

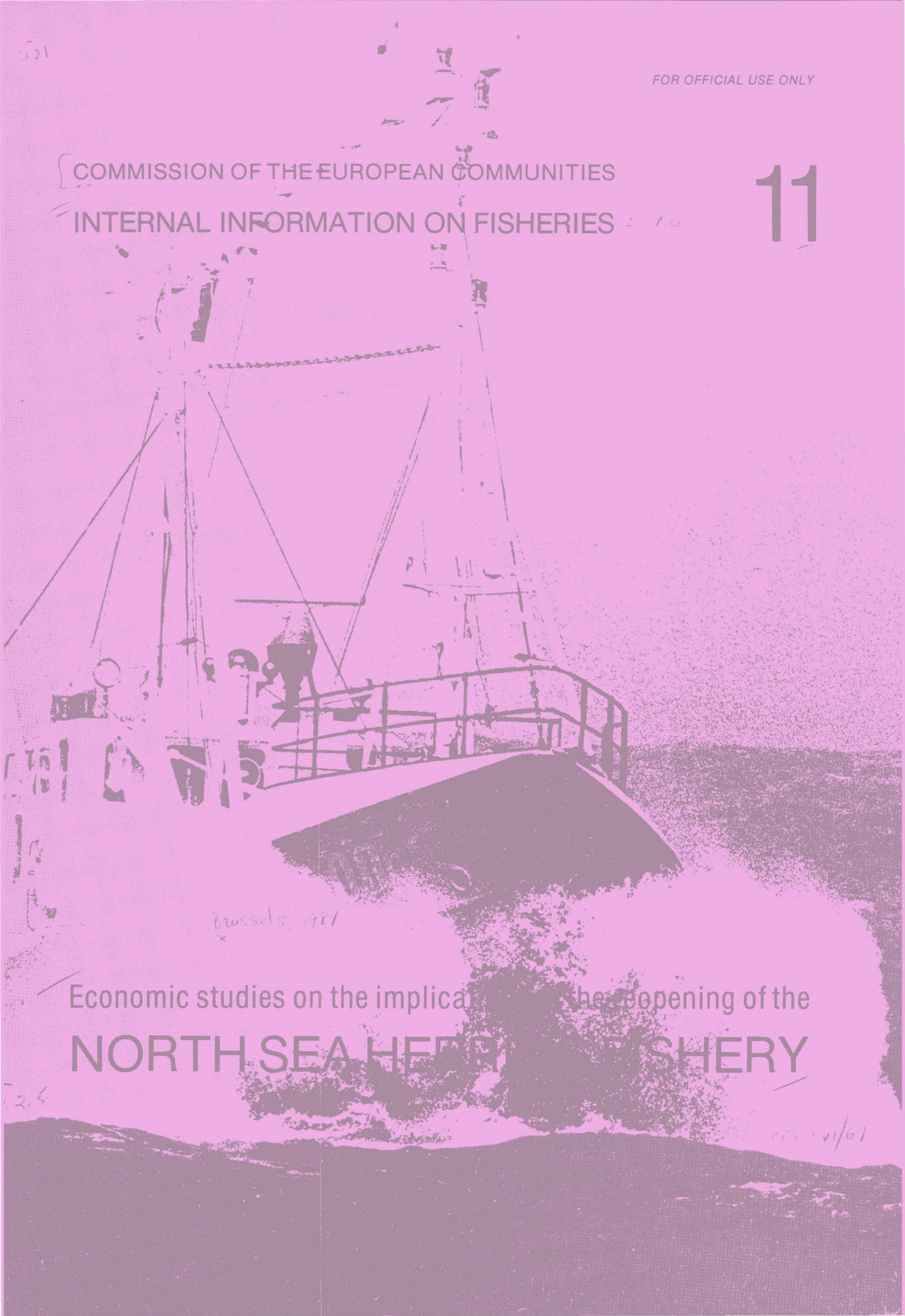
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INTERNAL INFORMATION ON FISHERIES : 10

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Brussels, 1981

Economic studies on the implications of the reopening of the
NORTH SEA HERRING FISHERY

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07/01/61

COMMISSION OF THE EUROPEAN
COMMUNITIES

DIRECTORATE GENERAL FOR FISHERIES

Division : Resources
Internal Resources

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FOREWORD

As part of its programme of studies, the Directorate-General for Fisheries of the European Communities commissioned Dr. J.R. BEDDINGTON of the International Institute for Environment and Development (London) to carry out this study which has been completed in collaboration with Mr. F.E. McALLISTER of the same institute.

The Internal Resources division of the Directorate-General for Fisheries contributed to the study.

*

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This study does not necessarily reflect the opinions of the Commission of the European Communities and in no way anticipates the future attitude of the Commission in this field.

Original: English

Manuscript completed in May 1981.

SUMMARY

This report is concerned with the economic implications of the reopening of the North Sea Herring Fishery.

An analysis of the demand for herring in various countries in the Community and in Norway indicates that the volume of landings largely determines the price obtained. This can be modified at a low volume of landings by the price of imports.

Analysis of the implications of these demand relationships indicates an approximate value of the long-term cost of the by-catch by the sprat fishery of young herring of £2 million per year.

The existence of different demand relationships within the Community affords the possibility for assessing the economic implications of different allocations of the TAC. These possibilities are explored both between the Community and Norway and within the Community.

Approximate calculations on the fleet size and composition needed to take different TAC levels are made. The costs associated with these fleets are investigated and simple calculations of profitability are presented.

Some qualitative assessment of the effect of various TAC levels on secondary industry within the Community is described.

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ECONOMIC STUDIES ON THE IMPLICATIONS OF
THE REOPENING OF THE NORTH SEA HERRING FISHERY.

J.R. Beddington* and F.E. McAllister*

INTRODUCTION

The central aim of this study is to examine the economic consequences of the reopening of the North Sea Herring Fishery. The closure of the Fishery following substantial overfishing has resulted in some increase in the biomass of the spawning stock to a level where a cautious reopening of the Fishery may be considered. In a parallel study to this, we analysed the expected changes in spawning stock biomass under a variety of harvesting regimes (Beddington and Grenfell, 1980).

The main thrust of that analysis was concerned with assessing the effect of random variations in recruitment. In this study with one exception a deterministic view of the biological system is taken with the expected size of the stock over time being estimated from the average of a series of computer simulations. A number of economic problems are generated by the biological potential for an increasing sustainable yield identified by this analysis which may conveniently be classified into the short, medium and long-term. The short-term may be defined as the period up to and including 1984, the medium-term to 1987 and the long-term post 1987. These periods are associated with estimates of expected spawning stock size of up to 1.5 million tons, 3 million tons and in excess of 4 million tons for the unexploited stock. These three periods also represent a potential for the total allowable catch (TAC) to be in the region of 100,000 tons, 250,000 tons and up to the MSY level of around 600,000 tons.

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In an important sense, there is a hierarchy of perceptions of the economic consequences of various harvesting levels. This starts with that of the Community itself, the member countries and their fishing industries and moves down to the level of the individual fishermen. Moving through the problems in this hierarchy, once a decision is made on the level of a TAC, there is an immediate problem of the division of this TAC both between the members of the Community and between the Community and Norway. Thus the primary question that may be posed concerns the economic implications of possible allocations of a given TAC. A priori, it is clear that unless the fishing industries of the countries involved have identical cost and revenue structures, different allocations will have different potential benefits. Once a management decision has been taken on this allocation, a new sequence of problems is defined. These concern the fishing effort required to take the allocation, the expected revenue, the costs of the fishing effort and the expected profits. Finally, the landings of herring will have economic consequences for the processing industries and the economies of the individual countries.

This sequence of problems and indeed of perceptions, determines the structure of the report.

In the first section we consider the demand for herring in the countries of the European Community and in Norway. This analysis is then used as a basis for considering the problem of the economic benefits of various TAC levels and various allocations. In this section we concern ourselves explicitly with the risks of a further closure of the Fishery due to overfishing and attempt to quantify economically the risks and potential benefits of different harvesting strategies.

The subsequent sections deal in order with the problems of fleet size and structure required to catch the allocation, the costs associated with fishing operations of various types, the profitability of fishing operations of various types and finally with the level of secondary industry that would be dependent on a recovered herring Fishery. In many of these later sections, problems of data shortage and confidentiality render quantitative assessment impossible. We have thus been forced into making a variety of assumptions to make assessments. Where this has been necessary, we present ranges of possibilities.

THE DEMAND FOR HERRING AND THE EXPECTED REVENUES FROM THE
HERRING FISHERY

PREAMBLE

In this section we investigate the determinants of the auction price of herring for those countries both in and outside the Community that are likely to be involved in fishing herring in the North Sea. These are Belgium, Denmark, France, West Germany, Netherlands, Norway and the United Kingdom. Necessarily the data base for the analysis comes from the history of the Fishery and hence all the analysis is open to some question. In particular, it has been necessary to assume that there have been no major changes in the factors that influence demand during the closure of the Fishery. Such an assumption is, of course, only testable when the Fishery reopens. As indicated earlier, in this section we are focusing attention on three central and interrelated questions:

- (1) How are various levels of Total Allowable Catch translated into economic benefits to the fishing industries of the Community?
- (2) How are these economic benefits affected by the allocation of a proportion of the TAC to Norway?
- (3) How are these economic benefits affected by changes in the allocation of the TAC within the Community?

The nature of these questions precludes the need for detailed and complex models of the demand for herring. Typically such models include the effects of substitutes, consumer income and imports as well as the effect of the quantity supplied. Imports of herring into the Community have played an important role in the period since the closure of the North Sea Fishery and it is clearly important to assess this effect. They are also reasonably predictable given the known areas of supply and the condition of the fish stocks. By contrast consideration of the supply of substitutes or consumer income produce whole new levels of complexity and uncertainty into the projections. Indeed, if these factors proved to be the dominant ones determining herring price, then even approximate answers to the central questions would be precluded. Fortunately, as will be demonstrated below,

simple models of demand using only the quantity supplied explain a high proportion of the variation in herring price and thus may be used in providing answers to the three questions. This is doubly fortunate as the detail with which the various countries publish their fishery statistics varies considerably and the more complicated demand models would have been possible only for a few countries.

In considering more detailed demand models we have been concerned primarily with producing qualifications and caveats concerning the use of the predictions from the simple models. Later in this section we consider the effects of imports on the price of landed herring and in Appendix IV a full model. These analyses and their implications are then used to qualify the conclusions of the basic analysis to which we now turn.

SIMPLE MODELS OF DEMAND

The statistical treatment of simultaneously adjusting linked equation systems of supply and demand is a complex and esoteric process. Fortunately in the case of the determinants of the landing price of fish a reasonable simplifying assumption may be made. This assumption is that the supply is determined exogenously by such factors as allowable catches, limitations of stock size, the availability of access to fishing grounds and weather. This permits a simple statistical estimation of the demand relationship as successive shifts in the supply curve trace out the demand curve. Thus a simple regression analysis is both the obvious and the best way to estimate the parameters of the demand model. This procedure is similar to that followed by Buchanan and Nicolson (1977).

The data base consisted of the total landings of fresh and frozen herring and their value at first-hand sale. Data sources are listed in Appendix I. Prices were adjusted to allow for inflation using the general retail price index. In a somewhat arbitrary way it was decided to use the data from the final twelve year period of the Fishery. In fact, fitting over considerably extended periods up to twenty-five years produced

essentially similar relationships, implying some constancy in the demand model. In Appendix II details of the various models investigated and their statistical analysis are presented. Table I contains a summary of the results of this procedure: for each country the model that produced the best statistical fit to the data is presented together with the appropriate parameter estimates and their statistical significance. These relationships are illustrated in Figures 1(i)-(vii)(a). In all cases the relationships and individual parameter estimates are highly significant and with the possible exception of the Netherlands the proportion of variation explained is satisfactorily high.

In most cases the models do not have a constant elasticity of demand. However, with the exception of the United Kingdom the elasticity of demand was less than unity throughout the quantity range investigated. This is illustrated in Figures 1(i)-(vii)(b) where the relationship between expected revenues and quantity landed are presented for each country. The United Kingdom revenue curve reaches a maximum around 100,000 tons and then declines. All the other revenue curves show a monotonic increase albeit at different rates, with quantity. These relationships now form the material for assessing the central questions.

ECONOMIC BENEFITS OF DIFFERENT LEVELS OF TAC

(i) Static Considerations

The most obvious way to address these questions is to perform the simple calculation of setting a TAC level, allocating a proportion of that to Norway and the remainder amongst the Community. Utilising the demand relationships to generate the expected revenue in each country and then converting these revenues to a real value base, using the currency exchange rates in some fixed period. The procedure is then repeated for different levels of the TAC. In this way expected revenues to each country and the Community as a whole may be estimated. The number of possible combinations are, however, limitless given the possible permutations of proportional allocation of a given quota. Accordingly, we have proceeded in a simple way by first setting a proportional

Table 1

BEST FIT MODEL, ASSOCIATED PARAMETERS AND SIGNIFICANCE LEVELS

Country	Model	Regression Coefficient, Estimated Constant (a & b)	Degrees of Freedom	F-values: Model Parameter a Model Parameter b	Probability of exceeding F
U.K.	$P=a+b\ln Q$	a= 1253 b= -100.23	1, 12	58.55 68.61 58.55	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Belgium	$P=a+b\ln Q$	a= 27436 b= -2308.3	1, 11	18.17 62.01 18.17	.001 $< 10^{-4}$.001
France	$P=a+b\ln Q$	a= 11815 b= -1012.2	1, 9	171.70 240.07 171.70	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Netherlands	$P=a+b\ln Q$	a= 1228.2 b= -36.15	1, 10	11.26 156.58 11.26	$< 10^{-4}$ $< 10^{-4}$.007
W. Germany	$P=a+b\ln Q$	a= 1664.5 b= -108.36	1, 10	28.16 64.60 28.16	$< 10^{-3}$ $< 10^{-4}$ $< 10^{-3}$
Denmark	$\ln P = \ln a + b \ln Q$	$\ln a = 11.39$ b= -0.38	1, 12	39.14 304.51 39.14	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Norway	$\ln P = \ln a + b \ln Q$	$\ln a = 11.27$ b= -0.39	1, 11	47.45 265.33 47.45	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$

Figure 1

DEMAND MODELS (a) AND EXPECTED REVENUES (b) FOR

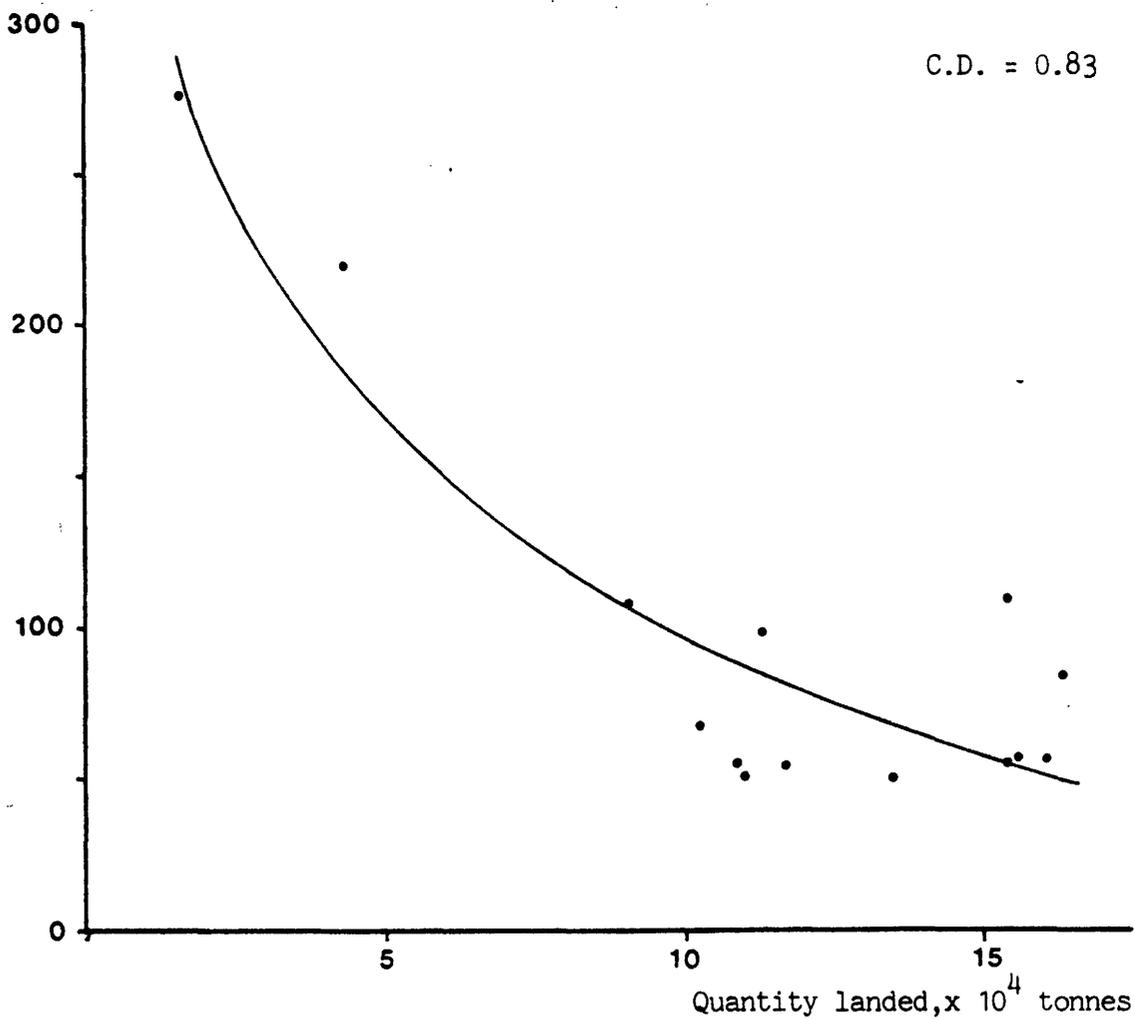
- (i) UNITED KINGDOM, (ii) BELGIUM, (iii) FRANCE,
(iv) NETHERLANDS, (v) W. GERMANY, (vi) DENMARK and (vii) NORWAY.

- (a) Demand Models are fitted in the currency of the individual countries adjusted to 1975 prices. The quantity landed is in metric tonnes of fresh and frozen herring. The coefficient of determination C.D. is indicated for the model.
(b) Expected Revenues are derived from the Demand Model.

Unit Price
£/tonne

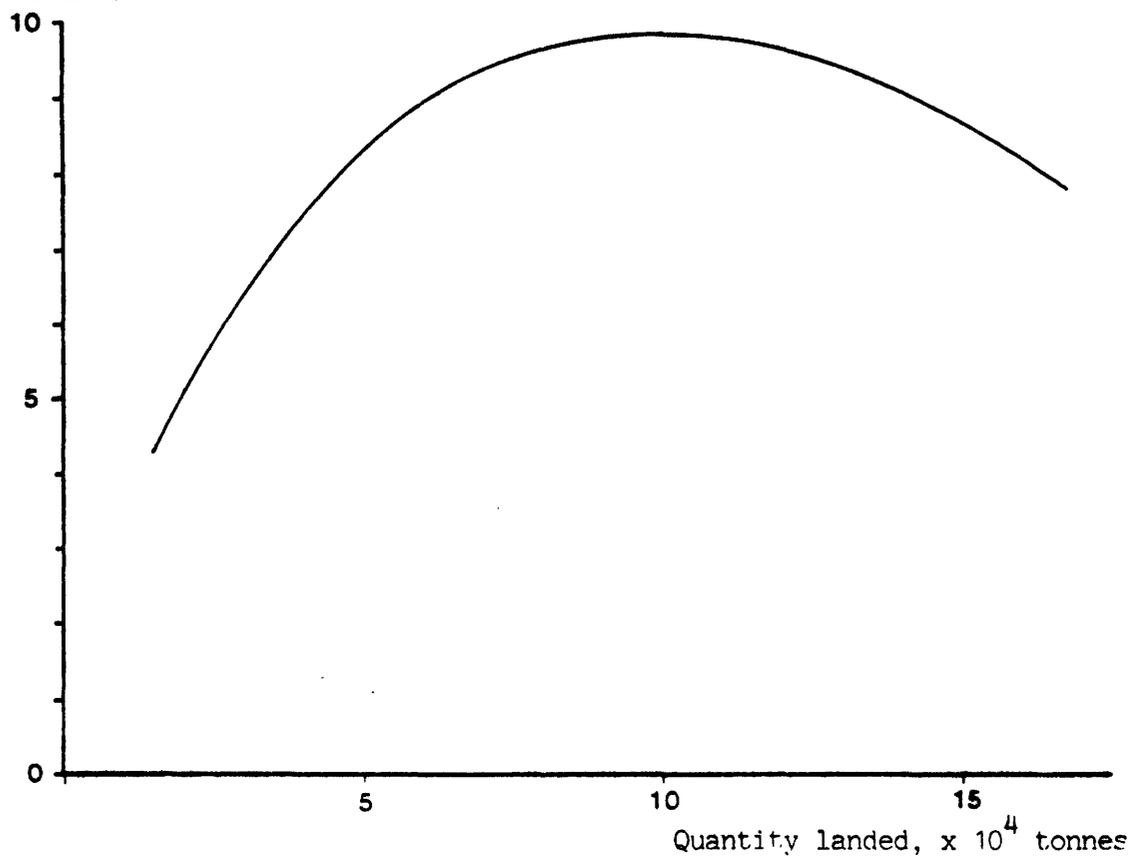
(a) Demand Curve

C.D. = 0.83



(b) Revenue Curve

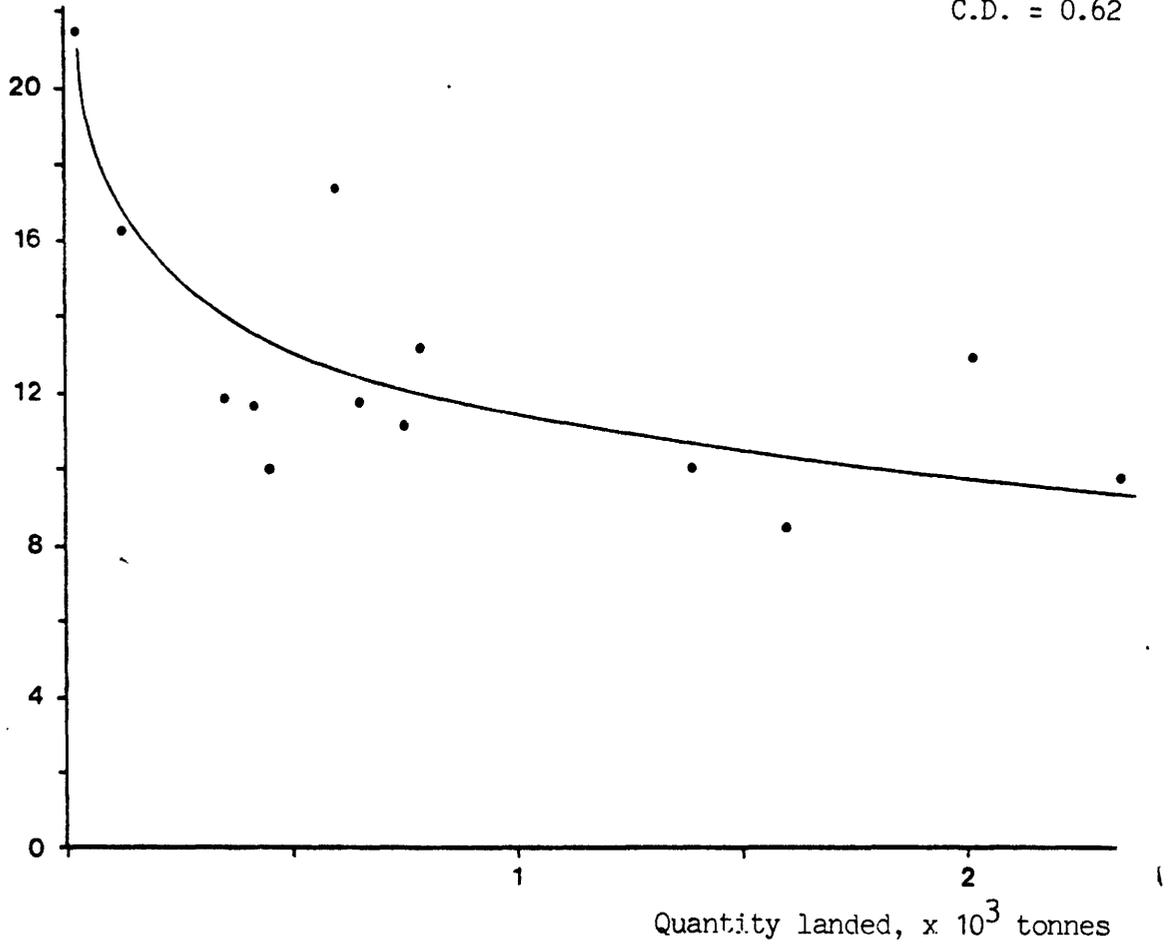
Revenue
£ x 10^6



(a) Demand Curve

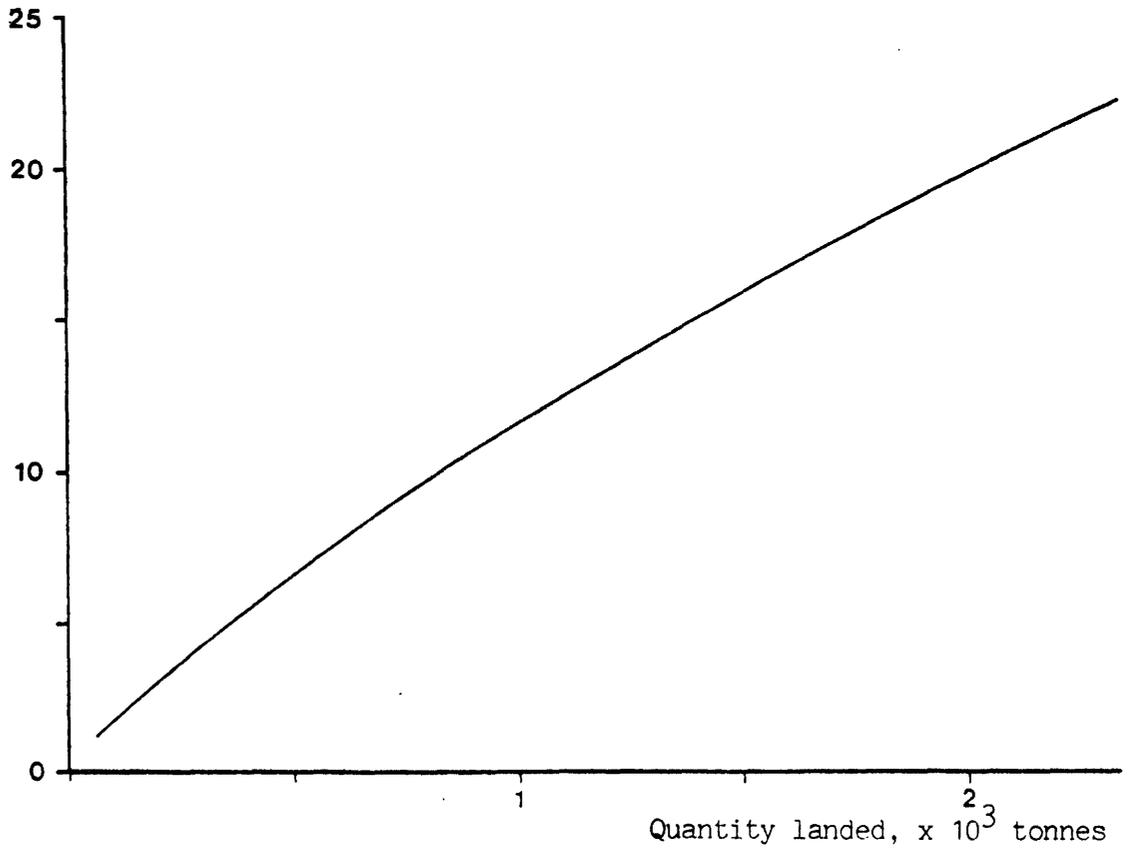
Unit Price
 $\times 10^3$ BF/tonne

C.D. = 0.62



(b) Revenue Curve

Revenue₆
 $\times 10^6$ BF

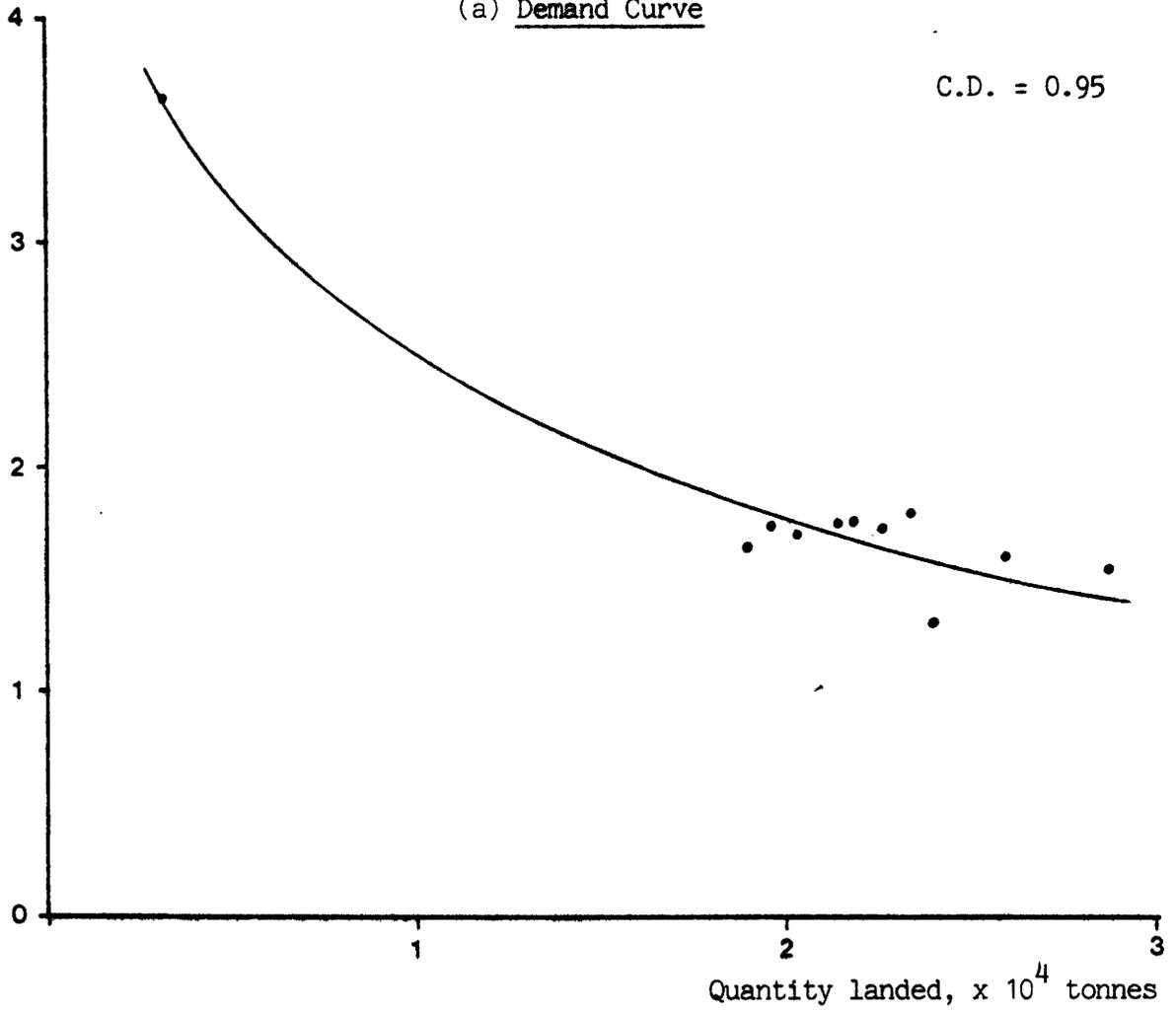


FRANCE

Unit Price
 $\times 10^3$ FF/tonne

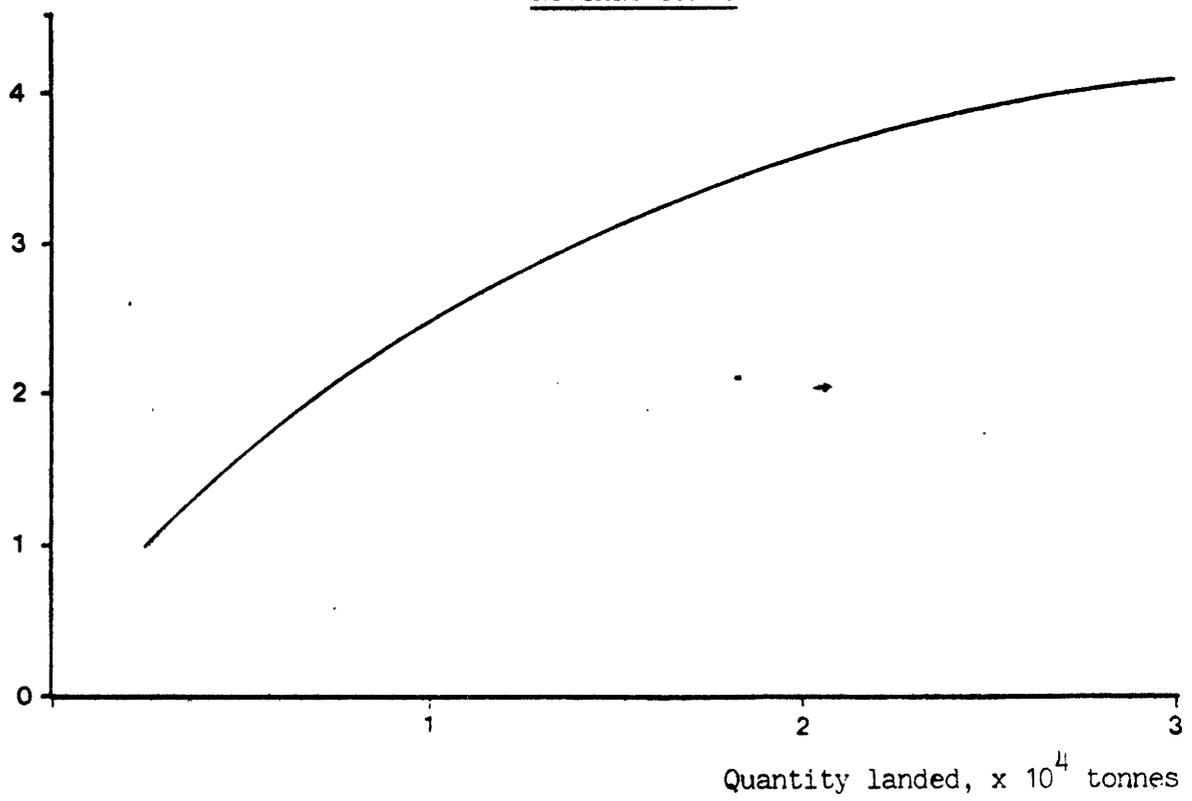
(a) Demand Curve

C.D. = 0.95



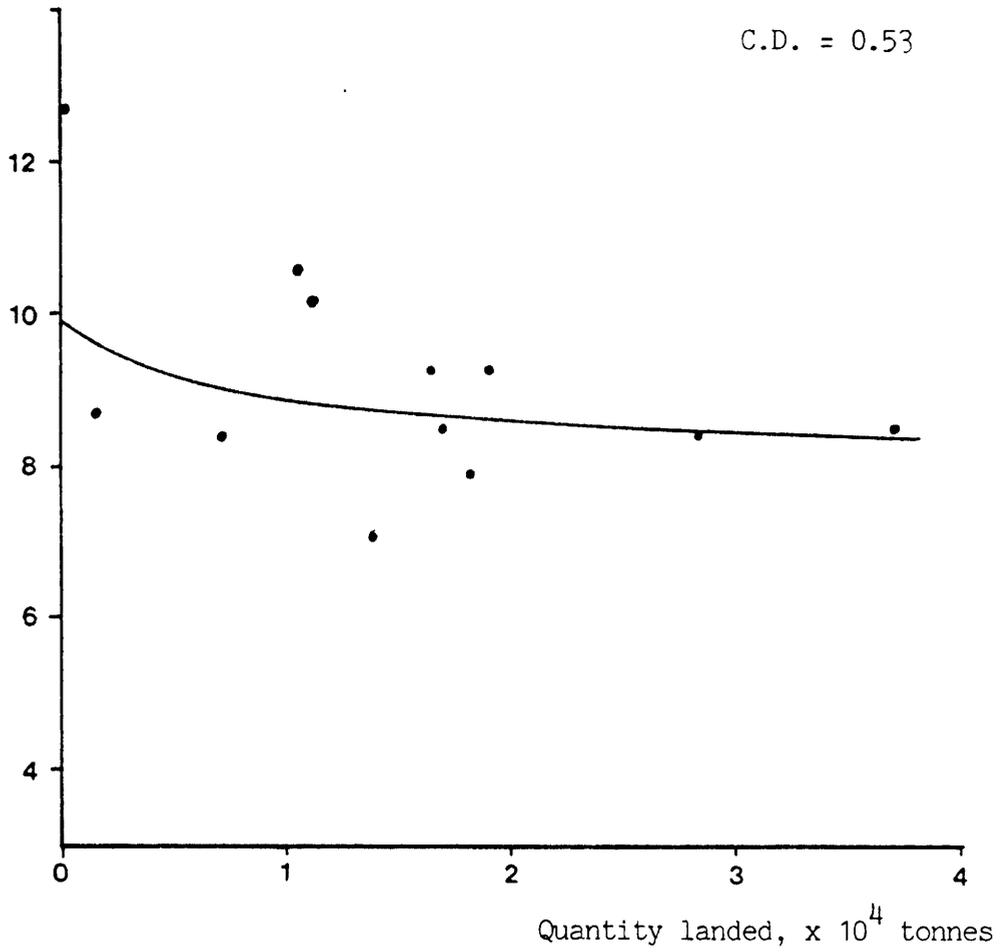
Revenue
 $\times 10^7$ FF

(b) Revenue Curve



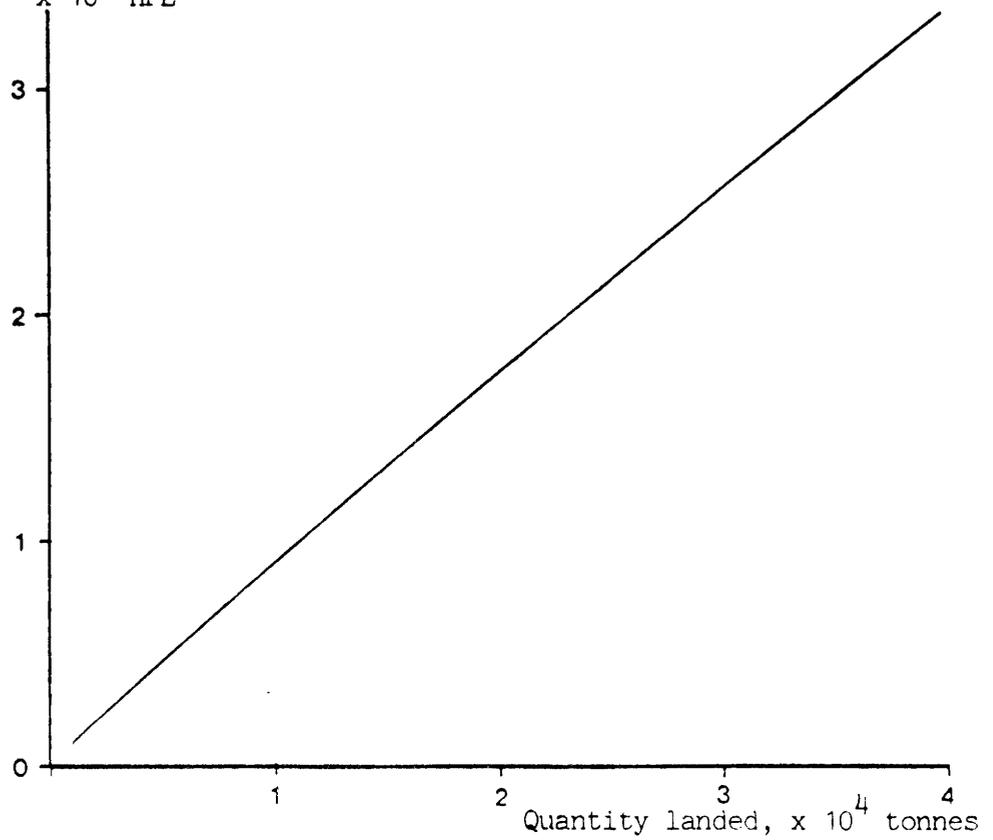
Unit Price
 $\times 10^2$ HFL/tonne

(a) Demand Curve



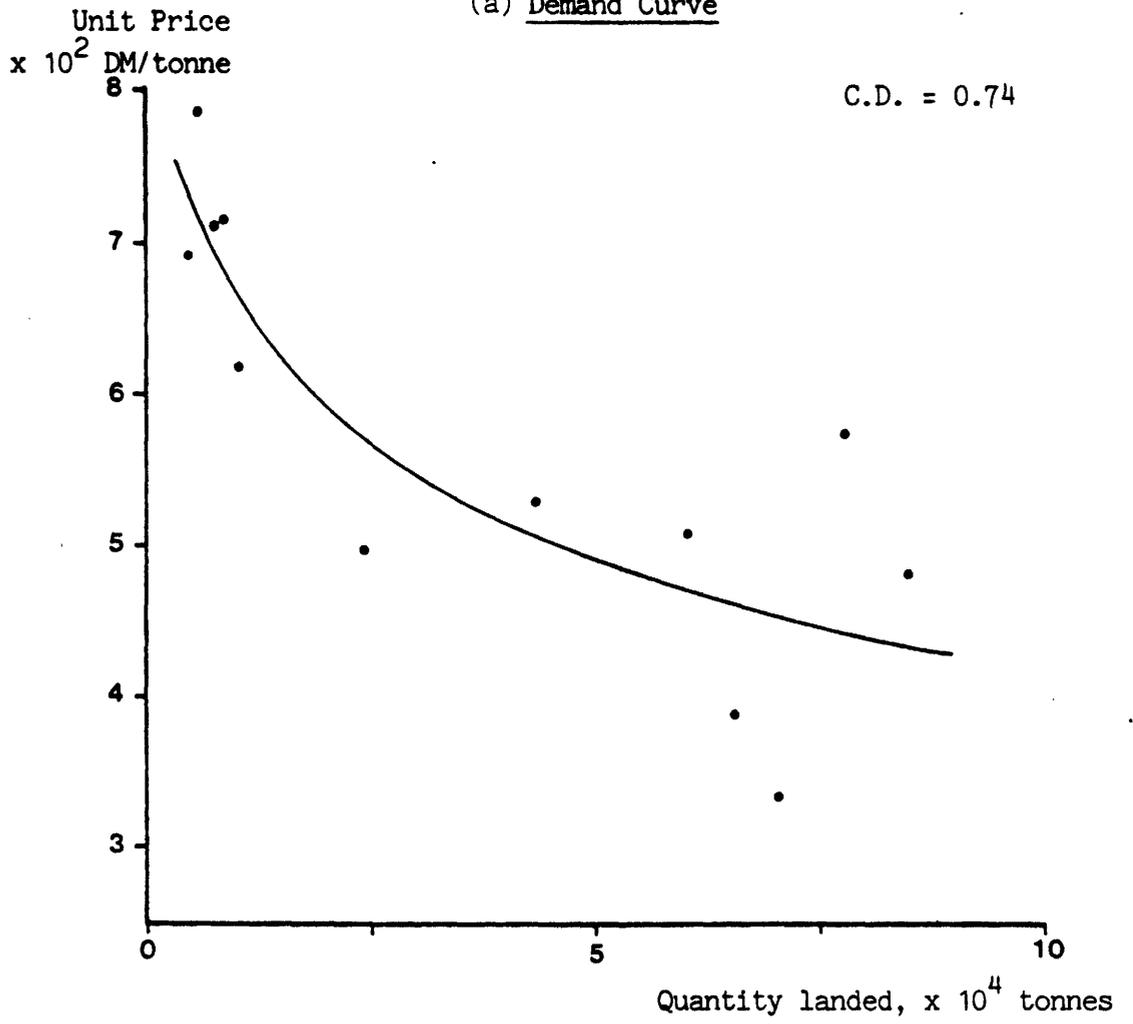
Revenue
 $\times 10^7$ HFL

(b) Revenue Curve

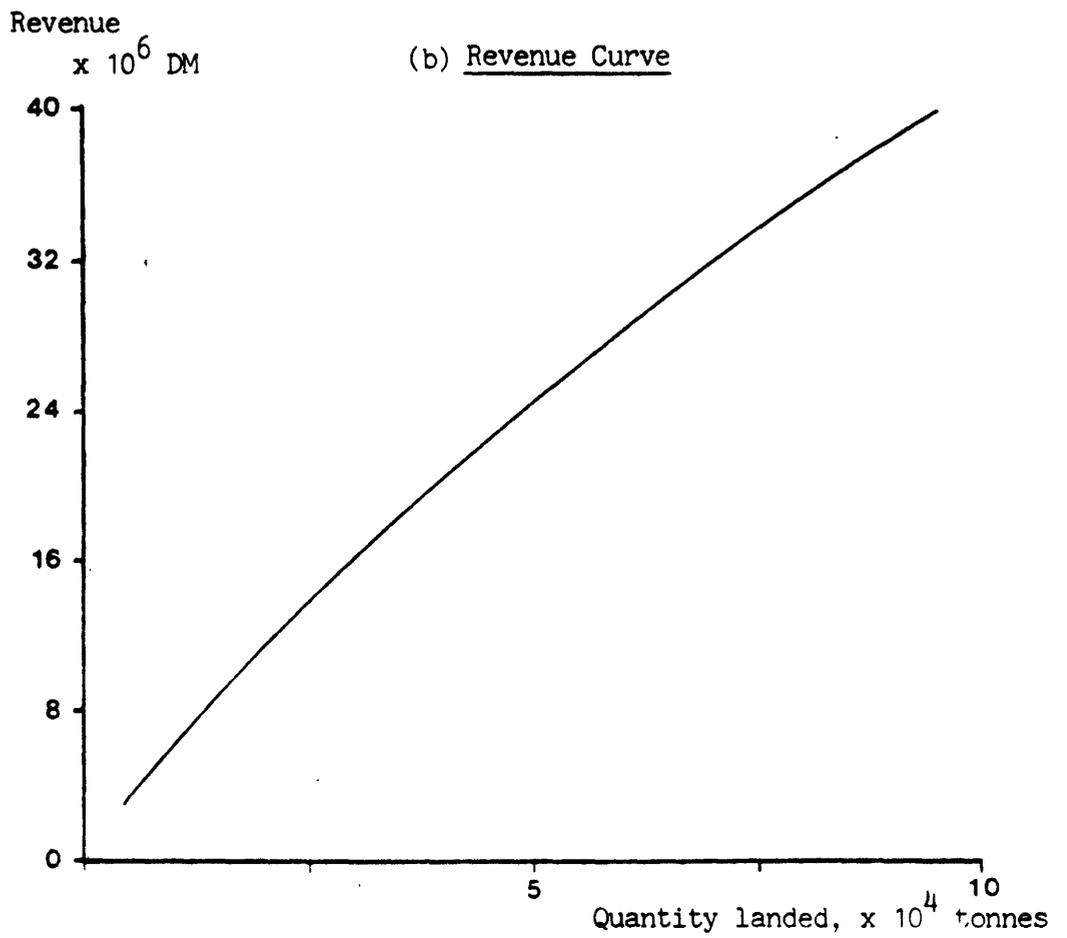


WEST GERMANY

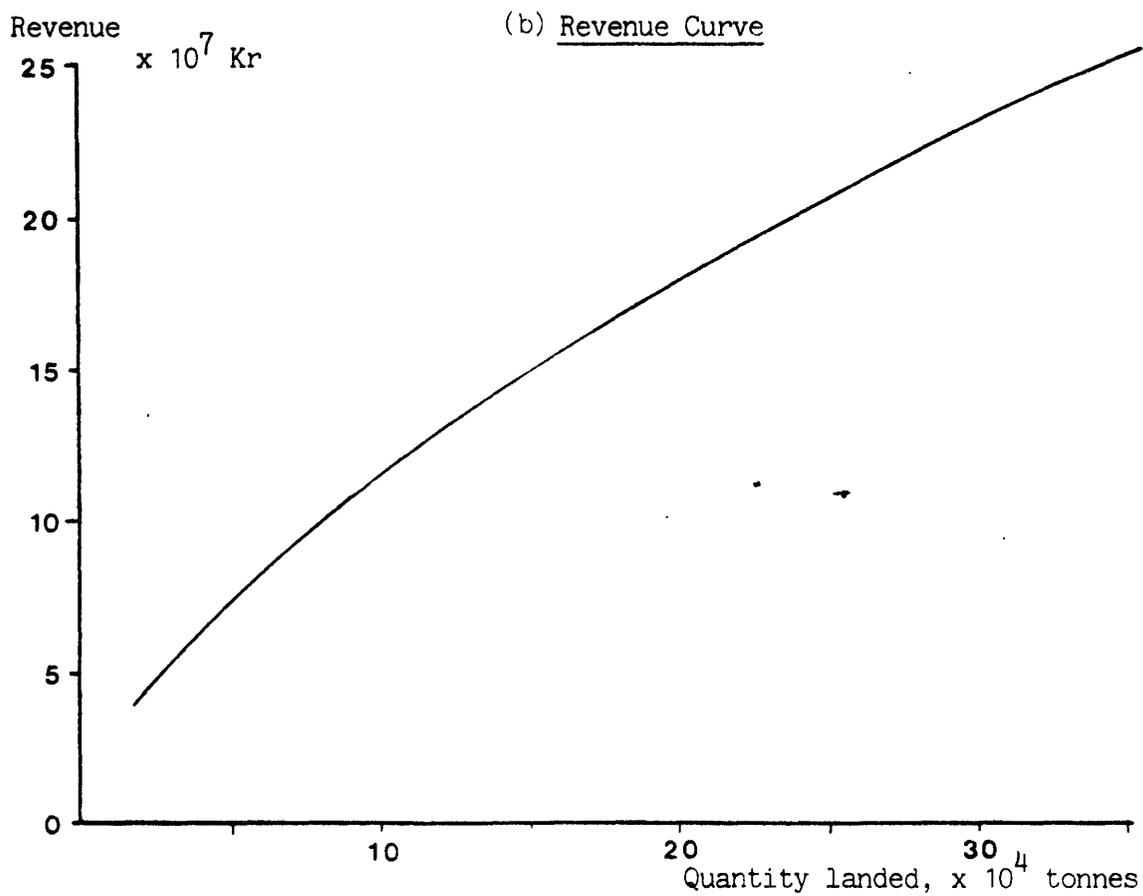
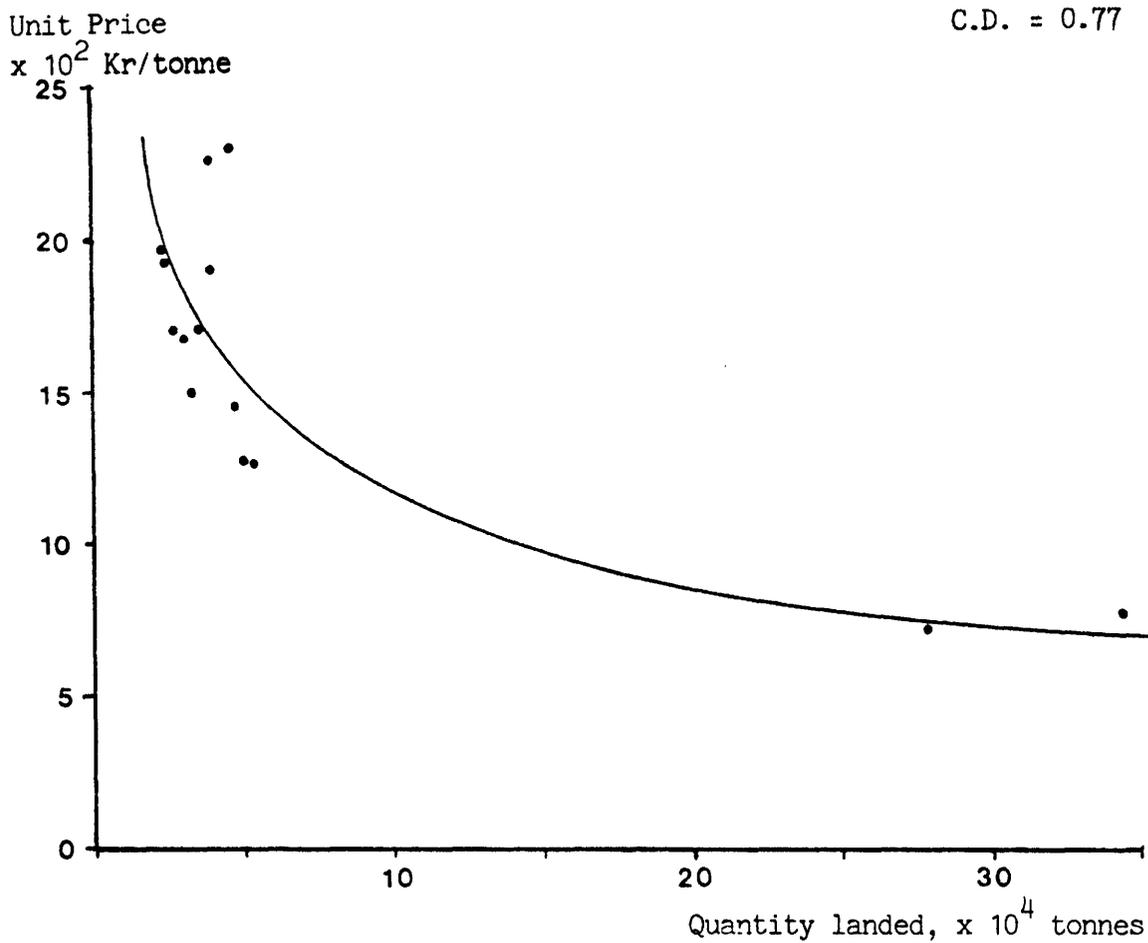
(a) Demand Curve



(b) Revenue Curve



(a) Demand Curve

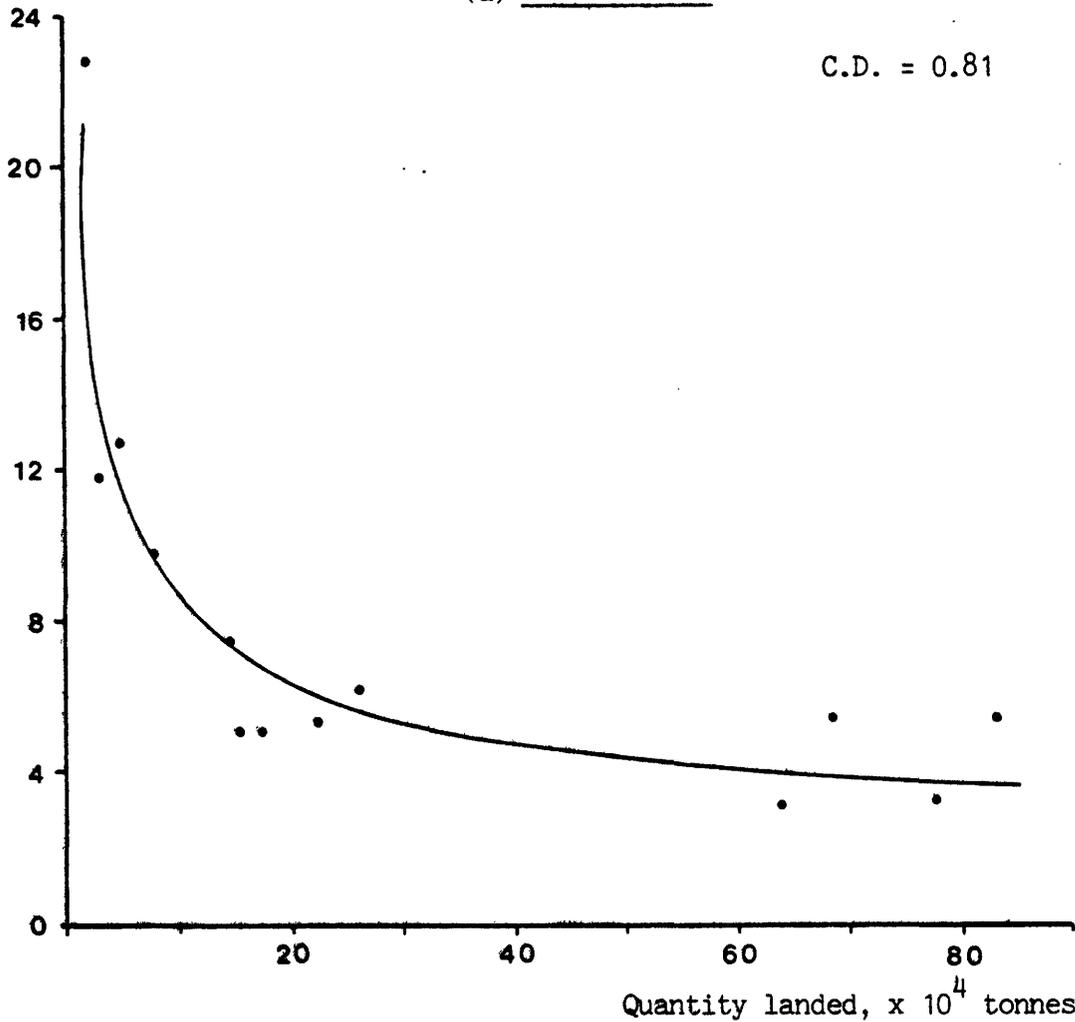


Unit Price
 $\times 10^2$ Kr/tonne

NORWAY

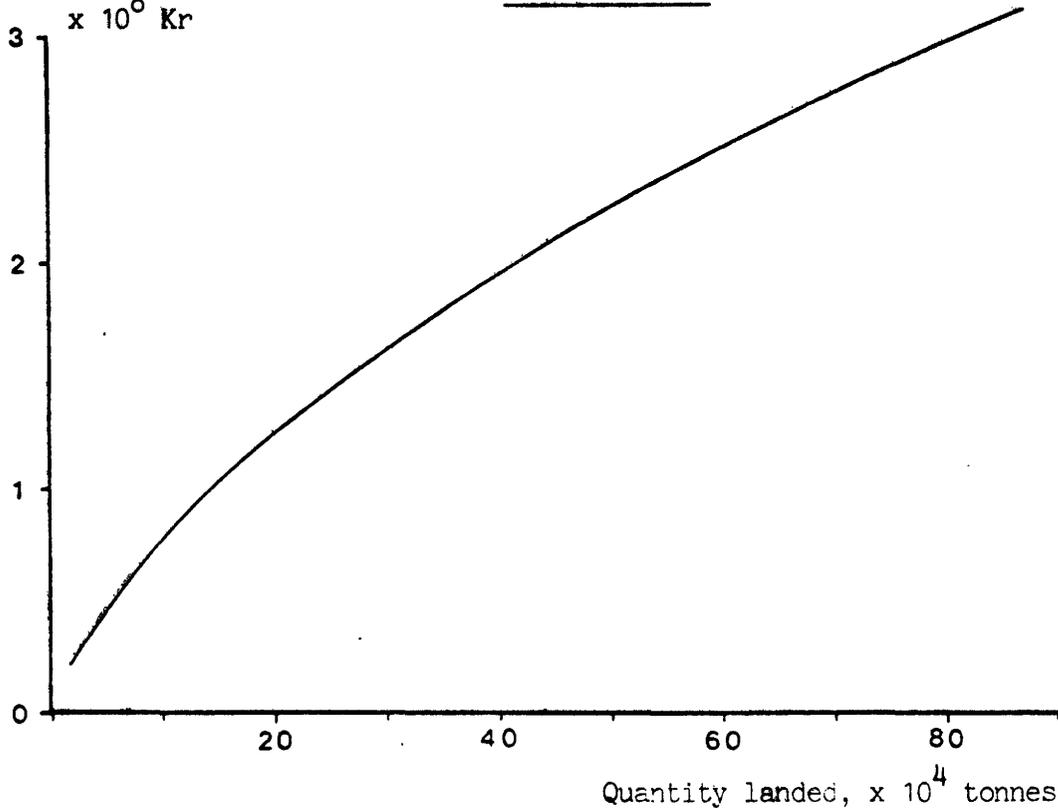
(a) Demand Curve

C.D. = 0.81



Revenue
 $\times 10^8$ Kr

(b) Revenue Curve



allocation within the Community and a fixed proportion to Norway. The effect of changes in the TAC on expected revenue are then calculated. Figure 2 illustrates this for one such combination¹. The revenue curve for the Community shows a monotonic increase with catch level, but additional increments in the catch show progressively less increments in revenue as the largest catch level (corresponding to the MSY level) is approached. A value of just under £90 million (1979 prices) being associated with this largest level.

(ii) Dynamic Considerations

So far we have examined the economic benefits of various catch levels in a framework isolated from any consideration of the status of the herring stock. Clearly a build up to high catch levels can only occur as the stock itself recovers from depletion. In Beddington and Grenfell (1980) we examined strategies based on expanding the catch in equal increments from 1981 until 1990. Allowing for random variation in recruitment it was possible to calculate the probability of collapse of the stock associated with each harvesting pattern. In this section we consider the economic benefits of such strategies in two ways. Firstly by calculating the present value of each strategy, allowing for a discount rate and secondly by calculating the expected revenue in present value terms allowing for the chance of stock collapse.

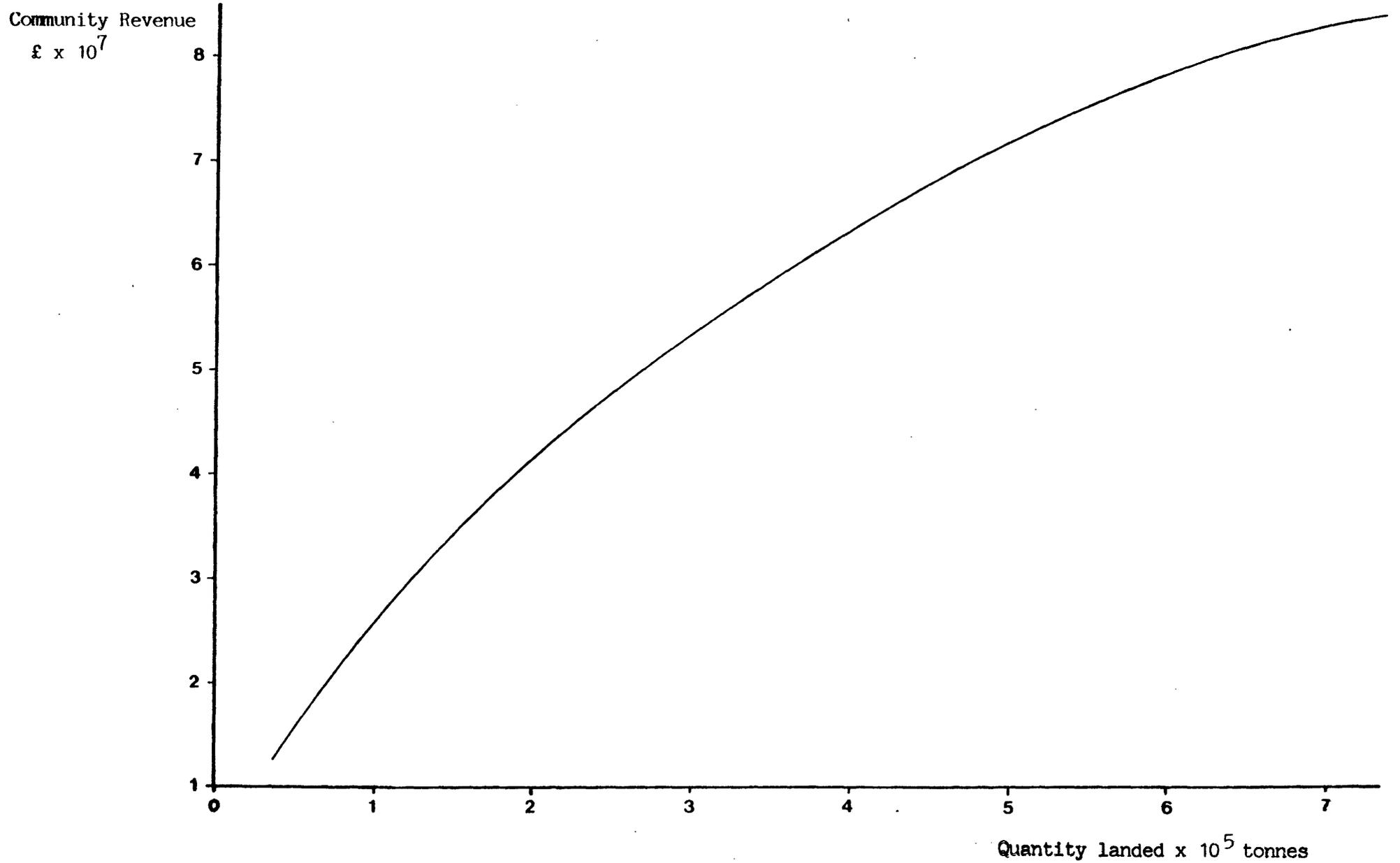
The present value PV of the strategy is simply defined by the equation:

$$PV = \sum_{t=1}^{10} R_t e^{-it}$$

where t is time, i the discount rate and R_t the expected revenue in year t. R_t is calculated as above by specifying some distribution of the TAC among the community members and Norway.

¹The expected revenue at the lowest level of TAC should be treated with some caution. The reason is that when divided up amongst the member countries, in the case of West Germany, Denmark and the United Kingdom their allocation falls below the historical levels used in fitting the demand curves.

Figure 2 Expected Revenue to the Community from different levels of TAC with a constant 20% allocation to Norway (1979 prices).



The specification of an appropriate discount rate for the Community to evaluate fishing strategies is beyond the scope of this study. Accordingly, we illustrate these calculations for three discount rates of 5, 10 and 15%. The results expressed as an average rate of return i.e. the present value divided by the number of years, are illustrated in Figure 3.

These alternative strategies have associated probabilities of producing a collapsed stock and using the analysis of Beddington and Grenfell we can calculate the expected average rate of return. In order to do this properly it is necessary to specify the economic loss associated with a collapse. It is far from simple to do this exactly, but relatively easy to specify best and worst cases. The worst case is when after a collapse no further revenue is obtained. The best when after a collapse a period of four years of zero catch permits recovery to a level where the average revenue may be obtained for subsequent years. The results are presented in Table 2, for strategies with and without a small by-catch of herring from the sprat fishery². They indicate that if there is a by-catch in the sprat fishery little benefit is to be obtained from increasing the catch strategy much beyond an initial level of 60,000 tons and a final one of 600,000 tons. By contrast without a sprat fishery a build-up from 70 to 700 thousand tons is possible. The associated 'cost' of the by-catch may be seen to be of the order of £2 million per annum (1979 prices).

ALLOCATION OF THE TAC

(i) Between the Community and Norway

In all the previous calculations an allocation of 20% of the TAC to Norway has been considered. It is, of course, possible to vary this and to investigate the possible costs and benefits associated with this

²The by-catch of the sprat fishery considered by Beddington and Grenfell has been considered somewhat low. A more realistic value being obtained from a fishing mortality of between .3 and .4. Such considerations, of course, depend on the efficiency of regulations and their application, but if such levels apply then the results presented would be optimistic and the cost of the sprat fishery underestimated.

Figure 3 AVERAGE RATE OF RETURN TO THE COMMUNITY AT DIFFERENT DISCOUNT RATES FOR STRATEGY OPTIONS OF INCREASING QUOTA IN EQUAL INCREMENTS IN THE PERIOD 1981-1990.

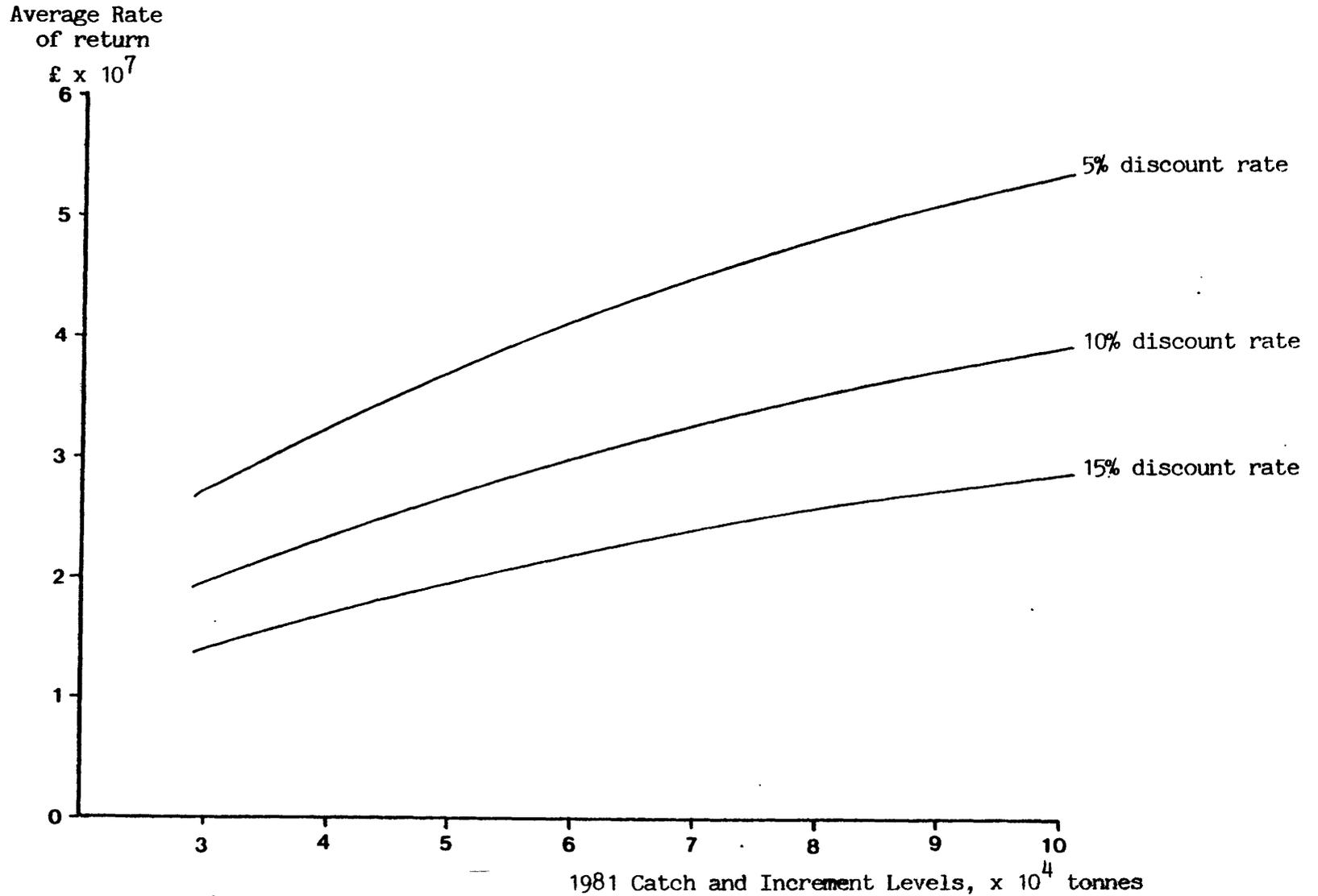


TABLE 2a

EXPECTED DISCOUNTED REVENUE CALCULATIONS ON INCREASING CATCH REGIMES 1981-1990, USING A DISCOUNT RATE OF 5%

Catch Increment x 10 ³ m.t.	Peak Reached in 1990 x 10 ³ m.t.	Expected Average Revenue per year, £'millions at 1979 prices			
		Best Case		Worst Case	
		Industrial Fishery x 10 ⁹ nos.		Industrial Fishery x 10 ⁹ nos.	
		.44	0	.44	0
30	300	27.1	27.1	26.9	26.9
50	500	36.6	36.9	35.5	36.3
60	600	40.5	40.7	39.0	39.4
70	700	42.7	44.0	39.2	42.4
80	800	42.6	45.1	33.9	40.2
90	900	41.7	44.2	27.6	33.8
100	1000	39.8	42.1	18.8	24.7

TABLE 2b

EXPECTED DISCOUNTED REVENUE CALCULATIONS ON INCREASING CATCH REGIMES 1981-1990, USING A DISCOUNT RATE OF 10%

Catch Increment x 10 ³ m.t.	Peak Reached in 1990 x 10 ³ m.t.	Expected Average Revenue per year, £'millions at 1979 prices			
		Best Case		Worst Case	
		Industrial Fishery x 10 ⁹ nos.		Industrial Fishery x 10 ⁹ nos.	
		.44	0	.44	0
30	300	19.4	19.4	19.3	19.3
50	500	26.4	26.5	25.6	26.0
60	600	29.2	29.3	28.1	28.4
70	700	30.9	31.8	28.4	30.6
80	800	30.8	32.7	24.5	29.1
90	900	30.2	32.1	20.0	24.5
100	1000	28.9	30.5	13.7	17.9

TABLE 2 c

EXPECTED DISCOUNTED REVENUE CALCULATIONS ON INCREASING CATCH REGIMES 1981-1990, USING A DISCOUNT RATE OF 15%.

Catch Increment $\times 10^3$ m.t.	Peak Reached in 1990 $\times 10^3$ m.t.	Expected Average Revenue per year, £'millions at 1979 prices			
		Best Case		Worst Case	
		Industrial Fishery $\times 10^9$ nos.		Industrial Fishery $\times 10^9$ nos.	
		.44	0	.44	0
30	300	14.1	14.1	14.0	14.0
50	500	19.1	19.3	18.5	18.9
60	600	21.3	21.4	20.5	20.7
70	700	22.6	23.3	20.7	22.4
80	800	22.5	23.9	17.9	21.3
90	900	22.2	23.5	14.7	18.0
100	1000	21.3	22.5	10.1	13.2

change to both the Community and to Norway. The results of such an exercise are illustrated in Figure 4 and Table 3.

Such information affords the possibility that negotiations between the Community and Norway could be guided by these simple benefit cost calculations. This would be particularly useful where herring was but one of a number of species for which quotas were being negotiated. It would then be possible to assess, subject to suitable constraints, what strategy of allocation afforded the greatest joint benefit.

(ii) Within The Community

An analogous procedure may be adopted for assessing the effects of a different distribution of the Community quota among members. The previous analysis had been done on the basis of the allocation given in Table 4.

TABLE 4

BASIC ALLOCATION OF TAC TO NORWAY AND THE COMMUNITY COUNTRIES

			U.K.	.250
			Belgium	.025
Norway	.200	E.E.C.	France	.150
		.800	Netherlands	.300
			West Germany	.075
			Denmark	.200

In this section the effect of changing these basic allocations on the revenue to individual countries and to the Community as a whole is investigated. Clearly there are an infinite number of possible combinations, even when the constraints of the fishing capacity of the individual countries is considered. To limit these possibilities to a manageable number, two basic strategies have been investigated:

- (a) Alteration of the allocation of an individual country with the change in allocation to the remaining countries being distributed according to the original allocations.
- (b) Bilateral substitution, with additions and subtractions operating between two countries.

Figure 4a Expected Revenue to the Community for different levels of TAC and proportional allocations to Norway (1979 prices).

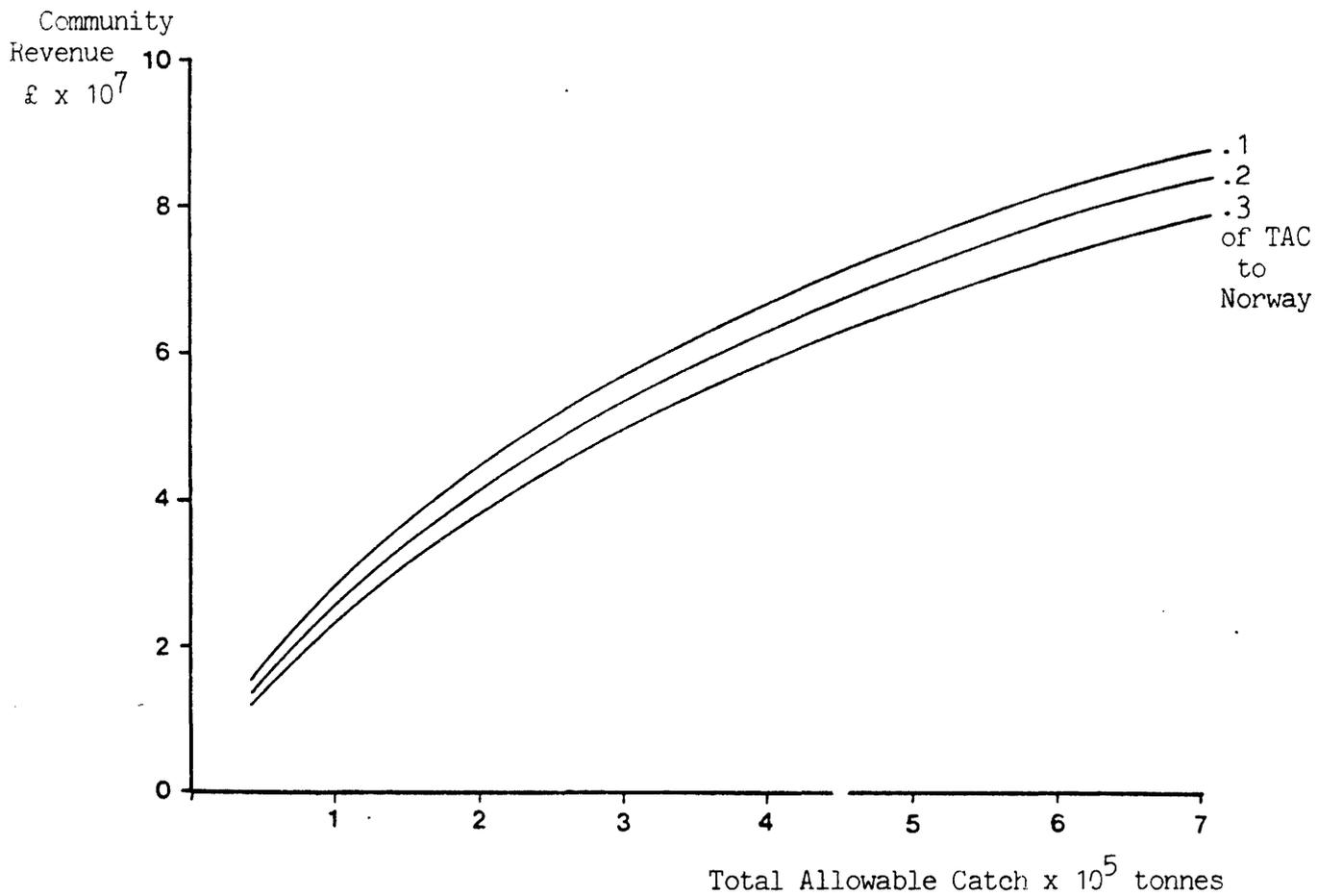


Figure 4b Expected Revenue to Norway for different allocation of TAC (1979 prices).

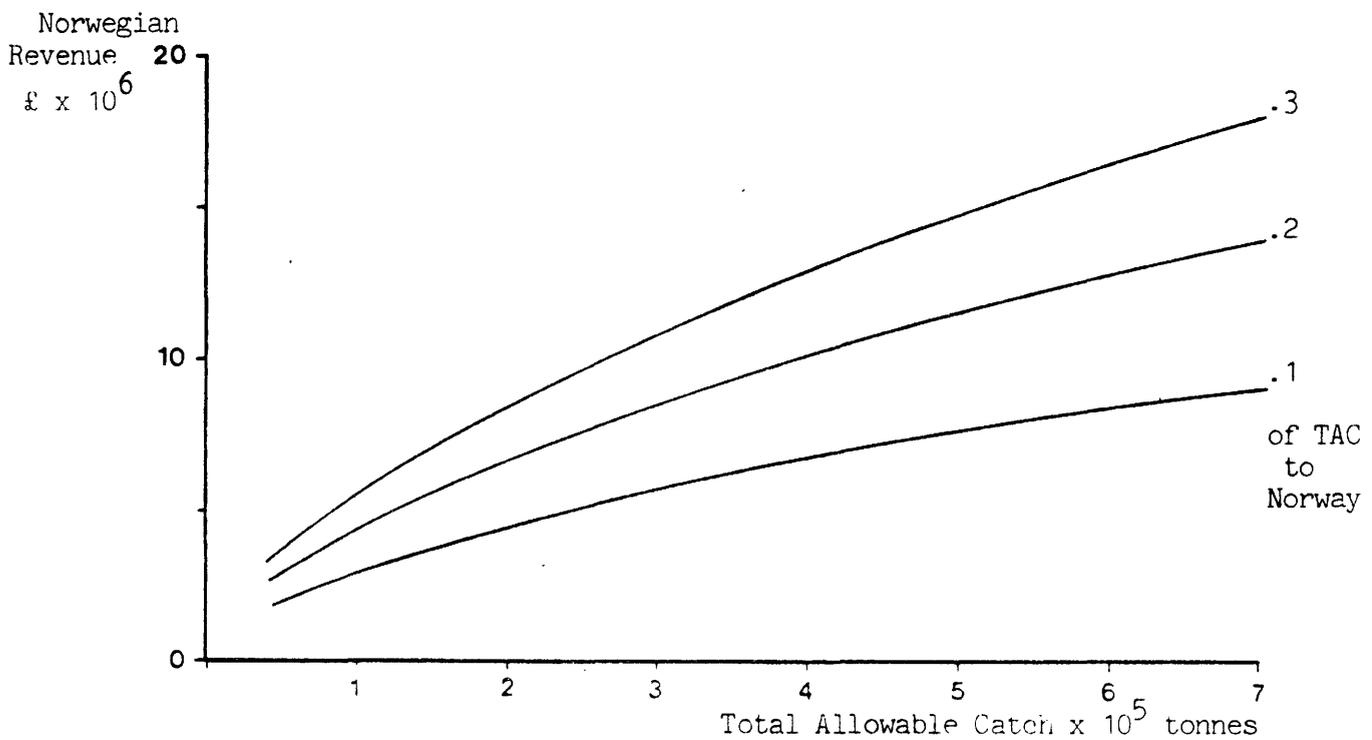


TABLE 3

THE EFFECT ON THE E.E.C. AND NORWEGIAN REVENUE FROM DIFFERENT CATCH LEVELS AND ALLOCATIONS OF THE CATCH.

Total Allowable Catch (tonnes)	E.E.C. Total Revenue in £'millions (1979 prices) Percentage of TAC to Norway			Norwegian Total Revenue in £'millions (1979 prices) Percentage of TAC to Norway		
	10%	20%	30%	10%	20%	30%
50,000	17.1	15.7	14.2	1.9	2.9	3.7
100,000	28.1	25.9	23.6	2.9	4.4	5.6
150,000	37.1	34.2	31.3	3.7	5.6	7.1
200,000	44.7	41.4	37.9	4.4	6.6	8.5
250,000	51.4	47.8	43.9	5.0	7.6	9.7
300,000	57.3	53.5	49.3	5.6	8.5	10.8
350,000	62.7	58.6	54.1	6.1	9.3	11.9
400,000	67.5	63.2	58.6	6.6	10.1	12.9
450,000	71.8	67.5	62.7	7.1	10.8	13.8
500,000	75.7	71.3	66.4	7.6	11.5	14.8
550,000	79.3	74.9	69.9	8.0	12.2	15.6
600,000	82.6	78.2	73.2	8.5	12.9	16.5
650,000	85.5	81.2	76.2	8.9	13.5	17.3
700,000	88.1	83.9	78.9	9.3	14.2	18.1

Some typical results are illustrated for (a) in Figure 5, Table 5 and Appendix V, and for (b) in Figure 6 and Appendix V.

As indicated earlier, low levels of quotas present a problem that the expected revenue generated from the demand curves comes from quantities outside the range of the statistical fitting. Hence considerable caution should be exercised in interpreting these figures, for details see Appendix II.

This analysis affords the possibility, as in the case of the Community/Norway analysis of providing useful information in the context of setting the allocations of a number of individual species within the Community's fishing area. Its aim has been to be illustrative of these possibilities rather than to define the actual benefit cost calculations on herring. These depend critically on the robustness of the simple demand models, both to a changing economic situation following the Fishery's closure and to the effects of other ignored factors on demand. In particular, the effect on the price of imported herring must be considered. This forms the next section.

THE EFFECTS OF IMPORTS ON DEMAND

Although the statistical fit of the simple models is encouraging, inspection of the pattern of residuals over time indicated a distinct possibility that other factors were operating. In other studies on fish demand, eg. Young (1977) and Buchanan and Nicholson (1977) the effects of other fish and meat substitutes have been investigated. Herring is a somewhat unusual fish and with the possible exception of mackerel is believed not to have any close substitutes. In a certain way we prejudged the issue by deciding to look initially at the effects of imports on auction price, prior to a full investigation of substitute effects. We felt that the latter would only be necessary if the other models failed to explain a satisfactorily high proportion of the variability in price.

Import data were readily available only for two countries, the United Kingdom and Denmark, and these consisted of unit price and quantity of imported fresh and frozen herring, and average price and quantity of all herring imports. Simple correlation of these four variables with the

Figure 5

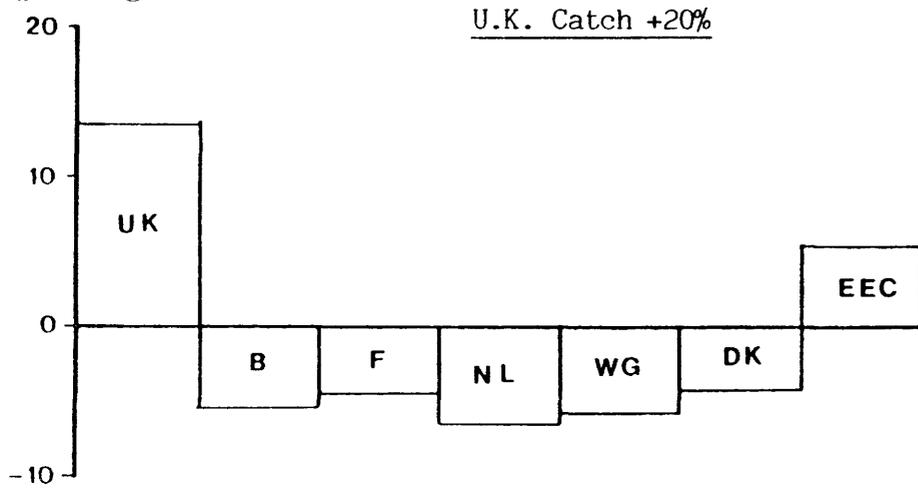
THE EFFECTS OF DIFFERENT ALLOCATIONS OF THE TAC ON REVENUES TO
THE INDIVIDUAL COUNTRIES OF THE COMMUNITY

- 5(a) Short-term
- 5(b) Medium-term
- 5(c) Long-term

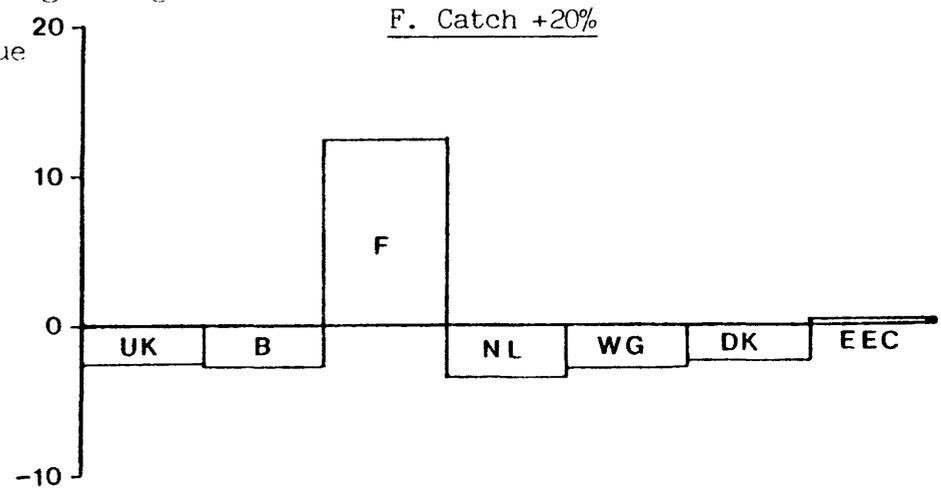
The calculations have been made in terms of a percentage change in revenue from the basic allocation by increasing or decreasing the allocation of an individual country and re-allocating the residual benefit or deficit proportionally to the remaining countries.

Figure 5a Short Term TAC : 50,000 tonnes

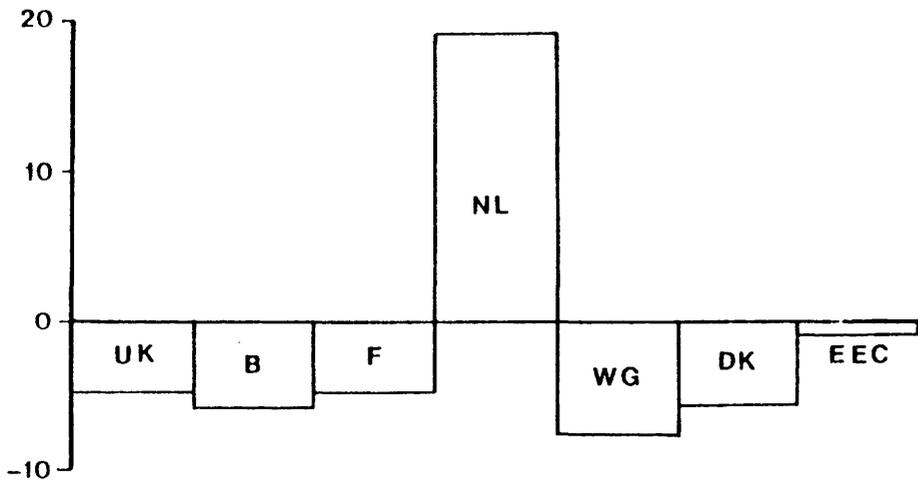
Percentage change
in
Revenue



Percentage change
in
Revenue



N.L. Catch +20%



D.K. Catch +20%

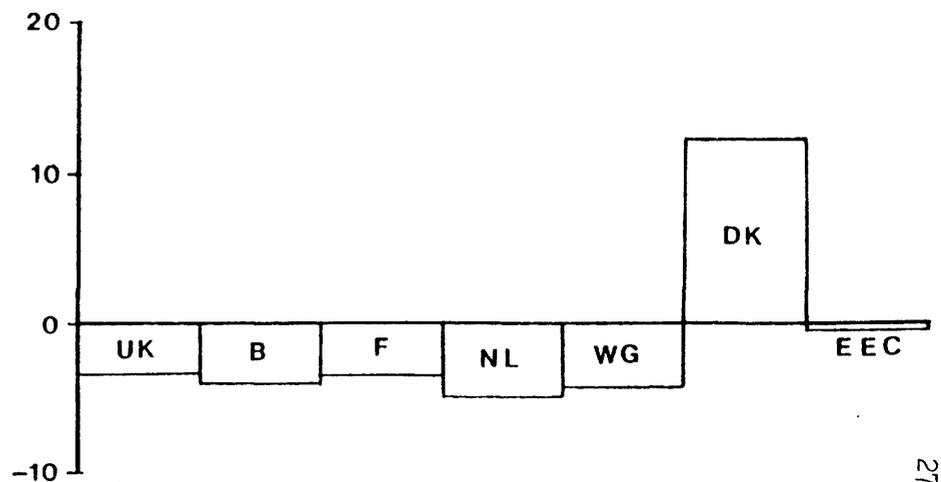
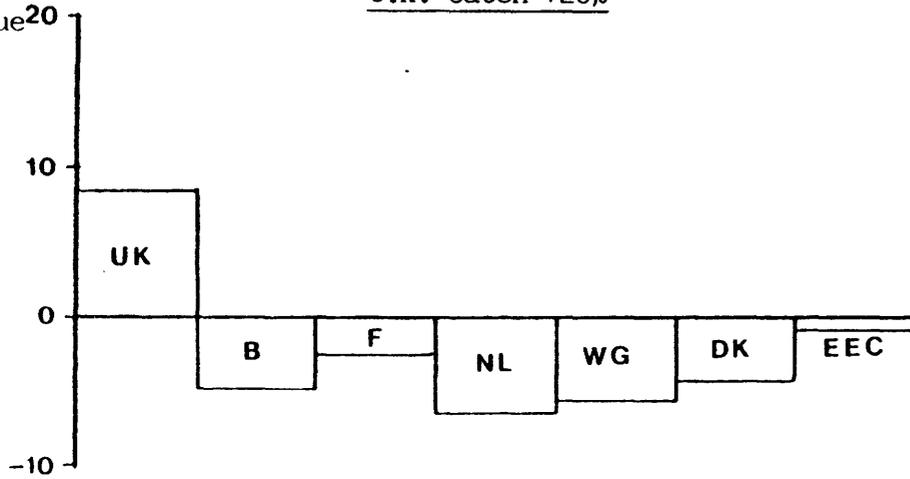


Figure 5b Medium Term TAC : 200,000 tonnes

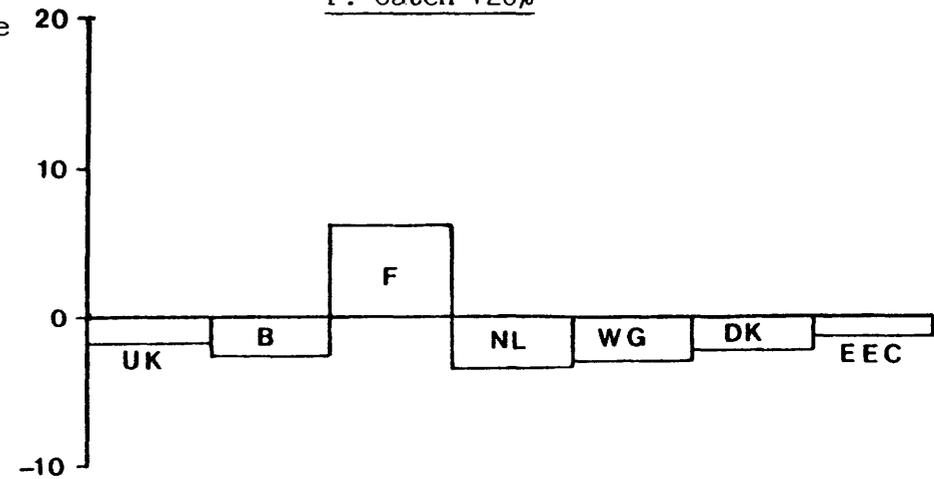
Percentage change
in
Revenue

U.K. Catch +20%

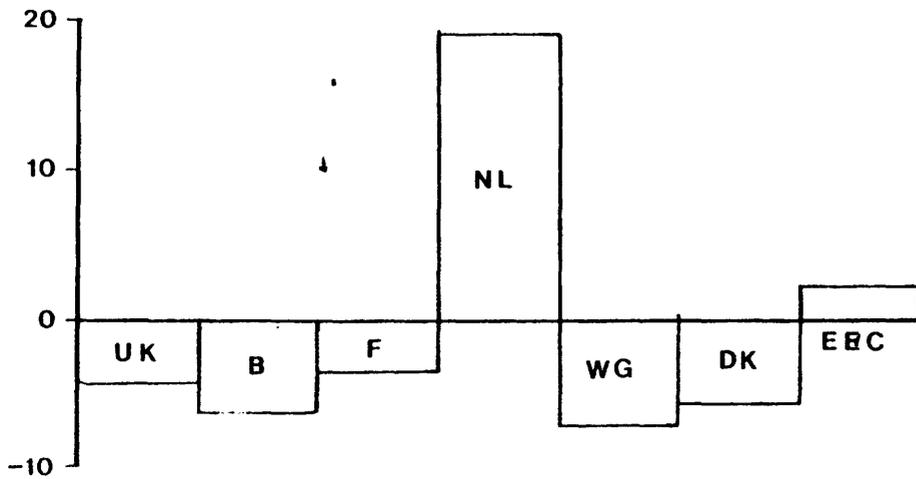


Percentage change
in
Revenue

F. Catch +20%



N.L. Catch +20%



D.K. Catch +20%

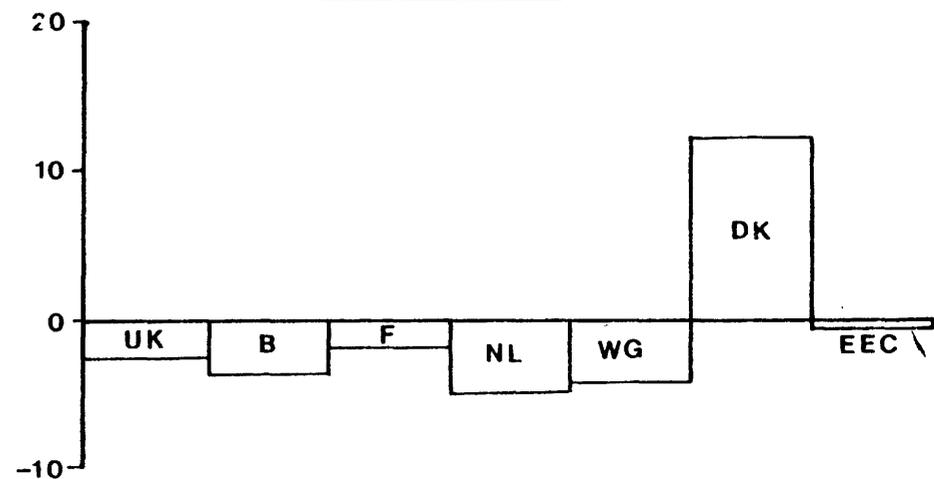
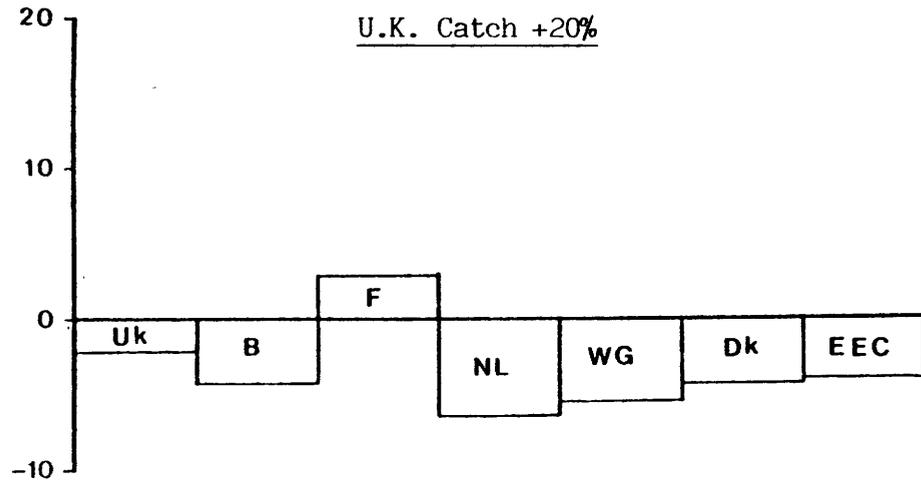


Figure 5c Long Term TAC : 500,000 tonnes

Percentage change
in
Revenue



Percentage change
in
Revenue

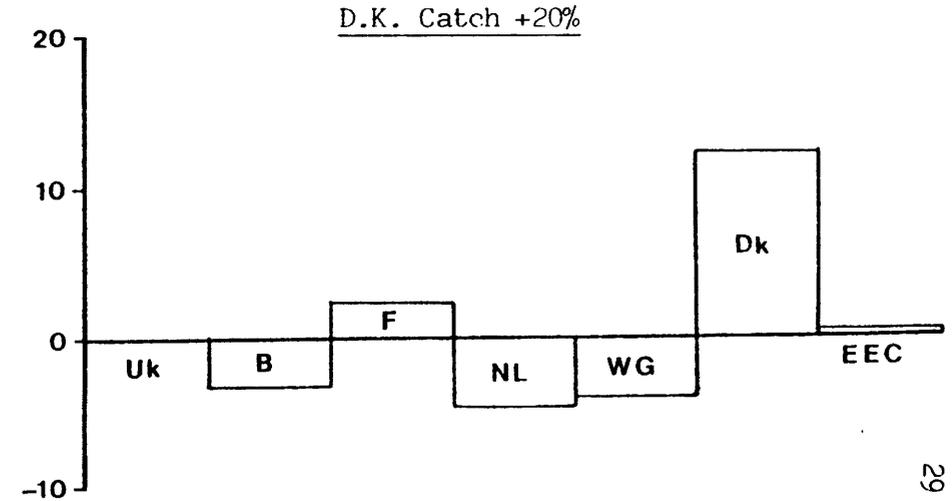
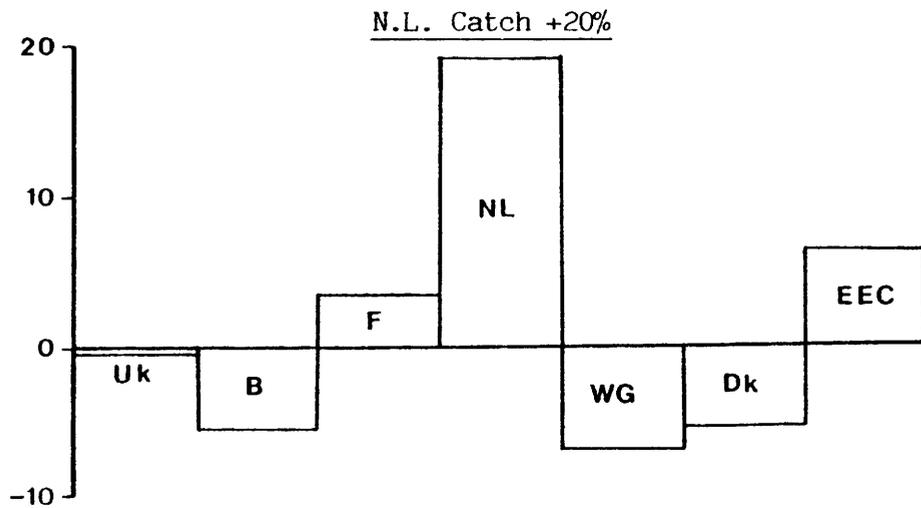
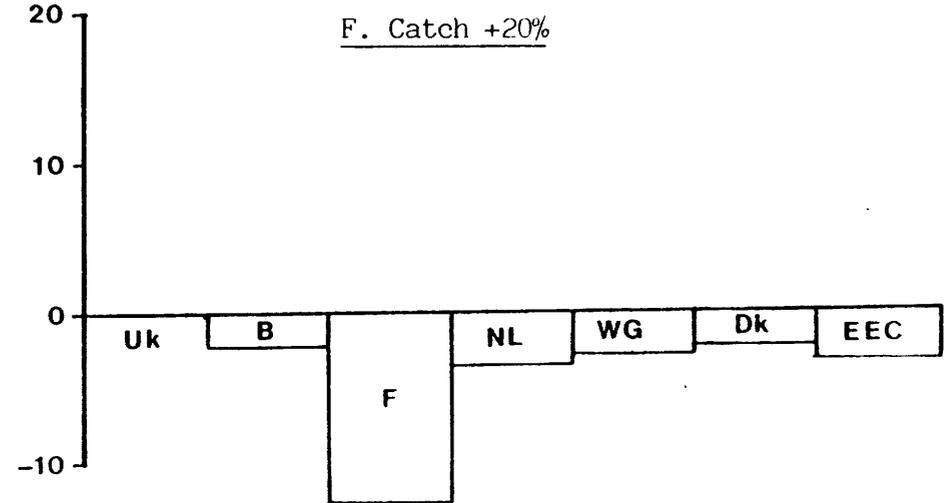


TABLE 5 a

EFFECTS OF DIFFERENT ALLOCATIONS OF THE TAC ON REVENUES TO THE
INDIVIDUAL COUNTRIES OF THE COMMUNITY

Short Term TAC : 50,000 tonnes

		Expected Revenue Changes, x 10 ⁶ individual currencies						
		E.E.C.	U.K.	B.	F.	NL	W.G.	DK
		£	£	B.F.	F.F.	H.F.L.	D.M.	Kr.
<u>Basic</u>								
<u>Allocation</u>		15.70	5.46	14.66	26.20	13.45	2.76	35.64
<u>Catch change</u>								
<u>U.K.</u>								
	+ 20%	+0.84	+0.74	-0.79	-1.18	-0.86	-0.16	-1.50
	+ 10%	+0.12	+0.38	-0.39	-0.58	-0.43	-0.08	-0.74
	- 20%	-0.28	-0.79	+0.78	+1.14	+0.86	+0.16	+1.47
	- 10%	-0.13	-0.38	+0.39	+0.57	+0.43	+0.08	+0.74
<u>F.</u>								
	+ 20%	+0.03	-0.13	-0.41	+3.31	-0.46	-0.08	-0.79
	+ 10%	+0.02	-0.06	-0.20	+1.70	-0.23	-0.04	-0.39
	- 20%	-0.06	+0.14	+0.41	-3.67	+0.45	+0.09	+0.78
	- 10%	-0.02	+0.08	+0.21	-1.78	+0.22	+0.05	+0.39
<u>NL</u>								
	+ 20%	-0.14	-0.32	-1.01	-1.52	+2.57	-0.20	-1.94
	+ 10%	-0.06	-0.15	-0.50	-0.75	+1.28	-0.10	-0.96
	- 20%	+0.12	+0.33	+1.00	+1.46	-2.59	+0.21	+1.88
	- 10%	+0.06	+0.17	+0.50	+0.74	-1.30	+0.11	+0.95
<u>DK</u>								
	+ 20%	-0.09	-0.18	-0.59	-0.88	-0.65	-0.12	+4.30
	+ 10%	-0.04	-0.09	-0.29	-0.44	-0.33	-0.06	+2.19
	- 20%	+0.06	+0.20	+0.59	+0.86	+0.64	+0.12	-4.63
	- 10%	+0.04	+0.10	+0.29	+0.43	+0.32	+0.06	-2.27

TABLE 5b

EFFECTS OF DIFFERENT ALLOCATIONS OF THE TAC ON REVENUES TO THE
INDIVIDUAL COUNTRIES OF THE COMMUNITY

Medium Term TAC : 200,000 tonnes

	Expected Revenue Changes, x 10 ⁶ individual currencies						
	E.E.C.	U.K.	B.	F.	NL	W.G.	DK
	£	£	B.F.	F.F.	H.F.L.	D.M.	Kr.
<u>Basic Allocation</u>	41.44	12.66	42.32	55.93	50.76	8.97	84.68
<u>Catch change</u>							
<u>U.K.</u>							
+ 20%	-0.33	+1.08	-2.07	-1.46	-3.25	-0.50	-3.57
+ 10%	-0.13	+0.57	-1.03	-0.71	-1.62	-0.25	-1.78
- 20%	+0.03	-1.34	+2.01	+1.30	+3.23	+0.50	+3.48
- 10%	+0.05	-0.63	+1.01	+0.67	+1.61	+0.25	+1.75
<u>F.</u>							
+ 20%	-0.49	-0.22	-1.09	+3.48	-1.72	-0.26	-1.88
+ 10%	-0.23	-0.11	-0.54	+1.90	-0.86	-0.13	-0.94
- 20%	+0.32	+0.21	+1.07	-4.89	+1.71	+0.26	+1.85
- 10%	+0.18	+0.11	+0.53	-2.25	+0.85	+0.13	+0.93
<u>NL</u>							
+ 20%	+0.89	-0.54	-2.66	-1.90	+9.67	-0.64	-4.67
+ 10%	+0.46	-0.26	-1.32	-0.92	+4.84	-0.32	-2.28
- 20%	-1.01	+0.49	+2.57	+1.65	-9.76	+0.64	+4.46
- 10%	-0.49	+0.25	+1.29	+0.86	-4.87	+0.32	+2.25
<u>DK</u>							
+ 20%	-0.20	-0.31	-1.55	-1.08	-2.43	-0.37	+10.21
+ 10%	-0.09	-0.15	-0.77	-0.53	-1.22	-0.19	+ 5.19
- 20%	+0.09	+0.29	+1.51	+0.99	+2.42	+0.37	-11.01
- 10%	+0.06	+0.15	+0.76	+0.51	+1.21	+0.19	- 5.39

TABLE 5 c

EFFECTS OF DIFFERENT ALLOCATIONS OF THE TAC ON REVENUES TO THE
INDIVIDUAL COUNTRIES OF THE COMMUNITY

Long Term TAC : 500,000 tonnes

	Expected Revenue Changes, x 10 ⁶ individual currencies						
	E.E.C.	U.K.	B.	F.	NL	W.G.	DK
<u>Basic Allocation</u>	£ 71.34	£ 16.42	B.F. 78.80	F.F. 59.09	H.F.L. 121.88	D.M. 18.98	Kr. 150.03
<u>Catch change</u>							
<u>U.K.</u>							
+ 20%	-2.88	-0.35	-3.35	+1.73	-7.77	-1.02	-6.32
+ 10%	-1.35	-0.10	-1.66	+0.91	-3.88	-0.51	-3.14
- 20%	+2.14	-0.31	+3.23	-2.13	+7.75	+1.01	+6.17
- 10%	+1.17	-0.06	+1.63	-1.02	+3.88	+0.51	+3.10
<u>F.</u>							
+ 20%	-2.26	0.00	-1.76	-7.47	-4.11	-0.54	-3.33
+ 10%	-1.08	0.00	-0.87	-3.33	-2.06	-0.26	-1.66
- 20%	+1.84	-0.01	+1.73	+3.91	+4.10	+0.54	+3.28
- 10%	+0.98	0.00	+0.87	+2.44	+2.05	+0.27	+1.65
<u>NL</u>							
+ 20%	+4.49	-0.04	-4.34	+2.15	+23.18	-1.31	-8.16
+ 10%	+2.28	0.00	-2.14	+1.16	+11.61	-0.65	-4.05
- 20%	-4.77	-0.07	+4.13	-2.81	-23.40	+1.30	+7.90
- 10%	-2.35	-0.02	+2.09	-1.33	-11.67	+0.65	+3.98
<u>DK</u>							
+ 20%	+0.17	-0.01	-2.50	+1.34	-5.83	-0.76	+18.08
+ 10%	+0.11	0.00	-1.24	+0.69	-2.91	-0.38	+ 9.20
- 20%	-0.37	-0.03	+2.43	-1.56	+5.81	+0.76	-19.98
- 10%	-0.16	+0.01	+1.23	-0.76	+2.91	+0.38	- 9.55

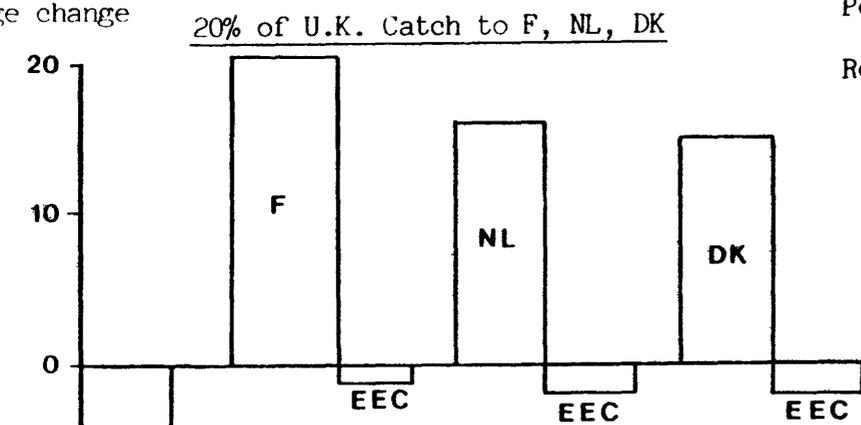
Figure 6

THE EFFECTS OF DIFFERENT BILATERAL SUBSTITUTIONS OF THE CATCH ON
THE COUNTRIES CONCERNED AND ON THE COMMUNITY REVENUE.

The histograms indicate the effect in percentage terms on the revenue to the countries involved in the substitution, and the gross effect on Community revenue.

Figure 6a Short Term TAC : 50,000 tonnes

Percentage change
in
Revenue



Percentage change
in
Revenue

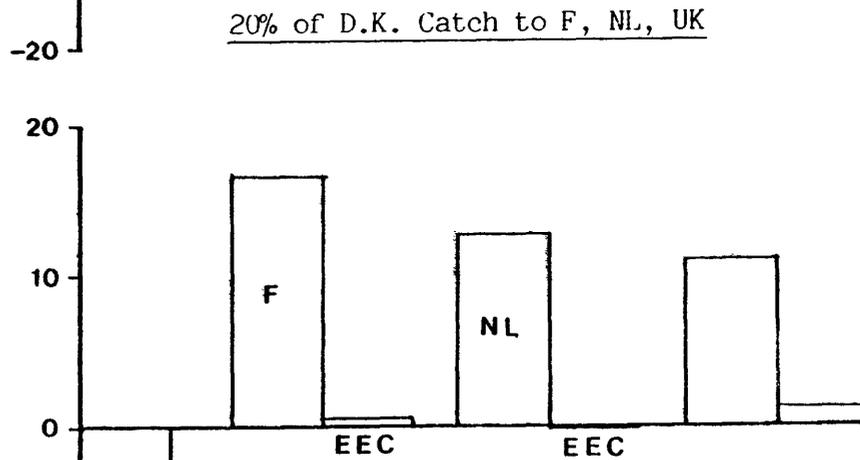
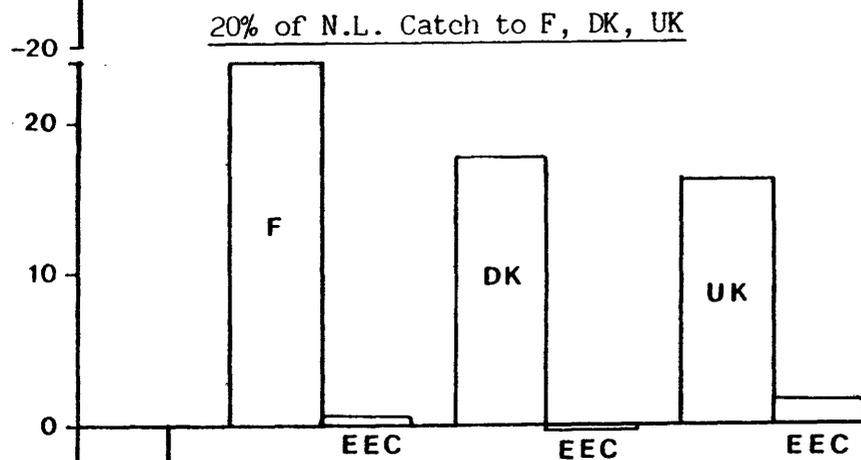
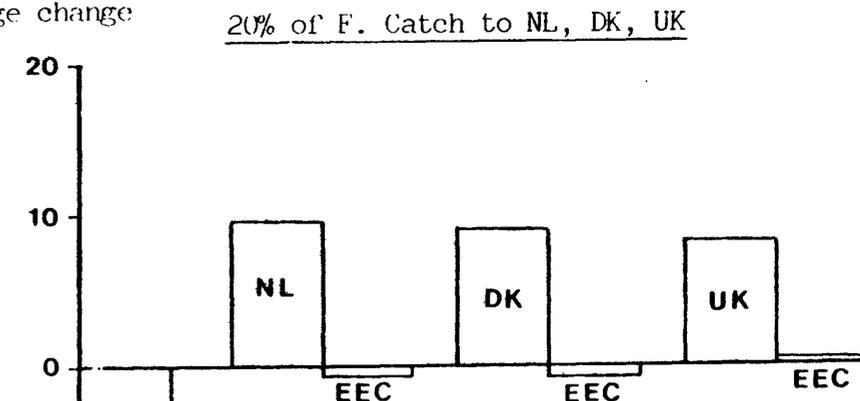
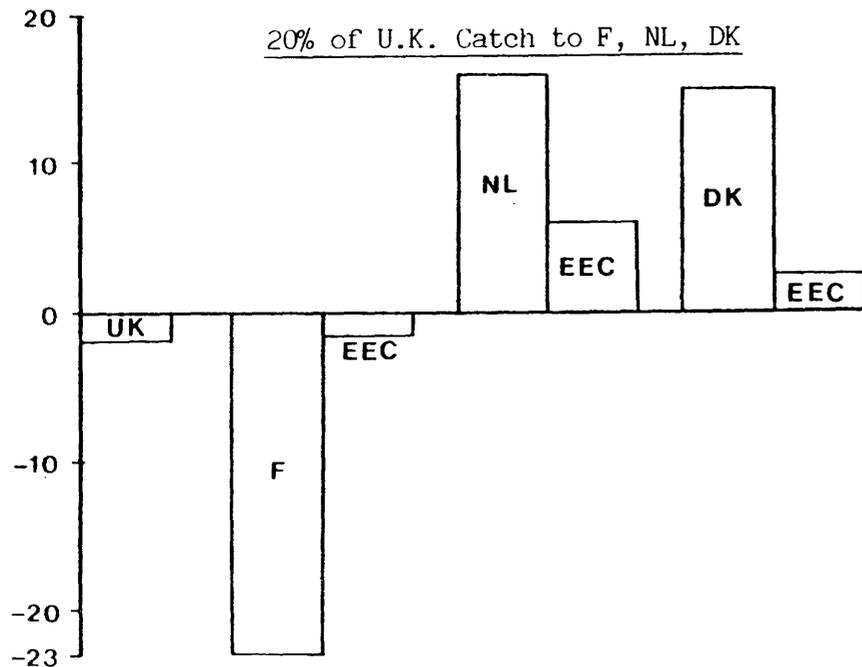


Figure 6c Long Term TAC : 500,000 tonnes

Percentage change
in
Revenue



Percentage change
in
Revenue

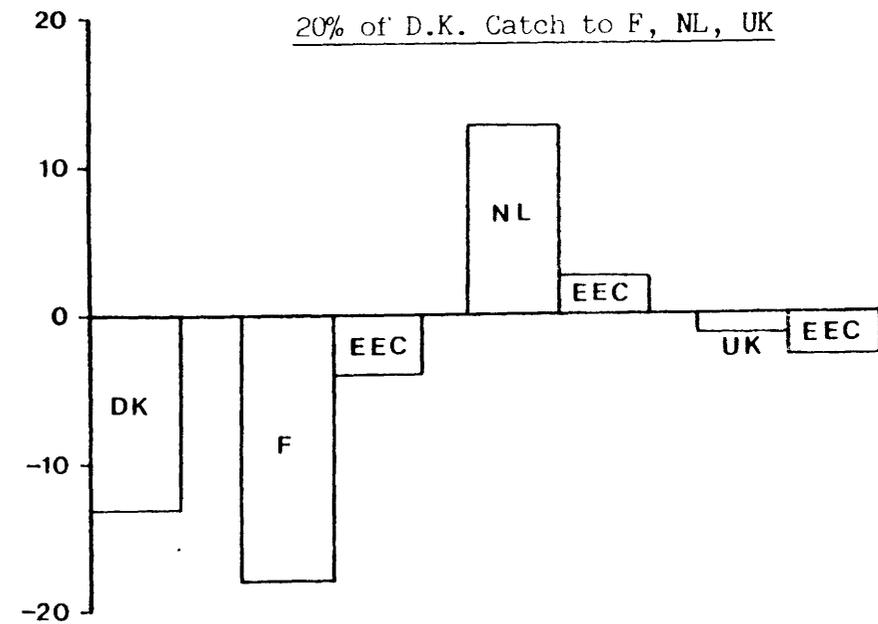
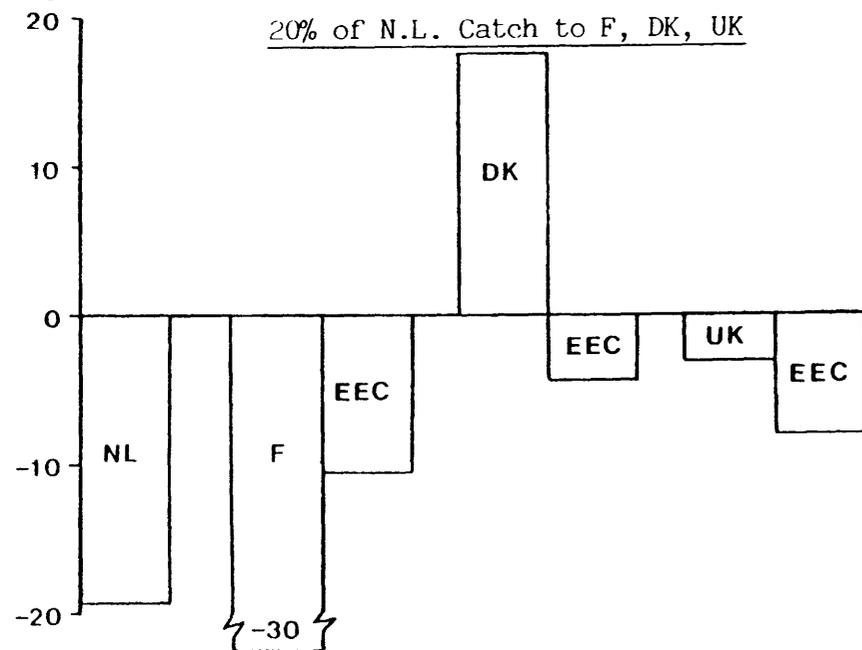
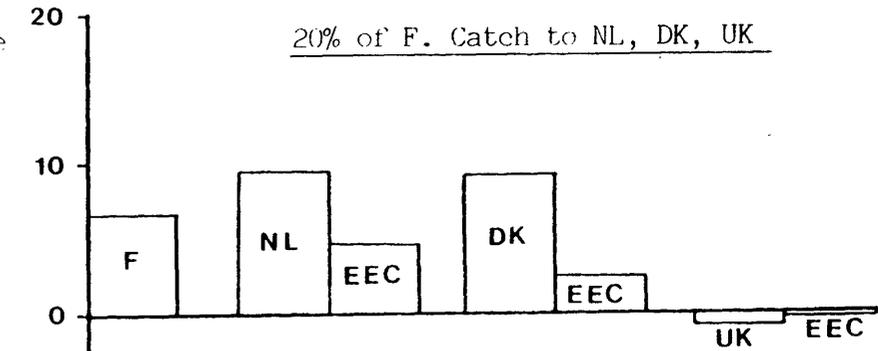
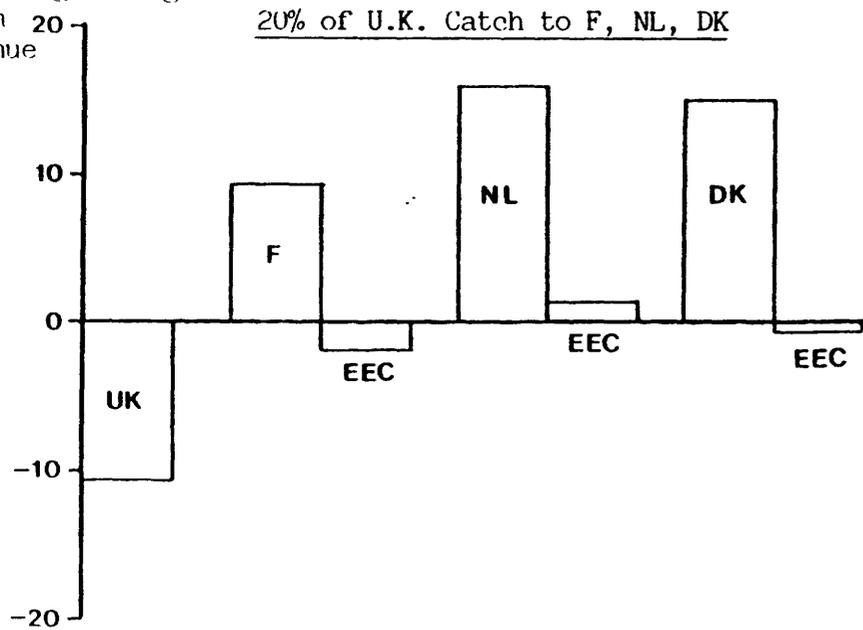
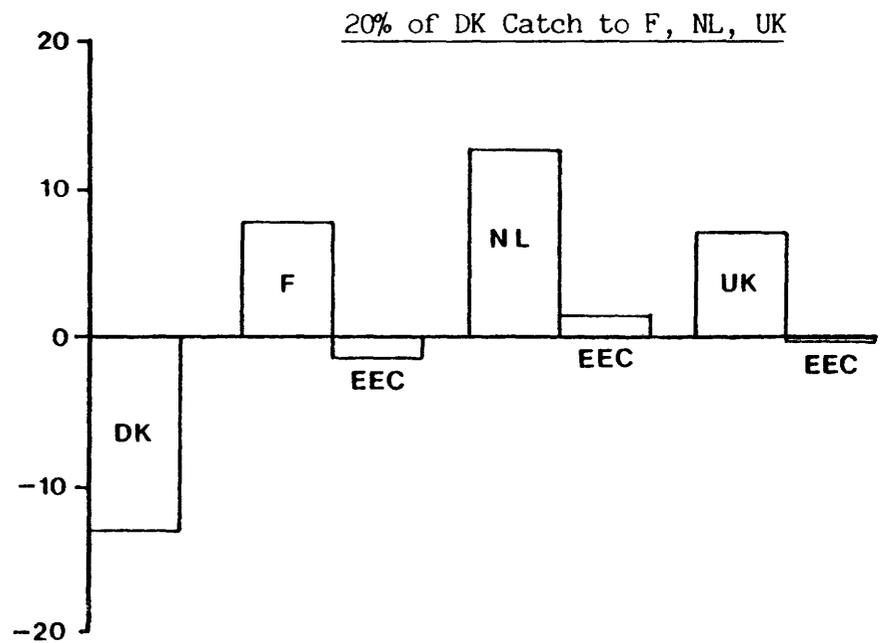
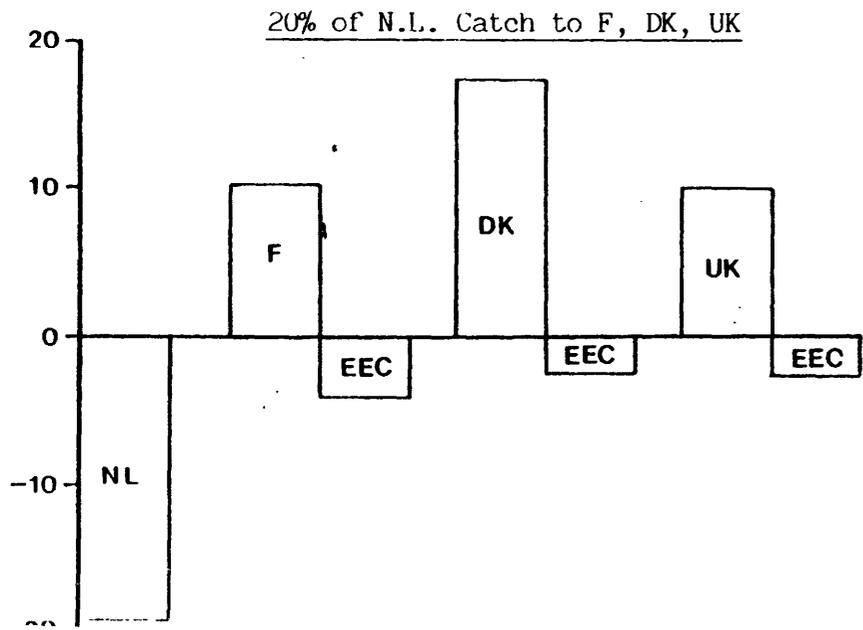
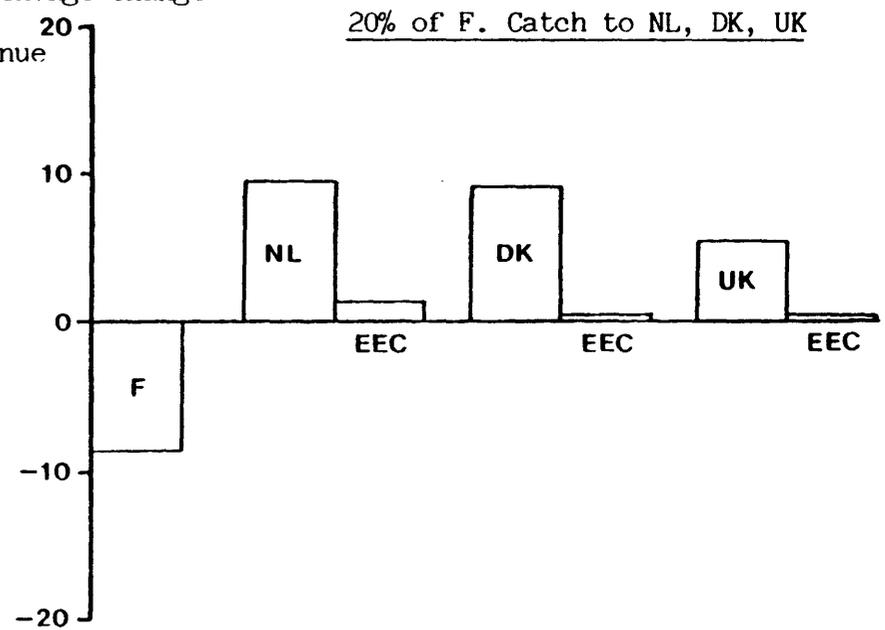


Figure 6b Medium Term TAC : 200,000 tonnes

Percentage change
in Revenue



Percentage change
in Revenue



residuals derived from the simple demand models indicated that the average price of imports of herring of all types was the most highly correlated variable. The quantity of imports did not appear to be at all important in determining the auction price.

A simple two variable least squares technique was used to fit a number of alternative models. Details of this procedure are given in Appendix III. Results are given in Table 6.

The coefficient of determination is in excess of 90% in both cases of the model of best fit and inspection of the residuals derived from this procedure indicated no remaining obvious trends. What is not clear is whether we have correctly identified a causal relationship, for it is clearly possible that the import price may be determined by the price of domestic landings. What seems likely is that recently, at low levels of domestic landings the import price has affected landing price, while at higher landings either the reverse was true or they were largely independent.

Currently it would appear that the mechanism by which the import price determines the auction price is that buyers negotiate import prices in advance and hence have a knowledge of the cost of alternatives prior to bidding for the herring landed.

RELATIONSHIP BETWEEN THE MODELS

It is unfortunate that data were not readily available on imports for the other countries given the strength of the relationship. However, recognising this constraint it is important to investigate the likely distortion caused by using the simple models. In Figures 7 & 8, the relationship between the simple model and the family of curves generated by the more complex model is illustrated. Although there are clearly going to be differences depending on import price, the use of the simple model for assessing harvesting strategies is unlikely to mislead badly. High import prices will tend to make the simple predictions somewhat pessimistic particularly at high quantity levels. But at these high quantity levels it seems likely that the price of imports will tend not to determine auction price, but are more likely to be determined by the auction price. The reason is that domestic demand will probably be

Table 6

BEST FIT DEMAND MODELS FOR U.K. AND DENMARK INCLUDING THE EFFECT OF IMPORT PRICE

UNITED KINGDOM

$$\text{Model : } P = a + b \ln Q + c \ln P_I$$

Coefficient of Determination	Parameter Estimates	Degrees of Freedom	F-values: Model Parameter a Parameter b Parameter c	Probability of exceeding F
0.91	a= 677.46 b= -73.88 c= 53.29	2,11	54.14 8.74 29.92 9.29	$< 10^{-4}$ 0.013 $< 10^{-3}$ 0.011

DENMARK

$$\text{Model : } \ln P = \ln a + b \ln Q + c P_I$$

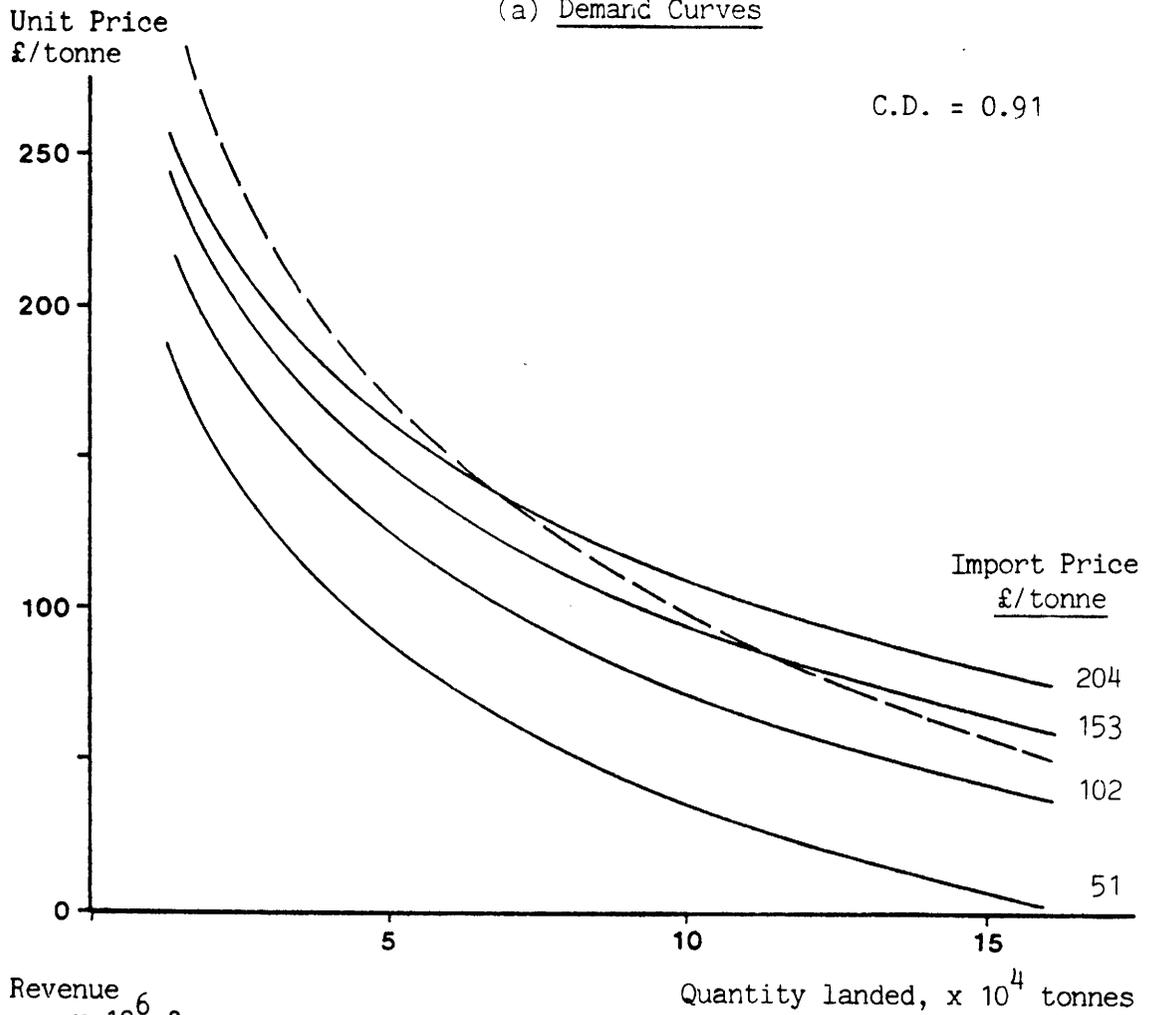
Coefficient of Determination	Parameter Estimates	Degrees of Freedom	F-values: Model Parameter a Parameter b Parameter c	Probability of exceeding F
0.92	$\ln a = 9.95$ $b = -0.32$ $c = 4.18 \times 10^{-4}$	2,11	59.09 354.25 60.63 19.31	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$ 0.001

Figures 7 and 8

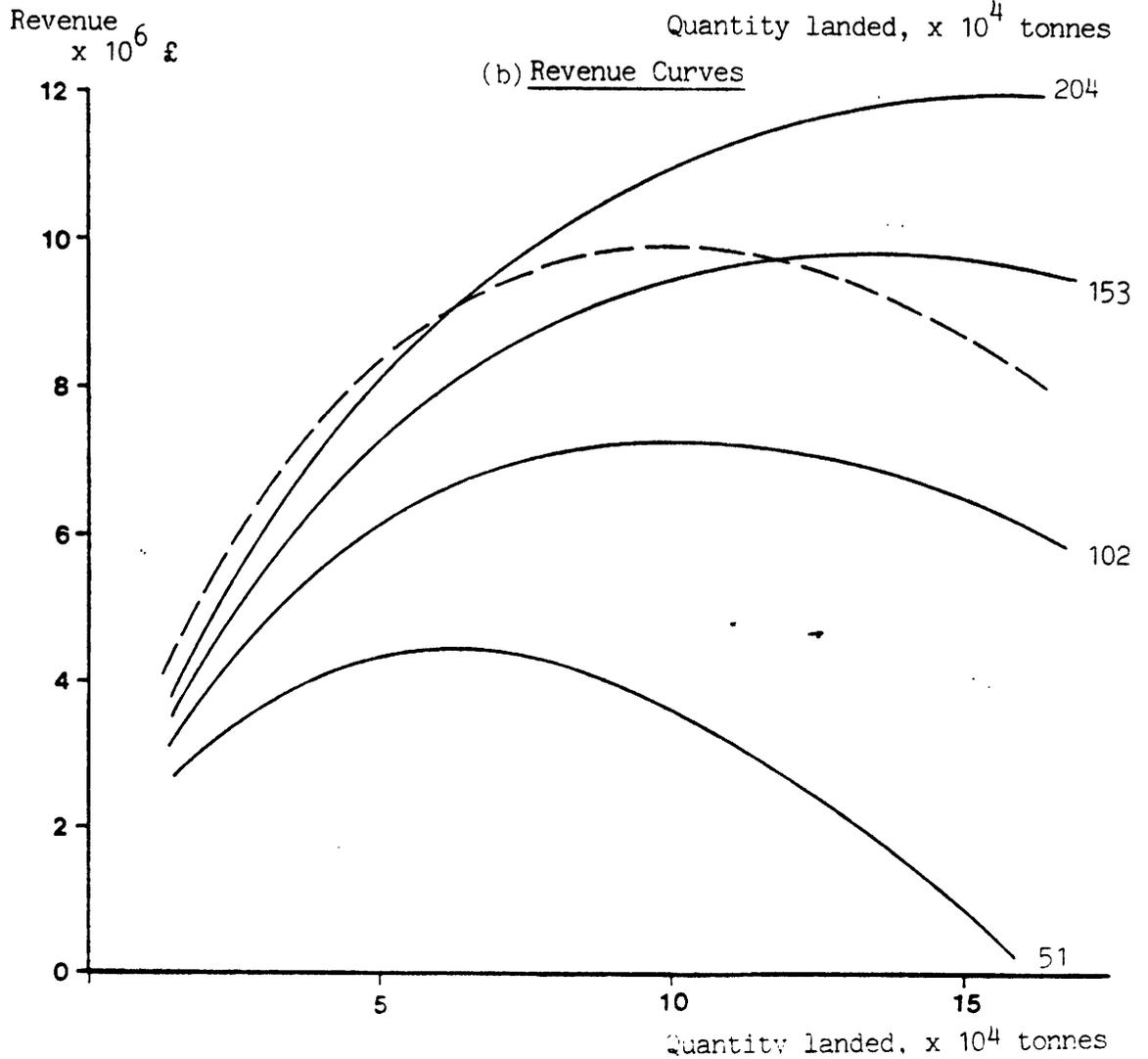
THE RELATIONSHIP BETWEEN THE DEMAND SURFACE DEFINED BY THE MODEL
USING IMPORT PRICE AND QUANTITY LANDED FOR THE UNITED KINGDOM AND
DENMARK AND THE SIMPLE DEMAND CURVE.

The contours of equal import price are given as solid lines, the
simple demand curve as a dashed line, 1975 prices.

(a) Demand Curves



(b) Revenue Curves

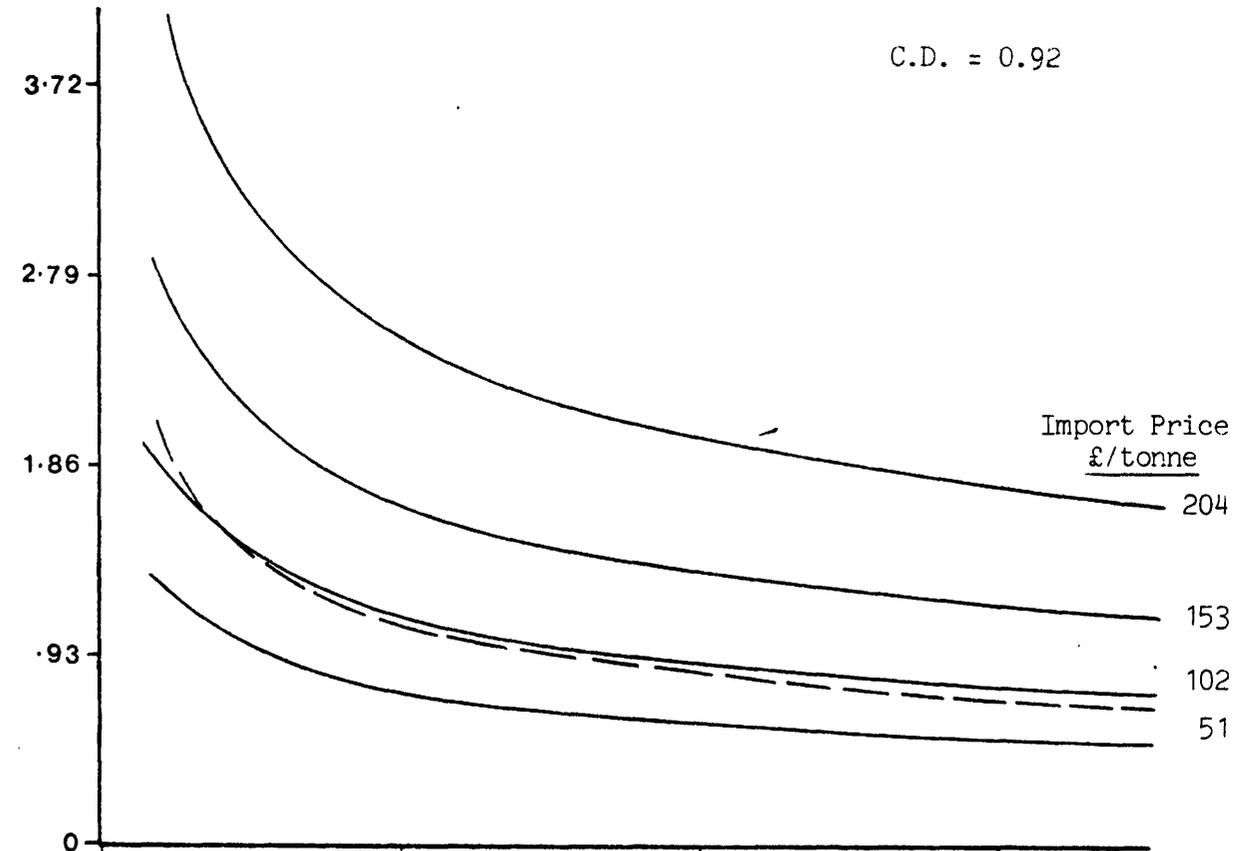


DENMARK

Unit Price
 $\times 10^3$ Kr/tonne

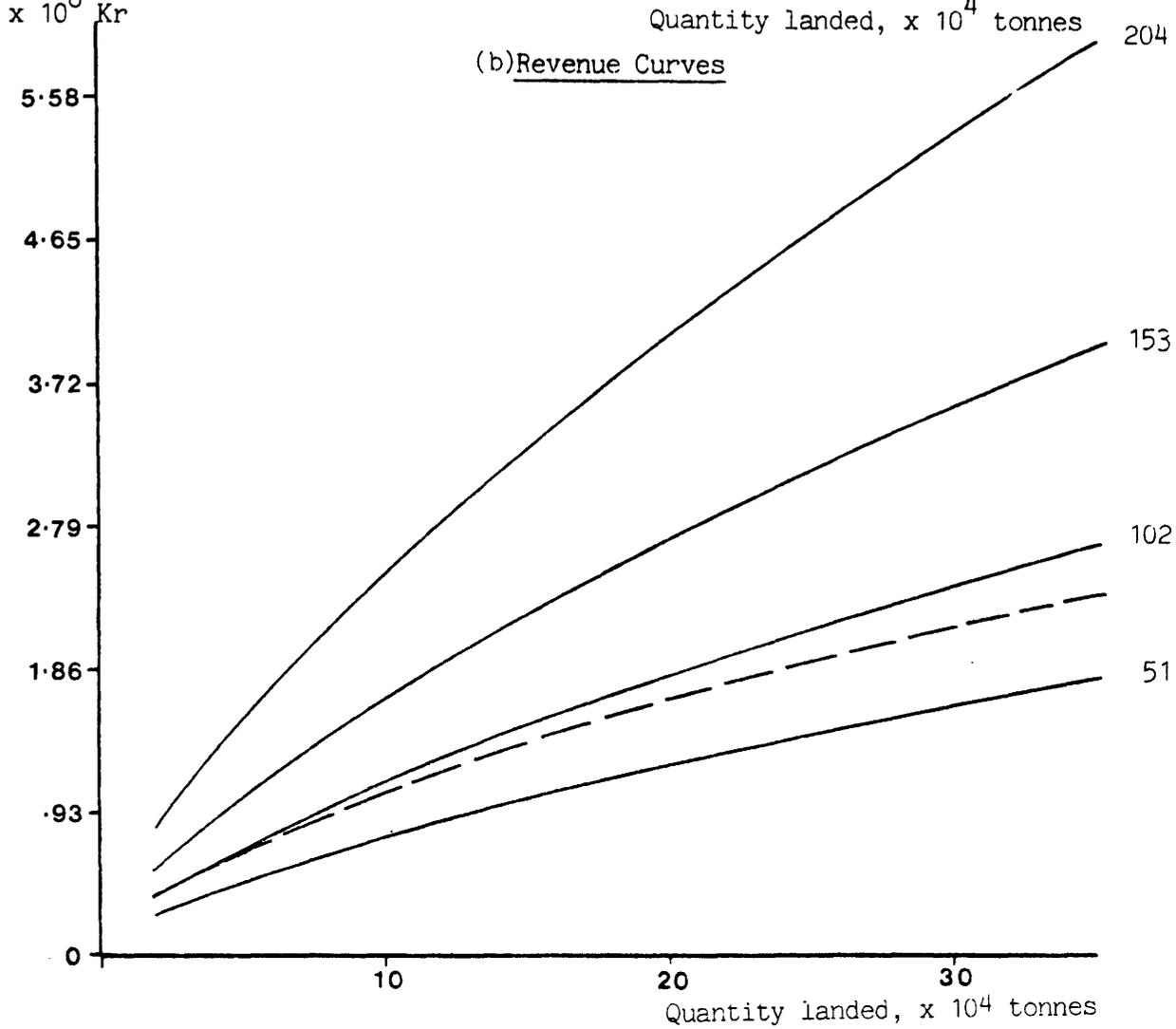
(a) Demand Curves

C.D. = 0.92



Revenue
 $\times 10^8$ Kr

(b) Revenue Curves



satisfied largely by domestic landings at these high quantities. In the short term however, it seems likely that import prices will play a significant role in determining auction price. The extent of this role may be observed for different levels of import price in Figures 7 & 8. For the United Kingdom the current price of imported herring (adjusted to 1975 prices) is around £170, indicating that expected prices derived from the simple demand curve will be optimistic for landings up to about 75,000 tons. Accordingly, for relatively small landings there is likely to be a slight bias. By contrast for Denmark where the most recent import price available is around £219 per ton (1975 prices) the simple demand is very close to that expected from this price for imports. Here the distortion is negligible. These analyses, coupled with the observation that in quality terms Canadian herring is believed to be inferior indicate that the use of the simple demand models is unlikely to produce serious distortion.

FLEET COMPOSITION AND SIZE FOR THE REOPENED FISHERY

The history of the herring Fishery in the North Sea has been a long one, but the period up to the closure of 1977 has shown the most dramatic trends. Figure 9 illustrates the catches by different countries in this period. It can be readily seen from these Figures that the composition of the Fishery by country has been changing markedly.

In parallel to this change there has been a significant change in the composition of the fleet with a major increase in the use of purse seiners. The extent of such changes, of course, differs by country and the pattern described has exceptions. Nevertheless, there is a need in any of the calculations concerning fleet size to allow for the different vessel types and their efficiencies. Table 7 gives a breakdown by size of the recent composition of the fleets of the countries involved, from which herring fishery operations would be taken.

The central question that is posed in this section is: what is the fishing effort required to catch various levels of TAC? In order to answer this question, it is clearly not necessary to calibrate effort with the care and precision needed for estimating mortality rates for stock assessment purposes. This is fortunate as the calibration of effort in a shoaling species such as herring is a difficult process. Nevertheless, the same general problems that one encounters in more rigorous analysis of effort are also present here. These are, firstly, a need to assess changes in efficiency with time of boats of various categories; secondly, a need to assess the relationship between catch rates and stock size.

THE EFFECT OF VESSEL TYPE AND EFFICIENCY CHANGES OVER TIME

Data were available in the publications of the Herring Industry Board on the catch rates of typical types of vessels operating from ports in the Eastern U.K. on the North Sea fishing grounds. These are presented in Table 8. All of the figures indicate an increase in the catch rate per week up to the early 1970's, followed by a decrease. This is a particularly pronounced phenomenon in the purse seiner data.

Figure 9(a)

HISTORY OF HERRING CATCH SINCE 1956 IN THE UNITED KINGDOM, WEST GERMANY, FRANCE AND NETHERLANDS.

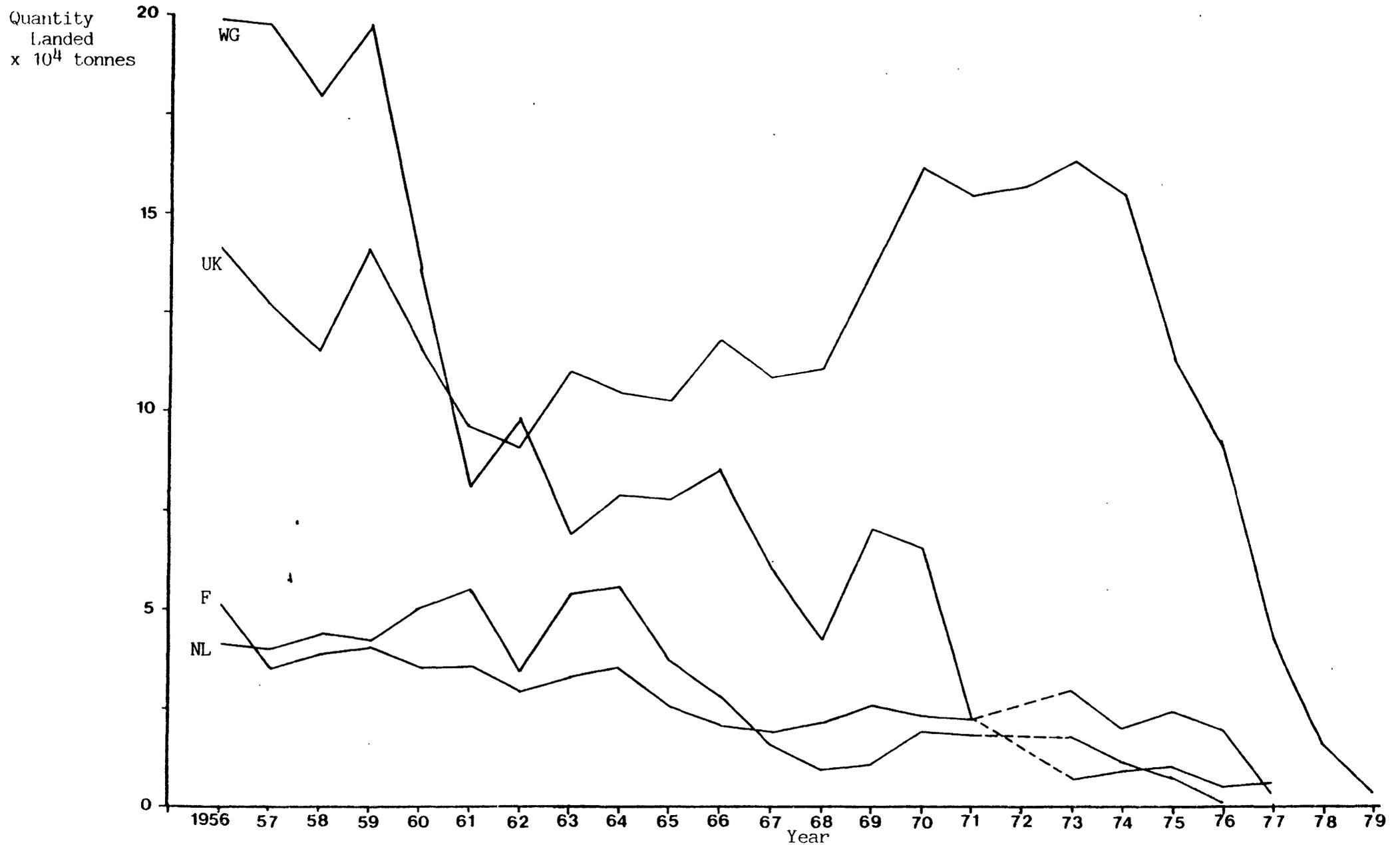


Figure 9(b)

HISTORY OF HERRING CATCH SINCE 1956 IN NORWAY, DENMARK AND BELGIUM.

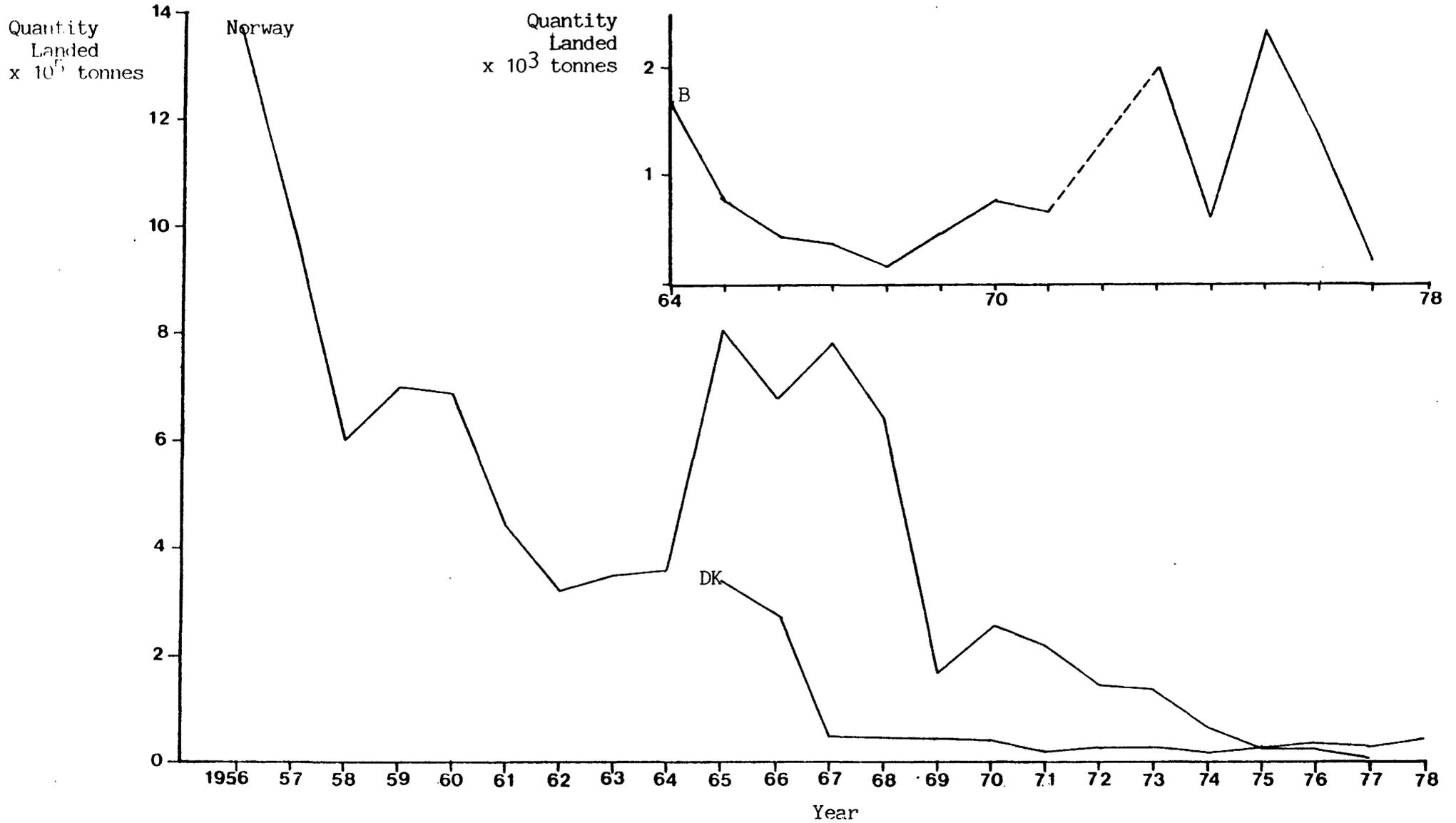


TABLE 7

DISTRIBUTION OF FISHING VESSELS 100 GRT AND OVER IN 1978

	<u>100-499</u>		<u>GROSS TONNAGE GROUPS</u>				<u>2000 +</u>		<u>Total</u>	
	<u>'000</u>		<u>'000</u>		<u>'000</u>		<u>'000</u>		<u>'000</u>	
	<u>No.</u>	<u>GRT</u>	<u>No.</u>	<u>GRT</u>	<u>No.</u>	<u>GRT</u>	<u>No.</u>	<u>GRT</u>	<u>No.</u>	<u>GRT</u>
Belgium	81	12.2	1	.6	-	-	-	-	82	12.8
Denmark	364	64.9	12	8.4	1	1.5	-	-	377	74.8
France	448	92.4	71	46.4	19	27.2	5	12.3	543	178.3
G.F.R.	80	13.3	39	34.7	8	12.7	25	72.8	152	133.5
Netherlands	365	77.3	10	6.3	2	3.4	-	-	377	87.2
Norway	586	148.9	89	59.2	10	13.0	-	-	685	221.1
U.K.	434	94.1	58	41.1	36	46.7	-	-	528	181.9

Source: Table 2 in Scott (1979).

TABLE 8

CATCH RATES OF HERRING BY TRAWLERS AND PURSE SEINERS FROM SOME PRINCIPAL EAST COAST FISHING PORTS

Year	Catch Rate in tonnes/vessel/week					
	North Shields	TRAWLERS			PURSE SEINERS	
		Lerwick	Fraserborough & Peterhead	Aberdeen	Lerwick	Fraserborough & Peterhead
1977	-	32.1	21.9	-	66.2	131.2
1976	22.2	-	26.7	29.8	45.6	43.7
1975	20.9	16.6	19.7	14.5	46.9	42.2
1974	36.8	-	49.4	43.9	63.3	30.0
1973	39.2	19.4	-	27.0	65.6	63.9
1972	3.0	-	23.0	-	75.4	56.9
1971	21.1	22.8	34.0	-	98.2	68.0
1970	26.5	-	20.6	-	63.3	46.1
1969	12.3	22.3	22.9	55.1	37.2	31.2
1968	12.9	10.5	8.4	-	23.0	24.1
1967	22.6	15.2	17.0	-	23.5	30.4
1966	9.4	-	-	-	44.9	37.0

Source: Herring Industry Board Annual Reports. 1966-1978.

These data were then plotted against estimates of North Sea herring stock size taken from Beddington and Grenfell (1980). Typical results are illustrated in Figures 10a and 10b. The pattern illustrated indicates that at low stock sizes there is an apparent fall in the catch rate; however, for the larger stock sizes there is an actual decrease in the catch rate with stock size. Using the simple model:

$$C_t = q_t E_t N_t$$

where for year t , C_t is catch, q_t catchability, E_t effort and N_t stock size, a simple plot of the ratio $C_t / E_t N_t$ against time will illuminate any change in efficiency. The results illustrated in Figures 11a and 11b are striking. The catchability coefficient increases massively. Accordingly, an attempt to assess the exact relationship between catch rates and stock size is plagued with difficulties. A general summary of the position would be that only at very low stock sizes is there likely to be an effect of stock size on catch rates. For higher stock sizes the expected rates from the highest catchability coefficients observed would almost certainly produce an exaggerated picture of efficiency as weekly catch rates will be limited by other processes than fishing. These handling times produce a non-linear relationship between catch rate and stock size which is most pronounced at the higher stock sizes. (Beddington 1979). With the increased efficiency which is reflected in the catchability coefficients, it seems likely that maximum catch rates will be independent of stock size for any, but the lowest of stock sizes: 400,000 tons or below. We have therefore used estimates of maximum weekly catch rates to produce answers to the question: what is the fleet size required to take a given catch?

FLEET SIZE AND COMPOSITION

Although the data considered in the previous section only involve the distinction between trawlers and purse seiners, some further discrimination is desirable. Accordingly, as it had been decided to use the maximal catch rate as a rough estimate of fishing power, it became possible to use less detailed data. In Table 9 we present the range of catch rates derived from a number of sources including the Herring Industry Board and the Department of Agriculture, Food and Fisheries for Scotland. The classification into small and large categories of vessel

Figure 10

THE RELATIONSHIP BETWEEN CATCH RATE AND STOCK BIOMASS.

- (a) Trawlers : North Shields and Lerwick
- (b) Purse Seiners : Fraserborough and Peterhead
and Lerwick.

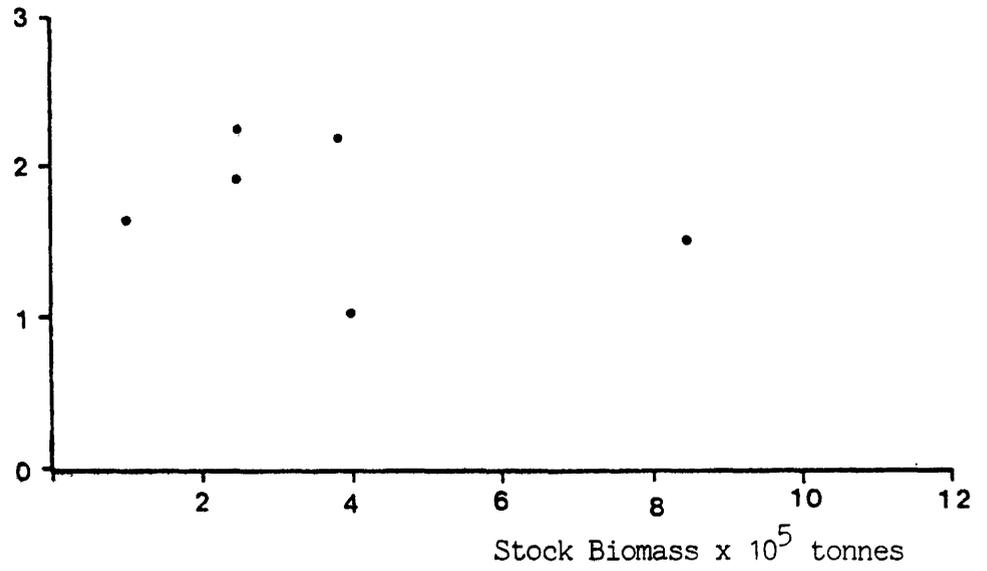
Biomass estimates have been taken from Beddington and Grenfell (1980) using a V.P.A. with mortality rate of 2. Catch rates are from the Herring Industry Board.

Figure 10

(a) Trawlers

Catch Rate
x 10 tonnes/vessel/week

Lerwick



Catch Rate
x 10 tonnes/vessel/week

North Shields

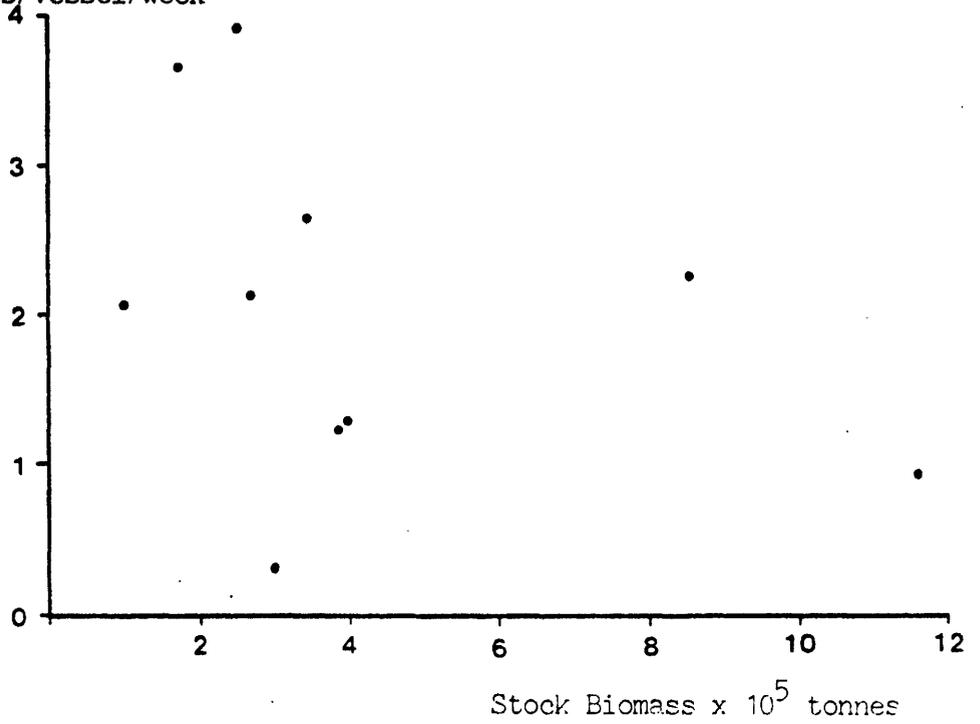


Figure 10

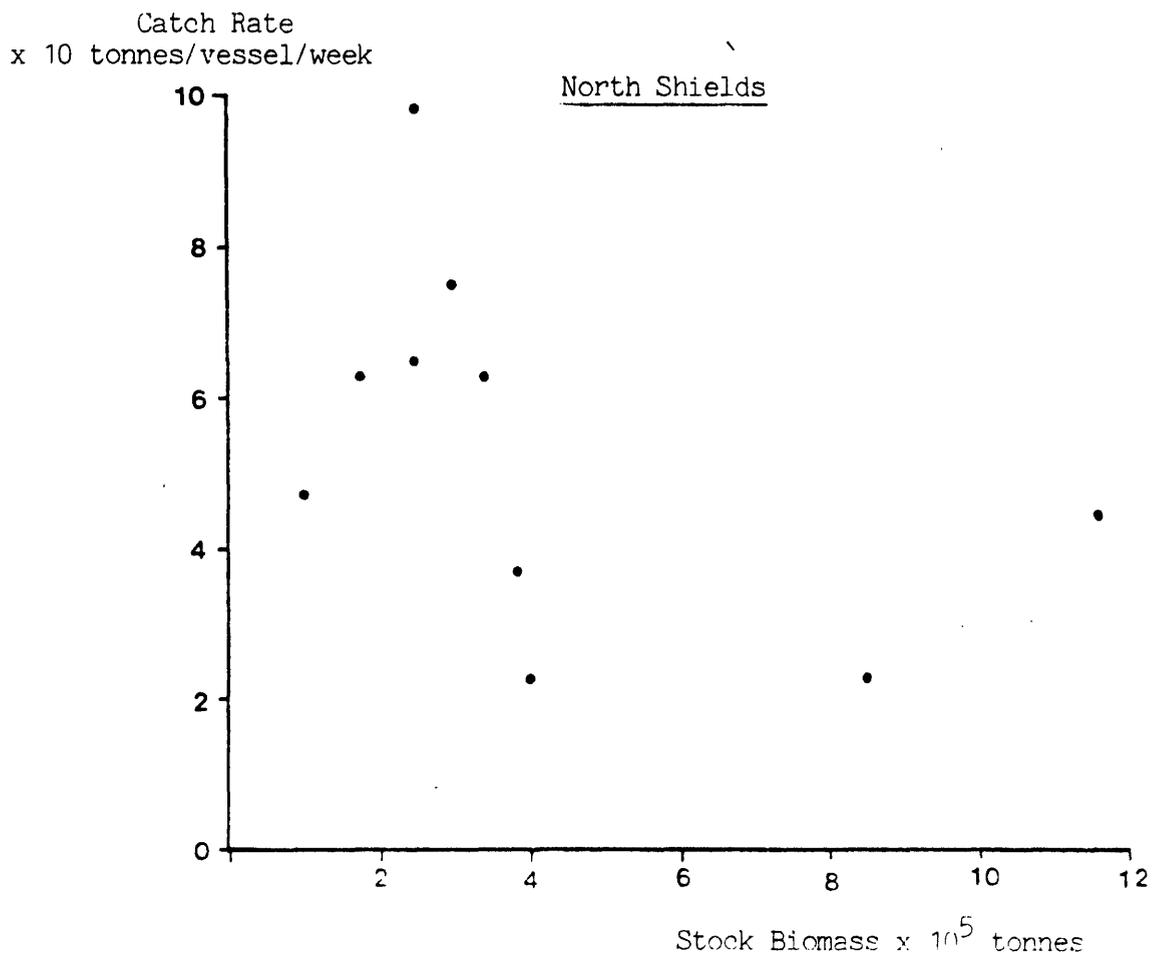
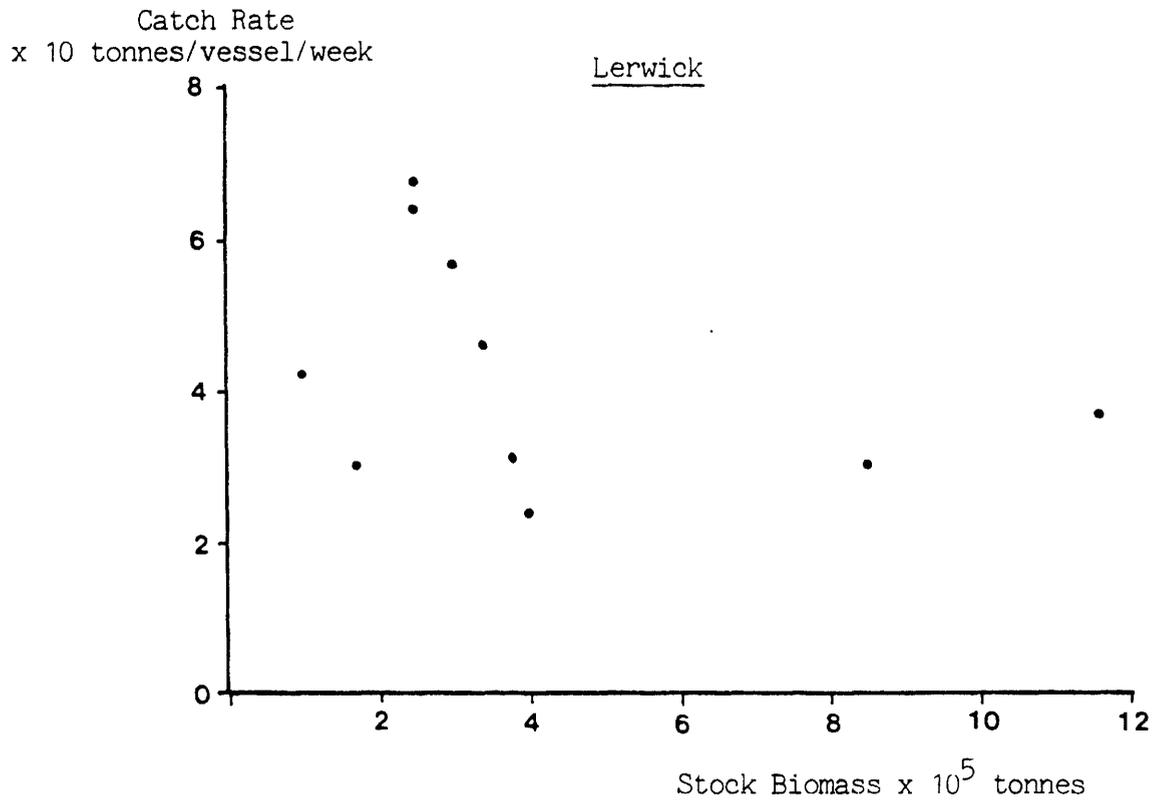
(b) Purse Seiners

Figure 11

CHANGES IN CATCHABILITY COEFFICIENT WITH TIME

(a) TRAWLERS : NORTH SHIELDS AND LERWICK

(b) PURSE SEINERS : FRASERBOROUGH AND PETERHEAD
AND LERWICK.

The catchability coefficient has been calculated using the simple linear model of equation : $C_t = q_t E_t N_t$.

Data sources as in Figure 10.

Figure 11

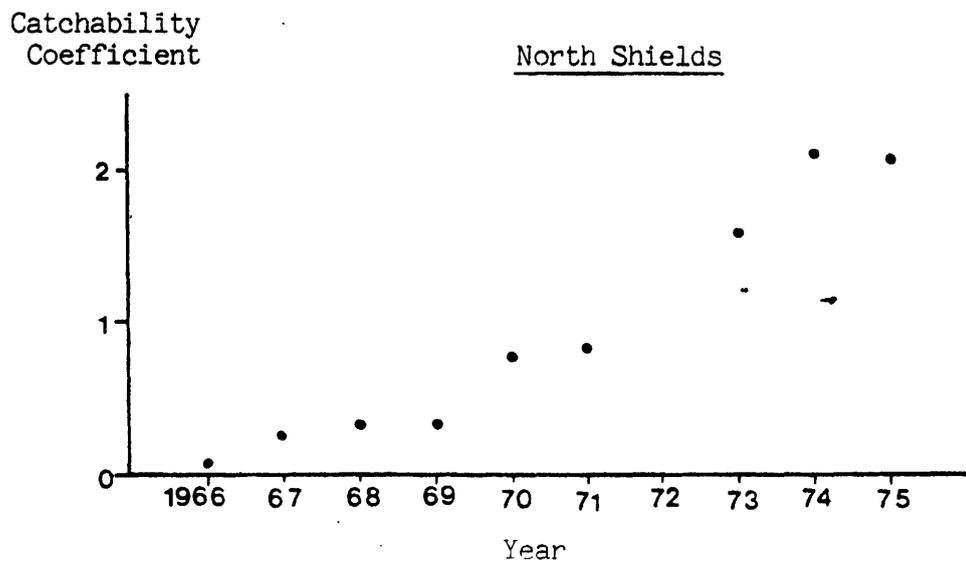
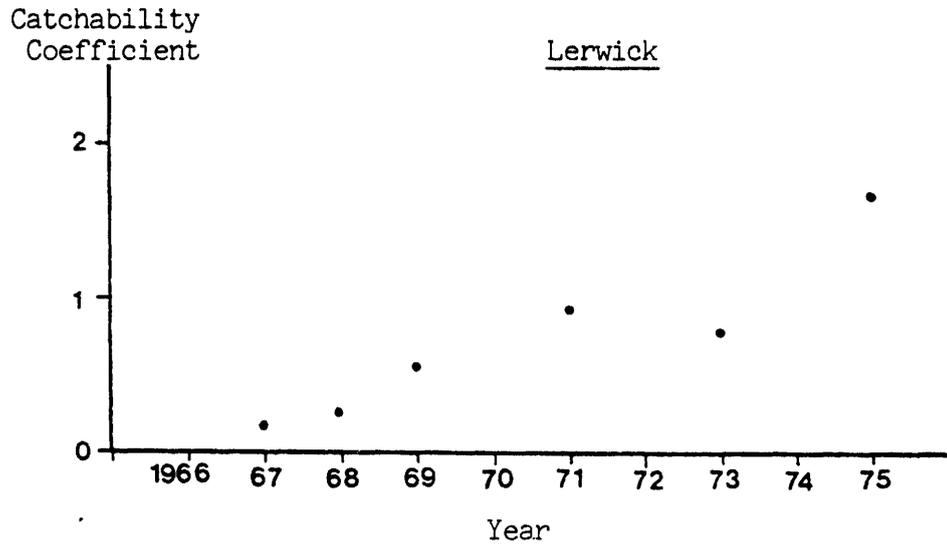
(a) Trawlers

Figure 11

(b) Purse Seiners

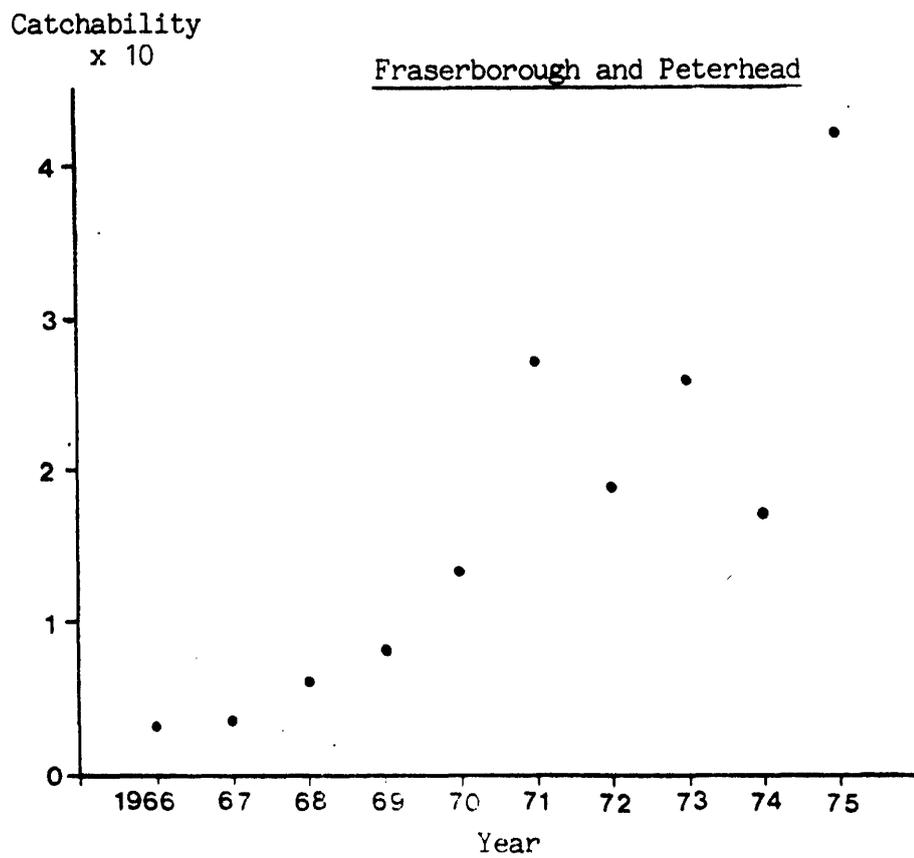
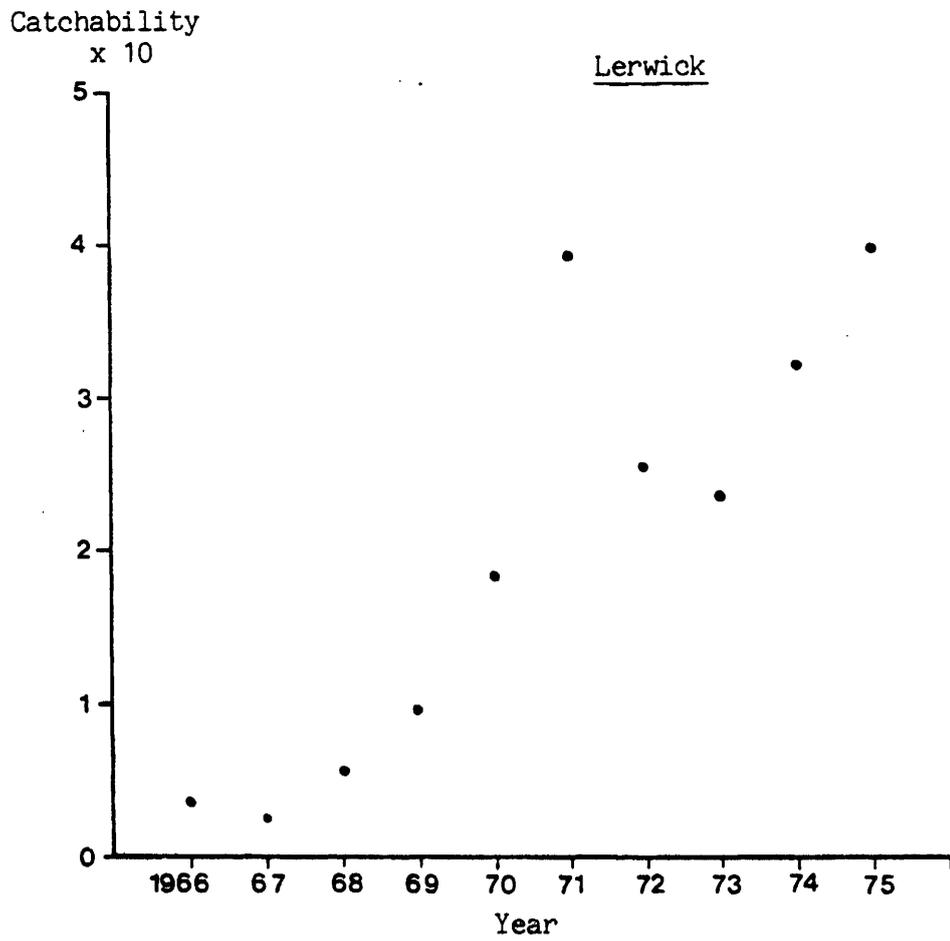


TABLE 9

ASSUMED MINIMUM AND MAXIMUM CATCH RATES FOR DIFFERENT VESSEL TYPES, TONNES/DAY.

	TRAWLERS		PURSE SEINERS	
	40 - 70 Ft.	70 - 80 Ft.	Small	Large
Maximum	18	27	40	49
Minimum	9	13	20	25

TABLE 10

NUMBER OF VESSEL DAYS REQUIRED TO TAKE HERRING CATCH WITH A FLEET CONSISTING OF TRAWLERS OR PURSE SEINERS, USING THE DIFFERENT CATCH RATES AS SHOWN IN TABLE 9.

Total Allowable Catch	Catch Rate	TRAWLERS		PURSE SEINERS	
		40 - 70 Ft.	70 - 80 Ft.	Small	Large
Tonnes					
50,000	Max.	2778	1852	1250	1020
	Min.	5556	3846	2500	2000
100,000	Max.	5556	3704	2500	2041
	Min.	11111	7692	5000	4000
200,000	Max.	11111	7407	5000	4082
	Min.	22222	15385	10000	8000
500,000	Max.	27778	18519	12500	10204
	Min.	55556	38462	25000	20000

enables some further refinement of cost calculations, which are considered below. The maximum catch rates taken are mainly derived from recent catch rates on mackerel. Minimum rates are derived from the Herring Industry Board data with an assumed $4\frac{1}{2}$ day week.

The figures of Table 9 are then used to calculate the number of fishing boat days required to land a number of catch levels. These calculations have been made on the assumption that the fleet consists entirely of vessels of a given type, but it is an obvious generalisation to consider for different fleet compositions the number of fishing days required to take the TAC. The results of these calculations are given in Table 10. One caveat that should be borne in mind is that the lower catch level associated presumably with the short-term development of the Fishery and relatively low stock sizes will tend to require a fishing power nearer the higher end of the range. This is a consequence of the slight effect on catch rates of stock size at low stock levels.

It is clear from these calculations that, for the short and medium-term, current fleet sizes within the Community are adequate to take the allowable catch. A build-up in the long-term to levels of around 500,000 tons may require some investment. Both this possibility and, indeed, the possibility that fishing will occur in the short or medium-term depends on its economic attractiveness. This is the subject of the next section.

COSTS OF OPERATING THE HERRING FISHERY

In this section we attempt to estimate for different classes of vessel the daily cost of fishing for herring. Cost data are notoriously difficult to obtain for fishing operations and such data that are available are usually constrained by the need for confidentiality. This often means that they are presented in conglomerate form with little meaningful sub-division. The scope of the study did not permit extensive investigation of unpublished material and it was necessary to confine searches to the possible United Kingdom sources. Any extrapolation to the other countries within the Community must therefore be surrounded with qualifications, for costs are almost certain to vary somewhat. In the United Kingdom data we were fortunate to obtain some rather detailed analyses of the running costs of a sample of United Kingdom small vessels, but even here have been forced to make some assumptions about capital costs. Similarly only rather anecdotal information was obtained on purse seiners. To indicate the degree of uncertainty of our analyses we have presented them on a range of different cost levels.

RUNNING COSTS

Some typical data available on vessels of different size groups in different years are presented in Tables 11 and 12. Using these data it has been possible to obtain estimates of the average running costs of different types of vessels in the period 1977-1979. These are presented in Table 13. Unsurprisingly, the effect of boat size on running costs is marked and this immediately presents a problem as a priori it is not possible to determine the probable size composition of the herring fleet although it is likely that very small boats will not be included. For the purpose of subsequent profitability calculations we have made an arbitrary grouping of vessel sizes and calculated weighted averages of the running costs of vessels in the range 40'-70' and 70'-80'. These are presented in Table 14. The increase in running costs over time is notable, but oddly enough when deflated to allow for inflation is negligible. Indeed both categories show a decline in real prices in 1979. We were unable to obtain any detailed information on the running costs of purse seiners. The assumptions we make are that a large purse seiner

TABLE 11

TYPICAL DATA SET ON 1979 COST BREAKDOWN BY VESSEL SIZE FOR
SCOTTISH INSHORE FLEET

VESSELS OF 55' - 59.9'

SAMPLE SIZE = 21

Costs	Aggregate	Per Vessel	Per Day at Sea
No. days at sea	4,461	212	-
	£	£	£
Labour	580,872	27,661	130.5
Fuel	173,602	8,267	39.0
Gear	134,295	6,395	30.2
Food	37,059	1,765	8.3
Ice	13,151	626	3.0
Hire of Equipment	72,734	3,464	16.3
Boxes	12,366	589	2.8
Travelling	27,704	1,319	6.2
Commission	69,072	3,289	15.5
Dues, Carriage	44,678	2,128	10.0
Insurance	75,831	3,611	17.0
Gross Repairs	230,898	10,995	51.9
Receipts from Insurance	24,510	1,167	5.5
Nett Repairs	206,388	9,828	46.4
Other	66,775	3,180	15.0
TOTAL	1,514,527	72,122	340.2
Depreciation	163,277	7,775	36.7

Source: Department of Agriculture, Fisheries and Food of Scotland.

TABLE 12

TYPICAL DATA SET ON 1979 COST BREAKDOWN BY VESSEL SIZE FOR
SCOTTISH INSHORE FLEET

VESSELS OF 75' - 79.9'

SAMPLE SIZE = 41

Costs	Aggregate	Per Vessel	Per Day at Sea
No. days at sea	8,174	199	-
	£	£	£
Labour	2,879,439	70,230	352.9
Fuel	1,100,461	26,841	134.9
Gear	528,103	12,881	64.7
Food	185,789	4,531	22.8
Ice	66,095	1,612	8.1
Hire of Equipment	177,146	4,321	21.7
Boxes	76,193	1,858	9.3
Travelling	49,496	1,207	6.1
Commission	255,741	6,238	31.3
Dues, Carriage	178,241	4,347	21.8
Insurance	428,944	10,462	52.6
Gross Repairs	784,142	19,125	96.1
Receipts from Insurance	78,846	1,923	9.7
Nett Repairs	705,296	17,202	86.4
Other	211,622	5,162	25.9
TOTAL	6,842,566	166,892	838.5
Depreciation	1,425,630	29,321	147.5

Source: Department of Agriculture, Fisheries and Food of Scotland.

TABLE 13

ESTIMATES OF THE DAILY RUNNING COSTS OF VESSELS OF DIFFERENT SIZES IN THE SCOTTISH INSHORE FLEET

Year	Vessel length groups (feet)								
	30-39.9	40-44.9	45-49.9	50-54.9	55-59.9	60-64.9	65-69.9	70-74.9	75-79.9
<u>1979</u>									
Sample Size	14	3	26	40	21	14	69	34	41
Running Costs	134.8	152.4	242.6	311.5	340.2	367.6	471.8	642.6	838.5
<u>1978</u>									
Sample Size	12	4	25	34	17	19	48	32	33
Running Costs	123.6	225.0	276.0	300.0	307.0	396.0	460.0	623.0	817.0
<u>1977</u>									
Sample Size	19	8	47	47	18	17	86	28	40
Running Costs	172.2	194.1	258.0	264.4	243.4	283.0	401.0	495.0	716.0

TABLE 14

ESTIMATES OF RUNNING COSTS AND DEPRECIATION OF SCOTTISH INSHORE FLEET

	1977		1978		1979	
	£'s per day at sea	Sample size	£'s per day at sea	Sample size	£'s per day at sea	Sample size
<u>40' - 70' vessels</u>						
Running Costs	313	223	359	147	370	173
Depreciation	27		39		41	
<u>70' - 80' vessels</u>						
Running Costs	625	68	722	65	750	75
Depreciation	45		110		142	

Source: Department of Agriculture, Food and Fisheries for Scotland.

has running costs of £2,500 per day and a small purse seiner of £1,500 per day³.

CAPITAL COSTS

(i) Depreciation

The period over which a capital asset will be depreciated is usually determined not so much by the decline in utility of the asset, but by the tax and interest rate structure of the economy concerned. For the same vessel grouping as for running costs, data were available on depreciation on a daily basis. These have been adjusted prior to presentation to allow for the proportion of days in the year that are spent fishing. The results are presented in Table 15. As in the case of running costs, the effect of vessel size is marked, particularly between boats less than 70' and those above. Accordingly, we have made the same grouping as for running costs and the weighted averages are presented in Table 14. The increase in the level of depreciation with time is probably an effect of the increased capital cost of vessels although the data do not permit investigation of this speculation.

If one assumes a fixed period of capital write-off and a fixed number of fishing days per year, these depreciation figures may be converted to estimates of capital value of the vessels. Table 16 gives an example of such a calculation on the groupings of Table 14. These capital value estimates can then be used as a basis for assessing the interest charges. Once again, we could obtain no detailed data on purse seiner depreciation. We assume that a small purse seiner will depreciate a capital cost of £500,000 over 15 years hence leaving a daily depreciation cost of £167 per day. A large purse seiner will depreciate a capital cost of £1,000,000 over 15 years, giving a rate of £333 per day⁴.

(ii) Interest Charges

The effective rate of interest in the economy is that prevailing on loans less the rate of inflation. Given that various tax concessions and

³ & ⁴ These figures were suggested as typical in discussion with various fisheries economists within the White Fish Authority and Herring Industry Board (United Kingdom). The figures suggested are for 1979.

TABLE 15

ESTIMATES OF THE DAILY DEPRECIATION OF VESSELS OF DIFFERENT SIZES IN THE SCOTTISH INSHORE FLEET

Year	Vessel length groups (feet)								
	30-39.9	40-44.9	45-49.9	50-54.9	55-59.9	60-64.9	65-69.9	70-74.9	75-79.9
<u>1979</u>									
Sample Size	14	3	26	40	21	14	69	34	41
Depreciation	13.0	10.5	24.1	37.7	36.7	41.6	51.3	102.7	174.7
<u>1978</u>									
Sample Size	12	4	25	34	17	19	48	32	33
Depreciation	10.1	30.0	31.0	32.0	37.0	44.0	48.0	84.0	136.0
<u>1977</u>									
Sample Size	19	8	47	47	18	17	86	28	40
Depreciation	10.2	20.4	22.0	24.9	22.1	20.0	33.0	45.0	-

TABLE 16

ESTIMATES OF THE CAPITAL VALUE OF VESSELS OF VARIOUS SIZES IN THE SCOTTISH INSHORE FLEET DERIVED FROM DATA ON DEPRECIATION.

Capital Costs £'s per day at sea	Vessel length groups	
	40' - 70'	70' - 80'
1979 Depreciation	41	142
Annual Depreciation (assuming 200 fishing days)	8,200	28,400
Capital if Depreciation over a 10 year period	82,000	284,000
Capital if Depreciation over a 15 year period	123,000	426,000

TABLE 17

ESTIMATES OF THE DAILY INTEREST COSTS OF VARIOUS VESSEL TYPES (1979 PRICES).

	Trawlers		Purse Seiners	
	40' - 70'	70' - 80'	Small	Large
Capital Cost (15 year Depreciation)	123,000	426,000	500,000	1,000,000
Real Interest Rate at 5%	6,150	21,300	25,000	50,000
Cost per day at sea (200 days)	30.7	106.5	125	250
Real Interest Rate at 10%	12,300	42,600	50,000	100,000
Cost per day at sea (200 days)	61.5	213	250	500

subsidies are available to fishermen, that these vary within the Community and that interest rates and inflation rates also differ, the problem of assessing the interest rate charges on various boats is formidable. In this section more than in any other we are forced into the position of presenting typical figures for different prevailing real rates of interest. In Table 17 we present the interest charges on a variety of different vessel types.

PROFITABILITY CALCULATIONS

The analysis in the previous sections has indicated the degree of uncertainty that is associated with the various cost calculations. It is nevertheless informative to perform simple profitability calculations on the basis of the expected revenue and cost to different types of vessel at different levels of TAC.

Although much of the analysis of cost has depended on data from the United Kingdom, in this section we assume that the costs are typical of the Community as a whole. In Table 18 the daily profits are estimated for different vessels under different assumptions on catch and interest rates. They are presented for three different levels of the TAC associated with the short, medium and long-term. Despite the intricacy of our cost calculations, it is abundantly clear that calculations of profitability are rather insensitive to these details. By contrast, the calculations on catch rates are critically important in determining the level of profitability. Similarly, the revenue curve derived for the Community from the individual countries' demand curves is important. Thus, for example, low import prices to the Community would certainly reduce the short-term profitability.

The analysis presented in Table 18 is on a daily basis for different vessel types; in Table 19 we calculate for the same catch levels the annual profitability of fleets composed of vessels of each type. This composite picture will, of course, differ from country to country as the revenues vary depending on the allocation of the TAC. Thus, the United Kingdom profitability will be higher as the expected price per ton is higher in the United Kingdom. However, it should be noted that the cost calculations are also made for the United Kingdom and that costs may be correspondingly lower in other countries. If this were the case, calculations for the United Kingdom, at least on a daily basis, would be more indicative of likely profitability, than the aggregate ones just presented. In Table 20 these calculations are presented for the United Kingdom, and in Table 21 similar ones presented for the United Kingdom fleets.

TABLE 18

ESTIMATED DAILY PROFIT IN £ STERLING (1979 PRICES) FOR DIFFERENT VESSEL TYPES UNDER VARIOUS COMBINATIONS OF INTEREST RATES AND ASSUMPTIONS ABOUT CATCH RATES. TYPICAL COMMUNITY FIGURES: SHORT, MEDIUM AND LONG TERM.

Catch Rate	Interest Rate on Capital	Trawlers		Purse Seiners	
		40' - 70'	70' - 80'	Small	Large
SHORT TERM		(40,000 tonnes to E.E.C.)			
Max	5%	6,632	9,612	13,928	16,174
	10%	6,601	9,506	13,803	15,924
Min	5%	3,095	4,110	6,068	6,742
	10%	3,064	4,004	5,943	6,492
MEDIUM TERM		(160,000 tonnes to E.E.C.)			
Max	5%	4,220	5,994	8,568	9,608
	10%	4,189	5,888	8,443	9,358
Min	5%	1,889	2,368	3,388	3,392
	10%	1,858	2,262	3,263	3,142
LONG TERM		(400,000 tonnes to E.E.C.)			
Max	5%	2,762	3,807	5,328	5,639
	10%	2,731	3,701	5,203	5,389
Min	5%	1,160	1,315	1,768	1,367
	10%	1,129	1,209	1,643	1,117

TABLE 19

ESTIMATED DAILY PROFIT IN £ STERLING (1979 PRICES) FOR DIFFERENT VESSEL TYPES UNDER VARIOUS COMBINATIONS OF INTEREST RATES AND ASSUMPTIONS ABOUT CATCH RATES. TYPICAL U.K. FIGURES : SHORT, MEDIUM AND LONG TERM.

Catch Rate	Interest Rate on Capital	Trawlers		Purse Seiners	
		40' - 70'	70' - 80'	Small	Large
SHORT TERM		(10,000 tonnes to U.K.)			
Max	5%	9,404	13,770	20,088	23,720
	10%	9,373	13,664	19,963	23,470
Min	5%	4,481	6,112	9,148	10,592
	10%	4,450	6,006	9,023	10,342
MEDIUM TERM		(40,000 tonnes to U.K.)			
Max	5%	5,228	7,506	10,808	12,352
	10%	5,197	7,400	10,683	12,102
Min	5%	2,393	3,096	4,508	4,792
	10%	2,362	2,990	4,383	4,542
LONG TERM		(100,000 tonnes to U.K.)			
Max	5%	2,402	3,267	4,528	4,659
	10%	2,371	3,161	4,403	4,409
Min	5%	980	1,055	1,368	867
	10%	949	949	1,243	617

TABLE 20

ESTIMATED ANNUAL PROFIT IN MILLIONS OF £ STERLING (1979 PRICES) FOR HYPOTHETICAL COMMUNITY FLEETS MADE UP OF DIFFERENT VESSEL TYPES TO TAKE CATCHES IN THE SHORT, MEDIUM AND LONG TERM.

Catch Rate	Interest Rate on Capital	Trawlers		Purse Seiners	
		40' - 70'	70' - 80'	Small	Large
SHORT TERM		(40,000 tonnes to E.E.C.)			
Max	5%	14.74	14.25	13.93	13.20
	10%	14.67	14.09	13.80	12.99
Min	5%	13.76	12.65	12.14	10.79
	10%	13.62	12.32	11.89	10.39
MEDIUM TERM		(160,000 tonnes to E.E.C.)			
Max	5%	37.51	35.52	34.27	31.38
	10%	37.23	34.89	33.77	30.56
Min	5%	33.58	29.15	27.10	21.71
	10%	33.03	27.84	26.10	20.11
LONG TERM		(400,000 tonnes to E.E.C.)			
Max	5%	61.38	56.40	53.28	46.03
	10%	60.69	54.83	52.03	43.99
Min	5%	51.56	40.46	35.36	21.87
	10%	50.18	37.20	32.86	17.87

TABLE 21

ESTIMATED ANNUAL PROFIT IN MILLIONS OF £ STERLING (1979 PRICES) FOR HYPOTHETICAL U.K. FLEETS MADE UP OF DIFFERENT VESSEL TYPES TO TAKE CERTAIN CATCHES IN THE SHORT, MEDIUM AND LONG TERM.

Catch Rate	Interest Rate on Capital	Trawlers		Purse Seiners	
		40' - 70'	70' - 80'	Small	Large
SHORT TERM		(10,000 tonnes to U.K.)			
Max	5%	5.20	5.10	5.02	4.84
	10%	5.20	5.06	4.99	4.79
Min	5%	4.98	4.70	4.57	4.24
	10%	4.94	4.62	4.51	4.14
MEDIUM TERM		(40,000 tonnes to U.K.)			
Max	5%	11.62	11.12	10.81	10.08
	10%	11.55	10.97	10.68	9.88
Min	5%	10.63	9.53	9.02	7.67
	10%	10.50	9.20	8.77	7.27
LONG TERM		(100,000 tonnes to U.K.)			
Max	5%	13.34	12.10	11.32	9.51
	10%	13.17	11.71	11.01	9.00
Min	5%	10.89	8.12	6.84	3.47
	10%	10.54	7.30	6.22	2.47

The results on the profitability of different fleet types are somewhat surprising, indicating that by and large the balance of profitability lies in fleets composed of similar vessels. It would be unwise given the considerable uncertainty about the cost data on purse seiner operations to make much of this point. However, it does contradict expectations given the recent trends in fleet composition.

The picture that emerges from this analysis even with the uncertainties is clear. There is a rather high level of profitability for vessels of all types, in the short, medium and long-term. This at once poses a problem in the short-term as the fleet capacity is well in excess of that required to take the catch. That implies that there must be some allocation of the catch to individual vessels where overall profitability will be determined by opportunities outside the herring Fishery.

In the medium and long-term, although it seems likely that a high level of profitability will prevail in the Fishery and that it will provide a major source of revenue and profitability to the Community's fishing industry, this profitability will depend on the processing industries using the landed herring and hence on their profitability. In essence, this concerns the validity of the demand models in the medium and long-term. Here there is a real problem as many dependent industries have been forced to close or diversify following the closure of the North Sea Fishery. What is critical is whether the processing industries can rebuild and move into the utilisation of herring at a rate comparable to the increase in catch. This has the further management implication that the predictability of the changes in catch levels over time will become critically important in determining the investment decisions that must be made. We return to this theme in the concluding section of this report. In the next section we examine some of the problems associated with the industries which are dependent on herring.

THE EFFECT OF HERRING LANDINGS ON DEPENDENT INDUSTRIES

The effect of various levels of catch on the associated industries of the Community, will depend initially on the distribution of the TAC amongst member countries. Within an individual country it will then depend on how the catch is distributed amongst the various possible products. These points are obvious enough, but their implication is that there will be great uncertainty about the multiplier effects of the landings on the economy both in income and employment. Put simply, herring that is used for Klondyking (i.e. export of fresh or frozen herring from the ships to other, usually East European vessels) will have little if any effect within the economy of the country. By contrast, herring processed in any way will have an associated industrial infrastructure with implications for income and employment. The different processes will also have very different effects, thus herring processed for pickling or kippering will have a much greater value added component than that used as fish meal.

These are the problems and they are formidable if any form of prediction is required. A central reason is that consumer demand will affect the distribution and consumer demand itself is affected by income¹. Additionally, the international market for fish meal, itself largely unpredictable, will determine in the medium and long-term the demand for herring as meal. Hence forecasting seems hopeless. Nevertheless, there are some generalities that we may expect to apply whatever the detailed changes in the determining variables. Of these, probably the most important is that the proportion of herring going to industries with a high value added component will diminish with the size of the catch. Thus, in the early stages of the reopening of the Fishery, most of the herring will be used for human consumption and although countries will differ, much of this will be for high value products. (In Appendix VI some of the product types for the main countries are examined). This process is indicated by the history of the Fishery in the U.K. where

¹Young (1977) for example, indicates a negative income elasticity for fresh herring implying a decrease in demand with consumer income.

as catches declined the proportion going to the high-value products increased. Table 22 summarises these data.

Data on the capital and labour requirements per unit product for herring processing are of course dependent on the product. In essence to have some idea of the scale of investment of both capital and labour required to process different levels of herring requires that the production functions for each process should be known. This it has not proved possible to do.

Crude approximations may be obtained by utilising the national income tables of the individual countries and assessing the multiplier effects for the fishing industry as a whole. These could then be applied to the different estimates of input revenue derived for different TACs and allocations. However, the driving variable for such calculations would be the first-hand sale of the herring. Given that this can be estimated quantitatively it is probably better to use it as an index of the value of the herring fishery to the Community rather than move to more problematic calculations.

TABLE 22

PERCENTAGE OF TOTAL LANDINGS GOING TO VARIOUS USES: UNITED KINGDOM¹.

Disposals Notified at First Sale	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Fresh and Kippered	41.05	31.45	31.88	34.68	29.56	33.91	32.62	37.64	} 54.70	68.44	76.18	78.78	87.02
Quick-frozen	17.16	15.93	18.30	16.66	14.62	11.60	10.15	11.48					
Canned	6.64	6.24	5.94	6.62	8.75	6.26	7.87	3.88	3.27	0.68	0.96	-	0.21
Cured	3.24	2.73	3.05	2.09	2.58	2.03	2.08	1.82	1.61	1.26	0.62	1.48	0.51
Redded	2.03	2.32	1.46	1.94	1.37	0.80	0.59	0.79	0.49	0.17	0.48	1.03	-
Marinated	2.38	3.63	3.25	2.81	3.31	1.91	1.91	1.66	1.97	2.16	2.03	2.49	-
Klondyked	3.71	6.69	10.52	5.70	16.61	28.16	21.37	19.43	25.48	18.25	11.95	12.83	11.77
Pet Food	13.47	10.52	11.63	12.90	8.92	5.47	7.64	5.10	0.33	1.70	4.07	1.46	0.23
Meal and Oil	10.32	20.49	13.97	16.60	14.28	9.86	15.77	18.20	12.14	7.34	3.72	1.94	0.26
Total Landed x 10 ³ tonnes	99.7	115.8	101.5	94.4	123.7	145.5	146.7	149.1	157.3	147.9	112.9	90.9	42.4

¹Source: Herring Industry Board, Annual Reports. 1966-1978.

DISCUSSION

In the parallel study to this (Beddington & Grenfell), we focused on the problems of variability in recruitment and the implications of this variability for harvesting strategies. In essence, this level of uncertainty is quantifiable and the risks inherent in managing under uncertainty can be estimated. By contrast as the reader will by now recognise the uncertainty in economic projections is far greater and much less easily quantifiable.

Even the rather dramatic increase in price of the herring landings in all countries, illustrated here in Figure 12 and analysed earlier, cannot be relied upon as a source for predictions for the future. The problem here is not so much the uncertainty about the demand models and whether the causal factors have been correctly identified, but whether, following the closure of the Fishery, they will continue to apply. The underlying uncertainty here is concerned with consumer demand for all herring products and whether it has been materially altered by the shortage. The demand analysis would seem to make this unlikely, but it is central to all subsequent analysis.

An immediate implication of this source of uncertainty is the observation that the longer the Fishery remains closed the less likely it is that demand will remain unchanged. This is a further source of argument for suggesting that reopening is economically desirable. The other is that early returns to the Fishery even from a low level of catch are going to be more attractive, firstly because of the discount rate effects and, secondly, because of the demand curve. Put simply, it is a more attractive economic strategy to forego long-term large catches at a low price for short-term small catches at a high price. Such considerations must, of course, be subservient to the major problem that catches too early at too high a level have an associated high probability of stock collapse. Carefully controlled expansion of the catch to follow the expected improvement in stock with low probability of collapse, economically, is thus likely to be more attractive than zero catch for a period until the probability of collapse is effectively zero. Such a strategy is also likely to have useful implications for secondary industries. Here the

Figure 12(a)

HISTORY OF LANDING PRICE CHANGES SINCE 1956 IN FRANCE, NETHERLANDS, UNITED KINGDOM AND NORWAY

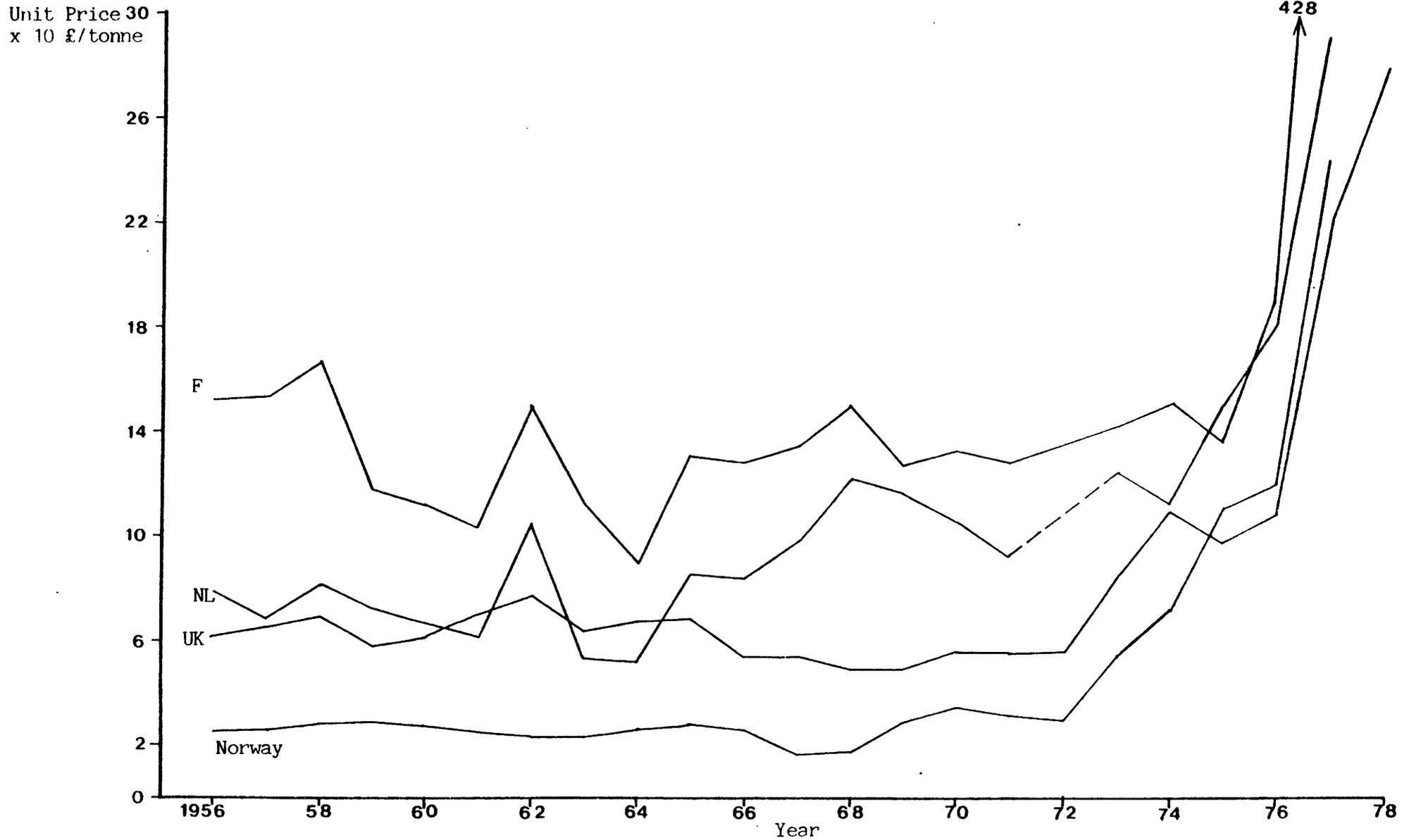
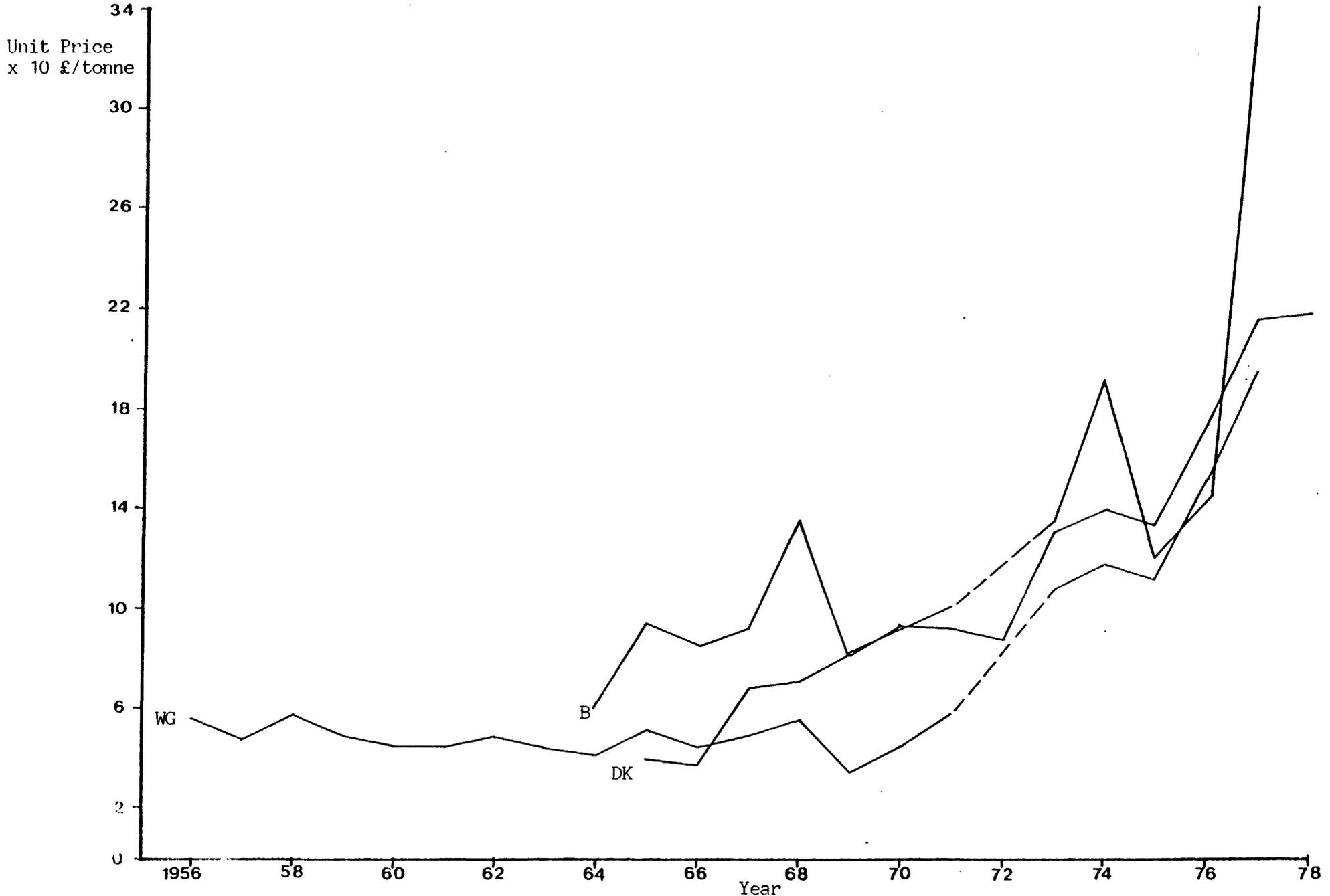


Figure 12 (b)

HISTORY OF LANDING PRICE CHANGES SINCE 1956 IN WEST GERMANY, BELGIUM AND DENMARK



cut-back in herring landings has necessarily led to diversification and contraction. In a situation where this has occurred, a predictable increase in the catch levels with an expected decline in unit costs provides an ideal background for the possibility of reinvestment. This is, of course, subject to the caution: if and only if the catch strategies have an associated low risk of stock collapse.

A further intriguing implication of these considerations is that a feedback harvesting policy aimed at producing a target fishing mortality on a variable stock will be rather unattractive to processors. Price will vary with landings which will buffer the fishermen against such variation, but the processors will have costs associated with the variation in supply of their raw material. In an important sense, predictability for the processing industry is probably more attractive than high levels of yield and low price of raw materials. Accordingly, strategies with maximum catch levels well below the deterministic MSY and hence having associated low probabilities of collapse are likely to be welcomed at least by this sector. These points all lead to interesting questions about the way catch levels are determined currently.

Similarly, allowing for the caveats about demand uncertainty, the results on the economic effects of different catch allocations are intriguing, particularly when one considers them in the light of the demand for other fish stocks within the Community's jurisdiction and for which allocations must be set. There is a distinct possibility that judicious manipulation of the catch allocations for different stocks would produce gains to all parties.

A similar possibility at a different conceptual level occurs in the case of the interaction between the sprat fishery and the herring. In this case, losses to the herring industry may be directly estimated and the corresponding gain to the sprat industry may in principle also be estimated.

It is hoped that these various possibilities will, with more economic data and knowledge of the fish stocks, produce an increased economic benefit to the fishing industries of all the member countries of the Community.

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APPENDIX 1DATA SOURCES

A. Quantity Landed and Values

<u>Country</u>	<u>Source</u>	<u>Notes</u>
U.K.	<u>Sea Fisheries Statistics Tables.</u> M.A.F.F.	Fresh and frozen landings.
Belgium France Netherlands West Germany	<u>Eurostatistics: Statistical Office of the European Communities.</u> Fishery: Catches by Belgium Fishery: Products and Fleet (Prior to 1975 - Agrarstatistik)	Fresh landings.
Norway	<u>Statistisk Arbok.</u> (Statistical Yearbook) Central Bureau of Statistics, Oslo, Norway.	North Sea, Fat and Small herring landings.
Denmark	<u>Fiskeriaarbogen.</u> (Fisheries Yearbook). København, Denmark.	Fresh and frozen landings.

B. Consumer/Retail Price Indices

<u>Country</u>	<u>Source</u>	<u>Notes</u>
U.K.	<u>Economic Trends.</u> Annual Supplements. Central Statistical Office (CSO).	General Index of Retail Prices 1975.
Belgium France Netherlands West Germany	<u>Eurostatistics. Monthly General Statistics Bulletin.</u>	General Consumer Price Index 1975.
Norway	<u>Statistisk Arbok.</u> (Statistical Yearbook).	General Consumer Price Index 1974.
Denmark	<u>Danmarks Statistik.</u> <u>Annual Statistical Revue.</u>	General Consumer Price Index 1975.

C. Import Data - Quantity and Value

<u>Country</u>	<u>Source</u>
U.K.	<u>Sea Fisheries Statistics Tables.</u> M.A.F.F.
Denmark	<u>Danmarks Statistik.</u> <u>Annual Trade Statistics.</u>

D. Currency Conversions

<u>Country</u>	<u>Source</u>	<u>Notes</u>
All countries	<u>Financial Statistics.</u> <u>Central Statistical Office.</u>	Yearly average exchange rates.

APPENDIX II

There are a number of obvious choices for functional relationships between quantity and price, however given relatively noisy data, it may not be possible to distinguish statistically between them. In this appendix we describe the investigation of four models. Where P is auction price and Q landed quantity, they are in linear form:

- (1) $P = a + bQ$
- (2) $P = a + b \ln Q$
- (3) $\ln P = \ln a + bQ$
- (4) $\ln P = \ln a + b \ln Q$

Initially the data were fitted by simple linear regression for each country for each of the models. Table 1 presents the results of this procedure as the coefficient of determination of each model on the same data sets. From this analysis the model with the highest coefficient of determination was chosen as that of 'best fit' for that country for use in the subsequent analysis.

Model 4 is a model which implies a constant elasticity of demand and recognising that this model may not in fact be distinguishable statistically from that of best fit we looked at the elasticity of demand estimated from the fit of this model. This is presented in Table 2. The results largely corroborate those of the best fit models. The United Kingdom has the most inelastic demand followed by France, Norway and Denmark. This is reflected in the best fit models where the United Kingdom actually has a change in elasticity of demand from elastic to inelastic within the data range. Extrapolation of the results of the model outside the data range for some other countries produces a similar result. These extrapolations must clearly be treated with caution, but are nonetheless intriguing as suggesting possibilities that may occur at high levels of TAC.

One further refinement that was considered, but not subsequently used, was to convert the currency of each country in each year to an appropriate standard. In this way it was hoped to smooth out some of the effects of differing inflation levels on the results. Table 3 presents the results of these analyses which have been taken to a base year of 1975 in £'s sterling.

In some cases the model is a much improved fit, but there are difficulties in interpretation, particularly between the periods prior and post the European Community Currency Unit. Accordingly, although the results appeared satisfactory for the rest of the analysis the models fitted in the individual country's currency were used.

Table 1

COEFFICIENTS OF DETERMINATION AND SAMPLE SIZE FOR MODELS 1 - 4

Country	1 $P = a+bQ$	2 $P = a+b\ln Q$	3 $\ln P = \ln a+bQ$	4 $\ln P = \ln a+b\ln Q$
U.K.	0.67	0.83	0.56	0.68
Belgium	0.31	0.62	-	0.57
France	0.85	0.95	0.83	0.90
Netherlands	0.18	0.53	0.15	0.45
West Germany	0.62	0.74	0.58	0.68
Denmark	0.58	0.61	0.74	0.77
Norway	0.37	0.74	0.50	0.81

Table 2

COEFFICIENTS OF DETERMINATION AND REGRESSION COEFFICIENTS FOR THE MODEL
 $\ln P = \ln a + b\ln Q$

Country	Coefficient of Determination	Regression Coefficient b	Standard Error of Coefficient b
U.K.	0.68	- 0.72	0.16
Belgium	0.57	- 0.16	0.04
France	0.90	- 0.40	0.04
Netherlands	0.45	- 0.04	0.01
West Germany	0.68	- 0.19	0.04
Denmark	0.77	- 0.38	0.06
Norway	0.81	- 0.39	0.07

Table 3

COEFFICIENTS OF DETERMINATION AND ASSOCIATED PARAMETERS FOR BEST FIT
MODELS, PRICES IN £'s STERLING

Country	Model, Coefficient of Determination	Estimated Parameters	Degrees of Freedom	F-values: Model Parameter a Parameter b	Probability of exceeding F
U.K.	$P=a+b\ln Q$ 0.83	a= 1253.0 b= -100.23	1, 12	58.55 66.61 58.55	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Belgium	$P=a+b\ln Q$ 0.43	a= 373.59 b= - 38.15	1, 10	7.42 17.62 7.42	0.021 0.002 0.021
France	$P=a+b\ln Q$ 0.96	a= 1595.20 b= -144.77	1, 10	233.50 290.08 233.46	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Netherlands	$P=a+b\ln Q$ 0.94	a= 301.77 b= - 19.67	1, 10	156.10 444.17 156.09	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
West Germany	$P=a+b\ln Q$ 0.83	a= 481.96 b= - 39.25	1, 10	49.33 70.39 49.33	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$
Denmark	$\ln P = \ln a + b \ln Q$ 0.65	$\ln a = 9.86$ b= -0.49	1, 10	18.64 63.04 18.64	0.002 $< 10^{-4}$ 0.002
Norway	$\ln P = \ln a + b \ln Q$ 0.91	$\ln a = 10.94$ b= -0.59	1, 10	105.00 247.64 105.03	$< 10^{-4}$ $< 10^{-4}$ $< 10^{-4}$

APPENDIX III

THE EFFECT OF IMPORTS ON THE LANDING PRICE OF HERRING

Data were only available on imports for two countries, the United Kingdom and Denmark. For the United Kingdom they were contained in the Sea Fisheries Statistics Tables (M.A.F.F.). For Denmark they were contained in the Annual Trade Statistics (Danmarks Statistik).

Following the fitting of the simple demand model, the residuals from this model were plotted against time, in both cases a marked increase in residuals occurred in the period from 1972-1977. These residuals were found to be strongly correlated with the price of imports. Other possible transformations of this variable were investigated and the one giving the strongest relationship was found to be the natural logarithm of the import price in the case of the United Kingdom and the import price in the case of Denmark. Essentially similar results were obtained using the residual for the entire period. It would thus appear that, although import price was not necessarily the causal factor affecting the landing price over the whole period, the assumption that it was doing so did not materially affect the estimated relationships.

Inspection of the pattern of residuals following the two variable least squares fitting of the two models:

$$\text{U.K.} : P = a + b \ln Q + c \ln P_I$$

$$\text{D.K.} : \ln P = \ln a + b \ln Q + c P_I$$

indicated a random pattern with no distinguishable trends.

APPENDIX IVSUBSTITUTE AND INCOME EFFECTS ON DEMAND.

The results of fitting the model:

$$P = a + b \ln Q + c \ln P_I$$

for the United Kingdom data revealed a pattern of residuals with no discernable trend. These were related to both the net disposable income and price of mackerel to see if there was any relationship.

In both cases no significant improvement in the model was obtained by including these factors. In the case of the price of mackerel, there appeared to be no substitute effect on herring price. The case of income is somewhat more complicated as income itself was highly correlated with the import price. This produced the following result when fitting the models:

$$P = a + b \ln Q + c \ln P_I + d \ln I$$

and

$$\ln P = \ln a + b \ln Q + c \ln P_I + d \ln I$$

where I = Net disposable income, income showed a significant positive coefficient, the quantity price relationship was preserved, but import price was non-significant. The results are given in Table 1.

This is clearly an effect of the correlation between import price and income and it was decided to treat the income effect as an artifact. This decision was reinforced by the results of Young (1977) on consumer demand in which he found a strong negative income elasticity. This implies that it is very unlikely that there would be a strong positive income elasticity on landings.

TABLE 1

PARAMETERS AND SIGNIFICANCE LEVELS OF MODELS INCLUDING INCOME AND IMPORT PRICE FOR UNITED KINGDOM.

Model	Coefficient of Determination, Parameter Estimates (a,b,c, and d)	Degrees of Freedom	F-values: Model Parameter a Parameter b Parameter c Parameter d	Probability of exceeding F
$P = a + b \ln Q + c \ln P_I + d \ln I$	0.82	3,8	12.40	0.002
	-1407.90		11.60	0.009
	- 41.17		3.98	0.081
	16.29		1.55	0.248
	184.85		12.72	0.007
$\ln P = \ln a + b \ln Q + c \ln P_I + d \ln I$	0.80	3,8	10.77	0.004
	- 15.25		6.80	0.031
	- 0.50		3.14	0.115
	0.22		1.52	0.253
	2.38		0.73	0.011

APPENDIX VTHE EFFECT OF DIFFERENT LEVELS OF TAC AND ALLOCATION ON THE EXPECTED REVENUES TO THE COUNTRIES OF THE COMMUNITY.

In this Appendix initially we set out the expected revenues to each country of the Community under different levels of TAC¹. These basic calculations are presented in Table 1. In Table 2 we set out the results of varying the allocation of different countries on the revenue to the remaining countries. Finally in Table 3 we indicate the effect of bilateral substitutions of various kinds.

All calculations have been done to a base year of 1979.

In the case of very small and very large levels of TAC, some caution must be used as the results are obtained by extrapolating outside the domain of fit of the underlying demand relationships.

¹A basic allocation to Norway of 20% is used throughout.

TABLE 1

EXPECTED REVENUES TO THE COUNTRIES OF THE COMMUNITY IN THEIR RESPECTIVE CURRENCIES,
DETERMINED FROM THE BASIC ALLOCATION OF THE TAC (1979 PRICES).

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15704355.	5468873.	14662297.	26199412.	13447416.	2763753.	35641814.
100,000	: 25893933.	8633983.	25241416.	40182503.	26136541.	5006548.	54937483.
150,000	: 34246121.	10929553.	34279365.	49554618.	38539454.	7052709.	70760100.
200,000	: 41436977.	12660442.	42316476.	55932361.	50756499.	8971177.	84679386.
250,000	: 47778039.	13971438.	49609368.	60083505.	62835336.	10794693.	97335410.
300,000	: 53449435.	14947819.	56309193.	62460274.	74804032.	12542541.	109068010.
350,000	: 58568624.	15645933.	62515819.	63361455.	86681138.	14227464.	120084480.
400,000	: 63218253.	16105833.	68300236.	62999440.	98479833.	15858519.	130522870.
450,000	: 67459605.	16357462.	73715510.	61532999.	110209970.	17442476.	140480830.
500,000	: 71339931.	16424062.	78802845.	59085408.	121879210.	18984592.	150030580.
550,000	: 74896762.	16324204.	83595144.	55755114.	133493660.	20489065.	159227450.
600,000	: 78160619.	16073064.	88119315.	51622610.	145058320.	21959329.	168114940.
650,000	: 81156799.	15683275.	92397749.	46754894.	156577340.	23398240.	176728060.
700,000	: 83906624.	15165530.	96449389.	41208651.	168054240.	24808216.	185095480.

TABLE 2

EXPECTED REVENUES TO THE COUNTRIES OF THE COMMUNITY IN THEIR RESPECTIVE CURRENCIES,
DETERMINED FROM DIFFERENT ALLOCATIONS OF THE TAC (1979 PRICES).

(i) U.K. Catch +20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15911696.	6199067.	13874474.	25020232.	12586144.	2603702.	34139421.
100,000	: 26025653.	9633618.	23937982.	38638564.	24464550.	4721175.	52621727.
150,000	: 34185129.	12024721.	32563064.	47953320.	36075824.	6655124.	67777381.
200,000	: 41105888.	13738205.	40254031.	54473329.	47513623.	8469893.	81109932.
250,000	: 47118732.	14947819.	47250395.	58915178.	58822427.	10196040.	93232473.
300,000	: 52415274.	15755895.	53693229.	61700937.	70028432.	11851563.	104470510.
350,000	: 57120629.	16230051.	59675743.	63109486.	81148952.	13448356.	115022620.
400,000	: 61322924.	16418351.	65264194.	63339053.	92196292.	14994872.	125021000.
450,000	: 65087552.	16356722.	70508114.	62537831.	103179650.	16497431.	134559200.
500,000	: 68464980.	16073064.	75445956.	60820861.	114106160.	17960937.	143706410.
550,000	: 71495301.	15589650.	80108432.	58280034.	124981530.	19389311.	152515610.
600,000	: 74211154.	14924700.	84520655.	54990479.	135810430.	20785756.	161028470.
650,000	: 76639594.	14093372.	88703523.	51014724.	146596740.	22152939.	169278530.
700,000	: 78803435.	13108497.	92674718.	46405679.	157343730.	23493114.	172293250.

(ii) U.K. Catch +10%

50,000	: 15816748.	5841534.	14270079.	25614888.	13017095.	2683943.	34895486.
100,000	: 25977036.	9148929.	24593085.	39420664.	25301175.	4864293.	53787106.
150,000	: 34241346.	11499829.	33426293.	48769167.	37308583.	6854565.	69278403.
200,000	: 41305607.	13229580.	41292024.	55223108.	49136319.	8721399.	82906220.
250,000	: 47490999.	14497449.	48438348.	59524671.	60830453.	10496447.	95297237.
300,000	: 52983395.	15397241.	55011370.	62110997.	72418119.	12198349.	106784160.
350,000	: 57904088.	15990942.	61107634.	63270935.	83917247.	13839422.	117569950.
400,000	: 62338457.	16322605.	66795757.	63209768.	95340578.	15428424.	127789760.
450,000	: 66349853.	16425168.	72127050.	62081006.	106697640.	16971897.	137539210.
500,000	: 69987131.	16324204.	77141331.	60003792.	117995830.	18474925.	146888990.
550,000	: 73289104.	16040134.	81870414.	57073297.	129241060.	19941565.	155893270.
600,000	: 76287348.	15589650.	86340302.	53367334.	140438150.	21375135.	164594670.
650,000	: 79008046.	14986655.	90572645.	48950664.	151591130.	22728398.	173027430.
700,000	: 81473269.	14242914.	94585757.	43878086.	162703390.	24153689.	181219640.

(iii) U.K. Catch -20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15421170.	4671757.	15437020.	27339397.	14306255.	2922134.	37107003.
100,000	: 25612067.	7500504.	26518650.	41648050.	27803666.	5288578.	57195889.
150,000	: 34082994.	9633618.	35956363.	51038331.	40995784.	7445280.	73668954.
200,000	: 41470154.	11314987.	44326516.	57234615.	53989644.	9465776.	88160444.
250,000	: 48065761.	12660442.	51902840.	61055866.	66836081.	11384990.	101336740.
300,000	: 54038423.	13738205.	58846554.	62984429.	79565035.	13223491.	113551650.
350,000	: 59497929.	14593355.	65264193.	63339054.	92196293.	14994872.	125021000.
400,000	: 64521430.	15257935.	71231472.	62346252.	104743910.	16708793.	135888500.
450,000	: 69166087.	15755894.	76805004.	60175425.	117218410.	18372478.	146255810.
500,000	: 73475935.	16105833.	82028729.	56958020.	129627940.	19991532.	156198150.
550,000	: 77485927.	16322605.	86937752.	52799064.	141979030.	21570434.	165773090.
600,000	: 81224468.	16418351.	91560763.	47784406.	154277010.	23112844.	175025930.
650,000	: 84715100.	16403178.	95921669.	41985547.	166526310.	24621814.	183993130.
700,000	: 87977641.	16285641.	100040660.	35462913.	178730680.	26099918.	192704530.

(iv) U.K. Catch -10%

50,000	: 15573087.	5079566.	15051242.	26774143.	13877130.	2843146.	36378849.
100,000	: 25773466.	8085746.	25883200.	40924753.	26970691.	5147967.	56073531.
150,000	: 34195125.	10309340.	35122615.	50310691.	39768500.	7249601.	72223344.
200,000	: 41494212.	12024721.	43327830.	56602443.	52374247.	9219285.	86430463.
250,000	: 47972612.	13362196.	50764022.	60593377.	64837178.	11090852.	99348203.
300,000	: 53804697.	14398521.	57587376.	62750782.	77186298.	12884229.	111323420.
350,000	: 59104090.	15184404.	63901092.	63383420.	89440772.	14612583.	122567700.
400,000	: 63950696.	15755895.	69778524.	62710754.	101614220.	16285273.	133221950.
450,000	: 68403736.	16139941.	75274511.	60896858.	113716840.	17909295.	143385820.
500,000	: 72508854.	16357462.	80431623.	58069099.	125756520.	19490082.	153133050.
550,000	: 76302290.	16425168.	85283869.	54329212.	137739580.	21031972.	162520100.
600,000	: 79813513.	16356722.	89859043.	49760377.	149671190.	22538512.	171591380.
650,000	: 83066941.	16163495.	94180296.	44431820.	161555640.	24012654.	180382610.
700,000	: 86083140.	15855106.	98267194.	38402121.	173396570.	25456895.	188923060.

(v) F. Catch +20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15728800.	5333459.	14246903.	29511306.	12991762.	2679236.	34851283.
100,000	: 25799612.	8444464.	24554739.	44363028.	25251996.	4855899.	53718977.
150,000	: 33973565.	10716618.	33375800.	53681577.	37236120.	6842869.	69190650.
200,000	: 40946860.	12444022.	41231345.	59406882.	49040936.	8706653.	82801206.
250,000	: 47040817.	13766353.	48368942.	62460274.	60712422.	10478836.	95176524.
300,000	: 52441389.	14765877.	54934399.	63384401.	72277655.	12178022.	106648890.
350,000	: 57269933.	15496958.	61024069.	62537831.	83754530.	13816503.	117421030.
400,000	: 61611872.	15998231.	66706424.	60175424.	95155759.	15403017.	127627890.
450,000	: 65530588.	16298584.	72032672.	56487706.	106490860.	16944096.	137364990.
500,000	: 69074957.	16420438.	77042550.	51622610.	117767200.	18144811.	146702920.
550,000	: 72283822.	16381710.	81767810.	45698269.	128990690.	19909212.	155675810.
600,000	: 75188770.	16197035.	86234401.	38811277.	140166140.	21340610.	164386170.
650,000	: 77816008.	15878611.	90463931.	31042046.	151297570.	22741763.	172808260.
700,000	: 80187598.	15436745.	94474672.	22458550.	162388360.	24115001.	180990100.

(vi) F. Catch +10%

50,000	: 15721449.	5401430.	14455067.	27895469.	13219676.	2721554.	35247883.
100,000	: 25856460.	8539751.	24899011.	42352986.	25694442.	4931342.	54330288.
150,000	: 34124334.	10823876.	33828983.	51738429.	37888047.	6947968.	69978025.
200,000	: 41211208.	12553286.	41775778.	57830062.	49899066.	8839154.	83743467.
250,000	: 47433508.	13870212.	48991490.	61472444.	61774312.	10637063.	96259610.
300,000	: 52974283.	14858429.	55624596.	63162999.	73541364.	12360639.	107862530.
350,000	: 57952938.	15573290.	61773212.	63230423.	85218440.	14022401.	118757250.
400,000	: 62453508.	16054140.	67507065.	61908314.	96818491.	15631245.	129080270.
450,000	: 66538325.	16330394.	72878293.	59371345.	108351200.	17193822.	138928170.
500,000	: 70255456.	16424884.	77927366.	55755113.	119824080.	18715297.	148372370.
550,000	: 73643083.	16355852.	82686611.	51167918.	131243130.	20199794.	157467590.
600,000	: 76732266.	16138209.	87182461.	45698269.	142613270.	21650684.	166256850.
650,000	: 79548756.	15784368.	91436908.	39419912.	153938580.	23070776.	174774770.
700,000	: 82114244.	15304826.	95468566.	32395162.	165222510.	24462442.	183049720.

(vii) F. Catch -20%

T.A.C.	E.E.C. £	U.K. £	B. BF	F. FF	N.L. HFL	W.G. DM	D.K. Kr
50,000	: 15637242.	5602217.	15074022.	22532640.	13902388.	2847803.	36421923.
100,000	: 25903349.	8819362.	25920753.	35292222.	27019722.	5156260.	56139926.
150,000	: 34391627.	11136276.	35171920.	44363028.	39840743.	7261145.	72308860.
200,000	: 41757949.	12868579.	43386924.	51038331.	52469335.	9233829.	86532802.
250,000	: 48304061.	14166171.	50831445.	55932361.	64954842.	11108209.	99465836.
300,000	: 54204241.	15117336.	57661966.	59406882.	77326321.	12904252.	111455230.
350,000	: 59572063.	15780416.	63981883.	61700937.	89602976.	14635148.	122712840.
400,000	: 64487377.	16196872.	69864683.	62984429.	101798450.	16310274.	133379690.
450,000	: 69009379.	16397706.	75365317.	63384401.	113922960.	17936641.	143555600.
500,000	: 73183687.	16406984.	80526435.	62999440.	125984410.	19519690.	153314370.
550,000	: 77046514.	16243924.	85382112.	61908315.	137989140.	21063768.	162712540.
600,000	: 80627312.	15924241.	89960185.	60175424.	149942310.	22572429.	171794550.
650,000	: 83950491.	15461024.	94283853.	57854362.	161848250.	24048630.	180596190.
700,000	: 87036603.	14865330.	98372728.	54990479.	173710570.	25494875.	189146770.

(viii) F. Catch -10%

50,000	: 15676645.	5535799.	14868610.	24415084.	13674986.	2805836.	36033141.
100,000	: 25910280.	8727181.	25581986.	37835479.	26578299.	5081519.	55540662.
150,000	: 34336295.	11033678.	34726994.	47105995.	39190349.	7157099.	71537003.
200,000	: 41620660.	12765528.	42853501.	53681577.	51613252.	9102733.	85609111.
250,000	: 48070018.	14070076.	50222660.	58253225.	63895507.	10951739.	98404095.
300,000	: 53861576.	15034104.	56988284.	61227924.	76065679.	12723742.	110265500.
350,000	: 59110847.	15714954.	63252007.	62874600.	88142642.	14431709.	121402940.
400,000	: 63899084.	16153388.	69086064.	63384400.	100139810.	16084856.	131955930.
450,000	: 68286522.	16379872.	74544472.	62900216.	112067220.	17690076.	142023220.
500,000	: 72319602.	16418067.	79669148.	61532998.	123932650.	19252716.	151677830.
550,000	: 76035190.	16286861.	84493584.	59371346.	135742320.	20777049.	160975670.
600,000	: 79463279.	16001705.	89045162.	56487706.	147501320.	22266569.	169960750.
650,000	: 82628717.	15575454.	93346662.	52942386.	159213880.	23724183.	178668430.
700,000	: 85552441.	15018989.	97417369.	48786368.	170883570.	25152350.	187127730.

(ix) N.L. Catch +20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15561877.	5136267.	13646848.	24675742.	16017225.	2557649.	33702830.
100,000	: 25984430.	8166236.	23560504.	38182276.	31124501.	4638993.	51948774.
150,000	: 34698024.	10401197.	32065090.	47473062.	45888322.	6540559.	66910610.
200,000	: 42331957.	12119878.	39654625.	54026137.	60429103.	8325376.	80072656.
250,000	: 49176074.	13454656.	46563733.	58543463.	74804032.	10023379.	92040168.
300,000	: 55397916.	14483503.	52930605.	61438497.	89046795.	11652201.	103134490.
350,000	: 61106706.	15257935.	58846554.	62984435.	103179650.	13223491.	113551650.
400,000	: 66379277.	15814567.	64376481.	63375436.	117218410.	14745530.	123422170.
450,000	: 71272606.	16180784.	69568908.	62756692.	131174900.	16224508.	132838390.
500,000	: 75830605.	16377827.	74461504.	61240880.	145058320.	17665232.	141868620.
550,000	: 80088163.	16422683.	79084353.	58918054.	158875980.	19071540.	150565160.
600,000	: 84073633.	16329220.	83462058.	55861750.	172633890.	20446570.	158969150.
650,000	: 87810534.	16108999.	87615087.	52133260.	186337040.	21792934.	167113710.
700,000	: 91318672.	15771787.	91560763.	47784419.	199989650.	23112845.	175025930.

(x) N.L. Catch +10%

50,000	: 15637110.	5304165.	14157400.	25446036.	14734810.	2661062.	34680481.
100,000	: 25946830.	8403300.	24406614.	39199305.	28635500.	4823492.	53455705.
150,000	: 34483304.	10670160.	33180708.	48539214.	42221356.	6797716.	68851551.
200,000	: 41899242.	12396540.	40996857.	55013082.	55602759.	8649719.	82395402.
250,000	: 48495350.	13721023.	48100684.	59355775.	68832132.	10410840.	94710069.
300,000	: 54445467.	14725231.	54636860.	62000131.	81940352.	12099535.	106126220.
350,000	: 59862939.	15463098.	60700974.	63232146.	94947819.	13728003.	116845550.
400,000	: 64827512.	15972962.	66360975.	63255099.	107869040.	15304910.	127002400.
450,000	: 69398313.	16283477.	71667652.	62220969.	120714850.	16836738.	136691770.
500,000	: 73620930.	16416895.	76660444.	60247731.	133493660.	18328518.	145983940.
550,000	: 77531569.	16390989.	81370847.	57429618.	146212210.	19784270.	154932750.
600,000	: 81159673.	16220283.	85824608.	53843678.	158875980.	21207277.	163580530.
650,000	: 84529647.	15916872.	90043169.	49554034.	171489550.	22600277.	171961340.
700,000	: 87662056.	15490988.	94044655.	44614942.	184056790.	23965580.	180103080.

(xi) N.L. Catch -20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15815621.	5789255.	15656080.	27658260.	10855579.	2967093.	37519251.
100,000	: 25743567.	9077282.	26878995.	42053083.	21104525.	5368573.	57831320.
150,000	: 33706233.	11421237.	36428640.	51441708.	31124501.	7556567.	74487395.
200,000	: 40426196.	13152109.	44891659.	57579299.	40995794.	9605922.	89139878.
250,000	: 46236580.	14427096.	52546673.	61299439.	50756499.	11552185.	102462560.
300,000	: 51330057.	15338790.	59557783.	63093107.	60429103.	13416296.	114813170.
350,000	: 55832285.	15948365.	66033420.	63284715.	70028433.	15212087.	126409940.
400,000	: 59831697.	16299306.	72050659.	62104853.	79565035.	16949393.	137398180.
450,000	: 63393877.	16424124.	77667115.	59725909.	89046795.	18637564.	147880670.
500,000	: 66569394.	16348054.	82927517.	56281698.	98479833.	20276308.	157933460.
550,000	: 69398423.	16091259.	87867604.	51879145.	107869040.	21876183.	167614770.
600,000	: 71913630.	15670210.	92516572.	46605612.	117218410.	23438916.	176970410.
650,000	: 74142108.	15098636.	96898745.	40533846.	126531270.	24967609.	186037230.
700,000	: 76106673.	14388135.	101034680.	33725395.	135810430.	26464886.	194845410.

(xii) N.L. Catch -10%

50,000	: 15763811.	5630528.	15161783.	26936599.	12154543.	9865754.	36587783.
100,000	: 25826094.	8858561.	26065394.	41133318.	23626623.	5188223.	56395577.
150,000	: 33986979.	11179786.	35361785.	50521452.	34841112.	7305631.	72638143.
200,000	: 40945811.	12912131.	43614446.	56786881.	45889321.	9289874.	86926859.
250,000	: 47024934.	14206587.	51090994.	60730287.	56811143.	11175095.	99918787.
300,000	: 52410752.	15152088.	57949056.	62823265.	67634838.	12981405.	111962780.
350,000	: 57224829.	15807396.	64292782.	63377421.	78376101.	14722093.	123271640.
400,000	: 61552709.	16214282.	70196202.	62614245.	89046794.	16406604.	133987080.
450,000	: 65457824.	16403968.	75714662.	60699320.	99655790.	18041999.	144209330.
500,000	: 68989087.	16400697.	80891127.	57761177.	110209970.	19633760.	154012540.
550,000	: 72185353.	16223834.	85759911.	53902521.	120714850.	21186266.	163453500.
600,000	: 75078217.	15889205.	90349078.	49207266.	131174900.	22703095.	172576870.
650,000	: 77693868.	15409985.	94681975.	43745288.	141593890.	24187228.	181418590.
700,000	: 80054384.	14797326.	98778358.	37575704.	151974970.	25641185.	190008100.

(xiii) D.K. Catch +20%

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15611225.	5276407.	14072707.	25318849.	12801699.	2643878.	39938000.
100,000	: 25731051.	8364240.	24266395.	39032190.	24883022.	4792844.	61559523.
150,000	: 34051738.	10626009.	32995970.	48365108.	36692443.	6755009.	79289367.
200,000	: 41239774.	12351331.	40774750.	54853372.	48325291.	8595866.	94886447.
250,000	: 47601004.	13677755.	47846524.	59226366.	59826839.	10346518.	109068010.
300,000	: 53311796.	14686295.	54354881.	61913696.	71223756.	12025286.	122214830.
350,000	: 58486937.	15430484.	60394704.	63199232.	82533660.	13644274.	134559200.
400,000	: 63207065.	15948365.	66033420.	63284716.	93769074.	15212087.	146255810.
450,000	: 67531917.	16268390.	71321455.	62321012.	104939360.	16735158.	157414080.
500,000	: 71507493.	16412638.	76297947.	60425208.	116051800.	18218480.	168114940.
550,000	: 75170301.	16398751.	80994160.	57690846.	127112180.	19666042.	178420380.
600,000	: 78550001.	16241142.	85435644.	54194364.	138125250.	21081105.	188379150.
650,000	: 81671179.	15951824.	89643680.	49999441.	149094970.	22466382.	198030470.
700,000	: 84554526.	15540944.	93636267.	45159931.	160024680.	23824171.	207406490.

(xiv) D.K. Catch +10%

50,000	: 15662050.	5373173.	14368446.	25761955.	13124733.	2703936.	37826655.
100,000	: 25819486.	8500177.	24755794.	39612995.	25510132.	4899937.	58305144.
150,000	: 34158333.	10779380.	33640500.	48968338.	37616474.	6904221.	75097687.
200,000	: 41350012.	12508017.	41549389.	55404165.	49541596.	8784003.	89870226.
250,000	: 47703272.	13827260.	48732667.	59669061.	61331964.	10571208.	103302060.
300,000	: 53396392.	14820253.	55337702.	62203931.	73014946.	12284636.	115753860.
350,000	: 58545520.	15541938.	61461869.	63300117.	84608626.	13936713.	127445650.
400,000	: 63232307.	16031361.	67174380.	63164673.	96125855.	15536267.	138523920.
450,000	: 67517268.	16317719.	72526979.	61952430.	107576250.	17089901.	149092280.
500,000	: 71447045.	16423676.	77559836.	59783558.	118967260.	18602741.	159227450.
550,000	: 75058656.	16367338.	82305038.	56754049.	130304850.	20079879.	168988070.
600,000	: 78382198.	16163495.	86788809.	52942386.	141593890.	21521662.	178420380.
650,000	: 81442612.	15824473.	91032986.	48413891.	152838430.	22933877.	187561480.
700,000	: 84260917.	15360697.	95056043.	43223847.	164041910.	24317880.	196441830.

(xv) D.K. Catch -20%

T.A.C.	E.E.C. £	U.K. £	B. BF	F. FF	N.L. HFL	W.G. DM	D.K. Kr
50,000	: 15759595.	5657182.	15244521.	27057935.	14091765.	2882689.	31007491.
100,000	: 25995072.	8895414.	26201704.	41288733.	27387323.	5218372.	47794240.
150,000	: 34357891.	11220628.	35540657.	50678005.	40382359.	7347589.	61559526.
200,000	: 41532332.	12952927.	43828732.	56923188.	53182235.	9342729.	73668954.
250,000	: 47835078.	14244339.	51335379.	60830453.	65836991.	11238169.	84679385.
300,000	: 53449721.	15184404.	58219304.	62874600.	78376101.	13051158.	94886451.
350,000	: 58496223.	15832292.	64585372.	63369402.	90819039.	14804075.	104470510.
400,000	: 63059100.	16230050.	70508113.	62537830.	103179650.	16497430.	113551650.
450,000	: 67201124.	16409129.	76043260.	60546629.	115468270.	18141734.	122214820.
500,000	: 70970722.	16393925.	81234069.	57525212.	127692950.	19741304.	130522870.
550,000	: 74406396.	16203938.	86115098.	53576957.	139860100.	21301749.	138523920.
600,000	: 77539490.	15855106.	90714579.	48786368.	151974970.	22906074.	146255810.
650,000	: 80396005.	15360697.	95056043.	43223847.	164041910.	24317580.	153749010.
700,000	: 82997843.	14731931.	99159378.	36948831.	176064640.	25779102.	161028470.

(xvi) D.K. Catch -10%

50,000	: 15737252.	5563534.	14954307.	26631360.	13769757.	2873334.	33373140.
100,000	: 25953043.	8765712.	25723356.	40740990.	26762266.	5112689.	51440596.
150,000	: 34313382.	11076610.	34912705.	50124373.	39461407.	7200493.	66256071.
200,000	: 41498633.	12808711.	43076196.	56438523.	51970034.	9157412.	79289367.
250,000	: 47822983.	14110422.	50476862.	60470409.	64336998.	11017004.	91139811.
300,000	: 53468335.	15069152.	57269635.	62683560.	76591068.	12799037.	102125600.
350,000	: 58553426.	15742660.	63556883.	63384242.	88751256.	14516572.	112440860.
400,000	: 63161850.	16171995.	69411359.	62790122.	100831070.	16178891.	122214830.
450,000	: 67355652.	16387856.	74887468.	61063993.	112840630.	17792936.	131538930.
500,000	: 71182677.	16414059.	80027436.	58332176.	124787750.	19364094.	140480830.
550,000	: 74680951.	16269644.	84864999.	54695599.	136678720.	20896668.	149092290.
600,000	: 77881408.	15970165.	89427719.	50236734.	148518640.	22394177.	157414080.
650,000	: 80809701.	15528571.	93738569.	45024288.	160311790.	23859549.	165478950.
700,000	: 83487455.	14955826.	97816959.	39116367.	172061770.	25295264.	173313780.

TABLE 3

EXPECTED REVENUES TO THE COUNTRIES OF THE COMMUNITY IN THEIR RESPECTIVE CURRENCIES,
DETERMINED FROM BILATERAL SUBSTITUTIONS.

(i) 20% from U.K. to F.

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15500269.	4671757.	14662297.	31552395.	13447416.	2763753.	35641814.
100,000	: 25495385.	7500504.	25241416.	46816363.	26136541.	5006548.	54937483.
150,000	: 33656743.	9633618.	34279364.	55932361.	38539454.	7052709.	70760099.
200,000	: 40659129.	11314987.	42316475.	61055866.	50756499.	8971177.	84679385.
250,000	: 46813474.	12660442.	49609367.	63210570.	62835336.	10794693.	97335409.
300,000	: 52299553.	13738205.	56309192.	62999440.	74804032.	12542541.	109068010.
350,000	: 57234586.	14593355.	62515818.	60820861.	86681138.	14227464.	120084480.
400,000	: 61701056.	15257935.	68300235.	56958020.	98479833.	15858519.	130522870.
450,000	: 65760115.	15755894.	73715510.	51622610.	110209970.	17442476.	140480830.
500,000	: 69458924.	16105833.	78802844.	44979003.	121879210.	18984592.	150030580.
550,000	: 72834932.	16322605.	83595143.	37158456.	133493660.	20489065.	159227450.
600,000	: 75918599.	16418351.	88119314.	28268297.	145058320.	21959329.	168114940.
650,000	: 78735168.	16403178.	92397747.	18397854.	156577340.	23398240.	176728060.
700,000	: 81305917.	16285641.	96449388.	7622710.	168054240.	24808216.	185095480.

(ii) 20% from U.K. to N.L.

50,000	: 15410732.	4671757.	14662297.	26199412.	15590280.	2763753.	35641814.
100,000	: 25737745.	7500504.	25241416.	40182503.	30295886.	5006548.	54937483.
150,000	: 34390066.	9633618.	34279364.	49554618.	44667578.	7052709.	70760099.
200,000	: 41986714.	11314987.	42316475.	55932361.	58822426.	8971177.	84679385.
250,000	: 48812134.	12660442.	49609367.	60083505.	72816029.	10794693.	97335409.
300,000	: 55030498.	13738205.	56309192.	62460274.	86681137.	12542541.	109068010.
350,000	: 60748722.	14593355.	62515818.	63361455.	100439390.	14227464.	120084480.
400,000	: 66041958.	15257935.	68300235.	62999440.	114106160.	15858519.	130522870.
450,000	: 70965885.	15755894.	73715510.	61532999.	127692950.	17442476.	140480830.
500,000	: 75563409.	16105833.	78802844.	59085408.	141208690.	18984592.	150030580.
550,000	: 79868583.	16322605.	83595143.	55755114.	154660510.	20489065.	159227450.
600,000	: 83909090.	16418351.	88119314.	51622610.	168054230.	21959329.	168114940.
650,000	: 87707861.	16403178.	92397747.	46754894.	181394710.	23398240.	176728060.
700,000	: 91284221.	16285641.	96449388.	41208651.	194686060.	24808216.	185095480.

(iii) 20% from U.K. to D.K.

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000 :	15389480.	4671757.	14662297.	26199412.	13447416.	2763753.	40968774.
100,000 :	25503768.	7500504.	25241416.	40182503.	26136541.	5006548.	63148334.
150,000 :	33907584.	9633618.	34279364.	49554618.	38539454.	7052709.	81335769.
200,000 :	41237251.	11314987.	42316475.	55932361.	50756499.	8971177.	97335409.
250,000 :	47784010.	12660442.	49609367.	60083505.	62835336.	10794693.	111882970.
300,000 :	53715534.	13738205.	56309192.	62460274.	74804032.	12542541.	125369110.
350,000 :	59140814.	14593355.	62515818.	63361455.	86681138.	14227464.	138032080.
400,000 :	64136356.	15257935.	68300235.	62999440.	98479833.	15858519.	150030580.
450,000 :	68758772.	15755894.	73715510.	61532999.	110209970.	17442476.	161476830.
500,000 :	73051646.	16105833.	78802844.	59085408.	121879210.	18984592.	172453880.
550,000 :	77049542.	16322605.	83595143.	55755114.	133493660.	20489065.	183025280.
600,000 :	80780537.	16418351.	88119314.	51622610.	145058320.	21959329.	193241090.
650,000 :	84267869.	16403178.	92397747.	46754894.	156577340.	23398240.	203141510.
700,000 :	87531115.	16285641.	96449388.	41208651.	168054240.	24808216.	212759510.

(iv) 20% from F. to N.L.

50,000 :	15600622.	5468873.	14662297.	22532640.	14734810.	2763753.	35641814.
100,000 :	25939326.	8633983.	25241416.	35292222.	28635500.	5006548.	54937483.
150,000 :	34536081.	10929553.	34279364.	44363028.	42221357.	7052709.	70760099.
200,000 :	42033483.	12660442.	42316475.	51038331.	55602760.	8971177.	84679385.
250,000 :	48727178.	13971438.	49609367.	55932361.	68832133.	10794693.	97335409.
300,000 :	54787935.	14947819.	56309192.	59406882.	81940353.	12542541.	109068010.
350,000 :	60327026.	15645933.	62515818.	61700937.	94947820.	14227464.	120084480.
400,000 :	65422703.	16105833.	68300235.	62984429.	107869040.	15858519.	130522870.
450,000 :	70132966.	16357462.	73715510.	63384401.	120714850.	17442476.	140480830.
500,000 :	74502510.	16424062.	78802844.	62999440.	133493660.	18984592.	150030580.
550,000 :	78566829.	16324204.	83595143.	61908315.	146212210.	20489065.	159227450.
600,000 :	82354778.	16073064.	88119314.	60175424.	158875980.	21959329.	168114940.
650,000 :	85890268.	15683275.	92397747.	57854362.	171489550.	23398240.	176728060.
700,000 :	89193449.	15165530.	96449388.	54990479.	184056800.	24808216.	185095480.

(v) 20% from F. to D.K.

T.A.C.	E.E.C. £	U.K. £	B. BF	F. FF	N.L. HFL	W.G. DM	D.K. Kr
50,000	15592271.	5468873.	14662297.	22532640.	13447416.	2763753.	38890954.
100,000	25805544.	8633983.	25241416.	35292222.	26136541.	5006548.	59945635.
150,000	34254929.	10929553.	34279364.	44363028.	38539454.	7052709.	77210654.
200,000	41593621.	12660442.	42316475.	51038331.	50756499.	8971177.	92398836.
250,000	48121429.	13971438.	49609367.	55932361.	62835336.	10794693.	106208590.
300,000	54011265.	14947819.	56309192.	59406882.	74804032.	12542541.	119010750.
350,000	59375679.	15645933.	62515818.	61700937.	86681138.	14227464.	131031490.
400,000	64293750.	16105833.	68300235.	62984429.	98479833.	15858519.	142421460.
450,000	68824051.	16357462.	73715510.	63384401.	110209970.	17442476.	153287190.
500,000	73011697.	16424062.	78802844.	62999440.	121879210.	18984592.	163707510.
550,000	76892493.	16324204.	83595143.	61908315.	133493660.	20489065.	173742270.
600,000	80495536.	16073064.	88119314.	60175424.	145058320.	21959329.	183140450.
650,000	83844928.	15683275.	92397747.	57854362.	156577340.	23398240.	192838750.
700,000	86960972.	15165530.	96449388.	54990479.	168054240.	24808216.	201968960.

(vi) 20% from F. to U.K.

50,000	15743466.	5914207.	14662297.	22532640.	13447416.	2763753.	35641814.
100,000	25966380.	9248200.	25241416.	35292222.	26136541.	5006548.	54937483.
150,000	34349724.	11608307.	34279364.	44363028.	38539454.	7052709.	70760099.
200,000	41570322.	13335972.	42316475.	51038331.	50756499.	8971177.	84679385.
250,000	47940071.	14593355.	49609367.	55932361.	62835336.	10794693.	97335409.
300,000	53639318.	15475972.	56309192.	59406882.	74804032.	12542541.	109068010.
350,000	58785660.	16046930.	62515818.	61700937.	86681138.	14227464.	120084480.
400,000	63461843.	16351086.	68300235.	62984429.	98479833.	15858519.	130522870.
450,000	67729230.	16421980.	73715510.	63384401.	110209970.	17442476.	140480830.
500,000	71635126.	16285641.	78802844.	62999440.	121879210.	18984592.	150030580.
550,000	75217106.	15962866.	83595143.	61908315.	133493660.	20489065.	159227450.
600,000	78505736.	15470658.	88119314.	60175424.	145058320.	21959329.	168114940.
650,000	81526345.	14823167.	92397747.	57854362.	156577340.	23398240.	176728060.
700,000	84300275.	14032362.	96449388.	54990479.	168054240.	24808216.	185095480.

(vii) 20% from N.L. to D.K.

T.A.C.	E.E.C. £	U.K. £	B. BF	F. FF	N.L. HFL	W.G. DM	D.K. Kr
50,000	15669533.	5468873.	14662297.	26199412.	10855579.	2763753.	41984165.
100,000	25596598.	8633983.	25241416.	40182503.	21104525.	5006548.	64713436.
150,000	33643775.	10929553.	34279364.	49554618.	31124501.	7052709.	83351638.
200,000	40507693.	12660442.	42316475.	55932361.	40995784.	8971177.	99747816.
250,000	46507962.	13971438.	49609367.	60083505.	50756499.	10794693.	114655940.
300,000	51828865.	14947819.	56309192.	62460274.	60429103.	12542541.	128476320.
350,000	56590329.	15645933.	62515818.	63361455.	70028433.	14227464.	141453140.
400,000	60876605.	16105833.	68300235.	62999440.	79565035.	15858519.	153749010.
450,000	64750086.	16357462.	73715510.	61532999.	89046795.	17442476.	165478950.
500,000	68258828.	16424062.	78802844.	59085408.	98479833.	18984592.	176728050.
550,000	71440964.	16324204.	83595143.	55755114.	107869040.	20489065.	187561480.
600,000	74327482.	16073064.	88119314.	51622610.	117218410.	21959329.	198030470.
650,000	76944049.	15683275.	92397747.	46754894.	126531270.	23398240.	208176270.
700,000	79312282.	15165530.	96449388.	41208651.	135810430.	24808216.	218032660.

(viii) 20% from N.L. to F.

50,000	15796492.	5468873.	14662297.	32528085.	10855579.	2763753.	35641814.
100,000	25572487.	8633983.	25241416.	47953321.	21104525.	5006548.	54937483.
150,000	33320210.	10929553.	34279364.	56923188.	31124501.	7052709.	70760099.
200,000	39782644.	12660442.	42316475.	61700937.	40995784.	8971177.	84679385.
250,000	45303110.	13971438.	49609367.	63361455.	50756499.	10794693.	97335409.
300,000	50080455.	14947819.	56309192.	62537831.	60429103.	12542541.	109068010.
350,000	54244509.	15645933.	62515818.	59648403.	70028433.	14227464.	120084480.
400,000	57886708.	16105833.	68300235.	54990479.	79565035.	15858519.	130522870.
450,000	61074911.	16357462.	73715510.	48786369.	89046795.	17442476.	140480830.
500,000	63861473.	16424062.	78802844.	41208651.	98479833.	18984592.	150030580.
550,000	66287999.	16324204.	83595143.	32395162.	107869040.	20489065.	159227450.
600,000	68388338.	16073064.	88119314.	22458550.	117218410.	21959329.	168114940.
650,000	70190569.	15683275.	92397747.	11492673.	126531270.	23398240.	176728060.
700,000	71718354.	15165530.	96449388.	-423157.	135810430.	24808216.	185095480.

(ix) 20% from N.L. to U.K.

	E.E.C.	U.K.	B.	F.	N.L.	W.G.	D.K.
T.A.C.	£	£	BF	FF	HFL	DM	Kr
50,000	: 15964631.	6338134.	14662297.	26199412.	10855579.	2763753.	35641814.
100,000	: 25897215.	9819602.	25241416.	40182503.	21104525.	5006548.	54937483.
150,000	: 33797169.	12222839.	34279364.	49554618.	31124501.	7052709.	70760099.
200,000	: 40409002.	13925872.	42316475.	55932361.	40995784.	8971177.	84679385.
250,000	: 46076762.	15108237.	49609367.	60083505.	50756499.	10794693.	97335409.
300,000	: 50999726.	15875682.	56309192.	62460274.	60429103.	12542541.	109068010.
350,000	: 55308001.	16298075.	62515818.	63361455.	70028433.	14227464.	120084480.
400,000	: 59093229.	16425082.	68300235.	62999440.	79565035.	15858519.	130522870.
450,000	: 62423417.	16293833.	73715510.	61532999.	89046795.	17442476.	140480830.
500,000	: 65351035.	15933148.	78802844.	59085408.	98479833.	18984592.	150030580.
550,000	: 67917778.	15366052.	83595143.	55755114.	107869040.	20189065.	159227450.
600,000	: 70157583.	14611369.	88119314.	51622610.	117218410.	21959329.	168114940.
650,000	: 72098584.	13684766.	92397747.	46754894.	126531270.	23398240.	176728060.
700,000	: 73764491.	12599489.	96449388.	41208651.	135810430.	24808216.	185095480.

(x) 20% from D.K. to U.K.

50,000	: 15873728.	6057783.	14662297.	26199412.	13447416.	2763753.	31007491.
100,000	: 26056485.	9443202.	25241416.	40182503.	26136541.	5006548.	47794242.
150,000	: 34303607.	11819953.	34279364.	49554618.	38539454.	7052709.	61559525.
200,000	: 41321452.	13541673.	42316475.	55932361.	50756499.	8971177.	73668955.
250,000	: 47437190.	14776319.	49609367.	60083505.	62835336.	10794693.	84679384.
300,000	: 52840595.	15622812.	56309192.	62460274.	74804032.	12542541.	94886450.
350,000	: 57655699.	16146515.	62515818.	63361455.	86681138.	14227464.	104470510.
400,000	: 61969932.	16393889.	68300235.	62999440.	98479833.	15858519.	113551650.
450,000	: 65848220.	16399669.	73715510.	61532999.	110209970.	17442476.	122214820.
500,000	: 69340683.	16190815.	78802844.	59085408.	121879210.	18984592.	130522870.
550,000	: 72487168.	15788868.	83595143.	55755114.	133493660.	20489065.	138523920.
600,000	: 75320119.	15211434.	88119314.	51622610.	145058320.	21959329.	146255810.
650,000	: 77866442.	14473174.	92397747.	46754894.	156577340.	23398240.	153749010.
700,000	: 80148822.	13586476.	96449388.	41208651.	168054240.	24808216.	161028460.

(xi) 20% from D.K. to F.

T.A.C.	E.E.C. £	U.K. £	B. BF	F. FF	N.L. HFL	W.G. DM	D.K. Kr
50,000	: 15766500.	5468873.	14662297.	30547318.	13447416.	2763753.	31007491.
100,000	: 25849730.	8633983.	25241416.	45620627.	26136541.	5006548.	47794242.
150,000	: 34000230.	10929553.	34279364.	54853371.	38539454.	7052709.	61559525.
200,000	: 40923340.	12660442.	42316475.	60293242.	50756499.	8971177.	73668955.
250,000	: 46945748.	13971438.	49609367.	62912754.	62835336.	10794693.	84679384.
300,000	: 52256937.	14947819.	56309192.	63284715.	74804032.	12542541.	94886450.
350,000	: 56980758.	15645933.	62515818.	61787608.	86681138.	14227464.	104470510.
400,000	: 61204504.	16105833.	68300235.	58690450.	98479833.	15858519.	113551650.
450,000	: 64993002.	16357462.	73715510.	54194364.	110209970.	17442476.	122214820.
500,000	: 68396293.	16424062.	78802844.	48455479.	121879210.	18984592.	130522870.
550,000	: 71454165.	16324204.	83595143.	41598502.	133493660.	20489065.	138523920.
600,000	: 74199006.	16073064.	88119314.	33253395.	145058320.	21959329.	146255810.
650,000	: 76657678.	15683275.	92397747.	24921017.	156577340.	23398240.	153749010.
700,000	: 78852842.	15165530.	96449388.	15257172.	168054240.	24808216.	161028460.

(xii) 20% from D.K. to N.L.

50,000	: 15687872.	5468873.	14662297.	26199412.	15162813.	2763753.	31007491.
100,000	: 26029620.	8633983.	25241416.	40182503.	29466229.	5006548.	47794242.
150,000	: 34565892.	10929553.	34279364.	49554618.	43445272.	7052709.	61559525.
200,000	: 41957414.	12660442.	42316475.	55932361.	57213665.	8971177.	73668955.
250,000	: 48509682.	13971438.	49609367.	60083505.	70825422.	10794693.	84679384.
300,000	: 54399703.	14947819.	56309192.	62460274.	84312353.	12542541.	94886450.
350,000	: 59743077.	15645933.	62515818.	63361455.	97695480.	14227464.	104470510.
400,000	: 64621238.	16105833.	68300235.	62999440.	110989740.	15858519.	113551650.
450,000	: 69094630.	16357462.	73715510.	61532999.	124206310.	17442476.	122214820.
500,000	: 73209894.	16424062.	78802844.	59085408.	137353860.	18984592.	130522870.
550,000	: 77004100.	16324204.	83595143.	55755114.	150439310.	20489065.	138523920.
600,000	: 80507414.	16073064.	88119314.	51622610.	163468330.	21959329.	146255810.
650,000	: 83744850.	15683275.	92397747.	46754894.	176445620.	23398240.	153749010.
700,000	: 86737504.	15165530.	96449388.	41208651.	189375180.	24808216.	161028460.

APPENDIX VI

HERRING PRODUCTS WITHIN THE COMMUNITY.

France

Most of the French herring catch is used for human consumption with only waste going to the fish meal industry.

In 1977, 99% of the catch was utilised fresh.

In 1976, 89% of the catch was utilised fresh.

In 1975, 79% of the catch was utilised fresh.

In 1974, 80% of the catch was utilised fresh.

Netherlands

Of the 1977 herring catch, 36% was utilised fresh and 64% was salted and cured. For example, 2,609 tonnes of 'pekkel-maaties' (young fat herring, pickled at 80° salinity), 1,800 tonnes of 'pekkel-volle' (dry salted, gutted herring) and 4,600 tonnes of 'steurharing' (round, cured herring packed in barrels) were produced.

Denmark

A major part of the Danish catch goes to fish meal and oil production, although the proportion has declined as the total catch has declined; for example, from 64% in 1976 to 59% in 1977.

Norway

In 1977, 43% of the Norwegian catch was salted, 31% was frozen, 16% was marketed fresh, 8% was canned and 2% went for reduction.

Source: White Fish Authority, Fisheries Economics Research Unit.

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