Atlantic Institute for AIMS Market Studies

CAI

CANADIAN AQUACULTURE: DROWNING IN REGULATION

ROBIN NEILL
BRIAN ROGERS

How to Farm the Seas (PAPER #1)
Brian Lee Crowley, Gerry Johnson
Series Editors

CONFERENCE PAPER

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The **Atlantic Institute for Market Studies (AIMS)** is Atlantic Canada's public policy think tank. Our goal is to help Canadians, both regionally and nationally, to imagine new and creative solutions to the public policy challenges that we face, whether in education, health care, equalization, oil and gas, or the host of other policy fields where AIMS is active.

The **Canadian Aquaculture Institute (CAI)** is a broad-based education and analysis group dedicated to aquaculture awareness and continuing education, especially in the fields of aquaculture medicine, fish health, and management. Working in close association with university faculty, industry professionals, and other organizations, CAI develops training programs with and for groups interested in all facets of sustainable aquaculture. CAI is a division of AVC Inc. of the University of Prince Edward Island.

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Brian has spoken nationally and internationally on aquacultural issues, in marketing, economics, and various technical areas. He has been featured in such magazines as *Forbes* and *Maclean's*, and in 1994 was the recipient of the Aquaculturalist of the Year award at the Atlantic Aquaculture Fair.

Executive Summary

Canadian aquaculture is mired in a dysfunctional regulatory system. That is the main conclusion of the two aquaculture conferences co-organized by the Atlantic Institute for Market Studies and the Canadian Aquaculture Institute in 2000 and 2001 and sponsored by the Donner Canadian Foundation.

When regulation is working well, economic activity is regulated to achieve the greatest possible net social economic benefit without undue interference with the freedom of buyers and sellers in the marketplace. When the regulatory environment fails in its economic and political purposes, it is dysfunctional. And to the extent that it does not benefit the national economy, but reflects rather an unresolved political struggle between contending special interests, the industry and the economy suffer economic losses.

Aquaculture in Canada is subject to a complex of institutions, guidelines, and injunctions that forms the regulatory environment. The resulting hurdles to aquaculture businesses span transnational organizations, conventions, and accords; federal government agencies and legislation; provincial agencies and legislation; and a number of miscellaneous organizations and associations. In short, there is an absence of an overall rational model for the assessment of net social economic benefits in aquaculture. The current regulatory environment is dysfunctional.

Among presenters at the two conferences were the federal commissioner for aquaculture development and the deputy minister of the Department of Fisheries and Oceans. Between them they made a number of salient points:

- There are unexplained administrative blocks preventing industry access to new sites for expansion and to new sources of wild fish for feed and for breeding purposes.

- Policy (in the *Fisheries Act*) with respect to escape of penned fish, and with respect to water pollution caused by unconsumed feed and fecal residue, is not clear, and enforcement is not well organized.

- The policy of the lead regulatory agency, the Department of Fisheries and Oceans (DFO), with respect to fish habitat has not been developed with aquaculture clearly in mind and, quite apart from that, is simply not clear.

- The *Navigable Waters Protection Act* – which deals with site approval, length of leases, site layout, navigation channels, and site marking – was not developed with aquaculture clearly in focus and, quite apart from that, is simply not clear.

- There are conflicts and contradictions among the federal and provincial regulations dealing with aquaculture.

Because aquaculture is a relatively new industry, some time lag in development of new regulations is to be expected. A basic problem, perhaps the basic problem faced by aquaculture, however, is that regulators are having difficulty freeing themselves from thinking in terms of the property rights structure of aquaculture's predecessor, the wild fishery. The wild fishery is based on a common property resource. Aquaculture, by contrast, is based on private property with respect to the resource (the fish, shellfish, and other farmed products) and should be organized and regulated accordingly. Currently, the private property rights necessary for efficient market development are not in place, and negative externalities, untoward costs, and regulations, hobble the industry.

Throughout both conferences it was clear that vested interests in traditional fisheries, both within DFO and without, hold considerable sway over the regulatory environment – to the detriment of the aquaculture industry. It was also clear that many organizations see aquaculture not as a viable, complementary industry but as an irritant and potential threat to the established, but declining, traditional fisheries. Little of the anti-aquaculture rhetoric seems to be rooted in scientific or economic reality.

Reports from BC, PEI, and New Brunswick confirmed that serious regulatory dysfunction exists nationwide in site allocation and tenure of aquaculture licences, and in access to stock. Furthermore, administrative inefficiency is pervasive.

If any conclusion can be drawn from the conference presentations, it must be that fundamental institutional change is required in the regulatory environment of Canadian aquaculture. We can look partly to other jurisdictions – such as the United States, Australia, and Norway – where aquaculture is considered an industry to be developed, not controlled, and where aquaculture-specific legislature exists. In its 2001 *Legislative and Regulatory Review of Aquaculture in Canada*, the Office of the Aquaculture Commissioner concluded that aquaculture is simply not included in the existing relevant legislation at both the federal and provincial levels..

The problems of the wild fishery all stem from its base in a common property resource. The solution to those problems is to establish well-defined private property rights. Agriculture had its own "tragedy of the commons," which was overcome by the establishment of private property in the form of individual ownership of farms. Aquaculture makes this solution possible in the fisheries. The challenge ahead lies in applying this deceptively simple prescription to a complex industry in a highly politicized environment. Yet, apply it we must if aquaculture is to reach anything like its potential to generate prosperity in coastal communities and produce a major increment in world food supplies.

Introduction

This report is a summary of comments made at two conferences on aquaculture in Canada – in September 2000 at the Rodd Brudenell River Resort in Montague, PEI, and in February 2001 in Vancouver, BC. The conferences were funded by the Donner Foundation and organized by the Atlantic Institute for Market Studies (AIMS) and the Canadian Aquaculture Institute (CAI).[1] They covered many matters pertaining to aquaculture in Canada: its growth, its industrial organization, its contribution to community development, its scientific basis, and its position in relation to aquaculture in other countries and in the world at large. In this paper we report only on matters pertaining to the regulatory environment of the industry. Copies of the presentations given at the conferences can be obtained from the organizing agencies.[2]

[1] CAI is a division of AVC Inc. (Atlantic Veterinary College) located at the University of Prince Edward Island.

[2] Much of the presented material is available for viewing on the AIMS Web site. See <www.aims.ca/Aqua/aqua.htm>.

A Functional Regulatory Environment

In a democratic political regime, economic activity is regulated to achieve the greatest possible net social economic benefit from the regulated activity, without infringing on liberal political values. Economic benefits are additions to the material standard of living of individuals. The *social economic benefits* of an industry are the sum of benefits to individuals deriving from the operations of the industry. *Net* social benefits are social benefits less social costs.

Social benefits and costs may be internal or external to the firms in an industry. *Internal* (or private) benefits and costs in an industry are measurable in the booked returns and expenditures of the individual firms in the industry. *External* benefits and costs arise outside those firms. For example, the costs of environmental pollution, insofar as they are not born by the polluting firm, are external costs. The value of byproducts that pass to society in general because they cannot be captured for exclusive use by the firms creating them is an external benefit. Consider, for example, that a portion of the food given to penned salmon escapes the pen to become food for wild fish. If local sport fishermen enjoy a larger catch as a result, the benefit to them is an external benefit of the aquaculture industry that would be added to the other benefits produced by the industry to constitute the social benefits of the industry. The industry's social costs are offset when calculating the industry's net contribution to society's standard of living.

Social benefits and costs are the sum of internal private benefits and costs and external benefits and costs. External costs and benefits can be objectively measured, with reasonable certainty, by public authorities. Unfortunately, in Canadian aquaculture they are not measured this way.

A Dysfunctional Regulatory Environment

Political constraints imposed by society to prevent an activity from infringing on liberal political values are, for the most part, based on non-economic values. Still, it sometimes happens that such constraints cause economic gains for special interests while causing economic losses for society as a whole. For example, a legally established right to use a publicly owned resource can politically enforce inefficiency and a lower standard of living if that use prevents an alternative use with greater economic value for society. It is also true, of course, that legally established rights that increase individual choices also encourage entrepreneurs to respond to consumer preferences as expressed in market demand. In short, the nature of legally established rights (in this case, the laws regulating aquaculture) is critically important for the aquaculture industry's contribution to economic and social well-being.

Insofar as a regulatory environment fails in its economic and political purposes, it is dysfunctional. For example, if a regulatory regime does not clearly define property rights with respect to natural resources, borrowing capital based on the potential of those resources is difficult, if not impossible. The regime thereby inhibits entrepreneurial activity and slows the development of the resources relative to other activities with less potential for increasing net social benefits. Insofar as a regulatory environment is slow, inconsistent, confusing, unnecessarily complex, and internally contradictory, it imposes additional costs on the industries it is supposed to support. It depresses entrepreneurial activity and reduces net social benefits. Insofar as a regulatory regime does not benefit the economic good of the nation as a whole, but reflects the political imbalance of an ongoing power struggle between contending special interests, net social economic benefit is not the criterion of regulation, and there are economic losses. These economic losses are in effect an imposition of one vested interest on another to the detriment of economic and political well-being in the nation as a whole.

The Canadian Regulatory Environment

It is tedious to lay out the list of agencies, directives, and legislative constraints facing aquaculture in Canada. Still, it is this complex of institutions, guidelines, and injunctions that forms the regulatory environment of the industry. The list (see box this page and next) illustrates the yawning opportunities for dysfunction. If you are new to the subject, you might choose simply to glance over the list and be suitably convinced of the daunting set of regulatory hurdles over which entrepreneurs in the aquaculture industry must leap. But if you are interested in some small part of the industry and having trouble seeing the forest for the trees, then reading in detail what is in fact a very truncated list could prove instructive.

Transnational Elements
United Nations Food and Agricultural Organization (FAO), especially with respect to its "Code of Conduct for Responsible Aquaculture", and its Committee on the Fisheries
Agenda 21 of UNCED, and the Rio Convention on Sustainable Development
World Bank directives on sustainable development
World Wildlife Fund directives
Canada-US Shellfish Agreement
International Pacific Salmon Commission
North Atlantic Salmon Conservation Organization
The Oslo Accord

Government of Canada
[A more complete summary of the federal government's direct involvement in aquaculture can be found on pages 16 and 17 of the Review published by the Office of the Commissioner for Aquaculture Development (2001).]
Agriculture and Agri-Food Canada
Canada Customs and Revenue Agency
Canadian Food Inspection Agency
Animal Health Production Division
Fish and Seafood Production Division
Veterinary Biologics and Biotechnology Division
Canadian International Development Agency
Department of Finance
Department of Foreign Affairs and International Trade
Environment Canada
Canadian Environmental Assessment Agency
Farm Credit Corporation
Fisheries and Oceans Canada
Office of Sustainable Aquaculture
Office of the Commissioner of Aquaculture Development
Federal Aquaculture Development Strategy [incomplete at this time]
Habitat Policies
Canadian Coast Guard
Boat Safety Regulations
Navigation Regulations
Health Canada

Bureau of Veterinary Drugs
Pest Management Regulatory Agency
Heritage Canada
Human Resources Development Canada
Indian and Northern Affairs Canada
Industry Canada
Atlantic Canada Opportunities Agency
Biotechnology Regulatory Assistance Virtual Office
Business Environmental Performance Office
Canada Economic Development for Quebec
Economic Development Initiative in Northern Ontario
National Research Council Canada – IRAP Programs
Western Economic Diversification Canada
Natural Resources Canada
Natural Sciences and Engineering Research Council
Statistics Canada

Federal Legislation (a selection)
The Fisheries Act
The Feeds Act
The Fish Inspection Act
Canadian Shellfish Sanitation Program
Seafood Quality Management Program
Navigable Waters Protection Act.
National Code for Introduction and Transfers [of eggs and milt – incomplete at this time]
National Fish Health Strategy [incomplete at this time]

Private National Organizations
Canadian Aquaculture Industry Alliance

Federal-Provincial Governmental Organizations
Canadian Council of Fisheries and Aquaculture Ministers
Aquaculture Task Force
Pacific Fisheries Resource Conservation Council [federal and provincial funding]

Provincial Governments
Provincial departments of fisheries
Provincial regulations with respect to natural resources
Provincial environmental and economic development legislation
Provincial cultural and heritage agencies
British Columbia Salmon Aquaculture (Environmental Assessment) Review

Private Provincial and Regional Organizations
Atlantic Salmon Federation
Provincial finfish & shellfish aquaculture associations

Miscellaneous
First Nations bands
Boat owners associations
Environmental non-governmental organizations (ENGOs)
Sport fishers associations
Property owners associations

Eliminating the Dysfunctions of the Regulatory Environment for Aquaculture

Senior government officials admit to the dysfunctions in the Canadian regulatory environment for aquaculture as asserted by the private sector of the industry. Therein lies the hope for their elimination – and the reason for maintaining pressure to have them eliminated. The best general summaries of the dysfunctions can be found in statements made at the two aquaculture conferences by Yves Bastien, the federal commissioner for aquaculture development, and Wayne Wouters, deputy minister of the Department of Fisheries and Oceans, and in a review of the *Fisheries Act* produced by the Office of the Aquaculture Commissioner (2001), *Legislative and Regulatory Review of Aquaculture in Canada.*

In this paper we focus on what was stated by the commissioner, the deputy minister, and others at the two conferences, but a citation from the *Review* nicely sums up the situation with respect to the dysfunctional nature of the regulatory environment of aquaculture in Canada:

> Many of the regulations under the *Fisheries Act* [by which aquaculture is regulated] are not well adapted or directly relevant to aquaculture – a situation that results in the aquaculture industry being managed as a subset of the traditional fisheries. This is analogous to equating traditional livestock and crop agriculture to the hunting and gathering of animals and plants (p. 1).

The points made by the commissioner and the deputy minister at the conferences include the following:

- There are unexplained administrative blocks preventing industry access to new sites for expansion and to new sources of wild fish for feed and for breeding purposes.

- Policy with respect to escape of penned fish, and with respect to water pollution caused by unconsumed feed and fecal residue (section 36 of the *Fisheries Act* deals with deposition of deleterious substances), is not clear, and enforcement is not well organized.

- The policy of the Department of Fisheries and Oceans (DFO) with respect to fish habitat has not been developed with aquaculture clearly in focus and, quite apart from that, is simply not clear.

- The *Navigable Waters Protection Act* – which deals with site approval, length of leases, site layout, navigation channels, and site marking – was not developed with aquaculture clearly in focus and, quite apart from that, is simply not clear.

- There are conflicts and contradictions among the federal and provincial regulations dealing with aquaculture.

The commissioner stated that all of these things are subjects of a forthcoming federal aquaculture development policy. The policy has yet to be enunciated, though the *Review* is a basis for stating what the policy should be. The best that the commissioner could offer at the conferences was a recapitulation of the problems and a statement of the roots of dysfunction in the regulatory structure.

Of the latter, he indicated two: (1) According to the commissioner there is no method in place by which risks of economic loss – to the aquaculture industry, to industries and activities competing with aquaculture for resources, or to society as a whole – can be assessed or managed. There is not even an attempt to measure the net social economic benefits of the industry or, indeed, of any specific operation of the industry. Without this knowledge the regulatory environment as a whole is without rational direction and is subject to whatever pressures particular interests can apply at different constituent local points in the structure of decision making. (2) The commissioner asserted that DFO is staffed by agents sympathetic with, or drawn from, activities other than aquaculture. That is, the vested interests of the wild, commercial, and sport fisheries; environmental protection interests; and cattle breeders have captured the regulatory process and biased it in favour of everything except the newly emerging firms in aquaculture.

The commissioner did not say that DFO was simply a rotten borough with respect to aquaculture regulations, but he did say that "a cultural shift" in the department would be necessary to be eliminate the dysfunctions in the regulatory environment in aquaculture. Clearly, then, the absence of an overall rational model for the assessment of net social economic benefits in aquaculture has provided openings for dysfunction at intermediate points in the Canadian aquaculture regulatory environment.

As damning as this assessment of the aquaculture regulatory environment may be, it is not an accusation of ill will on the part of the agents involved. Aquaculture is new on the scene, having been an element in the Canadian economy for thirty years at most, and for only ten years as a significant player. We must expect some time lag in the development of relevant regulations. Further, the emergence of aquaculture, in Canada at least, has been related to the advance of science, especially in biotechnology. This circumstance has natural entailments: regulatory agencies and directives fall behind the constant changes associated with scientific advance and economic development; and pressure groups – taking a conservative position with respect to the application of science to food production and biological reproduction, and finding aquaculture a suitable target – catch the attention of the regulators.

The problems in Canada have not been unique. A number of other countries with aquaculture sectors – Australia, Japan, New Zealand, Norway, and the United States – have exhibited many of the same problems. They are rooted both in the hangover of common-property institutions appropriate for a primitive gathering industry and in the consequent strength of assertions by interests competing with aquaculture for resources. The list of those assertions is universal: alleged external costs associated with fish escaping from pens; alleged external costs associated with the spread of diseases from penned fish; alleged external costs from the use of antibiotics and other chemicals to control diseases in penned fish; and alleged external costs caused by the concentration of organic effluent (e.g., feces) from penned fish. All of these assertions are defensive – and understandable. However, they focus on possible external costs, and, according to the commissioner for aquaculture development, the response to them in Canada has not entailed an objective measurement of the allegations.

The basic problem faced by aquaculture is the property rights structure of its predecessor, the wild fishery. The wild fishery is based on a common property resource and, in fact, is plagued with a number of problems on that score (Crowley, 1996). Its organization, inherited from the past, lies outside both the range of activities that fall under individual ownership of a resource and what has recently emerged as purely private enterprise in competitive markets. Aquaculture, as opposed to the wild fishery, is based on private property with respect to the resource – or, rather, it should be. It should be organized and allowed to function as any other modern, competitive industry. If properly regulated, it could fall nicely into the structure of a modern, liberal democratic state. Unless aquaculture is allowed to function as a settled culture free from the untoward organization of a nomadic hunting industry, it will be deprived of the dynamism afforded in modern, free enterprise economies.

The Openings for Dysfunction

There are methods for assessing the costs and benefits of alternative uses of a resource. In a market well founded in private ownership and competition, the test is profitability. In such a market there are no costs external to the firms involved. Their returns are dependent on an unbiased consumer's judgment of the value of their output. Their costs are held to a minimum by competitive pressures. If such firms can show that their expected returns are in excess of their expected costs in any new venture, financial intermediaries will be forthcoming with the necessary capital for development. In short, when markets work, capital is forthcoming to initiate what will be economically and socially efficient activities. The difficulty with aquaculture rises from its unfortunate obsolescent association with the organization of a common property resource. There are two consequences: (1) The private property rights necessary for efficient market development are not in place and (2) potential externalities exist. In consequence, the market fails to indicate the true net social benefit of fish farming, and will not do so until there are adjustments in property rights and objective measurement of alleged external costs. Such market failure constitute openings for dysfunction in the regulatory environment of aquaculture in Canada. It was the problems and policy proposals coming through this opening for dysfunction that speakers at the Brudenell and Vancouver conferences presented.

Coming through the Openings

The reaction of vested interests to advances in aquaculture are understandable. These interests do not openly oppose aquaculture, but they focus on preserving competing activities that are declining because they are based on obsolescent institutions. Unfortunately, given the present climate of opinion in the controlling bureaucracy, these vested interests need only assert the possibility that the decline in the wild fishery, for example, is caused by the rise of aquaculture, and that becomes the policy forming opinion. Where there is no attempt to measure objectively the risk of external costs in aquaculture (as the commissioner for aquaculture development stated), assertions of possible cause and effect go unchallenged. In fact, given the high fashion of the "precautionary approach" in the regulation of aquaculture (to which we will return), those assertions become the basis of policy, as the following examples show.

At the Vancouver conference John Fraser, chair of the Pacific Fisheries Resource Conservation Council (an "independent" body funded by the federal and BC governments) presented the council's views. With respect to attempts to calculate the economic costs and benefits of different uses of marine resources, he stated, "I took economics and got a first class, and I have never trusted the beggars ever since." Further, he admitted that the council is not a research institute in the sense that it does any scientific research. Despite this admission that the basis of the council's assertions were largely the unfounded opinions of some otherwise very fine people, Fraser proceeded to suggest that advance in aquaculture had caused the decline of the wild fishery, that "one of the real issues [was] the survival of wild salmon", and that the aquaculture industry should see to it that "it does not become an obstacle to the salvation of wild salmon". In short, it would seem that according to the Pacific Fisheries Resource Conservation Council, the main goal of aquaculture should be not be development of aquaculture, but development of some other industry. The potential for damage to the regulatory environment of aquaculture from this sort of opinion voiced by the socially prominent head of a publicly funded "independent" non-profit institution, especially when there is no corroborating or contradictory hard science, is evident.

There is no generally accepted scientific evidence that expansion of aquaculture is the cause of decline in wild fish populations over the past decade. Indeed, in the case of the East Coast cod stocks, the decline has occurred in the complete absence of aquaculture. But it is not that there is no evidence at all. The problem is the absence of generally accepted scientific evidence. That is what the commissioner for aquaculture development is calling for, because a little bit of questionable evidence tied to a lot of imagination is a dangerous thing, especially in the information environment of the present time, when science is at once so respected and so easily abused.

At the cutting edge, the conclusions of science are tentative and contested. Almost any position can find some "expert" with a bias in its favour. The room for junk science is extensive, and there are always some purveyors of sensational journalism who are keen to raise the volume of their readership by exploiting the public's natural fear of the unknown. What could be more entertaining than bringing Jurassic Park to life on the pages of the fishing news by repeating unfounded speculations about the horrors of modern biotechnology gone astray? The result, according to David Murray, Director of Research for the Statistical Assessment Service in Washington, D.C., is the liberation of public opinion – and, consequently, government policies based on public opinion – from the strictures of sound, established science. Addressing the Brudenell conference, Dr. Murray outlined the damage done in public policy by the spin doctors of the special interests.

At the Vancouver conference John Fraser stated that a professor at the University of British Columbia held that aquaculture "reduces global food supplies, disadvantages impoverished consumers in developing countries, and due to its great dependence on fossil fuels is inherently unsustainable". No proof whatsoever was given for these propositions, and, in fact, the arguments implied are fundamentally spurious. For example, can we conclude that the automobile industry, because of its heavy dependence on fossil fuels (gasoline) is unsustainable, and that therefore all production of automobiles should be stopped? Well, no. The automobile industry justifies its heavier cost in fossil fuels by its greater contribution to the welfare of society at present, and there are alternative fuels that will make the automobile industry sustainable into the indefinite future.

At the Brudenell conference Dr. Fred Whoriskey, spokesperson for the Atlantic Salmon Federation, clarified the federation's mission: to conserve and restore wild Atlantic salmon for recreational fishing. Not being able to account for the decline in wild salmon numbers by pointing to overfishing on the part of the federation's own clients, Dr. Whoriskey asserted, but did not substantiate, that there were risks associated with possible diseases emanating from farmed-fish pens and from what the daily press has taken to calling "frankenfish" – that is, genetically altered salmon, the underwater bogey man of the special interests. The goal of the federation, he said, was to have fish farming regulated, not for the socially efficient pursuit of that industry, but for the purposes of recreational fishing, and to have the regulations determined by a rule of zero possible damage to the wild fishery. He made no reference to a generally accepted measure of the costs and benefits entailed for society as a whole or, indeed, even for the wild fishery.

Dr. Whoriskey's espousal of the rule of zero *possible* damage [that is, possible, though not proven – and not even probable – damage] is not peculiar to the Atlantic Salmon Federation, but in fact, as the commissioner for aquaculture development pointed out, is pervasive in the regulatory environment. In 1983, Canada, Denmark, the European Union, Iceland, Norway, Russia, and the United States jointly established the North Atlantic Salmon Conservation Organization (NASCO). The objective of the organization was to contribute, through consultation and cooperation, to the conservation, restoration, enhancement, and rational management of salmon stocks subject to the Convention for the

Conservation of Salmon in the North Atlantic Ocean, taking into account the best scientific evidence available to it.[3] There is nothing objectionable about this, but that was not the end of it.

In 1995 NASCO adopted what has come to be called the Oslo Accord. The parties to the accord agreed to minimize possible adverse effects to the wild salmon stocks from salmon aquaculture. This meant that the contracting parties agreed to adopt and apply a "precautionary approach". The precautionary approach requires (1) consideration of the needs of future generations and avoidance of changes that are not potentially reversible; (2) prior identification of undesirable outcomes and of measures that will avoid them or correct them; (3) initiation of corrective measures without delay, and that they achieve their purpose promptly; (4) giving priority to conserving the productive capacity of the [natural; i.e., wild] resource where the likely impact of resource use is uncertain; and (5) appropriate placement of the burden of proof by adhering to the above requirements.[4]

Of course the Oslo Accord is susceptible to a benign interpretation, but that has not been the case in Canada. The commissioner for aquaculture development has put the matter in a clear, though reserved statement:

> [T]he application of the precautionary principle remains a matter of discussion in the federal government.
> ...
> The absence of a clear definition and policy on its application is considered by some as an impediment to any form of development – a perceived attitude of "if in doubt, do nothing" – and the very antithesis of an approach based on risk analysis and risk assessment (Office of the Commissioner for Aquaculture Development, 2001, p. 19).

Industry veteran Brad Hicks has put the matter more forcefully:

> One of the main reasons that DFO policy development for aquaculture has been so negative from the farmers' perspective is because these policies were and are being developed during a time when DFO is afraid of its own shadow. With the collapse of the cod fishery on the east coast and with the massive restructuring of the west coast salmon fishery and reallocation of salmon under the Aboriginal Fishing Strategy, DFO is afraid to try anything new. Indeed, it has in fact retreated behind the "precautionary principle, or precautionary approach," and is developing policies that have little to do with the well-being of the fishery or the generation of wealth, but rather policies that are perceived by DFO to simply *be without risk.*

[3] See the NASCO Web site [cited February 2002], <www.nasco.org.uk/html/about_nasco.html>.

[4] From NASCO "Agreement on Adoption of a Precautionary Approach" [cited February 2002], <www.nasco.org.uk/html/agreement_on_adoption_of_a_pre.html>.

> [S]everal environmental groups have taken advantage of DFO's profound lack of self-confidence and exploited the situation by frightening DFO into developing policies which these groups favour. For example, several environmental groups have pushed very hard to have feed and fish feces declared deleterious substances under the *Fisheries Act.* This could only occur if the *Fisheries Act* is unable to accommodate fish farming and if DFO in its present weakened state has retreated entirely from the concept that Canada's oceans should be a source of wealth for this country (Hicks, 2001, p. 3).

The upshot of all this is a dysfunctional climate of opinion for aquaculture – that is, an atmosphere in the lead regulatory agency that is poisoned against aquaculture. The purpose of aquaculture, in this perverse information environment, is to preserve the wild fishery, not to supplement it, and most certainly not to replace it – whereas, in any historically founded set of considerations, the last would be the most reasonable proposition.

Insofar as human welfare is concerned, the incontestable experience is that the productivity of land in the wild is much less than that of land owned and systematically cultivated with the aid of intelligence. Indeed, historically, the exhaustion of unhusbanded wild resources has moved humankind naturally toward settled, systematic cultivation. Societies based on settled cultivation have thrived, and those not so based have been marginalized. To what lengths will the vested interests of hunting and fishing go to show that this is not the case with respect to harvesting the seas? Perhaps quite far. There are biases in the information environment aiding and abetting them. In particular, the public's fascination with the media's sensationalist focus on losses, without reference to the accompanying much greater gains, is a major stumbling block to progress. Apparently, if it isn't bad, it isn't news.

For whatever reason, the present problems of the wild fishery, though a natural consequence of the resource not being organized to ensure sustainability as world population grows, has generated a defensive posture of denial in political institutions. The problem is the problem of a common property resource. The answer to the problem of common property is private property. Agriculture had a "tragedy of the commons", which was overcome by the establishment of private property in the form of individual ownership of farms. Aquaculture makes this solution possible in the fisheries. It can bring the fisheries into the institutional structure of modern liberal economic and political institutions. It can liberate fishing as agriculture liberated medieval Europe from the constraints of the hunting and gathering stage of economic development. Private ownership of sites and the fish held there can liberate fishing as private property liberated agriculture from the debilitating constraints of feudalism. It can put the fisheries on the same footing as other twenty-first century capitalistic enterprises.

The dysfunctions of the aquaculture regulatory environment are unnecessary, and they may be eliminated by some relatively simple adjustments to the institutional structure. In the United States, for example, the decline in wild stocks of fish that characterized the 1990s generated a policy of encouragement

for aquaculture, which was viewed as a means for maintaining the fish products industry. Aquaculture was viewed as a remedy for, not a cause of, the decline in the wild fishery. This was possible in the United States because of the attitude and structure of the US regulatory bureaucracy. The National Aquaculture Act of 1980 established a policy designed "to encourage the development of aquaculture in the United States". The act recognized the primary responsibility of the private sector in advancing the industry, but it attended to the research and information activities that no individual firm in the industry would find it profitable to undertake. It set up a Joint Subcommittee on Aquaculture, the lead agency of which was the Department of Agriculture. There was no department of fisheries involved.

Coming through the Window

The failure of public authorities to establish a scientific and economic basis for the allocation of resources to aquaculture in Canada leaves the window open to confusion as a multitude of alternative values direct the formation of, and behaviour in, the regulatory environment.

Any new and expanding industry needs access to capital. To get capital it needs security in the product of its investments. To get security of this sort in aquaculture, the aquatic sites (that is, the places on water) in which production is carried out have to be owned outright or, at the very least, have lease terms long enough to satisfy the demands of lending agencies. In the words of the *Legislative and Regulatory Review of Aquaculture in Canada*,

> Part of the uncertainty relates to the lack of long-term security for various forms of authorization and licensing of aquaculture activities. This is a deterrent to private investment in aquaculture. The lack of a clear federal leasing policy and regulations (or delegation of administrative responsibilities to the provinces) impedes development of the aquaculture sector, particularly as interest increases in developing areas further offshore. Currently there is no federal-provincial agreement on who has jurisdiction over the sea bed (p. 19).

On Prince Edward Island, shellfish sites are renewable but granted for only one year. In New Brunswick, until recently there was no secure length of tenure attached to site allocation, and the conditions for grants were such that aquaculture firms applied for leases not knowing what the conditions of the actual granting of a site would be. But, as Nell Halse, general manager of the New Brunswick Salmon Growers Association, pointed out at the Brudenell conference, the situation was worse than that. Even if the province had had a policy with predictable outcomes, the federal Department of Fisheries asserted the right to deny allocation to a successful applicant at the provincial level. Given the requirement of considerable investment in site assessment by a firm in the industry prior to making an application, Halse's presentation implied that the regulatory situation raised risks to a nearly prohibitive level, reducing industry expansion below the level at which it would best serve the communities involved

Yet it was not that New Brunswick had no policy at all. It did have the Bay of Fundy Marine Aquaculture Site Allocation Policy (applying only to the Bay of Fundy).[5] Indeed, appendix 1 of the policy suggests that, with declining wild stocks of fish, aquaculture might be the salvation of the region's

[5] See the New Brunswick government Web site [cited February 2002], <www.gov.nb.ca/0057/e-fundy.html>.

fish products industry. The policy statement itself, however, was somewhat less favourable to aquaculture. It contained no reference to length and security of site licences.[6] The policy's principal stated goal is to ensure the restructuring of the industry toward "a single year class management system"; that is, each pen contains only fish of the same age. The system was thought to be conducive to fish health. Sites were to be allocated to facilitate operators' attempts to meet this goal. Beyond that, sites were to be granted only to established operators, when there was prior assurance of economic viability and environment sustainability, and only after wild fish harvesters, property owners, and the federal government had been consulted. Even in a clean political climate this policy would have to be labelled conservative. In the existing poisoned climate it was obstructionist.

Uncertainty in Canadian aquaculture site leasing, of course, is not limited to length and security of leases. Again in the words of the *Review*, there are

> no clear and precise policies in place to determine when an interference with navigation is acceptable, or whether, to what extent, and what kind of effect on a wild fishery is acceptable (p. 18).

According to Steven Cross, president of an aquaculture research and development firm, at the time of the Vancouver conference the situation with respect to site allocation and tenure was particularly depressing in British Columbia. The provincial government had undertaken the Salmon Aquaculture (Environmental Assessment) Review in 1996. The report was not received until fully three years later and, a year after that, at the time of the 2000 aquaculture conference, none of its 49 specific recommendations had been implemented. There had not even been a public announcement of the findings. In the meantime, a moratorium on industry expansion, put in place while the review was underway, had remained in effect. Apparently the government, preoccupied with a desperate search for a solution to a problem of job losses in forestry and the wild fishery, not only could not recognize aquaculture as a solution, but seemed not to see aquaculture at all.

The *BC Salmon Aquaculture Review Final Report* (Salmon Aquaculture Review, [1998]) has since been published, the moratorium has been lifted, and most of the recommendations have been implemented. It is a nice question, however, as to whether the situation of aquaculture in British Columbia has been improved. Indeed, the report provides evidence of continuing dysfunction in the regulatory environment.

The Salmon Aquaculture Review, by its own admission, was undertaken because there was considerable uncertainly in the industry. The uncertainty concerning the authors of the report was not uncertainly within the aquaculture industry, though there certainly was some of that. It was uncertainty on the part

[6] Formally, lease lengths are governed by the province's *Aquaculture Act* (Chap. A-9.2, consolidated to June 30, 2000). Under this act aquaculture occupation permits, when granted, are allowed to salmon farmers for a temporary period of up to three years, though, in general, aquaculture leases may be granted for a period of twenty years. Permits and leases are subject to cancellation on non-fulfillment of conditions.

of other interests with respect to the effects of the industry on competing activities. All 49 recommendations reduce uncertainty outside the industry by restraining the internal development of the industry with the directive that "coastal zone management plans should be developed with the participation of all key stakeholders in a consensus-seeking setting". This directive implies that nothing happens in which the vested interests do not concur, objective costs and benefits notwithstanding. The Review was to examine five issues: (1) impacts of escaped farm salmon on wild stocks, (2) disease in wild and farmed fish, (3) environmental impacts of waste discharged from farms, (4) impacts of farms on costal mammals and other species, and (5) siting of salmon farms. Among the *Report's* general conclusions one finds the following:

> Salmon farming in British Columbia, as presently practiced and at current production levels, presents a low overall risk to the environment. ... [There were] significant gaps in scientific knowledge ... in areas such as the potential impacts of interactions of escaped farmed salmon with wild populations, identification and control of disease and disease pathogens, potential for disease transfer and impacts from antibiotic residues, and effects of waste discharges on water quality and seabed life.
> ...
> Significant gaps exist in scientific understanding of disease in wild and cultured fish. Current information indicates no evidence of exotic pathogens or parasites having been introduced to British Columbia, and the Technical Advisory Team found the probability of exotic disease outbreaks to be low.
> ...
> Based on current knowledge, the Technical Advisory Team found a low overall risk in the key areas of concern.

Still, the *Final Report* points to a conclusion that even though the risk of significant environmental impacts was determined to be low, the possibility nevertheless existed for the occurrence of what some special interests would consider a catastrophic event such as damage to wild salmon stocks. Needless to say, if damage to wild stocks were more than compensated for by a much greater increase in farmed stocks, the occurrence would hardly be catastrophic, but the report does not undertake such weighing of benefits against costs. On the basis of a one-sided view of things, it suggests that regulation should follow

> the precautionary principle, which advocates the consideration and anticipation of the potential negative impacts of an activity before it is approved. Similarly, the concept of preventative management allows government to manage to prevent certain specific effects even though not all potential outcomes can be predicted.

In short, the *Final Report* exemplifies all the problems with the regulatory environment that the commissioner for aquaculture development has depreciated. Consider the following statement in the Summary Report of the Salmon Aquaculture Review. It refers to operations in inland lakes:

> There is an increased likelihood of escaped salmon competing with native fish populations and establishing colonies. In addition, low production or oligotrophic lakes are particularly susceptible to eutrophication ...

This states that one species may replace another, and that lakes with a low level of nutrients may become lakes with a high level of nutrients. If there is a risk here, it is that a better-adapted species will replace an ill-adapted species and will thrive in a more nutrient-rich environment. Still, the report goes on to say, "To reduce these risks, the government should ..." We are here faced with a hiding of benefits and an exhibition of costs. Such blind spots can produce false impressions. For example, it could be said that farmed fish are subsidized up to sixty percent by wild stocks, because the eggs or smolts are drawn from wild stock, and part of the farmed fish feed is wild stock. But this would entail an unstated corollary that wild stock are subsidized one hundred percent by wild stock. What is true but not said generates a connotation that damages the image of aquaculture. A similar statement might be that it takes five pounds of wild fish to produce one pound of farmed fish. Such a statement covers over the fact that farmed fish receive some feed that is not wild fish, so that it takes, say, eight pounds of wild fish to produce one pound of wild fish. In an economically dysfunctional information environment – i.e., in a selectively politicized climate of opinion – the pros and cons of aquaculture are weighed on a biased scale.

Details of Dysfunction

The problem of site acquisition and tenure [the dysfunctional institutionalization of the property rights basis for aquaculture], according to Ruth Salmon, former executive director of the British Columbia Shellfish Growers Association, is more rooted in the regulatory environment than even the uncertainties of the official procedure would indicate. Addressing the conference in Vancouver, she pointed out that allocation of a site not only requires concurrence of several government offices, but is usually preceded by a local zoning meeting that is open to the vested interests of non-aquacultural users of the site being discussed. At such meetings public concerns are often based on the visual quality of the proposed operation. That is, they are based on a subjective assessment by people who, at the very best, will not directly benefit from the farming operation, and, at worst, will not benefit from the farming operation at all. Their judgment is not based on any assessment of the benefits to be gained by others and by society as a whole. There is no objective measurement of costs and benefits in the assertions made by special interests at such political meetings. As a result, the economic cost to local people of the shellfish farm may be negligible, but frequently it is the only cost made explicit. Little or no account is taken of any benefits to society at large.

All of this is bad enough, but appropriate property rights in siting and an attempt at objective measurement of benefits as well as costs are only two of the needs of aquaculture. The industry needs access to stock, exotic and wild, to develop new and better products. The Department of Fisheries and Oceans, however, is hesitant to approve applications to use such stock, due to putative risks perceived by its own, unsympathetic employees. The department was alleged to be producing a National Code on Introduction and Transfer of Aquatic Organisms, but it had not yet produced it at the time of the Brudenell conference, and, in the absence of the code, the paralyzing precautionary approach was producing the expected do-nothing answer to most emerging questions.

According to Brad Hicks, executive vice president of Taplow Feeds, speaking at Brudenell, there are no verified reports of disease being imported by salmon aquaculture, and no verified reports of disease spreading from farmed to wild fish. It is true that diseases are discovered first in aquaculture operations, but that is because the monitoring associated with disease management is much more thorough in settled aquaculture. Still, the industry is not allowed to import smolts from overseas, and only eggs and milt from specific certified-disease-free facilities are allowed into Canada.

But enumerating the long list of dysfunctions in the *Fisheries Act* is, perhaps, not appropriate here. They have been set out more cogently in the *Legislative and Regulatory Review of Aquaculture in Canada* (pp. 21–30) than they were at the conference, the presentations at which included coverage of a wider range of matters than did the *Review*.

Quite apart from the irrational basis of resource allocation in Canadian aquaculture, journalistic exploitation of the uncertainties of cutting edge science (if not journalistic exploitation of interested propagation of "junk science"), the admitted bias of the federal bureaucracy in favour of the vested interests of the declining wild fishery, and the limitations of most federal and provincial regulations, there is a separate issue of administrative inefficiency. This last is virtually inevitable given that in Canada there are three not-always-cooperating levels of government involved – and even more not-always-cooperating departments at each level of government.

The ideal would be one-stop shopping for firms in the aquaculture industry. Ideally, there would be one agency to which they could turn for site applications, licensing, and environmental permits; permits for moving and harvesting, processing animals, and drug use; and general information on what regulatory barriers will have to be removed in the pursuit of productive activity – barriers such as zoning laws; carrying capacity rules; codes of conduct; directives with respect to pond construction, feed management, effluent treatment, worker incentives; and still other directives that non-aquacultural interests have insisted be imposed on the industry. Further, the industry should be able to calculate readily what the cost of all these restrictions is going to be. For social efficiency, the entrepreneur's cost of getting to know what one is up against in any new venture should be at a minimum. In the Canadian regulatory regime of multi-layered governments and departments, this is simply not the case.

The real situation is multi-stop shopping, confusion, unnecessary expense, and lost time. For example, as Jim Brackett, general manager of Syndel Laboratories, told the attendees at Brudenell, not only does the Canadian drug approval system restrict domestic aquaculture to far fewer drugs than are used in Norway or Japan, but the Bureau of Veterinary Drugs charges more for applications for drug reviews than do similar agencies in other countries. Further, having promised responses within 180 days, the bureau generally responds with "common approval times of two years". Even if the promise were kept, according to Brackett, the time lag would be twice as long as it is in the United States.

The aquaculture industry has a right to expect reasonable efficiency in the public offices with which it has to deal. It has a right to expect adequate expertise and objectivity in the civil service of a government supported by all taxpayers, not just a special segment of the electorate. When the opponents of fish farming make spurious arguments set out in the rubrics and jargon of science, federal drug agencies in particular should reply with sound science and common sense. In fact, according to Jim Brackett, they do not, because in the existing cross jurisdictional confusion of the bureaucracies involved, the Bureau of Veterinary Drugs has been given no special expertise in fish, the Canadian Food Inspection Agency has a dubious mandate in the matter, and DFO, the lead agency, has divided loyalties that weigh more heavily in favour of aquaculture's opponents.

In fair measure the problem is institutional. Jurisdiction in all of these regulatory matters in Canada is constitutionally vested in several authorities. In general, provinces have responsibility for land use

decisions and for overseeing day-to-day operations. The federal government has responsibility for habitat, environmental sustainability, and navigable waters. Within these two jurisdictions responsibilities are carried out in a variety of departments and agencies. To add to this potential for confusion, both levels of government are responsive to public opinion as articulated through elections, through special interest pressure groups, and through the press. And, to bring matters to further confusion, the lead administrative agency, DFO, is made up of agents who, on the one hand, are not free of bias against aquaculture and, on the other, are not free from budgetary constraints.

This situation is not the personal fault of the administrators involved; they have been put in a position in which dysfunction is inevitable. It is the institutional structure of the regulatory environment that is the principal source of problems. DFO ought not to be the lead administrative agency. As Brad Hicks put it,

> The current situation of fish farming being managed and regulated under the *Fisheries Act* is the equivalent of dairy farming being managed by a wildlife act, or a chicken farm being managed by the *Migratory Birds Act.* (Hicks, 2001, p. 4).

A Window Open to Fresh Air

Aquaculture is relatively new in Canada and is expanding rapidly in relation to the wild fishery. Still, it is expanding slowly in relation to aquaculture in the rest of the world. No doubt there are historical reasons why this is so. If nothing else, the wild fishery in Canada has been very productive in the past. Unfortunately, it is now in decline. The rational response would seem to be expansion of fish farming, which is not at all in decline. But, it's an old story that time and again was told at the conferences at Brudenell and Vancouver: the institutional environment in which aquaculture has to expand is a product of what came before it. The interests of the wild fishery are entrenched in the civil service. The manipulators of democratic government have influence in the House of Commons and the Cabinet. Irrationally divided jurisdiction in Canada makes it easy for the vested interests of economically obsolescent activities to slow progress to a snail's pace. As the commissioner for aquaculture development pointed out, obstructionism and do-nothingism seize the day.

If any conclusion can be drawn from the presentations at Brudenell and Vancouver, it must be that fundamental institutional change is required in the regulatory environment of Canadian aquaculture. In the United States the simple fact that aquaculture is regulated by a national body oriented to the industry – the Joint Subcommittee on Aquaculture (on which the lead agency is the Department of Agriculture) – has made progress possible. Having said that, of course, there is much more to be said about the situation in the United States.

In Australia, most aquaculture occurs in state waters (within three miles of the shore), so most aquaculture comes under one jurisdiction. It is clear that in Commonwealth (federal) waters (three to twelve miles from shore), the Commonwealth government is the regulator. The confusion and uncertainty that characterizes the Canadian situation is thereby obviated. Further, the Australian government has a standing committee on fisheries and aquaculture, which has a subcommittee devoted solely to aquaculture. In this institutional environment the government produced in 1994 a National Strategy on Aquaculture in Australia. The goal of the strategy was how to develop, not how to control, aquaculture. Since the release of the strategy, the aquaculture industry in Australia has experienced significant growth.

Of course a change in formal organization is not sufficient. There must be a policy thrust to foster, not inhibit, aquaculture. In Norway four different ministries are involved in the administration of aquaculture: Fisheries, Environment, Agriculture, and Local Government and Labour. Still, the aquaculture industry has advanced beyond that of other countries. What is different in Norway is the presence of an act relating to the breeding of fish and shellfish, the purpose of which is "to contribute towards the balanced and sustainable development of the fish-breeding industry to help it become a profitable and viable

industry". The act has been in place since 1985. Further, in 1987 a program was established to assess the suitability of the costal zone for aquaculture. Under the program, sites that are unsuitable because of potential environmental damage and unwarranted incursion on competing activities are ruled out, but suitable sites are identified, and development in those sites is encouraged. Evidently, the intention to develop rather than to inhibit is as important as is legislating an enabling institutional environment.

Aquaculture has been relatively slow to develop in Canada because the wild fishery has been so productive in the past, and because the institutions of regulation and the intent of regulation are directed toward maintaining the wild fishery. Elsewhere, in Australia, Norway, and the United States, there is legislation with the intent to develop aquaculture. In New Zealand, in 1996, following a review of the Fisheries Act, it was determined that aquaculture was simply not included in existing legislation or explicit administrative organization. A similar review undertaken in Canada came to the same conclusion in the spring of 2001. Apart from the appointment of a commissioner for aquaculture development, whose office produced the review, however, there have been no administrative adjustments or legislative enactments to improve the Canadian aquaculture regulatory environment.

Where to Start

No one disputes the enormous economic benefits associated with liberal democratic institutions and a market system based on private property and individual choice. Some lament the materialism that economic prosperity has brought with it, others the distribution of the economic benefits. Even for the critics of capitalism, however, the solution is not to cling to the remains of feudalism or to technologically obsolescent production methods suited to a common property system. The solution is to enable capitalistic production, and then to ensure some equitable distribution of the increase in output. In aquaculture, eliminating the dysfunctions – that is, enabling capitalistic production – is the first step that has to be taken.

A functional regulatory environment must meet certain criteria. Where there are market failures, the institutions of public regulation should ensure that costs and benefits not accounted for or captured by private firms are taken into account, so that net social economic benefits are as great as they can be. Historical evidence shows that the regulatory environment in Canada, at least with respect to aquaculture, is not even attuned to this issue. If it were, its first task would be to identify the market failures in the industry, most of which stem from the attempt to carry on a modern market-oriented industry in the property rights structure (the regulatory environment) of the wild fishery. The problem of property rights for the wild fishery itself have been adequately outlined in Brian Lee Crowley's *Taking Ownership* (1996).

In a subsequent paper coming from the conferences in Brudenell and Vancouver, the nature of property rights in aquaculture, and how to get them into a functional form, will be addressed specifically. The problems of the wild fishery all stem from its base in a common property resource. The solution to those problems is to establish well-defined private property rights. That, of course, is precisely what would happen in the fisheries if aquaculture were accepted and properly regulated.

References

Crowley, Brian Lee, ed. 1996. *Taking Ownership: Property Rights and Fishery Management on the Atlantic Coast*. Halifax: AIMS.

Hicks, Brad. 2001. "Fish Farming is Farming not Fishing". *Northern Aquaculture* (August 2001).

Office of the Commissioner for Aquaculture Development. 2001. *Legislative and Regulatory Review of Aquaculture in Canada.* Ottawa: Communications Branch, Fisheries and Oceans Canada. Available on line [cited February 2002]. <http://ocad-bcda.gc.ca/elegalreview.pdf>.

Salmon Aquaculture Review. [1998]. *The Salmon Aquaculture Review Final Report* [online]. Victoria: Environmental Assessment Office. [Cited February 2002.] <www.eao.gov.bc.ca/project/aquacult/salmon/Report/final/vol1/toc.htm>.

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Conferences:

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