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SIMULATION MODEL OF ATLANTIC COMMERCIAL FISHERIES: A NEWFOUNDLAND REGION APPLICATION

by

R. Nowak

Program Coordination and Economics Branch

Scotia-Fundy Region

Department of Fisheries and Oceans

P.O. Box 550

Halifax, Nova Scotia

B3J 2S7

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ABSTRACT

A simple, financial simulation model of Atlantic commercial fisheries is described. The model generates simplified income statements and is useful in evaluating impacts of broad policy shifts. The model is used to obtain fleet estimates given two criteria: a minimum annual income of $18,000 for each fisherman and a 10 per cent return on investment to each enterprise. The results suggest that the required number of boats in the fishery of the Newfoundland Region would need to be significantly reduced if these criteria were to be met.

Keywords: Overcapacity, fisheries policy.

RÉSUMÉ

Un simple modèle de simulation financière des pêches commerciales de l'Atlantique est ici décrit. Ce modèle engendre des relevés de revenus simplifiés et est utile pour évaluer les conséquences de changements extensifs de politique. Le modèle est utilisé pour obtenir des évaluations de flottilles en tenant compte de deux critères: un revenu annuel minimum de 18 000 $ pour chaque pêcheur et une rentabilité des investissements de 10 pour cent pour chaque entreprise. Les résultats suggèrent que le nombre requis de bateaux dans la pêche de la région de Terre-Neuve devrait être considérablement réduit pour que ces deux critères soient rencontrés.

Mots clé: Surcapacité, politique des pêches.

PREFACE

The views and opinions expressed in this paper are those of the author and do not necessarily reflect an official position of the Department of Fisheries and Oceans.

The study was originated while the author was employed in Economic and Commercial Analysis Directorate, Department of Fisheries and Oceans, Ottawa.

INTRODUCTION

The purpose of this paper is to describe a simple, static financial model of Atlantic fisheries. In addition, the relationship between the revenue obtained from fishing and the amount of capital and labour employed (ie., overcapacity) is studied based on Newfoundland Region fishing fleets.

It is well-accepted that open access fishery management introduces redundant competition among fishermen and rises harvesting costs. Economists have suggested that assignment of property rights to fish would alleviate investment in unnecessary vessels and equipment. Such system, if these rights were transferable, would rationalize fishing operations by lowering total fishing costs.

This paper provides evidence of the large amount of economically unnecessary inputs in the fishery of the Newfoundland Region. It also suggests the potential difficulty of applying individual transferable quota (ITQ) management in the Newfoundland Region. In this respect, the paper agrees with recommendations included in an ITQ report under the chairmanship of P. Sutherland.[1] Specifically, the report identifies three characteristics of this fishery which may make an ITQ management less (or not) practical. First, the fishery is prosecuted by a large number of fishermen over a large area with many possible landing ports making sufficient enforcement costly. Second, social objectives in the fishery of Newfoundland seem to be more important than economic efficiency. And finally, the presence of excessive over-capitalization, as shown in this paper, already exists there.

The study is divided into two sections. The first section describes the model. The second section estimates reductions in fleet sizes necessary for the remaining participants to obtain specified "target" levels of income. The results support previous estimates of an "economically viable" harvesting employment in Newfoundland.[2] The appendices provide additional information on the model as well as examples of output.

SIMULATION MODEL

In 1987, the Department of Fisheries and Oceans commissioned the

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[1] Individual Quota Management in Canadian Fisheries: Taking Stock and Future Directions, A report prepared by a DFO Working Group, P. Sutherland, Chairman, August, 1990.

[2] For example, W. E. Schrank, N. Roy and E. Tsoa, Employment Prospects in a Commercially Viable Newfoundland Fishery: An Application of 'An Econometric Model of the Newfoundland Groundfishery', Marine Resource Economics, vol.3, 1986.

DPA Consultants to develop a model of Atlantic fisheries capable of generating simplified income statements and at the same time useful in evaluating impacts of broad policy shifts. The original DPA model, mostly due to apparent data inefficiencies, was further modified and updated in 1990.[3]

The harvesting model uses regional Costs and Earnings Reports which are based on financial and economic data of an average vessel (or enterprise in case of the Newfoundland Region). In general, the objective of the model is to create a financial fleet profile at time t which, on the one hand, uses the past and present (at time t) costs and earnings data and, on the other hand, is used to create a similar data framework beyond time t. Once this is accomplished, one can introduce changes in variables and/or parameters to obtain desired simulation results. These simulated results can then be compared with the basecase ("shock-free") data.

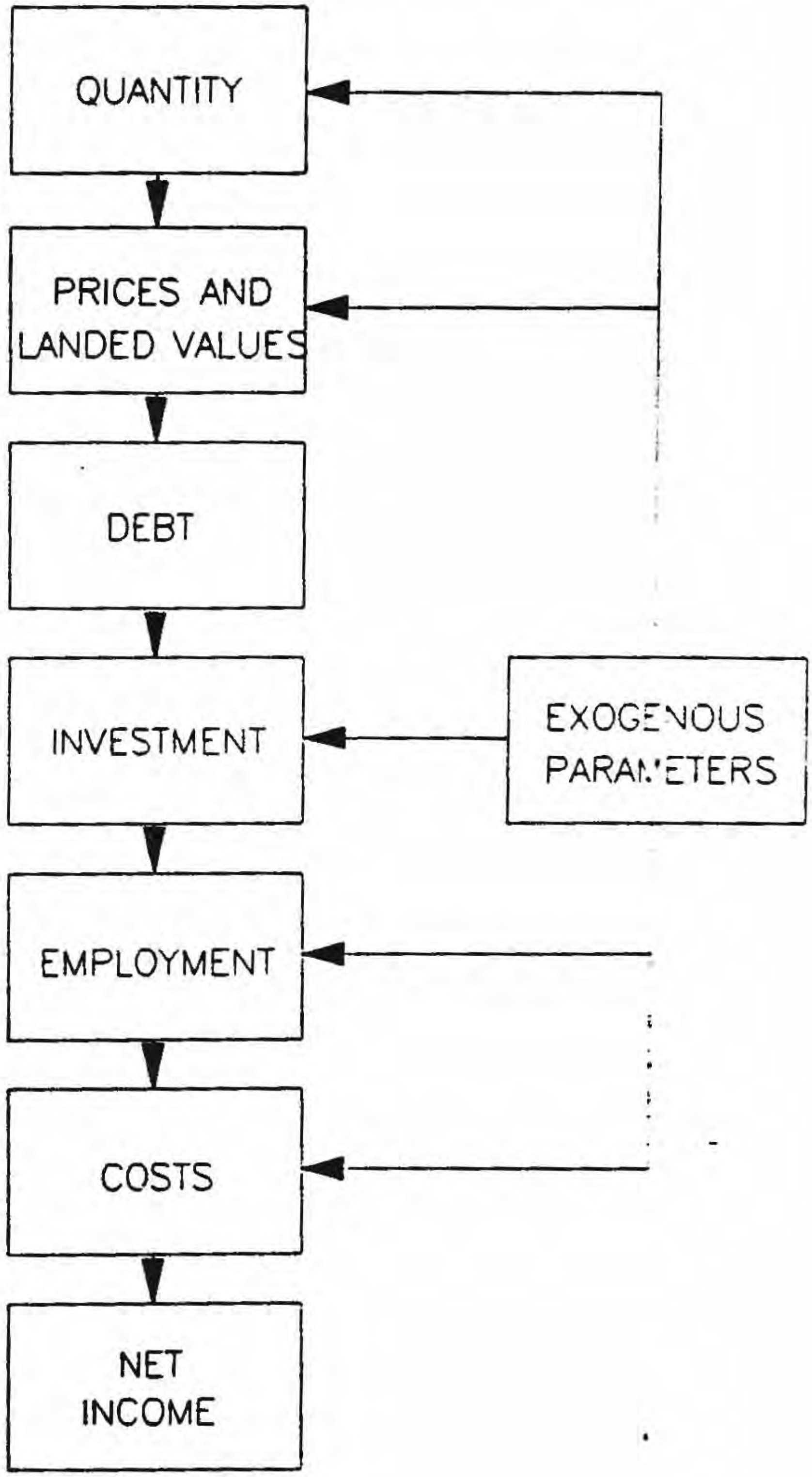
Given the above framework, the model consists exclusively of exogenous variables (those which are determined outside of the model) or parameters (parameters are those elements in the model which can be set arbitrarily) and "identity" relationships.

Figure 1 presents a flow chart of the model. The structure is fairly simple and consists of seven recursive blocks and one which enters independently. The independent block contains exogenous parameters: number of vessels, average crew size, time spent fishing, Consumers' Price Index, interest rate and reinvestment parameter.

The quantity allocation block determines the specific fleet's landings by species and the total for Atlantic Canada. The prices and landed values block determines, among others, fleet specific landed values relative to Atlantic-wide prices and values. The debt balance block establishes an average vessel's debt by assuming a minimum debt level to ensure a periodic vessel replacement. The investment block identifies individual vessel investment components. The common property phenomenon is attempted to be captured by "reinvestment parameter" where current investment is linked to last year's vessel performance (net income). The employment block is exogenous. Employment is strictly a function of number of vessels and average crew size. The cost block consists of labour, variable, debt servicing and capital costs. The net income is defined as income accruing to a vessel after total costs and skipper share.

[3] Simulation Models of Atlantic and Pacific Commercial Fisheries, Model Documentation and Final Report, The DPA Group Inc., Vancouver, May 1987.

FIGURE 1


QUANTITY
PRICES AND
LANDED VALUES
DEBT
INVESTMENT
EXOGENOUS
PARAMETERS
EMPLOYMENT
COSTS
NET
INCOME

DESRIPTION OF INDIVIDUAL BLOCKS

BLOCK 1 - Exogenous parameters

Exogenous parameters refer to a number of specified elements outside the model. Included as exogenous are the CPI (Department of Finance medium term forecast is used), interest rate (assumed to be 10 per cent), depreciation rate (straight line depreciation at 5 per cent annually), tax rate (30 per cent) and reinvestment parameter (originally set to zero). The reinvestment parameter is defined as a positive fraction of net incomes that will be reinvested in vessels and equipment. In addition, a fleet reduction rate may be specified in the model. It permits an assessment of the fleet reduction scenarios.

The following notation is used throughout:

s = species type

s = 1 for groundfish
s = 2 for pelagics
s = 3 for M&C

r = Region

r = 1 for Newfoundland Region
r = 2 for Scotia-Fundy Region
r = 3 for Gulf Region
r = 4 for Quebec Region

v = vessel type

$VES_{r,v}$ = number of active vessels in the v^{th} vessel class and the r^{th} region (X, 1)[4]

$$VES_{r,v}(t) = VES_{r,v}(t-1)$$

Average crew size ($AVGEMP_{r,v}$) is defined to include the skipper.

$$AVGEMP_{r,v}(t) = AVGEMP_{r,v}(t-1)$$

$AVGEMP_{r,v}$ = average crew size in the v^{th} vessel class and the r^{th} region (X, 1)

[4] The first character in brackets indicates variable type (I = identity, E = endogenous, X = exogenous, P = policy), the second indicates the number of the block in which the variable is created)

Weeks fished ($WKF_{r,v}$) may be used to calculate an average fisherman's UI eligibility.

$$WKF_{r,v}(t) = WKF_{r,v}(t-1)$$

$WKF_{r,v}$ = number of weeks fished by the v^{th} vessel class in the r^{th} region (X, 1)

Days fished ($DYF_{r,v}$) assumes that fishing effort remains constant and that CPUE changes with abundance for all inshore fleets.

$$DYF_{r,v}(t) = DYF_{r,v}(t-1)$$

$DYF_{r,v}$ = number of days fished by the v^{th} vessel class in the r^{th} region (X, 1)

CPI = Consumers' Price Index

INT = interest rate (constant at 10 per cent)

REINVEST = reinvestment parameter (originally set to zero)

BLOCK 2 - Quantity allocation block

Atlantic Coast catch data are determined exogenously. Catches beyond 1988 for all three major species groups are obtained using the following formula:

Groundfish: $LANDQ_{ATL}(t) = 0.69*TAC_{ATL}(t=89)$

Pelagics and M&C: $LANDQ_{ATL}(t) = LANDQ_{ATL}(t-1)$

$LANDQ_{ATL}$ = quantity of fish landed in Atlantic Canada (X, 2)
TAC = Total Allowable (groundfish) Catch (P, 2)

Landings are determined using the following formula:

$$LANDQ_{r,v,s}(t) =$$

$$LANDQ_{r,v,s}(t=88)/LANDQ_{ATL,s}(t=88)*LANDQ_{ATL,s}(t)*VES_{r,v}(t=88)/VES_{r,v}(t)$$

LANDQ = quantity of fish landed (X, 2)
$VES_{r,v}$ = number of active vessels in the v^{th} vessel class and the r^{th} region (X, 1)

BLOCK 3 - Prices and landed values block

Atlantic Coast prices (P_{ATL}) are determined by inflating the last historical observation by the CPI:

$$P_{ATL,s}(t) = P_{ATL,s}(t-1)*CPI(t)$$

P_{ATL} = Atlantic-wide price (X, 3)
CPI = Consumers' Price Index (X, 1)

Atlantic Coast landed values ($LANDV_{ATL}$) are determined through an identity:

$$LANDV_{ATL,s}(t) = LANDQ_{ATL,s}(t)*P_{ATL,s}(t)$$

$LANDV_{ATL}$ = value of landed fish in Atlantic Canada (I, 3)
$LANDQ_{ATL}$ = quantity of fish landed in Atlantic Canada (X, 2)

Total revenue includes revenues obtained from the sales of fish and "catch all" category called "other revenues" (eg., rebates).

Fleet specific landed values ($LANDV_{r,v}$) are calculated by:

$$LANDV_{r,v}(t) = \{\Sigma_s[LANDQ_{r,v,s}(t)*P_{ATL}(t)]\}*[P_{r,v,s}(t=88)/P_{ATL}(t=88)]$$

where

$$P_{ATL}(t=88) = \Sigma_s[LANDQ_{r,v,s}*P_{ATL,s}]/ \Sigma_s LANDQ_{r,v,s} \qquad (1988)$$

Note that the sum of landings of all vessel fleets does not equal the total for Atlantic. In other words, $\Sigma_s LANDQ_{r,v,s}$ does not equal $\Sigma_s LANDQ_{ATL}$.

Fleet specific price ($P_{r,v}$) (average for all species) is determined through an identity:

$$P_{r,v}(t) = LANDV_{r,v}(t)/LANDQ_{r,v}(t)$$

Other revenue ($OREV_{r,v}$) is equal to:

$$OREV_{r,v}(t) = LANDV_{r,v}(t)/LANDV_{r,v}(t=88)*OREV_{r,v}(t=88)$$

LANDV = value of landed fish (X, 3)

Total revenue ($TR_{r,v}$) is a sum of landed value and other revenue:

$$TR_{r,v}(t) = LANDV_{r,v}(t) + OREV_{r,v}(t)$$

TR = total revenue (I, 3)

BLOCK 4 - Debt balance

Debt balance ($DB_{r,v}$) is determined using the following statement:

$$\text{If } [DB_{r,v}(t-1)+CA_{r,v}(t-1)-PAY_{r,v}(t-1)]>DB_{85} \text{ then}$$

$$DB_{r,v}(t) = [DB_{r,v}(t-1)+CA_{r,v}(t-1)-PAY_{r,v}(t-1)]$$

otherwise:

$$DB_{r,v}(t) = DB_{r,v}(t-1)$$

There are two components of debt balance: an assumed base debt load and capital additions. The base debt load is the vessel debt load in 1985 (DB_{85}). It is assumed that debt in real terms never falls below this level. This assumes that for the fleet as a whole, the combined effect of normal debt paydown and vessel replacement by individual vessel owners causes total debt to be maintained at some base level.

Total debt (base debt and capital additions) is retired at a rate equal to the annual interest payments. A midpoint of an amortization period is assumed where payment of interest and principal are approximately equal.

BLOCK 5 - Investment

Investment block consists of investment in vessels (the vessel value is assumed to be maintained each year), gear, equipment, vessel construction subsidies and capital additions.

Capital Additions ($CA_{r,v}$) are:

If $NI_{r,v}(t-1)>0$ then $CA_{r,v}(t)=NI_{r,v}(t-1)*REINVEST+CPI(t)*CA_{r,v}(t-1)$

If $NI_{r,v}(t-1) < 0$ then $CA_{r,v}(t) = CPI(t)*CA_{r,v}(t-1)$

$NI_{r,v}$ = Net income of the average vessel in the r^{th} vessel class in the r^{th} region (I, 8)

REINVEST = reinvestment rate (X, 1)

Capital additions are supposed to capture the common property phenomenon of increasing investment as net incomes rise. Capital additions are a function of previously specified reinvestment rate and are assumed to be totally financed by debt.

Vessel Investment ($VINV_{r,v}$) is defined as:

$$VINV_{r,v}(t) = VINV_{r,v}(t-1)+CA_{r,v}(t-1)$$

CA = Capital additions (X, 5)

Gear Investment ($GINV_{r,v}$) is defined as:

$$GINV_{r,v}(t) = GINV_{r,v}(t-1)$$

Equipment Investment ($EINV_{r,v}$) is defined as:

$$EINV_{r,v}(t) = EINV_{r,v}(t-1)$$

Subsidies ($SUB_{r,v}$) are defined as:

$$SUB_{r,v}(t) = SUB_{r,v}(t-1)$$

Total Investment ($TINV_{r,v}$) is a sum of all investment components:

$$TINV_{r,v} = VINV_{r,v}+GINV_{r,v}+EINV_{r,v}+SUB_{r,v}+CA_{r,v}$$

TINV = Total investment (I, 5)

BLOCK 6 - Employment

Employment ($EMP_{r,v}$) is determined by multiplying the number of active vessels by the average crew size:

$$EMP_{r,v}(t) = VES_{r,v}(t)*AVGEMP_{r,v}(t)$$

$VES_{r,v}$ = number of active vessels in the v^{th} vessel class and the r^{th} region (X, 1)

$AVGEMP_{r,v}$ = average crew size in the v^{th} vessel class and the r^{th} region (X, 1)

BLOCK 7 - Costs

Labour costs:

Skipper share ($SS_{r,v}$) is fixed at a 1985 level:

$$SS_{r,v}(t) = 0.41*LANDV_{r,v}(t)$$

Crew share ($CS_{r,v}$) is defined as the last period's crew share divided by last year's total landed value and multiplied by this year's total landed value:

$$CS_{r,v}(t) = CS_{r,v}(t-1)/LANDV_{r,v}(t-1)*LANDV_{r,v}(t)$$

Variable costs:

Variable costs include crew share, skipper share, operating costs (food, fuel) and repairs and maintenance. Variable costs change with fishing effort and catch levels.

Operating costs ($OCOST_{r,v}$) are defined to be:

$$OCOST_{r,v}(t) = OCOST_{r,v}(t-1)*CPI(t)/CPI(t-1)*DYF_{r,v}(t)/DYF_{r,v}(t-1)$$

$DYF_{r,v}$=days fished of the v^{th} vessel class and the r^{th} region (X,1)

These vary with number of days fished but are independent of landings.

Repairs ($RCOST_{r,v}$) are defined as:

$$RCOST_{r,v}(t) = RCOST_{r,v}(t-1)*CPI(t)/CPI(t-1)*DYF_{r,v}(t)/DYF_{r,v}(t-1)$$

$DYF_{r,v}$=days fished of the v^{th} vessel class and the r^{th} region (X,1)

Fixed costs:

Fixed costs ($FCOST_{r,v}$) are defined to be:

$$FCOST_{r,v}(t) = FCOST_{r,v}(t-1)*CPI(t)/CPI(t-1)$$

Debt servicing costs:

Interest payments ($PAY_{r,v}$) are defined by:

If $DB_{r,v}(t-1)>0$ then
$PAY_{r,v}(t)=PAY_{r,v}(t-1)*DB_{r,v}(t)/DB_{r,v}(t1)*INT_{r,v}(t)/INT_{r,v}(t-1)$

If $DB_{r,v}(t-1) <0$ then $PAY_{r,v}(t) = PAY_{r,v}(t-1)*INT_{r,v}(t)/INT_{r,v}(t-1)$

Capital costs:

Depreciation ($DEP_{r,v}$) is defined to be:

$$DEP_{r,v}(t) = DEP_{r,v}(t-1)*TINV_{r,v}(t)/TINV_{r,v}(t-1)*DEPRATE(t)/DEPRATE(t-1)$$

Total cost ($TC_{r,v}$) is equal to:

$$TC_{r,v} = CS_{r,v}+OCOST_{r,v}+RCOST_{r,v}+PAY_{r,v}+FCOST_{r,v}+DEP_{r,v}$$

BLOCK 8 - Net income

Net income ($NI_{r,v}$) is defined as total revenue minus total cost minus skipper share:

$$NI_{r,v}(t) = TR_{r,v}(t) - TC_{r,v}(t) - SS_{r,v}(t)$$

Return on investment ($ROI_{r,v}$) is calculated using the formula:

$$ROI_{r,v}(t) = [NI_{r,v}(t)+PAY_{r,v}(t)]/TINV_{r,v}$$

APPLICATIONS

Overcapacity:

The fishing industry on the east coast witnessed significant changes in financial performance during the 1980s. In the early 1980s, a heavy reliance on debt financing and general over-confidence following extension of jurisdiction induced major restructuring of the industry. The years 1986-87 were remarkably profitable due to high groundfish prices - the staple species on the east coast. In the late 1980s, high interest rates, unfavourable exchange rates and resource shortages coupled with average commodity prices proved, once again, the general vulnerability of resource industries, particularly fishing.

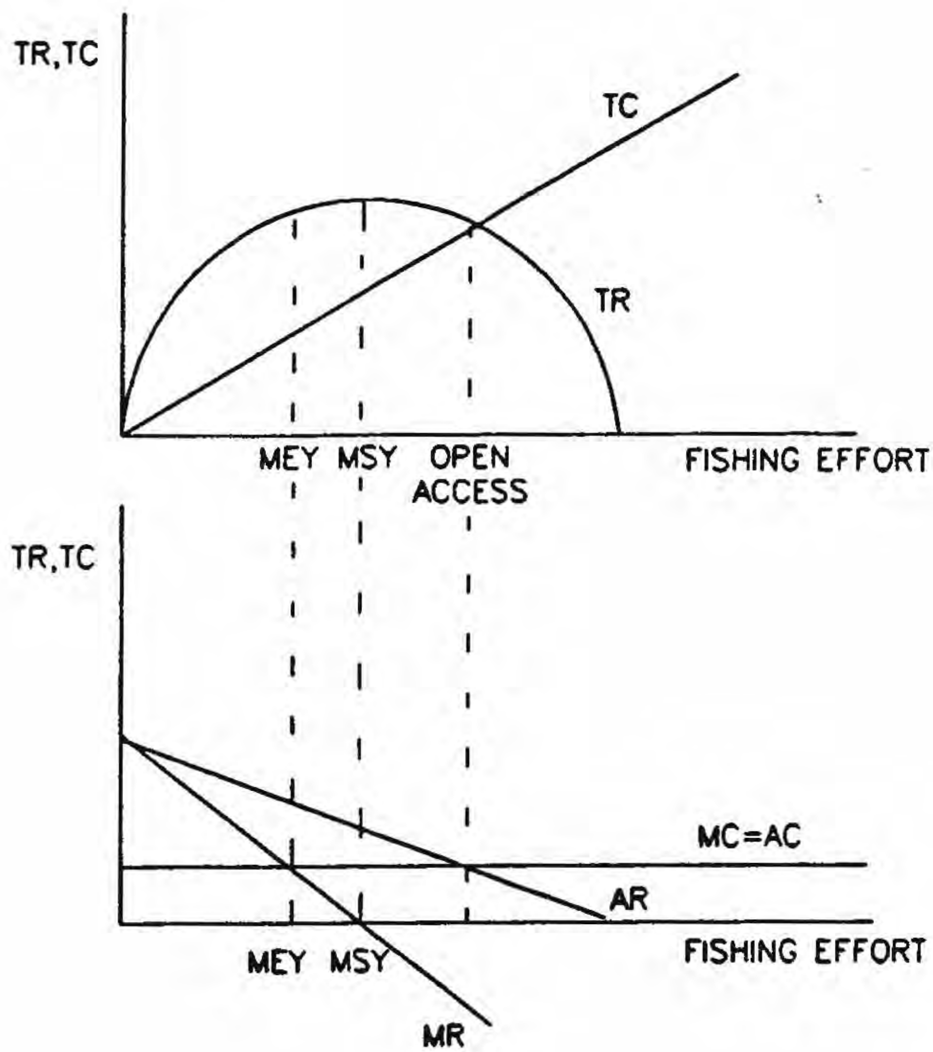
This section uses the Atlantic simulation model to estimate one of the underlying causes of the variable economic performance of the fishing industry in eastern Canada - overcapacity -by demonstrating the link between profitability of an average vessel and the number of vessels prosecuting the fishery.

Capacity utilization can be defined in many different ways, including the ratio of actual to potential output; the engineering relationship linking a given capital stock with the potential output; the point where the short run average cost curve reaches its minimum, or where it is tangent to the long run average cost curve. In this paper, however, capacity is defined to be the number of vessels relative to some chosen level of profits and rates of return.

Figure 2 illustrates the basic bio-economic model of fishing (called the Gordon - Schaefer model). The major premise of the model is that a given fish stock cannot be exploited too heavily without causing the ultimate decline in the fish population level. The total revenue (TR) curve in Figure 2 is obtained from the biological yield curve (with a fish population level on a horizontal axis and fish stock growth on a vertical axis). Because prices are determined in the world market and are assumed to be constant, multiplication of the sustainable yield by this price results in a total revenue curve. It should be noted that the sustainable yield curve is a long-run relationship. It is also assumed that fishing effort, in the long run, is changed by homogenous boats entering or leaving the fishery rather than by existing boats expanding their efforts. This assumption is necessary for the linearity of the total cost (TC) curve.

The concept of maximum sustainable yield (MSY) is the simplest biological management objective that aims at the maximum harvest (in perpetuity) without altering the stock level. It is clear that the MSY concept completely ignores economic costs of exploitation of the resource. Once they are included, the most desirable point of exploitation can be found between an open-access and the maximum economic yield (MEY) points depending on society's time preference.[5]

FIGURE 2



[5] This aspect of the model will not be elaborated here. However, it is reasonable to assume that society will always prefer to receive some quantity of income now to receiving the same quantity later.

In an open-access fishery, an equilibrium is established at an effort level where total revenue equals total cost. This equilibrium point is stable because at higher levels of effort, losses (negative profits) encourage contraction (exit of some boats from the fishery), at lower levels of effort the existence of positive profits encourages expansion of effort and entry of additional boats.

Figure 2 also illustrates the concept of maximum economic yield. On the one hand, the marginal revenue (MR) curve shows what happens to TR when effort changes by a small amount. On the other hand, marginal cost (MC) shows what happens to total cost when effort changes by a small amount. If MR exceeds MC, an increase in effort is clearly worthwhile, as is a decrease when MC is greater than MR. This point, where the MR and MC curves intersect, is called maximum economic yield (MEY) because it is the point where economic rent is maximized.

It needs to be explained why fishermen would fish at effort levels beyond MEY. The new entrants are not worried about their effect on other fishermen. They are concerned with their own revenues. In other words, they face the average revenue (AR) curve and not the MR curve. As long as AR is greater than MC new fishermen will be attracted to the fishery until the open-access equilibrium is reached.

The model clearly demonstrates that economic overcapacity exists when fishing effort (number of boats) exceeds the MEY point. Using Figure 2, it can be shown that a significant reduction of fishing effort (number of boats) can be accomplished without any significant change in total revenues. In other words, a move from the point of fishing effort associated with the open access to the MEY point results in the approximately same level of production with less inputs (boats) involved. From the economic point of view, the situation where the same output can be achieved with less resources, implies redundant capital and labour inputs. They are redundant because they are not necessary to harvest additional amounts of fish. More importantly, these resources could be employed productively elsewhere.

To further illustrate the concept of overcapacity in harvesting a simple example might be used. A virgin fish stock is discovered and fishermen are given the opportunity to prosecute it under open-access conditions. As a result, at least in the long-run, fishermen (vessels) enter the fishery each trying to maximize his share of the catch until total costs are equated with total revenues obtained from the fishery. This solution is doubly non-optimal. Firstly, the stock is fished beyond the MSY point threatening its biological survival. Secondly, the number of fishermen (vessels) is not optimal from an economic perspective as unconstrained entry results in equalization of average, not marginal costs and revenues. If a regulatory body at this point attempted to curb non-productive fishing effort by introducing, for example, limited entry licensing, the most likely response of these licence holders would be to expand fishing power of their vessels to increase their individual catches. This process is known as capital stuffing.

In fact, the history of fishery management in Canada follows closely the above-described example. The evolution could be characterized by the early preoccupation with conservation as a major guiding principle to fishery management and more recent attempts concentrating on improving economic performance. Following the period of open-access, Canadian fishery managers sought solutions in limited entry programs coupled with a global quota system to curb unproductive fishing effort. As time passed, it was clear that limited entry licensing did not prevent industrious fishermen from exerting more pressure on fish stocks. As a result, the Canadian fish stocks, which are capable of producing considerable economic rents to all Canadians including fishermen, yield low economic returns in aggregate. The costs of enforcing complex regulations and employment of redundant capital and labour inputs are directly related to this dissipation of rent.

Estimates:

First, the simulation model was used to estimate fishermen's incomes (both skippers and crewmen) and profitability of fishing enterprises in the Newfoundland Region. Then, the model was constrained with respect to fishermen's incomes and net income accruing to the average enterprise. Specifically, crew members and skippers were assumed to earn $18,000 annually (about the average industrial wage in Newfoundland) and net income was set to guarantee a 10 per cent rate of return on investment. In addition, for this base case simulation, Atlantic landings were assumed to stay constant at the 1990 levels.

Given a fixed fish supply allocated to each enterprise in the model, the only variable capable of adjusting was the number of active vessels. Thus, the pre-determined income level could only be achieved by a reduction in the number of vessels. It should be noted that income levels were chosen arbitrarily and the model of course is capable of accepting different scenarios. Simulations were performed for the inshore, nearshore, purse seine and crab fleets in the Newfoundland Region. Table 1 below presents a summary of results (Appendix 1 provides a copy of the standard output with <u>no reductions</u> in the number of vessels and assumption of constant average landings beyond 1990).

TABLE 1

FLEET REDUCTION ESTIMATES

ASSUMING $18,000 INCOMES AND A 10 PER CENT ROI

INSHORE	-66%
NEARSHORE	-47%
PURSE SEINE	-33%
CRAB	+54%

As Table 1 illustrates, between 33 and 66 per cent of the inshore, nearshore and purse seine vessels would have to be removed from the fishery to guarantee the remaining participants $18,000 annual incomes and a 10 per cent return on investment (ROI). The crab fleet, on the other hand, could be increased by 54 per cent. It can be seen that potential changes in the number of boats in the fishery of the Newfoundland Region would have to be significant.

Resource Simulations:

The above set of simulations was expanded to include different scenarios about the resource growth. (Previous analysis assumed no increases in landings over time.) This time, groundfish, pelagic and shellfish landings were assumed to change by five, one and negative five per cent. Since the model operates primarily on landed values these assumptions about landings are equivalent to prices increasing (decreasing) at the same rates.

Changes in the resource growth may indicate a relationship between the "optimal" (defined here as meeting a minimum $18,000 incomes for skippers and crewmen) number of boats and resource availability. In other words, it is possible to estimate an increase in the number of vessels due exclusively to the growth in average landings. This relationship is presented in Table 2 and is called elasticity. Elasticity is the measure of responsiveness in one variable due to a change in the other. In this case, it measures a percentage change in the number of "viable" boats due to a 10 per cent change in Atlantic (not Newfoundland) landings.

Other assumptions included: reinvestment rate is set at 10 per cent, fish prices increase at the rate of inflation (CPI), crew share is $18,000 in 1990 and subsequently stays at this level in real terms, skipper share and return on investment are respectively $18,000 and 10 per cent.

Estimates:

Table 2 illustrates adjustments necessary for a viable fishing industry in the Newfoundland Region in 1990. The table includes the base case scenario (zero resource growth) from the previous section. In this section simulations were not done for crab vessels as they satisfied the viability criteria.

If the fish stocks (landings) grew by 5 per cent in 1990, the inshore sector would have to be reduced by 64.5 per cent. If, for example, the stocks decreased by 5 per cent, the reduction of 68 per cent would be necessary. The elasticity column shows the response of the number of viable vessels to a 10 per cent growth in landings. Specifically, if landings increased by 20 per cent, the viable nearshore sector could be increased by 10 per cent (two times the elasticity of five per cent) relative to the "zero-growth" scenario.

Table 2

Fleet Reduction Estimates Assuming Resource Growth

Required Adjustments to Viability in 1990

Newfoundland Region

Year	1 9 9 0				
Annual Growth in Atlantic Landings	0	+1	+5	-5	+10% Elasticity
Inshore	0.663	0.660	0.645	0.680	3%
Nearshore	0.468	0.463	0.442	0.495	5%
Purse Seine	0.333	0.323	0.297	0.364	7%

Conclusions:

The Atlantic Simulation Model was used to obtain adjustment estimates given two criteria: a guaranteed annual income of $18,000 for each participant and a 10 per cent return on investment to each enterprise assuming different rates of growth in landings. The results suggest that the required number of boats participating in the fishery of the Newfoundland Region would need to be significantly reduced if these criteria were to be satisfied.

The magnitude of these adjustments should be interpreted with caution. The model is based on the financial performance of average vessels which represents a major shortcoming of this methodology. Therefore, the policy implications cannot be stated unambiguously. The estimates clearly indicate too many vessels for the available fish resource, but it would be virtually impossible to reduce the fleet capacity by, say, 50 per cent by removing 50 per cent of vessels. This is due to the fact that vessels are not uniform in their capacities to fish successfully.

In other words, reducing the number of those fishermen who do not catch substantial amounts of fish would not eliminate the pressure on the resource as the capacity of those remaining would not be significantly lowered. On the other hand, reducing the number of highly efficient fishermen (highliners) would need to be accompanied by a proper "distribution" of their catches to guarantee increases in average incomes of those remaining in the fishery. The reduction of highliners would not improve the average financial performance of the harvesting sector as a whole if their catch accrued to another group of highliners.

Finally, reductions in fishing effort (number of boats) will not instantaneously lead to an improved financial position. In fact, lower fishing effort may result in lower catches and lower revenues until a fish stock recovers. In other words, current revenue losses need to be compared with future gains. To accomplish this, a dynamic model is necessary. However, the static Gordon-Schaefer is still useful to illustrate the magnitude of required adjustments.

APPENDIX 1

ATLANTIC FLEET MODEL   Date: 23-Aug-90   02:47 PM

GENERAL DATA	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
FLEET REDUCTION RATE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
CPI	127.2	132.4	138.2	143.8	151.0	158.1	166.2	171.1	176.3	181.6	187.0
TAX RATE	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
INTEREST RATE	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
DEPRECIATION RATE	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
TOTAL LANDINGS TONNES											
GROUNDFISH	768,083	785,960	766,325	733,841	664,847	567,867	567,867	567,867	567,867	567,867	567,867
PELAGIC	271,370	293,800	319,941	390,907	336,446	336,446	336,446	336,446	336,446	336,446	336,446
M & C	148,484	165,520	179,164	199,549	221,841	221,841	221,841	221,841	221,841	221,841	221,841
CALCULATED LANDED PRICE		Wholesale to Landed Ratio			2.30						
GROUNDFISH	$0.39	$0.47	$0.67	$0.51	$0.53	$0.56	$0.59	$0.60	$0.62	$0.64	$0.66
PELAGIC	$0.20	$0.28	$0.25	$0.25	$0.26	$0.28	$0.29	$0.30	$0.31	$0.32	$0.33
M & C	$2.27	$2.59	$2.92	$2.70	$2.83	$2.97	$3.12	$3.21	$3.31	$3.41	$3.51
LANDED VALUE											
GROUNDFISH	$297,042	$368,160	$514,232	$372,477	$353,891	$316,890	$333,052	$343,043	$353,335	$363,935	$374,853
PELAGIC	$54,483	$81,200	$80,226	$98,613	$75,899	$93,313	$98,072	$101,014	$104,044	$107,166	$110,381
M & C	$336,632	$429,110	$523,001	$538,326	$447,360	$657,964	$691,521	$712,266	$733,634	$755,643	$778,312

NEWFOUNDLAND FLEET INSHORE	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Groundfish Kg	16832	17886	20536	24826	22,492	19,211	19,211	19,211	19,211	19,211	19,211
Pelagics Kg	3398	4452	3882	11848	10,197	10,197	10,197	10,197	10,197	10,197	10,197
M & C Kg	513	432	452	481	535	535	535	535	535	535	535
# OF ACTIVE VESSELS	3,747	3,747	3,873	4,015	4,015	4,015	4,015	4,015	4,015	4,015	4,015
Crew Size	1.9	1.7	1.6	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Weeks Fished	0.0	0.0	21.9	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Days Fished	70.0	73.3	71.8	78.9	78.9	78.9	78.9	78.9	78.9	78.9	78.9
INVESTMENT	REINVESTMENT RATE:		0.00								
Vessels	$9,142	$9,483	$11,345	$13,345	$14,130	$14,954	$15,817	$16,724	$17,659	$18,621	$19,612
Gear	$10,475	$10,390	$13,341	$16,035	$16,035	$16,035	$16,035	$16,035	$16,035	$16,035	$16,035
Facilities & Equipment	$1,790	$1,924	$2,116	$2,403	$2,403	$2,403	$2,403	$2,403	$2,403	$2,403	$2,403
Subsidies	$763	$779	$788	$754	$754	$754	$754	$754	$754	$754	$754
Capital Additions	$0	$501	$1,189	$785	$824	$863	$907	$934	$962	$991	$1,021
Total Investment	$22,170	$23,077	$28,779	$33,322	$34,146	$35,009	$35,916	$36,851	$37,813	$38,804	$39,825
DEBT BALANCE (year end)	$2,037	$1,948	$2,685	$2,809	$3,387	$3,962	$4,533	$5,106	$5,664	$6,209	$6,742
REVENUE	Calculated Landed Price 1988			$0.45							
Landings kg	20743	22770	24870	37155	33224	29943	29943	29943	29943	29943	29943
Avg. Price kg.	$0.47	$0.52	$0.78	$0.47	$0.50	$0.52	$0.55	$0.57	$0.58	$0.60	$0.62
Total Landed Value $	$9,796	$11,727	$19,366	$17,471	$16,764	$15,658	$16,456	$16,950	$17,458	$17,982	$18,522
Other Revenue $	$43	$131	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue $	$9,839	$11,858	$19,366	$17,471	$16,764	$15,658	$16,456	$16,950	$17,458	$17,982	$18,522
COSTS											
Crew Share	$3,077	$3,604	$4,024	$3,716	$3,566	$3,330	$3,500	$3,605	$3,713	$3,825	$3,939
Operating Costs	$1,401	$1,485	$1,658	$1,719	$1,805	$1,890	$1,986	$2,046	$2,107	$2,170	$2,236
Repair & Maint	$743	$1,740	$2,660	$2,727	$2,864	$2,998	$3,151	$3,246	$3,343	$3,443	$3,547
Interest	$152	$171	$204	$207	$250	$292	$334	$376	$417	$458	$497
Other fixed Costs	$344	$315	$310	$357	$375	$392	$413	$425	$438	$451	$464
Depreciation	$874	$790	$1,122	$1,247	$1,278	$1,310	$1,344	$1,379	$1,415	$1,452	$1,490
TOTAL COSTS	$6,591	$8,105	$9,978	$9,973	$10,137	$10,213	$10,728	$11,077	$11,434	$11,799	$12,173
SKIPPER SHARE	$3,248	$5,003	$9,388	$7,498	$6,873	$6,420	$6,747	$6,949	$7,158	$7,373	$7,594
NET BEFORE TAX	$0	($1,250)	$0	$0	($246)	($975)	($1,019)	($1,076)	($1,133)	($1,189)	($1,245)
EMPLOYMENT	7,119	6,370	6,197	8,030	8,030	8,030	8,030	8,030	8,030	8,030	8,030
RETURN ON INVESTMENT	1%	-5%	1%	1%	0%	-2%	-2%	-2%	-2%	-2%	-2%

NEWFOUNDLAND FLEET NEARSHORE	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Groundfish Kg	84454	72781	100030	59895	54,083	48,194	48,194	48,194	48,194	48,194	48,194
Pelagics Kg	12869	21098	13357	33900	29,177	29,177	29,177	29,177	29,177	29,177	29,177
M & C Kg	2506	3612	2190	4686	5,210	5,210	5,210	5,210	5,210	5,210	5,210
# OF ACTIVE VESSELS	503	503	413	432	432	432	432	432	432	432	432
Crew Size	3.4	3.5	3.6	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Weeks Fished	0.0	21.6	22.4	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
Days Fished	60.5	69.6	75.9	75.9	75.9	75.9	75.9	75.9	75.9	75.9	75.9
INVESTMENT	REINVESTMENT RATE:		0.00								
Vessels	$59,347	$68,461	$66,632	$67,113	$69,775	$72,570	$75,497	$78,573	$81,741	$85,004	$88,365
Gear	$25,653	$31,053	$30,683	$36,702	$36,702	$36,702	$36,702	$36,702	$36,702	$36,702	$36,702
Facilities & Equipment	$3,393	$3,218	$3,063	$3,732	$3,732	$3,732	$3,732	$3,732	$3,732	$3,732	$3,732
Subsidies (less)	$13,725	$14,626	$14,943	$8,798	$8,798	$8,798	$8,798	$8,798	$8,798	$8,798	$8,798
Capital Additions	$0	$1,258	$1,622	$2,662	$2,795	$2,927	$3,076	$3,168	$3,263	$3,361	$3,462
Total Net Investment	$102,119	$118,615	$116,945	$119,007	$121,802	$124,729	$127,805	$130,973	$134,236	$137,597	$141,059
DEBT BALANCE (year end)	$23,708	$23,826	$20,919	$21,350	$21,350	$21,350	$21,350	$21,350	$21,350	$21,350	$21,350
REVENUE	Calculated Landed Price 1988			$0.52							
Landings kg	79600	97490	115577	98282	88,470	80,581	80,581	80,581	80,581	80,581	80,581
Avg. Price kg.	$0.36	$0.46	$0.67	$0.56	$0.61	$0.65	$0.68	$0.70	$0.72	$0.75	$0.77
Total Landed Value $	$28,659	$44,453	$76,938	$54,587	$54,395	$52,285	$54,951	$56,600	$58,298	$60,047	$61,848
Other Revenue $	$77	$112	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue $	$28,735	$44,565	$76,938	$54,587	$54,395	$52,285	$54,951	$56,600	$58,298	$60,047	$61,848
COSTS											
Crew Share	$12,909	$19,631	$29,523	$19,715	$19,646	$18,884	$19,847	$20,442	$21,056	$21,687	$22,338
Operating Costs	$5,078	$5,421	$5,196	$5,699	$5,985	$6,266	$6,586	$6,783	$6,987	$7,196	$7,412
Repair & Maint	$3,969	$5,930	$7,535	$8,687	$9,122	$9,550	$10,038	$10,339	$10,649	$10,968	$11,297
Interest	$1,519	$1,824	$1,389	$1,298	$1,298	$1,298	$1,298	$1,298	$1,298	$1,298	$1,298
Other fixed Costs	$1,385	$1,858	$1,605	$1,822	$1,913	$2,003	$2,105	$2,168	$2,233	$2,300	$2,369
Depreciation	$3,199	$3,779	$4,722	$4,841	$4,955	$5,074	$5,199	$5,328	$5,461	$5,597	$5,738
TOTAL COSTS	$28,059	$38,444	$49,970	$42,062	$42,918	$43,075	$45,072	$46,358	$47,682	$49,047	$50,452
SKIPPER SHARE	$677	$9,536	$26,968	$12,525	$11,477	$9,210	$9,879	$10,242	$10,615	$11,000	$11,396
NET BEFORE TAX	$0	($3,415)	$0	$0	$0	$0	$0	$0	$0	$0	$0
EMPLOYMENT	2,799	1,781	1,492	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
RETURN ON INVESTMENT	1%	-1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

NEWFOUNDLAND FLEET CRABBER	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Groundfish Kg	12230	46596	47025	38105	34,522	29,487	29,487	29,487	29,487	29,487	29,487
Pelagics Kg	12485	60580	39582	51272	44,129	44,129	44,129	44,129	44,129	44,129	44,129
M & C Kg	104962	141930	121613	115747	128,677	128,677	128,677	128,677	128,677	128,677	128,677
# OF ACTIVE VESSELS	51	51	59	65	65	65	65	65	65	65	65
Crew Size	5.3	5.2	5.3	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Weeks Fished	0.0	26.0	24.1	23.9	23.9	23.9	23.9	23.9	23.9	23.9	23.9
Days Fished	60.9	71.8	54.3	71.5	71.5	71.5	71.5	71.5	71.5	71.5	71.5
INVESTMENT	REINVESTMENT RATE:		0.00								
Vessels	$165,391	$297,924	$300,875	$312,195	$317,354	$322,771	$328,443	$334,405	$340,545	$346,869	$353,383
Gear	$46,821	$67,358	$73,730	$75,450	$75,450	$75,450	$75,450	$75,450	$75,450	$75,450	$75,450
Facilities & Equipment	$10,879	$10,276	$6,758	$15,555	$15,555	$15,555	$15,555	$15,555	$15,555	$15,555	$15,555
Subsidies	$45,476	$105,184	$60,200	$61,203	$61,203	$61,203	$61,203	$61,203	$61,203	$61,203	$61,203
Capital Additions	$0	$3,382	$6,626	$5,159	$5,417	$5,672	$5,961	$6,140	$6,324	$6,514	$6,709
Total Investment	$268,569	$484,125	$448,189	$469,562	$474,980	$480,652	$486,613	$492,753	$499,077	$505,591	$512,301
DEBT BALANCE (year end)	$61,089	$112,858	$63,537	$100,100	$98,963	$98,155	$97,652	$97,471	$97,480	$97,672	$98,042
REVENUE	Calculated Landed Price 1988			$1.68							
Landings kg	234328	249107	208220	205124	207,329	202,293	202,293	202,293	202,293	202,293	202,293
Avg. Price kg.	$0.41	$0.76	$1.18	$1.44	$1.63	$1.74	$1.83	$1.88	$1.94	$2.00	$2.06
Total Landed Value $	$95,030	$189,982	$244,994	$295,381	$338,315	$351,806	$369,749	$380,841	$392,266	$404,034	$416,155
Other Revenue $	$1,071	$12	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue $	$96,101	$189,994	$244,994	$295,381	$338,315	$351,806	$369,749	$380,841	$392,266	$404,034	$416,155
COSTS											
Crew Share	$39,090	$74,368	$90,549	$113,118	$129,559	$134,726	$141,597	$145,845	$150,220	$154,727	$159,369
Operating Costs	$25,713	$28,926	$22,837	$23,488	$24,664	$25,823	$27,140	$27,954	$28,793	$29,657	$30,547
Repair & Maint	$5,122	$17,920	$23,769	$15,264	$16,028	$16,781	$17,637	$18,166	$18,711	$19,273	$19,851
Interest	$5,717	$7,314	$8,048	$6,297	$6,225	$6,174	$6,143	$6,131	$6,132	$6,144	$6,167
Other fixed Costs	$5,735	$8,069	$8,157	$14,046	$14,749	$15,442	$16,230	$16,717	$17,218	$17,735	$18,267
Depreciation	$8,417	$13,073	$22,711	$23,069	$23,335	$23,614	$23,907	$24,208	$24,519	$24,839	$25,169
TOTAL COSTS	$89,794	$149,669	$176,072	$195,281	$214,561	$222,561	$232,654	$239,022	$245,594	$252,374	$259,369
SKIPPER SHARE	$6,306	$27,308	$69,192	$100,100	$123,754	$129,245	$137,095	$141,819	$146,672	$151,660	$156,786
NET BEFORE TAX	$0	$13,018	($270)	$0	$0	$0	$0	$0	$0	$0	$0
EMPLOYMENT	224	268	311	356	356	356	356	356	356	356	356
RETURN ON INVESTMENT	0%	4%	2%	1%	1%	1%	1%	1%	1%	1%	1%

NEWFOUNDLAND FLEET PURSE SEINER	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Groundfish Kg	37089	30328	66537	41580	37,670	32,175	32,175	32,175	32,175	32,175	32,175
Pelagics Kg	157195	211998	182631	253545	218,221	218,221	218,221	218,221	218,221	218,221	218,221
M & C Kg	778	2334	1566	7678	8,536	8,536	8,536	8,536	8,536	8,536	8,536
# OF ACTIVE VESSELS	130	130	160	195	195	195	195	195	195	195	195
Crew Size	4.2	4.2	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Weeks Fished	0.0	20.0	21.8	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1
Days Fished	42.4	51.0	65.3	65.5	65.5	65.5	65.5	65.5	65.5	65.5	65.5
INVESTMENT	REINVESTMENT RATE:		0.00								
Vessels	$97,285	$83,786	$108,892	$116,659	$119,921	$123,346	$126,932	$130,701	$134,584	$138,582	$142,701
Gear	$49,946	$47,182	$56,199	$60,237	$60,237	$60,237	$60,237	$60,237	$60,237	$60,237	$60,237
Facilities & Equipment	$4,539	$3,575	$4,164	$4,874	$4,874	$4,874	$4,874	$4,874	$4,874	$4,874	$4,874
Subsidies	$24,092	$18,417	$26,734	$23,946	$23,946	$23,946	$23,946	$23,946	$23,946	$23,946	$23,946
Capital Additions	$0	$1,698	$2,534	$3,262	$3,425	$3,586	$3,769	$3,882	$3,999	$4,118	$4,242
Total Investment	$175,863	$154,658	$198,524	$208,978	$212,404	$215,990	$219,759	$223,641	$227,639	$231,758	$236,000
DEBT BALANCE (year end)	$44,332	$35,848	$33,341	$38,864	$38,864	$38,864	$38,864	$38,864	$38,864	$38,864	$38,864
REVENUE	Calculated Landed Price 1988			$0.35							
Landings kg	155877	244660	250734	302802	264,427	258,932	258,932	258,932	258,932	258,932	258,932
Avg. Price kg.	$0.23	$0.27	$0.34	$0.31	$0.35	$0.36	$0.38	$0.39	$0.40	$0.41	$0.42
Total Landed Value $	$35,867	$66,119	$86,395	$94,709	$91,383	$92,933	$97,672	$100,602	$103,620	$106,729	$109,931
Other Revenue $	$103	$1,634	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue $	$35,971	$67,753	$86,395	$94,709	$91,383	$92,933	$97,672	$100,602	$103,620	$106,729	$109,931
COSTS											
Crew Share	$17,515	$31,998	$29,683	$36,771	$35,480	$36,081	$37,922	$39,059	$40,231	$41,438	$42,681
Operating Costs	$6,744	$5,669	$7,279	$7,603	$7,984	$8,359	$8,786	$9,049	$9,321	$9,600	$9,888
Repair & Maint	$3,964	$5,814	$10,524	$12,301	$12,917	$13,524	$14,214	$14,640	$15,079	$15,532	$15,998
Interest	$2,657	$2,166	$1,795	$1,936	$1,936	$1,936	$1,936	$1,936	$1,936	$1,936	$1,936
Other fixed Costs	$2,249	$2,242	$2,272	$3,743	$3,931	$4,115	$4,325	$4,455	$4,589	$4,726	$4,868
Depreciation	$5,160	$4,579	$6,480	$8,288	$8,424	$8,566	$8,716	$8,870	$9,029	$9,192	$9,360
TOTAL COSTS	$38,290	$52,467	$58,033	$70,643	$70,672	$72,583	$75,898	$78,010	$80,184	$82,424	$84,731
SKIPPER SHARE	($2,319)	$10,821	$28,361	$24,039	$20,711	$20,350	$21,774	$22,593	$23,436	$24,305	$25,200
NET BEFORE TAX	$0	$4,465	$0	$26	$0	$0	$0	$0	$0	$0	$0
EMPLOYMENT	551	551	720	891	891	891	891	891	891	891	891
RETURN ON INVESTMENT	-3%	4%	1%	1%	1%	1%	1%	1%	1%	1%	1%

APPENDIX 2

FILES AND MODEL OPERATION

The model utilizes the Lotus 1-2-3 spreadsheet software and can be run on any microcomputer with sufficient memory. The new models and data are contained in the following files:

FLNEW.WK1	-	contains the new fleet model for the Newfoundland, Scotia-Fundy and Gulf regions.
QUEBEC.WK1	-	contains the new fleet model for the Quebec region.
PLANT.WK1	-	contains the updated plant model.
DATA8?.WK1	-	contains the cost and earnings data for all fleet types. There are currently 6 files. The ? stands for the numbers 3 through 8 (ie. 1983 - 1988).
D8?.WK1	-	contains the data from the corresponding DATA8?.WK1 file as values rather than as formulas. This intermediate file is necessary to transfer the data into the model files correctly.
BASECASE.WK1	-	contains the basecase values of the FLNEW.WK1 model. These numbers are picked up by the graphing macro in the model.
BASEQUE.WK1	-	contains the basecase values of the QUEBEC.WK1 model.
PLANTBAS.WK1	-	contains the basecase values of the PLANT.WK1 model.

Note: The keyboard macros described in the original report operate in a somewhat different manner but accomplish the same tasks as described in the earlier report.

Base Macro: this macro (ALT-B) updates the base case if it is necessary to compare two scenarios. It should not be necessary to use this macro often.

Output Macro: this macro (ALT-O) plots the output of the model. Once changes are introduced and the spreadsheet is recalculated (F9), the output macro will plot the base case and simulated data for visual comparison.

Fleet Macro: this macro (ALT-F) moves the fleet profile data from individual data files into the file containing the model.

Each of the DATA8?.WK1 files contains a macro at the range named "\0". These macros generate the value copies of the data(ie.D8?.WK1).

UPDATING THE DATA AND ADDING NEW DATA

In the following section a step by step procedure for adding 1989 costs and earnings data for Newfoundland region is described.

Step 1 - copy the file named DATA88.WK1 to a file named DATA89.WK1.

Step 2 - load DATA89.WK1 and enter the data in the columns corresponding to the fleet types in the costs and earning"s data. The calculated data for the model are found in ranges named NF_INSHORE, NF_NEARSHORE, NF_CRABBER AND NF_SEINE. By inspection of the formulas in each of these columns the corresponding columns for the basic data can be located (ie. NF_CRAB is weighed average of columns N and O).

Step 3 - invoke the macro by pressing Alt-0. An "r" will be left in the panel at the top. It is meant to tell lotus to replace the file when the file already exists. As this is the first time the macro has been used the file does not exist, therefore the macro does not need to replace it. The r is just a leftover and can be erased by pressing Esc. Do not forget to save the file DATA89.WK1. It contains the original data and formulas.

Step 4 - load FLNEW.WK1. and Goto \F and move left two columns. This area contains the macro for loading the data. The first column contains the year 1985 through 88. The next column has the range names for the various fleet types (ie. NF_INSHORE). The next column contains the macro instructions for the loading the data. They are in formula form and are calculated using the range name text in the previous column.

Step 5 - make a 1989 section. Copy the rows and columns containing the Newfoundland fleet ranges and macro formulas for 1988 to the bottom of the 1983 rows. Edit the first of the new macro formulas. The formula contains a (goto) NF_xxxxx (each of the fleet names have a range name located at the top of the 1985 column for that fleet type). The 1988 formulas will have three (right)'s to move the cell pointer to the top of the 1988 column. Add another (right) to move to the 1989 column. You should also change the file name from D88 to D89. Copy this edited cell to the rest of the 1989 Newfoundland macro cells.

Step 6 - goto the top row of the 1990 column in the Newfoundland Inshore part of the spreadsheet ({goto} NF_INSHORE 4 x {right}). Edit each of the rows in this column to change the fixed reference to the 1988 column (ie. $Exx) to a fixed reference to the 1989 column ($Fxx), with one exception. In the Landed value row is a reference to the calculate landed price. It should be left as $E. Once you have edited this column copy it out to the rest of the columns in this fleet type. Then copy this range (1990 - 1995) to the corresponding ranges in the other fleet types.

Step 7 - goto the calculated landed price in the Newfoundland Inshore section. Change the reference to column E (1988) to F (1989). Copy this formula to the corresponding locations in the other fleet types.

Step 8 - invoke the macro Alt-F to read in the new data. Invoke Alt-B to generate a new base case including the new data. Save this new version of the model.