Gylfinir Cymru Note: Curlew Predator Control Workshop

15th December 2022

Purpose

Gylfinir Cymru agreed that there was a need to assess the available evidence of predation pressure on breeding curlew *Numenius arquata* (see Meetings 11: 4th July 2022 and 12: 22nd September 2022). To address this need a workshop was held on the 15th December 2022 with an open invitation to all Gylfinir Cymru partners. The main purpose of the workshop was to develop thinking to support a Gylfinir Cymru position statement on the role of predator control as a mechanism for curlew recovery, but also to consider longer-term evidence needs to enable positive but sustainable actions for curlew recovery in Wales.

A small Task and Finish Group[1] convened to determine an agenda and briefing note for this workshop. Ian Danby (BASC), acting Chair of Gylfinir Cymru, opened the workshop and [redacted] took the Chair for the workshop session. The workshop began by setting the scene on the evidence that predation pressure is a limiting factor to curlew breeding success: a presentation by Andrew Hoodless (GWCT) - *Breeding curlew response to predation management* and a presentation by David Douglas (RSPB) - *The predation on Curlew nests and chicks.* A set of draft principles was discussed, and the session ended with a discussion of the need for Gylfinir Cymru to adopt such principles. The agenda is given in Appendix 1.

Background

One of the classic ecological questions is how predators affect the size of prey populations. Predation is a natural process, yet there are growing concerns about the role predation plays as a driver of population change in already declining populations. How to manage predation evokes strong and varied emotions and can cause polarised and adversarial responses. Most UK breeding bird species experience predation, at least at a particular vulnerable niche or life history stage (e.g. the egg and chick stages).

It has been demonstrated that nest productivity of ground-nesting birds, including waders, can be limited by predation of eggs and chicks (Roos *et al.,* 2018) and that this can prevent the recovery of reduced populations. Measures to tackle predation are governed by well-established legal frameworks, which in relation to avian predation at least, requires consideration of non-lethal solutions. There is also broad consensus that predator management alone will not lead to a sustainable recovery of curlew.

Evidence indicates that lethal predator control can be used to reduce the number of generalist predators, namely foxes *Vulpes vulpes* and carrion crows *Corvus corone,* at both site and regional scales (Bolton *et al.,* 2007; Baines *et al.,* 2008; Fletcher *et al.,* 2010). Studies indicate that predator control on grouse moors in the UK uplands leads to higher

[1] David Douglas and Michael MacDonald, Principal Conservation Scientists (RSPB); Andrew Hoodless, Head of Research (GWCT); Ian Danby, Head of Biodiversity (BASC) and [redacted]

breeding wader densities, including curlew, than on moorland with no predator control, and increases in wader populations have been documented following the reinstatement or experimental deployment of predator control (Tharme *et al.,* 2001; Fletcher *et al.,* 2010; Littlewood *et al.,* 2019; Ludwig *et al.,* 2019). In all of these cases, multiple predator species were lethally controlled across large landscapes, resulting in a detectable increase in prey numbers. However, in most cited predator control studies it is difficult to determine the relative contribution of individual species of predator to a prey response, (Roos *et al.,* 2018) and in Wales only a small proportion of the curlew population breeds on land managed for grouse shooting. Similarly, there are no peer-reviewed scientific studies that investigate or determine the efficacy of different predator control methods, such as shooting and snaring, different levels of effort and intensity and the influence of landscape features or the minimum area in which control should be deployed. Thus it is difficult to understand the relative contribution of predator control to achieving sufficient annual curlew breeding productivity at a population level.

There are several evidence gaps, such as a need to understand not only the minimum level of lethal predator control effort at a site to determine a response in curlew breeding success but also the efficacy of different lethal control measures required to increase breeding success sufficiently to produce a recovering population trajectory. There are no intensive studies of curlew chick survival, in addition it is fair to say there is little knowledge of how to effectively protect curlew broods to fledging. There is now some site-based anecdotal evidence that electric fencing relatively small areas around curlew nests can substantially increase hatching success on grassland, but this does not protect broods. Deploying electric fences across larger geographical patches to incorporate multiple nests and brood-rearing areas is inherently expensive and more difficult for curlew than for lapwing *Vanel/us vanel/us,* however it may be appropriate at some sites.

Significant progress has been made in understanding predator-prey relationships and the response of some prey species following control of predators, but over the course of the curlew 'emergency' many questions still remain. For example, the effects of predator control are not always apparent (e.g. Bodey *et al.,* 2011). Bolton *et al.* (2007) found that reducing fox and carrion crow numbers had no effect on lapwing nest or chick survival rates, or on population trends, although at some sites where an alternative measure of fledging success was used, twice as many pairs fledged young at some sites during periods of predator control. Douglas *et al.* (2023) illustrates that it can not be assumed that fox and crow control will produce the desired increase in breeding curlew productivity across UK landscapes, at least at an intensity deemed achievable away from driven grouse moors.

The impact of predator control on nest survival rates may vary depending on the density of predators present at that time (Bolton *et al.,* 2007). Several meta-analyses of the effect of lethal control on bird populations have concluded that the average overall effect is positive but that there is great variation in effect sizes among species and locations (Cote and Sutherland, 1997; Smith *et al.,* 2010). There are many possible causes for variable responses to predator removal, including annual variation in the abundance of predators or alternative prey, impacts from other predators which have not been targeted, density-dependent effects, individual variation in predator behaviour, predator control method(s) or varying intensity of predator control.

Whilst predator control can reduce predator densities at sites, high immigration rates indicate rapid replacement of culled foxes such that intensive culling is required to maintain low densities (Porteus *et al.,* 2019), calling into question the biological, spatial scale, ethical and financial sustainability of lethal control as a permanent solution. Control of a single 'key' predator species may also not achieve the desired conservation outcome due to potential

compensatory predation, which can involve combined effects of foxes, corvids and other predators (Roos *et al.,* 2018).

Gylfinir Cymru agreed that

- **The key reason driving UK curlew decline is currently poor breeding success** (Grant *et al.,* 1999; Brown *et al.,* 2015; Douglas *et al.,* 2021).

- **Peer-reviewed scientific evidence suggests the predation of eggs and chicks is a key driver of curlew breeding failure and population declines** (Grant *et al.,* 1999; Brown *et al.,* 2015; Douglas *et al.,* 2021).

- Nest monitoring highlights that **red foxes are frequent, if not the main meso-predator of curlew clutches,** with further losses to agricultural activities including mowing, rolling and trampling/egg consumption by livestock (Colwell *et al.,* 2020). A range of other mammalian and avian predators have been recorded predating clutches but the relative impact of these, and variation across sites and years, is unclear.

- **The UK has densities of foxes and carrion crows that are high when compared to other European countries** and these predators have increased numerically in the UK in recent decades (Roos *et al.,* 2018; Roos *et al.,* 2021). Wales has the second highest densities of foxes across European countries (Roos *et al.,* 2021).

As a result, Gylfinir Cymru considers that:

- **curlew recovery at the landscape scale is unlikely without reduced predation pressure on chicks and eggs.** To achieve this, a package of measures will be necessary to address habitat quality and local factors which could be influencing predator numbers and to reduce predation rates on nest and chicks. Under normal circumstances, lethal predator control would only be considered only after non-lethal methods had been tried and found ineffective. However, the state of curlew decline in Wales is such that we might consider advocating control of foxes and crows as an emergency measure, and always in combination with other interventions, even where non-lethal methods have not been exhausted. Where this happens, we must not conceal that we are advocating lethal control in the absence of conclusive evidence of its benefits, and collection of that evidence must form a central part of any such project. This will be an expensive and controversial approach (Colwell *et al.,* 2020), would need to continue for many years for positive effects to persist and there is no guarantee of success (Douglas *et al.,* 2023). However, in the short-term at least, it is considered that focused, effective control of foxes and crows will be needed at key sites as a contribution to raising curlew breeding success from the current very low levels.
- **where undertaken, control of foxes and crows must be in combination with measures to reduce the underlying drivers of high predation pressure, or at the very least not contribute to those drivers.** Abundance of generalist predators could in some situations increase, for example, as a result of failure to remove fallen livestock, woodland creation and the release of high densities of gamebirds. Ongoing research may identify the importance of these in landscapes for breeding curlews.

Evidence gaps

Gylfinir Cymru determined there are key evidence gaps:

1. **What influences predator behaviour and abundance?**

   It is unclear whether predators operate evenly through a prey population. They may concentrate in particular localities, for example where prey are unusually plentiful or vulnerable. Better knowledge is required to understand how landscape features, such as linear habitats and habitat fragmentation, influence meso-predator abundance and foraging behaviour, and how the role of habitat modification can influence predator foraging.

2. **Why are there disproportionately high meso-predator densities in Wales and UK compared to European countries?**

   The reasons for such high densities are unclear but several factors possibly driving predator abundance have been suggested, such as increased food subsidy from large scale release of non-native gamebirds (Pringle *et al.,* 2019; Baines, 2023), other anthropogenic food supplementation and the role of woodland supporting and acting as refugia for generalist predators. A rapid evidence review of lowland gamebird releasing in England found no evidence to prove or disprove the food subsidy theory (Madden and Sage, 2020). Douglas *et al.* (2014) showed that woodland can be negatively associated with curlew breeding success.

3. **What is the effect of controlling a single species of predator?**

   Roos *et al.* (2018) showed that predation, mainly by foxes and non-native mammals, can limit the numbers of ground-nesting species such as waders, gamebirds and seabirds. They suggested that predator management aimed at foxes and corvids simultaneously is more likely to result in stable or increasing prey populations, but it is unclear whether curlew breeding success increases in response to the removal of a single predator, such as red fox or multiple species (e.g. red fox and carrion crow).

4. **What is the appropriate scale and duration of predator control required to provide a curlew response?**

   Evidence of the effectiveness of control of foxes and crows in farmed landscapes in Wales is difficult to detect and far from conclusive. There are several reasons that may explain no effect of predator control on breeding wader nest success in experiments on farmland, such as: annual variation in other prey types (e.g. cyclic vole fluctuations), site-specific context (e.g. extent of woodland or gamebird abundance, Douglas *et al.,* 2023), control not delivered at sufficiently high intensity, density dependent effects and individual variation in predator foraging behaviour.

   Douglas *et al.* (2023) report, to date, there is no scientific published study undertaken outside areas managed for red grouse that has been able to replicate the level of response of breeding waders, in either breeding success and/or adult abundance. It remains unclear what is the minimum spatial scale and effort of predator control required to demonstrate a curlew breeding success of 0.5 fledged chicks per breeding pair.

   Further research is also required on predation of curlew broods and whether legal predator control conveys the same benefits as nest survival.

5. **What is the role of predator control in combination with anti-predator fencing?**

   Electrified-exclusion fencing, typically deployed as a permanent structure and with relatively high maintenance costs, is proven to benefit breeding lapwing in wetland grassland nature reserves. It is as yet uncertain whether temporary electric fencing,

erected prior to or during the curlew breeding season, will improve curlew breeding success. It remains unclear whether predator control in combination with electric fencing is required.

References

Baines, D., Redpath, S., Richardson, M. and Thirgood, S. 2008. The direct and indirect effects of predation by Hen Harriers *Circus cyaneus* on trends in breeding birds on a Scottish grouse moor. Ibis 150, 27-36.

Baines, D., Fletcher, K., Hesford, N., Newborn, D. and 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.

Bodey, T. W., McDonald, R. A., Sheldon, R. D. and Bearhop, S. 2011. Absence of effects of predator control on nesting success of Northern Lapwings *Vanel/us vanel/us:* Implications for conservation. Ibis 153, 543-555.

Bolton, M., Tyler, G., Smith, K. and Bamford, R. 2007. The impact of predator control on lapwing *Vanel/us vanel/us* breeding success on wet grassland nature reserves. Journal of Applied Ecology 44, 534-544.

Brown, D., Wilson, J., Douglas, D., Thompson, P., Foster, S., Mcculloch N., Phillips, J., Stroud, D., Whitehead, S., Crockford, N. and Sheldon, R. 2015. The Eurasian Curlew-the most pressing bird conservation priority in the UK? British Birds 108, 660-668.

Colwell, M., Hilton, G. & **Smart, M.** 2020. Saving England's lowland Eurasian Curlews. Brit. Birds 113: 279-292.

Cote, I. M., and W. J. Sutherland. 1997. The effectiveness of removing predators to protect bird populations. Conservation Biology **11:** 395-405.

Douglas, D. J. T., Bellamy, P. E., Stephen, L. S., Pearce-Higgins, J. W., Wilson, J. D. and Grant, M. C. 2014. Upland land use predicts population decline in a globally near-threatened wader. Journal of Applied Ecology 51, 194-203.

Douglas, D.J.T. et al. 2021. Recovering the Eurasian Curlew in the UK and Ireland: progress since 2015 and looking ahead. British Birds 114, 341-350.

Douglas, D.J.T. et al. 2023. Varying responses of breeding waders to experimental manipulation of their habitat and predators. Journal for Nature Conservation. 72.

Fletcher, K., Aebischer, N. **J.,** Baines, D., Foster, R. and Hoodless, **A. N.** 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 47, 263-272.

Grant, M. C., Orsman, C., Easton, J., Lodge, C., Smith, M., Thompson, G., Rodwell, S. and Moore, N. 1999. Breeding success and causes of breeding failure of Curlew *Numenius arquata* in Northern Ireland. J. App. Ecol. 36:59-74.

Littlewood, N. A., Mason, T. H. E., Hughes, M., Jaques, R., Whittingham, M. J. and Willis, S. G. 2019. The influence of different aspects of grouse moorland management on nontarget bird assemblages. Ecology and Evolution, 9, 11089-11101.

Ludwig, S. C., Roos, S. and Baines, D. 2019. Responses of breeding waders to restoration of grouse management on a moor in South-West Scotland. Journal of Ornithology 160, 789-797.

Madden, **J.R.** and Sage, **R.B.** 2020. *Ecological consequences of Gamebird Releasing and Management on Lowland Shoots in England: A review by Rapid Evidence* Assessment *for Natural England and the British Association of Shooting and Conservation.* Natural England Evidence Review NEER016. Natural England.

Porteus, T. A, Reynolds, J. C, McAllister, M. K. 2019. Population dynamics of foxes during restricted-area culling in Britain: Advancing understanding through state-space modelling of culling records. PLoS ONE 14(11): e0225201.

Pringle, H., Wilson, M., Calladine, J., **& Siriwardena, G.** (2019). Associations between gamebird releases and generalist predators. Journal of Applied Ecology, 56, 2102-2113.

Roos, S, Smart J., Gibbons, D. W. and Wilson, J. D. 2018. A review of predation as a limiting factor for bird populations in mesopredator-rich landscapes: a case study of the UK. Biological Reviews 93, 1915-1937.

Roos, S, Smart J., Gibbons, D. W. and Wilson, J. D. 2022. *Corrigendum* to 'A review of predation as a limiting factor for bird populations in mesopredator-rich landscapes: a case study of the UK', published in Biological Reviews 93, 1915-1937. Biological Reviews 97, 600-603.

Smith, R. K, Pullin A. S, Stewart, G. B. and Sutherland, W. J. 2010. Effectiveness of Predator Removal for Enhancing Bird Populations. Conservation Biology 24, 820-829.

Tharme, A. P., Green, R. E., Baines, D., Bainbridge, I. **P. and O'Brien, M.** 2001. The effect of management for red grouse shooting on the population density of breeding birds on heather-dominated moorland. Journal of Applied Ecology 38, 439-457.

Appendix 1. Agenda

1. Welcome (Chair, Gylfinir Cymru)
2. Introduction and aims of the predation [redacted]
3. Overview of curlew nest and chick predation (David Douglas, RSPB)
4. Breeding curlew response to predator control (Andrew Hoodless, GWCT)
5. Outline of proposed principles [redacted]
6. Discussion (All)
7. Close (Chair, Gylfinir Cymru)