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Article

Stakeholder Dialogues and Shared Understanding: The Case of Co-Managing Fisheries in Sweden

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Abstract: There is growing interest in communication, participation and learning in multiple fields, such as governance and policy research, natural resource management research and educational research. This paper reports a study on stakeholder dialogues and shared understanding in the context of co-managed fisheries aiming at participation and learning to increase aspects of efficiency, legitimacy and accuracy. The research investigates differing views held by participants on resource decline and how these could be affected through stakeholder dialogues. The results show that diverging views remained after four years of meetings and dialogues, but also that shared understanding in relation to certain topics developed. Participants highlighted that shared understanding was important for the feasibility of co-management, while also addressing issues of invisibility of the resource (fish living under water), uncertainty due to the complexity of the eco systems, and the epistemological difficulties of bringing scientific results into decision-making, which makes shared understanding in this case challenging and even impossible at times.

Keywords: communication; stakeholder dialogues; participation; learning; shared understanding; resource management; fisheries

1. Introduction

Policy, practice and research on natural resource management is generating increased interest in aspects of communication, participation and learning (e.g., [1]). It is seen as a way for: (i) increased efficiency; (ii) strengthened legitimacy (*i.e.*, rule compliance [2]); and (iii) improved accuracy. In regard to the last point, engaging stakeholders in communication and dialogue enhances the combination of different knowledge and experience of ecosystems and increases the likelihood of accurate and ecologically informed decisions impacting on the ecosystem and services. Management practices and institutions can therefore be better designed to “continuously respond to changes in the ecosystem, using the best available knowledge about complex social-ecological dynamics and updating this knowledge in a learning-by-doing process” [3].

Research on co-management, and in particular adaptive co-management (ACM), has sought insights into its causes, success and failures. This has taken place through various frameworks that have focused on: antecedents or preconditions, process characteristics, and outcomes [4] as well as various phases, such as preparing the system for change by engaging actors and building networks and seizing windows of opportunity to affect change, and working to build the resilience of the governance system by continuous learning, negotiation and experimentation [5,6]. Studies have also been carried out investigating stakeholder engagement with the purpose of incorporating their knowledge in (co-) management [5,7–11]. These studies point to the advantages of engaging stakeholders and including their knowledge of the ecosystem in order to enhance the accuracy of management decisions.

Although increasing the sources of knowledge used in decision-making by engaging stakeholders appears beneficial to resource management, the challenge of dealing with uncertainties and knowledge conflicts remain. Participants may hold different conceptions and views of the environment and the problems to be decided on. Udovyk and Gilek [12] analyze the use and definitions of “uncertainty” in scientific advisory documents, and identify three kinds of uncertainty—in terms of a knowledge relationship, towards the ecosystem itself, and as part of the “knowledge-based system”. The first relates to a lack of knowledge or the “ignorance, unpredictability, and even in terms of ‘too much knowledge or too little knowledge’” ([12] (p. 15), quoting [13]). The second addresses the complexity, interactions, and dynamics within the ecosystem. The last one means that the scientific knowledge is uncertain due to for example lack of data or methods used to calculate probabilities [12] (p. 15). The authors also conducted a literature review on strategies for reducing uncertainty and summarized them in terms of: (i) reducing uncertainty through further investigation and enquiry; (ii) a controlling strategy through the use of scientific methods, such as modeling and scenario building; (iii) a coping strategy, where uncertainty, in contrast to the previous ones, concerns the ecosystem itself. As the authors write “this strategy also implies a focus on identifying ways of ‘learning to live with uncertainty’” [12] (p. 16). However, the relation between scientific and experiential stakeholder knowledge is often conflicted and cannot be easily integrated with each other [14] and the question how stakeholders can co-construct knowledge and develop a shared understanding remains highly challenging.

In this research project we investigated the following questions on knowledge and knowledge generation concerning fishery, focusing both on the individual(s) (professional fishermen) and the collective level (stakeholder dialogues for management):

- What kind of ecological knowledge is developed by professional fishers, and how?
- What is the role of knowledge in decision-making in multi stakeholder managed fisheries?
- How are differing views negotiated in settings where different interests are represented?

Within the project, studies have been carried out investigating fishers' systemic understanding of aquatic ecosystems [15]. They show, in detail, fishers' understanding of the system in terms of "structure", "dynamics" and "function", and how experiential knowledge, in combination with scientific information, generate hypothesis-testing in practice. Another study in this project has investigated and compared participation processes in two collaborative management projects on fishery in Poland and Sweden. The applied analytical framework focused, in particular, on participation in terms of "access", "standing" and "influence" as key aspects. The results show that by supporting stakeholder dialogues in various ways (e.g., by skilled mediators ensuring constructive and respectful dialogues, and access to attend meetings through funding), the participatory process was successful in achieving positive outcomes in terms of learning, trust building and compliance [16]. With regard to the Swedish case, the results also showed that participants' influence concerning what they were allowed to decide upon was not clearly defined at the outset, which caused major problems and threats to the continuation of the project.

In this paper, we address the second and third questions identified above, examining differing views of stakeholders on particular fisheries' related issues and the role of science in this regard. We focus in particular on stakeholders' conceptions of causes to resource decline and possible changes in these conceptions. The paper also addresses their conceptions of uncertainty, and actions that seek to jointly enhance the stakeholders' knowledge (e.g., conducting investigations and using research). Although the study did not seek participants' views of "shared" or "common" understanding, this topic was addressed by the stakeholders and is also reported here.

2. Theoretical Perspective

In educational research there has been a growing interest in studying group cognition, and multiple terms have been used such as "common ground, team mental models, shared understanding, distributed cognition and collective mind" [17] (p. 40). This growing body of research reflects the interest to increase understanding of how groups can work together to enhance learning at the individual and/or group level. With reference to [18], Akkerman and colleagues write, "the development of group cognition is a process of negotiating and interrelating diverse views of group members. This process enables group members to learn from others' preferences and viewpoints by facing different viewpoints and by accepting the existence of them as legitimate" [17] (p. 40).

The theoretical perspectives in the reviewed literature were cognitive, socio-cultural, or a boundary crossing of the two [17]. Studies that were categorized as boundary crossing "were able to pursue a mixed discourse of both cognitive as well as socio-cultural perspectives on mind throughout the whole study" [17] (p. 48). The majority (11) used a cognitive perspective and group cognition was interpreted as similarity and overlap of individuals' mental models. The review also shows that interests in investigating group cognition were to explore cognition as input, process or output of groups working together, and that the majority of the studies had a focus on investigating group cognition as an end result (output) of a collaborative process. This paper uses the term shared understanding to mean

similarity among the participants' views, and has the interest of looking at group cognition from a cognitive perspective. We explore: (i) to what extent individuals' initial views were similar or different at the start of collaboration and dialogues; and (ii) how such similarities or differences will potentially effect management decisions; and, (iii) the output of the collaborative effort and change towards a convergence of views, and if so, possible explanations to this change.

This study takes a cognitive perspective (congruent to the definition by [17] above) although using the term constructivist perspective. It draws on work by [19,20] where conceptions and changes of conceptions are viewed as the individual's construction of reality, created as a result of interacting with the environment and others. It acknowledges the social and cultural dimensions of the individual's learning process. Social dimensions are here in particular considered in terms of conflicts (especially due to conflicting views on fisheries related issues and "facts"), and social relational aspects among the participants.

3. Method

3.1. Context

The geographical area of the study is Lake Vättern, Sweden, situated in the middle of four counties and eight municipalities. It is the sixth largest lake in Europe covering 1912 km². About 250,000 people depend on the lake as a source for their daily fresh water. Fishing is another important resource. Vättern is home to Sweden's largest and commercially most valuable stock of Arctic char (*Salvelinus umbla*). Since the 1990s, there has been a strong reduction in char, while American crayfish (*Pacifastacus leniusculus*) has increased at the same time. The latter has generated significant income for professional fishers and tourism linked to the crayfish fishery.

3.2. Case Study and Interviews

In 2004, the Swedish media reported on the decline of the Arctic Char in Lake Vättern. Over-fishing was reported as the cause for this decline, but the increase of crayfish was also identified as an influencing factor. In 2005, a report investigated the causes of the decrease and examined fishing pressure on arctic char, predation on roe and fry of arctic char by signal crayfish, and competition with planted salmon. Based on empirically collected data and an analysis using a food web model the results showed that "it is the fishing pressure on arctic char that has the greatest effect on its biomasses and that the great biomasses of signal crayfish in lake Vättern and salmon stocking, cannot alone be the reason for the decrease of arctic char in lake Vättern" [21] (p. 94). The media reports on possible causes to the declining fish stock caught the attention of researchers, and when the research project began, all stakeholders around the lake were engaged in a pilot project on co-managed fisheries supported by the Board of Fisheries (now the Swedish board for Marine and Water Management). The case thus seemed promising for investigating communication, differing viewpoints, and knowledge.

The Lake Vattern Society for Water Conservation (LVWC), an organization established in 1957 comprising government bodies and business around the lake on water and fishing issues, invited all interested parties and submitted an application to become a "co-management pilot project" to the Board of Fisheries in November 2004. The application was approved, and the project and meetings

began in 2005. In December the same year, one of the researchers contacted the chair of the project and visited the group in February 2006 at a project meeting, asking for permission to attend meetings and carry out interviews. The researchers then participated as observers of the co-management meetings from 2006–2009, and were present at all meetings in the first year of 2006 and until August 2007, and once a year until November 2009. After a Management plan was agreed upon in November 2009, presenting several investigations that had been carried out on various fish stock and suggestions and recommendations for co-management, structured interviews were conducted individually with all participants. The interviews focused on their views of the participatory process and outcomes (social, ecological, and economical), and, if they thought they had learnt about ecological, social or institutional aspects of fisheries as a result of taking part in the dialogues. The results from these interviews have been reported elsewhere (see [16] and Introduction).

Interview questions also concerned participants views of the decline of fishing stock of the arctic char, and interviewees were asked to recall and describe their view at the outset of the project (2005) and to give their present view (2009/2010). They were also asked about their view of uncertainty. Interviews were carried out over a period of six months from November 2009 to April 2010, were tape recorded on a digital recorder (Olympus DM 500), lasting between 60–120 minutes and were then transcribed in full. The researchers have also had access to all meeting notes and have attended meetings, and have been able to confirm interview statements concerning investigations or decisions made, as well as diverging viewpoints among participants, reported in the meeting notes.

The interviews, in total 10, were carried out with all participants (except one) of the group that formed part of the co-management project. The participants included representatives of professional and recreational fishery; one person representing the professional fishers, and two others, each representing one of the two recreational fishing organizations. There were also two representatives from the eight County Boards, and two representatives from the four County Administrative Boards (representatives with fisheries as expert areas and responsibility). Furthermore, a scientist, a water-owner representative, a representative from the Lake Vättern Society for Water Conservation and a project coordinator participated.

3.3. Analysis

In the analysis of the interviews, attention and coding was first given to the participants' statements of causes and change in fish stock. Secondly, answers on various meaning of uncertainty were thematized [22], and all the material was re-read a second time, concluding on the different ways of understanding uncertainty. The term "theme" implies a labelling of meanings that are relevant to cluster together and "captures something important about the data in relation to the research question, and represents some level of *patterned* response or meaning within the data set" [22] (p. 82). In the interviews, following the answers to the question on uncertainty, many participants gave statements on the advantages, disadvantages and challenges of a common understanding concerning fish stock and the aquatic system. These statements were coded as a theme on "views of shared understanding", and the interviews were read a second time, checking and coding for statements relating to this theme.

The interpretation and coding of the interview answers on causes to fish decline, and uncertainty, are to be regarded as "theory-driven" as the analysis focused on the various meanings of the answers

given on this topic (interview questions). On the other hand, the theme on shared understanding is “data-driven” as statements in the interviews concerning this issue were categorized to the theme on “shared understanding” [22] (p. 88).

4. Results

In this section, stakeholders’ views of causes to fish decline and shared understanding are presented. With regard to views of uncertainty, the results are presented as two themes: “knowledge, science and epistemological dimensions considered” and “invisibility”.

4.1. Various Views on the Decline of the Char

In the lake, the ecological crisis was paramount in the decrease of the Arctic char. This was of concern to all stakeholders (and was a core incentive to engage in the co-management initiative, see [16]) but different reasons for the decline were suggested: over-fishing, the increase of crayfish (eating char roe), reproduction problems (where climate change was seen to be effecting freezing of the lake, in turn influencing reproduction), and climate change causing higher water temperature which could potentially effect the char negatively as it is a cold-water fish.

In the interviews, the participants were asked to give their view on the decline of the arctic char when the project began (2005) and whether their view had changed or not after the project duration (2009). The majority (eight of 10) believed over-fishing was the cause, including those who stated it was a combination of several factors, including over-fishing. Nearly all of the participants, nine of 10, stated that their initial view had not changed; although some mentioned that there was perhaps the combination of several factors that simultaneously had caused the severe drop. One person, who believed that climate change was the main cause initially, stated that he viewed over-fishing as being the main cause. A reason to the participants maintaining or changing view to over-fishing is the fact that the stock of arctic char had increased by 2009, and as fishing regulations had been implemented (seasonal closures as in prolonged closure for mating period) this was seen as linked causally. However, a view that the problem of decline was caused by crayfish was no longer suggested (see below).

4.2. Shared Understanding

Several of the participants mentioned the importance of shared understanding for management, and the negative social consequences, such as rumors of resource extraction by certain fisher groups, resulting in social tension between the groups, when a shared view was non-existent. One of them claimed shared understanding to be the very key issue of resource management:

You need to have a shared view of the resource regarding what state it is in. This is something that should not be avoided, rather, it needs to be discussed, such as knowing the facts that you agree on. I am really convinced this is very important [23].

As there was a suggested problem and cause—the crayfish eating char roe, hence causing its decline—it was decided by all that a scientific investigation should be undertaken. It is probable that this was considered important to know as crayfishing was becoming of important economic interest. By investigating the effect of crayfish on the arctic char, it was also possible to avoid a social conflict

between fishers focusing exclusively on crayfish and those extracting other fish. The investigation was carried out and all participants accepted the results. It did not confirm the view of crayfish eating char roe, which could thus be ruled out as a cause.

In regard to the aspect of “shared views”, one of the participants did however describe the social consequences of differing views in positive terms, and the investigation of the crayfish was given as an example:

These issues are complex and difficult which easily results in diverging views and this can cause conflict, ... but it can contribute to a feeling of community and “brotherhood” as we share our wonders and thoughts regarding for example the crayfish and its effect on the arctic char. We can discuss it, and, it might also attract the interest of the participants [24].

4.3. Uncertainty—Knowledge, Science and Epistemological Dimensions Considered

In one of the interviews, the project coordinator brought into focus what he thought was key knowledge for the management of fish, and stated the following:

There are two fundamental concerns: you need to have surveillance of the fish stock in order to know *how much* fish there is, *i.e.*, production, size and age distribution, and natural mortality. And secondly, you need to have knowledge of *how much is being caught*. In lake Vättern, the knowledge concerning catch is good, but only with regards to professional fishing, not leisure fishing [25].

The statement points to the need for information and knowledge for improving management. However, several of the participants stressed that the exact or “true” picture is not possible to gain. With regard to science and scientific results, one participant gave the following statement, commenting on the difficulties of interpreting science:

It is simply too complex. And there might be figures such as 10% or 8% of something, and then one simply has to keep in mind; this is about right [24].

Also with regard to scientific reports, the representative for the Lake Vättern Society for Water Conservation commented on the challenges of interpreting and understanding scientific results, stating:

Someone will ask about crayfish, ‘How dangerous are they for the lake?’, ‘Well, I have no idea’. So, that’s the trouble with science itself, there are no straight answers, only probabilities, and that’s disturbing. But, that is how we work, and 90% probability—that’s good enough [26].

4.4. Uncertainty and Invisibility

As fish live in water there is an inherent challenge in gaining information about their status as they are not directly visible. Some of the participants addressed invisibility as a major problem when managing fisheries and made a comparison between wildlife on land and that of the marine world.

If you take hunting as an example, it is pretty easy to estimate how much is out there and as a hunter you can actually count them. ... You can make a quite accurate picture of the

stand and how much to hunt, and you do not need to be well educated or a scientist but you need to have experience of hunting and have knowledge of how the animals behave. It is more difficult to know ‘how is the fish doing today?’ and ‘how much fish is there?’ [25].

One of the fishers also addressed invisibility:

There are number of things that have an effect (on the aquatic eco system and fish). It is not only the fishers and fishing, it is the environment itself, it is the weather, and, it is simply difficult to manage something that you cannot see [27].

5. Conclusions and Discussion

The role and importance of diverse knowledge and learning in decision-making, in the context of natural resource (co)-management, has been highlighted in recent years (e.g., [3]). There is growing interest in governance and policy research on participation, collaboration and stakeholder dialogues. Parallel to this, educational researchers have come to focus on the role and outcomes of groups working together to solve tasks. They have explored theoretically and empirically the social and cognitive aspects of group work, where terms such as “group cognition”, “distributed cognition” and “shared understanding” are used.

This study aimed at exploring divergence in views and the development of shared understanding in a co-management project on fisheries. The results show that the diversity of views at the outset to a large extent still remained after the meetings and dialogue. However, participants also developed shared understandings and changes in views could be observed. Over-fishing, as the cause for the decline of fish was generally accepted, although some perceived over-fishing in combination with other negative impacts to be the cause. Furthermore, the study shows that the participants had a desire to enhance shared understanding by ruling out crayfish as possible cause to fish stock decline. Through a jointly agreed investigation, this was in fact possible. The study also shows that a fully shared understanding is highly unlikely due to the complexity of the resource itself, and the unpredictability of such a complex socio-ecological system. It could be argued that complexity generally makes the development of a shared understanding more difficult. However, by bringing the aspect of uncertainty into decision-making and the management process in an explicit and strategic manner may well result in a shared understanding of innate complexity of the system [12,16].

Uncertainty, and the various ways it is described by the participants, can be compared to the terminology developed by [12], showing that it is understood by the participants in terms of: (i) gaining more information in order to reduce uncertainty (through generating information on catch and by conducting research on species effecting fish stock); (ii) the inherent complexity of the ecosystem (as in dynamic changes) and fishing stock (as in natural dynamic changes and other changes in relation to changes in the ecosystem); and (iii) how scientific results and investigations are uncertain, for example with regard to probability, and the need of interpretation and discussion within an epistemological framework. In addition, this research showed that phenomena that are invisible further exacerbate the problem of uncertainty, as was highlighted by one of the participants when comparing hunting and fishing: the environment and environmental phenomena differ in what is perceivable.

Reflecting on whether lack of shared understanding is problematic or not in resource management, and in particular in co-management arrangements, will likely vary and presumably depend on a variety of aspects: the dependency of a particular resource as income, the relationships among stakeholders, and type of resource and its complexity. In this case, the fact that over-fishing was seen as the main problem by most along with the ability to rule out other factors that could potentially become economically and socially problematic was important in order to proceed with decisions to sustain the resource and maintain group cohesion.

In this paper we add another context to the studies presented in the review by [17], which investigated shared understanding in the context of schools, academic life and organizations. The context in the present study is characterized by: (i) decision-making with economic consequences for (some) of the participants; and (ii) decisions which concern natural resources and the environment. Decisions concerning the environment and natural resources often also have an impact on aspects beyond the stakeholders of organizations and companies being present, for example on what is perceived as the public's (and future public generations') goods and resources. We believe these aspects add emotional and social dimensions to the investigations of shared understanding (see [28] for a similar argument). The emotional component is present in the conflicting interests of the resources and changing one's understanding and view might therefore be more challenging and less straightforward. The emotional aspect in turn relates to the social aspect, as changing a viewpoint can be seen by others in the group, or oneself, as a change in the social relationship to fellow stakeholders. In the review by [17], it is concluded that future research on group cognition could benefit from expanding on either a cognitive or socio-cultural perspective, and, furthermore, that "in order to better understand how team learning works and under which conditions it is effective, research on the processes in and through which group cognition is actually developing is promising" [17] (p. 56). This study takes a cognitive perspective on shared understanding but has also considered economic, social and emotional components as part of the context for learning. We believe it has proven fruitful, as it has identified challenges for teamwork aiming at shared understanding. In future research the emotional and social aspects of learning in groups could be specifically addressed and attended to (*cf.* [29,30]). Additionally, the aspect of "what" is shared, and the topic of group work and discussions also needs to be furthered considered: how does the complexity of a phenomenon (such as fish stock and eco systems) influence the possibilities of shared understanding and what challenges does it bring?

Finally, when considering cognition and social aspects thereof, the study brings forth issues of challenges with regard to methodology and data gathering. Interviewing participants on their views of causes to fish decline, with over fishing being a contested topic, can be uncomfortable for interviewees and does put certain individuals (representing groups) in a situation of implicit accusation. It was stressed to the interviewees that it was not of interest to pin a certain viewpoint to an individual or organization, and anonymity was guaranteed. Still, it is our impression this topic might have led the interviewees to be less straight forward in their answers compared to other topics where shared understanding is being investigated.

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Author Contributions

Lundholm conducted data gathering and analysis of data and both authors contributed in the writing of the article.

Conflicts of Interest

The authors declare no conflict of interest.

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