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ABSTRACT

The worldwide growth of aquaculture over the last two decades has generated a lot of interest in the development of aquaculture in the Caribbean nations. However, unregulated aquaculture development can result in environmental degradation, negative impacts of exotic species on native species, and resource conflicts. The creation of national aquaculture plans by Caribbean governments is a prerequisite for the development of sustainable aquaculture industries in the Caribbean. The national aquaculture plan should identify the national goals for aquaculture development and actions for achieving those goals. Rules for regulating aquaculture development must be established and the lead regulatory agency must be identified. Policies for permitting and monitoring aquaculture enterprises should be clearly defined. By providing a framework for orderly development of aquaculture, governments can create an environment in which aquaculture can flourish in the Caribbean while protecting the public interest.

KEY WORDS: Sustainable aquaculture, Policies, Regulations

Políticas Regulatoras para Promover el Desarrollo de la Acuicultura Sostenible en el Caribe

El crecimiento mundial de acuicultura en la últimas veinte años ha generado bastante interés en el desarrollo de acuicultura en las naciones Caribes. Sin embargo, el desarrollo de acuicultura sin regulación pueda resultar en degradación ambiental, impactos negativos de especies exóticas contra las especies nativas, y conflictos de recursos. Creación de planes nacionales de acuicultura por los gobiernos Caribes es un prerequisite para el desarrollo sostenible de industrias acuícolas en el Caribe. El plan nacional de acuicultura debe identificar las metas nacionales para el desarrollo de acuicultura y las acciones necesario para realizar estas metas. Se debe establecer as reglas para regular el desarrollo de acuicultura y identificar cuál agencia tiene responsabilidad principal para su regulación.

PALABRAS CLAVES: Acuicultura sostenible, políticas, regulaciones

INTRODUCTION

The worldwide growth of aquaculture over the last two decades has generated a lot of interest in the development of aquaculture in the Caribbean nations. A successful and sustainable aquaculture industry would offer many benefits to the Caribbean countries. Aquaculture would provide desirable seafood products for island populations and would reduce dependence upon imported seafood products to meet the demands of the tourist industry. Aquaculture production could help relieve fishing pressure on threatened species, and might also provide a means of enhancing stocks of depleted populations. As a new industry, aquaculture would provide additional diversity to local economies and would offer new employment opportunities. Aquaculture also offers the potential for Caribbean nations to increase their export income.

However, poorly planned and unregulated aquaculture development can result in a number of problems, including resource conflicts, introduction of exotic species and diseases, genetic impacts on native species, and environmental degradation. The fragile island ecosystems and oligotrophic offshore waters present special challenges to Caribbean aquaculture project planners due to their sensitivity to nutrient discharges and other potential impacts of aquaculture production activities.

Governmental regulation of aquaculture is necessary to maximize the potential benefits and minimize the potential negative consequences of aquaculture development. Governments have an essential role to play in creating an environment in which aquaculture can flourish while protecting the public interest. The goal of regulating aquaculture is to provide an orderly and sustainable environment in which aquaculture can be developed (Ridler and Hishamunda 2001). By providing a framework for orderly development of aquaculture, regulations reduce negative externalities such as pollution or conflicts over water rights, land rights, and seabed areas caused by open-access property regimes.

In countries where there has been little effort to form a national aquaculture development policy, there has been little success in terms of growth of aquaculture (Wijkstrom 2001). In the interest of promoting sustainable aquaculture development, it is essential that each Caribbean nation develops an overall aquaculture policy. The aquaculture policy should be clearly stated in a national aquaculture plan. This plan will provide the basis for aquaculture legislation, and regulation. While national aquaculture policies will vary from one country to the next, there are essential elements that should be contained in each aquaculture plan:

- i) A definition of aquaculture,
- ii) Designation of the regulatory authority (or authorities) and a description of their responsibilities,
- iii) Identification of the rules that will govern the development of aquaculture,
- iv) A description of how aquaculture activities will be permitted and monitored, and how rules will be enforced, and
- v) Identification of the government's strategies for supporting and promoting aquaculture development.

Defining Aquaculture

The first step in creating a legal framework for regulating aquaculture is to provide a clear definition of aquaculture and to distinguish it from fishing activities. An important requirement for aquaculture is the principle of ownership of the stocks being cultivated (Pillay 1977). The FAO (1997) provides an unambiguous legal definition of aquaculture that firmly establishes this principle: "Aquaculture is the farming of aquatic organisms, including fish, mollusks, crustaceans, and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, and protection from predators. Farming also implies individual or corporate ownership of the stock being cultivated." The principle of ownership distinguishes aquaculture stocks from fisheries stocks, which are exploitable by the public as a common property resource. Unless government regulations clearly establish the principle of property rights of the aquaculturist to the cultured organisms, few entrepreneurs will be willing to accept the risk of starting an aquaculture business (DeVoe 1991).

Creation of a Regulatory Authority

An essential step in developing a sustainable aquaculture industry is to identify which agency will have regulatory authority over aquaculture. Because aquaculture impacts a wide variety of resources, aquaculture regulation may involve multiple government agencies. However, the regulatory process should only be as complex as necessary to adequately balance the needs of the government and its citizens (DeVoe 1991). A cumbersome regulatory bureaucracy may become overbearing and burdensome, stifling aquaculture development. To streamline the regulatory process, governments should centralize the regulation of aquaculture by creating or designating a lead regulatory agency (DeVoe 1991). This agency would have primary responsibility for all aspects of aquaculture policy, including permitting, enforcement of regulations, and aquaculture industry promotion. The lead regulatory agency should be able to provide clear and complete information about the permitting and regulatory processes to applicants for aquaculture permits (Van Houtte 2001). An effective strategy for streamlining the permitting process is to unite applications for the permits required by the various regulatory bodies into a single universal aquaculture permit application. In the U.S., many state governments, including Florida (FDACS 2002) and Mississippi (Mississippi Code 2000), have adopted one-stop permitting for aquaculture. The regulatory authority might be placed in the Department of Agriculture, since aquaculture is so similar to farming domesticated terrestrial crops and animals.

Establishment of Rules Governing Aquaculture

The purpose of governmental regulation of aquaculture is to encourage sustainable development of aquaculture while protecting the public interest. In fact, the concept of sustainability implies a balance of the needs of industry and the needs of society. The characteristics of sustainable aquaculture have been discussed by several authors (Tisdell 1996, Corbin and Young 1997, Ridler

and Hishamunda 2001). To be sustainable, commercial aquaculture should:

- i) Generate a stable return on investment competitive with similar alternate activities,
- ii) Conserve natural resources and biodiversity,
- iii) Minimize environmental degradation and pollution,
- iv) Utilize technologies appropriate for the species and the site,
- v) Minimize social disruptions and conflicts, and
- vi) Provide for community needs

The rules and regulations governing aquaculture should be carefully crafted to promote the goal of sustainable aquaculture. Traditionally, environmental regulation has been enforced using a “command and control” approach (Van Houtte 2001). With this approach, a set of codified laws establishes environmental standards that must be met and penalties for failure to meet the established standards. Usually the regulation does not mandate the technology that must be used to achieve compliance (Boyd 2003). This approach can be very effective, but only if adequate resources are available for enforcement (Van Houtte 2001, Boyd 2003).

A different approach to regulation is to require that aquaculture businesses adopt specific practices called Best Management Practices (BMPs) designed to minimize the environmental impacts of their activities. A BMP is considered to be the best and most practical method available for minimizing a particular environmental impact while still allowing production to be conducted in an economically efficient manner (Boyd 2003). BMPs are frequently developed by industry associations and stakeholders, then adopted by producers on a voluntary basis. However, in recent years some government regulatory agencies have required adoption of BMPs as part of the permit or licensing conditions (Bay 1995, FDACS 2002). Combining BMPs with required environmental standards may be the most effective regulatory approach to minimize the environmental impacts of aquaculture. With this combined approach, the environmental standard establishes the target, and the BMP establishes effective strategies for reaching the target.

Different sets of BMPs are not necessary for every aquaculture species. However, different types of production systems do require different sets of BMPs. For example, different sets of BMPs would be required for pond production systems, recirculating tank systems, flow through tank systems, and cage culture systems. The BMPs should address a full range of aquaculture activities, including:

- i) Site selection,
- ii) Facility construction,
- iii) Water resource utilization,
- iv) Effluent management and treatment,
- v) Feeding practices,
- vi) Chemical usage,
- vii) Disease management,
- viii) Genetic diversity of cultured stocks,
- ix) Collection of wild animals for broodstock and/or seedstock,
- x) Release of cultured organisms,

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- xi) Introduction and culture of exotic species,
 - xii) Procedures for natural disasters, and
 - xiii) Clean up procedures when closing the business.

Ideally, BMPs should be developed with stakeholder involvement (Sen 2001), including the different government regulatory agencies, aquaculture industry, aquaculture researchers, and environmental groups. It is not necessary to create the BMPs from scratch, as there are some very good existing BMPs that can serve as models. The Florida aquaculture BMP (FDACS 2002) was one of the first aquaculture BMP to be adopted into law by a state government, and has served as a model for other government BMPs. The U.S. Environmental Protection Agency (EPA) has drafted a set of BMPs (EPA 2002) to provide technical guidance for aquaculture production facilities to meet the requirements of EPA effluent limitations standards. The EPA BMPs are designed for recirculating systems, flow-through systems, and net-pen and cage culture systems.

Permitting and Monitoring of Aquaculture Activities

The aquaculture permit is the most effective instrument available to regulators for guiding the development of the aquaculture industry towards sustainability. The power to grant or decline license applications provides a means for governments to prevent undesirable aquaculture projects from being initiated (Howarth 1995). In addition, the permitting process gives the government a mechanism for placing conditions on the establishment of an aquaculture business. The permit may give the government some control over many critical aspects of aquaculture development, including where aquaculture can be practiced, what species can be cultured, what technologies are acceptable, and how potential environmental impacts will be mitigated. Requiring that aquaculture operations adhere to specified sets of BMPs as a permit condition should lessen the environmental impacts of aquaculture development.

Incorporation of Environmental Impact Assessments (EIAs) into the permitting process is another effective way of making sure that the environmental and socioeconomic consequences of an aquaculture project are identified early in the planning process, thus enabling proper environmental management measures to be incorporated into the project design and management (Phillips 1998, Pardee and Davis 2006). Such measures ultimately lead to more sustainable aquaculture development. The FAO (FAO Fisheries Department 1997) recognized the importance of EIAs and specifically recommended that governments should take measures to assure that environmental impact assessments are undertaken prior to establishment of aquaculture farms. However, the cost of conducting an EIA may be prohibitive for smaller scale aquaculture developments. Many governments exempt small scale projects from EIA requirements, reasoning that small scale projects are unlikely to have significant impacts on the environment (Corbin and Young 1997). The focus of EIAs on the environmental impact of a single enterprise may overlook the potential cumulative effects of many small-scale farms concentrated in one area. Problems of this sort may best be addressed through

an integrated coastal management approach (Phillips 1998).

Land tenure and water rights are key issues that must be addressed and resolved during the permitting process (Devoe 1991). This is especially true for projects in leased public areas where use conflicts may exist. If not, the aquaculturist faces an unstable and riskier environment which could undermine the viability of the operation. Leases should be of suitable size and duration to attract the industry. The leasing program should convey the necessary degree of exclusivity to minimize the risks of pollution, vandalism, theft, and other forms of encroachment, while protecting the rights of the public.

The process for reviewing and approving aquaculture permit applications should be as quick and transparent as possible. This reduces the potential for corruption and increases the likelihood of investment (Ridler and Hishamunda 2001). Transparency is created by publishing the details of the permit application review process. Deadlines should be imposed and each agency involved in the review process should screen only within its area of competence and jurisdiction.

The permitting process is only the first step in controlling potential negative impacts of aquaculture development. An effective framework for monitoring aquaculture activities and enforcement of the regulations is essential to ensure compliance with the conditions imposed by the aquaculture permit. In fact, weak enforcement, rather than the absence of regulations, may be the primary factor leading to unsustainable practices in aquaculture (FAO 1999). Operation of aquaculture enterprises without a permit or failure to comply with the conditions imposed by the aquaculture permit should be made a legal offence (Howarth 1995). Penalties for non-compliance may include warnings, fines, and revocation of the permit. Compliance is generally monitored by the lead regulatory agency through a combination of required reports, site inspections, and response to complaints from the public. Monitoring and enforcement of aquaculture regulations can be time-consuming and expensive. Therefore, the regulatory framework and monitoring systems should be kept as simple as possible.

Policies to Promote Sustainable Aquaculture Development

In most countries where successful aquaculture industries have developed, governments have implemented a variety of policies to stimulate aquaculture development. The following are some policies which can help stimulate aquaculture development.

Aquaculture leasing policies — Some types of mariculture projects by their very nature can only use bottom leases to culture organisms, such as clams and queen conch. Others such, as seaweed farms and cage culture of fish, need to use the water column. These types of aquaculture can only develop if governments create leasing programs to grant aquaculturist usage rights to publicly owned offshore areas. Coastal and offshore areas that are suitable for aquaculture should be identified, taking into account environmental sensitivity and potential conflicts with other uses. These areas can be zoned for aquaculture development as part of an overall integrated coastal management plan.

Investment incentives — A variety of policies can help stimulate investment in aquaculture projects. Many of the raw ingredients for aquaculture production, such as capital equipment items and feed, must be imported. Governments can help lower the cost of these items by waiving import duties for aquaculture businesses. Tax breaks can be offered to businesses for hiring local workers or for generating export income. Grants and low-interest loans can also be effective in stimulating aquaculture development.

Public support of aquaculture research — The rapid growth of the aquaculture industry over the last thirty years would never have happened without government support for applied aquaculture research. Aquaculture research is expensive, and new businesses cannot afford to conduct their own research programs. Aquaculture has flourished in countries such as Japan, Chile, Norway, and Thailand where governments have supported research to address industry needs (Corbin and Young 1997). Publicly funded research should focus on issues related to the sustainability of aquaculture.

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