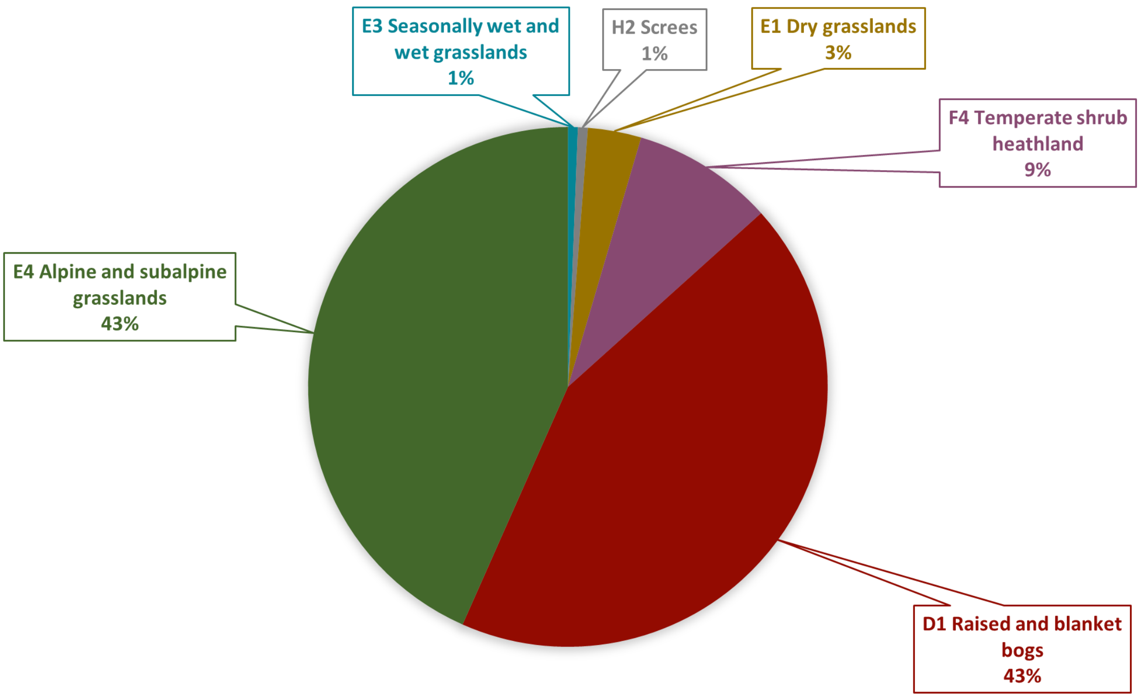


Figure 8. The mean percentage of land cover classifications in the 500 m buffers around Lapwing nest records submitted to the project.

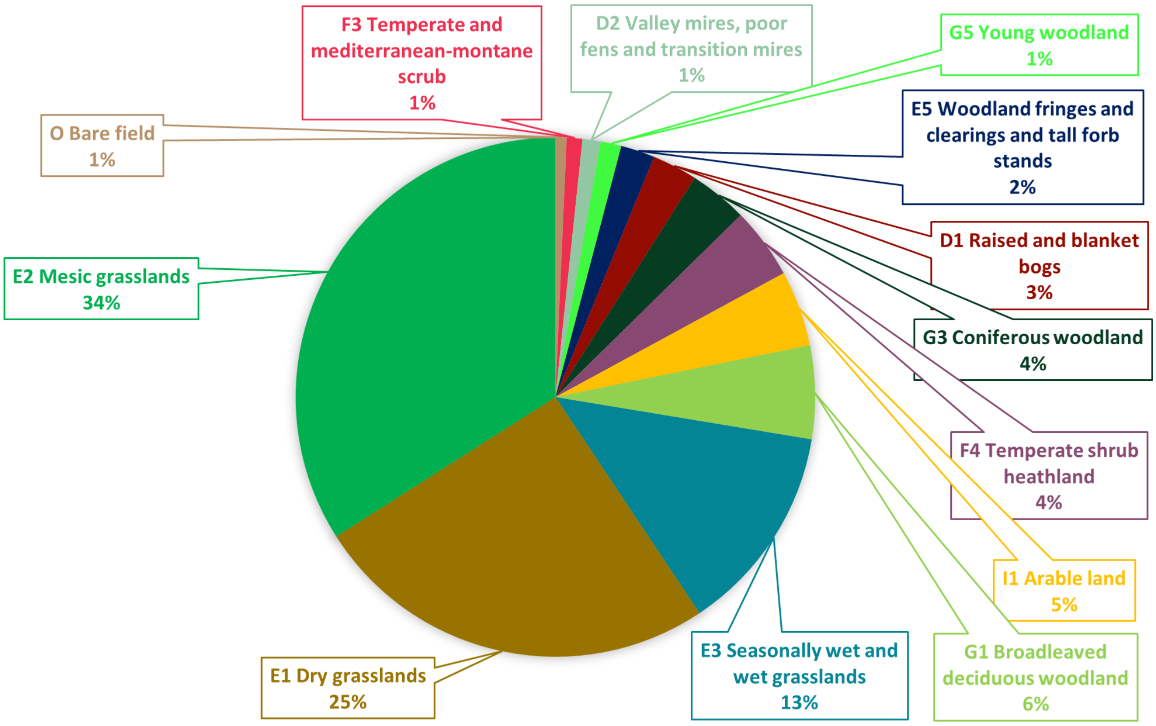
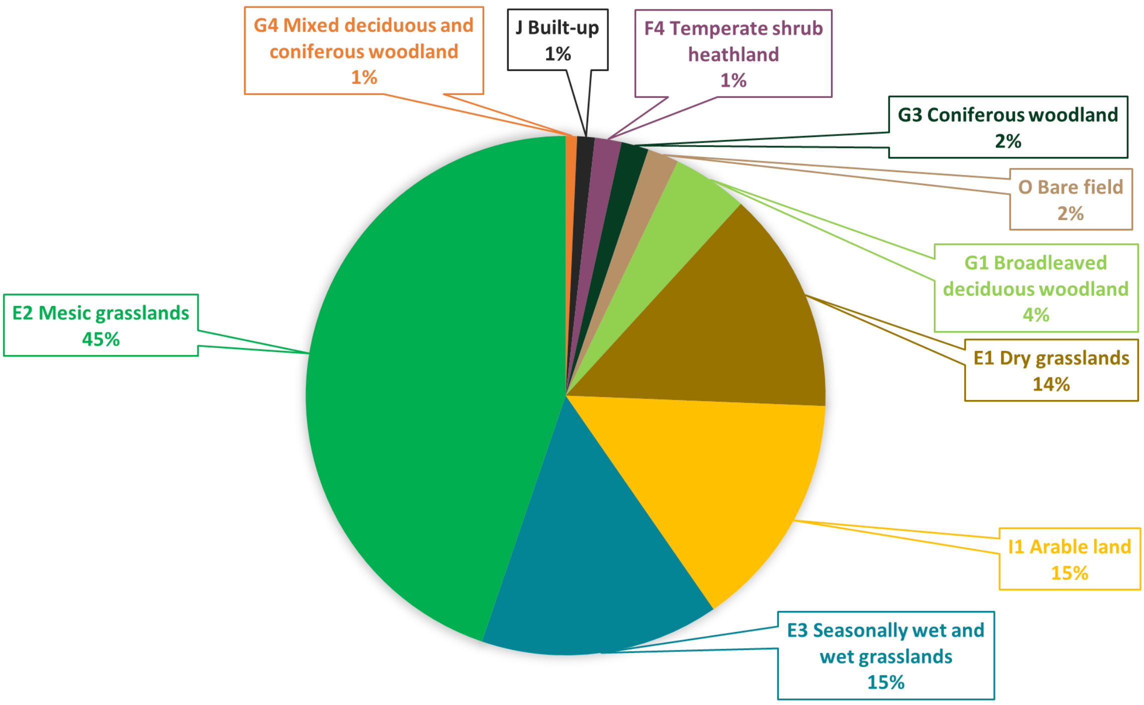


Figure 9. The mean percentage of land cover classifications in the 500 m buffers around Oystercatcher nest records submitted to the project.



Of the 23 predation events recorded during this project, there was only one where the predator could not be identified. This rate of predator identification (96%) is similar to the level of 92% reported by MacDonald & Bolton (2008) across multiple studies in which 16 out of 216 predation events were by unidentified predators. This indicates that participants in our project experienced similar success in determining predator identities from nest camera footage as the (mostly professional) participants in the studies reviewed by MacDonald & Bolton (2008). A high proportion of these identifications were supported by evidence from camera footage that we deemed to be conclusive. However, these were subjective decisions, and developing a clear protocol for interpreting nest camera evidence (that could be followed by the participants or project coordinators) would improve the consistency of interpretations of outcomes, as well as the transparency and accuracy of the project's interpretations of nest camera evidence.

The range of wild mammal predators (Fox, Hedgehogs and two mustelid species) recorded by participants was broadly comparable to that reported in MacDonald & Bolton's review (2008), which concluded that Hedgehog, Fox, and Stoat were the key mammalian predators of wader nests across Europe. The avian predators reported in the studies reviewed by MacDonald & Bolton (2008) also included Carrion Crow, as well as two gull species not among the predators recorded in our project. Excluding livestock predation, and considering our small sample size, the ratio of mammalian to avian predation (4:1) is broadly similar to that reported by MacDonald & Bolton (2008) (7:3).

The rate of Domestic Sheep predation reported by our participants (30% of all 23 incidents of egg predation) was considerably higher than the rate of less than 1% reported by MacDonald & Bolton (2008). Whilst we cannot extrapolate from our small and unrepresentative sample to a national scale, this finding suggests that, at least in some parts of Scotland, sheep could have a direct negative impact on wader productivity. Small numbers of Domestic Sheep predation events have been recorded by other studies (Sharpe 2006, Stillman et al. 2006, Katrínardóttir et al. 2015, Jarrett et al. 2017, Laidlaw et al. 2020). However, any evaluation of the overall impact of Domestic Sheep on wader populations should account not only for direct losses to sheep predation in different types of farmland, but also the effects of sheep grazing and management on the wider landscape. In Scotland, most waders breed in grassland managed for sheep and other livestock; any discussion on the negative impacts of livestock on wader breeding success should remain within the context of the beneficial impacts of livestock farming systems for waders.

If the analyses suggested above indicate the impacts of Domestic Sheep predation have a significant impact on wader populations, further research into mitigation measures should be prioritised. The risks posed by Domestic Sheep predation, as well as trampling, will depend upon the times of year that nesting fields are stocked with Domestic Sheep, and the densities in key wader nesting periods. Furthermore, wader nest site selection and egg-laying timings may itself be influenced by stocking densities and movements on pastoral farmland. Further research into the impacts of stock species, breeds, densities, and timings in fields on predation and trampling of wader nests could inform management advice and Scottish and UK agri-environmental scheme (AES) options, which could in turn be monitored to adaptively update advice and AES.

The lack of small mustelid (e.g., Stoat *Mustela erminea*) predation is another notable difference to previous studies (Macdonald & Bolton 2008; Teunissen et al. 2008). Nest cameras may have a higher probability of missing predation events for these smaller mammal species (though Hedgehog was recorded), however, our infrequency of unidentifiable predators suggests this is not the case. It is possible that these results reflect a genuine difference in numbers of wader nests predated by mustelids in Scotland, however, limited sample sizes could equally lead to the absence of a predator in any one given year simply due to stochasticity.

Overall, the general differences in nest predators to MacDonald & Bolton (2008) may be due to the different geographical scales (our study is just Scotland, MacDonald & Bolton (2008) is Europe-wide); for example, the second most common avian predator of wader nests in MacDonald & Bolton (2008) was Yellow-legged Gull *Larus michahellis*, a species that does not breed in Scotland. Likewise, the high rate of Domestic Sheep nest predation could be due to sampling differences; many of the project's nest records (and records of Domestic Sheep predation) came from one site that farmed Domestic Sheep. Multiple years of monitoring, greater engagement (so greater sample sizes), and comparison of nest record locations with predator species range and habitat associations would allow us to draw firmer conclusions on the representativeness of predators recorded as predating nests in this project.

4.2. Nest site habitat

We acknowledge that the distribution of nest cameras around Scotland was not systematic, and that the nesting outcomes recorded during the project are unlikely to be representative of the wider Scottish population of any of these species. However, for each wader species, mean habitat composition of the land within 500 m of nest sites broadly reflects what we know about the habitats and landscapes used by these species in Scotland (Silva-Monteiro et al. 2021, Calladine et al. 2022). This, and the fact that records were drawn from widely separated sites that appear to represent quite even coverage over much of mainland Scotland, suggests that our sample is not strongly biased by habitat or geographic region (beyond the lack of any records from island populations).

4.3. Use for wider research in Scotland

NatureScot issues a licence to BTO to allow volunteer fieldworkers in Scotland to briefly examine the nest contents of wild birds via the NRS. The NRS now holds over 2 million wild bird nest records that cover more than 200 species and have been used in hundreds of scientific publications (Crick et al. 2003, Walker et al. 2023). WfW Nest Camera Project records captured by the online Google Form are compatible with NRS and will be added to the NRS database to be accessed and used by anyone interrogating NRS for information on these wader species. The number of wader nest records submitted to NRS varies from year to year, with between 50 and 130 Curlew nest records submitted each year from across the whole of the UK between 2017 and 2022. This suggests that, at its current scale, nest records submitted by this project are likely to make a substantial contribution to available NRS data for some waders, especially if the project continues in the longer term.

In addition to its contribution to the NRS, the project also has potential to answer more specific research questions exploring relationships between nest survival, predator identity, land management and conservation interventions (particularly where interventions are designed to improve hatching success, e.g., temporary electric-fences deployed around nests). Ideally this would be combined with a wider, joined-up WfW conservation monitoring strategy, designed to inform and evaluate adaptive management for breeding waders in Scotland.

4.4. Participant and other stakeholder engagement and interactions

The number and quality of nest records returned indicates the project coordination was sufficient to support most participants in monitoring wader nests using cameras. However, it is important to note that in 2023 the number of nest records submitted dropped to less than half the number submitted in 2022. In addition, some participants who were sent WfW trail cameras did not engage with the project in either year. The reduction in the number of nest records received in 2023 was probably influenced by the lack of funded project coordination time, highlighting the importance of securing and sustaining resource to deliver coordination and support. This funding needs to be secured if the project is to be continued.

It is possible that the enthusiasm of some participants in the mobile phone messaging app group and online videoconference meetings deterred other less confident people from engaging. Negative reactions to the project on some online forums may also have discouraged some participants from engaging with the project. More public and higher profile support and endorsement of the project by its parent partnership might help to allay any concerns of current or potential participants and could also stimulate greater levels of engagement. However, coordinators and leaders of this project, as well as the wider WfW partnership, must remain aware of the need to balance the need for good data with risks to bird welfare, and be ready to examine any new evidence that could inform their assessment of these risks. Concerns that deploying nest cameras could disturb breeding adults, with possible negative consequences for their breeding success, may have limited engagement by some participants. While it is true that failure to follow good practice when monitoring bird nests can have a negative impact on nesting attempts (see NRS 'Code of Conduct', BTO 2024b), multiple studies have reported that deploying nest cameras while following good practice does not significantly reduce hatching success and, in some cases, may even increase it (Richardson et al. 2009, Mcguire et al. 2022, Salewski & Schmidt 2022). The rates and pattern of failures observed in this project do not suggest that our participants' monitoring activities greatly increased the risk of negative outcomes. However, it is important that WfW continue to advice participants, through a range of media, on how to avoid negative impacts on breeding waders, regularly re-evaluating risks posed by monitoring activities (and updating guidance given to participants) based on published studies, project results and participant feedback.

Where participants seek it, improved guidance, training, and opportunities to spend time in the field with more experienced fieldworkers could not only reduce the risk of disturbance but also provide participants with greater confidence that they are not causing undue disturbance, increasing their enjoyment of the project and the likelihood of their continuing to participate in the future. Furthermore, additional guidance and training could improve the nest-finding abilities of participants, which is likely to be another factor influencing engagement with and activity in the project. Project coordinators could mitigate the above by:

- Linking participants with local wader researchers e.g. through the WfW network or the BTO/WfW Wader Map (**https://app.bto.org/wader-map/index.jsp**); and/or
- Employing a paid post specifically to spend time at sites finding and monitoring nests with participants, to pass on key knowledge.

Whilst we received 14 nest records from individuals who did not receive WfW trail cameras, this does not represent a high proportion of the total wader nests monitored using cameras in Scotland. Though the focus of the project was to provide land managers with trail cameras and support them to use these to monitor wader nests, the data entry systems we developed could accept nest records from anyone monitoring wader nests in the UK. The overwhelming majority of individuals monitoring wader nests in Scotland are employed by ENGOs. Combining wader nest records from ENGOs, academics, and land managers would elevate trust in the evidence from all stakeholders. If WfW proactively consulted with ENGOs on wader monitoring data, to help ease data-sharing concerns and time-constraints that ENGO staff may have, it is probable that many more nest records could be included in the project. The approaches to data ownership of other bird monitoring citizen science projects (such as the BTO/JNCC/RSPB Breeding Bird Survey (Heywood et al. 2024) and NRS) provide suitable models for this.

4.5. Conclusions

Land managers are well-placed to contribute wader nest camera records that can be usefully combined with those of individuals from ENGO or academic backgrounds. Various aspects of the WfW Nest Camera Project, including the roles played by supporting staff, the guidance and monitoring protocols provided to participants, the deployment of cameras to collect footage and the capture of camera-based nest record information in standardised forms, can combine to deliver cost-effective, inclusive monitoring and robust, co-produced datasets. However, the effectiveness of this approach does rely on dedicated funding, not just to pay for equipment, analysis and reporting, but to cover the costs of coordinating participants and ensuring that as many as possible return useful records. In some situations, it may be possible to devolve some coordination responsibilities to experienced and dedicated volunteers, but to be stable in the medium to long term this model is likely to require ongoing professional input. With sufficient funding, several aspects of the project could be improved, including training opportunities and guidance for participants (in particular, advising them how best to avoid and mitigate disturbance to breeding waders during camera deployment and other fieldwork), and mechanisms for data entry and submission.

4.6. Key recommendations

We recommend that WfW:

- Continues the project and secures funding to cover the running costs (including coordination, analysis and reporting) as well as project development.
- In consultation with land managers, decides how best to deploy available management and monitoring resources to benefit breeding wader populations.
- Engages with ENGOs to discuss sharing of existing wader nest monitoring data.
- Ensures data collected by participants are regularly discussed with and made easily accessible to them, with findings and progress also communicated to the wider group of stakeholders.
- Is prepared to adapt and improve nest camera deployment protocols in the light of evidence arising from this or other projects to ensure that the right balance is struck between bird welfare, data quality, and engaging stakeholders.
- Develops robust protocols for interpreting nest camera footage (and other nest monitoring evidence) to assign outcomes accurately and transparently, ensuring we are interpreting the relevant evidence consistently.

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Appendix 1.

Working for Waders Nest Camera Project Data Collection Guidance

See below for the minimum **we ask you to record** during wader nest camera deployment. For both ethical and scientific reasons, it is essential to minimise disturbance when monitoring nests. Please read the **Working for Waders (WfW) Nest Camera Deployment Guidance** and BTO Code of Conduct.

1

Finding a nest

1. **Location** (10-digit grid reference or equivalent)
2. Wader **species**
3. **Date** you first visited the nest
4. **Number of eggs** in nest

Take photos of the nest!

2

Camera Deployment

5. **Date** of deployment
6. **Number of eggs** in nest
7. **Distance** of camera from nest (to nearest metre)

Take photos of the nest and your camera set up!

3

Camera Collection & SD Card Download

Take photos of the nest and any eggshells found!

8. **Date of last observation** of adult sitting, live eggs or live chicks
9. **Nest outcome** (Success, Failure or Unknown)
10. First **date the outcome was known** – i.e. earliest evidence the nest was no longer active (often, but not always, the same as date of last observation of adult sitting, live eggs or live chicks!)
11. **Evidence of outcome** (camera footage, field observations or other – if you're confident using eggshell evidence, enter details as other!)
12. If Failure: **reason for failure** (i.e. predation, farm operations, livestock trampling, human disturbance, other or unknown)
13. If predation occurred: **predator** identity (e.g. Fox, Badger, Carrion Crow, Sheep) if known
14. whether outcome is **confirmed** or **suspected**
15. If possible, please select a few **images that provide evidence** the nest was active, for the reported outcome, the nest and egg-shell fragments after outcome, and your camera set-up.

4

Data Return

Please submit your nest information using the **WfW Nest Camera Project Data Entry Form:** https://forms.gle/rcRmQj9fWCNyGRwn9 by the **end of November**. This requires a Google account, as any images uploaded will be saved to your own Google drive to be shared with WfW. If you do not already have one, Google accounts are free and simple to set up (see their support webpage: https://support.google.com/accounts/answer/27441?hl=en).

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Image credits (top to bottom): Sam Franks / BTO, Patrick Laurie, Colin Strang Steel

Working for Waders nest camera project 2021

Camera Trapping

This guidance is intended for people who are planning to use camera traps (or 'trail cameras') to take photos of wader nests. Camera traps take photographs when triggered by the movement of objects that are warmer than the background. Below are some notes, giving basic 'getting started' information. There are two basic principles to work to:

1) ***Try to minimise the influence of the camera on the outcome of the nest. Possible impacts could arise from disturbance to the nesting birds, or from predators being attracted to or avoiding the camera. To minimise the likelihood of such impacts, make the camera as inconspicuous as possible while also ensuring it can capture useful footage;***
2) ***The camera should be positioned so that it captures useful images of the activity of nesting birds and other animals on and around the nest.***

The first principle is the most important – make sure you are happy that the camera isn't so conspicuous that you are concerned about the welfare of the birds. That said, it should be possible to position the camera so that it takes clear images but doesn't disturb the birds. If in any doubt, don't install the camera.

Play around with the camera before you put it out in the field. This will allow you to see how it reacts to different light settings and explore distances at which it captures good quality images. It will also allow you to see how sensitive the different trigger settings are. **Before installing your camera, ensure the date and time are set correctly as this provides valuable information about the timing of key events at the nest.**

Below is some generic advice on cameras to help get you started. There is also a YouTube video showing how to use the specific cameras which we are loaning out for this Working for Waders nest camera project.

General Notes on Using Camera Traps

Camera Placement

As mentioned above the key consideration in placing a camera is to ensure that setting the camera does not cause undue disturbance to the birds and does not attract attention to the camera. Whenever setting or revisiting a camera, always be very careful around the nest: try to minimize disturbance to the surrounding vegetation and be as quick as possible.

Camera traps can be attached using the strap supplied to a stake or other similar object. Where possible, fix the camera to an existing fence post, rather than adding a new feature into the mix that might attract a predator such as a crow. This probably won't be possible on most nests, as birds don't nest close to fences but for lapwing nests on a short grazed field, it might be an option. If it is not possible to use an existing post, a discreet stake hammered into the ground is likely to be the most suitable, but if this is in a field with livestock, be prepared for animals to scratch on it. It either needs to be VERY sturdy or short and inconspicuous. Short stakes with the camera sitting just above ground level can work well as stock seem to ignore this, though can still knock them accidentally. Avoid long stakes in fields with livestock to avoid the risk of stock coming over to scratch on the post and posing a potential trampling risk. Try and make sure the vegetation in front of the camera isn't going to grow too high, or occasionally cut it back, though it is essential this doesn't disturb the nest site or increase its exposure. **It would be very helpful if you can take a photo of your setup as this will help us learn about camera placement and pass on this learning to others.**

When you have selected the general area for placing the camera, try to pick a spot from which the camera's line of sight to the nest is as clear as possible. This should generally be between 2 and 5 metres from the nest (depending on camera and terrain), and should certainly not be much closer than 2 metres. As well as posing a risk of disturbance to birds, cameras placed very close to nests are more likely to miss activity around the nest, and may even miss predation events if these are very quick. If the nest is in open pasture you will need to place the camera further away from the nest than areas with more vegetation as it will be more visible. You can carefully clear away small fallen branches, etc. by hand. If there is lots of brash (tree debris) or long grass this might ruin images of the target animal, especially during night-time, as light from the flash bounces back from such items. Orientate the camera so its lens is pointing towards the wader nest. Use the viewing screen, if your camera has one, to check the view from the camera. The nest should be approximately in the centre or the field of view, or just below it. Use small sticks wedged behind the camera to firm up the fixing, if necessary, and tilt the camera forward or back as needed. With the camera in "set-up" mode, the red light on the front will show when it detects movement that would trigger the camera. Don't forget to tidy the camera strap, don't risk it flapping in the wind for a range of reasons inducing unwanted images!

All else being equal, it is better for the camera to point away from where the sun will be at dawn or dusk (as the sun shining directly into the lens can trigger the camera and will obscure any animals in the images). Facing north will give the best results all-round in terms of lighting. Finally, don't forget to turn the camera on - you wouldn't be the first to forget to do so!

Still images vs videos

Most camera traps can be set to take videos or still images. Some can be set to take both during the same activation event – usually one or more still photos followed by a video sequence. This is sometimes referred to as Hybrid mode and can be a useful way of maximizing the chance of getting good pictures and videos, but does get through batteries faster. Videos have a greater chance of producing some nice behavioural footage, but do take longer to look through and use more battery power than still images alone, especially night-time videos. Generally, a camera activates faster when set to take stills - so we would advise you to favour these over video, in most situations. Most types of camera trap have wide-ranging functionality. Read through the manual to familiarize yourself with the options available. Do experiment to get the best settings and remember that what is best for one position is not necessarily the optimum for another. Think about how big the memory card is too and how much space different media will take up. Some cameras create large files on videos at max resolution. Be prepared to use lower resolution options if this otherwise risks filling the card.

Reviewing

For the Working for Waders nest camera project we are using two types of cameras, one which is mobile enabled and one which isn't. With the mobile enabled cameras it should be possible to browse through and download recent images taken by the camera on your mobile phone. Further information, including a YouTube video will be made available to those who have been supplied with this type of camera. Both cameras have a memory card. Images and videos can be downloaded to a computer from the memory card. The camera should come with a cable to link direct to a computer USB port but simply swapping over memory cards is easier and means the camera can stay out in the field. Many laptops have a slot into which the card can be inserted directly. Alternatively, use a SDHC card reader (which itself connects to a USB port).

Some camera traps have viewing screens that enable you to look at photos and videos directly on the camera. Being able to see captures instantly can be useful in the field particularly when deploying the camera, when it can be used to check it is set correctly. If your camera does not have a viewing screen, small readers are also available for viewing content from SDHC cards on mobile phones.

Sensitivity setting

We recommend setting the cameras at maximum sensitivity. This does run the risk of using up the batteries quickly and of lots of captured images being triggered by moving vegetation, but it will maximise the chances of capturing small or rapid movements, which could include hatched chicks or predation events. That said, you may be forced to decrease sensitivity if your camera is at risk of near-constant recording due to movement of long grass due to wind. This kind of situation is likely to require a compromise, and it may take a bit of trial and error to identify the best solution. "Auto" sensitivity may be another option, depending on the camera. This adjusts the sensitivity according to temperature. It may also be useful to carry out a check-up visit after a couple days to see how the camera is behaving on the settings selected – whether it needs sensitivity changing, or the programmed delay shortening or lengthening, or image resolution changing, etc. Although clearly you would need to be mindful of not causing undue disturbance. If you could capture any feedback on this aspect of the camera to share with others that would be very helpful.

Security

Camera traps are vulnerable to theft or vandalism so be careful where you set them. However, a camera trap sitting on a shelf is of no benefit, so accept that there is an element of risk of theft or vandalism whenever the equipment is used.

Batteries

Some camera traps can run with external power sources, or can be linked up to solar panels, but most common camera trap models run from AA batteries. We recommend using lithium batteries. Note that due to being effective at giving out constant levels of power, and not gradually weakening as they become depleted, battery indicator levels may show lithium batteries to still be fully charged when they are close to expiring. Some camera models allow the user to designate what battery type is used, so the camera's battery indicator can adjust accordingly, otherwise it is good practice to regularly check the camera is still working.

Rechargeable batteries can reduce wastage. However, regular rechargeable batteries do not last as long as lithiums and, especially, lose power in the cold. Remove batteries if storing the camera trap for any length of time.

Sending records in

Working for Waders will supply you with a recording form (spreadsheet) to send your records in. The type of information we will ask you for will include the species of wader which you are monitoring, whether the nest is successful or not, location, any predation events and timings of hatching, predation events etc. We will provide further guidance on what to do with the images, what information to collect and how to store and look through the images. Together these records and images will help to develop our understanding of how our waders are faring and of impacts on them.

Appendix 2

Table 7 Questions and format of answers for the Working for Waders Nest Camera Project Data Entry Form, which WfW Nest Camera Project participants were asked to submit for each nesting attempt monitored in the 2022 wader breeding season.

	Question text (as appeared on form)	Answer format
1.	Email:	Free text
2.	Full Name:	Free text
3.	Nest Location (UK Grid Reference - 10-digit, if possible, e.g. NS4173578707). If you do not already know the nest's grid reference, www.gridreferencefinder.com may help generate this:	Free text
4.	Wader species:	Drop-down selection (all common UK breeding wader species)
5.	Date you first visited the nest:	Date selection
6.	How many eggs were in the nest when you first visited it?	Number scale 1–10
7.	Date you deployed your nest camera:	Date selection
8.	How many eggs were in the nest when you deployed your nest camera?	Number scale 1–10
9.	Distance of camera from nest (to nearest metre):	Number scale 1–10
10.	Date of last observation of adult sitting, live eggs or live chicks:	Date selection
11.	Nest outcome:	Multiple choice (Success, Failure, or Unknown)
12.	First date outcome was known (Success, Failure or Unknown) - i.e. earliest evidence the nest was no longer active:	Date selection
13.	Evidence for outcome (you may select multiple options):	Check box (Options: Field observation(s), Nest camera footage, None, Other (user enters text))
14.	If nest outcome 'Failure', select reason for failure:	Drop-down selection (Options: Disturbance, Farm operations, Livestock trampling (select Predation if eggs eaten by livestock), Predation, Weather, Unknown, Other (user enters text))
15.	If predation of any eggs or chicks occurred, please select predator:	Drop-down selection (all common UK wader nest predators)
16.	If Success or Failure, is your reported outcome suspected or confirmed?	Multiple choice (suspected or confirmed)
17.	If possible, please upload a few images that provide evidence of the nest as active, the reported outcome, the nest during camera deployment and collection (including any eggshell fragments found) and your camera set-up:	File upload (shared via user's Google Drive, max. ten files, max. 100 MB)
18.	Notes (please include anything you think may be interesting or relevant that is not captured by the above responses):	Free text

Front cover: Colin Richards / BTO; back cover: (left to right): David Jarrett, Luise Janniche, and Patrick Laurie

Watching Out for Waders: The Working for Waders Nest Camera Project

Low rates of nest and chick survival, caused mainly by predation, have driven large declines in breeding wader populations across Scotland. Land managers can become frustrated when conclusions reached by scientists and policy-makers, particularly in relation to contentious topics such as impacts or management of predators, do not agree with their own understanding and experience. Using cameras to monitor the outcome of wader nesting attempts can help to make the information gathered accessible to a wide range of stakeholders. Also, camera footage can provide more definitive information on predator identities than data generated by most other kinds of monitoring.

We trialled the use of trail cameras by land managers and other wader conservation stakeholders to monitor the outcome of wader nesting attempts. We present the results of this trial and assess the potential for the project to improve wader conservation knowledge and management.

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Working for Waders

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