

A REVIEW OF INTERNATIONAL REGULATORY ISSUES RELATED TO MARICULTURE TENURE

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EXECUTIVE SUMMARY

- According to statistics available from the United Nations, Food and Agriculture Organization (UNFAO), aquaculture activities in 2000 represented 27.3% of the total global fish and seafood production.
- The importance of continued sustainable development of aquaculture is recognized by the The Bangkok Declaration and Strategy (Network of Aquaculture Centres in Asia-Pacific [NACA] and UNFAO, 2000) as necessary to enhance local food security, alleviate poverty and improve rural livelihoods.
- Developed to its full potential, aquaculture also makes a net contribution to economic growth, trade, and an improvement in living standards in communities and countries overall.
- Future world demand for seafood- the increase in world demand for seafood products is estimated at 0.5 - 3.0 % per year. On average, this means an additional annual requirement of 650,000 MT. in the EU, and 250,000 MT. in the USA. By the Year 2005 there will be a shortage of about 20 million MT. per year, and by 2010 it will increase to 40 million MT. annually.
- Brazil, already a significant producer of fresh water aquaculture species, during the past 15 years has begun steps toward the further development of a diverse Mariculture industry, through programs such as the Brazilian Mariculture Linkage Program and others.
- Federal and State Governments in Brazil are currently developing and updating the regulatory framework to support and control the development of the Mariculture sector.
- Aside from the requirement of adequate technologies, and entrepreneurship, the most significant issue with respect to stimulating and maintaining sustainable development of the marine culture sector is the issues surrounding property rights, acquisition of tenure or property, and regulations pertaining to environmental monitoring of Mariculture growout sites.

EXECUTIVE SUMMARY Continued

- This paper focuses on Mariculture tenure and provides a review of:
 - Aquatic tenure and property rights;
 - Acquisition of tenure for Mariculture purposes; and,
 - Environmental monitoring and regulation.

- Aquatic tenure and property rights
 - The issue of aquatic tenure and property rights are intertwined, as the mechanisms for access to aquatic tenure for the purposes of Mariculture are usually embedded in the definition of property rights generally defined within that countries constitution.
 - This chapter examines the issue of Property Rights in Commonwealth Countries, Canada, Chile, Mexico, Tasmania, Washington State (USA), and Hungary.

- Acquisition of tenure for Mariculture purposes
 - Mariculture from a global perspective represents a relatively a new commercial enterprise in countries.
 - As such most jurisdictions are currently involved in an ongoing process to develop regulations to support and control the development of this important industry sector.
 - Secured acquisition of the land/water base upon which Mariculture takes place is one of the crucial areas that requires appropriate regulatory development.
 - This Chapter reviews and summarizes a selection of Acts, Regulations, and Policies developed by a few countries as an example of different approaches taken and levels of development attained by specific countries with respect to acquisition of Tenure specifically in British Columbia, Canada, Tasmania, Jamaica, and Tanzania.

EXECUTIVE SUMMARY Continued

- Environmental monitoring and regulation.
 - Properly locating fish farms reduces the potential for negative impacts to the marine environment and results in a more efficient production of healthy fish. Good water quality, adequate currents, physical protection for farm structures and distance from sensitive marine areas are some of the factors that are In order to not infringe on the riparian rights of an upland owner, without consent, for the term of the tenure license.
 - To support the sustainability of marine fish farming in British Columbia the government has implemented the most comprehensive regulatory regime and protective framework for finfish aquaculture in the world.
 - The new regulation applies to all farms and includes provisions for registration, waste discharge standards, pre-stocking requirements, domestic sewage requirements, best management practices, monitoring and reporting, remediation, fees, offences and penalties.
 - The entire issue of marine fish farming, site identification, waste management, monitoring, and reporting are at the forefront of development for British Columbian and a global perspective. Documentation covering these collective issues covers thousands of pages of report, regulations, policies, and review.

TABLE OF CONTENTS

Preface - i -
Executive Summary - ii -
Table of Contents - vii -

1.0 INTRODUCTION 1

2.0 AQUATIC TENURE AND PROPERTY RIGHTS..... 3

2.1 Property Rights - Historical Perspective 3

2.2 Property Rights - Mariculture Tenure 4

 2.2.1 Canada..... 4

 2.2.2 Mexico..... 5

 2.2.3 Chile..... 5

 2.2.4 Washington State 7

 2.2.5 Hungary 8

2.3 Property Rights - Summary 9

3.0 ACQUISITION OF TENURE – REGULATION AND POLICY... 10

3.1 British Columbia – Canada..... 10

 3.1.1 Preliminary Evaluation of Tenure Sites 11

 3.1.2 Review of Required Regulatory Compliance 11

 3.1.2.1 Bacteriological Regulation..... 11

 3.1.2.2 Biotoxin Regulation 13

 3.1.2.3 Chemical Regulation..... 14

 3.1.2.4 Disease Monitoring and Regulation..... 16

 3.1.3 Completion and Submission of Development Plan with
 Application 17

 3.1.4 Advertising 17

 3.1.5 Shellfish Tenure: Pre-conditional Approval 18

TABLE OF CONTENTS Continued.

3.1.5.1	Environmental Assessment (MFEAP & CEAA)	18
3.1.5.2	Zoning	18
3.1.5.3	Aquaculture License	19
3.1.5.4	Performance Bond	20
3.1.5.5	Land Survey	20
3.1.5.6	Annual Tenure Rental	20
3.1.5.7	Taxes.....	20
3.1.5.8	Liability Insurance.....	23
3.1.5.9	Diligent Use	23
3.1.5.10	Summary	23
3.1.6	Regulatory Cost Comparison.....	23
3.1.7	Regulatory Permit Comparison.....	24
4.0	INTERNATIONAL TENURE AGREEMENTS.....	26
4.1	Jamaica.....	26
4.1.1	Major Issues for Jamaican Mariculture	27
4.1.2	Tenure Access	28
4.2	Tasmania.....	34
4.2.1	Tenure Access	35
4.3	Tanzania.....	38
4.3.1	Tenure Access	39
4.3.2	Land Tenure	39
4.3.3	Water Rights.....	43

TABLE OF CONTENTS Continued.

5.0 ENVIRONMENTAL MONITORING	47
5.1 British Columbia, Canada	47
5.1.1 Mariculture Siting	47
5.1.2 Monitoring of Marine Fish Farms	50
5.1.3 Relocation of Marine Fish Farms.....	55
5.1.4 Summary - British Columbia	56

6.0 REFERENCES.....	57
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7.0 APPENDICES

APPENDIX I - Mariculture Draft Policy and Regulation in Jamaica

APPENDIX II - Guidelines for Mariculture Applicants - Tasmania

APPENDIX III - Tanzania Mariculture Guidelines Source Book

1.0 INTRODUCTION

According to statistics available from the United Nations, Food and Agriculture Organization (UNFAO), aquaculture activities in 2000 represented 27.3% of the total global fish and seafood production. This represents an increase from 3.9% in 1970. In 2000, reported total aquaculture production (including aquatic plants) was 45.7 million tonnes by weight and US\$56.5 billion by value. This translates today to approximately 1 fish in 4 now produced through aquatic farming (UNFAO, 2002).

The importance of continued sustainable development of aquaculture is recognized by the The Bangkok Declaration and Strategy (Network of Aquaculture Centres in Asia-Pacific [NACA] and UNFAO, 2000) as necessary to enhance local food security, alleviate poverty and improve rural livelihoods. Developed to its full potential, aquaculture also may make a net contribution to economic growth, trade, and improvements in community living standards.

Specific information which suggests the future significance of aquaculture on a global scale include:

- The world's population is expected to grow by 3.5 billion in the next forty years to 9.5 billion in 2040.
- The world's per capita average seafood consumption is currently 18 kg. (39.6 pounds). The UN-FAO predicts this will increase to 20 kg. (44 pounds) by 2030.
- The combination of population growth and increased per capita consumption will require a doubling of the world's seafood supply from 90 million to 180 million tonnes. Of the current 90 million tonnes, 30 million are currently from aquaculture, or 33 % of the total
- The expected increase in aquaculture production would represent a quadrupling of current aquaculture production.
- Future world demand for seafood- the increase in world demand for seafood products is estimated at 0.5 - 3.0 % per year. On average, this means an additional annual requirement of 650,000 tonnes. in the EU, and 250,000 tonnes. in the USA. By the Year 2005 there will be a shortage of about 20 million tonnes. per year, and by 2010 it will increase to 40 million tonnes. annually. This increasing demand can only be satisfied by Aquaculture.

The greatest aquaculture production (57.9 %) takes place in fresh water with approximately 36 % taking place in Marine water (Mariculture), the balance 6.1 %, taking place in brackish water. In total Mariculture accounts for an annual production of approximately 12.8 million MT. valued at US\$17.4 Billion (UNFAO, 2002).

Brazil, already a significant producer of fresh water aquaculture species, has during the past 15 years begun efforts toward the further development of a diverse Mariculture industry, through programs such as the Brazilian Mariculture Linkage Program and others. Federal and State Governments in Brazil are currently developing and updating the regulatory framework to support and control the development of the Mariculture sector.

Aside from the requirement of adequate technologies, and entrepreneurship, the most significant issue with respect to stimulating and maintaining sustainable development of the marine culture sector are the issues surrounding property rights, acquisition of tenure or property, and regulations pertaining to environmental monitoring of Mariculture growout sites.

This short paper will focus on Mariculture tenure and provides a review of the following issues from an international perspective:

- Aquatic tenure and property rights;
- Acquisition of tenure for Mariculture purposes; and,
- Environmental monitoring and regulation.

2.0 AQUATIC TENURE AND PROPERTY RIGHTS

The issue of aquatic tenure and property rights are intertwined, as the mechanisms for access to aquatic tenure for the purposes of Mariculture are usually embedded in the definition of property rights generally defined within that countries constitution. What is interesting, however, is the substantial difference in ways that countries interpret their constitutional definition of property rights and the resultant impact that has on the development of Mariculture in that country.

2.1 Property Rights –Historical Perspective

History has shown us many examples of how, globally, we perceive and regulate the rights of property. A brief understanding of the complex subject of land ownership, property, and access rights is important in understanding and setting regulation for access to aquatic tenure.

Under English Law as embodied within the Magna Carta (1215) the issue of “Riparian Rights”, or the rights of access and egress to land and non-tidal waters, is granted so someone – whether that be an individual, local authority, corporate body, or the Crown (Government). Non-tidal rivers are generally assumed the private property of the landowner through which the river runs. In the absence of evidence as to who owns a river particular river the law assumes that the river bed is owned up to the center line by the land owner upon which the river fronts. There is no ownership of the flowing water and people may generally use the flowing water for access (navigation) and for permitted uses such as fishing.

A more appropriate discussion for this paper surrounds property rights associated with tidal waters, and fishing activities, which have formed the basis of how jurisdictions deal with the allocation of aquatic tenure for Mariculture purposes.

Historically, access to fish in the marine environment was open which was, and may still be appropriate under those circumstances in which the fish populations are healthy. As fishing pressure expands and the technology to capture becomes more efficient, over-fishing is often the result. Sometimes in order to protect fish stocks governments implement restrictions in fishing season or gear. Without property rights, no one fisherman owns the resource and no one respects the resource and often fish populations are overexploited. In reaction to overexploitation governments often focus their efforts on conservation, the restriction of gear, vessels, number of participants, fishing times or seasons, which usually do not solve basic economic problems associated with expanded fishing capacity (over capitalization, low price, etc.).

In the 1960's various governments began experimenting with the concept of individual ownership of the resource (Individual Quotas), and for the most part, wherever this concept has been regulated improvements in fishery resource management and economics has been the result. Specifically the benefits that are generated through the transfer of individual quotas or property rights in the fish include:

- Increase value of the catch.
- Improved conservation
- Improved economic returns, improved safety
- Increase value of the license holder (with the ability to purchase quota)
- Improved standard of living of fishermen, allowed the industry to internalize costs of science, enforcement, policing,

This concept of the transfer of property rights over the area of water (surface, water column, sea bed) has a similar benefit on how tenure, for the purposes of Mariculture, are allocated and secured.

2.2 Property Rights – Mariculture Tenure

2.2.1 Canada

In Canada, is a commonwealth country and, therefore, has its constitution based on the precepts of British Common Law and Riparian Rights. Generally, in Canada, the federal government owns the water column, the seabed, and the surface of the water and therefore, has the constitutional authority to make laws regarding fisheries.

In the specific case of the Province of British Columbia (BC), under a joint federal/provincial agreement (1912), the province owns the beds of certain bodies of water with certain headlands, essentially the majority of inter-tidal land within the province. Lands above the high water mark are generally privately owned or held by the Crown. Harbour's are often owned by the Federal Government.

Both the province and the federal government can make laws because of their land ownership. In addition to this proprietary jurisdiction based on property ownership, each level of government (federal, provincial and municipal) each have different constitutional powers to enact laws over different subject areas.

The BC fish/shellfish farmer, therefore, does not own the water, seabed, or sea surface, but Leases this from the provincial government. As a lease holder the fish/shellfish farmer has specific obligations, which are determined by the government. While the Province, then issues

tenures for the purposes of Mariculture under the Authority and Regulation of the Land Act the policy development continues to develop still hampered by property rights system developed.

New Zealand, Australia, and other Commonwealth countries use similar tenuring processes, all based on the historical tenants of Riparian Rights under British Common Law.

2.2.2 Mexico

Under the Constitution of Mexico, lifetime property rights over land may be assigned to members of an “ejido” which is a geographical based community in which citizenship is based on birth. It also grants the rights of offshore fishing activity to Cooperatives, though no foreign person may participate in a fishing Cooperative (Hugh M. Spall, Jr.).

While the granting of direct property rights to land, fish, or water, forms the basis for investment in commercial activity, “ejido” members, as well as members of the inland and offshore fishing Cooperatives cannot transfer their property rights to another person or organization. This, unfortunately, discourages the investment of capital in a developing Mariculture industry that may require transfer of certain rights or assets in order to ensure ongoing profitability.

Investment in Mexican Mariculture, therefore, may be riskier than in countries that do not restrict transfer of property rights.

2.2.3 Chile

Chile has a unitary form of government and a civil law system. Chilean law recognizes the right of citizens to develop any activity that is not contrary to morals, public order or national security and grants the right to acquire all the resources necessary for such activities unless the resources are, by their nature, common to all.

The Constitution does not attempt to provide an exhaustive list of such common resources. It only states that species in maritime waters and zones that are important to national security are common resources and that legislation can specify additional common resources.

There is, therefore, no restriction of property rights to certain groups, such as inland and offshore fishing Cooperatives and there is no restriction on the right to transfer resources between persons and entities.

Unlike the Mexican system, anyone can acquire “possessory” and the respective property rights over water, shoreline, ocean, lake, river and streambeds. Both Chileans and permanent foreign residents can obtain aquaculture permits.

If a Chilean property holder allows foreign capital to participate in a Company or Cooperative, they must comply with the laws and regulations governing foreign investment but do not lose rights to permit eligibility. This provision of the statute appears to permit a foreign investor to form a Chilean business entity and acquire an aquaculture permit provided he complies with the statutes and rules regulating foreign investment. Any ownership rights that were vested prior to the adoption of the Chilean Constitution continue to be recognized without the necessity of a concession or special permit.

Article 19 of the Chilean constitution permits the government to grant concessions or special contracts permitting private businesses to operate within these waters or zones or to operate enterprises itself. The Chilean Constitution requires the payment of fair market value if the government takes property and grants the judicial system the power to determine fair market value in the event of a dispute between the government and the citizen.

Waters that are not adjacent to the seacoast, that are not navigable by ships of 100 gross tons, and that are not part of an enclosed non-navigable system are under the jurisdiction of the Sub-secretary for Aquaculture Development and aquaculture activities in these waters cannot be undertaken without the authorization of this official.

Aquaculture activities in enclosed non-navigable water systems apparently are not under the control of any government agency, however, businesses undertaking aquaculture in these areas, however must register with the national aquaculture registry.

Before designating an aquaculture area in those zones subject to regulation, the responsible official must consult with the organizations whose activities would be impacted by aquaculture activities. He also must take into account the effects on communities that depend on these alternate activities, environmental effects, and the effects on national parks, reserves and monuments.

Additional issues surrounding the tenure permit include:

- The concession or permit granted for tenure sites offers the right to use the surface water and the area lying vertically under the surface;
- The regulatory authority grants aquaculture permits for specified species;
- The permit can be amended; and,
- The enterprise does not have to comply with any rules or regulations unless they are part of the permit that they receive.

Chile has developed a world-class aquaculture industry, focusing on salmon and crustaceans. In 1994, the industry, which was virtually non-existent in the early 1980's, supplied 7.6% of the world salmon market of one million tons. It is doubtful that this industry could have developed in the absence of the provisions present in Chilean property rights law.

2.2.4 Washington State

Washington State and Chile have similar climate and topography but the two regions differ their property rights system, which impacts directly on the cost of acquisition of investment capital for aquaculture.

As mentioned, Chile has a unitary form of government and a civil law system while the United States has a federal system of government and a common law legal system. As a result of this federal system, property rights in the United States are a subject of both national and state legislation and national and state court decisions.

Under Article 17, Section 1, of the Washington Constitution places ownership of the beds and shores of all tidal and navigable waters in the State unless the land had another vested owner at the time of the adoption of the state constitution. The state's ownership stops at the high water line. As a result companies or individuals privately own many of the inter-tidal shellfish beds in Washington State.

RCW 79.96.010 allows the Director of Natural Resources to lease the beds of all navigable tidal waters below extreme low tide, with the exception of lands protected by Article 15, Section 1, for the purpose of aquaculture. The statute limits such leases and subsequent renewals to a maximum term of 30 years.

There is no comparable statutory provision permitting leasing of non-navigable tidal waters. Leases of tidelands or the beds of navigable waters for the production of shellfish are subject to special restrictions. Before the initial lease of such lands, the Director of Wildlife must determine that the land is not necessary for the protection of existing natural oyster beds or seed stock. Any leases granted in tidelands must be for a term of at least five years, but not more than ten years.

Municipal communities under Article 15, Section 1, RCW 79.96.010 are able to exempt leases within drafted community boundaries including within the navigable waters of all harbors, estuaries, bays and inlets, or within one mile on either side of, the boundaries of any incorporated city. These lines can be relocated or reestablished at any time. The waters lying in front of these lines, as well as the waters within these lines and the high water line, cannot be sold, leased or donated to any private person, corporation or association.

This (Article 15) therefore, provides source of uncertainty for the aquaculture business as anyone who acquires shoreline and water in an area outside of the harbor line faces the risk that a newly formed municipal corporation will expand its harbour boundaries and the tenure is subject to loss.

The Fifth Amendment to the United States Constitution, however, requires the government to pay property owners the fair market value of any property that the government takes for a public use.

In addition, the acquisition of use rights in Washington State is subject to constraints imposed by zoning, the permitting provisions of the Shorelines Management Act (RCW 90.58 *et seq.*), the Washington Environmental Policy Act and the federal Endangered Species Act. Zoning specifies the uses that can be made of shoreline and ocean, lake and streambeds. The listing of a particular use (such as aquaculture) as a permitted use, however, does not automatically grant the right to conduct the specified activity on the shoreline or in the substrate.

2.2.5 Hungary

Hungarian law recognizes private property and distinguishes between possession, use and transfer rights.

Hungarian law places ownership of surface water and the banks and beds of watercourses in the national or municipal government unless the watercourse is encompassed entirely on the land of a single owner (such as a small lake contained within the bounds of private property).

The State also owns all subsurface waters. Hungarian statute allows government to lease and, perhaps, even sell its surface water rights to private enterprise, with the exception of certain specified lakes and watercourses and waters reserved for conservation purposes.

Section 11 of the Water Management Code requires concessions to be in harmony with regional and community development plans, environmental protection and nature conservation.

Because fish/shellfish farming could potentially affect the flow of a watercourse, or the quantity or quality of water in it, or the condition of channels and beds on banks or shores, such activities are considered a “hydraulic facility” and as such require the business to secure an operating permit from the government, the issuing of which triggers the Hungarian environmental protection statute.

Hungarian law provides for detailed environmental impact statements and for public hearings after the impact statement has been submitted to the responsible governmental agency (the inspectorate). Associations formed for the purpose of protecting environmental interests have the right to participate in these hearings and have the standing to file a lawsuit to contest the inspectorate’s decisions.

Hungarian environmental legislation has the obvious potential to make it quite costly to acquire the necessary property rights for the conduct of aquaculture. Fish farming is given a high

priority for water allocation in times of water shortage, ranking ahead of nature conservation, economic activities and recreation and behind subsistence drinking, public health and therapeutics. If this high priority reflects a general policy to favor this type of activity, the potential environmental impediments to the acquisition of the property rights necessary for aquaculture may not result in the imposition of significant costs to business.

2.3 Property Rights - Summary

Chilean property rights law appears to be more favorable to the development of aquaculture than property rights law in Canada, Washington state, Mexico or Hungary. In British Columbia, Canada, however, one of the more recent significant changes with respect to the issue of property rights and tenure is the right to sell or mortgage tenure. While the “ownership” of the tenure remains in the hands of the government Companies may sell the “rights to use the tenure” to another company or to mortgage the tenure to an institution for the purposes of financing.

This is significant as it relates to the ability to use the tenure to raise capital for development of the farm. The purchaser or Mortgage Company must realize, however, that they do not own the tenure only the rights to use that tenure under the terms of the Tenure Agreement.

In British Columbia there remains an issue over assignment of the tenure where one tenure holder can assign the tenure to another. This is frowned upon by the government as sometimes a farmer will secure a lease, not use it for aquaculture purposes, and then sell the lease to someone else generating value on land/water that they do not own. To deal with this issue the government often has a “no assignment policy” on a lease. However, the leaseholder could have the tenure in a company name and then sell the entire company to a new owner to carry on business.

To further deal with these issues and to ensure that tenures are not used for speculative purposes. the government has instituted a “Diligent Use Policy”. This policy requires that the tenure holder live up to the expectations of their site Development Plan. This may require a certain production, or seeding schedule be maintained. This Policy is rarely enforced and over the past 15 –20 years has rarely resulted in loss of tenure by an owner.

In the international context, if Mariculture is to grow, and become more profitable globally, it would be beneficial for individual countries to adopt legislation that would allow full property rights to both public and private owners of marine areas. Such rights, it is suggested, would require that owners:

- consider the consequences of their actions on others.
- allow others the enjoyment of their property.

- have an incentive to realize the maximum value from their property and therefore to seek ways to align their interests with those of others who might benefit from complementary uses of the property

In cases where that Country's Constitution does not allow this to happen the Canadian model of public ownership of tenure, with the ability to sell the rights to use, or mortgage, the tenure supports ongoing commercial and economic development.

3.0 ACQUISITION OF TENURE – REGULATION AND POLICY

Mariculture, from a global perspective, represents a relatively a new commercial enterprise in countries. As such most jurisdictions are currently involved in an ongoing process to develop regulations to support and control the development of this important industry sector. Securer acquisition of the land/water base upon which Mariculture takes place is one of the crucial areas that requires appropriate regulatory development.

Any review of international Mariculture initiatives will reveal that there is a great differential between countries with some having no development of regulation and some having quite detailed Acts, Regulation and policy supporting and controlling Mariculture. It is also apparent that those countries that have developed their regulatory reform in this area are the most advances producers of Mariculture products.

This Chapter reviews and summarizes a selection of Acts, Regulations, and Policies developed by a few countries as an example of different approaches taken and levels of development attained by specific countries with respect to acquisition of tenure specifically in British Columbia, Canada, Tasmania, Jamaica, and Tanzania.

3.1 British Columbia - Canada

Acquiring of tenure for the purposes of Mariculture is often a complex process, which may entail a wide range of activities including, but not limited to determination of:

- Identification of Site Characteristics
- Review of Required Regulatory Compliance
 - Bacteriological Water Quality (CSSP)
 - Biotoxin (CIFA)
 - Navigable Waters (MOT)
- Completion and Submission of a Development Plan/Application
- Advertising Intent- public notification
- Environmental Compliance
- Aquaculture License
- Performance Bond
- Zoning

In order to provide a basis of comparison for other jurisdictions the following provides a brief description of the above activities, which are part of the tenuring process in British Columbia, Canada.

3.1.1 Preliminary Evaluation of Tenure Sites

To determine the availability and suitability of a possible shellfish tenure site requires a certain amount of up front effort. Sites must be evaluated for biochemical, biophysical, and other parameters, including:

- Location
- Tidal height
- Current, salinity
- Temperature
- Upland habitation
- Exposure
- Water quality
- PSP.

3.1.2 Review of Required Regulatory Compliance

Shellfish, like other organisms, are subject to the conditions of the environment in which they live. Deleterious substances found in the marine environment, whether natural or man-made, may impact the health of the organism in question or the safety of that organism as an item for consumption.

There is great *potential* for consumers to become ill, or even perish, from consumption of seafood products. The identification of contaminants in harvest water and in consumable seafood's therefore is paramount. Contaminants are usually categorized as follows:

- Microorganisms (Bacterial/Viral/Parasitic)
- Naturally occurring toxins (Bio-toxins)
- Chemical Residues

3.1.2.1 Bacteriological Regulation

Bivalve shellfish such as oysters, clams, scallops, and mussels feed by filtering suspended particles from their environment. In the process they can extract and concentrate bacteria, viruses, natural occurring toxins (red tide), and/or chemical contaminants. Regulations governing the identification of specific harmful contaminants, sampling protocols, classification criteria, opening and closing of contaminated waters and the testing of shellfish grown or harvested from contaminated waters are legislated

under the control of the *National Shellfish Sanitation Program (NSSP)*. This internationally recognized program is the standard, which governs all aspects of shellfish water quality standards and the safety of shellfish for human consumption. The Canadian counterpart of the NSSP is the *Canadian Shellfish Sanitation Program (CSSP)*.

Under CSSP regulation the “quality” of water all shellfish growing (harvest) areas must undergo a Comprehensive Sanitary Survey to identify and evaluate all possible sources of contamination.

Once Comprehensive Sanitary Surveys are completed by Environment Canada, they provide the basis for the classification of coastal areas for the harvesting of clams, oysters, mussels, scallops, etc. In order that the area be considered “Approved” for the safe harvesting of shellfish, the waters must be free of hazardous concentrations of pathogenic micro-organisms, radionuclides, and toxic wastes in accordance with criteria established by the CSSP.

The CSSP categories of classification resulting from the analysis of sanitary surveys is as follows:

Approved

This sanitary survey indicates that sewage from adjacent communities (even under the most adverse environmental circumstances) would not reach this area in such concentration as to constitute a public health hazard. In these areas the median or geometric mean fecal Coliform level must be 14 mpn/100 ml or less with no more than 10% of the samples in excess of 43 mpn/100 ml.

Conditionally Approved

This area has the same sanitary quality as approved areas, however, the quality varies with:

- the effectiveness of sewage treatment at a community;
- rainfall or river flow; or,
- seasonal changes in sanitary conditions (i.e. tourist or summer cottage activity, vessel traffic, seasonal industrial operation).

Closed

Direct harvesting from this area is prohibited due to chemical or bacteriological contamination and shellfish can be used only by permit under specified conditions for depuration, relaying, experimental purposes or other approved processing.

Under the CSSP guidelines, each shellfish growing area must undergo a comprehensive survey and be classified before it can be approved for harvesting. Re-surveys are conducted regularly to determine if sanitary conditions have undergone significant change. Any changes in pollution source conditions are evaluated in all “Approved” growing areas annually by means of a formal reappraisal conducted both in the office and in the field. A complete re- evaluation of each approved area is conducted at least once every three years. This evaluation includes the field review of pollution sources, analysis of at least the last fifteen water samples from each key station and other field works as deemed necessary to determine the appropriate classification for the area.

Unclassified areas are regions where the sanitary suitability for harvesting is undetermined and therefore not approved for shellfish harvesting at present. Under the CSSP guidelines un-surveyed areas are closed but would need to be surveyed and classified prior to their approval for commercial harvesting.

3.1.2.2 Biotoxin Regulation

A number of naturally occurring toxins, found in various plankton species, have the ability to cause illness in humans once concentrated in shellfish and then consumed. As such growers, harvesters, processors and consumers of shellfish product should be aware of the potential risks these bio-toxins pose and the steps that exist to mitigate the risk of illness in people who consume shellfish.

There are a number of bio-toxins associated with shellfish. The specific illness caused by consumption of contaminated shellfish depends on the species of toxic algae concentrated by the various shellfish species. Those specific diseases identified by regulatory authorities include:

- Paralytic Shellfish Poisoning (PSP)
- Neurotoxic Shellfish Poisoning (NSP)
- Diarrhetic Shellfish Poisoning (DSP)
- Amnesic Shellfish Poisoning (ASP)

In British Columbia biotoxin accumulation has been recorded in the following species of bivalves:

- Pacific Oysters (*Crassostrea gigas*).
- Butter Clam (*Saxidomus giganteus*)
- Manila Clam (*Venerupis japonica*)
- Little Neck Clam (*Protothaca staminea*)

- Horse Clam (*Tresus capax*)
- Razor Clam (*Siquila patula*)
- Soft Shell Clam (*Mya arenaria*)
- Geoduck Clam (*Panope generosa*)
- Blue Mussel (*Mytilus edulis*)
- California Mussel (*Mytilus californianus*)
- Moon Snails (*Polynices lewisi*)
- Cockles (*Clinocardium nuttalli*)
- Purple-hinged rock scallops (*Hinnites multirugosus*) - viscera and muscle
- Pink Scallops (*Chlamys rubida*) - viscera
- Spiny Scallops (Spiny Scallops) - viscera
- Weathervane Scallops (*Patinoplectin caurinus*) - viscera and muscle

To safeguard the consuming public, the Federal government has established “mussel stations” to standardize the collection of bio-toxin data. California mussels (*Mytilus californicus*) are the internationally accepted indicator species for PSP monitoring. The mussels, are held in-situ (in the environment) and naturally accumulate any biotoxin present through their filtering activities. The mussel stations are sampled frequently and sampling protocol is designed to monitor the ongoing prevalence of biotoxin in shellfish. As toxicity levels in shellfish may vary by area, mussel stations are selected only after thorough analysis of historical toxicity data.

All Regions must have a monitoring program in place to adequately monitor marine biotoxins prior to the commercial harvest of bivalve shellfish species. As toxin levels begin to rise in sampled shellfish, sampling frequency increases in accordance with the speed of the rise to ensure timely closure. Areas that have been closed must to be monitored on a regular basis, but with increased frequency, as toxin levels decline toward acceptable levels.

3.1.2.3 Chemical Regulation

Public concern over the ‘chemical’ health of coastal waters led the National Oceanographic and Atmospheric Administration (NOAA) in the United States, in 1986, to initiate a National Status and Trends (NS&T) Program for marine environmental quality. As part of this program NS&T instituted the Mussel Watch Project, which monitors coastal waters by sampling mollusks (mussels and oysters) and sediments. The objectives of the program are to determine concentrations of trace metals and groups of organic compounds at sites on all coasts and to identify increasing or decreasing trends. The Mussel Watch Project is now the longest continuous national record of coastal water quality.

As may be expected, concentrations of chemicals in shellfish are related to the levels of chemicals in the water that they inhabit and in the food that they filter from the water. When the concentrations of chemicals increase or decrease in the water and in food sources, concentrations increase or decrease in shellfish (Roesijadi et al., 1987; Pruell et al., 1987; Wang et al., 1996). While technologies exist to monitor concentrations of chemical in ocean water and in suspended particles, it is simpler and less expensive to measure chemicals that have been concentrated in the flesh of marine organisms such as mussels, oysters, crabs, etc.

As identified earlier in this report, a number of trace metals and organic compounds are toxic to marine organisms and humans. Those chemicals and chemical compounds measured under the Mussel Watch Project include:

- Arsenic (As)
- Nickel (Ni)
- Cadmium (Cd)
- Mercury (Hg)
- Copper (Cu)
- Selenium (Se)
- Lead (Pb)
- Zinc (Zn)
- Total DDT (DDT)
- Total Chlordane ()
- Total Dieldrin (-7Dield)
- Total Polychlorinated Biphenyls (-TPCBS)
- Total Polycyclic Aromatic Hydrocarbons (2:PAHs)
- Total Butyltin (-TBT)

The existing Canadian program derives from the **Fish Inspection Act** passed in 1970 and amended most recently in 1985 (DFO, 1985). The inspection system mandated by that legislation is designed to be comprehensive and includes all fish imported to Canada, or exported from one province to another or out of the country. Complementary legislation exists at the provincial level that effectively includes within the same regulatory structure all intra-provincial trade in seafood. The Department of Fisheries and Oceans (DFO) has primary authority to implement the program, although some authority is shared with Agriculture Canada (which has limited oversight and auditing competence), Consumer and Corporate Affairs, and Health and Welfare Canada (which sets regulatory limits for seafood contaminants). However, in recognizing the potential confusion for both industry and consumers in such a shared regulatory environment, memoranda have been

signed by the agencies involved specifying a single federal contact for each regulated industry.

In Canada, under the *Canadian Shellfish Sanitation Program (CSSP)*, the guidelines for poisonous or deleterious substances are as follows:

<u>CONTAMINANTS</u>	<u>PRODUCT TYPE</u>	<u>ACTION</u>
Mercury	All fish products (Swordfish, shark, fresh & frozen tuna)	0.5 ppm
Arsenic	Fish protein concentrate	3.5 ppm
Lead	Fish protein concentrate	0.5 ppm
Fluoride	Fish protein concentrate	150 ppm
2,3,7,8 TCDD (Dioxin)	All fish products	20 ppt
DDT & Metabolites (DDD & DDE)	All fish products	5.0 ppm
PCB	All fish products	2.0 ppm
Piperonyl butoxide	Dried Cod	1.0 ppm
Other agricultural chemicals or their derivatives	All fish products	0.1 ppm

International regulation on levels of acceptability for poisonous substances may vary. Exporters are required to meet the requirements established by the country of import.

While there is Canadian and International regulations that stipulate the maximum level of chemical contaminants allowed in food products, there is little monitoring, except in cases of obvious pollution.

3.1.2.4 Disease Monitoring and Regulation

As the global movement of live shellfish increases, in response to market demand and the practice of shellfish aquaculture increasingly provides the source of this product, the opportunity to spread disease also increases. In the past 20 years the frequency of international shellfish transfers has increased dramatically and in part aquaculture has contributed to the spread of

diseases (Bower and McGladdery, 1997). Even though our shellfish aquaculture industry in British Columbia was founded based upon the introduction of exotic species, we have been fortunate that there are few incidences where disease has been a concern in our province.

The low incidence of disease in BC's shellfish aquaculture is in part due to the regulatory control provided by the *Fish Health Protection Regulations* in Canada. In British Columbia the joint Federal Provincial Introductions and Transplant Committee controls the movement of seed and shell stock under permit. This committee accepts applications and determines applicability of, and the requirements concerning, the issuance of permits for the import of new species, import of seed for existing cultured species, the transfer of seed and shell stock within the province. It also issues permits regarding the transfer of wild species within the province for the purposes of research.

British Columbia shellfish culturists also have the benefit of having a shellfish disease diagnostics laboratory at the Pacific Biological Station located in Nanaimo, The lab headed by Dr. Susan Bower undertakes diagnostic examinations on cultured and wild species and had developed a considerable expertise in dealing with local disease issues.

As part of recent revisions to the **Fish Health Protection Regulation** in Canada the Federal DFO is in the process of developing separate regulations and manuals of compliance for shellfish, which will include appropriate sampling protocols and diagnostic procedures. As a reference document for the development of these manuals and as an information source to industry, researchers, regulators and students, the publication "*Synopsis of Infectious Diseases and Parasites of Commercially Exploited Shellfish*" has been published by DFO (Bower, S.M., S.E. McGladdery, and I.M. Price, 1997).

• *Authors note: A copy of the full report is available on line at:*

- <http://www.pac.dfo-mpo.gc.ca/sci/sealane/aquac/papges/title.htm>

3.1.3 Completion and Submission of Development Plan with Application

A shellfish development plan identifies to the Crown Corporation of Land and Water British Columbia Inc., who maintain control over public resources and the tenuring process, the intent of the shellfish development. Detailed plans require specific identification of the site, tidal profiles, substrate, water quality status, PSP, site concerns, conflicts, zoning, planned seeding and production schedules by species by year, maps of

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the site, any equipment uses, etc. Development Plans must be submitted with an application.

3.1.4 Advertising

An application for tenure requires that the applicant make formal declaration of notice of intent to apply for tenure in various ways as a means to inform the general public, NGO's, and other interested parties of the objective of alienation of a particular water area for the purposes of Mariculture. This allows all parties to lodge objection with the government should they wish. Advertising may be required in a series of publications at the discretion of the government authority.

- Local Newspaper
- BC Gazette
- Canadian Gazette
- Land Title Filing

3.1.5 Shellfish Tenure: Pre-Conditional of Approval

3.1.5 1 Environmental Assessment (MFEAP &/or CEAA)

Upon receipt of a formal application Land and Water British Columbia Inc. sends a copy of the plan to various agencies. One critical agency is Fisheries and Oceans Canada as they are responsible for the protection and management of fish and fish habitat under the authority of the *Fisheries Act*. As a shellfish aquaculture project has the potential to affect fish and fish habitats, the project may require Approval under s.s. 5(1) or 5(2) of the *Navigable Waters Protection Act* (NWPA) and/or Authorization under s.s. 32 and /or 35(2) of the *Fisheries Act*. The issuance of an NWPA Approval or a Fisheries Act Authorization for a pending shellfish application requires DFO-Habitat Enforcement Branch to conduct a screening level review pursuant to the *Canadian Environmental Assessment Act* (CEAA). There is no cost associated with filing a CEAA review application.

If it is determined that a CEAA should be completed, the applicant is contacted and required to submit a CEAA review document or complete a full CEAA report. The reports are quite detailed (field testing, video, reporting) and experience with shellfish CEAA requirements suggest that submissions usually require third part assistance and the data required usually generates about a 100-page document.

If it is determined that a CEAA is not required the Habitat Enforcement Branch usually requests a Marine Foreshore Environmental Assessment Procedure (MFEAP) be completed which is usually a component of a full CEAA.

3.1.5.2 Zoning

As water based tenures are Crown land, local (Regional) governments often have enacted zoning bylaws with specific provisions relating to aquaculture. Local governments have authority over matters such as planning and regulation of the use and development of land, including areas of Crown land or water surfaces where leases or licenses of occupation have been granted. Under the *Municipal Act*, local governments may state, in their official community plans, broad objectives, policies and guidelines respecting present and proposed land uses and development. These may be implemented using zoning bylaws, permits and other instruments. Regional districts and the Islands Trust also may use rural land use bylaws for planning and regulation of land, including the surface of water.

The power to regulate includes the power to prohibit any use or uses in any zone or zones.

The B.C. Lands Aquaculture Policy provides that the sighting of all aquaculture leases and licenses will be consistent with local government bylaws at the time the tenure is initially granted.

Re-zoning can be a very political process within rules that continually change. Components of Re-zoning include:

- Preparation of background information;
- Filing of Formal Applications;
- Shepherding the process through three (3) reading after public hearing have been held;
- Advertising and signage according to regulation; and,
- Securing support of the Planning and Development Department

Many of the issues that affect re-zoning policy are concerns that seem likely to be resolvable if effective pre-planning is undertaken

3.1.5.3 Aquaculture License

Based upon a Memorandum of Understanding signed between both Canada and British Columbia in 1988, Canada recognizes the Province's rights to license industries dependent upon provincial resources. Aquaculture is an important part of that agreement.

Since the signing of the MOU, the province has developed an “*Aquaculture License*” which gives an operator the approval to operate an aquaculture operation within Provincial boundaries.

The Ministry of Agriculture, Food, and Fisheries (MAFF) is the lead agency for aquaculture development in BC. MAFF is responsible for all aquaculture endeavors under the Fisheries Act and Regulations, and for inspection and ensuring compliance and enforcement of aquaculture licensing, provisions and regulation. Through site investigations and field data collection, as well as a detailed review of a submitted shellfish aquaculture management plan, MAFF biologists assess the biophysical capability and technical feasibility of all aquaculture proposals prior to approval and, upon approval, issues an Aquaculture License which identifies the company, tenure, and species approved for culture.

3.1.5.4 Performance Bond

Performance bonds of \$1,000 or \$2,000 are required for inter-tidal or deepwater tenure respectively. Such Bonds ensure the governments ability to clean up any site that might be abandoned by the owner or any damages that might result from poorly maintained sites.

3.1.5.5 Land Survey

A formal land survey is required for all those tenures that are LEASED rather than a LICENSE OF OCCUPATION. Lease gives exclusive rights to an area with respect to access, etc. so survey ensures that the boundaries of the tenure are legally identified for the purposes of maps, etc.

3.1.5.6 Annual Tenure Rent

Rental is set at 4% of the tenure value for a license of occupation value or 5% for a lease. During the first 5 years, the rental rate is reduced to 1%. Current value of tenures is calculated at \$5,000 per hectare. Currently there is a minimum rental of \$600 for tenure of 3 hectares or less. Larger sites will pay more according.

3.1.5.7 Taxes

Holders of shellfish tenure are required to pay taxes based on the assessed value of the property plus the improvements on that property.

Prior to 1977, shellfish growers in BC were recognized as neither “fisherman” nor “farmers” for tax purposes. The legislative authority for this type of activity was divided between various acts, i.e. fisheries, fish inspection, health, and agriculture. Under the Fisheries Act they were not

fishermen, but “registered” as oyster growers, which created interpretations problems in areas of legislation.

After successful petitioning by the BCSGA effective October 7, 1977, and under the authority of Order-In-Council #3085, amendments were made to the Assessment Act which, in part, proclaimed that aquaculture activities i.e. oyster culture were classified as primary agricultural production and became eligible for tax concessions under the Assessment Act.

Tenure holders must apply for farm classification. Detailed eligibility and application information is available at <http://bcassessment.gob.bc.ca>

Once farm classification has been granted, the annual valuation of the property is undertaken by the BC Assessment Authority and determined on the value of the land, and improvements.

The value of the land portion of tenures is determined from a “Farm Land Valuation Schedule” (B.C. Reg. 381/96), which was prepared based on a specific rating system of biological and physical parameters developed by the province for rating tenure performance.

Under this rating system the value of a shellfish tenure ranges from \$247-\$2,470 per ha. (this valuation process is currently under review).

The improvement assessment is based on the actual depreciated value of any improvements. If the tenure holder has applied for, and is granted, farm status the first \$50,000 in improvement value is not taxable. A beach tenure that does not have any improvements would have a “0” improvement assessment. A deep-water tenure that had \$75,000 worth of depreciated improvement value would be assessed a value of \$25,000 (\$75,000 -\$50,000 deduction for farm status) for tax purposes.

Once the total assessment value is established for a particular tenure and its improvements, the information is forwarded to the particular regional agency that has the responsibility of determining the tax rate and the collection of property taxes. In British Columbia this may be a Regional District or Municipal Authority.

Calculation of the “rate of taxation”, based on the BC Assessment valuation, is a complicated task. Each taxation region, for example, may have multiple Electoral Areas, and within these areas, several minor tax jurisdictions, each having different taxation rates for specific items such as schools, libraries, refuse collection, fire protection, road services, etc. To be able to determine a tax rate for a specific shellfish culture operation requires the identification of a portfolio number, which identifies a particular grower, details which are not available to the authors.

To be able to identify sample tax rates for this review, BC Assessment, BC Taxation Branch, and the Comox Regional District collaboratively assisted in calculating a tax rate for a few unidentified shellfish farms located in the Baynes Sound and Cortes Island Areas, as follows:

Table 1. Sample Tax Valuation of Property Tax for a Shellfish Farm with a BC Assessment Value of \$30,000 (Comox-Strathcona Regional District)

Sample Tax Valuation	
Shellfish Farm Assessed Value	\$30,000
Tax Item	Rate/\$1,000
General Business	\$3.7000
School	\$9.9000
Hospital	\$1.0141
Assessment Authority	\$0.3245
Minicipal Fincal Authority	\$0.0001
Road	\$2.9547
Electric	\$0.0000
Garbage	\$0.6968
Fire	\$0.0000
Library	\$0.7639
Total Tax Rate	\$19.3541
Total Estimated Taxes	\$580.62
% of Assesment	1.94%

Table 2. Example of Tax Rates applied to random shellfish tenures in Baynes Sound, and Cortes Island, BC (Comox Strathcona Regional District)

Location	Assessed Value	Taxe Rate %
Cortes Island- Shellfish	\$30,000	1.9354%
Cortes Island- Shellfish	\$30,000	2.1460%
Cortes Island- Shellfish	\$100,000	0.9632%
Baynes Sound- Shellfish	\$30,000	2.3396%
Baynes Sound- Shellfish	\$30,000	2.0749%
Baynes Sound- Shellfish	\$100,000	1.0292%
Average Tax Assessment	\$53,333	1.75%
Range of Tax Assessment	\$30,000 - \$100,000	0.96 - 2.14

Based on this sample the average tax assessment on shellfish tenures in this area are approximately \$533.33 per annum given the operation was classified as “Farm Land”.

According to LWBC there are 493 shellfish sites or 451 tenures for shellfish culture in British Columbia. Using these tax assessment values and rates the property tax collected from the BC Shellfish growers is approximately \$262,400 or, based on a total of 2,663 ha under tenure (BCMAFF, 2003), this represents a property tax value of approximately \$98.53 per hectare. Given that the average tenure size in BC is approximately 5 ha the estimated average financial impact to a grower related to property tax purposes would be ~ \$493 annually.

LWBC indicates the total annual current rental fees collected for shellfish tenures total approximately \$447,000. Property tax rates then, in general, represent about 58% the value of rental for the majority of tenure holders in BC.

3.1.5.8 Liability Insurance

All tenure holders are required to have Liability Coverage to protect the Crown from claims. Membership in the BCSGA provides reduced rates for such coverage. Liability insurance of \$1,000,000 is available through such companies as Alder Insurance Services Ltd. (\$125 for the first lease and \$50 for each additional lease).

3.1.5.9 Diligent Usage

Diligent use of the tenure refers to adhering to the proposed seeding schedule set forth by the proponent in the shellfish development plan. The diligent use requirement for tenures can be examined by the regulatory agencies via a site visit or by evaluating production and seed purchase records for the past 3 years. As the seeding requirements on tenures varies depending on the activities of the farm, tenure size, type of culture, species grown, etc. the only way to determine planned actual seed costs is to summarize Shellfish Development Plans which is beyond the scope of this evaluation. Based, however, on an internal survey of various business plans undertaken for the shellfish industry, the cost of seed represents about 7-10% of the cost of operations.

3.1.5.10 Summary

The regulatory process to secure tenure for purposes of Mariculture in British Columbia is time consuming, complex, and costly as the individual businessman funds the vast majority of the regulatory process.

3.1.6 Regulatory Cost Comparison

As an example of this, in a recent confidential report produced on behalf of provincial government authorities by IEC INTERNATIONAL (Clayton, 2003) the British Columbia tenure regulatory burden was identified as the highest in a precursory evaluation of 11 jurisdictions including:

CANADA

- British Columbia
- Newfoundland
- New Brunswick
- Nova Scotia
- Prince Edward Island

USA

- Alaska
- Washington State
- Oregon
- California
- Hawaii

OTHER

- New Zealand

Through a comparison of 11 jurisdictions across Canada, the US, and New Zealand based on costs for 14 items that were verifiable, the value of direct costs required to make formal application for a Mariculture Tenure were highest in British Columbia (Clayton, 2003).

3.1.7 Required Permits Comparison

As a second example of the complex nature of the Canadian tenure issue, a review of the permitting structure for shellfish aquaculture indicates that British Columbia along with Washington State has the greatest number of referral agencies related to the application process for shellfish culture operations. And, while British Columbia has the lowest number of potential permits requiring approval, BC had the highest number of permits requiring fees.

A comparison of the number of permits requiring fees compared to the potential number of applicable permits between the 6 identified jurisdictions indicates that 76% of potential permits issued are associated with Fees as compared to the next closes jurisdiction 40% in Hawaii.

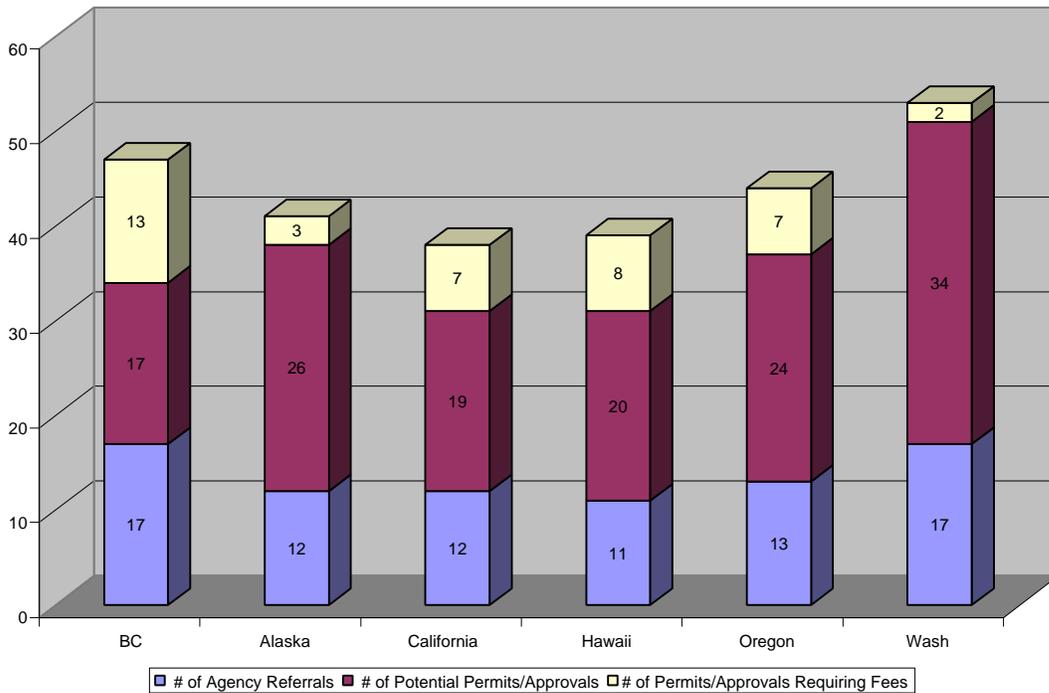
Summary of Permits required in the Tenure Process in 6 jurisdictions.

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Jurisdiction	# of Agency Referrals	# of Potential Permits/Approvals	# of Permits/Approvals Requiring Fees
BC	17	17	13
Alaska	12	26	3
California	12	19	7
Hawaii	11	20	8
Oregon	13	24	7
Wash	17	34	2

Summary of a Jurisdiction Comparison of Permits in the Tenure Process.

Overview of Jurisdictional Regulatory Burden for Shellfish Aquaculture



Percentage of potential permits that require fees in 6 jurisdictions.

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Jurisdiction	Potential Permits/Requiring Fees (%)
BC	76
Alaska	12
California	37
Hawaii	40
Oregon	29
Wash	6

The above suggests that the BC tenure acquisition model is not necessarily a good model to support the development of a Mariculture industry in other countries from a cost perspective. In those jurisdictions where similar regulations are in effect but where the cost of such regulation is low and/or the governments assume some of the cost burden the regulatory process with respect to accessing tenure for Mariculture purposes may not pose a burden and may support appropriate industry development.

4.0 INTERNATIONAL TENURE AGREEMENTS

To facilitate the development of Mariculture activities governments have enacted various regulations and policies with respect to the issuance of tenures. This section attempts to identify those regulations and policies from several jurisdictions to provide a base of comparison, scope and detail of regulations developed in this area.

4.1 Jamaica

The government of Jamaica has identified that the production of marine organisms through the industry of Mariculture represents an opportunity to provide a sustainable supplement or alternative to their overextended marine capture fisheries. It is also a means of diversifying the fisheries sector, introducing new skills and technologies into a largely traditional and somewhat static sector of the economy.

As a result the government, in 1977, initiated the Oyster Culture Project, a joint effort of the Ministry of Agriculture and the UWI Department of Zoology, to study the culturing of mangrove oysters (Crassostrea rhizophorae) in Bowden Bay, St. Thomas.

To support such development Country has developed a national policy to design to “support and encourage the managed use of the nation's marine resources to raise output of marine food products for domestic consumption and for export, and to generate local employment in communities that have traditionally relied upon the sea.” (Government of Jamaica).

In order to achieve this broad aim the Jamaican government is pursuing the following goals:

1. establishment of the principles for carrying out sustainable Mariculture.
2. end or effectively control potentially damaging practices associated with Mariculture.
3. promote the recognition of Mariculture as an option for the sustainable use of coastal resources.

In pursuing these goals, the government is guided by the following principles:

- The culture of local species is preferred, but under controlled circumstances introduction of species may be allowed.
- Sustainable Mariculture can only be achieved through the coordination of functions of the relevant government agencies, and close collaboration with Mariculture operatives and their communities.
- Public awareness of the importance of the role of Mariculture in preservation of marine species, and the need for good environmental quality must be improved.

- Ten policy statements are made in support of achieving the stated goals. Specifically, the policy seeks to: Establish designated areas for Mariculture; Exercise greater control over Mariculture Operations;
- Develop The Economic Potential Of Mariculture And In Particular Oyster Culture;
- Protect Mariculture operations From Pollution;
- Protect the environment from the harmful effects Of Mariculture by requiring an Environmental Impact assessment for Mariculture operations;
- Increase Public Awareness of the benefits of Mariculture as an alternative or supplement to the capture fishery, and as a useful tool for species management;
- Draft provisions for inclusion in a lease agreement, as well as some possibilities for expanding Mariculture operations are annexed.

Mangrove oysters and Marine Tilapia are the only commercial Mariculture species currently farmed in Jamaica, though there is interest in the culture of sea moss, marine shrimp, and finfish.

4.1.1 Major Issues for Jamaican Mariculture

Socio-cultural/Economic Issues

The main socio-cultural issues pertain to the granting of exclusive license to a special interest group(s) for using sections of the coastal zone. As population pressures increase, and as foreshore and near shore space becomes more intensively used, the granting of exclusive use of a particular site to a special interests may lead to conflicts. The main economic issue of concerns to oyster farmers is the lack of a dependable market, and a distribution network for their product.

- (i) Diminished Access To The Foreshore.

This may be similar to the debate, with respect to the right of all citizens to beach and foreshore access. At the present time, the government is at pains to resolve this issue by mediating between the public, whose right of access to the foreshore is established in the Beach Control Act, and some of the all-inclusive hotels, which have been issued licenses providing for exclusive use of the foreshore.

- (ii) Diminished Access To The Water Column, And Floor Of The Sea.

The issue with respect to granting exclusive rights for the leasing of the floor of the sea and the water column to Mariculture operators involves, primarily

two groups of fishermen, namely, those engaged in fin fishing, and shell fishing operatives. Though not presently a problem, Mariculture operations over time may affect the traditional territorial rights of fishing communities to their customary fishing grounds.

4.1.2 Tenure Access

Institutionally, Mariculture is under the purview of the Fisheries Division of the Ministry of Agriculture. The Aquaculture Branch of the Fisheries Division exercises operational control of the Oyster Culture Programme.

Three primary laws pertain to Mariculture: the Fishing Industry Act, the Natural Resources Conservation Act, and the Beach Control Act. While fisheries management falls under the broad mandate of the Fisheries Division, management of the seabed and foreshore, as mandated by the Beach Control Act and the Natural Resources Conservation Act, is under the jurisdiction of the NRCA.

One other agency having major control over Mariculture in Jamaica is the Ministry of Health - Environmental Control Division. This agency by virtue of the Public Health Act has responsibility for ensuring the sanitation of animals destined for human consumption, and the monitoring of water quality in areas where bivalve culture is carried out.

** The following is taken directly from the Jamaican Act and Regulation regarding a full-unedited copy of the document is available in APPENDIX I.*

Designation Of Areas For Mariculture

Criteria for site selection must be established in order to avoid or minimize user conflicts or other adverse environmental impacts.

Strategy

1. No area will be designated for Mariculture activities if the following is true:
 - The area is subject to injurious levels of pollutants;
 - Conflicts with prior users would arise;
 - The area is needed as a nursery area (e.g. for spat production);

Control Of Mariculture Operations

Control over Mariculture operations is necessary to ensure compliance with prescribed regulations particularly those pertaining to encroachment, and species management.

Strategy

1. Mariculture operatives will require a permit or lease from the NRCA or the Fisheries Division specifically to address the following:
 - Extent (Area) of Mariculture site;
 - Type of operation to be carried out (species to be cultured and method to be used e.g. Grow Out/Off Bottom);
 - Use of the water column, and the floor of the sea;
 - Time frame of the permit or lease;
 - Performance;
 - Fees;
 - Termination;

Develop The Economic Potential Of Mariculture And In Particular Oyster Culture

The local market for oysters is presently not large and the major sales are achieved through roadside peddling. A small amount is supplied to Jamaican Hotels.

Strategy

1. Provide technical and other assistance to those engaged in Mariculture particularly with respect to:
 - Product development, and marketing;
 - The provision of low cost loans for purchase of equipment, and rack building materials;

Protection Of Mariculture Operations From Pollution

Water quality data indicates occasions of unacceptable levels of bacteria at two prime oyster culture sites namely Green Island and Port Antonio. In addition there is an alleged report of deliberate contamination of water supply for the pond Mariculture operations.

Strategy

- i) Enact and enforce regulations to protect the rights of those engaged in Mariculture, as well as the consumer specifically to address the following:

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- Preventing the release of pollutants to waters used for Mariculture.
- Setting up of a process to ensure the settling of compensatory claims as a result of pollution incidents such as oil spills and the release of other contaminants.
- Monitor aquatic food products, particularly bivalves and other Mariculture products, to protect the public from the consumption of contaminated foods;

Protection Of The environment From Harmful Effects Of Mariculture.

The main environmental threats from Mariculture relate to the release of nutrient rich waters and sediments, as well as the release of larvae in return water from tank Mariculture. In addition, present oyster culture practice relies on mangrove forests as a source of poles for construction of racks.

Strategies

- i) Subject all or certain types of Mariculture development proposals to an Environmental Impact Assessment (EIA).
- ii) Adopt and enforce standards, and regulations to prevent the adverse impacts of Mariculture activities on coastal and marine ecosystems such as mangrove wetlands, coral reefs, and marine nursery areas. This will include but not necessarily limited to specific regulations for:
 - Allowable levels of contribution of nitrogen and phosphorous to the water column;
 - Allowable level of BOD in sediment;
 - Controlling the cutting of mangrove poles;

Increasing Public Awareness

The degradation of Mariculture sites is to some extent due to a lack of public awareness or appreciation for the need to protect keep these sites free from contaminating substances. In addition there is the need for heightened awareness of the importance of Mariculture as an alternative or supplement to the capture fishery, and as an effective tool for species conservation.

Strategies:

- i) Develop and implement a public education Programme on Mariculture and its socio-cultural, economic, and ecological significance.
- ii) Target the programme primarily at communities in close proximity to actual or potential Mariculture sites, as well as potential purchasers of produce.

- iii) Ensure wide circulation of specific regulations among fishing communities.
- iv) Develop demonstration projects.

Designation of Marine Areas to be Leases

NRCA jointly with the Inland Fisheries Branch of the Fisheries Division, Ministry of Agriculture, should designate areas to be reserved for leasing to parties engaged in Mariculture activities. These area designations will be subject to review and update periodically. No area will be leased if it is determined that the following conditions, among others, apply:

- The area is subject to high and/or widely variable levels of potentially injurious pollutants or;
- The area is needed for public spat production or;
- Leasing of the area could result in being a source of irreconcilable conflict with prior users.

Leasing of contaminated areas will only be permitted under exceptional conditions. Ministerial approval will be a requirement for these leases. Leasing of contaminated areas will automatically prohibit sale of shellfish products from those areas, except under conditions certified by the Ministry of Health, and after cleansing of the shellfish under conditions specified by public health authorities.

Lease Administration

- Natural Conservation Authority maintains jurisdiction over Mariculture leasing under the Authority of the Beach Control Act.
- Lease conditions may vary by site and will be established by the NRCA
- Administrative procedures, including duration, termination, compliance, and fee schedules will be publicly promulgated so that leaseholders and potential lease holders need not be in doubt as to any aspect of lease administration.

Size of Leasehold

- The maximum size limit on total leased area under the control of an individual, group, company or cooperative will be determined by the type of Mariculture to be pursued, and the potential effect on traditional users.
- It is suggested that the minimum area required for a viable oyster culture operation is .08 Ha. *

** In the case of oyster production the size of the leased area will be limited to that required for the deployment of 32 units (one unit is equal to a rack containing 250*

strings of oysters), with provision for larger allocations.. The minimum size limit will be 4 units, except in special circumstances.

Exclusive Lease Rights

- This lease application and license provisions will be specific as to the type of lease sought.
- Where the water column immediately above the leased bottom is utilized, there is a need for leaseholders to control the use of the water column above their lease. For this reason approval will be given by NRCA for the rights to the water column above the lease.

Tenure of Lease (Condition of Tenure)

- The lease period will be five (5) years, so long as all performance requirements and lease obligations are met.
- After the fifth year those leases in good standing will have the option to renegotiate with the lessor for three (3) year renewal periods.
- The lease will be subject to physical inspection annually to determine that performance requirements are being met.
- There will be provision that the lessee will be notified at year 4 if the Government does not intend to grant a three (3) year renewal at year 5.

Utilization of Leases

- Leaseholders will adequately utilize their leased area under possible penalty of forfeiture.
- Leaseholders will, under penalty of forfeiture, be obliged to commence active working of an approved lease within a six (6) month period from the date of the lease.
- Leaseholders shall not enter into an arrangement with any third party with intent to sub-let the leased area without prior approval of the NRCA upon satisfaction that there are extenuating circumstances for this action.

Annual Returns

- Leaseholders will be required to submit an annual return indicating the extent of operations. The required form will be provided by the NRCA.
- Failure to submit an annual return of operations by a specific date will result in automatic cancellations of the lease.

General Fees

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- The lease rental fee will be charged per year until such time as the lease is cancelled or transferred.

Lease Surveys and Re-Surveys

- Site surveys will be conducted either by the Survey Department or by a registered public land surveyor.
- The prospective lessee may choose to use a public land surveyor if he considers the extra cost justifiable in terms of obtaining a survey at an earlier date than might be possible using the Survey Department personnel.
- A survey charge will be levied for completed surveys carried out by the Survey Department.
- No charge will be levied in those cases where a public land surveyor is used. The following procedures will be taken:

Submission of Applications

- Applicants will submit applications to the NRCA on forms provided.
-
- If the prospective lessee does not wish to wait for the Survey Department to carry out the survey, he can arrange to have it conducted by a public land surveyor. A Ministry of Agriculture representative will be required to inspect the area to be surveyed to determine its availability and suitability for leasing. This will be based on criteria for site selection developed by the NRCA and the Fisheries Division in collaboration with the ECD. Establishment of a survey date suitable to the Ministry of Agriculture personnel will be the responsibility of the prospective lessee.

Priorities in Leasing

The following priorities have been established for granting new leases and for redistribution of cancelled leases:

- Existing oyster farmers - desiring to regularise their status and/or requiring additional holdings to make their combined total acreage leased a viable or economic enterprise.
- Cooperative farm units.
- New entrants.

- In a new area, persons trained in aspects of oyster culture and with a viable plan of operation.

Restrictions of Leasing

- Leases will be restricted to Jamaican Citizens ordinarily resident in Jamaica and/or Jamaican controlled corporations.
- Leases will also be considered for companies having joint venture arrangements involving Jamaican partners.
- No one company or individual shall obtain holdings by consolidation or assignment which might in the opinion of the Minister, prove contrary to the Public interest.

GENERAL:

- A lessee will be able to cancel his lease any time and with the consent of the Minister, or to surrender portions of his lease. There will be no refund of fees.
- Regulations could provide that, on cancellations of a lease, all works, improvements, and marine resources in and upon the leased land and in the water column above, will be the property of the Crown.
- Regulations could provide for lease cancellation for the infraction of lease regulations in respect to matters such as navigable waters and pollution control, and for other activities which are injurious to marine species in the area.
- Should an objection to a leasing procedure or related grievance arise the appellant will be heard by a special board appointed by the Minister of the environment or Chairperson of the NRCA. This board would be comprised of a fisheries officer, a fisherman and a neutral person from the general public, suitable to both parties. The NRCA could provide the secretariat to such a board. The Oyster Aquaculture Branch - Managers of the Oyster Culture Programme, will also be represented.

4.2 Tasmania

Mariculture expanded rapidly in Tasmania in the 1990s to become one of Tasmania's major industries. Other secondary industries have also grown up around Tasmania's marine farming industry, creating additional economic and employment benefits to the State.

The Mariculture industry is regulated by the Department of Primary Industries, Water and Environment (DPIWE) under the [Living Marine Resources Management Act 1995](#) and the [Marine Farming Planning Act 1995](#). The Act prescribes a statutory planning process for identifying State waters for zoning for the purposes of Mariculture. These processes involve comprehensive consultation procedures, which enable the interests of all parties to be considered in the development of marine farming development plans.

Under the Marine Farming Planning Act 1995 and the Living Marine Resources Management Act 1995, Tasmania allows Mariculture to take place in water or on land. On-Water Marine farming can only take place in State waters where a Marine Farming Development Plan is in force. An example of current and formative plans are available from the Primary Industries Water and Environment website www.dpiwe.tas.gov.au Once Development plans have been formalized; applicants are invited to apply for tenures within the Plan area. The Minister determines the terms and conditions of the leases.

Once a tenure (marine Farming Lease) has been granted by the government the tenure holder may apply for a Mariculture license. Licenses detail environmental requirements to ensure that marine farming operations are sustainable and do not have an unacceptable impact on the marine environment.

In addition, the Department of Health and Human Services manages the Tasmanian Shellfish Quality Assurance Program under the **Public Health Act 1997** and the **Food Act 1998**. This includes monitoring water quality in shellfish growing areas and the public health status of shellfish on marine farms, to ensure the safety of farmed shellfish for human consumption.

Species currently commercially farmed in Tasmania include abalone, scallops, mussels, oysters, rock lobsters, seahorses, trout and salmon.

4.2.1 Tenure Access

** The following is excerpted from Tasmanian Regulation. A full-unedited copy of the document is available in APPENDIX II*

Tenure

- Applications may be submitted for tenure by persons in the following category:
 - any person or class of person the Board has advised under [section 52](#) should participate in the process leading to the allocation of a lease;
 - any other person the Minister considers should participate in the process leading to the allocation of a lease.
- The Minister may require the applicant to supply any further information the Minister determines.

Granting of lease

- After considering any advice from the Board, the Minister may grant an application for a lease for marine farming for any area designated for that purpose in a marine farming development plan.

- A lease confers on the lessee exclusive possession of the area specified in the lease; and any specified area of the seabed comprised in the lease.
- A lease is subject to any condition the Minister determines.

Conditions and restrictions

A lease is subject to any condition and restriction the Minister specifies in the lease.

- If a marine farming development plan requires a condition to be inserted in a lease, the
- Minister must specify that condition in the lease relating to the area, which is the subject of the plan.
- The Minister may revoke any condition or restriction of the lease.
- A lessee must not contravene or fail to comply with any condition or restriction of the lease.
- A lessee must ensure that any employee, agent or sub lessee of the lessee or any person acting on behalf of the lessee complies with any condition or restriction of the lease.

Duration/Renewal of lease

- A lease is in force for the period, not exceeding 30 years, specified in the lease.
- A lessee, within 15 years before the lease expires, may apply to the Minister for the renewal of the lease.

(7) If the Minister grants an application after the lease expires –

Variation of lease

- A lease may be varied at the request of the:
 - Lease
 - The Minister
 - As a result of conviction of an offence under the Act
 - To correct a minor error in the lease.

- The Minister, if satisfied that a lease area is not being sufficiently or effectively used for marine farming, may reduce that area to an area, which, in the opinion of the Minister, is an appropriate area.
- Compensation is not payable in respect of any action by the Minister under [subsection \(2\)](#).
- The Minister may vary any condition of a lease as a condition of varying the lease at the request of the lessee.

Cancellation of lease by Minister

The Minister may cancel a lease if –

- satisfied that a lease area or part of a lease area is not being sufficiently or effectively farmed
- the lessee fails to maintain a marine farming license or ceases to hold a marine farming license
- with the consent of the Lessee

Removal of equipment and fish from area

The Minister, by notice in writing, may require the person who is the holder of a lease or permit to

- remove any equipment, debris and fish stock within a specified period from that area.
- remove any equipment, debris and fish stock within a specified period from that area or any other area not currently covered by the lease

Transfer of lease

- A lessee may apply to the Minister for approval to transfer the lease through the submission of an application on an approved form, accompanied by the prescribed fee to the Minister.
- The Minister may approve or refuse the transfer
- A lease transferred under this section is subject to any condition and restriction to which it was subject immediately before the transfer unless the Minister varies them under this Part.

- The Minister must not approve the transfer of any lease unless the Minister has already agreed to a transfer of an existing license authorizing the lessee to carry on marine farming in respect of the lease area.
- If the Minister approves the transfer of a lease, the Minister, by notice in writing, must inform the lessee of the approval.

Sub-leases

- A lessee must not sub-lease a lease without the Minister's written approval.
- The Minister may require the applicant to supply any further information the Minister determines.
- The Minister may grant or refuse the application
- The Minister, by notice in writing, must notify the applicant of the grant or refusal.
- Any offence committed in respect of a sub-lease or by the person holding the sub-lease is taken to be an offence committed by the lessee and any proceedings for that offence are to be instituted against the lessee.
- A sub-lease is subject to any condition or restriction the Minister determines.

Maintenance of structures

- A lessee must maintain any raft or structure used in a lease area in a safe and seaworthy condition to the satisfaction of the Marine and Safety Authority; and
- Mark the raft or structure in a manner approved by the Marine and Safety Authority.

Restraints on lease

- The Minister must not grant a lease or approve the transfer of a lease in relation to an area in State waters unless the Minister is satisfied that there is sufficient distance between the lease area and any other lease area having regard to all relevant circumstances.

Expansion of area

- A lessee may apply to the Minister for an expansion to the lease area under the following conditions. IE the lease:
 - Is within an area covered by a marine farming zone which is designated as being available for leasing
 - Is contiguous with the lease area; and

- does not, if added to the lease area, exceed the maximum leasable area established by a marine farming development plan for that marine farming zone.
- Before agreeing to expand the lease area, the Minister must consult with any other lessees who may reasonably be expected to have the water quality in their lease areas affected by the proposed expansion.
- Holder pays the appropriate fees

4.3 Tanzania

As in many countries Mariculture has been identified as a potential source of, and opportunity for, employment, food production, and community development. At this time small communities have developed marine seaweed culture operations and it was estimated in 1999 that approximately 20,000 individuals were involved in seaweed culture in that country.

Attempts at larger scale commercial development, however, have not been positive in part because the country was not prepared for the regulatory control of Mariculture as it developed. The result is that to date, no large-scale Mariculture projects have been able to obtain all permits required to establish a legal operation. The realization that the nation was not fully prepared to deal with regulation of Mariculture coincided with the planning period of the Tanzania Coastal Management Project (TCMP). Two excellent papers are available online which provide an interesting referenced approach to the development of “Tanzania Mariculture Issue Profile” - http://www.crc.uri.edu/comm/download/Tanz_Mari_all.pdf

and “Tanzania Mariculture Guidelines Source Book”
http://www.crc.uri.edu/comm/download/Tanz_Mari_%20Source_Full.pdf

both joint initiatives between the National Environment Management Council, and the University of Rhode Island Coastal Resources Centre.

Species currently commercially/experimentally farmed in Tanzania include marine plants, rabbit fish, tilapia, mollusks, and prawns/shrimp.

4.3.1 Tenure Access

The government of Tanzania has its land ownership structure system based on a traditional right of occupancy. Rights for aquaculture tenure therefore are a developing combination of Land and Water Rights Issues. These have not been fully integrated, as will be evident in the following summary. This summary does represent, however, various issues that unfamiliar constitutions

may impose on the development of Mariculture and provide an insight as to various approaches that may be valuable in some jurisdictions.

** The following is excerpted from “Tanzania Mariculture Guidelines Source Book” and represents efforts by that government to establish guidelines and regulations for Mariculture development in that country. This publication is available in APPENDIX III.*

4.3.2 Land Tenure

There are two types of land tenure systems in Tanzania: Customary Right of Occupancy and Granted Right of Occupancy

Customary Right of Occupancy (Traditional Tenure)

- Under this type of tenure, the whole community occupies the land under the supervision of elders and heads of the clan.
- It exists in the rural areas and is recognized in the current legal framework.
- This land is not transferable, but it can be leased.

- Customary land is controlled by a village or a clan and is not available to investors outside these groups.

- This type of land is allocated after receiving an application for a project that is wholly or partially owned by a Tanzanian citizen.

- The authorities responsible for approval and allocation depend on the size of the parcel requested
- Once this type of land is leased, it ceases to exist as a Customary Right of Occupancy.

- Features of the Right of Occupancy include:
 - A definite term for the occupation and use of land
 - Development conditions imposed on the occupier of that land
 - The occupier of that land has no right to subdivide, transfer or mortgage the same without the consent of the Commissioner for Lands
 - The occupier pays rent to the government
 - The occupier is allowed to apply for renewal for periods of less than 99 years
 - The president of the United Republic of Tanzania may revoke the right of occupancy of the land occupier

Granted Right of Occupancy (lease)

- Under the Granted Right of Occupancy tenure system, the occupier is granted a certain parcel of land and entitled to take possession of that land under specific terms and conditions.
- This system is also recognized in the current legal framework.
- The procedure for obtaining this sort of occupancy is under the control of the government.
- This is the type of occupancy that most investors will seek.

- Feature of Leasehold
 - Short-term lease that is not more than five years and long-term lease which is more than five years but less than 99 years.

 - Long-term lease derived under the right of occupancy needs consent of Commissioner for Lands/District Land Development officer and it is supposed to be registered.

Land Occupancy

There are several forms of ownership or occupancy for land. These forms of ownership or occupancy apply for lands held under Customary Right of Occupancy or Granted Right of Occupancy.

- ***Individual***
 - Under this kind of occupancy an individual under Customary Right or Granted Right of Occupancy acquires land.
 - If the occupier has land under Customary Right of Occupancy the security depends on its utilization, brought about by effective cultivation of the land or development of some other activity. In other words, the right to occupy
 - the land depends on its continued utilization, and ownership is only granted to the crops, buildings or other infrastructure on the land, not the land itself.
 - Under the Granted Right of Occupancy, the occupier is given a certificate of title accompanied by terms and conditions stipulated therein.

- ***Co-occupancy***
 - This category applies when more than one person acquires the land.
 - This could be between wife and husband, business partners, friends, etc.
 - If an investor acquires land held under lease by co-occupants, then all members who are co-occupiers should be in agreement before the land is transferred.

- **Clan land**
 - This is land occupied by a clan and it is for the use of all members of the clan and not transferable except where the whole clan membership agrees to do so.
- **Village land**
 - This is land occupied by the membership of an entire village and it is for the use of all village members.
- **Reserved land**
 - This is land occupied by the government, for example, national parks, forest reserve, that are gazetted.

Procedure for Acquiring Land

- The procedure of acquiring land in Tanzania differs depending on whether the land is rural or urban.

** Authors Note: For the purpose of Mariculture activities, only procedures of acquiring rural land are described because urban management and development plans rule out Mariculture operation in these areas.*

The two procedures for obtaining land are:

- Customary Right of Occupancy
 - Village Councils allocate land after receiving an application from the investor.
 - The Village Authority can authorize land use rights only for parcels up to 50 acres.
 - For larger parcels, the Village Authority must be consulted, but higher-level authorities make the final authorization.
 - A foreigner intending to operate a 100 percent foreign company does not have access to village land under Customary Right of Occupancy.
 - Local investors from different villages may register and obtain land in a village where the identified site is located.
- Granted Right of Occupancy:
 - Application is submitted to the village by the interested investor. The application is accepted and the Village Council informs the District Authority if the amount

of land requested for use is less than 50 acres. Otherwise, higher levels of government must ultimately approve the request after sequential approval by lower government levels.

- The steps are:
 - The land is surveyed and the applicant given a letter of offer
 - Development can commence at any time after receiving a letter of offer
 - The survey plan must be approved by the Ministry before paying the required fees (deed plan, registration and survey fee, land rent and stamp duty)
 - The procedure to obtain the certificate of occupancy and title deed can then be undertaken.

Title deed

- The certificate of occupancy is signed and sealed, this is then registered in the region or zone to make it a title deed. However the procedure and precautions of double allocation necessitates delays in obtaining title deeds.

Compulsory acquisition

There are two cases where compensation comes in with reference to land acquisition, one enacted in law, and one recommended.

- The Land Acquisition Act of 1967 (Act No. 47) empowers the president to acquire land for public purposes.
- Land granted as stated above may be acquired by the president if need arises. However where acquisition is done, compensation is to pay fully, promptly and fairly in accordance with section 3 (1) (f) of the Land Act of 1998.

Change of use

In a case where the occupier of a parcel of land wants to change the use of that land, for example from salt ponds to fish farming, an application is made to the Commissioner.

Transfer

The holder of certificate of title can transfer the right of occupancy at any time the decision to do so is made.

The main condition that must be adhered to is that the land being transferred is developed according to the terms and development conditions originally stipulated in the title. Consent to transfer is given by the Commissioner for Lands.

For efficiency, the Commissioner for Lands gives power to the District Land Officers to give consent on the behalf of the Commissioner.

Application

The following are the documents that need to be submitted by the applicant.

- Application letter – the applicant gives reasons for the transfer of that property
- Two copies of transfer deed – transfer deeds are documents that show the consideration under which the land use was originally granted and the names and signatures of both the seller and the buyer
- Certificate of Title – the seller attaches the certificate of title
- Consent fee – fee is paid and receipt is attached
- Land rent – a photocopy of the most recent receipt of land rent is attached
- Stamp duty and land registration fee are paid

4.3.3 Water Rights

All waters in Tanzania are vested in the United Republic of Tanzania. Therefore, any person or industry that wishes to use an appreciable amount of water must be permitted by obtaining a water use right. A serious consideration in the development of Mariculture and other industries potentially utilizing marine or brackish waters is that there is currently no procedure to obtain such a water use right for any source of water other than freshwater. However, water policy is under revision and will address some of the issues related to Mariculture, including the use of brackish water.

The Water Utilization and Regulation Act (No. 42 of 1974 that repeals Cap. 410) applies to everyone in the Tanzania Mainland including government departments, local authorities, the private sector, individuals and villages. Under this Act all water sources are divided into two categories namely national water sources and regional /basin water sources.

- The Minister responsible for water appoints a public officer to be the Principal Water Officer with jurisdiction over all national water supplies.
- The Regional Commissioner in each region appoints a Regional/Basin Water Officer with jurisdiction over regional/basin water supplies.
- A Central Water Advisory Board advises the Principal Water Officer while the Regional/Basin Water Officers are advised by Regional/Basin Water Advisory

Boards.

- Both Central and Regional/Basin boards advise the respective officers on all matters concerning the apportionment of water supplies, and the determination, diminution or modification of water right.
- The Water Advisory Boards should have a member from Fisheries and other relevant sectors who advise on matters related to fisheries and aquaculture.

Regulation of Fresh, Brackish Water, and Seawater

Mariculture may involve use or occupation of various types of water along the coastal zone. The coastal area is home to large areas of brackish water, and tidal influence may cause great variations in what salinity of water is present in a specified geographic location at any moment. Thus, the limitation of regulatory policy to freshwater is an issue that needs to be addressed.

Water Rights

- A water right is granted by law to take possession of water occurring in a natural source of supply and to divert the water for a beneficial use on, or in connection with, land.
- It is a right of use of water and not a right to the corpus of water itself. Anyone having lawful access to any water may abstract and use the same for domestic purposes without the necessity of obtaining a Water Right provided no construction works are made for the abstraction of water.
- The main legislation to control the extraction of water for different uses is that of the Water Utilization and Regulation Act (No. 42 of 1974, which repealed Cap. 410 of 1959). Acts No. 10 of 1981, No. 17 of 1989 and No. 8 of 1997 have amended the Act.
- Both the principal Act (No. 42), and its amendments are for the protection of the water resource and the user so that there is balance between the different uses.
- There are relatively few guidelines for the use and abstraction of water, and these do not provide oversight for the wide range of means by which aquaculture and Mariculture activities could use the various types and sources of water within the nation.

Grant of water rights

The Principal Water Officer grants water rights in respect to national water supplies, whereas it is the Regional/Basin Water Officer that grants water rights to regional/basin

water supplies.

Procedure for obtaining water rights

- Once the source of water to be used has been identified, an application giving details as required by the water application form available in the Water Department shall be made.
- An application fee is payable to the Permanent Secretary of the Ministry responsible for water (Water Act 1974).
- The application form shall be submitted to the Principal Water Officer for National Water Sources and to the Regional/Basin Water Officer for regional/basin sources. These are at the ministry headquarters and regional/basins offices respectively.
- Once the application form has been filled out and submitted (normally in quadruplicate) the water officer prepares a notice setting out the particulars of the application and causes it to be published in an official gazette. The gazette is served upon all persons named in the application as being affected by the grant of the right for which the application is made. It is also served upon such other person's deemed fit and it is displayed at the appropriate district office for which the application and potential grant of water rights will be exercised.
- The Water Department is responsible for granting a water right. A Principal Water Officer or Regional/Basin Water Officer signs the water right after being advised by either the Central or Regional/Basin Water Advisory Board. This law is applicable to freshwater sources and therefore does not include marine waters.

Conditions implied in water rights

That the water used under a water right:

- Is either made in the name of the applicant which cannot be transferred to any other person without the consent of the water officer, or as an appurtenant to the land which can be transferred with the land whenever the ownership of the land or part of the land changes hands.
- Be returned to the streams or body of water from which it was taken or to such other stream or body of water as may be authorized by the water officer
- Shall not be polluted with any matter derived from such use to such extent as to be likely to cause injury either directly or indirectly to public health, to livestock or fish, to crops, orchards or gardens which are irrigated by such water, or to any product in

the processing of which such water is used. Recommended water quality standards for discharge into receiving systems are available in the Water Department.

- Shall take precaution to the satisfaction of the water officer to prevent accumulation of silt, sand gravel, stones, sawdust, refuse sewerage, sisal waster or any other substance likely to injuriously affect use, in any receiving river, stream or water Although general water quality standards for effluents exist, there is a lack of water quality monitoring programs, except on project-specific activities. It is therefore difficult to assess continual compliance to specified water quality standards.
- Where any person who is the holder of a water right or has applied for the grant or water right without easement and has failed to secure an easement by agreement with the owner or occupier of the land over which the easement is required, he/she applies to the appropriate Water Officer for the creation of such easement.

Zoning For Water Use

Coastal habitats contain many areas where water and land overlap in a dynamic fashion, changing seasonally and with the tides. Mariculture bridges many habitat types, ranging from agricultural land to brackish wetlands to marine areas. Coastal habitats and coastal development have therefore proven difficult to manage given that the nature and use of coastal areas rarely coincides with the institutional and legal frameworks developed.

In the case of Tanzania

- there is fragmentation and lack of harmony for regulation of individual habitats
- there is little integration for simultaneous consideration of land and marine tenure issues.
- Zoning as a management tool can help regulate use in these areas, but initial steps must be taken before zoning can be applied.

5.0 ENVIRONMENTAL MONITORING

A Mariculture activity, by its very definition is an activity that takes place on, or that uses marine water resources for the production of food or other products. The previous two Chapters gave a brief overview of generic Property Rights as they pertain to the industry, and Regulations developed surrounding the allocation of tenure, which provide an individual, company, or other entity, legal access to inhabit and/or use water for production purposes. It is a basic premise of virtually all governments and societies that Mariculture activities take place within a context that it protects (or at least does not negatively impact) the marine environment, which supports it. This Chapter reviews the development and current status of environmental control of Mariculture activities as it pertains to the appropriate level of development in specific jurisdictions.

There is little scientific documented impact related to negative environmental impacts of shellfish Mariculture. For the most part shellfish, as filter feeders, are limited by primary production rather than self-degradation of habitat. Marine Fish, culture, however, has experienced problems with waste accumulation that has negatively impacted the marine environment. In this regard the following chapter will focus on Marine Fish and Environmental Monitoring

** Shrimp Mariculture, as it primarily takes place in fresh and brackish water is not included in this report, however, the regulations and policies developed for the siting, monitoring and relocation of marine fish farms has direct application to any marine shrimp aquaculture operation.*

5.1 British Columbia- Canada

5.1.1 Mariculture Siting

Properly locating fish farms reduces the potential for negative impacts to the marine environment and results in a more efficient production of healthy fish. Good water quality, adequate currents, physical protection for farm structures and distance from sensitive marine areas are some of the factors that are considered when selecting a suitable farm site.

In British Columbia a report the Environment Assessment Office published “Salmon Aquaculture Review” in 1997, which review the situation at the time and made recommendation with respect to adoption of siting criteria for new farms.

* The full review is available on line at

http://www.intrafish.com/laws-and-regulations/report_bc/

Since that time, various criteria have been further developed and are used primarily by government to evaluate application for fish tenure. Current guidelines for siting criteria I British Columbia include.

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Proposals for new salmon farms must meet the following requirements and minimum separation distances. Sites must be located:

- At least 1 km in all directions from a First Nations reserve (unless consent is received from the First Nation).
- At least 1 km from the mouth of a salmonid-bearing stream determined as significant in consultation with DFO and the province.
- At least 1 km from herring spawning areas designated as having “vital”, “major” or “high” importance.
- At least 300 m from inter-tidal shellfish beds that are exposed to water flow from a salmon farm and which have regular or traditional use by First Nations, recreational, or commercial fisheries.
- At least 125 m from all other wild shellfish beds and commercial shellfish growing operations.
- An appropriate distance from areas of “sensitive fish habitat”, as determined by DFO and the province.
- An appropriate distance from the areas used extensively by marine mammals, as determined by DFO and the province.
- At least 30 m from the edge of the approach channel to a small craft harbor, federal wharf or dock.
- At least 1 km from ecological reserves smaller than 1000ha or approved proposals for ecological reserves smaller than 1000 ha.
- Not within a 1km line of sight from existing federal, provincial or regional parks or marine protected areas (or approved proposals for these).
- In order to not infringe on the riparian rights of an upland owner, without consent, for the term of the tenure license.
- Not in areas that would pre-empt important Aboriginal, commercial or recreational fisheries as determined by the province in consultation with First Nations and DFO.
- Not in areas of cultural or heritage significance as determined in the *Heritage Conservation Act*.
- Consistent with approved local government bylaws for land use planning and zoning.

- At least 3 km from any existing finfish aquaculture site, or in accordance with a local area plan or Coastal Zone Management Plan.

The biophysical issues related to salmon farm siting are described in British Columbia are further described in four Technical Advisory Team (TAT) papers which were prepared for the BC Salmon Aquaculture Review (SAR). Issues related to escaped farm fish, fish health, waste discharges and aquatic mammals and other species, are described more fully in these reports.

Some of the observations related to siting are that wild salmon stocks in close proximity to farms are likely to be at higher risk than those stocks inhabiting areas further away. Good siting choices combined with improved technology may reduce the likelihood of escape and the potential risk of impacts. Siting decisions also need to consider the potential spread of drug residues to wild food species, and features of wild species that would make them more susceptible to the effects of pathogens or parasites of farm origin. Siting is an important factor in minimizing environmental degradation in the vicinity of the farm location. It can also help to address concerns such as loss of wildlife, danger to the public and disturbance to other user groups, which can result from farmers' attempts to protect their stocks from predators.

Socio-cultural issues have been grouped under six headings:

- Proximity effects are defined as the effects of farms on people when they are close to the sites, and they include noise, smell, visual impacts, and decline in water quality, air pollution and garbage.
- Effects on communities include employment and related economic benefits, as well as the social and economic costs of conflict when controversy over siting occurs.
- Resource use conflicts have occurred because the particular biophysical characteristics sought for fish farms often overlap with those of other uses such as tourism and recreation, anchoring, fishing, navigation, and forestry.
- First Nations perspectives include a wide variety of concerns related to: the importance of resources to their physical and spiritual lifestyle, concerns about health of the stocks and the effects on the health of First Nations people, protection of aboriginal rights, the management of the industry, and an interest in involvement in the decision-making process.
- Public service benefits and risks include safety and transport provided by and to salmon farmers as well as public awareness programs.
- Process issues include concerns about regulations and procedures for siting and managing aquaculture operations.

Site selection considerations for salmon farming include biophysical siting criteria for Chinook and Atlantic salmon preferred by the industry, e.g., temperature, salinity, dissolved oxygen, current speeds, depth, wind speed, wave height and acidity. In addition to these factors, farming operations require good water quality, suitable physical characteristics, adequate protection, appropriate biological factors, avoidance of marine mammals and sites for fallowing. There are also separate detailed criteria to determine appropriate lakes for salmon farming.

A Guide to Information Requirements for Marine Finfish Aquaculture Applications is available online at.

http://www.agf.gov.bc.ca/fisheries/pdf/MFF_Guide_colour_single-sided.pdf

5.1.2 Monitoring of Marine Fish Farms

To support the sustainability of marine fish farming in British Columbia the government has implemented the most comprehensive regulatory regime and protective framework for finfish aquaculture in the world. In accordance with the Environmental Assessment Office's 1997 recommendations, the Ministry of Water, Land and Air Protection has introduced a new finfish aquaculture waste control regulation.

The new regulation applies to all farms and includes provisions for registration, waste discharge standards, pre-stocking requirements, domestic sewage requirements, best management practices, monitoring and reporting, remediation, fees, offences and penalties. The Regulations require marine fish farmers to:

- register with the ministry and provide updated information about farm operations. Registration may be in the form of a management plan for an aquaculture license under the Fisheries Act, with supplemental information as prescribed in the regulation.
- ensure the sustainability of ocean floor organisms. A sediment chemical standard applies within the farm tenure and a biological standard at the perimeter of the tenure. Specific chemical conditions and monitoring requirements must be met if various chemical levels are exceeded during a production cycle.
- meet conditions for domestic sewage discharge as described in the regulation.
- prepare and implement a best management practices plan to meet specific objectives including:
 - Achieving waste standards.

- Continual reduction of waste discharge and management to preclude spillage.
- Handling spills and mortalities in a timely and appropriate manner.
- Husbandry techniques to preclude wildlife access and minimize impacts on wildlife.
- implement a monitoring program with accepted protocols and frequencies for:
 - Physical parameters, such as currents.
 - Routine sediment grab samples for soft-bottom sites and surveys of hard-bottom sites.
 - Biological analysis and contaminant analysis (such as pesticides and metals), when specified.
- Finfish farm operators must report monitoring results and other waste-related information to the regional waste manager. The ministry will undertake audits and inspections to ensure that such reporting is accurate and that the standards are effective in protecting the environment.
- pay annually, fees, based on the calculated discharge of specific substances. Farms not in compliance with the standards would be subject to enforcement measures which may include the following:
 - Written warnings.
 - Violation tickets.
 - Administrative penalties.
 - Formal prosecution.
 - Land tenure/aquaculture license suspension/cancellation.

The ministry's Protocols for Marine Environmental Monitoring, a handbook for the finfish aquaculture waste control regulation, provide further details about monitoring requirements. The Protocols document is available on the ministry's Web site:

http://wlapwww.gov.bc.ca/epd/epdpa/industrial_waste/agriculture/agri_fishf.htm

Once a marine farm is in operation monitoring must be carried out on an ongoing basis. One of the significant issues with respect to monitoring marine fish farms is the determination of "foot print" that is the specific area which is likely to be impacted by any waste or other material generated by the fish farm. These protocols are currently being developed and will change continually over the next few months as all levels of government and industry deal with the practicalities of such monitoring programs.

** Authors Note - IEC INTERNATIONAL has been instrumental in development footprint and monitoring models for BC finfish culture industry and are currently advising all levels of government and industry on protocol development.*

To support the Finfish Aquaculture Waste Control Regulation, the Ministry of Water, Land and Air Protection (WLAP) has developed protocols for marine environment monitoring. These protocols are developed to ensure that high quality data are collected, thereby, leading to sound decisions as to whether environmental standards are being met.

A brief outline of important sections of the Monitoring Protocol is listed following. An online copy of the Protocols for Marine Environmental Monitoring, including specifics as to equipment, statistical analysis, etc. are available online at:

http://wlapwww.gov.bc.ca/epd/epdpa/industrial_waste/agriculture/reg_protocols.pdf

Schedule A — Baseline Inventory

Part I — Currents Metering

The following ocean currents metering information is required for registration.

The currents regime at the site must be characterized at 2 depths: approximately 15 metres below the surface and approximately 5 metres above the bottom. Current direction must be measured in degrees true and current speed in centimeters per second. Speed and direction must be recorded at least once every 30 minutes for a period of at least 30 days. The locations where currents are metered must represent currents within the tenure, especially near containment structures and containment structure arrays. Follow the protocols for collecting currents data that appear in Section 1 of Protocols for Marine Environmental Monitoring (WLAP 2002).

Part II — Baseline Monitoring

A. Seabed Characterization

A baseline survey of the seabed within the tenure and at least 2 reference stations is required. The baseline survey must achieve the following objectives:

- describe variation in substrata, topography and bathymetry throughout the tenure and at reference stations
- locate reference stations with similar depths, substrata and other features
- determine the feasibility of collecting sediment grab samples and identify areas that need video survey for operational monitoring

- collect physical and biological data to compare with data collected during the operational period and to estimate the number of samples needed for operational monitoring.

Surveys of the probable footprints for all proposed locations of the containment structures, or containment structure arrays, are required. They must include enough transects to map all biophysical characteristics to a resolution of 50 metres. To describe depth variation, at least one transect must run perpendicular to the shore starting from the landward boundary of the tenure and running to its opposite perimeter.

B. Video Survey

Each reference station must have 2 video transects, each at least 100 metres long, including one perpendicular to shore. The transects must run straight, with start and end points recorded for future reference.

Surveys must characterize substratum types as bedrock, boulder (>256 millimetres in diameter), cobble (64-256 millimetres in diameter), gravel (2-64 millimetres in diameter), sand (0.0625-2 millimetres in diameter), silt, mud and clay (<0.0625 millimetres in diameter), or shell hash. For combination substrata, relative proportions must be noted (e.g. 50% bedrock: 50% boulder). Some will have associations of organisms or other features, which must be identified.

In areas where sediment grab sampling is not possible, the abundances of mega fauna, macro fauna and macrophytes must be measured. For mega fauna, record moving images along transect. For macro fauna, take still images of quadrats. For macrophytes, use both. There must be enough quadrats to adequately represent each substratum type within all probable footprints. At reference stations, 5 quadrats must be sampled midway on the transects. All images, whether moving or still, must be clear enough for counting and measuring the biota cover. All biota must be taxonomically identified to at least the level of class.

Sediment colour and the presence or absence of fish feed, fish faeces, flocculent organic material, macrophytes, terrigenous material and farm litter must also be recorded for each transect and quadrat. These observations are needed for proper comparison with observations made during operational monitoring. Unique seabed features or areas of interest must also be mapped.

The baseline survey must follow the protocols for video surveys in section 2 of Protocols for Marine Environmental Monitoring (WLAP 2002) unless the manager has authorized an alternative method, and the alternative method will meet the objectives for the baseline survey set out at the beginning of this Part.

C. Sediment Sampling

Following conduct of the video or alternate survey, sediment grab sampling is required wherever physically possible.

Grab sampling obtains physical, chemical and biological data to be used to determine the number of samples needed for operational monitoring and to be compared against the operational data. Within each of the probable footprint or accumulated probable foot prints a minimum of 3 grab samples must be taken for each sediment type and if only one sediment type is present, then a minimum of 5 grab samples must be taken. Two reference stations must be selected (as described for video surveys above) and at least 3 grabs must be taken at each reference station. Follow the sediment sampling protocols in Sections 3 and 4 of Protocols for Marine Environmental Monitoring (WLAP 2002).

The following physical and chemical parameters must be measured whenever a sediment grab sample is taken:

- free sulphides*
- redox potential*
- total volatile solids or total organic carbon
- sediment grain size (% gravel, sand, silt, mud and clay)
- total zinc (at sites where zinc is used in feed formulations)
- total copper (at sites where copper is used as an antifouling agent)
- other contaminants (if required by the manager) such as pesticides, therapeutic additives, therapeutants, pharmaceuticals, wood preservatives and persistent organic compounds
- other parameters if required by the manager.

* Follow the protocols for measuring free sulphides and redox potential in Sections 5 and 6 of Protocols for Marine Environmental Monitoring (WLAP 2002).

Record this additional information:

- sediment colour, odour and texture
- presence or absence of gas bubbles, Beggiaoa, fish feed, fish faeces, flocculent organic material, macrophytes, terrigenous material and farm litter.

Biota must be taxonomically identified to the level of species and counted. Also identify and count individuals of *Capitella*. After being processed, samples must be archived for at least 5 years. These samples must be properly stored and maintained.

5.1.3 Relocation of Marine Fish Farms

Due to past environmental problems and wide support towards sustaining a profitable and environmentally sustainable industry, both the BC Mariculture industry and the BC government are committed to relocating marine fish farms that were inappropriately located. Due to improvements in science and increased knowledge of the effects of marine fish culture, as a whole, there is a better understanding of those factors that make areas suitable or unsuitable for marine fish culture.

Over the past two years in British Columbia there has been 37 salmon farms identified that may be requires to relocated to more suitable sites. Some of the environmental considerations include in the decision to relocate include:

- Proximity to salmon bearing stream
- Kelp beds
- Herring spawn areas
- Shellfish beds
- Sensitive marine habitat
- Parks or protected areas

Other consideration was also given to biophysical factors such as current speed

- Waste dispersal,
- Susceptibility to algal blooms

Social aspects are also considered including:

- Proximity to First Nation reserves

- Know conflicts with nearby resource users
- Proximity to industrial pollution sources

Farm relocations are being made in compliance with new, [stricter environmental standards](#) and will ensure the continued protection of wild fish, marine mammals and other wildlife. Relocating poorly sited farms will also reduce the potential for social conflicts with other marine resource users.

5.1.4 Summary British Columbia.

All issues regarding the Mariculture of fish/shellfish species, including: site identification, waste management, monitoring, and reporting are at the forefront of development for British Columbia and many countries globally. Documentation covering these collective issues is contained within thousands of pages of reports, regulations, policies, and reviews. This brief summary was intended to identify major issues and direct the reader to historical and current data on this issue.

As this is a current and important issue new documents are being prepared on a very short time frame and numbers, requirements, limits, are being revised on an ongoing basis. It is the belief of BC industry, government, and the author that British Columbia is at the global forefront of these initiatives and represents the most up to date information in this area.

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