GULF OF MAINE
COUNCIL ON THE
MARINE ENVIRONMENT

AQUACULTURE IN THE GULF OF MAINE: A COMPENDIUM OF FEDERAL, PROVINCIAL AND STATE REGULATORY CONTROLS, POLICIES AND ISSUES

prepared by

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AQUACULTURE COMMITTEE

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"The Gulf of Maine Council on the Marine Environment was established to maintain and enhance environmental quality in the Gulf to allow for sustainable resource use by existing and future generations."

INTRODUCTION

This report has been prepared for the Aquaculture Committee of the Gulf of Maine Council on the Marine Environment. The Committee's purpose is to better understand respective aquaculture-environmental interactions and to focus on those issues in common that impact the Gulf of Maine ecosystem. The purpose of this report is to facilitate for the Committee a common base of knowledge concerning the laws, regulations, policies, protocols and issues attendant to aquaculture in each of the jurisdictions represented by the Gulf of Maine Council. The information contained herein has been obtained through interviews with federal, provincial, state and industry representatives involved in aquaculture in both Canada and the United States. Statutes, regulations, and other published material including scientific literature, trade journals, agency publications and electronic databases were also used.

Recent reports prepared separately in various member jurisdictions have addressed aquaculture related issues, some in exquisite detail, although none have addressed aquaculture throughout the jurisdictions bordering the Gulf of Maine. This report is intended as a bridge to all member jurisdictions, albeit in a very cursory fashion. It is not intended as an evaluation of differing management regimes or their effectiveness although, where appropriate, contrasts and comparisons are highlighted.

The most evident fact in both Canada and the United States is that the issues attendant to aquaculture do not fit exactly within the portfolio of any single agency as do issues related to agriculture or the capture fisheries for example. Consequently, aquaculture is administered by a plethora of agencies at both the federal and provincial/state level. Some of these agencies do not have clearly delineated authority vis-à-vis aquaculture and some degree of overlap and duplication of effort exists. This is particularly so with respect to the United States. From the perspective of both project developers, stakeholders and other interested parties, the array of cross-jurisdiction, statute, regulation and consequent applications, requirements, policies and protocols has created a situation of some confusion.

Because the Gulf of Maine Council's principal focus is upon environmental matters, this report does not address matters related to finance, economics or trade beyond the brief industry characterization below. Nevertheless, these are extremely important matters which have significant bearing upon virtually all matters relevant to aquaculture and their importance should not be disregarded.

REGIONAL PROFILES; AQUACULTURE IN THE GULF OF MAINE

Aquaculture continues to be the fastest growing sector of the world's fishery. The Food and Agriculture Organization of the United Nations reports that the supply of cultured finfish, crustaceans and mollusks has continued to expand rapidly with Asia dominate in production and China its largest producer in terms of volume. Global marine-based aquaculture production has increased at a rate of approximately 12 percent in volume and 10 percent in value per year since 1990 and equaled 17 million metric tons and 20 million dollars US in 1997 (Figure 1).

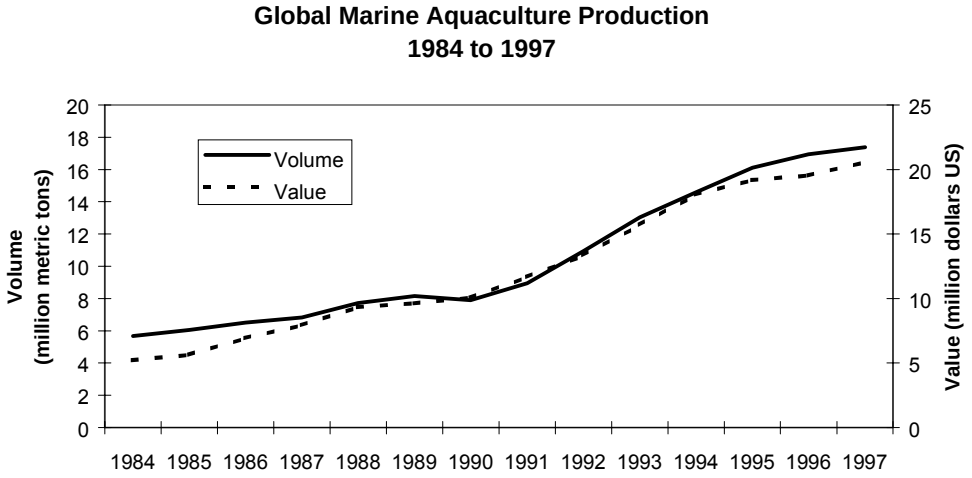

Figure 1: volume and value of global marine aquaculture production (Source: FAO Fishstat Plus)

It is important to note that production figures for aquaculture, regardless of the region or jurisdiction, should be regarded with a degree of caution. This is due, in part, to the source of information and its proprietary nature as well as the means of its reporting (mandatory or voluntary). There is also some question as to the nature of the products reported in that it is not always clear that reported production are exclusively marine-based or even a farm-cultured product. For the purposes of this report, aquaculture refers to the production of marine organisms at marine-based growout facilities only.

Logistical matters associated with any data collection program typically cause a lag time in available information and thus production data is often dated by as much as a year. The time lag for aquaculture reporting appears to particularly long. As a parenthetical comment, it is rather surprising that in this putative information age, data concerning aquaculture production is not readily available in the United States, either at the federal or state level. In contrast, the Canadian DFO Statistical Services have compiled national and provincial production figures which are available through the DFO home page (www.ncr.dfo.ca).

Aquaculture production in Canada and the United States has dramatically increased in concert with global production, yet North America's 208,000 metric ton contribution to marine-based world aquaculture in 1997 was slightly more than 1% of total global marine-based production. Canadian production in 1997 equaled 79,000 metric tons with a value of US$ 322 million (Figure 2). The United States production was of higher volume, but of lower value equaling 129,000 metric tons with a value of US$ 176 million (Figure 3).

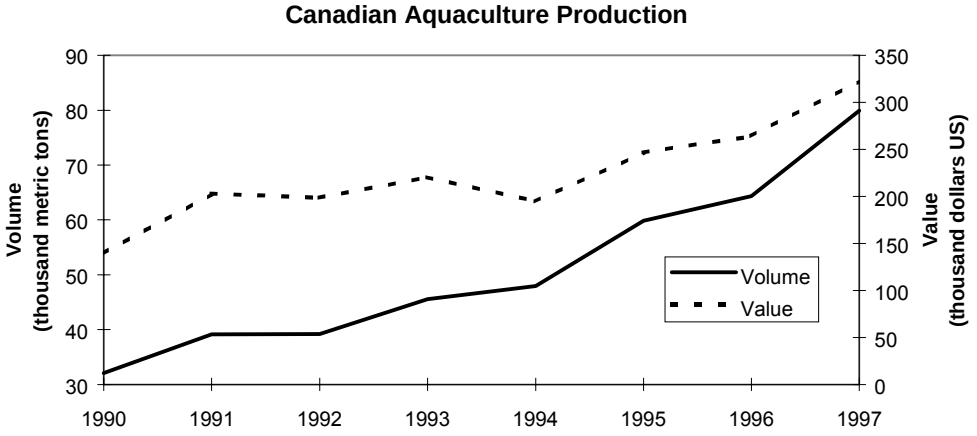

Figure 2: volume and value of Canadian total marine aquaculture production (Source: FAO Fishstat Plus)

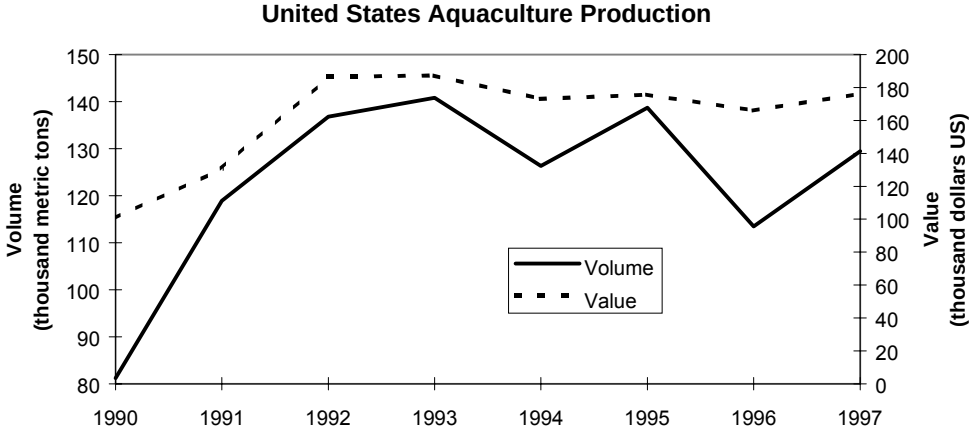

Figure 3: volume and value of US total marine aquaculture production (Source: FAO Fishstat Plus)

Aquaculture of a form has been practiced in the Gulf of Maine region for over a century including both finfish and shellfish culture. Marine aquaculture as an industry, however, is relatively new and dates to the early 1970s. Within the Gulf of Maine, aquaculture was worth US$ 167.8 million in 1997 up from US$ 72.3 million in 1990. These figures do not include shellfish production in the State of Maine which is not available or figures for the State of New Hampshire which has had only minimal marine-based aquaculture

production. New Brunswick's production in 1997 was dominate at 18,987 metric tons and a value of US$ 95.2 million. This was followed by Maine (13,482 metric tons / US$ 49.4 million), Nova Scotia (2,631 metric tons / US$ 7.5 million), and Massachusetts (103,162 bushels / US$ 1.5 million).

Nova Scotia. Oysters were cultivated in Nova Scotia more than 100 years ago and the first attempt to rear Atlantic salmon as a commercial product in a land-based saltwater facility took place here in the late 1960s. Today the principal species raised in Nova Scotia include salmon, steelhead, trout, mussels, oysters, and scallops in that order. Currently, there are 369 licensed sites stretching from the Gulf of St. Lawrence/Northumberland Straight where the focus is on American oyster, along the eastern shore where blue musses and sea scallop culture predominates, to the southern shore and Bay of Fundy region. The range of species cultivated in Nova Scotia, due to the significant variation in water temperature along its coast, sets this province apart from the other Maritime Provinces. The relatively warm water along that portion of Nova Scotia's coast within the Gulf of Maine region facilitates the production of Atlantic salmon. Other species for which interest has been shown include sea urchin, Atlantic halibut, haddock, various flatfish and sea plants.

New Brunswick. Aquaculture has been a rapidly growing industry in New Brunswick with Atlantic salmon the dominant species raised, accounting for approximately 97.8% in terms of volume of annual production in 1997. The feasibility of Atlantic salmon culture in the Maritimes was demonstrated by physiology work done at the St.Andrews Biological Station. Advancements made in the fields of disease prevention, nutrition and genetics made possible the growth of Atlantic salmon culture in both Canada and the United States. The first commercial scale venture was conducted in the late 1970s. By 1986, there were 28 salmon farms located in the Bay of Fundy producing an average of 25 tons of salmon per farm. Although the rate of growth in the industry slowed toward the end of the 1980s, there were 74 farms in 1996 producing in excess of 16 thousand metric tons of Atlantic salmon with a value of CDN$ 122,522,000. It has been projected that Atlantic salmon production in New Brunswick will reach 20,000 metric tons by the end of this decade.

Maine. In the early 1970s, entrepreneurs experimented with commercial mussel, oyster, coho salmon and rainbow trout farming in Maine. In 1973, perhaps the first strictly marine-based salmon pen operation in the Northeast was located in the Penobscot Bay. In 1981 the state issued the first lease for the purpose of aquaculture. Following the development of advanced pen-rearing techniques in New Brunswick, the first Atlantic salmon operation was established in Maine in 1982. By 1984 net pens in Cobscook Bay produced 63,000 fish and by 1988 approximately 1 million pounds of salmon valued at US$ 3 million was produced at 10 sites. Presently there are 30 farms operating at 79 leased sites from Eastport to Kittery. While Atlantic salmon is by far the dominate species produced, other species of importance include trout, mussels, oysters and nori, a red algae used in sushi.

New Hampshire. During the late 1970s and early 1980s there was a very limited commercial production of farm-raised quahog in New Hampshire coastal waters. However, the marine-based production became dormant until 1996 when a very limited (approximately 5,000 pound) of farm raised sea urchin was achieved. The state has issued licenses for aquaculture ventures involving mussels, oysters and summer flounder and anticipates commercial-scale production from demonstration-scale farms in 1999. It is also appropriate to note that a commercial-scale marine finfish hatchery has been operational in the state for the past few years.

Massachusetts. Marine aquaculture production in Massachusetts is driven exclusively by shellfish, primarily northern quahog and to a lesser extent oysters, scallops, soft shell clams, and mussels. The value of production over the past several years has remained relatively constant equaling US$ 1.5 million in 1997. The marine-based aquaculture industry in Massachusetts is concentrated on Cape Cod and areas beyond the Gulf of Maine including the outer islands and to a lesser extent along the southeastern shore.

ISSUES OF GULF-WIDE INTEREST

Regardless of the jurisdiction, there are facets of aquaculture that are of shared interest and concern. These include issues of competing uses of the marine environment, social issues attendant to private verses public ownership, and several issues related to environmental matters. These issues to varying degrees have driven the regulatory agenda in each of the jurisdictions represented by the Gulf of Maine Council. A brief review of these issues sets a context for the section below dealing with authorities, responsibilities and aquaculture related management and policies.

The most significant issues related to aquaculture development are access to capital and site access. Financing for any project can be difficult to secure in the private market, and virtually impossible in conventional markets without some form of ownership interest in production facilities. For the aquaculturist, gaining proprietary access to a marine-based growout site is of utmost importance. A lease or license issued by the government provides the aquaculturist with the proprietary right to use what is in essence public property.

A wide array of political, social, economic, and environmental considerations affect marine-based aquaculture. These are often site and species specific and demand evaluation of diverse types of information. Generally, these evaluations occur in two separate contexts, selection and establishment of a location (siting) and ongoing evaluation of ambient conditions at a site (monitoring). While related, siting and monitoring present differing perspectives and differing issues. It is also with respect to these topics that the panoply of issues related to aquaculture manifest beyond the scope of any single agency, leading to jurisdictional overlap and a need for agency coordination.

Questions that must be addressed when seeking a suitable site include: what species will be cultured, how much and what is its source? Will the production facility require

surface structures and support platforms including water- and land-based support? Are there potential conflicts with other uses of the area including traditional fisheries and marine transportation? Are there aesthetic impacts? How intensive will the surface water, water column, bottom and sub-surface at and adjacent to the operation be used and impacted? Does the proposed culturing operation have a potential for discharges? How will the environment be monitored and maintained? How will the health of the cultured product be monitored and maintained? How will harvesting and processing be conducted and will there be conflict with fisheries or wildlife management and regulation?

While the above recitation is simplistic, it does provide a sense of the basis upon which the regulation of aquaculture has evolved. In most instances, the regulation of aquaculture began as a means of providing legal protection for entrepreneurs and financial institutions – as a way to stimulate investment in an industry. As this industry has grown, so have the issues and the public policy has been refocused on the need to address problems, real or perceived. Initially, issues of user conflict were predominate and then, with time, aesthetic and environmental issues were brought to the fore. Consequently, the siting and monitoring provisions detailed in following sections have been developed and expanded to address the issues as they have arisen.

CANADIAN AND U.S. FEDERAL AQUACULTURE ROLE

Introduction. Marine-based aquaculture is predominately a provincial/state responsibility. Nevertheless, a federal role does exist in both countries. In the United States, no single federal agency has been delegated or statutorily charged with lead responsibility for marine-based aquaculture. In fact, marine-based aquaculture is not directly addressed in federal statute, but through authorities derived from various statutes, a number of agencies are involved. Major programs and resources are located within the U.S. Departments of Agriculture, Commerce and Interior. Many of these programs, however, relate to promotional activities, research and financial support and are not covered in this report. Other agencies with significant regulatory control include the U.S. Army Corps of Engineers, The Environmental Protection Agency, and the Health and Human Services Department's Food and Drug Administration (Brennan 1995). In addition, the Joint Subcommittee on Aquaculture (JSA) established in the National Aquaculture Act of 1980 (P.L. 99-198) serves as the federal government-wide coordinating group.

In Canada, the federal role in aquaculture is more clearly delineated and derived from a much more focused statutory authority than that of the U.S. The 1995 Aquaculture Development Strategy put forward the Canadian intention to create an economic and regulatory environment that fosters aquaculture while ensuring environmental integrity where aquaculture is practiced (Porter et al. 1998). This strategy requires that the integrity of all aspects of the aquatic environment be maintained including the seafloor and substrate, the habitat, and biodiversity. Towards this end, the federal government is committed to develop and implement a responsive and effective regulatory and policy framework to ensure that aquaculture is conducted in an environmentally sustainable manner. In addition, the 1996 Oceans Act (R.S.C. 1996, c. O-2.4) consolidates Canada's ocean related legislation and sets out principles for ecosystem based management and sustainable development.

While aquaculture is not specifically defined as a fishery, it is considered as such and is specifically addressed under provisions of the Fisheries Act (R.S.C , c. F-14, s.1.) which is a significant environmental statute (DFO 1999; Porter et al. 1998). The Department of Fisheries and Oceans (DFO), the Canadian Coast Guard which is a sub-agency within DFO, the Canadian Food Inspection Agency under the Department of Agriculture, the Department of Environment Canada, and the Pest Management and Regulatory Agency under the Department of Health Canada each have involvement with marine-based aquaculture.

This section presents the various federal agencies involved with aquaculture in both Canada and the United States and describes the basis of their authority and nature of involvement.

U.S. Army Corps of Engineers. The ACOE authority stems from Section 10 of the

River and Harbors Act of 1899 (33 U.S.C. § 403), Section 404 of the Clean Water Act, (33 U.S.C § 404) and Section 103 of the Marine, Protection, Research and Sanctuaries Act (16 U.S.C. 1431 *et seq.*). These laws require permits authorizing activities in or affecting navigable waters of the United States, the discharge of dredged or fill material in waters of the United States, and the transportation of dredged material for the purposes of dumping it into ocean waters. The ACOE Section 10 permit is the most comprehensive hurdle that a project developer must overcome and thus the ACOE is by virtue of its authority the *de facto* lead federal agency.

U.S. Environmental Protection Agency. Section 402 of the Federal Water Pollution Control Act established the National Pollutant Discharge Elimination System (NPDES) to ensure that point source discharges would not impair the nation's water quality. The EPA, which has statutory authority to administer NPDES permits, has determined that floating fish pens constitute "concentrated aquatic animal production facilities" under the Act and are thus subject to permit requirements. The agency has also determined that the Ocean Disposal Criteria of section 403(c) of the Act applies, thus mandating an environmental effects review of aquaculture projects.

U.S. Department of Commerce. Within the Department of Commerce are located several agencies with aquaculture involvement, both direct and indirect. The National Oceanic and Atmospheric Administration (NOAA), administers the Coastal Zone Management Act (16 U.S.C. 1451 *et seq.*), requiring a consistency determination with approved state coastal zone management programs for federally permitted activities that affect land, water, or natural resources of the coastal zone and NOAA's National Ocean Service provides consultation for certain projects pursuant to the Marine Protection, Research, and Sanctuaries Act.

Also located within NOAA is the **National Marine Fisheries Service.** The Service's principal role vis-a-vis aquaculture is with respect to its statutory authority to administer the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*), its statutorily shared responsibility with the U.S. Fish and Wildlife Service to administer the Endangered Species Act, (16 U.S.C. 1531 *et seq.*), and its prerogatives as a review agency under Section 10 of the Rivers and Harbors Act, the Fish and Wildlife Coordination Act, and the National Environmental Policy Act. The National Marine Fisheries Service also has regulatory authority to enforce measures adopted pursuant to provisions of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq.*).

U.S. Coast Guard. U.S. vessels, including barges, that support aquaculture facilities and that measure five net tons or larger must obtain Coast Guard documentation. Beyond vessel documentation requirements, the Coast Guard's interests pertain to navigational issues, including the design, placement, anchorage, and marking of structures within navigable waters. A Private Aid to Navigation Permit is required as is documentation confirming that applicants have read the applicable regulations pursuant to 14 U.S.C. 83 - 85. Permits are available from the 1st Coast Guard District in Boston.

Canadian Department of Fisheries and Oceans **Under provisions of the Fisheries Act the Department of Fisheries and Oceans (DFO) is deemed the lead federal agency with respect to aquaculture. This act at Section 4 enables the Minister of Fisheries of DFO to authorize the collection of fish for purposes of stocking or artificial breeding from wild stocks, the release of live fish into fish habitat and the transfer of live fish. Under Section 43 of the Fisheries Act, Fisheries (General) Regulations (SOR/93-53) are promulgated requiring that a license be obtained for these purposes**

The Fisheries Act also addresses habitat protection and pollution prevention. The core of the fish habitat provisions, Section 35, prohibits activities that may produce harmful alterations, disruptions or destruction of habitat unless specifically authorized by the Minister of DFO. Section 36, which is administered by the Department of the Environment Canada, **provides regulatory authority to define and set limits for the discharge and deposition of deleterious substances in the waters frequented by fish.**

Canadian Coast Guard **In some situations, the siting of aquaculture sites may require approval under Section 5.1 of the Navigable Waters Protection Act (R.S., c. N-19, S.1.) which is administered by the Coast Guard located within the Department of Fisheries and Oceans. The Navigable Waters Protection Act is intended to ensure safe vessel passage and thus the terms and conditions of the approval are intended to minimize the risk of collision with net pens and other site structures.**

Beyond the agencies and activities outlined above, there are several other federal agencies that may have involvement with aquaculture depending upon the nature of the venture. These agencies include the **Canadian Food Inspection Service** addressing issues related to importation, production procedures, and testing, etc. under the Health of

Animals Act, the **Canadian Pest Management and Regulatory Agency** where pesticides are used as topical agents, and **Health Canada** regarding issues of shellfish sanitation or the use of antimicrobial treatments, for example. In the United States, the **U.S. Food and Drug Administration** serves a role similar to that of Health Canada. Other U.S. agencies involved include the **Fish and Wildlife Service** as a review agency under Section 10 of the River and Harbors Act. And, under provisions of the Magnuson-Stevens Fisheries Conservation and Management Act, a **Regional Fishery Management Council** may propose management measures that affect aquaculture in the Exclusive Economic Zone. In addition, both Canada and the United States are involved in or party to a number of organizations and treaties which may have a direct and indirect bearing upon aquaculture such as **the Law of the Sea Treaty** (LOS), the **North Atlantic Salmon Conservation Organization** (NASCO), and the **International Council for the Exploration of the Sea** (ICES).

STATE AND PROVINCIAL AQUACULTURE ROLE

Introduction. The most significant tool used to manage aquaculture is the ability to lease, license, or grant to the aquaculturist the proprietary right to use what is in essence public property. In so doing, the state or province provides legal protection for entrepreneurs and financiers to foster investment in the industry. Nevertheless, regulation of ocean and coastal uses is a complex and often controversial undertaking because the marine environment is an interface between local, provincial/state, federal, and international jurisdiction. This section address the general authorities under which the provincial and state government administer aquaculture.

In Canada, both the federal Parliament and provincial Legislatures may enact valid legislation according to the powers distributed between them in the Constitution. The Constitution Act of 1867 (formerly the British North America Act) is the primary constitutional document that divides and allocates legislative power between the two orders of government which make up the Canadian federal system. Judicial interpretation has confirmed provincial authority over property, thus making it clear that the province has the power to manage Crown land, including those which occur subtidally, and the power to regulate aquaculture and license aquaculture operations (Hillyer 1997). The provincial government also maintains authority to establish standards for the business of aquaculture, the protection of consumers and markets, and waste management and environmental assessment applicable to aquaculture.

The original thirteen colonies of the United States succeeded to the sovereign rights of the English crown, thus each state owned tidal lands and the lands under navigable waters. Through judicial interpretation it has been affirmed that lands subject to the ebb and flow of the tides and the submerged lands are owned by the state and held in trust for the public. While a state's discretion is limited to a trustee responsibility with respect to *its* property, it has been determined that conveying exclusive rights to aquaculture operations is consistent with the public trust provided a clearly defined public purpose is being served. The state also maintains management discretion with respect to activities conducted in relation to its property including the management of resource therein and thus the state has the power to regulate aquaculture and license aquaculture operations (Wypyszinski 1994).

Despite the fact that in both Canada and the United States specific areas of authority are reserved exclusively to federal and provincial/state governments, there are some areas of similarity and overlap. This appears to particularly manifest in relation to areas pertaining to aquaculture. In order to reduce the complexity of development and management, including the application and review process, efforts have been taken to develop collaborative approaches. In Canada, the federal Department of Fisheries and Oceans has entered into Memoranda of Understanding with the provincial Departments of Fisheries and Aquaculture in both the Province of New Brunswick and the Province of Nova Scotia. The provincial departments are the lead agencies with respect to aquaculture development and the MOUs define the respective agency role in that regard. While the MOUs affirm provincial authority for leasing and licensing, proposals for aquaculture licenses and leases are forwarded to DFO for comment. The provinces have responsibility for administration of leases and licenses and there is a shared responsibility with DFO for monitoring, research and development (Porter et al. 1998).

Although not as rigorous in its formalization as the federal/provincial MOUs, a joint state/federal approach is utilized in the New England region. The State of Maine working in conjunction with various federal agencies, adopted such an

approach several years ago. Through agreement with the various state and federal agencies, the state Department of Marine Resources provides an aquaculture applicant with a comprehensive package that includes application material and instruction for all the necessary permits. The state agency then conducts a review process that meets the standards required by virtually all federal agencies and, although the respective decision making process remains separate, final decisions have proven to be consistent. The State of New Hampshire and the Commonwealth of Massachusetts are currently in the process of developing similar approaches and the New England Fishery Management Council has agreed to utilize a similar process in relation to aquaculture ventures proposed in the Exclusive Economic Zone.

Nova Scotia. The Province of Nova Scotia has recently revised and consolidated laws pertaining to its fisheries. The Fisheries and Coastal Resources Act (R.S.N.S. 1996, c. 25) symbolically reaffirmed the role of the province in aquaculture. Authority for aquaculture is delegated to the Minister of the Department of Fisheries and Aquaculture to issue aquaculture licenses and leases and to establish conditions for these vehicles. In so doing, the Minister is required to consult with other federal and provincial agencies, particularly the Department of Fisheries and Oceans and the Department of the Environment which, under provisions of the Environment Act (R.S.N.S. 1995, c.), includes designation regulations and conditions relevant to water quality, effluent control etc.

The Minister may also refer aquaculture applications to the private sector Regional Aquaculture Development Advisory Committees (RADACs) which were developed as a community-based review concept in an effort to facilitate economic development while simultaneously providing information to local residents and determining the level of public support for a project. The criteria

generally used by RADACs to review applications include current uses of the water body, possible user conflicts, the number of leases already in the water body and site location suitability.

Although a public hearing on an application is not required, the Minister may cause a public hearing to be held. Following the proscribed consultation period, including a public hearing process, the Minister may approve or reject the application, issue the requested lease or license, or issue a conditional lease/license. Both a license to operate and an aquaculture lease are limited to a specific geographic area to cultivate specific species for an initial 10 year period subject to other specific terms and conditions imposed by the Minister. Once granted, and subject to imposed conditions, the holder of an aquaculture lease has exclusive right for aquaculture purposes of the leased sub-aquatic lands and water column.

The Minister also may grant a special experimental license and in consultation with the aforementioned agencies, and with the approval of the Governor in Council, the Minister may designate special aquaculture development areas, imposing conditions and restrictions upon activities is such an area. Beyond the authorization for aquaculture activities in the subtidal area, the Minister may also lease and license portions of the intertidal area for the harvest of sea plants defined as fucoids and laminarians commonly known as rock weed and kelp, but not including Irish moss, dulse or eel grass.

New Brunswick. The Province of New Brunswick signed a Memorandum of Understanding with DFO in 1989 to promote the orderly development of aquaculture. The Department of Fisheries and Aquaculture is the primary provincial agency responsible for aquaculture including the issuance of licenses and leases, and the conduct of inspections. The provincial Department of

Environment administers the Clean Environment Act (R.S.N.B., 1998, c. C-6) the Clean Water Act (R.S.N.B., 1989, c. C-6.1) and the Pesticide Control Act (R.S.N.B., 1974, c. P-8) and reviews applications for projects affecting the flow of water and issues permits for the use of chemicals and pesticides. The Department of Natural Resources is responsible for the management of Crown lands, however, administration and control of these lands approved for aquaculture is transferred to the Department of Fisheries and Aquaculture.

Under provisions of the Aquaculture Act (R.S.N.B., 1988, c. A-9.2) and the Regulations under to the Act, the requirements related to siting and operating aquaculture facilities are stipulated. An aquaculture lease is required for operations located on public land and may be issued for a period of up to 20 years. An aquaculture occupation permit is also available which enable the temporary use of a site for up to three years. In both instances, terms, conditions and covenants are established by regulation and imposed by the Minister of Fisheries and Aquaculture. In order to carry out aquaculture operations at a site, an aquaculture license issued by the Registrar of Aquaculture must be obtained. This license stipulates conditions of site operations and specifies the species allowed to be cultured, the number of fish permitted, the capacity of the site and the environmental monitoring requirements.

The Minister of Fisheries and Aquaculture may refuse to issue an aquaculture lease or an occupation permit or may refuse to alter boundaries under an existing lease or permit where it would cause undue conflict with other fishery activities or with ecologically and environmentally sensitive areas, or where it would result in conflict with other resource users, have a poor environmental rating, or create an unacceptable environmental risk. All applications for a lease or occupation permit, or to alter boundaries are subject to public comment, although an aquaculture license is not.

Comments are solicited directly via letter sent by the Minister to each landowner within 100 meters of the proposed site advising them of the nature of the application and allowing a 30 day period for filing. Secondly, the applicant is required to arrange for the display of notices to appear twice in local newspapers in the area where the site is proposed. Public comments are taken into consideration as part of the departmental decision making process.

Maine. The State of Maine's first marine aquaculture statute, enacted in 1973, has been modified over the years to provide a comprehensive siting and leasing process that coordinates joint responsibilities of the state's Departments of Environmental Protection (DEP) and Marine Resources (DMR) (12 M.R.S.A. 6072 *et seq.*). Although a lease is not required in all instances, generally application is made to the DMR for a lease which affords a degree of exclusive use of a portion of the submerged lands of the state and the waters above them. A lease can not exceed a term of 10 years and individual tracts can not exceed 5 acres, although lease tracts equaling no more than 250 acres in the aggregate are permitted. The DEP issues a Water Quality Certificate affirming that the proposed project will not have a significant adverse effect on water quality or violate the standards ascribed to the receiving waters' classification. This certificate must be received before a lease can be granted. Bottom culture of indigenous shellfish species is considered less intensive and thus subject to a somewhat less rigorous array of requirements than the net-pen culture of finfish. In the past few years, the state in partnership with the several involved federal agencies has developed a joint application process, with the state Department of Marine Resources functioning as the *de facto*, although not statutorily charged, lead agency.

The information provided in the application as well as that collected by the Department during its site review is, by and large, the same information required by the various federal agencies. It is made available to affected municipalities, riparian land owners, and intervenors and other members of the public prior to a statutorily required adjudicatory hearing held in the vicinity of the proposed lease. A decision to grant a lease can only be made if the following conditions exist: the project will not unreasonably interfere with riparian ingress and egress; navigation; fishing and other uses of the area; the ability of the lease site to support existing significant flora and fauna; public use and enjoyment of municipal, state, or federal beaches, parks, or docks; and, the applicant has demonstrated that there is an available source of organisms to be cultivated.

The Commissioner may impose certain conditions on a lease to ensure the greatest multiple and compatible uses of the area, to support ecologically significant flora and fauna, and to preserve the exclusive rights of the lessee. Monitoring of the lease area is also required and the Department can compel the lessee to periodically provide information concerning bathymetry, benthic habitat and water column effects, feeding and production data, introduction and transfer data, disease and chemical therapeutant

use, and other information deemed necessary. Fees and Rents are levied according to a schedule which reflects the nature, scope, and intensity of the activity undertaken on the site and a production fee is assessed on salmon aquaculture ventures to support a monitoring and research fund.

New Hampshire. The State of New Hampshire has regulated marine aquaculture since 1978, requiring any person engaging in aquaculture of marine species to receive a license from the executive director of the New Hampshire Department of Fish and Game (N.H.R.S.A. 211:62-e). Issuance of a license does not convey property rights to the aquaculturist, although possession of a license does have the effect of providing an exclusive right to undertake a particular activity within a designated area. In granting a license, the executive director must determine that the proposed aquaculture operation will not adversely impact the state's marine resources or pose unacceptable disease, ecological, environmental, health, safety, or welfare risks to persons, the environment, or marine species. A final determination must also ensure that the proposed operation does not conflict with or negatively impact any recreational, commercial or other use of the proposed project area or adversely impact the value or use of private property in and around the area.

These determinations are made by the agency through the use of a comprehensive application and review process including a site assessment conducted between May and October and a public hearing. Shellfish projects are permitted only in areas classified as "restricted" or "conditionally restricted" by the state's public health agency and the importation and release of all species must be permitted and in compliance with state and federal fish health guidelines and regulations. The executive director has the authority to waive rules relative to the possession, sale and method of taking marine species for aquaculture operations.

Licensed operations are required to conduct environmental monitoring to determine any degradation of the environment or marine species directly related to the aquaculture operation and an annual report of harvesting activity, monitoring, summary of activities and other unusual events is required of licensees. An annual license fee is established based on a graduated schedule depending upon acreage and intensity and type of operation and a per organism or per pound harvesting/processing fee also is charged.

Massachusetts. A three-tiered system (local, state, federal) exists in the Commonwealth of Massachusetts reflecting a policy of strong local control over aquaculture. It is important to note that issuance of a state license does not convey any property rights to the aquaculturist. Generally, shellfish licenses are issued at the municipal level with certification by the Massachusetts Division of Marine Fisheries (DMF) that issuance of the license will have no adverse effect upon the shellfish, other existing resources, fisheries, or endangered species in the area. Municipal licenses for bottom and suspended shellfish culture are issued under the authority of Massachusetts General Law chapter 130, section 57 for a period of 10 years. Provisions of section 17B also require an aquacultural enterprise permit from the DMF to permit the possession,

take or harvest of any fish out of season or beyond the size restrictions established in state regulation.

Aquaculture is also subject to the state's Wetlands Protection Act which requires all shellfish and finfish aquaculture proposals to receive an "Order of Conditions" from the local conservation commissions authorizing the aquacultural activity and setting forth specific terms and conditions of the activity. Certain aquaculture activities, including bottom, suspended culture and net pen operations may be subject to requirements for waterways permits pursuant to the Massachusetts Waterways Licensing Statute. Depending upon the nature of the project, an applicant may be required to provide detailed plans and surveys, pay fees, and comply with standards for environmental protection, public rights and protection of existing water dependent uses. The Massachusetts Environmental Policy Act is also applicable to aquaculture if activities proposed in the project meet listed thresholds and certain forms of aquaculture may require a Massachusetts Surface Water Discharge Permit which is issued jointly with the EPA NPDES permit.

The 1995 Massachusetts Aquaculture White Paper and Strategic Plan (CZM 1995) lays out a framework to support aquacultural activity and to encourage growth in the industry. The underpinnings of the plan are 68 recommendations for changes to address the administrative needs of the industry, many of which have been implemented to date.

SITING AND MONITORING

Introduction. While federal agencies in both Canada and the United States maintain authorities and responsibilities with respect to aquaculture, the principal responsibility for siting and monitoring of aquaculture facilities rest with the provincial and state governments either through agreement with federal agencies or via constitutional prerogatives. In general, siting and monitoring involves the following considerations:

- Sensitive habitats such as protected species, known spawning or nursery areas, etc;
- Bottom characteristics including bathymetry and seafloor topography, sediment type, composition, chemistry, and grain size and identification of the depositional character of the area;
- Water currents including velocity and direction, direction of prevailing currents, and site wave characteristics, etc;
- Water chemistry including dissolved oxygen, salinity, suspended solids, biological oxygen demand, sulfide, nitrate/nitrite, etc;
- Biota including information on species composition, distribution and abundance, and occurrence of fish, mammals, and birds;

- Socio-economic factors including specifics about other uses of the site such as employment, and socio-economic value of these uses and activities.

While the scale and scope of the program may differ between jurisdictions within the Gulf of Maine as detailed below, the considerations above are typically components of provincial/state programs and, to some extent, federal programs as well. Jurisdictional accommodations have been reached by the two orders of governments and, while potential for overlap exists, duplication of effort has been minimized. The situation is much less clear for projects located in federal waters beyond the provincial/state territorial jurisdiction. This issue has recently come under closer scrutiny in the United States where offshore aquaculture projects have been proposed.

The Canadian federal government has a constitutional authority over coastal and inland fisheries, including marine mammals, and responsibility for the preservation and conservation of wild stocks. The federal government's mandate also includes navigation and shipping. The lead agency with respect to aquaculture is the Department of Fisheries and Oceans, although other agencies, for example Environment Canada, are also involved. Pursuant to the Memoranda of Understanding signed by the provincial and federal governments pertaining to aquaculture, the federal government maintains regulatory authority for fish health, conservation and protection of wild stocks and fish habitat, and protection of navigable waters. Outside the MOUs, the federal government maintains responsibility for food and public health safety. With respect to aquaculture, therefore, a number of federal approvals or exemptions are required for aquaculture, depending upon the nature of the venture proposed. This could include certification of importing, a navigation permit, a marine mammal lethal take permit, and other controls related to the use of medications and pesticides. Also in certain circumstances, an assessment under the

Canadian Environmental Assessment Act may be triggered.

In the United States, the federal government also has authority over fisheries, including marine mammals, and responsibility for navigation, fish health, and protection of wild stocks and habitat. The U.S. Army Corps of Engineers (ACOE) maintains *de facto* lead agency status and its Section 10 permit certifies that a project will not impede navigation or negatively affect environmental quality. Other federal agencies such as the National Marine Fisheries Service the U.S. Fish and Wildlife Service, the Environmental Protection Agency, and the U.S. Coast Guard are review agencies under provisions of Section 10 and or issue their own permits and authorizations. Applicants seeking an ACOE permit to install and maintain aquaculture facilities are required to provide general information about the proposed project, siting and operational information, an environmental description and impact assessment of the proposed project area, and the applicant may be required to complete environmental monitoring of the site.

Nova Scotia

Application The criteria generally used to review applications include current uses of the water body, possible user conflicts, the number of leases already in the water body and site location suitability. Both a license to operate and an aquaculture lease are limited to a specific geographic area to cultivate specific species for an initial 10 year period subject to other specific terms and conditions imposed by the Minister. Once granted, and subject to imposed conditions, the holder of an aquaculture lease has exclusive right for aquaculture purposes of the leased sub-aquatic lands and water column.

Allocation No specific site allocation policy

Baseline Baseline requirements include descriptions of water depth ranges, bottom type, fish habitat identification, tide profiles, current speed, exposure and temperature profiles. Video transects are suggested and if testing is indicated, redox potential and sulfides are required. Baseline carrying

capacity studies have been conducted in selected embayments as required and have included diver transects, invertebrate studies, sediment redox potential, sulfides, carbon content and benthic grain size profiles.

Monitoring

Generally done on a site by site basis with focus on larger operations although level of monitoring is being increased. Monitoring of seasonally operated sites is conducted at the commencement of peak production. Annual production sites are monitored on a yearly basis.

New Brunswick

Application

The review process for leasing and licensing of aquaculture sites in New Brunswick begin with the applicant filing an application and Site Development Plan with a required fee. Data required include location, species and numbers to be cultured, number of cages or rearing space required, and specific site criteria such as details of conflicting uses. Once the application has been received, a site evaluation is conducted and the application is sent by the Minister to the Registrar of Aquaculture.

The interagency review consists of sending the application to other provincial and federal government departments and is coordinated by the Department of Fisheries and Aquaculture as lead agency. Public hearings are not required although public participation in the decision-making process is afforded through a public comment period of at least 30 days. An aquaculture site evaluation committee meets to review the application and public input, and prepares comments for consideration by the Department of Fisheries and Aquaculture. The Registrar of Aquaculture advises the applicant of the decision. If the application is not approved, the Registrar's decision may be appealed to the Minister by the applicant within 30 days. Based on the public comment, the application review and the comments from the site evaluation committee, the Minister decides whether or not to issue a lease. The Minister's decision is final and can not be appealed.

Allocation

Site allocation policy in place although under review and no new sites will be approved until new policy is adopted. Under the current policy, should more than one eligible applications be submitted for one site, the order of preference is as follows: 1) a commercial fisherman who

registered interest in 1989 and lives in close proximity; 2) a commercial fisherman with registered interest in 1989; 3) a commercial fisherman from the Bay of Fundy; 4) a person who resides in close proximity and is experienced with the local marine environment.

Baseline Baseline requirements include sediment redox potential, water depth, current velocity and depth, fetch, quantification and extent of sentinel species, and transects across site using video. Core samples are also required for composition and grain size determination and samples for flora and fauna identification must be made.

Monitoring Annual monitoring at each site is conducted by a contractor hired at license holders expense. Monitoring requirements include sediment cores, video transects under cages and 50 meters up and downstream, and quantitative assessment of benthic habitat including sediment color, consistency, odor, outgassing, bacterial mat coverage, macrofauna abundance, feed and feces distribution.

Maine

Application Applicants for a state aquaculture lease must submit information including: a description of the proposed site; a list of species to be cultivated and their source; an environmental evaluation of the site including, bottom characteristics, flora and fauna, and hydrology; a description of commercial and recreational fishing in the area; a description of riparian land ownership and or permissions; evidence of financial and technical capability; and, other information deemed necessary to evaluate a specific project.

Information collected by the Department is made available to affected municipalities, riparian land owners, and intervenors and other members of the public prior to a statutorily required adjudicatory hearing held in the vicinity of the proposed lease. A decision to grant a lease can only be made if the following conditions exist: the project will not unreasonably interfere with riparian

ingress and egress; navigation; fishing and other uses of the area; the ability of the lease site to support existing significant flora and fauna; public use and enjoyment of municipal, state, or federal beaches, parks, or docks; and, the applicant has demonstrated that there is an available source of organisms to be cultivated. If the Commissioner approves the issuance of a lease, certain conditions may be imposed at the Commissioner's discretion to ensure the greatest multiple and compatible uses of the area, to support ecologically significant flora and fauna, and to preserve the exclusive rights of the lessee.

Allocation If more than one person applies to lease an area, preference is given as follows: 1) to the department of Marine Resources; 2) to the riparian owner of the intertidal zone within the leased area; 3) to fishermen who have traditionally fished in or near the proposed lease area; 4) to riparian owner within 100 feet of leased coastal waters.

Baseline Prior to adjudicatory hearing, the Department must conduct an assessment of the proposed site and surrounding area to determine the possible effects of the aquaculture activity on commercially and ecologically significant flora and fauna and conflicts with traditional fisheries. The site inspection must be conducted between May and October and typically includes an inspection of bottom composition, depth and features, resident flora and fauna, relative abundance of commercial and recreational species, evidence of fishing, distances to shore, and navigation channels and moorings. Baseline requirements include diver survey and video transects, water depth and current speed and direction;

dissolved oxygen, temperature and salinity profiles; sediment samples for grain size, chemical and biological infauna analysis; report of area resources including shellfish, finfish, and submerged vegetation; and riparian and other uses of the area.

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Monitoring Annual monitoring required at each site to be conducted by contractor hired by Department at industry expense. Semi-quantitative report requirements include video transects within footprint of site and 60 meters beyond; DO, salinity and temperature profiles; core samples for layer depth, grain size analysis, and infauna identification.

New Hampshire

Application Application is made to the executive director of the New Hampshire Department of Fish and Game who is authorized to issue a license to conduct aquaculture only if the proposed operation will not adversely impact marine resources or pose unacceptable disease, ecological, environmental, health, safety or welfare risks. The proposal is subject to a public hearing and public comment period and, final decisions of the executive director must take into consideration all information provided during the process.

Allocation No specific site allocation policy is stipulated.

.Baseline As part of the review process, the Department conducts a site assessment or evaluation for any area not assessed within the prior two years. Assessments must be conducted between May and October and baseline requirements may include an assessment of natural flora and fauna, a benthic substrate evaluation, a report of tidal currents and direction, identification and location of navigational conflicts, a

	review of fisheries and other uses of the area and the applicant must provide a listing of proposed biocides, algaecides, antibiotic, or other methods of control.
Monitoring	Annual monitoring to determine degradation is required

Massachusetts. The Commonwealth of Massachusetts does not currently have a siting and monitoring program as rigorous as those of other jurisdictions in the region, although a process of baseline determination and monitoring has been proposed in Massachusetts and elements similar to those in the above jurisdictions are being implemented presently, including diver surveys and water quality, benthic and sediment analysis. Generally, shellfish licenses are issued at the municipal level with certification by the Massachusetts Division of Marine Fisheries (DMF) that issuance of the license will have no adverse effect upon the shellfish, other existing resources, fisheries, or endangered species in the area.

CURRENT AND EMERGING ISSUES

Aquaculture in the region and nationally in both Canada and the U.S. has come under more scrutiny of late. In some respects that is due to the decline in the capture fisheries and the promise of aquaculture with respect to demand for seafood. On the other hand, focus has also been brought upon the potential environmental impacts of aquaculture and, by way of example, legislation which would have amended the Canadian Environmental Policy Act in this regard was introduced in Parliament last year.

Although there are perhaps several issues of local interest related to aquaculture including conflicts with riparians over specific sites, or debates about site allocation policies, and concerns about occupational safety, there are a number of issues that have broader applicability and are of regional interest. Without attempting to prioritize, these issues are identified briefly below within the following broad categories environment, genetics, health, jurisdiction, conflict, and economics.

Environment. Many aquaculture operations require large volumes of clean water and yet are potential polluters of that water. Water use and waste disposal can alter the habitat through organic loading of the water column and of the benthos for example. The fate and effects of waste products, pesticides, other chemicals, and refuse have come under closer scrutiny. Questions have been raised about the proliferation of sites, stocking densities, site separation distances, and site management practices. Impacts of poor environmental management can extend beyond habitat degradation, presenting risk of disease to animals within the production facility as well as to adjacent farms.

Losses of aquaculture products due to predation by birds, seals and other mammals have also become a much more significant issue. Salmon farms in particular attract predators species which can cause significant losses of culture species and damage to facilities. The potential damage caused to net pens also increases the risk of escapement and exacerbates

issues attendant to genetic concerns. Efforts to control these losses, however, present a significant public policy issue with respect to deterrent methods available given the special legal status afforded many of the predators species in question.

To address the range of environmental matters now being brought to the fore, an increased level of governmental intervention has been advocated in some circumstances, while in others a more effective use of existing regulatory mechanisms is called for. Monitoring of sites, for example, is an issue in this regard and more rigorous application of standards and protocols is under consideration in some jurisdictions. How many sites can be accommodated before the productivity of the marine ecosystem is altered. If limits are imposed, where will the industry expand? These questions are key to the future of aquaculture in the Gulf of Maine region.

Genetics. Concerns exists about the potential conflict between hatchery-reared or non-native fish and wild stocks. This issue relates to the potential damage to or occupation of spawning habitat as well as the impact upon genetic integrity and issues of parasite and disease introduction. Also of concern in this regard is the potential for nonindigenous and invasive introductions of exotic species. Issues related the potential effects of escaped fish or other introductions is complex. The questions associated with transgenic or genetically engineered fish and shellfish, either as a product enhancement or for wild stock protection, is even more difficult. The complexity of the policy and political nature of these issues is clearly demonstrated with respect to the current debate in Maine concerning the use of non-indigenous broodstock to enhance product quality. The adequacy of regulatory controls at both orders of government as well as international accommodations will be closely scrutinized with respect to genetics.

Health. Issues related to health with respect to aquaculture are not limited to those of fish and shellfish only, but to human health as well. The adequacy of current laws and programs to regulate the safety of fish and shellfish for human consumption, for example, continues to be of concern with respect to shellfish due to potential bacterial and biotoxin contamination. This has a direct bearing upon water quality issues and national and international protocols for shellfish sanitation. There is also a human health concern related to the fate and effects of chemicals, pesticides, and therapeutants used in aquaculture.

With respect to animal health, currently therapeutants for application in aquacultural facilities are limited and concern exists that this could constrain industry growth and put producers at competitive disadvantages. Consumer advocates have expressed concern about the potential for illegal or unregulated use of unapproved or untested drugs in North America and beyond. There is also concern about the regulation and international movement of fish and the potential for introduction of disease and domestic proliferation. Stocking densities and site operational procedures have come under close scrutiny in this regard. Where disease does exist, there is concern about eradication measures including handling of moralities. There is also significant concern about the potential for widespread parasitic infestations. As the industry struggles economically, many fear that

it will be unable to withstand further set backs.

Jurisdiction. Although this report is not intended to make recommendations, it is impossible not to conclude that marine-based aquaculture in the Gulf of Maine region is subject to regulatory control and intervention by a number of agencies at both orders of government, federal and provincial/state. The lack of clearly defined roles is especially pronounced in the United States where legislation was introduced in the last Congress to strengthen existing aquaculture programs within the Department of Commerce. A revised version of this legislation is being prepared for reintroduction and while the intent is not to amend authorities of other U.S. federal agencies vis-à-vis aquaculture, the proposal will undoubtedly generate debate about agency "turf." Agency jurisdictional matters pose issues for industry as well, particularly with respect to research and development. Issues likely to received attention in both countries include the potential for conflict of interest between promotion of an industry and its regulation by the same agency. This issue is clearly germane with respect to environmental matters and, given that aquaculture is primarily managed at the provincial/state level, focus on the federal management role is likely.

Conflict. The potential for conflicts among users of the marine environment is always an issue with respect to aquaculture and pertains to the preemption of fishing grounds and obstructions to navigation. The conflict is also one of direct and indirect impacts to species of commercial and recreational value, either through disease transmission, genetic modifications, and physical or chemical habitat alterations or contamination. As increased scrutiny is brought to bear on environmental matters, conflict over confidentiality and proprietary access to information will also arise. This is particularly so with respect to monitoring reports as well as data pertaining to chemical use and other site management and logistics information.

Economics. Concern about the future economic status of the industry is also expressed. In many respects marginal operators as well as larger operations are in a difficult financial position. This is as a result of or exacerbated by the effects of increased environmental pressure and economic competition from well beyond the region. The ability of the industry to remain viable in the face of economic competition and the added burden of increased regulatory controls has become a political concern in areas where alternative employment opportunities are limited.

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