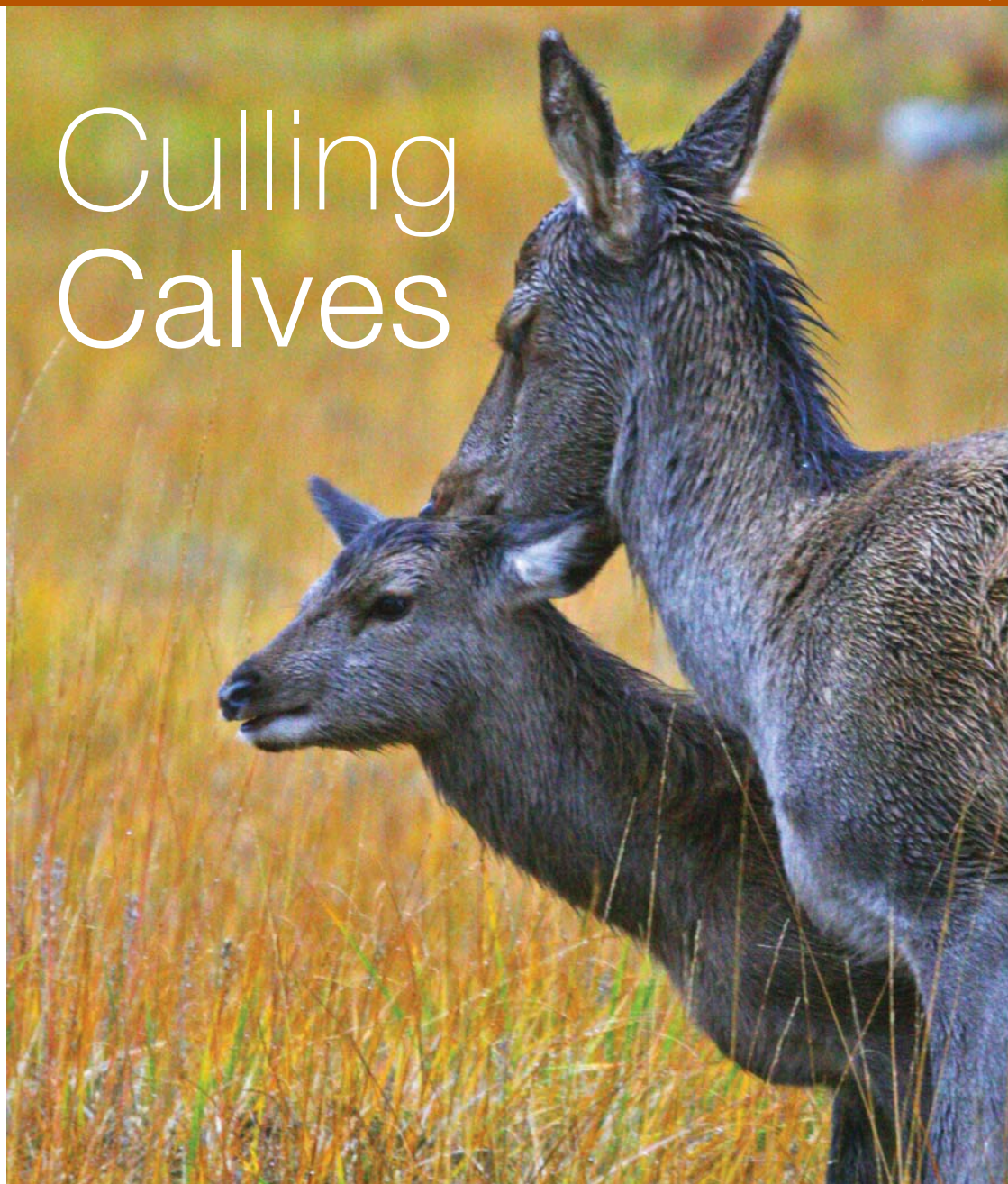


Culling Calves

The shooting of calves or fawns can be a controversial matter. While in some countries the consensus among deer managers for the culling of calves is clear, it is often less clear exactly why. **Jos Milner & Atle Mysterud** examine the pros and cons.



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Traditionally, young of the year have not been heavily hunted in the UK, although hunting patterns are changing. For example, the hind cull in Scottish red deer herds has tended to focus on yield (calf-less) hinds but as cull targets have risen, so has the harvest of milk hinds and their accompanying calves. But this situation contrasts markedly with many other European countries where calf hunting is a routine management practice, despite a reluctance among hunters in some places (the 'Bambi' factor). In Norway, hunters believe they shoot a lot of calves and many would prefer to shoot yearlings instead, but when they ask managers why calf harvesting is necessary, the managers themselves are often unsure.

We have compared harvest statistics of red deer in different European countries with a variety of hunting cultures to get an overview of how patterns

in harvest composition vary. Based on the proportion of calves versus adult males and females shot (yearlings were included with adults), Scotland, together with Switzerland, lies very much at the 'few calves shot' end of the scale (Fig. 1). At the opposite end of the scale are the Central European countries and France. Most people associate the Germanic cultures of central Europe with trophy hunting, but these countries also have a long tradition of taking calves to maintain stable populations. In France, young of the year were protected until the 1970s but have since formed a large part of the annual cull. Norway, despite the hunters' perceptions, lies in between. What separates Norway from other European countries is the high proportion of stags relative to hinds in the adult harvest. The result of this is that the remaining stags are young while old males are scarce – although this is changing in some areas.

Demographic, evolutionary and practical arguments

We have divided the arguments for shooting calves into the demographic and economic, the evolutionary and the purely practical (Table 1). The quality of these differs depending on whether the supporting evidence is direct or indirect, and whether it is mainly: (1) anecdotal e.g. “Calves can’t reproduce, so we should shoot them, not hinds”, (2) based on population or simulation models e.g. “given a population’s reproduction and survival rates, shooting calves will lead to increased population growth” (this is true, given that the assumptions are correct!), or (3) empirical e.g. “We see that populations where many calves have been shot have had rapid population growth and higher returns”. In many cases, empirical evidence, i.e. based on observations of what is actually happening to a population, is best. Such evidence can be further be broken down into whether it is purely observational, based on correlations, or whether it is the result of experiments. In fact there have never been any experiments carried out

specifically to test the effects of calf harvesting, despite this being a fundamental aspect of large game management in many countries. Here, we review the different arguments and examine the evidence to support them.

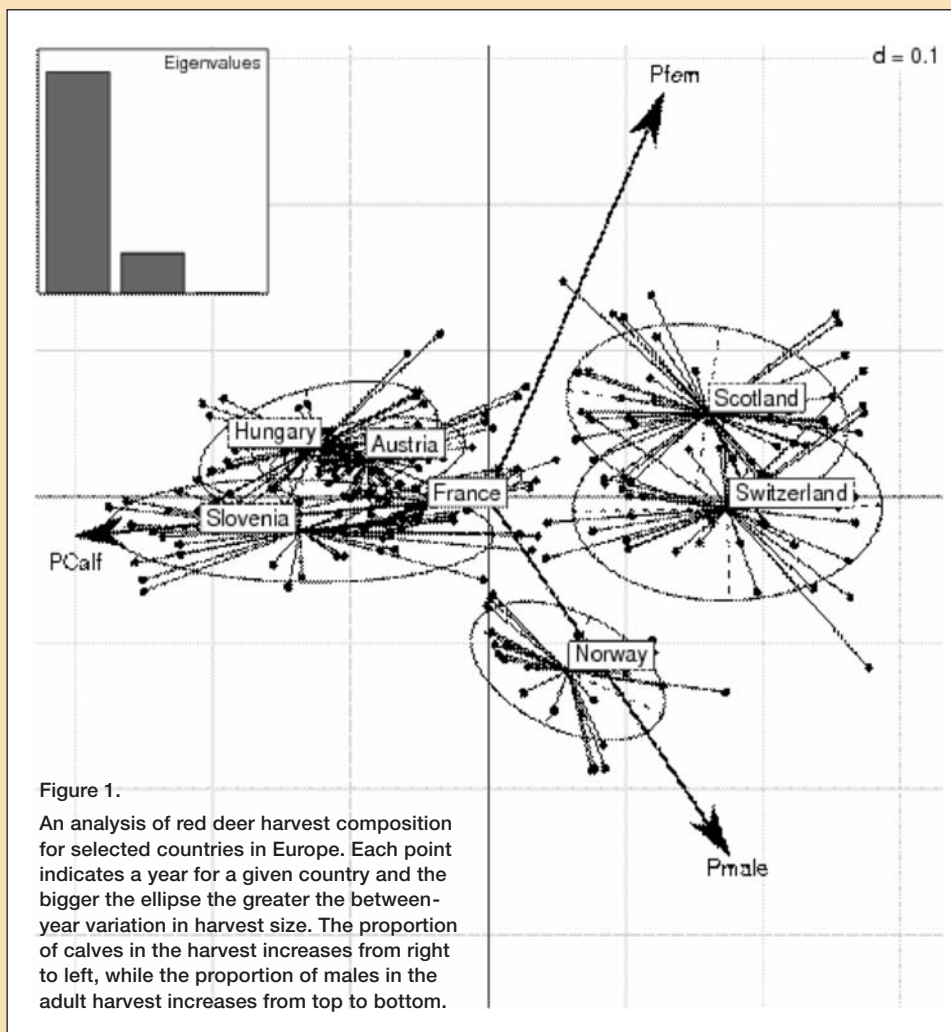
Demographic arguments: increased population growth, but reduced variation

The demographic argument for shooting a lot of calves probably has its origins in livestock production systems, where young of the year are the main output, at least among smaller-bodied species. It follows that this harvest strategy is used where maximising production is the principle management objective, as practiced in Scandinavia. Calves do not produce new calves so if you want a productive population it’s better to shoot the offspring than the mother. There is little doubt that this argument holds. And this is related to the argument that one needs to shoot fewer hinds when one shoots more calves. But a similar effect can be achieved by shooting stags – the

‘antlered’ harvest common in North American large game management. It has also been argued that since calves have a higher mortality rate than adults, winter populations with a lot of calves will be less stable than those with a low post-hunt proportion of calves. This should translate into a more stable harvest, but such an effect was not measurable in the European red deer harvest statistics. An increased proportion of calves in the harvest did not reduce variability in the number of animals killed between years. However, an increase in the proportion of calves in the harvest corresponds to an increase in the number of animals killed – which may be an advantage if maximising the number of hunting opportunities is important, or a disadvantage if the goal is to minimise hunting effort. Either way, it usually yields less meat. A reduced number of animals shot with a higher proportion of adults in the harvest is more than compensated for by the fact that older individuals are larger. But of course the quality of calf meat is better than from older individuals, although perhaps not so much better than yearlings.

Evolutionary arguments

The evolutionary effects of selective harvesting have come up as an important new element in game management, where we currently have more questions than answers. In fisheries, it is now clear that as a result of high intensity fishing with fixed mesh sizes we have ‘bred’ a ‘new cod’ that reproduces earlier at a smaller size, so it never grows large enough to be caught in the nets. Historically, the selective pressure on deer was from large predators which target young individuals. But now with fewer large predators, hunting is the main selective force in many populations. If we continue to selectively hunt adult animals it may become advantageous for them to reproduce earlier, at least in areas where hunting pressure is high. But by shooting a lot of calves can we avoid such selection pressure? Analyses of red deer data from western Norway where calf harvesting has been carried out over a 30 year period clearly show no trend towards earlier reproduction, even after the effects of increasing density have been accounted for. This suggests that shooting a lot of calves may be a good strategy to avoid evolution towards earlier reproduction.



Practical arguments

Meat yields will be higher if we manage to shoot yearlings instead of calves, and we do not see strong biological arguments against doing this. But there are practical arguments. In livestock farming one virtually has full control of breeding and cropping. Hunting is not as easy. This is especially true in dense forest or woodland and under drive hunting when things happen fast. It is much easier to be sure of what you are shooting when a calf or fawn is your target. By contrast it can be very difficult to distinguish a yearling female from a young adult female. Consequently yearling quotas tend to be very male biased because there is less danger of making a mistake, and this causes an adverse shift in the population sex ratio. From a manager's point of view, a simple strategy ('always shoot the calf') may be easier to implement than a complicated message ('shoot the calf - but only if...') in situations where hunters are unguided.

From population growth to regulation

The introduction of selective harvesting in Scandinavia has on the whole been a great success – at least in the hunters' eyes. There are plenty of animals to shoot compared with 30 years ago. Today, however, management goals are beginning to change. As in Scotland, the focus is turning towards population regulation or reduction in some areas. A harvest

Table 1. An overview of the arguments for and against shooting calves and the scientific evidence behind them

Demographic / Economic			
	ARGUMENTS	BASIS	EVIDENCE
FOR	Increases population growth/ gives highly productive population	Juveniles have lower reproductive value than adults	Empirical & modelling
FOR	Maximises yield in terms of number of individuals	Juveniles are the most numerous age group	Empirical & modelling
AGAINST	Low meat yield compared with hunting yearlings	Juveniles have low body mass but the fastest growth rate	Modelling
FOR	Reduces competition for limiting winter food resources with breeding stock	More resources per capita are available with fewer individuals	Empirical
AGAINST	Winter browsing is heavier than when yearlings hunted	Juveniles have a lower winter biomass intake than yearlings	Modelling
FOR	Removes individuals before first winter mortality enabling more individuals to be hunted	Juveniles have higher winter mortality than other age-sex classes	Empirical & modelling
FOR	Reduces between year variation in population size	Juvenile survival varies more between years than survival of other age classes	Anecdotal & modelling but found no empirical evidence
FOR	Increases average age of adults	Removes youngest individuals from post-hunt population, surviving adults will age	Anecdotal
Evolutionary			
	ARGUMENTS	BASIS	EVIDENCE
FOR	Mimics natural mortality and predation patterns	Avoids human-induced evolutionary effects	Empirical
FOR	Hunting before age-at-maturity to avoid selecting for earlier age-at-maturity	No selection on age at maturity if you shoot immature animals	Theoretical & empirical
FOR	Increases effective population size and reduces random genetic drift	Juveniles contribute little to effective population size	Modelling
Practical management/implementation			
	ARGUMENTS	BASIS	EVIDENCE
FOR	Reduces chance of hunter error (e.g. taking small adult female instead of yearling) and allows good hunter efficiency	Age determination of juveniles is easy in the field	Anecdotal
FOR	If target cull not achieved, have a second chance in following year	Juveniles and yearling males can be distinguished from adults in the field	Anecdotal
AGAINST	Hunters reluctant to shoot juveniles	Moral problem with shooting young, dependent animals	Anecdotal
AGAINST	Takes more time to regulate the population compared with harvesting adult females	More individuals must be shot; juveniles are unproductive	Anecdotal



Calves do not produce new calves, so if you want a productive population it's better to shoot the offspring than the mother.



strategy that focuses on calves is important if we want population growth but it's not the most efficient if the goal is population regulation. Hunting takes time, and under a calf harvesting strategy, quotas or cull targets would need to be high and then may often not be met. The obvious strategy for reducing population size is to shoot the most productive animals – adult females in their prime. And as such females are usually accompanied by calves, these calves must of course be shot too for ethical reasons, as their future prospect of survival is lower. Our demographic analysis of red deer harvest statistics in Europe clearly shows this strategy works. But harvest rates are also important, although frequently unknown. If harvesting is light, as has often been the case with the Scottish red deer hind and calf culls, population-level effects will be small.

What should we do?

Our aim here is not to say harvesting juveniles is right or wrong, so much as to present the evidence in one place and open up the discussion of why and to what extent. What one should do will, of course, depend on management objectives. It may also depend on species and on local conditions, as may the trade-off between harvesting calves versus yearlings which has received relatively little scientific attention. Personally, we don't understand the aversion to shooting calves – it is a natural part of modern wildlife management – but when it comes to the extent to which calves should be shot, there's no clear answer. We believe there should be room for some flexibility, and with local or regional management, maybe the decisions should be taken locally.

FURTHER INFORMATION:

This article is based on a fuller scientific analysis. See: Milner, JM, Bonenfant, C. & Myrsterud, A. Hunting Bambi - Evaluating the basis for selective harvesting of juveniles. *European Journal of Wildlife Research*: in press. DOI: 10.1007/s10344-010-0466-x

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