THE TRIALS BETWEEN HARMONY AND INVENTION: AN EXAMINATION OF HISTORICAL FISHING PRACTICES IN THE ENTERPRISE ALLOCATION PROGRAM IN ATLANTIC CANADA

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The Trials between Harmony and Invention: An Examination of Historical Fishing Practices in the Enterprise Allocation Program in Atlantic Canada

By

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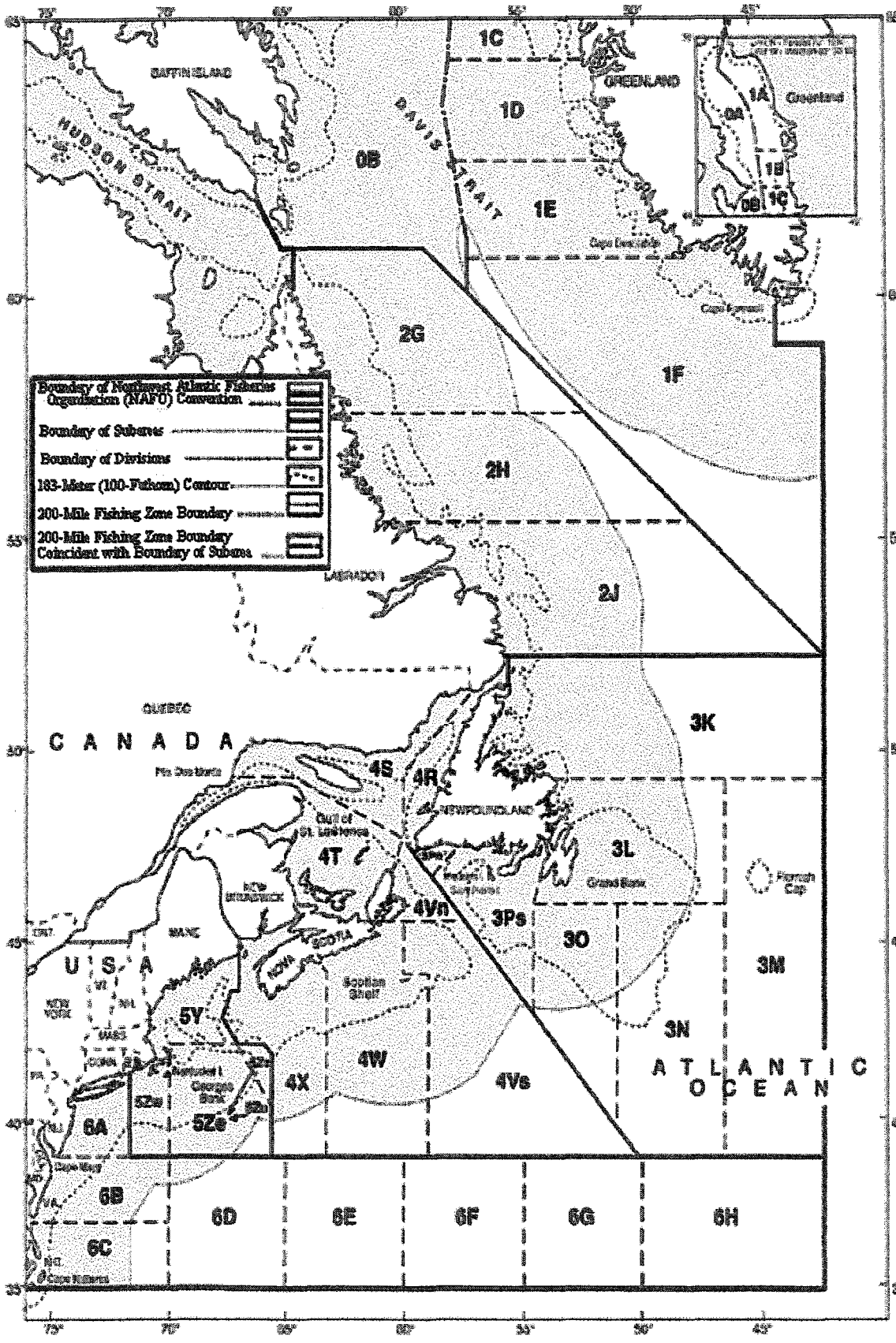
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183-Meter (100-Fathom) Contour
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CHAPTER 1

THE MOVE TOWARDS A RIGHTS-BASED FISHERY

With Canada's implementation of the 200 mile exclusive economic zone in 1977, came the hopes of a brighter, more prosperous future for those in the groundfish industry. An unfortunate result of moving foreign fleets outside of the 200-mile limit however, was the development of a Canadian fishing effort equally capable of depleting the resource. In response, fisheries managers, concerned about the offshore groundfish sector[1] began to experiment with quota licences referred to as enterprise allocations (EAs) -- a quasi-property right to harvest a certain quantity of fish. In theory, assigning individual or enterprise quota rights, whether by absolute quantities or percentage of the total allowable catch (TAC), encourages quota holders to cooperate in resource management, clearly defining shares in the current catch and also in all potential yields. This, in turn, should provide quota holders with a strong incentive to support sustainable fishing practices,

[1] Offshore groundfish sector is denoted by any vessel greater than 100 feet in length.

research, and stock enhancement. In practice, however, early evidence suggests a different story.

The Atlantic Groundfish Fishery: Its Future (1995), a report of the Standing Senate Committee on Fisheries states that:

> the evidence suggests that a major drawback to quota licence is the incentive they offer to misreport and intentionally reject [discard] low-value fish for higher-valued fish, especially if the individual quotas are too small to be economically viable. The practice of highgrading, in turn, imposed a heavier and costlier burden of enforcement, monitoring, and surveillance on fisheries managers (29-30).

The EA program was introduced to Canada's offshore groundfish fishery in 1982. Since then, this management system has produced the desired effect in so far as it has promoted efficiency and value-maximization behaviour among the companies. However, the evidence of improved resource management as expressed in motivation and behaviour is sparse and mixed. Angel et al. (1994) report a significant improvement in dockside enforcement through an industry-funded, dockside-monitoring program. Similarly, in a sociological study of the impact of Individual Transferable Quotas (ITQs) on stewardship (conservation ethic), Creed (1996) maintains that, "there is some credence in the claim that ITQs foster stewardship, even among those who are not

IQ owners, the crew and the captain" (73). In addition, she notes that those interviewed attributed the reduced level of illegal fishing to the introduction of square mesh, an industry funded dockside monitoring program, tough administrative sanctions, and the incentive to save fish for the future that the ITQ system made possible (73). Arbuckle and Drummond (1999) note that in a New Zealand ITQ for shellfish (scallops and oysters) a spectrum of informal and formal relationships within the industry, and between the industry, government and other stakeholders has developed. Further, self-governance initiatives in this fishery have contributed significantly to sustainable management. Similarly, in examining ITQs in Canada and the United States McCay et al. (1996) discovered that:

> Attitudes, if not behaviour, are indeed changing…Those who have invested in ITQs want to prevent quota busting by vessels that do not report their catch. They recognize that if fish are landed that are not reported it is not possible to use quota management for sustainable fisheries management (22).

However, not all are convinced of their benefits for conservation. Copes (1986) states that,

> There is no reason to assume that fishermen, where confronted with the rules of individual quota management, will lose either their ingenuity at circumvention of their incentive to

> promote individual interest at the expense of collective interest (132).

Similarly, Mace (1993) argues that "private owners cannot be counted upon to do the right thing for the resource and that therefore, government must retain its responsibilities in managing fisheries" (30). This argument is hinged upon the idea that property rights provide a greater incentive to misreport and highgrade in the short run, then to conserve resources for the future. In fact, this has been the experience for the Scotia-Fundy offshore groundfishery. Most regulations associated with quota management (misreporting, discarding, dumping, and highgrading) have not been enforceable. Moreover, many of these illegal fishing activities have increased as a result of EA and ITQ programs (Angel et al., 1994). In *A Report Card on Quota Management: The Scotia-Fundy Groundfish Experience (1994)*, Sinclair and colleagues contend that after the introduction of the enterprise allocations in the offshore groundfish sector, there was a slight reduction in fishing effort and fleet capacity. However, the expected benefits in better fishing practices (as suggested in Kirby, 1983) have not been realized.

> They [vessel captains] discard and dump beginning with the smaller fish of the most restrictive quotas (highgrading) or the entire catch of

> prohibited species, in order to stay on the water to fish for available quotas" (37).

1.1 THESIS RESEARCH QUESTION

The purpose of this thesis is to determine if an ethic of conservation arose as a result of the implementation of quasi-property rights in the Scotia-Fundy offshore groundfish fishery between 1983 and 1993. Focus is on past and present fishing practices to determine whether attitudes and behaviours have changed to reflect the connection between present fishing practices and the future sustainablity of the groundfish fishery. The study argues that there is some evidence to conclude that participants in the industry are becoming more conservation minded. Further, some companies have taken a proactive approach such that the mistakes of the past will not be repeated in the future.

1.2 THESIS ORGANIZATION

The organization of this thesis is as follows: Chapter 2 outlines the historical development of Canada's offshore fishery and traces its progression from a small boat, inshore fishery to the modern day offshore trawler fleet. A prevalent theme in this chapter is the effects of

technological innovations on the fishery and the resources in the Northwest Atlantic.

Chapter 3 describes the evolution of fisheries management philosophy in Canada from common property (open access) to quasi-property rights. It also discusses the theory underlying a rights based approach to fisheries management.

Chapter 4 reviews the methodology used in this study. This chapter commences with a brief summation of the benefits of utilizing a combination of quantitative and qualitative methodology. From there it proceeds to discuss the research project; sample and setting, selection of interviewees, interview protocol, ethical considerations, data collection and analysis of collected information.

Chapter 5 presents research findings drawn from the data obtained from the industry participant interviews, discarding data on observed and non-observed vessel trips, and the measurement of variance in length frequency data on land and at sea. As well, past and present fishing practices are described, paying particular attention to the movement towards a conservation ethic and potential self-governance in the offshore groundfishery.

Chapter 6 briefly restates the research findings and conclusions. Policy implications for future fisheries

management initiatives are explored in light of the research findings.

CHAPTER 2

HISTORY OF CANADA'S OCEAN FISHERY

2.1 PRE-MODERN PERIOD - Beginnings to 1945

Atlantic Canada's ragged coastline and painted landscape has lured a hardy breed of men and women to settle on its shores (Pope, 1997). Starting in the sixteenth century, Europeans came for fish and for the next two hundred years, French and English fought over the question of fishing rights and access to the lucrative near-shore and mid-shore fishing banks (Innis, 1954; Kurlansky, 1997; Briere, 1995). For more than two hundred years, the fishery has been the mainstay of the regional economy. Although many have left for one reason or another in recent years, the fishery remains prominent in all Atlantic provincial economies.

In its infancy, the industry was characterized by community-based, low-tech, small boat, and credit based inshore operations. As a result, it was slow to develop and had not attracted the large capital investment that marked patterns of commercial development in the fisheries of other parts of the world. Nonetheless, by the end of the twentieth century, a number of technological innovations affected this industry. Time would prove that these changes

would revolutionize the industry from a seasonal wet/dry, salted fish market to year round production of fresh/frozen fish for North American consumption. The most significant of the technological advancements contributing to this transformation was the development of the steam or gas-powered trawler, and refrigeration allowing longer preservation of the product (Innis, 1954: 422-28, Sinclair, 1985:57-65).

By the end of the 19th century, fishers in Atlantic Canada caught a variety of species including herring, mackerel, and lobster. But, the mainstays were dermersal species or groundfish -- cod, haddock, pollack, and hake. The industry's fish catching technology had changed little from that introduced by French, English, and Spanish fishers in the 16th century (Innis, 1954; Abreu-Ferreira, 1995; Briere, 1995). Fish were caught on handlines or longlines and were preserved by wet salting or a combination of salting and air-drying. This method of production persisted because dried saltfish stored and transported well, and had a considerable shelf life (Briere, 1995). The majority of Canada's dried saltfish was exported to Southern Europe and the Caribbean. Generally, the Caribbean markets accepted lower quality fish and were dumping grounds for fish not wanted by other markets

(Innis, 1954: 426). By the end of the 19th century, Norway and Iceland had taken over most of the valuable Southern European dried fish markets in Spain, Portugal, Italy, and Greece. This had an unsettling effect on the Canadian dried fish trade (Candow, 1995: 144-46).

By the early 1900's, the development of rail transportation made possible fresh fish markets in Quebec, Ontario and the Northeast United States from major shipping destinations in the Maritimes. The fresh fish trade began to assume a significant proportion of the market, and grew rapidly. Initially, high transportation costs restricted fresh fish shipments to more expensive varieties such as halibut or salmon. However, with technological improvements in freight refrigeration and improved rail scheduling, a wider variety of species were exported. Improvements in quality, cost and speed of service soon enabled the fresh fish market to establish itself as a viable alternative to dried fish.[2]

Despite improvements in transportation, fresh fish dealers had to contend with seasonal variations in the supply of fish. During the summer, there was a consistent

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[2] "The fresh fish exports from Canso grew from 162 in 1891 to 970 tons in 1895, and to 1,450 tons in 1900" (Balcom, 1997).

supply of fresh fish from inshore fishers.[3] In the winter, however, fishing was contingent upon favourable weather conditions. The year round demand for fresh fish provided the stimulus for the development of a new winter fishery. Sailing from Halifax and Lunenburg, and using longlines to catch cod and haddock, a fleet of fishing schooners began to make 7 to 10 day trips to the western banks. At times, and dependant upon good weather, it proved to be successful in supplying fresh fish to winter markets (Balcom, 1995: 187-88).

With improvements in transportation and emerging markets were simultaneous efforts to increase production. Fishers considered adopting the then current British fishing technology, the otter trawl.[4] The first experiment in Nova Scotia with otter trawl fishing took place in December 1897. A.N. Whitman and Son of Canso, acquired a

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[3] Inshore fishers benefited from the fresh fish trade. They received immediate returns for their fish, instead of waiting until the end of the season which was often the case in the dried fish fishery. In addition, fishers were getting a higher price for fresh than for dry fish.

[4] Prior to the development of the otter trawl -- forerunner to the modern dragger or trawler -- fishers in the North Sea were experimenting with a beam trawl. An oak beam (12ft long) was attached to a woven mesh net, and used to keep the mouth of the net open. In addition, runners were attached to each end of the beam to keep the net off the bottom, reducing the resistance of the seafloor. With the early designs, sail power was used to tow

wooden steam trawler *Active* from Aberdeen, Scotland, and outfitted the vessel with otter boards and trawls. (Balcom, 1995: 188) Otter boards were large rectangles of wood weighted with lead and iron. Each wing of the trawl had an otter board attached to it by a steel cable connected to the vessel. When under tow, the otter boards forced the mouth of the net open by directing water pressure inward, while their weight kept the trawl on the bottom. The bottom part of the net (the jaw) was fitted with footgear comprised of metal bobbins, or rollers that bounce along the seafloor. The top of the net (headline) was outfitted with floats that lift the upper lip of the net, giving height to the opening (Rogers, 1995).

Unfortunately, the experiment was a failure. Whitman reported that the vessel was too slow and did not have the power to pull the net fast enough (Rogers, 1995; Balcom 1997).

Despite the failure of the *Active*, interest in trawler technology continued to flourish. Reports of fishing success using the otter trawl began to spread from fishing ports around the Maritimes (Innis, 1954:423). At the same time, inshore fishers began to protest the use of domestic

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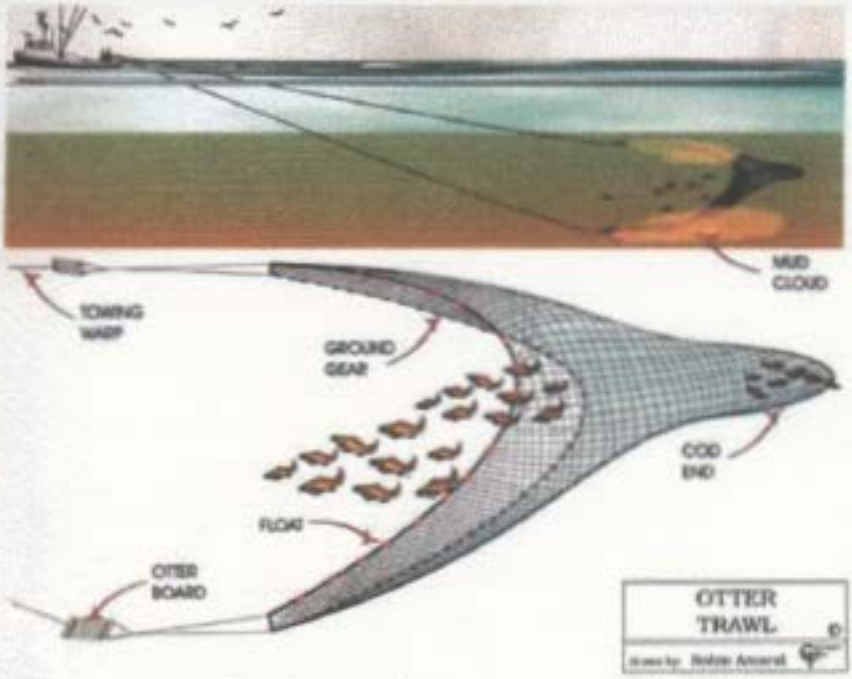
the net. However, soon afterwards, sail power would be replaced with steam and diesel.

SMOLOWITZ FIGURE 3 (page 49) A bottom trawl. Drawing by Robin Amaral.



trawler technology, and what they saw as potential monopoly and corporate control of the fresh fish industry (Balcom, 1995; Rogers, 1995).

Source: Smolowitz, Ronald. "Bottom Tending Gear Used In New England" in Effects of Fishing Gear on the Seafloor of New England.

With World War I came opportunities and constraints for the new industry. Increased demand for fish, coupled with an interruption in the ability of European competitors to fill the demand,[5] resulted in a considerable increase in fish prices. However, wartime competition for capital and labour limited new vessel construction, and the ability of fishing interests to capitalize on the situation. As a result, very few, if any, new trawlers were introduced to the fleet.

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[5] The outbreak of wartime hostilities made the northeast Atlantic unsafe for fishing.

By late 1918, the war had ended, and strong fresh fish markets in the United States encouraged a growth of the trawler industry. At the same time, stream trawlers were beginning to demonstrate their efficiency in production. Balcom (1997) states that in "1903 an excellent catch for a schooner on a ten-day trip was 170,000 lbs. By 1925, a steam trawler could catch twice that in half of the time." (190) Similarly, Innis notes that,

> diesel engines heightened the efficiency of trawlers and contributed to a marked increase in catch, especially after 1928. In 1931, 58 percent of fish landed were caught by trawlers and draggers. (242)

This dramatically increased catching capacity and prompted inshore fishers to demand curtailing their use. The 1927 Royal Commission investigating the problems of the East Coast fishing industry provided a forum for the trawler controversy. The indictment against trawler technology was focused in two general areas: conservation of fish resources and economic problems (the protection of fishermen). It was feared that trawlers would damage cod and haddock spawn, feeding grounds, and destroy fish recruitment by the indiscriminant catching of undersized juvenile fish. The commission stated that although most of the allegations against trawler technology were

inconclusive, there was, however, enough evidence to conclude that trawling had the potential to be destructive to juvenile fish such that there would "ultimately be very serious depletion of the fisheries."[6] The commission recommended that a ban be placed on the introduction of new trawlers, and strict controls on the use of existing trawlers. As a result, the number of trawlers fishing Atlantic Canada's waters did not increase significantly in the next two decades. During the same period, the advanced fishing nations of the world increased their catching capacity using this new technology while the Atlantic region remained a small boat fishery with only marginal growth in yearly groundfish production (Balcom, 1995).

2.2 MODERNIZATION 1945-1977

The end of World War II brought a sense of optimism throughout the Canadian economy. The government of Canada turned its intentions towards industrial development, playing a proactive role in the development of a new, modern fishery. In doing so, it forever changed the role of the state in the Atlantic fishery. The federal Department

[6] Quoted in Balcom (1997), p. 92-93 from the Royal Commission Investigating the Fisheries of the Maritime Provinces [1928].

of Fisheries and Oceans, led by the Deputy Minister of Fisheries, Stewart Bates argued, in 1944, that in order for Canada to take its rightful place among other leading fishing nations, it had to "modernize" its fishing industry (Bates, 1944: 111). For Bates, the term modernization did not mean building bigger, more powerful vessels; it implied adopting new attitudes, and values, moving away from old trading systems, and focusing on the emergent North American consumer culture. Bates argued that the two main sectors of the fishing industry -- fresh/frozen fish (trawler fishey), and the inshore fishery -- were undercapitalized, inefficient, and lacking in the technology necessary to increase production (Bates, 1944:11-12). Further, he maintained that future success was predicated on the consolidation and centralization of the fishing industry.

> The tardiness of development has allowed interests that were vested in the older forms of the fish trade (particularly saltfish) to maintain their influence, their outlook and vision over most of the fishing industry and its associated institutions. Even the techniques of production in fresh fishing has tended to be confined within the horizons of those interested primarily in the older branch of the trade. (Bates 1944, 33)

A fully modernized fishery needed new technology -- trawlers, mechanized cold storage, refrigerated

transportation -- but more importantly, a new spirit of enterprise, and a vision of the future that would filter through the entire Atlantic fishing industry. Clearly apparent throughout the Bates report was the assumption that the fresh/frozen fish industry offered the best hope for the future. A modern offshore industry using trawlers and large-scale processing had the greatest potential to attract significant capital investment (Wright, 1997). The government could and should he argued take a proactive role in assisting the modernization and development of this fishery.[7] He maintained that by developing an offshore fleet that operated year round, it would make better use of large fisheries resources - reducing unemployment, economic inequality, and poverty (Bates, 1944: 111). He explained that one of the key goals of modernization was to raise fisher's incomes by encouraging them to fish more efficiently and productively.

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[7] In the post World War II period, two approaches were applied to economic problems by western governments: Keynesian, and modernization. Although both involved fostering capitalism, Keynesianism was applied in areas already industrialized, whereas the modernist approach tended to be used in underdeveloped regions. According to the modernist paradigm, traditional societies needed to be infused with capital, technology, and education in order that they may become a modern, capitalist society.

Many of Bates's views regarding the direction of fisheries policy for Atlantic Canada occurred. The domestic fishery adopted many of the modern developments; new technologies in fish finding, catching, and processing.[8] Moreover, capital was attracted to the fishery as economic conditions improved; and more importantly, the industry experienced a period of relative stability. This new optimism provided the incentive for change at the corporate level - the formation of National Sea Products (NSP) in Lunenburg, Nova Scotia. With trawler fleets for harvesting and processing plants for handling fish, vertical integration began to characterize the groundfish industry. Through a series of mergers and acquisitions, National Sea Products grew to become one the biggest fishing companies in the world (Barrett, 1984).

In 1949, the ban on development of a Canadian trawler fleet was lifted, and programs of government incentives were designed to assist in the modernization of the domestic fishery. By 1962, the domestic offshore trawler fleet numbered thirty-seven vessels, a sign that Canada was

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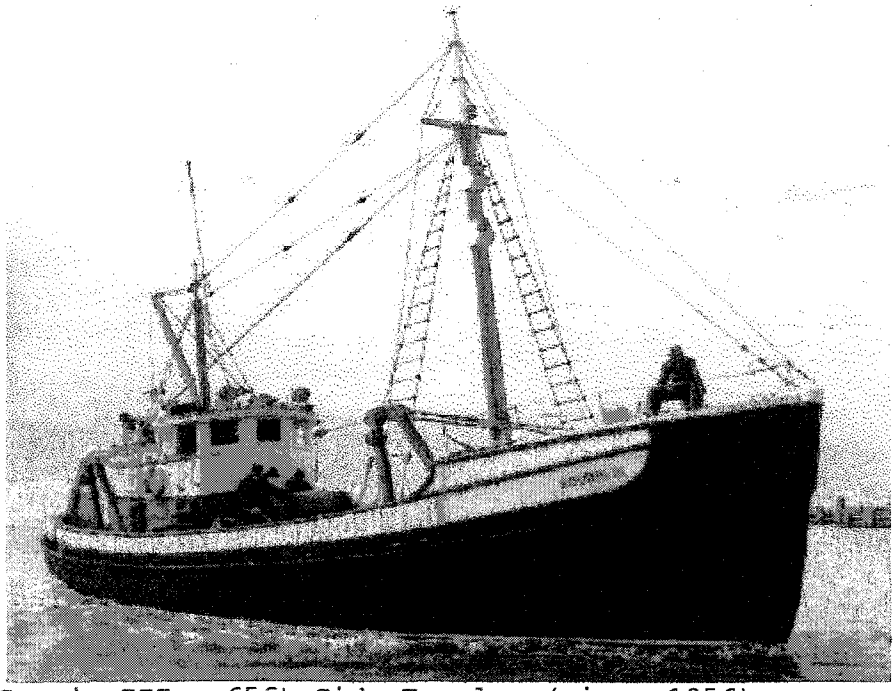
[8] The most significant Canadian contribution to fisheries technology was the development of the Atlantic Western trawl. This was a four panel or box trawl that provided a greater vertical opening and much better catches of high-swimming species like cod and haddock.

equipping itself to compete with the foreign offshore fleets fishing in the northwest Atlantic (Barrett, 1984).

The side-trawler was soon replaced by the new stern trawler. With wheelhouse moved forward to create more workable deck space as well as to accommodate the stern ramp, it made it possible to haul a much larger net up the stern of the vessel.



Souris III - 65ft Side Trawler (circa 1956)
Source: www.iosphere.net/~ian/boats/trawlers.htm

More importantly, it allowed the fleet to fish in rough conditions; the vessel could be kept bow to the waves and wind while the net was being hauled aboard.[9] Given the long

[9] In rough conditions, the side-trawler had to lay "side to" the wind when hauling the net, greatly increasing the chances of getting knocked over. This limited the amount that a side-

distance traveled (up to 200 miles offshore), and the variability

National Sea Products Stern Trawler
Source: National Sea Products Achives

of weather conditions in the Northwest Atlantic, these changes greatly increased the effectiveness of this technology. The influence that these technological transformations had on the offshore fishery cannot be understated. They led to an exponential growth in the index of fishing effort -- a combination of days fished by gross tonnage - and record catches landed (Blake 1997: 208).

In 1954, the British successfully introduced the first factory freezer\stern-trawler, *Fairtry*, and forever altered the nature of fishing throughout the world. Prior to the

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trawler could haul per tow. This was only one of the disadvantages when compared to the new stern trawler technology.

introduction of the factory trawler, fishing technology had been restricted to fishing relatively adjacent to processing plants and markets. The *Fairtry* changed all of this. Distance was no barrier and the rewards were great -- 600 tons of groundfish could be caught and processed in 40 days. The harvesting of fish became a global pursuit.[10]

> At more than 280 ft. in length and 2,600 gross tonnage, it was the first trawler that combined stern-trawling with on-board filleting machinery, freezing capability, and a fish reduction (fishmeal) plant; it became a model for a generation of fishing vessels (Blake, 1997:208).

With open access to groundfish stocks outside Canada's three-mile limit, these massive vessels could exploit Canada's adjacent fish resources like never before. By the 1960's, many other nations began to fish the Canadian Continental shelf. Poland, East Germany, Spain, Portugal and Japan -- one of the largest fishing fleets in the world -- sent factory trawlers to the Grand Banks. Scott and Neher (1982) stated that:

> Following the Second World War, a virtual fishing explosion took place in the northwest Atlantic as steel, steam-powered fishing vessels with fish-finding devices and improved gear began to dominate the offshore fisheries… By the 1950s there were many cases of concentrated fishing

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[10] Blake (1997) reported that by 1956, the Soviet Union had a fleet of 24 factory freezer trawlers identical to the *Fairtry* fishing on the Grand Banks, and within 2 years 11 more were added.

> decimating certain stocks, and general overfishing became the order of the day. (18)

A resource that, at the beginning of the century, was believed to be boundless[11] was under attack and Canada was either unwilling or unable to stop the pillage. Despite the warnings of scientists and fisheries managers about the possible consequences of overfishing and resource depletion, fishing continued without regard for conservation. Foreign fleets targeted the traditional groundfish species, cod, redfish, haddock, and flatfish but also developed new fisheries, with disastrous consequences. Essentially, the international fleets would target one species, and fish it until catch rates fell to an unprofitable level. They would then move on to another species and repeat the cycle. Significant offshore regulation did not emerge until 1977 when Canada declared a 200-mile economic management zone.

In Canada's domestic fishery, the offshore sector continued to grow through the postwar years to a place of dominance in the domestic groundfish fishery.[12] Much of the

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[11] J.J. Cowie, a scientist for the Canadian Fisheries department in the 1920s declared that the resources in the oceans were infinite, and not in any way vulnerable to overfishing.

[12] In 1981, the offshore sector caught 43% of all groundfish (Kirby, 1982).

growth involved the production of new offshore trawlers whose construction benefited from government subsidies and low interest loans. Barrett (1983) reports that for the period of 1974 to 1982, the federal Department of Regional and Economic Expansion (DREE) provided over $64 million in assistance to the offshore sector. As a result of the rapid expansion of the trawler fleet and shore-based processing facilities, the offshore catch and production in Atlantic Canada increased dramatically. By 1981, DFO reported that there were 152 registered vessels in the domestic offshore trawler fleet.[13] For some it was a sign that Canada's fishing industry had finally matured. Yet, there were many others that argued that the government had built a house of cards by encouraging overcapitalization that could not be sustained by the exploitative harvesting rates or the uncertain marketplace.

While most of the basic characteristics of the present day groundfish industry had been established by 1974, another set of familiar, but not totally predictable, circumstances occurred in that same year, i.e., the apparent six to seven year cycle of boom and bust. In 1967 the groundfish industry experienced declining end markets due to a recession; this resulted in an industry-wide

[13] Registered fishing vessels over 100 feet in length.

crisis of sufficient proportions to warrant the provisioning of government aid (there had also been a significant downturn six or seven years earlier). In 1974, the crisis was further exacerbated by declining catch rates and greatly increased fuel costs. The industry -- particularly the large trawler companies-- was on it knees. The Canadian government responded in two ways: it provided short term aid to the industry in order to tide it over the crisis period; and it carried out an extensive policy review which did much to influence future fisheries policy formulation.

2.3 EVOLUTION OF FISHERIES MANAGEMENT APPROACHES 1945-77

In the immediate post World War II era, there appeared to be little, if any, need to regulate the Northwest Atlantic fisheries, which at that time were an international common property resource (uncontrolled exploitation). Since most species were not thought to be exploited at anywhere near their potential, fishery resources appeared to be limitless. However, the appearance of foreign trawler fleets in ever increasing numbers beyond nautical jurisdictions, and past experiences with declining catches due to overexploitation seen in other fisheries, was sufficient inducement for all the major national

players to set up the International Commission for the Northwest Atlantic Fisheries (ICNAF) in 1949. Throughout the 1950's, ICNAF's mandate was to undertake research to better understand the growth and behaviour of fish stocks and bring order to the fishery by establishing minimum mesh sizes to reduce the catch of small groundfish.[14] This mandate was expanded in the 1970's to include control of the exploitation rate, establishing a total allowable catch (TAC) with annual quota allocations for the member states for various stocks (Mocklinghoff, 1973). ICNAF took this regulatory action because of the decline in abundance of groundfish stocks during the 1969-75 period. These new policy initiatives were difficult to enforce; there were no mechanisms to ensure that countries would abide by their allotted quota. Further, even if a nation was in violation of a regulation, there were no sanctions available to deter such behaviour in the future. The result was considerable overfishing on the part of member nations (Blake, 1997; Pinhorn and Halliday, 1990).

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[14] By the mid 1960's, some ICNAF members were warning that fishing activity was approaching, or had already exceeded the maximum sustainable yield for several of the most valuable groundfish species. Further, the ICNAF has done little to deal with the problem of overfishing, and that something had to be done to curtail the fishing effort.

The fisheries management objective fundamental to ICNAF operation was the Maximum Sustainable Yield or (MSY) -- the maximum amount of fish that can be removed from a population per unit of time without affecting the sustainability of that population. (Finlayson, 1994) This measure was widely accepted because it was based on a physical measure of the amount of fish caught. The MSY was reached when "removal of the older and larger fish (a process known as "fishing up" the accumulated stock), increased the rate of reproduction or the rate of growth or both." (Barrett 1984: 80) It was believed that "to harvest less than the maximum was to waste fish, and to harvest more than the maximum was wasteful to effort" (Larkin, 1980:247). For management based on this notion, it was necessary to determine the population of fish and the maximum amount of fish that can be removed without threatening its reproduction.

At the Canadian administrative level, major emphasis was placed not only on biological research for Canada's international regulatory participation, but also on engineering and technological expertise (McDonald 1984; Doeringer and Terkla, 1995). The Industrial Development Branch of the Department of Fisheries laid the framework for Canada's offshore and midshore fleet sectors. Here the

emphasis was placed upon technological development with respect to vessel and gear designs (including electronic navigation and fish finding equipment), and on vessel subsidies.

During the period 1945-76, there was a remarkable consensus on fisheries policy and management approaches at the federal, provincial, and industry levels. The Canadian approach to fisheries management was firmly rooted in population estimation analysis and the application of economic efficiency criteria manifested in MSY (Doeringer and Terkla, 1995). As well, Canada supported and placed its trust in ICNAF as the regulator of international fisheries. However, by the 1960's, ICNAF had proven terribly impotent. Although gear regulations, and quota limits were in place, they were essentially unenforceable. In response to these regulatory problems, the federal government (Department of the Environment) issued its *Policy for Canada's Commercial Fisheries (1976)*. The central focus of the new policy was on resource rehabilitation and industry reconstruction. The primary recommendation was the rejection of maximum sustainable yield as a management philosophy and adoption of a new guiding principle, the "best use", requiring maximization of net social benefit, or Optimum Sustainable Yield (OSY). Since 1976, Canada has used the $F_{0.1}$ (F=

fishing mortality) rule as the guiding principal for its management of fishery resources within the new 200 mile limit.[15] The $F_{0.1}$ reference level is the level of fishing mortality generally considered to be beneficial for stock conservation (approximately 18% of the harvestable biomass or F=.20). This rule ($F=_{0.1}$) developed as a more conservative replacement for the MSY as a management goal. As Halliday et al (1992) note, "in practical terms, this resulted in reduction in target fishing mortality (F) level from F_{max} on the yield-per-recruit curve, as used by the ICNAF, to $F_{0.1}$." (413) With the establishment of the Exclusive Economic Zone (200 mile limit) pending, this measure was introduced to allow fish stocks to rebuild sufficiently to provide consistent and stable catch rates.

Combined with a lower level of exploitation, the government was positioning itself to take on a new role in the fishery, a role that would see them directing and shaping the fishery of the future. Influenced by Gordon's economic theory of common-property resources [16], the policy

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[15] "F" simply means fish caught by commercial vessels, and a number in subscript to indicate the relationship of the weight of fish caught to the total exploitable biomass.

[16] Gordon argues that the fishery was a common property, to which all persons had rights of access. Under conditions of open access, competition generates overcapacity, which leads to

recommended control of entry into the groundfish fishery in an effort to reduce excess capacity in congested fleet segments (Rogers, 1995).

> Since the establishment of private-property rights in fishery resources is impracticable in the great majority of cases, the state's responsibility for resource conservation and allocation cannot be delegated.[17]

It was argued that controlling access to the resource would, in the short term, improve economic efficiency within the fleets involved. To accomplish its objectives (resource rehabilitation and industry reconstruction), two main administrative policies were instituted: (1) an annual Groundfish Management Plan, that established TAC levels and catch allocations by fleet; (2) and a Licensing and Vessel Replacement Policy (inshore vessels), which limited entry to the groundfish fishery and controlled vessel size and gear which could be used (Halliday et al., 1992).

2.4 ESTABLISHING THE EXCLUSIVE ECONOMIC ZONE: Canada's 200-MILE LIMIT

In 1977, Canada established the EEZ giving the government of Canada additional control over the harvesting

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chronic economic problems, as well as resource depletion (see Chapter 3 in this manuscript for more details).

of fish stocks from the coast outward to a distance of 200 nautical miles (Pinhorn et al., 1990). Department of Fisheries and Oceans was charged with the responsibility of implementing fishery management programs designed to maintain the fisheries resources at levels sustainable for long-term economic and social benefits (Fraser, 1986; Schrank, 1995).

Since 1977, the Northwest Atlantic coast groundfish resource has been governed by annual Groundfish Management Plans. In an effort to curb overexploitation and eventual depletion of groundfish stocks, DFO developed detailed management plans whose objectives were to prevent growth and recruitment overfishing (Sinclair et al., 1994; Halliday et al., 1992). At the same time, Canada's policy of modernization and fleet upgrading had the explicit objective of raising incomes of fishermen, enabling the groundfish processing industry to acquire fish supplies on a year round basis, as well as providing effective competition to the foreign fleets.

With Canada's implementation of the EEZ, and the prospect of greatly increased catches, a further expansion of the offshore fleet had occurred, while new processing

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[17] *Policy for Canada's Commercial Fisheries.(1976)* Ottawa: Department of he Environment, p. 20

plants were opened and others upgraded (Schrank, 1995; Hinds, 1995). However, the resource did not justify the expansion that had occurred; although the stocks were being allowed to rebuild under Canadian management (see Angel et al 1994), they really never recovered from the overexploitation in the late 1960's and early 1970's (Pinhorn et al., 1990).

Later evidence suggests that many of the groundfish stocks had experienced a fishing mortality much higher than $F_{0.1}$ perhaps twice or higher than $F_{0.1}$ and this has occurred (Sinclair et al., 1994). Sinclair and colleagues have acknowledged that the total allowable catch (TAC) had been exceeded after the EEZ declaration and that discarding and misreporting greatly contributed to the problem. Thus, in turn, it contributed to the frequent underestimation of the mortality and hence the overestimation of the harvestable biomass (8-14).

The resulting scenario was a classical example of "the tragedy of the commons" -- increased investment forced increased production, leading in turn to an unsustainable plundering of the resources. Thus, according to Barbara Neis (1992):

> Overcapitalization in the primary sector increases pressure upon the stocks, conceals the true level of fish mortality--forces participants

> to underestimate effort thus contributing to inflated TAC's... Scientists overlooked the impact of technology, skills, knowledge and fishing practices and made it seem as though catches in the commercial trawler fishery were a reflection of stock health, and not the result of changes in effort linked to technological improvements, cooperative fishing, and greater knowledge of the stocks. (157)

In an effort to resolve this situation, quasi-property rights in the form of allocations to fishing enterprises (enterprise allocations) were established in 1982 for a portion of the offshore trawler fleet (McDonald, 1984). The four large fishing companies that operated offshore groundfish trawlers at that time (National Sea Products Ltd., Fisheries Products Ltd., H.B Nickersons and Sons Ltd., and the Lake Group) were given, on a trial basis, enterprise allocations (EAs) in most commercially important groundfish fisheries. Using a formula based on historical catch, adjacency to the resource, and fishing capacity, the four large fishing companies negotiated quotas with DFO (Rettig, 1986). The pilot enterprise allocation project did not include the independent offshore group (IOG) of 17 smaller companies. The offshore vessels operated by the companies within the IGO competitively fished for the remaining portions of the offshore quota that had not been

allocated under the new enterprise allocation program (Fraser, 1986).

In 1983, one year after its inception, the EA program for the offshore groundfish fleet was temporarily discontinued. However, the industry, after seeing its benefits, decided to continue the EA program on an informal basis. In the same year, the federal government, acting in response to public concern about the Atlantic Fishery, established the Task Force on Atlantic Fisheries to recommend how to achieve and maintain a viable Atlantic fishing industry, with due considerations to the overall economic and social development of the Atlantic provinces (Kirby, 1983). In 1984, at the urging of the Kirby report, enterprise allocations were officially reintroduced into the Atlantic offshore groundfish fishery for all of the offshore companies. Enterprise allocations were assigned as percentage shares of the overall offshore quota in each of the major groundfish stocks on an individual basis for National Sea Products (NSP), Fishery Products International (FPI), and the independent offshore group of companies (IOG) (Fraser, 1986; Rettig, 1986).

CHAPTER 3

THEORETICAL APPROACH and LITERATURE REVIEW

As indicated in Chapter 2, beginning in the 1950's was a significant change in the management and general orientation of Canadian fishery policy. The focus of concern shifted from purely biological aspects of fish-stock conservation to a broader consideration of the social and economic aspects of the fishery. This paradigmatic shift seems directly related to the development of the economic theory of common property as applied to the fisheries (Gordon, 1954). The common property perspective led to viewing the fishery and its regulation as not only a biological system but being an embedded layer in a complex economic and social system. In other words, managing a fishery required more, much more, than simply counting fish.

In *The Economic Theory of Common-Property Resources: The Fishery,* H. Scott Gordon argued that many fisheries can be classified as common property, to which all persons have rights of access. Under conditions of open access, it is not rational for an individual to refrain from fishing to ensure the conservation of the fish stocks. Should they do so, others would most definitely take advantage of their actions and capture their share of available resources. Put

simply, when resources are limited, the rational decisions of each individual add up to an irrational dilemma for the group. Thus, according to Gordon (1954),

> there appears.. to be some truth in the conservation dictum that everybody's property is nobody's property. Wealth that is free for all is valued by none because he who is foolhardy enough to wait for its proper time of use will only find that it has been taken by another. The fish in the sea are valueless to the fisherman, because there is no assurance that they will be there for him tomorrow if they are left behind today. (124)

Those involved in regulating the fishing industry, trying to conserve stocks in the face of unlimited expansion of fishing pressure, began to feel that there was something fundamentally wrong with traditional open access, common property fisheries. Put simply, there were too many fishermen chasing too few fish. In *"Fishing Rights as Instruments of Fisheries Policy"* (1992), Pearse wrote that in common property, open access fisheries two identifiable problems exist: a conservation problem where "continuing expansion of harvesting pressure on stocks having limited natural productivity (what Hardin, (1968) might refer to as the "tragedy of the commons") was not sustainable" (73); and an economic problem, associated with the over-expansion of fishing fleets that became manifest in, "the waste of labour and capital in redundant catching capacity,

excessive costs, depressed incomes, and, generally the poor economic performance of open access, common-property fisheries" (73).

It became conventional government wisdom that something had to be done to intervene in the workings of the commons.[18] Needler (1979) argued for a limitation of fishing effort for the purposes of maintaining the fish stocks and yields at their optimum levels. In his opinion, this required some degree of limited entry to guard against overcapitalization (i.e., input restrictions). Similarly, MacKenzie (1979) asserted that restrictive measures were necessary to move excess labour out of the fishery and to prevent additional labour from entering it. He maintained that it was necessary to establish a professional, full-time fishery labour force to eliminate the part-time, "moonlighting" fishermen that use the fishery as an employer of last resort (816-17). Fraser (1979) took this one step farther claiming that in an open-access fishery, limiting the number of fishing units (vessels) was not adequate to control fleet expansion. Individual fishermen and fishing enterprises still had incentives to expand their fishing power to increase their shares of the catch.

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[18] See the Journal of the Research Board of Canada, July (1979) for a series of papers that formed the basis of that shift in the value orientation of Canadian fisheries policy.

Thus, Fraser argued for additional input restrictions on licence transfers, vessel replacement, and types of fishing gear used in the hopes of curbing the trend toward "capital stuffing" (759).

After input restrictions (by themselves) were found to have limited, if any, success in discouraging the "race for fish" (Kirby, 1983: 213; see Pearse, 1982), fisheries' economists began to consider a quite different approach. The total allowable catch in a fishery could be allocated among the licenced fisherman. Then, licences would convey not simply a right to fish but a right to take a specific quantity of fish (Berkes, 1985: 200-01). Scott and Neher (1981) recommended that "the common-property system of open access to each fishery should be replaced by a system of individual and exclusive rights of access or capture, or both." (41) Likewise, Moloney and Pearse (1979) argued that economic efficiency (rationalization) would be promoted by providing individual enterprises with rights (that could exist in perpetuity) to harvest specific quantities of fish i.e., a quota allocation. The allocation of fishing rights would allow fishermen to maximize profits through market forces that would transform the industry from supply to demand driven and provide a disincentive for inefficient

and costly fishing practices (862). This would enable, it was thought, once competitive fishing was eliminated, that vessel owners, and especially vertically integrated companies would be in a position to respond to prices when it comes to catch quality, quantity and timing.

Moreover, advocates of property rights usually emphasized a need to make quotas transferable or an "individual transferable quota" (ITQ). Under this system of rights based fishing, individual fishermen and/or fishing enterprises could sell their entire quota, or parts of their quota, to other operators for a season, a number of seasons, or in perpetuity (Arnason, 1993, Palmer and Sinclair, 1997: 68-69). The advantage of transferability of quota was that it further facilitates rationalization in the fishery. It was reasonable to assume that the prospect of rent would lead more efficient operators to buy the quota entitlements of less efficient operators. Thus, quota rights would be consolidated in the hands of the most efficient operators who would be able to fish full-time and reduce unit costs of operation (Arnason, 1993; Sissenwine and Mace, 1992).

The professed advantages of quota allocation management (property rights) lay in the removal of alleged important external diseconomies associated with open access

fisheries. It is contended that the guarantee of a quota means that fishers do not have to race each other to secure their share of the total allowable catch (Christy, 1973; Moloney and Pearse, 1979). When fishers were assured of their quota, they could fish in the most economical way available to them -- take their time, spread their effort optimally across the entire season, use the most economical configurations of gear and manpower in the process (Pearse, 1992). The externalities inherent in common property resources would drive fishers to act in accordance with their individual interests, where often it was contrary to their collective interest (Gordon, 1954). However, quota allocation management was not without its' potential drawbacks. It was argued that quota allocations could provide fishers with incentives to maximize their profit through illegal and unconservative fishing.

In fact, this has been alleged to be the case for the Scotia-Fundy EA program in the offshore groundfish sector. Most illegal fishing practices -- misreporting by area and species, dumping, discarding, and high-grading -- have increased rather than deceased with the introduction of property rights. Furthermore, since introduced, most regulations associated with quota management have not been enforceable. (Sinclair et al 1994; Angel et al. 1994).

3.1 MISREPORTING

Enforcement is one of the most difficult problems with a quota system because individuals within the industry appear to have been successful in finding ways to circumvent constraints on their fishing; misreporting is one. In an attempt to avoid restrictions imposed by the quota management system, most captains, at one point or another, have misreported landings (Wilson 1994, Schiochetti 1994). Misreporting of landings, most often, has been restricted to misreporting the species landed by area fished; however, there have been reported cases where companies were misreporting species landed[19]. This behaviour creates a serious problem for fisheries managers that require reasonably accurate reports on catch and effort from vessel operators as a basis for their estimation of stock strengths and optimal exploitation rates.

3.2 DISCARDING and HIGH-GRADING

Crean and Symes (1994) estimate that "one-third of all marine resources harvested in the world's capture fisheries

never reach the consumer, and were dissipated through post-harvest losses."(422) Although the problem of wastage occurs throughout the distribution chain, the losses are most significant at the point of capture. The principal cause is the deliberate discarding of fish at sea. The composition of the discarded biomass, which includes non-commercial material (bycatch), undersized juvenile fish (highgrading) and mature marketable species (most times of poor quality) delimit the complexity of the problem.

At this point, it would be beneficial to define the key terms that we will continue to emerge in this part of the discussion:

- **Discarding** -- returning to the ocean fish caught which cannot be legally retained and landed according to regulations.
- **Dumping** -- returning to the ocean fish caught which cannot be legally retained and landed according to regulations. Fish thrown overboard in a selective manner is interpreted as discarding (a culling process), while that act done indiscriminately is defined as dumping.
- **Highgrading** -- Dumping in the ocean by size and/or by species of fish caught which can be legally retained and landed in order to maximize the value of a set quantity of quota.
- **Culling** -- Discarding in the ocean, because of their low market value, unregulated fish species and/or damaged or low quality fish, which can be legally

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[19] This occurred before a comprehensive dockside-monitoring program was instituted to curb such behaviour.

retained and landed.

- **Capacity Dumping** -- Dumping in the ocean by size and/or by species because of the boat's capacity and/or processing plant capacity or requirements, when the fish can be legally retained and landed.[20]

Discarding is undesirable for many reasons; it undermines the conservation objectives of government and industry, it undermines effective scientific assessment in terms of reported data, and it is clearly, under most circumstances, self-destructive. However, conventional wisdom says that discarding is unavoidable in view of regulatory, stock management and market forces. Environmental and technological limitations also contribute to make it unavoidable. Copes (1986) wrote that:

> The fugitive nature of most fish stocks, together with the multiple resource use of their water habitat, made it usually impractical, if not impossible, to solve the problems by dividing fish stocks into discrete units for which effective property rights would be assigned(265).

Fisheries managers may attempt to set separate sets of quota allocations for different species in a mixed-stock fishery (Murawski, 1991). However, in a multispecies fishery, the probability that a fishing enterprise can

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[20] Fishers taking more than their allowed quota for a certain species (quota busting), and/or taking fish for which they have no quota at all (poaching) are frequent transgressions in a individual quota (IQ) based management system.

catch their quota precisely in proportion with the allotted amount per species is incalculable. Inevitably, they will fill some quotas before others and will find themselves with excess catches of some species when they continue to fish in order to fill all their species quotas. They may retain the excess catches, and risk consequences from DFO, or discard them, both of which would be undesirable results. In this situation, it seems the only option for fisheries managers would be to increase the tolerance for excess by-catch. However, the more tolerant they are in order to prevent discarding and quota overruns, the more fishing enterprises will "accidentally" take larger excess by-catches, particularly of the more valuable species in the mix.

In theory, it is argued that assigning an enterprise quota rights encourages quota holders to cooperate in resource management by clearly defining shares in the current catch and also in all potential yields. This, in turn, should provide quota holders with a strong incentive to support sustainable fishing practices, research, and stock enhancement (Walters and Pearse, 1996). Put simply, if fishers have a guaranteed stake in the future of a resource, there is an expectation that they will actively

work to ensure the continued sustainablity of the resource. The central idea is that a private property owner is much more likely than a non-owner to care about the long-term quality and quantity of their resources. Pearse (1992), he reports that when this management regime was introduced in New Zealand's deepwater fisheries, it produced significant benefits in terms of stock conservation. "The entire regulatory and enforcement effort had shifted from policing fishermen on the fishing grounds to monitoring landings and reconciling them with the quota holding of the fishermen." (77) Arbuckle and Drummond (1999) note that in a New Zealand ITQ fishery for shellfish (scallops and oysters), a spectrum of informal and formal relationships within the industry, and between the industry, government and other stakeholders developed. Further, self-goverance initiatives in this fishery have contributed significantly to sustainable management. This process is enhanced when fishers perceive management goals and fishing regulations to be fair, equitable and necessary to maintain the integrity of the resource. To this end, resource stewardship is thought to be greatly enhanced when fishers are actively involved in the management process.

However, not all are convinced of their benefits for conservation. Mace (1993) argues that "private owners cannot be counted upon to do the right thing for the resource and that therefore, government must retain its responsibilities in managing fisheries." (30) This argument is hinged upon the idea that property rights provide a greater incentive to misreport and highgrade in the short run, then to conserve resources for the future. In a survey of fishers along the south coast of England, Robinson and Pascoe (1997) found that in the face of unpredictable resources, profit maximization was the primary objective of most fishers (4).

> *I'll tell you when it all comes down to it. Fishermen are without any doubt the greediest people on earth. If you give'em fish to catch, he won't quit until he catches every last one of them. And if someone else caught 200,000 lbs. in 60 hours, I'd want to catch 225,000 in 59 hours. It's just the way it is. There was alot of competition between all the skippers in the fleet. If you arrived home without a full load of fish, everyone would look at you sideways. Naturally the money had alot to do with it.*
>
> *I suppose you could call it greed if you wanted to, but for us, we had to get a trip of fish. It didn't matter what I had to do. When I left the dock, it didn't matter what I had to go through, I was going for a load of fish. And that's all you had in your mind, you gotta get fish, you were going out there to make a living.*

In examining the implementation of Individual Quotas (IQs) the Dutch groundfish sea fishery, Wim Davidse (1999) writes that property rights, in and of themselves, were not successful in promoting a conservation ethic or a movement towards co-management. Quota busting and poaching[21] forced the managing authority to implement a system where the industry becomes co-responsible for compliance with national quotas. This system of enforcement pooled industry participants and their quotas into management groups, and made each group responsible for compliance with the total quota of its members.

> Property rights alone are not effective in promoting co-management. They should be accompanied with adequate enforcement to insure that fishers are not exceeding quota allocations." (6)

Similarly, McCay (1996) states that:

> It remains an open question whether the incentive to discard and highgrade can be counterbalanced by other features of the ITQ programs, including the possible creation of a "conservation ethic." (10)

In summary, there are strong arguments put forward from both sides of the rights-based management debate.

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[21] Fishers taking more than their allowed quota for a certain species (quota busting), and/or taking fish for which they have no quota at all (poaching) are frequent transgressions in a individual quota (IQ) based management system.

Those who support allocating individual fishing rights are convinced that if fishers have a guaranteed stake in the future of a resource, they will support conservative fishing practices and resource management. However, there are others who contend that if left to themselves, fishers will choose short-term profits over long-term sustainability. The growth of discarding in the EA program is indicative of a hubristic tendency to continue unsustainable practices without regard for the pending consequences. Why did such a tendency continue when the consequences of discarding were already becoming manifest?

CHAPTER 4

RESEARCH DESIGN and METHODOLOGY

Considerable disagreement exists over appropriateness of various methods and methodological stances for conducting evaluation research. One debate of growing intensity centers on the distinction between quantitative and qualitative methods. By quantitative methods, researchers have come to mean the techniques of randomized experiments, quasi-experiments, multivariate statistical analysis, sample surveys, and the like. In sharp contrast, qualitative methods -- ethnography, case studies, structured and semi-structured interviews and participant observation - is utilized for its descriptiveness and for its analysis through the language of its respondents. Bogdan and Taylor (1975) describe qualitative methods as:

> Research procedures that produce descriptive data: people's own written or spoken words and observable behaviour. This approach… directs itself at settings and the individuals within those settings holistically; that is, the subject of the study, be it an organization or an individual, is not reduced to an isolated variable or to an hypothesis, but is viewed instead as a part of a whole. (4)

Each of these method-types has acquired a separate constituency of advocates who argue that it is their preferred methods that are best suited to evaluation.

Campbell and Stanley (1966) and Riecken et al. (1974) are often cited as staunch proponents of quantitative methods. Although Campbell and Stanley were not primarily concerned with evaluation research, they describe the experiments as "the only way of establishing a cumulative tradition in which improvements can be introduced without the danger of a faddish discard of old wisdom in favour of inferior novelties." (2) Riecken et al. (1974) are only slightly more moderate in their claims about experiments and no less enthusiastic: "Experiments not only lead to clearer causal inferences, but the very process of experimental design helps to clarify the nature of the social problem being studied." (6,12)

Among others, Weiss and Rein (1972), Partlett and Hamilton (1976), and Guba (1978) are firmly on the side of the debate supporting qualitative methods. In particular, Weiss and Rein (1972) suggest several alternative research strategies deriving from the qualitative tradition that they believe, "to be superior to experimental design as a methodology for evaluating broad-aim programs." (243)

Partlett and Hamilton (1976), speaking specifically of educational evaluation, note that:

> Characteristically, conventional approaches have followed the experimental and psychometric traditions dominant in educational research. Their aim of achieving fully "objective methods" has led to studies that are artificial and restricted in scope. We argue that such evaluations are inadequate for elucidating the complex problem areas they confront and, as a result, provide little effective input to the decision-making process...Illuminative research is introduced as belonging to a contrasting anthropological research paradigm (141)

Similarly, Guba (1978) argues that naturalistic inquiry (which is likened to ethnographic fieldwork) offers "a more congenial and responsive mode of evaluation than any other practiced today." (81) The current debate over methods creates the impression that the researcher must not only choose a method because of allegiance to a paradigm, but must also choose between the qualitative and quantitative paradigms because those are the only choices available.

The two paradigms come from two quite different and unique traditions. The composite of attributes that make up the quantitative paradigm grew out of the natural sciences, whereas the qualitative paradigm came from work in social anthropology and sociology. It is not clear why either of these separate traditions would be expected to provide an appropriate paradigm for evaluation research.

Fortunately, evaluators are not restricted to these two choices.

Just because one conducts research in a holistic and naturalistic fashion, for example, does not mean that one must adhere to the other attributes of the qualitative paradigm, such as being exploratory and process-oriented. Rather, one could combine the naturalistic and holistic attributes from the qualitative paradigm with other attributes, such as being confirmatory and outcome-oriented, from the quantitative paradigm.

In fact, all of the attributes that make up the paradigms are logically independent. Just as the methods are not logically linked to any of the paradigmatic attributes, the attributes themselves are not logically linked to each other. Thus, according to Reichardt and Cook (1979) "researchers should feel free to change their paradigmatic stance as the need arises...a researcher's paradigmatic viewpoint should be flexible and adaptive." (19) Moreover, they maintain that in using a combination of qualitative and quantitative methods in attacking evaluation problems, two clear and distinct benefits emerge. First, when used together for the same purpose, the two method-types can build upon each other to offer insights that neither one alone could provide. And second,

because all methods have biases, only by using multiple techniques can the researcher triangulate on the underlying truth. Since quantitative and qualitative methods often have different biases, each can be used to check on and learn from the other.

4.1 INTERVIEWS with OFFSHORE SECTOR PERSONNEL

4.11 Sample and Setting

The participants in this study were selected from a group of fishers that, presently or in the past, have fished in the offshore groundfish sector. Most interviews were with offshore vessel captains, although several industry managers were interviewed in hopes that they would provide an insightful perspective. All participants in this study have at least six years of experience in the offshore sector. Interviews were conducted during a three month period -- October to December 1996 -- in numerous cities and towns across Nova Scotia: Lunenburg, Liverpool, Louisbourg, Canso, and Petite de Grate.

4.12 Selection of ~~Interviewees~~

The researcher and the thesis supervisor contacted Mr. Mike O'Connor of National Sea Products Ltd. to obtain a list of management and trawler captains who have worked or presently are working in the offshore groundfish fishery.

This required the presentation of a synopsis of the research proposal by the researcher, outlining the purpose of the inquiry, how anonymity of those interviewed would be guaranteed and the approximate duration of the information gathering phase. After a brief discussion about the research proposal, Mr. O'Connor provided the researcher with a list of seven active trawler captains, and a telephone number at which they could be contacted.

Working from personal recommendations by the Department of Fisheries and Oceans, Marine Fish Division, a list of ten retired, and inactive offshore personnel was generated. The remaining interviewees were selected by a "snowball sample" method that Creed (1996) deliberately chose for her interview survey. In a snowball sample procedure, interviewees are asked to provide additional names that they feel would be interested to taking part in the study. (Babbie 1986) All prospective interviewees were personally contacted by the researcher and informed in detail of the nature of the project. And after do so, only one (retired captain) prospective interviewee declined to be interviewed. In the end, those interviewed were as follows:

- 7 active offshore captains
- 2 inactive offshore captains
- 7 retired offshore captains

- 3 inactive offshore captains, now active inshore fishers
- 2 shore captains
- 4 industry managers

The possibility of including crew-members in the interview phase was considered but it was decided that their knowledge of discarding and misreporting practices would lack the detail necessary for this study.

4.13 Interview Protocol

The interviews themselves were conducted by the author, either in the interviewee's home or (for the some of the active offshore fishery personnel) in the offices of National Sea Products in Lunenburg. To those that agreed to participate, it was stressed that while they had consented, the interviews were voluntary, and they could withdraw at any time, before the interview or at and point during the interview.

Interviews were conducted following the general structure of an "open-ended topical" format as suggested in Patton (1980). In dealing with a similar target group, Creed (1996) used this "free-form" interview format with few if any standard questions, which she claims is a better approach for gathering sensitive information (as reports of discarding and misreporting certainly are). A list of

general topics was consequently brought into the interview setting and more particular questions evolved during the process of the interview. There were similarities among interviews due to the topical headings, but also much diversity because some questions were based on discussions or stories offered by each respondent. Indeed, much of the most interesting information from a more structured interview format often comes from impromptu discussions of matters that had not been anticipated by any formal questions. In essence, both parties determined the ultimate direction of the interview, the particular questions answered, and the length of time given to each topic or issue.

Individual interviews lasted between 30 minutes and 2 hours. Although all the interviews were open-ended discussions, there were some set questions used to gather career-related information; for example, years fished in the offshore sector, years fished as a captain in the offshore, other sectors fished. Further, there were other set questions sometimes used to assist interviewees in describing causal factors that contributed to misreporting and discarding, discuss specific kinds of unconservative fishing, and suggest ways in which these behaviours might be curtailed in the future.

4.14 Ethical Considerations

The rights and integrity of human subjects were respected, and anonymity was provided upon request. All interviews were conducted under a strict set of rules and procedures. Each interview began by asking permission to tape record the session. Of the 26 interviews, only one asked that the entire interview not be recorded, and two interviews could not be recorded due to their public location. At any point during the interview, the subject could request the tape recorder be turned off or specify certain information be placed off-the-record. This occurred on one occasion only. Further, at the beginning, and at the end of each interview, the subject was informed that they could be provided with a verbatim transcript of the interview. If requested, the subject could make any corrections, clarifications, additions, or deletions in the dialogue that he/she felt were necessary. Any published quotations or references to information acquired during the interviews would be from these self-edited transcripts. Of those interviewed, three requested a transcription of their interview, however, after reviewing their transcript, they decided not make any changes in the dialogue. This method is

similar to the interview protocol used by Finlayson (1994) with equally sensitive information and opinions. These precautions and guarantees are appropriate given the controversial nature of the subject, the potential sensitivity of some of the information and opinions offered during the interviews, and the vulnerability of some of the subjects to -- possibly quite serious -- repercussions.

4.2 COLLECTION and ANALYSIS of DISCARDING DATA

Programs of face-to-face interviews, supported by an interviewer completed questionnaire to collect quantitative data, have proven successful in gathering a variety of types of data from Maritime fishers (Kenchington & Halliday 1994) However, this general approach was not adopted. Instead, the necessary quantitative data on historical fishing practices were collected in two ways; by comparing the discard rate on observed and non-observed trips; and analysing recorded discards by calculating a variance in length frequency at sea (observer length samples) and on land (DFO port sampling program).

Beginning in 1984, captains in the offshore groundfish sector were required by law, on a set by set basis, to record in their vessel logbooks, all discarded biomass--by

species and weight. However, these discards were never entered into the DFO statistical database. The original logbooks were obtained from government archives and processed. The following data were extracted (years 1980-1990): year of trip, date of trip, vessel name, vessel captain, area fished, and discarded fish (by species and weight). After all discards were recorded into the data base, each vessel trip was cross referenced with the vessel observer data base to determine if the recorded discards on observed trips were greater than on non-observed trips. If there were more recorded discards on observed trips, it can be inferred that on non-observed trips, some discards were not recorded. Further, recorded discards on observed trips were checked to see if they correspond with the observer trip reports. Unfortunately, significant parts of these records are highly suspect or even known to be misleading, and the actual magnitude of the errors is not known. Several of those interviewed reported that the true numbers of discards were never recorded in the vessel logbook. Further, it was not until the late 1980's that many of the captains began to accurately record discarded fish.

In the final phase of the research, using length

frequency statistics collected at sea[22] and on land,[23] observed and non-observed trips were compared to see if observed trips were resulting in higher levels of small fish. If this was detected, then, it could be inferred that small fish were being discarded in favour of larger, more profitable fish on the non-observed trips. The variance in length frequency data between observed and non-observed trips would be a strong indicator of how much discarding has taken place.[24]

The difficulties in calculating the amounts of commercial fish discarded at sea are well known. Likewise, those conducting stock assessments tolerate with reluctance continually having to account for deficiencies in data. Even when there was an observer on the vessel, calculating discards traditionally depended on estimating the total weight of either discards or gross catch. It would be reasonable to assume that only when catches were small will crews have the time to put all discards in boxes of which

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[22] If an observer is onboard, they are required to collect length frequency data on a set by set basis. In other words, while the crew are processing fish, the observer is required take a length frequency of a random sample of fish.

[23] The DFO has established a dockside-monitoring program to take length frequency sample of catches of offshore vessels.

[24] Arnason (1993) estimates the discard rate in the Icelandic offshore groundfish fishery (ITQ) to be 8 to 10%. He reported that this statistic was calculated by determining the variance in

some would be weighed and the total number counted to generate an estimate of total discarded material.[25] Where this is impossible, the captain or delegate might estimate the quantity of fish in the catch (based on the number of boxes), and make an estimate of fish discarded based upon the amount kept. Using this method, it is reasonable to assume that discards would be frequently underestimated.

The advantages of calculating quantities of discards from length frequencies of fish caught, and landed are obvious; this methodology can be used to check on the spot estimates, and it can be used when large volume of catch make accurate discard estimates impractical or impossible.

The matching of length frequency distributions of catch landings over a totally recruited length range, and those of catch and discards over one totally unrecruited could permit an estimate of discards to be made in both numbers and weight of discards corresponding to a given weight of catch. (Hillis 1979, 1981).

This method requires that a scaleable factor (discard

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length frequency data from observed and non-observed trips (pers.comm.).

[25] As the fish were processed, small, damaged, or non-commercial fish were discarded through the discard hatch (skuppers, grinders) that were adjacent to the processing line. After all the fish were processed, the captain was provided with an estimate of retained and discarded fish (based on the number of boxes filled).

multiplier) be determined by which a sample of discards can be adjusted based on the length frequencies of reported catch.

$$X = \log (L + (D * F) / C)$$

$$= \log (L + (D * F) - \log C$$

where C = number of fish in catch sample

L = number of fish in landing sample

D = number of fish in discards sample

F = variable scalable factor which is used as a multiplier for D.

CHAPTER 5
HISTORICAL FISHING BEHAVIOUR 1983-1993

Enforcement is a critical issue in any management regime. Quota based systems, in particular, offer numerous opportunities for rule evasion. Most evasion occurs in the masking of actual fishing effort in altered logbooks and catch records. Several researchers have noted that most captains, at one point or another, have misreported landings (Wilson 1994, Schiochetti 1994). Misreporting of landings, most often, has focused misreporting species landed by area fished; however, there have been reported cases where companies misreported species landed[26]. This behaviour creates a serious problem for fisheries managers that require reasonably accurate report - species specific - on catch and effort from vessel operators as a basis for their estimation of stock strengths and optimal exploitation rates.

5.1 PAPER FISH

Misreporting of species landed by area fished seems to vary in frequency across time from *"occasionally"* to *"everytime you had the chance to."* With the exception of

one captain that was interviewed, all admitted that at one time or another, they had misreported catches by area fished. When asked about the extent of this fishing behaviour, some said the practice had ended by 1987 while others said that it extended into the early 1990's. For all the captains interviewed, misreporting catch was perceived an occupational hazard that was necessary and could not be avoided.

Several of the interviewees placed the blame for this behaviour on the company but the rest consistently stated that it occurred when quota areas and fish abundance were not congruent. For example, there were fish in one area where the boats had little or no quota and quotas in another where there were no fish (paper fish). As several stated, there was then no other way to make a trip than to misreport.

> *See you run into situations where that in some areas during some parts of the year, we'd have a shortage of fish. In order to get your trip of fish, we'd have to manipulate the areas and the numbers so that we could match the fish with the area we'd have quota in. Nobody was getting the right picture of what was going on.*
>
> *It was just accepted. You had to do it [misreport] to survive. And if you didn't do it,*

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[26] This occurred before a comprehensive dockside-monitoring program was instituted to curb such behaviour.

> *there were ten guys behind you waiting behind you for your job.*

An offshore captain with more than 20 years experience said:

> *Whenever there was room to do it, it would be done. Whether it is less steam time, whether it is for bigger fish, a lot of it was for bigger fish. Like if you could catch bigger fish in one area, and record it in the other area well then, it's just, you know it had to be done. Catch the bigger fish you went wherever you could get them, sometimes it didn't even matter if you had quota there.*

On occasions, all or most of a catch was reported to areas that were barely fished during that trip.

> *We'd be allowed say 200,000 lbs. of Yellowtails, 25,000 from the Grand Banks and rest from quereau [Bankquereau Bank]. If we had 8 or 9 days, we'd probably spend 6 of them on the Grand Banks, and spend maybe a day or a day and a half, never over 2 days on quereau. If you had your 200,000 Yellowtails, you'd mark 20,000 or 25,000 for the Grand Banks, and the rest to quereau.*

Certain areas experienced more misreporting than others, leading to landings data for some species being higher than the reported catches in these areas. These areas are as follows:

- 3Ps redfish reported as 4Vn.
- 3O cod and yellowtail reported as 4Vs in the early 1990's.
- 4Vn cod reported as 4Vs.
- 3P cod and flounder reported as 4Vs and 4Vn.

It was reported that by the early 1990's, the extent of misreporting in several areas had resulted in what fisheries managers called "paper fish" -- maintaining a catch history in an area that experienced an extensive amount of misreporting. In other words, over-fishing had resulted in the reduction of a stock such that an enterprise could not catch their quota in that area. Instead, they resorted to catching fish in another area and assigning them to the area in which they had a quota for that species.

Another less common form of misreporting is what several captains called "stealing fish". This could occur in two ways: catching fish in areas where you do not have quota, usually done under the cover of darkness; and requesting a small amount of quota in an area where the captain knew he could catch fish and report them to another area. In this situation, if the captain was boarded by a DFO patrol vessel or spotted by aerial surveillance, he would be justified in fishing that area.

> *I think everybody knew what was going on, I don't mean everybody, but the company knew what was going on. They might turn a blind eye now, but they had to know what was going on. For instance, if you were in 4Vs, they'd probably give you 25,000 to catch in 4Vn, just enough to get you in that area, then they'd say you were allowed 200,000 in 4Vs, it was just enough to get you in*

the other area. They knew that we could fish for a month and not get 200,000 in 4Vs.

If the company had a lot of cod quota in 4Vs, and not so much in 4Vn. They (company) would give us this piece of paper telling us what we were allowed to catch and we were allowed to catch it. They would give you say 100,000 of cod in 4Vs, 10,000 from 4Vn and 10,000 or so from the Grand Banks. We'd spend a couple of days in each area, and if we didn't get anything, we'd head out to the Grand Banks. We'd get a catch of fish from there, and come back up on Quereau (4Vs) and report that we caught them there. We caught loads of fish this way.

Aerial surveillance, which was supposed to prevent this practice, was easily evaded by keeping logbooks two or more days in arrears. The boat's true position could be reported whenever the plane flew over and the logbook completed as showing that the boat had steamed from wherever she was supposed to be to where she was sighted during two or more day reserve period.

5.2 DISCARDING and HIGHGRADING

Discarding of fish by the domestic fishing fleets of Canada's East Coast has been a long-standing problem. Historically, most people in the fishing industry felt that the percentages of the total catch discarded were insignificant, and unlikely to affect fish stocks dramatically. The ongoing crisis in the groundfishery has forced us to reassess this assumption.

On many occasions, company and fishing regulations contributed to the frequency of discarding. In 1988, the province of Nova Scotia introduced a minimum fish size requirement. Fishers and fishing companies were prohibited from landing cod, haddock, and pollock smaller than 41 cm in length. Thus, any fish too small to land was required to be "thrown back". Further, it has long been held that some companies provided their captains with a "shopping list" of species required. Along with it went a clear threat of non-payment, suspension or replacement if he/she did not comply. Under these conditions, it can be expected that a captain will discard any species over and above the recommended mix.[27]

> *We did what we had to do to get a load of fish, and land the required mix of species, and size. Because we knew that if we didn't do it, there would be plenty of people waiting to fill our shoes. The company made that quite clear.*
>
> *We was on a pollack trip to LaHave bank, I shot away and made a short tow. When we hauled back, we had 50,000 of haddock. I didn't know what to do with them. We call the Department of Fisheries and Ocean, they said that I couldn't land them or else I'd be fined. So what are you going to do? I just dumped them. After that all hell breaks loose when the papers hear that we're dumping all*

[27] Before each trip, companies provided their captains with specific a fishing plan that is expressed in terms of directed species, areas to be fished, and quantities to be caught. The purpose of the fishing plan is to match fish availability with market demand and processing capacity.

> *this fish. So, the department decides that now you're not allowed to catch them. First you weren't allowed to land them, which was stupid. Now you can't catch them. From that point on, all discarding went underground. There was no way I was going to write down anything in my logbook that they could come back and charge me with.*
>
> *They'd [company] say to you, you have to catch so many pounds of fish from this area, so many pounds from that area, and you can have a 100,000 codfish if you can get them 22 inches and up. You know, so what are you going to do? If you can get the 100,000 of codfish, you're going to take them. And if you happened to kill say for that 100,000, you happened to kill 500,000 catching them, well it was never even thought about, it was just normal procedure.*

During this period (1983-93), fish size limits affected the frequency of discarding behaviour.[28] The price paid to captains for their catch was dependent upon the size as well as the quality of the fish landed. Processing small fish was labour intensive and the resulting product fetches a low market value. Consequently, companies set minimum size standards. Thus, all fish below the minimum were likely to be removed (highgrading).

> *Take for example the codfish in 4Vn, we'd go in there and get little fish 12 - 14 inches long, company didn't want them. We'd get suspended if we brought them in. If we went there to get bigger fish then we had to throw those the little ones away. You had to fish under the orders you were given, but if you didn't do it, someone else would do it.*

Using an analogy, an insightful captain succinctly described one of the reasons why highgrading had occurred:

> *The problem was that there were so much mixed fish out there. With small fish, they were harder to process and you would less money for them… Let's put it this way, you got a big field of apples out there. You got big apples that bring you lots of money and you can sell them all. And you got small apples that bring you less money, and you can't sell them all because nobody wants them. What are you going to do? You're going to bring in those big apples, ain't you. I'm not saying it was right, but that's what we had to do, and that is what happened.*

Some areas, those possessing higher concentrations of small fish experienced more discarding than others. At certain times of the year, many of these areas were reported to have discard rates in excess of 50%, whereas in other areas, the discard rate hovered around 15-20%.[29] Further adding to the problem for management, many of the captains interviewed stated that from the early to mid 1980's, very little, if any, discarding was reported accurately, and that many if not most log entries would be highly suspect. The true numbers of discards were never recorded in the vessel logbook, and the actual magnitude of the errors will never be precisely known.

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[29] This statistic is based upon estimates by interviewees of discard rates in some areas.

I'd say the first 4 or 5 years of the EA program from '83 to '86, you'd have a big problem, all of that information is not really accurate. But from say '88 on it's bang-on.

As far as reporting discards, terrible. I mean I never told the fuckers the truth, and they'd know it you know. Well, I mean, nowadays, I think, you're getting good information, from us guys, the offshore.

5.3 ANALYSIS of LOGBOOK DATA

In 1984, DFO mandated that all offshore groundfish captains were required to record in their vessel logbooks all discarded biomass - by species and weight. Most captains freely admitted that these records are erroneous and misleading. However, if the logbooks were compared to the observer data base and observer trip reports, it potentially could shed some light on the discarding issue.

The analysis of logbook records has followed several lines of investigation. After all discards were recorded into the data base, each vessel trip was cross referenced with the vessel observer data base to determine if the recorded discards on observed trips were greater than on non-observed trips. If there were more recorded discards on observed trips, it can be inferred that on non-observed trips, some discards were not recorded. Further, recorded discards on observed trips were checked to see if they

correspond with the observer trip reports. The results are summarized in Table 1. If there were more recorded discards on observed trips, it can be inferred that on non-observed trips, some discards were not recorded.

In Table 1a,(see appendix 2)catch rates for cod have consistently been two times higher when observers are on present (highlighted in red). Although we can only speculate, the lower catch rate on non-observed trips may potentially reflect a significant amount of discarding on non-observed trips. Although Haddock and Flounder are quite variable, there has been a reasonable agreement in catch rates across time (highlighted in blue). Landings based on trip weightouts have generally been in agreement with observers at sea estimates of retained catches (see Table 1b in Appendix 3). This shows that there is some congruency between the amount of catch actually landed and what observers estimated was retained. Further, that observer estimates of discards are relatively accurate.

In Table 1c (in Appendix 4), the observer estimated discard rates are listed by year and species. Haddock and flounder rates seem to fluctuate from year to year. Cod discards, however, show a steady increase from 1% to 4%. Up until the late 1980's, only 20-25% of all offshore trips

were observed. Thus, it is possible that actual discard rates could be 3 to 4 times higher than estimated.

In examining discard data from the years 1984-1990, there seems to be some variance in recorded discards on observed trips vs. non-observed trips (Table 2a in Appendix 5). We see that in most cases, the reported discards on observed trips are larger than that of non-observed trips. This suggests that there may have been some change in fishing behaviour with an observer on-board. There is a greater chance that the captain recorded discarded fish on an observed trip than non-observed trip.

If we pay particular attention to documented discards of the most valuable commercial species after 1989 - the years alleged to be the most accurate as suggested in the interview data (Table 2b in Appendix 6). 80% of all reported discards of cod and 86% of all redfish discards occurred on observed trips. Similarly, in 1989 76% of cod and 78% of haddock recorded discards occurred on observed trips. Clearly there is a pattern of recorded discards in the later years of this study. However, these findings were not consistent in the early years of the study.

5.4 LENGTH FREQUENCY ANALYSIS

In the final phase of the research, length frequency statistics collected at sea[30] and on land,[31] observed and non-observed trips were used to compare to see if observed trips were resulting in higher levels of small fish. If this was detected, then, it might reasonably be inferred that small fish were being discarded in favour of larger, more profitable fish on the non-observed trips. The variance in length frequency data between observed and non-observed and analysing recorded discards by calculating a variance in length frequency at sea (observer length samples) and on land (DFO port sampling program) would be a strong indicator of how much discarding has taken place.[32]

This method required a simple logarithm to calculate a scaleable factor or discard multiplier that can be used to adjusted length frequencies of reported catch at sea and on land.

$$X = \log (L + (D * F) / C)$$

$$= \log (L + (D * F) - \log C$$

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[30] If an observer is onboard, they are required to collect length frequency data on a set by set basis. In other words, while the crew are processing fish, the observer is required take a length frequency of a random sample of fish.

[31] The DFO has established a dockside-monitoring program to take length frequency sample of catches of offshore vessels.

[32] Arnason (1993) estimates the discard rate in the Icelandic offshore groundfish fishery (ITQ) to be 8 to 10%. He reported that this statistic was calculated by determining the variance in

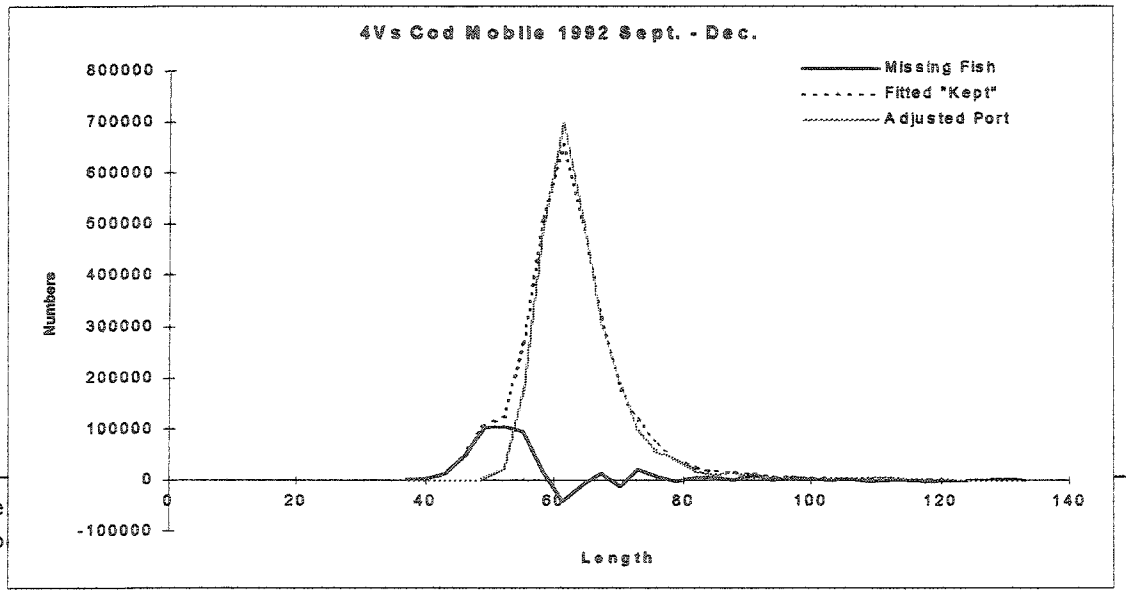
where C = number of fish in catch sample

L = number of fish in landing sample

D = number of fish in discards sample

F = variable scalable factor which is used as a multiplier for D.

Unfortunately, length frequency analysis failed to detect if smaller, less valuable fish were being discarded in favour of larger, more valuable fish. In most cases, the observer saw fewer smaller, and hence likely to be discarded fish than were actually seen in shore based samples. The only possible inference that can be made in the situation is that the presence of an observer has a significant on fishing practices. With an observer onboard, captains were able to avoid small fish, and possibility of having to discard them. If we examine the fall cod fishery



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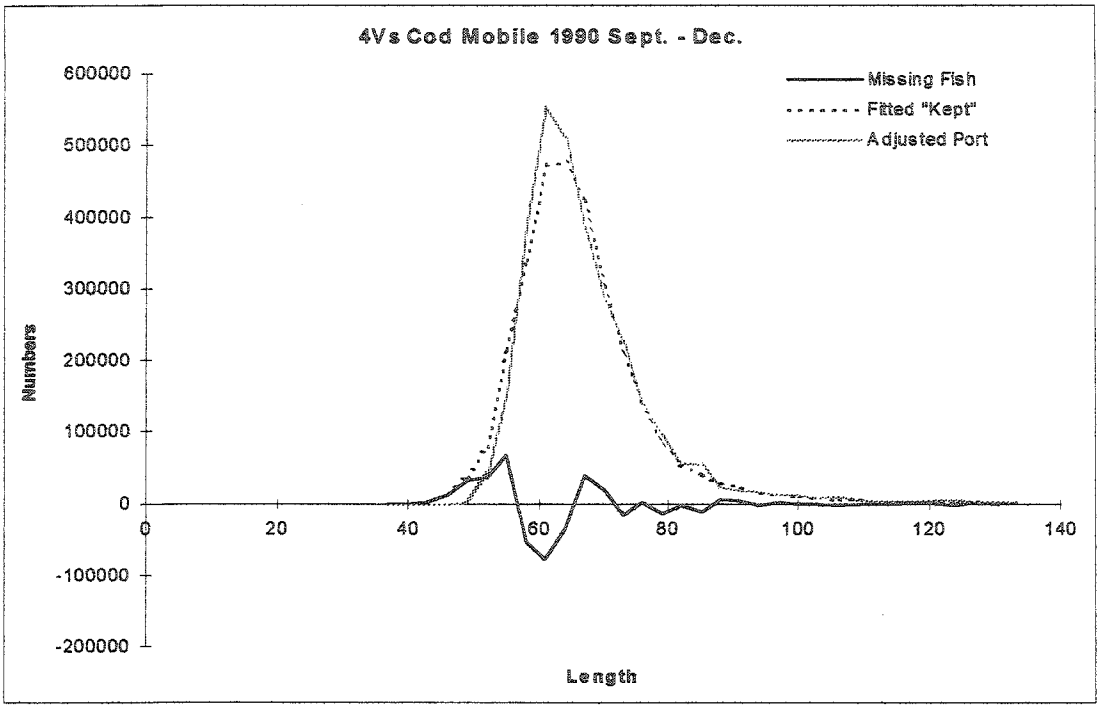
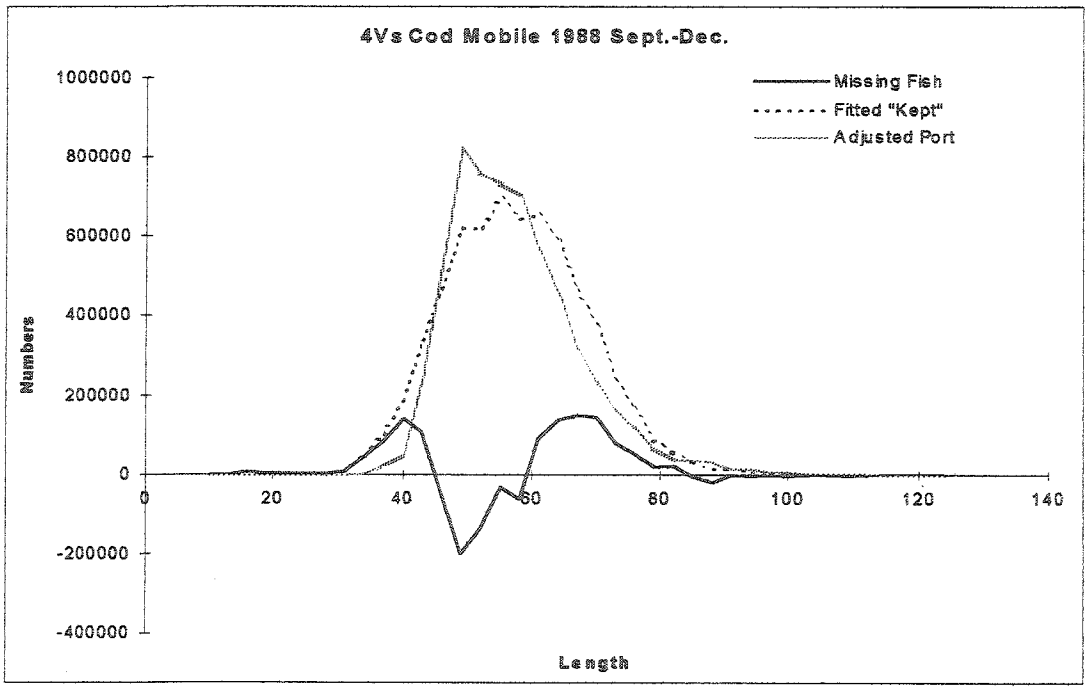
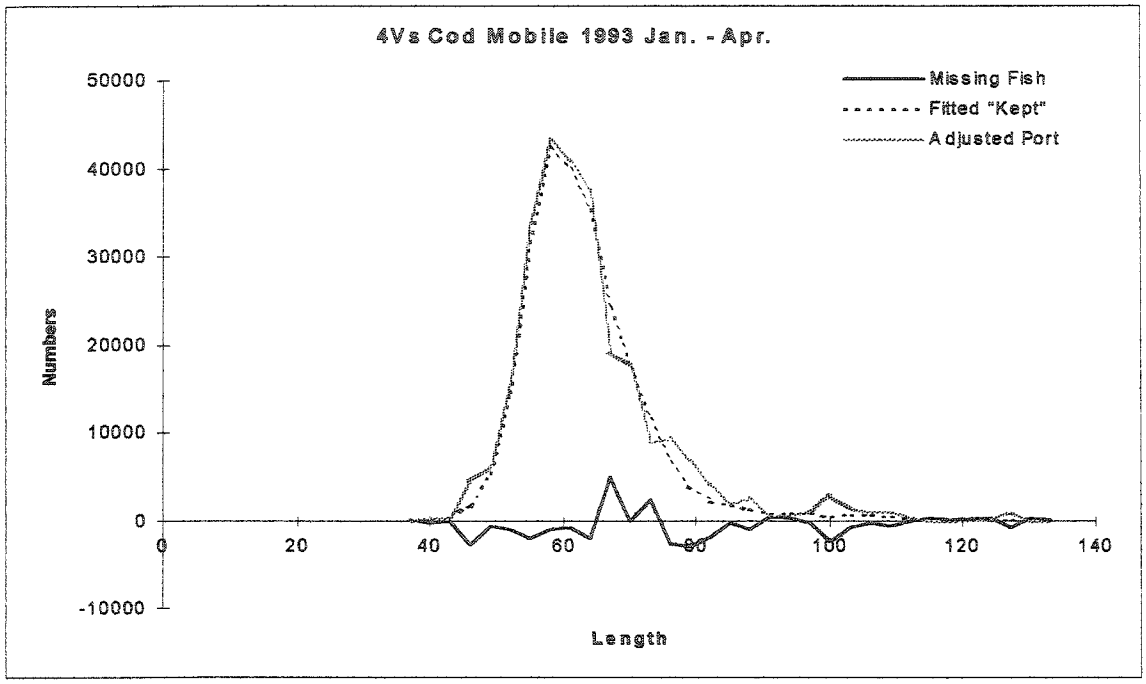
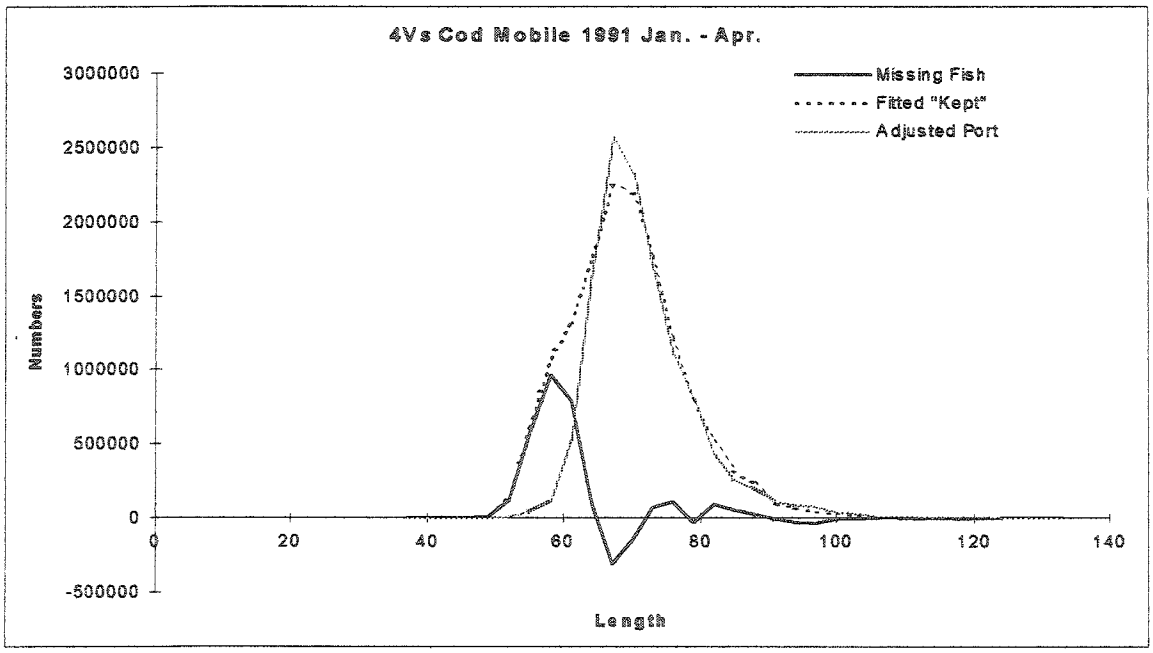
in 4Vs, there is some evidence of "missing fish". However, the pattern is not consistent across time.

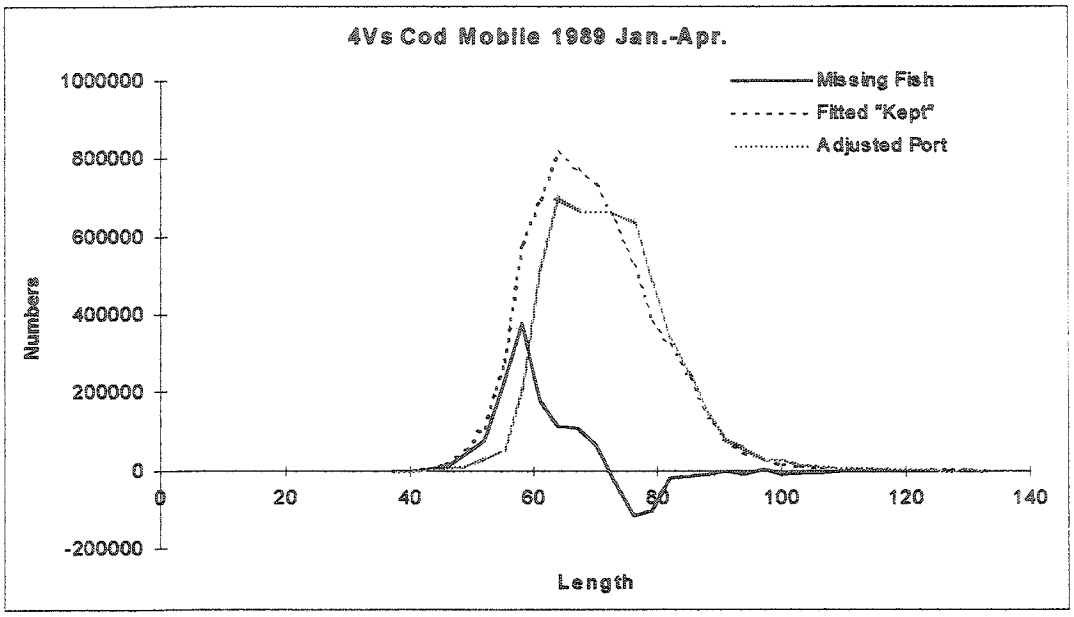




The evidence is similar for the winter fishery in 4Vs with very little, if any, "missing fish" showing up.







In summary, assigning enterprise quota rights - a right to harvest a certain quantity of fish - should encourage the holder to cooperate in resource management by clearly defining shares in the current catch and in all potential yields. Thus, it is reasonable to suggest that quota holders have a strong incentive to support sustainable fishing practices, and stock enhancement.

This chapter examined fishing practices across time to determine if those prosecuting this fishery were doing so in a conservative manner. Interview data revealed a consensus among those interviewed that misreporting catch was a regular occurrence that was encouraged by management.

Discarding data and length frequency data did hold some promise to help accurately quantify a level of discarding. However, any evidence of discarding was inconsistent across time. Thus, any conclusions were impossible.

CHAPTER 6
CONCLUSIONS and RECOMMENDATIONS

This chapter briefly summarizes findings regarding regulatory compliance, outlines an emergent company plan to address issues examined in the thesis, and makes recommendations for important future research directions including a case for multi-method co-operatively based methodologies.

6.1 FINDINGS

The thesis has explored responses of those in the offshore groundfish sector to a new property right-based fisheries regime -- Individual Quotas (IQs) and Individual Transferable Quotas (ITQs) in a region of Atlantic Canada. More specifically, issues of discarding unwanted fish in the course of normal fishing effort, and misreporting of species by area caught are investigated. Discarding has been suggested as one of, if not, the most critical compliance behaviour issues critical to the new management regime. Interview data found little evidence of willful discarding of commercial species that possessed monetary value. Discarding seemed to be the last option for fishers trying to work under regulatory conditions that were

perceived to be dramatically different from past practices. This is not to infer that discarding of commercial species did not take place. Indeed, at certain times and places, it was/is extremely high as freely admitted by many fishers.

Discarding seemed a major issue where and when regulatory and economic pressures served to restrict options. The most identifiable instance of this was when fishers were presented with a "shopping list" of species, quantity, quality, and length required by their by his/her employer. Fishers commonly reported that when faced with such constraints they frequently discarded any and all species not on that list. Further, Federal and provincial fishing regulations contributed to the discarding problem. DFO regulations were allowing fishers to use nets with mesh sizes small enough to catch undersized fish. The province of Nova Scotia introduced a minimum fish size requirement that prohibited fishers from landing cod, haddock, and pollock smaller than 41 cm in length.

DFO logbook analysis provided some insight on past fishing practices, in that some evidence of discarding on non-observed trip was detected. The use of qualitative information through semi-structured interviews determined that the majority of the logbook records were erroneous. This analysis underscores the advantage of using several

different methods (both qualitative and quantitative) to investigate fishing practices. Although the length frequency analysis did not detect the expected "missing fish", it did determine that captains fished more conservatively when an observer was aboard. This suggested that they were able to avoid small fish or fishing in areas where there were concentrations of small fish. This suggests very clearly that skippers could in the absence of countervailing pressure from employer or other sources avoid discarding relatively easily.

Misreporting was also found to be widespread and response to similar conditions. Misreporting can take many forms of which arguably the most important is creating "paper fish" or maintaining a catch history in an area that experienced an extensive amount of misreporting. In other words, over-fishing resulted in the reduction of a stock such that an enterprise could not catch their quota in that area. Instead, they resorted to catching fish in another area and assigning them to the area in which they had a quota for that species. Such a practice did not carry that moral stigma as discarding because it did not result in more killed fish but merely shuffling of catch histories from area to area. Thus, it was a more accepted form of fishing practice. Most of the captains interviewed stated

that misreporting was a daily occurrence, and a necessary practice in order to catch the required species, in the correct amounts, at the appropriate time.

6.2 RECOMMENDATIONS FROM FINDINGS

The ecological sustainability of our ocean fisheries is a major challenge for fisheries managers in the Scotia-Fundy region as well as worldwide. To meet this challenge, policy makers must find new and innovative ways to influence fishing behaviour. In interviews with fisheries managers, several suggested a more instrumental approach. They argued that people are driven by self-interest alone, that compliance is determined by the certainty and severity of the sanction in the event of violation of the rules. This is sometimes called the "deterrence" or the "big stick" approach.

> *I feel that the only way to conserve fish stocks is to set an accepted level of mortality, then guard that with your life. Make the punishment for getting caught a sufficient deterrent, see to it that they loose their quota or license, only then will fishermen respect the industry. To do that you must put observers on all vessels.*

Past experience suggests that this orientation was/is relatively ineffective due to the low level of acceptance by the fishing community (including fishing companies), and

the ingenuity of fishers to find new and innovative ways to circumvent the regulations.

An alternative to the deterrence approach exists. Termed the normative perspective, it stresses the centrality of fisher and corporate understanding, participation in and the acceptance of fisheries regulations. It is predicated upon the belief that regulated parties will comply with rules they believe are fair and reasonable, and that are being administered in a fair and reasonable manner. (McKinlay and Millington 1999). It underscores the widely accepted premise that serious consideration must be given to the human dimension of managing fisheries. In this view, effective fisheries management is primarily about managing people, individually as well as in their corporate form. It is about influencing behaviour to co-operatively achieve sustainability for fisheries and the communities that depend upon them. Simply, the most brilliantly designed management system will fail on the water unless the fishers working within it endorse the spirit of the system, are prepared to obey the rules that support it and do not encounter significant conflicts and tensions between such adherence and other economic and/or political pressures placed upon them

through their employment. Legitimation is the critical keystone for achieving the highest levels of compliance.

Interview data from the Scotia-Fundy groundfishery reinforces this latter orientation, that a more co-management based approach is needed. Fisheries stakeholders (companies and their employees) must be part of the management equation. People are much more likely to buy into a system when they see it as having legitimacy in terms of outcome and process. The key to achieving this legitimacy is with stakeholder participation in the development and operation of the whole fisheries management process.

To work in practice, the rules of the management system and the services that support the system must be developed and operated in collaboration with the regulated community and the other relevant stakeholders. In the future, fisheries managers must strive to forge strong working relationships with all fisheries stakeholders. Particular emphasis has to be given to the relationship with those who have the rights to harvest fish - rights or quota holders. It is this group who have the incentive to protect the resource. They must be encouraged to participate in all fisheries management processes,

including planning, research, and compliance strategy development and the delivery of fisheries services.

6.3 Local Attempts at More Cooperative Management

Some initial movement in this direction is now occurring. National Sea Products was the first fishing company in the domestic offshore groundfish sector to take steps towards promoting the evolution of a conservation ethic. With the creation and implementation of its new ***Fisheries Compliance Policy***, their goal is to achieve a sustainable level of resource exploitation and to ensure harvesting is performed in a responsible and conservative manner in compliance with all regulatory requirements. At least implicitly, this policy addresses issue of discarding and misreporting which are the foci of this thesis. A key consideration will be whether this new policy becomes truly and comprehensively integrated into both employee as well as corporate behaviour.

Table 3
The key components of the Compliance Policy

Land-it-all Policy	Unless otherwise instructed, vessel captains are required to land all of the fish captured during their trip.
At-sea monitoring	100% observer and video monitoring and electronic logs
Shore captain inspection	Boat is inspected pre and post sailing by the shore captain
Gathering of Scientific Information	Gathering catch data such as random length frequency measurements
Small fish protocol	If a catch has 10% small fish in two consecutive tows, a captain is required to leave the area he is fishing

This compliance policy seems to be accepted favourably by the employees interviewed for this study; they feel it may reduce destructive harvesting policies onboard.

> *The crews, I think they like the compliance policy too because they know too where their limits, and it's good for everybody really.*

> *If I go in an shoot away and get some codfish, and I put it in my logbook, which I did, maybe somebody would question me on it, but if an observer's there and he writes in, oh yeah, he's seen somebody else got codfish, he tried to avoid it. There's nothing to do when it does that. You know, it's accidental catch. But I'm sure if you never had an observer, you know and come in with some codfish, they could question you. I don't think that's right.*

6.4 Considerations for Future Research

The qualitative/quantitative methodology proved very successful in researching the complex and subtle behaviours and attitudes underlying resource management change. Each method provided valuable and insightful understanding independently but when combined and integrated, were able to shed much more light fishing behaviour that exists in the shadows.

The possibility of including crew-members in the interview phase of the research was considered. But it was decided that their knowledge of discarding and misreporting practices would lack the detail necessary for this study. I would suggest that any future research include crew-members for their knowledge of these behaviours can be checked against observer, and logbook records.

It would be very interesting and valuable to do an ongoing case study of this fishing sector and determine whether the new regulatory regime and its underlying assumptions have become part of the corporate culture of the companies fishing in the offshore sector. There are several questions left unanswered: if stocks recover, will these companies give into market pressures, and return to fishing as they have in the past? Are fishers more likely

to violate fishing rules in times of abundance? Is there a positive correlation between catch per unit effort (CPUE) ratio and average rate of discarding? A case study of this fishery could determine if this new ethic of conservation has permeated all levels of the fishing industry - from company management to deckhands.

6.5 Final Notes

Over 70% of major world fish population are overexploited or approaching maximum exploitation (Cochrane, 1999). Experience from the past 20 years suggests that imposed fishing regulations do not work. This thesis addresses the key components as we move toward a rights-based fishing regime, issues of rule avoidance - discarding and misreporting - are critical. It is an important contribution that which drives rule violation. Through understanding, we can develop a regulatory regime to decrease it.

The thesis has shown that captains have the ability and knowledge to avoid these practices, but a combination of personal greed and employer pressure led them to violate regulations without fully appreciating long-term consequences of their actions. It is hoped that with understanding sustainable fishing and participating in an

effective, co-operatively based fisheries management system, a system can be developed which simultaneously conserves fish stock while allowing families, and communities dependent on such resources to survive and thrive.

Appendix 1

Interview questions for participants in the industry

1. Background Information

- How many years have you been fishing?

- How many years have you fished under an EA management system?
  Of those years, specify what positions you held in relation to
  the boat you were working on?

2. Relationship between the skippers and their parent companies.

- How did this relationship influence past fishing practices? Did this relationship influence on the amount of discarding and misreporting?

- How did the system of payment and boat bonuses influence the
  way you fished?

- Has this relationship changed in recent years?
  If so, in what way has it changed?

3. Actual Fishing Practices
To this point, most of the information that has been gathered and documented on the offshore sector is speculative and anecdotal; Skipper A heard from one of his crew that Skipper B discarded X many lbs.of cod in 4Vs... The purpose of these interviews is to seek the truth about what actually happened, why it happened, and how it can prevented from happening in the future if and when all fisheries are re-opened..

- Did you at anytime use undersized mesh, cod-end liners, or
  tension belts or in the case of Longliners, use smaller than
  regulation hooks, and/or small bait size ?

If yes, how often?

- Did you continue to fish an area when previous sets were resulting in high quantities of small fish and/or by-catch?

- Given that discarding was not illegal or immoral for that matter, did you make it a habit of recording all discards (by weight and species) in your vessel log?

- If not, can you provide an estimate (in a percentage of an average trip catch) of how much was discarded without being recorded (specify species and areas)?

- What was the most common reason for discarding? (For example, below legal size to land, damaged or of poor quality, size not requested by the fish plant or owners, highgraded to fill quota with large fish, exceeded target or bycatch trip limits ..)

- Did you misreport catch by area?
  If so, what areas (and the corresponding species) did you most frequently misreport?

- Did you fish any differently when a DFO observer was on-board? If yes, in what way?

- Have these practices changes?
  If so, in what way have they changed and why have they changed? (For example.. you realize that discarding and misreporting can have an adverse affect on groundfish stocks, company policy does not allow such practices to occur..)

4. The Offshore Groundfish Fishery in the Future

Making the assumption that there has been a change in the conservation ethic, it begs some important (sociological) questions: What or who has been the impetus or driving force behind these changes? Has it been companies concerned about their share the future groundfish stocks (which, in theory, should result from a quasi-rights based fishing regime)? Is it merely a knee-jerk response to the present state of the industry? If and when the groundfish stocks return healthy and sustainable levels and

the fishery is reopened, will companies continue to fish as they have in the past (old habits are hard to break)? Sociologically, these are key questions to answer because who initiates the change is just as important as the change itself. It is essential for the future of the fishery that we get some idea if, and to what extent this ethic of conservation has been internalized by all those in the industry (not just company management).

- How has new DFO policy (increased mesh size, dockside monitoring, 100% observer coverage) affected your ability to fish profitably?

- Do you agree that these measures are necessary to insure a sustainable fishery?

- If the fishery were to reopen tomorrow, and groundfish stocks were at healthy levels, would you fish any differently than you did in the past? If yes, what sort of changes would you make?

- Would you support cameras, and black boxes on board your boat?

Appendix 2

Table 1a. Relative catch rates when observers are present (1) and absent (0).

		OBS		Ratio of
	YEAR	0	1	CPUE
Cod	1980	403.8257	788.1993	0.51234
	1981	488.625	945.2297	0.516938
	1982	600.3126	1000.65	0.599923
	1983	578.3213	1077.409	0.53677
	1984	802.2228	1088.108	0.737264
	1985	889.8159	889.9659	0.999831
	1986	977.1402	1354.378	0.721468
	1987	276.6554	745.0731	0.371313
	1988	644.0772	1513.672	0.425506
	1989	996.4777	1569.006	0.635101
Cod Total		996.4777	1569.006	
Haddock	1980	311.4036	485.453	0.64147
	1981	314.638	538.3165	0.584485
	1982	245.0842	352.8511	0.694583
	1983	192.5586	206.3884	0.932991
	1984	153.1367	156.0021	0.981632
	1985	214.1707	301.0721	0.71136
	1986	341.7249	335.1404	1.019647
	1987	80.09895	60.16902	1.331232
	1988	188.4507	124.3105	1.515967
	1989	276.6277	253.4064	1.091637
Haddock Total		341.7249	538.3165	
Flounder	1980	124.6636	194.3702	0.641372
	1981	91.33724	128.6489	0.709973
	1982	85.79485	70.86922	1.210608
	1983	97.18438	55.5221	1.750373
	1984	142.3378	107.8256	1.320074
	1985	84.52942	112.7559	0.749667
	1986	81.39418	87.44742	0.930779
	1987	33.89092	36.3747	0.931717
	1988	52.31696	62.07847	0.842755
	1989	96.9405	82.16141	1.179879
Flounder Total		142.3378	194.3702	

Appendix 3

Table 1b. Ratio of landed weighouts to observer estimates

Average of Land:Kept OBS	YEAR	1
Cod	1980	0.935224
	1981	0.896879
	1982	1.081416
	1983	1.553867
	1984	1.034814
	1985	1.020176
	1986	1.103323
	1987	1.167563
	1988	1.343992
	1989	1.010104
Cod Total		1.114736
Haddock	1980	0.90436
	1981	0.891368
	1982	1.089012
	1983	1.059666
	1984	1.084845
	1985	1.140914
	1986	1.194603
	1987	0.966579
	1988	1.019392
	1989	1.042148
Haddock Total		1.039289
Flounder	1980	0.993374
	1981	1.302998
	1982	1.250676
	1983	2.662361
	1984	1.270737
	1985	1.244543
	1986	1.459301
	1987	1.207782
	1988	1.174709
	1989	1.282228
Flounder Total		1.384871

Appendix 4

Table 1c. Observer estimated discard rates.

Discard rate		Observed
	YEAR	1
Cod	1980	0.012729
	1981	0.007082
	1982	0.008689
	1983	0.01043
	1984	0.0174244
	1985	0.0249936
	1986	0.0361084
	1987	0.0393682
	1988	0.0423975
	1989	0.0468156
Cod Total		0.024604
Haddock	1980	0.002216
	1981	0.003902
	1982	0.010419
	1983	0.039214
	1984	0.063706
	1985	0.057154
	1986	0.105268
	1987	0.04681
	1988	0.019341
	1989	0.028755
Haddock Total		0.037678
Flounder	1980	0.019326
	1981	0.039583
	1982	0.105726
	1983	0.064705
	1984	0.082998
	1985	0.135423
	1986	0.111081
	1987	0.054314
	1988	0.077748
	1989	0.080786
Flounder Total		0.077169

Appendix 5

Table 2a
Discards on Observ(1) and Non-observ(2) –1990

Species	Obsev 1	2	Grand Total
argentine	19450	0	19450
capelin	57000	0	57000
catfish	0	1800	1800
cod	1506037	371100	1877137
dogfish	551975	304200	856175
flatfish	1350	3025	4375
grenadier	200	0	200
haddock	27225	16010	43235
halibut	2135	2100	4235
herring	100	0	100
invertebrat	250500	500	251000
junk	8775	0	8775
Lg.sharks	26614	7200	33814
lobster	87	0	87
lumpfish	58410	314350	372760
mackeral	1200	50	1250
plaice	72423	1800	74223
pollock	96201	14025	110226
r.hake	14150	1700	15850
redfish	773650	129775	903425
s.hake	35240	11050	46290
sculpin	47800	7700	55500
shrimp	256858	17000	273858
skates	1453475	1048835	2502310
squid	2300	200	2500
turbot	211230	93800	305030
whiting	1250	2966	4216
wt flounder	75316	12295	87611
wt.perch	3800	4000	7800
Grand Tota	5554751	2365481	7920232

Appendix 6

Table 2b
Discards on Observ(1) and Non-Observ(2) --1989

	Observ			
	1	2	(blank)	Grand Tota
argentine	0	25	0	25
catfish	3150	2700	0	5850
cod	2455270	777694	0	3232964
dogfish	222970	369825	0	592795
flatfish	100	475	0	575
grenadier	1870	0	0	1870
haddock	103495	32615	0	136110
halibut	846	100	0	946
herring	700	0	0	700
invertebrat	22163	48600	0	70763
junk	11400	10200	0	21600
Lg.sharks	27780	1000	0	28780
lobster	340	170	0	510
lumpfish	15660	69200	0	84860
mackeral	1000	350	0	1350
plaice	4101	4696	0	8797
pollock	168050	97150	0	265200
r.hake	0	2200	0	2200
redfish	696509	68880	16000	781389
s.hake	9125	28595	0	37720
sculpin	5650	8900	0	14550
shrimp	81800	0	0	81800
skates	856110	1419375	0	2275485
squid	14763	1100	0	15863
turbot	78837	19600	2600	101037
whiting	7750	2800	0	10550
wt flounder	78811	30005	0	108816
Grand Tota	4868250	2996255	18600	7883105

Appendix 7

Table 2c
Discards on Observ(1) and Non-observ(2) trips -- 1988

	Observ 1	2	Grand Total
	0	500	500
capelin	0	375	375
catfish	10530	110	10640
cod	1019642	470995	1490637
dogfish	159402	560200	719602
haddock	36410	25373	61783
halibut	350	800	1150
invertebrat	1250	0	1250
junk	2400	3625	6025
Lg.sharks	10700	35500	46200
lobster	1550	0	1550
lumpfish	3800	9000	12800
mackeral	5800	200	6000
pollock	47076	53133	100209
r.hake	4106	68700	72806
redfish	53955	251115	305070
s.hake	26405	35305	61710
sculpin	16525	4675	21200
skates	668586.7	1210235	1878822
squid	50	0	50
turbot	500	26429	26929
whiting	1400	9550	10950
wt.flounder	44140	62680	106820
wt.perch	300	0	300
Grand Tota	2114878	2828500	4943378

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