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**REPORT OF THE WORKSHOP ON SCOTIA-FUNDY GROUND FISH MANAGEMENT  
FROM 1977 TO 1993**

by

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## ABSTRACT

Angel, J.R., D.L. Burke, R.N. O'Boyle, F.G. Peacock, M. Sinclair, and K.C.T. Zwanenburg. 1994. Report of the Workshop on Scotia-Fundy Groundfish Management from 1977 to 1993. Can. Tech. Rep. Fish. Aquat. Sci. 1979: vi + 175 p.

The objectives of the Workshop on Scotia-Fundy Groundfish Management from 1977 to 1993 were to:

1. identify the degree to which the management objectives for groundfish in the Scotia-Fundy Region have been met since the extension of jurisdiction (i.e. 1977); and
2. the degree that they have not been met, identify the causes that prevented successful attainment of the objectives.

Initially the objectives of groundfish management were described, as were the temporal trends in fish biomass and fishing mortality. Subsequently, a series of papers addressed the broad range of management actions from 1977 to 1993, and the responses by the fishing industry. The management actions included the scientific advice, development and implementation of management plans, and enforcement. The responses by industry included the changes in fishing practices that followed the various management initiatives. The next series of papers attempted to evaluate the accuracy of the landings statistics. Two papers described the degree to which changes in natural mortality (by environmental trends and seal predation respectively) over time may have compromised our ability to attain the management objectives. The final two papers addressed the accuracy of stock assessments in this geographic area, as well as the impacts of public pressure on decision-making. For each subject area presented, there was an attempt to evaluate whether the empirical observations were sufficiently well described such that conclusions could be drawn. During the final sessions of the Workshop, discussions were focused on the degree to which three categories of management objectives (conservation, economic performance, and employment) had been met. A summary and list of recommendations were prepared by the Workshop Steering Committee subsequent to the Workshop. The Workshop has generated a fuller understanding within the Region on the causes of the present groundfish resource and fishery crisis. It was an initial step toward identifying options for improving groundfish management actions.

## RÉSUMÉ

Angel, J.R., D.L. Burke, R.N. O'Boyle, F.G. Peacock, M. Sinclair, and K.C.T. Zwanenburg. 1994. Report of the Workshop on Scotia-Fundy Groundfish Management from 1977 to 1993. Can. Tech. Rep. Fish. Aquat. Sci. 1979: vi + 175 p.

Les objectifs de l'atelier concernant la gérance des poissons de fond dans la région Scotia-Fundy de 1977 à 1993 étaient de:

1. identifier dans quelle mesure on a atteint les objectifs de gérance des stocks de poissons de fond dans la région Scotia-Fundy depuis l'extension de la juridiction canadienne (i.e. 1977); et
2. identifier les causes d'échec là où les objectifs n'ont pas été atteints.

L'atelier a débuté avec la description des objectifs de gérance des poissons de fond, et des tendances temporelles de la biomasse de poisson et de la mortalité par la pêche. Ensuite, on présenta une série de communications couvrant l'éventail des mesures de gérance utilisées de 1977 à 1993, et

la réaction de l'industrie des pêches. Les mesures incluaient les conseils scientifiques, le développement et l'application des plans de gérance, et la mise en vigueur. Les réactions du secteur des pêches incluaient les changements dans les pratiques de pêche amenés par les diverses initiatives de gérance. Le groupe suivant de présentations visait à évaluer la justesse des statistiques de débarquement. Deux présentations décrivent comment les objectifs de gérance ont pu être compromis par des changements temporels dans la mortalité naturelle causés respectivement par des tendances environnementales et par la prédation par les phoques. Les deux dernières présentations couvrent la précision des évaluations de stocks dans ce secteur géographique, et les effets des pressions publiques sur la prise de décision. Pour chaque sujet présenté, on essaya d'évaluer si les observations empiriques avaient été assez bien décrites pour qu'on puisse en tirer des conclusions. La dernière session de l'atelier vit les discussions centrées sur le niveau de réussite dans les trois catégories d'objectifs de gérance (conservation, retour économique et emploi). Après l'atelier, le Comité de Direction de l'atelier a préparé un Sommaire et une liste de recommandations. L'atelier a élargi la compréhension des causes de la crise actuelle dans la ressource et les pêches dans cette région. Ce fut un premier pas vers l'identification des options disponibles pour améliorer les mesures de gérance des poissons de fond.

## 1. INTRODUCTION

The Workshop on Scotia-Fundy Groundfish Management from 1977 to 1993 was held at the Bedford Institute of Oceanography (BIO) in Dartmouth, Nova Scotia, on December 7 and 8, 1993. The aims of the Workshop were to:

- i) identify the degree to which the management objectives for groundfish fisheries in the Scotia-Fundy Region have been met since the extension of jurisdiction; and
- ii) the degree that they have not been met, identify causes that prevented successful attainment of the objectives.

The agenda and participants are shown in Appendices 1 and 2, respectively. A map of the Scotia-Fundy Region showing the Northwest Atlantic Fisheries Organization (NAFO) Statistical Areas is attached as Appendix 3.

Following opening remarks by the chairpersons on the aims of the Workshop, the objectives of groundfish management were described (paper 1), as were the temporal trends in fish biomass and fishing mortality (paper 2). Subsequently, a series of papers (3 through 8, as well as 13) addressed the broad range of management actions from 1977 to 1993 and the responses by the fishing industry. The management actions included the scientific advice, development and implementation of management plans, and enforcement. The responses by industry included the changes in fishing practices that followed the various management initiatives. The next series of papers (9 through 12, and part of 13) attempted to evaluate the accuracy of the landings statistics. Two papers (14 and 15) evaluated the degree to which changes in natural mortality (by, respectively, environmental trends and seal predation) over time may have compromised our ability to attain the management objectives. The final two papers addressed the accuracy of stock assessments in this geographic area (paper 16), as well as the impacts of public pressure on decision making (paper 17).

For each subject area presented, there was an attempt to evaluate whether the empirical observations were sufficiently well described such that conclusions could be drawn. Rapporteurs summarized the discussions that followed the presentations of the papers. During the final session of the Workshop, discussions were focused on the degree to which three categories of objectives of management (conservation, economic performance, and employment) had been met. **The report starts with the discussion of the papers prepared by the Steering Committee subsequent to the Workshop. The papers that follow (Section 4) reflect the views of the respective authors.**

## 2. DISCUSSION OF THE PAPERS ON GROUND FISH MANAGEMENT (J.R. ANGEL, D.L. BURKE, R.N. O'BOYLE, F.G. PEACOCK, M. SINCLAIR, AND K.C.T. ZWANENBURG)

### The Management Context

Groundfish resources in Canada have traditionally been treated as common property, as are other marine fishery resources. In the broadest sense, common property implies that all citizens may fish. In fact, access has been restricted in recent years. Nonetheless, the resource is still shared in common by licensed participants, where none own a particular share of fish. This basic characteristic creates what is called the common property problem.

The problem has three key elements. First, shared access can lead to over-exploitation of the resource. Without controls to protect stocks, overfishing is inevitable. Self-restraint by some is futile if others still fish. Second, harvesting becomes an economically wasteful race for fish characterized by increasingly effective fishing fleets, increasingly shorter and more hectic seasons, and a recurring cycle of investment in bigger, faster boats and more powerful gear. The race is futile as each effort to increase catching power is matched by others. Commercial harvesters incur debts, often fish in dangerous conditions, and suffer decreasing flexibility to deliver fish to meet market demands for

quality and time. Economic waste takes the form of unnecessarily high harvesting costs, lower quality and prices, and high management costs. Third, competition and social conflict becomes the defining feature of the relationship between participants. When management measures to resolve allocation issues are introduced, the competition for shares moves from the water to the meeting rooms. This can undermine the co-operation needed to properly husband the resource.

At the beginning of the 1977 to 1993 period under study, groundfish stocks and the fleets which pursued them were managed in a common property regime by the Federal Government of Canada. In the best administrative tradition, objectives covering conservation, economic performance, employment, and Canadianization of the resource, and strategies to pursue these objectives, were presented in various policy papers and task force reports. The most formal statement of these emerged in the report of the 1982 Task Force on Atlantic Fisheries, "Navigating Troubled Waters". These measures were given effect through a substantial body of regulations, administrative prohibitions, incentives, and a succession of annual fishing plans for groundfish commencing in 1978.

As it became clear that input controls (vessel replacement rules, hold capacity, horsepower limits, etc.) and fleet quotas could not curb investments in harvesting capacity, experiments began in the mobile gear fleets with Enterprise Allocations (EA) and Individual Transferable Quota (ITQ) systems. These programs aimed to change the fundamental motivations in common property systems by issuing quotas to companies or individual fishers. Enhanced ownership is expected to mitigate the "race for quota" and allow individual fishers to tailor capacity and ultimately to target fishing effort to the quotas they control. Fishers would then be able to maximize profits without having to maximize the volume from competitive quotas. EA programs were introduced to offshore fleets in 1982, vessels 65-100 ft. in 1988, and to the inshore mobile gear fleet in 1991.

Throughout the period, other public policies were acting on the fishery. Federal and provincial governments invested in the harvesting sector to Canadianize operations. They conducted research and development to improve the efficiency and effectiveness of vessels and gear, offered subsidies and loans for vessel construction, and both levels of government funded a restructuring of offshore companies in the mid 1980s. Often, provincially based investments were undertaken to ensure that fishers and plants in one province would not be placed at a disadvantage with regard to subsidized operations in other provinces.

The influence of Unemployment Insurance (UI) for fishers had an even greater impact on management programs. The payments, which are mainly transfers from workers in other sectors and not self-funded insurance, more than doubled in relative and absolute terms between 1981 and 1990 and currently equal one-third or more of the income actually earned from fishing. These subsidies play a significant and increasing role in attracting and retaining labour to the industry and in exacerbating capacity and effort pressures. They work in opposition to management efforts to restrict participation.

The relative importance of these policies is reflected in the absolute levels of public expenditure on various programs. The Department of Fisheries and Oceans' (DFO) budget in the Scotia-Fundy Region for the costs of managing fisheries including all enforcement, assessment, and research averaged \$43 million per year from 1987 to 1993. The Region also provided other non-management services such as Small Craft Harbours, Hydrographic, and other special services which were largely of benefit to the fishing industry and which could be considered an indirect subsidy to the fishery. The expenditure for these three programs averaged \$38 million per year over the same period. (The expenditures by other departments and the province are unavailable at this time.) With respect to labour subsidies, the net level (i.e., benefits less premiums paid) of UI transfers to fishers for the 1987 to 1991 period averaged \$64 million per year, far exceeding management expenditures. Altogether, public financial support for management was less than one-half that spent in direct or indirect subsidies to labour and capital.

## 2.1 OBJECTIVES OF GROUND FISH MANAGEMENT

It was concluded that even though four categories of objectives, strategies, and tactics (those for conservation, economic performance, employment, and Canadianization) for groundfish management are readily available in diverse documentation, there has been inadequate articulation at the policy level in the balancing of the diverse aims. In an operational sense, management targets have not been set such that consistent decision making can be made within a framework of a well understood overall strategy. The statement of objectives for conservation has been translated into an operational strategy, while those for economic performance, employment, and Canadianization have been more *ad hoc*. For example, the tactics for achieving the economic performance and employment objectives were not defined appropriately as specific targets, but rather have been described in vague terms (e.g., limit the number of enterprises, maximize employment). In addition, it was noted that an undocumented social objective has been re-emphasized in recent years (i.e., the maintenance of small communities that support a particular lifestyle). In sum, there has been no framework for the balancing of tactics for different management objectives - so that one objective is not inadvertently compromised in the long-term by the short-term achievement of competing objectives. Actions taken to promote the employment and economic performance objectives, often by other public agencies with regional development or social policy mandates, such as special UI provisions for fishers and low-interest boat loans, have compromised the attainment of the conservation objectives.

## 2.2 MANAGEMENT ACTIONS AND RESPONSES OF INDUSTRY

Some general conclusions were drawn from the papers summarized in Sections 4.3.1 to 4.3.6.

With respect to quota management:

- the Minister of DFO frequently set quotas at levels higher than the scientific advice, particularly during periods when the stocks were declining;
- the recorded landings frequently exceeded Total Allowable Catches (TACs), often during periods when the quotas were relatively low for a given management unit and the stocks were declining;
- the TACs (and the scientific advice) were frequently set at sufficiently high levels relative to the resource abundance that the quota was not reached by the end of the year; and
- annual fishing effort for most gear types, with the exception of Tonnage Classes 4 and 5 (i.e., offshore fleet greater than 65 ft.), has increased since 1977. There has been some stabilization in small dragger effort since 1986, but there has been no decline in days fished as the resource declined and the quotas were reduced. Technology changes have probably enhanced the power of one day's fishing over the time period.

With respect to management activities:

- growth in capacity within the mobile and fixed-gear components of the industry drove the management process toward micro-management, a delicate balancing act that would keep all gear sectors on the water throughout most of the year;
- the administrative complexity increased with the increase in micro-management, resulting in a reduction in time available for enforcement of regulations; and
- only under exceptional circumstances was a management unit closed to fishing when the quota was reached or exceeded (i.e., fishing continued on a by-catch or trip limit basis on other groundfish quotas).

With respect to enforcement:

- considerable success has been achieved in effectively enforcing the regulations imposed on foreign fleets fishing within Canadian waters and in minimizing illegal fishing by American vessels on Georges Bank;

- moderate success has been achieved in enforcing closed areas for spawning and juvenile fish;
- most regulations associated with quota management *per se* have not been enforceable (reporting by area and species, dumping, discarding, highgrading, using correct gear, etc.). Also, many of these illegal fishing activities have been concluded to have increased as a result of EA and ITQ programs;
- charges brought against fishers had to meet the "proof beyond reasonable doubt" burden and procedural rigour of the criminal code. Reasonable doubt and "due diligence" were valid and successfully used defences; and
- penalty levels were low relative to the gains which could be made from illegal action.

With respect to capacity controls:

- levels of fishing capacity under the limited-entry licensing policy allowed potential effort to greatly exceed that required to harvest the resource at moderate fishing levels;
- measures adopted to control growth in fishing capacity, primarily the vessel replacement rules, were ineffective under competitive quotas; and
- observations from EA and ITQ systems show restraint in the growth in capacity, or reduction in capacity, compared to fleet sectors under competitive quotas.

With respect to property rights:

- ownership of quota by enterprises and individuals has led to a reduction in administrative load by DFO and a stabilization or reduction in fishing capacity for these fleet components;
- anecdotal information suggests that economic performance for these fleets has been improved by ownership of quota; and
- there has been a significant reduction in the number of active vessels, a concentration of ownership of quota, and a reduction in the points of landing in the small dragger ITQ fleet.

## 2.3 PROBLEMS WITH STATISTICS ON CATCH

There is an internal consistency for several issues amongst the papers presented in Section 4.4 on the degree of accuracy of landings at dockside as estimates of actual fish caught. The anecdotal information from the port technicians and observers infers considerable misreporting by area and species. The specific "observations" by the port technicians of misreporting by area fit well for the time periods when quota was a limiting factor in one area and an unlimiting factor in a contiguous area. The prevalence of this category of misreporting is also indicated in the interview analysis of the accuracy of the catch monitoring system. In addition, all the analyses inferred high levels of dumping, discarding, and highgrading (by both mobile gear and fixed gear) due to trip limits, EAs, ITQs, and imbalances between quota and abundance for the cod, haddock, and pollock (CHP) species mix in a given area. The observer evidence infers that these practices have increased rather than decreased with the introduction of property at the enterprise level. The port technician anecdotal information and the interviews infer that property at the individual level (IQs) is providing more incentives for illegal fishing practices at sea, but the levels of such practices cannot be quantified. The interview of participants in dockside monitored fisheries indicated that the levels of this practice had not changed over the past five years.

With respect to landings at dockside, even though landings may be misreported by management unit, the diverse evidence infers minimal under-reporting of landings by tonnage. These analyses are somewhat inconsistent with the port technicians' reports and the interviews (which indicated a high level of landings not reported prior to dockside monitoring). Finally, the Dockside Monitoring Program (DMP) and the observer estimates of landings are relatively accurate.

## 2.4 POSSIBLE TRENDS IN NATURAL MORTALITY

The information provided on this issue was considered to be sufficient to draw some general conclusions of relevance to the Workshop aims. For the western Scotian Shelf and Gulf of Maine area, it is unlikely that temporal trends in natural mortality caused by seals and the physical environment have compromised the ability of management to achieve the objectives of fisheries management. The environment has undoubtedly caused variable natural mortality and accounted for considerable inter-annual variability in recruitment. The overall downward trend in mean recruitment, however, for the haddock stocks in 4X and 5 (and cod in 5Z), as well as the truncated age structure and low biomass levels of all the stocks of cod and haddock in the western area, is not plausibly accounted for by any increasing trend in natural mortality.

In 4VW, however, the issue is more complicated. Potential yield of cod (and possibly pollock and silver hake) to fishing is being increasingly reduced by seal predation. The environmental conditions have also been relatively colder during the past several years, but perhaps not sufficiently severe to account for the trends observed in haddock and cod biomass and recruitment in this area.

## 2.5 TRENDS IN EMPLOYMENT AND INCOMES FOR FISHERS IN NOVA SCOTIA (RATHER THAN IN THE SCOTIA-FUNDY REGION)

The number of registered full-time and part-time Nova Scotia fishers (all fishers, not just the groundfish sector) has increased by 22% from 1984 to 1993 (from 12,572 to 15,345). UI payments have increased as a proportion of the landed value (again, all species), from about 7% in 1981 to 16% in 1990. The percentage of income for both fishers and processors that comes from UI has also increased during this time period. Those employed in the fishing industry derive a much higher percentage of their income from UI (in 1990 between 20 and 30%) compared to the rest of Nova Scotia workers (~ 5% with no trend over time). At least until 1990, the incomes of fishers in Nova Scotia were higher than the average of other workers in the province.

## 2.6 OVERVIEW OF GROUNDFISH TRENDS FROM 1977 TO 1993

The summaries in Section 4.2 indicate that the management regime in the period since extension of jurisdiction has generated growth overfishing for most management units (with the exception of silver hake and pollock). Furthermore, for most stocks the fishing mortalities have increased sharply during the past several years as the resources have declined. There is also evidence of recruitment overfishing for all the haddock management units and the eastern Scotian Shelf cod management units. Because of the difficulties of interpreting declines in recruitment, however, there is not a consensus within the science community on this latter inference. For some of the management units (pollock and silver hake), the downward trend in mean recruitment is not attributed to overfishing.

In the discussion of the resource summaries it was concluded that, although the details of the assessments are subject to debate, there was a consensus that the historical trends of abundance and exploitation rate are robust for a reasonable range of assumptions.

From the summaries of stock status for the diverse groundfish management units, it is to be noted that different species and areas have different temporal trends. The haddock stocks have declined earlier than the others. This may be due to both the higher unit price for haddock and its distributional characteristics. The stocks in the western part of the Scotia-Fundy Region (4X and 5) appear to be more resilient than those in 4VW. For example, weight-at-age for cod in 4VsW has been declining whereas there are no downward trends for 4X and Georges Bank cod.

<u>Stocks</u>	<u>Growth Overfishing</u>	<u>Downward Trends in Mean Recruitment *</u>
4Vn cod	probably	probably
4VsW cod	yes	yes
4X cod	yes (?)	no
5Z cod	yes	no (?)
4TVW haddock	yes	yes
4X haddock	yes	yes
5Z haddock	yes	yes
pollock	no	yes
silver hake	no	yes
flatfish species	?	?
Atlantic halibut	?	?

\* Lack of consensus within the scientific community on the operational targets for recruitment overfishing

## 2.7 THE RELATIVE IMPORTANCE OF FISHING AND OF THE ENVIRONMENT ON RECENT TRENDS (I.E., SINCE ABOUT 1985) IN GROUND FISH STOCKS IN THE SCOTIA-FUNDY REGION

The Workshop allowed some general conclusions to be drawn on the relative importance of fishing and the environment on recent trends in characteristics of groundfish stocks in the Scotian Shelf and Gulf of Maine area. The term relative importance is stressed because there is a well supported body of theory that describes the environmental control of the abundance of marine fish. There is also compelling evidence that fishing can have major negative impacts on marine groundfish populations. The responses of populations to major reductions in fishing effort during the First and Second World Wars in the North Sea, following extension of jurisdiction off Canada in 1977 and off Namibia since 1990, indicated that overfishing had reduced populations to very low levels of abundance. Some large-scale experiments have been carried out that lead to robust conclusions on the power of fishing. Thus, we know that both the environment and fishing can cause dramatic fluctuations in abundance.

At the Workshop, specific features of the groundfish management units were of interest:

- number of spawning locations within management unit;
- recent trends in spawning stock biomass;
- recent trends in mean year-class strength;
- age-span trends; and
- weight-at-age trends.

There are some constraints to drawing conclusions on the relative roles of fishing and of the environment on changes over time in the above characteristics. These include:

- variable data quality on the biological features of interest, as well as on trends in fishing effort by gear sector and on trends in environmental parameters;
- the burden of proof of "cause and effect" stretches the state-of-the-art in ecology (thus conclusions are based on strong inference rather than proof); and
- the Workshop did not pose this specific question, thus all the information was not presented in a manner that would facilitate the drawing of conclusions.

From the discussion at the Workshop and comments on the draft report, it is apparent that there is a majority viewpoint rather than a consensus on the relative roles of fishing and of the environment



in generating the observed trends in the above-noted biological characteristics. It is the majority view that is summarized here.

For the western Scotian Shelf and Gulf of Maine area, the environmental trends described infer that nothing "abnormal" has been occurring in recent years. Fishing effort has been increasing or stable depending on the gear sector. Annual fishing mortality estimates in recent years have been:

4X cod	-	~ 40%
4X haddock	-	> 40%
5Z cod	-	~ 50%
5Z haddock	-	~ 50%

The  $F_{0.1}$  target for these management units is about 20%.

The trends in the biological characteristics are shown in the following text table.

SUMMARY OF TRENDS IN BIOLOGICAL FEATURES					
	# of Spawning Locations	Spawning Stock Biomass Trends	Mean Year-Class Size	Age Span	Weight at-Age
4X Cod	↓	lower quartile	no trend	↓	no trend
4X Haddock	?	lower third	↓	↓	no trend
5Z Cod	↓ (United States side)	lowest observed	no recent trend	↓	no trend
5Z Haddock	↓ (United States side)	lowest observed	↓	↓	no trend

The conclusions for the western Scotian Shelf are:

- overfishing inferred as the cause of many of the recent trends in the biological features of the management units;
- environmental trends do not indicate that the late 1980s and early 1990s have been abnormal; and
- fishing has been relatively more important than the environment in generating the negative trends in the biological features.

For the eastern Scotian Shelf (4VW), there have been important environmental trends in recent years. These include increasing areas of below 0°C water temperatures observed during the summer survey, slight declines in mean bottom water temperature for 4VW, and continued increases in grey seal abundance. The fishing effort has also been increasing overall, even though there have been some recent declines by certain gear sectors. Fishing mortality estimates in recent years have been:

4Vn cod	-	high (but not quantified)
4VsW cod	-	~ 60%
4TVW haddock	-	> 60%

The  $F_{0.1}$  target is about 20%.

The trends in the biological characteristics are shown in the following text table:

SUMMARY OF TRENDS IN BIOLOGICAL FEATURES					
	# of Spawning Locations	Spawning Stock Biomass Trends	Mean Year-Class Size	Age Span	Weight at-Age
4Vn Cod	?	very low	?	↓	↓
4VsW Cod	↓	lowest observed	↓	↓	↓
4VW Haddock	?	lower quartile	↓	↓	↓

The conclusions for the eastern Scotian Shelf are:

- overfishing is inferred as the cause of several trends in observed characteristics
  - : age span
  - : spawning stock levels
  - : number of spawning locations
  - : mean recruitment
- abnormal environmental conditions (including seals) inferred to have contributed to trends on several characteristics
  - : mean recruitment
  - : weight-at-age
  - : spawning stock levels

In conclusion, exploitation rates have been high throughout the Scotia-Fundy Region, but the combination of overfishing and adverse environmental conditions (including seals) has caused particularly severe declines in stock levels in 4VW.

## 2.8 DISCUSSION ON THE ACHIEVEMENT OF OBJECTIVES

Three categories of objectives (conservation, economic performance, and employment) were discussed. It was concluded that the Canadianization objectives have essentially been met, and in the interest of time available these issues were not further considered.

### Conservation Objectives

The 1976 conservation objective was to rebuild the groundfish stocks. Implicit in the objective was the prevention of growth and recruitment overfishing. In Section 4.2, the trends in spawning stock biomass, recruitment, and fishing mortality are summarized for the relevant management units. For most stocks (with the exception of the transboundary resources on Georges Bank), the stocks did rebuild during the late 1970s and early 1980s, subsequent to the removal of foreign fishing effort in the mid 1970s. The spawning stock sizes for most management units are, however, presently at very low levels, several equal to or below that observed during the mid 1970s.

Has the Canadian fishing effort contributed to changes in the characteristics of the stocks? The information provided strongly infers that the short answer is yes. Fishing effort (measured as annual trips by fleet sector without correction for changes in technology over time) has increased substantially from 1977 to 1993. The effort of the offshore large vessel fleet declined in the early 1980s and levelled off after that; the effort of inshore mobile gear vessels climbed rapidly until 1986

and levelled off. Effort by longline (and gillnet vessels) climbed steadily throughout the period. The estimates of fishing mortality indicate that the strategic target ( $F_{0.1}$ ) has been exceeded for most management units (with the exception of silver hake). For the cod and haddock management units, fishing mortalities in recent years, as the stocks have declined rapidly, have increased sharply to levels well above  $F_{max}$ . Anecdotal information suggests that heavy fishing on spawning concentrations may have resulted in losses of spawning components. The egg and larval surveys on Western Bank indicate the disappearance of this spring spawning component of cod in 4W.

The information presented on potential changes in natural mortality due to environmental trends and seal predation is complex. In sum, for the western Scotian Shelf and Gulf of Maine area (4X and 5), there is not a strong case to be made that decadal scale trends in natural mortality have accounted for the changing characteristics of the stocks in recent years. For the eastern Scotian Shelf (4VW), however, there is compelling evidence that seal predation on cod has increased over the time period under review (1977 to 1993), and that potential yield to fishing as a result of seal predation is being reduced substantially. The environmental trends in 4VW, however, do not seem sufficiently strong to have generated the observed trends in biomass. The haddock resource in 4VW declined prior to the period of colder temperatures and does not appear to have been affected by seal predation.

The combination of information on fishing effort, fishing mortality, reduction in spawning components, environmental trends, and seal predation leads to the conclusion that overfishing has strongly contributed to the resource changes. Growth overfishing has occurred for most management units, and recruitment overfishing is inferred for several (although there is not a scientific consensus on this latter point). It is concluded that licensing controls in competitive quota fisheries failed to limit the growth in fishing capacity and the tactic of quota management has not controlled fishing mortality at the strategic target in the high capacity environment. As a result, the conservation objectives have not been met.

#### Economic Performance Objectives

Groundfish landings in the Scotia-Fundy Region ranged between 260,000 and 300,000 t between 1981 and 1988; they fell to a range of 250,000 to 215,000 t between 1989 and 1992, and further to 120,000 t in 1993. Landed values in current dollars climbed from \$110 million to \$230 million between 1981 and 1987; they fell to a range of \$160 million to \$190 million between 1988 and 1992, and further to \$100 million in 1993. The constant dollar value of groundfish remained steady in almost all years around the level of \$180 million (1993 \$). The major exception was in 1986 and 1987 when it climbed over \$200 million and peaked at \$285 million due mainly to price increases, but it retreated to the \$180 million range in the next year. Landed value fell to \$100 million in 1993. Average prices for groundfish doubled in current dollars between 1981 and 1993 but in constant dollars prices rose by about 30% from \$650 to \$850 per tonne.

Information on the financial performance of various fleets in the fishery is limited. Most offshore fleets are vertically integrated harvesting/processing operations which catch fish, including non-groundfish species, in waters outside the study area. Some are multi-national operations. In the early 1980s, the combination of high interest rates, rising operating costs, and weak fish prices caused a financial crisis in the Atlantic groundfish industry which was felt particularly by these companies. The response was a government-aided restructuring and consolidation accomplished in part through the infusion of \$300 million of public equity between 1983 and 1986, \$150 million of which was recovered through a sale of shares in 1987.

There is little public information on the profitability of offshore companies and especially the profitability of their groundfish harvesting fleets. National Sea Products Ltd., the largest publicly traded offshore company, reported losses in all but three years since 1984. National Sea Products Ltd.'s reported sales on all operations peaked in 1990 at \$608 million; they fell steadily since then as the company rationalized international and Canadian operations. The company reported losses of \$32.5 million on sales of \$351 million in 1992, and \$42.5 million on sales of \$266 million in 1993.

The decline in sales was largely attributed to reductions in groundfish stocks, which have eroded steadily for the company since 1988. However, the company also reported its first profit from continuing operations in 1993 - \$3.6 million; the overall loss was attributed to a one-time write down of \$49 million to reflect the reduced value of assets and the groundfish downturn. Other offshore groundfish operators who harvest Scotian Shelf and Georges Bank stocks also have quotas on the Grand Banks and in the Gulf of St. Lawrence. Many of the operators have lucrative shrimp, scallop or lobster operations. The operational scope and complexity of these companies does not allow us to isolate the viability of vessels fishing Scotia-Fundy Region groundfish stocks.

Data on the profitability of other fleets are limited to that collected through cost and earnings surveys. These have been done for various fleets on a three-year cycle since 1985. Projections are used to fill in the intervening years. Results are available for groundfish fleets for the 1985 to 1990 period. (We have now extended this time series to 1992, but the data were not presented.) There are five years of observation for five mobile gear fleets under 100 ft.; profits were recorded for 24 of a possible 25 observations. The four longline fleets reported profits in 16 of a possible 20 observations over the same period.

The 1993 quota reductions saw the value of groundfish landings reduced by 40% compared to 1992. Inshore mobile gear fleets had been constantly warned of the threats to viability since a workshop on capacity was held in Yarmouth, Nova Scotia, in 1986. The message was reinforced by an industry Capacity Reduction Committee in 1988 and the Haché Task Force in 1989. New vessel replacement rules based on cubic measurement of fishing vessels were introduced in 1989. These warnings and measures helped discourage investment in new harvesting capacity in spite of the boom years in the late 1980s. As a result, most operations are carrying reasonable debt loads (estimated at 20%) into the current downturn. Information from the provincial loan board indicates that they continue to experience a very low default rate of under 3% on their outstanding loans.

In spite of the dramatic reduction in groundfish quotas and catches in 1993 (arguably outside the range contemplated when the economic objective was set in 1982), fishing operations in the Scotia-Fundy Region continue to survive the downturn. There has been a low failure rate, indicated by the numbers of bankruptcies and loan defaults. Government assistance has been provided, but the take-up rate in Nova Scotia has been less than 25% of the projected level and more than one-half of the assistance has been directed to plant workers. Fishers operating in ITQ programs continue to argue for confirmation that their program will be maintained and want it expanded to those stocks they fish competitively, rather than seeking adjustment assistance.

#### Employment and Income Objectives

Fisher registrations provide an indicator of employment in fishing, although up to one-third of those who register do not fish or fish very little. There was a significant increase in the number of registered fishers between 1984 and 1988 and a levelling off since then. Much of the increase occurred as the value of the fishery peaked in 1987; there has been no appreciable reduction in the registration level since then.

Income information from taxfiler data indicates that fishers generally kept pace with the rising income trends of non-fishers in the provincial economy. Fisher income surged ahead in 1986 and 1987 before falling back again to its pre-1986 level relative to non-fishers. Once UI payments are added to both groups, fisher incomes exceed the average of non-fishers in all years from 1981 to 1990.

Until the dramatic turndown in 1993, the industry maintained a workforce at levels that were at or above those of the early 1980s and paid wages which compared favourably to those of other workers. The relatively greater impact of the downturn in eastern Scotian Shelf stocks has impacted the local inshore fishers and the offshore companies who are more reliant on that area.

## 2.9 DISCUSSION OF WHY THE CONSERVATION OBJECTIVES WERE NOT MET

The second aim of the Workshop was to evaluate why the long-term objectives have not been met. It may be helpful to take a hierarchical approach to the discussion. First, were the conservation objectives realistic (i.e., can groundfish stocks be rebuilt)? The empirical observations strongly suggest that the conservation objectives were and are realistic and attainable. The removal of foreign effort in the mid 1970s did lead to stock rebuilding, and similar observations have been made for groundfish in other areas of the world (over the European Shelf during the Second World War, and off Namibia at present following their declaration of the 200-mile limit in 1990). Groundfish stocks do rebuild if fishing effort is controlled.

Second, was the strategy appropriate? The strategy has been to control fishing effort at low levels relative to resource abundance in order to generate a fishing mortality at  $F_{0.1}$  levels. Some limitations of this strategy are worth noting. By definition, this strategy should prevent growth overfishing within the management unit. However, if there are a number of spawning components within a management unit, there is the possibility that fishing at effort levels corresponding to  $F_{0.1}$ , if overly concentrated on individual components, could lead to overfishing on some spawning components. In sum, even though the Canadian strategy, i.e.,  $F_{0.1}$ , has been more conservative than that of most other nations, it has not explicitly addressed the key issue of protection of spawning components.

Third, were the tactics appropriate? The tactics have been to control fishing effort through annual single-species quotas for particular geographic areas (i.e., management units). This tactic involving so-called output controls has not worked during the period under evaluation (1977 to 1993). Quota management has not controlled fishing effort at levels that meet the strategic target for fishing mortality ( $F_{0.1}$ ). The ineffective implementation of input controls (especially the vessel replacement rules) failed to constrain the growth in fishing power. Minimum mesh size regulations were not regularly observed and limited use was made of closed areas for juveniles. These shortcomings helped compromise the ability of quota management to achieve the conservation objectives.

Given that the conservation objectives set in 1976 were realistic and the strategy not inappropriate (with the caveat of lack of consideration of minimum spawning stock requirements), why has the tactic of quota management not worked within the Scotia-Fundy Region?

The information summarized in Section 4 allows some tentative conclusions to be drawn. There are internal contradictions between the conservation, economic performance, and employment objectives that require ongoing trade-offs. Also, there has been no framework in place for ongoing evaluation of the degree to which the management activities were generating the specified results. Short-term decisions consistently traded off the conservation objectives for the economic and social interests. There was, in addition, an assumption of biological resilience in the resource and the feeling that economic constraints would restrain fishing effort prior to recruitment overfishing. The input controls did not restrain growth in harvesting technology, allowing the development of an extremely powerful and economically efficient small dragger fleet through the 1980s and the continuing expansion of inshore fixed-gear capacity. Fishing for groundfish with present technology (for both mobile and fixed gears) appears to be profitable at very low biomass levels. Recruitment overfishing is possible prior to economic overfishing. Under these conditions, it becomes essential that quota management effectively controls fishing effort at appropriate target levels. This has not occurred within the Scotia-Fundy Region.

An additional constraint has been the mismatch between single species quota management for multi-species harvesting technology. There are fundamental problems in conducting a multi-species fishery with harvesting technology which cannot be targeted selectively. Single-species quota management can exacerbate the problems by creating perverse incentives as quota limits are reached. Fishers misreport catches by species and assign them to adjacent stocks. If these options are not available, they 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 available

quotas. The problem is worse when small by-catch trip limits are imposed. Trans-shipping is another practice used by fishers at sea to avoid trip limit regulations or to take advantage of inter-fleet quota availability. High-value stocks such as haddock tend to be the first fished to low abundance; they continue to suffer heavy fishing pressure as legal by-catch (or as target species by the less conservation minded) while fishers pursue other quotas available to them.

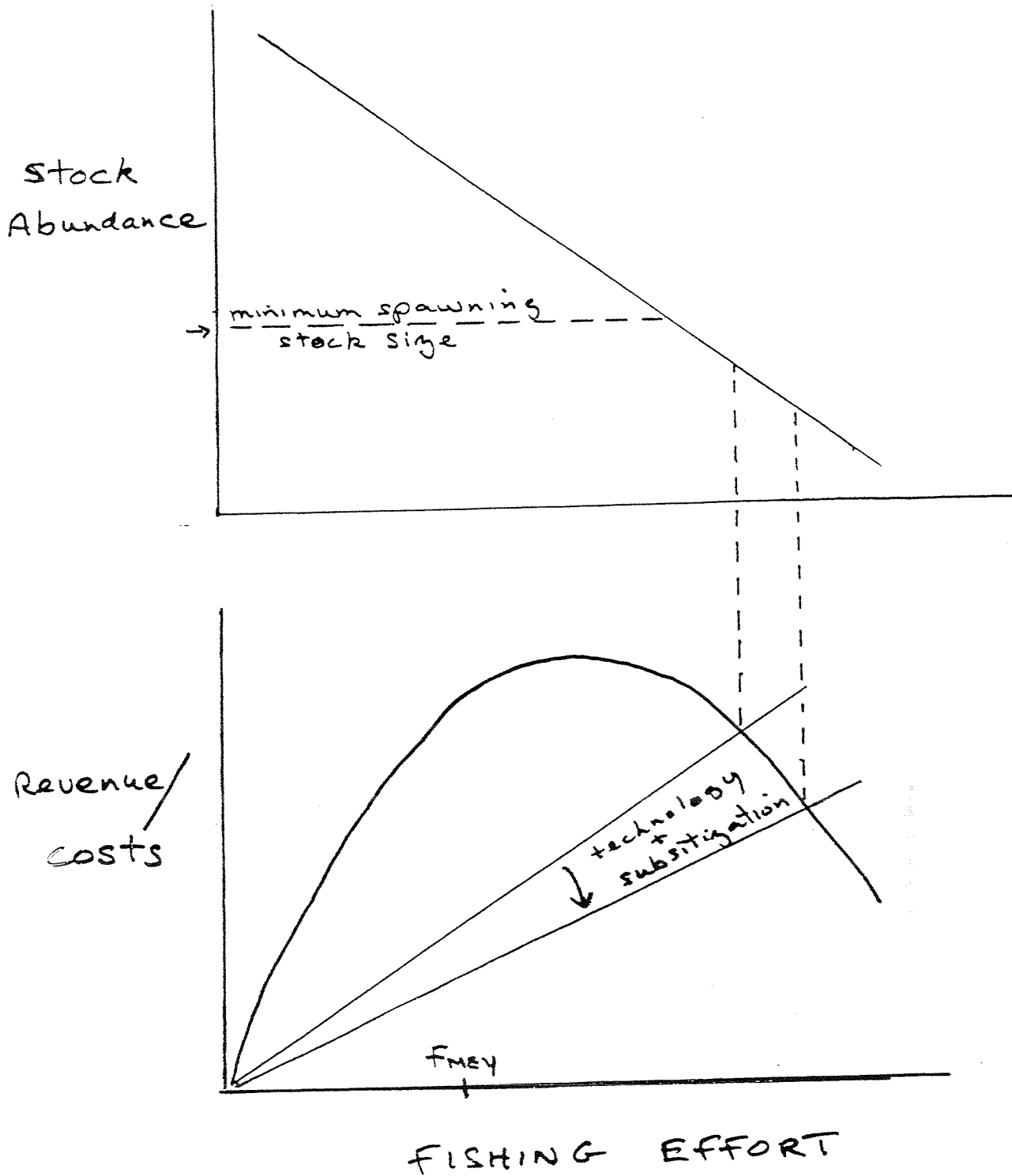
Individual quotas may relieve the pressure to discard in a number of ways: the rationalization of fleets places fewer boats on the water, control over quota allows fishers to be more careful and to avoid low-quota species as opposed to having to race, quota can be transferred to cover accidental catches, and the discard practices due to restricted trip limits are minimized. Nonetheless, the incentive under quota management to highgrade smaller, low-value fish or to discard catches of restricted species remains.

Under these conditions, enormous pressure was put on quota management to curb fishing effort at appropriate levels. This has not occurred within the Scotia-Fundy Region. TACs were regularly set above  $F_{0.1}$ ; the 50% rule institutionalized this practice. As capacity increased, a seasonal division of quotas and trip limits was used to extend the catch over the year. Attempts to increase mesh size and gear selectivity were resisted until the late 1980s. Legislation made it illegal to possess undersize fish; dumping was prohibited but "discarding" was acceptable, a subtlety which further undermined at-sea enforcement. When at-sea violations were detected, the burden of proof and procedural rigidity made prosecution difficult to achieve. When prosecutions were achieved, the courts assessed low penalties relative to the gains that resulted from the violation. Some of these conditions changed in the last two years by increasing penalty provisions in the legislation and introducing a new administrative sanctions method of dispensing justice through long-term licence suspensions.

In sum, the tactical approach chosen to control fishing mortality generated illegal behaviour which was not curbed by the available enforcement regime. In addition, it can be inferred from observations on fishing activity and stock abundance that the gear types used are capable of fishing profitably at extremely low stock abundances (i.e., several management units were closed because of concerns for the spawning stock biomass during the time period when the fishing industry was profitable). Thus, resource declines have not resulted in comparable effort reductions due to economic constraints (for at least some of the gear sectors). The open-access equilibrium point for the Scotia-Fundy Region groundfish fishery, due to increases in technical efficiency and subsidization (including UI), appears to be reached at fishing effort levels that go well beyond minimum spawning stock size. The strategy and tactics used for the other management objectives (i.e., economic performance, and employment) have allowed technology to evolve and have encouraged fishers to stay in the fishery during downturns. These activities, given the inability to date of quota management to sufficiently control fishing mortality, have further compromised the conservation objectives. In essence, the "regulated" groundfish fishery in the Scotia-Fundy Region under quota management appears in some instances to have pushed the open-access equilibrium point to levels of stock collapse. This is shown schematically in the following text figure. The inability to meet the conservation objectives, in part due to short-term trade-offs in support of economic and social objectives, has in the longer term undermined the sustainability of the commercial fishery and the fishing communities.

### 3. RECOMMENDATIONS

The Workshop was a first step in the evaluation of the present state of knowledge on the management of groundfish in the Scotia-Fundy Region. The papers presented, as well as the discussions, have identified gaps in knowledge and have clarified questions that require further research and analysis. The following recommendations are made by the Steering Committee:



management failed to  
control fishing effort  
at "MEY level" (N.F.O.)

1. A regional mechanism should be established for the ongoing review and evaluation of groundfish management activities in relation to the stated objectives. This should include a Registry of Management Measures, as well as an institutionalized framework for the evaluation of management measures.
2. A follow-up workshop should be held to discuss identified gaps in knowledge from the first workshop and the conclusions of the Steering Committee, and to identify what can realistically be changed to improve the management system. The next workshop should include representatives of the fishing industry.
3. A regional (industry/university/DFO) working group should be established to prepare position papers on practical alternatives or improvements to the present management system.
4. Papers need to be prepared for the following issues that were identified as requiring more work:
  - The trends in effort for the groundfish fleet sectors since 1977 should be finalized and published.
  - An analysis should be conducted using the commercial catch/effort data base to determine what the reduction in annual fishing mortality would be for a constant number of days fishing, but a restriction of fishing during months of spawning aggregations.
  - Through use of fishers' private logs and interviews, further evaluate the degree of discarding, dumping, and highgrading, and the degree to which this varies by gear sector and quota regime (competitive quota, EAs, ITQs).
  - Profitability of diverse gear sectors as a function of stock abundance (to link the gear-specific open-access equilibrium point to spawning stock biomass).
  - Further analysis of the costs and effectiveness of enforcements in order to draw conclusions on what activities can realistically be enforced.
  - Compile a summary of trends in licenses, active fishers, and capacity by gear sector and area (1977 to 1993).
  - Further analysis of the total costs of management broken down by the categories of objectives (conservation, economic performance, and employment).
  - Using interviews with fishers, as well as material already available, document the location of minor spawning components for different groundfish species (and any trends in time). Evaluate alternative management measures with respect to maintaining adequate spawning stock size.
  - Evaluate the effect of the retrospective problem on the provision of scientific advice for Scotia-Fundy Region management units, and compare stock biomass trends at  $F_{0.1}$  catch compared to estimated trends.
  - Prepare summaries of changes in age structure, mean recruitment, and spawning stock biomass (egg production) for each management unit.
  - Prepare an analysis of the deterrent effect of the enforcement, criminal legal proceedings, and penalty structure achieved under the Fishery Act between 1977 and 1993. Discuss the impacts of recent changes in penalty levels and the use of sanctions.
  - Prepare an analysis of catch monitoring systems and their evolution since 1977, including reconciliation of divergent evidence on the extent of under-reporting of landings by tonnage. Discuss the use of observer programs, port technicians, and the impacts of DMPs.
5. An alternative approach should be evaluated to providing scientific advice that depends on closer to "real-time" information, rather than on data from two years prior to the year for which the advice is to be used.
6. A means of collecting consistent catch/effort information should be evaluated for the purpose of deriving abundance trends based on experience in the commercial fishery. The International Observer Program, statistical system, and index fishers programs should be investigated for the most effective approach.



#### 4. SUMMARY OF PAPERS AND THEIR DISCUSSION

##### 4.1 THE OBJECTIVES OF GROUND FISH MANAGEMENT (D.L. BURKE, R.N. O'BOYLE, AND F.G. PEACOCK)

Four objectives were considered: conservation, economic performance, employment, and Canadianization. For each objective, the strategies and tactics for their achievement were outlined, as well as a preliminary evaluation of results. The strategies and tactics are summarized here, whereas the results are integrated into the following sections.

The conservation objective has been:

to ensure that utilization of the groundfish resource is sustainable and safeguards ecological processes and genetic diversity (based on United Nations definition). This generally implies that the resource should be neither growth overfished nor more particularly recruitment overfished.

The concern for recruitment overfishing, for example, is explicitly stated in the basic principles section of the annual Atlantic Groundfish Management Plans. Rule viii, Point 1, states: "if the stock assessment provides evidence of levels of spawning stock biomass likely to endanger recruitment, fishing effort in the coming year will be reduced to allow immediate growth in spawning stock biomass".

The strategy adopted by DFO in 1977 after the extension of jurisdiction has been to harvest the resource at a rate no greater than  $F_{0.1}$ . It was noted that this has always been the strategic target and, for example, the so-called 50% rule and three-year management plans are considered tactics to achieve this long-term goal. Prior to 1977, the strategy had been to harvest the resource at a rate no greater than  $F_{msy}$  or  $F_{max}$ .  $F_{max}$  is still the strategy for many other nations. Thus the recent strategy has been considered to be conservative from a global perspective. It was noted that even though the management plans include concern for minimum spawning stock abundance necessary for future recruitment, there has been no operational definition.

The tactics have been catch and effort controls to achieve the  $F_{0.1}$  harvesting rate. The catch controls include the annual setting of TACs for geographic management units, including the 50% rule (since 1986). Rule viii, Point 2, in the general principles states that where the  $F_{0.1}$  catch level for the next year differs 10% or 10,000 t from the current year's TAC, the following formula would apply:

- a) 50% rule;
- b) for larger reductions - twice  $F_{0.1}$  rule.

Also, there have been by-catch controls for management units that are "closed". The effort controls include:

- gear size and type regulation;
- time/area nursery closures; and
- time/area spawning closures.

The economic performance objective (from the Kirby Task Force recommendations) has been to maintain an economically viable industry on an ongoing basis where viability implies an ability to survive downtimes, with only a normal business failure rate and without government assistance. The strategies to achieve this level of economic performance have been to:

- maintain high stock abundance levels;
- contain or reduce costs of production;
- increase revenue from landings;
- control access to the resource through allocation decision making; and

- subsidize the fishery through DFO and other government departments.

The tactics can be considered separately for DFO and other departments (provincial and federal). DFO tactics include the following actions for the respective strategic elements listed above:

for high abundance:

- set TACs at low levels of fishing mortality;

for capacity control:

- limit the numbers of enterprises ("limited entry");
- limit the growth in physical capacity (and costs) of fleets and of fishing vessels with controls on vessel numbers and rules on size of replacement;
- licence freezes and cancellations;
- EA and ITQ programs;

for increasing revenue:

- programs and regulations to promote quality and increase prices;
- develop underutilized fisheries;

for controlling access to the resource:

- fleet quotas;
- sector management;
- EA/ITQ programs;

for subsidization:

- research and development to improve the efficiency (operating cost) and effectiveness of vessels;
- public investment in harbour infrastructure;
- vessel construction subsidies (eliminated in 1982); and
- equity investment in vertically integrated "offshore" companies (purchase 1983-84, sale 1987-88);
- public expenditures to enhance efficiency (charts, gear research).

Other federal departments and the provincial governments of Nova Scotia and New Brunswick have contributed to the tactics for economic performance through, for example:

- vessel loans by the Nova Scotia Loans Board;
- Atlantic Canada Opportunities Agency (ACOA) Regional Development Programs (much ACOA funding for groundfish in recent years has been directed away from the harvesting sector); and
- marketing and promotion assistance from Industry Science and Technology Canada.

The employment objective is that jobs should be maximized subject to the constraint that those employed receive a reasonable income through earnings and fishery-related transfer payments. The strategies are the same as those identified above for economic performance. In addition to the tactics described above, other departments provide training and income support that have a significant influence on the functioning of the groundfish fishery:

- Nova Scotia and New Brunswick provide training for fishers; and

- Canadian Employment and Immigration Commission (Human Resource Development) provides UI for fisheries and plant workers, and "make-work" projects are regularly used in cases where fishery workers would not otherwise qualify for UI.

The Canadianization objective is to maximize fish harvesting and processing by Canadians without competitive interference from foreign activities. The strategies to achieve this aim have been:

- extend the 200-mile limit;
- under the Law of the Sea guidelines, only allow stocks surplus to Canadian needs to be used for foreign harvest;
- Canadianize vessel ownership;
- maintain Canadianization of plant ownership (1977 "Grandfather clause"); and
- subsidize Canadian operations.

The tactics under the strategy for Canadianization have been:

- government funding by DFO and other agencies from 1950 to the present has been directed toward developing Canadian harvesting and processing capacity to displace foreign activity;
- the Coastal Fisheries Protection Act provides the legislation to control all foreign fishing within Canadian waters;
- the Foreign Investment Review Agency, and subsequently Investment Canada, evaluates acceptability and level of investment by foreign interests within Canada;
- the 1989 Ministerial Licensing Policy limits foreign ownership in vessels and processing plants to an upper limit of 49%;
- the short-term charter policy (which is now under the Foreign Licensing Review Board) controls use of foreign vessels;
- crew members must be either Canadian citizens, permanent residents, or hold an employment authorization;
- bilateral agreements with foreign fishing nations;
- NAFO participation to influence foreign fishing in waters contiguous to the Canadian zone.

In the discussion of this first paper it was concluded that even though the objectives, strategies, and tactics for groundfish management are readily available in diverse documentation, there has been inadequate articulation at the policy level on the balancing of the diverse aims. Nor, in an operational sense, have ongoing management targets been set such that consistent decision making can be made within a framework of a well understood overall strategy. The statement of objectives for conservation has been translated into an operational strategy, while those for economic performance, employment, and Canadianization have been more *ad hoc*. For example, the tactics for achieving the economic performance and employment objectives were not defined appropriately as specific operational measures, but rather have been described in vague terms (e.g., limit the number of enterprises). In addition, it was noted that an undocumented social objective has been re-emphasized in recent years (i.e., the maintenance of small communities that support a particular lifestyle). It was concluded that the information tabled on objectives is sufficient for the purposes of the Workshop, in particular as a framework to evaluate the degree to which the aims of management have been met.

#### **4.2 SUMMARY OF BIOMASS AND FISHING MORTALITY TRENDS (R.N. O'BOYLE AND M. SINCLAIR)**

Trends in biomass, recruitment (i.e., year-class strengths), and fishing mortality (where available) were provided for 12 groundfish management units. The results are summarized by stock:

#### 4Vn Cod

An analytical assessment (i.e., an assessment including a Sequential Population Analysis [SPA]) has not been carried out for this management unit because it is considered to be an area of variable mixing between several spawning populations at different months of the year. The more qualitative assessment indicates, however, that the resource is at extremely low levels and fishing mortality has been in excess of  $F_{\max}$  for several years. The TAC has not been caught since 1989, indicating that during this period the fishery has in essence been unrestricted by quota during a period of strong market demand. This observation in itself infers a very high harvesting rate.

#### 4VsW Cod

The biomass, recruitment, and fishing mortality trends from 1970 to 1993 are shown in Figures 1, 2 and 3. The biomass of Age 6 and older fish (Figure 1) indicates that the spawning stock is at the lowest level recorded. Also, there have been no strong year-classes entering the population since 1982 (Figure 2). From egg and larval surveys and anecdotal information from fishers, there is evidence that some spawning components have disappeared possibly due to recruitment overfishing. The fishing mortality trends (Figure 3) indicate that the harvesting rate has exceeded the target (i.e.,  $F_{0.1}$ ) since the extension of jurisdiction and also that during recent years the rate has been rising dramatically to about 70%. In Figure 4, the trend in the mean weight-at-age (for seven-year old fish in this example) has declined gradually since the late 1970s. The causes of this trend in weight at a given age are not well understood, but the implications on yield-per-recruit are significant.

#### 4X Cod

The biomass, recruitment and fishing mortality trends from 1960 to 1993 are shown in Figures 5 and 6. Although the spawning population (i.e., Age 3 and older fish) is presently at a low level, it is not at a level where one might expect recruitment failure (based on historical records at least). Recent year-class strengths are well within the range of past years (Figure 5). There is some concern, however, that the overall trend in biomass over the 30-year time period is slightly downward. This could be generated by the loss of smaller coastal spawning components due to local overfishing. There is no trend in fishing mortality (Figure 6) with the level exceeding  $F_{\max}$  (i.e., twice the target). Finally, there is no temporal trend in mean weight-at-age for this management unit (Figure 7). In sum, for 4X cod growth overfishing has occurred; but recruitment does not appear to have been influenced by fishing.

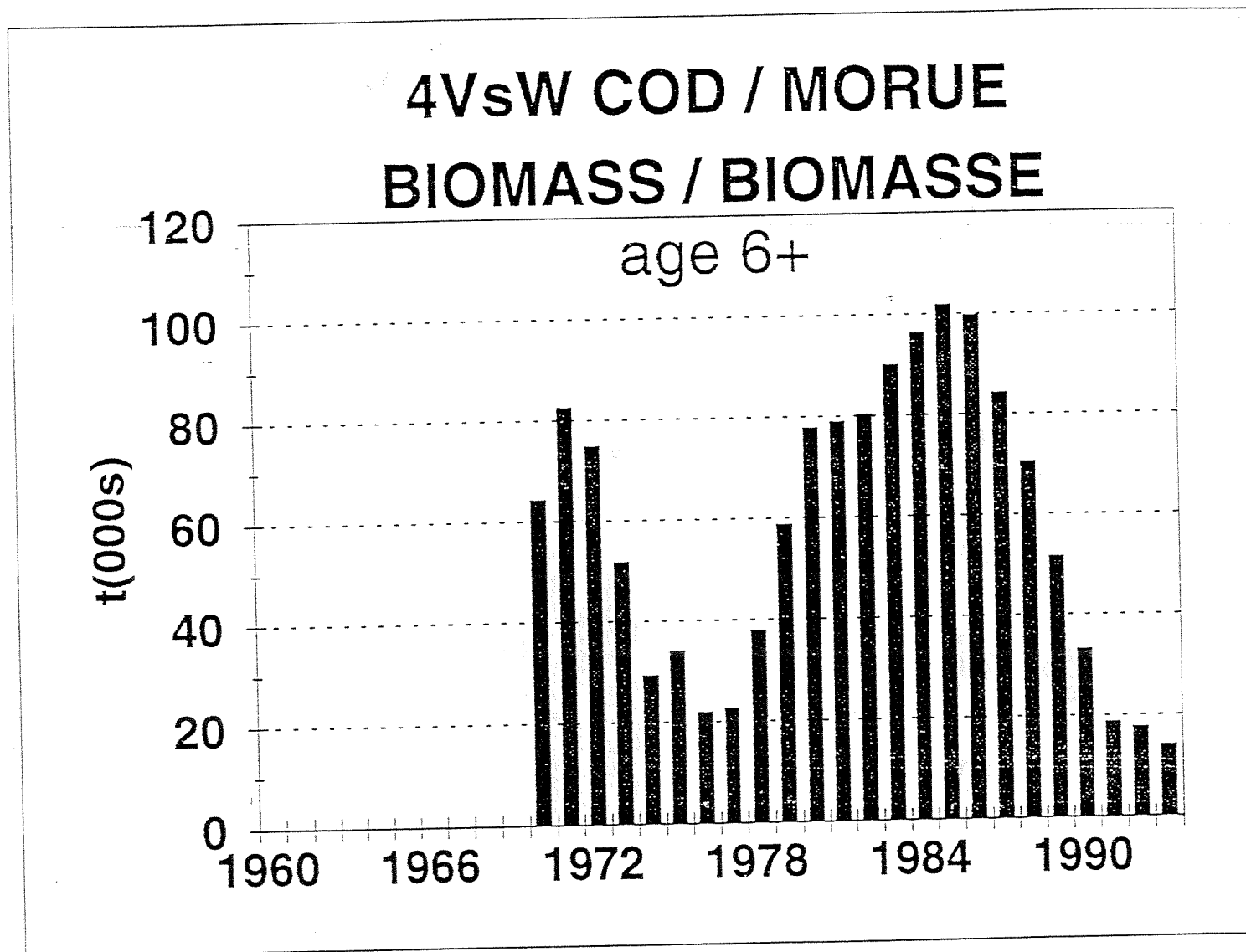
#### 5Z Cod

This management unit is transboundary with the United States. The biomass, recruitment, and fishing mortality trends from 1978 to 1993 are shown in Figures 8, 9, and 10. The spawning stock biomass is at historically low levels and there have been small year-classes (with the exception of 1991) since 1988.

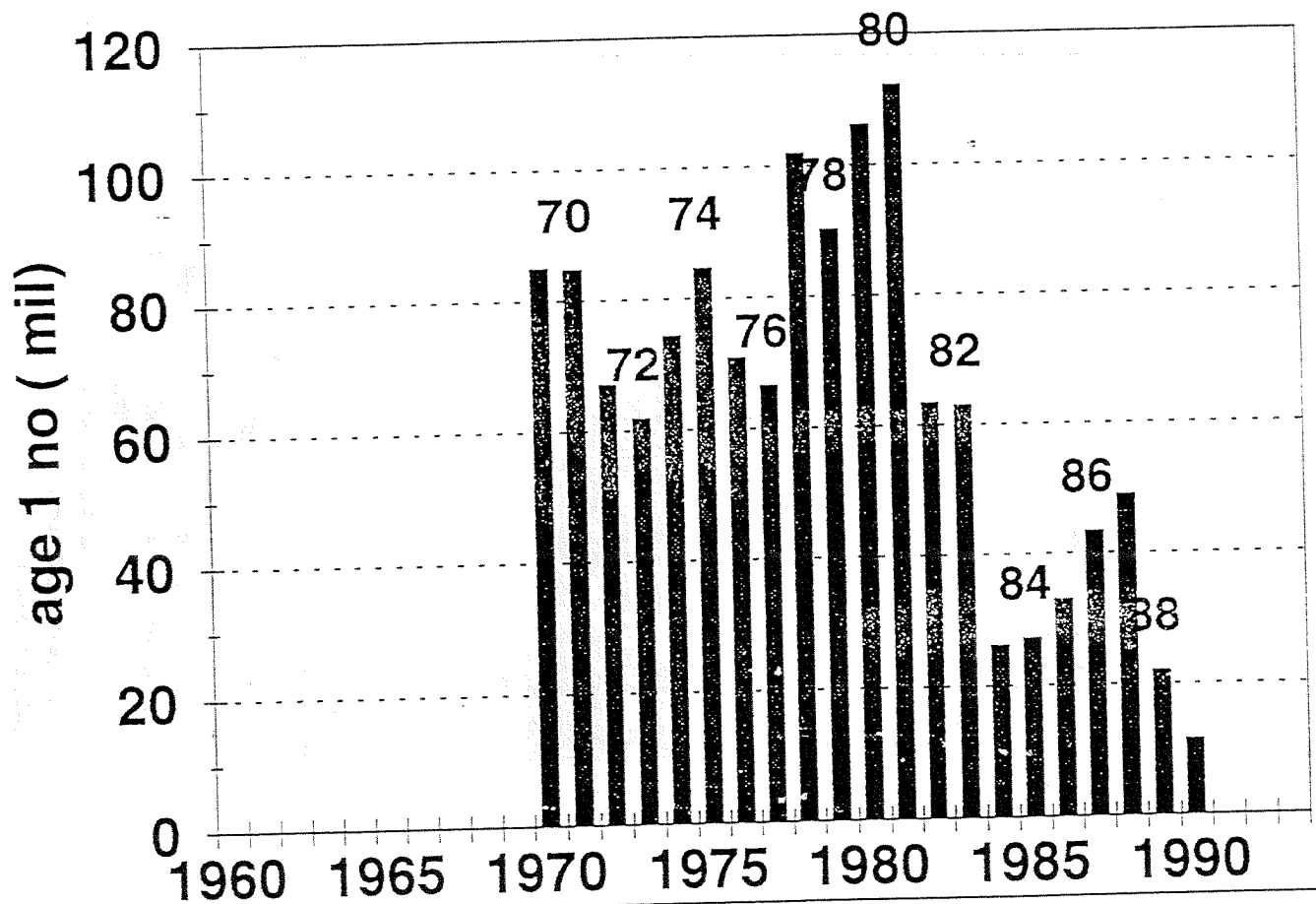
Fishing mortality has exceeded the target (Figure 10), but it is to be noted that  $F_{0.1}$  has not been the target for this resource because of its transboundary nature and the lack of consistent management by the two jurisdictions. The recent upsurge in fishing mortality is of concern. There is no temporal trend in weight-at-age for the cod in this area. In sum, growth overfishing has occurred in recent years; but it is difficult to make a conclusion on recruitment overfishing.

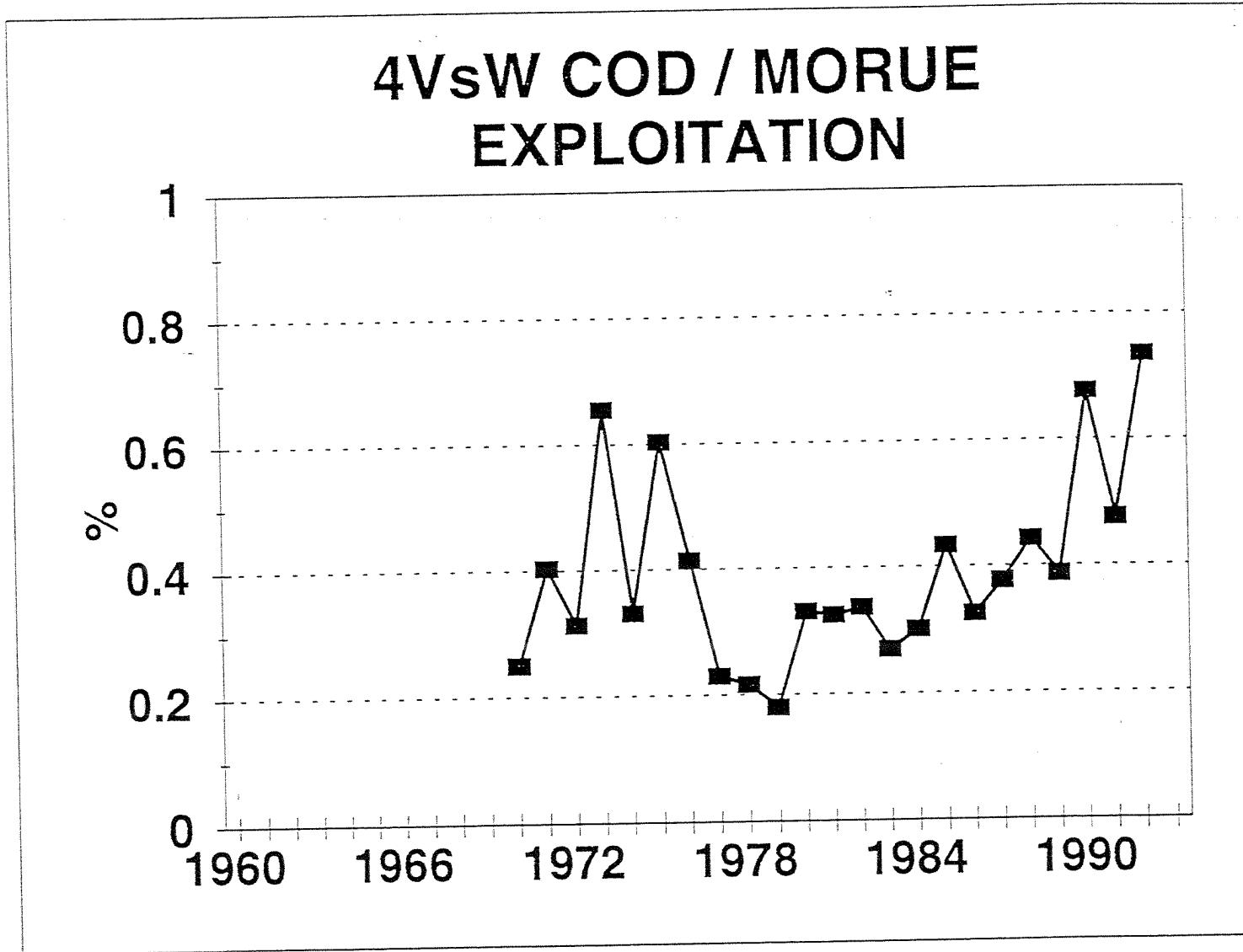
#### 4TVW Haddock

Because of problems with the statistics on landings and fishing effort, and with ageing, it has not been possible to carry out an analytical assessment of this management unit. The results of the summer research vessel survey, however, indicate that the spawning stock biomass is at a low level,

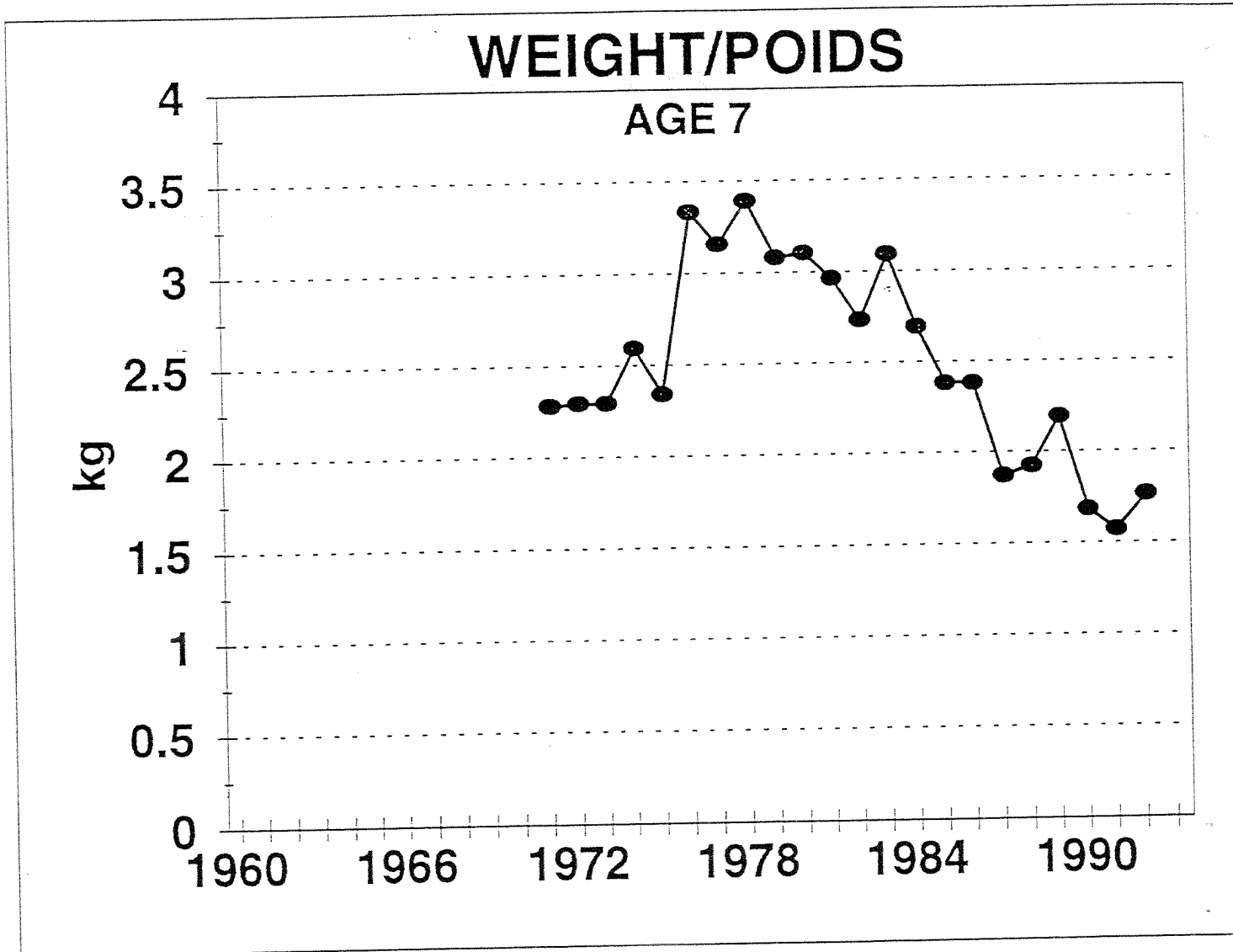


## 4VsW COD/MORUE RECRUITMENT / RECRUTEMENT

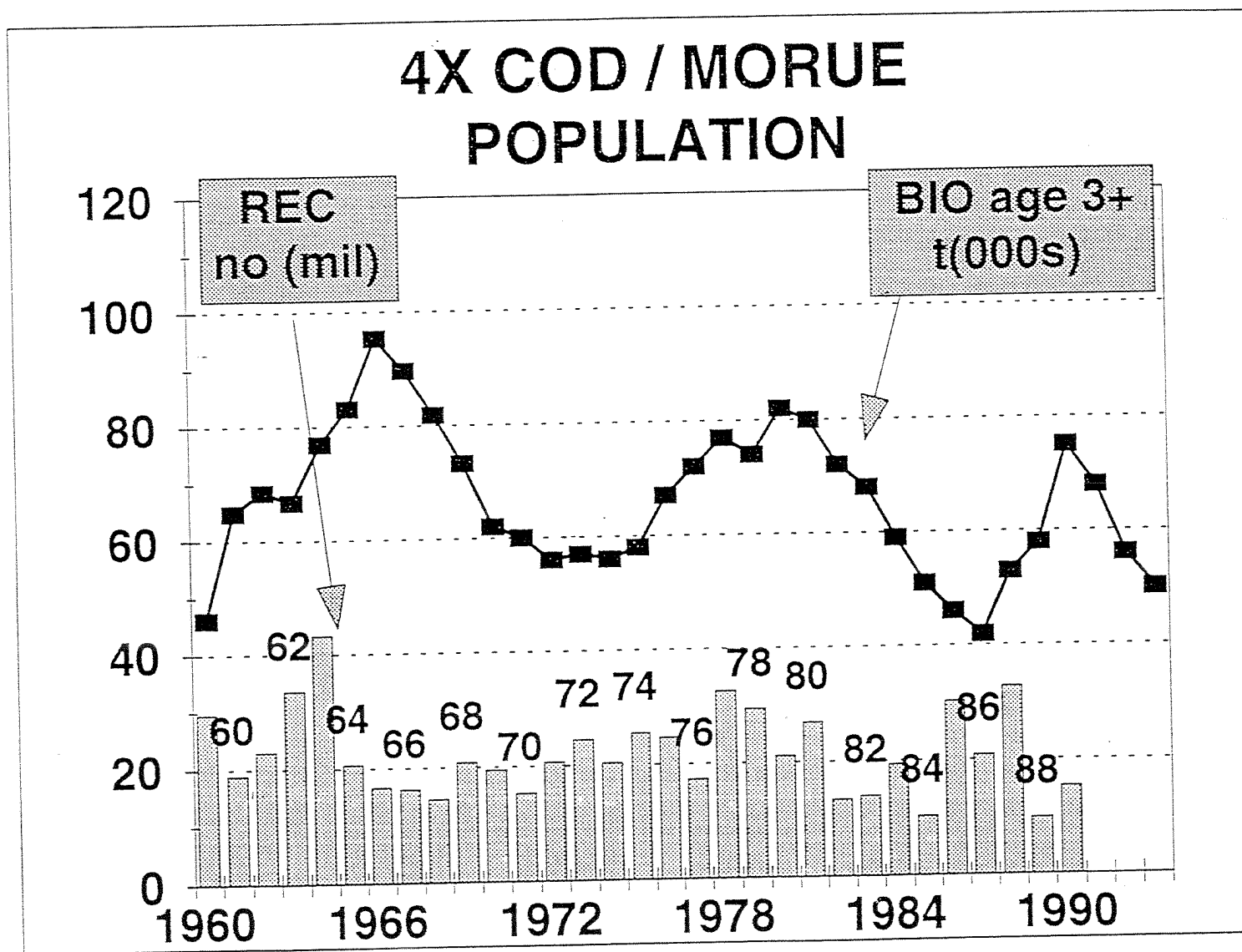


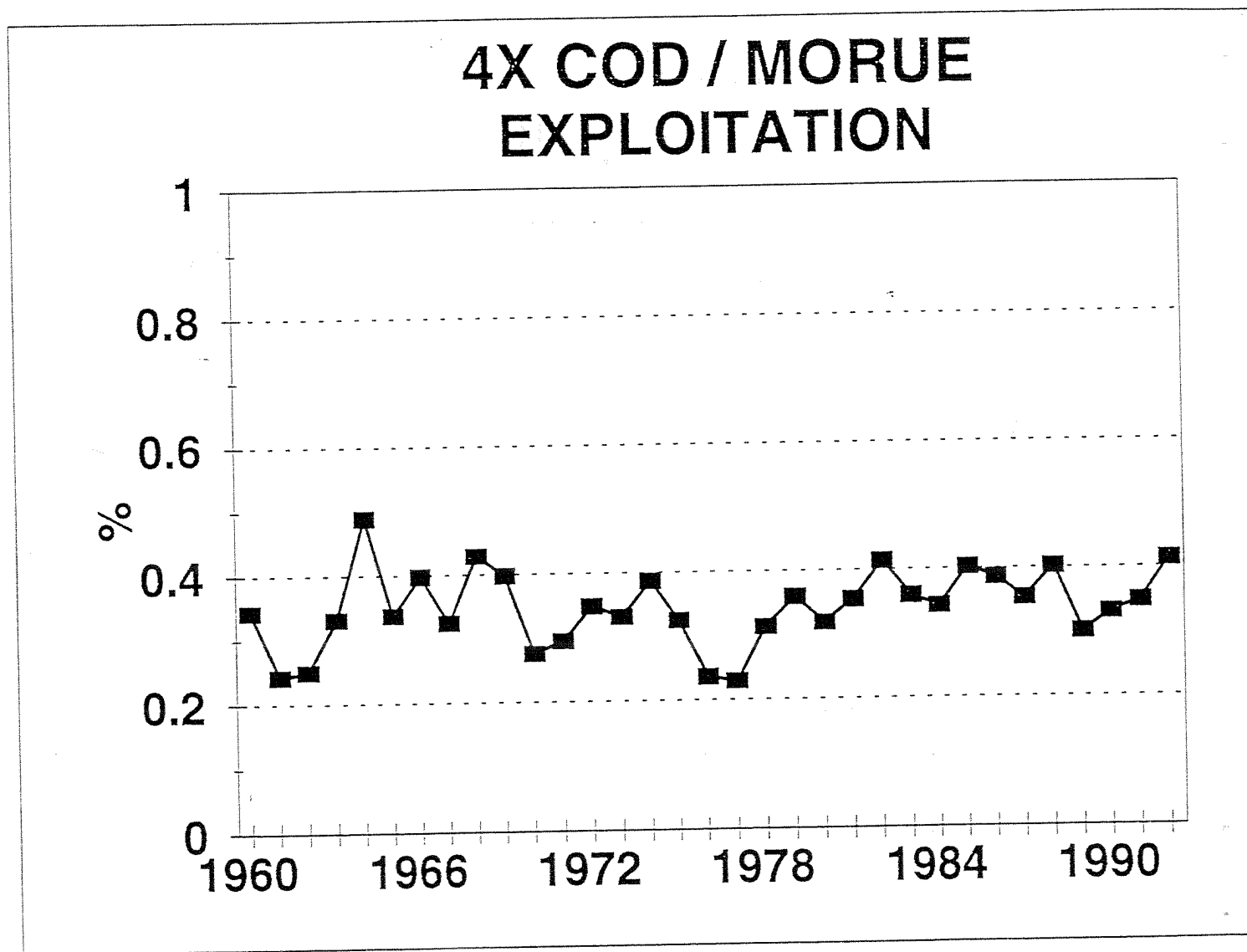


4VSW COD

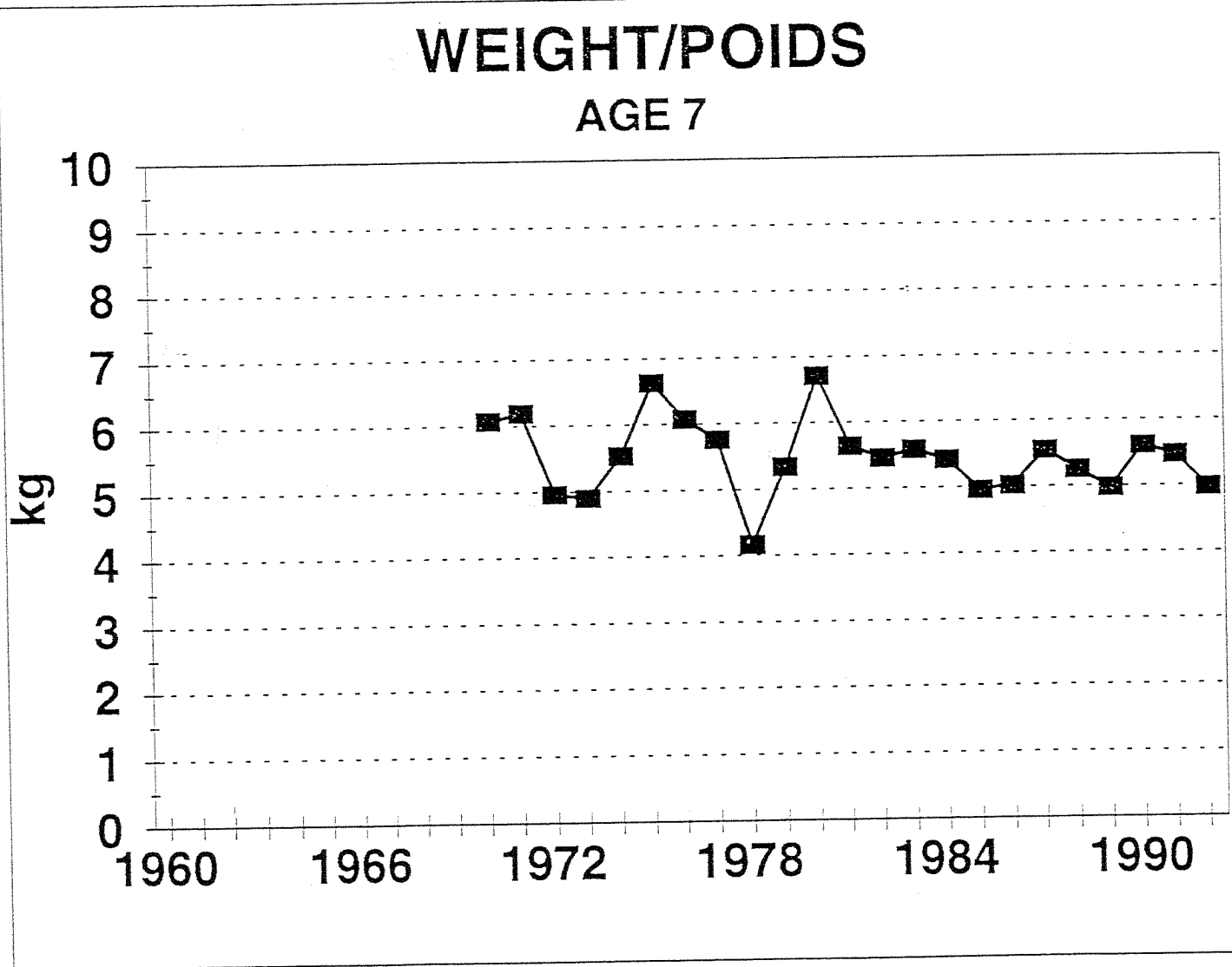


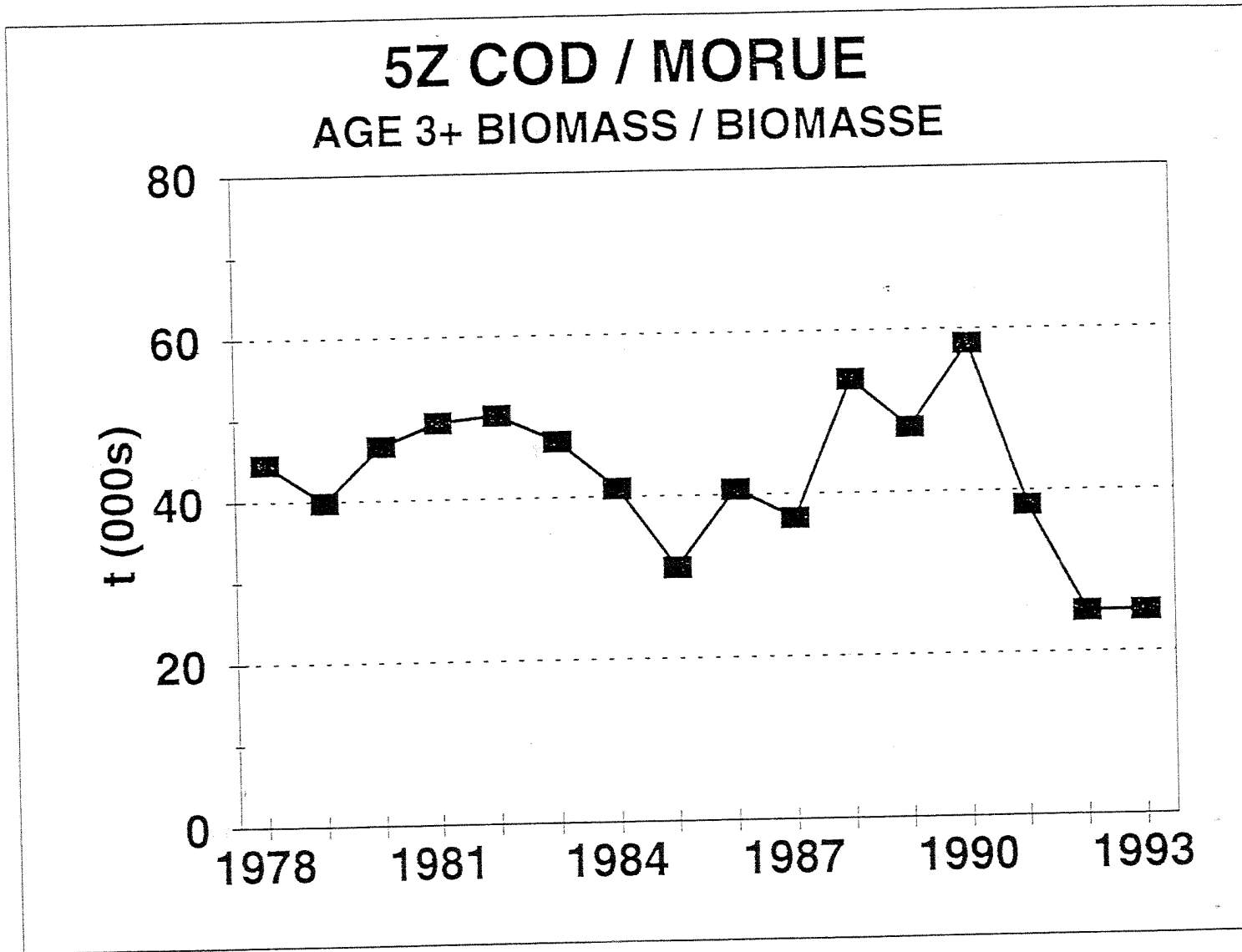


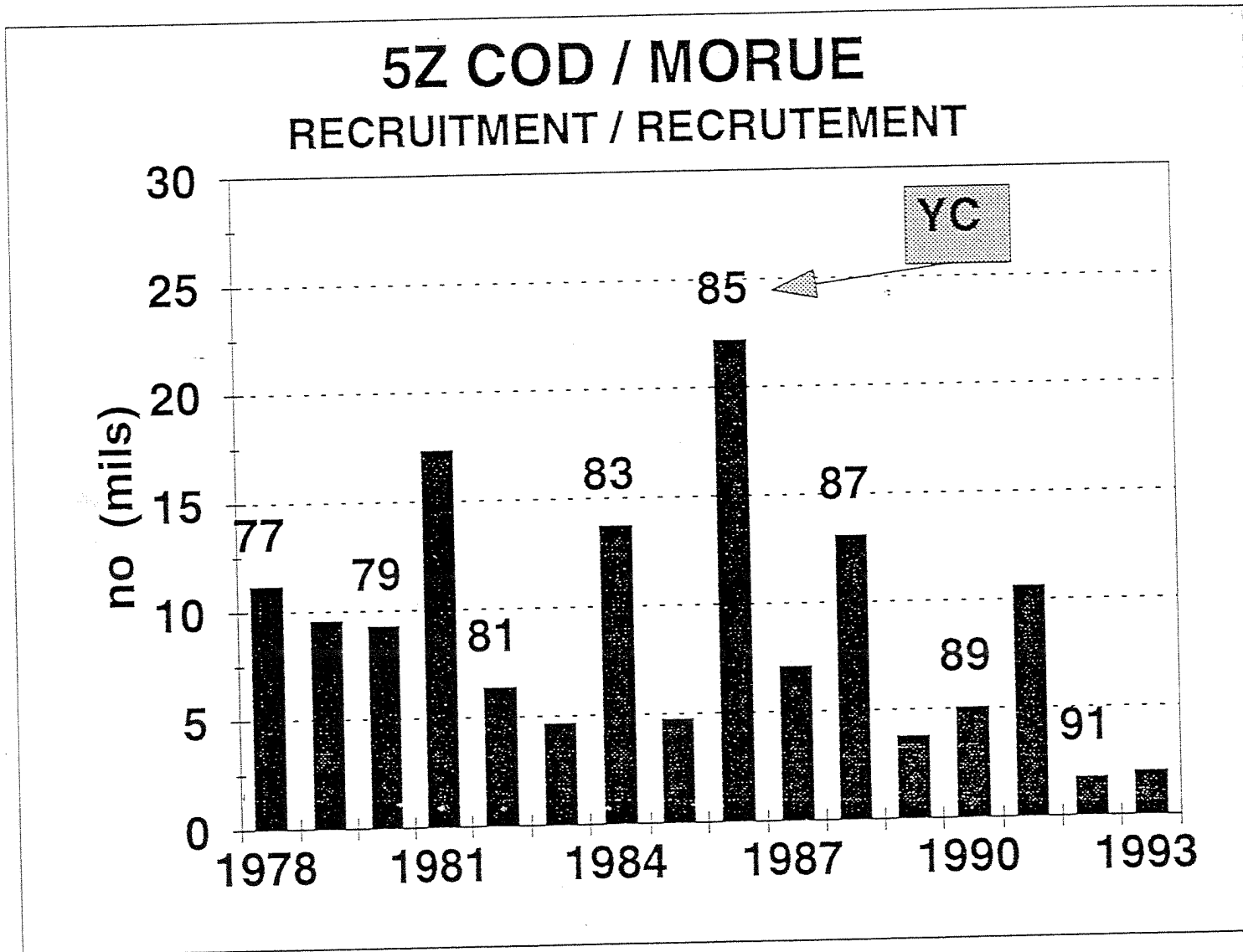


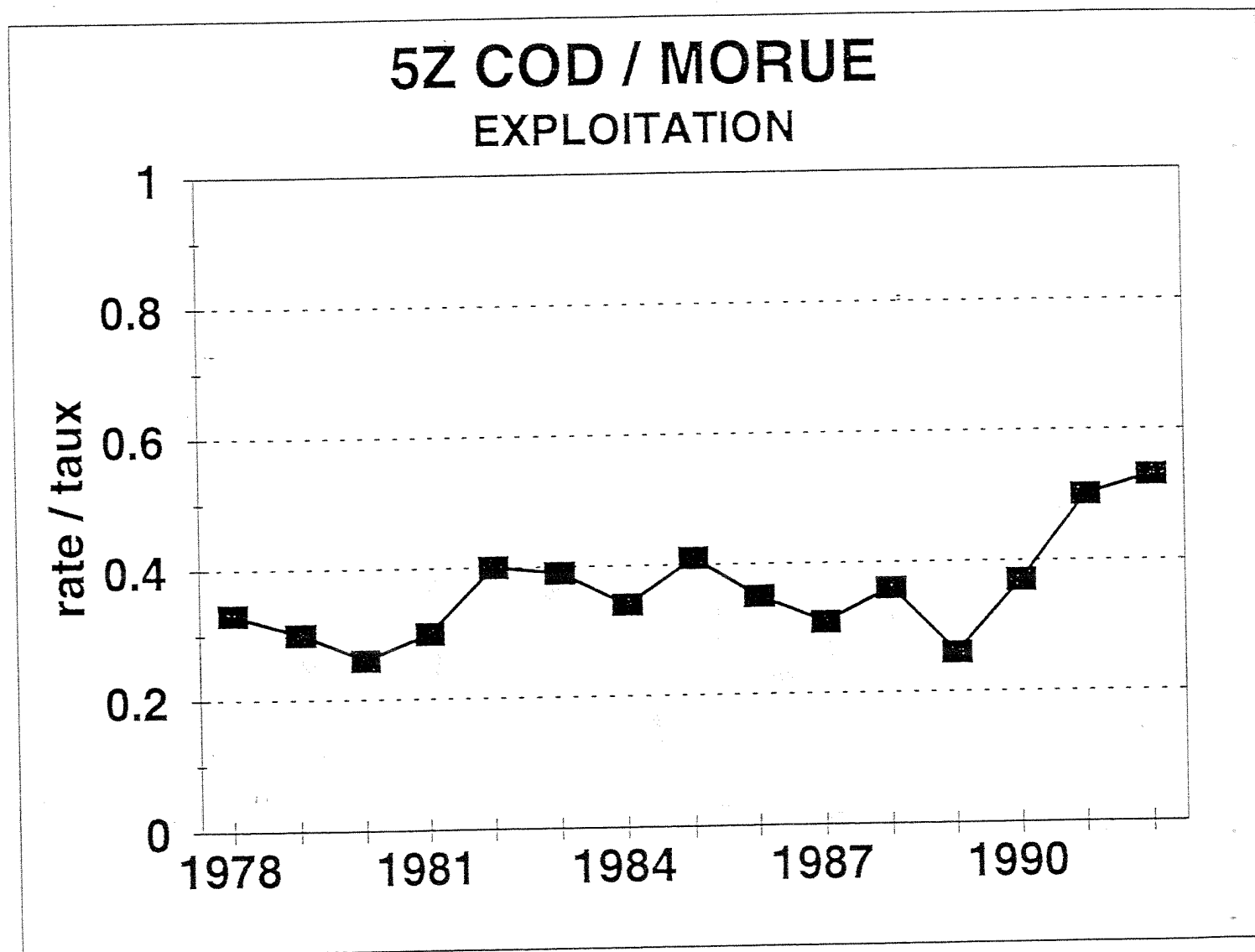


4X CUD









but not at the lowest recorded (Figure 11). Of great concern is the almost total loss of recruitment subsequent to the relatively abundant 1988 year-class. Estimates of fishing mortality from the changes in abundance in the research surveys were very high throughout the past decade (well over  $F_{max}$ ). There is evidence of both growth and recruitment overfishing for the population complex in this broad geographic area. There are no temporal trends in weight-at-age for any of the haddock stocks.

#### 4X Haddock

As is the case for 4TVW haddock, it has not been possible to carry out an analytical assessment of this management unit. The trends in the spawning stock biomass and recruitment (as estimated from the summer research survey) are shown in Figures 12 and 13. The biomass is at moderately low levels, but there have been some recent increases. The year-classes, however, have been relatively weak since the early 1980s. There is anecdotal evidence that some spawning components (i.e., on Roseway, Baccaro, and LaHave Banks) have been lost due to overfishing. The estimates of fishing mortality from the research survey data are very high, well in excess of  $F_{max}$ . In sum, there is evidence of both growth and recruitment overfishing for this management unit.

#### 5Z Haddock

This management unit is transboundary with the United States. The biomass, recruitment, and fishing mortality trends from 1969 to 1993 are shown in Figures 14, 15, and 16. The spawning stock biomass has declined sharply during the past several years, and year-class strengths have been relatively weak since the late 1970s (Figure 15). Fishing mortality has risen dramatically during the past three years. It is noted again that  $F_{0.1}$  has not been a target for the Georges Bank transboundary management units. In sum, there has been growth overfishing in recent years and possibly recruitment overfishing.

#### Pollock

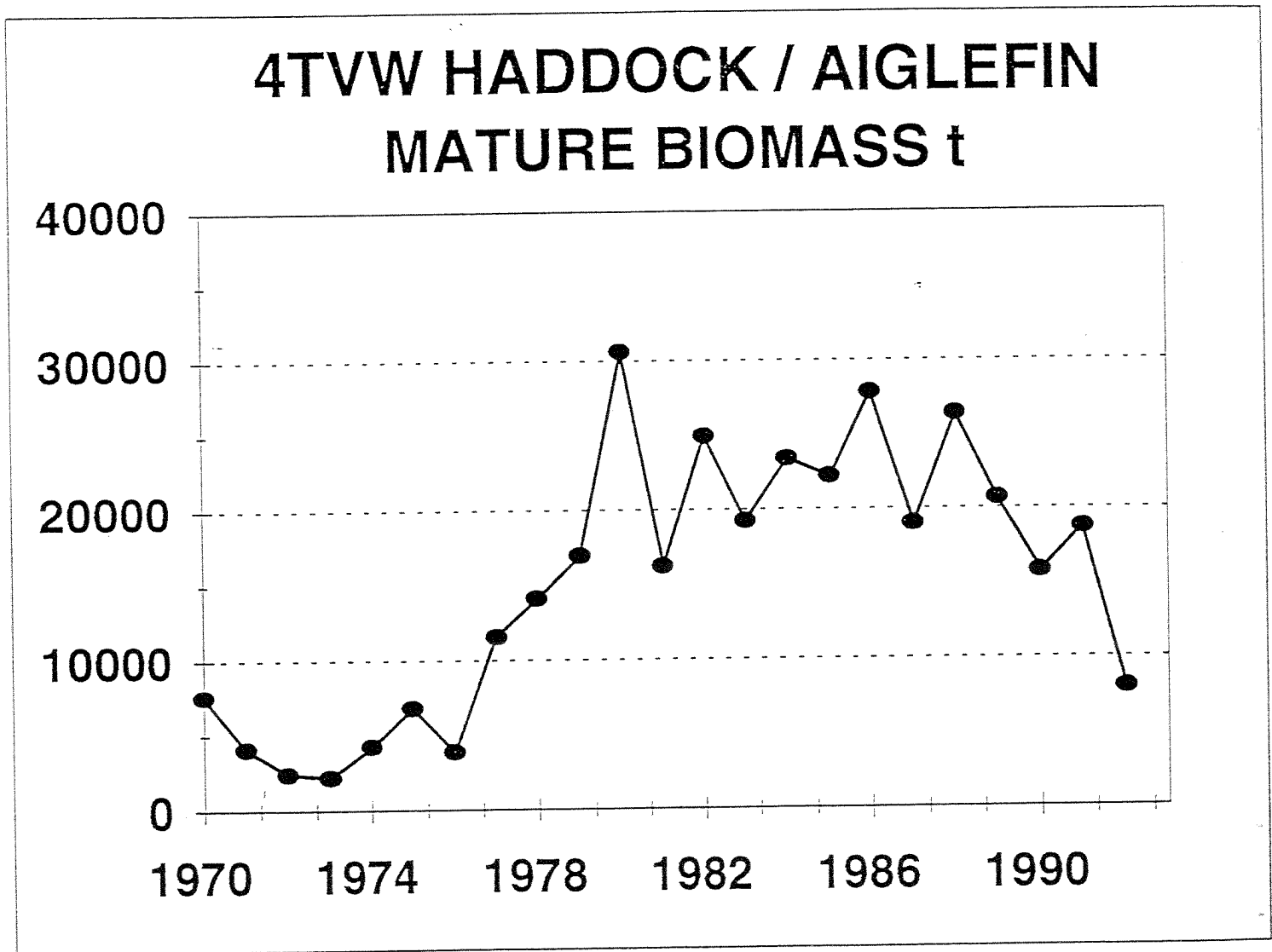
The trends in biomass, recruitment, and fishing mortality for pollock from 1974 to 1993 are shown in Figures 17 and 18. Although the spawning stock biomass has declined in recent years, it is still at moderate levels compared to the historical time series (Figure 17). Also the estimates of year-class strengths do not show any evidence of temporal trends, although above the  $F_{0.1}$  targets the fishing mortality levels have been relatively consistent and below  $F_{max}$  (Figure 18). Thus, there is no evidence of either growth or recruitment overfishing for this management unit.

#### Silver Hake

The trends in biomass (age 1 and older), recruitment and fishing mortality for silver hake from 1977 to 1993 are shown in Figures 19, 20 and 21. The biomass has been declining steadily since the mid 1980s in spite of the fact that fishing mortality for this management unit (Figure 21) has been close to the target of  $F_{0.1}$  ( $F_{0.1}$  for silver hake is 0.72). The decline has been due to relatively weaker year-classes since 1986 (Figure 20). In sum, there is no evidence of either growth or recruitment overfishing for silver hake. The trends in this resource indicate that declines can occur under modest levels of fishing (if downward recruitment trends occur).

#### Atlantic Halibut (3NOPs and 4VWX)

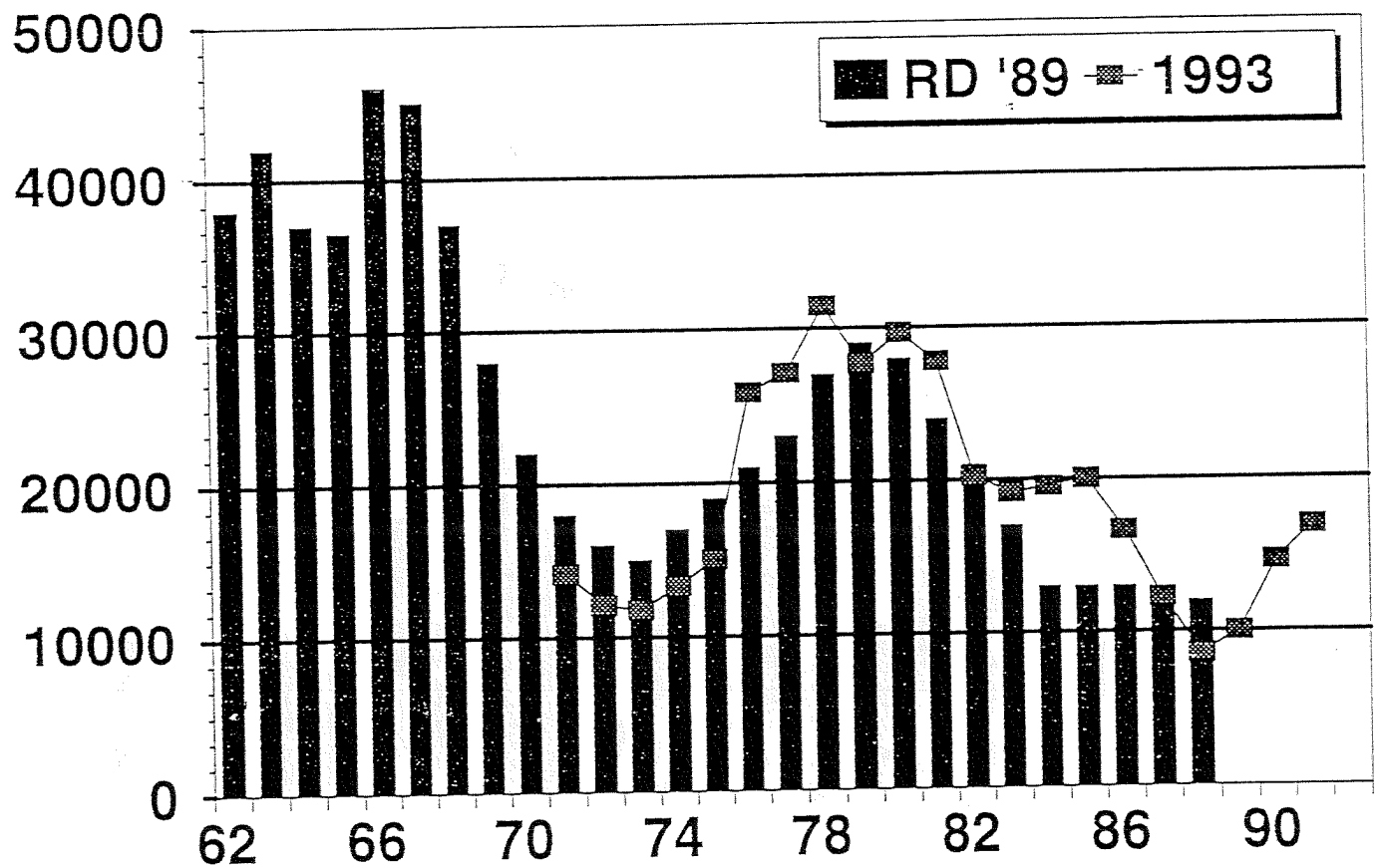
There is not an analytical assessment for this management unit. The data indicate that high exploitation rates are depleting the mature adult biomass (commercial catch rates are declining). The increase in estimates of abundance within 4VWX are due to increasing recruitment. Our knowledge of this species is not sufficient to make conclusions on the effect of fishing on recruitment. However, exploitation levels are interpreted to be generating growth overfishing.



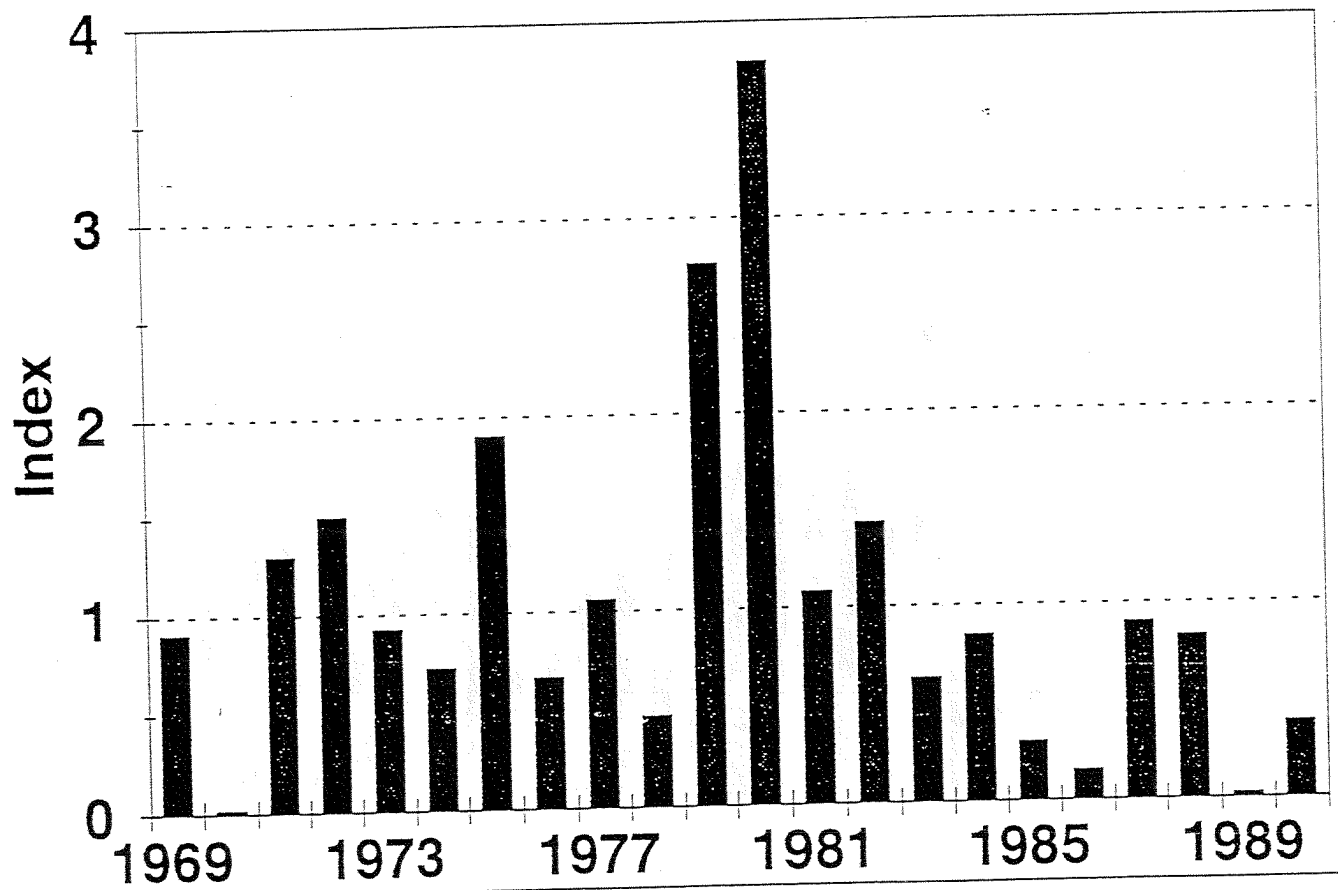


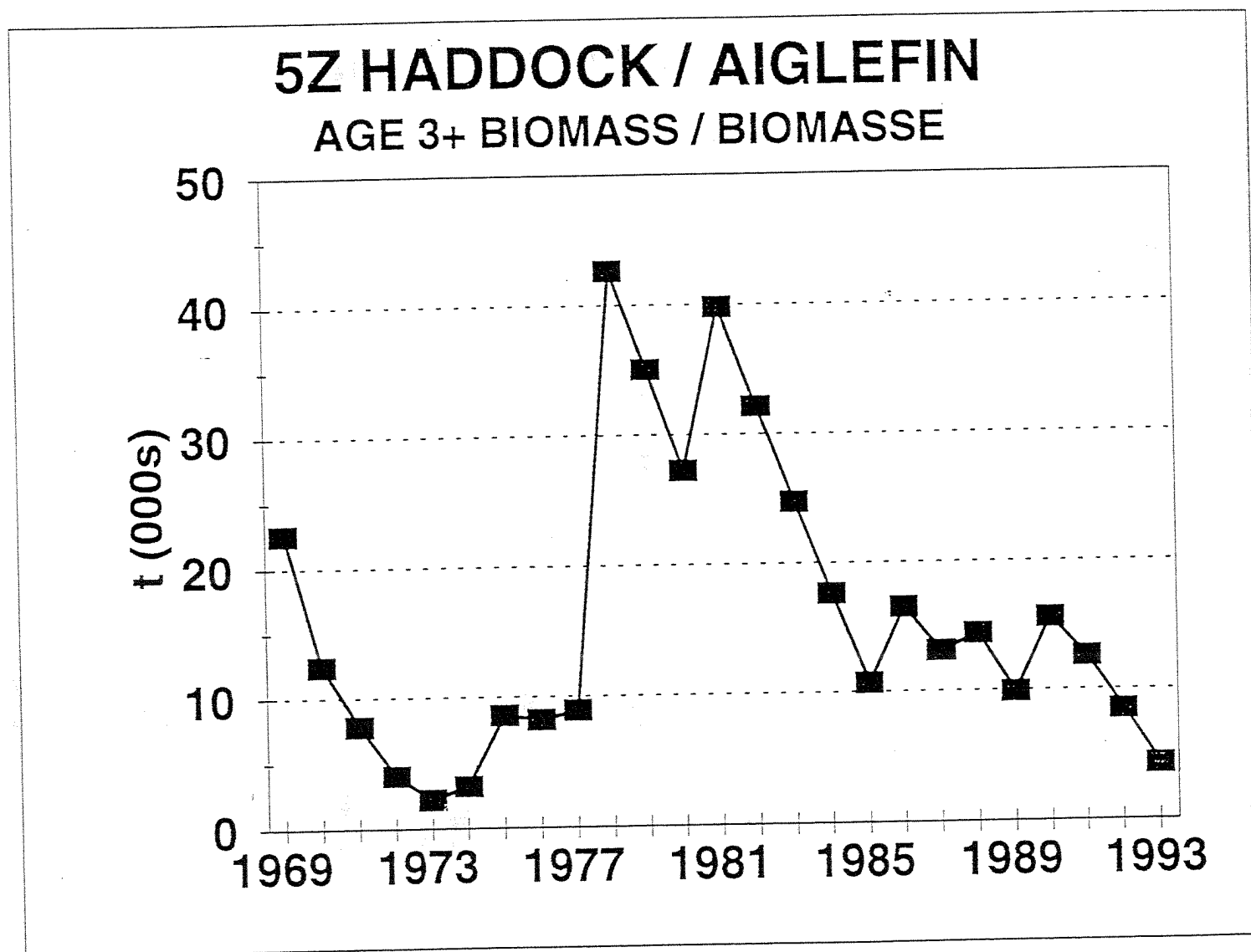
# 4X HADDOCK / AIGLEFIN

## MATURE BIOMASS/BIOMASSE MATURE t



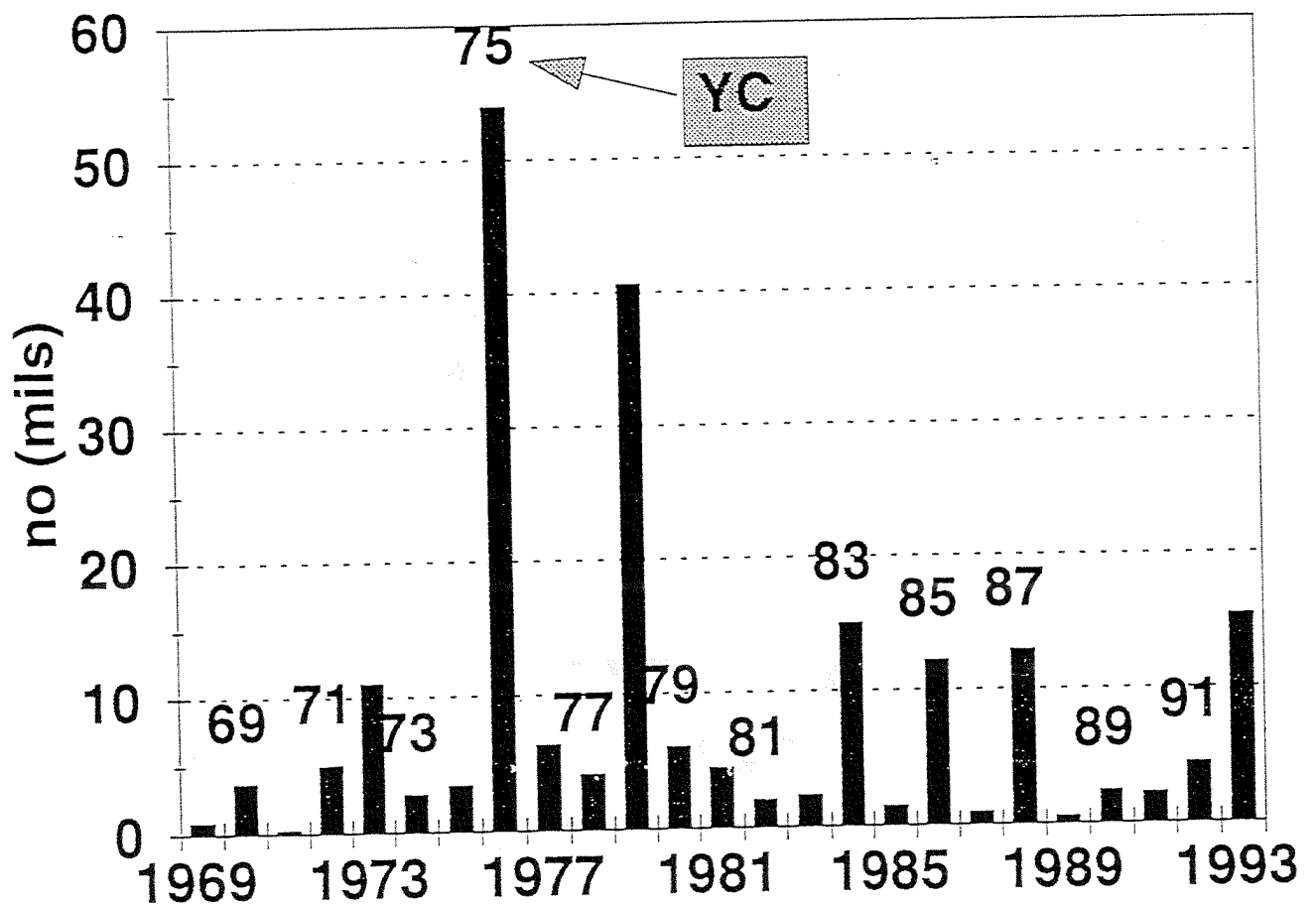
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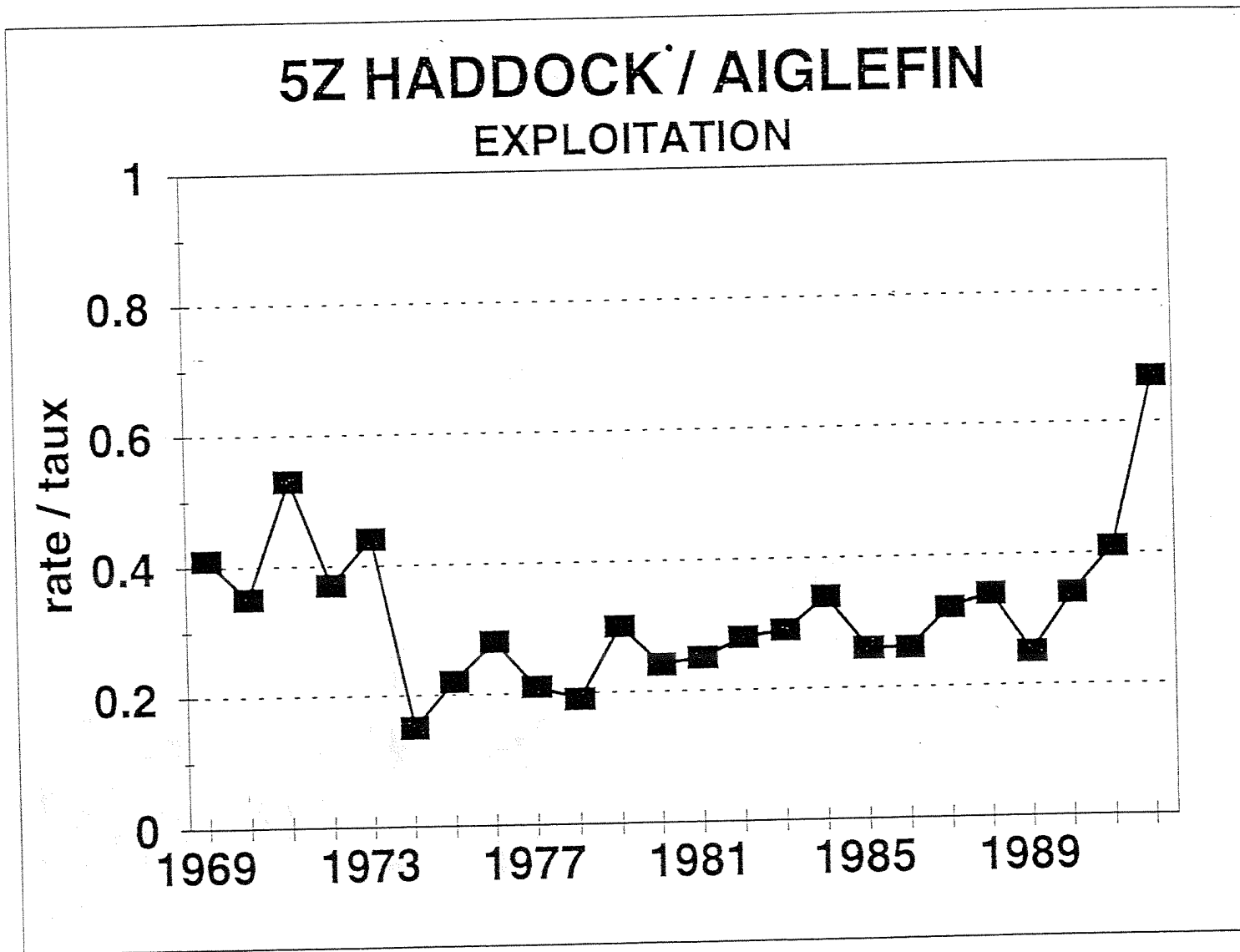


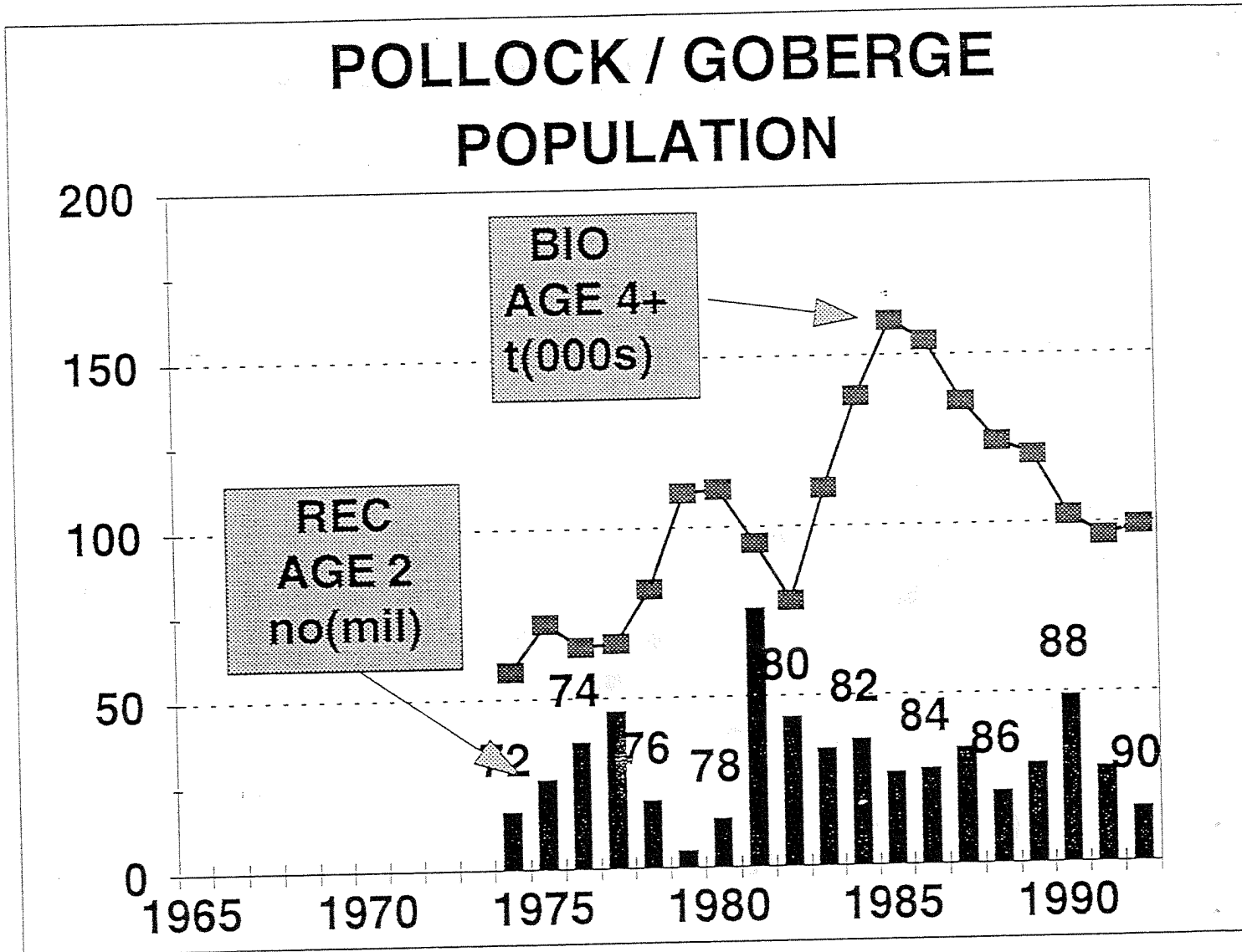


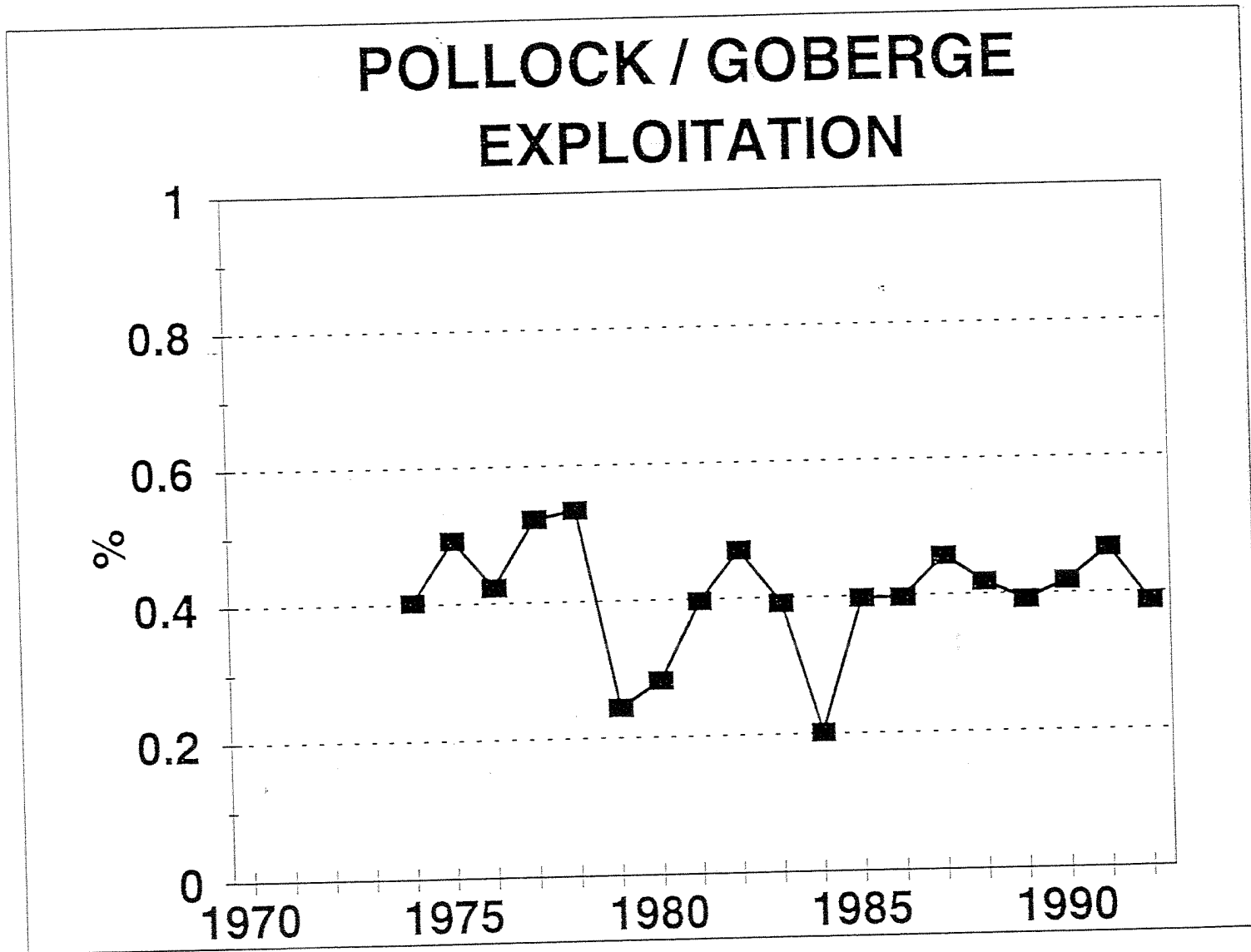
## 5Z HADDOCK / AIGLEFIN

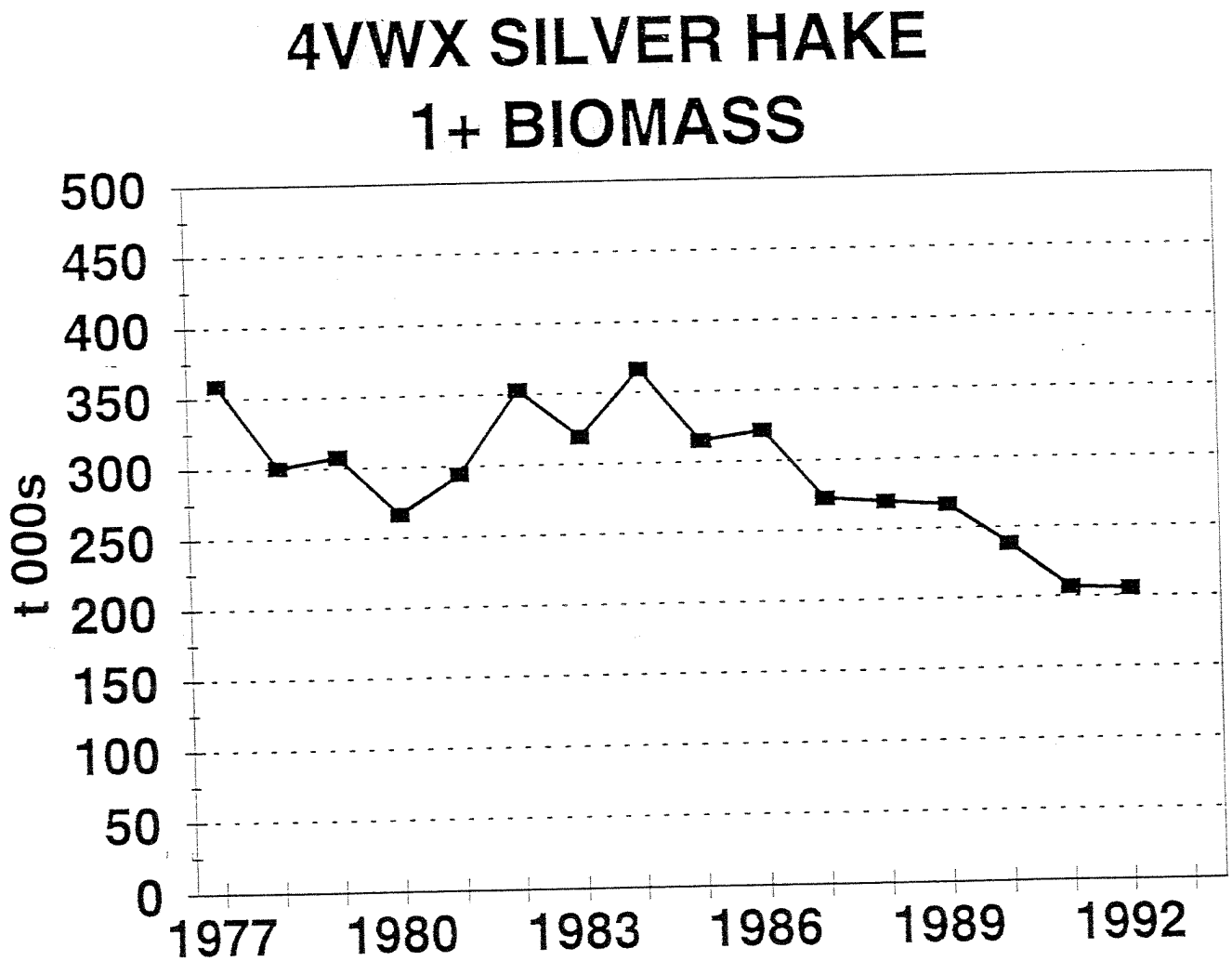
### RECRUITMENT / RECRUTEMENT



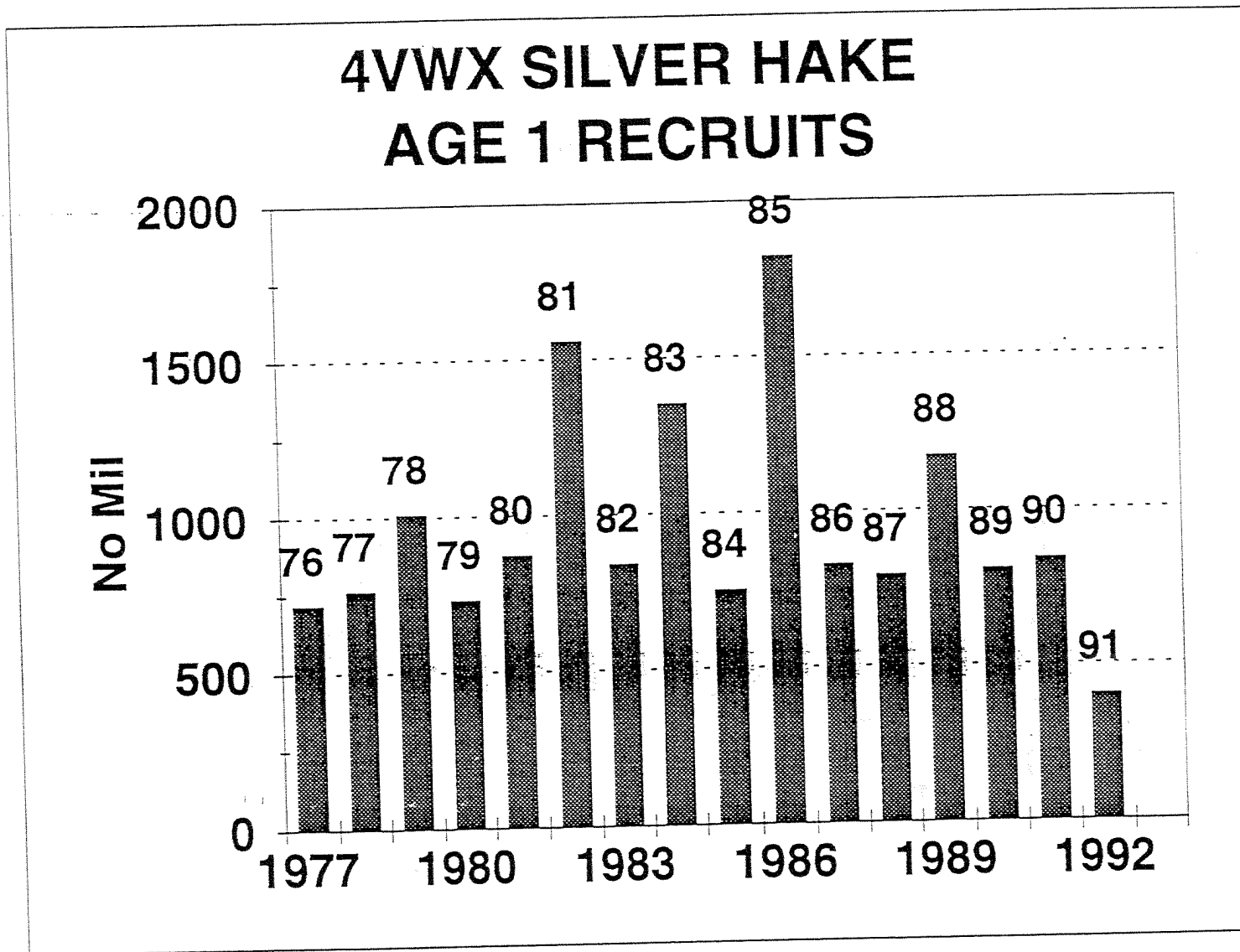




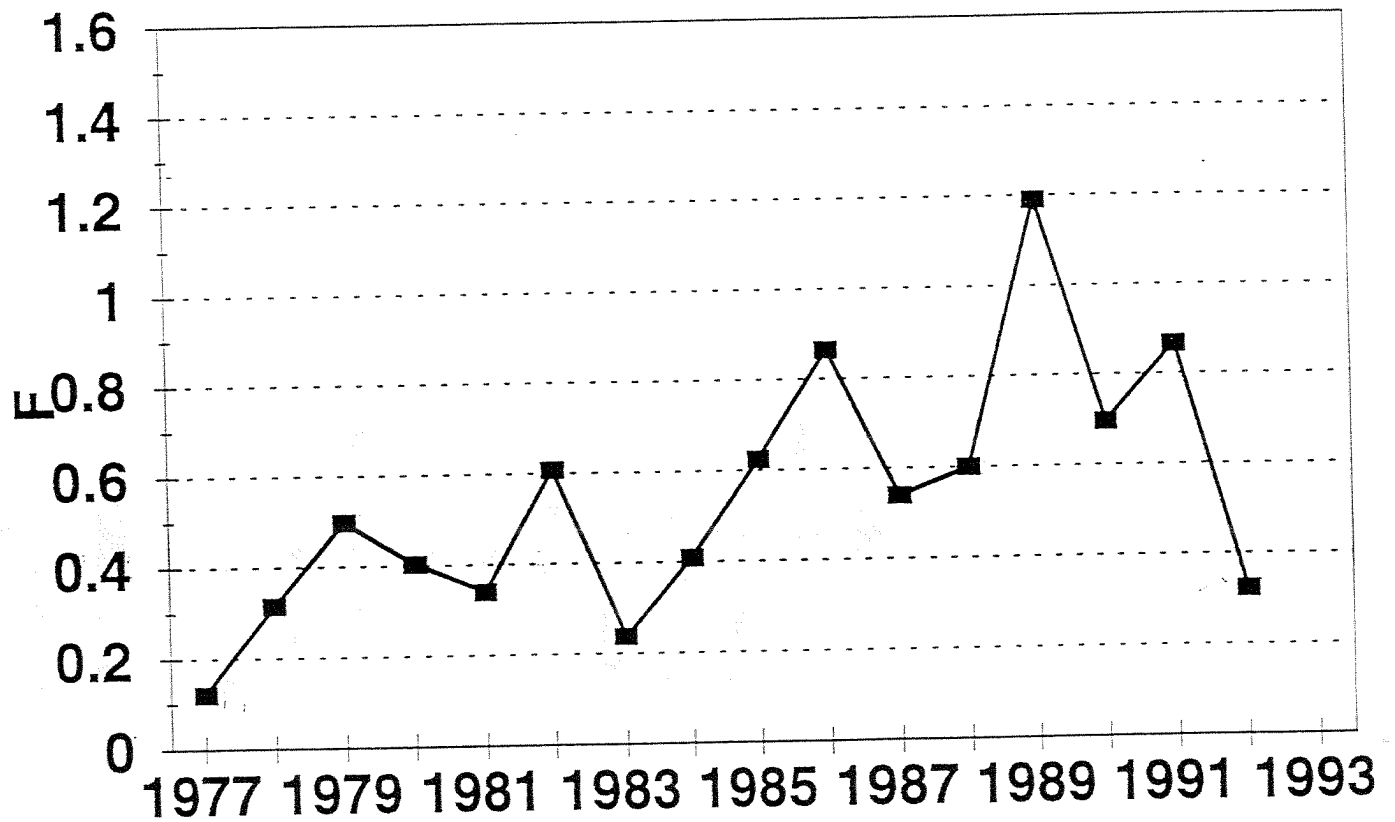








## 4VWX SILVER HAKE AGE 3-7 FISHING MORTALITY



4VWX Flatfish

This management unit comprises three species - American plaice, yellowtail flounder, and witch flounder. It is probable that there are several self-sustaining populations for each of the four species within this large geographic area. Present management actions, in part due to lack of statistics by individual species, do not generate harvesting levels by species (let alone population). Fishing effort has increased substantially in recent years as the quotas on the gadoid stocks have been reduced (and the markets for flatfish are strong). The following is a summary of estimates of abundance from the research surveys:

	<u>4VW</u>	<u>4X</u>
American plaice	medium	low
yellowtail	medium	low
witch flounder	low	low
winter flounder	low	high

Fishers during recent consultations are very concerned about the sustainability of these stocks at present levels of fishing effort. It is probable that some components have been experiencing growth overfishing and possibly recruitment overfishing (e.g., witch flounder in 4VW).

Overview of Groundfish Trends from 1977 to 1993

The above brief summaries indicate that the management regime in the period since extension of jurisdiction has generated growth overfishing for most management units (with the exception of silver hake and pollock). Furthermore, for most stocks, the fishing mortality has increased sharply during the past several years as the resources have declined. There is also evidence of recruitment overfishing for all of the haddock management units and the eastern Scotian Shelf cod management units. Because of the difficulties of interpreting declines in recruitment, however, there is not a consensus within the science community on this latter inference.

<u>Stocks</u>	<u>Growth Overfishing</u>	<u>Downward Trends in Mean Recruitment*</u>
4Vn cod	probably	probably
4VsW cod	yes	yes
4X cod	yes (?)	no
5Z cod	yes	no (?)
4TVW haddock	yes	yes
4X haddock	yes	yes
5Z haddock	yes	yes
pollock	no	no
silver hake	no	no
flatfish species	?	?
Atlantic halibut	?	?

\* Lack of consensus within the scientific community on how to define operational targets for minimum spawning stock biomass.

In the discussion of the resource summaries it was concluded that, although the details of the assessments are subject to debate, there was a consensus that the historical trends of abundance and exploitation rate are robust for a reasonable range of assumptions. It was also concluded that the information presented on resource and exploitation trends is sufficient for the aims of the Workshop.

### 4.3 SUMMARY OF MANAGEMENT ACTIONS AND THE RESPONSES BY THE FISHING INDUSTRY (1977 TO 1993)

#### 4.3.1 Documentation of Scientific Advice, Management Plans, Management Actions, and Year-End Results (K.C.T. Zwanenburg and J. Hansen)

The analysis was done following two approaches. The first approach listed by year (1978 to 1992) for five management units (4Vn cod, 4VsW cod, 4X cod, 4VW haddock, and 4X haddock) the annual scientific advice from the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC), the TACs decided upon by the Minister of DFO (taken from the Atlantic Groundfish Management Plans), and the estimated annual landings (from the statistical system). The information was put on a spreadsheet so that comments from the Steering Committee and on management initiatives could be readily included. Note that the transboundary resources on Georges Bank were not included in the analysis at this stage. The conservation targets for transboundary resources have not yet been articulated, which complicates the interpretation. This summarization allowed an analysis of the degree to which the scientific advice was accepted by the Minister of DFO, and also how effective implementation of the quotas have been if the official statistics are taken at face value. The second approach involved a chronological listing of the major management initiatives that were put in place in parallel with the annual quota management activities.

The spreadsheet information from the first approach is reproduced in Tables 1 and 2. A summary of the actions for each management unit is provided:

##### 4Vn Cod

The annual advised catch levels, the TACs, and the official landings statistics are shown in Figure 22. Key observations are that from 1978 to 1982 and 1987/88 the recorded landings exceeded the TACs by a substantial amount. During most of the remaining years, the TAC was sufficiently high with respect to resource abundance that the TAC was not reported as caught (i.e., the fishery was essentially unregulated with respect to quota). The TAC was generally in line with the scientific advice in the early years and since 1989. It exceeded the advice by about 15 to 50% from 1985 to 1988 as the scientific advice was for major reductions. In sum, for most of the time period either the landings exceeded greatly the TAC or the TAC was unrestrictive. The advice and TACs increased during recent years as the stock was declining to very low levels.

##### 4VsW Cod

The annual advised catch levels, the TACs, and the recorded landings for this management unit are shown in Figure 23. Overall there are some parallels with 4Vn cod. From 1978 to 1982, the recorded landings exceeded the TACs (which followed the advice) by a substantial amount. In recent years (1991 and 1992), the TAC has not been reached even though very high levels of F occurred (see Figure 3). The TACs generally were close to the advice (except for 1986 to 1988). The TACs tended to exceed the scientific advice during periods of quota reductions. During the recent rapid decline in biomass (Figure 1), the scientific advice endorsed a three-year management plan incorporating a 35,000 t TAC, indicating that this level of catch would not be detrimental to the resource.

##### 4X Cod

The annual advised catch levels, the TACs, and the recorded landings of cod for this management unit are shown in Figure 24. The recorded landings exceed the TACs by a large amount in the early period - from 1977 to 1982 and from 1987 to 1991. During the other years of management, the TAC was non-restrictive (i.e., too high). As was the case for eastern Scotian Shelf cod, quota management has not restricted fishing effort in this geographic area for quite a few years during the 1977 to 1993 time period. Also, the TAC has been substantially above the scientific

Species : Cod

Stock : 4Vn(M-D)

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1978	3,500.00			TAC set below recent catches to be relatively certain that no increase in exploitation rate could occur
1979	3,500.00		Estimated inshore catch and unavoidable bycatch of mobile fleet	CAFSAC again recommends a TAC for 1979 of 3500t in Subdivision 4Vn during May to December with no directed offshore catch, ie by-catch only for the offshore fleet
1980	5,000.00		Inshore catch unregulated (projected at 5000 t in 1980), offshore catches in May and December to be deducted from cod 4Vn (January to April) + 4T quota	
1981	0.10		Estimated Inshore catch is 7500 mt.	CAFSAC sees no reason to advise control on the inshore fishery at this time. Trends indicate that the inshore catch from local stocks will likely be about 7500 mt.
1982	10,000.00			4Vn(M-D) catch could be set at the long-term Sub-Division 4Vn average catch of 10000 mt in 1981 and 1982.
1983	15,000.00			It appears that the current stock size is above the equilibrium stock size level. Given these conditions the TAC could be increased to 15000 mt for 1983. It must be pointed out.....that this is above the long term 2/3 Fmsy yield and can only be maintained as long as recruitment remains at the current exceptionally high levels.
1984	14,000.00	14,000.00		...it would appear that a catch of 14000 mt in 1984 would roughly correspond to the 2/3 Fmsy
1985	10,000.00	10,500.00		...This suggests that the 4Vn(M-D) cod stock is above equilibrium and that it could support a catch above the long term sustainable yield presented above (10200 t) but CAFSAC was unable to quantify the extent to which the current abundance exceeds the equilibrium level and note the large uncertainties in the estimation of the parameters of the general production model. CAFSAC therefore advises that a catch of 10000 mt in 1985 would approximately correspond to 2/3 msy.
1986	10,000.00	10,500.00	Reference level = 2/3 Emsy	Although fishing mortalities calculated for recent years have been rather high, recruitment prospect appear good. CAFSAC has no basis upon which to advise any change in the advice offered in 1984, that is, that a catch of 10000 t in 1986 would approximately correspond to that of 2/3 Emsy.
1987	6,000.00	6,100.00		The estimated F on this stock is approx. twice F <sub>0.1</sub> . ....Using the catch equations the biomass (B) may be estimated as about 37000 t and a crude estimate of F <sub>0.1</sub> catch is 6100 t. This estimate is made with the Assumption that biomass had been relatively stable in the recent past, age structure is stable, recruitment has ben stable, and there have been no changes in partial recruitment. CAFSAC advises that it is unable to give a precise estimate of F <sub>0.1</sub> catch in 1987, a crude estimate is 6100 t, however F has been about twice F <sub>0.1</sub> in recent years.
1988	6,000.00	6,200.00		The estimate of F (0.4) and the average annual catch (11299 t in 1980-86) can be used to estimate the population biomass (37600 t) and hence the F <sub>0.1</sub> catch (6200 t). CAFSAC Advises therefore that a catch of 6200 t in 1988 would approximate the F <sub>0.1</sub> level
1989	7,500.00			Given the uncertain assessment and hence the range of possible population sizes, CAFSAC concludes that catches similar to the 1988 TAC would be within the range of likely F <sub>0.1</sub> catches.
1990	7,500.00			Considering the range of fishing mortalities given above (.25-0.37), CAFSAC advises that maintaining the current TAC of 7500 t would approximate fishing at F <sub>0.1</sub>
1991	8,725.00			Catches between 7500 and 10000 t are likely to be sustainable for at least the next three years.
1992	9,999.00			The present 10000 t TAC is likely to be too high until the 1986 and 1987 year-classes make a larger contribution to the catches.

Species : Cod

Table 1 (cont'd)

Stock : 4VsW

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1978	0.00		Minimum possible catch	
1979	7,000.00		Minimum practicable catch level (N.B the actual Advised catch was set at 0-7000 t)	Though it would be optimal to set the TAC at 0, it is realized that this is not feasible but CAFSAC recommends that under no circumstances should the catch be allowed to exceed 7,000 mt.
1980	45,000.00	45,000.00	Fishing at F0.1 or 2/3 Fmsy in 1980	
1981	50,000.00	50,000.00		CAFSAC ..... and advises that the catch in 1981 corresponding to fishing at F0.1 is 50,000 mt.
1982	50,000.00	53,700.00		CAFSAC felt that the evidence implies that this stock has currently stabilized and that the appropriate estimate of the 1982 F0.1 catch is 50000 mt, the same level as is currently in effect for 1981.
1983	64,000.00	64,000.00		...indicated a 1983 F0.1 catch of 64000 mt if the 1982 TAC of 50000 mt is taken
1984	53,000.00	53,000.00		Assuming the 1983 TAC of 64000 mt is caught, fishing at F0.1 = 0.2 in 1984 will result in a catch of 53000 mt. A catch of 64000 t in 1983 will generate an F on fully recruited age groups of 0.26
1985	53,000.00	53,000.00		The projected catch at F0.1 = 0.2 in 1985 is 53000 mt. The 1984 TAC of 55000 t corresponds to a fully recruited F of 0.264. Since the projected catch is within 10 % of 1984 TAC, CAFSAC advises that a catch of 55000 t in 1985 would approximately correspond to a fishing mortality of F0.1
1986	35,000.00	35,000.00		If the TAC of 55000 t, which would generate an F of 0.35, were taken in 1985, then the F0.1 catch in 1986 would be 35000 t. The projected F0.1 catches in 1985 and 1986 would be 33000 and 39000t.
1986	36,000.00	36,000.00		if the TAC of 55000 t is taken in 1985, the fishing mortality implied is 0.35 and the F0.1 = 0.2 catch in 1986 is projected to be 36000 t. The current assessment indicates that F has been in excess of Fmax=0.3 in all years but one (1977) since 1970. ....With catches of 55000 t in 1985 and 36000 t in 1986, it is projected that mean population biomass will continue to increase to between 250-300000 t in 1986.
1987	38,000.00	38,000.00		CAFSAC advises that if the 1986 TAC of 48000 t is taken, F in 1986 would be about 0.26 the projected catch in 1987 at F0.1 would then be 38000 t. CAFSAC notes that estimated fishable biomass in 1985 was 200000 t and with catches in 1986 and 1987 biomass will remain stable.
1988	32,000.00	32,000.00	Preliminary Advice	Assuming that the ..... it is estimated that the F0.1 catch in 1988 would be 32000 t.
1989	33,200.00	33,200.00		...CAFSAC estimates that the F0.1 (F=0.2) catch in 1989 would be 33200 t. The 1988 TAC is now estimated to imply an F=0.225, a little lower than the F=0.24 estimated on the basis of last years assessment. These projections, like those for other cod stocks are made however without projecting a continued decline in the average weights at age. There is no basis for CAFSAC to predict that such a decline will continue.
1990	35,000.00	34,000.00	N.B. Should have stated that the 50% rule was applied to arrive at the advised catch	CAFSAC estimates that if the 1989 TAC of 35200 t is caught the resulting fishing mortality will be F=0.22, slightly above the F0.1 target. Fishing at F0.1 in 1990 would imply catches of 34000 t.
1991	21,000.00	21,000.00		If the 35200 t 1990 TAC is taken, it will induce an F of about 0.40, or twice F0.1 and in fact equal to Fmax. The projected 1991 catch at F0.1 would be 21000 t. The 50 % rule would give 30000 t, while the constant catch under the multi year management plan would give 35200 t. CAFSAC believes that the 35200 t TAC applied for three years would not be detrimental to the resource.
1992	35,200.00	35,200.00	Multi-year plan	CAFSAC is therefore not able to provide formal catch forecasts. However, considering that the commercial catch rates are above average for the period 79-89, that the July survey indicates average abundance, and that the March survey is higher than average, CAFSAC concludes that catches in 1992 and 1993 equal to the multiyear plan TAC of 35200 t are unlikely to be detrimental to the resource.

Species : Cod

Stock : 4X

Applicable Year	Advised Catch	Reference Level	Footnotes /"Sci. Advice"	Comments
1978	4,000.00		Advised Catch for Offshore only	F remains high (0.60-0.70), no change in RV population abundance since 1971. Therefore under these circumstances no change in the TAC of 4000 t is recommended for 1978.
1979	4,000.00		Minimum practicable catch level (N.B the actual Advised Catch was set at 0-4000t)	the catch in 1979 must be kept to 4000 t or less.
1980	4,000.00		Minimum catch up to 4000 t	The actual advised catch was 0-4000 mt
1981			Advised catch should be less than 4000 mt.	If the management objective is to fish this stock at a level below Fmax in 1981, the catch should be kept to 4000 t or less.
1982	30,000.00			It is suggested therefore that a catch limitation of 30000 mt be instituted for cod in all of Division 4X to provide a limit on expansion of catches until such time as the reasons for the recent upswing can be defined. NB.(This represents advice for 4X total as opposed to previous years offshore only TAC's)
1983	30,000.00			Total mortality estimates from RV substantially above F0.1. Hoped that the 30000 mt TAC imposed in 1982 would reduce pressure, but since no results of these regulations were yet available, it is advised that the 1982 TAC (30000 mt) be maintained in 1983.
1984	25,000.00			Analysis confirm there is a complex of cod stocks in Div 4X inshore and on the offshore banks....lack of detailed info in the fishery info to deal with this. Available data suggests that all significant stock components are likely to be fully exploited or.....substantially in excess of the F0.1 level. As there is no evidence of a recent increase in resource abundance it is advised that catches be restricted to the expected long-term sustainable yield level of 25000 mt.
1985			NB. no number provided in the summary table of the advisory document	CAFSAC still has very little information from which to formulate advice and again must point out that unless a significant improvement in data concerning the level and locations of catches and concerning catch rates is achieved, the ability of CAFSAC to produce advice on the cod in Div. 4X will be severely limited. The long-term average catch for this area is 23700 t. The current TAC of 30000 t is near the highest reported catch and may not be sustainable in the long-term.
1986	15,000.00		Not precisely estimated	CAFSAC notes that since 1977 the average size of cod in the catches has been less than that expected when fishing at the F0.1 or Fmax levels and implies fishing mortalities over that period in excess of those levels. Because of the difficulty in tuning the cohort analysis, the precise value of the F0.1 catch in 1986 could not be determined but it may be in the order of 15000 t and certainly less than the average long-term from this area of 24000 t.
1987	13,000.00	13,000.00		CAFSAC Advises that if the TAC of 20000 t (corresponding to F=0.35) is taken in 1986, the F0.1 (0.20) catch in 1987 would be 13000 t.
1988	9,000.00	9,000.00		Should the 1986 TAC (17500 t) be taken the F0.1 catch in 1988 would be 9000 t. ....it is evident that present F is probably at least twice F0.1, and that catches at F0.1 would be less than 10000t.
1989	8,000.00	8,200.00		Should the 198 TAC (14000 t) be taken, CAFSAC advises that the F0.1 (F=0.2) catch in 1989 would be 8200 t. The long-term F0.1 yield...is estimated to be 21000t, but rebuilding appears unlikely at current levels of F (The 1988 TAC implies an F=0.34 more than twice the F0.1) stock size and recruitment.
1990	12,000.00	9,000.00	50% rule applied to advice	CAFSAC estimates that if the 1989 TAC of 12500 t is caught the resulting fishing mortality will be F=0.34, substantially above the F0.1 target. Should it be desired to go immediately to the F0.1 target, a decrease in fishing effort would be required to restrict the catch to the 9000 t thus implied. However CAFSAC notes that the biomass has increased in recent years and that considerations of spawning stock biomass do not require that F be reduced to F0.1 in 1990. Using the 50% rule gives 12000 t.
1991	20,000.00		Advised catch includes application of the 50% rule	CAFSAC believes that the 1991 to 1993 TAC's could be set at about 20000t

Species : Cod

Stock : 4X

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1992	26,000.00	26,000.00	Multi-year plan	The present assessment suggests that catches equal to the TAC will allow the biomass to increase until the end of 1992 and that F would decrease. However the biomass is currently high because of exceptionally good recruitment. As the strong 1985 and 1987 year-classes pass through the population the biomass is expected to decline.

Species : Haddock

Stock : 4VW

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1978	2,000.00		By-Catch only	Recommended that the TAC for 1978 be retained at 2000 t, reserved for by-catch only.
1979	2,000.00		Minimum practicable catch level	CAFSAC recommends that the removals be kept to the lowest practicable level and every effort should be made to ensure that the total does not exceed 2000 mt.
1980			Advice deferred pending re-analysis later in 1979	
1980	15,000.00	15,000.00		
1981	23,000.00	23,000.00		CAFSAC still considers the projection realistic and advises that the F0.1 catch in 1981 would be 23000 mt.
1982	23,000.00	23,000.00		Projections depend critically on the strength of the 1975-1977 year-classes which are now entering the fishery. ...considerable uncertainty is associated with estimates of their absolute sizes.
1983	19,000.00	19,000.00		The difference between the 1982 TAC and the current estimate of F0.1 catch is due both to a decline in the average weight at age in the 1981 catch at age and to lower estimates of the important 1975-1977 year-classes. There is considerable uncertainty associated with the latter....
1984	12,000.00	12,000.00		Assuming the TAC of 19000 t is taken in 1983, fishing at F0.1 = 0.22 in 1984 will give a catch of 12000 mt. A catch of 19000 mt in 1983 will generate an f of 0.42.
1985			Assessment deferred because of aging problems in the 1983 catch at age data	
1985	15,000.00	14,000.00		If the TAC of 15000 t is taken in 1984, the calculated fishing mortality rate on fully recruited ages will be 0.38 and the 1985 catch corresponding to F0.1 = 0.26 is projected to be 14000 t. Fishing at F0.1 in 84 and 85 leads to catches of 9500 and 15500 respectively. The low reported catches for the first 8 months of 1984 suggest that the 1984 catch will be near 9500 t. CAFSAC notes that the projected catch (using this figure) is within 10 % of the 1984 TAC.
1986	17,000.00	16,600.00		If the TAC (15000 t) is taken in 1985 the F0.1 catch in 1986 would be 16600t, whereas if the F0.1 catch of 13800 t is taken in 1985, the F0.1 catch in 1986 increases slightly to 16900 t. In either case CAFSAC advises that the F0.1 catch level in 1986 would be 17000t.



Species : Haddock

Stock : 4VW

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1987	3,800.00	3,800.00		The present review confirms that F has been underestimated in previous assessments...The 1986 catch is already higher than the estimated F0.1 catch for that year. Assuming that the 1986 catch would be equal to the 1985 catch of 12000 t, the F0.1 = 0.21 catch in 1987 would be 3800 t. ....The estimated female spawning stock biomass is appr. 11400 t well below the threshold and CAFSAC advises that the catch from the 4TVW stock be kept at the lowest possible level in 1987
1987	5,100.00	5,100.00		If the TAC of 17000 t is taken in 1986, the F0.1 catch implied for 1987 is 5100 t.
1988	0.00	4,500.00		The catch in 1988 that would correspond to removals at F0.1 would be 4500 t, assuming that the catch in 1987 is 3800 t. CAFSAC recommends that removals be held to a minimum to allow as rapid an increase of spawning stock biomass as possible, and that the prohibition on directed fisheries be continued
1988	3,000.00			N.B. There were no analyses presented to substantiate the advised catch
1989	4,500.00		Based on the 1987 assessment	Deferred until fall meeting
1989	6,700.00	6,700.00		Assuming that the catch in 1988 is 4500 t, a catch of 6700 t in 1989 would correspond to removals at F0.1. ....CAFSAC notes that there remains considerable uncertainty with respect to this assessment....due to ...changes in fishery regulations...changes in fish distribution, changes in age composition...unexplained disappearance of older fish from the population...underreporting of catches
1990	6,000.00	6,000.00		CAFSAC advises that a catch of about 6000 t approximates the F0.1 catch in 1989 and 1990. The application of the 50% rule is not advised for this stock because the spawning stock size is low compared with historic levels. CAFSAC notes that there are indications that reduced fishing mortality and area closures may have protected recruiting year-classes and therefore prevented further decline in biomass.
1991	0.00		Advise a by-catch reduction to 5% for mobile gear.	Stock is still being heavily exploited... CAFSAC concludes that present regulations do not appear to have decreased exploitation. A reduction in mobile gear by-catch would be helpful in that regard. Present closed area should be maintained year-round. CAFSAC suggests that the proposed management measures be applied during 1991 to 1993.
1992				CAFSAC is not presently able to complete an assessment using SPA but all indications are that fishing mortalities are high and should be reduced. In addition ...CAFSAC recommends a minimum hook-size inside the closed area.

Stock : 4X

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1978	15,000.00	21,000.00		The Subcommittee recommends a TAC for 1978 of 15000 mt
1978	17,000.00			The biological advice is that the total 1978 catch (including any discards which may occur) should not be allowed to exceed 17000 mt.
1979	26,000.00	26,000.00	F0.1 or 2/3 Fmsy	CAFSAC therefore recommends a TAC of 26000 mt for 1979.
1980			Advice deferred pending re-analysis later in 1979	

Species : Haddock

Stock : 4X

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1980	28,000.00	28,000.00		CAFSAC notes however that current levels of misreporting and unreporting of catches could mean that actual stock status is substantially different from the interpretation as provided by the present assessment. CAFSAC views this misreporting and unreporting with great concern and points out that these may in future preclude any meaningful assessments with methods using catch and effort data.
1981	28,000.00	28,000.00		CAFSAC Advises that the catch in 1981 corresponding to F0.1 is 28000 mt.
1982	32,000.00	32,000.00		Other estimates of both the 1977 and 1979 year-classes are higher than used in this analysis... however uncertainties in these estimates and from other factors such as misreporting dictate the present approach.
1983	32,000.00	32,000.00		Given uncertainty in the parameter estimates (survey variability, untrawlable bottom, historical discarding and misreporting 1976-1979) CAFSAC advises retention of the 1982 TAC of 32000 t for 1983.
1984	32,000.00	31,000.00		Assuming the 1983 TAC of 32000 t is taken, the catch fishing at F0.1 = 0.25 in 1984 is calculated to be 31000 mt. It is advised, therefore that the present TAC of 32000 mt also approximates the catch at F0.1 in 1984. A catch of 32000 mt in 1983 will generate an F of 0.31.
1985			Assessment deferred because of aging problems in the 1983 catch at age data.	
1985	10,400.00	10,400.00		The TAC is unlikely to be taken. Two projections were carried out, one with a 1984 catch of 20,000 t and another with a 1984 catch at F0.1 = 0.25 level. A catch of 20,000 t in 1984 corresponds to a calculated fishing mortality of 0.54 and to a 1985 catch at F0.1 of 10,400 t. Fishing at F0.1 in both years gives a projected catch of 10000 t in 1984 and 12100 t in 1985.
1986	12,000.00	12,000.00		N.B.— F in previous years was estimated to have been far in excess of F0.1 and higher than was estimated in the retrospective year.
1987	9,300.00	9,300.00		If the TAC of 15000 t is taken in 1986, a fishing mortality of 0.46 is implied and the catch in 1987 associated with F0.1 = 0.25 is 9300 t.
1987	12,300.00	12,300.00		Assuming that the 15000 t TAC for 1986 is caught, the 1987 F0.1 catch is estimated to be 12300 t. The 1987 catch is critically dependent on the estimate of the 1982 year-class (42% of the projected yield).
1988	8,200.00	8,200.00		CAFSAC notes that should the level of misreporting and or discarding be substantial, and particularly if the rates are changing, the assessment may be compromised. CAFSAC emphasizes however that the average age of the haddock in the population is consistent with a stock being fished in excess of Fmax. F0.1 in 1988 = 8200 t with 42 % of this composed of the 1982 year-class.
1988	12,000.00			N.B. There were no analyses presented to substantiate the advised catch.
1989	8,100.00	8,100.00		Present indications are that the catch in 1988 will be higher than in 1986-1987, and assuming that 8000t is taken, the F0.1 yield (F=0.26) in 1989 would be 8100 t. CAFSAC notes that total yield and spawning stock biomass would both be improved if measures were introduced to reduce the capture of haddock younger than age three. This would necessitate increases in minimum mesh size.
1989	8,200.00		Based on the 1987 assessment	Deferred until fall meeting.
1990	4,600.00	4,600.00		CAFSAC notes that the spawning stock biomass may be approaching a critically low level. It is probably within the harvesting capabilities of the fleets to fish this stock to economic extinction. Stock collapse may be imminent and therefore CAFSAC advises that there be no directed fishery for 4X haddock in 1990 and that the catch be maintained at the lowest possible level - below the F0.1 catch of 4600 t.
1991	0.00			CAFSAC believes that this assessment shows that there has been no increase in abundance compared with the previous assessment and stock recovery is very unlikely with preset catches. ...CAFSAC suggests that there be no directed fishery and that by-catch regulations be applied for 1991-1993. These by-catches should be kept to the lowest possible level.

Species : Haddock

Stock : 4X

Applicable Year	Advised Catch	Reference Level	Footnotes / "Sci. Advice"	Comments
1992	0.00			CAFSAC is not able to make a formal catch forecast but reiterates its previous advice that there be no directed fishery for this resource and that by-catches be kept to the lowest levels possible. Although the 1991 management plan does specify a by-catch fishery only, the current regulations appear ineffective because catches in the first quarter of the year were as high as in 1990. CAFSAC notes that the joint Cod/Haddock/Pollock or similar regime allows overexploitation of haddock while the species needs to be protected.

Species : Cod

Stock : 4Vn(M-D)

Applicable Year	Actual TAC	Landings	Regulatory measures
1977	3,250.00	7,921.00	Mobile gear will be restricted to a by-catch of 5000 lbs. or 10% when 75% of the TAC has been reached
1978	3,500.00	5,549.00	-Mobile gear fishery restricted to by a by-catch of 5,000 lbs or 10% of cod per trip. -No restriction on fixed gear.
1979	3,500.00	6,347.00	Vessels greater than 65 ft LOA using mobile gear will be restricted to a by-catch of 2500 kg. or 10 % of cod.
1980	5,000.00	10,190.00	
1981	7,500.00	12,648.00	
1982	10,500.00	12,333.00	
1983	14,000.00	9,412.00	1) For fixed gear vessels <65 ft the fishery will close at 80% of their quota and revert to a 1500 kg trip limit. 2) For mobile gear vessels <65 ft the fishery will close at 90% of their quota and revert to a 1500 kg trip limit.
1984	14,000.00	10,559.00	1) Fishery for all vessels <65 ft will close at 90% of their quotas
1985	12,000.00	12,494.00	
1986	12,000.00	11,854.00	1) Mobile gear vessel <65 ft to be managed in three 4-month blocks
1987	9,000.00	10,522.00	1) Mobile gear <65 ft managed in two blocks May - November, and November - December
1988	7,500.00	9,001.00	1) 50 % rule applied to TAC
1989	7,500.00	7,465.00	1) For mobile gear <45ft the fishery will be closed Aug1- Aug31. 2) For mobile gear 45-64' the fishery will be closed August 1 to August 31.
1990	7,500.00	5,205.00	
1991	10,000.00	4,602.00	
1992	10,000.00	3,866.00	

Stock : 4VsW

Applicable Year	Actual TAC	Landings	Regulatory measures
1977	6,550.00	10,390.00	Offshore fleet restricted to cod by-catch of 5000 lbs or 10% when 75% of offshore allocation has been reached
1978	6,600.00	25,405.00	1) No directed fishery for cod by mobile gear in 4VsW at any time in 1978. 2) After March 1, 1978, cod by-catch allowance will be raised to 10,000 lbs., or 25% cod. until such time as the quota of 3,000 t has been reached, at which time the fishery will revert to a 5,000lbs. or 10% by-catch level. 3) During January 1 to June 30 all vessels will be prohibited from fishing with an otter trawl for any species of fish within an area enclosing the White Head Hole and the Patch. This closure is to be in effect for 1978 on an experimental basis, in order to determine the impact of such a strategy on the small boat fishery. The coordinates of the closed area follow.....
1979	7,000.00	40,030.00	1) Vessels >65ft LOA will be restricted to a by-catch of 2,500 kg or 10% 2) During the period Jan 1 to Jun 30, 1978 the area known as the Whitehead Hole and the Patch will be open to inshore vessels only.
1980	45,000.00	49,252.00	1) Until the directed fishery opens (March 1, or March 15 depending on BHP of vessel) cod in 4VsW will be fished as a 20% by-catch, all cod caught in this manner will be deducted from the respective spring quotas. 2) When these quotas have been reached, directed fishery will be closed and the fishery will be managed on a 20% by-catch until 2,000 t has been reached when the fishery will revert to a standard by-catch of 1,500 t or 10%. 3) On October 15, the directed codfish fishery will resume with the remaining quota allocations for the two mobile gear vessel classes (<1050 BHP, >1050 BHP) All vessels will be limited to catches of 300,000 lbs per month (managed by industry). 4) Once the total yearly offshore quota of 30,850 is about to be reached the directed fishery will be closed and it will be managed on the standard by-catch of 1,500 kg or 10%. 5) Whitehead Hole closure to remain in effect.

Species : Cod

Stock : 4VsW

Applicable Year	Actual TAC	Landings	Regulatory measures
1981	50,000.00	53,718.00	For mobile gear >65ft 1) The area known as the Whitehead Hole will be closed from January 1 to June 30. 2) During closed periods the by-catch levels will be managed on a 30% by-catch with large mesh gear and a 20% by-catch for small mesh gear. 3) The directed spring cod fishery will open on the following dates and with the following spring quotas 4) On October 15 a directed fishery may resume for each vessel class. 5) After October 15 all vessels will be limited to catches of 300,000 lbs per calendar month for the remaining portion of the quota.
1982	50,000.00	55,754.00	
1982	55,600.00	55,754.00	
1983	64,000.00	52,380.00	1) For fixed gear vessels <65 ft. the fishery will close at 85% of their quota and revert to a 1500 kg trip limit. 2) For mobile gear <65 ft. the fishery will close at 90% of their quota and revert to a 1500 kg trip limit.
1984	55,000.00	52,546.00	1) The fishery for all vessels <65 ft will close at 90% of their quota.
1985	55,000.00	57,455.00	1) Fishery for vessels <65 ft will close at 90% of their quota.
1986	48,000.00	51,529.00	1) Mobile gear <65 ft managed in three 4-month periods
1987	44,000.00	45,503.00	1) Fixed gear <65 ft managed in by quarter 2) Mobile gear <65 ft managed by three 4-month blocks
1988	38,000.00	38,356.00	
1989	35,200.00	36,743.00	1) 50 % Rule Applied to TAC
1990	35,200.00	34,368.00	
1991	35,200.00	33,075.00	
1992	35,200.00	28,973.00	

Stock : 4X

Applicable Year	Actual TAC	Landings	Regulatory measures
1977	3,600.00	22,833.00	Quotas apply to offshore fishing only
1982	30,000.00	31,765.00	
1983	30,000.00	26,718.00	1) For all vessel <65 ft the fishery will close when 90% of their quotas are reached and then revert to a 1500 kg trip limit.
1984	30,000.00	22,440.00	1) The fishery for fixed gear vessels <65 ft will close at 90% of their quota. 2) The quota for mobile gear vessels <65 ft will be regulated in 3 4-month blocks.
1985	30,000.00	20,056.00	1) The mobile gear <65 ft quota will be managed on the basis of three 4-month blocks throughout the year.
1986	20,000.00	19,239.00	1) Mobile gear <65ft managed in three 4-month blocks
1987	17,500.00	19,005.00	2) Mobile gear <65 ft managed by three 4-month blocks
1988	14,000.00	20,049.00	
1989	12,500.00	19,894.00	1) 50% rule applied to TAC 2) The offshore quota will revert to its original 1988 proportional share of the TAC if and when the TAC increases to the 1984 level of 30,000 t. As the TAC increases towards this level the offshore quotas will increase towards the proportional shares.
1990	12,000.00	23,638.00	
1991	26,000.00	27,746.00	
1992	26,000.00	13,197.00	

Species : Haddock

Stock : 4VW

Applicable Year	Actual TAC	Landings	Regulatory measures
1978	1,700.00	5,901.00	<p>1) Directed fishing for haddock may be carried out by vessels only under the authority of a special haddock licence and pursuant to the conditions set out in that licence.</p> <p>2) Total landings of haddock regardless of area of capture must not exceed 70,000 lbs per month - with an allowable accidental overrun of 15,000 lbs. Where there is an overrun, the vessel will be restricted the following month to a total catch of 70,000 lbs less the amount of the overrun, with a 10% tolerance.</p> <p>3) For any vessel exceeding the monthly allowance, the amount of haddock in excess of 70,000 lbs. will be confiscated, the haddock licence suspended for one month for a first offence or permanently for a subsequent offence.</p> <p>4) When the quota is reached the fishery will be restricted to a by-catch only.</p>
1979	2,000.00	3,433.00	<p>This fishery will be fished as a by-catch of 4,500 kg or 25% until 75% of the quota is reached, at which time it will revert to a by-catch of 2,500 kg or 10%.</p>
1980	15,000.00	14,840.00	<p>Vessels Less than 125 ft LOA</p> <p>1) All vessels using mobile gear will require a special haddock licence in order to conduct a directed haddock fishery.</p> <p>2) Vessels fishing with longline gear will not require a special licence in order to conduct a directed haddock fishery.</p> <p>3) No vessel fishing under a special haddock licence may land in excess of 80,000 lbs of haddock in any calendar month (with not allowable overrun).</p> <p>4) Vessels may not proceed on a directed haddock trip unless the licence has been validated by a fishery officer.</p> <p>5) If a quota is not reached by the end of a quota period the uncaught portion will be added to the quota of the following period.</p> <p>6) If a quota is overrun in any period the amount of the overrun will be deducted from the following period.</p> <p>7) Any infraction of the monthly allowance will result in the cancellation of the special licence for the remainder of the year, and as such the vessel will be limited to a 1500 kg or 10% by catch of haddock.</p> <p>Vessels greater than 125 ft LOA</p> <p>1) All vessels using mobile gear will require a special haddock licence in order to conduct a directed haddock fishery.</p> <p>2) Vessels fishing under a special haddock licence will be restricted to 100,000 lbs per trip regardless of area of capture.</p> <p>3) The fishery will be divided into two time periods: January 1 - July 14, July 15 - December 31.</p> <p>4) During the first period total landings of haddock will not exceed 500,000 lbs (common landed form) regardless of area of capture with a maximum of 250,000 lbs form 4VW and 250,000 lbs form 4X.</p> <p>5) Total landings of haddock per vessel and maximum trip limits will be reviewed and adjusted as required to ensure total quota levels are met.</p>

Species : Haddock

Table 2 (cont'd)

Stock : 4VW

Applicable Year	Actual TAC	Landings	Regulatory measures
1981	23,000.00	20,009.00	<p>1) Haddock spawning areas will be closed to all vessels on March 1, 1981, and will reopen on June 1 1981.</p> <p>For Vessels less than 125 ft.</p> <p>1) All vessels using mobile gear will require a special licence in order to conduct a directed haddock fishery.</p> <p>2) Vessels may not proceed on a directed haddock trip unless the licence has been validated by a fishery officer.</p> <p>3) Vessels fishing with longline gear will not require a special licence in order to conduct a directed haddock fishery.</p> <p>4) The fishery will be managed in two units 4VW, and 4X/5.</p> <p>5) For 4VW, monthly trip limits will be 80,000 lbs common landed form subject to review as for 4X.</p> <p>6) Vessels cannot mix areas of capture during a single trip eg either all 4VW or all 4X/5.</p> <p>7) Should possible misreporting be suspected resulting from the above management plan the entire fishery shall revert to a common monthly trip limit for all areas.</p> <p>8) If a quota is not reached by the end of a quota period the uncaught portion will be added to the quota of the following period.</p> <p>9) If a quota is overrun in any period the amount of the overrun will be deducted from the following period.</p> <p>10) Any infraction of the monthly allowance will result in the cancellation of the special licence for the remainder of the year, and as such the vessel will be limited to a 1500 kg or 10% by catch of haddock.</p> <p>Vessels greater than 125 ft</p> <p>1) All vessels will require a special haddock licence in order to conduct a directed haddock fishery.</p> <p>2) The fishery will be managed in two units 4VW and 4X/5</p> <p>3) For each vessel greater than 125 ft a directed fishery will be permitted to a maximum of 300,000 lbs common landed form for 4VW and 300,000 lbs common landed form for 4X/5.</p> <p>4) When each vessel reaches its 300,000 lbs per management unit it will be limited to a 20% by-catch for that unit until further notice.</p> <p>5) Vessels may not proceed on a directed haddock trip unless the special licence is validated by a fishery officer.</p> <p>6) All vessels will refrain from fishing any species of groundfish in 4X/5 from July 15 to September 15.</p> <p>7) Total landings of haddock per vessel and maximum trip limits will be reviewed and adjusted as required to ensure total quota levels are met.</p>
1982	23,000.00	15,226.00	
1983	19,000.00	9,412.00	1) For mobile gear vessels <65 ft their fishery will be managed by the issues of a special haddock licence effective 01/01/83.
1984	15,000.00	8,021.00	
1985	15,000.00	11,664.00	
1986	17,000.00	16,921.00	1) Mobile gear <65 ft managed in three 4-month blocks
1987	0.00	3,877.00	<p>1) Fishery restricted to a 5% by-catch only</p> <p>2) Fixed gear &lt;65ft will be restricted to a 1500 kg trip limit after September 1987</p> <p>3) Mobile gear &lt;65 ft, 10% by-catch for the period May15-July31.</p>

Species : Haddock

Stock : 4VW

Applicable Year	Actual TAC	Landings	Regulatory measures
1988	0.00	4,540.00	Fishery restricted to 5% by-catch only 1) Specific closures to be in effect for haddock nursery areas in 1988 2) Fixed gear <65ft will be restricted to a 1,500 kg trip limit after March 1 3) Mobile gear <65ft will be restricted to a 1500 kg trip limit between March 15 and August 15. 4) Vessels over 100ft, 10% by-catch to a maximum of 4,500 kg for the period March 15 to August 15.
1989	6,700.00	9,128.00	1) Specific closures to be in effect for haddock nursery areas for 1989. 2) Mobile and fixed gear <65ft will be restricted to a 2,500 kg trip limit. 3) Mobile gear 65-100 ft restricted to 15% by-catch 4) Vessels >100 ft restricted to 15% by-catch.
1990	6,000.00	6,972.00	Specific closures to be in effect for haddock nursery areas in 1990.
1991	0.00	5,421.00	1) Fishery restricted to a by-catch only 2) Fixed gear vessels <65ft restricted to a 2500 kg trip limit. 3) Specific closures to be in effect for haddock nursery areas in 1991
1992	0.00	5,511.00	1) Fishery restricted to by-catch

Stock : 4X

Applicable Year	Actual TAC	Landings	Regulatory measures
1978	19,000.00	26,672.00	1) Directed fishing for haddock may be carried out by vessels only under the authority of a special haddock license and pursuant to the conditions set out in that license. 2) Total landings of haddock regardless of area of capture must not exceed 70,000 lbs per month - with an allowable accidental overrun of 15,000 lbs. Where there is an overrun, the vessel will be restricted the following month to a total catch of 70,000 lbs less the amount of the overrun, with a 10% tolerance. 3) For any vessel exceeding the monthly allowance, the amount of haddock in excess of 70,000 lbs. will be confiscated, the haddock license suspended for one month for a first offence or permanently for a subsequent offence. 4) When the quota is reached the fishery will be restricted to a by-catch only. 5) All vessels over 125 ft LOA will be excluded from fishing for any species of groundfish in Division 4X from August 1 to September 30, 1978 and restricted to a by-catch of haddock all other areas during this period. 6) Haddock spawning areas to be closed
1979	26,000.00	24,935.00	1) Unless requested by the offshore industry, vessels > 125ft will not be restricted to monthly catch limits, when the quota of 8,000 mt in 4X is reached (vsl > 125ft) those vessels will be excluded from fishing any species in 4X for the remainder of the year. 2) Spawning areas close on March 1/ 79, until it is considered spawning has been completed. Vessels < 125 ft LOA 1) Limited to 80,000 lbs per calendar month (no overrun) under conditions of a special haddock license. 2) May not proceed on a directed haddock trip unless license validated by Fishery Officer. 3) When 5,000 t is reached in 4X, fishery in both 4X and 5 reverts to by-catch until June 1 4) When 13,500 t is reached in 4X fisheries in both 4X and 5 revert to by-catch until October 1 5) When 1,000 t is caught in Subarea 5 fishery reverts to by-catch. 6) Uncaught portion for any period will be added to the following period. 7) Quota overrun in any period will be deducted from the following period. 8) Any infraction of the monthly allowance will result in a cancellation of the special licence for the remainder of the year, and vessel limited 2,500 kg or 10% haddock by-catch. 9) If during the first quota period widespread infractions are occurring, additional regulatory measures will be employed to correct this situation.



Species : Haddock

Stock : 4X

Applicable Year	Actual TAC	Landings	Regulatory measures
1980	28,000.00	29,006.00	<p>Vessels Less than 125 ft LOA</p> <ol style="list-style-type: none"> <li>1) All vessels using mobile gear will require a special haddock licence in order to conduct a directed haddock fishery.</li> <li>2) Vessels fishing with longline gear will not require a special licence in order to conduct a directed haddock fishery.</li> <li>3) No vessel fishing under a special haddock licence may land in excess of 80,000 lbs of haddock in any calendar month (with no allowable overrun).</li> <li>4) Vessels may not proceed on a directed haddock trip unless the licence has been validated by a fishery officer.</li> <li>5) When 6,500 t is reached in 4X, the fishery in 4X will revert to a by-catch fishery until June 1.</li> <li>6) When 17,000 t is reached in 4X the fishery will again revert to by-catch fishery until October 1</li> <li>7) If a quota is not reached by the end of a quota period the uncaught portion will be added to the quota of the following period.</li> <li>8) If a quota is overrun in any period the amount of the overrun will be deducted from the following period.</li> <li>9) Any infraction of the monthly allowance will result in the cancellation of the special licence for the remainder of the year, and as such the vessel will be limited to a 1500 kg or 10% by catch of haddock.</li> </ol> <p>Vessels greater than 125 ft LOA</p> <ol style="list-style-type: none"> <li>1) All vessels using mobile gear will require a special haddock licence in order to conduct a directed haddock fishery.</li> <li>2) Vessels fishing under a special haddock licence will be restricted to 100,000 lbs per trip regardless of area of capture.</li> <li>3) Vessels may not proceed on a directed haddock trip unless the special licence is validated by a fishery officer.</li> <li>4) The fishery will be divided into two time periods: January 1 - July 14, July 15 - December 31.</li> <li>5) During the first period total landings of haddock will not exceed 500,000 lbs ( common landed form) regardless of area of capture with a maximum of 250,000 lbs form 4VW and 250,000 lbs form 4X.</li> <li>6) Vessels exceeding the maximum quota in 4X/5 will have excess catches deducted from the quota in the subsequent period.</li> <li>7) All vessels will voluntarily refrain from fishing any species of groundfish in 4X/5 from July 15 to September 15.</li> <li>8) Total landings of haddock per vessel and maximum trip limits will be reviewed and adjusted as required to ensure total quota levels are met.</li> <li>9) The haddock reserve in 4X/5 for the period October 15 - December 31 allows for a directed fall pollock fishery. There will be no changes, additions, or deletions to these reserves without consultations with the offshore sectors.</li> </ol>

Species : Haddock

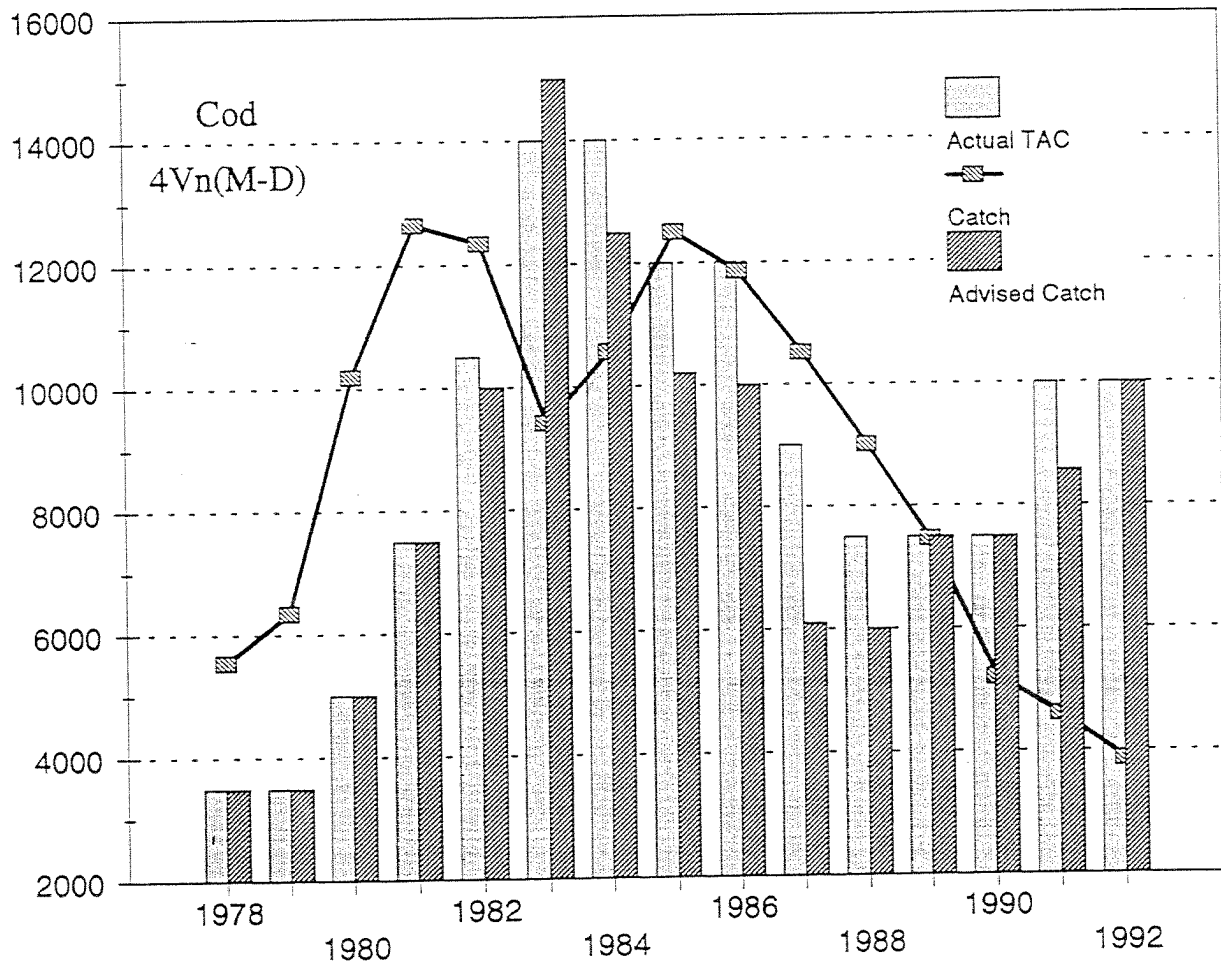
Stock : 4X

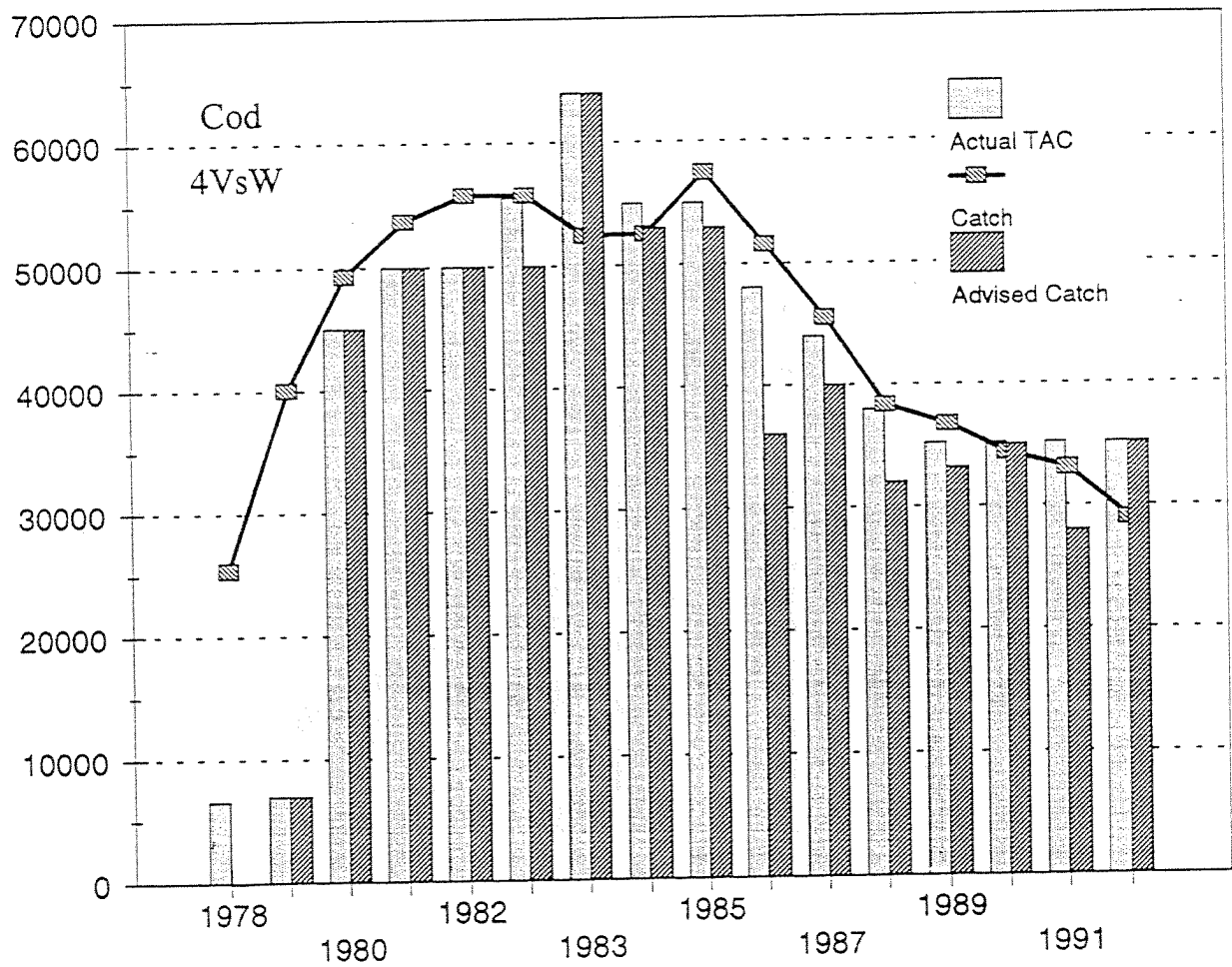
Applicable Year	Actual TAC	Landings	Regulatory measures
1981	28,000.00	30,962.00	<p>1) Haddock spawning areas will be closed to all vessels on March 1, 1981, and will reopen on June 1 1981.</p> <p>For Vessels less than 125 ft.</p> <p>1) All vessels using mobile gear will require a special licence in order to conduct a directed haddock fishery.</p> <p>2) Vessels may not proceed on a directed haddock trip unless the licence has been validated by a fishery officer.</p> <p>3) Vessels fishing with longline gear will not require a special licence in order to conduct a directed haddock fishery.</p> <p>4) The fishery will be managed in two units 4VW, and 4X/5.</p> <p>5) Monthly trip limits in 4X/5 will be initiated on January 1 at 120,000 lbs common landed form per vessel and subject to immediate review pending level of catch rates. eg if catch are excessive monthly trip limits will be adjusted accordingly.</p> <p>6) Vessels cannot mix areas of capture during a single trip eg either all 4VW or all 4X/5.</p> <p>7) Should possible misreporting be suspected resulting from the above management plan the entire fishery shall devreft to a common monthly trip limit for all areas.</p> <p>8) If a quota is not reached by the end of a quota period the uncaught portion will be added to the quota of the following period.</p> <p>9) If a quota is overrun in any period the amount of the overrun will be deducted form the following period.</p> <p>10) Any intraction of the monthly allowance will result in the cancellation of the special licence for the remainder of the year, and as such the vessel will be limited to a 1500 kg or 10% by catch of haddock.</p> <p>Vessels greater than 125 ft</p> <p>1) All vesels will require a special haddock llcence in order to conduct a directed haddock fishery.</p> <p>2) The fishery will be managed in two units 4VW and 4X/5</p> <p>3) For each vessel greater than 125 ft a directed fishery will be permitted to a maximum of 300,000 lbs common landed form for 4VW and 300,000 lbs common landed form for 4X/5.</p> <p>4)When each vessel reaches its 300,000 lbs per management unit it will be limited to a 20% by-catch for that unit until further notice.</p> <p>5) Vessels may not proceed on a directed haddock trip unless the special licence is validated by a fishery officer.</p> <p>6) All vessels will refrain from fishing any species of groundfish in 4X/5 from July 15 to September 15.</p> <p>7) Total landings of haddock per vessel and maximum trip limits will be reviewed and adjusted as required to ensure total quota levels are met.</p>
1982	32,000.00	24,450.00	
1983	32,000.00	25,401.00	1) For mobile gear vessels <65 ft their fishery will be managed by the issues of a special haddock llcence effective 01/01/83
1984	32,000.00	19,901.00	1) Seasonal haddock closures will be in effect
1985	15,000.00	15,340.00	1) Seasonal haddock closures will be in effect
1986	15,000.00	15,331.00	1) Seasonal haddock closures will remain in effect
			2) Mobile gear <65ft manged in three 4-month blocks
1987	15,000.00	13,797.00	1) Seasonal haddock closures will be in effect
			2) Mobile gear <65 ft will be managed in three 4-month blocks

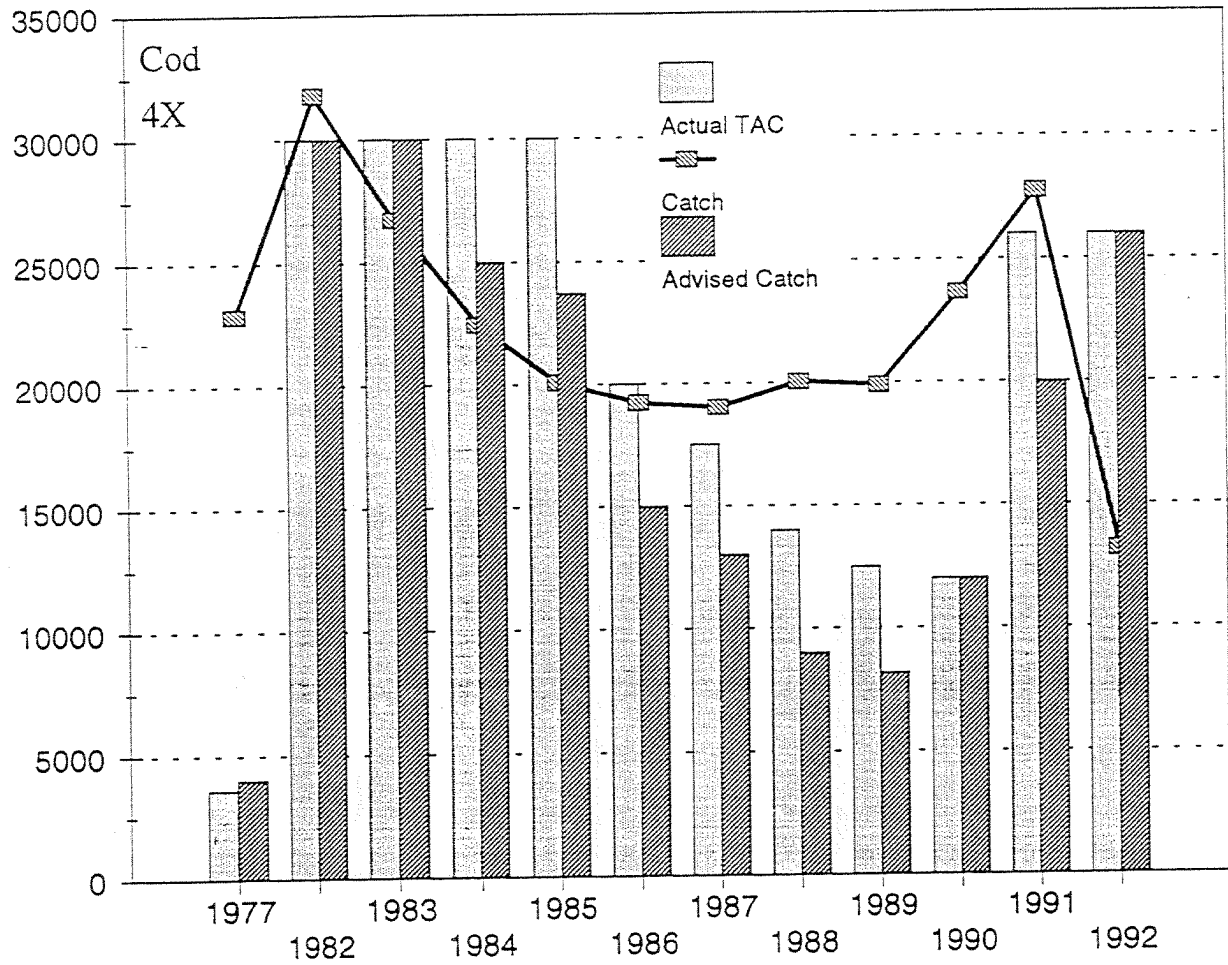
Species : Haddock

Stock : 4X

Applicable Year	Actual TAC	Landings	Regulatory measures
1988	12,400.00	11,295.00	1) Seasonal haddock closures will be in effect 2) The offshore quota will revert to its former 1984 proportional share of the TAC if and when the TAC increases to 25,000 t. As the TAC increases toward this level, the offshore quota will increase towards that proportional share.
1989	4,600.00	6,803.00	1) Seasonal haddock closures will be in effect 2) The offshore quota will revert to its former 1984 proportional share of the TAC if and when the TAC increases to 25,000 t. As the TAC increases toward this level, the offshore quota will increase towards that proportional share.
1990	4,600.00	7,391.00	1) 50% rule applied to TAC 2) The offshore quota will revert to its original 1988 proportional share of the TAC if and when the TAC increases to the 1984 level of 30,000 t. As the TAC increases towards this level the offshore quotas will increase towards the proportional shares.
1991	0.00	9,818.00	1) Fishery Restricted to a by-catch only 2) Seasonal haddock closures will be in effect. 3) Closure extends to June 15 on Brown's Bank 3) The offshore quota will revert to ....
1992	0.00	10,198.00	1) Fishery restricted to by-catch







advice during 1984 to 1989 and in 1991. The three-year management plan initiated in 1991 explicitly provided TACs substantially above the  $F_{0.1}$  target, based in part on the scientific advice that indicated that the stock was in reasonable shape (Figure 5) and recruitment at "normal" levels (Figure 6). Also, 1990 provides an example where the scientific advice indicated that the 50% rule would be appropriate from a conservation perspective (Table 1). The recorded landings, however, for that year were about 100% above the TAC (Table 2 and Figure 24).

#### 4VW Haddock

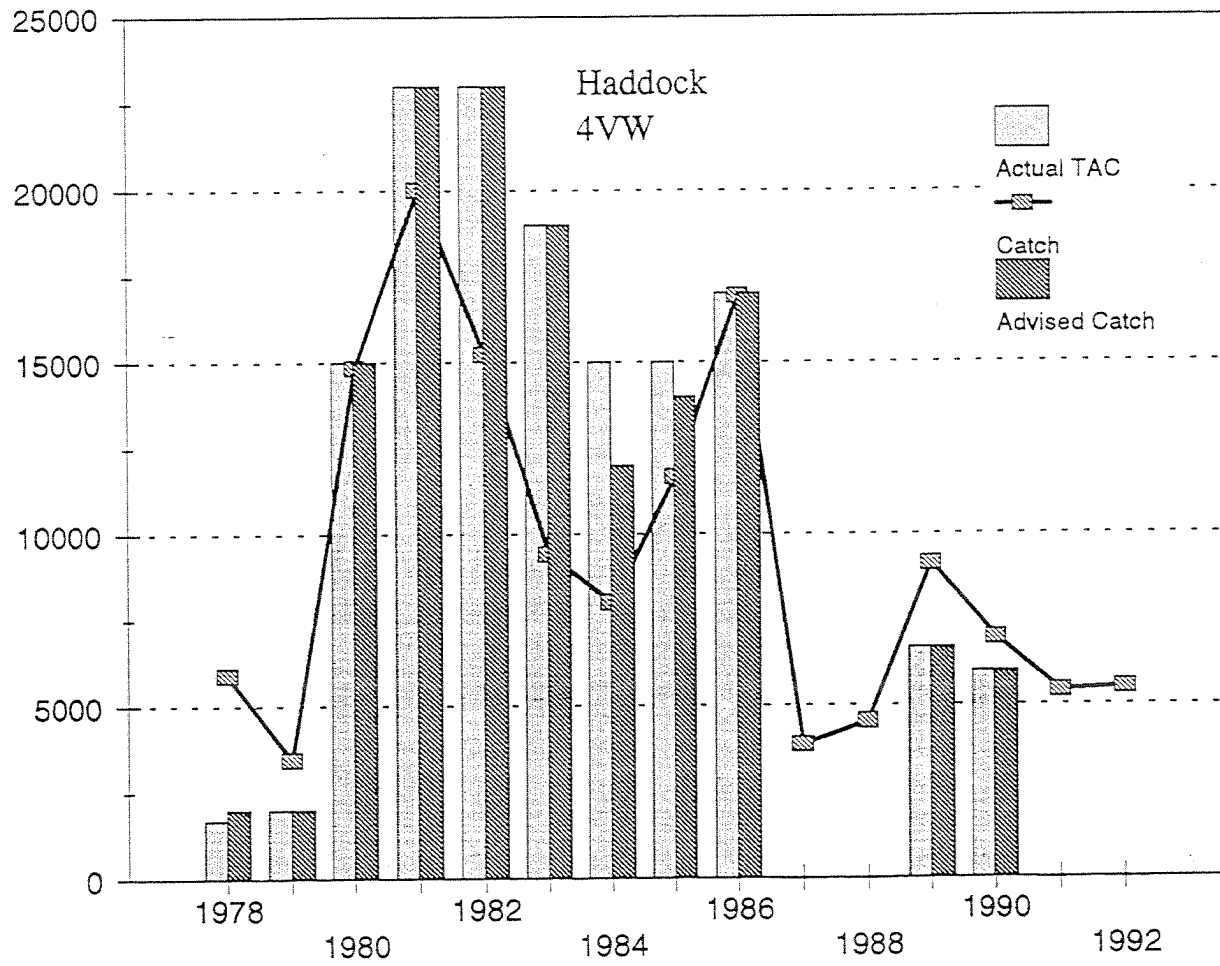
The annual advised catch levels, the TACs, and the recorded landings for haddock on the eastern Scotian Shelf are shown in Figure 25. It is noted again that for the haddock stocks it has not been possible to carry out analytical assessments for much of the time period under review because of problems with the landings data. Thus, specific  $F_{0.1}$  advice was not always available; rather the advice has tended to be more qualitative. From 1981 to 1985, the TACs were non-restrictive and thus quotas did not influence fishing effort. Since 1987, the advice has been either the "lowest possible" or a very small quota. The advice has been accepted, but the recorded landings have been substantially above the TAC. It is noteworthy that the scientific advice has been characterized by extreme shifts (i.e., 1979 to 1980 - from 3,000 to 15,000 t; and from 1986 to 1987 - from 17,000 t to zero).

#### 4X Haddock

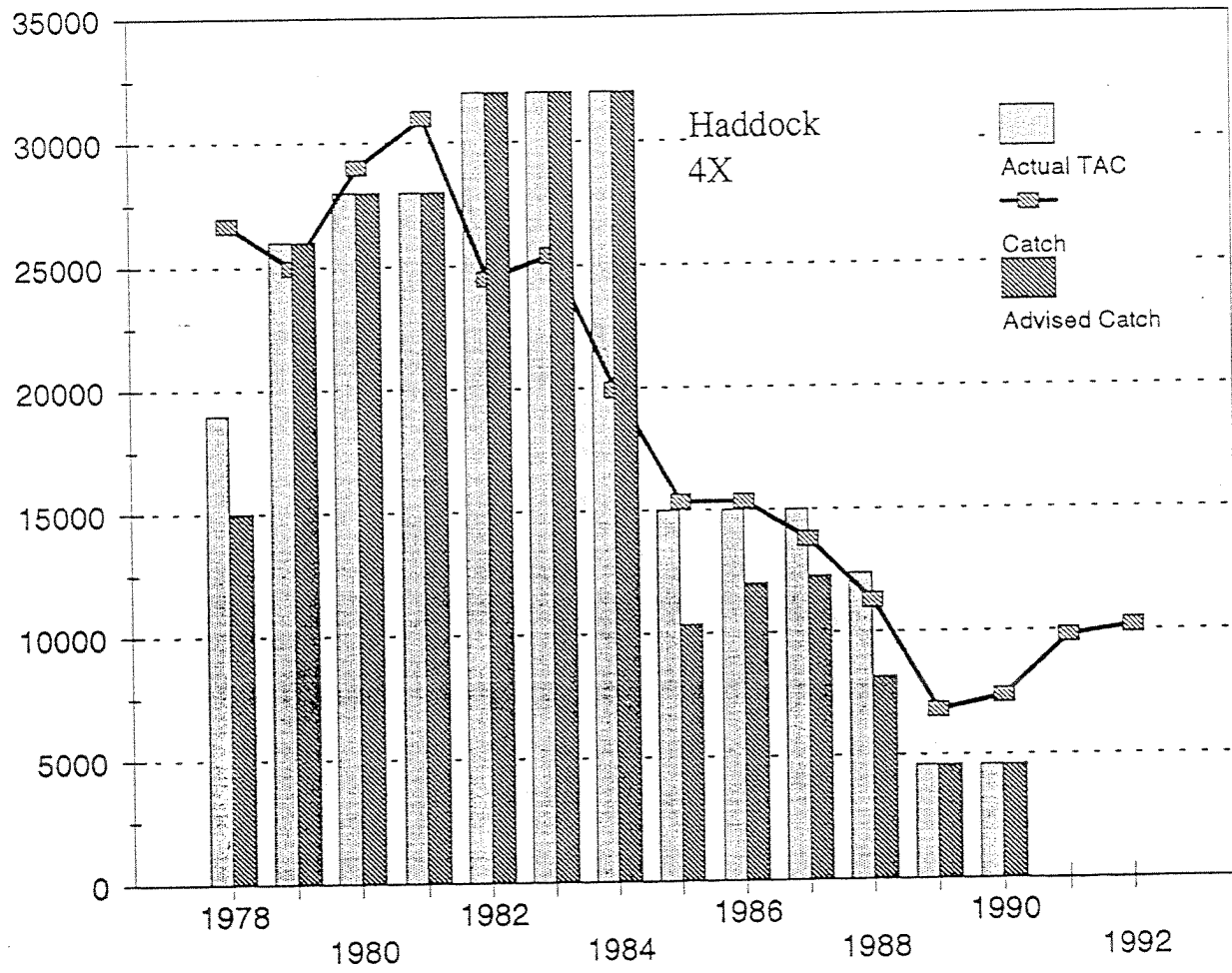
The annual advised catch levels, the TACs, and the recorded landings for haddock on the western Scotian Shelf are shown in Figure 26. During 1982 to 1984, the TAC was unrestrictive; from 1989 to the present, the recorded landings exceeded the TAC (again by a substantive amount given the depressed condition of the stock). The scientific advice was accepted by the Minister of DFO for much of the time period (with the exception of 1985 to 1988). As was the case for 4VW haddock, the scientific advice has changed dramatically between years (1984 to 1985 from over 30,000 t to about 10,000 t).

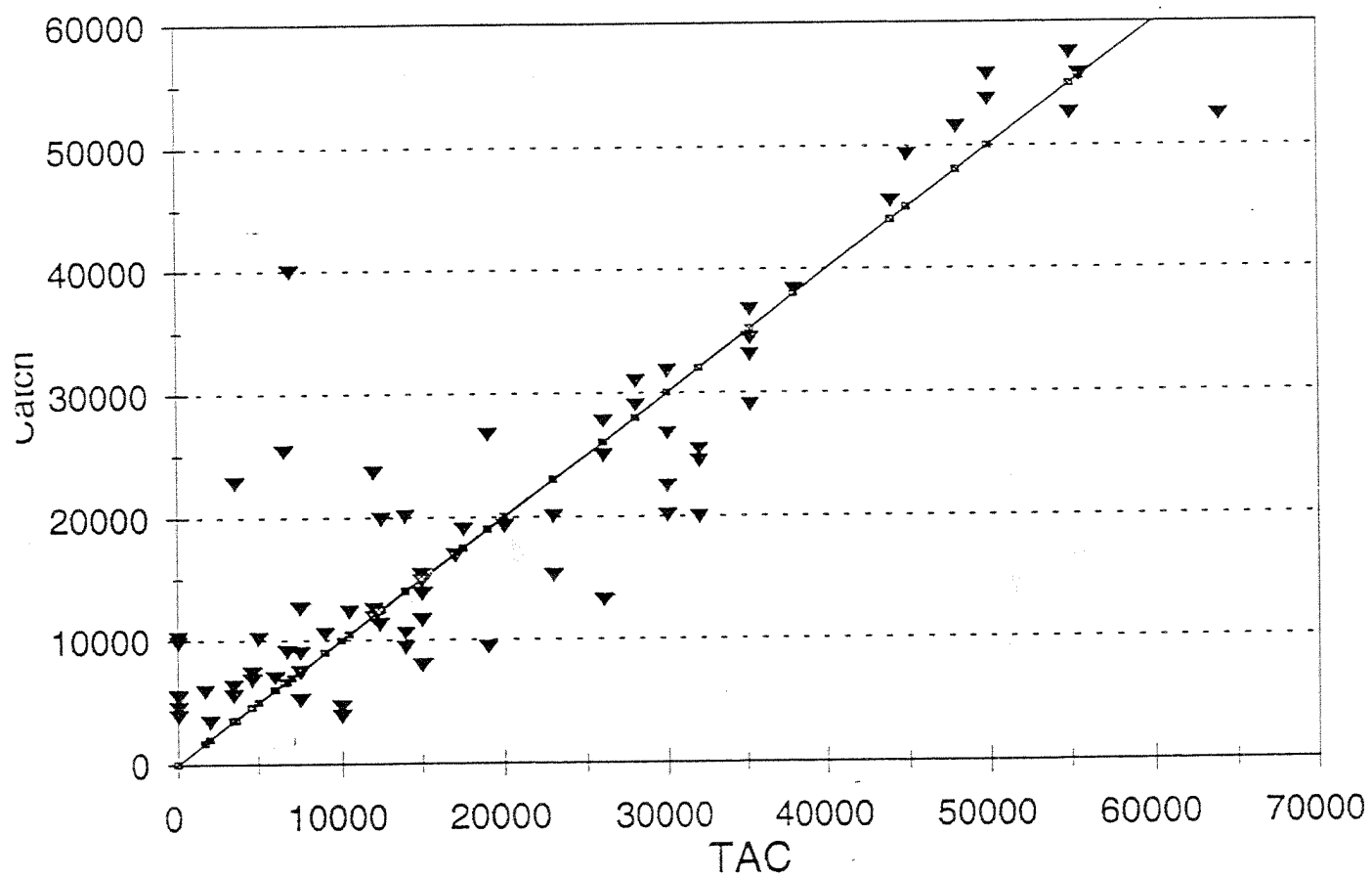
#### General Discussion

It was concluded that the information presented on advice, TACs, and landings was sufficient to draw some general conclusions on this key component of management. There are some observations that are common to all five management units. The TAC has not limited fishing mortality for much of the time period under review. However, the allocations to the most active sectors of the fleet may have limited fishing mortality. When the scientific advice has indicated the need for substantive decreases in landings in order to meet harvesting rate targets, the TACs set by the Minister of DFO have frequently been set at a level higher than the advice (e.g., years 1984 to 1989 for 4X cod in Figure 24). Also during such periods of declining fish biomass, the recorded landings have tended to exceed the TACs (which were set higher than the advice). In addition, for all five management units there have been time periods when the scientific advice and the associated TACs were sufficiently high relative to resource availability that fishing effort was essentially unregulated (e.g., 1981 to 1985 for 4VW haddock and 1990 to 1992 for 4Vn cod). Throughout the time period, markets for cod and haddock have been strong indicating that when the landings fell short of the TAC this result was probably not due to market limitations. The comparison between recorded landings and TACs for the overall data set is shown in Figure 27. Although the TACs did tend to limit fishing effort, they have not restricted it to the target levels. Paradoxically, the overshoots (i.e., landings exceeding TACs) and undershoots (i.e., TAC unrestrictive) do not seem to generate obvious increases in fishing mortality. However, during recent years when the TAC has been restrictive for 4Vn cod, 4VsW cod, 4X cod, and 5Z cod, the fishing mortalities have increased (clearest for 4VsW and 5Z in Figures 3 and 10). Also due to the multi-species nature of the groundfish fishery, it is not in practical terms possible to limit fishing mortality to low levels when the scientific advice calls for "lowest possible catch". The by-catch provisions that are necessary to allow fishing on other stocks generates, in some cases, very high fishing mortalities on the stock for which









the TAC is theoretically zero (e.g., 4VW haddock during 1987 to 1992 for which CAFSAC notes that "present regulations do not appear to have decreased exploitation").

The second approach to summarize the management actions has been to list in chronological order the key measures that have been adopted to regulate fishing effort to meet the diverse objectives. These are listed below:

- 1973 - Limited-entry licences for groundfish announced and freeze placed on construction subsidies.
- 1975 - Licensing policy implemented for vessels  $\geq 65$  ft. Entry frozen for all vessel classes.
- 1976 - Licensing policy implemented for vessels  $< 65$  ft. Freeze lifted for fixed-gear vessels  $< 65$  ft. and for mobile gear vessels of 45 ft. and under.
- 1977 - Extension of jurisdiction to 200 miles and TAC management set at  $F_{0.1}$  instead of  $F_{max}$  (MSY).
  - Detailed management plans first established (quota management set TACs at a relatively low level to allow stocks to rebuild).
- 1979 - Freeze placed on entry to all sectors (November 1978) removed for longline vessels in June 1979.
- 1980 - Freeze reinstated on longline licences.
- 1981 - All fixed gear placed under quota management for all stocks, but all sectors have a closure limit of 3,300 lb. or 10%. A full closure with no by-catch was not anticipated at this time, as quotas were higher and a low by-catch level was required to pursue other species. It was felt that 3,300 lb. trip limits would not result in significant landings, as only the smaller day boats would benefit from trip limits this low.
  - Non-Gulf of St. Lawrence based offshore vessels expelled from 4T except those less than 1,050 BHP. This was implemented to allow a greater percentage for Gulf-based vessels, while large offshore vessels were more mobile and could take advantage of incentives for northern cod and Grand Banks stock. The offshore vessels less than 1,050 HP were smaller side trawlers incapable of fishing great distances.
  - New Groundfish Licensing and Vessel Replacement Policy maintained freeze on entry on an indefinite basis and restricted vessel replacement to 5-ft. increments in length and a maximum of 110% increase in the hold capacity. The new replacement vessels were generally larger, and this policy was implemented to slow the rate of increase without limiting growth to zero. In response to this policy, fishers started to increase the beam of their replacement vessel to maximize their carrying capacity.
  - Mesh size standardized to 130 mm regardless of material, which actually increased the size as nylon, hemp, and manilla nets had been permitted to be 120 mm. The variety of synthetic materials being used was difficult to distinguish, and a single mesh size standard was created.
- 1982 - Sector management introduced for all vessels less than 65 ft. restricting these vessels to three zones - being Gulf, Scotia-Fundy and Newfoundland. Limited access to adjacent areas with exception of authorized (adjacent) and historical overlap privileges.
  - Sector management allowed regions to manage regional inshore vessels to the available Louisbourg stocks without having to account for the potential influx of vessels from other regions.
  - Trial EA program for two large companies initiated. Independent Others Groups remains on competitive quota. Trial EA program designed to reduce race for fish and introduce a more rational fishery with the ability to plan the fishing season.
  - Complete division of sector quotas into present length categories of  $< 65$  ft., 65-100 ft., and

- >100 ft. Prior to this division some of the quotas were for "all vessels <125 ft." or "all mobile gear". Increased competition between gear sectors led to the need to establish fixed percentage shares and the recognized gear/size differences which afforded some a better competitive advantage.
  - Kirby Report released in December.
- 1983 - Overcapacity of inshore first identified.
- Trial EA Program suspended due primarily to the collapse (financial) of the offshore sector.
- 1984 - Following collapse and restructuring of offshore companies and based on 1982 EA trial, EAs introduced for all offshore companies on a five-year trial. Competitive and by-catch quotas still remained for some of the different stocks.
- Hague Line established in October by World Court ending the overlapping jurisdiction on Georges Bank and Gulf of Maine. Canadian quotas now not subject to discussion with the United States.
- 1985 - Revised Atlantic Fisheries regulations which were introduced following year.
- 1986 - Revised regulations allowed regional managers to close a specific quota to zero instead of limited by-catch of 3,300 lb. or 10%. This previous limit was maintained for all FG <45 ft., but eliminated for other fleets. It also allowed trip limits and conditions of licence.
- 4X+5 seminar in Yarmouth, Nova Scotia, defining excess capacity of inshore at four times required to efficiently harvest the resource.
  - Overcapacity of inshore resulted in early closures and increased tension between inshore sectors. Extensive use of licence conditions to spread quota over the calendar year including trip limits and seasonal quotas.
- 1987 - Closure of large area in 4W as a haddock nursery area to reduce the catch of small haddock.
- Overcapacity of inshore resulted in January announcement of licence moratorium for inactive licences, as inactive capacity was capable of taking two times the available quota. The moratorium was designed to remove a small amount of the inactive capacity identified previously following the 4X seminar.
  - Licence moratorium lifted April 16, 1987, due to political pressure, but the Minister of DFO required industry to address overcapacity through committee. The majority of the licences returned became active despite a commitment to the Minister of DFO that this would not be the case.
  - 50% rule for reducing TAC was introduced to cushion any drastic drop in quotas.
  - Extensive use of seasonal limits and quotas continued.
- 1988 - EAs introduced for 65-100 ft. fleet.
- Continuing excess inshore capacity led to greater competition among fleet sectors and earlier closures resulting in further segregation of quotas with division at 45 ft. level for both mobile and fixed gear. FG quotas remained for <65 ft. in 4X+5Z. This was done as smaller vessels could not compete with 45-65 ft. sector who started fishing in January. Extensive use of trip limits continued despite claims that discarding was increasing.
  - Review of offshore EA program initiated as five-year trial period would end December 31.
  - Inshore sector formed Capacity Committee to address overcapacity. Report presented in November.
  - Overcapacity of inshore sector had resulted in temporary transfers from offshore to inshore during 1985-88. These transfers allowed inshore to continue to increase effort.
- 1989 - Temporary transfers from offshore to inshore made permanent; quotas split 60% in favour of MG <65 ft. The transfers were not volunteered by the offshore, but they viewed the permanent reallocation as an end to future temporary reallocations.
- Offshore EA system made permanent following five-year review. While the inshore sector

- did not fully support EAs they did not want a return to the competitive fishery and the seasonal glut of markets.
- In an effort to reduce discarding and area misreporting by inshore MG vessels, combined area and species management system implemented for 4X+5Z. Instead of having trip limits of 10,000 lb. each for cod, haddock, and pollock, a combined trip limit of 30,000 lb. was instituted to prevent discards when vessels were attempting to catch 10,000 lb. of each.
  - Seasonal quotas were quickly caught and MG <65 ft. sector constantly borrowed from next quota. Consequently, the total quota of 4X+5 cod and haddock had been caught by end of June and fishery closed for majority of MG vessels less than 65 ft.
  - The increased effort combined with decreasing quotas resulted in a further fleet division in MG where the <45 ft. sector was divided into specialist sector (44 ft., 11 in.) and generalist sector (directing mainly on flounder). The end of June closure did not apply to the generalist sector.
  - Discussion under way to try and implement recommendations of Capacity Committee and to introduce a new licensing and Vessel Replacement Policy (which mainly resulted in adoption of cubic capacity for vessel replacement rules instead of length, i.e., 5 ft. increments, and 110% hold capacity).
  - Early closure of MG <65 ft. escalated overcapacity situation and J.-E. Haché requested by Minister T. Siddon to establish a Task Force to address overcapacity. Report by Industry Capacity Committee not acted upon.
  - Public hearings held during 1989 and Task Force report presented to Cabinet by the end of the year.
- 1990 - Task Force Report accepted by Cabinet and discussions to implement recommendations continued throughout the year, primarily in developing IQ system (as MG <65 ft. was ordered by the Minister of DFO to implement IQ formula). Guidelines were developed for 1991 through MG <65 ft. Working Group.
- Quasi boat quota or monthly trip.
  - Limit established in 4X+5Z for MG <65 ft. (excluding generalists). Quota management on Georges Bank disbanded in lieu of eight trips of 35,000 lb. for each vessel.
- 1991 - IQs implemented for 4VWX CHP, and generalist sector confirmed for those choosing "generalists" in 1989-90.
- Eight trips with limits of 35,000 on Georges Bank for MG <65 ft. in lieu of quota management.
  - Dockside Monitoring for IQ fleet introduced.
  - Mesh size increase announced for March 1 at 140 mm square or 155 diamond. Reduced by Ministerial Press Release to 130 mm square or 140 mm diamond in July.
  - 3:2:1 quota exchange policy approved for IQ fleet, and regulations allowed for administrative sanctions.
  - Reduced offshore share of 4Vn (J-A) cod and Gulf redfish in favour of inshore Gulf fleet.
  - Handline licensing policy introduced which required all commercial handline fishers to be licensed.
  - Experimental gillnet area in Canso made permanent.
- 1992 - Limit the number of gillnet vessels less than 65 ft. in 5Z.
- IQs established for 5Z cod and haddock.
  - Moratorium on northern cod in June.
  - 3:2:1 quota exchange cancelled.
  - Dockside monitoring funded by users by end of the year.
  - Test fishery for 15% small fish by count introduced with at-sea monitoring.
- 1993 - Inactive licence freeze.
- Fisheries Resource Conservation Council established and mid-year TAC adjusted.
  - 3,300 lb./10% closure cancelled for FG <45 ft. sector.

- Mandatory landing of all groundfish introduced and minimum fish size removed from regulations.

The chronology of management measures indicates several trends. The growth in fishing capacity, in both fixed and mobile gear, has generated increasingly complex management structures to seasonally distribute the quotas (e.g., trip limits). The increasing levels of restrictions on all components of the groundfish fishery have been termed "micro-management". A second trend has been toward the allocation of quotas to gear sectors, enterprises (EAs), and individual vessels (ITQs). Competitive quotas and "allowances" have been partially replaced by increasingly finer divisions of the overall TAC. In turn, this has influenced the workload of the fishery officers and the requirement for more detailed information on fishing activities.

#### **4.3.2 Analysis of Variation Orders and Licence Conditions (L. Muise)**

Variation orders are issued by the Regional Director-General, Scotia-Fundy Region, in order to vary quota, season, or fish size within a prescribed area of fishing. Licence conditions provide similar local authority to control fishing activities within the framework of the legislated regulations. In order to quantify trends in management activities during the period under review, the variation orders and licence conditions were tabulated and analyzed (by management unit and gear sector) for 1983 to 1993. The numbers of documents issued by year are shown in Table 3. While the number of variation orders issued peaked in 1988, the number (and complexity) of changes to trip limits and fishing seasons continued to increase by licence condition. The majority of variation orders and licence conditions issued up to 1991 affected the mobile gear fleet under 65 ft. In the past two years, however, since the introduction of ITQs most of the changes affected other vessel classes. The reasons for issuing variation orders have changed as the fishery evolved:

- from 1983 to 1986, variation orders were used mainly to close fisheries after the quota had been caught;
- from 1987 to 1990, variation orders were used to control trip limits (and also to close fisheries); and
- from 1991 to 1993, they were used to close fisheries to amend licence conditions, to close for small fish, and to close fisheries when ITQs or global quotas were reached.

In recent years, licence conditions have become the principal tool to control fishing activities:

- from 1986 to 1989, licence conditions were used mainly to control the areas fished and to make prosecutions simpler; and
- from 1990 to 1993, licence conditions were also used to set trip limits, data reporting requirements, close fishing areas, use of port monitors, and restrictions on the type of fishing gear that is permitted. Also several provisions were included that make monitoring of the landings easier for the port monitor or fishery officer.

The evolution from variation orders to licence conditions has decreased the workload for DFO's Regulation Division in Halifax, Nova Scotia, but has substantially increased the administrative load of the fishery officers in the field (see Section 4.3.3).

The analysis quantifies the trend toward micro-management indicated in the chronology of management measures (described in Section 4.3.1). Until recent years, much of the regulatory workload has been directed toward controlling the activity of the mobile gear under 65 ft. and has predominantly involved socio-economic tactics (e.g., spreading out fishing effort). The increased administrative workload for these activities has decreased the resources available for the enforcement function.

# **VARIATION ORDER & LICENCE CONDITIONS** **NUMBER OF DOCUMENTS ISSUED**

## **VARIATION ORDERS**

YR	83	84	85	86	87	88	89	90	91	92	93
#	22	21	42	72	135	171	149	93	41	81	37

## **LICENCE CONDITIONS**

YR	83	84	85	86	87	88	89	90	91	92	93
#	0	0	0	0	0	0	0	47	25	31	30

NOTE: DOES NOT INCLUDE TIMES FISHERMEN WOULD CHANGE AREAS OR  
 SEEK AMENDMENTS ON THEIR OWNE.

## **TOTAL**

YR	83	84	85	86	87	88	89	90	91	92	93
#	22	21	42	72	135	171	149	140	67	112	67

### 4.3.3 Documentation of Enforcement Activities (R.B. Barnes, C.E. Goodwin, and R. Schiochetti)

The enforcement activities were analyzed in two ways. The effectiveness of enforcement at the points of landings (at-shore enforcement by fishery officers) was qualitatively evaluated by personal experiences of selected field personnel. In addition, the workload of three Sub-District Offices in southwestern Nova Scotia were analyzed in order to draw conclusions on time available for enforcement of groundfish regulations. The second approach was to summarize, in chronological form, the enforcement of fishing activities at sea.

**4.3.3.1 Land-Based Enforcement:** For the three busy southwestern Nova Scotia Sub-District Offices analyzed with respect to the average workload, between 58% to 66% of their time involved administrative tasks (Table 4). Of the remaining time available, between 3% and 18% was spent on groundfish enforcement. It was estimated that the administrative load for fishery officers has grown from 10% to 20% of the overall workload at extension of jurisdiction to the above estimate of about 60%. This conclusion is consistent with the inference made in Section 4.3.2 from the analysis of temporal trends in licence conditions.

Some general observations from personal experiences of fishery officers are:

- too many landings at various wharves (24 hours per day, 7 days per week); monitoring levels have generally been low;
- insufficient resources for enforcement activities to curb illegal fishing and to regulate species landed on trip limits;
- lack of weighing stations at wharveside;
- probability of illegal landings being detected during the 1980s was low. However, better enforcement practices are in the process of being developed;
- technical requirements that need to be proven in court for successful prosecution result in a high percentage of unsuccessful cases. "Due diligence" defences have often been accepted by courts. The maximum fine of \$5,000 until recent years has provided a low level of deterrence;
- many fishers in the late 1970s and 1980s believed that court fines and legal bills were simply a "business expense" and, as such, infractions did not curb illegal landings of groundfish. Some cases were not resolved for up to three years. Also, justices in many areas have not been supportive of conservation objectives. As a result, any excuse by fishers often resulted in "not guilty" decisions;
- the development of EAs has brought about an increase in highgrading and discarding. Fishing captains complain of a "shopping list" mentality by fleet captains which encouraged the above-noted wasteful fishing practices;
- restrictive IQ systems have generally brought about the same consequences; and
- by the fall of 1993, fixed gear were bringing in the smallest groundfish. Highgrading, dumping, and misreporting by area are becoming more common by this gear sector, as "allowances" are being replaced by stricter sector quotas and trip limits.

It was concluded that enforcement efforts at points of landing have had a limited effect on curbing illegal landings in the 1980s and illegal fishing practices for groundfish at sea. The importance of ensuring a high level of at-sea compliance, coupled with adequate deterrence systems for violators, was stressed.

**4.3.3.2 Offshore Enforcement:** Prior to the extension of jurisdiction, steps were taken to enhance the at-sea enforcement capability of DFO. The following is a chronology of enforcement activities with some estimates of the resource requirements (and their shortfalls) to meet surveillance targets:



Estimation of workload for three DFO Sub-District Offices in  
Southwest Nova Scotia During the Recent Time Period (Early 1990s)

**F/S Offices - SWNS**

	#1	#2	#3
<b>ADMINISTRATION</b>	63.6%	57.5%	66%
- Briefing	.7%	.2%	.3%
- Equipment Maint.	1.9%	2.1%	2.6%
- General Office	28.0%	15.4%	26.5%
- Licensing	10.6%	19.1%	7.1%
- Meetings	8.5%	6.1%	5.5%
- Public Relations	.6%	.3%	.5%
- Statistics	2.0%	.8%	.1%
- Training	2.3%	2.3%	5.5%
- Vacation	8.2%	8.3%	10.5%
<b>ENFORCEMENT</b>	36.1%	41.1%	34.0%
- Gaspereau	.2%	.1%	.7%
- Aquaculture	-	.1%	Bass .6%
- Shellfish Closed Areas	.5%	.1%	5.3%
- Clams	.1%	-	3.0%
- Groundfish EA	.9%	.1%	-
- Groundfish Gen	1.4%	2.0%	.4%
- Groundfish FG	4.1%	15.2%	.1%
- Groundfish MG	.9%	.2%	1.9%
- Habitat	1.8%	1.2%	3.3%
- Herring MG	-	.5%	.1%
- Lobster Inshore	12.6%	13.8%	9.8%
- Native Food Fish	.1%	.7%	-
- Salmon	5.0%	2.0%	2.5%
- Scallops (Off)	3.7%	-	.1%
- Scallops (Ins)	.2%	-	2.3%
- Swordfish	.1%	1.0%	1.3%
- Trout	.2%	-	2.0%
- Tuna	.1%	3.9%	.3%

- March 18, 1976, Cabinet directed the implementation of the following surveillance and enforcement coverage levels: monthly boardings of one-third of the foreign fleet and one-sixth of the domestic fleet; air patrols sufficient to permit location and identification of every fishing vessel in the offshore once per week throughout the year; and additional 20% reserve for areas of greater concern.
- November 1976, nine new offshore surveillance officers (OSOs) were hired to perform offshore surveillance duties aboard the patrol vessels and aircraft increasing the total complement from 6 to 15 effective January 1, 1977. In 1978, four more were added to the Corps to replace some who had been assigned other duties, i.e., Observer Program, foreign licensing, and supervision.
- During 1977 and 1978, DFO concentrated surveillance activities on foreign fishing to enforce the extension of fisheries jurisdiction.
- In 1977, FPV LOUISBOURG was built and added to the Scotia-Fundy Region fleet of patrol vessels, consisting of the CHEBUCTO and CYGNUS, which at that time were programmed to provide about 200 sea days each per year. This added a potential increase of approximately 180 sea days to the dedicated fisheries sea patrol effort. The main drawback regarding the LOUISBOURG was her inability to withstand rough sea conditions, inability to attain maximum planned speed, and high service and maintenance costs and down times due to highly sophisticated foreign-built machinery, i.e., German-built engines.
- In 1977 on the East Coast, there were about 16 recorded violations of foreign vessels with fines ranging from \$1,000 to \$5,000, and three domestic violations with fines and confiscations of \$200 to \$1,000.
- In order to increase annual sea days for DFO vessels from about 180 days to 270 days, the use of two complete crews was introduced on a trial basis in 1978 and implemented later in the year due to its success.
- In August 1978, Cabinet implemented a \$2.8 million reduction in the surveillance and enforcement budget. Cabinet-authorized levels of sea and air patrols were not achieved in 1977 and 1978 due to lack of resources. However, due to the work of the OSOs aboard the CHEBUCTO and CYGNUS, foreign boarding targets were exceeded; however, the domestic target of 17% of total effort per month fell considerably short.
- In 1978, there were nine recorded foreign violations with fines ranging from \$2,500 to over \$30,000. There were no domestic violations recorded for this period.
- By 1979, non-compliance by domestic fishing vessels was beginning to emerge as a growing problem. Increased levels of surveillance and inspection of both foreign and domestic fleets were seen as being necessary for two purposes: 1) deterrence; and 2) production of crucial management information. The low levels of penalties and low probability of being caught in an illegal act vs. the potential gain from illegal fishing was recognized as the primary equation influencing compliance. The balancing of penalties and the surveillance program began to involve major political considerations and operational cost effectiveness. Enforcement emphasis continued on the foreign fleet but remained low on domestic activities.
- In October 1984, the World Court at the Hague established the Canada/United States Boundary on Georges Bank and enforcement effort immediately shifted to this new priority, as it became immediately apparent that Canadian sovereignty would have to be firmly established to prevent illegal exploitation of fish stocks from the large potential American effort.
- In June 1986, Cabinet approved an initiative to re-arm the Atlantic patrol vessels in response to a high incidence of illegal intrusions by American vessels fishing the scallop and groundfish resources on the Canadian side of the Hague Line. Equipment was purchased and special training was provided to equip OSOs and crew members to forcibly stop vessels at sea and conduct armed boardings to arrest perpetrators. By January 1988, the Armed Boarding Program was fully operational.
- Circa 1987, the management of the offshore patrol vessels was moved from Queen's Wharf, Halifax, Nova Scotia. Patrol vessels and science vessels were managed on a comprehensive fleet basis, thus improving efficiency. An additional 60+ sea days were derived from the two offshore vessels, CYGNUS and CHEBUCTO (bringing the total to 600 per annum of available days). Also, over the next five years the utilization of area patrol vessels improved dramatically under a revised management program.
- In 1989, the troublesome engines of the LOUISBOURG were replaced with North American

manufactured ones, and the utilization of the vessel dramatically improved. The enforcement capabilities of this vessel were then directed to the coastal nearshore fisheries throughout the Scotia-Fundy Region (i.e., lobster and herring, the groundfish closure on Browns Bank, Bay of Fundy fisheries, gillnet closed areas, offshore/inshore scallop boundaries, Tuna Hell Hole fishery, and assistance to the Gulf Region and eastern Nova Scotia crab fisheries).

- April 1, 1989, a DFO helicopter was established in Yarmouth with the primary tasks of fisheries surveillance and search and rescue. The helicopter was immediately tasked with surveillance of the groundfish, scallop, and lobster fisheries and had sufficient operational funding to fly an average of 725 hours per annum for the period April 22, 1989, to March 31, 1993. This current fiscal year (1993/94), it is anticipated that the flying time will be reduced to 440 hours due to severe fiscal problems within the Scotia-Fundy Region. This is a net loss to enforcement from this platform of 285 hours over previous years. Of the total helicopter flying time, 42.5% is dedicated to groundfish enforcement.
- In 1990, due to budget problems, the operation of the LOUISBOURG was reduced. The vessel was removed from service for the winter period of December 15, 1990, through March 15, 1991. The vessel was programmed to achieve approximately 200 sea days in 1991, but approximately 60 days of effective surveillance time was lost through the necessity to return to the port of Halifax for a crew rest approximately every two weeks.
- On April 1, 1990, the Department of National Defence (DND) Tracker Program used for Aerial Surveillance was replaced by a three-year private sector contract utilizing a Beech King Air 200 aircraft with highly sophisticated radar, navigational, and data management systems. Funding was sufficient to provide aerial flights four to five days per week. Annual surveillance hours expended were: 1990/91 - 1,363 hours; 1991/92 - 1,291 hours; 1992/93 - 1,157 hours; and 1993/94 - 1,068 projected hours. Inflation and budget cuts have resulted in a 573-hour reduction in the fixed-wing program flying time over the four fiscal year periods compared to the first year of operation. This equates to 115 flights over four years. An average of 3,300 individual vessel sightings and identifications were recorded each year for the past three years, of which 500 per year were foreign fishing vessels. This information is used to identify fleet locations and movements, patrol planning, and direct enforcement of licence conditions regarding fishing areas and closures. 75% of fixed-wing flying time is dedicated to groundfish; 62% of detected violations were groundfish. The Tracker aircraft provided approximately 750 hours of dedicated fisheries surveillance time of which only 55-60% of the time was effective time over the fishing grounds due to the transit time from Summerside, Prince Edward Island. In addition, DND supplied about 500 hours of multi-tasked time without the presence of a fishery officer. These flights proved non-effective in terms of detecting infractions; however, vessel sighting information was fed into the system for reference purposes. The major drawbacks of the Tracker Program, in addition to the transit time from Summerside, were the limitations of the aircraft in terms of navigational accuracy (two miles), limited radar capabilities, and no onboard data management capabilities.
- On December 17, 1991, Canada and the United States implemented a formal reciprocal enforcement agreement pertaining to its boundaries on the East and West Coasts of Canada. The agreement, which has positive enforcement ramifications regarding the Hague Line, made it unlawful for the vessels of one country to enter or fish in the waters of the other without a licence to do so. The agreement represented the end of the Armed Boarding Program aboard Scotia-Fundy Region offshore patrol vessels, CYGNUS and CHEBUCTO. Approximately 54 vessels have been detected and prosecuted through the joint efforts of DFO, the United States Coast Guard, and the National Marine Fisheries Service since the agreement.
- On July 31, 1992, the LOUISBOURG was removed from service in the Scotia-Fundy Region due to budgetary problems arising from the Region's requirement to maintain the Yarmouth helicopter program. The Tuna Hell Hole was covered off through use of Canadian Coast Guard Search and Rescue vessels, i.e., MARY HITCHENS and ALERT. However, the seasonalization of the LOUISBOURG and its eventual elimination reduced coastal coverage of important fisheries, including groundfish, by more than 200 potential sea days.

Approximately 50% of the 600 available offshore sea days (CYGNUS and CHEBUCTO) is dedicated to groundfish enforcement. The total requirement for offshore surveillance in the Scotia-Fundy Region is 980 sea days; 600 can be supplied by the two vessels, leaving a shortfall of 380 days.

The seven coastal patrol vessels operated by the areas produce about 1,000 sea days per year of which approximately 300 days are required for groundfish enforcement and 1,300 days for other fisheries leaving a shortfall of approximately 600 days.

A qualitative analysis of the results of enforcement of selected management initiatives was presented based on personal experience of senior offshore enforcement staff. Their observations and conclusions are summarized here.

The first challenges subsequent to the extension of jurisdiction were to enforce the regulations imposed on the foreign fleets fishing within Canadian waters, as well as to initiate offshore enforcement of domestic fisheries that were under new "F<sub>0.1</sub> management plans". The emphasis was on coverage of foreign fleets with observers (50 to 60%). Approximately 5% of the 20,000 days of "offshore" fishing by domestic vessels >100 ft. was covered by observers. Reports emerged of dumping, discarding, misreporting of species and area, use of liners, and fishing in closed areas by this sector. In this early period of post-extension of jurisdiction management, there was not a lot of concern about reports of infractions as stocks seemed to be recovering. Indicators of performance and effectiveness were considered to be: boardings, sea days, and flying hours rather than cost/benefit analysis, detection rates, or successful prosecutions.

The introduction of EAs, sector management, and the division of quota in vessel categories in the early to mid 1980s significantly increased the offshore enforcement mandate to:

- detect misreporting by area;
- patrol sector lines to prevent illegal intrusion by vessels not licensed to fish in that sector;
- enforce quota closures for management units that were adjacent to open areas;
- enforcement of closures by vessel length; and
- reduce dumping, highgrading exacerbated by EAs.

As a result of "micro-management" the primary role of aerial surveillance switched from the routine identification of vessels and fleet movements to the detection of violations.

For foreign fisheries, emphasis was placed on correcting conversion factors and cost recovery. As a result of these two initiatives, a significant increase in conversion factors used for the production of cod in the French fishery (4Vn, 4RS, 3P), for cod and silver hake on the Scotian Shelf, and 100% observer coverage on foreign fishing vessels at no cost to Canada was achieved. As the Observer Program demonstrated effectiveness in monitoring compliance to regulations for the foreign vessels, the efforts of the patrol vessels and aircraft shifted in focus to domestic offshore trawlers and the expanding small dragger fleet and the Canada/United States boundary. The latter highly mobile domestic vessels ranged throughout the Scotian Shelf violating closed areas under the cover of darkness and adverse weather conditions, and landed illegal catches of cod, haddock, and pollock ashore at night in the numerous ports throughout the Region. The use of boom trucks on the wharves facilitated the speed with which these covert operations could be carried out, making detection difficult. The introduction of EAs in 1982 provided an avenue for the offshore vessels to be in any "open" area on a year-round basis; and there was an increased incentive for dumping, discarding, and highgrading of catches, as well as misreporting of area. Air surveillance and inspections at sea have not been effective in curbing these illegal fishing practices. As a result, 100% observer coverage on the domestic offshore fleet was recommended and accepted by the Haché Task Force. The actual coverage is shown in Table 5. Given the resources available and the lack of cost recovery, the coverage is not considered to have been sufficient to curb much of the at-sea illegal fishing practices.

Table 5. Domestic coverage levels for Scotia-Fundy Observer Program (1979 to 1993)

Year	Large Vessels (>100 Ft.)	Smaller Vessels (<100 Ft.)
1979	6%	--
1980	7%	--
1981	15%	--
1982	9%	1%
1983	8%	--
1984	9%	1%
1985	8%	1%
1986	9%	--
1987	16%	< 1%
1988	18%	< 1%
1989	25%	< 1%
1990	20%	1%
1991	20%	1%
1992	25%	1%
1993	40%	1%

In contrast to the lack of success in offshore enforcement of the domestic mobile fleet, there has been considerable success in curbing illegal fishing by American vessels in Canadian waters. Also there has been considerable success in preventing domestic fleets from fishing in closed areas (Browns and Georges Bank spawning closures and Western Bank haddock nursery area closure). The use of air surveillance by fixed and rotary wing and patrol vessels is felt to be effective.

ITQs introduced in 1990 significantly increased the enforcement requirements at sea, from being fleet specific to vessel specific. The major enforcement constraints have been the lack of an integrated computerized system to ensure timely dissemination of licensing information and the lack of ability to track a fishing trip from start to finish. The major side effects of the new ITQ program (as has been the case for EAs) have been dumping, discarding, and highgrading of catches at sea which are undetectable by conventional means and presently unenforceable. The implementation of trip limits as a management tool for fixed (and mobile gear not on ITQs) has generated similar problems which are equally difficult to detect/prosecute, and foster dumping, discarding, highgrading, illegal transfers at sea, and non-reported landings.

In sum, the offshore enforcement activities have been very successful at enforcing regulations imposed on the foreign vessels (including American illegal fishing on Georges Bank). They have also been moderately effective in enforcing closed areas. It is concluded, however, that offshore enforcement (as is the case for land-based activities) has not been effective in enforcing other categories of illegal fishing activities at sea (use of correct gear, transshipping, dumping, discarding, highgrading). It was also concluded that the incentives for illegal fishing practices have increased with the introduction of EAs and ITQs (and that as a result they have increased). This conclusion (for the EA vessels) is supported by the observations of the observers (see Section 4.4.2).

During the discussion of the enforcement information, it was concluded that it is difficult to evaluate the degree of effectiveness of enforcement activities with the present documentation. The conclusions thus are considered to be the "best estimates" of experts most closely involved. There was, however, agreement that current management plans have created a situation where effective enforcement is very difficult at best with available resources.

#### **4.3.4 Analysis of Trends in Effort (S. Gavaris)**

In Section 4.2, trends in the resources for the groundfish management units are described. Overall for most management units, there have been declines since the mid 1980s (with the exception of 4X cod and Scotian Shelf pollock). In Section 4.3.1, the management actions to control fishing effort to track the trends in biomass (and thus to generate a relatively constant and low harvesting rate) are also described. In this section, the trends in fishing effort itself (estimated as numbers of trips per year by gear sector and vessel category) are described in relation to the above trends in biomass and quota. The effort trends from 1977 to 1992 are shown in Figures 28 through 30.

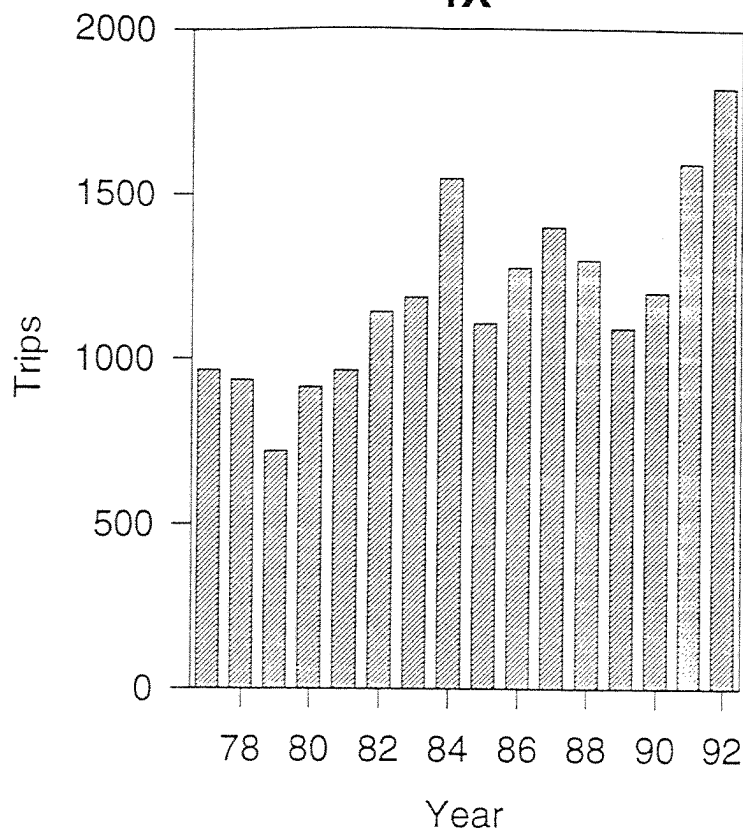
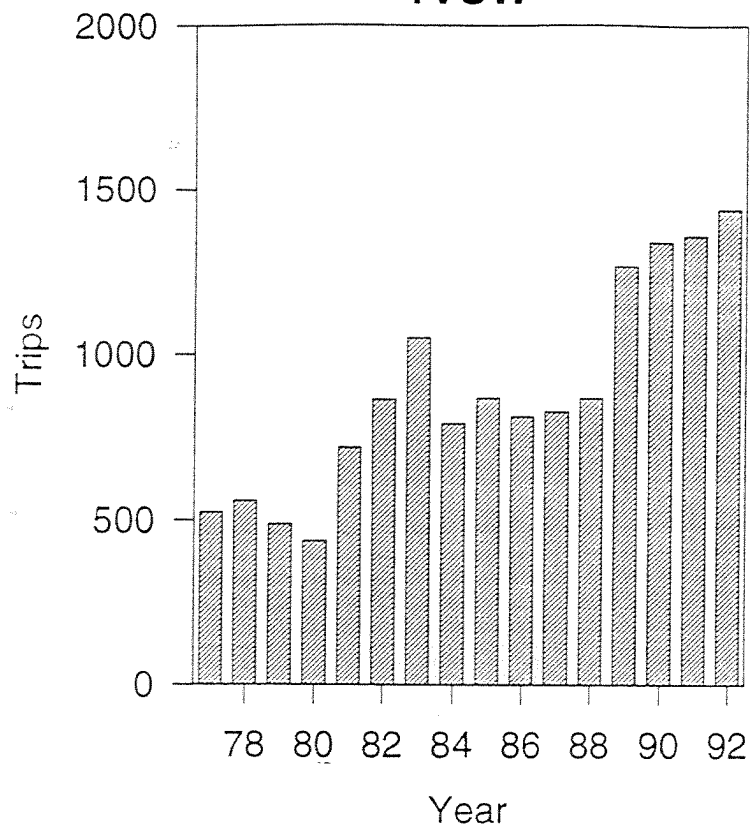
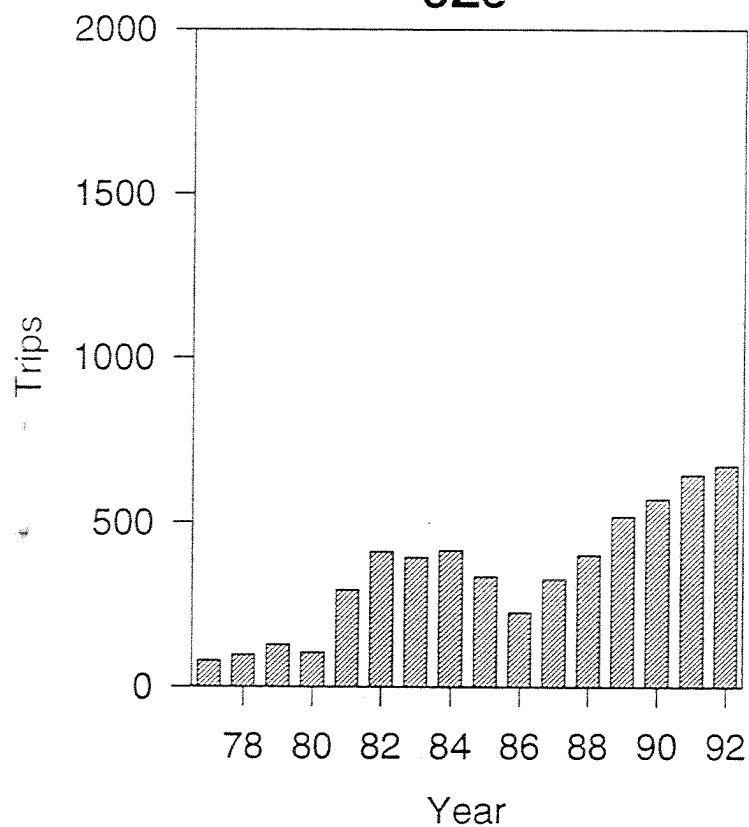
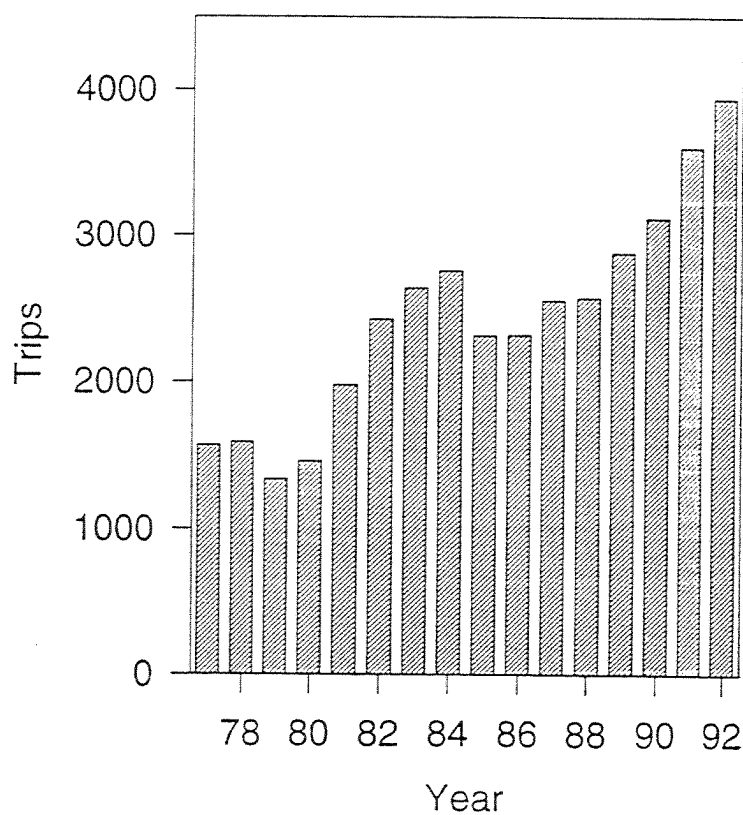
Tonnage Class 2+3 longliners show a steady increase everywhere, and in total their annual effort appears to have tripled (Figure 28). The annual effort of Tonnage Class 2+3 otter trawlers (i.e., vessels less than 65 ft.) increased in 4VsW until the late 1980s (Figure 29) and has subsequently decreased sharply. In 4X and 5Z, however, the effort has stabilized since 1986. The decrease in fishing effort in 1989 was due to the early June closure that year. There has not been a decrease in annual fishing effort within 4X and 5 by this fleet sector as the cod and haddock stocks have declined (see Figures 5, 8, 12, and 14). Tonnage Class 4+5 otter trawlers (greater than 65 ft.) had an increase in number of trips on the eastern Scotian Shelf during the early 1980s which has subsequently stabilized (Figure 30). There has been a decrease in number of trips by this gear sector in 4X and 5 during the mid 1980s, but it has subsequently remained stable.

**4VsW**

77

**4X**

Figure 28

**5Ze****Total**

Total trips for tonnage class 2 and 3 longliners fishing groundfish in 4VsW, 4X and 5Ze.

**4VsW**

78

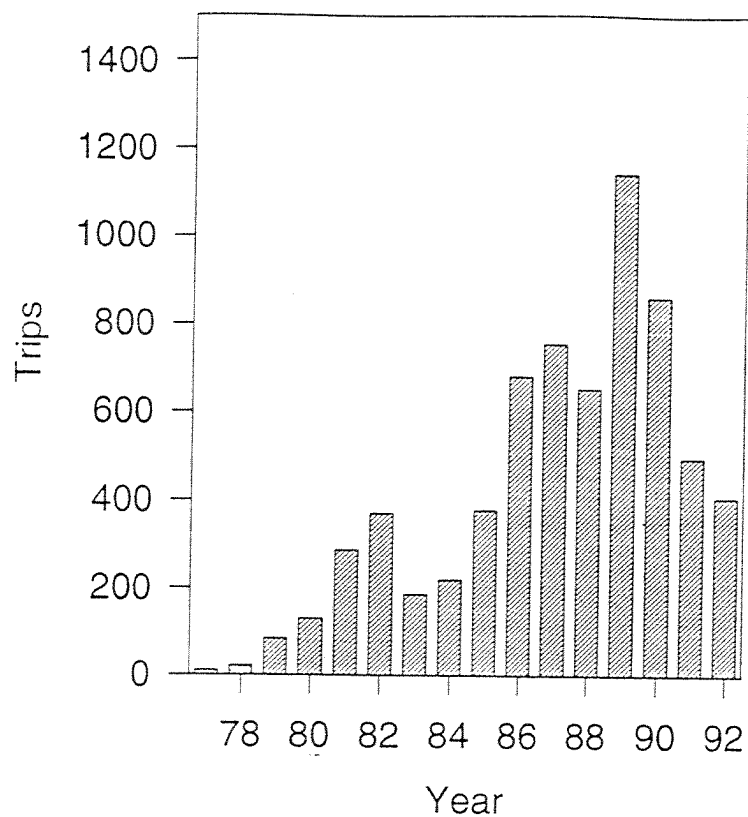
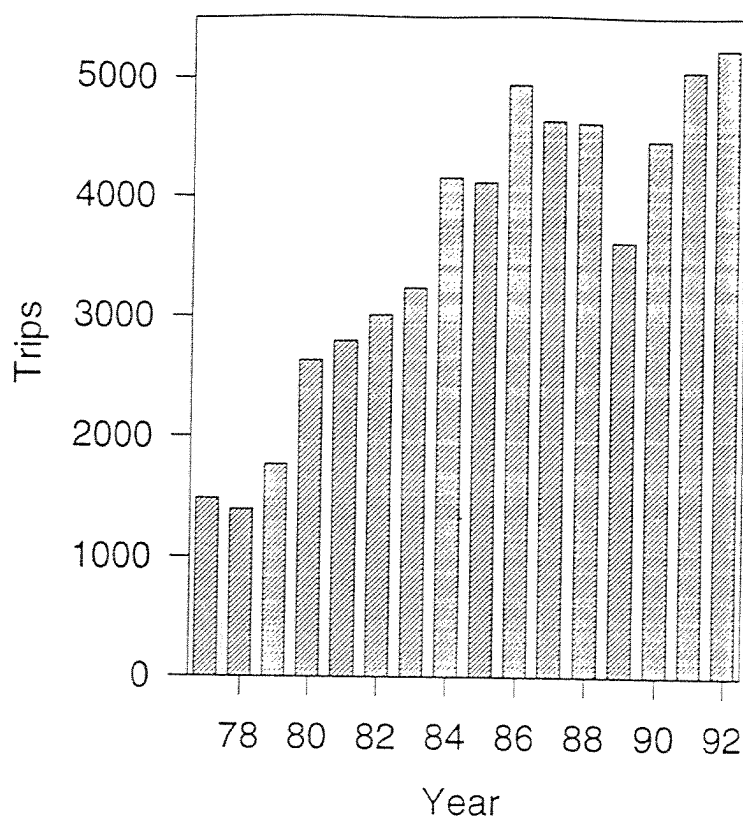
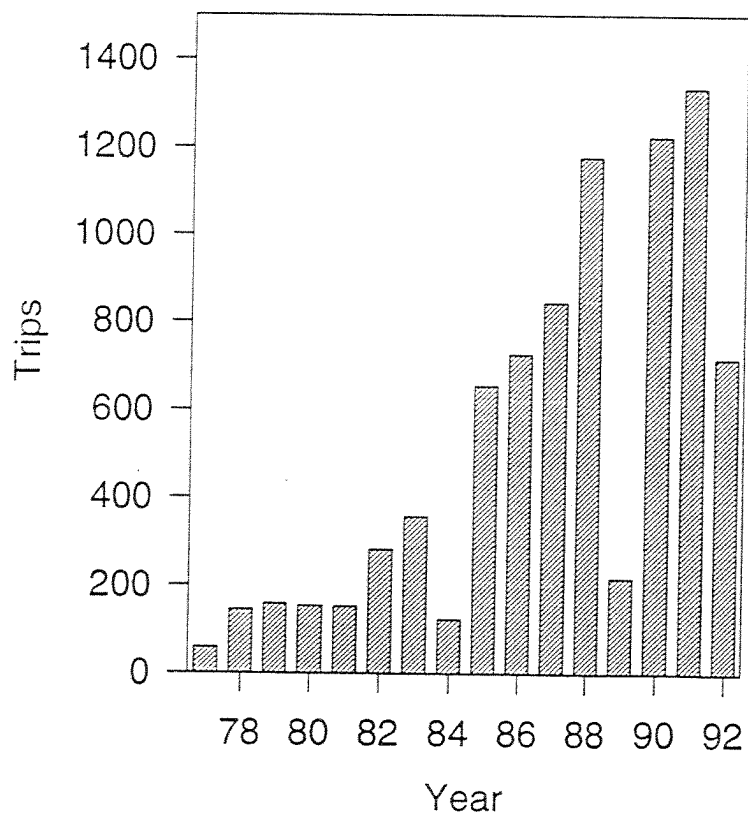
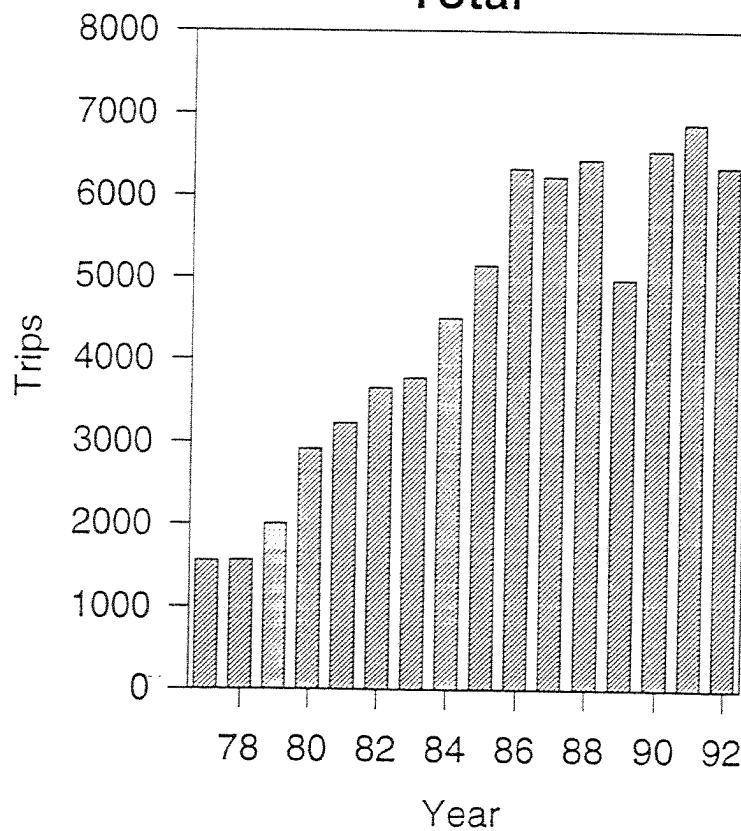
**4X**

Figure 29

**5Ze****Total**

Total trips for tonnage class 2 and 3 stern trawlers fishing groundfish in 4VsW, 4X and 5Ze.



**4VsW**

79

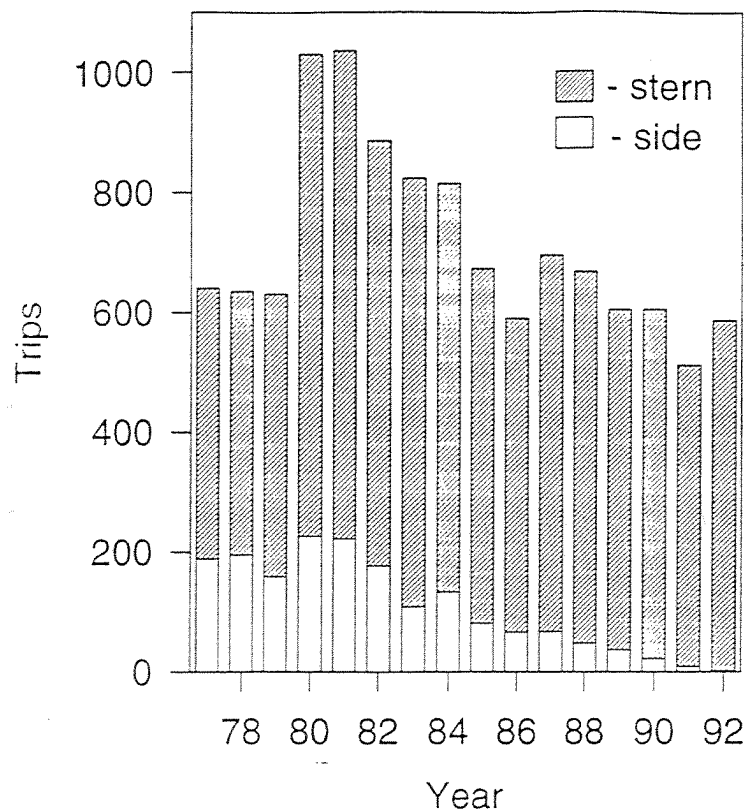
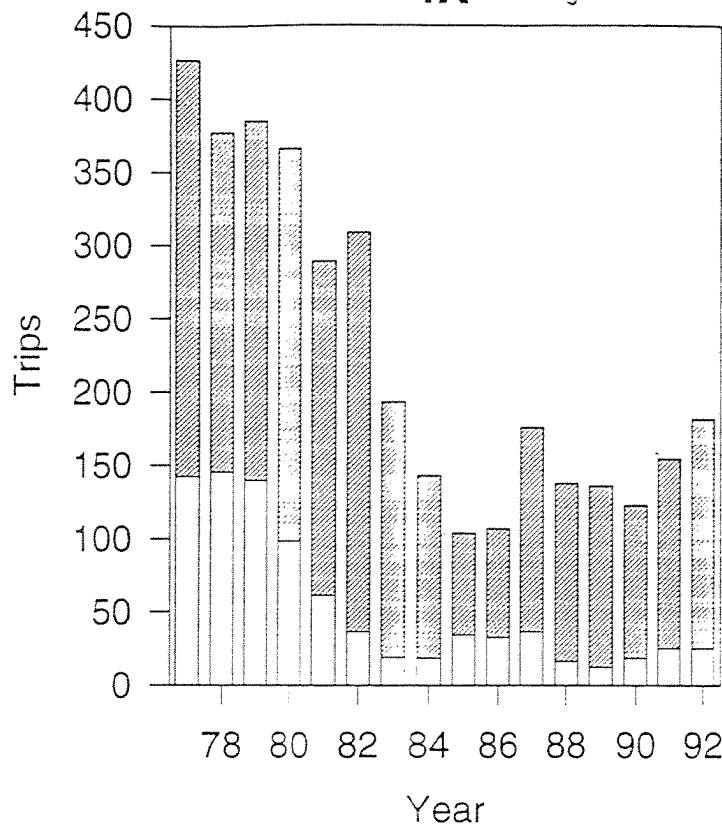
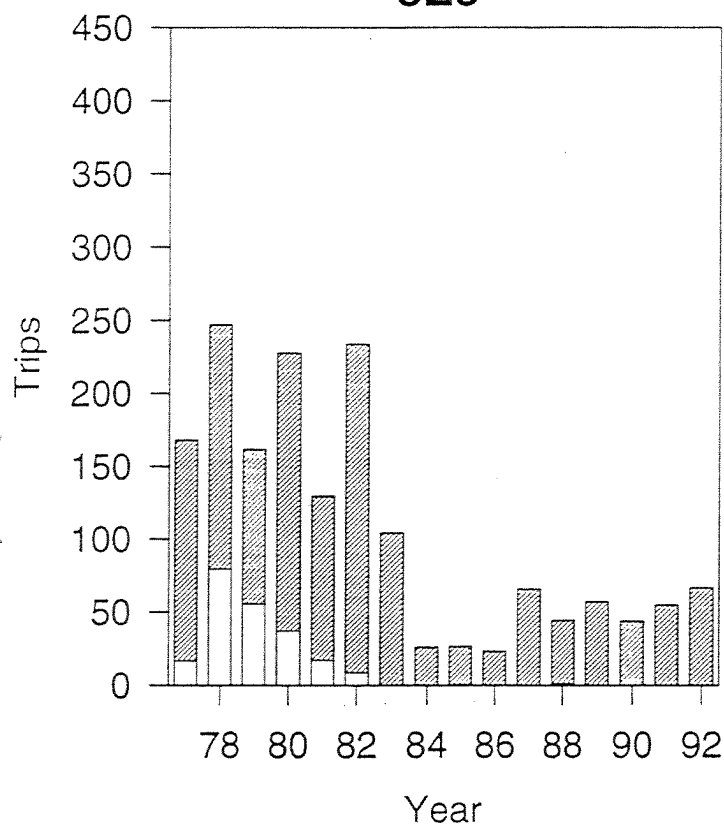
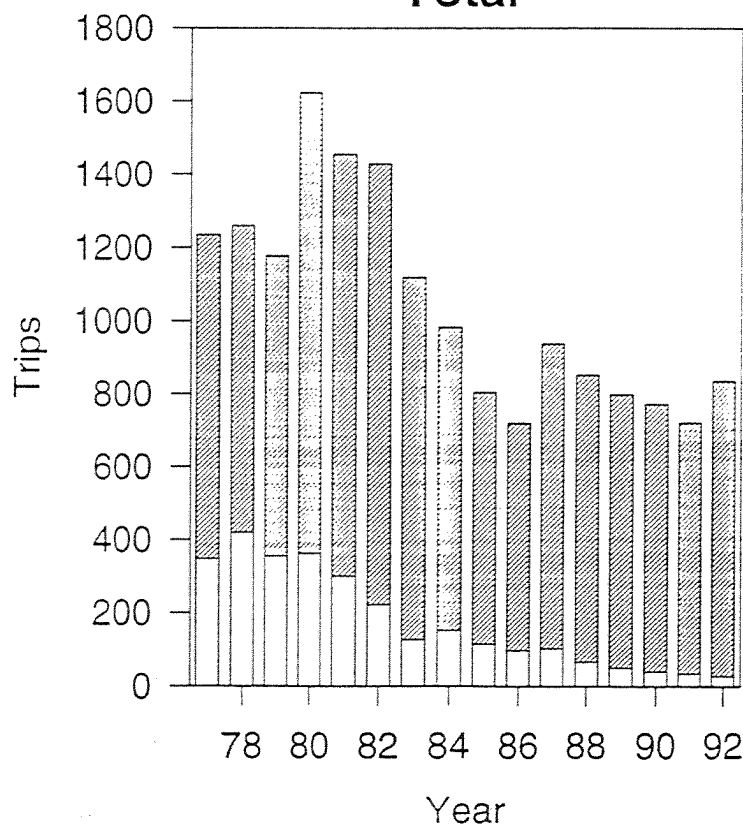
**4X**

Figure 30

**5Ze****Total**

Total trips for tonnage class 4 and 5 side and stern trawlers fishing groundfish in 4VsW, 4X and 5Ze.

It is noted that the length of trips has shown no trends over time, but the technology has improved substantially (navigation and fish finding capability). Thus, the "effective effort" may have increased at a faster rate than shown in the above-noted figures. Various restrictions on efficiency such as trip limits, however, have also had a restrictive effect on "effective effort".

Although the data base has many limitations and deficiencies, there was a general consensus that it was adequate for providing a "broad brush" picture of trends in effort. There has been a general increase in effort for most sectors since extension of jurisdiction in 1977. The mobile gear effort has been relatively constant since the mid 1980s, but the fixed gear has increased continually. Effort has not declined in response to declines in biomass since the mid 1980s. Furthermore, there does not appear to have been a decrease in annual effort since the introduction of EAs in 1984 (Figure 30). Note that the drop in fishing effort in the early 1980s by the offshore draggers was due to allocation shifts (northern cod allocations were up and less quota was allocated to this fleet sector in 4VWX).

**4.3.4.1 Trends in Fuel Consumption (G.L. Brander):** An alternative approach to evaluating trends in fishing effort considered fuel consumption for Nova Scotia fisheries in aggregate (lobster, scallops, pelagics, and groundfish). If broad-scale under-reporting of fishing effort is suspected, and if it has increased over time, then the trend should be apparent in fuel consumption data.

The fuel consumption time series is sufficiently sensitive to groundfish effort to see even relatively small changes. When the inshore dragger fleet of 300 vessels fished until its annual quota was used up by June 1989, the fuel data show a marked year-to-year increase in fuel consumed in the first half of 1989, and a corresponding decrease in the second half. No other fleets were affected by this closure.

Fuel data were available only for the time period 1979 to 1992. Aggregate fuel consumption increased rapidly from 1979 to 1983 and has remained relatively stable since that time (Figure 31). During the 1979 to 1983 period, the inshore dragger fishers were rapidly replacing smaller boats with "jumbo 44s," and the offshore groundfish fleet was increasing effort in the distant northern cod fishery. These events are probably sufficient to explain the increase in fuel consumption during that period. The data infer relative stability in overall fishing effort since 1983.

#### **4.3.5 Assessment of Enterprise Allocations, Individual Transferable Quota Fleet (D. Liew and R.M. Barbara)**

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The introduction of EAs in 1982 and ITQs in 1991 were fundamental shifts in the management strategy for achieving the objective of economic performance. One aim of these new property approaches to quota management was to reduce fishing capacity. In the analysis of capacity changes, several terms were defined. "Licensed capacity" is the capacity licensed to fish groundfish (active and inactive), whereas "active capacity" is the capacity of vessels which actually fished groundfish at some time during the year. For the active capacity component, a distinction was made between the portion of the active (annual) capacity that is directed at groundfish. This portion is defined as the "utilized active capacity". The remaining portion of the active (annual) capacity that is not directed at groundfish is defined as "unutilized".

##### Mobile Gear <65 Ft.

There were 455 mobile gear licences in Scotia-Fundy which could be activated at will before the ITQ program. As of November 1993, 325 licences have chosen to be in the ITQ program, 50 licences have opted for the Generalist program, 74 have chosen the fixed-gear option, and six licences have been cancelled. Of the 325 licences that have chosen the ITQ program, 68 have been banked, leaving 257 actively licensed. Finally, 24 of these actively licensed vessels did not fish

# FUEL CONSUMPTION and LANDINGS

## Nova Scotia Fisheries

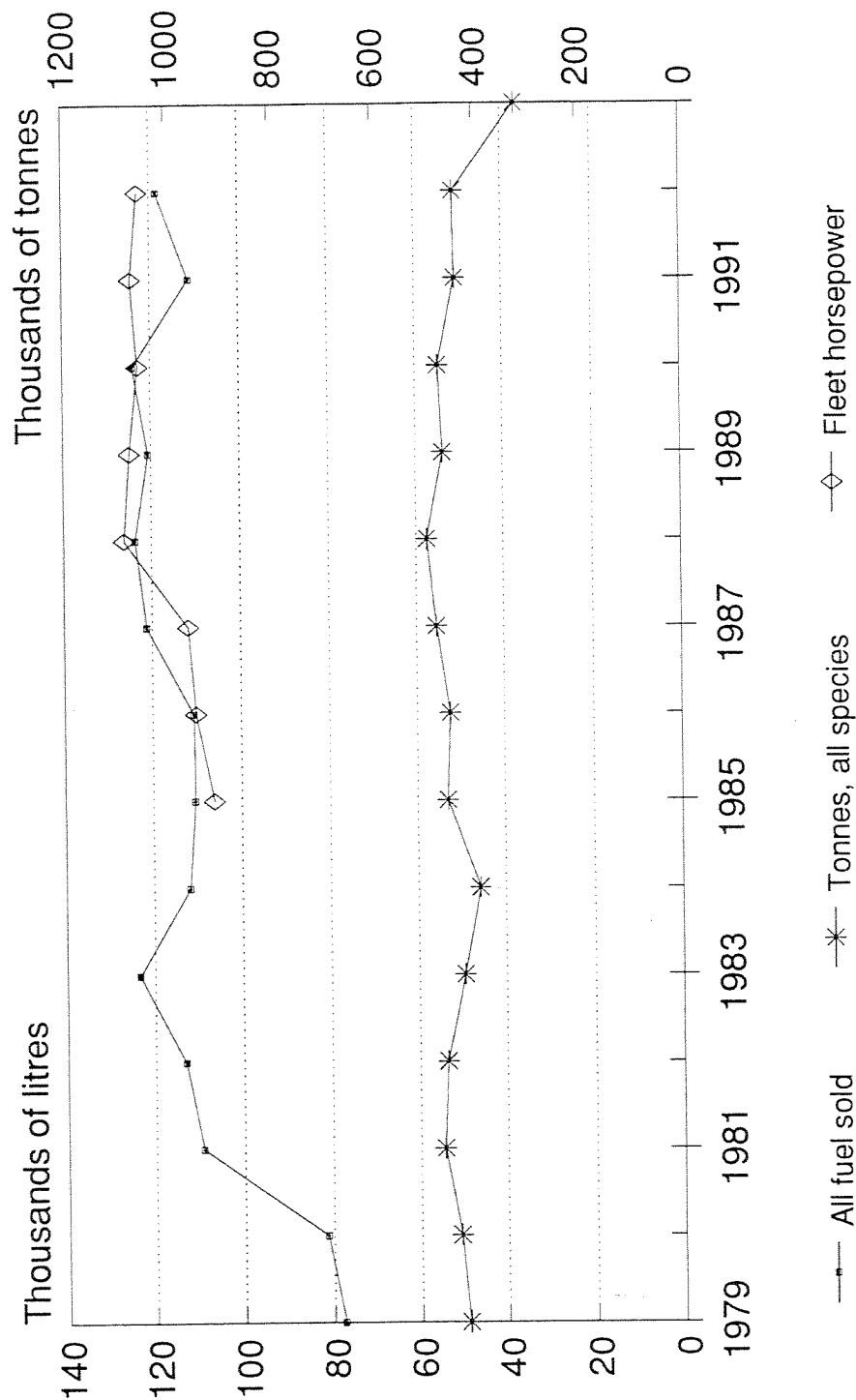


Figure 31

groundfish in 1993, choosing instead to transfer quotas. Of the original 325 ITQ holders, only 233 fished groundfish in 1993.

The trends from 1985 to 1993 in the number of vessels <65 ft. that fished groundfish with mobile gear are shown in Figure 32. These included all vessels using mobile gear irrespective of which programs they have opted for, but ITQ vessels comprised the lion's share. The estimates of the utilized and unutilized active capacity over the same time period are shown in Figure 33. Since the introduction of the ITQ program, the overall active capacity for dragging has decreased and the utilized portion of the total has increased. These are positive signs that the ITQ program is having the desired effect of reducing the absolute capacity.

In addition, ITQs also create a barrier to entry into the mobile gear fishery for two reasons:

1. licence holders with none or little quota would have to come up with the funds to buy quota; and
2. licence holders with both mobile and fixed-gear designations would have to give up their access to the fixed-gear fishery. This has the desired effect of reducing potential capacity.

#### Vessels 65-99 Ft.

This fleet consists mostly of longliners. The number of vessels in this group was relatively stable over the 1985 to 1993 period (Figure 34). However, the average size of the vessel increased (Figure 34). EAs in this fleet were introduced in 1988. With the exception of 1989 where the active capacity declined, there has been a small increase in capacity since the introduction of EAs in this fleet (Figure 35). There appear to be a number of reasons why the active capacity trend in this fleet is not as expected. These vessels were able to fish non-quota stocks to a greater degree than the smaller vessels and since 1990 they can also fish the offshore EA quotas. This is evidenced by the 17% increase in groundfish caught by this fleet between 1988 and 1992.

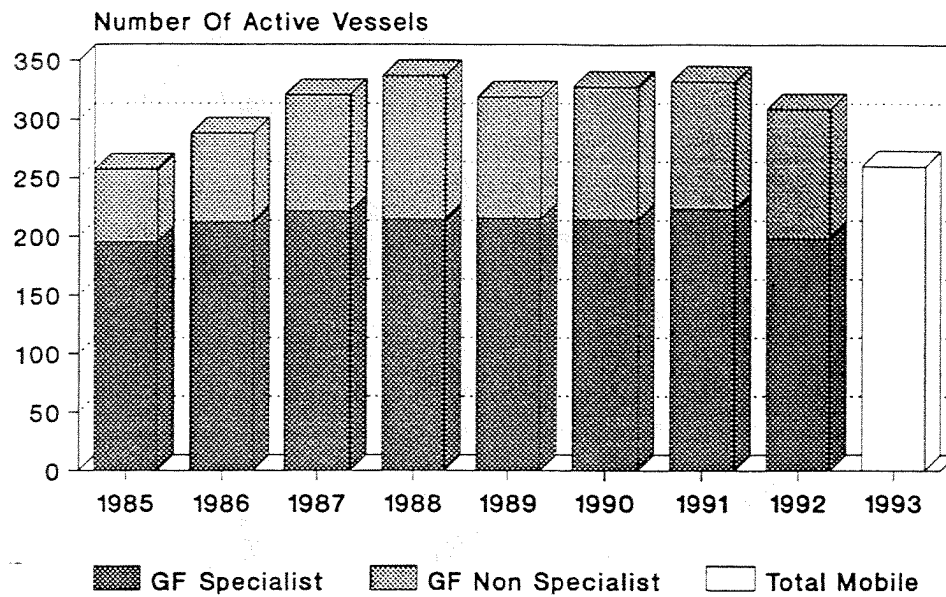
#### Vessels Greater than 100 Ft.

EAs were introduced for vessels greater than 100 ft. in 1982. Since 1985, there has been a modest reduction in total gross registered tonnage (GRT) which we used as an indicator of capacity, even though the number of vessels has declined substantially (Figures 36 and 37). There are two reasons for the larger average vessel size over this period. Older, smaller vessels have been retired; and containerization of vessels for boxing at sea to improve the quality have added to the GRT measurement and restrained the reduction in GRT. It should also be noted that some capacity reductions had already occurred between 1982 and 1984. Unfortunately, we have been unable to quantify it here. Earlier studies by Michael Gardner (Gardner Pinfold Consulting Economists, Halifax, Nova Scotia) which use annual carrying capacity as a measure showed that capacity declined by 21% between 1982 and 1987 for the National Sea Products Ltd. fleet.

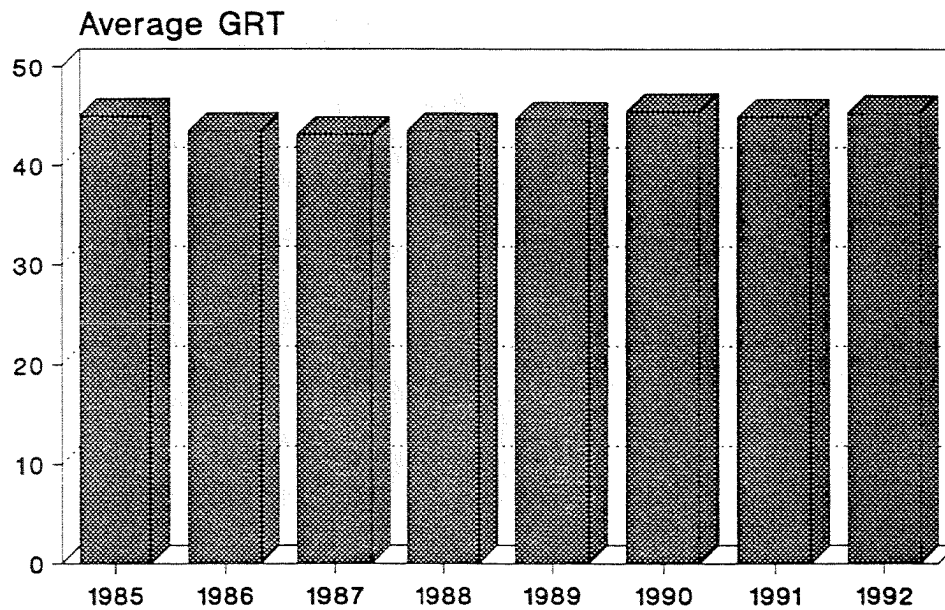
#### Comparative Trends

The trends for all gear sectors (those under competitive and non-competitive quotas) are shown in Figure 38a. Active capacity decreased in the mobile gear <65 ft. fleet by about 30% and for vessels greater than 100 ft. by about 20%. For vessels 65-99 ft., active capacity increased by about 20%. Capacity trends for fixed-gear vessels not on EA/ITQ programs show a more or less continuous increase since the mid 1980s (1992 capacity was about 75% higher than 1985 and about 25% higher than the previous peak in 1987). The utilization rate of vessels also increased for the mobile gear <65 ft. fleet and vessels 65-99 ft. For vessels greater than 100 ft., the utilization was high in the earlier years of the program, but has been declining in recent years due to the declining TACs (Figure 38b).

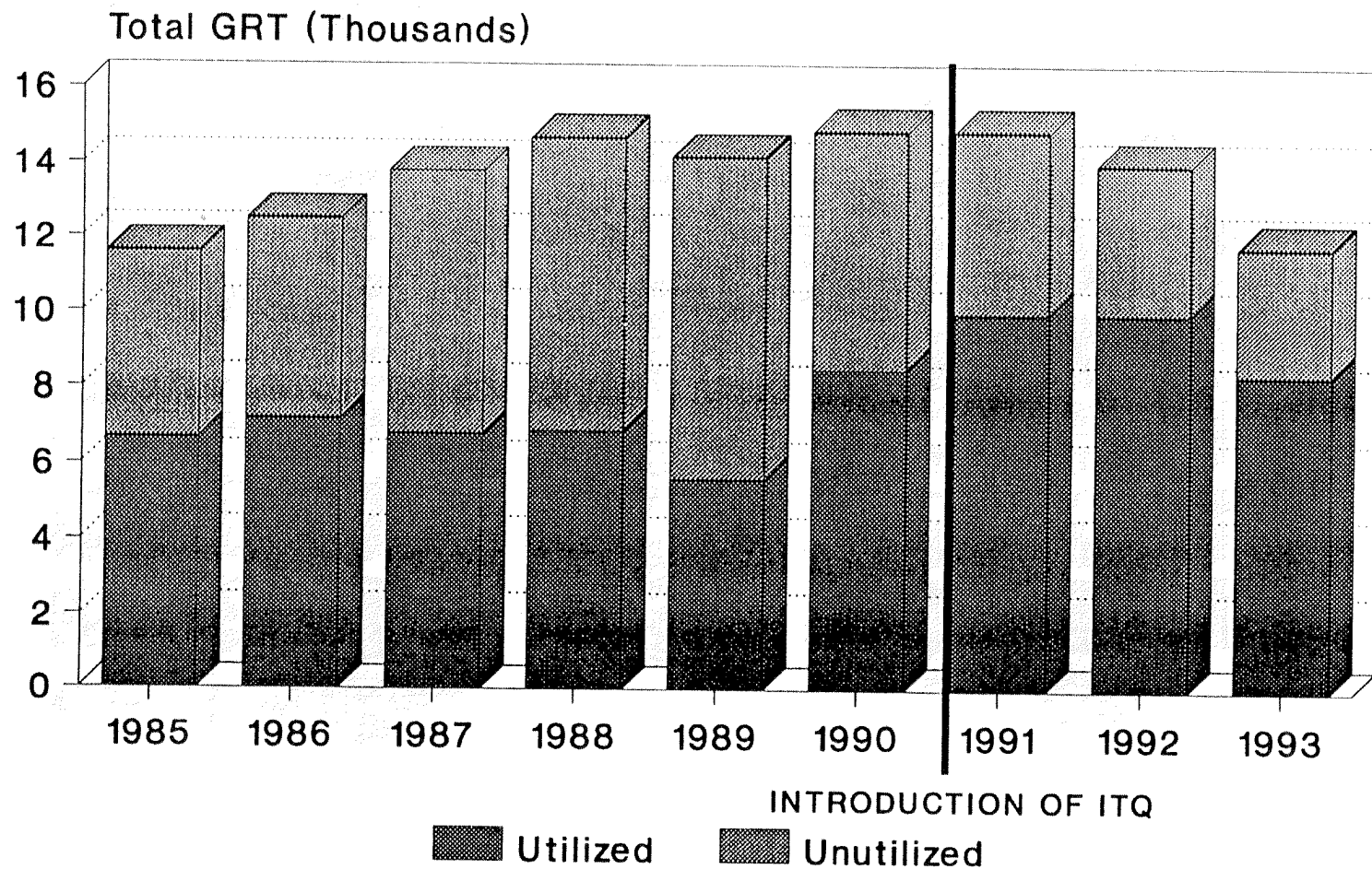
### Number Of Vessels < 65 ' Fishing Groundfish With Mobile Gear



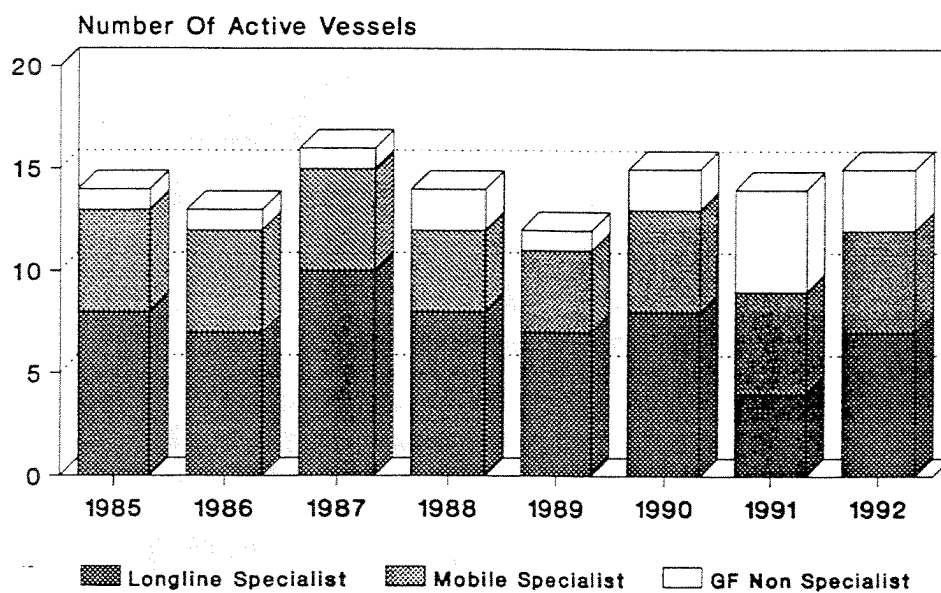
### Average Gross Registered Tonnage Groundfish Mobile Gear Vessels < 65'



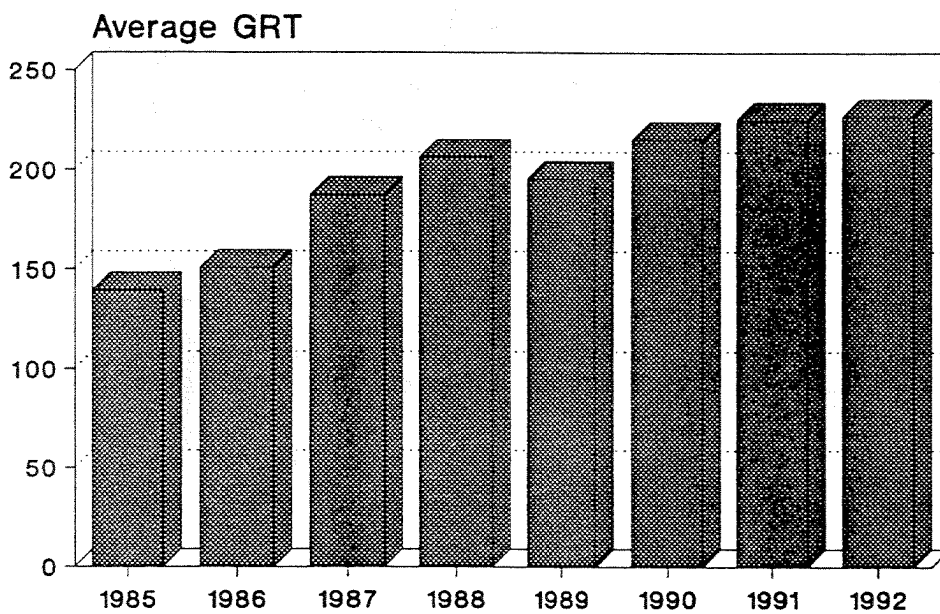
## Estimated GRT Utilized And Unutilized Groundfish Mobile Gear < 65 Ft.



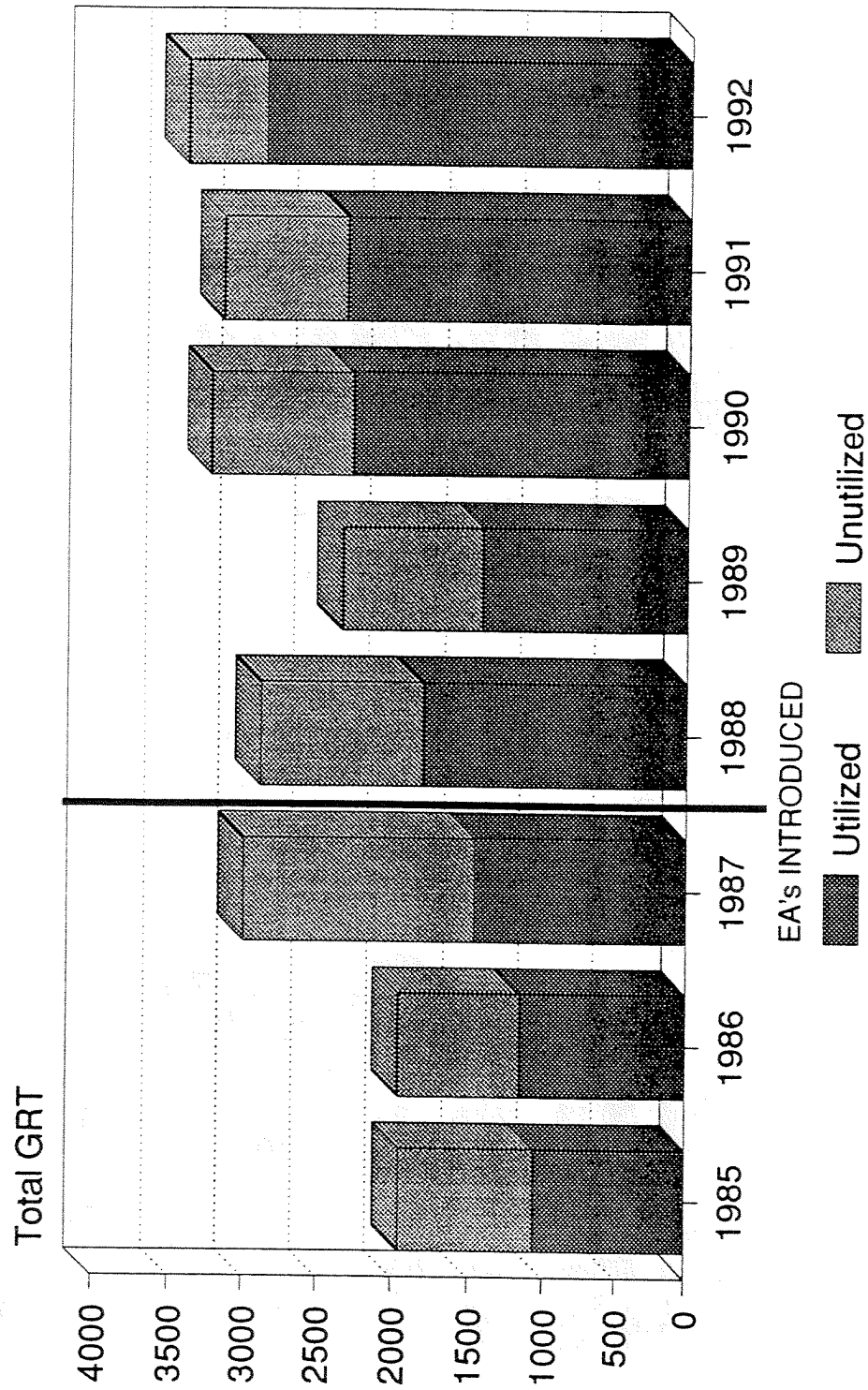
### Number Of Groundfish Vessels 65-99'



### Average Gross Registered Tonnage Groundfish Vessels 65-99'

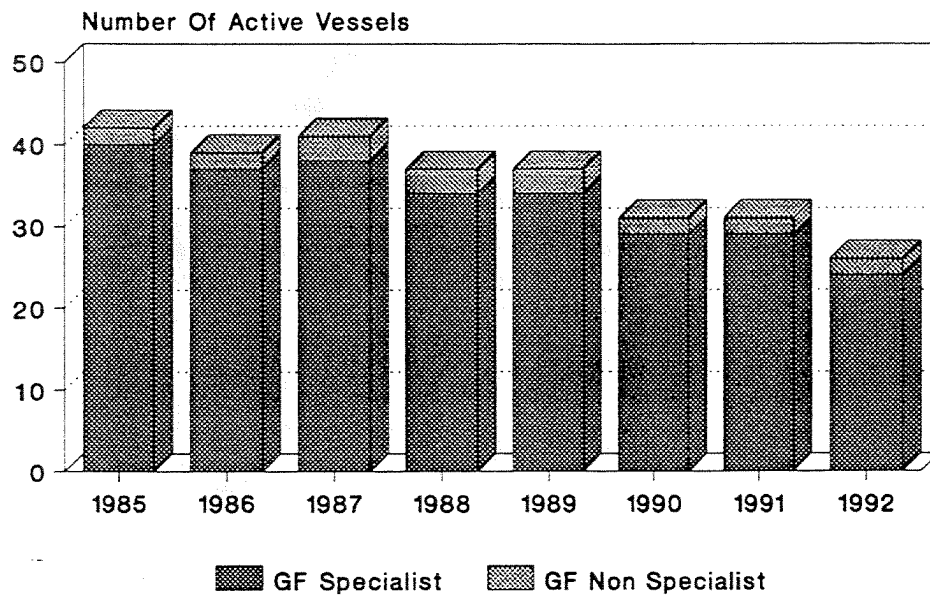


# Estimated GRT Utilized And Unutilized Groundfish Vessels 65-99'

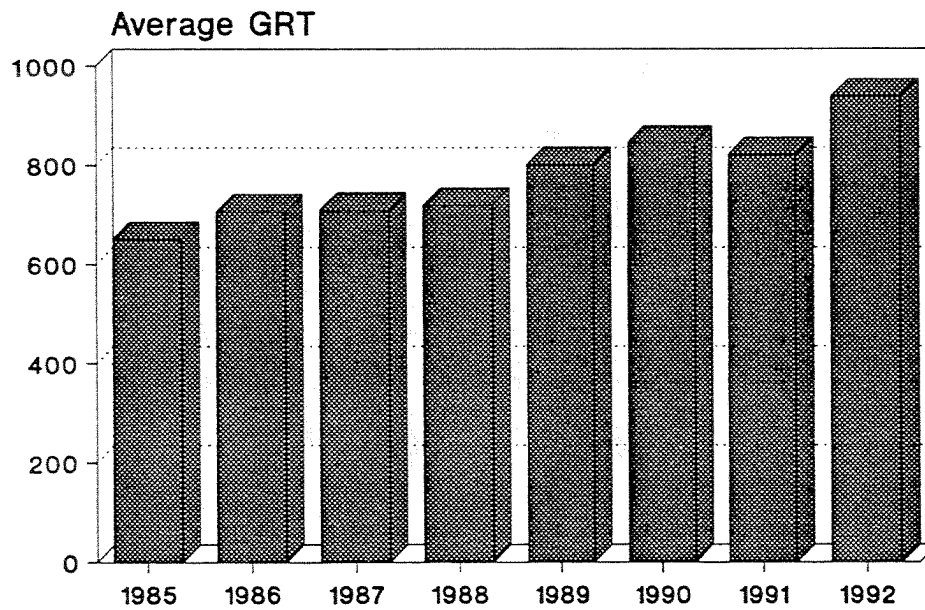




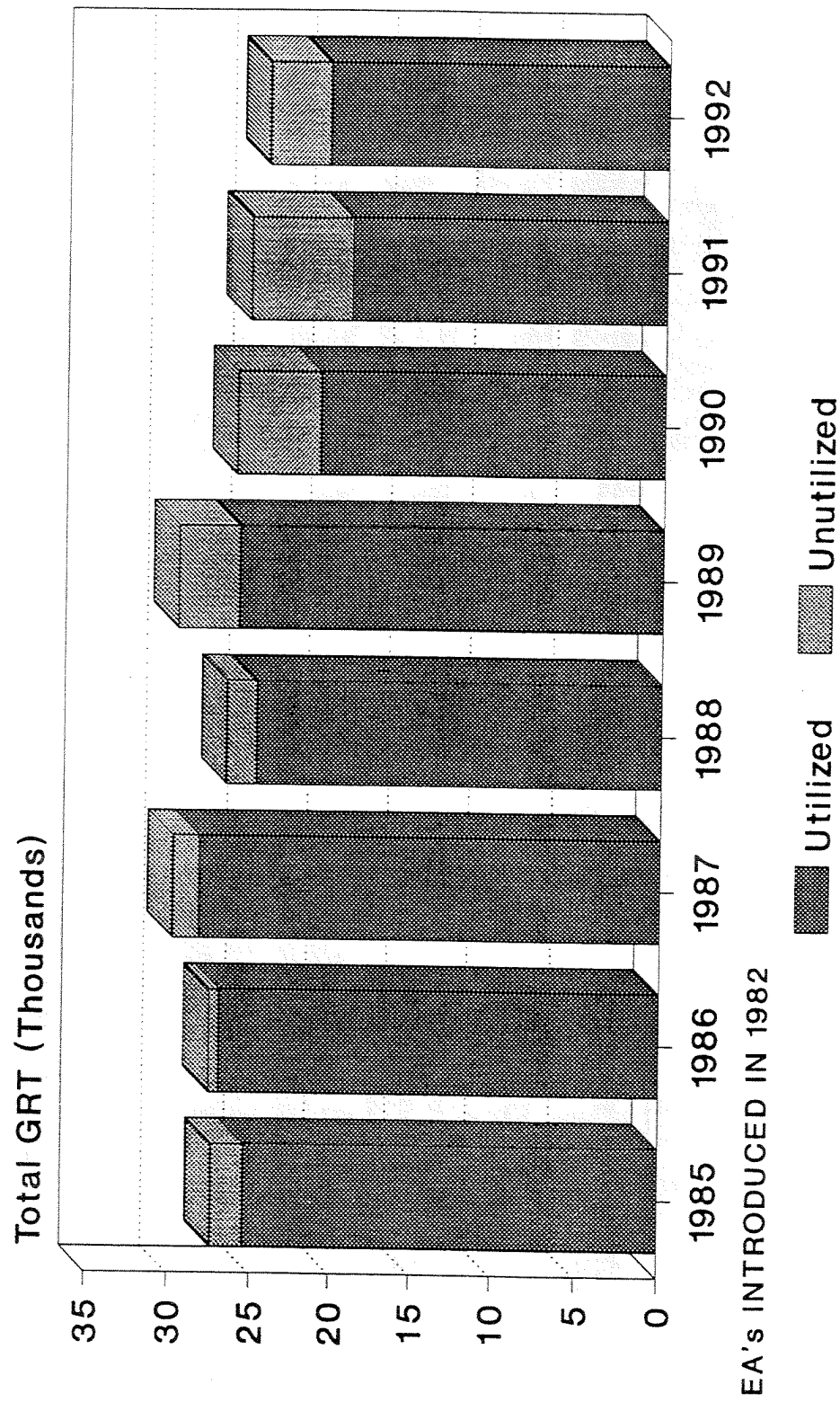
### Number Of Groundfish Vessels 100+'



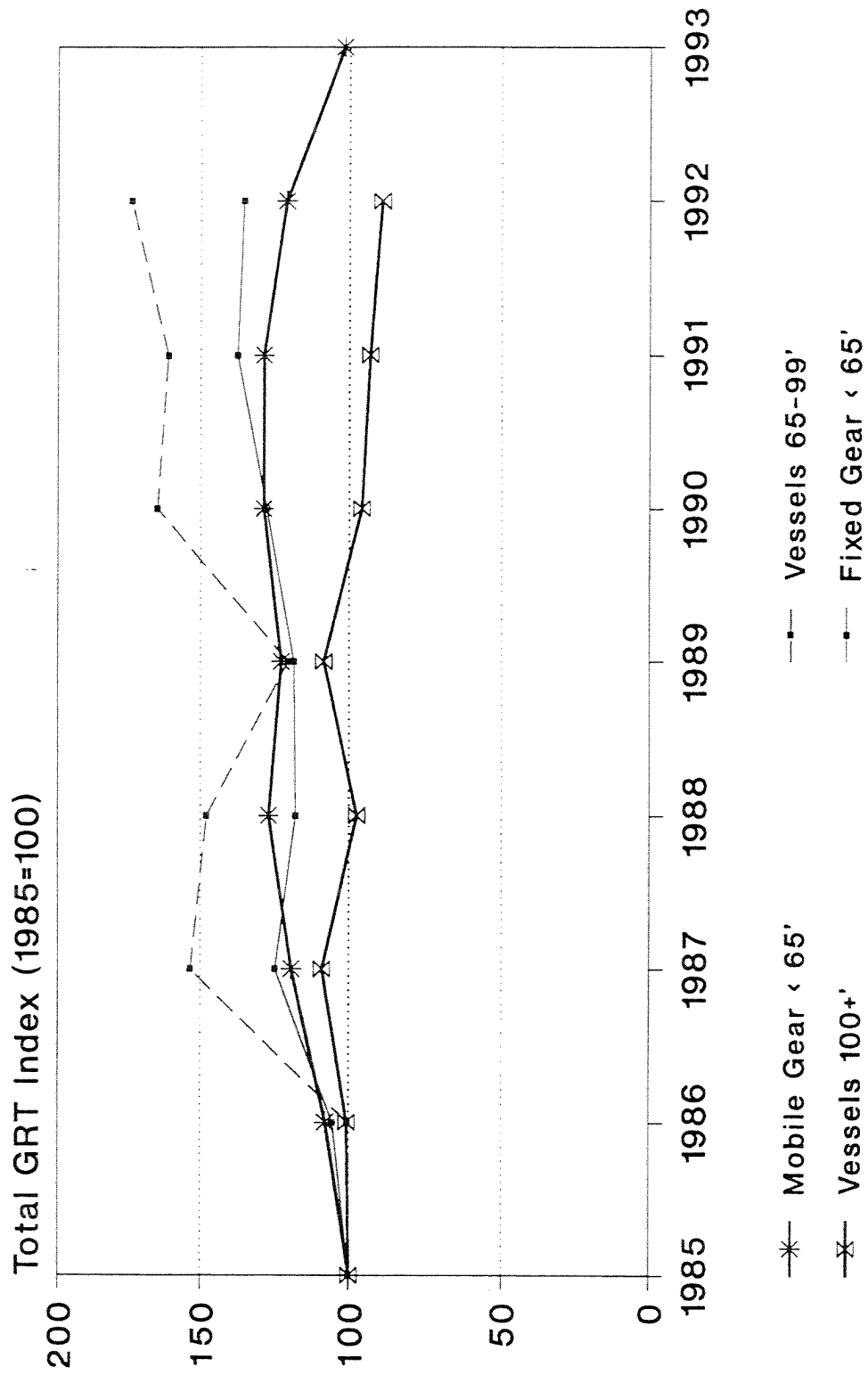
### Average Gross Registered Tonnage Groundfish Vessels 100+'

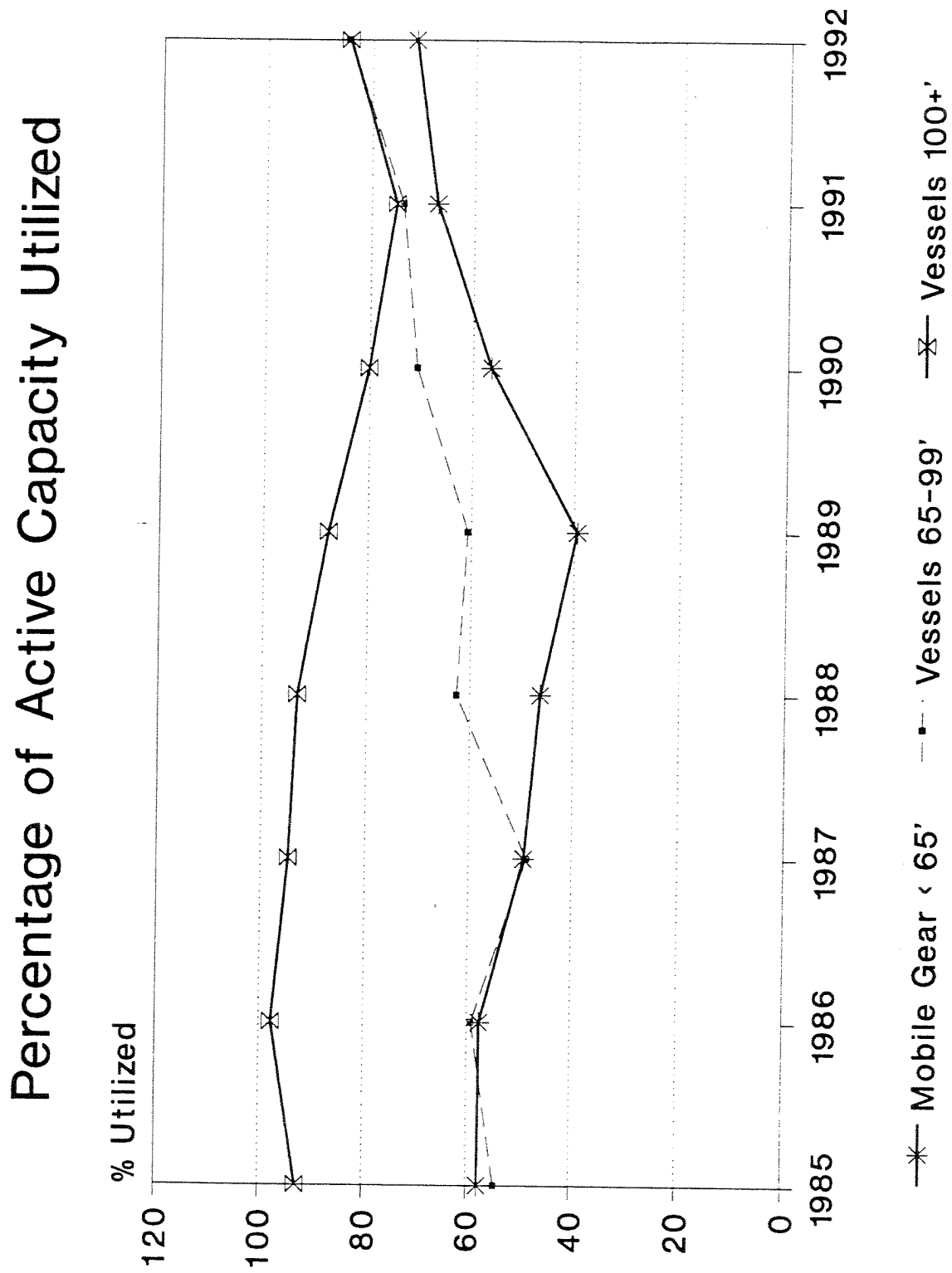


# Estimated GRT Utilized And Unutilized Groundfish Vessels 100+'



# Active Capacity





#### **4.3.6 Preliminary Assessment of Individual Transferable Quotas on Price/Supply, Operational Costs Versus Earnings, and Concentration of Ownership/Landings Locations (R.M. Barbara)**

An aim of the ITQ program was to improve the economic performance of the small dragger fleet. By removing the need to compete with one another for catch share and distributing their fishing effort through the year, it was expected that quota owners would be able to better take advantage of periods when prices for groundfish were at premium. It was also expected that they could more effectively control fishing costs to maximize profits from their individual quotas. A major concern by the fishers was that ITQs would lead to concentration of quotas and vessels by a few fishers/processors as capacity is reduced and quota is transferred permanently. The analysis of this section provides a preliminary evaluation of these projected effects of the ITQ program.

The seasonal distribution of cod, haddock, and pollock landings, as a percentage of annual landings, for two years (1988 under competitive quotas and 1992 under ITQs) is reduced as shown in Figure 39. The data suggest that, although a peak in landings still occurs during the early summer, proportionally more landings were made in other months since the introduction of ITQs.

There is also some evidence that a better quality of fish is being landed and that the price of fish caught by mobile gear is approaching that paid to the fixed-gear fleet (Figure 40). Pollock prices, however, do not show such a trend. At this stage, data are not available to evaluate whether the costs of mobile gear fishing have been reduced under the ITQ regime.

There is evidence that increased concentration of quota and fishing capacity under fewer owners is occurring. Increased concentration will inevitably occur when capacity is reduced (shown in Section 4.3.5). So-called "concentration curves" depict cumulative ITQ landings (CHP) as a percent of the total catch beginning with the vessel, port, or buyer with the most landings (Figure 41). The straight diagonal line represents equal distribution among all participants. The further away the curve is from this line, the more concentrated are the landings. Table 6 provides further evidence for increased concentration since the introduction of ITQs, but also shows that changing levels of concentration were evident in this fishery since 1986. 1989 and 1993 are anomalies since major factors affected the fishery in both of these years.

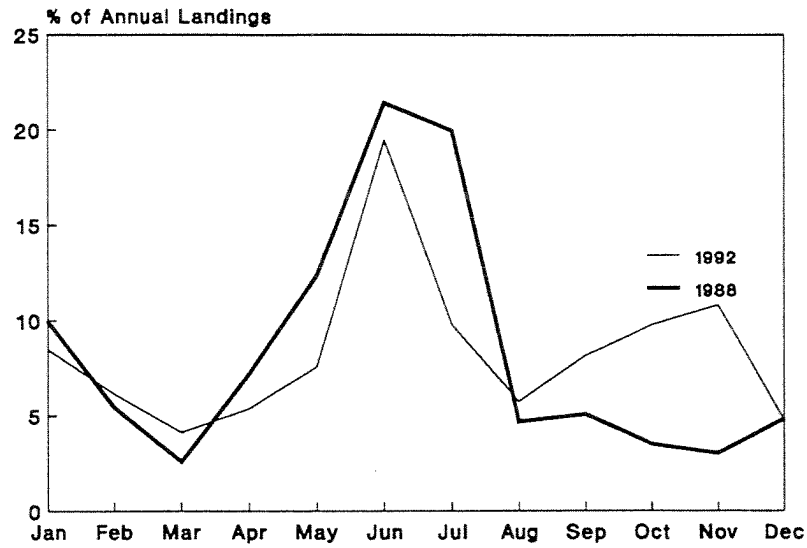
Reduced capacity and increased concentration does provide the benefit of lower administrative, enforcement, and regulatory costs. A decrease in the number of vessels and ports with landings directly affects the resource requirements for fisheries management. In addition, management functions have been passed on to industry, allowing more of the limited DFO resources to be focused on other fisheries if need be. Section 4.3.3.1 illustrates this.

In sum, the preliminary evaluation provides some support that the economic performance of the fleet has improved since 1991, insofar as prices are concerned. Also, there is evidence that decreased capacity and transfer of quotas has increased concentration of vessels and quota by fewer fishers/processors. This should serve to reduce capital costs. It was pointed out that two years is perhaps too short a time period to draw firm conclusions.

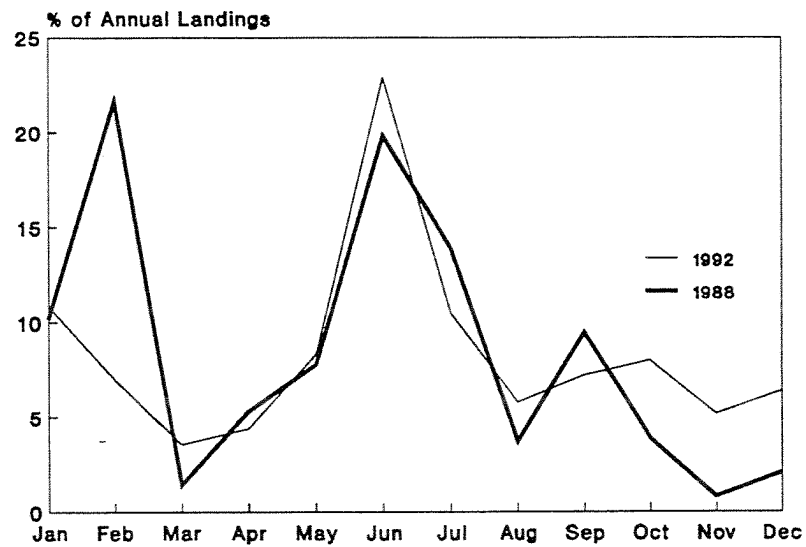
#### **4.3.7 General Discussion of the Management Actions and Responses of Industry Since Extension of Jurisdiction**

In Sections 4.3.1 to 4.3.6 documentation was provided on the management process and actions from 1977 to 1993, as well as on the response of industry to these actions. Some general conclusions can be drawn at this stage.

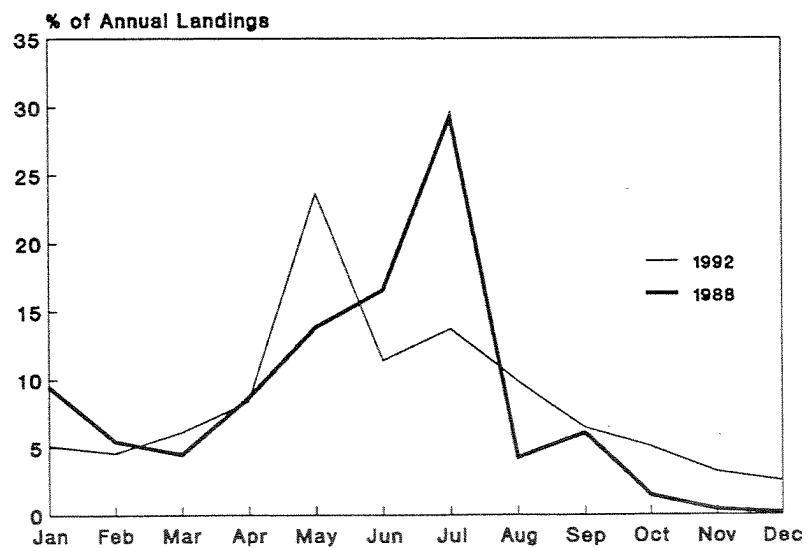
## ITQ Cod Landings



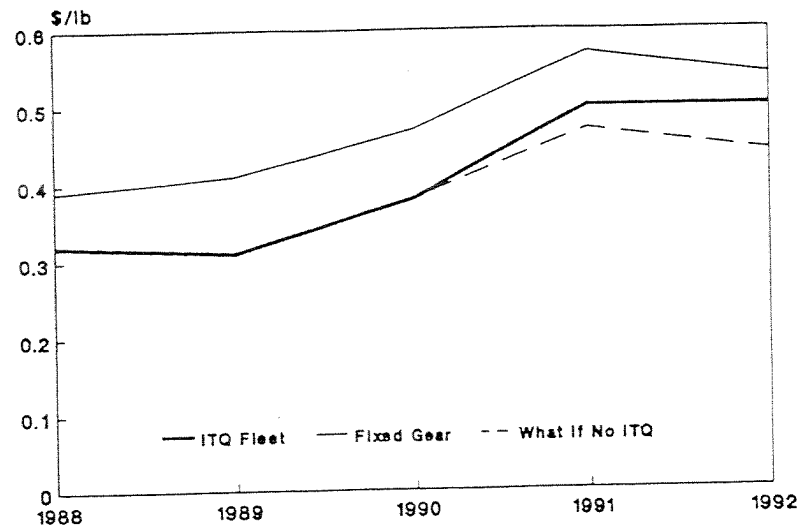
## ITQ Haddock Landings



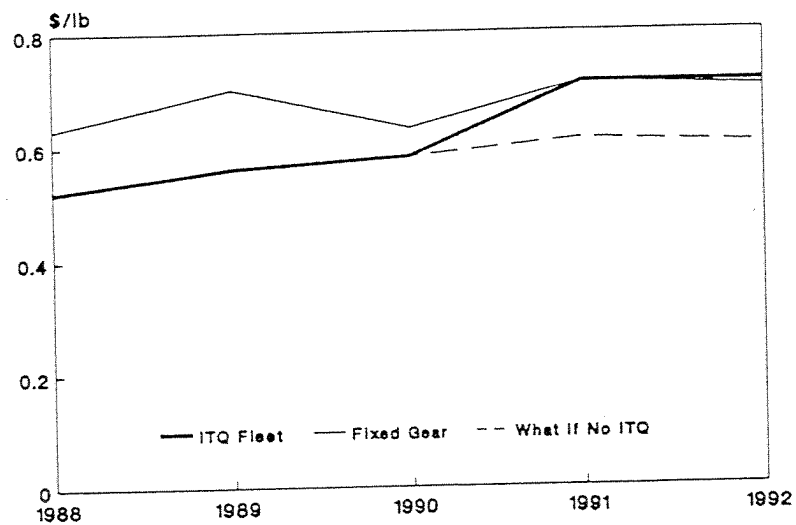
## ITQ Pollock Landings



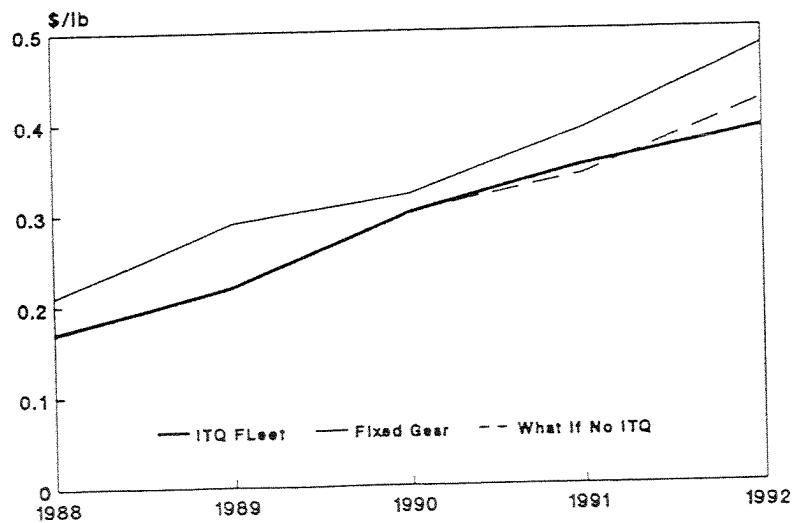
## Scotia-Fundy Cod Prices



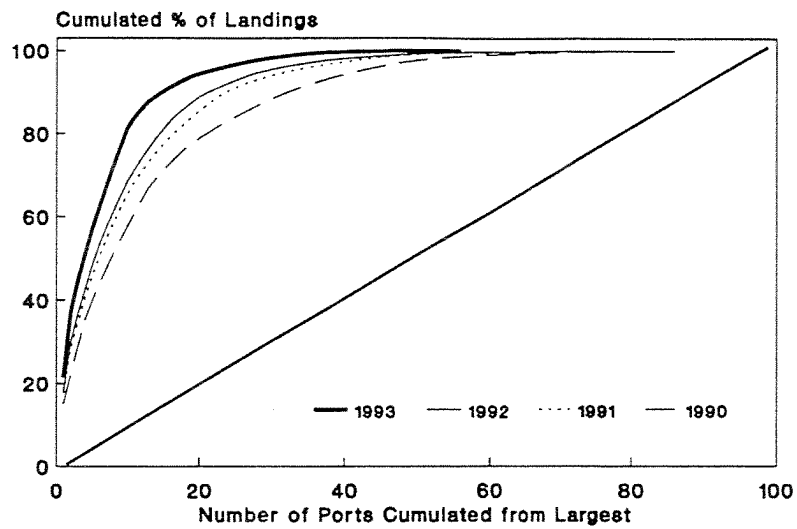
## Scotia-Fundy Haddock Prices



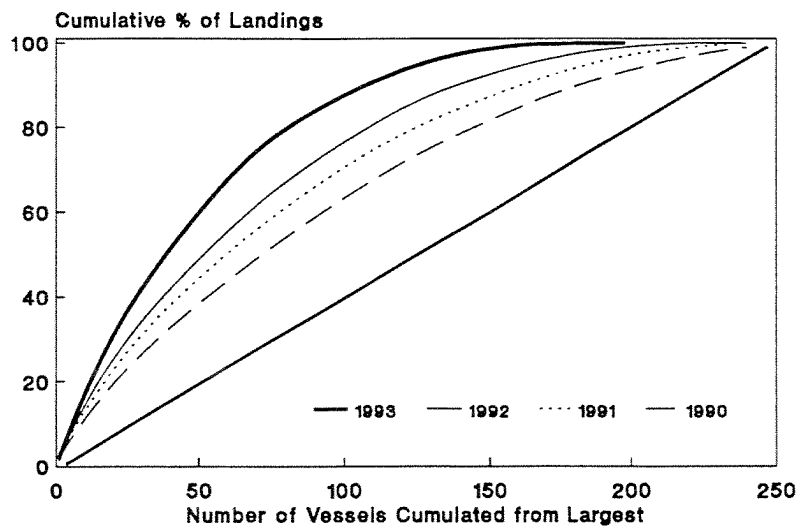
## Scotia-Fundy Pollock Prices



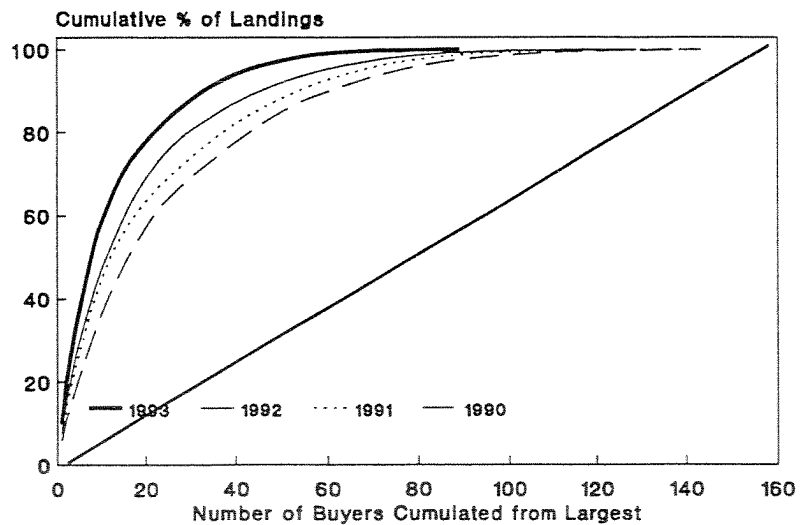
### Concentration of ITQ Landings by Port Cod, Haddock and Pollock



### Concentration of ITQ Landings by Vessel Cod, Haddock and Pollock



### Concentration of ITQ Landings by Buyer Cod, Haddock and Pollock





Distribution of ITQ CHP Landings  
By Port, Vessel and Buyer

	1986	1987	1988	1989	1990	1991	1992	1993
# of Ports	N/A	N/A	86	83	86	83	84	56
Top 10 (%)	N/A	N/A	56.8	54.1	57.5	65.1	68.3	81.1
# of Vessels	236	261	276	257	277	261	239	198
Top 10 (%)	17.6	15.7	12.2	14.2	11.1	13.1	14.3	16.9
Top 100 (%)	76.5	72.7	65.9	70.5	63.1	70.4	76.4	87.4
# of Buyers	121	125	130	127	143	144	129	89
Top 10 (%)	40.8	36.7	36.7	39.0	36.4	44.7	47.3	58.5

Source: Commercial Data Division, DFO, Halifax, N.S.

With respect to quota management:

- the Minister of DFO frequently set quotas at levels higher than the scientific advice, particularly during periods when the stocks were declining;
- the recorded landings frequently exceeded by a substantial amount, again more often during periods when the quotas were relatively low for a given management unit and the stocks were declining;
- the TACs (and the scientific advice) were frequently at sufficiently high levels relative to the resource abundance that the quota was not reached by year end and as a result fishing effort was essentially unregulated;
- annual fishing effort for most gear types, with the exception of Tonnage Classes 4 and 5 (i.e., offshore fleet greater than 65 ft.), has increased since 1977. There has been some stabilization in small dragger effort since 1986, but there has been no decline in days fished as the resource has declined and the quotas were reduced. Technology changes have probably enhanced the power of one day's fishing over the time period; and
- the combination of factors listed above indicates that quota management has not controlled fishing effort at levels corresponding to the strategic target.

With respect to management activities:

- growth in capacity within the mobile and fixed-gear components of the industry drove the management process towards micro-management, a delicate balancing act that would keep all gear sectors on the water throughout most of the year; and
- the administrative complexity increased with the increase in micro-management, resulting in a reduction in time available for enforcement of regulations.

With respect to enforcement:

- considerable success has been achieved in effectively enforcing the regulations imposed on foreign fleets fishing within Canadian waters and in minimizing illegal fishing by American vessels on Georges Bank;
- moderate success has been achieved in enforcing closed areas for spawning and juvenile fish; and
- most regulations associated with quota management *per se* have not been enforceable (reporting by area and species, dumping, discarding, highgrading, using correct gear, etc.). Also, many of these illegal fishing activities have been concluded to have increased as a result of EA and ITQ programs.

With respect to property rights:

- ownership of quota by enterprises and individuals has led to a reduction in administrative load by DFO and a stabilization or reduction in fishing capacity for these fleet components;
- initial results suggest that economic performance for these fleets has been improved by ownership of quota; and
- there has been a concentration of the small dragger ownership of quota and a reduction in the points of landing.

#### 4.4 CATCH AND EFFORT STATISTICS

In this section, a series of papers addresses the accuracy of the catch/effort statistical system. The section starts with a qualitative analysis on the degree of misreporting and under-reporting that has been evaluated by CAFSAC, the port technicians, and the observers. This is followed by a more quantitative analysis on the accuracy of the landings data based on interviews, including impacts of the new DMP. The section ends with two independent analyses of the accuracy of the aggregated landings data.

#### **4.4.1 Summary of Misreporting/Under-reporting from CAFSAC Reports and Port Technician Reports (S. Wilson)**

The first part of the analysis lists problems with information on estimated landings that were discussed within the CAFSAC Groundfish Subcommittee (1977 to 1993) and the Surveys, Sampling and Statistics Subcommittee (1977 to 1990). Discussions of discarding, highgrading, and misreporting for Scotia-Fundy Region were summarized in a spreadsheet form (Table 7). Some terms in the summary statements need defining:

- "notes" indicates that an issue was briefly raised in one or two lines at most;
- "discusses" indicates that the issue occupied from several sentences to several pages; and
- "recommends" or "advises" indicates that the Subcommittee made a formal recommendation or provided advice.

The analysis indicates that there were ongoing problems with the accuracy of the catch statistics from 1978 to present, particularly for landings in western Nova Scotia. In part, because of problems with the landings data, it has not been possible to carry out analytical assessments for the Scotian Shelf haddock management units since the late 1980s. Also, the catch rate data from the statistical system have been concluded to be sufficiently biased by poor data quality that this index of biomass trends cannot be used in the assessments. The conclusion that has been made from the CAFSAC documentation is that misreporting by area and species, as well as under-reporting, has been a major problem since 1977.

The second analysis lists observations of misreporting and discarding from the weekly reports of two port technicians (one in eastern Nova Scotia; one in western Nova Scotia) from 1984 to the present. The technicians are based in major fishing ports. Their major function is to sample the landings in order to collect data to generate estimates of the numbers of fish that are taken at each age by diverse gear sectors. The port technicians have been posted to fixed locations on a permanent basis. In order to ensure that they are sampling the landings from a known location, they have to develop an understanding of misreporting problems. As a result of their positive role in the fishing industry, they have built up a good rapport with many participants in the groundfish fishery and an "insider" understanding of fishing practices. They report observations on the fishery to BIO on a weekly basis. The observations relevant to the accuracy of catch statistics are summarized in Table 8.

There are observations on large-scale misreporting by area that are consistent with the TAC/landings comparisons described in Section 4.3. During 1984, 1985, and 1986, there were frequent observations of 4W cod being reported as 4X cod. During this time period, the TAC in 4X was sufficiently high that the quota was not taken, whereas in 4VsW the estimated cod landings exceeded the TAC. In contrast, when the 4X cod quota was relatively lower in 1988, cod caught in this area were recorded as having been caught in 5Z. In 1989 and 1990, when the 4X cod quota was still relatively low, fish were reported as coming from 4W (where the TAC was too high relative to resource abundance). There are frequent reports of 4X cod and haddock in 1990 and 1991 being reported as coming from 5Z (Georges Bank) where the TACs were more open ended. One report in November of 1987 indicates that all haddock and cod landed that month were misreported by species and area. In addition to reports of misreporting and under-reporting, there are indications of substantive discarding of haddock in 4X during 1991 and 1992 due to low ITQs for this management unit and of misreporting 4X haddock as coming from 5Z.

Although of an anecdotal nature, the consistency of these observations with the information on TACs and landings in Section 4.3 and with the observations of fishery officers noted in Section 4.3.3, the reports infer that misreporting, under-reporting, discarding, and highgrading are important.

**Summary of CAFSAC Subcommittee Report comments: Discarding and Misreporting**

	A	B	C	D	E	F
9 5	Subcommittee	Problem:	Stock Area:	Species:	Subcom. Rep. Ref.:	Summary:
1	Groundfish	Discarding	4VsW	Cod	SR 79/10: 1	Notes suspicion but no evidence of discarding of small cod by Spain in 4VsW
2	Groundfish	Discarding	4X	Haddock	SR 79/14: 9	Notes discard problems have arisen on occasion in this fishery
3	Groundfish	Discarding		Haddock	SR 80/2: 5	Notes catch report accuracy questionable due to discarding/mis-reporting
4	Groundfish	Discarding	4VWX56	Pollock	SR 80/2: 7	Notes stock analysis statistics questionable due to discarding/mis-reporting
5	Groundfish	Discarding	4TX		SR 81/21: 1-3	Discusses impact of mesh size changes on haddock, white hake & winter flounder fishery and discard practices
6	Groundfish	Discarding			SR 81/21: 4-7	Discusses sensitivity of management advice to accuracy of commercial catch statistics
7	SSSS	Discarding			SR 82/6: 1	Notes plans to compile inventory of discard data available from observer data
8	SSSS	Discarding			SR 82/6: 5	Discusses need for & uses of by-catch and discard data
9	Groundfish	Discarding	4x	Haddock	SR 82/8: 14	Notes discarding & mis-reporting in 1976-79 have distorted 4X haddock stats. Catches probably higher.
10	SSSS	Discarding	Scotia-Fundy	Groundfish/shrim	SR 83/1: 1, App. 3,5	Notes that Scotia-Fundy Observer program records discard data on set by set basis. Report in works.
11	Groundfish	Discarding	5Z	Haddock	SR 83/8: 14	Notes 76-79 landing reports not reliable due to extensive but unquantified US mis-reporting and discarding
12	Groundfish	Discarding	5Z6	Cod	SR 86/14: 33	Recommends monitoring cod discards in 5Z6 in 1987 to assess impact on 1985 year class
13	Groundfish	Discarding	4X	Haddock	SR 86/14: 44	Notes large-scale mis-reporting by species and area as well as discarding
14	Groundfish	Discarding	4TVW	Haddock	SR 86/8: 71	Recommends study of discarding (as explanation for observed recruitment) and closure (to help control discarding)
15	Groundfish	Discarding	4X	Haddock	SR 87/13: 19, 23	Recommends study of extent of mis-reporting/ discarding and impact on management capabilities
16	Groundfish	Discarding		Atl. halibut	SR 87/13: 32-33	Discusses discard mortality of halibut (35% survival bottom-trawl, 77% longline)
17	Groundfish	Discarding		CHP	SR 87/1: 1-4	Discusses discarding problem & impact on fishery & impact of management measures
18	Groundfish	Discarding	4TVn	Cod	SR 87/9: 74	Notes 4-8% discard rates in 4TVn
19	Groundfish	Discarding	4VWX		SR 87/9: 89	Gives discard rates for 4VWX 1985-86: Redfish 1%, plaice 11-17%, yellowtail 23-40%, witch 4-6%
20	Groundfish	Discarding	4X	Haddock	SR 88/13: 22	Notes large-scale misreporting of landings by area and species and discarding
21	Groundfish	Discarding		Groundfish	SR 88/8: 65-76, App. 1.	Discusses impacts of increase in trawl mesh size on groundfish fisheries and other species.
22	Groundfish	Discarding	4TVW	Haddock	SR 89/8: 31	Concern about lack of older (age 7+) fish. Attributable to discarding, under-reporting or emigration?
23	Groundfish	Discarding	5Zjm	Haddock	SR 89/8: 40	Recommends study of stock indices, including consideration of discards reported in late '70s-early '80s
24	Groundfish	Discarding	SW Nova	CHP	SR 89/8: 72-73	CHP management system designed to reduce discarding & mis-reporting can lead to overfishing on depressed stocks
25	Groundfish	Discarding	5Z	Cod	SR 90/13: 10	Notes pre-1978 5Z catches complicated by discarding
26	Groundfish	Discarding	4VsW	Cod	SR 90/13: 19	Notes a few reports of abundant undersized fish being discarded by mobile fleet
27	Groundfish	Discarding	5Zjm	Haddock	SR 90/13: 21	Notes IOP data showing low discard rates on both square 7 diamond gear
28	Groundfish	Discarding	5Zjm	Haddock	SR 90/13: 22	Notes use of estimated discard rates from interviews in estimating catch & weight at age
29	SSSS	Discarding	4Vn	White Hake	SR 90/7: 7	Recommends investigation of possible discarding in Jan-May 4Vn white hake fishery
30	Groundfish	Discarding	4TVW	Haddock	SR 90/9: 32	Notes lack of age 4+ haddock could be due to discarding, mis-reporting or non-reporting
31	Groundfish	Discarding	4X	CHP	SR 90/9: 57-58	Discusses impact of CHP quota system on cod, haddock & pollock stockd
32	Groundfish	Discarding	3Pn4RSTVn	Cod	SR 91/1: 3-8	Discusses evidence of industry discarding practices with respect to effects on estimates of mesh-size impacts
33	Groundfish	Discarding	4TVn	Cod	SR 91/9: 21	Discusses discarding estimates in 4TVn
34	Groundfish	Discarding	5Z	Cod	SR 91/9: 32	Notes pre-1978 5Z catches complicated by discarding
35	Groundfish	Discarding	4WX	Haddock	SR 91/9: 38	Notes consideration of discarding in estimates of age-composition and weight at age
36	Groundfish	Discarding	5Zjm	Haddock	SR 91/9: 45	Notes consideration of discarding in estimates of catch and weight at age
37	Groundfish	Discarding	4VWX5Zc	Pollock	SR 91/9: 51	Notes CHP management measures should address problems of misreporting & discarding
38	Groundfish	Discarding	4TVn	Cod	SR 92/10: 25	Discusses discarding rate estimates in 4T and 4Vn
39	Groundfish	Discarding			SR 92/19: 1-4	Report on possible measures to reduce catches of small fish
40	Groundfish	Discarding			SR 93/1: 1-2	Discussion of means to reduce excessive catches of small fish
41	Groundfish	Discarding	5Zjm	Cod	SR 93/5: 6	Notes consideration of discarding rates in estimates of length & maturity composition of Georges Bank cod
42	Groundfish	Discarding	3PN4RSTVn	Cod	SR 93/8: 19	Notes fishery characterized by large catches & high discards of small fish (less than 41 cm)
43	Groundfish	Discarding	4VW	Cod	SR 93/8: 20	Notes high discards of small fish may have reduced survivorship of ages 1-3 cod
44	Groundfish	Discarding			SR 93/8: 21	Notes discarding of small fish may have contributed to reduced survivorship of juveniles of a number of stocks
45	Groundfish	Discarding	4TVn	Cod	SR 93/8: 25	Includes estimates of discards in assessment data table
46	Groundfish	Discarding	4VsW	Cod	SR 93/8: 26	Includes estimates of discards in assessment data table
47	Groundfish	Discarding	4TVn	Cod	SR 93/8: 67	Discusses discard rates in 4T & 4Vn giving estimated values; Recommends further investigation into discarding practices
48	Groundfish	Discarding			SR 93/8: 7-8	Discusses measures to reduce catches of small fish; leads to less dumping & highgrading
49	SSSS	Discarding			SR90/14: 2-4	Discuss contribution of discarding to management undercertainty

**Summary of CAFSAC Subcommittee Report comments: Discarding and Misreporting**

	A	B	C	D	E	F
95	Subcommittee	Problem:	Stock Area:	Species:	Subcom. Rep. Ref.:	Summary:
50	Groundfish	Highgrading	4VWX, 5Zc	Pollock	SR 89/8: 41	Notes possibility of Pollock discarding under CHP combined quota system while more valuable Cod & Haddock kept
51	Groundfish	Highgrading	4VWX5Zc	Pollock	SR 90/9: 36	Discarding of pollock in favour of more valuable cod and haddock considered serious problem under CHP system
52	Groundfish	Highgrading	4X	CHP	SR 90/9: 57-58	Discusses impact of CHP quota system on cod, haddock & pollock stockd
53	Groundfish	Misreporting	4VsW	Cod	SR 79/10: 2	Notes large scale mis-reporting of area of capture by Canadian vessels in 1978; 1977 also suspect
54	Groundfish	Misreporting	4VsW	Cod	SR 79/10: 2	Notes incentives for both under-reporting & over-reporting of catches for 1971-76
55	Groundfish	Misreporting	4X	Haddock	SR 79/14: 9	Notes mis-reporting of area of capture & quantities in 1978; earlier years also suspect
56	Groundfish	Misreporting		Haddock	SR 80/2: 5	Notes catch report accuracy questionable due to discarding/mis-reporting
57	Groundfish	Misreporting	4VWX56	Pollock	SR 80/2: 7	Notes stock analysis statistics questionable due to discarding/mis-reporting
58	Groundfish	Misreporting			SR 81/21: 4-7	Discusses sensitivity of management advice to accuracy of commercial catch statistics
59	Groundfish	Misreporting			SR 81/21: 4-7	Discusses sensitivity of management advice to accuracy of commercial catch statistics
60	Groundfish	Misreporting	4X	Haddock	SR 82/8: 14	Notes discarding & mis-reporting in 1976-79 have distorted 4X haddock stats. Catches probably higher.
61	Groundfish	Misreporting	5Z	Haddock	SR 83/8: 14	Notes 76-79 landing reports not reliable due to extensive but unquantified US mis-reporting and discarding
62	Groundfish	Misreporting	4X	Haddock	SR 86/14: 44	Notes large-scale mis-reporting by species and area as well as discarding
63	Groundfish	Misreporting	5Z	Haddock	SR 86/14: 54	Recommends quantification of mis-reporting; Notes 2000 t of haddock caught in 4X may have been reported from SA5
64	Groundfish	Misreporting	4X	Haddock	SR 86/8: 72	Abnormally high tonnages of haddock reported from 5Ze suspected to be mis-reported from 4X
65	Groundfish	Misreporting	4X	Haddock	SR 87/13: 19, 23	Recommends study of extent of mis-reporting/ discarding and impact on management capabilities
66	Groundfish	Misreporting	4TVW	Haddock	SR 88/13: 18, 20	Notes investigation of paucity of older (7+) fish. Underreporting, natural mortality or migration?
67	Groundfish	Misreporting	4X	Haddock	SR 88/13: 22	Notes large-scale misreporting of landings by area and species and discarding
68	SSSS	Misreporting			SR 89/4: 10-11, 13, 31	Modelling effects of mis-reporting on assessments
69	Groundfish	Misreporting	4TVW	Haddock	SR 89/8: 31	Concern about lack of older (age 7+) fish. Attributable to discarding, under-reporting or emigration?
70	Groundfish	Misreporting	4X	Haddock	SR 89/8: 32-37	Recommends study of mis-reporting of stock by species and area from 1977-1989
71	Groundfish	Misreporting	SW Nova	CHP	SR 89/8: 71-73	Discusses extent, causes and measures to deal with mis-reporting and impact on stocks
72	Groundfish	Misreporting	5Z	Cod	SR 90/13: 11	Notes suspected misreporting affects ability to use commercial catch rates as stock abundance indices
73	Groundfish	Misreporting	4X	Cod	SR 90/9: 22-23	Notes mis-reporting down from 87 & 88, but C/E not reliable
74	Groundfish	Misreporting	4TVW	Haddock	SR 90/9: 30	Notes indications of mis-reporting by area after closure of 4X
75	Groundfish	Misreporting	4TVW	Haddock	SR 90/9: 32	Notes lack of age 4+ haddock could be due to discarding, mis-reporting or non-reporting
76	Groundfish	Misreporting	4X	Haddock	SR 90/9: 34	Notes high mis-reporting 1985-88, linked to restrictive quotas
77	Groundfish	Misreporting	4X	Cod	SR 91/9: 28-29	Notes suspected misreporting of up to 2000t by MG<65' & effect on commercial catch rate
78	Groundfish	Misreporting	5Zjm	Cod	SR 91/9: 32	Notes suspected misreporting compromising use of commercial catch data
79	Groundfish	Misreporting	3,4VsWX	Haddock	SR 91/9: 37	Notes suspected misreporting of 4X haddock as 4W; and of 4Vs fish as Subarea 3
80	Groundfish	Misreporting	4X	Haddock	SR 91/9: 42-44	Discusses effect of misreporting; Recommends magnitude of misreporting be investigated
81	Groundfish	Misreporting	4VWX5Zc	Pollock	SR 91/9: 51	Notes CHP management measures should address problems of misreporting & discarding
82	Groundfish	Misreporting	4X	Cod	SR 92/10: 37-38	Notes consideration of misreporting in assessment process
83	Groundfish	Misreporting	4X	Haddock	SR 92/10: 51	Notes increase of misreporting in 1991
84	Groundfish	Misreporting	4VWX5Zc	Pollock	SR 92/10: 58	Notes new regulations dealing with misreporting & discarding have been introduced
85	Groundfish	Misreporting	4X 5Zjm	Haddock	SR 93/10: 6	Notes increase of misreporting of 4X haddock as 5Zjm in 1993
86	Groundfish	Misreporting	4X 5Z	Cod	SR 93/8: 20	Notes misreporting still occurring, but apparently less than in '80s
87	Groundfish	Misreporting			SR 93/8: 21	Notes need prevent misreporting of quota species onto non-quota species
88	Groundfish	Misreporting	4X	Cod	SR 93/8: 80	Notes misreporting precludes use of commercial catch rate for SPA tuning
89	Groundfish	Misreporting	4X	Haddock	SR 93/8: 91-92	Notes misreporting of approx 10% during 1992; notes also reports of transshipment of catch ; Recommends further investigation
90	Groundfish	Misreporting	5Zjm	Haddock	SR 93/8: 91-92	Notes uncertainty regarding effects of misreporting
91	SSSS	Misreporting			SR90/14: 2-4	Discuss contribution of misreporting to management undercertainty

### Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
17-Jan-84	Misreporting	Cod	4Vc 4Xmn	Seems to be a bit of misreporting of 4Vc cod to 4Xm again
26-Mar-84	Discarding	Haddock	Emerald	Boats fishing Emerald Bank for ping-pong haddock, but plants don't want them; too much labour in processing, not enough yield/fillet
3-Jun-84	Misreporting	Cod Yellowtail	4Vn 4Vsc	One OTB2 misreporting 4Vn cod as 4Vsc yellowtail
11-Jun-84	Discarding	Haddock	Emerald	Some boats fishing Emerald Bank for small haddock, but most plants don't want to land it; too much labour in processing
18-Jun-84	Discarding	Haddock	Lurcher	Draggers fishing Lurcher Shoals for haddock finding fish running smaller, lot of discards
7-Aug-84	Misreporting	Cod	4Vc 4X 5Z	Misreporting of 4Vc cod to 4X & 5Z appears to be taking place again
20-Aug-84	Misreporting	Cod	4X 5Yb	A lot more cod being landed from the Bay of Fundy now, but misreported as 5Yb because of quota on cod in 4X
11-Dec-84	Discarding	Cod	4T	A lot of small fish around N Cape Breton & Cheticamp; some draggers discarding 50% of catch; LLs also reporting small fish
29-Apr-85	Misreporting	Haddock	4W	Several draggers landing ping-pong haddock from 4W; Supposed to be closed for haddock
6-May-85	Misreporting	Cod	4Vc 4Xmn	OT misreported 180K 4Vc cod as 4Xmn; same vessel did same thing last week
13-May-85	Misreporting	Cod	4Vc 4Xnon	Approx 106K 4Vc cod reported as 4Xno; total for month so far 541K 4Vc cod misreported as 4Xmno landed in just 1 port !!
29-May-85	Misreporting	Cod	4Vc 4Xmn	OT reported 75K cod from 4Vc & 235K from 4Xmn !! Looks like old story of misreporting 4Vc as 4Xmn is back again !!
2-Sep-85	Misreporting	Cod Haddock	4X 5Y	Misreporting has started: From 1 Sept on, cod & haddock caught in 4X misreported as 5Y 5Zj
23-Sep-85	Misreporting	Pollock Hake		Draggers misreporting pollock as hake
23-Sep-85	Misreporting	Haddock Pollock	4Xqr 5Yb	Misreporting still going on because of haddock pollock by-catch in 4X. Any boat landing >6K of 4Xqr haddock/trip is misreported as 5Yb
30-Sep-85	Misreporting	Pollock Hake		Pollock being misreported as hake by draggers; watch for hake landings to take a big hike in Sept/Oct 85
7-Oct-85	Misreporting	Cod	4Vb 4Xm	Approx 50K 4Vb cod misreported as 4Xm
18-Oct-85	Misreporting	Haddock	4Xo	Four shore boats landed 1-2K haddock from 4Xo; these trips seized by F/Os
2-Dec-85	Discarding	Cod	4T	4T draggers report approx. 30% undersize cod
9-Dec-85	Misreporting	Cod	4Vc 4Xmn	Two OTs misreported 110K 4Vc cod as 4Xm
10-Feb-86	Discarding	Haddock	3Oc	Reports of large discarding of small haddock in 3Oc
24-Feb-86	Misreporting	Cod	4Vbc 4Xm	200K Cod misreported from 4Vbc to 4Xm
24-Mar-86	Misreporting	Cod	3O 4Xm	110K Cod misreported from 3O to 4Xm
24-Mar-86	Misreporting	Cod	4Wfg 4Xn	Mobile gear <65 misreporting 4Wfg cod to 4Xn
24-Mar-86	Misreporting	Cod		Some good cod catches around Sable Island 4W misreported into 4X
1-Apr-86	Misreporting	Cod	4Vc 4Xm	One large OT misreported 50K cod from 4Vc to 4Xm
1-Apr-86	Misreporting	Cod		Most Digby draggers have moved to lesser-used ports to avoid F/Os; cod quotas have everyone upset; Misreporting rampant
14-Apr-86	Misreporting	Cod	4Vc 4Xn	180K cod misreported from 4Vc to 4Xn
28-Apr-86	Misreporting	Cod	4Vc 4Xn	136K cod misreported from 4Vc to 4Xn
5-May-86	Misreporting	CHP		No misreporting as of 4 May because of increased limits
9-Jun-86	Misreporting	Haddock Sole Redfish	5Zj	Misreporting of 5Zj cod rampant; Reported as Sole, Redfish
23-Jun-86	Misreporting	Cod Haddock	Georges	Some misreporting of Georges Bank cod & haddock because of 20/40K Haddock/Cod limit/week
14-Jul-86	Misreporting	Cod Haddock Hake	5Zj	Draggers landed good trips cod haddock from 5Zj; misreported as hake
21-Jul-86	Misreporting	Cod Pollock		A lot of misreporting of cod & pollock last couple of weeks because of by-catches on these species
8-Sep-86	Misreporting	Pollock		Draggers doing poorly except for what pollock they can sneak in
8-Sep-86	Misreporting	Pollock Redfish		Pollock landings of 50-100K/trip in spite of 10% by-catch; all misreported as redfish
22-Sep-86	Misreporting	Pollock		Draggers picking up lots of pollock when they can get away with it
22-Sep-86	Misreporting	Cod	4Vc 4Xn	2 OTs misreported 200K cod from 4Vbc to 4Xno
22-Sep-86	Misreporting	Cod	4Vbc 4Xno	2 LLs landed 70K cod from 4 Vc; misreported as 4Xn
28-Sep-86	Highgrading	Cod	4Vn	OTB2s <65' only allowed 15K/day 4Vn cod, so probably some discarding of smaller fish
13-Oct-86	Misreporting	Pollock Haddock	4X 4W	Still some misreporting of pollock catches in 4X and haddock also in 4W
20-Oct-86	Discarding	Haddock	4Wj	Reports of large discards of small haddock on Western Bank
20-Oct-86	Misreporting	Pollock	4X	Still a lot of misreporting of pollock going on; some boats landing 40K/trip
27-Oct-86	Misreporting	Pollock	4Xq	A few boats landing 50-80K pollock from 4Xq; all misreported due to quota; landing at night when everyone gone
10-Nov-86	Misreporting	Pollock		Still some misreporting of pollock catches this week; dropping off because many dragger fishermen change over to lobsters
22-Dec-86	Misreporting	Cod	4Vab 4Xmn	Entire catch of 143K cod misreported from 4Vab to 4Xmn

### Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
5-Jan-87	Misreporting	Pollock	Browns	Notes C&P seizing some dragger catches of 75-120K pollock because of 20 K trip limits
5-Jan-87	Discarding	Cod	4T 4Vn	Lots of small cod N of St Pauls Island in 4Tt & 4Vn; one boat had 50% <17"
27-Apr-87	Misreporting	Cod	4Vc 4Xn	175K Cod misreported from 4Vc to 4Xn
25-May-87	Highgrading	Cod	4Vn	Mobile fleet now with trip & catch limits; increased discarding of markets & scrod in favour of more valuable steakers
25-May-87	Misreporting	Cod	4T 4Vn	Fleet activity indicates a lot of misreporting of 4T fish into 4Vn
1-Jun-87	Misreporting		4X 5ZY	Log records rendered useless by latest DFO edict for reporting catches from 4X 5ZY
1-Jun-87	Misreporting			65' Digby draggers landing all they can get away with in Shelburne & then some !
13-Jul-87	Misreporting	Pollock		Draggers landing pollock at night 50-80K/day/boat; all pollock misreported as quota is 0%
15-Jul-87	Misreporting	Pollock	4Xo	Draggers landing 10-70K 4Xo pollock in Shelburne; some caught by DFO, some not
7-Sep-87	Misreporting	Haddock	Georges	Draggers fishing Georges for 20-30K haddock/day; quota 0.0%
7-Sep-87	Misreporting	Pollock	4Xr	Some draggers landing 40-100K pollock/day at night; misreporting as flounder, hake, redfish
14-Sep-87	Misreporting	Haddock Cod	Georges	Some draggers fishing Georges for haddock & some cod; Georges closed
21-Sep-87	Misreporting	Pollock		Digby draggers back in Shelburne reported to be landing pollock; noticed pollock in Cape Sable Island plant
21-Sep-87	Misreporting	Cod	Georges	A couple of draggers reported fishing Georges for cod
21-Sep-87	Misreporting	Cod Haddock	5Zj	Two draggers fishing Georges for 20K Cod/10K Haddock/trip; all misreported by area
28-Sep-87	Misreporting	Cod Pollock	4X 5Z	Some draggers sneaking in cod from 5Zj and pollock from 4X
5-Oct-87	Misreporting	Pollock	4Xq	Four draggers caught landing 30-50K Pollock from 4Xq; quota 0.0%
12-Oct-87	Misreporting	Pollock		Draggers not doing anything except for a few Digby 65's sneaking in a bit of pollock when they can
12-Oct-87	Misreporting	Pollock	4Xq	Most draggers still going for pollock even at 0.0%; pollock misreported
2-Nov-87	Misreporting	Cod Haddock	Georges	Two draggers landed 20-40K haddock/cod from Georges; all misreported; quota 0.0%
16-Nov-87	Misreporting	Cod Haddock	Georges	Couple of draggers fishing Georges 14-18K/day; all fish in last month misreported by species & areas
15-Feb-88	Misreporting	Cod Haddock	4X 5Zj	Notes all fish landed for next 2 weeks will be misreported as 5Zj because of low 4X quotas
22-Feb-88	Misreporting	Cod Haddock	4X 5Zj	Notes all fish landed this week misreported as 5Zj because of low 4X quotas
29-Feb-88	Misreporting	Cod	5ZY	Most draggers misreporting catch to 5ZY & plants misreporting species or altering price paid to reduce landing weights
29-Feb-88	Misreporting	Cod Haddock	4X 5Zj	Notes all fish landed this week misreported as 5Zj because of low 4X quotas; no boats fishing on Georges
28-Mar-88	Discarding	Haddock	4Xn	Notes 4Xn OT2 landed haddock with everything <17" discarded
4-Apr-88	Misreporting	Cod Haddock	Closed Area	Notes 2 draggers landed haddock from closed area & were caught by patrol boats
2-May-88	Misreporting	Cod	4Vn 4T	OTB2s catching 4Vn cod over 8K limit misreporting as 4T
16-May-88	Misreporting	Haddock	Closed Area	Reports haddock from closed area being landed
12-Sep-88	Misreporting	Cod	4X 5Z 5Y	Notes misreporting of fixed gear cod catches since 10 Aug from 5Z to 5Y & 4X
12-Sep-88	Misreporting	Haddock	Georges	Notes draggers sneaking haddock off Georges
12-Sep-88	Misreporting	Cod Haddock	Georges	Notes a lot of draggers fishing Georges disregarding closure
19-Sep-88	Misreporting	Pollock Haddock	4Xopq	Notes misreporting of pollock as haddock by draggers
19-Sep-88	Misreporting	Cod Haddock Shack	4Xp5Zj 4Xp5Y	Notes misreporting by LLs from 4Xp5Zj to 4Xp5Y
19-Sep-88	Misreporting	Cod Haddock	Georges Browns	Reports draggers fishing Georges, Browns for 50-60K cod/2 days; quota 0.0%
26-Sep-88	Misreporting	Cod Pollock Haddock	4Xnop 5Zj	Notes misreporting of cod & pollock as haddock by draggers
26-Sep-88	Misreporting	Cod Pollock Haddock	4Xop 5Zj	Notes draggers sneaking in cod pollock & haddock
26-Sep-88	Misreporting	Cod Pollock	4Xnop 5Zj	Reports draggers landing cod pollock from 4Xnop5Zj when chances of getting caught are rare
26-Sep-88	Misreporting	Cod Haddock	Georges Browns	Reports a lot of draggers fishing Georges for 25-50K cod/2 days; bank closed for boats <65
26-Sep-88	Misreporting	Cod Haddock Flounder	4Xq	Reports cod being reported as haddock, flounder because of dragger quota of 5K cod/trip
26-Sep-88	Misreporting	Cod Haddock Pollock Flounder	4Xopq 5Z	Reports some boats catching cod haddock pollock flounder in 4Xopq & reporting as caught 5Zb
5-Dec-88	Misreporting	Haddock	4X 5Zj	Reports draggers landing Browns Bank haddock misreporting as 5Zj
19-Dec-88	Discarding	Cod	4Vn	2OTB2s fishing 4Vn cod with small fish discards of 30-40%



### Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
9-Jan-89	Dumping	Pollock	Browns Bank	Reports dumping of pollock due to trip limits
6-Feb-89	Dumping	Pollock		Reports dumping of lots pollock due to low price
1-May-89	Dumping	Scrod Haddock	4Whj	Reports draggers fishing 4Whj dumping of a lot of small fish, landing 10-45K/trip
4-Jun-89	Discarding?	Cod Haddock	Georges Bank	45' draggers landing haddock with L-F peak at 38cm and observing a lot of 2cm cod caught in the twine knots of the nets on deck
4-Jun-89	Misreporting			Reports boats landing, unloading & sailing before C&P arrive; no purchase slips recorded
11-Jun-89	Misreporting			Reports a lot of unreported landings because of trip limits on C1 & C2 draggers
11-Jun-89	Misreporting	4Xn 4W		Reports C1 & C2 draggers misreporting fish actually caught in 4Xn as being 4W fish
11-Jun-89	Misreporting	4Xn 4W		Reports C1 & C2 draggers not making log recors or getting purchase slips for trips made
19-Jun-89	Misreporting			Lots of misreporting of catch weight & gear type, not area
26-Jun-89	Misreporting			Draggers <45 allowed 3300 lbs; some boats landing a lot more than this; 43K pollock in one port
26-Jun-89	Misreporting			Some misreporting from mobile gear to fixed gear
4-Sep-89	Misreporting		4Vw 4X	Reports a few draggers supposedly fishing 4VW actually on German Bank in 4X
18-Sep-89	Misreporting		4X	Some draggers <65 fishing 4X with no quota
18-Sep-89	Discarding	Cod	4Vs	OTs fishing Quero finding few cod, mostly small; a lot of discarding
18-Sep-89	Misreporting	Cod	4Vn	One OTB2-45 busted for 50K 4Vn cod; allowed 1K
9-Oct-89	Misreporting		4X	Several OT's fishing this week without observers; 2 caught in 4X
20-Nov-89	Misreporting	Flounder	4VW 4X	Dragger fished Lurcher for 10 K flounder; misreported 4X caught fish as 4Vw
11-Dec-89	Misreporting	Flounder	4VW 4X	Only dragger out misreported all fish as 4VW due to no 4X quota
18-Dec-89	Discarding	Cod	4Vn	Draggers around St Pauls finding small cod (20% discards); Fish near 4Vsb line larger (15% discards) but scarcer
1-Jan-90	Dumping	Cod Haddock Pollock		Reports draggers discarding cod & haddock to stay within quotas; not landing any pollock caught
15-Jan-90	Highgrading	Cod Haddock Pollock		Reports discarding of small cod & haddock for better prices; not landing any pollock caught
22-Jan-90	Discarding			Reports of a few boats discarding fish to stay within trip limits
29-Jan-90	Transferring			A lot of vessels giving fish to each other to stay within trip quotas
5-Feb-90	Highgrading		4Vsb	Highgrading prevalent in 4Vsb especially when boats getting big tows with only 15-20K allowed
12-Feb-90	Misreporting	CHP	4VW 4X	Many <45 draggers getting 4VW permits & fishing 4X for 20-30K/boat
12-Feb-90	Misreporting	CHP	4VW 4X	States all fish landed by <45 vessels from 13-17 Feb 90 Class I misreported as 4VW instead of 4X
12-Feb-90	Dumping			One boat had tow of 70K, had to dump 30K
26-Feb-90	Highgrading			Fishermen feel IQs will cause even more highgrading, keeping most valuable fish
12-Mar-90	Misreporting	Pollock	Browns Bank	Notes 2 draggers landing 50K Browns Bank pollock each, both misreported
9-Apr-90	Misreporting	Haddock	4Vs 3Ps	Large OTs misreporting 4Vs haddock as 3Ps
23-Apr-90	Dumping	Haddock	4Xn	Reports some boats dumping small haddock
30-Apr-90	Dumping	Cod Pollock	Bay of Fundy	Reports a lot of fish being dumped because of lack of quota & draggers being checked at wharf
28-May-90	Misreporting	Cod	4Vn 4Vs	OTs pollock fishing off St Pauls & Sydney Bight misreporting cod by-catch as 4Vs
4-Jun-90	Misreporting	Cod	4Vn 4Vs	70-100K 4Vn cod misreported as 4Vs
2-Jul-90	Highgrading			Fishermen feel IQs will cause highgrading & destruction of fish stocks
23-Jul-90	Misreporting		4X 5Z	Reports of OTs fishing 4X with 5Z permits
23-Jul-90	Misreporting	Haddock		Some draggers reported to be landing > 30% haddock limit by various means
20-Aug-90	Discarding	Redfish		NSP discarded all redfish this week; no markets
3-Sep-90	Misreporting		4X 5Z	Reports some boats misreporting catch as 5Z when actually caught in 4X
10-Sep-90	Misreporting	Cod Haddock	4X	Reports lots of Cod/Haddock misreported from 4X, no landing slips, no main office reports
15-Oct-90	Misreporting	Cod Haddock	4X 5Z	Reports draggers <65 fishing German Bank 50-60K/hr tow; landing fish at night, no purchase slips
18-Oct-90	Misreporting	Cod Haddock Winter Flounder	4X 5Z	Reports mobile gear with 5Z permits fishing 4Xq German Bank
3-Dec-90	Misreporting	Cod Pollock	4X 5Z	Reports seizure of 24K cod pollock from 1 vessel due to misreporting of catch
17-Dec-90	Misreporting	Pollock	4Xpq	Notes some misreporting of pollock in 4Xpq
24-Dec-90	Discarding	Cod	2J	OTs having to catch 500K , discarding 300K undersize, to get 200K legal size 2J cod



## Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
1-Jan-91	Discarding	Cod	4Vn	50% discards rumored in 4Vn
5-Jan-91	Dumping	Cod	4X	Reports unconfirmed rumors of draggers dumping cod & haddock
5-Jan-91	Transferring	Cod	4X	Reports the few haddock caught by draggers were large but too few for highgrading
19-Jan-91	Highgrading	Haddock	4X	Reports no need of dumping yet as all fish large
26-Jan-91	Dumping	Haddock	4X	Notes dragger complaints of too much cod available & IQ limits could lead to dumping
26-Jan-91	Dumping	Cod	4X	Reports no need of highgrading yet as all fish large
26-Jan-91	Highgrading	Haddock	4X	Reports no need of highgrading yet as all fish large
28-Jan-91	Discarding	Cod	4Vn	5-10% discards avg in Sydney Bight cod
4-Feb-91	Discarding	Haddock	4Xqr	OTs fishing German/Lurcher 5 days but bringing in no haddock due to IQs
4-Feb-91	Dumping	Haddock	4Xqr	OTs fishing German/Lurcher 5 days discarding 20,000-30,000 lbs haddock due to IQs
11-Feb-91	Dumping	Haddock	4X	Reports of draggers dumping a lot of haddock because of low IQs
11-Feb-91	Highgrading			Highgrading solution needed soon
25-Feb-91	Discarding	Cod	4VnVsb	Cod < 17" discards running 5-10%
4-Mar-91	Misreporting	Cod	4Vsb	At least 50K 4Vsb cod not reported on slips
1-Apr-91	Misreporting	Cod	4Vsb 3P	Only boats successful for cod in 4Vsb also fishing St Pierre Bank; some 3P cod misreported as 4Vs
8-Apr-91	Misreporting	Haddock	4Vsb 3P	Some 3P haddock marked as 4Vs
8-Apr-91	Misreporting	Cod	4Vsb 3P	Most boats successful for cod in 4Vsb also fishing 3PLNO; some 3PLNO cod misreported as 4Vs
14-Apr-91	Misreporting	Cod	4Vn 4Vs	Some 4Vn cod misreported as 4Vs; at least 50% on one boat
21-Apr-91	Misreporting	Cod	4Vn 4Vs	Some 4Vn cod misreported as 4Vs by big OTs
6-May-91	Misreporting	Cod	3 P 4Vn 4Vs	Large OTs commonly misreporting 3P4Vn cod as 4Vs; amounts to tens of Ks/trip
13-May-91	Discarding	Cod	4Vn	Draggers finding a lot of small cod, up to 40% fish < 17", average 10-20%
13-May-91	Highgrading	Cod		Boat quotas causing problems; highgrading has started & will get worse
13-May-91	Highgrading	Cod	3P 4Vn 4Vs	Large draggers misreporting a lot of 3Pn 4Vn cod as 4Vs to avoid company-imposed limits
20-May-91	Highgrading	Cod	4Vn	One of main inshore buyers offering one price for all cod; should reduce highgrading
2-Jun-91	Discarding	Cod	4Vn	Up to 20% discarding of small cod in some places; other spots none
17-Jun-91	Discarding	Habitat	Grand Banks	Grand banks Habituees discarding steakers because of limits
24-Jun-91	Discarding	Cod	4Vn	Discarding of <17" 4Vn cod running up to 10% in some places
19-Aug-91	Discarding	Cod	4Vn	One 65" dragger had 25-30% cod <17" fishing with 5.5" mesh
19-Aug-91	Discarding	Cod	4Vn	Some 4Vn OTs getting 10-20% cod <17"
9-Sep-91	Misreporting	Cod	4X SZ	OTs misreporting catches; fishing 4X with 5Z permits
23-Sep-91	Discarding	Cod	4Vn	One OT with 130 diamond gear with cod discards of 50%
30-Sep-91	Dumping	Cod		Several OTs fished Grand Manan culling catch at sea; 50% large market/50% steakers
30-Sep-91	Dumping	Cod		Reports from fishermen with no IQ quota left of dumping haddock, keeping only cod, pollock, etc
30-Sep-91	Discarding	Cod	4Vn	OT activity on Smoky Bank running at 10-20% discards
7-Oct-91	Misreporting	Cod	4X SZ	Misreporting by 10-20 vessels with 5Z permits fishing in 4X German Bank, landing up to 20K cod, 7K haddock, 5K flounder per boat
7-Oct-91	Discarding	Cod	4Vn	Small cod everywhere; OTs discarding 10-20%; LIs getting 10% <15" on 12/0 circle hooks
7-Oct-91	Discarding	Cod	4VsbW	OTs hard going for small fish with high discarding
14-Oct-91	Misreporting	Cod	4X SZ	5Z/4X misreporting again, but with lower catches of 8K-20K cod/haddock per boat. 5Z boats hitting 4X on way out & on way back in again
14-Oct-91	Discarding	Cod	4Vn	OTs on Smoky Bank up to 20% discards; LIs 10%
21-Oct-91	Highgrading	Cod	4Xqr	Reports 1K-5K landings of mostly steak cod culled from catch; higher price
21-Oct-91	Misreporting	Cod	4X SZ	Reports misreporting by vessels with 5Z permits fishing in 4X
21-Oct-91	Discarding	Cod	4Vn	4Vn OTs 10-20% discards
18-Nov-91	Discarding	Cod	4Vn	Gulf cod moving into 4Vn; OTs with 20-30% discards, up to 40% on some boats
25-Nov-91	Discarding	Cod	4Vn	Only small trash left around northern Cape Breton, discards up to 60%; even LIs reporting 40-50% undersized; large OTs at edge 20%
2-Dec-91	Discarding	Cod	4Vn	One L.L. up north reporting 40-50% discarding
9-Dec-91	Highgrading	Cod	4Xqr	Notes cod landings not sampled because steak cod culled at sea
9-Dec-91	Discarding	Cod	4Vn 4Vsb	4Vn cod discards up to 15-25% along edge & Smoky; higher around St Pauls Island & along coast; 4Vsb 25-30%
16-Dec-91	Discarding	Cod	4Vn	4Vn cod discards 30-40%; some boats 50-60%; 4Vsb cod 30-40%
21-Dec-91	Transferring	Haddock	4Xmmop	Reports rumors of LIs transferring haddock to other LIs to stay within 3300 lb trip limit
23-Dec-91	Discarding	Cod	4Vn	4Vn cod discards 30-40%; some lows up to 60%

### Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
1-Jan-92	Discarding	Cod	4Vn	Cod discards: St Pauls 25-30%; 4Vs-4Vn line 15-25%; mid-4Vn edge 5-10%
6-Jan-92	Discarding	Cod	4Vn 4Vsb	Cod discards: mid-4Vn edge 1-10%; 4Vsb & shallow water 4Vn up to 25%
13-Jan-92	Discarding	Cod	4Vn 4Vsb	Cod discards: 130-150 fathom waters 1-5%; 110-130 fathom waters 10-20%; 4Vsb 15-25%
25-Jan-92	Misreporting	Cod	3NOPs 4Vc	Several large LLs landed 100-180K of mostly cod from 3NOPs & 4Vc; suspect the cod was caught Grand Banks & misreported to 4Vc
27-Jan-92	Discarding	Cod	4Vn 4Vsb	Cod discards: 4Vn 1-5%; 4Vsb 15-25%
1-Feb-92	Misreporting	Haddock	4Xn	LLs landing last week with up to 23K 4Xn haddock; one was charged with exceeding 15K trip limit
1-Feb-92	Misreporting		3NOPs 4VW	Large LL landing from 4VW & 3NOPs; most likely 4Vc fish misreported from Grand Banks
3-Feb-92	Discarding	Cod	4Vsb	Cod discards: 4Vsb 1-5% with 145 diamond gear
3-Feb-92	Misreporting	Cod	3Ps 4Vsb	Some vessels misreporting 4Vsb cod as 3Ps because of company limits on amounts of fish/area
8-Feb-92	Misreporting	Cod	3Od 4Vc	Large LL landed 115K cod from 4Vc & 3Od; majority reported from 4Vc but probably caught 3Od
10-Feb-92	Misreporting	Cod	3Ps 4Vsb	125K 4Vsb cod misreported as 3Ps
17-Feb-92	Misreporting	Cod	3No 4Vn 4Vs	3NO & 4 Vn cod misreported to 4 Vs this week
24-Feb-92	Discarding	Haddock	4X	Reports of several boats dumping haddock because of low IQs & 10 months left to fish
2-Mar-92	Discarding	Cod	4Vn	Cod discards 1-5% , up to 20% in big tows
9-Mar-92	Discarding	Pollock	4Xn	Some reports of boats culling out small pollock at sea in 4Xn
24-Mar-92	Misreporting	Cod	4Vn 4Vs	At least 200K 4Vn cod misreported as 4VsW
6-Apr-92	Discarding	Cod	4Vn	Cod discards up to 10% with 145 diamond gear
13-Apr-92	Dumping	Cod Haddock	4Vsc 3P	Sign of some nice fish from Quero, but not allowed to land it, some dumped, some misreported as 3P
18-Apr-92	Misreporting	Haddock	Closed Area	One Digby dragger caught fishing for haddock in closed area last week
4-May-92	Discarding	Cod	4Vs	OTs around Gully & Sable for very small fish; alot of discards 20-30%; some boats landing fish as small as 36cm & still have 5% discards
11-May-92	Discarding	Cod	4Vs	Fish in fair concentrations in Gully but small fish & high discards
25-May-92	Discarding	Cod	4Vn	A lot of cod discarding in Gutter & around White Point Bank
15-Jun-92	Misreporting	Haddock	4X 5Z	Some misreporting of Haddock caught in 4X and misreported as 5Z due to low IQs
29-Jun-92	Misreporting	Cod	3NOP 4Vs	Big OTs in 3NOP & 4Vs same trip; easy to misreport area 3 cod as 4Vs; 4Vs catches mostly paper fish
6-Jul-92	Misreporting	Haddock	4X	Lots of misreporting of catches of haddock in 4X by generalists up the French Shore
13-Jul-92	Discarding	Yellowtail Plaice	4Vs 4Vn	Boats discarding approx. 20% with 140 square mesh gear
20-Jul-92	Misreporting	Cod Hake	4Vs 3NOP	Still misreporting of 3NOP fish as 4Vs by mostly OTs but some LLs fishing hake off NFLD reporting cod from 4Vs
24-Aug-92	Discarding	Cod	4Vn	Cod discards for LLs, Jiggers & OTs 5-20%; reports of OT using redfish gear for cod
5-Sep-92	Misreporting		Grand Banks	EA boats appear to be misreporting areas & species from Grand Banks
7-Sep-92	Misreporting	Pollock	4X	LLs doing well; trips of 8-10K cod, 5-10K haddock & misreporting 10-20K longline pollock; never seen so many longline pollock before !!
14-Sep-92	Misreporting	Haddock	4Xq 5Zj	100K Haddock caught in 4Xq misreported as 5Zj to finish up some boats quotas
14-Sep-92	Discarding	Cod	4Vn 4Vs	Cod discards 10-15% for 4Vn LLs; reports of a lot of small cod being discarded NW Sable Bar in 4VsW
24-Sep-92	Discarding	Haddock	4Vs	Big OTs at Stone Fence finding too much haddock mixed with cod, have to throw back haddock, but best catches of cod here
26-Sep-92	Misreporting	Haddock	4X	LLs fishing Baccarao & Browns having trouble staying under 3.3K haddock & some don't bother
28-Sep-92	Misreporting	Haddock	4Xq 5Zj	More misreporting of 50-75K 4Xq haddock misreported as 5Zj because of no IQ left in 4X
28-Sep-92	Misreporting	Haddock	4X	Generalist vesels also misreporting a lot of 4X haddock; not being weighed at wharf by weighmaster program
5-Oct-92	Misreporting	Haddock	4Xq 5Zj	Haddock misreported this week was 97K caught in 4X & misreported as 5Zj
5-Oct-92	Transferring	Haddock	4X	A lot of boats transfer haddock at night or in fog & land 25-30K all haddock; no other species
10-Oct-92	Discarding	Haddock	4Xno	LLs catching small haddock over most of 4Xno; DFO starting to watch them closer but a lot of haddock has already been landed
10-Oct-92	Misreporting	Cod	4Vs 3Ps	3Ps cod still being misreported as 4Vs, but even 3Ps hurting
12-Oct-92	Misreporting	Cod Haddock	4X 5Z	Lots of misreporting: 200K 4x haddock as 5Z, 50 K 4X cod as 5Z
17-Oct-92	Misreporting	Haddock	4Xno	LLs landing good catches haddock from Browns-Lahave with some landing 3 times their trip limit
19-Oct-92	Misreporting	Cod Haddock	4X 5Z	Only 35K haddock & 20K cod misreported from 4X as 5Z this week, but 40K cod & 10K haddock misreported from 4X as 4VW
19-Oct-92	Discarding	Cod	4Vn	LLs now going to 10/0 circle hooks, doubling landings with only small increase in discards
23-Nov-92	Misreporting	Cod	4Vs 4Vn	Large OTs finished 4Vn quota this week & are catching up 4Vs quota over 4Vn-4Vsb line
30-Nov-92	Discarding	Cod	4T	High discards reported 4T cod by OTs & LLs
30-Nov-92	Discarding	Pollock	4V	High discards of small 4V pollock by OTs; no large fish around
7-Dec-92	Discarding	Pollock	4V	Very high discard rates of small 4V pollock at mouth of Gully Cove; larger fish showing up late in week
12-Dec-92	Highgrading	Haddock	4X	Much bitching about 2.8K trip limit & a lot of cheating in haddock fishery, plus dumping of small fish
14-Dec-92	Misreporting	Haddock	4X 5Z	One dragger misreported 8K of 4X haddock as 5Z fish; trying to fish up haddock IQs for the year

## Summary of Port Technician Weekly Comments: Misreporting and Discarding

Date	Problem	Species	Area	Summary
25-Jan-93	Discarding	Cod	4Vs	Trial OT's fishing with 155 diamond gear reported 51% discards
8-Feb-93	Misreporting	Haddock	4Xp 5Z	One dragger landed 40K Haddock, 90K Pollock (10K reported, 30K caught 4X not recorded, 50K caught 4Xp misreported as 5Z due to 5Z per
15-Feb-93	Misreporting	Haddock	4X 5Z	Another 75K haddock caught W of Browns in 4X misreported as 5Z
3-May-93	Discarding	Cod	4Vs	No enforcement of landing all fish; trip limit of 4.5K cod unrealistic for boats steaming offshore; leads to discarding
17-May-93	Discarding	Flats	4V	Most buyers have minimum size of 13" on flats; boats wont land everything until buyers start buying it
24-May-93	Discarding	Cod	4Vs	High discards of small cod by L1.s 10-20%
24-May-93	Discarding	Plaice Witch	4V	High discards of small witch & plaice by boats using 140 square gear
12-Jun-93	Discarding	Haddock	4X	One L1 reported to have discarded 5K haddock on Laffave Bank, keeping 800lb
14-Jun-93	Misreporting	Pollock	4Vs	Nice pollock SE corner of Quero with illegal gillnets doing well

#### **4.4.2 Reports from Observer Program of Relevance to the Accuracy of Catch Statistics (R. Schiochetti)**

The coverage of the domestic fleet's fishing activities was shown in Table 5 (Section 4.3.3.2). With this level of coverage, the observers have picked up an in-depth understanding of the fishing practices of the offshore fleet, including differences in fishing behaviour when observers are on or not on a vessel. The reports of these observers of relevance to the accuracy of landings as estimates of catch from 1977 to 1990 are summarized below. This information is again of an anecdotal nature, and as a result is difficult to evaluate and quantify.

In 13 of deployments on foreign and domestic draggers, observers and the staff that work with their data have seen major changes in Departmental policies toward discarding of fish, but little change amongst fishers in their attitudes to the practice. The following is intended as a brief history of discarding and dumping problems from 1977 to 1990, as seen through an "observer's eyes":

##### 1977 to 1978

With the creation of the 200-mile zone, DFO found itself in a position to enforce anti-discarding provisions in both foreign and domestic regulations for the first time. Although the word "dump" is used in regulations, many interpreted the appropriate sections to mean that fishers were obligated to land everything they caught. This ideal fell far short of reality. The overwhelming majority of fishers were able to discard as they pleased, but refused to incriminate themselves by recording this in their logbooks. Even during rare visits from observers or fishery officers, surreptitious discarding continued. Even after observers acquired training in regulations pursuant to their role of monitoring a vessel's compliance, there were few charges.

##### 1979 to 1980

With a gradual increase in observer coverage on domestic vessels, DFO took a somewhat more aggressive approach to the discarding problem. Tolerances were developed to allow for limited discarding of unusable fish, and in some instances charges were laid where these were exceeded. Overall, however, the Department appeared to have little success in combatting the problem. Crews were still very much able to conduct their discarding when the observer was not there to see it and the fish-grinding machines, which are still in existence on many National Sea Products Ltd. trawlers, served to hide the evidence. Amongst captains, using their logbooks to acknowledge a discard remained an unknown practice. The observer coverage itself tended to occur in phases, when observers were not required in major foreign fisheries, rather than on a continual basis.

In a landmark decision, a Nova Scotia provincial court judge ruled that a Canadian dragger captain charged with illegal discarding was in actual fact selectively culling his catch. The judge considered this to be a legal practice, quite distinct from wholesale dumping, and acquitted the captain as a result. From this point on, all involved in fisheries management from observers to senior managers struggled to categorize any release of fish into the water based on this decision.

At this time, there was little change from the preceding years. With large sector allocations, draggers tended to engage in a race for fish and tended to discard only the small fish they felt were not worth bringing in for fish meal prices. On occasion, captains felt compelled to dump large quantities at the end of their trips due to lack of hold space; but the practice of rejecting unwanted species had yet to commence.

In foreign fleets, misrecording of species tended to be the worst problem. When faced with a large unwanted by-catch, many foreign captains found it easier to hide it as fish meal from a trash species rather than risk the observer's ire by discarding it. Discarding tended to be limited to

Japanese and Spanish vessels that simply could not process small or unwanted catches as fish meal, or Soviet vessels whose weak trawl winches and mesh material forced them to release fish.

#### 1983 to 1984

With the introduction of EAs and the restructuring of the major offshore companies in 1983, discarding problems took on a whole new perspective. Not wanting to be faced with the massive inventories they could not sell and which gave rise to their problems, companies started giving their captains lists of species to catch in an effort to meet specific market requests. With demands for a "hundred thousand pounds of this but only fifteen thousand of that," captains felt obliged to dump excess amounts or face unpleasant consequences on shore. During these so-called "Sobeys Trips" many complained to their observers "if I land it my company will suspend me, but if I dump it I am in trouble with DFO".

Following the 1981 decision, the emphasis in observer duties shifted from trying to detect discards to trying to encourage captains to record them. Success was limited at first, but has been gradually improving ever since. The greatest apparent obstacle was an attitude amongst captains and vessel owners that fish thrown back in the water represented a portion of the quota they did not wish to use at that time and that discards should not be deducted from the overall quota.

On the large offshore draggers, the steady improvement in recording of discard practices continued; but problems created by trip limits were still very much in evidence. In the Soviet and Cuban silver hake fishery, large unwanted catches of dogfish forced many judgement calls on the distinction between dumping and selective discarding. The consensus was usually that vessel crews should make reasonable efforts to cull out usable fish and ensure the discard was recorded. Even though this took place on foreign vessels, the experience was in many ways later applied to domestic activity.

#### 1987 to 1988

The anticipated increase in domestic vessel coverage did not take place in spite of the introduction of foreign cost recovery. A combination of increased costs and involvement in new fisheries such as offshore clams effectively prevented it. The year 1987 was significant, however, in that full coverage was imposed for all large vessels fishing for 2J-3KL cod in order to better assess cod discards. A new methodology was devised whereby observers were required to spend between 40% and 70% of all processing time monitoring discards. This not only led to improved data, but gave observers a means of assessing high levels of discards in other areas.

The major development in 1988 was the introduction of minimum fish size requirements by the Province of Nova Scotia. This in essence compelled vessels to discard all cod, haddock, and pollock that were less than 41 cm in length. This applied even to the new factory freezer trawler CAPE NORTH in spite of the presence of a fish meal plant on board. There was also a major amendment to the Foreign Vessel Fishing Regulations which seemed to finally acknowledge the practice of selective discarding provided it was recorded, but this was not accompanied by a similar change in domestic regulations.

#### 1989 to Present Day

Company-imposed trip limits stemming from EAs continue and domestic vessel captains are still "walking a tightrope" between their companies and DFO. Even though recording practices have improved tremendously since 1977, many captains are still hesitant to discard "under the nose" of an observer; but their crews freely admit to massive dumping when observers are not aboard. The new regulations specifying minimum sizes for retention have created far more problems than they solved.

Reports of massive discarding by foreign vessels are largely unfounded as problems tend to lie in the area of misreporting instead. An incident involving the Soviet vessel LUNOKHOD I was more of an isolated instance attributable to lack of communication, rather than a case of wanton dumping. There were also strong suspicions that several vessels in the Soviet Arctic Fleet were discarding significant amounts, but no solid proof could be obtained.

Some crewmen of domestic vessels have recently charged that some observers spend long periods in their bunks and fail to monitor discards adequately. While observers obviously cannot spend 24 hours on their ft., they are under explicit instructions to vary their routine in the hopes of detecting suspicious activities. The fact that domestic and foreign captains can never be sure when observers are likely to appear on deck or in the factory lends credence to the suggestion that the worst problems are on unobserved vessels. Increases in observer coverage, careful monitoring of their activities, and an attempt to combat the root causes for dumping are the only measures that will resolve the situation.

Continued concerns about unreported dumping and discarding led to the establishment of a new regulation compelling retention of all groundfish on January 1993. In addition to the above-noted synthesis, some comments from specific vessels are listed from 1979 to 1985 (Appendix 4).

The inferences that can be drawn from the observer reports on the offshore mobile gear are similar to those from the two port technicians who have more experience with "inshore" fleets. Dumping, discarding, highgrading, and misreporting by species and area have been an ongoing practice since extension of jurisdiction in 1977. Furthermore, the introduction of EAs in 1982 generated more incentives to continue these activities as the fleet captains made specific requests for a species and size mix for each trip. The consistency in comments between captains (Appendix 4), for example the claim of substantive dumping of small haddock in 1984/85 on Banquereau Bank, suggests that these claims are of substance.

#### **4.4.3 Estimates of the Accuracy of the Statistics on Landings Through Interviews (G. VanHelvoort and M.L. Etter)**

The statistical system has changed for part of the groundfish fishery in 1991. In January 1991, a 100% DMP was implemented in the Region for all groundfish mobile gears <65 ft. in order to better monitor the ITQ program. The Scotia-Fundy Catch Monitoring Association, a non-profit company, was established to run this activity. In August 1993, the offshore EA program supported a similar monitoring system with TAVEL. The four fundamental requirements of dockside monitoring in the Scotia-Fundy Region are:

1. third-party independence with arms-length relationship from both DFO and industry;
2. hails from sea including offloading authorization from DFO;
3. monitoring the accurate determination of weights by species at dockside; and
4. provision of correct data on landings and effort and entry of data to DFO computer system.

Given the importance of this program to ITQs, it has been evaluated using interviews (completed in November 1993). It should be noted that the interviews done were the opinions of industry participants. This analysis is a quantitative presentation of those opinions. The "numbers" in Table 9 are not absolutes, but should be considered an indicator of trends in data quality prior to and after the DMP was introduced.

The "data accuracy survey" involved interviewing 14 individuals (fishers, processors, industry representatives) who are familiar with the ITQ fishery and the DMP. The results (summarized in Table 9) indicate that the majority of those interviewed believe that DMP made a substantial improvement in the quality of data on landings reported to DFO. Although 50% felt there were still landings after DMP not reported to DFO (down from 86%), the majority of these indicated that the

SURVEY RESULTS FROM INTERVIEWS WITH INDUSTRY PERSONNEL INVOLVED IN THE GROUNDFISH IQ FISHERY.

QUESTIONS REGARDING ACCURACY OF DATA REPORTED TO DFO	PRIOR TO PUTTING DMP IN PLACE			AFTER DMP WAS PUT IN PLACE			STATUS SINCE DMP			CHANGE DUE TO DMP	
	% of respondants said YES	% of respondants said NO	% landings not reported/ misreported	% of respondants said YES	% of respondants said NO	% landings not reported/ misreported	% said decrease	% said increase	% said unchanged	% said YES	% said NO
Landings not reported	85.7	14.3	26.7	50.0	50.0	6.3	71.5	7.1	21.4	90.9	9.1
Misreporting of fishing area	66.7	33.3	40.0	66.7	33.3	28.3	25.0	8.3	66.7	*	*
Misreporting of species	92.9	7.1	36.1	21.4	78.6	*	78.6	7.1	14.3	75.0	25.0
Misreporting of weights	84.6	15.4	36.7	23.1	76.9	*	61.5	7.7	30.8	88.9	11.1
Dumping at-sea	92.9	7.1	*	78.6	21.4	*	42.9	14.2	42.9	0.0	100.0
Transshipping at-sea	75.0	25.0	*	87.5	12.5	*	25.0	12.5	62.5	12.5	87.5

\* Too few respondents.

number of unreported landings had decreased and this was mostly due to DMP. Respondents decreased their estimate of unreported landings from 27% to 6%. The unreported landings were believed to be localized to certain geographic areas (i.e., rural and unpopulated areas). Misreporting of species and weights at dockside decreased significantly in the majority of the opinions expressed. DMP was seen as responsible for these changes.

The interviewees indicated the amount of misreporting of fishing area has decreased or remained unchanged since DMP was implemented. No one attributed these changes to DMP. It was commented that the main deterrent to the misreporting of area was the presence of the DFO helicopter and the potential for sanctions. Others felt that the helicopter's coverage was not sufficient to prevent misreporting of area fished. Some respondents indicated that even the increased position information, required on the more comprehensive monitoring document that came into use with DMP, did not affect the misreporting of area fished.

Virtually all interviewees believed there is presently a problem with dumping and transshipping at sea. Of these, 43% believed dumping had decreased, 14% believed it had increased, and the remainder said the level of dumping had remained unchanged in the last five years. 88% of the respondents felt that transshipping was occurring after DMP, up from 75% prior to DMP. Transshipping was most commonly reported to occur when an ITQ vessel had caught most of its quota for the year and would therefore transship the fish at sea to a fixed gear vessel which could land the fish against fixed gear quotas. The catch could still be recorded but against the wrong gear type.

Respondents generally offered the opinion that dumping in the years prior to ITQs was mostly due to the following:

1. trip limits - limitations on amounts landed for certain species on a trip basis caused some dumping and highgrading; and
2. by-catch regulations - if a vessel caught more than the allowed by-catch of a particular species the excess may have been dumped.

After ITQs came into practice the reasons for dumping changed somewhat according to the interviewees:

1. small ITQs for some species - if the catching ratio of fish was unproportionate to a vessel's ITQ, dumping of the lower quota species or highgrading of small fish would occur; and
2. cancellation of exchange program - in 1991, a program was introduced which allowed for the exchange of one species of fish caught against quota held for another species. The exchange rate was based on different values for different species in order to reduce the incentive to target higher value species. The option was withdrawn at the end of 1992. Most respondents believed that dumping increased when this program ended.

In 1993 a mandatory landing provision was implemented requiring all fish caught to be landed, hence disallowing selective discarding. In spite of this provision, some respondents felt that it was easier to dump fish than to arrange transfers.

In order to evaluate the accuracy of landings, comparisons between DMP weighouts and at-sea observer estimates have been made. To date in 1993, there have been approximately 85 IQ trips covered by at-sea observers of which 24 were in the month of July. A comparison of these trips is shown in Table 10.

The difference between the at-sea observer estimates and the weighout by dockside observers (as a percentage of the weighout) is less than 7.0% for each species. Haddock, which shows the largest discrepancy (-6.94%), has the dockside observer weighouts less than the estimates at sea.



## COMPARISON OF AT-SEA OBSERVER AND DOCKSIDE OBSERVER DATA FOR IQ LANDINGS (KGS) IN JULY 1993

TRIP #	COD				HADDOCK				POLLOCK				TOTAL CHP			
	AT-SEA	DOCK	DIFF	% DIFF	AT-SEA	DOCK	DIFF	% DIFF	AT-SEA	DOCK	DIFF	% DIFF	AT-SEA	DOCK	DIFF	% DIFF
1	3277	3232	-45	-1.39%	751	858	107	12.47%	3283	3016	-267	-8.85%	7311	7106	-205	-2.88%
2	1568	1362	-206	-15.12%	222	291	69	23.71%	365	616	251	40.75%	2155	2269	114	5.02%
3	570	635	65	10.24%	247	205	-42	-20.49%	95	160	65	40.63%	912	1000	88	8.80%
4	8295	7834	-461	-5.88%	55	86	31	36.05%	7855	8032	177	2.20%	16205	15952	-253	-1.59%
5	355	476	121	25.42%	550	483	-67	-13.87%	150	237	87	36.71%	1055	1196	141	11.79%
6	1240	1851	611	33.01%	256	358	102	28.49%	5746	6443	697	10.82%	7242	8652	1410	16.30%
7	57	90	33	36.67%	0	0	0		0	0	0		57	90	33	36.67%
8	3998	4175	177	4.24%	453	450	-3	-0.67%	835	1158	323	27.89%	5286	5783	497	8.59%
9	9329	8140	-1189	-14.61%	449	475	26	5.47%	263	314	51	16.24%	10041	8929	-1112	-12.45%
10	2198	2548	350	13.74%	2408	1935	-473	-24.44%	63	84	21	25.00%	4669	4567	-102	-2.23%
11	3929	3305	-624	-18.88%	2635	2781	146	5.25%	237	466	229	49.14%	6801	6552	-249	-3.80%
12	610	599	-11	-1.84%	335	299	-36	-12.04%	1573	1467	-106	-7.23%	2518	2365	-153	-6.47%
13	1724	1812	88	4.86%	1391	962	-429	-44.59%	3724	4141	417	10.07%	6839	6915	76	1.10%
14	1872	1968	96	4.88%	1699	1574	-125	-7.94%	50	59	9	15.25%	3621	3601	-20	-0.56%
15	3485	3767	282	7.49%	745	827	82	9.92%	6500	5564	-936	-16.82%	10730	10158	-572	-5.63%
16	4640	4225	-415	-9.82%	1270	1175	-95	-8.09%	11	11	0	0.00%	5921	5411	-510	-9.43%
17	5417	5248	-169	-3.22%	761	745	-16	-2.15%	3421	4181	760	18.18%	9599	10174	575	5.65%
18	1255	1329	74	5.57%	1730	1168	-562	-48.12%	3128	3302	174	5.27%	6113	5799	-314	-5.41%
19	2707	3189	482	15.11%	2154	3085	931	30.18%	274	483	209	43.27%	5135	6757	1622	24.00%
20	22	9	-13	-144.44%	11	9	-2	-22.22%	1264	1265	1	0.08%	1297	1283	-14	-1.09%
21	620	662	42	6.34%	240	228	-12	-5.26%	280	314	34	10.83%	1140	1204	64	5.32%
22	3021	2573	-448	-17.41%	1865	2043	178	8.71%	3800	3876	76	1.96%	8686	8492	-194	-2.28%
23	2365	2729	364	13.34%	2575	1294	-1281	-99.00%	6540	6161	-379	-6.15%	11480	10184	-1296	-12.73%
24	295	0	-295		9	0	-9		0	0	0		304	0	-304	
TOTAL	62849	61758	-1091	-1.77%	22811	21331	-1480	-6.94%	49457	51350	1893	3.69%	135117	134439	-678	-0.50%

Pollock is the opposite. There are some large discrepancies when you look at individual trips, but most of these trips have very small amounts of fish landed (i.e., see cod on trip numbers 7 and 20).

### Conclusion

In conclusion, the majority of the people interviewed felt that misreporting of species and weights to DFO has decreased substantially and this was a direct result of implementing DMP. They also felt that the number of unreported landings has decreased, but one-half of the group interviewed believed there were still some landings not reported. Misreporting of fishing area, dumping, and transshipping at sea have remained for the most part unchanged over the last five years and have been unaffected by DMP. In addition, the at-sea observer estimates and dockside observer weighouts appear to be close in weight and species, exhibiting confidence in both sources of data.

The conclusions noted here on the accuracy of data prior to DMP tend to be consistent with the analysis on anecdotal information (Sections 4.4.1 and 4.4.2). However, the indication from interviews and comparison of at-sea and dockside observer data are that since DMP the reporting of landings data by the ITQ fleet has improved substantially. This infers that the introduction of a DMP can improve the reliability of species and weights reported for fish landed, but will have no effect on the illegal fishing practices at sea.

#### **4.4.4 Comparison of Aggregate Landings Data to Export Data (G.L. Brander)**

A second quantitative approach to estimate the accuracy of landings data was presented (a comparison of aggregate annual landings data to export data). Export and import data to/from Canada is compiled by Statistics Canada from documents collected by Customs at the borders or at ports of entry or exit. In recent years, Statistics Canada has been recording the province of origin of the goods exported. They "harmonize" export data to the United States with American imports data to help ensure accuracy of Canadian export data. They do not, however, claim to always get the province of origin correct.

To compare the Nova Scotia groundfish reported landings with exports of groundfish to all countries, it was necessary to convert all exported product forms to a round weight using standard conversion rates. Any imports of these species were also deducted from exports. Even if the conversion process was 100% accurate, we would expect landings to exceed net exports by the amount consumed locally or shipped elsewhere in Canada. No data are available on such consumption.

Table 11 shows the results for cod. The Nova Scotia landings and exports match closely, but New Brunswick's much smaller totals (exports twice landings) suggested provincial identification might be poor. When all of the cod from the Atlantic Provinces are aggregated there is a good match (with landings being 5 to 10% higher than exports). In Table 12, the comparisons are extended to cover all groundfish exports from Nova Scotia (cod, haddock, pollock, and an aggregated category of other groundfish [NES]). The haddock landings for Nova Scotia exceeded exports by over 50%. This suggests high haddock consumption in Canada. The pollock data are suspect, with landings data 100% over exports. Part of this may be explained by the use of a considerable amount of pollock in cooked fish products produced in Lunenburg. These products are sold almost exclusively in Canada. The export data contained several thousand tons of aggregated other species (NES). Some of the pollock may have been included in this category. When added to pollock, a reasonable balance between pollock landings and exports is achieved. The landings/exports comparison for the Province of Nova Scotia is credible regardless of whether this aggregated NES category represents pollock or not. It is also important to note that no significant quantities of pollock or haddock appeared in the exports for other provinces. Thus, there is no complication of misrepresentation by province for these two species.

# NET EXPORTS AND LANDINGS BY PROVINCE\*

## COD ONLY

1992                  1991                  1990  
 ('000 tonnes round)

### NOVA SCOTIA

Landings	90.2	101.4	112.6
Exports	92.5	105.8	144.8
Landings/exports (%)	97.5%	95.9%	77.8%

### NEWFOUNDLAND

Landings	74.4	179.0	245.7
Exports	61.0	136.7	193.2
Landings/exports (%)	121.9%	131.0%	127.2%

### ATLANTIC PROVINCES (4)

Landings	170.8	290.3	372.8
Exports	163.1	259.9	366.1
Landings/exports (%)	104.7%	111.7%	101.8%

\* Imported fish products were subtracted from exports.

# COD, HADDOCK, POLLOCK EXPORTS NOVA SCOTIA, 1990-92

To all markets outside Canada

	<u>1992</u>	<u>1991</u>	<u>1990</u>
	'ooo tonnes		
EXPORTS (Converted to round)			
COD	92.5	105.8	144.8
HADDOCK	14.1	12.2	12.3
POLLOCK	12.2	18.4	15.3
NES PRODUCTS *	<u>14.3</u>	<u>26.4</u>	<u>23.0</u>
TOTAL CHP+NES	133.1	162.7	195.4

## LANDINGS (Round)

COD	90.2	101.4	112.6
HADDOCK	20.9	20.9	20.2
POLLOCK	<u>32.1</u>	<u>37.6</u>	<u>35.6</u>
TOTAL CHP	143.3	159.9	168.5

## LANDINGS / EXPORTS (%)

COD	98%	96%	78%
HADDOCK	148%	172%	164%
POLLOCK	263%	204%	233%
POLLOCK+NES	121%	84%	93%
TOTAL CHP	121%	117%	98%
TOTAL CHP+NES	108%	98%	86%

\* Includes any fish products of unidentified species, except those classified as nes flatfish.

A final check was made with respect to the haddock comparison, in order to determine whether the large difference between exports and landings could be explained by local consumption (Table 13). Haddock is the whitefish of choice for most Maritime residents. The difference between exports and landings is about 5,000 t annually (round form). This equates to about 1 kg per capita for Maritime residents. The Canadian total per capita consumption of fish is in the range of 15-20 lb. per year. Thus, 5,000 t of local consumption is not out of line.

In sum, the comparison supports the accuracy of the groundfish landings when considered on an aggregate basis by species.

#### **4.4.5 Matched Comparisons Between Statistics and Costs/Earnings Data (C. Milley)**

The third quantitative evaluation of the accuracy of the landings data compared cost and earnings data (from surveys of fishers) with their reported landings from the DFO statistical system. The results are shown in Table 14 and Figure 42. They indicate that there are not large differences between earnings data from the survey data and landings data in the statistical system. This suggests, as in Section 4.4.4, that on aggregate the landings data are relatively accurate.

#### **4.4.6 General Discussion of Section on Problems with Statistics on Catch**

There is an internal consistency for several issues amongst the several papers presented on the degree of accuracy of landings at dockside as estimates of actual fish caught. The anecdotal information from the port technicians and observers infers extensive misreporting by area and species. The specific "observations" by the port technicians of misreporting by area fit well for the time periods when quota was a limiting factor in one area and an unlimiting factor in a contiguous area. The prevalence of this category of misreporting is also indicated in the interview analysis of the accuracy of the catch monitoring system. In addition, all the analyses inferred dumping, discarding, and highgrading (by both mobile gear and fixed gear) due to trip limits, EAs, ITQs, and imbalances between quota and abundance for the CHP species mix in a given area. The observer evidence infers that these practices have increased rather than decreased within introduction of property at the level of an enterprise. The port technician anecdotal information and the interviews infers that property at the individual level (IQs) is providing more incentives for illegal fishing practices at sea, but the levels of such practices cannot be quantified.

With respect to landings at dockside, even though landings may be misreported by management unit, the diverse evidence infers minimal under-reporting by tonnage. These analyses are somewhat inconsistent with the port technicians' reports and the interviews (which indicated in excess of 25% of landings not reported prior to dockside monitoring). Finally, the DMP and the observer estimates of landings are relatively accurate.

### **4.5 FACTORS POTENTIALLY GENERATING TEMPORAL TRENDS IN NATURAL MORTALITY OF GROUND FISH**

It has been interpreted that changes in environmental conditions have been a major contributor to the declines in northern cod off Newfoundland and Labrador. By inference, it has been concluded by some that environmental conditions have increased natural mortality in other areas where stocks have also declined steadily since the late 1980s. The continuous growth of the grey seal populations since the extension of jurisdiction has also been considered to be important. The aim of the following two papers has been to evaluate the degree to which trends in environmental conditions and seal predation has compromised our ability to achieve the objectives of groundfish management.

# HADDOCK EXPORTS

## NOVA SCOTIA, 1990-92

To all markets outside Canada

	<u>1992</u>	<u>1991</u>	<u>1990</u>
	'000 tonnes		
EXPORTS (Converted to round)			
FRESH WHOLE OR DRESSED	11084	9916	10260
FRESH FILLETS	2470	1923	2118
FROZEN FILLETS	1968	2307	2922
OTHER PRODUCTS	<u>82</u>	<u>78</u>	<u>392</u>
TOTAL HADDOCK	15604	14224	15692

LANDINGS	20941	20854	20192
APPARENT CONSUMPTION	5337	6630	4500
CONSUM. in FILLET WT.	1779	2210	1500
kg per capita (MARITIMES)	0.99	1.23	0.83

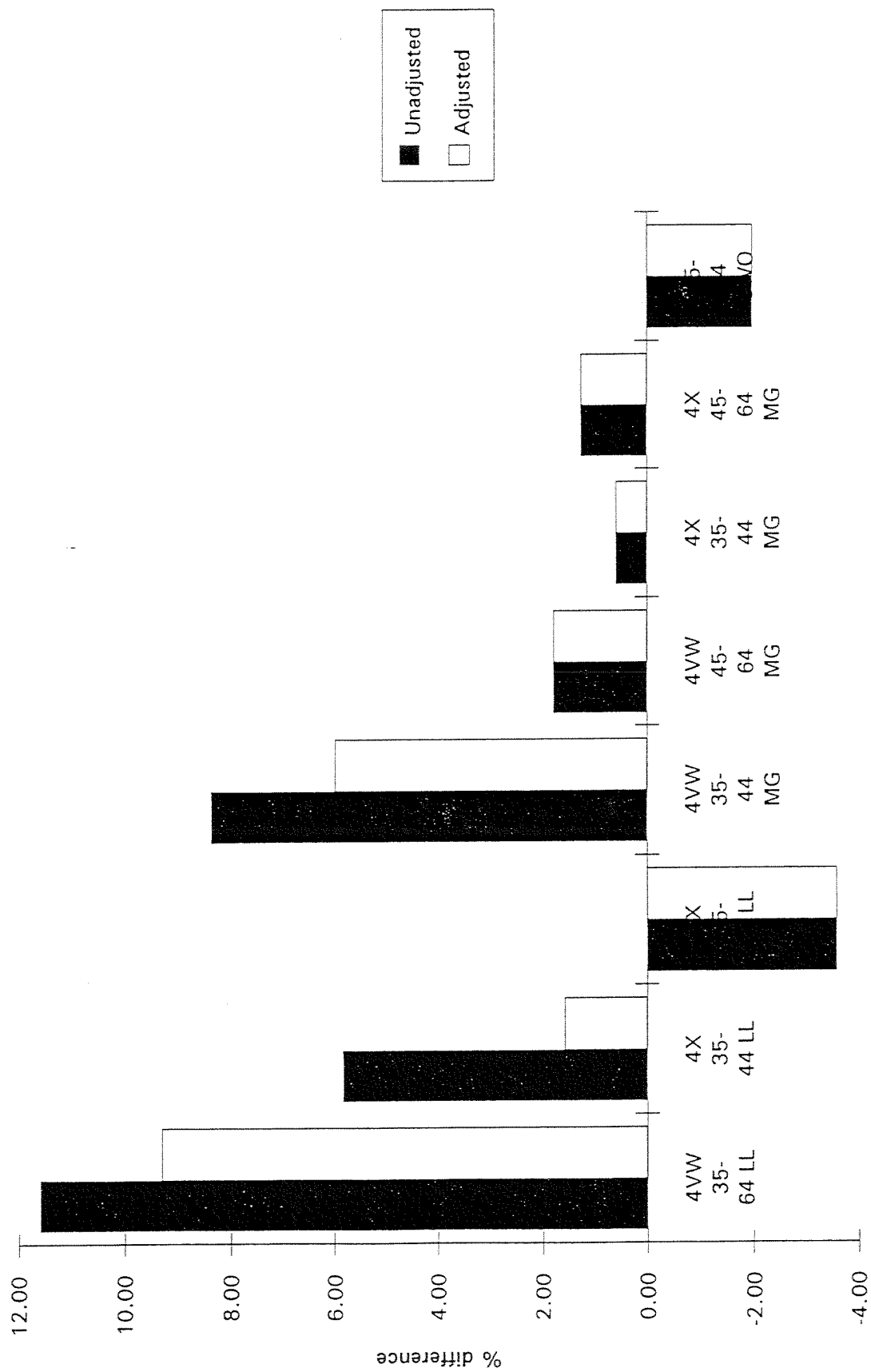
### FRESH WHOLE AS:

PERCENT OF EXPORTS	71%	70%	65%
PERCENT OF LANDINGS	53%	48%	51%

# Summary of Comparison of Catch Effort Data and Cost Earnings Data

Vessel Type	Number	Number of identical values (< 1% difference)	% same value	Catch Effort Mean (dollars)	Cost Earnings Mean (dollars)	Max. Diff. (dollars)	Mean Diff. (dollars)	Max. Pos. Diff. %	Max. Neg. Diff. %
4VW 35-64 LL	20	1	5	132,293	145,854	114,140	13,560	78.0	-10.2
4X 35-44 LL	32	3	9	164,362	166,984	80,286	2,622	56.3	-11.6
4X 45-64 LL	6	3	50	243,212	234,763	-25,331	-8,448	3.8	-9.9
4VW 35-44 MG	17	0	0	112,390	119,535	143,416	7,145	91.7	-13.4
4VW 45-64 MG	10	8	80	320,172	325,985	50,129	5,813	8.4	0.0
4X 35-44 MG	31	16	52	165,026	165,999	58,302	972	20.6	-18.0
4X 45-64 MG	26	13	50	333,714	337,931	49,873	4,216	30.0	-20.1
35-64 SWO	12	3	25	163,637	160,433	-48,734	-3,204	15.5	-10503.0

% difference between Catch/Effort data and Cost-Earnings survey data by vessel type





#### 4.5.1 Overview of Environmental Trends (F.H. Page)

Trends in the following environmental parameters were described:

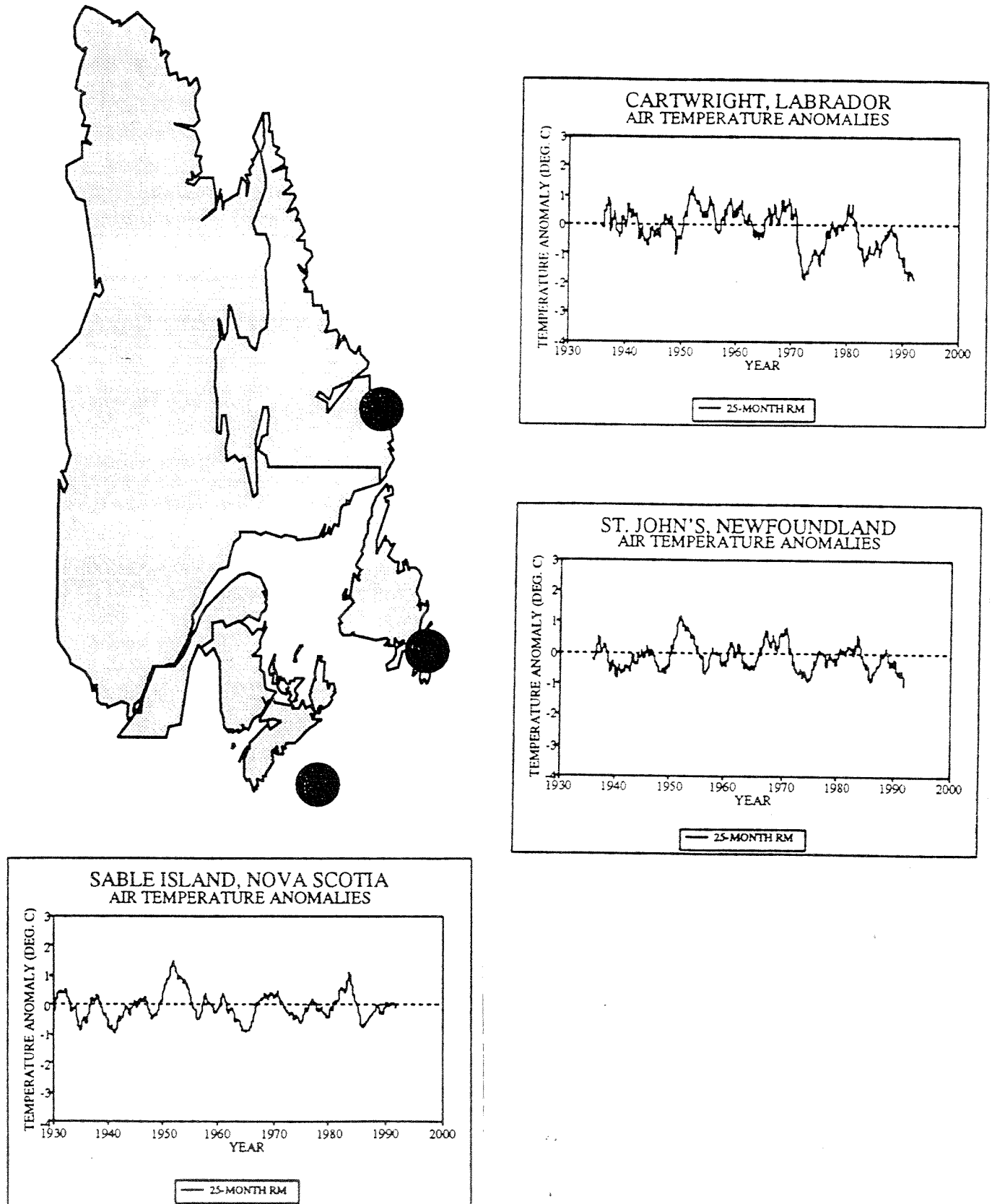
- Sable Island air temperature (Figure 43);
- the North Atlantic Oscillation index (an index of the strength of winter westerly winds over the northern North Atlantic - Figure 44);
- the geographic location of the Scotian Shelf/slope front (Figure 45);
- the northern boundary of the Gulf Stream (Figure 46);
- water temperature at long-term monitoring stations (St. Andrews and Halifax - Figure 47);
- water temperature and salinity distributions from the groundfish research vessel surveys (Figure 48a-d);
- species diversity from the research surveys (Figure 49); and
- changes in geographic distribution of cold-water species (Figure 50).

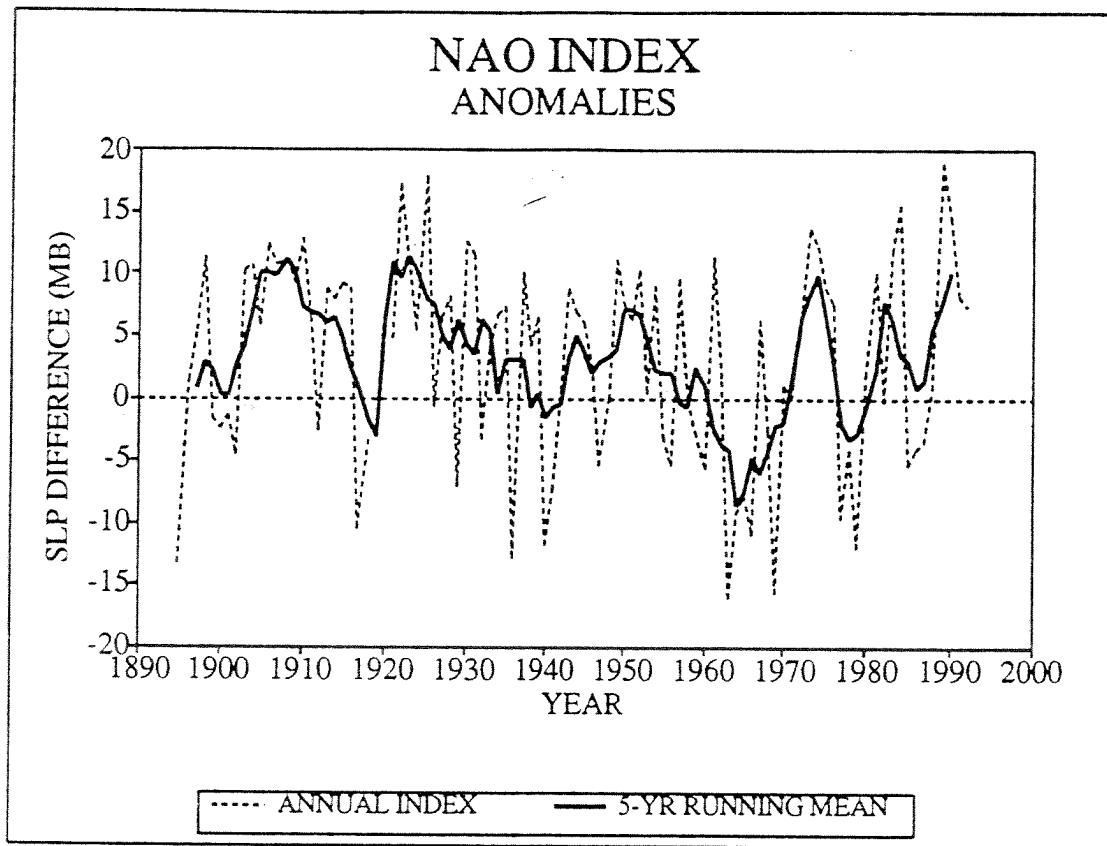
These environmental patterns were discussed in relation to the trends in biomass and recruitment for the diverse groundfish management units (see Section 4.2). Although there was some disagreement, it was concluded that for the western Scotian Shelf and Gulf of Maine area, the trends in environmental factors are unlikely to have caused the trends in biomass observed. Although surface water temperatures have been somewhat colder during the late 1980s and early 1990s, they are not outside the range of the time series. Also, the absolute temperatures are well within the range tolerated by the groundfish species of interest (for example 5°C bottom water on Georges Bank in spring), shown in Figure 48b. Colder temperatures within the range observed in this geographic area may well provide more positive living conditions (some of these species are near their southern limit of distribution in the Gulf of Maine area). There is no temporal trend in summer bottom water temperatures for 4X (Figure 48a). Also, the trends in plankton in the Gulf of Maine area (Boston to Yarmouth) do not indicate any negative changes in feeding environment for the larval stages of fish. If anything, zooplankton abundance has been increasing during the past decade. Taken on aggregate, there is nothing dramatic in the environmental trends during the late 1980s and early 1990s. The reduction in the number of age classes in the fishery for all "western" management units, the recent lowest recorded levels of spawning stock biomass for Georges Bank cod and haddock, and the loss of spawning components for some management units are more likely to be caused by fishing pressure than by adverse environmental conditions. Also, the decadal scale downward trends (not the inter-annual variability) in recruitment for haddock in 4X and 5Z do not appear to be linked to environmental trends.

There is, however, some evidence that environmental trends in 4VW have been significant with respect to distribution and abundance of groundfish. Figure 48d shows an increase in the number of observations of below-zero temperatures in 4V. However, the mean bottom temperature in the spring (the coldest time of the year) shown in Figure 48c suggests a weak downward trend. Note, however, that the mean bottom water temperature in 4VW is considerably colder than in 4X and 5, and thus small changes downward have the potential to have greater physiological significance. Trends in the distribution of more northern species (Figure 50) not usually characteristic of the eastern Scotian Shelf, such as capelin, suggest that these changes in environment are having a significant impact on geographical distribution and the composition of the finfish community.

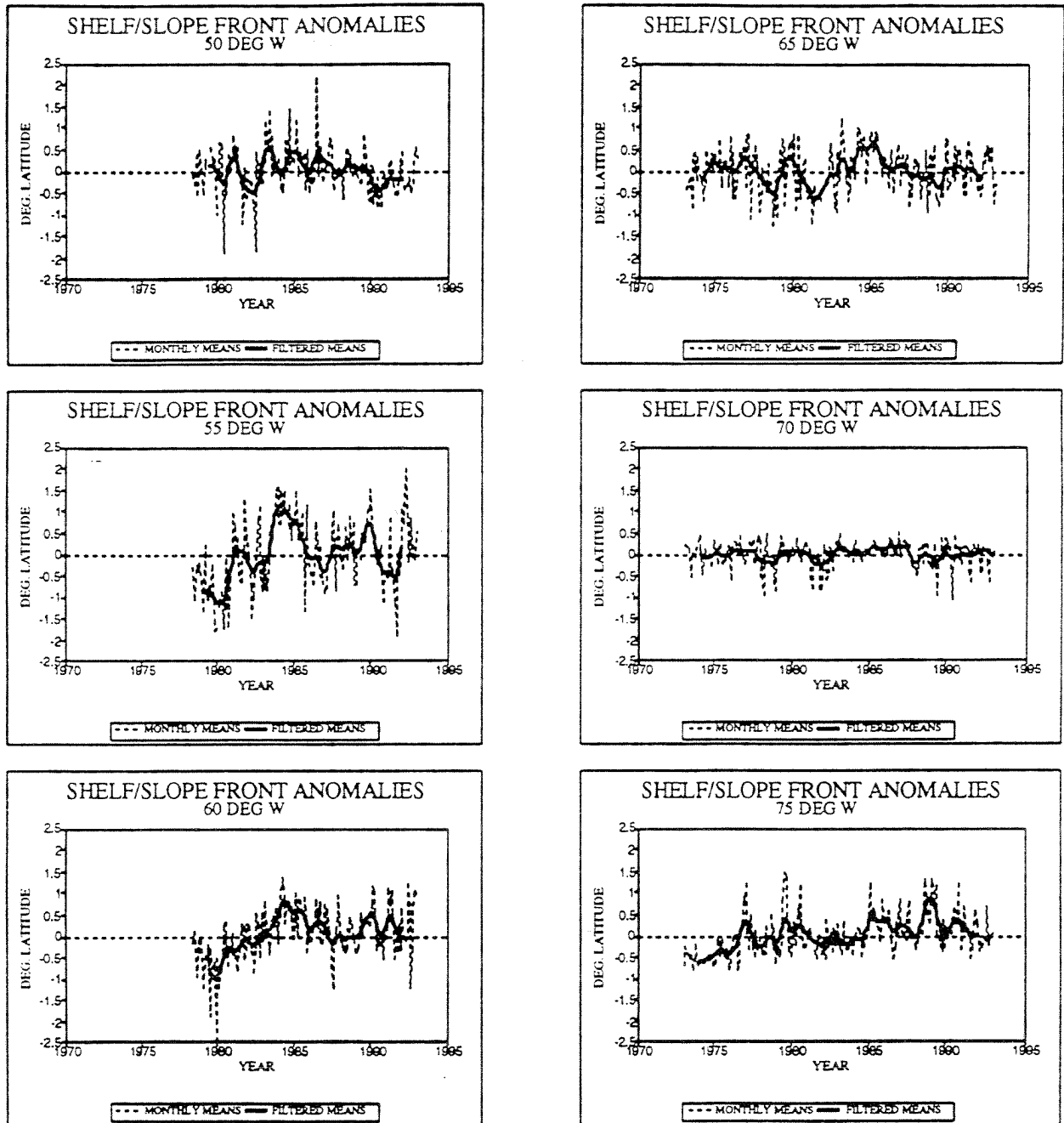
Given the above-noted observations, it is still difficult to account for the major decreases in biomass of 4VW cod and haddock biomasses and recruitment levels (as shown in Section 4.2) due to the environmental trends that have been described. Again it is the observed recent downward trends in biomass, rather than the inter-annual variability in recruitment, that are unlikely to have been generated by poor environmental conditions. The environmental conditions described are unlikely to have been that extreme to fully account for the extremely low levels of recruitment of haddock and cod observed since the mid 1980s.

# Air Temperature Trends

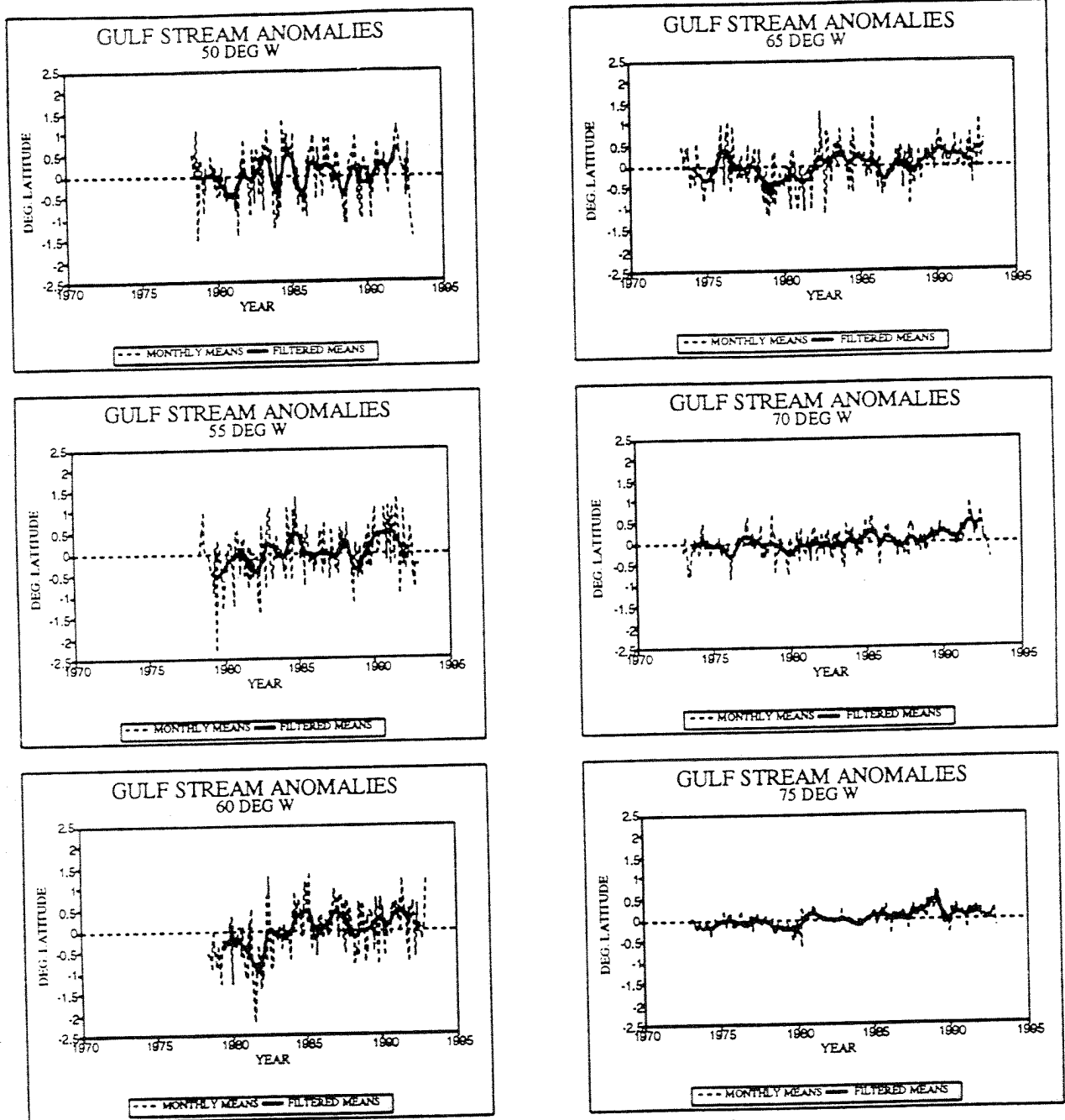




The North Atlantic Oscillation Index defined as the winter (December, January, February) sea level pressure at Ponta Delgada in the Azores minus Akureyri in Iceland.

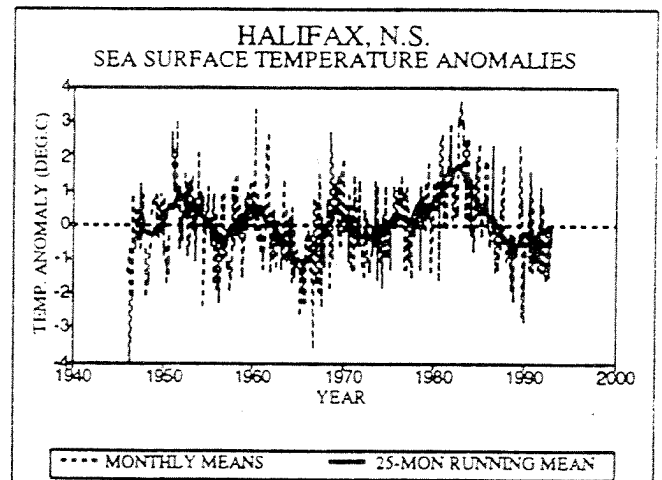
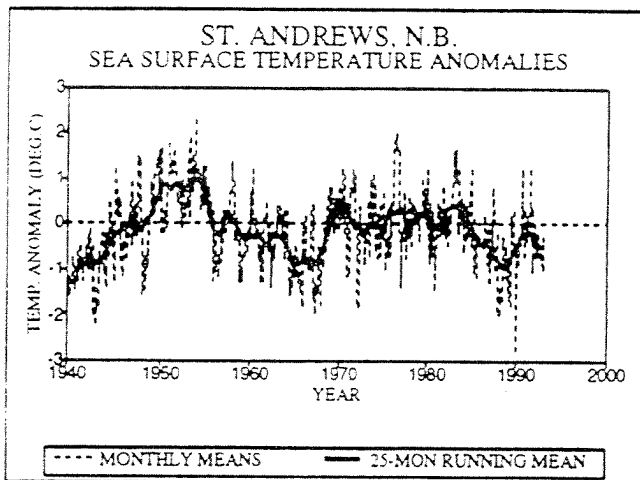
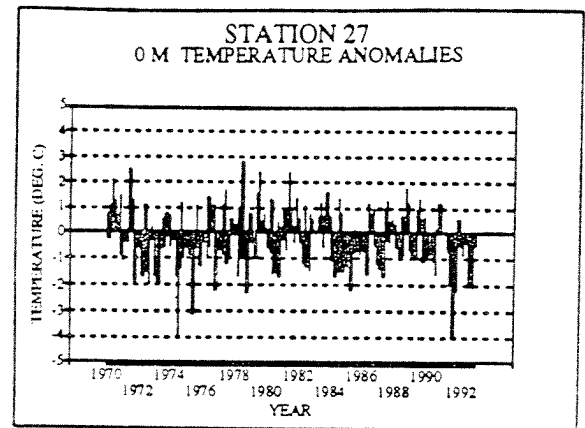
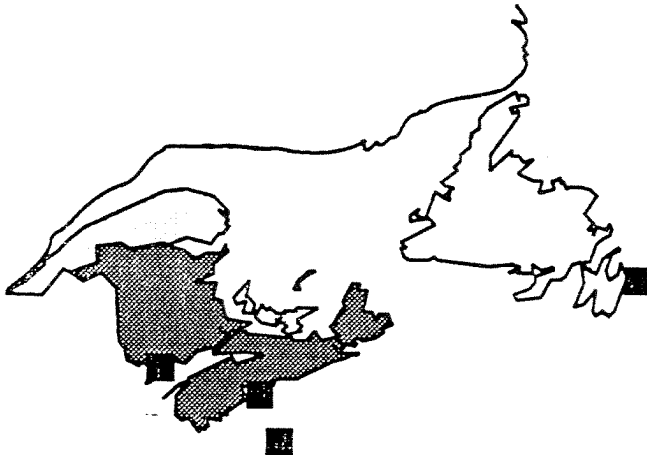


The monthly and filtered time series of the anomalies of the shelf/slope frontal position at each  $5^{\circ}$  of longitude between  $50^{\circ}\text{W}$  and  $75^{\circ}\text{W}$ .

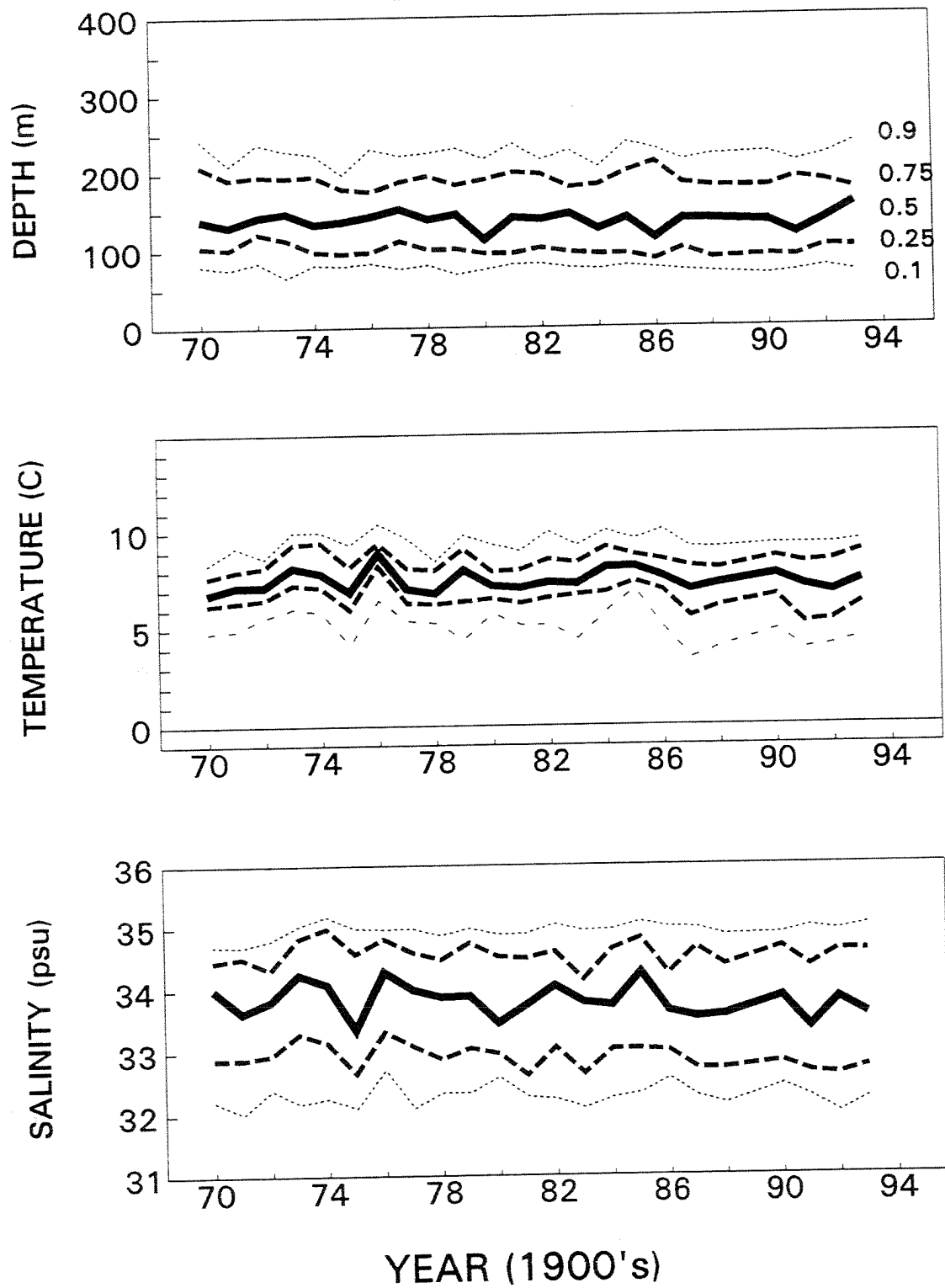


The monthly and filtered time series of the anomalies of the Gulf Stream frontal position at each  $5^{\circ}$  of longitude between  $50^{\circ}\text{W}$  and  $75^{\circ}\text{W}$ .

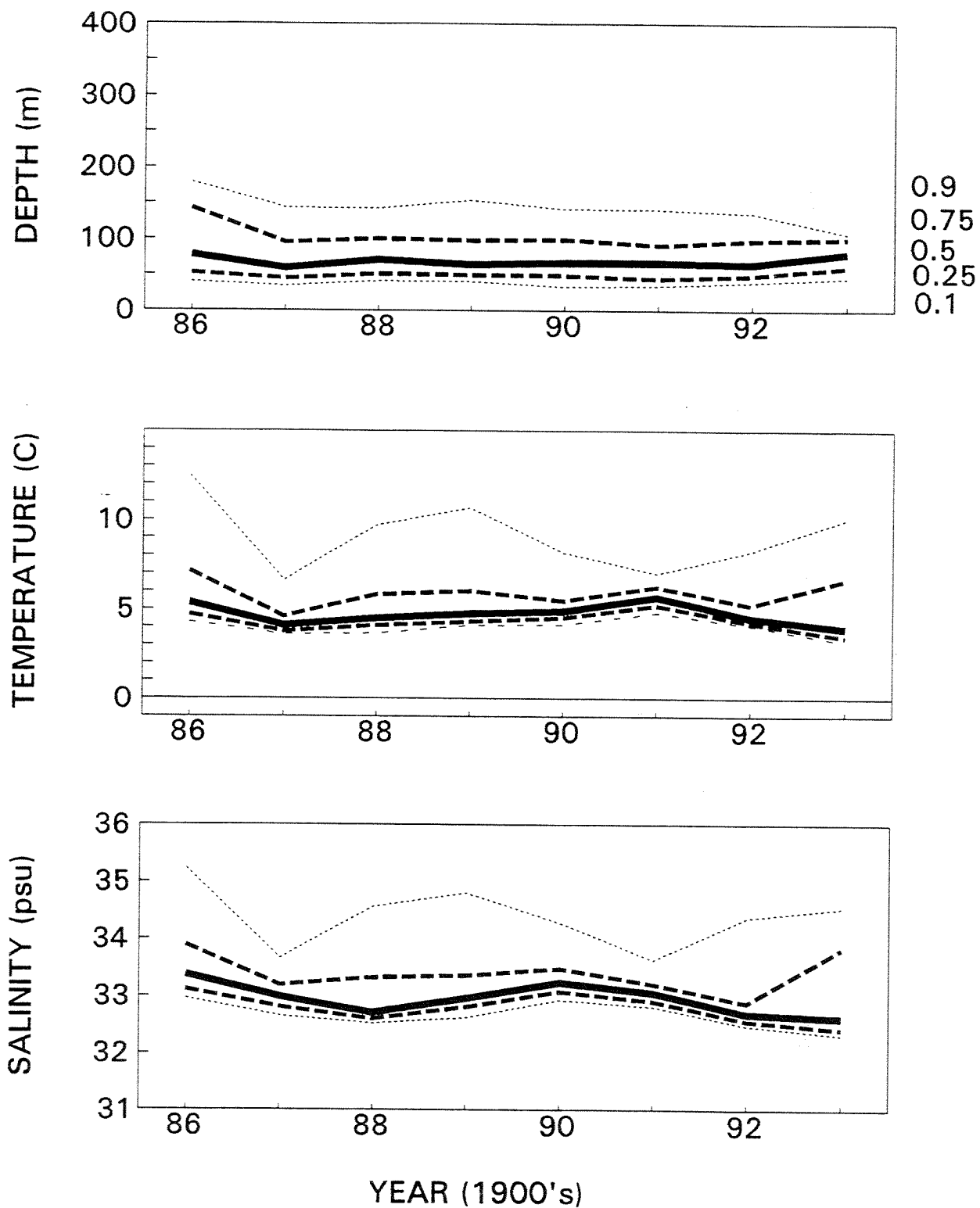
# Water Temperature Trends Near Surface



## SUMMER RV 4X

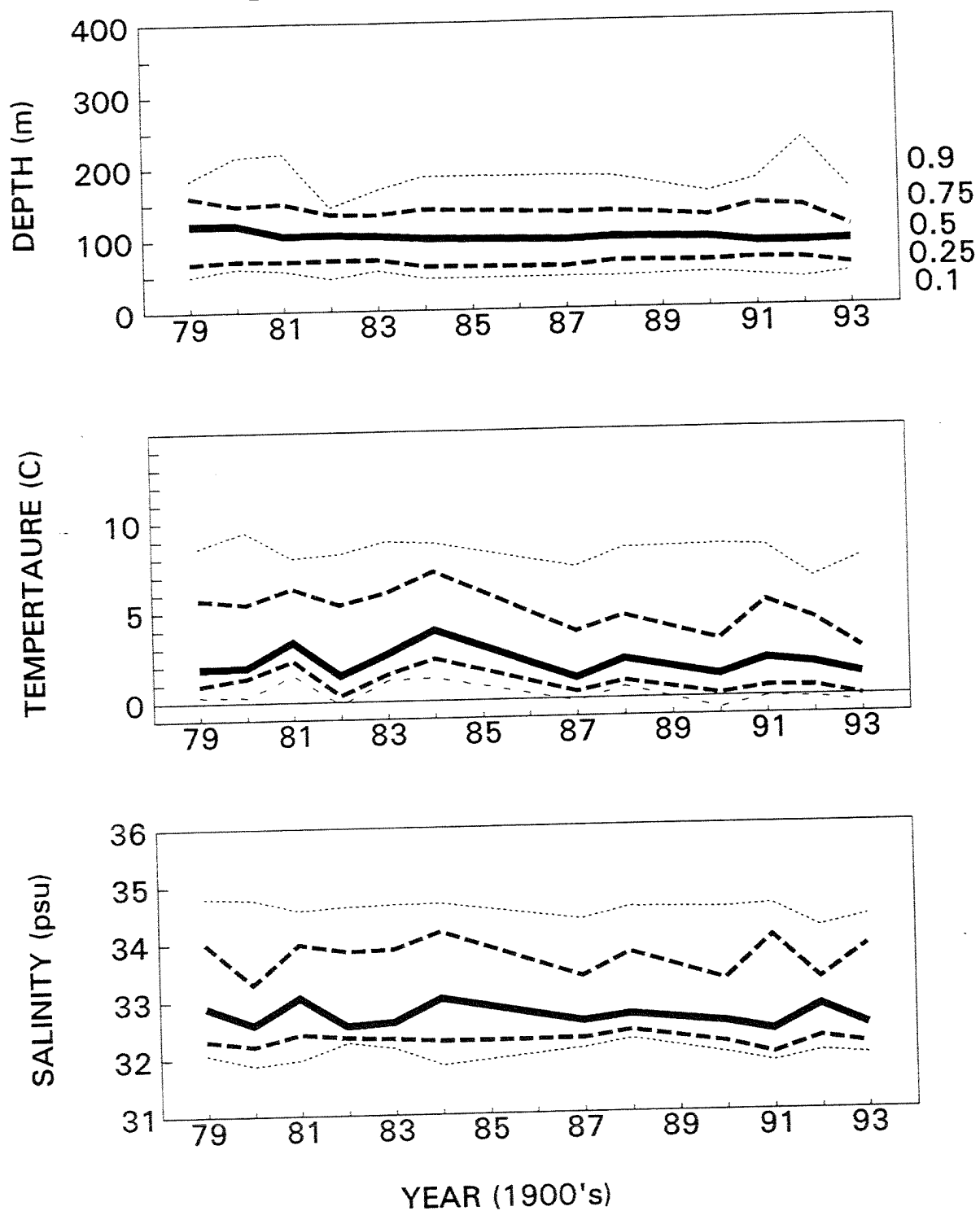


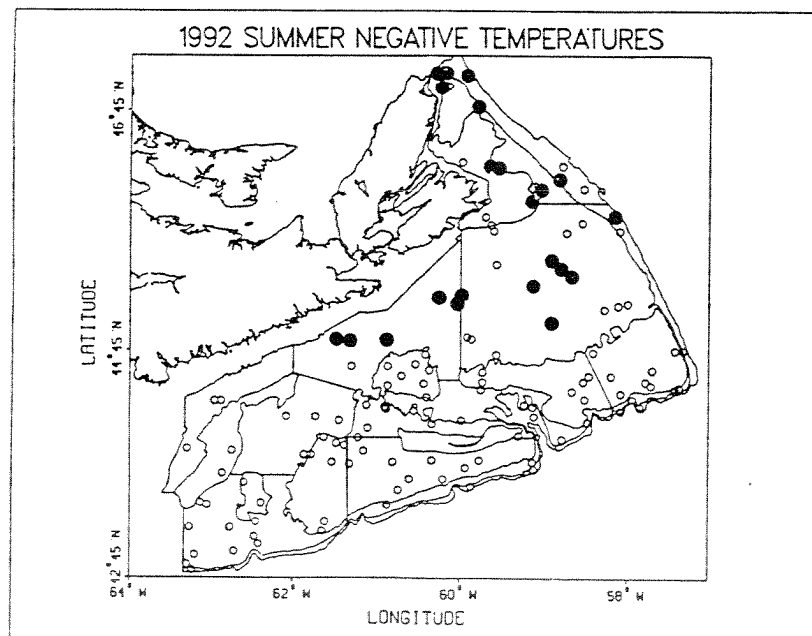
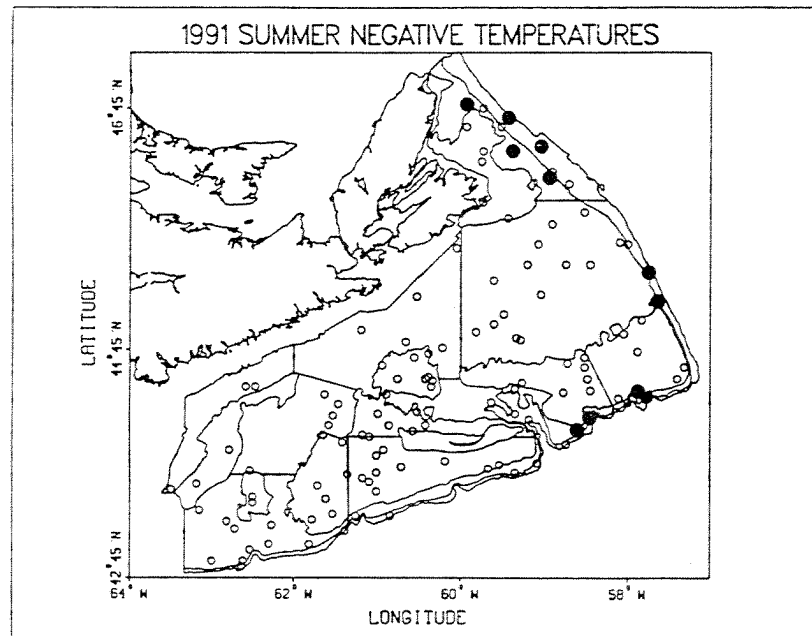
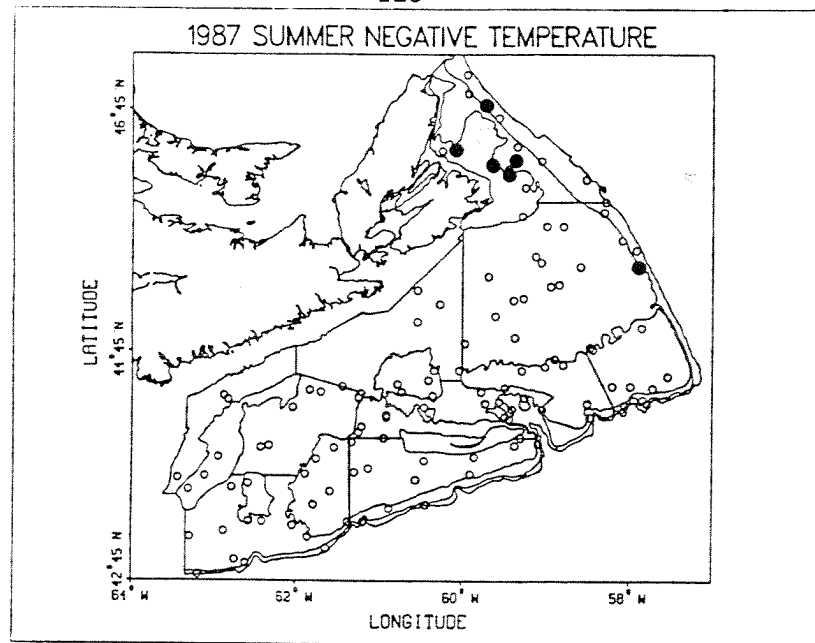
# SPRING RV 5Z

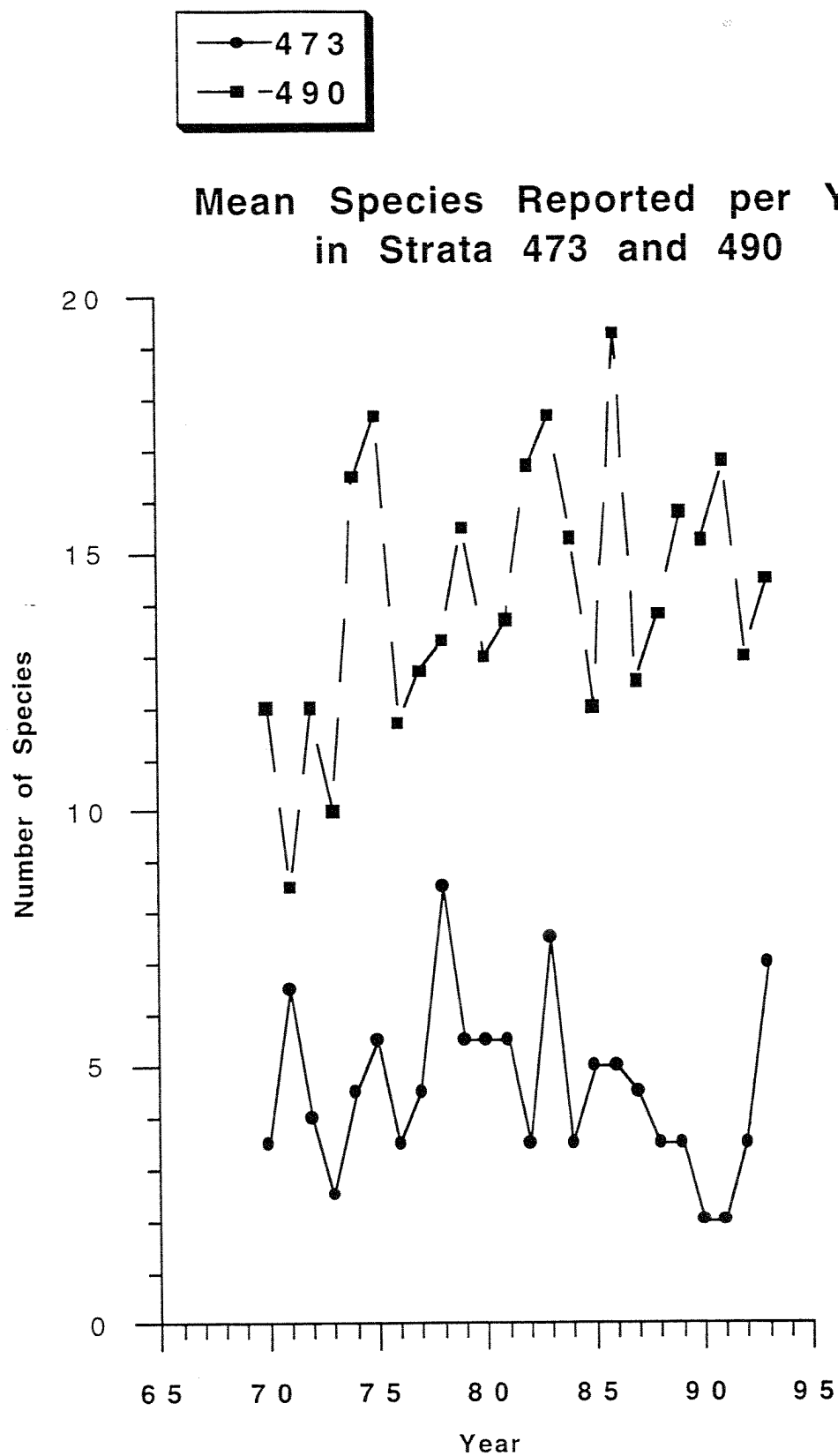


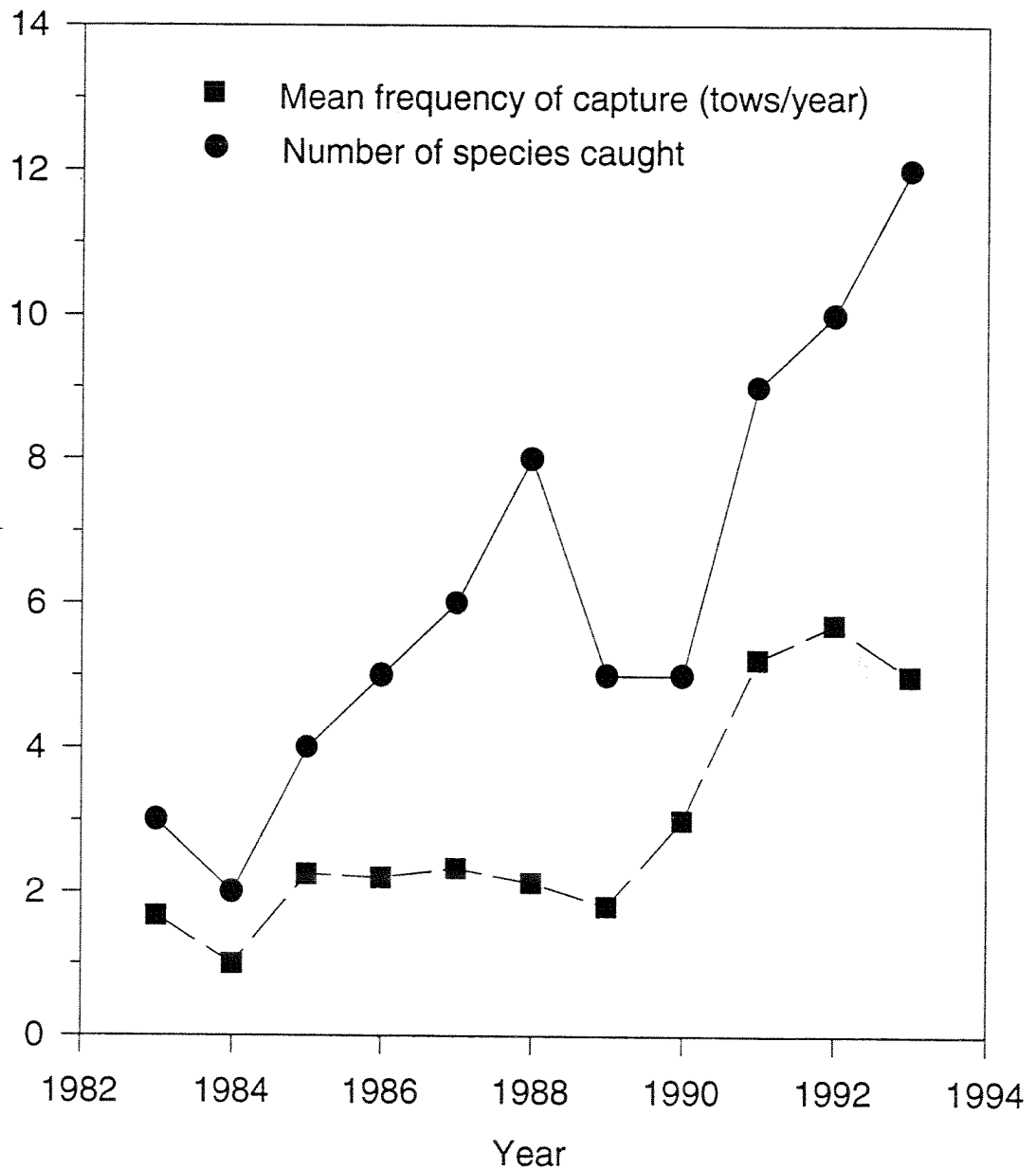


# SPRING RV 4VW









Number of cold water species caught, and the mean number of tows in which each species was caught during the 4VSW summer surveys between 1983 and 1993.

#### **4.5.2 Grey Seal Impacts on 4VsW Cod (W.D. Bowen and R.K. Mohn)**

Grey seal populations in the Gulf of St. Lawrence and on the Scotian Shelf have been growing continuously since the extension of jurisdiction, with a doubling time for the Sable Island breeding population of about six years (Figure 51). The total abundance is estimated to be about 150,000 animals, with about equal numbers breeding in each of the two areas. The Sable Island population has been growing more rapidly than that in the Gulf. Subsequent to breeding on the Island and ice in the Gulf, tagging results indicate fairly extensive migrations with some Gulf seals coming onto the Scotian Shelf and vice versa.

In recent years, relatively good data have been collected on the food consumption of grey seals on the Scotian Shelf. Cod is a variable item in the diet (Figure 52). A modelling exercise is under way to estimate the numbers and biomass of cod in 4VsW that are eaten by grey seals. The preliminary estimates are shown in Figures 53 and 54. In recent years, seals have become a significant predator on cod in this area, with the relative impact increasing annually (cod stock has been declining as the accumulative seal feeding has been increasing). Trends in natural mortality caused by grey seals are shown in Figure 55. The estimates of cod natural mortality assume no "compensation" by other non-seal predators on cod (i.e., that other predation has remained at a constant rate while seal predation has increased).

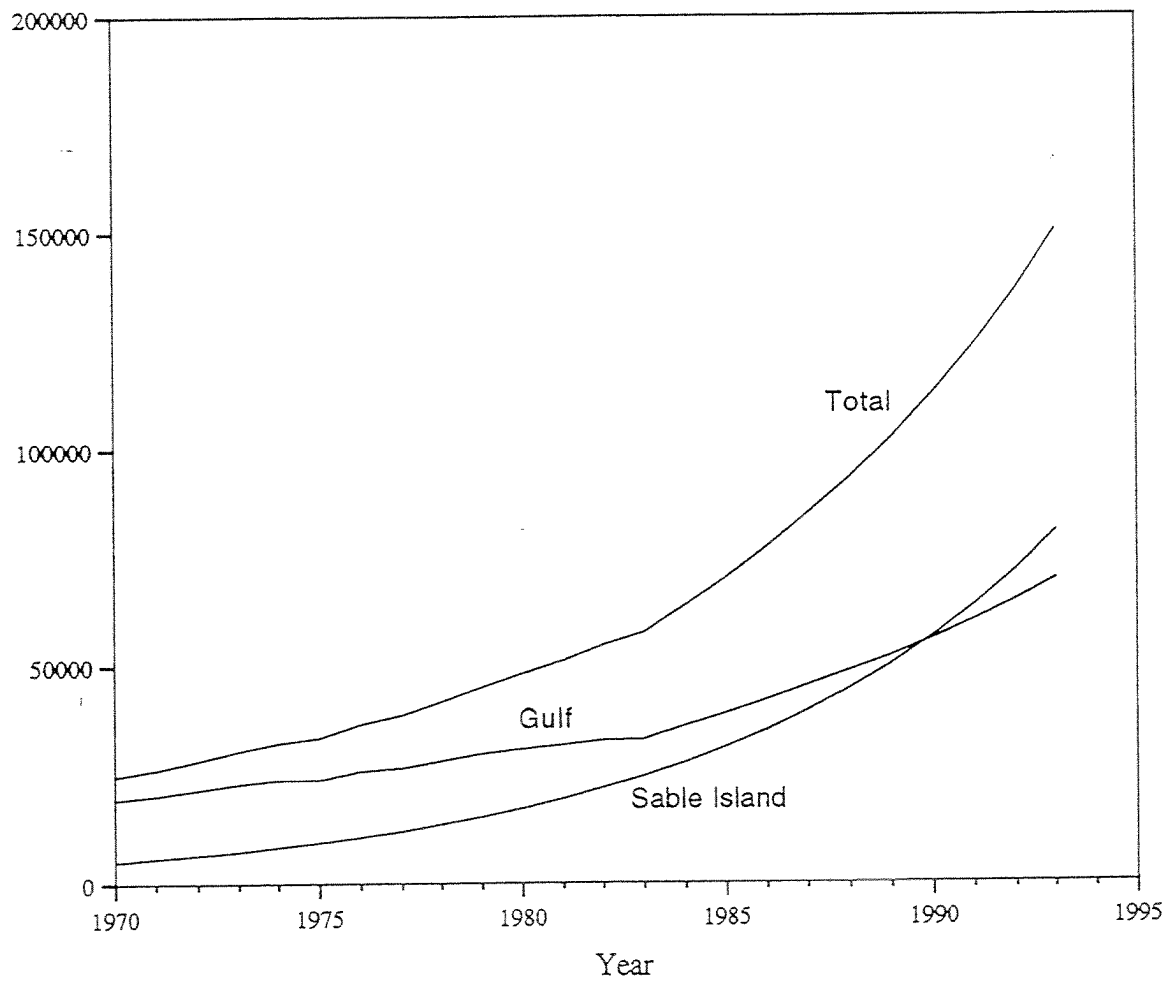
In the discussion of this paper, it was concluded that yields to the fishery, for 4VsW cod at least, have been influenced by seal predation. Haddock do not appear to be a component of the diet of grey seals. Silver hake, however, is seasonally important in the diet and recruitment trends are downward for this stock. The abundance of seals in 4X and 5 until now are not believed to have been a major factor in the trends in the population dynamics of groundfish in this western part of the area under review. Finally, it was noted that there is still considerable breeding space on Sable Island for the expanding population and no indication of food limitation as of yet. Thus, the impact of seals in 4VW on cod could increase substantially in the coming decade. If  $M$  is 0.2, then at present levels of predation the potential yield to the fishery is being significantly reduced.

#### **4.5.3 General Discussion of Possible Trends in Natural Mortality**

The information provided on this issue was considered to be sufficient to draw some general conclusions of relevance to the Workshop aims. For the western Scotian Shelf and Gulf of Maine area, it is unlikely that temporal trends in natural mortality caused by seals and the physical environment have compromised the ability of management to achieve the objectives of fisheries management. This is not to say that the environment does not cause variable natural mortality and account for considerable inter-annual variability in recruitment. The overall downward trend in mean recruitment, however, for the haddock stocks in 4X and 5 (and cod in 5Z), as well as the truncated age structure and low biomass levels of all the stocks of cod and haddock in the western area, is not plausibly accounted for by any increasing trends in natural mortality.

In 4VW, however, the issue is more complicated. Potential yield of cod (and possibly pollock and silver hake) to fishing is being increasingly reduced by seal predation. The environmental conditions have also been relatively colder during the past several years, but perhaps not sufficiently severe to account for the trends observed in haddock and cod biomass and recruitment in this area. The reduction in the age spans within the management units, changes in spawning areas and times, record low spawning biomass levels, and downward trends in mean recruitment levels are also due to heavy fishing mortalities.

Number of grey seals in Sable Island and Gulf of St. Lawrence herds



Estimates of %wt of cod in  
grey seal diets

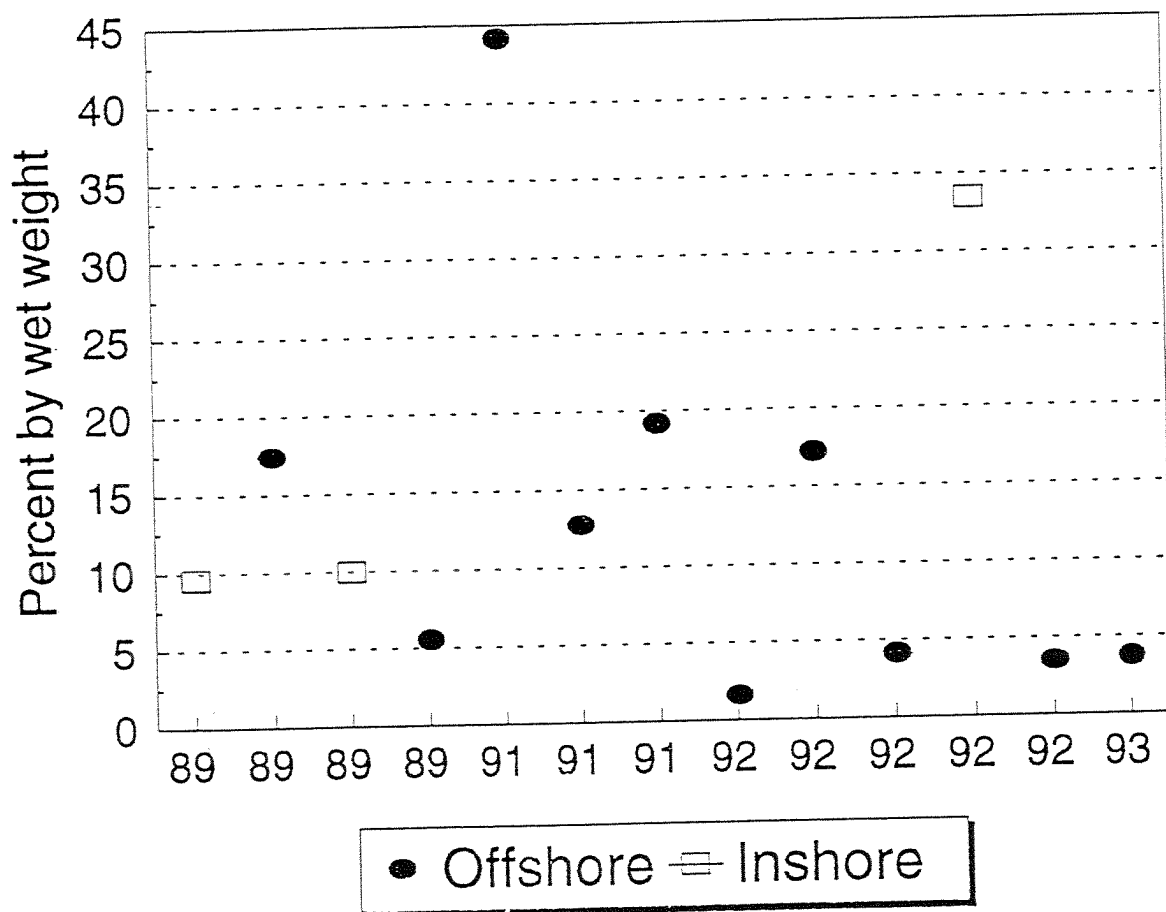


Figure 53

4VsW cod recorded landings and mean seal consumption in tons of fish.

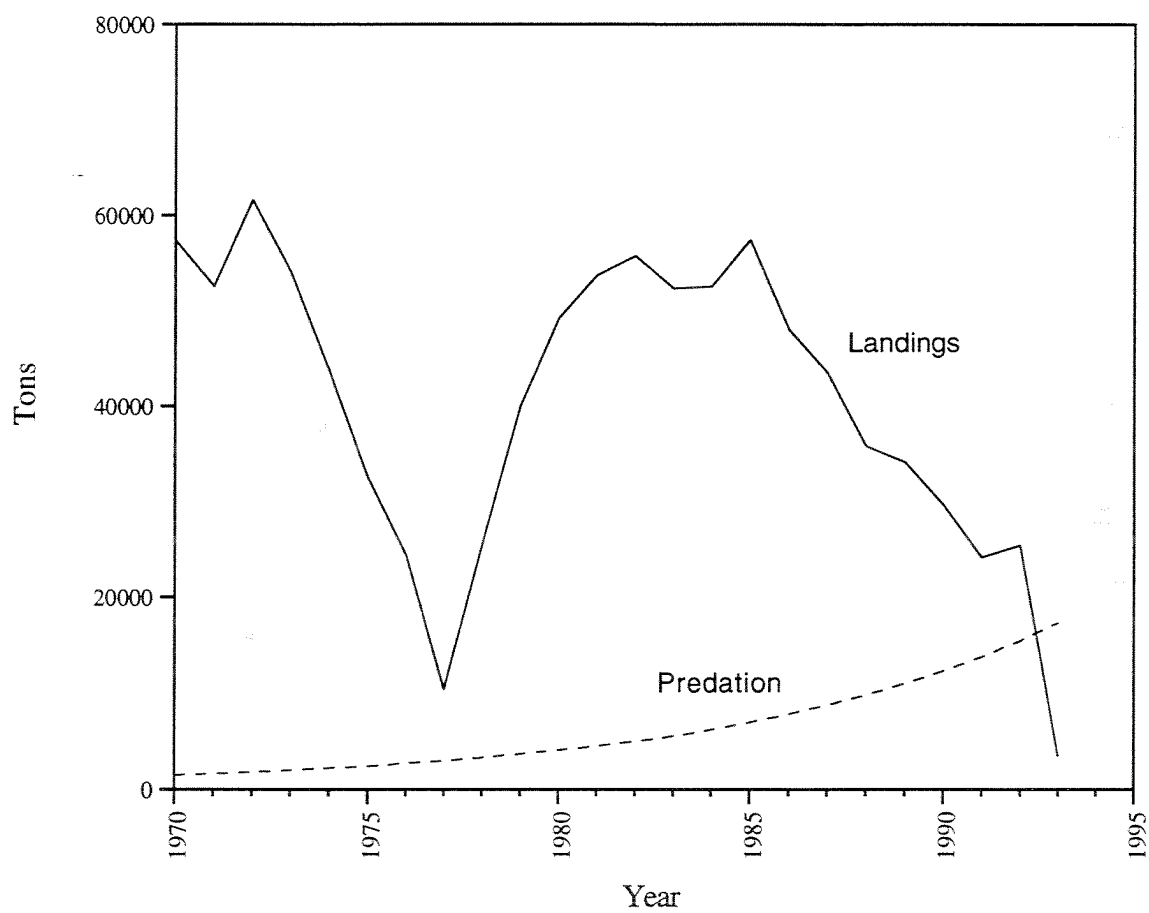
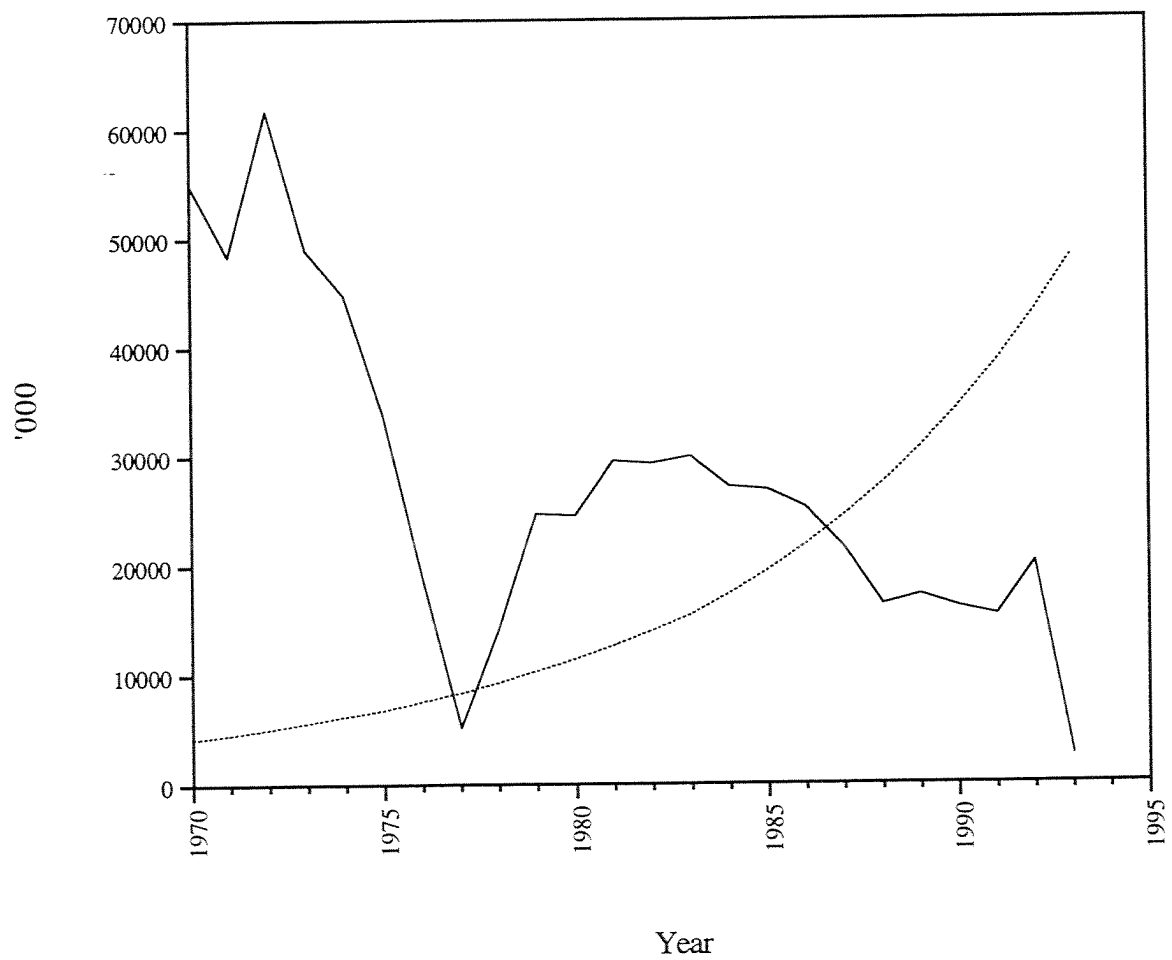


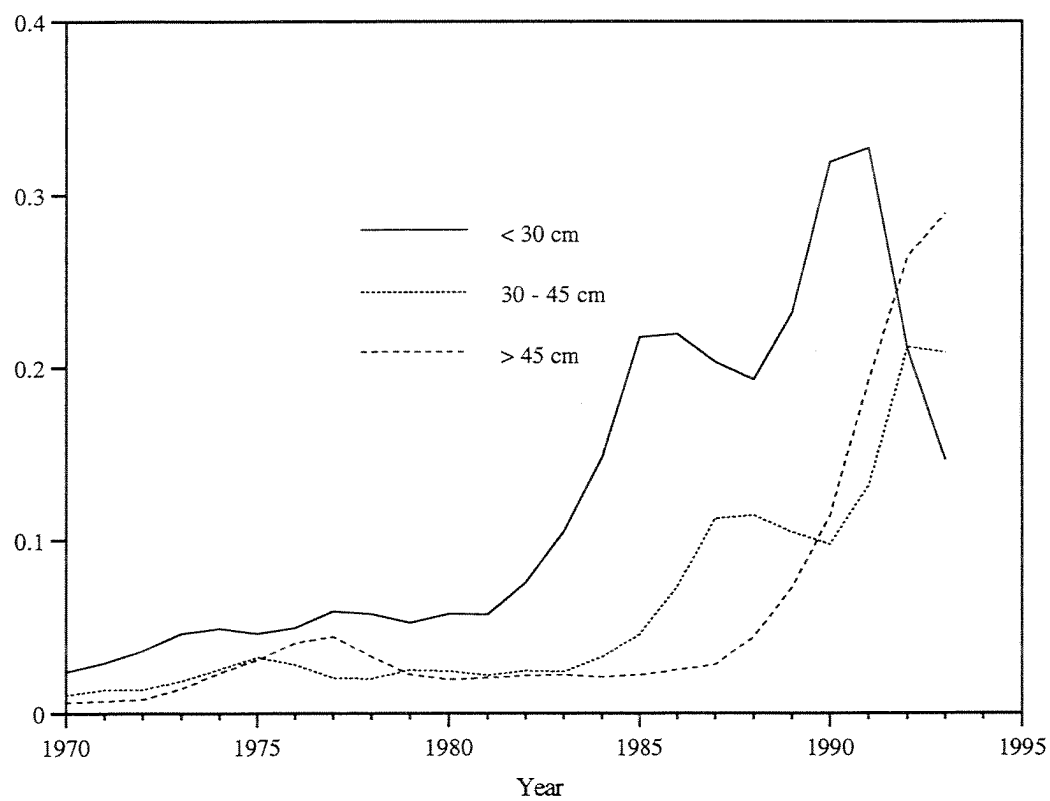


Figure 54

4VsW cod recorded landings and mean seal consumption in numbers of fish.



Average predation mortality of seals by size class.



#### 4.6 RETROSPECTIVE ANALYSIS OF THE ACCURACY OF STOCK ASSESSMENTS (R.K. MOHN AND R.N. O'BOYLE)

Stock assessment is critical to the success of fisheries management. Without it, one has no idea if the conservation objectives are being met and whether or not regulatory changes are required. It follows that errors in stock assessment cause severe difficulty for management. A recent problem that has been discovered in stock assessments is that of the retrospective pattern. Simply put, it means that assessments in the current year generally provide more pessimistic historical views of the resource than had been assessed in those years. This effect tends to be more severe for the younger age groups and is well exemplified by the situation of 4X haddock (Figure 56). Here the most recent assessment (1987) provides a more pessimistic view of the resource than almost all previous assessments.

The first hints that the retrospective problems existed were provided in a Marine Fish Division (DFO) workshop in the summer of 1984. These led to two CAFSAC initiatives (1986 and 1989). The results of these investigations led to work by the International Council for the Exploration of the Sea Working Group on Methods of Fish Stock Assessments in 1991. The results of these groups confirmed the 1984 observations and showed that they are not isolated to Canada, but are of more wider North Atlantic applicability.

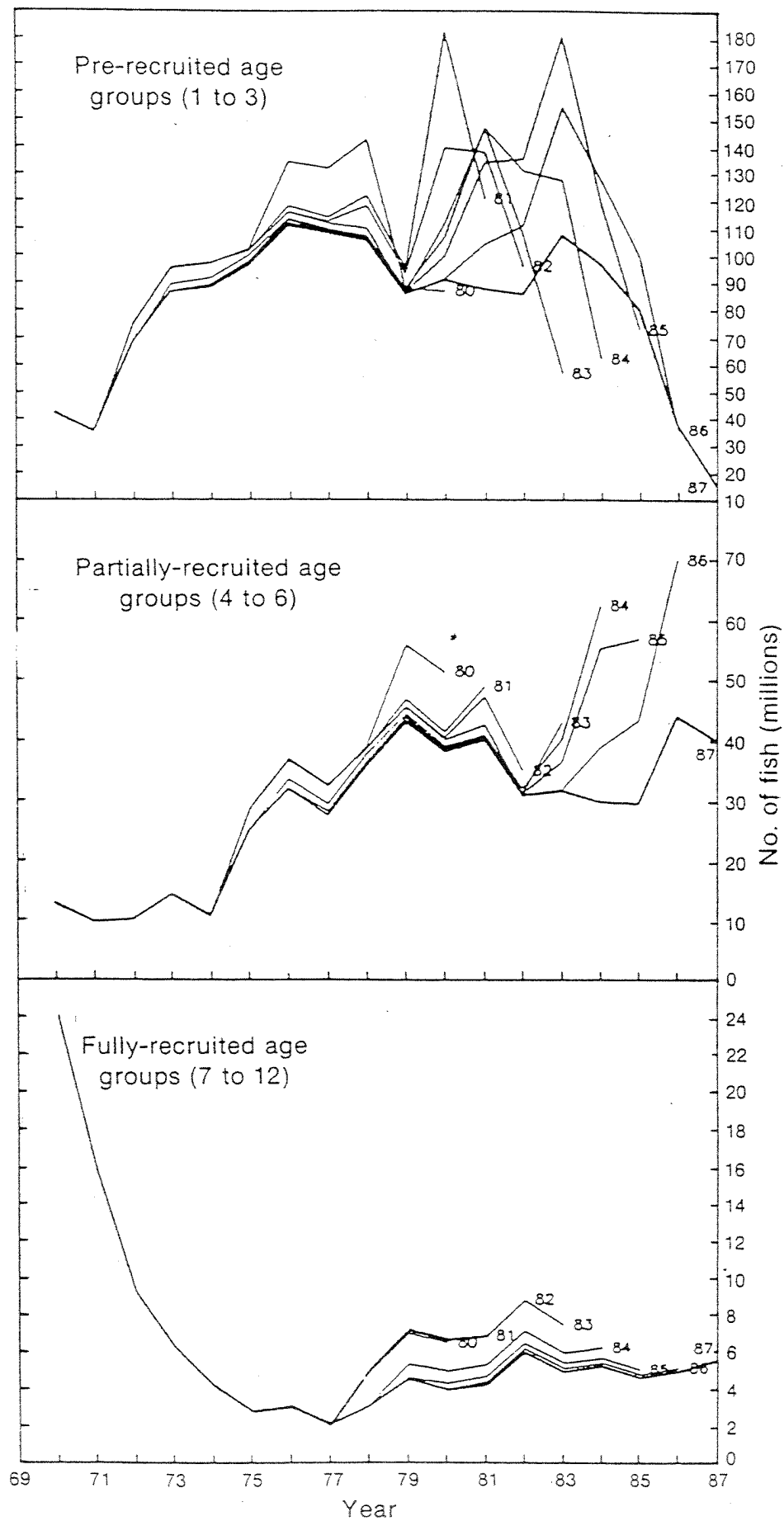
Figure 57 provides the Retrospective Analysis of the Northwest Atlantic stocks conducted by CAFSAC in 1989. The ratio is the assessed population size divided by that in the most recent assessment for each year that an assessment was conducted. For instance, for stock six (4X haddock) eight stock assessments were available (1980-1987). Each one provides a view of historical population size back to 1970. The reference assessment is taken as that in 1987, the most recent year. Therefore, for each of the recruited (Ages 1 to 3), partially-recruited (Ages 4 to 6), and fully recruited (Ages 7 to 12) fish, seven ratios are available - 1980/1987 to 1981/1987. The distribution of the ratios is provided in Figure 58 by stock. The ratios above one indicate a bias in the assessment procedure.

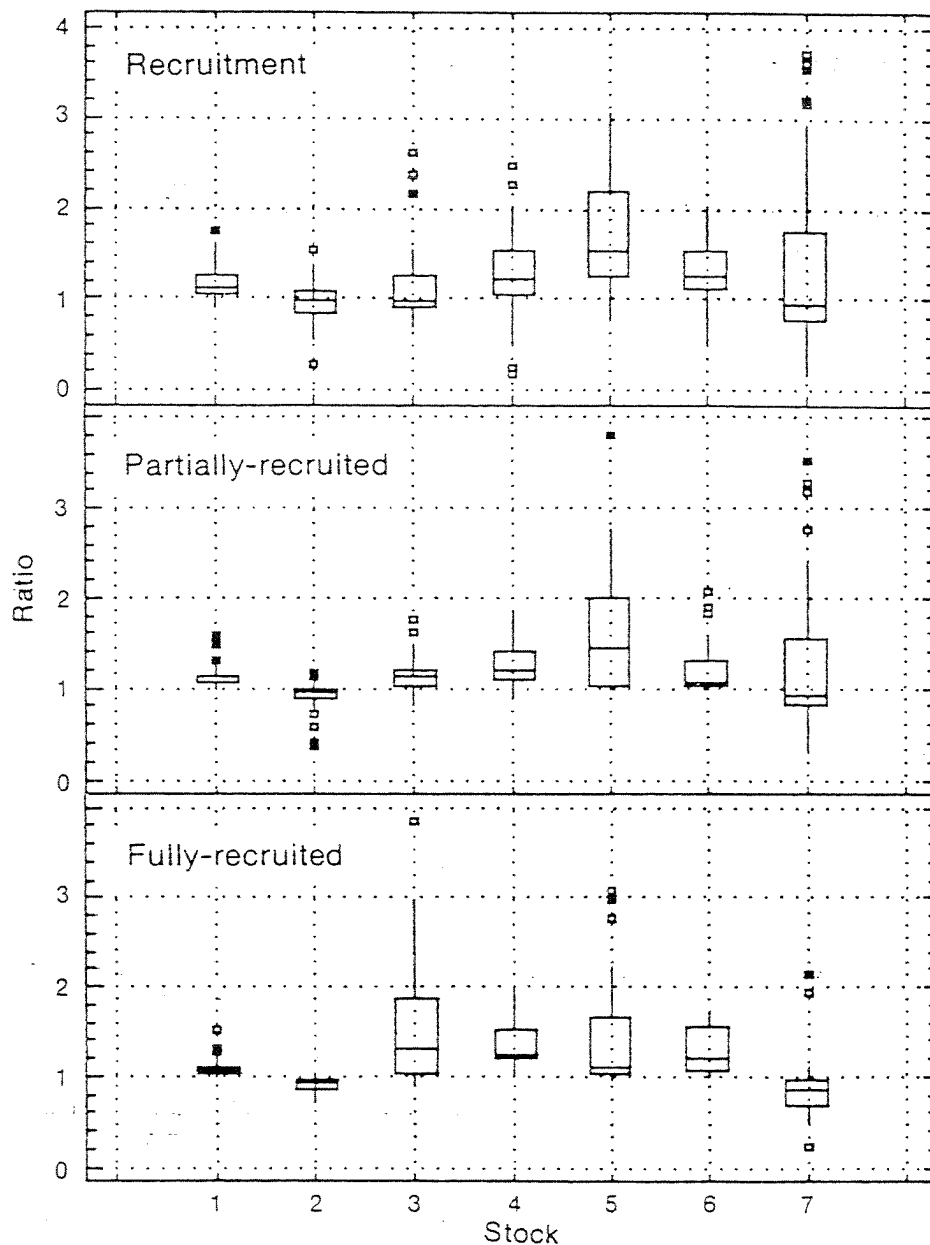
In order to fully understand the potential sources of the bias, one must have a general understanding of the assessment method. In general, SPA depends upon the accumulation of each age group or year-class in the fishery.

If fish died due only to fishing (e.g., no natural mortality), then given enough time and reliable catch data eventually every fish would be caught and thus a reliable estimate of the year-class abundance before fishing occurred would be obtained. Assuming that fish do die naturally (starve or are eaten) does not change this principle, but rather only scales up the abundance. Bias in the SPA can be the result of error in the input data (i.e., catch-at-age from landings statistics) and errors in the model assumption. Regarding the former, it has been shown that errors in the catch statistics and/or ageing information can generate a retrospective pattern. This is because the addition of new, incorrect data in fact distorts our view of the historical abundance. In general, most scientists feel that there is a bias in current assessments. Regarding model assumption, incorrect estimates of natural mortality and partial recruitment (pattern of fishing mortality by age) can generate a retrospective problem or can cause trends in survey and/or fishing catchability.

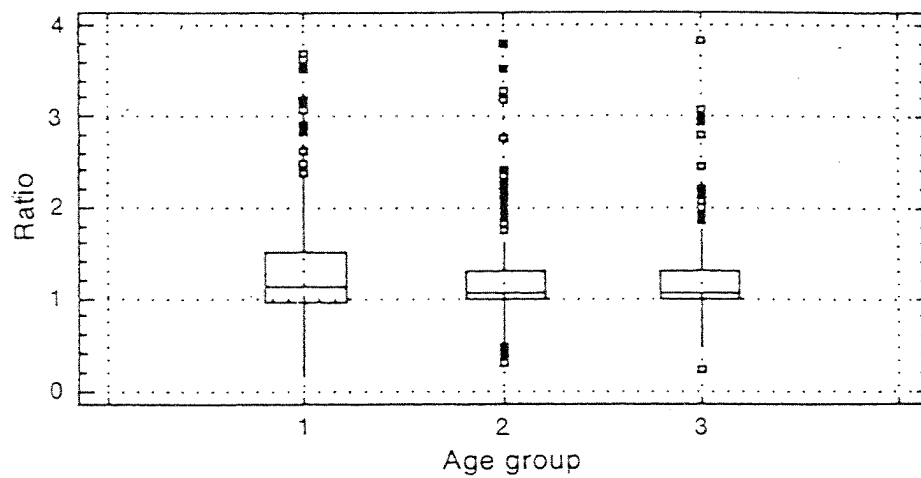
All of the above effects are currently under investigation by fisheries scientists. The relationships are complex, with the problem likely having different origins in different stocks. For instance, it is unlikely that the retrospective pattern observed in the silver hake assessment is due to bad catch data. Also, it may be that the combination of several data problems causes the retrospective pattern. The analysis of the 4VsW cod assessment showed that the variability in current estimates of fishing mortality was highly skewed. As data accumulated in the assessments, the distribution of these data became more normal. The explicit inclusion of variability calculations in the 4VsW cod assessments have accounted for the retrospective pattern in that resource.

## Retrospective Analysis: Div. 4X Haddock





Box and Whisker plots of the distribution of the ratios between assessed and reference population estimates for seven Northwest Atlantic groundfish stocks. The stocks are 1 — Div. 2J+3KL cod, 2 — Subdiv. 3Pn+Div. 4RS cod, 3 — Div. 4T+Subdiv. 4Vn cod, 4 — Subdiv. 4Vs+Div. 4W cod, 5 — Div. 4TVW haddock, 6 — Div. 4X haddock, 7 — Div. 5Z haddock.



The distributions of ratios between assessed and reference population estimates for all seven stocks combined, but separated by age groups (1 — recruitment, 2 — partially-recruited, 3 — fully-recruited).

It is difficult to predict what the impact of the Retrospective Pattern has been on harvest advice. An upward bias in the assessment of 50% does not, however, directly translate into a 50% bias in the TAC advice.

#### **4.7 IMPACT OF PUBLIC PRESSURES AND INDUSTRY DEMANDS ON MANAGEMENT DECISIONS (J.R. ANGEL AND F.G. PEACOCK)**

The final paper presented dealt with the degree to which public pressures and industry lobbying has influenced, in a detrimental manner, the ability of management to achieve the stated objectives. The analysis was not comprehensive, but rather is a listing of examples. Some of the examples and results are briefly outlined below:

- In a seminar on the growth of fishing capacity in 1986, it was recommended to the Minister of DFO that there be a licence moratorium. The intent of the moratorium was to remove the inactive portion of the licences and thus limit the increase in fishing effort. The Minister of DFO accepted the recommendation. However, following intense lobbying, the Minister of DFO rescinded the moratorium and announced an Industry Capacity Committee to address the problem. As a result of these events, within two years all the "inactive" licences became active to ensure that they would not be cancelled. The small dragger fleet increased to over 400 active vessels from about 250.
- In 1986, lobbying by local fisheries organizations and political representatives led to the introduction of an experimental gillnet fishery in the Guysborough County/Richmond County, Nova Scotia, area. The experiment involved 150 new licences which became permanent in 1991 in contravention to the recommendations of the Scotia-Fundy Region Task Force Report on groundfish.
- The vessel replacement policy introduced in 1981 attempted to limit the growth in fishing capacity by not allowing any increases in length or hold capacity. After lobbying by fisheries and boat builders, the policy was modified to allow for incremental increases at 5 ft. intervals and in hold capacity (110% rule). As a result, the growth in fishing capacity was not slowed as much as it could have been under the original policy.
- In 1992, lobbying by fishers led to the expansion of the gillnet fishery onto Georges Bank (26 vessels) at a time period when there has been excessive effort. This has led to increased gear conflict and potentially to "ghost fishing" by lost monofilament nets.
- The 1990 recommendations by the Scotia-Fundy Groundfish Task Force for major increases in mesh size for trawls (to 155 mm diamond or 140 mm square) was accepted by the Minister of DFO (to begin in 1991). Intense lobbying resulted in the mesh size being decreased to 130 mm square (or 145 mm diamond). As a result, enforcement application was different from regulations and discarding was not dealt with as effectively as the initial change.
- In the summer of 1993, fixed-gear fisheries blockaded Shelburne Harbour, Nova Scotia, because of the relatively small haddock quotas and the elimination of the 1,500 kg/3,300 lb. "allowance" per trip. Because of this pressure, this gear sector was given fishing trip limit concessions which thus led to an overrun of their quota.

The above examples indicate the degree to which public pressures and lobbying have modified decisions of the Minister of DFO involving the broad range of management objectives. The pressures have all led to increases in fishing effort (gear modification, new licences, etc.) or quota. None of the lobbying has been on the side of conservation.

#### **4.8 SUMMARY OF TRENDS IN EMPLOYMENT AND INCOMES FOR FISHERS IN NOVA SCOTIA (D.L. BURKE)**

As stated in Section 4.1, one of the objectives of groundfish management has been to maximize employment subject to the constraint that those employed receive a reasonable income through earnings and fishery-related transfer payments. Some information relevant to this objective was

included in the annexes of that first paper and is extracted here. The information is for all Nova Scotian fishers, rather than for only the groundfish sector in the Scotia-Fundy Region.

The trend in the number of registered full-time and part-time fishers from 1984 to 1993 is shown in Table 15 and Figure 59. The increase has been modest (22% over 10 years). There has not been a decrease in the number of fishers as the resources have declined.

UI payments have increased in relation to the landed value (all species) from about 7% in 1981 to 16% in 1990 (Figure 60). Also, the percentage of income for both fishers and processors that comes from UI has also increased over the same time period (Figure 61). Those employed in the fishing industry derive a much higher percentage of their income from UI (in 1990 between 20 and 30%) compared to the rest of the Nova Scotia workers (~5% with no trend over time). Finally, Figure 62 shows that the incomes of fishers in Nova Scotia is higher than the average of other workers in Nova Scotia.

In sum, it is clear that the UI system provides an important incentive to keep fishers in the industry (generating higher-than-average incomes). The UI contribution also has a direct influence on the costs of fishing compared to revenues. Fishers can afford to lose money on fishing activities if they will be collecting a large portion of their income from UI. Additional information is provided in Appendix 5.

## **5. ACKNOWLEDGEMENTS**

The authors would like to thank K.L. Harrie for her part in the organizational aspects of the Workshop, R.E. Lavoie for translating the Abstract, and D. Guilcher and S. Morgan for their technical assistance in publishing this report.

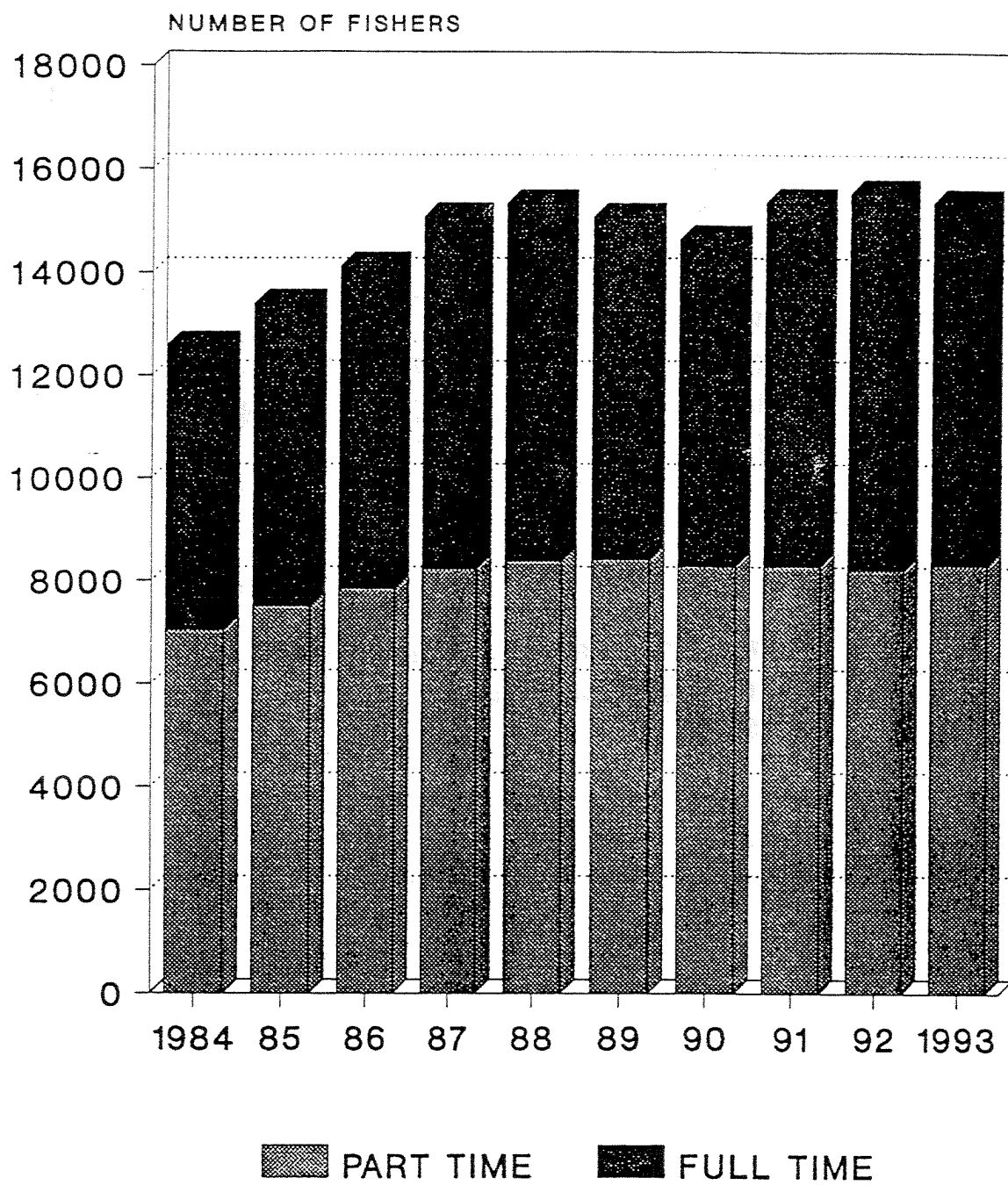


**Numbers of Registered Fishers  
Scotia-Fundy Region (DFO)**

<u>YEAR</u>	<u>FULL-TIME</u>	<u>PART-TIME</u>	<u>TOTAL</u>
1993	8326	7019	15345
1992	8224	7305	15529
1991	8294	7054	15348
1990	8289	6336	14625
1989	8426	6629	15055
1988	8383	6935	15318
1987	8237	6825	15062
1986	7857	6253	14110
1985	7510	5882	13392
1984	?	?	12572

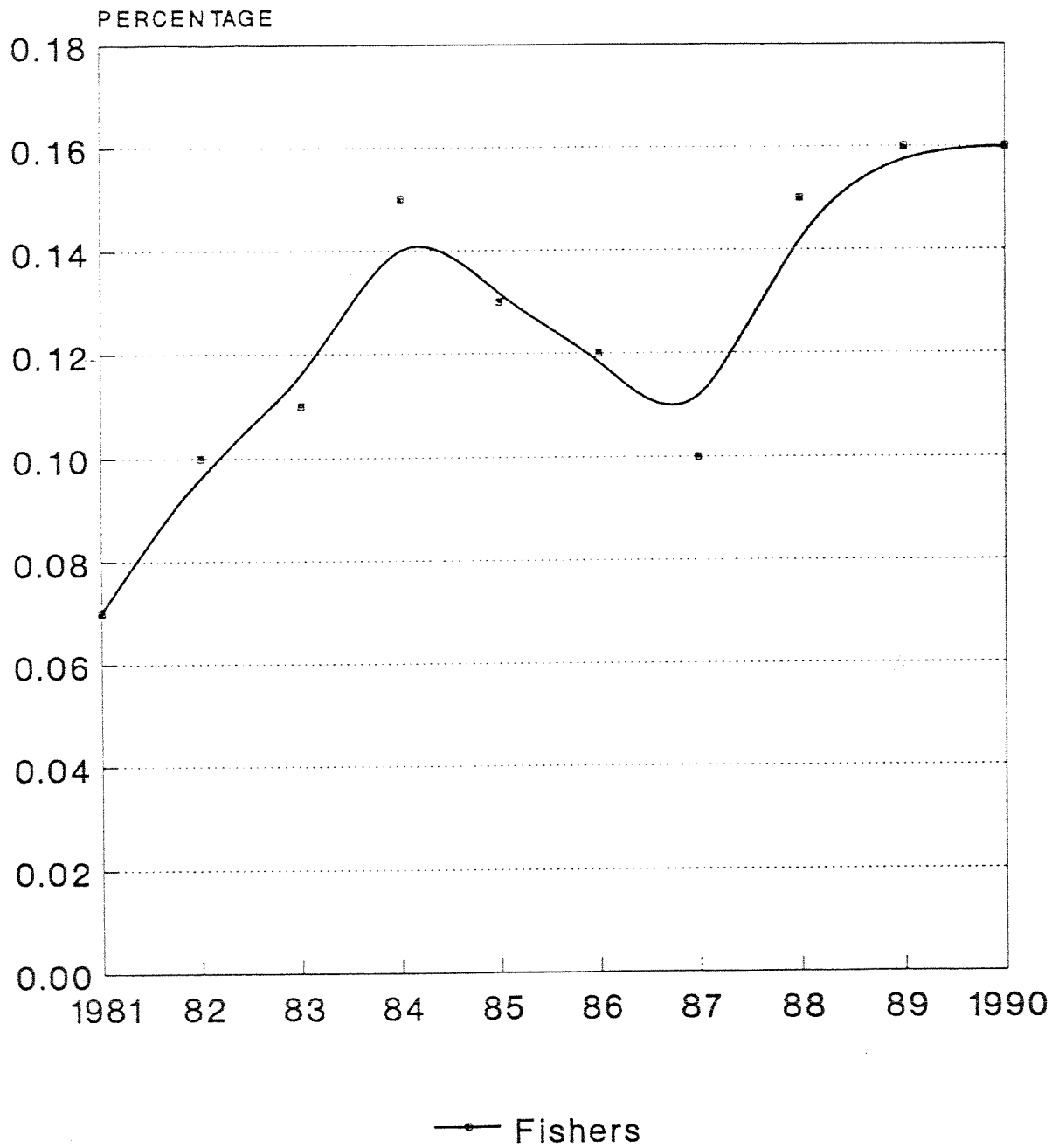
**Program Coordination & Economics Branch  
Dept. Fisheries & Oceans  
16 Sept 1993**

# SCOTIA FUNDY REGISTERED FISHERS FULL TIME AND PART TIME (1984-1993)

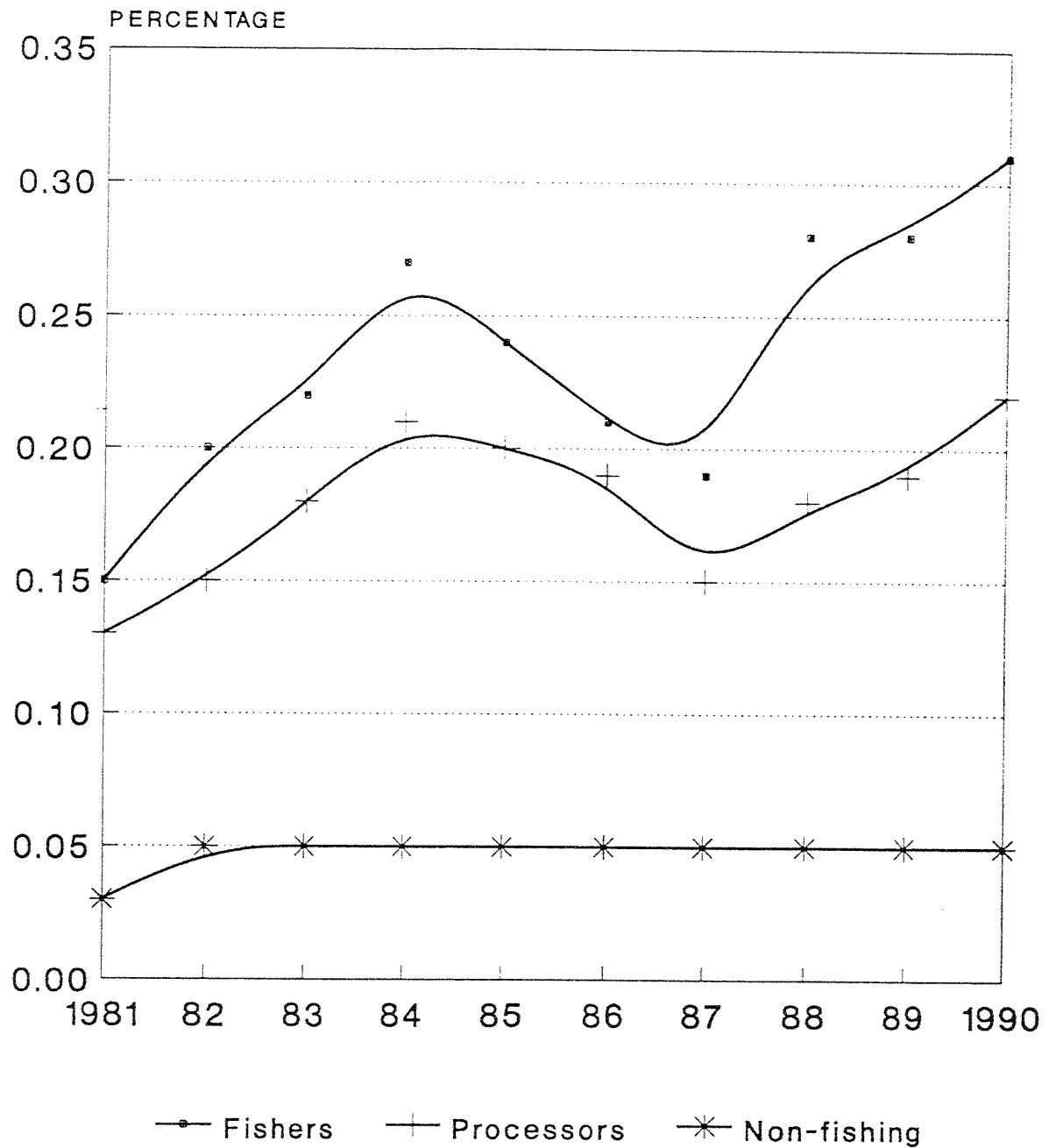


1984 Part Time & Full Time Estimated

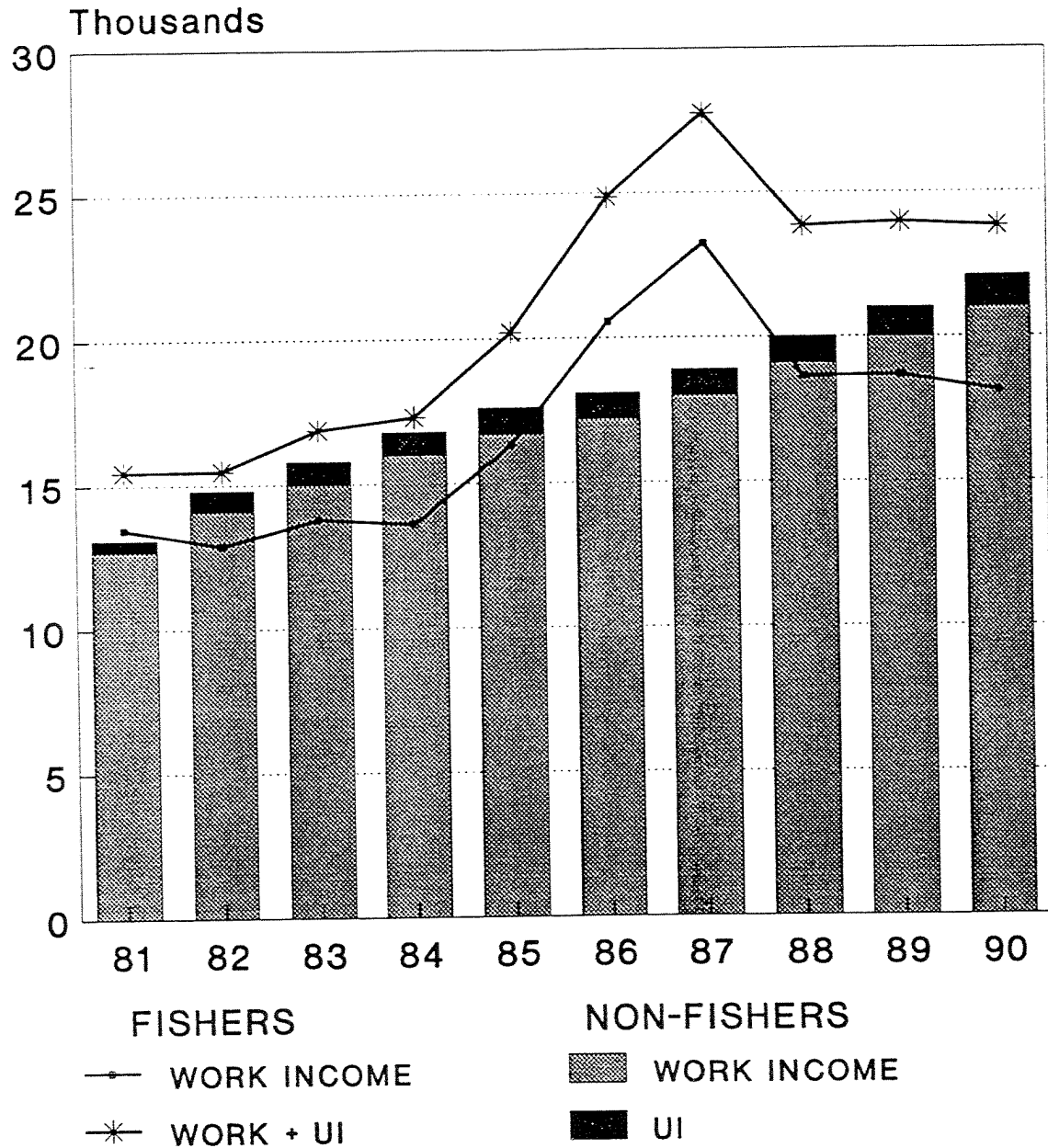
## UI PAYMENTS TO N.S. FISHERS AS A % OF LANDED VALUE FOR ALL SPECIES



## UI PAYMENTS AS A % OF EARNED INCOME FOR FISHING AND NON-FISHING SECTORS



# INCOME COMPARISONS OF N.S. FISHERS AND NON FISHERS





**AGENDA FOR WORKSHOP  
SCOTIA-FUNDY GROUND FISH MANAGEMENT  
FROM 1977 TO 1993  
7 & 8 DECEMBER 1993**

**Bedford Institute of Oceanography  
6th Floor Seminar Room, Polaris Building**

**7 December 1993**

- |           |                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------|
| 0830-0840 | Opening remarks (co-Chairs)                                                                                                  |
| 0840-0910 | Objectives of groundfish management (D.L. Burke, F.G. Peacock, R.N. O'Boyle)                                                 |
| 0910-0930 | Summary of biomass and fishing mortality trends (R.N. O'Boyle)                                                               |
| 0930-1030 | Documentation of scientific advice, management plans, management actions and year-end results (K.C.T. Zwanenburg, J. Hansen) |
| 1030-1045 | COFFEE BREAK                                                                                                                 |
| 1045-1115 | Analysis of "variation orders" (L. Muise)                                                                                    |
| 1115-1200 | Documentation of enforcement activities (R.B. Barnes, P.E. Partington, C.G. Goodwin)                                         |
| 1200-1300 | WORKING LUNCH (in seminar room)                                                                                              |
| 1300-1345 | Analysis of trends in fishing effort (S. Gavaris)                                                                            |
| 1345-1410 | Assessment of EA, ITQ fleet capacity changes (D. Liew)                                                                       |
| 1410-1430 | Preliminary assessment of ITQ: concentration, price/supply, operational costs, returns (R.M. Barbara)                        |
| 1430-1450 | Comparison of aggregate landings data to export data (G.L. Brander)                                                          |
| 1450-1510 | Matched comparisons between statistics and costs/earnings data (C. Milley)                                                   |
| 1510-1530 | COFFEE BREAK                                                                                                                 |
| 1530-1600 | Summary of misreporting/under-reporting from CAFSAC reports, port technicians reports (S. Wilson)                            |
| 1600-1630 | Accuracy of dock-side monitoring program (M.L. Etter/G. VanHelvoort)                                                         |

**8 December 1993**

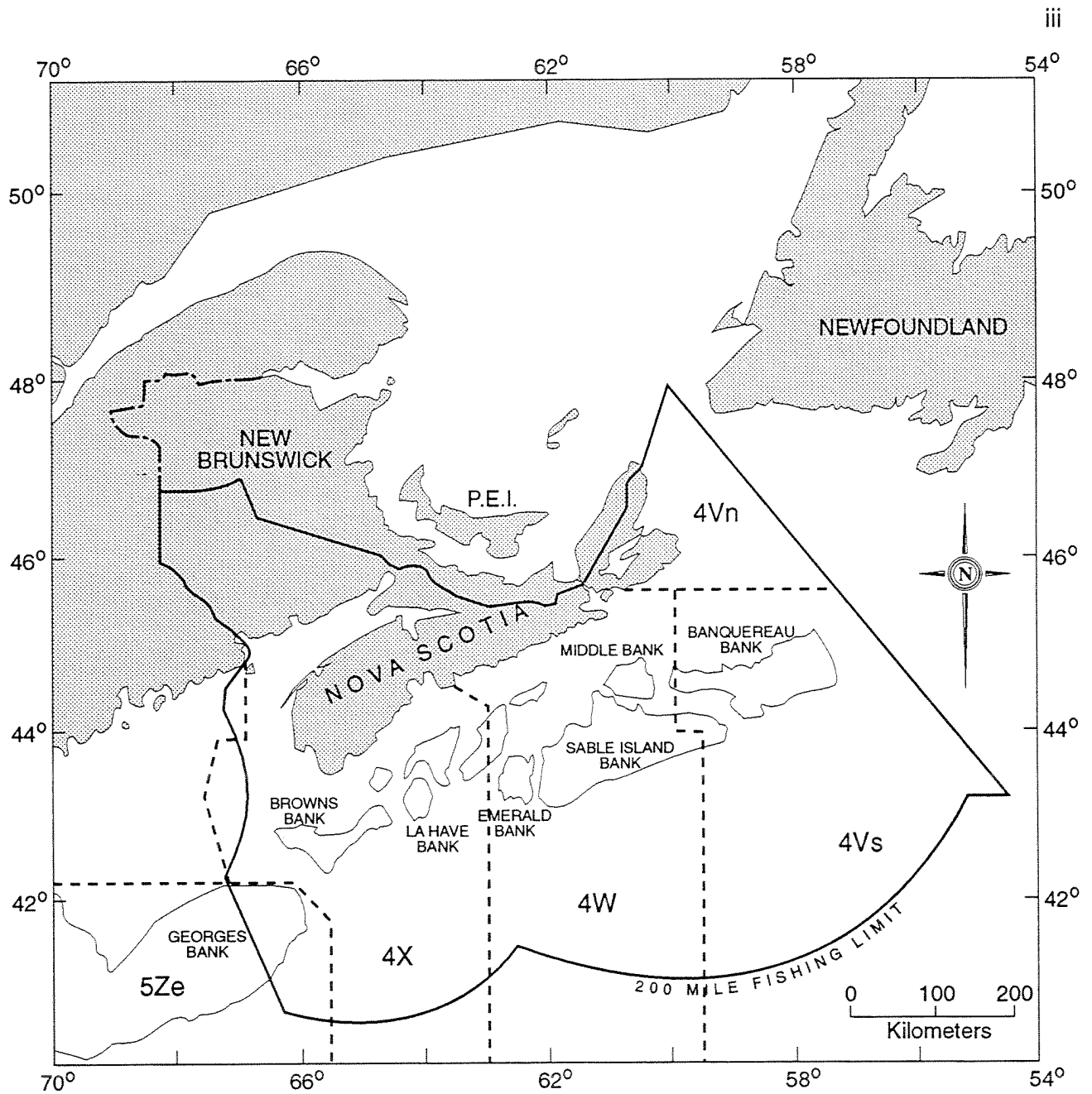
- 0830-0900 Effect of observer program on accuracy of landings data (R. Schiochetti)
- 0900-0930 Overview of environmental trends (F.H. Page)
- 0930-1000 Grey seal impacts on 4VsW cod (W.D. Bowen, R.K. Mohn)
- 1000-1015 COFFEE
- 1015-1115 Retrospective analysis of accuracy of stock assessments (R.N. O'Boyle, R.K. Mohn)
- 1115-1200 Impact of public pressures and industry demands (J.R. Angel, F.G. Peacock)
- 1200-1300 WORKING LUNCH (in seminar room)
- 1300 General discussion on causes of shortfall in meeting objectives of groundfish management, and "where do we go from here?"



**WORKSHOP PARTICIPANTS**

Fred Allen  
John Angel  
Rob Barbara  
Bob Barnes  
Don Bowen  
Leo Brander  
Les Burke  
Marianne Etter  
Jim Fennel  
Dave Fraser  
Stratis Gavaris  
Carl Goodwin  
Ralph Halliday  
Bob Huggins  
Doreen Liew  
Daryl Lyon  
Steve MacPhee  
Ted Maher  
Chris Milley  
Bob Mohn  
Leo Muise  
Debbie Murphy  
Bob O'Boyle  
Fred Page  
Greg Peacock  
Mike Sinclair  
Gus vanHelvoort  
Scott Wilson  
Kees Zwanenburg





Map of the Atlantic Provinces showing the boundaries of DFO's Scotia-Fundy Region (solid polygon), and NAFO Statistical Areas for which this Region is responsible (4V, 4W, 4X and 5Ze).



**EXTRACTS FROM OBSERVER REPORTS (R. SCHIOCHETTI)**1979

**BARBARA N** - While fishing for cod in 4T several tows consisted of large catches of small cod which were discarded.

**MARJORIE COLBORNE** - The captain stated that he would like to see observers on all domestic vessels to control catches and discards.

1980

**CANSO CONDOR** - The crew commented that this captain constantly fished in closed areas and that other captains did the same thing. A directed trip for haddock was made and this species could not be found in any quantities.

The crew thought that observers were the only way to stop vessels from fishing in closed areas. The captain also said that he could not fish in the areas he wished when an observer was carried. It was his opinion that either all of the vessels or none should carry observers. In addition to this, he expressed a concern about both domestic and foreign overfishing.

**CAPE ANN** - It was stated that vessels were fishing in 4T and reporting the cod as caught in 4Vn. The captain thought that the pollock catch should be restricted to 50% throughout the year rather than imposing a 10% limit when most of the quota had been caught.

The captain believed that enforcement of the regulations should be applied more consistently. He said that some vessels which should have been charged were not and in his opinion this only encouraged the fishers to break the regulations.

**CAPE DOR II** - It was said that haddock caught in 4W was reported as caught in 4X. This captain believed that problem vessels should have to carry observers.

**CAPE FAME** - The crew members of this vessel told the observer that by-catch was thrown overboard when it exceeded the allowable limit.

**CAPE NELSON** - It was said that it was a common practice to misreport the area of capture (i.e., catch half a load of redfish in 3N, steam to 4Vs and load up with cod and report it as caught in 3N). The observer was told that this vessel had intended to misreport the catch on this trip until they found out that they had an observer.

The captain stated that he had been planning to make a two for haddock before landing even though the vessel did not have a haddock licence. However, he would not do this because of the observers presence.

**CAPE ROUGE** - The captain said that the misreporting of cod catches was routine. He also thought that the use of small mesh gear was very destructive to the fishery.

**CAPE SCOTIA** - It was said when observers were not onboard the vessels that liners were frequently used. Unwanted catch was also discarded and not logged.

**HILLSBOROUGH** - The captain felt that observers should be on all of the vessels or none. Inshore vessels were said to be catching haddock and logging it as pollock while other vessels were supposed to be fishing in closed areas. He also said that a senior company rep had told him that he could increase his income by \$3,000 by fishing illegally.

#### 1981

**CAPE ANNE** - This captain believed in an individual vessel quota system. It was also indicated that the vessels fished in closed areas when an observer was not on board.

#### 1982

**CANSO CONDOR** - It was said that the companies were assigning the areas and species to be caught and that some vessels received special treatment. As a result many vessels fished in one area and reported the fish as caught in another.

The shore captain took this vessel on a trip and stated to the observer that he knew that some captains were misreporting catches (area).

The crew commented that the catches were always smaller when an observer was on board and wondered why (crew were kept ignorant of where the vessel fished as a matter of routine).

**CAPE FORTUNE** - The crew stated that stern draggers were using liners when observers were not on board.

**CAPE HUNTER** - Crew members on this vessels said that fish were dumped to stay within company imposed trip limits. The observer on this trip actually heard one captain tell another over the radio that he had to dump fish.

**CAPE YORK** - While on this vessel, the observer heard the captain tell a company official that he could not discard fish because he had an observer on board and that he needed another day to cover off his pollock. The extra day was refused and the captain did not dump the fish, but remarked that he probably would not be paid for it.

**GULF GEORGETOWN** - The captain stated that a lot of fish was misreported as a result of the companies ordering vessels to fish in specific areas. He said that the company had asked him to report catch 4Vn cod as caught in 4Vs. The captain believed that the vessels should be operated independently from the plants.

**ATKINSON** - The crew commented that small trawlers often arranged for a vessel to breakdown and while this vessel was being towed to port by a patrol vessel, the other vessels would be fishing in the closed haddock areas (B&C).

**CAPE YORK** - The crew commented that high rates of discards of small fish were common.

**UNIMARFISH** - The crew stated that the captain commonly used a liner, misreported catch, discarded fish and fished in closed areas.

**ATKINSON** - The captain stated that a lot of fish was discarded and misreported this summer.

**EASTPACK # 1** - It was said that NatSea had a policy in place that the crew would not be paid for any CHP landed that was less than 22 inches/56 cm. in length.

**CAPE BEAVER** - The captain said that haddock are scarce. The plant had instructed him to land only large CHP.

observers noted that small fish were discarded and not recorded. Only the main species caught was recorded in the log.

The vessels were restricted to trip limits and the size of fish that was caught was said to result in a large amount of dumping. Captains were often resentful when they had to carry observers as they had no choice but to fish where the company told them and small fish had to be kept.

#### 1984

**ANN SPENCER** - The observer heard two captains talking on the radio who said that they had to discard ~17.5 tons each because the cod in 4Vn was too small and the company would not let them land it.

**BARBARA N** - The company policy was that all fish less than 50 cm. were to be discarded. Dumping was said to occur all the time.

**CAPE CHARLES** - The captain said that the haddock fishery should be closed as only small fish were caught and these were discarded. In particular, large amounts of small haddock were said to be caught and discarded on Banquereau Bank.

**CAPE HOWE** - The captain thought that haddock were scarce due to the use of liners in the past.

**CAPE SCOTIA** - It was stated by the captain that observers should be on these vessels in the summer when haddock were directed for as only 25% of the fish caught were retained.

**H.M. KAISER** - He thought that haddock should be directed for, at least for a couple of years. Companies were said to force the vessels to fish for haddock when observers were not on board and that the discarding was high due to the large number of small fish which were caught.

#### 1985

**ESTHER BOYD** - The captain thought that a haddock fishery in 3Ps was possible on a limited basis. He also believed that too much cod was taken on Banquereau and that the discards of this species were too high. The company had a policy that CHP under 43 cm should be discarded.

The captain also said that it was a common practice to discard all by-catch when more than two species were caught. A captain who landed more than the trip limit for a species of fish was not paid for the excess fish, would receive a warning the first time then a suspension and finally be fired. As a result, he said that most individuals discarded any fish which would result in the trip limit being exceeded. The amount of fish discarded was said huge.

One crew member stated that recently 40,000 lb. of pollock had been dumped when 7,000 lb. of cod was caught which would fill the hold.

**CAPE HUNTER** - The captain considered the Scotian Shelf haddock fishery to be a thing of the past.

**CAPE LAHAVE** - The captain thought that the haddock stock on Banquereau had been damaged by the large amount of fishing effort in this area. Most of the haddock were said to be small and were discarded when caught.

**HILLSBOROUGH** - The captain thought that a 3Ps haddock fishery would help to reduce the fishing pressure on the much battered Banquereau Bank. In addition to this, the captain said that when an observer was on board he could not dump large quantities of fish to conform to trip limits. The plant recognized this and must therefore pay for the fish caught. Captains now prefer to carry observers as it is an advantage rather than a disadvantage. (Company policy has changed to allow the landing of fish above the trip limit when an observer is on board but not otherwise.)

**CAPE BAULD** - Later in the year this vessel was granted a permit allowing the vessel fish in the closed area on Browns Bank for haddock. While significant quantities of haddock were found, they were all smaller than the desired size and were discarded.

**A.W. HENRIKSEN** - Crew members wondered why observer coverage was so low in the spring when the discarding of cod was so high.

**BARBARA N** - The captain said that when fishing for haddock the vessels were asked not to land any pollock. Evidently haddock and pollock were frequently caught together and the unspoken order was to discard all pollock.

**BEDQUE** - The captain indicated that vessels were misreporting the area of capture. When an observer was not on board it was said that all fish which exceeded the imposed trip limit were dumped. Due to this the captain found it to be an advantage to carry an observer as the company did not expect him to dump fish when an observer was on board.

**H.M. KAISER** - Crew members said that they were pleased when an observer was deployed to their vessel as they were not asked to discard fish.

**CAPE FORCHU** - The captain was concerned about the large numbers of small haddock which were caught and discarded.

**CAPE HOWE** - The crew of this vessel thought that this ship should always carry an observer as this would prevent the use of codend liners. The Bosun said that every vessel should carry observers as when observers were not present a lot of dumping occurred. He also said that the company frequently ordered vessels to use liners.

**CAPE CHARLES** - The captain believed that haddock should be restricted by a 1-% by-catch in 4VW. These fish are too small and the company policy of not accepting small fish has led to wide spread dumping.

**CAPE BALLARD** - The captain blamed the stock depletion in 4WX on the inshore draggers. He thought that closure for haddock would be effective in stopping the large scale dumping of this species. The crew mentioned that the level of dumping has increased sharply over the last couple of years.

**W.R. RITCEY** - The captain thought that there was too much activity in 4Vs and reported that the bulk of the haddock caught was undersized and discarded. He thought that freezer trawlers were a necessary evil.



**PROFITABILITY +/-****SCOTIA-FUNDY GROUND FISH FLEETS  
1986-1990**

	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
OFFSHORE MG	?	?	?	?	?
MOBILE GEAR 65-99'	+	+	+	+	-
LONGLINE 65-99'	+	+	+	+	+

4VW MOBILE 45-64'	+	+	+	+	+
4X MOBILE 45-64'	+	+	+	+	+
4VW MOBILE 35-44'	+	+	+	+	+
4X MOBILE 35-44'	+	+	+	+	+

4X LONGLINE 45-64'	+	+	-	-	-
4VW LONGLINE 35-64'	+	+	+	+	+
4X LONGLINE 35-44'	+	+	+	0	+

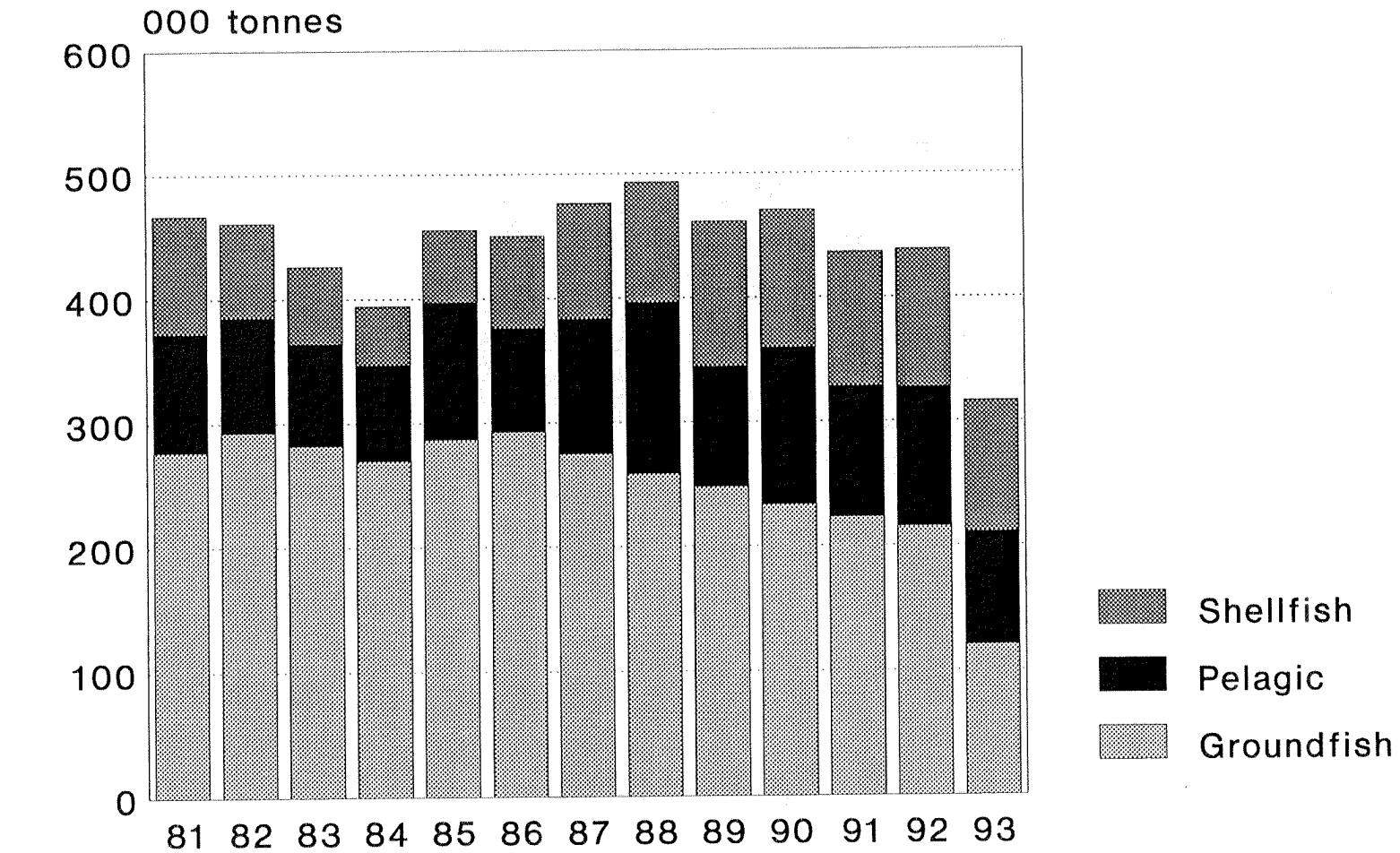
NOVA SCOTIA LANDINGS BY MAJOR SPECIES  
Q=TONNES

SPECIES	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
GROUND FISH	277,959	293,473	282,048	269,908	287,974	293,859	275,059	259,904	248,424	232,700	223,095	215,109	120,000
COD	128,259	154,385	151,276	144,633	149,453	139,183	132,492	129,178	122,217	114,019	100,813	90,234	
HADDOCK	50,569	44,386	38,924	31,297	34,028	39,031	23,802	25,528	22,206	20,260	20,795	20,941	
OTHER GRNDFISH	99,131	94,702	91,848	93,978	104,493	115,645	118,765	105,198	104,001	98,421	101,487	103,934	
PELAGIC	94,519	91,529	82,114	77,156	110,179	82,725	108,131	136,641	96,478	128,481	104,526	112,277	90,000
HERRING	84,242	80,046	74,042	68,774	100,152	74,928	98,397	124,176	84,026	111,888	90,802	97,564	
OTHER PELAGIC	10,277	11,484	8,072	8,382	10,027	7,797	9,734	12,465	12,452	14,593	13,724	14,713	
SHELLFISH	94,995	75,790	61,694	47,440	58,389	74,137	92,798	97,058	117,151	111,014	108,636	111,621	106,000
SCALLOP	79,965	59,614	44,067	28,549	38,395	49,298	66,295	68,322	79,957	69,350	69,673	75,564	
LOBSTER	7,897	8,804	11,066	12,427	14,236	17,958	18,427	18,583	19,073	22,429	23,340	17,984	
OTHER SHELLFISH	7,133	7,372	6,561	6,464	5,758	6,881	8,076	10,153	18,121	19,235	15,623	18,073	
GRAND TOTAL	467,473	460,792	425,854	394,504	456,542	450,721	475,988	493,603	462,053	470,195	436,257	439,007	316,000

NOVA SCOTIA LANDED VALUES BY MAJOR SPECIES  
CURRENT - \$'000

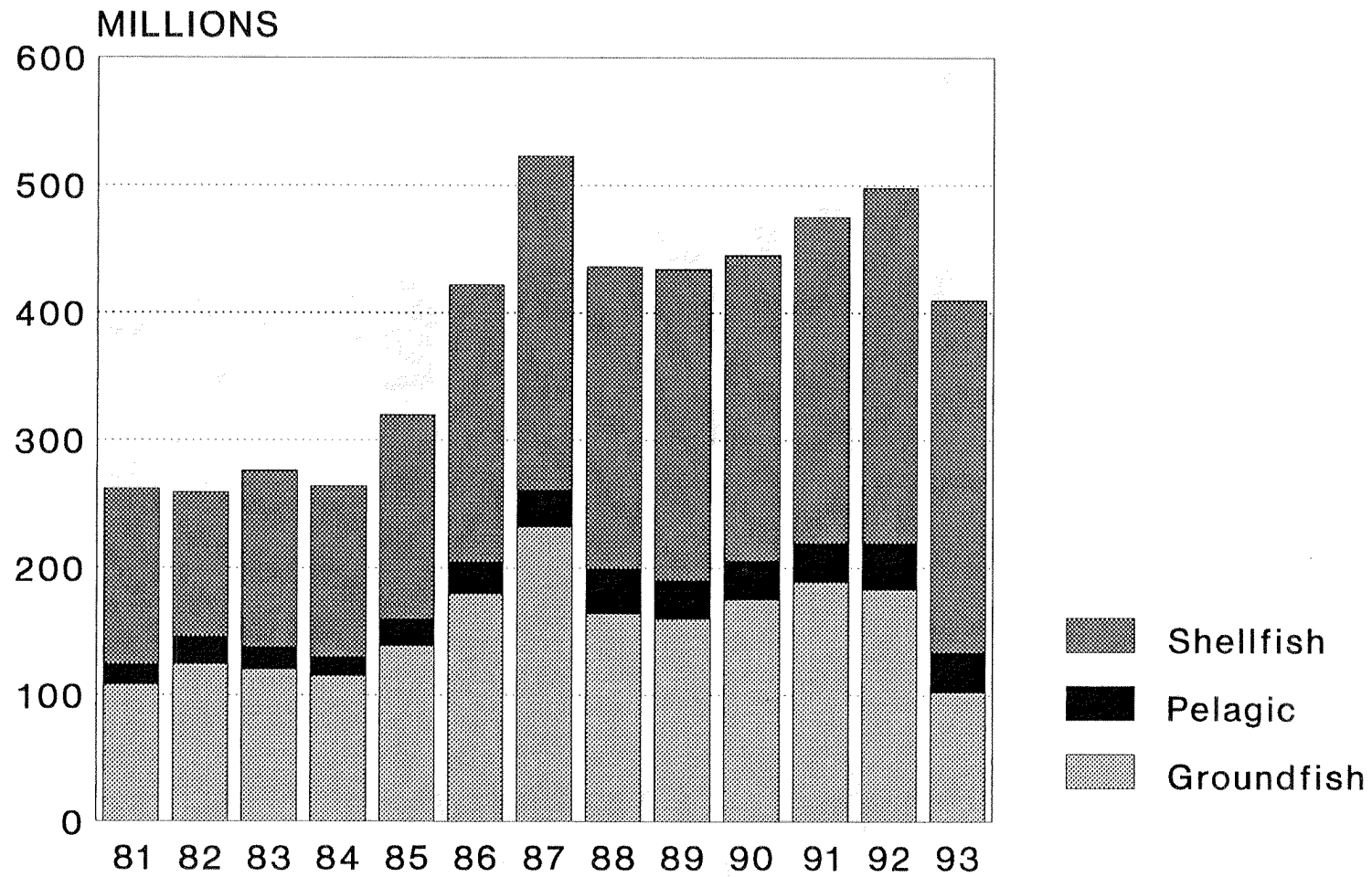
SPECIES	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
GROUND FISH	108,457	124,225	119,533	114,730	139,159	180,174	232,045	164,278	160,458	174,712	188,804	182,882	102,000
COD	53,942	68,306	63,164	56,874	69,039	82,121	120,743	81,582	76,842	88,574	93,416	83,420	
HADDOCK	23,014	22,366	23,972	22,137	26,704	34,990	32,211	26,343	23,941	23,362	30,189	29,744	
OTHER GRNDFISH	31,501	33,553	32,397	35,719	43,416	63,063	79,091	56,353	59,675	62,776	65,199	69,718	
PELAGIC	16,480	21,513	17,507	15,310	20,861	24,897	29,416	34,500	29,938	31,209	29,765	35,831	31,500
HERRING	12,439	15,253	11,466	9,831	15,436	15,314	18,868	20,602	12,297	16,026	11,791	11,716	
OTHER PELAGIC	4,041	6,260	6,041	5,479	5,425	9,583	10,548	13,898	17,641	15,183	17,974	24,115	
SHELLFISH	137,665	112,798	138,347	134,388	160,187	216,785	261,641	237,095	243,746	238,789	255,768	279,242	275,600
SCALLOP	88,336	55,103	60,336	43,481	49,471	63,021	83,464	73,944	79,269	71,961	70,046	83,278	
LOBSTER	41,314	49,956	68,189	81,445	101,550	140,304	160,349	141,094	138,930	134,754	153,194	159,236	
OTHER SHELLFISH	8,015	7,739	9,822	9,462	9,166	13,460	17,828	22,057	25,547	32,074	32,528	36,728	
GRAND TOTAL	262,602	258,536	275,387	264,428	320,207	421,856	523,102	435,873	434,142	444,710	474,337	495,955	409,100

# NOVA SCOTIA LANDINGS BY SPECIES QUANTITY TONNES



1993 IS PROJECTED

# NOVA SCOTIA LANDED VALUE CURRENT \$

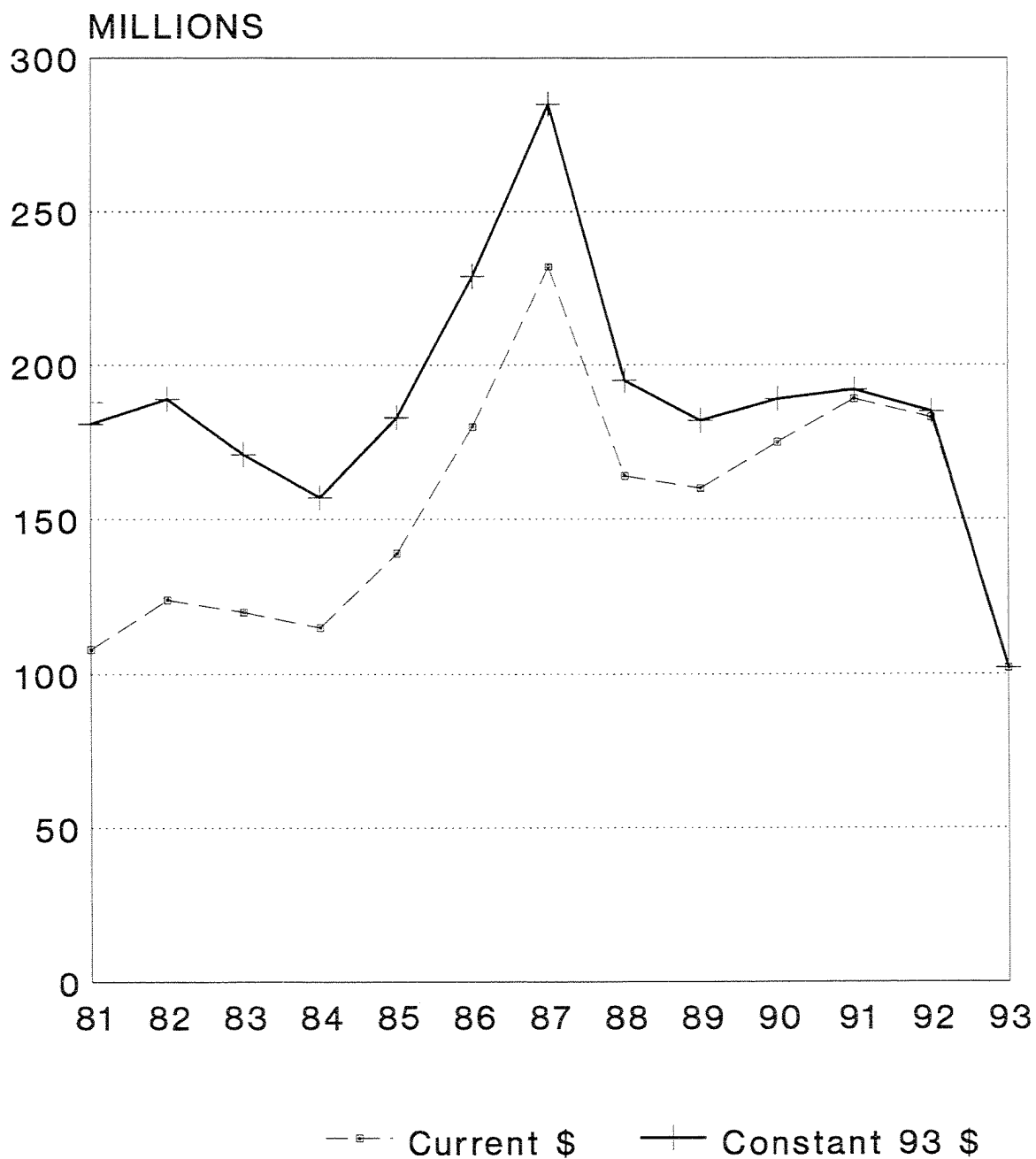


1993 IS PROJECTED

## NOVA SCOTIA LANDED VALUES BY MAJOR SPECIES IN CONSTANT 1993\$ (\$000)

SPECIES	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
GROUND FISH	180809	189239	171030	157259	182673	229181	285456	195291	182397	189135	192589	185359	102000
COD	89927	104054	90376	77957	90627	104458	148535	96983	87349	95886	95289	84550	0
HADDOCK	38367	34071	34300	30343	35054	44507	39625	31316	27214	25291	30794	30147	0
OTHER GRNDFISH	52515	51113	46354	48960	56992	80216	97296	66992	67834	67958	66506	70662	0
PELAGIC	27474	32772	25049	20985	27384	31669	36187	41013	34031	33785	30362	36316	31500
HERRING	20737	23236	16406	13475	20263	19479	23211	24491	13978	17349	12027	11875	0
OTHER PELAGIC	6737	9536	8644	7510	7121	12190	12976	16522	20053	16436	18334	24442	0
SHELLFISH	229502	171831	197950	184204	210276	275751	321864	281855	277073	258502	260896	283025	275600
SCALLOP	147265	83941	86330	59599	64940	80163	102675	87904	90107	77902	71450	84406	0
LOBSTER	68875	76101	97566	111636	133304	178467	197257	167730	157926	145878	156265	161393	0
OTHER SHELLFISH	13362	11789	14054	12969	12032	17121	21932	26221	29040	34722	33180	37226	0
GRAND TOTAL	437785	393842	394030	362449	420334	536601	643507	518159	493502	481422	483847	504700	409100

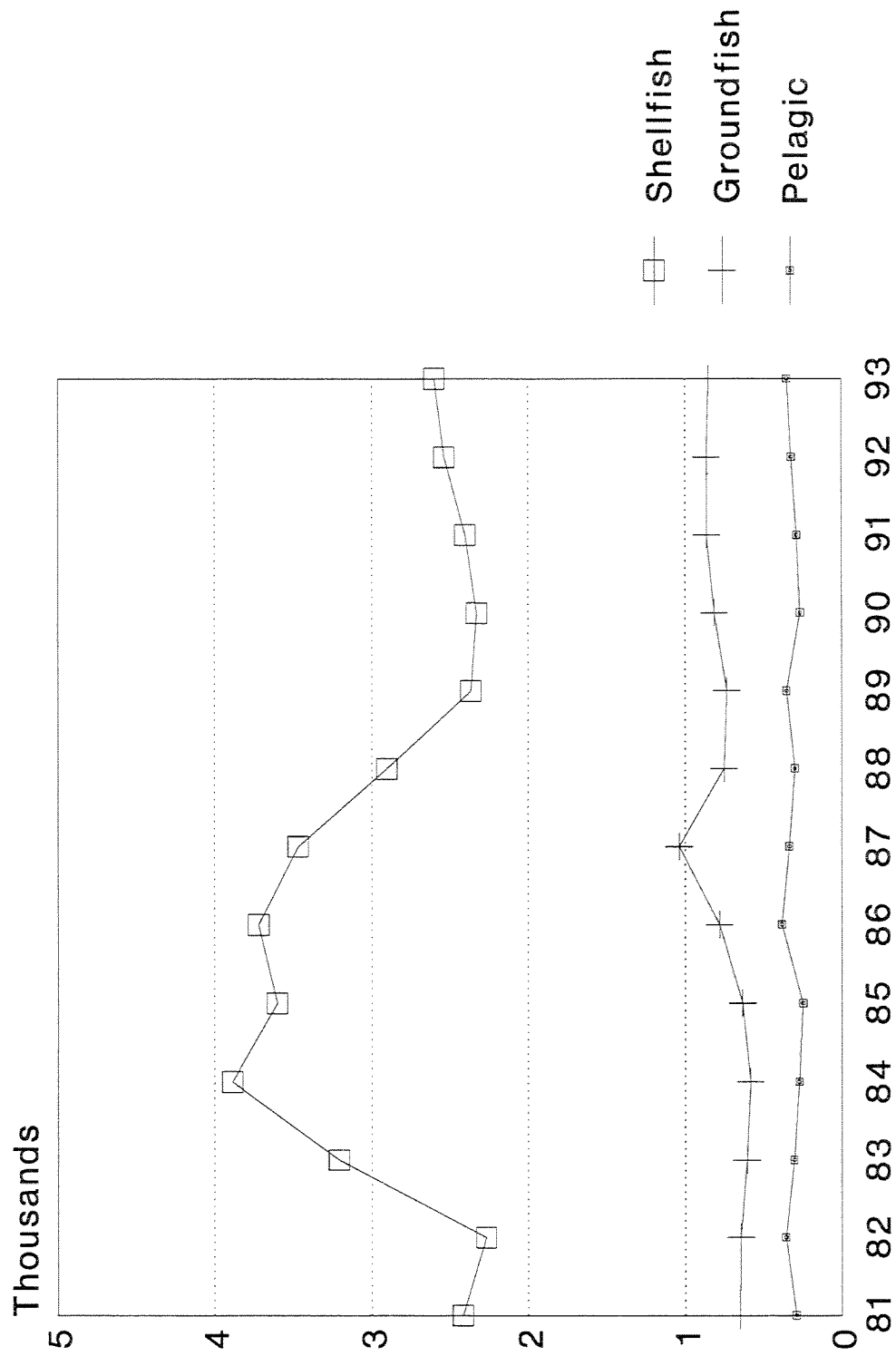
# VALUE FOR GROUND FISH LANDED IN N.S. CURRENT & CONSTANT 93 \$



NOVA SCOTIA PRICE PER METRIC TON FOR MAJOR SPECIES IN CONSTANT 1993\$

SPECIES	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
GROUND FISH	650	645	606	583	634	780	1,038	751	734	813	863	862	850
COD	701	674	597	539	606	751	1,121	751	715	841	945	937	
HADDOCK	759	768	881	970	1,030	1,140	1,665	1,227	1,226	1,248	1,481	1,440	
OTHER GRNDFISH	530	540	505	521	545	694	819	637	652	690	655	680	
PELAGIC	291	358	305	272	249	383	335	300	353	267	290	323	350
HERRING	246	290	222	196	202	260	236	197	166	155	132	122	
OTHER PELAGIC	656	830	1,071	896	710	1,563	1,333	1,325	1,610	1,126	1,336	1,661	
SHELLFISH	2,416	2,267	3,209	3,883	3,601	3,719	3,468	2,904	2,365	2,329	2,402	2,536	2,600
SCALLOP	1,842	1,408	1,959	2,088	1,691	1,626	1,549	1,287	1,127	1,123	1,026	1,117	
LOBSTER	8,722	8,644	8,817	8,983	9,364	9,938	10,705	9,026	8,280	6,504	6,695	8,974	
OTHER SHELLFISH	1,873	1,599	2,142	2,006	2,090	2,488	2,716	2,583	1,603	1,805	2,124	2,060	
GRAND TOTAL	936	855	925	919	921	1,191	1,352	1,050	1,068	1,024	1,109	1,150	1,295

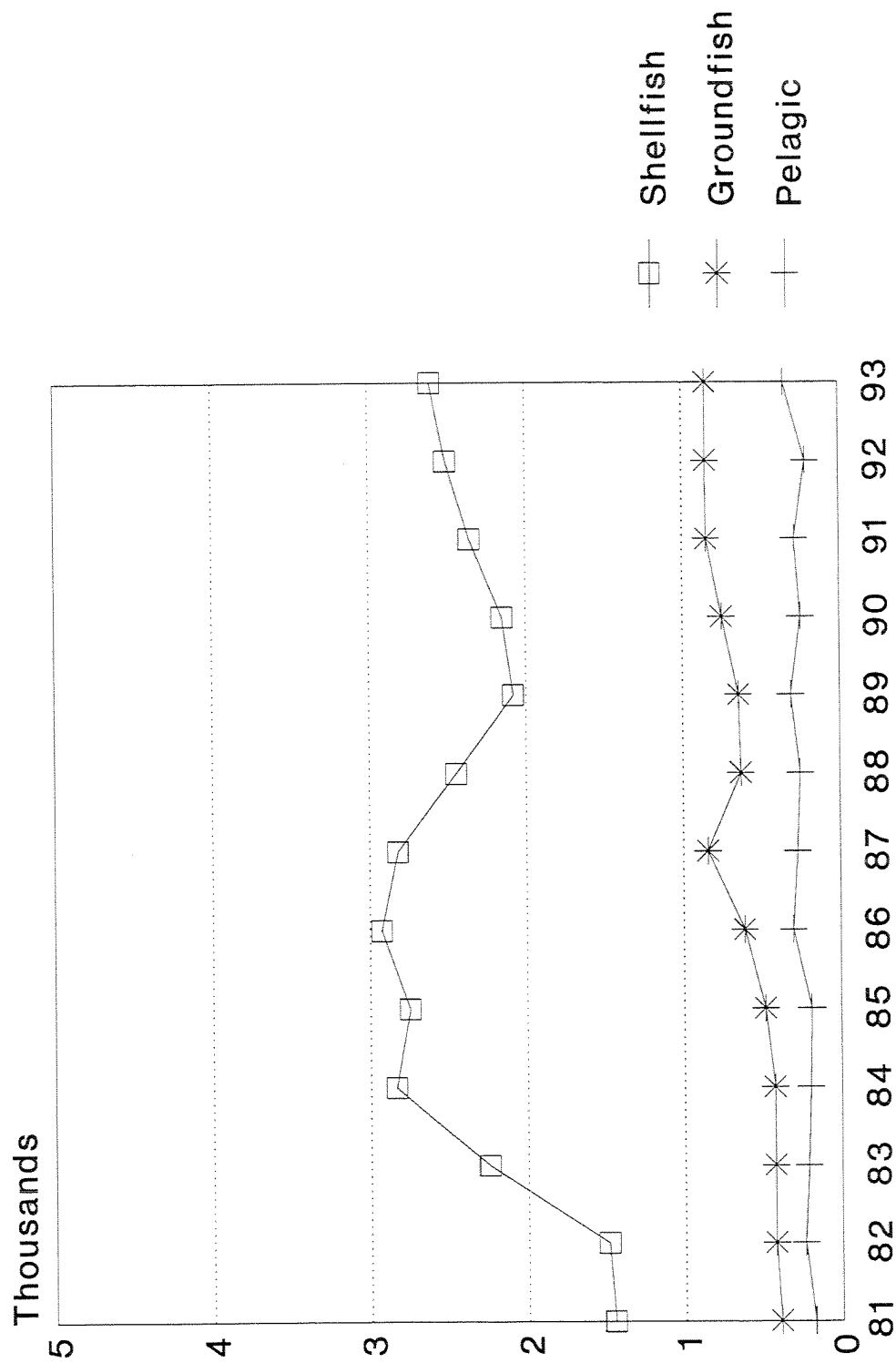
# NOVA SCOTIA PRICE PER METRIC TON FOR MAJOR SPECIES IN CONSTANT 1993 \$



1993 IS PROJECTED



# NOVA SCOTIA PRICE PER METRIC TON FOR MAJOR SPECIES IN CURRENT \$



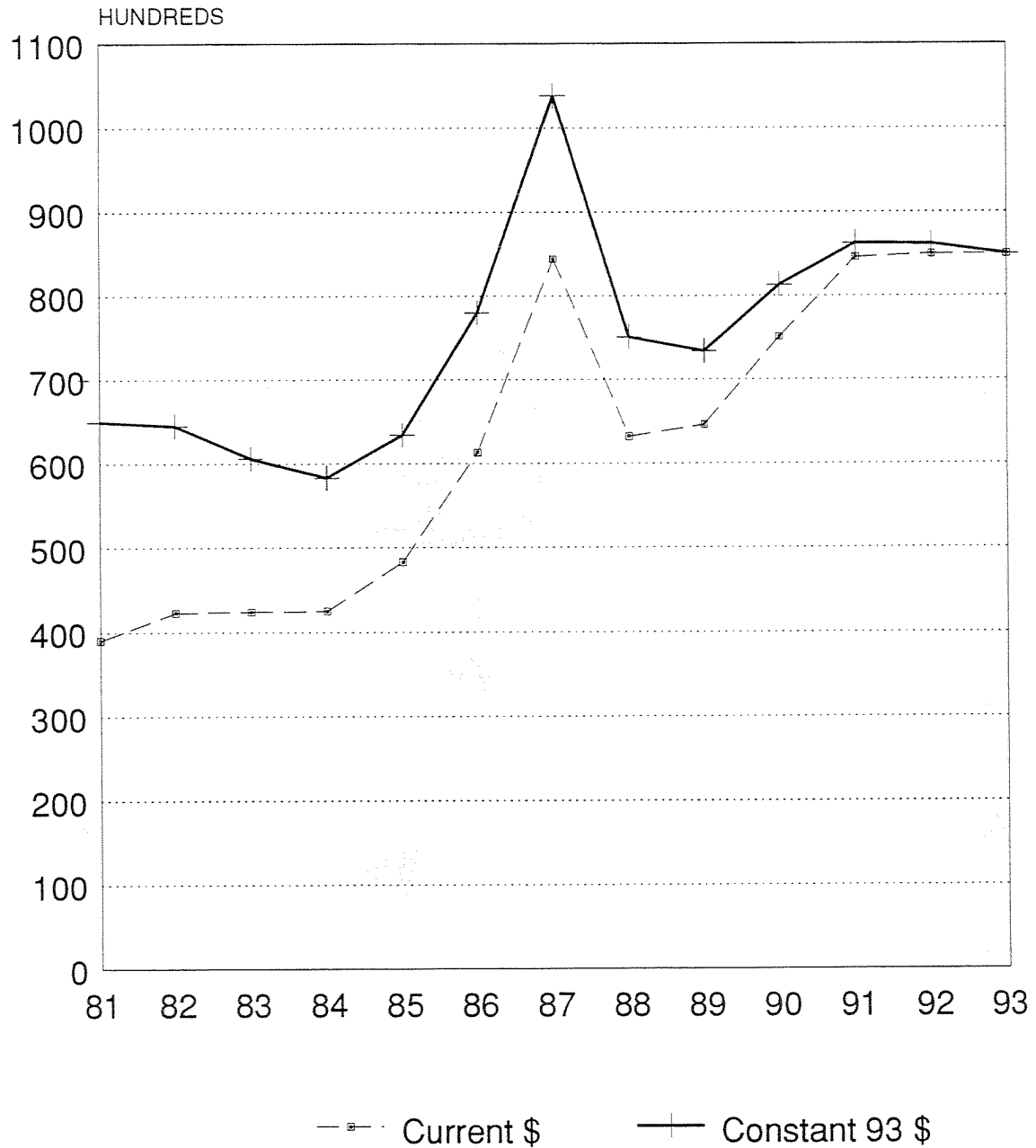
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## NOVA SCOTIA PRICE PER METRIC TON BY MAJOR SPECIES

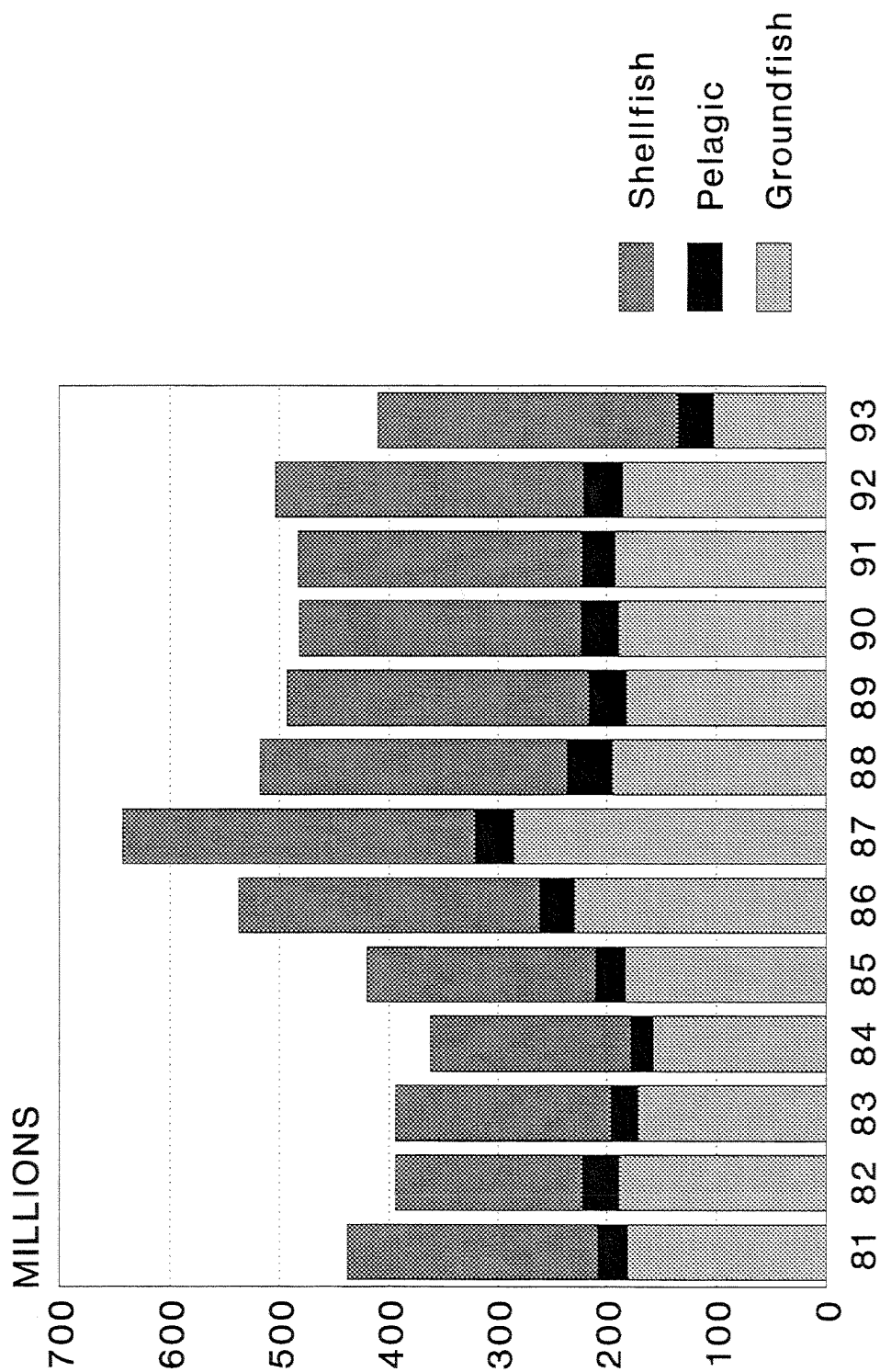
PRICE - CURRENT \$

SPECIES	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
GROUND FISH	390	423	424	425	483	613	844	632	646	751	846	850	850
COD	421	442	418	393	462	590	911	632	629	777	927	924	
HADDOCK	455	504	616	707	785	896	1,353	1,032	1,078	1,153	1,452	1,420	
OTHER GRNDFISH	318	354	353	380	415	545	666	536	574	638	642	671	
PELAGIC	174	235	213	198	189	301	272	252	310	247	285	319	350
HERRING	148	191	155	143	154	204	192	166	146	143	130	120	
OTHER PELAGIC	393	545	748	654	541	1,229	1,084	1,115	1,417	1,040	1,310	1,639	
SHELLFISH	1,449	1,488	2,242	2,833	2,743	2,924	2,819	2,443	2,081	2,151	2,354	2,502	2,600
SCALLOP	1,105	924	1,369	1,523	1,288	1,278	1,259	1,082	991	1,038	1,005	1,102	
LOBSTER	5,232	5,674	6,162	6,554	7,133	7,813	8,702	7,593	7,284	6,008	6,564	8,854	
OTHER SHELLFISH	1,124	1,050	1,497	1,464	1,592	1,956	2,208	2,172	1,410	1,667	2,082	2,032	
GRAND TOTAL	562	561	647	670	701	936	1,099	883	940	946	1,087	1,130	1,295

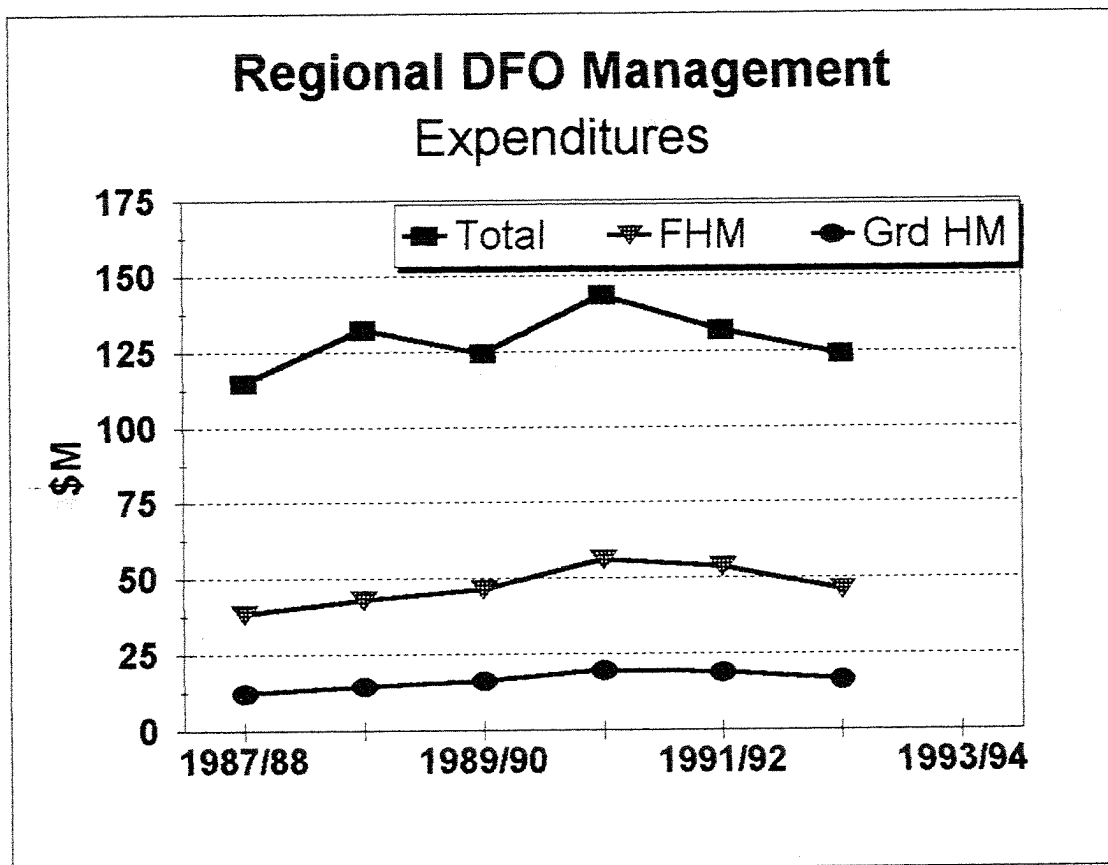
# PRICE PER METRIC TON FOR GROUNDFISH LANDED IN N.S.



# NOVA SCOTIA LANDED VALUE CONSTANT 1993 \$



1993 IS PROJECTED



**Total.** Total Expenditures of DFO Scotia-Fundy

**FHM.** Fisheries Harvest Management Expenditures including

Enforcement & Surveillance

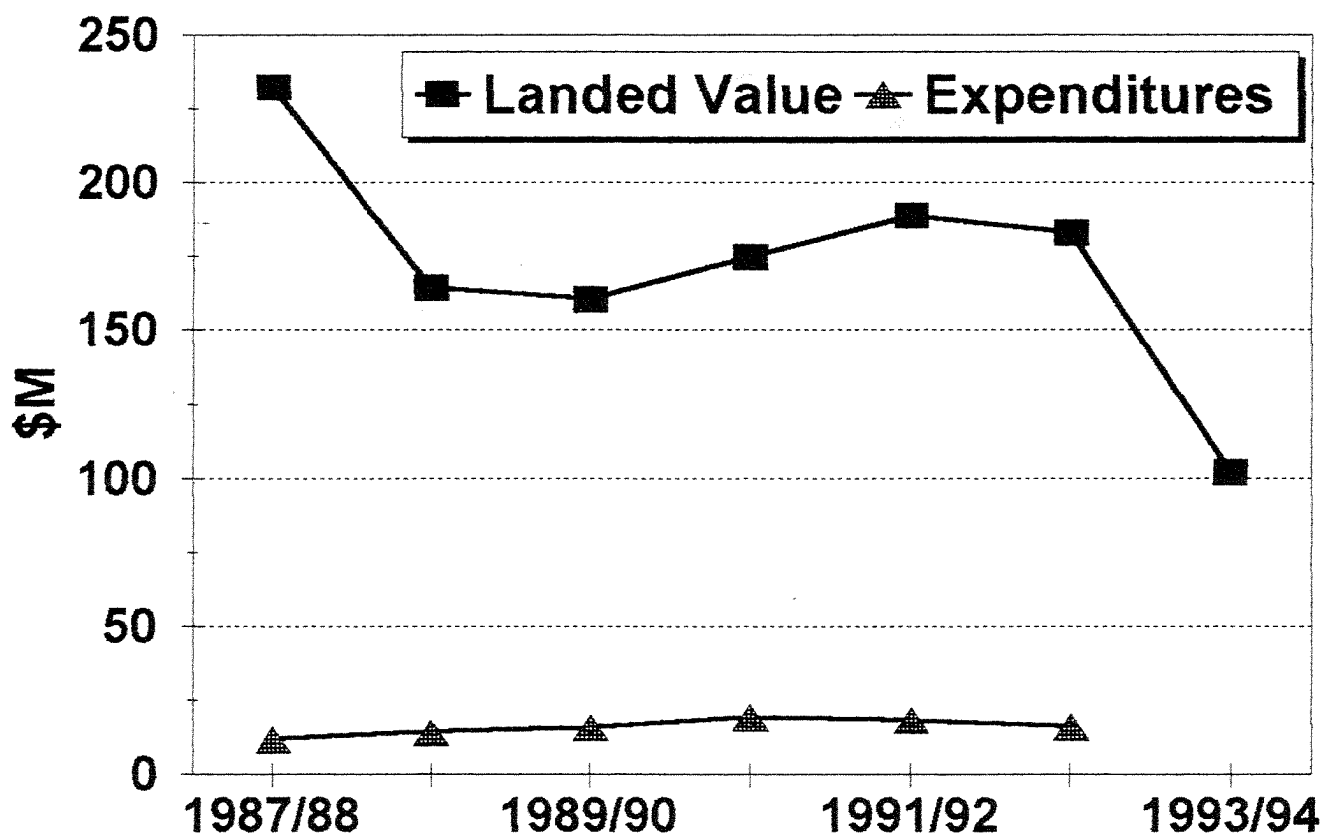
Resource allocation

Economics

Science

**Grd HM.** Groundfish Management Expenditures

## Groundfish Management Expenditures Versus Groundfish Landed Value



# Scotia-Fundy Regional Fiscal Year Expenditures (\$ millions)



	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93
<b>Fisheries Harvest Management</b>	<b>38.3</b>	<b>42.8</b>	<b>46.3</b>	<b>56.1</b>	<b>53.5</b>	<b>46.0</b>
Biology	14.3	17.7	17.7	19.1	18.8	18.0
Economics	1.2	1.3	1.4	1.6	1.7	1.5
Resource Allocation	5.8	6.1	7.1	9.2	7.6	6.4
Surveillance and Enforcement	17.0	17.7	20.1	26.2	25.4	20.1
<b>Habitat Management</b>	<b>2.2</b>	<b>3.6</b>	<b>3.9</b>	<b>4.9</b>	<b>4.7</b>	<b>4.7</b>
<b>Inspection</b>	<b>5.6</b>	<b>6.3</b>	<b>6.7</b>	<b>8.1</b>	<b>7.3</b>	<b>6.4</b>
<b>Special Services to Fishing</b>						
Industry	8.8	9.0	3.7	3.3	6.4	9.6
Service to Aquaculture	8.1	3.4	2.4	4.8	3.8	2.6
Small Craft Harbours	16.4	32.6	26.0	18.5	13.8	14.8
Hydrography	11.2	10.6	11.6	16.2	11.6	7.9
Oceanography	21.4	21.1	21.0	27.1	25.4	26.0
Service to Other DFO Regions	2.2	2.5	2.5	3.9	5.0	5.3
Service to Other Departments	0.2	0.3	0.2	0.4	0.3	0.6
<b>TOTAL EXPENDITURES</b>	<b>114.4</b>	<b>132.2</b>	<b>124.3</b>	<b>143.3</b>	<b>131.8</b>	<b>123.9</b>

## Scotia-Fundy Regional Fisheries Harvest Management Expenditures by Activity

Enforcement and Surveillance							Economics						
	87-88	88-89	89-90	90-91	91-92	92-93		87-88	88-89	89-90	90-91	91-92	92-93
Groundfish	4.8	5.8	7.0	9.2	8.9	7.1	Groundfish	0.4	0.5	0.8	0.8	0.9	0.8
Lobster	4.8	4.3	5.0	6.6	6.4	5.0	Lobster	0.2	0.2	0.3	0.2	0.2	0.2
Scallop	1.5	1.8	2.0	2.6	2.5	2.0	Scallop	0.2	0.2	0.1	0.2	0.2	0.2
Herring	0.9	1.6	2.0	2.6	2.5	2.0	Herring	0.1	0.1	0.1	0.1	0.1	0.1
Tuna		2.7	3.0	3.9	3.8	3.0	Tuna						
Other	5.0	1.7	1.1	1.3	1.3	1.0	Other	0.3	0.3	0.1	0.3	0.3	0.2
Total	17.0	17.9	20.1	26.2	25.4	20.1	Total	1.2	1.3	1.4	1.6	1.7	1.5

Resource Allocation							Biology						
	87-88	88-89	89-90	90-91	91-92	92-93		87-88	88-89	89-90	90-91	91-92	92-93
Groundfish	1.4	1.4	1.6	2.1	1.7	1.5	Groundfish	5.3	6.5	6.5	7.1	7.0	6.7
Lobster	1.0	1.3	1.6	2.1	1.7	1.5	Lobster	2.4	3.4	3.1	3.1	3.1	2.9
Scallop	0.6	0.7	0.6	1.0	0.8	0.7	Scallop	1.1	2.8	1.4	1.5	1.5	1.4
Herring	0.6	0.5	0.8	0.8	0.6	0.5	Herring	2.7	1.4	3.3	3.7	3.6	3.5
Tuna		0.7	0.8	1.0	0.8	0.7	Tuna						
Other	2.2	1.5	1.7	2.2	1.8	1.5	Other	2.8	3.6	3.4	3.7	3.6	3.5
Total	5.8	6.1	7.1	9.2	7.6	6.4	Total	14.3	17.7	17.7	19.1	18.8	18.0



**Table 1. Scotia-Fundy DFO Expenditures**

	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94
TOTAL RES. \$M	114.40	132.20	124.30	143.30	131.80	123.90	?
FISH HAR. MGT. \$M	38.30	42.80	46.30	56.10	53.50	46.00	?
GRD. MGT. \$M	11.90	14.20	15.90	19.20	18.50	16.10	?
GRD. LAND. VALUE \$M	232.05	164.30	160.50	174.70	188.80	182.90	102.00

**Table 2. Scotia-Fundy DFO Groundfish Management Expenditures**

	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93
GRD. ENFOR/SURV. \$M	4.80	5.80	7.00	9.20	8.90	7.10
GRD. RES. ALLOC. \$M	1.40	1.40	1.60	2.10	1.70	1.50
GRD. ECON. \$M	0.40	0.50	0.80	0.80	0.90	0.80
GRD. SCIENCE \$M	5.30	6.50	6.50	7.10	7.00	6.70
GRD. MGT. \$M	11.90	14.20	15.90	19.20	18.50	16.10