

The Importance of Trust and Legitimacy in the Management of Common-pool Resources (CPR): Lessons learned from implementation of a fishery co-management system in a complex society

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ABSTRACT

The aim of this paper is to provide insights into how the implementation of co-management systems can be a way of building trust between authorities and the users of a common-pool resource (CPR). In this paper, it is shown that a new co-management system can be triggered by an ecological crisis, and that trust and social factors are crucial for successful institutional development. This paper also discusses the definition of the concept of 'co-management' and the importance of scale and horizontal/vertical linkages in the management of CPRs.

It is concluded that managing fisheries with unexpected changes and complexity in linked social-ecological systems require actors (both fishermen and authorities) who learn from failures and, when necessary, initiate and achieve institutional change. The creation of social-ecological resilience can be looked upon as a process – a socially-generated collective good – which is likely to result in better governance systems. In this context, the role of institutions in building adaptive capacity and supporting collective rationality is important. To the extent that the conclusions derived from this case study are applicable to society in general, this would indicate that, in order to restore the legitimacy of and trust in policy making and governing institutions in society, more bottom-up processes with user participation and engaged citizens are needed.

Key-words: Common-pool resources, social-ecological resilience, governance, institutions, local management, collective action, trust, legitimacy.

1. Introduction¹

This paper uses a case study relating to the regulation of the fishing of vendace (whitefish) in the Gulf of Bothnia to illustrate a common dilemma in the governance of a *complex common-pool resource (CPR) problem*.² The aim is to provide insights into how implementation of co-management systems can be a way of building trust between authorities and the users of a CPR.

¹ This paper has its point of departure in a PhD thesis – *Flipping the Pyramid: Lessons from Converting Top-down Management of Bleak-roe Fishing* (Rova, 2004) – presented in December 2004.

² Fish stocks can be seen as common-pool resources which have two important characteristics. The first is *excludability*: the physical nature of the resource, or the legal and other instruments that govern it, are such that controlling access by potential users may be costly and, in the extreme, virtually impossible. The second basic characteristic is *subtractability*: each user is capable of subtracting from the welfare of other users. As with private goods, the resource units of CPRs share the characteristics that one person's consumption subtracts from the quantity available to others (Ostrom, 1990).

The dilemma essentially is this: fishing, as is well known, suffers from a structural collective action problem in which contradictions arise between what is individually and collectively rational behaviour on the part of actors.³ Without appropriate institutions and, accordingly, without incentives for individual fishermen to limit their landings, a situation can arise in which catches voluntarily reduced by one fisherman only result in increased catches by another. Regulation is needed to overcome the collective action problem, if there is to be sustainable development of the fisheries. Consequently, fisheries could not exist without an appropriate institutional arrangement, because fishermen “would simply not know how to behave” (Jentoft, 2004:138).⁴ This is the major theme in this paper.

2. Governance of a dynamic, diverse and complex natural resource

It is a well-known fact that, independent of whether a fishery is formally regulated by political-administrative methods or not, a rich variety of actors and interests influence the structure of every fishery system. The success of a fisheries management regime depends upon how it is perceived by stakeholders. Stakeholders not only provide legitimacy, knowledge and implementation capacities, but can obstruct the implementation of regulations when refusing support. Thus, questions like “who governs what, when, to whose benefit and why?” in a particular fishery cannot be answered by reference to formally spelled-out rules and regulations. It is an empirical question. In this paper, it is assumed that the extent to which it will be possible to tailor good management regimes for the Swedish coastal fisheries will be a matter of *governance* rather than *government*.⁵

Contrary to the notion of government, which typically refers to “the government” or to actions performed by central parts of the State, the concept of governance often is associated with forms of governing, whereby the focus has shifted from formal organisations and hierarchical management to informal organisation, coordination and complex interactions among a wider range of actors (Björk et al., 2003). An important distinction between governance and government is that the former considers the concepts of transaction costs and behaviours that link institutions to individuals, “concepts that remain external to the narrower

³ Collective action refers both to the process by which voluntary institutions are created and maintained and to the groups that decide to act together.

⁴ In fisheries management, the regulatory aspect of institutions generally is the one emphasised, but institutions do not only create restraints. They confer rights as well as responsibilities; for example, by providing fishing licenses. Institutions also define what is appropriate for a particular person to do, what is required of the fishermen, what is morally acceptable and justified, and so on.

⁵ A management regime is defined by an establishing law or document which defines a management institution which “empowers the institution, and set goals for it to achieve” (Holling et al., 1993:27).

terms of *government* and *control*” (Hanna, 1999:276). Thus, governance can be seen as a way of reaching a more complete understanding of multiple levels of action and the different kinds of variables that can be expected to influence performance in a natural resource system. Hence, governance conceptualises fisheries management differently than traditional top-down government: “the governance approach takes into account that the fishing industry forms an interactive socio-economic and ecological system embedded in institutions, social networks, and cultures” (Kooiman et al., 1999:260).

In the literature, there are numerous examples of traditional societies that have succeeded in regulating harvesting and access to different common-pool resources with *bottom-up governance* – i.e., self-governing. Users have created self-governing institutions (rules and norms) to overcome collective action problems. Much of this research has focused on locally-situated small user groups and communities (see, for example, Baland and Platteau, 1996; Bromley, 1992; Ostrom, 1990; Pinkerton, 1989; Tang, 1991). Notwithstanding the fact that many of these traditional management systems have some form of common management, they often have been undermined by privatisation and government policies driven by the belief that they are under open access. In a pure self-governing system, fishermen are in sole control of their fishery. However, in a modern and complex society, many external factors can affect resource use. When a market develops for a resource like fish products, it can put pressure on the resource, resulting in increased production for sale that undermines traditional management. Increased pressure and integration with the surrounding society also can undermine management. Traditional societies potentially may fail to adopt rules other than those “answering the rather immediate need to regulate access to the local CPR, and this failure may possibly take place even when vital resources are threatened with depletion or degradation” (Baland and Platteau, 1996:210). It, therefore, is argued that it is doubtful whether totally autonomous self-governance is a realistic option for a complex and diverse fishery in a modern industrialised society – i.e., it is uncertain whether these institutions would be capable of tackling the range of management responsibilities demanded by modern fisheries (Symes and Phillipson, 1999:64).

Top-down governing (hierarchical governing) of fish resources often relies upon centralised command and control decision-making, and is based on legal and administrative tools. The reasons that many top-down systems fail to manage natural resources are numerous and complex. The most important of them – which usually have the effect of reducing the incentives of local users for managing resources in an ecologically-sound manner – are high information costs, lack of adequate monitoring devices, lack of trained personnel and/or

financial resources, and subordination of environmental concerns to shorter-term economic or political interests (Baland and Platteau, 1996:346). Management of fisheries is a “diverse, complex and dynamic phenomenon” (Kooiman, 1999:3), and these complexities of the ongoing ecological process often result in imperfect knowledge.

Accordingly, the basic problem with fisheries is one of governance. Top-down governing emphasizes legal incentives, while a bottom-up perspective emphasizes normative incentives that influence fisheries and fishermen. Yet neither bottom-up nor top-down approaches to regulation can be expected to work on their own. Bottom-up approaches lead to insufficient conservation, since there are wider public interests in conservation that are unlikely to be fully internalised into the calculations of fishermen themselves. On the other hand, top-down approaches fail, first because fisheries are a complex and unstable ecological system that only can be managed with significant local knowledge; and, second, because rapid and continuous feed-back loops are needed between those operating on the ground and those defining the rules for sustainable fishing. Thus, there are no basic and fixed governance structures that apply to all types of fisheries; “all involve tradeoffs between stability and flexibility, authority and representation, social and individual” (Hanna, 1999:280). To cope with the dynamics in the ecological system, each system needs to reflect on how to best incorporate stability and consistency, while retaining flexibility and adaptability.

2.1 Ecosystem dynamics and resilience in fisheries management

One of the most important concepts necessary for understanding sustainable use of renewable natural resources like fish stocks is that of *resilience*. Resilience, as defined by the Resilience Alliance (2002), is a measure of the amount of change a system can undergo and still retain the same control on function and structure; the degree to which the system is capable of self-organisation; and the ability to build and increase the capacity for learning and adaptation (www.resalliance.org). Thus, resilience can be seen as a measure of robustness and buffering capacity in the face of disturbance and emergent behaviour; i.e., changing conditions. A resilient fishery can withstand shocks and remain in a functionally similar state – thus, increased resilience moves the resource system away from thresholds. Reduced resilience increases the vulnerability of a resource system to smaller disturbances that it previously could handle, and there is a high risk of shifting into a qualitatively different state – hence, loss of resilience moves the resource system closer to thresholds (Berkes, 2002:313f). Once thresholds have been exceeded, changes can be irreparable. Due to their complexity, the predictability of ecosystems is limited and restoring an ecosystem to its

previous state can be expensive, complex and sometimes impossible. Sustaining ecological resilience is strongly linked to and dependent upon social mechanisms in management (Berkes et al., 1998, 2003).

Having the capacity to deal with ecosystem dynamics requires relevant knowledge of the social system. This knowledge can be acquired as a collective learning process that evolves with ecosystem change (Folke et al., 2003). Thus, effectively managing ecosystem uncertainties requires adaptive approaches and a system of continuous learning, so as to expand knowledge and practices to interpret and respond to ecological feedback (Olsson, 2003). *Adaptive co-management* can be the path used to succeed with this demanding task. This approach emphasises *learning-by-doing*, as well as the importance of resource users' localised ecological knowledge. In this context, the level of social resilience in a social-ecological system is a key factor in promoting individuals to adapt to ecological change. In this paper, social resilience is defined as “the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change” (Adger, 2000:347). Adger also emphasised the “fairness in representation”, meaning, for example, that resource users should participate in decision making. There must be fairness in both procedures and institutions, which is a great challenge for environmental governance (Adger, 2003).

In fisheries, two coupled frames of resilience – which span from the individual fish to the human societal-level – can be measured: (1) At the stock level (i.e., the ecological level), *resilience* is defined as the ability of the stock to recover from variations in stock size, spawning biomass and reproduction rates – due to the fact that a fish resource is a fluctuating resource, some level of variation is normal as long as central functions are maintained. (2) At the social/institutional level, resilience is evaluated according to the social system's capacity to change, reduce vulnerabilities, and support adaptation to meet new ecological, social, and economic circumstances. Thus, social resilience is understood and measured in terms of *adaptability* and *transformability*. On the other hand, to enjoy legitimacy and trust among stakeholders, institutions should be stable and settle on rules with some level of stability over time (North, 1990). This is, to some extent, a paradox and a challenge for adaptive management.

Generally, if a governing system acquires new knowledge, its adaptability is considered good. If the system can reorganise, using this knowledge when new circumstances (social, political or environmental changes) make this necessary, its transformability also is considered good. One could expect that, due to the fluctuating nature of fish resources, social-

ecological resilience, by necessity, entails ongoing processes of learning-by-doing. In this context, social resilience can be seen as a measurement of governance structures' abilities to adapt and innovate, when new conditions make this necessary. Consequently, given the varying and fluctuating nature of fish resources, proper functioning is sustained when the management system is allowed to develop and renew itself, and ecological resilience is combined with social/institutional resilience (Rova and Carlsson, 2001:324). This is the *working hypothesis* of this study, exemplified by the case of coastal fishing in the Swedish County of Norrbotten.⁶

3. Bleak-roe fishing in Norrbotten

The fishing of vendace (*Coregonus albula*), in the northern part of the Gulf of Bothnia, is a good illustration of the type of problems that have been described above (Rova, 1999, 2004, Rova and Carlsson, 2001). Vendace (*siklöja* in Swedish) is a local species of whitefish that belongs to the salmon family. The roe (eggs) from the fish, known as *bleak-roe*, are of high commercial value.⁷

For a long period of time, bleak-roe fishing has been regulated extensively by the state with a classical top-down management approach. The trawl fishery in Norrbotten started in the 1960s and led to strong increases in bleak-roe catches. Since trawling started, the economical importance of bleak-roe fishing for commercial fishermen in Norrbotten has been significant. It is a seasonal fishery and the fishing season is, by law, restricted to the period from the end of September through the end of October.⁸ Despite the fishing season being just over a month, the long-term survival of the commercial fishing fleet in Norrbotten is very much dependent upon this fishery.

In the 1990s, the economic importance of bleak-roe fishing declined, due to decreased catches (Hasselborg, 1999-06-22). During this time, the National Board of Fisheries estimated that the stock was below a sustainable level, or would be if fishing continued with the same intensity. The recommendation was that fishing capacity should be reduced (Thoresson and

⁶ This study is built on data collected from three main sources: (1) Semi-structured in-depth interviews with 31 of totally 39 fishermen who hold trawl fishing licenses were conducted. Additionally, interviews with officials at the National Board of Fisheries office in Luleå also were performed; (2) These interviews were complemented with various written material, which included meeting proceedings, program documents, reports, official statistics and other official documents. (3). Other data sources have been used, such as telephone interviews, direct observations and participant observations in bleak-roe fishing and in meetings with the trawl fisher group and officials.

⁷ In the study area, fresh-water species like vendace are caught in salt-water fishing in this area (the Swedish County of Norrbotten) because the water is highly desalinated, owing to the input of fresh water from major rivers. The Baltic Sea is the largest brackish water area in the world (ICES, 2003:9).

⁸ The exact date varies from year to year, but usually fishing is allowed from September 20th until October 31st.

Sandström, 1997:5-18). Given that the bleak-roe fishery is rather geographically-limited and fairly regulated, the seriousness of the crisis is somewhat puzzling. Notwithstanding the fact that good statistics have been available to regulating authorities, how can it be explained that this resource crisis occurred, despite extensive top-down regulation by the state, and despite the resource being non-migratory and concentrated in a rather limited area? If the discussion in the previous sections is right, the answer should be found in a significant lack of social-ecological resilience.

However, in the year 2000, the downward trend was broken and catches started to increase. As shown in Figure 1, the catch statistics for 2003 are on the same high level as the record years in the 1970s and 1980s. Certainly, one could say that catches have increased considerably. Perhaps this increase can be explained by an increase in effort? This is not a valid explanation though; in fact, considering the decrease in trawl-teams, the situation is even more remarkable.

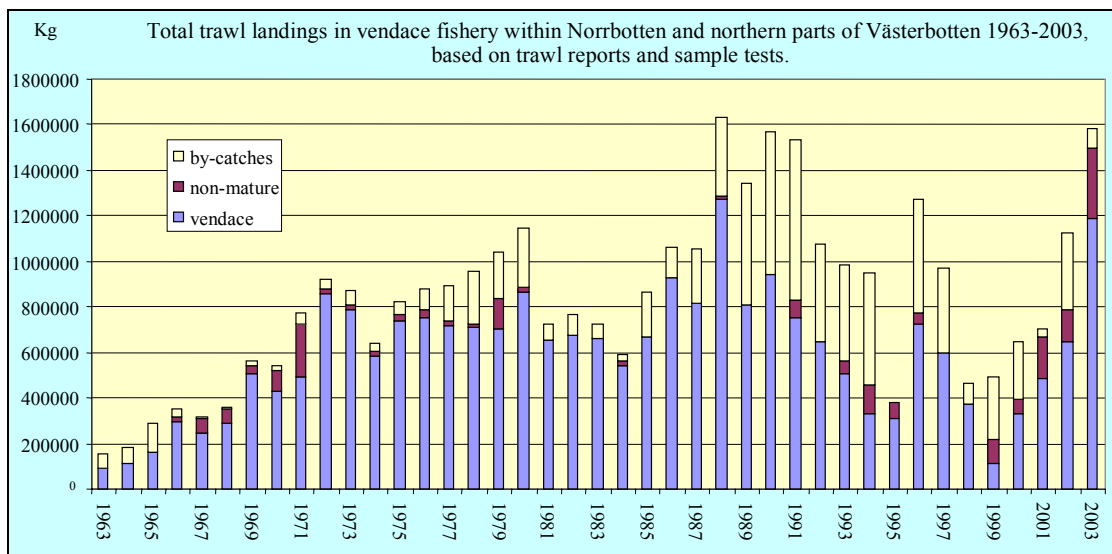


Figure 1. Total trawl landings in vendace fishery 1963-2003, based on trawl reports and sample tests (data from the National Board of Fisheries Research Office in Luleå 2004-04-15).⁹

From 1999 onwards, there have been approximately 20 trawl-teams. For the period 1994 – 2003, the number of trawl licenses decreased by 37 percent. The remaining teams have been restricted to certain areas, as well as in the hours they could fish; even so, they have landed very high catches. However, the mean age of the vendace stock remains low and a large share

⁹ The diagram is based on trawl reports and sample tests. Usually, by-catches consist of herring, whitefish and smelt. Non-mature is, accordingly, not sexually mature vendace i.e., juvenile vendace (data provided by the National Board of Fisheries Research office in Luleå 2004-04-15).

of vendace catches consists of young individuals. At the same time that catches have increased, the time spent in bleak-roe fishing for 2003 has been reduced by five percent (around 100 hours) compared to 2002. In comparison with the time period 1994 – 2001, the time spent in bleak-roe fishing had decreased by 63 percent in 2003. Since 1999, the hours spent in bleak-roe fishing have decreased from 5,100 hours in 1999 to 2,300 hours in 2003 (Hasselborg 2004-04-15). Surely, there has been an increase in efficiency.

This positive development has continued during the last few years and a change has not only occurred in the ecological system, but also in the social system; how can this change be understood in terms of governance? How and through what mechanisms have these changes affected the resource?

3.1 An analytical case study: institutional change in bleak-roe fishing

The bleak-roe case is believed to provide a good illustration of a deliberate attempt to handle a resource crisis by transforming a conventional top-down management system into a new governance system, guided by intentions to make the fishery become more effective (in terms of generating annual incomes to fishermen) and also more sustainable than previously. Many problems pertaining to the unsustainable management of natural resources worldwide have been due to a limited number of basic governance shortcomings, such as ill-defined property right definitions, leading to open access, or insufficient enforcement of existing rules.¹⁰

This is, however, not the situation in the bleak-roe case; the property rights system has been well-defined with extensive state governance, since trawling started in the early 1960s. Formal rules, implemented by state agencies, have been supervised in a rather limited area by a comprehensive control system, involving both the National Board of Fisheries and the Coast Guard. In addition, there is no indication of deliberate infringements of rules and regulations. Sweden has a low level of corruption and a high level of scientific knowledge and competence. Even with these favourable conditions, and despite good intentions, it seems like top-down management produced an unsustainable fishery, seemingly governed by catch-maximising intentions among fishermen (Rova and Carlsson, 2001). What are the main determinants for this ecological and institutional failure?

¹⁰ The term ‘property’ covers the range of institutions governing access to a particular stream of benefits. Property regimes usually are divided into four categories: open access, state, common, and private property.

Experience has shown that institutions of collective action and property rights play an important role in how people use a fish resource, which, in turn, shapes the outcomes of the fishery. The migratory nature of fish resources and the large area to monitor make regulations heavily dependent upon voluntary contributions and the cooperation of fishermen. Without this understanding, there is a risk that decision-making will be driven by short-term maximisation, without adequate concern for long-term consequences. In complex societies, like Sweden, common-pool resource use (e.g. fish resource use) is not isolated from the surrounding society; instead, it is nested in the political, legal, and economic environment that are a part of both the CPR system and the surrounding society. Institutions interact with one another, both horizontally (i.e., on the same level of social organisation) and vertically (across levels of social organisation) (Young, 2002:264). Thus, since society consists of layers of institutions, centrally-decided management policies might experience difficulties penetrating through all the institutional layers of society. For example, policy decisions made at the National Board of Fisheries in Gothenburg might have difficulties being accepted and put into practice in the day-to-day decisions made by the local bleak-roë fishermen in Norrbotten. Moreover, technology, qualities of users, and the resource itself also affect resource use and the potential to manage the resource in an effective and sustainable manner.

Presumably, conditions have not been favourable for a local management system for bleak-roë fishing. The current generation of fishermen lacks experience in self-management. They have performed their fishing in an environment of extensive state regulation, where the state has taken full responsibility for when and how bleak-roë fishing should be performed. Today, there is no single group of fishermen that participates in bleak-roë fishing. Recreational bleak-roë fishing is open for all, as long as one follows prescriptions regarding gear use. The trawl group consists of fishermen from almost all coastal communities in Norrbotten. Thus, the user group is not heterogeneous, and the pre-conditions for joint collective action among users probably are not advantageous. Heterogeneity generally is expected to affect prospects for collective action; for example, sharing important social, cultural or economic characteristics may facilitate collective action (Poteete and Ostrom, 2004:441). Another factor that affects the fishery is the development of technology. The technological development of trawls, vessels and equipment has been extensive since the 1960s and, as a result, the increase in catch effectiveness for each vessel has been considerable.

3.2 Changes in the vendace system

Due to rapidly diminishing catches and a dramatic stock decrease, together with significant pressure to reorganise the management system, the trend in the vendace system was towards a deep crisis in the social-ecological system in the late 1990s (Rova and Carlsson, 2001).¹¹

To prevent further over-fishing, officials from the National Board of Fisheries proposed extensive restrictions in trawling areas, which provoked anger amongst trawl fishermen. As a response to poor performance and the threat of withdrawal of trawl areas, the fishermen themselves, through the *Swedish East Coast Fishermen's Association* (SOC), exerted considerable pressure to develop a co-management system that involved the sharing of power and responsibility between the Board and the trawl fishermen. The Board's Coastal Research Institute drafted a proposal for a new management arrangement and, in August 2000, the Board decided that no further restrictions should be implemented before a test with local management had been evaluated (Thoresson et al., 2001; Fiskeriverket, 2001). Consequently, before the fishery started in 2000, a self-governing programme was implemented. According to the Board's decision, it was SOC's responsibility to create a suitable management organisation. However, it should be emphasised that no formal authority was delegated to the SOC, and that management of vendace was, and still is, performed within the limits of the fishing law (FIFS 1993:31). The purpose of the project, according to the Board, was to carry out self-management "within the law", but the fishermen should have the potential to sharpen regulations (Fiskeriverket, 2001). It also was stated that control and supervision were the Board's responsibility, and should be carried out in accordance with previously-established routines. Furthermore, the management group should have no formal authority to impose sanctions (Fiskeriverket, 2000-09-25; Hasselborg 2004-01-22).¹²

A management group – which included six representative trawl fishermen, the president of the SOC, the Board's Research Office in Luleå, the County Administrative Board, and a biologist from the Board's Institute of Coastal Research – was created. However, the six trawl fishermen in the group have full responsibility for coordinating and making decisions to sharpen regulations pertaining to the fishery. These six members were elected by the trawl

¹¹ The development of the vendace system corresponds very well with Holling's and Gunderson's (2002) theory of system crisis; viz., that it is only at points of deep crisis in both the ecological and the social system that fundamental conceptual and structural changes are possible.

¹² In the original plan from the Board's Institute of Coastal Research, the intention was to delegate full responsibility for control and management to the fishermen during 2002 (The National Board of Fisheries Institute of Coastal Research, Plan 2000-08-25). Still, in 2006, this has not been done.

fishermen.¹³ Initially, the management group made some quick decisions, before the fishing season in 2000: (1) In order to deal quickly with changes during the fishing season, it was decided that information concerning the condition of and changes in the resource should be spread by VHF or cellular telephone. For example, if the share of juveniles appeared to be disproportionately large, or if other factors made a particular bay unsuitable for trawling, this information should be spread quickly among the fishermen. (2) It was decided to cut down the trawling period (by seven days) and the co-management group also shortened the time for trawling during the day (from 06.00 – 17.00). Additionally, the management group forbade trawling on Fridays and Saturdays (earlier, there had been no limits regarding hours during the trawling period). (3) Bays with disproportionately high shares of juveniles were excluded from trawling, and the group decided to stop trawling in other bays if the share of non-mature vendace was too high. It should be noted that the excluded areas were almost the same as the areas proposed earlier by the Board; something that, at the time, invoked significantly negative sentiments among the fishermen. (4) To prevent catches of non-mature vendace, a decision was made that all trawls must be equipped with selection panels; meaning that fewer juveniles would be caught in the trawls. (5) As a complement to the Board's catch samplings (by random control of trawl catches and by test fishing), it was decided that every trawl-team should do their own samplings and send the results to the Board's Coastal Research Office (Ostkustfiskarna PM. 2000-09-12; Thoresson et al., 2001; Fiskeriverket, 2001).

These measures have remained quite stable, with only small adjustments since 2000. For example, in 2003, the fishermen's own samplings were conducted on a daily basis and the hours for trawling were reduced further (06.00 – 15.00). There also have been many heated discussions whether the time had come to open up some of the closed areas. Another hot issue has been whether the management group should have formal authority to impose penalties or not (Meetings with the management group on 2003-09-08 and 2004-01-29; Hasselborg 2004-01-22).

To summarize: changes have been made in the management that has dominated the vendace fishery for decades. At the same time, it should be emphasised that formal institutional changes, in terms of laws and regulations, have been insignificant. Bleak-roe fishing still is regulated by national law (FIFS 1993:31), and the only power that has been delegated to the collective of fishermen is the right to sharpen regulations. As has been noted

¹³ However, all the meetings with the management group are not particularly formal and, in practice, interested trawl fishermen are free to participate (Meetings with the management group, 2003-09-08 and 2004-01-29).

in this section, the fishermen have utilised this right and have imposed further restrictions, immediately, when needed.

4. Evaluating co-management in bleak-roe fishing

Recreational and subsistence bleak-roe fishing possess some fundamental qualities of social resilience. For example, fishermen easily can vary the intensity of use. In times of decreasing catches, and if a recreational fisherman is not rewarded for his effort, he always can withdraw from fishing. This is exactly what happened in bleak-roe fishing during the 1990s. Thus, the system is, to some extent, quite self-regulating, because fishermen go ashore when times are bad; and when the resource returns, they may enter the arena again. However, after the crises in the 1990s, when catches started to increase, recreational fishermen did not enter the bleak-roe arena again, due to changes in the social-ecological system; i.e., the boost in the grey seal population and the ‘new fishing law’ (1993) which restricted the number of nets for recreational fishing.¹⁴

In the present-day situation, all trawl fishermen participate in other types of fisheries (e.g., salmon and whitefish), which means that, if bleak-roe fishing is not working well, they can put more effort into other fisheries. “It is lucky that I had decent incomes from the salmon fishery during the bad bleak-roe years. Otherwise, I would not have survived” (Fisherman, 12). Notwithstanding the fact that bleak-roe fishing is the most economically-important fishery, the fishermen in Norrbotten still can alternate and put more or less emphasis into different fisheries (and species), depending upon the supply. If this had not been the case, there certainly would have been even greater pressure on the resource during the bad years. However, this also was a problem before local management was implemented.

One can note increased engagement in and concern (collective rationality) for the resource among the fishermen. This was accomplished in association with quick decision-making at the local level; something that is proof of better adaptability within the social system. The trawl-group’s self-imposed regulations, together with the law, govern day-to-day decisions in the fishery. According to the fishermen, these regulations are more compatible with the special circumstances and local conditions of the vendace resource, versus the previous type of governance (Rova, 2004). One positive result of these self-imposed regulations is that fishermen change bays, if they catch too many non-mature vendace. Obviously, fishermen

¹⁴ Since 1990 and until 2002, the average growth rate of the grey seal population in the Bothnian Bay was 11 percent per year (Helander and Karlsson, 2002:24). The fixed gears used by recreational fishermen are destroyed by the seals which also frighten away the fish from gears.

have the capacity of making such adjustments. “We, who spend so much time out at sea, can see where you should trawl or not, and with self-management, we can call off a bay one day and, as a result, no one is trawling in that bay the next day” (Fisherman, no. 15).

The new management system has been able to make significant quick decisions when this has been necessary; for example, regarding adjustments in trawling areas when the shares of non-matures were found to be too high. Based on our interviews with fishermen and with representatives from the authorities, one can conclude that, currently, there is an ongoing process of discussion to improve the fishery. This process involves dialogue among the fishermen, and between the fishermen and representatives of the Board’s office in Luleå, as well as with biologists at the Board of Fisheries Research Institute. The potential for fishermen to test and impose restrictions, in accordance with their local knowledge, instead of obeying general regulations from central authorities, also contributes to the resource system’s ability to quickly handle disruptions and new ecological conditions.

One also should note that the current management process also involves repeated tests to obtain better selection panels on the trawls and, accordingly, to save non-matures in the fishery. All this can be seen as an *increased learning-by-doing capacity* (i.e., adaptability) which is essential in promoting social resilience. Consequently, at the level of operational rules, the adaptive capacity has improved. To some extent, the governing authorities actually re-organised, in connection with the 1990s’ crisis, and made necessary institutional changes (i.e., transformability). They changed the rules of the game, by reducing the number of trawl-teams and implementing a co-management scheme. The reduction in trawl-teams seems to have been an almost necessary condition to succeed with local management – i.e., according to the trawl fishermen, the present number of trawl-teams is in harmony with the technological improvements and the fluctuating nature of the resource (Rova, 2004). Thus, since the year 2000, the capacity to adapt and innovate, both at the constitutional-choice (fishermen are accepted as a legitimate part of the system) and collective-choice (fishermen participate in the decision-making process) levels has improved.¹⁵ To summarize, it can be concluded that *social resilience has increased since the new co-management system was implemented*.

As has been noted, the negative trend in the total stock of vendace appears to have reversed, with the resource stock now slowly beginning to rise. There has been a boost in

¹⁵ According to Kiser and Ostrom (1982), there are three levels of rules that shape institutional arrangements: operational rules, collective-choice rules, and constitutional-choice rules (for further discussion, see Kiser and Ostrom 1982, Tang 1991 and Imperial 1999).

catches over the last few years, which indicates that spawning has been successful. Nonetheless, even though slightly improved, catches still consist of too many juveniles, and the mean age of the stock remains too low. All experts agree that, without an adequate age structure, the stock is more vulnerable to disturbances, shocks and ecological changes. However, compared to the situation in the late 1990s, recent developments appear to be heading in the right direction. Work with selection panels continues and some progress has been made. If the development of selection panels on trawls continues and is successful, resilience probably will increase even more, consequent to the policy of saving non-matures at sea. The high share of non-matures and the relatively low mean age also might be seen as an indication of a high functioning ecological system, evidenced by successful spawning. The increased concern – from both the authorities and the fishermen – about how surrounding factors are believed to affect the resource also is notable. The number of trawl-teams has been reduced. The consequence of this change has been that, during good years when there are plenty of fish to be caught, there are fewer teams that just catch the amount of fish they can handle (i.e., squeezing capacity), leaving more vendace in the sea.¹⁶ During bad years, the number of teams that are striving to reach their catch capacity has been reduced. The reduction of trawl areas, a reduction implemented by local management, has resulted in an extension of designated untouchable areas, where vendace can spawn and grow up. This will improve the age structure in the vendace stock.

Together, all these factors indicate that the buffer capacity has increased in the system, and, compared to the situation in the late 1990s, not only social resilience, but also *ecological resilience* has improved.

4.1 Through which means has this development been accomplished?

The increase in collective action has resulted in more engagement in and more adherence to rules and regulations among the fishermen. Thus, they look further than just today's catches. If the Board alone had imposed the restrictions in trawl areas without the current co-management system, it is debatable whether the restrictions would have had any effect. Without the legitimacy of regulations that local management generated, given the reactions

¹⁶ The so-called “catch limitation” in the handling of catches – a fisherman only catches as much as there is capacity to squeeze roe – during good years, can be seen as a positive condition in promoting ecological resilience (i.e., increasing buffering capacity) during these years. However, to reach the catch capacity during bad years, fishermen spend more and more hours on the trawlers to chase enough vendace to fill up their handling capacity. With this strategy, fishermen try to catch as much as possible, even when the stock is decreasing, having the effect that the system becomes more and more over-taxed and the buffering capacity decreases.

among fishermen when these restrictions once were presented, the legitimacy of management would have been perceived to be very low and the costs for monitoring (transaction costs) would have been very high.

A natural resource, like vendace, can be seen as a constantly moving target. This, in turn, puts pressure on the governance system to be adaptive and flexible, on one hand, and stable enough to be able to enjoy legitimacy among the stakeholders involved, on the other hand. Thus, besides being adaptable to ecological conditions, a governance system for a natural resource, like vendace, must support learning-by-doing, must create trust, and must enable collective action and economic gains for the users. Consequently, any positive development is the result of coping with the fluctuating nature of the vendace resource and the qualities of the governance system. When it comes to vendace, this is not only the result of local management, but also a result of the Board's authority, especially its decision to reduce the number of trawl licenses, which made the pre-conditions for success with co-management advantageous.

However, the only formal change that has been made is that the trawl group has received the "right to impose further sanctions". How can one explain that such small formal changes in governance can affect its performance to such an extent?

4.1.1 Homogeneity among the group of resource users

After the extensive reduction in recreational/subsistence fishing, and the reduction in trawl licenses, the user group is smaller and rather homogenous. The reduction of trawl licenses by the Board in the 1990s affected institutional performance in a positive way. Having a smaller and more homogenous group of appropriators was a good start for local management. If the group would have been too large, likely it would have been very difficult for the local management system to reduce the number of licenses among its own members.

An overwhelming majority of the fishermen are of the opinion that subsistence/recreational bleak-roe fishing does not affect the trawl fishery at all, which means that no other group is competing with the trawl fishermen in this arena. A conclusion that can be drawn from interviews is that, nowadays, the trawl group seems to have a rather united view of bleak-roe fishing, both with respect to the earlier and present systems, and with respect to future governance. To most questions, the fishermen's answers are almost identical, and no major disparity can be seen in answers from respondents in different geographical areas (Rova, 2004).

4.1.2 Increased social capital and learning-by-doing capacities

According to Poteete and Ostrom “[t]he predicted correspondence of small group size with homogeneity of interests provides [...] reason to expect size to influence prospects for collective action” (Poteete and Ostrom, 2004:443). Compared to the situation in the 1990s, there currently are more contacts, more frequent face-to-face communications, and a greater degree of co-operation between the users. Thus, there has been an increase in social capital. Generally, high levels of social capital lower the transaction costs of working together; “people have the confidence to invest in collective activities, knowing that others will do so too” (Pretty, 2003:1912). This definitely has been the case with bleak-roë fishing. Fishermen’s own rules are regarded as ‘holy’ and breaking them raises an outcry – i.e., trust and rule compliance within the system both have increased.¹⁷ There also is greater awareness of and engagement in resource conservation, and commitment to sustain non-matures for future fishing (Rova, 2004). This development is remarkable, due to the long history of centralised top-down management by the state. Earlier, the governance system generated few incentives for fishermen to engage in management, or in resource conservation.

The willingness to impose and follow regulations is much higher with bottom-up approaches. Before the co-management project was initiated, the trawl fishermen reacted very strongly against the proposal from the Board to impose further restrictions in 2000. When the fishermen had their own management system, they implemented more or less the same restrictions as the ones they so loudly criticised before. The difference was that the trawl fishermen accepted these restrictions, as they had been allowed to participate in their development and implementation.

All this implies that, contrary to the “tragedy scenario” (see Hardin, 1968), if a group of resource users is homogenous and small, and has fairly clearly defined boundaries, and if the ecological resource mostly is non-migratory, fishing can be accepted to have a certain degree of uncertainty. Thus, bleak-roë fishing is a game wherein the players *learn* how to act to achieve collective goals (Axelrod, 1987, Kinzig et al., 2003). Ecological knowledge about the vendace among biologists and researchers is not complete; nor is this knowledge inherent in the local group of fishermen. But, as the vendace case demonstrates, both might have a

¹⁷ In 2003, one trawl-team intentionally violated the restrictions and trawled in a closed bay for a couple of hours. The problem is that, formally, this trawl-team did not break any law. Despite the fact that the areas in question were declared closed by the local management, they were open according to the fishing law. Without any formal rights to impose sanctions, the collective could not expect any actions from the authorities. However, information about the infringement was spread quickly among the trawl fishermen. They acted immediately and held a meeting the next day with all trawl fishermen who were able to participate. A heated discussion was held with the guilty trawl-team and there were no further infringements in the fishery (Rova, 2004).

constructive and important role to play. “The success of adaptive management will depend on fisheries managers and fishers keeping an open mind to work together and share knowledge” (Pomeroy and Riviera-Guieb, 2006:167). It has been verified that fishermen relations with the Board’s Office in Luleå and with the responsible biologist at the Board’s Coastal Research Institute have improved (Rova, 2004). This might be an excellent start to creating fruitful long-term co-operation between fishermen and the authorities. Through increased engagement and co-operation, also between authorities and fishermen, important knowledge has, to some extent, been put into practise; for example, this was demonstrated by the trawl-groups testing different selection panels and their changing bays when new ecological conditions so require. All this can be seen as important parts of a learning-by-doing process, which serve as building blocks for further adaptive management of the vendace resource.

The bleak-roë case demonstrates that, once a group of users receives appropriate incentives from the authorities – in this case, permission to participate in bottom-up processes for implementing operational rules – this may promote collective action, even in a system with a tradition of top-down government. In the initial stages of bottom-up bleak-roë resource management, it obviously has been enough to have “the right to impose further sanctions” to encourage co-operation and engagement within the group.

4.1.3 Rules-in-use and monitoring

Bleak-roë fishing is formally regulated by the government, with its authority delegated to the Board in Gothenburg, and the collective-choice rules, as well as the constitutional-choice rules, are the authorities’ responsibility. The operational rules also fall within the jurisdiction of the Board. However, in practice, and as long as they work within the law, the fishermen design their own operational rules. The trawl fishermen are allowed to impose further restrictions (i.e., with respect to fishing times and trawl-areas), but cannot modify the regulations that are stipulated by the fishing law. Together with this law, the self-imposed regulations govern day-to-day decisions in the fishery and, according to the fishermen, these regulations currently are more compatible with the special circumstances and local conditions of the vendace resource than previous regulations were. As a result, the fishermen respect and follow their own rules to a much greater extent than rules imposed by the authorities (Rova, 2004). The *rules-in-use*, which currently govern the bleak-roë fishery, are these self-imposed operational rules combined with the rules of law.

The ultimate test of the current co-management system will happen on the day fishermen try to open up closed areas for trawling, or the next time there is a resource crisis and the

group must impose extensive regulations and perhaps take further and more radical steps. It is much easier to govern a fishery when the resource is increasing. Even though individual fishermen and officials might have had doubts about the concept of local management before it was implemented, the boost in catches has made it easier to accept, and easier for the new management system to develop legitimacy. Hence, the system largely has been legitimized by its success (Van Kersbergen and Van Waarden, 2004). However, the developments in collective action, engagement and concern have increased the likelihood that the system will function properly even in bad times. The bleak-roe case shows that, when transforming a governance system, it is important for policy makers to have the right timing for implementation. As was done in the bleak-roe case, authorities also should create favourable conditions for the new system. For instance, if there are any difficult decisions that have to be made and that, presumably, might create division and mistrust in the group, the authorities should make these decisions before implementation. A good example is the Board's reduction of the number of trawl licenses, before local management was put into practice, which played an important role in the new system's successful start.

While *monitoring* still is a responsibility of the authorities (i.e., the Swedish Coast Guard), no one has the formal responsibility for monitoring the restrictions that have been imposed by local management. In practice, these restrictions are monitored by the fishermen themselves. The trawl fishermen seem to be a group that monitors each other very well. They all know each other, as well as what is happening within the group. Fishermen also give witness to the existence of social pressure, which influences any trawl fishermen who have violated a rule to take into account the social cost of this behaviour. Cheating on your colleagues has a price, in terms of distrust and the risk of being labelled an outsider in the collective of fishermen. To the extent that this informal system functions, the trawl fishermen in the vendace system constitute a group which easily can prevent free-riding by monitoring each other, also in relation to other issues. The fishermen also emphasise that, in order to solve problems that constantly pop up, they currently discuss more with each other than they did before (Rova, 2004).

5. Adaptive co-management as a learning-by-doing process

The role of the overarching governance structures is central in the functioning of CPRs and fishery management – e.g., the kind of incentives that are generated by the governance structures. It should be judged after its institutional performance, whether particular

arrangements lower transaction costs and raise resilience, as well as promote collective action in the resource system.

This paper shows that the likelihood of success in promoting collective action is much higher if rules are implemented using bottom-up processes. Decentralised empowerment and street-level participation, accordingly, are very important in policy making and in the implementation of rules in the governance of CPRs. Lipsky (1980) argues that lower levels of bureaucracy – “street-level bureaucracy” – are central to effective functioning in organisations. However, Lipsky’s argument views effective functioning from the perspective of implementing policy and regulations from above; i.e., top-down government. The bleak-roe case challenges this perspective. Local officials do play an important role in bleak-roe management, but only emphasising street-level bureaucracy is not enough. The determining factor in this case has been the participation of fishermen; thus, the bottom-up governance. Local officials and fishermen do not distort or reinterpret central rules or regulations; they improve them, in the sense that they form a new system that fits and meets ecological, as well as other local circumstances. It already has been demonstrated that collective action, resilience, adaptability and transformability are promoted, when the fishermen take an active and constructive role. In the words of Stiglitz, “to a large extent, they need to be in the driver’s seat” (Stiglitz, 1999:9).

Local management of vendace is constructed in such a way that the State is the *de facto* holder of all legal rights. There is a regular exchange of information between the Board (data gathering: statistical and biological information/analysis regarding the status of the stock, the share of non-matures, etc.) and the fishermen (data gathering and information regarding regulations and performance, etc.). This can be labelled “capacity building”, defined as “the sum of efforts needed to nurture, enhance, and utilize the skills and capabilities of people and institutions at all levels” (Berkes, 2002:299).

Capacity building seeks to develop the capacity within fisheries to resolve their own problems, to increase the effectiveness of management performance, and to improve the quality of resource management. In bleak-roe fishing, representatives from the authorities participate in meetings with the management group, and provide biological data and information on other relevant issues. Both fishermen and the authorities are involved in the development of selection panels. Hence, a form of joint group has been formed, wherein trawl fishermen, in co-operation with researchers (at the Board’s Coastal Research Office) and officials, manage bleak-roe fishing at the operational level. This co-operation can be seen as a network that has the qualities of an epistemic community. This means that it is a network of

“professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area” (Haas, 1992:3). An epistemic community can lay the groundwork for broader acceptance of the ideas and beliefs regarding proper functioning of the vendace system. This also has been the case in bleak-roë fishing. Currently, many fishermen are more concerned and engaged than before, and they also express a long-term view of the resource (Rova, 2004). In times of scarcity, there might be an opportunity for this joint group to present new alternatives that can be adopted and accepted, both by the fishermen and the authorities.

It is known that, when fishermen’s knowledge is given more credence, this may improve data sets and enhance research. Nonetheless, scientists, officials and fishermen have different opinions regarding many questions; for example, regarding the cause of the resource crisis in the late 1990s, how trawling affects spawning areas and the resource, whether the local management system should (fishermen) or should not (authorities) have more rights and power than just imposing further restrictions, how biological data should be interpreted, etc. However, the ongoing *process* of co-operation in management might result in a more well-defined and better functioning system in the future. As time passes, fishermen and officials might define and re-define their positions and obligations. One potential result of this process would be a larger number of shared norms or, at least, better mutual understanding. The face-to-face contacts between authorities and fishermen help to define such relationships between state and society (Peters, 1996).

In the previous discussion, it has been indicated that the experiment with local management can be labelled a form of co-management system.¹⁸ However, such systems, characterised by power-sharing between users (e.g., trawl fishermen) and the State (e.g., the National Board of Fisheries) comprise a wide spectrum. Co-management includes instances of nearly full community control (i.e., minimal state involvement) to nearly full government control (Carlsson and Berkes, 2005). The bleak-roë case, obviously, is a system with nearly full government control. The authorities have kept an eye on almost all decisions, and the fishermen report that they feel a pressure to “make the right choices.” In many of the interviews, one can read between the lines that, at the moment, there is something of a moment of truth for the management system. If more power and responsibility will not be delegated to the fishermen, the legitimacy of the management system will be reduced; with an

¹⁸ Co-management as a type of governance structure also is in accordance with the EU’s principle of subsidiarity, which stipulates that the authority should be delegated to the lowest competent level of governance (Gray and Hatchard, 2003).

obvious risk that the inclination towards following rules also will decline (Rova, 2004). Increasing dissatisfaction over the lack of independence and power-sharing in the vendace system indicates that the fishermen also must be represented in policy making more long-term, not only at the day-to-day operational level. Experience world-wide has shown that real participation increases awareness of and appreciation for important issues, and contributes to improved management (Lane and Stephenson, 2000:390). However, the ongoing process of co-operation in management might result in a different type of co-management system in the future.

In this paper, co-management is understood as a “continuous problem-solving *process*, rather than a fixed state...” (Carlsson and Berkes, 2005:65). As the vendace case has demonstrated, management and, particularly, co-management of a CPR is a more complicated process than just analysing formal aspects and sharing power between official authorities and fishermen. One should agree with Carlsson and Berkes, that “power-sharing is the *result*, and not the starting point, of the process” (Ibid:73). Understanding a co-management system as an ongoing, adaptive learning-by-doing process, instead of focusing on formal structures, strengthens the argument that ecosystem management requires a multi-level approach to match social and ecological structures and processes operating at different scales (Olsson, 2003:21).

This view of co-management, as a learning-by-doing process, whereby power-sharing is the result, and not the starting point, definitely is applicable to bleak-roe management. The development of bleak-roe management can be seen as a process whereby the authorities themselves were provided with an alternative way to manage a resource, a way that fit into the already existing government structure. A critical view of the process could be that implementing the discussed co-management scheme was just a desperate, but suitable way, to cope with a resource crisis by passing responsibility to the fishermen, while relieving the Board of full responsibility. If the downward trend had continued, there certainly would have been extensive criticism directed at governmental authorities and officials from the fishermen, the public, and from local politicians. Thus, not only fishermen have benefited from the management success. The Board has appeared to solve a serious resource crisis problem and has been innovative in implementing a new management system. This system was adapted from an already-existing institutional arrangement. Hence, the existing governance structure will continue to dominate. Only minor adjustments were required to satisfy the fishermen at

the start, while the authorities have secured their agency's turf.¹⁹ However, to secure the future, the process must go on: "government must not only foster conditions for fisher participation but sustain it" (Pomeroy, 2003:248). In the absence of an appropriate legal basis, the system can be undermined.

6. Conclusions

In this paper, it has been argued that co-management is, and should be seen, as a process, and that shifts in governance methods affect social and ecological resilience. With an increase in bottom-up processes and user participation, social and ecological resilience increase for a resource like vendace. Inversely, with more top-down methods and more involvement of state-centred bureaucracy, social and ecological resilience decrease.

If we assume that, in a complex and modern society in which resource use often is just a way to secure incomes, the formal institutional framework generates the incentive structure for resource users. Thus, the shape of the formal institutional setting and the incentives it provides affect the potential for collective action among user groups. As this case has demonstrated, changes in governance methods and in social-ecological resilience are not necessarily proportional, but non-linear processes. Fairly small changes in the governance system might affect collective action among resource users in a disproportional, but positive way. Logically, if bottom-up processes decrease, collective action might disintegrate rather quickly. With no claims of precision, it can be concluded that changes in governance likely affect social resilience more than ecological resilience; i.e., the increase is not believed to be proportional. However, such changes open up possibilities for ecological resilience to catch up to social resilience; i.e., adjustments in social resilience cause changes in ecological resilience.

Another important observation from the vendace case is that incentive structures, generated by governance, never are static. Within the framework of the same institutional setting, the incentive structure for participants might change drastically over time. The co-management experiment in bleak-roë governance indicates that, if the process does not continue, the gain in social capital that has been created might vanish rapidly. Without continuation of the *process*, any gains might easily be converted into a hostile attitude towards governance. Thus, if the institutional setting is frozen, it is reasonable to assume that, over time, movements will

¹⁹ The most common threats to an agency's turf are job security or career enhancement; challenges to an agency's professional expertise; loss of policy direction; undermining traditional priorities; and anxiety over accountability (Imperial, 1999:457). Consequently, those who benefit from the institutional order will be in a stronger position to defend the existing institutional arrangement, because they will not necessarily give up easily.

be towards decreasing social resilience, which, in turn, will affect ecological resilience negatively.

A relevant question is: why should people engage and invest time, if they have the feeling that they only give away, without having any potential to gain authority? This issue was expressed by one fisherman in the following way: “We only can impose further restrictions, but nothing more” (Rova, 2004). With regards to the vendace case, initial satisfaction from increased responsibility might fade away, when fishermen are confronted with the hard realities of daily work, coupled with the tasks of managing and trying to unify the group. In the long run, it might be difficult to unify user groups to take part in restrictions, when there are few chances that there ever will be any positive pay off.²⁰ The logical argument against this reasoning is that fishermen, for example, typically are paid off via increased catches. However, due to the dynamics of fish resources, worse times always will come. Experience world-wide (in commercial fisheries in general) has demonstrated that, without suitable bottom-up processes, and by focusing only on catch-levels, the potential for developing social capital and collective action is small. It is a reasonable assumption that we manage and use our resources according to our perception of our opportunities and our validation of the alternatives at hand. With this assumption, the likelihood of a co-management system’s success, when some central actors have the feeling that they only have duties, is not great in the long-run. For example, in 2000, new restrictions in trawl-areas for vendace were put into practice by the fishermen. If these regulations had been implemented by means of top-down methods, the likelihood of rule compliance would have been small. Hence, the importance of bottom-up processes should not be underestimated.

Consequently, not only management, but also the overarching governance structure, should be looked upon as an ongoing process with potential learning-by-doing capacities. In the same way that conditions for the ecological system constantly change, the conditions and incentives generated by governance systems do as well. For example, other compositions of user groups, such as the trawl-group for vendace, might understand the incentives generated by management in another way. This, in turn, affects the existing governance system’s ability to successfully govern the fishery. The same institutional setting might generate a totally different result, if the composition of the user group (in this case the trawl-group) changes. Other modifications to the nested institutional environment, of which all resource systems are

²⁰ Although it has not been the aim of this paper, the vendace case clearly supports Ostrom’s theory, which stipulates that only under particular circumstances are people willing to invest time and effort in trying to create systems for self-governance. Obviously, the vendace case fulfills the criteria (see Ostrom 2001:17 ff. and Stern et al., 2002:456.).

part, might produce other, unpredictable results. For example, norms and values may change, which might challenge existing formal rules and regulations. The inflexibility of governance in response to new conditions can be seen in many areas in society - new values related to the preservation of wildlife and consumption of meat are two examples. Possible clashes between new values and existing institutional systems might indicate a governance system that is too static. People's preferences and incentives have changed over time, without an adequate change in governance, which, in turn, affects the legitimacy of regulations negatively. This can cause unexpected changes in the perceived legitimacy of various rules and regulations. Based on the insights provided in this paper, it can be concluded that, not only fisheries, but also any high-functioning society needs flexible and adaptive institutions which enhance engagement, trust and collective action among its citizens. How to reach this goal, however, is an issue for policy makers and politicians. What we know for sure is that not only "[f]ish swim across political boundaries and migrate without regard for management plans [...]" (McGinn, 1999:140).

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