Assessing Governability in Capture Fisheries, Aquaculture and Coastal Zones

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Abstract: Capture fisheries, aquaculture and coastal zones are closely-related resource systems with varying representations of diversity, complexity, dynamics and scale. They require different management approaches and appropriate governance structures which, as this paper suggests, can be determined partly through assessments of their governability. The governability of a resource system is defined as its overall capacity for governance, which is assessed by determining the properties, qualities and functionality aspects that make it more or less governable. The premise is that assessing governability might help to identify areas where governance can be improved. From an interactive governance perspective, we used a theoretical framework to assess qualitatively the governabilities of capture fisheries, aquaculture and coastal zones, focussing on the system-to-be-governed, the governing system, and the interactions between them. Overall, governability was found to be likely to be highest for aquaculture, moderate for capture fisheries and relatively low for coastal zones. One criterion that distinguishes aquaculture from the other resource systems examined is that it is generally owner-operated, making it more governable than the other systems. The results, strengths and weaknesses of the governability assessment framework used are discussed, with the aim of stimulating further development of methods and research on governabilities and governance of these and other resources systems.

Key words: governability, interactive governance, assessment framework, aquatic resource systems

1. Introduction

The concept of governability used here is based upon the interactive governance perspective developed by Kooiman (2003) and Kooiman *et al.* (2005), and described in its basic conceptualisation by Kooiman *et al.* in this volume. Governability pertains to the totality of any system that is governed (SG), its governing system (GS), and their governance interactions (GI) (Kooiman 2003). Governability is assessed by exploring the diversity, complexity, dynamics and scales of an SG, its GS and their GI. Generally speaking, resource systems that are highly diverse, complex and dynamic, and that encompass large ranges of spatial scale, are expected to be difficult to govern, and governance systems that function well in them are likely to differ from those that are successful in systems with lower diversity, complexity, dynamics and scale.

Capture fisheries, aquaculture and coastal zones are good candidates for assessment of governability. Capture fisheries are often overexploited. Aquaculture contributes much to fish supply but, like agriculture, has inevitable environmental and social costs. Coastal zones attract human settlement, rapid development of infrastructure and various types of industry, as well as being ecosystems that support capture fisheries and aquaculture. Assessment of the governabilities of these resource systems could provide insights into factors that enhance or limit their governance, helping to ground expectations about what is realistically achievable and to increase the inclusiveness and transparency of processes, and thereby enhancing the legitimacy of the resulting governance arrangements. Such understanding is largely missing from the current management discourse (Jentoft 2007).

The governability assessment framework proposed here follows the initial formulation and conceptualization of governance and governability presented in Kooiman (2003) and Kooiman *et al.* (2005), and their application to marine protected areas (Jentoft *et al.* 2007). We begin with a brief description of the interactive governance perspective and make the case for assessing governability. Next, we describe a methodological framework for governability assessment. Using capture fisheries, aquaculture and coastal zones as comparative case studies, we then illustrate how the framework can be applied. These general overviews of the three resource systems are intended to stimulate further thinking about their governance and governabilities, by illustrating how this can be approached. They are not put forward as exhaustive analyses. We conclude with a summary of results, brief discussion and suggestions for future research.

The term 'fisheries', where used alone here, means capture fisheries and does not include aquaculture. Aquaculture is the farming of aquatic organisms, which can take place on land and at sea. Coastal zones comprise land and sea areas, with varying boundaries depending on political, administrative, legal, and ecological considerations.

2. Interactive Governance and Governability

Interactive governance theory posits that a GS has three major components: elements, modes and orders (Figure 1). Governance elements comprise images, instruments and actions. These are all closely connected, not always easily distinguishable and generally do not present themselves in an orderly sequence. An image, or set of images, might be developed unilaterally to rationalize managerial choice of a particular instrument. Alternatively, an instrument might be chosen only because it gets sufficient political or user support. Sometimes, instruments are implemented through actions that generate the anticipated results but often the effects of such instruments are minimal and even counter-productive in the long-term. The aim is for the choice of instruments to be based upon images that are considered accurate and legitimate, and to provide the basis for effective actions by users and governors alike. The same applies to the process for the formation of images. When images, instruments, and actions are not clearly defined and formulated, governability is expected to be low.

Interactive governance recognizes three modes under which institutional frameworks operate in a GS: self-, hierarchical, and co-governance. Self-governance depends entirely on the capacity of the society. Hierarchical governance is predominantly carried out by the state, although involvement from the market and the civil society can also be expected. Co-governance is horizontal, reflecting the border-lines between state, market and civil society, and is normally expressed in organizational forms such as networks and co-management.

A GS can also be typified by its orders of activities. First order activities are the day-to-day affairs that take place whenever and wherever people and their organisations interact to solve societal problems and create opportunities. In diverse, complex and dynamic societies, first order governing faces special challenges. It starts with the identification of problems, which are not an objective reality but which become such only in the minds of societal actors. Once problems have been identified, attention shifts to the solution space where opportunities may emerge. Second order governing focuses on the institutional arrangements within which first-order governing takes place. Examples of these are systems of agreements, rules, rights, laws, norms, roles and

procedures. Meta-governance forms the core of the entire governance exercise by setting and applying normative governance principles.

Interactive governance recognizes that societal problems and opportunities can be characterized by their diversity, complexity, dynamics and scale and that governance responses must therefore come not only from the state, but also from the market and civil society. In capture fisheries and aquaculture, this governance perspective stresses the importance of looking at the 'fish chain' in its totality in stead of looking exclusively at its parts. In other words, governance applies to the entire fish chain that includes pre-harvest (e.g., the ecosystems), harvest (e.g., fishing and farming) and post-harvest (e.g., processing and marketing). Similarly, coastal zone governance requires a holistic and integrative approach. For all three resource systems (as SGs), attention must be paid to the limitations of command-and-control GS and to the need for involvement of broader sets of actors and GI. Interactive governance is achieved by the creation of interactive, social-political structures and processes that stimulate communication among actors and create common responsibilities for individuals and for society. The challenge is to make GI mutually supportive and collectively productive.

Capture fisheries, aquaculture and coastal zones as SGs, as well as their GS appear to be inherently diverse, complex and dynamic (Kooiman *et al.* 2005). Diversity is about the heterogeneity and variability of system elements. Complexity is related to the linkages, relationships and interdependencies among the various components in the systems. Dynamics refers to changes that take place over time, either linearly or non-linearly and whether predictably or unpredictably. Additionally, capture fisheries, aquaculture and coastal zones, the scope of their uses, and related concerns all come in varying spatial and temporal scales. The extents of the diversity, complexity, dynamics and scale of these SGs, GS and their respective GI will, according to the interactive governance perspective, define their governabilities. Discussions about governance and governability are framed around an analysis of the SG, the GS and their GI (Figure 1).
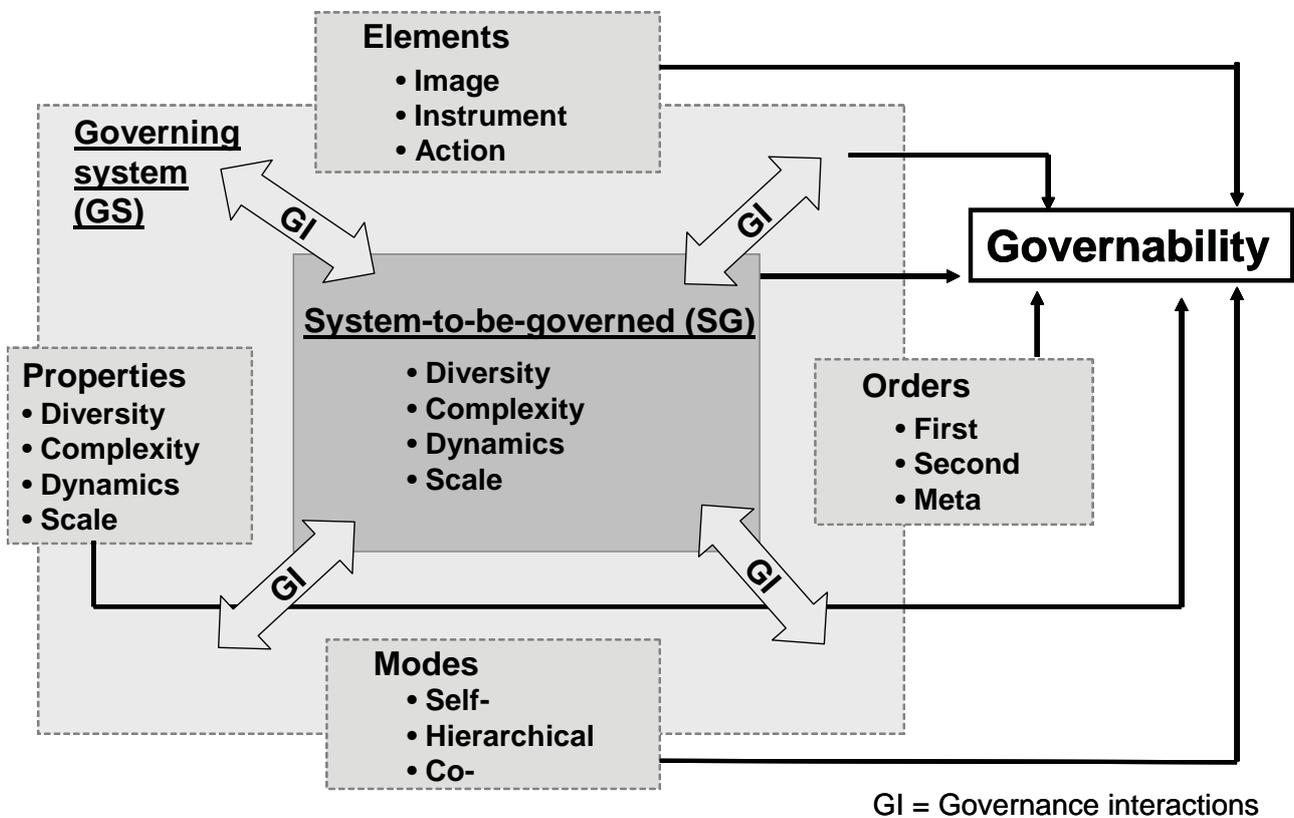
Figure 1. Components of the interactive governance model and their linkages to governability (Adapted from Kooiman and Chuenpagdee 2005; Kooiman 2008).

The governability of any natural and social SG depends upon its diversity, complexity, dynamics and scale. SGs with higher diversity, complexity, dynamics and scale are generally expected to be less governable. Lack of recognition and understanding of the importance of these features might be one of the major reasons why much of the historical and present day governance of capture fisheries, aquaculture and coastal zones has been and remains inadequate. Diversity, complexity, dynamics and scale will also vary among GS, also influencing governability.

An SG and its governing system do not exist in isolation. According to the interactive governance theory, their GI contributes significantly to the governability of all. Governing the problems and opportunities of fisheries and coastal systems requires clarity about the nature of the GI that are involved in a problem to be tackled or an opportunity to be created, and about the ways in which these GI are interrelated. The basic relationships among diversity, complexity and dynamics at various scales, are the interactions seen in the social-political world. Insight into the diversity of actors required for effective governance can be gained only by involving them all in the governing process and giving them all the opportunity to act out their identities. Any social-economic-cultural-ecological system, such as the three studied here, contains a multitude of GI taking place in many different forms and intensities.

3. Governability Assessment Framework

Governability assessment poses great methodological challenges. One option, proposed by Kooiman and Chuenpagdee (2005), is to develop an analytical framework by which several governability criteria can be assessed. Jentoft *et al.* (2007) took this further in considering the governability of marine protected areas, posing a series of probing questions about each component of interactive governance. Table 1 summarizes the criteria and presents examples of questions that form a governability assessment framework.

For an SG, the focus is on assessing the prevalence of its properties. In other words, the main governability criterion is about how diverse, complex and dynamics, and how wide ranging are the objects of governance (i.e., the natural and social systems). Diversity in the natural system implies inquiring about topics, such as the types of ecosystems and habitats that are represented, the composition and relative of their species assemblages etc. For a social system, diversity refers to the multiplicity of stakeholders,

Table 1. *A governability assessment framework (Modified after Kooiman and Chuenpagdee 2005 and Jentoft et al. 2007)*

Governance component	Governability criteria	Examples of governabililty questions
System-to-be-governed (SG)	- Prevalence of properties (i.e., diversity, complexity, dynamics and scale)	*Diversity* - Types of ecosystems and habitats that are presented - The demographics of stakeholders *Complexity* - The linkages between species, ecosystems and habitats - Level of cooperation and/or conflicts between stakeholders *Dynamics* - Short and long-term bio-ecological changes - Level of migration and mobility of stakeholders *Scale* - The range and representativeness of the ecosystem - The social, cultural and ethnic boundary of stakeholders
Governing system (GS)	- Goodness of fits of elements (i.e., images, instruments and actions) - Responsiveness of modes (i.e., self-, co-, and hierarchical) - Performance of orders (i.e., first, second and meta)	- The appropriateness of the governing elements in moving towards desirable outcomes - The effectiveness of the governing mode and its ability to respond to governance challenges - The capacity of the governing orders to function, operate and lead to desirable outcomes
Governance interactions (GI)	- Presence of interactions	- The existing forms and qualities of the interactions, including representativeness, effectiveness of communication and level of information flow

based upon factors such as education, ethnicity, social status, lifestyles, values and preferences. Questions about complexity are related mainly to the interconnectivity among species, populations, ecosystems, and habitats, as well as among stakeholder groups, which could be cooperative or conflicting. For dynamics, the main focus is on the changes that take place over a period of time brought about by succession, migration, or general mobility of the community members. For scale, the ranges and boundaries of natural and social systems must be identified, in order to determine the uniqueness and the function of the systems.

As Table 1 shows, governability depends also on other aspects like goodness of fit, responsiveness and performance of the GS. These three measures are related to the main components of the GS, i.e., elements, modes and orders. Goodness of fit indicates to what extents the images, instruments and actions developed and selected for governance are consistent and correspond well with the governance goals. Generally, one needs to assess whether a chosen action applied to an instrument is appropriate and supports the image, for a given situation. Some examples of 'misfits' can be found in cases where attempts to introduce alternative livelihood and employment options to rural communities, as a means to alleviate poverty, do not take into account social and cultural background, resulting thus in undesirable outcomes (Pollnac *et al.* 2001). The second criterion for a GS - responsiveness of governing modes - indicates whether a particular or chosen mix of modes (self-, hierarchical, and co-governance) leads to successful solutions to problems and challenges that exist within the SG. Quite often during the problem-solving process, a solution is 'found' based on its own attractiveness, and not necessary on its ability to address the problem. In such cases, responsiveness would be deemed to be low. When a governing mode or mix of modes produces effective and timely responses, governability is likely to be high. The third criterion for a GS, performance, assesses its ability to turn problems into opportunities, to adapt institutional designs to address societal problems and govern activities, and to set governance principles in accord with societal norm. High scoring of performance indicates high governability.

Finally, as emphasized in the interactive governance framework, the relationship between the systems has to be examined in the context of the presence or absence of GI. These include participation, communication, information sharing and learning, all of which are essential for governability. GI are also diverse, complex and dynamic, such that a GS may influence actions of the human dimension of its SG, which may lead either to protecting or degrading of the natural dimension of its SG. For example, in order to halt ecosystem degradation, a GS must work with and through the social subsystem in an attempt to understand their interrelationships (Jentoft 2007). When there are abundant and strong GI between an SG and its GS, it is likely that governability will be high.

4. Comparative Assessment of the Governabilities of Capture Fisheries, Aquaculture and Coastal Zones

A broad, comparative analysis of three resource systems - capture fisheries, aquaculture and coastal zones - is provided here, first describing each according to the proposed framework and then applying assessment criteria and suggesting a likely qualitative level of governability associated with each criterion: *very low*, *low*, *moderate*, *high*, and *very high*.

4.1 Capture Fisheries
Capture fisheries usually have high diversity, deriving from fisheries resources and from the societies that exploit them. Post-harvest arrangements are also often diverse, depending on the local, national, and export demands for various types of products. For example, artisanal or small-scale fisheries using small vessels and simple gear may serve local food demand, or they may contribute to a larger system that collects and processes the product for export. There is increasing appreciation of the importance of understanding how fishers, in their local communities, interweave fishery-related activities with other livelihood components, and the consequent complexity. For example, complex livelihood strategies among fishers and their families incorporate activities such as foraging for firewood, taxi driving or providing labour for construction and agriculture. Further, attention to livelihood strategies has sharpened awareness of gender issues as recognition that men and women differ in their roles as household providers of food and income grows.

At national and global levels in the fish chains that depend on capture fisheries, diversity and complexity are also high among all the human systems. Conventional businesses, trading nationally and internationally, with investors to satisfy, may have vastly different value systems than those at the local level. Moreover, they interact dynamically through formal and informal relationships. Complexity and dynamics arise from the multiple linkages that occur laterally within the fish chain (Kooiman *et al.* 2005), or between fishery and non-fishery activities, as well as through vertical linkages. They may also emanate from unpredictable external factors, ranging from environmental effects on fish stocks to global markets. As humans adapt and respond to variability and uncertainty, they continuously change their behaviour, for instance to dampen negative effects, to take advantage of opportunities and to get around regulations. In other words, human behaviour in capture fisheries as well as shifts in the productivity and profitability of the fisheries are usually uncertain and unpredictable. The scale of capture fisheries can be described in many ways; for example, by the size of the resource (small local stocks vs. large wide-ranging stocks), the types of vessels used (small, inshore vs. large, ocean-going), the nature and state of technological development of fishing gear (manual, home-made vs. advanced electronic and hydraulic), and their administrative arrangements (small vs. large fisheries departments and national vs. regional and international administrations). Problems arise when aspects of capture fisheries are scaled up or down without careful consideration of the consequences for functionality. For example, some small developing countries have attempted to replicate large-country fisheries department capacity in small departments, with the result that few function effectively (Chuenpagdee and Juntarashote 2008). A lack of fit between some fisheries management practices and the scale at which they are applied can contribute to real or perceived failures. When governance considers various spatial, temporal, and organizational scale in capture fisheries, their governability might be greatly enhanced.

Diversity, complexity, dynamics and scale are all highly expressed and embedded within capture fisheries, constraining their governability. Based on these criteria, and compared to aquaculture and coastal zones, the level of governability for capture fisheries is assessed to be moderate.

Images, instruments and actions, as defined in interactive governance, provide a structured way of looking at problem-solving and opportunity creation in capture fisheries. Images of fisheries relate to specific governing issues and also contain assumptions on fundamental matters such as the relationships between humans and nature, and the roles of state, market and civil society. Bundy *et al.* (2008) capture the concept of the image by contrasting the classical system thinking of human at the top of the trophic pyramid with the 'inverted pyramid,' an alternative image for ecosystem governance. While it is generally acknowledged that there is strong trend towards overfishing, the driving factors behind this are not necessarily agreed upon. The questions arise thus whether those involved in fisheries governance have appropriate images for fulfilling their roles and where capture fisheries images come from. These questions are critical because of the potential consequences of images. For example, one of the most influential, but increasingly controversial, images in fisheries management in the last decades has been the 'tragedy of the commons' of Hardin (Hardin 1968). Criticisms of this theory are related to the linking of the problems of the commons mainly to incomplete or lack of property rights (that is, common property or open access) and the consideration that humans are self-serving individuals with utility maximizing goals, thus subjecting them to market failure (McCay and Jentoft 1998). The 'fish chain' as a governing image may be less controversial.

The range of instruments available in fisheries governance is wide. For example, a fisheries management plan is recognised as a powerful instrument for drawing actors into agreements. Why is a particular instrument chosen, and not another one? Are choices of instruments made interactively or unilaterally? Who are the winners and losers? Conventionally, there has been a strong and worldwide emphasis on managing by 'technical' instruments, such as gear controls, licensing, and quota systems. However, effective governance of capture fisheries often requires specific innovations, particularly in developing proper combinations of instruments.

Fisheries governors, public and private have potentials for action in all parts of fish chains and at all levels. Locally, fisher families or fisher organizations take the lead in day-to-day governance, although the role of the community as an actor in fisheries govern-

ance is not always appreciated by higher authorities. The state is reaching its limits as the primary actor in fisheries governance, while the roles of the market and civil society (e.g., non-governmental organizations, or NGOs) are growing. Ecolabelling is a good illustration of the increasing role of the market, where high pricing of certified products provides market incentives. Similarly, NGOs focus on increasing awareness among fish consumers, through programs such as 'Fish List' (www.thefishlist.org) that rate fish products based on stock status and fishing methods, and 'Don't Eat Babies' (www.incofish.org), a new sustainability indicator designed to help consumers buy fish that have reached maturity, helping thus preserve the fish stock for future generations. New forms of action are needed to increase the governability of fisheries, particularly in leadership, mobilization, and coordination. Support and political will for implementation of effective fisheries governance at the national and local levels are often lacking, despite wide ratification of many principles such as the FAO Code of Conduct for Responsible Fisheries (CCRF) (FAO 1995) and the Convention on Biological Diversity (CBD). The bottlenecks at national and local levels are often due to inadequate leadership, lack of motivation and incentives as well as insufficient coordination of efforts, for example, on upholding indigenous peoples' rights and adequate recognition of the roles of women in fisheries governance.

Based upon these considerations, the goodness of fits of governance elements in capture fisheries are likely to make them moderately governable.

In capture fisheries, the three major modes of governance (self-, hierarchical and co-) all influence governability. Self-governance in fisheries remains common world-wide, with its basis usually in local communities, contrary to many other branches of economic and social activity. The main reason is the use of fisheries resources as common property, and the need to regulate their use, for conservation reasons and/or to avoid conflicts. In developed countries, this mode of governance in its purest form has become rare, though remnants are still in operation in some parts of southern Europe (Allegret 1999). Self-governance in fisheries is an important contributor to governability within the mix of the three modes.

Hierarchical governance in fisheries is also widespread, particularly in industrialised countries where interventionist interactions by the state are prevalent. However, this involvement by the state is not unchallenged. Erosion of traditional self-governing modes and their replacement with hierarchical, state-run management have often not worked well. Although hierarchical governance is mainly connected with the state, it is also common in the market sector, particularly by multi-national companies. In such cases, hierarchical governance by the state is replaced by hierarchical governance by the market.

Co-governance in fisheries has potentially broad appeal as it aligns with the widely known co-management, which advocates more participation and delegation of some resource management responsibilities from government to community organizations (Jentoft 1989). After more than a decade of implementation in different settings with varying success (Jentoft and McCay 1995; Sen and Nielsen 1996; Wilson *et al.* 2003), experiences in co-management suggest that these frameworks may have been adopted too vaguely that their substance may have been lost (Nielsen *et al.* 2004). Capture fisheries governance faces many constraints including limited local capacity, inefficient process, lack of appropriate institutional arrangements and legal frameworks and insufficient political support. These factors, among others, contribute to unsustainability in fisheries worldwide (Swan and Greboval 2006).

Overall, the low level of responsiveness of governing modes in capture fisheries is likely to result in low governability.

In terms of performance, all three orders of governance (first, second and meta-) are part of a capture fisheries GS, thereby contributing to its short- and long-term governability. Discussions about crises in fisheries are at the first order of governance, where the focus is on solving problems and creating opportunities. But, are such problems and potential opportunities the same everywhere? Who are the problem-makers, small- or large-scale fishers, or both? Does this concern only the fish harvesting part of the fish chain, or also post-harvest activities and trends such as globalization? From the interactive governance perspective, questions like these require an approach that takes into account not only the diversity, complexity and dynamics of fisheries,

but also the technological, economic, and political factors that influence fisheries and the other sectors with which fisheries interact.

Handling of the many problems and opportunities in fisheries governance requires capacities for the fusion of local knowledge with wider technical knowledge and information, gradually expanding the circle until all actors are involved. This may still be rare, especially where management approaches emphasise means and resources and where policies focus mainly on political or administrative feasibility. Narrowly defined roles and interests, whether public and private, remain very common in fisheries and are reflected in the ways in which fisheries problems and opportunities are defined, as well as appraisal of stakeholders' abilities to interact on profitable terms and to communicate with each other effectively.

In the broadest sense, where a fisheries resource is publicly owned, all citizens are stakeholders. Tensions between fisheries management and actors along the fish chain, from fishers to marketers, arise when conventional control-based approaches limit opportunities or conflict with market stimulated opportunities that appear. This happens in fisheries because opportunity takers and problem solvers are different groups of people. Often, opportunities are taken with minimal attention to the problems and efforts at problem-solving are looked at without recognising opportunities within easy reach.

Second order governance refers to institutional capacities. Institutions in capture fisheries governance are, among other things, supposed to enable or to control the processes through which societal problems are solved or opportunities created. The state has major responsibilities here, mainly through controlling or enabling fishing efforts, although its role is often inhibited by lack of political will to carry concerns, such as those for conservation, forward into action. Market institutions govern the channels through which fish and fish products reach consumers or other users. Civil society, and in particular NGOs, act as guardians and stewards of fisheries ecosystems, through efforts to minimise the environmental consequences of fisheries, and by raising public awareness (Jacquet and Pauly 2007). Tasks and responsibilities of these institutions are seldom examined systematically. Globally, changes within and among governing institutions

in fisheries are gradual and a proper balance of the responsibilities between public and private (market and civil society) actors has not yet materialised. When institutions and organizations are poorly matched with the problems that they are intended to address, they may obstruct rather than enable problem-solving. This often is the case in fisheries. Local, national and international institutional levels of governing are seldom in tune, and sometimes operate counterproductively. What has been achieved at one level can be undone at another. Because of this, the governabilities of most capture fisheries remain seriously hampered.

Meta-governance principles of relevance to fisheries are widely recognized and internationally agreed. For example, the CCRF and its still expanding series of accompanying guidelines are major contributions to establishing principles for responsible fisheries, upon which interactive governance of fisheries can build on. However, although FAO has given substantial technical assistance, implementation of the CCRF in practical terms has sometimes been limited (Bavinck and Chuenpagdee 2005).

The current performance of governance orders in capture fisheries is not impressive and, based on this, their governability is likely to be low.

Finally, an understanding of GI in capture fisheries is far from complete. For example, the ecosystem-based approach to fisheries is a fairly new concept and requires considerations and knowledge of the various components and their interactions (Pikitch *et al.* 2004). Interactions within fishing households and communities have been relatively better studied than those in the market sphere. The governability of some fisheries has changed drastically since their interactions become global or regional. Many more levels in fisheries governance beyond those of predominantly small-scale fisheries have been added, increasing thus the range and interdependency of actors. Globalization has, in effect, created new fisheries and fish chains and has modified existing ones to various extents. It has led to lengthening of the interaction chains among the many parties concerned and has muddled any single actor's view. In other words, actors at lower levels, such as local fishers and fishmongers, have to adjust to new market places operating at high level, with linkages and chains that have never been present before. Globalization also tends to further

existing divisions of labour, creating a plethora of specialised niches and activities. The dynamics of global fisheries derive from various sources along the fish chain, including climate change, degradation of ecosystems, market forces, and the wider social, cultural, and political environment, and regulatory regimes. Processes such as globalization do not affect capture fisheries across all scales in the same manner. Problems frequently arise when fisheries governance is scaled up or down without careful consideration of the consequences for functionality. Generally, effective governance of capture fisheries requires insights into the scale of primary interactions and of those induced by globalization.

The presence of GI in capture fisheries therefore suggests only moderate governability.

4.2 Governability in Aquaculture

Aquaculture is the farming of aquatic animals (mainly crustaceans, finfish and molluscs) and plants (macro- and microalgae and freshwater macrophytes) from 'seed' to marketable size, usually in fixed areas of land and water, owned or leased by fish farmers. Some types of aquaculture have interactions with capture fisheries. For example, culture-based fisheries are enhanced by aquaculture through the release of hatchery-raised fish and both farmed and fished aquatic produce often enter the same post harvest fish chains. However, most aquaculture has more direct contact with crop and livestock farming, forestry, human settlements, industrial development, tourism, water resources management, and waste management than with capture fisheries. Aquaculture governance has more in common with agriculture governance than with capture fisheries governance (Pullin and Sumaila 2005).

Aquaculture has high diversity. Farmed finfish and invertebrates comprise over 400 species (Science Council Secretariat 2005). Farmed aquatic organisms are still relatively undomesticated compared to farmed terrestrial plants and livestock, for which domestication and breeding has been pursued over thousands of years. However, the application of genetics in aquaculture is resulting in increasing numbers of distinct breeds of farmed fish, especially in widely farmed species such as carps and tilapias (Bakos and Gorda 2001; ADB 2005a). Aquaculture is classified according to the intensity of operations, in terms of nutrient inputs, areas used and stocking levels. Extensive aquaculture includes pond, pen and cage farms in which stocked fish eat only feeds that are produced naturally in the surrounding water (e.g., plankton) and require minimal husbandry. Semi-intensive aquaculture involves addition of feeds and fertilizers, produced on- or off-farm; for example, integrated crop-livestock-fish systems with livestock manure fertilizing the pond water and rice bran and other farm by-products contributing to fish feeds. Intensive aquaculture is similar to feedlot livestock systems. Intensively farmed fish are dense populations, entirely dependent upon formulated feeds, usually with close husbandry.

Aquaculture operations vary in scale from homestead and farm ponds of less than 100 m^2 to cage, pen and pond farms covering hundreds of hectares. Small-scale aquaculture, sometimes as a part-time occupation, makes large contributions to poverty alleviation in Asia, as shown recently by the Asian Development Bank (ADB 2005b). Aquaculture is also a major supplier of fish for large food corporations; for example, farmed shrimp and tilapia are globally traded fish commodities. Coldwater aquaculture (e.g., trout and salmon farming) and warmwater aquaculture (e.g., tilapia farming) have differences that mirror the broad differences between temperate and tropical agriculture. There are also differences between rural aquaculture and urban aquaculture. The latter resembles peri-urban livestock and vegetable farming. Organic aquaculture is developing rapidly. It is usually defined very broadly as farming herbivorous/omnivorous fish (not carnivores) by environment-friendly and humane methods, and without use of agricultural chemicals and drugs.

Aquaculture also has considerable complexity, largely because of the complex life histories of aquatic organisms and the complex technical requirements of providing for these organisms in captivity and under effective management by humans. Farmed fish breeding programs strive for genetic improvement of commercial traits. Fish hatcheries produce seed (as eggs, larvae, postlarvae, fry, spat etc.) and fish nurseries grow those early life history stages to fingerlings or juveniles of more viable size. Fish farmers then proceed to 'growout', raising those juveniles to marketable size. Hatchery, nursery and growout operations are often at different locations and under different management systems (public, private and public-private partnerships). They utilize

a wide range of farming systems (cages, pens, ponds, raceways, tanks etc.), in fresh-, brackish- or seawater, according to the requirements of the farmed species and their life history stages. Arrangements among hatchery, nursery, growout and post harvest operations are complex because of seasonal and other shifts in supply and demand and the advent of new technologies and products.

Interrelationships among aquaculture and other sectors represent high dynamics, especially those concerning land and water use, environmental impacts, farm workers health and safety, and farmed fish health, quality and safety for consumers. Aquaculture is often risky. Unpredictable climatic conditions (especially extreme temperatures, high or low rainfall and storms), operator error, equipment failure, and largely uncontrollable events such as toxic algal blooms, diseases and pollution all cause mass mortalities of farmed fish. Farmed fish are vulnerable to theft and the laws and penalties applied to fish poaching are often ineffective, compared to those that protect crops and livestock. Despite these risks, the contributions of aquaculture to world fish supply grew from about 7% in 1975 to about 30% in 2000 and are expected to increase further (Asche and Tveteras 2002).

The high diversity, complexity, dynamics and scale of aquaculture constrains its governability which, based upon this criterion, is likely to be low.

The images of aquaculture, the instruments that are applied to it and the extents to which these fit potentials for action, all vary greatly. About 91% of world aquaculture production comes from Asia, but many Asian countries still have very little aquaculture development. Outside 10 Asian countries (Bangladesh, the Peoples' Republic of China, India, Indonesia, Japan, the Republic of Korea, the Philippines, Taiwan, Thailand and Vietnam) and a few countries in other regions (e.g., Chile, Norway and the USA), politicians and the public rarely see aquaculture. Their images of aquaculture are therefore learned from media reports about aquaculture elsewhere, and these are usually about problems: for example, pollution of fjords by salmon cages and destruction of mangroves to build shrimp ponds. New, environment-friendly technology (e.g., the use of probiotics - beneficial bacteria - to enhance feeding efficiency of farmed shrimp and reduce waste outputs; and the farming of specific-pathogen-free shrimp) and the large

contributions of responsible aquaculture to poverty alleviation are not yet reported widely. Indeed the voluminous literature on impacts of aquaculture is concerned almost exclusively on its adverse impacts. This needs to be corrected, because the same biased perspectives are not commonly applied to other sectors such as agriculture and plantation forestry. Irresponsible development of aquaculture has of course had serious adverse impacts (see, for example Pullin and Sumaila (2005). Aquaculture is often still a new frontier and even where it has been long established, new technologies and new market opportunities sometimes result in far too rapid expansion, inequitable distribution of benefits, booms and busts, and legacies of environmental and social harm. New frontiers are typified by ineffective controls and attract some entrepreneurs who flout authority. Aquaculture is no exception. For example, although authorities may try to limit entry of fish cage farmers according to a lake's carrying capacity for cages and its use by fishers and others, such lakes often end up hosting many more cages than the numbers authorized. Just as fishers try to cheat fishing effort restrictions, fish cage farmers seek ways to exceed limits on cage size and numbers. This, together with overfeeding and overstocking of caged fish, degrades the lake ecosystems and causes massive fish kills. Agriculture has also caused serious problems: for example, desertification and saline pollution of lands; BSE in cattle; avian influenza etc. Public familiarity with agriculture tends to limit the extents to which these negative images affect action, whereas potentials for action in aquaculture sometimes encounter opposition from those who see no reward for its very existence.

Given the relative strangeness of aquaculture to the public in many countries, it is difficult for governors and the governed to keep abreast of real potentials for action to solve problems and to seize opportunities in aquaculture. Provisions for the development of responsible aquaculture are included in the CCRF and in some accompanying guidelines (e.g., FAO 1997), but the characteristics of aquaculture and its newness described thus far can mean that legal and other instruments applied to it are frequently ineffective and out-of-date. Even in more stable areas of aquaculture development, such as fishponds in irrigated farming areas, it has not been easy to implement instruments that encourage and reward responsible behaviour. For example, quarantine ar-

rangements for fish and precautionary controls over the introduction and farming of alien aquatic species are still ineffective in many developing countries. National and international biosafety instruments for these purposes are often readily available, but lack of political will, limited knowledge of risks, and a general lack of accountability of farmers to biosafety authorities have severely limited their application. Action here and throughout aquaculture requires realism among regulators as well as more responsible behaviour among farmers.

Overall, many of the current images of and instruments for aquaculture do not reflect adequately the action potentials for it to become a responsible and synergistic partner with other sectors, especially in multiple uses of freshwater, integrated coastal zone management, and biodiversity conservation. False images of and inadequate instruments for aquaculture are therefore constraining its governability.

The poor goodness of fits of governance elements in aquaculture also suggests low governability.

Fish farmers, like most farmers tend to be independent and somewhat isolationist in terms of how things are done within the boundaries of their farms. The consequence for governability of aquaculture is that self governance of family and corporate fish farms is likely to predominate, except in those cases where there is collaboration or collective action among farmers for social, commercial or political reasons. This means that, aside from the influences of climate and other externalities, the governability of aquaculture is largely determined by the governability of fish farmers. Where they have the necessary knowledge, skills and attitudes to farm fish well, in harmony with the reasonable needs of their neighbours and of other sectors, including biodiversity conservation, aquaculture can be highly responsive to self governance and has high governability. Conversely, farmers who choose to farm irresponsibly, in pursuit of short-term advantages over fellow farmers, are actually governing themselves poorly and their operations have low governability.

The scope for hierarchical governance in aquaculture appears limited, not only because of the independence and individualism of farmers but also, in many countries, because of underdeveloped legal and administrative provisions. Administrative arrange-

ments and regulations for aquaculture are typically combined with those for capture fisheries. Broader arrangements also exist, lumping aquaculture together with agriculture, fisheries and other forms of food production and/or with environment and natural resources. In some countries, administrative arrangements for aquaculture are combined those for national parks and wildlife or for inland waters and forestry. None of these arrangements facilitates adequately the recognition that aquaculture is part of agriculture, with farmed aquatic organisms being properly considered as part of agrobiodiversity and fish farms as agroecosystems. Even in single ministries and departments that cover agriculture and aquaculture, there is typically high separation of their staff and budgets.

Most states apply hierarchical governance in sectors such as agriculture (crop and livestock farming) and capture fisheries. The images, instruments and institutions for these sectors are much better established than those for aquaculture and allow for more confident and sometimes more well received interventions. In contrast, except where it is well established and of high economic importance, aquaculture is likely to have low responsiveness to hierarchical governance. The more common situation is that responsibilities for attempts at hierarchical governance of aquaculture are assigned to other sectors, often with aquaculture regarded as a subsector of capture fisheries and rarely as a part of agriculture - where it belongs.

These limitations for hierarchical governance of aquaculture mean that the scope for co-governance in aquaculture will also usually be limited. Responsiveness of aquaculture to co-governance depends upon the attitudes of largely individualistic farmers to others in their own communities (fellow farmers and other resource users), and to local, provincial and national government officials, extension agents and scientists. Where farmers perceive that these persons have knowledge and skills to share that will be of mutual benefit and provide legitimacy as partners in development, co-modes can work. However, when officials and experts adopt a top-down approach and tell fish farmers (who are often the pioneers of new farming systems) what they must do, there will be high resistance and few productive co-activities. There is a huge literature on this in agriculture, forestry and rural development in general and it is

well recognized in recent works about aquaculture development, for example (Edwards *et al.* 2002).

Much of aquaculture is under self-governance, by its own operators. Independent or collective action by fish farmers themselves is often the predominant feature and the trend towards more responsible aquaculture depends upon them. Compared to the rest of agriculture, aquaculture is still relatively unresponsive to hierarchical and co-governance. This situation will probably persist, except in areas where aquaculture becomes well established and well administered.

The moderate level of responsiveness of aquaculture to governing modes suggests moderate governability.

In terms of governance orders, first order governance (solving problems and seizing opportunities as they arise) has high relevance in aquaculture, as in all farming. Fish farmers must be responsive to daily changes in circumstances; for example, weather conditions, fish health, water quality, farm security, feed and energy availability and costs, market opportunities etc. This requires a wide range of knowledge and skills throughout all operations: fish breeding, seed production in hatcheries, nurseries, growout, harvesting and marketing. Individual farmers rarely have adequate facilities and experience for all of these operations and therefore tend to specialize as either seed producers (hatchery and nursery operators) or growout farmers. There are also specialized harvesting workforces and personnel for post harvest operations. All are essentially operating under first order governance. In large-scale, corporate aquaculture, vertical integration of operations (breeding, seed production, feed mills, veterinary services, growout and marketing) is common. Some corporations achieve their production through multiple contract growers (individual farmers) to whom they supply seed, feed, medication etc., and from whom they buy the harvests.

Second order governance also has high relevance in aquaculture because the institutions, through which these diverse operators acquire the information, authorizations, financing, environmental protection, veterinary assistance, marketing advice etc. essential for successful aquaculture, are the framework for first order governance. However, the development of such institutions for aquaculture is highly variable.

In many developing countries, government extension to small-scale fish farmers is far from adequate. In contrast, large-scale salmon and trout farmers are usually served by robust institutions, including government research organizations, trade associations and public-private partnerships.

Meta-governance should also be of high relevance for aquaculture but presently comprises theoretical possibilities rather than rationally agreed strategies and an enabling climate for development and sustainability. Until aquaculture becomes more widely recognised as part of agriculture, more of a partner with other sectors that use natural resources, and more rationally evaluated than current images and instruments allow, the very broad meta-governance context needed for development of responsible aquaculture will not emerge. Overall, the CCRF and its accompanying technical guidelines are the most important set of meta-governance principles for governing aquaculture and its intersectoral relationships. The provisions of the CCRF are not legally binding, but they are undoubtedly influencing positively the ways in which governments are approaching aquaculture development as well as the activities and outputs of regional bodies (see NACA/FAO 2000), and are probably having more impacts than some legally binding instruments. For example, the United Nations Convention on the Law of the Sea (UNCLOS) provides for Parties' rights to 200-mile Exclusive Economic Zones but also requires Parties to take good care of their marine natural resources. This obligation has been widely ignored. Similarly, CBD gives its Parties sovereignty over their national biodiversity, but also requires them to conserve their biodiversity (genes, species and ecosystems) effectively, *in situ* and *ex situ*. Progress towards that end has been very limited, in inland waters and coastal zones. However, food safety provisions, including Hazard Analysis Critical Control Point principles, have become widely accepted in aquaculture - see, for example the World Health Organization (WHO 1999) and the private sector have begun to develop best aquaculture practices and certification instruments.

Overall, first and second order governance have substantial relevance for aquaculture and can increase its governability. Meta-governance should provide the broader context for this, but the provisions of the CCRF and other sources for meta-governance principles need to be much more widely implemented.

The quality of governance orders in aquaculture suggests moderate governability.

Finally, aquaculture operations and institutions depend upon multiple interactions with each other. These interactions are shaped mainly by market forces. For example, fish breeding in government research stations and seed production in private hatcheries can function well as public-private partnerships. Expansion of aquaculture has inevitable consequences for equitable sharing of natural resources. Small-scale fish seed producers and farmers cannot easily compete with larger operators. Aquaculture and the rest of agriculture are very similar in this respect. Aquaculture has been growing for over 20 years, about 9% per year, something that cannot be achieved without multiple interactions. However, the persistent image of aquaculture as a special 'thing in itself', still often administered as a subsector of fisheries, is limiting interactions that could increase its contributions to world food production in synergy with other sectors.

Many of the world's institutions are established in ways that limit interaction between conservation of biodiversity and food production, in terms of policymaking, administrative arrangements and budgets. The CBD regards all wild and farmed organisms and their supporting ecosystems as biodiversity. The fish that humans consume, as well as the agroecosystems from which more and more are derived through aquaculture, are indeed biodiversity. The GI in aquaculture do not yet reflect this well, because institutions are still fostering its separation from agriculture and its false alliance with capture fisheries.

GI in aquaculture, though underdeveloped, suggest high governability.

4.3 Governability of Coastal Zones

Literature on coastal zones and integrated coastal management is large and rapidly expanding, including a recent volume that is particularly relevant to considerations of governance of coastal zone development (Visser 2004). Coastal zones suffer problems of definition, particularly in spatial terms. In the 'narrow' sense, a coastal zone includes a strip of land area of a certain width along the coast and coastal water up to a certain depth or distance from shore. For example, coastal lowlands, intertidal areas,

salt marshes, wetlands and beaches, and offshore features, such as reefs and island habitats are considered parts of the coastal zone. Broader definitions of coastal zones include entire inland watersheds that can extend hundreds of kilometres from shore and in some cases entire Exclusive Economic Zones. In all coastal zones, there are land and sea interfaces with high diversity, complexity, and dynamics and multiple interactions among natural and human systems. In tropical coastal zones dominated by mangroves, seagrass beds and coral reefs, these system properties are crucial to the abundance, productivity and richness of fishes and other living organisms, and to the services that coastal zones provide for human, animal and plant populations (Agardy and Alder 2005). Coastal zones in temperate regions, while generally less diverse than those of tropical and subtropical regions, are often densely populated by humans and therefore exhibit different types of complexity and dynamics. In both cases, human interactions with coastal ecosystems create unique challenges for governance and governability.

Coastal zones represent high diversity, complexity, dynamics and scale in natural and human systems. Among many others, capture fisheries and aquaculture are integral sectors in many coastal zones. Intersectoral interactions are of paramount importance in coastal zones, and these interactions also have high diversity, complexity, dynamics and scale. For example, coastal areas attract urban and industrial development, as well as development of ports and tourism. These activities are in direct competition with fishing livelihoods of many coastal communities, particularly those involved in traditional small-scale fishing and reef gleaning, as well as commercial and recreational shellfish gathering.

Diversity in coastal zones increases as their spatial definitions and boundaries expand. Most diversity in coastal zones is due to differences in geophysical and biological characteristics. For example, coastal areas with a delta are geologically different from those in barrier islands, having different substrates and vegetation. Mangroves are found in inter-tidal coastal areas, whereas corals are found in fringes, patches or barrier reefs some distance from the shore. These diverse natural ecosystems result in varying degree of species richness, from relatively high in coral reefs to low in sandy and muddy substrates. Beaches are important breeding areas for birds and reptiles and

also provide construction materials and areas for recreational activities and aesthetic appreciation. The diverse ecological functions, services and values associated with coastal ecosystems inevitably lead to high diversity in social and economic contexts. The success and sustainability of coastal activities and coastal cultures depend largely on the diversity within and among coastal ecosystems. Fishing is often the main activity that contributes to the formation and longevity of coastal communities, in which the majority of the population relies on fish harvesting, processing and marketing and other related industries for subsistence and economics. Some communities have long fishing traditions with unique social constructs and governance systems. Others have diverse cultures, with people coming from other areas to settle on the coast. Many coastal communities are greatly diversified with other economic activities such as agriculture, forestry, industrial and urban development, mining, oil and gas industry, ports, shipping and tourism.

Coastal zones demonstrate substantial complexity in their ecology, societal and economic activities and governance. For example, the ecological functions of mangroves include stabilization of shorelines, assimilation of wastes and protection of juvenile fish and invertebrates: benefits that are additional to their economic importance in production of charcoal and construction materials, and their recreational, aesthetic and educational values (Barbier 2000). Social and economic complexity in coastal zones results from the multiplicity of coastal stakeholders and their interactions. Competition in coastal zone uses and activities is often high, although in some circumstance they can be complementary. For example, small-scale fishers in many tropical coastal areas can benefit from coastal tourism by taking tourists out on their boats or providing local accommodation. Therefore, coastal zone managers face complex tasks having to deal with a large number of people concentrated in coastal areas and a range of planned and unplanned activities. Many 'megacities' (with populations of 10 million or more) are coastal cities, requiring careful coastal planning in order to avoid problems such as waste, congestion, erosion and flooding. Coastal governance also extends far inland, as activities such as logging in the upland areas and dam construction affect coastal zones. From an interactive governance perspective, private ownership of coastal lands helps to reduce

complexity whereas the common property nature of resources in coastal water results in considerably more complex situations.

The diverse ecosystems, wide range of activities and continuing flux of people to settle on the coast induce changes and alteration to coastal zones, creating high dynamics. These make coastal zones less governable. Some changes are permanent or semi-permanent: e.g., building breakwaters and seawalls to provide storm protection and construction of roads and other infrastructure. Others are more dynamic and fluctuate with market incentives, but with irreversible and lasting impacts, as in the case of 'boom and bust' in shrimp farming (particularly for tiger prawn, *Penaeus monodon*) in Thailand (Patmasiriwat *et al.* 1999). A shrimp farming boom took place in the late 1980s and Thai coastal areas were greatly altered for pond construction. From 1987 to 1998 alone, according to DOF (1999), the number of shrimp farms increased from about 6,000 farms taking up an area of about 45,000 ha to 10,000 farms, covering 55,000 ha. Thai shrimp farming continued to grow until a major disease outbreak in 1990 caused a collapse, particularly in the inner Gulf of Thailand. Although modern farming technology was developed to mitigate environmental problems, many ponds were abandoned when they became unprofitable (Dierberg and Kiattisimkul 1996).

Concerning scale, the spatial extent of coastal zones can be such that an entire country can be considered a coastal zone; e.g., a small island state or a country that is entirely or mostly a coastal strip. Management of coastal zones is difficult at any temporal and spatial scale. Achieving sustainable coastal development goals, balancing the uses, conservation and protection of sensitive and vulnerable coastal resources and ecosystems, require innovative governance.

Overall, the high representation for diversity, complexity, dynamics and scale of coastal zones suggests very low governability.

Images of coastal zones are difficult to form and to unify, whether they are visual, knowledge-based, judgments, presuppositions, hypotheses, ends and goals. This is despite the use of technological advanced tools such as Geographical Information System, which is used widely for coastal management and coastal decision-making (see Jude *et al.*

2001; Brown *et al.* 2006). An integrated, holistic, systematic and transparent approach to coastal zone management is difficult to attain. Different coastal stakeholders have different relationships to the coast and thus their interests may vary. Coastal fishers, for example, are likely to have more attachment to the marine component of the coast than people who live along the coast, but who earn their livelihoods from land-based, non-fisheries related employment. People who enjoy aquatic activities may value the recreational benefits of coastal zones more than others. A 'shared' image can be created only when these diverse interests are reconciled and conflicts, whether perceived or actual, are resolved. There is an opportunity, however, in creating images for coastal zones, taking advantage of the fact that knowledge about the natural and human systems is never complete. Common visions and goals can be formed through participatory approaches that combine knowledge, judgments and values of all stakeholders, as discussed in Sohng (1996) and Chuenpagdee and Pauly (2004), and through the use of simple visualization tool such as the Coastal Transects Analysis Model (Chuenpagdee *et al.* 2007).

Given the characteristics of natural and social systems in coastal areas, an integrated and comprehensive framework is intended to handle the complexity of coastal zones and their multiplicity of stakeholders. The general goal of integrated management is not different from sustainable management of any natural resources. For example, one of the aims is to improve quality of life of coastal communities while maintaining the biodiversity and productivity of coastal ecosystems. Understanding impacts of activities on coastal ecological and human systems is desirable, but not always achievable due to lack of scientific knowledge, uncertainty and difficulty in assessing cause and effect relationships. Further, as issues related to coastal zones are often beyond local government's jurisdiction, coordination among agencies at various levels is essential.

Similar in scope to the CCRF, the Pan-European Code of Conduct for Coastal Zones (CCCZ) for EU countries was proposed in 1999 (Council of Europe Secretary 1999). It overlaps with the CCRF in its use of the precautionary principle for protection of coastal land- and seascapes, as well as human lives, and in its provisions concerning introductions of alien species, whether purposeful (e.g., for aqua-

culture) or accidental (e.g., in the ballast waters discharged by ships). Another focus of the CCCZ is ecosystem integrity, which is seen in its provisions for the preservation of natural systems and pristine areas and the enhancement and maintenance of coastal processes, especially in relation to sedimentation and shoreline stabilization. The CCCZ uses the 'Polluter Pays Principle' (OECD 1975) to account for short-term and long-term economic, environmental and social costs associated with the use of coastal resources. The CCCZ gives the public access to information and encourages wide participation in decision-making.

Integrated Coastal Zone Management (ICZM) is an instrument for coastal governance, designed to be as complex as its target systems. There are at least 700 ICZM efforts in over 145 coastal states although, according to Sorensen (2002), only 45% are in operation. Success in the implementation of and its effectiveness in governing the coastal zone vary greatly. When collaboration exists between state and local government or when there is partnership between federal and state, integrated coastal management programs tend to be successful. In Australia, for example, there is an 'Intergovernmental Agreement on the Environment', which coordinates activities among nine Australian states and territorial government in governing natural resources including those in coastal areas (Kay and Alder 2005). Ecuador has 20 years of experience in using a 'parallel' approach to integrated management by combining national policy and strategic framework in community level projects. The development of location-specific participatory integrated coastal management programs that include learning and sharing of experiences is identified as one of priorities for coastal management in the next decade (Olsen and Christie 2000).

Although not restricted to coastal management, one of the important challenges is sustainability. Many of coastal zone management programs come to a halt after initial funding ends and aid is withdrawn. As discussed extensively at the first Coastal Zone Asia-Pacific Conference held in Bangkok in 2002 (Chuenpagdee and Pauly 2004), education is considered one of the tools that can help sustain ICZM. Existing education tools, such as those used in the Philippines and Indonesia, cover a wide range of issues, including reefs and fisheries conservation and are available in various format, e.g., books,

web site, TV program, and board games, suitable for different audiences (e.g., Milne *et al.* 2004). These examples suggest that local capacity building, through formal and informal education, can help the implementation of integrated coastal management and foster its success.

The goodness of fits of images, instruments and actions in coastal zones suggests moderate governability.

Can self-governance be expected in coastal zones? Is it possible, for example, to create a 'level playing field' for all coastal stakeholders when it is obvious that some groups enjoy higher political power and financial influence than others? In fisheries and aquaculture, inequality exists among large-scale and small-scale fishers and farmers. Small-scale fishers, for example, are often marginalized geographically because of their remote location, economically because of their weak marketing power, and politically because of both of these circumstances (Pauly 1997). When hotel owners, land developers and oil and gas industry operators are added to the picture, hierarchical, top-down governance, or at a minimum some kind of intervention from government institutions, may be more appropriate. It is possible, however, to consider involving stakeholders in participatory decision-making and in co-governance, as is recognized and attempted in many parts of the world (see examples in Christie and White (1997)). In Chile, for example, a centralized state where democratic process is still recent, improving public participation in ICM is now encouraged (Barragán 2005).

The boundaries of coastal zones are sometimes defined from political, administrative and legal considerations. Issues of overlapping jurisdictions, conflicting objectives (e.g., short-term vs. long-term considerations, conservation vs. development), and variable responsiveness to governing modes are prominent in coastal zones. Appropriate institutional and legislative frameworks are required in ICZM to address these problems. In some instances, community-based coastal management is deemed suitable, especially when coupled with programs that build capacity for local governance and leadership; for example, in Bangladesh (Huda 2004). Intersectoral and administrative coordination to develop harmonized, internally coherent and mutually supportive policies also contribute to successful programs, as seen in the EU (Humphrey and Burbridge

2003) and Australia (Capobianco 2003). As such, it seems that a mix of governing modes, particularly a combination of co- and hierarchical governance, is desirable for coastal zones.

The responsiveness to governing modes in coastal zones is likely to be very low, implying very low governability.

With respect to first order governance, where people and their organizations interact to solve societal problems and to create new opportunities, coastal zones face many challenges. People come together more easily to address certain aspects of ICZM than for the entire program. For example, programs such as beach protection for conservation of sea turtles, protected areas for coral reefs and biodiversity, and beach cleaning for aesthetic value are likely to attract public attention. While coastal zone problems are not difficult to envisage, there is still a general lack of direct involvement in problem solving by environmental organizations, compared to their efforts elsewhere, for example in nature conservation. Successful ICZM thus requires a mix of objectives, projects and tools that will contribute to its general goal. Synergy among similar initiatives is helpful and ICZM programmes are best situated in contexts that are considered highly important by the general public. For example, over 4,000 marine protected areas have been established around the world (Westcott 2004). More synergy among these protected areas and increased integration of management efforts can create new opportunities to address problems of balancing resource conservation and use in coastal zones.

The design and establishment of new institutions to deal directly with coastal zone issues in many countries suggest an encouraging trend in the performance of second order governance. At national level, new ministries, such as the Ministry of Environment in Cambodia and the Ministry of Natural Resources and Environment in Thailand, are mandated, among other things, to protect and to conserve coastal resources. In Thailand, however, operation of the new ministry is still evolving due to some remaining ambiguity and overlaps in the duty and responsibilities of staff, many of whom had worked previously under the Department of Fisheries, Ministry of Agriculture and Cooperatives.

At the level of meta-governance, there is no difference between the principles and norms for governing coastal zones and those for capture fisheries and aquaculture. Governors face similar ethical and moral requirements. Coastal zones might appear more challenging and require incorporation of a wider range of values, but all of these are still based on the same principles of transparency, inclusiveness, justice, and moral responsibility.

Despite the encouraging trend in the second order governance, the overall performance of governance orders in coastal zones remains poor, suggesting low governability.

The ecological, social and economic conditions of coastal zones are such that the chain of (natural and human) producers of various coastal products and services to consumer can be described as 'coastal webs'. The intricacy of these webs is enhanced by multitude of interactions: among living organisms in coastal ecosystems, among coastal stakeholders, and between humans and ecosystems. Therefore GI are seen everywhere in coastal zones: as they become more vulnerable with alteration and extraction of their resources, from natural and anthropogenic causes; with short-term or long-term management goals; and with the high risks associated with decision-making. Understanding GI is the key to addressing all these challenges. Managing coastal activities to minimize risk and damage to ecosystems, and controlling undesirable ecological, social and economic impacts might be more attainable than trying to achieve ideal and holistic goals. Both reactive and proactive approaches can be applied in risk-management situations, particularly where coastal resources are highly vulnerable and the cost of damages may be high. A pre-determined damage schedule, for assessing incidents such as oil spills and other coastal degradation is an approach that can be used proactively to prevent such incidents, as shown by Chuenpagdee *et al.* (2001).

The presence of GI in coastal zones suggests moderate governability.

5. Summary of Results and Discussion

This initial assessment of the governabilities of capture fisheries, aquaculture and coastal zones is summarized in Table 2, building upon the earlier assessment by Kooiman and Chuenpagdee (2005). These results are a broad, preliminary, subjective and qualitative exploration of the governabilities of the three resource systems. The exercise has served mainly to illustrate how a framework can be used to assess governability. The aim here was not primarily to indicate which system was the most governable**.** Rather, it was to explore the usefulness of the framework in identifying areas where governance can be improved.

Table 2. *The governabilities of capture fisheries, aquaculture and coastal zones*

Governability criteria	Level of governability		
	Capture Fisheries	Aquaculture	Coastal zones
For a system-to-be-governed(SG): Prevalence of properties	Moderate	Low	Very low
For a governing system(GS): Goodness of fits of elements	Moderate	Low	Moderate
Responsiveness of modes	Low	Moderate	Very low
Performance of orders	Low	Moderate	Low
For governance interactions(GI): Presence of GI	Moderate	High	Moderate

The governability assessments by criteria in Table 2 were generalized, by authors' consensus based on sharing information about the current situations of these three resource systems, to give an overall ranking of governabilities. The consensus was that overall governability is likely to be highest for aquaculture, moderate for capture fisheries and relatively low for coastal zones. One criterion that currently distinguishes the governability aquaculture from capture fisheries and coastal zones is its responsiveness of governing modes, mainly due to the prevalence of self-governance among fish farmers. On the other hand, images, instruments and action seem to have better fits in capture fisheries and coastal zones than in aquaculture.

The governability criteria used here cover many important aspects of governance, but other criteria should also be considered. The quality of GI is important, not just their presence or absence. GI quality implies, for example that participation is meaningful, communication is effective and learning is two-way. Further empirical testing of the framework that was used here is required in various systems and contexts, in order to improve governability assessment methods.

In conclusion, governability is a fruitful concept with which to address the governance of capture fisheries, aquaculture and coastal zones and can help to identify areas where improvement in governance is required. Further research could target more specific resource systems - such as given types of fisheries, farming systems or coastal zones - as well as improving methods.

Acknowledgements

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