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REGULATION, INDUSTRY STRUCTURE, AND THE FUTURE OF THE NORTH ATLANTIC FISHING INDUSTRY

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Audrey Watson

Much of the recent media attention devoted to the North Atlantic fishing industry has been focused on fishing moratoriums and Canada's attempts to reduce Spanish and other European Union fishing pressure on turbot (Greenland halibut) stocks outside Canada's Exclusive Economic Zone (EEZ).* These issues are symptomatic of underlying problems of fisheries regulation and the global competitiveness of the fishing industry in the northwest Atlantic. Now that Canada and the European Union have reached an agreement on the allocation of turbot stocks, both Canada and the U.S. must still try to revive their badly depleted groundfish stocks which much of the Eastern Canadian and New England fishing industries depend upon for economic survival.

Groundfishing, the harvesting of species such as cod and haddock that swim near the ocean floor, is one of the oldest industries in New England and Atlantic Canada. It is threatened with extinction

because stocks have been fished down to historically low levels and, even though fishing effort is now sharply restricted by area closings and moratoriums in both countries, natural predators and other environmental changes may impede the recovery of stocks.

The collapse of the industry follows a period of prosperity dating back to the late 1970s when both countries dealt with rampant foreign fishing by extending their offshore economic zones to two hundred miles. But prosperity was short-lived. It has now given way to falling landings and declining incomes as regulatory policy has failed to stem excessive exploitation of stocks by each country's domestic fleet.

The fishing industry provides a textbook illustration of the "tragedy of the commons", a well-established principle in resource economics in which uncontrolled access to a productive resource results in over-exploitation (Anderson, 1986). Both the United States and Canada have long recognized this problem and have nominally embraced similar policy goals to restrict over-fishing. Yet each country has adopted very different regulatory practices to achieve this goal.

The United States has largely followed a laissez-faire and decentralized policy. It has allowed the industry in New England a considerable measure of self-management with regulation largely limited to controls such as gear restrictions and the closing of fishing areas. Canada has a more tightly controlled, centralized policy that relies on a wider range of tools, including entry limitation and a quota system, to control catch. As the stock collapses of the 1990s have revealed, both approaches have resulted in serious overfishing.

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Fishing is also an example of an industry in which a "competitive" advantage is taking over from a "comparative" advantage in global markets. Atlantic Canada once dominated certain global markets for frozen fish because of its abundant stocks, while New England controlled the higher value-added U.S. market for fresh fish because of lower transportation costs. Recently, market growth and cheaper transportation have led to head-to-head competition between New England and Atlantic Canada over ownership of stocks and control of the highly lucrative fresh fish market in the United States. As a result, industry performance now hinges far more on the organizational efficiency of production and distribution, quality control, and reliability of delivery schedules.

The industry also has a variety of production arrangements. Historically, harvesting and processing were carried out almost exclusively by small-scale, family-owned businesses. Now atomistic and large-scale, vertically integrated producers directly compete with one another; factory-owned vessels operate alongside family-owned vessels; and large, highly mechanized processing plants compete against small, labor-intensive ones.

This diversity has raised critical issues for industrial as well as regulatory policy. At several critical junctures Canada has tailored its regulatory policy to the industrial structure of the industry. The most dramatic example of such coordinated policy intervention was in the early 1980s when Canada combined enterprise catch quotas for large processors with an industry restructuring program that aggressively fostered a large-scale, vertically integrated harvesting and processing sector. In contrast, U.S. regulatory policy has been developed independent of other policy initiatives and the U.S. government has made no attempt to shape the structure of the processing and harvesting industries. As a result the New England industry has retained a much more atomistic structure without significant vertical integration.

The combination of stock declines and increased competition has raised the level of economic conflict between the two countries and has highlighted the differences in their industrial and regulatory policies. The contrasting experiences of New England and Atlantic Canada provide important lessons for public policy: how common property resources should be regulated, what should be the mix between large and small-scale producers, and why regulatory, industrial, and economic development policies should be linked.

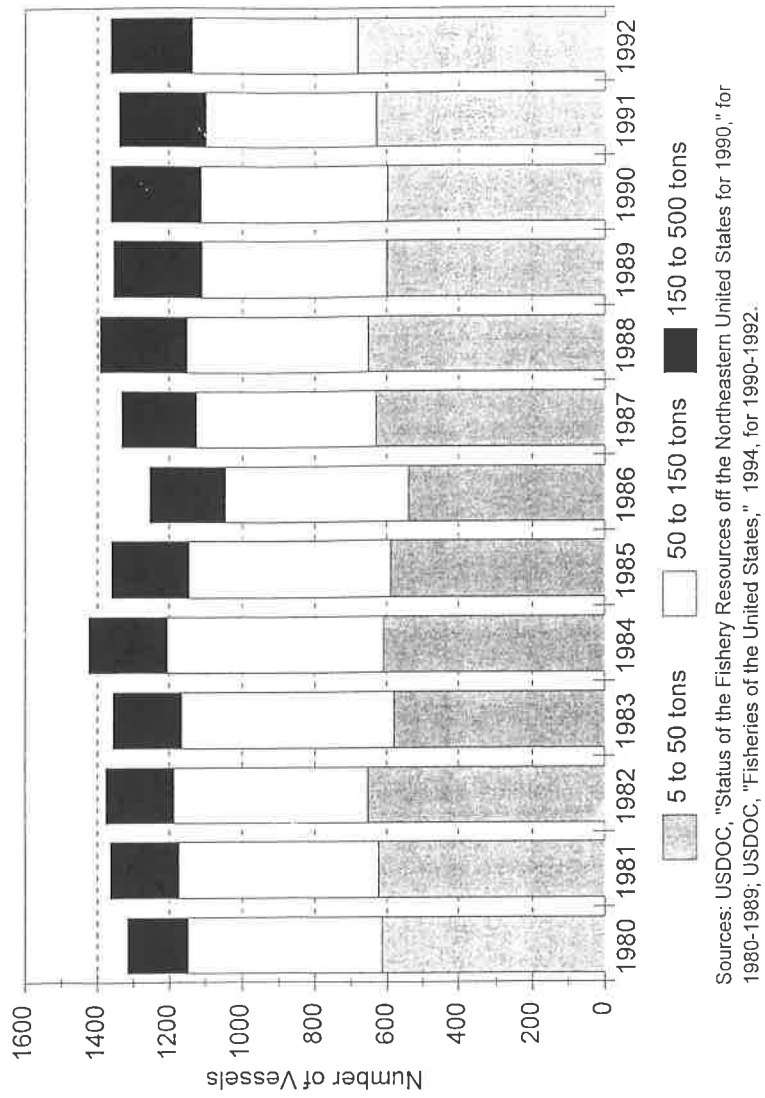
I. A BRIEF HISTORY

The fishing industry in New England and Atlantic Canada has had a volatile history in terms of its economic fortunes. Fishing dates back to the colonial period when wooden vessels and nets were used to fish for cod (Innis, 1940; Barrett, 1992a). The final product was either consumed fresh or salted for later use. While the saltfish (and later canned fish) were exported, fresh fish were only consumed locally in both countries until the late nineteenth century when relatively small amounts of iced fish were shipped by rail to inland cities. Since then products and markets have shifted, technology has changed in both harvesting and processing, international competition has become more intense, government regulation has increased, and various direct and indirect subsidy programs have benefited the industry in both countries.

In the late nineteenth and early twentieth centuries, for example, steamships replaced schooners and refrigeration supplemented salting and canning as a method of preserving fish. The industry also experienced a number of technological changes in processing and marketing that helped to open new markets. The first major frozen fish companies were founded in the United States, and innovations such as mechanical filleting and rapid-freezing processes (invented in 1923) expanded markets for groundfish. These new technologies, particularly the increased use of refrigeration and freezing, required large capital investments and eventually led to increased industrial concentration in the frozen fish processing industry (Innis, 1940). But perishability of fresh fish meant that this market largely remained confined to coastal areas. It took the development of refrigerated trucking in the 1930s to open inland markets, and by 1940 almost 60 percent of Boston's fresh and frozen fish was shipped over 200 miles. In the late 1940s the U.S. fresh fish market grew again as air transport began to link Boston with retailers in major cities across the United States (White, 1954).

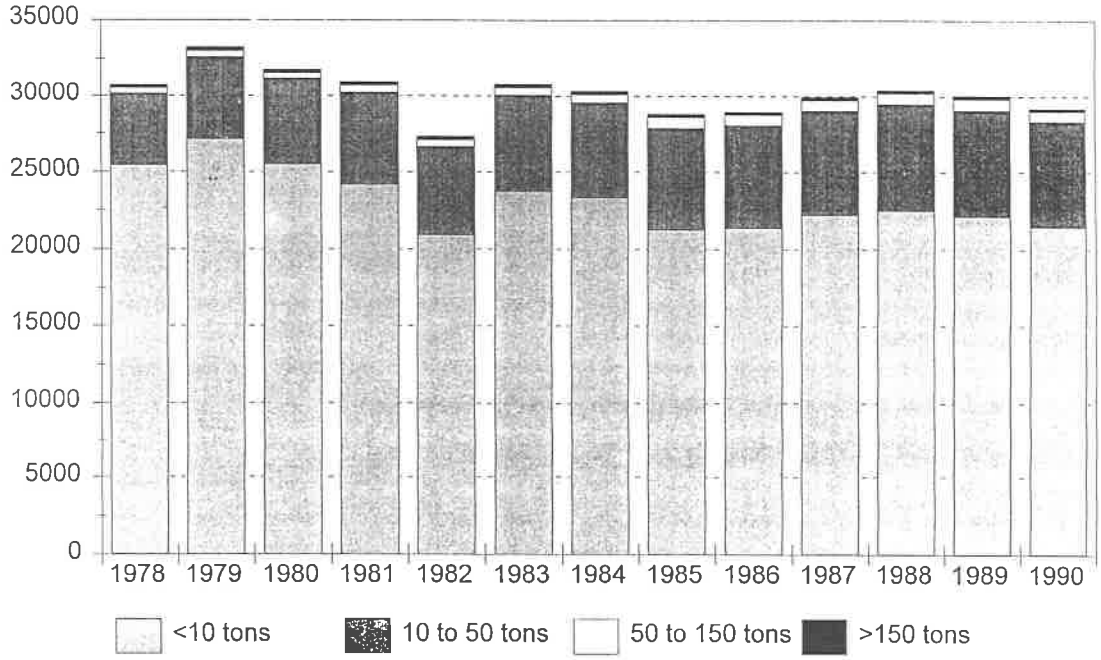
Today the industry is substantially larger in Atlantic Canada than in New England and is more central to the economy of Atlantic Canada. Fishing accounts for about 15 percent of GDP in the major fishing provinces of Nova Scotia and Newfoundland (DFO, Annual Statistical Review, various years) while it contributes only a tiny fraction to the GDP of the New England region. Although the fact that New England data include only vessels greater than five tons tends to exaggerate the apparent difference in size between the two

Figure 1: Number of Fishing Vessels By Size, New England, 1980-1992



Sources: USDOC, "Status of the Fishery Resources off the Northeastern United States for 1990," for 1980-1989; USDOC, "Fisheries of the United States," 1994, for 1990-1992.

Figure 2: Number of Registered Vessels by Size, Atlantic Canada, 1978-1990

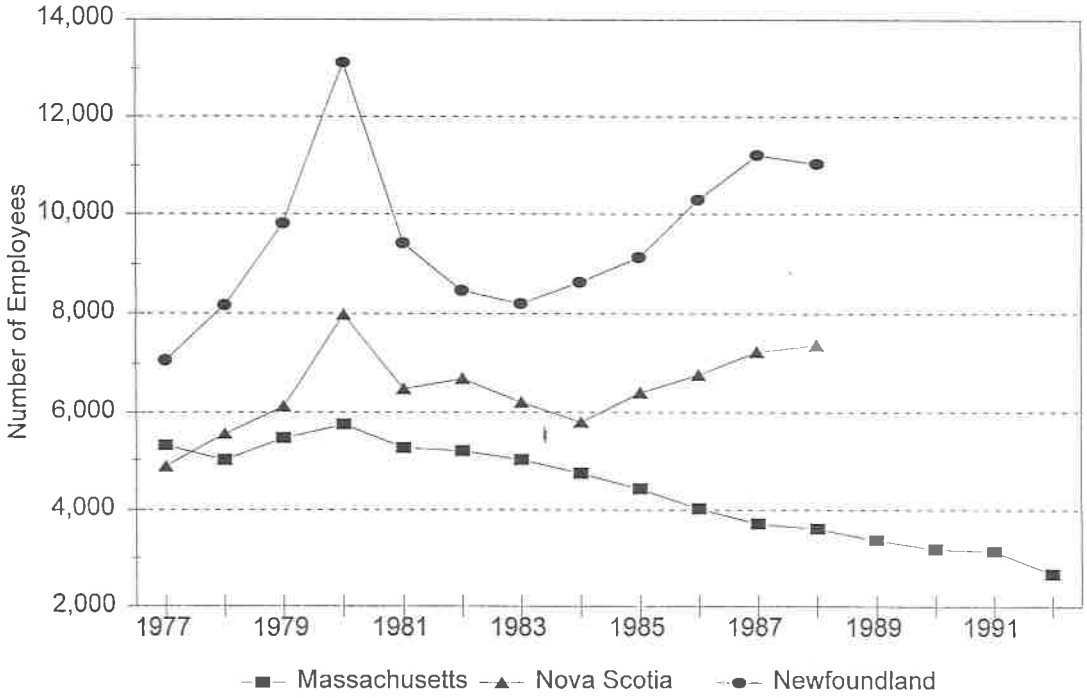


Data for Quebec not available for 1980 and 1982. Post-1984 data have been converted from length to weight according to the following scale:

under 35 feet	<10 tons	35 to 54.9 feet	10 to 50 tons
55 to 99.9 feet	50 to 150 tons	100 feet and over	>150 tons

Source: DFO, "Annual Statistical Review," various years.

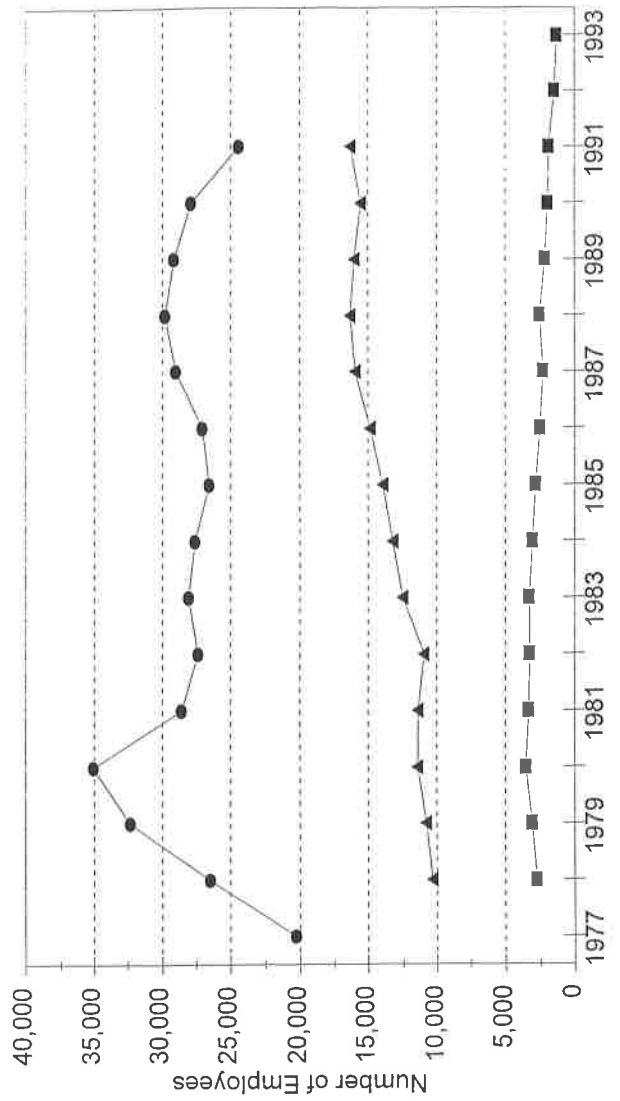
Figure 3: Number of Employees in Fish Processing Plants in Massachusetts, Nova Scotia, and Newfoundland, 1977-1992



Massachusetts data: Source: USDOC, "Fisheries of the United States," various years.

Nova Scotia and Newfoundland data: Source: DFO, "Annual Statistical Review, " various years, for 1977-1987; unpublished data from DFO for 1988.

Figure 4: Number of Employees in Fish Harvesting in Massachusetts, Nova Scotia, and Newfoundland, 1977-1993



Massachusetts data: Source: USDOL, "Employment and Wages, Annual Averages," various years, for SIC 0912 (finfish).

Nova Scotia and Newfoundland data: Sources: DFO, "Annual Statistical Review," various years, for 1977-1987; unpublished data from DFO for 1988-1991.

fleets, 29,203 vessels were registered in Canada in 1990 while the New England fleet contained only 1,362 vessels (Figures 1 and 2). The main segment of the Atlantic Canadian fleet (vessels 10 tons and over) is nearly six times as large as the New England fleet. While it is likely that both fleets have contracted sharply following the decline in fish stocks over the last few years, industry observers maintain that relative difference in the sizes of the two fleets remains the same.

Similarly, employment in processing and harvesting is also much larger in Atlantic Canada than in New England both in terms of number of workers and as a percentage of total employment. There are six times as many processing workers in Nova Scotia and Newfoundland, where most of the Canadian industry is located, than in Massachusetts where New England processing is concentrated (Figure 3). An even larger difference exists between the harvesting sectors in each country (Figure 4). Nevertheless, even in New England, fishing remains an important source of jobs and income in a handful of large ports and in some rural coastal regions.

A. Recent Industry Trends

Trends in output and revenue are shaped by a variety of factors, many beyond the control of individual fishermen. Output is inherently volatile, relying as it does on a biological resource subject to shocks from disease, predation, water temperatures, and climatic conditions. This inherent volatility leads to substantial year-to-year fluctuations in landings and revenues. Output and revenue also are influenced by a number of other forces, including the effects of common resource ownership, government regulatory and industrial policies, changing dietary preferences, and luck. Although this complex interplay of factors makes it difficult to offer meaningful statements about short-term changes in the economic condition of the industry, it is nonetheless possible to distinguish major trends over the longer term.

Wide fluctuations in catch are indicative of a high risk industry and, along with declines in landings, should have signalled that it was time for the industry to contract. But the negative effects of volatility and decline in landings in the fishing industry have frequently been countered by higher fish prices. The catch declines brought about by foreign fishing in the late 1960s and early 1970s, for example, were offset by significant increases in the prices of fresh and

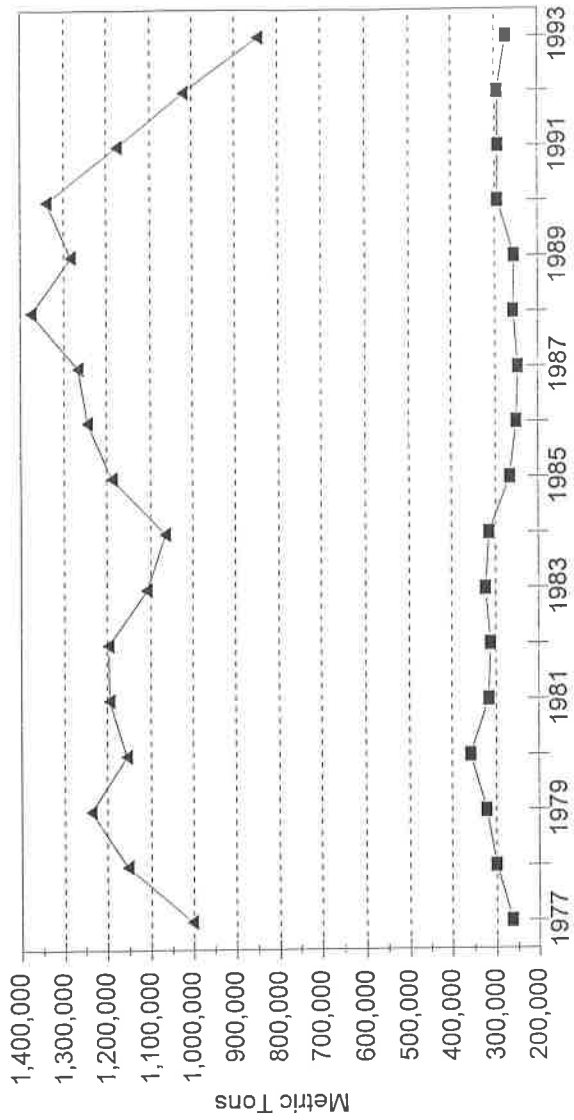
frozen fish as a result of growing global demand. Between 1965 and 1975 the value of the New England catch rose steadily from $75 million to $154 million, a real increase of almost 20 percent (Doeringer, Moss, and Terkla, 1986a). Likewise, the real value of the Atlantic Canadian catch increased by 7.2 percent (DFO, Annual Statistical Review, various years) between 1968 and 1975.

After the imposition of the 200-mile limit and the decline of foreign fishing helped to raise catch levels (Figures 5 & 6), the unit values (in real terms) of all species remained relatively stable in both countries as increases in supply were offset by substantial increases in demand (Figure 7). This growth in output, even with stable prices, drove up the real value of landings. Real values of catch in Atlantic Canada rose by 25 percent between 1977 and 1982 and by 16 percent in New England (Figure 8). For key groundfish species such as cod, the increase in revenues was even more dramatic-- the real value of cod landings rose 92 percent in Atlantic Canada and 37 percent in New England during this period (Figures 9 and 10).

Rising revenues attracted some additional labor to the industry, but the main effect was to increase fishing effort through the adoption of new electronic fish-finding technologies and other improvements in vessel efficiency. As landings fell again after 1980, rising demand and buoyant prices initially sustained industry revenues and validated new investments. The real value of the cod, haddock, and flounder catch in New England, for example, fluctuated around an average of $147 million between 1980 and 1987. By the early 1990s, however, price increases were no longer offsetting continued declines in groundfish stocks. The real value of landings of these species fell by almost 37 percent between 1987 and 1993, with nearly three-fourths of this decline occurring after 1991 (Figure 9).

In Atlantic Canada declining catches in 1983 and 1984 were not offset by higher prices because of elastic supplies in global markets for frozen and salt fish, and revenues declined during these years. But 1985 rising catches, coupled with higher prices and a shift in the composition of exports to the United States in favor of higher-valued fresh fish, caused revenues to soar; in 1987 the real value of the Atlantic Canadian catch was 43 percent above its 1980 level. Nevertheless, by the late 1980s Canada began to experience the same problems as the United States as revenues began to decline due to falling landings and slower increases in fish prices (Figures 8 and 10).

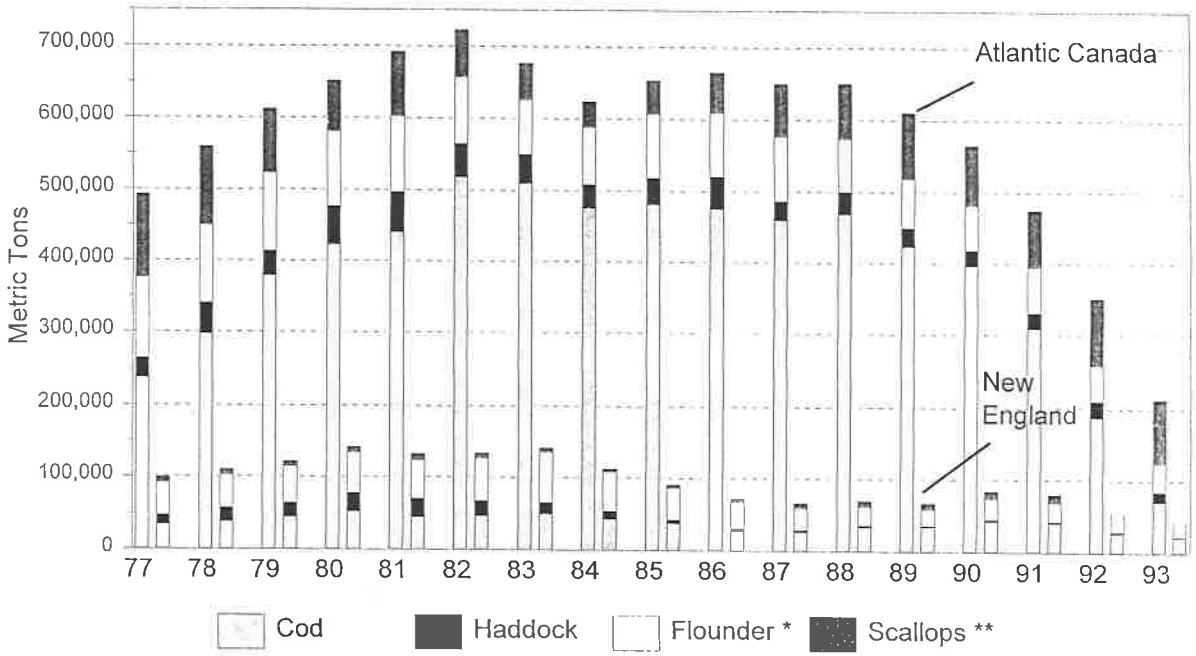
Figure 5: Landings, All Species
Atlantic Canada and New England, 1977-1993



New England data: Landings are in metric tons of live weight, except for univalve and bivalve molluscs, for which weights are exclusive of their shells. Source: USDOC, "Fisheries of the United States," various years.

Atlantic Canada data: Landings are in metric tons of live weight (fish and shellfish only). Sources: DFO, "Annual Statistical Review," various years, for 1977-1987; unpublished preliminary data from DFO for 1988-1993.

Figure 6: Landings by Species
Atlantic Canada and New England, 1977 - 1993

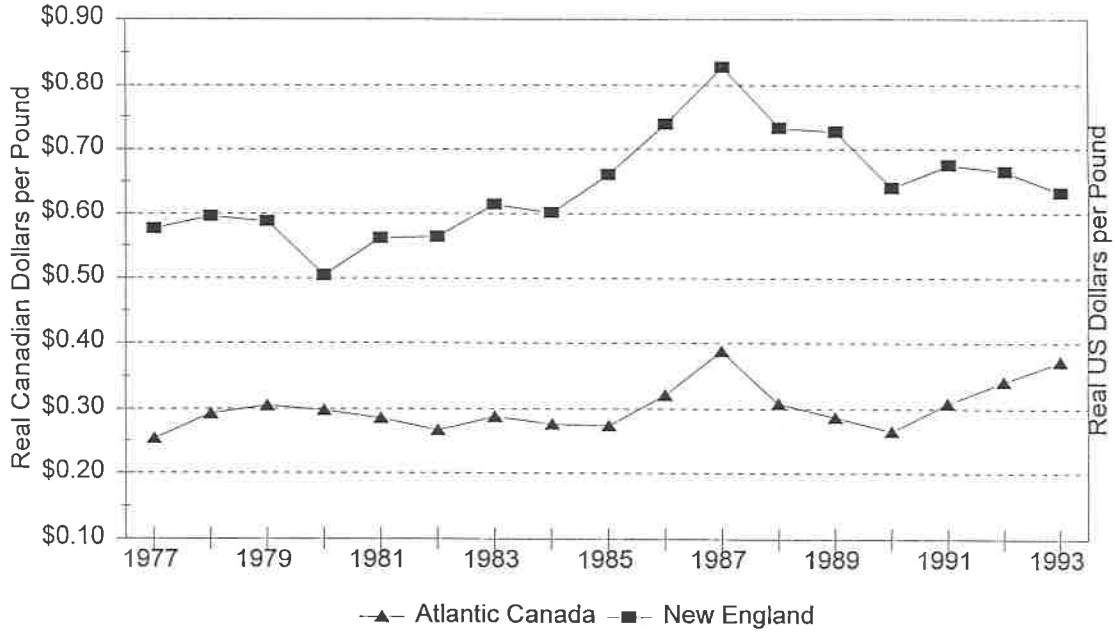


* New England flounder landings are calculated as the sum of blackback (winter), yellowtail, and "other flounder". Atlantic Canada flounder = "small flatfishes".
** Data on New England scallop landings not available for 1992 and 1993.

Atlantic Canada data: Landings are in metric tons of live weight. Sources: DFO, "Annual Statistical Review," various years, for 1977-1987; unpublished preliminary data from DFO for 1988-1993.

New England data: Landings are in metric tons of live weight, except for scallops, for which weights are exclusive of their shells. Sources: USDOC, "Fisheries of the United States," various years; Georgianna, et. al., 1993.

Figure 7: Real Unit Values, All Species,
Atlantic Canada and New England, 1977-1993



Atlantic Canada data: prices calculated in Canadian dollars per pound of live weight from landings and values taken from DFO, "Annual Statistical Review," various years, for 1977-1987; unpublished preliminary data from DFO for 1988-1993. Real values calculated using Canadian consumer price index, 1986=100.

New England data: prices calculated in US dollars per pound of live weight from landings and values taken from USDOC, "Fisheries of the United States," various years. Real values calculated using US consumer price index, 1982-1984=100.

B. Employment and Earnings

In 1990 processing and harvesting employment represented about 16 percent of total employment in Newfoundland and 6 percent of total employment in Nova Scotia. In that same year there were almost 16,000 full and part-time registered fishermen in Nova Scotia and almost 29,000 in Newfoundland (Figure 4). The corresponding figures for processing employment (1988) are over 7,000 in Nova Scotia and over 11,000 in Newfoundland (Figure 3). Since, the industry is highly seasonal, approximately half of the fishermen and a substantial fraction of the processing labor force in both provinces work part-time (DFO, Annual Statistical Review, various years).

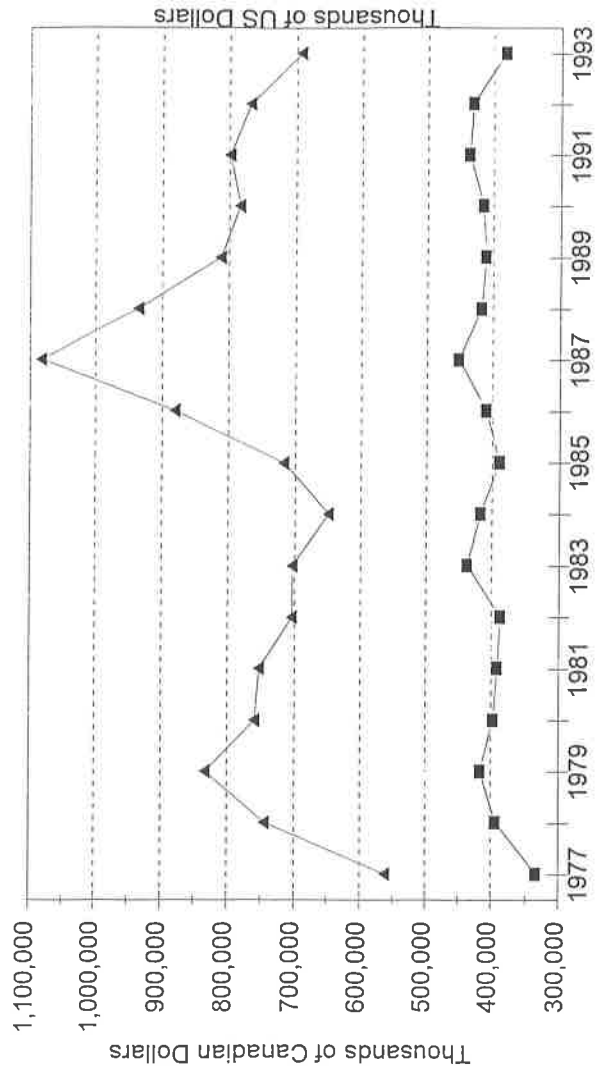
In contrast, while there are variations among states, the fishing industry in Massachusetts alone (where most of the fleet is concentrated) accounts for less that 1 percent of statewide employment, with the fraction remaining much higher in the largest ports of Gloucester and New Bedford (Doeringer, Moss, and Terkla, 1986a). The New England fleet employs only about 6,500 fishermen (1985), around 3,500 of whom are offshore workers with substantial year-round employment (Doeringer, Moss, and Terkla, 1986a).

Fishermen's earnings are based on the revenue of their vessels, and incomes, at least in the short term, are closely tied to changes in the value of catch. After the establishment of the 200-mile economic zone, for example, the landed value of all species in Atlantic Canada rose 48 percent in real terms between 1977 and 1979 and by 24 percent in New England (Figure 8).

During periods of rising catch or rising prices, fishermen's incomes can increase substantially above that of alternative onshore employment. But the longer term earnings have approximated those of semi-skilled, on-shore jobs. Within a year after the revenue surge from the establishment of the 200-mile limit, harvesting employment began to rise in both countries. Between 1978 and 1980 employment in harvesting rose 11 percent in Nova Scotia, by 33 percent in Newfoundland, and by 29 percent in Massachusetts (Figure 4). While the correlation between employment and catch is most evident in periods of strong growth in catch revenue, subsequent employment trends have been consistent with fluctuations in the prosperity of the industry in the two countries.

Processing employment is semi-skilled and fluctuates with the level of landings. The increase in landings after the 200-mile limit was established drove processing employment up by 64 percent in

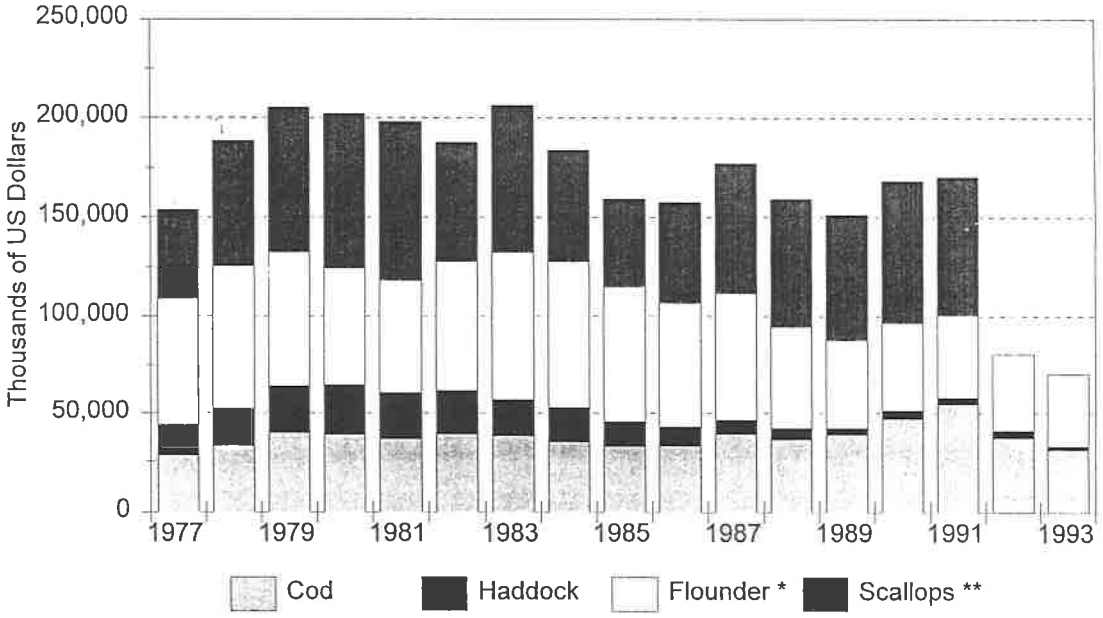
Figure 8: Real Landed Values, All Species
Atlantic Canada and New England, 1977-1993



Atlantic Canada data: Landed values are in thousands of Canadian dollars. Real values calculated using Canadian CPI, 1986=100. Sources: DFO, "Annual Statistical Review," various years, 1977-1987; unpublished preliminary data from DFO for 1988-1993.

New England data: Landed values are in thousands of US dollars. Real values calculated using US CPI, 1982-1984 = 100. Source: USDOC, "Fisheries of the United States," various years.

Figure 9: Real Landed Values by Species, New England, 1977-1993

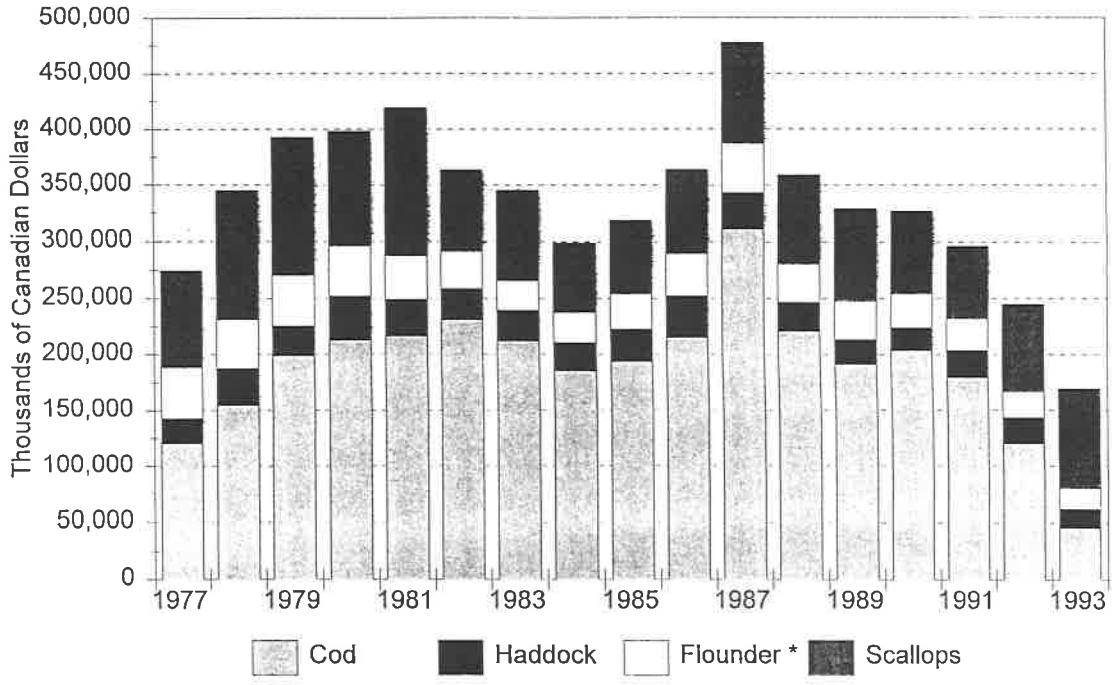


*Flounder landings are calculated as the sum of blackback (winter), yellowtail, and "other flounder" landings.

** Information on scallop landings not available for 1992 and 1993.

Landed values are in thousands of US dollars. Real values calculated using US CPI, 1982-1984=100.
Sources: USDOC, "Fisheries of the United States," various years; Georgianna, et. al., 1993.

Figure 10: Real Landed Values by Species, Atlantic Canada, 1977-1993



* small flatfishes.

Landed values are in thousands of Canadian dollars. Real values calculated using Canadian CPI, 1986=100.
Sources: DFO, "Annual Statistical Review," various years, for 1977-1987; unpublished preliminary data from DFO for 1988 -1993.

Nova Scotia and by 86 percent in Newfoundland between 1977 and 1980 (Figure 3). Massachusetts processing employment rose by only 8 percent between 1977 and 1980 (Figure 3), but catch-driven changes in employment in the fresh fish sector are presumably masked by the greater employment stability in the larger frozen fish processing sector, which does not depend on domestic landings. Case studies repeatedly find that processing wages are much lower than those for harvesting and are tied to the local labor market rather than to changes in the value of the catch (Doeringer, Moss, and Terkla, 1986a; Apostle and Barrett, 1992b, 1992c; Macdonald and Connelly, 1986a, 1986b).

C. Trends in Product Markets

Although the Canadian and New England fleets harvest the same major groundfish species from contiguous resource pools in the Northwest Atlantic, the two countries have traditionally differed in the proportions of fresh, frozen, and salted fish products offered for sale. Product mix has been influenced by a number of factors, including prices of alternative products, the scope of the domestic market, size of the resource base, market access, and quality of catch. Frozen and saltfish markets can accommodate fish of lower quality and freshness; transportation times and shelf life are less important than in fresh markets. These markets are also globally competitive and yield far lower prices than fresh fish markets. In contrast, the fresh fish market demands a high-quality product. Fish in excellent physical condition that are caught and landed on the same day command the highest price premiums.

The New England industry has access to a smaller resource base and faces a larger domestic demand than its Canadian counterpart. Consequently, the New England industry specializes almost exclusively in the production of high-value fresh fish products while frozen fish processors rely almost entirely on Canadian and other foreign sources of frozen fish blocks. Most of the fresh fish products have traditionally been consumed within the New England and greater New York regions, but improvements in air transportation have opened markets in other parts of the country.

Canadian producers have traditionally found their access to both domestic and U.S. markets limited by longer distances and poorer transportation networks. Since only a fraction of Canadian landings could be sold fresh in the local market, Canadian producers

concentrated on producing for the global salted and frozen fish markets throughout the 1960s and 1970s (DFO, Annual Statistical Review, 1955-1976). Even as late as 1980, only 11 percent of the key groundfish species were sold fresh, while frozen and salted products accounted for 66 percent and 23 percent of sales respectively (DFO, Annual Statistical Review, 1981).

In the 1980s Canadian producers took advantage of falling transportation costs, mechanized filleting technology, and packaging improvements to enter the high-value U.S. fresh fish market (USITC, 1984; USITC, 1986). Nova Scotia producers were particularly successful at penetrating the U.S. market because of their proximity to year-round fishing grounds and to the United States' market. The inshore fleet of southwest Nova Scotia supplies most of the whole fresh Canadian fish exports to the U.S., largely because these fish tend to be larger and more carefully handled than those caught by the Canadian offshore fleet. Beginning in the mid 1980s, however, large processors also began to enter the U.S. fresh market. Unlike the smaller producers who concentrated on whole fish, the large processors focused on selling large orders of higher-valued fresh fish fillets to supermarket chains. National Sea Products, the dominant vertically-integrated firm in Nova Scotia, became the largest single supplier of fresh fish to U.S. markets.

The U.S. market for fresh fish expanded rapidly during the 1980s. Per capita seafood consumption rose by 22 percent between 1982 and 1989 as the public became aware of the health benefits of eating fish (Food Marketing Institute, 1990, 1991). Supermarkets were a primary beneficiary of this increased demand (Hasselback and Marris, 1991) which further strengthened the marketing opportunities of mass suppliers of fillets, such as National Sea Products.

II. INDUSTRY STRUCTURE

The traditional differences in product specialization have led to corresponding differences in industrial structure in the New England and Canadian fishing industries. The New England industry is atomistic, reflecting the region's focus on high-value fresh fish products. Both vessels and processors are independently-owned and operated. Enterprises are typically small in scale, with little vertical integration between harvesting and processing. Although the Atlantic Canadian industry possesses a similar atomistic sector, the region's extensive participation in the global market for frozen

fish has also encouraged the development of a large-scale corporate sector. It is composed primarily of two large and vertically-integrated processors, each maintaining its own offshore fleet and handling marketing and distribution tasks. The presence of this corporate sector accounts for the industry's greater concentration in Canada than in New England.

A. The New England Harvesting Industry

The New England groundfish and scallop fleet has nearly doubled over the last two decades from 703 vessels of five tons or greater in 1965 to 1,362 vessels in 1992, but most of this growth occurred in the late 1970s following the declaration of the 200-mile limit (Figure 1; Doeringer, Terkla, and Moss, 1986a). The overall number of vessels in the fleet has remained roughly stable over the past decade, but the proportion of large vessels (between 150 and 500 tons) has risen sharply. Growth in vessel size along with increased technical sophistication sharply increased its fishing power.

The fleet is divided between inshore and offshore vessels. Inshore vessels (5 to 50 tons) make up about half the fleet but account for a far smaller proportion of landings. In 1991 this sector accounted for about 20 percent of overall New England groundfish landings (NEFMC, 1993, 184; USDOC, 1990). The average inshore vessel employs two to three crew and earned annual gross revenues of around $60,000 in 1989 (USDOC, 1991a). Because of their small size, these vessels must remain near shore and cannot fish in inclement weather. Consequently, most of their fishing activity is concentrated in the summer months. Since fishing trips are short-- most last only one day, with a maximum length of two to three days-- their catches are fresher than those landed by offshore vessels and are generally destined for the premium-quality fresh fish market. Competition is greater in the inshore than in the offshore fishing grounds, and the availability of particular species varies more widely. As a result inshore vessels must have the flexibility necessary to fish for different species and employ different gear in the course of the season.

Offshore vessels (over 50 tons) comprise the remainder of the fleet. These vessels are primarily concentrated in the large ports; most have their home berths in Gloucester and New Bedford with smaller concentrations in Portland, Boston, and Port Judith, Rhode Island. These vessels have crews of six to twelve and earn annual gross revenues approximately ten times those of inshore vessels (USDOC, 1991a). They are able to fish year-round and at great distances from shore; a typical trip may last a week or more and take the vessel two or three hundred miles from shore. Although their fish are consequently less fresh, almost all are still sold in the fresh fish market.

Concentration in both the inshore and offshore sectors in New England is low, with most vessels owned by individuals (who frequently captain their boats as well) or small family-based corporations. The majority of offshore groundfish vessels are owned and crewed by ethnic families, primarily Italians and some Portuguese in Gloucester and Portuguese in New Bedford; few families own more than two boats. Vessels are costly, with prices ranging from $600,000 to $1,000,000 for a new offshore vessel; scallop vessels are the most expensive.

B. The Atlantic Canada Harvesting Industry

The Atlantic Canada fleet ranges from numerous small boats under 10 tons to large vessels greater than 150 tons. Like the New England fleet, the main segment of the Atlantic Canadian fleet (vessels 10 tons and over) grew rapidly over the past two decades, particularly in the late 1970s following the declaration of the 200-mile limit. In 1973 3,473 vessels of 10 tons or greater were registered, rising to 6,252 boats in 1980. In 1990, the most recent year for which data are available, the comparable figure was 7,785 boats, though it is probable that the number of vessels has fallen since then in response to declining fish stocks (Figure 2; DFO, Annual Statistical Review, various years).

The distinction between the inshore and offshore fleets is far more important in Atlantic Canada than in New England because ownership structure, regulatory practices, and product markets differ markedly between the two groups of vessels. Under the current classification system adopted in the mid-eighties, the traditionally-defined inshore fleet is broken down into three categories: "inshore" vessels are considered to be those less than 35 feet in length or around 10 tons, "nearshore" vessels are those between 35 and 65 feet (10-75 tons), and "midshore" vessels are between 65 and 100 feet (75-150 tons). In 1987 nearshore vessels accounted for almost 24 percent of the total Canadian fleet and 32 percent of the groundfish catch, while midshore vessels accounted for less than 1 percent of the fleet and 3 percent of the catch. In contrast inshore vessels made up

74 percent of the total fleet but landed only 18 percent of the total groundfish catch (Hache, 1989). Together these three categories make up about 98 percent of the fleet but account for only about 50-60 percent of total landings, a percentage kept fairly constant as a result of regulatory policies dividing total catch quotas between the inshore and offshore fleets (Gardner, 1988). Then in the late 1980s division of overall quotas shifted in favor of the inshore fleet from 53 percent of the total allocation in 1982 to 58 percent in 1989, partly as a result of political pressure from owners of the smallest vessels who faced increasing competition from the growing numbers of high-capacity "jumbo" vessels (Hache, 1989; Halliday, et al., 1992).

The offshore fleet (vessels over 100 feet in length or greater than 150 tons) consisted of 192 vessels in 1990, roughly the same as the number of comparable ships in the New England fleet (Figures 1 and 2). About 90 percent of this fleet is located in Nova Scotia and Newfoundland. In 1987 the offshore fleet landed over 45 percent of the total groundfish harvest, with over fourth-fifths of this catch hauled by the largest vessels (over 500 tons) (DFO Annual Statistical Review, 1987). While most vessels in the Canadian inshore fleet are independently-owned and operated, the offshore fleet is owned almost entirely by the two large Canadian processing firms. An advantage of this corporate ownership is that it enables the processors to coordinate the fleet's fishing activity and to distribute landings among processing plants more efficiently.

Regulatory restrictions on the entry of vessels greater than 65 feet in length since 1973 (though the restrictions were not fully implemented until 1975) appear to have shaped the size and composition of the fleet. While New England saw an increase in the proportion of large vessels over the past decade, most of the growth in the Canadian fleet has been in the small (10 to 50 tons) and medium-sized (50-150 tons) vessels, with the number of large ships actually shrinking during the 1980s. In 1976 entry restrictions were extended to some smaller vessels and, since 1980, entry has been completely frozen. Current regulations require potential entrants to purchase a license from an existing vessel, although enforcing these restrictions has been somewhat difficult (MacDonald, 1984; Halliday, et al., 1992).

Entry restrictions were successful at controlling the number of vessels in the offshore fleet, but they were less effective in limiting the size of the inshore fleet. Between 1977 and 1982 rising revenues and government financial assistance resulted in an expansion of vessels in the nearshore fleet. The number of vessels between 35 and 45 feet increased by 25 percent, while the number of vessels between 45 and 65 feet increased by 16 percent (Kirby, 1982). This trend was especially pronounced in Nova Scotia, where the number of vessels between 45 and 65 feet increased by nearly 45 percent. Regulators responded in 1982 by instituting new entry restrictions on vessels between 45 and 65 feet. Consequently, when rising fish prices resulted in increased revenues during the mid-eighties, inshore fishermen upgraded to new "jumbo" vessels -- high-capacity fiberglass vessels less than 45 feet in length. Between 1985 and 1989 the number of these new vessels in Nova Scotia increased by nearly one-third (Hache, 1989).

C. The New England Processing Industry

Fish processors in New England tend to specialize in either fresh or frozen products. The latter use frozen blocks purchased in global fish markets and thus have little connection with the rest of the New England fishing industry. Unlike their Canadian counterparts, New England processors produce little for export, selling almost all of their product in the United States. Canadian imports dominate the lower end of the U.S. frozen product market, while the U.S. produces most of the brand-name fish sticks and portions. Thus little direct competition occurs (Kirby, 1982).

The majority of fresh fish processors are located in Massachusetts and there is an apparent trend towards increasing geographic concentration of the industry (Georgianna, et al., 1993). In 1980 Massachusetts plants accounted for 70 percent (by weight and value) of total U.S. fresh groundfish processing; five years later the figure was 80 percent (USITC, 1986 and Georgianna and Ibara, 1983). This trend largely mirrors a decline of processing activity in other areas such as New Hampshire and Maine rather than any pronounced increase in the number or scale of Massachusetts firms (Georgianna, et al., 1993). Within that state the industry is concentrated in Boston (where over half the state's processing firms are located) and New Bedford. The reduction of processing in other parts of the state, particularly Gloucester, suggests a pattern of increasing intrastate geographical concentration with much of the processing activity moving to Boston (Terkla and Wiggin, 1994).

While concentration within the processing industry is low, there is substantial oligopoly within particular ports. In 1983 the top four firms accounted for only about 28 percent of industry production but recent interviews suggest that the top four firms in Boston, New Bedford, and Gloucester account for around 60 percent, 80 percent, and 90 percent of each port's respective output (USITC, 1984; Doeringer and Terkla, 1995). In general the same firms have dominated the industry for the past ten or twenty years. These larger companies are better able to secure supplies of fish-- from Canada and other foreign countries, if necessary-- and consequently can offer their customers more reliable delivery and a wider variety of species (Georgianna, et al., 1993). Predictability of supply and prices is also an advantage in expanding into new markets. In a period of declining fish stocks these larger processors appear more likely to survive than their smaller competitors. Hence it is possible that concentration will increase in the future as many small firms are forced to leave the industry.

Most fresh fish processing firms are small, family-owned and operated businesses employing fewer than 50 workers. Despite the potential for economies of scale, the average size of firms has remained relatively constant or declined over the last twenty years. Although more sophisticated processing technology has become available over the past two decades, processors have been reluctant to invest in costly equipment in the face of uncertain fish supplies (Georgianna and Hogan, 1986). The industry, however, is monopolistically competitive as firms tend to produce for specific market niches, defined either by product or by clientele. Reliance on personal relationships between processors and their customers, while reducing uncertainty for both parties, also creates transactions costs that make developing new markets more difficult.

Personal relationships are also very important between processors and harvesters. Most fishermen rely on one or two processors to purchase their catches. In addition, the relationships between harvesters and processors frequently extend to other matters. In Gloucester, for example, harvesters depend on processors and wholesalers for fuel, ice, small informal loans, and, until the renovation of the state fish pier in 1993, for berthing space. Despite the fact that few processors own vessels, then, the industry exhibits a fair amount of effective vertical integration. Strong ties between harvesters and processors as well as between processors and their customers also reinforce the monopolistically competitive nature of the industry.

D. The Atlantic Canada Processing Industry

The Canadian fish processing industry is far larger than that in New England, reflecting Canada's position as a major exporter of fish products. In 1987 Atlantic Canadian firms processed almost 200,000 metric tons of groundfish, over twice the 1987 output of New England processors (DFO, Annual Statistical Review, 1987; USDOC, Fisheries of the United States, 1988). In the previous year Atlantic Canada exported over 84 percent of its groundfish landings -- and an even higher proportion of processed groundfish-- with the vast bulk going to the United States (DFO, Annual Statistical Review, 1986).

Geographically, the Canadian processing industry is less concentrated than the New England industry, with processors located along the lengthy coast from Quebec through Nova Scotia to much of Newfoundland. But geographical concentration has been increasing in recent years, with many plants closing as a result of stock declines and restructuring of the corporate sector during the 1980s.

Canadian processing firms exhibit great diversity in scale and structure, ranging from small firms specializing in producing saltfish and exporting whole fresh fish to the United States to large, vertically-integrated, capital-intensive firms producing fresh and frozen fish products. Despite the presence of many small firms, concentration in the Canadian processing industry has always been high. In 1980, for example, 63 percent of the total output of processed groundfish was produced by the top four firms.

This concentration increased dramatically during the 1980s as a result of a government-mandated industry restructuring in response to a financial crisis among the large processors caused by high interest rates and increased competition from Iceland and Norway (Kirby, 1982; Barrett, 1992b). Responding to the processors' requests for help, the Canadian government granted 15 million Canadian dollars to the five largest firms on the condition that they merge into two corporations. The resultant firms-- National Sea Products of Nova Scotia and Fisheries Products International in Newfoundland-- together accounted for about 75 percent of frozen groundfish processing in 1985 (USITC, 1986). The federal government, and to a lesser extent the provincial governments, further supported these firms through significant equity purchases: an additional US$142

million in federal funds was used to purchase a 20 percent interest and US$8.1 million in preferred stock in National Sea Products, as well as a 60 percent interest and US $61 million worth of preferred stock in Fisheries Products International (USITC, 1984).

Despite this government support the large processing companies have continued to suffer in recent years. Both have responded to falling landings by downsizing. National Sea Products shut down all but two plants and these are operating at significantly lower levels (DFO, 1993). It reported losses of almost C$43 million in 1993 following deficits in each of the prior five years. For 1994 it finally reported a profit of C$6.3 million (personal communication, 1995). Fisheries Products International has cut the number of its plants in operation almost in half from 17 in 1992 to 9 in 1994. It reported losses of C$67.3 million in 1992 and C$15.4 million in 1993 but also recovered in 1994, reporting a profit of C$13.9 million (personal communication, 1995).

E. Industry Dualism and Public Policy

The dual structure of the industry that results from differences between atomistic and large-scale, vertically-integrated production has been reinforced by industrial policies, subsidies, and regulatory policies, as well as by differences in the mix of fish products each country produces. While both countries regulate their harvesting sectors, the federal and provincial governments in Canada have always been more deeply involved in the structure of the industry than their U.S. counterparts (Sinclair, 1986; Apostle and Barrett, 1992a). In Canada, for example, fisheries regulation has been tailored to accommodate differences between the atomistic and the large-scale sectors and the government has intervened directly in the restructuring and refinancing of the largest processors.

The restructuring of the industry was intended to bring both increased efficiency to production of frozen fish in the large-scale corporate sector and an increased capacity to sell fresh fish in the United States. Mass fresh fish markets are likely to be the niche where the greatest profit potential lies, especially in the untapped customer base outside of the northeast. This potential market is likely to differ in important ways from established markets in the northeast. Customers in established markets are familiar with fluctuations in price and availability of different species and are willing to accept price differentials over alternative sources of protein such as beef or chicken. But success in opening new markets will require both an initial ability to price fish competitively with meat and to maintain supplies and prices that are sufficiently reliable to underwrite major advertising campaigns.

Recent catch declines have affected both the regularity of supply and the price competitiveness necessary to serve these mass markets. Yet even when supplies were more abundant, neither the Canadian nor the New England fishing industry was able to produce the large, reliable supply of high-quality fish necessary to exploit profit opportunities in other areas of the United States. The relative efficiency of the atomistic and corporate sectors remains controversial. Shorter transportation times and greater experience in fresh fish markets give New England firms the advantage in quality. But the fragmented, small-scale New England processing industry has been unable to secure a large and steady supply of fish. This is a great disadvantage in selling to mass-market outlets: in a recent survey of supermarkets, 80 percent of retailers listed inconsistency of supply as their main problem with the current small-scale processing industry structure (Hasselback and Marris, 1991).

The large Canadian processors, on the other hand, have been more successful in guaranteeing large supplies of fish. But despite efforts to raise quality, the large Canadian firms still need to improve their ability to provide fish of the consistently high quality demanded in fresh fish markets. While the corporate sector has developed a core of supermarket customers in the United States, the atomistic sector still accounts for the largest share of fresh fish exports to the United States. For both countries the precipitous fall in catches in the late 1980s and early 1990s presents the major stumbling block to expanding U.S. mass markets. Unless the health of the fisheries is successfully restored, processors will remain unable to expand their sales to take advantage of the growing and potentially lucrative U.S. market.

III. THE COMMON PROPERTY RESOURCE PROBLEM

The fishing industry is a classic example of market failure arising from "common property" problems in the harvesting sector. Without private ownership of fisheries stocks, profit maximization and unrestrained competition among firms will lead to inefficient over-exploitation of the resource. Achieving efficient catch level, therefore, requires regulatory institutions that restrict fishing effort.

The intuition behind the economic theory of the fishery is that when there are no restrictions on entry or harvesting, no single person or firm has ownership rights or control over these resources. Without individual ownership there is no market incentive to husband stocks. Each fisherman has an incentive to harvest as many fish as is profitable, as quickly as possible, in order to beat competing fishermen to the resource. The result is that too many resources are devoted to the fishing industry and the stocks become over-harvested.

To avoid this scenario, economic theory argues that there must be management of the fishery that seeks to rationalize the industry by limiting the amount of resources devoted to harvesting the stock. Successful rationalization will result in society receiving the maximum profit (or rent) from the fishery. The value of fish harvested, less the cost of harvesting, will be as large as possible. Usually this involves creating the equivalent of private property rights over the resource.

Such rationalization objectives can be implemented through a wide variety of regulatory options, some more effective than others. These include full privatization of the fishery (aquaculture), measures designed to increase the cost of fishing (open access restrictions), setting aggregate catch quotas limiting entry into the fishery, and using economic incentives such as taxes and transferable quotas. But in practice fisheries managers must also consider the distributional consequences of regulation which complicates the process of rationalizing the industry. Reducing the level of fishing effort implies that some vessels will go out of business and some fishermen will become unemployed. Moreover, if regulatory measures are successful in reducing fishing effort, rents from the fishery will increase, thus raising the issue of how these should be distributed. Such distributional considerations, and their attendant political ramifications, must be balanced against economic efficiency criteria. The common result is a trade-off between achieving efficient catch levels and avoiding particular distributional outcomes.

IV. REGULATORY OPTIONS

Aquaculture is the only truly privatized fishery. While marine aquaculture is used in the northeastern U.S. primarily for oysters, clams, and salmon (valued at around $121 million in 1992) and in Canada for salmon and at times for lobsters, it has yet to be applied to groundfish (Bush and Anderson, 1993). Proposals exist in both countries for the development of large ocean fish pens that could be used to farm some groundfish species, but these are still too experimental to be relied upon to help solve the current crisis.

One alternative is the use of open access restrictions which involve limiting fishing technologies (for example, requiring large mesh nets), closing fishing areas permanently or seasonally, and/or prohibiting fishing for particular species for specified periods of time. Because they do not limit entry into the industry and have favorable distributional consequences, these restrictions have proven popular with fishermen.

But in raising the cost of any given level of fishing effort (which in theory should reduce the amount of fishing effort), they increase the cost to society of catching the existing fish stock. Furthermore, open access restrictions do not limit the number of vessels or fishermen and they encourage fishermen to devise unregulated harvesting techniques that can be substituted for those that are constrained by the management regulations. Since fishermen would choose the most cost-efficient techniques if unconstrained, these unregulated substitute techniques will most likely be more costly to society. Such economic inefficiencies may be counteracted by perceived distributional advantages. Although there will ultimately be winners and losers under this policy, it is not clear *a priori* who will fall into which category. As a result industry representatives may see this policy as more "fair" and more politically acceptable.

Regulators may also choose to set aggregate catch quotas which restrict the total allowable annual catch (TAC) of a particular species, with further harvesting prohibited once the quota has been reached. Unlike individual transferable quotas (ITQs) discussed below, aggregate quotas do not give individual fishermen the right to a specified share of the catch. Consequently, each fisherman will have an incentive to expand his harvesting capacity (i.e. increase the number of vessels, size of vessels, and number of employees) in order to garner as much as possible as quickly as possible before other fishermen "beat him" to the catch. This increases the cost of catching a given amount of fish as well as creating substantial unemployment and underutilized capital once the quota is reached. Although, like open access restrictions, aggregate quotas are perceived as distributionally neutral, they are much less popular with the industry.

Limited entry regulations attempt to reduce fishing effort by restricting the number of vessels or fishermen allowed in the industry. While these regulations may successfully limit one dimension of effort, fishermen have an incentive to circumvent the restriction by increasing effort along other dimensions. For example, if the number of vessels is restricted, fishermen may respond by increasing the fishing capacity of each vessel; similarly, restricting the number of fishermen may simply lead to the use of more capital-intensive fishing methods. Consequently, these restrictions may have little effect on the overall level of fishing effort.

Regulators must also deal with a number of distributional issues: for example, who will leave the industry, who will be permitted to enter, and how rents from the fishery will be shared within the industry and between the industry and government. Conflict over these issues may make implementing entry restrictions politically difficult.

Alternatively, economic incentives can be used to reduce harvesting effort. Under one option, a tax can be placed on the value of the catch (as a proxy for hard-to-measure fishing effort) to increase the cost of fishing and thus reduce fishing effort to the optimal level. The tax will induce the least efficient fishermen to leave the industry, ensuring that the remaining fishing effort is conducted as efficiently as possible. Although rent may be maximized under this policy, it does not accrue to the fishing industry but rather to the government as tax revenue. This factor, combined with the negative connotations associated with "taxing" and the fact that many fishermen would be forced to leave the industry, makes such a policy politically unpopular.

A second option, ITQs, avoids some of the problems associated with taxes on fishing effort. Under this policy the regulator sets an aggregate catch quota which is then divided into shares and distributed to fishermen as individual quotas. Because each fisherman (or vessel) has a right to the fish stocks represented by his quota, this option serves to privatize fish stocks. Fishermen have the further right to trade quotas among themselves. The least efficient fishermen will find it profitable to sell their shares to more efficient fishermen, ensuring that fishing effort will be conducted at the lowest possible cost.

Using ITQs instead of harvesting taxes allows more flexibility in the allocation of rents between the government and the industry. Auctioning the quotas, for example, would transfer the rents to the government, as occurs under the tax option; giving the quotas away would instead allow the rents to remain in the industry. Implementation of this policy nonetheless remains politically challenging, because not only would fishermen be forced out of the industry, but prospective entrants would also be required to purchase an existing quota, making entry more difficult.

V. MANAGEMENT OF THE NORTH ATLANTIC FISHERIES

The recent collapse of groundfish stocks in New England and Atlantic Canada has led to claims that the regulatory processes in both countries have been equally defective. But the stock collapse appears to have had different causes in each region. The declines in New England stocks are almost solely attributable to domestic overfishing, while faulty stock analyses, changes in the oceanic environment, and overfishing of trans-boundary stocks by foreign trawlers join overfishing by the domestic fleet as significant causes of the stock collapse in Canada. Alternative regulatory models are needed for improving long-term industrial performance in both New England and Atlantic Canada, but the most recent stock crisis should not overshadow the constructive policy lessons of the last two decades that are provided by a comparison between the two countries' regulatory policies.

A. Early Attempts at Regulation

Efforts to regulate the fishery can be traced back to the turn of the century in both New England and Atlantic Canada. Yet it was not until after World War II when technological innovations such as on-board processing facilities threatened the vast fisheries resource in the Gulf of Maine that formal regulation was attempted. A new regulatory body, the International Commission for the Northwest Atlantic Fisheries (ICNAF), was created to regulate harvesting of the northwest Atlantic offshore stocks beyond the twelve-mile territorial limits of the United States and Canada. ICNAF started with 11 countries as signatories, including Great Britain and the Soviet Union, but was dominated by the United States and Canada.

In the late 1960s and early 1970s regulation under ICNAF began to encounter serious problems when foreign fishing firms from Eastern and Western Europe sent large factory vessels into waters off

the North American coast. These vessels were capable of harvesting and freezing 25 percent to 50 percent more fish per hour than traditional vessels (Warner, 1983). Under the pressure of foreign catches, the fishing industries in New England and Atlantic Canada faced severe economic losses as the total catch of all species in New England fell almost 30 percent from 1965 to 1975 and the Atlantic Canada catch suffered an even larger decline (down 36 percent from its 1968 peak).

In 1976, coincident with an international movement to extend sovereign state control over coastal resources, the United States declared separate governance rights over resources within 200 miles of its coastlines, effective March, 1977, to stem the further loss of catch to foreign vessels. Canada implemented its 200-mile economic zone on January 1, 1977. The establishment of 200-mile national economic zones marked the beginning of divergent fisheries management policies in the United States and Canada. Two years later, both countries had their own distinct regulatory systems and ICNAF had been dissolved. While Canada opted for the centralized federal management of its fisheries resources, the United States took the opposite tack, giving substantial authority to regional fisheries councils.

Although the United States and Canada have each developed regulatory policies that are at least nominally guided by economic theory, Canada has relied on a wide range of tools, including entry limitation and a transferable quota system to control catch. In contrast, (until January, 1994) regulation in New England has largely been limited to open access restrictions, such as limitations on fishing gear and the closing of fishing areas.

B. Recurrent Catch Declines

The management regimes adopted by both countries in the mid-1970s were based on the shared belief that heavy foreign fishing was the primary cause of the poor state of the stocks (Acheson, 1984). With the exclusion of most foreign fishing, landings in the U.S. and Canada did increase dramatically in the late 1970s. Between 1977 and 1980 catches of key groundfish species (cod, haddock, and flounder) rose from 494,384 to 651,713 metric tons in Canada and from 91,414 to 133,922 metric tons in New England, increases of 55 percent and 47 percent respectively (Figure 6). But, this rebound was only temporary and was assisted by an independent upward fluctuation in the underlying biological resource as a result of several good year classes (Acheson, 1984). After 1980 New England landings began to decline, falling to 31 percent below their 1980 peak by 1987 (Figures 5 and 6). Although landings of cod recovered somewhat before falling again in 1992 and 1993, catches of other key groundfish species such as haddock and flounder have exhibited pronounced and persistent declines since the late 1970s.

The relatively more conservatively-managed Canadian stocks fared better throughout the 1980s. Canadian landings of key groundfish species peaked in 1982 and remained roughly constant, although at a somewhat lower level, for several years before beginning to decline in 1989. Despite substantial year-to-year fluctuations, landings of all species continued to increase through 1988. But by the early nineties Canadian landings, like New England landings, had begun to display a persistent downward trend. Landings of the three key groundfish species fell to 123,617 metric tons in 1993, 78 percent below their 1988 peak of 572,823 metric tons (Figures 5 and 6).

C. Contrasting Approaches to Management

While both countries have experienced substantial overfishing of key groundfish species during the late 1980s and early 1990s, the drop in landings in New England mainly reflects reduced catch from relatively constant fishing pressure. But the Canadian decline in part reflects the sharp reduction in fishing effort due to the regulatory closures of many fishing areas. Canada has followed a limited entry management policy and in particular segments of some industries uses market-oriented techniques such as transferable quotas. In contrast, New England has chosen a more laissez-faire approach, relying more on open-access policies than on direct management of catch and fleet size. The radically different approaches to management of the stocks taken by the two countries may also partially explain the relatively better Canadian experience during the 1980s. In addition to limited entry, Canada has used a version of the transferable quota system since 1982 known as "enterprise quotas" to regulate the major portion of its N.W. Atlantic offshore fleet owned by the two large processing firms. Each firm has been given quotas for the year based in part on its past catch and projected ability to harvest resources. The success of this system has led to its extension to most of the individually-owned, smaller vessel fleet.

In the United States one of the main obstacles to adopting more economically efficient regulatory methods has been the ability of vested economic interests to be articulated in management policy through direct involvement of the industry in determining its regulation. The New England fishing industry has been strongly opposed to limited entry, even though a successful implementation of that policy would make those remaining in the industry better off. One reason for the opposition voiced by many fishermen is that entry restrictions undermine the independent nature of the harvesting industry that attracted them to the fishery in the first place. Another argument that has moved to the forefront in the early 1990s is that the ecological system that controls fish stocks is too complicated and our understanding of it too rudimentary to support limited entry or transferable quotas (Wilson, et al., 1991; Wilson, 1992).

In contrast to the U.S., the Canadian approach to management is much more centralized and, at least on the surface, is somewhat more insulated from direct political pressures from fishermen and processors. But the Canadians have not been immune to such pressures as is revealed by the use of regulatory policy and government subsidies to support the fishing industry in the many underdeveloped areas of Newfoundland and Nova Scotia where fishing and processing are the primary sources of employment (Copes, 1983; Charles, 1992).

Declining stocks have resulted in a new crisis for the industry in both countries. Canadian quota levels for major groundfish species have been cut by 75 percent since 1989 (DFO, 1994). The northern cod fishery off Newfoundland has been closed since July, 1992, and most other groundfishing areas have been closed since 1993. The Canadian government is currently considering proposals for reducing industry capacity through vessel buy-outs, retraining of fishermen, and expansion of aquaculture to absorb displaced fishermen.

In the United States the Conservation Law Foundation and Massachusetts Audubon Society filed a federal suit against the U.S. Secretary of Commerce on June 28, 1991, for failure to prevent overfishing of the New England groundfish stocks. This was partially motivated by the discovery of a possible major ecological shift on Georges Bank with a large expansion of skates and dogfish taking the place of the over-harvested traditional groundfish species. The suit was settled with the proviso that the New England Management Council must take immediate action to restore cod and flounder

populations to their pre-1960s levels within five years, and haddock populations within ten years.

The final plan adopted, essentially prohibiting new vessels from entering the industry and requiring existing vessels to reduce their fishing time, represents a substantial change in management policy. Such regulations are economically inefficient because they mean that all vessels will be idle during some part of the year when they would normally be fishing. But the plan is likely to force marginal vessels, for which effort reduction threatens their economically viability, out of the industry. There has already been discussion within the Council of allowing these marginal vessels to sell their fishing rights to more profitable vessels. If this were allowed to spread, the system would evolve into an individual transferable quota plan. In that case the most inefficient vessels would leave the industry and the remaining vessels would be able to fish full-time.

Even before this new management plan has had a chance to be fully implemented, the August, 1994, report by fisheries scientists indicating that the cod, haddock, and yellowtail flounder spawning stocks were at dangerously low levels has prompted emergency closures of major sections of Georges Bank until at least June, 1995. The New England Council is currently examining more stringent management measures that are likely to be implemented by the summer of 1995.

VI. TRANSFORMING THE INDUSTRY FOR THE FUTURE

From an historical perspective, structural change and policy reform in the fishing industry almost always emerge from periods of crisis and conflict. The current crisis is no exception. But the recent stock collapse in both countries has focused attention on the need for stricter regulation and programs to ease the displacement of labor and capital as a result of downsizing the industry, rather than on the questions of what the future structure of the industry should be or how the gains and losses from restructuring should be distributed.

A. Conflicts Between Canada and the U.S.

Both the Canadian and U.S. industries have suffered from excess capacity in their fishing industries, leading to conflicts over resources between the two countries. One manifestation of this problem was the contest, finally resolved by a World Court decision in 1984, over whether the United States or Canada would control the

rich scallop and groundfish resources in Georges Bank and the Gulf of Maine where the 200-mile economic jurisdictions of both countries overlapped. While the Georges Bank boundary dispute ended in a draw, significant conflicts have continued over who would dominate the lucrative market for fresh groundfish in the United States.

Canada has been a major exporter of frozen groundfish to the United States for several decades, but Canadian exports were not historically a significant factor in the higher value-added fresh groundfish markets where most of the New England catch was sold. Beginning in the late 1970s the composition of Canadian exports shifted sharply as the quantity of fresh Canadian cod and haddock exports to the United States almost tripled from 1977 to 1990. While Canadian fresh groundfish exports were increasing, New England landings were falling and Canadian exports equaled over one quarter of U.S. production by the mid-1980s.

This penetration of New England's traditional markets for fresh groundfish had a dampening effect on fresh fish prices in the United States. Depressed prices adversely affected the economic prospects of New England fishermen who depended on rising prices to offset the gradual declines in catch. In the face of this new head-to-head competition in fresh fish markets, the New England industry repeatedly blamed public policy in Canada for unfairly subsidizing fisheries production. In the mid-1980s the New England industry finally sought tariff protection against fresh Canadian fish (USITC, 1984). Canada countered that its policies were not intended to subsidize the industry but were directed at achieving long term efficiencies in a common property industry that had developed considerable excess capacity. In the Canadian view the United States had also subsidized its industry but was primarily at fault for not achieving comparable regulatory efficiency. The United States International Trade Commission (USITC) awarded a minimal countervailing duty of less than 6 percent on fresh whole groundfish and rejected any duty on fresh groundfish fillets. Contrary to much of the rhetoric about unfair subsidies, this ruling suggests that the net effect on trade of differential subsidies in the two countries has not been large.

While the current unprecedented crisis in stock depletion has temporarily alleviated conflict between the two countries' fishing industries, what does the future hold? Current emergency measures taken to restore stocks have prompted a number of short-term policies to shore up falling incomes and remedy job loss in the industry. In the longer term, however, both counties recognize that a smaller and very different industry must emerge from this crisis and that substantial reforms in regulatory practices must occur.

B. The Future Shape of the Industry

The process of industry transformation can be guided by the experience of different models of industry structure in each country. In the New England and Canadian processing industries, for example, differences in product specialization have resulted in the development of distinct institutional structures. The New England firms, as well as a portion of the Canadian industry, have traditionally specialized in the production of whole fresh groundfish for the New England market. These firms tend to be small, displaying low capital intensity and little vertical integration. In contrast, the Canadian corporate processing sector has historically concentrated on the production of frozen fish products for world markets. Frozen fish production is subject to economies of scale: freezing capacity is capital intensive, effective marketing requires access to large and steady supplies of raw material, and both buyers and major competitors are large and concentrated (Ministry of External Affairs, 1983). As a result the corporate processing sector has evolved to favor large, capital-intensive, vertically-integrated firms, a tendency reinforced by the government-sponsored industry restructuring of the 1980s.

Economic theory predicts that competition will lead to convergence around the most efficient institutions. The historical experience suggests that while large, vertically-integrated firms are the most efficient producers of frozen fish for global markets, fresh fish processing is best performed within a small-scale atomistic industry. But in the last few years the Canadian corporate processing firms have begun to penetrate the U.S. market for fresh fillets. Their success indicates that economies of scale may provide a competitive advantage in fresh fish markets as well. In particular, the ability to secure reliable supplies of fish is potentially vital in opening U.S. mass markets. Despite pooling stocks and acquiring additional supplies from independent Canadian sources, the small New England processors have had only limited success in stabilizing fluctuations in landings.

Economies of scale, coupled with advances in transportation and packaging, would seem to favor an increase in concentration in the processing industry. But critics argue that large firms suffer from

high fixed costs and bureaucratic inefficiency; as a result, they lack the flexibility necessary to adjust to fluctuations in landings and species and will tend to rely on public subsidies in order to remain in operation (Apostle and Barrett, 1992a). Consequently, it is not clear that increasing industry concentration will improve economic performance. If these costs are outweighed by gains in marketing and production efficiency, it is possible that the New England industry will begin to resemble its Canadian counterpart, with larger firms supplying mass markets while smaller ones continue to supply local restaurants and retail outlets. But even with increasing similarity in the degree of industry concentration, remaining differences in industry structure and regulation may serve to give one country's industry an advantage over its competitor. In particular, future success for either country is heavily dependent on the restoration of fish stocks to healthy levels.

C. The Future of Regulation

Despite common regulatory goals and the recent stock collapses in both countries, regulatory targets are generally believed to have been set closer to efficient levels in Atlantic Canada. Moreover, Canadian regulatory practices are thought to permit relatively better enforcement of harvesting targets than those in the United States.

In principle, the Canadian regulatory approach has many advantages in achieving conservation objectives and in directing economic activity. It can deal directly with capacity by limiting entry of vessels and fishermen, and the enterprise allocation approach can directly limit fishing effort by those vessels with the largest capacity. But the regulatory arrangements governing parts of the independent sector in Atlantic Canada are subject to many of the same problems that have led to overfishing by the New England fleet, and the recent collapse of Canadian stocks is partly attributable to difficulties in enforcing catch targets on the atomistic, independent fleet. These regulatory problems have also led to the extension of transferable quotas to a significant portion of the Nova Scotia inshore fleet.

D. Industrial Organization Concerns

Ease of entry and the large numbers of harvesters and processors make the monitoring and control of effort costly in the atomistic sector. Moreover, the flexibility and diversity of this sector argue for a decentralized regulatory process that can recognize the possibility

of social and community-based regulation of common property problems and that can accommodate the efficiencies associated with the species and gear flexibility of small-scale producers. In contrast, the barriers to entry and the concentration of producers in the large-scale sector make it easier to observe and control fishing effort. Because the large-scale sector is also less flexible than the small-scale sector, the regulatory process can be more centralized and more tightly-linked to species-specific stock assessments. The decentralized and flexible policy system corresponds roughly to the arrangements traditionally followed in New England, and the centrally-controlled system most closely resembles Canadian regulation of the large-scale corporate sector. The experiences of New England and Atlantic Canada provide a powerful test of the efficacy of interventionist policies compared to more laissez-faire policies. They also offer predictions for which set of production arrangements and labor market institutions are most likely to prevail.

But choosing the balance between these systems is not simply a matter of comparing efficiency properties and net social benefits of each system at a particular point in time. The atomistic policy system, because of its flexibility, will dominate in an industry that is highly volatile and prone to sudden and unexpected collapses in catch. In contrast, the large-scale, vertically-integrated system has efficiency advantages if the underlying biology of the industry can be stabilized at or near the level required for efficient harvesting, as defined by neo-classical common property theory. The allocation of catch between these systems is, therefore, more a matter of the quality of biological science and the political will of government to grant property rights to the most efficient producers than of the choice among different economic theories of the industry.

Until recently, the direction of efficient policy in both countries seemed clear. The atomistic system of small-scale producers had the advantage in supplying fresh whole fish for white tablecloth markets of specialty stores and restaurants in the United States. Because it was costly to regulate, regulatory constraints were *de facto* more flexible in both countries, and this flexibility was reinforced in New England by the decentralized system of self-management by the industry.

But in the long-term it appeared that the large-scale system in Canada would come to supply the bulk of the fresh fish market in the United States. Canadian landings were roughly double those of New

England and this resource base gave Canada the clear numerical advantage. Given these resources, the relatively steady landings of Canadian groundfish and the regulatory policy of enterprise quotas favored the scale-economies of the large-scale sector. Furthermore, this sector had a competitive advantage in opening highly-profitable mass markets for fresh fish in supermarket chains.

E. Labor Market Concerns

A second consideration involving regulation with diverse production systems is the extent to which factor inputs into harvesting and processing are fixed. In the case of labor inputs, for example, the large-scale sector can quickly adjust its workforce to changes in catch levels. There is a single margin of adjustment defined by factors such as seniority and the marginal productivity of labor in the industry. In contrast, in much of the small-scale sector family employment obligations preclude downward adjustments in employment when catch declines (Doeringer, Moss, and Terkla, 1986b). Instead, adjustment occurs at a different rate and along different margins so that the least efficient labor is not necessarily the marginal labor in the industry.

The presence of such "sticky" labor has implications for regulation. On the one hand, the combination of sticky labor and employment adjustments that are not based upon the marginal productivity of labor means that the social opportunity cost of labor employed in the industry is lower than would otherwise be the case. As social opportunity costs fall, the efficient level of catch for regulatory purposes increases (Terkla, Doeringer, and Moss, 1988). Moreover, the lags in labor force adjustment caused by sticky labor mean that year-to-year variations in regulated catch levels will be more efficient if they follow a lag structure that corresponds to that of each employment system.

A further implication of labor attachment is that labor mobility responds asymmetrically to fluctuations in output. Rising revenue draws labor into the industry relatively quickly, but labor recruited to the small-scale sectors is not readily released. It is, therefore, important that regulatory policies reflect the need to control the entry of labor, as well as capital, into the industry to constrain harvesting capacity to efficient levels.

At present these considerations are largely ignored by the regulatory process in both countries. Catch levels and regulatory practices in New England are set without regard either to differences

in production processes, type of market, or type of employment system. In Atlantic Canada regulatory distinctions are drawn between the large-scale, offshore sector and the small-scale, inshore sector, but neither the Canadian estimates of optimal catch levels nor the allocation of catch between sectors reflects differences in adjustment flexibility.

Proposals have been made in some fisheries to decentralize the regulatory process to the community level to take advantage of social forms of regulatory control (Ruddle, *et al.*, 1992). Such decentralization would allow for the adjustments in catch levels needed to incorporate the efficiency implications of sticky labor. But even a decentralized regulatory system would not resolve problems of overfishing by vessels not subject to community-based social controls such as corporate-owned offshore vessels and vessels from different communities that are sharing common fishing grounds.

Rather than supporting an exclusive reliance on the traditional economics of common property regulation, or rejecting it outright in favor of community-based self regulation, this study strongly demonstrates the need for blending standard common property regulation with industrial and labor market policies that recognize the structure of the industry's economic institutions. Such a broad-gauged approach to policy is needed to address the tensions between policies directed at two different types of market failures-- one that is based upon the failures of large scale, vertically-integrated markets structures and the other upon failures of atomistic markets-- and between the efficiency and distributional consequences of regulatory policy.

VII. HARMONIZATION OF REGULATION AND ECONOMIC DEVELOPMENT

Institutional sources of labor stickiness are reinforced by the underdevelopment of many fishing communities and by unemployment insurance practices, particularly in Atlantic Canada. If alternative employment prospects for fishing industry labor were to be improved, there would be increased incentives for surplus labor to leave the industry, the social opportunity costs of fishing labor would increase, the amount of sticky labor would be reduced, and optimal catch levels could be adjusted accordingly.

Although the New England economy has achieved a higher level of income than that of Atlantic Canada, neither country has been able to make much progress in diversifying its weakest port commu-

nities in order to reduce the problem of labor stickiness. Lack of effective economic diversification has led to a number of alternative policies-- fisheries industry subsidies, income transfer programs, and (in Atlantic Canada) regulatory allocations of catch-- that have had the effect of further reinforcing the attachment of labor to the industry and made regulatory reform more difficult.

The most constructive approach to achieving greater adjustment efficiency is to decouple more fully these policy instruments from the fishing industry. This means treating industry subsidies as part of general development incentives rather than as dedicated to the fishing industry; integrating special fisheries unemployment insurance schemes with regular unemployment insurance; and linking structural adjustment programs of training and relocation to jobs outside of fishing.

A. Labor Market Adjustment Policies

While economic development policy is one means of addressing the problem of sticky labor in the fishing industry, it must also be accompanied by adjustment programs to facilitate the movement of labor to other industries. Labor market information, retraining, and relocation programs are the common components of such adjustment policies.

But the effectiveness of these policies is often limited by the characteristics and job preferences of the fisheries industry workforce. Particularly for harvesters, earnings during periods of prosperity are considerably higher than those received by comparable workers in other sectors (Doeringer, Moss, and Terkla, 1986a). The expectation of periodically high earnings, when coupled with the non-pecuniary attractions of fishing as a way of life and the economic security of kinship and paternalistic employment practices, means that alternative employment must pay relatively high earnings to induce sticky labor to leave the fishing industry. The higher the wages needed in alternative employment, the higher are the costs of economic development incentives and of human resources adjustment programs. Given these cost impediments, economic development and labor market adjustment policies are unlikely to provide sufficient re-employment opportunities for the surplus labor in the industry, particularly in the short term. Where there are not enough jobs, training programs can become income-maintenance programs and pressures for direct income subsidies increase.

This scenario is already apparent in short-term responses in both Atlantic Canada and New England to the stock collapse. The restrictions on fishing effort following the stock collapses in both countries prompted various emergency measures-- industry and community development assistance, retraining programs, and expanded unemployment insurance-- to alleviate financial hardship and to develop employment alternatives for the fishing industry in the short-term. But many of these measures remain tied more to the preservation of the fishing industry and its workforce than to reducing capacity sharply. A recent analysis of Canada's major program for the Atlantic fishing industry, The Atlantic Groundfish Strategy, concluded it that has failed in most of its objectives "except that of pumping money into the hands of out-of-work East coast fishermen and plant workers" (Greenspan, 1995).

Labor market adjustment needs to be predicated on helping to shape a future in which the industry has less harvesting and processing capacity and a much smaller workforce than in the late 1980s. Adjustment programs to reach this leaner industry should recognize both the immediate hardships on the workforce and the importance of containing employment to a level that is consistent with efficient catch targets. The latter will be especially difficult because of the economic incentives for entry that are inherent in efficiently-regulated common property industries.

For those younger workers who will be permanently in surplus, economic development and retraining programs are the preferred policy option, while income maintenance and early retirement may be more appropriate for more senior workers. Income maintenance is also the most straightforward way of alleviating the current hardship for that fraction of the workforce that will be re-employed when stocks rebound.

One challenge to these policy goals is to find a workable means for distinguishing between those who can reasonably expect to be part of the permanent fisheries workforce and those who cannot. A second is to avoid having income maintenance reduce adjustment incentives for those who should seek alternative employment, or to contribute to unnecessary labor stickiness in the industry.

B. Forming Transboundary Partnerships

Regardless of the extent of institutional change, both countries can benefit from a greater integration of the northwest Atlantic

regional fishing economy. Even at present stock levels, Canada has a sufficient biomass potential to meet the foreseeable U.S. demand for fresh fish. New England processors and distributors have much to offer the Canadian industry in terms of quality control, marketing contacts, and distribution networks. If the New England industry cannot soon reach some accommodation with the Canadian industry, then this advantage will be lost as Canada will develop its own capabilities in these areas.

A regional integration of the fishing economy should also be extended to include reciprocal harvesting and landing rights and the encouragement of transboundary capital and labor mobility. For example, under current statutory and boundary arrangements, Canadian and American vessels are barred from fishing in each other's territory and Canadian vessels cannot land catch in American ports. These arbitrary demarcations, within the context of common resource pools and common markets, breed inefficiencies for fishermen, processors, and consumers in both countries as trawler tows must be aborted when vessels approach the boundary line and Canadian fish must be transported over unnecessarily lengthy overland routes to American markets.

Integration in harvesting should also be coupled with harmonized management practices, particularly in contiguous fishing zones such as on the Georges Bank. One market with a common resource pool is not well-served by two distinct regulatory arrangements. While the regulatory legislation in both countries has remarkably similar goals, the differences in regulatory instruments, regulatory procedures, and standards for catch levels have been serious obstacles to joint management. This is largely the result of three factors-- the importance of regulatory policy as an element of regional development policy in Canada, the incompatibility of Canadian-style enterprise allocations with the atomistic and independent harvesting industry in New England, and the differences in the distribution of power among the industry interests as they are vested in the regulatory process in both countries. Developing joint regulatory plans would eliminate one major obstacle to cross-boundary fishing. Ending the prohibition on Canadian vessels landing catch in American ports would remove a second obstacle.

There are also restrictions on the entry of U.S. processing firms into Canada as a result of the preference given to Canadian firms in the enterprise allocation formulas. There are similar restrictions on

labor migration from Atlantic Canada to New England. The regional integration of politically troublesome industries such as fishing is most easily accomplished within a framework of more general economic integration.

C. Institutional vs. Market Failures

The principal theme of this essay is that institutional as well as market factors can affect economic performance and that there can be institutional as well as market failures. The various institutions affecting the fishing industry in new England and Atlantic Canada boldly illustrate this point. Industrial structures and regulatory practices often have been out of "sync" with changing markets on both sides of the border.

But changes in institutions are much slower and more erratic than changes in markets. Needed restructuring of the Canadian industry was progressing too slowly for the industry to remain competitive until the pace of change was accelerated by government intervention. Regulatory policy in the United States has been beset by sufficient conflict to prevent meaningful preservation of the stocks of key species. Improvements in quality have been hard to achieve in the large-scale processing sector in Canada, and independent fishermen and producers have failed to devise institutional solutions that would gain them entry into emerging mass markets for filleted fish in the United States.

Institutional failures, unlike many market failures, are inherently transitory. But the political pressures to protect fisheries jobs and incomes and the consequent lags in the adjustment process compound to produce long delays in institutional change. The political economy of the North Atlantic fishery highlights the importance of thinking more systemically about linking regulatory policy to industrial policy, human resources policy, and economic development policy.

ABBREVIATIONS

DFO	Canada Department of Fisheries and Oceans
EEZ	Exclusive Economic Zone
GDP	Gross Domestic Product
ICNAF	International Commission for the Northwest Atlantic Fisheries
ITQs	individual transferable quotas
NEFMC	New England Fisheries Management Council
TAC	total allowable catch
USDOC	United States Department of Commerce
USITC	United States International Trade Commission

NOTES

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