

UNDERSTANDING PREDATION

Initial findings for Review Seminar participants



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INTRODUCTION

The role that predators play within ecosystems and the management of predatory species is a subject both of policy relevance and of considerable interest to stakeholders across Scotland. It is also a topic that raises strong passions. On the one hand, there is concern about the negative impacts of predators and calls for more predator control to benefit a range of prey species. On the other hand, predation is recognised as one of many natural processes within functioning ecosystems.

Decision making in this challenging area therefore requires an assessment of the evidence of predator impacts and the effectiveness, or otherwise, of alternative management strategies. Typically such assessments focus on scientific knowledge to help guide decision making and do not consider local knowledge held by practitioners. However, the benefits of integrating these two forms of knowledge to improve the effectiveness of research and decision making are increasingly recognised.

This project seeks to explore the understanding of predators and predation impacts through reviewing the scientific and local ecological knowledge held by stakeholders in Scotland. We seek to examine the different arguments and evidence and investigate the reasons for uncertainties and differences between different knowledge forms. Ultimately, we need local knowledge to help ensure that future research asks the right questions at the right scale and is produced with stakeholders.

The project is founded on a shared aspiration of the stakeholder community to establish and maintain balanced, healthy populations of all wild birds in Scotland and their predators and builds on a previous review of the scientific literature: *The impact of predatory birds on waders, songbirds, gamebirds and fisheries interests* (Park et al. 2005).

The aim of this project is to: **build a shared and accessible evidence base that collates and critically assesses the available information from science and stakeholders, highlights where these forms of knowledge agree or disagree, and analyses the reasons for any differences.** We have done this through a review of the scientific literature, a questionnaire and a series of workshops with the main stakeholder organisations. Specifically, our focus is:

- (a) Reviewing the published scientific evidence of predator-prey interactions, focusing on species trends, drivers of change in populations, the impact of predators on their prey and the existing evidence for the success or otherwise of alternative management options;
- (b) Establishing stakeholder knowledge and management experience of predator-prey interactions, examining the arguments and evidence supporting these; and
- (c) Exploring the reasons for uncertainties and gaps in comparisons between scientific and local knowledge.

Focal species: Members of the Moorland Forum identified six wild bird prey species in upland and lowland systems as particularly important foci for this research:

Black Grouse Curlew Golden Plover Grey Partridge Lapwing Oystercatcher



Four common predators were also identified by the Research Group for use in the stakeholder engagement work:

Buzzard



**Carrion Crow / Hooded Crow
(grouped as 'crows')**



Raven



Red Fox



This short report summarises the key, initial findings for discussion in 3 seminars (The Dewars Centre, Perth, Oct 27th; Great Glen House, Inverness Nov 7th, Silvan House, Edinburgh Nov 12th). We present findings in five sections: 1) Common goals, 2) Knowledge, 3) Species trends, 4) Drivers of wild bird population change, and 5) Conservation-management options. The findings presented here and their interpretation will be discussed with stakeholders in these seminars. Discussion and feedback will help contribute to the final report.

METHODS IN BRIEF

In total we received 400 completed questionnaires and held nine workshops with 15 organisations and 62 participants. We examined more than 12,500 pieces of scientific literature. For some of the analyses presented here, we have focused on responses from 221 'Local knowledge' participants (52% of the respondents), who told us in their questionnaire responses that they relied mostly on 'personal field observations or field management experience' to build their understanding of the issues considered, rather than scientific knowledge. We did this because one of the main objectives of the project was to compare findings from local knowledge with a review of the natural science literature. For other analyses, we also included responses from 'Scientific knowledge' participants (110; 28%) and 'Other knowledge' participants (79; 20%), who relied on 'academic/scientific peer-reviewed articles' or various other kinds of knowledge respectively.

COMMON GOALS

We first asked questionnaire respondents to tell us why they were interested in the project. Overall, 55% of respondents had interests related directly to conservation of ground nesting birds, followed by a professional interest in ground nesting birds (23%), an interest in experiencing ground nesting birds in their natural surroundings (18%) and an interest in the ecology of ground nesting birds (17%). Many participants cited more than one reason for their interest in the predation of ground nesting wild birds and interests often overlapped.

We also sought to explore the aspirations and likely management goals of stakeholders by asking them how they would define "healthy populations of predator and prey species in upland and lowland systems in Scotland". Most respondents suggested a common goal of wanting to maintain sustainable populations of both wild bird prey species and their predators (Table 1). After that, respondents emphasized a concern for prey populations and /or a need to control predator populations. Almost twice as many local knowledge users recorded this second definition compared to respondents from the other two groups. Much smaller numbers of respondents provided other varying definitions (see Table 1 and its footnotes).

Overall, our findings from this part of the project show a high degree of common interest and shared goals across the respondents.

Table 1: Summary of the 400 questionnaire respondents' definitions of 'healthy populations of predators and prey species in upland and lowland systems in Scotland', according to their preferences for different types of knowledge. The figures given are the percentage of participants within each group that made a statement relating to each summary definition. Note that some statements were coded by more than one summary of definition.

	Local knowledge users	Scientific knowledge users	Other kinds of knowledge users
Overall balance and/or sustainability (of both prey and predators)	82%	82%	66%
Control predators and/or maintain or promote prey (emphasis on prey)	46%	28%	29%
Limit environmental/conservation impact of human activities ¹	0%	9%	1%
Ensure viability of rural economy and industries ²	1%	1%	4%
Specifically pro-predator ³	0%	1%	1%
Difficult to interpret as a definition	1%	8%	5%

Notes

1 Including cessation of illegal killing of predators, cessation of sport shooting, managing human impacts and preventing artificial increase of non-native species.

2 Including ensuring well managed and balanced grouse moor and no negative economic impact on rural industries.

3 Mentioning only large numbers of predators.

KNOWLEDGE

We then explored the types of knowledge on which respondents relied and why some people mostly rely on local knowledge and others rely on scientific outputs.

Our findings show that respondents often strongly favour one type of knowledge over another and have suggested reasons why this may be the case.

These are some of the main points that were made by respondents about the two major knowledge types that were considered:

Personal field observations or field management experience:

- The experience of witnessing first-hand how different factors can affect the dynamics of natural systems at a local geographic level;
- The 'man on the ground' trusts his own long-term, detailed observations of the natural environment and considers them the most reliable, unbiased and appropriate source of information to carry out their professional role in their local area;
- Mistrust of scientific evidence because of perceived biases relating to who funds or peer-reviews the research, biases in the objectives and framing of studies, problems relating to geographic scale and timeframe, lack of **generalisability** from one location or species to another, and potential for misinterpreting results due to the short-term 'snap-shot' of data gathered.

Academic/scientific peer-reviewed articles:

- The issue of predator-prey relations is an emotive, political or controversial subject which requires decision-making to be based on unbiased, independent, academically robust

studies, preferably conducted by scientific organisations with significant relevant experience;

- The ability to conduct documented, repeatable experiments based on facts and sound observation and to apply data analyses which can help to reduce biases to a minimum and measure the significance of findings. Critical evaluation of scientific studies, particularly through peer-review is paramount to the success of scientific research because it allows evidence gathered to be tested to a high standard, scrutinised and challenged by well-qualified experts before publication;

- Decision-makers, especially politicians, value scientific knowledge more highly than local knowledge, so scientific studies could potentially be used to positively influence the development of more appropriate legislation and management approaches regarding predator-prey interactions;

- A reliance on circumstantial evidence or hearsay could polarise views and cause scepticism about the issues. This was related to a mistrust by some respondents of non-scientific sources (e.g. the news media) and non-peer-reviewed literature written by non-government organisations which they said was sometimes politically motivated or could be influenced by the interests of some members.

Questions for the Review Seminar discussion:

- **What opportunities are there for the co-production of knowledge (local and scientific)?**
- **How can we best use local knowledge to design and frame scientific studies?**
- **Can we identify appropriate geographic scales and timeframes for conducting collaborative research?**

SPECIES POPULATION TRENDS

We compared the average change in abundance of different species as perceived by those questionnaire respondents who rely on local knowledge with the findings from the most recent Bird Atlases.

There is strong agreement between Bird Atlas data and local knowledge about how species abundance has changed for all species except Carrion/Hooded crow (Figure 1).

The crows are perceived by questionnaire respondents to have undergone more positive changes in abundance than the Atlas data would suggest.

There is strong shared understanding regarding recent declines in the six focal prey species, and the recent increases in Scottish Buzzard and Raven populations.

During the workshops and other discussions, various reasons have been suggested for why this difference may occur for crows, including:

- Bird Atlas abundance methods are designed to record birds during the breeding season but questionnaire assessments relate to the whole year.
- The more positive stakeholder assessments may be much more influenced by flocks of non-breeders and wintering birds (but note that the divergence of views does not occur to such an extent for raven, which also forms large flocks).
- Stakeholders may also be particularly familiar with the types of areas that hold flocks of non-breeders.

- Many of the respondents that relied on local knowledge were gamekeepers who routinely come into contact with crows during predator control operations – the numbers of crows they trap may have increased due to changes in the distribution, numbers or behaviour of crows.
- If crows are perceived to impact negatively on the economic or recreational interests of stakeholders, then continued or intensified declines in the range of prey species valued by stakeholders could trigger a perception of more increased population changes.

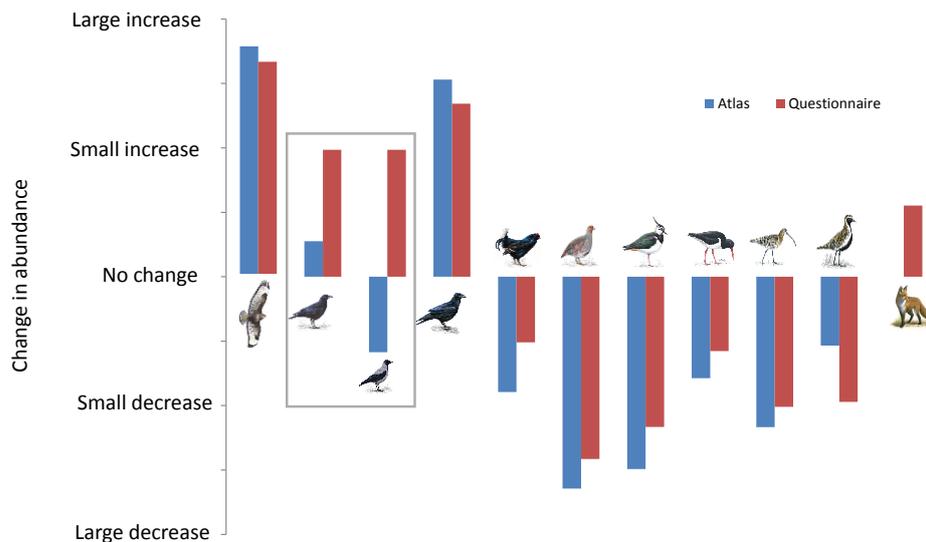


Figure 1: Comparison of local stakeholder knowledge and Bird Atlas information for the focal prey species and some of their predators. Comparisons relate to specific areas of Scotland identified by respondents as areas for which they had particular knowledge. Respondents were asked to categorise changes in abundance over the last 25 years from ‘large increase’ to ‘large decrease’ and the continuous measure of change in abundance available from the two most recent Bird Atlases was categorised in an equivalent manner (where ‘large increase’ represents an approximate doubling of breeding numbers and ‘large decrease’ a halving). Note that there are no equivalent atlas data for Red Fox but the National Gamebag Census shows a significant decline in Scotland between 1996 and 2009.

Questions for the Review Seminar discussion:

- Can we agree which, if any, of the suggested reasons above may explain the difference in understanding of recent population changes for crows?
- Can you think of other possible reasons to explain the observed differences?

DRIVERS OF WILD BIRD POPULATION CHANGE

We compared the ranked order of importance of different drivers of change for the six prey species as recognised through local knowledge and scientific literature.

Our initial findings suggest broad agreement in the relative order of importance of different factors between the scientific literature and local knowledge, with most drivers scored within one rank difference of each other (Figure 2).

Any suggested divergence of views between the sources can be summarised as: those relying on local knowledge view predators as the most important driver of population change for all six focal species, whereas the literature suggests that habitat / land use change (3 species), herbicides/pesticides (1 species), predation (1 species) and climate change (1 species) are the most important. Local knowledge also consistently suggests that recreational disturbance is more important than is reflected in the scientific literature (Figure 2).

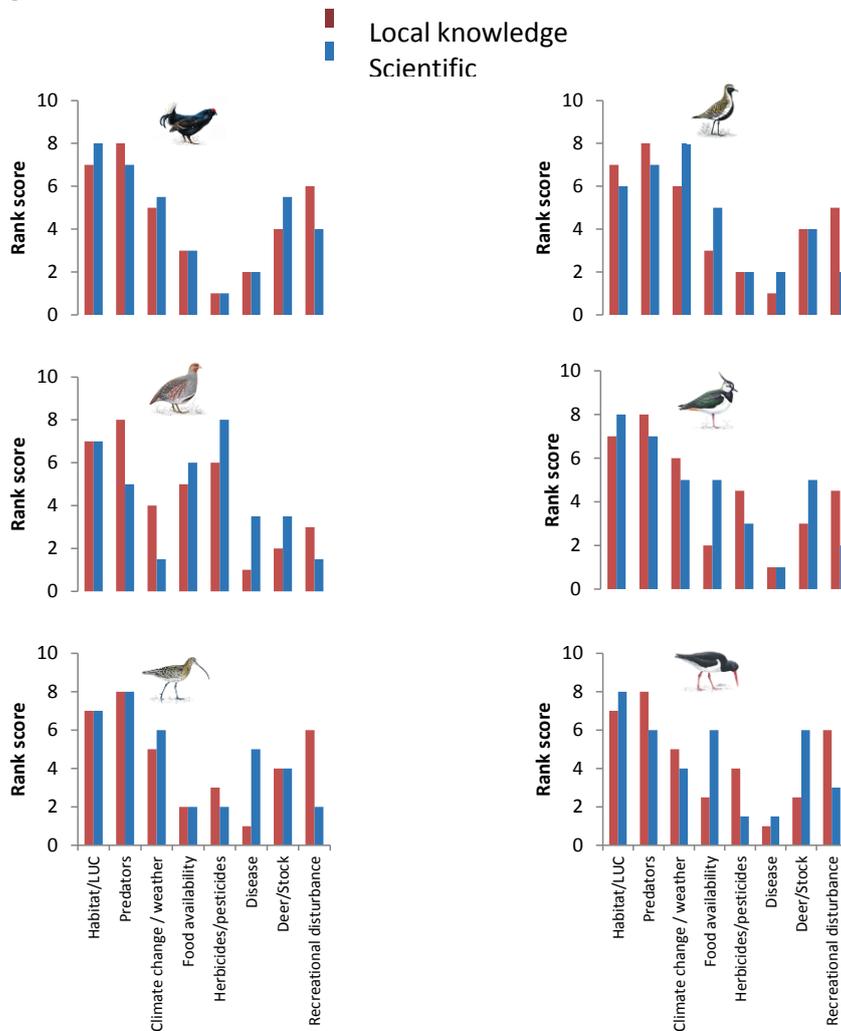


Figure 2: Comparison of the findings of local stakeholder knowledge and natural science reviewing on the drivers of change of populations of the six focal prey species. For the local knowledge, ranks were based on the percentage of respondents that perceived each driver to have a 'medium to high impact on the prey population'. For the scientific reviewing, each driver was scored according to the evidence base that supported it, taking into account the number of relevant studies and consistency of their findings, the design and scale of the available studies, where studies were carried out (i.e. relevance to the Scottish context) and the strength of any driver effect found. The highest rank was 8, reflecting the most important driver for each species. It should also be noted that the scientific literature suggests much evidence for different drivers working together to influence population change ('interaction of effects') but comparable information was not collected from local knowledge stakeholders.

We also compared the relative importance of four different predator species on populations of the six focal prey species.

Once again, the views of those relying on local knowledge are largely consistent with the findings from the scientific literature in terms of the ranking of the predators (Figure 3).

Both local and scientific knowledge consistently highlight the greater importance of predation by Red Fox and crows, with some variation between prey species. There is less research evidence for an effect of foxes on Oystercatcher, partly because some of the main research studies have been carried out on fox-free islands.

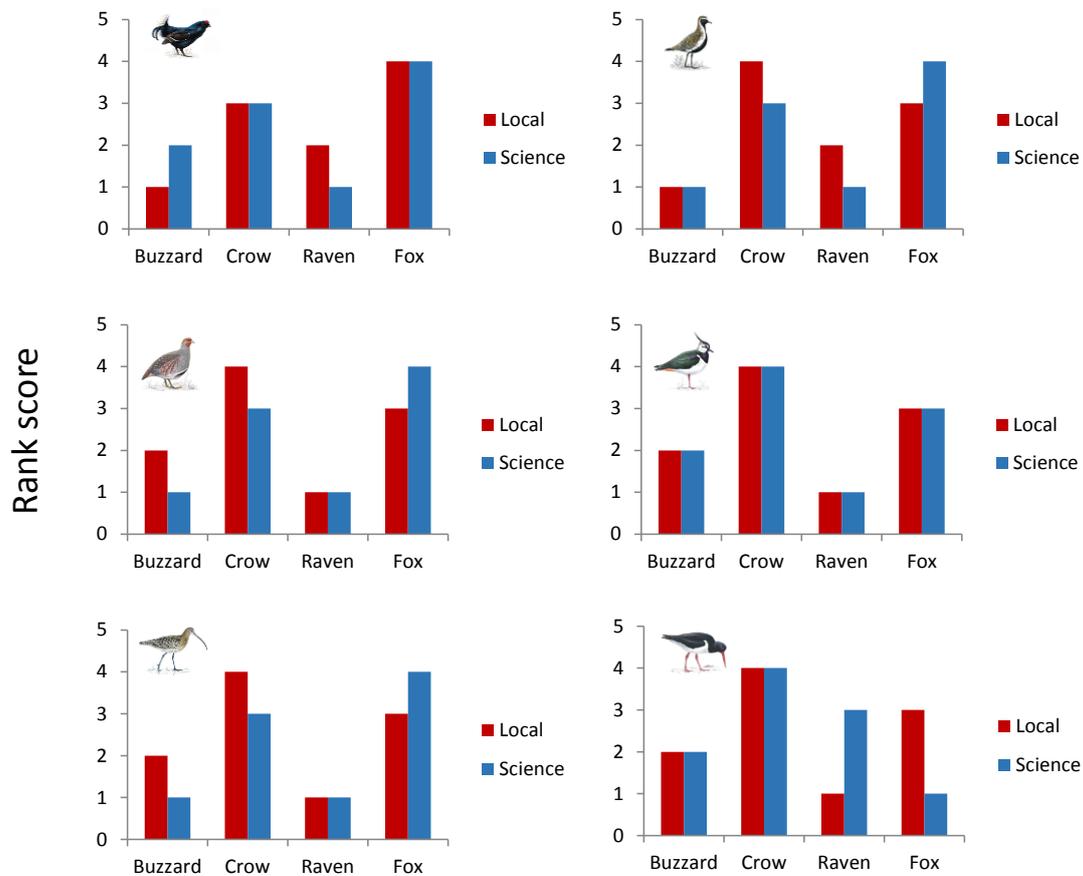


Figure 3: Comparison of the findings of local stakeholder knowledge and natural science reviewing on the relative importance of four of the predators of the six focal prey species. For the local knowledge, ranks were based on the percentage of respondents that perceived each predator to have a ‘medium to high impact on the prey population’. For the scientific reviewing, each predator-prey species interaction was scored according to the evidence base that supported it, taking into account the number of relevant studies and consistency of their findings, the design and scale of the available studies, where studies were carried out (i.e. relevance to the Scottish context) and the clarity (attribution to specific predator) and strength of any predation effect found. The highest rank was 4, reflecting the most important of the four predators for each prey species.

Questions for the Review Seminar discussion:

- Can we suggest why local knowledge consistently ranks predation as the most important driver of population change in the six prey species, in contrast to the scientific literature?
- Can we suggest why local knowledge suggests recreational disturbance as a more important driver of population change in the six prey species, in contrast to the scientific literature?
- Are there any other similarities or differences that you consider are of particular interest or warrant further exploration?
- How should these findings influence future research in this field?

CONSERVATION-MANAGEMENT OPTIONS

We compared the findings from local knowledge and reviewing of the scientific literature about the effectiveness or otherwise of three classes of conservation-management techniques:

- Predator control (directly reducing predator numbers);
- Habitat management (managing cover for prey; managing food abundance/quality for prey; managing habitat for predators; managing prey availability for predators); and
- Other predator management (catching and moving predators; diversionary feeding for predators; zoning for predators).

Questionnaire respondents who expressed a preference for local knowledge had greater confidence in the effectiveness of predator control than in either habitat management or other predator management techniques. Both the proportion of respondents who expressed an opinion about this management technique, and the proportion of these who rated the technique as generally effective, were higher than for the other two management types. Evidence of management effectiveness from the scientific literature was relatively similar for predator control and habitat management. However, there was very little published information on other predator management techniques, with 96% of studies not considering any of them.

Questions for the Review Seminar discussion:

- Can we suggest why local knowledge respondents consider predator control more effective than is suggested by the scientific literature, and more effective than the other management techniques?
- Are there any other contrasts that you consider are of particular interest or warrant further exploration?
- How should these findings influence future research in this field?
- What are the implications of these findings for future work to address the goal of maintaining healthy populations of both wild bird prey and their predators?

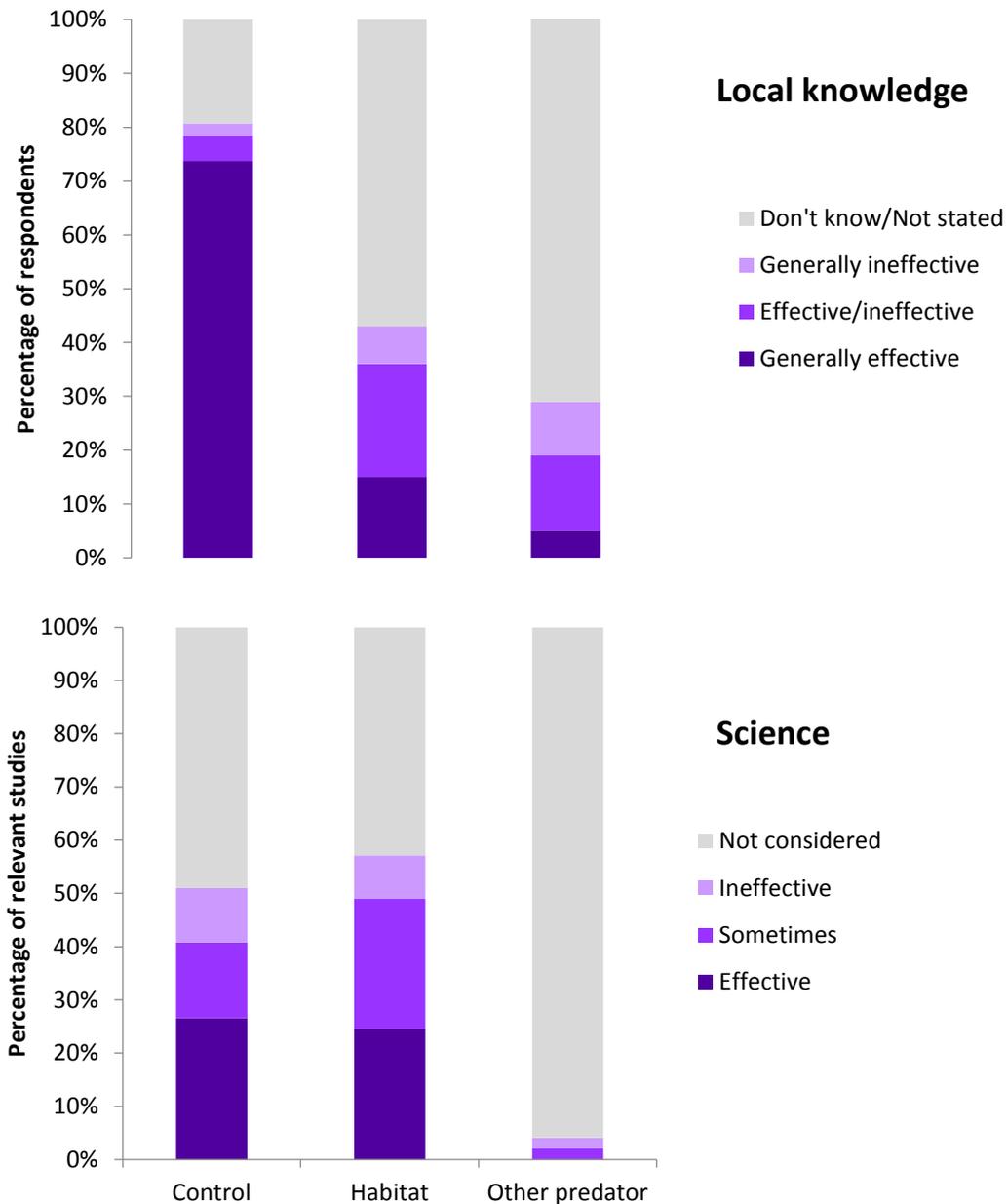


Figure 4: Comparison of the findings of local stakeholder knowledge and natural science reviewing on the effectiveness or otherwise of a range of conservation-management techniques. For the local knowledge assessments, respondents were asked to indicate whether any management techniques of which they had understanding or direct experience were either 'generally effective', 'sometimes effective/sometimes ineffective' or 'generally ineffective'. They could also respond 'don't know'. For the scientific reviewing, 49 separate scientific studies that considered the influence of management on gamebirds or waders were categorised as showing that management was either 'effective', 'sometimes effective' or 'ineffective', or not considered by the study.