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Co-management in fisheries – Experiences and changing approaches in Europe

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Abstract. This article aims to identify conditions of success for European fisheries co-management and its integration in broader strategies for sustainable resource management. Co-management of fisheries, broadly defined as the involvement of users in management, developed in Europe in various experimental forms of participation of fishermen in the management process, in advisory roles or through delegation and sharing of power. During its history, fisheries co-management has been revealed as multi-functional, addressing different knowledge and resource management problems, with varying success. This analysis focuses on knowledge-related issues that are important for the functioning of co-management, especially the combination of scientific and local knowledge. First we review European literature on co-management and secondly we analyse two exemplary case studies (EU Regional Advisory Councils and Fisheries Local Action Groups). Thereupon the possibilities for future development of co-management in Europe are discussed with regard to knowledge integration and environmental governance. Under the influence of the ideas of adaptive governance and sustainable resource management, modifications of forms and functions of co-management systems are described.

Keywords: European fisheries; fisheries co-management; participatory management; knowledge integration; adaptive management; environmental governance; sustainable resource management

1. Introduction

The discussion of co-management in fisheries has intensified since the 1990s with attempts to establish local or regional co-management systems in many countries. In Europe, fisheries co-management went through a series of experiments for the sharing of responsibility, power and knowledge. Symes' (2006: 113) definition of co-management as "systems in which responsibility for management is shared between the state and user groups, usually at the local level" differentiates co-management from community-based resource management with purely local approaches of self-management by users. The strengthening influence of local resource users has proved to be multi-functional, making co-management instrumental for the solution of different problems.

To understand the conditions for success and failures in attempts to change managerial institutions, the first part of the paper reviews the discourse on fisheries co-management with regard to 1) purposes, 2) governance and 3) knowledge problems (section 2). Co-management is discussed from the perspectives of single-species management, varying forms of ecosystem-based management (Katsanevakis et al. 2011) and adaptive management (e.g.,

Williams 2011). The second part of the paper presents an analysis of two EU cases, the Regional Advisory Councils (RACs) and Fisheries Local Action Groups (FLAGs), with a focus on experiences from the Baltic Sea and Sweden (section 3). These studies are based on qualitative case study design informed by document analyses, interviews and ethnographic field research through participant observation. On the basis of these case studies, we discuss further developments of co-management with regard to knowledge integration and the sustainable governance of natural resources (sections 3.4, 4 and 5).

The guiding ideas and principles of co-management include the participation and empowerment of stakeholders, collaboration and shared responsibility between resource users and managers, process-based instead of result-based management, institutional embedding and the decentralisation of decision-making, as well as equity and justice regarding access to and use of resources. With these ideas, co-management appears as a flexible, context-specific strategy, drawing on ideas from research on natural resources and common pool resource management (Becker and Ostrom 1995; Ostrom 2007; 2009). The multifunctional and changing aims of this strategy were recognised early in the debate on fisheries co-management (Jentoft 1985). Jentoft (2000) discussed co-management in the coastal zone, addressing questions of complexity and the possibilities of building communities of interest. Accordingly, discussions of how to develop, specify and broaden co-management became more important in the following years. With adaptive management, fisheries management shifts to a learning perspective in which experimentation is necessary. Therefore, what first appeared to be a deficit of co-management, i.e., the lack of clear and specific targets, can become a condition for continued learning, improvement and adaptation in managerial institutions. Furthermore, influential ideas from ecological research include the concepts of nested and coupled social-ecological systems (SES), of which Ostrom's (2007; 2009) research provides examples. Over time, co-management evolved from solutions for specific, limited problems, such as the overfishing of fish stocks, to solutions of complex problems in multi-functional management systems, for example, as part of ecosystem-based management.

With the broadening co-management debate, the issues of power- and knowledge-sharing have become important ways to address various resource management problems simultaneously, such as overfishing; the changing states of resources and ecosystems; vulnerability and resilience; changing cultural, social and economic conditions and different views of resource use; negotiations and the combination of knowledge for natural resource management; and the development of innovative institutions and policies to promote sustainability. Such multifunctional co-management systems can be analysed vertically, including multi-scale resource management in hierarchical, nested structures, as well as horizontally, referring to the following:

- *spatial complexity* and interconnections of local, national, regional, and global resource management processes;
- *ecological complexity* and the changing states of human-dominated ecosystems with regard to their vulnerability, resilience and sustainability (Cumming et al. 2005); and

- *social complexity*, which includes "lessening the environmental impact per unit of economic activity, lowering the worldwide rate of economic growth, and addressing global income inequality" (Stutz 2011: 49).

Whether such a broadening of perspectives actually exceeds the limits of co-management, or modifies and transforms it, needs to be assessed critically. This paper therefore investigates the above mentioned issues for conditions of success for co-management in Europe, which are of particular relevance for current changes of the EU's Common Fisheries Policy (CFP) from a top-down system towards processes with increased involvement of stakeholders and resource-users, as attempted for example with the implementation of the discard-ban to be introduced from January 2015 within the newly reformed CFP (see section 3.2). It hence aims to contribute to a more sophisticated understanding of how these new or revitalised approaches enable the establishment of long term sustainable fisheries (co-)management systems with the involvement of stakeholders. The according central question, what it takes to maintain co-management systems, is addressed from two overarching perspectives: 1) *what prevents a broad and enduring practice of co-management?* and 2) *is the integration of co-management into broader approaches of resource management improving co-management, or will this finally end the co-management debate?*

2. Co-management research – a review of reviews with a focus on Europe

The following review of co-management research presents the development of the discourse in three themes: (1) The search for and discussion of the purposes of co-management prevailing in the early debate; (2) Policy and governance questions of co-management appearing in the past decade; (3) Forms and requirements of knowledge integration for fisheries management as the least-discussed aspects of the discourse, currently gaining increased importance

2.1 The early discussion: seeking problems for which co-management can be a solution

McCay and Jentoft (1996: 247) conclude from a discussion of decentralisation and user participation in fisheries management with cases from Europe and other countries that the concepts and principles of decentralisation, subsidiarity, participatory management, and communicative rationality should be subjected to rigorous practical and empirical testing to find out: When do decentralised and participatory arrangements contribute to communicative decision-making, improved knowledge and databases, equity in resource management, and legitimacy of management systems?

Sen and Raakjær Nielsen (1996: 417) discuss the different types of *instructive*, *consultative*, *cooperative*, *advisory*, and *informative* co-management and describe the introduction of co-management with types of boundaries, user groups, political culture and social norms. The 22 cases analysed do not yet show sufficient experience with co-management, more its emergence from crisis situations like overexploitation of fish stocks or conflicts between resource users and management institutions.

Jentoft et al. (1998: 434) discuss expectations connected with fisheries co-management in a theoretical perspective, presenting different paradigms and assessment perspectives of co-management. They highlight the controversial discussion of management regimes and regulatory decision-making, the complicated and time-consuming processes of changing institutions, the social dilemmas that arise and the hard choices that must be made to solve them, and hence argue for pragmatism and caution with regard to institutional changes.

Wilson et al. (2003) review co-management experiences from many parts of the world, including Europe, confirming the immature state of co-management while adding the economic issue of lowering transaction costs. Also knowledge problems are analysed with respect to different types of knowledge by Wilson et al., as later developed by Hoefnagel et al. (2006, see 2.3). Also Jentoft (2005: 6) sees lower transaction costs as advantage of co-management connected with improved communication and reduced conflicts. He describes empowerment as a core issue of co-management and concludes that the neglected psychological and sociological aspects of empowerment and power sharing should be emphasised more clearly when building co-management systems.

Drawing conclusions from the early co-management experiences, Carlsson and Berkes (2005) argue, in coherence with Jentoft (2005), that the discussion of formal, legal and institutional arrangements of co-management tends to neglect the functional aspects of the aims and problems that must be solved: the allocation of practical tasks, the exchange of information and resources, the forms and degrees of power sharing, the linking of different types and levels of organisation, the reduction of transaction costs, the sharing of risks and the resolution of conflicts. Co-management is (re-)interpreted as a multi-functional approach that is developed through deliberation, negotiation and joint learning, intended to solve a variety of changing problems. This perspective approaches the idea of adaptive management (Carlsson and Berkes 2005: 65, 73): increasing knowledge, enhancing learning and decreasing uncertainty (Allen and Gundersen 2011: 1379). Adaptive management widens the perspective of co-management through a critical assessment of prior resource management practices (Acheson 2006; Ostrom 2007) with arguments directing resource management towards sustainability.

When addressing *policy, power* and *governance issues*, fisheries co-management becomes part of a policy-centred participation debate about changing institutional functions, structures and decision-making processes in governmental organisations responsible for natural resource management.

2.2 Power and governance issues of co-management and policy reform

Gray (2005), in an interim step in the broadening discourse of fisheries governance, discusses three key themes in the later debate: the value of participation, the transition from single-species management to ecosystem-based management, and the relationship between local or experiential and scientific knowledge, still in a somewhat narrow policy perspective, summarised in the normative message that all stakeholders have responsibility and public duty to act as stewards of the marine environment.

Symes (2006: 113) identifies governance issues in fisheries co-management that can be connected to ecosystem-based management: (a) everyday issues (short-term perspective); (b) institutional arrangements (long-term perspective); and (c) the construction of values and principles in fisheries policy-making (very long perspective). Meta-principles to guide fisheries management include (a) rationality in the choice of instruments, (b) responsiveness regarding representation and equity, and (c) performance regarding the effectiveness and legitimacy of a management system, all of them including representation and interactive learning. Co-management broadens beyond its original context as "a pragmatic response to a crisis in state-industry relations" towards "interactive governance as requiring a fundamentally new approach building upwards from firm foundations in ethical values and carefully articulated governance principles" (Symes 2006: 116).

Mikalsen and Jentoft (2008: 176) describe decentralisation and participatory practices in six European countries, arguing for the inclusion of additional stakeholder groups in the participation process because "restricting participation and real influence to users (and bureaucrats) is part of the problem rather than the solution". Co-management, requiring the change of institutions under specified goals entails the development of institutions to support long-term perspectives of sustainable fisheries management through broader participation and legitimation of affected stakeholders. Similarly, Griffin (2009: 573) assesses current EU fisheries co-management practices critically: instead of "collective empowerment" enabled through RACs she concludes that "the hierarchy has been somewhat reconfigured".

Daw and Gray review the *Common Fisheries Policy* (CFP) of the EU, identifying deficits in the institutional and decision-making systems that fail to achieve the goal of sustainable fisheries management. For this purpose, the co-management and de-centralisation of decision-making are important principles, as in other sectors of EU policy. The advisory system of the CFP has not been effective in solving the crisis in EU fisheries management, making new principles of resource management necessary: "Closer co-operation between policy makers, scientists and fishers; the integration of social and fisheries sciences; and the realignment of research objectives towards usable management goals" (Daw and Gray 2005: 197).

Hegland et al. (2012: 3) develop a conceptual framework for restructuring the regionalisation of the CFP. Deficits with regard to institutional changes include the failing success of new modes of governance and the failing of co-management to develop responsible behaviour. This negative assessment converges with Walters' (2007) review of failures in adaptive management systems in fisheries, mainly due to institutional inertia and resistance. Among five "archetypes of regionalisation" discussed by Hegland et al. (nationalisation, regional fisheries management organisations, regional fisheries co-management organisations, regional marine management organisations, and cooperative member state councils), no simple selection of a best model can be made. While all variants represent different ways forward, archetypes two and three signify advances in the direction of involving affected parties in the management process.

Aspects of ecosystem-based management have been studied and reviewed in recent years in European research. Varjopuro et al. (2008) present, from the European FRAP- and IBEFISH-

projects, a conceptual framework for dealing with the interaction between fisheries and the environment in an integrated approach called ecosystem-based fisheries management. According to Varjopuro et al., a well-informed reduction of complexity requires that four key governance issues be taken into account: information management, legitimacy, social dynamics, and costs.

Relating to the same projects, Berghöfer et al. discuss the idea of institutional innovation as requirement of ecosystem-based and participatory fisheries management. According to their synthesis, institutional innovation calls for quickly applicable information; improved legal backing for continued collaboration; efficient and clearly defined practices of participatory decisions; the specification and just distribution of costs; multi-scale spatial planning; and cross-sectorial integration of fisheries management (Berghöfer et al 2008: 251). Some of these ideas are similar to those formulated earlier by Becker and Ostrom (1995) as principles supporting local cooperation in common-pool resource use and management.

While practice-oriented and regionally specific governance aspects, including best practices, are discussed in evaluations of EU fisheries management and the CFP (cf. websites of MariFish 2007; EFIMAS 2008), no in-depth analysis of knowledge-related questions follows these discussions. Some knowledge problems involving difficulties associated with the classification and integration of different knowledge types are revealed by the following review.

2.3 Knowledge issues in fisheries co-management

In Motos and Wilson (2006: 85ff), the knowledge base of fisheries management is analysed , including European areas. Knowledge facets, the plurality of knowledge types, such as tacit and discursive, oral and written knowledge are explicitly addressed to develop a knowledge base for co-management connecting to fishers' knowledge for co-management and the 'local knowledge debate'. The role of fishers' knowledge in science and management has received growing attention over the last two decades. Generated by the northern cod stock collapse (Neis 1992; Finlayson 1994), this research has proliferated and been connected to more inclusive approaches of "interactive governance" (Kooiman et al. 2005) and co-management (Wilson 2003, see above). While earlier publications concentrated on the rejection of the value of fishers' knowledge by managers and scientists (e.g., Neis 1992), subsequent research focused on its utility and potential usefulness for policy integration (Palsson 2000; Holm 2003; Hoefnagel et al. 2006; Murray et al. 2005). Today the value and usefulness of fishers' knowledge for management purposes is generally acknowledged, but new questions dominate research and practice, e.g., how to effectively include fishers' knowledge in policy systems, such as the CFP (Linke and Jentoft 2014; Mackinsson and Wilson 2014).

With the establishment of the RACs after the CFP reform in 2002, co-management research has gained momentum with regard to the inclusion of additional knowledge perspectives into the production of advice for political decision-making. Using the example of the North Sea RAC, Griffin (2009) discusses the rescaling of institutions and changing knowledge and power relations in EU fisheries. RACs are "changing not only the nature of the production of knowledge, but also what scales of knowledge are considered to be legitimate … universal

science is undermined and local knowledge claims are elevated" (Griffin 2009: 573), which confirming that knowledge production processes are key issues for the generation of new resource management strategies.

On-going research pursues the integration of knowledge from the fisheries sector and scientific research for policy- and decision-making in the CFP (e.g., Mackinson et al. 2011; Mackinson and Wilson 2014). These investigations recognise a more dynamic interaction between scientific and other knowledge forms and therefore focus on methods of participatory action research and "learning-by-doing" initiatives. The continuation of the CFP reform agenda – to include and empower stakeholders for increased responsibility and co-management – is acknowledged and supported to achieve sustainable fisheries management in Europe.

Berkes (2009) takes up knowledge-related issues to take into account various functions and facets of co-management: power sharing, institution building, creation of social capital, process orientation, problem solving and global governance. Three meta-functions connect these facets: knowledge generation, bridging organisations and social learning. Strategies to improve co-management include the bridging of knowledge, the co-production of knowledge, cooperation, participatory research, collaborative monitoring, participatory scenario building, the democratic distribution of power and downward accountability (Berkes 2009: 1694 ff).

2.4 Conclusions from the review

In the following, we assess the research reviewed above with regard to (a) empirical findings, (b) theoretical implications, and (c) ideas for future co-management.

(a) Empirical findings - variants of fisheries co-management in Europe: Symes (2006a) describes some lessons learned that resulted in rethinking co-management with regard to its functions (more flexibility), capacity building (where knowledge becomes important), and questions of representation and legitimacy (who should co-manage?). These considerations can be incorporated in the broader perspective of Berkes (2009, see section 2.3). In this developing perspective, co-management appears as a learning process in the daily practices involved in resource management, through-trial-and-error-based learning and formalised rules and principles.

The conclusions by Berghöfer et al. (2008: 251) emphasise, beyond country-, culture- and region-specific variations of co-management systems, the complexity of natural resource management, particularly with respect to multi-functional and multi-scale management systems. Griffin (2009) and other analyses of the RACs describe changes of co-management perspectives from formal power relations to more encompassing knowledge practices. Investigating the Baltic Sea RAC, Linke and Jentoft (2013; 2014) conclude that while RACs represent innovative and promising organisations for stakeholder participation and cooperation, in practice, both institutional and procedural hindrances often exacerbate the process of joint problem discussions and knowledge inclusion (see Box 1 below). Consequently, the difficulties identified by empirical research mandate the rejection of one-sided problem views and the broadening of governance perspectives.

(b) Theoretical implications of co-management: Fisheries co-management is not directed by a single scientific theory. In the repeated reframing of the discourse and ideas of co-management, theory appears in various discursive forms of dealing with new management problems. Co-management and user participation were at first mainly seen as a reaction to resource crises (overfishing), institutional crises (centralised decision-making by governmental institutions) and knowledge crises (lack of exact data and reliable knowledge). The view of co-management changed from a solution for specific management problems towards a more encompassing strategy of natural resource management in which co-management appears as part of integrated, networked, and multi-scale governance systems, thus creating new explanations.

Such explanations for the success or failure of co-management experiments highlight a variety of factors. Theoretical discussions typically introduce situation-specific explanations by a process of inductive generalisation rather than by attributing success or failure to one or a few broad causes in a single theory. Thus, the main theme of theoretical analysis is the complexity of processes and problems in co-management. The main conceptual frameworks adopted – ecosystem-based fisheries management, adaptive management and sustainable resource management – use ecological models and reproduce complexity by way of limited generalisation, with context-specific explanations that reject linear and mono-causal explanations (cf. discussion in sustainability science). Knowledge integration is part of such cognitive strategies, but refined concepts, typologies and frameworks for the analysis of knowledge practices in co-management need to be elaborated to improve integration.

(c) Ideas for the future of co-management: For the further development of co-management systems, new practical and theoretical approaches are required to address the complexity of management situations. This implies a need to address the contradicting requirements, dilemmas and paradoxical effects of management. Components from different theories can be used to reflect on problems such as transdisciplinary knowledge use, where the cooperation of scientists from different disciplines, resource users and managers create good conditions for such reflection. Consequently, the development of co-management cannot rely on one strategy of action, but requires combinations of several strategies to address social and ecosystem structures and functions, as well as power and knowledge aspects. Coping with failures of institutional transformation, changes in the spatial, temporal and social perspectives of fisheries management, or non-anticipated consequences in management requires policy reforms and "interactive knowledge development" (Seijger et al. 2014). How to implement the changes required for institutional transformation is not sufficiently answered in the otherwise intensive co-management discourse. It seems that the further clarification is left to other fields of resource management research, such as adaptive management (Allen and Gundersen 2011), (global) environmental governance (Margerum 2008, Mazi 2009), science studies (Michael and Irwin 2003), and the discourse on transformation research, in which the capacities required from resource users and managers are formulated as "environmental literacy" and "transformative literacy" (Scholz 2011).

3. EU fisheries co-management – empirical studies

Guided by the conclusions from the review above, the following empirical studies illustrate possibilities to develop co-management approaches within the current EU fisheries governance framework. Criteria for the further development of co-management approaches are discussed in the perspective of adaptive governance with the guiding questions: (1) *How should the cooperation between researchers, decision makers and practitioners be organised to develop a "learning system"?* (2) *How can knowledge integration be improved to develop fisheries management?*

3.1 Empirical material and methods of analysis

The two EU initiatives RACs and FLAGs were established to improve the involvement of stakeholders from the fisheries sector and other interest groups in the EU fisheries policy and management system. RACs are situated at regional management levels, e.g., the Baltic or North Sea, whereas FLAGs are placed at local levels, in geographically, culturally, economically or socially distinct areas, such as the island of Bornholm in the Baltic Sea (see Figure 1). Although both initiatives do not explicitly use the term 'co-management', they are key examples of the approach as discussed below.

The empirical material analysed stems from own long-term field study research investigating stakeholder interaction in EU fisheries management at different levels ranging from local, national to the regional and EU-level.[1] The data collection consists of a combination of document studies, interviews and ethnographic research through participant observations. This approach enables us to observe and analyse the currently unfolding processes of EU co-management approaches over a long-time perspective with RACs and FLAGs serving as key examples. Data collection was done through extensive participant observations at relevant meetings, followed up by informal and formal interviews and policy-document studies, to trace i) the political ambitions, ii) connected theoretical approaches and iii) most importantly, the practical realities for the actors involved and affected by the studied policy changes. As part of a project investigating the social dimensions of knowledge interactions in fisheries management commenced in 2011, the case study on RACs is based on document analyses covering the period from 2001 until 2014, detailed participatory observations in 26 RAC and various other meetings executed between 2008 and 2014 as well as numerous informal communications with RAC members and other stakeholders. We executed 10 semi-structured open-ended face-to-face interviews with key RAC stakeholders. Additionally numerous informal interviews were performed during the usually two-three days lasting lasting RAC meetings. The analysis is furthermore informed by an additional interview study of 12 key stakeholders in Baltic Sea fisheries management executed in 2010.[2] The case study on FLAGs is of a less extensive nature because these organisations are the result of recent initiatives and research is thus still preliminary. This study is based on policy document analyses, informal talks with active stakeholders, and 8 explorative interviews with FLAG leaders and

[1] The analyses have been part of the project "The Social Dimension of Knowledge: the Controversy of Sustainable Fishery" (http://anslag.rj.se/en/fund/41924).
[2] This analysis is part of the project "Environmental Risk Governance of the Baltic Sea" (RISKGOV), in which one of the authors (SL) participated (http://webappl.web.sh.se/riskgov; see Linke et al. 2014).

participating actors from Sweden, Denmark, Finland and the EU level (DG MARE). While the total number of the three different types of interview techniques sum up to 30 formal and numerous informal interviews, the most important value of our study lies in our view in the ethnographic approach to "follow the actors" in their practical work through participant observations that included close personal interaction with key actors. These key actors of Baltic Sea fisheries' stakeholders followed and interviewed in our study come from the fisheries, NGO or policy sectors and form a distinct, manageable sample size. Extensive field notes where taken under the participant observations, which have been analysed by using the same methods as for the interview analysis explained below.

The interviews centred on obstacles and opportunities for establishing co-management with the two EU initiatives with emphasis on the role of organizations, stakeholder representation and disagreements, options for knowledge exchange and inclusion into policy-making and challenges for developing trust and progressive climate among the stakeholders for establishing co-management. The interviews were noted in detailed field notes as raw data, audio-taped and partially transcribed and thereupon analysed using a qualitative analysis, which according to Berg (2001) can be defined as a careful, detailed, systematic examination and interpretation of a particular body of material to identify patterns, themes, biases, and meanings. This method, not using a detailed coding technique, was employed because the relevant terms 'co-management' and 'stakeholder involvement' or 'knowledge inclusion' were often not outspoken specifically in the interviews, but expressed by using various other terms, personal examples and different lines of reasoning, often distinct to the various actor groups. An initial scanning of the interview material after these key themes was therefore necessary and followed by a close examination of the attitudes and judgements of the actors regarding co-management and the concrete gaps and opportunities for knowledge exchange and inclusion in the two cases.

<Figure 1 about here>

3.2 The EU Regional Advisory Councils

The CFP is often seen as "perhaps the most top-down fisheries management system on the planet" (Degnbol and Wilson 2008, 189) and "perhaps the most science-dependent sector in the EU" (Griffin 2009, 563). To counter increasing problems and conflicts with this centralised top-down and science-based management approach, the CFP underwent a substantial reform in 2002 (EC 2002), recognising a need for "more effective and participatory decision-making" to cope with "shortcomings and internal systemic weaknesses of the CFP" identified as "poor enforcement, lack of multi-annual management perspectives, fleet overcapacity and insufficient stakeholder involvement" (COM 2002, 4). As a consequence, seven RACs have been established as the first step towards increased co-management, following the demand for "broad involvement of stakeholders at all stages of the policy from conception to implementation" (EC 2002, 6; Symes 2012). RACs should ensure "that they include all the interests affected by the Common Fisheries Policy while recognising the primacy of the fishing interests given the effects on them of management

decisions and policies" (EC 2004, 17). RACs have representatives from the fishing industry (two-thirds) and "other interest groups" (one-third), the latter sector being dominated by environmental NGOs. Today (2014 onwards), this distribution has changed to 60/40, and the name "RACs" has been revised to merely "Advisory Councils" (ACs).

As regional advisory bodies, RACs provide recommendations from the stakeholder sector to the EU Commission, mainly regarding fishing quotas as the central management tool of the CFP but also on issues such as long-term management plans or technical measures such as gear restrictions and closed seasons or areas. By integrating multiple knowledge perspectives in the advice to policy- and decision-making in the CFP, the RACs reflect a decisive change from top-down management towards a new experiment with co-management. Highlighting the innovative features of RACs, Sissenwine and Symes (2007: 66) described them as "the first formal attempt to generate a network of multi-national, multi-interest advisory organisations with a strong regional focus". While, according to the EU Commission (EC 2008), RACs seem to have delivered what they were created for, other authors observe that "the impact so far of the RACs on decision-making within the CFP is less striking than their organisational structure and continues to be the subject of on-going debate" (Long 2010: 294). Here, we use the RACs as cases to analyse their capacity in serving as stakeholder bodies for new co-management approaches in future EU fisheries governance.

High expectations rest on the RACs' future role as the most important stakeholder organisation that should be more integrated in fisheries (co-)management and policy-making at regional levels. However, RACs are subject to the difficulties mentioned above when fisheries management tries to keep up with new resource management ideas. For the implementation of the new (post-2013) CFP, the EU Commission has addressed the need for the RACs to take a more responsible role and proactively contribute to the development of new management plans (mainly connected to a discard ban to be introduced in 2015), in coordination and collaboration with member states in the region. The main incentive for RACs and member states to become proactive in this endeavour is that if they fail to do so, the EU will unilaterally return to traditional top-down management (see the EC seminar on implementation of the CFP reform: http://ec.europa.eu/fisheries/news_and_events/events/20131025/index_en.htm). The Baltic region and its RAC have been depicted as pioneers in this development because a cooperative member state forum already exists (BALTFISH), which can integrate and potentially harmonise the interests of stakeholders and member states in the region.

Box 1: Experiences from RACs

Cooperation and development of a "learning system" in RACs: RACs are currently the only EU organisational structure for stakeholder interaction, deliberation and knowledge inclusion from the fisheries and other sectors at the regional level. In the RACs, fisheries representatives and other stakeholders, such as NGOs, as well as researchers and decision-makers from national and international agencies (national governments or EU Commission) can cooperate and discuss their different perspectives, agendas and new ideas for improving sustainable fisheries management at the regional level. While RACs unsurprisingly experience difficulties with the inclusion of different stakeholders' knowledge perspectives into EU's fisheries management, they expose

new avenues for doing so. Within the Baltic Sea RAC, a new culture of communication and dialogue has emerged and developed since its establishment in 2006. While conflicts between the fisheries and NGO sectors prevail that often exacerbate the RACs' work, in many cases effective cooperation occurs, jointly formulating insights and advice for improving sustainable fisheries management in the Baltic Sea. However, the opportunities for the RACs to contribute to new forms of "interactive governance" (Kooiman et al. 2005), as idealised in the concept of co-management, are not straightforward. What is needed are long-term financial resources, engaged actors, an ability to learn from best practices and, last but not least, continuous criticism and debate about the appropriateness of methods for stakeholder engagement, requiring regular assessment and update (cf. Irwin et al. 2013). Obstacles and challenges for the RACs in this process have been identified and classified in *institutional* and *procedural* aspects (Linke and Jentoft 2013). With regard to institutional design, it has proven difficult, for example for the Baltic Sea RAC, to harmonise the different interests of actor-groups represented unequally in the RAC given the dominance of the fishing industry over environmental groups. Attempts to compromise between these two camps to provide unanimous recommendations to the EU Commission, which the RACs should do to affect decisions, have often failed, resulting in majority positions that mirror fishing interests and opposing minority statements from the 'green sector' (Linke et al. 2011). This conflict has also been observed in the North Sea RAC, which "strives for a consensus and tries to avoid minority reports", but has "an ongoing debate among the conservationists about the extent to which their participation is achieving conservation goals or 'green-washing' the desires of the industry that holds the majority of the seats" (Degnbol and Wilson 2008, 194).

Knowledge integration in fisheries management through RACs: As to deliberation and decision-making within RACs, problems have emerged regarding the best way to balance the knowledge from scientific research with the practical experiences from the fisheries sector. They range from technical questions, e.g., how to systematise and integrate data and knowledge from the fisheries sector in scientific assessments, or consequences of specific gear use, to basic issues of how to communicate different types of knowledge across the various actor-groups and synchronise different knowledge cultures such as those of fishers and scientists, where the understanding of topics such as scientific uncertainty and anecdotal experience differs substantially. Such communication problems constitute major challenges for the RACs when moving towards new and more inclusive forms of governance. Research also highlights these difficulties for other attempts to bridge the gaps between different forms of knowledge – i.e., between researchers, fisheries practitioners, NGOs and decision-makers (Verweij et al. 2010). While the green paper for the 2002 CFP reform stated that research and scientific advice "must maintain an open channel to fishermen's own knowledge" (COM 2001, 40), more than a decade later, this issue is still high on the agenda, with increased efforts sought for collaboration. At meetings between ICES and the RACs, the best ways to address the knowledge complexity of science and fisheries perspectives within the EU system have been discussed intensively, and the topic has developed as one of the most pressing issues for advancing EU fisheries (co-)management (cf. ICES 2013; 2013a; 2014). Accordingly, the way towards generating and implementing new approaches for joint knowledge production and problem framing between science and the stakeholder sector is still cumbersome and requires significant further efforts in the EU system, which are exacerbated by legal obligations for centralisation and member state harmonisation. The EU situation differs significantly from, for example, Norway, where one of the most advanced forms of collaboration between science and fisheries has been established, with the so-called Reference Fleet serving "as a new trust-based cooperation between fishers and scientists" (Bjørkan 2011:16).

Sources: own research and sources quoted in the box

Different cultures of communicating personal beliefs can be found among the actor-groups involved in the RAC-deliberations. Consequently, discussions in the Baltic Sea RAC often reveal a clash between the more political discourse used by fisheries representatives and academic arguments used by NGO representatives, scientists and decision-makers, which reveals obstacles for knowledge sharing between the sectors (Linke and Jentoft 2013). Hence, a key challenge rests with the difficulties for actors from all stakeholder groups to overcome

the hindrances of vested interests when communicating problems and compromising to allow for the collective learning process that co-management requires.

Apart from the institutional and procedural challenges exposed by RACs, a new role of science and its capacity to adapt to a changing EU fisheries policy system is required for the success of such co-management approaches. This role is developed in the process of harmonising and communicating perspectives between scientists and other sectors of fisheries management in various stages: (1) framing problems jointly in collaboration, e.g., between fisheries practitioners and scientists, i.e., the "step zero for fisheries co-management" described by Chuenpagdee and Jentoft (2007); (2) communicating on and selecting the forms and methods of collecting information and data from different sectors and subsequent knowledge (co-)production; (3) expressing and communicating the advice from such a collaborative knowledge production process for decision-making to political actors (Linke forthcoming).

Analyses of the discursive processes within RACs – e.g., the Baltic Sea RAC (Linke and Jentoft 2013; 2014), North Sea RAC (Degnbol and Wilson 2008; Griffin 2009), South Western Waters RAC (Tørrissen Guerreiro 2013) and Pelagic RAC (Hegland and Wilson, 2009; Coers et al. 2012) – show differing results. Not all RACs developed at equal speed, and they have thus evolved to varying stages of co-management, which need to keep up with the changing contexts and requirements of fisheries management. Whereas the Baltic and the North Sea RAC can be seen as the most advanced in terms of integrating stakeholder groups with divergent interests (fisheries, various NGOs and consumer groups), the North and South Western Waters, as well as the Pelagic and Long Distance RACs, have been the most advanced in terms of science-industry cooperation and other collaboration with actors outside the RAC. The Mediterranean RAC, on the other hand, still lags behind.

Consequently, the experiences of the RACs and their capacity for developing new co-management approaches more than a decade after their introduction in the CFP differ. As new stakeholder organisations in EU fisheries governance, not all RACs have sufficiently developed their capacity for taking on new responsibilities in the management system; some RACs do not yet seem prepared for shifting the burden of proof and management responsibility in their direction (Linke and Jentoft 2013). Apart from positive experiences and "unforeseen benefits" (Ounanian and Hegland 2012), RACs have also experienced disappointments, where unsuccessful efforts to inform decision-making resulted in the discouragement of stakeholders. This happened for the Baltic Sea RAC, for example, with a forceful but unsuccessful effort to contribute to a new management plan for salmon (Linke and Jentoft 2014). Such experiences cause RAC stakeholders to still feel excluded from the system, despite engaged efforts to support EU management decisions, ultimately risking undermining the legitimacy of the RACs and their original purpose in the CFP.

Furthermore, Gray and Hatchard criticised the adherence of the CFP to exclusive decision-making from the EU authorities and emphasised that stakeholder input from RACs is still restricted to a pre-decision phase. The authors conclude that "these reservations and restrictions seriously question the Commission's commitment to the principle of participation

as a right or entitlement of stakeholders" (Gray and Hatchard 2003, 548). They consequently argue that the RACs might just be another "lip-service" paid by the Commission to take up new concepts of "good governance" … "while to some extent the rhetoric has shifted from the discourse of authoritarianism to the discourse of democracy, the reality of its [the CFP system's] top-down structure has not materially changed - indeed, on balance it has been reinforced" (ibid, 553). A decade later, it is an open question whether the RACs are trapped in the authoritarian framework of EU fisheries or whether they can live up to new forms of stakeholder involvement and co-management, especially for the new CFP reform from 2014 onwards and its regionalisation approach. So far, RACs have contributed significantly to facilitate information sharing, cultivating better relationships, trust and understanding among different stakeholders (Ounanian and Hegland 2012). In many instances, they have shown their ability as responsible co-management actors by successfully combining a range of stakeholder interests and channelling the divergent perspectives into decision-making in a new EU governance framework. Such empowerment of stakeholders and partial release of management responsibility to the industry and/or other actors is still an intriguing experiment to follow in the coming years with the newly reformed CFP.

3.3 Fisheries Local Action Groups: experiences from the local level

In contrast to RACs, FLAGs are EU initiatives on the local level. In Sweden, for example, two out of the 14 established FLAGs represent the Northern and Southern Bohuslän areas on the West coast, and the South Baltic FLAG is responsible for Sweden's southernmost coast. FLAGs are initiated through the Axis 4 of the European Fisheries Fond (EFF; from 2014 onwards called European Maritime and Fisheries Fond) to develop local fisheries areas within the CFP to benefit primarily the small-scale and coastal fleet sectors. They aim to support sustainable development with local actors from various sectors (public, private, and civil society), to jointly design and implement integrated local development strategies. FLAGs are attempts to "mobilise and involve local communities and organisations as well as citizens to fully contribute to national and European wide objectives" (https://webgate.ec.europa.eu/fpfis/cms/farnet/). The FLAG approach is a form of broadening the basis of co-management through the inclusion of more stakeholders, as demanded in the scientific discourse (cf. above). The support unit FARNET acts as a platform for networking of fisheries areas, guiding FLAGs in devising and implementing local solutions in the fisheries areas and assisting them in implementing EU measures for local sustainable development. Since 2007, over 300 FLAGs have been established in 21 EU Member States, supporting a total number of 6500 local projects (FARNET Newsletter March 2014).

While RACs almost exclusively represent stakeholders from large-scale national fishing industries, FLAGs activate local small-scale fishing sectors EU-wide, as their rapidly increasing number and distribution shows. Presently, minimal scientific literature concerning the FLAGs exists (an exception is a recent DG-MARE commissioned study of Axis 4; cf. CapGemeni 2014 forthcoming). Below, we describe their potential ability to innovate co-management approaches. The definition of relevant fisheries areas for establishing a FLAG, as well as the role FLAGs should play in fisheries management, remain contested issues. While the European Fisheries Fond provides a framework for the design and possible roles of

FLAGs, the "exact nature of this role will depend on the type of challenges faced by the FLAG area, challenges that usually depend on a variety of factors which are best understood by local people" (EU 2013a, 4).

Box 2: First experiences from FLAGs

Cooperation and development of a "learning system" with FLAGs: Inadequate experience currently exists to assess how well FLAGs support the transformation of fisheries management into a learning system where a culture of organisational learning is established in the routines of co-management. However, the adaptation of FLAGs to local requirements certainly helps to develop such a learning culture, as it includes characteristics of the particular area (distance to cities, population increase/decrease, local economy), the type of fishing activities (gear-use, segments, scale, aquaculture) and the specific organisation of the fishing sector in the particular area (EU 2013a). Within FARNET, diversity is highlighted as a key step to start learning processes, based on the argument that "there is no such thing as a single European fisheries sector", but rather a variety of different sectors across sea basins, countries and regions with specific local contexts of fishing communities (ibid, 5). Through their capacity to influence decisions affecting the future of their fishing sectors, FLAGs can potentially play an important role in empowering local fishing communities, particularly those that are currently marginalised or in competition with other fisheries areas. According to FARNET, many FLAGs have already been able to play such a uniting role for local communities and helped them to achieve better performance in terms of knowledge and skills for conducting and implementing practical projects.

Knowledge integration in fisheries management through FLAGs: EFF regulation mandates the provision of opportunities to activate local knowledge through FLAGs and that this local knowledge be made accessible for management processes at higher levels. It therefore recommends that FLAGs be built in a "bottom-up approach", involving a cross-sector representation of all relevant local stakeholders. The objective of this stakeholder involvement is two-fold: first, to ensure the full utilisation of unique and relevant local knowledge; and second, to engage the local knowledge holders in the FLAG development process. FLAGs should act as organisations that enable stakeholder knowledge use for innovation processes by providing an "opportunity to bring together the local knowledge of fishermen with the expertise of scientists and the dynamism of local entrepreneurs to explore and launch products in this field" (EU 2013a, 24). The establishment of such public-private-partnerships under the FLAG approach depends on resources, not only financially but also on appropriate responsible actors and uses of time and, perhaps most crucially, on the successful mobilisation of the local knowledge from the fisheries sector. Particularly in areas facing decline and other economic or social challenges, the focus on partnership is seen as the most promising solution to problems that are too complex to be handled independently within separate sectors (EU 2013b, 11). The knowledge of the local area and its specific social, economic and environmental characteristics are therefore highlighted as core aspects for the FLAGs' practical work.

Sources: own research and sources quoted in the box

Regarding the interpretation of their role as opportunities for co-management, FLAGs expose a variety of different views that reflect the local conditions of their action. Some FLAGs, such as those of Northern and Southern Bohuslän, perceive themselves as being deliberately decoupled from political activity and decision-making and hence attempt to follow a strategy of not becoming involved in management (interview, FLAG leader). Others, such as the South Baltic FLAG, try to actively influence political development and decision-making: "Our FLAG works hard to influence both local politicians as well as regional and central authorities. This is one of our key goals to achieve. We want to change the overall system. We want a Swedish fishery policy that takes account of our diversified needs. We want a focus on

a locally integrated fishing sector. That is the only way to ensure the survival of the small-scale coastal fisheries." (interview, FLAG leader). It is obvious that a controversy about the nature of the role of FLAGs is unfolding, resembling those of the new social and environmental movements, regarding whether new resource use practices should develop from within the political system or from outside, i.e., in parallel activities.

The involvement in local or higher-level decision-making has been reported as a success factor for several FLAGs across Europe. For example, the French FLAG *Pas d'Auray* has been described as an entry point to local decision-making because the local administrative structure running the FLAG has allowed the fisheries sector to take a prominent role in decision-making, ensuring that fisheries and aquaculture interests can influence important land planning processes (EU 2013a, 13). Similarly, campaigns to influence national decision-making have been reported from other countries (ibid), where FLAGs aim to modify existing regulations stating that fishermen can host tourists on their vessels to supplement their income.

As described in Box 2, key aspects for FLAGs are to motivate local knowledge and expertise to identify problems and find opportunities to counter them (EU 2013b, 21). FLAGs offer prospects for such co-managerial aims, but how well they succeed in creating routines of knowledge integration and joint learning will vary greatly. This can already be seen from their early stages of development, showing diversity and varying degrees of progress and success. They are designed for the participation and involvement of all key stakeholders in the particular area, focusing on cooperation and networking among groups, as well as on sharing and transferring knowledge and experience. The FLAGs can, therefore, be seen as new organisations for empowering local stakeholders for fisheries co-management beyond merely users and managers, thus reacting to a deficit criticised in co-management research (Mikalsen and Jentoft 2008; see section 2.2). Furthermore, Jentoft refers to this conditional role of empowerment and community-building for fisheries co-management, arguing, "co-management entails more than institutional design and participatory democracy. It also requires capacity enhancement" (Jentoft 2005, 1). Consequently, the broadening of participation and empowering local stakeholders are continued challenges for co-management, community development, and the FLAGs that provide opportunities for experiments in the coming years to find ways of gradual change for EU fisheries governance.

3.4 Reflecting on experiences from RACs and FLAGs

The observations from RACs and FLAGs confirm the non-simultaneity in the development of fisheries co-management organisations within the EU system. In the scientific and political discourse on environmental and resource use problems, ideas for institutional changes in governmental policies have long been formulated with the concepts of co-management; integrated, ecosystem-based and adaptive management; environmental governance; or the building of resilient and sustainable social and ecological systems (SES). However, the dominant institutional practices under the guidance of EU policies have not changed significantly. RACs and FLAGs can be understood as restarting institutional change with new knowledge and experiences. To develop fisheries co-management as an effective institutional

change and policy reform requires that all actors develop new capacities: to cooperate; to integrate knowledge; to work with principles and ideas, as well as with data and experience; to address complexity; and to mitigate conflicts of interests. These capacities imply that resource users, researchers and managers must learn to work in similar ways to create, combine, select and communicate the knowledge required for managerial decisions.

Institutional transformations include, beyond joint or social learning (as soft institutional change), changes of power structures, formalised organisational rules and new modes of knowledge production. Combining several of these approaches, including co-management, can help to initiate an improved environmental governance through: (1) developing institutions for *stakeholder participation*, (2) developing *transdisciplinary knowledge practices* to combine scientific and practical knowledge, (3) integrating *conflict mitigation* with co-management and (4) unfolding *long-term perspectives* of integrated and sustainable co-management of natural resources. In these processes, the following neglected components must be identified to formulate conditions for improving resource management.

(1) Experiences after two decades of *stakeholder participation* in research and resource management show that participation works, with difficulties to persist for a long time or in reducing the dominance of powerful actors and governmental institutions, however, it is still exceptional. No consensus can be found regarding (a) concrete forms and principles of participation, (b) the question of who shall participate in a specific resource management context and who shall be excluded, and (c) how to organise effective representation of these actors. Participation extends beyond changes of formal power relations, mechanisms for power-based, transdisciplinary knowledge integration and its transfer and use. With these practices, the question of who counts as legitimate provider of knowledge is a key problem.

(2) *Transdisciplinary knowledge practices* are insufficiently developed in the co-management experiments of RACs and FLAGs. Knowledge sharing and integration includes a critical discussion of the knowledge relevant for conservation and resource management, as well as decisions about the scientific, managerial or local knowledge applicable in a given situation. These decisions require more refined models and methods and a better understanding of the interactions between science and public policy and how to address different values and ethical norms for knowledge application. Because of its particularistic nature, local ecological knowledge is not just complementary to scientific knowledge but requires, as does all knowledge for resource use, a careful evaluation of its accuracy and usefulness, which transforms knowledge integration into a complicated process of translations, interpretations and negotiations (Holm 2003).

(3) Developing fisheries co-management with overarching approaches of integrated and sustainable resource management requires dealing with

controversies, conflicts, insecurity and failures of the past. In the transition to sustainability, the *solution of local conflicts* between resource users is necessary. Actors need to learn how to actively transform conflicts in cooperation as a way to change power structures. Most resource-use conflicts require sophisticated methods for their resolution before cooperation is possible, e.g., for negotiations between the stakeholders involved in the conflicts that need to cooperate later on (Stepanova and Bruckmeier 2013).

(4) *Long-term perspectives* on integrated and sustainable management of natural resources are built stepwise, including bridging strategies such as co-management and adaptive management. When problems are socially and ecologically complex and decisions have long-term effects, multiple spatial and temporal scales must be matched and surprises must be handled. Current routines and time horizons of planning are not sufficient for long-term thinking and anticipation. Only a few heuristic methods are available, among which scenario-analysis is growing in popularity. The use of scenarios can help SES to navigate the transition to sustainability, opening new trajectories of development. However, strategies for sustainable resource management require more, especially learning, capacity building and the identification of transformation pathways.

Co-management in RACs and FLAGs is consequently developed and improved through learning from the broader approaches discussed above. In this process, controversies emerge and conflicts need to be solved as a key part of resource management. Qualifying co-management actors to address such difficulties requires them to answer the question: *cooperation and participation should occur for which purposes and in what phases of the resource management process?*

4. Discussion – future perspectives of co-management

The variants of government-, market- and community-based resource management discussed over the past decades (Acheson 2006) follow the dominant institutional complex of late modern societies: the state, the market economy and civil society. Within these societal components, resource management models neglected the necessity of learning and transformational change in connected SESs where heterogeneous system dynamics interact. A way to improve these models with co-management approaches is to use knowledge about ecosystem dynamics, as formulated by Berkes with the idea of "adaptive co-management": "Different maturity stages of co-management can be identified in terms of the degree of power sharing, shifts in worldview, rules and norms, the building of trust and the elaboration of network arrangements… maturing co-management arrangements become adaptive co-management in time, through successive rounds of learning by doing" (Berkes 2009, 1699). Our review and analysis of two co-management experiments shows the integration of scientific and local knowledge as part of new managerial knowledge cultures that can become

effective for institutional transformation. Learning processes for that purpose require sophisticated forms of "double-loop learning", "environmental literacy" and "transformative literacy" (see section 2 above).

Whether participatory, ecosystem-based and adaptive (co-)management are sufficient to unfold new perspectives of SES governance needs to be further discussed, given that similar ideas have been used earlier in simpler strategies of integrated coastal zone management. These faded away due to failures in managing the complexity of ecosystems (see critical analyses of European initiatives by McFadden 2007; Shipman and Stojanovic 2007; McKenna et al. 2008). Future avenues involve a continued improvement through joint learning and contextualising of co-management approaches, in fisheries and coastal management, as well as other areas. Similar experiences and learning necessities can be found in agriculture and rural development in Europe. Early attempts to overcome sectorial limitations through integrated rural development, reacting to environmental and resource use problems, showed limited success and required repeated upgrading of ideas and the successive broadening of approaches to endogenous, multifunctional, and sustainable rural development (Bruckmeier and Tovey 2008; Milone and Ventura 2010).

Fisheries management under the broader perspectives of ecosystem-based and adaptive management of SESs is still fisheries management, but strengthened and qualified through composite strategies. Cross-scale management, participation of resource users and transdisciplinary knowledge integration are building blocks of adaptive governance that reappear in research on resilience and sustainable resource management. In this context, they guide towards resource use practices that meet the requirements of conservation and sustainability (Wilson 2007; Salomon et al. 2011), including the empowerment of local actors in the governance system (Bensted-Smith and Kirkman 2010, 69).

5. Conclusions - questions without final answers

Two questions have been discussed in our two-stage investigation of fisheries co-management in Europe with the literature review and the two case study analyses.

(1) *What prevents a broad and enduring practice of co-management?* This question is partially answerable from the experiences accumulated in co-management experiments: it requires broader knowledge perspectives beyond policy analysis. Institutional inertia and bureaucratic structures are no longer sufficient explanations for failure, but do reflect the complexity of managing coupled SES.
(2) *Is the integration of co-management into broader approaches of resource management improving co-management, or will this finally end the co-management debate?* We argue for the first alternative, highlighting improvements through complexity management. However, the second alternative also seems possible in future developments of resource management systems.

These questions indicate the multi-dimensional characters of the problems and processes appearing in fisheries management and co-management: complexity and uncertainty remain as final and continuing problems to address. Reducing complexity to simpler forms or single problems, necessary as it may be for cognitive and practical reasons, appears to be insufficient. Methods to address complexity and approaching gradually improved and more sustainable forms of resource management include reflexivity, knowledge integration, process management and collective learning. With these ideas, co-management is broadening without losing a co-management perspective. Fisheries co-management in trans-sectorial coordination and in networked and globally managed resource use is also still a necessary component of attempts to address uncertainties and risks at various levels of resource management. Co-management needs to be further discussed in terms of integrating resource management systems and of opening new management perspectives by studying spatial, social and ecosystem complexity as introduced in section 1 above.

The experiences from the EU's RACs and FLAGs show that the implementation of co-management under these guiding ideas is not straightforward and requires, besides substantial time and resources, adequate institutional structures and processes for stakeholder interaction, conflict mitigation and knowledge inclusion, as well as engaged actors that are willing to cooperate and hence capable to serve and fulfil these functions for a long-term development of co-management (see also section 3.4 for conclusions on RACs and FLAGs).

Fisheries co-management as a solution to resource use problems and conflicts is hence part of efforts to achieve socially, economically and ecologically sustainable resource use. In this process, the complexity of coupled SES appears as the main problem to address in "adaptive co-management" (Sandström and Rova 2010) or SES-based management. Joint problem-solving strategies of cooperating actors in resource management therefore require, beyond power sharing and knowledge integration, a refinement of research questions about vulnerability, resilience, risk, and sustainability.

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