Canadian Fisheries Policy: Challenges and Choices

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Les pêches océaniques posent de sérieux défis au Canada. Les problèmes comprennent l'effondrement du stock de poissons de fond de l'Atlantique au début des années 90, les conflits internationaux au sujet de la pêche en zones partagées et chevauchant les frontières, les conflits entre pêcheurs en compétition de même que les faibles revenus et la surcapitalisation dans plusieurs types de pêches. Nous présentons l'état actuel des pêches océaniques au Canada, évaluons sa gestion présente et passée pour prendre en considération ces problèmes et proposer des politiques visant à aider le Canada à profiter du plein potentiel de ses ressources maritimes.

Canada faces grave challenges in its ocean fisheries. The problems include the collapse of Atlantic groundfish stocks in the early 1990s, international disputes over shared and straddling fisheries, conflicts among competing fishers, and low incomes and overcapitalization in many important fisheries. We assess the present state of Canada's ocean fisheries, evaluate past and current management to address the problems and propose policies to help Canada realize the full potential from its marine resources.

> We have some of the world's most valuable fish resources, they are capable of yielding great economic and social benefits; yet many commercial fishermen and fishing companies are near bankruptcy, sport fishermen and Indians are preoccupied with declining opportunities, and the fisheries are a heavy burden on Canadian taxpayers. Peter H. Pearse (1982, p. 3).

Introduction

Canada faces grave challenges in the management of its fisheries. In the Pacific, serious concerns remain over the decline in certain salmon stocks, such as some coho and chinook runs; commercial, native and sports fishers are in conflict over allocation and fishing rights; and a dispute continues with the United States over interception of salmon that spawn in Canadian streams and rivers. In the Atlantic, most of the important groundfish fisheries have collapsed and are under harvesting moratoria, disputes continue over foreign fishing on Canada's continental shelf and many fishers have very low incomes.

The difficulties facing Canada's fisheries can be ascribed to the common-pool nature of fisheries, fluctuations in fish populations, and failures in omission and commission in policy. Despite the many

problems, some of which have existed for decades, we believe that changes in management could significantly improve the economic viability and the sustainability of our fisheries. To explain what these policies should be and what they can and cannot solve, we present an overview of the current state of the harvesting sector of Canada's ocean fisheries. We then review existing and planned fisheries management practices and strategies. Our perspective on how to begin to solve Canada's fishery problems, in terms of the harvesting sector, follows. It focuses on remedies for the common-pool problem, necessary institutional changes, ways to improve decision making by fishery managers and strategies to help resolve disputes over the management of shared and straddling fish stocks.

Current State of Canada's Ocean Fisheries

Canadian fisheries in 1993 directly and indirectly employed over 165,000 people and generated a total landed value of catch of almost $3 billion (Canada. Department of Fisheries and Oceans 1996*a*). In some provinces, such as Newfoundland, the fisheries are a major employer and throughout Atlantic Canada and British Columbia many small coastal communities depend on fisheries for their very existence. Harvesting moratoria on groundfish stocks in Atlantic Canada and a steep decline in the catch of some Pacific salmon species, such as coho and chinook, threaten the livelihood of many fishers and fish-processing workers. Overlaying these declines in the resources are low returns to fishers and overcapitalization in vessels and gear.

We examine the state of Canada's ocean fisheries from the perspective of the common-pool problem in fisheries, subsidies for fishers, current management practices and the disputes associated with shared and straddling fish stocks.[1]

The Common-Pool Problem

Perhaps the greatest difficulty faced by policymakers in fisheries is the common-pool problem where one person's catch is at the expense of someone else. Rivalry for the same resource leads to competition as fishers try to maintain or increase their harvests, which reduces the yields of others. Unfortunately, this competition often raises harvesting costs as fishers increase the size and power of their vessels and gear while failing to increase the sustainable harvest from the fishery, a harvest which is limited by the providence of nature.

If a fishery is open to all with no restrictions on entry, competition among fishers almost always leads to excess fishing effort and biological and economic overfishing. Where the total harvest from a fishery is regulated or controlled, but the behaviour of individual fishers is not, competition among fishers will increase the cost of fishing resulting in economic overfishing. These costs can be substantial. For example, Dupont (1990) estimated that removing redundant vessels from the British Columbia salmon fishery would increase net returns by $52 million. The returns from the fishery would increase by another $20 million if vessels were at their optimal size (Ibid.). Where fishers have little or no incentive to consider the effect of their individual actions on others, a fishery will tend towards a low-level equilibrium which provides poor returns to many fishers and which is neither resilient to natural fluctuations in fish populations nor changes in market conditions.

Despite limited entry, employment and the value of capital in the Pacific and Atlantic fisheries increased rather than fell over the 1970s and 1980s. In British Columbia, although the number of salmon fishing vessels declined from a peak of around 6,000 in 1969 to a little over 4,000 vessels in 1996, vessels have become larger, faster, and much more effective at catching fish. The improvements are such that some vessels are six times more effective at fishing than their counterparts 25 years earlier and thus the problem of overcapitalization remains (Grafton

and Nelson 1997). In Atlantic Canada, despite limited entry, the gross registered tonnage has increased in a number of important fisheries (Halliday, Peacock, and Burke 1992) and, prior to the collapse of the groundfisheries in 1992, thousands more were employed than two decades previously. The basic problem is that although the number of vessels may be restricted, the incentive for fishers to compete among themselves for a limited catch is not. The history of fisheries regulation in Canada suggests that fishers are often far better at devising ways to invest in their vessels and gear to compete with other fishers than are policymakers at devising regulations to restrict the inputs that fishers can use (Dupont 1996).

Subsidies

Overlaying fisheries management on both the Atlantic and Pacific coasts is a system of subsidies to the fishing industry which has exacerbated the common-pool problem and increased employment and the capital employed in fisheries. Since the 1970s, hundreds of millions of dollars have been spent collectively on federal deficiency payments, subsidies to build or upgrade vessels, and debt and interest write-offs (Crowley, MacEachern and Jasperse 1993). Canada's unemployment insurance system has also provided a significant share of the total income received by fishers. In 1990, unemployment insurance benefits for self-employed fishers in Atlantic Canada were on average over 80 percent of the income they received from fishing (Task Force on Incomes and Adjustment in the Atlantic Fishery 1993). This income support to fishers has encouraged people to enter and remain in the industry although earnings from fishing may be very low.

Management Practices

The overemployment and excess capital in fisheries has also had a negative effect on some fish stocks. In salmon fisheries a critical aspect of management is determining the correct number of "escapements" — the number of fish that are permitted to spawn. The more effective the fishing power of vessels, the less time it takes for fishers to harvest a given number of salmon. In turn, this reduces the safety margin when setting an opening, a period of time when fishers are permitted to catch fish, and increases the chance that an error may be made such that not enough fish are allowed to spawn. For groundfish species, like cod and haddock, the problem of excess fishing effort comes in the form of economic and social costs associated with reductions in a total allowable catch (TAC).

In fisheries where labour may have limited alternative employment, decision makers may trade-off the long-term consequences of not reducing harvests today, and its effect on the long-term sustainability of the fishery, with the short-run adjustment costs of fishers and fishing communities. This helps explain why decision makers are less quick to reduce harvests with a decline in the fish population than to increase harvests with a rise in the number of fish. This has resulted in such strategies as a "50 percent rule" which limited the reductions in the harvests of groundfish in Atlantic Canada from year to year (Charles 1995). Such an approach has led to overharvesting and has contributed to declines in some Atlantic groundfish stocks, such as Northern cod (Hutchings and Myers 1994).[2]

Setting the appropriate TAC for commercial fisheries is a difficult task, even in the absence of excess fishing effort and political considerations. Fisheries may be inherently chaotic and are subject to environmental shocks which can make it difficult to estimate current stocks and to predict future populations (Grafton and Silva-Echenique 1997). For example, in 1982 it was confidently predicted that the annual catch from Northern Cod would be 400,000 tonnes by the late 1980s (Task Force on Atlantic Fisheries 1982) — in fact, the fishery collapsed in the early 1990s and has been under a harvesting moratorium since 1992. In Canada, errors in prediction have been compounded by a decision-making process that fails to fully take into account uncertainty and risk and use all the information that can be provided by fishers (Stephenson and Lane 1995). In addition, decision makers have often failed

to reconcile scientific advice with the objectives of fisheries management that include biological, economic, and social goals (Palsson, Lane and Kaufman 1993). Too frequently, the focus of scientific advice is on what level to set the TAC (Underwood 1995) with too little attention paid to how, when, and where fish are caught.

Straddling and Shared Fisheries

Canada faces the problem of foreign harvesting of "Canadian" fish. In particular, fish that migrate between the exclusive economic zones (EEZs) of the United States and Canada — shared stocks — and fish that migrate to and from Canadian waters and the high seas — straddling stocks. At the time of Canada's declaration of a 200-nautical-mile fishing zone in 1977,[3] it was thought that the problem of foreign interception of "Canadian" fish in the high seas would disappear. In fact, the 1995 "turbot war" between Canada and the European Union (EU) indicates that problems still exist (Missios and Plourde 1996). The principal source of the conflict is foreign fishing vessels taking fish from parts of Canada's continental shelf that lie outside Canada's EEZ — such as the Nose and Tail of the Grand Banks.

On the Pacific coast an ongoing dispute between Canada and the United States and the states of Oregon, Washington, and Alaska exists over the interception of salmon that would otherwise spawn in Canadian streams and rivers (Munro, McDorman and McKelvey 1997). Despite a 1985 treaty between the United States and Canada designed to protect the resource and ensure that each country receives benefits in proportion to the production of salmon from its own rivers, an impasse remains between the parties that prevents long-term agreement on conservation plans (Canada. Department of Fisheries and Oceans 1996*b*).

Current Practices and Strategies

The collapse of the Atlantic groundfish stocks in the early 1990s, which put thousands of people out of work, and conservation concerns and low incomes in the Pacific salmon industry, are evidence that past policies have often been unsuccessful in ensuring economically viable and sustainable fisheries. We review current management practices and direct our discussion to the use of output controls, licensing policy, and co-management of fisheries.

Output Controls

A recognition that changes in fisheries policy are required has led to a number of important innovations in the past decade. To help address the common-pool problem and past failures of limited-entry regulations, the Department of Fisheries and Oceans has introduced individual output controls for fishers. By fixing output to individual fishing units, fishers no longer have the incentive to overinvest in vessels and gear merely to increase their share of the total harvest. Output quotas permit fishers to catch fish at the time that best suits them rather than in a mad rush before the TAC is exceeded. In several fisheries, output controls are transferable between owners of vessels licensed to fish a given species and are called individual transferable quotas (ITQs). Transferability allows lower cost fishers to increase their share of the total harvest by allowing them to buy quota from higher cost fishers. These transfers can, over time, reduce the excess capacity in the fishery and increase the net returns from the resource.

Currently, Canada has over 20 rights-based fisheries which in total account for over a third of the total landed value of fish (Macgillivray 1996). Although rights-based management has not been without its problems, such as the discarding of lesser-valued fish at sea so as to maximize the return per unit of quota,[4] most fishers under rights-based fisheries seem to prefer output controls over the fisheries regulations that were previously in place (Ibid.).

Licensing Policy

In tandem with a move to individual transferable quotas, the Department of Fisheries and Oceans is changing its policies with respect to licences that

govern access to fisheries. In the new regime, access to the Atlantic fisheries will be determined by a "core" licence which will be given to fishers who meet certain eligibility criteria. Coupled with these changes are significant increases in the annual cost of owning a licence on both the Pacific and Atlantic coasts. In the Pacific salmon fisheries, vessel licences are also now denominated by area with a separate licence required for each area coupled with a restriction to only use one gear type per licence. In addition, the Government of Canada has allocated $80 million for a buyback of salmon licences in the Pacific which has removed about 800 licences. In the Atlantic groundfish fisheries, $60 million has been spent to remove over 450 licences and accompanying vessels. The goal of these licence changes and buybacks is to reduce the number of vessels in overcapitalized fisheries so as to decrease fishing effort and increase the incomes of the fishers who remain.

Co-Management

The lack of appropriate industry and public involvement in fisheries decision making is seen as a critical factor in the failure of fisheries management to date (Pearse and Walters 1992; Hilborn, Pikitch and Francis 1993). A recognition of this problem is leading to greater co-management and partnership agreements between fishers, the Department of Fisheries and Oceans, and provincial governments (Anderson 1997). In part, these changes are motivated by planned budget cuts to the Department of Fisheries and Oceans of almost 25 percent from 1994-95 to 1998 (Mifflin 1996). Proposed changes to fisheries management and Canada's Oceans Act (Canada. Department of Fisheries and Oceans 1996*a*; International Ocean Institute 1996), however, do not give up the paternal, overriding powers of the federal minister and the ultimate decision-making responsibility in commercial marine fisheries.

Co-management involves decentralization of management responsibilities and requires that fishers take on greater responsibilities for fisheries and pay a greater share of the costs of management (Grafton 1992; 1996*a*). An example is the federal government partnership agreement with the British Columbia government over salmon fisheries. The agreement involves the creation of joint management councils and advisory boards (Canada. Department of Fisheries and Oceans 1997*a*), although management authority and responsibility remains with the Department of Fisheries and Oceans. Increased responsibilities for fishers are also to be negotiated under the rubric of "partnering" between the federal government and the fishing industry, and/or the local coastal municipalities who have a socioeconomic stake in fishing. For example, transfers of financial and operational management responsibility have devolved to fishers in some rights-based fisheries such as the British Columbia halibut and the Scotia-Fundy herring fisheries (Lane and Stephenson 1997).

Improving Canadian Fisheries Policy

Despite recent reforms in Canadian fisheries policy, a number of important changes are required if Canada wishes its fisheries to yield greater social and economic benefits. We propose that Canada expand the use of rights-based fisheries management, bring about institutional change both within and outside of the Department of Fisheries and Oceans, improve the process of fisheries management decision making that would explicitly consider multiple objectives and uncertainty, and use property rights to help overcome the problems of shared and straddling fish stocks.

1 Rights-Based Management

Rights-based fisheries management in Canada comes in three forms: individual vessel quotas that are non-transferable, individual vessel quotas that are transferable, and enterprise allocations that allocate quota to corporate entities rather than specific vessels. Collectively, rights-based management helps regulate fisheries as diverse as shellfish and groundfish in British Columbia to herring and offshore groundfish and shellfish in Atlantic Canada (Crowley and Palsson 1992; Grafton 1996*b*).

Overall, most rights-based programs have been successful at increasing the returns from the fishery while reducing the costs of management to the Department of Fisheries and Oceans (Grafton 1995; Crowley and Palsson 1992). In some cases, such as the British Columbia halibut fishery, ITQs have increased the length of the fishing season from just a few days to over six months which has eliminated a glut of fish and may have increased product prices by as much as 55 percent (Casey *et al.* 1995). The biggest difficulty with rights-based management has been misreporting of catches and highgrading — the dumping of lower valued fish at sea to maximize the return per unit of quota. Recent changes in Atlantic Canada to more dockside monitoring, the use of observers, and greater penalties for infractions have helped address some, but not all, of these problems.

Other concerns with Canadian rights-based management is the security of the property right. In some valuable fisheries, fishers not initially allocated quota were subsequently given access to fish (Grafton 1996*b*). For example, recently it was announced that all "core" fishers in Newfoundland with vessels under 35 feet in length will be eligible for a temporary snow-crab permit in 1997 and 1998. In addition, the quota for "temporary" permit holders will be increased by 42 percent (Canada. Department of Fisheries and Oceans, 1997*b*). This change in licensing policy encourages investment and employment over what is required to harvest the TAC and emphasizes the arbitrary nature of the property right, such that individual quota and licences can be disposed of at the discretion of the minister of fisheries. In addition to avoiding arbitrary changes to the property right, as practised in the snow-crab fishery, fisheries managers should also ensure that harvesting rights are both transferable and divisible so that those fishers who are able to harvest at a lower cost are permitted to increase their share of the total catch.

We address the use of rights-based management in two of Canada's most important fisheries — the Pacific salmon fisheries and the Atlantic inshore groundfish fisheries.

Pacific Salmon Fisheries

The nature of some fisheries makes it difficult to apply individual output controls, such as ITQs. For example, in salmon fisheries the estimated number of fish that can be caught, without jeopardizing the sustainability of the fishery, can vary enormously from year to year and must be continuously updated during the fishing season (Grafton and Nelson 1997). In such fisheries, which can be closed at any time to ensure a sufficient number of fish, ITQs may offer very little security to fishers and thus may not change their incentive to compete among themselves. To deal with problems of excess fishing effort and to help in conservation of the Pacific salmon stocks, the Government of Canada is implementing the so-called Mifflin Plan that includes a buyback of salmon licences, a licensing requirement denominated by gear type that restricts vessels to designated fishing areas for four years, and a provision for the stacking of salmon licences (Canada. Department of Fisheries and Oceans 1996*c*).[5]

We propose a change to the management system that does not restrict fishers to limited areas, would not involve a buyback of licences but would help solve a fundamental problem — too many vessels at individual salmon openings. These salmon openings, designated by time and place and gear, specify when fishers can harvest salmon and are strictly controlled to permit sufficient escapement of fish to spawn. Currently, the Department of Fisheries and Oceans only imprecisely controls the number of vessels by area licensing and gear restrictions. Too many vessels at openings leads to congestion and increased harvesting costs and also compromises the ability of fishery managers to ensure sufficient escapement. We recommend a rights-based system that uses fishers' individual salmon harvesting rights (FISHRs), a transferable property right in the form of annually exhaustible but renewable bidding rights or "chits" over the right to fish for salmon (Grafton and Nelson 1997). These chits would be allocated

gratis to current licence holders and would be used to bid for the right to be allowed to fish at salmon openings.[6]

Under a system of FISHRs, the number of vessels allowed to fish at an opening would be set by the Department of Fisheries and Oceans. At each salmon opening a reserve price, in terms of chits, would be set along with the number of permitted vessels. Salmon licence-holders would be free to bid as many chits as they like at any opening provided it does not exceed the amount they were allocated or were able to purchase from other licence holders. To ensure the effective operation of FISHRs, the bidding process would have to be to as flexible as possible and should allow for telephone bids and easy access to information about openings (Grafton and Nelson 1997).

A major benefit of FISHRs is the limit on the number of vessels per opening which provides a much greater safety margin when determining escapement and could also reduce racing behaviour and excess mobility, as well as congestion costs. If the number of vessels were sufficiently small, it could also lead to more co-operative and less competitive behaviour between fishers. Who would participate at an opening would be determined solely by competitive bidding by licence-holders using their FISHRs or chits, rather than money. The system would permit vessel owners to focus their bids at salmon openings that best suit them and, unlike area licensing, would not restrict them to a particular area of the coast. Transferability of FISHRs would enable more profitable licence-holders to increase their share of the catch by allowing them to purchase bidding rights from others. FISHRs are also flexible enough to allow, where appropriate, direct output controls such that successful bidders could also be allocated a share of the catch at any opening equal to their share of the total number of chits successfully bid at the auction. In addition, FISHRs also have the potential to reduce conflicts between Aboriginal and non-Aboriginal fishers because the government has the potential to buy FISHRs from one group and reallocate them to another.

Atlantic Inshore Groundfish Fisheries

The Atlantic inshore groundfish fishery is perhaps in the worst state of any natural resource in Canada. Most of the fisheries have been under moratoria since 1992. In response to this crisis, the federal government established a $1.9 billion program of aid called The Atlantic Groundfish Strategy (TAGS) which pays individuals between $11,000-$20,000/year and is expected to expire in August 1998 (Grafton 1996*b*). The TAGS program has been very effective in providing income support to displaced fishers and fish processing workers but it has not restructured the industry. Of the total $2.5 billion allocated by the Government of Canada under TAGS and a previous support program, just $60 million or less than 3 percent of the total funds, and less than a quarter of the $270 million allocated for buybacks, has been spent removing vessels and excess capital (Grafton 1996*b*).

Despite a change in licensing policy to "core" fishers and billions of dollars in expenditures, the groundfish fisheries will face the same problems of overcapacity and low incomes should the fish ever return in commercial quantities. Indeed, as of 1997, over 10,000 fishers are in the "core" group that hold groundfish licence-holders and less than 10 percent of the total fishing capacity has been removed from the fisheries (Auditor General of Canada 1997, chap. 15, p. 13). Rather than waiting to restructure the fishery, if and when the fish come back, it should take place as soon as possible. Restructuring the inshore fishery and eliminating redundant capital should be the highest priority during the moratorium period. The large corporate fisheries interests with major stakes in the offshore fishery have already taken major steps in this direction by selling off their offshore dragger fleet, closing plant operations permanently, and diversifying their fish supply opportunities abroad. Meanwhile, thousands of inshore fishers remain poised to "get back on the water" once the fishery is reopened.

We propose that individual transferable quotas, denominated as shares of TACs, be allocated *gratis* to all inshore vessel owners as a proportion of their catch histories prior to the collapse of the stocks. The ITQs allocated to these fishers would also be denominated by areas to provide management control over different sub-stocks of inshore fish. ITQs could, however, be transferable across regions. For the system to work effectively, the ITQs would have to be viewed as a durable and exclusive property right. ITQs could also be used in conjunction with local community management boards that could help regulate groundfish fisheries in well-defined areas along the coast.

Whether or not ITQs are coupled with local community management, the success of rights-based management in the inshore groundfisheries will depend critically upon adequate monitoring and enforcement. Dividing up the inshore into area ITQs would also provide an opportunity to experiment with different methods and technology for monitoring compliance (Apold and Guy 1996). As it is likely that different groundfish stocks will be reopened at different times, the monitoring system could be adapted and improved over time (Grafton 1996*b*). If implemented effectively, rights-based management has the potential to change the inshore groundfish fisheries from dependency on government support to a financially viable and sustainable industry.

2 Institutional Change

The institutions of fisheries management and income support, in the form of employment insurance, have shaped Canadian fisheries policy for decades. We propose changes that address the challenges faced by both the fishing industry and policymakers.

Fisheries Management

To improve fisheries policy we need an understanding of the environmental, social, and economic constraints faced by fishers and managers. Above all, policy must ensure that the fisheries are managed for the benefit of stakeholders in the fishery (Larkin 1988), that is, harvestors, processors, dependent communities, and consumers.

We recommend a re-engineered and interdisciplinary approach to fisheries where the fundamental goal is to support the operational management of the fishery.[7] We propose that support for fisheries management be based around interdisciplinary teams of fisheries experts including, for example, a biologist, an economist, a sociologist, industry and community representatives, a data analysis specialist, and a strategic planner all working together on issues directly related to the operation of a commercial fishery. The team's focus would be on developing a "bottom-up" operational management support perspective on where, how, and when actual fishing takes place. These teams would have the responsibility for managing the fishery from day-to-day operations through to longer term strategic planning while considering the interests of fishers, communities, and other stakeholders. Fisheries research would try to meet the goals of the fisheries management teams. Long-term research needs would be provided by an independent scientific body, separately financed, and with long-term pragmatic objectives. By contrast, current fisheries management separates areas of expertise, for example, biology, economics and policy planning, and operations, and is best described as a functional based "top-down" linear management process where TACs are set annually with little direct input from industry and social scientists (Lane and Stephenson 1995).

A reorientation of fisheries policy could be accomplished by establishing institutions that focus on overall fisheries management performance rather than separately on the disciplinary functions of biology, policy planning and economics, and monitoring and enforcement. For example, Canada's Department of Fisheries and Oceans is now organized into semi-autonomous branches of Science, Policy, and Operations. Consequently, for a given fishery, Science Branch activities are carried out independently from the other branches and for the most part are only loosely connected with the

development and implementation of management plans that are the responsibility of the Operations Branch. Alternatively, we propose a revised institutional arrangement for fisheries management that is activity-based (versus functionally-based), that is, it is focused on the interdisciplinary issues of a particular fishery, for example, groundfish, pelagics, invertebrates, and so on. Such a framework would require integration, coordination, and joint cooperation among all areas of fisheries expertise dedicated to the particular problems and issues of the fishery under investigation.

Income Supports

Regular and fishermen's employment (formerly unemployment) insurance have traditionally provided an important source of income support to fishers, especially in Atlantic Canada. Recent changes in both programs will reduce benefits to just 50 percent of insurable earnings for high intensity users (Human Resources Development Canada 1997). Despite these revisions, employment insurance will still provide an income support that permits individuals to be fishers who may otherwise need to seek other employment

The current system, even with recent changes, will provide an ongoing income support for an average self-employed fisher in high unemployment areas that will equal the earnings from fishing. The issue is not that providing support to low-income individuals and families — a cornerstone of Canadian social policy — is unjustified but that this support should be decoupled from participation in the fishery. Direct income supports for participants in a particular industry is distortionary and provides important financial incentives for individuals to remain fishing or to become fishers. Subsidizing individuals to go fishing on a common-pool resource encourages overexploitation and dissipation of the potential returns.

We propose, therefore, that the fishers' employment insurance scheme be eliminated and that income support, in the form of welfare, should be used to provide assistance to low-income individuals and families, irrespective of their participation in the fishery. To assist some "have not" provinces that would incur considerable costs and a rise in welfare rolls with such a change, the federal government could allocate the same funds currently paid in fishers' employment insurance in block funding. These funds, paid directly to the "have not" provinces, could then be used by provinces to provide welfare support based on need rather than participation in the fishery. Additional income support could also be provided through changes in the federal tax system.

We also propose reforms to the regular employment insurance system that would change the incentives for employers to layoff workers after they have received sufficient weeks of employment and earnings. In the current system, employees are penalized in terms of their benefit rate if they are high-intensity users of employment insurance. A reformed system should penalize employers who frequently lay off workers, taking into account the seasonal nature of fishing, by imposing higher employer premiums for employment insurance than the industry average. An experience rating system for employers may help avoid some of the high turnovers in the workforce in fish processing and could increase productivity.

3 Management Decision Making

Current decision making in Canadian fisheries management is based upon "standardized" principles such as maximum sustainable yield, targeted fishing mortalities, and an even more diffuse concept of "best use" that tries to encompass biological, economic, and social considerations (Sissenwine 1978; Parsons 1993). Unfortunately, standardized biological reference points have often been confused with management objectives (Wooster and Miller 1988; Smith, Hunt and Rivard 1993). Socioeconomic considerations, long recognized as important factors in fisheries management, have usually been left to the political decision makers and often appear to be in opposition to biological advice. Further, no

integrated decision-making framework exists to review and analyze socioeconomic or operational considerations, along with biological analysis.

We propose that Canadian fisheries management be changed to incorporate a specific methodology to integrate biological considerations with the economics of the harvesting and processing sectors and social aspects of fishing communities. This change requires a combination of fisheries science and management science together (Stephenson and Lane 1995) called "Fisheries Management Science" (FMS).

To implement FMS, managers require well-defined objectives and associated performance indicators, a structured form of decision making (Healey 1988), and a temporal and spatial focus to management. Objectives should be defined for the stock abundance estimates, industrial performance, employment, and administrative components of the fishery. Operational performance indicators associated with these objectives would include in-season estimates of spawning stock biomass and ongoing stock condition indices, *pro forma* statements of harvesting and processing components (including costs and revenues of fishers), employment statistics, and the cost of fisheries administration (including costs incurred in monitoring and enforcement or stock assessment). Performance measures would provide ongoing decision support information for developing analytical evaluations, integrated and strategic planning, and the development and evaluation of decision alternatives and projections of their implications on all aspects of the fishery. The fundamental principles of decision making in fisheries are embodied in the United Nations, Fisheries and Agricultural Organization's *Code for Responsible Fisheries* (FAO 1995) and in recent work of the Fisheries Committee of the Organisation for Economic Development and Cooperation (OECD 1997).

A framework for FMS already exists which uses stochastic models to provide a new foundation for decision making in fisheries management based on operations research (Hillier and Lieberman 1974; Lane 1989, 1992). A simulation approach and explicit consideration of uncertainty in decision making in fisheries is part of this broad-based framework (Hilborn and Walters 1992; Grafton and Silva-Echenique 1997). FMS also embodies the principles of "Management by Objectives" (Drucker 1954) which focus on: the setting of specific goals and milestones; participatory decision making where stakeholders have the responsibility and the means to contribute to decision making; and feedback and appraisal on the performance of goal attainment. Structured evaluation and a feedback approach is "adaptive management" (Hilborn and Walters 1992) and in the business environment is referred to as "Total Quality Management" (Deming 1982). Above all, it involves the monitoring of the effectiveness and continuous improvement of decisions by regularly adjusting the decision and control process using updated information.

4 Managing Shared and Straddling Fisheries

Canada faces two potential problems in the international management of its fisheries. First, it shares important fisheries with the United States, such as the Pacific salmon stocks, where there is the potential for American interception of "Canadian" fish in American waters. Second, the Law of the Sea Convention only gives Canada and other coastal nations extended fisheries jurisdiction 200 nautical miles off shore and not over the continental shelf. This has led to an ongoing dispute with the European Union over fishing outside of Canada's EEZ on the Nose and Tail of the Grand Banks which culminated in the arrest by Canada of a Spanish trawler in March 1995 (Missios and Plourde 1996). The ongoing conflict with the United States over American interceptions of salmon, which would otherwise spawn in Canadian waters, has led Canada to impose penalties on US fishers so as to encourage their cooperation. The penalties include fees for US fishing vessels that pass through Canadian waters on their way to Canada and aggressive fishing of salmon (Munro 1996*a*). The problem is that a resolution to the salmon dispute requires agreement by both countries

in addition to the states of Alaska, Washington, and Oregon. Unfortunately, in the case of Alaska, Canada can impose few penalties or offer incentives to lead to a cooperative outcome (Huppert 1995; Munro, McDorman and McKelvey 1997) because salmon first pass through Alaskan waters on their way to spawn in Canada and the states of Washington and Oregon.

The recently concluded United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (UNCSF) offers the possibility of resolving some of the conflicts associated with straddling fisheries (Barston 1995). Under the agreement, regional organizations have the authority to impose and enforce fisheries regulations. Thus, the UNCSF may change the Northwest Atlantic Fishing Organization (NAFO), first established in 1979 by Canada and distant water fishing nations to help manage fisheries in the northwest Atlantic, into an effective organization. For NAFO to be successful at encouraging cooperation among existing members, some mechanism must be found to prevent free entry of new member countries who may wish to take a share of the benefits of improved management. In addition, NAFO must devote adequate resources to monitoring and enforcement of the vessels of member countries. To prevent other countries free-riding on the efforts of NAFO members, entry into the organization should be permitted only after purchasing membership from an existing member (Munro 1996*b*). This approach, the creation of property rights and the use of side-payments to encourage cooperative behaviour, offers the promise of substantial benefits to Canada.

To be effective in solving the problems associated with shared and straddling fisheries, property rights not only have to be created on a country basis but also for individual vessels. If not, the common-property problem of overcapacity and rent dissipation will arise. One possibility is to create ITQs for straddling stocks which would be jointly managed, monitored, and enforced by a regional fisheries organization such as NAFO. The allocation of quota would be in two stages — one, a country allocation and two, an allocation to individual vessels within a country with transfers of quota across countries permitted. In this fashion, every fisher and member nation has a stake in the cooperative outcome. New members would be permitted provided that they bought a share of a country's quota and respected the rules of the organization.

A rights-based approach could also be tried for shared stocks such as Pacific salmon. For example, salmon fishing rights would be allocated to each country, and in the case of the United States by state, based upon the origin of the fish or other criteria.[8] Agreeing upon such allocations would be difficult but negotiations should be made easier if policymakers and fishers knew that both Canadian and American licence-holders would have the right to bid to participate at salmon openings, whatever the jurisdiction. Following an agreement on national and state salmon allocations, allocations could be then be made by state jurisdictions (or in Canada's case, the Department of Fisheries and Oceans) to individual fishers in terms FISHRs, provided the total allocation did not exceed the total agreed to for each jurisdiction. Fishers from any state in the United States and Canadian salmon fishers with chits would then be able to bid for the right to participate at any opening in any jurisdiction. Thus, Canadians would be allowed to participate in all American openings as would Americans in Canadian openings, provided they were successful in the bidding process. In this fashion, fishers themselves through their bidding would determine what fish were caught and where.

Concluding Remarks

Canada faces major problems in its fisheries including depleted fish stocks, low incomes in many important fisheries, overcapitalization in fishing vessels and gear, and ongoing disputes over straddling and shared stocks. In an effort to address these problems the Department of Fisheries and Oceans has

instituted a number of important changes in terms of fisheries management including a new *Oceans Act*, a move to co-management with greater responsibilities for industry, an increasing reliance on rights-based management, licence buybacks, and a shift in licensing policy.

We believe that further reforms are necessary if Canada is to realize the full potential from its fisheries. We propose four broad changes to fisheries policy. First, the further use of rights-based management in the form of bidding rights in the Pacific salmon fisheries and individual transferable quotas in the Atlantic inshore groundfish fisheries and enhancement of the security, divisibility, and transferability of property rights in existing rights-based fisheries. Second, institutional change in the structure of the Department of Fisheries and Oceans and the development of interdisciplinary management teams for commercial fisheries, as well as fundamental reform of the employment insurance program for fishers. Third, a shift in decision making from tactics and methods to strategies and planning that is adaptive, explicitly considers uncertainty, and is directed toward achieving well-defined and measurable environmental, social, and economic objectives. Fourth, the use of individual and state property rights to encourage cooperative outcomes in terms of the management of shared and straddling fisheries.

The proposed changes are, by no means, a panacea to the many and varied problems of Canada's fisheries. What they do offer is a fundamental shift in management that is forward-looking, objective-based, and adaptive; a set of incentives for fishers to help mitigate the common-pool problem; and mechanisms to help resolve Canada's international fisheries disputes.

Notes

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[1]The shortcomings of fisheries policy has been identified by others including Sutinen and Hanson (1986) and Wooster (1988). Past concerns have led to special governmental investigations such as Pearse (1982), Task Force on Atlantic Fisheries (1982), Task Force on Incomes and Adjustment in the Atlantic Fisheries (1993) and Parsons (1993).

[2]It is unlikely that the collapse of the Atlantic groundfish stocks can be attributed to any one cause, including overharvesting. Despite harvesting moratoria over the past five years only a few of the stocks appear to be recovering and there is evidence that adverse environmental factors, such as changes in water temperature, have contributed to the decline in abundance (de Young and Rose, 1993).

[3]Canada's 200 mile exclusive economic zone was not officially established until 1996 with the passage of Canada's *Ocean Act.*

[4]Copes (1986) provides a good review of the potential problems with individual output controls and Grafton, Squires and Kirkley (1996) describe the management of various ITQ programs in different countries.

[5] At the end of 1996, 798 licences had been purchased in the buy-out and about 400 licences had been stacked (Pacific Salmon Revitalization Plan Review Board 1996). The plan also involves loans to fishers who wish to purchase salmon licences from other vessels, a limited buyback of fishing gear made redundant by single-gear licensing, and $15 million for habitat restoration.

[6]A number of different initial allocations are possible. For example, all salmon licence holders could be allocated the same number of "chits." Alternatively, each of the three fleets that use different gear (seine, gill net, and troll) could be allocated a block amount of chits equivalent to their traditional share of the catch and then every vessel within each fleet could receive an equal share of the chits allocated to the respective fleets.

[7]This approach has been proposed in various forms by Royce (1984), Wooster (1988), Pearse and Walters (1992), Hilborn, Pikitch and Francis (1993), Stern (1993), Stephenson and Lane (1995), and Lane and Stephenson (1995).

[8]A similar approach has been proposed by Chan and Fujita (1994) but instead of using FISHRs they propose the use of salmon quotas that could be traded between the United States and Canada.

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