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Predator Control for Conservation

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Summary

- **Carefully-planned, legal predator control can benefit some species of conservation concern, particularly ground-nesting birds.**
- **The law currently permits the control of five species of predatory bird (all members of the crow family) for the conservation of wild birds and around eight species of predatory mammal by a range of methods, primarily shooting and trapping.**
- **It is essential that all predator control complies with the strict wildlife conservation and animal welfare legislation that controls its use.**
- **As an alternative or supplement to direct predator control, there are a number of indirect methods, including habitat and prey manipulation, which may have a beneficial effect.**

Introduction

Predator control is a long-established part of rural land management in Scotland, primarily for the protection of game and livestock. It can be a controversial issue with the wider public, but there is considerable scientific evidence that targeted, legal predator control can play an important role in the conservation of some of our most vulnerable wildlife, particularly ground-nesting game and wading birds, such as black grouse, capercaillie, grey partridge, curlew and lapwing. There is little evidence that predation has a major impact on songbird populations (Gibbons et al. 2007).

Our native predator and prey species evolved together and have co-existed for many thousands of years in the natural environment without significant human intervention, so predation is rarely the primary cause for wildlife declines. However, human impacts on the landscape ecology of Scotland have shifted the balance between some predators and their prey resulting in situations where predation can cause reductions of already struggling wildlife populations or prevent recovery.

In common with many other species of wildlife, 'generalist' predators such as crows and foxes can show a pronounced 'edge effect' where the highest populations occur near the boundaries between woodland, which provides cover for breeding and resting, and open habitats that provide better feeding areas, particularly as agriculture has become more productive. As human activity has resulted in a diverse patchwork of open and wooded habitats across much of Scotland, the populations of some generalist predators (as well as many other species) are likely to have increased due to these edge effects. For those species of wildlife that are more specialised and restricted to woodland or open habitats and which do not themselves benefit from an edge effect, the reduction and fragmentation of their habitat means that they are never likely to be very far from the habitat edge and consequently may be exposed to higher levels of predation than was the case when their habitats were more extensive.

The introduction of rabbits (a non-native species), which only started to spread in the wild from the 18th century onwards and which were rare in northern Scotland until the 19th century provided an abundant source of food that is also thought to have increased the populations of many predators, particularly stoats, but also foxes (Harris et al. 1995).

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Non-native predators also pose a significant risk as our native wildlife evolved in their absence and are not necessarily adapted to cope with the effects of their predation. The introduction of the American mink has been the main factor in the decline of the water vole, while mink, brown rats and grey squirrels have been implicated (as nest predators) in the declines of seabirds, wading birds and woodland birds in some areas. On some islands, the absence of predators that are native to the mainland, such as foxes, badgers and hedgehogs has allowed high densities of ground-nesting birds to develop and the introduction of these species onto such islands could be very damaging to these important populations.

The purpose of this note is to provide an overview of the legal and practical requirements of undertaking predator control, with a particular emphasis on its role in the conservation of biodiversity, although much of the practical and legal advice is relevant to predator control for other purposes.

Planning Predatory Control

As predator control is often time-consuming and expensive, the greatest benefits will accrue where it is used as a supplement to habitat management. Although predator control may allow some of our scarce wildlife to survive in small fragments of suboptimal habitat, a more sustainable solution in the long term is to enlarge and link areas of suitable habitat and to improve their quality for target species. This may reduce the requirement for predator control and in certain circumstances may remove the need for it altogether. Non-lethal methods of predator control (discussed later in this note) may also play a useful role. It is always important to try to assess whether predation is having a significant impact on the species that you are trying to conserve, as it may be a waste of effort if other factors are more important.

Where predator control is required, it should be carefully targeted to maximise its effectiveness. Sporadic or occasional control is likely to be of little benefit. For example, efforts to protect ground-nesting birds should typically be concentrated around the breeding season and around areas that are important for the species being conserved. It is important to remember that removing predators from an area of land may create a 'vacuum' effect that can draw in more predators from surrounding areas if control is not carried out on these too, resulting in an ongoing effort to maintain the benefits of predator control in the long term.

The overall level of predator control required for conservation alone will generally be lower than that required for wild game management for hunting. In both situations the production of young by the species being conserved must offset annual adult mortality to maintain a stable population from year to year, but for game management, it must also provide a harvestable surplus for hunting. However, in some circumstances, a surplus may also be desirable for conservation purposes, particularly where the aim is to increase the population of a species from a low level or to allow it to re-colonise new areas. Production of a surplus of young in some areas may also help to maintain populations in other areas where productivity is below the level required for stability (known as 'source-sink' population dynamics).

Finally it is important to ensure that all predator control is carried out in strict accordance with the law. Failing to comply with the law can lead to prosecution and potentially the loss of agricultural subsidies through cross-compliance rules. The Wildlife and Natural Environment (Scotland) Act 2011 introduced the offence of vicarious liability, which means that land owners and managers can be held responsible for certain crimes committed against wild birds on their land by their employees, contractors or agents unless they can demonstrate that they did not know the offence was being committed and took all reasonable steps and due diligence to prevent it. Incorrect use of traps that leads to animal welfare issues could also increase the likelihood of certain methods of trapping being prohibited or more strictly controlled. Although not illegal, the display of corpses of predators (e.g. gamekeepers' gibbets) serves no useful purpose and is also likely to provoke a negative reaction towards predator control among many countryside users.

All predatory animals that may be legally controlled in Scotland are either birds or mammals and include some species such as grey squirrels and brown rats, which may not typically be thought of as predators, but which regularly predate birds' nests. The legal protection and permitted control measures for predatory birds and mammals are detailed in the following sections.

Predatory Birds

Legal protection

All wild birds, their nests and eggs are protected by law under the Wildlife and Countryside Act 1981 (as amended) and it is an offence to intentionally or recklessly kill, injure or take any wild bird (apart from Schedule 2 species outside the close season) or to take, damage, destroy or otherwise interfere with the nest of any wild bird while it is in use, unless licensed to do so by NatureScot (formerly Scottish Natural Heritage), as the statutory nature conservation agency.

Specific licences to control birds will normally only be issued for small-scale selective control where the evidence supporting the licence application stands up to scientific scrutiny and if there is no satisfactory non-lethal alternative. However, NatureScot issues general licences each year which allow any authorised person to kill or take certain bird species for particular purposes, without applying for an individual licence. The relevant general license in this case is *General License 01: to kill or take certain birds for the conservation of wild birds*. Authorisation to use the licences must come from the owner or occupier of the land in question and each licence can only be used for the purpose for which it is issued. Anyone with an unspent conviction for a wildlife or animal welfare offence since 1 January 2015 cannot make use of the general licences and NatureScot can withdraw the right to use general licenses from specific individuals and/or areas of land.

It is very important to check the current terms of the licences as they are renewed on the 1st January each year and both the species included and permitted methods of control may change from one year to the next. For example, there was a significant change to the general licenses in 2020, removing gull species and reducing the range of species that can be used as decoys in a Larsen trap. The species currently listed on the general licenses are shown in Table 1. Note that Rooks can only be controlled under a separate general license to prevent damage to livestock and crops and not to prevent predation of wild birds.

It is important that anyone using the general licence is able to confidently identify the listed species (and their nests and eggs if these are being targeted). The raven (*Corvus corax*), which is widespread throughout Scotland and the chough (*Pyrrhocorax pyrrhocorax*), which is restricted to the Argyll islands, are fully protected but could both be confused with other corvids that are listed on the general licences.

Table 1 Predatory bird species that can currently be controlled under General License 01 for the conservation of wild birds

Common Name	**Scientific Name**
Carrion Crow	*Corvus corone*
Hooded Crow	*Corvus cornix*
Jackdaw	*Corvus monedula*
Jay	*Garrulus glandarius*
Magpie	*Pica pica*

Control methods

The control methods which are permitted under the general licence are (in increasing order of potential welfare impact):

- Pricking of eggs
- Oiling of eggs
- Destruction of eggs and nests
- By hand
- Targeted falconry
- Shooting with any firearm, including semi-automatic firearms, shotguns or air weapons
- A multi-catch cage trap
- A Larsen mate trap
- A Larsen pod trap
- A Larsen trap

Authorised persons should consider the least impactful permitted method of taking or killing available in the circumstances. However, shooting and trapping are generally the most common methods used. Only traps that are designed to capture birds alive and uninjured are permitted under the general licences. Anyone using a trap must be registered with NatureScot and the individual's registration number must be displayed on the trap. This replaces the previous system of getting a code from the police. When a trap is not being used it must be rendered incapable of use and of being easily re-activated by a third party (for example by removing the trap or one of its panels or padlocking the door open).

A Larsen trap is a small portable cage with a spring activated trap door at the top or side that will close behind any bird heavy enough that enters the trap. Either bait or a live decoy bird can be used to attract target birds into the trap, with decoy birds often greatly increasing the effectiveness of the trap. Only a single live decoy can be used and it must be in a separate closed compartment within the cage. At the time of writing, only Carrion Crows, Hooded Crows or Magpies are permitted as decoy birds in Larsen traps that are set under the general licence for the conservation of wild birds. The use of any other species as a decoy (e.g. a pigeon) is an offence.

Larsen mate and Larsen pod traps are types of cage trap where the two halves or doors of the cage close over a bird if it lands on a baited perch in the middle of the trap. Due to concerns that such traps could injure larger non-target species such as raptors that attempt to reach the bait, there is an additional requirement to register if using meat-based baits in these traps and to annually report any non-target species caught and released. Larsen traps and Larsen mate and pod traps must be securely pegged or staked to the ground.

Multi-catch cage traps are much larger and typically have a narrow ladder or funnel in the top which birds can easily drop through but are unable to fly back through. Carrion Crow, Hooded Crow, Jackdaw and Magpie may be used as a decoy in a multi-catch cage trap.

For all types of cage trap live decoy birds must be provided with food, water, a suitable perch and shelter from the prevailing wind and rain. All traps must be inspected at least once every 24 hours, so it is important not to set more traps than can be easily checked every day. Any non-target species must be released immediately and any target birds to be killed should be dispatched humanely. Any dead or sick decoy birds must removed immediately. It is illegal to trade in decoy birds, so these must be acquired by initially baiting traps, or by asking another crow trapper to give you one that they have caught.

Corvid control should concentrate on the spring and summer period (March-July) as this is when they are most likely to affect prey species through nest predation. Territorial breeding pairs of crows are likely to be the greatest threat to other nesting birds, so these should be targeted rather than groups of nonbreeding crows which tend to roam over much larger areas. Shooting crows at the nest must be done with great care as some protected bird species (such as kestrels or long-eared owls) sometimes make use of old crow nests. Traps should be set close to known crow nest sites or, if these are unknown, close to woodland edges, clumps of trees or thick hedges. If nothing is caught within a couple of days, the trap should be moved to another location.

There are additional standing conditions for using the general license in or adjacent to certain designated sites, which authorised persons should make themselves aware of.

Predatory Animals

Legal Protection

Unlike birds, there is no over-arching legal protection for mammals. Instead those mammals that cannot be killed or taken are covered by three separate pieces of legislation: those listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), European Protected Species listed in the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and badgers (*Meles meles*), under the Protection of Badgers Act 1992 (as amended). All of these species are protected from being deliberately or recklessly killed, injured, captured or disturbed in a place of shelter. Their places of shelter are also protected from damage or obstruction – for European Protected Species this is an offence of strict liability (i.e. it is an offence even if not deliberate or reckless). Table 2 shows the predatory mammal species which are protected and the relevant legal protection.

Schedule 6 of the Wildlife and Countryside Act 1981 lists mammals that cannot be killed or taken by certain methods that are otherwise legal, including trapping, snaring, lamping/night shooting. In practice, the only species on Schedule 6 that are not already protected by Schedule 5 or the Protection of Badgers Act are hedgehog and shrews (all species), which can only be killed or taken by very limited methods.

Table 2: Protected predatory mammals that cannot be killed or taken

Badger	*Meles meles*	Protection of Badgers Act
Otter	*Lutra lutra*	European Protected Species
Pine Marten	*Martes martes*	Schedule 5 Species
Wildcat	*Felis silvestris*	European Protected Species
Red Squirrel	*Sciurus vulgaris*	Schedule 5 Species

As with protected birds, it is possible to apply for specific licences to allow activities that would otherwise constitute an offence against these species. This could include control measures to protect another species, but would be subject to strict conditions and there would have to be strong evidence of the benefits of such measures for a licence to be granted.

In practice, the species listed in Table 3 are the predatory mammals that can be legally controlled and which are most likely to be the target of predator control efforts. As with birds, it is important to be able to confidently identify the species involved. Feral cats (which can be controlled) may be difficult to distinguish from wildcats (protected) or domestic cats (which could be classed as property and thus protected by the law on criminal damage). An inexperienced observer could even confuse grey and red squirrels, although it is more likely that a reddish coloured grey squirrel could be mistaken for a protected red squirrel than vice versa.

Table 3: The main predatory mammal species that can be legally controlled.

Red Fox	*Vulpes vulpes*
Stoat	*Mustela erminea*
Weasel	*Mustela nivalis*
American Mink	*Mustela vison*
Feral Ferret	*Mustela furo*
Feral Cat	*Felis catus*
Grey Squirrel	*Sciurus carolinensis*
Brown Rat	*Rattus norvegicus*

Control methods

There are strict rules on the methods that can be used for control of predatory mammals.

Under the Wild Mammals (Protection) Act 1996 (as amended) it is illegal, with certain exceptions (including actions made lawful by means of a snare or trap lawfully used for the purpose of killing or taking any wild mammal), to mutilate, kick, beat, nail or otherwise impale, stab, burn, stone, crush, drown, drag or asphyxiate any wild mammal with intent to inflict unnecessary suffering.

The Protection of Wild Mammals (Scotland) Act 2002 prohibits the use of dogs to deliberately hunt any wild mammal. However, it is permitted to use a dog under control to stalk or flush a wild mammal from cover above ground for pest control purposes, provided that the target mammal is shot or killed by a bird of prey as soon as possible after it is flushed. Fox and mink may also be flushed from cover below ground provided that reasonable steps are taken to prevent the dog from becoming trapped or injured.

The Wildlife and Countryside Act 1981 (as amended) prohibits the use of self-locking snares, bows or cross-bows, explosives (other than ammunition for firearms) and the use of any live mammal or bird as a decoy to catch a wild animal.

Under the Control of Pesticides Regulations 1986 (as amended), the only poisons approved for mammals are rodenticides for mice and rats that must only be used where they cannot be accessed by children, pets and non-target species.

There are therefore four main methods of legal control of predatory mammals: shooting, cage traps, spring traps and snares.

Shooting

The use of firearms is of course strictly controlled by the Firearms Act 1968 (as amended), but particular care must be taken when shooting predatory mammals as this often takes place at night using night vision equipment or, more commonly, a spotlight ("Lamping"). A code of good practice is available from the British Association for Shooting and Conservation (BASC) which can help to ensure shooting is safe and humane. Individuals undertaking night shooting should be familiar with the terrain that they are shooting over to ensure that they are aware of safe directions for firing and the proximity of potential hazards such as houses, paths and roads and should never shoot from a moving vehicle. Shooting at a pair of eyes is unacceptable and care must always be taken to identify the body of the target animal. For foxes a .22 rifle should be used, but at close range (<30m) a shotgun with cartridges containing at least 36g of large shot (No.1 or No.3) is a suitable alternative. Air weapons must never be used for fox control but may be acceptable for killing small species at close range (e.g. humane and safe dispatch of mink, stoat or grey squirrel in a cage trap).

Cage Traps

Live–capture cage traps may be used to catch any non-protected mammal including all species listed in Table 3. Care must be taken to avoid placing them where there is a risk of capturing protected species. Baits can be used to attract target animals into the trap but it is illegal to use live decoys in mammal traps under the Wildlife and Countryside Act 1981 (as amended). Different sizes and shapes of trap are available depending on the target animal with the trap door usually being triggered by a foot plate or a hook from which bait is suspended. Cage traps should be checked at least once a day as failure to do so could constitute an offence under the Protection of Animals (Scotland) Act (1912) or the Abandonment of Animals Act (1960). Any non-target or protected species must be released and any target species must be humanely dispatched, usually by shooting. Note that where cage traps are used to catch grey squirrels or American mink, it is an offence under the Wildlife and Countryside Act 1981 (as amended) to release these species back into the wild as they are non-native species, listed on Schedule 9 of the act.

The requirement to check cage traps every day means that they can be labour intensive to operate, particularly in remote areas, so a number of methods have been developed to more effectively target effort. The efficiency of cage trapping for American mink can be greatly increased by the use of 'Mink rafts' developed by the Game and Wildlife Conservation Trust (GWCT). These are floating plywood platforms with a tunnel on top that are tethered at the edge of a watercourse. Within the tunnel is a wet clay pad which records the footprints of animals that explore the tunnel. As the raft is not operating as a trap at this stage, it does not need to be checked every day, and several sites can be monitored with an inspection frequency of one or two weeks. If mink footprints are found on a raft, a cage trap can be set in the tunnel and inspected daily with a much higher likelihood of catching a mink within a short time. It is important that the cage trap is secure within the tunnel so that there is no risk of the trap being dislodged and resulting in a captured animal drowning.

Remotely activated cameras (variously known as camera traps, trail cameras or game cameras) provide another method of monitoring potential trapping sites prior to the deployment of an active cage trap that requires regular checking. These cameras are triggered by the movement of an animal and can be checked weekly and have a wider application than the mink raft (e.g. monitoring squirrel feeders for the appearance of grey squirrels). More recently, remote monitoring of cage traps has become available, using a sensor that transmits a message by text or email when the trap door is triggered. Such units are currently relatively expensive but have the potential to reduce the frequency with which remote traps need to be checked. This may be particularly useful where the target species is present in low numbers. However, it is recommended that advice is sought from an appropriate authority before using such a system, to ensure that its operation complies with animal welfare legislation. In particular this system will only work where there is a mobile phone signal sufficient to allow a message to be sent.

Spring Traps

Spring traps incorporate a pair of jaws that snap shut around the target species, killing it immediately, when it steps on a trigger plate. These can be used to kill stoats, weasels, mink, rats and grey squirrels, but only specific makes of trap listed in the Spring Traps Approval (Scotland) Order 2011 (as amended) may be used. The order also lists which target species each model is approved for. The Spring Traps Approval (Scotland) Amendment Order 2018 removed the approval for certain traps (notably Fenn traps) to be used to catch Stoats. This is to ensure compliance with the agreement on International Humane Trapping Standards. From 2020 onwards, stoat control using spring traps must be carried out according to *General License 14: to use certain traps to kill stoats for the conservation of wild birds or for prevention of serious damage to livestock*. This license specifies the traps makes that can be used and how they can be set.

Spring traps must by law be set in a natural or artificial tunnel which is suitable for minimising the chances of capturing, killing or injuring non-target species whilst not compromising the killing of target species. This means that the entrances to the tunnel must be constricted sufficiently to prevent a larger non-target species (e.g. otter, pine marten, fox, raptor) to enter. Certain traps may require internal baffles within the tunnel to further minimise the risk. Spring traps must be securely anchored to prevent an injured animal from dragging the trap away and should be inspected at least once every day between sunrise and sunset. Any injured animal should be dispatched humanely.

Snares

Snares are anchored wire nooses designed to trap an animal around the neck or body and restrain it by tightening around the animal. They are a cheap and effective way of catching foxes, but have attracted strong criticism from animal welfare groups for their perceived cruelty and from some conservation groups as they can catch non-target species included protected species such as the badger, otter and capercaillie. As a result of this criticism the use of snares is now strictly controlled through amendments to the Wildlife and Countryside Act 1981 by the Wildlife and Natural Environment (Scotland) Act 2011.

Only individuals issued with an identification number by the police may operate snares and they must have the permission of the owner or occupier of the land where the snares are set. The police will only issue identification numbers to suitably trained individuals, and as a result snaring accreditation courses are now available. Every snare must have a tag attached that is not easily removed and which shows the identification number of the individual who set it, along with the type of animal intended to be caught. All snares must be firmly attached to the ground or a heavy object so that they cannot be dragged by a trapped animal. They must not be set where there is a risk of the trapped animal becoming fully or partially suspended or being drowned. Snares set for foxes must be fitted with a stop that prevents the noose from reducing to a circumference of less than 23cm but must otherwise be free-running. All snares must be visited at least every 24 hours and any animal caught must be released or removed, whether alive or dead and the snare must be checked to ensure that it remains free-running.

A record must be kept of every snare set in position currently and within the past two years, including a clear indication of its location, the date it was set and the date it was removed and the details (date and species) of every animal caught. These records must be available for inspection by the police within 21 days of a request being made.

Non-Lethal Predator Management and Control

In addition to direct methods of controlling predators through shooting and trapping, there are a number of non-lethal methods of controlling predators that may be more acceptable to some land managers and to the general public. They may also reduce the need for labour intensive direct control and the risk of falling foul of the complex legislation surrounding direct predator control. Non-lethal methods may also help to reduce predation by protected predators such as badgers, pine martens or raptors where these are considered to be having an impact on species of conservation concern.

Anti-predator fencing

Electric fencing is widely used as a method of preventing foxes from accessing poultry runs or game-bird pens, but it has also been successfully used to protect ground-nesting birds such as terns and waders at nature reserves. Various designs of electric fencing have been used to exclude foxes and other predators. These include simple stranded electric fences with nine alternating earthed and live wires up to a height of 1.1 metres and with the gap between wires increasing from 6cm at the bottom to 20cm at the top or more permanent combination fences which consist of a 1 metre high livestock fence with 8cm square mesh buried 25cm into the ground and with two live wires 10cm and 20cm above the livestock netting and another offset 20cm from the outside face of the fence and 65cm above the ground. The combination fence design is more expensive, but is more permanent, requires less maintenance and also acts as a livestock fence. It is important for electric fences to have a high voltage to work effectively and vegetation must be cleared along its length to prevent the fence from shorting to the ground. Using such fencing around areas of up to 50 hectares on wetland nature reserves in England was found to increase lapwing breeding productivity from 0.23 to 0.79 fledged young per pair. As at least 0.6 fledged young per pair is thought to be necessary to maintain a stable population the fencing turned lapwing population ‘sinks’ into sources for recolonizing surrounding areas (Malpas et al. 2013).

An advantage of anti-predator fencing is that it can also be effective against protected predators such as badgers (although care must be taken not to obstruct access to and from badger setts if there are any close to the proposed fence line). However, fencing will only be a realistic solution to protect sites with high concentrations of ground-nesting birds in a relatively small area, such as nature reserves. Very large areas enclosed in this way may require some additional fox control, as the fences are not always 100% effective.

Creation of cover and refuges

Interactions between predation and habitat quality mean that it is sometimes possible to use habitat management to reduce predation to sustainable levels. One of the most obvious and successful methods is the creation of areas of cover or other refuges where predators are less likely to detect their prey. Examples include:

- Provision of wild bird cover crops that are more than 30cm tall in late winter and early spring to reduce sparrowhawk predation on grey partridge in otherwise open landscapes (Watson 2004)
- Providing tall ground cover of shrubs, young trees or piles of brash to protect capercaillie in their forest habitat (Kortland 2006)
- Creation of island refuges in reedbeds and other wetlands to allow water voles to avoid mink which more typically hunt along linear features such as ditches and river banks (Carter & Bright 2003).
- Maintaining a high water table throughout the breeding season in important nesting areas for wading birds to discourage predation by foxes (Bellebaum & Bock 2009).

Indirect reduction of predator numbers

Management may also attempt to counteract the factors that have led to predator numbers being higher than some species of conservation concern can tolerate. Habitat management to reduce edge effects and efforts to reduce high populations of primary prey species such as voles and rabbits are two methods of indirectly reducing predator numbers. In forests and woodlands that are important for capercaillie this may involve encouraging woodland expansion through natural regeneration or planting and avoiding large clear-fells which can encourage grassy vegetation, resulting in large vole populations and a consequent increase in the numbers of predators (Kortland 2006). In open areas that are important for ground nesting waders, it is often considered beneficial to remove trees or avoiding planting them close to suitable habitat in the first place, while maintaining a high water table in wetland areas may also reduce vole populations and consequently their attractiveness to predators.

However, with this type of indirect predator management, there are a number of potential negative issues that must be considered. Having a patchwork of different habitats and its associated edge effects probably increases overall biodiversity in many parts of Scotland as many different species benefit from habitat edges, and in such areas it would not be appropriate to reduce habitat fragmentation. The examples that were outlined above regarding forest management for capercaillie and wetland management for wading birds are situations where reducing edge effects and fragmentation is most frequently encouraged, but even in these cases it may be necessary to consider potential negative effects on other species and habitats. It is also important to recognise that efforts to reduce vole populations may negatively affect non-target predators, such as barn owls or kestrels, so should only be attempted where significant impacts on such species are unlikely and where there is likely to be a clear benefit to other priority species under threat from predation. Efforts to reduce rabbit numbers are less likely to impact on non-target predators, except in parts of the eastern Highlands where rabbits can be an important prey item for the endangered Scottish wildcat and the golden eagle.

Supplementary feeding – spillover predation or diversionary feeding?

Management practices that have been suggested as having the potential to artificially increase predator numbers and result in increased pressure on other species include the large-scale release of gamebirds and the routine discarding of grallochs (internal organs) following culling of deer. This is most likely if these additional food sources are abundant at a time when natural food availability might normally be limiting for predators, for example during the winter. However, provision of supplementary food at other times of the year, when natural food is not limiting may divert predators from species of conservation concern. This is most likely to be effective during the bird nesting season, when the greatest predation impacts on ground-nesting birds tend to occur. Diversionary feeding with rats or chicks for a short, critical period, when predators might otherwise be feeding on chicks of species of conservation concern, has been demonstrated to reduce Hen Harrier predation on grouse chicks and Red Kite predation on lapwing chicks, without boosting the populations of the predators themselves.

Intraguild predation

In recent years there has been increasing interest among ecologists and conservationists in the role of intraguild predation (predators eating or competing with other predators) on predator-prey relationships. The theory is that the presence of larger, more dominant predators can reduce the numbers of smaller predators (either by direct predation, competition or avoidance behaviour). As smaller predators are often more efficient predators of small prey, the presence of more dominant predators may reduce the overall levels of predation on smaller prey species. While there is evidence supporting this theory from around the world (Prugh et al, 2009), its applicability to Scottish ecosystems and particularly to practical management is unclear, although it is being investigated in the Cairngorms Connect Predator project. The greatest potential is probably within the predatory bird assemblage, which is more complete than the mammalian predator assemblage where the larger, more dominant predators are extinct. Goshawks are known to reduce buzzard density and breeding success as well as preying on corvids (Sergio and Hiraldo 2008), while it has been suggested that the golden eagle could naturally limit hen harrier numbers on grouse moors (Fielding et al. 2003) and that the White-tailed eagle could have a controlling effect on American mink (Salo et al. 2008). Golden Eagles have also been recorded preying on foxes and badgers in Scotland. At present we know too little about the relative importance of the different predators and their interactions to develop practical predator management strategies based around intraguild predation, but as the numbers of some predatory species increase, it is important to be aware that the potential exists for some top predators to actually be beneficial to some of their prey species due to their effect on more efficient lower predators.









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