The European Association of Fisheries Economists

EAFE-AC REPORT

The Potential Economic Impact on Selected Fishing Fleet Segments of TACs Proposed by ACFM for 2002 (EIAA-model calculations)

A Report of the European Association of Fisheries Economists Advisory Committee

May 2002

European Association of Fisheries Economists Advisory Committee

Chairman:	Philip Rodgers
Members:	Jean Boncoeur Denis Bailly Henning Jørgensen Massino Spagnolo Vincenzo Placenti Erik Buisman Hans Frost
Ex Officio Members:	Jorgen Lokkegaard, EAFE President Aaron Hatcher, EAFE Secretary

Contact:
Jorgen Lokkegaard
President of EAFE
Fødevareøkonomisk Institut
Rolighedsvej 25
1958 Frederiksberg C.
Phone: +45 35 28 68 90
Fax: +45 35 28 68 01
E-mail: jl@sjfi.dk
Website: www.sjfi.dk

EAFE Website: www.eafe-fish.org

Acknowledgement: The model used in this Report was developed from that set out for the Economic Interpretation of ACFM Advice[1] originated under FAIR PL97-3541 and funded for 2001 by the Danish Institute for Agricultural and Fisheries Economics (SJFI), now the Danish Research Institute of Food Economics (Fødevareøkonomisk Institut, FØI). Most of the data presented was collected under the EU funded project 'Data on the economic performance of the fisheries sector' (EU contract no. 00/32 DG Fisheries).

[1] Concerted Action: Promotion of Common Methods for Economic Assessment of EU Fisheries (2001) *Economic Interpretation of ACFM Advice, Specimen Report No. 3,* LEI, Den Haag, 2001.

THE POTENTIAL ECONOMIC IMPACT ON SELECTED FISHING FLEET SEGMENTS OF TACS PROPOSED BY ACFM FOR 2002: (EIAA-MODEL CALCULATIONS)

Contents

Introduction to the EIAA Report for 2001

This report is composed of 2 sections. The first gives an assessment of the expected economic impact of the TACs proposed by the ACFM for 2002. The second describes the EIAA Model. It is intended to throw light on some bio-economic features of the model that will help non-economists and that dovetail with the conventional bio-economic advice.

To carry out an assessment of the financial impact of ACFM advice, the fleet segments examined need to be subject to quotas, and knowledge of the catch composition for the national fleet and each fleet segment is also required. The costs and earnings information is from the Annual Economic Report (AER).

Section 1 includes the segments for which all the information is available. The economic information is quite reliable. Definitions and explanation of diagrams are found in Sections 2.2 and 2.3. In this report it has been possible to include segments from each EU member state as follows:

Belgium	1 segment
Denmark	4 segments
Finland	2 segments
Netherlands	2 segments
Sweden	2 segments

The assumptions for the calculations for these 5 countries are:

- ❖ Future prices are base period prices adjusted with a flexibility rate of 0.2 based on the whole TAC for the EU for the relevant. Species.

- ❖ For Belgium, Denmark, the Netherlands and Sweden the stock-catch flexibility rate is 0.6 for demersal species and 0.1 for pelagic. That means that an in increase in stock abundance lowers the amount of effort. For Finland the stock effects is zero for pelagic species because of the schooling behaviour and 0.6 for demersal species.

- ❖ The change in effort is proportional to the change in the quotas for the relevant segment.

- ❖ Costs are calculated at fixed prices (base period) but adjusted proportionally with the change in effort for future years.

Segments subject to quotas but with no information or no sufficiently reliable comparable information about the catch composition for the relevant segments are those of Ireland, Portugal, Spain and United Kingdom.

Segments for which no applicable information is available also include those of France, where there has been a change of base for data collection and hence as yet no time series, and Germany where no information was collected for 2001. Segments that are not subject to quotas, or very few quotas, are those of Italy and Greece.

Section 1

THE POTENTIAL ECONOMIC IMPACT ON SELECTED FISHING FLEET SEGMENTS OF TACS PROPOSED BY ACFM FOR 2002: (EIAA-MODEL CALCULATIONS)[2]

[2] Concerted Action: Promotion of Common Methods for Economic Assessment of EU Fisheries (2001) *Economic Performance of Selected European Fishing Fleets, Annual Report 2001,* November, SJFI, Copenhagen.

I BELGIUM

I.a Beam trawlers

Segment

The Belgian beam trawl fleet targets shrimps and flatfish. In 2000 it comprised 89 of the 124 vessels over 10m in length in the whole Belgian fleet and accounted for nearly 90% of landings by value. The fleet provided 85% of employment on board and represented 90% of invested capital in the Belgian fleet.

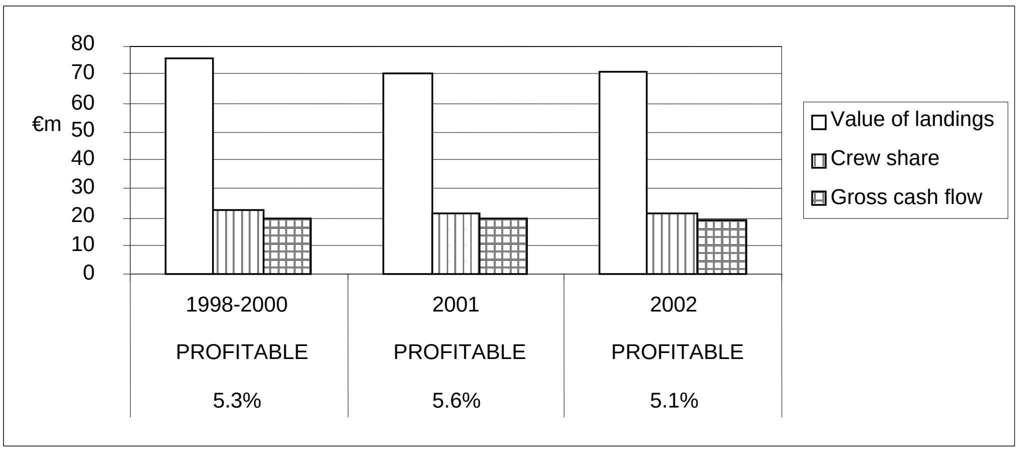
While the number of vessels in the Belgian fleet continues to decline, the fleet's total capacity in GRT and kilowatts has remained steady over the last five years. This suggests an increase in the average fishing power in vessels other than the beam trawlers whose numbers and capacity measured in both GRT and kilowatts has remained virtually unchanged.

Sole provided 44% of the value of landings of the beam trawl fleet, plaice18% and cod 9%.

Beam trawlers with an engine power below 221kw are considered to be shrimpers and part of the coastal fishery. They have not been included in the analysis.

Scenarios

The TACs proposed for 2002 will render the Belgian Beam Trawler fleet profitable at 5.1% of the value of landings, and only slightly less so than in the two previous years. The value of landings is expected to remain virtually unchanged at €71million. The same is expected of crew share at €21 million and gross cash flow at €19 million. Thus gross value added will amount to €41million, virtually what it was estimated to be in 2001.



II DENMARK

II.a Trawlers > 200 GT

Segment

Trawlers greater than 200 GT comprised 136 vessels at the end of 1999 representing 48% of the Danish fleet by tonnage and 29% by kilowatts power. The segment provides 25% of Danish employment in fishing vessels over 10 metres registered length and its share of the earnings of the whole fleet is also 29%.

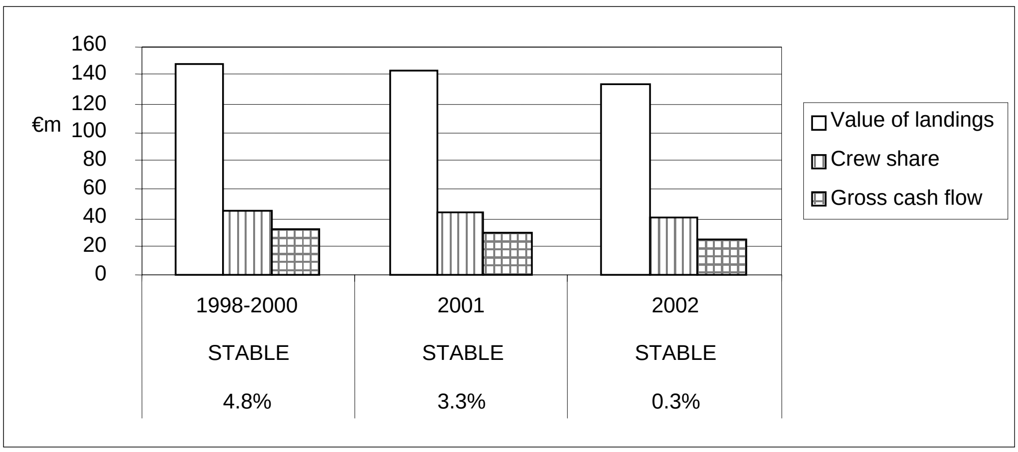
The industrial sector within the segment recovered from a share of only 58% of the earnings of the segment in 1999 to 64% in 2000. The industrial sector fishes mainly for sandeel, sprat, blue whiting, and norway pout.

Herring and mackerel contributed 14% of the segment's earnings and flatfish another 10%. *Nephrops* and northern prawn provided 5%. The contribution of cod and other *gadoids* remained steady at 2.7% in 2000 compared to 1999 but the total earnings of the segment fell by 9%.

Scenarios

The total value of landings of trawlers greater than 200 GT is expected to show an accelerated decline from €146 million in 2000 and €143 million in 2001 to €133 million in 2002, a fall of 9% over the previous year.

The loss of earnings impacts on crew share, and both the gross cash flow and profitability of the fleet. Both crew share and gross cash flow show falls of 9% for 2002 compared to 2001. This has not been a particularly profitable fleet segment in recent years and the forecast is that on the basis of the 2002 TACs the 4.8% and 3.3% profit levels of the two previous years will be all but wiped out. The segment will virtually break even at a level of profitability of 0.3%for 2002.



II DENMARK (CONT)

II.b Trawlers < 200 GT

Segment

There were some 571 trawlers of less than 200 GT at the end of 1999 and they comprised 25% of the Danish fleet by tonnage but 33% by power. The segment is an important contributor to employment in fishing, providing nearly 40% of jobs in the Danish catching sector. It represents 30% of invested capital but only 4% of vessels are less than ten years old.

The value of landings by the segment has been fairly steady over the period 1995 to 2000 and amounted to €152 million in 2000, some 35% of all Danish landings. 11% of the segment's revenue came from industrial species.

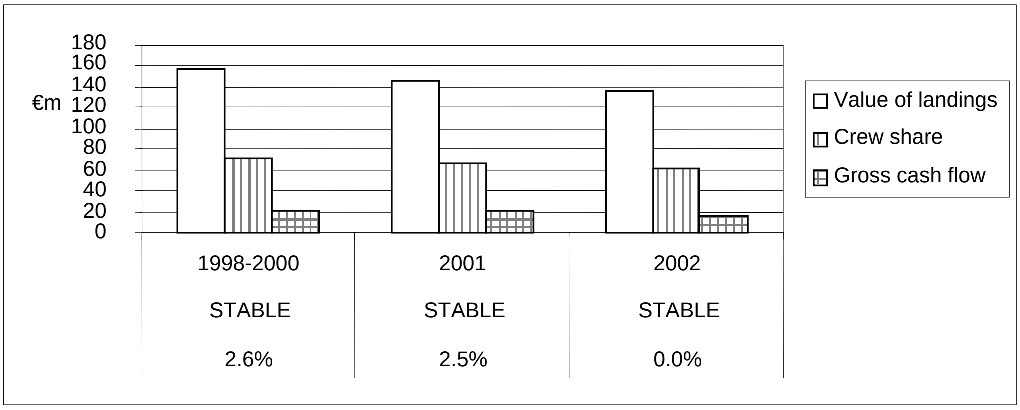
Cod and other *gadoids* contributed 30% of the segments earnings in 2000, flatfish some 19%, and *nephrops* and northern prawn 32%.

Scenarios

The TACs proposed for 2002 are expected to provoke a decline in the value of landings between 2001 and 2002 of 9% following a fall of the same percentage in the previous year.

Crew share is forecast to fall to €62 million in 2002 from €66 million in 2001 and €71 million in 2000. Gross cash flow shows similar percentage falls to €18 million from €21 million and €22 million.

The sector has not done much better than break even in recent years and though it is expected to have made a small profit of 2.5% of earnings in 2001, this will be eliminated completely and the segment will break even under the 2002 TACs.



II DENMARK (CONT)

II.c Danish Seiners

Segment

At the end of 1999 there were 94 registered Danish Seiners. They comprised 4% of the GT of the Danish national fleet and 8% by kilowatts power. All except one of the vessels were built before 1990.

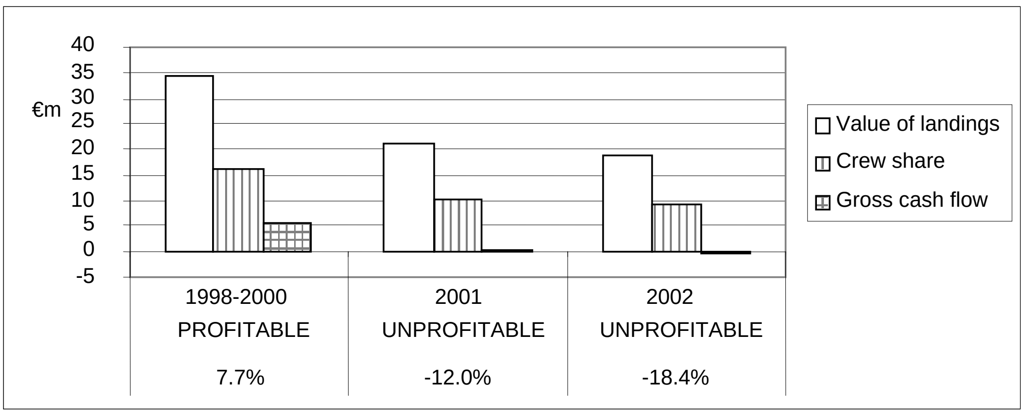
They provide 7% of the employment on board Danish vessels, or 337 crew places.

The Danish Seiners segment contributes 6% to the value of landings of the national fleet. Its target species are flatfish, which provide 62% of landings by value with plaice and sole alone contributing 50%. Cod landings comprise 34% of the segment's earnings.

Scenarios

The value of landings by Danish Seiners is expected to fall by 11% in 2002 compared to the previous year following cuts in the cod quota, in addition to having declined by 11% between 2000 and 2001. Similar falls are forecast for crew share and gross cash flow, with gross cash flow in 2002 being negative.

The TACs reductions are forecast to have pushed the segment into losses of 12% of already declining earnings in 2001, worsening to 18% in 2002. Since the segment would not be covering its depreciation and interest, this represents a serious and unsustainable position.



II DENMARK (CONT)

II.d Gill Netters

Segment

All but 73 of the 1190 Gill Netters in the Danish fleet are under 20GT in size. They comprise 28% of the fleet by number but only 8% by tonnage and 22% by kilowatts power. More than 1100 of these vessels were built before 1990.

The segment is an important contributor to employment, providing 1215 jobs at sea or some 27% of employment in fishing in Denmark. It earns 16% of the value of landings of the Danish fleet.

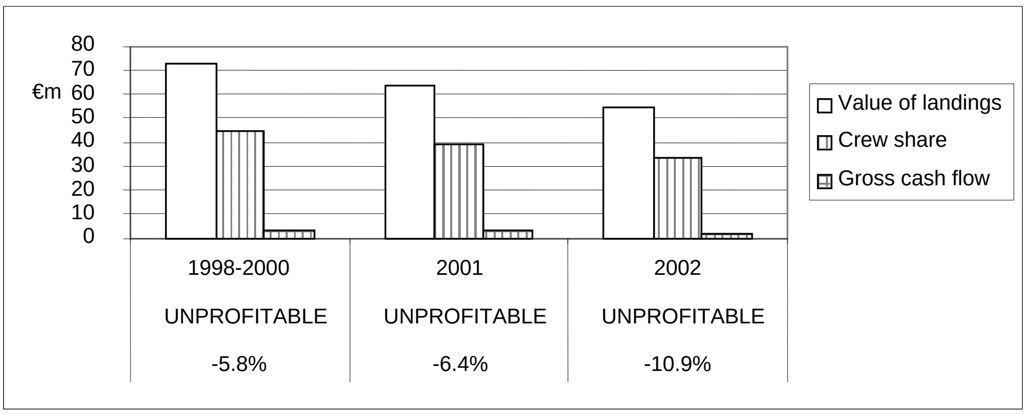
Cod is the most important target species providing 64% of the value of segment landings. Flatfish contribute another 24%, with plaice and sole alone providing 19%.

Scenarios

Because of the segment's heavy dependence on cod and flatfish it has been unprofitable in recent years, though the losses have been borne by depreciation charges which allow businesses to continue ultimately until they are forced to close because they are unable to renew their vessels.

Landings value is forecast to continue to fall in 2002, by 14% over the previous year, having fallen by 22% between 2000 and 2001. Crew share is forecast to fall by 14% between 2001 and 2002 and Gross Cash Flow by 50%.

The losses of the segment will worsen to 6% of earnings in 2001 and 11% in 2002 as a result of the cuts in cod and plaice TACs. From a weak position, the segment faces increasing losses which will become greater than the value of interest and depreciation in 2002, an unsustainable position for the segment.



III FINLAND

III.a Pelagic Trawlers

Segment

There were 120 vessels in the Finnish pelagic trawler segment in 2000. The number has fallen steadily from 169 in 1995. They comprise 3% of the national fleet by number but 37% by GT and 19% by kilowatts power. The segment's fleet is ageing. All the vessels were built before 1990 and 49 were built before 1970.

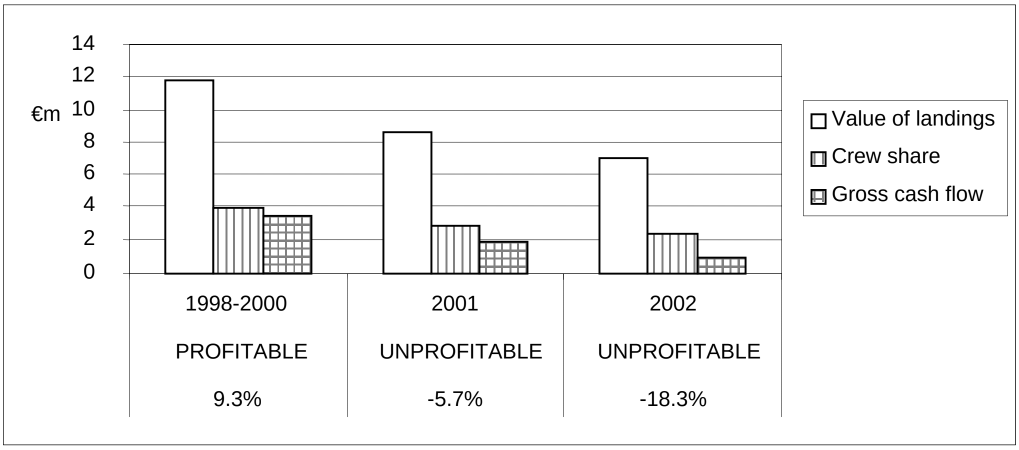
The segment provides 296 jobs or 108 full-time equivalent jobs, reflecting the seasonal nature of the fishery. These represent 11% of the employment in fishing in Finland.

The segment targets sprat and baltic herring. Baltic herring provides 83% of earnings and the segment contributes 52% of the value of landings of the Finnish fleet.

Scenarios

It is forecast that the TACs proposed for 2002 will continue to render the Finnish pelagic trawler segment unprofitable. The value of landings is expected to fall by a further 8% in 2002 after falling by 31% between 2000 and 2001. Crew share will decrease by 8% in 2002 compared to its 2001 level and gross cash flow by 48%.

In the years 1998 to 2000 this segment averaged about 9% profitability. The 2001 TACs converted this to a loss of 9%, still covered by depreciation but those of 2002 will produce unprofitability of more than 24%. Given the scale of the losses, the implications for the size of the segment are significant.



III FINLAND (CONT)

III.b Offshore Vessels

Segment

There were 36 vessels in the Finnish Offshore fleet in 2000. They comprised 1% of the national fleet by number, but 4% by tonnage and 3% by kilowatts power. None of the fleet is less than twelve years old but nearly 60% were built after 1979.

The segment provides 61 full-time equivalent jobs, 2% of those in fishing in Finland.

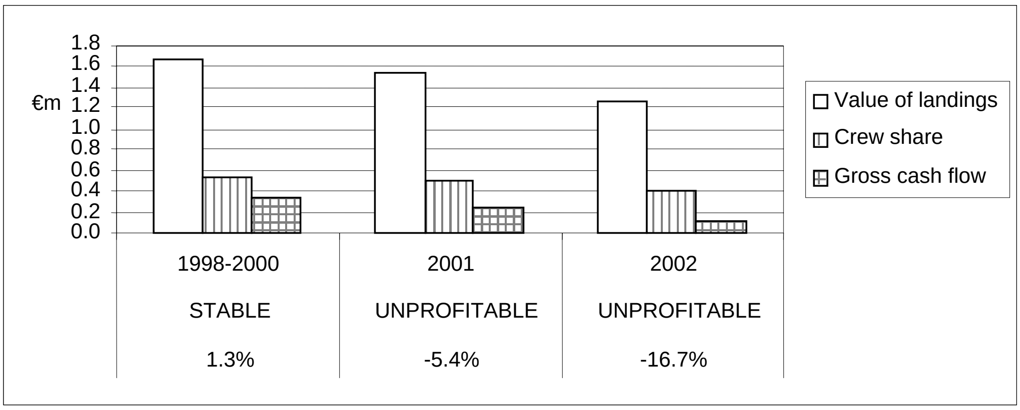
Cod and salmon are the main target species providing 28% and 57% of the segment's earnings. The segment contributes 8% of the landings by value of the Finnish national fleet.

Scenarios

Between 1998 and 2000 the performance of the Offshore Vessels segment was stable at slightly better on average than breaking even. The 2001 TACs have reduced it to unprofitability and this is expected to worsen in 2002.

The decline in landings by value of 8% forecast for 2001 compared to 2000 is expected to worsen markedly by a further 18% in 2002 compared to the previous year. Crew share is forecast to fall by 18% in 2001 and the same amount again in 2002. Gross cash flow will fall by 32% in 2001 and by another 53% in 2002, compared to the previous years.

Compared to losses of 5.4% in 2001, the result is that the TACs for 2002 will bring about losses of more than 16% of earnings for the segment. This is unsustainable for the segment as the losses go beyond depreciation.



IV NETHERLANDS

IV.a Eurocutters 261-300 HP

Segment

In 2000 there were 159 vessels in the Dutch 261-300 Horse Power Eurocutter segment. They comprised 38% of the national fleet by numbers but 7% by GT and 8% by kilowatts power. The average age of vessels in this segment is 27 years, though over the last ten years there have been three or four new vessels commissioned each year.

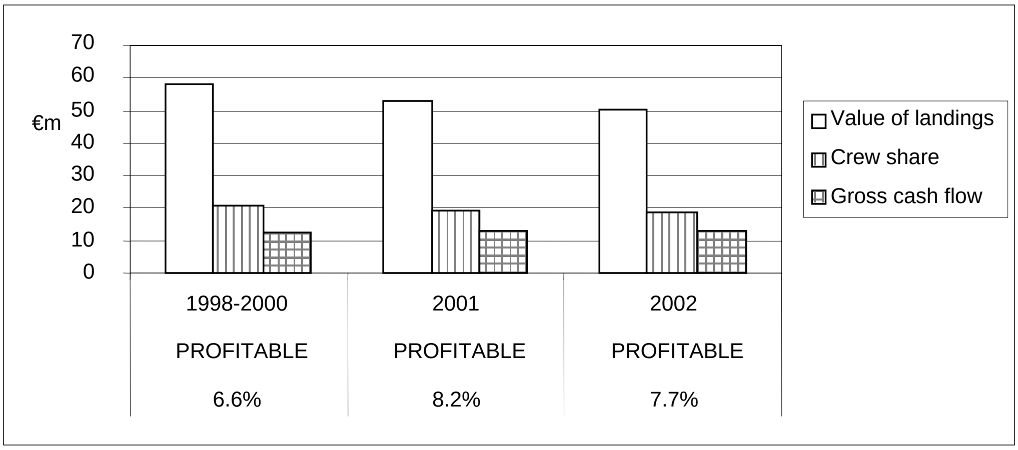
508 full-time equivalent jobs are provided by the segment or some 21% of jobs in fishing in the Netherlands.

The main target species are shrimp and sole. Sole provided 32% of segment earnings in 2000. Plaice contributed 7% and cod 6%. Other species, notably shrimp, added a further 54%.

Scenarios

The 261-300 HP Eurocutter segment is expected to remain profitable under the 2002 TACs. Earnings are forecast to continue the fall seen in 2001, declining by 4% in 2002 compared to 2001 when there was a 12% fall. Crew share is forecast to fall by 9% in 2001 and 10% under the 2002 TACs but gross cash flow is expected to rise by 37% in 2001 but fall back by 3% in 2002.

The profitability of the segment rises from an average of 6.6% of earnings over the years 1998-2000 to 8.2% in 2001, falling back slightly to 7.7% in 2002.



IV NETHERLANDS (CONT)

IV.b Beam Trawlers > 811 kw

Segment

There were 157 vessels in the beam trawlers > 811 kilowatts segment in 2000. They comprised 37% of the fleet by numbers but 38% by GT and 62% by power. 41 of these vessels have been built since 1990.

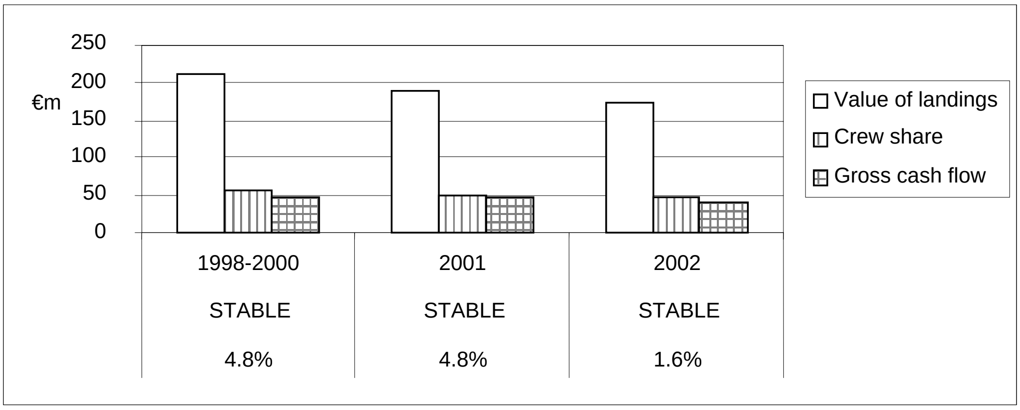
They provide 46% of employment at sea in the Dutch fishing industry.

In 2000 these large beamers contributed 53% of the landings value of the Dutch national fleet. Their main target species are flatfish, especially sole and plaice. Sole landings amounted to 54% of their earnings and plaice 25%. Cod were 4% and other species 17%.

Scenarios

Earnings of the beam trawlers > 811 kw are expected to continue to fall under the 2002 TACs. They are forecast to have fallen by 12% in 2001 compared to 2000 and by a further 9% from 2001 to 2002. Crew share remains almost unchanged in 2001 compared to 2000 but falls by 8% in 2002. Gross cash flow rises sharply by 29% in 2001 only to fall back by 13% in 2002.

The effect of this on profitability is that it remained steady from 2000 to 2001 at 4.8% but falls to little better than break even in 2002 at 1.6%.



V SWEDEN

V.a Pelagic Vessels ≥ 20m

Segment

In 2000 there were 60 pelagic vessels ≥ 20 metres registered length. Though they comprised only 3% of the Swedish fleet by numbers, they provided 45% of the Gross Tonnage of the fleet and 26% of its power. 48 of the vessels are more than ten years old, but of the remainder five were commissioned in the last four years.

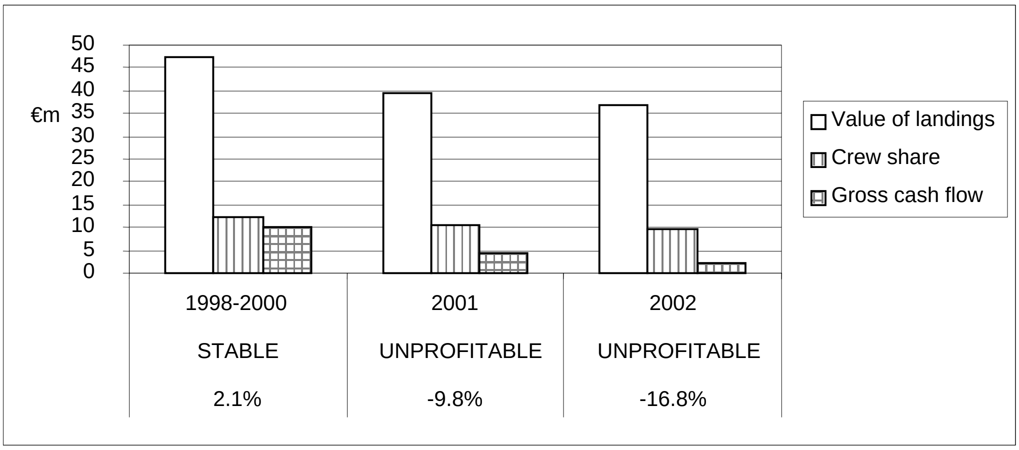
These large pelagic vessels provide 17% of the employment at sea in the Swedish fishing industry. They contributed 38% of Swedish landings by value in 2000.

The main target species of the fleet are herring, which provide 52% of their landings by value in 2000, and sprat, which provided 20%. Mackerel contributed 7%.

Scenarios

Earnings of the pelagic vessels ≥ 20m are expected to fall in 2002. They are forecast to have virtually remained steady from 2000 to 2001 with a fall of 1% but are expected to fall by a further 7% in 2002. The same percentage changes are forecast for crew share. However, gross cash flow records a forecast fall of 13% from 2000 to 2001 and a further fall of 50% in 2002 caused by the fall in gross earnings.

The effect is that the fleet lapses into unprofitability, amounting to 10% of gross earnings (landings) in 2001. Its position worsens in 2002 to losses of 17% of gross earnings.



V SWEDEN (CONT)

V.b Demersal Vessels ≥ 20m

Segment

In 2000 there were 38 demersal fishing vessels ≥ 20 metres registered length. They comprised 2% of the Swedish fleet by numbers but provided 15% of the Gross Tonnage of the fleet and 9% of its power. 35 of the vessels are more than ten years old but the remaining three were commissioned in the last five years.

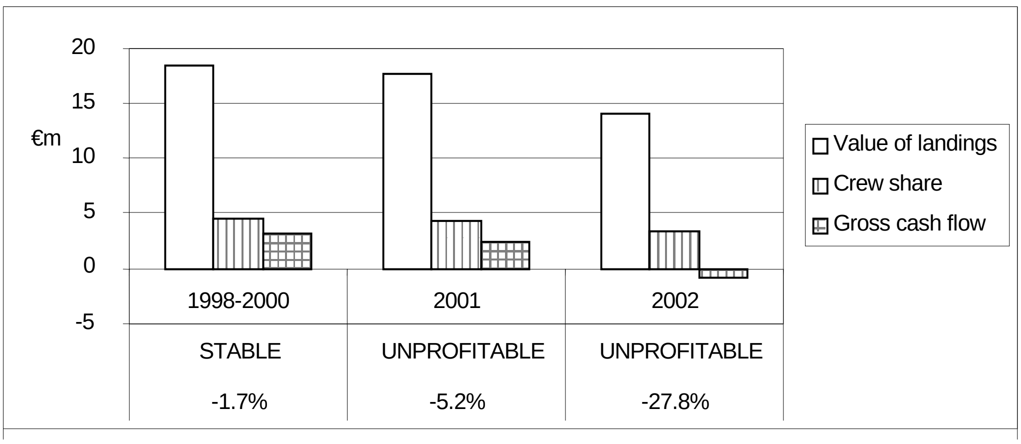
The large demersal vessels provide 8% of the employment at sea in the Swedish fishing industry and contributed 21% of Swedish landings by value in 2000.

The main target species of the fleet is cod, which provided 62% of their landings by value in 2000.

Scenarios

Earnings of the demersal vessels ≥ 20m are expected to continue to fall in 2002. They are forecast to have fallen by 17% from 2000 to 2001 and are expected to fall by a further 20% in 2002. In the same periods crew share is expected to fall by 25% and 20%. If this is not reversed in coming years the socio-economic consequences are likely to include a fall in the supply of crews. Gross cash flow records a forecast fall of 24% from 2000 to 2001 and becomes negative in 2002. These effects are largely the result of the fall in gross earnings.

The upshot is that the fleet descends into unprofitability, amounting to 5% of gross earnings (landings) in 2001. Its position worsens in 2002 to losses of 28% of gross earnings, where depreciation and interest payments are not covered, an unsustainable position for the fleet.



SUMMARY

Country	Segment	Percentage Level of Financial Profitability 2002	Impact of 2002 TAC on Financial Profitability compared to 2001
Belgium	Beam Trawlers	5.1	Lower
Denmark	Trawlers ≥ 200 GT	0.3	Lower
	Trawlers < 200 GT	0.0	No longer Profitable
	Danish Seiners	-18.4	Worsened
	Gill Netters	-10.9	Worsened
Finland	Pelagic Trawlers	-24.4	Worsened
	Offshore Fleet	-16.7	Worsened
Netherlands	Eurocutters 261-300 HP	7.7	Lower
	Beam Trawlers >811kw	1.6	Lower
Sweden	Pelagic Vessels ≥ 20m	-16.8	Worsened
	Demersal Vessels ≥ 20m	-27.8	Worsened

Section 2

The EIAA Model

Methodology, Definitions and Features

1. Methodology

Background

The background to this report is the need for economic assessment to supplement the ACFM advice demanded by STECF and other interested agents.

Objective

To produce short-term economic forecasts that take into consideration the quota advice given by ACFM for the fleet segments specified in the economic report.

Data requirements

- Technical details of fleet segments
- Landings by species
- Prices by species
- Cost information for fleet segments
- ACFM advice for landings by management stocks

Costs and earnings data should be drawn from the Annual Economic Report on Economic Performance of Selected European Fleets, while ACFM advisory data should be extracted from pertinent ACFM reports.

Scenario calculations

The EIAA report presents scenarios. They are intended as information to aid in making political choices. Therefore the scenarios should not be interpreted individually but rather in comparison with one another for each country. Such comparison indicates what change can be expected if one or another choice is made.

On many major species the ACFM provides options according to the level of fishing mortality. Different options for various stocks can be combined in the catch composition of the fleet segments leading to a potentially very large number of scenarios, many of them not leading to converging results.

It cannot be foreseen which TAC will be decided upon by the Council of Ministers and to which extent quotas will be swapped between Member States. For some stocks ACFM does not provide any advice. In other cases the advice is not identical to the TAC management areas.

Only for a relatively few stocks are precautionary Spawning Stock Biomasses and TACs estimated.

Data problems

When combining biological assessment and advice with economic assessment and advice, a number of data problems arise. Based on the problems detected in the work with the economic assessment the problems could be divided into 6 areas:

1. Where quota species are constituting a large part of the landings composition of the fleet segments but the final data are not available

2. Where item one applies, but where data exists and where the management decisions have been made already

3. Where the quota species constitute only a small share of the total landings of the fleet segment

4. Where no biological assessment is made but where precautionary quotas are fixed

5. Where the biological stock assessment areas are inconsistent with the quota management areas

6. Where no assessment and no quota management is in function

The model can be applied with necessary adjustments to all areas.

Assumptions

In many cases assumptions have had to be made regarding information lacking which is essential for use in the model, e.g. the composition of costs and catches of specific fleet segments, price flexibility rates of certain species, etc.

Constant fishing patterns

The calculations require an assumption regarding the relative shares of the various national fleet segments in the national landings of a specific species.

It is assumed that this fishing pattern will not change from the reference year to the year for which the evaluation is made. In other words there is no substitution effect between the inputs to fishing.

The time that becomes available due to reduced effort on one stock remains unused. It is not utilised in another fishery or another species. For short term forecasting, when the quota changes remain within reasonable limits, this assumption can be justified. However, over a longer time period and with more substantial changes in the overall composition of fishing opportunities (quota and non-quota species) the fleets may adjust their fishing pattern to the new conditions.

Effort and catch of non-target species

When a TAC is changed the effort on the specific species will have to be adjusted accordingly. At the same time catches of other species may be affected because of the change in effort and their catch per unit effort (CPUE). These adjustments have been introduced as follows:

- Effort: The fishing effort exerted on a particular species in the reference year is assumed to be proportionate to the share of that species in the total value of the landings of the fleet segment. Consequently, when F<1 is selected in a scenario, the total fishing effort of that fleet segment will be reduced by weighing the new Fs of all species with the respective shares in value of landings (see the example on page 27). Consequently, the composition of effort of one fleet segment by target species shifts away from the species which is to be protected. At the same time the role of all fleet segments fishing this species remains proportionately the same.

- Non-target species: Landings of non-target species are not affected by the reduction of effort on the target species. The implicit assumption may be that either the CPUE increases or that the vessels search for other fishing grounds with different proportions of various species in their total catch.

The effort influences the variable costs in the short and the long run while fixed costs are unchanged. Variable costs are assumed to be non-linear with effort because it is assumed that the stock abundance influences the CPUE in a non-linear way. This implies that i.e. a smaller quota requires less fishing effort to be caught and therefore lower variable costs.

At the same time a lower stock abundance leads to a lower CPUE, which offsets some of the lower effort needed to catch the lower quota. To include this assumption the model operates with a catch-stock abundance flexibility rate. The procedure is summarised in the following items:

- Fishing mortality is changed only for a few species (quota species)

- Initial effort is normalised relative to the catch composition for the relevant fleet segment

- Species effort is changed according to change in recommended landings (TACs and F values)

- Landings per unit effort are dependent on stock abundance

- Landing flexibility rate is assumed 0.1 for pelagic species and 0.6 for demersal species; if no stock information is available the flexibility rate is 0

- Total effort is changed as a weighted average of the landing composition

- Effort is assumed to change as a weighted average of the stock abundances.

Live weight equivalents

As the ACFM advice is provided in live weight, all catches and landings are assumed to be live weight equivalents. In practice some fish is landed headed or gutted so that also the respective price information regards dead weight price per kg. At this stage the prices are unadjusted. This leads to overestimation of forecasted values. It is considered to correct for that in future model versions.

Quota uptake

Nominal quota, as set at the beginning of the year, is considered. However, in practice quotas are swapped between countries, some quota remain unutilised and/or some are exceeded. The total effect of these changes is summarised in an uptake correction factor. This factor allows the projected landings of the coming year to be different from the proposed quota.

Prices

Price level is adjusted to changes in the volume of landings. Future price is calculated based on a price flexibility rate at -0.2. Consequently, value of lower quota is somewhat (20%) offset by higher prices. General price trends could not yet be included and neither could the total European or global catches be taken into account. A greater refinement of price elasticity by species will be pursued in a later stage.
In the model price changes are calculated for each species (e.g. one herring and cod species etc.). Landings from third countries are not included.

2. Definitions

Gross Earnings of the vessel and catches (Value of landings)

Gross earnings of a vessel are evidently determined by annual volume of catches per species and the prices, which those species fetch. The time, which can be spent at sea, and the productivity achieved per unit of time (catch per unit of effort) determine the annual volume.

Variable costs

Variable costs vary directly with effort i.e. fuel, provisions, repairs. When effort, exerted on a certain stock, is reduced due to lower F (or TAC), the total variable costs of that fleet segment are reduced relative to weight of the reduced species in the fleet segment's composition of landings (cf. above concerning effort).

Fixed costs

Fixed costs (including interest payments and depreciation) are kept constant and are assumed not to vary with effort. This is justified because in the short-run no changes in the invested capital can be expected.

Gross value added

Gross value added = depreciation costs + interest + crew share + net profit, or,
Gross value added = Gross revenues - all expenses (excl. labour remuneration, instalments and interest payments on loans).

Crew share

Crew share is a percentage of the difference between gross revenue and variable costs.

Gross cash flow

Gross cash flow = gross value added – crew share *(= income to the vessel)*

Net result

Net result = gross revenues – variable costs – fixed costs – crew share

3. Presentation and interpretation of results

EIAA contains a short, a medium and a long-term assessment of expected changes in economic performance. Four main indicators are used for this purpose:

- *Gross revenue:* Is total landing value and is easy to relate to because it compares to total landing volume and are often used as an indicator of gross income.

- *Crew remuneration:* Earnings of the crew members, including a skipper-owner. An important indicator for the economic attractiveness of the profession. If the figure is divided by an opportunity salary, employment measured in full-time fishermen is easily calculated.

- *Gross cash flow:* Can be considered the main indicator for the feasibility of the survival of fishing companies in the short run (2-3 years). Negative cash flow cannot be born for long, as the cash expenses exceed cash income. Low cash flow will lead to problems of repayment of loans. The policy of the banks becomes of crucial importance in such situation.

- *Net profit (result):* Represents the "above normal" economic remuneration of invested capital. As this is the ‘bottom line’ of the calculations, it is very sensitive to changes in earnings or costs. It must be stressed that the net result calculated in EIAA is an economic and not a fiscal indicator. This means that it shows the long-term feasibility of survival of the sector. A low economic net result may be still quite satisfactory in fiscal terms in the medium term (4-5 years). Net result is presented in the diagrams relative to the gross revenue, and in this way the result represents a substitute for net profit relative to investments.

This information is presented in diagrams, with the scenarios placed along the horizontal axis. The value of landings, crew share and gross cash flow are shown as histograms. Below each scenario there is a verbal indication of the economic performance of the fleet segment and the precise value of the ratio of net profit to gross value of landings. The classification is derived from this ratio as follows:

- *Profitable:* Net profit/gross value of landings > 5%.

- *Stable:* -5% < net profit/gross value of landings < 5%

- *Unprofitable:* Net profit/gross value of landings < -5%. In this situation fishing cannot continue in the long run.

4. Specification of the biological data required for the EIAA model

All data specified below must be defined with precise correspondence to the definition of TACs in terms of species and areas for all North East Atlantic stocks, i.e. including Norway, Iceland, Russia, Faeroe Islands, etc.

The following data is required:

- Estimation of long term TAC under precautionary conditions (yield per recruit at Fpa * number of recruits).

- Time series of SSB, annually up-dated to reflect latest VPA or another indicator reflecting fish density SSB under long term sustainable conditions.

- Sets of proposed Fs, incl. Fpa, with the corresponding TACs, e.g.:

    - TACs at Fpa,

    - TACs at 0.8 F, and

    - TACs at 1.2 F.

- Indication of the multi-species effect, e.g. probability distribution that all stocks will recover at the same time, if management is properly implemented.

If information about fishing mortalities and SSB does not exist, which is the case for a number of management areas, only the TAC fixed for the management area is used in the calculation.

5. Selected model features

The use of price and stock abundance flexibility rates

The forecast prices *P* for species *i* and fleet segment *j* are calculated by use of the subsequent formula, where α is the price flexibility rate and Q is the landing volume.

$$Pfcast_{i,j} = \frac{Pbase_{i,j}}{Qbase_i^{\alpha}} \cdot Qfcast_i^{\alpha} . \qquad \text{It is assumed that } \alpha \leq 0 \qquad (1)$$

The variable costs *VC* of fleet segment *j* is adjusted by the change in effort caused by the change the total allowable catches *TAC* of each species *i* and the change in the stock abundance (density) calculated by the spawning stock biomass SSB in the base year and the forecast year. The flexibility rate β indicates the impact on *VC*, through the effort change, by the change in stock abundance. For pelagic species it is assumed that the flexibility rate (density impact) is small while it is large on demersal species.

The forecast effort for each member state and member state fleet segment (member state subscript omitted) is calculated in the following way. Forecast landings value of each species *i* subject to a TAC (LVTAC) is put relative to the sum of landing values of TAC species in the base case for the fleet segment. This produces coefficients displaying the shares of the species in the landing value composition of the TAC-species.

These coefficients are adjusted (multiplied) with the relationship between the spawning stock biomasses (SSB) lifted to an exponent (the flexibility rate). This relationship expresses the change in stock density. Finally, the coefficients calculated for each species are added into one figure for the fleet segment showing the effort required to catch the fleet segment's share of the new TAC

$$Efcast_j = \sum_i \left(\frac{LVTACfcast_{i,j}}{\sum_i LVTACbase_{i,j}} \cdot \left(\frac{SSBfcast_i}{SSBbase_i} \right)^{(-\beta)} \right); \quad \text{It is assumed that } 0 \leq \beta \leq 1 \qquad (2)$$

The change in effort affects the variable fishing cost in a linear way. The element *Ebase* is included in the equation to secure that effort in the forecast situation is normalised relative to base case situation. Effort in the base case is not always fixed at 1 because there are minor differences between the observed landing values derived from the Annual Economic Report (AER) of quota species and the landing values that are calculated in the EIAA-model taking the empirically estimated fleet segment landings multiplied with recorded prices. The landing values (*LVTAC*) in the base case are the ones from the AER-report.

$$VCfcast_j = VCbase_j \cdot \frac{Efcast_j}{Ebase_j} \qquad (3)$$

In the new version of the model the above formula (2) has been changed to allow for a non-linear increase in future effort, and hence variable fishing costs, as a function of future changes in landings volume.

$$E_{fcast_j} = \sum_i \left(\frac{LVTAC_{fcast_{i,j}}}{\sum_i LVTAC_{base_{i,j}}} \cdot \left(\frac{LTAC_{fcast_{i,j}}}{LTAC_{base_{i,j}}} \right)^{(\chi)} \cdot \left(\frac{SSB_{fcast_i}}{SSB_{base_i}} \right)^{(-\beta)} \right) \quad (4)$$

Where it is assumed that χ is very close to 0 until otherwise is documented.

LVTAC is landings in value and future quotas in value, LTAC is landings volume and future quota, SSB is spawning stock biomass.

The flexibility rate:

Assuming a price-quantity function as below, the flexibility rate is equal to the exponent to the independent variable:

$$Pbase = a \cdot Qbase^{\alpha} \Rightarrow a = \frac{Pbase}{Qbase^{\alpha}} \, and \, \frac{\partial Pbase}{\partial Qbase} = \alpha \cdot a \cdot Qbase^{\alpha - 1}$$

$$flex = \frac{\frac{\partial Pbase}{Pbase}}{\frac{\partial Qbase}{Qbase}} = \frac{Qbase}{Pbase} \cdot \frac{\partial Pbase}{\partial Qbase} = \frac{Qbase}{f(Qbase)} \cdot \frac{\partial f(Qbase)}{\partial Qbase}$$

By proper substitution we get:

$$flex = \frac{Qbase}{a \cdot Qbase^{\alpha}} \cdot \alpha \cdot a \cdot Qbase^{\alpha - 1} = \alpha$$

This result also applies to stock abundance-catch flexibility rate.

6. Special Features of the EIAA Calculations

The purpose of this section is to throw light on two features of the EIAA model and its application. First, the possible application and related process is discussed. Secondly, the way the model works, and in particular how it handles effort and effects of stock abundances is described. The EIAA model is set out in detail in Salz and Frost (2000)[3].

The work with the EIAA model aims at producing advice that could form the basis for the final determination of the TACs. The following procedure has been proposed but it has been difficult to implement in practice:

- The Annual Economic Report, containing data on fleets, costs and earnings of fleets, etc. should be finalised in draft form before November 1st. This is the case now for a large number of fleet segments.

- ACFM advice on TACs should be available in late October and could then be applied in the EIAA model together with the information from the AER.

- An EIAA Report could be presented to the STECF together with the developed model at the STECF meeting in November.

- Any changes to the ACFM advice made by the STECF could be substituted into the model for economic assessment for selected fleet segments and afterwards be conveyed to the Commission.

A number of factors have made this procedure difficult to pursue. One is that there is still some work to do in the development of the interface between the species list in the EIAA model and the TAC list for the EU management areas. Another and more important reason is that the ACFM information arrives very late and is incomplete with respect to the EU management areas and the data needed.

The EIAA model requires the following data:

- TACs allocated to the EU, and the biomass levels, for all management areas for the short run calculations.

- Estimation of TACs and biomasses under long-term sustainable conditions for the long run calculations.

In the short run the aim is to improve the EIAA calculations by including more fleet segments. What is required to accomplish this is that data for the catch composition (landings) for a number of fleet segments is improved.

The EIAA model has further been developed to assess the medium to long run sustainable situation with respect to fish stocks, which requires data about the fish

---

[3] Salz, P. and H. Frost (2000): Model for economic interpretation of ACFM advice (EIAA) page 165-181, in E. Lindebo and N. Vestergaard edt. Proceeding of the XIIth Annual Conference of the European Association of Fisheries Economics (EAFE)

stock biomasses. This area is not subject to the same time restriction as is the information about the TAC's for the short-term assessments but on the other hand the data information about long run biomasses and TAC's is at present incomplete in the EIAA model and could without doubt be improved.

In the following sections some particular features of the EIAA calculations are highlighted. The EIAA model is designed to calculate the required effort measured from the output side i.e. landings to catch the TACs. This is contrary to many models that work from the input side i.e. calculate how much could be caught varying the effort.

An explicit functional form for the effort calculation in the EIAA model is:

$$\mathrm{E} = a * \frac{L^{\chi}}{X^{\beta}}$$

where

L: landings
X: spawning stock biomass
chi and beta are parameters ("elasticities")

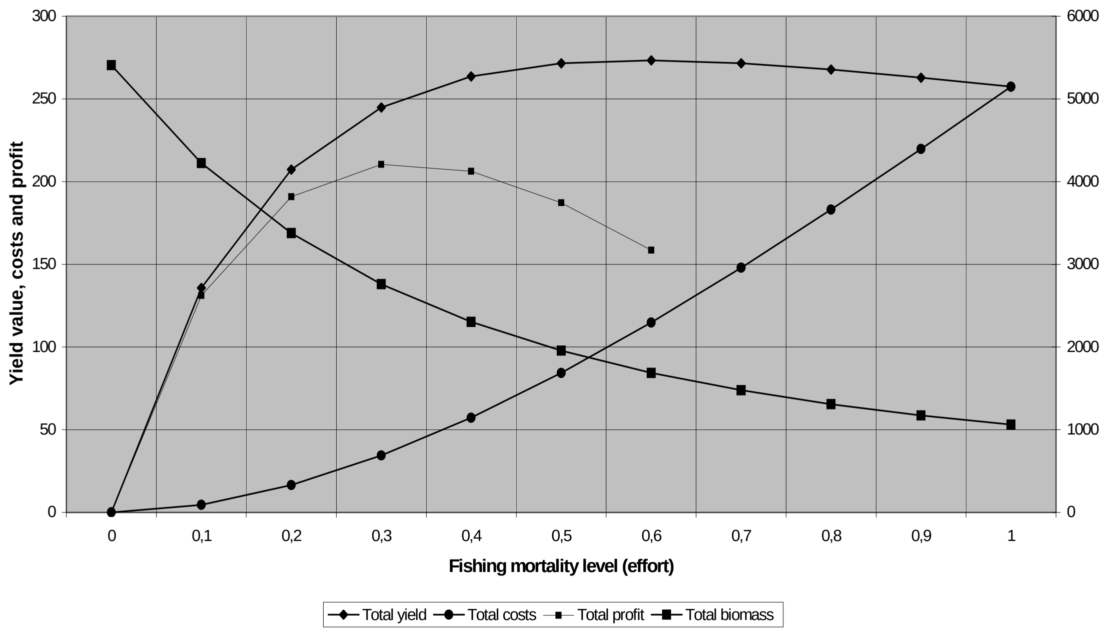
Effort is positively correlated with the size of the landings and negatively correlated with the size of the fish stocks X. The way the model works is that once E is determined for the future years for the country in question where L is equal to the quotas, the variable costs determined in the base case are adjusted linearly up or down for the future years. The landings are exogenously given by the quotas and the landing value is determined by the quota multiplied with the prices. The management authorities fix the quotas following biological advice. The biological calculations that form basis for the TAC advice also calculate and advise upon the stock abundance X.

The relationship between E and X is very important for the calculation in the EIAA model because it controls the CPUE, and this relationship forces effort backwards to the peak point, or to the left of the peak, of the yield curve. If X is high enough effort will decrease for a given TAC.

When and if the EIAA model is to be used for long term assessment the inclusion of the fish stock abundances is imperative, and that type of information has to be introduced in cooperation with biological expertise.

In a stylised form the EIAA model is shown in the subsequent figure for a single species, plaice, reflecting growth and mortality characteristics in an age structured biological model. If the current situation is described by the intersection between gross revenue and cost at fishing mortality level 1, an increase in the TAC in association with an increase in the stock biomass (i.e. moving to the left will increase costs to start with because of the higher landings but this increase is more than counterweighted because of the stock abundance effect).

EIAA model functioning (measured per recruit)



The EIAA model works in such a way that it is assumed that the TACs are taken, but it also works on fleet segment levels rather than by species. That means that a number of species are included in the pertinent fleet segments' catch composition at the TAC point and the stock abundances for each segment differ.

The equation that determines effort in the EIAA model for each country is:

$$E_{0+t,j} = \sum_i \left(\frac{VQUOTA_{0+t,i,j}}{\sum_i VQUOTA_{0,i,j}} \cdot \left(\frac{QUOTA_{0+t,i,j}}{QUOTA_{0,i,j}} \right)^{(\chi)} \cdot \left(\frac{SSB_{0+t,i}}{SSB_{0,i}} \right)^{(-\beta)} \right)$$

The indices *t, i, j* are time, species, and fleet segment, and 0 is the base year that is constituted by three years average to level out variations in landings and prices.

The first element in the equation says that fishermen direct their effort according to the landings value of the species, the second element determines the accessibility to the species which is controlled by the χ exponent; if χ is zero the fish is easily accessible, and χ increases if accessibility becomes harder. The default value in the model for χ is zero (the element becomes 1) but the inclusion of the element makes it possible to distinguish between different accessibilities in particular for demersal and pelagic species. Finally, the SSB element accounts for the effect of the biomass on effort. The default value of β = 0 implies that there is no stock abundance effect on effort. With a full effect β = 1.

A numerical example shows how the equation works with a price for each species equal to 1. Although the landings increase by 50% (135 to 202.5), the effort (and costs) stays almost the same (increases 5%). This is the net effect of an increase in effort due to higher landings at 50%, but counterweighted by the increase in stock abundance.

Example of effort calculation with the EIAA formula

Species	Landings = quotas						Stock abundance				Effort
	Year 1		Year 2				Year 1	Year 2			Year 2
	Land ings	Share (effort)	Quota	Share (effort)	Chi (χ)	Effort adjust.			Beta (β)	Effort adjust.	
	1	2	3	4	5	6	7	8	9	10	11
1	50	**0.370**	75.0	0.556	0.1	1.041	200	400	0.6	0.660	**0.382**
2	40	**0.296**	60.0	0.444	0.1	1.041	150	300	0.6	0.660	**0.305**
3	30	**0.222**	45.0	0.333	0.1	1.041	100	200	0.6	0.660	**0.229**
4	10	**0.074**	15.0	0.111	0.1	1.041	50	75	0.6	0.784	**0.091**
5	5	**0.037**	7.5	0.056	0.1	1.041	50	75	0.6	0.784	**0.045**
Total	135	**1**	202.5	1.500							**1.052**

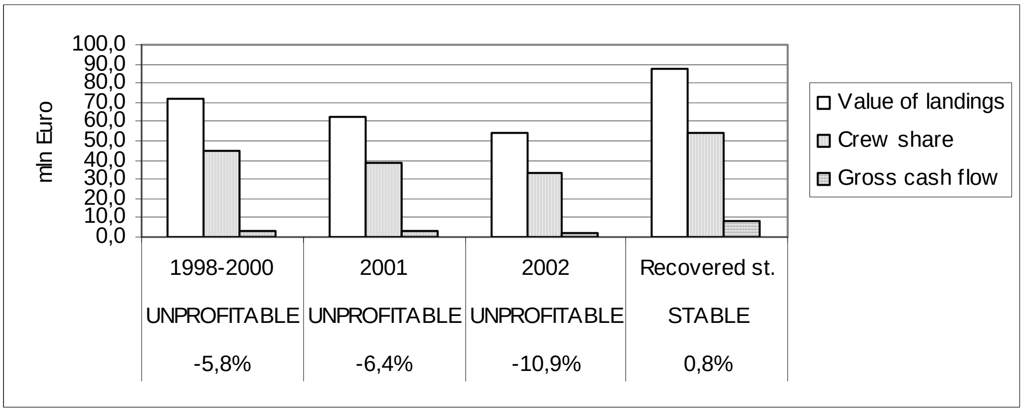
Note: Column 11 is calculated as Col.4 * Col.6 * Col.10

In the subsequent figures are shown examples of recovered stock situations for a Danish and a Dutch fleet segment for which reasonably good estimates for recovered stocks are available for the most important species such as cod, plaice and sole. The calculations are made with χ values at 1 and β values at 0.6. These assumptions imply that there are decreasing returns to scale in the fishery which is an often used assumption in economic calculations.

Effort ratios for one Danish and one Dutch segment (based on quota species only)

Period	Denmark, gill netters	The Netherlands, Beam trawlers > 811 kW
1998-2000	1.000	1.000
2001	0.716	0.812
2002	0.603	0.752
Long term	1.081	0.964

Denmark, Gill Netters



The Netherlands, Beam Trawlers > 811 kW