A guidance document on the methodologies of
Systematic Predator Management for the conservation of
Hen Harriers in the Slieve Bloom Mountains.
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Background:

Direct evidence from breeding Hen Harrier (*Circus cyaneus)* surveys in the Slieve Bloom Mountains is un-equivocal: nest predation is now a significant factor driving poor breeding outcomes that are unsustainably low. It is more likely that the increased frequency of predation at Hen Harrier nests in the Slieve Bloom Mountains is driven by the fragmentation and the loss of their nesting and foraging habitats. Moreover, the area available to sustain a breeding population has contracted by ~ 69%. The fragmented configuration of the forestry has also disrupted previously contiguous habitats of conservation importance (Sheridan *et al*. 2020), replacing them with significantly increased forest edge exploited by nest predators known to prefer edge habitats (Sheridan *et al*. 2020, Mac Mahon *et al*. 2019; Douglas et al., 2014, Reno *et al*. 2009). Sheridan et al. demonstrated that edge-to-area ratios associated with blocks of commercial forestry in the Slieve Bloom Mountains were positively associated with Hen Harrier nest site selection. Hen Harriers exhibit reproductive site fidelity (Balfour and Cadbury 1979, Strandberg *et al.* 2008, Geary *et al.* 2018, cited in Sheridan *et al*. 2020). For Hen Harriers breeding in the Slieve Bloom Mountains this behaviour has inadvertently created an ecological trap compounding the problem of reducing predation to a more sustainable level.

Ground-nesting bird species are considerably more prone to predation because their nests are easily accessible to mammalian and avian predators (Martin 1993). Experimental evidence indicates that a seasonal reduction in the number of predators can significantly increase the net breeding productivity of most ground-nesting bird species, e.g., (Newton 1993; Fletcher *et al*., 2010; Potts 1986, 2012; Ellis-Felege, *et al*., 2012; Tapper *et al*.1996) including the Hen Harrier (Baines & Richardson, 2013; Ludwig *et al.* 2017). Evidence shows that interventional predator management may prove productive at delivering conservation objectives (Gilsdorf & Rossi, 2008; cited in Mc Mahon *et al.,* 2020). Seasonally focused systematic predator management has more impactful conservation outcomes because it increases hatching and fledgling success by interrupting nest predation from a full suite of predators. This approach reduces the impact of compensatory predation. In this scenario, the predators left behind take advantage of the absence of competition caused by removing only a subset of nest predators.

Breeding Hen Harriers in the Slieve Bloom Mountains, the conservation reality:

The recovery of the breeding Hen Harrier population in the Slieve Bloom Mountains will ultimately depend on restoring the habitats at a landscape scale. However, we are nowhere near that situation because habitat restoration at the required scale is not achievable in the short term. Systematic predator management seeks to maximize the breeding productivity of Hen Harriers while accepting that other population dynamics, such as post-fledgling survival, are beyond its scope. Nonetheless, direct and meaningful interventions to reduce nest predation to more sustainable levels may buy more time to deal with the underlying issue driving poor breeding productivity: the destruction and the fragmentation of their upland habitats.

What is effective predator management?

- All things being equal, effective predator management in the Slieve Bloom Mountains can only be measured by the number of Hen Harrier chicks that fledge at the sites undergoing a nest protection program.
- Protecting Hen harrier nests from a suite of predator species in focus areas by a professional gamekeeper(s) is much more effective than controlling single predators on an ad-hoc basis.
- The continuity of predator management should remain unbroken throughout the Hen Harrier's breeding season. Depending on habitat dynamics at the site level, foxes *(Vulpes vulpes)* can be highly mobile and capable of hunting over large territories in an altogether unpredictable manner.
- Reducing the impact of fox predation requires an unbroken continuity of effort during the nesting and chick-rearing period. After that, fox control is a zero-sum game. It is unnecessary and will burn up resources better targeted for predator management in the following Hen Harrier breeding seasons.
- Systematic predator control reduces the likelihood of compensatory predation as the source of mortality.
- Systematic predator management reduces nest losses caused by itinerant foxes “moving into” the vacated territory caused by removing the previous occupant(s).
- By law snare lines should and must be checked at least once a day – every day they are set.
- For animal welfare reasons, live catch traps must be checked each day they are set.

Predator Management Methodologies.

Snaring - The Laws and Legislative Restrictions:

The primary legislation governing Ireland's legal predator control is the 1976 to 2018 Wildlife Acts (as amended). This legislation provides the framework for protecting and conserving wild fauna and flora. The legal requirements for the use of snares and traps are outlined in S.I. No. 620/2003 - Wildlife Act 1976 (Approved Traps, Snares, and Nets) Regulations 2003. The Wildlife Act(s) do not legislate for animal welfare per se, as its primary purpose is wildlife conservation. However, predator management is subject to the Animal Health and Welfare Act 2013.

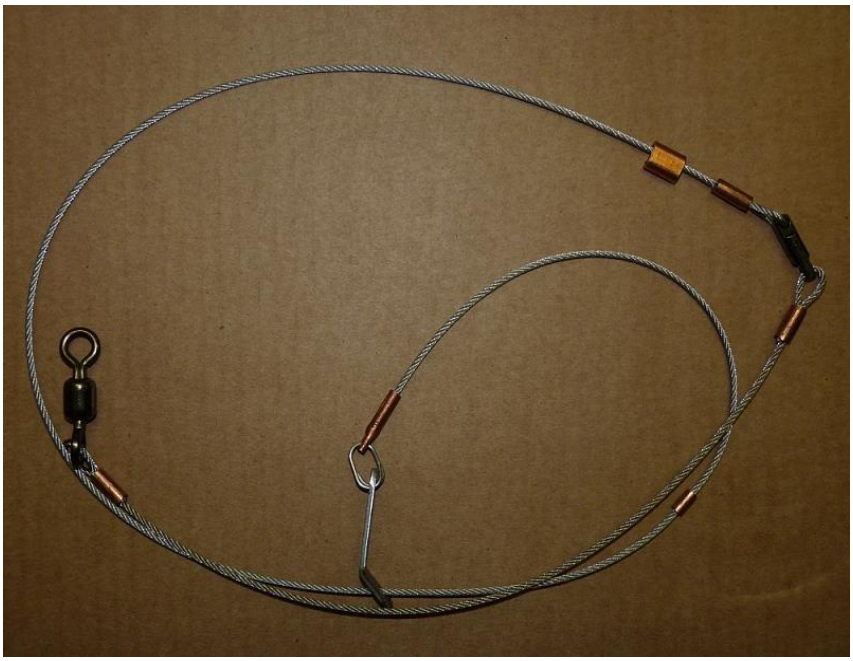

Photo 1: Fox snare designed to restrain foxes and engineered to release non-target mammals.

Fox control - snaring by restraint:

The extent of cover available in the Slieve Bloom Mountains makes it very difficult to control foxes using one method alone. Snaring can be a highly effective technique and a humane way of reducing the impact of fox predation on ground nesting breeding Hen Harriers. Snares were not designed to kill; they are a restraining device that allows the humane dispatch of a snared fox. The snare in Photo 1 has been engineered to restrain a fox while allowing non-target animals, such as badgers (*Meles meles),* to break free and escape. The performance of this snare type was experimentally tested in 1,296 captures, which measured the force exerted by restrained foxes (Short *et al.* 2012). The stop can be fixed to comply with Ireland's statutory regulations governing traps and snares. Depending on the challenges of predator management in different habitats, these snares are available in two-wire materials, galvanized or stainless steel, and with either a copper-eyed crimp or a wire loop at the end of the snare. This model also has an anchor system, which may be advantageous in open ground with no fixed points to secure a snare. The snare in Photo 1 is designed to catch and restrain foxes without injuring them.

Photo 2: This model has an anchor system, which may be advantageous in open ground where there are no fixed points to secure a snare.

Other methods of fox control:

The principal method used to control foxes is shooting with a rifle (for example, a high-powered .222 caliber), operated at night using a high-powered spot lamp. To control "lamp-shy" foxes, a keeper should always carry their shotgun while checking live catch traps and fox snares on their beat. A beat is defined as the keepers' area of operation in which there will be an unbroken continuity of predator management until all Hen Harrier chicks have fledged and left their nests. The use of several high seats should also be considered. Using these high seats affords an individual marksman a safe line of sight for rifle shooting while also giving a vantage point to survey for the presence of predators during early morning and late evenings.

Rifle:

The most common method used to control foxes is using a high-powered rifle and lamp during night-time hours by competent practitioners with detailed knowledge of the land being shot over. Any caliber less than .22 hornet centrefire, including .22 rimfire and .17 rimfire rifles, are not permitted to shoot foxes, as they fall below the standards required for humane dispatch. Bullets from a high-powered rifle can travel distances of more than 1km. Thus, they must be aware of the destination of the discharged bullet and only discharge the shot when they know a suitable backstop is present.

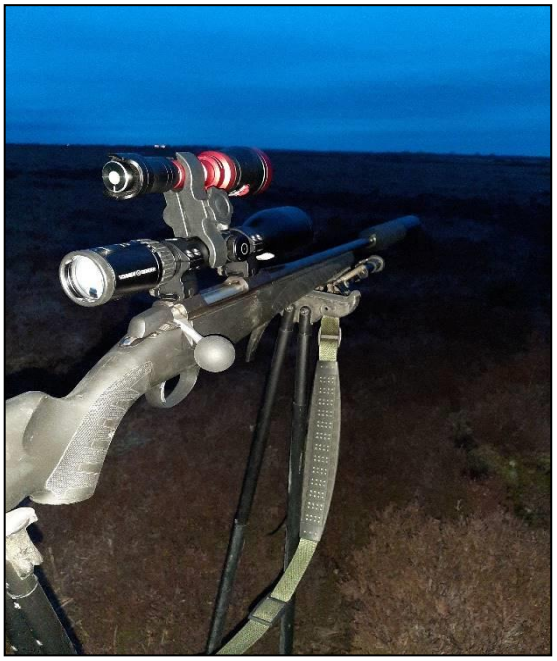

Photo 3: Example of a suitable backstop when shooting

Fox control with shotgun:

Shotguns are primarily used to control corvid species, such as the grey crow (*Corvus cornix*) and the magpie (*Pica pica*). Although shotguns although not widely used to control foxes – they are nonetheless a useful tool to control foxes, particularly for chance encounter(s) with a fox. Moreover, when applied correctly, they can be used to humanely dispatch trapped or snared foxes using a shot size of AAA, or B.B.

Fox Middens:

A midden area has been baited with food to draw in foxes to control their numbers locally. When fox densities are very high, Middens provides a focal point that may encourage foxes away from breeding Hen Harrier nesting sites.

The legislation on the control of foxes:

Under the 1976 to 2018 Wildlife Acts, the fox is not a protected wild animal. Consequently, it can be hunted all year. However, certain restrictions apply to the use of any fox caller. Using any electrical instrument capable of emitting sound requires a Section 35 (1) (d) license. Also, any mechanically propelled vehicle to hunt foxes is not permitted unless the person has a Section 36 license granted by the Minister.

When shooting fox, other restrictions apply, and thus, a person shall not:

1. Shoot from a public road, including standing on a highway or within less than 60 feet of a public road.
2. Hunt/lamp from any mechanically propelled vehicle (stationary / moving) – without a license.
3. Use any caller[1] capable of emitting sound.
4. Use night vision mounted scopes without a license.
5. Shoot over land without permission.
6. Shoot over roads.
7. An Garda Síochána must license all firearms. Each firearm is licensed to a person and cannot be operated by another person unless there is a license provision for that purpose: the Gardaí can grant a license to two people to use a gun.

Guidance on the use of fox snares:

- When using fox snares, the person setting the restraint is legally obliged to ensure it meets the minimum requirements in the legislation, specifically the S.I. No. 620/2003 (Approved Traps, Snares and Nets) Regulations 2003.
- The snare must have a 'stop' with a minimum length from noose to stop of 33 cm to ensure it does not injure, choke, or strangle the animal.
- The snare must be anchored securely to the ground – using a drag pole to secure a cable restraint is not permitted (by law).
- Once set, the snare must be checked at least once a day.
- Best practice governs where snares should be placed to avoid entanglement and the capture of non-target species. They should not be set close to public rights of way or access; this includes areas where the public may walk their dogs routinely or along runs frequented by livestock. Snares should not be set where entanglement could occur, such as wire fence lines, tight natural gaps in trees, or locations by water (where the caught animal may drown). In periods of adverse weather, they are checked twice a day.

[1] Electronic callers attract target species within shooting range. They can be used (under license) to call in corvids, such as Magpies, Grey Crows, and Foxes, to the shooting range.

Grey Crows and Magpies (Corvids):

The grey crow and the magpie are species of corvid that pose a significant threat to ground-nesting birds, and it is not uncommon, between spring and early summer, to see corvids using perching posts to scan breeding areas or flying low over breeding habitats looking for nests and chicks (Tapper *et al.* 1986). During this period, territorial pairs of grey crows and magpies are removed by Larsen trapping. In addition to the removal of territorial birds, the continuity of Larsen trapping disrupts the attempts by other corvids to establish or defend a newly acquired territory caused by the removal of the pair that has been trapped. Control of these corvids is only required from March to July. Outside of this time, control is unnecessary and a waste of time and resources.

The Legislation & the Legal Requirements:

All bird species, including grey crows and magpies, are protected under the 79/ 409 EU Birds Directive. However, this Directive recognizes that some bird species can cause damage to, e.g., crops, livestock, and fauna. Consequently, Article 9 of the Directive allows Member States to issue derogations allowing control of certain species in different situations. For the grey crow and the magpie, the circumstances in which they can be controlled and the methods allowed are set out annually in a state-wide derogation by the Minister and are available on the NPWS website. https://www.npws.ie/legislation/irish-law/eu-birds-directive-derogations. Corvid control using Larsen traps is governed by Section 35 (5) of the Wildlife Acts 1976 – 2018 and the Animal Health and Welfare Act 2013. The derogations permit the control of corvid species. In addition, under Section 35 of the Wildlife Act, the use of decoy birds in cage traps is only permissible "in a cage with sufficient dimensions to enable it to move and exercise freely." The wing span of a Grey Crow is ~ 1 meter. Thus, to comply with the law, the call bird compartment of all Larsen traps must be of a dimension greater than 1 meter in all directions. Some standard box-type Larsen traps used in Ireland currently fall short of this. There are also issues with using the Hexagonal type Larsen trap. Its geometric dimensions also fall short of the conditions set out in Section 35 of the Wildlife Acts 1976-2018. Consequently, using these traps is illegal – and shall not be used as a method of corvid control.

The call/decoy birds shall:

1. Always be provided with clean water.
2. Always have sufficient food that is palatable and suitable quality to sustain the bird.
3. Always have protection from the elements by a suitable shelter.
4. Only be used to trap birds of the same species.
5. Be provided with a perch situated under a suitable shelter.
6. Only be kept in a suitably sized cage where it can move and exercise freely
7. Only be housed in a Larsen trap when it is in use.
8. The cage is regularly cleaned to avoid a build-up of fecal waste or old food.
9. The Larsen trap is checked at least once every 24 hours; in adverse weather conditions, twice a day is advisable.

Larsen trapping:

Larsen traps are used to catch and remove breeding pairs of grey crows and magpies from areas where Hen Harriers are known to breed. A live Grey Crow or Magpie, known as the call bird (or decoy bird), is placed in the Larsen trap's centre compartment, and the trap is set in an area suspected of holding territorial birds.

Larsen trapping is most effective when resident corvids are highly territorial between March and June. This time coincides with the breeding season of the Hen Harrier. It is, therefore, an essential tool for conservation purposes. While many types of Larsen traps are available for purchase, few reach the standards required by Section 35 (5) of the Wildlife Acts for use with grey crow. Only Larsen Traps that meet both legal and ethical standards shall be used. No legislation governs how long a decoy bird may be kept; however, according to best practice, call birds should be held in the trap for a two-week maximum time limit. After this, the bird is dispatched (rather than released into the Hen Harrier breeding territories). At the end of the trapping season, traps are decommissioned, and the call birds are released.

The Ladder Trap:

The ladder trap is used to catch multiple corvids over some time. It is a large trap, usually 5 or 6 ft^2, with a ladder-type entrance on the roof. Corvids can freely enter the trap through the ladder but cannot exit. It is mainly used to control non-breeding birds which flock together during spring and summer, often in large numbers. The ladder trap is generally baited for some time before the ladder roof is installed. Trapped birds quickly catch other corvids that have become accustomed to the trap from the surrounding area. Both ladder and Larsen traps may inadvertently catch non-target species. In such instances, these are immediately released unharmed. As with Larsen traps, ladder tarps must be checked once per day.

The dispatching of trapped corvids:

Once caught, a trapped corvid can be used as a decoy in another Larsen trap. Excess birds are humanely dispatched. Birds shall be humanely dispatched out of sight of call birds as soon as possible after it is known that a bird has been caught. At the end of the trapping season, traps are decommissioned, and the call birds shall be released unharmed.

Small Ground Mammals & Feral Cats:

Mink (Mustela vison), Feral Cats (Felis catus), and Brown Rats (Rattus norvegicus) will, if the opportunity presents itself, predate adult birds, their eggs, and their un-fledged juveniles.

Mink:

Invasive species are listed as one of the greatest threats to global biodiversity, and the American Mink is listed as one of the world's worst 100 invasive non-native species by the IUCN's Invasive Species Specialist Group (www.issg.org) (Roy *et al.* 2009). A seasonal reduction of these predators is achieved by establishing a network of traps at strategic points, such as watercourses, woodland edges, or drain systems in upland habitats. Mink rafts can be used both to monitor the population or presence of Mink and to trap animals with the addition of a cage or spring trap. When used for surveying, the topside of the mink raft is lined with clay or sand to show the tracks of any animal that enters the tunnel. Once their identifying tracks have established the presence of Mink, a cage trap is inserted.

Feral Cats:

Feral Cats are a very destructive predator of ground-nesting birds, killing incubating females on their nests and entire broods of unfledged Hen Harrier chicks. It is estimated that there are currently 200,000 Feral Cats in Ireland (ISPCA). While the number of feral cats is unknown, the damage that one cat can do to a ground-nesting birds of serious conservation concern in Ireland is very significant. The most effective methods of dealing with feral cats are lamping at night and trapping - or a combination of both. Cat traps shall be checked every day they are set.

Brown Rats:

Rats threaten all ground-nesting birds as they are known to nest predators (Tapper *et al*. 1986). Rats can be targeted in various ways to conserve ground-nesting birds. Rats are ubiquitous creatures found in upland habitats along drains, hedgerows, and the edge of woodland. Using approved spring traps in tunnels placed strategically in all these areas should reduce the chance of encountering a Hen Harrier nest. Both Fenn marks 4/6 and Doc 150/200 are legally used to control rats.

Photo 4: Mink Raft

The Legislation:

As an invasive mink control, it is widely practiced in Ireland. This species is often found in the same habitats as the Irish stoat *(Mustela ermina*) a protected species in Ireland that cannot be trapped or killed without a Section 42 license. The 1976 Wildlife Act and its amendments, specifically the S.I., are the principal legislation governing the trapping of small ground mammals. No. 620/2003 - Wildlife Act 1976 (Approved Traps, Snares and Nets) Regulations 2003.

To conform with the legislation:

1. All traps (spring and live catch traps) must be checked at least once daily.
2. It is illegal to drown any animal, including mink.
3. To help reduce the accidental trapping of non-target species all spring traps must be housed in a suitable tunnel

The Agreement on International Humane Trapping Standards (AIHTS).

In 1997, the E.U., Canada, and Russia reached an agreement on International Humane Trapping Standards to develop a specific testing regime for equipment that traps nineteen (19) species of fur-bearing animals. Before this, no legally binding humane standards had been agreed upon. Signatories to this agreement undertook to outlaw any traps that did not meet the approved criteria. However, Ireland has no legal obligation to adhere to this agreement (because species on the list are not legally trappable/trapped in Ireland).

In the interests of animal welfare and following best practices, therefore:

- Cage traps are not placed in areas where flooding may occur overnight.
- Cage traps are set away from livestock and the public to eliminate stress on the animal.
- Cage traps are covered to prevent stress: mink should not be exposed to the elements as they instinctively do not like being caught in the open.
- Live trapped animals are dispatched humanely and immediately with an appropriate firearm (a rifle, shotgun, or air gun).

Meso-predator control at breeding Hen Harrier sites:

Meso/smaller ground predators include rats, stoats and mink. Stoats are a protected wild mammal. Therefore, a program of seasonal control in a Hen Harrier nesting locations requires a Section 42 license. To ensure the highest standard of animal welfare is applied, the trap in photos 5 and 6 is the New Zealand Department of Conservation (DoC) humane trap. This trap model is designed to control meso predators humanely.

Photo 5: New Zealand Department of Conservation (Doc) approved spring trap

Photos 6: The Department of Conservation (DoC) approved traps from the control of meso ground predators. Since 2018, Ireland has been morally obliged but not legally bound to implement the International Humane Trapping Standards (AIHTS) agreement.

Wildlife Licences and Protected Species:

Based on published evidence, generalist predators, particularly foxes, are the principal agents causing depredation on ground-nesting bird species (Zielonka *et al*. 2019; Grant *et al*. 1999). However, there is direct evidence that protected species, such as the pine marten (Martes martes) & badgers are nest predators capable of causing a complete breeding failure of ground-nesting birds including the Hen Harrier. Thus, a section 42 license is required for translocations and possession by accidental capture.

Section 42 of the Wildlife Act 1976

- Section 42 of the Wildlife Act, 1976 (as amended) provides, among other things: where protected wild animals or birds are causing severe damage to:
- Food (including human food products and animal feeds), livestock, poultry, or crops (including vegetables or fruit) on pasture or cultivated land.
- Pen-reared wild birds on any land.
- **Other fauna.**
- Flora.
- A woodland, a forest plantation, or a fishery.
- Buildings and other structures and their contents, or aquaculture installations

Meso- predator Aversion:

Apex predators can limit the abundance and behaviour of meso-predators, thereby reducing predation on smaller species. This suggests apex predators may have stronger suppressive effects on meso-predators (Cunningham *et al.,* 2020). Meso-aversion techniques attempt to exploit the innate fear meso-predators have for Apex Mammalian Predators. Whether this works or assists the conservation efforts on behalf of the Hen Harrier by reducing predation in an Irish upland is unknown. However, every tool available at our disposal should be used if there is the remotest chance it will tip the balance in favour of the breeding Hen Harriers. It is envisaged that trialling the use of apex predator scat such as wolf (*Canis lupus)* or lion (*Panthera leo*) as a deterrent to foxes from areas where Hen Harriers are known to be breeding. This trial shall begin in 2024. To that end, Dublin Zoo has been contacted. They are willing to assist the project by providing the excrement. There is also the possibility of trialling the use of the scat around a bait point, compared to a control site without any scat. Camera traps will monitor each site to minimize human disturbance and sent.

Recommended measures for nest protection:

Territorial corvids respond fast to intruders by rapidly reoccupying vacant territories. Therefore, there should be no break in the continuity of corvid control throughout the breeding season. The use of ladder traps should reinforce Larsen trapping. The Larsen and the ladder traps should be maintained to a standard that gives due consideration to the welfare of each call bird. In line with the ethical treatment of predatory species, each trap should be attended by a suitably trained/qualified person and visited at least once daily to ensure a continuity of welfare. Traps to control mink and rats should be established at each Hen Harrier breeding location. Systematic predator management should be sustained throughout the Hen harrier egg laying, incubation, and chick-rearing periods from March to July 31st. Outside of that time, predator management (no matter how good) makes no difference.

Concluding remarks:

Predator removal within one group may not translate to additive increases in overall nest success, but rather results in shifts in the identity of predators responsible for nest failures (Ellis-Felege, *et al.*, 2012). For those charged with the management of an EU Annex 1 bird species - the loss of individuals from locally abundant predator populations is necessary to deal with a conservation reality: the likelihood of a local extinction in the absence of a direct intervention to reduce nest predation to a more sustainable level. While the loss of individual predators from abundant predatory populations may be acceptable – the extinction of a breeding species that continues to decline in an SPA designated for them is not.

Courchamp *et al.* (1999) studied the effect of removing what was described as a "super predator" (feral cat) threatening endemic bird species in an ecosystem that also included rats. Results showed that only one predator may be sufficient to drive an endemic prey species to extinction. Still, removing the feral cat may also release the rat from predation by the cat, which may cause the extinction of the endemic prey. So, these predator-prey relationships can be complex. With increasing human modifications of the Slieve Bloom Mountains, prey populations have become more fragmented, isolated, and more vulnerable to predation. Thus, direct interventions are now urgent to restore the balance necessary for the survival of a species with an average net breeding productivity of 0.46 (± 0.240) chicks fledged per confirmed breeding pair. On average, this is 0.75 below the minimum threshold required for population stability. If the Slieve Bloom Mountains is to remain an SPA for breeding Hen Harrier, a net breeding productivity of at least 1.0 –1.4 fledged young per confirmed breeding pair is necessary: the upper end of this figure being the requirement (Ruddock *et al.*, 2016).

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