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Support for decision-making in conservation

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SUPPORT FOR DECISION-MAKING IN CONSERVATION

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SUPPORT FOR DECISION-MAKING IN CONSERVATION

Executive Summary

Conservation increasingly involves making decisions on appropriate action from a wide range of options. There is, however, no formal structure to support decision-making across the conservation community and no structure to enable effective transfer of scientific evidence into practical action. The aim of this project was to gather data on the current practice of decision-making in conservation and to assess the applicability to conservation practice of the evidence-based framework developed to support decision-making in medicine. Specific objectives were; to investigate and analyse the current mechanisms used for the capture and use of scientific evidence in conservation practice; to assess the validity and relevance of the medical model in conservation; and to construct a framework for the support of evidence-based practice in conservation.

Current mechanisms for the use of scientific evidence in conservation were investigated by examining: 1.the process of compiling management plans for nature reserves through examination of management plans, a questionnaire survey of management plan compilers, and follow-up telephone interviews and 2. the process of compiling action plans for species and habitats by interview with key individuals involved in the process and analysis of official documentation.

The results suggest that despite the increasing amount of scientific information produced on management of species and habitats, conservation practice remains largely experience-based, relying heavily on traditional land management practice with limited evaluation of what works and what doesn't. Generally, scientific evidence is not being explicitly used to justify management actions; scientific literature is not being accessed to gather evidence but information (of varying quality) immediately available in the working environment forms the basis of decision-making; and experience-based information has a greater input than evidence-based information to decision-making. Additionally, although gaps in knowledge are recognised and scientific research advocated, there is no formal mechanism for benefiting from the outcome of such research through wider dissemination of results. Accessibility of evidence (in a usable form) to practitioners is a problem emphasised by the data collected in this study. The lack of this type of support for decision-making appears to be forcing practitioners to adopt practices that perpetuate largely experience-based decision-making.

A model to support decision-making, commonly referred to as ‘evidence-based practice’, is available from the field of medicine and public health, where it has been used successfully and has resulted in what has been called an "evidence-based revolution". The process of evaluating evidence on the effectiveness of alternative practices is seen as an opportunity to improve information flow between scientists and practitioners and to encourage formation of productive partnerships and decision support systems. Accessibility of evidence is a key issue addressed through the commissioning of systematic reviews and active dissemination of resulting information in a usable format. The role of funding bodies and particularly governments in catalysing this process is seen as key to achieving more evidence-based conservation practice. The suggested long-term goal is the establishment of an independent unit for systematic review and dissemination of information of the same nature as those existing to support medicine and public health.

1 - Background and Rationale

Conservation increasingly involves making decisions on appropriate action from a wide range of options. Many conservation organisations now manage species and habitats, and produce action plans containing a diversity of objectives. There is, however, no formal structure to support decision-making across the conservation community and no structure to enable effective transfer of scientific evidence into practical action. A similar problem was faced by the medical community, to which the response was the formation of a system termed 'evidence-based practice', that provides a support framework for decision-makers as practitioners or policy formers (Pullin & Knight 2001). The rationale behind this pilot project was that this medical model could provide a valuable guide to the development of decision support in conservation. The overall aim was to gather data on the current practice of decision-making in conservation and to attempt to compare the medical and conservation systems to assess the applicability of the evidence-based framework to conservation practice.

2 - Project Objectives

To investigate and analyse the current mechanisms used for the capture and use of scientific evidence in conservation practice.

To assess the validity and relevance of the medical model in conservation

To construct a framework for the support of evidence-based practice in conservation

3 - General Methods

Current mechanisms for the use of scientific evidence were investigated by examining the way in which a selection of conservation organisations formulate their Reserve Management Plans and Species and Habitat Action Plans. Thus two separate decision-making processes were analysed

1. The process of compiling management plans for nature reserves
2. The process of compiling action plans for species and habitats

3.1 The Compilation of Management Plans

Sources of information used to support decision-making by reserve management plan compilers and information arising from their decision-making were investigated in three ways.

Analysis of Management Plans

Management Plans for nature reserves were analysed for extent of use of information in decision-making. A total of 38 Management Plans were obtained from 6 organisations (Butterfly Conservation, English Nature, National Trust, Plantlife, RSPB, Worcestershire Wildlife Trust). Plans were selected on the basis of availability and the most contemporary were selected in

preference to older plans. Each was read and its content analysed for a number of key issues relating to gathering and use of information (see appendix 1).

Questionnaire Returns From Management Plan Compilers

Questionnaires were sent out to management plan compilers from seven medium to large conservation organisations (Butterfly Conservation, English Nature, Ministry of Defence, National Trust, Plantlife, RSPB, The Wildlife Trusts). Compilers were asked to complete one questionnaire summarizing their overall experience. Questions were asked concerning the extent of their experience, use of information, access to information, and evaluation of their decision-making (see Appendix 2). The organizations were a mixture of statutory and non-governmental. Most were primarily nature conservation oriented whilst some had nature conservation as a secondary objective. The questionnaires were either distributed directly to the appropriate person in each organisation or given to a central co-ordinator within the organisation for distribution via their intranet. In the latter case it was not possible for all organizations to accurately estimate the number of potential respondents (see results).

Interviews with Management Plan Compilers

After the questionnaires returns had been received and analysed, a subset of 20 responders was followed up by telephone interview. Supplementary questions were asked to further understand the responses received from all returns (Appendix 3). The subset was selected on the basis of their responses being generally typical of the whole sample.

Analysis

The data from the management plan analysis, questionnaire and interview responses were collated on a spreadsheet using Microsoft Excel and subsequently statistically analysed using SPSS Version 11.

3.2 The Compilation of Action Plans

The process of Action Plan compilation was examined for those plans under the leadership of English Nature. The process was largely controlled and coordinated centrally and therefore does not lend itself to a questionnaire approach. Therefore a number of individuals with key roles in the process were consulted and an overview reached on the decision-making process. The following comments should not be seen as in any way critical of the process as it was carried out at the time, This report simply seeks to link the process that was followed with the level of support that was available.

4. Results And Discussion

4.1 The Compilation of Management Plans

4.1.1 Management Plan Analysis

A total of 38 management plans were analysed. All were written between 1996 and 2002. Caution was exercised in drawing information from simply reading the plan, as decisions may have been made and processes undertaken in its compilation, that do not subsequently appear in writing in the plan. However, subsequent information from compilers (see below) has suggested that the information gained is a reliable reflection of the sample.

In 97% of the plans the actions proposed were clearly linked to the objectives set out. In 79% of cases justification was given for the choice of action. In 13% of cases it was not clear if justification was given and in 8% justification was not given. When justification was clearly given it was by reference to one or more of the sources given in Table 1.

Table 1. Percentages of Management Plans in which proposed actions were justified by reference to the listed information sources.

Information Source	
Primary scientific literature	11%
Secondary reviews of literature	16%
Habitat Management Handbooks	29%
Biodiversity Action Plans	29%
Accounts of traditional management	71%

Table 1 clearly indicates the reliance on traditional management as an indicator and guide to future management. 58% of practical management actions were direct continuations of traditional management and a further 26% were influenced by, or modifications of, traditional management. Of course, to follow traditional management practices may or may not be the right action in each case and this judgement was not made in this study.

In 66% of plans alternative actions appear not to have been considered (although this may have occurred but not written into the plan) and in only 16% of plans were alternative actions discussed. In only 8% of the plans was there any explicit attempt to review the literature and in no plan was it evident that the review was extensive. In no plan was the quality of evidence in support of actions considered. It appears, with the caution expressed above, that most Management Plans are being compiled using only a limited amount of the total information available to support decision-making. The reasons for this are explored below.

In 45% of plans, action to fill knowledge gaps was advocated, but in only 13% was this action described in specific terms. Only 5% of plans contained specific targets set within a timeframe. 53% of plans outlined methods to monitor outputs, and these were usually relevant to the objectives, but in only 16% was it clear that the monitoring was sufficient to enable evaluation of

effectiveness of the plan. No plans described a method of evaluating effectiveness. These results suggest that compilers are well aware of gaps in knowledge and the need to monitor outputs from actions, but the process of addressing these issues is not formalised. The consequence of this may be that the important processes of further research on outcomes of possible actions and evaluating effectiveness of current actions are not carried through and lose out in terms of resource allocation. These issues are further explored below.

4.1.2 Questionnaire and Interview Analysis

Response rate to Questionnaire

A total of 141 returns were received from a total of seven organisations. Relative contributions ranged from 1 (from the smallest NGO) to 44. Estimating the return rate is complicated by the fact that one organisation was unable to provide an estimate of how many of their staff to whom questionnaires were distributed had actually compiled a Management Plan for a nature reserve and were therefore potential responders. If this organisation is excluded from the analysis the return rate is 54%. This varied among organisations from 100% for a small NGO to a minimum of 30%.

Characteristics of respondents

Almost half of the respondents compiled or contributed to the compilation of between 3 and 10 management plans (Fig. 1), a quarter less than 3, and 10% have written more than 20. There is consequently a good range of experience represented in the sample.

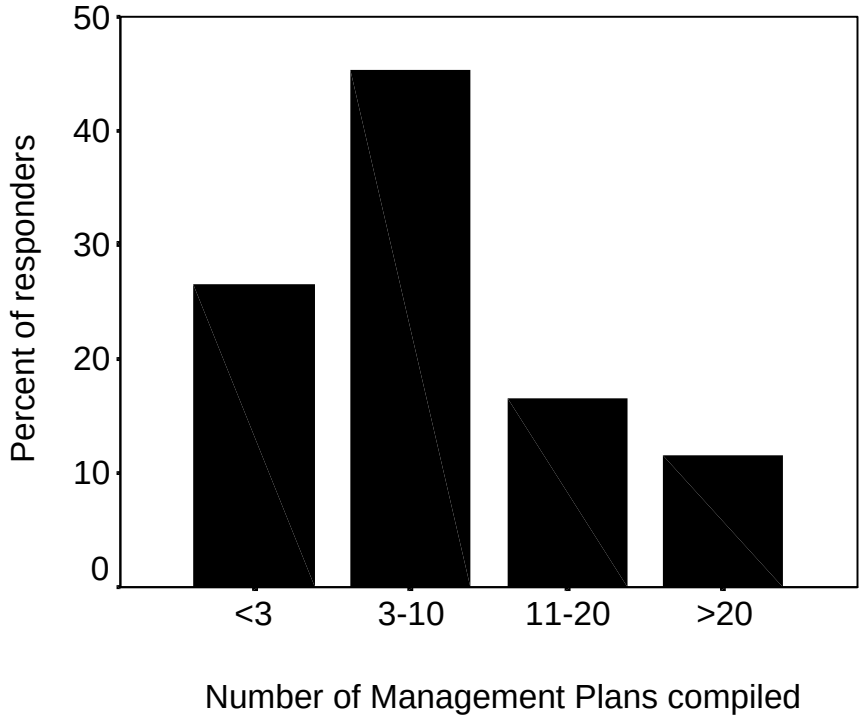

Figure 1. The distribution of Management Plan compilation experience among responders to the questionnaire.

When asked who was involved in the compilation of management plans, 29% responded that they always compiled their plans alone and a further 32% said that this was usually the case. Combining these, it indicates that almost two thirds of the group are making decisions without any support from colleagues. It is not known to what extent this is personal choice or organisational practice. In contrast 23% never compiled plans on their own. The latter reflects policy of some participating organisations to provide 'in-house' support.

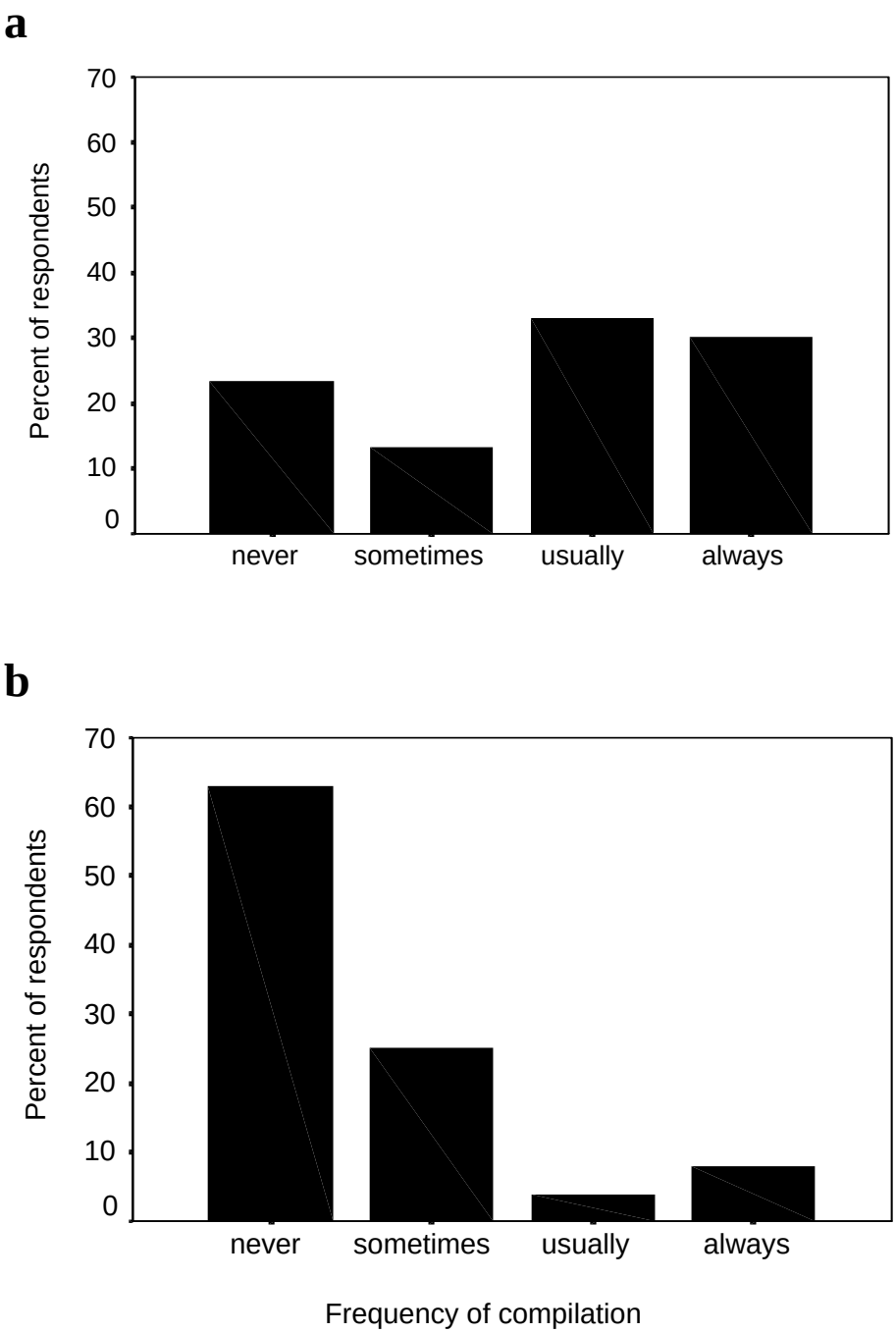

Figure 2. (a) frequency with which management plans have been compiled by individuals and (b) by a working group derived from more than one organisation.

It was the norm among 28% of respondents to use a working group within their organisation to compile management plans, whilst 46% said that this never happened. Only 11% normally used a working group derived from more than one organisation whilst 57% never did this (Fig. 2). These figures should be viewed with some caution as the term “compilation” is open to interpretation by the individual responder. Some may have interpreted this as the physical writing of the plan and therefore tended to view it as a solitary exercise, whilst some may interpret the term as information input and therefore have tended to view it as a group exercise.

When asked about the extent to which they had to decide among possible alternative actions in order to achieve the objectives set in the plan, 67% said they always or usually had to make these sorts of decisions; 4% said they never had to do so. It is clear therefore that decisions on which of a number of alternative actions should be followed, have to be made and are actively considered by most compilers.

Information sources used in decision-making

When asked about the sources of information used to support them in their decision-making, the most frequently used (by combining the always and usually responders) were existing management plans (60%), expert opinion (50%), published reviews, books or handbooks (47%) and documentation or personal accounts of traditional management practices (46%). Least frequently used sources were electronic/web-based materials (4%), published popular articles (13%) and published scientific papers (23%). It appears that, in terms of written material, compilers are relying heavily on current (often traditional) practices to guide them (Fig 3d), with the addition of expert opinion (Fig 3c). But interestingly, they do frequently use secondary literature, in the form of reviews and handbooks, when they are available (Fig. 3b). Primary scientific literature is only infrequently accessed and 12% said they never did this (Fig 3a).

When asked at follow-up interview why they generally do not access primary literature to help them in their decision-making, the most frequent response (65%) was that this literature is too time consuming to locate and access. 60% also said this literature is too time consuming to read. A smaller number (25%) said primary literature is too technical and difficult to interpret in the context of their decision-making. A number also stated that they rely on advisors or expert groups to feed information from primary literature to them (25%).

Other individual responses were as follows:

- "reviews/handbooks more convenient"
- "don’t know when its available"
- "not relevant as management is not exact science – better information from other practitioners"
- "no great need for it "
- "decisions are based on experience and traditional practice rather than new research"

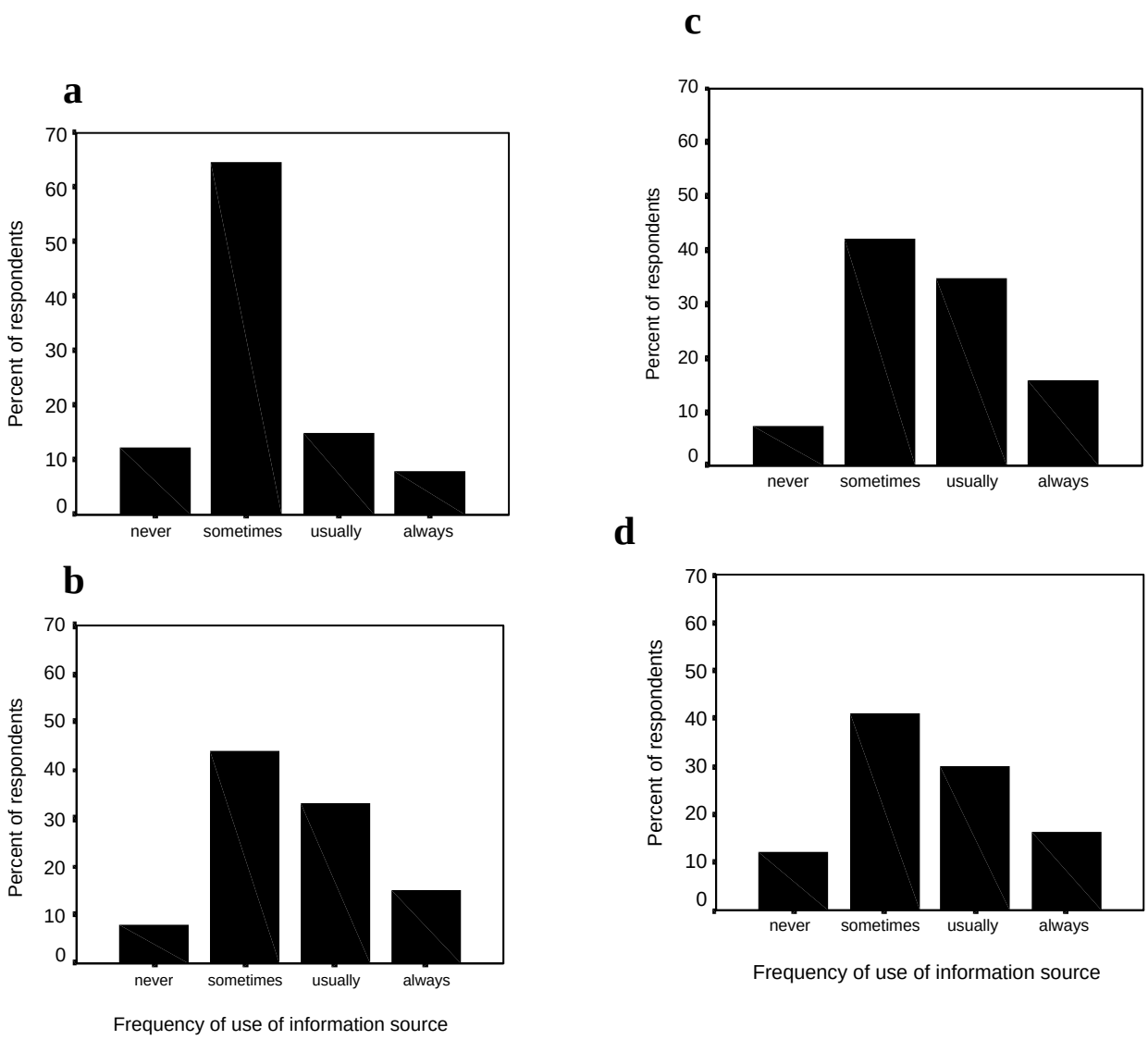

Figure 3. Comparison of the frequency of use of different information sources in compiling Management Plans; (a) published scientific papers; (b) published reviews (books/handbooks); (c) expert outside opinion; (d) documentation or personal accounts of traditional management practices.

Locating information sources

To locate published information only 8% of respondents routinely hand searched library resources (Fig. 4a) and only 3% searched library databases electronically (Fig. 4b). Percentages are even lower for unpublished material. 72% have never undertaken an electronic search of a library database in connection with management plan compilation. Less than 1% routinely used a web-search for publications and 76% have never done so (Fig. 4c). Combining the usually and always used categories, most respondents rely on literature recommended by a colleague (42%) or use of their own or a colleague's personal collection (56%) to locate published material (Fig. 4d,e). Figures are similar for unpublished material. Considering the time constraints on the subject group is not surprising that literature is not being systematically sought out or reviewed, but it is of particular interest that they are predominantly using literature that is immediately available to them.

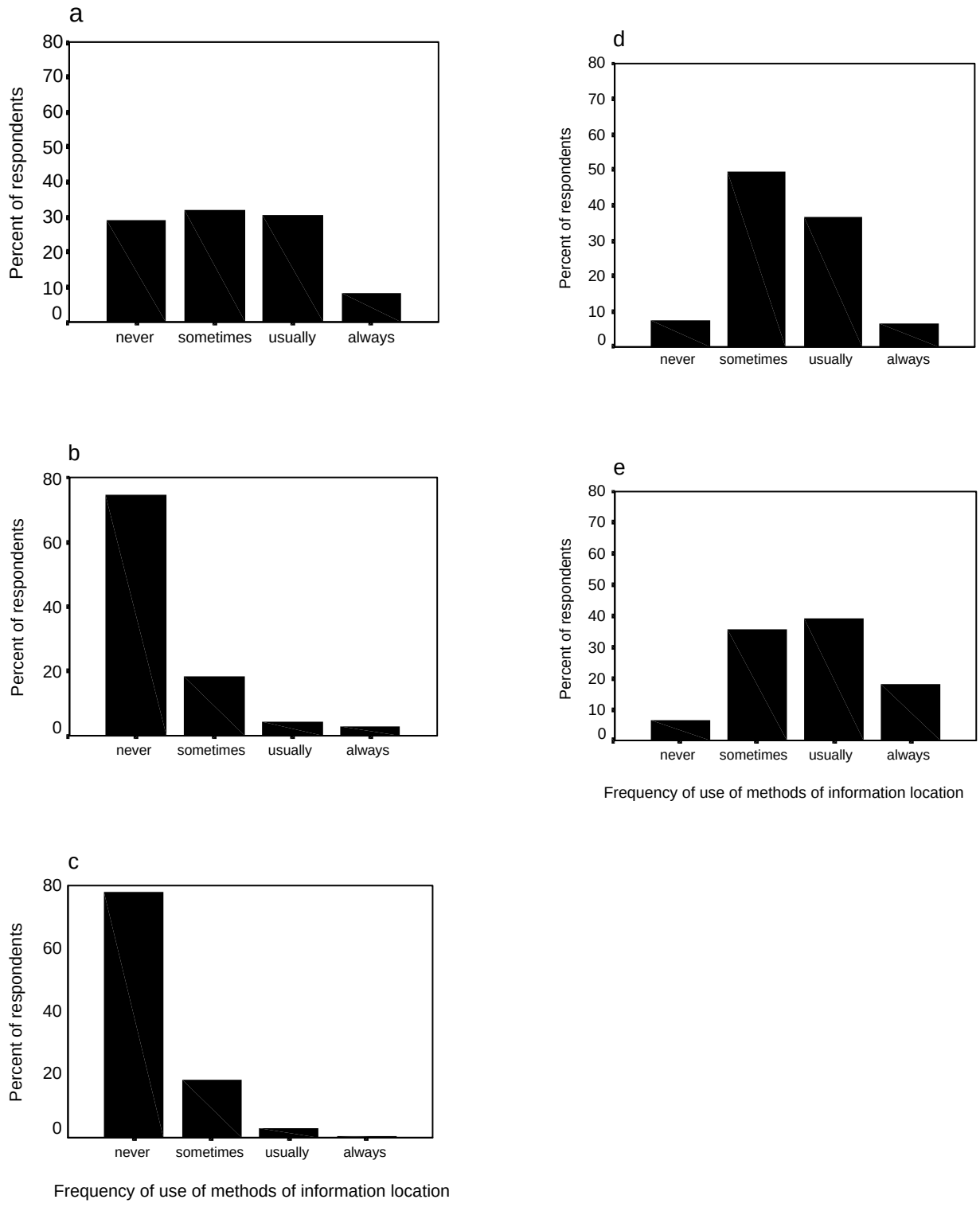

Figure 4. Comparison of frequency of use of different information location methods to support management Plan compilation; (a) hand searching libraries; (b) electronic searching of libraries; (c) web-based searching of publications databases; (d) recommendations from colleagues; (e) use of personal collection.

Access to Information

Of the respondents, 58% have easy access to a library, either at work or elsewhere. 4% have no access. 65% have easy access to the internet, over 90% have some access, but 4% said they had access but were not trained to use it. The latter figures are encouraging as it suggests that the vast majority could access electronic information if it was delivered in a suitable form.

General experience of compilation process

When asked for the general experience of finding relevant information to support decision making, there was a relatively even spread between those who found it relatively quick and easy (22%) and those who found it difficult and time consuming (16%) with the majority expressing no strong preference (62%) (Fig. 5). When asked if there was enough published material to support their decision-making, 37% thought there was enough, 9% thought there was none or next to none and 51% thought there was some but not enough (Fig. 6). Equivalent figures for unpublished material were 28%, 23% and 45%.

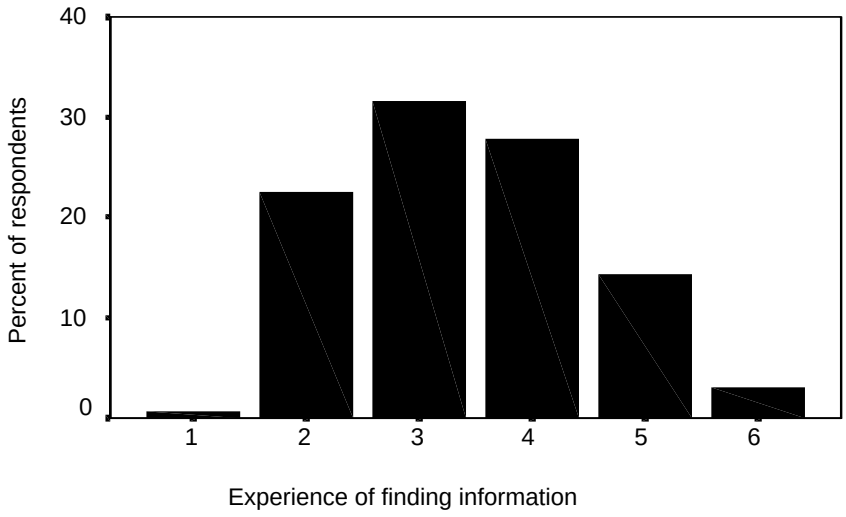

Figure 5. General experience of finding relevant information to support decision-making on a scale from 1 (quick and easy) to 6 (difficult and time-consuming).

A subset who found the process quick and easy was selected for a follow-up interview question asking why this was their experience. 47% replied that this was because they confined their search to that which was immediately available within their organisation. 24% replied that they were already aware of all the information and 24% felt they had enough information after relatively little search effort. Three (18%) benefited from having information provided by others. The same number (3) said the process was quick and easy because they relied on their personal experience and that of their colleagues.

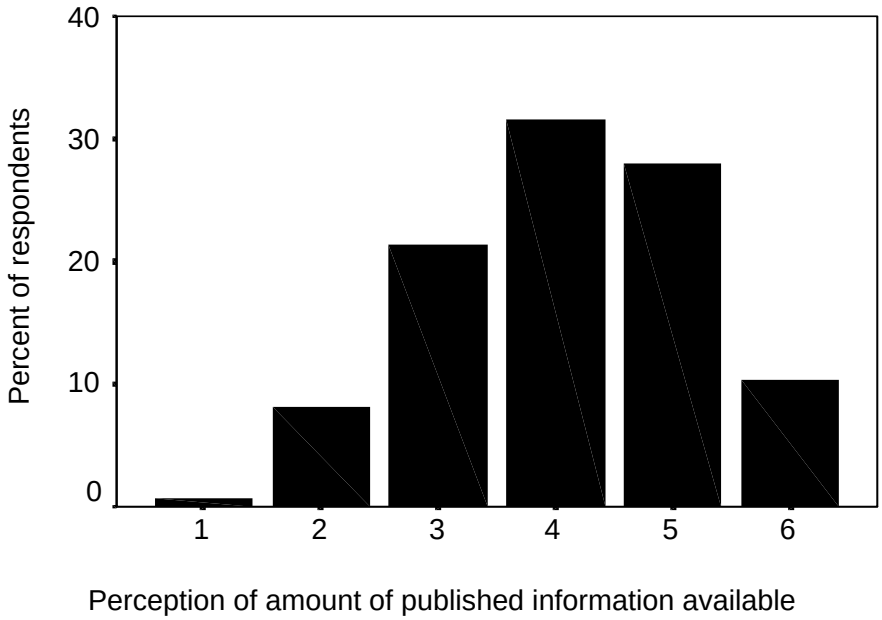

Figure 6. Compilers perception of the amount of published material available to support their decision-making on a scale from 1 (none) to 6 (enough).

A subset of those who felt there is enough published information was asked why. 89% thought this was partly or wholly because they had enough information to remove all reasonable doubt about the course of action required to meet their objectives. 33% also felt that there was enough in the sense that they would not have time to digest any more.

Relative inputs of experience and evidence to decision-making

When asked to scale the relative inputs of experience-based information (e.g. qualitative description, expert opinion) versus evidence-based information (quantitative measurement and experimental analysis), 75% thought that the greater input was from experience-based information (Fig. 7). Analysed in a little more detail, 49% thought that experience-based information was much more influential, whilst only 5% thought evidence-based information was much more influential.

Responses to information deficit

When asked if they were able to identify knowledge gaps in the compilation process where further research was required, 63% responded that they were always or usually able to do so; 4% thought they were not able to do so. Those that answered yes were then asked if they were able to go further and describe the research required and 57% thought they were always or usually able to do so; 5% thought they were not able to do so.

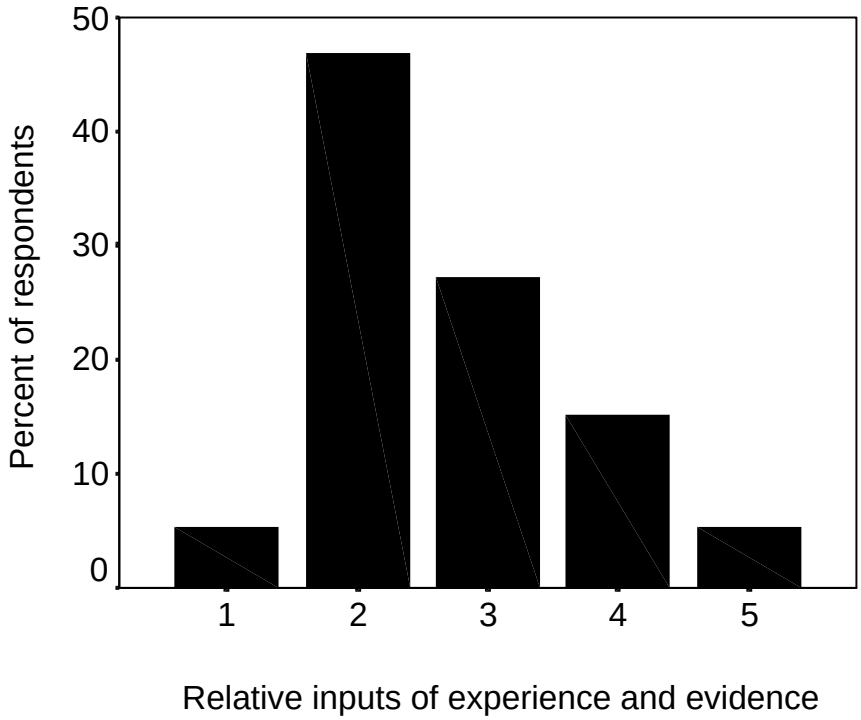

Figure 7. Compilers perception of the relative inputs of experience and evidence to decision-making on a scale from 1 (all experience) to 6 (all evidence). Note no responses of 6 were recorded.

A subset of those able to identify knowledge gaps were asked whether this extended to a description of the experimental design required and 95% responded that it did not. 15% said that they routinely asked experts from their own organisation to design appropriate experiments.

The full set were asked if they had subsequently approached any body to get the research done and 36% had always or usually done so; 11% had not done so. Asked if any research had subsequently been initiated, over 80% said it had, 9% said it had not and 3% didn't know. A subset of those who said that research had been initiated were asked by interview what had been done with the results? 50% said they had research that was ongoing and awaiting results, 22% said some results had been published at one time or another, whilst 72% said results had been written up in a report but either not disseminated or only locally disseminated either within the organisation or local area. In some cases research had been undertaken but not written up (22% of respondents had had this experience).

Monitoring and evaluation of actions

Asked if the actions proposed in the management plan had been implemented, only 3% said all had, whilst 73% said most had. A further 19% said some had.

A subset was asked by interview why all actions had not been implemented. 78% cited lack of resources, 17% said there had not yet been enough time since the plan was written. Other reasons given by individuals were:

- "barriers caused by bureaucracy and external bodies"
- "conflict between management plan and national policy"
- "non-compliance of landowner"

Asked if monitoring programmes had been put in place to measure the outcome of actions proposed in management plans, 22% responded that this was always done. A further 48% said this was usually done and 5% said it was not done.

Asked if they had been able to evaluate the effectiveness of actions in their management plans, 16% said yes all, 36% said most had been evaluated, 37% said some had and 6% said none had.

A subset of those who said they had done at least some evaluation of the effectiveness of their plans was asked, at interview, how effectiveness was measured. 45% said that evaluation was only qualitative and often experience-based. 35% said they used annual counts of species and species trends and 20% had put in place direct monitoring of progress toward targets set out in the plan. Each was subsequently asked what has been done with the information arising from the evaluation. 25% said the information was formally written up as a report but in no case was this widely disseminated. 75% of evaluations were not formally written up, but 35% were referred to in the next management plan in some form.

4.2 The Compilation of Action Plans

Summary of the Biodiversity Action Planning Process

Details of the development of Species and Habitat Action Plans were obtained through direct interview of individuals involved in the process, examination of early drafts of plans and examination of some of the correspondence from interested parties consulted during Plan development. The following summary is not intended to be a detailed history of the process but to be a list of key stages relevant to the decision-making process.

The UK 'Biodiversity Challenge Group' originally identified a list of species and habitats for which action plans should be written. More have subsequently been added. This report is not directly concerned with the process of selecting species and habitats although this is obviously a decision-making issue.

First drafts of action plans were written by groups of, or individual, experts identified by the Country Agencies. Guidance on format was given but no specific guidance was given on how to reach decisions on appropriate actions or on collection of relevant information to inform this decision-making. First drafts contained specific actions for which agencies/organisations were identified as actors.

First drafts were sent out for consultation to all relevant organisations and interest groups. Comments were returned and considered by an editing group of experts, co-ordinated by the Lead Agency. There was no formal process for making decisions on inclusion (or not) of amendments arising from comments.

Second drafts were drawn up and sent out for further consultation (several further drafts were sometimes necessary). Later amendments generally consisted of political and economic compromises. Final approval was sought from Government and the UK Biodiversity Group.

Recommendations

The above is obviously a simplistic view of the process as it took place and it is not the purpose of this report to be critical. It is the purpose to be constructive in suggesting how the process might benefit from a more formalized use of evidence.

The key stages where evidence should be formally reviewed and presented are;

1. In considering candidate species for inclusion in the process
2. In justifying the proposed actions at the first draft stage
3. In deciding on amendments to draft plans

The rest of this discussion will focus on Stages 2 and 3. Stage 1 is seen as objective setting (not the subject of this project). Stage 3 is likely to be politically weighted although an amendment could be made on purely scientific grounds.

Stage 2. – In preparing the first draft, the expert group could be provided with a formal structure for the gathering of evidence on which to base their decisions. The evidence gathered can then be combined with their experience in supporting the decision-making process. This can be achieved by;

1. The establishment of an evidence-based support unit that overseas the production of systematic reviews and dissemination of evidence.

2. Enabling the expert group to undertake or commission (where none exists) a systematic review of evidence on a key issue relating to the plan.

The latter could then be added to the systematic review database for future use. The details of the reviews of evidence used in the decision-making process should be presented, either within or alongside the plan to make the process as transparent as possible.

Following this process, the expert group will also be in a good position to identify gaps in knowledge and suggest strategic research to address these gaps. This will make the “research needs” aspects of Action Plans much more focused and more formally linked to support for future actions. At this stage the research needs should be formally costed and partnerships between the scientific and practitioner communities established to run the research programme.

Stage 3. – At the comment stage, the opportunity should be given to challenge the decisions made on scientific grounds. If the original decisions were evidence-based then the process is simplified to three types of challenge;

1. Where evidence exists that has not been included in the systematic review and changes the overall conclusions. This may necessitate a revision of the systematic review.
2. Where a further systematic review is submitted that itself presents new evidence.
3. Where the interpretation of the evidence is challeneged.

The advantages of this system to Stage 3 are that;

1. it makes the process more structured and consistent across plans
2. it makes the process of decision-making more transparent and understandable
3. it (potentially) makes the scientific argument for action more robust and persuasive.

5. Overall Conclusions

Despite the increasing amount of scientific information produced on management of species and habitats, conservation practice remains largely experience-based, relying heavily on traditional land management practice with limited evaluation of what works and what doesn't. Accessibility of evidence in a usable form to practitioners is a problem emphasised by the data collected in this study. The lack of this type of support for decision-making appears to be forcing practitioners to adopt practices that perpetuate experience-based decision-making.

It is widely accepted that conservation practice should be more evidence-based and that we should seek to facilitate the flow of evidence from scientists to practitioners and policy makers. Although scientific evidence is used in many ways its provision and use are not formalised so as to encourage the development of evidence-based practice. A framework is required both to help decision-makers access and utilise the scientific evidence that is available, and to communicate priorities for research to address gaps in knowledge.

A model to support decision-making, commonly referred to as ‘evidence-based practice’, is available from the field of medicine and public health, where it has been used successfully and has resulted in what has been called an "evidence-based revolution". The process of evaluating evidence for alternative practices is seen as an opportunity to improve information flow between scientists and practitioners and to encourage formation of productive partnerships and decision support systems. Accessibility of evidence is a key issue addressed through the need for systematic reviews and their results being actively disseminated. The role of funding bodies and particularly governments in catalysing this process is seen as key to achieving more evidence-based conservation practice.

6. The Way Forward

Pullin and Knight (2001) drew attention to the framework for achieving more evidence-based action provided by the fields of medicine and public health, which have much in common with conservation in that they both developed as crisis disciplines that were established on experience of practitioners. Evidence-based practice is a tool for proceeding in decision-making that aims to provide the best available evidence to the decision-maker(s) on the likely outcomes of alternative actions proposed to achieve set objectives (Cochrane 1972; Stevens and Milne 1997). The aim is that a decision will be made on the basis of existing evidence that has been critically evaluated and provided in a format that is accessible to policy makers and practitioners alike. The crucial element is the link made between research and practice. In medicine it was recognised that even for some of the commonest procedures performed, there was little evidence for their effectiveness. Choice of which treatment to pursue or surgical operation to perform, depended largely on the experience of

the individual clinician. For some medical interventions research on effectiveness had in fact been carried out but the results had little impact on practice. The challenge was therefore twofold:

1. to increase good quality research into the effectiveness of interventions;
2. to ensure that the research impacted upon practice.

The concept of "evidence-based medicine" has been rapidly accepted and an information industry supporting it has developed (Dawes 2000). This has since been extended to cover most areas of decision making within the health arena, including areas of public health dealing with human population ecology (Stevens *et al*. 2001).

In Appendix 4 we have contrasted the current position of clinical practice resulting from the application of an evidence-based model and the current position of conservation as we see it. Some may view the apparent differences as evidence that the same revolution cannot occur in conservation, particularly when the added complexity of many species interactions are considered. We argue that the paradigm shift achieved through evidence-based medicine (Walshe & Rundall 2001) is a template for significant improvement in conservation practice. One could take the view that the success of evidence-based practice in medicine is evidence for the value of applying the general framework to the field of conservation.

Information availability and decision-making in conservation

The availability of information on conservation practice has increased enormously over the last 10 to 20 years. New scientific peer-reviewed journals have appeared and grown in terms of the number of papers published per year (e.g *Conservation Biology, Biodiversity and Conservation*). More practically based journals and magazines that focus on conservation management issues have also appeared and many in-house magazines are in circulation to keep decision-makers and practitioners within larger organization abreast of new developments. Added to this, the internet information revolution has made possible the rapid exchange of ideas that may have an influence on management policy.

Practical conservation, as with medicine, involves day to day decision making. Decision-makers are faced with questions regarding what actions they should take to achieve objectives, and most decisions will involve a level of uncertainty of outcome. In many such cases, the uncertainty may be minor, and individual experience may be good enough, but in cases involving more fundamental decisions that may influence the health of the ecosystem, quality of the habitat or viability of a population, how can the manager compare the possible alternative actions? Ideally, decisions should be based on probability of successful outcome or effectiveness of the action in achieving the objectives as demonstrated by scientific experiment, but how can such information be obtained? Realistically, decision makers, particularly those directly involved in practical management do not have the time to access the primary information they need on effectiveness, let alone evaluate it, when faced with the day to day pressures of executing actions. They require a framework to support their decision-making.

Evaluation of evidence

Fundamental to evidence-based practice is the systematic review in which research papers selected on the basis of their relevance to the question, are subjected to 'critical appraisal' whereby they are assessed using a standard protocol (Dawes 2000). This covers the whole research process from the

hypothesis to be tested, study design, selection of subjects, data collection and analysis. Checklists have been developed for appraisal of different types of study (NHS CRD 1996) that can be easily converted for use in conservation. For example, in the case of a cohort study where some populations of a species had been exposed to an action (e.g. management) and others left unexposed, some key questions would be;

- Is the exposed cohort of populations a representative sample?
- Were the unexposed populations selected from the same group as the exposed?
- Was the exposure reliably ascertained and verified?
- What factors, other than the exposure, may affect the outcome and were the cohorts comparable on these important confounding factors?
- Was the follow-up long enough for the outcomes to occur?

Studies that do not meet the required quality standard, as judged by these questions, are either rejected or are further evaluated with their limitations in mind. Results from those remaining are summarized to enable common themes and messages to be drawn out. A specialized form of this process is meta-analysis, increasingly common in the ecological literature (e.g. Bender *et al*. 1998; Hartley and Hunter 1998) the result of which is a more powerful analysis than was possible from the individual studies.

Systematic reviews are therefore not simply research reviews of a chosen subject area as published in many ecological journals but are reviews that result from systematic searches for and critical evaluation of evidence in the literature that has a bearing on a specific question. They thus distil information from existing research and expert knowledge to make it more accessible to managers. The depth of the search has not been widely agreed even within the medical field, but would normally include searching electronic databases (e.g. Science Citation Index), hand searching relevant journals, searching for unpublished reports that may reside with statutory bodies or NGOs and conference proceedings. It is important that these reviews should be as free as possible from bias (not always the case with traditional reviews that may be written from a particular standpoint). A particular problem in this regard is that positive outcomes are more likely to be published in high profile journals than negative ones. This makes it doubly important to trawl the more obscure published and unpublished literature.

In conservation the amount of evidence available is likely to be relatively small and the quality of evidence relatively low (although not always) compared to that in medicine. In some cases, relatively few high quality experiments may be complemented by a larger number of lower quality data sets that may provide valuable additional evidence on the wider application of an action. In cases of conflicting outcomes, the quality of the evidence is crucial in the interpretation and conclusion on the effectiveness of the action.

Dissemination of Evidence

Once the information, in the form of systematic reviews and their outcomes, has been produced it is crucial that it is effectively disseminated to the point of need. This study has clearly shown that decision-makers are time limited and are not going to use information that requires significant time to find and interpret.

The increasing accessibility of the internet suggests that the most efficient means of dissemination will be via a website that enables keyword searching and the facility to download information. Newsletters might also be effectively used to bring attention to new reviews that are available.

Despite the anticipated difficulties in rising to a standard of evidence-based conservation practice, the principle is established for care of our own species. I argue that effectiveness in conservation can improve by working to that principle, both with the evidence currently available to us and by putting in place a framework to increase the quality of evidence available in future. As a consequence we can improve our decision-making ability and bring about a paradigm shift in practice (Appendix 5).

7. Short term goals and long term vision

The next step in the development of an evidence-based framework for conservation must be to test whether the process of systematic review and dissemination used in medicine are effective in a conservation context. I therefore propose to pilot the evidence-based framework for review and dissemination of information in user-defined areas of need and to obtain feedback from users/practitioners on the value of the information and the utility of the framework. Methods for systematic review will be trialled and recorded for assessment of efficiency and coverage/recovery of information. Experts in the subject area will be consulted and their feedback obtained on the results of reviews. Current mechanisms and formats for information dissemination in medical practice will be researched in order to develop best practice in this area. Results of systematic reviews will then be collated and delivered to the user group for evaluation. Feedback will be obtained by questionnaire and interview. Utility of the information and delivery system will be evaluated and reported.

The long term vision is to establish a Centre for the systematic review and dissemination of information in the field of conservation, and other related environmental fields. Such a Centre would employ a skilled workforce capable of undertaking systematic reviews and their evaluation but would also commission systematic reviews from relevant experts. The Centre would require core funding for salaries and infrastructure, but would be otherwise independent (the two medical centres are based at universities). A partnership of conservation bodies would advise on the commissioning of reviews. Dissemination would be primarily through an open access website with a newsletter circulated to partnership organizations to alert them of new developments. The scope of the Centre could be national, or through collaboration, continental or global.

8. Acknowledgements

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Appendix 1. The question sheet used to analyse Management Plans.

MANAGEMENT PLAN ANALYSIS

Type of Management Plan:

Management Plan Title:

Site Status:

Date of Publication:

Lead Organisation:

Compilers/authors:

Objectives

Proposed Actions

Questions asked of Management Plans

1. Are proposed actions relevant and linked to objectives/targets?

☐ yes ☐ no ☐ unclear

2. Has justification been given for actions proposed?

☐ yes ☐ no ☐ unclear

if yes was this in the form of

☐ primary scientific literature

☐ secondary reviews of literature

☐ by reference to Habitat Management Handbooks (e.g. English Nature, RSPB)

☐ by reference to Biodiversity Action Plans

☐ knowledge of traditional management

☐ other ……..

3. Are actions a continuation of traditional practices?

☐ yes ☐ no ☐ unclear

4. Are alternative actions considered?

☐ yes ☐ no ☐ unclear

5. Are there potentially conflicting actions in the plan?

☐ yes ☐ no ☐ unclear

6. Is the relevant literature reviewed?

☐ yes ☐ no

7. Was all existing evidence taken into consideration in determining appropriate action?

☐ yes ☐ no

8. Is quality of evidence considered?

☐ yes ☐ no

9. Is further research to fill knowledge gaps advocated?

☐ yes ☐ no

If yes, is research programme described in specific terms?

☐ yes ☐ no

10. Are specific targets and timeframe set?

☐ yes ☐ no ☐ unclear

11. Is there a plan for monitoring outputs?

☐ yes ☐ no

If yes, are outputs/targets relevant to objectives?

☐ yes ☐ no ☐ unclear

12. Are monitoring plans sufficient to allow evaluation of effectiveness?

☐ yes ☐ no ☐ unclear

13. Does the plan contain a method of evaluating effectiveness?

☐ yes ☐ no

Appendix 2. The questionnaire form sent out to Management Plan Compilers.

SUPPORT FOR DECISION MAKING IN CONSERVATION

QUESTIONNAIRE SURVEY OF MANAGEMENT PLAN COMPILERS

This questionnaire has been sent to you as part of a project funded by English Nature to investigate how we can improve provision of information to support decision-making in conservation. Conservation increasingly involves making decisions on appropriate action from a wide range of options. Many conservation organisations now manage species and habitats and produce action plans containing a diversity of objectives. Despite the increasing amount of scientific information produced on management of species and habitats, conservation practice still appears to face a lack of available or appropriate information on what works and what doesn't.

The objective of the first phase of this project is to investigate and analyse the current mechanisms used for the capture and use of scientific information in conservation practice. In doing so we hope to get a clear understanding of the nature and scale of the issues in order that we can address these directly and effectively in later phases.

This questionnaire focuses on the process of formulating Management Plans and is targeted at authors/compilers of such plans. **It is important to emphasise that this project is not an evaluation of you or your organisation's work in any sense and no comments (written or otherwise) will be made concerning the performance of any individual or organisation.** The information provided by you will remain confidential and whilst your responses may contribute to a sample for statistical analysis, no specific reference will be made to individual returns. This project is designed to provide support to all conservation organisations and to enable them to work even more effectively.

All participating organisations will be circulated with the results of this pilot project and will be consulted on the nature of future phases. The longer-term objective we seek is a framework to support decision-making in conservation policy and practice through effective information delivery to decision makers.

Completion of this questionnaire should take no longer than 15 minutes

Please return this questionnaire either by email to a.s.pullin@bham.ac.uk or print off and post to Dr A.S. Pullin, School of Biosciences, The University of Birmingham, Edgbaston, Birmingham B15 2TT by **21st October 2002**
Please do not hesitate to contact me for more details if you wish. Tel/fax: (0121) 414 7147 or 445 6673 Email: a.s.pullin@bham.ac.uk

Your Name ……

Your Organisation……

Section 1 – This section seeks to confirm the subject of the questionnaire and you as the appropriate respondent to the questions.

Please complete all questions by ticking the appropriate boxes

1. **Are you a compiler/author of one or more conservation management plans**

☐ yes ☐ no

If the answer is no please return to me or forward to a compiler/author within your organisation.

---

2. **How many management plans have you have compiled (either alone or as part of a working group).**

☐ less than 3

☐ 3-10

☐ 10-20

☐ more than 20

Please give some examples titles of management plans you have compiled.

……

……

……

……

……

Section 2 - In this section we wish to understand the level of support available to you in formulating proposed actions for the Management Plans

3. Were the Management Plans generally compiled by:

	always	usually	sometimes	never
you alone (with advice from others)	☐	☐	☐	☐
a working group within your organization	☐	☐	☐	☐
a working group derived from more than one organisation	☐	☐	☐	☐
other, please explain below	☐	☐	☐	☐

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.....

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4. In compiling the Management Plans did you have to decide among <u>possible</u> alternative actions that might achieve your main conservation objectives (e.g. a cutting versus grazing regime)?

(*tick one box only*)

☐ yes, always

☐ yes, usually

☐ yes, sometimes

☐ no

5. In addition to your (or working group's) expert knowledge, what other sources of information have you used to support your decision-making on appropriate actions?

(*please tick one box for each source*)	always	usually	sometimes	never
Existing Management Plans (e.g. for same habitat but from elsewhere)	☐	☐	☐	☐
Published scientific papers	☐	☐	☐	☐
Published popular articles (e.g. British Wildlife)	☐	☐	☐	☐
Published reviews/books/handbooks	☐	☐	☐	☐
Unpublished papers/reports	☐	☐	☐	☐
Electronic/web-based material	☐	☐	☐	☐
Expert opinion from outside the working group	☐	☐	☐	☐
Documentation or personal accounts of traditional management practices	☐	☐	☐	☐

---

6. If published material (books, journal papers, published reports) was used how did you generally locate and access it?

Published material was not available ☐

(*please tick one box for each source*)	always	usually	sometimes	never
Hand search of literature from library sources (any library)	☐	☐	☐	☐
Electronic search of library databases	☐	☐	☐	☐
Web-based search of publications databases	☐	☐	☐	☐
Literature recommended by colleague(s)	☐	☐	☐	☐
Use of personal collection (either your own or a colleague's)	☐	☐	☐	☐
Other, please describe below	☐	☐	☐	☐

……
……
……
……

7. **If unpublished material (various reports and correspondence) was available how did you locate and access it?**

Unpublished material was not available ☐

(*please tick one box for each source*)	always	usually	sometimes	never
Hand search of literature from library sources	☐	☐	☐	☐
Electronic search of library databases	☐	☐	☐	☐
Web-based search of databases	☐	☐	☐	☐
Literature recommended by colleague(s)	☐	☐	☐	☐
Use of personal collection (either your own or a colleague's)	☐	☐	☐	☐
Other, please describe below	☐	☐	☐	☐

……
……
……
……

8. **What was your general experience of finding relevant information to support your decision-making?**
(*Indicate by ticking one box only on scale*)

Quick and/or easy ⟶ Difficult and/or time consuming

☐ ☐ ☐ ☐ ☐ ☐

9. **In your experience how much published information is available to you to support your decision-making?**
(*Indicate by ticking one box only on scale*)

None ⟶ Enough

☐ ☐ ☐ ☐ ☐ ☐

10. **In your experience how much unpublished information is available to you to support your decision-making?**
(*Indicate by ticking one box only on scale*)

None ⟶ Enough

☐ ☐ ☐ ☐ ☐ ☐

---

11. Generally, what do you feel are the relative inputs of experience-based information (qualitative description, expert opinion, written or verbal) and evidence-based information (quantitative, experimental) to your decision-making?
(*Indicate by ticking one box only on scale*)

Experience ⟶ Evidence

☐ ☐ ☐ ☐ ☐ ☐

---

12. Do you have access to a library?

(*Tick one box only*)

☐ yes, where I work

☐ yes, off-site but easy access

☐ yes, off site but difficult/time consuming to access

☐ no

---

13. Do you have Internet/Web access at work?

(*Tick one box only*)

☐ yes, easy access

☐ yes, but not easy access

☐ yes, but I am not trained to use it or find it difficult to use

☐ no

Section 3 explores how you responded, in planning terms, to the amount of information you had available to you

14. Were you able to identify knowledge gaps (existing or new) that required further research (not including survey)?

(*Tick one box only*)

☐ yes, always

☐ yes, usually

☐ yes, sometimes

☐ no

If you answered yes, were you able to describe the further research required in the Management Plan(s)?

(*Tick one box only*)

☐ yes, always

☐ yes, usually

☐ yes, sometimes

☐ no

---

15. Have you approached any person or organisation with a view to getting the research done?

(*Tick one box only*)

☐ yes, always

☐ yes, usually

☐ yes, sometimes

☐ no

If you answered yes, was this a

(*Tick as many boxes as relevant*)

☐ Amateur/volunteer expert

☐ Private consultant

☐ University (or academic working within)

☐ Research Institute (or scientist working within)

☐ Statutory Organisation (e.g. English Nature)

☐ Someone in your own organisation

☐ Other, please describe below

……
……
……
……

---

16. Has any relevant research subsequently been initiated?

(*Tick as many boxes as relevant*)

☐ yes, by you

☐ yes, by you in partnership with others

☐ yes, by others

☐ no

☐ don't know

---

17. Have monitoring programmes been put in place to measure the outcome of any actions

(*Tick one box only*)

☐ yes, always

☐ yes, usually

☐ yes, occasionally

☐ no

18. Have the actions proposed in the management plan been implemented?

(*Tick one box only*)

☐ yes, all

☐ yes, most

☐ yes, some

☐ no

---

19. Have you, or others been able to evaluate the effectiveness of any Management Plans?

(*Tick one box only*)

☐ yes, all

☐ yes, most

☐ yes, some

☐ no

---

20. Do have any other comments to make on the level of support for your decision-making?

(continue on a separate sheet if necessary)

Thank you for taking the time to complete this questionnaire.

Please return this questionnaire by email to a.s.pullin@bham.ac.uk or print off and post to Dr A.S. Pullin, School of Biosciences, The University of Birmingham, Edgbaston, Birmingham B15 2TT by 21st October 2002

All participating organizations will be sent feedback on the analysis of questionnaire returns and invited to comment on the way forward in increasing support for decision-making in conservation.

Appendix 3. Interview questions put to Management Plan Compilers

Q1- From the questionnaire survey, few management plan compilers are using primary literature (scientific papers in journals) as a source of information to support decision-making. Why do you feel that this is case?

Q2- You responded to question 8 "was your general experience of finding relevant information to support your decision-making?" by saying that it was relatively quick and easy. Why do you feel that this is case?

Q3- In question 9, You felt that there was enough published material to support your decision making. Why do you feel that this is case?

Q4. You responded to question 14a that you were able to describe the further research required to fill gaps in knowledge in the Management Plan. Was this

a. a description of the question/problem or
b. did it extend to a description of the experimental regime required to address the question/problem.

Q5 - Referring to question 16, where research to fill knowledge gaps has been initiated what has happened to the results?

Q6 - Referring to question 18, where only some actions proposed in the Management Plan have actually been implemented. Why is this is case?

Q7 - Referring to question 19, how was effectiveness of the proposed management actions evaluated?

Q8 - what has been done with the information arising from the evaluation?

Appendix 4. A comparison of elements of clinical and conservation practice at the present time. Adapted from Walshe & Rundall (2001).

	Clinical practice	Conservation practice
Subject	• Single species, individual and population based; relatively few relevant interactions with other species or fundamental geographical variables	• Genes to ecosystems; complex system of many species with many interactions; geographically variable.
Organizational culture	• Highly professionalised with a strong formal body of knowledge and control of entry to the profession, resulting in coherence of knowledge, attitudes and beliefs. • High value placed on scientific knowledge and research, with many researchers who are also practitioners (and vice versa).	• Less professionalised, with less formal body of knowledge, no control of entry into profession and great diversity among practitioners. • Personal experience and self-generated knowledge highly valued: intensely pragmatic. • Less understanding of research and some suspicion of value and motives of researchers. • Divide between researchers and practitioners with little interchange between the two.
Research and evidence	• Strong biomedical, empirical paradigm, with focus on experimental methods and quantitative data. • Belief in generalizability and objectivity of research findings. • Well-organized, indexed literature, concentrated in certain journals with clear boundaries; amenable to systematic review and synthesis.	• Weak natural history paradigm, with more use of qualitative methods and less empiricism. • Tendency to see research findings as less generalizable. • Poorly organized and indexed literature, spread across academic and popular journals and grey literature, with unclear boundaries; heterogeneous and not easy to review systematically or synthesize.
Decision-making	• Many clinical decisions taken every day, mostly by individual clinicians with few constraints on their decision. • Decisions often homogeneous, involving the application of a general body of knowledge to specific	• Complex mix of day to day and larger decisions, often requiring negotiation and compromise, with many organizational constraints. • Decisions are heterogeneous and rarely based on applying a general body of knowledge to specific circumstances.

	circumstances. • Long tradition of using decision support systems (handbooks, guidelines etc.). • Results of decisions often relatively clear with some immediate feedback.	• Little tradition of using decision support systems. • Results of decision and causal relationship between decision and subsequent events often difficult to determine.

Appendix 5. The possible paradigm shift of conservation practice enabled by an evidence-based approach. Adapted from the paradigm shift experienced in health care (Walshe & Rundall 2001).

	From	To
Research strategy	No national leadership of conservation research; funding fragmented across many research funders with poor communication and coordination.	Strategic leadership at a national level; coordination of research activity and funders resulting n a more coherent research agenda.
Research direction	Researcher-led; tied to academic agendas; little coordination	Needs-led; tied to conservation priorities; well coordinated.
Research quality	Much ad hoc, piecemeal, small scale, variable quality research, sometimes repetitive; not well managed.	Coherent research programs made up of well-planned and funded research projects of high quality.
Research outputs	Publication in peer-reviewed academic journals seen as researchers' primary goal.	Changes in conservation practice seen as primary reason for research with publication as one step toward that goal.
Dissemination of research findings	Journals, textbooks, expert opinions and narrative reviews.	Online databases, summaries of evidence, management guidelines, systematic reviews.
Mode of access to research findings	"Pull" access, reliant on decision-makers seeking information by accessing libraries, journals, databases etc.	"Push" access, with relevant research findings delivered to decision-makers proactively.
Decision-makers understanding of research findings	Dependent on integration of information from individual research studies.	Provided by meta-analyses and systematic reviews of relevant appraised research.
Decision-makers attitudes to research	Relatively uninformed, often suspicious of methods and motives and/or lacking time for research appraisal and interpretation	Informed, accustomed to using and participating in research and applying it to own practice.
Major influences on conservation practice	Personal experience, precedent, tradition and expert opinion.	Empirical evidence, ecological research.
Responsibility for implementing research findings.	Left to individual decision-maker with little corporate involvement.	Seen as key organizational function, supported by investment in information resources with corporate involvement in decision-making.

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