Governance in marine aquaculture: the legal dimension

David R. Percy
Faculty of Law, University of Alberta
Edmonton, Canada
E-mail: dpercy@law.ualberta.ca

Nathanael Hishamunda
FAO Fisheries and Aquaculture Resources Division
Rome, Italy
E-mail: nathanael.hishamunda@fao.org

Blaise Kuemlangan
FAO Development Law Service
Rome, Italy
E-mail: blaise.kuemlangan@fao.org

Percy, D.R., Hishamunda, N. & Kuemlangan, B. 2013. Governance in marine aquaculture: the legal dimension. *In* A. Lovatelli, J. Aguilar-Manjarrez & D. Soto, eds. *Expanding mariculture farther offshore: technical, environmental, spatial and governance challenges. FAO Technical Workshop, 22–25 March 2010, Orbetello, Italy*. FAO Fisheries and aquaculture Proceedings No. 24. Rome, FAO. pp. 245–262.

ABSTRACT

In recent years, mariculture aquaculture, also called marine aquaculture or the rearing of animals and plants in brackish and marine environments including coastal, off-the-coast and offshore areas, is playing an increasingly important role in feeding humanity and making contributions to the economies of a number of countries around the world. Most mariculture operations occur in coastal sheltered waters, which are within national jurisdictions. Because marine aquaculture competes with many other activities close to the coast, operators increasingly tend to move fish farms to more distant areas while pushing governments to allow new operations further from the coast. This paper argues that, as aquaculture operations extend further offshore, and especially as they extend to the high seas, serious issues of law and governance arise. The general principle of freedom of the seas almost certainly includes the right to conduct marine aquaculture, but public international law affects mariculture only in minor ways. Mariculture is incidentally affected by a number of provisions of general international law and by treaties which were designed to deal with other problems, particularly those concerning fisheries or the marine environment. The existing applicable principles of international law and treaty provisions provide little guidance on the conduct of aquaculture operations in these waters. This results in a regulatory vacuum as aquaculture activities extend from a state's Exclusive Economic Zone to the high seas. There are a number of options to fill this vacuum. It is possible that states might extend existing regulatory regimes to mariculture operations conducted by their nationals on the high seas. It would be desirable to create a treaty concerning mariculture on the high

seas, but this is likely to be very long-term project. In the interim, the most promising approach would be to adapt a number of existing organizations and practices, such as Regional Fisheries Organisations and the FAO Code of Conduct for Responsible Fisheries (CCRF) to include mariculture.

INTRODUCTION

Aquaculture continues to expand more rapidly than all other animal producing food sectors at a time when there are increasing concerns about the maintenance of wild fish stocks (UN News Centre, 2003). It is also clear that a growing shortage of land and access to clean water threatens to impose limits on the growth of freshwater aquaculture. Both of these factors have contributed to a significant interest in the rapidly growing field of marine aquaculture (referred to in this paper as "mariculture"[1]).

Traditionally, mariculture was carried on in bays and inlets very close to the shore. However, mariculture is increasingly pursued at a greater distance from the shoreline and it is now feasible even on the high seas.

Inshore aquaculture[2] was always seen as a matter entirely within the national jurisdiction of the coastal state and posed few questions in international law. As mariculture extends further from the shore, it begins to have greater implications in international law and to create corresponding limitations on the sovereign power of the coastal state. When ultimately it is carried out on the high seas, the jurisdiction of the coastal state is almost entirely extinguished and any governing rules are found almost solely in international law.

The experiences of coastal states in managing traditional mariculture provide vital lessons as the industry extends further out to sea. The management of mariculture in national waters has exposed a myriad of governance issues relating to policy, legal and regulatory questions and administrative and institutional design. It is vital to bear these issues in mind when considering the potential problems posed by mariculture that is carried out far from the shore. Many of these issues remain equally important when mariculture moves to the high seas, beyond the jurisdiction of the coastal state. By definition, the coastal state does not have jurisdiction over the high seas, but most of the problems that arise from mariculture in national waters continue to exist.

This study is concerned with both national and international issues in mariculture that is carried out at increasing distances from the shores of the coastal state. The purposes of this study are to:

1. Make an inventory of the governance issues that arise from mariculture in national waters, determine widespread shortcomings in schemes of national regulation and suggest critical elements of successful governance schemes.
2. Examine the applicability of the critical elements where mariculture is carried out in waters beyond national jurisdiction and, where they are applicable, discuss how those elements can be imposed and enforced while still preserving the interests of developing countries.
3. Analyse the international and regional regimes that govern mariculture on the high seas, their shortcomings and problematic issues.
4. Suggest options to improve the governance of high Seas aquaculture, including policy, institutional and legal and regulatory mechanisms.

In order to achieve these purposes, the study will consist of four substantive sections on: (i) the impact of international law on mariculture; (ii) on national regulations of

[1] Some experts define mariculture as the rearing of animals and plants in the ocean only. Others describe it as a segment of aquaculture that takes place in brackish and marine environments including outside the ocean.

[2] Aquaculture carried out in the internal waters or territorial sea of a coastal state. These concepts are discussed in more detail in the following sections of this paper.

mariculture; (iii) on issues that arise in mariculture on the high seas; and (iv) a section that suggests options to improve the governance of mariculture on the high seas.

THE IMPACT OF INTERNATIONAL LAW

In contrast to the specialized body of international law that has evolved in the area of fisheries, there is no international law of aquaculture or mariculture.

Like many other activities, aquaculture and, especially mariculture, is incidentally affected by aspects of international law that were designed to deal with other problems. Mariculture can be affected by a number of provisions of general international law, such as the developing regime for the protection of the marine environment (Long, 2007) and by treaties. Many treaties create general obligations that can affect state management of mariculture. In particular, the 1982 United Nation Convention on the Law of the Sea (UNCLOS) requires states to prevent, reduce or control pollution of the marine environment from a number of specified land-based sources.

Although mariculture has not been the subject of treaties of general application, it has been affected by action taken and other treaties, particularly those that deal with fisheries or the marine environment. For example the Convention for the Protection of the Marine Environment in the North-East Atlantic (commonly known as the OSPAR Convention) has resulted in a number of initiatives designed to minimize the impact of aquaculture on the marine environment.

The OSPAR Commission has been active in identifying concerns about the impact of mariculture, seeking information from its Contracting Parties and calling on them to adopt the best available techniques and environmental practices (Long, 2007). Commentators have also noted that other treaties, such as the 1992 Convention on Biological Diversity, have potential application to mariculture (Wilson, 2004). In addition, codes of practice, such as the FAO Code of Conduct for Responsible Fisheries (CCRF), which have no binding legal effect unless incorporated into national law, can set out principles and standards for the development of marine aquaculture.

It is unlikely that inshore mariculture will often have sufficient international dimensions to conflict with international obligations of this nature. However, as coastal states permit mariculture at ever increasing distances offshore, there is a correspondingly greater likelihood that their activities will begin to be affected by international obligations.

International law deals with marine activities by placing geographical areas of the sea into a number of categories ranging from internal waters to the territorial sea to the Exclusive Economic Zone (EEZ) and ultimately to the high seas. The potential impact of international law on mariculture will be considered with reference to each of these zones.

Internal waters

The UNCLOS defines the territorial sea as the area of the sea that lies beyond a "baseline". The baseline is best understood initially as the low water mark of the coastal state (LeGresley, 1993). However, in order to deal with the variety of indentations found in a coastline, such as bays, estuaries, and fjords, the UNCLOS allows coastal states to determine where the territorial sea begins by drawing straight baselines that follow the general trend of the coast. All waters to the landward side of the baseline are the internal waters of the coastal state. The coastal state can exercise essentially the same rights of sovereignty over its internal waters as it does over land, subject to rare cases in which foreign vessels may have a historical right to pass through those waters. For the purposes of mariculture, the coastal state has the same freedom to regulate operations in internal waters as it does in respect of land-based operations.

The territorial sea

The UNCLOS is explicit in extending the sovereignty of a coastal state beyond its land and internal waters to its territorial sea (1982 UNCLOS, Art.2 [2]). At first sight, this principle suggests that there is no distinction between the jurisdiction of the coastal state over internal waters and its jurisdiction over the territorial sea. However, in the territorial sea, the sovereignty of the coastal state begins to be tempered by international obligations. Notably, ships of all states have the right of innocent passage through the territorial sea and the coastal state has the concomitant obligation to publicize navigational hazards.

This restriction only limits mariculture activities that might be a threat to navigation and, at most, it requires the coastal state to deal with the navigational aspects of pens and cages. The coastal state is entitled to legislate in order to protect facilities and installations, including mariculture projects, within the territorial sea, but it must give due publicity to its laws and regulations (1982 UNCLOS, Art.21[4]). International law does not impose other general restrictions on how the coastal state manages mariculture within the territorial sea.

The exclusive economic zone

The UNCLOS recognizes the existence of an EEZ, which extends 200 nautical miles (370.4 km) seaward from the baseline and can be claimed by the adjacent coastal state. Most states have claimed the maximum permissible EEZ, although in some cases it has been described as an Exclusive Fishing Zone. The differing terminology has no significant practical consequences.

The UNCLOS exhibits a greater international interest in the EEZ than in the territorial sea. The coastal state is not described as exercising sovereignty over the EEZ, but it has only "sovereign rights" for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters within the EEZ (1982 UNCLOS, Art.56 [1][a]). In addition, the coastal state has jurisdiction over the establishment and use of artificial islands, installations and structures (1982 UNCLOS, Art.56 [1][b][i]).

The sovereign rights to manage the natural resources of the EEZ undoubtedly allow the coastal state to establish mariculture operations in the EEZ. The right to establish installations and structures is accompanied by the right to establish safety zones around them which are sufficient to protect mariculture operations. Sovereign rights also allow the coastal state to regulate and manage mariculture as it sees fit, but the international interest in the EEZ has placed additional obligations on those regulatory and management rights. Those obligations and rights take two principal forms that deal with pollution control and the management of straddling and highly migratory fish stocks. Each obligation will be considered in turn.

The obligation to control pollution

An initial reading of the UNCLOS suggests that pollution in the EEZ is a matter for the coastal state alone, even if it has international implications. Article 56 (1)(b)(iii) states that within the EEZ the coastal state has jurisdiction with regard to the protection and preservation of the marine environment. However, developments since 1982 have shown that this provision can create rather than exclude international obligations by emphasising that where states have jurisdiction, they must exercise it in a manner that achieves agreed international purposes.

For example, the Rio Declaration, adopted at the United Nations Conference on Environment and Development in 1992 (U.N. Doc. A/CONF.151/26 [Vol. I]), incorporates both the theme of sustainable development and the precautionary principle. Principle 3 states that: "The right of development must be fulfilled so as to equitably meet development and environmental needs of present and future generations." Principle 15 provides that "where there are threats of serious irreversible

damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

Although not legally binding, these principles place a constraint on coastal states when exercising their sovereign rights under Article 56. They can undoubtedly permit mariculture activities, but they are obliged not to do so in a manner that threatens sustainability or the precautionary principle.

Migratory and straddling fish stocks

Articles 63 and 64 of the UNCLOS recognized that the sovereign rights of the coastal state within the EEZ had to be limited where they had an impact on highly migratory species and on fish stocks that migrated to and from the EEZ of the coastal state and another state or between the EEZ and the high seas. Both articles contemplated that these questions would be resolved by subsequent agreement. The agreement, commonly known as the Fish Stocks Agreement (1995) (U.N. Doc. A/CONF.164/37), was a major step in this resolution.

The Agreement has commanded a high degree of support, and places five requirements on the parties, which can limit their freedom to authorise mariculture activities within the EEZ. The relevant requirements are to:

1) adopt measures to ensure the long-term sustainability of straddling fish stocks and highly migratory fish stocks;
2) adopt, where necessary, conservation and management measures for species belonging to the same ecosystem;
3) minimize pollution, waste, discards and impacts on associated or dependent species;
4) assess the impacts of fishing, other human activities and environmental factors on target stocks and species belonging to the same ecosystem;
5) protect biodiversity in the marine environment.

The Fish Stocks Agreement addresses a number of issues that are often controversial in the management of aquaculture. It imposes legal constraints on how states which have acceded to the Agreement manage mariculture within the EEZ, because a failure to comply with these requirements amounts to a contravention of the Agreement.

The high seas

The high seas consist of those areas of the sea beyond the EEZ in which coastal states have no jurisdiction (LeGresley, 1993). Although states lack sovereign rights over the high seas, they have some well-defined freedoms and obligations.

All states have freedom of navigation and fishing on the high seas, as well as the freedom to construct artificial islands and other installations permitted under international law (1982 UNCLOS, Art.87 [1][d]). There is little doubt that the freedom to construct artificial islands and other installations is sufficient to permit mariculture operations that employ cages or pens on the high seas. Mariculture operations are permitted under international law, and intrude less on the management of the high seas than artificial islands or other installations. They are less intrusive than activities which are widely assumed to be permissible beyond the EEZ. Some of these include those activities that are intended to produce or support the production, transportation or transmission of energy. In the United States of America, they can be permitted by Congress on the outer continental shelf under Section 388 of the Energy Policy Act of 2005 (Eberhardt, 2005).

Although it is safe to conclude that mariculture can be carried out on the high seas, there is a clear obligation to ensure that it does not conflict with the rights of other states. In particular, the UNCLOS imposes many duties on states to preserve and protect the marine environment (Kalo, Hildreth and Christie, 2007).

Four of these duties are particularly relevant to mariculture on the high seas:

1) All states have an overriding obligation to protect and preserve the marine environment and to take all measures consistent with the Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source. The requirement for states to take anti-pollution measures is limited to using the best practicable means at their disposal and in accordance with their capabilities (1982 UNCLOS, Art.192 and 194 [1]). This limitation suggests that developing countries may be less accountable under these articles than their counterparts in the developed world.
2) States must take all measures necessary to prevent the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes (1982 UNCLOS, Art.196).
3) States are required, either directly or through competent international organizations, to monitor as far as practicable the risks or effects of pollution of the marine environment (1982 UNCLOS, Art.204).
4) When States have reasonable grounds for believing that planned activities under their jurisdiction or control may cause substantial pollution of, or significant and harmful changes to, the marine environment, they must, as far as practicable, assess the potential effects of such activities (1982 UNCLOS, Art.206).

Thus, international law emphasizes that, although mariculture can be carried out on the high seas under international law, its conduct is accompanied by significant international obligations. In this respect, mariculture is similar to other activities, such as shipping and fisheries, in which states can exercise their rights on the high seas, subject to rules derived from customary international law and treaties.

However, mariculture differs from those activities in two respects. Firstly, it is subject to international obligations that are far less specific than those applicable to shipping and fisheries. Secondly, it is relatively easy to trace international responsibility when offences relating to fisheries and navigation are detected, because ships are required to fly the flag of one state and assume the nationality of that state. The responsibility for certain offences is then assigned to the flag state. It is potentially more difficult to determine where the responsibility lies if mariculture on the high seas leads to a violation of one of the international obligations described in this section. In contrast to shipping, there is no requirement that cages or pens must be registered in a given state, to which it is then possible to assign responsibility for any violations of international law.

Two provisions of the UNCLOS alleviate this concern by allowing a link to be made between mariculture operations on the high seas and state responsibility. The Convention establishes the principle that a state is responsible for its nationals by providing that: "All States have the duty to take, or to cooperate with other States in taking, such measures for their respective nationals as may be necessary for the conservation of the living resources of the high seas" (1982 UNCLOS, Art.117). This provision is supported by a clear statement of the state's obligations:

- States are responsible for the fulfilment of their international obligations concerning the protection and preservation of the marine environment. They shall be liable in accordance with international law.
- States shall ensure that recourse is available in accordance with their legal systems for prompt and adequate compensation or other relief in respect of damage caused by pollution of the marine environment by natural or juridical persons under their jurisdiction (1982 UNCLOS, Art.235 [1][2]).

Although it may not initially be clear who is responsible for a particular mariculture operation on the high seas, once it is possible to identify the nationality of the operator, Article 235 establishes state responsibility to ensure that obligations for the protection and preservation of the marine environment are observed.

The following section discusses how states have exercised their jurisdiction by regulating mariculture in their internal waters, the territorial sea and the EEZ, with a view to examining, in the section on governance of mariculture on the high seas, how key elements of those regulatory schemes can be made applicable to the high seas.

THE GOVERNANCE OF MARICULTURE IN NATIONAL WATERS

The first part of this section this will set out the central issues involved in the governance of aquaculture, based on the experience of governments in enacting schemes for the regulation of mariculture in national waters over recent decades. The second part will identify common shortcomings in the governance of mariculture that threaten to prevent this form of aquaculture from achieving its full potential.

Governance issues

Establishing control: permit and licence systems

The cornerstone of any effective scheme to regulate aquaculture is the establishment of a licence or permit system. The underlying principle is that no person can carry on mariculture without first obtaining a licence from the state. The requirement of a licence confirms that the state has the right to regulate all mariculture activities and to prosecute those who carry on an operation without fulfilling the requirements. In particular, the requirement of a licence enables the state to directly regulate the operator of a mariculture facility, to enforce the basic rules of mariculture, to restrict the location and number of mariculture facilities and to obtain public input on projected developments.

These purposes are commonly achieved through the following techniques:

- Requirements of licences enable the state to assess the capacity of the applicant. For example, in Namibia, the Minister may examine the technical and financial ability of the applicant in considering an application for a licence (Namibia Act, s. 12[3][a]). Under the Norwegian Aquaculture Act of 2005, it is necessary for the applicants to demonstrate that they have the necessary professional qualifications, either through formal education or work experience, before obtaining a licence, including the necessary knowledge of how to prevent, detect and limit the escape of fish (FAO, 2012).
- Requirements of licences require applicants to show in advance how they will meet all regulatory requirements (Long, 2007) and can go so far as requiring the applicant to supply an economic guarantee to repair certain types of damage that might occur as a result of the mariculture operation (FAO, 2012).
- Requirements of licences enable the state and others to identify all the operators of aquaculture or mariculture facilities by maintaining a register of licences. The register can allow an assessment of all the rules applicable to those facilities by including copies of all licences that have been issued (Long, 2007), as well as, records of any transfers of licences. The most sophisticated registry system can also permit the registration of mortgages or other financial instruments which an operator has granted against the security of an aquaculture licence (FAO, 2012).
- Requirements of licences provide a means of enforcing the basic rules applicable to a mariculture operation through the attachment of conditions to the licence. Although it is preferable for the governing legislation to stipulate the most important rules relating to tenure and environmental responsibility, the conditions of the licence are appropriate for setting out site-specific requirements and incorporating codes of conduct that will govern the operation (Nambia Act, Section 14[4]).
- Requirements of licences enable the state to control the number of licences issued, so as to avoid excessive concentration of mariculture facilities, as well to supervise the geographical distribution of licences. This requirement can ensure that mariculture is established only in suitable locations and that interference with other activities is minimized (FAO, 2012).

- In almost all modern legislation, the requirement of a licence is used to obtain public input on the proposed operation. It is now commonplace for legislation to require the applicant to provide notice of its application to the public and to allow the members of the public to submit objections or representations to the ultimate decision maker (Namibia Act, Section 12[4]).

The selection of the site and the tenure of the operator

As indicated in the previous section, the licensing system provides a strong basis for ensuring that mariculture is carried out only at appropriate sites. The applicant should be required to provide information about the relationship of the proposed site to other sites and activities in the area and to any marine protected areas, as well as its relationship to other public activities (FAO, 2012).

In order to avoid a close examination of the appropriateness of the proposed site in every application and the dangers of discretionary decision-making, it is helpful if the government designates in advance areas of water that are suitable for mariculture. It is also vital that the licence, in combination with the governing legislation, clearly states the nature of the tenure of the operator to an extent that will allow the mariculture operation to be financed, to flourish over an extended period and to enable other people to be excluded from the area (Percy and Hishamunda, 2001).

The operator's exclusive rights to the site of the project can be realized in a number of different ways. Ireland vests ownership of the aquaculture resource in the licensee. In contrast to other marine resources, the relevant Irish legislation provides unequivocally that "the ownership of any fish... specified in the licence... vests in the licensee" (Long, 2007). The Norwegian legislation states that a person who holds an aquaculture licence has "exclusive rights to the withdrawal and capture of the released species at the site" and allows the relevant ministry to limit or ban any traffic on or other use of the site and adjoining areas, including fishing, where this is necessary to protect aquaculture production. Similarly, a licence in Namibia confers "an exclusive right to farm and harvest aquaculture products within the site defined in the licence" (Namibia Act, Section 14[2][3]).

The legislation must also address the length of the licensee's tenure. The Irish legislation allows the licensing authority to grant a licence for a period of up to 20 years, depending on the nature and production cycle of the aquaculture operation and the applicant's business plan (Long, 2007). Other countries give no guidance on the duration of a license, but leave that determination to the approving authority (Namibia Act, Section 14[4][j]). Under this model, it is vital for the approving authority to grant licences for a sufficiently long-term to provide the security of tenure that will encourage the development of the industry. Instead of relying on short-term licences, the regulator should retain control through its power to revoke licences if necessary upon the commission of certain specified offences. When dealing with the territorial sea or the EEZ, it is also important to ensure that the governing legislation grants the government the power to authorize the use of offshore waters by the licensee (Baur, Eichenberg and Sutton, 2009).

Measuring the environmental sustainability of the project

Even after an appropriate site has been chosen, the requirement to obtain a licence or permit prior to engaging in an aquaculture project provides the regulator with the opportunity to consider the environmental sustainability of the proposal. The threshold question concerns the extent of the information that the applicant must submit to enable the regulator to decide whether and under what conditions the proposal can be accepted.

Existing regimes for regulating mariculture in national waters provide a large range of requirements for the submission of environmental information in licence applications.

The requirements can be as extensive as a full environmental impact assessment or as minimal as the provision of a basic operational plan. It is important for the governing legislation to state explicit criteria for determining how much information an applicant must provide both to ensure that applicants are fairly treated and to recognise the great expense that can result from the requirement of an environmental impact assessment. National regimes tend to recognize the broad principle that an environmental impact assessment should be required only for those projects that create a genuine risk of environmental damage.

The European directive on environmental assessment provides an example of this approach. Applications for aquaculture licences are not automatically subjected to an assessment, but aquaculture belongs to a category of projects for which an environmental assessment is required if there are likely to be significant effects on the environment.

The potential for significant effects on the environment is measured by factors including the nature, size or location of the proposed project (Directive 85/337/EC, as amended by Directive 97/11/EC of 3 March 1997). National legislation implementing the European directive reflects this approach by subjecting only certain categories of aquaculture projects to an assessment. In Ireland, for example, an environmental impact assessment is required where an applicant proposes to introduce a new species into the marine environment. This is a common requirement in national regulatory schemes and is also found in Namibia, which requires an environmental assessment where a new or genetically modified aquatic organism is to be introduced into Namibian waters (Namibia Act, Section 7). This type of provision can be accompanied by a direction to the regulator to have regard to the likely effects of the proposed aquaculture on wild fisheries, natural habitats and flora and fauna (Long, 2007).

In Ireland, applicants are required to submit an environmental impact statement for other projects, because of their scale and location, as well as for certain classes of aquaculture where the regulator or, in some applications, the Minister, considers that the proposed project is likely to have significant effects on the environment. The applicant must make copies of its environmental impact statement available to interested parties (Long, 2007).

In Norway, the general principle is that an aquaculture licence will be granted only if the aquaculture project presented is "environmentally responsible". The application of this principle gives the relevant Minister the power to require that any applicant for an aquaculture licence shall conduct necessary environmental surveys and document the environmental condition of the site. As a general principle, an environmental impact assessment is required for large-scale aquaculture installations or hatcheries, if they are likely to have significant effects on the environment.

The Norwegian legislation also illustrates that type of information that an applicant must submit where the project is not subjected to a full environmental impact assessment. The Licensing Regulations require an applicant to provide information regarding the currents at the proposed site, a map of the proposed site and the results of an environmental survey of the sea bottom at the site (FAO, 2012).

In other countries, if the project is not one which attracts a mandatory environmental assessment, the governing legislation sometimes leaves the type of information to be submitted by an applicant to the discretion of the regulator (Namibia Act, Section 12[1]).

Control of water quality

The permit approval process provides an ideal opportunity to deal with any concerns about water quality arising from a proposed mariculture facility. Net pens or cages are used widely in offshore aquaculture and they can release high levels of solids and wastes, composed of feces, uneaten foods, antibiotics and pesticides. Virtually, all national regulatory schemes deal with wastes, although at different levels of detail.

At a basic level, some countries leave the control and waste subject to the discretionary inclusion of conditions in licences. Namibia permits the Minister to issue a licence subject to conditions relating to water quality (Namibia Act, Section 14[4][c]) and Ireland grants the licensing authority discretion to make a license subject to whatever conditions it thinks appropriate, as long as they are in the public interest. In the Irish legislation, the authority is specifically empowered to include conditions relating to the protection of the environment and the control of discharges (Long, 2007).

Other national legislation is much more detailed. In Norway, an applicant for an aquaculture licence is first required to obtain a permit to discharge waste water. The permit will require that residues must remain within acceptable limits (FAO, 2012). One of the most detailed regimes was contained in National Offshore Aquaculture Bills, which were introduced in the United States of America in 2005 and 2007. Although neither of these bills became law, they provided a very strong basis for regulating waste from mariculture operations.

The 2007, Bill would have subjected aquaculture facilities to the Clean Water Act, which directs the Administrator to issue procedures and guidelines for permitting aquaculture projects. The Environmental Protection Agency issued regulations under the National Pollutant Discharge Elimination System, which defined concentrated aquatic animal production facilities as point sources of pollution.

Following this development, the Agency established categorical effluent guidelines for the aquaculture industry. The strongest feature of the proposed system was its focus on requirements to minimize the release of pollutants, including the proper management of feed, the storage of drugs and pesticides and the disposal of feed bags, nets etc and the need to minimize the discharge of dead animals and parts. This preventive approach would have been supplemented by stringent siting requirements for new facilities and regular inspections (Powers and Smith, 2009). Despite the fact that this Bill has not become law, its provisions for dealing with waste are notable because they establish a close link between aquaculture and provisions of the Clean Water Act that are both powerful and effective.

Enforcement of the regulatory scheme

Virtually, all national legislation dealing with aquaculture or mariculture sets out a list of general rules for the conduct of operations and stipulates penalties that are applicable in the event of infractions. However, the rules can be almost meaningless unless they are accompanied by an effective enforcement scheme.

There is no substitute for legislative provisions that establish an adequately financed and effective inspectorate charged with the enforcement of the governing legislation. It is also vital that the legislation should provide the inspectorate with the basic legal powers required to enable them to carry out their functions, such as the power to enter privately owned facilities, inspect records, take control of evidence and take immediate remedial action where necessary (Namibia Aquaculture Act, Section 37). These powers are the cornerstone of an enforcement scheme, but it is necessary to face the reality that even in highly developed countries there are complaints about the lack of a specialized and effective inspectorate (Long, 2007).

The licensing system can supplement the governing legislation in a number of ways. It can augment the general provisions set out in the statute with more detailed rules applicable to individual operations. In practice, the supplementary rules have typically been used to deal with four issues in particular: the incorporation of codes of conduct applicable to the licensee; rules relating to the escape of farmed animals; the reporting and treatment of diseases; and emergency responses. In addition, licences can supplement the powers of the inspectorate by providing the information, foundation required for effective enforcement. Each of these topics will be dealt with in turn.

1) **Codes of conduct** – Legal regimes for the conduct of aquaculture are often supplemented by documents that may be known as codes of conduct, codes of practice or technical guidelines. The codes allow governments to address a problem which is pervasive, but which causes particular difficulties in developing countries. Limited budgets can mean that regulators are not equipped to insist on proper operational standards for individual aquaculture operations. The incorporation of a licence term which provides that operations must be conducted in accordance with a specified code of conduct can alleviate this problem, provided that there is some sensitivity to ensure that the guidelines contained in the relevant code are suitable to the needs of the particular country. The incorporation of a code into a licence is a useful means of providing the code with the force of law (Percy and Hishamunda, 2001).

2) **Escapes** – The initial decision on granting the licence should incorporate precautions to minimize the risk of escapes. The operational requirements of the licence often include an immediate duty to notify the regulator if there is a suspicion that fish may be escaping or if escapes have been detected and impose a duty on the licensee to take effective action in the event of an escape. The notification requirements are typically accompanied by supplementary provisions that require the licensee or authorise other persons to recapture the escapees, although these requirements may not be effective in practice (Long, 2007).

3) **Diseases** – Licence terms also tend to impose a duty of immediate notification if a disease occurs or is suspected in the area covered by the licence. This requirement may well be supplemented by a duty to report abnormal losses or mortality among the farmed stock. In addition, the licensee should be required to keep precise records of all chemicals and antibiotics that have been used in the aquaculture operation, together with the times at which they were administered (Long, 2007). In some jurisdictions, the regulations expressly forbid the movement of stocks when there is reason to suspect a contagious disease (FAO, 2012).

4) **Emergency responses** – The governing legislation frequently requires the licensee to keep an up-to-date emergency plan, although this requirement can also be contained in the terms of the license. The plan must typically deal with responses to escapes and disease, together with other eventualities such as sudden pollution, harmful water temperatures or invasions of algae or jellyfish (FAO, 2012). The licensee should be required to notify the regulator immediately if it becomes necessary to implement the emergency plan.

5) **Enforcement** – Even an ideal national regime for regulating aquaculture or mariculture is of limited use unless it is accompanied by the creation of an effective and efficient inspectorate. In practice, limited financial resources often constrain the ability of the regulator to fully supervise aquaculture operations. Although there is no substitute for effective inspection, the terms of the licence can help to make the regulations more effective. It is common to require a licensee to keep detailed records of operations for a specified period and to produce them to the regulator on request. The records can deal with every aspect of the operation and include matters relating to escapes, disease, chemicals and antibiotics are set out earlier. In addition, they can require the licensee to make and record inspections of specified aspects of the operation (FAO, 2012). These steps can be of great assistance to the regulator, although they require the active cooperation of licensee. Because of their importance, it is vital to ensure that licensees indeed keep the require records and to specify meaningful penalties if they fail to do so.

Common shortcomings in national regimes

The first part of this section used some highly developed national systems to explore major issues in the governance of mariculture. Even advanced systems of national regulation suffer from some recurring problems. In most jurisdictions, there is a fragmented approach to the regulation of mariculture and difficulty in assuring an adequate level of regulatory supervision. These problems are magnified in jurisdictions with less comprehensive regimes. In addition, in some schemes of regulation in the developing world, there are particular problems that involve the assurance of an adequate level of regulation at a reasonable cost and the need to ensure that the products of mariculture can be sold in markets in the developed world. Each of these shortcomings will be addressed in turn.

A fragmented approach

A fragmented approach is one of the commonest weaknesses in the regulation of land-based aquaculture. A proponent is typically required to obtain permits from a number of government departments and is subjected to a number of different statutes. Many countries recognise this defect and seek to overcome it by providing a single window system for obtaining the necessary approvals. Even this approach does not overcome the problems of cost and delay, unless a lead agency is established to take responsibility for an application and pilot it through the regulatory requirements (Percy and Hishamunda, 2001).

The problems of fragmentation are increased in offshore areas. Countries rarely have a comprehensive approach to the governance of the offshore; and so mariculture operations are likely to be subjected to many of the same agencies that regulate onshore aquaculture, with a further layer of requirements imposed by various marine authorities. In Ireland, for example, environmental impact assessments for aquaculture projects in coastal and offshore areas are governed by six different pieces of legislation (Long, 2007).

There is even greater complexity in federal states, such as the United States of America and Canada, and in federal-like systems, such as the European Union. In federal states, mariculture may be complicated by competing regulatory efforts at both the state or local government level and at the federal level. For example, in the United States, there is increasing interest in establishing mariculture facilities in the EEZ, but the regulatory regime is unclear. States have sovereignty over waters within 3 nautical miles (5.5 km) of shore, but federally regulated activities beyond that point must, in the case of potential conflict, be consistent with the state's coastal zone management plan. As mariculture occurs further offshore, it "falls within the purview of a number of federal departments and agencies, implementing a myriad of federal laws" (Baur, Eichenberg and Sutton, 2009). At least six major federal agencies can play a role in regulating offshore mariculture in the United States of America.

A fragmented regulatory regime poses two categories of problems. Firstly, without serious coordination efforts, there is no mechanism for looking at the impact of the proposed project as a whole, rather than examining only its individual aspects. Secondly, the difficulty of complying with the requirements of many different agencies can impose significant costs and delays for applicants, thereby rendering aquaculture projects uncompetitive.

Regulatory supervision

A pervasive theme in analyses of national regulatory schemes is the need to establish an inspectorate with all the necessary powers to enter fish farms and to enforce the governing legislation. Even in some developed countries, aquaculture legislation fails to include the necessary provisions. In Ireland, for example, "a number of public representatives have expressed the view that the absence of a specialized inspectorate

for the aquaculture industry is a critical omission in the legislative framework" (Long, 2007). In addition, the inspectorate must be adequately trained and funded. In the absence of a professional inspectorate, the enforcement of legislation is typically piecemeal and can involve the various government agencies which regulate different aspects of the mariculture operation. By default, in the absence of a specialized inspectorate, fisheries authorities are likely to be those most involved in policing mariculture.

The problem of inspection is even greater for developing nations. A lack of financial resources means that the agencies that supervise the various individual aspects of mariculture operations may lack an inspectorate and that a specialized body of inspectors is less likely to exist. Without a proper inspectorate, even the most sophisticated regulatory regimes are unlikely to fulfil their objectives.

Cost effective regulation

In the previous section on "Measuring the environmental sustainability of the project", it was observed that national regimes tend to recognize the principle that an environmental impact assessment should be required only for those projects that create a genuine risk of environmental damage. Some of the major exceptions to this trend are found in the developing world and they make it difficult to concentrate scarce and administrative resources on regulating difficult proposals that create a real risk of a environmental harm.

In achieving the laudable purpose of passing comprehensive environmental legislation, some countries require most or even all aquaculture projects to undergo an environmental assessment (Percy and Hishamunda, 2001). If broad requirements of this type are administered in accordance with the governing law, they can result in a cursory examination of all projects, because a lack of adequate administrative resources prevents the identification of individual projects that might pose a genuine threat to the environment. In addition, broad requirements for an environmental assessment can deter investment by imposing unnecessary costs on proponents of projects that pose only minimal risks.

Some suggestions to ensure that environmental assessments are limited to genuinely controversial proposals are of particular interest to mariculture. The simplest response was provided by the International Symposium for Sustainable Industrial Fish Farming in a document that became known as the Holmenkollen Guidelines. The Guidelines suggested that environmental impact assessments should be applied only to "large-scale" aquaculture projects (Howarth, 1999). This solution is properly criticised because it measures the potential for environmental harm through the size of the project; smaller scale projects might pose a greater environmental threat, especially if they are highly intensive and located in a sensitive area or if they involve exotic species.

The problem of determining which mariculture activities should be subjected to an environmental assessment has been a problem for all jurisdictions. The determination requires an examination of environmental risk factors. This examination has resulted in decisions that seek to eliminate the risk or to ensure that it is fully taken into account. The former possibility is illustrated in California (USA), which absolutely prohibits ocean farming of genetically modified and non-native species (California Code, 15007). Although draconian, this approach could ease the supervisory burden on administrators and allow them to focus on other important aspects of the approval process, including dealing with the regulation of feed, chemicals and antibiotics or the management of waste. The broad prohibition could be modified or abolished if experience elsewhere in the world shows that the risks created by some genetically modified or non-native species can be effectively managed.

The latter possibility of ensuring that the risk is fully taken into account is much more common and is illustrated by the Namibian example, discussed earlier. Namibia

requires an environmental assessment of any proposal that involves the possible introduction of a new species or a genetically modified aquatic organism. These examples show the importance of ensuring that proposals that genuinely threaten the environment will undergo a proper assessment. They also illustrate the importance of making this decision on the basis of a realistic assessment of the regulatory resources available to the jurisdiction.

Safeguarding exports

Increasingly, national regimes for the regulation of aquaculture contain detailed provisions relating to food hygiene and food safety. In Europe, these provisions place primary responsibility for the safety of food on the producer, who is required to use a Hazard Analysis and Critical Control Points system, but national authorities are obliged to certify compliance with food law and food hygiene regulations (Long, 2007).

The enactment of complex codes dealing with food hygiene and safety is challenging for many developing countries. If they wish to enter export markets, particularly in Europe and North America, they face the challenge of incorporating the standards of the major potential importers into domestic legislation. The standards are likely to go so far as regulating many of the inputs into a mariculture operation. However, the mere enactment of standards is not enough to secure access to export markets. The importing jurisdiction is likely to require an unfailingly credible certification that there has been compliance with those standards.

At a minimum, national legislation must provide for a certification procedure and a certifying authority. In reality, access to export markets may require that the certifying authority is an agency based outside the country in which the mariculture occurs. Although this requirement is often perceived as a significant limitation on sovereignty, the producing country is effectively required to comply if it wishes to export its products.

GOVERNANCE OF MARICULTURE ON THE HIGH SEAS

As discussed in the earlier section on "The impact of international law", no state can assert sovereignty over the high seas because they are beyond national control. The UNCLOS recognises the general freedom of the high seas and provides a non-exclusive list of individual activities that are permitted under that principle (Christie and Hildreth, 2007). As stated in the section on "The high seas" of this study, the freedom of the high seas almost certainly includes the right to conduct mariculture. The only limitations on that right are found in the general rules of public international law, in the terms of applicable treaties and in the general obligations under the UNCLOS, such as the duty to exercise the right of freedom of the seas with due regard to the interests of other states and to take the measures necessary for the conservation of the living resources of the sea (1982 UNCLOS Art.87[2], Art.117).

The applicable principles of public international law and treaty provisions may touch on aspects of mariculture, but only in minor ways. If the conduct of mariculture operations involves a breach of a principle of international law or of a provision of a treaty, a state can be held liable for the acts of its nationals under the rule of state responsibility as described in section on "The high seas". However, it is probable that any such breach will deal only with some tangential aspects of mariculture, such as interference with navigation. The existing body of international law simply does not deal with the potential problems of mariculture that are typically included in the national regimes described in the earlier section on "The governance of mariculture in national waters".

At the present time, it can only be concluded that there is no significant regulation of mariculture on the high seas. If mariculture does extend from a state's Exclusive Economic Zone to the high Seas, there is a regulatory vacuum; which means that the potential problems of mariculture are almost completely neglected.

There are three potential solutions that can address the problem of a legal vacuum with varying degrees of effectiveness. The vacuum can be filled by the extension of state regulatory regimes, by the treaty making process or by the adaptation of existing organizations and practices. Each of these options will be considered in turn.

The extension of state regimes

Although states have no jurisdiction over the high seas, they are capable of exercising jurisdiction over their nationals. It is conceivable that a state could make its mariculture laws applicable to nationals who carry out mariculture on the high seas. The state has some incentive to pass legislation of this type because the UNCLOS makes it clear that a state is responsible for the actions of its own nationals.

In theory, a state could apply its regulatory regime to its nationals on the high seas in much the same way as it does within the EEZ. However, in practice, the enforcement of the regime is likely to be limited. This is because the state can enforce its regulations only against its own nationals and because of the increased costs of enforcement at a great distance from the state's own territory. It must also be recognized, as discussed earlier, that because of the lack of adequately trained and funded inspectorate, the enforcement of mariculture regulations is often difficult even in national waters and this problem can only be magnified on the high seas.

A state is also limited in the type of regime it can apply on the high seas. The state governance of marine aquaculture considered in the section above on "The governance of mariculture in national waters", dealt with aquaculture from a facilitative and a regulatory perspective. The facilitative perspective involved the state providing the operator with the necessary rights to conduct marine aquaculture operations. Although a state might enforce regulations against its nationals on the high seas, it cannot provide them with the same rights that apply in national waters. Moreover, because of the principle of freedom of the high seas, the state cannot grant any type of secure tenure to any portion of the high seas, provide for the exclusive possession of a site or even grant an effective authority for the use of a particular area of the sea.

The extension of State regimes can thus never be more than a partial solution to the regulation of mariculture on the high seas. It is probable that a number of states will not extend the scope of their legislation and, even where they do so, the effectiveness of the legislation will be nullified if the mariculture operations are carried out by non-nationals.

The creation of a treaty

In the absence of existing legal principles, new international law governing mariculture on the high seas can be created only through the making of a treaty. If there is a serious likelihood of a major extension of mariculture into the high seas, there is no doubt, as a matter of law, that a treaty would be the best solution. However, in realistic terms, this solution is unlikely to be achieved even in the medium-term future. All treaties involve a great deal of preparation, followed by prolonged negotiations to produce a final text and often a lengthy period until the required number of countries accedes to the treaty. More importantly, before a treaty can even be contemplated, it must deal with a topic that is seen to be sufficiently pressing and important to justify the attention and resources of the international community. Despite the growing importance of aquaculture worldwide, it is difficult to envisage that the international community will consider aquaculture on the high seas as an appropriate subject for a treaty for many years.

The adaptation of existing organizations and practices

The prospects of creating a new regime to regulate mariculture on the high seas are thus bleak. It is much more promising to consider building on successful existing models to

achieve the required level of control. The field of international fisheries provides some of the most promising avenues for the management of mariculture.

The urgent need to manage diminishing fish stocks without significant delay required considerable innovation to overcome the laborious treaty making process. The initial UNCLOS had a glaring weakness in the management of migratory and straddling fish stocks and left this question to be dealt with by future agreements (UNCLOS, Art.63). The Fish Stocks Agreement (1995) filled this gap by providing an impetus for cooperation and compatibility in the management of fisheries within and beyond EEZs. Countries which fish for straddling or highly migratory species are required to satisfy their obligation to cooperate through existing treaties and international arrangements or through regional fisheries organizations. The Fish Stocks Agreement provides that all countries (whether or not they are parties to the Agreement) may not participate in managed high seas fisheries unless they are members of a regional fisheries organization or accept that organization's management measures.

The Agreement directs non-complying and non-party states not to authorise fishing by their vessels in managed fisheries and contains an unusually direct enforcement mechanism. Parties are authorized to take measures consistent with the Agreement and international law to deter non-parties from undermining the effectiveness of regional management measures, in some circumstances even if those measures are taken against non-party vessels (Christie and Hildreth, 2007). The Agreement was a major advance in the effort to deal with the depletion of fish stocks. It is legally controversial because it attempts to bind states, and contemplates enforcement actions against states, that are not parties to the Agreement. Nevertheless, it has been accepted widely in a short period of time. The Fish Stocks Agreement came into force in 2001 and had been ratified by 77 countries by November 2009.

One of the best prospects for the management of mariculture on the high seas is found in the regional fisheries organizations created under the Fish Stocks Agreement; and, there is already some precedent for action. In 1994, the North Atlantic Salmon Conservation Organisation (NASCO) agreed to adopt measures to protect wild Atlantic salmon from the impacts of salmon farming. In 2003, it became apparent that the 1994 measures had not been entirely effective and in the Williamsburg Resolution, NASCO adopted a much more detailed scheme to protect wild salmon. The Williamsburg Resolution deals with many of the issues found in national mariculture regimes. It requires parties to reduce escapes to a level that is as close as possible to zero, to protect wild fish from irreversible genetic change, to deal with the ecological impacts of salmon farming and the impact of disease and parasites (Long, 2007).

Although the precise legal basis of the Williamsburg Resolution is controversial, it provides mechanisms which are likely to be at least as effective as many of those found in the conventional international law of fisheries. Regional fisheries organizations have a wide geographical reach and are recognised as among the most useful international bodies dealing with fisheries. Unless properly regulated, mariculture operations on the high seas could potentially have an impact on straddling and migratory species. It is likely to be in the interest of regional fisheries organizations to impose a level of regulation on high seas mariculture that is the least similar to that found in the Williamsburg Resolution. That level of regulation can be supplemented by reference to some existing international practices.

Since the creation of the UNCLOS in 1982, it has been necessary to find ways to deal with some of its inadequacies and even to modify some of its central principles, such as the concept of maximum sustainable yield which proved ineffective in managing rapidly declining fish stocks. The FAO CCRF (1999) was a major response to this necessity and it contains a number of principles and standards for aquaculture development both within and beyond national jurisdictions (Long, 2007).

The FAO CCRF has been most effective when incorporated into national legislation. Its impact is otherwise somewhat limited, because it is difficult to enforce a voluntary code against an unwilling state. However, the existing legal scheme of the Fish Stocks Agreement provides an opportunity to do so through the principle which prevents states from participating in managed high seas fisheries unless they are members of a regional fisheries organization or accept its management measures. A substantial level of control over mariculture can be achieved if those management measures incorporate either the FAO CCRF or independent rules regulating mariculture. This level of control can be supplemented by the measures set out in the Fish Stocks Agreement to deter non-parties from undermining the effectiveness of regional management measures.

CONCLUSION

It is clear that the possibility of open ocean fish culture is being explored in a number of countries around the world. It is only a matter of time before significant mariculture operations are carried out on the high seas. Such operations can create important benefits, but experience with mariculture closer to shore shows they can also be the source of serious problems. Coastal states have frequently addressed these problems in waters that they control through comprehensive schemes of regulation.

Aquaculture on the high seas will create many of the problems that already exist in state controlled waters. Yet there is no management or regulatory regime that will apply to mariculture on the high seas. Once operations begin to occur on a large scale, vested interests will make it increasingly difficult to impose unnecessary regulations.

Although existing treaties incidentally affect some aspects of mariculture, it is irresponsible to fail to take some immediate steps to address systematically the problems that are bound to occur in the future. The ideal solution would be to begin discussions on a treaty respecting mariculture on the high seas, but this will be a long-term process. Meanwhile, preparatory work that will be helpful in creating a future treaty should begin. The preparations can involve the development of a Code for Responsible Mariculture on the High Seas by the FAO, perhaps under the umbrella of the existing CCRF. Regional fisheries organizations offer the best prospect of meeting immediate regulatory needs. They are the only multilateral organizations with the mandate, arising out of the Fish Stocks Agreement, the incentive through a shared need to safeguard wild fisheries and, in some cases, the experience to address mariculture on the high seas in the foreseeable future.

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