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REPORT OF THE FIRST and FOURTH MEETINGS OF THE SUBGROUP ON REVIEW OF STOCKS. (SGRST-05-01 and SGRST-05-04) OF THE SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

EVALUATION OF THE COD RECOVERY PLAN

Ispra, 13-17 June and 19-21 September 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.

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STECF EVALAUTION AND ENDORSEMENT: ASSESS THE EFFECTIVENESS OF THE COD RECOVERY PLAN

STECF was asked the following:

STECF should deliver an opinion based on the conclusions of subgroup meetings SGRST-05-01 (13-17 June 2005) and SGRST-05-4 (19-21 September 2005) which aimed to (a) identify the location and season of the most important fishable concentrations of cod in the North Sea, Skagerrak, eastern Channel, Kattegat, Baltic Sea, west of Scotland, Celtic Sea and the Irish Sea (b) review the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004) (c) evaluate systems feasible for management of fishing effort in the context of a multi-annual management plan for the cod stocks in the Baltic Sea.

Background

STECF notes that the objectives of the cod recovery plan are rebuilding targets related to SSB increases, and the maintenance of fishing mortality below precautionary levels. Unfortunately these objectives were not embodied within the Terms of Reference of these SGRST meetings. SGRST's terms of reference included a request to review of "the current system for the management of fishing effort (Annex IVa of Regulation 27/2005) in the context of the cod recovery plan (Regulation 423/2004)."

STECF considers that the effectiveness of the cod recovery plan is best evaluated with reference to the current status of cod recovery stocks. STECF considerations of the current status of cod stocks are given by the SGRST in the Stock Status Review (SGRST-05-04)

STECF comments

Under the present term of reference STECF was asked to base its opinion on the reports of the SGRST meetings 05-01 and 05-04. The following STECF comments on the effectiveness of the cod recovery plans consider the sub-group's discussion of effort limitation.

Effort limitation was introduced in "cod recovery" areas as a mechanism for achieving desired reductions in fishing mortality. These effort regulations limited the days that vessels of different categories may spend at sea but did not specify how these limitations related to previous levels of effort exerted. Furthermore, the introduction of days at sea restrictions was not accompanied by clearly defined objectives for the reduction of effort, nor for fishing mortality, and the relationship between effort and fishing mortality remains unclear. The SGRST review of the efficacy of effort regulations was therefore complicated by the lack of stated objectives of the regulations in terms of intended fishing mortality reductions.

Trends in effort for the main fleets exploiting cod

The SGRST summarized recent trends in nominal effort (kW days) by the main fleets:

- For the west of Scotland effort data were reported for the whole of Division VIa rather than for the area within which effort is regulated. SGRST was therefore unable to evaluate changes in effort exerted by regulated gears to the west of Scotland.
- In the Irish Sea, there has been an overall decline of 19% from 2000-2004 in the effort exerted by vessels using 70-99mm meshes. From 2000-2003 the nominal effort of demersal trawlers using ≥100mm mesh increased. In 2004 the effort reported for this category declined by 19% relative to 2000 (38% relative to 2002). There is some evidence since 2002 of a transfer of effort from trawls using ≥100 mm mesh to 70-99mm mesh. The nominal effort in 2004 of beam trawlers using ≥ 80mm mesh has decreased by 15% and 35% compared to 2000 and 2002, respectively.
- In the North Sea and Skagerrak, the total nominal effort for all demersal gears decreased between 2000 and 2004 by 21% (15% between 2002 and 2004). Demersal trawlers using ≥100mm mesh showed the greatest decline in effort (43% since 2000, 35% since 2002), while the effort of demersal trawlers using 70-99mm mesh increased by 54% and 12% over the same periods. Between 2000 and 2004 nominal effort of beam trawlers using ≥ 80mm mesh declined by 25% (14% between 2002 and 2004).
- In the Eastern Channel, total nominal effort increased between 2000 and 2004 by 22%, and decreased between 2002 and 2004 by 3%. Demersal trawlers using 70-99mm mesh accounted for most of the fishing effort, and this increased by 14% between 2000 and 2004 and decreased by 3% during 2002-2004.

- In the Kattegat, total nominal effort decreased by 27% during the period 2000 to 2004 (16% between 2002 and 2004). Effort of demersal trawlers using ≥100mm mesh decreased by 79% whilst that of demersal trawlers using 70-99mm mesh decreased by 22% between 2000 and 2004.

STECF notes the SGRST conclusion that effort regulations have provided an incentive for some vessels previously using >100mm mesh demersal trawls to switch to smaller mesh gears, thus claiming a higher number of days-at-sea. Under EC Regulation No. 850/1998 these vessels are also required to target either Nephrops or anglerfish, megrim, and whiting, with various catch and bycatch composition limits.

The SGRST findings of minimal decreases / increases in the effort of trawlers using 70-99mm mesh and simultaneous decreases in the effort of ≥100mm mesh demersal trawlers indicate an overall reduction in the mesh size used in demersal fisheries. Adherence to catch composition regulations required when using 70-99mm mesh would result in high-grading and discarding of cod and other species. The SGRST report provides evidence of discarding of cod, and other demersal species, particularly in the 70-99mm mesh category.

The SGRST was also provided with information on the control and enforcement of effort regulations (Commission's evaluation report: Cod recovery verification programme 2004, Working Document 9 to SGRST-05-01). The report considers that the actual reduction in terms of fishing effort by the main fleets is likely to have been modest, that high-grading and mis-declaring of cod was a common practice during 2004 and that landings composition regulations of the regulated gears were poorly enforced.

STECF conclusions and recommendations

STECF draws the following conclusions from the SGRST report:

- high-grading, discarding and mis-declaring of cod will compromise the intended impact of effort management,
- current exploitation rates remain excessive in the context of the cod recovery plan.

Given these conclusions STECF considers that effort controls, as currently formulated in Annex IVa of Regulation 27/2005, have not, and are unlikely to satisfy the objectives of the cod recovery regulation.

1. Summary

- The 4 cod stocks presently managed by the cod recovery plan (Council Regulation (EC) No 423/2004 of 26 February 2004), namely the cod stocks in the (1) North Sea, Skagerrak and eastern Channel, (2) Kattegat, (3) west of Scotland and (4) Irish Sea, are classified by ICES AFCM as suffering reduced reproductive capacity and being harvested unsustainably.

- The geographic patterns of the recent cod fishery based on officially reported landings have been consistent since 2000 and over the quarters, i.e. there were low amounts of cod landings reported from the central North Sea. In the cod recovery zone, highest landings were reported from the western Baltic, Kattegat, Skagerrak, northern and southern North Sea and south of Ireland. The areas in the eastern Baltic must be considered poorly presented due to incomplete data. STECF notes that the presented data are officially reported landings that do not allow conclusions to be drawn about cod population densities.

- Historic and recent distribution patterns of both juvenile cod at age 1 and juvenile and adult cod at ages 2+ (the ages dominating the commercial landings) are illustrated based on survey results for the North Sea, Skagerrak, Eastern Channel, Kattegat, eastern and western Baltic and west of Scotland. There were no applicable data to illustrate or describe the cod distribution patterns by rectangle in the Irish and Celtic Seas.

- The requested review of the current system for the management of fishing effort in the context of the cod recovery plan is a broad task with scope for misinterpretation. Discussions between STECF and the Commission revealed that quantitative information regarding recent catch composition of the regulated gears by age including discards from onboard observations was the main interest, as well as trends in nominal fishing effort. However, such analyses were impossible due to insufficient or inconsistent data submissions for various reasons, also because of restricted access to commercial fishing trips. It was noted that for some member states the meeting dates were too early in the year to accomplish the volume and detailed analysis required for the work requested, and that more effort and catch data by fleets would be available later in the year. Thus it was decided to continue the data compilation and analyses related to this task inter-sessionally and during an extra meeting in 19-21 September 2005 at the JRC, Ispra, Italy.

- The evaluation of systems feasible for management of fishing effort in the context of a multi-annual management plan for the cod stocks in the Baltic Sea was impossible as the expertise represented in the group was limited to scientists with some knowledge of the Baltic cod stocks and their fisheries. In addition the group had insufficient data to hand to quantify current fishing practices or fishing capacity in the Baltic. Some expert knowledge on the Baltic Sea fisheries and management is given.

2. Introduction

2.1 Terms of Reference

The SGRST on the review of the cod recovery plan will meet during 13-17 June at the Joint Research Centre in Ispra (Itlay)

(1) STECF is requested to identify the distribution by age, season and ICES rectangle of cod and to identify the location and season of the most important fishable concentrations of cod in the North Sea, Skagerrak, eastern Channel, Kattegat, Baltic Sea, west of Scotland, Celtic Sea and the Irish Sea, and taking due account of estimated discards and other unallocated catches, to quantify the proportion of cod caught in these areas and/or seasons. The analysis should present data on:

- *(a) a recent short period, reflecting present conditions;*
- *(b) a sample of years when cod was within safe biological limits to indicate its distribution at that time.*

(2) STECF is requested to review the current system for the management of fishing effort in the context of the cod recovery plan (Annex IVa of Regulation 27/2005) and to :

- *a. review the definition of the area defined in Point (2), the gear categories defined in Point 4, and the associated days at sea defined in Point 6 and associated conditions;*
- *b. recommend ways to improve the conservation of cod, consistent with the Cod Recovery Plan (Regulation 423/2004) and to improve the access of fishing vessels to other, underexploited resources.*

(3) STECF/ICES is requested to evaluate systems feasible for management of fishing effort in the context a multi-annual management plan for the cod stocks in the Baltic Sea. The evaluation should include but not necessary be limited to:

- *a. systems similar to the days at sea system adopted in the TAC and quota regulation (Annex IVa of Regulation 27/2005);*
- *b. systems based on closed seasons and/or areas.*

In the foregoing evaluations, STECF is requested to take account of unallocated catches and of fish catches that are discarded as well as those that are landed.

2.2 Introductory notes

The STECF Sub-group SGRST on Evaluation of the Cod Recovery Plan met at the European Joint Reseach Centre in Ispra, Italy, during 13-17 June 2005 to deal with the terms of reference listed in the section 2.1. The list of participants is given in Appendix 1.

Representatives from the following stakeholder organisations attended the opening session held on 13 June 13.00 hours and the concluding plenary session on 17 June 14.00 hours. The representatives of the stakeholder organisations commented on the terms of references. Such opening and closing comments are addressed under the respective chapters of this report. The group benefited from the presence of a scientific expert from Norway (s. Appendix 1).

A list of working documents and additional requests from stake holders in written formats related to the ToRs and available to the working group is given in Appendix 2. References and advice are given under the appropriate chapters of this report.

The work of the group was supported by JRC's excellent organisation of the meeting 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=23).

The requested review of the current system for the management of fishing effort in the context of the cod recovery plan is a broad task with scope for misinterpretation (ToR 2a and b). Discussions between STECF and the Commission revealed that quantitative information regarding recent catch composition of the regulated gears by age including discards from onboard observations was the main interest, as well as trends in nominal fishing effort. However, such analyses were impossible due to insufficient or inconsistent data submissions for various reasons, also because of restricted access to commercial fishing trips. The work of the group was significantly affected by both lack of data submissions, late submissions and data submissions which were inconsistent with the request for data

by some member states. The group acknowledged that the data submissions were on a voluntary basis, and incomplete or inconsistent data submissions are tabled in the appropriate chapters of this report. It was noted that for some member states the meeting dates were too early in the year to accomplish the volume and detailed analysis required for the work requested, and that more effort and catch data by fleets would be available later in the year. Thus it was decided to continue the data compilation and analyses related to this task inter-sessionally and during an extra meeting in 19-21 September 2005 at the JRC, Ispra, Italy.

As a consequence, this report covers analyses and advice for ToRs 1a, 1b, 3a and 3b only while the group will provide its analyses and advice regarding ToRs 2a and 2b in an extra Appendix 4 to be delivered by end of September 2005.

As a start, the group reviewed trends in SSB and fishing mortality as derived from the most recent ICES assessments (ICES 2004a) of the 4 cod stocks presently managed under the recovery plan (Council Regulation (EC) No 423/2004 of 26 February 2004), namely the cod stocks in the (1) North Sea, Skagerrak and eastern Channel, (2) Kattegat, (3) west of Scotland and (4) Irish Sea. As the ToRs also cover the additional 3 European cod stocks in (5) eastern and (6) western Baltic as well as in the (7) Celtic Sea, the group also reviewed their most recent trends in SSB and fishing mortality.

(1) Cod stock in the North Sea, Skagerrak and eastern Channel

Based on the most recent estimate of SSB and fishing mortality ICES classifies the stock as suffering reduced reproductive capacity and is harvested unsustainably (Fig. 2.1).

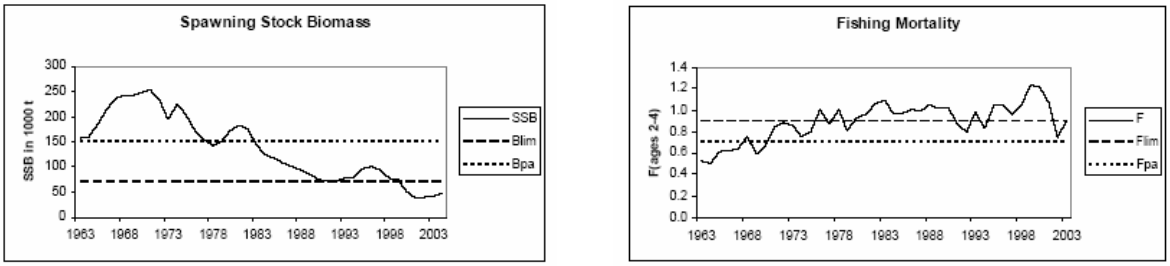


Fig. 2.1 Trends in SSB and fishing mortality in the cod stock in the North Sea, Skagerrak and eastern Channel (Div. 3an, 4 and 7d).

(2) Cod stock in the Kattegat

Based on the available evidence on SSB and fishing mortality ICES classifies the stock as having reduced reproductive capacity. Given the low stock size, the present fishing mortality is high and the stock is harvested unsustainably. The estimated SSB in 2004 is considerably below Blim (Fig. 2.2).

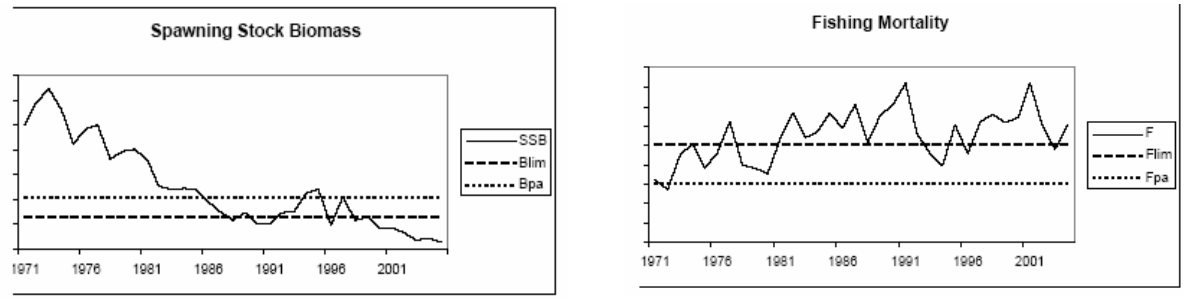


Fig. 2.2 Trends in SSB and fishing mortality in the cod stock in the Kattegat (Div. 3as).

(3) Cod stock west of Scotland

The state of the stock is uncertain. The survey SSB estimates indicate that the stock has been declining and is presently at a historical low. From survey estimates of mortality, there is no indication of a decline in overall mortality in recent years. Information from catch-at-age data also indicates that the stock is at a historical low (Fig. 2.3).

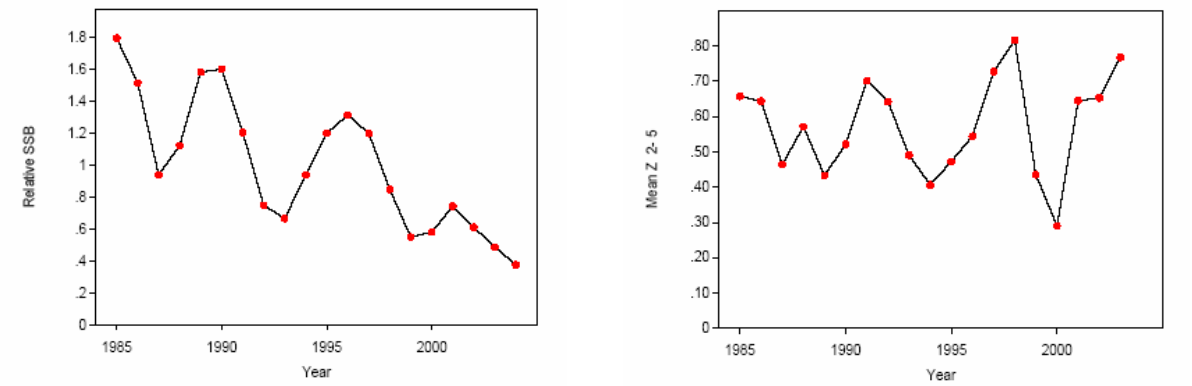


Fig. 2.3 Trends in relative SSB and total mortality in the cod stock west of Scotland (Div. 6a).

(4) Cod stock in the Irish Sea

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having reduced reproductive capacity and as being harvested unsustainably. Fishing mortality has been above Fpa since 1980 and close to, or above Flim since 1989. SSB is below Bpa and has been below Blim since 1995, and is projected to remain below Blim in 2005 (Fig. 2.4).

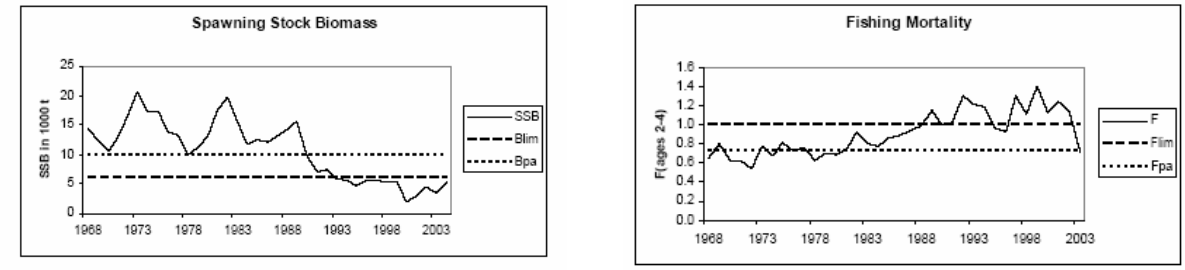


Fig. 2.4 Trends in SSB and fishing mortality in the cod stock in the Irish Sea (Div. 7a).

(5) Cod stock in the Eastern Baltic

The stock is at historical low levels and there is no indication of increase in the spawning stock biomass. Based on estimates of SSB and fishing mortality ICES classifies the stock as suffering reduced reproductive capacity and being harvested unsustainably (Fig. 2.5).

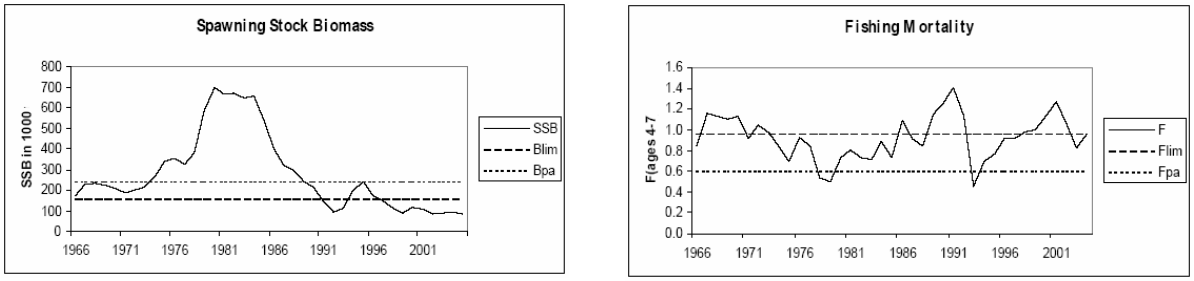


Fig. 2.5 Trends in SSB and fishing mortality in the cod stock in the eastern Baltic (Sub-areas 25-32).

(6) Cod stock in the Western Baltic

Based on the most recent estimates of SSB, ICES classifies the stock as being at risk of reduced reproductive capacity. In the absence of defined fishing mortality reference points, the state of the stock cannot be evaluated with regard to these. An analytical assessment demonstrates that the most recent estimated fishing mortality exceeds the IBSFC fishing mortality reference point (1.0, Fig. 2.6). The current fishing mortality is well above what is likely to be sustainable in the long term.

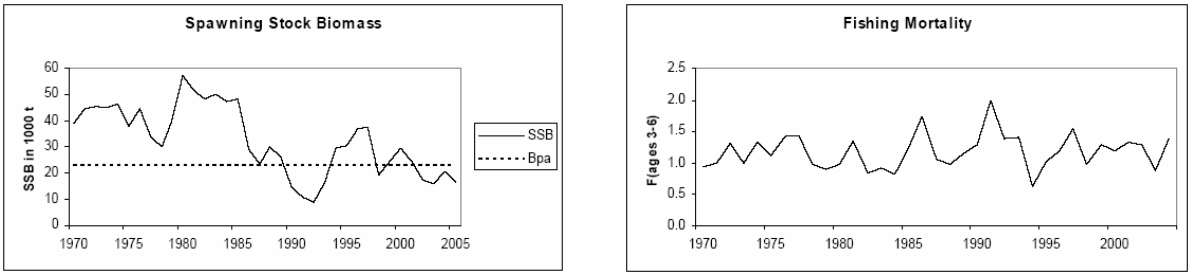


Fig. 2.6 Trends in SSB and fishing mortality in the cod stock in the western Baltic (Sub-areas 22-24).

(7) Cod stock in the Celtic Sea

Based on the most recent estimates of SSB and fishing mortality ICES classifies the stock as having full reproductive capacity. In recent years SSB has fluctuated around 10 000 t and is estimated in 2004 to be just above Bpa. Based on the most recent fishing mortality ICES classifies the stock as being harvested sustainably. Fishing mortality has been above Fpa since 1986 but has decreased in the last 4 years and is estimated to be just below Fpa in 2003 (Fig. 2.7).

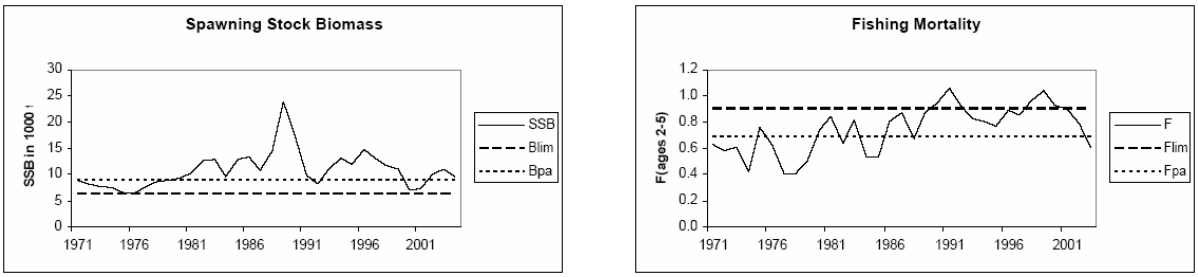


Fig. 2.7 Trends in SSB and fishing mortality in the cod stock in the Celtic Sea (Div. 7e-k).

3. Location and season (by quarter) of the most important fishable concentrations of cod

3.1 Distribution of the cod fishery

In order to illustrate the distribution patterns of the recent cod fishery since 2000, the group compiled officially reported logbook data (landings) for a number of species by year, quarter, fleet (gear and mesh size) and statistical rectangle. The data formats requested are given in Appendix 3. Such landings data comprise all ages aggregated without discards and unallocated landings. The available scientific sampling coverage on such data is considered inappropriate to provide estimates of the age compositions of catches including discards and unallocated landings at such detailed level of aggregation by rectangle. Therefore, only aggregated landings data over all ages are evaluated.

The evaluation of the distribution of the cod fishery is considered incomplete due to incomplete data. It must be noted that Estonia, Lithuania, Poland have not provided the requested data. Table 3.1.1 lists the provision of the data by member state.

SGRST concludes that

- the presented data are officially reported landings that do not allow conclusions to be drawn about cod densities. They illustrate a combination of stock spatial distribution, distribution of fishing effort and fisher's reporting practices.

- the geographic patterns of the recent cod fishery based on officially reported landings are consistent since 2000 and over the quarters (Fig. 3.1.1-3.1.3), i.e. there were low amounts of cod landings reported from the central North Sea. In the cod recovery zone, highest landings were reported from the western Baltic, Kattegat, Skagerrak, northern and southern North Sea and south of Ireland. The areas in the eastern Baltic must be considered poorly represented due to incomplete data.

SGRST considers that

- a spatial evaluation of cod abundance would be improved by more representative catch data including discards and unallocated landings and effort data by area and gear type including mesh size. This could be facilitated by data collected by observers at sea and confidential logbook reports.

The stake holders commented that

- the official landing statistics should be considered imprecise especially in terms of reported rectangles.

Table 3.1.1 Overview on data submissions of landings by member states on landings by year, quarter, area, fleet and rectangles, 2000-2004.

Country	**Year restrictions**	**Area restrictions**	**Fleet restrictions**	**Rectangles**	**Species restrictions**
Belgium	2003-2004	Data provided	No mesh size in the North Sea	Data provided	Main species
Denmark	Data provided	Data provided	Data provided	Data provided	Data provided
Estonia	No data	No data	No data	No data	No data
Finland	Data provided	SA 22-24, 25-32	No mesh size	Data provided	Data provided
France	Data provided	Data provided	No mesh size in the North Sea	Data provided	Main species
Germany	Data provided	Data provided	Data provided	Data provided	Data provided
Ireland	Data provided	Data provided	No mesh size	Data provided	Data provided
Netherlands	Data provided	Data provided	Not all beam landings classified to engine power	Data provided	main species
Latvia	Data provided	SA 22-24, 25-32	Data provided	Data provided	Data provided
Lithuania	No data	No data	No data	No data	No data
Poland	No data	No data	No data	No data	No data
Sweden	Data provided	Data provided	Data provided	Data provided	Data provided
UK England	Data provided	Data provided	Data provided	Data provided	Data provided
UK Scotland	Data provided	Data provided	Data provided	Data provided	Data provided
Norway	2002-2004	Data provided	Data provided	Data provided	Data provided

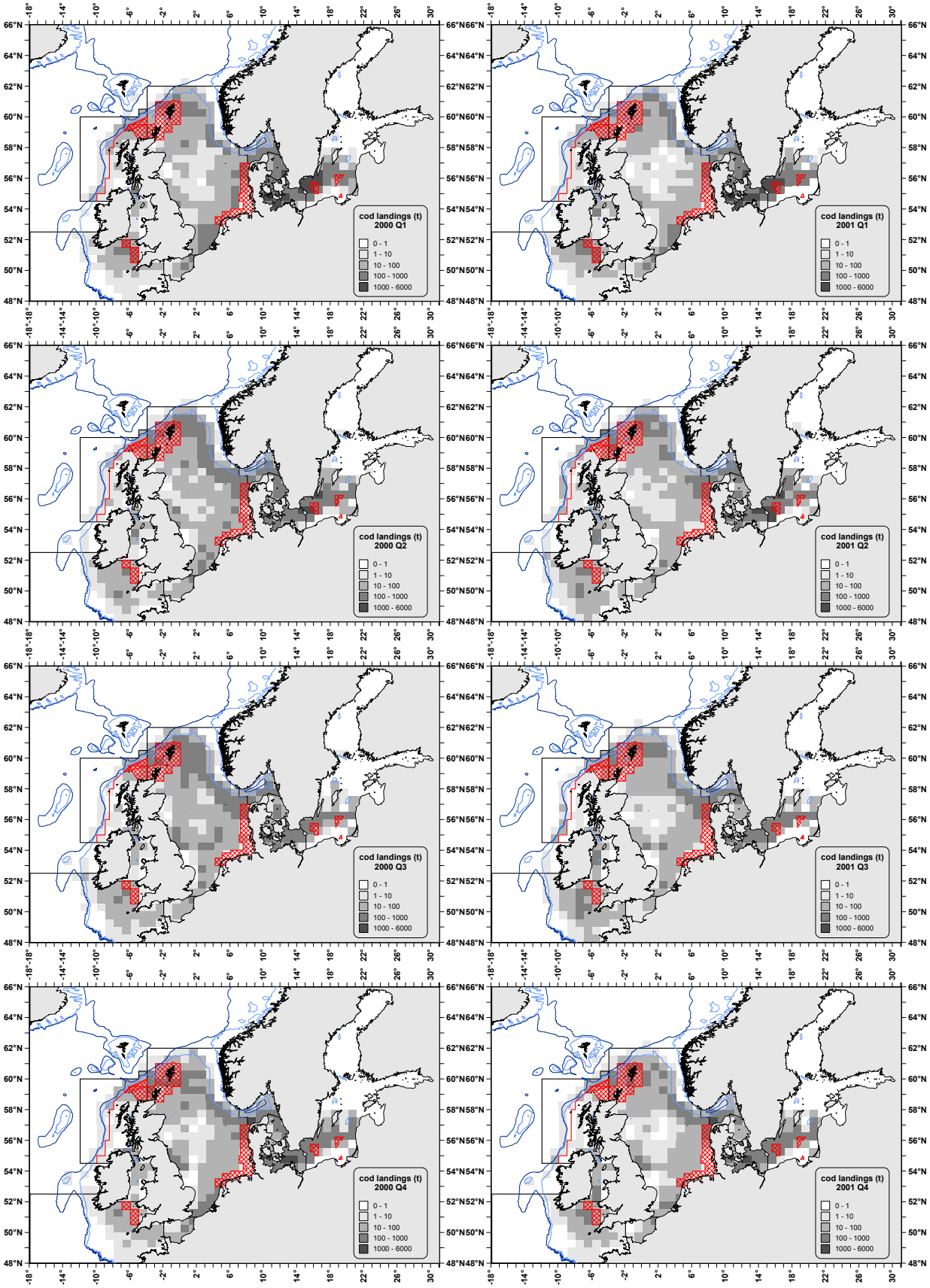


Fig. 3.1.1 International landings 2000-2001 by quarters in comparison with restricted access areas in 2005 affecting demersal fisheries. The 3 eastern Baltic areas are closed all year. Note that Western Baltic (Sub-areas 22-24) is closed from 1 March to 30 April 2005 (inclusive) and the Eastern Baltic (Sub-areas 25-32) is closed from 1 May to 15 September 2005 (inclusive). Fishing in the North Sea is restricted by the plaice box affecting large beam trawlers (kW), and the Shetland box limiting the effort through a license system. The West of Scotland is also covered by the Shetland box and the West of Scotland box which was closed all year in 2005. Celtic Sea closures are from 1 January 2005 until 31 March 2005 (inclusive).

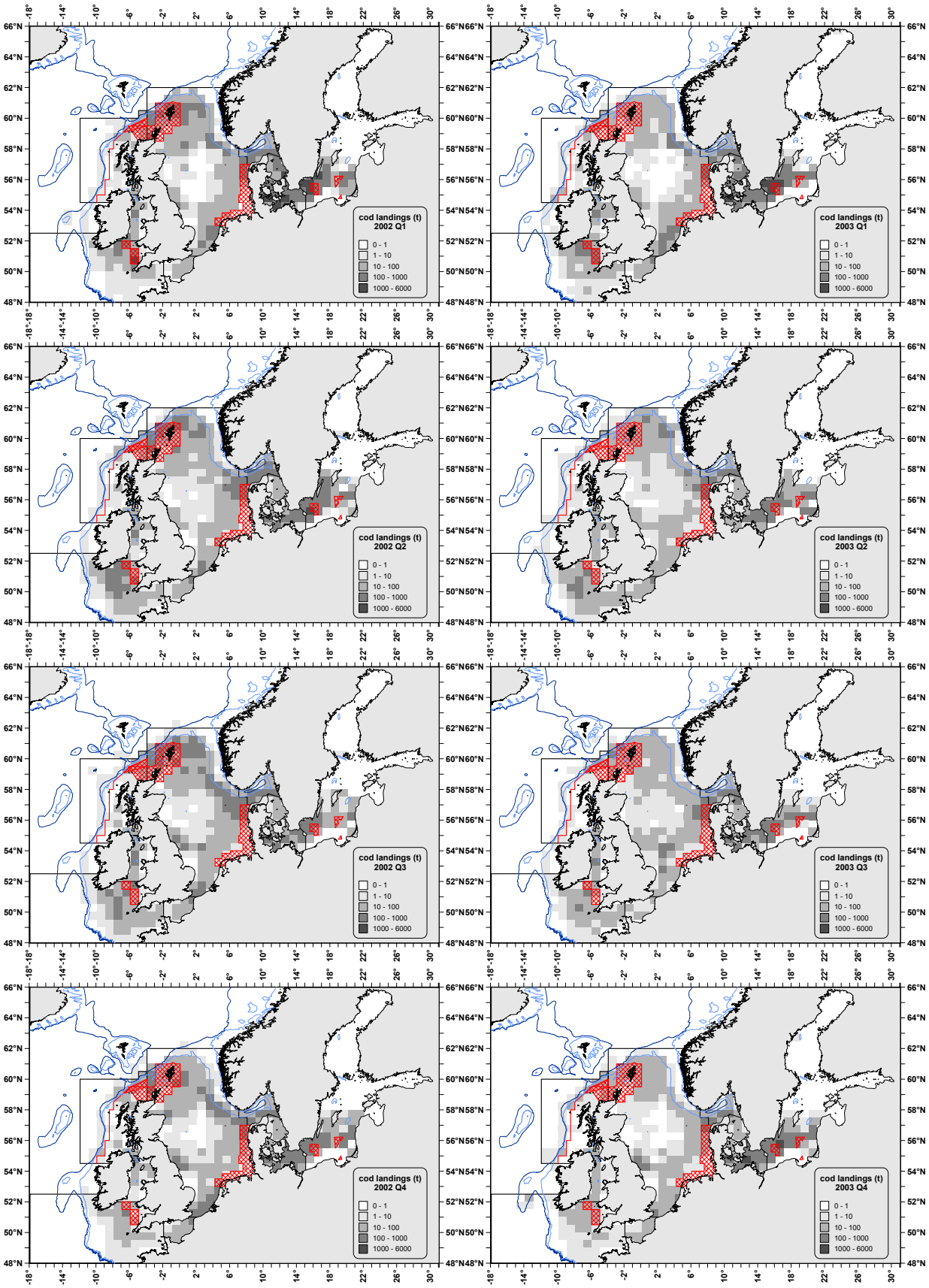


Fig. 3.1.2 International landings 2002-2003 by quarters in comparison with restricted access areas in 2005 affecting demersal fisheries. The 3 eastern Baltic areas are closed all year. Note that Western Baltic (Sub-areas 22-24) is closed from 1 March to 30 April 2005 (inclusive) and the Eastern Baltic (Sub-areas 25-32) is closed from 1 May to 15 September 2005 (inclusive). Fishing in the North Sea is restricted by the plaice box affecting large beam trawlers (kW), and the Shetland box limiting the effort through a license system. The West of Scotland is also covered by the Shetland box and the West of Scotland box which was closed all year in 2005. Celtic Sea closures are from 1 January 2005 until 31 March 2005 (inclusive).

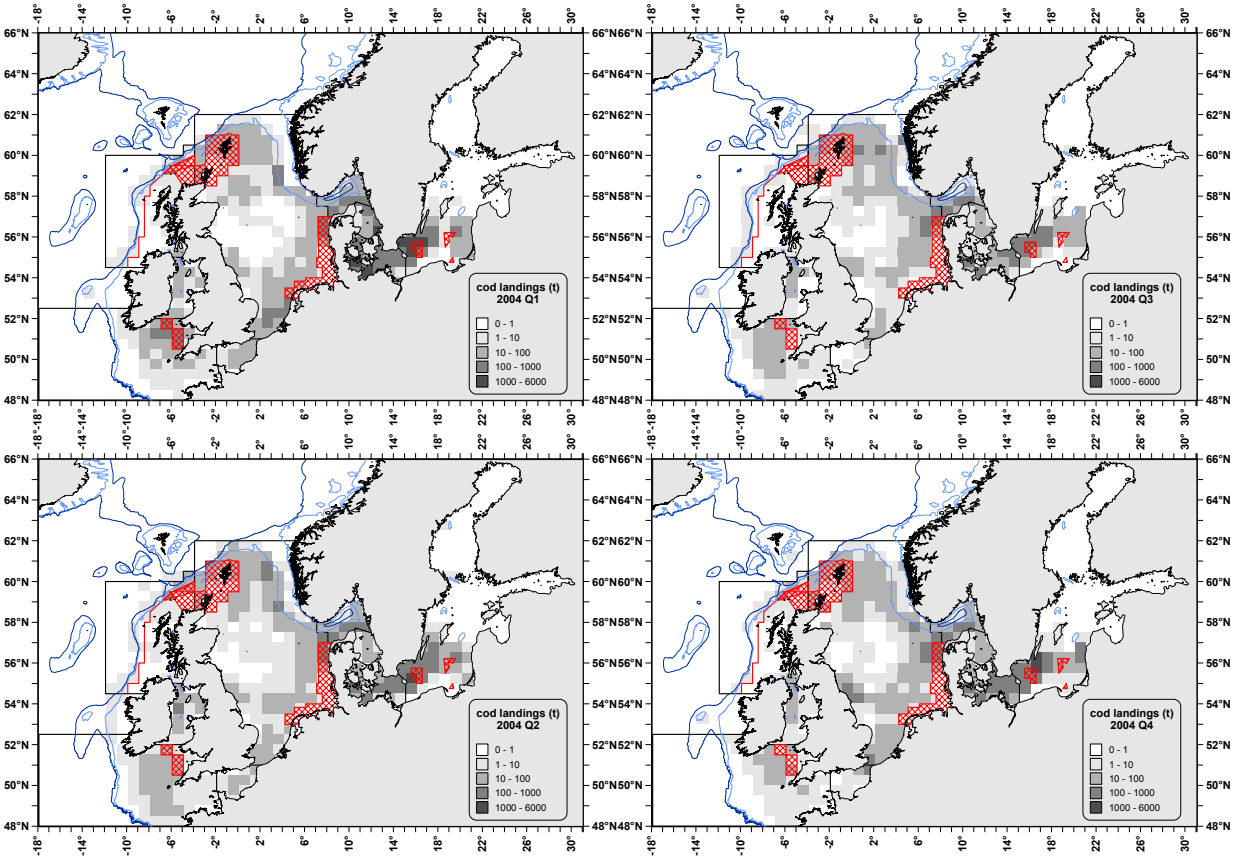


Fig. 3.1.3 International landings 2004 by quarters in comparison with restricted access areas in 2005 affecting demersal fisheries. The 3 eastern Baltic areas are closed all year. Note that Western Baltic (Sub-areas 22-24) is closed from 1 March to 30 April 2005 (inclusive) and the Eastern Baltic (Sub-areas 25-32) is closed from 1 May to 15 September 2005 (inclusive). Fishing in the North Sea is restricted by the plaice box affecting large beam trawlers (kW), and the Shetland box limiting the effort through a license system. The West of Scotland is also covered by the Shetland box and the West of Scotland box which was closed all year in 2005. Celtic Sea closures are from 1 January 2005 until 31 March 2005 (inclusive).

3.2 North Sea, Skagerrak and eastern Channel, Div. 3an 4 and 7d

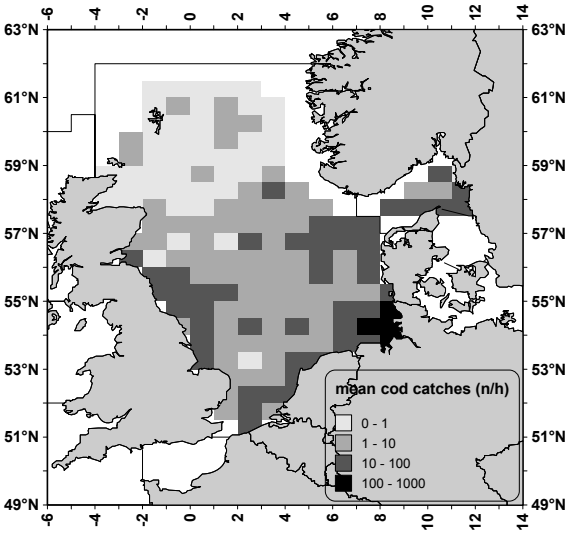
3.2.1 Recent distribution of the reported cod landings

Officially reported landings excluding discards and unallocated landings are illustrated in Fig. 3.1.1-3.1.3. Since 2000, there have been low levels of landings reported from the central North Sea, the majority of the landings were reported from the northern North Sea, the Skagerrak, southern North Sea except the German bight and south-western North Sea with little annual or quarterly variation.

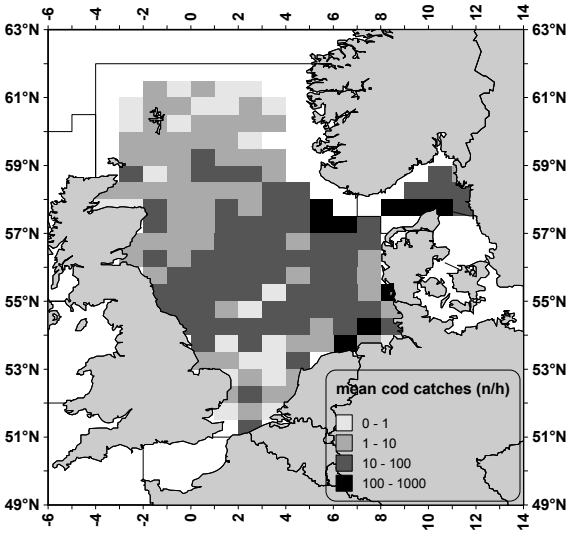
3.2.2 Historic cod distribution patterns at ages 1 and 2+

The analyses are based on the international bottom trawl surveys in the North Sea and the Skagerrak conducted during the first and third quarters in 1983-1987 and 1991-1995, respectively. Additional information is available from the French bottom trawl survey covering the eastern Channel conducted during the fourth quarter in 1991-1995. This survey is not used for the purpose of cod stock evaluation but may provide valuable insight into distribution patterns during the fourth quarter.

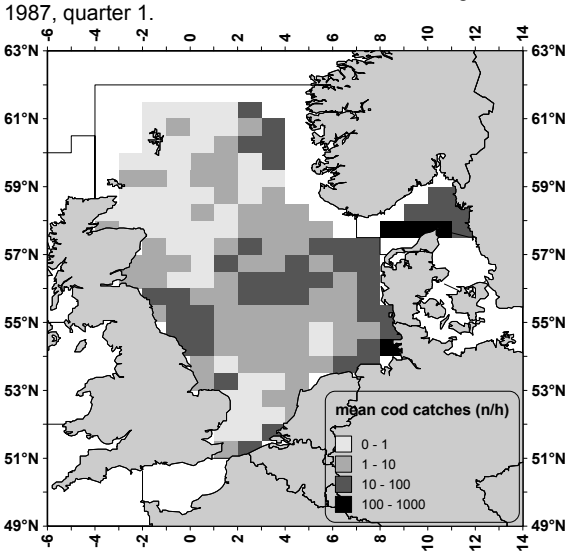
In the North Sea and Skagerrak, historic catches of 1 group cod were found in a region extending from the north east coast of England to the Skagerrak and in the German Bight with a predominantly central and southern spatial distribution. The small area in eastern channel does reveal higher densities of 1 year old cod close to the North Sea and lower densities in its south-western parts (Fig. 3.2.2.1).



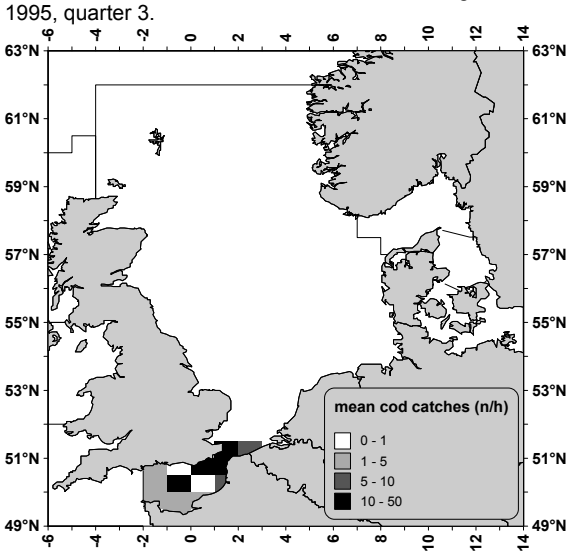
Mean cod distribution in the North Sea and Skagerrak 1983-1987, quarter 1.



Mean cod distribution in the North Sea and Skagerrak 1991-1995, quarter 3.



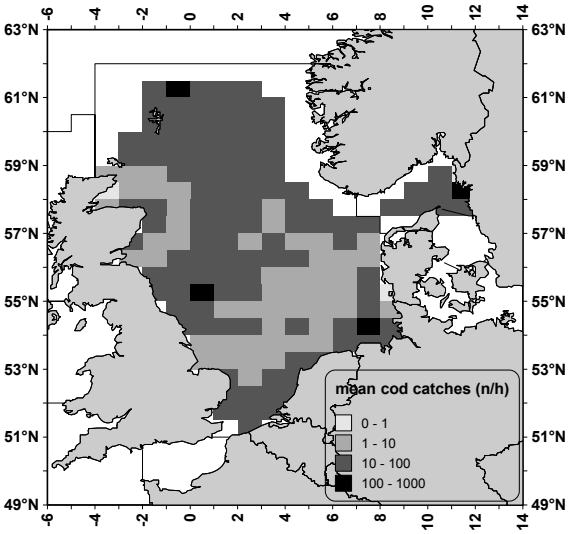
Mean cod distribution in the North Sea and Skagerrak 1991-1995, quarter 1.



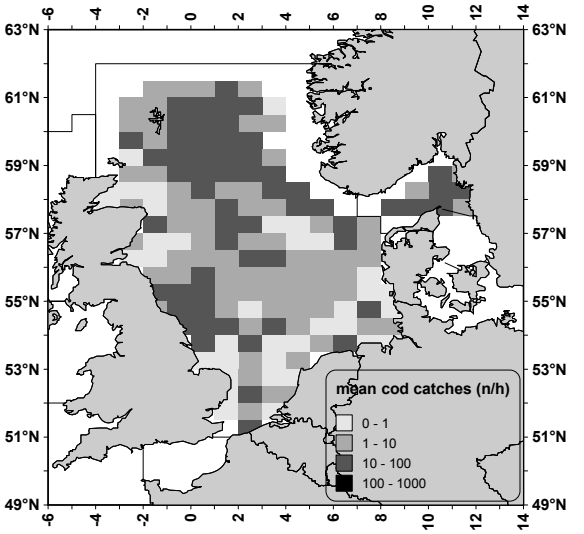
Mean cod distribution in the eastern Channel 1991-1995, quarter 4.

Fig. 3.2.2.1 Mean historic cod distribution patterns at age 1 as derived from various surveys in 1983-1987 and 1991-1995 by quarter.

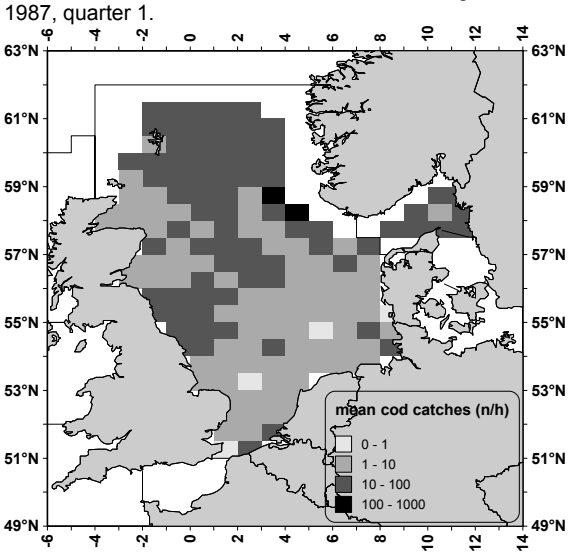
During 1983 – 1987 catch rates of 2+ cod were higher in the 1st quarter in the northern North Sea, the east coast of England, the German Bight and Skagerrak. Catch rates in the first and third quarters during 1991 – 1995 are lower, in line with the reduced stock abundance but have similar spatial distributions. However, high catch rates in the 3rd quarter are more widely dispersed, most probably as a result of dispersal into feeding areas, and higher due to increased catchability resulting from increased size. The eastern channel does not reveal a significant historic pattern in the distribution of cod at ages 2+ (Fig. 3.2.2.2).



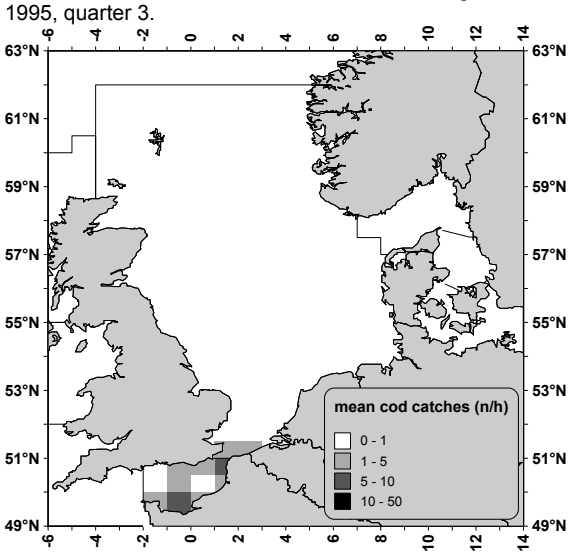
Mean cod distribution in the North Sea and Skagerrak 1983-1987, quarter 1.



Mean cod distribution in the North Sea and Skagerrak 1991-1995, quarter 3.



Mean cod distribution in the North Sea and Skagerrak 1991-1995, quarter 1.



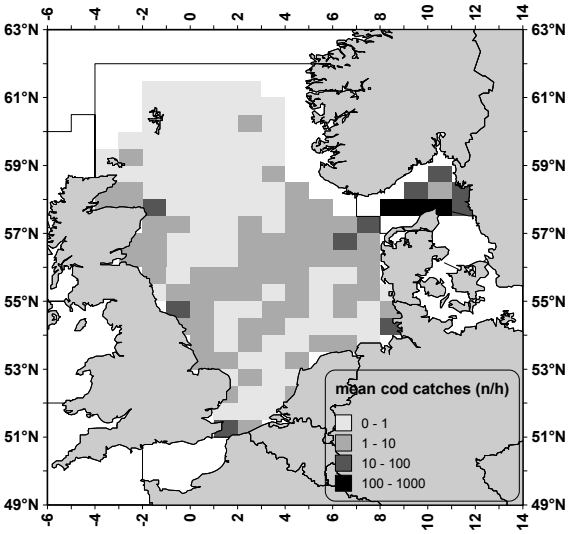
Mean cod distribution in the eastern Channel 1991-1995, quarter 4.

Fig. 3.2.2.2 Mean historic cod distribution patterns at age 2+ as derived from various surveys in 1983-1987 and 1991-1995 by quarter.

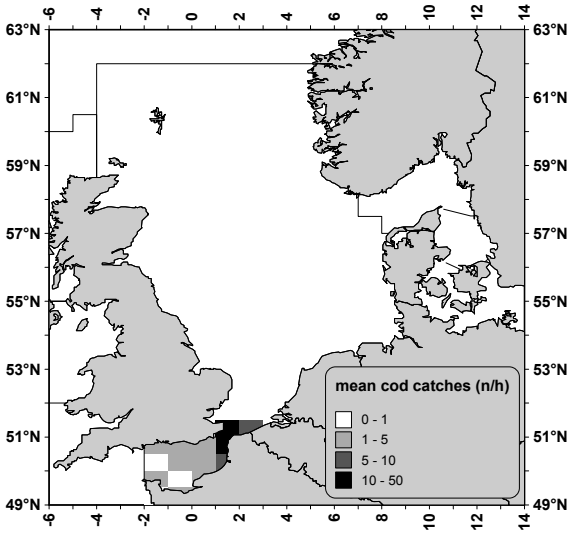
3.2.3 Recent cod distribution patterns at ages 1 and 2+

The analyses are based on the international bottom trawl surveys in the North Sea and the Skagerrak conducted during the first and third quarters in 2001-2005 and 2000-2004, respectively. Additional information is available from the French bottom trawl survey covering the eastern Channel conducted during the fourth quarter in 2000-2004. This survey is not used for the purpose of cod stock evaluation but may provide valuable insight into distribution patterns during the fourth quarter. In comparison with the historic situation, catch rates have declined throughout the North Sea in all surveys. The spatial distribution of catch rates has contracted over time and cod are located within restricted areas.

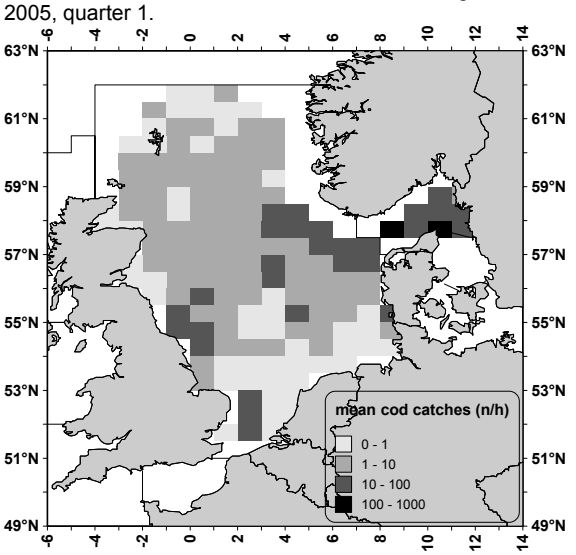
In the North Sea and Skagerrak, catch rates of 1 group cod in the IBTS first and third quarter surveys, that were previously high in the German Bight have been negligible (Fig. 3.2.3.1). The remaining concentrations of 1 group cod are located in the central North Sea, Skagerrak and along the east coast of Scotland and England and the Danish coast. In the eastern Channel, age group 1 cods were observed mostly at the southern end of the Dover Strait and along the French and British coasts in the eastern side of the area.



Mean cod distribution in the North Sea and Skagerrak 2001-2005, quarter 1.



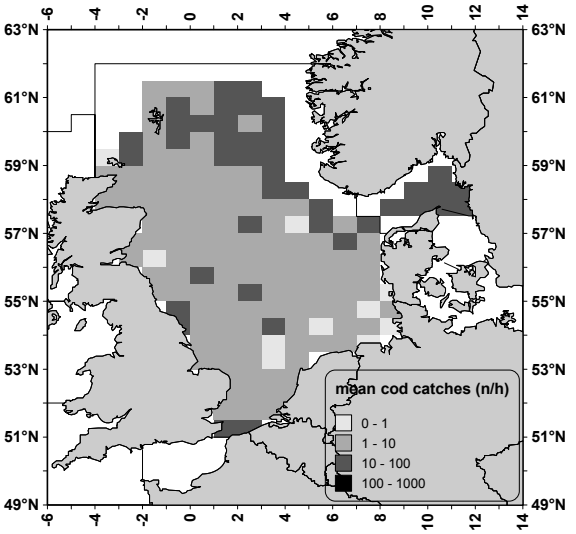
Mean cod distribution in the eastern Channel 2000-2004, quarter 4.



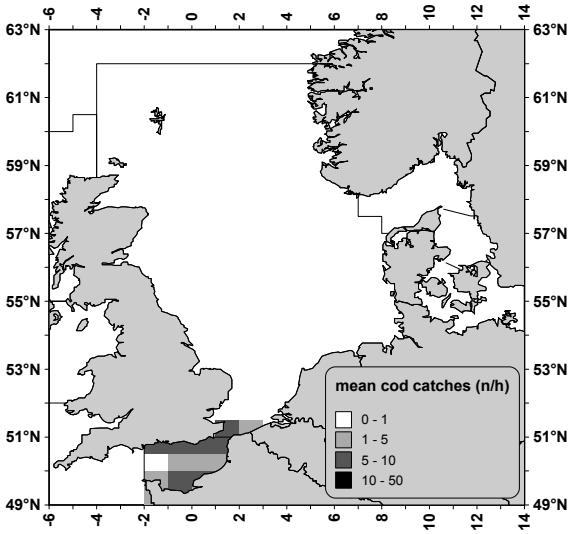
Mean cod distribution in the North Sea and Skagerrak 2000-2004, quarter 3.

Fig. 3.2.3.1 Mean recent cod distribution patterns at age 1 as derived from various surveys in 2000-2005 by quarter.

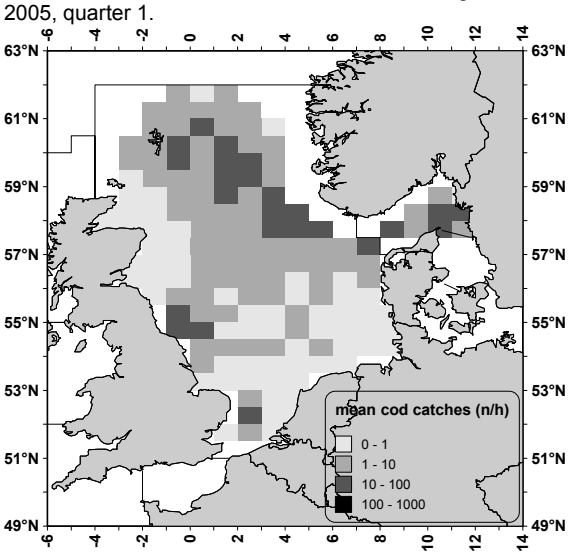
Recent first quarter catch rates of 2+ group cod have fallen markedly compared to historic levels. The remaining concentrations of cod are located on the north east coast of England, in the north-eastern North Sea and the southern Bight. A region of low catch rates extends across the southern North Sea and catch rates in the German Bight are now low. Third quarter catch rates have similar and even more dispersed distributions with low levels of 2+ cod in the German Bight and on the east coast of Scotland in the third quarter (Fig. 3.2.3.2). In the eastern Channel, age group 2+ cods distribution resembled that of Age group 1 although it expended further west along both British and French coasts.



Mean cod distribution in the North Sea and Skagerrak 2001-2005, quarter 1.



Mean cod distribution in the eastern Channel 2000-2004, quarter 4.



Mean cod distribution in the North Sea and Skagerrak 2000-2004, quarter 3.

Fig. 3.2.3.2 Mean recent cod distribution patterns at age 2+ as derived from various surveys in 2000-2005 by quarter.

3.3 Kattegat, Div. 3an

3.3.1 Recent distribution of the reported cod landings

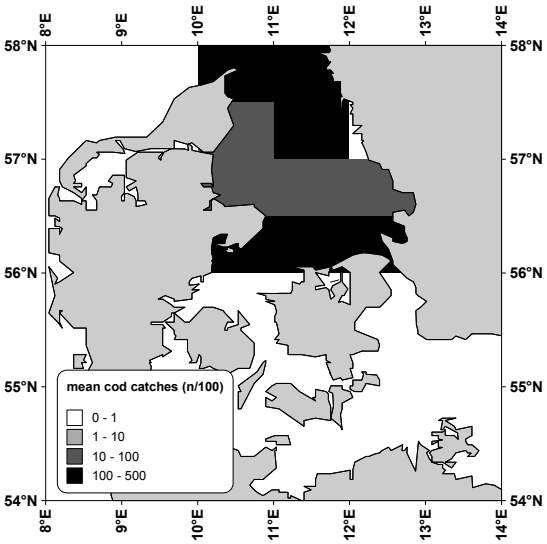
The recent landings in 2000-2004 of cod in Kattegatt were highest in south-eastern and in the northern part of the Kattegat during the first quarter (Fig. 3.1.1-3.1.3). The spatial distribution of landings is closely correlated with the areas of known spawning grounds. The official cod fishery in the Kattegat is also viewed as a fishery on spawning aggregations. No clear spatial pattern of cod landings was observed in the other quarters.

3.3.2 Historic cod distribution patterns at ages 1 and 2+

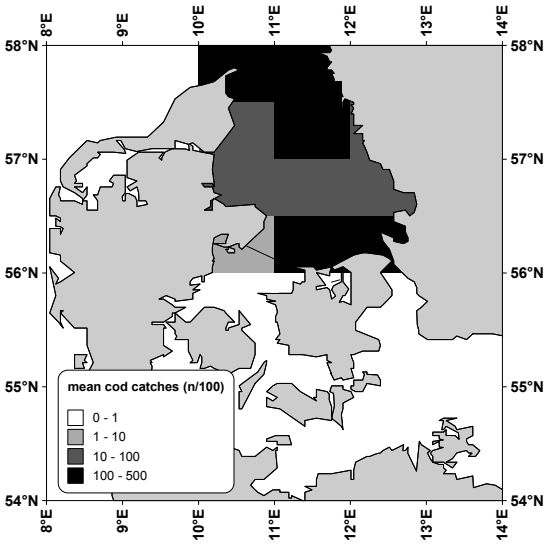
Distribution maps of cod distribution by age were produced based on the Swedish IBTS carried out in 1991-1994 during the first quarters (Fig. 3.3.2.1).

In the beginning of the 1990's, age 1 group of cod was mainly found in the north and in the south of the Kattegat and along the Swedish coast. In later seasons it can be found in the shallower areas in centre of the area. They occasionally extended westward and were observed along the Danish coast.

In 1991-1994, the distribution of cod age groups 2+ resembled that of younger ages, with a predominant occurrence in the northern and southern Kattegat. However it can be suggested that that older cod found in these areas are also cod from adjacent areas.



Mean cod age 1 distribution in the Kattegat 1991-1994, quarter 1.



Mean cod age 2+ distribution in the Kattegat 1991-1994, quarter 1.

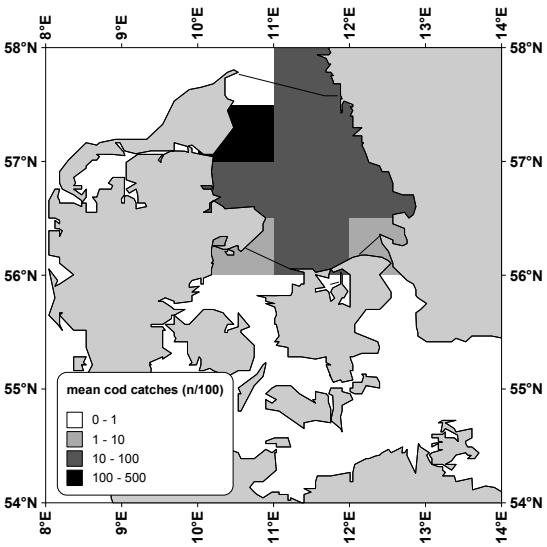
Fig. 3.3.2.1 Mean historic cod distribution patterns at ages 1 and 2+ in the Kattegat as derived from surveys in 1991-1994 during quarter 1.

3.3.3 Recent cod distribution patterns at ages 1 and 2+

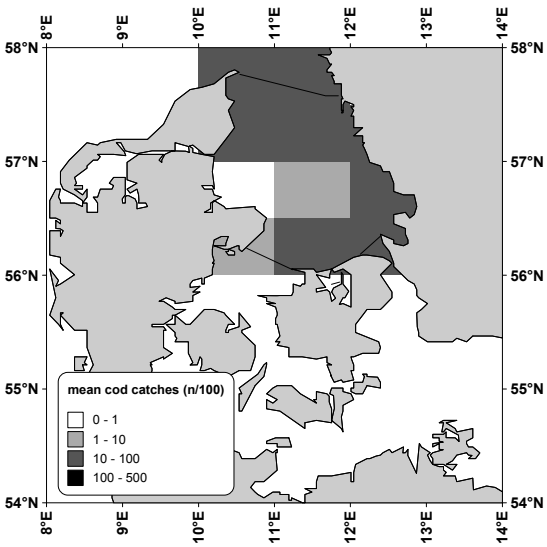
Distribution maps of the recent cod distribution by age were produced based on the Swedish IBTS carried out in 2001-2005 during the first quarters (Fig. 3.3.3.1). A similar spatial pattern of cod could be observed based on results from the Danish vessel Havfisken (not presented here). There is evidence that there are sub-populations of cod along the Swedish coast. Aggregations of cod were also found during this short term.

The distribution of age 1 cod shows no clear spatial pattern in this small area. It seems to be a shift in productivity of the stock in the last 5-6 years, with very low recruitment in the last three years**.**

Recently cod at age 2+ was mainly found in the northern part of the Kattegat. However these catches of cod in the northern Kattegatt are probably also North Sea and Skagerrak cod.



Mean cod age 1 distribution in the Kattegat 2001-2005, quarter 1.



Mean cod age 2+ distribution in the Kattegat 2001-2005, quarter 1.

Fig. 3.3.3.1 Mean recent cod distribution patterns at ages 1 and 2+ in the Kattegat as derived from surveys in 2001-2005 during quarter 1.

3.4 Eastern and western Baltic SD 22-24 and 25-32

3.4.1 Recent distribution of the reported cod landings

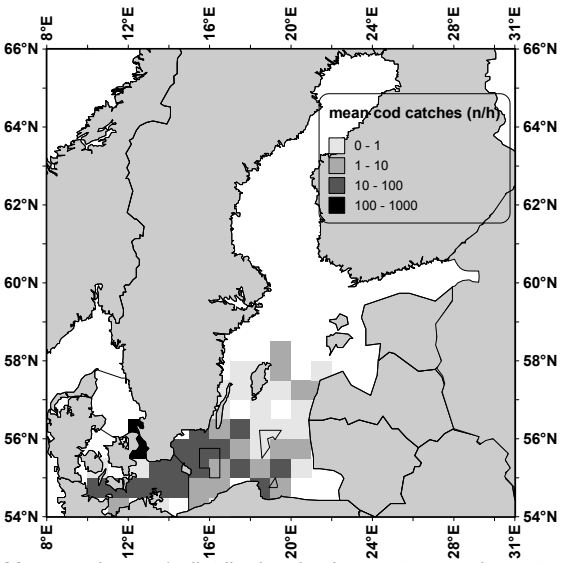
The recent distribution patterns of quarterly landings in 2000-2004 of cod in the Baltic Sea are shown in Figures 3.1.1-3.1.3. The landings of cod in the Western Baltic (SD 22-24) do not show any obvious spatial or seasonal patterns. Indeed on the scale at which they are presented, landings of cod from the Western Baltic appear rather uniform in distribution. It is difficult to draw any conclusions about the distribution of landings of cod from the Eastern Baltic (SD25-32) as no data were available from Estonia, Lithuania and the main fishing nation Poland. However, the spatial distribution of landings is closely correlated with the areas containing known spawning grounds. The absence of landings from the Northern Baltic reflects the fact that the salinity in this area is normally too low to support cod.

3.4.2 Historic cod distribution patterns at ages 1 and 2+

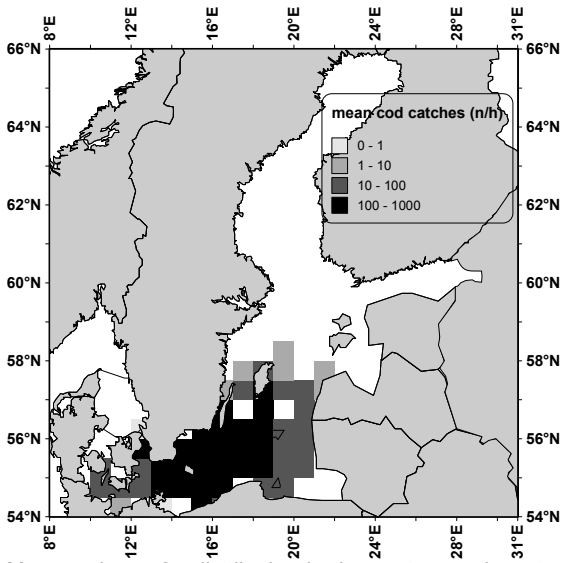
The distribution of cod in the Eastern Baltic is strongly influenced by environmental conditions. It should be noted that the abundance and environmental conditions were rather similar in the two periods considered here (1991-1994 and 2001-2005). The environmental conditions, in particular the oxygen concentration, are highly dependent upon inflows of water from the North Sea. Two major inflows have occurred during the last decades, in 1993 and 2003.

The maps of cod distribution by age in 1991-1994 were produced based on the international survey in the Baltic (BITS) during the first quarter. The catch at age is based on two different gears (TV3 520 and TV3 960) and also on vessels with different fishing powers. The data presented in the figures below are not corrected for the effects.

The limitations of the data and the requested spatial scale (statistical rectangles) mean that the resultant plots (Figure 3.4.2.1) are rather uninformative about the distribution of cod in the Baltic.



Mean cod age 1 distribution in the eastern and western Baltic 1991-1994, quarter 1.



Mean cod age 2+ distribution in the eastern and western Baltic 1991-1994, quarter 1.

Fig. 3.4.2.1 Mean historic cod distribution patterns at ages 1 and 2+ in the eastern and western Baltic as derived from surveys in 1991-1994 by quarter.

3.4.3 Recent cod distribution patterns at ages 1 and 2+

The maps of cod distribution by age in 2001-2005 were produced based on the international survey in the Baltic (BITS) during the first quarter. The catch at age is based on two different gears (TV3 520 and TV3 960) and also on vessels with different fishing powers. The data presented in the figures below are not corrected for the effects.

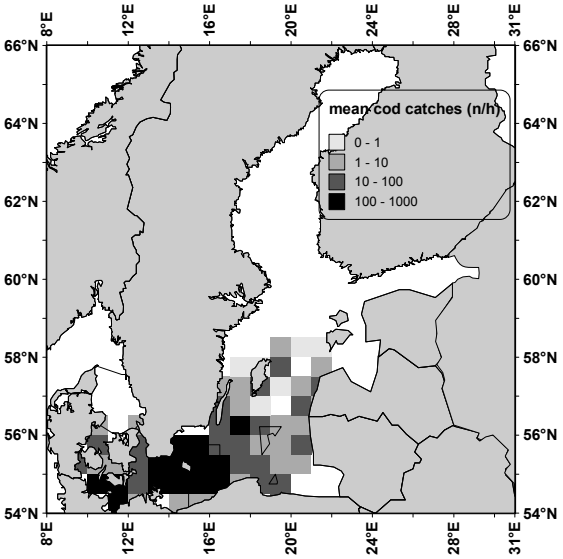
The limitations of the data and the requested spatial scale (statistical rectangles) mean that the resultant plots (Figure 3.4.3.1) are rather uninformative about the distribution of cod in the Baltic, although the saline inflow in 2003 appears to have resulted in both small and large cod being found in SD 28 (Fig. 3.4.3.1).

In response to an early request by the International Baltic Sea Fisheries Commission, ICES has recently presented extensive, detailed information on the distribution of cod in the Baltic in relation to possible closed areas. This is presented in ICES (2004b). In relation to changes in distribution of adult and age 1 cod, ICES (2004b) note the following:

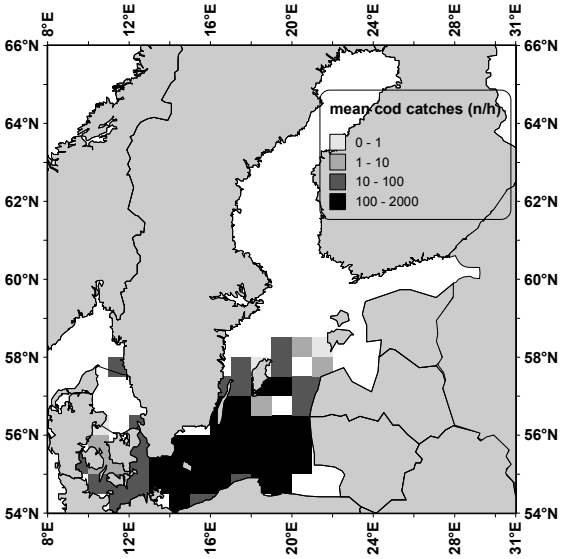
The abundance of spawning stock biomass in early- and mid-1980's was high in all Sub-divisions. At that time there were high abundances of spawning cod on the Gotland Deep and Gdansk Deep spawning grounds. The Bornhom Basin has remained an important spawning ground throughout the observation period, while Gotland Deep and Gdansk Deep lost their importance as spawning ground. The largest reduction of SSB has been observed in Sub-division 28, where the abundance of SSB has decreased to about 10 % of the maximum value observed in the time series.

The estimates of 1-group cod indicate the importance of Gotland Deep area as a nursery ground in early 1980's and show clearly, that in the 1990's the Gotland Deep did not have any significance for either successful reproduction, judged from the juvenile abundances encountered. However, there is also a clear indication of the importance of Sub-division 26 and its coastal areas as a nursery area for young cod.

ICES (2004b) also includes plots of distribution of catches of 1-group and spawning-age cod from a longer-time series of surveys which are corrected for difference in gear and fishing power.



Mean cod age 1 distribution in the eastern and western Baltic 2001-2005, quarter 1.



Mean cod age 2+ distribution in the eastern and western Baltic 2001-2005, quarter 1.

Fig. 3.4.3.1 Mean historic cod distribution patterns at ages 1 and 2+ in the eastern and western Baltic as derived from surveys in 2001-2005 by quarter.

3.5 West of Scotland Div. 6a

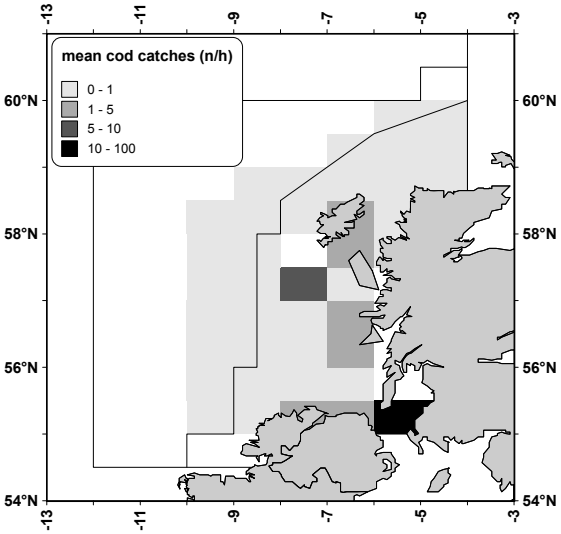
3.5.1 Recent distribution of the reported cod landings

The recent landings in 2000-2004 of cod west of Scotland were reported mainly from the northern part of the Division 6a along the shelf edge. However, cod are also landed from areas outside the cod recovery zone defined by the west of Scotland line running along the shelf edge (Fig. 3.1.1-3.1.3).

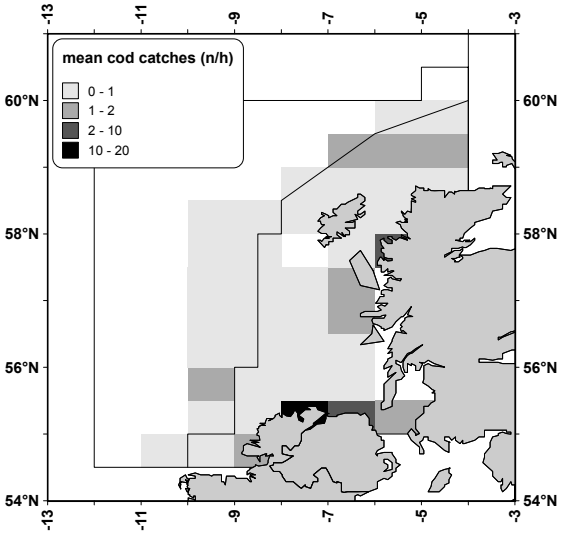
3.5.2 Historic cod distribution patterns at ages 1 and 2+

The historic cod distribution patterns are derived from the Scottish west coast groundfish surveys carried out in 1983-1987 and 1996-1999 in the first and fourth quarter, respectively. During the first quarters in 1983-1987, the highest indices of cod at age 1 were found in the Clyde area. They were also relatively high for ICES rectangles along at the north coast of Ireland and west of Scotland between 56°N and 58.5°N. Very small concentrations were recorded west of the west of Scotland line. The consistent pattern of zero abundance across ages during the fourth quarters in 1996-1999 suggests a series heavily influenced by a small number of non-zero catches. There are a considerable number of rectangles where no or very low fish at this age were recorded in any year (Fig. 3.5.2.1).

Cod at age 2+ were generally more abundant in the survey catches and more widely distributed west of Scotland, also outside the west of Scotland line during the first quarters in 1983-1987. Values are relatively high in a region between 56°N and 57.5°N. Later during the fall season in 1996-1999, the older fish were mainly distributed along the northern shelf edge both in and outside the cod recovery zone. There were rectangles of zero catch in the central area consistent with the pattern for age 1 fish (Fig. 3.5.2.2).

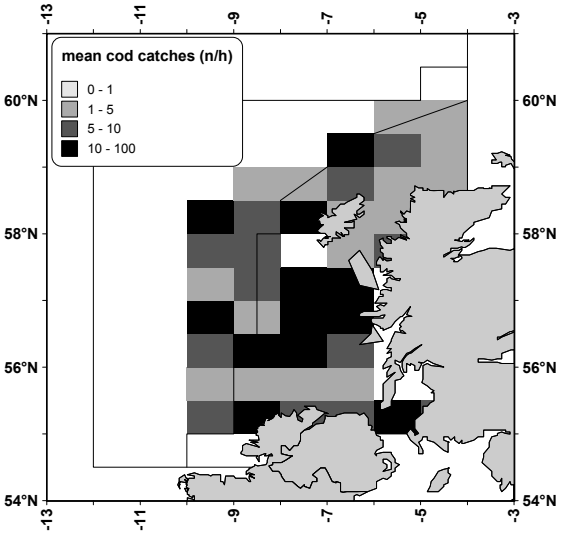


Mean cod age 1 distribution west of Scotland 1983-1987, quarter 1.

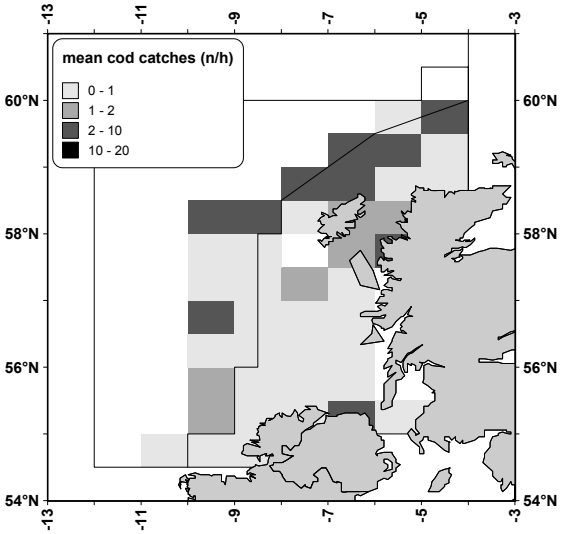


Mean cod age 1 distribution west of Scotland 1996-1999, quarter 4.

Fig. 3.5.2.1 Mean historic cod distribution patterns at age 1 as derived from surveys in 1883-1987 and 1996-1999 by quarter.



Mean cod ages 2+ distribution west of Scotland 1983-1987, quarter 1.



Mean cod ages 2+ distribution west of Scotland 1996-1999, quarter 4.

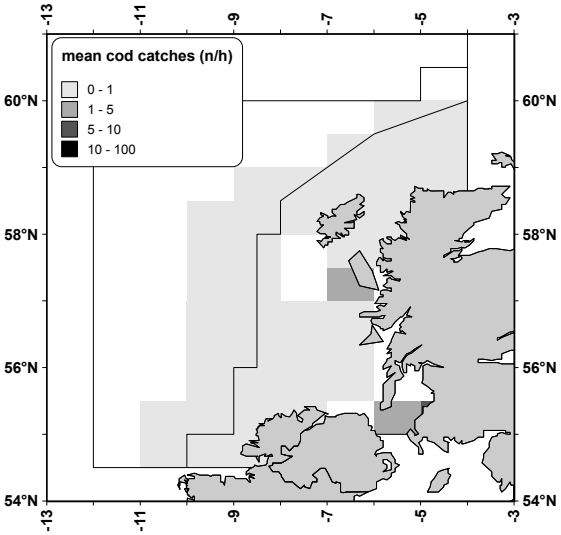
Fig. 3.5.2.2 Mean historic cod distribution patterns at ages 2+ as derived from surveys in 1983-1987 and 1996-1999 by quarter.

3.5.3 Recent cod distribution patterns at ages 1 and 2+

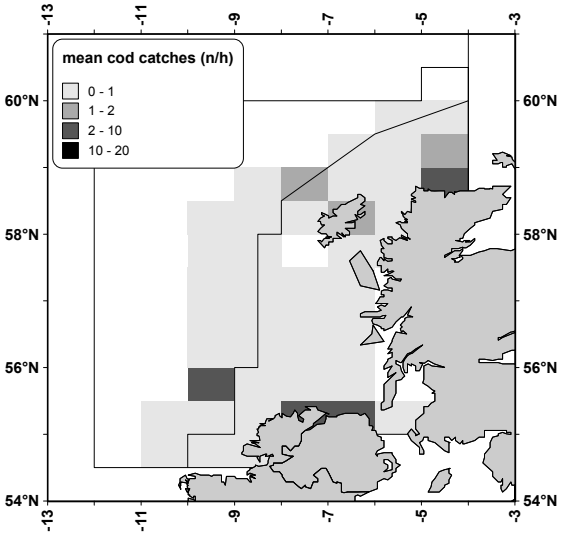
The recent cod distribution patterns are derived from the Scottish west coast groundfish surveys carried out in 2001-2005 and 2000-2004 in the first and fourth quarter, respectively.

During the first quarters of 2001-2005, highest density indices of cod at age 1 are in the Clyde region and in the South Minch/Inner Hebrides area. However, the recent abundance of juvenile cod appears to be reduced compared to the 1983-1987 period and very low in all areas in Div. 6. During the fourth quarter, the distribution of the low indices appears more scattered with highest values at the north coast of Ireland (Fig. 3.5.3.1).

The mean abundance indices of cod at ages 2+ by rectangle during 2001-2005 in quarter 1 are generally lower compared with the historic values. The higher values seen between 56°N and 57.5°N are mostly absent. During the fall season, the recent patterns indicate a more northerly distribution along the shelf edge (Fig. 3.5.3.2). Older fish were found both inside and outside the cod recovery zone.

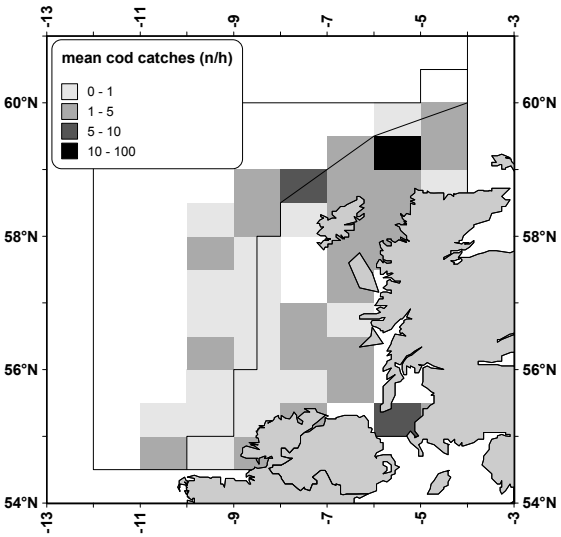


Mean cod age 1 distribution west of Scotland 2001-2005, quarter 1.

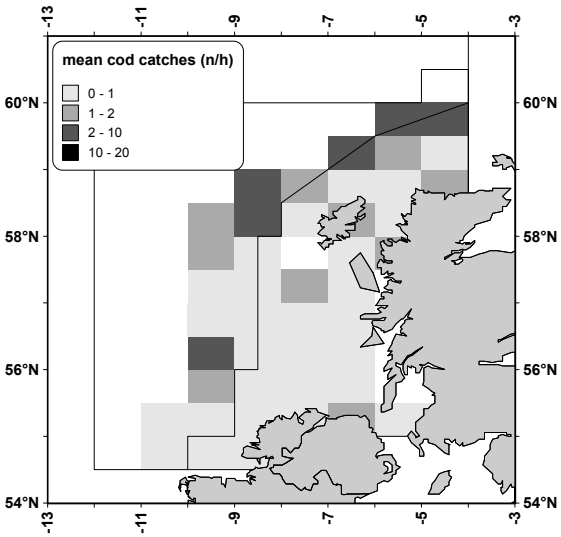


Mean cod age 1 distribution west of Scotland 2000-2004, quarter 4.

Fig. 3.5.3.1 Mean recent cod distribution patterns at age1 as derived from surveys in 2001-2005 and 2000-2004 by quarter.



Mean cod ages 2+ distribution west of Scotland 2001-2005, quarter 1.



Mean cod ages 2+ distribution west of Scotland 2000-2004, quarter 4.

Fig. 3.5.3.2 Mean recent cod distribution patterns at ages 2+ as derived from surveys in 2001-2005 and 2000-2004 by quarter.

3.6 Irish Sea Div. 7a

3.6.1 Recent distribution of the reported cod landings

Plots of the distribution of reported cod landings in the Irish Sea are given in Figures 3.1.1-3.1.3. Data were made available by all countries contributing significantly to the total cod landings in the Irish Sea. In all quarters reported cod landings are concentrated in the western Irish Sea and North Channel.

3.6.2 Historic cod distribution patterns

No data were available to evaluate the survey distribution of cod prior to 1992.

3.6.3 Recent cod distribution patterns

Age-structured indices of abundance of cod in the Irish Sea are available (ICES 2005a) from the following surveys:

- UK(Northern Ireland) groundfish surveys: March 1992-2005 and October 1992-2004.
- UK(Scotland) groundfish surveys: March 1996-2005 (9 stations in 1996; 15-17 stations in 1997-2005) and autumn 1997-2004.
- Irish groundfish survey, autumn 2003 and 2004
- UK(Northern Ireland) MIK net surveys of pelagic-stage 0-group cod, western Irish Sea 1994 – 2004
- UK(England & Wales) beam trawl survey, 0-1 gp cod, 1988-2004
- UK Fishery Science Partnership pelagic trawl survey, western Irish Sea, spring 2004 and 2005 (presented as Working Document 16 to the 2005 WGNSDS)
- UK Fishery Science Partnership otter trawl survey, eastern Irish Sea, spring 2005 (limited data for 2004 are also presented in Working Document 16 to ICES 2005a).

Irish Sea data from the discontinued Irish Sea Celtic Sea Groundfish Survey (Ireland, 1997-2002) were provided to SGRST (Cod Recovery). However, this survey is not used in the assessment and does not include recent years. Data from the UK (Northern Ireland) Groundfish Surveys are used in the assessment and were obtained by SGRST from the draft 2005 WGNSDS Report.

Unlike the North Sea IBTS surveys most surveys in Western waters are not stratified by rectangle but by bottom type and depth. Catches at stations can therefore only be considered representative of the station (and strata), but not the rectangle. Producing distribution plots by rectangle is considered inconsistent with the survey design and interpretation.

Distribution maps for cod in the UK (Northern Ireland) groundfish surveys (March: 1992-2005 and October: 1992-2004), showing catch rates (kg per 3-mile tow) for cod below and above the minimum landing size (MLS) of 35 cm, were evaluated by the group. The March survey shows inter-annual changes in the relative abundance of cod > MLS in the eastern and western Irish Sea (e.g. 1993 and 2003), and occasional large individual catches (e.g. March 2002). Recently, cod > MLS are relatively more abundant at the western Irish Sea survey stations than at the eastern Irish Sea. However, there is no evidence of a marked change in the spatial distribution of cod over the time series of the survey data.

3.7 Celtic Sea Div. 7e-k

3.7.1 Recent distribution of the reported cod landings

Plots of the distribution of reported cod landings in the Irish Sea are given in Figures 3.1.1-3.1.3. Data were made available by all countries contributing significantly to the total cod landings in the Irish Sea. The presented cod distributions in the Celtic Sea indicate that for quarters 2, 3 and 4, cod landings are mostly evenly spread all over the Celtic Sea. The 3 rectangles closed at the start of 2005 were based on landings from recent years and cover parts of the areas with the highest cod landings in the first quarter. It should also be noted that other high cod landings are observed along the southern Irish coast up to about 50 miles offshore.

3.7.2 Historic cod distribution patterns

Three surveys, carried out in various parts of the cod assessment area VIIe-k were available for evaluation on spatial distribution of cod in the Celtic Sea. The French EVHOE survey carried out in quarter 4 (1997-2004), the UK(E&W) Western Channel Groundfish Survey (1992-2003), and Ireland's Irish Sea - Celtic Sea Groundfish Survey in VIIg carried out in October-November, 1997-2002. The Irish survey is not used in the assessment and does not include recent years.

Neither the French nor the UK surveys are specifically designed to catch cod. Therefore the numbers of cod caught are very low and conclusions on spatial distribution from these surveys are consequently inappropriate. SGRST concluded that distribution plots from these surveys would not be representative and therefore did not provide them.

In the absence of an evaluation of spatial distributions from survey data, an evaluation of commercial CPUE by rectangle could give some indication of the spatial distribution of cod in the Celtic Sea.

3.7.3 Recent cod distribution patterns

SGRST decided for the reasons mentioned in section 3.7.2 that the available survey data were also not appropriate to provide reliable distribution plots for the recent cod distribution patterns in the Celtic Sea.

It should be noted that new surveys have been designed to have higher catchability for cod. However these surveys (an Irish Groundfish survey and a 4th quarter UK(E&W) Groundfish survey) have only 2 years of data and therefore are not yet able to provide conclusive distribution patterns of age-classes.

4. Review of the current system for the management of fishing effort in the context of the cod recovery plan (Council Regulation (EC) 27/2005, Annex IVa)

As described in the introductory notes (chapter 2.2), the work of the group was significantly affected by incomplete or inconsistent data provisions and the compilation and evaluation of data related to ToRs 2a and 2b will be continued and concluded both inter-sessionally and during a second group meeting scheduled for 19-21 September 2005 at the JRC, Ispra, Italy. The report of that second meeting will be delivered by end of September as Appendix 4 to this report.

5. Evaluation of systems feasible for management of fishing effort in the context a multi-annual management plan for the cod stocks in the Baltic Sea.

The Group was asked to address the term of reference 3a and 3b given above in section 2.1. This is a very broad and complex question and to address it properly would require expertise in a range of different areas, particularly control and enforcement. The expertise represented in the group was limited to scientists with some knowledge of the Baltic cod stocks and their fisheries. In addition the group had no data to hand to quantify current fishing practices or fishing capacity in the Baltic. As a result the group was limited in the extent to which it was able to address this term of reference. The approach taken was to discuss the characteristics of the cod fisheries in the Baltic in relation to the features of possible effort management schemes, and to try and draw on experience with practical effects of such schemes as discussed for other stocks considered by the current group. As such this section should not be considered as a scientific evaluation, but rather as a discussion drawing on information which is largely anecdotal.

For stocks/fisheries which are currently covered by days at sea schemes under Annex IVa, the regulations were introduced by the management authorities and the basis for the establishing e.g. the days-at-sea allocations is not clear. However, the basic process appears to have involved the initial assumption or estimation of a baseline value of monthly fishing effort by vessels in the various vessel/gear categories prosecuting the relevant fishery. Each of these vessel categories was then assigned a limited number of fishing days per month which was lower than the baseline value. Usually, there have also been various derogations which apply based e.g. on catch composition or

area considerations, and there has also been scope for adjusting the monthly effort allocations on an annual basis. To provide scientific advice on such a scheme would require information on current fishing practices and on the relationships between capacity, effort and fishing mortality in the fleets involved in the fishery. Such hard information is not available for the Baltic cod fisheries. However, there are a number of features of the Baltic and its fisheries which may have practical implications for such a scheme, and it may be useful to give some information on these.

A key feature of the fisheries on Baltic cod is their relative simplicity. There are few target species with little scope for switching to different target species. In addition, relatively few gears are in use, with most cod caught by trawlers and gillnetters, followed by a limited amount of long-lining. With regard to demersal species, cod is the only target species. In the eastern Baltic the only bycatch species is flounder but this of such low value that the catch is frequently discarded. Other flatfish species occur at low densities in the Western Baltic, but again, cod is the main target species. Trawlers have the possibility to switch to targetting pelagic species (herring and sprat) when market conditions make it worthwhile to do so. One response of introducing days-at-sea regulations which has been observed in other areas (see Appendix 4) is a switch in gears so that vessels target fisheries which have higher days-at-sea allocations, e.g. the switch from >100mm mesh to 80-90mm mesh observed in demersal trawl fisheries in the North Sea. Given the relative lack of other fishing opportunities, such switches would perhaps be less likely if a similar scheme were introduced in the Baltic. Another consequence of the single species nature of the fishery is that vessels sometimes have quite substantial sailing times in order to reach productive fishing grounds. This is particularly true when boats are exploiting pre-spawning aggregations in the Bornholm area as reaching this areas from the home port involves sailing times in excess of 24 hours for vessels from some national fleets.

TACs are the main management measure currently in place for the Baltic cod fisheries. There has been substantial non-compliance with these in the Eastern Baltic, with recent landings estimated to be at least 40% in excess of reported totals (ICES 2005b). Such non-compliance will remain likely to occur in the absence of adequate enforcement, or if the available quotas or effort allocations are not sufficient to make fishing profitable. Some decommissioning of vessels has recently occurred, particularly among new EU member states where there is substantial demand amongst fishers for further decommissioning. If this decommissioning achieves reductions in fleet capacity then it should help address this problem.

In fisheries management in general, controls on inputs (such as fishing effort) are regarded as being more effective than controls on output (e.g. TACs). Given the extensive non-compliance with TACs in the Baltic cod fishery, a scheme based on effort limitation, rather than catch limitation, would have the potential to be much more effective in this case. The lack of information on such things as current fishing practices, and the relationship between capacity and fishing effort means that this group is not able to provide any data to guide the introduction of such a scheme. Despite this, it is still possible to outline a number of features that an effort control scheme might have in this context. The absence of hard information on effort, capacity, efficiency etc. means that an adaptive approach to setting effort allocations would be appropriate. This might involve setting an initial ceiling on fleet effort, along with rules to reduce this over time until the required reduction in fishing mortality was achieved. It would also be desirable for the scheme to involve clearly stated objectives, and extensive dialogue with stakeholders to ensure that the objectives were understood and accepted.

In relation to the potential use of closed areas and seasons within an effort management scheme, ICES (2004b) summarise information on the seasonal and spatial distribution of fisheries in the Eastern Baltic. They note that the peak catch rates have historically corresponded with the pre-spawning period. This suggests that the spawning areas are also relatively important fishing grounds. The closed areas introduced at the start of 2005 correspond to spawning areas, although the precise location of spawning and pre-spawning aggregations may vary in response to environmental conditions. Prevention of fishing on these aggregations would not reduce fishing effort, but might result in a reduction in overall fishing mortality through reducing catchability.

One possible management measure which could have application in the Baltic cod fishery might be a maximum landing size. The rationale to this is that under recent environmental conditions, recruitment to the Eastern Baltic cod stock has been limited by egg survival. This might be improved by having a higher proportion of large females in the spawning stock as they produce larger, more buoyant eggs which may have a higher probability of survival. It is possible to conceive of a grid-based system for use in trawls which would release larger individuals, although of course such a measure would also

require an overall reduction in fishing mortality in order to ensure improved probability of survival to sufficiently large sizes.

6. References

ICES 2004a. Report of the ICES Advisory Committee on Fishery Management and Advisory Committee on Ecosystems, 2004. ICES Advice. Volume 1, Number 2. 1544 pp.

ICES 2004b. Report of the Study Group on Closed Spawning Areas of Eastern Baltic Cod. ICES CM 2004/ACFM:17, Ref. H, 98 pp.

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 Baltic Fisheries Assessment Working Group. ICES CM 2005/ACFM:19, Ref. H, 595 pp.

Sangster, G.I. and M. Breen 1998. Gear performance and catch comparison trials between a single trawl and a twin rigged gear. Fisheries Research 36, 15–26

Appendix 1 List of participants

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Appendix 2 List of working documents

WD 01 Darby, C. Designing closed areas with the objective of reducing North Sea cod fishing mortality.

WD 02 Darby, C. Bullet points on closed area management of the North Sea cod.

WD 03 Williamsson, K. A note on the reduction in partial fishing mortaliy from the UK fleets in the North Sea.

WD 04 Williamsson, K. Cod recovery plan; analysis of fishing effort by UK vessels 2001 to 2004

WD 05 Metcalfe, J.D., C.J. Fox, D. A. Righton, P. J. Wright, J. Casey. A review of the biological evidence for cod stock sub-structure in the North Sea.

WD 06 Danish Fishermen's Association. Proposal for an effort management scheme in the Kattegat

WD 07 Graham, Norman. Review of Gear Classification, their relation with mesh size and other issues

WD 08 Holmes, S.J. and C. L. Needle. Survey-based analysis of mortality and other population trends in different areas of the North Sea.

WD 09 EU Commission working paper. Evaluation report: Cod recovery verification programme 2004.

Appendix 3 Format of data bases collected by the group.

1. National logbook data 2000-2004 by following table fields (columns)

1. Country, code: Annex 2
2. Year, format: 4 digits like 2000
3. Quarter, format: 1 digit like 1
4. Area, Annex 5
5. Gear, code: Annex 3
6. Mesh size range, code: Annex 4
7. Rectangle, format: 4 digits like 37G3

8.-90. Aggregated landings (sum, kg) by species alpha-3 code, format: numeric long integer, Annex 6

2. Full time series on surveys by stock

standardised catch at age by station with the following table fields

1. Stock, format: text in accordance to Annex 1
2. Vessel, format: text 10 characters
3. Date, format: numeric long integer YYYYMMDD
4. Station, format: numeric long integer
5. rectangle, format: 4 digits like 37G3
6. longitude, format: numeric, 2 decimals like -5.55 for West (negative) and 3.40 for East (positive)
7. latitude, format: numeric, 2 decimals like 55.55 for North
8. Age 1, format: numeric long integer
9. Age 2, format: numeric long integer
10. Age 3, format: numeric long integer
11. Age 4, format: numeric long integer
12. Age 5, format: numeric long integer
13. Age 6+, format: numeric long integer

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

STECF Sub-group SGRST

Evaluation of the Cod Recovery Plan

Appendix 4

Joint Research Centre
Ispra, Italy, 19-21 September

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1. Summary

The various cod recovery plans in place include measures relating to particular areas and fishing effort allocations for specific fleets. The SGRST considered a number of specific points in relation to the areas concerned, and also summarised recent trends in nominal effort by relevant fleets, and catch composition data by these fleets to investigate the impact of the cod recovery measures on catches of cod and other species. The summary below details the SGRST's specific findings in relation to the definition of management areas, and also of recent trends in nominal effort and catch composition by fleet.

Definition of management areas in relation to cod recovery regulations

- The cod stock in the North Sea, Skagerrak and Eastern Channel is comprised of a number of more or less reproductively isolated component populations or sub-stocks. However, it is currently not practical to provide scientific advice on the state of the stock based on the assessment of component populations, primarily because of the difficulties involved in separating catches, especially during periods when the populations are mixed. Therefore STECF-SGRST does not recommend any changes to the area within which the North Sea stock is defined and assessed.
- Separate effort regulations should be specified for each of the TAC management areas. In order to rebuild the cod stocks and provide precautionary management for all potential North Sea sub-stocks, fishing mortality should be reduced at all ages in all areas. This requires a balanced reduction in effort in all fisheries that catch, land or discard cod throughout the North Sea.
- Cod taken in Division VIId (Eastern Channel) should be included with the North Sea cod TAC.
- The cod stock west of Scotland (Division VIa) is comprised of fish from a number of more or less reproductively isolated component populations including one to the north of Scotland straddling Divisions VIa and IVa. However, it is not currently practical to provide scientific advice based on the assessment of component populations primarily because of the difficulties involved in separating catches, especially during periods when the populations are mixed. Therefore STECF-SGRST does not recommend any changes to the area within which the stock west of Scotland is defined and assessed.
- Contingent on the findings of a more detailed analysis of survey locations, an adjustment of the boundary of the cod recovery zone in Division VIa (West of Scotland) to the west of its current position, to follow more closely the 200m contour south of 58ºN, should be considered.
- Given the existence of small local populations, the cod stock in the Kattegat should be kept as a specific management unit. Furthermore, incorporating the Kattegat cod stock in either the Baltic or the North Sea/Skagerrak management unit could be dangerous for the local spawning populations because of the high risk of effort displacement into the area.
- On the basis of current knowledge there seems to be a sound basis for treating cod in the Eastern and Western Baltic as two separate stocks.
- The area within which the Irish Sea cod stock is defined and assessed should be maintained as it is currently delineated.

Recent trends in nominal effort by fleet (gear) category

- In the North Sea and Skagerrak, the total nominal effort for all demersal gears expressed in Kwdays decreased between 2000 and 2004 by 21% and by 15 % between 2002 and 2004. The demersal trawl≥100 mm showed the greatest decline by 43% since 2000 and by 35% since 2002, while the demersal trawls 70-99mm category increased by 54% and 12% over the same periods. Between 2000 and 2004 and 2002 and 2004, nominal effort of beam trawls≥80 mm declined by 25% and 14%. Trends in nominal effort of the different gear categories appear to be only partly connected to the introduction of days at sea regulations in 2003. The increase in effort by vessels using demersal trawls with small mesh size 70-99mm and the simultaneous decrease in the demersal trawl ≥100mm have resulted in an apparent overall reduction of the mesh size used in demersal fisheries. SGRST notes that the achieved reductions in fishing effort coincide with a reduction in estimated fishing mortality but that the

reduction in fishing mortality is insufficient to be considered consistent with the cod recovery plan.

- In the Eastern Channel, total nominal effort increased between 2000 and 2004 by 22% and decreased between 2002 and 2004 by 3%. Vessels using demersal trawls with small mesh size 70-99mm deployed the main fishing effort which increased by 14% between 2000 and 2004 and decreased by 3% during 2002-2004. Such continuous trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan.
- In the Kattegat, total nominal effort has decreased by 27% during the period 2000 to 2004. The decrease between 2002 and 2004 was 16%. Effort of demersal gears>100 mm decreased by 79% and demersal gears 70-99 mm decreased by 22% between 2000 and 2004. The observed trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan.
- Effort data reported for the west of Scotland were for the whole of Division VIa. It was therefore not possible for the SGRST to evaluate changes in nominal effort exerted by regulated gears within the cod recovery zone.
- In the Irish Sea, there has been an overall decline of 19% from 2000-2004 in the effort exerted by vessels using 70-99mm meshes. However, there is some evidence since 2002 of a transfer of effort from trawls using ≥100 mm mesh to 70-99mm mesh. Such trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan.

Catch compositions by fleet category

- To estimate the catch composition of a fleet requires information on both landings and discards by that fleet. 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.
- Despite the relatively low level of sampling, the estimated catch compositions of the regulated gears including discards in the North Sea and Skagerrak appear fairly consistent over the years 2003 and 2004 and with the ICES WGNSSK assessment inputs.
- The estimated catch compositions do not include unallocated catches which may be substantial in some fleets according to Commission inspection reports.
- In the North Sea and Skagerrak, cod are mainly caught by demersal trawls ≥100mm (42%). Cod catches of beam ≥80mm, demersal trawls 70-99mm and static gears are lower and in the same order of magnitude (15-20 %).
- In the North Sea and Skagerrak the discards rates in relation to the estimated total catch of cod in 2004, were 10% for beam trawls≥80 mm, 6% for demersal trawls ≥100mm and 5% for demersal trawls 70-99 mm.
- In the North Sea and Skagerrak, estimated discard amounts are highest for whiting and plaice while haddock discards appear to have decreased recently.
- In the Kattegat, the majority of cod and plaice were caught in the 70-99mm category, even though the small fleet using demersal trawl ≥100mm also target cod and plaice. In 2004, the estimated discard rates by the 70-99mm category for cod, plaice, sole and Nephrops were respectively 42%, 65%, 16% and 35% in weight.
- West of Scotland (Division VIa) cod are caught mainly by demersal trawls. In 2004, vessels in the ≥100mm category accounted for 83% of the catch by weight; a further 15% of the catch was taken by demersal trawls 70-99mm. Discard rates for cod in the 70-99mm category of 38% were higher than in the ≥100mm category (12%), but the total quantities of fish discarded and numbers at age discarded by these two gear categories were comparable. Landings data

reported for west of Scotland were for the whole of Division VIa. It was therefore not possible for SGRST to evaluate catch composition by all regulated gears within the cod recovery zone.

Ways to improve the conservation of cod, consistent with the Cod Recovery Plan (Regulation 423/2004) and to improve the access of fishing vessels to other, underexploited resources:

- Implications associated with the use of closed area management of the North Sea cod are given.
- Potential management actions were discussed with stakeholder representatives without definitive proposals.

STECF recommends to

- hold a meeting once a year during the second half to review recent gear specific catch compositions including discards and trends in fishing effort. Joint Research Centre should assist in the required data compilation, in a format to be agreed in advance by participants.

2. Introduction

The STECF Sub-group SGRST on Evaluation of the Cod Recovery Plan met at the European Joint Reseach Centre in Ispra, Italy, during 19-21 September 2005 for the second round to deal with outstanding terms of reference 2a and 2b (TOR) listed in the following section 2.1. Such outstanding ToRs were left open from the first meeting of the Sub-group, which dealt with and completed the ToRs 1a, 1b, 3a and 3b, providing information on the geographical distribution patterns of the 4 cod stocks managed under the cod recovery plan and 3 additional cod stocks, as well as providing comments on the management of the cod stocks in the Western and Eastern Baltic. The report of the first meeting is downloadable from the Sub-group's internet site http://stecf.jrc.cec.eu.int/event.php?id=23.

The review of the current system for the management of fishing effort in the context of the cod recovery plan, essentially ToRs 2a, and 2b, could not be completed at the first meeting of the Sub-group, mainly because of insufficient or inconsistent data submissions for various reasons. This report reflects the Sub-group's analyses and conclusions regarding ToRs 2a and 2b and is presented as Appendix 4 to the report of the first meeting.

The list of participants is given in Appendix 1 to this report.

Working documents (WD) reviewed during both meetings are listed in Appendix 2 of the first meeting's report.

Two representatives from stakeholder organisations attended the concluding plenary session of the meeting on 21 September 9.00-12 hours. They commented on the terms of reference, and the conclusions emerging form the SGRST's discussions.

During both its meetings, the 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=36).

2.1 Terms of Reference

The SGRST on the review of the cod recovery plan will meet during 13-17 June at the Joint Research Centre in Ispra (Italy)

(1) STECF is requested to identify the distribution by age, season and ICES rectangle of cod and to identify the location and season of the most important fishable concentrations of cod in the North Sea, Skagerrak, eastern Channel, Kattegat, Baltic Sea, west of Scotland, Celtic Sea and the Irish Sea, and taking due account of estimated discards and other unallocated catches, to quantify the proportion of cod caught in these areas and/or seasons. The analysis should present data on:

(a) a recent short period, reflecting present conditions;

(b) a sample of years when cod was within safe biological limits to indicate its distribution at that time.

(2) STECF is requested to review the current system for the management of fishing effort in the context of the cod recovery plan (Annex IVa of Regulation 27/2005) and to :

a. review the definition of the area defined in Point (2), the gear categories defined in Point 4, and the associated days at sea defined in Point 6 and associated conditions;

b. recommend ways to improve the conservation of cod, consistent with the Cod Recovery Plan (Regulation 423/2004) and to improve the access of fishing vessels to other, underexploited resources.

(3) STECF/ICES is requested to evaluate systems feasible for management of fishing effort in the context a multi-annual management plan for the cod stocks in the Baltic Sea. The evaluation should include but not necessary be limited to:

a. systems similar to the days at sea system adopted in the TAC and quota regulation (Annex IVa of Regulation 27/2005);

b. systems based on closed seasons and/or areas.

In the foregoing evaluations, STECF is requested to take account of unallocated catches and of fish catches that are discarded as well as those that are landed.

3. Review of the current system for the management of fishing effort in the context of the cod recovery plan (Council Regulation (EC) 27/2005, Annex IVa)

3.1 Definition of the areas

The SGRST reviewed documents contributing to the question of whether the area definitions specified by the days-at-sea regulations are consistent with the biological cod stock units and their distribution areas.

3.1.1 Cod in the North Sea, Skagerrak and Eastern Channel

WD No. 5: Metcalfe. J.D., C.J. Fox, D.A. Righton, P.J. Wright, J, Casey 2005. A review of the biological evidence for cod stock sub-structure in the North Sea. Working Document to the STECF-SGRST sub-group meeting “cod recovery plan” Ispra, 13 – 17 June 2005

Cod in the North Sea (ICES sub-area IV, divisions a, b & c) and eastern English Channel (ICES division VIId) and Skagerrak (ICES division III) have been assessed as one stock at the ICES North Sea and Skagerrak working group since 1996. Since 2003, cod fisheries in the North Sea have been subject to a recovery plan that does not include any spatial structure. However, there is increasing evidence that cod populations are spatially and genetically structured at a finer scale than the current assessment and management units (Metcalfe *et al.*, 2005). Stock substructure may be important for the overall dynamics of the species, its genetic diversity and recovery potential may be reduced if management does not take account of these effects.

Cod populations in other areas of their geographic range (i.e. in the North Atlantic but outside the North Sea) exhibit a variety of overlapping population types each of which can be defined according to the degree of migration and philopatry (site fidelity). They include ‘sedentary residents’ that exhibit year round site fidelity, ‘accurate homers’ that return to spawn in a specific area, ‘inaccurate homers’ that home to a much broader area around the original release site in subsequent years, and ‘dispersers’ that move and spawn in a haphazard pattern within large geographical areas.

For cod in the North Sea, Metcalfe *et al.* (2005) considered distribution data from scientific surveys of eggs, larvae, and young fish; recent genetic studies of cod using micro-satellite DNA; analysis of conventional tagging experiments and; phenotypic information – principally age-at-length data.

While cod are widely distributed across the North Sea, scientific survey data indicate that there are concentrations of distribution in the Southern Bight, off Flambrough, in the German Bight, in the Moray Firth and in the north-eastern North Sea. As overall stock abundance fluctuates, these groupings appear to be more or less discrete. They established that the decline in the North Sea stock over the last 10-15 years is associated with an apparent greater reduction in the relative densities of 3+ cod in

the southern and central North Sea and German Bight. This may be an indication that as the stock has declined, their distribution has contracted into smaller areas. In the last three years, the highest densities of 3+ cod have been observed in the deeper waters of the northern North Sea and in the central North Sea.

Recent genetic studies, although limited, indicate the existence of four genetically divergent cod populations resident in the northern North Sea; off Bergen Bank, within the Moray Firth, off Flamborough Head and within the Southern Bight. Although tagging data for some North Sea areas (Viking Bank, central North Sea) were not available to this study, tagging experiments support the existence of regional populations of cod in the Moray Firth, at Flamborough Head, in the German Bight, in the Southern Bight and in the English Channel that separate during the spawning season and, in some cases, inter-mix during the feeding season.

Dispersal and displacement in all populations is linked to size and season. Cod < 50cm are generally captured closer to their release location and are less dispersed than are cod > 50cm. Cod captured in quarters 1 and 4 are caught closer to putative spawning grounds and are less dispersed than cod captured in quarters 2 and 3. However, mean displacement and the extent of dispersal varies considerably between populations. For example, cod in the Moray Firth appear to be resident and are generally caught within 30 km of their release, even several years after release. In contrast, cod of the Southern Bight migrate up to 250 km between putative spawning grounds in the southern and south-eastern North Sea and feeding grounds in the central North Sea, where they intermix with the German Bight population. Other populations, such as those of the German Bight, the English Channel and Flamborough Head, do not appear to exhibit such clear seasonal migrations, but have a larger geographic range during the feeding season than during the spawning season. Nonetheless, the displacement of cod of these populations is rarely more than 150 km.

For cod in the North Sea the authors conclude that the evidence indicates that, similar to other North Atlantic regions, there is a variety of overlapping population types. There appear to be resident or "coastal" cod populations, off Flamborough and in the Moray Firth. These populations can receive periodic influxes of cod from neighbouring areas although we do not currently understand what regulates this. In addition, the cod population in the Southern Bight (IVc) is relatively discrete from the cod population in the northern North Sea in the deeper waters north of the Flamborough front. There is a limited net influx of young cod from the eastern English Channel (VIId) into the Southern Bight (but probably no further north), but no significant movement of cod back from the Southern Bight into the eastern English Channel. Cod in the German Bight show some limited mixing with cod in the Southern Bight.

SGRST considers that:

there is accumulating evidence that cod stock in the North Sea, Eastern Channel and the Skaggerak is comprised of fish from a number of more or less reproductively isolated component populations. However, it is currently not practical to provide scientific advice on the state of the stock based on the assessment of component populations, primarily because of the difficulties involved in separating catches, especially during periods when the populations are mixed.

- **Therefore STECF-SGRST does not recommend any changes to the area within which the North Sea/Eastern Channel/Skaggerak cod stock is defined and assessed.**

SGRST recommends that:

- **separate effort regulations should be specified for each of the TAC management areas.**

SGRST agrees with ICES advice (2004b) that "Cod catch in Division VIId is managed by a TAC for Divisions VIIb-k,VIII, IX, X and CECAF 34.1.1, (i.e. the TAC covers a small proportion of the North Sea cod stock together with cod in Divisions VIIe-k). Cod taken in Division VIId should be included with the North Sea cod TAC.

SGRST recommends that:

- **Cod taken in Division VIId should be included with the North Sea cod TAC.**

SGRST considered a Working Document (Holmes and Needle 2005, WD No. 8) which presented an analysis, based on survey data, of trends in fishing mortality in different areas of the North Sea. This indicates that that fishing mortality has declined more in the north than in the south of the North Sea. It was suggested that this reflects the proportionately greater reduction in the demersal trawl fishing effort (>100mm) than other gear categories.

SGRST notes that:

within the North Sea a spatial dichotomy in fishing mortality may be occurring. In order to rebuild the cod stocks fishing mortality should be reduced for all ages of fish and in all areas over which the stock is distributed. When considering effort regulation, the focus should not only be on gears or fisheries with the highest cod catches, but on a balanced and effective reduction in effort across all fisheries that land or discard cod. SGRST notes that the introduction of large closed areas (section 4.1) or other measures that displace effort into unrestricted regions, with concomitant increases in localised mortality rates, could lead to imbalances with undesirable consequences for local populations which contribute to the stock.

3.1.2 Cod West of Scotland

Knowledge of cod population structure in Division VIa is based mainly on studies of historic and recent spawning distribution and tagging experiments. A synthesis is presented by Wright *et al.* (in press). These authors found that recent surveys of spawning cod distribution confirm the widespread occurrence of spawning in Division VIa with concentrations off the Butt of Lewis, in the Minch and the Clyde. This is in broad agreement with the spawning areas identified in the 1950s from egg surveys and suggests that these spawning groups have persisted during the decline of the VIa stock.

From 383 cod tagged during the spawning season and recaptured during successive spawning seasons over 90% were recaptured within 80 km of coastal release sites. In the Clyde, the majority of cod were recaptured within the Clyde spawning area. One individual left the release area and was recaptured off the west coast of Ireland. Another fish was recaptured south of Shetland (travelling 509 km, shortest calculated distance) and a third off the west coast of Ireland. Cod tagged in the North Minch showed fidelity to this spawning area and adjacent grounds to the west of the Hebrides, although the number of recaptures was very low in this region. Cod released at these coastal spawning grounds also tended to remain in these areas during the summer feeding season implying that they belonged to resident spawning groups.

Tag recapture experiments conducted within a much larger network of spawning grounds to the north of Scotland indicated that cod from this area moved more extensively, within Division VIa and into Division IVa with the majority of recaptures extending from the Butt of Lewis to the Moray Firth. How this movement relates to the migratory categories described in section 3.1.1 (above) is largely dependent on the spatial scale at which the spawning area is viewed. Within the confines of the release area and adjacent ICES rectangles the large displacement distances could be considered to reflect a disperser strategy. However, despite the movement away from the release site by the following spawning period, cod tended to remain within the vicinity of the large spawning area that extends from the Butt of Lewis to Orkney. As such they could be regarded as 'inaccurate homers' that home to a much broader area around the original release site in subsequent years or even as 'residents' if the patchy network of spawning grounds are considered as one area. The lack of spawning fidelity to any specific ground within the larger spawning area is consistent with the results of another tag-recapture study where cod that were released off the Butt of Lewis in March and April returned to sites off the northern coast and Papa Bank (Easey, 1987). As such, movement of spawning cod in this region may reflect the larger extent of spawning grounds compared to the Moray Firth and Clyde areas.

Tagging studies have also been carried out in the south of Division VIa. In 2003 and 2004, over 11,500 cod were tagged and released from an area off Greencastle, Co. Donegal, Ireland. Over 10% of the tagged fish have since been recaptured, the majority were caught soon after tagging in close

proximity to the release area. The remainder have been recaptured in the North Channel, around Islay, the Stanton Bank and in the Clyde. Recapture locations also indicate a limited, but more extensive movements from VIa. A small number of recaptures (<1%) have been made in the Irish Sea, mainly from the North Irish Sea and the North Channel. Only two cod tagged in Division VIa have been recaptured further afield (in Division VIIj). The concentration near the release area of cod recaptured after extended periods, indicates strong philopatry (site fidelity) for the release area.

Analyses of otolith shape suggested differences in shape among fish from the South Minch and Irish Sea and the Moray Firth (Division IVa) and the Clyde. These results are consistent with genetic evidence for low gene flow between these areas and evidence for resident populations from tag recapture studies

SGRST considers that:
there is accumulating evidence that the cod stock west of Scotland (Division VIa) is comprised of fish from a number of more or less reproductively isolated component populations including one to the north of Scotland straddling Divisions IVa and IVa. However, is not currently practical to provide scientific advice based on the assessment of component populations primarily because of the difficulties involved in separating catches, especially during periods when the populations are mixed.

Therefore STECF-SGRST does not recommend changes to the area within which the cod stock west of Scotland is defined and assessed.

3.1.2.2 Management line West of Scotland

The areas defined in Point 2 of Annex IVa of Regulation 27/2005 include a specific definition of the area to the West of Scotland in Division VIa within which effort is regulated:

"For vessels notified to the Commission as being equipped with vessel monitoring systems in accordance with Articles 5 and 6 of Regulation (EC)No 2244/2003, the following definition for the area West of Scotland shall apply:
ICES Division VIa excluding that part which lies to the west of a line drawn by sequentially joining with straight lines the following geographical coordinates:
60 °00 'N,04 °00 'W
59 °45 'N,05 °00 'W
59 °30 'N,06 °00 'W
59 °00 'N,07 °00 'W
58 °30 'N,08 °00 'W
58 °00 'N,08 °00 'W
58 °00 'N,08 °30 'W
56 °00 'N,08 °30 'W
56 °00 'N,09 °00 'W
55 °00 'N,09 °00 'W
55 °00 'N,10 °00 'W
54 °30 'N,10 °00 'W."

This line approximates the 200m depth contour (see Figures 3.1.1 to 3.1.3 main report). These arrangements in effect exclude the time spent by appropriately equipped vessels fishing west of the line from the days at sea allocations for the cod recovery zone (CRZ). These will include vessels targeting saithe and demersal and deep water species on the shelf edge and beyond.

As part of TOR 2a SGRST is requested to review the definition of the area defined in point 2 of Annex IV.

In addition, SGRST considered a Working Document 10 (Rihan, 2005) which includes a proposal to alter the area to the west of Scotland within which effort should be regulated, to exclude the area east of the current line south of 55ºN. The basis for this argument is that almost no cod were caught in the area during extensive trials of Technical Conservation Measures in 2002. A supporting report on these TCM trials was also presented to SGRST as a Working Document 11 (BIM, 2005 WDxx_VIa TCM trials_BIM.doc)

To review the area defined SGRST considered the distribution of landings of cod in Division VIa from 2000 to 2004 which are summarised in Figures 3.1.1 to 3.1.3 (main report) and available survey data. The latter are from the Scottish west coast quarter 1 and quarter 4 groundfish surveys. These are summarised in Section 3.5.2 of the main report, with the mean abundance indices of cod at age 1 and 2+ for historic and more recent periods mapped in Figures 3.5.2.1 – 3.5.3.2. Both the surveys are fixed station surveys. The majority of hauls are made at stations in the depth range 35-185 metres. The maximum depth is 400m.

The early part of the Scottish quarter 1 survey data series (1983-1987), shows relatively high catch rates of cod age 2+ at stations within the Cod Recovery Zone (CRZ) and in statistical rectangles to the west of the line defined in point 2 of Annex IVa (Figure 3.5.2.2.). The area to the south of 55ºN was not included in the survey area during this period. The quarter 4 survey (1996-1999) indicates highest concentrations of 2+ fish in rectangles straddling the line in the north of VIa and some non-zero mean catches in rectangles west of the line.

Mean abundance indices for more recent years (2001-2005, for quarter 1 and 2000-2004 for quarter 4) are low compared to those earlier in the series, but again indicate some non-zero catches to the west of the line and south of 55ºN. Catches of cod age 1 west of the line for the whole of the survey time series are typically low.

Detailed Information on the location and depth of survey stations was not available at the meeting. Cod are, however, not generally captured in significant numbers below 200m. It is likely that some of the hauls which contribute to the historic distributional pattern and the more recent non-zero mean survey indices in statistical rectangles west of the management area were made at depths of less than 200m.

Whilst the SGRST has no basis for concluding that there are currently significant concentrations of cod which are excluded from the CRZ in the west of Scotland, the historic survey data suggest that the shelf immediately west of the management line, including that part south of 55ºN, were previously important areas in the distribution.

The SGRST recommends:

- **contingent on the findings of a more detailed analysis of survey locations, an adjustment of the management boundary of the cod recovery zone in Division VIa (west of Scotland) to the west of its current position, to follow more closely the 200m contour south of 58ºN, should be considered.**

The SGRST notes that an adjustment of the boundary may have implications for shelf edge and deepwater fisheries for saithe and other species which are excluded from days at sea regulations, but subject to effort regulation, and that these should also be considered.

3.1.3 Kattegat cod stock

The Kattegat stock is a small management unit. In contrast to other small stocks, the state of the Kattegat stock is likely to be more affected by immigration and emigration from the North Sea through Skagerrak and from the western Baltic due to the transport of water in the area. Current evidence suggests that there is a local population of cod in Kattegat. Spawning aggregations are well known in the central and southern part of the Kattegat (Hagström *et al.*, 1990). However, there are indications of a significant transportation of cod larvae from the North Sea stocks into the Kattegat (Munk *et al.*, 1995; 1999; Cardinale and Svedäng, 2004). This implies that North Sea cod stock components may be suppliers of cod larvae via transportation to the Skagerrak-Kattegat area. Recent tagging studies also suggest that Kattegat may also function as nursery area for North Sea cod, and that return migration to the North Sea are commonplace. This implies that immature cod in the area are a mix of North Sea cod and Kattegat cod components although the proportion of the two stocks in the area is unknown.

SGRST recommends that:

- **given the existence of small local populations, the cod stock in the Kattegat should be kept as a specific management unit. Furthermore, incorporating the Kattegat cod stock**

in either the Baltic or the North Sea/Skagerrak management unit could be dangerous for the local spawning populations because of the high risk of effort displacement in to the area.

3.1.4 Western and Eastern Baltic cod stocks

The evidence for treating cod in the Western Baltic (Sub-divisions 22-24) and Eastern Baltic (Sub-divisions 25-32) is summarised by ICES (2001, Section 7). There are biological differences between the two stocks resulting from the low salinity conditions encountered in the Easten Baltic. The reproductive biology of the Eastern Baltic stock has adapted to cope with these conditions, whereas fish from the Western Baltic stock would not be able to produce viable eggs in the Eastern Baltic. While cod in the Baltic do seem to constitute two biologically separate units, there is nonetheless some movement of cod between the two stock areas. Studies using data storage tags are currently underway and should shed more light on the extent of these movements.

SGRST recommends that:

on the basis of current knowledge however, there seems to be a sound basis for treating cod in the Eastern and Western Baltic as two separate stocks.

3.1.5 Irish Sea cod stock

In 2003 and 2004, over 11,500 cod were tagged and released from an area off Greencastle, Co. Donegal, Ireland in the south of Division VIa. Over 10% of the tagged fish have since been recaptured, the majority were caught soon after tagging in close proximity to the release area. Recapture locations also indicate a limited, but more extensive movement from Division VIa into VIIa. A small number of recaptures (<1%) have been made in the Irish Sea, mainly from the North Irish Sea and the North Channel.

A cod tagging programme was also conducted from 1996 to 1999 to examine the movements of cod in the waters around Ireland, particularly in the Irish and Celtic Seas. A total of 2,913 cod were tagged of which 257 were recaptured. Only one cod tagged in the Celtic Sea was recaptured in the Irish Sea. Recapture information showed that cod tagged in the Irish Sea showed fidelity towards their release location (the western Irish Sea cod spawning grounds).

Movement information from tagging studies provides little evidence for extensive immigration of cod into the Irish Sea and some evidence of fidelity of cod towards Irish Sea spawning grounds.

Management of the Irish Sea cod stock on the basis of sub-stock assessment regions would be difficult in practice (particularly the separation of catches, especially during periods when the stock units are mixed).

SGRST therefore recommends that:

the area within which the Irish Sea cod stock is defined and assessed is maintained as it is currently delineated.

3.2 Definition of gear categories

3.2.1 Introduction

STECF-SGRST received a working document by Graham, N. (WD 07) concerning “Review of Gear Classification, their relation with mesh size and other issues” from the chairman of the ICES Working Group on Fishing Technology and Behaviour (WGFTFB).

Regarding towed gears and the effort regulation, the paper states that the increase in minimum mesh size from 100 to 120 mm in 2001/2002 (before the introduction of effort regulation 27/2005) partly caused a shift to 80 mm mesh sizes in the mix fishery trawls due to the loss of valuable *Nephrops*

catch. Catch composition regulations for this mesh size resulted in increased discarding and high grading.

With the introduction of the days at sea scheme, vessel operators were further encouraged to reduce mesh size and shift to other fisheries, particularly Nephrops trawling, in order to gain more days at sea. While the mesh size changes and effort limitations may have had some effect on cod stocks, the impact on haddock and whiting are undesirable. This should be viewed in the context of the potential for an Irish Sea whiting recovery programme and the very poor haddock recruitment from recent IBTS surveys.

Concerning static gears it is stated that it is unlikely that any stock benefits could be achieved by manipulation of days at sea allocations but may cause increased soak time and increased number of gears, and following potential increased discarding due to quality reduction of the catch.

When it comes to promoting more selective fishing methods, it is suggested that the effort scheme can provide a powerful and unique mechanism to encourage more selective fishing methods. Potential species selective devices are mentioned and it is suggested that further investigation into an incentive based system would be useful.

It is pointed out that any gains in reductions in F for younger age groups need to be assessed against reduction in overall F obtained with effort management. There is a need to identify suitable technical measures for specific fisheries when discarding is problematic.

Referring to gear classification, the WD considers a need to expand the towed gear classifications to include multiple rig trawling and pair trawling and seining. Any effort limitation scheme needs to consider the fishing gear used and research is needed to determine the relative fishing capacity between gear types. Single- and twin trawls have shown significantly different CPUE which should be taken into account in gear classifications.

STECF-SGRST acknowledges that FTFB has proposed a ToR for the next meeting to identify issues relating to gear classifications, including an update of the 1971 FAO gear code classification. The group also intends to identify measurable components of gear design that may provide a better proxy for estimating fishing power, for example door spread, fishing circle dimensions etc.

STECF-SGRST received 2 papers concerning the mandatory use of species selective *Nephrops* trawls in Swedish national waters (Ulmestrand and Valentinsson, 2003 and 2005).

In a national Swedish recovery plan for demersal fish one action was to move the trawling limit off shore to 4 nautical miles outside the baseline. A problem with this was that almost half of the Swedish Nephrops landings originate from the area inside the new trawling limit. Species selectivity trials were therefore carried out with *Nephrops* trawls equipped with a species sorting grid of 35 mm bar space (Nordmøre design) and 70 mm full square mesh cod end and extension piece in order to target *Nephrops* only and investigate potential derogations from the regulations inside the new trawling limit.

A presentation on the selectivity study and the implication on catch composition one year after it was legislated in Swedish national *Nephrops* grounds was given to the STECF-SGRST sub group. The experimental results showed that this type of trawl reduced the fish by-catch without any significant loss of full-sized *Nephrops*. The catch of full-sized roundfish decreased by 90-100% and under-sized fish by 50-70% compared to the catch in conventional *Nephrops* trawls. According to published results, this level of selection is unlikely to be achieved using techniques that depend solely on mesh selection.

Since February 2004 it is mandatory to use this species selective grid and 70 mm square mesh cod-end when trawling for Nephrops in Swedish national waters. Data from on-board observers and logbook records show that the grid trawl is highly species selective and that by-catch of cod, plaice and sole is well below 5%. Log book landings from about 11000 trawling hours with this new trawl during 2004 and 16000 trawling hours until August 2005 consisted of 95 % and 96% respectively Nephrops in the species composition. On-board observer data also indicate that the species selectivity is greatly improved with this gear when compared to traditional *Nephrops* trawls. The grid trawl is since 2005 allowed more days at sea than the traditional trawl in the 70-99 mm category (21 vs. 9 days) in Skagerrak and Kattegat (Council Reg. 27/2005).

STECF-SGRST also received 2 Working Documents 10 (Rihan, 2005) and 11 (Anon., 2005) which considered fleet definition, gear classification and associated days at sea, and area definitions (with some particular reference to the Irish fisheries). The following issues were identified:

In order to avail of a higher effort allocation, many vessels have reverted from using 100mm + mesh sizes to 70-99mm mesh sizes. The WD considers that this provision runs contrary to efforts made in 2001/2002 by several Member States to increase codend mesh size. Furthermore, incentives to increase mesh size in order to reduce discarding have effectively been removed in *Nephrops*/mixed demersal fisheries. Given the need to stay within catch composition regulations required when using 70-99mm mesh, the WD reports that high-grading and discarding of haddock and cod is prevalent.

The WD suggests that the current towed gear classifications should be altered to recognise the differences in relative fishing power of different gear types, particularly multiple-rigs, single-boat seining, and also pair trawls/seines. The WD further suggests that multiple-rig vessels targeting Nephrops to maintain their days at sea allocation could be required to work a larger mesh size to help balance the difference in catching power. A similar situation arises with pair seine/trawl gear, given the effective increase in swept area in comparison to single rig operations. The WD notes that single seine net gears are more selective and less impacting on the seabed, and therefore suggests that incentives for vessels to use such gears could be employed (e.g. additional days compared to trawl gears of the same mesh size).

The WD suggests that a review of the current towed gear classifications should also recognise the differences in the relative fishing power of vessels. Larger horsepower vessels can tow gear much faster, reducing selectivity and through the use of heavy trawl gear can work areas inaccessible to smaller boats. The WD suggests that, perhaps as an alternative to (or in addition to) to restricting the days for such vessels, they could be required to work a larger mesh size to help balance the difference in efficiency.

The WD suggests that there are a considerable number of selective devices that could be promoted through the rewarding of increased effort allocation. Examples are given of improved selection achieved using separator panels, topless trawls and square mesh panels in *Nephrops* trawls, the "Bacoma" trawl, and turned 90º codends. The WD suggests that the approach of providing incentives for fishermen to use more selective gears should not be restricted only to cod.

The WD considers that, for static gears, it is unlikely that much reduction in fishing mortality will be achieved under the current regulation. It is argued that gillnet fishers may compensate by increasing the amount of gear fished and the soak time of the gear. The WD concludes that this will increase discards through fish spoilage and suggests that an alternative approach to effort regulation in static gears should consider restricting net surface area multiplied by days.

The WD questions the current restriction of longliner effort given the very small number of longliners in most Member States, and their minimal targeting of cod.

The WD suggests that *Nephrops* directed effort management levels in Area VII be de-coupled from the North Sea and the Baltic Sea. Examples are given of *Nephrops* fisheries in the Irish Sea, Celtic Sea and west of Ireland where *Nephrops* generally constitute >75% of the catch compared to fisheries in the North Sea where *Nephrops* make up only 20-30% of the catch composition. The WD reports that cod by-catch in the *Nephrops* fisheries in Area VII are small by comparison to the North Sea fisheries and therefore concludes that adjustments to the current regulation outside the North Sea should not be based on the situation in the North Sea.

The SGRST notes that catch composition can vary considerably between areas in *Nephrops* fisheries. In the North Sea the catch composition depends largely on the functional units being targeted. It is possible to identify fisheries taking a very clean catch of *Nephrops* and those within which catch composition is more mixed.

The SGRST notes that the current definition of gear categories subject to effort regulations is based on mesh size. The 70-99mm category will include vessels involved in diverse fisheries and catch composition will vary according to area (cod recovery area) and location (within area).

Dis-aggregation of the 70-99 gear category (and beam trawlers) to reflect different fisheries, spatial depiction of the fishing effort and information on the sampling intensity (discard and age sampling) would greatly assist in the evaluation of cod recovery measures and future developments.

STECF-SGRST recommends that

- **Nephrops trawls with highly species selective properties (eg. grid, separator panel) may be rewarded in the cod recovery plan to create positive incentives to minimize fishing mortality on cod, plaice and other weak demersal fish stocks.**

3.2.2 Fleet specific catches and discards data, also by age

The catch data provided are in the format defined by the ICES Study Group on the Development of Fishery-based Forecasts (ICES, 2004a) which allows stratification into fleets based on area, year, quarter, gear, mesh size groups and national fisheries (metiers). The format is described in Appendix 3 to the first meeting's report. Each nation's fleet specific landings and discard data are estimates raised using official national landings. Fleet specific estimates of age compositions and mean weight and length at age by species are also supplied. This data are used to estimate the catch composition of the regulated gears by species and by age group for both landings and discards.

3.2.3 Availability of data

Table 3.2.3.1 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 and Celtic Seas 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.

Catch compositions of the regulated gears including estimates of discards for the years 2003 and 2004 do not include unallocated catches.

Table 3.2.3.1 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 and Southwest of Scotland, Irish and Celtic Seas.

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	No data for Celtic and Irish Seas	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	Only 2004	All available	All available in 2004, no weights at age
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

3.2.4 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 SGDFF 2004 format. Fleet definitions are based on area, year, quarter, gear and mesh size groups and national fisheries (metiers) 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 (metiers).

- 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:

  $$DR = \frac{\sum_{snf} D_{snf}}{\sum_{snf} (L_{snf} + D_{snf})}$$ with $D_{snf} \geq 0$ and with $L_{snf} + D_{snf} > 0$ otherwise 0 (means no catch)

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

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

  Fleets without any discards information remain as such.

- 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

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

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

  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.

- 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

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

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

  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). 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.

3.2.5 Catch composition by regulated gears in the North Sea and Skagerrak

Tables 3.2.5.1 lists the numbers of fleets (year, quarter, area, gear and mesh size groups and specific national criteria) using regulated gears (no pelagic trawls) with quantitative discard information. Such estimates must be considered as minimum estimates, as data reports were not consistent for parameters describing data quality. However, it can be seen that among the 6 regulated gears the demersal trawls 70-99 mm and ≥100 mm and beam trawls≥80 mm are reasonably covered by samples, while demersal trawls 16-31 mm and static gears appear underrepresented. Even the group of others, gears without effort regulations excluding pelagic gears or with missing mesh size information are represented by a number of fleets.

Despite the low sampling levels, estimated catch compositions of the gears including discards appear fairly consistent over the years 2003 and 2004 (Tab. 3.2.5.2 and Fig. 3.2.5.1) and with the ICES WGNSSK assessment inputs. These estimates indicate that a substantial proportion of the catch of some species, e.g. plaice, haddock, and whiting, is discarded.

3.2.5.1 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. 3.2.5.1), 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. 3.2.5.2 and Fig. 3.2.5.1). Discard rates in weight are highest for whiting (97%), but also significant for cod (47%) and plaice (~50%). The estimate of annual whiting discards exceed 30,000 tons in 2004, but must be considered uncertain in this order of magnitude. The estimated discards of cod are approximately 3,000 tons in 2004. Age compositions for discards of round fish are not sufficient for raising. The discard rates of plaice indicate discards in the order of the TAC of about 50,000 tons, and the discards are mainly fish at age 3 and younger (about 90% in numbers are discarded, Fig. 3.2.5.5). Discards of sole are estimated in the order of 10 % of the catch weight and are mainly fish at ages 2 and 3 (Fig. 3.2.5.6). Catches of haddock, saithe and *Nephrops* appear low.

3.2.5.2 Gear category demersal trawl ≥100mm

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. 3.2.5.2 and Fig. 3.2.5.1). Discard rates by weight are highest for whiting (around 40%), haddock (around 20-30%) and plaice (10-40%). Cod (10%) and saithe (10%) discard rates are relatively 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 older (Fig. 3.2.5.1 and 3.2.5.3).

3.2.5.3 Gear category demersal trawl 16-31mm

In 2003 and 2004, Denmark deployed 90 % of the international effort for this gear category. The catch composition is dominated by Norway pout. The target species of the gear group demersal trawl16-31mm are Norway pout, blue whiting and sprat, while sandeel fisheries often use mesh <16mm 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 category is sparse.

3.2.5.4 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 (since 2005 also fitted with a species selective grid). 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 3.2.5.2) are indicated for whiting (75%), plaice (50-70%), haddock (40-55%), cod (30-40%). It should be noted that *Nephrops* discards have not been reported to the data base. The strong 1999 haddock year class can be identified clearly (Fig.3.2.5.3). The large majority of the fish discarded of all species are juveniles (Fig.3.2.5.2-5). Numbers of discarded cod at ages 1 and 2 by the 70-99 mm gear category are lower than for the demersal trawl ≥100mm but of the same order of magnitude (Fig. 3.2.5.2), and fish in age group 0 are caught and discarded. The 70-99 mm category does not to select saithe and sole, for which both landings and discards are low.

3.2.5.5 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. Landings are generally low compared to other gear categories and no discard information is available.

3.2.5.6 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 per month. 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 3.2.5.2 and Fig.3.2.5.1). Also saithe appears a significant part of the landings.

3.2.5.7 Gear category other

This gear category of "other" represents gears which are not effort regulated and landings for which gear types 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 3.2.5.2 and Fig.3.2.5.1).

3.2.5.8 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 (64 %) to the estimated discards added of cod, haddock, whiting, saithe, plaice and sole in 2004 (>150,000 t), while demersal trawls ≥100mm and demersal trawls 70-99 mm contributed 22 and 15 %.

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

The proportions of discarded cod numbers at age (Figure 3.2.5.2) 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%, (WGNSSK, ICES WGNSSK 2004 CM:) are consistent.

In the North Sea and Skagerrak, cod are mainly caught by demersal trawls ≥100mm (42% in weight). Cod catches of beam ≥80mm, demersal trawls 70-99 mm and static gears are lower and in the same order of magnitude (15-20 %). The discards rates in relation to the estimated total catch of cod in 2004, were 10% for beam trawls≥80 mm, 6% for demersal trawls ≥100mm and 5% for demersal trawls 70-99 mm. Estimated cod catches at age 1 taken by the regulated gears demersal trawls 70-99 mm and demersal trawls ≥100mm are in the same order of magnitude and mainly discarded.

Tab. 3.2.5.1 Overview on number of fleets using regulated gears (no pelagic trawls) with quantitative discard information in the North Sea and Skagerrak in 2003 and 2004. Note that the discard information for *Nephrops* is sparse.

REG_GEAR	YEAR	COD	HAD	NEP	PLE	POK	SOL	WHG
Beam>=80	2003	4	4	3	10	22	10	3
Beam>=80	2004	13	2	3	15	31	18	11
DemTrawl>=100	2003	70	74	8	14	116	4	74
DemTrawl>=100	2004	67	65		28	129	14	66
DemTrawl16-31	2003	1	2			4		1
DemTrawl16-31	2004	1	1			5		1
DemTrawl70-99	2003	31	30	8	15	46	2	21
DemTrawl70-99	2004	35	29	8	19	52	6	28
Longline	2003	8	7		2	14		2
Longline	2004	8	7		4	15		1
Other	2003	24	26	16	8	54	2	18
Other	2004	25	21	16	9	41	2	17
Static	2003	8	8	6	8	51	5	8
Static	2004	9	8		10	68	8	8

Table 3.2.5.2 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	5370		5370		
COD	2003	DemTrawl>=100	12736	1127	13863	0.08	0.03
COD	2003	DemTrawl16-31	6	0	6	0	0
COD	2003	DemTrawl70-99	3692	2217	5909	0.38	0.07
COD	2003	Longline	1637		1637		
COD	2003	Other	821	0	821	0	0
COD	2003	Static	5404	0	5404		
SUM			29665	3345	33009	0.1	0.1
COD	2004	Beam>=80	3754	3309	7063	0.47	0.1
COD	2004	DemTrawl>=100	12264	2024	14289	0.14	0.06
COD	2004	DemTrawl16-31	2	0	2	0.05	0
COD	2004	DemTrawl70-99	3408	1721	5129	0.34	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	7058	33842	0.21	0.21

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
HAD	2003	Beam>=80	555		555		
HAD	2003	DemTrawl>=100	34708	16882	51590	0.33	0.25
HAD	2003	DemTrawl16-31	33	2	35	0.06	0
HAD	2003	DemTrawl70-99	5362	6950	12311	0.56	0.1
HAD	2003	Longline	496	0	496		
HAD	2003	Other	614	137	751	0.18	0
HAD	2003	Static	596	0	596		
SUM			42363	23970	66333	0.36	0.36
HAD	2004	Beam>=80	502	14	516	0.03	0
HAD	2004	DemTrawl>=100	44243	13380	57623	0.23	0.2
HAD	2004	DemTrawl16-31	6	1	7	0.13	0
HAD	2004	DemTrawl70-99	5163	3423	8586	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	16845	67875	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	1513		1513		
NEP	2003	DemTrawl16-31	1		1		
NEP	2003	DemTrawl70-99	11631		11631		
NEP	2003	Other	346		346		
NEP	2003	Static	3		3		
SUM			13533		13533		
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		

Table 3.2.5.2 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	49481	52702	102183	0.52	0.38
PLE	2003	DemTrawl>=100	8393	797	9190	0.09	0.01
PLE	2003	DemTrawl16-31	3		3		
PLE	2003	DemTrawl70-99	6985	15159	22144	0.68	0.11
PLE	2003	Longline	0	0	0		
PLE	2003	Other	693	0	693		
PLE	2003	Static	5158	0	5158		
SUM			70713	68658	139371	0.49	0.49
PLE	2004	Beam>=80	46118	47393	93512	0.51	0.37
PLE	2004	DemTrawl>=100	9963	6534	16497	0.4	0.05
PLE	2004	DemTrawl16-31	1		1		
PLE	2004	DemTrawl70-99	6296	8153	14449	0.56	0.06
PLE	2004	Longline	4	0	4		
PLE	2004	Other	327	0	327		
PLE	2004	Static	3671	9	3680	0	0
SUM			66380	62089	128469	0.48	0.48

SPECIES	YEAR	REG_GEAR	LANDINGS	DISCARDS	CATCH	DISC RATE BY GEAR	DISC RATE BY TOTAL INT. CATCH
POK	2003	Beam>=80	39	0	39		
POK	2003	DemTrawl>=100	85203	6105	91307	0.07	0.06
POK	2003	DemTrawl16-31	53	0	53		
POK	2003	DemTrawl70-99	2969	464	3433	0.14	0
POK	2003	Longline	589	0	589		
POK	2003	Other	863	6	869	0.01	0
POK	2003	Static	7298	0	7298		
SUM			97014	6575	103589	0.06	0.06
POK	2004	Beam>=80	40	0	40		
POK	2004	DemTrawl>=100	84931	8227	93158	0.09	0.08
POK	2004	DemTrawl16-31	28	0	28	0	0
POK	2004	DemTrawl70-99	3154	763	3917	0.19	0.01
POK	2004	Longline	430	0	430		
POK	2004	Other	972	11	984	0.01	0
POK	2004	Static	4522	0	4522		0
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	16243	1752	17995	0.1	0.09
SOL	2003	DemTrawl>=100	151	0	151		
SOL	2003	DemTrawl16-31	1		1		
SOL	2003	DemTrawl70-99	151	0	151		
SOL	2003	Longline	2		2		
SOL	2003	Other	177	0	177		
SOL	2003	Static	1437	0	1437		
SUM			18162	1752	19914	0.09	0.09
SOL	2004	Beam>=80	16881	2524	19405	0.13	0.12
SOL	2004	DemTrawl>=100	193	15	207	0.07	0
SOL	2004	DemTrawl70-99	139	139	278	0.5	0.01
SOL	2004	Longline	0		0		
SOL	2004	Other	108	0	108		
SOL	2004	Static	1167	5	1172		
SUM			18488	2683	21171	0.13	0.13

Table 3.2.5.2 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	521	17271	17792	0.97	0.39
WHG	2003	DemTrawl>=100	5021	3476	8497	0.41	0.08
WHG	2003	DemTrawl16-31	0	0	1	0.34	0
WHG	2003	DemTrawl70-99	4116	13776	17892	0.77	0.31
WHG	2003	Longline	3	0	3		
WHG	2003	Other	179	38	217	0.18	0
WHG	2003	Static	30	0	30		
SUM			9870	34562	44431	0.78	0.78
WHG	2004	Beam>=80	1190	32780	33970	0.96	0.59
WHG	2004	DemTrawl>=100	4967	3979	8947	0.44	0.07
WHG	2004	DemTrawl16-31	2	2	4	0.44	0
WHG	2004	DemTrawl70-99	3607	8468	12075	0.7	0.15
WHG	2004	Longline	4	0	4		
WHG	2004	Other	63	10	73	0.13	0
WHG	2004	Static	40	0	40		
SUM			9873	45239	55112	0.82	0.82

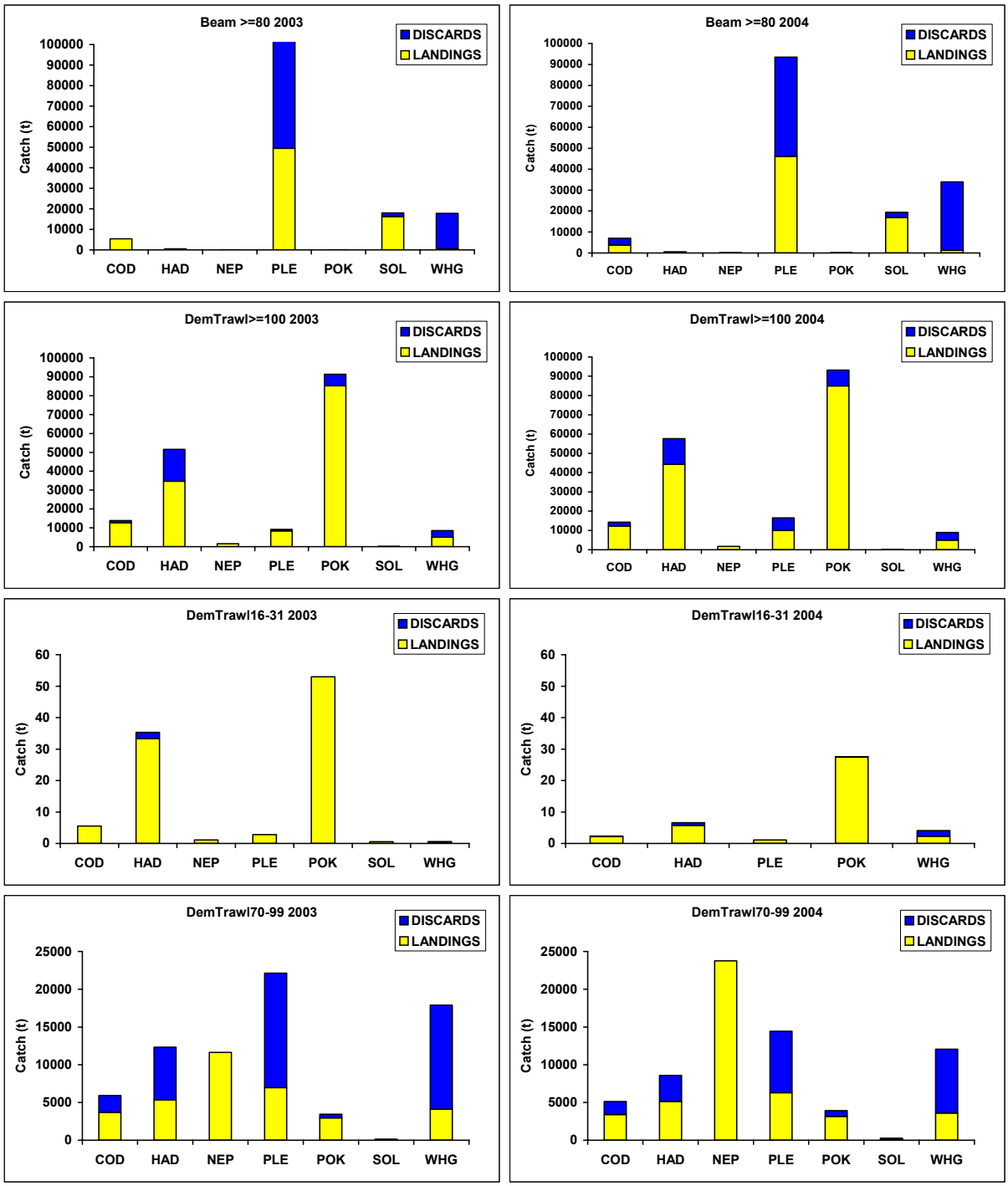


Fig. 3.2.5.1 Landings and discards by regulated gears and by species in the North Sea and Skagerrak in 2003 and 2004.

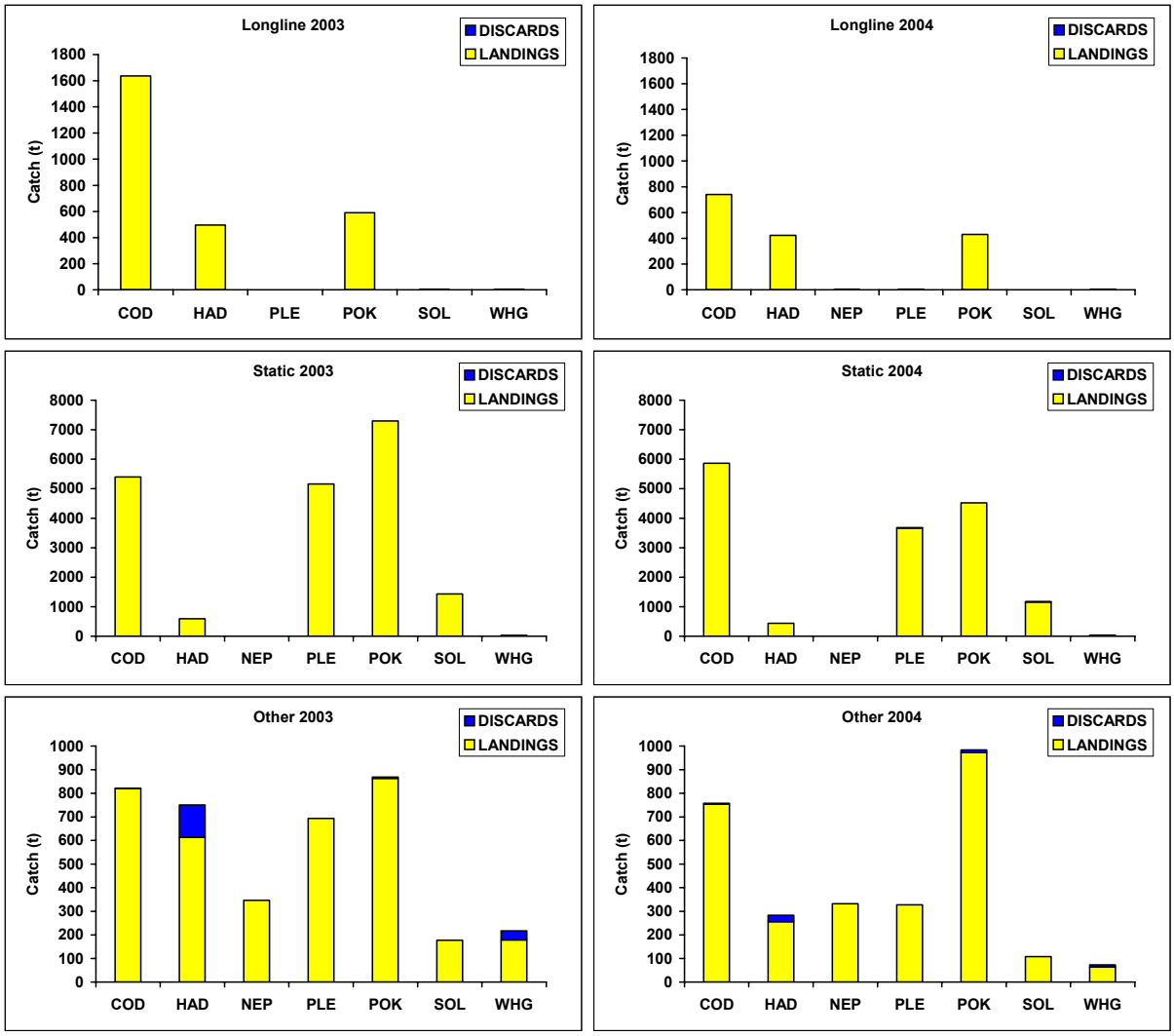


Fig. 3.2.5.1 continued. Landings and discards by regulated gears and by species in the North Sea and Skagerrak in 2003 and 2004.

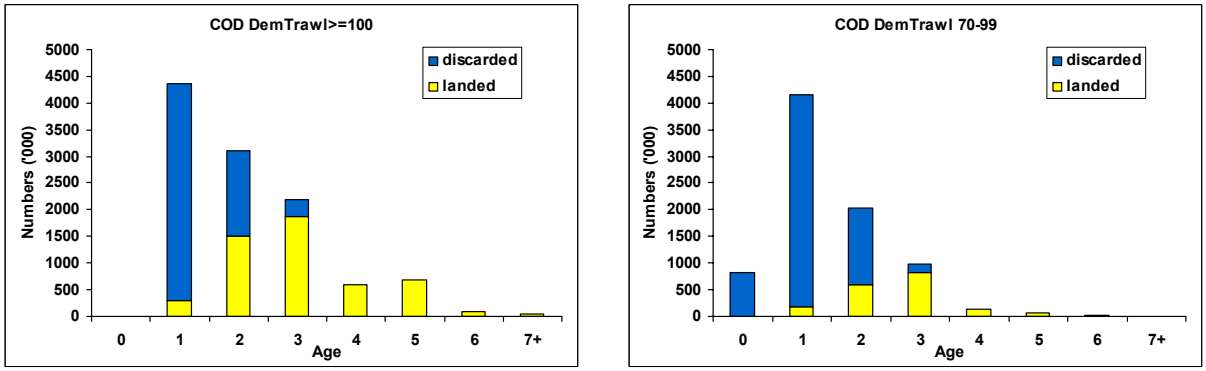


Fig. 3.2.5.2 North Sea, Skagerrak in 2004. Landings and discards at age for cod by the regulated gears demersal trawl≥100mm and 70-99mm.

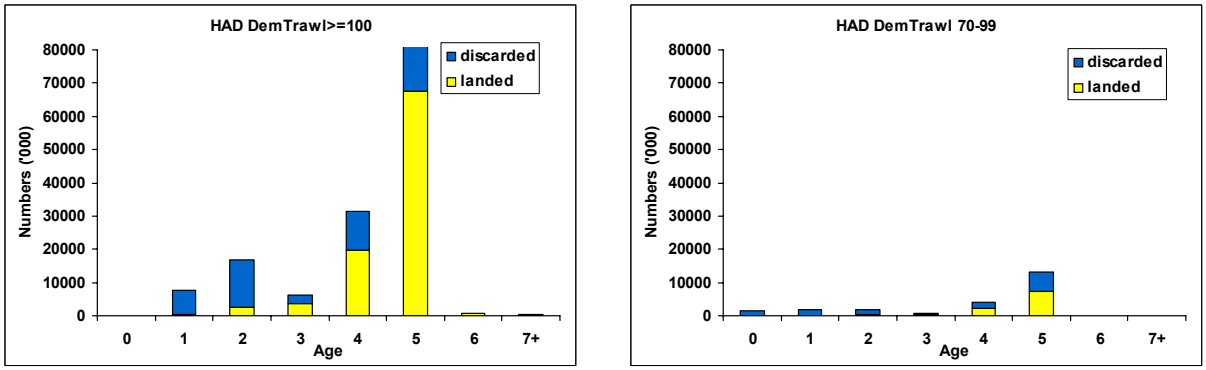


Fig. 3.2.5.3 North Sea, Skagerrak in 2004. Landings and discards at age for haddock by the regulated gears demersal trawl≥100mm and 70-99mm.

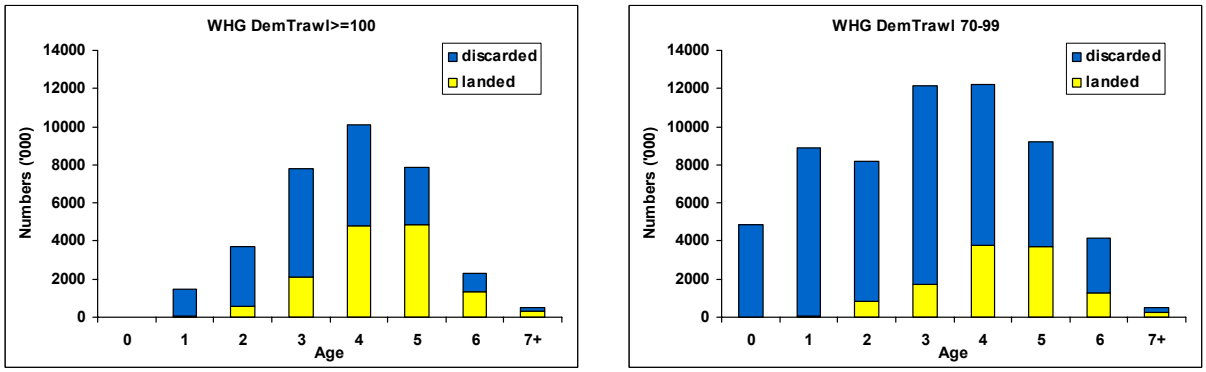


Fig. 3.2.5.4 North Sea, Skagerrak in 2004. Landings and discards at age for whiting by the regulated gears demersal trawl≥100mm and 70-99mm.

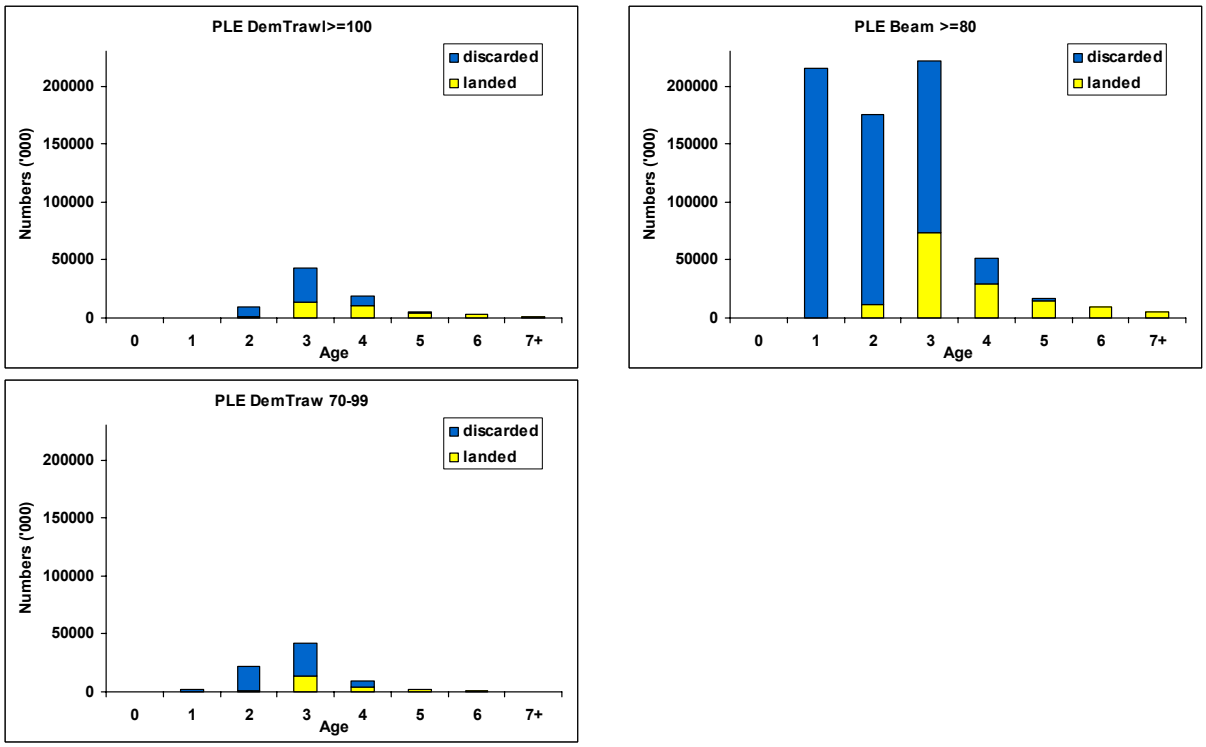


Fig. 3.2.5.5 North Sea, Skagerrak in 2004. Landings and discards at age for plaice by the regulated gears demersal trawl≥100mm, 70-99mm and beam≥80mm.

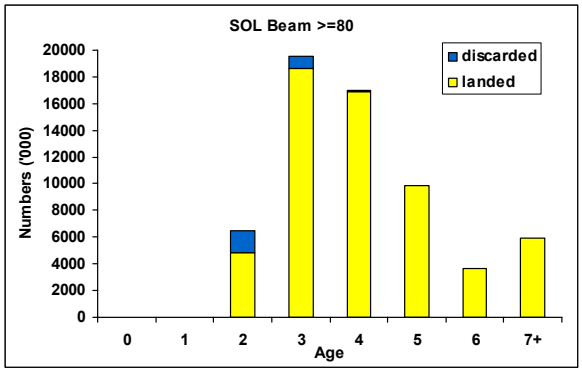


Fig. 3.2.5.6 North Sea, Skagerrak in 2004. Landings and discards at age for sole by the regulated gear beam≥80mm.

3.2.6 Catch composition by regulated gears in the Eastern Channel

No discard information is yet available for the Eastern Channel despite the fact that observations were done on board of the two most important French fleets (demersal trawls 70-99 and statics gears) during 2003 and 2004. Thus, the gear specific data presented are landings only and do not represent catch compositions.

3.2.6.1 Gear category beam ≥80 mm

This fleet which targets mainly sole, plaice and turbot is not very important in the Eastern Channel. Large dutch and Belgian twin trawlers work 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 on Table 3.2.6.1 and Figure 3.2.6.1 landings are mainly composed of sole and plaice. In 2003 and 2004, cod catches represented less than 2% of the total catch.

3.2.6.2 Gear category demersal trawl ≥100mm

This fleet is not important in the Eastern Channel. It is more present in the North Sea and West of Scotland. The Figure 3.2.6.1 shows that less than 40 tons of cods were landed in 2003, and only 2 t in 2004.

3.2.6.3 Gear category demersal trawl 16-31mm

This coastal fleet targets predominantly shrimps and only a small number of boats are involved in this fishery. In order to reduce discards, a selective gear (Asselin type) is commonly used in the Bay of Somme; cod and flat fish landings are very low. This fleet cannot be compared to the similar category fishing in the North Sea.

3.2.6.4 Gear category demersal trawl 70-99 mm

This gear segment is the most important in this area and divides its fishing time between the Eastern Channel and the Southern part of the North Sea. Whiting is the main target species throughout the year and red mullet during seasonal periods. By-catch is composed of red gurnard, common pout and cod. Figure 3.2.6.1 shows a decrease in cod landings during the 2 recent years and represents less than 6% of the total landings in 2004.

3.2.6.5 Gear category demersal longline

This fleet category has a low impact in this area.

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

Trammels and similar bottom-set nets compose the most traditional part of a range of fixed gears to catch flatfish, especially sole. Gill nets made of only one sheet of netting (instead of 3 for trammels) use different mesh sizes adapted to the targets species. The height of the net and how it is set on the bottom will also change according to the species targeted (1 m for sole, 3 m for cod).

Gillnets and other static gears are considered traditional along the French Eastern Channel coast and became widespread in inshore waters. Figure 3.2.6.2 shows the landings composition in two types of French gillnet fisheries in the Eastern Channel. One net fishery is directed at sole (using trammel nets), plaice and cod, although cod contributed less than 7% in weight. In this fishery, total landings have slightly increased between 2000 and 2003 after which they decreased. On average, 90 t of cod were landed from this fishery, while only 28 t were landed in 2004. In the other type of gillnet fishery, cod is, next to sole and plaice, more important and contributed between 8-39% to the total landings. Total landings decreased by 60% between 2000 and 2004. On average, 461 tons were landed in this fishery; 67 tons were landed in 2004.

3.2.6.7 Gear category other

This category groups vessels working with several types of towed demersal gear trawls. Sole and plaice are the main fish species targeted. Dredges catch mainly scallops. This activity takes place in the centre of and to the south side of the Eastern Channel from October to May. The figure shows that sole and plaice catches are rather high in 2003 and decreased in 2004.

3.2.6.8 Conclusions

The landings data presented are inappropriate to describe recent gear specific catch compositions. No age compositions of the landings or discards were made available. Most of cod landed is taken by the demersal trawls 70-99mm.

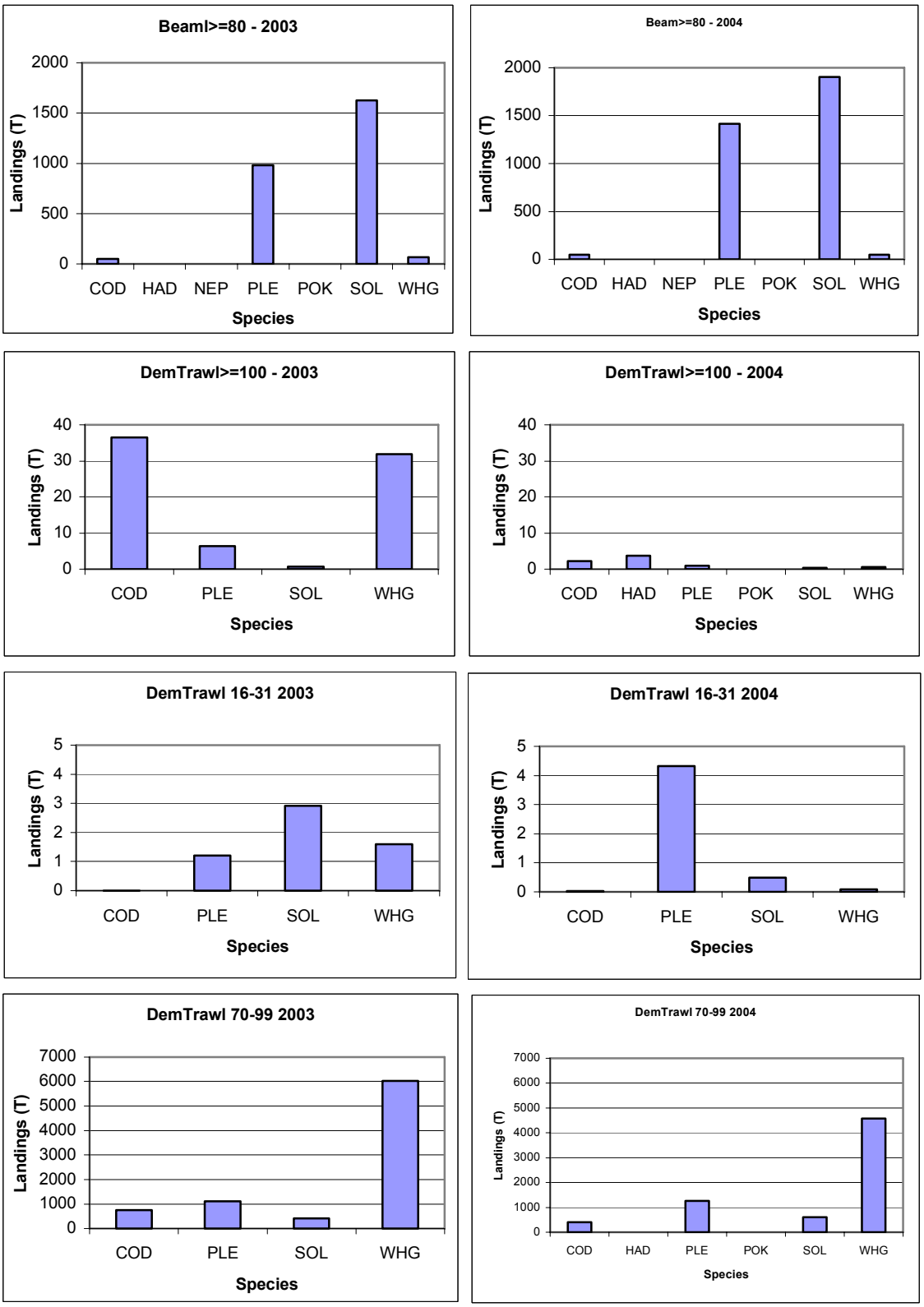


Fig. 3.2.6.1 Landings by regulated gears and by species in the Eastern Channel in 2003 and 2004.

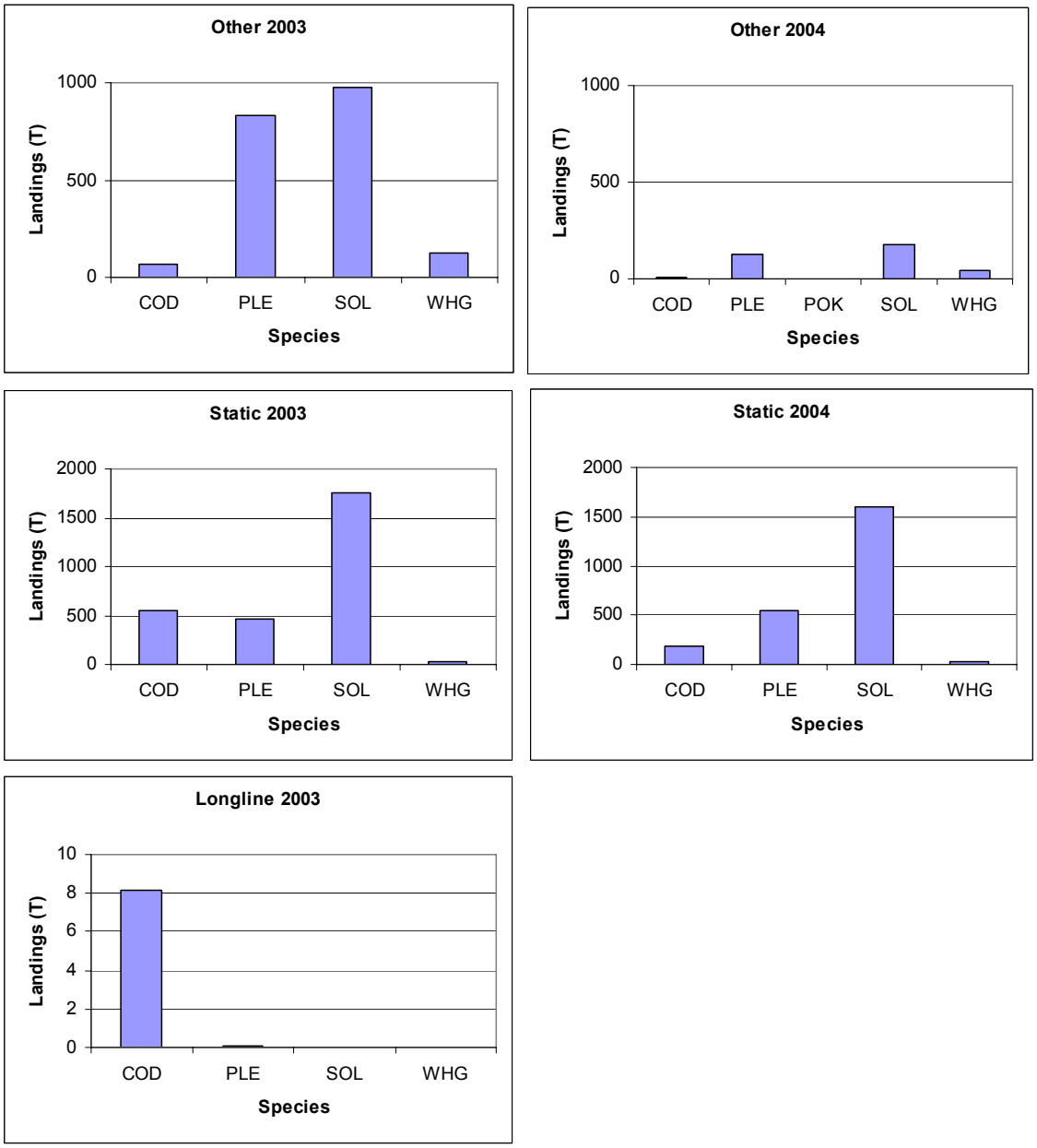
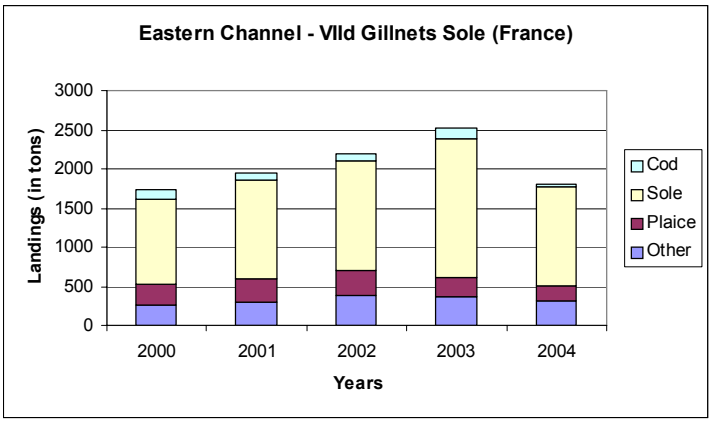


Fig. 3.2.6.1 continued. Landings by regulated gears and by species in the Eastern Channel in 2003 and 2004.



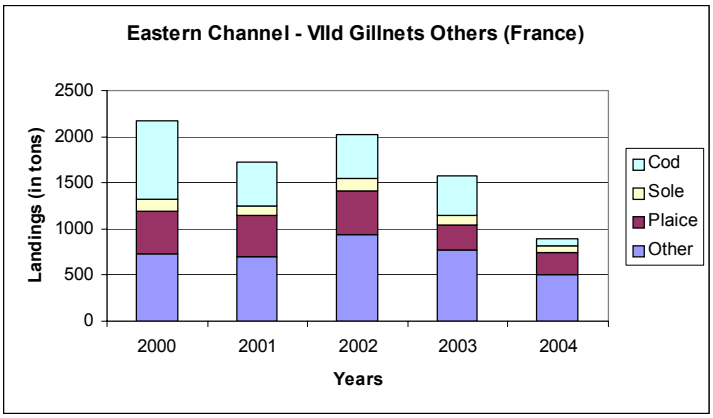


Fig. 3.2.6.2 Landings composition by 2 types of French gill net fisheries in the Eastern Channel 2000-2004.

3.2.7 Catch composition by regulated gears in the Kattegat

Table 3.2.7.1 list the numbers of trips by vessels using regulated demersal gears in 2003 and 2004 which were sampled to provide estimates of discards. The sampling includes coverage of both Danish and Swedish vessels. It can be seen that among the 5 regulated gears, only demersal trawls using 70-99 mm mesh are sampled regularly. There is limited Danish sampling of other fleets, but this is too sparse to be used to estimate fleet-specific discards.

3.2.7.1 Gear category beam ≥80 mm

This fleet category is not present in Kattegat.

3.2.7.2 Gear category demersal trawl ≥100mm

The demersal trawl ≥100mm 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 ≥100mm mainly target cod and plaice (Fig. 3.2.7.1).

3.2.7.3 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.

3.2.7.4 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. 3.2.7.2 and Fig. 3.2.7.1) are indicated for cod (~40%), plaice (~70%), and *Nephrops* (35-50%). 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. 3.2.7.1). 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. 3.2.7.2).

3.2.7.5 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.

3.2.7.6 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 3.2.7.2 and Fig. 3.2.7.1). Discard sampling of Danish gillnetters was stopped in 2001 as observed discard rates for this fleet were consistently very low.

3.2.7.7 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 3.2.7.2 and Fig.3.2.7.1).

3.2.7.8 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 ≥100mm 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.

Tab. 3.2.7.1 Overview on number of fleets using regulated gears (no pelagic trawls) with quantitative discard information in the Kattegat in 2003 and 2004.

REG_GEAR	YEAR	COD	HAD	NEP	PLE	POK	SOL	WHG
DemTrawl>=100	2003							
DemTrawl>=100	2004							
DemTrawl16-31	2003							
DemTrawl16-31	2004							
DemTrawl70-99	2003		11		11	11		8
DemTrawl70-99	2004		12		12	12		9
Other	2003							
Other	2004							
Static	2003							
Static	2004							

Table 3.2.7.2 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		

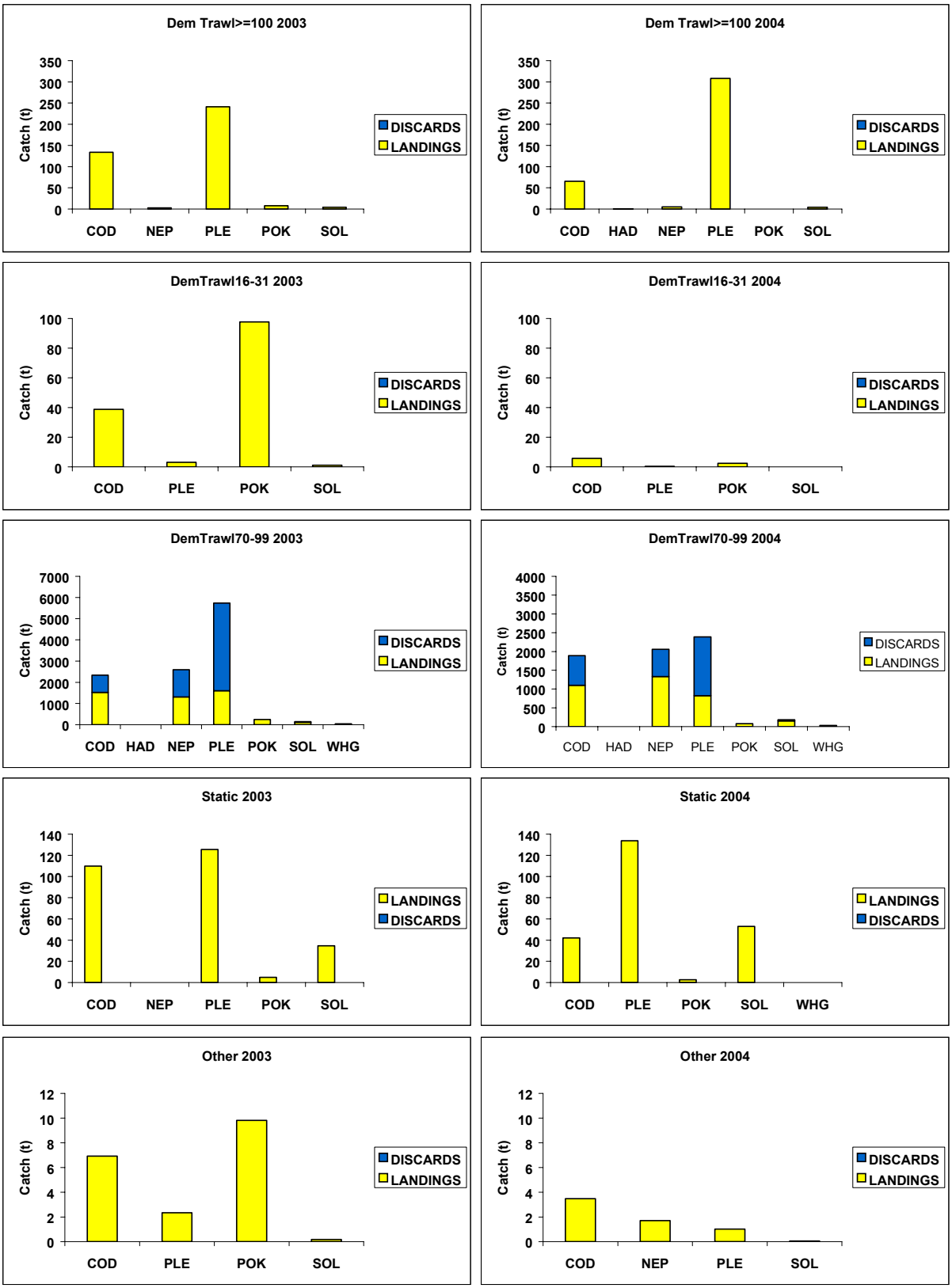


Fig. 3.2.7.1 Landings and discards by regulated gears and by species in the Kattegat in 2003 and 2004.

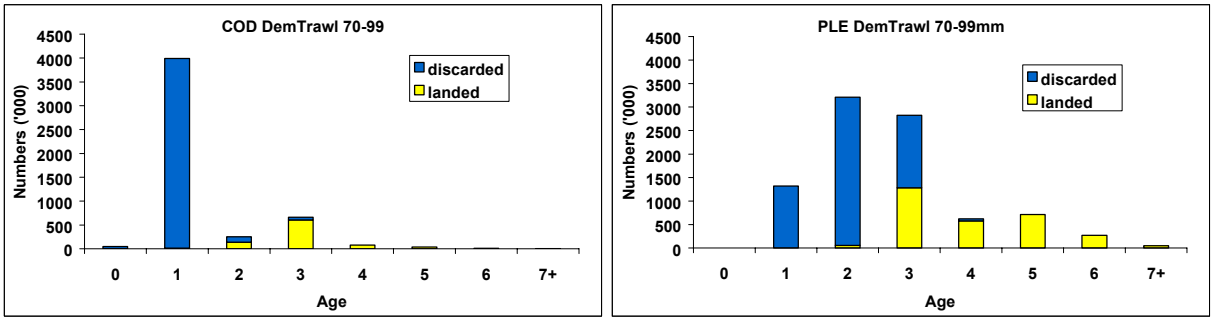


Fig. 3.2.7.2 Kattegatt in 2004. Landings and discards for cod and plaice at age for whiting by the regulated gear demersal trawl 70-99mm.

3.2.8 Catch composition by regulated gears West of Scotland

Information on the number of fleets using regulated demersal gears available in 2003 and 2004 is summarised in Table 3.2.8.1. The sampling includes coverage of Scottish vessels. Of the regulated gears, only demersal trawls in the ≥100mm and 70-99mm gear categories are sampled regularly. Discard data from the Scottish sampling programme were only reported for 2004. Information on discards for 2003 is therefore scant, (only available for saithe) and only catch compositions for 2004 are considered below.

In addition, because data are reported for vessels fishing over the whole of Division VIa, no distinction can be made with regard to catch composition by regulated gears inside and outside the cod recovery zone.

3.2.8.1 Gear category beam trawl ≥80mm

A small number of beam trawlers, including UK registered, Irish and French 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 (Table 3.2.8.1 and Figure 3.2.8.2), with only 6.4 tonnes of cod landed in 2004. No information on discards is available (Table 3.2.8.1).

3.2.8.2 Gear category demersal trawl ≥100mm

Vessels in this category will 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.

According to the sampling data, the catch of this gear category comprises predominantly haddock and saithe with whiting and cod being caught in lesser amounts (Table 3.2.8.2 and Fig. 3.2.8.1). In 2004, an estimated 4,000 tonnes of haddock, 60% by weight of the catch, was discarded (Figure 3.2.8.1). Fish of all ages between 0 and 5 were discarded in varying proportions (Fig 3.2.8.3). For saithe 13% of the catch by weight was discarded. Saithe discards were mainly fish age 3 (not shown).

Although relatively small amounts of cod are caught compared to other demersal species, the ≥100mm gear category accounts for 83% of the cod catch in Division VIa. It is estimated that approximately 12% by weight of the cod catch in 2004 by the ≥100mm gear category was discarded. Discards were predominately fish age 1. 77% of fish age 1 and 30% fish age 2 were discarded (Fig. 3.2.8.2).

The catch data indicate a high proportion, 81% by weight, of the whiting caught by this gear category were discarded (Table 3.2.8.2 and Fig. 3.2.8.1), mainly in the age range 0 to 2 years (Figure 3.2.8.4).

3.2.8.3 Gear category demersal trawl 16-31mm

No landings were reported in 2004 for this gear category.

3.2.8.4 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 Noup and on the Stanton Bank. Landings are predominantly *Nephrops* (*Nephrops* discard data not reported) but small quantities of haddock, whiting and cod are also caught (Table 3.2.8.2 and Figure 3.2.8.1).

In the case of cod, an estimated 38% of the catch by weight was discarded in 2004. Discarded cod were mainly age 1 (Figure 3.2.8.2). Discard rates of haddock and whiting were higher, 76% and 92% of the catch by weight, respectively. Only haddock ages 2 years and older were landed (Figure 3.2.8.3). Most of the whiting caught were young fish (ages 0–2) and virtually all these were discarded.

3.2.8.5 Gear category 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 (Figure 3.2.8.1). No information on discards is available.

3.2.8.6 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 (0.225 t) and anglerfish (ca. 40 t). No information on discards is available.

3.2.8.7 Gear category 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 ≥ 100mm and the 70-99mm category. Less than 0.3 tonnes of cod was landed (Table 3.2.8.2 and Figure 3.2.8.1).

3.2.8.8 Conclusions

On the basis of the data provided, SGRST was only able to estimate catch compositions (landings and discards) of the regulated gears for 2004.

The analyses indicate that cod west of Scotland (Division VIa) are caught mainly by demersal trawls. In 2004, vessels in the ≥100mm category accounted for 83% of the catch by weight; a further 15% of the catch is taken by demersal trawls 70-99mm. Discard rates for cod in the 70-99mm category of 38% are higher than in the ≥100mm category (12%), but the total quantities of fish and numbers at age discarded by these gear categories were comparable.

However, 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 (WGNSDS); for cod the SGRST estimate is 16% as compared with 12% (WGNSDS); for haddock the SGRST estimate is 62% as compared with 43% (WGNSDS) and for whiting 86% as compared with 76.5% (WGNSDS). This will reflect differences in the way sample data have been raised, aggregated and dis-aggregated according to mesh size. In some instances, low sampling coverage and treatment of data may lead to bias in discard estimates, particularly of numbers at age. These data should be treated with caution.

It also should be noted that landings data reported to the SGRST are for vessels fishing over the whole of Division VIa. Catches for demersal trawls ≥100mm will reflect reported landings and discard estimates both inside and outside the cod recovery zone and in different fisheries. However, for the species data reported, this is only likely to be problematic in the case of saithe, which is taken in fisheries on the shelf and on the shelf edge. Most of the cod catches by gear in the ≥100mm category and by demersal trawls in the 70-99mm category will be on the shelf and within the cod recovery zone.

Tab. 3.2.8.1 Overview on number of fleets using regulated gears (no pelagic trawls) with quantitative discard information for the West of Scotland in 2003 and 2004. Note that the discard information for 2003 is sparse.

REG_GEAR	YEAR	COD	HAD	NEP	PLE	POK	SOL	WHG
DemTrawl>=100	2003					11		
DemTrawl70-99	2003					1		
Other	2003					2		
Static	2003					1		
Beam>=80	2004					2		
DemTrawl>=100	2004	38	39			51		36
DemTrawl16-31	2004		1					1
DemTrawl70-99	2004	16	16			10		15
Longline	2004					2		
Other	2004	1	4			2		2

Tab. 3.2.8.2 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

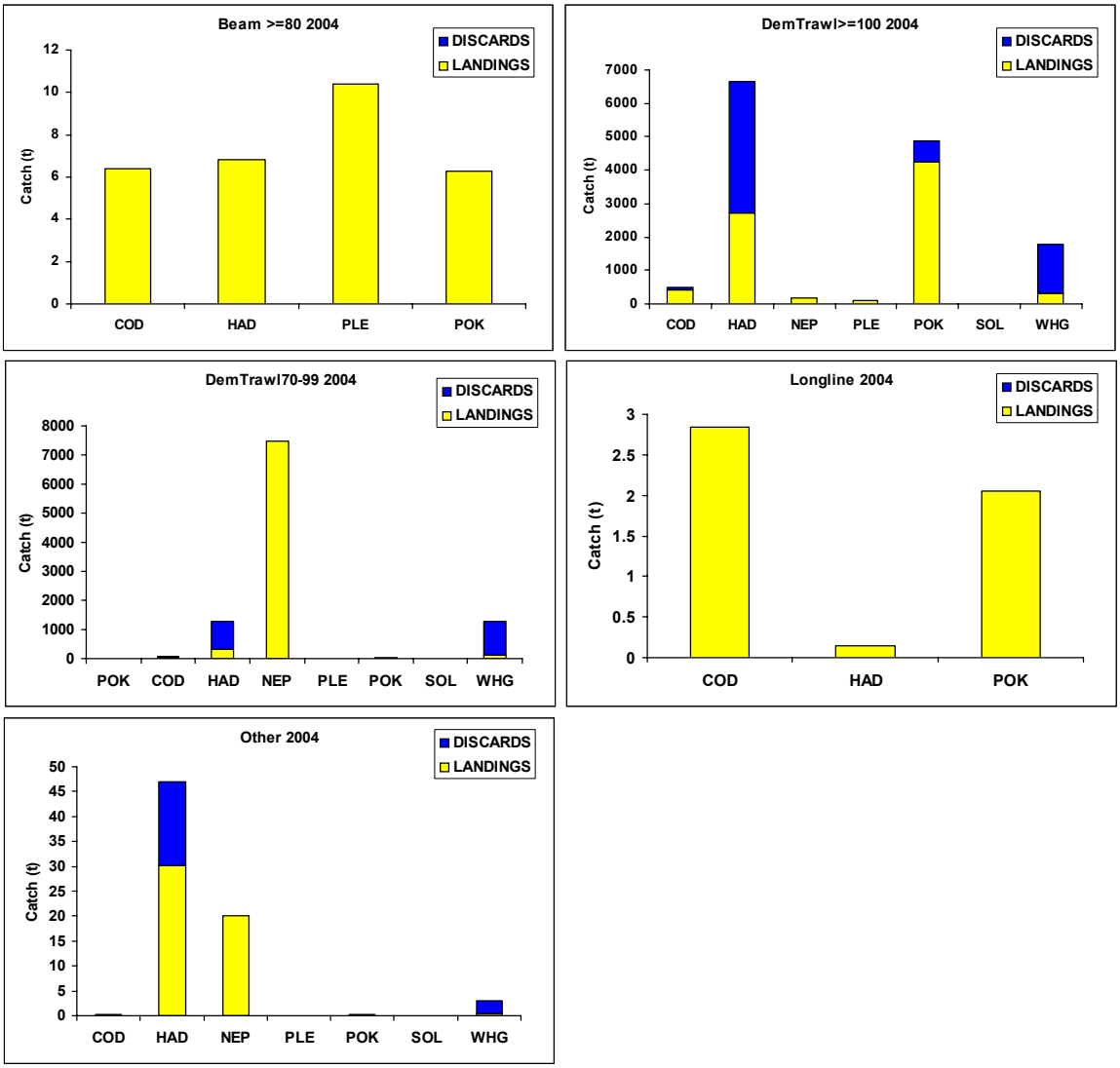


Fig. 3.2.8.1 Landings and discards West of Scotland by regulated gears and by species in 2004.

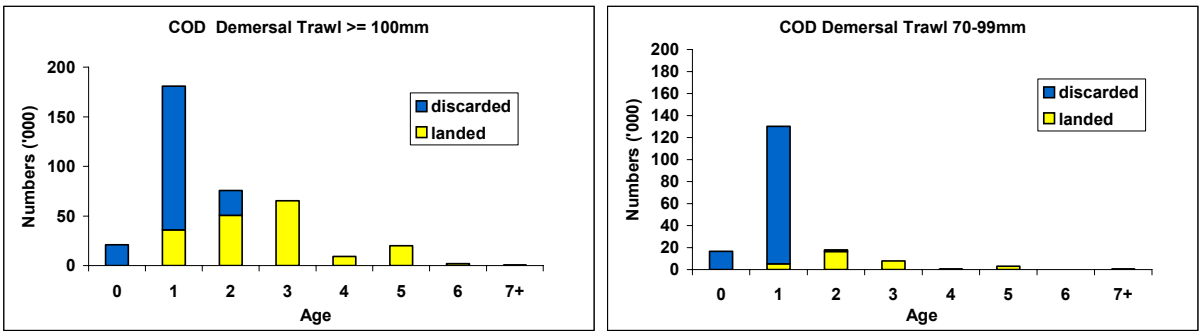


Fig. 3.2.8.2 West of Scotland. 2004 landings and discards at age for cod by the regulated gears demersal trawl≥100mm and 70-99mm and other gears.

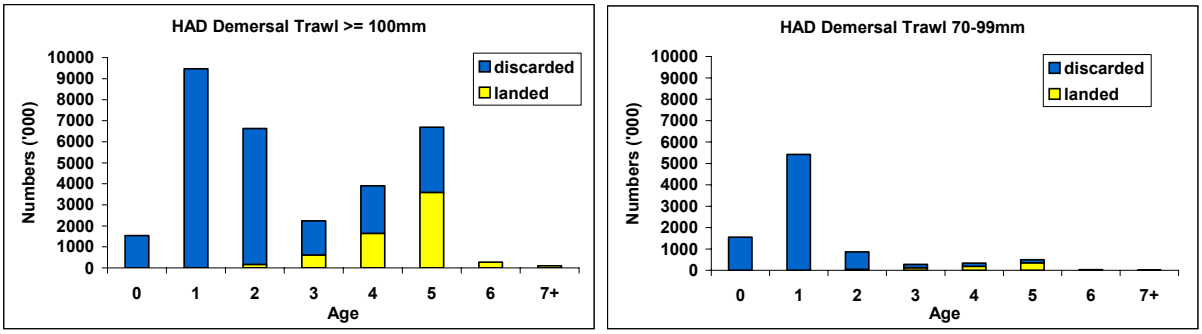


Fig. 3.2.8.3 West of Scotland. 2004 landings and discards at age for cod by the regulated gears demersal trawl≥100mm and 70-99mm and other gears.

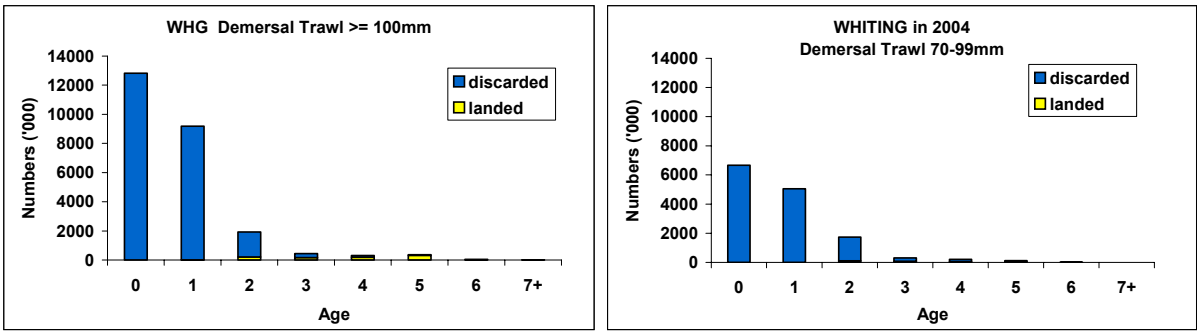


Fig. 3.2.8.4 West of Scotland. Landings and discards (D) at age for whiting by the regulated gears demersal trawl≥100mm, 16-31mm and 70-99mm and other gears.

3.2.9 Catch composition by regulated gears in the Irish Sea

The reported catches of Irish Sea cod are considered too biased to form the basis of an analytical catch-based assessment (ICES, 2005). 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.

3.3 Evaluation of time series of nominal effort

SGRST was provided with information on the control and enforcement of effort within the COM's evaluation report (WD 9): Cod recovery verification programme 2004.

The report noted that, in general terms, there is a considerable improvement in the implementation of effort limitation schemes by MS, particularly with respect to previous years. The existence of a system in place to implement Annex V was not in itself a guarantee that an actual reduction in fishing effort at

the target levels required by the recovery plan has been achieved. Member States implemented Annex V in a manner that caused minimal disruption for the fishing industry. Cod quotas were not exhausted and vessels operated in the area during the whole 11 months management period. As a side effect of this effort regime and due to the flexibility of transfer of fishing opportunities between vessels, a market of rights in terms of effort (days absent from port) developed. Furthermore, the report considers that the actual reduction in terms of fishing effort by the main fleets is likely to have been modest. As a result of an imbalance between the allocation of days and the available quotas, the authors consider that high grading and mis-declaring cod was a common practice during 2004. It also appeared that landings compositions of the regulated gears were poorly enforced.

SGRST concludes that:

- **any transfer of effort between areas will result in an imbalance of fishing activity and management intentions. Similarly, high-grading, discarding and mis-declaring of cod will each lead to reductions in the levels of mortality that are lower than those required for recovery.**

3.3.1 Availability of data

The nominal fishing effort data (Kw*days at sea) called in the format defined by the ICES Study Group on the Development of Fisherey-based Forecasts (ICES, 2004a) allow stratification by fleets based on area, year, quarter, gear and mesh size groups and national fisheries (metiers). The format is described in Appendix 3 to the report of the first meeting of the SGRST. The data cover the period 2000-2004, for some countries back to 1997. The data availability is listed in Table 3.3.1. The effort data cover the management areas of the North Sea and Skagerrak, Eastern Channel, Kattegat, West of Scotland and the Irish Sea.

Table 3.3.1 Data provided on fleet specific nominal effort data (Kw*days at sea), 2000-2004, for the various management areas North Sea and Skagerrak, Eastern Channel, Kattegat, Eastern and Western Baltic, West of Scotland, Irish and Celtic Seas.

Country	Year restrictions	Area restrictions	Fleet restrictions
Belgium	Data provided	Data provided	Otter trawlers without mesh
Denmark	Data provided	Data provided	Data provided
Estonia	No data	No data	No data
Finland	2002-2004	Data provided (22-24, 25-32)	Data provided
France	Data provided	No Celtic Sea	Data provided
Germany	Data provided	Data provided	Data provided
Ireland	Data provided	Data provided	No mesh sizes
Netherlands	1997-2004	Data provided	Not all beam efforts classified to engine power
Latvia	Data provided	Data provided	Data provided
Lithuania	No data	No data	No data
Poland	No data	No data	No data
Sweden	1997-2005	Data provided	Data provided
UK England	1997-2004	Data provided	Data provided
UK Scotland	1997-2004	Data provided	Data provided
UK Northern Ireland	1997-2004	Data provided, included in UK England	Data provided, included in UK England
Norway[1]	Data provided	Data provided	Data provided

[1]) Kw*fishing days

3.3.2 Estimation of fleet specific trends in nominal effort

The nominal effort data (Kw*day at sea) are aggregated by year, the management areas of the North Sea and Skagerrak, Western and Eastern Baltic, Kattegat, West of Scotland, Irish and Celtic Seas as well as by the regulated gear types. The aggregation is by summing the national fleet nominal efforts.

3.3.3 Trends in fleet specific nominal effort in the North Sea and Skagerrak

3.3.3.1 Trends in fleet specific nominal effort by regulated gears and countries

Overall, the total nominal effort of demersal gear types decreased steadily since 2000. Compared with 2000 and 2002, the relative decreases in 2004 amounted to 21% and 15% (Tab. 3.3.3.1 and Fig. 3.3.3.1), respectively. Main fishing gears in terms of nominal effort are beam ≥80mm, and the demersal trawls≥100 and 70-99 mm, contributing about 80% to the total effort deployed. Other gears, comprising regulated gears but without mesh size information, contributed less than 20% to the total effort. National trends in nominal effort by regulated gears are given in Table 3.3.3.2 and illustrated in Fig. 3.3.3.2.

For 2004, the regulated gear beam ≥80mm reveals a decrease in nominal effort by 25% and 14% when compared with the years 2000 and 2002, respectively. Since 2000, the greatest decrease in absolute terms was met by the Dutch fleets, while the French and UK-England fleets show the highest relative decline since 2000 of about 50%, (Tab. 3.3.3.2 and Fig. 3.3.3.2).

During the period 2000-2004, the nominal effort of demersal trawls ≥100mm, the gear type distinguished by the highest cod catches, decreased strongly by 43%. Since 2002, the decrease amounts to 35%. Scotland contributed most to this decrease in absolute terms and almost all other countries reported significant declines in this sector. Only the main holders of the saithe quota, Norway, France, and Germany increased their relatively low effort due to the derogation for saithe directed fishing (Fig. 3.3.2.2).

The target species of the gear group of demersal trawl 16-31mm are Norway pout, blue whiting and sprat while sandeel fisheries often use mesh <16mm with catch retained on board consisting of no more than 10% of any mixture of other species. Danish and Swedish effort decreased significantly in 2002 leading to an overall reduction by about 60% since 2000.

The effort of the great variety of fleets aggregated under the category of demersal trawl 70-99mm increased by 54% from 2000 until 2004. The increase since 2002 is estimated to amount to 12%. While all countries increased their efforts in this fleet sector significantly, main contributors are Scotland and Denmark in absolute terms (Fig. 3.3.2.2).

Scotland is the only country reporting significant nominal efforts using demersal longlines. During 2002 to 2004, the effort decreased strongly by 64 %, and by about 69% since 2000.

Static gear fisheries are dominated by Danish vessels which showed an overall decline of 22% between 2002 and 2004. Scotland, the Netherlands and Sweden are distinguished by strong increases of their low efforts since 2000.

Significant effort is are reported for other demersal gears without mesh size information and the fleets of demersal otter trawl<16mm or otter trawls with 32-54mm, mainly directed at sandeel, herring, northern prawn (*Pandalus borealis*) and horse mackerel. There are also other nations reporting such mesh sizes fishing for squid or a variety of targets without any discard information. Also included in other gears is significant amounts of effort from small and large beamers using mesh sizes of 16-31 mm, fishing for brown shrimp (*Crangon*). Such high nominal efforts of Denmark, Germany and Sweden appear unchanged since 2000. Pelagic trawls are not considered.

UK national effort analyses and trends were presented to SGRST and are given in working documents No. 3 and 4.

3.3.3.2 Conclusions

Overall nominal effort has decreased between 2000 and 2004 by 21% and between 2002 and 2004 by 15 %. The roundfish trawl≥100 mm has shown the steepest decline of 43% since 2000 and 35% since 2002, while the demersal trawls 70-99mm show significant increases of 54% and 12%, respectively. During the periods 2000 to 2004 and 2002 to 2004, beam trawls≥80 mm show modest declines of 25% and 14%. Such continuous trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003.

The recent strong effort increase by vessels using demersal trawls with small mesh size 70-99mm in the North Sea and Skagerrak and the simultaneous strong decrease in the demersal trawl ≥100mm have resulted in an apparent overall reduction of the mesh size used in demersal fisheries.

North Sea cod fishing mortality as estimated by the 2004 ICES WGNSSK meeting and reported in ICES ACFM advice (ICES, 2004b) is presented in Table 3.3.3.3. Relative to the year 2000, fishing mortality is estimated to have declined by 40% from 2000 – 2002 and 25% between 2000 and 2003. The WGNSSK considered its most recent estimate of fishing mortality (that in 2003) to be uncertain and therefore the reduction in mortality between 2000 and 2003 is likely to be in the range of 25 – 40%. The range of the reductions in fishing mortality estimated by ICES are consistent with the reductions in international effort recorded in Tables 3.3.3.2.

SGRST notes that the achieved reductions in fishing effort coincide with the estimated reduction in fishing mortality but that the reduction in fishing mortality is insufficient to be considered consistent with the cod recovery plan.

Table 3.3.3.1 Trends in nominal effort (Kw*days at sea) by effort regulated gear types in the North Sea and Skagerrak, 2000-2004.

GearReg	2000	2001	2002	2003	2004
Beam>=80	71613627	68955178	62810456	55318313	54001358
DemTrawl>=100	57646663	53227168	50440783	38105983	32773830
DemTrawl16-31	245638	269251	146763	169729	100509
DemTrawl70-99	16268495	17359576	22249439	25618005	25014902
Longline	203275	146005	173568	137190	62635
Other	27023031	27951600	25471036	26131462	24729156
Static	5124366	4748754	4327918	3267396	3377810
SUM	178125095	172657532	165619963	148748078	140060200
change relative to 2000		-0.03	-0.07	-0.16	-0.21
change relative to 2002				-0.1	-0.15

Tab. 3.3.3.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the North Sea and Skagerrak, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
Beam>=80	BEL	5381338	4947690	4508762	3779583	3578123
Beam>=80	DEN	1074157	1230444	1393934	1349965	1290806
Beam>=80	ENG	8316622	8283711	6072252	4809522	4723454
Beam>=80	FRA	111520	75680	112752	57246	54338
Beam>=80	GER	2850547	2357885	2155098	1891552	2377306
Beam>=80	NED	47289070	45040459	41491705	37816572	35220714
Beam>=80	NOR	1251569	1126981	1600285	997447	1421391
Beam>=80	SCO	5338804	5892328	5475668	4616426	5335226
sum		71613627	68955178	62810456	55318313	54001358
change relative to 2000			-0.04	-0.12	-0.23	-0.25
change relative to 2002					-0.12	-0.14
DemTrawl>=100	DEN	9402721	10069985	9971411	7094101	6111104
DemTrawl>=100	ENG	4424917	4204662	3163570	1958711	1295282
DemTrawl>=100	FRA	1967547	1855316	2610036	2548157	2782250
DemTrawl>=100	GER	2472476	2082833	2833663	2763762	3478294
DemTrawl>=100	NED	1449902	966601	1048343	468983	408732
DemTrawl>=100	NOR	2554237	2733642	5429344	6313703	5043732
DemTrawl>=100	SCO	34885864	30847606	24870201	16786930	13559088
DemTrawl>=100	SWE	488999	466523	514215	171636	95348
sum		57646663	53227168	50440783	38105983	32773830
change relative to 2000			-0.08	-0.13	-0.34	-0.43
change relative to 2002					-0.24	-0.35
DemTrawl16-31	DEN	223951	225245	133891	145366	84048
DemTrawl16-31	ENG	4486		231	2189	4369
DemTrawl16-31	FRA	6804	3240	6156		365
DemTrawl16-31	GER	1967	4940	570	1088	
DemTrawl16-31	NED	1372	4248	5283	10439	3544
DemTrawl16-31	SCO		4470		10647	4853
DemTrawl16-31	SWE	7058	27108	632		3330
sum		245638	269251	146763	169729	100509
change relative to 2000			0.1	-0.4	-0.31	-0.59
change relative to 2002					0.16	-0.32
DemTrawl70-99	DEN	4714929	4290768	5822251	7016629	7386546
DemTrawl70-99	ENG	1148516	1179118	981560	2030896	1832405
DemTrawl70-99	FRA	989056	1849271	1473167	1207857	1512267
DemTrawl70-99	GER	280033	292311	323114	969416	829333
DemTrawl70-99	NED	412305	574437	779432	1411082	1064050
DemTrawl70-99	SCO	6232892	6718610	10399358	10864642	10437309
DemTrawl70-99	SWE	2490764	2455061	2470557	2117483	1952992
sum		16268495	17359576	22249439	25618005	25014902
change relative to 2000			0.07	0.37	0.57	0.54
change relative to 2002					0.15	0.12

Tab. 3.3.3.2 continued. Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the North Sea and Skagerrak, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
Longline	FRA			2080		327
Longline	NED			964	2399	356
Longline	SCO	203275	146014	170524	134791	61952
sum		203275	146014	173568	137190	62635
change relative to 2000			-0.28	-0.15	-0.33	-0.69
change relative to 2002					-0.21	-0.64
Other	BEL	1018496	955783	706235	715551	569881
Other	DEN	14336912	15868920	13499550	13470263	12538888
Other	ENG	590730	657674	683573	632029	424925
Other	FRA	12022	23014	6688	19023	18111
Other	GER	7390406	7097012	7130754	7897258	7424426
Other	IRL	158235	194575	222269	155107	195394
Other	NED	805644	578810	624301	533987	660959
Other	SCO	555815	366784	388080	669273	832415
Other	SWE	2154771	2209028	2209586	2038971	2064157
sum		27023031	27951600	25471036	26131462	24729156
change relative to 2000			0.03	-0.06	-0.03	-0.08
change relative to 2002					0.03	-0.03
Static	DEN	3456283	3368330	2943832	2065065	2171621
Static	ENG	472282	465253	267184	176270	216268
Static	FRA	645511	553006	666174	447862	459167
Static	GER	341031	117740	164420	184958	116779
Static	NED	60170	84163	96687	95024	113532
Static	SCO	70429	77229	95591	195184	171723
Static	SWE	78660	83033	94030	103033	128720
sum		5124366	4748754	4327918	3267396	3377810
change relative to 2000			-0.07	-0.16	-0.36	-0.34
change relative to 2002					-0.25	-0.22

Table 3.3.3.3 The 2004 ICES ACFM (ICES, 2004b) estimates of North Sea cod average fishing mortality across ages 2 to 4 for the years 2000 – 2003 and the change relative to the estimate for 2000.

Year	Average F Ages 2 - 4	Relative to 2000
2000	1.21	1.00
2001	1.06	0.87
2002	0.75	0.61
2003	0.91	0.75

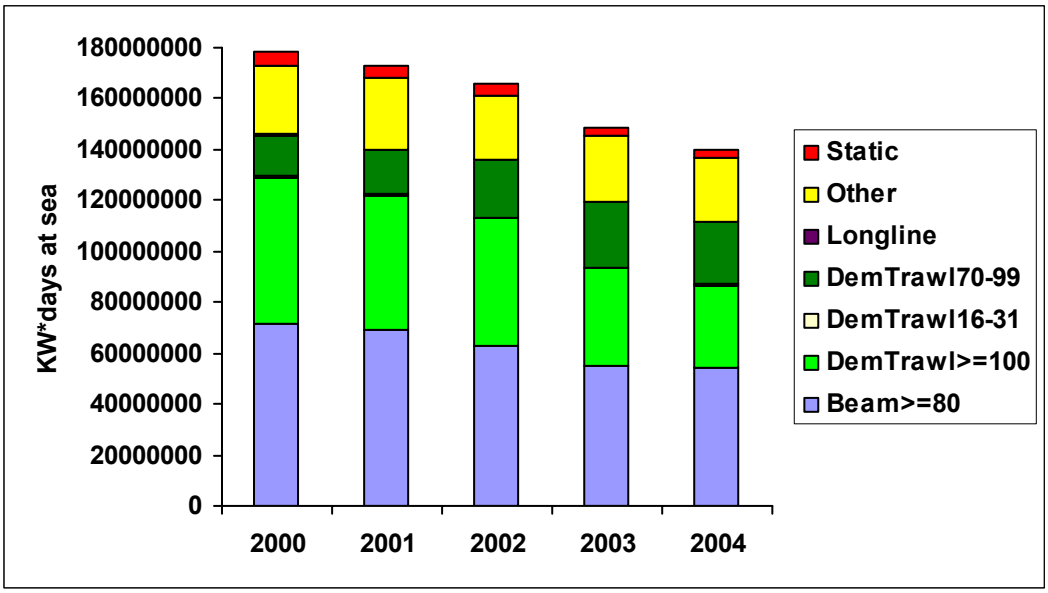


Fig. 3.3.3.1 Trend in nominal effort (KW*days at sea) for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the North Sea and Skagerrak, 2000-2004.

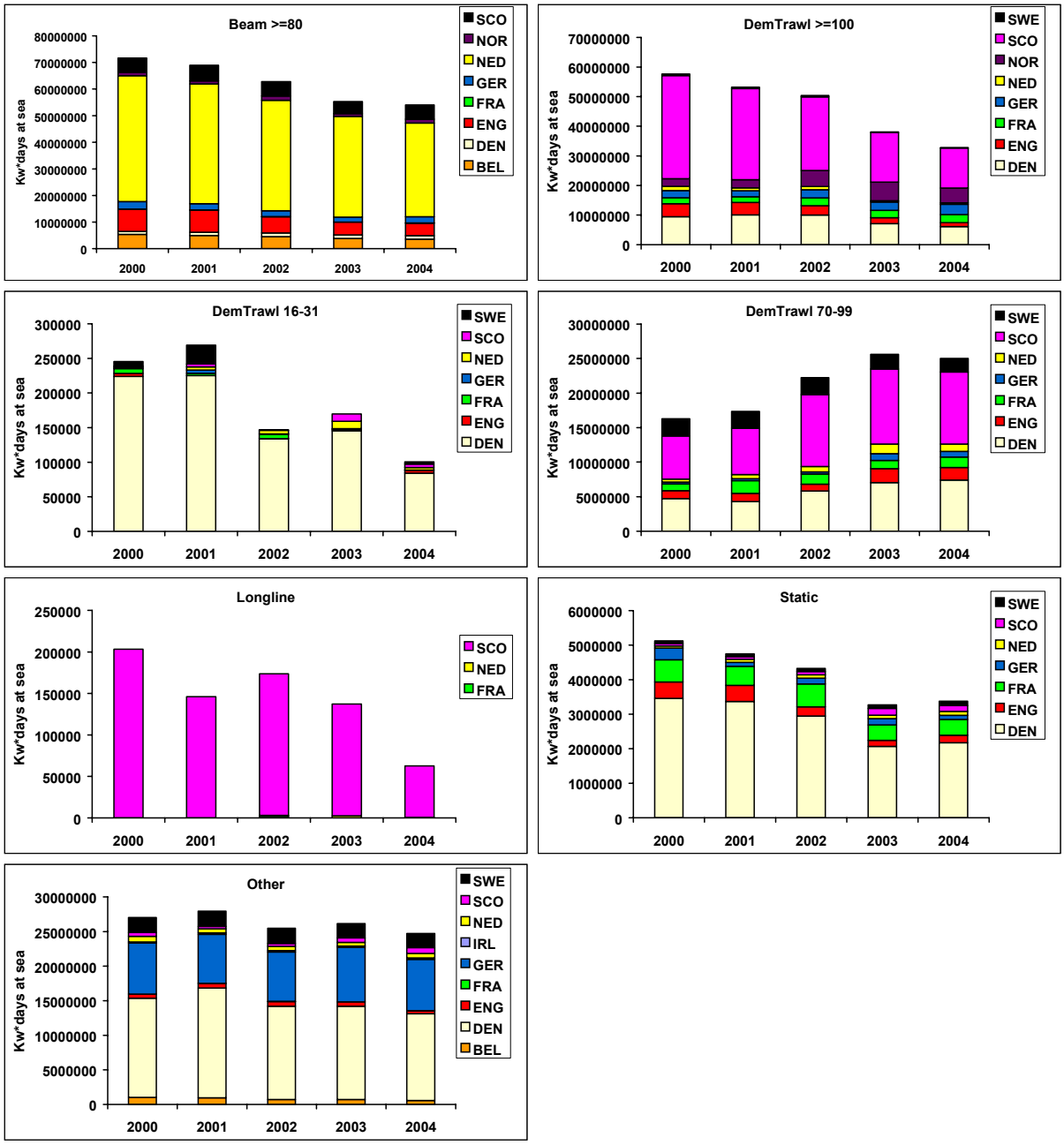


Fig. 3.3.3.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the North Sea and Skagerrak, 2000-2004.

3.3.4 Trends in fleet specific nominal effort in the Eastern Channel

3.3.4.1 Trends in fleet specific nominal effort by regulated gears and countries

Figure 3.3.4.1 presents fishing effort of the fleets fishing in the Eastern Channel for 2000 to 2004. The total nominal fishing effort increased until 2002, but appears to have decreased for the last 3 years. During 2000-2004, the overall increase amounted to 22%, while the recent decrease from 2002 to 2004 is estimated at 3%. Demersal trawlers 70-99 mm are the most abundant fleet in the Eastern Channel with more than 50% of the total effort. Unlike the other demersal trawlers (DemTrawl>=100 and DemTrawl 16-31) their fishing effort increased by 14% from 2000 to 2004. Fishing effort of the demersal trawlers with other mesh sizes is less important and has decreased since 2000. Beam trawlers also show an increase in effort between 2000 and 2003 (by 32%), after which effort decreased in 2004 to a level of 17% lesser than in 2002. The effort of static gears has increased since 2000; its contribution to the total effort was less than 10% in 2000 but increased to more than 20% in

2004. The high variation in nominal effort by gear types can be explained by the small area of this management area.

Figure 3.3.4.2 shows the fishing effort by country for each fleet fishing in the Eastern Channel. Except for the beam trawlers, all activities are dominated by France. The French trawlers, for example, contribute >90% of the effort for demersal trawlers with a mesh size range of 70-99mm. In contrast to the English fleet, fishing effort of the French fleet for this category has slightly increased since 2000. Beam trawling in the Eastern Channel is mainly executed by England, France and Belgium. Longlining is a marginal activity although the figure shows a fast increase between 2000 and 2003 (2004 data are not available). Fishing effort of static demersal nets, which includes gill nets, trammel nets and tangle nets, has tripled since 2000. It is mainly a French coastal activity which can be divided into two categories: gillnets which target mainly sole and plaice and other gillnets.

3.3.4.2 Conclusions

Total nominal effort increased between 2000 and 2004 by 22% and decreased between 2002 and 2004 by 3%. The main fishing effort is deployed by vessels using demersal trawls with small mesh size 70-99mm which increased by 14% between 2000 and 2004 and decreased by 3% during 2002-2004. Such continuous trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan.

Table 3.3.4.1 Trends in nominal effort (Kw*days at sea) by effort regulated gear types in the Eastern Channel, 2000-2004.

GearReg	2000	2001	2002	2003	2004
Beam>=80	2507662	2995361	3217570	3312100	2663290
DemTrawl>=100	369316	180637	359713	119924	32608
DemTrawl16-31	8421	2415	2255	4423	3005
DemTrawl70-99	6770937	6914296	7902002	7308224	7703747
Longline	1403	8448	23900	27606	
Other	850901	1071955	1287272	1735048	645960
Static	1020939	1351764	1797378	1747460	3049539
SUM	11529579	12524876	14590090	14254785	14098149
change relative to 2000		0.09	0.27	0.24	0.22
change relative to 2002				-0.02	-0.03

Tab. 3.3.4.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Eastern Channel, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
Beam>=80	BEL	1416646	1576944	1849430	1942327	1475379
Beam>=80	ENG	611297	810697	791480	866981	672449
Beam>=80	FRA	477536	606025	576660	502792	510672
Beam>=80	NED	2183	1695			4790
sum		2507662	2995361	3217570	3312100	2663290
change relative to 2000			0.19	0.28	0.32	0.06
change relative to 2002					0.03	-0.17
DemTrawl>=100	ENG	45135	26799	28910	31745	473
DemTrawl>=100	FRA	315878	139958	330803	84232	28754
DemTrawl>=100	NED	832	13880		3947	3381
DemTrawl>=100	SCO	7471				
sum		369316	180637	359713	119924	32608
change relative to 2000			-0.51	-0.03	-0.68	-0.91
change relative to 2002					-0.67	-0.91
DemTrawl16-31	ENG		99		87	
DemTrawl16-31	FRA	8421	2316	2255	4336	3005
sum		8421	2415	2255	4423	3005
change relative to 2000			-0.71	-0.73	-0.47	-0.64
change relative to 2002					0.96	0.33
DemTrawl70-99	ENG	378736	330075	261729	285857	291775
DemTrawl70-99	FRA	6354814	6500748	7585541	6908611	7197597
DemTrawl70-99	NED	37387	81685	54732	113756	214375
DemTrawl70-99	SCO		1788			
sum		6770937	6914296	7902002	7308224	7703747
change relative to 2000			0.02	0.17	0.08	0.14
change relative to 2002					-0.08	-0.03
Longline	FRA	1403	8448	23900	27606	
sum		1403	8448	23900	27606	
change relative to 2000			5.02	16.03	18.68	
change relative to 2002					0.16	
Other	BEL	17875	23902	8526	11895	23861
Other	ENG	5637	12461	471	6379	18902
Other	FRA	822655	1031918	1263995	1697556	536293
Other	NED	4734	3674	14280	19218	66904
sum		850901	1071955	1287272	1735048	645960
change relative to 2000			0.26	0.51	1.04	-0.24
change relative to 2002					0.35	-0.5
Static	ENG	31194	16212	9117	15689	11927
Static	FRA	975819	1335552	1788261	1731771	3037612
Static	GER	13926				
sum		1020939	1351764	1797378	1747460	3049539
change relative to 2000			0.32	0.76	0.71	1.99
change relative to 2002					-0.03	0.7

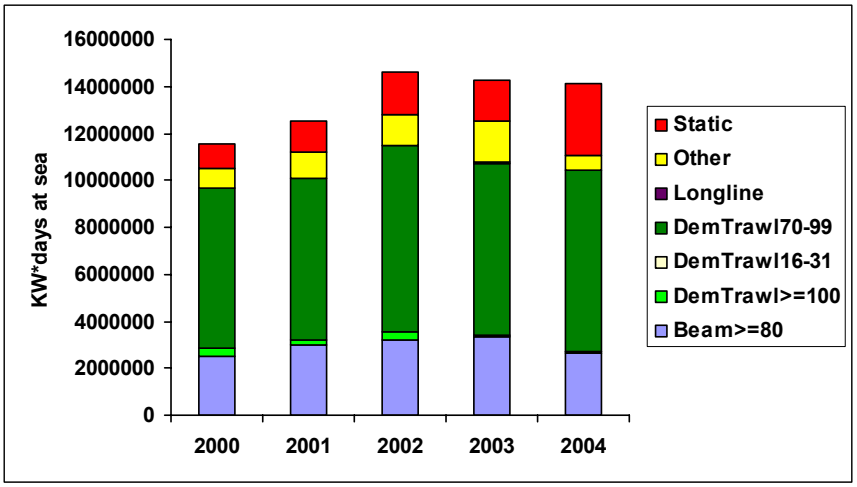


Figure 3.3.4.1 Fishing efforts by fleet in the Eastern Channel, 2000-2004.

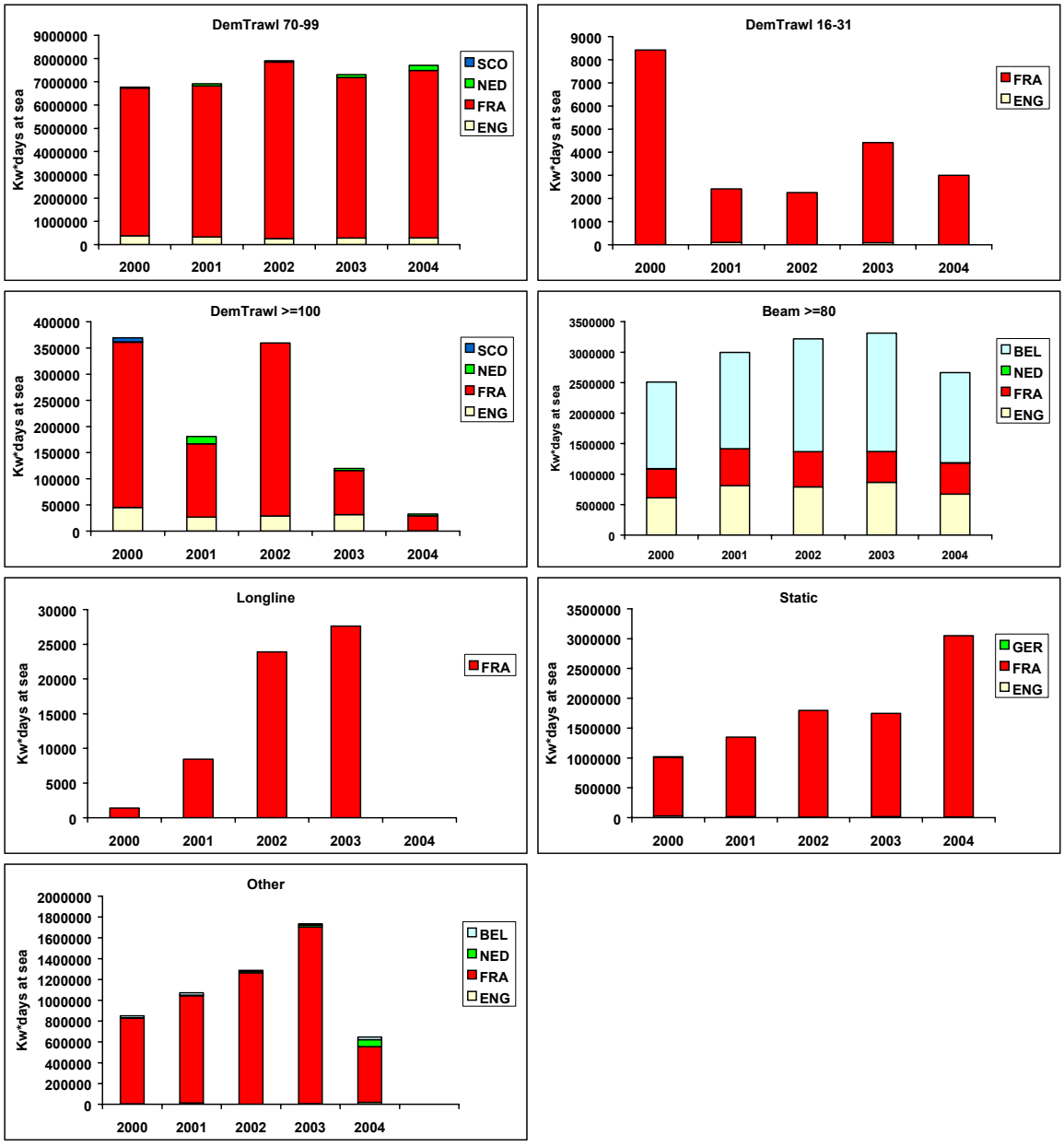


Fig. 3.3.4.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Eastern Channel, 2000-2004.

3.3.5 Trends in fleet specific nominal effort in the Kattegat

3.3.5.1 Trends in fleet specific nominal effort by regulated gears and countries

Overall, the total nominal effort of demersal gear types decreased steadily since 2000. Compared with 2000 and 2002, the relative decreases in 2004 amounted to 27% and 16% (Tab. 3.3.5.1 and Fig. 3.3.5.1), respectively. The main fishing gear, in terms of nominal effort, is the demersal trawl 70-99mm, contributing about 80% to the total effort deployed. Other gears, comprising also regulated gears but without mesh size information, contributed less than 10% to the total effort. National trends in nominal effort by regulated gears are given in Table 3.3.4.3 and illustrated in Fig. 3.3.4.2.

During the period 2000-2004, the nominal effort of demersal trawls 70-99mm, the gear type distinguished by the highest cod catches, has decreased by 22%. Since 2002, the decrease was approximately 8%. The total effort for Germany is insignificant compared to Sweden and Denmark. Sweden shows the strongest decrease in effort in this segment while Germany shows no trend. The use of this gear category is very different when compared to the North Sea, where this segment increased by 54% from 2000 until 2004. The reason is the lack of incentives to use gears with smaller mesh sizes due to different minimum mesh sizes/catch composition regulations during this period.

The nominal effort in demersal trawls >100 mm has decreased for both Denmark and Sweden. During the period 2000-2004, the nominal effort decreased with 79% while the decrease in effort was 65% between 2002 and 2004 for these demersal trawls.

The target species of the gear group of demersal trawl 16-31mm are herring, sprat and to some extent sandeel. Overall the effort has increased by 32 % from 2000 until 2004, which is mainly explained by the fact that Denmark increased their effort. The Swedish fishery in this gear category is insignificant in this segment.

The nominal effort using demersal longlines (mainly Denmark) peeked in 2002 but has since then decreased dramatically and is now insignificant. The reason for the decline is not known.

The nominal effort in static gear fisheries has decreased in Denmark while the nominal effort for static gears in Sweden and Germany has been fairly stable. The overall nominal effort has decreased by 48% during the period 2000 to 2004 and 51% since 2002.

Table 3.3.5.1 Trends in nominal effort (Kw*days at sea) by effort regulated gear types in the Kattegat, 2000-2004.

GearReg Beam>=80	2000	2001	2002	2003	2004
DemTrawl>=100	854305	827600	512765	198615	180654
DemTrawl16-31	266036	400237	369662	500635	352307
DemTrawl70-99	4546498	4663476	3868318	4267161	3551584
Longline	111	23104	47217	2691	184
Other	318833	385241	345226	406974	344223
Static	296113	299445	316923	224412	155128
SUM	6281896	6599103	5460111	5600488	4584080
change relative to 2000		0.05	-0.13	-0.11	-0.27
change relative to 2002				0.03	-0.16

Tab. 3.3.5.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Kattegat, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
DemTrawl>=100	DEN	607525	651734	424609	152913	160275
DemTrawl>=100	GER	18347	9643	1305	1332	5258
DemTrawl>=100	SWE	228433	166223	86851	44370	15121
sum		854305	827600	512765	198615	180654
change relative to 2000			-0.03	-0.4	-0.77	-0.79
change relative to 2002					-0.61	-0.65
DemTrawl16-31	DEN	237909	388908	369346	500635	352307
DemTrawl16-31	GER	1989				
DemTrawl16-31	SWE	26138	11329	316		
sum		266036	400237	369662	500635	352307
change relative to 2000			0.5	0.39	0.88	0.32
change relative to 2002					0.35	-0.05
DemTrawl70-99	DEN	2888699	3077272	2558517	2841847	2470740
DemTrawl70-99	GER	58156	11675	35773	54576	40268
DemTrawl70-99	SWE	1599643	1574529	1274028	1370738	1040576
sum		4546498	4663476	3868318	4267161	3551584
change relative to 2000			0.03	-0.15	-0.06	-0.22
change relative to 2002					0.1	-0.08
Longline	DEN	111	23104	47217	2691	184
Longline	GER					
Longline	SWE					
sum		111	23104	47217	2691	184
change relative to 2000			207.14	424.38	23.24	0.66
change relative to 2002					-0.94	-1
Other	DEN	239228	267008	266551	331294	253447
Other	GER					
Other	SWE	79605	118233	78675	75680	90776
sum		318833	385241	345226	406974	344223
change relative to 2000			0.21	0.08	0.28	0.08
change relative to 2002					0.18	0
Static	DEN	241377	259959	268331	166408	112327
Static	GER	1932	1600	11861	13796	14289
Static	SWE	52804	37886	36731	44208	28512
sum		296113	299445	316923	224412	155128
change relative to 2000			0.01	0.07	-0.24	-0.48
change relative to 2002					-0.29	-0.51

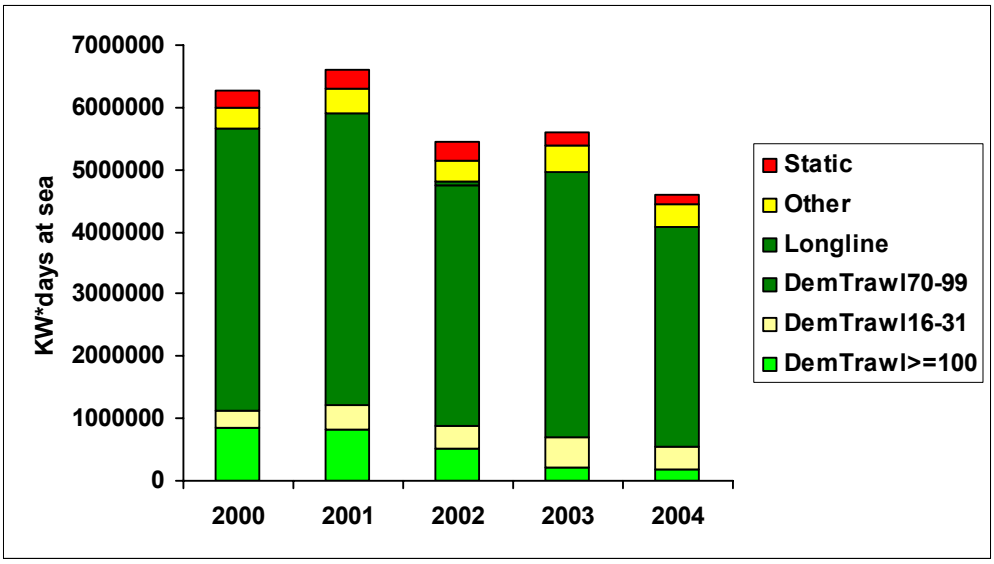


Fig. 3.3.5.1 Trend in nominal effort (KW*days at sea) for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Kattegat, 2000-2004.

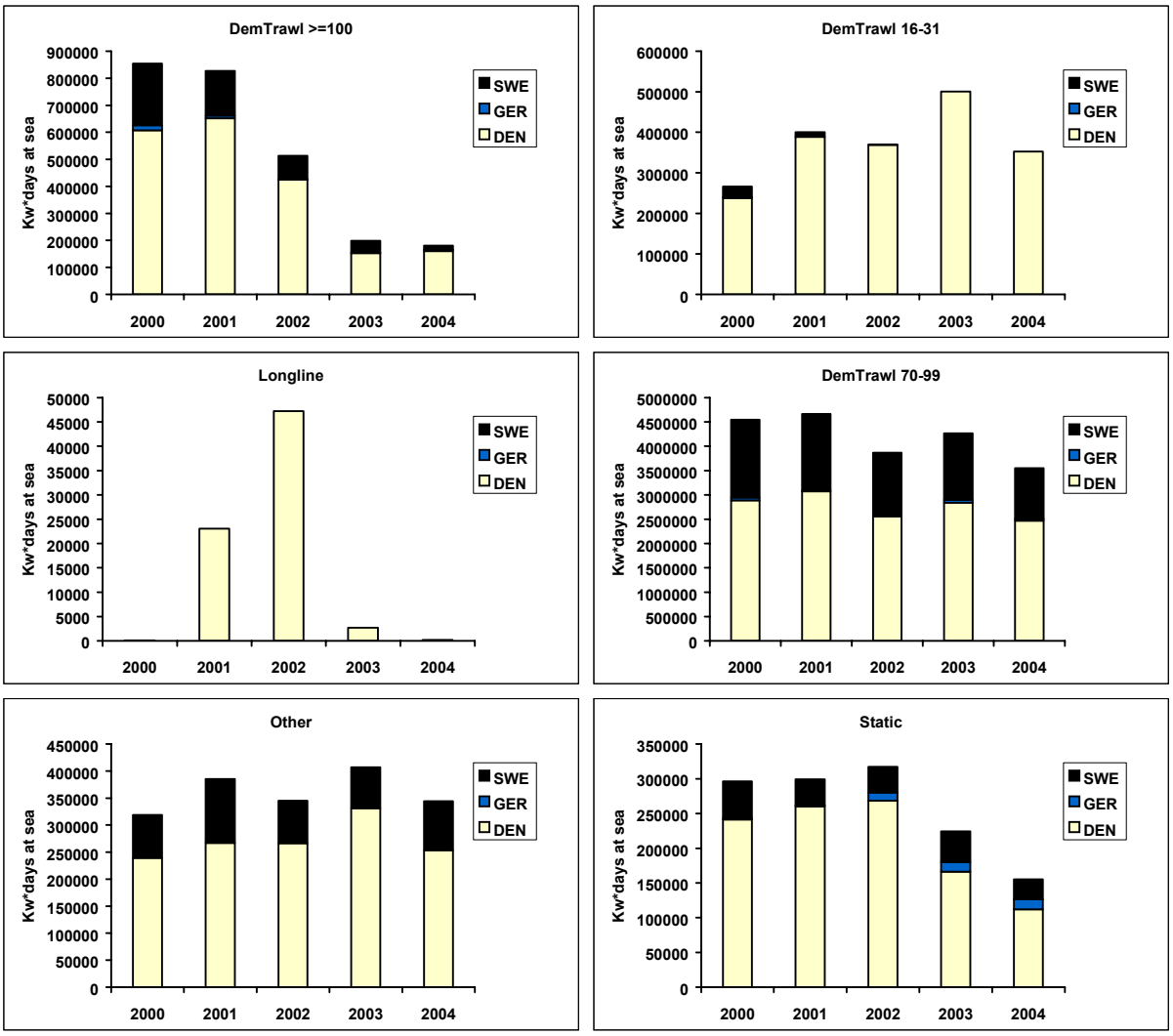


Fig. 3.3.5.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Kattegat 2000-2004.

3.3.5.2 Conclusions

There has been no dramatic shift in total nominal effort by gear types used during the period 2000 to 2004 even though demersal gears>100 mm have decreased drastically and demersal gears 70-99 mm have decreased by 22%. The total nominal effort has decreased with 27 % during the period 2000 to 2004. Such continuous trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan. The overall reduction in nominal effort is not in agreement with the recent trend in fishing mortality during this period.

3.3.5.3 Comments on the industry's proposal "Effort management Scheme in Kattegatt"

Overall, SGRST considers that an effort management scheme in Kattegat, where there is mixed fisheries, is a good idea and should be explored further. One possible advantage is that an effort-regulated system may result in lower discard rates. Furthermore, SGRST can see the advantages by using Kattegat as a trial area, because the Kattegat is a small area and few countries are involved in the fishing. Furthermore, many species in the Kattegat is managed together with Skagerrak (management unit 3A). However, SGRST is concerned with the proposal in its current form.

In the Danish proposal, it is unclear how the effort system is to be set up. In section 2.1 in the proposal, it is stated that the TAC for the Kattegat is suspended or theoretically fixed at a high level and in section 2.5 it is stated that each vessel is apriori allocated a number of 15 days at sea per month. The present situation is however that the "fish" fishery is allowed only 9 days at sea (the 90 mm fishery) while fishermen using a grid in the trawl (catch of fish is low) is allowed days at sea (the same rules applies for Skagerrak). It is stated in section 2.9 that an overall effort reduction must be taken into account. According to section 2.9 the effort reduction to be used in the proposal is based on the total effort (in Kw days at sea) for the fishing year 2004. It is not clear how to calculate the reduction factor and how it is to be implemented. SGRST notices that there is a problem going from a TAC regulated system towards an effort-regulated system. For example, it is not known how the fishing efficiency of the fleet in terms of catch/kw days at sea is related to the different TACs in the area. This is crucial and by no means at all clear in the proposal how this would be done in the effort scheme in Kattegat. The 3-month period and the possibility to redistribute days within the period are also unclear. This could result in that all days for the 3-month period are used in the beginning of the period and then the vessel can fish elsewhere. It is thus also unclear what the consequences on neighbouring areas will be SGRST foresees a potential risk of area misreporting in this area between Skagerrak and the Western Baltic and allocation of fishing effort to the Kattegat.

A problem with using Kattegatt as an effort management experiment is that the cod population is in an extremely poor state. The advice from ICES 2005, is zero fishing in 2006 and the advice states that even with no fishing in 2006 the SSB will be under Blim in 2007. Hence, there is an urgent need to rebuild the stock and in such situation it is important to have a low fishing mortality independent of management system (TAC or effort management). In the current situation it is also difficult to determine what effort should be allowed in the Kattegat to allow the cod stock to rebuild. Therefore the SGRST subgroup does not think that the proposed full-scale experiment effort management scheme (five years) is a fruitful way to address the problems in the Kattegat and alternatively an effort management experiment could be set up in the Skagerrak instead where the cod population is in a relatively better situation.

The first step towards a effort-regulated system could be a small-scale experiment with a fraction of a fleet that are able to fish based on days-at-sea and to compare this fraction of the fleet with the fleet that are fishing accordingly to the current management system. The experiment would also be set up during a short time. This would allow us to quantify and compare the efficiency, discards and exploitation patterns between the two groups. In the current management system, exploitation patterns and effort could in many ways be independent of the actual densities of fish populations but instead depending on quotas and weekly rations as well as expectations of future quotas and rations and overall profit (i.e. the Faeroe Islands). It is thereby difficult to use data on efficiency and exploitation patterns from such a system to make predictions about how the fishing fleet would behave in an effort regulated system.

3.3.6 Trends in fleet specific nominal effort West of Scotland

The total nominal effort reported for gears in Division VIa varied between 2000-2004 but with little discernible trend (Tab. 3.3.6.1 and Fig 3.3.6.1). Between 2000 and 2002 total nominal effort decreased by 14% and between 2002 and 2004 total nominal effort increased by 12%. Demersal trawls ≥100mm and the 70-99mm gear category, are the main gears contributing about 80% to the total effort deployed. The "other" gear category (including regulated gears but without mesh size information) contributed about 15% with the remaining effort attributable to static gears and longline fisheries. Beam trawl>=80 mm contribute less than 1% in all years. Because effort data were reported and complied for the Division VIa as a whole, SGRST was unable to comment on trends inside and outside the cod recovery zone.

3.3.6.1 Trends in fleet specific nominal effort by regulated gears and countries

National trends in nominal effort by regulated gears are given in Table 3.3.6.2 and illustrated in Fig. 3.3.6.2.

Beam trawls ≥80mm contributed a very small component of the overall nominal effort for the west of Scotland. Scottish registered vessels predominate with English, Irish and France vessels contributing to a lesser extent. There is no discernable trend in beam trawl effort reported by Scotland but that reported by other nations increased between 2003 and 2004.

During the period 2000-2002, nominal effort of demersal trawls ≥100mm decreased by about 13%, but increased between 2002 and 2004 by about 5%. Effort by UK vessels in this category has declined, particularly since 2003, whereas effort of French and German fleets has increased.

The nominal effort of the fleets in the 70-99mm demersal trawl category remained relatively constant during the period 2000-2004. Highest reported effort for this category was in 2003. Vessels in this category are predominantly Scottish Nephrops trawlers which fish on inshore grounds and on Stanton Bank and Noup.

Longline nominal effort has increased by 65% over the period 2000-2004, particularly since 2003. The main contributors are England and Germany with France increasing its effort in 2004.

Effort of static gears increased between 2000 and 2004 by 89%. Prior to 2004, most of the effort was reported by Scotland. French and UK vessels exerted 25% of the effort in 2004.

Effort for the 'other' gear category includes effort of unregulated gears and regulated gears without mesh size information. The majority of effort in this category is attributable to Irish vessels, with UK, Dutch and French vessels contributing but to a much lesser extent.

UK national effort analyses and trends were presented to SGRST and are given in working documents No. 3 and 4.

3.3.6.2 Conclusions

There have been some changes in effort in regulated gear categories, particularly in demersal trawls ≥100mm which accounts for most of the cod catch in Division VIa. However, because effort data reported for the west of Scotland were for the whole of Division VIa, it was not possible for the SGRST to evaluate changes in nominal effort exerted by regulated gears within the cod recovery zone.

Tab. 3.3.6.1 Trend in nominal effort (Kw*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information and excluding pelagics) for the West of Scotland, 2000-2004.

GearReg	2000	2001	2002	2003	2004
Beam>=80	101399	168334	163575	106521	191984
DemTrawl>=100	11115858	11917973	9619005	8376922	10107775
DemTrawl16-31	24667	2222		30170	8969
DemTrawl70-99	5918815	5664432	5383948	6581231	6183765
Longline	83856	129058	176294	126183	189899
Other	3781869	3525578	2773119	3235043	3453050
Static	247150	266094	211834	370745	402264
SUM	21273614	21673691	18327775	18826815	20537706
change relative to 2000		0.02	-0.14	-0.12	-0.03
change relative to 2002				0.03	0.12

Tab. 3.3.6.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information and excluding pelagics) for the West of Scotland, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
Beam>=80	ENG	4150	1550	861	1274	12067
Beam>=80	FRA		1472			35746
Beam>=80	GER					
Beam>=80	IRL	8382	9396			21752
Beam>=80	NED					
Beam>=80	SCO	97249	165312	162714	105247	144171
sum		109781	177730	163575	106521	213736
change relative to 2000			0.62	0.49	-0.03	0.95
change relative to 2002					-0.35	0.31
DemTrawl>=100	ENG	701690	576499	426818	613658	244072
DemTrawl>=100	FRA	2138124	1987170	1492510	1760515	4319230
DemTrawl>=100	GER	372527	396153	61620	103023	938979
DemTrawl>=100	IRL					
DemTrawl>=100	NED					
DemTrawl>=100	SCO	7903517	8958151	7638057	5899726	4605494
sum		11115858	11917973	9619005	8376922	10107775
change relative to 2000			0.07	-0.13	-0.25	-0.09
change relative to 2002					-0.13	0.05
DemTrawl70-99	ENG	144274	105239	97589	76928	169194
DemTrawl70-99	FRA	20952	6582	2868	25263	30882
DemTrawl70-99	GER					
DemTrawl70-99	IRL					
DemTrawl70-99	NED					
DemTrawl70-99	SCO	5753589	5552611	5283491	6479040	5983689
sum		5918815	5664432	5383948	6581231	6183765
change relative to 2000			-0.04	-0.09	0.11	0.04
change relative to 2002					0.22	0.15
GearReg	COUNTRY	2000	2001	2002	2003	2004
Longline	ENG	98009	108713	157229	98150	91579
Longline	FRA	14920	27399	21016	4843	89666
Longline	GER	117283	91759	11907	210918	165518
Longline	IRL	2603	14083	6446	12726	14596
Longline	NED					
Longline	SCO	14335	24140	15236	44108	40905
sum		247150	266094	211834	370745	402264
change relative to 2000			0.08	-0.14	0.5	0.63
change relative to 2002					0.75	0.9
Other	ENG	77163	3196	14929	6876	16913
Other	FRA	14562	50864		1754	564
Other	GER					
Other	IRL	3111043	3197175	2466723	3115393	3094920
Other	NED			19783	682	
Other	SCO	579101	274343	271684	110338	340653
sum		3781869	3525578	2773119	3235043	3453050
change relative to 2000			-0.07	-0.27	-0.14	-0.09
change relative to 2002					0.17	0.25
Static	ENG	4150	1550	861	1274	12067
Static	FRA		1472			35746
Static	GER					
Static	IRL					
Static	NED					
Static	SCO	97249	165312	162714	105247	144171
sum		101399	168334	163575	106521	191984
change relative to 2000			0.66	0.61	0.05	0.89
change relative to 2002					-0.35	0.17

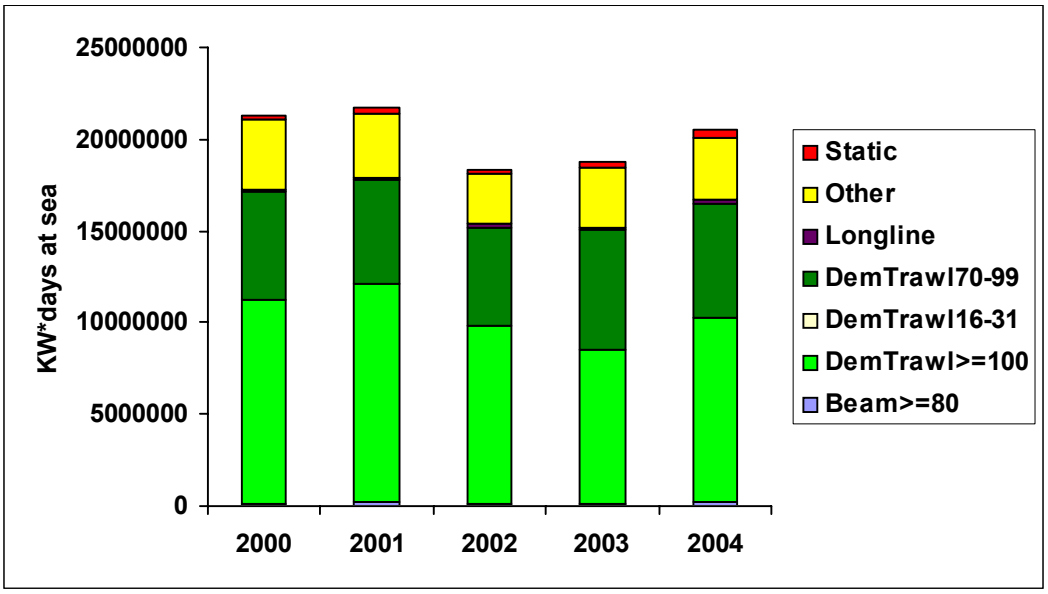


Fig. 3.3.6.1 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information and excluding pelagics) for Division VIa. west of Scotland, 2000-2004.

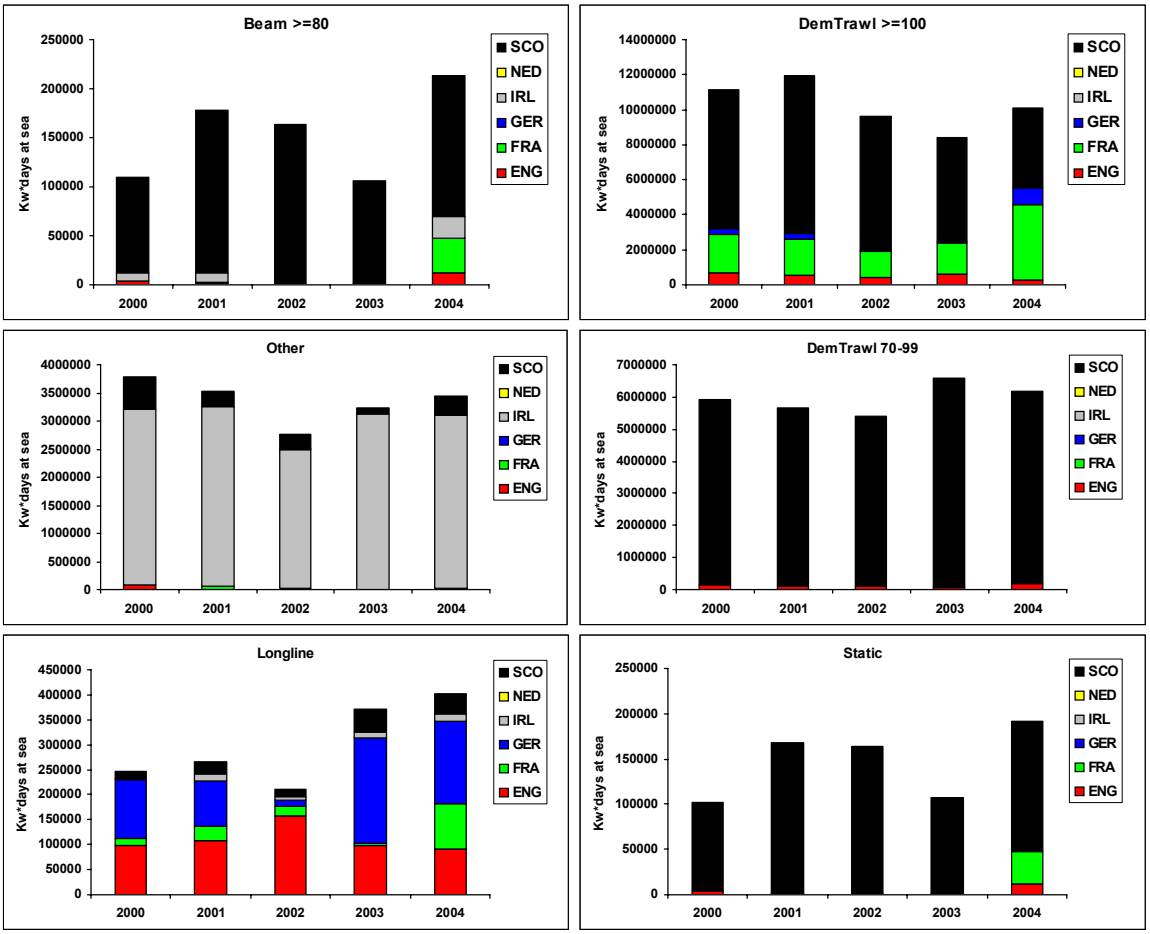


Fig. 3.3.6.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information and excluding pelagics) for Division VIa, west of Scotland, 2000-2004.

3.3.7 Trends in fleet specific nominal effort in the Irish Sea

3.3.7.1 Trends in fleet specific nominal effort by regulated gears and countries

Overall, the total nominal effort of demersal gear types has decreased since 2000. Compared with 2000 and 2002, the relative decreases in 2004 amount to 17% and 13% respectively (Table 3.3.7.1 and Figure 3.3.7.1). Main fishing gears in terms of nominal effort are beam ≥80 mm, and the demersal trawls ≥100 and 70-99 mm, contributing about 80% to the total effort deployed. Other gears, comprising also regulated gears but without mesh size information, contribute about 20% to the total effort.

National trends in nominal effort by regulated gears are given in Table 3.3.7.2 and illustrated in Figure 3.3.7.2.

Until 2004, the regulated gear beam ≥80mm reveals a decrease in nominal effort by 15% and 35% when compared with the years 2000 and 2002, respectively. Between 2000 and 2004 Belgian beam ≥80 mm effort was highest in 2002 and declined markedly in 2004. Irish beam ≥80 mm effort also declined markedly in 2004 (Table 3.3.7.2 and Figure 3.3.7.2).

During the period 2000-2003, the nominal effort of demersal trawls ≥100mm increased. In 2004 there was a substantial drop in the effort reported for this category, amounting to declines of 19% and 38% relative to 2000 and 2002, respectively.

The effort of the fleets aggregated under the category of demersal trawl 70-99mm decreased by 19% from 2000 until 2004. However, since 2002 effort in this category is estimated to have increased by 12%. Changes in the UK(England & Wales, Northern Ireland & Scotland) fleets account for most of these changes. Further descriptions of changes in the effort deployed by UK fleets can be found in Working Documents 3 and 4.

Significant efforts are reported for other demersal gears without mesh size information. Mesh size information was not available from Ireland. All Irish mobile gears (except beam trawl) were therefore aggregated into the category “other”. These Irish vessels are mainly using the regulated gears 70-99mm (in otter trawl fisheries targetting Nephrops) and ≥100mm (in fish-directed otter trawl fisheries).

Effort reported by other regulated gear categories (16-31mm, longlines & Static gear) is relatively low in the Irish Sea. Ireland has reported substantially more static gear effort in the most recent years. However the overall increase in this category is relatively insignificant compared to the amount of effort exerted by fleets deploying mobile gears.

3.3.7.2 Conclusions

There has been an overall decline of 19% from 2000-2004 in the effort exerted by vessels using 70-99mm meshes. However, there is some evidence since 2002 of a transfer of effort from trawls using ≥100 mm mesh to 70-99mm mesh. Such trends in nominal effort appear only partly connected with the days at sea regulations enforced since 2003 and imply higher fishing mortalities than those consistent with the cod recovery plan.

Notwithstanding the changes observed in effort there has been no evidence from recent assessments (ICES 2004b) of an increase in SSB during the period 2000-2004, nor of a reduction in fishing mortality consistent with that required by the cod recovery plan. However, it must be noted that access to commercial data used in the assessment has been hampered in recent years. This has resulted in increasing uncertainty over the most recent levels of fishing mortality.

Table 3.3.7.1 Trends in nominal effort (Kw*days at sea) by effort regulated gear types in the Irish Sea 2000-2004.

GearReg	2000	2001	2002	2003	2004
Beam>=80	1922867	2208549	2509432	2402617	1637164
DemTrawl>=100	1692759	2093165	2224980	2535771	1376026
DemTrawl16-31				134	
DemTrawl70-99	4411335	4265769	3198881	3651695	3577440
Longline		7872		3608	300
Other	2094534	1857434	1728915	1716932	1796048
Static	33126	36539	59045	74840	64863
SUM	10154621	10469328	9721253	10385597	8451841
change relative to 2000		0.03	-0.04	0.02	-0.17
change relative to 2002				0.07	-0.13

Tab. 3.3.7.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Irish Sea, 2000-2004.

GearReg	COUNTRY	2000	2001	2002	2003	2004
Beam>=80	BEL	1004688	1486557	1760619	1517628	1118670
Beam>=80	ENG	127815	216216	138474	213235	110838
Beam>=80	IRL	609304	505776	608444	671754	407656
Beam>=80	NED	181060		1895		
sum		1922867	2208549	2509432	2402617	1637164
change relative to 2000			0.15	0.31	0.25	-0.15
change relative to 2002					-0.04	-0.35
DemTrawl>=100	ENG	1589754	2001127	2147052	2453880	1341227
DemTrawl>=100	SCO	103005	92038	77928	81891	34799
sum		1692759	2093165	2224980	2535771	1376026
change relative to 2000			0.24	0.31	0.5	-0.19
change relative to 2002					0.14	-0.38
DemTrawl16-31	ENG				134	
sum		0	0	0	134	0
change relative to 2000						
change relative to 2002						
DemTrawl70-99	ENG	4384793	4242703	3181048	3625964	3550736
DemTrawl70-99	SCO	26542	23066	17833	25731	26704
sum		4411335	4265769	3198881	3651695	3577440
change relative to 2000			-0.03	-0.27	-0.17	-0.19
change relative to 2002					0.14	0.12
Longline	IRL					300
Longline	SCO		7872		3608	
sum		0	7872	0	3608	300
change relative to 2000						
change relative to 2002						
Other	BEL		4416		518	8107
Other	ENG	13780	17018	8248	7422	2042
Other	IRL	2067939	1836000	1720667	1708992	1784795
Other	NED	12485				
Other	SCO	330				1104
sum		2094534	1857434	1728915	1716932	1796048
change relative to 2000			-0.11	-0.17	-0.18	-0.14
change relative to 2002					-0.01	0.04
Static	ENG	24572	15157	16321	14873	12548
Static	IRL	8554	20942	42724	59967	50152
Static	NED		440			
Static	SCO					2163
sum		33126	36539	59045	74840	64863
change relative to 2000			0.1	0.78	1.26	0.96
change relative to 2002					0.27	0.1

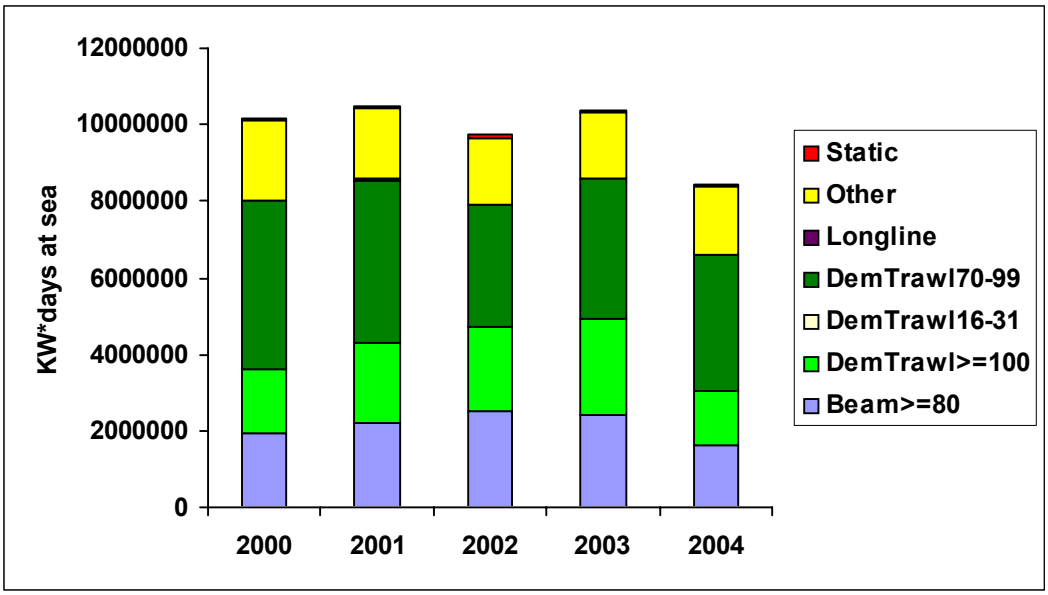


Fig. 3.3.7.1 Trend in nominal effort (KW*days at sea) for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Irish Sea, 2000-2004.

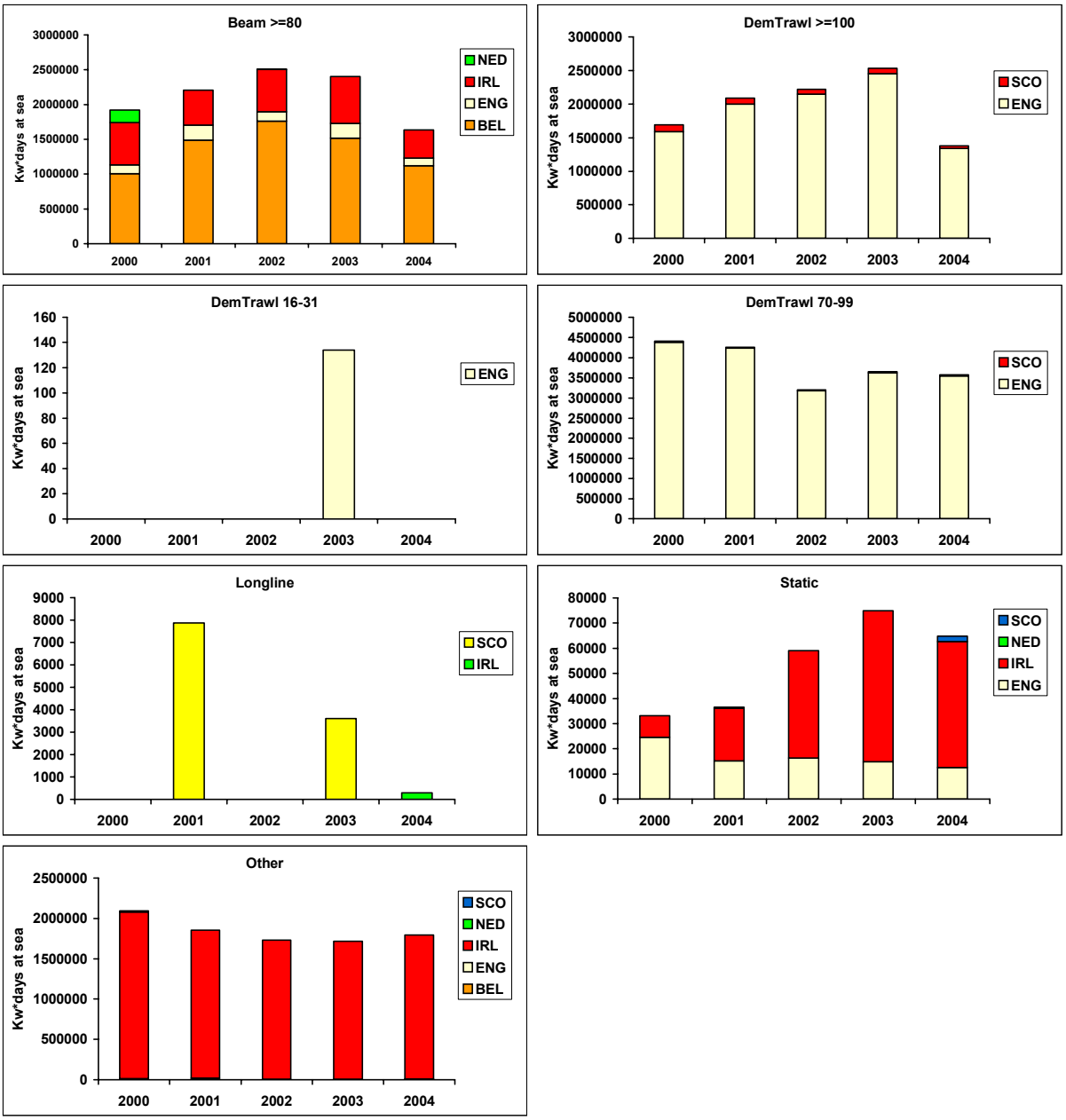


Fig. 3.3.7.2 Trend in nominal effort (KW*days at sea) by country for the effort regulated and other unregulated gears (including reports without mesh size information) except pelagics in the Irish Sea, 2000-2004.

4 Potential ways to improve the conservation of cod, consistent with the Cod Recovery Plan (Regulation 423/2004)

SGRST was provided with information on the control and enforcement of effort within the COM's evaluation report: Cod recovery verification programme 2004 (WD No. 9).

The report noted that, in general terms, there is a considerable improvement in the implementation of effort limitation schemes by MS, particularly with respect to previous years. The existence of a system in place to implement Annex V was not in itself a guarantee that an actual reduction in fishing effort at the target levels required by the recovery plan has been achieved. Member States implemented Annex V in a manner that caused minimal disruption for the fishing industry. Cod quotas were not exhausted and vessels operated in the area during the whole 11 months management period. As a side effect of this effort regime and due to the flexibility of transfer of fishing opportunities between vessels, a market of rights in terms of effort (days absent from port) developed. Furthermore, the report considers that the actual reduction in terms of fishing effort by the main fleets is likely to have

been modest. As a result of an imbalance between the allocation of days and the available quotas, the authors consider that high grading and mis-declaring cod was a common practice during 2004. It also appeared that landings compositions of the regulated gears were poorly enforced.

SGRST concludes that:

- **any transfer of effort between areas will result in an imbalance of fishing activity and management intentions. Similarly, high-grading, discarding and mis-declaring of cod may compromise effort management and will each lead to reductions in the levels of fishing mortality that are lower than those required for recovery.**

4.1 Closed area management

Closed areas have been proposed as one of a range of potential management approaches that could be applied to control the exploitation rate of the North Sea cod stock. However, whilst theoretical studies of the potential effects of closed area are numerous, they are of limited use for providing practical management advice because they are not case specific. Darby (2005, working documents 1 and 2) presented the conclusions drawn from studies into the outcomes and problems associated with the use of closed area management of the North Sea cod which were endorsed by the SGRST. The studies brought together fishermen's knowledge of current and potential future North Sea fleet fishing activity with research on the spatial movement of fleets, cod population biology and the impact of fishing on benthic biodiversity in order to provide practical advice on the impact of closed area management in the North Sea.

Examples of closed area management regimes for the North Sea cod were simulated and the impact on the catches of cod, mixed gadoids and benthic productivity and diversity evaluated. The study examined three example scenarios: two evaluating the impact of large, broad scale, North Sea closures while the third was focused at a more detailed scale, considering the effect of a localised closure for which more detailed fleet specific data was available. The outcome of the predicted changes in the distribution of the North Sea fleets' effort on the benthos and the cod stock were examined and conclusions drawn with respect to the potential impact of the closures on mortality rates, including comparisons with other management actions or technical measures that could be employed to manage the stock; the design of closed areas for restricting access to stocks; and the effectiveness of the modelling approaches.

The research has resulted in an improved understanding of the potential impact that closed areas could have on the fleet yields and the population dynamics of the cod, especially recovery rates to biological reference points. However, the analyses also highlighted areas where the science and knowledge base is limited and where further industry input and additional data analysis are required to provide a rapid response to managers and stakeholders when closed areas are proposed. Key points, by relevant subject area, are summarised below:

Effort management

- Removal from the fishery of the effort directed into a closed area results in the most significant impact from a closure. If effort is allowed to relocate into areas remaining open, the impact of the closed area is reduced substantially and the effects on the stock could be detrimental. Similarly any derogation to fish in a closed area will reduce its impact.

- The approach used by fishers to relocate effort displaced from a closed area is a critical determinant to the effectiveness of the closure.

- Case specific dialogue with fishers with regard to the potential changes in effort distribution resulting from a closure, during the design process is considered to be an important factor in reducing uncertainty associated with expected returns.

- Closed area management cannot be used in isolation from quota and effort regulation. Closed areas are designed to make fishers less efficient at catching protected species. If effort or

efficiency increase after relocation to open areas, in order to compensate for the reduced efficiency, the benefits of the closure will be reduced.

- The movement of large numbers of new boats into an area will result in conflicts between local and relocated fishers.

- Fishers prevented from accessing local stocks will be moved into areas that they may not have fished before. This will introduce inefficiency and reduce income. The incentive to provide biased landings and effort data will be greater. Catch and effort data quality are likely to become even more uncertain, until the stock recovers and pressures are relieved.

- The evaluations are based on relative stability in the amount, location and type of gears used, switching to alternative gears will reduce the impact of closed areas.

The North Sea cod fishery

- At a time of increasing uncertainty in the resource status resulting from bias in catch data, closed areas will remove some of the cod stock from exploitation, protecting at least a portion of the resource.

- The effectiveness of a closed area is conditional on its design, with respect to the decisions which fishers must take when they are redistributing effort.

- If fishers target cod using effort displaced from closed areas, the current approach to designing closed areas, adopted by the Commission of the European Union, could increase cod fishing mortality rates substantially. This results from areas in which high catch rates occur being omitted from closed areas that are based on total annual catch.

- Designing closed areas with respect to the areas from which high proportions of catch are taken and the potential catch rates in other areas provides a management approach, to reducing fishing mortality, that is more robust to the way in which effort is relocated.

- If re-designed, then closed areas of the magnitude suggested by the EU Commission could reduce cod fishing mortality. However, the estimated reductions in mortality rates are small and, at best, would only stabilise the decline in stock; they will not result in recovery of spawning stock biomass to safe biological levels.

- Closed areas that deliver “guaranteed” reductions in cod mortality, leading to stock recovery, without reducing current levels of effort would require the closure of substantial areas (50% or greater) of the North Sea. The impact of displacing significant proportions of the fleet’s effort into areas remaining open would be considerable and could result in many traditional fishing grounds being closed and numerous conflicts of interest and could increase exploitation of local stock units.

- Catches recorded from the North Sea cod fishery have spatial structure within them, indicating possible sub-stock structure (Section 4.1). The study did not evaluate the impact that this might have for each sub-unit. Closure of an area containing one sub-unit may completely protect it from exploitation whilst forcing effort onto a second making it more vulnerable to exploitation.

- Seasonal migration and movement can have a significant impact on the effectiveness of a closed area. Closed areas must be designed to be robust to temporal variability in stock distribution; boundaries may have to be moved during the year or alternatively permanent closures expanded in order to maintain their effectiveness.

- In all cases, removal from the fishery of the effort directed into the example closed areas examined, had, by far, the most significant effect on reducing the mortality of North Sea cod and avoided the side effects associated with closure. If effort is allowed to relocate into areas remaining open the reduction in mortality rates was reduced substantially or mortality rates could even increased. If total effort increases in the open areas the effect may be negligible. This implies a restriction on total effort.

- Simulation models using simplified assumptions with respect to the underlying population dynamics of cod gave consistent results to more complex models. However, the simple models omit density dependent spatial variation in the stock structure. If adopted the methodology would require frequent revision if and when the stock rebuilds and historic spatial patterns are revisited. In addition the model used spatial distributions obtained from research surveys to estimate effects. Time series of the spatial distributions of the fleets and gears fishing in the North Sea are required before the robustness of the results and the effect of seasonal changes in spatial distribution of the cod (Section 4.1) could be fully evaluated.

Alternative management strategies and mixed fishery aspects

- The North Sea fishery selection at age ogive (relative fishing mortality) estimated by the latest ICES Working Group is congruent with that of a 90mm mesh, well below the 120mm required for directed cod fishing. Although boats directing fishing towards gadoids in the North Sea are required to use 120mm mesh, boats using a wide range of gear types catch and discard or land cod; the combined effect is a much lower effective mesh selection.

- The use of 120mm mesh throughout all of the fisheries catching cod would have the same impact as the reduction of discards to zero and for an unchanged level of effort results in growth of the stock to Blim; using 140mm mesh increases biomass to between Blim and Bpa and 160mm allows the stock to recover to above Bpa. The analysis assumed that effort did not increase in order to compensate for the loss of smaller species and the initial losses of small cod from the catch.

- Relocating fishing effort away from concentrations of cod will impact on the catches of other species. Displaced boats will require additional quota for other species and the relative stability of their quota allocations will be impacted. Seasonal migration and movement had a significant impact on the available catch composition, therefore detailed studies of the impact of closure on all displaced gear types are required before estimates of new allocations can be made.

Impact on the benthos

- Closure of fishing grounds will move fishers away from traditional fishing areas resulting in increased effort and sea bed disturbance in areas that were previously, relatively, lightly fished (Jennings *et al*., 2001; Dinmore *et al*., 2003). There is therefore a net reduction in diversity and biomass across the North Sea before any increases within the closed areas have had time to accrue.

- Redistribution of fishing effort from the example area closures that were not accompanied by associated effort reduction had negative effect on the biomass and production of benthic invertebrate communities. Removing fishing effort from the closed areas always had a positive effect on benthic community biomass and production.

- The large scale closure scenario results indicate that at time scales of less than ten years, closing areas had a negative effect on benthic biomass and production when effort was redistributed into areas that remain open, and that only after more than 10 years benthic community biomass started to recover in some scenarios.

4.2 Other potential improvements to the conservation of cod

A number of potential management actions to improve the conservation of cod were discussed with stakeholder representatives. Real time closures were interpreted as a tool which may provide protection for juveniles depending on their design, but their effects are generally hard to monitor or evaluate. There was, however, consensus that a closer scientific monitoring of the various fisheries is required.

Further changes in effort management (i.e. definition of licences, lower flexibility) were discussed without definitive proposals. A discard ban of TAC regulated species for certain fisheries was discussed, with the implications of difficult control measures and potential advantages in recording of catches.

Specific examples to target other, underexploited resources were not concluded on the basis of the discussions. Either, the status of such potential resources are unclear (i.e. squid), their market situation is unsatisfactory (i.e. saithe, haddock) or technical interactions to fully or overexploited resources were considered to be very close.

5. References

Cardinale, M. and Svedäng, H. 2004. Modeling recruitment and abundance of Atlantic cod, Gadus morhua, in the eastern Skagerrak-Kattegat (North Sea): evidence of severe deple-tion due to a prolonged period of high fishing pressure. Fisheries Research, 69: 263-282.

Dinmore, T.A., Duplisea, D.E., Rackham, B.D., Maxwell, D.L., and Jennings, S. 2003. Impact of a large-scale area closure on patterns of fishing disturbance and the consequences for benthic communities. ICES Journal of Marine Science, 60: 371-380.

Hagström, O., Larsson, P.-O., and Ulmestrand, M. 1990. Swedish cod data from the interna-tional young fish surveys 1981-1990. ICES CM 1990/G:65.

ICES 2001. Report of the ICES Baltic Fisheries Assessment Working Group, ICES CM 2001/ACFM:18.

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 of the ICES Advisory Committee on Fishery Management and Advisory Committee on Ecosystems, 2004. ICES Advice. Volume 1, Number 2. 1544 pp.

Jennings, S., Dinmore, T.A., Duplisea, D.E., Warr, K.J., and Lancaster, J.E. 2001. Trawling disturbance can modify benthic production processes. Journal of Animal Ecology, 70: 459-475.

Munk, P., Larsson, P.-O., Danielssen, D.S., and Moksness, E. 1995. Larval and small juvenile cod Gadus morhua concentrated in the highly productive areas of a shelf break front. Ma-rine Ecology Progress Series, 125: 21-30.

Munk, P., Larsson, P.-O., Danielssen, D.S., and Moksness, E. 1999. Variability in frontal zone formation and distribution of gadoid fish larvae at the shelf break in the northeastern North Sea. Marine Ecology Progress Series, 177: 221-233.

P.J. Wright*, E. Galley, I.M. Gibb & F.C. Neat 2005. Fidelity of adult cod to spawning grounds in Scottish waters. Fisheries Research, in press.

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

Ulmestrand, M. and D. Valentinsson. 2003. Sea trials with species-sorting grid installed in Nephrops trawls. PM, Swedish Board of Fisheries.

Ulmestrand, M. and D. Valentinsson. 2005. Mandatory use of species-selective grids in the Swedish Nephrops trawl fishery on national waters. Experiences after one year with new gear regulations. PM, Swedish Board of Fisheries.

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