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Rights Based Fisheries Management in Canada

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Abstract *The conflict between efficiency and maximization of employment colours all aspects of fisheries management in Canada, including implementation of rights based fisheries management regimes. Even though rights based systems are strongly based on considerations of efficiency, sometimes at the expense of maximization of employment, a number of such regimes have been put in place in recent years. These are generally little known and little analyzed. This paper attempts to address this gap in our knowledge by surveying such schemes. For a number of reasons outlined in the paper, rights based regimes in Canada have not usually involved transferability or divisibility of quotas. Nonetheless, efficiency gains have been made where such schemes have been implemented. These are illustrated in case studies of the Atlantic offshore groundfish fishery and the Atlantic purse seine herring fishery.*

Keywords Fisheries management, property rights, quota values, limits on transferability of rights, rationalization of fisheries.

Introduction

This paper surveys rights based regimes in Canada. Most of the regimes have been adopted to address the common property nature of the fisheries. We assess the general operation of these regimes and then describe two in detail.

In Canada, the federal government has exclusive jurisdiction over all "sea coast and inland fisheries". The federal Department of Fisheries and Oceans (DFO) regulates approximately 70,000 commercial fishermen that landed fish with a value of $1,634 millions in 1989. The principal instrument for catch regulation is the annual Total Allowable Catch (TAC) which is set each year for most species. The Fisheries Act gives the Minister of Fisheries and Oceans the power ". . . in his absolute discretion, wherever the exclusive right of fishing does not already exist by law, to issue . . . leases and licences for fisheries or fishing. . ."[1] This power to licence is elaborated in Section 34 of the Fisheries Act, which gives the Minister the right to enact regulations for:

"(a) . . . conservation and protection of fish. . . .
(d) . . . operation of fishing vessels. . . .
(e) . . . use of fishing gear and equipment. . . .

[1] Fisheries Act, Revised Statute of Canada, 1970, f-14 Sec 7.

(g) . . . terms and conditions under which a . . . licence may be issued. . . .
(m) . . . to vary the close time, fishing quota, or limit'' that has been fixed by the regulations.

The Minister's extensive powers were used only sparingly before the 1960s. However, during the 1960s and 1970s, regulatory control of inputs increased considerably. Input control measures consisted chiefly of season closures, gear restrictions and area closures. This type of regulation did not solve basic problems resulting from the common property nature of the fishery and as result, emphasis shifted to the principal devices currently used to manage the fisheries:

- Total allowable catches (TACs) by fishery.
- Enterprise Allocations (EAs) or percentage shares of TACs.
- Individual licences.
- Vessel registration and replacement restrictions.
- Regulations on fishing gear.
- Area regulations by vessel class, gear and dates of operation.

The current management approach was developed following severe crises on both east and west coasts in the late 1970s. Overall, the approach has been to extend enterprise allocations (EAs) and related quota systems to new sectors of the fishery and subsequently to deregulate these sectors once EAs have begun to take effect.

The thinking behind this strategy was formalized in two early 1980's Royal Commission reports on the state of Canadian fisheries.[2] The Task Force on Atlantic Fisheries or ''Kirby Report'' prefaced its recommendations with the following objectives for Canadian fisheries policy:

Objective 1: The Atlantic fishing industry should be economically viable on an ongoing basis, where to be viable implies an ability to survive down turns with only normal business failure rates and without government assistance.

Objective 2: Employment in the Atlantic fishing industry should be maximized subject to the constraint that those employed receive a reasonable income as a result of fishery-related activities, including fishery-related transfer payments.

Objective 3: Fish within the 200-mile Canadian zone should be harvested and processed by Canadians in firms owned by Canadians wherever this is consistent with Objectives 1 and 2 and with Canada's international treaty obligations.

It is crucial to understanding Canadian fisheries policy to appreciate the role of ''Objective 2''. Employment maximization is an unstated policy objective of fisheries policy in many countries. And this is no less the case in Canada. However, this objective is in fundamental conflict with Objective 1: achievement of one compromises achievement of the other. Rights based approaches that are currently in place (especially in Atlantic Canada) implicitly or explicitly recognize the

[2] Task force on Atlantic Fisheries, Navigating Troubled Waters: A New Policy for the Atlantic Fisheries, Ottawa, December 1982 (known as the ''Kirby Report'' after the Commission chairman, Senator Michael J. L. Kirby). Commission on Pacific Fisheries Policy, Turning the Tide: A New Policy for Canada's Pacific Fisheries, Ottawa, September, 1982 (known as the ''Pearse Report'' after Commissioner, Peter H. Pearse).

Table 1
Rights Based Management in Canadian Fisheries, 1990, by Fishery Type of Regime and Date of Introduction

Atlantic Fisheries	Type & Unit	Date of Introduction
1. Herring (4RTVnWX)	ITQ-Vessel-% of TAC	1983
2. Offshore Groundfish (All areas)	IQ-Company-% of TAC	1982, 1984
3. Northern Shrimp (2G,3K)	IQ-Company-tonnage	1987
4. Offshore Lobster (4X,5)	IQ-Company-tonnage	1985[1]
5. Offshore Clam (4Vs)	IQ-Company-% of TAC	1987
6. Offshore Scallop (4X,5Ze)	IQ-Company-% of TAC	1986
7. Offshore Tuna (All areas)	IQ-Company-tonnage	1987
8. Inshore Groundfish (4RST,3Pn)[2]	IQ-Vessel-% of TAC	1983–89
9. Midshore Groundfish (All Areas)[3]	IQ-Vessel-% of TAC	1988
Freshwater & Arctic Fisheries		
10. Lake Erie	ITQ-Individuals-% of TAC	1984
11. Lake Winnipeg	ITQ-Individuals-% of TAC	1986[4]
12. Arctic Fisheries	Community	
Pacific Fisheries		
13. Geoduck	ITQ-Individuals-% of TAC	1989
14. Abalone	IQ-Individuals-% of TAC	1980
15. Herring Spawn-On-Kelp	IQ-Individual-tonnage	1980
16. Herring Food and Bait	IQ Company-% of TAC	1985

Notes:
[1] Individual vessel quota were introduced into this fishery in 1977. Vessel quota were converted to a more extensive individual quota program in 1985.
[2] Applies to mobile gear, otter trawls, less than 65 foot vessels.
[3] There are five separate programs affecting midshore groundfish.
[4] An initial individual quota system was introduced in 1972. Licenses were not transferable and individual entitlements were small. Retired licenses were given to those in the industry based on a "point system" that assured that the number of licenses remained stable within a designated community license area.

need to maximize employment and this compromises the efficacy of the approach. As discussed later in this paper, however, this does not mean that there have been no efficiency gains from rights based regimes.

Canada began seriously to apply rights based regimes to the management of fisheries in 1982 (Table 1). Prior to the establishment of enterprise allocations (EAs) in the offshore fisheries in 1982, rights based management was tried in a number of small fisheries.[3] However, these were experiments and none really led to wider applications of rights based management. This may seem surprising in view of the strong tradition of "supply management" for a whole range of agricultural products in Canada.[4]

[3] For example, individual quota in Lake Winnipeg in 1972, individual vessel quota for Atlantic offshore lobster in 1977 individual quota for B.C. abalone in 1980 and individual quota for B.C. herring spawn-on-kelp in 1980.
[4] Individual transferable quota give Ontario farmers (for example) the right to produce specific quantities subject to the following marketing boards: The Ontario Chicken Producers' Marketing Board, The Ontario Egg Producers' Marketing Board, The Ontario Flue-Cured Tobacco Growers Marketing Board, The Ontario Milk Marketing Board, and The Ontario Turkey Producers' Marketing Board.

Prior to the 1970s, provincial fluid milk marketing boards and the flue-cured tobacco marketing board in Ontario had successful systems of individual transferable quotas. After the federal government passed the Farm Products Marketing Agencies Act in 1971, additional boards in other areas quickly made their quotas enforceable and often valuable.[5] The lessons learned in agriculture, however, were not readily transferable to the fisheries. No doubt there are many reasons for this but chief among them is the traditional role of the fishery in Atlantic Canada. It has been not only the employer of last resort, but in many areas the employer of only resort, and maximization of employment has often been an overriding objective.

The Department of Fisheries and Oceans introduced rights based regimes with EAs for the four largest offshore groundfish companies in 1982. They were suspended the following year pending the restructuring of the Atlantic groundfish industry. However, the offshore companies nonetheless continued with informal EAs during 1983 and in 1984, DFO re-introduced EAs for the offshore ground fishery during a five year trial (1984–88). The program was made permanent in 1989. The original program of course has been modified since 1982.

The Department introduced a separate EA regime in 1984 for the inshore groundfish fishery on the west coast of Newfoundland (mobile gear less than 65 feet in NAFO zones 4R, 3Pn, see Figure 1). In 1985, EAs were introduced into the offshore lobster fishery (zone 4X) and in 1986 into the offshore scallop fishery (zone 4X). In 1987 they were introduced into the northern shrimp fishery (zone 0–2). By this time the introduction of EAs had become the de facto strategy for fisheries management development.

This paper surveys all rights based programs in Canada and then reviews two of the regimes in more detail. One detailed review is the offshore EA program noted above. The offshore EA program is DFO's "flagship" in terms of fisheries management through establishment of rights. The second is the program for transferable vessel quotas in Atlantic zone 4WX herring. This latter fishery is not especially important in terms either of value or employment, but it was one of the first to have vessel quota and it illustrates many key points about quota management. The Department of Fisheries and Oceans intervened substantially from 1974–76 and again in 1983 into the 4WX herring fishery. Each intervention carried management further in the direction of enhanced rights.

Rights Based Programs in Commercial Fisheries in Canada

Table 1 provides a listing of Canadian fisheries with some form of property rights. Most of these programs were introduced into "open access" fisheries. These fisheries had generally developed into fisheries where too many fishermen and boats earned too low average incomes.

The academic community has actively encouraged the introduction of rights based management regimes. Moloney and Pearse (1979) advocated quantitative rights which could be allocated annually, though they stated a preference for perpetual rights.[6] Scott and Neher (1981) recommended that "the common prop-

[5] For a discussion of the role of marketing boards in Canada, see C. Green, Canadian Industrial Organization and Policy, Toronto McGraw-Hill-Ryerson, 1985, pp. 416–439.

[6] David G. Moloney and Peter H. Pearse, "Quantitative rights as an instrument for regulating commercial fisheries", Journal of the Fisheries Research Board of Canada, 1979, 36 pp. 859–866.

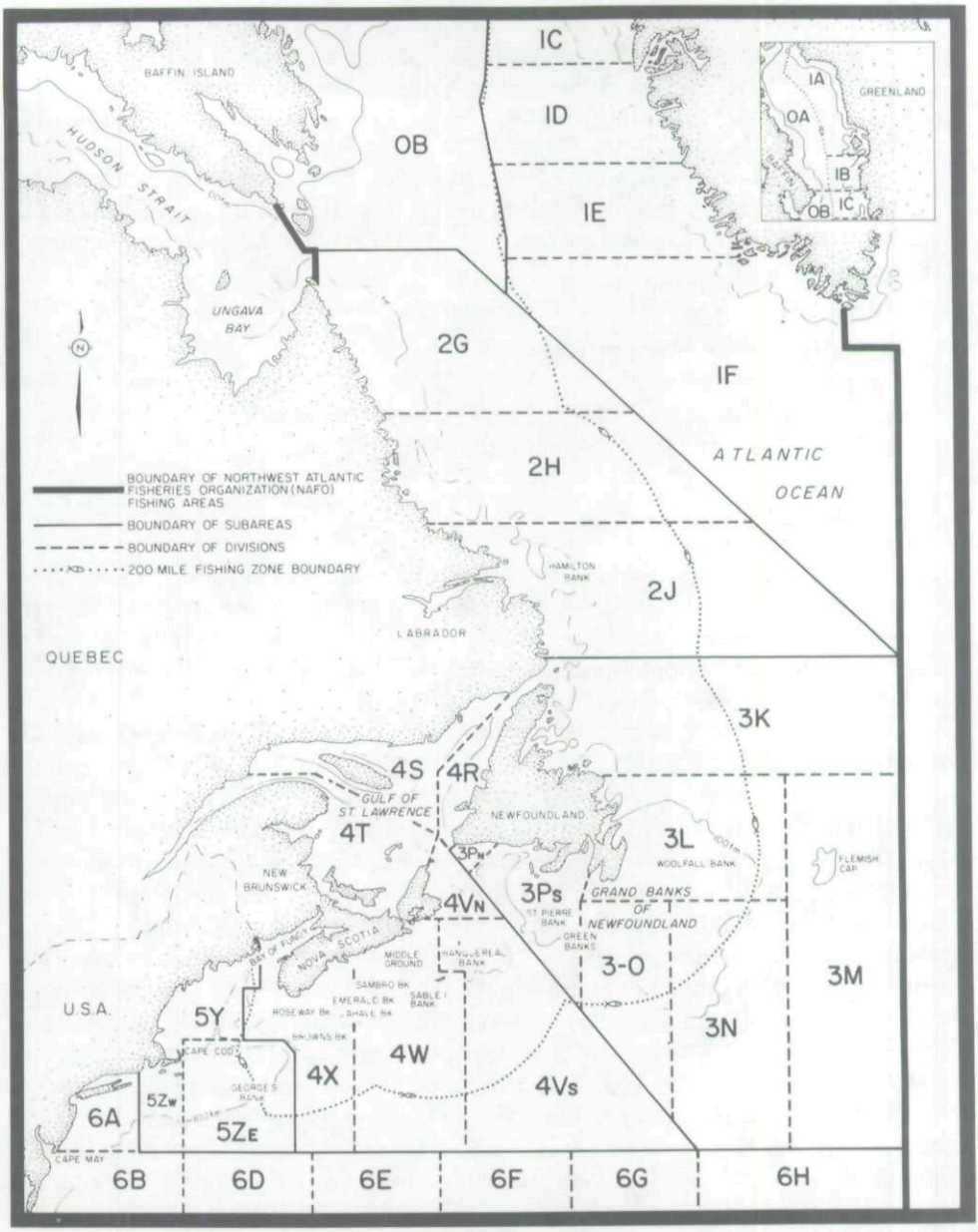

Figure 1. Subareas and Divisions of the NAFO Convention Area and limits of the Canadian fishing zone (East coast).

erty system of open access to each fishery should be replaced by a system of individual and exclusive rights of access or capture, or both".[7] To yield full economic benefits their rights based system would have rights that are ". . . marketable, divisible, specific with respect to species, time, location and gear

[7] Anthony Scott and Philip A. Neher, (editors), The Public Regulation of Commercial Fisheries in Canada, Ottawa: Economic Council of Canada, 1981, p. 41.

(STLG), and risk and pre-assignment".[8] The Task Force on Atlantic Fisheries echoed this in its recommendation 7.

For all regimes in Table 1, the "species, time, location and gear" stipulation is met, but transferability and pre-assignment of rights is not. When rights have been introduced, industry has usually resisted transferability and pre-assignment. In subsequent rounds of program design, however, they have often conceded the need for transferability. Existing rights based fisheries are designated IQ (individual quota) if quota are not transferable and ITQ (individual transferable quota) if they are.

In what follows, a rights based program is considered successful if it results in:

- Increased incomes of participants.
- Respected catch limits.
- Respected gear regulations and other conservation rules.
- Exit of labour and capital from a particular fishery.

Biological Characteristics of the Fisheries

The fisheries where rights based programs apply are heterogenous in terms of numbers of species and stock characteristics. Some are single species fisheries. Others are multi-species. Some species are long lived. Others are not. Most stocks reflect year-class developments. Shrimp are the result of essentially independent generations.

It is important to note that precision in stock assessments varies across rights-based fisheries. Stock estimates normally are subject to errors of plus or minus 20 per cent for groundfish and slightly higher for pelagics.[9] Some stocks are declining. Others are growing or cannot be assessed using standard biological methods.[10] To date, there is no evidence that biological factors translate in any predictable way into a prerequisite for a successful rights based program. Hence, rights based fisheries have reflected a variety of biological conditions.

From Table 1, the following rights based programs are single species fisheries: herring (4RTVnWX), northern shrimp (2G,3K), offshore lobster (4X,5), offshore clams (4Vs) and offshore tuna on the Atlantic coast; and geoduck, abalone and herring are all single species programs on the Pacific coast.

Multi-species rights based programs are offshore, mid-shore and inshore (4RST,3Pn) groundfish (Atlantic) and the Lake Erie, Lake Winnipeg and Arctic fisheries. The multi-species program in Lake Erie has over 240 boats and a combination of short and long lived species. It is a model fishery in all of the success

[8] Ibid, p. 41.

[9] Canadian experience is similar to experience assessing stocks for the North Sea. For a survey, see K. Brander, "How well do working groups predict catches? " Journal du Conseil International pour l'Exploration de la Mer, Vol 43, pp. 245–252. For a review of the Canadian experience, see Denis Rivard and Malcolm G. Foy, "An Analysis of Errors in Catch Projections for Canadian Atlantic Fish Stocks", Journal of the Fisheries and Aquatic Science, 1987, Vol 44, pp. 967–981.

[10] N. A. Sloan and P. A. Breen, "Northern abalone, haliotis kamtschatkana, in British Columbia: fisheries and synopsis of life history information", Canadian Special Publication in Fisheries and Aquatic Science, 1989. There is no known method for age determination of abalone.

terms noted above: fishermen comply with conservation regulations; participants respect catch limits and gear regulations; and incomes have increased considerably.

Number of Participants and Landing Sites/Ports

The number of participants in rights based programs varies. Of course, the administrative burden of a rights based program increases in general with the number of companies, vessels and landing sites. The experience in Canadian fisheries, however, suggests that large numbers of vessels, fishermen and landing sites can be effectively managed under such schemes (see discussion below). The first order of business is to ensure that only legal gear is used to harvest fish. The second is to ensure a proper paper trail from a point of landing in order to monitor quota effectively. Such data are part of the administrative procedures for several successful rights based programs. It is notable that where industry has monitored landings, it has usually monitored 100 per cent in order to ensure the completeness of the monitoring process.

The Lake Erie fishery has the largest number of vessels of all rights based programs. But it is a day fishery and has only six to eight landing sites. Observers at landing sites ensure vessel quotas are not exceeded. These observers are employed by a company jointly owned by fishermen and processors and operate under the aegis of the Ontario Ministry of Natural Resources. Observers base estimates on actual weighing of a 20 per cent sample of catches. If plant reports are not within five per cent of the landing site observer estimate, a follow-up investigation is initiated.

The fifty-five participants in the geoduck fishery on the Pacific coast have also hired a private firm to monitor catches. To minimize costs, they have limited the number of ports which are designated as landing sites. Moreover, only one or two landing sites in the southern part of the province can be open at any time.

There are two Atlantic herring fisheries, 4RTVn and 4WX, both of which have compliance problems. However, each has relatively few participants with 11 vessels in the former and 40 in the latter. The number of potential landing sites, however, is large and this has been the primary cause of problems. Without a weightmaster or a fishery officer at the landing site, collusion among fishermen and processors can assure successful misreporting of catches. Misreporting and discarding at sea has meant that the (TACs) have not always been respected.

Nor is the problem unique to this fishery. A five year pilot program (1983–88) for 4RS3Pn groundfish in western Newfoundland, which preceded the current program, was plagued by discarding and misreporting. Participants in the current program for the less-than-65-feet mobile fleet are now funding their own monitoring program by means of a levy on landings.

Are there conclusions to be drawn about the size of programs and number of landing sites? Program design rather than numbers of participants has seemed to be the primary ingredient of successful rights based programs. However, number of landing sites can be important if there are insufficient resources to ensure effective monitoring. Of course, the cost of monitoring can be borne by program participants rather than governments and restricting numbers of ports, times of operation, and sampling can be used to reduce costs.

Transferability and Exit of Labour and Capital

Economic theorists state that tenure in perpetuity, transferability and divisibility of quota entitlements are required to achieve efficiency. These conditions are not fully met in any of the existing programs. Under the Fisheries Act, the Minister of Fisheries and Oceans reserves the right at his "absolute discretion" to change even permanent rights based programs; hence, no true property rights to fish have been created in law under any of these programs.

Full transferability and divisibility is a feature only of the Lake Erie ITQ program. In the case of the 4RTVnWX Atlantic herring fisheries, there is restricted transferability and divisibility. Transfers are allowed only when quota held by a vessel are sold because a participant is exiting the fishery, at which time quota are divisible. For Lake Winnipeg and the offshore programs, there are restricted transferability provisions; the total licence must be purchased on a permanent basis and it is not divisible.

These limits on transferability have not prevented consolidation and rationalization of harvesting capacity in rights based fisheries. Some data are presented in Table 2 which show clearly the reduction in number of vessels that occurred after rights based fisheries were introduced. Once implemented, rights based programs produce adjustments that reduce the number of vessels and raise catches per vessel. (In some fisheries, of course, rationalization of harvesting capacity is not an issue. Northern shrimp, offshore clams and offshore tuna are all fisheries still in process of development.) Incomes of crews have improved in all rights based fisheries. For example, in the Lake Erie fishery, the number of crew decreased from 915 to 714 and average incomes increased from around $25K to over $40K. This all took place within a very short space of time (one year).

With respect to the Atlantic offshore groundfish fishery, side trawlers have been replaced with more efficient stern trawlers. The number of companies in the independent offshore group has declined from 18 in 1982 to 11 today. National Sea Products (NSP) had 52 trawlers in 1982 but has only to 41 at present: Fishery Products International (FPI) 71 in 1982 and 58 at present; other companies had 16 in 1982 and 16 now. FPI and NSP are large enough companies to realize the gains from internal rationalization. Incomes of trawler crews grew moderately over the period. The number of sea days per boat has increased for the two largest com-

Table 2
Changes in Numbers of Vessels in Selected Rights Based Fisheries

Fishery	Number of Vessels Before Rights Based Program	Number of Vessels at Present
Herring (4RTVn)	16	11
Herring (4WX)	49	40
Offshore groundfish	139	115
Offshore scallop (4X,5Ze)	73	61
Offshore Lobster (4X,5)	8	8
Lake Erie	248	242
Lake Winnipeg	800–1000	400–600

Source: unpublished reports

panies, Fisheries Products International (FPI) and National Sea Products (NSP), though it has declined for other operators.

For offshore lobster, the number of vessels has stayed the same but the fleet has been renewed with introduction of larger vessels. Average crew incomes grew from under $20K in 1984 to over $40K in 1986. For offshore scallops the number of license holders declined from 10 to seven. Crew incomes grew from $22K before 1983 to $37K after 1987. These rates of growth (15–40%) are considerably above the rate that wages grew in the fisheries sector during the same period (7%).

For 4RST and 3Pn groundfish, only limited success was achieved in shedding excess capital and labour. Participants in the program still obtained some economies in harvesting variable costs by eliminating the race for fish.[11] These savings were realized to a larger extent in the other programs (cited above) where there was also reduced excess capacity.

Overall, these programs (as does fisheries management generally) work best when labour and capital can exit (enter) reasonably freely. Especially in Atlantic Canada, concern with the employment objective means that this condition is not usually met.

Quota Values

All rights based programs result in a value or price being placed on quota. This is because quota convey a right to harvest (and implicitly sell) fish at prices greater than marginal cost. Quota are scarce relative to demand, and price is the way the market deals with scarcity. It is virtually impossible to determine these values with any precision because government does not recognize their existence either for fisheries policy or taxation purposes. Fishermen are understandingly wary of discussing values/prices of their quota because of obvious implications. Most quota trades are also part of a package which includes tangibles such as boats and this further clouds the issue.

The only reasonably neutral source of information is newspaper notices advertising availability of licences and quota and stating an asking price. However, these notices cover only a portion of sales and it is far from clear that they are representative of the population. Table 3 presents some data from such sources, but they should be treated with great caution. Nonetheless, these data clearly indicate that governments have created considerable wealth as a result of limiting entry and instituting rights based regimes.

Quota values are important because they can be used as a gross measure of the benefits to the participants of a rights based program. For example, one per cent of the 4WX herring TAC appears to be worth $76–100K.[12] This means that fishermen are willing to pay this amount to participate because the limited number of participants creates a preferred outcome.

[11] J. Jones and M. Murphy, D. Rowe, D. Dunn, "Toward an enterprise allocation program: Review of past management and future options in the otter trawl fishery of Western Newfoundland", unpublished report, Department of Fisheries and Oceans, 1987, p. 17.

[12] D. A. MacFarlane, "An economic assessment of the herring purse-seine fleet restructuring plan of 1983, the ten-year management plan at mid-term". Economic Commercial Analysis Report No 31, Department of Fisheries and Oceans, 1989, p. 16.

Table 3
Estimated Values of Licenses, by Fishery, March, 1990

		Value of Licenses
Offshore Tuna	Newfoundland	$100,000
Crab	Newfoundland/Nova Scotia	$40,000–100,000
Capelin	Newfoundland	$8,000–12,000
Inshore Groundfish	Newfoundland/Nova Scotia	$10,000–100,000
Lobster	P.E.I./Nova Scotia	$40,000–50,000
Shrimp	Quebec	$50,000–75,000
Scallop	New Brunswick/Nova Scotia	$100,000–200,000
Midshore Groundfish	New Brunswick/Nova Scotia	$200,000–300,000
Salmon	Pacific	$40,000–750,000
Herring	Pacific	$80,000–900,000
Sablefish	Pacific	$200,000–300,000
Halibut	Pacific	$70,000–200,000
Shrimp	Pacific	$15,000–150,000
Geoduck	Pacific	$130,000–400,000

Source: Data are based on informal surveys of a variety of sources (local fisheries officers, fishermen, lawyers, local fisheries trade publications, newspapers). They should be considered only as "ballpark" estimates.

The 4WX Purse Seine Herring Fishery[13]

The purse seine herring fishery in zone 4WX was developed as a fish meal fishery in the early 1960s to produce fish meal. Uncontrolled expansion of both fleet and plants coupled with low meal prices led to a near collapse of this fishery in 1974. The government intervened and barred the entry of additional purse seiners in 1974 pending a study of the problem. The study resulted in what were radical interventions in 1976. These interventions consisted of:

- Ban on harvesting herring for fish meal.
- Vessel quotas with daily and weekly catch limits to match processing capacity and designed to equalize catches among fishermen.
- Government assistance to fishermen to acquire the purse seine fleet, explicitly separating harvesting from the processing.
- Price support payments.

Processing companies were compensated for redundant capital as a result of lost fish meal production. Assistance was provided in such a way that they could acquire capacity to produce food herring. And perhaps most significant of all, the Atlantic Herring Fishermen's Marketing Cooperative was established to control harvesting and marketing of fresh herring.

Managing 4WX herring stock has always been a challenge. In terms of biology

[13] The authoritative references on the early years in this fishery are: Harry F. Campbell, "The Bay of Fundy Herring Fishery", Ottawa, Economic Council of Canada, 1981; and F. Gregory Peacock of Dougald A. MacFarlane, "A Review of Quasi-Property Rights in the Herring Purse Seine Fishery of the Scotia-Fundy Region of Canada" in Nina Mollett (ed), Fishery Access Control Programs Worldwide, Proceedings of the Workshop on Management Options for the North Pacific Longline Fisheries, Orcas Island, Washington, 1986.

Table 4
The 4WX Herring Fishery '000s Tonnes, 1977–88

Year	Total Allowable Catch (TAC)	Reported Landings Purse Seine	Landings All Gear
1977	109.0	117.1	117.2
1978	110.0	95.9	114.0
1979	99.0	59.0	77.5
1980	65.0	79.6	107.0
1981	100.0	87.7	137.0
1982	80.2	84.7	105.8
1983	82.0	84.4	117.4
1984	80.0	78.1	135.9
1985	125.0	112.4	112.4
1986	97.6	73.7	73.7
1987	126.5	101.2	101.2
1988	151.2	124.6	124.6

Source: R. L. Stephenson and M. J. Power, "Assessment of the 1988 4WX herring fishery", DFO unpublished CAFSAC Research Document. 89/59, Table 3, p. 15.

". . . the 4WX Atlantic herring management unit is clearly not a population in any definable ecological sense".[14] A retrospective look in 1983 at the 1978 stock assessment done indicated that ". . . the 1978 assessment overestimated stock size of the most recent year by about 90 per cent, and the quota derived by applying the management strategy fishing mortality (in this case F0.1 from the analytical model) to the stock size was too high by the same margin".[15]

Assessments of this fishery were even more difficult because of the state of near anarchy in quota compliance. One analysis of under reporting (Mace, 1985) estimated that 50 per cent of catches were not reported in some years. The effects of this are presented in Table 4.

The 1976 intervention gradually broke down. The Fishermen's Marketing Co-op splintered into rival groups. Misreporting became rampant with increasing collusion between fishermen and processors. By 1985, the Department of Fisheries and Oceans was spending $500,000 (total departmental enforcement budget in 1985 was $43.1 millions) on enforcement at the twenty odd landing sites. This was a 42 vessel fishery worth about $20 million (about one per cent of total Atlantic fishery) in 1985. Enforcement efforts have subsequently been stepped up, but still with only limited success.

As late as 1978, new large seiners were added to the fleet. This added capacity created pressure for an already overcapitalized fleet to cheat on quotas. In 1979, the Department of Fisheries and Oceans tried limited fleet separation to address existing problems. The number of purse seine vessels was limited in the Gulf of St.

[14] M. Sinclair, V. C. Anthony, T. D. Iles and R. N. O'Boyle, "Stock assessment problems in Atlantic herring in the Northwest Atlantic", Canadian Journal of Fisheries and Aquatic Science, 1985, p. 891.
[15] Ibid, P. 890.

Lawrence and each vessel received a reduced allocation to protect stocks and give more herring to inshore gillneters. But pressure on the 4WX herring stock did not abate, and probably increased.

The 1982 Report of the Task Force on Atlantic Fisheries (Kirby) devoted an entire Chapter (Chapter 20) to discussing the herring seine fleet. It recommended that government: "Implement immediately the assignment of transferable vessel quota to seiners, with the initial allocation distributed on the basis of relative catches in the past three years. The program would be managed by a board elected by current licence holders, with a federally appointed chairman."[16]

The Report also recommended a buy-back program in the herring fishery, and the adoption of "stringent measures to prevent misreporting of landings." The government accepted these recommendations, though it never did institute a buy-back program. In August 1983, two new interventions were made.

1. Fleet Separation: Part of the fleet (Scotia-Fundy fleet) was given exclusive access to Bay of Fundy and Chedabucto Bay (4WX) while another part (Gulf fleet) was given exclusive access in The Gulf of St. Lawrence and portion of Sydney Bight (4RT and 4Vn).[17]
2. Fleet Reduction: the combination of vessel quotas through purchases was to be encouraged within these two distinct fleets.

To ensure that investments in additional quota would not be diluted, the Minister of Fisheries and Oceans guaranteed the percentage shares between the inshore and purse seine sectors for a ten year period. The Minister of Fisheries and Oceans further guaranteed the following conditions for the Scotia-Fundy purse seine fleet:

- 80 per cent of the 4WX TAC would be assigned to purse seine vessels.
- no increase in the number of licences.
- no change in vessel quota policy.

The 49 vessel Scotia-Fundy[18] fleet was divided among 27 Class A licences (1.6% of 4WX TAC), 15 Class B licences (2.7% of TAC) and 7 Class C licences (2.33% of TAC)[19] (See Table 5). The trade and transfer of quotas was restricted by the Minister as follows:

- Class A could purchase class A.
- Class B could purchase class B.
- Class C could purchase class C.
- Class A or B could purchase Class C providing certain criteria were met.

[16] Report of the Task Force on Atlantic Fisheries, p. 336.
[17] Canada's Atlantic Region is divided into four fisheries management districts: (1) Scotia-Fundy consists of part of the Atlantic and the Bay of Fundy, (2) Gulf consists of the Gulf of St. Lawrence (excluding the part abutting Quebec), (3) Newfoundland consists of the North Atlantic, and (4) Quebec connects the part of the Gulf of St. Lawrence abutting the Province of Quebec (see figure 1).
[18] Sixteen seiners based in the Gulf of St. Lawrence are ignored for the remainder of this paper.
[19] Licences were classed as follows: Class A: Fishermen owned vessels with no history of participation in the 4W fishery during the period 1980–83 (non mobile). Class B: Fishermen owned vessels which participated in the 4W fishery during the period 1980–83. Class C: Vessels owned by herring processors either mobile or non mobile.

Table 5
Number of Licences in the Scotia-Fundy Herring Fleet, 1983 and 1988

	1988		1983	
	Number	TAC %	Number	TAC %
A Licenses	24	43.2	27	43.2
B Licenses	12	43.2	15	40.5
C Licenses	4	13.9	7	16.3

Source: DFO (Scotia-Fundy Region) Fisheries Management Plan: Herring 1983–1988.

Other rules regarding quota trades reinforced the restrictiveness and narrowed the scope for fleet rationalization. In particular,

- Owners of licensed vessels were allowed to accumulate quota not exceeding four per cent of the total.
- Any number of license holders was allowed to participate in the purchase of quota; however, a seller was required to divest his entire quota and exit the fishery on a permanent basis.
- Upon purchasing a quota, all purchasers were required to install or have a circulating fish chilling system to enhance landed quality.

No length or tonnage restrictions were applied to vessel replacement.

The purse seine fleet reform package was restrictive. It fell short of assigning full rights to the purse seine licence holders, but it represented one of the most clearly defined property rights to fish in Canada.

Indeed, the program has many provisions which hinder trading in rights. Specifically, the three vessel classes and the discrimination against backward integration with herring processors work to frustrate fleet rationalization. There is no economic reason for the four per cent limitation on TAC ownership, other possibly than to maximize employment.

The fact that the regime could expire within a ten year period has restricted its usefulness in rationalizing the fleet; as well, unless the current program is extended, there will be a so-called "last period problem" in 1993. Quota owners will wonder whether and how many new licences could be issued in 1993. This complicates decision making and creates an extra source of uncertainty. Another complicating factor is limited quota monitoring. If quota owners can acquire herring without buying quota, they have little incentive to purchase quota. Moreover, because the 4WX herring stock is not discrete, access outside the 4WX management area must be controlled to ensure a stable rights based fishery.

Some of these problems are not as unsurmountable as they might appear. Fleet rationalization has taken place and a market in quota has developed. Based on available (largely anecdotal) data, the price for one per cent of the 4WX purse seine herring quota since 1979 has ranged between $76,000 and $96,000 with no trend. In 1988, a 4 per cent quota was 5,132 tonnes of herring plus 104.0 tonnes in bait.

In summary, the rights based approach has helped to create a viable herring fishery in 4WX. The "right to herring" has been moderately successful as an

instrument for rationalizing the 4WX purse seine fleet, but who knows how successful it could have been if there had been no restriction on transferability.

The Offshore Groundfish Fishery

The Canadian offshore groundfish fleet expanded rapidly in the late 1960s and early 1970s. Operators wanted to increase their share of offshore catches before Canada declared a 200 mile fishing zone. However, the federal government imposed limited entry and vessel replacement restrictions (foot for foot and tonne for tonne) in 1973 to fight the overcapitalization that was occurring in the offshore fleet. The Department of Fisheries and Oceans in addition unilaterally canceled about 30 inactive offshore trawler licences in 1980. This reduced the number of trawler licences from 170 to about 140.

In 1977 the government established the Atlantic Groundfish Management Plan. Fish stocks were divided between Canadian and foreign allocations. The Canadian allocation was further split between offshore and inshore. Both the offshore and the inshore allocations were available to be fished on an open access basis. It was soon determined that this was a recipe for disaster.

In 1981, the offshore quota of northern cod (NAFO zones 2J3KL, see Figure 1) was caught within seven weeks of the start of the year. Through the late 1970s the fishery had remained open to the end of April before the offshore TAC was exhausted. Similar developments were also occurring with respect to other stocks.

Many subsequently charged the offshore companies with disorderly and ruinous harvesting. The Minister of Fisheries and Oceans called for the race for the fish to end. The larger offshore companies of the day—National Sea Products, Fishery Products, H. B. Nickerson and the Lake Group—devised the system of Enterprise Allocations. This quota scheme carved up the offshore fishery into company allocations by stock areas based on historical catches and adjacency. The "Big Four" left a pool of fish to be caught on a competitive basis by a group of smaller companies usually referred to as the Independent Offshore Group (IOG). The Minister announced the "experimental" EA program in 1982.

Following acceptance of the Report of the Task Force on Atlantic Fisheries, the Government of Canada began to restructure the Atlantic fisherieas.[20] In 1983, it suspended the new EA system to prevent the sale or transfer of quota. The delicate political balance among Canadian provinces required quota stability by province during discussions for a long term program. Anything less could have triggered a movement for provincial (rather than company) quota. The offshore companies did keep the EA program on an informal basis, however, and it was reintroduced in 1984 for a five year trial period.

Under the Enterprise Allocation program, quota are provided to National Sea Products Ltd., Fishery Products International Ltd. and the Independent Offshore Group (a group of smaller companies) as a percentage share of total offshore allocations (normally about 50 per cent of the total Canadian TAC). Table 6 provides a summary of EA allocations over the period 1982 to 1990. The program is managed through published regulations, monitoring of company reports, use of

[20] In 1983, Parliament passed the Atlantic Fisheries Restructuring Act to facilitate this process.

Table 6
Enterprise Allocations by Company, '000s of Tonnes, 1982–1990

Year	National Sea Products	Fishery Products International	Independent Offshore Group	Total
1982	195.3	178.8	57.5	431.6
1983	203.8	194.3	67.7	465.8
1984	208.6	193.0	75.9	477.5
1985	189.8	198.5	82.3	470.6
1986	182.4	205.2	83.5	471.1
1987	172.3	196.9	81.3	450.5
1988	170.6	183.3	81.9	435.8
1989	152.3	156.3	89.1	397.7
1990	123.2	117.0	88.3	328.5

Source: DFO Resource Allocation Branch, Atlantic Fisheries, unpublished reports.

on-board observers, and spot checks by DFO enforcement vessels. This program does not permit trading of quota but does permit bartering of allocations (one species for another) among program participants in any given year.

The permanent EA system introduced in 1984 was modified in 1986 after extensive consultations with industry and the provinces. The following changes were made:

- A formula was adopted to share TAC declines among EA participants.
- Access fees were charged, based on each company's EAs.
- Individual percentage shares were established for companies in the Independent Offshore Group.
- A reserve was established to improve utilization of EA's.

The Department of Fisheries and Oceans, in consultation with provincial Ministries, further reviewed and evaluated the EA program in 1987–88 in preparation for the end of the first trial period in 1989. The evaluation focused on five objectives:

1. EAs should reduce or eliminate the annual "race for fish".
2. EAs should reduce harvesting costs by encouraging better fleet utilization.
3. EAs should promote more efficient processing operations.
4. EAs should encourage increased fish quality.
5. EAs should promote deregulation of the fishery.

How did the program fare? Below, we look in turn at each of the above objectives.

Objective 1: Eliminating the Race for Fish

The long established race for fish resulted in gluts at plants and the production of too many fish blocks (rather than fillets or other more profitable product forms). As well, the concentration of production at the beginning of the year increased the cost of carrying product inventories. The evidence is fairly conclusive that the EA

program resulted in offshore effort being spread more evenly throughout the year. Capacity came to be used on a year round basis and there was a marked reduction in the production of blocks.

Objective 2: Reduced Harvesting Costs

The majority of economic benefits from EAs was expected to flow from meeting this objective. Following implementation of EAs, there was an overall downward trend in the number of vessels (see Table 7), but this does not tell the whole story. The fleet had been old and largely out of date at the start of the EA program. Most side trawlers would probably have been replaced by trawlers without the program. Since stern trawlers are more efficient than side trawlers, it is hard to draw conclusions on what the reduced number of harvesting days meant for overall effort (Table 8). To help clarify this, Table 9 provides an index of effort per trawler.

These data are still difficult to interpret. Both FPI and the IOG were affected by trawlermen strikes in 1984–85. As well, restructuring disrupted operations of FPI's predecessor companies operations during 1983. Trawler utilization appears to have improved after EAs were introduced in 1982. But it should be noted that improvement can mean fewer sea days per trawler in a fixed quota regime (such as is the case for the IOG quota). Both FPI and NSP have containerized catches and staying out longer means they are handling their catches more efficiently. (Both FPI and NSP have further to sail than most members of the IOG which explains to some extent the different adjustment strategies.)

Table 8 presents data on catch rates by vessel and by sea day. It confirms a general productivity improvement in catches by all offshore operators. This could be due to:

- Stock recovery.
- Technological improvement (stern trawlers replacing side trawlers).
- Enterprise allocations.

Table 7
Number of Offshore Vessels, by Company, 1978–88

Year	National Sea Products	Fishery Products International	Independent Offshore Group	Total
1978	47	70	12	129
1979	51	72	19	142
1980	51	70	17	138
1981	50	74	15	139
1982	52	71	16	139
1983	45	67	16	128
1984	45	60	16	121
1985	41	57	15	113
1986	41	58	16	115
1987	42	60	16	118
1988	38	60	16	114

Source: DFO, Resource Allocation Branch, Atlantic Fisheries, unpublished reports.

Table 8
Atlantic Trawlers, Performance by Type, 1978–86

Year	Number of Side Trawlers	Sea Days	Number of Stern Trawlers	Sea Days
1978	43	7,890	86	19,015
1979	46	8,047	96	19,783
1980	42	7,295	96	18,152
1981	40	6,711	99	19,050
1982	33	4,776	106	21,371
1983	26	2,954	102	17,134
1984	20	2,248	101	16,891
1985	11	1,396	102	20,488
1986	10	1,532	105	22,865

Source: DFO, Resource Allocation Branch, Atlantic Fisheries, unpublished reports.

Rationalization within the IOG has proceeded through mergers. There were approximately 18 companies in the IOG in 1982; now there are 11. These mergers obscure the issue of transferability since they essentially accomplished the same end as full transferability.

Companies have become increasingly attractive as takeover targets as quota become more valuable. The British Columbia Egg Marketing Board had egg quotas "tied" to farms from 1967–76. The number of producers declined by almost half through mergers.[21] Tied quotas did not prevent consolidation, so producer quota became transferable after 1976. Similar reforms could be contemplated for the offshore EA program.

Objective 3: Promote More Efficient Processing Operations

Production became more uniform throughout the year compared to the pre-EA regime. As a result, plants were more efficiently utilized under the EA regime than they had been before.

There is also some evidence, largely qualitative, of more specialized production by National Sea Products and Fishery Products International. Both companies have designated plants by species and as appropriate, trawlers are directed to those plants rather than to a designated home port. Specialized production of new consumer packs such as microwave fish trays has also been a positive development.

There is a general agreement in the industry that both FPI and NSP are more market driven than they were before EAs were introduced. The management of both companies changed radically with 1983–84 restructuring. Gardner (1988) analyzed this aspect of NSP and concluded that the company had ". . . gone from supply driven to a demand driven organization . . ." as the result of EAs.[22]

[21] T. Borcherding and G. W. Dorosh, The Egg Marketing Board: A Case Study of Monopoly and Its Social Costs, Vancouver: Fraser Institute, 1981, p. 13.
[22] Michael Gardner, "The enterprise allocation system in the offshore groundfish sector in Atlantic Canada", in P. A. Nehr, R. Arnason, and N. Mollett (eds.), Rights Based Fishing, Proceedings of the NATO Advanced Research Workshop on Scientific Foundations for Rights Based Fishing, Amsterdam: Kluwer Academic Publishers, 1989, pp. 293–320.

Table 9
Indexes (1982 = 100) of Average Sea Days Per Trawler by EA Participants, 1978–88

Year	National Sea Products	Fishery Products International	Independent Offshore Group
1978	107.3	122.2	74.7
1979	99.5	117.1	71.9
1980	99.5	98.3	85.4
1981	94.3	101.7	95.9
1982	100.0	100.0	100.0
1983	97.6	71.6	91.2
1984	103.8	63.6	77.2
1985	113.4	101.7	71.9
1986	120.6	116.5	79.5
1987	118.7	118.2	78.4
1988	111.0	110.2	81.3

Source: Calculations based on DFO, Resource Allocation Branch, Atlantic Fisheries, unpublished reports.

Objective 4: EAs Should Encourage Increased Fish Quality

A number of qualitative indicators indicate improvements in fish quality. Most important, containerization has replaced bulk storage aboard trawlers. Thirty seven such conversions have been completed or are planned. These conversions sacrifice carrying capacity for quality enhancing storage.

The introduction of trawl windows to limit tow size and reduce fish damage has complemented containerization. Dockside grading has been introduced to the NSP fleet to reward quality landings. FPI has moved in the same direction.

Objective 5: EAs Should Provide Deregulation of the Fishery

This objective has not yet been met. To prevent discards, DFO has instituted observer coverage for 100 per cent of foreign and 50 per cent of domestic offshore trawler fleet operation. Quota monitoring has also been a demanding activity in the context of EAs. And recent new regulations on net mesh etc. further complicate this situation, reducing the flexibility of companies to operate without regulations.

The regulations that became redundant under EAs, like seasonal closures and trip limits, were never very important in offshore groundfish management in Canada. In short, there is scope for considerable improvement in this area.

Conclusions

Canada has had limited but important experience with rights based fisheries management. As this article was being completed, new applications of such schemes were being made in fisheries such as Nova Scotia groundfish. This experience has yielded some important insights.

Table 10
Indexes (1982 = 100) of Catch Per Vessel and Per Sea Day for Offshore Trawler Companies

	National Sea Products		Fishery Products International		Independent Offshore Group	
Year	Per Trawler	Per Sea Day	Per Trawler	Per Sea Day	Per Trawler	Per Sea Day
1978	87.9	82.1	84.8	69.4	57.1	76.8
1979	89.1	89.4	91.5	78.0	55.6	77.5
1980	83.1	83.5	85.4	86.9	72.4	85.0
1981	88.8	93.9	97.4	95.8	83.5	87.3
1982	100.0	100.0	100.0	100.0	100.0	100.0
1983	99.3	101.9	90.6	126.4	107.5	117.8
1984	109.8	105.6	83.3	130.5	109.4	142.3
1985	122.9	108.2	115.7	113.7	135.1	187.7
1986	127.5	105.5	124.8	106.9	133.2	167.3
1987	111.1	93.6	116.3	98.5	126.1	160.7
1988	109.7	98.7	115.3	104.5	127.9	157.0

Source: Same as Table 9.

First, although economic theorists would not give Canadian rights based regimes high marks for completeness, there have been efficiency gains from granting rights and ensuring resource rent capture. Second, enforcement of rights is costly and demanding. If fleets are overcapitalized at the start of a rights based regime, there are pressures to cheat on quota. These can be avoided only by effective monitoring, which in turn is costly. Third, quota have been traded under EAs despite legal discouragement. Considerable wealth has been created and economic decisions are based on this wealth. For example, offshore companies on the Atlantic coast have been purchased as much for their EAs as for their business assets. Similarly, vessel quota in 4WX have been traded at considerable value despite restrictive conditions on such trades. Ways to recapture publicly these increased values need to be explored.

Neither biological factors nor the objective of maximizing employment appear to have been serious impediments to success in any of the existing Canadian rights based programs. The absence of divisibility and ready transferability has possibly slowed but not prevented the consolidation and rationalization of rights based program fisheries. Conservation pressures have complicated the application of rights based regimes, but overall they have not been a serious restraint. Most rights based program fisheries have shed both labour and capital, and the ability to do this is a important ingredient of success. Incomes of rights based program fishermen have in many instances increased substantially. Based on anecdotal evidence, quota in all rights based fisheries have become quite valuable.

The overall lesson from the Canadian experience is that a system of property rights can yield substantial benefits, even if the rights are attenuated. It is not a disaster if the original design includes extraneous objectives such as employment maximization or regional segregation of quotas. In any case, a regime can be refined over time with the active support of participants. The direction of Cana-

dian fisheries policy has been beneficial, though the pace and extent of change could be considerably enhanced.

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