AQUA-CULTURE REGULATORY FRAMEWORKS

Trends and initiatives in national aquaculture legislation

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CONTENTS

Executive Summary

Aquaculture as source for food and income for countries is developing rapidly, especially in developing countries. Management of a sector that has major implications for the aquatic ecosystem, environment and general aquatic health, must be based on a sound regulatory framework that is managed by stable institutional set-ups. There are many considerations that must be taken into account. Public sector institutions play a particularly important role in this regard, which should carefully map out the objectives and goals of a national aquaculture sector. The institutional foundations and the basic legal rules should support and protect aquaculture farmers, encourage investments in the country, ensure that the production sustains regional and international standards for export and consumption, and in general protect the environment. This paper seeks to generally present the most important issues to take into consideration when developing a national aquaculture regulatory framework. In addition, the latest trends and developments in aquaculture legislation during the past twenty years are presented, as well the most common challenges.

Introduction

The ability to develop sustainable aquaculture operations depends on the establishment of a number of necessary institutional and technical preconditions. Public sector institutions play an important role in each stage of an aquaculture project development. Several issues must be addressed in order to gain the full potential of any aquaculture operation that takes place while minimizing the risks and impacts. The basis for a sustainable aquaculture operation is careful planning, zoning and prioritization of sites among the different potential users. Conflicts with other users and other economic activities (e.g. fisheries, agriculture, forestry, tourism, and subsistence users) can be costly and result in the failure of the investment as well as the irreversible damage to ecologically and economically critical resources.

Another key factor is the clear identification of national policies and procedures. Governments should establish clear policies and procedures before the development of the industry explodes. Such policies and procedures do not have to be exhaustive, but they should address the most common issues and impacts that aquaculture activities involve. This means that the procedure for obtaining permits, licenses, concessions, land titles and approvals for projects should be clear and transparent. This is one way to insure that proponents are in compliance with the appropriate procedures and that government officials have clear guidance about how to proceed with approvals.

To ensure the rights of aquaculture farmers and to protect the interests of the state, a sound legal framework should be implemented. This framework should include minimum requirements for the procedures and institutional set-up mentioned above. Other possible methods for regulating aquaculture activities include bans, restrictions, land-use classification and zoning, environmental impact assessment, mitigation plans, permits, user fees, performance bonds, and monitoring requirements. Specific methods applied widely to regulating aquaculture include environmental impact assessments, effluent discharge permits, limitations on the use of non-native species, restrictions on drug and chemical uses, standards for feed composition, restrictions on feed use, and other management practices.

Evolution of aquaculture regulatory framework

Countries where a degree of aquaculture development has taken place have built up a legal framework which allows for control of the access to and operation of aquaculture activities. The legal framework also sets the institutional framework and orientations for the management of aquaculture activity, including formalities related to certain procedures.

Aquaculture is directly affected by other sectoral laws such as the land law, including the use of public domains as mangrove areas, the water law, environmental law, animal health and animal disease law, fisheries law, and trade law. Many of the issues and concerns involved are not unique to aquaculture and may be regulated under a more general legislative regime. In addition, many of the laws and regulations in place may not even apply directly to aquaculture and are thus often applied to the sector in an inconsistent manner. Conflicts may arise within the range of legislation applicable to aquaculture or among the agencies and institutes involved.

Numerous countries have enacted specific rules relating to aquaculture under aquaculture-specific legislative text,[1] basic fisheries law,[2] water law,[3] or another piece of legislation.[4] These laws tend to set up some principles on aquaculture and then invest the legitimate authority with the power to regulate aquaculture.

It has especially become common to regulate capture fisheries and aquaculture in the same piece of legislation, even though aquaculture as an activity is closer to agriculture than capture fisheries. In countries where the aquaculture sector is being developed governments find it useful to have the same authority enforce and control both sectors. However, the two should be separated both legally and institutionally. From a legal point of view, an existing fisheries legislation often does not form an adequate basis for regulating aquaculture.

Changing a law is often a bigger process than developing and adopting a new one. There are many concerns that must be taken into account for aquaculture that is not naturally provided for in fisheries legislation such as quality of feeds, disease management and control, use of drugs and chemicals, management of temperature and water quality. The best and soundest regulation of aquaculture is therefore done through individual legislation.

Many of the recently adopted fisheries laws deal with certain aspects of aquaculture. In some cases, the fisheries and aquaculture sectors are even mentioned side by side, indicating that the legislature attaches a similar importance to both sectors.[5] Examples include Madagascar's Fisheries and Aquaculture Ordinance of 1993, Burkina Faso's Forestry Code of 1997, Malawi's Fisheries Act of 1997, Zambia's Fisheries Act 2011 and Chad's Forestry, Fauna and Aquatic Resources Act 2008.

The expansion of the aquaculture industry has caused significant environmental damage, and governments are increasingly recognizing that uncertain and inappropriate legislative arrangements are seriously hindering the sustainable development of the sector. Aquaculture laws and regulations have developed some commonality in terms of approach and the required minimum elements for their sound management. This is being driven by a variety of factors, including: greater political attention as the economic importance and potential of

[1] Australia, Fisheries Management (General) Regulation (1995); Mozambique, Decree No 35/2001 - General Aquaculture Regulation (2001); Norway, The Aquaculture Act 1985 (2003).
[2] China, Fisheries Law of the People's Republic of China (1986); Philippines, the Philippine Fisheries Code Act (1998).
[3] Portugal, Decree-Law No. 74/90, (1990).
[4] Brazil, Act No.8.17 (1991); Brazil, Order No. N-1 (1977).
[5] FAO. 2004. *Trends in National Acquaculture Legislation – Part II*. FAO Aquacultue Newsletter No. 31. Rome.

aquaculture become more apparent; greater awareness that inappropriate laws and institutional arrangements can significantly constrain the development of the sector; evidence of environmental damage and social disruption as a result of the rapid and largely unregulated expansion of aquaculture activities; and a growing emphasis on improving the quality and safety of aquaculture products in international trade.[6] The following analysis highlights the most significant trends and initiatives in national aquaculture legislation in recent years, and the most common elements found in aquaculture legislation.

The need to develop policies and a legal framework for aquaculture is now widely recognized.[7] Governments need to develop legal and institutional instruments to: (a) recognize aquaculture as a distinct agricultural sector; (b) integrate aquaculture concerns into resource use and development planning; (c) improve food safety and quality to safeguard consumers and meet the standards of importers; and (d) improve the management of aquaculture, particularly where it has the potential to be socially or environmentally unsustainable.

It is recognized that issues such as registration and access, planning and management, and the many environmental impacts of aquaculture should be dealt with in a consistent manner in order to protect the industry, the environment, other resource users, and consumers. The need to incorporate these aspects into new legal frameworks has been recognized by countries that have become farmed-shrimp producers, such as the Philippines. The Philippines Fisheries Code of 1998 provides for the development, management and conservation of fisheries and aquatic resources, and includes a range of issues such as the use of public lands, leasing of fishponds, the establishment of an aquaculture Code of Practice, incentives and disincentives for sustainable aquaculture practices, and the establishment of an Aquaculture Investment Fund.

Establishing an institutional framework

The most important role for national governments is to plan and administer expansion of aquaculture in a sustainable manner. It is the exclusive role of the government to set the national agenda for aquaculture development, including the necessary administrative, regulatory, and enforcement mechanisms for its realization. Comprehensive public-sector development and planning for aquacultural policy has become more prevalent. Governments wanting to foster sustainability should develop clear and achievable policies for aquacultural development, based on financial, social, and environmental sustainability. Moreover, these sustainability-based policies should be elaborated using dialogue among national agencies, non-governmental organizations (NGOs), the private sector, and international organizations.

The need for states to establish, maintain, and develop an appropriate legal and administrative framework for the development of aquaculture as stated in Article 9.1.1 of the FAO 1995 Code of Conduct for Responsible Fisheries (CCRF) carries with it a range of institutional responsibilities. Legislation is only as good as its implementation and

[6] FAO. 1997. *Development of Regulatory Frameworks*. *In* Review of the State of World Aquaculture. FAO Fisheries Circular No.886, Rev. 1. Rome.

[7] For example, in India, the Guidelines for Sustainable Development and Management of Brackish Water Aquaculture of 1995 recognize the need for measures for sustainable aquaculture development and the need to reduce or eliminate the environmental impacts of the industry. The guidelines refer to experiences in other countries where intensive shrimp farming has led to environmental degradation and subsequent threats to the long-term sustainability of the industry. Similarly, a Code of Practice for aquaculture under the Philippines' Fisheries Code of 1998, will outline principles and guidelines to promote the sustainable development of the industry. Similar statements on the concept of sustainable development can be found in other recent laws, such as the 2001 Peruvian aquaculture law, and in recent government policies and programmes, such as Mexico's Programa de Pesca y Acuacultura of 1995-2000, and Viet Nam's Aquaculture Development Programme for 1999-2010.

enforcement, and neglect of these matters could be fatal to the realization of the policy objectives which regulation seeks to secure. The nature of aquaculture is such that a range of overall supervisory functions need to be exercised by governments over the general policy and functioning of the industry.[8]

Issues of national concern, such as the formulation of a comprehensive national policy, need to be the responsibility of the central government to secure a coherent overall direction for the aquaculture industry. Likewise, the enactment of appropriate laws to govern aquaculture must rest with the government and the central legislative body. However, this does not preclude the enactment of implementing regulations at national, regional, and local levels. The general pattern for the distribution of administrative responsibilities involves the allocation of overall responsibility for aquaculture policy and legislation to the central government. However, in federal states, this responsibility is delegated to different degrees among local bodies, each one of which is responsible for technical and local concerns.

The most common problem in the administration of aquaculture policy is administrative overlap and interference. Efforts are duplicated and conflicts are frequent between government departments, as well as between different levels of government.

Legal requirements for developing industrial aquaculture

The aquaculture legal framework must provide the operator with a secure right to conduct aquaculture operations on the property where the fish farm will be located, and to water of good quality. It must also establish control over the industry through an authorization or license system, to control and plan the competing uses of resources such as land and water. Licenses also ensure the environmental sustainability of aquaculture by examining the suitability of proposed fish farm locations, and the potential environmental effects of their operations.

Licensing system

The first step in controlling aquaculture activities is to require an operator to obtain an authorization or a license before undertaking aquaculture activities. The title of the document is not important; whether it is called an authorization, permit, or license, the term employed will depend on its common usage or practices within an individual country. For instance, the Ukrainian legislature when adopting the 2012 Law on Aquaculture was reluctant to use the word license as it would be contrary to the existing Law on Licenses.

However, it is important for the document to perform two basic functions. First, the permit must provide the government authorities with the legal basis to control all aquaculture operations, and to supervise their environmental impacts. This enables the government to assess the environmental sustainability of the proposal, and to impose conditions that require that the farm be operated in a sustainable way. Secondly, the permit should also provide farmers with a clear right to operate the aquaculture facility, as long as the operator complies with the terms of the permit, the relevant environmental laws, and any applicable codes of aquaculture practice.

[8] FAO. 2001. *Legislation Governing Shrimp Aquaculture: Legal Issues, National Experiences and Options*. FAO Legal Paper Online No. 18. Rome.

The permit can be an unconditional requirement for the establishment of an aquaculture farm, or it can impose conditions for environmental or other purposes.[9] Permit systems may be universal, or can to farms of certain sizes only. There can also be a fee connected to the license. “Development licensing” is a convenient general term to identify any system of public land use control that requires the owner of land to secure specific authorization for the development or change in use of land for particular purposes.[10] This implies that unauthorized development of private or public land without the necessary permission will result in the imposition of a sanction.

Countries that employ a regulated licensing system include Canada, Norway, Australia, Cambodia, Gabon, Madagascar, Zambia, and the Democratic People’s Republic of Korea.

Access to land

The acquisition of land for aquaculture activities depends on the general system of land ownership and land holding in each national jurisdiction. Here there is a contrast between those countries that allow private ownership of land and those that subject the land ownership to state control. A key issue is the extent to which the acquisition of land rights for aquaculture imposes environmental and social requirements upon the land holder.

The farmer must obtain a secure legal right to the lands on which the farm is located. In the case of freshwater aquaculture, this is most often not a major problem, as land laws typically allow farmers to obtain ownership interests. However, when the land is owned by the state, located in coastal zones, or held under a traditional tenure system, special considerations may apply.

In certain countries where land rights are subject to complete state control, there is an additional question as to whether rights should be granted for use of the body of water body sub – and adjacent to it. These countries, often located in the Central Asian and Caucasus regions, refer to the leasing of land in their legislation, instead of a license to an aquaculture establishment.

Fish farming can sometimes create a problem of competition with other farming activities for the use of resources. Fish farming requires land, water, labor, time, and nutrient inputs. Therefore, it has to be integrated into the existing farming system. The integration of different farm activities can increase the efficiency of the overall farm and thereby increase the chances for adoption.

Integration can also involve activities that complement each other, and guarantee a more efficient use of resources. Improving efficient use of those resources that limit overall farm production offers the best chances for success. For example, the amount of available water may limit increased production, and improving the efficiency of water use can increase total farm output. Integration of aquaculture and agriculture aims to increase overall production through the improvement of water use, labor, and the diversification of farm production.

In conclusion, resource-use efficiency may be achieved through integration of agriculture with other uses such as aquaculture and inland fisheries. Increasing the awareness of agricultural policy makers and planners about opportunities for and economic benefits of such integration

[9] Article 9.1.5 of the *Code of Conduct for Responsible Fisheries* notes that “[s]tates should establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic and social consequences resulting from water extraction, land use, discharge of effluents, use of drugs and chemicals, and other aquaculture activities.”

[10] FAO. 2001. FAO. 2001. *Legislation Governing Shrimp Aquaculture: Legal Issues, National Experiences and Options*. FAO Legal Paper Online No. 18. Rome.

would help it become a reality. The motivation for such integration will probably increase with increasing pressure on resources. There is also a need to encourage and support research that develops new forms of integrated aquaculture-agriculture systems, and other innovative systems that can effectively respond to resource and environmental challenges[11].

Access to water resources

Although the supply of an adequate quantity of water, of sufficient quality, is essential for any aquaculture installation, meeting this need can also lead to conflicts with other water users who seek to use the same water for other purposes such as agriculture, fishing, industry, recreational activities, or drinking water supply purposes. Because of this competition, there can be major problems of access to water for fish farming, and in developed countries, access to the seashore can be a big issue. Water rights may be granted subject to various conditions including a limitation on the amount of water which may be withdrawn under a particular license. The general tendency is for states to control water use through concessions or environmental licences.

Environmental management in aquaculture

Uncontrolled and unregulated aquacultural development can pollute the environment, disrupt rural communities, and encourage overuse of natural resources. The goal of environmental management is to minimize, prevent, or mitigate adverse environmental effects of human activities to permit more sustainable uses of resources through better practices. The following conditions can be helpful to determine whether environmental management is effective: (1) the possible adverse environmental impacts of human activities must be identified; (2) standards must be formulated to specify changes in variables that are permissible without causing unacceptable environmental effects; and (3) technology-based management practices must be available to prevent excessive changes in environmental variables.

Government and the private sector traditionally share the responsibility of ensuring environmental quality. Government is responsible for establishing standards for environmental management, and adopting regulations and laws to enforce compliance with these standards. The private sector is responsible for the cost of evaluations to determine possible ecological impacts, but governments must provide guidelines and approve the conclusions and recommendations of such evaluations.

As aquaculture activities develop, environmental aspects become of an increasing concern. Management deficiencies or accidents at aquaculture facilities can have significant negative impacts. Potential effects of aquaculture activities include lower water quality, negative impacts on the ecosystem, and reductions in other economic activities.[12] Environmental concerns form part of licensing procedures, from the potential environmental impacts of establishing an aquaculture activity to the impacts that arise through the actual operation of an aquaculture farm.

[11] Csavas, I. 1993. *Aquaculture development and environmental issues in the developing countries of Asia*, p. 74-101. *In* R.S.V. Pullin, H. Rosenthal and J.L. Maclean (eds.) Environment and aquaculture in developing countries. ICLARM Conf. Proc. 31.

[12] Dominguez, L. Molina & J.M. Vergara Martin. 2004. *Aquaculture environmental impact assessment.*p. 321-33. *In:* V. Popov, H. Itoh, C.A Brebbia & S. Kungolos (eds.) Waste Management and the Environment II. International Conference on Waste Management and the Environment, No.2. Rhodes, Greece.

Therefore, proposed legislation should subject proposals to an environmental impact assessment when the operation threatens serious environmental harm.

An approach that is getting increasing attention in aquaculture management is the Ecosystem approach to aquaculture (EAA).[13] The purpose of the EAA is to promote the sustainable development of interlinked ecosystems and manage the aquaculture sector in a way that does not jeopardize the wider ecosystem.[14] Environmental considerations are very important to achieving these goals.

The ecosystem approach should primarily be mentioned in a country's policy framework. Legislation under the ecosystem approach can be done in several ways, and is often done through a series of provisions. The EAA can be seen more generally as an overriding principle, and thus be placed in the introductory articles of an aquaculture act. Legislation under the EAA also includes provisions that strengthen institutions and associated management systems.[15]

Site selection and Environmental Impact Assessment (EIA)

One of the most common reasons for the failure of fish farms or for adverse environmental impacts is the location of farms on inferior or marginal sites.[16] Therefore, a comprehensive site evaluation should be conducted to determine if site characteristics are suitable for the construction and sustainable operation of a farm. These evaluations should determine the availability and quality of water, climatic conditions, freshwater flow, and other related factors. The information obtained should also be included in a thorough environmental impact assessment (EIA).

Submission of an EIA is usually a precondition for the issuance of a general aquaculture license. The EIA addresses various factors such as the proposed size of the aquaculture farm, and the sensitivity of the area involved. Because the location of an aquaculture farm at an undesirable site can be disastrous, the suitability of the site is one matter that should be specifically considered by the administration prior to the grant of a permit. This decision on a permit application also allows government agencies to integrate the siting of aquaculture farms with plans for the management of coastal zones and lakeshores. [17] In some cases, the planned location of a proposed aquaculture operation should be examined along with the other environmental effects of the proposal. It is therefore important to determine when an EIA is required.

When the application for a permit is received, an initial decision must be taken as to whether the project will be subject to an EIA.[18] The legislation should propose explicit criteria for

[13] FAO. 2010. *Aquaculture Development: Ecosystem approach to aquaculture*. *In* FAO Technical Guidelines for Responsible Fisheries No. 5 Supp. 4. Rome. The Ecosystem approach to aquaculture is defined by FAO as "a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and resilience of interlinked social-ecological systems".
[14] FAO. 2007. *Building an Ecosystem approach to aquaculture*. FAO Aquaculture and Fisheries Proceedings 14. Palma de Mallorca, Spain.
[15] FAO. 2010. *Aquaculture Development: Ecosystem approach to aquaculture*. *In* FAO Technical Guidelines for Responsible Fisheries No. 5 Supp. 4. Rome.
[16] Boyd, C.E. & J.W. Clay. 1998. *Shrimp aquaculture and the environment.* p. 58-65. *Scientific American* No.278 (June).
[17] New, M. 1999. National Aquaculture Policies, with special reference to Namibia. p. 303-318. Svennevig et al. (eds.) *Legislation for Sustainable Commercial Aquaculture.* Balkema, Rotterdam.
18 Environmental laws in developing countries also increasingly subject aquaculture activities to an EIA. The 1994 National Environment Act of the Gambia and the 1994 Environment Protection Act of the Seychelles both contain detailed regulations requiring an EIA before initiating aquaculture projects in sensitive areas. Likewise, the 1997 Environment Protection Act of Mozambique requires an environmental license and mandatory EIA for marine and fresh water aquaculture projects.

determining whether an assessment is required for a proposed aquaculture project. Because an EIA can impose great expense on the applicant, it should be required only for those projects that create a genuine risk of environmental damage.

The criteria for determining whether this risk exists should focus on factors such as the size of the proposed project, the maximum carrying capacity of the site, possible discharge of waste into sensitive areas, protecting exotic species or products from modern technology or genetically modified organisms, and whether the project threatens rare or endangered species.

When an EIA is required, the regulator's decision to grant a permit, and the conditions of the permit itself, should reflect the results of the assessment. When an EIAis not required, the regulator should grant permits based on explicitly stated principles. In order to draft good aquaculture legislation, "it is essential that particular decisions about the granting or withholding of development are made against a background of explicit policy principles."[19]

Effluent regulation

A major concern arising from the operation of aquaculture farms lies in their capacity to produce large amounts of waste products which, if not properly managed, are capable of having serious detrimental effects upon the environment.[20] Waste products can impact the receiving aquatic environment, and pose a hazard to human health.

There are two distinct regulatory approaches to the control of unsatisfactory effluent from fish farms. The first is the imposition of a discharge licensing scheme which sets maximum quantities of contaminants that may be present in waste water from fish farms, with an associated sanction when these quantities are exceeded. The second approach involves the prohibition or restriction of use of particular drugs and chemicals which are known to have a damaging effect upon the quality of receiving waters and ecosystems.

Discharge licensing systems that include water quality and/or water volume criteria require regular monitoring at specified intervals to demonstrate compliance. This kind of discharge licensing is suitable for large operations with one or more effluent outfalls. The most effective system appears to use general discharge permits that require farmers to implement a set of specified operational Best Management Practices (BMPs), with minimal basic monitoring requirements.

Drug and chemical use control

The overuse and misuse of chemicals in the aquaculture industry causes pollution and contamination of the aquatic environment. This is especially problematic when the expanding aquaculture industry adopts chemicals originally developed for use in other sectors, most notably the agricultural sector. In addition, aquaculture farms are extremely vulnerable to poor water quality, and the improper use of chemicals can negatively affect the quality of the aquaculture products and subsequently harm human health.

Chemical contamination is controlled through legislation in three ways. The first way directly prohibits or restricts the use of specific chemicals that are harmful to the environment. The use, import, distribution, or sale of these hazardous chemicals can be made a criminal

[19] Howarth, W. 1999. *Legislation for Sustainable Commercial Aquaculture: A Legal Perspective on the Holmenkollen Guidelines*. p. 319-334. *In* Svennevig et al. (eds.) Legislation for Sustainable Commercial Aquaculture. Balkema, Rotterdam.

[20] Accordingly, Article 9.4.6 of the Code of Conduct for Responsible Fisheries emphasizes that "[s]tates should require that the disposal of wastes such as offal, sludge, dead or diseased fish, excess veterinary drugs and other hazardous chemical inputs does not constitute a hazard to human health and the environment" when planning for aquaculture development .

offence, while less dangerous chemicals can be subject to authorization schemes and licensing requirements. Generally, this type of legislation is not formulated exclusively in relation to aquaculture farming, but is found in basic environmental laws or more specific acts related to the use of chemicals. In some countries, such as China, Thailand, and Viet Nam,[21] legislation that singles out chemicals that can be used in aquaculture has been adopted, including rules on how these chemicals must be used.

The second way to control chemical contamination is to develop a wastewater discharge licensing system. Licences are most likely to be regulated under general environmental or water legislation.

A third way to regulate the use of chemicals is to directly ban the use of certain drugs, chemicals, and hormones that can negatively affect the physiological functions and well-being of the fish. Drugs, chemicals, and hormones are sometimes seen as compensation for malfunctioning aquaculture establishments or a general lack of well-being. In Norway, the legislature addressed the issue by banning the use of chemicals used to compensate for poorly functioning aquaculture systems. [22]

The Code of Conduct for Responsible Fisheries also recognizes the problem of chemical misuse in aquaculture. Article 9.4.4 provides that states should promote effective farm and fish health management practices favoring hygienic measures and vaccines.[23] States should also ensure the safe, effective, and minimal use of therapeutants, hormones, drugs, antibiotics, and other disease control chemicals, and should regulate the use of chemical inputs in aquaculture which are hazardous to human health and the environment.[24] Almost all countries recognize the potential hazards associated with chemical misuse in aquaculture activities. However in most cases legislation is not formulated exclusively in relation to aquaculture activities.

Waste and waste management

As in other food industries, the aquaculture industry can produce waste in different forms. This waste may have a detrimental effect on the processing environment and should be limited as much as possible. Countries should have systems for waste disposal and storage, and should preferably regulate these activities through legislation. Many countries have adopted national legislation that deals with waste disposal. For example, Chile requires aquaculture farms to adopt measures to prevent the dumping of solid or liquid waste and residue that could harm the surrounding environment.[25]

The Zambia Fisheries Act allows the government to attach conditions to an aquaculture license to minimize the disposal of dead fish, the escape of waste products, and the pollution of the water in and around the aquaculture facility.[26]

The Namibia Aquaculture Act bans the discharge of waste that may have harmful or detrimental effects on human health and the environment. Furthermore, it states that waste should be disposed of in accordance with the terms and conditions of the aquaculture license.[27]

[21] China, Provisions on the supervision over and administration of the quality safety of agricultural products intended for export (2006); Thailand, Code of Conduct for Shrimp Aquaculture (1985); Viet Nam, Joint Circular No. 27/2003/TTLT/BQP-BTS (2003).
[22] Norway, Aquaculture Regulation, §36 (2008)
[23] FAO. 1995. The Code of Conduct for Responsible Fisheries, Article 9.4.4. Rome.
[24] FAO. 1995. The Code of Conduct for Responsible Fisheries, Article 9.4.5. Rome.
[25] Chile, Environmental Regulation No. 320, Article 4 (2001).
[26] Zambia, Fisheries Act Article 43 (2011).
[27] Namibia, Aquaculture Act Article 20 (2002).

Coastal aquaculture as part of integrated coastal management

The idea of integrating the aquaculture sector into coastal area management is gradually gaining ground and has now been implemented in some countries. For example, the Belize Coastal Zone Management Act of 1998[28] specifically includes aquaculture proposals that should be dealt with in Coastal Zone Management Plans.[29] In addition, the Act establishes an Advisory Council whose members include technical experts with a background in aquaculture Similarly, Chapter 1 of the Philippines' Fisheries Code of 1998 declares that it will be state policy to "manage fishery and aquatic resources, in a manner consistent with the concept of an integrated coastal area management in specific natural fishery management areas, appropriately supported by research, technical services and guidance provided by the state."

There are numerous tools to integrate aquaculture into coastal areas, such as the use of EIAs, the creation of protected areas or buffer zones, restrictions on private ownership, and the recognition of indigenous rights. One of the most important tools is zoning, whereby land and water areas are set aside for certain types of aquaculture. The Chilean Fisheries and Aquaculture Law[30] identifies particular coastal zones for aquaculture. Outside these areas, aquaculture activities are forbidden. Another example of zoning can be found in the Tasmanian Marine Farming Planning Act of 1995, which provides for the creation of Marine Farming Development Plans in areas where marine farming may occur. The plans are developed in consultation with the public and take into account the physical suitability of potential aquaculture sites, the current legal situation, and the minimization of the impact on other coastal zone users.

Escapement

The escape of fish from an aquaculture facility, also known as escapement, has become increasingly important to regulate. The reason is that escaped fish tend to genetically pollute the environment causing a genetic degradation of the species. Here, rules on veterinary control and ecological safety are particularly relevant, such as quarantine and exploitation of introduced or alien aquaculture species. These rules, when embedded in the aquaculture legislative framework, may reduce the possible effect of introduced or alien species on farmed local species, wild endemic species, and the biodiversity of natural water bodies.

Possible veterinary control and ecological safety rules include provisions that minimize the risk of escapement, or minimize damages if escapement occurs. This includes provisions on reporting and informing about incidences of escapement. Examples of countries that adopt similar legislation include Norway, Canada, and Zambia.[31]

A question that arises when fish escape is: who is the owner of that fish? If fish escape from an aquaculture farm, the owner should have the right to retrieve it. This is also important to establish so that escapement can be avoided, and preventative measures can be taken against the owner of the escaped fish.

Belize, Coastal Zone Management Act (1998)

[29] Section 6(1)(l)(i) refers to the potential inclusion of aquaculture experts in the Advisory Council, and Section 23(1)(c)(v) requires that the Coastal Zone Management Plan includes proposals relating to aquaculture.

[30] The 1989 Ley General de Pesca y Acuicultura.

[31] Zambia, Fisheries Act Article 43 (2011); Canada, Aquaculture Regulation, B.C. Reg 78/2002 (2002); Norway, Forskrift §§37-38 (2013).

The Namibia Aquaculture Act deals with ownership in the case of escapement. [32] Under the Act, specified aquaculture products are the exclusive property of licensees as long as they are contained within the boundaries of the site. If the products are released or escape, they remain the exclusive property of the licensee as long as the licensee can prove their identity. The Zambia Fisheries Act gives the possibility for secondary legislation to contain provisions on ownership.

Protection of trans-boundary aquaculture ecosystems

Also related to escapement is the regulation of trans-boundary aquatic ecosystems. These are often regulated in international or regional law, and involve cooperation with riparian countries in marine aquaculture. Aquaculture farmers should be obliged to protect trans-boundary aquatic ecosystems from environmental threats such as escapement, waste, diseases, and effluent. This depends on countries coming together and cooperating. The issue of protecting trans-boundary aquaculture ecosystems is treated in CCRF Article 9.2. Examples of countries that regulate this issue are Zambia, Uganda, and Ukraine.

Trade and health issues

National aquaculture legislation should seek to implement international standards on trade and quality control as they relate to the development and conduct of aquaculture activities. If a country is considering exporting fish products from aquaculture production to markets in the European Union (EU), a regulatory framework should be adopted that meets EU market standards. If international trade is being considered, World Trade Organization (WTO) rules, including requirements under the Sanitary and Phyto-Sanitary Agreements of WTO, have to be met.

The Code of Conduct for Responsible Fisheries, although voluntary, also contains certain agreed norms of international law, and states that have endorsed the Code should also seek to incorporate it into national law. For many developing countries, aquaculture products are a source of vital income. The Code incorporates various dimensions of international trade that helps states meet legal export requirements and secure this income. For example, the Code sets minimum standards for safety and quality throughout the industry.

Similar to the Code, the European Directive on Hazard Analysis and Critical Control Point (HACCP) sets standards for export to the European Union.[33] Internationally adopted standards include the Codex Code of Practice for Fish and Fishery Products.[34]

[32] Namibia Aquaculture Act, No. 18 (2002), Article 31.
[33] The legal basis for HACCP is provided by European Community Directive 91/493/EEC (the "Seafood Directive") and the United States Seafood HACCP Regulation. Broadly, these two measures have similar food safety implications for countries that wish to export shrimp and other fishery produce to the European Community, the United States, and other countries where the legislation applies. The European Community requirements include conditions that allow placing fishery products on the market regardless of their place of origin. 'The United States regulations require seafood producers to put in place a HACCPT plan consistent with US Seafood Regulation where an identifiable food safety hazard is reasonably likely to exist. Failure to develop and implement such a plan would classify seafood from that country as "adulterated," allowing the US Food and Drug Agency to deny entry of the product.
[34] FAO. 2005. Code of Practice for Fish and Fishery Products.

Introduction and movement of species

One of the potential serious effects of aquaculture on the environment is the introduction of exotic species into environments where they may compete with, or replace, native species. As a result, legislation and policies should include precautionary provisions on importation, quarantine, and distribution of non-indigenous species. These policies should be based on reliable information and should explicitly consider the uncertainties and negative consequences associated with the introduction of new species. Several existing codes of conduct[35] and regional guidelines[36] provide sample approaches to regulating species introductions and transfers, with particular emphasis on controlling the spread of diseases.

The movement of species may give rise to a wide range of environmental, ecological, and disease control impacts. First, the collection of aquaculture stocks from the wild for cultivation in aquaculture farms may have a detrimental impact on native stocks and ecosystems. Introduction of non-native species that can escape into the wild could result in harm to the local ecosystems through adverse genetic impacts upon native stocks, or through invasive habitat competition. The movement of species stocks between farms also risks the transmission of diseases that are capable of having devastating economic consequences for individual farms and for the aquaculture industry as a whole.[37]

Initially, species movement licensing regimes will prevent unacceptably hazardous movements and allow individual evaluation before authorization is granted. By making certain categories of movement unlawful, these regimes will prevent adverse ecological impacts and the spread of disease. Another benefit of licensing regimes is that they can impose conditions requiring all significant movements to be recorded and facilitate the communication of that information to the relevant authorities. Monitoring movements allows recently moved diseased stock to be traced to other potentially infected locations.

Food safety and health

Aquaculture products, like other food products, need to be regulated through public health laws to protect consumer health and safety. The Code of Conduct for Responsible Fisheries focuses on public health and supports states that ensure the food safety of aquaculture products and promote efforts to maintain product quality and value before and during harvesting, on-site processing, storage, and transport.[38] The Code also encourages states to adopt appropriate measures to ensure the right of consumers to safe, wholesome and unadulterated fish and fishery products.[39] Lastly, the Code encouarges states to establish and

[35] FAO. 1997. *Aquaculture Development: Ecosystem approach to aquaculture*. *In* FAO Technical Guidelines for Responsible Fisheries No. 5. Rome

[36] FAO-NACA. 2000. *Asia regional technical guidelines on health management for the responsible movement of live aquatic animals and the Beijing consensus and implementation strategy*. *In* FAO Fisheries Technical Paper 402, Rome.

[37] The Food and Agriculture Organization and the Network of Aquaculture Centres in Asia-Pacific have also produced the *Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals* (the "Technical Guidelines") and their associated implementation plan, the *Beijing Consensus and Implementation Strategy.* The Guidelines aim at assisting "countries to undertake movement of live aquatic animals in a way that minimises the disease risks associated with pathogen transfer and disease spread, both within and across boundaries. This will enhance protection of the aquatic environment as well as the interests of aquaculture and capture fisheries. It is also a mechanism to facilitate trade in aquatic species and to avoid unjustifiable trade barriers based on aquatic animal health issues" (*FAO Fisheries Technical Paper 402*, 2000).

[38] FAO. 2005. Code of Conduct for Responsible Fisheries, Article 9.4.7. Rome.

[39] FAO. 2005. Code of Conduct for Responsible Fisheries, Article 11.1.1. Rome.

maintain effective national safety and quality assurance systems to protect consumer health and prevent commercial fraud.[40]

Similarly, the HACCP has increasingly been incorporated into aquaculture legislation in many countries that import aquaculture products. The United States and many EU countries are at the forefront of such legislative developments. While exporting countries may have advanced implementation of safety assurance systems in the fish-processing sector, the application and enforcement of such systems at the aquaculture farm level is relatively new.[41]

Since January 2002, the EU has required that all fishery and aquaculture products offered for retail sale to final consumers be labelled with their country of origin and species.[42] So-called eco-labelling can create a market-based incentive for environmentally-friendly production, although it can be controversial. In this regard, the Code of Conduct provides that "[s]tates should ensure that international and domestic trade in fish and fishery products (including aquaculture products) accords with sound conservation and management practices through improving the identification of the origin of fish and fishery product treated."[43]

Mitigating investment risks

The legal framework must "reconcile the needs of the environment with the facilitation of an efficient aquaculture industry which functions in the common interest of all."[44] Environmental regulations are thus indispensable to good aquaculture laws, but if their application imposes excessive costs on the operator, aquaculture activities will not be commercially successful or sustainable in the short and long term. This danger can be avoided by legislation that ensures that the total costs of the aquaculture operation, including external and social costs, do not exceed the benefits that it produces.

In order to encourage the commercial development of the aquaculture industry, the legal system should ensure that environmental goals are met without imposing unnecessary costs on applicants. To accomplish this, countries could adopt a single window approach to the numerous approvals required for an aquaculture operation and for the initial screening of applications so that only those that present a significant environmental risk are subject to a full environmental impact assessment. Countries could also consider the creation of a single agency to promote aquaculture and monitor the progress of applications through other government departments.

[40] FAO. 2005. Code of Conduct for Responsible Fisheries, Article 11.1.2. Rome.
[41] The 1998 Sri Lanka Fishery Products (Export) Regulations implement EU requirements for aquaculture products at both the processing and farm levels. In 1999 Jamaica adopted the Aquaculture, Inland and Marine Products and By-products Act, which provides for the inspection and certification of various categories of aquaculture, inland, and marine products intended for export, and for the licensing of persons and facilities engaged in the production, harvesting, processing, handling, storage and, transport for export of such products. The Act also includes the development of a HACCP plan.
[42] European Community. Commission Regulation No. 104/2000 (2000); European Community. Commission Regulation No. 2065/2001 (2001).
[43] FAO. 2005. Code of Conduct for Responsible Fisheries, Article 11.1.11. Rome.
[44] Howarth, W. 1999. *Legislation for Sustainable Commercial Aquaculture: A Legal Perspective on the Holmenkollen Guidelines*. p. 319-334. *In* Svennevig et al. (eds.) Legislation for Sustainable Commercial Aquaculture. Balkema, Rotterdam.

Aquaculture and zoning

Increasing concern regarding the environmental impact of aquaculture has induced governments to set aside public lands for multiple uses, including for aquaculture uses.[45] As previously discussed, zoning is a useful tool to integrate aquaculture in coastal areas. Zoning controls the environment at a farm level, balances competing interests, and resolves conflicts regarding protection, use, and exploitation of coastal resources. For example, Hong Kong SAR has designated 26 Marine Fish Culture Zones and requires all marine fish culture activity to operate under a license in designated fish culture zones. [46] In Ecuador, local zoning agreements between shrimp farmers and local residents allow shrimp farming to continue alongside traditional uses.[47] Likewise in Zambia, conservation-planning areas that specify the layout of land for fish farms have been set up.[48]

One way to improve the legal and regulatory process for offshore aquaculture is to incorporate the creation of specific sites for aquaculture leases such as a Marine Aquaculture Zone (MAZ). Marine zoning faces significant challenges that its land-based counterpart does not, such as boundary disputes, enforcement difficulties, and more frequent user conflicts.

Zoning has been a useful land-based tool to set aside areas appropriate for industry development. The creation of a Marine Aquaculture Zone (MAZ) requires the designation of a national agency responsible for the management of the zone, the issuance of leases to the water column and seabed, and the issuance of permits that incorporate the concerns of other relevant national agencies.

Because the number of optimal sites is potentially limited, aquaculture zoning ensures that natural resources are accessible, increasing the likelihood of successful aquaculture activities. Zoning also eases the burden of site marking using zone perimeter buoys and individual cage lights, thereby decreasing theft, vandalism, and liability issues associated with boat-cage collisions. In addition, zoning decreases the risks associated with recreational fishers capturing reef fish attracted to the cages.

In Madagascar, financial and economic incentives have guided prospective aquaculture farmers towards the establishment of preferential trade zones, called "Régime de Zone Franche."[49] However in practice, since the early 1990s, areas for aquaculture activities have been identified and potential developers are invited to develop aquaculture activities in these areas by obtaining ‘preferential trade status’ which facilitates access to government financial and economic incentives.

Simplification of administrative procedure: Single window approach

A major feature of aquaculture legislation is the use of government authorizations to exercise control over aquaculture establishments. Authorizations can take the form of a licence, permit,

[45] For example, Albania, Australia, Bulgaria, the EU, Hong Kong SAR, Peru, and Vietnam have all utilized zoning to promote aquaculture.
[46] Hong Kong SAR, Marine Fish Culture Ordinance, Chap.353 (1997).
[47] Bodero A.Q. & D. Robadue, Jr. 1995. *Strategies for managing mangrove ecosystems*. p.43-69. *In* Robadue (ed.) Eight Years in Ecuador: the road to integrated coastal zone. Rhode Island, USA.
[48] Zambia, Fisheries (Prescribed Areas) (Declaration) Order (1986); Hishamunda, N & N. B. Ridler. 2008. *Sustainable commercial aquaculture: A survey of administrative procedures and legal frameworks.* p.167-178. *In* Aquaculture Economics & Management. London, UK.
[49] The “Regime de Zone Franche” was established by the Law No 89-027 of December 29, 1989, amended by the Law No 91-020 of August 12, 1991 governing the Industrial Free Trade Zone in Madagascar.

concession, or lease and are commonly subject to certain conditions. They constitute a good basis for governments to regulate the limited natural resources available and allow governments to integrate the siting of aquaculture farms within their integrated coastal management plans.

The authorization process can be a complicated affair for the aquaculturist, since the approval and operation of an aquaculture project involves a variety of laws and agencies. This is particularly the case when access to public land and water is involved. Not only are fishery and aquaculture authorities implicated, but also land use planning institutions, water institutes, health agencies, and environmental protection authorities. Usually a number of documents are needed before an applicant may establish or operate an aquaculture farm, such as land concessions, water licences, effluent discharge permits and other types of environmental licences. The challenge in aquaculture law now is to remove existing legal and bureaucratic obstacles and to increase the cost-effectiveness of aquaculture operations. The trend is toward the unification of licensing requirements and the streamlining of approval procedures through the creation of a single or lead aquaculture agency which controls the application process.

The initiatives that have been advanced to streamline application procedures are promising. For example, in Chile only one application for aquaculture activities is required under the Aquaculture Concessions and Authorisations Regulations.[50] In Mexico, a special office for aquaculture development handles all the required permits, concessions and authorizations for establishing an aquaculture farm.[51]
In Madagascar, a special administrative unit (the “Single Window Office”) was established as a one-stop investment shop within the Offices of the Prime Minister and transferred to the Ministry of Economy, Plan and Social Recovery.[52] The Office plays a key role in the development and establishment of commercial aquaculture activities by (a) collaborating with technical ministries, informing potential investors on technical, administrative, legal economic and social environments as well as investment opportunities in the country, (b) assisting investors in complying with investment formalities and procedures, and (c) receiving applications for companies to establish facilities in preferential trade zones or to obtain the status of free trade enterprises.

Malawi has adopted a position which encourages investment in aquaculture projects without restrictions. The publications of the Malawi Investment Promotion Agency[53] highlight investment in aquaculture. This change places aquaculture on the same commercial footing as agriculture. A ministerial committee uses an informal single window approach to the approval of foreign investment applications that is similar to the ones discussed above.

Financial incentives

The recognition of the need to grant security to the aquaculturist, irrespective of size, in cases where public lands are involved, characterizes a number of aquaculture-related laws. To this end, in some countries,[54] agricultural status is granted for agricultural use of public land, the duration of leases are extended or renewable, and marine tenure systems are introduced for

[50] Reglamento de concesiones y autorizaciones de acuicultura (1993).
[51] Mexico, Fisheries Law and Regulation (1999).
[52] Madagascar, Decree No. 94-0257 (1994); Madagascar, Regulation No. 1879 (1994).
[53] The Malawi Investment Promotion Agency (MIPA) was established in 1991 as a result of the Investment Promotion Act 1991 to stimulate investment and became operational in 1993. Through MIPA, investors can access general incentives and export incentives, including Export Processing Zones (EPZs).
[54] For example, Albania, Madagascar, and Vietnam.

private-sector involvement.[55] In Vietnam, rules relating to the allocation of land to households and individuals have been provided to grant "stable and long term use" for purposes of aquaculture.[56] The land lease lasts for a maximum of 20 years, and is renewable.

Long-term leases/concessions (up to 10, 20 and 50 years) are also being designed in some developing countries in Asia and Latin America, in order to:

- create a more permanent linkage over time between producers and supervisors;
- generalize the concept of sustainability; and
- guarantee future and permanent supplies to the aquaculture industries holding these concessions.

The government's right to revoke such leases/concessions is limited and may only be used in cases of serious violations of management plans and/or relevant laws. Wide powers to terminate leases for poorly defined reasons tend to disappear. However, this increasing trend remains still ambivalent. Despite more security being provided, one should look in practice whether or not:

- such leases/concessions tend to put aside the monopolistic approach to aquaculture ownership;
- competition is distorted; and
- access to aquaculture by others is being limited.

Incentives for aquaculture are provided for under the Mozambique Investment Law 1993, where aquaculture investments are prioritized to receive incentives from the Government. Mozambican Investment Law does not contain any provision that restrict private or public investment, whether national or foreign, on aquaculture. Articles 11 and 12 of the Act determine that all economic activities are open to the private sector, unless provided otherwise by the Council of Ministers. In 1982, an Investment Promotion Centre was created to assist the Ministry of Planning in the co-ordination, assessment, and assistance of both national and foreign investment. All investors seeking to obtain tax relief and benefit from incentives must submit a request to this effect to the Investment Promotion Centre. Tax incentives may include exemption or reduction of import, circulation, and consumption taxes and a 50 percent reduction of income tax, such as the industrial contribution tax. Because of the large number of bodies involved in obtaining the necessary permits for an aquaculture operation in Mozambique, it has been suggested that the permit and tax procedures are rather bureaucratic.

In Malaysia, the Promotion of Investments Act 1986 allows the Minister of International Trade and Industry to publish a list of activities or products to be promoted, thereby enhancing the development of aquaculture. With the agreement of the Minister of Finance, the Minister may grant a 'pioneer status' certificate to a company wishing to engage in a promoted activity. Companies with pioneer status are entitled to an investment tax allowance from five years from the date production begins, which exempts them from income tax on 70 percent of the corporate income for a five year period.

Social impacts

The perceived social consequences of fish farming are as disconcerting as its environmental impact. Social issues can be compelling reasons to disallow or regulate fish farming projects. Traditionally, access to resources in many countries has been open to all users. In such instances, privately held fish farms are viewed as incompatible with traditional open-access

[55] This has been done in the United States (State of Washington), Indonesia, and the Solomon Islands. It should be noted that these elements have also been introduced for the purposes of enhancing environmental conservation, and in particular, marine conservation.
[56] Vietnam, Land Law (1996).

use. The benefits of fish farming are perceived to accrue disproportionately to investors and fish farm owners. Furthermore, because fish are produced for export, the economic benefits of fish farming are limited and do not extend to local communities.

Important socio-economic consequences include conversion, expropriation, the privatization of mangroves and other lands, salinization of water and soil, reduced food security, marginalization of coastal communities, unemployment, urban migration, and social conflicts. These consequences often follow the development of aquaculture activities in many countries.

Conflicts often occur when aquaculture farm cut off the traditional routes of access that community members have to coastal resources. When farms are very large, this means that communities no longer have easy access to resources they once exploited. Securing access to land and water is often a key element of both survival and livelihood strategies for rural communities. Social conflicts over property rights often result when property rights are not well defined. The major problem in bringing order to the aquaculture sector is sorting out all of the land tenure problems.

Many rural communities have opposed transfers of water to outsiders in part on the assertion that such transfers can impose significant economic and social costs on the community. Employment conditions can be limited because unskilled workers on aquaculture activities usually come from the zone in which the farm is located. Because these individuals have few other sources of employment, there is little competition for their services in the labor market.

Land privatization and land security

The importance of mangroves to local communities, beyond their ecological role, is well known today. Local fishermen complain of decreasing catches of commercial species in mangrove areas. Often this decrease is attributed to the industry practice of catching larvae and destroying the accompanying fauna. Another social impact accompanying changes made by the fish farming industry is that in some areas, access to mangroves, lagoons and estuaries are compromised or lost. Sometimes, local people are forced to move away. The consequence of this is that the source of food, energy (firewood), and ultimately income is lost to some of the local population.

This is recognized by the industry in some countries where shrimp farmers have obtained permission from the government to use coastal lands that are not under private ownership. "This land had formerly been used by local people for home sites, agriculture, the gathering of wood for fuel and construction, hunting, fishing, and other purposes. The conversion of the land to shrimp farms can restrict resources for local inhabitants or even force people from the land."[57] But from the industry point of view, the loss of traditional uses is balanced by regular employment from shrimp culture development.

People controlling the production process (large rural landowners, urban entrepreneurs, government officials, bankers, etc.) are invariably seen in a pejorative sense. "They can also be viewed as rational economic actors responding to prevailing opportunities and constraints, and gaining appropriate returns to enterprise and risk-taking. In turn, this may contribute to the generation of surplus capital for investment in other productive enterprises; a necessary component of economic growth."[58]

[57] Global Aquaculture Alliance (GAA). 1998. *Code of Practice for Responsible Shrimp Farming* (available at http://www.gaalliance.org/book.html).
[58] FAO-CEMARE. 2001. *Shrimp aquaculture: economic perspectives for policy development.* p. 265–279. Marine Policy 25. Portsmouth, UK.

Conclusion: Enforcement

Until the 1990s, aquaculture was rarely mentioned in any enforcement provision. When aquaculture was dealt with under a basic fisheries law, the law enforcement sections had often been drafted with only capture fisheries in mind. Progress has certainly been made in recently adopted fisheries and aquaculture laws. In many countries, practicing aquaculture without authorization, discharging wastewater from aquaculture facilities without a permit or importing fish or aquatic organisms without authorization all result in some sort of defined penalty. In general, the enforcement systems that have been adopted mirror traditional sanctions schemes, including administrative measures (such as the revocation or suspension of licences) and fines. In addition, one often finds provisions outlining the rights, duties and responsibilities of enforcement officers, such as the right to enter, inspect and search aquaculture facilities.

However, due to the overlap of laws and institutions involved in aquaculture, the implementation of enforcement mechanisms remains difficult. A major problem, particularly in developing countries, is limited budgets and insufficient staff, which means that aquaculture rules often cannot be properly enforced. Therefore, options other than the classic "command and control" mechanisms are being explored in order to encourage farmers to make more efficient use of resources and to take full responsibility to mitigating or minimizing environmental changes caused by their aquaculture operations.

In particular, there appears to be a growing interest in the use of economic instruments, such as subsidies and tradeable permits. The Philippines' Fisheries Code of 1998 is illustrative of developments in this field. The Code charges the responsible authority with formulating incentives and disincentives, including effluent charges, user fees and negotiable permits, to "encourage compliance with the environmental standards and to promote sustainable management practices."[59]

At the national level, some farmed-shrimp producing countries have prepared voluntary guidelines. In the Philippines, a Code of Practice for Aquaculture has been developed.[60] Similar initiatives have taken place in Sri Lanka[61] and Thailand.[62] As noted above, in India the Guidelines for Sustainable Development of Brackish Water Aquaculture have been important for the sustainable development of the industry.[63] In Japan, the development of aquaculture management has even led to a completely self-imposed and self-monitored system via Fisheries Cooperative Associations (FCAs), whose members engage in aquaculture according to FCA-management plans. Other recent acts establish an inspection and enforcement system for aquaculture, and define specific offences and penalties for breach of the aquaculture legislation.[64]

Another strategy for enforcement consists of agreements between government and industry to protect the aquaculture environment, such as "eco-contracts" in Denmark[65] or "covenants" in the Netherlands.[66] The basic idea of these agreements is that pollution control cannot be

[59] Philippines, Fisheries Code sec. 48 (1998).
[60] Philippines, Fisheries Administrative Order No. 214 (2001).
[61] Siriwardena, P.G.S.N. & R. William. 2003. Code of Good Management Practices for Shrimp Aquaculture in Sri Lanka. Report prepared under the World Bank, NACA, WWF and FAO Consortium Program on Shrimp Farming and the Environment.
[62] Thailand, Code of Conduct for Shrimp Aquaculture (1985).
[63] India, Guidelines for Sustainable Development of Brackish Water Aquaculture (1995).
[64] The Namibia Aquaculture Act, No. 18 2002, the 2003 Tonga Aquaculture Management Act and the 2008 Chad law on Forests, Fauna and aquatic resources.
[65] Rest, A. 1993. *New Legal Instruments for Environmental Prevention, Control and Restoration in Public International Law*, p. 263-66. *In* Environmental Policy and Law 23/6.
[66] Rest, A. 1993. *New Legal Instruments for Environmental Prevention, Control and Restoration in Public International Law*, p. 263-66. *In* Environmental Policy and Law 23/6.

achieved without close and active cooperation of industry. Therefore, binding objectives and targets for the reduction of pollution are laid down on a sector-by-sector basis. Then industry members party to such agreements work out plans and mechanisms and set time frames for the shared reduction of pollution. The scheme reduces the need for licences and permits for pollution and helps to limit bureaucracy and government control.

The importance of legal, procedural and planning frameworks designed to facilitate sustainable aquaculture development is emphasized in the FAO Code of Conduct for Responsible Fisheries. On the global scale, it is difficult to isolate legal and institutional issues, as legal issues are so numerous and closely related to institutional issues. Although in one country it is possible to give an exhaustive list, at the world scale it remains difficult. As with other coastal activities, aquaculture covers a wide range of regulations such as environmental, forestry, fisheries, and agriculture or water regulations. But in spite of this, some main trends can be identified:

- Existing laws, especially related to the environment, are suitable to control and accompany aquaculture development. Under local and international pressure and facing social problems or environmental damage, specific laws targeting aquaculture are implemented with particular attention to land tenure systems, sanitary norms, Environmental Impact Assessment or zoning. But law enforcement problems still remain in many areas.
- These specific laws mainly target: land tenure systems and water management, mangrove protection (conservation and/or restoration, sustainable exploitation), resources preservation and aquatic anaimal health and food security.
- There are very few economic incentives through licences, fees or input-output taxes to orientate the development of aquaculture in a more sustainable manner.

Aquaculture legislation can impose significant costs on an applicant in acquiring the necessary rights to land and water and the right to carry on the operation, as well as in complying with all environmental requirements. Great care must be taken in both the design and the administration of the legislation to ensure that rights are acquired and environmental goals are achieved without the imposition of unnecessary costs, especially those which are unrelated to the achievement of environmental goals. It must be recognized that compliance with regulatory schemes can impose significant costs on operators and that higher costs will deter the development of commercial aquaculture. It is therefore important to investigate means of minimizing costs and eliminating the imposition of unnecessary costs while, nevertheless, ensuring that the goals of the legislation are achieved.

This can occur, for example, by adopting a single window approach for the numerous approvals that are often necessary for an aquaculture operation, screening initial proposals so that only those with the potential for adverse effects on the environment are subjected to an environmental impact assessment, and by creating a single agency whose function is to act as an advocate for aquaculture within government and to monitor the progress of applications for the acquisition of rights and the approval of operations through other government departments.[67]

The overall effectiveness of a legal system for the management of aquaculture depends in large measure on effective government administration of the aquaculture sector. Today the dividing lines between public and private sectors are becoming blurred, with shared public and private interests.

[67] FAO, 1989. Van Houtte, A., Bonucci, N. and Edeson, W. R. 1989. *"A Preliminary Review of Selected Legislation Governing Aquaculture".* Aquaculture Development and Coordination Programme FAO ADCP/Rep/89/42 Rome 81 pp.

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