HUNTing for sustainability
-research on the wider meaning of hunting

SEVENTH FRAMEWORK PROGRAMME

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Best practice recommendation:

Social-ecological modelling for sustainable hunting

Context and challenges

The management of hunted species is a complex process driven by interactions between the population dynamics of the species, the decision-making and behaviour of stakeholders and uncertainty at various levels of the management process and the natural system.

Harvest management models often do not explicitly incorporate the social processes underlying harvester behaviour, and are based on the use of a "best" management solution to achieve a single objective. Where the system is relatively simple and harvesters abide by rules, such as in some recreational hunts in the developed world, this may not be problematic. However, in complex systems, with multiple stakeholders and severe uncertainties, it is generally difficult to provide a single best harvest policy. Instead, there is a need to find robust approaches that meet management objectives under a range of potential states of the world.

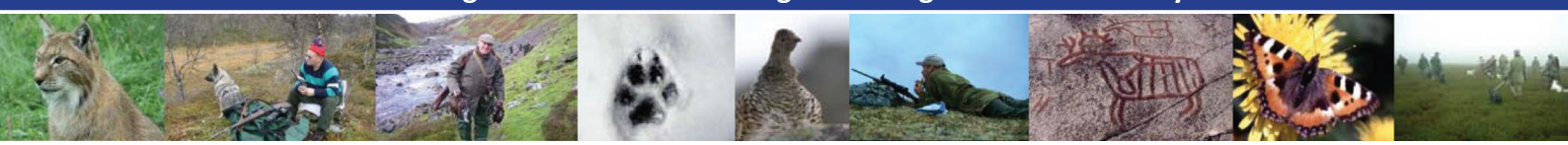
One approach that aims to do this has gained considerable ground within fisheries science: Management Strategy Evaluation (MSE) uses simulation models within an adaptive framework that enables the comparison of alternative strategies in a virtual world under multiple and often conflicting objectives. We have expanded the MSE framework to include individual harvester decision-making to make it more suitable for terrestrial conservation.

MSE has five major advantages over standard approaches to providing management advice: (i) It allows experimentation with a range of possible management procedures under a range of circumstances, without the risks and costs of real-world experimentation. (ii) Stakeholders can be directly involved in the development of the management scenarios, which can reduce conflict. (iii) MSE enables researchers and managers to examine the implications of various forms of uncertainty, including process, measurement and structural uncertainty, on the performance of different management options. (iv) MSE carries out prospective rather than retrospective evaluations of the performance of different management procedures under a range of circumstances. (v) MSE can be incorporated into real-world management, to guide learning and adaptation over time.

Case studies – illustrating our experience

Mountain nyala in Ethiopia: The mountain nyala is an endangered ungulate endemic to Ethiopia and is hunted for trophies by mostly foreign hunters. We have a good understanding of the decision-making process used to set the quotas, but we have less understanding of the monitoring process and the error in the abundance estimates. Life history parameters, such as fecundity and survival rates, are missing for mountain nyala, which adds additional uncertainties to the sustainable management of trophy hunting. Our models clarified the relationship between the length of the monitoring period, the uncertainty about key parameters (including poaching and abundance estimation) and the flexibility of the hunting quotas (how quickly they should change in response to new information). We developed a simple harvesting rule that is robust to changing circumstances and allows managers to increase both their quota and the nyala population. However, this is dependent on engaging local people more, so as to reduce the external threats posed by poaching and habitat encroachment.

Lynx in Norway: Since 1994 the lynx population in Norway has been subject to quota hunting as a means to control population size, but also to allow recreational harvest. In fact, Norway is unique in Europe by managing lynx as a normal game species. Nonetheless, the lynx quota harvest is often associated with controversy in Norway due to the charismatic nature of large carnivores and their high conflict potential with livestock husbandry. To increase the understanding of ecological and social factors affecting lynx harvest and lynx population dynamics in Norway we used a wide set of tools. In particular, we focused on factors affecting the relationship between management decisions (quotas) and actual harvest off-take, on the appropriateness and accuracy of the current monitoring scheme, as well as the direct effects of harvesting on lynx population dynamics. As time lags in the monitoring



process in the past seem to cause unstable dynamics, a statistical prognosis tool forecasting the lynx population (with associated uncertainties) one year ahead under a given harvest scenario has been developed and is likely to reduce this issue by giving wildlife managers a formal tool to use in setting quotas. Further developing models under the MSE framework would allow simultaneous consideration of uncertainties in both ecological and management process. This would be a valuable next step and much of the knowledge is now available for such a model to be developed.

Partridges in Spain: The main uncertainty for partridge management in Spain is the relationship between the number of captive-reared birds released, a sustainable quota for shooting and the estimated abundance of wild birds. Good data exist on the uncertainties surrounding monitoring of abundance and the relationship between estimated abundance and realised hunting. However, the decision-making process on how many to release, how to set the quota and the role of hunter demand in driving management practices is less transparent and less well known. This needs further investigation using social science methods. We are developing a model that will demonstrate the need for research into these key uncertainties, and will enable us to test different combinations of releases and quotas to enhance estates' sustainability.

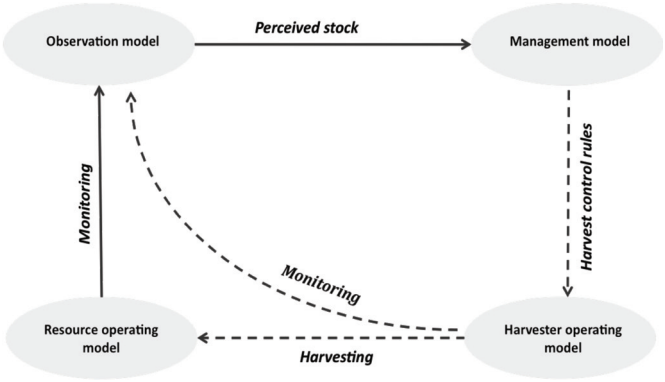
Lions in Africa: Lion hunting provides an opportunity to generate conservation revenue, but recent data show a declining trend in lion numbers across Africa due to trophy hunting. Most hunting areas lack good monitoring data on abundance; in fact often there is no estimate of lion population size that can be used to set hunting quotas. Using the MSE framework we developed a new approach to quota setting, based only on data which are easily available to hunting companies: the time it takes to find and kill a trophy lion. Using a simple decision rule, we simulated the sustainability of quotas under a range of uncertainties, including the possibility of hunters misidentifying lion age and so killing younger lions by mistake. This rule is very robust, and so would be a useful component of hunting rules, complementing the existing restrictions on hunting younger lions. This approach is applicable to any circumstance where hunters kill a single animal on a hunt (i.e. most trophy hunting).

Best practice approaches – our experience

- Uncertainty needs to take centre-stage in the modelling process. It plays a fundamental role in the dynamics of ecological and economic systems, in our measurement and understanding of these systems, and in the devising and implementation of rules to control harvesting.
- Hunting is a crucial contributor to people's livelihoods in many parts of the world. Management often works against the short-term economic interests of those who depend on resources by decreasing the harvest or closing areas to protect its natural resources. The welfare of resource users, securing ecosystem service provision and integrating conservation and development is of key importance for social-ecological modelling. This means that the incentives and decisions of people who depend on the resource must be included in the MSE model.
- It is crucial to develop systems understandings collaboratively and with a range of stakeholders, not just scientists, and explicitly model trade-offs between different objectives, and the perspectives of different stakeholders

Outlook for future studies

- There is a need to engage with, and overcome, the reluctance of social and economic disciplines to engage with a quantitative approach to institutional and cultural complexities.
- Engaging with stakeholders early, and in a participatory manner, is crucial for success, but scientific researchers are not always equipped with the tools, contacts and experience to do this. Engagement should be done before the modelling starts, and throughout the modelling process, so there is a need to be organised about this, and develop strong collaborations from the start.
- The MSE approach can readily be integrated within an adaptive management framework so as to guide learning in the real world, but this needs a substantial amount of time (several years) which we did not have on this project.



Flow diagram for the Management Strategy Evaluation framework comprising a resource operating model (simulating the "true" population biology of the species), the observation model to monitor the species (with error) and the management model, using the perceived stock to create and implement the harvest control rules. In the extended model (dotted line) the harvest control rule is fed into an additional harvester model which allows for individual decision-making by harvesters. In this model, the harvester can also be monitored through the observation model (dotted line).

Reference

Bunnefeld N., Hoshino E. and Milner-Gulland, E.J. (2011) Management strategy evaluation: A powerful tool for conservation? Trends in Ecology and Evolution 26(9): 441–447.

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