The science-policy interface in fisheries management: Insights about the influence of organizational structure and culture on information pathways

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Abstract
Understanding how information flows between scientific and decision-making communities is essential for the creation of effective strategies to link scientific advice to management decisions. Interviews of scientists and managers in two inter-related fisheries management organizations – the Department of Fisheries and Oceans (DFO) and the Northwest Atlantic Fisheries Organization (NAFO) – and direct observations at science and management meetings revealed important organizational characteristics that influence the production, communication, and use of scientific information in decision-making. Formal processes for communicating scientific advice to managers – DFO’s Canadian Scientific Advisory Secretariat (CSAS) and NAFO’s Fisheries Commission’s Request for Advice – demonstrate the use of credible, relevant, and legitimate advice for operational decision-making for fisheries management. Such defined processes, in addition to governmental bureaucracy, departmentalization, and de-centralization, can limit communication as highlighted for Canada as a Contracting Party to NAFO. Administrative mechanisms can pose challenges to implementing ecosystem approaches to fisheries management (EAF) and to addressing the impacts of climate change. Emerging organizational structures and behaviors facilitate communication at the science-policy interface, within and between the organizations, thereby improving understanding of science and management needs and promoting trust relationships between scientists and managers. The involvement of multiple stakeholders in the information pathways addresses concerns about scientific uncertainty in assessment advice. A linear model of information flow typifies operational decision-making; however, collaborative models that incorporate different types of information, apart from fisheries science, are required to enable ecosystem-based management. The characteristics of the information pathways are particularly relevant as the organizations address their EAF mandates.

1. Introduction

Vast quantities of scientific information are produced annually by governmental and non-governmental organizations that are intended to guide policy- and decision-making [1]. Yet, despite the availability of scientific information and the development of decision-making processes, the uptake of information into environmental management remains problematic. Policy- and decision-making are multi-faceted processes in which scientific knowledge interacts with numerous factors that contribute to the complexity of the science-policy interface. These factors include governance models; political regimes; institutional and personal interests, values, and ambitions of multiple actors; and the characteristics of the information itself [2–5]. Many of these elements can be characterized as organizational structures and cultures that define the way persons and institutions communicate and manage information and can directly affect the use of scientific information in decision-making processes.

This paper examines the role of organizational structures and cultures in decision-making in fisheries management. The research was conducted within a national government department and a regional fisheries management organization: the Canada Department of Fisheries and Oceans (DFO) and the Northwest Atlantic Fisheries Organization (NAFO) [6–8]. Fisheries scientific reports produced by these governmental organizations are often intended to inform policy decisions to address problems such as overfishing. However, the uptake of this information in fisheries decision-making is not always apparent. Scientists within these organizations perceive a need to enhance the use of scientific information in decision-making for traditional fisheries management as well as ecosystem-based approaches to management.

2. Background

The science-policy interface, in its simplest form, describes the context in which information flows among science and policy- and
decision-making activities. The movement of information between the producers (scientists) and the users (policy and decision-makers) is seldom linear or unidirectional – adding to the complexity of activity at the science-policy interface [9]. Models and perspectives about the science-policy interface and information use reported in the literature are primarily based on evidence-based or evidence-informed decision-making which assumes that policy-makers identify problems, gather and review data related to solutions and their consequences, and select the solution that best matches their goals [10,11]. Government bureaucracy and organizational structure and culture often guide the communication and uptake of information as they define how tasks are carried out and relationships are maintained [12–16]. In governmental organizations responsible for fisheries management, fisheries managers are often the operational decision-makers who communicate information produced by scientists to policy-analysts who are primarily responsible for providing informational inputs and policy advice to policy-makers. Policy-makers are usually senior civil servants and politicians [17].

Over the past two decades, policy-making communities have expanded to include a range of stakeholders, including civil society [18,19]. In fisheries management contexts, networks of stakeholders can be extensive, consisting of formal or informal links within and across government departments and external agencies; these networks facilitate and enhance information production, communication, and use [20–22].

Information use can vary at different governmental levels depending on jurisdictional concerns, e.g., national or provincial/state interests. The formal hierarchical structure of bureaucracies creates departmentalization and centralization which can influence communication and information transfer in a multiniti organization [23]. Across governmental departments and organizations, different value systems and framing of issues related to economic, social, and biological aspects of fisheries management can determine priorities for action and the information needed [24,25]. The level of technical detail in scientific information provided as advice, the degree of scientific uncertainty, and the engagement of various stakeholders, e.g., the fishing industry, in policy-making, can influence government decisions [26–28]. Science and politics often do not exist as independent entities and may be inseparable, e.g., in the blurred boundary between advocacy and scientific research reporting where scientific advice can carry a political bias even if unintentional [29].

Since the introduction of global initiatives at the end of the twentieth century to promote an ecosystem approach to fisheries management (EAF), the demands on managing fisheries in terms of access to and use of scientific information have increased the complexity of decision-making processes [30,31]. EAF seeks to balance diverse social, biological, and economic values and goals with conventional fisheries management. Fisheries management organizations, such as DFO and NAFO, recognize that adopting an ecosystem approach changes science support in traditional areas such as stock assessment for fisheries management, and changes fisheries management itself [32,33]. DFO’s attention to developing an ecosystem science framework that integrates advice for decision-makers and NAFO’s efforts to develop a roadmap for implementing an ecosystem approach illustrate the new organizational directions for management [32,33]. Adopting an ecosystem approach, however, complicates rather than facilitates communication at the science-policy interface.

Research on knowledge utilization in policy-making has highlighted aspects of communication of information, not the quality of the science, as limitations to the use of information in decision-making [34]. Few studies have investigated communication of information in policy-making processes from a resource management perspective, including fisheries management [35,36]. The results of the research conducted in DFO and NAFO discussed in this paper add to the growing body of knowledge on important organizational characteristics that influence communication.

3. Methodology

The research was conducted in DFO and NAFO between September 2013 and April 2014. DFO is the lead federal fisheries management agency responsible for ocean and fisheries management in Canada and is comprised of five administrative regions [6]. Data were collected from the Fisheries Management and Science branches (also referred to as sectors) of the DFO-Maritimes Region (DFO-MR), and the DFO-Newfoundland and Labrador Region (DFO-NLR). NAFO is a regional fisheries management organization in the Northwest Atlantic region [7]. Data was collected from two constituent bodies of NAFO – the Scientific Council and the Fisheries Commission – and focused on Canada as a Contracting Party represented by DFO. Scientists and decision-making groups, including program managers, advisors, and policy-makers in DFO, and those participating in NAFO, were interviewed. DFO scientists and managers participating in NAFO were employed mainly in the DFO-NLR and DFO National Capital Region (DFO-NCR) since their fisheries management responsibilities include the NAFO Regulatory Area. Direct observations were made at scientific and management meetings of DFO as well as meetings in NAFO attended by Canada and other Contracting Parties.

Seventeen scientists and 25 managers employed at DFO were interviewed; these respondents worked between 10 and 39 years in their respective roles. The interviews averaged 50 min in length and were audio-recorded when permitted; otherwise, notes were taken. All responses were treated with strict confidentiality. Direct observations were conducted at eight meetings in the DFO-MR and included the DFO Canadian Science Advisory Secretariat (CSAS) Regional Peer Review meetings, fisheries advisory committees’ annual meetings, and interdepartmental meetings [37–39]. Direct observations in NAFO included the 35th NAFO annual meeting and meetings of the Scientific Committee’s ecosystem working group, as well as meetings of joint Fisheries Commission-Scientific Council working groups [40–43]. Active participation did not occur in observations of the meeting discussions and only detailed notes were taken of presentations, discussions, and interactions among groups.

The aim of the interviews and direct observations of meetings was to gain an understanding of:

- How scientific advice related to fisheries management is produced (including the processes and actors);
- How available scientific advice is used in DFO and NAFO for decision-making; and
- What are the drivers, enablers, and the barriers to information flows, in production, communication, and use of scientific information in decision-making?

The interview responses and notes of direct observations were transcribed and coded using themes that describe characteristics of the science-policy interface. Direct quotations from the interviews are used to illustrate the research findings. Alpha-numeric codes are used to identify the respondents, e.g., DFO 1 and NAFO 2.

4. Results

4.1. Information pathways – production, communication, and use of scientific advice

4.1.1. The Canada Department of Fisheries and Oceans

The Canadian Science Advisory Secretariat administers and coordinates a defined process for requesting scientific advice from the program areas of DFO [44]. The process includes internal science reviews (described by DFO as peer-reviews) and provision of scientific advice to management on behalf of the DFO science sector. The flow of information, primarily from the perspective of the information produced in the CSAS process, is shown in Fig. 1. The provision of scientific
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