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Trade-offs between welfare, conservation, utility and economics in wildlife management — a review of conflicts, compromises and regulation

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Abstract

In choosing among alternative wildlife management techniques, trade-offs between animal welfare and conservation, utility or economics are often apparent. This paper reviews the roles of science, scientists, regulators and educators in attempts to overcome this inter-dependence and to make simultaneous progress on all fronts. Illustrations are drawn in particular from trapping and pest population control. Against the real progress that can undoubtedly be made through scientific study, there is a regrettable lack of structure because of poor philosophical and logical coherence within the welfare movement.

Keywords: *animal welfare, ethics, pest control, regulation, traps, wildlife management*

Wildlife management, welfare, and the role of the scientist

The wildlife manager is explicitly concerned with the interface between humans and wildlife. His/her techniques — whether they involve fresh intervention or the regulation of existing human activities — almost invariably have consequences for the welfare of wild animals.

Wildlife management has been substantially science-based for several decades (for instance the *Journal of Wildlife Management*, first published in 1937, now extends to 67 volumes). The processes wildlife management attempts to control are incredibly complex, and extraordinary ingenuity has been exercised to untangle them at every level, from practical field-craft to statistical analysis. Many of us involved in wildlife biology wish we could limit our activity to the field and laboratory, but the scientist does have a unique value beyond the pure application of scientific method to wildlife issues.

Before even beginning research, the scientist has an important role in helping to frame meaningful questions. Given that scientists are experts in their fields, this is arguably a duty. (One might add that there is a further duty not to try to 'fudge' answers to meaningless or impossible questions set by others.) This role can mean picking apart the questions being asked by legislators or pressure groups, correcting misconceptions, and channelling attention towards shrewder questions that cut to the heart of the issue. The scientist must therefore perform well in logical abstract thought, text linguistics, and communication. It is also for the scientist to define the type and quality of evidence required to answer a question unambiguously.

For example, during Lord Burns' inquiry into hunting with dogs (Burns *et al* 2000), the central issue was humaneness, but other qualities were being weighed in the balance. Lord Burns contracted two teams of scientists to consider (among other things) "the effectiveness ... of different methods of controlling foxes." Up until this point in the inquiry, most submitted evidence had discussed the value of different methods in terms of the number of foxes killed by each within the UK. Actually, these numbers could not be estimated reliably, but in any case they said nothing at all about effectiveness (Macdonald *et al* 2000). Effectiveness in achieving aims (population control and/or damage limitation) was almost universally confused with efficiency (animals culled per unit effort or unit cost). In reality, most of the available methods were employed in all regions of England and Wales — hence there was no way to compare the effectiveness of single methods practiced in isolation. Furthermore, individual culling methods lend themselves to different circumstances — and because each method therefore has a seasonal and regional bias, the method, season, and region (and all that region represents, including variation in fox abundance) were inevitably confounded in any naïve analysis (Heydon & Reynolds 2000; Reynolds 2000).

It is also necessary to state what a scientist *cannot* do; the limits that define where his/her expert role ends and he/she becomes just another voice. Every scientist's interpretation of evidence will be coloured in some way by their personal values. The very fact that we chose to become wildlife biologists says something about our personal values. It is therefore critical that peer review is employed to give the non-expert confidence in scientific findings, but individual scientists too must take care to point out where scientific method ends and interpretation begins (see Sandøe *et al* 2004, pp 121–126, this issue).

No scientist can measure welfare: it is not a directly measurable property. Rather, scientists must measure factors that may contribute to good or poor welfare, or measure physiological and behavioural states believed to reflect good/poor welfare (Broom & Johnson 1993). Science is of enormous value in assessing, and especially in comparing, such proxies for welfare; but this branch of science is still in its infancy. How should we judge the welfare of wild animals? At present, no technical measure of such a welfare proxy allows direct comparison between domestic and wild animals, or among species. For instance, while the hypothalamic-pituitary-adrenal (HPA) axis is regarded as a meaningful barometer of stress, we would expect a wild animal to show a greater HPA response than its domestic counterpart in the same situation because domestication involves selection for a suite of characteristics that collectively make the animal easy to handle (Hemmer 1989). The 'confident' and 'fearful' strains of mink (*Mustela vison*) studied by Malmkvist and Hansen (2002) and by Malmkvist *et al* (2003) illustrate the extent to which fearful behaviour and the HPA response to stressors can vary with genetics. The 'wildness' of a wild animal is evidence both of selection in the wild and of the animal's fitness for life in the wild. So is the animal coping better or worse if it shows a greater HPA response? At present we cannot say. We would also need to know whether it has the same thresholds, the same scale of response, and the same recovery time as its domestic counterparts before we can answer this.

The scientist working in wildlife biology is concerned with harvests, conservation, productivity, population control, welfare, damage limitation, etc. All of these aspects are pretty much meaningless except in comparative terms (greater or smaller harvests, higher or lower risk conservation status, population control at higher or lower densities, different levels of damage risk, etc). For welfare, this comparative aspect raises puzzling philosophical issues. If the purpose of studying welfare scientifically is to improve the welfare of wild animals caught up in that interface with humans, should scientists confine themselves to measuring welfare proxies, or should they be careful to address other aspects that may be linked to welfare? For, as experts in their field, it will often be apparent to them that gains in welfare are bought at the expense of some other aspect, often some aspect of utility. Their work can certainly clarify those relationships; but how, ultimately, should one weigh up welfare against those other factors, or indeed against the overall aim of the practice? These are ethical questions for society as a whole. Failure to answer such questions at an early stage can place the scientist in a very awkward position.

Another puzzle is whether to be more concerned for the welfare of the individual or for the conservation of a species. For instance, establishment of the North American grey squirrel (*Sciurus carolinensis*) in Italy, from two pairs introduced in 1948, gave the species a toe-hold on the Eurasian continent. Scientific assessment (Bertolino & Genovesi 2003) judged that the species posed a serious threat to the indigenous red squirrel (*S. vulgaris*), not just in a restricted area, as was the case in Britain, but across the whole of the Eurasian boreo-temporal zone; that it also posed a threat to economic forestry and possibly to forest ecosystems; that its introduction to Italy had therefore been a grave mistake in conservation and economic terms; and that it was feasible to eradicate the grey squirrel by taking action while the population was still small. Eradication of alien species is, after all, explicitly recommended by the International Union for the Conservation of Nature and Natural Resources on the grounds of conserving biodiversity (IUCN 2000). The remedial action thus proposed (and initiated) on conservation grounds was challenged in the courts by animal rights groups, causing such delay that the opportunity to remove the grey squirrel from the continent at realisable cost, and to prevent it from invading the whole of Eurasia, passed for ever. The consequences of this will unfold over the next few centuries. The scarcely veiled exasperation of the scientists involved (Bertolino & Genovesi 2003) is easy to understand because they had taken care to discuss welfare aspects of the action with non-governmental organisations (NGOs), including animal rights groups. By this means, a protocol was established by consensus of a majority of interest groups, although explicit legal authority for eradication was not established. Because of the pest status of the grey squirrel in other countries, it seems certain that the number of squirrels killed in the future will far outnumber those that would have been killed to eradicate the nucleus population.

Philosophical questions beyond the reach of science

There is little consensus regarding our attitudes towards wildlife. On the contrary, marked inconsistencies are evident in relation to different wildlife species and to different human activities. Is it even appropriate to be concerned for the welfare of wild animals? For domesticated animals we clearly have a duty of care. Domestication has the consequence that animals must be protected from predators, provided with food and water, protected against diseases that arise through crowding, assisted during birth, etc. Wild animals (by definition) are not reliant in this way, and there is no obvious duty of care except in a conservation sense of care for populations. So if we are to concern ourselves with the welfare of wild animals, where should that concern end? It is uncontroversial to argue that deliberate interventions should be made with minimum impact on welfare, but should that concern extend to animals that are affected only unintentionally or indirectly by human activities (Kirkwood 2000)? Does it extend to a lifetime concern for animals whose very existence is itself a consequence of human activities?

Is it ever acceptable to compromise the welfare of wild animals, and if so, when? Kirkwood (2000) defines four ethical stances on this issue: 'biocentric environmentalism', 'anthropocentric environmentalism', 'animal rights', and 'human moral hygiene'. Of these, the first two allow practices that will compromise the welfare of individual wild animals; the latter two do not. The categories may in

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fact be blurred, in that the exploitation of wildlife populations for biological products and/or sport — normally regarded as anthropocentric use — need not be either disrespectful of animal welfare or unrestricted. Hunting ethics containing strong elements of conservation concern and animal rights are among the oldest human traditions.

Kirkwood (2000) insists that a 'hands-off' relationship with wildlife, advocated by some animal rightists (eg Regan 1983) is not only unrealistic, but also impossible. Yet curiously, supporters of such 'let them be!' ethics are the driving force behind contemporary debates on animal welfare. As a result, it is unclear whether debate should focus on the aims of exploitation/control, or on its methods. Are we seeking to re-write the aims of society to optimise wild animal welfare, or are we seeking better welfare, given the aims? In practice, the debate veers unhelpfully between the two.

Linked to this uncertainty is the question of yardsticks. Where should we look for yardsticks by which to compare welfare for different practices? The answer depends on whether we want to define absolute minimum standards of welfare or to promote steady improvement. Below, I use the regulation of trapping to illustrate this dilemma.

Trade-offs in practical wildlife management

Welfare in wildlife management is an issue that is increasingly addressed scientifically by measuring those aspects of management techniques that are likely to contribute to it. Typically, welfare is found to be inter-dependent with other qualities. Alternative ways of intervening with wildlife offer different blends of values, but intermediates are often simply not available. Two examples illustrate how science can help to define the available options and to make advances.

Choice of culling season in population control

It is widely recognised that the population control of wildlife pests by culling is rendered more efficient by seasonal targeting. Consideration of population biology alone shows that the desired population level can be reached with least culling by focusing effort to follow (temporally) the season of highest 'natural' (ie non-culling) mortality. Typically this means culling just prior to the breeding season. For the same eventual pest population, this strategy involves the least culling, but not the lowest overall mortality, and not necessarily the best average welfare for the animals that die (because welfare may actually be better for animals dying through culling than for those dying through other causes). In real life, a cull restricted to a tight seasonal window may be difficult to achieve, with underachievement leaving higher pest numbers and leading to higher damage levels. Extension of the culling season earlier into the non-breeding season requires greater numbers to be culled to achieve the aims, whereas extension later into the breeding season often carries the extra welfare cost of orphaning dependent young. The welfare of dependent young was in fact the central issue that blocked the proposed eradication of grey squirrels from Italy, described above (Bertolino & Genovesi 2003). Taking a long-term view of population control, the choice is thus between an incisive control campaign that quickly reduces the population and thus the frequency of welfare issues, or one in which the severity of any welfare problems is lessened at the cost of population impact, thus increasing the number of animals ultimately involved.

Often population control is a secondary (desirable, but not essential) aim, with damage control being the more important objective. If the damage period coincides with the breeding season of the pest (as it often does), then breeding season control may be an appealing option in terms of effectiveness and cost.

Many pest control activities have a sport aspect in which the acquisition and exercise of hunting skills provides a motivation that alleviates the costs of culling for the interest group suffering damage. Protection of the sport by hunters may then conflict with the aim of population control, and an approach to population control which balances damage limitation, population control, the provision of hunting, or any other interest, may be very involved indeed.

All of these complexities are exemplified in the continuing debate over fox-hunting in the UK — for a scientific and dispassionate review see Macdonald *et al* (2000).

Exclusion of non-target species in spring-trapping

In the UK, spring-traps used to take certain vertebrate pest species are regulated by the Department for Environment, Food and Rural Affairs (DEFRA) under the Pests Act 1954. Under DEFRA approval orders, spring-traps may be used in the UK only for a defined list of target wildlife species, all relatively small mammals (except in the case of the Aldrich trap, licensed for large non-indigenous mammals). To help ensure this, traps must be used within a tunnel. 'Tunnel' is undefined, although in practice most operators choose dimensions that closely fit the trap to target a particular size range of species and to ensure clean kills. To prevent neophobic avoidance, artificial tunnels are typically left permanently in suitable sites, the trap being deployed intermittently. It is obvious that a range of similar-sized non-target species can also enter trap tunnels. A few years ago, the best advice available to prevent this was to sink two or more sticks into the ground at the tunnel entrance, leaving a gap "just large enough for stoats and rats to enter, but preventing birds from being caught" — stoats and rats being target species (Game Conservancy 1994). There was no advice on what the dimension should therefore be.

In 1998, The Game Conservancy Trust was commissioned by English Nature (EN) to design an excluder that would keep out pine martens, a special concern to EN because they were considering reintroducing martens into parts of their former historic range in the UK. In fact, other species protected under UK legislation (Wildlife and Countryside Act 1981) for conservation reasons are also at risk in trap tunnels, including polecats and hedgehogs. Conservation and welfare goals seem to coincide here because non-target species that differ in size from target animals are unlikely to be killed humanely.

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A physical barrier was designed, assuming stoats to be the most important target species, and tested using captive animals (Short & Reynolds 2001). Although it was possible to exclude the protected species, to exclude the smallest female polecat the gap could be no larger than 3.25 cm, and this is only just sufficient to let a large male stoat through. The leeway is a matter of 2 or 3 mm. Field-testing by gamekeepers in a properly randomised design clearly demonstrated the underlying trade-offs. Excluders that would have prevented the capture of prestige species such as pine marten and polecat (had they been present) did not detectably alter capture rates for stoats and weasels, but did substantially reduce effectiveness to catch a range of other legitimate target species, notably rat, grey squirrel and rabbit. Furthermore, it was the biggest individuals, the mature and fecund ones that are critical to successful control, that were excluded.

The extent to which tunnel traps contribute to the successful control of rats, squirrels and rabbits remains an unanswered question. On a large (farm population) scale, rats and squirrels are more effectively controlled by anticoagulant poisons, but there are downsides to these that have been pointed out elsewhere (humaneness [Mason & Littin 2003]; secondary poisoning [Newton *et al* 1999]). Furthermore, the incisive removal of a single hedgerow rat in spring by trapping may be far more beneficial for breeding birds than is large-scale poisoning around the farmyard.

Regulation on the basis of scientific tests ensures that approved spring-traps operate to defined minimum standards of humaneness for target species. Humaneness towards non-targets is untested. Target specificity is not a feature of the hardware (tunnel design and location are unspecified, excluders are voluntary additions). Some non-target species are of conservation concern. Thus, optimisation of effectiveness and target specificity remains an operator skill.

One might wonder why spring-traps are necessary at all, and why live-capture traps cannot be used. Generally, live-capture traps are perceived to be considerably less efficient (captures per unit effort) than killing traps, although there are no published studies that make this comparison. In welfare terms, the choice between holding animals captive for up to 24 h (under UK legislation) before dispatch, or killing them with guaranteed speed and reliability, is not as clear-cut as one might imagine. For the operator, live-capture traps are bulkier and less convenient.

Influencing practice in favour of animal welfare

Regulation

Trapping nicely illustrates the issues surrounding regulations to improve wild animal welfare because the regulation of trap hardware would appear to have considerable implications for welfare. Nevertheless, there is no general agreement on what constitutes a humane trap. Pressure groups motivated by sympathy for the trapped animal have been active since at least the early 20th century, with aims that range from developing humane traps to banning all traps. In the opinions of some, no trap can be acceptably humane: even live-capture traps cause measurable stress — and apparent distress — to the animal (eg White *et al* 1991). But if we were to define yardsticks for the welfare of trapped wild animals, what should they be? Should we apply standards developed for domesticated animals in slaughterhouses, etc (Manser 1992 unpublished, cited in Proulx 1999, Chapter 1), or those used for laboratory animals (eg Poole 1999)? Is it more meaningful to compare the welfare of animals in human interventions with that of animals subject to natural deaths (Noseworthy 1992)? Or should we pragmatically adopt 'state-of-the-art' standards that reflect the best of current designs (Proulx 1999, Chapter 1). Each approach presents tremendous difficulties in interpretation.

In 1968, the Canadian Federation of Humane Societies and the Canadian Association for Humane Trapping developed a programme that brought engineers, biologists, veterinary pathologists and technicians together to research scientifically the development of more humane trapping systems. Then an initiative from Gambia at the 1983 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) meeting sought to prohibit trade in products from animals "taken by cruel methods". Discussion of that proposal revealed how little agreement there was over what constituted a humane method. This led to the formation, in 1987, of a Technical Committee of the International Standards Organisation (ISO), which aimed to establish a set of humaneness standards for traps. From the outset, this initiative was hampered by lack of agreement about both the agenda and the constitution of the committee. Ultimately, countries that traded in wild animal products but were not themselves producers (eg the UK) were allowed into the process, and the agenda was revised to deal with the issue of how to test traps (a matter of science), rather than how to judge them (a matter of ethics).

Nevertheless, quite independently, the European Union (EU) had started to develop its own set of trap standards for trading partners who dealt in animal products. This culminated in an agreement between the EU and fur-trading countries, including Canada and Russia. Russia has yet to ratify the agreement, a necessary step before any signatory country can enact it. In the UK, DEFRA has adopted the test procedures and humaneness standards outlined in the EU agreement as the basis for its own trap-testing programme, but this arrangement is full of anomalies. Because of the existing legislative framework in the UK, the procedures (and their standards) are not being applied to mouse, rat or mole traps, or to snares, live-capture traps, box-traps or cage-traps. Equivalent standards do not exist for chemical pesticides (although under Article 5 of European Parliament Directive 98/8/EC, animal welfare is considered in assessing biocides, no guidance is given on what constitutes "unacceptable effects"); nor do equivalent standards exist for what we might call 'traditional' hunting control methods, which more closely resemble natural predation; these are being judged separately, individually and arbitrarily by primary legislation.

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Kirkwood *et al* (1994) proposed that welfare assessment should be based not only on the severity and duration of suffering and on the capacity of the animal to suffer, but also on the number of animals affected. This implies a more contextual view of management methods than is embodied in approval procedures for spring-traps. Such a perspective would necessarily review alternative strategies, including the time of year at which control was attempted. It could conceivably sanction the use of a less humane trap if this facilitated incisive population or damage control. It is unclear whether such an approach lends itself to statutory regulation or whether it becomes a matter of education and discretionary choices by practitioners.

A frequent topic of discussion has been the difficulty of ensuring progress in welfare once standards have been agreed. The EU agreement on trap testing promises a review of standards after a period of a few years. There are also difficulties for innovators. The market is small and offers little incentive to develop and pilot new designs. Back in the 1920s, humane societies in the USA and elsewhere offered prizes to inventors of acceptably humane traps (Dunlap 1988). For inventors today, the incentives are small, while testing requirements introduce a delay that is very costly in business terms. It is also unlikely that the industry could bear the cost of testing, as is the case with chemical pesticides.

Should regulations allow the use of only the single method that offers the 'best' welfare, or should they enforce a minimum standard that allows a range of methods? Because of trade-offs between the many aspects of culling methods, practitioners typically argue to have a range of methods available from which they can choose the method most appropriate to each situation. If a range of methods is allowed, there need to be rules defining the deletion of methods by regulators as well as the entry of new ones. If a new method functionally replaces an older one and offers advantages in welfare or in other respects, then it might reasonably displace the older one from the list. However, this too is a complex decision because different methods rarely have exact functional equivalence, even within a category such as spring-traps.

Codes of practice and education

If a range of methods is allowed as described above, how does one dictate the proper decision-making route for practitioners? Increasingly, hunters and wildlife managers in the UK use Codes of Practice to define agreed standards of conduct. Published by The British Association for Shooting and Conservation, such codes currently exist for shooting, shotguns, air rifles, fox snares, flight ponds, gundogs, lamping, picking-up, trapping pest birds, trapping pest mammals, wildfowling, and woodpigeon shooting (see http://www.basc.org.uk/content/codesofpractice). Other organisations offer educational material on specific techniques that amount to recommended practice (eg Reynolds 1991, 1998; Game Conservancy 1994). These are not legally binding, although they have sometimes been used in UK legal courts to define responsible conduct in relation to specific charges. Training schemes for trapping methods exist in many countries, including the UK; these often lead to formal accreditation of the candidate (although not in the UK).

The whole concept of setting standards for trap hardware assumes that the defining properties of the method are invested in the trap hardware. In reality, operator skills may be at least as important as the hardware itself. Target specificity, in particular, depends on where and how the trap is set, as well as on the kind of bait used. Because traps can be mechanically efficient only for a limited range of body sizes and shapes, welfare is inextricably linked to target specificity.

It is difficult to evaluate the effectiveness of voluntary Codes of Practice to influence trapping practices that are deployed widely across the countryside, but the same may be said for legislation too, much of which has proved difficult to police and adjudicate upon.

Conclusion

Routes towards the improved welfare of animals in the context of wildlife management undoubtedly can be, and should be, identified through scientific study. However, the direction of such research is confused by the incoherent attitudes shown at all levels of society towards wild animal welfare. In the UK, the legislature relevant to wildlife management practices fails to exhibit any consistent approach towards welfare, and this is likely to be true elsewhere in the world. Ultimately, regulation is only one tool towards improved welfare, and a combination of education, science, and voluntary development will also be necessary.

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