



COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 2.4.2007
SEC(2007) 465

COMMISSION STAFF WORKING DOCUMENT

**REPORT OF THE SECOND MEETING OF THE
SUBGROUP ON REVIEW OF STOCKS. (SGRST-05-02)
OF THE
SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES
(STECF)
MIXED FISHERIES
Ispra, 17-21 October 2005**

This report has been evaluated and endorsed by the Scientific, Technical and Economic Committee for Fisheries (STECF) in its plenary session of 7-11 November 2005

This report does not necessarily reflect the view of the European Commission and in no way anticipates the Commission's future policy in this area.

Table of Contents

STECF evaluation and endorsement ON MIXED FISHERIES.....	4
<i>Background</i>	4
<i>STECF Comments and Recommendations</i>	4
1 Summary	5
2 Introduction	6
2.1 Terms of reference	6
2.2 Conduct of the meeting	6
3 Development of Mixed Fisheries Models	6
3.1 Consideration About the Use of MTAC	6
3.2 Working Document 1 on Further Software Development	8
4 Area based analyses	9
4.1 Availability of fleet specific data	9
4.2 Estimation of fleet specific international landings and discards	9
4.3 North Sea and Skagerrak (ICES Division IV and IIIa)	12
4.3.1 Fleet overview and specific data.....	12
4.3.2 Assessment data overview.....	17
4.3.3 Mixed fisheries analyses.....	21
4.4 Eastern Channel (ICES Division VIId)	29
4.4.1 Fleet overview and specific data.....	29
4.4.2 Assessment data overview.....	30
4.4.3 Mixed fisheries analyses.....	30
4.5 Kattegat (ICES Division IIIa)	33
4.5.1 Fleet overview and specific data.....	33
4.5.3 Mixed fisheries analyses.....	37
4.6 West of Scotland (ICES Division VIa)	37
4.6.1 Fleet overview and specific data.....	37
4.6.2 Assessment data overview.....	41
4.7 Irish Sea (ICES Division VIIa)	42
4.7.1 Fleet overview and specific data.....	42
4.7.2 Assessment data overview.....	42
4.7.3 Mixed fisheries analyses.....	43
4.8 Porcupine Bank, Celtic Sea, Bay of Biscay (ICES Divisions VIIb, e, f, j, k, VIIIa, b, d)	43
4.8.1 Fleet overview and specific data.....	43
4.8.2 Assessment data overview.....	51
4.8.3 Mixed fisheries analyses.....	52
4.9 Iberian Peninsula (ICES Divisions VIIIc-IX) Jose	52
4.9.1 Fleet overview and specific data.....	53
4.9.2 Assessment data overview.....	53
4.9.3 Mixed fisheries analyses.....	54
5 References	55
Appendix 1 List of participants and addresses.	56
European Commission	56
Appendix 2 Exchange data formats.....	57

Appendix 3 on the terminology of MTAC settings and output.....	64
---	-----------

STECF EVALUATION AND ENDORSEMENT ON MIXED FISHERIES

STECF was asked the following:

STECF should deliver an opinion based on the work done by subgroup SGRST-05-02 (17-21 October, 2005) which compiled recent data on demersal mixed fisheries, identified stocks, areas and fleets where there are significant mixed catches and estimated catches for 2006.

Background

The Commission convened a STECF-SGRST mixed fisheries meeting in Ispra (Italy) at the JRC premises during 17-21 October 2005 as a follow up of a series of annual meetings, with the following terms of reference:

1. Obtain and compile all available recent data concerning mixed-species demersal fisheries in Community waters and adjacent areas. The data of specific interest are landings and discards by species and by fleet, where possible disaggregated by age and by number of fish.
2. Review the data compiled in (1) and identify those stocks, areas and fleets where significant technical interactions exist and for which adequate data exist to permit those interactions to be evaluated.
3. For each of the area-fleet-stock groupings identified in (2), calculate catch forecasts for 2006 for the stocks concerned, based on:
 - the most recent ICES assessments
 - ACFM advised catches for 2006
4. an appropriate range of assumptions for the factors describing the relative policy weights to be attached to each fish stock, including any particular values that may be requested by the Commission services on receipt of the ICES advice. In support of the above tasks, continue methodological and software development as initiated by this Ad Hoc Working Group since 2002.
5. The main conclusions and STECF comments and recommendations are presented below.

STECF Comments and Recommendations

STECF agrees with the findings presented in the report of October 2005 STECF-SGRST meeting on mixed fisheries and has drawn the following conclusions and recommendations:

1. STECF notes that sampling of catch at sea including discards to quantify technical interactions between mixed demersal fisheries is expensive and difficult. This means that sampling coverage tends to be rather limited, and raised estimates of discards are subject to high uncertainty. This is true of all of the discard estimates, and in some cases the discard estimates presented represent the first attempt to use the discard data from some fisheries in an advisory context. Where the coverage is considered adequate to estimate the overall catch compositions of specific fleets these are presented in the sub-group report. However STECF considers that, they only provide an approximate indication of fleet catch compositions.
2. Technical interactions between mixed demersal fisheries in the North Sea and Skagerrak, Kattegat and West of Scotland only, are indicated in the report based on estimated catch data including discards.
3. Both the lack of stock specific forecast inputs on stock size and exploitation rates and considerable concern regarding incomplete fleet specific catch data including discards prevented meaningful analytical mixed fisheries forecasts for the management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish Sea, Porcupine Bank, Celtic Sea, Bay of Biscay and around the Iberian Peninsula.
4. All mixed fisheries scenarios for the North Sea and Skagerrak that attempt to balance the ICES advice for 2006 of 0-TAC for cod and a 0.68 F-multiplier for plaice, indicate that stringent cuts in fleet-specific fishing mortality are required across the board. Such overall cuts imply that the fishing possibilities as advised under precautionary single species boundaries would have to be severely reduced. STECF considers that the fleet landings and discard information and specific stock parameters are too imprecise to provide MTAC runs that are an acceptable basis for management advice.

1 Summary

- The STECF-SGRST on Mixed Fisheries notes that sampling of catch at sea including discards to quantify technical interactions between mixed demersal fisheries is expensive and difficult. This means that sampling coverage tends to be rather limited, and estimates of discards are subject to high uncertainty. This is true of all the discard data used here, and in some cases the discard estimates presented represent the first attempt to use the discard data from some fisheries in an advisory context. Where the coverage is considered adequate to estimate the overall catch compositions of specific fleets these are presented, but they are intended only to provide an approximate indication of fleet catch compositions.
- Technical interactions between mixed demersal fisheries in the North Sea and Skagerrak, Kattegat and West of Scotland are indicated based on estimated catch data including discards.
- Both the lack of stock specific forecast inputs on stock size and exploitation rates and considerable concern regarding incomplete fleet specific catch data including discards prevented analytical mixed fisheries forecasts for the management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish Sea, Porcupine Bank, Celtic Sea, Bay of Biscay and around the Iberian Peninsula.
- Sensitivity analyses of mixed fisheries scenarios for the North Sea and Skagerrak indicated that attempts to balance the ICES advice for 2006 of 0-TAC for cod and a 0.68 F-multiplier for plaice is unaffected by the uncertainty in the cod assessment and would involve stringent cuts in effort across the board. Such general effort cuts would imply major deviations from the fishing possibilities as advised under precautionary single species boundaries. The precise level of cuts is, however, conditional upon the uncertainty in the fleet landings/discards database and the specific stock parameters which are both considered such that the MTAC runs are too imprecise for management purposes. Major fleets, i.e. beam $\geq 80\text{mm}$, demersal trawls $\geq 100\text{mm}$ and demersal trawls 70-99mm and static gears, all contribute significantly to the catch of the reduced cod and plaice stocks and thus appear too poorly defined to generate scope for increased catches of other underexploited species through fleet specific management. **The SGRST mixed fisheries stresses that the exploratory analyses are not in any way intended as viable or realistic options for management purposes!**
- SGRST mixed fisheries provides further guidelines on how to use the model on mixed fisheries TACs (MTAC, Vinther *et al.*, 2004).
- Some changes in the data formats are proposed for the south-western ICES divisions to be considered in future data compilations.

2 Introduction

The STECF Sub-group SGRST on Mixed Fisheries met at the European Joint Research Centre in Ispra, Italy, during 17-21 October 2005 to deal with terms of reference 1-5 (TOR) listed in the following section 2.1. The list of participants is given in Appendix 1 to this report.

2.1 Terms of reference

STECF Subgroup SGRST on mixed fisheries 2005 has been given the following Terms of Reference:

1. *Obtain and compile all available recent data concerning mixed-species demersal fisheries in Community waters and adjacent areas. The data of specific interest are landings and discards by species and by fleet, where possible disaggregated by age and by number of fish.*
2. *Review the data compiled in (1) and identify those stocks, areas and fleets where significant technical interactions exist and for which adequate data exist to permit those interactions to be evaluated.*
3. *For each of the area-fleet-stock groupings identified in (2), calculate catch forecasts for 2006 for the stocks concerned, based on:*
 - *the most recent ICES assessments*
 - *ACFM advised catches for 2006*
4. *an appropriate range of assumptions for the factors describing the relative policy weights to be attached to each fish stock, including any particular values that may be requested by the Commission services on receipt of the ICES advice.*
5. *In support of the above tasks, continue methodological and software development as initiated by this Ad Hoc Working Group since 2002.*

2.2 Conduct of the meeting

The meeting started on Monday 17 October at 9.00 hours. The SGRST Mixed Fisheries meeting was attended by 10 participants from Belgium, Denmark, England, France, Germany, Netherlands, Northern Ireland, Scotland and Spain. A full list of the participants and addresses is given in Appendix 1.

There was only one working document (WD) reviewed during the meeting which is summarised in section 3.2.

SGRST was supported by JRC's excellent secretariat and the provision of an internet site which was used for distribution of information, working papers and data submissions (<http://stecf.jrc.cec.eu.int/event.php?id=24>

The meeting was adjourned on Friday 21 October 2005 12.00 hours.

3 Development of Mixed Fisheries Models

3.1 Consideration About the Use of MTAC

The MTAC model has not been developed further. The Group reiterates some instructions on the use of MTAC and the interpretation of the results, as well as a minor problem with the program that was discovered last year. Furthermore we communicate a new insight on the use of the optional setting $p=1$ (for the meaning of optional settings, see Appendix 3).

There are two main ways in which the results of MTAC can be used in a management context.

1. Aggregate MS-TAC advice, using the MS-TACs (mixed species TACs) of the MTAC output.
2. Fleet specific advice, adjusting the effort of the individual fleets through the fleet factors of the MTAC output.

The choice between these two management approaches requires fundamentally different implementations of MTAC and therefore the objectives of management must be stated upfront before

mixed fishery analyses. Aggregate MS-TAC advice (approach 1) is obtained by setting $p=0$, $q=0$ (i.e. the effort of all fleets is adjusted by the same amount). Fleet specific advice (approach 2) is obtained from the permutations of $p=1$, $p=2$ and $q=0$, $q=1$. Note that the use of MTAC for the provision of aggregate MS-TAC advice (approach 1) when $p \neq 0$ and $q \neq 0$ is fundamentally incorrect and will not deliver the expected results.

Another point to emphasize is that where the MS-TAC is higher than the SS-TAC the results are generally not in agreement with the Precautionary Approach and/or any recovery plans.

In the 2003 report of this Group, investigations were made into the use of 0 and very small decision weights, finding that the results of MTAC were potentially quite sensitive to such a choice. It was recommended to use very small decision weights rather than 0 when no priority is given to a stock. However, the 2004 report of this Group states that the stocks with no analytical assessment should receive a decision weight of 0 to ensure that they have absolutely no influence on the MS-TACs. The conclusion, therefore, is: for species included in the MTAC analysis with no analytical assessment always use decision weight 0, and for other species that should receive no priority use a very small non-zero value for the decision weight.

A small problem was found last year when running MTAC as part of the STECF mixed fisheries working group. When the data files are set up so that the following conditions hold the program will crash:

1. In the file 'species.dat' there are zero historical catches at a particular age for all species;
2. The file 'fleet.dat' is empty.

This is because MTAC reconstructs an age distribution for the population from the historical catches at age. If there is a particular age group with zero catches for all species then this age group seems to be 'deleted' by the program. This causes the matrix dimensions of the internal data to be inconsistent and MTAC will crash.

This problem was initially discovered when entering zero historical catches at age 0 for all species. This particular case can be considered as a misspecification of the input data as the age at first capture in 'species_setup.dat' was not consistent with the data entered for the historical catch in 'species.dat'.

However, consider the example of a data set where all species have a high age class with zero historical catches, but higher age classes have non-zero historical catches. The first and last age of capture in 'species_setup.dat' would be well defined, but this age class with zero historical catches would be 'deleted' and the program will crash.

To avoid this problem, one should make sure that if the file 'fleet.dat' is empty, then there should be no age class in the file 'species.dat' that has zero entries for all species. A simple solution is to insert a '1' in this age class for one of the species. This makes no difference to the final results but will allow the program to run correctly.

Based on a new insight the Group strongly recommends not to use the optional setting $p=1$, because results of MTAC runs with this setting are highly dependent on the number of species included in the MTAC analyses. The catch composition data are very far from being complete. This implies that the catch compositions of the fleets (proportions of species' catches, in weight, within the total catch of the fleet) used in MTAC do not correspond to reality. For example, if only 5 species are considered in the analyses, cod may make up e.g. 30% of a fleet's catch (of those 5 species), whereas if all species are considered cod perhaps makes up only e.g. 10% of that fleet's total catch. Or even more extreme, a fleet could target a particular species, e.g. *Crangon*, and catch a very small by-catch of cod. Whether or not the target species is included in the MTAC analysis has a great influence on the outcome in case MTAC is used with option $p=1$. Option $p=1$ leads to a solution where fleets having a large proportion of cod in their catch have to reduce their effort to a greater extent than fleets having a small proportion of cod in their catch. This implies that if the target species is not included in the MTAC analysis and the fleet's catch thereby consists for e.g. 100% of cod, it has to reduce its effort to a very great extent, whereas if the target species would be included, and the fleet's catch consists only for e.g. 5% of cod, it has to reduce its effort to a very small extent. This example shows that MTAC results under $p=1$ depend on the inclusion of other species in the analysis.

The solution to this problem does not lie in acquiring more complete data sets (i.e. containing reliable data on all species in the catch). This will raise the question which species should be considered. Should by-catch of invertebrate benthos be considered? And birds? Such reasoning ad absurdum shows that the option $p=1$ does not make much sense. In that case a fleet catching a lot of cod, but catching even more of other species would have to reduce its effort to a lesser extent than a very small fleet that catches cod only (but a very small proportion of the total international cod catch). Using the optional setting $p=2$ makes more sense. With this option a fleet has to reduce its effort according to the proportion of its catch of an endangered species relative to the total international catch of that species. Thus, fleets with high impact on an endangered species should reduce their effort most.

3.2 Working Document 1 on Further Software Development

The SGRST reviewed a working document (WD) describing further software development to analyse and describe mixed fisheries and their effects on exploited stocks. The working document by Rätz *et al.* (2005) is accepted and in press. A summary of the main conclusions is given below:

Based on a case study of North Sea fisheries in 2004 the WD concludes that the geographical distribution patterns of the commercial landings of the 6 main target fish species cod, haddock, saithe, whiting, plaice and sole and Norway lobster (*Nephrops*) and the catch compositions of the different fleets (gear types) are inhomogeneous. Gadoids and *Nephrops* are mainly caught by demersal trawls in the northern North Sea while the flat fish fishery operates mainly in the southern North Sea. All demersal gears appear to be less frequently used in the central North Sea.

TAC regulations alone appear insufficient for a sustainable management of mixed fisheries, mainly because discards remain unregulated within the Common Fishery Policy (CFP) but affect negatively future catch potentials. Such discards occur in cases of ecological and economical conflicts in the short term fishing strategies of jointly caught stocks, which naturally do develop differently. Catches in excess of TACs, discarded or illegally landed contributed significantly to the failure of conservation measures in the recent past for cod and plaice.

Fleet based management is considered an effective and easily controllable tool to control fishing mortality through fleet specific effort in the case of mixed fisheries. Especially high discard rates and black market landings in excess of TACs can be avoided.

The fleet specific effects on the main commercially exploited demersal fish stocks in the North Sea in 2003 could be quantified on the basis of extensive data collations on board of fishing vessels. According to the sampling data, demersal trawls $\geq 100\text{mm}$ and beam trawls $\geq 80\text{mm}$ had the highest effect on the demersal fish stocks considered, especially on cod and plaice. Such results support the decisions of the Fishery Council regarding fishing possibilities since 2003, which limit the effort of such gear types most.

Fleet definitions are critical and should consider the technical properties (area, season, gear type and mesh size). The assessment of the fleet specific effects on the stocks should be based on the qualitative and quantitative catch composition including discards, due to the fact that discards have the same effect on the stock dynamics like landings.

A variety of numerical variations for fleet based management is conceivable. The catch of the fleets and the status of the stocks with regard to precautionary reference values of SSB and fishing mortality should be the main criteria when assessing fleet specific effects.

Given an appropriate fleet based management a substantial yield increase is attainable in short term in the case of the demersal mixed fisheries in the North Sea under the condition of compliance with precautionary management and recovery plans.

4 Area based analyses

4.1 Availability of fleet specific data

Data were called in the format as designed by the ICES Study Group on Fishery Based Forecasts (ICES 2004a) for 2003 and 2004. The exchange data formats are given in Appendix 2. Identical data calls were issued in preparation of the STECF-SGRST cod recovery meetings in 2005. Such data bases were corrected for data reports from UK-England and updated for data reports from Portugal and Spain.

Table 4.1 lists an overview on data submissions covering the various management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish Sea, Porcupine Bank, Celtic Sea, Bay of Biscay and around the Iberian Peninsula by country. Fleet specific discard data for cod were reported only by UK-Scotland, UK-England, Germany, Sweden, Latvia, and Denmark. Danish discard data, however, was provided in an inconsistent format but included in the analyses regarding the Kattegat. Dutch discard information covered sole and plaice but cod discards recorded were considered non-representative to allow raising to the landings of the fleets.

The reported catch compositions of the regulated gears or fishing métiers including estimates of discards for the years 2003 and 2004 do not include unallocated catches.

4.2 Estimation of fleet specific international landings and discards

The estimation of fleet specific international landings and discards is based on linking the information about fleet specific discards and catch and discards at age among countries and replacing poor or lacking values with aggregated information from other countries.

Reported data by country are aggregated by fleet properties and raised to the officially reported landings or discards in the SGDF 2004 format (ICES 2004a). Fleet definitions are based on area, year, quarter, gear and mesh size groups and national fisheries (métier) definitions.

The data management and estimation procedures follow the simple raising strategies outlined below :

- Data management:
The fleets are classified to their management areas, years, quarters and effort regulated gear groups disregarding the countries and fisheries (métiers).
- Estimation of discard rates by fleet (DR):

Let the following notation be : D =discards, L = landings, snf = sampled national fleet, unf = unsampled or poorly sampled national fleet.

A poorly sampled fleet is defined as such when $SOP_{snf} < 0.75$ or $SOP_{snf} > 1.25$

The available landings and discards are aggregated (summed) by fleets and mean discard rates are calculated:

$$DR = \frac{\sum_{snf} D_{snf}}{\sum_{snf} (L_{snf} + D_{snf})} \quad \text{with } D_{snf} \geq 0 \text{ and } \text{with } L_{snf} + D_{snf} > 0 \quad \text{otherwise } 0$$

(means no catch)

Fleet specific discard amounts are calculated when no discard information is available by

$$D_{unf} = \frac{L_{unf} \cdot DR}{(1 - DR)} \quad \text{when } D_{unf} \text{ is null (empty)}$$

Fleets without any discards information remain as such.

Table 4.1 Data basis on fleets' specific landings and discard data, also at age by nation, 2003-2004 for the various management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish Sea, Porcupine Bank, Celtic Sea, Bay of Biscay and around the Iberian Peninsula.

Country	Year restrictions	Area restrictions	Fleet restrictions	Species restrictions	Landings	Discards	Landings at age	Discards at age
Belgium	Data provided	Data provided	No mesh size for otter trawls	Main species	Data provided	No data	No data	No data
Denmark	Data provided	Data provided	Data provided	Data provided	Data provided	Cod data provided but not included	All available	Cod data provided but not included
Estonia	No data	No data	No data	No data	No data	No data	No data	No data
Finland	Data provided	Eastern Baltic only	Inconsistent fleets, no mesh	Main species	Main species	Main species	No data	No data
France	Data provided	Only some data for Celtic and Bay of Biscay	Data provided	Main species, no Nephrops	Data provided	No data	Only 2003	No data
Germany	Data provided	Data provided	Data provided	Data provided	Data provided	Data provided	All available	All available, only cod in the Baltic
Ireland	2004 only	Data provided	No mesh size	Main species	Data provided	Not by quarter	All available	Not by quarter
Netherlands	Data provided	Data provided	Beam trawls	Plaice, sole, cod, whiting	Plaice, sole and cod, whiting	Only plaice and sole, quality of cod data too poor	Plaice, sole and cod	Only plaice and sole
Latvia	Data provided	Data provided	Data provided	Data provided	Data provided	Data provided	All available	Only cod
Lithuania	No data	No data	No data	No data	No data	No data	No data	No data
Poland	Data provided	Data provided	Data provided	Only cod	Only cod	No data	Only cod	No data
Sweden	Data provided	Data provided	Data provided	Only cod and plaice	Data provided	Data provided	Only cod and plaice	Only cod and plaice
UK England	Data provided	Data provided	Data provided	Main species	Data provided	Data provided	All available	Data provided
UK Scotland	Data provided	2003 North Sea 2004 North Sea and west of Scotland	Few otter, gill and small beamer without mesh	Main species,	Data provided	Data provided	All available	All available
UK Northern Ireland	Included in UK England	Included in UK England	Included in UK England	Main species	Included in UK England	No data	No data	No data
Norway	Data provided	Data provided	Data provided	Main species	Data provided	Data provided	No data	No data
Spain	Data provided	Data provided	By metiers	Main species	Data provided	Data provided	Data provided	Data provided
Portugal	No data	No data	No data	No data	No data	No data	No data	No data

- Estimation of landings in numbers and mean weight at age for non or poorly sampled national fleets

Let i be the age reference

Landings in numbers ($N_{snf,i}$) and mean weight at age ($W_{snf,i}$) are aggregated by sampled fleets when $SOP_{snf} \geq 0.75$ and $SOP_{snf} \leq 1.25$.

Raising of numbers and mean weights at ages 0-11 to non or poorly sampled fleets by

$$N_{unf,i} = \frac{\sum_{snf} (N_{snf,i}) \cdot L_{unf}}{\sum_{snf} L_{snf}}$$

$$W_{unf,i} = mean(W_{snf,i})$$

The mean weights are unweighted and an appropriate weighing procedure, i.e. number of fish measured, should be explored.

Fleets without any landings at age information remain as such.

An example of this raising procedure is given in Table 15.2.3.2 under the header "Landings", the values between parenthesis are the estimated values.

- Estimation of discards in numbers and mean weight at age for non or poor sampled fleets

Discards in numbers ($N_{snf,i}$) and mean weight at age ($W_{snf,i}$) are aggregated by sampled fleets when $SOP_{snf} \geq 0.75$ and $SOP_{snf} \leq 1.25$ along the same procedure as for the landings.

Raising of numbers and mean weights at ages 0-11 to non or poorly sampled fleets by

$$N_{unf,i} = \frac{\sum_{snf} (N_{snf,i}) \cdot D_{unf}}{\sum_{snf} D_{snf}}$$

$$W_{unf,i} = mean(W_{snf,i})$$

The mean weights are unweighted and an appropriate weighing procedure, i.e. number of fish measured, should be explored.

Fleets without any landings at age information remain as such.

An example of this raising procedure is given in Table 15.2.3.2 under the header "Discards", the values between parenthesis are the estimated values.

- Catch at age estimation including discards

Catches by fleets are estimated as the sum of landings and discards. Missing discards are ignored.

Catches at ages 0-11 in numbers are estimated as the sum of landings at age in numbers and discards at age in numbers. Missing discards are ignored.

Mean weights at ages 0-11 are estimated at weighted means (according to ratios of landings at age and discards at age to catches at age).

Finally, all fleets' catches and catches at ages in numbers and mean weights are aggregated finally over management areas, years and effort regulated gear groups.

Fleets without any information on discards or landings at age and discards at age remain unchanged and need to be raised separately on an agreed basis in case that they constitute significant landings.

The SGRST notes that:

sampling of catch at sea including discards is expensive and difficult. This means that sampling coverage tends to be rather limited, and estimates of discards are subject to high uncertainty. This is true of all the discard data used here, and in some cases the discard estimates presented represent the first attempt to use the discard data from some fisheries in an advisory context. Where the coverage is considered adequate to estimate the overall catch compositions of specific fleets these are presented, but they are intended only to provide an approximate indication of fleet catch compositions.

In cases where there are little data, the estimated discard rates may be biased and imprecise (Stratoudakis *et al.*, 1999).

Despite the relatively low level of sampling, the estimated catch compositions of the regulated gears including discards appear fairly consistent over the years 2003 and 2004 and with the ICES WGNSSK assessment inputs for the North Sea and Skagerrak (ICES 2006a).

The mean weights are estimated as unweighted means. This results in a biased estimate. An appropriate weighing procedure, i.e. number of fish measured, should be explored.

4.3 North Sea and Skagerrak (ICES Division IV and IIIan)

4.3.1 Fleet overview and specific data

Gear category beam ≥ 80 mm

This fleet segment is mainly targeting flatfish with sole and plaice as the most important species, but is known to also catch also cod and whiting and dab. The fleet is operating in known nursery grounds for cod, whiting, plaice and sole and creates ecologically problematic high by-catches and discards of non-target species, especially invertebrates. Since 1989, the fleet operates under an area management, the so-called plaice-box, which is accessible only for beamers with ≤ 221 Kw engine power. Large by-catches of undersized plaice are caught in the 80 mm beam-trawl fisheries (Fig. 4.3.1), and the effort deployed is substantially higher than that needed to take the highest sustainable yield of plaice. Scientific advice has pointed to a need to reduce effort directed at plaice. Any increase in mesh size would have a significant negative short term-effect on catches of sole.

According to the sampling data, the catch of this category is mainly composed of plaice, whiting, sole and cod (Tab. 4.3.1 and Fig. 4.3.1). Discard rates in weight are highest for whiting (~90%), but also significant for cod (32% in 2004) and plaice (~50%). The estimate of annual whiting discards are in the order of 10,000 tons, but must be considered uncertain in this order of magnitude. The estimated discards of cod are approximately 2,000 tons in 2004. The discard rates of plaice indicate discards in the order of about 40,000 tons, and the discards are mainly fish at ages 3 and younger (Fig. 4.3.5, about 90% in numbers are discarded). Discards of sole are estimated in the order of 10 % of the catch weight and are mainly fish at ages 2 and 3 (Fig. 4.3.6). Catches of haddock, saithe and *Nephrops* appear low.

Gear category demersal trawl ≥ 100 mm

This gear segment covers a wide range of fisheries targeting roundfish and flatfish and it is within this segment we find the vessels that have the highest catch of cod. The other demersal stocks exploited by this fleet segment are all, with the exception of saithe and haddock, fully utilised or overfished. Derogations based on track records are effective for vessels with less than 5% each of cod, sole and

plaice in their landings in 2002. This derogation seems in practice only to affect vessels having targeted saithe. The derogation adopted in December 2004, giving more days to vessels fishing with mesh sizes above 120 mm, has most likely not had a positive effect on the cod stock.

Depending on the various fishing strategies, the catch composition is found to be more diverse than in the beam ≥ 80 mm and is mainly composed of round fish species haddock, saithe, cod and whiting. Plaice, whiting and *Nephrops* constitute minor components of the catch (Tab. 4.3.1 and Fig. 4.3.1). Discard rates in weight are highest for whiting (~40%) and haddock (around 20-30%). Cod (10%) and saithe (10%) discard rates are low, but indicate total annual discards of around 1,000-2,000 and 6,000-8,000 t respectively. The estimate of annual whiting discards is approximately 3,500 tons annually. The majority of discarded fish are haddock (~15,000 t) but with a decreasing tendency as the clearly identifiable strong 1999 year class becomes less abundant (Fig. 4.3.3).

Gear category demersal trawl 16-31mm

In 2003 and 2004, Denmark deployed 90 % of the international effort. The catch composition is dominated by Norway pout. The target species of the gear group demersal trawl 16-31mm are Norway pout, blue whiting and sprat, while sandeel fisheries often use mesh < 16 mm with catch retained on board consisting of no more than 10 % of other species. The Norway pout fishery was closed during the whole year 2005. The sandeel fishery was closed in July 2005. As the great majority of the catch is reduced to meal and oil, discarding is not an issue for these fleets.

The information of the catch composition of this gear group is sparse.

Gear category demersal trawl 70-99 mm

The main target species for this fleet segment is *Nephrops*. The "*Nephrops*" fishery can operate with only 30% *Nephrops* on board, up to 20% of cod, and the remaining catch made up of whiting, anglerfish, sole etc. As such it is effectively a mixed *Nephrops* /fish fishery, though individual fishing operations can target particular species quite effectively. The *Nephrops* trawl has to be equipped with certain escapement devices (square mesh panel). The net needs to be equipped with a 80 mm square-meshed panel if a mesh size of 70-99 mm is to be used in the North Sea and if a mesh size of 70-89 mm is to be used in the Skagerrak and Kategatt the codend has to be square meshed. In addition to the *Nephrops* vessels the segment also includes vessels fishing with a mesh size of 80 mm or more for plaice and/or roundfish like cod, haddock, whiting and red mullet in the southern part of the North Sea, often using multi-net rigs or seines. Saithe is a minor by-catch. The target species (almost all species except cod, saithe and haddock) must account for at least 70% of the landings. The 20% cod limit also applies to these vessels. The latest scientific advice on the relevant *Nephrops* stocks is from 2003. The general conclusion in 2003 was that the stocks were exploited at sustainable levels. Unofficial information indicates substantial landings in excess of those officially reported in recent years.

As described above, the sampling programmes of commercial catches reveal that these small meshed trawl fisheries have the most diverse catch composition with almost equal shares of *Nephrops*, haddock, whiting and plaice. Substantial discard rates in weight (Table 4.3.1) are indicated for whiting (75%), plaice (50-70%), haddock (40-55%), cod (35%). It should be noted that *Nephrops* discards have not been reported to the data base. The large majority of the fish discarded of all species are juveniles (Fig. 4.3.2-4). Numbers of cod caught at ages 1 to 3 in numbers are lower than for the white fish trawl ≥ 100 mm but of the order of magnitude of discards estimated for the white fish trawl ≥ 100 mm (Fig. 4.3.2). Even age group 0 appears with high quantity. The gears do not select saithe and sole, for which both landings and discards are low.

Gear category demersal longline

This gear could target almost all species in a highly selective pattern, but is used mainly to catch round fish. Professional fishermen deploy this gear with a very low effort, but in local recreational fisheries the catches could raise to significant levels.

The data base on catches including discards indicates this gear category as targeting the round fish species with insignificant landings and no discard information is available.

Gear category static including gill nets, trammel nets and tangle nets

This group covers a diversity of fisheries, including cod-directed gill net fisheries, large-mesh static nets directed at turbot or anglerfish, and smaller-meshed trammel nets directed at sole. A derogation is available permitting vessels in the eastern channel to fish with trammel nets of mesh size equal to or less than 110mm and absent from port for no more than 24h per trip to be absent from port for 19 days. In the North Sea, gear of this type is used by Denmark to target sole, by Denmark and UK to catch both sole and cod, and also by France to target cod. Data are not available concerning the catch composition in these fisheries in the eastern channel.

The compilation of national landings and discard data reveals that static gears catch cod, sole, plaice and monk with very low discard rates (Table 4.3.1 and Fig. 4.3.1). Also saithe appears a significant part of the landings.

Gear category other

This gear category of others represents gears which are not effort regulated and gears which have been insufficiently precisely defined (e.g. mesh size information missing). It covers a variety of gears, mainly demersal trawls including small meshed beam trawls. Pelagic trawls are not considered. All the main demersal target species cod, haddock, whiting, saithe, plaice, sole and Nephrops constitute significant portions in the landings or discards. However, overall the landings and discards appear relatively low (Table 4.3.1 and Fig. 4.3.1).

Conclusions

The estimated catch compositions are based on landings and discards sampling. Levels of discards sampling are very low. Despite the relatively low level of sampling, catch compositions of the regulated gears including estimates of discards appear fairly consistent over the years 2003 and 2004. The landings and discard data compiled and estimated in the mixed fisheries data base are consistent with the assessment inputs with the exception of whiting, where high discards in the beam trawl fleets resulted in different estimates. Overall, the data base appears suitable to quantify the gear specific effects on the demersal fish stocks in the North Sea and Skagerrak.

In the North Sea and Skagerrak, beam trawls ≥ 80 mm contributed most (50 %) to the estimated discards added of cod, haddock, whiting, saithe, plaice and sole in 2004 (~100,000 t), while demersal trawls ≥ 100 mm and demersal trawls 70-99 mm contributed 28 and 20 %.

In the North Sea and Skagerrak, estimated discard amounts are highest for plaice and whiting while haddock discards appear to have decreased recently.

The proportions of discarded cod numbers at age as raised from the Member States data, and the estimates of discard proportions used to raise landings to catches by the ICES North Sea Working Group, age 1=85%, age 2=50%, age 3=17%, (ICES 2004b) are consistent.

In the North Sea and Skagerrak, cod are mainly caught by demersal trawls ≥ 100 mm (43% in weight). Cod catches of beam ≥ 80 mm, demersal trawls 70-99 mm and static gears are lower and in the same order of magnitude (15-20 %). Estimated cod catches at age 1 taken by the regulated gears demersal trawls 70-99 mm and demersal trawls ≥ 100 mm are in the same order of magnitude and mainly discarded.

Tab. 4.3.1 Landings and discards (t) and discard rates in the North Sea and Skagerrak by species and gears (no pelagic trawls) in 2003 and 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
COD	2003	Beam>=80	5352	13	5365	0	0
COD	2003	DemTrawl>=100	12703	1089	13792	0.08	0.03
COD	2003	DemTrawl16-31	6	0	6	0	0
COD	2003	DemTrawl70-99	3665	2078	5742	0.36	0.06
COD	2003	Longline	1637	0	1637		
COD	2003	Other	821	0	821	0	0
COD	2003	Static	5401	0	5401		
SUM			29584	3180	32764	0.1	0.1
COD	2004	Beam>=80	3754	2082	5836	0.36	0.06
COD	2004	DemTrawl>=100	12264	1783	14047	0.13	0.06
COD	2004	DemTrawl16-31	2	0	2	0.05	0
COD	2004	DemTrawl70-99	3408	1660	5068	0.33	0.05
COD	2004	Longline	740	0	740		0
COD	2004	Other	753	4	757	0	0
COD	2004	Static	5862	0	5862	0	0
SUM			26783	5528	32312	0.17	0.17
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
HAD	2003	Beam>=80	552		552		
HAD	2003	DemTrawl>=100	34536	16332	50869	0.32	0.25
HAD	2003	DemTrawl16-31	33	2	35	0.06	0
HAD	2003	DemTrawl70-99	5316	6420	11735	0.55	0.1
HAD	2003	Longline	496		496		
HAD	2003	Other	613	137	749	0.18	0
HAD	2003	Static	596		596		
SUM			42141	22891	65032	0.35	0.35
HAD	2004	Beam>=80	502		502		
HAD	2004	DemTrawl>=100	44243	13218	57461	0.23	0.2
HAD	2004	DemTrawl16-31	6	1	7	0.13	0
HAD	2004	DemTrawl70-99	5163	3413	8576	0.4	0.05
HAD	2004	Longline	422		422		
HAD	2004	Other	256	27	283	0.09	0
HAD	2004	Static	437		437		
SUM			51030	16658	67688	0.25	0.25
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
NEP	2003	Beam>=80	40		40		
NEP	2003	DemTrawl>=100	1754		1754		
NEP	2003	DemTrawl16-31	1		1		
NEP	2003	DemTrawl70-99	13068		13068		
NEP	2003	Other	348		348		
NEP	2003	Static	3		3		
SUM			15212		15212		
NEP	2004	Beam>=80	44		44		
NEP	2004	DemTrawl>=100	1772		1772		
NEP	2004	DemTrawl70-99	23765		23765		
NEP	2004	Longline	1		1		
NEP	2004	Other	332		332		
NEP	2004	Static	0		0		
SUM			25915		25915		

Tab. 4.3.1 continued. Landings and discards (t) and discard rates in the North Sea and Skagerrak by species and gears (no pelagic trawls) in 2003 and 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
PLE	2003	Beam>=80	48370	44915	93285	0.48	0.35
PLE	2003	DemTrawl>=100	8388	276	8664	0.03	0
PLE	2003	DemTrawl16-31	3		3		
PLE	2003	DemTrawl70-99	6968	14055	21023	0.67	0.11
PLE	2003	Longline	0		0		
PLE	2003	Other	693		693		
PLE	2003	Static	5158		5158		
SUM			69580	59246	128826	0.46	0.46
PLE	2004	Beam>=80	46118	37111	83229	0.45	0.34
PLE	2004	DemTrawl>=100	9963	701	10664	0.07	0.01
PLE	2004	DemTrawl16-31	1		1		
PLE	2004	DemTrawl70-99	6296	5746	12042	0.48	0.05
PLE	2004	Longline	4		4		
PLE	2004	Other	327		327		
PLE	2004	Static	3671	8	3679	0	0
SUM			66380	43566	109946	0.4	0.4
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
POK	2003	Beam>=80	41		41		
POK	2003	DemTrawl>=100	86410	6105	92515	0.07	0.06
POK	2003	DemTrawl16-31	53		53		
POK	2003	DemTrawl70-99	2972	464	3437	0.14	0
POK	2003	Longline	589		589		
POK	2003	Other	863	6	869	0.01	0
POK	2003	Static	7299		7299		
SUM			98228	6575	104803	0.06	0.06
POK	2004	Beam>=80	40		40		
POK	2004	DemTrawl>=100	84931	8227	93158	0.09	0.08
POK	2004	DemTrawl16-31	28		28		
POK	2004	DemTrawl70-99	3154	763	3917	0.19	0.01
POK	2004	Longline	430		430		
POK	2004	Other	972	11	984	0.01	0
POK	2004	Static	4522		4522		
SUM			94076	9001	103078	0.09	0.09
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
SOL	2003	Beam>=80	16241	1740	17981	0.1	0.09
SOL	2003	DemTrawl>=100	150		150		
SOL	2003	DemTrawl16-31	1		1		
SOL	2003	DemTrawl70-99	151		151		
SOL	2003	Longline	0		0		
SOL	2003	Other	177		177		
SOL	2003	Static	1438		1438		
SUM			18158	1740	19898	0.09	0.09
SOL	2004	Beam>=80	16881	2393	19274	0.12	0.11
SOL	2004	DemTrawl>=100	192	4	196	0.02	0
SOL	2004	DemTrawl70-99	139	30	170	0.18	0
SOL	2004	Longline	0		0		
SOL	2004	Other	108		108		
SOL	2004	Static	1167		1167		
SUM			18488	2427	20914	0.12	0.12

Tab. 4.3.1 continued. Landings and discards (t) and discard rates in the North Sea and Skagerrak by species and gears (no pelagic trawls) in 2003 and 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
WHG	2003	Beam>=80	517	8444	8961	0.94	0.24
WHG	2003	DemTrawl>=100	4987	3237	8224	0.39	0.09
WHG	2003	DemTrawl16-31	1		1		
WHG	2003	DemTrawl70-99	4073	13799	17873	0.77	0.39
WHG	2003	Longline	3		3		
WHG	2003	Other	179	38	217	0.18	0
WHG	2003	Static	30		30		
SUM			9790	25518	35308	0.72	0.72
WHG	2004	Beam>=80	1190	9321	10511	0.89	0.3
WHG	2004	DemTrawl>=100	4944	3584	8528	0.42	0.11
WHG	2004	DemTrawl16-31	2	2	4	0.44	0
WHG	2004	DemTrawl70-99	3607	8408	12015	0.7	0.27
WHG	2004	Longline	4		4		
WHG	2004	Other	63	10	73	0.13	0
WHG	2004	Static	40		40		
SUM			9850	21325	31175	0.68	0.68

4.3.2 Assessment data overview

As the applied mixed fisheries forecast models require analytical input parameters by stock, the following table 4.3.2 lists the state of the stocks as assessed by ICES and the availability of such information.

Table 4.3.2 State of the stocks and availability of analytical forecasts as estimated by ICES (2006b).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to high long-term yield	Analytical forecast available
Cod 4, 7d and 3a	Reduced reproductive capacity	Uncertain	Overexploited	no
Haddock 4 and 3a	Full reproductive capacity	Harvested sustainably	Close to target	yes
Whiting 4 and 7d	unknown	unknown	unknown	no
Saithe 4, 3a and 6	Full reproductive capacity	Harvested sustainably	Appropriate	yes
Plaice 4	At risk of reduced reproductive capacity	Harvested sustainably	Overexploited	yes
Sole 4	Full reproductive capacity	Harvested unsustainably	Overexploited	yes
<i>Nephrops</i> 3a and 4	Unknown	Unknown	Unknown	no

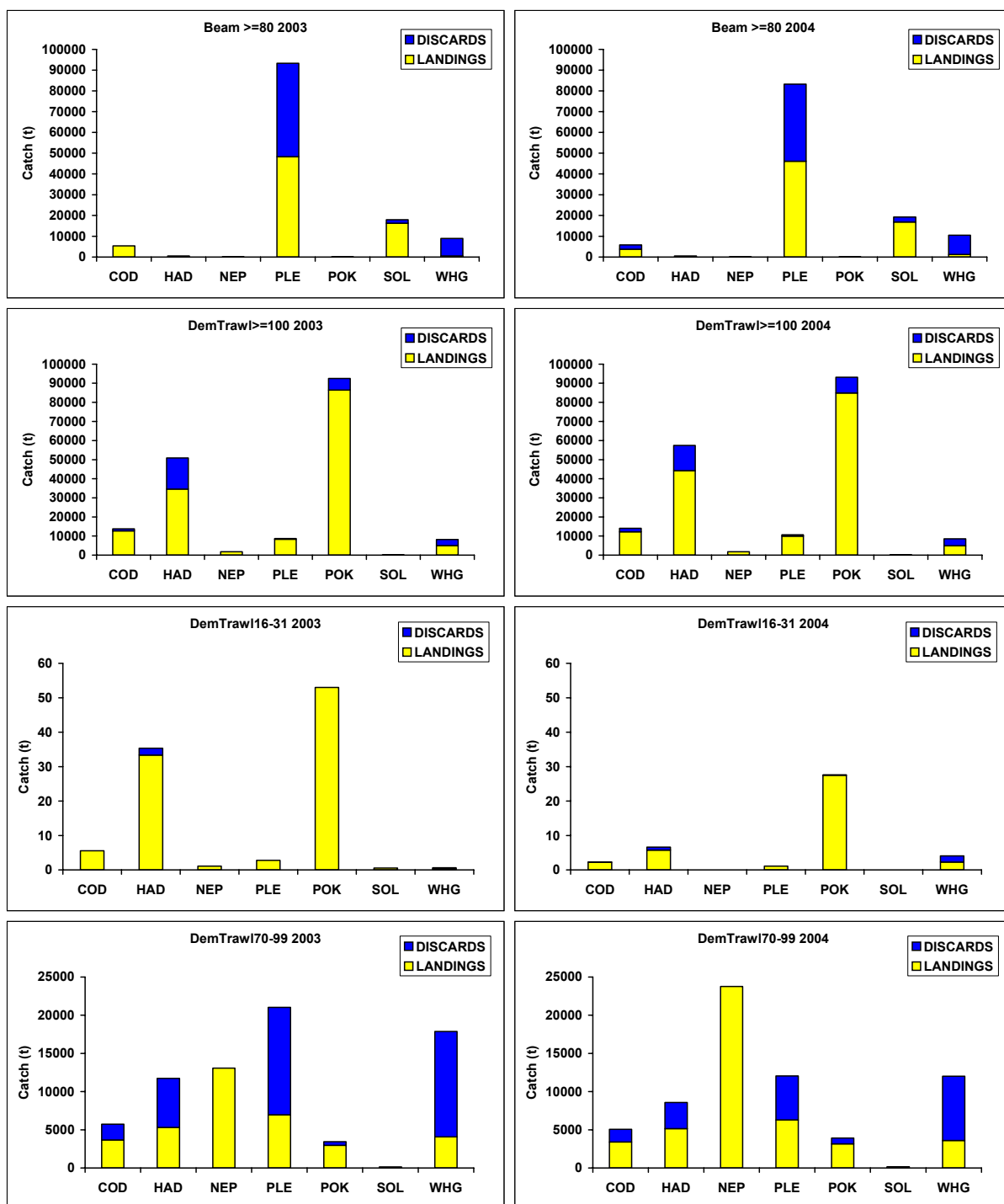


Fig. 4.3.1 Landings and discards by regulated gears and by species in the North Sea and Skagerrak in 2003 and 2004.

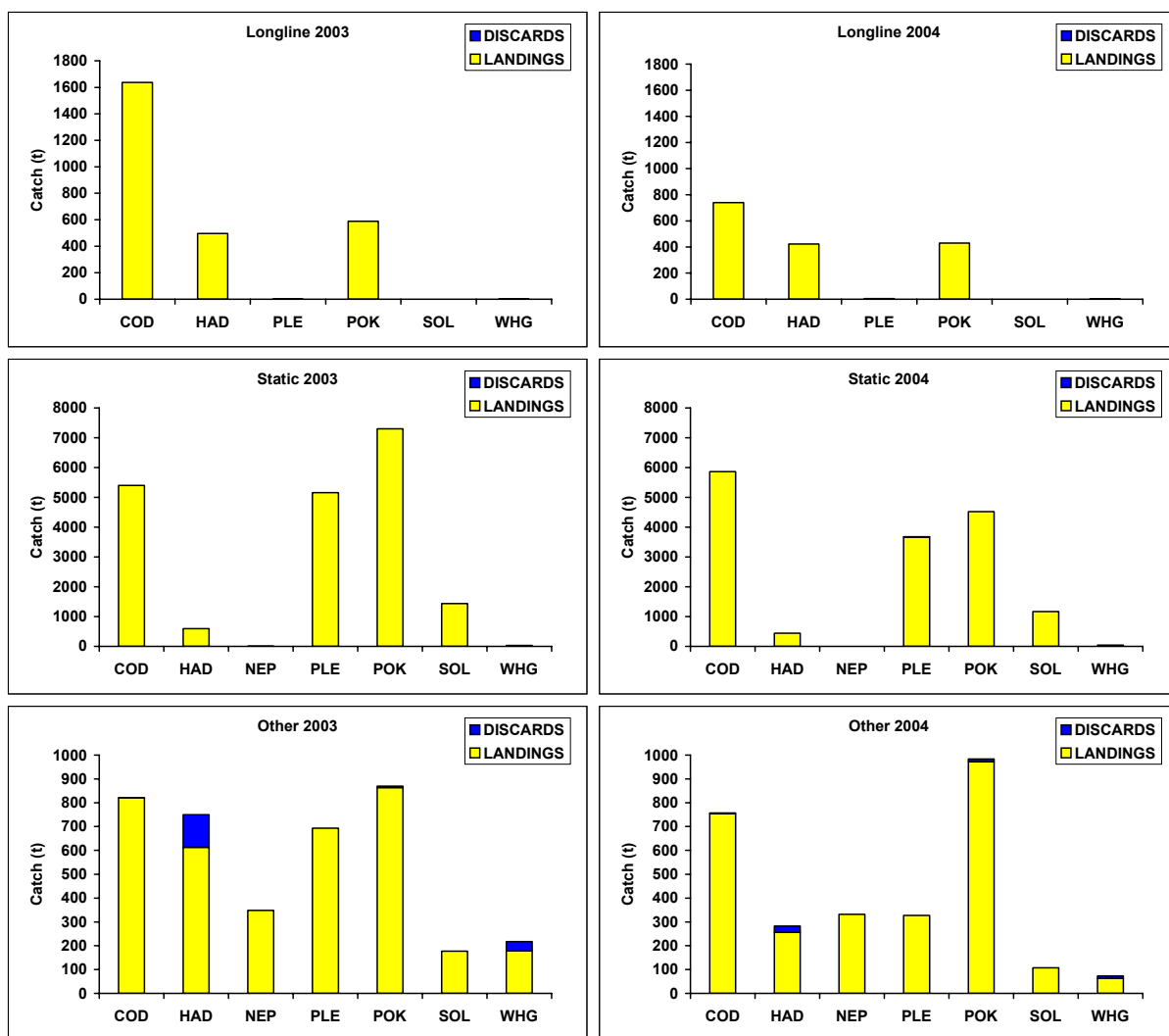


Fig. 4.3.1 continued. Landings and discards by regulated gears and by species in the North Sea and Skagerrak in 2003 and 2004.

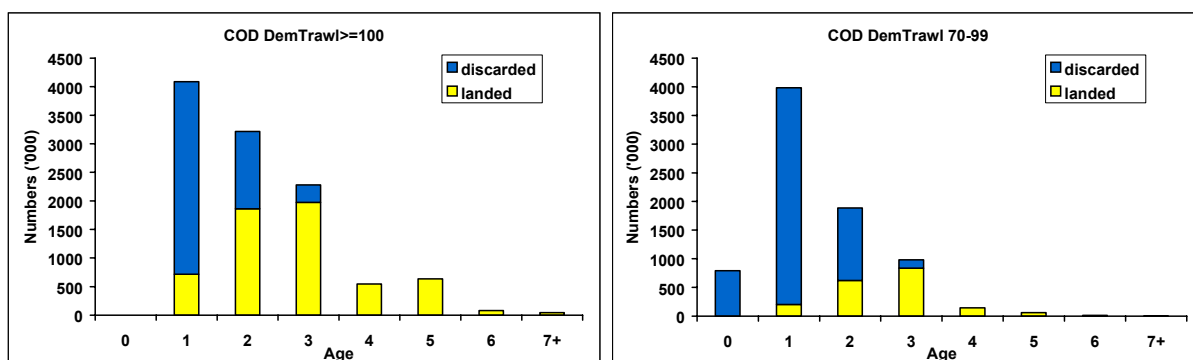


Fig. 4.3.2 Cod landings and discards at age caught by demersal trawls ≥ 100 mm and 70-99mm in the North Sea and Skagerrak in 2004.

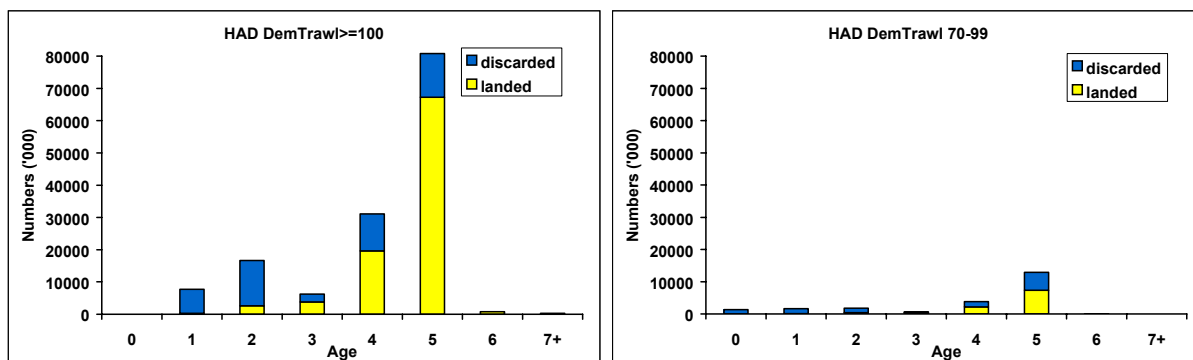


Fig. 4.3.3 Haddock landings and discards at age caught by demersal trawls ≥ 100 mm and 70-99mm in the North Sea and Skagerrak in 2004.

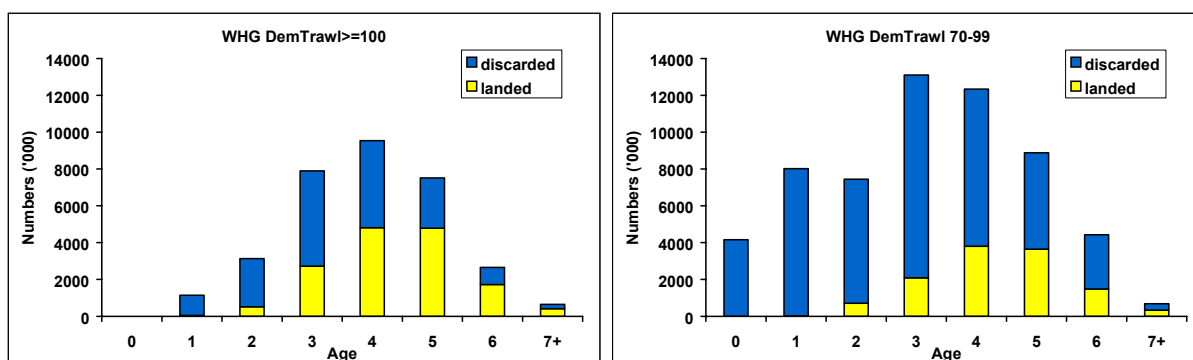


Fig. 4.3.4 Whiting landings and discards at age caught by demersal trawls ≥ 100 mm and 70-99mm in the North Sea and Skagerrak in 2004.

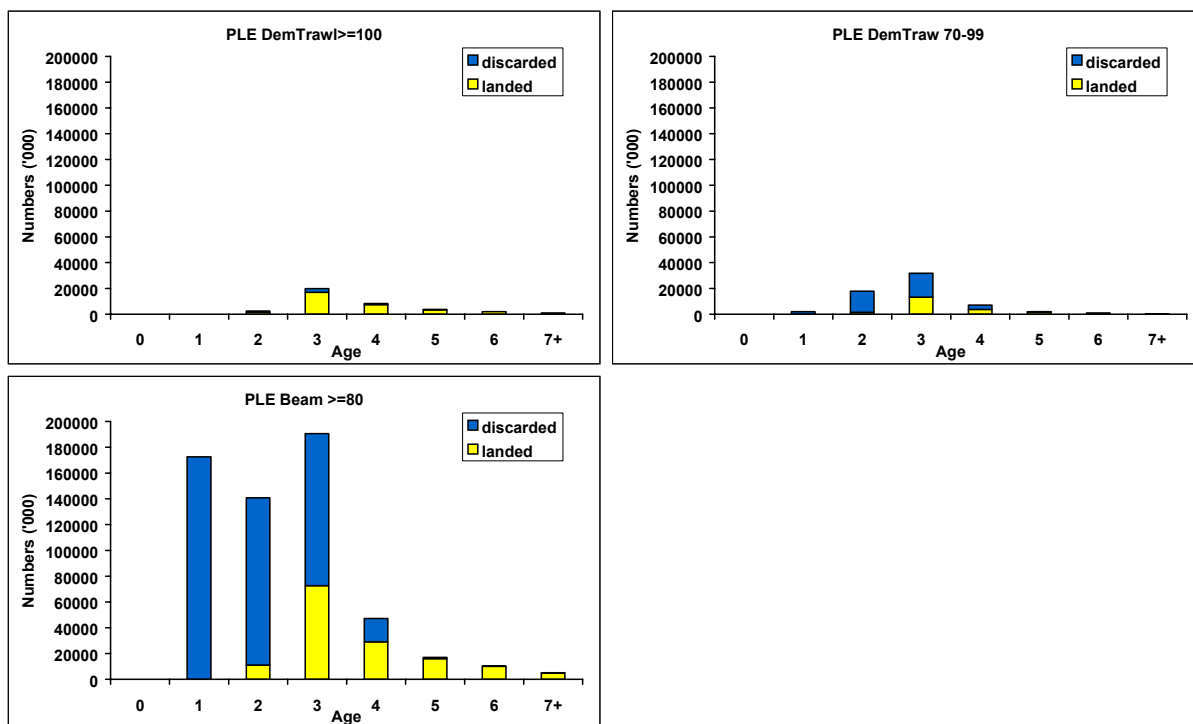


Fig. 4.3.5 Plaice landings and discards at age caught by demersal trawls ≥ 100 mm and 70-99mm and beam trawls ≥ 80 mm in the North Sea and Skagerrak in 2004.

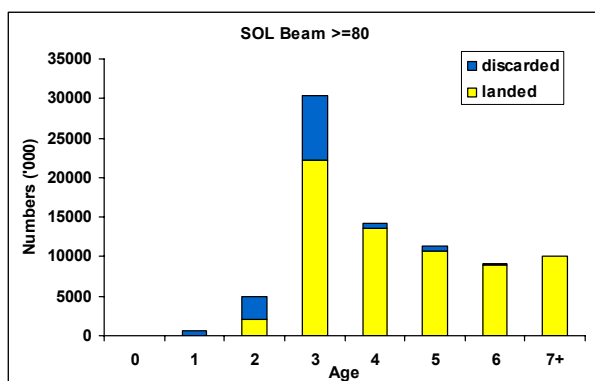


Fig. 4.3.6 Sole landings and discards at age caught by beam trawls ≥ 80 mm in the North Sea and Skagerrak in 2004.

4.3.3 Mixed fisheries analyses

Owing to the lack of accepted assessments and concerns that the mixed fishery database is considered to have inadequate coverage of discards, the following analyses are presented in terms of sensitivity analyses to investigate the effect of some aspects of uncertainty in the input data. **They are not in any way intended as viable or realistic options for management purposes.**

4.3.3.1 Exploratory MTAC runs

4.3.3.1.1 MTAC settings and analyses

The group received no requests from the Commission specifying the settings for the MTAC runs. The Group decided on the settings according to ToRs 3 and 4. The p- and q-options were set at $p=2$ and $q=1$ (see Appendix 3), as was requested by the Commission last year; also note in section 2.1 that the optional setting $p=1$ is inappropriate.

The MTAC analyses include cod, plaice, sole, haddock, saithe and *Nephrops*. With $p=2$ it is not necessary to include data on species that are not targeted and for which no analytical assessment exists, such as Norway pout, sandeel, and whiting. The targeted *Nephrops* fishery should be included in order to influence the fleet factors and the MS-TACs of the main species. However, since no analytical assessment of *Nephrops* exists, MTAC will not provide advice on the MS-TAC of *Nephrops*.

The F-multipliers were set with regards to ToR 3 according to the ACFM advice; the rationale for their choice is presented in Table 4.3.3.1.1.

With regards to ToR 3, the Group decided to set a high decision weight on cod (80), a four times lower one on plaice (20), and very low decision weights (0.1) on the other species, thus reflecting the high importance given to cod recovery and to keeping plaice within safe biological limits.

Table 4.3.3.1.1 Rationale for the choice of F-multipliers, and decision weights.

Species	Target F-multiplier	Rationale (based on ACFM advice)	Decision weight
Cod	See Table 4.3.3.1.2	See Table 4.3.3.1.2.	80
Plaice	0.68	F expected to rebuild SSB to the proposed B_{pa} in 2007	20
Haddock	0.95	Agreed management plan setting F in 2006 to 0.3	0.1
Saithe	1.48	$F < F_{pa}$	0.1
Sole	0.86	F expected to lead to SSB of B_{pa} in 2007	0.1
Nephrops	1	No increase in effort	0.1

With regards to ToR 3, the input data for the MTAC analyses (population numbers and fishing mortalities) were taken from the respective assessments and short term forecasts accepted by ICES as far as they exist. For Nephrops dummy data were used to ensure that the relative catch compositions for Nephrops were included in the calculations. A range of dummy population data were tested for Nephrops and as expected, the exact values used have no bearing on the outcome of the model.

ACFM considered the exploitation rate of the North Sea cod stock to be highly uncertain due to concerns regarding the catch data and inconsistencies in the surveys in 2005. The relative size of the stock (i.e. close to the lowest observed) was fairly consistent between various model runs. ACFM was therefore unable to accept any one analytical assessment and consequently did not perform the short term forecasts required as input to the MTAC model.

In order to evaluate this uncertainty in terms of potential mixed fishery advice the Group used the results of one of the assessments presented to ACFM, however **THIS DECISION SHOULD NOT BE TAKEN AS AN ENDORSEMENT OF THIS PARTICULAR ASSESSMENT AND THE INPUT VALUES AND RESULTS MUST BE VIEWED AS PURELY ARBITRARY.**

The B-ADAPT model (Darby, 2004) uses survey data to project removals from the stock over the terminal years, thus the resulting F actually represents the reported landings and discards plus any additional unallocated mortality. This additional mortality could come from a variety of sources including natural mortality (predation, disease and senescence), fishing activity (missing discard estimates, misreporting of landings, mortality induced by escape from fishing gear) or other sources such as ghost fishing from discarded/lost gear. There are no data to elucidate which additional mortality source is the more likely and therefore two scenarios are presented, one assuming that the unallocated mortality is independent from fishery management decisions and the other assuming that adjustments to the fishing effort has a direct effect upon unallocated mortality. In this case the unallocated mortality is distributed amongst the fleets in proportional to the cod catch of each fleet.

In order to get from the terminal population and mortality estimates to input values for MTAC (stock numbers at age 1st Jan 2006), an intermediate year forecast was performed on the terminal population (2005) numbers. The selection pattern for projection was the average of the previous 3 years of mortality. The exception to this was fishing mortality at age 4 which was determined as the mean value for 2002 & 2003 because of the concerns regarding the exceptionally high value for 2004. Two values of F were considered, the unscaled 3-year mean and a 40% reduction from the 2001 estimate. This second value investigated the assumption that the reduction in effort of the main whitefish fleets (working paper to cod recovery meeting) has lead to a reduction in F. Recruitment at age 1 in 2005 was assumed to be the short term geometric mean (1998-2002). Due to the truncated age structure of North Sea cod, the relatively high total mortality and early maturation, the recruitment at age 1 in 2006 will be influential upon the level of SSB in 2007. Three recruitment values for 2006 were investigated,

1. the continuation of the current run of low recruitments – geometric mean (1998-2002).
2. long term geometric mean (1983-2002)
3. a relatively strong recruitment at the level of that seen in 1997.

MTAC also requires either a TAC or an F-multiplier as indicated by single species advice. The joint EU-Norway management plan states that fishing mortality should be adjusted such that SSB will rise by 30% per year. To this end F-multipliers were determined for each recruitment scenario that permitted a 30% increase in SSB from 2006 to 2007. ICES advice for North Sea cod in 2006 is for a TAC of 0, hence an F-multiplier of 0 was imposed using the long term geometric mean recruitment at age 1 in 2006 (arbitrarily chosen).

For each scenario governing recruitment, intermediate year F and the 0 TAC scenario we investigated the effect of assumptions for the source of unallocated mortality. For those scenarios assuming that the unallocated mortality is independent of fishery management, the unallocated portion of mortality was added to M (natural mortality) instead of being part of fishing mortality.

In total there were 16 scenarios defined in the following table (Table 4.3.3.1.2).

Table 4.3.3.1.2. Definition of scenarios and according variations of cod stock parameters used for the North Sea MTAC exploratory runs.

Run	Location of unallocated mortality	Recruitment in 2006	F-multiplier for 2006 and rationale	F 2005
1	F	Short term GM ("low")	0.66 (EU-Norway)	F_{sq}
2	F	Long term GM ("medium")	0.75 (EU-Norway)	F_{sq}
3	F	1996 yearclass ("high")	0.85 (EU-Norway)	F_{sq}
4	M	Short term GM ("low")	0.54 (EU-Norway)	F_{sq}
5	M	Long term GM ("medium")	0.68 (EU-Norway)	F_{sq}
6	M	1996 yearclass ("high")	0.83 (EU-Norway)	F_{sq}
7	F	Long term GM ("medium")	0 (ICES ADVICE)	F_{sq}
8	M	Long term GM ("medium")	0 (ICES ADVICE)	F_{sq}
9	F	Short term GM ("low")	0.66 (EU-Norway)	$0.6^* F_{2001}$
10	F	Long term GM ("medium")	0.75 (EU-Norway)	$0.6^* F_{2001}$
11	F	1996 yearclass ("high")	0.85 (EU-Norway)	$0.6^* F_{2001}$
12	M	Short term GM ("low")	0.54 (EU-Norway)	$0.6^* F_{2001}$
13	M	Long term GM ("medium")	0.68 (EU-Norway)	$0.6^* F_{2001}$
14	M	1996 yearclass ("high")	0.83 (EU-Norway)	$0.6^* F_{2001}$
15	F	Long term GM ("medium")	0 (ICES ADVICE)	$0.6^* F_{2001}$
16	M	Long term GM ("medium")	0 (ICES ADVICE)	$0.6^* F_{2001}$

The catch compositions of the fleets are based on data from 2003 and 2004 (see section 4.3.1).

The results for the MTAC runs from scenarios 1-8 are displayed in Figures 4.3.3.1.1 and 4.3.3.1.3. Scenarios 9-16 are shown in Figures 4.3.3.1.2 and 4.3.3.1.4. A summary plot of the fleet effort factors for all 16 scenarios is given in Figure 4.3.3.1.5.

In all scenarios with a non-zero F-multiplier for cod (scenarios 1-6 & 9-14), the DemTrawl_16-31 fleet can continue fishing with status quo effort. For this fleet the database contained almost no cod catches. The Longline fleet and the fleets categorized under "Others" have only minor adjustments to their effort. The DemTrawl_70-99 and static fleets have to reduce effort to 80-95% of its current level. Greater reductions, to 45-95% of the current level, are required from the Beam \geq 80 and DemTrawl \geq 100 fleets; these fleets catch plaice and cod respectively, the species that need restriction and had received high decision weight. With the F-multiplier for cod = 0 (scenarios 7 and 8), only the Longline fishery has to be closed completely and all other fleets have to reduce to less than 50% of the current level.

Under the assumption of lower cod recruitment, effort restrictions needs to be greater than when at recruitment is at higher levels. When fewer recruits come in at the start of 2006, fishing needs to be restricted more in order to reach the goal of a 30% increase in SSB over the TAC-year, that is from 2006 to 2007. Some of the recruits of 2006 will be mature and contribute to SSB in 2007.

Under the assumption that the unaccounted mortality is independent of fishery management (scenarios 4-6, 8, 12-14 & 16), greater effort reductions are needed than under the assumption that the unaccounted mortality is associated with fishing (scenarios 1-3 and 7). The assumption about the unaccounted mortality has no observable influence when the cod F-multiplier = 0.

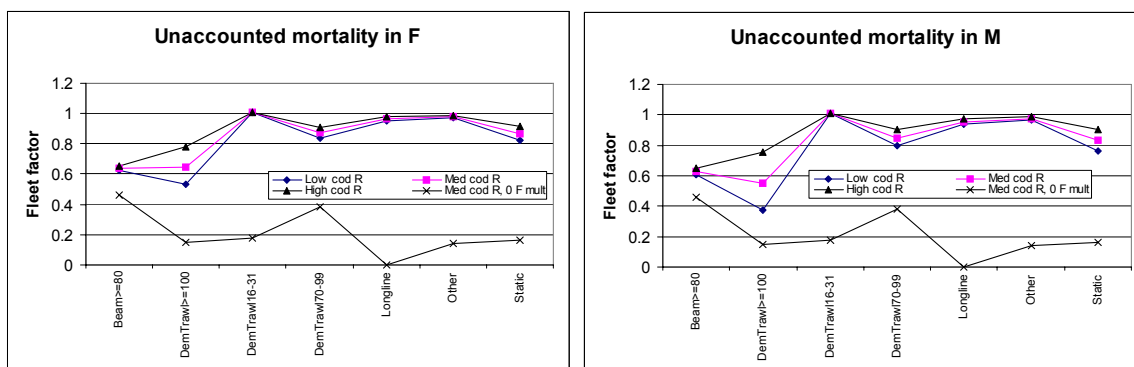


Figure 4.3.3.1.1. The fleet factors from scenarios 1-8.

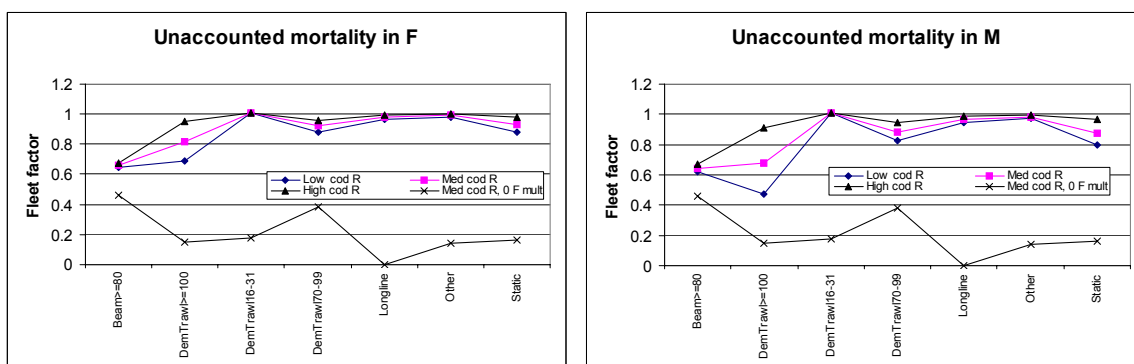


Figure 4.3.3.1.2. The fleet factors from scenarios 9-16.

In all scenarios with a non-zero F-multiplier on cod (scenarios 1-6 & 9-14), the targets for cod and plaice are approached quite closely, and this is due to the high decision weights given to these species. The targets for sole and haddock are undershot in all scenarios. The target of the only species with an F-multiplier > 1, implying that fishing for this species is allowed to increase, saithe, is heavily undershot; the severe effort restrictions needed for cod and plaice leads to missed fishing opportunities for saithe. With the cod F-multiplier = 0 (scenarios 7, 8, 15 & 16), the targets of all other species are severely undershot whilst the ratio MS_TAC/SS_TAC cannot be calculated for cod in this scenario because the $SS_TAC = 0$.

For all species except cod, the assumption of lower cod recruitment results in lower MS_TAC/SS_TAC ratios – i.e. the implied SS TAC is undershot. For cod the MS_TAC/SS_TAC ratio is close to one although the exact pattern requires further explanation. Under the assumption of low recruitment the SS target F-multiplier is lower and therefore the resulting MS F-multiplier is more likely to be slightly higher. Conversely, when the SS target is not so stringent (i.e. higher cod recruitment), under-shooting the SS target is more likely given the stringent effort restriction required for plaice.

For all species except cod, the assumption that the unallocated mortality is independent of fisheries management (scenarios 4-6, 8, 12-14 and 16) leads to lower MS_TAC/SS_TAC ratios. As was explained above, under the assumption that this mortality is independent of fishery management, more severe restrictions are necessary, leading to lower exploitation of the other species. For cod, it is more difficult to reach these lower targets when the other species are pulling the compromise towards higher effort.

The effect of a lower intermediate year F (scenarios 9-16) implies less restrictive fleet effort factors for the demersal trawls, particularly when recruitment in 2006 is assumed to be high. There is less influence of the intermediate year F on the fleet effort factors for beam trawling, and no effect when the desired F-multiplier is zero (scenarios 15 & 16).

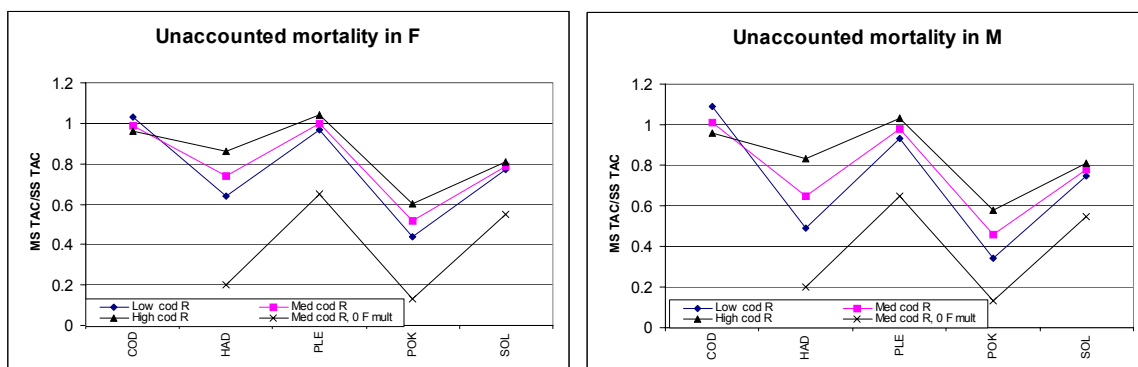


Figure 4.3.3.1.3. The ratios MS_TAC/SS_TAC (reflecting how well the target is approached, see Annex 3) under scenarios 1-8. Where F-mult cod=0, not ratio can be displayed because the $SS_TAC = 0$.

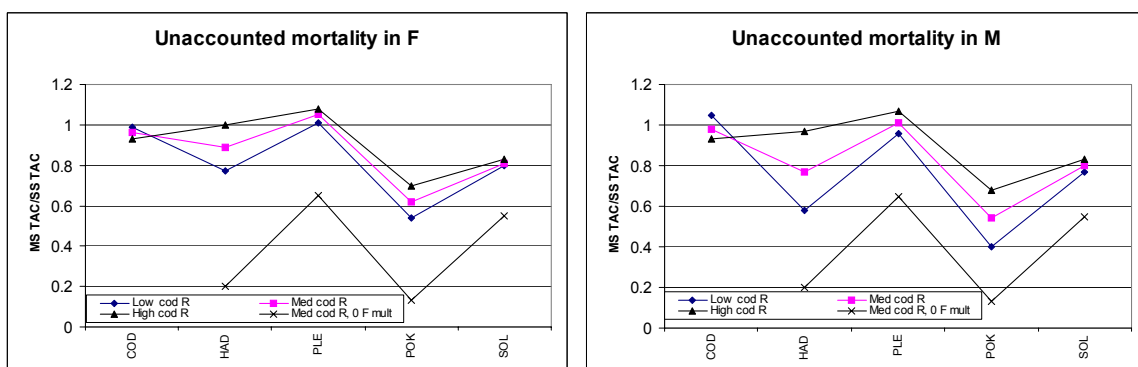


Figure 4.3.3.1.4. The ratios MS_TAC/SS_TAC (reflecting how well the target is approached, see Annex 3) under scenarios 9-16. Where F-mult cod=0, not ratio can be displayed because the $SS_TAC = 0$.

From Figure 4.3.3.1.5 it can be seen that even the limited uncertainty explored in this years MTAC runs, namely uncertainty in the intermediate year F and the nature of unallocated mortality, gives rise to a huge variation in fleet effort factors for the demersal trawl $\geq 100\text{mm}$.

The scenario of medium cod recruitment and unallocated mortality in F (scenario 2) was run also with 0 decision weight on *Nephrops* (instead of 0.1). Only the fleet factor of the fleet that targets *Nephrops* changed and then to a hardly discernible extent; all others stayed the same. The lack of effect can be explained because the target for *Nephrops* is quite neutral: the F-multiplier was set to 1, so no change is required. Also, the decision weight on *Nephrops* was already low in the first place.

4.3.3.1.2 Conclusions on the MTAC simulations

As stated before, there is considerable concern regarding incomplete discard data going into the fleet catch composition database, changes to this would undoubtedly affect the fleet effort multipliers. The limited range of uncertainties investigated surrounding the state of the cod stock demonstrates that the management implications are diverse. The management action required to abide with the EU-Norway agreement is therefore highly uncertain.

Attempting to balance the ICES advice of 0-TAC for cod and a 0.68 F-multiplier for plaice is unaffected by the uncertainty in the cod assessment and would involve stringent cuts in effort across the board. Such general effort cuts would imply major deviations from the maximum fishing possibilities as advised by ICES for the other species. The precise level of the fleet effort factors will be conditional upon the input database and are therefore subject to the uncertainty. The MTAC output for the 0-cod catch scenarios are therefore only qualitative and must not be used as justification for exact advice.

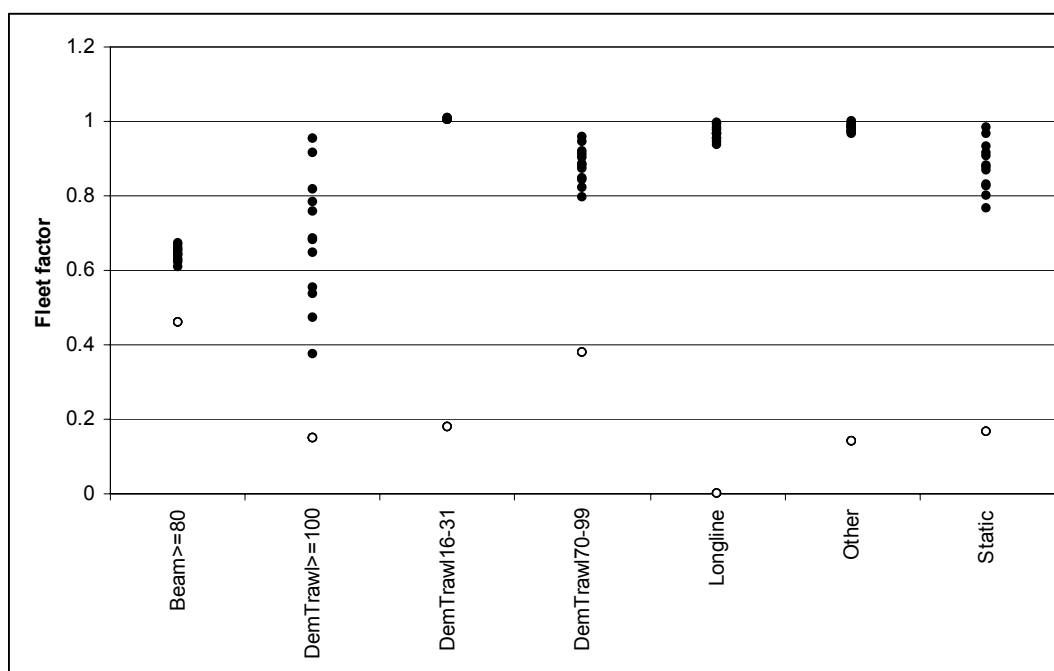


Figure 4.3.3.1.5. The range of MTAC fleet factors, by fleet for the 16 scenarios. Filled points are for those scenarios where North Sea cod SSB in 2007 was constrained to be 30% higher than in 2006. Open circles are those scenarios where the input F multiplier for North Sea cod was 0 (ICES advice for 2006).

4.3.3.2 Exploratory SMP mixed fisheries simulations for the North Sea

Exploratory runs of the further developed SMP model (section 2.2, WD 1) were run in order to evaluate appropriate fleet effort changes taking into account the precautionary management references in minimum SSB and maximum fishing mortality for the 5 main demersal species, cod, haddock, saithe, plaice and sole.

4.3.3.2.1 SMP settings and analyses

The SMP model formulations are based on the estimated catch including discards for the 7 fleets described in section 4.3.1 and the most recent analytical forecast inputs as used by ICES for haddock, saithe, plaice and sole. For cod, the inputs of starting populations are those adopted in the MTAC scenarios (Darby, 2004) and described in section 4.3.3.1.1. Natural mortality M is raised in order to account for unallocated removals resulting in rather low fishing mortality F and the short term geometric mean represents rather low recruitment. Fishing in 2005 is assumed at status quo level. The B_{pa} and F_{pa} used as constraining management boundaries until 2007 correspond to management references for haddock and saithe as stipulated in the EU-Norway agreement in 2004. For plaice and cod ICES PA references or the recovery plan were applied, respectively. As the model allows a choice to which degree the fleet management is implemented, 2 scenarios were estimated to simulate no versus full fleet based management.

The results confirm that both managements scenarios of no and full implemented fleet management could achieve the management goals being constrained by the maximum allowed fishing mortalities and minimum SSB by species. The differences in the scenarios indicate that all fleets would have to reduce their effort to about 60 % under the assumption of no fleet specific management (Fig. 4.3.3.2.1-3). The fleet specific calculations resulted in reductions to about 40-60% of the main catching gears, i.e. beam ≥ 80 mm, demersal trawls ≥ 100 mm and demersal trawls 70-99mm and static gears (Fig. 4.3.3.2.1-3). All these gears are indicated to contribute significantly to the catch of the reduced cod and plaice stocks. Only the highly selective gears of demersal trawls 16-31mm, longlines and the category of others, which are indicated having only a little effect on cod and plaice, can increase their efforts. However, such general effort cuts of the main catching gears under both scenarios would imply major deviations from the fishing possibilities advised under precarious single species boundaries

(Fig. 4.3.3.2.4). The fleet definitions thus appear too poorly defined to generate scope for increased catches of other underexploited species through fleet specific management.

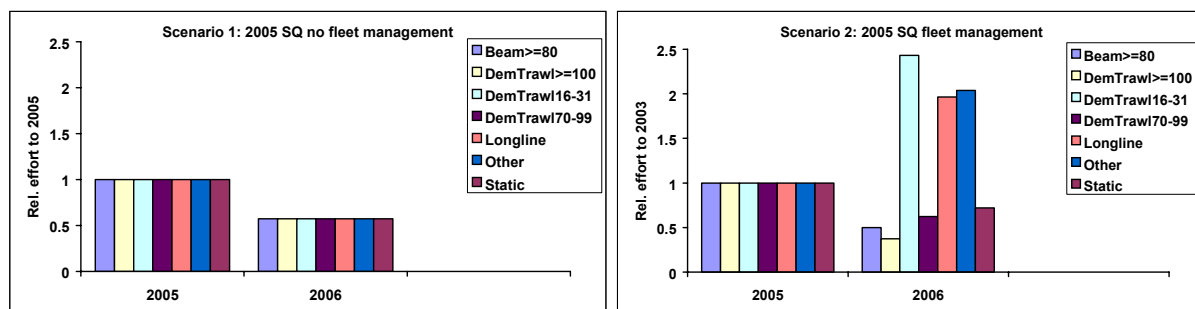


Fig. 4.3.3.2.1 Change in fleet specific effort in 2005 relative to 2005 for 7 fleets under no and full fleet specific management scenarios.

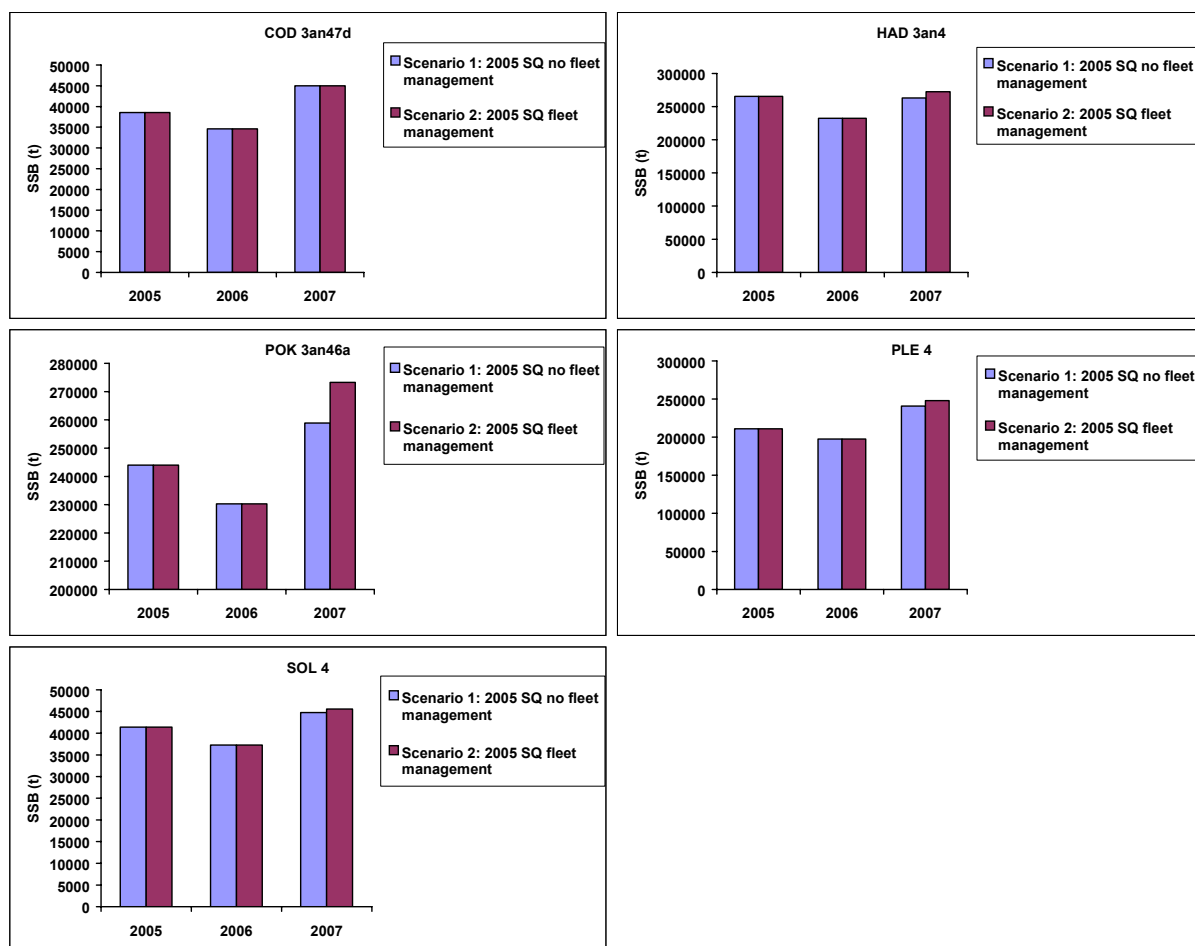


Fig. 4.3.3.2.2 Trends in SSBs by species in 2005-2007 by species under no and full fleet specific management scenarios.

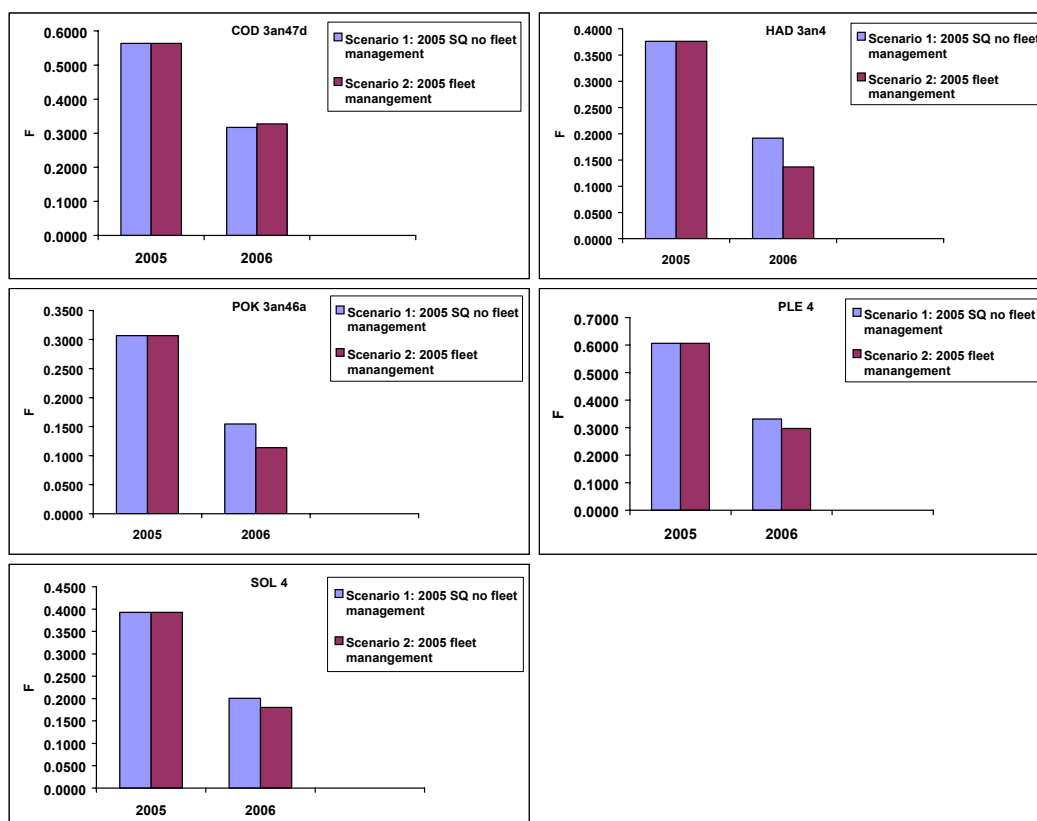


Fig. 4.3.3.2.3 Trends in reference Fs by species in 2005-2006 under no and full fleet specific management scenarios.

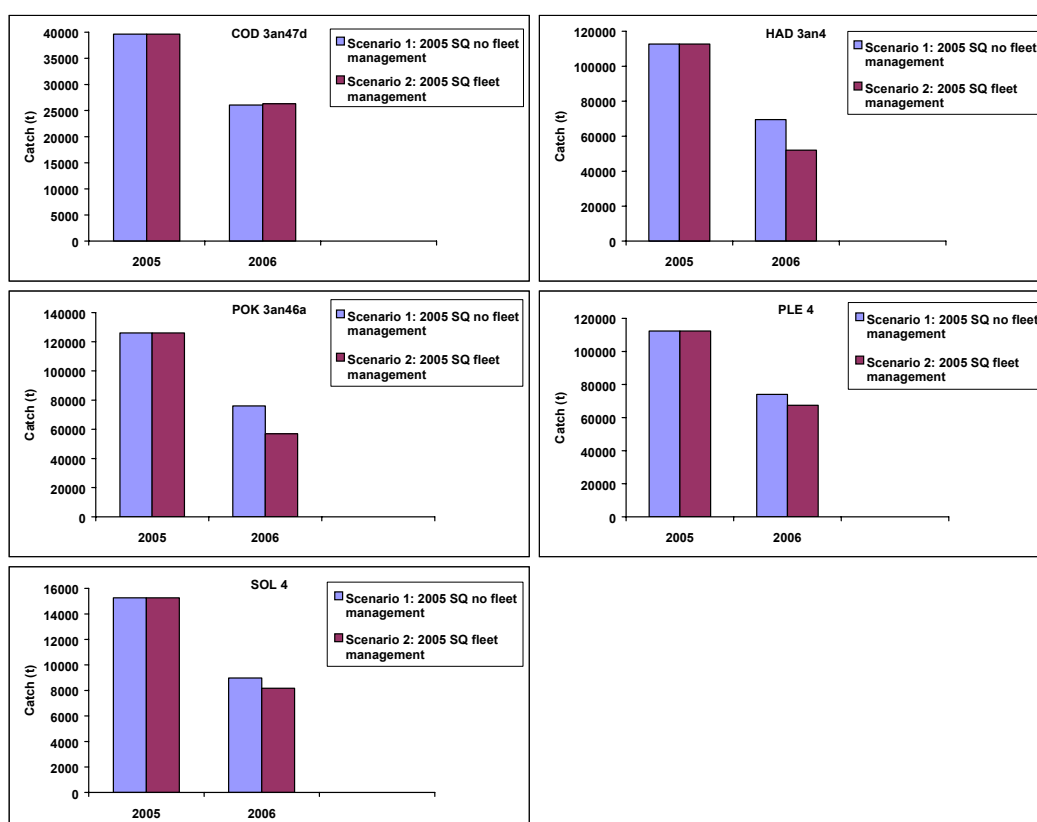


Fig. 4.3.3.2.4 Trends in catches including discards by species in 2005-2006 under no and full fleet specific management scenarios.

4.3.3.2.2 Conclusions on SMP simulations

The fleet specific calculations resulted in general reductions to about 40-60% of the main catching gears, i.e. beam ≥ 80 mm, demersal trawls ≥ 100 mm and demersal trawls 70-99mm and static gears, regardless of the fleet specific management being implemented or not. Such general effort cuts of the main catching gears would imply major deviations from the fishing possibilities advised under precautionary single species boundaries. The fleets thus appear too poorly defined to generate scope for increased catches of other species through fleet specific management. The results of the SMP model runs are quite consistent with results from the MTAC runs.

4.4 Eastern Channel (ICES Division VIId)

4.4.1 Fleet overview and specific data

Total landings by fleet were made available for cod, haddock, whiting, saithe, sole and plaice in 2003 and 2004. Regarding discards, data were collected in 2003 and 2004 on board vessels belonging to the two most important French fleets (demersal trawlers 70-99 mm and netters). However, figures could not be raised to the overall fishery, and discard information could not be used by the Group.

Demersal trawlers 70-99 mm

This fleet segment is the most important in the Eastern Channel. Demersal trawlers operate both in the Eastern Channel and the Southern part of the North Sea. In the Eastern Channel, this fleet may use a minimal mesh size of 80 mm when fishing for whiting (Council Reg. (EC) 850/98). Whiting is the main target species of that fleet in landings weight. However, valuable species are targeted in specific seasons (cephalopods in the third quarter, red mullet in the fourth quarter), while sea bass landings appear to have increased in recent years. Other by-catches include red gurnard, common pout and cod. Figure 4.4.1 shows a decrease in cod landings between 2003 and 2004. In 2004, cod landings represented less than 6% of the total landings.

Netters

Trammel nets and similar bottom nets are the main fixed gears used to catch flatfish, with sole being the target. Other fixed gears are gill nets made up of one single panel (as opposed to three for trammel nets). These nets may have different mesh sizes and heights depending on their target species (e.g. 90 mm mesh and 1 m height for sole, 100 mm mesh and 3 m height for cod). Figure 4.4.2 shows the landings composition in two types of French gillnet fisheries in the Eastern Channel. One gillnet fishery is directed at sole, plaice and cod, although cod contributed less than 7% in weight. In this fishery, total landings have slightly increased between 2000 and 2003 and decreased in 2004. On average, 90 t of cod were landed from this fishery over 2000-2003, while only 28 t were landed in 2004. For the other gillnet fishery the proportion of cod in landings was on average 30% over the period 2000-2003, and then decreased down to 8% in 2004.

Other commercial fleets and fisheries

The other commercial fisheries have a more limited activity in the Eastern Channel. Of particular interest are the dredgers targeting valuable scallops in the middle and Southern Eastern Channel from October to May. Beam trawlers using a mesh size above 80 mm mainly target sole, plaice and turbot. Large Dutch and Belgian twin trawlers fish mainly in the North Sea. They are fishing in the Eastern Channel occasionally (January/February) to catch sole. Smaller French boats (mean length of 14 m) work with a single beam to target sole and plaice in spring and winter. As described in Figure 4.4.1 landings are mainly composed of sole and plaice. In 2003 and 2004, cod catches represented less than 2% of the total catch. Demersal trawlers using a mesh size of 16-31mm target predominantly shrimps and only a small number of boats are involved in this fishery. In order to reduce by-catches of juvenile flatfish, a selective gear (Asselin type) has been used since 2002. By-catches of cod and flatfish are small.

Recreational fishery

This fishery is considered important in the Eastern Channel. A survey has been conducted in 2003 and 2004 to evaluate the quantities of sea bass landed by French sports fishermen. The results of that survey indicated that recreational landings of bass were around 4,000 t for the Atlantic and Channel. A similar survey will be conducted in 2006 to evaluate the impact of recreational fishing on cod landings in the Channel and the Celtic Sea.

Conclusions

The landings figures presented are inappropriate to describe recent gear specific catch at age compositions. No age compositions of the landings or discards were made available. The majority of cod landings is taken by the demersal trawls 70-99mm. A decrease of the cod proportion in landings is observed for all fleets between 2003 and 2004, the fleets appear to have redirected their activity towards other species (e.g. red mullet, bass, cephalopods for trawlers, sole for netters). The impact of the recreational fishery on cod landings is to be investigated.

4.4.2 Assessment data overview

Most of the stocks in the Eastern Channel are defined and assessed together with other ICES divisions.

4.4.3 Mixed fisheries analyses

Both the lack of stock specific forecast inputs on stock size and exploitation rates and considerable concern regarding incomplete fleet specific catch data including discards prevented analytical mixed fisheries forecasts.

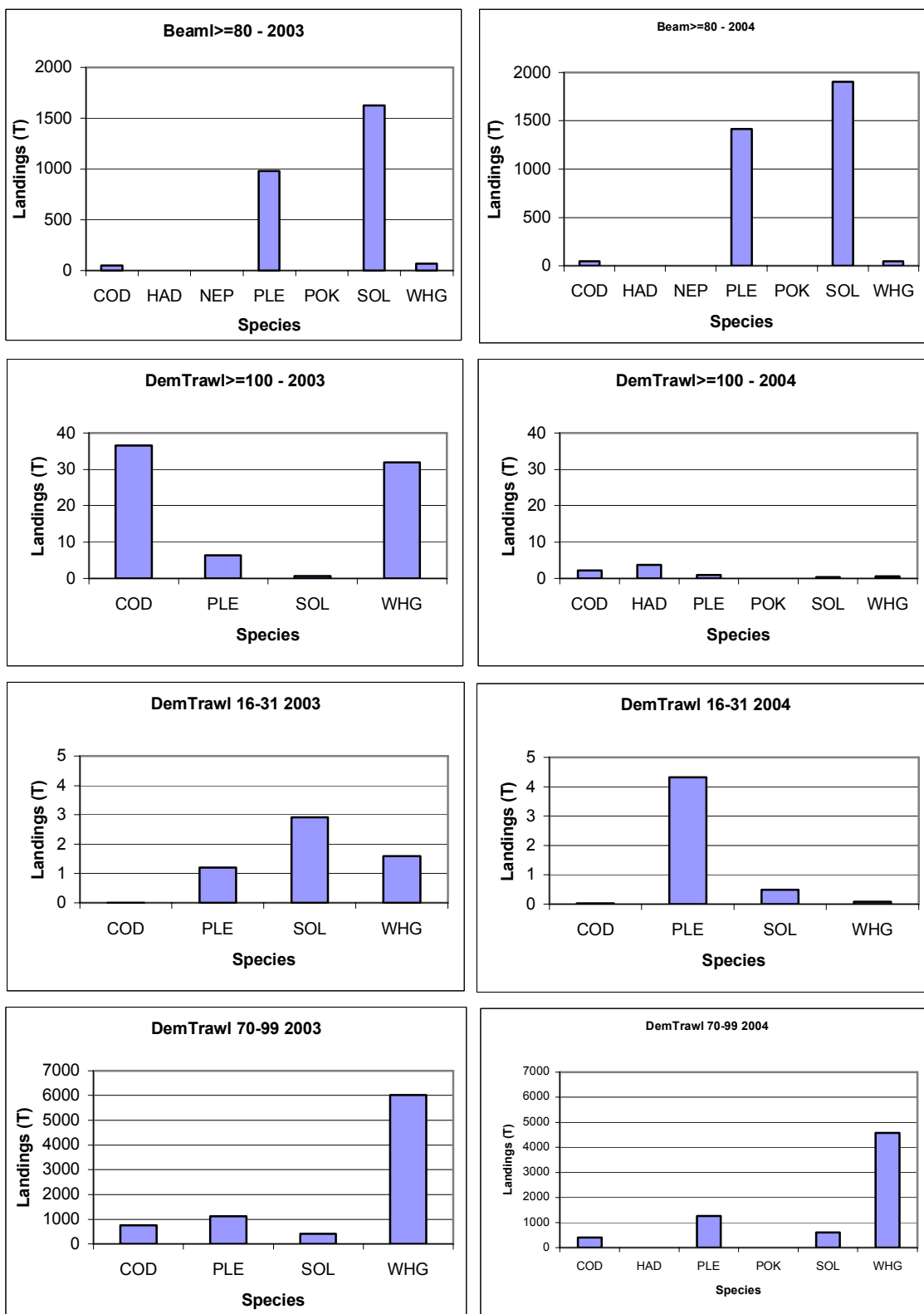


Fig. 4.4.1. Landings by fleet and by species in the Eastern Channel in 2003 and 2004.

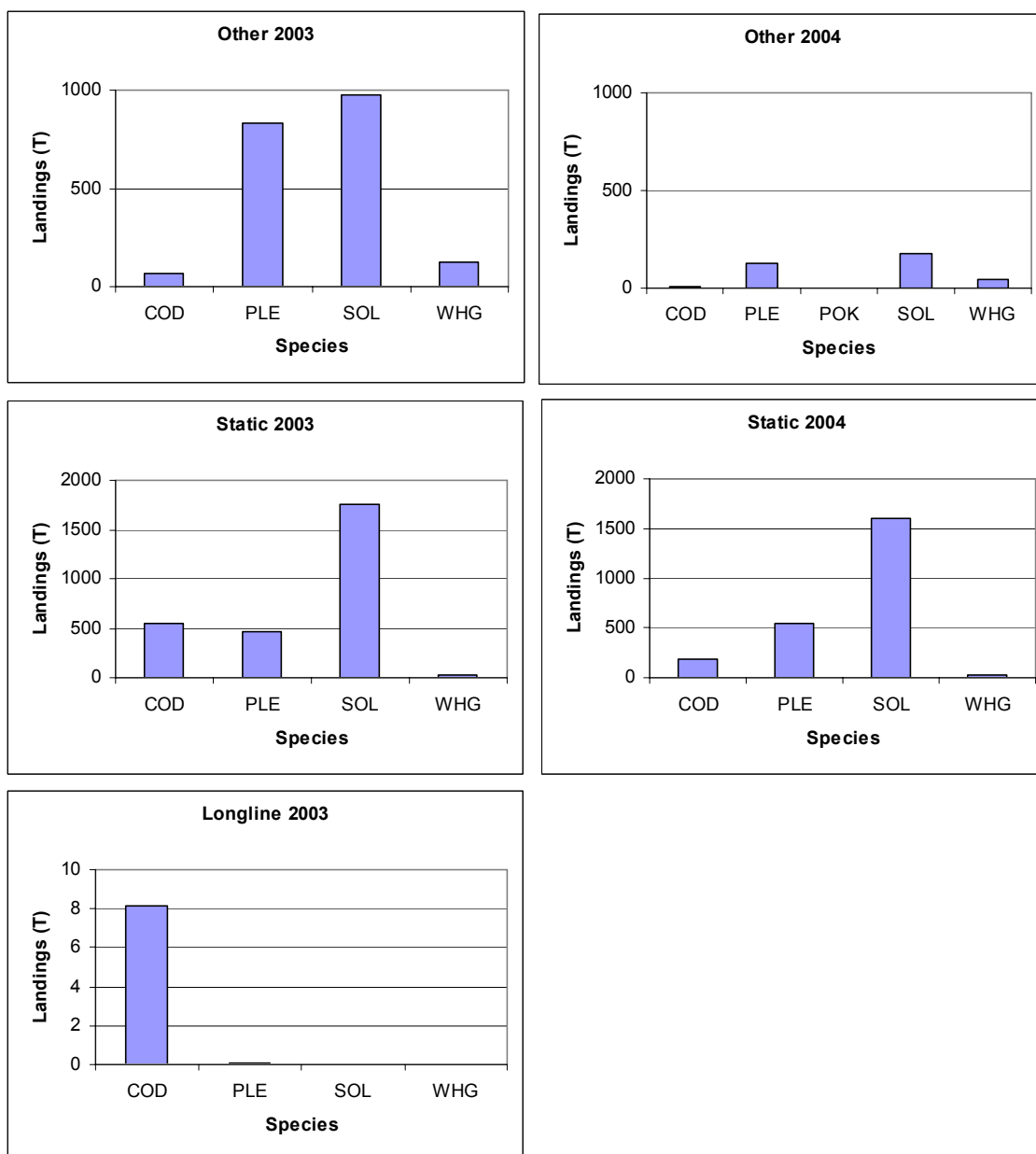


Fig. 4.4.1 continued. Landings by fleet and by species in the Eastern Channel in 2003 and 2004.

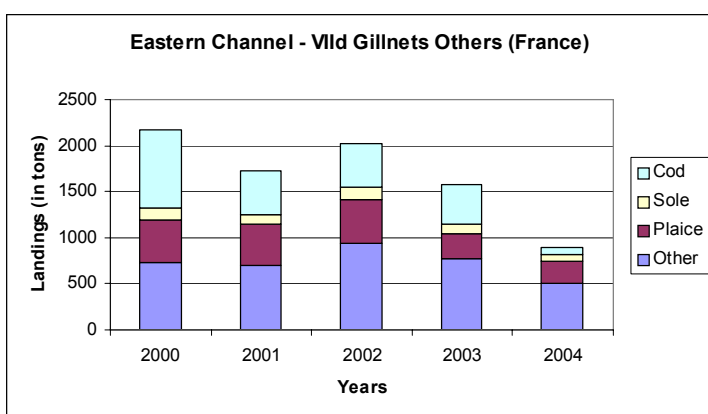
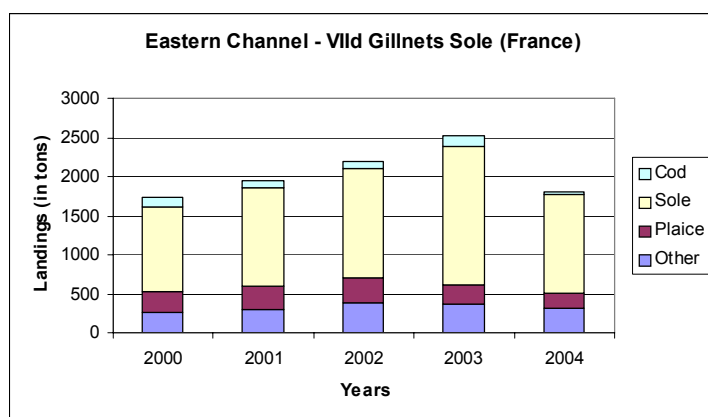


Fig. 4.4.2. Landings composition by 2 different French gill net fisheries in the Eastern Channel over 2000-2004.

4.5 Kattegat (ICES Division IIIas)

4.5.1 Fleet overview and specific data

The four main demersal species in Kattegat are Cod, Plaice, Sole and *Nephrops*. These species were evaluated as candidates for the MTAC analysis.

Catch data were submitted for Kattegat and for Skagerak separately for all four species. Denmark submitted data for all 4 species whereas Sweden submitted data for cod and plaice. In addition Denmark delivered data for monkfish, herring, hake, mackerel, and whiting.

Discard data by fleet and age were delivered by Sweden only, whereas Denmark could deliver only the total weight of discards for all fleets combined. Only Sweden delivered discard data in SGDFF-format.

Gear category beam ≥ 80 mm

This fleet category is not present in the Kattegat.

Gear category demersal trawl ≥ 100 mm

The demersal trawl ≥ 100 mm is not an important fleet category in the Kattegat. The main fleet segment targeting roundfish and flatfish is the ≥ 90 mm and hence, the majority of fish was caught in the 70-99mm category (see below). The small fleet using demersal trawl ≥ 100 mm mainly target cod and plaice (Fig. 4.5.1)

Gear category demersal trawl 16-31mm

Catches of demersal species by this fleet constitute bycatch in the industrial fisheries. These are small, and discarding is negligible as all catches go for reduction.

Gear category demersal trawl 70-99 mm

The demersal trawl segment 70-99mm was the main fishing segment in a mixed fish and *Nephrops* fishery. Trawls with a mesh size >90mm has no minimum target species composition and trawls larger than 90mm are considered as fish trawls. The 70-89 mm fishery can operate with only 30% *Nephrops* on board. The main target species for this fleet segment are *Nephrops*, cod, plaice and sole. The gear category as a whole is effectively a mixed *Nephrops*/fish fishery, though individual fishing operations can target particular species quite effectively. In addition to the more specialized *Nephrops* vessels, the segment also includes vessels fishing with a mesh size of 90mm or more for plaice and cod. The latest scientific advice on the *Nephrops* stocks suggests that the stocks were exploited at sustainable levels. Unofficial information indicates substantial landings in excess of those officially reported in recent years. No demersal fish stock in this area allows a potential increase in catches. It is noteworthy that since 2005 the 70-89mm fishery must use a species selective grid in order to minimize cod catches when targeting *Nephrops*. This segment is allowed 21 days at sea while the 90 mm fishery is allowed 9 days at sea (the same rules applies for Skagerrak). The sampling programmes of commercial catches reveal that these small meshed trawl fisheries have a diverse catch composition with large proportions of *Nephrops*, cod and plaice. Substantial discard rates in weight (Tab. 4.5.1 and Fig. 4.5.1) are indicated for cod (~40%), plaice (~70%), and *Nephrops* (35-50%). The minimum landing size for *Nephrops* in Kattegat and Skagerrak is 40mm carapace length in comparison with 25mm carapace length in North Sea, which explains the higher discard proportions of *Nephrops* in this area. Observations of discarding of sole indicate discard rates of between 15 and 20%. High discard rates of haddock, whiting and saithe were observed during some sampling trips, often with 95-100% of the catch being discarded. However, the quantities involved were small, and landings of these species from the area are very low (Fig. 4.5.1). No attempt has been made to estimate discards of these species as this would require a different approach to raising the samples than using total landings of the species. Discards of cod are mainly 1 and 2 year olds while for plaice 1-3 year old are discarded. Discard estimates are only available for this fishery (Fig. 4.5.2).

Gear category demersal longline

This gear could target almost all species in a highly selective pattern, but is used mainly to catch round fish. The database on catches including discards indicates this gear category as targeting the round fish species, but with insignificant landings and there is no effort information available.

Gear category static including gill nets, trammel nets and tangle nets

This group covers a variety of fisheries, including cod and plaice-directed gill net fisheries and smaller-meshed trammel nets directed at sole. The compilation of national landings data reveals that static gears catch cod, sole, and plaice with very low discard rates (Table 4.5.1 and Fig. 4.5.1). Discard sampling of Danish gillnetters was stopped in 2001 as observed discard rates for this fleet were consistently very low.

Gear category other

The gear category "other" is not effort regulated and data is probably not provided in a consistent way to be linked to the regulated gear types (mesh size information missing). It covers a variety of gears, mainly demersal trawls. Pelagic trawls are not considered at all. The main demersal target species are cod, plaice, sole and *Nephrops*. However, no information is available on discards (Table 4.5.1 and Fig. 4.5.1).

Conclusions

Recent discard sampling in the Kattegat has mainly been confined to the principle demersal gear, which is demersal trawls using 70-99mm mesh size. The catch compositions of this gear, including discards, appears fairly consistent over the years 2003 and 2004. The majority of cod and plaice in the Kattegat were caught in the 70-99mm category, even though the small fleet using demersal trawl ≥ 100 mm also target cod and plaice. The discard rates for cod, plaice and Nephrops were relatively high compared to other areas. The discard rates presented here represent the first attempt to use discard data from the Kattegat in an advisory context. As such the results should be treated with great caution.

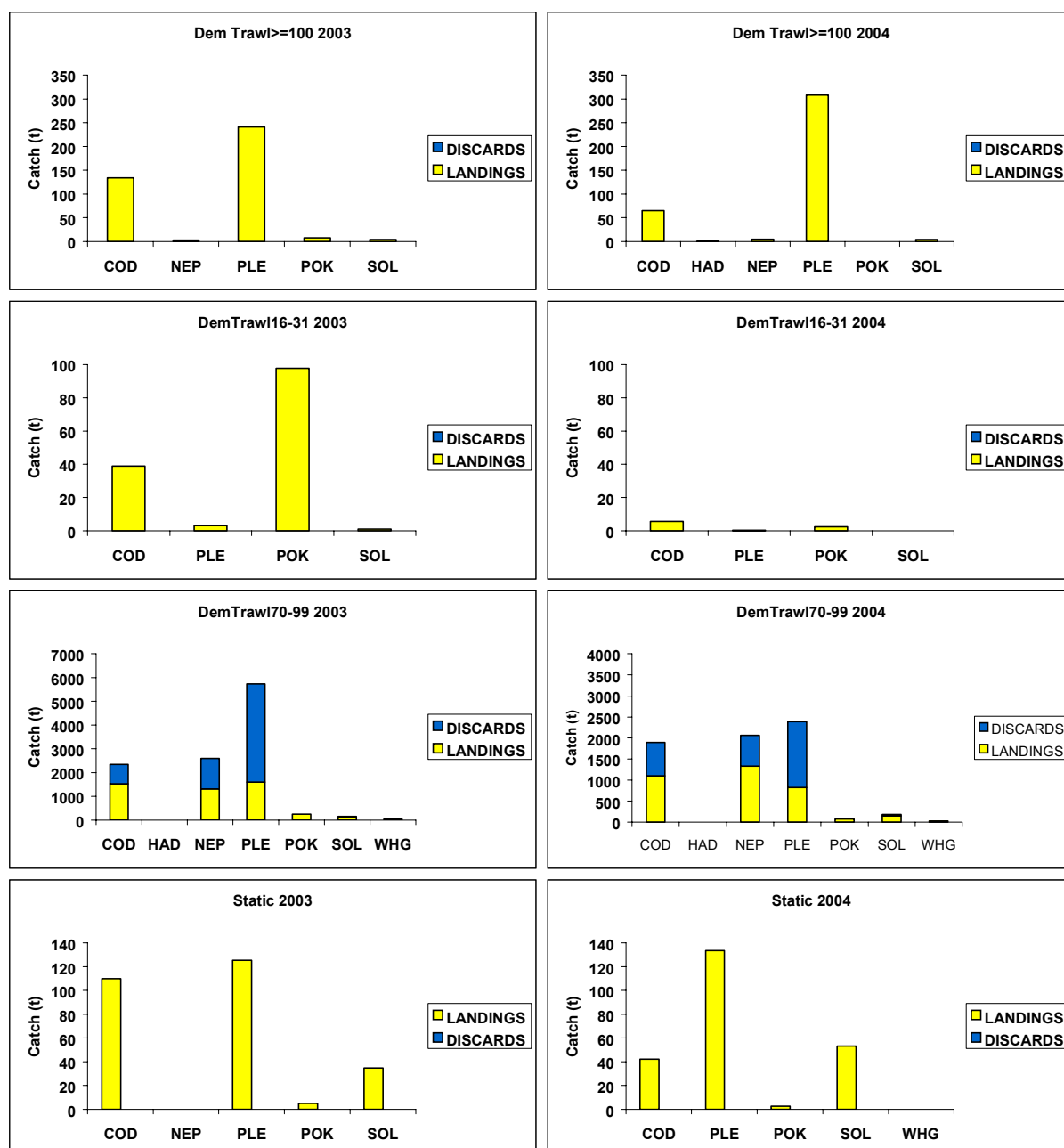


Fig. 4.5.1 Landings and discards by regulated gears and by species in the Kattegat in 2003 and 2004.

Table 4.5.1 Landings (t) and discard rates in the Kattegat by species and gears (no pelagic trawls) in 2003 and 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
COD	2003	DemTrawl>=100	134		134		
COD	2003	DemTrawl16-31	39		39		
COD	2003	DemTrawl70-99	1522	808	2330	0.35	0.31
COD	2003	Other	7		7		
COD	2003	Static	110		110		
SUM			1811	808	2619	0.31	0.31
COD	2004	DemTrawl>=100	65		65		
COD	2004	DemTrawl16-31	6		6		
COD	2004	DemTrawl70-99	1101	790	1891	0.42	0.39
COD	2004	Other	3		3		
COD	2004	Static	42		42		
SUM			1217	790	2007	0.39	0.39
HAD	2003	DemTrawl70-99	0		0		
SUM			0		0		
HAD	2004	DemTrawl>=100	0		0		
HAD	2004	DemTrawl70-99	0		0		
SUM			0		0		
NEP	2003	DemTrawl>=100	3		3		
NEP	2003	DemTrawl70-99	1310	1283	2593	0.49	0.49
NEP	2003	Static	0		0		
SUM			1313	1283	2596	0.49	0.49
NEP	2004	DemTrawl>=100	5		5		
NEP	2004	DemTrawl70-99	1334	722	2056	0.35	0.35
NEP	2004	Other	2		2		
SUM			1341	722	2063	0.35	0.35
PLE	2003	DemTrawl>=100	241		241		
PLE	2003	DemTrawl16-31	3		3		
PLE	2003	DemTrawl70-99	1598	4140	5738	0.72	0.68
PLE	2003	Other	2		2		
PLE	2003	Static	125		125		
SUM			1970	4140	6110	0.68	0.68
PLE	2004	DemTrawl>=100	308		308		
PLE	2004	DemTrawl16-31	0		0		
PLE	2004	DemTrawl70-99	824	1563	2387	0.65	0.55
PLE	2004	Other	1		1		
PLE	2004	Static	134		134		
SUM			1267	1563	2830	0.55	0.55
POK	2003	DemTrawl>=100	8		8		
POK	2003	DemTrawl16-31	98		98		
POK	2003	DemTrawl70-99	244		244		
POK	2003	Other	10		10		
POK	2003	Static	5		5		
SUM			364		364		
POK	2004	DemTrawl>=100	0		0		
POK	2004	DemTrawl16-31	2		2		
POK	2004	DemTrawl70-99	78		78		
POK	2004	Static	3		3		
SUM			83		83		
SOL	2003	DemTrawl>=100	4		4		
SOL	2003	DemTrawl16-31	1		1		
SOL	2003	DemTrawl70-99	118	29	147	0.20	0.15
SOL	2003	Other	0		0		
SOL	2003	Static	35		35		
SUM			158	29	187	0.15	0.15
SOL	2004	DemTrawl>=100	4		4		
SOL	2004	DemTrawl16-31	0		0		
SOL	2004	DemTrawl70-99	152	28	180	0.16	0.12
SOL	2004	Other	0		0		
SOL	2004	Static	53		53		
SUM			209	28	237	0.12	0.12
WHG	2003	DemTrawl70-99	34		34		
SUM			34		34		
WHG	2004	DemTrawl70-99	30		30		
WHG	2004	Static	0		0		

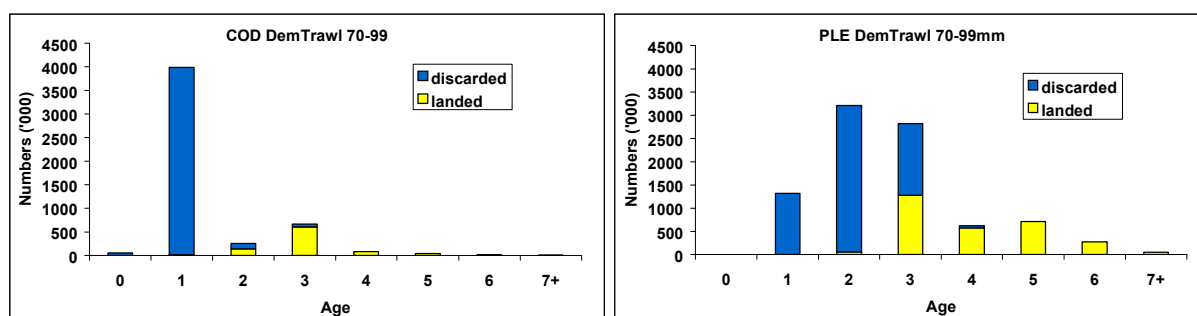


Fig. 4.5.2 Kattegatt in 2004. Landings and discards for cod and plaice at age for whiting by the regulated gear demersal trawl 70-99mm.

4.5.2 Assessment data overview

The two flatfish species are not assessed for Kattegat separately, but only for the total area IIIa. The *Nephrops* has not been assessed. Thus only the cod has been assessed for Kattegat in isolation. Table 4.5.2 summarises the assessments made in 2004-5 of cod, plaice, sole, *Nephrops* in Kattegat.

Table 4.5.2 State of the stocks and availability of analytical forecasts as estimated by ICES (2006b).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	Analytical forecast available
Cod in Kattegat	Reduced reproductive capacity	Harvested unsustainably	Over-exploited	yes
Plaice in IIIa	Full reproductive capacity	At risk of being harvested unsustainably	Over-fished	yes
Sole in IIIa	Full reproductive capacity	Harvested sustainably	Over-fished	yes
<i>Nephrops</i> in Kattegat (FU 4)	exploited at sustainable levels.			no

4.5.3 Mixed fisheries analyses

SGRST considers the MTAC analysis problematic in the case of Kattegat for the following 2 reasons:

- 1) Plaice and sole are assessed for the IIIa (Skagerak + Kattegat) management area.
- 2) *Nephrops* is not analytically assessed.

The group concluded that an analysis of Kattegat by MTAC would be inappropriate due to the mismatch between the areas within the main target stocks are defined and assessed.

4.6 West of Scotland (ICES Division VIa)

4.6.1 Fleet overview and specific data

The demersal fisheries in the waters to the west of Scotland are dominated by otter trawl fisheries exploiting cod, haddock, whiting, saithe, *Nephrops*, anglerfish, megrim, hake and deepwater species.

The majority of the vessels in the demersal fishery are locally-based Scottish trawlers using 'light-trawls' (otter trawlers >27.4m, 90 feet), but trawlers from Ireland, Northern Ireland, England, France, and Germany also participate in this fishery. Scottish trawlers also take part in fisheries for *Nephrops* on inshore grounds, and in recent years Irish vessels have also been targeting *Nephrops*, mainly on offshore grounds.

A brief description of the catch composition for each of the regulated gears is provided for 2004, as compiled by SGRST. The sampling includes coverage of Scottish vessels. Of the regulated gears, only demersal trawls in the $\geq 100\text{mm}$ and 70-99mm gear categories are sampled regularly. It should be noted that for the main demersal species the procedures applied by the SGRST produce generally higher estimates of discards (% of catch by weight) for Division VIa than those reported by the ICES working group for the Northern Shelf Demersal Stocks (ICES, 2005a).

Beam trawl $\geq 80\text{mm}$

A small number of beam trawlers, including UK registered and Irish vessels, fish in shelf waters west of Scotland. Landings in 2004, comprising plaice, cod, haddock and saithe, were small relative to those reported for other gear categories (Tab. 4.6.1 and Fig. 4.6.1). No information on discards is available.

Demersal trawl $\geq 100\text{mm}$

Vessels in this category include otter trawlers fishing on the shelf to the west of Scotland for roundfish (cod, haddock and whiting) with bycatches of anglerfish, saithe and flatfish and otter trawlers which fish further offshore targeting mainly saithe, anglerfish and / or deep water species.

The catch of this gear category comprises predominantly haddock and saithe with whiting and cod being caught in lesser amounts (Tab. 4.6.1 and Fig. 4.6.1). Although relatively small amounts of cod are caught in this fishery, compared to other species, this gear category appears to account for the majority of the cod catch in Division VIa, discarding mainly at cod at age 1 (Fig. 4.6.2).

A Spanish Bottom Otter Trawl fleet operating in Subarea VI targets Blue Ling, Witch Hake and Anglerfish. Discard data is available and catch are composed of blue ling (23%), witch (20%) and Scorpion fishes (12%). The rest of the catch is made of anglerfish (11%), Great Fork beard (9%), Hake (8%), Megrim (7%) and Ling (4%). Around 20 commercial species are caught in this fishery.

Demersal trawl 16-31mm

No landings were reported in 2004 for this gear category.

Demersal trawl 70-99mm

This gear category includes Scottish trawlers fishing for *Nephrops* on inshore grounds and also Scottish and Irish trawlers targeting *Nephrops* further offshore at the Stanton Bank. Landings are predominantly *Nephrops* (discard data not available in appropriate format) but small quantities of haddock, whiting and cod are also caught (Tab. 4.6.1 and Fig. 4.6.1). The gear category appears to discard cod at age 1 in a similar magnitude as the demersal trawl $\geq 100\text{mm}$ (Fig. 4.6.2). Haddock and whiting are also discarded at young ages in high numbers but at a lesser extent compared to the demersal trawl $\geq 100\text{mm}$ (Fig. 4.6.3-4).

Demersal longline

A small demersal longline fishery is located offshore, probably associated with the shelf edge. Landings of the main demersal species for this gear are very low, less than 10 tonnes in total for cod, haddock and saithe combined (Tab. 4.6.1 and Fig. 4.6.1). No information on discards is available. A Spanish longline fishery also exists in this area, targeting hake (around 85% of landings), but also taking ling, blue ling, monkfish and congers.

Static gears

Gears in this category will include gillnets on the continental slopes to the west of Scotland and other fixed and trammel nets. Landings reported by species for this gear in 2004 comprised cod (<1 t) and anglerfish (ca. 40 t). No information on discards is available.

Other

This gear category 'other' represents landings for gears which are not effort regulated or landings which were reported to SGRST but not disaggregated according to regulated gear category. For west of Scotland most of the landings in the 'other' category fall into the later group. The catch composition, comprising a mixture of *Nephrops* and haddock is consistent with those of demersal trawlers in the ≥ 100 mm and the 70-99mm category (Tab. 4.6.1 and Fig. 4.6.1).

Conclusion

The fisheries on the West of Scotland are dominated by the 70-99 and ≥ 100 mm demersal trawler gear categories, targeting *Nephrops* and roundfish, respectively. Observed discard rates vary considerably, but data are not available for all fleets or fisheries.

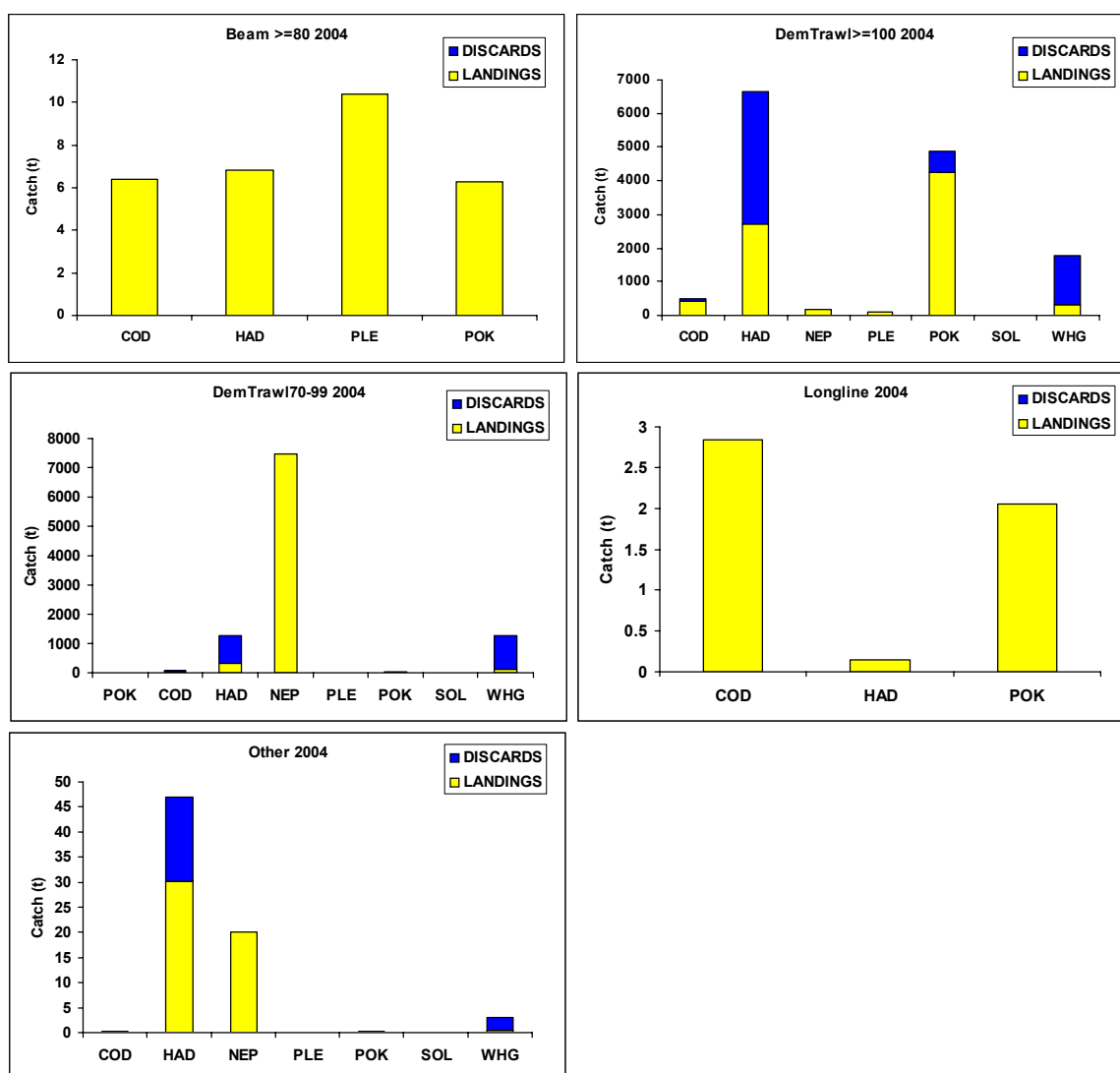


Fig. 4.6.1 Landings and discards West of Scotland by regulated gears and by species in 2004.

Tab. 4.6.1 Landings and discards (t) and discard rates West of Scotland by species and gears (no pelagic trawls) in 2003 and 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
COD	2004	Beam>=80	6		6		
COD	2004	DemTrawl>=100	417	57	474	0.12	0.1
COD	2004	DemTrawl70-99	53	32	86	0.38	0.06
COD	2004	Longline	3		3		
COD	2004	Other	0	0	0	0.1	0
COD	2004	Static	0		0		
SUM			480	90	570	0.16	0.16
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
HAD	2004	Beam>=80	7		7		
HAD	2004	DemTrawl>=100	2702	3964	6666	0.59	0.5
HAD	2004	DemTrawl16-31	1	0	1	0.34	0
HAD	2004	DemTrawl70-99	309	963	1272	0.76	0.12
HAD	2004	Longline	0		0		
HAD	2004	Other	30	17	47	0.36	0
SUM			3048	4944	7993	0.62	0.62
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
NEP	2004	DemTrawl>=100	184		184		
NEP	2004	DemTrawl70-99	7497		7497		
NEP	2004	Other	20		20		
SUM			7700		7700		
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
PLE	2004	Beam>=80	10		10		
PLE	2004	DemTrawl>=100	99		99		
PLE	2004	DemTrawl70-99	20		20		
PLE	2004	Other	0		0		
SUM			130	0	130		
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
POK	2003	Beam>=80					
POK	2003	DemTrawl>=100	3282	0	3282		
POK	2003	DemTrawl70-99	0	0	0		
POK	2003	Longline					
POK	2003	Other	21	0	21		
POK	2003	Static	15	0	15		
SUM			3318	0	3318		
POK	2004	Beam>=80	6	0	6		
POK	2004	DemTrawl>=100	4238	644	4883	0.13	0.13
POK	2004	DemTrawl70-99	17	29	46	0.63	0.01
POK	2004	Longline	2	0	2		
POK	2004	Other	0	0	0	0.33	0
POK	2004	Static					
SUM			4264	673	4937	0.14	0.14
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
SOL	2004	DemTrawl>=100	0		0		
SOL	2004	DemTrawl70-99	1		1		
SOL	2004	Other	0		0		
SUM			2	0	2		
SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
WHG	2004	DemTrawl>=100	330	1433	1763	0.81	0.47
WHG	2004	DemTrawl16-31	0	0	0	0.29	0
WHG	2004	DemTrawl70-99	110	1181	1291	0.92	0.39
WHG	2004	Other	1	3	3	0.83	0
SUM			440	2617	3058	0.86	0.86

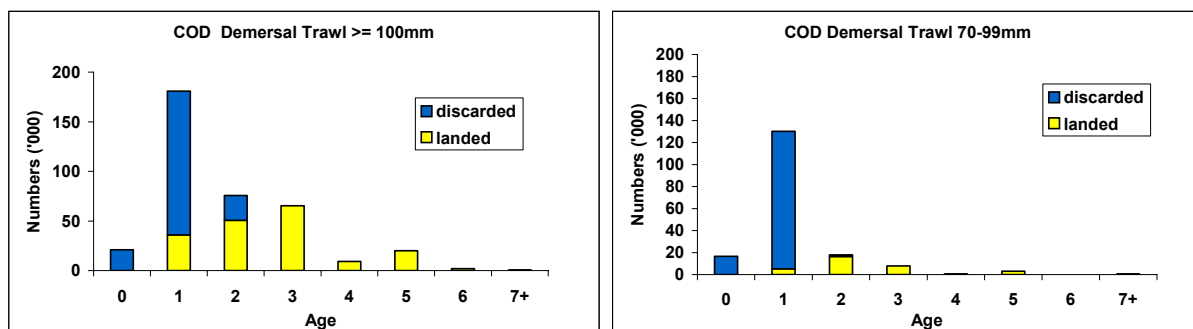


Fig. 4.6.2 West of Scotland. 2004 landings and discards at age for cod by the regulated gears demersal trawl \geq 100mm and 70-99mm and other gears.

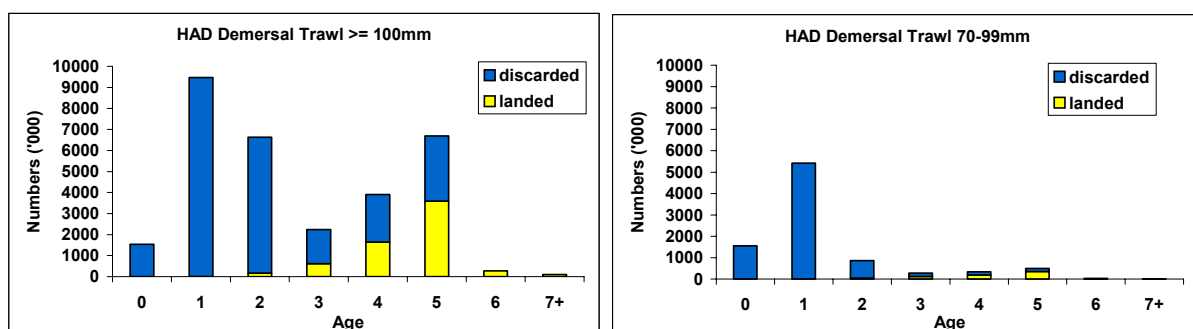


Fig. 4.6.3 West of Scotland. 2004 landings and discards at age for cod by the regulated gears demersal trawl \geq 100mm and 70-99mm and other gears.

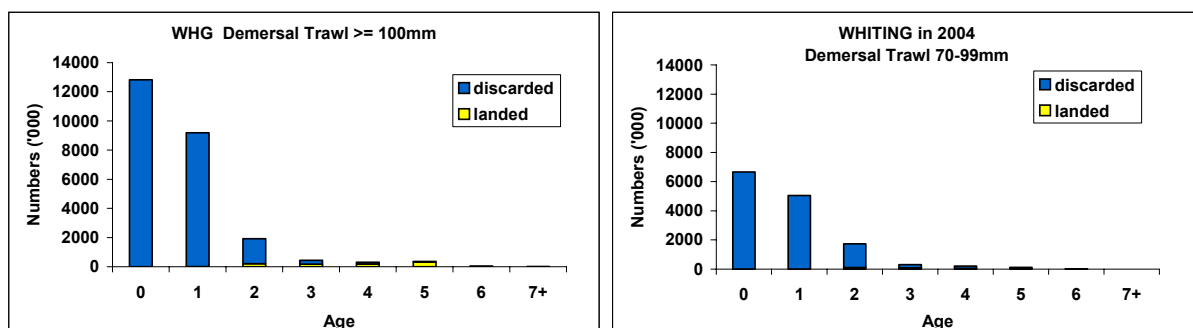


Fig. 4.6.4 West of Scotland. Landings and discards (D) at age for whiting by the regulated gears demersal trawl \geq 100mm, 16-31mm and 70-99mm and other gears.

4.6.2 Assessment data overview

The October 2005 ICES advice with regard to single-species exploitation boundaries for the principle demersal stocks in ICES Division VIa is summarised in the Table 4.6.2 below.

Table 4.6.2 State of the stocks and availability of analytical forecasts as estimated by ICES (2006b).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	Analytical forecast available
Cod Via	Reduced reproductive capacity	Unknown	Unknown	no
Haddock Via	Harvested sustainably	Overexploited	Not defined	yes
Whiting Via	Unknown	Unknown	Not defined	no
Nephrops in Division VIa	Unknown	Unknown	Unknown	no

4.6.3 Mixed fisheries analyses

ICES is not in a position to give quantitative forecasts for many of the above stocks, and it is therefore not appropriate to undertake mixed species analysis.

4.7 Irish Sea (ICES Division VIIa)

4.7.1 Fleet overview and specific data

No fleet specific catch data including discards were available.

Demersal stocks in the Irish Sea are fished mainly by fleets from Northern Ireland, England & Wales, Ireland and Belgium. Some vessels from Scotland fish in the northern Irish Sea whilst some French vessels fish in the southern Irish Sea. The main fleet sectors are the *Nephrops* fleets using 70-80mm single or twin otter trawls, whitefish trawlers using 100-120mm mesh otter and mid-water trawls and seine nets, and beam trawlers using 80mm mesh. Small landings are recorded for pair-trawlers and fixed gears such as gill nets, tangle nets and long-lines. A more detailed description is given in the ACFM report (ICES, 2006b), ICES (2005a) and also STECF (2003 and 2004).

Fisheries interactions in the Irish Sea have been described by ACFM (ICES, 2006b) as follows:

“Demersal fisheries in the area are mixed fisheries, with many stocks exploited together in various combinations in different fisheries. Four main fishery units can be described in the Irish Sea: these are *Nephrops* otter trawlers, roundfish otter trawlers, semi-pelagic trawlers, and beam trawlers.

Possibly the strongest mixed fishery interaction in the Irish Sea is between the *Nephrops* fishery and the whiting stock, although discard estimates for fleets targeting *Nephrops* are incomplete and are considered imprecise. The use of square mesh panels for vessels targeting *Nephrops* with 70-mm cod-end mesh have been obligatory since 1994. Despite this technical conservation measure the proportion of small whiting caught and discarded in this fishery has continued to increase. ICES points out that in addition to effort restrictions further technical measures (e.g. increased cod-end and square mesh panel mesh sizes, separator panels, and fixed grids) should be investigated and may substantially reduce bycatch and discarding of whiting in this *Nephrops* fishery. The measures implemented do not seem to have improved the selection pattern in the fishery or the overall status of the stock. This implies that a more radical re-design of *Nephrops* trawls or the introduction of other fishing technologies (e.g. pot fisheries) to reduce whiting bycatch to the lowest possible level is required.

The cod fishery was traditionally carried out by otter trawlers targeting spawning cod in spring and juvenile cod in autumn and winter. Activities of these vessels have decreased, whilst a fishery for cod and haddock using large pelagic trawls increased substantially during the 1990s. Cod are also taken as a bycatch in the *Nephrops*-directed fishery. Although discard estimates for cod in the Irish Sea are not available discard rates are not thought to be substantial. However, misreporting and under-reporting of cod is thought to occur in some VIIa fisheries. Estimates of mis-reporting for some nations are included in the assessment, but the scientific advice for zero catch of the cod stock requires that the practice be terminated.”

The extent to which the stocks are taken in the same fisheries cannot be quantified on basis of the available data. A table summarising the level of stock and fisheries interactions based on existing information is given in ICES (2006b). There is, however, no basis to quantify the interactions.

4.7.2 Assessment data overview

The October 2005 ICES advice with regard to single-species exploitation boundaries for the principle demersal stocks in ICES Division VIIa is summarised in the Table 4.7.1.

The stock status of Irish Sea demersal fish stocks (cod, haddock, whiting and sole) are relatively uncertain, except for plaice. ICES presented no analytical catch-based assessments for these stocks in 2005 that can form the basis for sufficiently precise forecasts, due to various attributing factors. The major deficiency for the cod, haddock and whiting assessments is poor quality of the input data due, in

part, to sampling problems due to a lack of access to ports for sampling in some years. Some discarding information is available for these stocks, which indicates that discarding is substantial for younger age-classes. Recent discard data are limited and discard estimates may be imprecise due to problematic estimation and raising procedures. Consequently, discards are not currently incorporated into the assessments. The reported catches are also considered too biased to form the basis of an analytical catch-based assessment (ICES 2005a). Whilst methods can be applied in order to estimate total unallocated catches there are no data available that can reliably describe the landings and discards disaggregated by regulated gear category.

There is also uncertainty in the stock estimates of sole due to substantial problems with the input data (anomalously low weights-at-age and exploitation pattern) in 2002 and 2003, which did not allow for an analytical assessment. The status of the *Nephrops* stocks in this Management Area is unknown. Previously advice for *Nephrops* has been based largely on historical landings but there are now concerns over the accuracy of official landings and effort statistics.

Table 4.7.1 State of the stocks and availability of analytical forecasts as estimated by ICES (2006b).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	Analytical forecast available
Cod VIIa	Reduced reproductive capacity	Harvested unsustainably	Overexploited	no
Haddock VIIa	Undefined	Unknown	Unknown	no
Nephrops FU 15 & FU 14 (Management area J)		Unknown		no
Whiting VIIa	Unknown, low SSB	Unknown	Unknown	no
Plaice VIIa	Full reproductive capacity	Harvested sustainably	Harvested sustainably	yes
Sole in VIIa	Unknown	Unknown	Unknown	no

4.7.3 Mixed fisheries analyses

Given that no single stock analytical catch-based assessments were presented for the majority of the Irish Sea stocks, the inability to reliably forecast catches, the lack of discard data and no well-defined fisheries, no analytical mixed fisheries forecasts were performed.

4.8 Porcupine Bank, Celtic Sea, Bay of Biscay (ICES Divisions VIIb, e, f, j, k, VIIIa, b, d)

4.8.1 Fleet overview and specific data

French landings for 2004 were provided by age and FU for hake.

Spanish catch data from 2004 were provided by age and fishery, as defined in Prellezo *et al.* (2005) for hake, anglerfish (both species), and megrim (*Lepidorhombus whiffiagonis*). Length distributions of Spanish catches (landings and discards) of *Nephrops* from Functional Unit 16 were also provided. Catch (landings and discards) composition is provided by Spain for hake, monkfish and megrim. Landings at age by fishing unit were made available by France for hake. Spanish catch and available French landings compositions are shown in Table 4.8.3 and Figure 4.8.1.

Total landings by fleet were available for the other countries involved in the fishery (Belgium, UK, Ireland).

As no data for all countries and species involved in the fisheries were available it was therefore decided that no MTAC analysis will be carried out. Discard data were only available for hake, megrim and both anglerfish, although in the hake and anglerfish assessment, these are not used. For the *Nephrops* Functional Unit 16 discards data were not available by age.

In the present Subgroup, no attempt to compile 2004 international landings data by traditional Fishing Units (FU) was tried as this exercise was already carried out during last year. 2003 data were

aggregated over traditional FUs and countries but no useful analysis was obtained from the MTAC (STECF 2004).

An attempt was also made to extend the number of species including the *Nephrops* Functional Units. Thus, in relation to *Nephrops* data, for the functional Units: FU16 (Porcupine Bank), FU 17 (Aran Ground), FU 18-19 (Ireland W) and FU 23-24 (Bay of Biscay), just the FU 23-24 was assessed during the last (ICES 2005b).

So, in relation to data compilation, problems identified were as listed below:

- No common definition of fisheries was agreed among countries
- No discards were included in the single stocks assessments
- Fleet-disaggregated landings at age data were not provided for all species by some of the major contributing fishing units
- Not all species were taken into account
- The species concerned have different management/assessment areas (Northern hake distribution includes Northern Shelf, while the Northern Stocks of megrim and anglerfish are properly delimited to the Porcupine bank, Celtic Sea and Bay of Biscay)
- Stock assessments were not accepted by ICES for some of the major species in the area (e.g. Celtic Sea cod and haddock)

The Group recommends the following amendments to the formats of the mixed fisheries data:

Appendix 2, Annex 3 Gear coding, the introduction of another category to be discussed:
Pair trawls operated with bottom high vertical opening nets.

Appendix 2, Annex 5 Area coding:
Divisions 8abd should be added together
Iberian Peninsula: 8c and 9a should be added

Appendix 2, Annex 6 Species coding, the following species to be included:
EG: *Lepidorhombus whiffiagonis*
LDB: *Lepidorhombus boscii*
MON: *Lophius piscatorius*
ANK: *Lophius budegassa*

The SGRST notes that the recommended changes are not yet included in the appendixes specifying the data collection for mixed fisheries analyses nor have they been considered in the data base itself. The management areas off the Iberian Peninsula and in the Bay of Biscay as well as the landings and discards of the listed species taken by the Spanish and Portuguese fleets are thus inconsistently grouped.

4.8.1.1 Introduction

No fleet specific catch data including discards were available.

The main demersal species (assessed and) exploited in the Southern Shelf area are hake, sole, cod, plaice, megrim, anglerfish and *Nephrops*. They are caught by a large variety of gears either as target species or as by-catch. This includes trawls (otter or beam trawl), gillnets and longline. Other demersal and pelagic species are also caught by those gears in this area. As many of them are not under the TACs and Quotas system or are not assessed, they will not be taken into consideration in the present study. However, some of these “other species” may represent for some fleets the bulk of their catches.

Historically, in relation to Hake, Anglerfish, Megrim and *Nephrops*, a set of several Fishery/Fishing Units (FU) was defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985 in order to study the interaction of the fishing activity related to these demersal species in Divisions VIIe-k and VIIla,b,d (ICES, 1991). The FUs then selected and defined are presented below in Table 4.8.1.

Tab. 4.8.1 Fishery/Fishing Units (FU) was defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985.

FU	Sea Area	Description	Countries
1	VII	Long line in medium to deep water	Spain UK(E+W)
2	VII	Long line in shallow water	France
3	VII	Gill net	Spain France UK(E+W)
4	VII	Non-Nephrops trawling in medium to deep water	Spain France UK(E+W) Ireland UK (Scot)
5	VII	Non-Nephrops trawling in shallow water	France UK(E+W) Ireland UK (Scot)
6	VII	Beam trawling in shallow water (B/T)	UK(E+W)
7+8	VII	Nephrops trawling in medium to deep water	France UK (Scot)
9	VIIIabd	Nephrops trawling in shallow to medium water	France
10	VIIIabd	Trawling in shallow to medium water	France
12	VIIIabd	Long line in deep and medium water	Spain France
13	VIIIabd	Gill nets in medium to shallow water	Spain France
14	VIIIabd	Trawling in deep and medium depth	Spain
15	VII + VIIIabd	Miscellaneous	France Ireland UK (Scot) Netherlands Belgium Others
16	IIIa IVab VIab VIIa-d	"Outsiders" Trawl, Long line, Gill net and Purse seine, all together	Spain France UK(E+W) Ireland UK (Scot) Netherlands Belgium Denmark Norway Sweden Germany Others
00		Unknown	France

As the fleets fishing in the more northern sea areas of distribution of the northern Hake (that is assessed as only one stock) were not considered by the 1985 ICES Working Group on Fisheries Units in Sub-areas VII and VIII, later a new FU was introduced for the case of the Northern Hake and was denominated "Outsiders" (FU 16). This new FU does not have a so precise definition as most of the other ones because it comprises four sea areas (Divisions IIIa, IVa,b, VIa,b and VIIa) and four main métiers (trawl, long line, gillnet and Danish purse seine).

During the Hake Technical Measures Meeting in October 2003 in Lisbon (STECF 2003b), in order to reflect a more recent description of the Spanish fleets, it was decided to revise the old FUs assignation, as it was found that for FUs 4 and 14 (trawlers in sub-area VII and VIII, respectively) was better to split them between Bottom Trawl and Pair Trawl components for both areas. During the period 1994-1999 very important changes have taken place in the relative composition of Spanish trawler fleets. Thus four different components have been included in the same Fishing Unit along the 80s and 90s: the "baka"-trawl, the "bou"-trawl (which disappeared in 2000, but was very important in the 70s, 80s and 90s), the new pairs-trawl (operating with "Naberan" nets) since 1993, and the experimental métier of boats operating with twin nets, implemented in 1999-2000, but disappeared in 2001 and appearing again in 2004.

Thus, new métier definitions for Spanish trawl fishery operating in the Porcupine Bank, Celtic Sea and Bay of Biscay were carried out and presented during the SGDF 2004 by institute (Castro and

Punzón, 2005). A jointly analysis and posterior catch profile comparisons was carried out between both institutes, IEO & AZTI, in order to reflect a more summarised description of the different fisheries (Prellezo *et al.*, 2005). Finally, taking into account passive gears, Spanish fleets are being segmented in 11 fisheries:

1. SP-LLS-VI: Long line VI
2. SP-OTB-VI: Bottom Otter Trawl VI targeting BLI-WIT-HKE-ANF
3. SP-LLS-VII: Long line VII
4. SP-GNS-VII Gillnet VII
5. SP-OTB-VII-HKE: Bottom Otter Trawl VII target HKE
6. SP-OTB-VII-MEG/ANF: Bottom Otter Trawl VII target MEG & ANF
7. SP-PTB-VII: Bottom Pair Trawl VII target HKE
8. SP-LLS-VIII: Long line VIIIabd
9. SP-GNS-VIII: Gillnet VIIIabd
10. SP-OTB-VIII-mixed: Baca trawl VIIIabd mixed
11. SP-PTB-VIII: VHVO Pair trawl VIIIabd target HKE

A proposal has also been made to further segment the traditional French fishing units in the Celtic Sea and the Bay of Biscay (ICES, 2004a), and this is presented in the Table 4.8.2 below.

4.8.2 Traditional French fishing units FU in the Celtic Sea and the Bay of Biscay (ICES, 2004a)

FU	Area	Gear	Target species
4	VII	Bottom trawl	Benthic
5	VII	Bottom trawl	Gadoids
5	VII	Bottom trawl	Other
8	VII	Bottom trawl	Nephrops
8	VII	Bottom trawl	Nephrops mixed
9	VIII	Bottom trawl	Nephrops
9	VIII	Bottom trawl	Nephrops mixed
10	VIII	Bottom trawl	Gadoids
10	VIII	Bottom trawl	Other
14	VIII	Bottom trawl	Benthic
16	V-VI	Bottom trawl	Benthic
16	V-VI	Bottom trawl	Other (Deep)
16	V-VI	Gill nets	Mixed
25	VII-VIII	Other trawls	Other
3	VII	Gill nets	Anglerfish
3	VII	Gill nets	Hake
3	VII	Gill nets	Sole
3	VII	Gill nets	Other
13	VIII	Gill nets	Anglerfish
13	VIII	Gill nets	Hake
13	VIII	Gill nets	Sole
13	VIII	Gill nets	Other

Most of the demersal fisheries in this area have a mixed catch. However, it is currently possible to associate specific target species with particular fleets and sea areas. Thus, various quantities of hake, anglerfish, megrim and *Nephrops* are taken together, depending on gear type and area where these operates. Some fleets have also a large part of valuable non-TAC species in their catch (squids, cuttlefish, red mullet, etc.). This is particularly the case for purely mixed fisheries deployed in the Bay of Biscay.

The main interactions between the stocks in the Porcupine Bank, Celtic Sea and Bay of Biscay are between:

- Hake, anglerfish and megrim in the otter trawl fishery in the Celtic Sea and the Bay of Biscay;
- Gadoids (cod, haddock, and whiting) within the trawl fishery for roundfish, mainly within Divisions VII,f,g;
- Nephrops and cod in the Celtic Sea, *Nephrops* and hake in the Porcupine Bank and the Bay of Biscay;
- Deep-water fish in the otter trawl fishery in the Celtic Sea;

- Sole and plaice in the beam trawl fishery in Divisions VII f,g and VI e, and sole and anglerfish in VIII a,b;
- Mixed species within undirected demersal trawl fisheries.

The directed fisheries for hake (pair trawl, longlines, and gillnets), anglerfish (gillnets) and Bay of Biscay sole (trammel nets) have few interactions with other stocks.

4.8.1.2 The mixed-species fisheries

Otter trawl fishery directed at hake, monkfish and megrim in the Celtic Sea and the Bay of Biscay

Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay, on the shelf edge around the 200-m contour to the south and west of Ireland and Bay of Biscay in the 1970s and expanded until 1990. This fishery used single and twin rig otter trawls in medium and deep water in Subarea VII and Div. VIII ab,d. By-catch species include hake, megrim and demersal elasmobranchs (*Leucoraja fullonica*, *L. circularis*, and *Dipturus spp.*). Although effort in most fleets appears to have declined since the early 1990s the increasing use of twin trawls may have increased the overall efficiency.

The Spanish otter-trawl fishery may be further fragmented into 2 components:

- Bottom Otter Trawl operating in Subarea VII targeting Hake (SP-OTB-VII-HKE). Catches of Hake deployed by single Otter trawlers operating in Subarea VII ranges, in the last 3 years 2002 to 2005, from 22 to 27 % of the total Hake Spanish catches. In general, Hake comprises close to 75 % of the catches of this fishery.
- Bottom Otter Trawl operating in Subarea VII targeting Megrim and Anglerfish (SP-OTB-VII-MEG/ANF). This fishery mostly directed to Megrim and Anglerfish is deployed in depths larger than Otter trawlers targeting Hake. Thus the first one is considered mostly as a more benthic fishery while the one targeting Hake is considered a demersal fishery.

Otter trawl fishery directed at gadoids in the Celtic Sea

Fisheries for demersal gadoids target mainly cod, whiting, haddock, and take by-catches of flatfish, rays and skates. These fisheries are mainly operated by French otter trawlers, which prior to 1980 were mainly fishing for hake in the Celtic Sea. The other countries contributing to that fishery are UK, Ireland, Spain, and Belgium. Cod is mainly landed by French gadoid trawlers. UK (England and Wales) accounts for about 10% and Ireland for 15%, while Belgian vessels take about 5%. In Ireland in recent years, cod has increasingly been targeted using gillnet, rather than trawl. Landings are made throughout the year, but mainly in the winter months during November to April. French trawlers contribute to about 60% of the whiting landings. Ireland takes about a third of the landings and the UK and Belgium each take under 10% of the landings. Irish demersal trawlers from south-west Ireland have traditionally targeted Celtic Sea whiting in a mixed trawl fishery. In response to poor catches in other areas vessels have been attracted into this fishery in recent years from other part of Ireland, County Donegal. French trawlers contribute to about 50-60% of the haddock landings. Ireland has usually taken about 25-40% of the landings. Irish demersal trawlers from Dunmore East and Castletownbere and other ports in south-west Ireland have traditionally targeted haddock in a mixed trawl fishery. In Divisions VII b and c the Irish fleet operates mainly from the ports of Rossaveal and the Aran Islands. Fleets from Belgium, Norway, the Netherlands, Spain, and the UK take the remainder of the haddock landings.

Otter trawl fishery directed at *Nephrops*

The *Nephrops* fishery developed in the 1970s and 1980s. Fishing effort has decreased continuously since the early 1990s. However, gear efficiency has increased in recent years and this may have helped maintaining LPUE at relatively high levels. In the Bay of Biscay, since 1st January 2000, the mesh size used when fishing for *Nephrops* has increased and is now similar to the one used for other demersal fish (70 mm). Management of these fisheries needs to be sensitive to bycatches of other stocks.

This fishery is mostly operated by French otter trawlers in the Celtic Sea and the Bay of Biscay. Twin trawls began to be used in the nineties for that fishery. In 2004, 70% of the vessels targeting *Nephrops* were equipped with twin trawls, resulting in a substantial increase of efficiency for that species. In the Celtic Sea, vessels targeting *Nephrops* catch a substantial amount of cod and whiting. In the Bay of Biscay *Nephrops* fishing results in by-catches of juvenile hake. Square-meshed panels have been introduced recently to improve the selectivity of the trawls.

Otter trawl fishery directed at deep-water species in the Celtic Sea

A deep-water fishery, mainly operated by French vessels, targets roundnose grenadier, with by-catches of black scabbard and deep-water squalids. Orange roughy is targeted by Irish vessels, but technical interactions with the other commercial deep-water species are estimated to be at low levels.

Undirected otter trawl fisheries

Some fisheries are not targeting particular assemblages of species. For example, some Spanish bottom otter trawlers operating in Division VIIIabd target a variety of species (SP-OTB-VIII-mixed) including hake, anglerfish, megrim, but also flatfish, squids, elasmobranchs. The single trawling in deep and medium depth of the Bay of Biscay shelf, that traditionally represented the first position of the Hake landings in this area, have presented very important changes. In 1990's, it accounted close to 25% of the Spanish landings of Northern hake, however hake has comprised around 2 % in 2004.

Beam trawl fishery directed at flatfish

The targeting of sole and plaice in the Celtic Sea using beam trawls became prevalent during the mid-1970s, leading to an increase in the landings of these two species. More recently, cuttlefish have become an important component of beam trawl landings, particularly during the winter months. The gradual replacement of otter trawls by beam trawls has occurred in the Belgian and UK fleets. In the Bay of Biscay there has been a substantial replacement of inshore trawling by gillnet fisheries targeting sole since the 1980s.

In the Western Channel, UK vessels have in recent years accounted for around 70% of the total international landings, with France taking approximately a quarter and Belgian vessels the remainder. Sole is the target species of an offshore beam-trawl fleet, which is concentrated off the south Devon & Cornish coasts, and also catches plaice and anglerfish. In recent years a winter beam trawl fishery targeting cuttlefish has developed in the Western Channel.

The beam-trawl fishery in VIII,g involves vessels from Belgium, taking approx. 3/4, the UK taking approx. 1/4, and France and Ireland taking minimal amounts of the total landings. Sole are mainly targeted by beam trawlers and the fishery is concentrated on the north Cornish coast off Trevose Head and around Lands End.

The beam trawl fishery in the Bay of Biscay is mainly operated by Belgian vessels from June to August. However a noticeable Dutch contribution occurred in 2001.

4.8.1.3 Fisheries with limited technical interactions

Pair trawl fishery directed at hake

This fishery is operated by Spanish vessels. This fishery may be further fragmented into 2 components:

- Bottom Pair Trawl with Very High Vertical Opening nets (VHVO) operating in Subarea VII targeting Hake (SP-PTB-VII). VHVO Bottom pair trawl in Subarea VII is a clean fishery which landing profiles shows more than 90% of hake. This fleet catch landed around 22% of the Spanish landings of Northern hake in 2004.
- Bottom Pair Trawl with VHVO nets operating in Division VIIIabd targeting Hake (SP-PTB-VIII). Pair trawling towing Very High Vertical Opening Bottom nets in deep and medium depth

continues representing the first position of the Hake landings in the Bay of Biscay. In 2004, landings deployed by this fishery were around 20% of the total Spanish landings. Catch composition of this fishery is mostly composed by Hake in more than 80%.

Gill net fishery directed at hake

Gill-nets have traditionally been one of the main gears used to target hake in the Celtic Sea and the Bay of Biscay, along with otter trawls and long-lines. This fishery is mainly operated by French and Spanish vessels. The Spanish fishery is segmented into two components:

- Gillnet operating in Sub area VII (SP-GNS-VII). The gill net fishery for Northern Hake in Celtic Sea appears to be, together with gillnet in Bay of Biscay, the fishery that experimented recently a larger decrease in the proportional landings from all the Spanish Northern hake landings since 1999. In 2004 Gillnets operating in Subarea VII comprised just the 6% of the total hake Spanish landings. Landing composition of this fishery is mostly composed by Hake and in much more smaller amounts anglerfish and megrim.
- Gillnet operating in Division VIIIabd (SP-GNS-VIII). This gill net fishery occupied in 1999 the second position of the Hake landings in the Bay of Biscay. This fishery has remained relatively stable during the last ten years, accounting for around 10% of the Spanish landings of Northern hake.

Gill net fishery directed at anglerfish

A gillnet fishery targeting anglerfish developed in the Celtic Sea on the shelf edge around the 200-m contour to the south and west of Ireland in the 1990s. There has been an expansion of the French gillnet fishery in the last decade in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels based in Spain and fishing in medium to deep waters.

Gill net fishery directed at sole

This fishery is operated by French vessels using trammel nets in the Bay of Biscay, and it has contributed to the majority of the total official international landings of Bay of Biscay sole in the last ten years. A part of the boats operate in coastal areas, being generally less than 12 m long and using often several gears. The boat length of the offshore fleet is mainly between 12 and 25 m. Although sole is taken throughout the year, the catch of coastal boats is less important in autumn and winter, while those of offshore boats are highest in the first quarter. Sole is a major resource for all these boats, given the price of this species on the market. Gill-netters were a minor component of the French fleet operating in the Bay of Biscay up to the middle of the 80's. However, the proportion of gill-netters increased steadily from 25% in 1985-88 to more than 75% in recent years.

Longline fishery directed at hake

Longlines have traditionally been one of the main gears used to target hake in the Celtic Sea and the Bay of Biscay, along with otter trawls and gill nets. This fishery is mainly operated by Spanish vessels. The Spanish fishery is segmented into three components:

- Long line operating in Sub area VI (SP-LLS-VI): Although the sea area where this fishery operates is out of this report section, the fishery is here included because hake, the main species exploited, stock range goes from Subarea III to the Bay of Biscay (Div. VIIIabd). The landing composition of Spanish longliners operating in Subarea VI is composed mostly by Hake (around 85%) the rest of the catch is made up of ling, blue ling, monkfish, congers...
- Long line operating in Sub area VII (SP-LLS-VII). The long line in medium to deep water fishery consist on an almost monospecific one directed to hake. This fishery represented the first position of total Northern hake landings in 1994, but its importance has gradually decreased comprising around 30% of the total hake Spanish landings in 2004. Spain continues to be the only country mainly involved in it.
- Long line operating in Division VIIIabd (SP-LLS-VIII). The long line fishery in deep to medium water that had in the 80s and beginning of the 90s a relatively high importance of the hake

fisheries in the Bay of Biscay, has decreased markedly since 1994. In 2005 3% of the Northern hake Spanish catches were landed by this fishery.

Table 4.8.3 Spanish landings and discards (t) and discard rates in the Porcupine Bank, Celtic Sea and Bay of Biscay by species and gears in 2004.

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE	EDISC RATE BY TOTAL SPN. CATCH
HKE		2004 SP-LLS-6	184.068		184.068		
HKE		2004 SP-OTB 6	305.815		305.815		
HKE		2004 SP-LLS-7	8548.062		8548.062		
HKE		2004 SP-GNS-7	1665.275		1665.275		
HKE		2004 SP-OTB-hke-	5401.34647	37.535	5438.882	0.01	0.00
HKE		2004 SP-OTB-meg	1735.86711	1020.628	2756.495	0.37	0.03
HKE		2004 SP-PTB-7	807.786426		807.786		
HKE		2004 SP-LLS-8	774.674		774.674		
HKE		2004 SP-GNS-8	3068.151		3068.151		
HKE		2004 SP-OTB-8	703.794	14.515	718.309	0.02	0.00
HKE		2004 SP-PTB-8	5845.011	27.980	5872.991	0.005	0.001
HKE		2004 FR-FU02	4767.100		4767.100		
HKE		2004 FR-FU03	2287134.100		2287134.100		
HKE		2004 FR-FU04	1090045.600		1090045.600		
HKE		2004 FR-FU05	2043538.800		2043538.800		
HKE		2004 FR-FU08	750008.700		750008.700		
HKE		2004 FR-FU09	5071871.500		5071871.500		
HKE		2004 FR-FU10	2319726.200		2319726.200		
HKE		2004 FR-FU12	50318.800		50318.800		
HKE		2004 FR-FU13	3402709.800		3402709.800		
HKE		2004 FR-FU16	537978.000		537978.000		
HKE		2004 FR-FU00	377278.300		377278.300		
sum			29039.850	1100.658	30140.508		

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE	EDISC RATE BY TOTAL SPN. CATCH
MEG		2004 SP-LLS-6					
MEG		2004 SP-OTB 6					
MEG		2004 SP-LLS-7					
MEG		2004 SP-GNS-7					
MEG		2004 SP-OTB-hke-	50.140	26.527	76.666	0.35	0.00
MEG		2004 SP-OTB-meg	7260.977	4518.225	11779.202	0.38	0.15
MEG		2004 SP-PTB-7					
MEG		2004 SP-LLS-8					
MEG		2004 SP-GNS-8					
MEG		2004 SP-OTB-8	136.670		136.670		
MEG		2004 SP-PTB-8					
sum			7447.787	4544.752	11992.538		

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE	EDISC RATE BY TOTAL SPN. CATCH
MON		2004 SP-LLS-6					
MON		2004 SP-OTB 6					
MON		2004 SP-LLS-7					
MON		2004 SP-GNS-7					
MON		2004 SP-OTB-hke-	1164.704	4.526	1169.230	0.004	0.000
MON		2004 SP-OTB-meg	2281.813	350.227	2632.040	0.13	0.01
MON		2004 SP-PTB-7					
MON		2004 SP-LLS-8					
MON		2004 SP-GNS-8					
MON		2004 SP-OTB-8	698.462	1.741	700.203	0.002	0.000
MON		2004 SP-PTB-8					
sum			4144.979	356.494	4501.473		

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE	EDISC RATE BY TOTAL SPN. CATCH
ANK		2004 SP-LLS-6					
ANK		2004 SP-OTB 6					
ANK		2004 SP-LLS-7					
ANK		2004 SP-GNS-7					
ANK		2004 SP-OTB-hke-	70.432		70.432		
ANK		2004 SP-OTB-meg	1242.078	205.175	1447.253	0.14	0.01
ANK		2004 SP-PTB-7					
ANK		2004 SP-LLS-8					
ANK		2004 SP-GNS-8					
ANK		2004 SP-OTB-8	470.692		470.692		
ANK		2004 SP-PTB-8					
sum			1783.202	205.175	1988.377		

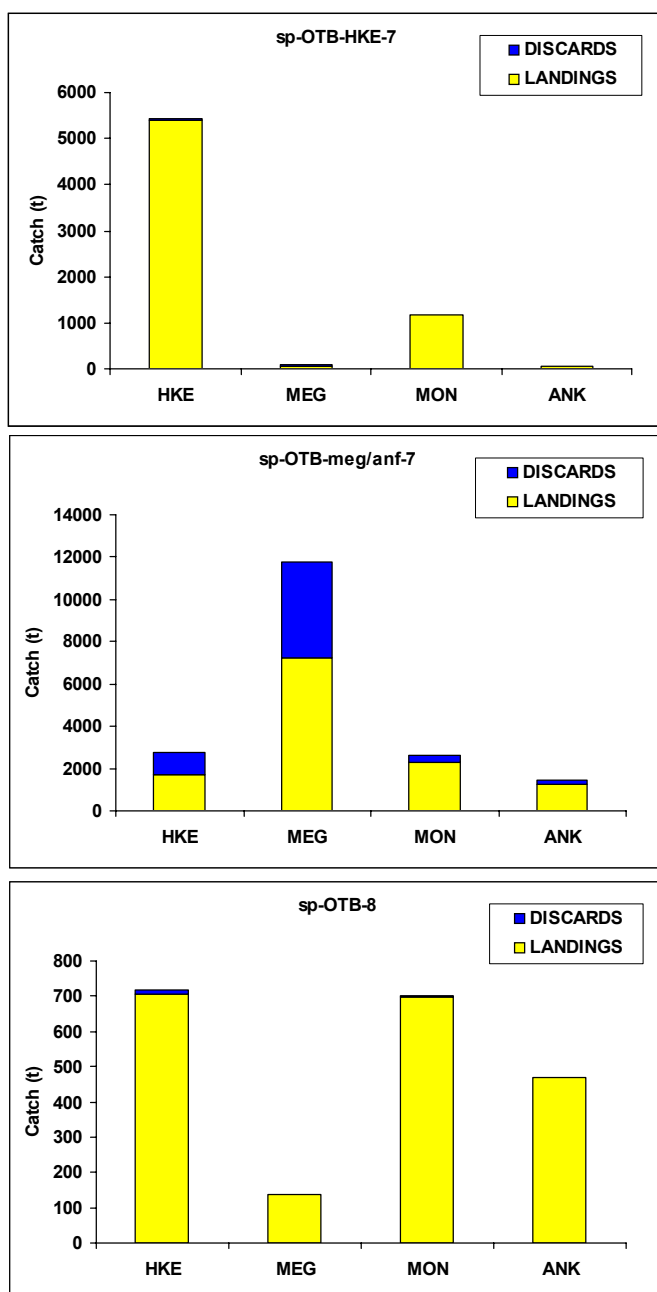


Fig. 4.8.1 Spanish landings and discards by trawling gears and by species in the Porcupine Bank, Celtic Sea and Bay of Biscay in 2004. No static gears are presented as catch composition is mostly hake.

4.8.2 Assessment data overview

State of the main demersal target species and the availability of short term forecasts are listed in Table 4.8.4.

Table 4.8.4 State of the stocks and availability of analytical forecasts as estimated by ICES (2006a).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	Analytical forecast available
Anglerfish in VIIb-k and VIIIa,b (<i>L. piscatorius</i> and <i>L. budegassa</i>)	Full reproductive capacity	Increased risk (<i>L. piscatorius</i>) Harvested sustainably (<i>L. budegassa</i>)	Overexploited	yes
Cod in VIIe-k	Unknown	Unknown	Unknown	No
Haddock in VIIb-k	Unknown	Unknown	Unknown	No
Hake - Northern stock (IIIa, Subareas IV, VI and VII, and VIIIa, b, d)	Increased risk	Harvested sustainable	Overexploited	yes
Megrim in VIIb,c,e-k and VIIIa,b,d (<i>L. whiffiagonis</i> and <i>L. boscii</i>)	Full reproductive capacity	Increased risk	Overexploited	yes
Nephrops in VIIb,c,j,k (Management Area L)	Unknown	Unknown	Unknown	No
Nephrops in VIIf,g,h, FU20-22 (Management Area M)	Unknown	Unknown	Unknown	No
Nephrops in VIIIa,b (Management Area N)	Reference points not defined	Reference points not defined	Unknown	No
Plaice in the Celtic Sea (VIIf and g)	Increased risk	Unknown	Overexploited	yes
Plaice in VIIe (Western Channel)	Increased risk	Increased risk	Overexploited	No
Plaice Southwest of Ireland (VIIh-k)	Unknown	Unknown	Unknown	No
Plaice West of Ireland (VIIb,c)	Unknown	Unknown	Unknown	No
Sole in the Celtic Sea (VIIf and g)	Full reproductive capacity	Harvested unsustainably	Overexploited	yes
Sole in VIIe (Western Channel)	Increased risk	Harvested unsustainably	Overexploited	yes
Sole in VIIIa,b (Bay of Biscay)	Increased risk	Increased risk	Overexploited	yes
Sole Southwest of Ireland (VIIh-k)	Unknown	Unknown	Unknown	No
Sole West of Ireland (VIIb,c)	Unknown	Unknown	Unknown	No
Whiting in VIIe-k	Full reproductive capacity	Unknown	Overexploited	yes

4.8.3 Mixed fisheries analyses

Given the concerns expressed in section 4.8.1 on data availability, no attempt was made this year to run an MTAC analysis for this area. However, the Group considered that progress has been made in the process of integrating the definition of fisheries in the Celtic Sea, the Porcupine Bank and the Bay of Biscay. The Group suggests that fleets and fisheries definitions be consolidated by the ad hoc Group of EU experts that will meet in January 2005 to discuss fleets and fisheries segmentation in the context of the forthcoming DCR programme.

4.9. Iberian Peninsula (ICES Divisions VIIIc-IX) Jose

The Atlantic Iberian Peninsula waters (ICES Divisions VIIIc and IXa) include the Portuguese and the Atlantic Spanish coasts. The fleets operating in that area are composed by large number of small vessels using a variety of gears and targeting a variety of species, doing specially complicated to get a suitable fleet segmentation. Moreover, both the artisanal and the trawl fleet have greatly changed during last years, making specially needed a review of the fleet components. A research project has been recently aproved by the European Commission DGFISH for supporting the extra effort needed to get over those difficulties, with the participation of the three laboratories covering the area: AZTI, IEO, and IPIMAR. Unfortunately, only some preliminary results regarding fleet segmentation have been obtained, and they are not still enough for permitting a data compilation disaggregated by métiers, which would permit to calculate a mixed-fisheries forecast.

4.9.1 Fleet overview and specific data

The traditional fleets operating in the Atlantic Iberian Peninsula waters have been widely described in previous “STECF: Mixed Fisheries” reports (STECF, 2002; STECF, 2004). In relation to new segmentations some improvements have been made by both countries involved, Spain and Portugal.

Spain

Preliminary results were obtained classifying the Spanish bottom trawl fleet operating in the ICES Divisions VIIIc (Cantabrian Sea and Northern Galician waters) and IXa-North (Southern Galician waters) by using multivariate analysis (Punzón *et al.*, 2001; Bellido *et al.*, 2003). A more recent analysis of individual trips based on the species composition of landings was made separately for the bottom otter trawl (OTB) and the bottom pair trawl (PTB) fleets, obtaining five and two catch profiles from each one, respectively (Castro and Punzón, 2005):

- OTB-jax (bottom otter trawl targeting horse mackerel)
- OTB-mac (bottom otter trawl targeting mackerel)
- OTB-whb (bottom otter trawl targeting blue whiting)
- OTB-hmmn (bottom otter trawl targeting hake, megrim, monk and *Nephrops*)
- OTB-mixed (bottom otter trawl targeting a variety of species)
- PTB-whb (bottom pair trawl targeting blue whiting)
- PTB-hke (bottom pair trawl targeting hake)

These results show that most of the bottom otter and pair trawl métiers are surprisingly targeting pelagic species. Further investigations are needed to establish a definitive number of trawl fleet components and to put into practice similar analysis with the artisanal fleet.

Similar multivariate analysis were carried out for the trawl and artisanal Spanish fleet operating in the Gulf of Cadiz (ICES Division IXa-South) (Silva *et al.*, 2002; Jiménez *et al.*, 2004). However, the high number of métiers obtained is still being a difficulty to decide a suitable and workable number of groups for effective sampling.

Portugal

A multivariate analysis of the coastal Portuguese bottom trawl fleet was carried out using the 2002-2004 monthly landings per vessel, i.e. fishing trips (Campos *et al.*, 2005). A correspondence between some of the “fishing trip types” obtained, each defined by the relative importance of their target and by-catch species, and fleet components could be established. These patterns indicate the existence of groups of trawlers developing the same fishing pattern over time:

Trawlers for invertebrates:

- Crustacean trawlers (targeting *Nephrops* and/or rose shrimp).
- Cephalopods trawlers (targeting *Octopus*).

Fish trawlers:

- targeting small pelagic species (horse mackerel, mackerel and blue whiting).
- targeting a combination of *Octopus* with demersal fish species (hake).

Due to the preliminary stage of the analyses described above, a suitable compilation of catch data segmented by métier was not carried out.

4.9.2 Assessment data overview

State of the main demersal target species and the availability of short term forecasts are listed in Table 4.9.1.

Table 4.9.1 State of the stocks and availability of analytical forecasts as estimated by ICES (2006b).

Stock	Spawning biomass in relation to precautionary limits	Fishing mortality in relation to precautionary limits	Fishing mortality in relation to target reference points	Analytical forecast available
Southern stock of hake (VIIIc and IXa)	Reduced reproductive capacity	Harvested unsustainably	Overexploited	yes
Megrim (<i>L. boscii</i> and <i>L. whiffiagonis</i>) in VIIIc and IXa	Not defined	Not defined	Appropriate (<i>L. boscii</i>), Appropriate (<i>L. whiffiagonis</i>)	yes
Anglerfish (<i>L. piscatorius</i> and <i>L. budegassa</i>) in VIIIc and IXa	Not defined	Not defined	Overexploited	yes
<i>Nephrops</i> in VIIIc North Galicia (FU25) (Management Area O)	Reference Points not defined	Reference Points not defined	Unknown	yes
<i>Nephrops</i> in VIIIc Cantabrian Sea (FU31) (Management Area O)	Reference Points not defined	Reference Points not defined	Unknown	no
<i>Nephrops</i> in IXa Galician West and North of Portugal (FU26-27) (Management Area Q)	Reference points not defined	Reference points not defined	Cannot be defined	no
<i>Nephrops</i> in IXa - SW and South of Portugal (FU28-29) (Management Area Q)	Reference points not defined	Reference points not defined	Cannot be defined	yes
<i>Nephrops</i> in IXa - Cadiz (FU 30) - (Management Area Q)	Reference points not defined	Reference points not defined	Cannot be defined	no

4.9.3 Mixed fisheries analyses

During the 2004 STECF Mixed Fisheries meeting (STECF 2004), a MTAC for the Atlantic Iberian Peninsula stocks was carried out using the traditional fleet segmentation. However, the traditional segmentation does not represent the reality of the fishery and so it was recommended not to use these preliminary results for advice purposes. Some advances have been made regarding new definitions. However, the second step, the compilation of the data under that new segmentation, needs further investigations. Thus, the possible consequences in the respective National Sampling Programmes would need to be analyzed. As a result of this lack of appropriate data, a reliable mixed fisheries forecast for this management area remained impossible.

5 References

- Council Regulation (EC) No 850/98, Official Journal of the European Communities
- Bellido, J.M.; N. Pérez; J. Castro; and H. Araujo 2003. Some insights on a possible métiers definition of the North coast Spanish demersal fishery by using total catch data. WD 4 presented to ICES (2004b)
- Campos, A.; P. Fonseca; T. Fonseca; J. Parente 2005 Definition of fishing trip types in the bottom trawl fisheries off the Portuguese coast. ICES CM 2005/ L:28
- Castro, J. and A. Punzón 2005. Pelagic métiers of the Northern Spanish coastal bottom trawl fleet. WD to ICES (2005b).
- Darby, C. D. 2004. Estimating systematic bias in the North Sea cod landings data. ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak, 7 – 16 September 2004 (ICES 2004b)
- ICES 1991. Report of the ICES Working Group on Fisheries Units in Sub-areas VII and VIII. ICES CM, 1991/Assess:24
- ICES 2004b. Report of the Working Group on the Assessment of Southern Stocks of Hake, Monkfish, and Megrim. Gijón, Spain. May 2004.
- ICES 2004a. Report of the Study Group on the Development of Fishery-based Forecasts. ICES CM2004/ACFM:11, Ref. D, 37 pp.
- ICES 2004b. Report on the Assessment of Demersal Stocks in the North Sea and Skagerrak. ICES CM 2005/ACFM:07, 820 pp.
- ICES 2006b. Report of the ICES Advisory Committee on Fishery Management and Advisory Committee on Ecosystems, 2005. ICES Advice, in press
- ICES 2005a. Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks. ICES CM 2005/ACFM:01, 722 pp.
- ICES 2005b. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim. ICES CM 2005/ACFM:02.
- ICES 2006a. Report on the Assessment of Demersal Stocks in the North Sea and Skagerrak. ICES CM 2006/ACFM, in press
- Jiménez, M.P., Sobrino, I. and Ramos, F., 2004. Objective methods for defining mixed-species trawl fisheries in Spanish waters of the Gulf of Cadiz. Fish. Res. 67: 195-206.
- Prellezo, R., I. Lazkano, J. Castro, A. Punzón, M. Santurtún, A. Iriondo and P. Lucio 2005. The use of catch profiles for defining the Spanish North Eastern Atlantic trawl fisheries. WD 5 (ICES, 2005b).
- Punzón, A., G. Costas, R. Gancedo and R. Morlán 2001. Segmentation of the mixed baca trawl fishery that exploits demersal resources in the Cantábrico (ICES Division VIIIc). ICES CM 2001/Q:19.
- Rätz, H.-J., S. Ehrich and E. Bethke 2005. Mixed fisheries in the North Sea and their effects on demersal fish stocks. Inf. Fischwirtschaft, Hamburg, in press
- Silva, L.; Gil, J.; and Sobrino, I. 2002. Definition of fleet components in the Spanish artisanal fishery of the Gulf of Cadiz (SW Spain ICES Division IXa). Fish. Res. 59: 117-128.
- STECF 2002 Report of the STECF/SGRST: Mixed Fisheries. SEC(2002) 1373.
- STECF 2003a Report of the STECF/SGRST: Mixed Fisheries. SEC(2003) 1428
- STECF 2004 Report of the STECF/SGRST: Mixed Fisheries. SEC(2004) 1711.
- STECF 2003b. STECF Technical Report on Hake Technical Measures Meeting. October 2003, Lisbon (Portugal).
- Stratoudakis, Y., Fryer, R.J., Cook, R.M. and Pierce, G.J. 1999. Fish discarded from Scottish demersal vessels: estimators of total discards and annual estimates for targeted gadoids. ICES Journal of Marine Science, 56, 592-605
- Vinther, M., St. A. Reeves and K. R. Patterson 2004. From single-species advice to mixed-species management: taking the next step. ICES Journal of Marine Science, 61: 1398-1409

Appendix 1 List of participants and addresses.

STECF members

Name	Institute, Address	Tel. and Fax	email
Hans-Joachim Rätz Chairman	Federal Research Centre for Fisheries, Institute for Sea Fisheries, Palmaille, 9, 22767 Hamburg, Germany	Tel: +49-40-38905 169 Fax: +49-40-38905 263	hans-joachim.raetz@ish.bfa-fisch.de
Willy Vanhee	CLO-Sea Fisheries, Department Ankerstraat, 1 8400 Oostende, Belgium	Tel: +32-59-34-22-55 Fax: +32-59-33-06-29	willy.vanhee@dvz.be

Invited experts

Name	Institute, Address	Tel. and Fax	email
Ewen Bell	CEFAS Lowestoft Laboratory, Pakefield Road, Lowestoft, Suffolk, NR33 OHT, United Kingdom	Tel. 01502 524238	e.d.bell@cefass.co.uk
Jose Castro	Instituto Español de Oceanografía, Centro Oceanográfico de Vigo, Cabo Estai-Canido, Apdo 1552, 36200 Vigo, Spain	Tel: +34-986-492111 Fax: +34-986-492351	jose.castro@vi.ieo.es
Sarah Kraak	RIVO, Netherlands Institute for Fisheries Research, Haringkade 1, P.O.Box 68, NL-1970 AB IJmuiden, The Netherlands	Tel: +31-255-56-46-46	sarah.kraak@wur.nl
Marchal Paul	IFREMER, 150 Quai Gambetta, BP699, 62321 Boulogne sur Mer, France	Tel: +33-32-19-95-616 Fax: +33-321-99-56-01	paul.marchal@ifremer.fr
Maria Santurtun	Fundación AZTI, Txatxarramendi Irla s-n, 48395 Sukarrieta, Spain	Tel: +34-94-602-9400 Fax: +34-94-687-0006	msanturtun@suk.azti.es
Pieter-Jan Schön	DARDNI, AFESD Aquatic Sciences, Newforge Lane, BT9 5PX, Belfast, United Kingdom	Tel: +44-28-90255015 Fax: +44-28-90255004	pieter-jan.schon@dardni.gov.uk
Per Sparre	DIFRES, Danmarks Fiskeri undersogelser, Charlottenlund Slot, 2920 Charlottenlund, Denmark	Tel: +45-33-96-33-53 Fax: +45-33-96-33-33	pjs@dfu.min.dk
Ian Tuck	The Marine Laboratory, 375 Victoria Road Torry, Aberdeen, AB11 9DB, Scotland	Tel: +44-0-12-24-87-65-44 Fax: +44-0-12-24-29-55-11	Tucki@marlab.ac.uk

European Commission

Name	Institute, Address	Tel. and Fax	email
Hendrik Doerner	European Commission, Joint Research Centre, TP 266, 21020 Ispra (VA), Italy	Tel: +39-0332-789343 Fax: +39-0332-789658	hendrik.doerner@jrc.it
Althoff Wiking	European Commission, Joint Research Centre, TP 266, 21020 Ispra (VA), Italy	Tel: +339-0332-785995 Fax: +339-0332-789658	wiking.althoff@jrc.it

Appendix 2 Exchange data formats

Mandatory Catch data for 2003 and 2004 aggregated (sum) by ID except for mean weight and mean length in landings and discards at age under the data section

Catch data include total catch weight for a fishery and an optional catch at age matrix. Information is organised in a header section giving the fishery description, total catch weight and sampling specific data. The header section is followed by a data section giving catch at age information, if available.

Header information:

1. ID (this is a unique identifier; e.g. the combination of country, year, quarter, gear, mesh size range, fishery or métier, and area; this is free text with a maximum of 40 characters without space)
2. COUNTRY (this should be given according to the code list provided in Annex 2)
3. YEAR (this should be given in four digits)
4. QUARTER (this should be given as one digit)
5. GEAR (gear should be given according to the code list provided in Annex 3, which follows the EU data regulation 1639/2001)
6. MESH_SIZE_RANGE (the mesh size range should be given according to the code list provided in Annex 4, which follows the Council regulation 850/98)
7. FISHERY (species complex and gear) or métier (species complex, gear and vessel characteristics) (this is free text with a maximum of 40 characters without space; this specification may include e.g. target species, roundfish area or quarter) (a fishery can encompass, e.g. more than one mesh size range; in this case separate records have to be provided, e.g. one for each mesh size range, with the same fishery identification)
8. AREA (the ICES division or sub-area should be given according to the code list provided in Annex 5)
9. SPECIES (the species should be given according to the code list provided in Annex 6, which follows the Council Regulation EC 2287/2003)
10. LANDINGS (estimated landings in tonnes should be given; if age based information is present, this quantity should correspond to the sum of products)
11. DISCARDS (estimated discards in tonnes should be given; if age based information is present, this quantity should correspond to the sum of products)
12. NO_SAMPLES_LANDINGS (the number of samples should be given that relate to landings only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
13. NO_LENGTH_MEASUREMENTS_LANDINGS (the number of length measurements should be given that relate to landings only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
14. NO_AGE_MEASUREMENTS_LANDINGS (the number of age measurements should be given that relate to landings only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
15. NO_SAMPLES_DISCARDS (the number of samples should be given that relate to discards only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
16. NO_LENGTH_MEASUREMENTS_DISCARDS (the number of length measurements should be given that relate to discards only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
17. NO_AGE_MEASUREMENTS_DISCARDS (the number of age measurements should be given that relate to discards only; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
18. NO_SAMPLES_CATCH (a number of samples should be given here if it relates to catch, i.e. landings and discards; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
19. NO_LENGTH_MEASUREMENTS_CATCH (a number of length measurements should be given here if it relates to catch, i.e. landings and discards; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
20. NO_AGE_MEASUREMENTS_CATCH (a number of age measurements should be given here if it relates to catch, i.e. landings and discards; a number should be given only if it relates to this fishery only; otherwise “-1” should be given)
21. MIN_AGE (this is the minimum age in the data section; if minimum age and maximum age are both “-1”, no age based data are given; otherwise age data must follow in the data section for each age in the age range MIN_AGE to MAX_AGE; minimum age and maximum age must either both be “-1” or both be not “-1”)

22. MAX_AGE (this is the true maximum age in the data section (no plus group is allowed); if minimum age and maximum age are both “-1”, no age based data are given; otherwise age data must follow in the data section for each age in the age range MIN_AGE to MAX_AGE; minimum age and maximum age must either both be “-1” or both be not “-1”)
23. Age, No. landed, Wt. landed, Len. landed, No. discard, Wt. discard, Len. discard (this is just a header line; if minimum age and maximum age are both “-1”, this line must be present and is the last line in the record)

Data section:

Age is a number within the range MIN_AGE to MAX_AGE. No. landed (numbers landed) and No. discard (number discarded) must be given in thousands. Wt. landed (mean weight of landed fish) and Wt. discard (mean weight of discarded fish) must be given in kg. Len. landed (mean length of landed fish) and Len. discard (mean length of discarded fish) must be given in cm; missing values should be given by “-1”; if numbers at age are given, both mean weight at age and mean length at age must be given as well; age based data must be given for all ages consecutively from the minimum age to the maximum age, with number equals “0” if no fish are landed or discarded in this age group; if the number at age is “0”, “-1” must be given for both mean weight at age and mean length at age; if no age based information is available, the data section should not be given).

All fields in the header information must be repeated for each set of catch at age data for a species.

An example of a mandatory catch data record is given below:

```
ID, SCO.2002.3.OTTER.70-79.NEPHROPS.4
COUNTRY, SCO
YEAR, 2002
QUARTER, 3
GEAR, OTTER
MESH_SIZE_RANGE, 70-79
FISHERY, NEPHROPS
AREA, 4
SPECIES, HAD
LANDINGS, 1357
DISCARDS, 789
NO_SAMPLES_LANDING, 5
NO_LENGTH_MEASUREMENTS_LANDINGS, 300
NO_AGE_MEASUREMENTS_LANDINGS, 30
NO_SAMPLES_DISCARDS, -1
NO_LENGTH_MEASUREMENTS_DISCARDS, -1
NO_AGE_MEASUREMENTS_DISCARDS, -1
NO_SAMPLES_CATCH, -1
NO_LENGTH_MEASUREMENTS_CATCH, -1
NO_AGE_MEASUREMENTS_CATCH, -1
MIN_AGE, 4
MAX_AGE, 6
Age, No. landed, Wt. landed, Len. landed, No. discard, Wt. discard, Len. discard
4, 1.4, 5.66, 125.5, -1, -1, -1
5, 0, -1, -1, -1, -1, -1
6, 0.5, 7.34, 135.5, -1, -1, -1
```

4. Mandatory effort data for 2000-2004, aggregated (sum) by ID

1. ID (this is a unique identifier; e.g. the combination of country, year, quarter, gear, mesh size range, fishery or metier, and area; this is free text with a maximum of 40 characters without space)
2. COUNTRY (this should be given according to the code list provided in Annex 2)
3. YEAR (this should be given in four digits)
4. QUARTER (this should be given as one digit)
5. GEAR (this identifies gear, and should be given according to the code list provided in Annex 3, which follows the EU data regulation 1639/2001)
6. MESH_SIZE_RANGE (the mesh size range should be given according to the code list provided in Annex 4, which follows the Council regulation 850/98)

7. FISHERY (species complex and gear) or métier (species complex, gear and vessel characteristics) (this is free text with a maximum of 40 characters without space; this specification may include e.g. target species, roundfish area or quarter)
8. AREA (the ICES division or sub-area should be given according to the code list provided in Annex 5)
9. NOMINAL_EFFORT (effort should be given in kWdays, i.e. engine power in kW times days at sea; if nominal effort is not available, "-1" should be given)
10. EFFECTIVE_EFFORT (optionally, gear specific effort can be given in other units, to be specified in the next field, than the nominal effort; if effective effort is not available "-1" should be given)
11. EFFORT_UNIT (this field should state the unit of effort used for the optional effective effort in the field above; this is free text with a maximum of 40 characters without space; if no effective effort is given, "-1" should be given)

An example of an effort record is given below:

ID, SCO.2001.3.OTTER.70-79.NEPHROPS.4
 COUNTRY, SCO
 YEAR, 2001
 QUARTER, 3
 GEAR, OTTER
 MESH_SIZE_RANGE, 70-79
 FISHERY, NEPHROPS
 AREA, 4
 NOMINAL_EFFORT, 1000
 EFFECTIVE_EFFORT, 713
 EFFORT_UNIT, hours.hauling.time.x.kW

Annex 1 List of cod stock/management areas

North sea, Skagerrak and Eastern Channel	cod 3an47d
Kattegat	cod 3as
Western Baltic	cod 22-24
Eastern Baltic	cod 25-32
West of Scotland	cod 6a
Irish Sea	cod 7a
Celtic Sea	cod 7e-k

Annex 2 Country coding

COUNTRY	CODE
Belgium	BEL
Denmark	DEN
Estonia	EST
Finland	FIN
France	FRA
Germany	GER
Ireland	IRL
Latvia	LAT
Lithuania	LIT
Netherlands	NED
Norway	NOR
Poland	POL
Portugal	POR
Spain	SPN
Sweden	SWE
United Kingdom (Jersey)	GBJ
United Kingdom (Guernsey)	GBG
United Kingdom (Alderny/Sark/Herm)	GBC
United Kingdom (England and Wales)	ENG
United Kingdom (Isle of Man)	IOM
United Kingdom (Northern Ireland)	NIR
United Kingdom (Scotland)	SCO
Other countries	OTH

Annex 3 Gear coding

TYPES OF FISHING TECHNIQUES			Gear code
Mobile gears	Beam trawl	<221kW	SMALL_BEAM
		>=221kW	LARGE_BEAM
		Outside North Sea	BEAM
	Demersal trawl & demersal seine	Bottom trawl	OTTER
		Danish & Scottish seiners	DEM_SEINE
	Pelagic trawl & Seiners	Pelagic Trawl	PEL_TRAWL
		Pelagic seiner & purse seiner	PEL_SEINE
	Dredges		DREDGE
Passive gears	Longlines		LOGLINE
	Drift & fixed Nets		GILL
	Pots & traps		POTS

Annex 4 Mesh size coding

Gear type	Mesh size range
Mobile gears	<16
	16-31
	32-54
	55-69
	70-79
	80-99
	100-119
	>=120
Passive gears	10-30
	50-70
	90-99
	100-119
	120-219
	>=220

Annex 5 Area coding by WG, ICES Division and IBSFC areas for Baltic

North Sea, Skagerrak, Eastern Channel

3an

4

6an

7d

Northern Shelf

2

3a

6

6a

6b

7

7a

Southern Shelf

7b

7c

7e

7f

7g

7h

7j

7k

8a

8b

8d

Baltic

3as

22-24

25-32

Annex 6 Species coding according to Council Regulation (EC) No. 2298/2003

	Common name	Alpha-3 code	Scientific name
1	Albacore	ALB	<i>Thunnus alalunga</i>
2	Alfonsinos	ALF	<i>Beryx</i> spp.
3	American plaice	PLA	<i>Hippoglossoides platessoides</i>
4	Anchovy	ANE	<i>Engraulis encrasicolus</i>
5	Anglerfish	ANF	<i>Lophiidae</i>
6	Antarctic icefish	ANI	<i>Champscephalus gunnari</i>
7	Atlantic catfish	CAT	<i>Anarhichas lupus</i>
8	Atlantic halibut	HAL	<i>Hippoglossus hippoglossus</i>
9	Atlantic salmon	SAL	<i>Salmo salar</i>
10	Basking shark	BSK	<i>Cetorhinus maximus</i>
11	Bigeye tuna	BET	<i>Thunnus obesus</i>
12	Birdbeak dogfish	DCA	<i>Deania calcea</i>
13	Black scabbardfish	BSF	<i>Aphanopus carbo</i>
14	Blackfin icefish	SSI	<i>Chaenocephalus aceratus</i>
15	Blue ling	BLI	<i>Molva dypterygia</i>
16	Blue marlin	BUM	<i>Makaira nigricans</i>
17	Blue whiting	WHB	<i>Micromesistius poutassou</i>
18	Bluefin tuna	BFT	<i>Thunnus thynnus</i>
19	Capelin	CAP	<i>Mallotus villosus</i>
20	Cod	COD	<i>Gadus morhua</i>
21	Common sole	SOL	<i>Solea solea</i>
22	Common shrimp	CSH	<i>Crangon crangon</i>
23	Crab	PAI	<i>Paralomis</i> spp.
24	Dab	DAB	<i>Limanda limanda</i>
25	Flatfish, flounder	FLX	<i>Pleuronectiformes, Platicthys flesus</i>
26	Forkbeards	FOX	<i>Phycis</i> spp.
27	Greater silver smelt	ARU	<i>Argentina silus</i>
28	Greenland halibut	GHL	<i>Reinhardtius hippoglossoides</i>
29	Grenadier	GRV	<i>Macrourus</i> spp.
30	Great lantern shark	ETR	<i>Etmopterus princeps</i>
31	Grey rockcod	NOS	<i>Lepidonotothen squamifrons</i>
32	Haddock	HAD	<i>Melanogrammus aeglefinus</i>
33	Hake	HKE	<i>Merluccius merluccius</i>
34	Herring	HER	<i>Clupea harengus</i>
35	Horse mackerel	JAX	<i>Trachurus</i> spp.
36	Humped rockcod	NOG	<i>Gobionotothen gibberifrons</i>
37	Kitefin shark	SCK	<i>Dalatias licha</i>
38	Krill	KRI	<i>Euphausia superba</i>
39	Lantern fish	LAC	<i>Lampanyctus achirus</i>
40	Leafscale gulper shark	GUQ	<i>Centrophorus squamosus</i>
41	Lemon sole	LEM	<i>Microstomus kitt</i>
42	Ling	LIN	<i>Molva molva</i>
43	Mackerel	MAC	<i>Scomber scombrus</i>
44	Marbled rockcod	NOR	<i>Notothenia rossii</i>
45	Megrim	LEZ	<i>Lepidorhombus</i> spp.
46	Northern prawn	PRA	<i>Pandalus borealis</i>
47	Norway lobster	NEP	<i>Nephrops norvegicus</i>
48	Norway pout	NOP	<i>Trisopterus esmarki</i>
49	Orange roughy	ORY	<i>Hoplostethus atlanticus</i>
50	'Penaeus' shrimps	PEN	<i>Penaeus</i> spp.
51	Plaice	PLE	<i>Pleuronectes platessa</i>
52	Polar cod	POC	<i>Boreogadus saida</i>
53	Pollack	POL	<i>Pollachius pollachius</i>
54	Porbeagle	POR	<i>Lamna nasus</i>
55	Portuguese dogfish	CYO	<i>Centroscyrnus coelolepis</i>
56	Redfish	RED	<i>Sebastes</i> spp.
57	Red Seabream	SBR	<i>Pagellus bogaraveo</i>
58	Roughhead grenadier	RHG	<i>Macrourus berglax</i>
59	Roundnose grenadier	RNG	<i>Coryphaenoides rupestris</i>
60	Saithe	POK	<i>Pollachius virens</i>
61	Sandeel	SAN	<i>Ammodytidae</i>
62	Seabass	BSS	<i>Dicentrarchus labrax</i>
63	Short fin squid	SQI	<i>Illex illecebrosus</i>
64	Skates	SRX	<i>Rajidae</i>
65	Rays	RAJ	<i>Rajidae</i>
66	Smooth lantern shark	ETP	<i>Etmopterus pusillus</i>
67	Snow crab	PCR	<i>Chionoecetes</i> spp.
68	South Georgian icefish	SGI	<i>Pseudochaenichthys georgianus</i>
69	Spanish ling	SLI	<i>Molva macrophthalmus</i>
70	Sprat	SPR	<i>Sprattus sprattus</i>
71	Spurdog	DGS	<i>Squalus acanthias</i>
72	Swordfish	SWO	<i>Xiphias gladius</i>
73	Toothfish	TOP	<i>Dissostichus eleginoides</i>
74	Tope shark	GAG	<i>Galeorhinus galeus</i>
75	Turbot	TUR	<i>Psetta maxima</i>
76	Tusk	USK	<i>Brosme brosme</i>
77	Unicorn icefish	LIC	<i>Channichthys rhinoceros</i>
78	Velvet belly	ETX	<i>Etmopterus spinax</i>
79	White marlin	WHM	<i>Tetrapturus alba</i>
80	Whiting	WHG	<i>Merlangius merlangus</i>
81	Witch flounder	WIT	<i>Glyptocephalus cynoglossus</i>
82	Yellowfin tuna	YFT	<i>Thunnus albacares</i>
83	Yellowtail flounder	YEL	<i>Limanda ferruginea</i>

Appendix 3 on the terminology of MTAC settings and output

The MTAC program (Vinther *et al.*, 2004) calculates fleet factors (multipliers for fleet effort or partial status quo F) and Mixed Species catch forecasts (MS-TACs) for each individual species fished in a given area, taking into account the mixed nature of the fisheries, under the objective to approach set targets (such as, e.g., single species advice) as closely as possible. These can be seen as a compromise that aims to resolve the conflict that arises when fleets have depleted their quota for some species but not for others while these species are unavoidably caught together.

MTAC needs as input:

- Target SS-TACs or F-multipliers which imply SS-TACs (user-specified, e.g. from the ACFM advice);
- Status quo F-at-age (from the WG);
- N-at-age at start of TAC year (from the WG or derived through a user-specified assumption for the intermediate year);
- Historical catch data by species, by fleet, by age.

The MTAC program contains several options that have to be set by the user.

The p-options state how the fleets' partial status quo F should be reduced:

- p = 0: Equally for all fleets;
- p = 1: Proportionally to the catch of the species within the total catch of the fleet (in weight);
- p = 2: Proportionally to the fleet's catch of the species as a fraction of the total catch of that species (in weight).

The species specific fleet factors may conflict between species. The overall fleet factors are calculated as the weighted averages of the species specific fleet factors. The weighting is done by user-specified decision weights, reflecting priority given to approaching the target for that species.

The STECF Mixed Fisheries Study Group in 2003 (STECF 2003a) recommended (on the basis of model results and some sensitivity analyses) that in case no priority at all is given to a species, the decision weight should be set to a very small value instead of 0. No sensitivity analyses were done as to how sensitive the outcomes are to the actual value within a range of very small values. Therefore, the Group arbitrarily chose to set decision weights at 100 for species with high priority versus 0.25 for species with no priority.

The decision weights can be modified or not (q-option):

- q = 0: No modification;
- q = 1: Multiply the decision weights by proportion of the catch of a species within the fleet's catch in weight.

Setting the p-option at 0 and the q-option at 0 is equivalent to not using fleet based information, i.e. just calculating the weighted average of the species target F-multipliers. In this case all fleets have to reduce their effort equally.

The outcome of MTAC runs is often presented as ratios of MS-TAC/SS-TAC for each of the species. This ratio reflects the extent the MTAC scenario is overshooting or undershooting the species' target. If this ratio is smaller than 1, the total forecasted catch will be lower than the single species target catch. If this ratio is larger than 1, the total forecasted catch will be higher than the single species target catch. The closer to 1 the ratio is, the closer the scenario has approached the target for that species.