Fisheries and coastal governance as a wicked problem ☆

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ABSTRACT

Inspired by Rittel and Webber [Dilemmas in a general theory of planning. Policy Sciences 1973;4:155–69], it is argued that fisheries and coastal governance is confronted with problems that are inherently "wicked." Problems are wicked (as opposed to "tame") when they are difficult to define and delineate from other and bigger problems and when they are not solved once and for all but tend to reappear. Wicked problems have no technical solution, it is not clear when they are solved, and they have no right or wrong solution that can be determined scientifically. Instead, for wicked problems governance must rely on the collective judgment of stakeholders involved in a process that is experiential, interactive and deliberative. In this paper, the wicked problem is identified as a governability issue, recognizing that there are limitations to how rational and effective fisheries and coastal governance can possibly be. The paper offers a framework which could help us locate the wicked problems within the fisheries and coastal governance system, as well as examine their governability.

1. Introduction

Fisheries and coastal systems are intrinsically diverse, complex and dynamic. As such, they confront governors with a daunting task where no simple solution may be found and where no single management tool will suffice. Governors need to recognize that there is no one way of dealing with the fisheries and coastal governance problem, and that they can never be certain that the chosen solution will work. Since problems are not always what they may seem at first glance, it is not appropriate to rush to judgment with regard to what the nature of the problem is and what the solution should be. Instead, governors must proceed cautiously as decisions may have consequences that they later regret. Indeed, as Laurence J. Peter said: "Some problems are so complex that you have to be highly intelligent and well-informed just to be undecided about them (quoted by Conklin [2, p. 1])". Given that this is a rather precise characterization of fisheries and coastal systems, the question is what such a lack of clarity pertaining to the complexity of the problem implies for the process of governance. If there is no remedy available and yet governors have to come up with some, how can they arrive at solutions that can be acted upon? And what can they then possibly expect of governance outcomes? The answer, elaborated on in this paper, is that they need to understand the nature of the problem.

Drawing on Rittel and Webber's [1] seminal paper on dilemmas in planning theory and practice, it is argued here that fisheries and coastal governance is confronted with problems that are particularly "wicked." A problem is wicked, in the meaning of complex, tricky or thorny (or as Hisschemöller and Gupta [3] referred to as "unstructured"), when it is difficult to define and delineate from other and bigger problems. Wicked problems are not solved once and for all but pose a constant challenge, partly because it is not known for sure when or if they are solved. Interactive governance theory [4], on which this paper draws, would think of wicked problems as a "governability" issue and that there are limits to how systematic, effective and rational a governing system can be in solving them. With limits of governability, one must assume that governance outcomes are not always as planned, and that governors are often in a situation where they would have to accept solutions that are less than ideal, which is also Rittel and Webbers' assumption. Indeed, they would regard governance in itself as a wicked problem.

Previous work on fisheries and coastal governability [5–10] holds that limits of governability are to be traced within what is called the governing system and the system-to-be-governed and their governing interactions. The current paper suggests that limits of governability are also related to, or located within, the actual problem that the governing system tries to solve. In other words, limits of governability are not only about the nature of the system, but also about the nature of the problem that the system must deal with. The next section recapitulates the idea of planning as a wicked problem according to Rittel and Webber

and the research literature that they inspired. A synopsis of governance theory and governability and how it has been applied on fisheries and coastal systems is also presented. This is followed by a discussion of some of the wicked problems commonly encountered in fisheries and coastal governance. Finally, a framework that will assist in locating wicked problems within fisheries and coastal governance and in examining their governability is presented.

2. What are wicked problems?

Rittel and Webber [1] and Rittel [11] confronted the leading planning paradigm, which they thought was overly simplistic, naive and unrealistic. Conventional planning, which is also the common approach of fisheries and coastal management, assumes a process with an obvious beginning and end. It generally starts by defining the problem, setting the goal, seeking and analysing information, outlining the available alternative solutions, calculating their relative merits, making and implementing a decision, and finally evaluating outcomes and, if needed, making modifications (cf. [12]). This, according to Rittel and Webber, is an approach which may work for what they call "tame" (or benign) problems, but not for wicked ones which are more common in real-life situations. Tame problems have a well-defined statement; it is clear what they are and what they are caused by. What they require is a systematic methodology typical of engineering or scientific inquiry, as they belong to a class of problems that can be solved in a similar way each time. Also tame problems have a definite stopping point, i.e. it is known when the problem is solved, as in a chess game or with a math problem, and it is clear whether the solution is right or wrong. Important also is that how such a problem is solved at one point has no bearing on future options.

Rittel and Webber argue that the problems that social planners deal with most of the time are wicked problems, i.e. "they are inherently different from the problems that scientists and perhaps some classes of engineers deal with" [1, p. 163]. They are not of a technical nature. Instead, they have no definite formulation and no well-described set of potential solutions. They depend on the perspective, i.e. how the problems are looked upon, and that may vary from one person to the next, conditioning on the extent to which the person in question is affected by it. Problem perceptions and definitions are often social constructs (as opposed to individual) [4], i.e. they are outcomes of a social process where a problem must first be "set" before it can be solved [13, p. 40]. Defining the problem is therefore in itself a wicked problem. "Wicked problems persist, and are subject to redefinition and resolution in different ways over time. Wicked problems are not objectively given but their formulation is subject to the viewpoints of those presenting them" [14, p. 6]. A reason is that social problems, as the philosopher John Dewey [15, p. 488] remarked, tend to be interpreted in moral terms. This implies that, with wicked problems, people often disagree about what they are, what they are caused by, and therefore what it would take to solve them. They may not even agree whether they are really solved, partly because they do not have a true-or-false solution. As Rittel and Webber phrase it, wicked problems "have no stopping rule" that tell us when the answer is found and the problem is out of the way. This is also because there is no once-and-for-all solution: The problem has a tendency to reappear and must therefore be *re*solved. Further, wicked problems are often symptoms of larger issues; they are problems within other problems. Thus, wicked problems are often operative at various scales. Important also is that wicked problems are essentially distinct. As formulated by Allen and Gould [16, p. 22]: "Each wicked problem concerns an assemblage of resources combined with effective demands in ways that are unique in time and space." They may have features that are known but they occur in situations and in contexts that are different. For instance, a fisheries crisis in one country may resemble one in another country, but when looking in the details, they are different. The circumstances in which they occur would also differ and potentially be important both in explaining and resolving the crisis. Finally, a planner, in contrast to a scientist, cannot afford to be wrong, as solutions leave a trace and have consequences. If a mistake is made the first time, it would affect how the outcomes are dealt with in the next. This means that for wicked problems planners cannot experiment with solutions as easily as they can with tame problems, because they cannot start all over again with a clean slate if they should change their mind about which solutions are preferable.

3. Governance and governability

For wicked problems, a governance approach is needed whereas management is for what Rittel and Webber call tame problems. What then are the distinguishing characteristics of governance versus management?

1. Governance is a concept that has traditionally been related to governments and what they do. In recent interpretations, however, governance is a more complex structure and process. Here, government is not the only governor, and governance occurs not only nationally and internationally, but also at the local level or within a particular industry. Governance is the shared, collective effort of government, private business, civic organisations, communities, political parties, universities, the media and the general public. In this wider definition, governance is less top-down than it is bottom-up, and in many instances also horizontal, as when business enterprises within the same industry attempt to coordinate their actions. Governance can be more or less organised, formal and routine. Sometimes when a crisis calls for immediate measures, governance occurs ad hoc. Governance is often conflictive, particularly when interests collide. But in modern society, governance is mostly interactive, as when actors consult each other or take into consideration what others do and therefore try to avoid getting in each other's way, for instance by dividing the market among them. Sometimes, governance is also co-operative, as when actors collaborate in some joint venture or establish strategic networks [18]. Hence, the term "interactive governance," which Kooiman et al. define as "the whole of interactions taken to solve societal problems and to create societal opportunities, including the formulation and application of principles guiding those interactions and care for institutions that enable them" [5, p. 17].

Governance involves a process much like the one envisioned by Rittel and Webber for the resolution of wicked problems. The systems-to-be-governed may be too diverse for the top-down approach. Diversity suggests that no one-size-fits-all situations exist, that problems, as noted by Rittel and Webber, are basically unique and governance solutions cannot therefore be standardized. Local knowledge is essential, which implies that governance must be exercised in proximity to the problem, by involving "those who know." Hence, devolution of governing functions and systems would be more suitable to respond to local demands than centralized initiatives from far away. Wicked problems are typically complex. They are, as Rittel and Webber say, often just indications of problems that go deeper. Problems that are often identified with fisheries and coastal areas such as poverty, social conflict, civil disobedience or corruption can be dealt with at the symptom level, which they most often are. But measures at this

level would hardly be effective if the problems are caused by broader social structures (for instance class injustice) or are issues at larger scale (e.g., related to governing institutions that lack legitimacy). In these cases, governance would therefore require a more comprehensive political, social and institutional reform than simple symptom treatment.

For wicked problems, Rittel and Webber envision a radical departure from the text book planning process prescription. Wicked problem solving "must be understood as an argumentative process: one of raising questions and issues towards which you can assume different positions, with the evidence gathered and arguments built for and against these different positions" [11, p. 395]. As Rittel and Webber [1] posited, images of the problem and of the solution gradually emerge among the participants as a product of incessant judgment. This is because the knowledge needed "is not concentrated in any single head" and that the judgment required is based on consideration of what "ought-to-be" [11, p. 394, italic in the original]. Thus, the process prescribed for wicked problems is one of interactive communication and learning among stakeholders, where norms and values are played out and where different ethics, ideologies, and epistemologies are active. Gilmore and Camilius [12, p. 878] have captured the issue well:

> The nature of strategic issues, especially in dynamic, complex environments, requires a fundamental change in how strategic planning is conducted. The focus of the exercise must shift from defining the solutions for problems which are assumed to exist, to defining a process which is responsive to the wicked characteristics of the perceived issues, a process which is alive and changing as additional learning takes place. A process which is inclusive and self-correcting.

This is also similar to what interactive governance theory would recommend, and for many of the same reasons.

2. Governance is broader than management. Management is a technical issue, something that involves a set of tools that can be applied to solve a concrete task, where the goal is clear and the outcome measurable. Management is something that professionals, experts, planners, engineers, scientists and bureaucrats do. They are involved in the implementation of stated goals, and would ask themselves: Was the goal achieved, and at what cost? Could the same goal be realized with less effort? Governance, on the other hand, includes also the deliberation and determination of these goals, including the values, norms and principles underpinning them [19]. Governors therefore ask themselves: Which goals are good? If there are several concerns involved, which should have priority? Whose goals are more important than others? These are questions that cannot be decided by experts, like managers or scientists, because problems in the real world rarely correspond to the traditional disciplinary problems [20]. Rather they necessitate complex ethical and philosophical considerations. They also require a different knowledge than the one of experts; a practical, ethical, contextual and experience-based knowledge, much in line with what Aristotle called "phronesis"—in contrast to his concepts of "techne"—the knowledge of a craftsman, or "episteme", the universal knowledge typical of a scientist [21,22]. Science can of course help a long way, but science alone cannot provide the answers to questions of which values, norms and principles should be applied in real-world governance.

Governance theory and research starts with the assumption that goals are not external to the process, but their formulation is part of governance itself. Therefore, goals are not assumed a priori, but are an empirical research issue: What are they? How did they become what they are? Who brought them to the table, who supported or opposed them, and why? In this perspective, goals are negotiated and not necessarily agreed upon. Instead, they often end up as fragile compromises. Consequently, goals are not expected to be permanent but preliminary, and therefore instable. They would change, for instance, according to the relative composition of stakeholder power. Goals also fluctuate with the change of ideas, preferences, and expectations about what the system could deliver. They do not adapt automatically, but they do so as an outcome of a re-negotiation and/or learning process. The same reasoning applies to rationality: Rationality becomes an empirical question, where institutional, cultural and contextual factors are believed to matter. It follows from the definition of the governance concept, indeed also from the ideas of Rittel and Webber, that rationality is not only instrumental, as is the perspective of management, but "value-based" and "communicative."

3. Interactive governance theory works from a three system's model; a governing system, a system-to-be-governed, and a system of governing interactions, i.e. one that links the other two (cf. Fig. 1). It assumes that there are constraints as to how effectively and efficiently these systems can be governed—hence, the concept of governability, which is defined as the overall capacity of a system to govern or to be governed [4]. Furthermore, the theory holds that all three systems are structurally diverse, complex and dynamic, and are operative at various scales which means that the governability challenge is persistent and must be addressed on a continuous basis—just like a wicked problem without a stopping rule. It also implies that the problem may, as Lindblom [23] argued, only partially be resolved and that governors must often be satisfied with less than ideal outcomes. Notably, the limits of governability are not necessarily written in stone but can sometimes be stretched—yet within limits. As the case may be, through intervention there is a potential for marginal or radical governability enhancement. What these limits are and how they can be moved are governance research issues.

Interactive governance theory suggests that wicked problems and the governability challenge that they pose are to be identified within each of the three systems. Governability is therefore a function of their structural characteristics as well as their functioning. The diversity, complexity, dynamics, and scale of systems create a "problem situation" [4, p. 140] fertile for wicked problems. The more diverse, complex and dynamic, and the larger the scale, they are, the more wicked the problem of governing. The problem solution would need to be addressed in a way that fits the challenge. If the problem is unique, as wicked problems typically are, so must the governing solution. It cannot easily be copied from somewhere else but must be tailor made.

The wicked problem concept suggests that governability does not only pertain to the particular system within which the problem occurs. It is also intrinsic to the problem and problem solution. Wicked problems require governance mechanisms that are participatory, communicative, and transparent. But creating such mechanism and making them work is in itself a wicked problem. As with democracy in general (cf. for example [24]), interactive governance is no easy remedy. Besides, trying to tame it, goes against the very essence of what democracy is. Democracy is not supposed to be tamed. The same is true for fisheries governance, for instance co-management which is now one of the popular governance arrangements. As has been demonstrated by Wilson et al. [25] and many others, making co-management arrangements work is inherently difficult. It is certainly no tame problem and efforts in trying to tame it, like streamlining and controlling it, should not be entertained either. On the contrary, if following Ruggill and McAllister [26], collaboration is almost
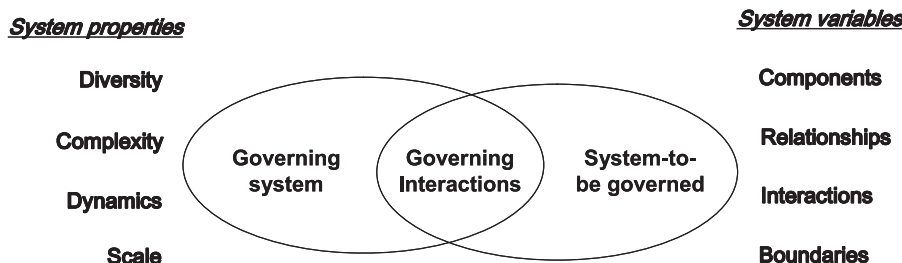
Fig. 1. Governability assessment framework.

always a "wicked problem." With regard to ecosystem management Rauscher points to the same: "Creating a vision of the decision-making environment in which ecosystem management must function is itself a wicked problem with no single best answer" [27, p. 176]. Thus, it may be concluded that although the problem that is to be solved is certainly wicked, wicked is also the problem *of trying to solve it*. The latter is complicated by the fact that no technical solutions can compensate for the human factor. People are part of the system within which the problem occurs. They cannot simply act as external agents and enforce solutions onto others. They are themselves involved, affected and responsible.

4. Fisheries and coastal governance

As outlined above, wicked problems have a number of properties that fisheries and coastal governors would recognize, if not *in toto* so at least in part. Most of the time the problem to be solved is not all that clear, and neither are the causes that are leading to it. Also in fisheries and coastal governance "[t]he formulation of a wicked problem *is* the problem!" [1, p. 61]. For instance, what explains resource degradation is not always clear, not in any particular case. Is the reason natural or human made? If both, what is their relative importance? In most cases, there is no single natural or social variable that explains outcomes. Even the best scientists find it hard to give clear answers with regard to problem definitions and solutions. To sustain the resource base, for instance, leaves the question—at which level? How large should this stock biomass be? If a recovery plan is needed, how fast should it proceed? Should the state of the resource be the only concern, or are there other concerns that are important as well? Which concern should be given the greatest attention and resources, and in what sequence? These are questions where science falls short. Science may help raise critical questions, but on its own it cannot provide answers that belong to the political arena. Other concerns may play a role, different rules may apply, and conflict may be a major driver. On political issues, stakeholders tend to have different views and priorities, which are not based on knowledge as much as values and interest. Here, not only the problem definitions and the solutions that one may support reflect a political stand, politics also determine which questions are asked [28].

As Rittel and Webber [1] argue, for wicked problems, the problem definition and solution cannot be kept apart. Once wicked problem is identified and defined, an idea of a solution, or at least part of it, is already conceived. "A problem well-stated is on its way to a possible solution," Dewey said [29, p. 112, see 15]. Fisheries and coastal governance provides easy illustrations: If for instance, a resource crisis is defined as a "tragedy of the commons" [30], which is typically the case, the policy prescription follows automatically. Inherent in the model is an institutional

failure (deficient property rights) that leads to a market failure (the tragedy). Thus, to avoid the tragedy from unfolding, property rights must be fixed. However, hardly anything in fisheries and coastal politics, or in society as a whole, is as contested as property rights. Supporting one or the other solution is not just a technical issue, but it is an issue which also says something about values and politics. It typically divides people into a right or left wing. Management tools come with ideologies; they are not value free: In fisheries and coastal governance, means are as contested as goals.

Solutions tend to live their own lives. The tool box of fisheries and coastal governance is pretty full, ready made and well-known. To be an expert in fisheries management is to know what these tools are and what use they have. There is also a lot of tool import, as fisheries management recipes are copied from elsewhere, sometimes from very different areas of the world. Applying tools on wicked problems would require knowledge of a particular context. Tools rarely have universal application [31] but must be developed for a particular problem and in the context which they are to be applied. Also, tools have consequences. Applying them in concrete situations leaves traces, as any craftsmen would know; they change the subject matter in lasting ways. Thus, governors should be careful not to use a tool that does not do exactly what they want it to do.

Fisheries and coastal governance addresses issues of biological, economic and social nature that are closely linked. Natural, economic and social goals get in each other's way. Thus, governance is a complex exercise: As governors deal with one issue or goal, unintentionally or intentionally they also deal with others. The wickedness is increased because concerns are often in conflict and difficult to reconcile. It is hard to both conserve and utilize at the same time. Despite intentions to conserve and preserve, resource utilization may easily lead to marine ecosystem damage. The problem is also wicked by the fact that governors are always operating within limits that are not exactly known. Natural and social systems have thresholds below which they cannot prevail or continue to exist in current form—as when biodiversity is lost or a fishing community dies—but it is not always easy to tell when to intervene. For fisheries and coastal governance, trying to maintain a healthy ecosystem and a good balance between the ecosystem and the social system is a persistent problem. It needs constant attention and action. Decisions about how to deal with it must be made on a routine basis, but governors would also have to be prepared for sudden changes that occur for reasons that may or may not have anything to do with how they actually try to govern them. This would require a capacity for flexibility and for reflexivity, and the ability to implement the precautionary approach.

Fisheries and coastal governance involves hard but delicate choices often between equally desirable but contradictory goals [5]. The wickedness of a governability problem is enhanced when

social values are in conflict. For some people, nature is culture, something they live with while protecting its integrity. For others, nature is something to invest in, for reasons that are related to their own wealth generation. The problem is also that stakeholders have different interests that will not go away no matter how much people agree on basic values and principles. Distributional issues, such as allocation rules and justice claims, are therefore always at the core of fisheries and coastal governance. There is for instance in a small-scale versus large-scale fisheries controversy, which also reflects larger issues like poverty, food security, habitats, communities and gender.

Given these circumstances, it is also expected that stakeholder perceptions of the problem and the solution differ. When there are conflicts of interest, someone's solution may be another person's problem, as when users face newcomers on their fishing grounds. Stakeholders will naturally be ambiguous and inconsistent with regard to their own goals, individually as well as collectively. They cannot have the cake and eat it too, but still acts as if they can. Therefore problem definitions, goal formulations and solution strategies in fisheries and coastal governance are always challenged. Policies usually meets resistance, if not by all so at least by some. Conflicts are not fully resolved, and settlements of an issue last until battles reopen. As Turnbull [28] stresses with regard to political arenas, solutions "transforms things to a greater or lesser degree but they do not usually eliminate problems altogether" (p. 5). This may easily create a legitimacy deficit, as stakeholders would not only question outcomes and/or procedures but may even try to combat them by "voice" or by "exit" [32], resulting negatively thus on governability. Compliance will be low because stakeholders cannot be easily "tamed" through some authoritarian rule. Under these circumstances, the wicked problem of conflict resolution cannot be engineered. Rather it must be solved though a process of communication, argumentation, and negotiation that is essentially political, and where consensus is often out of reach or exists insofar as stakeholders agree to disagree [3]. But that is a volatile compromise. Fisheries and coastal governance is a constant battle that does not only work in the long run but also in the short run. Governors do not only make decisions on basic norms and principles that are supposed to last. Fisheries and coastal governance is a decision-making machine that is running all the time and at high speed. The health of the ecosystem needs to be continuously watched. Harvesting levels must be constantly controlled and harmful potentials regularly monitored. This is an issue related to the diversity, complexity, dynamics and scale of the system-be-governed. The diversity implies on-site presence. The complexity requires an eye for interaction, by-effects and latent functions. The dynamics do not allow the governing system a rest. The dynamics are such that change does not necessarily converge towards equilibrium. Things change in lasting ways. As Rittel and Webber argue, with wicked problems, solutions have consequences that are not easily reversible because they create path dependency. Therefore, the idea of adaptive governance and corrective feedbacks with inbuilt learning do not work well with wicked problems. Change sometimes brings us beyond the point of no return, as with the privatization of resource rights. Once common property is transformed into private property, it is in practice very difficult to reverse even if it creates undesirable impacts, for instance with regard to distribution of wealth, power and social values. Adaptive governance is thus within limits, whereas transformative governance is about surpassing or stretching them. Adaptation suggests marginal rather than fundamental, radical change and that a new solution would be sought in proximity to old ones. It also suggests that change will occur automatically, as a natural process, or easily, as from a re-adjustment of the governing mechanism. Unfortunately, in reality, drastic moves are often required.

5. Governability assessment

A governabilty assessment starts from the assumption that there are barriers that may inhibit a system to be brought from an actual to a preferred state. It builds on the idea that governance would be served if these limitations were known and located [9]. It is also expected that efforts to surpass these limits would confront governors as a wicked problem. As pointed out already, wicked problems require a different governance approach than tame problems. Their resolution cannot be reduced to a technical exercise. Neither can governors follow cookbook recipes since the problem is unique. Such uniqueness implies that governors cannot know what these problems are until they have actually tried to define them. That would require a process of inquiry, a governability assessment, to which social and ecological research can make a contribution. In effect wicked problems necessitate interdisciplinary research [33].

Following the interactive governance framework, wicked problems can be attributed to and traced within the system-to-be governed, the governing system, and the governing interactions that make up the entire governance system (cf. Fig. 1). Here is also where an assessment should be oriented. More specifically, interactive governance theory emphasizes four inherent characteristics of these sub-systems: their diversity, complexity, dynamics and scale. In the analysis, wicked problems are assumed to be endogenous or exogenous to the system in focus. They are either self-produced (autopoietic—cf. [34]) or generated from the outside. In the real world, none of the systems is in its original state, unfettered by human influences. Therefore, fisheries and coastal ecosystems would have already been exposed to external interventions or pressures. A governability assessment would be about knowing how these influences impact on the sub-systems. It would also watch out for potential future threats. Notably, such an assessment is performed for both theoretical and practical purposes. Knowledge gained is aimed at understanding as well as improving governance, by helping to identify means through which wicked problems can be handled in a way that is instrumentally effective, morally sound, and socially just. It is assumed that at the end of the day governability hinges on all these qualities.

Fig. 1 presents a conceptual model for assessing wicked problems of fisheries and coastal systems. The model provides guidance and direction, but would still need further detailing. This is because any assessment methodology must take into the account that governance systems have unique features largely determined by the particular socio-ecological context with which they are operative. Neither do assessment tools guarantee that the assessor is on the right track, but they would help in formulating multiple hypotheses that can be tested empirically. A governability assessment would not be a one shot exercise. Rather, it is an ongoing affair partly because wicked problems tend to reappear, often in new forms and partly because it is the symptoms that are treated rather than the root causes.

As indicated in Fig. 1, a distinction is made between system properties and system variables. With regard to the former, *diversity* is about the heterogeneity of system elements and variability that calls for fine-tuned, particularistic governing approaches. Generally, governance is more effective if it occurs where the problem is felt (or where the opportunity actually appears), and in co-operation with those who are affected by it. *Complexity* raises the problem of connectivity and the fact that intervention into the system is likely to have an effect on how the whole system works. Following Merton [35] it would be important to watch out for "latent functions", that intervention will have unexpected positive or negative side-effects, because such functions are often hard to discern and account for. *Dynamics*

suggest that the system-to-be-governed, the governing system and the governing interactions are volatile; they change over time, sometimes linearly but frequently unpredictably and unexpectedly, as when crisis hits. Change may be triggered by external interventions and interactions, and an analysis of these how systems are linked is required, like how the governing system is connected to and interacts with the system-to-be-governed. Sometimes change is generated from within; when one system element moves, shifts position or orientation, others are affected. Governability would in both instances be expressed as the capacity of systems to respond to internal and external pressure or demand. *Scale* pertains primarily to the spatial dimension of the system. A fisheries system, be it a system-to-be-governed or a governing system, may be situated at local, regional, national and/or global levels. Thus, when a fishery is being referred to as large scale, it is not so much about the fishing technology but the extensiveness that this technology enables, i.e. how far the boats travel and the ecological and social impacts of their operations that the governing system needs to deal with. Further, this system is often nested in systems of larger scales. For these reasons, a problem is wicked because it may be part of bigger problems, and their solution would therefore need to involve initiatives at a higher or lower scale than where the problem is actually felt and discerned. This, among other things, makes the problem wicked, because the problem have causes that are not easily located and because the solution have wider implications, invoke obstacles elsewhere and involve stakeholders who are not present where the problem is felt.

As to the system variables listed in Fig. 1, when searching for wicked problems related to system diversity, the focus is on system *components*; the things that the system is made of; their characteristics and numbers. What/who are they? How different are they from each other? When focusing on system complexity the unit of analysis is *relationships*: and how do they condition each other? As to system dynamics, the assessment would be targeting *interactions*; how do related system components play together, how do they influence each other, and how does change in one part of the system impact on other elements and the system as a whole? For scale, the focus is on system *boundaries* and how they confine relationships (like networks) and interactions, and how they define what its components are.

5.1. Components

Fisheries and coastal systems are partly natural and partly social. The diversity is therefore related to both. What organism, species, habitats are there? Tropical biodiversity is known to be much greater than temperate. The hypothesis would be that the greater the diversity among system components, the lower the governability. For instance, diversity implies a more heavy demand on knowledge, on particularistic governance mechanisms. The governing system then requires data of "a high resolution" regarding, for example, particular habitats, e.g. spawning grounds and biotopes [36], as well as "vertical knowledge" that enables a deep understanding of ecosystems [37]. There is a similar need regarding social systems. For instance, who are the direct or indirect beneficiaries of the ecosystem services? Are they heterogeneous or homogenous as a group? How do they draw from the resource base, and by what kind of technology? What is their situation, their capacities and rationalities? As Siry [38, p. 268] concludes, the greater the diversity, the greater the need for a decentralized governance mode in order to perceive and deal with details and subtleties: "[T]he huge range of biodiversity, the large variation in types of coastal zones within a country, varied human populations and diverse regional economics among regions within a country are the main reasons why coastal zone management needs to be decentralized and community-based approaches promoted." But decentralization/self-governance comes with its own wicked problems, for instance pertaining to administrative order and efficiency, rights, equality, and how to deal with mobile users who belong to several systems-to-be governed.

5.2. Relationships

What constitutes a system is not the compilation of parts (species/humans) per se, but the relationships that connect them. Species and organisms form communities and trophic chains. People form networks, groups, communities and institutions for the purpose of managing their resource utilization. Both natural and social systems are characterized by mutuality and interdependence that condition what individual elements and the system as a whole can possibly be or become. The hypothesis would be that the more complex systems are, the lower the governability and the wickeder are the problems that governors have to deal with. One should not assume equilibrium, linearity or order. Neither should one expect internal compatibility, coherence or symmetry. Rather, systems may expose signs of conflict and disarray, as when stakeholders have interests in conflict like when taking up space at the expense of others. The governing systems would have problems understanding and controlling internal as well as external interconnectedness. Much time and effort would have to be concentrated on conflict resolution and balancing of incongruent demands. A governing response in this situation could take the form of spatial demarcation and boundary control. When, for instance, competing user groups are kept apart, there is less likelihood that they will get entangled in conflict. An alternative response is to encourage co-operation by forming partnerships. The relationship between fisheries, coastal tourism, marine aquaculture, coastal transport and off-shore oil exploration does not have to be antagonistic. How to transform a conflictive actual or potential relationship into a co-operative and symbiotic one is a wicked problem "par excellence."

5.3. Interactions

Here, the focus is on the systems *in vivo*, i.e. the interactions and transactions that take place among system elements. Systems are therefore often unstable, exposed to forces that require a response that may or may not change the way they work. The hypothesis is that the more dynamic the system is, the lower the governability. Luhmann suggests that the idea of unilateral control should be abandoned. "There may be hierarchies, asymmetries, or differences in influence, but no part of the system can control others without itself being subject to control" [34, p. 36]. An issue here is the interaction that occurs between the system-to-be governed and the governing system; i.e. the ways the two communicate and the means that are employed. How do stakeholders participate in the governing systems? Fisheries and coastal systems are not always adaptive. Rather they often resist change because, for instance, it is in the interest of those who inhabit them to do so. Social systems do not adapt and change through natural selection but because members make them do it by choice. A dynamic feature is interactive learning, which is always a wicked problem. As Chua et al. [39, p. 305] argue: "Learning is an important part of ICM [integrated coastal management] dynamics as it requires sound management skills to address a host of complex and complicated issues very often interwoven into a sophisticated matrix of political, economic, social, cultural and conservation interests." The advantage

partnership arrangements as governing interaction modes is that they widen the source of knowledge, including tapping local knowledge, and provides opportunities for interactive learning [40]. It allows stakeholders to learn from each other, and learning is always a plus sum.

5.4. Boundaries

What make systems are also their boundaries, as they delineate which components, relationships and interactions occur. System boundaries are actual as well as analytical, natural as well as socially constructed. These boundaries determine the scale of the systems, which could be small—like a lake for a natural system or a local community for a social system—or large—like a large marine ecosystem or a coastal industrial zone. At the boundary, relationships and interactions among system components would be fewer and less intense. Governability is an issue of scale, as large-scale systems whose diversity, complexity and dynamics are assumed to be more pronounced would then be less governable, compared with those of smaller scales. System boundaries are also a matter of perception and conception [41], providing therefore the basis on which governing systems are designed. In other words, a governing system is devised for dealing with a system-to-be-governed whose boundaries must be determined in order to delineate a mandate. In some instances, more than one governing systems operate within the boundaries causing problems with coordination and harmonization. This is an issue sometimes referred to as "legal pluralism" [42]. The governability problem would be enhanced if the boundaries of the system-to-be-governed and the governing system do not match as when the jurisdiction of the governing system does not encompass the entire ecosystem or the social system. If several governing systems are operative within the same boundaries, governability problems are to be expected. What then happens at the boundaries and the overlapping areas is an interesting research issue for governing interactions. For example, how are mismatches dealt with? Do problems or opportunities fall between the cracks? Boundaries may be more or less permeable. Interactions and relations may cut across boundaries and link systems at the same or at different scales. The scale at which a problem is addressed may determine the governability of the system as a whole.

6. Conclusion

Although this paper argues that fisheries and coastal governance is addressing problems that are inherently wicked and that they must be treated as such, it does not suggest that these problems were always perceived and treated as if they were tame. Certainly, not all governance aspects are wicked; rather they are on a gradient. What is submitted, however, is that increasingly fisheries and coastal governors and scientists are recognizing, through numerous governance failures, that the problems they are facing are more wicked than they in the past have tended to think. Governance failure may be related to a number of deficiencies, but treating wicked problems as if they were tame is a sure recipe for failure, as it would provide wrong medicine and intensify the problem (cf. Dewey in [15]). Therefore, the particular context and the uniqueness of the problem to be solved must be taken into consideration. Caution would also be needed because solutions tend to leave traces that are difficult to erase even within "adaptive" governance schemes. The solution to wicked problems and hence, the governability of the system-to-be-governed, is not to be found in the management tool box. They are not technical first and foremost, but institutional, political, even philosophical.

Interactive governance theory would therefore argue that wicked problems require interventions at all "orders" of governance, what Kooiman [4] calls first-, second- and meta-orders, where the latter concerns the basic values, norms and principles that lay the foundations for the governing institutions (second order) and instruments (first order).

However, the limitations that wicked problems pose on governability of fisheries and coastal systems do not only pertain to the system-to-be-governed but also to the governing system and governing interactions (see Fig. 1). In fisheries and coastal governance, governing systems and the system-to-be-governed would often, and probably have to, match structurally: The governing system becomes diverse, complex and dynamic. They are hybrid institutions in flux and therefore a wicked problem to administer. In fact, the governing system becomes a system-to-be-governed, i.e. shifting from being the subject to the object of governance. Among the relevant questions then is the classic "*quis custodiet ipsos custodes*—who governs the governors?"

Finally, wicked problems require governing interactions that are participatory and communicative, which imply stakeholder partnerships and co-management arrangements. This is due to the time and effort needed to arrive at an agreement on how to frame the problem. The problem does not speak for itself and there are several ways of seeing it. Nobody can claim that their definition has authority, even if stakeholders attempt to get their particular ideas accepted by others. This makes governing interactions potentially conflictive, the evidence of which is easily detected in fisheries and coastal governance.

Ridden with ambiguity, dilemmas and hard choices, fisheries and coastal governance needs deep reflection at all orders of governance rather than quick "first-order" fixes. In line with Dewey's philosophy (for a summary cf. [43]), the process of wicked problem solving as an inquiry starts with the questioning of experience and when answers have been found ends by again engaging experience. That is also how knowledge about how to approach wicked problems in particular governance contexts is gained, such as those confronting fisheries and coastal governance in the concrete.

This paper offers a conceptual framework that may help to do so in a systematic and exhaustive fashion through empirical research. The expectation is that the wicked problem of governability is to be located within the governing system, the system-to-be-governed and the governing interaction. The emphasis is on system diversity, complexity, dynamics and scale, which in this framework are perceived as the structural roots of wicked problems. It also highlights the need to focus on system components, the relationships that form them, the interactions they give rise to, and which also facilitate their adaptation and transformation, and finally the boundary within which they operate. In other words, the governing system, the system-to-be-governed and the governing interactions are *where* to look, the diversity, complexity, dynamics and scale of these systems are *what* to look *for*, whereas the components, relationships, interactions and boundaries are *what* to look *at*.

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