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Overcoming barriers to knowledge exchange for adaptive resource management; the perspectives of Australian marine scientists

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ABSTRACT

The sustainable science-based management of natural resources requires knowledge exchange between scientists and environmental decision-makers; however, evidence suggests that information flow is inhibited by a range of barriers. To date, our understanding of the range and importance of factors limiting knowledge exchange between scientists and decision-makers is based primarily on the perceptions of decision-makers, while the perceptions of scientists have been largely overlooked. This study addresses this knowledge gap by quantitatively assessing the perceptions of scientists, represented by a sample of 78 Australian marine scientists, regarding (i) the role and importance of engaging with environmental decision-makers on a personal level, (ii) the role and importance of engaging with environmental decision-makers at the institutional level, (iii) current barriers to engaging with environmental decision-makers and (iv) options for overcoming barriers to engaging with environmental decision-makers. Survey results suggest that Australian marine scientists feel that they have an obligation to engage decision-makers in their science, and that engaging with and communicating to environmental decision-makers is important on a personal level. This study also identifies a range of barriers that impede engagement activities, including inadequate measures of science impact that do not account for engagement activities, a lack of organisational support for engagement activities, insufficient time to conduct engagement activities in addition to other responsibilities and a lack of funding to support engagement activities. To overcome these barriers, participants identified the need for institutional innovation by research institutions, research funders and decision-making agencies alike to promote a culture whereby knowledge exchange activities are legitimised as core business for research scientists, and recognised and rewarded appropriately. Although difficulties exist in implementing such institutional innovations, doing so will improve two-way knowledge exchange among scientists and decision-makers and improve the likely success of environmental management.

1. Introduction

The integration of science into the decision-making process for the sustainable management of natural resources remains a significant challenge [47,24,20], with potential adverse flow-on effects to the communities that depend on the goods and services they provide. This is most commonly attributed to a legacy of disciplinary fragmentation between scientists and decision-makers [42], preventing the effective and efficient exchange of knowledge among the groups [40,52,26]. As a result a growing body of scientific literature aimed at understanding and overcoming the barriers to successful knowledge transfer has emerged (e.g.—[9,46,11]). This research has focused primarily on moving beyond the current knowledge-deficit model of communication and knowledge transfer, whereby scientists as the primary producers of knowledge are solely accountable for making new information available to decision-makers, to contemporary approaches emphasising the need for the two-way exchange of information [42,51,8]. As a result several new approaches to knowledge exchange have been advocated, such as the co-production of knowledge, whereby decision-makers actively participate in scientific research programs (e.g.—[7,14,50]), and the use of knowledge brokers or boundary organisations [36,35,10].

Despite the documented increase in effort to improve knowledge exchange among scientists and environmental decision-makers, an implementation gap remains [39], suggesting that efforts to date may be failing to address the key underlying barriers. These include

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a range of cultural differences between scientists and decision-makers, reinforced by institutional (dis-)incentives and structures [1,4,45]. For example, scientists are likely to be driven and rewarded according to institutional incentives such as achieving strong scientific outputs (e.g.—peer reviewed publications, h-index, etc.) which hold little bearing or relevance for decision-makers [12]. As discussed by Roux et al. [42], such reward systems are also likely to enforce an inward-looking and self-serving scientific culture. In turn, decision-makers are typically focused on day-to-day operations that reflect current, and often changing, political interest opposed to long-term strategic reflection on research and development investment [42]. This may result in decision-makers having a poor understanding of the information available or needed to support their decisions, and as such, cannot communicate them clearly to scientists to help guide the development of research proposals and activities. Identifying and overcoming such barriers is paramount to improving the uptake of scientific information into the decision-making process [18].

To date, our understanding of the range and extent of factors prohibiting knowledge exchange among scientists and decision-makers is largely based on the perspectives of the decision-makers (e.g.—[41,44,53]). Comparatively fewer studies have sought to understand the perceptions of scientists, and very little research has examined whether and how these might differ across scientific communities (but see [45]). Doing so, however, is critical for moving beyond the knowledge-deficit model of communication, and to ensure that scientists are provided with the necessary support and tools to undertake engagement activities. This study aims to fill this gap by quantitatively assessing the perceptions of a group of scientists in relation to engagement with environmental decision-makers. Specifically, this study quantifies the perceptions of scientists regarding (i) the role and importance of engaging with environmental decision-makers on a personal level, (ii) the role and importance of engaging with environmental decision-makers at the institutional level, (iii) current barriers to engaging with environmental decision-makers and (iv) options for overcoming barriers to engaging with environmental decision-makers. This study also explores how these perceptions differ according to career level.

The aims of this study are addressed through a focus on Australian marine scientists. This group represents a suitable sample community to explore and test our study objectives, given the intrinsic relationship between the applied nature of their research and the decision-making process [2], which suggests that this group should be at the forefront of knowledge exchange activities. However, a recent study found that although marine resource managers and scientists have similar values and goals, decision-makers were unaware of the breadth of existing scientific information that they could use to inform the decision-making process [11]. Subsequently marine resource decision-makers were found to rely on individual experiences or other secondary sources of information when developing and implementing conservation actions in isolation from scientific evidence [13]. Accordingly, enhancing knowledge exchange and improving the uptake of science by marine resource decision-makers is expected to result in more effective policies and programs to ensure that the goods and services provided by marine ecosystems are maintained for future generations.

2. Methods

2.1. Survey design

A combination of qualitative and quantitative research methods were used to assess the perceptions of Australian marine scientists regarding the four study aims. Firstly, to develop the research approach a qualitative scoping study was undertaken where six Australian marine scientists were surveyed to gauge their perceptions regarding the four focal research categories. These participants were sourced from four different research institutions and represented different levels of experience ranging from early career scientists (post-doctoral) to senior scientists. The range of participants in the scoping study resulted in a wide range of experiences and opinions for developing the final quantitative survey [19,34].

In total four open-ended questions formed the basis of the scoping study, and these were designed to directly explore perceptions in relation to the aims of our study. Open-ended questions were considered advantageous for the scoping study as they provided the research team with the means to explore ideas and opinions in greater depth during the scoping surveys, therefore allowing the final quantitative survey to be comprehensive [5]. The questions asked during the scoping study were: (i) is engaging with and communicating to decision-makers important to you personally and why? (ii) do you believe that engaging with and communicating to decisions-makers is important to your organisation and why? (iii) what barriers do you perceive prevent you from engaging with and communicating to environmental decision-makers?, and (iv) what support would you like to overcome these barriers to better help you engage with decision-makers? Scoping responses were then transcribed and converted into a series of statements for use in the final quantitative survey.

The quantitative survey was developed to assess the perceptions of Australian marine scientists as efficiently as possible within each of the scoping categories. As such all questions were presented to participants as a statement (developed from the scoping study), and respondents were asked to indicate how strongly they agreed or disagreed with each statement on a ten point Likert scale. Under this approach a score of 1 indicated that the participant strongly disagreed with the statement, while a score of 10 meant that the participant strongly agreed with the statement. This scale also allowed for clear interpretation of data since there is no mid-point, and therefore a score of 5 would indicate that the participant slightly disagreed with the statement they were presented with, while a score of 6 would mean that the participant slightly agreed with the statement [5]. Participants were reminded of this scoring protocol at the beginning of each set of statements to ensure that scores were correctly applied. Prior to dissemination, the final quantitative survey was pre-tested for readability, ambiguity and variability in responses by four scientists (who were subsequently excluded from completing the final survey), and refined accordingly.

The methodological design for this study could have taken many forms, however, the practicalities of eliciting information from a large number of marine scientists across widely distributed organisations and geographies suggested that a structured survey, informed by a preliminary scoping study, would work best [5,19]. In this case other methodologies such as focus group work or workshop techniques were not practical given geographic constraints.

2.2. Survey administration

For the purpose of this study, participants were limited to those who self-identified as a scientist working on marine issues currently employed in an Australian research institution or university, and not currently enrolled as a student. To capture the perceptions of suitable participants across a large geographic range and large number of institutions the survey was converted into an online electronic survey for ease of distribution and accessibility.

To ensure that a diverse range of participants across multiple disciplines and organisations were included, the final survey was endorsed by the council for the Australian Marine Sciences Association (AMSA) and circulated to all current members. AMSA was selected on the basis that it is the largest and most broadly