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Research article

How do potential knowledge users evaluate new claims about a contested resource? Problems of power and politics in knowledge exchange and mobilization

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ABSTRACT

This article examines how potential users of scientific and local/traditional/experiential knowledge evaluate new claims to knowing, using 67 interviews with government employees and non-governmental stakeholders involved in co-managing salmon fisheries in Canada's Fraser River. Research has consistently shown that there are major obstacles to moving new knowledge into policy, management, and public domains. New concepts such as Knowledge Exchange (KE) and Knowledge Mobilization (KMb) are being used to investigate these obstacles, but the processes by which potential users evaluate (sometimes competing) knowledge claims remain poorly understood. We use concepts from the sociology of science and find that potential users evaluate new knowledge claims based on three broad criteria: (1) the perceived merits of the claim, (2) perceptions of the character and motivation of the claimant, and (3) considerations of the social and political context of the claim. However, government employees and stakeholders have different interpretations of these criteria, leading to different knowledge preferences and normative expectations of scientists and other claimants. We draw both theoretical and practical lessons from these findings. With respect to theory, we argue that the sociology of science provides valuable insights into the political dimensions of knowledge and should be explicitly incorporated into KE/KMb research. With respect to practice, our findings underline the need for scientists and other claimants to make conscious decisions about whose expectations they hope to meet in their communications and engagement activities.

1. Introduction

The question of how to move or "mobilize" new knowledge about social-ecological systems into policy, management, and public domains has become a major area of applied research in recent years (Fazey et al., 2012; Singh et al., 2014; Cvitanovic et al., 2015a; Hulme, 2015). New knowledge claims have always faced barriers of acceptance from people and institutions that have invested in established ways of knowing and doing (Kuhn, 1962). However, ongoing environmental changes at local and global scales suggest that new knowledge of all kinds – scientific, local/traditional, and experience-based – is urgently needed if management systems are to keep up (Adams and Sandbrook, 2013). Concepts such as evidence-based management, adaptive management, and adaptive co-management reflect the importance of rapidly diffusing new knowledge to policy-makers, managers, and stakeholders alike to improve decision-making at multiple levels (Sutherland et al., 2004; Armitage et al., 2007; Cook et al., 2010). However, a wide range of studies have shown that these groups are far more likely to draw on intuition, personal and collective experience, and other forms of informal and tacit knowledge than on empirical evidence or data in their decision-making (e.g., Sutherland et al., 2004; Pullin et al., 2004; Roux et al., 2006; Fazey et al., 2006; Cook et al., 2010; Cvitanovic et al., 2014; Ntshotsho et al., 2015). Part of the problem is that knowledge is difficult to move across social and epistemic boundaries, even when there is a

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strong desire among both knowledge-generators and potential users to see it communicated and implemented (Roux et al., 2006; Bainbridge et al., 2014).

Researchers have recently developed several concepts to investigate the conditions under which knowledge does and does not transcend these barriers, and propose strategies and techniques for improvement. These concepts, which include "knowledge exchange" (KE) and "knowledge mobilization" (KMb), attempt to capture the social dimensions of knowledge creation, diffusion, and application. In our view, the differences between the two terms are trivial. KE has been more popular in the environmental studies literature, while KMb originates in efforts to measure the impact of education and social policy research (Provencal, 2011; Fazey et al., 2012). KE and KMb research both stress the iterative and non-linear nature of knowledge movement, the impact of social practices and relationships on how people access and interpret knowledge, and the fact that knowledge can be mobilized in multiple ways (for instance, as an instrumental or symbolic resource) depending on context. KE/KMb research also emphasizes several major obstacles to knowledge movement, including poor communication among knowledge generators and potential users, a lack of incentive for researchers to package their knowledge in a consumable way, and a lack of capacity among potential users to access new knowledge and apply it to real-world problems (Young et al., 2013; Singh et al., 2014; Cvitanovic et al., 2015a). Based on these observations, researchers have argued for several structural changes in knowledge production and communication, from educating scientists about policy-making processes (and vice versa), to establishing "boundary organizations" that can serve as knowledge brokers between the scientific and policy communities, to job exchanges and "connection rituals" such as regular workshops and brainstorming sessions to bring these groups together in the co-production of knowledge (Roux et al., 2006; Cook et al., 2013; Reed et al., 2014; Chapman et al., 2015; Cvitanovic et al., 2015b).

While the literature on KE and KMb is advancing, there remain some significant gaps. One of these gaps is our understanding of how potential users perceive and evaluate new knowledge claims – how they judge them to be of greater or lesser quality or utility – which is a key step in their mobilization and use. Most KE/KMb-inspired research assumes that the key challenge is to enhance exposure and exchange between knowledge generators and potential users, but the field has yet to directly investigate how new knowledge is received by heterogeneous audiences who may have different priorities and viewpoints than scientists and other claimants (Amara et al., 2004; Lacey et al., 2015). In this article, we use concepts and insights from the sociology of science to address this problem. One of the strengths of the sociology of science is the explicit link it makes between knowledge and social power (Jasanoff, 2012; Wynne, 2014). In fields such as natural resource management, for instance, claims to knowing can have profound political consequences, particularly if knowledge claims imply that certain policy actions are logical or necessary to address a given problem or challenge (Sarewitz, 2004). Attention to power therefore provides critical context for understanding how different actors evaluate the reliability of (sometimes competing) knowledge claims and the motives and actions of claimants. Our position is that explicit incorporation of concepts from the sociology of science strengthens the KE/KMb research agenda and provides more in-depth explanations of how potential users evaluate new claims.

The sociology of science is a broad field that encompasses several distinct traditions. We focus here on what Sismondo (2008) calls "the engaged program of science and technology studies", which examines relationships between science and society. Research in this area has shown that authorities, citizens, and stakeholders use complex criteria for evaluating knowledge claims and claimants. For instance, sociologists of science have found that evidence is often interpreted through the lens of values, so that experts and research whose conclusions align with one's values and priorities are seen as more credible than those that do not (e.g., Yamamoto, 2012). Sociology of science research also suggests that disagreement about the validity and meaning of evidence is sometimes used as a proxy for conflicts over political interests, in a process Irwin et al. (2012) call "higher order games". Higher order games are common in collaborative and consultative processes, particularly among less powerful groups who may withhold agreement or consensus in order to gain leverage or advance their interests. In turn, authorities often see knowledge claims – particularly scientific and expert claims – as tools for "de-politicizing" social controversies (Boswell, 2009). By appealing to scientific data, knowledge, and expertise, authorities can assert that their practices and decisions are rational and inevitable, rather than politically determined. In most fields of public policy, this approach is widely accepted by the general public as appropriate and beneficial (Leiss, 2001). In the context of controversies and conflicts, however, the rhetorical mobilization of scientific evidence by authorities is less satisfactory, particularly to stakeholders who see it as an infringement on democratic rights and processes (Wynne, 2014). Citizen and stakeholder skepticism of scientific claims is therefore often about how it is *used* by authorities, rather than a rejection or distrust in science or evidence itself (Engdahl and Lidskog, 2014). This is often misunderstood by those same authorities, who fail to see that stakeholders are taking a different view of the appropriate role for scientific evidence in decision-making (Wynne, 2002; Jasanoff, 2012).

In summary, the sociology of science literature suggests that perceptions of knowledge are intertwined with issues of social power, and that this matters for KE/KMb processes and outcomes. In this article, we analyze how potential knowledge users perceive and evaluate new claims to knowing from multiple scientific and non-scientific sources, using the case of contested salmon fisheries in Canada's Fraser River.

2. The case

The Fraser River, which winds 1375 km through the province of British Columbia before meeting the Pacific Ocean near Vancouver, is one of the most productive salmon rivers in the world (Cohen, 2012). Five species of Pacific salmon pass through the river on their way to spawning grounds (sockeye, coho, chum, pink, and Chinook as well as the anadromous rainbow trout known as steelhead). However, annual salmon returns to the river have declined significantly from historic highs (Northcote and Atagi, 1997; Cohen, 2012). Reckless practices during the twentieth century in forestry, mining, damming, and urban development have had a lasting impact on salmon habitat and spawning grounds (Evenden, 2004). Today, old problems are being exacerbated by new threats from climate change, as warming river waters place increased physiological stress on migrating salmon that likely enhances vulnerability to infection and disease (Hinch et al., 2012; Martins et al., 2012).

Three fishing sectors targeting adult migrating Pacific salmon occur in or near the Fraser River: commercial, recreational, and First Nation (indigenous), all with different catch allocations and restrictions. Regulation of these fisheries is complex (see Cohen, 2012), involving both the Canadian Department of Fisheries and Oceans (DFO) and the Canada-US bi-national Pacific Salmon Commission (PSC), which regulates fish populations that migrate across the international border. DFO's first priority is conservation of the fisheries it manages, an obligation that is enshrined in legislation

and gives the Department the authority to order fishery closures. Canadian courts have ruled that, once spawning ground recruitment targets have been met, first priority of access is given to First Nations people to harvest for non-economic "food, social, and ceremonial purposes" (Cohen, 2012: 89). Following this, allocations are made to the commercial and recreational sectors, as well as to First Nation "economic opportunity fisheries" that allow commercial sale.

Prior to the 1990s, DFO was a notoriously closed bureaucracy that relied almost exclusively on internal science and decision-making (Bavington, 2010). Along with evolving social expectations, the 1992 collapse of the Atlantic cod population off the coast of Newfoundland and the resultant public anger prompted a change in approach. Over the subsequent decades, DFO has developed a range of policies for co-managing key fisheries. In the case of Pacific salmon, co-management efforts are coordinated by the Regional Office headquartered in Vancouver. The co-management system is complex and multifaceted. First, DFO consults directly with First Nation groups and communities along the Fraser River system, using an informal system in which both parties can bring issues to the table for discussion (Cohen, 2012: 77). DFO also maintains advisory boards with other stakeholders: the Commercial Salmon Advisory Board, the Sport Fish Advisory Board, and the Marine Conservation Caucus (with representatives from ENGOs). These groups also have representation on the PSC. In 2004, DFO created Integrated Harvest Planning Committees with representatives from all four groups to review data from the prior season, identify areas of concern, and provide planning advice and recommendations for the upcoming season. Finally, DFO has an internal review process for evaluating scientific claims on issues of concern to fisheries managers, entitled the Canadian Science Advice Secretariat (CSAS), that includes representatives from potentially affected groups. These processes mean that stakeholder groups play a significant role in evaluating the evidence-basis for decision-making in this case.

3. Methods

This research was conducted as part of a larger project entitled "*Mobilizing New Knowledge for Fisheries Management in the Fraser River*" that investigates how government employees and stakeholder groups access, interpret, and use different types of knowledge about salmon fisheries in the river (see also Young et al., 2016). The interview schedule for this project was developed in three stages. First, a review of the literature on KE and KMb was conducted to collect information on existing empirical measures. Second, the interview schedule was sent to three collaborators at DFO for comment. Third, the schedule was pretested with two government employees and two representatives of stakeholder groups.

Given the exploratory nature of this research, the interview schedule uses a mixed-methods approach that blends closed- and open-ended questions (Axinn and Pearse, 2006). Measuring perceptions of knowledge requires care on behalf of researchers (Young and Matthews, 2007). Views of knowledge are known to be complex and context-sensitive, meaning that care must be taken to avoid terms that may prejudice responses from respondents of varying backgrounds. To minimize bias, our questions focused on perceptions of the "reliability" of different types of claim from different groups. Reliability is a less normative or "suspicious" term (Barnes, 2005) than other possible descriptions of knowledge quality, such as credibility, legitimacy, trustworthiness, or accuracy. We acknowledge that reliability is only one dimension of knowledge quality, but existing research suggests that it applies widely to multiple types of knowledge. Scientists regularly judge one another's work based on the perceived reliability of methods and findings (Ziman, 1991). Similarly, advocates of local and traditional knowledge submit that these types of knowledge are highly reliable because they are grounded in "learning by doing" as a type of repeated experimentation (Moller et al., 2004). The pretests also found that the issue of reliability is familiar, relevant, and politically neutral for our study population.

This article analyzes responses to two questions in particular on the reliability of different types of knowledge. The first is a Likert-style closed-ended question: "In your opinion, how reliable is the knowledge or information from the following sources about the state of salmon populations in the Fraser River?" The second is an open-ended question meant to elicit in-depth explanations of respondents' views: "Generally speaking, in your opinion what makes knowledge or information about the Fraser River 'reliable' or 'unreliable'?" To avoid steering or limiting respondents' answers, we left the terms knowledge and information undefined. Quantitative data from the interviews were analyzed using Stata 12 software, and qualitative data were analyzed using Nvivo 10 software. Coding of responses to open-ended questions was performed according to a three-step inductive process (Thomas, 2006). First, responses were read to identify key words, which became a list of potential codes. Similar potential codes were then grouped into themes. Responses were read a second time and sorted under these themes to provide a measure of their prevalence. A response may have multiple thematic codes if warranted.

The sample population was developed in consultation with representatives of DFO to ensure that key government employees and stakeholders were identified. The original population was supplemented by snowball sampling when respondents voluntarily referred us to others. The government employees group includes a large number of people in fisheries management, as these are the employees most directly involved in daily decision-making and collaborations with stakeholders (see Table 1). It also includes employees in DFO Science Branch who were identified by the organization as working closely with fisheries managers and stakeholder groups. Several senior managers were also interviewed, as well as members of the PSC. The stakeholder group includes representatives of commercial and recreational fisheries, First Nations communities, ENGOs, and environmental consultants (who are often engaged by stakeholders and play a role in co-management processes). We acknowledge that the term stakeholders is imperfect in this context, because each of the groups described in Table 1 have distinct identities, interests, and perspectives. However, there are also important similarities among the groups in this context, as they are all involved in co-management but stand outside (and are frequently critical of) the state and its regulatory apparatus – thus making them a qualitatively different audience than government employees (see Nguyen et al., 2016). To address this, we present two versions of our findings. The tables in the main article directly contrast the views of government employees with those of stakeholders as an imperfect category. The supplementary material accompanying this article, however, contain full tables that present the findings according to each specific group.

Table 1
Affiliations of respondents.

Government employees	N	Stakeholders	N
Fisheries management branch (DFO)	18	Commercial fishery	4
Science branch (DFO)	4	Recreational fishery	8
Senior management (DFO)	3	First Nation fishery	5
Pacific Salmon Commission	6	ENGO	8
Other	2	Environmental consultants	4
		Other	5

A total of 67 interviews were completed between November 2013 and September 2014; 33 with government employees and 34 with non-governmental stakeholders (51 men and 16 women).[1] Three-quarters of the interviews were conducted in-person, with one-quarter conducted over the telephone. Because some requests for interviews were communicated internally by DFO, we can only estimate the response rates (approximately 66% for government employees and 63% for stakeholders). Interviews lasted between 40 min and 3 h, depending on the level of detail provided by respondents.

4. Findings

4.1. Whose knowledge is reliable? A quantitative measure

Table 2 presents data from the closed-ended Likert-style question. Respondents were asked to indicate their views across a five-point scale: always reliable (4), usually reliable (3), sometimes reliable (2), rarely reliable (1), never reliable (0), with an option for "don't know". Overall, Table 2 shows that university and government scientists are viewed most favourably on this measure by both government employees and stakeholders. Recreational river users (e.g. boaters) are viewed the least favourably. Looking more closely at the findings, we see that government employees have a significantly more positive view of the reliability of government scientists and government managers than do stakeholders. Stakeholders give slightly more credence to the claims of environmental groups (ENGOs) and First Nation fishers, but these differences are not statistically significant.

We also note that the standard deviations in Table 2 are quite small and fall under 1.0, with the exception of stakeholder views of recreational river users. Very few respondents made extreme attributions (of "always reliable" or "never reliable"), and the vast majority of answers were clustered in the middle range of the scale. Overall, these findings suggest that both government employees and stakeholders have balanced views of the reliability of different types and sources of knowledge. While traditional generators of Western science – academics and government scientists – are seen as most reliable, both groups accept that stakeholders produce information and knowledge that is "sometimes reliable". In our view, this convergence of opinions is important. It is consistent with other studies that have found that government officials involved in co-management are intellectually open to non-scientific forms of knowledge, but are not uncritical (Young and Matthews, 2007). Our findings suggest this is also the case for stakeholders. To further explore this, we turn next to qualitative findings.

4.2. What is reliable and unreliable knowledge? A qualitative measure

This section considers answers received to the open-ended question: *Generally speaking, in your opinion what makes knowledge or information about the Fraser River "reliable" or "unreliable"*? Tables 3 and 4 present the thematic codes associated with "reliable knowledge" and "unreliable knowledge" respectively, along with the number of respondents making mention of each theme.

Similarities and differences between the groups are evident in these tables. Starting with Table 3, a sizable minority of both groups cite the importance of sound research design and methods, as well as the reputation of the claimant. Similar numbers across the two groups also cite neutrality or balance, peer review, and a lack of bias as important markers of reliable knowledge. Important differences include government employees' focus on quantifiable data, a "facts only" approach, and the importance of "clear relevance or applicability" of findings, while stakeholders focus more on the claimant's knowledge of broader issues and his/her hands-on experience. Similarly, Table 4 shows that respondents from both groups cite the predetermination of findings, presence of ulterior motives, and the self-interest of the claimant as markers of unreliable knowledge. Differences include government employees' focus on the problem of "undue extrapolation" (which is not mentioned by stakeholders), while stakeholders are more concerned with the possible "influence of funders" on research methods or conclusions, as well as the general "bias" of researchers.

In the following sections, we use quotations from the interviews to analyze and illustrate key differences between the two groups. Taking the findings from Tables 3 and 4 as our starting point, we argue that government employees and stakeholders use similar criteria to evaluate knowledge claims, but apply them in different ways. These criteria are: (1) evaluation of the merits of the claim, (2) judgements about the character and motivation of the claimant, and (3) considerations of the social and political context of the claim. While these three criteria overlap considerably, we consider each in turn.

4.2.1. The merits of the claim

Government employees and stakeholders appear to evaluate the merits of claims to knowing based on different criteria. In discussing the reliability of knowledge, government employees frequently make reference to the distinction between "observation" and "facts" on the one hand, and "interpretation" and "opinions" or "beliefs" on the other. A reliable claim is one that focuses on the former, and minimizes or eliminates the latter. Occasionally, this criterion is evoked to make a distinction between reliable Western

Table 2
In your opinion, how reliable is the knowledge or information from the following sources about the state of salmon populations in the Fraser River? (0–4).

	Govt empl	Standard dev	Stakeholders	Standard dev	Significance
University scientists	3.00	0.62	2.96	0.64	
Govt scientists	3.00	0.44	2.67	0.63	*
Govt managers	2.91	0.61	2.54	0.59	*
ENGOs	1.86	0.48	2.13	0.68	
Commercial fishers	2.05	0.52	2.09	0.61	
FN fishers	1.95	0.60	2.04	0.37	
Anglers	1.90	0.62	1.91	0.53	
Rec river users	1.69	0.70	1.76	1.72	

N = 59; *p < 0.05, based on Wilcoxon rank-sum test for ordinal data.

[1] A detailed gender breakdown is not provided to ensure the anonymity of respondents.

Table 3
Criteria for judging knowledge to be "reliable" (number of respondents making a mention).

	Government employees	Stakeholders
Acknowledgement of uncertainty	2	1
Clear relevance or applicability to a problem	9	1
Facts-only approach	7	–
Hands-on experience of claimant(s)	1	7
Inclusive of stakeholders	1	–
Institutionally reviewed	10	–
Knowledge of broader fisheries issues and conflicts	1	8
Lack of constraints on claimant(s)	1	–
Neutrality, balance	3	3
Peer reviewed	2	3
Personal relationship with claimant(s)	–	2
Politically defendable	3	–
Precautionary approach	–	1
Quantifiable/numerical	10	2
Replicable findings	4	5
Reputation of claimant(s)	6	10
Sound research design and methods	7	9
Transparency of process	–	4
Triangulation (validated by science and local/traditional knowledge)	–	2
Unbiased	3	2
Total N (excludes respondents who did not answer or stated "I don't know")	30	28

Table 4
Criteria for judging knowledge to be "unreliable" (number of respondents making a mention).

	Government employees	Stakeholders
Agendas/ulterior motives	4	3
Anecdotal	4	2
Bias	3	9
Conclusions based on hearsay	2	–
Influence of funders on methods or conclusions	–	4
Group pressures	1	2
Incompetence of claimant(s)	1	–
Lack of personal experience with the fishery(ies)	–	1
Models too simple	1	3
Opinion	4	2
Pre-determination of findings	4	3
Self-interest of claimant(s)	2	4
Traditional knowledge (TEK)	1	–
Undue extrapolation from data or observations	9	–
Total N (excludes respondents who did not answer or stated "I don't know")	30	28

science and unreliable traditional or local knowledge. For example:

> [Stakeholders] have beliefs. Normally these are based on elements of fact but they seldom know the whole picture. For First Nations too, [their claims] are always a mix of local traditional knowledge and observations of what's actually happening now. Call that a temporal mismatch if you will. … It's hard to see how they go from observations to interpretations. (Interview #34; Science branch)

Importantly, however, the observation-interpretation critique is also applied to university-based science. As we saw earlier, government employees generally have a high opinion of the reliability of academic science. Nevertheless, some government employees criticized academic science for inappropriately presenting "opinions" or "commenting" on findings. For example:

> For me, reliable information is fact-based information [that has been] scientifically tested and … presented without opinions. … Sometimes the commentary [about] the facts is way out in left field. It's not helpful. (Interview #27; Fisheries management branch)

The aversion to interpretation expressed by government employees occasionally translates into a preference for numerical or quantifiable data. According to this narrative, quantitative data is more straightforward and easier to interpret and communicate than other forms of knowledge that may conflate observation and interpretation. For example:

> Quantitative data speaks for itself, and frankly that's the [kind of] data that helps us to model and predict. … It's easier for us to interpret, because it speaks for itself and doesn't need an extra layer of interpretation. (Interview #50; Fisheries management branch)

In contrast, stakeholders did not express reservations about the observation-interpretation distinction or dynamic. In some cases, interpretation was in fact described as a strength of certain knowledge claims, making them more usable and reliable. This seems to be particularly true for groups and organizations that focus on public education and/or political activism. For example:

> It is helpful to us when scientists explain what their findings mean in plain language, so everyone can see what's behind the

stats and the jargon and stuff. It's not as impactful when we summarize it as when they do. (Interview #28; ENGO affiliation)

I think words are really important. Words tell a story more than do [statistical] error bars and confidence levels and all that. … The most useful knowledge from our point of view is knowledge that helps the public [to] make a decision or influence[s] our government to move towards more responsible direction. (Interview #12; ENGO affiliation)

Some stakeholders were also critical of the idea that quantitative data alone could represent the realities of what is going on in the river, arguing that these are but one relevant input for understanding complex systems. Note the distinction made between quantitative data and story-telling in the following quotation:

Is the science [about the river] reliable? Well, [the problem] is that many scientists mistake information for knowledge. Knowledge has to be built around information. That's why Aboriginal people don't want to write down their traditional knowledge, for fear that they'll miss something and it won't be reliable anymore. Often it's the colours and the flavours and the story that matters and [science] doesn't even know how to interpret that yet. … Within that story are nuggets of information, nuggets of wisdom and you use that knowledge and that wisdom to guide [your interpretation of] the facts. (Interview #61; Environmental consulting affiliation)

4.2.2. Judgements about character and motivation

Government employees and stakeholders also use judgements about the character and motivation of the claimant as a way of evaluating the reliability of a knowledge claim. Again, however, these judgements are based on different criteria. For government employees, good character is often associated with objectivity and restraint. Scientists who stick to the facts are generally considered more trustworthy than those who are perceived to mix research and politics:

The point is to be objective. To stick to the facts, give good advice about the facts, and not get dragged into the political arena. Let others decide the policy unless you are asked [directly]. (Interview # 51; PSC)

As shown in Table 4, government employees are particularly wary of "undue extrapolation from data or observations". Articulations of this complaint are often accompanied by suggestions that some claimants – both scientists and holders of local knowledge – intentionally exaggerate or extrapolate in an inappropriate and irresponsible way in order to serve ideological or political ends:

A lot of non-scientists – including anglers – can be good observers, so long as they don't quickly come to conclusions or let their conclusions guide their observations, if you know what I mean. Their observations can be good, yes, but not their opinions. … When they give us their opinions it gets difficult, because it's their interests you're really hearing. This is my experience with any [stakeholder], they tend to start the discussion with a wilful misinterpretation of their observations. (Interview #13; Fisheries management branch)

Some scientists – a lot of them even at universities – are just known to have agendas, and they will choose their methods to suit their goals, and *voilà,* come to conclusions that reflect their agenda. That creates a real bitterness inside of DFO. … It gets predictable, that every time there's an anomaly these people portray it as a disaster. (Interview #18; Fisheries management branch).

In contrast, stakeholders perceive a strong link between a claimant's character and his/her experience and awareness of the broader social and ecological issues involved in the fishery. Awareness of these issues, along with hands-on experience with fieldwork, are thought to enhance the authenticity and relevance of findings, because researchers understand the context of their research and conclusions. This contrasts strongly with the dominant view among government employees about objectivity and restraint:

Overall, I'd say a group or a person's firsthand knowledge with the fisheries makes [them more] reliable. [I mean] their knowledge of the fisheries in their entirety – of the context of their research and what it means to all the [stakeholder] groups. (Interview #10; Recreational fishery affiliation)

I don't read studies, I don't read studies coming out of wherever, but I listen to people. … I listen to the [researchers] who I know come down [to the river] to see what's really going on. (Interview #15; Recreational fishery affiliation)

4.2.3. Social and political context

Government employees and stakeholders are highly aware of the tense social and political circumstances surrounding fisheries in the Fraser River, and this affects how they perceive knowledge claims. First, government employees spend a good deal of time imagining and anticipating how stakeholders might react to certain knowledge claims, particularly those that might require changes in management approach. This is particularly true for those in senior management who decide on policy directions in the region. For instance, the following quotation refers to how considerations of possible stakeholder objections and complaints are used to evaluate knowledge claims:

You can't take the word of some scientists verbatim, you have to know what it means in the wild …. You have to look at how defensible is it [to stakeholders] … and how it will unfold in terms of manageability. Because there's lots of things you can do, but if you have a real patchwork of management approaches, it becomes very difficult to manage. So we actually have to look at manageability, and you know, maybe taking a certain course of action in one place, or with one sector, and not in another area or with another sector – that kind of thing. So there's lots of considerations that come into play and it always comes down to specific issues and circumstances, how we actually end up moving forward. (Interview #53; Senior management)

Second, government employees rely heavily on the official internal process for evaluating knowledge claims that was mentioned earlier, called the CSAS process. A CSAS review draws on both internal and external expertise, including academic scientists and stakeholders. It is also expensive and time-consuming, meaning that it is engaged sparingly and only on the approval of senior management (Cohen, 2012: 56). Several government employees directly referred to the CSAS process as an important "green light" for using new knowledge in fisheries management decisions. It is seen as a major validator of knowledge, because, in the view of government employees, its major purpose is to critically evaluate and synthesize a large number of studies, thus creating institutionally-endorsed knowledge. For example:

> To know that research is truly reliable – that is, actionable by DFO; you know, into management decisions – we have a rigorous review process [CSAS] that evaluates all the relevant research. It is meant to strip out the bad stuff, the bias and opinions, and give everything a higher degree of reliability. (Interview #29; Senior management)

> A CSAS will look at the design of lots of studies and come up with independent conclusions – independent of any one study. We can then take that, turn it into management options, and present it to [stakeholder] groups and get their advice on it. … [CSAS] is a very valuable process that way. (Interview #56, Fisheries management branch)

In contrast, stakeholders see knowledge as a site of struggle, in which they are often at a disadvantage. The first quotation refers to a widely-held belief that science is used to silence stakeholders and impose decisions, while the second refers to the perceived second-class status of stakeholder knowledge in decision-making.

> The problem is that DFO will use their science as a political tool, to shut us up or ignore us or whatever … We need to make sure that new research is being heard and acted upon as opposed to it getting political. If it's not [consistent with] the direction the government is going, it gets ignored. (Interview #12; ENGO affiliation).

> I think there are more barriers for [local] knowledge. … You know knowledge from fishermen who have been doing it for 50 years, don't really get into management practices. There are things that they just don't take into account, like the tide, the moon – it all plays a role in [fish behaviour] but none of that makes it into the model … So it's hard not to feel like your experience doesn't matter much in the process. (Interview #24; Commercial fishery affiliation)

5. Discussion

For knowledge to be useful in environmental management and decision-making, it must first be accepted as reliable by potential knowledge users. We have argued that evaluations of knowledge remain a gap in KE and KMb research, and that insights from the sociology of science can help fill these gaps and further refine efforts to move new knowledge into practice. The sociology of science tells us that potential users are likely to evaluate knowledge and claimants through the lenses of values, interests, and political strategy. Our research with government employees and stakeholders involved in the co-management of Fraser River fisheries indeed finds evidence of these influences. In this section, we review the implications of our findings for KE/KMb theory and practice.

Findings from the interviews suggest that government employees have a strong preference for knowledge claims that address a specific problem, that generate quantitative data or observations, and that minimize "interpretation" on behalf of the claimant. These expectations apply both to scientific knowledge and local/traditional/experiential knowledge. Government employees are intellectually open to the notion that stakeholder groups produce reliable knowledge (see Table 2). However, reliability is enhanced "when [stakeholders] don't quickly come to conclusions or let their conclusions guide their observations". Importantly, government employees are not arguing against interpretation *per se*, but that interpretation should be done by the appropriate authority. Implicit in many of the quotations presented earlier is that the appropriate authority is the employee him or herself. As one respondent put it: "Reliability means that I can use that information … if it's reliable, I'll use it, if not, I won't use it" (interview #58; Fisheries management branch). In other words, interpretation should happen at the point of application by the eventual user (the employee) rather than by the claimant – something that several respondents mentioned is easier to do with numerical, quantitative data whose meaning and applications are clearer. In more complex cases, interpretation is the responsibility of the governing institution (DFO) via the CSAS process. A CSAS review provides employees with an approved set of interpretations that "strip out … the bias and opinions" that come from outside sources.

These preferences make sense when considered from the perspective of the sociology of science and its attention to the links between knowledge and power. Government employees are ultimately responsible for implementing policy and making workable decisions – they are the "authorities" in this case, even in conditions of co-management (Nadasdy, 2005). Their position as authorities motivates them to prefer knowledge that de-politicizes potential conflicts and provides clear direction for decisions (Irwin, 2006; Wynne, 2014). In other words, government employees generally (but not in all cases) prefer knowledge that is consistent with technocratic governance, or governance that relies on seemingly neutral technical information and decision-making procedures.

Stakeholders evaluate knowledge and claimants differently. Stakeholders tend to see reliability more as a personal attribute – as originating in the experience and character of the claimant – which then affects the knowledge that person generates. In other words, the personhood of the claimant is key, and inseparable from the knowledge he or she generates. The person's reputation, experience, background, affiliations, awareness of broader issues, and style of research (such as "being on the river" or not) all matter to stakeholders in evaluating the veracity of their claims. In other words, knowledge about the claimant is important for evaluating the quality of his or her observations or findings. Importantly, stakeholders are also concerned with the utility and applications of knowledge, although again in a different way than government employees. Several stakeholders spoke about the importance of interpretation in making knowledge more useful, and particularly that "scientists explain what their findings mean" to enhance or reinforce a message or story. The utility of knowledge is not only in its immediate application to a problem, but in its social value for teaching, explaining, or making a narrative case.

From the perspective of the sociology of science, these views are more consistent with what we know about local and traditional knowledge systems, in which knowledge is intertwined with practice or "doing" (Berkes, 2012). People who have "done" – who know the issues, have experienced the river directly, and participated in the debates – are seen as more credible than claimants who lack these experiences. While stakeholders have a positive view of academic and government scientists (see Table 2), they are critical of authorities for using scientific claims to impose decisions in a technocratic way. Overall, there is a clear preference for knowledge that is contextual, non-reductionist, and connected to both social and ecological issues. Politics are highly present in this type of knowledge, although it is inaccurate to label it as "politicized" in the pejorative sense. Instead, stakeholders appear to prefer knowledge that leaves room for political action, and this is an important counter-point to the preferences of authorities for knowledge that contains or diminishes the role of politics in decision-making (see Wynne, 2014).

We draw both theoretical and practical lessons from these findings. With respect to theory, the interview findings demonstrate that KE/KMb research needs to directly address how political considerations influence the preferences and expectations of

potential knowledge users. While this research is exploratory, the preference of government employees for knowledge that depoliticizes conflicts and encourages a technocratic approach contrasts strongly with stakeholders' preferences for knowledge that is grounded in, and allows room for, political claims-making. In our view, the sociology of science provides an important set of tools for understanding the role of power and politics in the evaluation of knowledge, and should be directly incorporated into future KE/KMb research.

With respect to practice, our findings point to a dilemma. Given the contrasting expectations held by government employees and stakeholders, it is possible that efforts to build credibility with one group may diminish it with another (Cash et al., 2003). Turning to Pielke's (2007) well-known typology of scientific identities, government employees are expecting scientists to be "pure scientists" (and non-scientists to be "pure observers") who communicate findings and observations irrespective of their potential social-ecological consequences – leaving interpretation of this type to the users of knowledge. In contrast, stakeholders expect knowledge generators to be directly engaged in the issues, demonstrating awareness of the human and ecological tensions of fisheries management. This is a role that is more suited to Pielke's "issue advocate" identity (in which the claimant takes a clear position on a desired political course of action) or "honest broker" identity (in which the claimant seeks to interpret and explain the range of possible policy responses without endorsing any one approach).

As Lacey et al. (2015) rightly point out, these competing expectations raise important questions of personal and professional ethics. While Lacey and colleagues endorse the honest broker stance as the most ethical in situations of high uncertainty or conflict, in our view there is no single right answer as to how scientists and other claimants should behave, communicate, and interact with potential users of their knowledge. However, we argue that claimants do have an obligation to reflect on the political dimensions of their claims and make conscious decisions about what type of public role they want to assume. As shown in our research, these decisions can have a significant impact on how knowledge claims and claimants are perceived. As such, they are best made purposefully and in full consideration of the expectations and preferences of different audiences.

6. Conclusion

This article has used the case of contested Pacific salmon fisheries in Canada's Fraser River to examine how potential knowledge users perceive and evaluate knowledge claims and claimants. Research has consistently shown that there are major obstacles to moving new knowledge into environmental policy and decision-making, both among authorities and stakeholders. We used concepts from the sociology of science to investigate the preferences and normative expectations that government employees and stakeholders have of knowledge claims and claimants. We found that potential users make these judgements based on three broad criteria: (1) the perceived merits of the claim, (2) perceptions of the character and motivation of the claimant, and (3) considerations of the social and political context of the claim. The two groups have different interpretations of these criteria, however, with government employees preferring knowledge that is problem-oriented, quantitative, and stripped of unnecessary interpretation (the assumption being that interpretation can and should be added at a later stage by end users themselves). Overall, this is a technocratic view of evidence that we argued aims to depoliticize knowledge and avoid potential conflicts. In contrast, stakeholders demonstrate a preference for knowledge that reflects the experiences and contextual social-ecological knowledge of the claimant. Interpretation – in the form of words, explanations, and stories – plays an important role in this type of knowledge, particularly as a means of position-taking in political contests and debates.

Theoretical and practical lessons can be drawn from this research. On the theoretical side, the findings demonstrate that the concepts of KE/KMb are incomplete without explicit attention to how political considerations affect knowledge perception and evaluation across different types of audience. On the practical side, we argued that the observed differences across potential users put scientists and other claimants in a difficult position of addressing one or another set of expectations. Building credibility with one group risks alienating members of the other – a situation that is further complicated in co-management arrangements. Scientists and other claimants need to be clear eyed about this problem, and make conscious decisions about what type of public role they wish to adopt as they seek to enhance the impact of their knowledge on real-world social-ecological issues.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jenvman.2016.10.006.

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