

**A COMPARATIVE STUDY OF SALMON AQUACULTURE SITE ATTRIBUTION BY PUBLIC AGENCIES IN EASTERN CANADA AND, MAINE, USA (HOOP JUMPING VS. OPPORTUNITY COST PRICING)**

Youssef Boudribila<sup>a</sup>

James R. Wilson<sup>b</sup>

University of Quebec at Rimouski, Department of Economics and Management,  
Marine Resource Management.

[Boudribila77youssef@yahoo.ca](mailto:Boudribila77youssef@yahoo.ca)

**ABSTRACT**

We focus on problems of access to marine sites for aquaculture in different countries, particularly in Maine, U.S.A. and Canada. The main question examined is how public natural goods (marine space) are allocated for aquaculture activities. Using ideas from law and economics, as well as institutional economics, we looked at legal frameworks of different countries to see how they contribute to the allocation of marine sites.

Aquaculture sites are means of production that generate rents. Who ultimately gets the rent may depend upon the rules of attribution. Like land, higher quality sites become scarce sooner, leading the industry to seek solutions such as open ocean aquaculture. However, this also makes entry deterrence an attractive strategy as well. Maximising rents may not even be an objective for public managers, despite arguments by some economists that encouraging more transparency and competitive bidding for public goods like aquaculture sites is more efficient. It is therefore reasonable to explain why these recommendations are not more routinely followed by public managers.

One hypothesis is that both public managers and those being regulated prefer administrative approaches to site attribution rather than open competitive pricing systems. Though property rights to aquaculture lease sites are evolving in most countries, the history of resource allocation in other sectors shows that the first-comers tend to form rules that reinforce their position, as long as they are able to extract a benefit over the costs of deterrence.

For this reason we explore legal frameworks that afford the possibility of improvements in allocation and use efficiencies.

**Keywords:** Aquaculture, sites, rents, allocation, opportunity cost.

**INTRODUCTION**

This article concerns the allocation of aquaculture sites. Aquaculture is an industry which has seen an important expansion, mainly because it is a source of supply of the consumption market, replacing in part traditional fishing of wild stocks which are in decline because of overexploitation (FAO, 2003). However, by occupying maritime spaces, generally near the zones which are endowed with harbor facilities, aquaculture operation can generate multiple externalities<sup>c</sup>, which adds to competition over these resources used by fishermen, marine

transport, boaters and tourists, and scientists. Therefore, how submerged land passes from the public to private hands seems a pertinent research agenda.

We use examples from the aquaculture industry in the eastern provinces of Canada (New Brunswick (NB); Quebec; Newfoundland & Labrador (NF&L); Nova Scotia (NS) and Prince Edward Island (P.E.I)), and the state of the Maine, U.S, to explore legal and other institutional frameworks derived from national and international legislation. Since aquaculture development is happening globally, we also make reference to practices in other countries, for example Ireland and Norway. Many of the laws framed for specific aquaculture measures have their origins in legislation drafted for other purposes: environmental/pollution laws, water quality regulations, capture fisheries legislation, nature conservancy directives, health and disease laws, trade laws, tax laws, etc. (Pickering, 1998; FAO, 1995; OCAD, 2002). These legal institutions may arouse controversies notably in the way sites are attributed, as well as the property rights implied by these activities. This is because a number of potential externalities, and the liability rules surrounding them, may have been ignored or not addressed during the process of attribution. For example, the effects of pollution and the abridgement of other use rights engendered by the installation of aquaculture operations are common types of problems.

The institutions which govern the distribution of public goods engender environmental transactions which can promote economic efficiency or discourage it. The analyses of the practices of some governments in the calculation of cutting rights in forests, in the leasing or selling of mining and pasturing rights as well as other activities in the public domain, suggest that governments seldom charge a rental value for the access which represents the true economic costs of using these goods (Vourch, Ann, 2001). There is some evidence, at least in Canada, that the attribution of aquaculture sites follows a similar pattern.

Marine aquaculture sites have biophysical endowments which can generate rents (Costanza, R., 1999; Arrow, K, *et Al.*, 1997; Cheung, 1970). However, as in the attribution of other resources, the state may grant use rights at lower than the actual rental value of the resources, or use attribution methods that have little to do with competitive pricing. Although this directly benefits those who are fortunate enough to obtain these rights, the state, and the public at large, does not directly benefit from these resources except perhaps through the generation of lower-priced finished products and the increased employment that might occur.

The aquaculture industry has existed for a long time in the countries we have studied (more than 20 years), but there has been surprisingly little impetus to reconsider the method of maritime sites attribution by governmental agencies, in order to maximize the collection of aquaculture rents.

There are three reasons that may explain this. First, the resources may be so abundant and the opportunity costs are so low that the transactions costs implied by full opportunity cost pricing outweigh the gain from the emplacement of such a policy. Secondly, although aquaculture sites are composed of environmental attributes that generate rent for different users, it may not be clear what the customary use values are, in part because the market for the implicit factors of aquaculture land, at least in Canada, is not as highly developed as it is for agricultural land. This may be due to the non-existence of markets and customs regulating this “new good.” Finally,

however, there seems also to be a lack of market information on the actual trading value of the sites, because of the ambivalent institutional nature of submerged land.<sup>d</sup> It seems simply that, public managers may tend to use potential aquaculture sites as a way of promoting regional development, in much the same way as uplands have been used to promote development agendas in the past (see, for example, Anderson and Hill 1983; Allen 1991; Anderson and Hill 1990).

## **THE NATURE OF THE RESOURCE**

For this case study, the resource is maritime space with a number of biophysical characteristics; plankton density, temperature range (very important for salmon farming) which can affect growth rate and survival of the individuals, dissolved oxygen, local currents (e.g. upwelling), presence or absence of parasites, presence of complementary fishery resources, and the presence of mining and oil resources. Another characteristic of the maritime space is its geographic location (proximity of harbor facilities, roads, markets and the other means, as well as the presence of populations of predator species, or other species that compete for the same characteristics. All these factors are to one degree or another taken into account for the choice of aquaculture sites. Through the legal framework, an environmental assessment under the Canadian Environmental Assessment Act (CEAA), the navigable water approval under section 5(1) of the Navigable Water Policy Act (NWPA), and the prevention of the possibility of a harmful alteration, disruption or destruction (HADD) under the Fishery Act (section 35), are required to issue authorization for aquaculture activities by the federal government of Canada.

Aquaculture promoters may have to provide other proofs of feasibility to satisfy the federal government of Canada. These may include determinations of the impact of proposed sites with respect to native rights and land claims, impacts on migratory birds, utilization by other groups, and shellfish safety. However, every province conducts its own assessment under Memoranda of Understanding (MOUs), which allow the provincial governments to administer the leasing process of all “near-shore”<sup>e</sup> activities (except in P.E.I). The consultation with riparian owners is required, but the ultimate decision is made by the provincial minister. Equivalent and more specified requirements are applied in Ireland through EU environmental policy (McMahon, 2000) which is involved in and inaugurates certain procedural formalities involved in setting up aquaculture activities, i.e., licensing procedures.

The state of Maine in the U.S. has multiple requirements with respect to all patterns cited above. In addition, the riparian owners’ agreement is determinant to site attribution. All the information gathered helps to define primary conditions (at time zero) of the site, before proceeding to any activity of installing cages or other means of production and culture. This information serves as a reference to control aquaculture development process and its impact in the area, especially on sediment and water quality. One of the important goals of the policies framed by all those countries is to provide suitable areas that meet the necessary characteristics for aquaculture activities. However, the costs for the environmental assessment are paid by the promoters (In Canada, from C\$30,000 to C\$100,000<sup>f</sup>). The site selection process, then, often generates a substantial amount of biophysical and environmental information on an area, which may or may not be shared with the public at large.

There may be variations in trading value from country to country that reflect relative abundance of sites, and certainly the anecdotal evidence is that Eastern Canada may still have a relative abundance of sites. However, since much of the transactions costs of knowing a site's intrinsic value is borne by the promoter before obtaining approval, the final (low) lease values administratively fixed may not be a good measure of relative abundance of marine sites, or for that matter, of site quality. The low administrative price may therefore be due to the uncertainty before the fact that public managers may have with regard to the desirability of aquaculture sites.

There may be problems with such an incremental approach, however. For example, charging individual promoters with demonstrating the feasibility of a site may result in unfairly costing first-movers to an area with information acquisition costs. As a region develops, the information costs on adjacent sites may be lessened by the positive externalities associated with acquired information, for which the first mover may not be remunerated. On the other hand, keeping this information non-public could result in more myopic development of aquaculture zones that could result in sudden external effects, again for which there is no clear market or legal recourse envisioned. Institutions surrounding agricultural zoning attempt, with varying degrees of success, to limit unexpected and uncompensated negative external effects. However, the institutions surrounding aquaculture zoning seem to be, at least for the case of Atlantic Canada, less well developed. The disease spread in the Bay of Fundy in New Brunswick in 1996, and in the gulf of the Maine in 2001 was costly for both the industry (losses in production and in time of awaiting the total disinfection of all the area), and to the companies in terms of disinfection costs and lost production time for the growers. In the case of New Brunswick, the problem was so acute that the Federal and provincial governments were finally called upon to provide aid to the salmon aquaculture sector using public money. It seems reasonable to conclude that incomplete information about carrying capacity limits for an entire zone may be exacerbated by the institutional rules in place governing how sites are attributed.

None of the legal regimes we have studied so far have been the type where the public administrators know beforehand the value of aquaculture lands they have, and then go onto a competitive land market to sell or rent the sites. The legal frameworks in Canada and the U.S. are similar to most other countries in that the responsibility for proving that a proposed site is propitious is in the hands of the promoter. On the other hand there is considerable variability with regard to the level of public agency support for compiling a dossier, and how this information is used in a public forum. Maine, for example, makes most of the supporting documentation public through a hearings process, and indeed most of the banked information is public usually collected by the Army Corps of Engineers. Canada, on the other hand, relies more on private provision of information, most of it proprietary. Nevertheless, while some countries like Canada have comparative advantages in aquaculture land, a world market for this land is rapidly evolving, regardless of the legal frameworks used. This appears to be inciting a parallel market for aquaculture sites.

## **AQUACULTURE LAND RENT DISTRIBUTION**

As in land economic analysis, sites are not the same from one place to another. These qualitative differences and their effects on land rent are easily understood by appealing to old notions of

Ricardian rent and scarcity of the resource. Consequently, in a mature industry, one would expect situations of congestion of production capacity with the attendant technological externalities. For example, in New Brunswick Canada, 95% of the production is localized in space of 30x60 Km<sup>2</sup>, which is 30 miles from Maine (Chang, B.D. 2001)). This situation is beginning to lead aquaculture investors to look for maritime spaces offshore. Based upon these observations, it is reasonable to view aquaculture development as a classical land economics problem, in the tradition of Von Thunen and Ricardo. However, other processes that diverge from the competitive process may be at play. Lands are being transferred gradually from the public to the private domain; an inherently non-competitive process which may engender the equally “classical” outcomes of rent-seeking and rule-making aimed at entry deterrence using administrative “hoop-jumping” as tools by economic actors to reap Marxian or scarcity rents. Resource rents are mixed in with other sources of revenue from an aquaculture operation, net of all relevant costs including payments to capital and labour and negative externalities, or the opportunity costs of displacing or diminishing other human activities and uses that generate rents. Resource rent is often thought by economists to be the most important factor that attracts claimants to capture it, because it is something that does not directly arise from their own efforts (Eggertsson, 1990; N.S, Cheung, 1970; Anderson And Hill, 1995; Davis and Gartside, 2001). However, the capture of this rent depends upon the rules of attribution (N.S. Cheung; Demsetz.)

If we compare, for example, the willingness to pay for subleasing sites in the Bay of Fundy and around Grand Manan Island in NB by salmon aquafarmers (C\$75,00-100,000 in 1995 and between 1996 and 1998, Marshall, J.2001), and the lease fee charged by the provincial government for the same sites (250\$ per hectare, fishery Act), the difference is very surprising. The pricing is a C\$ 5-7 per salmon fish cultured in the site. A special case is the administratively set rental fee (C\$0.50/hectar/year) for shellfish activities in the Madeleine Islands in Quebec. In Maine, the rent paid under each lease is determined after consulting with the Director of the Bureau of Public Lands. The rent is supposed to represent a fair value based upon the use of and any structures in the leased area, but in no instance may the rental fee be set at less than US \$50 an acre. The commissioner has the discretion to increase the rental fees for categories of leases. These changes may take effect over the term of a lease. The commissioner also may discount a portion of the rental fee during the first 2 years of operation of a new lease. This discounted rate is not less than \$50 an acre.

The farmed salmon industry is consolidating into large vertically integrated multinational companies with operations in many countries, increasing market power and economies of scales in production processing, distribution and marketing. Major production of farmed salmon is concentrated in a few companies, most of them Norwegian. Incentives to increase production are may be provided by the weakness of the policies regulating the activities and the market demand at the same time. Some provincial governments like New Brunswick have mechanisms for transferring public aquaculture lands to Canadian citizens, who then are permitted to engage in informal transfers to other economic agents who have the know-how and can extract higher benefits from it (which begs the question of whether it is land rent or entrepreneurial rent). Maine, on the other hand, limits access to sites by citizenship (U.S. citizen and Maine resident) and the limited number of acreage (250 acres per person). Ideally, the prices charged for aquaculture sites should be equal to the capitalized values of its composite attributes, and should therefore vary from one location to another according to these attributes. Values of using marine

spaces for aquaculture might also be looked at in light of the opportunities forgone by that use (fishing, recreation, mineral extraction, navigation, etc.) For public goods, often these types of costs are juxtaposed with use values for aquaculture through different types of public hearing processes. However, institutions that do not allow a comparison of values in this way may result in an inefficient distribution of the public good. An efficient policy may be defined as one which maximizes the net benefits accruing to society from a given course of action. Governments as the owners of the resources have to achieve this goal through an efficient system of allocation of the public resources. Of course, there may be other objectives than this, as for example, employment and regional economic development. But the industry history showed that between 1985 and 2000 in Norway the industry increased its production and the number of jobs declined by 20%<sup>g</sup>.

Therefore, it may be that in the case of Canada, one of the reasons for such low administrative prices might be that public managers do not directly face those who would express the greatest marginal willingness to pay, *and* may not fully take account of opportunity costs associated with the land used in aquaculture through appropriate economic analyses and public hearings. However, such institutions then favor transfers to some Canadians who then negotiate private agreements with those whose values for the sites are much greater. Such a distribution from the transfer of essentially public goods should probably be explored more carefully from a welfare economics standpoint.

## RESOURCE ALLOCATION METHOD

We studied aquaculture allocation procedures in the provinces of eastern Canada and compared the State of the Maine in United States and some other reference countries<sup>h</sup>. The methods of attribution differ from one country to another, but generally, it is the principle of first come first served which is applicable in all the regions. Differences are the approaches and the governance structures established for this purpose. These methods inform us on two important points: First, the nature and the tenure of established legal rights which include: a) statements about the exclusive property rights over cultivated species, with possibility to re-capture escaped stock; b) statements about the right of customary usage of a public good for purposes of fish farming under certain conditions, including the rights of installation of the necessary infrastructures for that purpose, as well as rights of access to sites for boats or vessels as well as the others equip for the sowing and the harvest of fishes. Secondly, the means of distribution of these rights, which hide behind them the structure of governance established by public managers who administer resource, and describe the firmly rooted in western legal culture and social practice-rule of first appropriation (“first come, first served” (FCFS); “finders, keepers.”) This method was criticized as inefficient by some economists (Allen, Douglas, W, 1991; Libecap, G, 1989, Luek, 1987).

The agencies which administer the maritime sites are organized by legal executives, mechanisms which offers a number of rights for the aquafarmers in public waters which guarantee them specifically the right: 1) to use a particular space for the fish farming; 2) to exclude the others of this space; 3) to introduce particular sorts for the breeding in this space; 4) to set up structures or to use equipment for purposes of breeding; 5) to discharge waste (food, feces, excrements, and antibiotics) in public waters; 6) to introduce chemicals into the public waters; 7) to protect private property placed in the site; 8) to raise(bring up), and 9) to harvest, to transport and market

the product. Some of these rights are conveyed in the form of the lease, while others are in the license or permit. The study identifies differences in some characteristics of the rights described above, especially in terms of tenure, geographic limits, transferability, and public consultations.

### *The licenses (permits)*

These rights are granted under some conditions with respect of the environmental issues sited above, and financial capability (Maine, Ireland and Newfoundland (NF) and Laborador (L).) In all the countries in this study, the permits (licenses) are not transferable, at least in principle. The tenure is 1 year and nonrenewable in Quebec, after which a new permit is granted. NF&L license is also for one year and the number of the renewal depends on the tenure of the lease, and the license shall expire on the last day of the calendar year in which it is issued. NS authorize permits for a period of ten years with a right of renewal by the licensee, at the Minister's option, for further terms of five years each. Two permits are granted in NB. One is for the occupation of the sites for three years, and one is for aquaculture activities for no more then 20 years. In Maine, the initial issuance of each special license specifies the number of times the license may be renewed after the initial issuance. Each license may be renewed at least 4 times (up to 19 renewals.) The infrastructure used cannot exceed 400 square feet.

### *The lease*

The lease is the contract most related to sites in most of the countries, and it is transferable. The lease gives the exclusive right to use the leased sub-aquatic lands and water column to the lessee. The state of Maine grants different type of lease with the right of renewal. The issuance and the transfer are an adjudicatory proceeding subject to the notice and hearing requirements. An experimental lease is 3 years or less, and for 2 acres or less. A limited-purpose lease may not be issued for a period greater than 10 years, and cannot be issued for an area in excess of 2 acres. The lease does not result in a person being a tenant in leases covering an aggregate of more than 250 acres; and no single lease may exceed 100 acres in size. However, the riparian owners' written agreement is required for the issuance of the lease. Quebec and NS grant a lease for a period of 10 years with the rights of renewal. However, in Quebec, while the Department of Food, Fisheries and Agriculture (MAPAQ) is the agency regulating and managing aquaculture activities, the lease is issued by the Department of Environment, Quebec. The public is advised by notice, but its opinion might not be considered by the minister. The NB grants lease for a period of 20 years, privileging people who are already operating in salmon culture<sup>i</sup>, until 2001, but without any public hearing process.

The duration and transferability are the most important features of efficient allocation of property rights. They make rights consistent and help eliminate uncertainties about long-term development and reduce risk costs by riding out short term market fluctuations. Transferability and long tenure provide incentives for long-term profit maximizing and lease improvement (Keithly *et al.* 1992). The transfer of the rights must be examined by the relevant administrative authority to avoid any waste of the resource and external effects.

These rights are granted on a discretionary ‘first come, first served’ (FCFS) basis. This system may work if the resources are in abundant supply relative to the demand for the access. Though property rights to aquaculture lease sites are evolving in most countries, the history of resource allocation in other sectors shows that the first-comers tend to form rules that reinforce their position, as long as they are able to extract a benefit over the costs of deterrence. One of the evidence of this situation is the privilege offered to salmon farmers operating in the sector to access to new sites in the Bay of Fundy.

Despite the regulatory frameworks we see in different legal regimes across countries, an impressive parallel market for access to aquaculture sites has evolved rapidly, which seems to take account of the various values of aquaculture sites to aquaculturists. However, since little of this is codified because in many cases it is not technically allowed, the trading values for these sites remain largely anecdotal (see, for example Marshal, 2001). In part, the reason for this may be due to public policy-makers who do not care to know about the true willingness to pay for sites by aquaculturists, and who do not want to hear about the opportunity costs of aquaculture either. This seems to be particularly the case for provinces like New Brunswick, and to some extent the Federal government of Canada as well. However, institutions that drive this sort of administrative wedge in the site attribution process can end up creating an informal market for aquaculture sites which may not entirely reflect other costs.

## CONCLUSION

Although the aquaculture industry has existed for a long time in the countries we have studied (more than 20 years), there seems to be little impetus to reconsider the method of submerged attribution by some governmental agencies, in order to maximize the collection of aquaculture rents. There may be four reasons for this. First, although aquaculture sites are composed of environmental attributes that generate rent for different users, it may not be clear what the customary use values are, in part because the market for the implicit factors of aquaculture land, at least in Canada, is not as developed as it is for agricultural land. This is due to the non-existence of markets and customs regulating this “new public good.” Secondly, however, there seems also to be a lack of market information on the actual trading value of the sites, in part due to the ambivalent institutional nature of submerged land. Finally, these resources have been perceived by public managers as so abundant with opportunity costs that are so low, that the transactions costs associated with defining their value did not justify the effort.

It may become increasingly difficult to justify the latter argument, with the passage of time. There is ample anecdotal evidence to suggest that promoters of aquaculture are not being irrational. Aquaculture site resources are not so abundant, and what is happening in NB and other regions exemplify this.

It may well be that aquaculture development is following a similar pattern as the fishery. This would be for public managers to initially promote wide use under weak institutional contexts to promote broad social objectives like regional development or employment. Social rules

development will tend to favor first comers, but this may not provide sufficient brakes to slow development to a pace that allows for a scrutiny of social costs and benefits, and the formation of liability rules that govern external effects. Because of this, overshooting environmental capacity and subsequent costs are likely to occur. In Canada, there have been examples of where taxpayers have borne these costs. These sorts of results seem to occur because first comers along with public management might fix the institutional rules of acquisition and exchange as loosely as possible, so little is known about the true worth of the sites. The only problem is that those who are the most likely to pay top dollar for aquaculture sites are foreign investors, and market information may be scarce enough to lead to efficiency problems implicit in “thin markets.” Canadian license and lease-holders may not, themselves, be ceding their use rights with sufficient information on real estate values. Further, opportunity costs associated with site development may not be adequately identified. Finally, if there is a public interest in capturing resource rents instead of letting them flow into the economy (or be captured outside the economy), then most legal frameworks we have looked at, with the possible exception of Maine’s, preclude this possibility.

Public managers involved in aquaculture need to ask themselves whether there are enough safeguards in place to determine the economically and socially optimal distribution of aquaculture sites. Given the pace of aquaculture land development and the ambiguous nature of submerged real estate in some countries and in some provinces, this is not an idle question.

We think that at minimum, to have a more informed debate on aquaculture site attribution, legal frameworks should provide for the following:

1. A full public consultation of riparian homeowners and the general public before attribution, with full disclosure of documents supporting an aquaculture site application to that public;
2. The use of institutions similar to those that are used in agricultural land, including assessments that are based upon actual physical qualities of the lands in question for aquaculture. This would involve, among other things, a public record of site attributes by geographic area, and economic analyses and evaluations that are attribute-based.
3. A review of lease and permitting arrangements with a view towards legitimizing sub-leasing arrangements, and making them a matter of public record.
4. A review of citizenship and residency laws with a possible view of allowing foreign nationals to competitively bid on lands that are in the public domain, and which have not yet been leased to nationals.

These recommendations are in part aimed at legitimizing and making things that occur anyway a matter of public record. The reasons for doing so are mainly to support the public debate part of the attribution process. No one likes to buy “sight unseen.” But aquaculture sites are becoming rare, and debates over them contentious. With the relatively informal institutional rules that have evolved, information asymmetries may be playing a relatively important role in both the values we do not see, and the externalities we are beginning to experience.

**REFERENCES**

- Allen, Douglas W. (1991), ‘Homesteading and Property Rights; or “How the West Was Really Won”’, 34 *Journal of Law and Economics*, 1-23.
- Anderson, Terry L. and Hill, Peter J. 1983, Privatizing the Commons: An Improvement? *50 Southern Economic Journal*, 438-450.
- Anderson, Terry L. and Hill, Peter J. 1990, The Race for Property Rights, 33 *Journal of Law and Economics*, 177-197.
- Arrow, K. Gretchen Daily. Partha Dasgupta. Simon Levin. Karl-Göran Mäler. Eric Maskin. David Starretti. Thomas Sterner and Thomas Tietenberg. 1999, Managing Ecosystem resources. In <http://www.beijer.kva.se/publications/pdf-archive/disc122artikel.pdf>.
- Chang, B.D. 2001, The salmon Aquaculture Industry in New Brunswick: Why go Offshore? In *The conference of Open Ocean Aquaculture, St Andrew, New Brunswick, Canada*.
- Cheung, S.N.S., 1970, The structure of a contract and the theory of non exclusive resource, *Journal of Law and Economics*. 1-44.
- Costanza, R., 1999, The ecological economics and social importance of the ocean, *Ecological Economics* 31, 199-213.
- Cullinan, C. and A. Van Houtte. 2000. Development of regulatory frameworks. In FAO Fisheries Department Review of regulatory frameworks for aquaculture. <http://www.fao.org/fi/publ/circular/c886.1/legal.asp>.
- Derrin Davis , Donald F. Gartside. 2001, Challenges for economic policy in sustainable management of marine natural resources, *Ecological Economics* 36(2001), 223-236.
- Eggertsson, T. 1990, *Economic behavior and institutions*. Cambridge University Press.
- FAO, 2003, Fisheries Circular No. 886, Rev. 2. Review of the State of World Aquaculture.
- FAO, 1995, A Code of Conduct of Responsible Fishery.
- Libecap, Gary D. (1989), Distributional Issues in Contracting for Property Rights, 145 *Journal of Institutional and Theoretical Economics*, 6-24.
- Lueck, Dean (1995), The Rule of First Possession and the Design of the Law, 38 *Journal of Law and Economics*, 393
- Kite-Powell, H.L., P. Hoagland, D. Jin and K. Murray. August, 2001, Aquaculture Regulation: Economic and Legal Models for the US Exclusive Economic Zone, Marine Policy Center <http://www.who.edu/science/MPC/dept/research/SKAquaRegFinalRpt.pdf>.
- McMahon, T, Regulation and monitoring of marine aquaculture in Ireland, *Journal of Applied Ichthyology* 16(2000) 177-181.
- Marshall, Joan. 2001, Landlords, leaseholders & sweat equity: changing property regimes in aquaculture, *Marine Policy*. 25 (2001) 335-352.
- Office of the Commissioner for Aquaculture Development, Marsh, 2001, Legislative and regulatory review of Aquaculture in Canada, <http://ocad-bcda.gc.ca/elegalreview.pdf>
- Pickering, H., 1998. Legal Issues associated with free fish farming at sea, *CEMARE RES.PAP.NO.132, 25P*.
- Vourch, Ann.2001. “Encouraging Environmentally Sustainable Growth in Canada,” OCDE, Economics Department, *Working Papers*N°.209, March, 56p.

**Legal and policy References:**

**New Brunswick:**

<http://www.gnb.ca/0177/f-fundy.htm#intro> CHAPITRE A-9.2 *Loi sur l'aquaculture.*

Politique d'attribution des sites aquacoles marins dans la Baie de Fundy,  
<http://www.gnb.ca/0177/f-fundy.htm#species>;

<http://www.gnb.ca/0177/f-fundy.htm#intro>.

**Nova Scotia:**

Fisheries and Coastal resources Act Chapter 25 of the act of 1996 Amended 1999,c.2& Aquaculture Licence and Lease regulations (Made under section 64 of the Fisheries and Coastal Resources Act) S.N.S. 1996,c. 25 O.I.C. 2000-31 (February 2, 2000), N.S. Reg. 15/2000 as amended by O.I.C. 2000-352 (June 29, 2000), N.S.Reg.125/2000

<http://www.gov.ns.ca/just/regulations/regs/fcrlicen.htm>

<http://www.gov.ns.ca/legislature/legc/statutes/fishand.htm>

[www.gov.ns.ca/nsaf/aquaculture/nsadc/index.htm](http://www.gov.ns.ca/nsaf/aquaculture/nsadc/index.htm)

[www.gov.ns.ca/nsaf/aquaculture/nsadc/index.htm](http://www.gov.ns.ca/nsaf/aquaculture/nsadc/index.htm)

[http://www.gov.ns.ca/nsaf/aquaculture/application/aqua\\_fees.htm](http://www.gov.ns.ca/nsaf/aquaculture/application/aqua_fees.htm)

**Quebec:**

Politique québécoise des pêches et de l'aquaculture. MAPAQ. N°de pub : 00-0099.

**New Foundland & Labrador:**

RSN1990 CHAPTER A- 13 AQUACULTURE ACT Amended:

1991 c36 s74; 1994 c39; 1997 c 13 s2; 1998 c24; 2001 c6

Aquaculture Licensing Policy and Procedures Manual- Department of Fisheries and Aquaculture. Revised-October, 2000. (Printed October 4, 2000)

<http://www.gov.nf.ca/Fishaq/aqua/licencing.stm#Cost>

**The State of Maine U.S.A**

<http://www.maine.gov/dmr/aquaculture/finfish%20application.pdf>

**Ireland :**

Aquaculture policy. <http://www.dcmnr.gov.ie/display.asp?pg=117>

Foreshore Act, 1933 to 1998.

Report by the Minister for the Marine and Natural Resources for the Year Ended 31 December 2001, <http://www.gov.ie/oireachtas/frame>

**ENDNOTES**

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<sup>a</sup> Graduate Student, Marine Resource Management Program, Université du Québec à Rimouski. Comments should be directed to the first author at [boudribila77youssef@yahoo.ca](mailto:boudribila77youssef@yahoo.ca). This paper is based on my master thesis and a part of project funded by Aquanet. It is also based on work done for Quebec Ministry of agriculture, fisheries and food.

<sup>b</sup> Professor, Marine Resource Management, Université de Québec à Rimouski.

<sup>c</sup> The Auditor General's December 2000 report noted that it was acknowledged that there was evidence of damage to the sea bed below and adjacent to salmon farms. The individual in question, a former Member of Parliament (Lynn Hunter of the David Suzuki Foundation), explained to the Committee that neither the provincial government nor the

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DFO had acted upon a 1996-1997 provincial report (obtained through the *Access to Information Act*); the report found that wastes were accumulating and spreading beyond the farm. See for example the interim report on the website of the parliament of Canada about fisheries & aquaculture: <http://www.parl.gc.ca/37/1/parlbus/commbus/senate/com-e/fish-e/rep-e/repintjun01part2-e.htm#NOTES>

<sup>d</sup> As an example, conversations with agents from the Assessment and Real Property branches in New Brunswick (Edgar Quinton and Bill Morrison, personal communication) reveal that until recently, the valuation for aquaculture land for salmon is based upon the administrative lease price of 250\$/hectare, divided by a discount rate of 10%. Although aquaculture land is considered to be real estate in New Brunswick, transactions are generally not a matter of public record, as they are for upland transactions. Nevertheless, the market for salmon aquaculture land in New Brunswick reflects the carrying capacity of the water column and the substrate, which appears to be between 5\$ and 7\$ a fish.

<sup>e</sup> The near-shore is an indefinite term according to the OCAD. The federal and provincial governments do not agree on the jurisdictional authority, that is where the provincial ends and the federal starts, with respect to the seabed beyond the tidal mark. OCAD- March 2001.

<sup>f</sup> Interview with François-Mougnan Montmagny of the Ministry of Agriculture, Fish and Food (MAPAQ).

<sup>g</sup> Anonymous. 2001. Key figures from Norwegian Aquaculture Industry, 2000. Directorate of Fisheries, Department of Aquaculture. Bergen, Norway. 15 pages.

<sup>h</sup> We specifically looked at legal frameworks and practice in Ireland, Norway, New Zealand, Australia, Scotland, U.K. various states in the United States, and British Columbia, Canada.

<sup>i</sup> Politique d'attribution des sites aquacoles marins dans la Baie de Fundy : <http://www.gnb.ca/0177/f-fundy.htm#species>