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# Improving aquaculture governance: what is the status and options?

## Expert Panel Review 2.1

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## Abstract

This paper examines aquaculture governance from a global perspective, looking at its current status and the role of governments in administering and regulating aquaculture, including licence procedures, possible strategies and policy instruments. It also looks at the role and responsibilities of other stakeholders, such as industry, non-governmental organizations and communities.

Over the past decade, considerable progress has been made in addressing aquaculture governance issues. For example, many governments worldwide utilize the FAO *Code of Conduct for Responsible Fisheries* (CCRF), particularly its Article 9. They also use the FAO published guidelines for reducing administrative burdens and for improving planning and policy development in aquaculture, and several countries have defined adequate national aquaculture development laws, policies, strategies and plans. Moreover, individual countries have used best management practices (BMPs) and manuals on farming techniques which have

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been promoted by industry organizations and development agencies. The aim is to ensure an orderly and sustainable sector development. However, aquaculture governance remains an issue in many countries. Some of its manifestations include conflicts over marine sites, disease outbreaks that could have been prevented, a widespread public mistrust of aquaculture in certain countries, inability of small-scale producers to meet foreign consumers' quality standard requirements and inadequate development of the sector in certain jurisdictions despite favourable demand and supply conditions.

There are other key observations that emerge from this global perspective of aquaculture governance. Firstly, the importance of governance cannot be overstated. It is as critical to successful aquaculture as feed, seed, capital and technology. Without good governance aquaculture operations will not appear or will not last. Markets and inputs may exist, but unless there are individuals willing to spend time and money, and take on risks, aquaculture operations will not endure. Secondly, private-sector entrepreneurs are the drivers behind durable aquaculture. Their operations may be capital intensive or low-input intensive, but their motivation is risk-adjusted net income, as with agriculture. Hence, secure exclusive rights to the property and proceeds, including protection from arbitrary confiscation of farms, are among the minimum conditions for private-sector investment. Such property rights are among the factors that underpin an "enabling environment". Other factors include economic and political stability, the rule of law, low levels of corruption, and effectiveness and efficiency of government services. If they are in place, and markets and inputs exist, entrepreneurs are more likely to invest in aquaculture. Thirdly, the behaviour of entrepreneurs must be circumscribed. This can be done by economic incentives, peer pressure or regulations. The ideal would be for self-regulation, because then entrepreneurs' sense of corporate governance would value all stakeholders, including future generations. Unfortunately, experience has demonstrated that many entrepreneurs will ignore negative externalities in their pursuit of profits. Hence, their behaviour must be modified so their interests are reconciled with those of society. In addition, there are problems in society that are not of farmers' own making and cannot be mitigated even by responsible practices. These problems – usually the result of social dysfunctions – also underline the need for regulation. Finally, because the goal of aquaculture governance is to maintain a sustainable industry, the three observations above must be acknowledged by policy-makers. Not only must an enabling environment permit entrepreneurs to create a profitable and competitive industry, mitigate or avoid negative externalities and be granted the social licence to operate, but also policy-makers must learn from best practices elsewhere and implement them. The industry also has an important responsibility to work with policy and rule-makers so that regulations, especially, are not excessively restrictive and prone to circumvention. Mariculture governance will require particular attention.

**KEY WORDS:** *Aquaculture, Governance, Development, Global trends, Sustainable aquaculture.*

## Introduction

Governance has become a focus of studies because of its importance. A recent study compared agricultural sectors across 127 countries (Lio and Liu, 2008). Using World Bank governance indicators, it demonstrated that the primary explanation for differences in agricultural productivity was the quality of governance. Those countries which ranked higher in the governance indicators tended to have higher agricultural productivity. Political, institutional and legal environments were statistically significant compared with other explanatory variables such as differences in precipitation or the number of tractors. Not all World Bank governance indicators were equally important in explaining agricultural performance. The rule of law, control of corruption, effectiveness of government and regulatory efficiency were the most important. Moreover, divergences in agricultural productivity widened over time because of governance. Countries with good governance initially had greater agricultural output with a given input, but they also had higher investment and capital accumulation. With growing capacity over time, the initial divergence in agricultural productivity between countries continued to widen. The World Bank has confirmed the critical role of governance in agriculture. In its 2008 World Development Report, the World Bank acknowledged that many of its recommendations on agriculture had failed because of weak governance (World Bank, 2008).

Aquaculture is a primary industry with similar property rights to agriculture, and its productivity and long-term growth are equally dependent on governance. As the Bangkok Declaration noted, “effective national institutional arrangements and capacity, policy, planning and regulatory frameworks in aquaculture and other relevant sectors are essential to support aquaculture development” (NACA-FAO, 2000). The focus of government intervention must be to provide an enabling environment for aquaculture to prosper, while also ensuring that society is protected against market failures. Business-friendly enabling policies, such as security of property rights, enforcement of contracts, and macroeconomic and political stability are important to stimulate entrepreneurship. These must be balanced with policies that reduce risk and costs to society.

Policy implications for the aquaculture sector are clear. Inputs such as seed and technical support are necessary for development of aquaculture but are not sufficient. Governance issues including institutions, the rule of law and the process of policy implementation matter as much, if not more than resource endowments or technical inputs in influencing aquaculture output.

The body of this report consists of three main sections. The first section addresses the question: “What is the current state of knowledge in aquaculture governance?” It also seeks to answer the question: “Who is responsible for what?” Governments, with their panoply of legislative and regulatory controls are stakeholders whose responsibilities need to be clarified. The same

applies to other stakeholders, including producers and their associations, non-governmental organizations (NGOs) and local communities. The next section looks at historical developments in governance since the Bangkok Declaration and answers questions such as: “How has governance changed over the last decade?”, “What are the trends?”, and “Has aquaculture governance met the expectations expressed in the Bangkok Declaration?” The third major section looks to the future and asks: “What are the emerging issues in aquaculture governance?”, “What are the expectations regarding governance in the future?”, and finally, “What improvements in governance are recommended?” This review does not offer definitive answers but suggests the consideration of practices that have been successful in different jurisdictions.<sup>1</sup>

## Current state of knowledge in aquaculture governance

### General

#### *Principles of governance*

Sustainability is now recognized as the principal goal of aquaculture governance because it enables aquaculture to prosper. Long-term prosperity is predicated on fulfilling the four prerequisites for sustainable aquaculture development: technological soundness, economic viability, environmental integrity and social licence. Meeting these also ensures that human well-being is compatible with ecological well-being. These prerequisites are implicit in the Food and Agriculture Organization of the United Nations’ (FAO) *Code of Conduct for Responsible Fisheries* (CCRF) (FAO,1995a), which provides guidelines that satisfy many of the criteria for good governance in aquaculture. In particular, Article 9.1.1 requires states to “establish, maintain and develop an appropriate legal and administrative framework to facilitate the development of responsible aquaculture” and Article 9.1.3, “the regular up-dating of aquaculture plans to ensure that resources are being used ecologically and efficiently”. There are other articles on the importation of exotic species, the maintenance of genetic diversity and ecosystem integrity and the need for environmental assessment of aquaculture. The CCRF accounts for social factors by requiring access to fishing grounds by local communities (Article 9.1.4) and stakeholder and community participation in developing management practices (Article 9.4.2). In addition, there are articles on postharvest practices and trade.

Broader and softer than “government”, governance covers not only what a government does but also the process by which collective action is taken (Gray, 2005). Thus, aquaculture governance includes how decisions are made and how conflicting interests are reconciled, in addition to the implementation of those decisions. It is therefore broader than the traditional concept of “government”.

<sup>1</sup> Some of the material presented in this report comes from a forthcoming FAO Fisheries and Aquaculture Technical Report on improving aquaculture governance by Nathanael Hishamunda and Neil Ridler.

### ***Type of governance***

The type of governance that is closest to “government” is hierarchical, where governments develop policy independently, leaving producers to manage their farms. In some countries, this type of governance has disappeared for practical reasons. This was once the case in Thailand where command and control measures failed to produce sustainable shrimp aquaculture; laws became outdated, enforcement was inadequate and producers non-compliant (Stead, 2005).

A second type is “market governance”. Market governance leaves aquaculture mainly to supply and demand forces. The danger is that market excesses result in unanticipated environmental damage. Such damage occurred with the initial development of commercial milkfish and shrimp farming in Southeast Asia (Hishamunda *et al.*, 2009a). Attracted by aquaculture’s potential to contribute to livelihoods and foreign exchange earnings, governments failed to regulate external costs as farmers pursued myopic profit-maximization. The result was destruction of mangroves and social unrest. Since then, countries in the region and elsewhere have learnt from that experience and have attempted to mitigate negative externalities. In Europe, where market governance predominates (although participatory forms of governance are increasing with coastal aquaculture), market excesses are mitigated by domestic regulations on environmental protection, health and safety (Stead, 2005). Demand-side governance reforms require increased accountability and transparency, and this has resulted in Thailand’s aquaculture governance becoming more participatory and less hierarchical.

The third type of governance is “participatory governance”. This is increasingly the norm in aquaculture, particularly industry self-regulation using codes of practice, and co-management of the sector with industry representatives and government regulators. Participatory governance is exemplified at the local, national and international levels as demonstrated by the following examples:

- At the local level, neighbouring (and competing) farmers work together to co-ordinate environmental and production measures, and compliance is enforced by peer pressure. One example is fallowing and medication of farmed salmon in Scotland (Howarth, 2006). In Norway, the industry is increasingly becoming self-managed, although animal welfare aspects of aquaculture are co-managed (Norwegian Ministry of Fisheries and Coastal Affairs, 2008). Such local self-regulation is behind the “salmon neighbourhoods” which Chile is proposing as part of its strategy to control infectious salmon anaemia (ISA).
- At the national level, several countries have codes of conduct as part of self-regulation. The incentive for farmers to meet these codes is certification of quality, but industry organizations must also have the ability to exclude those which do not comply. There are many national examples of such forms of participatory governance. Canada has a national code of conduct

for responsible aquaculture, Scotland has its “Quality Assurance” scheme and Thailand has its good aquaculture practice (GAP) guidelines for the responsible husbandry of shrimp. Thailand also has a sophisticated code of conduct that demands international quality standards.

- At the international level, an example of self-regulation is the European industry association Federation of European Aquaculture Producers (FEAP). It has a code of conduct that has nine themes that cover, among other issues, environmental protection, consumer concerns, husbandry, socio-economic indicators and the public image of the industry.

## **Who is responsible for what in aquaculture governance?**

### ***The responsibilities of the state***

#### *Nature and extent of government intervention in aquaculture*

One question that arises in aquaculture governance is the balance between the role of the state and that of the private sector. There is now a consensus that modern aquaculture is driven by the private sector and risk-adjusted profit motives. Such aquaculture need not be large scale but does entail a business orientation as with any small and medium enterprise (SME).

The state must provide an enabling environment, such as secure property rights, political stability, some capital goods (e.g. roads, utilities, etc.), and research and development (R&D), designed to address market failure, in order to reduce costs and risks to entrepreneurs and to protect the interests of the community at large. Without these services, rent seeking rather than efficiency becomes rational behaviour in resource use. The state must intervene to prevent the private sector from concentrating on short-term profits at the expense of the environment and society. Market failures such as externalities, scale economies, asymmetry in information and non-excludability in research require intervention through regulations, economic incentives or a combination of these.

While some public intervention in aquaculture governance is needed, there is less agreement about its extent and timing. Many governments, particularly in developing countries, have successfully provided inputs and services to industry early in the development of aquaculture. For example, in Thailand there was considerable success in producing seed in government hatcheries for distribution to fish farmers early on in the development of its aquaculture industry, and in Viet Nam, in the provision by government of fingerlings of marine species for aquaculture. The government hatcheries also provided training to farmers who eventually set up their own hatcheries. The government hatcheries, unencumbered by mass seed production and commercial chores, then focused on R&D and extension. This also precluded them from competing with the nascent private seed production industry. Governments have also successfully promoted positive externalities, whether through the clustering of small farms or through the nucleus farm programme of Indonesia. However, in other cases, results of government development-oriented policies have been poor or ill-

timed, as was the case of a public seed hatchery in Indonesia, that was made redundant by private hatcheries. Public provision may also be inefficient with perverse incentives. An illustration is public tilapia hatcheries in the Philippines with subsidized seed of questionable quality that undercut private hatcheries (Hishamunda *et al.*, 2009b). In some instances a further argument for reducing the role of the state is the impact on corruption. “The more the state is involved in supplying inputs such as fertilizer and credit..., the greater is the potential for corruption” (World Bank, 2008). Because of these shortcomings, supply-side governance reforms have attempted to curtail the role of the state.

### ***How should the state administer aquaculture?***

#### ***The regulatory authority***

In many countries, particularly where the industry is new or small, the competent authority for aquaculture is the relevant department or ministry in charge of fisheries, and is administered with regulations designed for capture fisheries (Percy and Hishamunda, 2001). Some of the largest aquaculture producers such as China, India and Thailand have lead agencies that fall under their respective ministries of agriculture. In other jurisdictions, the competent authority is neither fisheries nor agriculture. In Chile, for example, responsibility for aquaculture governance falls under the Ministry of Economics, and in Zimbabwe, it is under the Ministry of the Environment and Tourism. In some countries, such as Angola, Mozambique and South Africa, inland aquaculture and marine aquaculture are the responsibility of different ministries.

Where there are different tiers of government, policy-making for aquaculture is best served by a combination of input from high-level and local jurisdictions. In India, there is co-management between central and state governments. A similar arrangement has been made in Canada, another federal country. Canadian federal and provincial ministers have agreed to joint management of aquaculture, with most provincial governments assuming responsibility for site selection through federal-provincial Memoranda of Understanding. In Australia, state (provincial) governments effectively have full legislative control (e.g. of site selection, licensing, management plans, etc.) over aquaculture development and management within their respective geographic boundaries, with the role of the federal government being primarily the management of nationally significant environmental assets and trade-related biosecurity risks.

Whatever ministry or department is responsible, a lead agency for aquaculture is desirable (NACA-FAO, 2000; FAO, 2008a). Its focus would be to co-ordinate, plan and establish regulatory requirements for the industry, integrating aquaculture policy horizontally and vertically. Where such a lead agency does not already exist, a new body can be established. An example is INCOPESCA (Instituto Costarricense de Pesca y Acuicultura) in Costa Rica, which was created as the lead agency for the development of aquaculture (and aquaculture research) in 1994. In Honduras, DIGEPESCA (Dirección General de Pesca y Acuicultura) not

only regulates the sector but also prepares aquaculture development plans. The recently established lead agency for aquaculture in Mozambique, INAQUA (Instituto Nacional de Desenvolvimento da Aquicultura), plays the same role. It is responsible for research and the over-sight of incentives, as well as policy development and authorization of licences (INFOSA, 2009).

The advantage of having a lead agency for delivery of aquaculture governance is improved horizontal and vertical integration of administrative and regulatory initiatives, which can be encouraged by decree, for example, the Planning and Building Act in Norway, which obliges agencies to co-operate in terms of delivering multifaceted governance arrangements. In addition to reducing administrative “turf wars”, a lead agency enhances administrative accountability, can be pro-active and can reconcile the many legislative regulations that impinge on aquaculture (FAO, 2008a). The absence of a lead agency can handicap aquaculture: for example, it is argued that marine aquaculture has been stymied in the United States of America by the absence of such an agency at the federal level (Pew Trust, 2007).

Administrative co-ordination is important for licensing procedures, because streamlining licensing procedures facilitates investment. This way, each department does not completely reassess applications or require environmental assessment. One-stop shops where all information is available in one place are advisable. They do not require full institutional integration, merely a common location of applications and information. The lead agency responsible for guiding aquaculture in Norway, the Ministry of Fisheries and Coastal Affairs, provides a one-stop shop for licence applications and for providing time lines for decisions. A refinement to this arrangement is to have front office/back office separations where customers do not meet those who process the applications (FAO, 2007a). This reduces the opportunities for influence peddling.

### *The legislative and regulatory framework of aquaculture*

As a new sector, aquaculture rarely has dedicated laws and rules, and is often regulated under provisions of an existing act (Glenn and White, 2007). Having dedicated legislation in part depends on the relative economic importance of aquaculture compared with other primary industries. In many countries, aquaculture may be merely acknowledged through an enabling clause in fisheries legislation, without specific criteria for licensing. This arrangement may lead to unintended consequences, and leaving discretionary power to officials is susceptible to rent-seeking (Spreij, 2003). On the other hand, if the aquaculture sector is not likely to be an important industry, benefits from a complex legislative framework may not be worth the cost.

Regulations exist to provide an orderly and sustainable development of aquaculture. This is done by reducing negative externalities such as pollution or conflicts over land rights, and by encouraging positive externalities (e.g.



Indonesia's policy of promoting estates in which small-scale aquaculture farms are provided technical assistance by estate management). In the planning and operation stages, a minimum list of regulations would include an environmental assessment, avoidance of unacceptable impacts through the release of exotic species, protection from the ecologically destructive use of resources, control of fish movement to limit transmission of diseases and prevention of intrusions which conflict with the legitimate interests of others (Howarth, 2006).

In addition to regulations that control fish production, fish quality is gaining regulatory attention because quality is important for domestic consumers and for gaining access to international markets. Standards are responding to consumer demands transmitted through retail chains. These retail chains are "buyer-driven" and set quality and sometimes husbandry standards downstream to producers and processors. These standards include quality and hygiene standards and labour regulations, which often requires that fish meet quality standards as specified by hazard analysis and critical control points (HACCP) and by chemical and drug quality control boards with traceability procedures.

In addition to fish quality, animal welfare will require attention from jurisdictions exporting to Europe. This may involve regulations and indicators to ensure that ethical standards are met in the husbandry, transport and slaughtering of fish.

The danger is that compliance with fish quality standards may be prohibitively expensive or technically unfeasible for small-scale farms. In general, regulations can be overly cumbersome, adversely affecting the profitability of aquaculture (Knapp, 2008). By adding further costs such as environmental monitoring, they can make an otherwise viable business economically unprofitable. Excessive regulations also provide opportunities for regulators to enrich themselves (World Bank, 2008). For internationally traded products, over-regulation can destroy comparative advantage if competitors have a framework that is more industry friendly.

This would suggest that regulations should be relevant and be kept to a minimum. Ideally, strong corporate social responsibility of aquaculture farmers would induce "beyond compliance" behaviour (Lynch-Wood and Williamson, 2007). Self-regulation and co-management may be the best policy except for severe and irreversible impacts (Howarth, 2006). In this context, the emerging role of better management practices (BMPs) in aquaculture in developing countries is noteworthy in the absence of an effective state-based system alternative (Tucker and Hargreaves 2008). Cluster-based BMPs are a functional form of participatory governance designed to facilitate smallholder compliance with buyer, consumer and general community expectations about product quality, food safety and environmental integrity (De Silva and Davy 2010). As a form of participatory governance, BMPs more realistically reflect the limitations

of available resources, infrastructure and technology, but also facilitate accountability, innovation and continuous improvement by producers.

In addition to relying on self-management and co-management, there are other options to avoid over-regulation. The lack of enforcement of existing regulations (because of resources) may be more important than weak legislation in explaining unsustainable practices in aquaculture (FAO, 1995b). One means of developing relevant or curtailing unnecessary legislation is to have a mandatory regulatory appraisal process prior to law enactment. This ensures that implementation of the law is considered before and not after its enactment. In addition, periodic reviews of regulations to assess their relevance and effectiveness lessen the likelihood of overlapping laws, regulations and jurisdictions. Overlapping contributes to confusion, inefficiency and bureaucratic rigidity.

As recommended in the Bangkok Declaration, an alternative or complement to environmental regulations as a form of aquaculture governance is the use of economic incentives. Rather than control regulations that explicitly detail pollution levels or methods, economic incentives aim to change behaviour through price or tax signals. They act as a signaling device to farmers to adopt best practices; for example, “payments for environmental services” (PES) are now used in farm carbon emission offsets in Mexico (FAO, 2007b). Their application in aquaculture would encourage the adoption of integrated multi-trophic aquaculture (IMTA) (Soto, 2009).

### ***Some aquaculture strategies and policies***

#### ***Strategies***

An integral part of successful aquaculture governance is a strategy that contains specific instruments to meet development objectives outlined in the overall policy (FAO, 2008a). Among possible supply-side strategies are integrated coastal zone management (ICZM), promotion of foreign investment and encouragement of clusters and large companies.

#### ***Integrated Coastal Zone Management***

Siting of marine aquaculture development zones is of critical importance to mitigating environmental impacts of aquaculture. Many of the adverse impacts of cage aquaculture can be attributed to siting (Pew Trust, 2007). While siting does not replace good management or regulations, it can make the difference between a sustainable operation and one that fails. At the very least, marine zoning should consider carrying capacity, proximity of sensitive habitats, risks of disease spread and interactions with wildlife (Pew Trust, 2007).

In many countries, siting is the most contentious issue, as it must also take into account potential conflict with other users. Applications for a particular site usually face opposition, whether from cottagers, workers in other sectors, environmental groups or the wider public. In Canada, opposition to sites is

perhaps the major impediment to development of the salmon-farming industry (McConnell, 2006).

A strategy that appears to have been successful in addressing siting-related issues by reconciling different interests is ICZM. ICZM has long been one of the general principles that should guide management of coastal aquaculture development (FAO, 1992). Using the ICZM approach to governance, ecological and human activities that are compatible are incorporated within assigned zones. Such holistic zoning at the beginning of aquaculture development has been an effective tool in preventing conflicts (McConnell, 2006).

ICZM (and associated aquaculture zoning) is the strategy being adopted in many jurisdictions. In Australia, zoning has been proposed in Queensland (Queensland Government, 2008). In Chile, separate sea areas are zoned for salmon farming and the capture fisheries. Similarly, in Belize and the Philippines, zoning is an explicit tool for managing aquaculture. In Namibia, aquaculture zones are a proactive means of promoting the industry in areas which are particularly suitable for aquaculture, and for encouraging the transfer of technology (Republic of Namibia, 2002). In Europe, ICZM is the favoured strategy of the European Commission (EC) to improve both the democratic deficit and the ecosystem deficit (Kaiser and Stead, 2002).

#### *Promotion of foreign investment*

One strategy that has been successful in developing aquaculture is to attract foreign investment. It absorbs some of the risks of establishing a new industry and the costs of acquiring technology and knowledge, as well as providing capital.

Costa Rica developed its commercial aquaculture through encouraging foreign investment. One foreign company dominates its tilapia industry. The demand for feed from this company alone was sufficiently large to stimulate feed production by domestic manufacturers. The company also prompted interest in tilapia production by domestic farmers, encouraging emulation and domestic investment in the sector. Similarly, in Africa, Madagascar has adopted policies to attract foreign investment in shrimp farming, and in Mozambique, the two largest shrimp farms belong to foreign (French) investors. In Zimbabwe, the largest farms belong to foreign investors.

In Southeast Asia, foreign ownership is relatively small. In Indonesia, foreign ownership varies by species. Farming of groupers is primarily foreign owned, but ornamental fish operations and seaweed farming are primarily domestic. In Malaysia, the only major foreign participation is in ornamental fish cultivation. Viet Nam has encouraged foreign investors and as a result, the number of foreign companies involved in aquaculture doubled every year between 1998 and 2003. In marine seed production, which Viet Nam has declared a priority, foreign companies are exempt from value added tax (VAT); they also enjoy

reduced land taxes. Feed production is still predominantly by foreign firms, but their share has been declining in favour of domestic producers (Hishamunda *et al.*, 2009a).

However, foreign investment has an economic cost. Investors may also expect tax exemptions and other incentives. Honduras has encouraged its shrimp farming industry by offering tax holidays to foreign investors and the lost tax revenues have reduced multiplier effects for local communities (Stanley, 2003). A further possible cost is non-economic – it is social. Foreign investments can generate resentment among the local population, particularly if the large farm is an enclave-type development, with managers hired from abroad, few backward linkages, little training provided and research done elsewhere. The predominance of foreign-owned companies in British Columbia, Canada, for example, exacerbates NGO opposition to salmon farming.

#### *Clusters and large companies*

Small-scale farms often lack technical expertise to meet quality standards and market access. One strategy to mitigate these handicaps is to encourage clustering of farms or the establishment of a large farm. This strategy should encourage many of the benefits from size, including economies of scale in the provision of inputs and of marketing. It could also improve management of watersheds.

One country that has used clusters as a strategy for developing aquaculture is Chile. Aquaculture is ranked high in national policy because it is a sector with high potential with few impediments to growth (Pinto, 2007; Alvarez, 2009). It also benefits from positive locational economies because of geographical concentration in southern Chile, particularly the X<sup>th</sup> region. Other examples include the cluster-based approach to development of BMPs and marketing to enhance export markets, for example, the shrimp farming sector in Andhra Pradesh, India (De Silva and Davy, 2010).

A cluster requires a number of attributes: there must be geographical concentration of companies, perhaps caused by agglomeration economies; a strategic inter-relationship with other linked activities; a network of private and public support services and a significant economic and social impact. Aquaculture often meets these criteria. In Chile, to encourage continued expansion of the sector, there is a Strategic Council for the Aquaculture Cluster presided over by the Ministry of Economics.

Another strategy for promoting small-scale farming is a “nucleus” farm. It has been successful in Costa Rica and Jamaica, encouraged in Indonesia and suggested for Mozambique (INFOSA, 2009). In Jamaica, where a large farm already existed (the Jamaican Broilers Group), the farm was able to stimulate backward and forward linkages with its market power and depth of resources.

Its success prompted small-scale farms to “piggy-back” using inputs provided by the large farm. This strategy is followed in Indonesia, where large farms must involve satellite farms. The government’s role has been to facilitate and to monitor these partnerships, suggesting improvements. In Mozambique, where there are no existing nucleus farms, the strategy is to establish them because they are seen as a means of enabling SMEs to acquire technology and economies of scale (INFOSA, 2009).

It seems clustering is a win-win strategy for both the nucleus and satellite farms, implying that there should be no need to use regulations to enforce such strategies, except perhaps at the initial stage, when some level of regulation is necessary so as to achieve more equitable development of the sector, one of the requirements of sustainability.

## *Policies*

### *Supply-side policy instruments*

Most policy instruments to promote aquaculture focus on supply because that is often where there is a constraint. There may be no feed industry or insufficient seed. There may also be diseases and limited funds to curb them, owing to a shortage of investment capital. The usual tool for stimulating supply is a fiscal incentive such as a tax holiday for investors. This may be made available to both domestic and foreign investors. Fiscal policies are less costly to administer than monetary policies; custom exemptions and land tax exemptions can be administered by a few officials. They also do not require an immediate outlay from the public purse, but they bear an opportunity cost of the lost tax revenues for governments.

For the farming of most species, feed is the major operating cost. In most developing countries, access to credit can be equally or more limiting than feed. Many policy options exist to alleviate these constraints, but it is important to note that governance reforms now strive to limit direct provision of inputs by governments because they incite rent seeking by officials (World Bank, 2008). Some needs of industry are beyond the government fiscal capacity of many developing countries, whereas others, such as government assistance with business plans, involve no outlay of public money.

To assist with the shortage and/or the high cost of capital, policy instruments used in aquaculture include cash grants, (e.g. as in Canada), and credit subsidies (e.g. as in Indonesia). Policy instruments that do not involve direct budgetary expenditures have also been implemented. This is the case of government loan guarantees in Europe and state assistance with business plans in Madagascar, which also improved access to bank credit. There may also be the potential for extending the same (crop) insurance available to agriculture, which would reduce the risk premium on bank loans and encourage banks to lend (Van Anrooy *et al.*, 2006). Subsidized interest rates were both inefficient and inequitable

in the Philippines (Hishamunda *et al.*, 2009b). In Côte d'Ivoire, borrowers of government-supervised loans from the African Development Bank viewed loans as handouts with minimal pay-back rates. In the Philippines, subsidized interest rate loans principally benefited the larger borrowers, who had more collateral and less risk. As a result, market, rather than subsidized, interest rates are now charged. There is also the question whether interest rates *per se* are the most important capital constraint for aquaculture farmers, including smallholders, who sometimes are willing to borrow from informal financiers, even at usurious rates. More important than the rate of interest appears to be the ease and convenience of getting a loan approved with minimal paper work and documentary requirements (Hishamunda, *et al.*, 2009b).

In some countries, the quantity and quality of feed constrain the aquaculture sector. Feed cost has tended to increase with the rising price of fishmeal, and feed quality can also be an issue.

Policy instruments to encourage more and better feed production include explicit incentives for foreign investment (e.g. as with Uganda and Viet Nam). Other policies include encouraging livestock companies to diversify into aquaculture and feed production (e.g. as in Jamaica), lowering tariffs on imported feed (e.g. as in the Philippines) and undertaking research to substitute imported fishmeal with local ingredients (e.g. as in Malaysia).

Quality and shortages of seed can also be a constraint. Seed availability can be increased by offering hatcheries tax holidays (e.g. as in Malaysia). Another example is Viet Nam, with its plan to increase marine seed production. Viet Nam also used soft loans, exemptions from VAT and reduced land taxes. To improve the quality of seed, research has been promoted in many countries in public fish stations. Research can also be undertaken by private companies on site, or as in the case of the genetically improved farmed tilapia (GIFT) strain in the Philippines, in collaboration with a university.

#### *Demand-side policy instruments*

Governments and producer associations can promote aquaculture through demand-side policy instruments such as marketing incentives. In Jamaica, the government, through the Inland Fisheries Unit, encouraged producers to switch from the Mozambique tilapia (*Oreochromis mossambicus*), which was unpopular with consumers, to the culture of Nile tilapia (*O. niloticus*). It also appointed a marketing officer to create a market for the farmed fish. In Chile, marketing was also a tool for promoting the industry, but through producer associations. Generic marketing of farmed salmon was promoted by collaboration with producer associations of rival salmon-producing countries. In addition, the Chilean Producers' Association engages in brand marketing, as do associations in other countries.

Governments can also ensure fish quality and safety through the hygienic handling and selling of fish. In China, the government played an active role in investing in trading markets. In Thailand, fish can only be sold through fish agents who must be registered with the Department of Fisheries. Similarly, Indonesia assisted with market infrastructure (Hishamunda *et al.*, 2009a).

### ***The responsibilities of other stakeholders in aquaculture governance***

Increasingly, corporate self-regulation and decentralization are extending the role of stakeholders, other than governments, in managing aquaculture. Costs of monitoring and enforcement have encouraged delegation of certain husbandry decisions to a collection of neighbouring farms, which are then subject to peer pressure. In addition, communities wish to be part of decision-making in allocating aquaculture sites.

#### *Local communities*

Paragraph 6.13 in the FAO's CCRF says that the decision-making process should be timely and transparent, with active participation by stakeholders in fishery decision-making. Involvement by all stakeholders provides legitimacy for aquaculture plans and policies and induces compliant behaviour in enforcing difficult decisions (FAO, 2008a). In various countries, BMPs have been used as a vehicle for engaging local communities in managing environmental impacts of aquaculture to alleviate conflict and to facilitate positive local relations (Tucker and Hargreaves, 2008).

There are several economic arguments for having stakeholders participate in aquaculture decision-making. Firstly, participation should increase acceptance and compliance, thereby reducing transaction and enforcement costs. Secondly, by educating the public, trust in aquaculture should be enhanced, increasing consumer acceptance of farmed seafood. Thirdly, participation encourages the incorporation of local (indigenous) knowledge in decision-making, which could improve productivity. However, while participatory governance of aquaculture has come to the fore in many countries, there are questions about its effectiveness and cost-efficiency. Government officials may use it as a tactic to avoid making decisions. Alternatively, it may be used to “rubber stamp” decisions already made. In addition, obtaining consensus can be expensive, as it requires both human and financial resources.

The question of subsidiarity suggests that certain issues should be left to local authorities. Where there are neither externalities nor economies of scale (as with site selection), local communities are usually able to make their own decisions based on their own priorities. In most of Canadian aquaculture, siting is *de facto*, a provincial responsibility, and in Norway, siting is a responsibility of municipalities. Where there are externalities, as with regulations over importing exotic species, higher-level decision-making is needed. The importation of exotic species is regulated at the regional level within the Southern African

Development Community (SADEC) (SADEC, 2002). The higher-level consideration prevents “environmental dumping”, by which one jurisdiction accepts standards unacceptable to others, a decision that will have negative repercussions on all.

This more local or community driven development (CDD) approach appears to be the route that much aquaculture governance will follow in the future. Linked to decentralization, CDD encourages industry, communities and the local government jurisdiction to decide priorities. There are certain principles that should be followed; in addition to all levels of government (national, provincial, indigenous and urban), there should be representatives of industry and environmental groups (Black *et al.*, 2007). Residents in an area of resource use should be an equal partner in the decision-making process, and more remote urban interests should not dominate the process. All participants in resource allocation decisions must respect all users’ interests and aspirations. CDD is increasingly a focus of development strategies; for example, the World Bank now allocates approximately 10 percent of its funding to CDD strategies (World Bank, 2008).

In spite of its merits, decentralization requires not only local decision-making but also local fiscal capacity. This has also been noted for ICZM implementation. Local tax bases are often low and inflexible. Most developing countries have experimented with decentralization, but have faced resistance to the shift of personnel and the tax base from central to local jurisdictions (World Bank, 2008).

#### *Non-governmental organizations (NGOs)*

NGOs can have a constructive role in aquaculture governance and can be a useful counter-weight, particularly where policy-making is *de facto* dominated by business with short-term horizons. NGOs can then act as environmental and social watchdogs and as lobby groups, putting pressure on business to increase transparency and improve working conditions.

They may also be part of aquaculture advisory boards (as in Chile) and publish scientific studies that are not available elsewhere. The latter is particularly important where academic research is limited because of capacity. Their impact on government policy can be important, even if indirect. An example of the constructive role of an NGO is the Dialogue funded by the World Wide Fund for Nature (WWF). Industry representatives, NGOs and other stakeholders meet to develop guidelines to improve sustainability of aquaculture. Traditionally, the Dialogue focused on environmental and ecological challenges facing the farming of different species, but now there are technical committees to examine socio-economic issues.

However, NGOs have certain inherent deficiencies, as they are not accountable, unlike politicians who are often democratically elected. They do not have



to compromise, but merely satisfy single-issue partisans who may not be representative of the broader society. Moreover, reliance on donor funding can lead to sensationalism in order to attract media attention. The result may be vociferous rejection of aquaculture without weighing the benefits that accrue from it. Sometimes they include technical assistance among their functions, without the appropriate or adequate technical expertise.

### *Producer associations*

Producer associations take many forms. They vary from local institutions, sometimes called “one-stop aqua shops”, to sophisticated national organizations. In most countries, aquaculture does not have the economic weight of agriculture or even the capture fisheries. Thus, its interests are often overlooked and therefore producer organizations can be useful just as lobby groups. In addition, they are frequently used as a means of exchanging information and diffusing technical knowledge. The cluster-based approach to farmer associations designed to facilitate aquaculture development has recently seen the emergence of the value chain approach to supply chain reform and broader industry development. This appears to be a viable means by which smallholder farmers can effectively “corporatize” and engage larger-scale producers, processors and buyers in a way that traditional governance mechanisms cannot. In Africa, producer associations have managed shared water supplies and acted as financial intermediaries issuing credit (Hishamunda and Ridler, 2004).

Producer associations can also be marketing agents and monitors for environmental self-policing, as with the Chilean Salmon and Trout Growers’ Association. The association maintains HACCP and quality standards, thereby ensuring that all products exported are of a uniformly high quality. It has also played a major role in marketing farmed salmon, collaborating with other producing countries in generic advertising of salmon, and in differentiating Chilean salmon by brand marketing. Research has also been an important priority for the Chilean association. This association established the Salmon Technology Institute to fund demand-driven research and to encourage the transfer of technology.

## **Changes in aquaculture governance over the last decade: were the expectations expressed in the Bangkok Declaration met?**

More than a decade ago, the FAO identified the principal issues of aquaculture governance as: “how to develop institutions and rules that recognize aquaculture as a distinct agricultural sector; integrate aquaculture concerns into resource use and development planning; improve food safety and quality to safeguard consumers and meet the standards of importers; and improve the management of aquaculture, particularly where it has the potential to be socially or environmentally unsustainable” (FAO, 1995b).

The Bangkok Declaration reiterated the important role that institutions and policies play in the sustainability of aquaculture. It stated that “one of the key issues for the growth of aquaculture will be the ability of countries and organisations to strengthen their institutional capacity to establish and implement policy and regulatory frameworks that are both transparent and enforceable”. The Bangkok Declaration also acknowledged that “the potential of aquaculture to contribute to human development and social empowerment cannot be fully realized without consistent, responsible policies and goals that encourage sustainable development” (NACA-FAO, 2000; Articles 2.15 and 2.17).

Over the past decade, in spite of lacunae, considerable progress has been made in aquaculture governance. The FAO has contributed to this progress through its *Code of Conduct for Responsible Fisheries* (CCRF) (FAO, 1995a) and in particular Article 9. It has published guidelines for reducing administrative corruption and for improving planning and policy development in aquaculture (FAO, 2007a, 2008a). The FAO also provides Internet access to the aquaculture legislation of more than 40 countries, enabling policy-makers to learn from other jurisdictions (FAO, 2010). Improvements in husbandry management have been promoted by industry organizations such as the Federation of European Aquaculture Producers (FEAP) with their “Best Management Practices”, and agencies such as the Network of Aquaculture Centres in Asia-Pacific (NACA), with manuals on farming techniques, development of “aquaclubs” and the introduction of BMPs to smallholder farmers.

Most jurisdictions have improved aquaculture governance. This is in part because governance has become a priority for the World Bank and other development agencies, and the lessons learnt have been transferred to aquaculture, which is increasingly viewed as a “sunrise industry” able to meet the growing shortage of seafood. There is recognition now in many countries in sub-Saharan Africa that sustainable aquaculture must rely on the private sector and the risk-adjusted profit motive, rather than subsistence farming. There has been an encouragement of aquaculture small and medium enterprises (SMEs) and in certain countries, a better enabling environment. In the Americas, Canada has attempted to reduce the regulatory burden facing potential and actual aqua-farmers, and Chile, which has suffered from disease challenges, is developing legislation that will improve protection of the environment. It is important that the working conditions of salmon workers and the enforcement of labour standards will be included. In Asia, countries such as Viet Nam have adopted aquaculture as an engine of economic development. Regulations were established to improve fish quality, and incentives are offered to domestic and foreign investors to encourage investment. Specific funding has been allocated for research priorities such as mariculture and for sending students overseas for aquaculture education and training.

Among the strategies advocated in the Bangkok Declaration is greater stakeholder involvement. As mentioned above, in Thailand and elsewhere, hierarchical governance is giving way to more participatory forms, which is in line with the Bangkok Declaration that “improving co-operation amongst stakeholders at national, regional and inter-regional levels is pivotal for further development of aquaculture” (NACA/FAO, 2000: 2.16).

Similarly, the Bangkok Declaration urges “organisations and institutions representing the private sector, NGOs, consumers and other stakeholders” to be involved in order to make institutional capacity more effective. This has increasingly become the norm worldwide. For example, producers are involved in managing the “bay system” in New Brunswick, Canada and co-operate in husbandry operations in Scotland. The same occurs in Norway because self-management and co-management reduce the burden of regulatory enforcement. NGOs are active watchdogs over ecological developments in British Columbia, Canada and over ecological and labour conditions in Chile. Consumers are the ultimate arbiters of responsible aquaculture because they influence import certification through retail establishments, which may cease selling questionable products, as occurred with Chilean salmon in the United States of America. Demand for aquaculture products appears generally good, but consumers now have a constant source of information or misinformation, and their reaction can adversely affect demand very severely. Local communities are often involved in siting decisions, and consultation is critical if zoning and ICZM are to be effective.

The strategy of “developing, through a participatory approach, comprehensive and enforceable laws, regulations and administrative procedures that encourage sustainable aquaculture and promote trade in aquaculture products” has been less successful. An illustration of this failure is seen in the Chilean ISA crisis and the fines levied against salmon companies there for violations of the labour code. With licences granted in perpetuity, with market governance aimed at keeping costs to a minimum to gain competitive advantage, and with weak enforcement, salmon farming in Chile ceased to be environmentally and socially (and perhaps even economically) sustainable. Weak enforcement has resulted in heavy losses of Atlantic salmon (*Salmo salar*), several deaths (of divers) and numerous violations of International Labour Organization (ILO) labour standards (Pinto, 2007).

There are limits to participation, mostly due to scarce resources. Participatory methods involve expenditure of money, time and skills. In particular, the absence of long-term funding for participation has handicapped the credibility and effectiveness of coastal planning in Europe (Stead, 2005). Time constraints will also determine the extent of participation. Methods for participatory governance have different cost-efficiency and have been used. Two methods of particular interest are the Analytic Hierarchy Process (AHP) (Cai, Leung and Hishamunda,

2009) and the Delphi method (Hishamunda, Poulain and Ridler, 2009). Both have been applied to analyze a number of aquaculture issues, including criteria for aquaculture sustainability, the constraints on capital-intensive polyculture and developing aquaculture plans (e.g. in Chile).

Another strategy that has developed in aquaculture governance and was advocated in the Bangkok Declaration is the increased use of incentives: “incentives, especially economic incentives, deserve to be given more attention in the planning and management of aquaculture development”. Self-regulation and codes of conduct, whether at the local, national or regional level, use peer pressure and the threat of exclusion to induce responsible behaviour.

Many countries have adopted the Bangkok strategy of “developing a clear aquaculture policy, and identifying a lead agency with adequate organisational stature to play a strong co-ordinating role”. The 2008 “FAO Expert Consultation on Improving Planning and Policy Development in Aquaculture” reiterated the importance and role of a lead agency for aquaculture (FAO, 2008a). While certain lead agencies, such as INCOPECSA in Costa Rica and DIGEPESCA in Honduras were established prior to the Bangkok Declaration, others, such as INAQUA in Mozambique were established more recently. As suggested in the Bangkok Declaration, their role is to integrate aquaculture policy horizontally and vertically.

The Bangkok Declaration also stated that “the collection and dissemination of accurate and verifiable information on aquaculture may help to improve its public image and should be given attention”. Yet, in many countries, data collection is often overlooked, is incomplete or otherwise unreliable due to inadequate quality assurance/quality control, and typically lacks any form of independent audit to validate outputs. To develop a robust database requires planning (FAO, 2008a). The method of collection will depend in part on trust and on resource availability. There may also be a comparison of cost-effectiveness between methods (e.g. between enumeration and sampling). Southeast Asia provides an illustration of different collection processes (Hishamunda *et al.*, 2009a). In some countries, such as Cambodia and Costa Rica, producers are required to record information and pass this on to the authorities. While this individual reporting may be relatively inexpensive, concern by farmers over tax repercussions can reduce compliance. It can also result in deliberate inaccuracies.

As recognized in the Bangkok Declaration, research and dissemination of research results are an integral part of aquaculture governance. “There is a need to increase investment in aquaculture research, whilst making efficient use of research resources.” This was reiterated in the Norwegian strategy: “Experience from salmon farming has shown that research is decisive for a profitable and sustainable development” (Norwegian Ministry of Fisheries and Coastal Affairs, 2008). In Norway, the aquaculture industry funds mostly applied research,

leaving basic research predominantly to universities (Norwegian Ministry of Fisheries and Coastal Affairs, 2008). In the Philippines, demand-driven research was encouraged by private-public research partnerships (Hishamunda *et al.*, 2009a). Such private-public research has also been successful in Canada, where broader research in aquaculture was encouraged with a federal research programme, AquaNet, which only funded projects that were multidisciplinary. Efficiency of research can also be enhanced by collaboration among national and regional institutions. Collaboration diminishes duplication and encourages specialization, particularly if there is co-ordination of research efforts, perhaps by a lead agency.

Once the research results are known, it is important that they be widely disseminated. In India, the Farmers Training Centres not only disseminate technology to farmers, but also provide a communication channel to the researchers about field problems and indigenous technical knowledge.

Although perhaps not explicitly recommended in the Bangkok Declaration, a recent trend in aquaculture governance over the last decade is the increasing consideration of ecological sustainable development (ESD) principles and the associated use of risk-based aquaculture management planning involving expert panel-based risk analysis and decision support systems. There are many examples of this approach in Australian aquaculture, for example, in prawn aquaculture (DOF, 2009). In Canada, risk analysis is used by the lead agency for aquaculture, the Department of Fisheries and Oceans, in managing coastal allocation. Its advantages are that there is a common language and understanding of ecosystem effects of certain activities and that it can guide appropriate mitigation measures.<sup>2</sup> There are four stages in risk analysis. The initial stage is assessment, which is the identification of risks. It is followed by the analysis of risks and their measurement. The third stage is risk response, which may require mitigation. The last step is risk communication.

While beneficial in providing a scientific basis for the assessment of potential hazards, risk analysis can be problematic at the policy level. In some cases, probabilities are unknown, and the danger is that there could be heavy economic and social impacts of disallowance. The opportunity costs of lost incomes or abandoned communities may not be considered in the scientific analysis. A final caveat is the communication of risk. Its scientific context may not be understood by the public, for whom the concept of risk is very negative; poor communications can create mistrust for aquaculture activities and for farmed fish (Mazur and Curtis, 2008).

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<sup>2</sup> Source: presentation given by I. Burgetz on *Ecosystem based approaches to environmental interactions of marine aquaculture: a Canadian perspective*, PICES 17th Annual Meeting October 24 – November 2, 2008, Dalian, PR China (available at: [www.pices.int/publications/presentations/PICES\\_17/Ann2008\\_S5/9\\_s5\\_Burgets.pdf](http://www.pices.int/publications/presentations/PICES_17/Ann2008_S5/9_s5_Burgets.pdf)).

## Expectations regarding aquaculture governance in the future

Governance will become more important, with jurisdictions ambitious to develop aquaculture adapting “best practices” from elsewhere. With its successful expansion of salmon farming without major environmental or social challenges, Norway appears to be a model. It has a dedicated aquaculture law focused on economic interests but subject to sustainability constraints. This economic orientation is reflected in its ambition to simplify administrative and regulatory procedures so as not to penalize producers and jeopardize comparative advantage. Licensing procedures meet the four governance principles suggested earlier; plus, they are constantly evolving and improving. Participation of local communities is necessary because they decide on siting.

There will be dissemination and adoption of best practices such as these. There will also be more emphasis on pre-appraisal of regulations, as countries will strive to avoid over-regulating aquaculture; over-regulation has been an alleged deterrent to investment in aquaculture in some countries, including Canada. Not only may over-regulation be a disincentive to investment, it may also result in lack of enforcement. All jurisdictions find monitoring and enforcement costly; regulations that cannot be enforced undermine legislative credibility.

Social acceptability, also known as social license, is an integral part of sustainability. Yet, it has usually become an issue for aquaculture planners only after sections of the population have demonstrated discontent through conflicts, boycott or litigation. While aquaculture can contribute to economic growth, it can also create social disruption and inequities. Jealousy, concern over resources and resentment over hiring practices may trigger social conflict, as with shrimp farming in parts of South Asia. This can be particularly acute if small elites, domestic or foreign, dominate the industry.

Policy-makers must be aware of perceptions towards aquaculture that are often negative. The repercussions for aquaculture development can be severe, as demonstrated by opposition to site licenses for salmon farming along the west coast of Canada. This kind of attitude towards aquaculture is likely to continue or even become more severe. As mentioned above, respondents to a global Delphi survey expected public opposition to aquaculture to be “very detrimental” to aquaculture development in North America to 2020 (Hishamunda, Poulain and Ridler, 2009). In the same survey, respondents from Asia and Western Europe were also concerned about “social opposition to aquaculture due to sensationalist media”.

Too often, communications have been ignored or down-played by the aquaculture industry and by governments, leaving NGOs alone to dominate the media. This can have deleterious consequences. If food safety concerns become an

issue, demand for farmed fish, which appears to be generally strong, suffers. An example was the refusal of Safeway in the United States of America to sell salmon from Chile following a report in the New York Times in March 2008 about excessive use of antibiotics.

Concerns about fish quality standards and the manner in which fish is produced reflect a matter of trust. In some instances, public mistrust of aquaculture is demonstrated by legal challenges to site allocation, by pressure put on politicians to declare moratoria on aquaculture expansion, or even by vandalism. A study of Canadian attitudes towards aquaculture, particularly salmon cage culture, illustrates how opinion can impact decision-makers (DFO Canada, 2005). In British Columbia, Canada, perceptions of focus groups were almost uniformly hostile to aquaculture, largely because of ecological concerns. The result has been such vigorous opposition to aquaculture siting that a moratorium on new sites was imposed in 1995 (Galland and McDaniels, 2008); it was only lifted in 2002. The report concluded that the public wanted reassurance about the environmental risks of cage culture, and from a credible source.

To counter public opposition, there must be more transparency and less secrecy on issues such as fish health and pollution. Information on escapees, on diseases and on any health risk must be provided to governments, who could then disseminate it to the public. There should also be pro-active media communication strategies. Countering public opposition could also be achieved by informing the public with campaigns about all aspects of aquaculture, ensuring that sound information is available from credible sources and using the Internet for two-way information sessions. Widespread participation in aquaculture planning also induces trust in the industry (Mazur and Curtis, 2008).

## **Emerging issues in aquaculture governance**

### ***Endogenous factors***

Aquaculture governance is likely to become ever more important in the future if the sector is to remain sustainable. This is because all four factors of sustainability – economic, environmental, social and technical – will face challenges. Some of the likely challenges that are intrinsic to the industry as it grows include the emergence of oligopolies in the production of certain species, the dominance of individual monopsonists in local communities, reconciling competing claims to water and land, the need to manage aquaculture within a deteriorating ecosystem, vocal opposition from well-funded NGOs and funding of local research.

Industrial concentration is an endogenous issue that is emerging for farmed species which are global commodities and whose production is capital-intensive and therefore susceptible to economies of scale. An example is farmed salmon, where consolidation has occurred through bankruptcies and mergers. In 1996, about 114 farms produced 80 percent of the world supply of farmed salmonids.

By 2006, the number of farms producing 80 percent of the world supply had fallen to 46 (Marine Harvest, 2008).

The concentration ratio (the proportion of the four largest farms in total national production of farmed Atlantic salmon) in Canada in 2006 was 92.3 percent; three farms alone produced 90 percent of output (Marine Harvest, 2008). This concentration ratio is higher even than in the United Kingdom (88.6 percent) and appreciably higher than in Norway (47.4 percent) and Chile (44.2 percent). In Canada, two firms, Marine Harvest and Mainstream, dominate production on the west coast, with Marine Harvest alone accounting for about half the production.

With concentration has come foreign ownership. Globally, two transnational companies, both based in Norway, dominate salmonid aquaculture. The most important is Marine Harvest. It has operations in Norway, Chile, Scotland, Canada, Ireland and Denmark (the Faroe Islands); in all these countries, it is the single largest producer. It produced about 380 000 tonnes of salmonids in 2006, of which 358 800 tonnes were Atlantic salmon (more than one-quarter of world output). It is a major fish processor, with European plants in Belgium, Spain, France and the Netherlands. The second major transnational company is Mainstream, whose holding company is Cermaq. The principal shareholder is the Norwegian Government, with 43.5 percent of the capital. It is the third-largest producer in Chile and the second-largest in Canada's British Columbia. The Cermaq group includes the world's largest feed manufacturer.

Diversifying geographically to different countries, as Marine Harvest and Mainstream have done, is a rational strategy for farms. Diversification reduces disease risk and economic risks due to exchange rate volatility (Ridler *et al.*, 2007). However, there are dangers to communities reliant on a single employer, particularly one which is foreign. If there is a negative shock to the market, a dominant company can demand environmental or wage concessions. If foreign, the company may have little commitment to the community if unsatisfied. How responsible the company feels to its employees (stakeholders) as well as its owners (shareholders) depends on its commitment to social responsibility and corporate governance, but the danger of regulatory abandonment exists. As concentration in aquaculture continues and even accelerates, this issue will also be one for aquaculture governance in general.

Currently, most aquaculture operations occur in areas under the sovereignty or national jurisdiction of the coastal state (internal waters, archipelagic waters, territorial sea, contiguous zone, exclusive economic zone (EEZ) and the continental shelf). Although they might be weak and their enforcement imperfect, legislative and regulatory frameworks that govern aquaculture in these waters exist in most aquaculture-producing countries.



With the growing scarcity of land available for fish farming in most countries around the world and the escalating shortage of freshwater, the majority of aquaculture expansion in the coming decades is likely to occur in seas and oceans. With improved technology, sophisticated culture systems will induce a movement away from inshore to deeper offshore waters. These waters could be within the EEZ of countries, or even further, beyond the 200 mile belt of national jurisdiction. In 2009, Marine Harvest announced plans for four new offshore sites in the United Kingdom, each farm producing 20 000 tonnes of salmon.

As aquaculture expands offshore, the problem of farming in an environmentally and socially responsible manner will become more challenging. Governance will be of a critical importance in ensuring that any expansion of the industry occurs on socially responsible principles. For example, when sites are located some hours from shore, workers may be paid only when they arrive on site rather than from the time they depart. This issue has arisen in Chile. In order that offshore aquaculture can be sustainable, administrative and regulatory frameworks will have to be developed, even for aquaculture within the EEZ (USDC, 2008).

Aquaculture will compete with other activities, particularly those related to the utilization of living and mineral resources, and to navigation and communication. Thus, one of the biggest challenges facing policy-makers is to establish international policy, institutional, legal and regulatory regimes for use to govern aquaculture operations that occur in waters that are beyond national jurisdiction. There is no clear regulation of mariculture on the high seas, which suggests that if mariculture extends from a state's EEZ to the high seas (or even beyond the territorial sea in the case of the Mediterranean), there will be a regulatory vacuum. The challenge will also be to have these regimes address the shortcomings commonly found in the national schemes.

### ***Exogenous factors***

In addition to factors that are inherent and/or endogenous to aquaculture, there will be exogenous shocks. Because of environmental repercussions and trade, aquaculture is a sector that is vulnerable to wider global and regional shocks. Hence, aquaculture governance cannot be divorced from international and inter-regional influences. Among these shocks are the growing role of the retail sector in dictating standards, the public's increasing interest in food safety and the environment, climate change and the spread of animal diseases, and financial imbalances resulting from the global recession. The latter could threaten public funding of aquaculture research and limit the ability of producers to access credit from financial institutions.

The issue of the role of the retail sector in dictating standards and the public's increasing interest in food safety and the environment impact on trade. Domestic and international trade are globalizing hygiene and traceability standards, obliging governance of aquaculture to adapt. Globalization of food chains,

expansion of supermarkets' standards and the World Trade Organization (WTO) require increased traceability, ecological sustainability, and health and safety certification. Domestic consumers are also more demanding. There is growing legal pressure on companies to demonstrate due diligence in food risks, and a certain sense of corporate social responsibility. Carrefour, for example, sends inspectors on a regular basis to producers and processors to ensure that they satisfy its 85 page manual (Phyne, Apostle & Horgaard, 2006). The gatekeeper for checking quality can be a certifying body or perhaps a supermarket chain, rather than a competent authority overseeing international trade. However, the effect is similar, because it obliges producers to ensure traceability and meet consumer demands for environmentally responsible production (Ababouch, 2008).

There is a danger that private certification schemes could duplicate government standards, adding compliance costs to farmers, particularly small-scale farmers. Consumer concerns about human and animal health, safety and environmental sustainability drive changing and more demanding standards; NGOs compound them. They have already obliged retailers in some importing countries to demand standards through the supply chain. Certification raises concerns about protectionism and whether private certification complies with the WTO's Agreement on Sanitary and Phytosanitary Measures. Aquaculture in developing countries is particularly vulnerable. Compliance for developing countries can be very difficult, jeopardizing their export opportunities (Bagumire, *et al.*, 2009).

As the FAO "Technical Consultation on the Guidelines on Aquaculture Certification", which was organized in Rome in February 2010, demonstrated, FAO Members show an increasing interest in the certification of aquaculture systems, practices, processes and products, and are striving to improve responses to these concerns, assure consumers and secure better market access. However, certification will remain an issue for some years ahead. In this context, the role of value chains and the cluster-based approach to development and adoption of BMPs by smallholder producers is particularly relevant.

A future global shock to aquaculture governance could come from climate change and weather uncertainty (FAO, 2008b). Some effects may be beneficial. Growing periods could shorten, with improved growth rates and feed conversion rates. However, many effects will be negative, particularly as most aquaculture is in tropical and subtropical Asia. There could be increased virulence of pathogens and animal diseases, reduced ecosystem productivity in warmer waters and adverse impacts on livelihoods (Soto and Brugere, 2008). Sea-level rise would damage onshore facilities and cause salt-water intrusion, while extreme weather conditions cause destruction of cages, with escapees, possibly leading to loss of biodiversity. Good governance is essential to facilitate strategies designed to adapt to and/or mitigate the effects of climate change in aquaculture.

At the regional level, climate change and extreme weather could reinforce regional institutions and structures (FAO, 2008a). There may be regional co-operation in areas such as the gathering of common data and the sharing of best practices, as well as in the control of fish diseases and the introduction of exotic species. Climate change, therefore could reinforce regional governance of certain issues in aquaculture. Increased supply volatility and the need to reduce carbon footprints could oblige individual producers to review supply chains and distribution outlets, which would encourage more local trade, perhaps at the cost of global trade in commodity species such as salmon; for example, the transport of 1 kg of salmon 7 000 km from Chile generates 8.2 kg of CO<sub>2</sub> (Valenzuela, 2009).

### ***The way forward***

Aquaculture governance remains an issue in many countries where there are still conflicts over marine sites and preventable disease outbreaks. In addition, in certain countries, there is still widespread public mistrust of aquaculture, particularly marine cage culture; another indication of poor governance. The lack of development of aquaculture in certain jurisdictions, in spite of favourable demand and supply conditions, may also be a reflection of poor governance.

While several countries have made commendable efforts to set up policies, administrative, legal and regulatory frameworks to properly manage aquaculture, there is evidence that such efforts could be particularly hampered by the lack of financial and skilled human capacity to establish, enable, monitor and enforce regulations. Policies and regulations may be enacted, but unless there are sufficient government personnel with adequate skills and financial resources to monitor and enforce them, they will remain ineffective. The lack of resources for monitoring and enforcement may be as critical as the absence of laws or regulations. This issue needs to be tackled if aquaculture governance is to improve.

There is also a need to continue empowering local communities in aquaculture governance and to improve collaborative management. In many places, dialogue between the public and the production sectors is poor, and when it occurs, it is often biased towards big businesses at the expense of small-scale farmers and the rest of the community. It is therefore important to improve dialogue among farmers themselves, especially the resource-poor small-scale farmers, and to empower them to compete in the market. Assisting farmers to organize themselves into “clusters” or farmer associations and building their capacity to better manage their farming practices has proven beneficial, particularly in the shrimp sector. This practice could be encouraged further in other sectors as well.

An important means of easing many of these concerns could be to collect and disseminate positive and negative experiences in aquaculture governance

and to elaborate and disseminate “Technical Guidelines on Aquaculture Governance”. The purpose would be to assist developing countries in setting up good governance practices based on lessons learnt elsewhere. A special focus could be placed on mariculture governance.

## Conclusions

One of the major determinants of successful aquaculture is governance, which includes not only the means of managing the industry but also the process by which decisions are made and implemented. Processes vary with traditions and values, which precludes a universal template, but there are enough common features for an overall guide.

One feature is the common goal of aquaculture governance: its sustainability. Sustainability requires profitability consistent with all risks associated with aquaculture, and environmental neutrality, so that ecological impacts are mitigated. It also entails social acceptability of the industry. To achieve this goal of sustainability, four governance principles are proposed: accountability, effectiveness and efficiency of government activities, equity and predictability.

Another common feature of successful aquaculture governance is an enabling environment. An enabling environment implies the rule of law and the secure right of property. Contracts must be enforceable, theft and corruption must be punished, and farmers must be convinced that all outputs resulting from their efforts and expenditures will accrue to them rather than be siphoned off. An enabling environment also needs economic and social stability. Uncertainty is an anathema to investors, so governments must reduce risks and transaction costs where possible. Exchange rate stability, low inflation, a minimum of regulation and lack of violence are fundamental.

Strategies to increase predictability, such as zoning and ICZM, also reduce risk and transaction costs. Participation appears to be effective, particularly if the producers are included. Self-regulation by the industry empowers producers to pressure those who are reluctant to comply, thus encouraging wider compliance and reducing costs of enforcement. Wider participation by the public is also useful for zoning and ICZM strategies because interests are then explicit early in the spatial planning process. This obviates conflicts during siting decisions.

Governance will become increasingly important as aquaculture expands in an environment of deteriorating ecosystems, vocal and well-funded NGOs, climate change, consumer concerns over food safety and the environment, and internationalization of regulations due to import requirements. The industry will become more concentrated for those species which are global commodities, with oligopolistic, even monopolistic structures. This may create resentment, particularly if the dominant firms are foreign-owned. Trust in the industry will

be critical to maintain social licence, which will oblige governments and the aquaculture industry to increase transparency and to improve communications.

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