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Scientists' framing of the ocean science–policy interface

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ABSTRACT

Scientists' ideas, beliefs, and discourses form the frames that shape their choices about which research to pursue, their approaches to collaboration and communicating results, and how they evaluate research outputs and outcomes. To achieve ocean sustainability, there are increasing calls for new levels of engagement and collaboration between scientists and policy-makers; scientists' willingness to engage depends on their current and evolving frames. Here, I present results about how scientists involved in diverse fields of ocean research perceived their role as scientists working at or near the ocean science–policy interface and how this related to their perceptions regarding ocean research priorities. The survey of 2187 physical, ecological and social scientists from 94 countries showed that scientists held different perspectives about their appropriate level of engagement at the ocean science–policy interface and the relative primacy of science versus politics in formulating ocean policy. Six clusters of scientists varied in their frames; three clusters accounted for 94% of the sample. Of 67 research questions identified from 22 research prioritization and horizon scanning exercises, the top eight were shared among all three clusters, showing consistency in research priorities across scientists with different framings of their role at the science–policy interface. Five focused on the mechanisms and effects of global change on oceans, two focused on data collection and management for long-term ocean monitoring, and one focused on the links between biodiversity and ecological function at different scales. The results from this survey demonstrated that scientists' framings of the role of ocean science at the science–policy interface can be quantified in surveys, that framing varies among scientists, and that research priorities vary according to the framings.

1. Introduction

A variety of threats affecting ocean environments and resources are well documented and are exacerbated by population growth, globalization, and ineffective ocean governance and management regimes (e.g., Berkes et al., 2006; Doney et al., 2012; Halpern et al., 2008; Hughes et al., 2013). In general, there is an urgent need to build understanding about environmental dynamics, ecological structure and function, the role of human agency in shaping and adapting to environmental change, and the potential responses of coupled socio-ecological systems to governance and management interventions (Hackmann et al., 2014; Liu et al., 2007; Mooney et al., 2013; Pahl-Wostl et al., 2013). Once evidence is assembled and knowledge created, it must also be effectively communicated (Fazey et al., 2014; Sarkki et al., 2014), sometimes in politicized environments (Lupia, 2013), ensuring that it is effectively brought to bear on sustainability challenges. Demands on scientists to increase the level of integration and synthesis in their work, and to communicate increasingly sophisticated information to policy-makers and society, will only grow (e.g., Carney, 2014; Carpenter et al., 2009; Meyer et al., 2010; Petes et al., 2014; Stafford et al., 2010; Weaver et al., 2014). Scientists are being called on to take greater responsibility (Lubchenco, 1998; Nowotny et al., 2001) and make efforts to engage in mobilization activities beyond the traditional boundaries of academia in order to address global environmental change (e.g., Cornell et al., 2013; Weaver et al., 2014). In the marine realm, knowledge from the natural and social sciences is needed to help identify and communicate solutions to help sustain oceans and the people and cultures they support.

Scientists traditionally viewed their task as one of passive information provision (McNie, 2007; Owens, 2005), supplying credible scientific evidence to information users who, after considering scientific evidence and other socio-political factors, could make informed decisions. Scientific evidence may flow through, and be filtered and framed by, a variety of intermediaries

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or boundary actors (e.g., academics, science advisors, risk assessors, policy analysts) outside or within government (Bremer and Glavovic, 2013; McNie, 2007; Meagher et al., 2008; Meyer et al., 2010; van Kerkhoff and Lebel, 2006). A number of different schools of thought exist among policy researchers that study science–policy interfaces (Spruijt et al., 2014), each placing varying levels of emphasis on the roles that science–policy boundary arrangements and actors play during the knowledge mobilization process. In their meta-analysis of 125 science–policy articles, Spruijt et al. (2014) found five distinct perspectives among scientists (which they labelled as post-normal science, science and technology studies, science policy studies, politics of expertise, and risk governance). Scientists' ideas, beliefs, and discourses form these frames that scientists use to decide what constitutes excellent science and the role that scientists should play in the policy-making process (Fischer, 2003; Parry and Murphy, 2013); this can influence their choice about which research to pursue, how to pursue it, whether to collaborate with scientists from other disciplines and with information end-users from government and society, how to disseminate their findings, and how to evaluate research outputs and outcomes. Among scientists, there are competing frames and an ongoing evolution of discourses about the science–policy interface (Cornell et al., 2013; Parry and Murphy, 2013). Variations in scientists' own perspectives about their appropriate level of engagement at the science–policy interface and the ocean science–policy context within which they work may thus both shape the degree to which scientific evidence is available for use by policy-makers to address complex ocean challenges.

One useful typology, from the politics of expertise literature (Spruijt et al., 2014), to help organize thinking about the science–policy interface first considers actors' beliefs about boundary arrangements along a converger–diverger axis (Hoppe, 2009). Strong divergers see science and politics as incompatible, operating in separate worlds, and emphasize the need to bridge the gap between science and policy (Hoppe, 2005, 2009; Lawton and Rudd, 2014). At the other extreme, strong convergers believe that science and politics ultimately serve the same purpose, and that scientists and policy-makers can and should co-produce knowledge to support important environmental policy decisions. It is also useful to consider a second axis representing actors' beliefs about the primacy of scientific relative to political authority in the policy-advisory process (Hoppe, 2009; Hoppe and Wesselink, 2014). Hoppe (2009) borrowed the concept of primacy from Habermas and it refers to who has relative decision-making primacy in terms of control and authority. For example, some scientists argue that political decisions should be constrained given environmental realities, while others argue that scientific evidence should only inform, not drive, decisions (e.g., Rice, 2011). The combination provides linkages to established theoretical typologies of the science–policy interface (Wittrock, 1991) and also meshes well (Rudd, 2011a) with recent efforts to understand and build science–policy cooperation through participatory horizon scanning and research prioritization exercises (Parker et al., 2014; Sutherland et al., 2011).

Hoppe (2009: 239) noted that it was "surprising how little research has actually been done on the role of scientific expertise in politics and policymaking in which the differences between views of the participants themselves... have been empirically probed seriously." Despite substantial qualitative research on processes surrounding boundary actors at the environmental science–policy interface (e.g., Bremer and Glavovic, 2013; Nursey-Bray et al., 2014; Sarkki et al., 2014), relatively little quantitative research has focused on the role that scientists see themselves playing at that interface (but see Neff, 2011; Rudd, 2011b). My goal in this study was to examine how scientists involved in diverse fields of ocean research perceive their role as scientists working at or near the ocean science–policy interface and the relationship between these framings and scientists perceived research priorities. Here, I present results from a survey of 2187 physical, ecological and social scientists (from 94 countries) who recently (2011–13) published research on a wide range of ocean-related topics in peer-reviewed journal articles. I assessed how scientists differed in their science–policy interface perspectives, testing for differences in opinions about if and how scientists and policy-makers can and should work together. In particular, my focus was on (1) differences in science–policy interface perspectives between natural and social scientists, (2) among natural scientists, on differences in perspectives between physical and ecological scientists, and (3) differences in perspectives among scientists from different regions. Given prior findings about the importance of disciplinary background on environmental research priorities (Rudd, 2011b, 2014; Rudd and Lawton, 2013) and the wide range of disciplinary and demographic backgrounds of global respondents to this survey, I hypothesized that there would be substantial variation in scientists' frames of the science–policy interface and that those differences would be associated with distinct patterns of research priorities. The results of this study identify important determinants of those differences but also highlight a surprising level of consistency regarding research priority rankings across regions and disciplines.

2. Methods

2.1. 2014 ocean research survey

This study used data collected during a 2014 survey of scientists involved in diverse domains of ocean-related research (see Rudd, 2014, for details about survey development and implementation). A candidate pool of 657 potentially important research questions for informing decisions regarding ocean sustainability and policy was initially identified from across 22 research questions prioritization and horizon scanning exercises (Rudd, 2014). Those were distilled to a short list of 67 distinctive research questions used in the survey (some relevant non-marine research questions were slightly rephrased to cast them in a marine context). A total of 2179 scientists from 94 countries ranked those 67 research questions. The survey results (Rudd, 2014) suggested that there was substantial congruence regarding the top 20 research priorities between physical (n = 604) and ecological (n = 1429) scientists. However, there were striking differences in orientation between the natural scientists (n = 2038) and a smaller group of social scientists (n = 154). Table 1 shows the aggregate rank of all 67 research topics (see supplementary data S1 for the full wording of research questions abbreviated into research topics below).

Data about a variety of demographic and professional factors (Table 2) were collected in the survey. Three survey-specific factors were also recorded: (1) self-reported levels of satisfaction with respondents' personal ranking results (i.e., how well respondents thought their personal ranking results, shown in the survey after they completed the ranking tasks, corresponded with their 'true' priorities); fitness score, a measure of respondents' internal consistency in rankings across the 36 ranking tasks in the survey; and (3) survey completion time. For this analysis, fitness scores and completion times were divided into deciles, each containing near equal numbers of respondents.

The survey included a series of 12 science–policy interface statements (Table 3). The statements were originally derived from 42 survey items used by Hoppe (2009) and reduced to 12 in number based on items found to be significant in Hoppe's study and to reflect key theoretical cleavages among individuals working at the science–policy interface (Lawton and Rudd, 2014). The