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# Science, Policy Advocacy, and Marine Protected Areas

NOELLA J. GRAY* AND LISA M. CAMPBELL

Nicholas School of the Environment, Duke University Marine Laboratory, 135 Duke Marine Lab Road, Beaufort, NC 28516–9721, U.S.A.

**Abstract:** *Much has been written in recent years regarding whether and to what extent scientists should engage in the policy process, and the focus has been primarily on the issue of advocacy. Despite extensive theoretical discussions, little has been done to study attitudes toward and consequences of such advocacy in particular cases. We assessed attitudes toward science and policy advocacy in the case of marine protected areas (MPAs) on the basis of a survey of delegates at the First International Marine Protected Areas Congress. Delegates were all members of the international marine conservation community and represented academic, government, and nongovernmental organizations. A majority of respondents believed science is objective but only a minority believed that values can be eliminated from science. Respondents showed only partial support of positivist principles of science. Almost all respondents supported scientists being integrated into MPA policy making, whereas half of the respondents agreed that scientists should actively advocate for particular MPA policies. Scientists with a positivist view of science supported a minimal role for scientists in policy, whereas government staff with positivist beliefs supported an advocacy or decision-making role for scientists. Policy-making processes for MPAs need to account for these divergent attitudes toward science and advocacy if science-driven and participatory approaches are to be reconciled.*

**Keywords:** credibility, marine protected area, policy advocacy, policy making, positivism

Ciencia, Cabildeo Político y Áreas Marinas Protegidas

**Resumen:** *Mucho se ha escrito en años recientes sobre sí y hasta que punto deben involucrarse los científicos en el proceso político, y el enfoque ha sido principalmente en el tema del cabildeo. No obstante extensas discusiones teóricas, se ha hecho poco para estudiar las actitudes hacia y las consecuencias del cabildeo en casos particulares. Evaluamos actitudes hacia la ciencia y el cabildeo político en el caso de áreas marinas protegidas (AMP) con base en un muestreo de delegados en el Primer Congreso Internacional de Áreas Marinas Protegidas (1CIAMP). Todos los delegados eran miembros de comunidad internacional de conservación marina y representaban a organizaciones académicas, gubernamentales y no gubernamentales. La mayoría de respondientes consideraron que la ciencia es objetiva pero solo una minoría creyó que los valores pueden ser eliminados de la ciencia. Los respondientes mostraron apoyo solo parcial a los principios positivistas de la ciencia. Casi todos los respondientes apoyaron que los científicos deben ser integrados a la definición de políticas para las AMP, mientras que la mitad de los respondientes estuvo de acuerdo en que los científicos deben cabildear activamente a favor de políticas AMP particulares. Los científicos con una visión positivista de la ciencia apoyaron un papel mínimo para los científicos en política, mientras que el personal gubernamental con creencias positivistas apoyó un papel en el cabildeo y toma de decisiones para los científicos. Los procesos de definición de políticas para AMP deben considerar estas actitudes divergentes hacia la ciencia y el cabildeo sí se quiere reconciliar a los métodos basados en ciencia y los participativos.*

**Palabras Clave:** área marina cabildeo político, protegida, credibilidad, positivismo

**email njg3@duke.edu*
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## Introduction

The question of whether and to what extent scientists should engage in the policy process has been debated extensively, in this journal and elsewhere (e.g., *Conservation Biology*, vol. 21 issue 1; vol. 10 issue 3). This debate typically hinges on the issue of advocacy. Some argue that scientists have an ethical obligation to act as advocates (e.g., Shrader-Frechette 1996; Blockstein 2002), whereas others are adamant that advocacy oversteps the bounds of appropriate scientific activity. They think scientists should contribute to the policy process but not go so far as to advocate (e.g., McCoy 1996; Lackey 2007). Despite the extensive discussion, there has been little work done to study attitudes toward and consequences of such advocacy in particular cases (Lach et al. 2003). Marine protected areas (MPAs) represent a case that warrants this type of analysis. As both a policy tool and an object of scientific inquiry, MPAs are one environmental arena in which the boundaries between science and policy advocacy are being actively debated. We assessed attitudes toward science and policy advocacy in the case of MPAs, through a survey of participants in the international marine conservation community. We also compared these attitudes with those found in a similar study (Steel et al. 2004) of forest management in the Pacific Northwest (U.S.A.). In comparing results on attitudes toward science and policy advocacy in two different environmental contexts, we hoped to gain a sense of the extent to which such attitudes are generalizable.

Assessing attitudes toward science and policy advocacy is not as simple as delineating those who are for or against advocacy. Although many scientists believe there is a line that should not be crossed on the data-to-advocacy continuum, they disagree over where to place that line (Blockstein 2002). In addition, there are different forms of advocacy. Brussard and Tull (2007) identify four types: professional advocacy, advocating for science, advocating for ecosystem services, and advocating for the natural world. Lackey (2007) discusses a fifth type, policy advocacy. We focused on the distinction between professional advocacy, which Brussard and Tull (2007:21) define as "informing policy makers, managers, and the public about issues that arise in one's area of expertise," and policy advocacy, which Lackey (2007) describes as the statement of preference, either explicitly or implicitly, for a particular policy or class of policies. Professional advocacy—the explanation and dissemination of research findings—is fairly innocuous and does not necessarily constitute advocacy, whereas policy advocacy is more controversial (McCoy 1996).

The distinction between professional advocacy and policy advocacy is similar to the distinction between facts and values. Scientists routinely distinguish between facts (objective, scientific information) and values (policy preferences). Many scientists, fearing that advocacy will ruin the credibility of science, are reluctant to engage in policy processes because they believe it blurs this fact–value distinction (Kinchy & Kleinman 2003; Lach et al. 2003). Others suggest that so long as a distinction is made between data and opinions and uncertainty is acknowledged, scientists can and should act as advocates (e.g., Shrader-Frechette 1996; Rykiel 2001; Blockstein 2002). In discussions of credibility, values, and policy advocacy, the fundamental concern is with beliefs about what constitutes science, beliefs that vary considerably within and beyond the scientific community. Scholars in the field of social studies of science have critiqued the modern scientific enterprise, including its tenets of objectivity, neutrality, and logical positivism, and argue instead that science is a historically and culturally situated activity that extends a particular vision of reality through networks of power (Latour 1987; Haraway 1991; Takacs 1996; Hacking 1999). When such critiques have registered within the scientific community, responses have often been defensive (e.g., Soulé & Lease 1995; Sokal & Bricmont 1998), although many scientists are nonetheless moving away from positivist notions of a fact–value distinction.

Conservation biologists are typical of this new type of normative scientist: "practitioners who recognize and accept the fact that their science and the scientific knowledge they produce are never truly objective or universal but are always inherently uncertain, purposeful, and emergent" (Robertson & Hull 2001:973). Newer concepts of science that explicitly allow for public deliberation of values, such as postnormal science (Ravetz 1999) and public ecology (Robertson & Hull 2001; Robertson & Hull 2003), are emerging alongside and competing with older positivist models. Nevertheless, despite critiques of positivism, several of its fundamental principles continue to inform commonly held beliefs about science. In addition to the fact–value dichotomy, positivism is characterized by the underlying ideas that science is unbiased and neutral, can provide accurate information about the world, and allows sufficient understanding of the world that humans might predict, control, and manipulate it in particular ways (Steel et al. 2004).

With respect to environmental and conservation issues, questions regarding what constitutes science, how it should be produced, how it should be used, and how scientists should be incorporated into policy processes are answered not just by scientists, but also by policy makers and citizens working through government agencies, nongovernmental organizations (NGOs), and other groups (Jasanoff 1990; Forsyth 2003). Particularly with respect to environmental issues, NGOs have become a major arbiter of science (Yearley 1996; Rogers-Hayden & Campbell 2003; Eden et al. 2006; Gordon 2006). The boundaries between science and policy are not fixed; rather, they are routinely renegotiated by various stakeholders in particular contexts and in regards to particular

issues. For example, in their study of attitudes toward science and advocacy in forest management in the Pacific Northwest, Steel et al. (2004) found that interest-group members were most accepting of positivist views of science, whereas scientists and public land managers were most critical of the scientific process and least accepting of positivist science. With respect to advocacy, 46% of interest group members supported scientists actively advocating for particular resource management policies, whereas only 16% of scientists and 8% of land managers agreed with scientists taking on such an advocacy role. In this case the boundaries of acceptable scientific activity are not clearly fixed and are not agreed on by the different stakeholders.

Marine protected areas are a prominent environmental arena in which the boundaries between science and advocacy are being actively contested. Marine protected areas, particularly no-take zones, are an increasingly popular conservation tool, considered by many to be essential in the international effort to halt the "rapid and radical degradation of the world's oceans" (Lubchenco et al. 2003:S3). Marine protected areas can be used to meet a variety of objectives, such as conserving biodiversity and habitat, achieving sustainable fisheries, and providing opportunities for recreation, education, and research (Jones 2002; Airamé et al. 2003; Lubchenco et al. 2003). To achieve their stated objectives, it is commonly argued that MPAs must incorporate sound science or the best available science.

There is a divergence, however, between those who support a principally science-based approach to MPA design and management and those who insist on a sociopolitically acceptable approach that prioritizes local participation (Jones 2002). Advocates of expert knowledge argue that unless MPAs are designed according to scientific criteria, they cannot possibly meet their objectives (e.g., Sala et al. 2002), whereas advocates of local participation argue that citizen participation in and support of MPA designation and management is critical to the success of an MPA (e.g., Christie et al. 2003; Mascia 2003; Dalton 2005). A key challenge is the "determination of a constructive role for science in the selection, design and management of MPAs, accepting that this role lies somewhere between these divergent views" (Jones 2002:210–211). Increasingly, compromises between these two positions are being supported and implemented, in recognition of the need to account for both biological and sociopolitical factors in MPA policy making (e.g., Friedlander et al. 2003; Fernandes et al. 2005; Lundquist & Granek 2005).

There remains, however, substantial variation in how science is incorporated into the MPA policy process and how stakeholders perceive its integration (Bergen & Carr 2003). For example, Weible et al. (2004) compared two attempts to establish MPAs in California, a "top-down linear scientific approach" and a subsequent "collaborative process." Despite the perceived failure of the initial top-down scientific effort, federal and state government officials, scientists, and environmental interests all continued to support this approach, a result that can be attributed to the underlying core belief in a positivist view of science held by these stakeholders (Weible et al. 2004).

To contribute to this ongoing discussion of views of science in MPA design and management, we focused specifically on possible roles for scientists. Amid calls for greater contributions by environmental scientists to the policy process (Lubchenco 1998; Myers 1999), there is also concern that science and advocacy are becoming blurred with respect to MPAs (Willis et al. 1998; Agardy et al. 2003; Jones 2006) and that uncritical advocacy for MPAs will erode the credibility of marine science and scientists (Sale et al. 2005). Given current debates over science and advocacy with respect to MPAs, it is pertinent to examine how the marine conservation community at large perceives policy advocacy by scientists. Rather than argue for a particular view of science or advocacy, we present empirical findings of the perspectives on such issues among the international marine conservation community.

## Methods

We surveyed attendees of the first International Marine Protected Areas Congress (IMPAC1) (October 2005), which assembled a global community of marine conservation scientists, policy makers, and practitioners. We distributed 600 paper copies of the questionnaire at the meeting, which was attended by approximately 700 delegates. To ensure that the questionnaire reached as many delegates as possible, we sent an email message to all registered delegates listed in the conference program in December 2005, inviting them to complete an on-line version of the survey if they had not previously completed the paper version. The questionnaire, which included questions about the nature of science and the role of science and scientific advocacy in MPA planning and management, was modeled after a similar survey instrument described by Steel et al. (2004). Although the survey used by Steel et al. was developed specifically for their study of ecologists and other stakeholders in natural resource management in the Pacific Northwest, we chose it as a model because it had already been successfully implemented and our results could then be compared with theirs. Most questions were close ended or Likert scale, although an open-ended question also elicited more nuanced opinions on the topic (Fowler [2002] for discussion of question types and survey methods). Respondents were divided into four groups on the basis of their employer (academic institutions, government agencies, NGOs, and others) so results could be compared across these stakeholder groups.

In the first part of the survey, respondents were asked to agree or disagree with a series of statements designed to gauge their attitudes toward positivist science. Mean scores were compared for four groups of delegates (academics, government employees, NGO employees, and others) with a one-way analysis of variance. Following Steel et al. (2004), we also constructed a summary index of attitudes toward positivism by adding responses to five statements together (index range from 5 to 25: 5, little agreement with principles of positivism; 25, high level of agreement with principles of positivism).

To assess attitudes toward policy advocacy by scientists, respondents were asked to agree or disagree with a series of statements regarding the involvement of scientists in MPA design and management. These statements, adapted from Steel et al. (2004), represent a range of roles for scientists: a reporting role, in which scientists report results; an interpretive role, in which results are communicated to policy makers and the public; an integrating role, in which scientists work with managers to integrate scientific findings into decision making; an advocacy role, in which scientists promote particular policies; and a decision-making role, in which scientists are responsible for making decisions. Respondents were presented with the statements but not with the role descriptions. Although these statements were not mutually exclusive, it was unlikely that anyone who agreed with a limited reporting role for scientists would also agree that scientists are ultimately responsible for policy decisions. In terms of the different types of advocacy outlined earlier, both the interpretive and integrating roles could be understood as forms of professional advocacy (the explanation and dissemination of research findings), whereas the advocacy role crosses the line into policy advocacy (the statement of preference for particular policies).

Finally, attitudes toward positivist science were compared with attitudes toward various roles for scientists in the policy process. We calculated pairwise correlation coefficients between attitudes toward science (as measured by the positivism index score) and attitudes toward the five statements representing different roles for scientists.

## Results

A total of 200 completed questionnaires were returned (143 paper and 57 on-line), for a response rate of approximately 29%. Given the potential threat to external validity posed by this low response rate, the results may not represent the views of all conference delegates or the marine conservation community more generally. Nevertheless, the response rate is comparable to rates achieved in similar surveys of conference attendees (Kleypas & Eakin 2007; Scott et al. 2007). Sample sizes for different questions varied because not all respondents answered all questions. The majority of respondents were employed by government agencies (37%), academic institutions (29%), or NGOs (25%), the main groups involved in MPA research and management. Remaining respondents (10%) were categorized as other and included self-employed people and private-sector employees. Unlike the study conducted by Steel et al. (2004), there were no representatives of the "attentive public" in this sample.

There were no statistically significant differences among the four groups of participants (academics, government employees, NGO employees, and others) for any of the five statements about positivist science (Table 1; agreement with these statements reflects a belief in positivist principles of science). Respondents had mixed attitudes toward positivist views of science, with the most support for the following statement: "Science provides objective knowledge about the world." Although there was no significant difference among groups' index scores for attitudes toward positivism, the index was useful for comparative purposes (see below).

For all 10 statements that assessed respondent attitudes toward the role of scientists in MPA design (Table 2) and MPA management (Table 3), there were no significant differences among group mean scores. There were similar trends, however, in responses for questions about MPA design and management. Respondents almost unanimously agreed that scientists should be involved and work closely with managers and others to integrate scientific results into MPA policy decisions, approximately half the respondents in each group were comfortable with scientists taking on an advocacy role, and a very small percentage supported a decision-making role.

Of the four respondent groups, government was the only one that showed a strong relationship between attitudes toward science and roles for scientists (Table 4). There were five significant correlations for government employees, whereas for academics and other stakeholders there was one significant correlation, and there were none for NGO employees. Government employees who believed in the key principles of positivism were more likely to support an advocacy or decision-making role for scientists, for both MPA design and management, as well as an interpretive role in MPA design.

## Discussion

Our results suggest that the international marine conservation community is divided in its attitudes toward science and policy advocacy with respect to MPAs, in ways that both reinforce and contradict the findings by Steel et al. (2004). First, there was a lack of consensus regarding what constitutes science. In some cases respondents followed a positivist model of science (e.g., more than 70% of respondents agreed that science provides objective knowledge about the world), whereas

**Table 1. Respondents' attitudes toward positivist statements about science.**

| *Statements* | *Academia: % agree,[a] mean[c] (SD),* n | *Government: % agree, mean (SD),* n | *NGO[b]: % agree, mean (SD),* n | *Other: % agree, mean (SD),* n |
|---|---|---|---|---|
| Use of the scientific method is the only certain way to determine what is true or false about the world; $F = 0.73$ | 39, 2.75 (1.30), 57 | 31, 2.79 (1.16), 72 | 29, 2.53 (1.14), 49 | 42, 2.94 (1.22), 19 |
| The advance of knowledge is a linear process driven by key experiments; $F = 0.14$ | 25, 2.5 (1.14), 56 | 21, 2.58 (0.99), 73 | 24, 2.63 (1.03), 49 | 26, 2.57 (1.02), 19 |
| Science provides objective knowledge about the world; $F = 0.71$ | 79, 3.82 (1.04), 57 | 75, 3.74 (1.01), 73 | 70, 3.56 (0.99), 50 | 79, 3.84 (1.01), 19 |
| It is possible to eliminate values and value judgments from the interpretation of scientific data; $F = 2.33$ | 33, 2.68 (1.17), 57 | 42, 2.97 (1.13), 73 | 18, 2.55 (0.96), 49 | 16, 2.37 (1.12), 19 |
| Facts describe true states of affairs about the world; $F = 0.25$ | 43, 3.19 (1.05), 54 | 48, 3.26 (1.07), 73 | 51, 3.14 (0.98), 49 | 42, 3.05 (1.13), 19 |
| Positivism index<br>mean<br>SD<br>*n*<br>$F = 0.78$ | <br>15.09<br>4.07<br>54 | <br>15.36<br>3.82<br>72 | <br>14.29<br>3.71<br>48 | <br>14.79<br>3.65<br>19 |

[a] *Percentage of agree and strongly agree.*
[b] *Nongovernmental organization.*
[c] *Scale used: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; and 5, strongly agree.*

in other cases there was support for a postpositivist view of science (e.g., a minority of respondents agreed that it is possible to eliminate values and value judgments from the interpretation of scientific data). In contrast to Steel et al.'s (2004) results, which showed interest-group members had more positivist views of science than either scientists or managers, we did not find significant differences among stakeholder groups in their attitudes toward positivism. Scientists and nonscientists alike were equally likely to be critical of positivist views

**Table 2. Respondents' attitudes toward roles for scientists in design of marine protected areas (MPAs).**

| *Statements (role for scientist)* | *Academia: % agree,[a] mean[c] (SD),* n | *Government: % agree, mean (SD),* n | *NGO[b]: % agree, mean (SD),* n | *Other: % agree, mean (SD),* n |
|---|---|---|---|---|
| Scientists should only report scientific results and leave others to make decisions about MPA design (reporting role); $F = 1.82$ | 11, 2.18 (0.92), 56 | 21, 2.42 (1.0), 73 | 14, 2.22 (0.86), 50 | 33, 2.72 (1.41), 18 |
| Scientists should report scientific results and then interpret the results for others involved in designing MPAs (interpretive role); $F = 1.20$ | 68, 3.75 (1.13), 56 | 77, 3.74 (0.88), 73 | 69, 3.5 (1.09), 50 | 78, 4.0 (1.14), 18 |
| Scientists should work closely with managers and others to integrate scientific results into MPA design decisions (integrating role); $F = 0.71$ | 95, 4.52 (0.74), 56 | 97, 4.48 (0.67), 73 | 96, 4.4 (0.73), 50 | 100, 4.67 (0.49), 18 |
| Scientists should actively advocate for specific MPA designs they prefer (advocacy role); $F = 0.03$ | 49, 3.25 (1.02), 55 | 55, 3.29 (1.03), 73 | 48, 3.24 (0.94), 50 | 39, 3.22 (1.06), 18 |
| Scientists should be ultimately responsible for making decisions about MPA design (decision-making role); $F = 0.69$ | 9, 2.05 (0.90), 56 | 7, 1.87 (0.81), 71 | 10, 2.08 (0.94), 50 | 6, 2.0 (0.91), 18 |

[a] *Percentage of agree and strongly agree.*
[b] *Nongovernmental organization.*
[c] *Scale used: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; and 5, strongly agree.*

**Table 3. Respondents' attitudes toward roles for scientists in management of marine protected areas (MPAs).**

| *Statements (role for scientist)* | *Academia: % agree,[a] mean[b] (SD),* n | *Government: % agree, mean (SD),* n | *NGO[b]: % agree, mean (SD),* n | *Other: % agree, mean (SD),* n |
|---|---|---|---|---|
| Scientists should only report scientific results and leave others to make MPA management decisions (reporting role); F = 2.58 | 12, 2.25 (0.87), 57 | 21, 2.62 (0.97). 73 | 6, 2.26 (0.66), 50 | 16, 2.52 (1.07), 19 |
| Scientists should report scientific results and then interpret the results for others involved in MPA management decisions (interpretive role); F = 2.03 | 82, 3.95 (0.87), 57 | 78, 3.73 (0.79), 73 | 71, 3.52 (1.05), 50 | 74, 3.68 (0.95), 19 |
| Scientists should work closely with managers and others to integrate scientific results into MPA management decisions (integrating role); F = 0.62 | 100, 4.49 (0.50), 57 | 99, 4.34 (0.57), 73 | 96, 4.4 (0.57), 50 | 89, 4.53 (0.70), 19 |
| Scientists should actively advocate for specific MPA management policies they prefer (advocacy role); F = 0.20 | 49, 3.26 (1.03), 57 | 51, 3.26 (1.02), 72 | 48, 3.14 (0.93), 50 | 53, 3.16 (1.21), 19 |
| Scientists should be ultimately responsible for making decisions about MPA management (decision-making role); F = 1.71 | 11, 2.14 (0.93), 57 | 7, 1.81 (0.88), 73 | 4, 1.86 (0.81), 50 | 5, 1.84 (0.90), 19 |

[a] *Percentage agree and strongly agree.*
[b] *Nongovernmental organization.*
[c] *Scale used: 1, strongly disagree; 2, disagree; 3, neutral; 4, agree; and and 5, strongly agree.*

of the scientific process. This calls into question the numerous arguments in favor of advocacy so long as a distinction is made between scientific findings and values (e.g., Shrader-Frechette 1996; Rykiel 2001). Our results indicate that neither scientists nor other stakeholders are convinced that such a distinction is possible.

Second, respondents were equally divided over the appropriate role for scientists in the MPA policy process. Almost all (97%) agreed that scientists should be integrated into MPA design and MPA management, whereas 49% agreed that scientists should advocate for particular MPA designs or management policies. Although the distinction between MPA design and MPA management may be fuzzy, the similarity in responses to questions regarding the role for scientists in each of these processes reinforces the importance of underlying core beliefs about science in informing views on policy (Weible et al.2004).

There was a tolerance curve with respect to advocacy in both MPA design and management. There was little support for a limited role for scientists, strong support for an interpretive role, almost universal support for an integrated role, moderate support for an advocacy role, and little support for a complete decision-making role for scientists. Half of the respondents were supportive of

**Table 4. Correlations between attitudes toward science (positivism index) and roles for scientists in the marine protected area (MPA) policy process.[a]**

| *Role for scientist* | *Academia Pearson's* r, n | *Government Pearson's* r, n | *NGO[b] Pearson's* r, n | *Other Pearson's* r, n |
|---|---|---|---|---|
| MPA design | | | | |
| report | −0.21, 53 | 0.06, 72 | 0.28, 48 | 0.33, 18 |
| interpret | 0.33*, 53 | 0.24*, 72 | 0.06, 48 | 0.07, 18 |
| integrate | −0.09, 53 | 0.16, 72 | −0.21, 48 | −0.01, 18 |
| advocate | 0.09, 53 | 0.30*, 72 | −0.06, 48 | 0.07, 18 |
| make decisions | 0.24, 53 | 0.52***, 71 | 0.01, 48 | 0.30, 18 |
| MPA management | | | | |
| report | −0.08, 54 | 0.06, 72 | 0.15, 48 | 0.46*, 19 |
| interpret | 0.18, 54 | 0.21, 72 | 0.03, 48 | 0.19, 19 |
| integrate | 0.16, 54 | −0.10, 72 | −0.04, 48 | −0.19, 19 |
| advocate | 0.14, 54 | 0.31**, 72 | 0.00, 48 | 0.09, 19 |
| make decisions | 0.19, 54 | 0.39***, 72 | 0.10, 48 | 0.36, 19 |

[a] *Correlations (Pearson's* r*) are between positivism index in Table 1 and the statements describing roles for scientists in the MPA design and management process in Tables 2 and 3. Significance level:* $^{*}p < 0.05$; $^{**}p < 0.01$; and $^{***}p < 0.001$.
[b] *Nongovernmental organization.*

scientists crossing the line between informing and advocating for specific MPA policies, whether related to MPA design or MPA management and regardless of stakeholder group. In contrast, Steel et al. (2004) found that interest-group members were supportive of scientists taking on an advocacy role (46% agreed), but scientists and managers were much less supportive of such a position (16% and 8%, respectively). The explanation for these differences may be that scientists and managers involved in MPAs are more tolerant of scientists engaging in policy advocacy than are their counterparts in forest management in the Pacific Northwest. One possibility is that the greater scientific uncertainty associated with MPAs, compared with forest management, may lead respondents to support an integrated role for scientists. Given the uncertainty, respondents may perceive a greater need for scientists to explain and engage with managers and other stakeholders.

Alternatively, the context of (rather than the issue at stake in) the studies might be key. Whereas Steel et al. (2004) surveyed stakeholders engaged in a specific issue and location (research and management of Pacific Northwest forests), our respondents assessed the role of scientists in an abstract or global sense (for MPAs in general). It is possible respondents would have been less (or more) tolerant of policy advocacy by scientists in specific instances of MPAs with which they were engaged.

Third, different stakeholder groups exhibited different relationships between their attitudes toward science and toward policy advocacy by scientists. Scientists who agreed with positivist views of science were more likely to support an interpretive role for scientists in MPA design. In contrast, those government representatives who expressed positivist beliefs were more likely to support scientists taking on advocacy or decision-making roles in both MPA design and management. These results were consistent with those found by Steel et al. for managers and scientists. Although scientists draw on positivist beliefs in science to explain a reluctance to engage in policy advocacy (for fear of ruining credibility) (e.g., Kinchy & Kleinman 2003; Lach et al. 2003), the opposite may hold true for government employees (e.g., managers). In our study, managers who agreed that science is objective and value free were also more likely to believe scientists *should* advocate and make policy decisions. As those responsible for making and implementing policy (and this is the case for protected areas in general and MPAs specifically), managers may be keen to turn to the authority of scientists to justify and aid their decisions, viewing their own credibility as enhanced if they engage scientists as policy advocates.

Nevertheless, in our study there were no correlations between NGO respondents' attitudes toward science and their attitudes toward scientists' roles in policy, whereas Steel et al. found significant correlations for the integrated, advocacy, and decision-making roles. It may be that the NGO respondents in our study differed from the interest-group respondents in Steel et al.'s study (e.g., in terms of scientific training or advocacy orientation), which could affect the results. Nevertheless, even within one NGO, or among similar NGOs, attitudes toward science and the role of scientists can vary significantly, with NGOs sometimes espousing contradictory views of science in different situations (Jeanrenaud 2002; Rogers-Hayden & Campbell 2003). The difference in our results may also be a function of the ambivalent relationship that NGOs can have with science. In addition, many NGOs are actively engaged in reconciling science (and the role of scientists) with local interests (Gordon 2006). In the case of MPAs, this tension is pervasive (Jones 2002). The difference between our results and those of Steel et al. suggest that NGO views of science may not map neatly onto views of appropriate roles for scientists.

The differences in attitudes toward science and policy advocacy outlined above have important implications for MPA policy making. Unlike Steel et al., we did not find significant differences in attitudes toward science and advocacy among stakeholder groups (academia, government, or NGOs), although there was variation within groups. In MPA design and management, as in other conservation and resource management activities, it is common to establish advisory groups and consultation processes that identify and include representatives of stakeholder groups. The importance of such participatory processes for MPAs has been emphasized by numerous authors (e.g., Fiske 1992; Mascia 2003; Dalton 2005). There are many challenges in this approach (Cooke & Kothari 2001), and our results highlighting the variation in attitudes toward science and advocacy speak to at least two of these: identifying individuals who can effectively represent their stakeholder groups and agreeing on the appropriate role for each contributor to the process. Because views within stakeholder groups varied, both regarding what science is and how it should be incorporated into the MPA process, it should not be assumed that any particular individual would represent the attitudes of the larger stakeholder group toward science and advocacy. As more recent work in political ecology (and other fields) has begun to demonstrate, knowledge does not necessarily align neatly with stakeholder designations (e.g., male or female, state or community, academic or NGO, expert or layperson) (e.g., Fairhead & Leach 2003; Robbins 2006).

Participants from different stakeholder groups also held different views of the role scientists should play, even when views of science were the same. For example, even if a scientist and a manager share a similarly positivist understanding of science, the manager may expect the scientist to advocate for particular policies, whereas the scientist may resist such a role. One survey respondent remarked, "Scientists do not necessarily cast themselves in the role they end up with; the planners/managers push

them into roles they may not wish or feel competent of . . . don't blame the scientist . . . look at the system." Participatory processes that emphasize stakeholder interests may overlook more fundamental differences in attitudes toward what constitutes knowledge and the appropriate role for scientists (and not just science) in MPA policy processes.

Although it is unlikely that controversial debates over science and advocacy will be settled soon, the variation in attitudes we found highlights the need for explicit attention to these issues with respect to MPAs. In efforts to reconcile divergent top-down (expert-driven) and bottom-up (participatory) approaches to MPA design and management, it is necessary to consider understandings of science and the role of scientists, not just science in the abstract.

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