Review of environmental impact assessment and monitoring of aquaculture in Latin America

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ABSTRACT

This review includes the results of a compilation and synthesis of the existing environmental impact assessment (EIA) and environmental monitoring (EM) practices for aquaculture-related activities, in six Latin American countries; namely Brazil, Colombia, Cuba, Ecuador, Honduras and Mexico. It is divided into three major segments: first, the legal framework that includes EIA and its procedures. Second the actual practice of environmental norms enforcement and follow-up, and finally, a series of recommendations to improve the effectiveness of such instruments.

The methodology included open-answer questionnaires sent to a representative number of actors in the aquaculture sector from each of the six countries. Subsequently, the main legal instruments dealing with aquaculture in every country were analysed, namely the General Constitution; the general environmental laws; the regulatory framework for environmental impact assessments and, when applicable, the specific legal framework for fisheries and aquaculture. Such analysis was based chiefly on the information made public by the country's authorities through Internet, and in two cases, Mexico and Brazil, using primary sources (government representatives). Finally, the document presents a series of recommendations to overcome the weaknesses detected in the analysis, especially those related to the actual compliance with the law and monitoring programmes.

CONTENTS

Acronyms and abbreviations

General	
BMP	best management practice
CITES	Convention on International Trade in Endangered Species
EIA	environmental impact assessment
EM	environmental monitoring
ES	environmental strategy
GIS	Geographic Information Systems
GMO	genetically modified organisms
HACCP	Hazard Analysis Critical Control Points
IDB	International Development Bank
NGOs	Non-Governmental Organizations
SEAP	The Special Secretariat for Aquaculture and Fisheries
UNDP	United Nations Development Programme
Brazil	
ABCC	The Brazilian Shrimp Growers Association (*Associação Brasileira de Criadores de Camarão)*
EEZ	exclusive economic zone
EIA/RIMA	Environmental Impact Study and Report of Environmental Impact (*Estudo de Impacto Ambiental e Relatório de Impacto Ambiental)*
IBAMA	Brazilian Institute of the Environment and Renewable Natural Resources (*Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis)*
MMA	Ministry of Environment *(Ministério do Meio Ambiente)*
PLDC	Local Plan for Shrimp Farm Development (*Planos Locais de Desenvolvimento da Carcinicultura)*
PLDM	Marine Aquaculture Development Plans (*Planos Locais de Desenvolvimento da Maricultura)*
RAS	Simplified Environmental Report *(Relatório Ambiental Simplificado)*
RGP	General Fishery Register (*Registro Geral da Pesca)*
Colombia	
CARs	Autonomous Regional Corporations
ICA	Colombian Institute for Agriculture and Livestock
INCODER	The Colombian Institute for Rural Development
POT	territorial management plans
Cuba	
MIP	Cuban Ministry of Fishing Industry
MEP	Cuban Ministry of Economy and Planning
MAC	Cuban Agriculture Ministry
AAAr	Environmental Responsible Application Authority
TROs	Territorial Representation Offices of the Ministry of Science, Technology and Environment.

Ecuador

AAA	Environmental Application Authority
AAAc	The Environmental Cooperative Application Authority
AAN	National Environmental Authority
AAAr	The Environmentally Responsible Reinforcement Authority
MINA	The Ministry of the Environment
SUMA	System for Environmental Management

Honduras

DECA	The Environmental Evaluation and Control Directorate
SINEIA	National Environmental Impact Assessment Evaluation System

Mexico

CAN	National Aquaculture Chart
CONAFOR	National Forest Commission
CONAGUA	National Water Authority
CONAPESCA	National Fisheries and Aquaculture Commission
LGEEPA	General Law for the Ecological Balance and Environmental Protection
MIA	Environmental Impact Description
NOMs	Official Norms
POAs	aquaculture territorial management plans
PROFEPA	Environmental Protection Agency
PTF	Project Technical File
SAGARPA	Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food
SEDEMAR	Secretariat of the Navy
SEMARNAT	Secretariat for Natural Resources and the Environment
SENASICA	National Service of Animal Health, Food Safety and Agri-foods Quality
SRO	State Representation Offices
UMAs	aquaculture management units

Summary

Latin America has experienced an unprecedented growth of aquaculture as a result of a number of factors which include the recognition by local governments of the importance of this industry in their national economic diversification, and the comparatively higher level of competitiveness of the Latin American region, in terms of the availability and price of land, water, energy, skilled labour and price of inputs which, altogether, stimulated large international investment in the activity over the past 30 years.

The pace at which aquaculture has evolved throughout the region, mostly through intensive and semi-intensive systems, has been much faster than the capacity of local governments to plan and monitor the development of the sector, especially in relation to the environmental impact associated with unsustainable production practices, thus resulting in numerous examples of severe, some even irreversible environmental impacts in the region, particularly during the first rapid expansion of aquaculture in the 1970s, due to the lack of planning, specific zoning for aquaculture development and, in general, the lack of environmental management tools to ensure a sustainable development.

Over the past two decades, however, most aquaculture-producing countries of the region have introduced a series of regulatory measures for aquaculture practices at different levels. These range from simple, flexible, non-mandatory rules, through to strictly-enforced, compulsory legal acts that all aqua-farmers are obliged to follow. In addition, as more producers are incorporated into a country's export chain, along with tougher internal environmental protection norms, international agreements and requirements force such farmers to comply also with best management practices, thus gradually generating a whole culture of awareness of environmental issues related to aquaculture.

Through a series of open-answer questionnaires sent to academics, producers and government officials, as well as through the direct collection of secondary information published by government authorities, a review was made of the legal frameworks and technical methods for assessing the environmental impact and monitoring of aquaculture projects, in six Latin American countries, namely Brazil, Colombia, Cuba, Ecuador, Honduras and Mexico.

General environmental legislation is found in all countries reviewed, dating in some cases form the early seventies. However, specific aquaculture legislation has only been enacted in Brazil, Ecuador and Mexico in the past five years. Currently, most aquaculture-producing countries of the region are in the process of developing a specific aquaculture legal framework.

Environmental impact assessment tools have been officially introduced in all countries covered by this study. Generally speaking, it is a special technical and administrative procedure whose objective is to identify potential impacts and to prevent environmental deterioration generated by human activities.

Currently, numerous policies, instruments and environmental plans in most Latin American countries offer many alternatives to cope with environmental issues. Despite the diversity of such instruments, the general objectives are common to all countries:

i) to identify potential environmental impacts by specific human activities such that these can be avoided or mitigated;
ii) to increase public awareness on the environmental effects of non-sustainable production practices;

iii) to try to induce a positive change of economic actors regarding environmental protection;
iv) to improve the formulation of environmental policies;
v) to monitor the health of ecosystems as a key element for decision-making in environmental management.

Standard environmental impact procedures common to all countries reviewed include a preliminary EIA which, depending on the level of risk perceived by the analyst, can be assessed in more detail to decide whether the project is permitted or refused. The actual resolution on the EIA issued by the environmental authorities usually includes a series of conditions aimed at mitigating the potential environmental impacts that were identified. These may include a wide range of considerations. Some examples include infrastructure modifications, strengthening biosafety measures, wastewater monitoring, ecological studies of recipient waterbodies, potential predators control, etc.

As far as the actual effectiveness of EIA and environmental monitoring tools are concerned, stakeholders in the region believe that important steps have been taken as far as adapting national legal frameworks and introducing EIA tools for regulatory purposes in Latin America; however, a common denominator seems to be the lack of resources to carry out environmental monitoring of aquaculture projects and associated watersheds where they are present. Another drawback is that projects promoted by the government are treated with more flexibility than those promoted by the private sector.

In countries where there are official environmental norms specific for aquaculture projects (i.e. Brazil, Mexico and Honduras), these are fairly general and sometimes meaningless within a particular geographic context, regardless of its aquaculture importance. For example, the upper limits stated in Honduran norms for wastewater discharges, are much higher than those generally recommended as safe to avoid eutrophication of natural waterbodies elsewhere.

Furthermore, there is no official mechanism for regular revision of these norms derived from systematic environmental monitoring of ecosystems affected by aquaculture practices. This makes such norms obsolete in many instances or out of context.

Some recommendations for improvements identified in the present review, are the following:

- There should be a pre-determined timeframe for the systematic revision of the environmental regulatory framework for aquaculture in every country, taking into consideration a) changes in the international legislation, b) growth rate of the activity within each country, c) changes in the ecological conditions of specific aquaculture regions, d) technological and scientific developments contributing to more sustainable methods of production, e) global and regional tendencies regarding BMP and environmental certification.
- Revision of the regulatory frameworks should be participatory, thus including all stakeholders within the sector.
- It would be wise to consider the creation of more specific (state or provincial) regulatory frameworks to respond to local environmental contexts and issues.
- All countries should create specific aquaculture norms as environmentally precautionary reference points, especially related to: water quality associated to wastewater, management of exotic species, use of prophylactics and of therapeutic drugs; quality of supplementary feeds and overall biosafety measures, among other aspects. Again it is important to take into consideration the national and regional contexts, to avoid generalizations.

Introduction

Aquaculture can be developed in a sustainable manner to generate food, employment and improve the standard of living of the rural population, particularly in developing countries. However, in many instances, especially in developing countries, aquaculture is growing at a faster rate than the ecosystems´ capacity to replenish the resources used by this and other economic activities.

There is a universal consensus on the need to formulate scientifically-based, robust regulatory frameworks for the sustainable development of aquaculture. This has resulted in a growing number of countries formulating specific laws aimed at protecting the environment to ensure that resource-demanding activities such as aquaculture are practiced in a rational and sustainable manner. Moreover, farmers themselves have started to acknowledge the need to introduce sustainable management practices, thus creating codes of conduct and environmental certification programmes to stimulate more environmentally sound production management strategies.

Although the political will of governments and farmers' associations is fundamental, it is not the key factor determining the success of environmental policies, but rather the actual compliance with the law by all actors involved in aquaculture. Hence clear, integral legal frameworks, formulated in a participatory manner, as well as rigorous law enforcement systems, are essential if aquaculture is to be sustainable.

The present document reviews both legal frameworks for aquaculture and aquaculture-related activities, as well as the practical EIA procedures and the environmental monitoring activities derived from such assessments, in six aquaculture-producing countries of Latin America, namely Brazil, Colombia, Cuba, Ecuador, Honduras and Mexico. Finally a chapter of recommendations for improvement, stemming from the analysis, is presented.

BACKGROUND AND SCOPE

According to Morales and Morales (2005) and FAO (2006a, b), Latin America, with an average annual increment of 21.3 percent between 1950 and 2004, experienced the world's highest aquaculture growth rate over this period. Of the 31 countries that practice aquaculture in the region, Chile contributes more than 51 percent, followed by Brazil, Mexico and Ecuador, which together contribute more than 80 percent of the total regional aquaculture volume. Overall production in the region has grown by a cumulative 73 percent since 1994, reaching 1.34 million tonnes by 2004, thus representing 2.3 percent of global aquaculture production.

Even though the number of native species cultured either experimentally or commercially in the region is over 40, the bulk of the industry is concentrated on only a handful of introduced species of high commercial value aimed at export markets, namely the Atlantic salmon (*Salmo salar*) and other introduced salmonids in Chile; the white Pacific shrimp (*Litopenaeus vannamei*), cultured throughout the coastal tropical countries of the region including the Atlantic coasts where it is exotic, and tilapia (*Oreochromis niloticus*) of various strains, cultured intensively and semi-intensively in an increasing number of countries and regions of tropical and sub-tropical Latin America.

Other introduced species cultured commercially in relatively large volumes include carps (chiefly the common carp *Cyprinus carpio* and Chinese carps, i.e. bighead *Aristichthys nobilis* and grass carp *Ctenopharyngodon idella*), molluscs such as the Japanese oyster *Crassostrea gigas* and abalone (*Haliotis* sp), as well as a number

of "emerging" marine and freshwater finfish species that are being introduced and intensively cultured for export purposes, such as cobia (*Rachycentrum canadum*) in marine environments and sturgeon (*Acipenser baerii*) in freshwater environments.

Only few native species are being cultured commercially in the region, although both the species diversity and their production volume are increasing. Such species include the pacu (*Piaractus mesopotamicus*) and the tambaqui (*Colossoma macropomum*), chiefly cultured in Brazil, and the striped mojar (*Cichlasoma urophthalmus*) in Mexico.

The unprecedented growth of the aquaculture industry in Latin America is the result of a) a gradual recognition by local governments of the importance of aquaculture in their national economic diversification, which led them to make important changes in their legal frameworks to foster investment in aquaculture and b) the comparatively higher level of competitiveness of the Latin American region with regard to more developed areas of the globe, in terms of availability and price of land, water, energy, skilled labour and price of inputs which, altogether, stimulated large international investment in the activity over the past 30 years.

However, the pace at which aquaculture has evolved throughout Latin America, (mostly through intensive and semi-intensive systems, which have a high demand for water, space, feed inputs and energy) has been much faster than the capacity of local governments to plan and monitor the development of the sector, especially in relation to the environmental impact associated with unsustainable production practices.

There are numerous examples of severe, some even irreversible environmental impacts in the region, particularly during the first rapid expansion of aquaculture in the 1970s, due to the lack of planning, lack of specific zoning for aquaculture development and, in general, the lack of environmental management tools that ensured sustainable development.

Over the past two decades, however, most aquaculture-producing countries of the region, have introduced a series of regulatory measures for aquaculture practices at different levels. These range from simple, flexible, non-mandatory rules, through to strictly-enforced, compulsory legal acts that all aqua-farmers are obliged to follow. In addition, as more producers are incorporated into a country's export chain, along with tougher internal environmental protection norms, international agreements and requirements force such farmers to comply also with best management practices (BMPs), thus gradually generating a whole culture of awareness of environmental issues related to aquaculture.

There are, nonetheless, big asymmetries among countries in relation to the actual enforcement and effectiveness of these regulatory measures. The scope of the present document is to compile the legal framework and structure employed by six representative countries of the Latin American region, in terms of their assessment of the environmental impacts associated with aquaculture practices, as well as to formulate recommendations for improvement.

METHODOLOGICAL APPROACH

The current review was done following the terms of reference presented in Part 4 – (this review) – Annex 1 and consisted of the collection of information published on each of the countries and abroad, in periodic journals, government Web sites and others (including FAO Web page), reports and publications. Additionally, the authors consulted through e-mail and telephonic communications with professionals on each country (see Annex 1). Finally, a questionnaire (Annex 2) was distributed to diverse individuals and organizations by e-mail (about 100 e-mails), however the reply was very low, less than 10 percent (see Annexes 3 and 4). Information provided by all these individuals contributed specially to the chapter on checking the effectiveness. The information on Brazil was provided in writing by Mr Felipe Suplicy. The authors are very grateful to all those contributors.

GENERAL INFORMATION

Background of the environmental legislation of Latin America

Over the past 20 years, Latin American environmental legislation has experienced rapid development, particularly after the United Nations Conference on Human Development and the Environment in 1972, which resulted in the Stockholm Declaration. Later, the Biodiversity Convention and the Climate Change Convention during the Earth Summit of Río de Janeiro in 1992 fostered a growing awareness of the need for legal frameworks aimed at environmental protection.

Other international agreements, such as the Rio de Janeiro Declaration on Environment and Development and Agenda 21, were also formulated at that Convention. These two conferences significantly influenced the proliferation of environmental norms in Latin American countries.

Some of the early environmental protection legislation in Latin American aquaculture producing countries includes the following:

- *Brazil:* (1981) Law No. 638: National Environmental Policy (Politica Nacional do Meio Ambiente) with its application instruments.
- *Chile* (1994) General Environmental Law (Ley General del Medio Ambiente).
- *Colombia:* (1974) National Code for Renewable Natural Resources and Environmental Protection (Código Nacional de Recursos Naturales Renovables y de Protección del Ambiente).
- *Cuba:* (1981) Law No. 33: Environmental Protection and Use of Natural Resources (Protección del Medio ambiente y el Uso de los Recursos Naturales) (derogated in 1997).
- *Ecuador:* (1976) Law for the Prevention and Control of Environmental Pollution (Ley para la Prevención y Control de la Contaminación Ambiental).
- *Honduras:* (1993) General Environmental Law (Ley General del Ambiente).
- *Mexico:* (1988) General Law for the Ecological Balance and Environmental Protection (Ley General del Equilibrio Ecológico y Protección Ambiental). This law substituted the Federal Law for the Protection of the Environment (Ley Federal de Protección del Medio Ambiente) in 1982.

As a general rule, the primary legal steps taken by Latin American countries as part of their environmental legal framework were directly related to the formulation of instruments to regulate the use of natural resources (i.e. permits, concessions, authorizations, licenses, etc). As environmental awareness and technical capacity of Latin American governments increased, the formulation of activity and/or resource-specific norms and standards aimed at preventing and/or mitigating environmental degradation, developed. Currently, most aquaculture-producing countries of the region have or are in the process of having a specific aquaculture legal framework.

The analysis of the legal instruments that relate to aquaculture of the countries included in this review reveals that the actual term aquaculture is, nonetheless, not included in any constitutional text, but rather approached from the viewpoint of the natural resources which aquaculture depends upon (i.e. water, land, aquatic biota, ecosystems, etc).

Introduction of EIA tools in aquaculture projects

Over the last three decades, there have been important changes in the legislation regarding aquaculture in Latin America. These include the development of scientifically-based policy instruments for environmental management and rational use of natural resources. Examples of this are the implementation of EIA methodologies, land use zoning for territorial management, sanctions related to responsibility for environmental harm, environmental economic valuation instruments, environmental protection activities and community participation in environmental issues.

Environmental impact assessment tools have been officially introduced in all countries covered by this study. Generally speaking, EIA is a special technical and administrative procedure whose objective is to identify potential impacts and to prevent environmental deterioration generated by human activities.

Currently, numerous policies, instruments and environmental plans in most Latin American countries offer many alternatives to cope with environmental issues. Despite the diversity of such instruments, the general objectives are common to all countries:

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Through the years, there have been important national and international efforts to improve the technical qualification of the governmental agencies responsible for EIA. Moreover, re-design of EIA tools, which originated in developed countries with completely different environmental contexts, have been adapted to local or regional situations, thus increasing their usefulness and precision. Some recent examples of such efforts include attempts to locate the EIA in the context of the geographical organization or environmental classification of the territory; the obligation of any project promoter to carry out an EIA prior to any modification of a given site; the use of a participatory approach along the different phases of environmental impact assessment processes, and the mandatory nature of EIA as well as *ex-post* monitoring follow-up programmes as key instruments for the construction of early warning systems in ecosystem management.

Checking the requirements

BRAZIL

Environmental legal framework

Several specific decrees define the authorizations for aquaculture activities and aquaculture plans:

- (2003) Decree No. 4.895: defines the conditions for the authorization of aquaculture in federal waterbodies.
- (2004) Normative Instruction No. 6: defines complementary rules for authorization of aquaculture in federal waterbodies.
- (2005) Normative Instruction No. 17: defines the criteria and procedures for the formulation and approvement of Marine Farm Development Plans (PLDM).
- (2008) Normative Instruction No. 18: defines complementary Geographic Information System (GIS) criteria for the formulation of Marine Farm Development Plans (PLDM).

On the other hand the legal framework on the subject of Environmental Impact Study and Report of Environmental Impact (*Estudo de Impacto Ambiental e Relatório de Impacto Ambiental - EIA/RIMA)* contained in the Brazilian Constitution of 5 October 1998 states specific requirements for the installation of projects or activities that can potentially cause significant deterioration to the environment. In addition, Article 6 IV establishes that the executive organization that must oversee the compliance of policies is the Brazilian Institute of the Environment and Renewable Natural Resources (*Instituto Brasileiro de Meio Ambiente e dos Recursos Naturais Renováveis – IBAMA*), an administrative unit of the Ministry of Environment (Ministério do Meio Ambiente – MMA). The manual of environmental licensing elaborated in 2002 by MMA, IBAMA, United Nations Development Programme – UNDP and International Development Bank - IDB states that EIA/RIMA are necessary for the licensing of activities that cause modifications and significant impacts on the environment.

Proponents of aquaculture projects must submit their application to the Directory of Environmental License and Quality within IBAMA, who will classify the potential environmental impact of the enterprise according to their activity, jurisdiction, project phase and stage of environmental studies. Based on this classification, proponents may have to elaborate an EIA/RIMA, a Simplified Environmental Report (Relatório Ambiental Simplificado - RAS) or just fulfill the requirements to obtain an environmental license as listed in specific aquaculture regulations. In fact, an environmental license is required for the establishment of any activity that is likely to cause harm to the environment. As stated by CONAMA Resolutions No.1 of 1986 and No.237 of 1997, the set up of aquaculture farms requires environmental licensing. In fact, aquaculture is unarguably an activity potentially affecting the biota (flora and fauna of a region), the environment and the quality of natural resources (i.e. water resources), as required by the former resolution. Additionally, to avoid all doubts, the latter explicitly mentions the management of living aquatic resources (*manejo de recursos aquaticos vivos*) and the breeding of animals (*criação de animais*).

Legislation provides for three different types of environmental licenses, according to the stage of development of the project:

- preliminary licence (*Licença Previa*, LP): approving the concept-project and location;

- installation license (*Licença de Instalação,* LI): authorizing the setting up of the activity;
- operation license (*Licença de Operação,* LO): authorizing the commencement of the project.

The license procedure goes through the following steps:

1. determination (by competent authority and applicant) of necessary documentation to support the application (there are 22 classes of activities according to the type of required procedure);
2. filing and delivering of application to the competent authority, with supporting documentation (including EIA/RIMA, when required);
3. analysis of application and supporting documents;
4. request for clarification or additional documentation, if necessary;
5. public review, when required;
6. request for clarification or additional documentation, if necessary;
7. issue of conclusive technical advice and of legal advice, where appropriate;
8. granting or denial of license and publication.

Aquaculture investors whose projects are not set to be implemented in federal waterbodies, but in state rivers and dams and in private properties using ponds or cages, must refer to state regulations to obtain an aquaculture environmental license. According to the national environmental regulation, each state can propose its own criteria for environmental licensing, provided it is not more permissive than the federal regulation. As a consequence, strong differences in terms of procedures and criteria can be found in aquaculture environmental regulation among states. While in some states aquaculture is grouped together with other potential harmful activities like salt mining, in others there is no specific regulation. From 27 states, specific environmental regulation for aquaculture is in place in only 17. In some of them it covers finfish and shrimp farming, in a minority bivalve molluscs are included, but none have specific procedures for seaweed or amphibians.

Regarding shrimp farming, Resolution CONAMA No.312 of 2002 defines three categories of aquaculture facilities according to the size of the inundated area:

- small establishments (≤10 ha) shall undergo the simplified licensing procedure;
- medium establishments (>10 ha and ≤50 ha) are subject to the regular licensing procedure;
- large establishments (>50 ha) small and medium establishments causing significant harm to the environment and those located in the area of influence of other establishments must present an EIA/RIMA.

The resolution requires specific documentation to support applications and states the minimum content of the Environmental Control Plan (Installation License phase, LI) and the Environmental Monitoring Plan (Operation License phase, LO). The federal government is now developing a PLDM analogous process plan and manages shrimp farm areas, with the use of GIS and an integrated coastal management approach to identify and demarcate suitable areas for shrimp production. The draft version of this regulation, called Local Plan for Shrimp Farm Development (*Planos Locais de Desenvolvimento da Carcinicultura – PLDC)* is currently under public consultation.

Irrespective of the nature of the waterbody (public or private), all aquaculture farmers must also be registered within the General Fishery Register (*Registro Geral da Pesca – RGP*). Procedures for registration are defined in Normative Instruction N°3 /2004. Applicants shall file their applications through the SEAP Office of their State of residence, including the following supporting documentation:

- application form properly filled in and signed by the applicant or by a legal representative;
- for companies, a copy of a document attesting its legal status as a company;
- copy of the certificate of residence of the applicant;

- detailed projection of the existing or upcoming infrastructure;
- copy of the environmental license, when required;
- receipt of tax payment for aquaculture farmer registration.

Related "soft laws"

Shrimp aquaculture is the most extensively organized aquaculture sector in Brazil. The Brazilian Shrimp Growers Association (*Associação Brasileira de Criadores de Camarão,* ABCC) has developed four codes for best management practices concerning shrimp farming, shrimp feed production, shrimp hatchery operation and shrimp processing plants. These latter are mainly based on HACCP standards, whereas the former tackle the following issues:

Sustainable and responsible shrimp aquaculture management (*Código de Conduta para Desenvolvimento Sustentável e Responsável da Carcinicultura Brasileira*) (June 2004):

- mangrove conservation;
- site selection, standards and construction techniques;
- feed and feeding practices;
- shrimp health and biosafety measures;
- prevention of shrimp escapes;
- use of chemicals and veterinary drugs;
- hatchery management;
- harvest, conservation and transport;
- effluents and solid wastes;
- rights of other water users;
- relationship with employees and the local community.

Shrimp feed production (*Código de Conduta e de Boas Práticas de Fabricação para Fabricantes de Rações para Camarão*) (January 2004):

- site selection and location of facilities;
- selection and purchase of ingredients;
- storage and use of ingredients;
- processing;
- formulation;
- packaging and labeling;
- storage and transport of feed;
- human resources;
- sampling and testing methods.

Marine shrimp larviculture (*Código de Conduta e de Boas Práticas de Manejo para Laboratórios de Larvicultura de Camarão Marinho*) (May 2004):

- site selection and location of facilities;
- disinfection of the hatchery;
- operation and management;
- feed;
- animal health and biosafety;
- use of chemicals and veterinary drugs;
- harvest, packaging and transport;
- effluents and solid wastes;
- employees and social relations.

The Special Secretariat for Aquaculture and Fisheries (SEAP, its acronym in Portuguese) has prepared a draft version of a Best Management Practices Manual for fish, molluscs and frog culture, which are available for public consultation through the SEAP Web site, as well as the sustainable aquaculture management code from the ABCC:

- code of conduct for sustainable development of frog farming *(Código de Conduta para o Desenvolvimento Sustentável e Responsável da Ranicultura Brasileira*, June 2004);

- code of conduct for sustainable development of mollusc farming *(Código de Conduta para o Desenvolvimento Sustentável e Responsável da Malacocultura Brasileira*, June 2004);
- code of conduct for sustainable development of fish farming *(Código de Conduta para o Desenvolvimento Sustentável e Responsável da Piscicultura Brasileira*, June 2004).

These documents contain guidelines for the following activities:

- aquaculture site selection;
- farm construction/installation;
- feed and feeding practices;
- biosafety;
- control of cultured animals escapes into the environment;
- use and storage of chemicals and therapeutic substances;
- farm management practices;
- effluents treatment and residues disposal;
- consideration of other users rights of aquatic resources;
- consideration of rights and needs of local communities;
- relationship with employees.

Citizen participation

With regard to citizen participation, according to the law, when the EIA-RIMA is requested as part of the environmental license process, the study and related report will be accessible to the public if the applicant does not request its information to be confidential. The environmental impact assessment copies are at the disposition of any interested person or company in the centers of documentation and in the environmental agencies libraries. Public organizations that show interest in the study or have a direct relationship with the project will receive a copy of the EIA-RIMA if requested. At the end of the EIA and with the presentation of the RIMA, the competent authority (IBAMA or the pertinent state or municipality) will determine the date to receive comments from public organizations and other interested parties and it will promote a public hearing to deliver the information about the project and its environmental impacts.

COLOMBIA

Environmental legal framework

In Colombia, Decree 1220, in articles 7, 8 and 9, establishes that all projects need to obtain an environmental license to operate. The law also states that the EIA is the basic instrument for decision-making regarding projects and activities likely to affect the natural or an artificial environment.

The government entities that have the authority to grant or deny an environmental license are the Ministry of the Environment, Housing and Territorial Development, The Autonomous Regional Corporations for Sustainable Development and the municipalities, districts and metropolitan areas which have an urban population of over one million inhabitants (Article 2 of Decree 1220).

Some of the functions and responsibilities of the Ministry of the Environment are to establish the environmental norms and general regulations for urban centres and human establishments, as well as the mining, industrial and transportation sectors and, in general, every other service and activity that may generate environmental impacts.

Other functions of the Ministry of the Environment include ensuring the compliance of the regulatory framework to control and reduce pollution; to define and regulate the administrative instruments and mechanisms for the prevention of environmental deterioration, and determine the evaluation and environmental management criteria of economic activities in the framework of various legal instruments.

Wastewater discharges are regulated by Law No. 9 of 1979 and Legislative Decrees No. 2.811 of 1974 and No. 1.594 of 1984, which include water uses and liquid wastes. This latter decree sets the standards for water quality for the purpose of conservation of flora and fauna, including aquaculture.

As far as the import of exotic species into the country is concerned, the existing regulatory framework, establishes that the Ministry of Environment and The Colombian Institute for Rural Development (INCODER) must jointly grant the corresponding authorization. Under the terms of the Law No. 99 of 1993, the introduction of exotic species of flora or fauna that might negatively affect natural ecosystems and wildlife is subject to the granting of an environmental license by the Ministry of the Environment.

In addition, the Colombian Institute for Agriculture and Livestock (ICA), is the authority responsible for veterinary health certification for imports and exports in general, this includes fish, molluscs and crustaceans and their eggs, larvae or juveniles.

Regarding the use of water all projects are requested to apply for a water use permit. This together with an environmental management plan, are required by the Autonomous Regional Corporations (CARs) directly or through the compliance of environmental guides. In the case of shrimp culture, such guides already exist and guides for fish culture are currently being elaborated with the support of regional councils of the productive chain. The objective is to achieve an environmentally friendly and sustainable activity.

Environmental impact studies have to be presented together with the official environmental license application form. The authority then issues a resolution either granting or refusing the license.

Territorial Management Plans (POTs, their acronym in Spanish) have been formulated in some of the country's departments and municipalities. In many such POTs aquaculture has been labelled as an important economic activity for regional development, especially in those areas with waterbodies and soils adequate for fish farming.

Sanctions

According to the Colombian environmental laws, the environmental license can be suspended or revoked by the same environmental authority that granted it, whenever the license grantee has failed to comply with any of the terms, conditions, obligations or inherent responsibilities he is subject to by law.

Additionally, when an infraction is detected, daily fees are applied up to a sum equivalent to 300 minimum wages. Licenses, concessions, permits or authorizations may also be suspended. Temporary or definitive closure of projects and seizure of individuals or specimens of flora and fauna or of products or implements used to commit infractions are also sanctions included in the law.

When applicable, specific studies and evaluations can be carried out to establish the nature and characteristics of environmental impacts caused by the project. Subsequently, the necessary measures to mitigate or compensate for the damages are applied. (Law Number 99, 1993. Fundaments of the Environmental Policy of Colombia).

Article 18 of the same law states that if a project generates polluting wastes then a number of sanctions may be applicable, depending on the severity of the impact on the environment. They can include fines or the suspension or closure of projects. *Law 23 of the 12th of December of 1973. Code of Natural Resources and Protection of the Environment).*

Soft Laws

There is a mechanism that rewards products originated from renewable natural resources whose extraction, processing, etc, have been made employing environmentally sound practices that entitle the products to be certified with a "green label". Such eco-labels

effectively translate into increased sales prices and consequently greater revenues for those that choose to comply with the strict standards required by the certifier.

Citizen participation

As stated in Article 76 of Law 99, before an environmental license is granted in regions where black and indigenous populations exist, there must be a public hearing. Moreover, the political constitution establishes that the law will guarantee the participation of the communities in all the decisions that may affect them. Any company or individual may intervene in the administrative process of issuing, modifying or cancelling permits or licenses to projects and activities that affect or may affect the environment.

A public hearing may be requested to be held before the authority decides on any EIA-evaluated project. This hearing is generally chaired by regional or federal environmental authorities.

Article 30 refers to community participation on the environmental evaluation and licensing processes. This article establishes that those communities located in the area of direct influence of the project, must be thoroughly and properly informed about its nature, likely environmental impacts and the proposed mitigating measures. Once the activities have started, the community must be periodically informed about the results of the implementation of the environmental management plan and the corrective measures that derive from it.

CUBA

Environmental legal framework

In Cuba, Article 24 of Law Number 81, the Law of the Environment, states that any human activity that poses an environmental risk, will require the granting of an environmental license by the Ministry of Science, Technology and the Environment.

An environmental impact assessment is demanded in cases of new projects, works, activities, expansions or modifications of projects that use natural resources or any source of energy. (*Resolution No. 77 / 99 Regulatory Framework of the Process of Environmental Impact Assessment of the Ministry of Science, Technology and Environment*).

Article 2 of the same regulatory instrument establishes that the government institution responsible for the supervision of the Environmental Assessment System is the Ministry of Science, Technology and Environment and its representative offices in the Cuban provinces.

The Environmental Law (1997) and the Regulatory Framework of the Environmental Impact Assessment Process (1999), are the most important elements of the Cuban EIA system leading to the granting of an environmental license. Aquaculture is explicitly mentioned among the activities that are subject to the EIA process.

The National Centre for Biosafety is the official agency responsible for processing all applications concerning projects or activities that involve biological agents and organisms, therefore aquaculture projects must also pass through the technical scrutiny of this entity.

The Ministry of Science, Technology and the Environment may analyse fisheries development plans and policies also employing EIA tools.

Cuban legislation deals with waste and wastewater produced by aquaculture through a series of general principles relating to appropriate wastewater treatment, reduction of water pollution and wastewater in general. The legislation on inland waters establishes four precautionary rules aimed at protecting freshwater resources:

- Extensive culture and capture of fish must comply with the provisions made by the National Institute of Water Resources and the Ministry of Public Health.

- Intensive and semi-intensive breeding of fish is not allowed in reservoirs used for human consumption.
- The establishment of intensive and semi-intensive fish breeding facilities is subject to the approval of the National Institute of Water Resources and of the Ministry of Public Health.
- The total or partial extraction of water from a reservoir for the culture of fish requires the approval of both the National Institute of Water Resources and the resident manager of the reservoir.

Regarding the import of aquatic species into the country, the importer must apply for the required authorization at the Import/Export Veterinary Services Department of the National Veterinary Medicine Institute, providing the following information:

- species to be introduced;
- quantity;
- origin (establishment and country);
- exporter;
- destination;
- purpose of the introduction;
- conditions and location of the quarantine facility where the organisms are to be kept;
- representative of the Ministry for the Fishing Industry, responsible for the quarantine supervision.

An additional document regarding ecological, genetic and health issues must be submitted to the Board of the Ministry of the Fishing Industry and to the Environmental Agency. The Resolution specifies the health certificates that have to be presented and establishes the corresponding conditions for the quarantine period. The Ministry of Science, Technology and the Environment is responsible for monitoring the introduction of new species and species falling under specific regulations (i.e. CITES).

According to the Decree-Law on Biosafety (1999), the Ministry of Science, Technology and the Environment, along with the National Centre for Biosafety, will grant, suspend or revoke authorizations concerning activities related to genetically modified organisms (GMOs). The Resolution for granting Biosafety Authorizations (2000) issues three types of authorizations, depending on the potential biological risk to workers, the community and the environment. These are the Biosafety License, the Biosafety Permit and the Notification.

The control of diseases is regulated by two main legislations. These are the Decree-Law No.54 on Basic Health Provisions (1982) and the Decree-Law on Veterinary Medicine (1993). Aquatic animals are not specifically mentioned in either. The Fisheries Regulation states that the Ministry of the Fishing Industry, jointly with the Veterinary Medicine Institute, shall issue health regulations to prevent the introduction of diseases into the country that might affect aquatic resources. It should also establish animal health surveillance systems and other measures pertaining aquatic health.

The Resolution on Hygienic and Sanitary Regulations establishes the relevant measures to be complied with by any aquaculture facility in order to prevent the occurrence and spread of diseases. Every establishment must do the following:

- apply for import and export authorizations;
- comply with the specific technical rules to prevent the introduction and proliferation of diseases;
- systematically monitor the aquatic population to look for potential pathogens;
- hold the required health certificates issued by the concerned Laboratory of Aquaculture Health of the Fisheries Research Centre or by any authorized laboratory;
- comply with the OIE Code (International Animal Health Organization – International Office for Epizootics);

- apply the Animal Health Surveillance System of the Veterinary Medicine Institute;
- hire qualified staff to ensure an adequate sanitary management.

Sanctions

Article 20 establishes that the authority may guarantee the protection of the environment by a series of means, including the cancellation or suspension of the environmental license. (Resolution No. 77/99 Regulatory Framework of the Process of the Environmental Impact Assessment, Ministry of Science, Technology and Environment).

Article 26 of the Law of the Environment indicates that the programmes, projects or activities that do not have an environmental license, or projects that do not comply with the demands and controls that are mandated by the environmental authority, may be temporarily suspended or confiscated completely by the Ministry of Science, Technology and Environment.

Citizen participation

The environmental authorities must establish, during the process of the Environmental Impact Assessment, the pertinent consultations with organizations of the Central Administration of the State, which are responsible for the management of natural resources. Such consultations must be answered within 15 working days. In case of no response, the approval of the corresponding measures will be effective, so that the interests and concerns of the communities and citizens in general are taken into account.

ECUADOR

Environmental legal framework

State environmental institutions in Ecuador are part of the National Decentralized System of Environmental Management. These institutions are subordinated to the mandate and regulations established by the National Council for Sustainable Development, which in turn form the System for Environmental Management (SUMA, its acronym in Spanish). SUMA is integrated by the National Environmental Authority (AAN, its acronym in Spanish); the Environmental Application Authority (AAA, its acronym in Spanish), the Environmentally Responsible Reinforcement Authority (AAAr, its acronym in Spanish) and the Environmental Cooperative Application Authority (AAAc, its acronym in Spanish).

This system constitutes a trans-sector coordination, integration and cooperation mechanism among the different instances dealing with environmental and natural resource management. The scope and competency of the SUMA are mandated by the Law of Environmental Management (Law No. 99-37, 1992).

Article 8 of the Law of Environmental Management establishes that the National Environmental Authority (AAN) is the Ministry of the Environment (MINA, its acronym in Spanish). This is the official governing, coordinating and regulating entity of the National Decentralized System for Environmental Management. However, some aspects are dealt with by other government agencies. Article 20 of this Law, states that the person with the intention to start a project likely to generate an environmental impact, must obtain an environmental license from the MINA.

The only specific provisions concerning aquaculture are found in the General Fisheries Regulation and Fisheries Development Law, which states that the granting of authorizations for aquaculture in the Ecuadorian Highlands using groundwater sources, is subject to EIA and evaluation by the Environmental Management Commission (*Comisión de Gestión Ambiental*).

Following the approval of the Environmental Impact Study, an environmental license must be issued by the Ministry of the Environment within seven days of the application date. Applicants must pay an annual insurance policy equivalent to USD 3 000, for each hectare of surface area open to production. The development of shrimp farming prompted some of the current environmental measures (Griffith and Schwarz, 1999; Chamberlain, 2002).

Obligation of compliance

Article 22 of the Law of Environmental Management states that projects that have been the subject of an EIA or have been granted an environmental license, should be selected at random for periodical inspection so that, if needed, corrective measures can be introduced in a timely manner. This evaluation is carried out through an environmental auditing, practiced by qualified consultants registered and authorized by the MINA.

The official entity responsible for EIA evaluation of aquaculture projects is the General Administrator´s Office of the Government of Ecuador. This entity is responsible for procedures and approval of technical studies and Environmental Impact Assessments, thus concluding on their objectiveness and validity in accordance with the environmental legislation.

The project promoter may hire independent consultants to carry out the EIA or auditing. Additionally, article 26 of the Law of the Environment indicates that the contracts contained in Environmental Impact Assessments, must include the specifications, parameters, variables and characteristics of these studies and will establish the obligation of applicants for preventing or mitigating environmental impacts.

Sanctions

Article 45 of the Law of Environmental Management establishes sanctions in case the project owner does not comply with the regulatory measures. Such sanctions are specified by the National Health Code (Chapter II of Title I, Book II).

Related "soft laws"

In 2001, a new certification standard for organic shrimp farming was formulated in coordination with farmers, importers, the Naturland Association (German-based certifier of organic products) and the GTZ (German Technical Cooperation Institution – *Deutsche Gesellschaft für Technische Zusammenarbeit*). Currently, only five farms produce shrimps according to these standards. An accredited independent third-party certification body is responsible for assessing compliance with Naturland's eco label.

Citizen participation

The Law of Environmental Management establishes that every person or institution has the right to be informed promptly and properly about any activity of the State institutions that, in accordance with this Law, may produce environmental impacts.

HONDURAS

Environmental legal framework

The General Law of the Environment (Law 104/93) mandates the Secretariat of the Environment to coordinate and regulate the National Environmental Impact Assessment Evaluation System (SINEIA, its acronym in Spanish). Such a system is specifically constituted by all actors involved in a given project, namely the promoter, the Secretariat of the Environment; the Environmental Units (regional or local governmental offices dealing with environmental issues); the Environmental Protection Agency of the country; citizens and NGOs that express concerns about the development of the project and, when appropriate, a scientific committee (academics and members

of professional associations appointed by the Secretariat of the Environment, according to their field of expertise, to provide technical advice).

The Environmental Evaluation and Control Directorate (DECA, its acronym in Spanish), as part of the Secretariat of the Environment, coordinates the SINEIA.

The Regulatory framework of the National Environmental Impact Assessment System, in its Article 5 stipulates that the EIA is an instrument that will be used for the prevention of potential negative effects on the environment. Such an instrument also dictates the need for all projects potentially harmful to the environment to obtain an environmental license form the Secretariat of the Environment.

An official classification of projects issued by the Secretariat of the Environment through Resolution 635/2003 defines, depending on their nature and magnitude, a numerical categorization for project licensing:

- Category one corresponds to activities with the least impact which, after analysis of their technical documentation, are granted an *Environmental Registration Number*.
- Category 2 corresponds to projects with higher but predictable impacts that can be mitigated through standardized approaches. These require an environmental diagnostic of the project site and are granted an *Environmental Authorization*, which contains a signed agreement by the requesting party, to comply with the mitigating strategies stated in the resolution.
- Category 3 is reserved for projects with the highest potential impacts on the environment that can be mitigated through tough measures of control. They have to submit an EIA and, if approved, are granted an *Environmental License.*
- There is a special category (4) reserved for high environmental risk projects, which cannot be approved under any circumstance.

Consequently, the technical and administrative requisites that have to be fulfilled by project promoters in order to get the corresponding permit from the environmental authorities, depends on the category. Aquaculture projects are classified as indicated in Table 1.

TABLE 1
Environmental classification of aquaculture projects by the Secretariat of the Environment of Honduras

Type of project	Category 1 (Environmental registration)	Category 2 (Environmental authorization)	Category 3 (Environmental license)
Pond fish culture	<1- ≤ 5 ha	>5 - ≤ 10 ha	> 10 ha
Cage fish culture	-	≤ 0.25 ha	≥ 0.25 ha
Shrimp farming	-	≤ 5 ha	≥ 5 ha

Source: Secretariat of the Environment, Honduras. Available at: www.serna.gob.hn/servicios/licencias_amb/tabla_cat/Paginas/default.aspx

Sanctions

Article 76 establishes two types of offences against SINEIA: starting a project without having the corresponding environmental license; and not complying with the mitigation measures or what is established in the Environmental Monitoring and Control Plan. This includes altering the results or deliberately omitting information that could lead to a biased environmental assessment. The Secretariat of the Environment will decide the corresponding sanctions, according to Environmental Law, its regulations and other applicable laws *(Regulation of the National Environmental Impact Assessment System. 1993).*

Citizen participation

The Law of the Environment establishes that the general public and NGOs may express their doubts, complaints and suggestions to the Secretary of the Environment,

regarding a given EIA. The Secretary must then establish the time frame and process for the reception of such comments and it may include these observations in the terms of reference section of the study. The authority will inform the interested parties if their observations where taken into account.

Article 60 establishes that once the EIA report is submitted to the environmental authorities, the applicant must publicly notify it by using the major national newspapers and even radio stations.

MEXICO

Environmental legal framework

The legal framework that derives from the National Environmental Policy of Mexico, is the General Law for the Ecological Balance and Environmental Protection (LGEEPA, its acronym in Spanish), formulated and enacted in 1988. Its operational instrument to regulate environmental impact assessments is the code No. 30-05-00. The governmental entity responsible for technical assessment and authorization of any operation license for aquaculture projects, is the Secretariat for Natural Resources and the Environment (SEMARNAT, its acronym in Spanish), through its state representation offices (SRO). The technical analysis of aquaculture projects is carried out, in many instances, in coordination with the National Fisheries and Aquaculture Commission (CONAPESCA, its acronym in Spanish), which is the ultimate aquaculture authority of the country.

On July 2007, the General Law for Sustainable Fisheries and Aquaculture was enacted. Among its major instruments for fostering an environmentally responsible aquaculture industry are: the creation of the National Aquaculture "Chart" (CAN, its acronym in Spanish); the creation of Aquaculture Management Units (UMAs, its acronym in Spanish) and the legal obligation to formulate aquaculture territorial management plans (POAs, its acronym in Spanish).

The CAN is an annually-revised, comprehensive, technical and geographic aquaculture chart, which contains relevant information on the national inventory of aquaculture species and their culture systems; the territorial aquaculture zoning with information on the regional potential as well as the applicable regulatory framework in relation to the environment, and that of aquaculture sanitary and farmed fish food products safety measures.

As far as the UMAs are concerned, these are geographic micro to meso-regions whose environmental characteristics and species cultured are similar. Specific management plans are formulated for each UMA which contain the following elements:

- short, mid and long term aquaculture development plans within the context of the overall regional development plans;
- the actual carrying capacity of major waterbodies where aquaculture is to be developed or expanded;
- the geographic characteristics of the region;
- both the existing and planned basic infrastructure associated with aquaculture development;
- organization and participation mechanisms that ensure the inclusion of all stakeholders in aquaculture development plans;
- environmental protection measures and compliance with the applicable environmental legal framework;
- foreseen regional or local aquaculture sanitary actions;
- health and environmental hazards prevention programme.

The Aquaculture Territorial Management Plans have to be aligned with the National Ecological Territorial Management Plan, as well as to the corresponding State Ecological territorial Management and the Integrated Coastal Zone Management Plans.

All the above are legal instruments that influence the decisions regarding the approval or rejection of an environmental license and the actual aquaculture permit for a given project.

Aquaculture Projects Registration Procedure

Depending on the magnitude, location, water source and species to be cultured, an aquaculture project may or may not officially require an EIA in Mexico. Yet, all new aquaculture project promoters are required to formulate a thorough technical description of the project (hereafter referred to as the project technical file or PTF), including its exact location, water source and volume, farm dimensions and infrastructure, species and culture system, source of seed and expected production volumes and crop schedule. The PTF can be formulated and presented directly by the project owner, that is, there is no need for an aquaculture technical expert to submit or sign a PTF.

Since CONAPESCA is an entity subordinate to the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA, its acronym in Spanish), the PTF is submitted to the Aquaculture Department of the corresponding State Representation Office of SAGARPA, along with an application form to obtain a National Fisheries Registration Number and an aquaculture permit.

Checking for the need and type of EIA of an aquaculture project

It is mandatory for any aquaculture project promoter (this is a literal translation of the official term used by Mexican and all other Latin American countries´ environmental authorities, when referring to the person or company that requests an aquaculture project environmental license) to officially request the State Representation Office of SEMARNAT, to carry out a technical project site visit. Such a technical visit takes place within 20 days after the request has been submitted along with the PTF.

As a result of both the visit and the analysis of the PTF, SEMARNAT issues either an official request for an EIA if the magnitude and characteristics of the project require it, or an EIA-exemption authorization.

Other agencies involved in the process include the National Water Authority (CONAGUA, its acronym in Spanish), which is responsible for water management, thus granting permits for using surface and/or ground waters; the National Forest Commission (CONAFOR, its acronym in Spanish), since vegetation clearing for aquaculture projects requires a Technical Study of Land Use Change; and the National Service of Animal Health, Food Safety and Agri-foods Quality, or SENASICA, its acronym in Spanish, if the seed to be used is external and an in-farm quarantine facility is to be authorized (Figure 1).

Article 5 of the code 30-05-00, which is the actual operational instrument of the LGEEPA in its chapters R through U, specifies all activities related to aquaculture that need to be assessed for possible environmental impacts (Table 2).

SEMARNAT may, in addition to its own assessment, request the technical opinion of any entity of the Federal Government, or even consult external experts should it be required. In this case, the project promoter will be notified of the purposes of the consultation by SEMARNAT.

Depending on the magnitude, nature and consequently the potential geographical range of impact of the project, the EIA required by SEMARNAT can be categorized as “Particular” or “Regional”. In general, aquaculture projects of more than 500 ha are required to submit a “Regional” EIA.

Where highly hazardous activities are involved, the EIA must include a risk analysis which contains preventive scenarios and possible mitigation measures.

If the project promoter makes modifications after the official authorization is issued, He must request a specific additional authorization from SEMARNAT for such

FIGURE 1

Schematic representation of all official environmental impact assessments and biosafety risks analysis followed by aquaculture project promoters in Mexico. (Note: environmental impact assessment is a responsibility of SEMARNAT. Numbers represent the approximate time period before the step of the procedure is finalized or resolved).

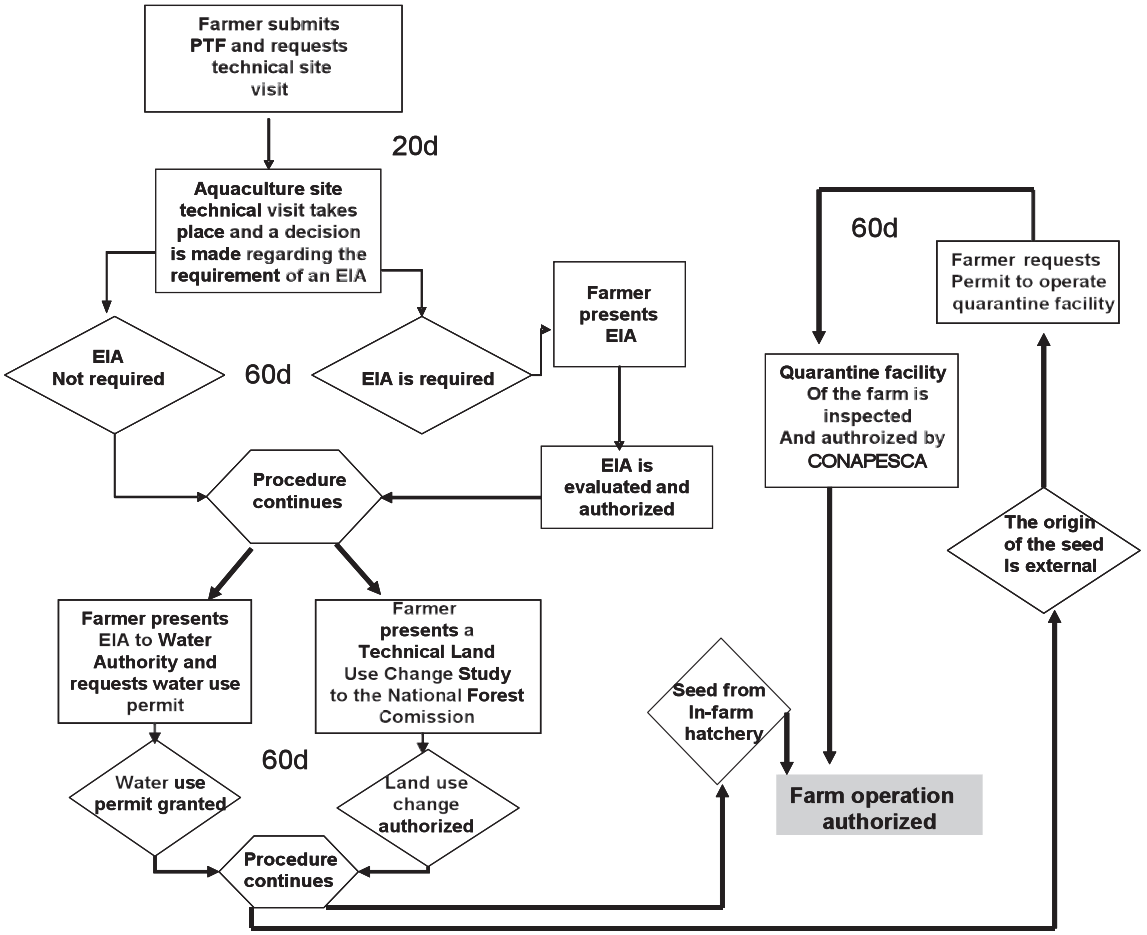

TABLE 2

Summary of zones and activities related to aquaculture for which an EIA is required in Mexico

Zone	Type of activity, infrastructure for which an EIA is mandatory	Chapter of the EIA Code 30-05-00
Mangrove areas, wetlands, coastal lagoons, lakes, rivers and littoral zones.	All anthropogenic activities except for self consumption fisheries and the construction of single family housing structures by native dwellers using local materials.	5-R
Protected Natural Zones	All anthropogenic activities except for self consumption fisheries and the construction of single family housing structures for native dwellers in buffer or peripheral zones.	5-S
Fish recruitment and nursery areas	Fishing activities in oceanic, coastal and inland waters that serve as recruitment and nursery areas dwelled by species under special protection.	5-T
Aquaculture operations in national waters or critical ecosystems	Construction and operation of aquaculture farms that involve the modification of habitats, use of common waters and discharge of wastewaters into natural waterbodies. Production of aquaculture seed in hatcheries, with the exception of species native to the ecosystem that becomes the water source and discharge point, and no chemicals are utilized. Seed production of exotic species. Placement of artificial reefs of any material.	5-U

changes. Depending on the nature of these modifications, a new EIA can be requested by the authority.

Finally, all Mexican states have enacted their own environmental legislation and many of them have a State Secretariat that deals with environmental protection. Furthermore, in states where aquaculture is one of the most important economic activities, such as the State of Sonora, a specific aquaculture law has been enacted. According to the LGEEPA, states have the authority to also request an EIA, in coordination with municipalities, whenever an activity or project is likely to affect local areas that are not exclusively reserved to the assessment of the federal government.

Additional permits required by aquaculture projects in coastal and marine areas

If the aquaculture facility is to be located on the coastal fringe or in open marine waters, a request for a coastal land use concession has to be made in the first case or, in the latter case, the EIA and its corresponding resolution issued by SEMARNAT, have to be presented and approved by the Secretariat of the Navy (SEDEMAR, its acronym in Spanish), which in turn revises it according to the Regulatory Framework to Prevent and Control Marine Pollution Caused by Wastes and Spills Act.

Related "soft laws"

CONAPESCA has stimulated the creation of regional and national systems which integrate all elements of both production and commercial chains for a given aquaculture product. These are called "product-systems". The most important aquaculture species of the country (shrimp, tilapia, carp, rainbow trout and oysters) have a product-system.

The National Service of Animal Health, Food Safety and Agri-foods Quality, is the official agency responsible for certifying that aquaculture products are cultured employing good management practices, processed under strict sanitary conditions and are safe for human consumption.

This agency has developed a series of best management practices manuals (BMPM) for both culturing a number of species and processing aquaculture products. These manuals are aligned with international standards and are intended to improve the sustainability of aquaculture projects, as well as maintain the quality and safety of aquaculture food products (Plate No. 1)

It is through product-systems and voluntary certification programmes that environmentally sound aquaculture practices and BMP codes are being agreed and introduced by farmers associations. Although not mandatory within the national legal framework, failure to comply with such codes could leave farmers out of the export chain.

Some state aquaculture agencies (i.e. the State of Sonora Institute of Aquaculture), as well as some aquaculture farmers organizations, in particular shrimp farmers, have

PLATE No.1

Examples of Best Management Practices Manuals for rainbow trout culture, molluscs culture and fishery and aquaculture processing, published by SENASICA

developed their own codes of conduct for responsible aquaculture practices, which are being intensively stimulated and are gradually being incorporated into the Mexican states legal frameworks (Alvarez and Avilés, 1995; Alvarez, 2000).

Citizen Participation

The Secretariat (SEMARNAT) publishes a weekly list of all authorizations (licenses) granted, including those pertaining to aquaculture projects. Recently enacted laws of transparency and access to information, allow any Mexican to get access to and consult all information regarding EIA and environmental licensing, unless specifically requested by the project promoter, upon demonstration that disclosure of his project information could affect industrial property rights.

The Mexican environmental framework also includes the participation of Regional Sustainable Development Councils. These are constituted by representatives of all sectors of society, namely chambers of commerce; non-governmental organizations (NGOs); academics; farmers associations; government officers and any other socially relevant group member. These Councils are consulting groups and might intervene in the decision of granting environmental licenses or aquaculture permits if asked by the corresponding authorities.

If the project is of a magnitude or nature such that public interests could be affected, a public hearing could be organized by the local environmental authorities, thus seeking a social consensus.

Checking the practice

MONITORING

As far as the actual follow-up of the environmental mitigation actions imposed by environmental authorities on aquaculture projects is concerned, in all of the countries reviewed, legal frameworks dictate that the project promoter is responsible not only for compliance of those actions, but also for timely informing of the authorities of every step taken in this direction.

Environmental laws in most countries state that the Environmental Impact Assessment should include a monitoring scheme either for impact mitigating actions or for early warning strategies (i.e. possible ecological disturbances of areas surrounding the project).

The regulatory framework of Brazil, Honduras and Mexico, establish general reference official norms, especially those related to wastewater discharges. Moreover Brazil and Mexico have specific norms to ensure that aquaculture practices are carried out with a minimum impact on the environment (Borghetti, Ostrensky and Borghetti, 2003).

In the case of Brazil this is through norms, while in Mexico it is through guidelines and in Colombia through the Environmental Management Plan. In the remaining countries (Honduras and Ecuador) no norms or regulations were found on the matter. Nevertheless, there is a possibility that the monitoring subject is stated in other instruments that were not found/analysed.

The process of environmental monitoring varies greatly from country to country. However, the lack of a standard that governs the sampling methodology appears to be a common denominator in the subject countries. All the people surveyed for this report mentioned that there are no methodologies specified by the authority. In some cases, there were some recommendations to take into account but there was no obligatory law to follow.

BRAZIL

The Environmental Impact Assessment of Aquaculture Projects

Environmental Impact Assessment Studies are drafted according to the following guidelines:

- consider different options for the development of the project (technology and location);
- identify and assess potential environmental impacts;
- define the project area of influence;
- consider governmental plans and programmes concerning the area of influence.

Moreover, the preparation of the study must at minimum involve the following activities:

- environmental diagnosis of the area of influence;

analysis of environmental impact of the project and alternative options;

mitigation measures;

- monitoring programme.

On the other hand, Environmental Impact Reports (RIMAs) contains at minimum:

- project objectives and justifications;
- description of project and alternative options;

- summary of results of environmental diagnosis of the area of influence;
- description of probable environmental effects on the area of influence;
- characterization of future environmental quality of the area;
- description of expected positive effects of mitigation measures;
- impact monitoring program;
- indication of recommended alternative option.

Environmental Impact Assessment and associated Report of Environmental Impact (EIA-RIMA) in Brazilian aquaculture can be undertaken individually at farm level or at local level through government strategies to plan and manage aquaculture development. Although Brazil has specific regulations about EIA, these are very broad and general and encompass all potentially impacting activities. They do not contain specific criteria or environmental assessment applied to aquaculture. In spite of this, aquaculture EIA procedures can be found on state and federal regulations to obtain an environmental license to aquaculture.

At individual level, investors that want to develop aquaculture on federal waterbodies (i.e. exclusive economic zone – EEZ, federal rivers and hydroelectric reservoirs) must submit an application according to the Decree n° 4.895/2003, which regulates the use of federal waterbodies to aquaculture, and the Inter-ministerial Normative Instruction (INI) n° 6/2004, which sets complementary norms, provide the application forms and details the procedures to obtain an aquaculture lease permit. INI n° 6/2004 sets the requirements for different classes of aquaculture projects, including research projects, demonstration units for training purposes, commercial aquaculture and areas for allocation of multiple farmers, called aquaculture parks. Aquaculture parks are defined on Decree n° 4.895/2003 as "Continuous physical space on aquatic environment, which encompasses a set of aquaculture areas and where other activities compatible with aquaculture can also be realized." These two regulations also foresee the delimitation of preferential areas for small-scale aquaculture, defined in the same decree as "Areas where allocation priority will be given to traditional communities attended by social inclusion programs".

Any change in the condition of the project or permanent data must be communicated within 60 days to the competent SEAP State Office, attaching the relevant documentation. Furthermore, when the change consists of the incorporation of a new aquaculture unit, the application shall be filed with the SEAP Office of the state where the activity is established. This procedure is required for verification purposes and to either update the original registration or issue a new registration certificate.

For federal waterbodies, proponents of aquaculture areas and aquaculture parks projects must answer a number of items in order to obtain an environmental license, as summarized below:

Methods employed for EIA of aquaculture projects

There are no specific methodologies but the EIA must include: project characterization, evaluate the potential impacts of farm residues on local water quality, propose mitigation actions for each potential impact, provide environmental diagnostic, prognostic and strategies for control, compensate and mitigate impacts.

EIA report and its follow up

Project characterization

There must be a site selection justification, social and economic analysis, evaluation of alternative technology and siting, and proponent opinion about environmental issues and the possibility of non-realization of the project.

Technical characterization should include description and quantification of farming structures, justification of their distribution, information about project work force, stocking densities, feeding practices, feed conversion ratio, mechanisms to avoid feed

dispersal, farm management and operation, harvest procedures, control of escapes when farming exotic aquatic species, and environmental control program. For the latter, proponents must inform where the water sampling points will be and which parameters will be monitored, with their limits and description of analysis procedures.

Evaluate the potential impacts of farm residues on local water quality and propose mitigation actions for each potential impact.
Evaluate regional effects, with an analysis of their relation to governmental programs and aquaculture legislation for the region. Evaluate project compatibility with federal and state coastal management programs, reservoirs conservation programs and with the needs of other aquatic resource users.

Environmental diagnostic
This should include; definition and characterization of project surrounding areas, with information about water level amplitude for freshwater reservoirs and tide range for marine or estuarine areas, identification of potential pollutant activities that may affect the quality of water used in aquaculture.

There should be analysis of possible interactions, synergic and cumulative impacts with other aquaculture projects already installed in the same waterbody. For freshwater aquaculture an analysis of carrying capacity of the aquatic resource for aquaculture development should be undertaken.

Description of climatic conditions, aquatic resources, hydrodynamic processes and water quality, with measurements of the following parameters: pH, temperature, salinity, turbidity, dissolved oxygen, phosphate, nitrogenous compounds, oxygen biochemical demand, chlorophyll a, total and fecal coliforms.

Biota characterization with information about aquatic and terrestrial fauna, presence of exotic species introduced or established in the waterbody, description of phytoplankton community, information about endemic and endangered aquatic species and identification of environmental conservation units present in the region.

Socioeconomic characterization of the area influenced by the project, identifying rural and urban areas, navigation routes and tourism and leisure areas, fishing grounds, use and occupation of surrounding land areas.

Environmental prognostic
This component includes: evaluation of positive and negative impacts, their intensity and duration, stating if they are permanent or cyclic, reversible or non-reversible, local or regional. Impacts must be identified, measured and evaluated for the setup, operational and decommissioning phases of the project, and must cover physical, biological and socioeconomic issues.

Strategies for control, compensation and mitigation of impacts
Based on the environmental prognostic, proponents must describe actions and management practices that will be adopted to minimize or eliminate the negative impacts during the different project phases, with clear definition of tasks and responsibilities. Such strategies should also encompass environmental monitoring programs for water quality and other aspects when necessary.

Law Enforcement

The Brazilian constitution establishes in article 225, section VII, 3, that people or companies that engage in projects or activities considered harmful to the environment, will be subject to penal and administrative penalties. Those found to be causing harm will be obliged to compensate for the damages caused. (*Constitution of the Federal Republic of Brazil, 5 October 1998).*

Difficulties, constraints and some opportunities

The Special Secretariat for Fisheries and Aquaculture in Brazil (SEAP) created a National System for the Authorization of Aquaculture in Union Waters (Sistema de Informação das Autorização de Uso das Águas de Domínio da União para Aqüicultura - SINAU) using GIS to manage the concession of aquaculture areas in federal waterbodies (http://200.198.202.145/seap/sinau_web/html2/index_intro.html).

So far, 1 357 applications for aquaculture projects have been analysed – 652 for marine and 704 for inland aquaculture. By July 2008, only two individual proposals (0.01 percent) were approved by all authorities involved in the analysis process. This low approval rate demonstrates the enormous difficulty in the access to natural resources by small-scale farmers. Another 16 proposals of aquaculture demonstration units obtained permission for installation; however, the application process for demonstration units follows simplified analysis and does not require an environmental license to be issued.

On the other hand, the Ministry of Fisheries and Aquaculture in Brazil is currently making significant investments on aquaculture planning to demarcate aquaculture parks in federal hydroelectric reservoirs and coastal areas. This should facilitate access by aquaculture farmers to inland and coastal waterbodies, and at the same time ensure better analysis of the cumulative and additive impacts of multiple aquaculture farms located in the same area. Six parks are already approved.

There is a specific regulation to guide the elaboration of studies to demarcate marine aquaculture parks. The Normative Instruction n° 17/2005 sets the criteria and procedures for the elaboration and approval of Local Plans for Marine Aquaculture Development (*Planos Locais de Desenvolvimento da Maricultura – PLDM*), in order to delimitate coastal aquaculture parks and preferential areas for traditional communities. Normative Instruction n° 11/2008 provides some improvement on the guidelines for the PLDM elaboration, with more guidance on GIS products that must be developed in the plan, and procedures to select suitable areas for the aquaculture parks. The process begins with a strategic environmental analysis at local level, with the identification and localization of environmental reserves, review of users of coastal resources (navigation, leisure, tourism and fishery grounds), detailed environmental characterization of selected marine areas and surrounding land activities that might negatively impact aquaculture development, logistic consideration and biological requirements of target aquaculture species. Once elaborated, draft versions of the PLDM are discussed at state and local committees with participants from the environmental agencies, navy, universities, fishermen and aquaculture organizations, extension agencies and NGOs. A similar approach is used in the demarcation of inland aquaculture parks, although there is no specific regulation as for the PLDM for marine areas.

For inland aquaculture, the main hydroelectric reservoirs have been the object of studies to demarcate aquaculture parks (Plate 2). These studies include carrying capacity analysis according to the method proposed by Dillon and Rigler (1974) adapted by Beveridge (1987). The method requires information about Phosphorous content on feed and fish body, food conversion ratio, sedimentation rate and residence time to calculate the sustainable stocking density of each reservoir. The planning process also includes the development of a GIS for the selection of suitable areas and demarcation of aquaculture parks. An example of GIS developed for one major hydroelectric reservoir can be viewed at http://ecologia.icb.ufmg.br/~rpcoelho/Parques_Aquicolas/website/index.htm or http://200.145.243.69/parqueaquicola/index.php. Table 3 shows the total area of the six main reservoirs, the estimated carrying capacity for tilapia production, number and area of demarcated aquaculture parks and some social and economic indicators.

For coastal aquaculture, the planning and management process through the PLDM is under development in 11 states and 77 municipalities along the Brazilian coastline.

PLATE 2
Six main Brazilian inland reservoirs with demarcated aquaculture parks.

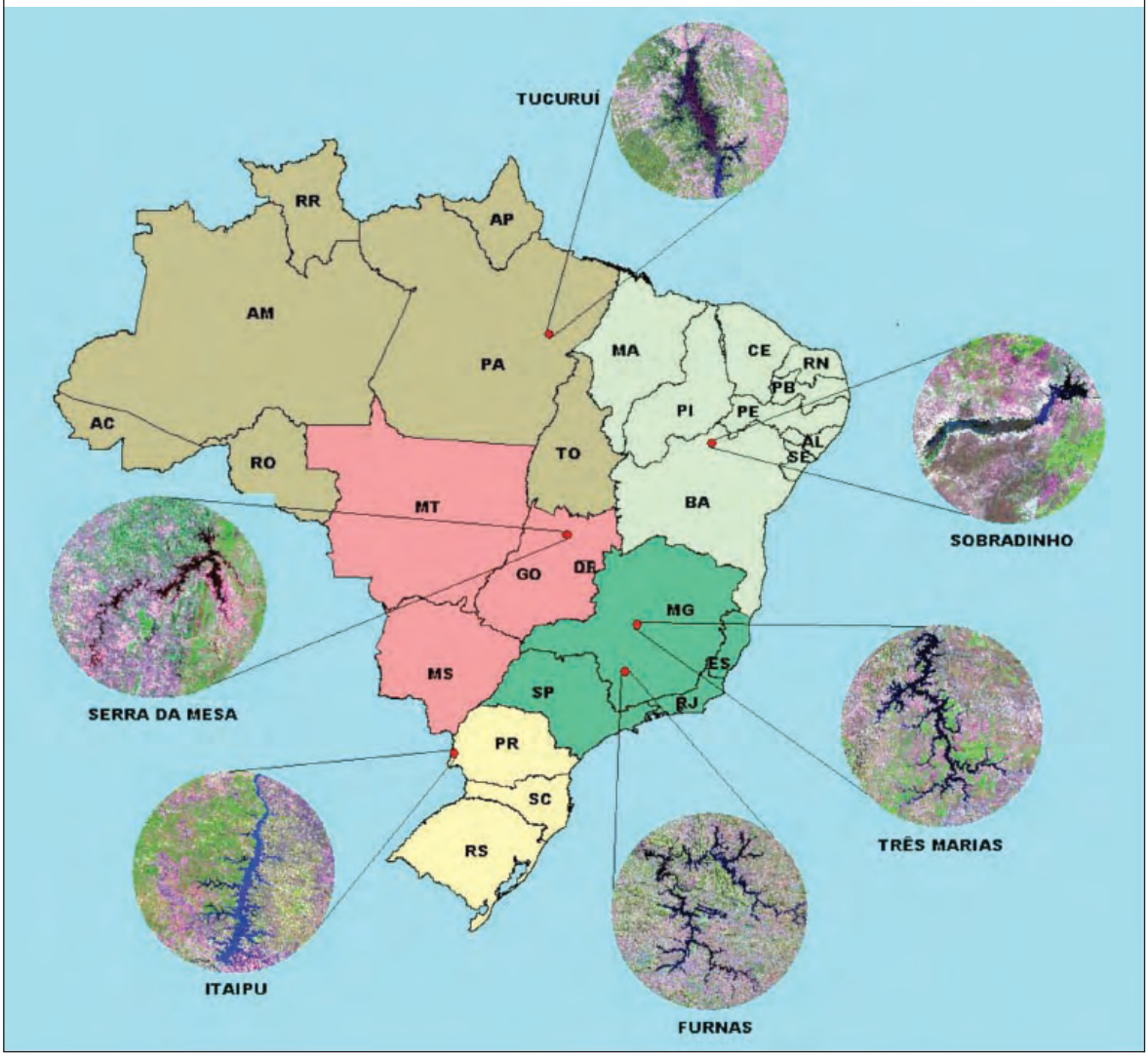

TABLE 3
Total area of the six main reservoirs, the estimated carrying capacity for tilapia production, number and area of demarcated aquaculture parks and some social-economic indicators

Reservoir name	Total area (km²)	Carrying capacity (Tons)	Aquaculture Parks	Aquaculture parks area (ha)	Families attended	Direct employments
Furnas	1 440	79 269	16	3 087	9 896	39 586
Ilha Solteira	1 195	104 105	14	1 813	8 996	35 986
Três Marias	1 090	55 875	5	3 040	5 630	22 520
Castanhão	320	32 000	3	7 307	3 224	12 896
Itaipu	1 350	6 038	3	11 289	608	2 432
Tucuruí	1 165	14 753	4	7 000	1 117	4 468
Total	6 560	288 380	45	33 547	29 471	117 888

The first PLDM approved, at Santa Catarina state, demarcated 36 000 ha of marine aquaculture parks with 2 420 ha of production areas for bivalves and seaweeds. These parks will regularize 800 aquaculture farmers already in operation and also plan the allocation of further production areas for 2 585 new farmers. Estimated direct and indirect employment generated with this action are 7 740 and 31 000 respectively. The GIS developed for the PLDM in Santa Catarina can be viewed at www.arcims.ciram.com.br/epagri/.

The demarcation process of marine aquaculture parks through the PLDM involves at least two public hearings at each municipality. There is also strong public participation through the state and local committees. Granting of an individual lease permit in federal waterbodies involves a public tender process with ample publicity before the area is allocated to the investor.

COLOMBIA

The Environmental Impact Assessment of Aquaculture Projects

The procedure for environmental licensing starts with an application that must be submitted to the Ministry of the Environment by the project promoter. The Ministry, in turn, determines if an environmental analysis of alternatives is needed. When required, this document must contain the following information:

- exact location of the project, its dimensions and approximate costs;
- general description of the project, providing information on the social and environmental conditions of the area of influence of the project;
- certificate from the Ministry of the Interior, stating that the project will be located in areas where there are no indigenous or Afro-American populations;
- the actual EIA.

The sections required for an EIA, are the following:

- project location;
- environmental management plan of the project;
- the biotic, abiotic and socioeconomic elements that may be negatively affected by the project;
- impact assessment;
- outline of the prevention, mitigation, correction and compensation plans proposed.

Environmental control and project follow-up

Control and follow-up of projects likely to generate environmental impacts is undertaken during all stages of a licensed project. The decisions of the environmental authority regarding unsustainable practices should be technically justified and must be adopted by the project promoter in a timely manner (Decree No. 1728, 6 August of 2002 by which is regulated the Title VII of the Law 99 of 1993 on Environmental Licensing).

In Colombia, aquaculture is not explicitly included in the regulatory framework of environmental impact studies, possibly due to the lesser surface area and production volume compared with agriculture or livestock. However, an environmental management plan established by regional environmental authorities, requests the producers to take a series of preventive measures such as the construction of septic wells to minimize solid and liquid wastes discharge into natural waterbodies and oxidation lagoons to avoid the escape of farmed fish.

The Colombian legislation demands farmers that use natural resources (i.e. water) to obtain a permit from the Autonomous Regional Corporation. Issue of the corresponding permit demands an environmental monitoring plan. The frequency of monitoring depends on the corporation; however, on average, it is done every six months both within the project (i.e. culture ponds) and in the area of influence of the project.

There are standardized methods that the environmental authority may request the producer to follow in monitoring physical, chemical and microbiological parameters. These have to be followed by the farmer and the corresponding reports have to be regularly sent to the environmental authorities. It is also requested that the monitoring process is carried out by certified laboratories.

CUBA

The Environmental Impact Assessment of Aquaculture Projects

Applications for an environmental license require the following information:

- macro location, including a certificate issued by the Institute of Physical Planning (*Instituto de Planificación Física*), when appropriate;
- micro location, including a copy of the site report issued by the Institute for Physical Planning;
- project surface area;
- detailed budget;
- general description of the natural and socioeconomic environment;
- quantitative and qualitative characterization of biotic and abiotic environments of the site;
- description of the feasible alternatives, if appropriate;
- description of the effluents and possible indices of pollution to be monitored;
- connection of the sanitary network to the nearest existing waste treatment system;
- technologies to be used and their contribution to "clean production";
- specifications regarding toxic chemical by-products and/or dangerous wastes;
- identification and description of the potential positive and negative environmental impact;
- prevention and mitigation measures for the identified environmental impacts;
- preventive measures for possible persisting effects at the end of the project;
- prevention measures for accidents;
- documentary evidences of the public hearing held to inform the community of the possible effects of the project;
- monitoring programme.

Within ten working days, the authority decides on each application. It can decide a) to grant a license, b) to request the presentation of an EIA within the following year, or c) to reject the application.

The decision as to whether the project requires the submission of an EIA or not, is based, among other things, on the criteria listed below:

- health risks for the community (effluents, waste and noise);
- negative effects on the quantity and quality of natural resources and on the integrity of the ecosystem;
- relocation of human communities, alteration of their life system or practices;
- proximity of the project to human communities, resources or protected areas that could be adversely affected and consequently affect the overall environmental value of the area;
- alteration of the scenic or tourism value of the area;
- alteration of monuments, sites with anthropological, archaeological or historical value and cultural heritage in general;
- public perception after public hearings;
- environmental solutions proposed.

Each EIA study must contain the following information:

- purpose of the project (i.e. social benefit, commercial, etc);
- feasible alternative projects;
- relationship between financial costs and environmental costs for each alternative option;
- characteristics and duration (i.e. temporary or permanent) of the potential effects on the environment, health and life quality of the community;
- prevention, mitigation and negative impact correction plan;
- characterization of the environment of the project area;

- conditions to ensure the sustainability of the natural resources used in the project;
- qualitative and quantitative description of the natural resources and other raw materials, as well as an estimate of effluents and emissions, if applicable;
- technologies to be used and their contribution to clean production if applicable;
- detailed description of the energy sources and an estimate of the demand;
- detailed programme of environmental surveillance and monitoring;
- evaluation of any possible negative impact outside the project area;
- description of contingency and risk assessment plans;
- measures established in case the project has to be abandoned;
- results of the public hearings held with local authorities and the community;
- an estimation of the probability of occurrence of the identified impacts.

Environmental monitoring of aquaculture farms

The Cuban legal framework does not explicitly oblige farmers to carry out environmental monitoring plans. However there are a number of instruments aimed at exhorting producers to comply with sustainable practices in their respective farms, the most important being the Environmental Strategy (ES), which is a Plan of Action elaborated at territorial, regional and sector levels. Fisheries authorities revise this plan of action annually and a State environmental inspection is carried out systematically to farmers to induce the compliance of the ES.

With regard to monitoring and control of environmental licensees in Cuba, article 14 of the Law of the Environment establishes that the Inspection and Environmental Control Centre is responsible for establishing and adopting specific methodologies for the process of environmental impact assessment. This organization acts as a law-enforcement body and provides control and assessment on the process of Environmental Impact Assessment through the Territorial Representation Offices (TRO´s) of the Ministry of Science, Technology and Environment. This entity also keeps the TRO´s informed on EIA resolutions, as stated by Decree 77/99.

ECUADOR

The Environmental Impact Assessment of Aquaculture Projects

The process begins with the notification to the Environmental Responsible Application Authority (AAAr) of the intent to develop a project. The AAAr will determine the following steps and ensure inter-institutional coordination. No specific reference is made to aquaculture in these laws. However, the Environmental Management Law requires that any activity entailing environmental risks is subject to environmental licensing and therefore to technical scrutiny.

The study must be prepared in accordance with the following guidelines:

1. presentation of the study (premises, objectives, scope, methodology, legal framework);
2. description of the project (structural, technical and managerial);
3. characterization of the area of influence;
4. environmental baseline (characterization of the physical, biotic, socio-economic and cultural environment prior to any modification);
5. detailed description of the alternative options to the project, if any;
6. comparison and environmental assessment of the alternative options (including option zero or no-project alternative);
7. technical and environmental justification of the selection of the best option;
8. identification and assessment of the environmental impacts of the selected option;
9. impact mitigation plan;

10. environmental management plan;
11. conclusions and recommendations;
12. bibliographical references;
13. annexes with maps and photographs;
14. name and credentials of the technical expert that drafted the study;
15. executive summary of the study.

Follow-up of EIA resolutions

In Ecuador, article 9 establishes that it is the Ministry of the Environment's responsibility to define a control and monitoring system for aquaculture projects, according to the norms and parameters to be followed as a result of environmental studies. Article 22 defines the environmental management system required for environmental impact assessments as well as the evaluation system for projects with an environmental license.

The actual evaluation of the degree of compliance of the environmental management plan approved for each aquaculture project is carried out through environmental audits practiced by independent consultants accredited by the Ministry of the Environment, in order to establish the corrective measures needed.

According to stakeholders surveyed in Ecuador, in reality, an obligatory environmental monitoring established by the environmental authorities for aquaculture projects that have been granted environmental licenses is non existent. There are neither norms nor procedures for environmental monitoring and the environmental authority only evaluates projects in the case of an environmental emergency or after social claims.

HONDURAS

The Environmental Impact Assessment of Aquaculture Projects

Projects classified as Category 3, require an EIA. The legal documents of the aquaculture company, a technical project description and an environmental diagnostic of the project site are submitted by the project promoter to the DECA, which undertakes a preliminary analysis.

DECA then summons the members of the SINEIA to formulate, collectively, specific terms of reference for the EIA. The EIA is carried out by independent consulting firms within a timeframe established in the corresponding terms of reference. Depending on the complexity and potential environmental risk posed by the project, DECA can also request the participation of the scientific committee of the SINEIA.

Once the terms of reference for the EIA are elaborated by the SINEIA, the project promoter is responsible for contracting an independent expert to carry out the EIA within the timeframe indicated by the authority.

The EIA final report is then submitted to the DECA for technical analysis in which the SINEIA might be involved. Depending on the nature of the project, public hearings can be requested in the terms of reference, and evidence of these are to be submitted along with the EIA final report.

Follow-up of EIA resolutions

Reference limits and intervals for key parameters that must be observed by the project promoter, are those stated in the official technical norms. Table 4 summarizes the two types of official technical norms that serve as reference points for aquaculture projects in the country.

Once the EIA is approved by the DECA, the environmental license is issued firstly for a period of one year, to ensure that all mitigation actions stipulated in the document of approval are complied with. After this period, if conditions are satisfied, the environmental license is renewed indefinitely but the project is subject to regular inspection.

TABLE 4
Official environmental technical norms that serve as frame of reference for aquaculture projects

Technical norms for wastewater discharges into natural waterbodies and into sewage systems	Parameters/ factors regulated of relevance to aquaculture projects	Observations
Water quality of wastewater discharged into natural waterbodies	Physical and chemical parameters, including DO; pH; temperature; TSS; TAN; TP; BOD; COD; heavy metals; PB; hydrocarbons; total coliforms load.	Given the general scope of the norms, maximum allowable limits of most parameters are much higher than the recommended for aquatic biota.
Technical norms for the use of wild fauna	Import/export authorizations; CITES certificates; collection of wild broodstock and/or juveniles.	Aquaculture is not explicitly mentioned in these norms, possibly because they derive from laws aimed at protected natural areas and sustainable use of forests.

Source: Secretariat of the Environment, Government of Honduras, available at: http://www.serna.gob.hn/institucional/legislacion/Documents/Normas%20Técnicas.pdf)

In Honduras, the Regulation of the National System of Environmental Impact Assessment establishes technical norms that serve as reference for the evaluation of projects and activities. Additionally, these technical norms are used as control mechanisms in technical audits. Article 71 of the Law of the Environment establishes that control and follow-up will be defined in the EIA resolution issued by the DECA and signed by the project promoter.

There may be an economic collateral deposit, usually required in cases of high environmental risk projects. This collateral might be required by the Secretariat of the Environment. This deposit is a condition for being granted the Environmental License *(Regulation of the National System of Environmental Impact Assessment 1993).*

MEXICO

The environmental impact assessment of aquaculture projects

According to Mexico´s Environmental Law (LGEEPA), the term "Environmental Impact Description" (MIA, in Spanish), is defined as …*"the technical document through which the potential environmental impacts of a given project are described, as well as the ways in which they can be mitigated.."*. Hence, as a first approach, the PTF, along with the technical project site visit, are sufficient to determine whether an in-depth EIA is required for an aquaculture farm.

This same Law defines the term Environmental Impact Assessment, as "… *the procedure through which the Secretariat (SEMARNAT) analyses the potential environmental impacts, and imposes the conditions under which a given project is allowed to operate in order to ensure that no ecological disturbances occur, nor pre-established limits to prevent environmental deterioration, are surpassed…"* This of course applies to aquaculture projects, for which a number of specific activities are listed within the law.

Methods employed for EIA of aquaculture projects

There are no official methods imposed or followed by the Mexican environmental authorities regarding EIA of aquaculture projects. However, a series of specific guidelines for EIA are provided to farmers and consulting firms. The phases in which SEMARNAT divides the EIA are presented in Table 5.

Once an EIA requested by SEMARNAT is elaborated and submitted, standard qualitative analytical procedures are applied by the EIA evaluators. Basically the following methods are suggested and employed:

- cause-effect standard impact assessment matrix;
- successive impact matrices;
- reciprocal action matrix (Leopold Matrix);

TABLE 5
Elements, analysis and phases of an environmental impact assessment recognized by SEMARNAT, Mexico

Phase	Involves
1. Description of the project as well as the preliminary actions involved.	General description of the project and activities involved, including those that take place before the actual operation. Technical attributes and environmental risks should be emphasized.
2. Breakdown of the project in its principal components	This is a logic detailed description of the four conventional phases accepted by Mexican norms: site preparation, construction, operation and abandonment, identifying possible environmental impacts.
3. Description of the environmental state of the site prior to its modification (ecological baselines)	General description of the physical environment, including the biotic and abiotic components, based both on relevant literature and in situ direct observations. This phase includes a description of the social and economic dynamics of the site and region where the project is to be developed.
4. Identification of the most sensitive environmental features of the project site	This includes an analysis of the degree of disturbance of the project site, or the existence of pristine zones in the site´s potential influence range; diversity and uniqueness of biotic elements; critically important ecosystem areas (i.e. nursery areas). This is carried out employing a systemic approach.
5. Analysis of the possible influence of the project on other development or environmentally sensitive areas	This involves the cross-analysis of possible overlapping of the project and its influences on other development projects or environmentally protected areas that can be incompatible.
6. Impacts identification	This phase defines all possible repercussions of each of the activities involved, and on what elements of the environment. Each identified impact is quantified and finally all impacts quantified are added up to yield an overall measure of the environmental impact of the project as a whole.
7. Alternatives	If there are more than one technical or geographical alternative to the project, these are analysed and compared trying to balance their environmental impact and the actual needs of the project. The environmental criteria dictate the resolution.
8. Mitigation measures	The final report must include a series of practical measures whose adequate and timely application, should ensure the sustainability of the project.
9. Residual impacts valuation	Externalities are carefully identified in assessing the project. This applies to all negative side effects of the project that were overlooked over the previous phases.
10. Control plan	This last phase involves the formulation of a thorough follow-up plan that includes the critical parameters to be monitored, the monitoring frequency, as well as the adequate indices that measure the effectiveness of the mitigation plan.

- overlap method;
- Batelle-Columbus Method (quantitative factor tree).

All these methods are recommended in the specific EIA guidelines for aquaculture projects, and the cross-application of all of them, constitutes the standard procedure for identification of possible impacts of aquaculture projects and decision-making. Some of the concepts included in EIA matrices, are presented in Table 6.

The EIA report and its follow-up

The actual resolution on the EIA presented by the project promoter usually includes a series of conditions aimed at mitigating the potential environmental impacts that were identified. These may include a wide range of considerations. Some examples include infrastructure modifications, strengthening biosafety measures, wastewater monitoring, recipient waterbodies ecological studies, potential predators control, etc.

The project promoter is thus obliged to strictly comply with such conditions. A copy of every EIA resolution is sent to the Environmental Protection Agency (PROFEPA, its acronym in Spanish), which is the entity with the legal responsibility of inspecting all project sites, to ensure that conditions stated in the EIA resolution are fulfilled.

Representation offices of SEMARNAT in every Mexican state, have the authority to assess and issue one of the following resolutions: a) a document stating that the aquaculture project does not require a further EIA and can thus operate if CONAGUA (the water authority) and CONAFOR (the Forest Commission) or any other governmental entity, have no technical or legal objections; b) the aquaculture

TABLE 6
Example of a standard Impact assessment matrix employed for the identification and estimation of the degree of magnitude of possible environmental impacts of aquaculture projects in Mexico. Each type of impact is categorized qualitatively as low, medium or high in magnitude

Activity	Impacts on physical resources	Impacts on ecological systems	Overall changes in the landscape	Social and economic aspects
Construction phase				
Vegetation clearing	Soil erosion; sedimentation; drainage and runoff; topography; surface and ground waters, etc	Habitat modification; biodiversity; ecological niches; migratory patterns; nursery areas, etc.	Overall aesthetic quality; social perception.	Net social costs and benefits for the community; health issues; employment; effects on the quality of life.
Operation phase				
Water exchange	Flooding; soil erosion; sedimentation.	Eutrophication of recipient waters; organic matter accumulation; changes in community structure.	Overall aesthetic quality; social perception; unpleasant odors.	Potential organic pollution of agricultural lands; potential availability of organic matter for fertilization of agricultural plots.
Closing down and abandonment of the project site				
Pond inter-connection	Flooding; runoff; drainage.	Habitat modification, migratory patterns; biodiversity; ecological niches.	Overall aesthetic quality; social perception; unpleasant odors.	Net social benefit of the creation of a wetland; health issues; access roads.

Source: H. Ricalde, SEMARNAT-Mexico, pers.comm. 2008

TABLE 7
Selection of official norms that have to be observed by aquaculture projects in Mexico

Norm code	Relates to	Factors/parameters included
NOM-ECOL-001-1996	Maximum allowable limits of physical and chemical parameters of wastewaters discharged into common use waters.	Water temperature; suspended solids; BOD5; Total Nitrogen; Total Phosphorus; heavy metals
NOM-059-SEMARNAT-2001	Native flora and fauna species protection; risk categories; criteria for inclusion/exclusion of species in the list of threatened or endangered species	List of species by category (threatened, endangered; subject to special protection).
NOM-062-SEMARNAT-1994	Strategies to mitigate the effects of land use change	Specifies a series of measures to prevent the total loss of vegetation cover around the project site
NOM-010-PESC-1993	Health requirements for imported aquaculture organisms	Health certification requirements for imported aquaculture organisms
NOM-011-PESC-1993	Norms to regulate quarantine periods and procedures for the import of live aquaculture organisms	Procedures to quarantine imported aquaculture organisms; specifications for in-farm quarantine areas; certifiable and notifiable diseases.
NOM-002-PESC-1993	Norms to regulate the capture of broodstock and postlarvae in waters of federal jurisdiction.	Procedures, season and marine zones for the capture of shrimp breeders and postlarvae.
NOM-EM-006-PESC-2004	Measures to prevent the dissemination of high impact diseases and the use of aquaculture antibiotics	Practical preventive measures to avoid epizootics. Lists of allowed and banned therapeuticals.

farm operation is authorized as long as mitigation strategies (stated in the document) are implemented and reported, or c) the project is not allowed to operate due to major environmental considerations.

There are a number of official norms (NOMs), as well as other instruments such as integrated territorial management plans and protected areas management plans, that determine both the maximum allowable limits of key physical and chemical parameters for aquaculture projects and the geographical limits for aquaculture projects. Table 7 presents a selection of official Mexican norms that have to be complied by aquaculture projects in Mexico.

Mitigating actions stated in the resolution may have to be made prior to, during and/or after the execution of the project, and a timeframe for the compliance of each of them is provided. In case of monitoring programmes (i.e. wastewater) a pre-established frequency is specified.

In all cases, the project promoter has the legal obligation to inform SEMARNAT within the timeframe stipulated in the resolution, about every mitigating action taken, and to produce a comprehensive report of the environmental monitoring programme requested by the authority. Failure to comply could lead to administrative (monetary) sanctions or might even be considered a criminal offence, depending on the magnitude of the potential negative effects.

The official standards for the environment and/or for fisheries and aquaculture (see Table 5 for examples) constitute legal references for preventing the disturbance of critical ecological processes, and hence become points of reference of EIA resolutions. Although many official aquaculture standards cover general aspects, the majority of them relate to the major aquaculture species, and in particular, to shrimp.

Law enforcement

The Federal Environmental Protection Agency randomly selects aquaculture projects that have been authorized by SEMARNAT to operate under mitigation conditions and carry out environmental auditing visits. Such site inspection visits are to ensure that all conditions are complied with in a timely manner. PROFEPA is the environmental law enforcement entity of the government and its authority includes the prosecution and sanctioning of project licensees that do not comply with EIA resolutions.

Difficulties and constraints

Despite gradual efforts to improve environmental law enforcement in Mexico, there are several drawbacks, especially in the field of aquaculture, which could be summarized as follows:

- PROFEPA, the environmental law enforcement entity of the Mexican government, has a critical shortage of trained staff to inspect aquaculture operations, many of which have been authorized to operate subject to mitigating measures.
- Many aquaculture projects, particularly those promoted by state or municipal governments, are treated with more flexible criteria than private projects, regardless of the environmental impacts detected. That is, social or political criteria are put above environmental protection.
- In order to foster aquaculture in many regions of the country, state governments have invested in basic infrastructure to create “aquaculture parks”, many of which have overlooked environmental externalities that affect even the farms that constitute the park themselves. This also makes it difficult to identify and make individual farmers accountable for environmental degradation.
- The pace at which aquaculture is growing in the country is much faster than the capacity building of the Federal Government in terms of EIA in aquaculture, thus depending on external sources for analysis. This can generate conflicts of interests, since many independent experts or academics consulted, are the same consulted and hired by the industry.
- Mid-sized and small-scale aquaculture farmers lack the economic capacity to modify their culture facilities and/or biosafety infrastructure. Nor do they have the capacity to incorporate better management practices. This, on the one hand, prevents their farms from operating in a more environmentally sound manner and on the other hand, prevents them from getting integrated in commercial chains that demand BMP certification.
- Small-scale farmers do not usually approach the environmental authority and therefore do not formulate an EIA. They are not enforced to do so, given

their marginal individual contribution to the national aquaculture production. However, the sum of the production of all small-scale aquaculture farms, in some cases highly concentrated in localized areas, is significant and consequently worth environmental monitoring.

- In-depth environmental risk analysis tools are not commonly employed or demanded by the environmental authority, even though many aquaculture projects require it. Consequently most decisions are made on the basis of the general information requested by the EIA guidelines.

Checking the effectiveness

APPRAISAL OF EFFECTIVENESS OF EXISTING EIA AND MONITORING REQUIREMENTS AND PRACTICES

The present review shows that there is a growing recognition in Latin American States and societies of the importance of formulating legal frameworks that stimulate sustainable production practices in general and, in some countries, in the aquaculture sector in particular.

The creation of specific norms and EIA guidelines for aquaculture projects indeed are significant steps, considering that aquaculture was a sector excluded from national development plans and the environmental legislation of many aquaculture-producing countries of the region up until the late 1980s. Some of the worst environmental impacts caused by aquaculture in the region took place during this decade, as a result of governmental actions aimed at fostering export-oriented aquaculture farms in ecologically sensitive zones (e.g. mangrove ecosystems) due to the lack of a systemic vision of aquaculture as a natural resource user, and the lack of recognition of the importance of introducing environmentally sound, sustainable production strategies.

Environmental impact assessment for aquaculture projects has only been recently applied as a decision-making tool in many countries of Latin America. Important aquaculture regions (e.g. shrimp farming in Guayas Province, Ecuador and the coastal fringe of Northwestern states of Mexico) expanded rapidly over more than a decade since the early 1980s, without having to submit an EIA nor having a clear picture of ecological baselines prior to the construction of aquaculture farms.

In more recent years, many farms have been set up within those same aquaculture regions but only after obtaining an EIA-based permit conditioned to the compliance of tough environmental regulations.

The above makes it difficult to assess the effectiveness of the application of EIA and monitoring requirements, given the lack of ecological baselines in aquaculture regions prior to the establishment of aquaculture farms and prior to the legal obligation of EIAs and environmental monitoring systems. Consequently direct "before and after" comparison is difficult.

However, considering the perception of some aquaculture farmers, researchers and regulators in Brazil and Mexico[1] (second and third larger aquaculture producers of the region), there seems to be a consensus that EIA tools have been effective at:

- bringing together all stakeholders of the sector in a participatory approach to the environmental impact assessment of aquaculture projects;
- creating the need for environmental experts in aquaculture-oriented EIA tools;
- identifying the potential environmental impact of aquaculture projects;
- generating a precautionary approach for aquaculture development;
- gradually generating a public perception of aquaculture as an activity that can be practiced in a more sustainable manner.

[1] Source: Telephone survey carried out to the following persons: M. Hipólito, aquaculture researcher at the Instituto Biológico, São Paulo, Brazil; O. Ribeiro; aquaculture researcher, Universidade Federal de Viçosa, Brazil; Hélio Guimarães, fish farmer, Aquahel, Ltda, MG, Brazil; M. Abraham, fish farmer, Acuícola Emmanuel, S.A., Yucatan, Mexico; R. Gonzalez, fish farmer, Yucatan, Mexico; H. Ricalde, officer responsible for EIA of aquaculture projects, SEMARNAT Representation Office in Yucatan, Mexico.

Some experts and stakeholders in the region (see Annex 1) perceive the EIA as another component of the country's bureaucratic burden and consequently they do not recognize its usefulness in real prevention of environmental impacts.

Some of the weak points of the EIA that regional experts identify are:

- unclear definition of the coverage and scope of the studies;
- lack of in-depth analysis results in a weak environmental management plan;
- lack of revision and evaluation mechanisms of both EIA and environmental monitoring;
- high tolerance of non-compliance by the existing regulatory mechanisms generates a lack of credibility in the system and impunity.

As far as the appropriateness of the EIA methods employed is concerned, both the guidelines and methods have in general been adopted from standard international methodologies such as the very early guidelines included in the US National Environmental Policy Act of 1970. Ever since then, multiple sector and activity-specific adaptations to the EIA (including aquaculture) have been made in all Latin American countries.

In general the type of information required by EIA guidelines and the methods employed are similar throughout the countries of the present review. Moreover, many international aid agencies (e.g. USAID) include EIA guidelines for Latin American countries; hence EIA terminology and assessment methods have become fairly standardized throughout the region and are familiar and common not only to regulators but to farmers themselves.

In countries where there are official environmental standards specific for aquaculture projects (i.e. Brazil, Mexico and Honduras), these are fairly general and sometimes meaningless within a particular geographic context, regardless of its aquaculture importance. For example, the upper limits stated in Honduran standards for wastewater discharges, are much higher than those generally recommended as safe to avoid eutrophication of natural waterbodies elsewhere.

Furthermore, there is no official mechanism for regular revision of these standards derived from systematic environmental monitoring of ecosystems affected by aquaculture practices. This makes the standards obsolete in many instances or out of context.

Even though there seems to be an increasing awareness by aquaculture farmers of the importance of EIA tools and monitoring systems, application of such requirements still appears to be more the result of law enforcement actions than a genuine environmental conscience of farmers. Hence data generated as a result of EIA is not fully utilized by farmers to the advantage of the sustainability of their projects, but rather as a way to comply with environmental regulations.

Direct participation of all stakeholders in the revision of the EIA and environmental monitoring legal frameworks is not common in the countries reviewed. However technical procedures, terms of reference for EIA and monitoring requirements for aquaculture projects, are elaborated by EIA systems that incorporate representatives of all stakeholders in countries like Honduras. No feedback mechanisms whereby farmers, environmental experts and regulators provide their views for improvement of EIA and monitoring requirements were identified in the countries reviewed.

However, there has been an increased demand by the general public to participate in the different stages of EIA and monitoring programmes of aquaculture projects. The increased participation contributes to the trustworthiness of the results, the viability of environmental decisions and to the transparency of the process.

Latin American governments have been creating opportunities specially intended for community participation in the process of environmental impact assessment projects, plans, programmes and policies. Some of them are:

- creation of specific participatory consultation committees in preliminary evaluations of projects in order to define the approach and scope of EIA studies;

- obligatory social participation plans during the elaboration of environmental studies;
- publication of both EIA studies and their results through mass media;
- public exposition of EIA results;
- legally established periods for communities to express opinions and make observations regarding projects in the process of obtaining environmental licenses.

In some countries like Mexico, citizen participation is fostered through the Regional Councils for Sustainable Development, where all stakeholders groups are represented and can have an influence on decision making with regard to project licensing or revocation.

In Brazil, the National Council for the Environment consists of official representatives, as well as the presidents of the national unions of Industry, Agriculture and Commerce, the National Union of Workers, the Brazilian Association of Sanitation Engineering, the Brazilian Foundation for the Conservation of Nature and two environmentalist NGOs. It is an organization that has critical functions with regard to the formulation of policies and norms. Also, the national Council of Hydrologic Resources is represented by users of water resources and sectors of the civil society. This council's principle function is to control the execution of the National Plan for the management of water resources.

In Colombia, the National Environmental Council promotes the participation of representatives of industry, NGOs and indigenous communities. Meanwhile, two NGO representatives hold seats in the Directive Councils of the regional independent corporations (the 33 environmental authorities at the regional level). Two seats on this council are presided by the private sector and two represent ethnic minorities. Six representatives of the local, regional and national governments are also a part of this council.

Suggesting possible improvements

LEGAL FRAMEWORKS

Generally speaking there seems to be a consistent and genuine response of Latin American governments to the demand made through international agreements (i.e. the Rio Summit) for adjusting and/or creating environmental legislation aimed at stimulating sustainable forms of production; introducing EIA tools and environmental monitoring systems; fostering environmental awareness of economic actors; and creating regulatory frameworks that facilitate law enforcement.

All of the countries reviewed possess environmental legislation that includes EIA as an analytical tool for decision-making regarding environmental licensing, although only Brazil, Ecuador and Mexico have specific guidelines for aquaculture projects.

There are only two countries, namely Brazil and Mexico that possess a specific fisheries and aquaculture law. This reflects the increasing importance of the aquaculture sector in these countries and the need for a specific regulatory framework. However, resource allocation for stimulating aquaculture growth and development is increasing, while financial and human resources allocated for the sustainable management of the sector by the government remain insufficient.

Some areas of opportunity detected as a result of the present review, are the following:

- There should be a pre-determined timeframe for the systematic revision of the environmental regulatory framework for aquaculture in every country, taking into consideration a) changes in the international legislation; b) growth rate of the activity within each country; c) changes in the ecological conditions of specific aquaculture regions; d) technological and scientific developments contributing to more sustainable methods of production; e) global and regional tendencies regarding BMP and environmental certification.
- Revision of the regulatory frameworks should be participatory, thus including all stakeholders within the sector.
- It would be wise to consider the creation of more specific (state or provincial) regulatory frameworks to respond to local environmental contexts and issues.
- All countries should create specific aquaculture standards as environmentally precautionary reference points, especially related to: water quality associated to wastewater; management of exotic species; use of prophylactics and of therapeutic drugs; quality of supplementary feeds and overall biosafety measures, among other aspects. Again it is important to take into consideration the national and regional contexts, to avoid generalizations.

Many governments of Latin American aquaculture-producing countries are being challenged by the pace at which the aquaculture industry is growing (15–30 percent per annum). This calls for an integrated vision of the sector, including the following aspects:

- Regional and subregional planning of aquaculture development, supported by research-based information on ecological baselines; aquaculture carrying capacity; meso and microregional geographic characterization in relation to species and systems of interests and regional and local land use.
- Capacity building of regulators in EIA of aquaculture projects, in particular in aquaculture regions, thus not having to depend on central environmental authorities for EIA. This will allow for a better understanding of the particular challenges of the sector and improve the dialogue with farmers.

- Decentralization of competencies in order to foster local decision-making in relation to environmental licensing, provided the technical capabilities of the staff have improved to match such a responsibility.
- Creation of systematic environmental monitoring programmes throughout coastal and inland ecosystems where aquaculture is present, in order to generate pertinent information in a timely manner for the sustainable management of the sector. These programmes should be included in the environmental legislation of each country.
- Identification of possible sustainability indicators and the ecological and production information required for their measurement, to incorporate them in the systematic monitoring programmes.
- Aquaculture authorities should encourage the creation of national and regional aquaculture development councils with the following objectives: a) to generate a common goal towards the sustainable development of the aquaculture sector among governments, NGOs, farmers, certifiers, environmental experts, etc b) to collectively monitor and share information on the development of global tendencies in more sustainable technologies, environmental certifications and international environmental legislation.
- Creation of national and regional (i.e. state, province, etc) environmental information systems for the aquaculture sector. This would involve specific databases fed with information derived from the environmental monitoring programmes and would eventually include the overall tendencies of sustainability indicators.

The aquaculture industry of the reviewed countries is based on high value species cultured for export markets. Analogous to other consolidated agriculture and livestock production sectors, a small percentage of the net revenues by export sales from aquaculture products could be channelled towards capacity building, environmental monitoring and the environmental information system. This could be a proposal emanated from the aquaculture development councils, thus including the agreement of aquaculture farmers.

Conclusions derived from the surveys indicate that one cause of the lack of effectiveness in monitoring is tied to the centralization of these processes and, in many cases, the lack of personnel in the governing institutions. In some other cases, a lack of execution capacity, lack of financial resources, dispersion of responsibilities in different institutions, forcing multiple tasks and a slowing down of the process are also significant factors.

Those surveyed relate the lack of follow-up and monitoring to budgetary problems and a lack of personnel at the institutions, distance of the sites, limited qualification of the existing personnel and the lack of standardized norms and procedures for monitoring. The little or reduced reliability of results and feedback is associated with the lack of standardization of methodologies for the collection of samples and analysis of the results, as well as the lack of systematization of the collected data.

According to those surveyed, the perception that exists amongst the producers is that the monitoring is not efficient because it is expensive and the results have little or no applicability. Additionally, the lack of education on these subjects is evident among the townships, which limits their effective participation.

In conclusion, we can say that in general abundant laws exist relating to the management of environmental impact. However, there is limited guidance and few standards relating to monitoring (methodology; frequency; qualifications). Without such standards, a legal base does not exist to ensure either the collection or the utility of the data. This means there is usually little basis for taking corrective measures where negative impacts occur. The problem is exacerbated by the lack of capacity in most countries to follow up and ensure compliance with any standards.

Furthermore, according to the surveys, there is limited correlation between the environmental problems and the requirement of monitoring, which in many cases causes the producers to view this as bureaucracy, as opposed to information required to solve or to prevent environmental problems.

Recommendations

Since ample environmental legislation exists in the subject countries, efforts should be focused on the development of operative technical instruments that ensure their success.

1. Economic instruments should be considered to stimulate the fulfillment of environmental norms and the application of follow up monitoring.
2. The processes involved in the decentralization of environmental management in this region should be deepened and oriented to organize monitoring systems that when coupled with shorter distances and increased relevance to the zone of study will prove more efficient.
3. A gradual increase in citizen participation should be promoted and reinforced through publicity, activities, and training. Priority should be given to local participants, for a greater and more efficient impact.
4. The countries involved in this study should combine higher level management to underpin ecosystem services with planning and management of administrative systems at the state level. This implies the development of joint work mechanisms between institutions at different levels, incorporating environmental criteria in regional decisions.
5. The governing institutions should develop a greater association with the agencies that define parameters, and they should obtain a more scientific analysis and interpretation of the data generated from monitoring. They should promote investigations that contribute to the solution of the problems, thus obtaining feedback directly from the participants as well as a reduction of costs and a more effective flow of relevant information.
6. Environmental management instruments such as guidelines and standards should be developed to promote consistency and efficiency. Standard methodologies and frequency of sample collection should be established, including to geo-referencing of sample stations.
7. Responsibilities and qualifications for monitoring should be clarified. Accreditation of ISO 17025 certified laboratories should be promoted to ensure the quality and trustworthiness the monitoring.
8. Governments should establish budgetary allocations sufficient to assure effective monitoring that contributes to improved environmental management and economic performance of the activity.
9. Reducing investment costs by focusing environmental impact studies on economic activities that represent a particular risk to the environment would also prove beneficial.
10. Develop processes in order to establish obligatory commitments and measures that derive from the results of monitoring.
11. The subject countries should assign resources and organize processes for human resources development. This would allow for more effective use of monitoring as a management instrument.

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ANNEX 1

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ANNEX 2

QUESTIONNAIRE ON ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MONITORING FOR AQUACULTURE

NOTE: Spaces can be expanded to fit your responses.

SECTION 0
BACKGROUND

1. Name:

2. Title:

3. Professional specialization:

4. Work area:

5. Country:

6. Institution you work for (ministry, research center, farm):

7. Electronic mail:

8. Fax:

9. Telephone:

10. Which are your country's three main aquaculture species?

11. How would you describe your role in the Environmental Impact Assessment (EIA) and Monitoring process? (indicate (x) for all that apply)

Role	EIA	Monitoring
Policy maker		
Regulator		
Scientist		
Researcher		
Industry representative		
Farmer		
NGO		
Other		
Comments:		
_____ _____ _____ _____		

SECTION 1
REQUIREMENTS

1. What are the requirements for Environmental Impact Assessments (EIA) in your country? What are the requirements to carry out farm monitoring?

2. What are the legal and regulatory requirements for?

   a. A proposal for a new farm development (new project)

   b. A change of practice in the established farms (i.e. expansion)

   c. Regular environmental monitoring (as carried out according to the particular legal regulations)

3. Information or direct sources for information on the matter in your country:

SECTION 2
VOLUNTARY AGREEMENTS

1. Which are the main methodologies used in the execution of Environmental Impact Assessments and Environmental Monitoring in your country?

2. Which are the law-based practices for carrying out the Environmental Impact Assessment and related environmental monitoring (i.e. practice codes, voluntary agreements, schematic certifications, etc.) in your country?

3. How is the Environmental Impact Assessment (EIA) carried out in the field?

4. In general, is there a requirement for the collection of data for the preparation of Environmental Statements? If so, which are the most common types of data that are required (e.g. benthic, side scan, nutrient concentrations, water currents, etc)?

5. Are initiatives for the application of models being used? If so, name examples.

6. If field sampling is required, are the sampling methods and equipment described in any procedure/norm? If not, are there any common standards?

7. Are there any norms or procedures for the degree of sample replication, identification of the number of stations and/or the length of the observation?

8. How is Quality Assurance addressed for field sampling and analysis? Is it established in any procedure?

9. Are there prescribed or standardized methods for data interpretation, analysis and presentation?

10. Have these methods been assessed for practicality and cost effectiveness?

11. Have Ecological Quality Standards been set for benthos or water columns?

12. Who is in charge of field measurements? (Farmers, consultants, regulators, researchers, NGOs, etc)

13. What are the most important constraints on monitoring practices? (Budget, expertise, bureaucracy, access to sites, etc)

SECTION 3
ASSESSING EFFECTIVENESS

1. Is there a general agreement on environmental protection between the industry, regulators and researchers, etc?

2. What is your opinion or personal evaluation regarding this?

3. Are there any feedback mechanisms for environmental monitoring, improved site selection, aquaculture performance and farm development? If there are, how do they work in practice, both at the individual farm level and regional or national level?

4. Are the prevention/mitigation/compensation measures recommended by the EIA process actually implemented? Do they reduce impacts on environmental quality? Please provide examples.

5. Have environmental quality objectives been set? Is there any effective environmental monitoring to assure they are met?

6. Is there an effective environmental monitoring that assures that these objectives are complied?

7. Are the legal requirements for EIAs, monitoring practices and procedures regularly reviewed? How frequently?

8. Do stakeholders have different perceptions of the effectiveness of the EIA process in comparison with the regulating organization's perceptions? If you are a stakeholder, please describe your views and those of others.

SECTION 4
SUGGESTED IMPROVEMENTS

1. Can you identify any constraints related to technical, scientific, financial, social and legal issues involved in the EIA process?

2. Can you suggest improvements which may be applied to these areas?

3. Which are the main needs of capacity building, development of competition and cooperation between producers, organizations, EIA and monitoring experts, regulators, NGOs, certifiers, etc. in your country?

4. Which are the most important environmental effects of the culture of the three most important species in your country? Please rank these with a scale of 1, 2 or 3. (1 being the most important issues and 3 being the least important issues).

Generic problem	*Rank (comments)*
Benthic / sediment effects	
Nutrients / water column / pelagic	
Medicines, chemicals	
Escapes	
Sea lice /diseases	
Other (describe)	

5. Are the most serious impacts well avoided or minimized with current EIA implementation in your country? Can you suggest any improvement to the EIA system and to other regulatory processes?

6. Do you have any other comments related to the way in which the aquaculture industry is regulated in your country?

SECTION 5
ENVIRONMENT AND NATURAL RESOURCES

1. Have new species been introduced in your country in the last ten years for aquaculture purposes? If so, which ones?

2. Do you possess any information related to mangroves and aquaculture (i.e. establishment, reestablishment, rehabilitation and usage for aquaculture?) Please provide quantitative data is you have it at your disposition.

3. Is the change of species culture appreciated in your country? Please provide quantitative data is you have it at your disposition.

4. Who else should we send this questionnaire to?

If you have any other comment that may contribute to this questionnaire, we would be pleased to meet you.

Thank you very much for contributing to this study.

ANNEX 3

PERSONAL INTERVIEWS

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Emilio Ochoa
Ecuador

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