

**EVALUATING COMMUNITY FISH QUOTA MANAGEMENT IN ATLANTIC CANADA:
Lessons from the Start-Up Years**

Lucia M. Fanning

Dalhousie University, Marine Affairs Program
lfanning@dal.ca

Abstract In Atlantic Canada, as elsewhere, coastal communities and governments have been experimenting with the co-management model to achieve the sustainable use of coastal and marine resources. One example, introduced as a three-year trial in 1997, was community quota management by the inshore, fixed gear ground fish sector in the Scotia Fundy region. Using structured and unstructured interviewing techniques, this paper examines the rationale behind the pursuit of community quota management and the organizational, legal and regulatory, socio-economic, and science-based issues that confronted the newly-formed community management institutions. By focusing on the early stages of community quota management, the analysis assesses the importance of these start-up issues and provides lessons to others contemplating community-based methods for fisheries management within the Canadian context and elsewhere.

Introduction

The literature abounds with examples of management practices that have failed to provide for the sustainable use of coastal and marine resources (Pinkerton 1989; McGoodwin 1990; Cashin 1993; Christensen *et al.* 2003). Among the more dramatic of these examples within the Canadian context, are the collapse of the northern cod fishery off the coast of Newfoundland (Finlayson 1994) and the subsequent closure of the cod fishery there and elsewhere, including NAFO-designated fishing management zones 4Vs, 4Vn and 4W in the Scotia Fundy region in September 1993.

With declining fish stocks in Atlantic Canada, coastal communities and governments sought mechanisms to jointly address this urgent environmental and socio-economic situation. A possible strategy cited by both resource users and regulators was to consider assigning greater responsibility to users for the management of renewable resources. The

emerging popularity of co-management, a shared regime for the sustainable use of coastal and marine resources (Jentoft 1989; Pinkerton 1989; Pomeroy 1994), owed much to the failure of the centrally-imposed bio-economic models which were developed in the 1950s and which sought to optimise the management of renewable resources (Clark 1976). Pursuing this approach, resource managers in both industrialised and developing countries failed to either foresee, or overcome, the now-familiar and seemingly intractable problems in coastal and marine resource use world-wide (Pauly *et al.* 2002). It is only in the past decade, with the collapse of major industrialised fisheries and over-exploitation by non-industrialised, small-scale coastal resource users, that attention has shifted to the actual inclusion of users in the joint management of renewable, common pool resources in Canada. Other key factors supporting the adoption of co-management included the growing costs and difficulty associated with implementing and enforcing centrally-imposed rules.

Using both structured and unstructured interviewing techniques with representatives involved in community quota management for the in-shore groundfish fishery in the Scotia Fundy region of Atlantic Canada, this paper focuses on understanding the factors affecting co-management efforts during the start-up years. Although it is of considerable academic and practical interest to follow the evolution of co-management institutions throughout their life cycle, the emphasis of this paper on the start-up phase is two-fold. First, a thorough understanding of the challenges faced during this critical period can provide valuable lessons that enhance the ongoing survivability of these institutions and in turn, the success of co-management efforts within the Canadian context and elsewhere. Second, although numerous scholars have reported on collective governance mechanisms in jurisdictions around the world (Ruddle and Johannes 1985; Pinkerton 1989; Jentoft 1989; Ostrom 1990; Pomeroy *et al.* 2004), the literature is surprisingly deficient in its assessment of this crucial period in the life history of co-management institutions. Addressing this gap is significant given the increasing call to shift from the traditional hierarchical form of governance to a more distributed or inclusive form, purported to better guide the setting of decision rules for managing coastal and marine resources (Fanning 2000; Mahon *et al.* 2005).

Theoretical Underpinning for a New Approach to Fisheries Management

The rationale for the traditional hierarchical approach to managing fish stocks and that approach's subsequent failure on a global scale has been well-described for some time (Jentoft 1989).

Drawing on arguments from Aristotle to Hobbes to Hardin, governments have justified their control of common-pool resources in the interests of efficiency and equity, and because of their administrative capacity.¹ The claims that open access led to declining resources and the loss of resource rents meant the state had a responsibility to control harvesting capacity. Equity required a fair distribution of opportunities and incomes among participant groups. Finally, only the state had the authority and resources to implement and enforce the resulting rules. However, in the latter half of the twentieth century, governments faced the challenge of trying to balance the seemingly incompatible goals of keeping the industry viable and profitable while securing equitable income distribution. Indirect regulation, such as controlling harvesting effort, generally failed to address overcapitalization or resource depletion as resource users responded by adopting more efficient forms of technology. More direct intervention, such as fixing a level for the total allowable catch (TAC), met with some success but proved difficult for governments to enforce.

Governments found that effectively managing a fishery was not easily achieved. The imposition of restrictions oftentimes led some resource users to bypass them. It was hypothesized that increasing the legitimacy of the rules amongst the resource users would lead to greater compliance. Four theoretical propositions address the question of how to improve legitimacy, defined as the degree of acceptance that the political regime enjoys among the community (Jentoft 1989). These include two substantive propositions (1 and 2) and two procedural propositions (3 and 4) as follows:

1. Content of the rules—the more resource users believe that the rules address the problems they themselves perceive, the more legitimate the rules will be regarded;
2. Distributional effects—the more equitably restrictions are imposed, the more legitimate the rules will be regarded;
3. Rule-making—the more involvement of users in the rule-making process, the more legitimate the resulting rules will be regarded; and
4. Implementation—the more directly involved the users are in installing and enforcing the rules, the more these will be accepted as legitimate.

A key assumption of these propositions is that governments are willing to share management responsibility with the resource users. By co-managing the resource, governments would expect an improvement in the quality of the rules, greater adherence to the rules and an increase in its own legitimacy. Thus co-management is viewed as the meeting point between government's concerns for efficient resource utilization and protection and the resource users' concerns for equal opportunities, self-determination, and self-control.

Rationale for a Co-Management Approach in the Scotia Fundy Region

While the decline in Atlantic groundfish stocks gained global attention in the early 1990s with the imposition of fishing moratoria, evidence of the growing significance of the problems was reported in a number of earlier studies (Government of Canada 1976; Kirby 1982). As highlighted in the 1976 report, the acute economic crisis of the Atlantic fishery in the 1970s resulted from a variety of related factors. These pertained to a decreased demand for Canadian fish by foreign markets, decreased prices being paid to harvesters and processors, poor quality of product and increased production costs. The causes for these outcomes were subsequently identified to be: the common property and open access nature of the resource; poor management; the economics associated with a seasonal inshore fleet as compared to a year-round offshore fleet; the relatively high share of catch allocated to the inshore fleet over a short fishing season; poor marketing approaches; the trade-off between employment and level of income provided to fishers; and the extensive financial support provided to the industry in the form of subsidies and income support (Kirby 1982; Angel *et al.* 1993; Burke *et al.* 1996).

Cashin (1993) attributed the problems in the Atlantic fishery to an over-abundance of people and capacity within the fishery and a social, historical tradition in Atlantic Canada of a right to fish. He also identified a lack of economic alternatives and the use of the fishery as the employer of last resort. It was argued that pressures on the resource were exacerbated by factors including the application of new fishing technologies and mismanagement of the resource. Management failed to control entry or enforce limits and lacked meaningful partnerships between government and the users of the resource. Over-capacity in both harvesting and processing followed, further increasing pressures on the resource and resulting in '...too many fishers with too many boats with too much gear trying to supply too many plants by finding and catching too few fish.' (Cashin 1993,14).

With the lack of any clear evidence of a recovery in the groundfish stocks in the mid-nineties, government efforts focused on improving groundfish management for conservation objectives. This led to an increasing number of federal policies aimed at rationalisation and conservation of the resource (Burke *et al.* 1996). Despite being among the most highly regulated industries in Canada, the imbalance between fishing capacity and resource shares in the Atlantic fishery, particularly in the inshore fleet, reached crisis proportion (Halliday *et al.* 1992). The vicious circle of over-capacity leading to greater pressures on the resource, and the conflicting objectives of economic efficiency and maximising em-

ployment, contributed to the eventual collapse of the groundfish in parts of Atlantic Canada by 1993 (Sinclair *et al.* 1998).

Given the decades of failure of government-mandated solutions to the problems of the inshore, groundfish fishery, coastal fishing communities recognised the need for solutions of their own design, and to work with the federal Department of Fisheries and Oceans (DFO) in adopting potential community-devised solutions. The solution to implement community quota management was initiated by the coastal fishing community of Sambro in eastern Nova Scotia. As envisioned, community quota management offered the inshore fixed gear community (consisting of handline, gillnet and long-line fishers using vessels less than 45 feet long) an opportunity to maintain a way of life that seemed certain to disappear under the then *status quo* centrally-imposed management regime (Loucks 1998).

The Community Quota Management Approach

The concept of community quota management in the Scotia Fundy region was initially raised in 1995 by the fishers in Sambro as an alternative to trip-limits imposed by DFO. This was proposed as a result of the excessive distances fishers from this community had to travel in order to fish in 4X5Y, after the closure of the nearby 4VsW groundfish fishery. The concept gained support among industry representatives in 1996 when a trial fishery using quota-groups was prosecuted under conservation harvesting plans developed and managed by gear-type specific fishing associations, instead of DFO. Since conservation harvesting plans established the rules regarding how the quota allocated by the government was to be harvested each fishing season, the development of the plans by the resource users, subject to compliance with existing fisheries legislation, was a significant step in the adoption of a co-management approach for the fishery. The trial fishery of 1996 was followed by a unanimous industry recommendation to expand the management structure from specific gear-type associations to regionally-determined communities, where all groundfish fixed gear associations for each community could be represented on a single community management board to develop the community's conservation harvesting plan.²

Additional support for community quota management by the resource users was enhanced after DFO introduced three new conservation requirements affecting the management of the inshore groundfish fishery (Anand and Hansen 1997). The first of these was the abolition of a 3,300-pound daily by-catch trip limit that was triggered once the total allowable catch was reached. The other factors centred around the re-

quirement for agreement to the DFO-developed conservation harvesting plans before any fishing occurred and the elimination of the previously-allowed DFO regulated trip limits. Dissatisfaction with these unilaterally-imposed requirements increased the demand by fishers for more involvement in the micro-level management of the fishery. Fishers wanted assurance that the harvesting plans being developed would provide the flexibility to respond to the seasonality and fishing patterns that most benefited the various communities along the Scotia Fundy shore. It became evident that ensuring such flexibility required hand-on involvement of fishers in the development of the harvesting plans and community quota management was thus viewed a preferred alternative to the DFO-imposed approach to managing the inshore groundfish fishery.

With decreasing fish stocks forcing DFO to implement more stringent conservation rules that were proving to be ineffective in addressing the goals of both government and fishers, the community quota system of management within the 4X5Y NAFO-designated management areas was formally introduced in 1997 for a three-year trial period by DFO. Although, the trial was initially set for three years, at the conclusion of the second year under community-based management (1998), the industry requested and DFO agreed to terminate the trial period and to formally recognize community based management for another 5 years, beginning in 1999. Currently, the approach remains an approved mechanism for managing the inshore ground fish fixed gear quota.

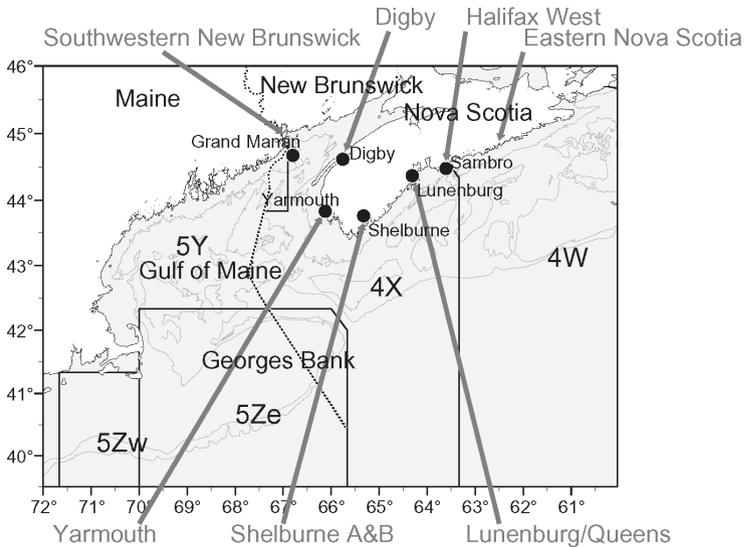


Figure 1. Community Management Boards in the 4X5Y NAFO-Designated Fishing Zones in the Scotia-Fundy Region

This approach to community-based management shifted the micro-level management of the inshore groundfish fishery from the federal regulator to the harvesters of the resource in 4X5Y, affecting some 3,221 fixed gear, inshore licences (Government of Canada 1997). At the beginning of the trial period, seven geographically-defined communities were identified within the 4X5Y management zones (Figure 1). The total quota for the inshore, fixed gear sector was divided among these communities, based on the 1986-1993 reported catch history (Table 1). In order to calculate the quota shares of the major groundfish stocks for each community, the industry agreed to a catch history formula based on the identification of the ground fish registered owner-operator (GRO), as distinct from a vessel or individual fisher registration. This reinforced the sector's com-

Table 1. 1996-'99 Ground fish Community Quota Shares for 4X5Y Fishers based on 1986-'93 Catch History³

Stock	12 months quota	ENS	HFXW	L-Q	SHEL (total)	YAR	DIBGY	SWNB	Total
Cod	%	6.92%	4.33%	10.61%	58.70%	5.41%	7.48%	6.54%	100%
	1996 MT	422	264	647	3579	330	456	399	6097
	1997 MT	496	310	761	4209	388	536	469	7170
	1998 MT	355	222	544	3011	277	384	335	5128
	1999 MT	267	167	410	2266	209	289	253	3861
Haddock	%	10.97%	1.33%	3.83%	76.17%	2.74%	4.64%	0.31%	100%
	1996 MT	237	29	83	1642	59	100	7	2157
	1997 MT	215	26	75	1493	54	91	6	1961
	1998 MT	260	31	91	1806	65	110	7	2371
	1999 MT	260	31	91	1805	65	110	7	2370
Pollock	%	2.47%	10.05%	30.57%	30.65%	5.82%	10.60%	9.88%	100%
	1996 MT	58	236	718	720	136	249	232	2349
	1997 MT	87	352	1072	1075	202	372	346	3505
	1998 MT	115	470	1429	1433	272	495	462	4676
	1999 MT	69	282	857	860	163	297	277	2805
Hake	%	4.05%	4.41%	24.95%	36.45%	11.14%	13.41%	5.59%	100%
	1998 MT	89	97	549	802	245	295	123	2200
	1999 MT	by catch only							
Total	1996 MT	717	529	1448	5941	525	805	638	10603
	1997 MT	798	689	1908	6776	644	999	822	12636
	1998 MT	819	820	2613	7052	859	1284	927	14375
	1999 MT	596	480	1358	4931	437	696	537	9036

Source: Table constructed with data provided by DFO and Fisheries Research Conservation Council. ENS = Eastern Nova Scotia; HFXW = Halifax West; L-Q = Lunenburg-Queens; SHEL = Shelburne A&B; YAR = Yarmouth; DIBGY = Digby and the Islands; SWNB = South Western New Brunswick

mitment to the owner-operator as the principal stakeholder in the inshore fishery and the only legitimate entity to which catch history should be attributed. Furthermore, the homeport of a licence holder as of December 31, 1996 was the criterion used to determine which community would be credited with the resulting catch history. In cases where landings could not be identified to a specific GRO or where fish was sold or purchased in a community without any identification to fisher or vessel, the landings were credited to the community where the purchase slip originated (Government of Canada 1997). The total landings, identified and unidentified, for each community were then used to calculate the share, as a percentage, each community would receive of the annual quota allocated to this inshore sector.

It is important to note that not all licensed fixed gear fishers in 4X5Y harvested groundfish under a community quota system. At the beginning of each fishing year, fishers had the option to remain in a system developed by DFO, designated as Group X. All other fishers were required to identify their membership in one of the eight DFO-recognised community management boards prior to the onset of the fishing season.

Community Management Boards

Each community established a single management board with the exception of the community of Shelburne, where two boards (Shelburne A and Shelburne B) were eventually established in 1998. This situation arose as the vast majority of the inshore groundfish quota was allocated to the community of Shelburne, which also had the greatest number of fishers. Because of the numbers involved, the degree of heterogeneity among fishers in Shelburne was significantly greater than in other geographic communities. This led to an inability to reach consensus on a fishing plan and, given the differing philosophical approaches to management within this one community, DFO and the Shelburne fishers agreed to have two management boards serve the area for the 1998 fishing season. As such, at the onset of the second year of the trial period in 1998, eight community management boards, with membership drawn from the different fishing associations in the community, oversaw the harvesting of the community quota by their members. Each community management board was given the task of developing an annual conservation harvesting plan and of determining how each community quota would be shared among its members. Management board membership ranged from one fishing association to a total of five (Table 2), illustrating the diversity amongst the management boards in numbers of associations, active licences, quota shares, and the methods of sub-allocation they adopted. All community boards used gear type as a means of sub-allocating quota to groups within the board but the method for allocating quota to individual

Table 2. *Community-Based Quota Management Boards for the Fixed Gear, (<45 feet) inshore Sector: Structure, Membership and Total Quota Allocated*

Name of community board	Number of associations	Number of licenced / active fishers ^A 1997 1998	Total ground fish quota ^C in tonnes 1997 (%-share) 1998 (%-share)	Sub-allocation method to association members	Sub-allocation method to individual members
Eastern Nova Scotia 4X Community Management Board (ENS)	5	75/52 59/47	798 (6%) 819 (6%)	By gear type, equal basis, based on number of boats	Needs of members and equal share basis, depending on group
Prospect Area Full Time Fishermen's Association Management Board (HfxW)	1	83/40 72/41	689 (5%) 820 (6%)	By gear type, equal basis, based on number of boats	Equal share basis
Lunenburg-Queens Community Management Board	2	273/155 214/133	1908 (15%) 2613 (18%)	By gear type and need per group	Sharing formula based on species
Shelburne County Ground fish Management Board (ShelB)	5	Not available 382/293	Not available 6136 (51%)	By gear type, catch history and equal share basis	Catch history and equal share basis, breakdown depending on gear type
Shelburne County Management Board (ShelA)	3	Not available 152/129	Not available 644 (5%)	By gear type, competitive fishery	Competitive fishery
Yarmouth County Fixed Gear Management Board (Yar)	1	157/127 109/83	644 (5%) 859 (6%)	By gear type and catch history	Weekly trip limit by dollar value or pounds of fish caught, depending on gear type
Fundy Fixed Gear Council (Digby)	2	245/154 231/104	999 (8%) 1284 (9%)	By gear type	Equal share for gill-netters and weekly allowance for other gear type
SWNB Groundfish Management Board	3	226/97 81/63	822 (7%) 927 (7%)	By gear type	By percentages set by gear sector
TOTAL	22	1654/1138 ^B 1300/893	12636 ^P (100%) 14375 (100%)		

^A Data on numbers of licensed and active fishers taken from DFO-provided Table entitled 'Final FG <45 1998 fishery', provided at FGAC meeting, February 3, 1999. Note that these numbers do not include fishers in Group X who totalled 37 (licensed) and 21 (active) for 1997; 8 (licensed) and 4 active for 1998.

^B Total for 1997 includes 595 (licensed) and 513 (active) for Shelburne A and B combined, as reported by DFO.

^C Total ground fish values for 1997 relate only to cod, haddock and pollock. There was no quota allocated for hake and halibut in 1997 while the 2200 MT quota for hake is included in the data for 1998. Data on quota obtained from DFO-provided Table entitled 'Final FG <45 1998 fishery', provided at FGAC meeting, February 3, 1999.

^P This figure includes a quota of 6776 MT to Shelburne A and B fishers combined for 1997.

fishers varied considerably. A competitive fishery existed in the Shelburne A group while catch history or a form of individual quota to some members was used within the Shelburne B board. This diversity in allocating fishing access to individual fishers reflected the diverse needs of the fishers within the Scotia Fundy inshore fixed gear sector in general and in the community of Shelburne in particular. The ability to have such flexible micro-level management at the community level was seen by fishers as one of the major advantages of the community-based management structure.

Conservation Harvesting Plans

Each board was responsible for developing the annual fishing plan by which fishers within that community agreed to harvest the quota. In compliance with the Canadian federal Fisheries Act and DFO policies, particularly those relating to meeting the Department's conservation objectives (Government of Canada 1997), the plan was subject to DFO approval. Under the existing legislation and its associated regulations, no power or authority could be delegated to the community management boards, thus the legislative authority for all aspects of fisheries management remains with the Minister. In cases where the terms and conditions in a community-developed fishing plan were not specifically governed by existing DFO policies, they were not enforced by DFO. A civil agreement in the form of a binding contract between the fisher and the representing association (serving as a member of the community management board), became the instrument through which such terms could be enforced.

For Group X fishers who opted to remain under a DFO-developed harvesting plan, DFO included and enforced a number of conditions such as trip limits, 100 percent dock-side monitoring and closure for all members of Group X when the quota for any species had been met. At the onset of the community quota management trial in 1997, twenty-one active fishers were registered under Group X. In 1998, only four active fishers opted to remain within this category.

Start-Up Issues Affecting Community Board Management

Organisational Issues

Fishers who opted to become members of one of the eight community management boards were able to participate in the development of allocation rules to determine how and when their quota was caught. However, the effectiveness of community-struck management boards was affected by factors including the degree of heterogeneity, allocation rules, man-

agement capability, and the varying roles played by government, other industry players, and advisory bodies.

Heterogeneity — The Scotia Fundy inshore fishing sector is a heterogeneous grouping of fishers with fishing methods that include hand-lining, gill-netting, and long-lining. Each of these methods has been shown to require different shore-based services and the different technologies employed result in different rates of catch per unit effort (Willett 1992). This heterogeneity among members of a single management board posed a challenge to developing a single, yet fair, community-based conservation harvesting plan which satisfied the majority of its members. As mentioned above, the two management boards formed for the geographic area of Shelburne resulted from the inability of a large and heterogeneous group of fishers to reach consensus on management strategies for the harvesting of the resource. Shelburne had the largest number of fishers, the largest quota and also the largest number of associations (eight) representing the fishers (Table 2). Following the split, membership dropped to three associations in the Shelburne A management board and five associations in the Shelburne B board. Since the number of associations reflected the diversity among the fishers within a community, this finding suggested that constructive community-based management could be undermined by excessive heterogeneity among members. This conclusion is supported by the observation that the remaining six communities, with fewer members overall and no more than five associations, were each able to get agreement on the management of the fishery within a single management board.

Allocation Rules — A community-based process of allocation can be extremely divisive since, depending on the strategy developed for sharing the quota, some licence holders could find themselves being eliminated from the fishery early in the season. For example, as a management approach, the Shelburne A management board adopted a competitive, ‘first come, first served’ fishery strategy based on its members input on how best to harvest the allocated quota. In contrast, the remaining boards developed strategies based on a different suite of membership objectives. These objectives were identified as protecting access rights to the fishery, ensuring a longer fishing season and, maximising the economic value of the resource through flexible decision-making. The community management structure thus gave fishers an opportunity to set, and if necessary, change the rules by which their fisheries operated each fishing season. This level of control reflected the stated needs of the members, assuming decisions were made in a truly democratic manner. However, the potential for ‘local notables’ to unduly influence decision-making has been identified as a possible concern for community-based management structures (Palsson and Petursdottir 1997). In the event that a fisher be-

came dissatisfied with the majority decision or the undue influence of 'local notables', the choice of opting to fish as a Group X fisher remained viable for Scotia Fundy inshore fishers. However, the restrictions imposed by DFO on fishers who selected this alternative made it less attractive than remaining in a community board even if the fisher disagreed with specific decisions.

Capability — Successful sharing of management responsibility for common pool resources builds on the inherent strengths of the parties involved (Ostrom 1990). The start-up phase showed that communities brought many capabilities to the management of the resource. However, the communities themselves identified the need for additional training and resources to meet their new responsibilities (Kearney and MacIntosh 1998). Furthermore, there were few other viable institutions within the fishing sector to assume the management functions. This appeared to be particularly true in the Scotia Fundy region of the Maritimes, where the fishers' traditions were entrepreneurial and independent, and did not promote the development of group interests (Pross and McCorquodale 1990).

During the start-up phase, boards were interviewed on a number of issues including their readiness to enter into formal partnership arrangement with DFO for the management of the resources, if that option were made available. Of the seven boards which responded, three (Eastern Nova Scotia, Halifax West and Shelburne B) stated categorically that they had the capability and were ready to enter into partnership arrangements. Two were hesitant (Digby and Lunenburg-Queens) and the other two (Yarmouth and South-Western New Brunswick) were not prepared to enter into a partnership agreement at that time. The management board in New Brunswick felt it lacked the management capabilities while the Yarmouth Board cited dissatisfaction with current allocation levels, indicating it needed sufficient allocation to guarantee minimum earnings of 3,000 Canadian dollars (approximately 2,500 US dollars) per week over the season (April to September) to satisfy its members.

Government role — As community management boards developed their capability to manage the fishery, they needed to draw on the strengths of their co-management partner, the federal government. One example of such strength was the oversight role played by government, as it responded to recommendations made by other sectors of the fishery. Community management boards recognised that they would not have much clout influencing the activities of other sectors within the fishery, without government intervention.

During the start-up period, the community management boards indicated the important requirement for the federal government to continue to be a critical partner in the management of the fishery. Six of the seven

boards responded that government was needed to provide enforcement in the fishery, for all fishing sectors. Three boards (Digby, Lunenburg-Queens and Halifax West) cited science and quota allocation as important roles for government and one (Shelburne B) specified licensing to be an important government role. Government support for community rules was also mentioned as essential for building the authority of the boards among their members.

Other players — Although DFO had given responsibility for the management of the community quota to the community management boards, other professional fishing organisations (including processors), aboriginal groups, and recreational fishers remained influential in both government's and industry's decisions on fisheries issues. Thus, the power of these outside organisations to affect the success of community management was identified as a key area for attention by the boards, with the support of the federal government.

Advisory Bodies — The Fisheries Resource Conservation Council (FRCC), comprised of industry and academic experts, was established in 1992 to advise the federal Minister of Fisheries and Oceans on annual conservation issues for the groundfish resources of Atlantic Canada. Each year, the FRCC conducts an extensive consultative process, during which it hears the views expressed by members of the industry as well as the scientific advice presented by government scientists. Curiously, the FRCC required the inshore fixed gear sector to be represented at their hearings only as members of fishing associations, reflecting the institutional arrangements in place prior to the establishment of community management boards. As such, neither the Fixed Gear Advisory Council (FGAC), the tertiary body representing the interests of inshore fixed gear fishers, nor the community management boards, were allowed to present their possibly more unified input to the FRCC. This requirement by the FRCC to restrict representation to fishing associations may have served to minimise the perpetuation of undue influence by local notables, highlighted earlier as a potential threat to democratic decision-making by community management boards. However, the role of community boards as the institutions managing the inshore fixed gear sector suggested that some benefit might have been obtained from representations made by the boards and the FGAC to the FRCC. Since the FRCC advice has traditionally been used to affect quota allocation for a given fishing year, the decisions reached by the Council could have significant consequences on the success of the management strategies developed by community management boards. For example, it was clear that any in-season adjustment recommended by the FRCC, could penalise boards that had planned for an extended fishery and benefit those that had favoured a short-term, competitive approach (Apostle *et al.* 1997).

Legal and Regulatory Issues

Legal and regulatory issues during the start-up period of community quota management included challenges to the legitimacy of the management boards, and the dockside monitoring and at-sea observer coverage imposed by DFO.

Legislative authority — Increased user participation in the management of common pool resources is reported to increase the legitimacy of the resulting laws, rules and regulations (Jentoft 1989). Typically, such legitimacy is built on a legislative recognition of the authority of the users to set the rules (MacCallum 1998). During its start-up period, community quota management in Scotia Fundy did not benefit from such legislative recognition. This did not appear to deter the boards from their efforts to build management capability and to get fishers to enter into civil contracts to abide by the community-developed conservation harvesting plan.

Ostrom (1990) identified a number of criteria considered essential for the successful co-management of common pool resources (CPR). Among these, legal and regulatory issues were dominant, including the need for the clear legal authority of the designated CPR institution granted by the governmental authorities. Other criteria included a clear mandate to regulate the conditions such as appropriation rules, monitoring, sanctions and enforcement, and conflict resolution mechanisms. These are generally developed as a result of the collective choice of members comprising the CPR institution.

It would appear that the legal and regulatory conditions under which the community quota management system was established failed to meet many of the criteria listed by Ostrom (1990). However, it is important to recognise that Ostrom's analysis was based on an *ex post* examination of enduring institutions and the conditions confronting these institutions during their formative stages were not captured. It seems unlikely that Ostrom's examples of long-enduring CPR institutions had all the attributes for success clearly defined and available at their outset. Clearly community-based management boards within Scotia Fundy lacked many of these success elements during their start-up phase. However, the ongoing lack of a legislative mandate a decade later and the continued support provided by the fishers and the government to community management, suggest that the claim that legislative support is essential may be context-specific.

Dockside monitoring and enforcement — The shift of the financial burden from DFO to industry for monitoring and enforcement was of considerable concern to community management boards. During the start-up period, the regulatory requirements for dockside monitoring ranged from twenty to 100 percent of landings, depending on fleet sector

and area fished. Group X fishers were subjected to 100 percent dockside monitored, regardless of the area being fished.

The costs and coverage percentages for dockside monitoring were raised repeatedly as issues by the community boards and DFO at the joint industry-government FGAC meetings. The boards argued that with declining quotas, the cost for monitoring was posing an increasing burden for fishers, particularly the hand-line group, whose catches were relatively small. Despite this concern, DFO was committed to an industry-funded monitoring system to accurately document catches and to use the information for both management and stock assessment purposes. Access to timely and accurate data on harvesting was also of importance to the community boards since there were severe penalties for overfishing their quotas. These included closure of the fishery to all community members if the quota for any species was exceeded and a reduction in the following year's quota, calculated as a pound for pound reduction on any overruns between ten to 19.9 metric tonnes. For overruns exceeding twenty metric tonnes, community members were penalised the following year at a rate of two pounds for every one pound overfished.

There were problems with the dockside monitoring system during the start-up phase. Third-party monitoring companies questioned the economic viability of providing monitors at every landing site in Scotia Fundy. Many fishers, in particular those using handlines, questioned the distributive fairness of the monitoring costs given their relatively small catches, despite the obvious management-related benefits associated with acquiring timely data from all boats. To address the fishers' concern of inequity, a number of boards developed community-derived mechanisms to share the costs of monitoring more equitably among its members. The economic viability of the dockside monitoring companies was improved by identifying a selected number of designated ports for landings to be made and monitored. However, this led to increased operational costs for fishers who were not residents of the designated ports and added transportation costs for processors whose plants were not located at these ports. It also created the risk of closure of processing plants in coastal communities lacking *designated port* status.

Observer coverage — Although linked to the issue of dockside monitoring, a separate regulatory requirement was industry-paid at-sea observer coverage. In areas where twenty percent dockside monitoring was required, management boards had to pay for one at-sea observer day for every 100 tonnes of cod, haddock and pollock allocated to the board. Reduced observer days (offsets) were allowed for areas with higher dockside monitoring requirements. During interviews, the majority of the boards indicated that if given the option, they would minimise observer coverage by participating in industry-developed and DFO-approved science-based

activities or joint activities with DFO. This proposed science-based alternative to observer coverage was seen as providing scientific information of direct value to the community while the willingness of DFO to replace observer coverage lent support to claims by members of the inshore fishery that at-sea observers on the fixed gear fleet provided limited value. By the end of the start-up period, additional offsets were agreed to by DFO for boards that conducted activities in support of science.

Because both dockside monitoring and observer coverage requirements were solely determined by DFO while the management of the quota was community-determined, there were mismatches between what industry felt was appropriate, based on their communal management needs, and what DFO required, based on its more macro-level management regimes. These mismatches led some fishers to question the legitimacy of the rules and regulations of both DFO and their community management boards, leading potentially to an undermining of the management efforts of the community boards.

Socio-Economic Issues

A range of socio-economic issues affected community quota management during the start-up period. Among these were the social implications of public policies affecting the fishery as a whole, such as the long-standing and conflicting goals of employment maximisation and resource conservation. This was further exacerbated by the economic and ecosystem implications of technological modernisation in all gear sectors. There was also the shifting balance between the pursuit of personal economic gain and community obligations, arising from different values and assumptions by different stakeholders and the challenges associated with maximising economic returns.

Conservation versus employment maximisation — With the collapse of the cod fisheries, fishers in Scotia Fundy acknowledged the overcapacity in the industry as one of the contributing causes to the decline in groundfish stocks. Both harvesting and processing capacity was significantly reduced during the start-up period for community quota management. Although this management regime was instituted to involve fishers in the management of the resource more than before, it may have contributed to reducing fishing capacity as well. However, the degree to which this contributed in the complex mix of factors responsible for a decrease in the numbers of active fishers could not be determined. Nonetheless, DFO data showed the total number of fixed gear vessels continuing to decline during this time from a high of approximately 2,300 vessels in 1993 to approximately 1,200 by the end of the start-up phase.

Personal gain and community obligations — Prior to the onset of community management, sociologists in Atlantic Canada had reported on

studies aimed at better understanding the balance between the pursuit of personal economic gain by fishers with community obligations (Davis 1991; Matthews 1993). While their findings suggested there was a sense of community responsibility among inshore fishers in Atlantic Canada, it was not clear whether inshore fishers shared a collective belief in the right to manage the fishery for the benefit of the community and to the exclusion of outsiders. During the start-up years, community management boards struggled to come to consensus on this matter. Some boards, such as Eastern Nova Scotia, Digby and Yarmouth, demonstrated a high commitment to their communities that militated against personal gain achieved at the expense of other members of the community. In other boards, the right of the members to benefit economically from their personal achievement took precedence. Despite their philosophical differences, both Shelburne A and B tended to support this latter ideology but did so using different approaches; Shelburne A subscribed to personal reward based on a competitive fishery while Shelburne B recognised personal catch history for allocating quota shares to members.

Maximising economic return — Introduction of the multi-species quota policy (closure of the fishery for all species once the quota for one species had been reached) imposed significant limitations on the community boards trying to maximise the length of the fishing season and the economic benefit to fishers. The multi-species policy rested on the recognition of the strong technical interactions between groundfish species, reflecting their close interactions at the ecosystem level. However, the multi-species quota level set at the onset of the trial period in 1997 for cod, haddock and pollock was based on the historical landings for fishers during the years 1986 to 1993. The potential thus existed for discrepancies between the multi-species quota based on historical catches and the composition of the various species relative to each other during the start-up years. To maximise the available catch for all three species allocated to a community, management boards responded by voluntarily trading or buying and selling species quota to other management boards. The result was a close match between total multi-species quota allocation and total catch across all management boards. Thus, transferability of quota among management boards allowed them to maximise catch, while staying within the imposed, historically-based, multi-species quota allocation. This solution was viable only because all community management boards participated in the activity. In situations of multi-species quota harvesting, the use of transferability to maximise the overall economic return to the fishers is significant. Its role was also recently reported for the ITQ fishery on the Canadian west coast, suggesting the cross-cutting nature of this policy option to the industry, irrespective of the management regime (Branch *et al.* 2006).

Science-Related Issues

The science-related issues confronting community management boards were the subject of two in-depth studies by DFO immediately prior to the onset of community management. Following a 1993 workshop on groundfish management in the Scotia Fundy region, key issues identified included: poor communication between scientists and fishers; disagreement on minimum spawning stock biomass; limited ecological information; and, unavoidable errors in the assessment models used to determine the total allowable catch (Angel *et al.* 1994). A second workshop in 1996 (Burke *et al.* 1996) recommended that DFO-Science work with the industry to provide mutually acceptable estimates of spawning stock biomass for as many management units as possible; seasonal and area closures to protect spawning fish; and, efforts to reduce catch wastage. The once-held belief that the long-term abundance of a single exploited species was primarily controlled by fishing effort seemed to be challenged by a growing recognition among fisheries managers and scientists of the complexity of the relationship and the influence of numerous ecosystem interactions (Sherman *et al.* 1993; Slocombe 1993). Within DFO too, recognition of the limitations of the assessment models used to manage the fisheries was growing. Other parameters, such as predator-prey relationships, multi-species interactions, environmental factors and the chaotic nature of fisheries systems were acknowledged as influencing the estimation of total allowable catches.

To sum up, the limitations of achieving conservation objectives by attempting to manage population abundance through simple control of total fishing mortality (or total catch) were well-recognised. While movement to community quota management was viewed as a step in the right direction by both fishers and government managers, the challenge facing both community management boards and DFO was how to access, value, and incorporate fishers' knowledge into policy decisions. To unseat the dominance of catch-control methods, the industry recognised the need to work with government to acquire the understanding of effort-related controls capable of meeting management objectives. Increased communication between fishers and government was an obvious first step. With the establishment of a small number of management boards representing the inshore, fixed gear, groundfish fishery, the potential for meaningful dialogue with government was in place. As well, the development of a Fishermen Scientists Research Society during this period, with volunteer members from government and all sectors of the fishing industry, led to a greater understanding on both sides of the issues to be resolved at the scientific and operational level.⁴

How Successful was the Start-Up Period for Community Quota Management?

As described in this paper, community quota management was implemented on a three-year trial basis in 1997 as an alternative to a single, DFO-managed fishing plan for the inshore, fixed gear sector. After two years, and at the request of the fishers, the trial period was terminated and community quota management in the Scotia Fundy Region was formally established for a five year period, subject to terms and conditions consistent with the *Fisheries Act*. By 2002, the regime remained an acceptable management option for both DFO and the inshore, fixed gear sector (Government of Canada 2002) and in 2006, it continues to be an acceptable management approach for the 4X5Y inshore groundfish fishery. It is reasonable to assume that the formal adoption of the approach signalled that both fishers and DFO were satisfied with community quota management. However, at the start of the trial period no specific hypotheses and no evaluative criteria were established to assess the success of the trial. Furthermore, no formal assessment of the management system's ability to meet the expectations of the fishers and DFO was conducted prior to its formal extension.

Possible Performance Indicators

Before identifying any suite of indicators to measure the performance of community quota management, it is essential to clarify what constitutes success. DFO may define success as the ability of the community boards to attain stated conservation-based goals and the degree to which fishing capacity in the sector is reduced. For the inshore fishers in Scotia Fundy, success could be identified as the protection of access rights to the fishery, ensuring a longer fishing season and maximising the economic value of the resource through flexible decision-making. The institutional performance of community management boards, as measured by improved coordination between fishers and government managers and scientists, may be another gauge by which success is evaluated. Success by this latter measure does not require that either DFO or fishers objectives be met. Alternatively, success may be defined as satisfying all parties involved, such that the attainment of the goals of government, the fishers and the devised institutional arrangement are met.

The institutional analysis and development (IAD) framework (Ostrom *et al.* 1994; Imperial 1999) provides a useful model for selecting evaluative criteria to analyze the structure and performance of devised institutional arrangements, such as the community management boards. IAD focuses on: the physical characteristics of the ecological system and the nature of the problem; the culture of the individuals/organisations trying to solve

the problem; and, the institutional setting within which the individuals/organisations are embedded (Crawford and Ostrom, 1995). The linkages between key elements of the IAD framework and the evaluative criteria used to identify strengths and weaknesses of different institutional arrangements are illustrated in Figure 2.

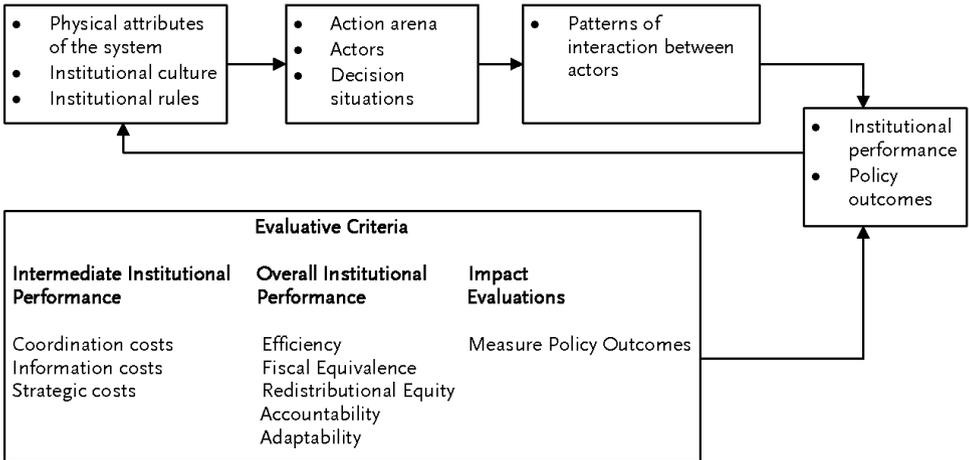


Figure 2. *The Institutional Analysis and Development Framework.* (modified from Ostrom *et al.*, 1994 by M.T. Imperial, 1999)

Evaluative criteria assess the intermediate performance and overall performance of the institution and the policy level achievements. Intermediate performance criteria measure the transaction costs imposed by the institutional arrangement, including coordination costs, information costs and strategic costs, such as those benefiting at the expense of others due to asymmetry in information, power or other resources. Overall institutional performance criteria measure efficiency costs relating to administration, the degree of fiscal equivalence or the ‘user pay’ principle and redistributive equity which structures programs around differential abilities to pay. Additional indicators in the IAD model assess the level of accountability (partners’ ability to monitor each others' behaviour) and the degree to which the institutional arrangement is adaptable, responding to changing political, economic, cultural and environmental conditions. Finally the policy outcome is assessed as the contribution of the implemented policies towards solving the target problems.

Preliminary Assessment of the Success of Community Management Boards

Guided by the IAD framework, a preliminary qualitative assessment, of community quota management was conducted, using data collected from interviews with all of the community management boards following the completion of the initial start-up period in 1999.

From a policy outcome perspective, fishers considered that community quota management had significantly assisted them in addressing declining allowable catch and changes in regulations that promoted the government's goal of conservation. They reported that community management let them focus their efforts on industry-specific goals, within the constraints of the DFO-determined quota allocations. The structured interviews with management boards unanimously confirmed that community quota management had increased fishers' certainty in planning their fishing season activities. The degree of fishers' involvement in the management of the resource had correspondingly increased and they felt they achieved their objectives of maximising the economic value of the resource through flexible decision-making and providing for a longer fishing season.

Data provided by DFO on the total allowable catch and number of active fishers for the two years of the experiment were consistent with a decrease in fishing effort, one of the conservation objectives at that time. Unfortunately, the contribution of community quota management to this success could not be separated from other initiatives such as the government's licence buy-backs or simply the decrease in quota allocations.

The transaction costs associated with community quota management seemed to have lowered the coordination costs for all parties. Fishers direct involvement in setting the terms and conditions for fishing their allocated quota seemed to make negotiating, monitoring, and enforcing fishing agreements between the boards and their members more cost-effective than they had been previously with DFO. Similarly, costs of coordination between DFO and the management boards were reduced since the number of boards was significantly less than the number of fishers the department had interacted with under the previous regime. Information quality was expected to increase, as the longer-term impact of errors in data on management decision-making became more apparent to fishers who were more directly involved in management. However, the incentives to under-report in any quota system in order to obtain the immediate benefit of more catch were still thought to be present, despite its detrimental long-term effects. This may improve in the medium term as fishers' involvement in science-related projects and/or management increases their appreciation of the importance of accurate data. Strategic costs were qualitatively assessed to be lower under community-based management simply because the fishing sector provided more informa-

tion and resources to manage the fishery. Under the previous regime, the information and power rested primarily with DFO, as did the bulk of the costs, which allowed industry to receive a disproportionate amount of the benefits.

From a government perspective, efficiency had improved since the cost of administering the management program had decreased. However, half of all management boards interviewed in 1999 reported increased costs or reduced efficiency, while the other half claimed to have observed no change. The costs of dockside monitoring and observer coverage, which depended on the amount of quota allocated, reflected the government's attempt to make the costs of management fiscally equivalent for all gear sectors, not only amongst the community management boards but amongst all gear sectors, inshore and offshore. Although efficiency considerations should result in the optimal utilisation of management resources, equity considerations can lead to different, and hence less efficient, resource allocation decisions. Differences in the trade-offs between efficiency and equity reflected the differing philosophies amongst the management boards in terms of the weights given to these two criteria. However, in spite of these differences, it was concluded that the community quota management addressed redistributive equity better than the previous management regime or other gear sectors did.

The remaining criteria of accountability and adaptability also appeared to be better served under community quota management. Under the old regime, government managers were often unable to respond to the diverse or changing needs of fishers, both as a result of trying to be fair to all parties and the nature of bureaucracies to be slow to respond to change. In contrast, community management boards were being held accountable by their members who were now in a position to demand changes to the fishing plans in response to changing political, social, economic and environmental circumstances for the fishery. At the community scale, community quota management was judged by members to better respond to changes in their needs. However, it needs to be recognised that adaptation to larger-scale changes, such as changes in technology or other management programs, can be more difficult for the community boards since the appropriate responses to these changes may be beyond the scope of any given institution.

Conclusion

Despite extensive regulation of harvesting and limits on participation, Atlantic groundfish stocks continued to decline over the period 1982 to 1993 leading to the well-publicised fisheries moratoria. This resulted in

socio-economic hardships for both harvesters and processors of the resource, and the consequential social burdens affected all levels of government, industry and society. Differing fleet capabilities, differing fishing strategies, or simply different geographic locations, meant that the traditional open, competitive fishery was an inequitable approach to managing the inshore fishery. This was especially clear in the case of fishers whose adjacent fishing grounds were closed by the moratoria. One alternative approach to addressing these concerns was community quota management,

An assessment of the start-up phase of the community-based management experiment within Scotia Fundy Region identified a number of key lessons for resource managers and users both within the Canadian context and in other jurisdictions.

Key among these lessons is an understanding of the rationale behind the movement towards self-organisation and a determination of the readiness of government not to impede the process. In the case study examined, the motivation behind the establishment of community-driven, co-management institutions was a crisis that threatened the viability of the inshore fixed gear sector and the sustainability of coastal communities dependent on the fishery. Industry and government recognised that DFO actions alone were insufficient to address all the issues satisfactorily. These include the seemingly incompatible goals of conservation and a sustainable fishery that provide an equitable livelihood for the resource users. Thus, the sector proposed, and DFO agreed, to implement the community-based management experiment for the entire 4X5Y region.

Once established, co-management institutions need to be aware of their limited capability to address the numerous challenges that will arise. For both government and industry partners, the willingness to acquire the necessary skills and resources and to adopt a learning-by-doing approach are essential attributes. This is particularly important during the start-up period as partners encounter the new suite of issues arising from shared management. In the case of the community management boards, these included having to address key organisational issues such as community heterogeneity. Legal and regulatory issues included challenges to the legitimacy of the management boards. A range of socio-economic issues included reconciling members' values with community objectives. Finally, community management boards were faced with a range of science-related issues which many lacked the technical capability to address. Given the expected dominance in terms of scientific expertise and funding for research by the government partner, the boards recognised the need to develop their capacity by partnering with government scientists in cooperative research arrangements. This highlights an important lesson

of building on the strengths of co-management partners, rather than attempting to duplicate capacity, or worse, ignore the importance of a partner's abilities.

The start-up phase of the community-based management experiment within Scotia Fundy was an unusual modification of community-based management as described in the literature on common pool resources. More precisely, it was a tangible example of subsidiarity in that it assigned micro-management of the fishery to those closest to the resource while retaining legislative macro-level decision-making at the level of the federal government. Based on the preliminary analysis of this experiment, empowering resource users who self-organise to make decisions based on their needs and knowledge is an important step towards achieving the goal of a sustainable fishery. However, ongoing and careful evaluation of this process is needed to ensure any co-management effort, including community based quota management, lives up to the expectations placed on it.

Acknowledgements

The author wishes to thank the members of the 4X5Y Community Management Boards and personnel in the Science Branch and Fisheries Management Branch at DFO who provided valuable documents, gave of their time to participate in the study and who generously agreed to allow the author to attend a number of closed session meetings during the research period.

Notes

- ¹ Aristotle observed in his discourse on *Politics* that 'what is common to the greatest number has the least care taken of it.' In 1651, Thomas Hobbes supported Aristotle's claim by arguing in *Leviathan* that people were incapable of collective action toward their common good, and as such, to save them from themselves, the rule of law had to be exogenously imposed. For Hardin's argument, see G. Hardin, *The Tragedy of the Commons*, *Science* 162 (1968): 1243–1248.
- ² It is important to note that, in addition to the inshore groundfish fixed gear sector, a mobile gear fishery co-existed in the 4X5Y area. This fishery was managed using ITQs and operated separately from the fixed gear fishery. For a discussion on the mobile gear fishery and the resistance to ITQs for the fixed gear fishery, see R. Apostle, G. Barrett, P. Holm, S. Jentoft, L. Mazany, B. McCay and K. Mikalsen (1998), *Community, State and Market on the North*

Atlantic Rim: Challenges to Modernity in the Fisheries. University of Toronto Press, Toronto.

³ The actual community share identified is based on 97 percent of the community average for the 1986-93 base years. The remaining 3 percent is divided 1.5 percent to top up any community which received a lower quota for 1996 than it had caught in 1995 and 1.5 percent to the Digby and Yarmouth community groups.

⁴ Information on the Fishermen Scientists Research Society may be accessed at www.fsrs.ns.ca

References

- Annand, C., J. Hansen.
1997 *Management Activities for the Groundfish Sector in 1996 Scotia Fundy Sector, Maritimes Region*. Department of Fisheries and Oceans, Research Document 97/114.
- Angel, J.R., D.L. Burke, R.N. O'Boyle, F.G. Peacock, M. Sinclair, K.C.T. Zwanenburg.
1994 *Report of the Workshop on Scotia Fundy Groundfish Management from 1977-1993*. Can. Tech. Rep. Fish. Aquat. Sci. 1979.
- Apostle, R., B. McCay, K. Mikalsen.
1997 The Political Construction of an IQ Management System: The Mobile Gear ITQ Experiment in the Scotia Fundy Region of Canada. In: G. Palsson and G. Petursdottir (Eds.), *Social Implications of Quota Systems in Fisheries*. TemaNord:27-49.
- Branch, T.A., K. Rutherford, R. Hilborn.
2006 Replacing Trip Limits with ITQs and Implications for Discarding. *Marine Policy*. In Press.
- Burke, D.L., R.N. O'Boyle, P. Partington, M. Sinclair.
1996 *Report on the Second Workshop on Scotia Fundy Groundfish Management*. Can. Tech. Rep. Fish. Aquat. Sci. 2100.
- Cashin, R.
1993 *Charting a New Course: Towards the Fishery of the Future*. Report of the Task Force on Incomes and Adjustment in the Atlantic Fishery. Ottawa, Canada.
- Christensen, V., S. Gu enette, J.J. Heymans, C.J. Walters, R. Watson, D. Zeller, D. Pauly.
2003 Hundred -year decline of North Atlantic predatory fishes. *Fish and Fisheries* 4:1-24.
- Clark, C.W.
1976 *Mathematical Bioeconomics: The Optimal Management of Renewable Resources*. New York: Wiley.

- Crawford, S.E.S., E. Ostrom.
 1995. A Grammar of Institutions. *American Political Science Review* 89:582-600.
- Davis, A.
 1991 *Dire Straits: The Dilemmas of a Fishery: The Case of the Digby Neck and Islands*. Memorial University of Newfoundland. Institute of Social and Economic Research, Study No. 43. St. John's, NF.
- Finlayson, A.C.
 1994 *Fishing for Truth: A Sociological Analysis of Northern Cod Stock Assessments from 1977-1990*. St. John's Institute of Social and Economic Research, Memorial University of Newfoundland, St. John's, NF.
- Government of Canada.
 2002 *Groundfish Integrated Fisheries Management Plan: Scotia Fundy Fisheries, Maritimes Region*. Department of Fisheries and Oceans, Ottawa, Canada.
 1997 *Integrated Fisheries Management Plan: Atlantic Groundfish 1997*. Department of Fisheries and Oceans, Ottawa, Canada.
 1976 *Policy for Canada's Commercial Fisheries*. Fisheries and Marine Service, Department of the Environment, Ottawa, Canada.
- Halliday, R.G., F.G. Peacock, D.L. Burke.
 1992 Development of Management Measures for the Groundfish Fishery in Atlantic Canada: A Case Study of the Nova Scotia Inshore Fleet. *Marine Policy* (Nov. 1992):411-426.
- Imperial, M.T.
 1999 Analyzing Institutional Arrangements for Ecosystem-Based Management: Lessons from Rhode Island Salt Pond SAM Plan. *Coastal Management* 27:31-56.
- Kearney, J., P. MacIntosh.
 1998 *A Needs Assessment of Scotia Fundy Fixed Gear Groundfish Management Boards*. Extension Department, St. Francis Xavier University, Antigonish, Nova Scotia.
- Jentoft, S.
 1989 Fisheries Co-Management: Delegating Government Responsibility to Fishermen's Organization. *Marine Policy* (April 1989):137-154.
- Kirby, M.J.L.
 1982 *Navigating Troubled Waters: A New Policy for the Atlantic Fisheries*. Report of the Task Force on Atlantic Fisheries. Ottawa, Canada.
- Loucks, L.
 1998 Sambro Community Quota Fisheries Management: A Case of Innovative Community-Based Decision-making. In: L. Loucks, T. Charles and M. Butler (Eds.), *Managing Our Fisheries, Managing*

- Ourselves*. Gorsebrook Research Institute for Atlantic Canada Studies, St. Mary's University, Halifax, Nova Scotia:54-58.
- MacCallum, R.
1998 The Community-Based Management of Fisheries in Atlantic Canada: A Legislative Proposal. *The Dalhousie Law Journal*. Spring 1998:49-91.
- Mahon, R., M. Bavinck, R. Roy.
2005 Fisheries governance in action. In J. Kooiman, M. Bavinck, S. Jen-toft and R. Pullin (Eds.) *Fish for life: Interactive governance for fisheries*. MARE Publication Series No. 3. University of Amsterdam Press, Amsterdam:353-378.
- Matthews, R.
1993 *Controlling Common Property: Regulating Canada's East Coast Fishery*. University of Toronto Press, Toronto, ON.
- McGoodwin, J.R.
1990 *Crisis in the World's Fisheries: People, Problems and Policies*. Stanford University Press, Stanford, CA.
- Ostrom, E.
1990 *Governing the Commons: The Evolution of Institutions for Collective Action*. Political Economy of Institutions and Decisions Series, Cambridge: Cambridge University Press, UK.
- Ostrom, E., R. Gardner, J. Walker.
1994 *Rules, Games and Common Pool Resources*. Ann Arbor, MI: The University of Michigan Press.
- Palsson, G., G. Petursdottir.
1997 *Social Implications of Quota Systems in Fisheries*. TemaNord.
- Pauly, D., V. Christensen, S. Gu enette, T.P. Pitcher, U.R. Sumaila, C. Walters, R. Watson, D. Zeller.
2002 Towards sustainability in world fisheries. *Nature* 418:689-695.
- Pinkerton, E.
1989 *Cooperative Management of Local Fisheries: New Direction for Improved Management and Community Development*. University of British Columbia Press, Vancouver, BC.
- Pomeroy, R.S.
1994 *Community Management and Common Property of Coastal Fisheries in Asia and the Pacific: Concepts, Methods and Experiences*. Manila: International Center for Living Aquatic Resources Management.
- Pomeroy, R., P. McConney, R. Mahon.
2004 Comparative analysis of coastal resources co-management in the Caribbean. *Ocean and Coastal Management* 47:429-444.
- Pross, A.P., S. McCorquodale.
1990 The State, Interests and Policy Making in the East Coast Fishery. In W.D. Coleman and G. Skogstad (Eds.), *Policy Communities and Pub-*

- lic Policy in Canada: A Structural Approach*. Mississauga: Copp-Cark Pitman Ltd.:34-58.
- Ruddle, K., R.E. Johannes. (Eds.)
 1985 *The Traditional Knowledge and Management of Coastal Systems in Asia and the Pacific*. Jakarta: UNESCO Regional Office for Science and Technology for South-East Asia.
- Sherman, K, L.M. Alexander, B. Gold. (Eds.)
 1993 *Large Marine Ecosystems: Stress, Mitigation and Sustainability*. American Association for the Advancement of Science Press, Washington, DC.
- Sinclair, M., R.N. O'Boyle, F.G. Peacock.
 1998 *Why Some Fisheries Survive and Others Collapse?* Second World Fisheries Congress:23-35.
- Slocombe, D. S.
 1993 *Implementing Ecosystems-Based Management: Development of Theory, Practice and Research for Planning and Managing a Region*. *Bioscience* 43:612-622.
- Willett, L.
 1992 *Captains and Buyers in Ganegen Harbour*. In: R.Apostle and G. Barrett (Eds.), *Emptying Their Nets: Small Capital and Rural Industrialization in the Nova Scotia Fishing Industry*. University of Toronto Press:194-209.