
Policy Advocacy in Science: Prevalence, Perspectives, and Implications for Conservation Biologists

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Introduction

Conservation biologists conduct research on topics that are important to society, and results of that research are often the basis for decisions that significantly affect natural resources and involve millions of dollars. Nevertheless scientists often disagree on their role in public policy (Noss 1996; Kaiser 2000; Ehrlich 2002). Should scientists simply provide and interpret information based on the applicable research or should they advocate policy positions? The issue is fraught with conflict. If scientists choose the latter, they risk being labeled as advocates; if they choose the former, they risk failing to contribute effectively to policy development. These concerns are not new. Over 10 years ago, the Society for Conservation Biology (SCB) published a series of essays exploring the relationships among conservation, values, science, and advocacy (Barry & Oelschlaeger 1996; Noss 1996; Tracy & Brussard 1996). A decade later, the tension between science and advocacy is still very much present and relevant for conservation.

Much of the debate about advocacy has focused on the way science is communicated to the public and policy makers (Pouyat 1999; Lackey 2001; Rykiel 2001). Policy advocacy is potentially problematic because it may compromise use of research findings in policy and management deliberations if the information is not viewed as credible by all sides. Our ability to inform all interested parties on issues of importance to conservation biologists thus is diminished to the extent that our information is

perceived as advocacy (Scott & Rachlow 2006). In the discourse at the science-policy interface, as in diplomacy and national security, nuances in language often convey more than statements of intent. If conservation biologists are to be valued by decision makers and society as the source of information on conservation, we must be perceived as neutral in the conduct and communication of our science.

Lackey (2004, 2007) argues that advocacy is pervasive in the ecological and natural resource scientific literature and that common use of value-laden language in scientific writing represents "stealth policy advocacy" because policy preferences are being assumed. The recent controversy regarding the taxonomic status of the Preble's meadow jumping mouse (*Zapus hudsonius preblei*) illustrates potential consequences of this issue. The debate regarded whether or not the subspecies was distinct from others and hence should remain listed under the U.S. Endangered Species Act (Ramey et al. 2005), a decision that could affect development of highly valued property. The ensuing controversy focused, in part, on the perception that policy advocacy was embedded in the science that was reported in the peer-reviewed literature (Crandall 2006; Martin 2006; Vignieri et al. 2006).

To assess the extent of advocacy in the reporting of research in the natural resource sciences, we asked whether advocacy is prevalent in the peer-reviewed literature and whether conservation biologists perceive this to be the case. Although there are many forms of advocacy, we focused on policy advocacy, defined as "support of a

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particular policy or class of policies" (Lackey 2007). To quantify occurrence of policy advocacy in the scientific literature, we reviewed research papers from multiple natural resource disciplines and asked three questions: (1) How prevalent is policy advocacy in the published research literature? (2) Does prevalence vary across disciplines? and (3) If policy advocacy is present within a research paper, where is it most likely to occur? To evaluate whether conservation biologists share the perception that advocacy is common in the scientific literature, we surveyed attendees of the 2006 annual meeting of SCB. These efforts provide data to inform the discussion about the relationship between science and advocacy and its implications for conservation biologists.

Methods

Review of Scientific Literature

We reviewed research papers in six flagship journals published by the largest professional societies representing diverse natural resource disciplines and evaluated each for evidence of policy advocacy. Within disciplines we focused on journals that emphasized application of science to conservation and management. Journals included in the literature review were *Conservation Biology*, *Ecological Applications*, *Forest Science*, *Journal of Range Management*, *Journal of Wildlife Management*, and *North American Journal of Fisheries Management*. We randomly selected 45 papers published in each journal during 2000–2004 by first listing all research papers sequentially and then selecting a random start for a systematic sample that spanned the 5-year period. We excluded papers that did not report the results of original research (e.g., review papers, editorials, essays).

We evaluated papers for two indicators of policy advocacy: use of normative or value-laden language and stipulation of a preferred policy or management preference. Normative language reflects perceptions about what ought to be rather than describing the state of what is (Lackey 2004). Although the line between *ought* and *is* is clear in principle, language is a fuzzy tool (Freyfogle & Newton 2002). As a result, *ought* and *is* are points on a continuum that fades to grays that depend on context and other, often idiosyncratic, facts. Because the intent of words often depends on their context, we evaluated contextual information when determining whether specific words represented normative language. For example, *negative* might be scored as advocacy neutral if referring to a declining trend in a response variable, but it might be scored as normative language if referring to negative effects of a specific treatment on habitat. The following are examples of normative words and phrases in the scientific research papers we evaluated: "massive degradation," "great conservation interest," "detrimental," "favor-

able conditions," "natural resources can be negatively affected," "profound ecosystem consequences," "negative impacts from contaminants," and "suffered from lower nesting success."

The second indicator of advocacy is the stipulation of policy or management preferences. This type of policy advocacy may be either explicit or implicit (Lackey 2004). The following two examples of policy preferences are paraphrased from research papers we reviewed: (1) Reserves need to be managed to prevent the penetration of exotic species in order to minimize their direct and indirect effects on natural communities. (2) Anthropogenic pools function as ecological traps for breeding amphibians in most years, and thus they should be avoided or designed with adequate size, depth, and shading. These two examples could be presented in policy-neutral terms that relate the research to management but do not stipulate what the policy or management should be. (1) If the direct and indirect effects of exotic species on natural communities are to be minimized within reserves, then management should focus on preventing penetration of reserve boundaries. (2) Anthropogenic pools function as ecological traps for breeding amphibians in most years. This can be avoided if such pools are not created or are designed with adequate size, depth, and shading.

We evaluated four sections in each research paper—Abstract, Introduction, Discussion, and Conclusions (also under the headings of Management Implications or Conservation Implications)—and scored each paragraph with a 1 or 0, representing, respectively, presence or absence of each indicator of policy advocacy (normative language and stipulated policy preference). Although we evaluated each indicator as a binary response, we acknowledge that perceptions of advocacy likely occur across a gradient. We quantified prevalence of advocacy as the proportion of paragraphs per section or per paper that contained advocacy, testing for differences among journals and sections for each indicator. We predicted that advocacy would be more common in the Conclusion section, where research results are frequently interpreted in light of policy or management issues.

Eight people participated in the literature review, and each paper was independently read and scored by three different reviewers. Effort of each reviewer was distributed approximately equally across all six journals. To foster consistency among reviewers, we (1) developed criteria for evaluating presence or absence of advocacy; (2) collaboratively developed words and phrases to be considered in searching for normative language; and (3) performed independent reviews for papers that were not included in the literature review and then discussed results as a group.

We conducted split plot multivariate analysis of variance (MANOVA) to evaluate differences in the prevalence of both normative language and preferred policy preference among journals and sections within journals (SAS

PROC GLM; SAS Institute 2002). We followed this analysis with univariate mixed-effects models of analysis of variance (ANOVA) to evaluate the influence of journal and section (fixed effects) and reviewer and article (random effects) on prevalence of normative language and policy preference (SAS PROC MIXED; SAS Institute 2002). We used protected least significant difference tests to evaluate pairwise comparisons of least squares means. Mean values are reported (\pm SE).

Survey of Conservation Biologists

We surveyed attendees of the annual meeting of the SCB in San Jose, California (June 2006). We distributed 1000 questionnaires with registration materials for the meeting, which was attended by approximately 1700 registered participants. We included questions about perceptions of and opinions about advocacy in scientific literature. The questions analyzed in this paper are available from J.M.S.

Results

Review of Scientific Literature

We identified evidence of policy advocacy in almost all of the 270 papers we reviewed. Normative language was identified by ≥ 2 out of the 3 reviewers in 94% of papers and stipulated policy preferences were present in 55% of papers. Proportion of paragraphs per paper with evidence of advocacy ranged from 0 to 0.97 for normative

language ($n = 270$, mean = 0.35 ± 0.010) and 0 to 0.43 for stipulation of policy preference ($n = 270$, mean = 0.08 ± 0.005). These results suggest that policy advocacy was widespread in the research literature.

Multivariate analyses of both indicators of policy advocacy demonstrated that although the interaction between journals and sections (Wilks lambda = 0.9069, $df = 30$, $p = 0.0002$) was significant, the trends were similar. The main effects of journals (Wilks lambda = 0.8228, $df = 10$, $p < 0.0001$) and sections (Wilks lambda = 0.7147, $df = 6$, $p < 0.0001$) had the largest influence on analyses. Evaluation of canonical structure indicated that both variables (policy preference and normative language) contributed to the differences among journals and sections.

Although present in all journals, we detected policy advocacy most frequently in *Conservation Biology*. Prevalence differed significantly among journals for each indicator (normative language: $F = 5.09$, $df = 35$, $p = 0.001$; policy preference $F = 5.65$, $df = 35$, $p < 0.001$). Prevalence of normative language in *Conservation Biology* ($n = 45$, mean = 0.58 of paragraphs ± 0.068) was significantly higher than all other journals we reviewed (Fig. 1a). The lowest occurrence of normative language was identified in the *Journal of Range Management* ($n = 45$, mean = 0.35 ± 0.067), but differences among journals other than *Conservation Biology* were not significant ($p > 0.050$). Results for prevalence of stipulated policy preference were similar. The highest level was detected in *Conservation Biology* ($n = 45$, mean = 0.25 of paragraphs ± 0.039), which differed significantly from other journals we reviewed (Fig. 1b).

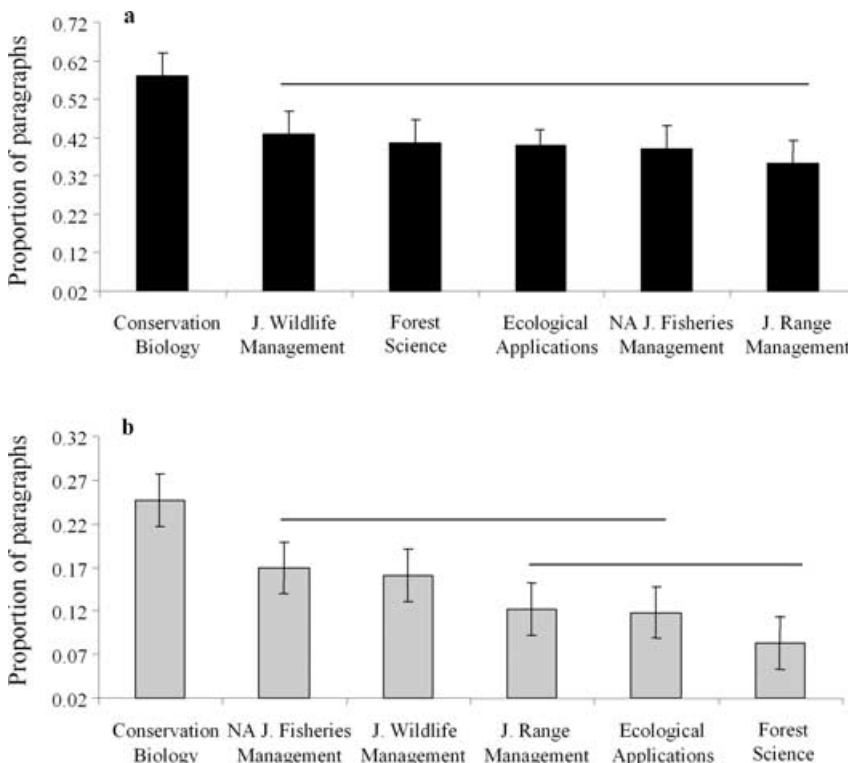


Figure 1. Prevalence of advocacy (mean \pm SE) in research articles published in professional journals during 2000–2004. Prevalence was assessed as proportion of paragraphs in which (a) normative language was identified or (b) stipulation of preferred policy preferences was identified. Journals connected by the lines above the bars did not differ significantly ($p > 0.05$).

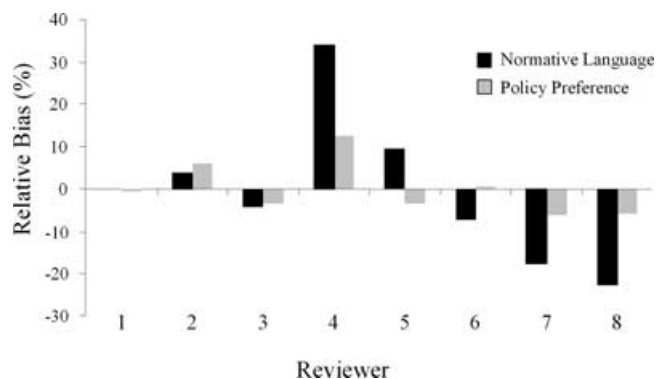


Figure 2. Relative bias of eight reviewers (individual mean relative to the grand mean) for prevalence of two indicators of advocacy in scientific literature, normative language and stipulation of preferred policy. Prevalence was recorded as the proportion of paragraphs per paper with evidence of advocacy.

Occurrence of advocacy was not uniform throughout research papers. Differences among sections significantly influenced analyses of both normative language ($F = 30.76$, $df = 21$, $p < 0.001$) and policy preference ($F = 29.98$, $df = 21$, $p < 0.001$). As predicted policy advocacy was most frequently identified in the conclusions sections. Across all journals over half the paragraphs in the conclusions contained normative language ($n = 142$, mean = 0.56 ± 0.065), and almost one-third stipulated policy or management preferences ($n = 142$, mean = 0.31 ± 0.039). Prevalence of normative language in Abstracts ($n = 142$, mean = 0.51 ± 0.062) did not differ significantly from conclusions ($p = 0.199$); however, both sections more frequently ($p < 0.001$) contained both indicators of policy advocacy than Introduction or Discussion sections.

Despite our efforts to standardize our evaluations, individual variation among reviewers was pronounced. Some reviewers regularly identified more or less advocacy than others (Fig. 2), and a test of reviewers and reviewer interactions was significant in analyses of both normative language (likelihood ratio test = 621.7, $df = 5$, $p < 0.001$) and policy preference (likelihood ratio test = 297.0, $df = 5$, $p < 0.001$). The simple effects of journals for each re-

viewer, however, matched the overall results (Fig. 1a-b). Specifically, five of eight reviewers identified significantly higher ($p < 0.05$) levels of normative language in *Conservation Biology* than in all other journals, and seven of eight reviewers recorded higher mean levels of policy preference in *Conservation Biology* than in *Ecological Applications*, *Journal of Range Management*, and *Forest Science*. Regardless, differences among reviewers underscored the importance of individual variation in perceptions of advocacy.

Results of the literature review represent a North American bias. Although articles from institutions in 19 countries were included, the percent of lead authors whose affiliation was listed as an institution in the U.S.A. or Canada ranged from 64% for *Conservation Biology* to 90% for the *North American Journal of Fisheries Management*.

Survey of Conservation Biologists

Three hundred and five questionnaires about advocacy in science were completed. Sample sizes for different questions varied because not all respondents answered all questions. Over 64% of respondents ($n = 282$) indicated that they were “aware” or “very aware” of the issues concerning advocacy in science. For respondents who regularly read the journals we reviewed, most indicated that those journals “regularly” or “irregularly” published scientific research articles that advocated policy preferences. Over 70% of respondents thought *Conservation Biology* articles advocated policy preferences (Table 1). These results suggested that conservation scientists perceive advocacy as pervasive in the research literature, which is consistent with the results from our literature review.

When asked if scientific journals should publish research papers that advocate policy preferences, most respondents indicated “yes.” Results for scientific journals in general (72%) and for *Conservation Biology* in particular (70%) were similar. The percentage of respondents who indicated that policy advocacy should be included was higher for *Conservation In Practice* (85%). Many added written comments on this question to their questionnaires. Two themes that frequently accompanied positive responses were that policy preferences should be included only when the policies are supported by the

Table 1. Responses of conservation biologists to survey questions on how frequently scientific journals publish research articles that advocate policy preferences.*

Journal	n	Advocate policy preferences				
		regularly	irregularly	infrequently	never	no opinion
<i>Conservation Biology</i>	141	41.9	32.6	14.9	0.7	9.9
<i>Ecological Applications</i>	59	18.6	37.3	23.7	8.5	11.9
<i>Journal of Wildlife Management</i>	34	35.3	32.4	14.7	2.9	14.7

*Data are reported only from respondents (n) who indicated they regularly read the specific journals (i.e., read ≥ 2 articles/issue). Only journals with >30 respondents (n) were included.

science and “only if the policy preference is clearly separated from the science.” Comments that supplemented negative responses included that implications of alternative policies should be addressed and that “conservation considerations can easily be written without advocacy by clarifying outcomes of practices and speaking to priorities.” These annotations suggested that survey respondents saw more complexity in this issue than our question implied.

Discussion

Our findings indicate that value-laden language and stipulation of policy preference occur frequently in research journals in the natural resource disciplines. These indicators of policy advocacy were most frequently identified in *Conservation Biology*. The prevalence of advocacy that we documented was, in part, a function of the indicators we used. We chose fairly rigorous standards because of the consequences associated with a perception of bias by policy makers. Regardless, we applied the same criteria to all papers; therefore, the relative comparisons among journals are meaningful. Furthermore, perceptions of conservation biologists responding to our questionnaire mirrored the prevalence of advocacy that we documented in the literature. Most respondents to our survey acknowledged that policy advocacy was present in the scientific journals and stated that it occurred more frequently in *Conservation Biology*.

There are several important caveats in the interpretation of our results. First, we restricted our definition of *advocacy* to policy advocacy. Other forms of advocacy have been identified in conservation science. Wiens (1997), for example, contends that advocacy can occur throughout the conduct of our research from framing the questions and identifying study areas to reporting and interpreting results. We did not examine the former types of advocacy (i.e., framing of questions, selection of study areas, methods used) in our review of advocacy. In addition, advocacy for science (i.e., arguing for use of the “best available science” in decision making) is almost universally promoted in discussions about the science-policy interface (Safina 1999; Rykiel 2001; Blockstein 2002; Lackey 2004). Brussard and Tull (2007), for example, urge conservation biologists to participate in four types of advocacy, including “professional advocacy,” which involves providing relevant science to policy makers and managers. We believe this important mission can be accomplished without policy advocacy. Bringing results of scientific research to the attention of all stakeholders, the public, and decision makers and managers is a responsibility of scientists (Franklin 1995; Meffe & Viederman 1995; Lackey 2004), especially when research is supported by public funds. Clarifying the distinction between advocacy for sci-

ence and the scientist-advocate is important for advancing discussions about how conservation biologists can effectively contribute to policy.

A second caveat is that our review of the scientific literature was influenced by research conducted by scientists at North American institutions. We selected journals for review that were published by the largest professional societies in each natural resource discipline because of the potential role of professional societies in shaping policy. Broader geographic representation, however, might yield different results, particularly for use of language that clearly differs with cultural context.

A third caveat is that, although advocacy is often viewed as dichotomous (present or absent), some elements of advocacy are more accurately viewed as a continuum. Stipulation of preferred policy is readily viewed as a binary variable; however, identification of what constitutes value-laden language is more subjective. Some actions by scientists clearly are policy advocacy and some clearly are not; others, such as the way we use language, are debatable (Fig. 3). Our review of the scientific literature revealed variation in perceptions among reviewers despite efforts to standardize our reviews. Similarly, individual perspectives regarding what constitutes policy advocacy also may have influenced the responses of conservation biologists to our questionnaire. Greater clarity in defining policy advocacy and delineating those actions that represent advocacy would help sharpen our understanding of this issue and its consequences for conservation science.

Nonetheless, our survey indicated that the opinions of conservation biologists vary widely with respect to policy advocacy. Many respondents indicated that advocacy should be a part of scientific literature, especially in the pages of *Conservation Biology* and *Conservation In Practice*. Some respondents provided qualifiers or limitations to this position, suggesting that perspectives on this issue are complex. One such condition was that authors should explicitly state that they were writing from an advocacy viewpoint rather than a scientific one (Freyfogle & Newton 2002). Whether this is sufficient to prevent others labeling the authors as advocates both in the conduct of their science and in their public statements is uncertain.

Scientists can influence policy not only individually, but also collectively in a diversity of forums. Scientific organizations such as the U.S. National Research Council serve to provide technical reviews and evaluation of policy-relevant science issues. Others such as the World Wildlife Fund advocate for conservation of ecosystems and species. What is the role of professional societies with respect to advocacy and policy? This issue has been discussed and debated by several scientific societies that promote conservation, including the SCB (Noss 1993; Robinson 2006). One value held in common by all sides of the issue is a desire that the science of conservation biology and the SCB have a more influential voice in science-policy

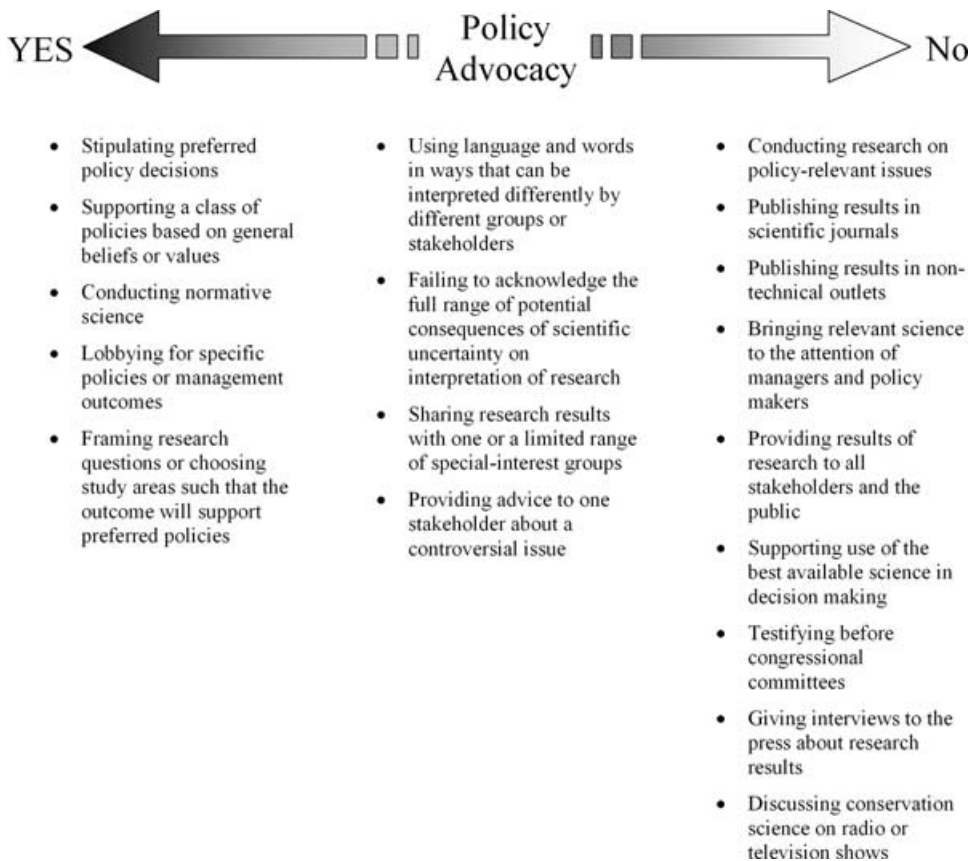


Figure 3. A continuum of policy advocacy and examples of actions that conservation biologists might take in conducting and reporting research. Actions on the left represent policy advocacy, those on the right do not, and those in the center may or may not.

discourse (see www.conbio.org/Activities/Policy/). Everyone wants their findings to be useful and used by society and decision makers in the science-policy forum.

To be so valued, the findings must be brought to the attention of policy makers and those that influence policy. To do so, we suggest sending results with short statements of their relevance to a specific policy issue to all interested parties (e.g., National Woolgrowers Association and Defenders of Wildlife; Fig. 3), lobbyists for all interested parties, and members of legislative bodies and their staffs. Findings can also be made available by testifying before all interested groups (e.g., legislatures, Congress, state and federal agencies), presenting results of research at unlikely venues such as the Rotary Club and garden clubs, appearing on radio and television shows, and giving interviews to the press. These actions can help increase the impact of conservation science in policy discussions. They cannot, however, ensure that research results will actually influence decisions. Nonetheless if the information is viewed as not credible because of its language or is characterized as the opinions of a special-interest group because it stipulates a preferred policy option, then we lose our opportunity to inform all parties in the science-policy discourse.

For these reasons, we believe that scientists and professional societies should strive to conduct policy-relevant science, to report it in value-neutral language, to state clearly the policy implications of the findings, and to be

vigorous in their efforts to bring that information to the attention of decision makers and all interested parties. In doing so, we leverage our ability to inform conversation at the science-policy forum.

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