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Salmon, science, and conservation: Organizational power and the listing and recovery planning of an endangered species

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ABSTRACT

Following the New Political Sociology of Science, I use co-citation analysis and social network analysis to examine the structures that undergird the determination and deployment of 'the best available science' in the listing and recovery planning of the Inner Bay of Fundy Atlantic salmon. The analyses reveal that the COSEWIC and SARA reports prioritize non-peer reviewed, government science over peer reviewed science and that the Department of Fisheries and Oceans' central position in the organizational network may account for the multi-stakeholder committees' legitimation of government research over the more influential research on Atlantic salmon conservation. I suggest that a tension between the SARA mandate to employ the best available science and to follow the precautionary principle creates opportunities for conservation committees to employ science selectively (and strategically) in the listing and recovery process and that organizations that hold advantageous network positions may benefit the most from this selective use of science.

Passed in late 2002 and fully implemented in 2004, Canada's Species at Risk Act (SARA) was the first comprehensive endangered species law in the country. Though the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) had been identifying species at risk and making recommendations to the Canadian government since its establishment in 1977, with the passing of SARA the committee was given legal status to advise the federal government on species at risk of extirpation or extinction.

With an estimated 200 or fewer salmon remaining, COSEWIC declared the Inner Bay of Fundy (iBoF) Atlantic salmon endangered in 2001. While the passing of SARA in 2002 meant the iBoF salmon was listed as 'at risk' without government review, a reassessment was mandated. The resulting 2006 COSEWIC report reaffirmed the salmon's endangered status which, under SARA, justified and informed both a Recovery Report in 2010 and an Action Report in 2016.

The 2006 COSEWIC report and the two SARA reports were produced collaboratively by committees of scientists, government, NGO, and First Nations representatives, among other relevant stakeholders (see Appendix A). By policy, each report was to be based on the best available *peer reviewed* science about Atlantic salmon conservation *and* follow the precautionary principle – the idea that conservation efforts must move forward even in the face of scientific uncertainty. Determinations of what science is the best available and how it ought to be deployed in the listing and management of an endangered species are contentious. There can be no unambiguous standard for what counts as "the best science" because scientific knowledge is debated as new information is discovered, new theories proposed, and existing ideas challenged. What science is considered the best is also influenced by 'invisible colleges' (Crane, 1972), or scholarly networks that formally and informally influence which literatures scientists give acclaim. The use of scientific knowledge in non-scientific contexts such as policy making, conservation activities, and socio-political activism complicates this further as norms for assessing scientific claims may be disregarded as science is used toward non-scientific ends (Jasanoff, 1987).

The New Political Sociology of Science (see Frickel and Moore, 2006a) centers on the cultural processes, social structures, and social networks that impact what science gets completed – and thus what knowledge is available and legitimated – and what research questions are unanswered or selectively ignored (e.g., Hess, 2016; McGoey, 2012a; Elliott, 2013). Accordingly, the repertoire of scientific knowledge from which 'the best' can be recognized is a product of inequitable distributions of resources, advantageous individual and organizational network connections, and privileged social locations and social status. What is considered the best science is dependent on the context in which the determination is made and for what purposes.

In this paper, I assess three reports that are mandated by the Canadian federal government to employ the best available *peer reviewed* science for the recovery and conservation of the iBoF Atlantic salmon, the COSEWIC report reaffirming the species as endangered and the two SARA reports on the recovery planning and assessment of this group of

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salmon. Through co-citation analysis (CCA) and social network analysis (SNA) of organizational ties, I examine the scholarly and institutional structures that undergird the production of these reports and demonstrate how these network structures impact the reports' contents. I use CCA to determine which studies on Atlantic salmon conservation were the most influential (i.e., the best available peer reviewed science) at the time the three reports where produced and then compare these to the sources used in the COSEWIC and SARA reports. Next, I examine the organizational network underlying the reports' production to determine whether any organization had a structural advantage that may have influenced the content of the reports and which scientific studies were referenced.

The analysis reveals that each of these reports employ peer reviewed science selectively and rely mainly on non-peer reviewed, government research – specifically, research produced by the Department of Fisheries and Oceans (DFO) – to justify the listing of the iBoF salmon as endangered and to legitimate recovery plans. This prioritization of DFO research in the COSEWIC and SARA reports created an impression that this particular population of Atlantic salmon is genetically distinct from other regional populations even though there is no conclusive scientific evidence with which to support the SARA listing nor to justify funding research and recovery programs.

1. The best available science

The selection, interpretation, and presentation of the best available science in policy reports is a social-political process. Reports that draw on scientific information are not innocent of the power relations that necessitate them, nor are they ever uncontested. Similarly, the stock of available science from which scientists deem which is 'the best' is itself a social, political, and historical outcome and often mired in dispute and controversy; and the conditions that influence what research questions are pursued are as much a result of social structural locations, social networks, and scientific norms as they are the idiosyncrasies of individual scientists to follow whatever research agenda they fancy.

The New Political Sociology of Science (NPSS) examines the cultures, social structures, and contexts under which scientific knowledge is produced, disseminated, and accepted. As Frickel and Moore (2006b) write: 'The centerpiece of the NPSS project…is the analysis of institutions and networks as they condition the availability and distribution of power in the production and dissemination of knowledge' (8). One consequence of the uneven production, distribution, and legitimation of scientific knowledge is that research questions are strategically and selectively pursued and not all feasible and important research is conducted, not because of a lack of interest, but for social and/or political reasons. As a result, some interests are better served than others by the available stock of scientific information. According to Hess (2016), for instance, some social movement organizations cannot easily use scientific knowledge to legitimate their diagnoses of social, political, or environmental problems – nor to justify their preferred solutions – because the legitimating information needed has not been produced by scientists. In such cases of "undone science", more accepted and popular understandings of social, political, and environmental issues may abound because current scientific evidence may appear to support them in the absence of alternative research.

According to Hess (2015b, see also Hess, 2007), well-funded social movement organizations may respond to this lack of strategically useful scientific knowledge by providing funding for researchers and/or by conducting the research themselves. Alternatively, researchers may opt to conduct research on their own with the hope that it will help a movement with which they have affinities. Under these circumstances, however, the legitimacy and acceptance of the knowledge produced may be questioned by those skeptical of, or opposing, a social movement's goals (even if the research is of high quality) because it may be deemed to be ideologically motivated (Hess, 2009, 2015a; Kinchy, 2012; Moore, 2008).

One example of this is conservation biology, a scientific field whose practitioners produce scientific research in an assortment of contexts in support of a variety of public and private conservation efforts and thus conflates science with environmental movement politics. This is not to suggest that conservation biologists are less scientific in their research (or lesser scientists for applying their skills to important environmental problems), but only to acknowledge that this combination of science and conservation creates a tension that these scientists must navigate (e.g., Bocking, 2018). Like ecologists (e.g., Kinchy and Kleinman, 2003; Young and Matthews, 2010), conservation biologists get *some* undone science completed so that environmental issues may be better understood and legitimated and so environmental campaigns and initiatives can be better accepted and successful. Because this knowledge and its dissemination is at risk of being politicized, however, conservation biologists must also engage in boundary work (e.g., Gieryn, 1983; Kinchy and Kleinman, 2003) to have their science accepted both by their peers and by concerned and knowledgeable publics. They must be sure to follow the norms of biological science to have their discoveries stand as science rather than disqualified as ideology.

In the best of circumstances, the use of scientific knowledge in government policy strains the ideals of conservation science further. Policy-makers must balance between using scientific evidence in ways that are consistent with the norms of conservation science while also utilizing that knowledge to legitimate non-scientific goals, namely conservation policies and laws. As Jasanoff (1987) shows, as they do this scientific knowledge is often presented in government reports as more consistent and uncontested than it really is. When conservation biology is employed for government policy within the context of multi-stakeholder committees (like the ones mandated by SARA), academic science, government science, and environmental activism may overlap, and contestation over the interpretation and use of scientific knowledge and evidence may follow, especially in determining what scientific studies to deem 'the best available' and in how to use that research to justify conservation plans and programs. While people from a variety of organizations from government and civil society sectors may all agree on the ideals of conservation, their interests and ideas about science and about conservation initiatives are likely to differ and cause conflict and necessitate compromise. Multi-stakeholder committees may also find that the peer reviewed research needed to justify and fulfill their conservation efforts has not been conducted and that answers to key questions are missing. In the face of undone or uncertain science, conservation committees may turn to (non-peer reviewed) government science.

2. Methods and data

My research is based on two sets of data, one for the co-citation analysis (CCA) and one for the social network analysis (SNA) of organizational ties that impact the content of COSEWIC and SARA reports. The CCA reveals the most influential studies on Atlantic salmon conservation at three points in time (2005–2006, 2009–2010, and 2015–2016), each of which represents a repertoire of the best available science on Atlantic salmon conservation. This allows me to assess how well the COSEWIC and SARA reports reflect the best scientific literature at the time of their production and whether some of the most important or influential studies on Atlantic salmon inform them. It also enables me to assess if the subfields within the Atlantic salmon conservation literature are adequately represented and considered in the reports.

The data on organizational ties permits me to assess the organizational power that undergirds the production and contents of the reports. This allows me to examine the information flows to the COSEWIC and SARA reports and what organizations within the network have the most influence and which have the least. The COSEWIC and SARA communities are multi-stakeholder committees that are supposed to be transparent. By examining the latent network structure of organizational affiliation – as well as the affiliations of the authors of the cited