The Irish Breeding Curlew EIP

END OF PROJECT REPORT

MARCH 2024

Project Manager: Kathryn Finney

Project Ecologists:

Kyle Sweeney, Marina Mulligan, Mark Gilligan, Kieran Flynn, Kate Bismilla, David Miley

Conservation Keepers:

Shane Sweeney, Anthony Healy
Jimmy Kneale, Richard Walsh
David Ferguson

eip-agri
AGRICULTURE & INNOVATION

BirdWatchIreland
birdwatchireland.ie
protecting birds and biodiversity

Irish Grey Partridge
Conservation Trust

IRISH NATURA & HILL FARMERS ASSOCIATION (INHFA)

teagasc
AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

This report should be cited as follows: Finney, K., Sweeney K., Mulligan M., Gilligan M., Sweeney S., Healey A., Donaghy A., (2024). The Irish Breeding Curlew EIP Project Report 2024. BirdWatch Ireland Unpublished Report.

Corresponding author: kfinney@birdwatchireland.ie

Photo credit: Marina Mulligan

Acknowledgements: Members of the Irish Breeding Curlew EIP Operation Group; participating farmers without whom this project could not have taken place and who demonstrated such commitment to saving Ireland's breeding Curlew; all the dedicated staff who have worked on this project throughout: Shane Sweeney, Kyle Sweeny, Anthony Healey, Marina Mulligan, Mark Gilligan, Kieran Flynn, Kate Bismilla, David Ferguson, David Miley, Richard Walsh and Jimmy Kneale.

Project Partners:

Funders: This project is funded by the European Union under the European Innovation Programme Agriculture and the Department of Agriculture Food and the Marine.

Table of Contents

Tables & Figures

1 Background to the Curlew EIP

Breeding Curlew *Numenius arquata* are in danger of extinction in the Republic of Ireland with only 105 confirmed breeding pairs recorded during the 2021 NPWS national survey (Colhoun, K., *et al.,* 2022), an estimated 98% decline since the 1980s.

Curlew is Red listed on Birds of Conservation Concern in Ireland and represents one of the highest conservation priorities in Ireland (Gilbert *et al.* 2021). The global population of Eurasian Curlew has been classified as 'near threatened' by the International Union for the Conservation of Nature (IUCN) due to sustained and rapid population declines (BirdLife International, 2015). Ireland represents the western-most periphery of its range.

A bird of farmland, bogs and the uplands, Curlew breed between March and July, typically in wet or marshy habitats including bogs, fens, moors, and damp grasslands. In Ireland they are most likely to be found on peatland habitats, unimproved or semi-improved grassland (particularly rushy pastures) wetlands and other open habitats with a heterogeneous vegetation cover comprising some short and some tall (< 0.5m) vegetation or in damp meadows, such as the Shannon Callows (Denniston, 2013; Donaghy 2014). Curlew avoid forests and woodland, built-up areas, improved grassland with a uniform sward and areas with active peat extraction. In Ireland, they are not known to nest in arable areas (O Donoghue *et al.* 2019). Outside the breeding season they are primarily found in muddy, coastal habitats, often in flocks which include birds from Northern Europe who migrate to Ireland to overwinter. It is believed that most breeding Curlew in Ireland are resident over-winter, though other European populations generally move NE from their wintering grounds to bogs, moors, fens, or wet grassland in the breeding season. (del Hoyo *et al.* 1996).

Habitat loss and degradation (as a result of agricultural intensification, land drainage and afforestation), predation, and human disturbance have been identified as the primary threats to breeding populations in Europe (European Commission, 2007, Wilson *et al.*, 2014; Brown, 2015), and Ireland (O'Donoghue *et al.,* 2019).

The Irish Breeding Curlew EIP aimed to develop solutions to population declines, through the development and trial of agri-environment measures which addressed habitat degradation and depredation by predators, in the Republic of Ireland.

2 Curlew EIP Project Aims

The Curlew EIP's main objectives were to design and trail agri-environmental measure to maintain or enhance Curlew breeding habitat and reduce the impact of depredation by predators.

The project operated in two distinct landscapes, seasonally flooded wet grasslands of south Lough Corrib Co Galway, within the Natura network, and high nature value farmland in Co. Leitrim / Longford adjacent to bogs (including Natural Heritage Areas (NHAs)).

Specifically, the project aimed to:

- Trial a results-based approach to management of Curlew breeding habitats with provision of advice and support.
- Develop and trail a measure whereby farmers undertake predator control for key threatened, ground nesting bird species, particularly Curlew.
- Develop and trial Capital Works to enhance breeding habitat for Curlew and reduce depredation and trial ways of establishing more landscape scale management.
- Trial the use of temporary electric fences (TEFs) to help reduce predation.
- Assess the effect of turf cutting on breeding Curlew.

The project also served to maintain and enhance species-rich Natura and HNV grasslands, provide for other Red Listed Birds of Conservation Concern, such as Lapwing Vanellus vanellus, Redshank Tringa Totanus, Snipe Galinago galinago, Skylark *Alauda arvensis* and Meadow Pipit *Anthus pratensis*; provide carbon services through the protection and enhancement of carbon rich wet soils; and help to safeguard water quality through restrictions on fertiliser and herbicide use.

3 Project Structure

3.1 The Curlew EIP Operational Group

The Operational Group (OG) was formed from the project partners who together submitted the project proposal to DAFM's European Innovation Partnerships Programme Call in 2017. The purpose of the Operational Group was to support and advise the Irish Breeding Curlew EIP in its development and operation. The skillsets and experience of the members were important in progressing the project, and meetings were held regularly throughout the project. See Table 1 for Operation Group members and their associated organisation.

Due to Covid-19 restrictions some OG meetings and sub-group meetings were carried out remotely or by phone in 2020 and 2021.

Table 1 Operational Group members and their associated organisation.

Individual Member	Organisation
Anita Donaghy	BirdWatch Ireland (Lead Partner)
Daniel Maloney	BirdWatch Ireland
Kieran Buckley	Irish Grey Partridge Conservation Trust
Michael Martyn	Irish Grey Partridge Conservation Trust
Henry O'Donnell	The Irish Natura and Hill Farmers Association
Glenn Corbett	Teagasc
Catherine Keena	Teagasc
Dáire O'hUllacháin	Teagasc
Kieran Kenny	Teagasc

3.2 Project Timeframe.

The Curlew EIP was to run from April 2018 until December 2021 with a budget of €1.1 million. In 2021 it became evident that delays to Ireland's CAP Strategic Plan (CSP), would mean that there would be no on-the-ground delivery for breeding waders during 2022. An application to extend the project until December 2022 was made and an additional €648,283 was secured.

A second project extension was granted in January 2023 to cover that year, however there was no extension in budget. Instead, a slimmed down version of the project was enacted, using the balance of unspent project funds.

3.3 Staffing Arrangements

The project was initiated in April 2018, when the Lough Corrib Conservation Keeper was appointed. The Project Manager was appointed in late November 2018 and reported directly to the Operation Group. Prior to this, the management of the project was carried out by the Operational Group.

In South Leitrim the project was staffed by two permanent staff, employed in February 2019 – an Ecological Advisor and a Conservation Keeper. In both 2022 and 2023 a seasonal Assistant Conservation Keeper was employed between March and July.
In Lough Corrib, there was one permanent member of staff, the Conservation Keeper, and a seasonal Ecological Advisor in 2019. In February 2020, the Ecological advisor position was made permanent, until 2023 when it reverted to a seasonal contract. As in Leitrim a seasonal Assistant Conservation Keeper was employed between March and July in both 2022 and 2023.

The projects two fulltime Conservation Keepers carried out systematic predator control in each of the project areas during the Curlew breeding season. Outside the breeding season, they assisted in the design and implementation of the Conservation Keepering Scheme with farmers.
The project ecologists assisted in the implementation of the Curlew Habitat Option(s). They also carried out full breeding and productivity surveys (with input from the Keepers) each year, to monitor the effects of control and any habitat improvements.

4 Project Areas

The project focused on two important geographical regions. The southern end of Lough Corrib, Co. Galway, and several bog complexes in south Co. Leitrim. These areas were chosen by the Operation Group as they complimented the work of the NPWS Curlew Conservation Partnership, set up in 2017, which operated in six Curlew strongholds identified during the 2015-17 national survey. The areas identified for the Curlew EIP held a significant proportion of the remaining breeding population and were representative of the two main breeding habitat types for Curlew: wet grassland (Lough Corrib) and bog and damp rushy pasture (South Leitrim). Within these regions, target areas were selected by applying a 1-km buffer around previous breeding records from the 2015-2017 NPWS National Breeding Curlew Survey of Ireland (O'Donoghue *et al.,* 2019).

4.1 South Leitrim Project Areas

The South Leitrim bogs area comprises a complex of raised bogs located east of the N4 at Roosky and Dromod. They stretch eastwards towards the townlands of Gortletteragh, Esker North and Cloonageeher. Four of the bogs are designated as Natural Heritage Areas: Aghnamona, Cloonageeher, Cashel and Corracramp, although Cashel and Corracramp are currently being proposed for de-designation (Fitzmaurice, 2018).

The National Curlew Survey, aided by reports from the public, reported 13 breeding sites in the South Leitrim bogs area, located across seven bogs and one agricultural field. During the 2017 survey only five breeding pairs were recorded. (O'Donoghue *et al.,* 2019)

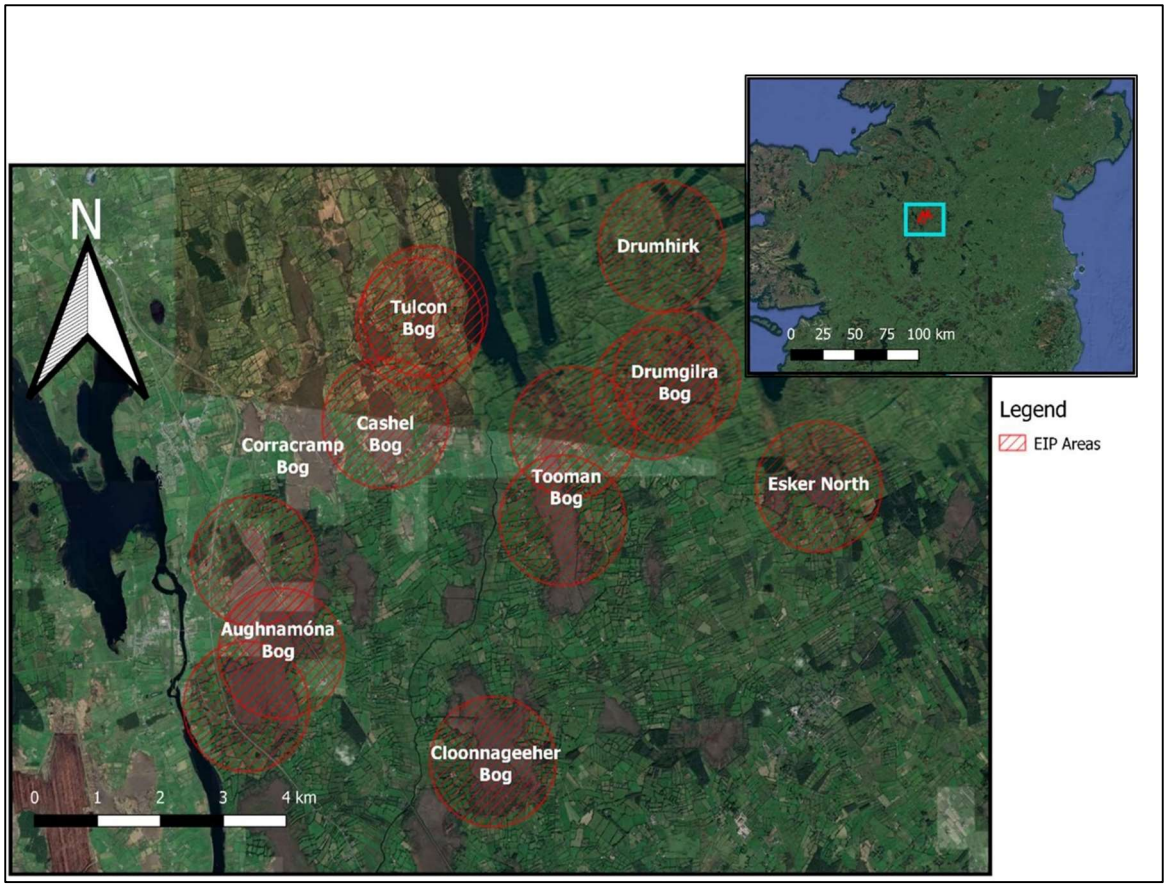


Figure 1 South Leitrim project area target areas (red crosshatch).

4.2 South Lough Corrib Project Areas

Within the South Lough Corrib, the main habitat is wet grassland with only two bogland sites - Wormhole and Curraghmore. Many of the wet grassland sites also adjoin the Curraghmore Bog. All occur within the Natura 2000 Network, within the Lough Corrib Special Area of Conservation (SAC) under the EU Habitats Directive (92/43/EEC). Most sites are also within the Lough Corrib Special Protection Area (SPA) under the EU Birds Directive (2009/147/EC).

Five sites were targeted, based on six breeding records from the National Curlew Survey (O'Donoghue *et al.,* 2019). During 2019, these were amended and extended, based on more recent breeding data collected by the project. These changes ensured the Curlew EIP operated in the most important areas for the local Curlew population.

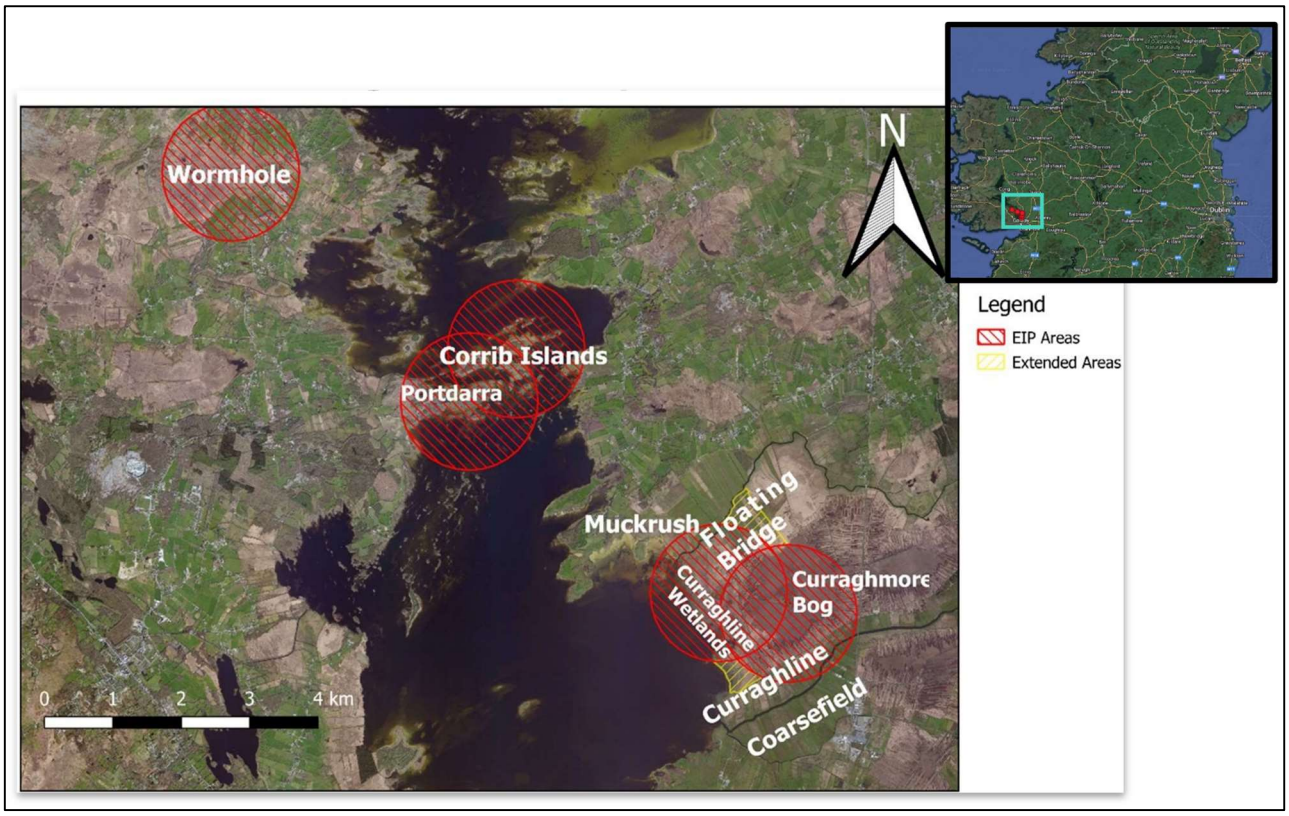


Figure 2 Lough Corrib project area (red crosshatch).

5 Trialling of Project Schemes with Farmers

As part of the project, two agri-environment measures, the Curlew Habitat Option(s) measure and the Conservation Keepering Scheme, were developed and trialled in project areas and were opened to farmers via a series of calls for application.

Any fields contained within or intersected by the 1km buffers shown in Figures 1 & 2 were deemed to be eligible. 72 farmers fell within the project area in Lough Corrib, and 236 farmers in South Leitrim.

As this was a highly targeted scheme, an open call to all farmers through local media was not considered appropriate. Instead, a shapefile of the project areas was sent to the Department of Agriculture, Food and Marine (DAFM), along with an information pack which was sent to farmers within the project area by DAFM on the project's behalf. A number of calls were opened in 2019 and candidates for 2020 were selected based on these.
In total *circa* 53% of all eligible farmers submitted an Expression of Interest (EOI) for the Curlew Habitat Option(s), and *circa* 25% submitted an EOI for the Conservation Keepering Scheme during the 2019 and 2020 calls.

In late 2020 DFAM announced that the Green Low carbon Agri-environment Scheme (GLAS), Ireland's agri-environmental Scheme under the 2014-2020 Rural Development Programme (RDP) was to be extended. This led to budgetary savings which meant the EIP had additional budget available for 2021 and could facilitate new entrants. Another call was opened in late 2020 for new applicants to the Curlew Habitat Option(s) and the Conservation Keepering scheme in 2021.

Table 2 No of Expression of interest forms received from farmers in response to calls for applications in 2019 and 2020.

		Lough Corrib	South Leitrim	Total*
Curlew Habitat Option(s)	1st Call (2019)	21	51	72
	2nd Call (2019)	33	22	55
	3rd Call (late 2020)	11	26	37
	Total no. of applications	**65**	**99**	**164**
	% of total no. of farmers eligible to apply	**90%**	**42%**	**53%**
Conservation Keepering Scheme	1st Call (2019)	19	32	51
	2nd Call (late 2020)	8	21	29
	Total no. of applications	**26**	**52**	**78**
	% of total no. of farmers eligible to apply	**26%**	**22%**	**25%**

**A very small number of applicants submitted an EOI for more than one call, these have not been subtracted from totals.*

5.1 Selection Criteria for the Curlew Habitat Option(s)

One-kilometre buffers were considered the minimum level at which to target conservation measures for breeding Curlew. While largely site faithful, Curlew can move breeding locations between years.

Not all habitat within each buffered site was suitable for breeding Curlew, however even accounting for this, project budgets did not facilitate entering all suitable land within the target area. Consequently, a number of key Curlew breeding sites were identified, based on most recent occupation, together with selection criteria for applicants, shown in Table 3; applicants with land in or adjacent to key breeding sites were given priority entry.

Table 3 Criteria used to prioritise land being shortlisted for the Curlew Habitat Option(s).

Priority	Criteria
1	Agricultural land at or directly adjacent to key breeding sites
1b	Land in GLAS for Curlew/Breeding Waders at or directly adjacent to key breeding sites
1c	Agricultural land near key breeding sites
2	Agricultural land inside buffers with breeding Curlew
2b	Land in GLAS for Curlew not at or adjacent to key breeding sites
3	Agricultural land inside buffers with no breeding Curlew

In South Leitrim due to the large number of applicants, land was further prioritised, so that fields which directly bordered bogs with active breeding were given highest priority for entry. S*ee Table 4 below*.

Table 4 Prioritisation criteria for Priority 1 land shortlisted for the Curlew Habitat Option(s) in South Leitrim.

South Leitrim Prioritisation for Curlew Habitat Option(s)	
P1 Priority	**Criteria**
A	Only land directly bordering bogs with breeding Curlew, or known feeding fields
B	Land not directly bordering bogs with breeding Curlew

After selection, sites visits were carried out to verify that the land was suitable habitat for breeding Curlew, prior to offering farmers entry into the scheme and initiating farm plans.

5.2 Selection Criteria for the Conservation Keepering Scheme

Proximity to breeding sites was the main selection criteria for applicants to the Conservation Keepering Scheme.

Table 5 Prioritisation criteria used to shortlist applicants for the Conservation Keepering Scheme in 2020.

Priority	Criteria
1	Agricultural land (and bog) directly beside key breeding sites within buffer zones
1b	Bogland at key breeding sites
2	Agricultural land within breeding buffer but further distance from breeding location
3	Land outside of key breeding sites

For new applicants to the scheme in 2021, priority was given to farmers who were also in the Curlew Habitat Option(s) and therefore able to provide Curlew with both suitable breeding habitat, and protection from depredation.

6 The Curlew EIP Habitat Option(s)

DAFM approved the Curlew Habitat Option, which comprised a range of elements not previously brought together as one scheme to target breeding Curlew. Several new measures in the Curlew Habitat Option (1.1 to 1.3) and additional to the project proposal were also designed for trial, with approval from DAFM. Elements of the scheme were:

1. A Curlew Habitat Results-based Option

1.1 A Breeding Tier Only Option, suitable for overlaying with the GLAS Geese & Swans option.

1.2 A Late Seasons Only Tier

1.3 A Delayed Mowing Option for meadow land in key breeding areas.

2. A Capital Works programme for land in the habitat options, and also as a standalone option for land adjacent to key breeding sites.
3. A Curlew Knowledge Sharing Group

Shortlisting of applicants for the Curlew Habitat Option(s) was completed in early spring each year, before contacting famers to draw up farm plans. Covid-19 restrictions meant that in-person site visits to discuss and draw up farm plans could not take place in 2020 and 2021. On-site meetings are important when finalising bespoke farm plans, helping to foster higher levels of trust, and they provide farmers with information in a way that is accessible and open to discussion. When this approach was not possible, farmers were sent Farm Plans by post, with follow up phone calls by project staff to talk through the detail. Although more time consuming, this approach was found to work well.

Farmers were offered an annual contract in 2020, following this, they were automatically eligible for entry into the scheme in subsequent years.

No farmers were entered into the Curlew Habitat Option(s) during the 2023 project extension.

6.1 The Results-based Curlew Habitat Option

The results-based Curlew Habitat Option aimed to reward farmers for delivering high quality Curlew breeding habitat by giving each field a score which was linked to payment levels. Scores were calculated on a field-by-field basis. The scoring was based on several physical and biotic features that indicated the habitat value for Curlew and breeding waders. These features included the grass sward

structure during the breeding and post breeding season, rush cover and density, quality of wet features suitable for chick feeding and predator habitat. The Curlew EIP scoring system used the Results Based Agri-environment Project (RBAPs) score card developed for breeding waders in the Shannon Callows, as a model (Finney *et. al* 2018).

The scoring system was a 10-point system, where the most desirable Curlew habitat was scored as a 10 and least desirable scored as a 1 (see Appendix 1 for the scorecard). Fields were scored twice annually, firstly during late May/early June during the Curlew breeding season when chicks would be expected to be on the ground; habitat features beneficial for breeding birds (categories A, B and C) were scored. Category D was scored during October or November.

Options to select only the Breeding Season Tier or Late Season Tier were available where the farmer was unable to enter the full annual option (i.e. due to other conflicting agri-environment measures such as GLAS Geese and Swans, or where priority land was identified after the breeding season had begun). These measures used separate scorecards and received reduced payment rates, reflecting the management required. Entrants to the Late Season Tier had to enter the full annual option in the following year if they were to continue with the scheme.

In the participants first year, payment was guaranteed at a field score of 5. This was to allow farmers time to become familiar with the requirements of the scheme and scoring criteria. Thereafter, payment rates were made based solely on results. Where a participant failed to achieve a field score of 3 or more in two successive years, they received no payment in the second year, as this was considered indicative of a lack of commitment to the objectives of the scheme.

A top up option was available on plots entered into any GLAS option, paid at a lower rate, thereby avoiding dual funding. *See Table 6.*

Table 6 Payment rates for land in the Results-Based Habitat Option(s).

Scoring Scales and Corresponding Payment Rates											
	Points out of 100	0-10	10.1 - 20	20.1 - 30	30.1 - 40	40.1 - 50	50.1 - 60	60.1 - 70	70.1 - 80	80.1 - 90	90.1-100
Payment Rate	**Field Score**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
EIP Curlew Habitat Option	€ / ha	€43	€86	€129	€172	€215	€258	€301	€344	€387	€430
Breeding Tier Habitat Option	€ / ha	€24	€48	€72	€96	€120	€143	€167	€191	€215	€239
Late Tier Habitat Option	€ / ha	€19	€39	€58	€77	€97	€116	€135	€154	€174	€193
GLAS Top-Up Payment Rates	**Field Score**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Farmland Habitat	€ / ha	€35.10	€70.20	€105.30	€140.40	€175.50	€210.60	€245.70	€280.80	€315.90	€351
Geese & Swans	€ / ha	€22.50	€45	€67.50	€90	€112.50	€135	€157.50	€180	€202.50	€225
Breeding Wader & Curlew	€ / ha	€6.40	€12.80	€19.20	€25.60	€32	€38.40	€44.80	€51.20	€57.60	€64
Traditional Hay Meadow	€ / ha	€11.50	€23	€34.50	€46	€57.50	€69	€80.50	€92	€103.50	€115
Low Input Permanent Pasture	€/ ha	€11.60	€23.20	€34.80	€46.40	€58	€69.60	€81.20	€92.80	€104.40	€116

6.1.1 Results

6.1.1.1 Participation by farmers

In the first year of the scheme a total 26 farmers entered the Curlew Habitat Option(s), with 36 and 35 farmers entering in the subsequent years. Only two farmers left the scheme. One farmer exited in 2021 in order to enter the new Results Based Environment Agri Pilot Programme Scheme (REAPS) (participation in both schemes was not allowed under the terms and conditions of REAPS). The second farmer was required to exit because he had not declared his field for the Basic Payments Scheme (BPS), a requirement for payment under the Curlew Habitat Option. Existing farmers entered additional fields to the scheme in later years, and there was some movement between fields in the results-based Curlew Habitat Option and the Delayed Mowing Option, between years.

Table 7 No of farmers and hectarage in the Curlew Habitat Option(s).

		Corrib			Leitrim		
		2020	**2021**	**2022**	**2020**	**2021**	**2022**
Total number of farmers in the Curlew Habitat Option(s)		**12**	**16**	**15**	**14**	**20**	**20**
Total ha in the Curlew Habitat Option(s)		***106.1***	***139.7***	***146.3***	***64.3***	***98.1***	***102.6***
	Curlew Habitat Option	86.3	118.3	125.6	53.2	85.7	89.7
	Breeding Season Tier	6.65	16.7	16.7	0	0	0
	Late Season Tier	10.95	0	0	7.55	0	0
	Delayed Mowing	2.2	4.0	4.0	3.7	12.5	12.9
Total number of fields in the Results-based Curlew Habitat Option		22	31	33	29	43	49
Total number of fields in the Delayed Mowing Option		2	3	3	5	13	10
Total number of Capital works only plans		0	1	0	0	1	1

6.1.1.2 Baseline scoring

Baseline field scoring was carried out between September 2019 and January 2020 on land about to be entered to the scheme, and prior to farmers beginning their contract. Although key elements, such as bereding season sward could not be scored accurately at this stage (as scoring for these is carried out in May/June) it was considered that baseline scoring could still give a good indication of habitat quality, especially for physical features such as wet features and predator habitat.

In their first year farmers were to receive specialist advisory and training on the scorecard and how to provide suitable Curlew breeding habitat and improve their scores. However, due to Covid-19 no farmer training was carried out in 2020. It is therefore considered that the results of this first year field scoring could be used as baseline scores. The number of fields in each score category in 2020 are shown in Table 8. In Leitrim, half the fields score a 5 or 6, whereas in Lough Corrib, there was a

greater distribution across all the categories. Field scores presented in Table 8, show actual scores achieved, even thou payment was guaranteed at a field score of 5 or above in the first year.

Table 8 No. of fields by each field score for Leitrim and Lough Corrib after completion of 2020 field scoing.

Site	Field score										Total no Fields
	1	2	3	4	5	6	7	8	9	10	
Leitrim	1	0	4	3	9	6	5	1	0	0	29
Lough Corrib	0	0	2	3	4	4	2	2	3	2	22

6.1.1.3 Analysis of Curlew Habitat Option field scores

Analysis of variance was used to determine if differences in field scores between years were significant. Field scores from both regions were combined and then each region analysed separately; fields entered into the Breeding Tier only (i.e. GLAS Geese & Swan fields) and Late Season Tier only were excluded, as these scores were not calculated in the same way as those in the annual measure. Where scores of 1 or below were awarded, these were displayed as outliers within the data. Only fields entered into the scheme for at least two of the three years, between 2020 and 2022 were included for analysis.

Table 9 shows field scores per year in each of the Curlew EIP project areas.

Table 9 Field scores per field, year, and area.

Field	Leitrim			Field	Corrib		
	2020 Field Score	2021 Field Score	2022 Field Score		2020 Field Score	2021 Field Score	2022 Field Score
L1	5	7	7	**C1**	10	10	10
L2	3	4	4	**C2**	9	10	10
L3	5	7	8	**C3**	9	10	10
L4	0.5	7	9	**C4**		10	10
L5	6	6	9	**C5**		10	10
L6	6	5	5	**C6**		10	10
L7	5	8	8	**C7**		10	10
L8	7	8	9	**C8**		10	10
L9	4	6	7	**C9**	4	6	7
L10	7	4	4	**C10**	4	7	7
L11	3	5	5	**C11**	7	5	7
L12	3	5	5	**C12**	7	5	7
L13	3	5	7	**C13**	10	8	10
L14	4	4	4	**C14**	6	6	8
L15	6	8	9	**C15**			8
L16	5	3	6	**C16**			8
L17	5	8	8	**C17***	n/a	n/a/	n/a
L18	6	6	9	**C18***	n/a	n/a	n/a
L19	7	5	7	**C19**	4	6	8
L20	5	6	8	**C20**	9	9	10
L21	6	7	7	**C21**	3	6	7
L22	5	4	7	**C22**	3	6	7
L23	5	7	7	**C23**	5	6	6
L24	4	7	7	**C24**	5	7	6
L25	5	6	7	**C25**	8	8	10
L26	7	4	4	**C26**	8	7	9
L27	8	3	5	**C27**	5	5	8
L28	7	2	5	**C28**	6	7	9
L29	6	5	5	**C29**	6	7	9
L30		4	5	**C30**	5	5	4
L31		5	5	**C31**	6	7	7
L32		5	6	**C32**		0	8
L33		5	7	**C33**		0	7
L34		3	2	**C34**		0	5
L35		7	6	**C35**		10	7
L36		7	5				
L37		8	6				
L38		4	4				
L39		7	7				
L40		3	3				
L41		5	6				
L42		6	6				
L43		8	8				
L44			3				
L45			3				
L46			6				
L47			6				
L48			7				
L49			6				

** These fields were grazed in comanage with C19 and C20 and therefore received the same field score as these fields.*

***Where scores are left blank, fields were not entered into the scheme in that year. ***Some fields within this table were excluded from the analysis because they were entered into the GALS Geese & Swan or Late Season measure.*

When all field-scores on fields entered into the scheme for at least two years were analysed (n=159), the increase in field scores was shown to be highly significant [F(2,156) =8.195, p<0.001). Further post hoc analysis using Tukey HSD showed a highly significant increase between 2021-2022 (an average increase of 1.1) and between the years 2020-2022 (an average increase of 1.6 points). There was no significant difference in field scores between 2020-2021.

The average field score in Leitrim was 5.1 in 2020, 5.6 in 2021 and 6.2 in 2022. This represents an increase in the average field score of 1 for fields in the scheme from 2021 to 2022, and an increase of 1.1 for fields in the scheme in all three years, from 2020 to 2022. When field scores from Leitrim alone were analysed (n=87), there was a highly significant increase in average field scores over the three years [F(2,84) = 6.20, p<0.01). Post-hoc analysis using Tukey HSD, indicated that mean scores between the years 2020-2022 and 2021-2022 showed a significant increase. No significant difference was found in the average field score between 2020-2021. *See Figure 3*

The average field score in Lough Corrib was 6.3 in 2020, 6.9 in 2021 and 8.2 in 2022. This represents an increase in the average field score of 1.3 for fields in the scheme from 2021 to 2022, and an increase of 1.9 for fields in the scheme in all three years, from 2020 to 2022. There was a highly significant increase in average field scores over the three years [F(2,69) = 5.49, p<0.001). When further analysed using Tukey HSD tests, it was found that the mean score between the years 2020-2021 and 2021-2022 and 2020 – 2022 was significant. *See Figure 3*

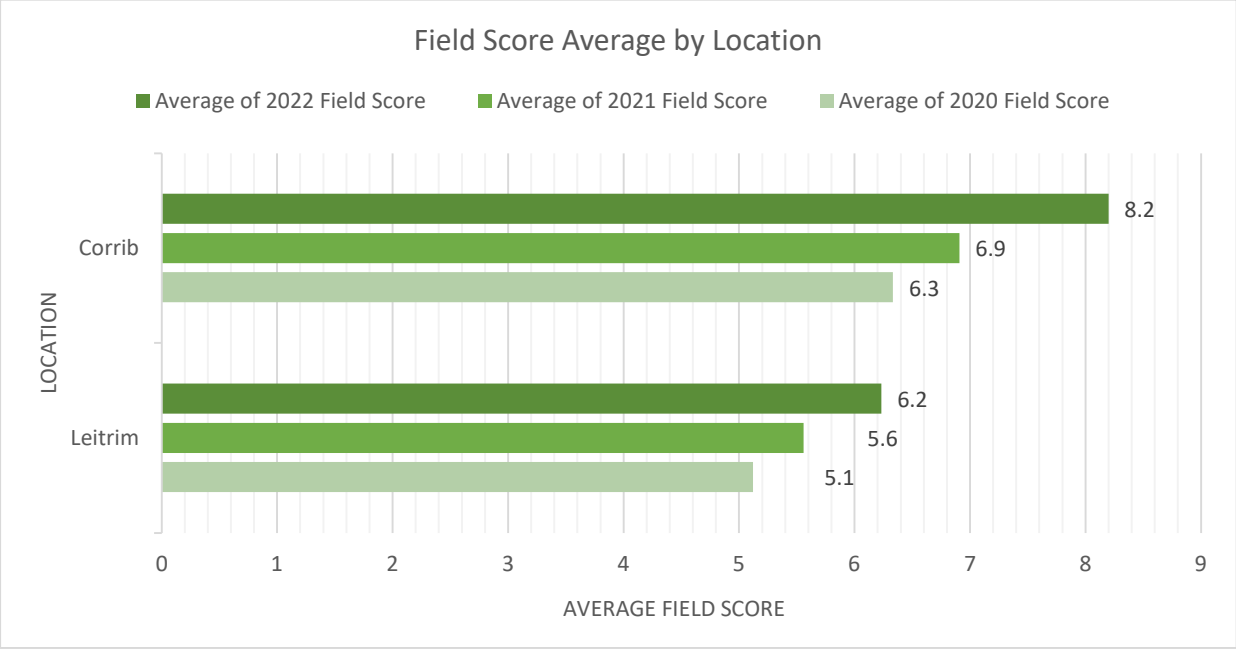


Figure 3 Average field scores per year for Leitrim and Corrib 2020 – 2022.

Field scores in Corrib have been consistently higher over the three-years in comparison to Leitrim, an indication in the difference in habitat between the sites.

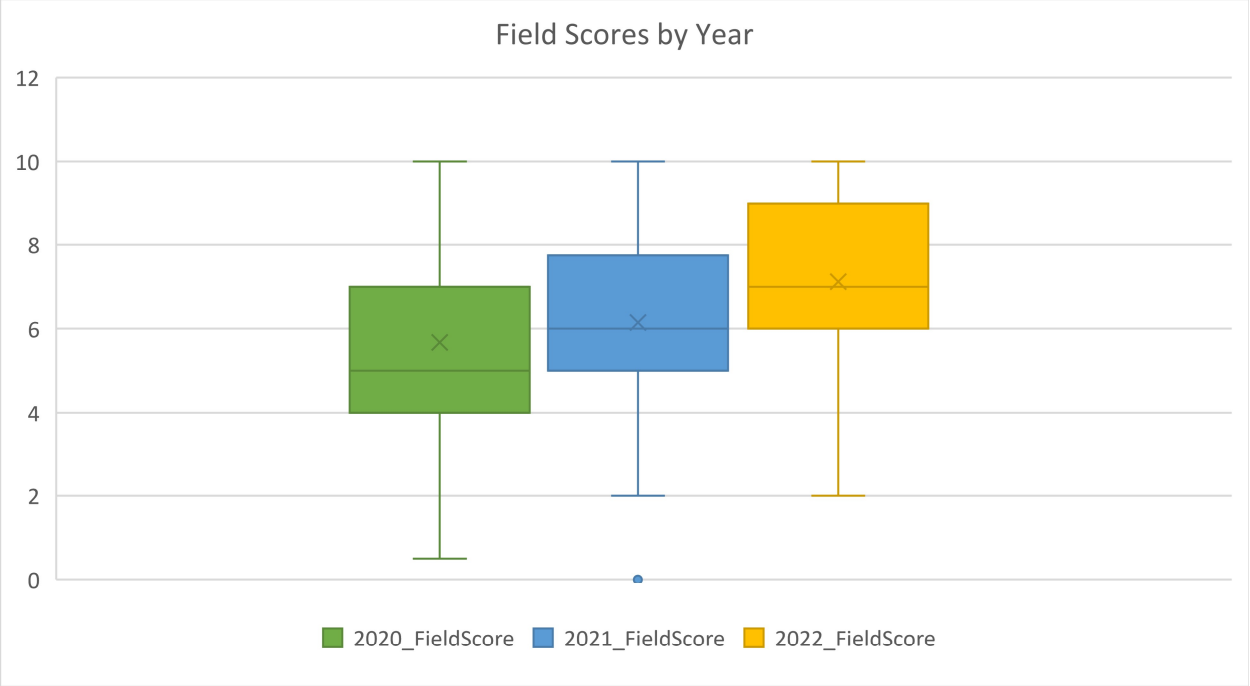


Figure 4 Boxplot showing average, mean and annual variance of field scores across years.

When fields in the scheme for all three years were analysed (n=56), average fields scores across years showed a highly significant increase [$F(2,53) = 8.20$, $p<0.001$). Average field score was 5.7 in 2020, 6.1 in 2021 and 7.1 in 2022. The outlying scores of 0.5 in 2020 and of 0 in 2021 represent fields where no scoring took place in that year due to a breach in the scheme's terms and conditions (relating to tractor operations or grazing management).

6.1.2 Discussion of results

The increases in field scores obtained on fields entered into the Curlew Habitat Option for at least two years was found to be highly significant. Consequently, the Curlew Habitat Option has been shown to be effective in delivering improvements in suitable breeding habitat for Curlew, (and other breeding waders) over the life of this project.

When field-scores for fields in the scheme for at least two years were analysed, there was no significant difference between the years 2020-2021. The provision of specialist advice and training to

farmers is a key element in the successful delivery of higher biodiversity schemes (Peach *et al.* 2001, Aebischer *et al.* 2000), and an essential element of results-based schemes. It is considered that the absence of training in the first year of the scheme due to Covid-19 restrictions, hampered farmers understanding of the measure and consequently affected field scores. In all other year's farmers received specialist advice and training, and fields scores showed a significant increase both between 2020 and these years, and between each subsequent year.

Overall Corrib fields consistently scored higher than Leitrim fields. This is due to the difference in habitat between the two areas. Corrib fields consisted of open wet grassland often bordering the lake, while Leitrim fields were damp rushy pasture mostly boarding bogs. Leitrim fields were smaller in size, more enclosed, contained substantially more scrub (predator habitat) and less wet features, than Corrib fields. In order to achieve top field-scores in Leitrim fields typically required substantial capital investments, which were not always possible due to financial constraints. Even so, significant improvements in fields-scores (and Curlew breeding habitat) were achieved and by 2022 average fields scores were 6.2.

Corrib field scores were shown to significantly improve year-on-year, with some sites maintaining high to maximum scores between years. S*ee Table 9*

High scores in category A (relating to breeding season sward structure) are vital in achieving high overall field scores. Project Terms & Conditions specified a stocking rate of >1LU / ha (*see Appendix 2 for coefficients*) between March and July to avoid trampling of nests and chicks. Stocking early is vital in achieving sward requirements, and in avoiding grass getting ahead of livestock when numbers are limited.

6.2 The Delayed Mowing Option

The Delayed Mowing Option was designed and implemented in spring 2020 to facilitate entry of priority land that farmers were managing as silage or hay meadow. Under the option farmers were required to delay mowing until after the 15 July, after the Curlew breeding season.

There were three payment rates:

1. Land in GLAS under the Traditional Hay Meadow Option received payment of €135/ha. Farmers also received a payment of €80/ha for *Survey & Engagement* – this payment

covered the farmer's time to survey their meadow for Curlew prior to mowing and to engage with project staff to learn how to survey for Curlew.

2. Land not in GLAS which was cut for hay received a payment rate of €215/ha. This payment included *Survey & Engagement.*

3. Land not in GLAS which was cut for silage received a payment rate of €250/ha.

6.2.1 Results

In total seven fields were entered into the Delayed Mowing Option in 2020, 16 in 2021 and 13 in 2022. Survey visits to these fields were carried out on the 14 July to check for compliance with the mowing date of the 15 July. In 2021 one farmer cut four of her fields a week early, due to a misunderstanding with her contractor. Under the schemes Terms and Conditions, she received no payment for these fields.

6.2.2 Discussion

The Delayed Mowing Option is considered an important addition to the measures trialled by the Curlew EIP. It allowed for the development of a measure aimed at safeguarding breeding attempts on land under meadow or silage, which Curlew in particular are known to utilize during breeding and chick rearing. This option also benefits a wide range of other threatened ground nesting birds which are also known to breed in this habitat, including Snipe, Redshank, Skylark, Meadow Pipit and Whinchat *Saxicola rubetra,* (although later mowing dates are more beneficial for Whinchat in particular).

6.3 The Capital Works Programme

The Capital Works (CW) Programme was complementary to the Curlew Habitat Option(s). It facilitated farmers in carrying out once-off CW, that although important for breeding Curlew, were not part of normal farm management. The project team defined the works required and set costings were used to determine the price for each. All CW were linked elements scored in the Curlew

Habitat Scheme, and although not compulsory, where farmers undertook them their scores in these elements increased; and overall payment rates likely increased.

The Capital Works Scheme had three primary objectives:

1. To remove and/or reduce predator habitat in project areas, particularly those closest to Curlew nest sites.
2. To create and/or enhance Curlew chick feeding habitat (through the creation or management of suitable wet features).
3. To increase the availability of breeding habitat, through the removal of rush infestations greater than 30% of the field area, and the removal of predator habitat.

Most CW, including the removal of scrub/ trees had to be carried out outside the bird nesting season (1 March – 31 August), in accordance with the Wildlife Act 1976, and the Wildlife (Amendment) Acts 2000-2012.

The project trialled the implementation of capital works on both designated land consisting of sensitive habitats, and non-designated land. In Leitrim four sites are designated as a Natural Heritage Area (NHA) by Statutory Instrument under the Wildlife (Amendment) Act 2000.
All sites in Lough Corrib occurred within the Natura 2000 Network.

This scheme was available to all famers, including those participating in GLAS options, and on both pasture and bog. As bog is non-Utilisable Agricultural Area (UAA), traditionally no BPS or agri-environmental payments are allowed, however under the EIP payments could be made. Land did not have to be entered into any other Curlew EIP Habitat measure to be entered into the CW programme, thereby allowing for landscape-level habitat improvements.

In 2020, DAFM agreed that CW could be undertaken on land that was not under the control of a farmer. Funding could be made available to either a designated landowner who was a farmer in the proposed area of work, or directly to the project. This was an important development, paving the way for landscape-level works in key breeding areas.

The project also trialled the training and certification of contractors.

Code	Detail	Unit	Cost/unit	Revised Cost/unit 2022
CW1	Mechanical tree / scrub removal - digger	per hr	€35.00	€60.00
CW2	Mechanical tree / scrub removal - chainsaw	per hr	€45.00	€50.00
CW3	Tree / scrub off site	per hr	€30.00	€57.00
CW4	Chemical scrub management upto 25% cover	per ha	€129.00	
	Chemical scrub management 25 - 75% cover	per ha	€203.00	
	Chemical scrub management over 75% cover	perha	€277.00	
CW5	Rush control using herbicide	per hr	€47.25	
CW6	Creation / reprofiling of drains	per hr	€35.00	€60.00
CW7	Waer scrape creation	per scrape	€140.00	€240.00
CW8	wader scrape maintenance	per scrape	€70.00	€120.00
CW9	Forced grazing materials and maintenance	100m & fencer	€230.00	
CW10	Digger call out fee	per hr	€17.50	
CW11	Dificult site suppliment (not including islands)	per hr	€17.50	
CW12	Erection of predator proof fence	per job	per job	
CW13	Transport to island sites	per job	per job	
CW14	Pasture pump	per pump	€345.00	
CW 15	Transportation to island sites	per job	per job	
CW16	Installation of a bridges across drains	per bridge	€132.40	
CW 17	Use of strimmer to remove vegetation.	per day	€193.00	
CW 18	Use of mechanical hedgecutter, flail or sawhead	per hr	€66.00	
CW 19	Chemical Rhododendron ponticum management	per hr	€12.40 + materials	

Figure 5 List of Capital Works and unit pricing.

6.3.1 Results

Many of the proposed Capital Works (CW) included in the farm plans required statutory permissions prior to being carried out. In 2020 DFAM assumed responsibility as the competent authority in this regard.

Capital works in Co. Leitrim were subject to screening under the European Communities Environmental Impact Assessment (EIA) Agriculture Regulations S.I. No. 456 of 2011 and European Communities Environmental Impact Assessment Agriculture (Amendment) Regulations S.I. No 407 of 2017. Certain sites also required permission under the NPWS NHA Activities Requiring Consent (ARC) legislation. Permissions were granted in January 2021, and some farmers were able to begin work prior to the 1 March, the beginning of the bird nesting season.

All sites in Lough Corrib were within the Natura 2000 network. And actions undertaken (including actions for the creation of scrapes, reprofiling of drains and scrub removal) required consent in case of any implications the Qualifying Interests (QI).

Following completion of an initial Appropriate Assessment (AA) screening, most CW proposed by the project were subject to a stage 2 Appropriate Assessment. A consultant ecologist familiar with the Lough Corrib SPA was employed to complete this. A Natura Impact Assessment (NIS) was also prepared which included mitigation measures to be implemented by farmers and contractors whilst carrying out CW. In late 2020 a NIS was also developed for the Corrib Island sites. Two island sites, each with two pairs of breeding Curlew were identified for removal of scrub and predator habitat. Permissions were declined for these islands due to the presence of Lesser Horseshoe bat – a QI of the Lough Corrib SAC. All other permissions were in place by October 2020, however within days of being obtained the area was under an early winter flood, which lasted until March 2021. Works had to be postponed until the following September, in compliance with the Wildlife Acts.

6.3.1.1. Results of CW carried out by farmers.

In total, a third of CW included in farmer's plans were carried out. Substantially more scrub removal was required in Leitrim than Corrib, a reflection of the habitat condition on breeding sites in that area. Although more units of scrub removal by hand were planned in Leitrim than Corrib (166 compared to 52 respectively), farmers in Corrib were more likely to complete this action with 54% of planned works completed compared to only 19% in Leitrim. In Leitrim the areas of scrub were generally large, less accessible, and therefore more difficult to work, when compared to Corrib where they largely consisted of small patches and individual trees along drains.

A lower number of wader scrapes than planned were completed in Corrib, however some farmers elected to carry out more drain reprofiling instead. *See Table 10.*

Table 10 No. of units and percentage of total Capital Works that were completed 2021 – 2022.

	Unit value	Leitrim			Corrib			% of Total CW completed
		no units planned	no. units completed	% units completed	no units planned	no. units completed	% units completed	
Scrub removal digger	**1 hr**	612	210	**34%**	87	35	**40%**	**35%**
Scrub removal hand (chainsaw)	**1 hr**	166	31	**19%**	52	33.5	**64%**	**42%**
Removal of cut trees / scrub off site	**1 hr**	18	9	**50%**	0	0	**n/a**	**n/a**
Chemical scrub management 25%	**1/2ha**	9	1.5	**17%**	12	4.2	**35%**	**27%**
Wader scrapes	**1 scrape**	7	3	**43%**	6	2	**33%**	**39%**
Reprofiling of drains	**100 meters**	2	0	**0%**	5.8	12.8	**221%**	**164%**
Bridges	**1 bridge**	6	2	**33%**	0	0	**n/a**	**33%**
Rhododendron management	**1 hr**	444	258	**58%**	0	0	**n/a**	**58%**

Farmers did not complete some CW (especially where these were large), due to rising contractor and diesel costs. Unit prices for some CW were increased in 2022 (s*ee Figure 5*) to try to increase uptake by farmers. Even so, some farmers could not find a contractor to carry out their CW as a there was a shortage of contractors. Farmers were only paid for CW by the project once the work was completed, and this meant that some contractor costs were beyond the farmers ability to pay upfront, and they did not carry out their CW.

New CW were introduced for trial in 2022, including the removal of rhododendron and the creation of bog bridges. Only one farmer completed the removal of rhododendron.

Where possible farmers used scrub and trees for firewood. Where brash was left this was disposed of in line with Leitrim County Council's "Advance Notice in accordance with Article 5 of the Waste Management" (Prohibition of Waste Disposal by Burning) Regulations. In Lough Corrib they were removed to a green waste facility or by mulching.

6.3.1.2 Results of landscape level CW.

In Lough Corrib large areas of scrub were present on an area of land adjacent to a key breeding site for Curlew, Lapwing, Redshank and Snipe site (the Wetlands, s*ee Figure 2*). The landownership consisted of long narrow bog strips, which extended across a drain and into a large contiguous site, which was grazed in commonage. In total there were 31 individual plots (often only a few meters wide), owned by 20 individual landowners. Scrub occurred across these plots, with no obvious definition as to where plots began or ended. While some of the landowners were farmers, others were not.

DFAM agreed to allow the project to carry out scrub removal on all these plots, regardless of whether the plots were owned by farmers in the Curlew EIP or non-farmers. Under agri-environment payment rules, land must be in the control of an active farmer for payment to be made, this was therefore a significant deviation from normal payment rules. The project carried out the CW's on behalf of all landowners. Otherwise, each individual owner would have had to carry out minor scrub removal and this would have caused difficulties in securing and paying a contractor, and in determining where plot boundaries lay.

Ownership was established by asking local farmers and through Land Registry, and written consent allowing the project to carry out the work was obtained from each landowner. One landowner refused to give permission and his land (at the end of the target area) was omitted.

A single contractor was employed, and scrub removal was completed in November 2021. The removal of brash was delayed by winter flooding, however this was completed in 2022 by removing to a green waste facility and flattening the remaining brash to decay naturally.

6.3.1.3 Results of contractor training

Developing contractor training and certification was a desired aim of the project. To do so, all contractors known to and employed by farmers were invited to attend training workshops. Uptake was very low. Many contractors stated that they did not have the time to attend training, especially because workloads were so high due to shortages in contractors. The lack of payment for attending training was also a factor.

Two contractors were trained in Co. Leitrim and two in Co. Galway. All stated that they found it useful, however they were not sure if it would be of any benefit to them in securing additional work, given the small scale of the project.

6.3.2 Discussion

Framers completed over a third of CWs written into their farm plans. This uptake is considered good, given the delays in securing the required legislative permissions, poor weather conditions, and the increasing costs.

Farmers received training on the requirement and rational for legislative permissions, how to carry out CW and how to implement the mitigation measures specified in the NIS. Most farmers said that they found this informative and interesting, and it is considered that the uptake of CW would have been lower without it. Where farmers did not complete their CW, they said that they would have done so in subsequent years, had the project continued.

Scrub removal planned for some Leitrim sites, adjacent to NHAs, was the first case nationally to require Dual Consent from both DFAM (under the Environmental Impact Assessment Agriculture Regulations) and NPWS (under the NHA ARC legislation). As there was no procedure on how such applications should be dealt with, this caused significant delays. Without a robust procedure, it was possible that one department could give permission for the CW, while the other did not. Thus, leaving farmers vulnerable to prosecution where they acted on one permission alone. This was further complicated by the fact that farmers were not made aware of the requirement for Dual Consent when they initially submitted their

application to DFAM under the EIA Regulations, and similar would have occurred if they applied to NPWS first.

To avoid any confusion for farmers, DFAM were asked not to send their letter of permission (under the EIA Ag. Regulations) until NPWS were also ready to grant permission. Senior DFAM and NPWS staff were made aware of the issue and subsequently met to develop mechanisms to streamline and simplify this process for future cases. This requirement for dual consent is very likely to occur again on other sites nationally.

Curlew, as with other breeding wader species, are not a Qualifying Interest for any SPA nationally and this can cause significant barriers to conservation actions on certain sites. In Lough Corrib, permission to remove scrub on two islands, each with two pairs of breeding Curlew, was declined because these sites could either now or in the future be strategically important for Lesser Horseshoe Bat movement (a QI of the Lough Corrib SAC). Conflicts between the needs of critical species or habitats are not uncommon, and often require compromise to find solutions which will provided for the needs of both. However, the fact that breeding waders are not QIs for the Natura network (for various reasons) means that the interests of the QIs take precedence, at times at the expense of breeding wader management and protection. This can be a barrier to progressing management actions.

Using Agri-environment funding to pay for CW on land not under the control of an active farmer has set an important precedent. It has paved the way for landscape level habitat restoration. And in doing so, practical site-specific solutions to conserve critically endangered species, such as Curlew, can be delivered. It also provides support to farmers taking part in agri-environmental measures, and where the success of the measure can be influenced by factors outside the farmers control; in this instance, depredation by predators occupying scrub on adjacent land. Supporting agri-environmental measures in this way, may improve their cost-effectiveness and lead to improved value for money for taxpayers.

There was low uptake of contractor training. Some contractors said that without payment, they could not attend training. Ultimately it is envisaged that certified contractors would benefit from an increase in business. However, in this instance, given the small scale of the project, contractors were unlikely to benefit financially. On inclusion of CW in the national agri-environmental programme, it is likely that more contractors would be willing to undertake training.

6.4 Curlew Knowledge Sharing Groups

Farmers were invited to take part in four group meetings per year. Meetings were a mix of site-based visits, workshops and presentations and paid at €75 per meeting. Due to Covid-19 restrictions some meetings were carried out on-line.

Initially this option was only available to farmers taking part in the Curlew Habitat Option(s). However, in 2022 it was extended to all farmers, including those in the Conservation Keepering Scheme. Joint meetings were held, thereby connecting farmers who were providing suitable breeding habitat, with those carrying out predator control.

6.4.1 Results

Farmer participation in Knowledge Sharing Group meetings was very good, with most farmers attending all four meetings annually, (*see Table 11*). Attendance at all meetings declined over time, however most farmers attended at least some meetings each year; except for one farmer who did not attend any meetings in 2022.

Table 11 Percentage and number of farmers who attended Knowledge Transfer Group meetings, by area 2020 – 2022.

No. of meetings attended	Leitrim			Corrib		
	2020	2021	2022	2020	2021	2022
4	79% (n=9)	90% (n=5)	68% (n=20)	75% (n=9)	31% (n=5)	44% (n=7)
3	21% (n=3)		6% (n=2)	25% (n=3)	31% (n=5)	12.5% (n=2)
2		10% (n=2)	20% (n=6)		31% (n=5)	25% (n=4)
1			6% (n=2)		7% (n=1)	12.5% (n=2)
0						6% (n=1)
Total	100% (n=14)	100% (n=20)	100% (n=30)	100% (n=12)	100% (n=16)	100% (n=16)

Farmers in Leitrim engaged more fully in Curlew Knowledge Sharing group meetings than in Corrib, with a higher percentage of farmers attending three or four meetings each year.

Guest speakers and peer to peer learning was an important element of these groups. Topics related to the objectives of the scheme and to wider issues faced by farmers in the project areas.

Table 12 List of Knowledge Sharing Meeting topics 2020 – 2022.

2020	Introduction to Knowledge Sharing Groups and project discussion
2020	Managing your land for Curlew
2020	Capital Works - best practice and mitigation measures
2020	Less is more, improving profitability on HNV farmland
2021	Breeding Curlew scorecard training workshop
2021	The role of predator management (through direct and indirect control) on the conservation of breeding Curlew and other ground nesting birds.
2021	Carrying out of Capital Works
2021	The role of species rich grass swards in improving the economic sustainability of farming High Nature Value (HNV) land with guest speaker Henry O'Donnell Project Manager of the Inishowen Uplands EIP
2022	Seasonal flooding farming, with guest speaker Michael Silk a farmer from the Shannon Callopws who has been farming for waders since 2006
2022	Rhododendron control with guest speaker Trish Dean from the MacGillicuddy Reeks EIP
2022	How to minimise disturbance for breeding waders and Curlew while carrying out predator control or farming operations
2022	Site visit to the Shannon Callows, including local farmers as guest speakers
2022	Site Visit to the Corrib Wetlands, including local farmers as guest speakers

6.4.2 Discussion

Curlew Knowledge Sharing Groups played an important role in enhancing farmer buy-in and influencing a change in behaviour, almost certainly resulting in better management for Curlew. This platform allowed farmers to discuss and share strategies to increase scores and habitat quality, in addition to discussing how best to dovetail their existing farm enterprises with the scheme. It also allowed farmers to relay any feedback or concerns to the project team, and in this way assist in the development of the project.

6.5 Training of Agricultural Advisors

In 2022 the project developed and delivered a training workshop for agricultural advisors working in or adjacent to the Leitrim project area. Advisors were contacted using the list of Farm Advisory Service (FAS) accredited advisors and invited to attend the workshop by e-mail. In total six advisors attended.

The workshop consisted of a presentation on the ecology and needs of breeding Curlew and how these were delivered through the Curlew EIP Habitat measures. This was followed by a site visit to carry out field scoring and discuss the scorecard in more detail.

In Corrib plans to carry out advisor training were postponed in 2022. This area fell within an area delineated under Ireland's new agri-environment climate scheme - the Agri-Climate Rural Environment Scheme (ACRES) - as one of the Co-operation Project (CP) areas. These eight CP areas had access to additional schemes and elements, in comparison to ACRES General which

covered the rest of the country. Instead, training for the ACRES West Connaught team was delivered in 2023, once the group was established.

Training was carried out over two days, with an initial on-line presentation to the entire ACRES West Connaught team covering breeding wader ecology, and the measures included in ACRES CP. A subsequent site visit was carried out to one of the Corrib project sties to discuss the score card more fully and look at CW that had been delivered by the Curlew EIP. All the Curlew EIP's Lough Corrib project sites were subsumed by the ACRES West Connaught CP area, and this workshop provided the new team with fist hand knowledge of working with breeding waders in the area.

6.6 Inclusion of Curlew EIP Habitat Measures in The Agri-Climate Rural Environment Scheme (ACRES)

The key aim of the Curlew EIP was the development and trial of agri-environmental measures for inclusion in Ireland's new agri-environmental programme under Common Agricultural Plan (CAP) 2023.

The Curlew EIP played a significant role in the development of Irelands new CAP Strategic Plan. Though participation in a forum of EIP Project Managers, it was influential in the development of Co-operation Project areas and measures that would adequately address the needs of Curlew and other breeding waders nationally. It identified the need for a higher biodiversity scheme in the Shannon Callows, an area important for breeding Curlew and other waders, and which did not fall within the CP areas proposed. A Shannon Callows EIP was subsequently written into the Irelands CAP Strategic Plan.

Through work with BirdWatch Ireland, (the Curlew EIP lead partner) the Curlew EIP worked to ensure that there were adequate measures for Curlew (and other breeding waders) at national scale. Many sites for breeding Curlew and other waders fell out with ACRES CP areas, and thus had no breeding wader measures available to them under ACRES General, which covered the rest of the country. Extensive work by BirdWatch Ireland and the Curlew EIP, and through the development by BirdWatch Ireland of Breeding Wader Hotspot Maps (Kennedy *et al.* 2023), resulted in the inclusion of a National Breeding Wader EIP in Ireland's new CAP Strategic Plan.

Some of the measures delivered through the Curlew EIP were first trialled under the RBPAS project in the Shannon Callows and the Cooperation Across Boarders for Biodiversity (CABB) project in Co Donegal. These were further developed under the Curlew EIP and along with other measures trialled incorporated into ACRES CP; and may be carried forward by the National Breeding Wader EIP, once operational.

The Conservation Keepering Scheme as outlined in Section 7.2 was not included in Ireland new agri-environment program.

Table 13 Curlew EIP measures, and those adopted by ACRES CP under CAP 2023.

Curlew EIP Measures Trialled	**Adopted by Acres CP**
Curlew Results-based Habitat Measure Curlew Delayed Mowing Option Capital Works (including scrub removal and wader scrapes) Temporary Electric Predator Fences The Conservation Keepering Scheme	Adopted with some additional element as the Breeding Wader Measure Delayed Mowing **ACRES No-Productive Investmenst** Wader Scrapes Scrub removal by hand **ACRES Landscape Actions** Scrub removial (by machinery) Temporary Electric Predator Fences Drain Reprofiling Controlled grazing

7 The Control of Predators

Some studies have shown that systematic predator control can reduce the negative effect that depredation has on productivity of Curlew and other ground nesting birds, but the effect is often variable across sites (Fletcher *et al.,* 2010, Bolton *et al*. 2007, Baines *et al*.2023).
Predation by generalist mammalian meso-predators and avian predators such as Corvids have been identified as a key factor in the decline of Curlew populations across the Republic of Ireland and the United Kingdom (Franks *et al.,* 2017; Grant *et al.,* 1999, McMahon *et. al*. 2020, Douglas *et al.* 2021). Red Fox *Vulpes vulpes*, American Mink *Neovison vison*, Corvids *Corvus cornix*, such as Hooded Crow *Corvus cornix* and Magpie *Pica pica* are all considered to be significantly impacting the breeding success in Ireland and are generally the primary species to be targeted for control operations. Targeted predator control was a recommendation of the National Curlew Task Force 2017 and has been implemented at key sites through e.g., the NPWS Curlew Conservation Programme.

The Irish Breeding Curlew EIP developed its "Conservation Keepering" tool which set out the standards and methods to be employed, with the aim of establishing it as the go-to method in predator management for endangered ground-nesting birds. Committed to implementing standards which complied with, and in many cases exceeded, statutory responsibilities relating to predator management, it drew on international best practice and placed ethical standards of animal welfare at the core of its approach. Finney et. all 2022

Complementary to this, the project also developed and trialled a scheme whereby farmers carried out predator control at a landscape level – the Conservation Keepering Scheme. Such a scheme has long been espoused as a conservation need and a Predator Control Option was offered as part of Scotland's Rural Development Programme (2014-2020); however, no scheme was available in Ireland, partly due to the complexity of development and implementation. The advent of new models of scheme delivery through the EIP locally-led approach which incorporates specialist advisory support, paved the way for the successful development of this much needed conservation tool.

7.1 The Curlew EIP Predator Control Policy Document for Ground Nesting Birds

Key to the development of the "Conservation Keepering" tool was the creation of the governing policy document – The Curlew EIP Predator Control Policy Document for Ground Nesting Birds (Finney *et al.* 2022). This document defined the context and rational for predator control as a tool for the conservation of endangered ground nesting birds (such as Curlew) and set out when it was appropriate to use. It clearly outlined the methods of control and their governing legislation, the equipment that was permitted for use, and the standards to be adhered to by the project keepers and farmers, which often exceeded statutory requirements and encompassed international best practice.

7.2 The Conservation Keepering Scheme

The Conservation Keepering Scheme was a measure whereby farmers carried out predator control. It was intended to augment the work of the professional Conservation Keepers, and to trial the effect of landscape level population control of predator species in important areas for ground nesting birds. In the past much of this landscape control would have been carried out by local gun clubs (of which farmers were often active members). However, this activity has declined in recent decades, is considered more of a recreational activity, and may not be targeted where or when is needed for the conservation of endangered ground nesting birds.

7.2.1 Scheme design

The Conservation Keepering Scheme was open to any farmer within the project area. Although desirable, land did not have to be declared for, or in receipt of BPS to be eligible. Thus, activity could be targeted at non-UA areas of the farm, such as bogs which are often important Curlew breeding sites, or scrubby areas which may hold high predator populations.

Farmers could incorporate another person's land into their plan, providing they could provide the project team with written permission from these landowners. As with all other agricultural measures, farmers could nominate or sub-contract an individual to carry out work on their behalf, providing these individuals were fully licenced and insured.

Any combination of the methods of control set out in Table 14 could be chosen by farmers. For options requiring the use of firearms, farmers (or individuals acting on their behalf) needed to have a

suitable licensed firearm of the calibre specified by the scheme and provide up to date firearm certificates.

Table 14 Methods of control for farmer in the Conservation Keepering Scheme.

Fox	Mink & Rat	Corvid (Hooded Crow & Magpie)
Shooting / lamping	DoC200/250 kill trap	Larsen trap
	Live cage trapping	Ladder trap
		Shooting

Plans were map-based, and clearly showed the fields where control work was to be carried out, in addition to the number, location and type of traps being run. *See Appendix 5 for an example plan.* Multiple locations were mapped for each trap, and farmers were free to move between these during the season. In addition, traps could be moved within 100 metres of positions mapped, thereby providing additional flexibility, and ensuring that trapping locations were kept clean (from faecal build up etc.).

Farmers were paid for their time rather than the number of predators they culled. Each farmer carried out *circa* 120 – 170 hours of control between mid-March and mid-July (the Curlew breeding season). Typically, this equated to *circa* 10-14 hours per week over 9-15 weeks. Plan hours were paid at the standard agricultural hourly rate of €12.40 per hour.
Each trap type was allocated a set amount of time per day to check and maintain. Each shooting visit was allocated a set number of hours per week, per unit. *See Table 15*. Farmers were paid for the number of traps/visits they undertook and the number of days/weeks these were operational for.

Each plan had several free weeks during the designated trapping season which was *circa* 18 weeks long. Within this season farmers were free to choose when to run their traps or carry out shooting visits. They could take breaks when desired, and in an emergency, they could contact the scheme keepers to close traps for them. *See Table 16 for an example plan*.

Table 15 Defined time per day for each trap / option.

Activity / Trap Type	No. of min. per trap / day	No. hours per shooting visit
Mink DoC (kill) trap	10 min	
Mink live cage trap	10 min	
Larsen trap	20 min	
Ladder trap	20 min	
Ladder trap – operating on another farmer's land	An additional 20 min	
Corvid shooting		1 hour
Fox shooting		2 hours

Table 16 An example Conservation Keeper Plan.

Plan Summary	Control Works						
Methods of Control	**No. of Hours per Week**	**Payment per Week @ €12.40 / h (€)**	**No. of Hours per Year**	**Total No. of Days**	**Total No. of Weeks**	**Total Maximum Payment per Year @ €12.40 / h (€)**	**No. of Days / Weeks Free***
Lamping							
Corvid Shooting	1hr	€12.40	16hrs	12	16	€198.40	2
Larsen	2hrs 20mins	€28.93	37hrs 20mins	91	16	€462.93	2
Ladder	2hrs 20mins	€28.93	21 hrs	63	9	€260.40	9
Mink - DoC Trap	4hrs 40mins	€57.87	74hrs 40mins	91	16	€925.87	2
Mink - Cage Trap		€0.00		0	0	€0.00	0
Total	**10hr 20min**	**€128.13**	**145hrs**			**€1,847.60**	

7.2.2.1 Equipment

All equipment used by the farmers was specified in The Curlew EIP Predator Control Policy Document for Ground Nesting Birds. *See Section 7.1*. Much of this equipment was imported and provided to the farmers by the project team.

7.2.3 Training

Specialist training and advisory was a fundamental element of the Conservation Keepering Scheme, and this was delivered by the project's professional keepers. All training, other than for the shooting options, was carried out between winter and early spring, prior to farmers beginning work on their plan.

In their first-year farmers took part in up to 20 hours of paid training; thereafter there were refresher modules for some elements each year. Training modules were paid at €15.00/hour and consisted of group workshops as well as tailored one-to-one sessions on farmer's own land.

Workshops covered a range of topics and were both practical in application (i.e. making housing for mink boxes), or theoretical (i.e. the legislation). All modules were mandatory and included the overarching modules which all participants had to complete (*see Section 7.2.3.1*), and option specific modules relevant to each farmer's individual plan (*see Section 7.2.3.2*).

7.2.3.1 Overarching workshops

The first overarching module was carried out prior to accepting farmers into the scheme and developing a farm plan. The pre-plan workshop outlined the requirements for entry to the scheme, the governing legislation, the methods of control and the standards to be adhered to. Only once completed were farmers asked to decide their chosen methods of control. Farmers received payment for this workshop regardless of whether they elected to join the scheme or not.

- **Pre-plan workshop.** Farmers were required to complete this group workshop prior to entering the scheme.
- **Plan development workshop**. An on-farm site visit to assess the farms suitability for the methods of control chosen and to map trap locations.
- **Predator control legislation, Wildlife Licences and data recording**. A group workshop setting out the legislation governing predator control in Ireland and the best-practice standards adhered to by the Conservation Keepering Scheme. This workshop also included the requirement for Wildlife Licences and farmers were helped to fill out licence applications, for submission to NPWS Wildlife Licencing Unit by the project team. The rational and requirement for data recording was also covered in this workshop. Farmers were shown how to fill out the recording sheet.
- **Carrying out predator control close to a breeding site.** A group based, on-site workshop which gave practical advice on how to carry out predator control and stock management, without causing disturbance to ground nesting birds.

7.2.3.2 Option-specific training

- **Making DoC trap housing.** A practical workshop carried out one-one or in small groups.
- **Setting up and maintaining a mink trap.** An on-site practical workshop carried out one-one or in small groups. It covered both DoC and live cage traps and included training in humane dispatch (for live trap catch).
- **Building and running a ladder trap.** A practical workshop**,** with follow up in the field. Carried out one-one or in small groups, it also covered humane dispatch.

- **Setting up and maintaining a Larsen trap.** An on-site practical workshop run one-one or in small groups, it also covered humane dispatch.
- **Corvid shooting visit.** An individual or small group on-site workshop, it covered practical aspects in the control of corvids by shooting, including corvid ecology and the legislation.
- **Lamping visit.** An individual on-site workshop, it covered practical aspects in the control of Fox by shooting and the legislation.

Farmers were not trained to shoot by project keepers. Instead, training covered the prescribed rifle calibre, range and shot size that farmers had to adhere to, in addition to practical elements, such as choosing hunting routes.

7.2.4 Data recording

At the end of season, farmers were required to submit their data sheets for payment. These detailed when their traps were open, and the species and numbers caught (including accidental by-catch). These sheets were crosschecked against the farmers plans and approved, prior to paying farmers.

At the end of the season a review of catch data and farm plans was carried out, to check that farmers were carrying out the most suitable control measures based on predator populations in their area, and to flag any concerns. Accidental by-catch returns, a requirement of the Wildlife Licences, were submitted to National Parks and Wildlife Licencing Unit by the project on behalf of farmers.

7.2.5 Insurance

An important factor in the development of the Conservation Keepering Scheme was ensuring that farmers had access to appropriate insurance cover. This was especially relevant where farmers were working on another person's land or carrying out riskier methods of control, such as those requiring firearms.

Legally the scheme was judged a compensation scheme. As such farmers who held National Association of Regional Game Councils (NARGC) Compensation Fund cover were fully insured, including on land not owned or controlled by them. Countryside Alliance also provided similar cover, although this was not as extensive. Sub-contractors working on behalf of farmers were deemed to be employees and as such were not covered by NARGC Compensation Fund cover, instead they required specific cover. All farmers were made aware of this.

It was strongly recommended that all farmers and sub-contractors held appropriate cover.

7.2.6 Results

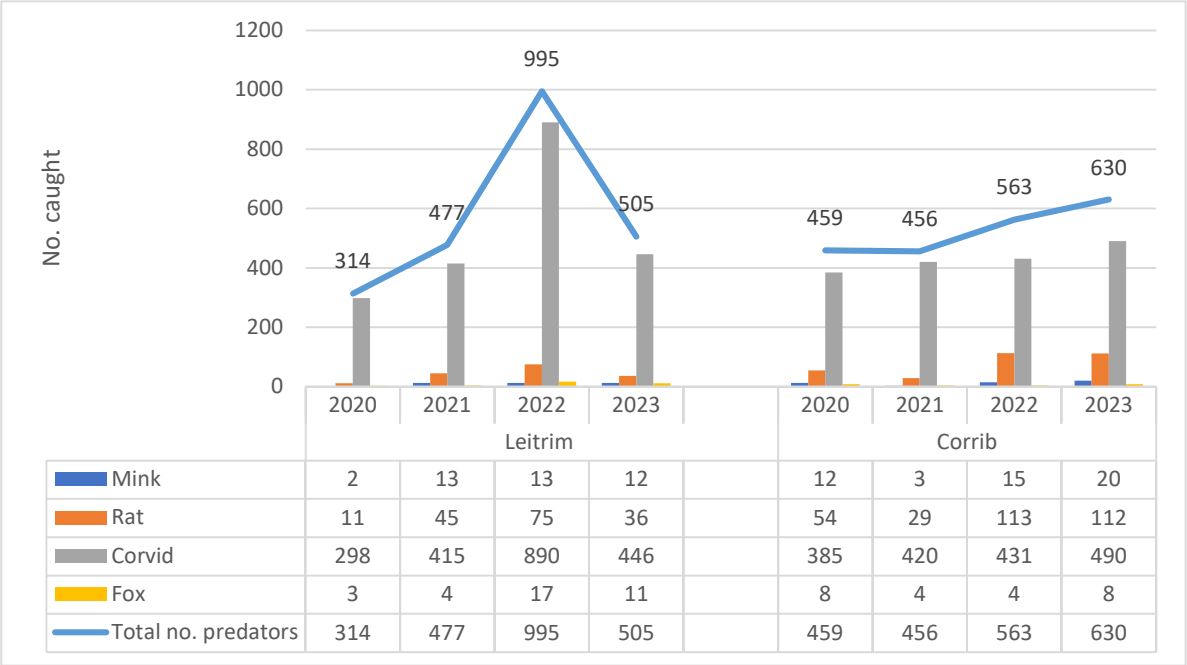
Twenty-one farmers entered the scheme in 2020, 32 in 2021 and 33 in 2022 and 2023. The most frequent methods of control chosen were related to Mink and Corvid control. Fox control was the option least chosen. Entry to this option was reliant on farmers having firearms, of the calibre specified by the scheme and was the most skilled of the methods of control. *See Table 17.*

Table 17 Number of scheme participants by methods of control and area 2020 - 2023

	South Leitrim							South Lough Corrib						
	Total no of scheme Participants	Mink Cage Trapping	Mink DoC Trapping	Larsen Trapping	Ladder Trapping	Corvid Shooting	Fox Shooting	Total no of scheme Participants	Mink Cage Trapping	Mink DoC Trapping	Larsen Trapping	Ladder Trapping	Corvid Shooting	Fox Shooting
2020	**12**	9	10	11	7	7	6	**9**	4	8	7	5	3	2
2021	**21**	7	20	21	15	9	5	**11**	4	10	8	9	3	2
2022	**22**	8	21	22	15	10	5	**11**	4	10	9	10	3	1
2023	**22**	8	21	22	15	10	5	**11**	4	10	9	10	3	1

Farmers were audited on three occasions during the season to check for compliance. Compliance was found to be excellent.

Figure 6 details the number of predators culled by farmers over the four years of the scheme. Participating farmers were all in, or immediately adjacent to Curlew breeding sites; other wader species were often present on these sites also. Figures presented are additional to the number of predators controlled by the project's keepers (*see Section 7.3*).



	Leitrim				Corrib			
	2020	2021	2022	2023	2020	2021	2022	2023
Mink	2	13	13	12	12	3	15	20
Rat	11	45	75	36	54	29	113	112
Corvid	298	415	890	446	385	420	431	490
Fox	3	4	17	11	8	4	4	8
Total no. predators	314	477	995	505	459	456	563	630

Figure 6 Number of predators culled by farmers, by area and year.

7.2.7 Discussion

Fifty two percent of farmers responded to a questionnaire about the Conservation Keepering Scheme. Asked what influenced their decision to take part in the scheme, all respondents stated that their desire to help protect Curlew or nature on their farm influenced their decision. All respondents also stated that the training and advisory element was a “significant”, or “extremely significant”, factor in their decision to take part.

There was a recognition among farmers that their knowledge of the legislation, and practice of predator control, was out of date. During the trial farmers said that the training they received, together with the detailed specifications of the methods of control, gave them confidence by ensuring they were operating within the law. In the questionnaire, all farmers stated that this training greatly improved their understanding of the legislation and methods of control.
The group training also meant that they built up a good network with other entrants to the scheme. This network helped provide fresh call birds when needed giving farmers the flexibility to open and close their Larsen / Ladder traps at short notice. Ongoing mentoring by project keepers also meant that they could seek advice and guidance when needed.

Farmers were paid for their time and not based on the number of predators they culled. Cull rates can fluctuate from year to year, whereas effective control for the conservation of breeding ground nesting birds is dependent on consistency of control during their breeding season. By paying farmers for their time, it is more likely that this consistency is maintained; that catch rates are reported accurately, and that the scheme is auditable.
All farmers felt that 10-14 hours of control per week was the optimum amount of time that they could accommodate in their working week. They felt that they had enough flexibility to work around busy periods on their farm/ homelife by closing traps, during free days/weeks. Most farmers were able to check traps while carrying out stock management, and it became a routine part of their daily farm management.

All the farmers were in or immediate adjacent to a Curlew breeding site. The total number of predators controlled by the farmers point to very high background predator populations which are likely to be impacting breeding Curlew. Even more so when it is considered that the number of predators controlled by farmers were additional to the those controlled by the project keepers.

If this trial scheme is scaled up to other areas, amendments to auditing and inspection would be required to ensure that the scheme can be administered to a greater number of farmers. The advancement in new technologies and administration systems in recent years can facilitate this, and such a system has been identified by this project allowing for further development at a future date.

The scheme was successfully implemented by the participants who actively engaged with it. The measure was oversubscribed, and many farmers were refused entry due to budgetary constraints. Most of the farmers entered were also in the Curlew Habitat Option. They appeared to take ownership and feel pride in the role they played in providing Curlew (and other waders) with both suitable habitat and protection from predators. Concerns over the auditing and governance of such a scheme should be viewed in this light, as farmers are more likely to take ownership of a measure which directly benefits the biodiversity on their land and in their community.

7.3 Predator Control by the Project Keepers

The project employed two full-time Conservation Keepers to carry out systematic predator control during the Curlew breeding season. Thereafter they assisted in the design and implementation of

the Conservation Keepering Scheme. In later years they were supported by two seasonal assistant keepers.

7.3.1 Methods

Predator control was systematically carried out, in advance of, and during the Curlew breeding season (from March until mid-July), or until breeding was finished on individual sites.

Thereafter low levels of mammalian control were carried out, to protect young, fledged birds from depredation and prevent predator populations from building to unsustainable levels prior to the following years breeding season. Effort was concentrated where pairs were actively attempting to breed, and for this reason the Conservation Keeper and Ecologist worked closely as a team throughout the season. Effort was further concentrated where pairs were confirmed breeding (through nest identification or chick alarm calling).

The keepers worked in line with the principles and practice established under the Conservation Keepering Scheme and as set out by the associated policy document (*see Section 7.1*). Much of the equipment was sourced from outside Ireland, drawing on best practice in the UK and New Zealand.

Keepers had defined areas of operation where predator control was carried out and where the Conservation Keeper walked their beat in a systematic manner during the early hours of the morning and late in the evening. This method of continuously walking a defined area allowed them to account for any trap shy animals. Each keeper also undertook three to four nights lamping per week using a high-powered rifle and a thermal imaging monocular.

7.3.2 Results

Four species of predator were actively controlled in each project area. These were Red Fox, American Mink, Hooded Crow and Magpie. Rat *Rattus norvegicus,* was controlled where the opportunity arose.

Results are presented for keepering activity between mid-March and mid-July, as these dates correspond to the breeding season for Curlew (*see Tables 18 and 19*). Where breeding finished before mid-July and keepers ceased control work, results are only presented until this date.

Table 18 Results showing control of predators and effort during the Breeding season in Leitrim 2019 – 2023.

Leitrim Breeding Season 2019-2023*		n visit days					n Shot					n Shot per visit day					n of visit days per predator shot				
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Shot	Fox Lamping	35	24	35	129	103	41	32	8	153	86	1.2	1.3	0.2	1.2	0.8	1	1	4	1	1
Shot	Corvid						46	70	55	62	20										
		n days					n traps					n trap days					n caught				
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Cable Restrained	Fox	50	36	20	192	102	4-18	0-31	0-21	18-55	10-22	1339	790	288	7836	1836	5	2	0	10	8
Trapped	Mink	79	46	40	192	102	1-4	8-13	0-9	8-18	4-16	602	524	381	2664	1068	3	1	3	0	0
Trapped	Hooded Crow	79	44	40	192	102	1-4	5-11	1-11	7-20	6-20	659	426	924	2826	840	126	75	44	192	101
Trapped	Magpie	79	44	40	192	102	1-4	5-11	1-11	7-20	6-20	659	426	924	2826	840	49	35	37	124	76
Trapped	Corvid All	79	44	40	192	102	1-4	5-11	1-11	7-20	6-20	659	426	924	2826	840	175	110	81	316	177
Trapped & Cable Restrained	Total											2600	1740	1593	13326	3744	183	113	84	326	185
		n caught per trap day					n of trap days per predator caught														
		2019	2020	2021	2022	2023	2019	2020	2021	2022	2023										
Cable Restrained	Fox	0.004	0.003	0.000	0.001	0.004	268	395	N/A	784	230										
Trapped	Mink	0.005	0.002	0.008	0.000	0.000	201	524	127	N/A	0										
Trapped	Hooded Crow	0.19	0.18	0.05	0.07	0.12	5	6	21	15	8										
Trapped	Magpie	0.07	0.08	0.04	0.04	0.09	13	12	25	23	11										
Trapped	Corvid All	0.27	0.26	0.09	0.11	0.21	4	4	11	9	5										
Trapped & Cable Restrained	Total	0.07	0.06	0.05	0.02	0.05	14	15	19	41	20										
		2019	2020	2021	2022	2023															
Total Number of Predators Controlled		**270**	**215**	**147**	**541**	**291**															
Total number of Predators Caught per Trap Day and Visit		**0.10**	**0.12**	**0.09**	**0.04**	**0.08**		*8 April - 14 July 2019, 23 March - 4 July 2020, 22 March - 12 July 2021, 21 March - 10 July 2022, 13 March - 08 July 2023														

** Numbers of Corvids shot was opportunistic, rather than through a systematic approach. Therefor only total numbers shot are presented.*

*** For Fox cable restrained, the number of cable restraints open varied between weeks, therefore the minimum and maximum number opened are presented under* n_{traps}*. The number of trap days has been calculated using weekly figures and accurately reflects effort.*

Table 19 Results showing control of predators and effort during the Breeding season in Lough Corrib 2018 – 2023.

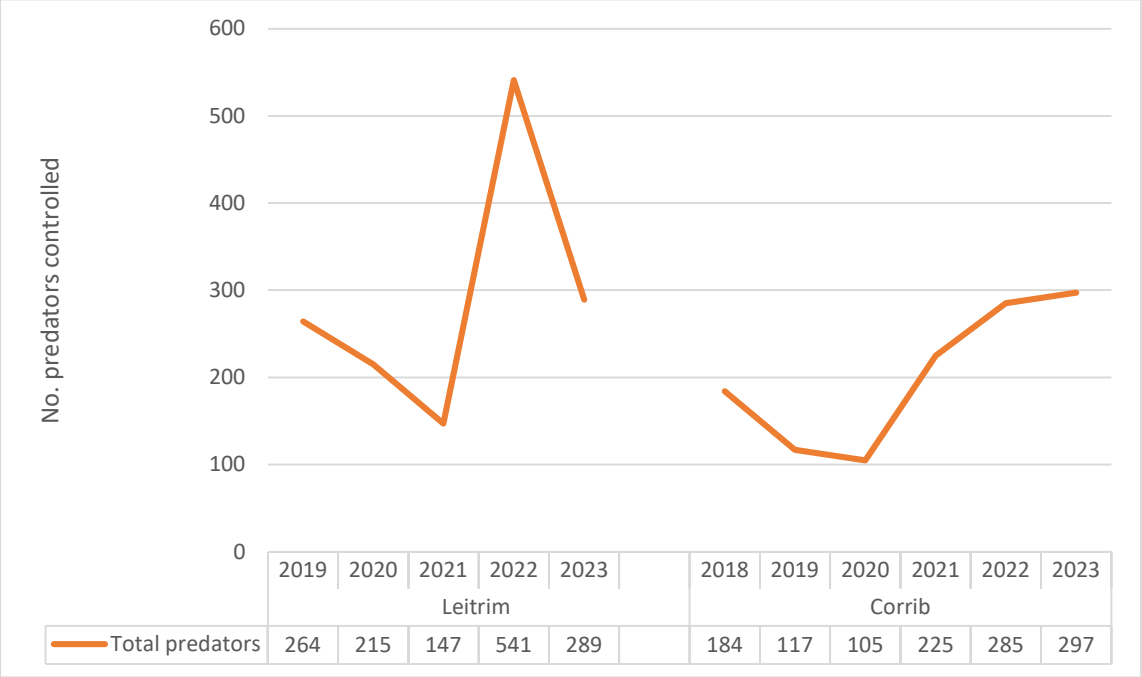
Lough Corrib Breeding Seasons 2018-2023*		nvisit days						nShot						nShot per visit day						n of visit days per predator shot					
		2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023
Shot	Fox	44	35	20	78	96	108	18	13	14	31	35	41	0.4	0.4	0.7	0.4	0.4	0.4	2	3	1	3	3	3
Shot	Corvid							33	21	28	59	71	86												
		ndays						ntraps						ntrap days						ncaught					
		2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023
Cable Restrained	Fox	71	98	33	101	200	140	20-69	69	20-50	55	0-60	15-60	4258	6762	1480	5555	7735	7735	6	4	3	5	4	5
Trapped	Mink	91	98	33	102	200	131	10-20	17-20	10-20	10-20	10-25	7-5	1680	1852	545	1700	4170	2605	7	5	5	5	9	0
Trapped	Hooded Crow	86	94	33	103	200	200	1-12	12	5-12	2-12	4-12	3-12	867	1128	332	1086	2053	1376	78	67	46	116	120	100
Trapped	Magpie	86	94	33	103	200	200	1-12	12	5-12	2-12	4-12	3-12	867	1128	332	1086	2053	1376	42	7	9	9	46	66
Trapped	Corvid All	86	94	33	103	200	200	1-12	12	5-12	2-12	4-12	3-12	867	1128	332	1086	2053	1376	120	74	55	125	166	166
Trapped & Cable Restrained	Total													6805	9742	2357	8341	13958	11716	133	83	63	135	179	171
		ncaught per trap day						n of trap days per predator caught																	
		2018	2019	2020	2021	2022	2023	2018	2019	2020	2021	2022	2023												
Cable Restrained	Fox	0.001	0.001	0.002	0.001	0.001	0.001	710	1691	493	1111	1934	1547												
Trapped	Mink	0.004	0.003	0.009	0.003	0.002	0.000	240	370	109	340	463	0												
Trapped	Hooded Crow	0.09	0.06	0.14	0.11	0.06	0.07	11	17	7	9	17	14												
Trapped	Magpie	0.05	0.01	0.03	0.01	0.02	0.05	21	161	37	121	45	21												
Trapped	Corvid All	0.14	0.07	0.17	0.12	0.08	0.12	7	15	6	9	12	8												
Trapped & Cable Restrained	Total	0.02	0.01	0.03	0.02	0.01	0.01	51	117	37	62	78	69												
		2018	2019	2020	2021	2022	2023	*16 Apr - 22 July 2018, 11 March - 21 July 2019, 18 March - 5 July 2020, 8 March - 29 July 2021, 21 March - 10 July 2022, 19th March - 30th July 2023																	
Total Number of predators Controlled		184	117	105	225	285	298																		
Total number of predators caught per trap day and visit day (fox & corvid shot) combined		0.03	0.01	0.04	0.03	0.02	0.03																		

** The project began in Lough Corrib in April 2018 with the employment of the Corrib Kepper, no keeper was employed in Leitrim that year.*

*** Numbers of Corvids shot was opportunistic, rather than through a systematic approach. Therefor only total numbers shot are presented.*

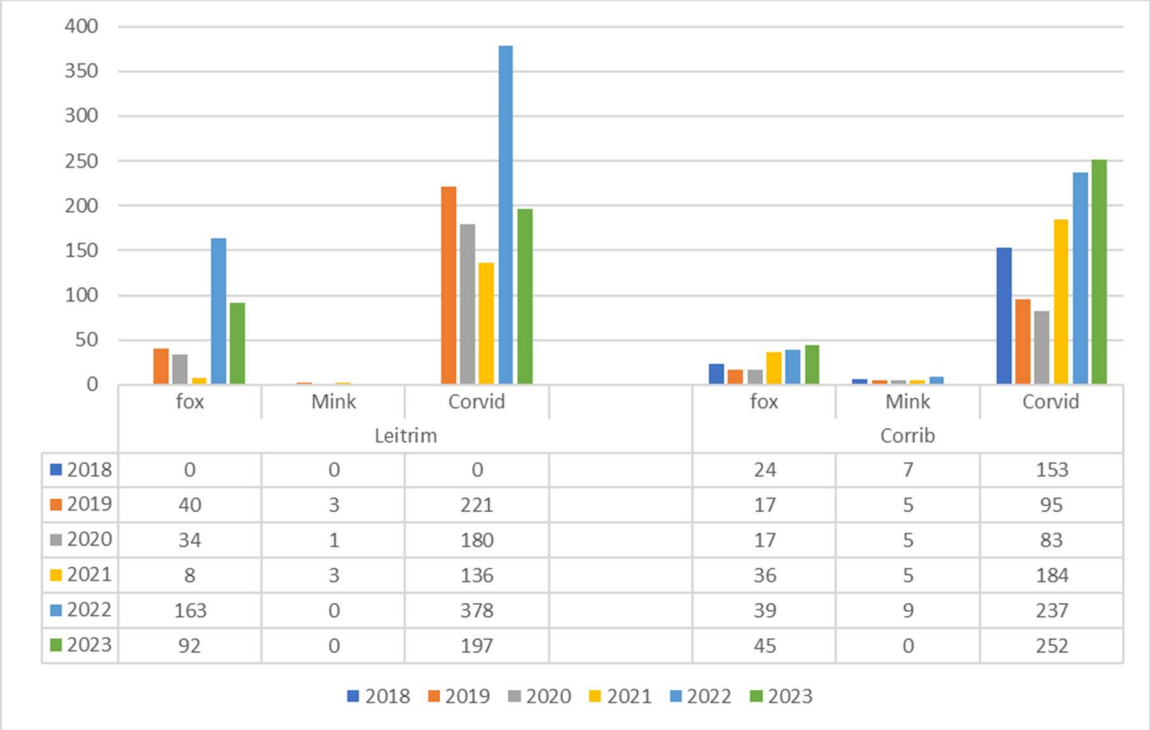
*** *For* Fox cable restrained, the number of cable restraints open varied between weeks, therefore the minimum and maximum number opened are presented under ntraps. The number of trap days has been *calculated using weekly figures and accurately reflects effort.*

Figures 7 –15 show the control effort in South Leitrim and Lough Corrib by species between 2018 and 2023. Dates correspond to dates in Tables 18 and 19.



	2019	2020	2021	2022	2023		2018	2019	2020	2021	2022	2023
	Leitrim						Corrib					
Total predators	264	215	147	541	289		184	117	105	225	285	297

Figure 7 Comparison of total number of predators controlled in Leitrim and South Corrib, by year.



	fox	Mink	Corvid		fox	Mink	Corvid
	Leitrim				Corrib		
2018	0	0	0		24	7	153
2019	40	3	221		17	5	95
2020	34	1	180		17	5	83
2021	8	3	136		36	5	184
2022	163	0	378		39	9	237
2023	92	0	197		45	0	252

Figure 8 No. of predators controlled by species, year and region.

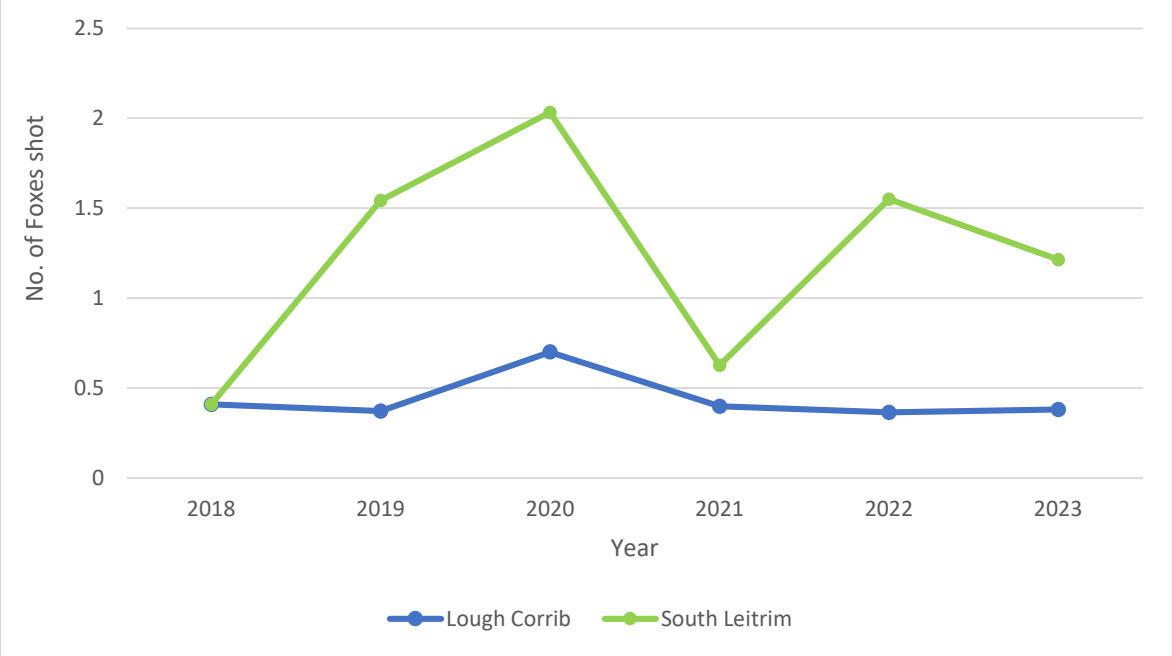


Figure 9 Foxes shot per visit day, by region and year.

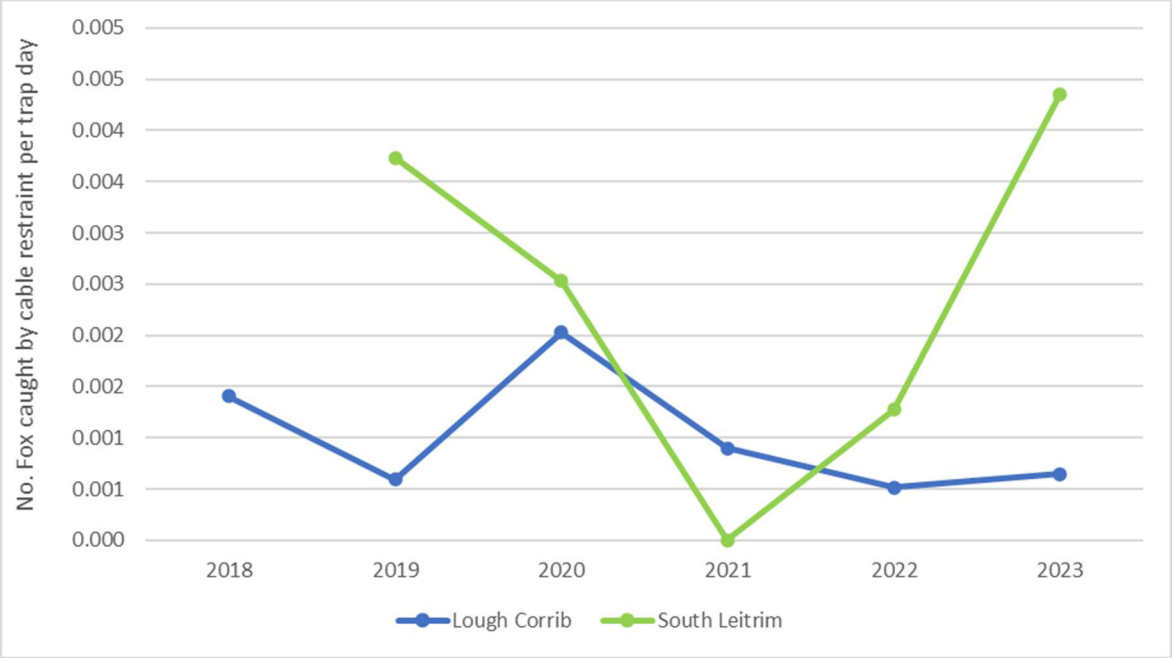


Figure 10 Foxes caught in cable restraints per trap day, by region and year.

** There were no Fox caught by cable restraint in Leitrim in 2021, although some traps were open.*

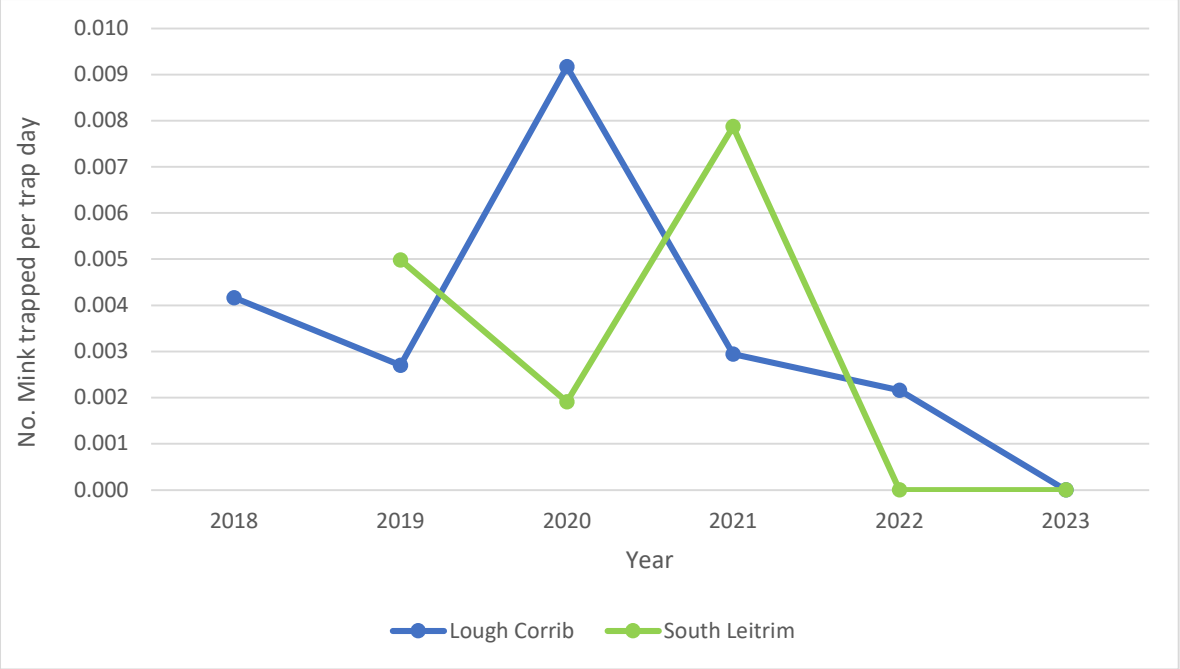


Figure 11 Mink trapped per trap day, by region and year.

** There was no Mink caught in Leitrim in 2022 or 2023 or in Corrib in 2023, although traps were open.*

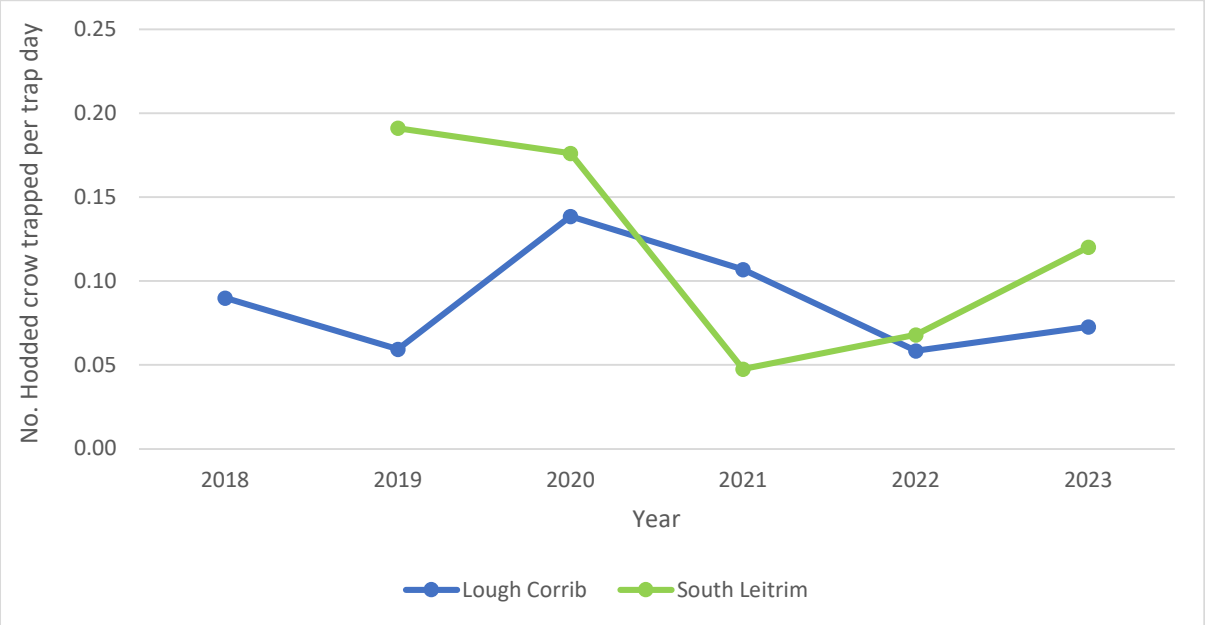


Figure 12 Hooded crow trapped by trap day, by region and year.

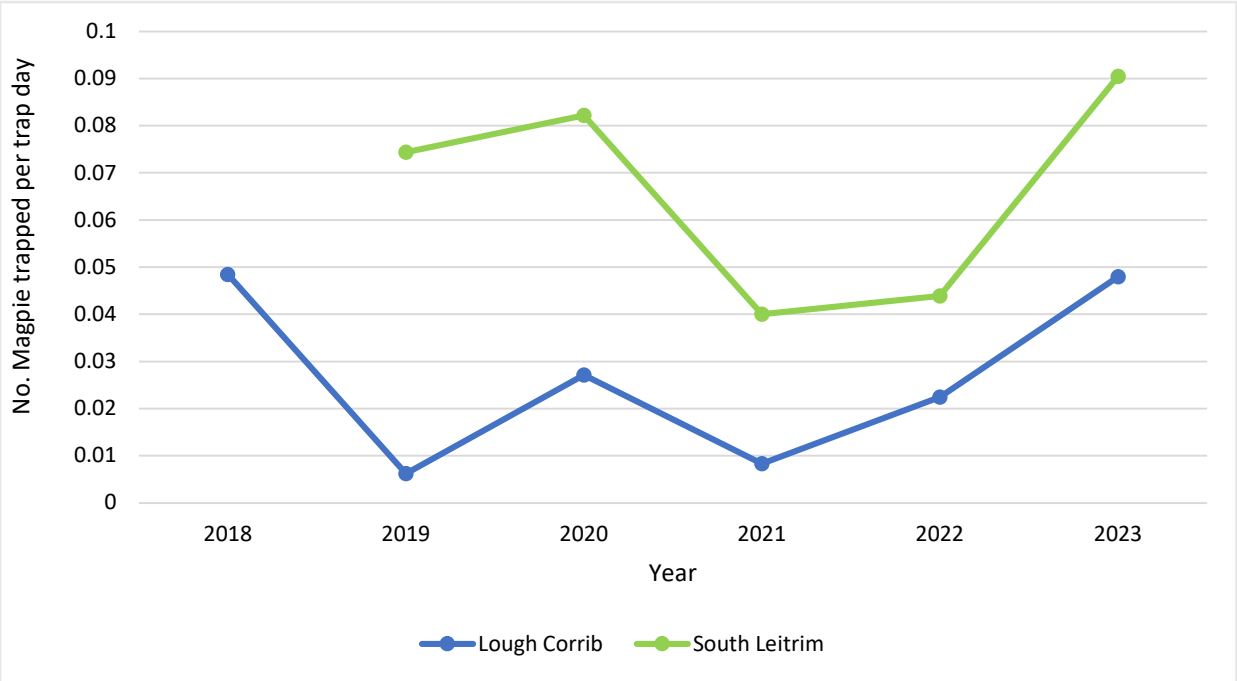


Figure 13 Magpie trapped per trap day, by region and year.

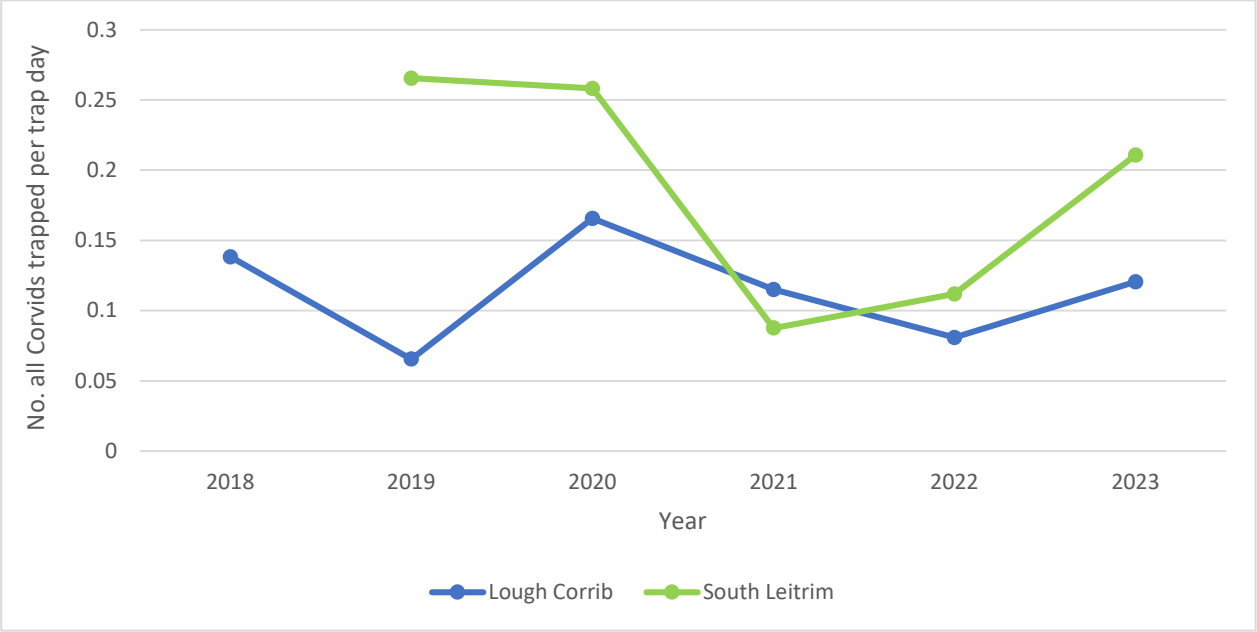


Figure 14 All corvids trapped per trap day, by region and year.

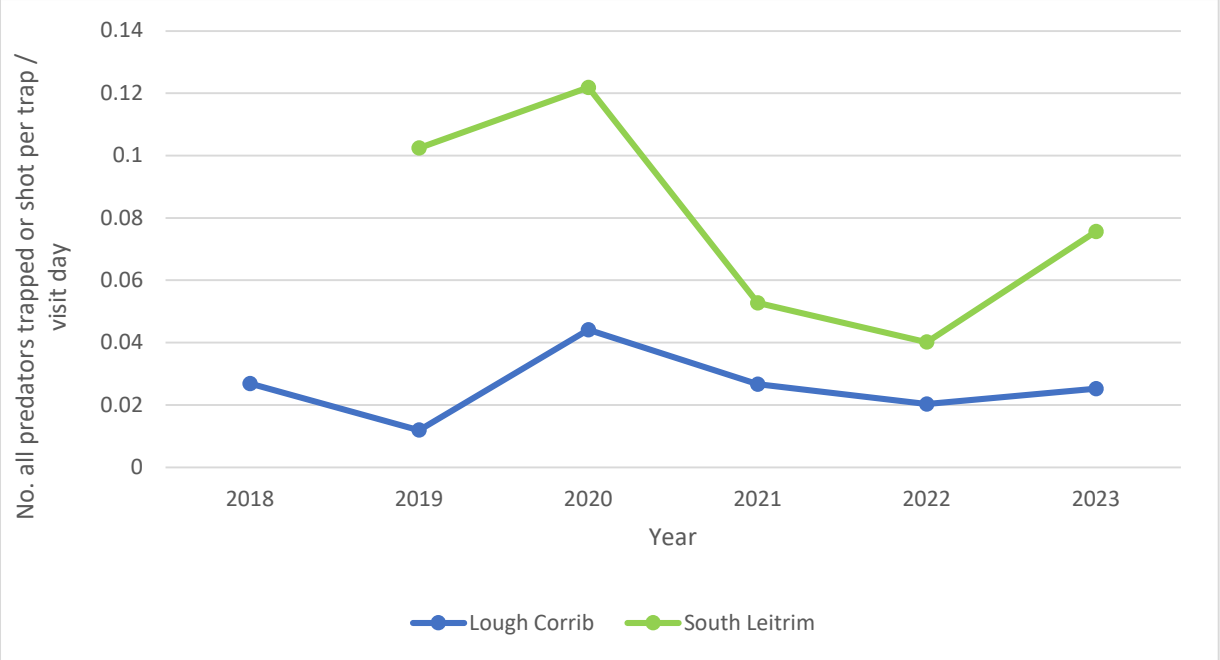


Figure 15 All predators trapped and shot per trap and visit day, by region and year.

Number of predators controlled by both the project Keepers and the farmers in the Conservation Keepering Scheme is presented in Figure 16 below.

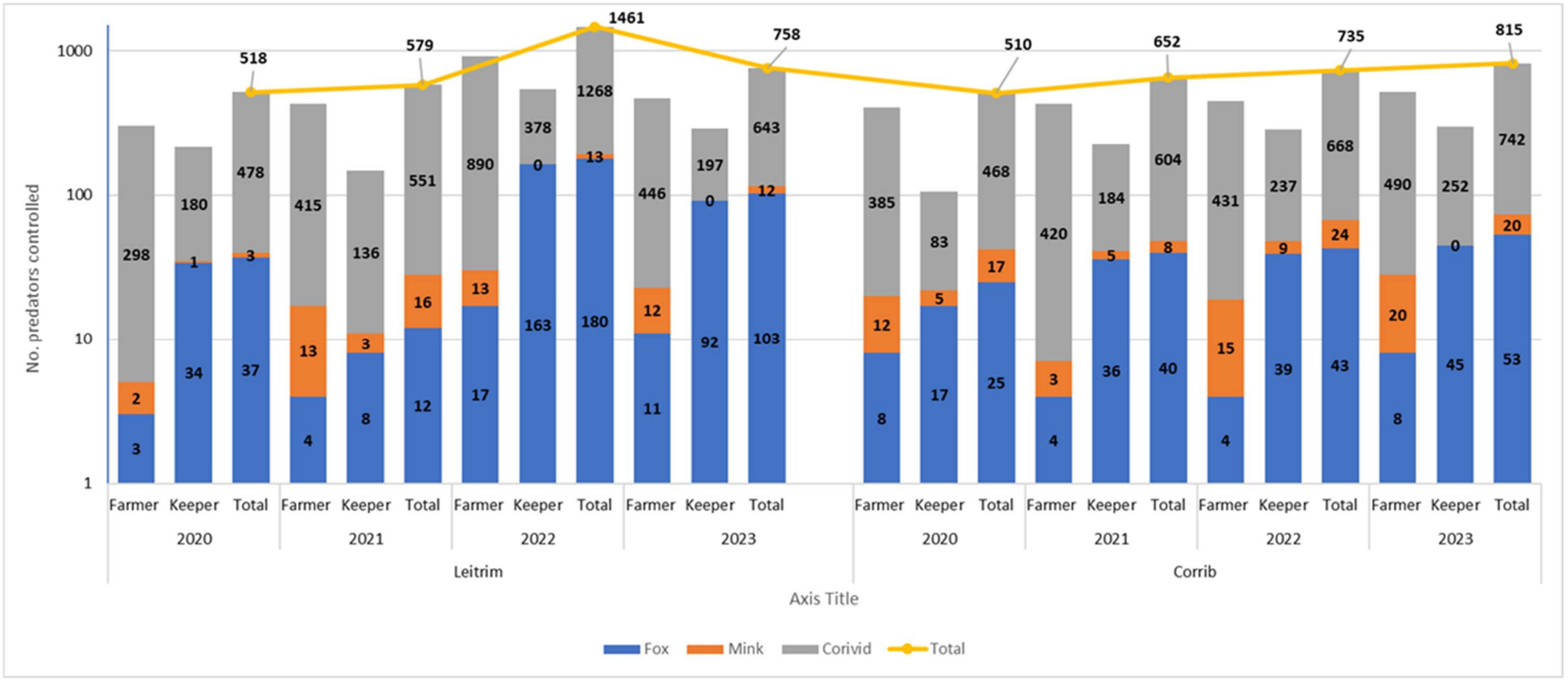


Figure 16 Total no. of predators controlled by both project keepers and farmers in the Conservation Keepering Scheme combined, by area and year.

7.3.3 Discussion

In 2020 keepers did not begin work until early-May due to Covid-19 restrictions. Consequently, this resulted in greater numbers of predators controlled per effort in 2020, when compared to other years (the exception being Mink, and Fox controlled by cable restraint in Leitrim). Indicating there were higher levels of predators due to the lack of control in the preceding months.

In 2021 in Leitrim there was a decrease in total the number of predators controlled, and also the number controlled by effort by project keepers for all species, except Mink. This was a result of staffing issues and gaps in delivery in that year. Numbers of Corvid and Fox controlled in 2022 showed a marked increase - this is likely a result of a buildup of predators during 2021 while there were gaps in delivery.

Both the number of predators controlled, and numbers culled by effort, was greater for Leitrim than Corrib for all year's bar 2021 (when there were gaps in delivery in Leitrim). There is substantial afforestation and much more scrub on, or adjacent to breeding sites in Leitrim. Such habitat favors predators, and their populations are likely to be higher than in Corrib, where the habitat largely comprises of open wet grassland, with less habitat for predators.

In 2022 and 2023 seasonal assistant keepers were employed and numbers of predators controlled showed an increase both overall, and when measured against effort. The exception is Mink, where numbers controlled in both Corrib and Leitrim declined over time and no Mink were controlled in either area in 2023. Although Mink were controlled by farmers in these years and it is possible that farmers were able to control populations through the Conservation Keepering Scheme (see Section 7.2.6). This may point to slower recolonization rates by Mink once territories become vacant, or lower background populations. For all other species it points to very high background populations and relatively fast recolonization rates.

Farmers and keepers were operating in close proximity to Curlew breeding sites and combined the catch rates in Figure 18 present a picture of the predator pressure on breeding Curlew at these sites.

7.4 Temporary Electric Fencing (TEF) Option

The use of electrified predator exclusion fences has been proven to be successful in reducing the impacts of predation on wading birds' nests by mammalian predators (Malpas *et al.,* 2013). The Curlew EIP trialled the use of temporary electric fences between 2020 – 2023 on pasture and bog plots to protect known Curlew nests from predation.

Farmers were trained in the erection, maintenance and dismantling of fences and compensated for their time. Fencing materials were provided by the project team and the TEFs erected as soon as nest were located and operated for several weeks post-hatching. The fences were then dismantled and stored until the following season.

Based on knowledge gained of the habitats in the project area during the 2019 survey season, the materials to be used (electric sheep netting as outlined in the project proposal) were modified. Instead, electric posts capable of carrying seven strands of electric wire beginning at ground level were used. This allowed for the erection of fences on uneven ground, faster erection, increased voltage, and ease of transport to inaccessible areas, where vehicles could not travel.

7.4.1 Results

In total six nest fences were erected in Leitrim and three in Corrib between 2021 and 2023. Fences were *circa* 25m^2 , although the shape was modified as necessitated by the terrane. All but two nests successfully hatched chicks; two nests were predated by avian predators. Once hatched chicks moved beyond the fence and most were believed to have been predated, although one brood is suspected of having perished because of silage mowing. Only one nest successfully fledged chicks from Corrib in 2021.

Of the nests fenced all but two were found through satellite tagging birds (*see Section 8*).

7.4.2 Discussion

Nest fencing has been proven, by this and other projects (Malpas *et al.,* 2013) to positively influence hatching success. However, whilst hatching success is usually higher, fledging success can still be low if chicks are predated beyond the fence. This is especially the case where there are high background predator populations, or habitats are in poor condition.

TEF cannot provide protection from avian predators, and this in itself is a limitation, especially in areas with high Corvid populations.

7.5 Predator Scat Transect Surveys

Predator scat transect surveys can be an important tool to measure abundance of predator populations. They were used by this project to see if it was possible to ascertain the effect of systematic predator control over time on background populations. It was hoped that the information gathered would give a clear indication of species present and how quickly the species recolonise the area once predator management was carried out or ceased for the season. Whilst only species as permitted under the Wildlife Acts were controlled, the abundance of all mammalian predators was monitored.

7.5.1 Methods

The method deployed was predator scat transect surveys, partially adopted from Banks et al. (1997). In each region transects were carried out at a site with intensive predator control and a control site. The control was an area of similar habitat but without any predator management (to our knowledge) and far enough away so as not be to be influenced by control on the actively managed site.
A 2-km route was plotted for each site which followed linear features where possible. These are the areas mammalian predators tend to follow/use and are often territorial boundaries marked by scent/urine/scat.

The transect was visibly marked every 25 meters, and the route recorded on a mobile phone app, to ensure the transect could be accurately repeated. During the initial set up, any scat found within one meter of the center of the transect was removed. Thereafter, every month on the same date (or as close as possible) the transect was repeated, noting, and removing the number of scats one meter either side of the transect line, and identifying the predator species. Both the control site and site with active predator control were surveyed on the same day.

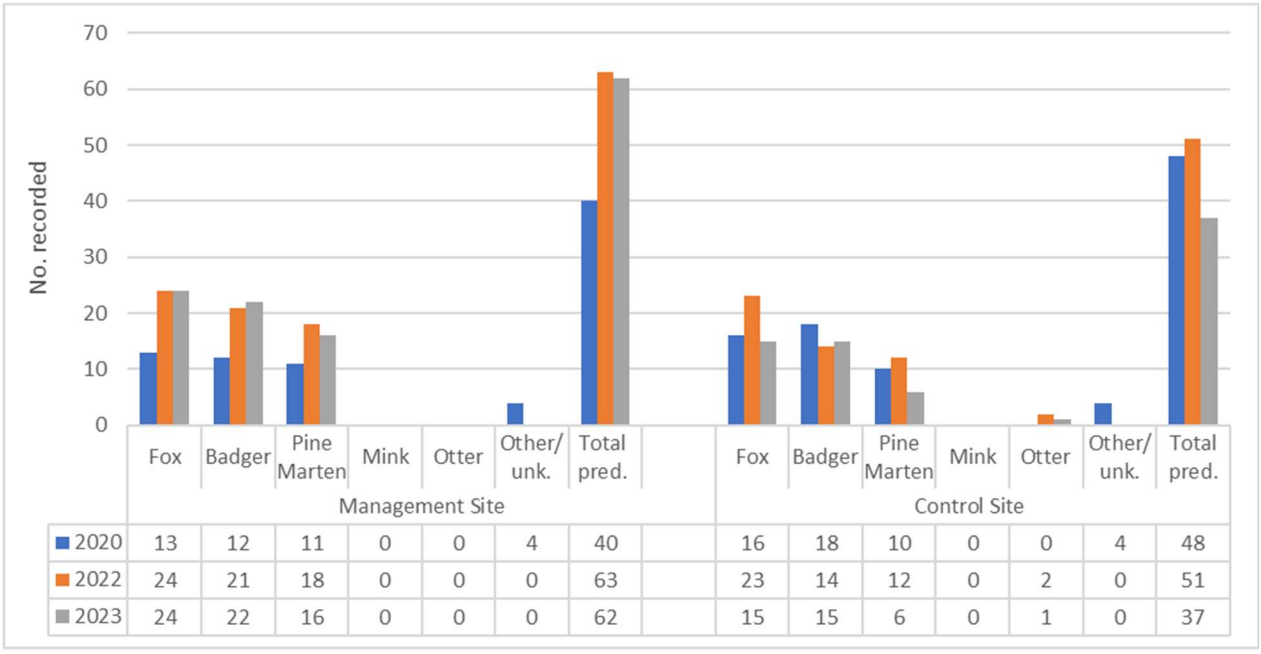
7.5.2 Results

The habitats on the sites chosen for the Predator Scat Survey in South Leitrim were very similar. Both the managed site and the control site incorporated disused bog lanes, drainage ditches, and active railway lines along the edge of which the transects were plotted. Both had areas of scrub willow, birch and gorse, with patches of bracken, but were predominantly rank heather.
Fox and Badger *Meles meles,* were the most prevalent predators identified on both the managed and control site. Pine Marten were recorded frequently on both sites; there was no evidence of Mink on either. *See Figure 17.*

The habitats in South Corrib varied, as it proved difficult to find a suitable control site. The managed site (at Curraghmore) followed linear features along drainage canals on both unimproved and wet grassland, and along the edge of reedbeds interspersed with areas of gorse, willow and bog myrtle scrub. The control site passes through an area of unimproved grassland, bog "cut away" and bog, which comprised mainly of scrubby heather and rushes, this transect also follows linear ditch/bank features.

Fox was the predator identified most frequently on both the management and control site.

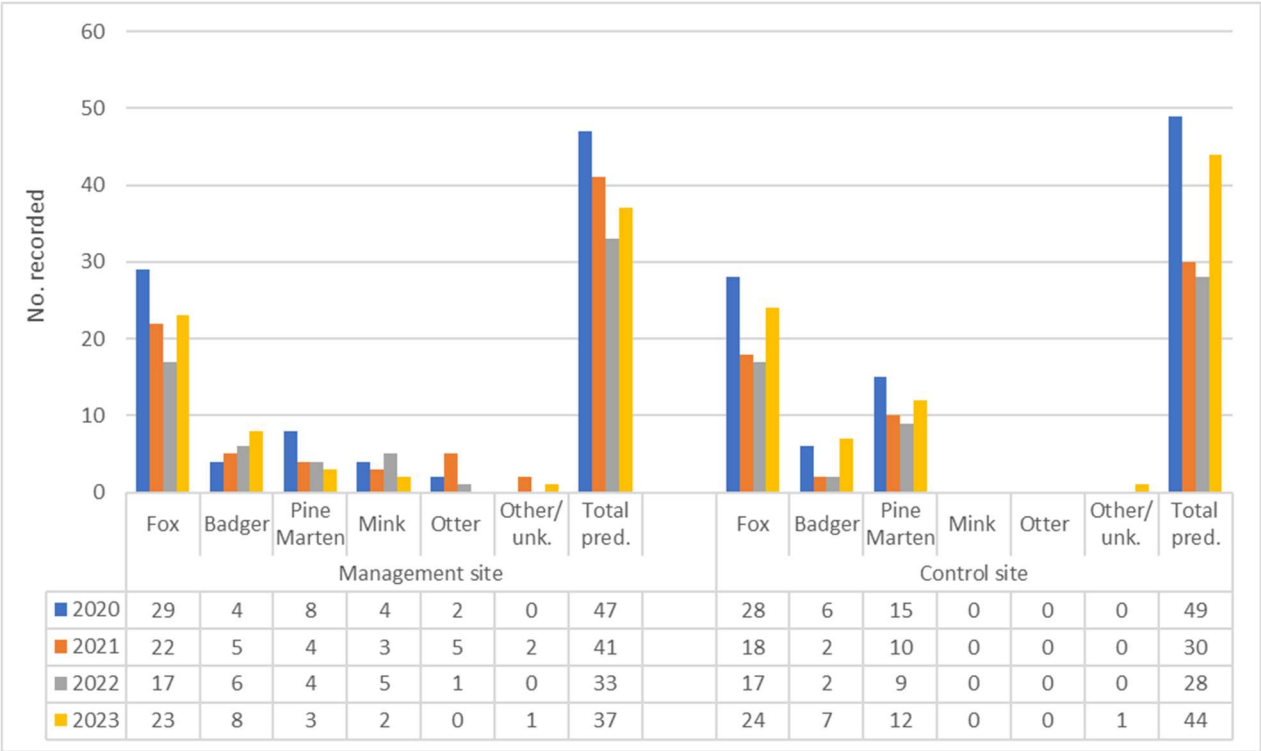
Both Badger and Pine Marten were recorded on all sites, however Pine Marten were more prevalent on the control site. Mink and Otter *Lutra lutra,* were identified only on the managed site. *See Figure 18*.



	Management Site							Control Site						
	Fox	Badger	Pine Marten	Mink	Otter	Other/ unk.	Total pred.	Fox	Badger	Pine Marten	Mink	Otter	Other/ unk.	Total pred.
2020	13	12	11	0	0	4	40	16	18	10	0	0	4	48
2022	24	21	18	0	0	0	63	23	14	12	0	2	0	51
2023	24	22	16	0	0	0	62	15	15	6	0	1	0	37

Figure 17 Scat survey results for Leitrim 2020 – 2023

** No scat transect surveys were carried out in Leitrim in 2021 due to staffing issues*



	Management site							Control site						
	Fox	Badger	Pine Marten	Mink	Otter	Other/ unk.	Total pred.	Fox	Badger	Pine Marten	Mink	Otter	Other/ unk.	Total pred.
2020	29	4	8	4	2	0	47	28	6	15	0	0	0	49
2021	22	5	4	3	5	2	41	18	2	10	0	0	0	30
2022	17	6	4	5	1	0	33	17	2	9	0	0	0	28
2023	23	8	3	2	0	1	37	24	7	12	0	0	1	44

Figure 18 Scat survey results for Corrib 2020 – 2023

7.5.3 Discussion

In South Leitrim, no Mink and only one Otter were recorded, most likely due the fact that both sites were dry with no substantial water source nearby. Badger was one of the most frequent predators recorded in Leitrim, more so than in South Corrib. Pine Marten was also recorded more frequently in Leitrim than Corrib. This is a result of the difference in habitat types between the two areas (see Section 4).

Fox was more frequently recorded in South Corrib. However, numbers of Fox controlled by project keepers was higher in Leitrim, than in Corrib (see Section 7.3.2).

No semi aquatic predators (Mink and Otter) were recorded at the control site in Corrib. This was likely because the site was located further away from the lake shore than the managed site at Curraghmore, which was less than 500m away and contained more drains. Mink populations are in line with Philcox & Grogan's (1997) methodology which estimates that the Curraghmore should support approximately one Mink per 3- 5.5km.

Overall predator populations were higher in South Leitrim, than in Corrib. This is considered a factor of the difference in habitat both at a site and landscape level, between the two areas. There was

very little difference in the numbers of Fox recorded on the management and control sites in both Leitrim and Corrib. Recolonisation of the management site appears to be occurring rapidly, pointing to very high background populations.

7.6 General Discussion on Predator Management

It is generally accepted that background populations of predators have increased over recent decades (Pringle *et al.* 2009, Balmer *et al.* 2013; McMahon *et al.* 2020). In Ireland there has been a significant increase in Corvid populations (Balmer *et al.* 2013). Meanwhile it is generally accepted that populations of Fox have increased since the removal of the national bounty in the 1980's, and the fall off in gun club activity. American Mink have also successfully colonized available habitat and are now widespread, while other protected species such as Pine Marten have become re-established in many areas. The extinction of terrestrial apex predators in Ireland, (Grant, 2022), changes in farming practices and other landscape factors have favored conditions for generalist meso-predators, also leading to an increase in populations. (McMahon *et al.,* 2020)

Nest fences have been proven to protect against depredation at the egg stage, thus supporting the work of keepers by buying time in their effort to reduce predator populations in advance of chick rearing.

The number of predators controlled by farmers and project keepers, and the results of predator scat transects, point to high background predator populations. To adequately protect critical ground nesting species such as Curlew from unsustainable depredation rates, predator populations need to be addressed at a landscape level. By engaging farmers, the Conservation Keepering Scheme could have a key role in affecting landscape level control, and in supporting the work of professional keepers. Lack of difference in numbers between management and control sites probably indicates that predator control needs to be established for much longer and at a greater scale than was possible in this project.

There was a general lack of knowledge among farmers, and those applying for project keeper roles, of the methods of control and related legislation. The familiarity with and understanding of the need for Wildlife Licenses was also especially poor. Membership of a local gun club did not seem to influence this, especially among farmers, although farmers were often not very active members. There is no significant culture of professional keepers in Ireland (when compared to other countries such as Scotland with a culture of keepered estates) and there has been a decline in hunting among

rural communities over the last number of decades. Therefore, this lack of knowledge is not surprising. However, if Conservation Keepering is to be an effective tool in the protection of Ireland's endangered ground nesting birds, this must be addressed.

Upscaling of the Conservation Keepering Scheme trialled in this project could provide opportunities not just for farmers, but also for their families and the wider rural community. Employment opportunities could be created in overseeing the scheme, in training farmers and as sub-contractors for farmers partaking in the Conservation Keepering Scheme. Conservation graduates, locals and gun club members could be encouraged to invest in developing their knowledge and skills to avail of these opportunities.

The current capacity of professional keepers in Ireland is a limiting factor, and an immediate barrier to the roll-out of the Conservation Keepering Scheme. Because of its contentious nature among the public, predator control for conservation is not actively promoted by the organisations carrying it out, and this creates barriers in itself. By default, it is not a well-known or obvious career path for individuals who might otherwise be interested.

To help address this, project staff gave Tralee IT Conservation Biology students a presentation on the role of predator control in conservation, and the work of the Curlew EIP in developing "Conservation Keepering". It also employed seasonal assistant keepers in each of the project areas, to act as an understudy to the permanent keepers. However much more needs to be done, and at scale. The establishment of certified training for perspective keepers in Ireland will be key. As will efforts to normalise predator control as a conservation tool for endangered ground nesting birds.

Direct participation by farmers and their families in the Conservation Keepering Scheme could help by raising awareness in their local community. However, it is also recommended that the organisations and agencies involved in conservation and predator management align and develop a shared statement of agreement on the need for predator control for conservation purposes.

8 Satellite Tagging of Breeding Curlew

Satellite tagging was first carried out by the Curlew EIP in 2021 due to difficulties in locating nests to trail nest fencing on (see Section 7.4), and as a means of directing predator control. Thereafter it was carried out in 2022 and 2023. Tagging was carried out at both sites.

Results from project work in Donegal (Moloney D. *pers com.*) and other projects across the UK showed that it was a valuable tool, both in the location of nests and in carrying out population and productivity monitoring (Potts P., *et al.,* 2019; Taylor R., *et al.,* 2000). The NPWS Curlew Conservation Project (CCP) also began satellite tagging in the same year and data from both the Curlew EIP and the NPWS CCP was combined for an MSc study to examine habitat usage and home range size during various stages in the breeding cycle, and to inform on future conservation measures for Curlew.

Satellite tagging breeding Curlew was still a relatively innovative approach when included for trial by the Curlew EIP. Within the Republic of Ireland, it had been trialled in Donegal (with support from the Local Biodiversity Action Fund (LBAF) and the CABB project), in Northern Ireland as part of the Lough Neagh Partnership (K. Mackie *pers com.*), and by only a few projects throughout the UK and Europe (Potts P., *et al.,* 2019; Taylor R., *et al.,* 2000; Gerritsen, G.J. 2021).

In Ireland, the Curlew EIP was the only project to carry out satellite tagging on the same sites and targeting the same birds in successive years, and this provided a unique insight into population dynamics.

8.1 Methods

Birds were caught by cannon netting at the start of the breeding season in April and May. Males were primarily targeted, due to their more aggressive response to tape lures and decoys, and because they stay with chicks until fledgling, unlike females (who usually leave when chicks are approximately two weeks old (Currie *et al.,* 2021)).
In order to catch birds, field staff first identified when birds were back on site and sufficiently territorial to capture using the lure and decoy. Too early, before birds are sufficiently territorial, or too late into incubation, birds are not aggressive enough to capture using this method.

The sex of birds caught was determined by bill length, according to Summers et. al. 2023.

Birds were fitted with remotely downloading Ornitela OT-9 or OT-10 solar powered tags (www.glosendas.net), which were *circa* 9.5 grammes. Tags were attached to a small area of clipped feathers on the birds back, using gauze and superglue. Caught birds were also fitted with a metal BTO ring and a combination of colour rings, unique to individual, for subsequent field identification in later years (see Table 21).

In 2021, GPS locations were taken every 5 minutes while battery levels exceeded 75%, every 10 minutes when battery levels were between 50% and 75% with less frequent readings below 50%. In 2022, GPS locations were taken every 10 minutes to 240 minutes depending on battery levels and tag performance.
GPS locations were taken less frequently between dawn and dusk.

All data and movements of tagged Curlew could be viewed on associated desktop platform. Data was typically set to download every 6 -24 hours depending on how current data was needed and tag battery performance.

8.2 Results

In total 12 birds were successfully tagged (*see Table 20*). In 2022, there was a fire on the Curraghline bog as the tagging programme was in progress. The area was within or beside three breeding Curlew territories, and as result of the fire, birds left the area. Only one bird returned and was caught when tagging resumed at a later date. No birds were tagged in 2023. Poor spring weather meant that birds were not obviously territorial or displaying and it proved too late into incubation when tagging was attempted.

Table 20 Number of birds satellite tagged per site and year.

Site	2021	2022	2023	Total no. tagged
Leitrim	4	4	0	**8**
Corrib	3	1	0	**4**
Total	**7**	**5**	**0**	**12**

Table 21 Colour ringing codes for all birds tagged, by site and year.

Year	Leitrim	Corrib
2021	ATP Yellow ATT Yellow ATU Yellow ATV Yellow	ATX Yellow AEH Yellow APA Yellow
2022	CPT yellow APY yellow AHT yellow AHU yellow	AHV yellow

Three of the tagged birds (all male), were confirmed breeding in 2021 through the location of nests from GPS fixes (APT and ATV in Leitrim and APA in Corrib). Tagging did not begin until mid-May in 2021 and it is possible that breeding for some birds caught, failed in advance. Satellite data for one male bird in Leitrim was indicative of a nest, but the site flooded before it could be confirmed by project staff, and the bird did not attempt to relay. This bird, together with three other birds (who did not attempt to breed) were recorded as non-breeding.

In 2022 three of the four birds tagged in Leitrim were confirmed breeding through the location of nests (two males APY and AHT and one female AHU). The Corrib bird (AHV) was non-breeding. Non-breeding birds were considered to be either adults of breeding age who had failed to find a mate, or juvenile birds who were prospecting/ visiting future breeding sites.

Only one bird tagged in 2021, returned in 2022 (ATV). New birds were found to be occupying the territories held by birds previously tagged (in 2021), in both Leitrim and Corrib.

In 2023, no birds were caught and tagged. ATV and his mate, a female tagged in 2022 (AHU) were the only birds to return to their breeding site in Leitrim. Again, new birds (obvious from the lack of colour rings) were found to be occupying territories held by some previously tagged birds, and in Leitrim there was an overall decline in the Curlew population (from five to two pairs). *See Figure 19, Section 9.3.* No birds tagged in either 2021 or 2022 returned to Corrib.

In 2021, the Corrib male APA was found predated within days of chicks hatching. Females typically leave when chicks are *circa* two weeks old, and it was not known whether his mate would remain with the chicks. As a precaution, the project applied to NPWS Wildlife Licensing Unit for a license to captive rear the chicks, however, it was decided not to intervene unless the female left. She stayed and successfully fledged two chicks on the 27 July.

In 2023, in Leitrim, the female AHU also stayed with her mate (ATV) until two chicks fledged on the 27 June. It is not known what influenced her decision to remain, as this is considered atypical behavior.

In his analysis of data on 25 birds tagged by both The Curlew EIP and the NPWS CCP (14 breeding and 11 non-breeding) Colclough, (2024), showed that there is a wide range of home ranges both for breeding birds (0.7km^2 to 46.5km^2) and non-breeding birds (28km^2 to 1,135km^2) including one bird that made several trips to the UK over the breeding season. During incubation, birds ranged from 0.04km^2 to 10.5km^2. During the chick rearing stage birds ranged between 0.3km^2 to 82.5km^2.

Of the 14 breeding birds, only one birds breeding season home range was within a 1km radius of its nest site (a bird tagged by the Curlew EIP). For all other birds, between 67-100% of their home range was contained within a 3km radius of their nest.
Of the six birds tagged by the Curlew EIP, 100% of four birds home range was contained within 2km of their nest. While for all six birds, between 75-100% of their home range was contained within a 3km radius of their nest.
Of these 14 tagged birds, breeding failed during incubation for three pairs, whilst ten failed during chick-rearing, with the Corrib female and mate of APA (the predated male), the only pair to successfully fledge chicks. Colclough, 2024.

Colclough, (2024), outlined the proportion of area within 1km of nest sites covered by trees. Table 22 below presents the results for the six breeding birds tagged by the Curlew EIP (one bird relayed on a second site in 2022). APY and AHT failed to hatch chicks, both were predated by avian predators; they had the highest proportion of tree cover at 0.21 and 0.20 respectively. APA had the lowest proportion of tree cover and was the only pair to successfully fledge chicks, from Corrib.

Table 22 Proportion of area covered by trees, within 1km of nest sites for Curlew EIP nesting attempts for satellite tagged birds.

Year	Site	Bird Id	Proportion of area within 1Km of nest site covered by trees
2021	Leitrim	ATP Yellow	0.14
	Leitrim	ATV Yellow	0.12
2022	Leitrim	APY yellow	0.21
	Leitrim	AHT yellow	0.14
	Leitrim	AHT yellow	0.20
	Leitrim	AHU yellow	0.11
	Corrib	APA Yellow	0.00

Post breeding birds tagged by the Curlew EIP were shown to disperse widely, with some Leitrim birds staying within or adjacent to the project area. Last known locations and dates are presented in *Table 23*, below.

Table 23 Last known location and dates of satellite tagged birds.

Year	Leitrim			Corrib		
	Bird Id	Last GPS fix	Last known location	Bird Id	Last GPS fix	Last known location
2021	ATP Yellow	07/08/2021	Drumgrilia, Co. Leitrim (within the Leitrim project area)	ATX Yellow	20/08/2021	Inch, Co Kerry
	ATT Yellow	25/08/2021	Ccloheen, Clonakilty, Co Cork	AEH Yellow	16/06/2021	Tonavane, Tralee, Co Kerry
	ATU Yellow	07/07/2021	Meelick Co Roscommon (adjacent to Leitrim project area)	APA Yellow	27/06/2021	Predated on breeding site
	ATV Yellow	08/07/2021	Fearagh, Co Roscommon (adjacent to Leitrim project area)			
2022	CPT yellow	29/07/2022	Cloonaman, Co Kerry	AHV yellow	29/06/2022	Grange, Co Galway (adjacent to Corrib project area)
	APY yellow	01/08/2022	Gortnagier West, Co Galway			
	AHT yellow	10/08/2022	Lack, Co Clare			
	AHU yellow	12/07/2022	Lisdeen, Co Clare			

8.3 Discussion

Curlew are particularly cryptic breeders and locating nests is notoriously difficult. Most nest found by this project were located through satellite tagging (see Section 7.4). Identifying exact nesting locations, helps in distinguishing key fields or areas to focus habitat related or predator management

work. Therefore, it is an incredibly important tool in the conservation of breeding Curlew and should be retained and expanded where possible.

Non-breeding satellite tagged birds were found to be highly territorial and exhibit typical breeding behaviour (display flights and calling), holding territory for successive survey visits. In the past it was thought that only breeding birds exhibited this behaviour. Some were also observed loosely chick calling when in the vicinity of breeding birds with chicks. In both Leitrim and Corrib, particular non-breeding satellite tagged birds were shown to have visited pairs with chicks within days of hatching. In some cases, they were judged to be too far from these pairs to have been attracted by chick alarm calling. It is unknown if this was coincidental or whether they were attuned to other cues. If this behaviour can be identified and isolated, it may be possible to locate breeding Curlew by surveying areas visited by these tagged non-breeding birds.

Similar behaviour of non-breeding birds has been found by other satellite tagging projects in the UK and Europe (Gerrit Gerritsen, Netherlands, Rachel Taylor UK *pers com*.).

The behaviour of non-breeding birds has implications for population and productivity analysis of Curlew using standard methodology. Typically displaying birds, holding territory over successive visits would be considered as probable breeders and would be included in population and productivity data. It is likely that such analysis is both overestimating the breeding population and underestimating the productivity of breeding pairs. Factoring this into future analysis will be difficult.

Satellite tagging is one of the most reliable means of determining with certainty if birds are actively breeding or non-breeders. However, repeat tagging is not a viable approach as birds are known to be difficult to catch on successive attempts (Colhoun, K., Makie K., *pers com*.). It is therefore vital that other methods to assess breeding status and/or locate nests (such as Conservation Dogs, and further work on drone techniques) are improved or developed.

Of the 12 birds tagged by this project only two returned to the project area in subsequent years. Existing territories were occupied by new birds, and without tagging these new birds would have been judged to be the former birds. Productivity for Curlew has long been below the level required for population stability (O'Donoghue *et al.,* 2019). Given the findings of this study, one possible explanation for the low incidence of returning adults is high rates of adult mortality at these sites, because of an aging population with little inward recruitment (from successful breeding).

Population and productivity data outline in this section and in Section 9.3, appear to concur. In Corrib, high productivity has largely only stabilised populations, while in Leitrim where low productivity is occurring population have begun to decline rapidly. Low productivity must be

addressed urgently, if national and local Curlew populations are to be saved from extinction. It is therefore considered that head stating is vital, in the short term at least.

Brown *et. al.* (2015) found that there was an edge effect, with forests/woodland leading to greater populations of Corvids and Fox and increased predator pressure on nests on open ground within 1km or more. In this study, both nests that failed at the egg stage had the highest proportion of trees within 1km of the nest site. It is likely that Corvid populations were higher in these areas. All birds that hatched chicks failed, except for in Corrib which had no woodland within 1km of the nest.

This has implications for Irelands afforestation policy, especially in light of findings on Curlew home range during the breeding season, with most birds tagged by this project having a home range of at least 2km around nest sites. Ireland new afforestation programme 2023 only safeguards a 1.5km radius around known nest sites. In addition, nest sites can move year to year, therefore minimum distances of 1.5km may not adequately protect breeding Curlew in any given year. Increased buffers must be incorporated in Ireland's new afforestation policy, if we are to adequately protect Irelands last remaining breeding Curlew.

9 Population and Productivity Monitoring

The Curlew EIP project areas in south Lough Corrib and the south Leitrim bogs area are nationally important for breeding Curlew. When the project commenced, together they held *circa* 10% of Irelands breeding population (six and six to eight pairs respectively). (O'Donoghue *et al.,*2019).

The aim of surveys was to monitor Curlew nesting locations and breeding productivity within the project areas, with a focus on surveying areas where breeding pairs were recorded in previous years. On going monitoring also ensured that the Conservation Keepers were working in the most appropriate areas to safeguard breeding attempts, and that any work with farmers, was appropriately targeted. It also allowed for nest fencing to be trialled, by identifying nest sites.

Generally, estimates of populations and productivity are made by carrying out standard field surveys, usually 3-5 visits per site over the course of the breeding season (O'Brien & Smith 1992), or by more intensive methods involving nest monitoring and radio tracking of chicks. This project used the standard field survey method, but increased survey visits in frequency and number where pairs were confirmed breeding. Satellite tagging also assisted in population and productivity monitoring (*See Section 8*).

The areas surveyed by the Irish Breeding Curlew EIP also contained suitable habitats for other breeding waders, Northern Lapwing, Snipe and Redshank. Breeding populations of these species have also experienced significant declines in recent years (Gilbert *et al.,* 2021; Henderson *et al.,* 2002). Population and productivity data was also collected on these species, where present.

9.1 Site Selection

Curlew EIP target areas included the locations of breeding pairs from the 2015-2017 NPWS National Breeding Curlew Survey and applied a buffer zone of 1km around each breeding area. Additional areas were added based on project team observations or reports by farmers and the public.

9.1.1 South Leitrim bogs

The thirteen previously occupied sites in Leitrim mostly comprised of bog and adjacent agricultural land (O'Donoghue *et al.,* 2019). Some of the sites overlapped and for the purposes of surveying by

this project, these were usually combined and given one name, for example Aghnamona Bog. In total nine sites (comprising of all 13 previously occupied territories) were surveyed. Two sites, Cloonageeher and Esker North, extend into Co. Longford. *See Figure 1 for locations*.

Nine sites surveyed were:

- Aghnamona Bog NHA, Co. Leitrim
- Cashel Bog NHA, Co. Leitrim
- Cloonageeher Bog NHA, Co. Leitrim/Co. Longford
- Corracramp Bog NHA, Co. Leitrim
- Drumgilra Bog, Co. Leitrim
- Drumhirk, Co. Leitrim
- Esker North, Co. Longford/Co. Leitrim
- Tooman Bog, Co. Leitrim
- Tulcon Bog, Co. Leitrim

9.1.2 South Lough Corrib

Eight sites were surveyed in south Lough Corrib, these were broken down into areas of surveying and included:

- The Curraghline Wetlands
- Curraghmore Bog
- The Corrib Islands - Walsh's Island and Illaunnashinnagh, Illaunnvaragh/Browne's Island
- Wormhole
- The Floating Bridge
- Coarsefield and an extension to Curraghline
- Muckrush
- Portdarragh

Sites fell within the boundaries of Lough Corrib SAC and SPA except for Coarsefield and Wormhole which fell within Lough Corrib SAC only. *See Figure 2 for locations*.

9.2 Methodology

Survey methodology was in line with O'Brien and Smith (1992). Where possible three to six survey visits were carried out during the breeding season between the following dates:

- Visit 1: late March to April 14th
- Visit 2: April 15th to May 8th
- Visit 3: May 9th to May 28th
- Visit 4: May 29th to June 18th
- Visit 5: June 19th to June 30th
- Visit 6: July 1st to July 14th

Where breeding extended past the 6th visit, subsequent visits were carried out until breeding finished.

Sites were walked to within 100-200m of all suitable breeding and feeding habitat. Vantage point surveys were carried out where possible and when birds were recorded on a site. If no birds were seen by the third visit, subsequent visits were not carried out. Bird numbers, flight lines and behaviour were recorded on field maps during each visit. For sites in close proximity to each other, such as the South Leitrim bogs or mainland sites in Lough Corrib, coordinated visits were carried out by project staff to ensure pairs were not moving between sites and therefore double counted.

Where birds were satellite tagged, walk over surveys were no longer carried out (although they continued where other breeding wader species were present), and bird were monitored through the platform, with follow up vantage point surveys in the field.

Location of a nest with eggs/young or chick alarm calling by adults was taken as confirmed breeding, all other pairs were recorded as probable / possible breeders, provided they were seen in the same area on repeat visits. Where birds were confirmed breeding, these sites were visited at least weekly to monitor breeding success more closely. As the estimated fledging date approached, sites were visited even more frequently to confirm fledging. In cases where brood calling continued up until the estimated fledging date, but fledglings were not seen, these pairs were regarded as having successfully fledged young and attributed a value of one fledgling per pair. Outcomes were judged to have failed if adults were no longer observed, before fledging was expected. Where there was some doubt, outcomes were classified as unknown.

Breeding status* was identified using BTO behaviours:

Table 24 BTO breeding status codes.

Catogory	Code	Defination
Non-breeding:	**FO**	**F**lying Over
Possible Breeding:	**SH**	**S**ingle Curlew seen/heard in suitable nesting **H**abitat
	PH	**P**air of Curlew seen/heard in suitable nesting Habitat
Probable Breeding:	**CD**	**C**ourtship and **D**isplay observed (in/near breeding habitat)
	PT	**P**ermanent Territory presumed, after territorial behaviour (song, display etc) seen on at least two different days a week or more apart, at same place
	AN	**A**gitated behaviour and alarm calling from adults, but left the site or flew away from the observer. (i.e. **N**ot AP as below)
	NS	Seen dropping down and moving to probable **N**est **S**ite or seen sitting and presumably incubating
Confirmed Breeding:	**AP**	**A**gitated showing **P**ersistent and vociferous, remained in area or returned quickly, possibly flew in tight circles above observer (indicates nest/young)
	NE	**N**est with **E**ggs found
	NY	**N**est with **Y**oung found
	CH	**Ch**icks recorded (with or without adult present)
	FL	Recently **Fl**edged young seen in suitable habitat or near suspected nest or territory

Productivity was calculated using total number of pairs, to ensure that figures are representative of any attempts that failed prior to hatching; and to ensure comparability with previous Curlew surveys. However, figures have also been presented based only on pairs that were confirmed breeding (nests with eggs/chicks or chick alarm calling adults), as it is known from satellite tagging that some probable breeders were in fact non-breeding birds (*see Section 8*).

Breeding evidence was recorded for other breeding wader species (Lapwing, Redshank and Snipe) during sites visits and when present in the area.

9.3 Results

Surveys between March and May (visit 1 – 3) are important in establishing territorial breeding birds. In 2020 surveys only began during Visit 3 (May 9 - May 28) when staff resumed fieldwork in line with NPWS field staff and government Covid-19 guidelines. It is possible that breeding failed for some birds before this, and it is considered that the 2020 survey data is incomplete.

Number of pairs and productivity per sites and location are presented in Tables 25 and 26 below. *For locations See Figure 1 and Figure 2.*

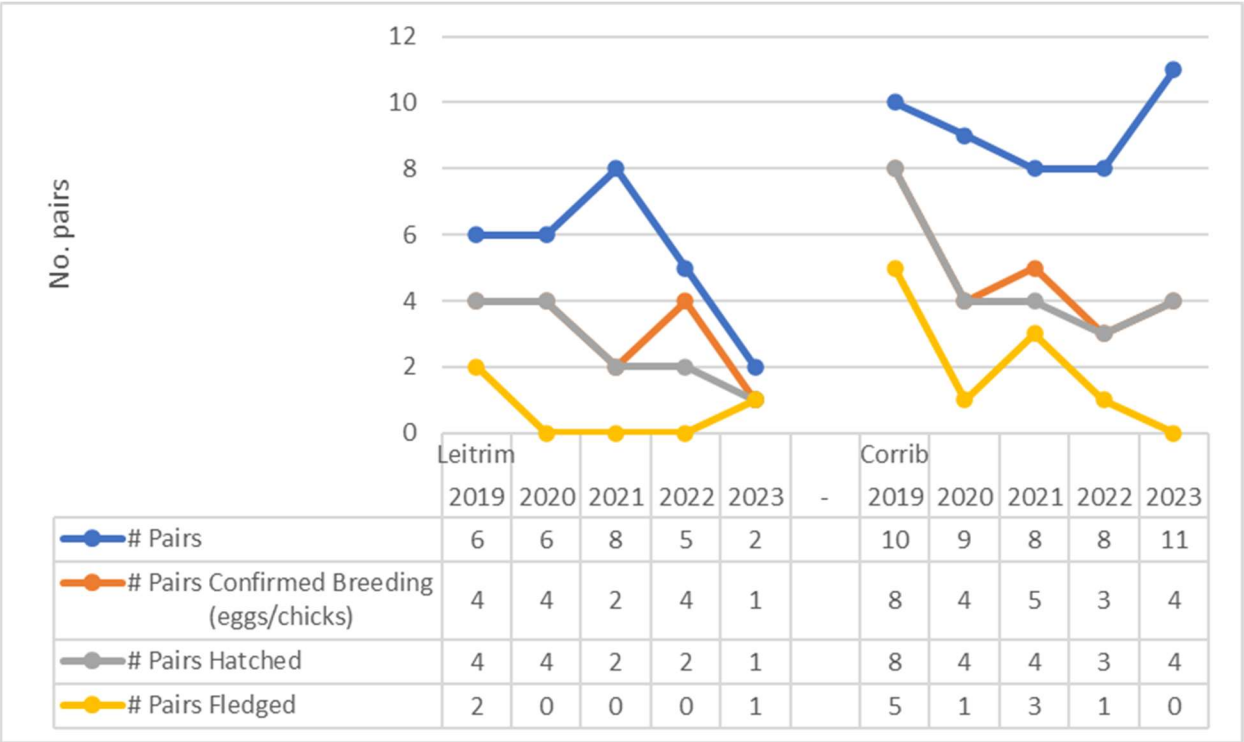
Table 25 Number of pairs and productivity per site and year, Lough Corrib.

Site/Location	Total no. Pairs					Total number of pairs confirmed breeding (nest / chicks)					No. Pairs Hatched					No. Pairs Fledged					Total no. Fledged* Chicks seen					Total Productivity All Pairs					Total Productivity by Pairs Confirmed Breeding				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Curraghline Wetlands	1	1	1	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Curraghmore Bog	0		1	0	0	0	0	1	0	0	0		1	0	0	0	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	2	0	0
Walsh's Island	2	2	1	1	1	2	0	1	u*	0	2	0	0	u*	0	2	0	0	0	0	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Illaunnashinnagh Island	2	2	2	2	2	2	1	2	2	1	2	1	2	1	1	2	0	2	0	0	2	0	2	0	0	1	0	1	0	0	1	0	1	0	0
Portdarragh	1	1	0	1	1	1	1	0	0	0	1	1	0	0	0	u	1	0	0	0	u	1	0	0	0	0	1	0	0	0	0	1	0	0	0
Wormhole	0	0	1	1	3	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Addergoole Wetland	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Floating Bridge	2	2	1	2	2	2	1*	0	2	0	2	1	0	2	0	1	0	0	1	0	1	0	0	2	0	0.5	0	0	1	0	0.5	0	0	1	0
Coarsefield/Curraghline	1	1	1	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muckrush	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10	9	8	8	11	8	4	5	3	4	8	4	4	3	4	5	1	3	1	0	5	1	4	2	0	0.5	0.11	0.5	0.25	0	0.63	0.25	0.8	0.67	0

Table 26 Number of pairs and productivity by site and year, Leitrim.

Site/Location	Total no. Pairs					Total number of pairs confirmed breeding (nest / chicks)					No. Pairs Hatched					No. Pairs Fledged					Total no. Fledged Chicks*					Total Productivity All Pairs					Total Productivity by Pairs Confirmed Breeding				
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023
Aghnamona Bog	1	0	3	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Cashel Bog	1	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cloonageeher Bog	1	1	1*	1	0	1	1	0	1	0	1	1	0	0	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	2	0	0	0	0
Corracamp Bog	1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drumgilra Bog (Farnagh)	0	0	0	1 (relay)	1	0	0	0	1 (relay)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drumhirk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Esker North	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tooman Bog	2	2	2	1	0	1	1	0	0	0	1	1	0	0	0	u	0	0	0	0	u	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tulcon Bog	0	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	2	0	0	0	0	2	0	0	0	0	2
Total	6	6	8**	5	2	4	4	2	4	1	4	4	2	2	1	2	0	0	0	1	3	0	0	0	2	0.5	0	0	0	1	0.75	0	0	0	2

Total number of pairs recorded in each project area between 2019 - 2023 are presented in Figure 19 below.



	Leitrim						Corrib				
	2019	2020	2021	2022	2023	-	2019	2020	2021	2022	2023
# Pairs	6	6	8	5	2		10	9	8	8	11
# Pairs Confirmed Breeding (eggs/chicks)	4	4	2	4	1		8	4	5	3	4
# Pairs Hatched	4	4	2	2	1		8	4	4	3	4
# Pairs Fledged	2	0	0	0	1		5	1	3	1	0

Figure 19 Total no. of pairs, pairs confirmed breeding, hatching, and fledging by area and year.

Between 2019 and 2023, the total number of pairs decreased from 16 to 13 pairs in the project areas, and the number of pairs confirmed breeding decreased from 12 to 5 pairs. Declines were variable between sites, with Corrib recording an increase in total number of pairs, although numbers of confirmed breeding pairs declined. Leitrim experienced pronounced declines between 2019 and 2023.

For Curlew, productivity (no of young fledged per pair) of 0.48 – 0.62 is required for a stable population. National productivity figures are between 0.16 – 0.51 per pair, below this level (O'Donoghue *et al.,* 2019).

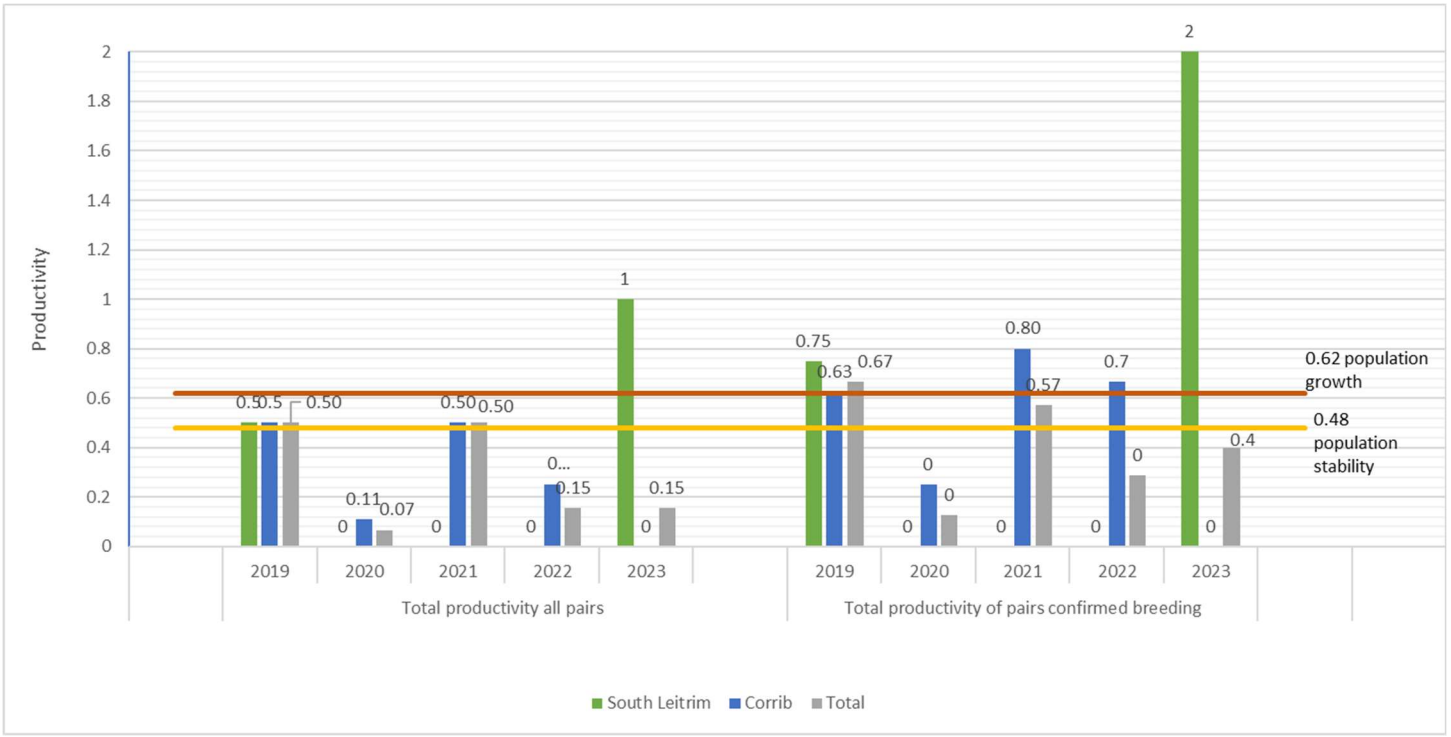


Figure 20 Productivity presented by total number of pairs, and number of pairs confirmed breeding, by site and year.

Productivity results are presented here, for both total number of pairs recorded (using standard methodology) and total number pairs confirmed breeding (through locating nests or observing chick calling), due to learnings from the satellite tagging project (*see Section 8*). It is likely that the real productivity figure is somewhere between these two, as some pairs may have failed before they were confirmed breeding.

Productivity as measured against total number of pairs achieved figures required for population stability (0.48) in both 2019 and 2021 for all areas, and figures required for population growth (0.62) in Leitrim in 2023. When only measured against total number of pairs confirmed breeding, all sites were at or above the level needed for population growth (0.62) in 2019. Corrib recorded productivity figures above the level needed for population growth in both 2021 and 2022, while Leitrim was well above the figure needed in 2023.

Leitrim had exceptionally poor productivity in most years with no fledglings produced, and consequently populations showed continual decline. Most juvenile birds do not breed until their second or third year and it is considered that the high productivity figures recorded in Corrib in 2019, 2021 and 2022 resulted in population stability and lead to an increase in numbers of pairs recorded in 2023. *See Figure 20.*

9.3.1 Results of other wader species

Table 27 Population and productivity of all other Breeding Waders species in Corrib, by species, site, and year.

		No. pr	No. pr hatched	No pr fledged	No. pr. failed	No. pr	No. pr hatched	No pr fledged	No. pr. failed	No. pr	No. pr hatched	No pr fledged	No. pr. failed	No. pr	No. pr hatched	No pr fledged	No. pr. failed	No. pr	No. pr hatched	No pr fledged	No. pr. failed
Lapwing	**Curraghmore Bog**	1	1	1	0	1	1	1	0												
	Floating Bridge	2	1	1	1	2	2	1	1	1	0							2	2		
	Curraghline Wetlands	20	18	17	3	14	11	8	2	12	7			8	5			1	1		
	Portdarragh & Bohilmore	2	0	0	1	5	2	2	1					1	0						
	Wormhole	1	0	0	1	3	1	1	0	0	0			1	0						
	Muckrush	2	1	1	0	1	2	2	1	3	3			3	3			3	3		
	Addergoole Wetland	0	0	0	0																
	Coarsefield/Curraghline	2	0	0	2	3	2	2	0	3	3							3	3		
	Illaunnashinnigh	1	1	u	0	3	3	2	0	1	1										
	Walsh's Island	0	0	0	0	0	0	0	0												
	Total	**31**	**22**	**20**	**8**	**32**	**24**	**19**	**5**	**20**	**14**			**13**	**8**			**9**	**9**		
Redshank	**Curraghmore Bog**	1	1	1	0	5	3	3	1												
	Floating Bridge	0	0	0	0	1	1	1	0					1	0						
	Curraghline Wetlands	18	16	15	2	5	4	4	0	5	5			4	4						
	Portdarragh & Bohilmore	1	0	0	0	1	1	1	0												
	Wormhole	1	0	0	1	1	1	1	0					1	0						
	Muckrush	7	6	6	0	3	3	3	0	3	3			3	3			3	3		
	Addergoole Wetland	1	0	0	1																
	Coarsefield/Curraghline	0	0	0	0	0	0	0	0	2	2			2	2						
	Illaunnashinnigh	1	0	0	1	3	3	2	1	0	0										
	Walsh's Island	0	0	0	0	1	1	1	0												
	Total	**30**	**23**	**22**	**5**	**20**	**17**	**16**	**2**	**10**	**10**			**11**	**9**			**3**	**3**		
Snipe	**Curraghmore Bog**	0	0	0	0	3	3	2	u												
	Floating Bridge	4	2	2	0	5	3	2	1	1				1							
	Curraghline Wetlands	16	8	8	0	3	2	2	0	2				3							
	Portdarragh & Bohilmore	0	0	0	0	3	2	2	0												
	Wormhole	0	0	0	0	4	2	2	1	3											
	Muckrush	3	1	1	0	2	2	2	0	0				2				14			
	Addergoole Wetland	1	0	0	0																
	Coarsefield/Curraghline	0	0	0	0	8	5	5	2	0								1			
	Illaunnashinnigh	0	0	0	0	2	2	2	0	0											
	Walsh's Island	0	0	0	0	2	2	1	0												
	Total	**24**	**11**	**11**	**0**	**32**	**23**	**20**	**4**	**6**				**6**				**15**			
	All Species Total	**85**	**56**	**53**	**13**	**84**	**64**	**55**	**11**	**36**	**24**			**30**	**17**			**27**	**12**		

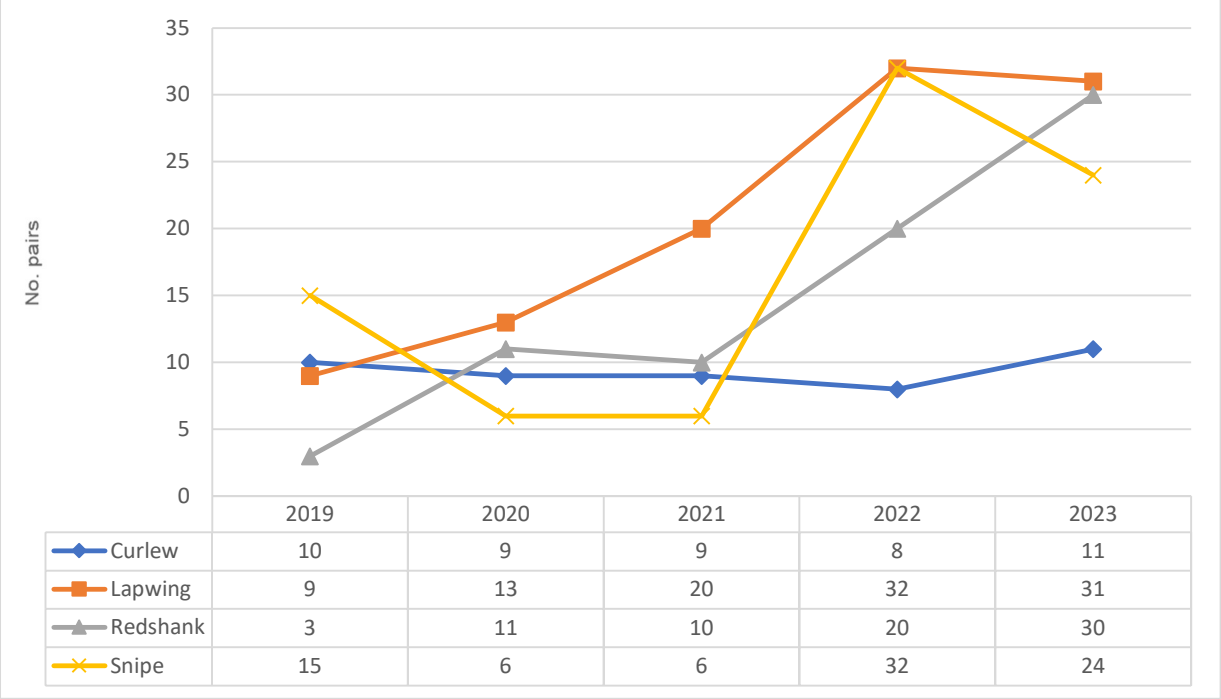
Sites which were not surveyed in any given year have been left blank. Where productivity was not gathered these columns are also left blank.

The Lough Corrib project area also holds good populations of Lapwing, Redshank and Snipe. Breeding populations of these species have also experienced significant declines in recent years (Gilbert *et al.,* 2021; Henderson *et al.,* 2002). The habitat and predator control measures in place to benefit breeding Curlew are known to benefit these species also. Finney *et al.* 2014

Table 27 shows population and productivity data for all other wader species between 2019 and 2023, by site and year. Population data was gathered every year, however figures shown for Lapwing, Redshank and Snipe between 2019 and 2020 represent the maximum number of breeding pairs/pairs brood calling observed on a single survey visit (rather than standard methodology as per O'Brien & Smith 1992). In addition, and due to staff capacity, productivity data was only accurately gathered in 2022 and 2023, in all other years records were somewhat incidental while field staff were out on site.

Snipe are notoriously difficult to survey (Hoodless *et al.* 2006) and demand intensive survey effort; therefore population data was not gathered as intensively between 2020 and 2021 as for other species. It is also likely that productivity figures in all years are under recorded due to survey effort.

Populations for all species showed a marked increase since the project began and total populations increased by 215 % from 27 to 85 breeding pairs. *See Table 27 and Figure 21.*



	2019	2020	2021	2022	2023
Curlew	10	9	9	8	11
Lapwing	9	13	20	32	31
Redshank	3	11	10	20	30
Snipe	15	6	6	32	24

Figure 21 Total number of pairs for all species, by year in the Corrib project area.

Table 28 Number of fledged young per pair, by species Lough Corrib 2022 and 2023.

a) 2022

Species	Total no pairs	No pairs seen with fledglings	No Fledglings seen	Estimated total no of pairs known to have fledged	Estimated total no fledglings per pair
Lapwing	30	16	23	6	0.97
Redshank	20	12	15	4	0.95
Snipe	32	5	9	16	0.78

b) 2023

Species	Total no pairs	No pairs seen with fledglings	No Fledglings seen	Estimated total no of pairs known to have fledged	Estimated total no fledglings per pair
Lapwing	31	8	22	12	1.10
Redshank	30	3	14	9	0.77
Snipe	24	1	4	10	0.58

Pairs that were not seen with fledglings but were known to have successfully fledged chicks have been attributed a value of one fledgling per pair.

The standard rates for population growth/stability in Lapwing are 0.83-0.97 (Peach *et al.* 1994). There are no figures for Redshank, or Snipe. Lapwing productivity has been above the level required for growth in both 2022 and 2023. *See Tables 28a & b.*

Snipe is the only other wader species found on project sites in Leitrim. Population and productivity data were not gathered for Leitrim. Without the need to survey for other species (such as Lapwing and Redshank), surveys were considered less beneficial and likely to cause disturbance to breeding Curlew; and because many of the Curlew monitored on Leitrim sites were satellite tagged, thereby eliminating the need for walk over surveys.

9.4 Discussion

Based on the results of the 2021 NPWS National Breeding Curlew Survey, the project area now accounts for 12% of the national breeding Curlew population (possible to confirmed breeding pairs), with eleven and two pairs respectively. Populations in Corrib have stabilized and increased slightly, while populations in Leitrim have continued to decline.

For total number of Curlew recorded in the project area, populations showed productivity rates below the 0.42 required for population stability in three of the five survey years. Overall total populations declined, although this decline was concentrated in the Leitrim area. Populations in Corrib stabilised and began to show growth over the lifetime of this project. There appeared to be enough recruitment into the population to account for the loss of adults observed by the satellite tagging project; believed to be a result of adult mortality in an aging population (*see Section 8*).

Curlew populations are still as critical as when the project first began, with continued declines both nationally and within the project area. However, results for Corrib and other NPWS CCP sites point to some successes (Colhoun, *et al.* 2022). Genuine growth will only be seen once populations have been stabilised. In Corrib, over the short timescale of this project population stability was achieved. It is now imperative that the work initiated by this project continues if population growth is to be achieved. Only then will the true effect of the measures trialled by this project be realised. While Corrib shows some level of success, if local populations are to be saved in Leitrim substantial efforts will need to be made to address habitat limitations and the very high predator populations.

10 The use of Drones to locate Curlew Nests

The use of drones to locate or survey species is becoming increasingly common. They have the advantage of being able to cover large areas in a short timescale, while causing minimal disturbance to the target species. The use of drones to locate nesting Curlew was trialled during the 2021 breeding season. Drone Consultants Ireland were employed to carry out this work.

10.1 Methods and Equipment

10.1.1 Equipment

A DJI M200 drone with a high-grade thermal imaging camera Zenmuse XT2 (thermal sensitivity 40-50mK), was used. Its capabilities and software options were considered capable of providing accurate co-ordinates on the identified heat sources of sitting Curlew, for ground truthing by project staff.

10.1.2 Methods

Drone surveys were carried out on areas know to hold Curlew, and as identified by project staff by the presence of territorial and displaying Curlew. However, the presence or location of nest was not known.

Each location was inspected before flight to identify any hazards to the craft i.e. overhead cables, or sharp inclines in topography which would interfere with communication with the drone. All surveys were carried out in suitable weather conditions with good visibility, and no wind.
Beginning between 3:30am and 4:00am the drone was flown slowly at an altitude of 25-30 meters using a grid pattern with the camera facing straight down. Surveys were initially carried out using thermal imaging, and as daylight improved switched between cameras to confirm locations or visually identify objects. Multiple “drone cycles” took place throughout the course of the day until early afternoon.

10.2 Results

Surveys were carried out in Lough Corrib on the 11 May 2021 and in Leitrim on the 14 and 15 May 2021. It was anticipated that birds would be incubating at this stage and therefore provided the best chance of trialling this approach for nest finding. By carrying out surveys in both Lough Corrib on wet grassland sites, and in Leitrim on bogs, its potential use in different habitat types was investigated.

No nesting Curlew were identified in either location. The thermal camera proved too sensitive in these habitats and was unable to distinguish between the multiple sources of thermal emissions. As a result, there were overabundant and indiscriminative heat signatures displaying on the monitor from wet ground, pools or damp flushes.

It was originally intended to use visual surveys to verify possible nesting Curlew identified by thermal surveys. However, given that none could be identified through thermal surveys, it was decided to carry out visual surveys (using the same grid pattern), to investigate whether it was possible to locate sitting Curlew visually. This approach has been used with some success in the UK, although software was employed to analyse the data which took several weeks. No Curlew were located using visual surveys, and the project did not have access to the relevant analytical software used in the UK.

10.3 Discussion

The wet and damp landscapes that Curlew breed on were found to severely limit the ability of this technology to identify nesting Curlew. It is possible that no incubating Curlew were present in either of these sites to begin with. Although field surveys recorded Curlew which were territorial and exhibiting breeding behaviour on all sites prior to carrying out drone surveys, hatching was only confirmed on one site later in the breeding season. Thus, its effectiveness as a tool for locating nesting Curlew cannot be ruled out by the results of this trial.

It is recommended that any future thermal drone trials first include a survey of a known nest location. Following this, the thermal camera should be calibrated to record within a narrower temperature range (which includes the thermal heat signature of a sitting Curlew). This may eliminate a range of the heat signatures and increase the likelihood of a sitting bird being detected but is not guaranteed and would require careful testing.

11 Assessing the Effect of Turf Cutting on Breeding Curlew.

As part of the project, a dialogue was to be formed with local turbary rights owners to work with them to create a management plan for bogs with breeding Curlew, with measures to minimise disturbance and carry out habitat improvement works. Early in the project the technical advisor from the Turf Cutters and Contractors Association (TCCA) advised that this element be postponed indefinitely, as negotiations were at a sensitive stage between NPWS and local turf cutters in the areas. It was felt that the measures proposed by NPWS needed time to bed in with local TCCA members.

In South Leitrim all Curlew recorded were breeding on bog sites. Although these are important habitats, under CAP Pillar II rules they are not eligible for agri-environmental payments. The EIP programme did have the facility to make payments on non-utilisable agricultural (UA) land. Consequently, in consultation with DAFM, and because of the postponement of bog management plans, it was decided to try and develop a new option (additional to the project proposal) specifically targeted at working with farmers to improving Curlew breeding habitat on bog sites.
The Curlew Bogs Scheme was to be a results-based payments option to reward landowners for maintaining or improving habitat and managing bogs in a Curlew-friendly manner. Two suitable bogs were shortlisted, based on their size and site conditions and work to identify land ownership was carried out. A combination of suitable indicators was due to be developed to assess the physical/hydrological characteristics of the bog as well as the vegetative composition and structure of flora. It was anticipated that this new measure would be ready for trial by 2021. However, increased workloads in delivering core elements of the project, due to Covid-19 meant that this option was not developed further.

Instead, in late 2020 the project reached out to the NPWS Bog Restoration project to see if co-operative works could be developed between DAFM through the Curlew EIP and NPWS.
Many farmers in South Leitrim with otherwise suitable Curlew habitat in priority areas were ineligible to participate in a Curlew Habitat Option, due to areas of scrub between their land and the bog on which Curlew were breeding. This scrub was, in most cases, not under the control of the farmers in question.
In spring 2021, it was agreed that the Curlew EIP would assist the NPWS Bog Restoration project by liaising with farmers in the project area, outlining to them the benefits of carrying out bog restoration works, which would both benefit breeding Curlew and facilitate their entry into future

agri-environmental measures for breeding Curlew. NPWS agreed to carry out tree and scrub removal on key areas of NHA bogs with breeding Curlew, thereby complementing the CW carried out by the Curlew EIP. These were to be carried out in areas that the project would not otherwise have access to, or the budget to implement. Works were to begin in September 2021, however the NPWS Bog Restoration project did not progress with these, or any other bog rehabilitation works in Leitrim thereafter. It is recommended that a mechanism to progress this work in the future be investigated.

12 Dissemination and Outreach

12.1 Local Advisory Groups

A LAG was scheduled for March 2020, this meeting was cancelled due to the Covid-19 pandemic.

12.2 Conferences, Events and Meetings

- **Corrib Beo conference** – The Project manager gave a presentation in 2019.
- **The International Wader Study Group Conference** - the Project Manager attended the on-line conference on the 10 –11 October 2020. This is an important conference where international experts on wader research and conservation management can interact.
- **Burren Beo conference** – The Project Manager attended on-line on the 21 and 22 October 2020.
- **Meeting with Minister Noonan** - The Project Manager represented the Curlew EIP at a meeting with Minister Noonan on farmland bird declines and the decline in breeding Curlew and other waders, on the 19 November 2020,
- **The Irish Wildlife Trust** – The Project Manager gave a presentation for as part of their Birds on the Edge webinar on the 1st February 2021. https://iwt.ie/what-we-do/communication/webinars/
- **Laoise Wildlife trust** - The project Manager gave a presentation for Word Wetlands Day on the 2 February 2021
- **Teagasc Webinar** - The Project Manager gave a presentation as part of the Extensive Farming and EIP's Webinar on the 16 February 2021.
- **BirdWatch Ireland Meath Branch** – The Project Manager gave a presentation - Curlew Project - Hopes and Prospects for Irelands most critically endangered bird, on the 3 May 2021 https://www.youtube.com/watch?v=1ftAyA5goFc
- **Meeting with Minister Noonan** - The Project Manager represented the Curlew EIP at a meeting with Minister Noonan to highlight the factors affecting breeding Curlew (and other breeding waders) and calling for the inclusion of a National Breeding Wader EIP to be included in Irelands CAP Strategic Plan, in March 2022.
- **Site visit with Minister Pippa Hackett** – The Project Manager attended a site visit with Minister Hackett to discuss the factors affecting breeding waders and Curlew in Ireland and the Shannon Callows, and to outline the rational for the inclusion of a Shannon Callows EIP

in Ireland CAP Strategic Plan, in June 2022. https://www.pippahackett.ie/post/shannon-callows-farmers-outline-the-challenges-they-face

- **Teagasc Signpost Serious** - The Project Manager gave a presentation on the 17 November 2023. https://irepod.com/podcast/the-signpost-series/the-irish-breeding-curlew-eip
- **CAP Network Ireland** – The Project Manager gave a presentation at a seminar on establishing a local need, on the 10 October 2023. https://www.youtube.com/watch?v=r4SJcL3djzM&t=475s

12.3 Local and National Media

- **Shannonside FM News and as a Podcast** - The Project Manager gave a radio interview aired in early June 2020. https://www.shannonside.ie/news/local/leitrim/heartbreak-leitrim-curlew-project-death-chicksjust- days-hatching/49
- **Leitrim County Council's Connecting Through Heritage Podcast** – The project ecologist took part in series. An interview was carried out in August 2020. https://leitrimheritage.buzzsprout.com/
- **European Commission Representative in Ireland** - The Project Manager contributed to a European Commission publication "*What's the Story" – 25 Irish Success Stories celebrating Irelands EU membership, in 2020.* https://vb.nweurope.eu/media/8076/25_stories_art_v02_singlepages.pdf
- **ITV Tonight Show** - The Project Manager contributed to a television interview in June 2020.
- **Mooney Goes Wild** - The Project Manager was interviewed on for a programme about Curlew Conservation. The programme was aired on 4 January 2021. https://www.rte.ie/radio/radio1/mooney/2020/1130/1181519-mooney-goes-wild-monday-30-november-2020/
- **BirdWatch Ireland Web-site** – The project Manager published an article for World Curlew Day: *celebrating one of Ireland's most precious birds* on April 21 2021 https://birdwatchireland.ie/world-curlew-day-celebrating-one-of-irelands-most-precious-birds/
- **British Birds** - The Project Manager contributed to the following scientific paper: David J. T. Douglas, Daniel Brown, Simon Cohen, Mary Colwell, Anita Donaghy, Allan Drewitt, Kathryn Finney, Samantha Franks, Danny Heptinstall, Geoff Hilton, Sean Kelly, Patrick Lindley, Ben McCarthy, Neil McCulloch, Barry O'Donoghue, Sarah Sanders, Patrick Thompson and Sian Whitehead. *Recovering the Eurasian Curlew in the UK and Ireland: progress since 2015 and looking ahead.* June 2021 – vol. 114, issue 6, pp 341–350

https://britishbirds.co.uk/content/recovering-eurasian-curlew-uk-and-ireland-progress-2015-and-looking-ahead

- **Noteworthy, The Journal Investigates** - The Project Manager contributed to an article by Niall Sargent titled: *A win for farming, a win for nature: scheming for sustainability -Farm subsidies to protect biodiversity need to be channelled into results-led projects*. 8 October 2021 https://www.noteworthy.ie/cash-cow-pt2-5565511-Oct2021/
- **Friends of Ardee Bog –** The project ecologist gave a presentation at the Friends of Ardee Bog's Bog Café in County Louth on the 25 September 2022.
- **Irish Birds -** The Project Manager contributed to the following scientific paper: Kennedy J., Finney K., Lusby J., Moloney D., Duggan O., Donaghy A., (2023) Mapping of Farmland Bird Hotspots: a method to assist targeting of agri-environment measures. Irish Birds 45: 35–48
- **BirdWatch Ireland Wings Magazine** – The Project Manager contributed to an article on the Irish Breeding Curlew EIP for the Spring 2023 edition.

12.4 Social Media and Website

A website page for the Curlew EIP is hosted through the BirdWatch Ireland website (https://birdwatchireland.ie/our-work/species-habitat-conservation/countryside-wetlands/curleweip/).

A twitter account for the Curlew EIP (@CurlewEIP) is managed by the Project Manager. It currently has 2230 followers.

In addition, the project has been publicised through the following web-sites:

- **National Rural Network** https://nationalruralnetwork.ie/eip-agri/eip-agri-case-studies/conservation-of-breeding-curlew-in-ireland/
- **European Commission Website**. Representation in Ireland. BirdWatch battles to save the Curlew https://ireland.representation.ec.europa.eu/projects/birdwatch-battles-save-curlew_en
- **Results Based Payments Network** https://www.rbpnetwork.eu/country-infos/ireland/the-irish-breeding-curlew-eip-20/
- **European Commission EIP Agri website** - https://ec.europa.eu/eip/agriculture/en/find-connect/projects/conservation-breeding-curlew-ireland.html

12.5 Collaboration

- The Curlew EIP collaborated with NPWS, providing satellite tagging data. The data was analysed by a master's student to investigate habitat usage and home range during various stages in the breeding cycle, and to inform on future conservation measures for Curlew (See Section 8).
- The project collaborated with a UK study by the Curlew Recovery Partnership and Shefield University on fertility and egg quality in Curlews. Samples of hatched eggshell and unhatched or predated eggs were provided between 2022 and 2023.
- The project collaborated with an Irish PhD study, University College Dublin, on genetic sampling of Eurasian Curlew, by providing samples collected and supplied to the Curlew Recovery Partnership.

The Project Manager sits on the UK and Ireland Curlew Action Group. She also sits on the Teagasc Environmental Stakeholder Group. She participated in the EIP group facilitated by FFTG and fed into the CAP reform through this and work with BirdWatch Ireland.

13 Financial Reporting

The Irish Breeding Curlew EIP secured €1.1 million for the operation of the project between April 2018 and December 2021. In January 2022, due to delays in Ireland's new CAP Strategic Plan, an extension was granted and an additional €648,283 in funds made available.

Table 29 Allocated project budget and drawdown 2018 - 2023, per year.

CURLEW EIP BUDGET 2018-2023								
		2018	**2019**	**2020**	**2021**	**2022**	**2023**	**Total**
	Total budget available 2018-2023	**claimed**	**claimed**	**claimed**	**claimed**	**claimed**	**claimed**	**claimed**
Total Administration	678,081		131,969	155,405	173,161	161,990	120,125	**742,650**
Total Implementation	423655	39,714	74,047	90,852	77,705	117,298	73,286	**472,902**
Total Farmer Payments	558050	0	0	83039	135,282	151,265	61,204	**430,790**
Total Overheads (10%)	88498		12,908	15,541	17,316	32,398	23,780	**101,943**
TOTAL	**1748284**	**39,714**	**218,924**	**344,837**	**403,464**	**462,951**	**278,395**	**1,748,285**
Balance of project funds								**0**

**Administration included staff costs, T&S, office running costs, steering committee time, events, training & development, and dissemination; Implementation included keeper staff costs, predator equipment and knowledge transfer: Framer Payments included all farmer related payments.*

14 Bibliographies

Aebischer, N.J., Green, R.E. & Evans A.D. (2000) From science to recovery: four case studies of how research has been translated into conservation action in the UK. Pages 140-150 in: J.A. Vickery, P.V. Grice, A.D. Evans & N.J. Aebischer (eds.) The Ecology and Conservation of Lowland Farmland Birds. British Ornithologists' Union, Tring.

David Baines, D., Fletcher, K., Hesford, N., Newborn, D., Richardson, M., (2023). Lethal predator control on UK moorland is associated with high breeding success of curlew, a globally near-threatened wader. European Journal of Wildlife Research 69:6 https://doi.org/10.1007/s10344-022-01631-5

Balmer, D.E., Gillings, S., Caffrey, B.J., Swann, R.L., Downie, I.S. & Fuller, R.J. (2013). Bird Atlas 2007–11: The Breeding and Wintering Birds of Britain and Ireland. BTO, Thetford.

Banks, Peter B., Christopher R. Dickman, and Alan E. Newsome (1988). "Ecological costs of feral predator control: foxes and rabbits." The Journal of Wildlife Management: 62(2) 766-772

BirdLife International. (2012). Numenius arquata. The IUCN Red List of Threatened Species. Version 2015.2. [Online]. www.iucnredlist.org. [Accessed 18 August 2015].

Bolton, M., Tyler, G., Smith, K., and Bamford, R., (2007), The impact of predator control on lapwing Vanellus vanellus breeding success on wet grassland nature reserves. Journal of Applied Ecology, 44: 534-544. https://doi.org/10.1111/j.1365-2664.2007.01288.x

Brown, Daniel, Wilson Jeremy, Douglas David, Thompson Patrick, Foster Simon, McCulloch Neil, Phillips James, et al. (2015). "The Eurasian Curlew–the Most Pressing Bird Conservation Priority in the UK." British Birds 108 (11): 660–68.

Colclough Gary (2024) Home Range of the Eurasian Curlew during the breeding season. Masters thesis submitted to University College Dublin School of Biology and Environmental Science.

Colhoun, K., Flanellu F., ONeill J., Phelan E., Servignat H., ODonoghue B., Kelly B., and Kelly S. (2022). "Status and Distribution of Breeding Eurasian Curlew in Ireland 2021". Irish Wildlife Manuals, No 138, National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Currie, Dave, Valkama Jari, Berg Åke, Bschert Martin, Norrdahl Kai, Häannien Mikko, Korpimäki Erki, Pöyri Ville, and Hemminki Ossi. 2001. "Sex Roles, Parental Effort and Offspring Desertion in the Monogamous Eurasian Curlew Numenius Arquata." Ibis 143 (3): 642–50.

Del Hoyo, J., Elliott, A. & Sargatal, J. (1996). Handbook of the Birds of the World, Volume 3: Hoatzin to Auks. Lynx Edicions, Barcelona, Spain.

Denniston, H. (2013). Exploring the relationship between declines in breeding Curlew Numenius arquata and habitat change in Ireland. MSc. Thesis, University College Cork.

Donaghy, A. (2014). Surveys for breeding Curlew in the Border Counties 2011-2014: Halting environmental Loss Project. Kilcoole, Co. Wicklow: BirdWatch Ireland.

Donaghy, A., Manley D., Finney, K., (2018). Bord na Móna – BirdWatch Ireland Curlew Conservation Project. BirdWatch Ireland.

Douglas, David JT, Brown Daniel, Cohen Simon, Colwell Mary, Donaghy Anita, Drewitt Allan, Finney Kathryn, Samantha Franks, Danny Heptinstall, Geoff Hilton, Sean Kelly, Patrick Lindley, Ben McCarthy, Neil McCulloch, Barry O'Donoghue, Sarah Sanders, Patrick Thompson and Sian Whitehead (2021). "Recovering the Eurasian Curlew in the UK and Ireland." British Birds 114 (6).

European Commission 2007. Natura 2000 Technical Report 003-2007: Management Plan for Curlew (Numenius arquata) 2007 –2009. Luxembourg: Office for Official Publications of the European Communities.

Finney, K., Donaghy, A. (2014). The Effect of Management Measures on Breeding Wader Populations in the Shannon Callows. Irish Birds 10(1): 1-10.

Finney, K., Kelly, S., Edge, R., Donaghy, A. and Copland, A. (2018). Breeding Waders in the Shannon Callows: Scoring Guidelines Report prepared for the European Union, DG Environment, Agreement No. 07.027722/2014/697042/SUB/B2

Finney, K., Kelly, S., Edge, R., Donaghy, A. and Copland, A (2018). Measure Handbook Results Based Agri-Environmental Payment Schemes – Shannon Callows Breeding Waders. Report prepared for the European Union, Agreement No. 07.027722/2014/697042/SUB/B2

Finney, K., Kelly, S., Edge, R., Donaghy, A. and Copland, A (2018). Breeding Waders - Best practise guidelines for farming for conservation on the Shannon Callows. Report prepared for the European Union, Agreement No. 07.027722/2014/697042/SUB/B2

Finney, K., Miley D., Bismilla K., Ferguson, D., Sweeney, S., Donaghy A., (2020). The Irish Breeding Curlew EIP 2020 Annual Report. BirdWatch Ireland unpublished report.

Finney, K., Buckley, K., Ferguson, D., Donaghy, A., Miley D., Sweeney, S., (2022). The Curlew EIP Predator Control Policy for Breeding Curlew and Ground Nesting Birds. BirdWatch Ireland unpublished report.

Fitzmaurice, M., 2018. Fitzmaurice welcomes legislation for de-designation of Natural Heritage Areas. Fitzmaurice welcomes legislation for de-designation of Natural Heritage Areas. URL http://www.michaelfitzmaurice.ie/fitzmaurice-welcomes-legislation-for-de-designation-ofnatural-heritage-areas/ (accessed 11.11.19).

Fletcher, K., Aebischer, N., Bains, D., Foster, R., Hoodless, A. (2010). Changes in breeding success and abundance of ground nesting moorland birds in relation to the experimental deployment of legal predator control. Journal of Applied Ecology Vol 47, No 2, pp 263-272.

Franks, S.E., Douglas, D.J.T., Gillings, S., Pearce-Higgins, J.W. (2017). Environmental correlates of breeding abundance and population change of Eurasian Curlew Numenius arquata in Britain. Bird Study 64, 393–409. https://doi.org/10.1080/00063657.2017.1359233

Gerritsen, G.J. (2021) - Curlew, breeding biology in West-Overijssel, The Netherlands' https://www.researchgate.net/profile/Gj-Gerritsen

Gilbert G, Stanbury A and Lewis L (2021), “Birds of Conservation Concern in Ireland 2020 –2026”. Irish Birds 9: 523—544

Grant, M.C., Orsman, C., Easton, Jon., Lodge, C., Smith, M., Thompson, G., Rodwell, S., Moore, N. (1999). Breeding success and causes of breeding failure of curlew Numenius arquata in Northern Ireland. Journal of Applied Ecology 36, 59–74. https://doi.org/10.1046/j.1365-2664.1999.00379.x

Grant, G., (2022). Estimating the relative importance of predator-prey interactions in the provision of marine ecosystem services (Doctoral dissertation, Queen's University Belfast

Hemmings N., Thompson J., (2022) Fertility and egg quality in Curlews: 2022 preliminary report on the 2022 breeding season. Unpublished report University of Sheffield.

Hemmings N., Thompson J., (2023) Fertility and egg quality in Curlews: 2022 preliminary report. Unpublished report University of Sheffield.

Henderson, I.G., Wilson, A.M., Steele, D., Vickery, J.A., 2002. Population estimates, trends and habitat associations of breeding Lapwing Vanellus vanellus , Curlew Numenius arquata and Snipe Gallinago gallinago in Northern Ireland in 1999. Bird Study 49, 17–25. https://doi.org/10.1080/00063650209461240

Hoodless, A.N., Inglis, J.G. & Baines, D.2006. Effects of weather and timing on counts of breeding Snipe Gallinago gallinago Bird Study53:205–212.

Kennedy J., Finney K., Lusby J., Moloney D., Duggan O., Donaghy A., (2023) Mapping of Farmland Bird Hotspots: a method to assist targeting of agri-environment measures. Irish Birds 45: 35–48

Malpas, L.R., Kennerley, R.J., Hirons, G.J.M., Sheldon, R.D., Ausden, M., Gilbert, J.C. et al. (2013). The use of predator-exclusion fencing as a management tool improves the breeding success of waders on lowland wet grassland. J Nat Conserv. 21: 37-47

McMahon, Barry J., Doyle, S., Gray, A., Kelly, S., Redpath, B.A., Steve, M. (2020). European bird declines: Do we need to rethink approaches to the management of abundant generalist predators? Journal of Applied Ecology DOI: 10.1111/1365-2664.13695

O'Brien, M., Smith, K.W., 1992. Changes in the status of waders breeding on wet lowland grasslands in England and Wales between 1982 and 1989. Bird Study 39, 165-176. https://doi.org/10.1080/00063659209477115

Peach, W.J., Thompson, P.S. & Coulson, J.C (1994) Annual and long term variation in the survival of British Lapwings Vanellus vanellus. Journal of Animal Ecology 63: 60-70.)

Peach, W.J., Lovett, L.J., Wotton, S.R., and Jeffs, C. (2001). Countryside stewardship delivers cirl buntings (Emberiza cirlus) in Devon, UK. Biological Conservation 101:3, 361-373.

Philcox, C. and Grogan, A. (1997) A Survey of American Mink (Mustela vison) on Hiiumaa Island, Estonia. The Wildlife Conservation Research Unit, University of Oxford.

Potts, P., Hoodless, A., Page, A., & Atkinson, P. (2019). Movements of GPS-tracked Curlews within the New Forest and The Solent. Hampshire Bird Report 2018: 200–227.

Pringle, H., Wilson, M., Roy, S., Reid, N., McDonald, R.A. (2009). A review of mink predation and control in Ireland. Irish Wildlife Manuals, No. 40. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Summers, Ron W, Pálsson Snæbjörn, n Etheridge Bria, Foster Simon, and Swann R L. 2013. "Using Biometrics to Sex Adult Eurasian Curlews Numenius a. Arquata." Wader Study Group Bulletin 120 (April): 71–74.

Taylor, R., Bowgen, K., Burton, N., & Franks, S. 2020. Understanding Welsh breeding Curlew: from local landscape movements through to population estimations and predictions. NRW Evidence Report No. 485. Natural Resources Wales, Bangor.

Teunissen, W., Schekkerman, H., Willems, F. & Majoor, F. (2008). Identifying predators of eggs and chicks of Lapwing Vanellus vanellus and Black-tailed Godwit Limosa limosa in the Netherlands and the importance of predation on wader reproductive output. Ibis 150 (Suppl.1): 74-85.

Wilson, J. D., Anderson, R., Bailey, S., Chetcuti, J., Cowie, N. R., Hancock, M. H., Quine, C.P., Russell, N., Stephen, L. & Thompson, D. B. A. (2014). Modelling edge effects of mature forest plantations on peatland waders informs landscape-scale conservation. Journal of Applied Ecology 51(1), 204–213.

14 List of Appendix

Appendix 1 The Call - Farmer Information Pack

Appendix 2 The Curlew Habitat Option Annual Scorecard

Appendix 3 Livestock Coefficients used by the Curlew Habitat Option

Appendix 4 Extracts from a Curlew Habitat Farm Plan

Appendix 5 Extracts from a Conservation Keepering Scheme Farm Plan

Appendix 6 Scat Survey Transect Maps

The Irish Breeding Curlew EIP

What are European Innovation Partnership (EIP) projects?

European Innovation Partnership projects (EIP's) are funded by the Department of Agriculture and the Marine (DAFM) under the Rural Development Programme 2014-2020. These locally led schemes promote local solutions to specific issues. They involve the establishment of Operational Groups (made up of stakeholders and experts) to develop ideas or take existing ideas / research and put them into practice by being hands on in working toward the resolution of a practical problem.

What is the Irish Breeding Curlew EIP project?

The Irish Breeding Curlew Operational Group were one of 23 successful applicants under the DAFM EIP programme. The Operational Group is made up of BirdWatch Ireland (the Lead Partner), The Irish Natura and Hill Farmers Association (INHFA), The Irish Grey Partridge Conservation Trust (IGPCT) and Teagasc.

The Irish Breeding Curlew EIP Project aims to develop and trial new approaches to stem the decline of breeding Curlew in Ireland, over the next three years (until 2021). The project is operating in two specific areas – South Lough Corrib, Co Galway and the South Leitrim bogs area.

The core measures being trialled in these two areas include:

- **A Curlew Habitat option** - a results-based agr-environmental scheme (for agricultural land)
- A **Curlew Knowledge Sharing Group** (for participants in the Curlew Habitat Option)
- A **Capital Works Programme** (i.e. to remove trees / scrub on or beside land in the Curlew Habitat option)
- A **Conservation Keepering Scheme** - an agri-environmental option for farmers to carry out predator control.
- A **nest protection option**, to trial the protection of nests using temporary electric fencing

How will farmers be selected?

As this is a pilot scheme, with a limited budget, the project is targeted around known breeding Curlew sites, as outline in the attached maps. You have been identified by the Department of Agriculture and the Marine (DAFM) as having land within the project target area and as a result DAFM have sent you this information pack on behalf of the Curlew EIP group.

The project is open to **all** farmers, regardless of whether or not they are participating in GLAS and landowners who own / lease / share the bogs identified in the maps (different options will apply to each group).

The selection criteria for the Curlew EIP options are:-

1 **<u>All</u>** applicants must be a registered farmer.

2 Areas must be located within the target areas (outlined in the maps).

3 The application must be from the person farming the land, or in the case of leased land, the lease, or shareholder in the Commonage.

4 Specific criteria for the Curlew Habitat Option(s):

a. Agricultural land must be grazed and there must be a livestock enterprise on the farm.

b. Land must be in receipt of BPS payments, or declared (and accepted) for BPS in 2021.

c. Land must be suitable breeding Curlew habitat – damp unimproved or semi-improved agricultural land, or bog. As general guide, agricultural fields must be damp unimproved or semi improved grassland; they should ideally be grazed by cattle. Rush cover should in general be less than 50-75%. Scrub, trees and bushes must not be dominant. Each sites suitability will be clarified during a site visit.

d. In order to test the scheme with a number of different farmers and suitable areas, entry under single ownership must be less than 24ha in size.

5 Specific criteria for the Conservation Keepering Scheme:

a. Applicants must have land within the project area in order to qualify (as outlined in the attached maps). However, once this criteria has been met, the scheme can operate on land outside the project area.

i. Land in the scheme dose <u>not</u> need to be in receipt of BPS payments.
ii. Farmers may use sub-contractors to carry out this option.
iii. Farmers may operate this scheme on another farmer's land, providing permissions etc. are secured.

6 Those areas with breeding Curlew will be prioritised. These are:

Lough Corrib: Addergoolie / Barrannie, Curraghmore, Walshes Island and Maddens Island / Boghilmore Island, Browne's Island / Portdarragh

South Leitrim: land around Aghnamona bog, Cashel bog, Tooman bog, Corracramph bog, Cloonageeher bog and Tulcon bog

Thereafter, the most suitable sites to influence breeding success and the most suitable sites around key breeding sites.

If you meet the selection criteria outlined and wish to partake in this trial scheme, please submit an **Expression of Interest Form** to the Curlew EIP team either:-

By post to

By email to

Expression of Interest Forms will be accepted until 5pm on Friday 30th October 2020

Selection will be made on the basis of the information provided by you and on a site visit by the Curlew EIP team.

Filling in the Expression of Interest Form

An Expression of Interest Form has been included in the documents sent to you.

Please note - submitting an expression of interest form does not guarantee entry to the scheme.

Please return the completed expression of interest form by return post or e-mail.

Expression of Interest Forms will be accepted until 5pm on Friday 30 October 2020

What happens after I submit the Expression of Interest Form?

When the Curlew EIP team receive all Expression of Interest Forms, applicants will be ranked against the selection criteria.

If you are invited to participate in the project, the Curlew EIP team will be in contact again to arrange a farm visit, outline the options available to you and draw up a Farm Plan in agreement with you for 2021.

On entering a plan, you will enter a (pro rata) contract for 2021.

What will taking part in the Curlew EIP mean for me?

The options available to you under the Curlew EIP, will depend on what Curlew habitats you have on your farm, and your participation in other schemes i.e. GLAS.

However, **all** farmers will potentially be eligible for:

- The **Curlew Habitat Option**, for agricultural land
- A **nest protection option**, to trial the protection of nests using temporary electric fencing
- A **Capital Works Programme** to improve Curlew breeding habitat
- The **Curlew Knowledge Sharing Group**.
- **The Conservation Keepering Scheme**

This pilot project aims to develop practices that are suitable and practical for farmers as well as delivering for breeding Curlew; it is therefore essential that we receive feedback, both positive and negative, to help inform how the scheme may be developed for wider rollout. Participants in the scheme will be required to provide feedback to the project team during the contracts in order to evaluate the success of the project. This will take the form of questionnaires, on-farm meetings with the Curlew EIP team and attendance at training events.

The Curlew EIP team will work closely with you in 2021 and we look forward to welcoming successful farmers on board**.**

For information on the pilot contact the Curlew EIP Project Manager	
Kathryn Finney	Tel: Email:

Project Partners

BirdWatchIreland birdwatchireland.ie protecting birds and biodiversity

Irish Grey Partridge Conservation Trust

teagasc Agriculture and Food Development Authority

IRISH NATURA & HILL FARMERS ASSOCIATION (INHFA)

SEEKING FAIRNESS NOT FAVOURITISM

Curlew EIP Expression of Interest Form

Please read supporting documents before completing this form

NAME _____ **PHONE**_____

MOBILE _____

ADDRESS_____

_____

HERD NO._____

_____

Are you in GLASS **Yes / No** _____

Tick which area you are in:

☐ **South Co. Leitrim**	☐ **South Lough Corrib, Co Galway**

Tick which option (s) you wish to apply for:

☐ **Curlew Habitat Option (s)**	☐ **Conservation Keepering Scheme (*predator control)***

I. **Please complete for <u>all</u> relevant plots that fall within the target area. It is important that you complete as much information as possible. Please include the enclosed map with the <u>field(s)</u> you wish to enter into the scheme indicated as far as possible.**

Townland	LPIS Plot No:	Size of LPIS plot (ha)	Agricultural land	Bog – (name if applicable)	Owned/Rented
e.g. Bullock Island	*LPS11101*		*No*	*Cashel*	*owned*

II. **If Applying for the Conservation Keepering Scheme, please indicate below which species / measures you may be interested in**

Species	Method of Control	Tick if interested	Please state whether you intend using a rifle or shotgun and the gauge of the gun
Fox	Shooting / Lamping / Trapping		
Mink	Live trapping		
Mink	Kill trapping		
Corvids (Hooded Crow & Magpie)	Larsen trapping / Ladder trapping		
Corvids (Hooded Crow & Magpie)	Shooting		

Declaration

I understand that submission of an Expression of Interest Form does not guarantee entry to the Curlew EIP, and that entry is at the discretion of the Curlew EIP management team, based on the selection criteria set out in the Curlew EIP information document provided to me.

Signed: _____ Date: _____

Expression of Interest Forms must be returned by 5pm Friday 30 October 2020
By post to Kathryn Finney Curlew EIP Project Manager **By e-mail**

For further information or to discuss your application, please feel free to contact Kathryn Finney, Curlew EIP Project Manager, at:

Appendix 2 The Curlew Habitat Option Annual Score Card

Curlew EIP - Habitat Assessment Sheet

Farmer Code:			
Management Unit (MU):		Surveyor:	
No. & type of stock in MU:		Date:	
Evidence of recent tractor operations (Y/N):		Breeding waders present:	

Scoring: circle the most appropriate value/description — **Final Score A & B & C:**

BREEDING SEASON

A. Field vegetation

A.1 Breeding Season Sward Height

Long	Mixed	Short
7.5	17.5	17.5

A.2 Tussock Coverage

Absent	Rare	Occasional	Frequent, Abundant or Dominant
2.5	7.5	12.5	17.5

A.3 Rush Coverage: Choose the single most dominant type of rush present in MU and score this only

A.3.1 Level of Dense Rush Cover

>50% of plot	30 - 50% of plot	10 - 29% of plot	<10% of plot
-2.5	7.5	12.5	17.5

A.3.2 Level of Sparse Rush Cover

>70% of plot	30 - 70% of plot	<30% of plot
-2.5	7.5	17.5

A.3.3 Level of Very Sparse Rush Cover

>75% of plot	<75% of plot
7.5	17.5

B. Wet Features

B.1. Wet Features

Damaged	Insuffident	Limited	Suffident	Ample
Damaged / removed without advice	within plot	features of appropriate slope, wetness and vegetative cover	but plot could be improved by increasing the amount / quality	features of appropriate slope, wetness and vegetative cover
-27.5	-12.5	-2.5	12.5	17.5

Describe wet features (if any):

C. Other Features

C.1 Scrub Encroachment Level

Newly established stems. Mgt advised	Very young stems. Mgt advised	No Stems / Maintain status quo
2.5	7.5	12.5

Describe scrub encroachment (if any)

C.2 Predator Habitat

Extensive; Major management required	Needs Management	None / Maintain status quo
-2.5	7.5	17.5

Describe predator habitat (if any)

Comments and management recommendations (if any):

Appendix 3 Livestock Coefficients Used by the Curlew Habitat Option

Livestock Unit Values

Note: livestock unit values used here differ from those published by DAFM. For this scheme, stock units are taken as:

Dairy cow/ horse: 1
Beef cow: 0.75
Sheep: 0.09
Bull: 0.65
Bullock/Heifer: 0.5
Lamb: 0.06
Calves: 0.3* Calves are defined as Bullocks/ Heifers *under* six months.

Appendix 4 Excerpts from a Curlew Habitat Option Farm Plan

Figure 22 Example Curlew Habitat Farm Plan map showing the fields in the scheme, location and type of Capital Works to be undertaken.

Participant's Details			
Farmer's Name:		Address:	
Farmer Code:		Phone Number(s):	
GLAS (Y/N) if Yes - Exit Date:		Herd Number:	

Curlew EIP Option(s) (Y/N)			Curlew EIP Advisor(s) and Contact Details:	
	Curlew Habitat Option (CH)	Y		Marina Mulligan 086-085803
	Curlew Knowledge Sharing Groups (CKSG) - 4 Meetings per year	Y		Kathryn Finney - 057-9151676/086-8052514
	Temporary Electric Fencing Option (TEF)	Unknown		
	Conservation Keepering Option (CK) - see separate plan	N		

Plot Details

Field	LPIS number	LPIS Plot Whole/Part	GLAS Option	Designated Land (SPA, SAC, NHA)	Digitized Area (ha)	Claimed Area (ha) *	Ownership	Curlew EIP Option	Payment Rate	Maximum POSSIBLE Payment**	2020 Score	2020 Payment***	2021 Score	2021 Payment***
1		Part		SAC, SPA	N/A			CH	Farmland Habitat		8		7	
2		Part		SAC, SPA	N/A			CH	Farmland Habitat		5		5	
3		Part		SAC, SPA	N/A			CDM	Hay Meadow		N/A		N/A	
									Survey & Engagement					
4		Part		SAC, SPA	N/A			CDM	Hay Meadow		N/A		N/A	
									Survey & Engagement					
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CKSG	N/A		N/A		N/A	
Total						0.00				€0.00		€0.00		€0.00

Scoring Scales and Corresponding Payment Rates											
	Points out of 100	0-10	10.1-20	20.1-30	30.1-40	40.1-50	50.1-60	60.1-70	70.1-80	80.1-90	90.1-100
Payment Rate	Field Score	1	2	3	4	5	6	7	8	9	10
EIP Curlew Habitat Option	€/ha	€43	€86	€129	€172	€215	€258	€301	€344	€387	€430
Breeding Tier Habitat Option	€/ha	€24	€48	€72	€96	€120	€143	€167	€191	€215	€239
Late Tier Habitat Option	€/ha	€19	€39	€58	€77	€97	€116	€135	€154	€174	€193
EIP Curlew Delayed Mowing Option Payment Rates											
Silage	€/ha	€170									
GLAS THM/ hay meadow	€/ha	€135									
Survey & Engagement	€/ha	€80									
GLAS Top-Up Payment Rates	Field Score	1	2	3	4	5	6	7	8	9	10
Farmland Habitat	€/ha	€35.10	€70.20	€105.30	€140.40	€175.50	€210.60	€245.70	€280.80	€315.90	€351
Breeding Wader & Curlew	€/ha	€6.40	€12.80	€19.20	€25.60	€32	€38.40	€44.80	€51.20	€57.60	€64
Low Input Permanent Pasture	€/ha	€11.60	€23.20	€34.80	€46.40	€58	€69.60	€81.20	€92.80	€104.40	€116

** Underlined values are areas calculated by the Curlew EIP, otherwise values are those on your BPS documents.*

***Maximum payment per plot is based on a field score of 10 and dependant on the field's GLAS status. Where a field exits GLAS mid-way through the season, payments rates will be adjusted accordingly.*

**** In order to receive payment for the Curlew Habitat Option land must be declared with the Basic Payment Scheme by the time of payment in 2022. However land need not be in receipt of a BPS payment."*

Figure 23 Example Curlew Habitat Farm Plan details page.

Capital Works:

Please tick all tasks agreed to be carried out by the farmer, under guidance from the Irish Breeding Curlew EIP Team.

Capital Works aim to enhance the ecological condition of a plot.

Curlew EIP Option	Field	CW Code	Work	Work Description and General Instructions	Work Unit	Rate per Unit (€)	Required Units	Farmer Payment (€)	Consultation / Permissions Required?	Agreed to do	Year Work Completed
CH	2	CW2	Management of scrub/predator habitat: Mechanical tree / scrub removal - chainsaw	Use of a chainsaw for the complete removal of scrub/tree(s)	per hour	50.00	0.66	33.00	Yes	☐	
CH	3	CW2	Management of scrub/predator habitat: Mechanical tree / scrub removal - chainsaw	Use of a chainsaw for the complete removal of scrub/tree(s)	per hour	50.00	0.66	33.00	Yes	☐	
CH	4	CW2	Management of scrub/predator habitat: Mechanical tree / scrub removal - chainsaw	Use of a chainsaw for the complete removal of scrub/tree(s)	per hour	50.00	0.66	33.00	Yes	☐	
CH	2, 3, 4	CW4	Chemical Scrub management <25% cover	Using Roundup Pro Bioactive to treat cut tree stumps within 4 hours of cutting.	Cost of labor and materials			35.00	Yes	☐	
										☐	
						Total CW €		€134.00			

Payments for Capital Works will be made alongside the corresponding annual score-based payment.

Where specified keep receipts for capital works as these need be submitted in order to receive payment.

Note: payments for Capital Works are subject to satisfactory completion of work planned, obtaining all necessary permissions and complying with any conditions attached.

For full details on the descriptions and requirements for each of the Capital Works listed, refer to the Management Guidance documents provided.

Figure 24 Example Curlew Habitat Farm Plan Capital Works details page.

Appendix 5 Excerpts from a Conservation Keepering Farm Plan

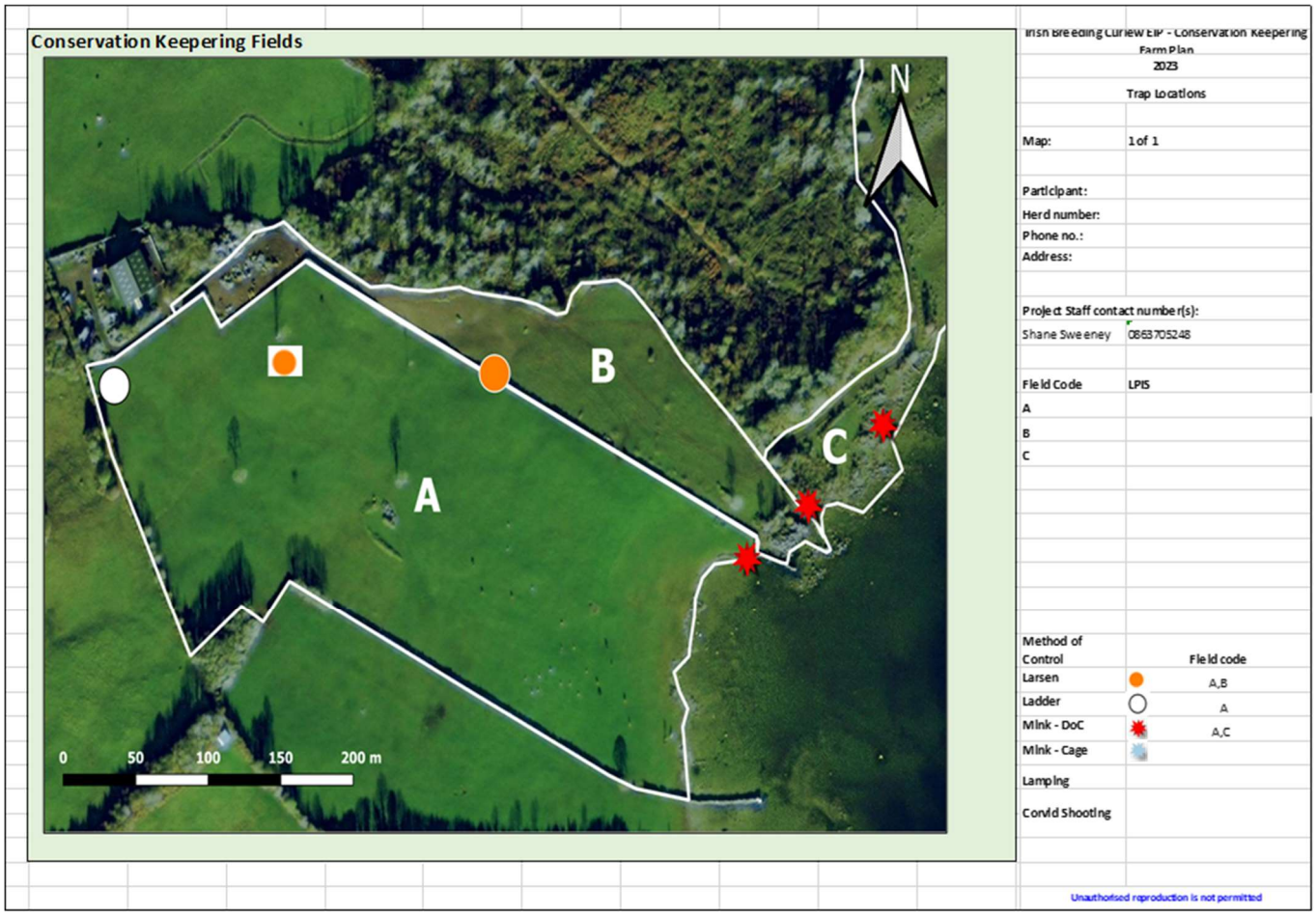


Figure 25 Example Conservation Keepering Farm Plan map showing the fields in the scheme, type and location of traps.

Participant's Details			
Farmer's name:		Address:	
Farmer Code:		Phone Number(s):	
Farmer Herd No.:		Name of Sub-Contractor:	

Conservation Keepering Method(s) of Control (Y/N):					Curlew Advisor(s) and Contact Details:	
	Lamping:	N	Mink - DoC Trapping:	Y		Kathryn Finney - 057-9151676/086-8052514
	Corvid Shooting:	N	Mink - Cage Trapping:	N		Shane Sweeney - 086-3705248
	Larsen Trapping:	Y				
	Ladder Trapping:	Y				

Plan Summary	Control Works						
Methods of Control	No. of Hours per Week	Payment per Week @ €12.40 /h (€)	No. of Hours per Year	Total No. of Days	Total No. of Weeks	Total Maximum Payment per Year @ €12.40 /h (€)	No. of Days / Weeks Free*
Lamping							
Corvid Shooting							
Larsen	4hrs 40mins	€57.91	70hrs	105	15	€868.00	3
Ladder	2 hrs 20mins	€28.93	35hrs	105	15	€434.00	3
Mink - DoC Trap	3 hrs 30mins	€43.40	52hrs 30mins	105	15	€651.00	3
Mink - Cage Trap							
Total	10hrs 30mins	€130.24	157hrs 30mins			€1,953.00	

Payment Rates	
Training	Control Work
€15/hour	€12.40/hour

Training Workshop Record												
Workshop	Initial Training Workshop	Plan Development and Locating Traps	Securing Licences & Data Recording Workshop	Making Mink Boxes	Making & Deploying a Ladder Trap	Corvid Shooting Workshop	Lamping Visit	Larsen Trap Deployment and Call-bird Care	Locating and Deploying Mink DoC Trap	Locating and Deploying a Mink Cage Trap	Carrying Out Predator Control in a Breeding Curlew Area	Total
Hours Training**	0	0	0	0	0	0	0	0	0	0	0	0.0

* Control works are to be carried out for 18 weeks / 126 days between March 13th - July 16th 2023. In your plan there are a number of free days / weeks where control works do not need to be carried out. It is at your discretion how you use these, however accurate records must be kept. You will be paid according to the total number of hours worked.
**Training dates and training completion dates will be recorded on a seperate record keeping form. Hours may change to those recorded here but any changes will be discussed with you.

Figure 26 Example of a Conservation Keepering Farm Plan details page.

Trap Inventory - Field Code and GPS Co-ordinates of Keepering Activity									
Field Code	Larsen Trap ITM Co-ordinates	Field Code	Ladder Trap ITM Co-ordinates	Field Code	Mink - Cage Trap ITM Co-ordinates	Field Code	DoC 200 ITM Co-ordinates	Lamping Field Code	Corvid Shooting Field Code
B		A				A			
A						C			
						C			
Total Traps Allocated	2	1				3			

Figure 27 Example of a Conservation Keepering Scheme Farm Plan trap inventory and location page.

Name of Applicant and/or Nominated Keeper:	

Wildlife Licences Sought				
Licence Type	Licence Required (Y/N)	Start Date	Expiry Date	Copy of License Received (Y/N)
Section 35 - Licence to use decoys, lures, scarecrows. Electronic Caller & Mouth Caller. Species: Fox.	N			
Section 35 - Licence to use decoys, lures, scarecrows. Electronic caller and/or plastic decoy. Species: Grey Crow and Magpie.	N			
Section 36 (2) - Licence to hunt using a mechanically propelled vehicle. Species: Fox, Badger (Not targeted but in case of accidental capture in lamp shine).	N			
Sections 23 & 34 - Licence for accidental by-catch of non-target species. DoC Trap/Mink Cage Trap. Species: Pine marten, Stoat, Hedgehog.	Y			
Sections 22 & 34 - Licence for accidental by-catch of non-target corvids. Ladder/Larsen Trap. Species Rook and	Y			

Is this plan operating on another landowner's property?			
Landowners Name	Landowner's Herd No.	Written Permission Received (Y/N)	Copy of Permission Received (Y/N)

Gun Type				
License Holder	Gun Type & Serial Number	Firearms Cert No	Expiry Date	Copy of License Received (Y/N)

Insurance					
Name(s) of Insured Person	Insurance Provider	Policy No.	Start Date	Expiry Date	Copy of Insurance Received (Y/N)

Figure 28 Example of a Conservation Keepering Farm Plan Licences and insurance page.

CORVIDS

Legislative Requirements

- **The call bird must**
- have food and clean water at all times
- have a perch with a shelter over it
- ***must not be held in the trap when it is not in use***
- have adequate room to exercise and stretch its wings
- ***traps must be checked daily*** - more often during periods of extreme heat, or when catch rates are very high.
- You cannot use an electronic caller without licence

Best Practice

- Call birds should be kept for no longer then two weeks- after this they should be replaced with a new call bird
- When dispatching trapped call birds make sure to do so out of sight of other call birds
- The Larsen trap must be regularly cleaned to prevent a build up of waste.

These are the standards to be adhered to by the scheme

A breach of any of the legislative requirement will render your insurance null and void

Figure 29 Example of a Conservation Keepering Farm Plan methods overview page.

Irish Breeding Curlew EIP Conservation Keepering Farm Plan - Information for Farmers

This Irish Breeding Curlew EIP Conservation Keepering Farm Plan sets out the details of your control activities and training.

Payment is made based on hours worked. Fields do not need to be registered or in receipt of payment for Basic Payment Scheme with the Department of Food, Agriculture and the Marine (DAFM); this will be discussed with you by your Curlew EIP advisor.

Please refer to the Irish Breeding Curlew EIP Terms and Conditions for full requirements of this measure. Neither the Curlew EIP or DAFM are liable for any breaches of legislation by participants while undertaking activities under this scheme. Applicants (and any nominated persons or sub-contractor, where relevent) are liabale under the law for any breach of the Wildlife Acts, Animal Welfare acts or other relevent legistalion. Participants are required to adhere to the the standard and operating proceedures set by the Curlew EIP when undertaking this measure. A summary of the legislative requirements and standards set by the Curlew EIP have been included in this plan.

Please note that the Irish Breeding Curlew EIP Conservation Keepering Farm Plan does not affect or change any of the regulations relating to designated land (e.g. Natura SAC/SPA land).

Control works are to be carried out for 18 weeks / 126 days between March 13th - July 16th 2023. In your plan there are a number of freed days / weeks where control works do not need to be carried out. It is at your disctresssion how you use these, however accurate records must be kept. You will be paid according to the total number of hours worked.

Farmer's Declaration:

To the best of my knowledge, all details given in this Irish Breeding Curlew EIP Farm Plan are correct and have been fully explained to me by the Irish Breeding Curlew EIP Project Team. I accept responsibility for all work undertaken by me and by contractors on my behalf and I agree to abide by the Irish Breeding Curlew EIP Terms and Conditions.

Signed:_____ Date:_____

Irish breeding Curlew EIP Declaration:
To the best of my knowledge, all details given in this Farm Plan are correct.

Signed:_____ Date:_____

This project is funded by the Department of Agriculture, Food and the Marine through the European Innovation Fund. The opinions expressed on this form or in project documents do not necessarily reflect those of the funders.

Figure 30 Example of a Conservation Keepering Farm Plan declaration page.

Appendix 6 Scat Survey Transect Maps

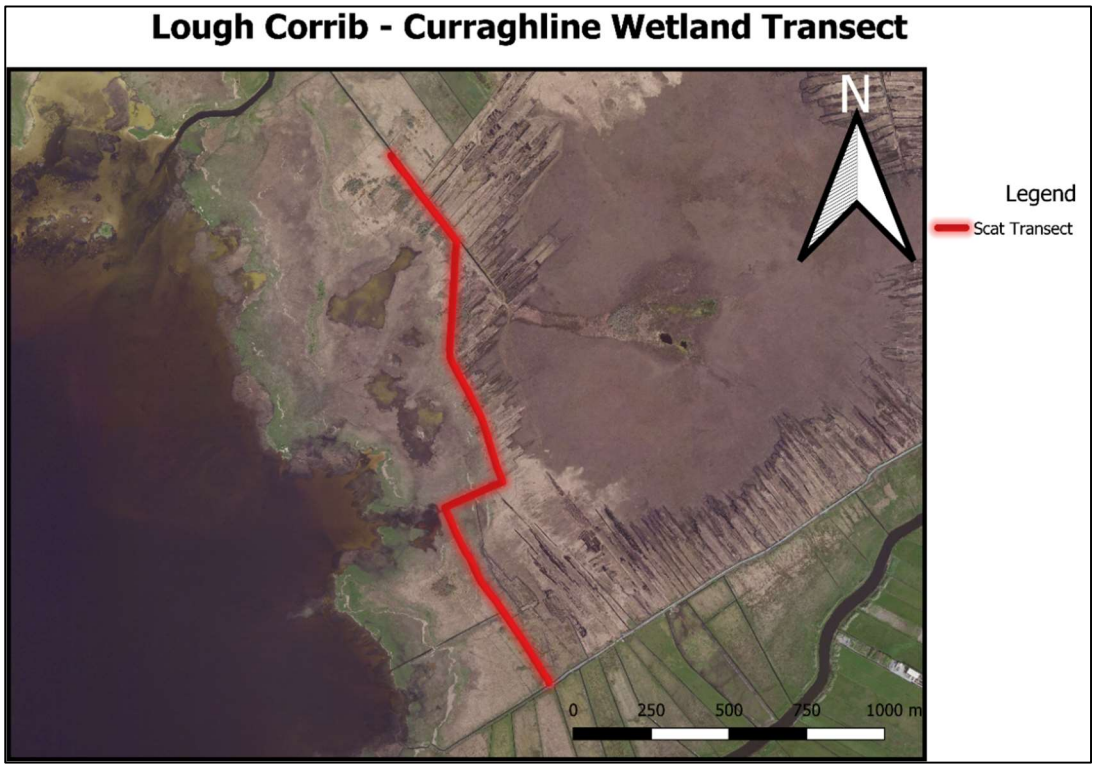


Figure 31 Map of Lough Corrib scat survey transect for site with predator control.

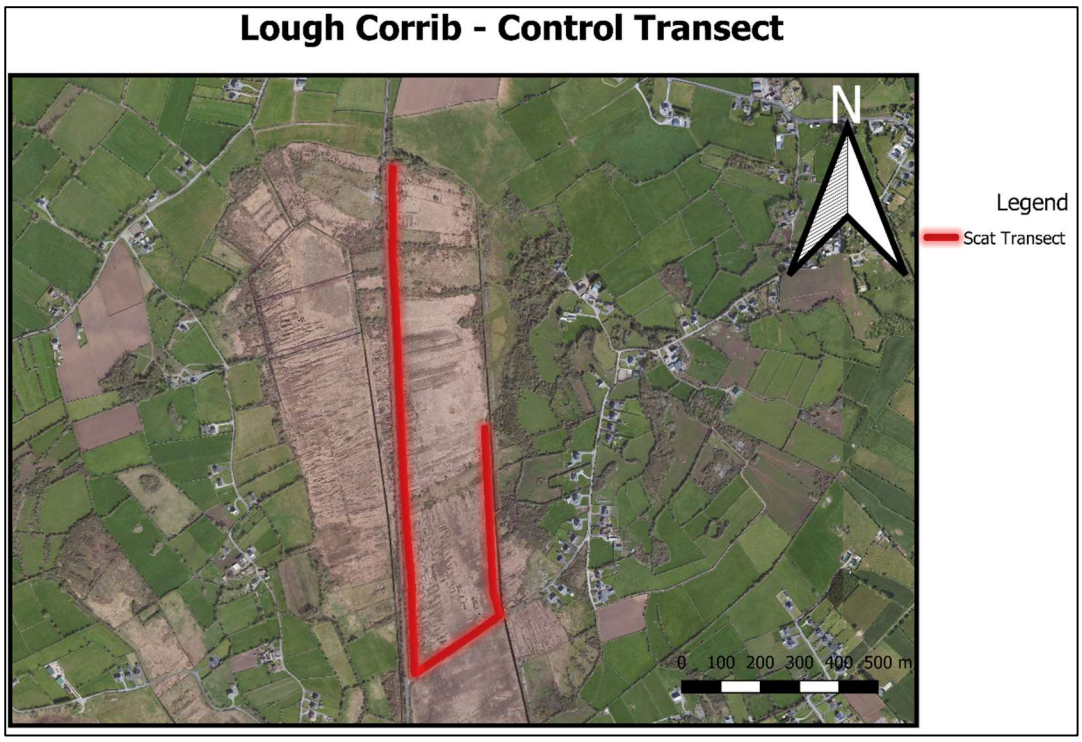


Figure 32 Map of Lough Corrib scat survey transect for control site without predator management.

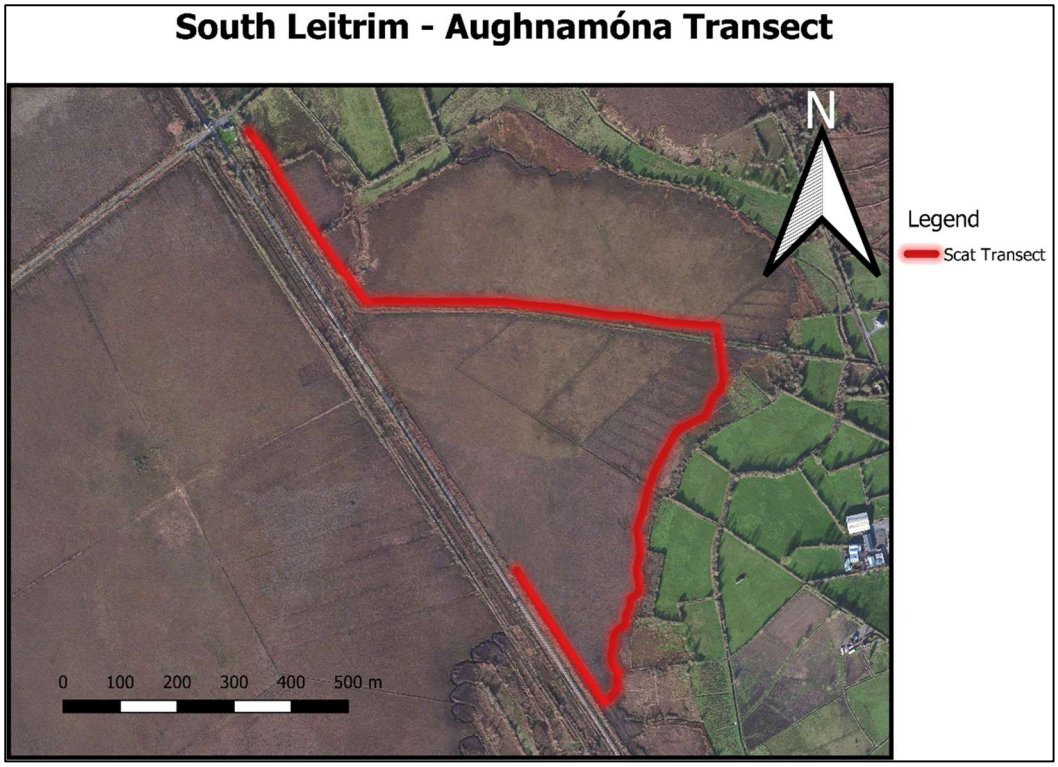


Figure 33 Map of South Leitrim scat survey transect for sites with predator control management.

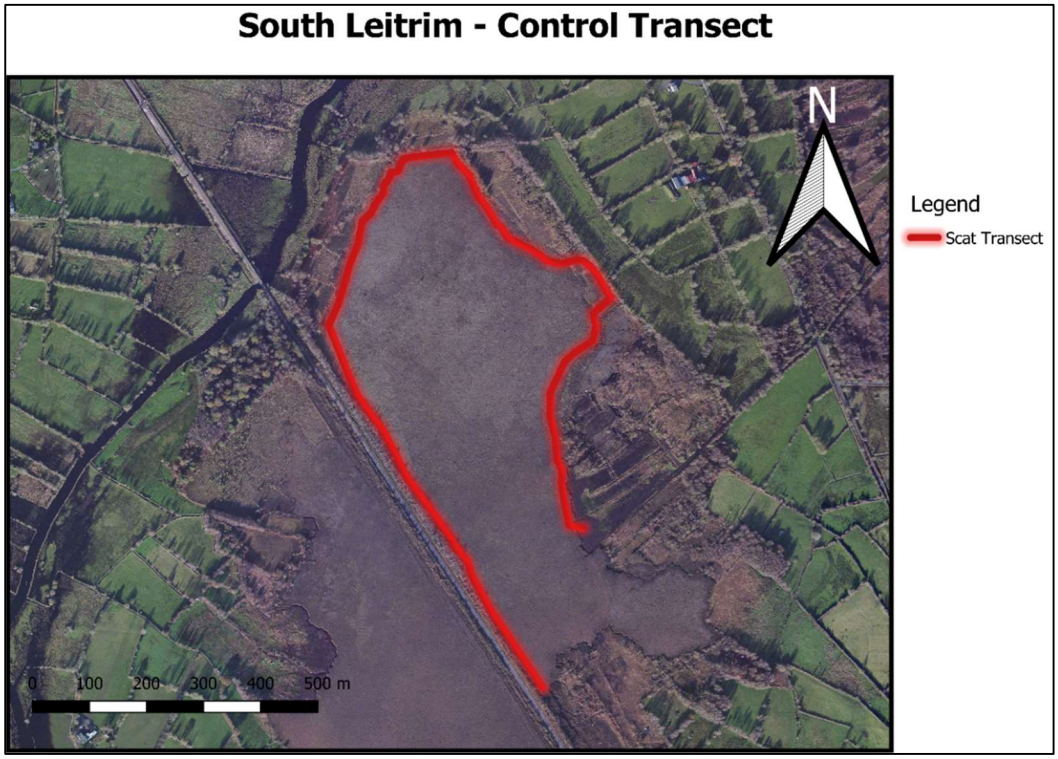


Figure 34 Map of South Leitrim scat survey transect for sites without predator control management.