COUNCIL OF
THE EUROPEAN UNION

Brussels, 12 January 2005

5285/05

PECHE 9

COVER NOTE

from:	Secretary-General of the European Commission, signed by Ms Patricia BUGNOT, Director
date of receipt:	23 December 2004
to:	Mr Javier SOLANA, Secretary-General/High Representative
Subject:	COMMISSION STAFF WORKING PAPER Scientific, Technical and Economic Committee for Fisheries (STECF), Subgroup on Review of scientific advice on Stocks (SGRST) MIXED FISHERIES Brussels, 18-22 October 2004

Delegations will find attached Commission document SEC(2004) 1711.

Encl.: SEC(2004) 1711

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 23.12.2004
SEC(2004) 1711

COMMISSION STAFF WORKING PAPER

SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

Subgroup on Review of scientific advice on Stocks (SGRST)

MIXED FISHERIES

Brussels, 18-22 October 2004

This report has been evaluated and endorsed by the Scientific, Technical and Economic Committee for Fisheries (STECF) in its plenary session of 1-5 November 2004

Executive sumary.

1. The group compiled fleet-based fishery data for the North Sea, Irish Sea, Celtic Sea, Iberian Peninsula and Bay of Biscay. The level of fishery disaggregation varied by sea area and discard data were only available from the North Sea.

2. The group was requested by the Commission to perform mixed fishery calculations for the above sea areas and provided a range of management scenarios.

3. Mixed fishery forecasts were made for the North Sea and full results are presented in the report. The data coverage, including discarding is much improved from previous years. There are still a large number of gaps in the database and these have been interpolated with a very coarse fill-in. This proceedure may have an adverse effect on the results.

4. Mixed fishery forecasts were also made for the Irish Sea, Celtic Sea, Iberian Peninsula and Bay of Biscay. Due to the lack of discard data and a number of grave concerns regarding data quality in each of the areas, the results presented are preliminary and the group strongly recommends that they are not used for management purposes.

5. The group was also asked to advise on the extent to which plaice and sole in the North Sea could be managed seperately. A similar request was made for cod, haddock and nephrops stocks. Given the short period of time allowed for this task (less than 24 hours) the analyses were brief, but catch by fleet data indicate that there may be scope for managing the stocks independently.

6. A presentation was made to the group relating to area based management in area VI in relation to Nephrops stocks and the "Windsock" closed area. The group considered the scientific content of the presentation and felt that further information was required before a rigorous assessment could be made of the proposals.

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1.1. Terms of reference.

1. Obtain and compile all available recent data concerning mixed-species demersal fisheries in Community waters and adjacent areas. The data of specific interest are landings by species and by fleet, where possible disaggregated by age and by number of fish.

2. Review the data compiled in (1) and identify those stocks, areas and fleets where significant technical interactions exist and for which adequate data exist to permit those interactions to be evaluated.

3. For each of the area-fleet-stock groupings identified in (2), calculate catch forecasts for 2004 for the stocks concerned, based on:

- the most recent ICES assessments
- ACFM advised catches for 2005
- an appropriate range of assumptions for the factors describing the relative policy weights to be attached to each fish stock, including any particular values that may be requested by the Commission services on receipt of the ICES advice.

4. In support of the above tasks, continue methodological and software development as initiated in the 2002 and 2003 meetings of this Ad Hoc Working Group.

Under ToR 3, the Commission presented the Group with the following requests.

1. Advise on the extent to which fisheries for plaice and sole (and the mortality rates experienced by these stocks) in the North Sea can be managed independently, or otherwise.

2. Advise on the extent to which fisheries for Nephrops and for haddock (and the mortality rates experienced by these stocks) in the North Sea can be managed independently from the fisheries catching cod, or otherwise.

3. Forecast options requested by the Commission services (in addition to whatever the group may consider appropriate) are listed below :

   3.1. ***North Sea :***

   a. 60% reduction in F for cod with respect to 2003 with all decision weight on cod. Other species : according to ICES SSEB.

   b. 30% reduction in F for cod with respect to 2003 with all decision weight on cod. Other species : according to ICES SSEB.

   c. 60% reduction in F for cod with respect to 2003, reduction in F to 0.3 for plaice with 50% decision weight on cod, 50% to plaice. Other species : according to ICES SSEB.

   d. 30% reduction in F for cod with respect to 2003, reduction in F to 0.3 for plaice with 50% decision weight on cod, 50% to plaice. Other species : according to ICES SSEB.

e. 30% reduction in F for cod with respect to 2003, reduction in F to 0.6 for plaice with 50% decision weight on cod, 50% to plaice. Other species : according to ICES SSEB.

Irish Sea :

a. 29% reduction in F for cod with respect to the average F 2001-2003 with all decision weight on cod. Other species : according to ICES SSEB except whiting, F *status quo.*
b. 15% reduction in F for cod with respect to the average F 2001-2003 with all decision weight on cod. Other species : according to ICES SSEB except whiting, F *status quo.*

Celtic Sea :

a. 17% reduction in F for cod with respect to the average F 2001-2003. Other species : according to ICES SSEB

Kattegat (Depending on availability of data) :

a. 59% reduction in F for cod with respect to 2003 with all decision weight on cod. Other species : according to ICES SSEB.
b. 30% reduction in F for cod with respect to 2003 with all decision weight on cod. Other species : according to ICES SSEB.

Iberian Atlantic Waters (VIIIc IXa)

a. 10% reduction in F for southern stock of hake with respect to 2003 with all decision weight on hake.
b. 30% reduction in F for southern stock of hake with respect to 2003 with all decision weight on hake.
c. 60% reduction in F for southern stock of hake with respect to 2003 with all decision weight on hake.

1.2. Participants

The participants are listed below and contact details are given in **Annex 3.**

STECF member
Hans-Joachim Rätz
GeorgePetrakis
Willy Vanhee

Invited experts
Ewen Bell (Chair)
Jose Castro
Edd Codling
Ciáran Kelly
Sarah Kraak
Paul Marchal
Maria Santurtun
Pieter-Jan Schön
Cristina Silva
Per Sparre
Ian Tuck

STECF Secretariat (European Commission)
Franco Biagi
Ken Patterson

1.3. Development of Mixed Fishery Issues.

Since the last meeting of this Group, there have been a number of meetings and developments concerning mixed fishery issues.

In it's November 2003 meeting, STECF reviewed the report of this group from 2003. Among its overall comments, STECF noted that:

- *As the MTAC analysis is carried out with either limited or no discard data this results in errors in the catch by fleet and will result in errors in optimised catch by fleet used to give mixed species TACs.*
- *The multispecies TACs supplied by MTAC will not deliver the required fishing mortality unless the distribution of MTAC implied TACs is fully implemented across the fleets. A failure to implement the implied allocation key at the fleet level is likely to reduce considerably or negate the effectiveness of the management.*
- *Given the objective of improved mixed species fisheries management it is considered that despite the current limitations of the input data (incomplete catch data, sub-optimal fleet segmentation) and the likely failures in implementation the report nevertheless provides a step forward in providing improved mixed fisheries options for management.*

The concerns of STECF were generally those already voiced by ACFM prior to the 2003 meeting of this Group which were commented on in the previous report of this Group. The situation in 2003 regarding a lack of agreed analytical assessments for some stocks and hence also stock forecasts was not ideal. This situation has not improved in 2004.

Following the STECF meeting in November 2003, the Commission based a number of TAC proposals for the 2003 quota negotiations upon results of MTAC forecasts. This occurred despite the number of concerns which this Group, ACFM and STECF had regarding the quality of the input data.

The ICES study group on the development of fishery-based forecasts SGDFF met in January 2004. During this meeting attempts were made to further compile landings and discard data on a fishery basis. This exercise met with limited success, due partially to a lack of commitment from institutes to the procedure. Despite this, progress was made for stocks covered by the following ICES assessment working group areas; North Sea, Southern Shelf and Northern Shelf. The SG also defined data exchange formats which would facilitate the compilation of fishery-based data. These formats have subsequently been used and are generally considered to be satisfactory.

Considerable effort was placed upon further compilation of fishery-based data during several assessment working groups, namely Hake, Monkfish and Megrim, North Sea Skagerrak and Eastern Channel. The comprehensiveness of the datasets are described in the relevant chapters of this report. The requirement that data be provided at the fishery level has not, however, been taken up equally amongst Member States or assessment working groups, and further efforts should be made to remedy this.

1.4. Conduct of the meeting.

At the start of the meeting, the Commission presented the Group with a number of scenarios for MTAC runs in the North Sea (IV), Irish Sea(VIIa) and Celtic sea (VIIe-k). The fishery based datasets available to the group had the facility to perform analyses on highly disaggregated fleet definitions. The Commission requested that the Group dealt with fleets based upon broad gear categories, aggregated across nations. The administration of fishery management on a few, broad categories of fishing vessels is undoubtedly easier than managing and enforcing 50-100 different fishery units. It is also possible that such an approach to mixed fishery analysis may reduce the extent to which MTAC results violate the principal of "relative stability" although this has not been examined by the Group. The counter-argument to the use of broad, aggregate fleets is a reduced flexibility in fleet effort allocation and hence reduced ability to simultaneously achieve the single species TACs. This is of particular concern where aggregation has occurred over fishery units with widely differing catch compositions. Therefore, in addition to the fleet classifications specified by the Commission, some MTAC runs have also been performed on more disaggregated fleet definitions.

MTAC requires stock numbers and fishing mortalities at the start of the following year (e.g. for this meeting we required stock numbers on January 1st, 2005). These numbers come from the most recent short term forecasts produced by ACFM. The timing of this meeting in relation to ACFM was exceptionally close with no working days between ACFM closing and this group starting. There is always a period of time between the closure of ACFM and the final reports in order to check for errors and the timing of this meeting did not allow for this. The ACFM forecast files were not available to this group until the third day of the meeting which presented us with considerable time constraints. One result of this timing structure is that there has not been enough time to error check our own work.

On the 4th day of the 5 day meeting, the commission presented the Group with a further range of MTAC scenarios and other requests. Fortuitously, some of the scenarios had already been investigated by the group, but the additional requests for advice regarding the ability to independently manage specific stocks came too late for substantial work to be undertaken.

At the end of the meeting it was discovered that Nephrops had not been treated correctly in the MTAC runs. For those stocks where there was no analytical assessment performed in 2004, stock sizes in MTAC were arbitrarily set to 1. This was to ensure that the catches of the stock were considered when determining fleet factors whilst making no attempt to determine MS-TACs. As there were no analytical assessments of Nephrops in 2004 this procedure was followed in all sea areas. In reality, ICES stock assessments for Nephrops are considered valid for 2 years, hence the 2003 assessment value should have been used. The result of this oversight is that there are no mixed species TACs (MS-TAC) for Nephrops in the outputs of the MTAC runs. The landings of Nephrops were correctly included in the calculation of the fleet effort factors and Nephrops always received minimal decision weight (at the request of the Commission), hence the impact of this oversight is expected to be very small in relation to the other MS-TACs.

In the 2003 report of this Group, investigations were made into the use of 0 and very small decision weights, finding that the results of MTAC were potentially quite sensitive to such a choice. The analyses presented this year have exclusively used non-zero decision weights for all stocks, including those with stock sizes set to 1 (i.e. those stocks for which there was no analytical assessment). With hindsight, the stocks with no assessment should have received a decision weight of 0 to ensure that they had absolutely no influence on the MS-TAC's. Some exploratory runs were performed on the North Sea dataset to investigate the sensitivity of the model to the choice of minimal or zero decision weights on species with stock size of "1". These runs indicate changes to fleet effort factors and MS-TAC's of less than 1% for the majority of fleets. The only fleet where a significant effort change was observed was that targeting Norway pout.

2. Model development.

A Working Document was presented to the group outlining procedural rules and implications for the use of MTAC. (Kraak 2004; this document was also presented at the WGMG, 11-18 February 2004, Lisbon) There are two main ways in which the results of MTAC can be used in a management context. One approach is to use the mixed species TAC's (MS-TAC) and apply them to the entire existing management and fleet structure (aggregate MTAC advice). The second approach is to adjust the effort of individual fleet components. The choice of management approach requires fundamentally different implementations of MTAC and therefore the objectives of management must be stated upfront before mixed fishery analyses. Aggregate MS-TAC advice (approach 1) is obtained by setting $p=0$, $q=0$ (i.e. the effort of all fleets are adjusted by the same amount). Fleet specific advice (approach 2) is obtained from the permutations of $p=1$, $p=2$ and $q=0$, $q=1$. The use of MTAC for the provision of aggregate MS-TAC advice when $p>0$ and $q>0$ is fundamentally incorrect and will not deliver the expected results. Another point raised by the document is that where MS-TAC's are higher than the SS-TAC they are generally not in agreement with the Precautionary Approach and/or any recovery plans.

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

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

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

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

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

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

3. Area based analyses

3.1. North Sea

3.1.1. Fleet overview

The demersal fisheries in the North Sea can be categorised as a) human consumption fisheries, and b) industrial fisheries which land the majority of their catch for reduction purposes. Demersal human consumption fisheries usually either target a mixture of roundfish species (cod, haddock, whiting), a mixture of flatfish species (plaice and sole) with a by-catch of roundfish, or *Nephrops* with a by-catch of roundfish and flatfish. A fishery directed at saithe exists along the shelf edge. On average 90% of the landings for reduction consist of sandeel, Norway pout, blue whiting and sprat. The industrial landings also contain by-catches of various other species (e.g. haddock and whiting). Gear types vary between fisheries. Human consumption fisheries use otter trawls, pair trawls, seines, gill nets, or beam trawls, while industrial fisheries use small meshed otter trawls.

3.1.2. Data availability

The SGDFF-formatted landings, discard, numbers and weights at age data were submitted by each country and compiled into a tabular-formatted database. Information on industrial by-catch of haddock and whiting was not available.

995 fisheries strata (i.e. combinations of "country", "fishery", "area", "quarter", "gear", "mesh size range" and "species") were defined using the SGDFF format specifications. This large number of strata resulted in numerous missing entries. A coarse procedure was implemented to fill in such missing entries

- Missing discards for a given stratum were estimated by multiplying the landings of that stratum by the ratio of total international discards to total international landings
- Missing landings at age for a given stratum were estimated by multiplying the landings of that stratum by the overall landings at age ogive estimated for the species under consideration
- Missing discards at age for a given stratum were estimated by multiplying the discards of that stratum by the overall discards at age ogive estimated for the species under consideration.

The stocks for which fishery- and age-disaggregated information was available, are given in Table 1. The landings from the documented fisheries, as reported in the MF database, have been compared to official landings. Table 1 indicates that the landings coverage in the MF database is close to 100%. The discards coverage is reasonable for haddock and sole, but not so for saithe, plaice, cod and whiting (the fleets for which discard information was available landed less than 50% of the international landings). While the poor availability of discards information is probably not a major problem for the saithe fishery, where only little discarding is believed to occur, it appears to be a concern for the plaice and whiting fisheries, which are subject to high discarding. It was not possible to evaluate the extent to which the coarse discard fill-in procedure would adversely affect the quality discard estimates for these two species during the meeting.

Fishery-disaggregated (but not age-disaggregated) data were also provided for Sole (Division VIId), Nephrops (Sub-Area IV and Division IIIa), Sandeel (Sub-Area IV) and Norway pout (Sub-Area IV). Total landings and discards by fishery and by country are presented respectively in Tables 2 and 3.

Table 3.1.1. Comparison between official landings, landings included in the North Sea mixed-fisheries database, and landings by fleets with total discard information available.

Stock	Official landings (OL) in tonnes	MF database landings (MFL)		MF landings of fleets with discards information available (MFLD)	
		MFL (t)	MFL/OL	MFLD (t)	MFLD/MFL
Cod 3an, 4, 7d	34105	31190	0.91	8651	0.28
Haddock 3a, 4	44262	43650	0.99	31852	0.73
Plaice 4	65688	66463	1.01	29722	0.45
Saithe 3a, 4, 6a	110518	107519	0.97	7195	0.07
Sole 4	16692	17998	1.08	13506	0.75
Whiting 4, 7d	17817	17244	0.97	5698	0.33

Table 3.1.2. North Sea fisheries. Total landings and estimated discards by gear and mesh size for the North stocks investigated by STECF/SGRST04.

		COD_NS		HAD_NS		NOP_NS		PLE_NS		POK_NS		SAN_NS		SOL_NS		WHG_NS		NEP_NS	
Gear	Mesh_size	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc
-1	-1	1572	76	1045	471	9381	0	1428	646	3401	208	14493	0	191	17	19	9	258	5
BEAM	>=120	56	3	41	18	0	0	0	0	9	1	0	0	0	0	0	0	0	0
	100-119	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DEM_SEINE	>=120	2286	110	7995	3600	0	0	1840	833	895	55	0	0	1	0	896	405	1	0
	-1	6	0	2	1	0	0	28	13	0	0	0	0	0	0	0	0	0	0
	100-119	49	2	467	211	0	0	233	105	14	1	0	0	0	0	41	18	0	0
	32-54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	55-69	0	0	69	31	0	0	0	0	4	0	0	0	0	0	5	2	0	0
	70-79	1	0	11	5	0	0	0	0	1	0	0	0	0	0	3	1	0	0
	80-99	241	12	303	136	0	0	192	87	68	4	0	0	0	0	20	9	15	0
DREDGE	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	80-99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
GILL	>=220	16	1	0	0	0	0	11	5	0	0	0	0	3	0	0	0	0	0
	-1	108	5	0	0	0	0	12	6	0	0	0	0	117	10	7	3	0	0
	100-119	95	5	14	6	0	0	80	36	4	0	0	0	323	28	4	2	0	0
	10-30	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
	120-219	5478	263	583	262	0	0	4346	1967	7309	447	0	0	167	15	25	11	2	0
	50-70	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	90-99	271	13	0	0	0	0	69	31	0	0	0	0	670	58	16	7	0	0
LARGE_BEAM	>=120	640	31	302	136	0	0	3419	1547	24	1	0	0	36	3	15	7	3	0
	-1	4	0	0	0	0	0	163	74	0	0	0	0	0	0	0	0	0	0
	100-119	2376	114	180	81	0	0	3468	1569	1	0	0	0	157	14	1499	677	3	0
	16-31	0	0	0	0	0	0	17	8	0	0	0	0	10	1	1	0	0	0
	32-54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	80-99	912	44	151	68	0	0	39957	18082	0	0	0	0	15443	1339	229	103	328	6
LONGLINE	-1	1600	77	473	213	0	0	0	0	575	35	0	0	2	0	3	1	0	0
OTHER	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	32-54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTTER	<16	13	1	34	15	2054	0	0	0	120	7	256037	0	0	0	0	0	0	0
	>=120	10000	480	24046	10829	0	0	4083	1848	64195	3926	0	0	131	11	3556	1606	1133	22
	>120	35	2	46	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-1	136	7	23	10	0	0	345	156	113	7	0	0	56	5	87	39	216	4
	100-119	455	22	2192	987	0	0	1730	783	23363	1429	0	0	4	0	541	244	243	5
	16-31	6	0	33	15	1490	0	0	0	53	3	0	0	0	0	2	1	0	0
	32-54	529	25	505	227	0	0	4	2	609	37	0	0	1	0	45	20	61	1
	55-69	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
	70-79	280	13	310	140	0	0	73	33	100	6	0	0	4	0	209	95	53	1
	80-99	3785	182	4809	2165	0	0	4025	1822	2800	171	0	0	91	8	9857	4452	10831	213
PEL_SEINE	32-54	3	0	7	3	0	0	0	0	3749	229	0	0	0	0	0	0	0	0
PEL_TRAWL	100-119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	32-54	2	0	0	0	0	0	0	0	74	5	0	0	0	0	8	4	0	0
	80-99	7	0	0	0	0	0	0	0	0	0	0	0	0	0	32	15	0	0
POTS	-1	76	4	2	1	0	0	6	3	14	1	0	0	10	1	0	0	11	0
SMALL_BEAM	>=120	12	1	5	2	0	0	54	24	2	0	0	0	0	0	0	0	0	0
	-1	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0
	100-119	0	0	0	0	0	0	6	3	0	0	0	0	0	0	0	0	0	0
	16-31	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0
	80-99	105	5	0	0	0	0	783	354	0	0	0	0	514	45	69	31	1	0
ZZZ	-1	23	1	0	0	0	0	86	39	19	1	0	0	51	4	50	23	0	0
Total		31190	1498	43650	19657	12925	0	66463	30077	107519	6575	270530	0	17988	1560	17244	7788	13159	258

Table 3.1.3. North Sea fisheries. Total landings and estimated discards by country for the North stocks investigated by STECF/SGRST04.

	stock	Data																
	COD_NS		HAD_NS		NOP_NS		PLE_NS		POK_NS		SAN_NS		SOL_NS		WHG_NS		NEP_NS	
country	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc	Land	Disc
BEL	1445	69	356	160	0	0	4489	2032	43	3	0	0	1583	137	211	95	230	5
DEN	7962	382	5252	2365	12925	0	13731	6214	10511	643	269996	0	609	53	76	34	2000	39
ENG	2214	106	1561	703	0	0	7224	3269	0	0	0	0	483	42	652	294	0	0
FRA	1971	95	1105	497	0	0	258	117	21550	1318	0	0	724	63	8813	3980	0	0
GER	2106	101	1679	756	0	0	3802	1721	9015	551	534	0	752	65	332	150	48	1
NED	2303	111	141	64	0	0	28224	12773	0	0	0	0	13462	1167	1492	674	956	19
NOR	4987	240	2304	1038	0	0	1967	890	61690	3772	0	0	125	11	38	17	100	2
SCO	7692	369	31105	14008	0	0	6768	3063	4711	288	0	0	250	22	5630	2543	9825	193
SWE	510	24	147	66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	31190	1498	43650	19657	12925	0	66463	30077	107519	6575	270530	0	17988	1560	17244	7788	13159	258

The weights at age in landings and discards used by ICES to provide single-species forecasts and by SGRST to provide mixed-fisheries forecasts are given in Figure 1. The weights at age derived from the two groups are very similar, except for the discards of haddock aged 5-7, the amount of which were in any case very small.

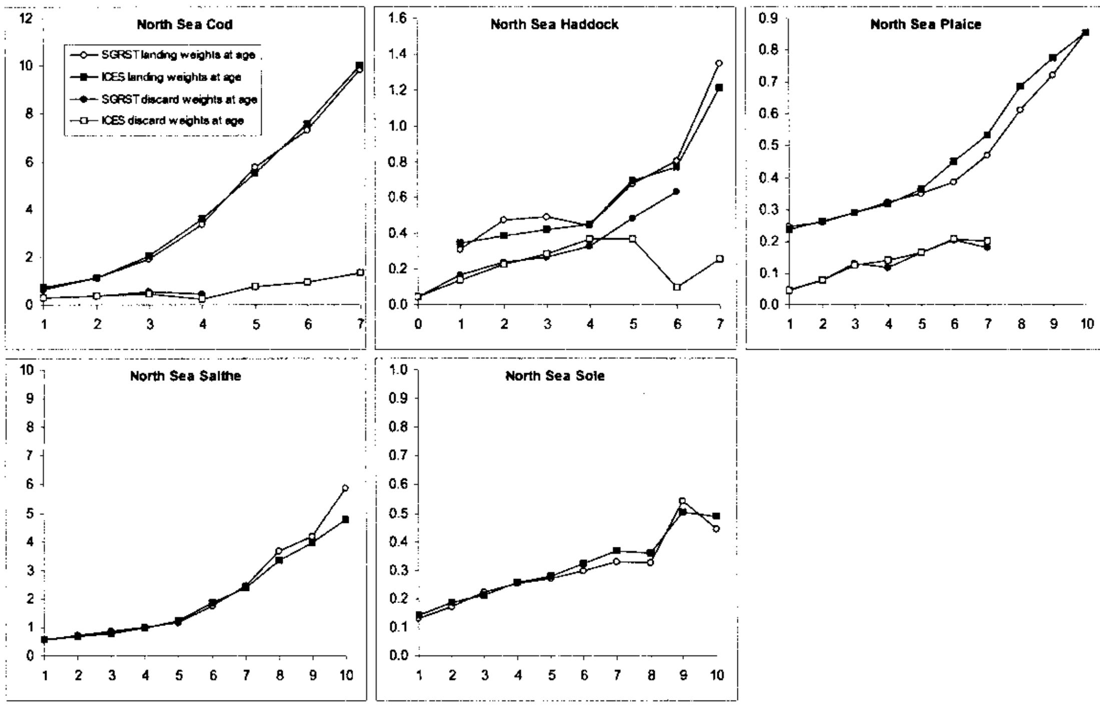

Figure 3.1.1. Landings and discard weights at age (kg) as estimated by ICES WGNSSK04 and by STECF SGRST04.

The landings and discards numbers at age used by ICES to provide single-species forecasts and by SGRST to provide mixed-fisheries forecasts are given in Figure 2. The landings at age derived from the two groups are consistent. Some differences appear in the saithe landings, as a result of Norway, the main country contributing to the saithe fishery, not providing age information for the MF database. The large difference between ICES and SGRST cod discards at age is due to the misreported catches being accounted for in the ICES assessment inputs, but not in the mixed-fisheries database. Misreporting figures were calculated using an indirect method during WGNSSK, and these were not included in the MF database. The small differences in the discards numbers at age for the other stocks is probably due to ICES and SGRST using different procedures to estimate total discards. The discards at age ogives were in any case consistent across data sources for all stocks.

Industrial by-catch were not available for haddock, although they are explicitly used in the assessment as one component of the fishing mortality. Haddock industrial by-catches are estimated at 1,500 t, the majority of them coming from the 0-group. This results in the 0-group being under-represented in the SGRST database.

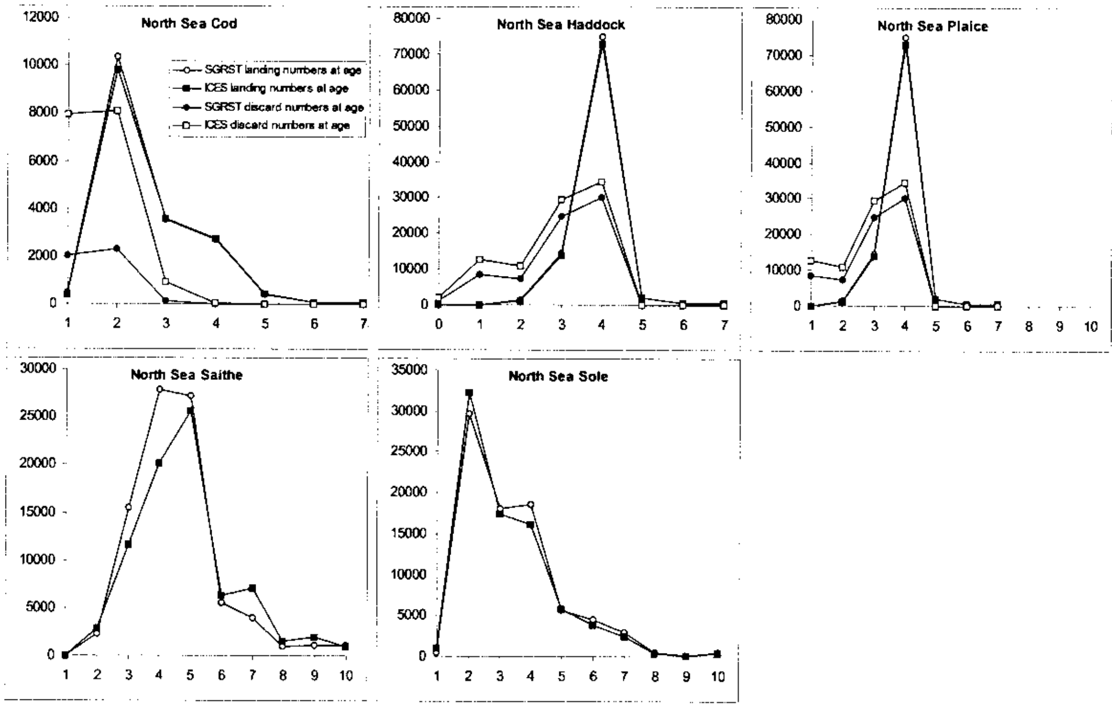

Figure 3.1.2. Landings and discard numbers at age ('000) as estimated by ICES WGNSSK04 and by STECF SGRST04.

The Commission suggested that the large number of fisheries strata (995) was not suitable for management purposes, and that the fleet aggregation level should be that decided by EU2287/2003:

- demersal trawls, seines or similar towed gears of mesh size equal to or greater than 100 mm except beam trawls;
- beam trawls of mesh size equal to or greater than 80 mm;
- static demersal nets including gill nets, trammel nets and tangle nets;
- demersal longlines;
- demersal trawls, seines or similar towed gears of mesh size between 70 mm and 99 mm except beam trawls with mesh size between 80 mm and 99 mm;
- demersal trawls, seines or similar towed gears of mesh size between 16 mm and 31 mm except beam trawls.

The catch weights at age and the catch numbers at age estimated for the newly-defined fisheries are reported in Figures 3 and 4.

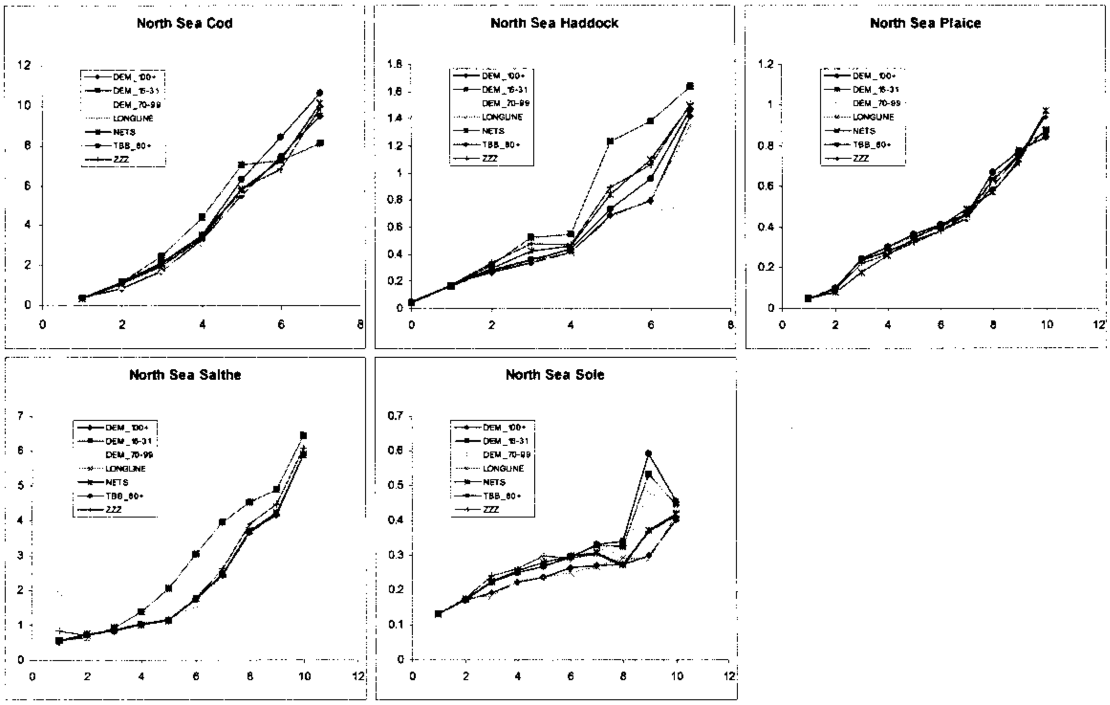

Figure 3.1.3. Catch weights at age (kg) by fleet as estimated by STECF SGRST04.

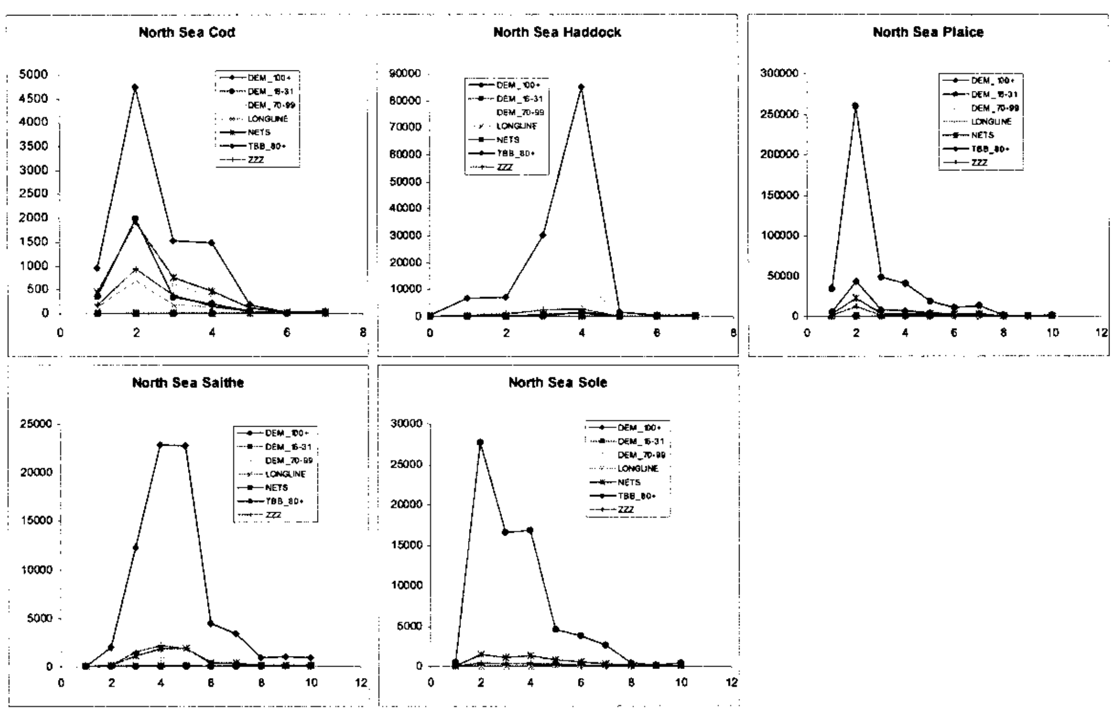

Figure 3.1.4. Catch at age numbers ('000) by fleet as estimated by STECF SGRST04.

Input data to stock forecasts were made available by ICES for haddock, plaice, sole and saithe. No definitive forecast was available for cod, and two optional scenarios were suggested by ICES. The fisheries-based landings at age ogives derived from the

MF databases were used to generate the MTAC inputs relevant to all species. The fisheries-based discards at age ogives derived from the MF databases were used to generate the MTAC inputs relevant to cod, haddock and plaice. No discards were assumed in the assessment of saithe and sole, so the discards at age ogives derived from the mixed-fisheries database were not used. No final assessment was available for whiting.

Conclusions on the quality of the North Sea mixed-fisheries data

The group has made progress in compiling fishery-, age-disaggregated landings and discards data. An exploration of the database suggested that the age-structured landings and discards provided by the database were consistent with ICES assessment inputs. Nevertheless, in the context of running mixed-fisheries forecasts, this database is still subject to the following limitations:

- The data coverage is still not comprehensive, particularly with regards to discards information on plaice and whiting. Missing information was eventually completed with a coarse procedure (missing discards by fisheries strata were estimated over all available information). This procedure is only a first proxy, and any results derived from the current MF database should be interpreted cautiously.

- The mixed-fisheries database did not include information on industrial by-catches, which resulted in an under-estimation the haddock 0-group.

3.1.3. MTAC settings

The Commission requested the Group to run the following scenarios, with p-option 2 and q-option 1.

Table 3.1.3.1 MTAC Scenarios as requested by the Commission.

Scenario	Target F-multiplier on COD	Target F-multiplier on PLE	High decision weight on
a	0.4	0.85	COD
b	0.4	0.45	COD
c	0.7	0.85	COD
d	0.7	0.45	COD
e	0.4	0.85	COD & PLE
f	0.4	0.45	COD & PLE
g	0.7	0.85	COD & PLE
h	0.7	0.45	COD & PLE

For cod this means that F is either reduced by 60% or by 30%, as requested by the Commission. For plaice, F is either reduced to Fpa (F-multiplier 0.85), or F is set such that SSB is predicted to be above Bpa in January 2006 (F-multiplier 0.45). The STECF Mixed Fisheries Study Group in 2003 (STECF 2003a) recommended that where no priority is given to a species, the decision weight should be set to a small value instead of 0. The Group followed this recommendation, and set the decision weight for high priority species at 100 versus 0.25 for the low priority species (see

Annex I). In one set of runs, high priority is only given to reaching the cod target, and in the other set of runs equal (high) priority is given to reaching the cod and plaice targets. The p-option set at 2 implies that the fleets' partial Fsq should be reduced proportionally to the fleet's catch of the species as a fraction of the total international catch of that species (in weight). The q-option set at 1 implies that the decision weights are multiplied by the proportion of the catch of a species within the fleet's catch (in weight).

The target F-multipliers for the other species are set as follows (for all scenarios).
Table 3.1.3.2 Rationale to the choice of f-multiplier for non-priority species.

species	Target F-multiplier	Rationale
HAD	2.8	Management plan
POK	1.38	Precautionary
SOL	0.9	Precautionary
WHG	1	No ICES advice; Commission requested Fsq.
NEP	1	No ICES advice; Commission requested Fsq.
NOP	0	ICES advice
SAN	0.4	Precautionary under a conservative assumption of recruitment

Each of the eight Commission requested scenarios was run with a different assumption for F on cod in the intermediate year (resulting in a total of 16 scenarios). The two alternative assumptions for the intermediate year are:

- F in the intermediate year is equal to Fsq
- The TAC is taken, but corrected for misreporting as suggested by ACFM (Technical Minutes WGNSSK), by adding the mean bias for 1993-2003 (0.39). This transforms the TAC 2004 of 27300 t to a catch 38000 t. This amounts to 0.45 * Fsq.

No analytical assessments were done for *Nephrops* and whiting in 2004. For Norway pout and sandeel no fleet-based age disaggregated data were provided. For these species no age-structured data were included as input in MTAC and stock size was set to 1. As a result there are no MS-TAC's presented for these species.

The structure of North Sea fleets was collapsed to seven categories as described in section 3.1.2.

The consequence of using different p- and q- options was explored using the following table of p- and q- settings for scenario f (table 3.1.3.1). This choice of scenario is purely arbitrary.

P=0	Q=0
P=0	Q=1
P=1	Q=1
P=2	Q=1

The consequence of using 49 fleets (fleet definitions across countries, see section 3.1.1.) as opposed to the 7 defined by the Commission was also explored using scenario f, with p=2, q=1. the hypothesis being that targets can be reached more easily with more disaggregated fleet definitions.

3.1.4. Results

Full tables of results including MS-TAC's can be found in annexe 2.

The results are presented as fleet effort factors, implying that under the respective scenarios current fleet efforts should be multiplied by these factors for 2005 (Table 3.1.4.1). It is interesting to know to what extent each MTAC scenario is overshooting or undershooting the species' targets. Therefore, for each species the ratio of the sum of all fleets' catch forecasts (MS-TAC) to the single species target (SS-TAC under the formulated target) is presented (Table 3.1.4.2). If this ratio is smaller than 1, the total forecasted catch will be lower than the single species target catch. If this ratio is larger than 1, the total forecasted catch will be higher than the single species target catch, which likely implies a violation of the precautionary approach and disagreement with any recovery plan in place.

All runs result in very low catch forecasts for haddock and saithe (there targets are severely undershot, see Table 3.1.4.2.), which are the two species on which F is allowed to increase. The fishing opportunities on these species suffer from the restrictions on other species.

Only four runs (6, 8, 14, and 16) are consistent with the Management Plan for plaice that SSB in 2006 should be above 230 000 t (Bpa). These use Commission scenarios f and h where the target F-multiplier for plaice set at 0.45 (which is the necessary level for getting SSB in 2006 above 230 000 t) and priority given to plaice (in addition to cod).

Under the assumption of Fsq for cod in the intermediate year, only two runs (1, 2) are consistent with the cod Recovery Plan. These are scenarios a and b where a target of a 60% reduction of F on cod is set and all priority given to cod. Under the assumption of the TAC constraint plus misreporting for cod in the intermediate year (runs 9-16), none of the runs are consistent with the cod Recovery Plan.

All in all, there are no scenarios that are consistent with both the cod Recovery Plan and the plaice Management Plan. The run which gets closest to simultaneously achieving the cod and plaice Plans is run 8.

From Table 3.1.4.1. it can be seen that when priority is given to cod only (runs 1-4 and 9-12), the level of the cod target makes a difference only to the DEM 100+ fleet; the larger the reduction of F on cod, the more this fleet has to reduce effort (compare *e.g.* scenario 1 with scenario 3). When plaice gets priority in addition to cod (runs 5-8 and 13-16), the TBB 80+ fleet is influenced as well by the cod target. In addition, when plaice and cod get priority, the level of the plaice target makes a difference; the larger the reduction of F on plaice, the more the TBB 80+ fleet has to reduce effort (compare *e.g.* run 5 with run 6). The fleet factors are barely influenced by the choice of the intermediate year assumption for cod (compare runs 1-8 with runs 9-16).

Table 3.1.4.2. shows that when priority is given to cod only (runs 1-4 and 9-12), the level of the plaice target influences whether the plaice target is undershot or overshot; the lower target is overshot and the higher target is undershot (compare *e.g.* run 1 with run 3). When priority is given to plaice and cod (runs 5-8 and 13-16), the level of the plaice target influences how closely the targets are reached for cod and sole. With a lower plaice target, the sole target will be undershot to a higher extent but the cod target is reached more closely (compare *e.g.* run 5 with run 6). When priority is given to plaice and cod (but not when cod only gets priority) (runs 5-8 and 13-16), also the level of the cod target influences how closely that target is reached. When the target is lower, the ability of the MTAC model to reach it is decreased (compare *e.g.* run 6 with run 8). The choice of the assumption for the intermediate year of cod, barely influences how closely the targets are reached (compare runs 1-8 with runs 9-16).

Table 3.1.4.1. Resulting fleet factors (effort multiplication factors) under the 16 different runs.

	DEM_ 100+	DEM_ 16-31	DEM_ 70-99	Longline	Nets	TBB_80+	other
1. (Commission scenario a) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD COD interm. year Fsq	0.05	0.65	0.68	0.88	0.54	0.69	0.73
2. (Commission scenario b) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD COD interm. year Fsq	0.05	0.65	0.68	0.88	0.54	0.67	0.73
3. (Commission scenario c) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD COD interm. year Fsq	0.54	0.65	0.84	0.94	0.77	0.84	0.80
4. (Commission scenario d) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD COD interm. year Fsq	0.53	0.65	0.84	0.94	0.77	0.82	0.80
5. (Commission scenario e) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year Fsq	0.47	0.66	0.85	0.88	0.76	0.80	0.85
6. (Commission scenario f) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year Fsq	0.43	0.66	0.83	0.88	0.74	0.30	0.84
7. (Commission scenario g) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year Fsq	0.73	0.66	0.92	0.94	0.88	0.81	0.89
8. (Commission scenario h) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year Fsq	0.69	0.66	0.90	0.94	0.85	0.31	0.88

Table 3.1.4.1. Continued.

9. (Commission scenario a) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD COD interm. year TAC+	0.07	0.65	0.68	0.88	0.54	0.70	0.73
10. (Commission scenario b) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD COD interm. year TAC+	0.07	0.65	0.68	0.88	0.54	0.68	0.73
11. (Commission scenario c) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD COD interm. year TAC+	0.54	0.65	0.85	0.94	0.77	0.84	0.80
12. (Commission scenario d) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD COD interm. year TAC+	0.54	0.65	0.85	0.94	0.77	0.82	0.80
13. (Commission scenario e) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year TAC+	0.47	0.66	0.86	0.88	0.77	0.80	0.85
14. (Commission scenario f) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year TAC+	0.43	0.66	0.83	0.88	0.74	0.30	0.84
15. (Commission scenario g) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year TAC+	0.73	0.66	0.92	0.94	0.88	0.81	0.89
16. (Commission scenario h) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year TAC+	0.70	0.66	0.90	0.94	0.85	0.31	0.88

Table 3.1.4.2. Ratios of MS-TAC to SS-TAC under the 16 different runs.

	COD	PLE	HAD	SOL	POK
1. (Commission scenario a) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD COD interm. year Fsq	1.04	0.77	0.07	0.79	0.14
2. (Commission scenario b) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD COD interm. year Fsq	1.03	1.26	0.07	0.77	0.14
3. (Commission scenario c) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD COD interm. year Fsq	1.01	0.96	0.23	0.94	0.47
4. (Commission scenario d) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD COD interm. year Fsq	1.01	1.57	0.23	0.92	0.47
5. (Commission scenario e) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year Fsq	1.53	0.92	0.21	0.90	0.43
6. (Commission scenario f) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year Fsq	1.36	0.89	0.19	0.44	0.41
7. (Commission scenario g) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year Fsq	1.12	0.97	0.30	0.92	0.60
8. (Commission scenario h) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year Fsq	1.02	0.98	0.28	0.46	0.58

Table 3.1.4.2. Continued.

9. (Commission scenario a) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD COD interm. year TAC+	1.04	0.78	0.07	0.79	0.15
10. (Commission scenario b) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD COD interm. year TAC+	1.03	1.27	0.07	0.77	0.15
11. (Commission scenario c) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD COD interm. year TAC+	1.01	0.96	0.23	0.94	0.48
12. (Commission scenario d) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD COD interm. year TAC+	1.01	1.58	0.23	0.92	0.48
13. (Commission scenario e) F-mult. COD 0.4 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year TAC+	1.52	0.92	0.21	0.90	0.44
14. (Commission scenario f) F-mult. COD 0.4 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year TAC+	1.36	0.89	0.20	0.44	0.41
15. (Commission scenario g) F-mult. COD 0.7 F-mult. PLE 0.85 Decision w. COD & PLE COD interm. year TAC+	1.12	0.97	0.30	0.92	0.60
16. (Commission scenario h) F-mult. COD 0.7 F-mult. PLE 0.45 Decision w. COD & PLE COD interm. year TAC+	1.03	0.99	0.28	0.46	0.58

The exploration of how the different p- and q-settings influence the relative fleet-factors and the ability to reach the species targets is displayed in Figure 3.1.4.1. and Figure 3.1.4.2. respectively. This exploration was arbitrarily done for Commission scenario f.

From Figure 3.1.4.1. it is clear that the longline fleet, which targets cod but does not contribute much to the international catch, is heavily penalized under p-option = 1 but not under p-option = 2. Conversely, the demersal 100+ fleet, which takes a large part of the total catch but does not particularly target cod, is more heavily penalized under p-option = 2 than under p-option = 1. The TBB 80+ fleet, which targets plaice and takes a large part of the total plaice catch is penalized under both p-options.

Figure 3.1.4.2. shows that under p-option = 1 the targets are approached slightly closer than under p-option = 2. For both cod and plaice the optimum p-option appears to be p=0, the benefit of chosing p=0 being greater for cod than plaice.. In this case the outcome is consistent with the cod Recovery Plan and the plaice Management plan. (With the p-option = 1 the outcome is consistent with both Plans only in case the effort in 2004 had been 50% lower than in 2003 [through decommissioning and the days at sea regulation and the cod protection area]).

The result of p=0 being the best option (in terms of achieving management goals) for the North Sea in 2005 is a function of the particular f-multipliers chosen. Previous experience with MTAC model results indicate that p=0 is not normally optimal. A similar exploration was conducted for Commission scenario e, resulting in the plaice and sole targets being approached less closely under p-option =0 (Figure 3.1.4.3.). (Note also that scenario e is not consistent with the cod Recovery.)

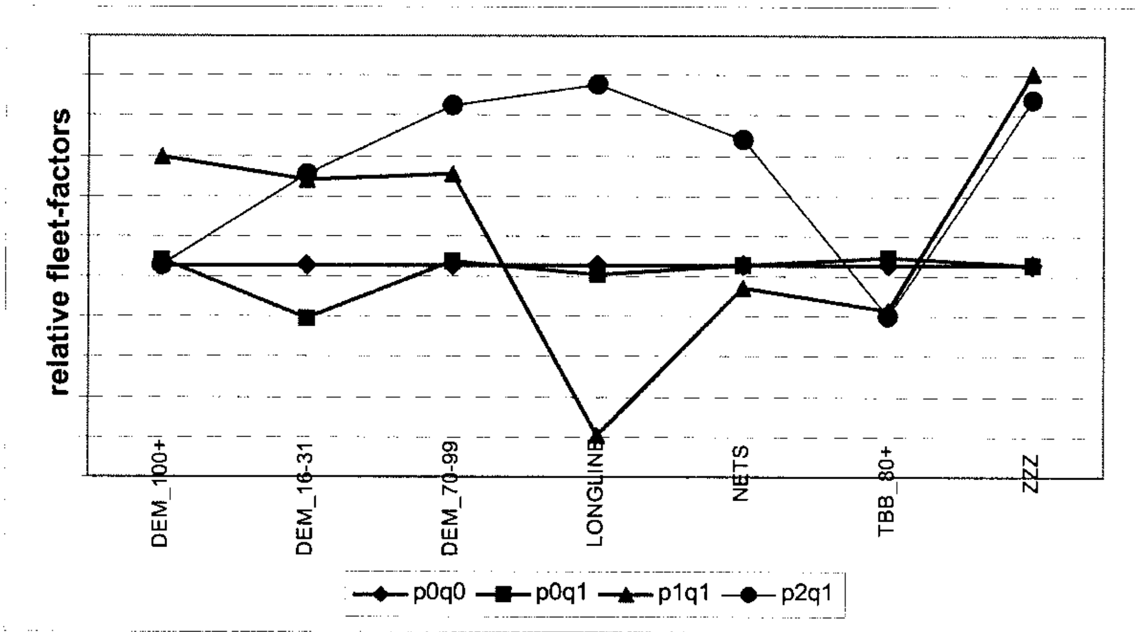

Figure 3.1.4.1. Comparison between different p- and q-settings; fleet-factors. The lines joining points is to facilitate the visualization of the results as the factors of the fleets are independent from one another and no sequence or continuity between them exists.

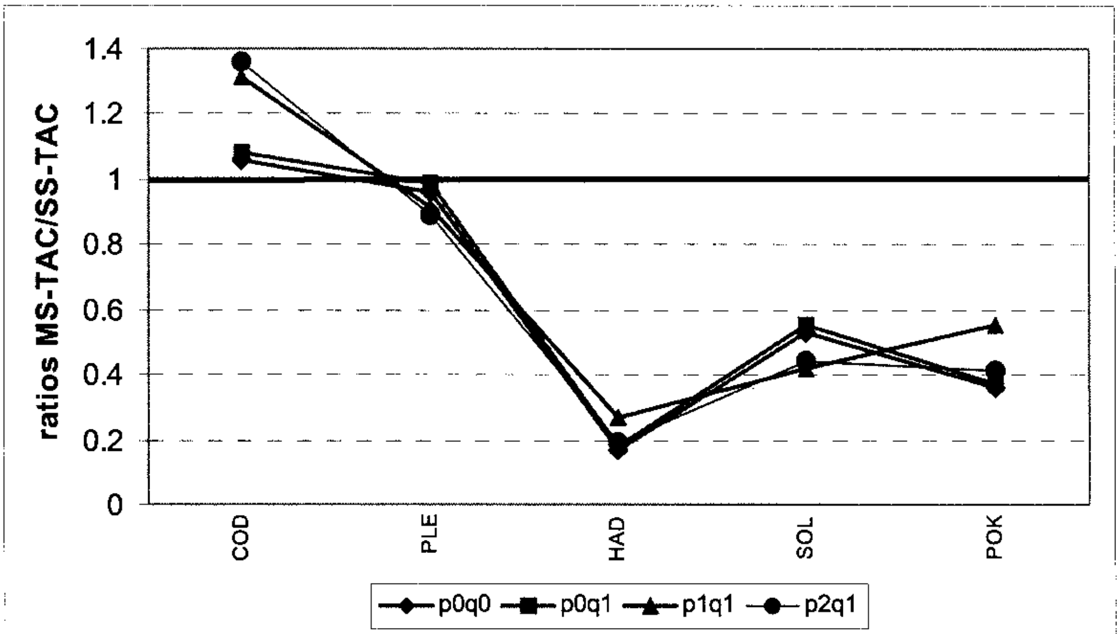

Figure 3.1.4.2. Comparison between different p- and q-settings of Commission scenario f with the assumption of Fsq for cod in 2004 ; MS-TAC/SS-TAC ratios. The lines joining points is to facilitate the visualization of the results as the ratios for the species are independent from one another and no sequence or continuity between them exists.

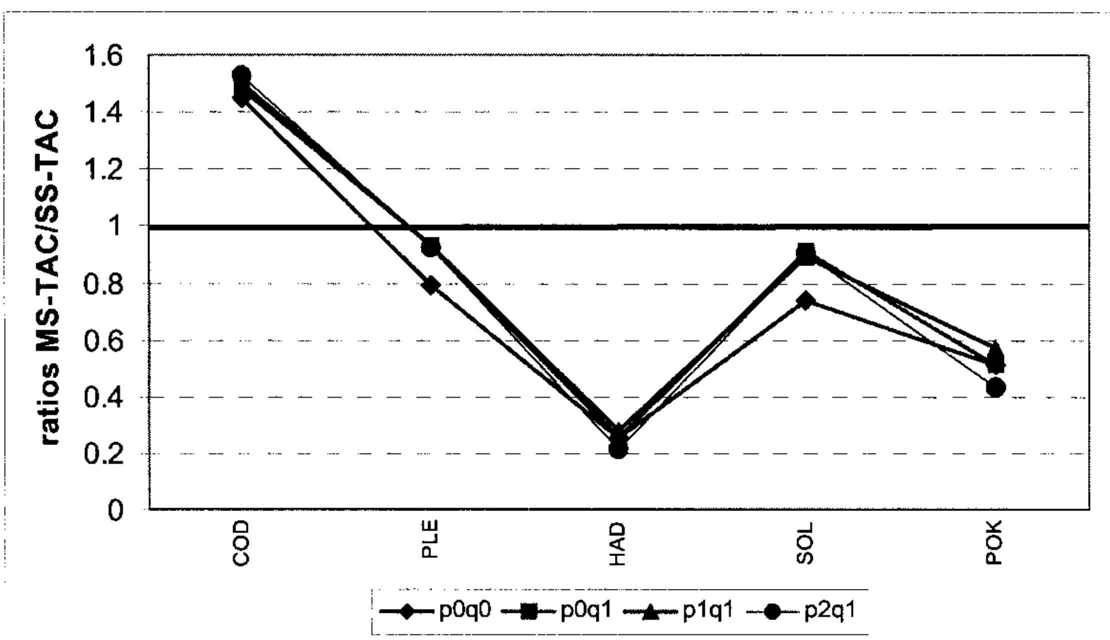

Figure 3.1.4.3. Comparison between different p- and q-settings of Commission scenario e with the assumption of Fsq for cod in 2004; MS-TAC/SS-TAC ratios. The lines joining points is to facilitate the visualization of the results as the ratios for the species are independent from one another and no sequence or continuity between them exists.

The comparison of disaggregation by 7 fleets versus disaggregation by 49 fleets is displayed in Figure 3.1.4.4. This exploration was arbitrarily run with Commission scenario f with the assumption of Fsq for cod in 2004. There is relatively little difference in the ability of either model to simultaneously achieve the required TAC's. Under the 7 fleet disaggregation, the targets for cod, plaice, and sole are reached slightly closer. However, when disaggregating by 49 fleets, the targets for haddock and saithe are reached slightly closer. In other words, aggregation to the level of 7 fleets is better for the species whose F needs to be reduced, whereas aggregation to the level of 49 fleets is better for the species whose F can be increased. These differences are, however, marginal which may reflect the method of using global averages to fill in missing strata in the fleet database.The outcome of the run with 49 fleets is consistent with the plaice Management Plan but inconsistent with the cod Recovery Plan, which is the same result as when considering only 7 fleets.

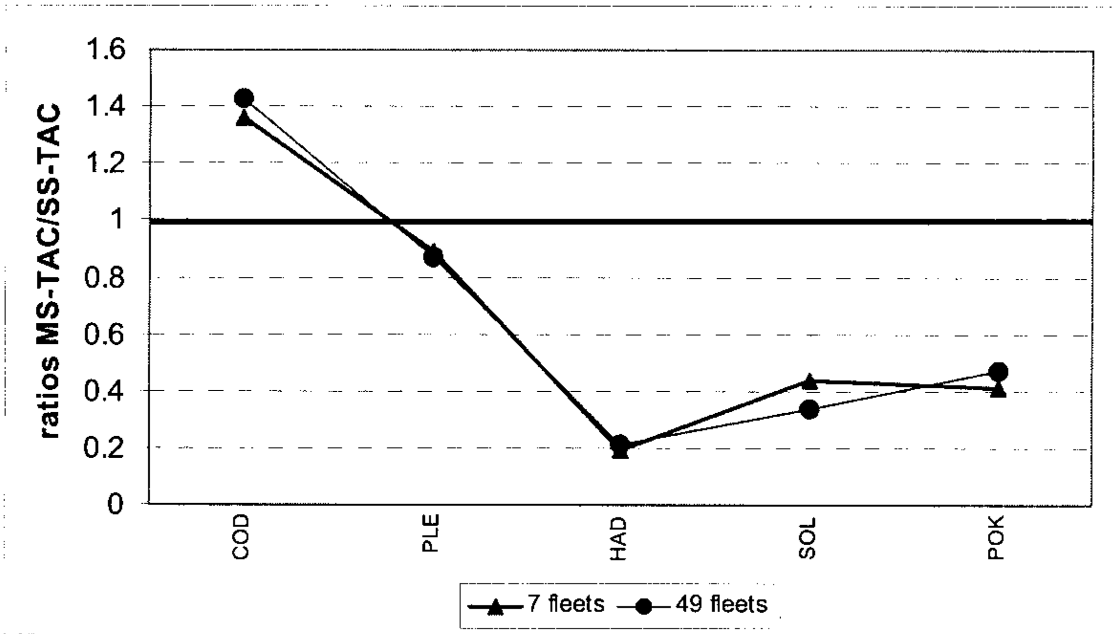

Figure 3.1.4.4. Comparison between different aggregation levels of fleets; MS-TAC/SS-TAC ratios. The lines joining points is to facilitate the visualization of the results as the ratios for the species are independent from one another and no sequence or continuity between them exists.

3.1.5. Conclusions on the MTAC runs.

The dataset underpinning the MTAC analyses is greatly improved from that used last year. There are fewer missing strata (gear, mesh, area, quarter,species, age) and discard data have now been included. The dataset is not, however, complete, and missing strata have been filled in with a coarse algorithm which takes grossly averaged data. Any usage of the results of MTAC for this year should bear this in mind.

In terms of meeting the criteria for the cod Recovery Plan and the plaice Management Plan, no single run achieves this feat simultaneously. The closest MTAC could get was with run 8, an f-multiplier of 0.7 on cod, 0.45 on plaice, p=2, q=1.

3.1.6. Exploratory SMP mixed fisheries simulations for the North Sea

In order to evaluate mixed fisheries advice and mixed fisheries catches which are consistent with the precautionary reference points and the cod recovery plan, 5 SMP model (short term mixed fisheries prediction) simulations were run based on the latest stock parameters derived from the analytical assessments of the ICES WGNSSK. The SMP model calculations of fleet management is based on fleet weightings of 6 fleets and 5 stocks, cod 3an47d, haddock 3an4, saithe 3an46a, plaice 4 and sole 4 in the North Sea in 2003. Whiting 47d and Nephrops functional units in the North Sea were not considered as there are no analytical assessments available. The 6 fleets defined are demersal otter trawls and seines≥100 mm (DEM_100+), demersal otter trawls and seines 70-99 mm (DEM_70-99), longline, fixed nets (NETS), beam trawls ≥80 mm (TBB_80+) and other gears (ZZZ). The demersal otter trawl fleet 16-31 mm was removed from the analyses because no age disaggregated catch data for the 5 stocks are available. The partial Fs of such fleets were weighted by stock specific factors (analogous to MTAC decision weights) and the calculations are constrained by the precautionary reference values for spawning stock biomass and fishing mortalities.

The SMP methodology was presented to the STECF sub-group on mixed fisheries in 2003 and is described in an appendix of the last year's report (Commission Staff Working Paper, Ad hoc working group on mixed fisheries, Brussels 21-24 October 2003, Sec (2003) 1428). SMP is a program for short term multi species/multi fleets stock and catch projections. The program calculates mixed fisheries catches constrained by minimum spawning stock biomass values at the start of the year after the TAC year and maximum fishing mortality during the TAC year. Such constraints could be set to the precautionary reference points in fisheries management or any other values to be defined through mixed fisheries considerations. Fleet weighting is based on the contribution of the fleets to the total fishing mortality of the species (partial F reference) and can be manipulated by species weighting. The program code is written in Visual Basic for Applications and uses an EXCELworkbook and its spread sheets as input and output forms.

The 5 scenario runs with the SMP program are identified by combinations of

1. status quo fishing mortality in 2004 and equal stock weights
2. status quo fishing mortality in 2004 and all weight to cod
3. status quo fishing mortality in 2004 and most weight on cod and plaice
4. 50 % reduction in fishing effort in 2004 of the 2 cod sensitive fleets DEM_100+ and DEM_70-99 as indicated by a working paper presented to the ICES NSSK WG 2004 (due to decommissioning, days at sea regulation and cod protection area) and equal stock weights
5. 50 % reduction in fishing effort in 2004 of the 2 cod sensitive fleets DEM_100+ and DEM_70-99 as indicated by a working paper presented to the ICES NSSK WG 2004 (due to decommissioning, days at sea regulation and cod protection area) and most weight on cod and plaice

The assumed fleet factors in 2004 and resulting fleet factors in 2005 under these 5 scenarios are shown in Fig. 3.1.6.1. Given equal weights to the 5 stocks considered, all 6 fleets would have to reduce their efforts equally by about 60 %. The SSB of cod will increase by 30 % from 2005 to 2006 and plaice SSB will exceed 230.000 t in

2006 as determined in the management plans. Fishing mortalities and catches of all stocks would accordingly be reduced by 50-60%, respectively. Generally, the resulting fleet factors in 2005 react quite insensitive to the varying stock weights as they all contribute to the cod and plaice catches and the simulations are restrictively constrained by the cod recovery plan and the precautionary plaice SSB to be reached in 2006. The only fleet for which a less significant effort reduction would be advisable under varying species weights is the fleets of other gears (ZZZ), which comprises relatively low catches from all stocks. The assumption of a reduced effort in 2004 of the fleets DEM_100+ and DEM_70-99 results in almost identical fleet efforts required for 2005 to accomplish predefined management goals in 2006 compared to the status quo assumption. As expected, the effort reduction in 2004 would result in higher levels of SSB estimates and catches in 2005-2006 for all species except plaice and sole, which are less selected by the 2 effort reduced fleets in 2004. Figure 3.1.6.2 illustrates SSB trajectories of all 5 stocks.

Under scenarios 1-3 for all 5 species, fishing mortalities and corresponding catch levels in 2005 would need to be consistently reduced by about 50 % compared with 2004 (Fig. 3.1.6.3 and 3.1.6.4). Under scenarios 4 and 5, cod, haddock and saithe would profit from suggested effort reductions in 2004. In general, catch estimates in 2005 of cod amount to about 40,000 t, plaice catches to about 60,000 t and sole catch estimates do not exceed 10,000 t.

Haddock and saithe catch estimates for 2005 are well below the single species exploitation boundaries with respect to the precautionary approach because of the poorly defined fleet DEM_100+. More appropriate fleet definitions including area and species catch composition effects may allow significant increases of catches in 2005 given the state of the stocks.

Whiting and Nephrops catches in 2005 can be estimated under the assumptions of constant catch rates of the 6 fleets over 2003-2005.

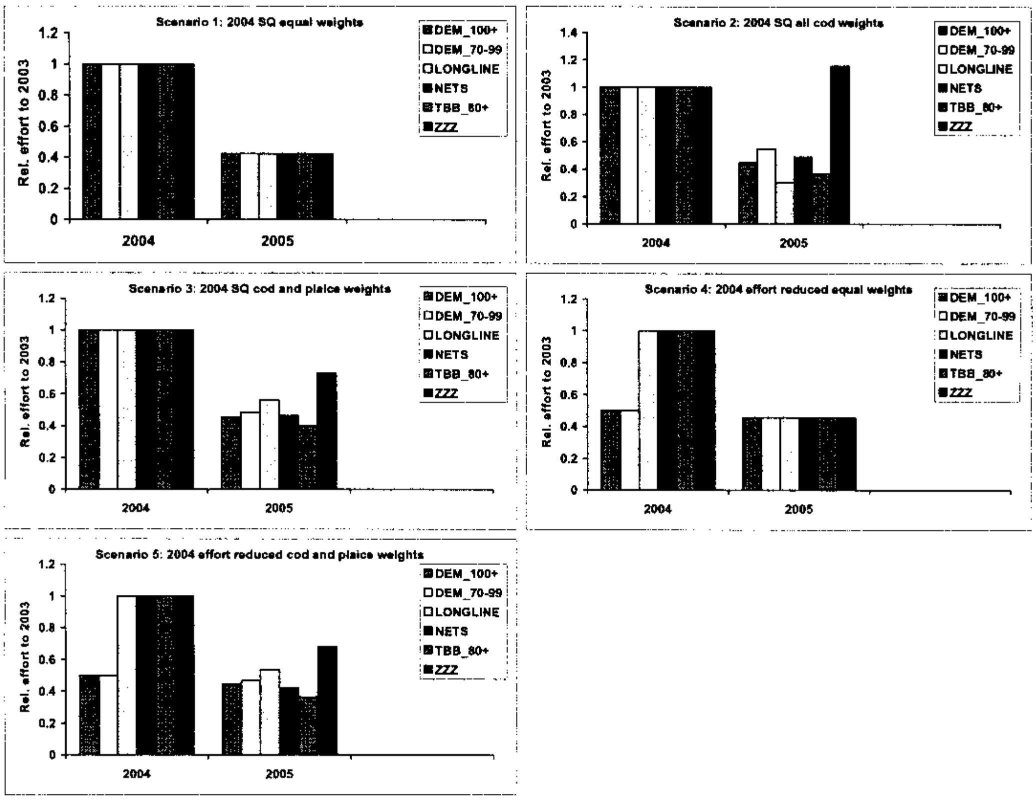

Fig. 3.1.6.1 SMP model results for mixed fisheries in the North Sea. Relative fleet factors to 2003 in 2004 and 2005 under 5 different scenarios.

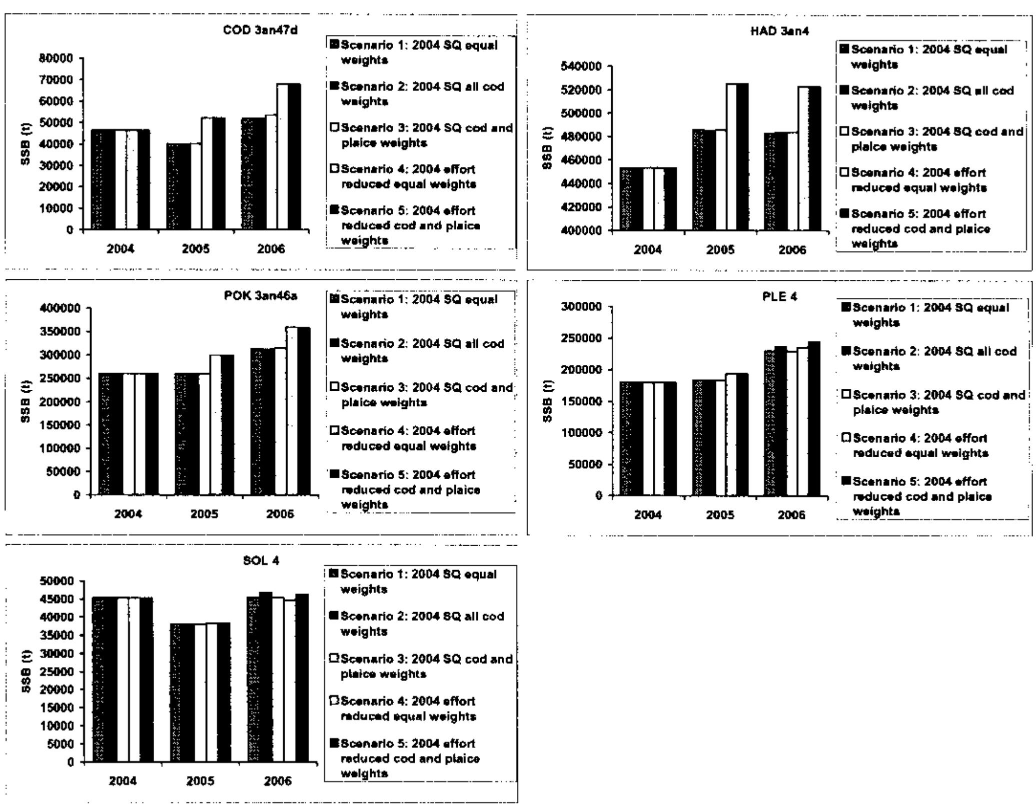

Fig. 3.1.6.2 SMP model results for mixed fisheries in the North Sea. SSB trajectories in 2004-2006 of 5 stocks under 5 different scenarios.

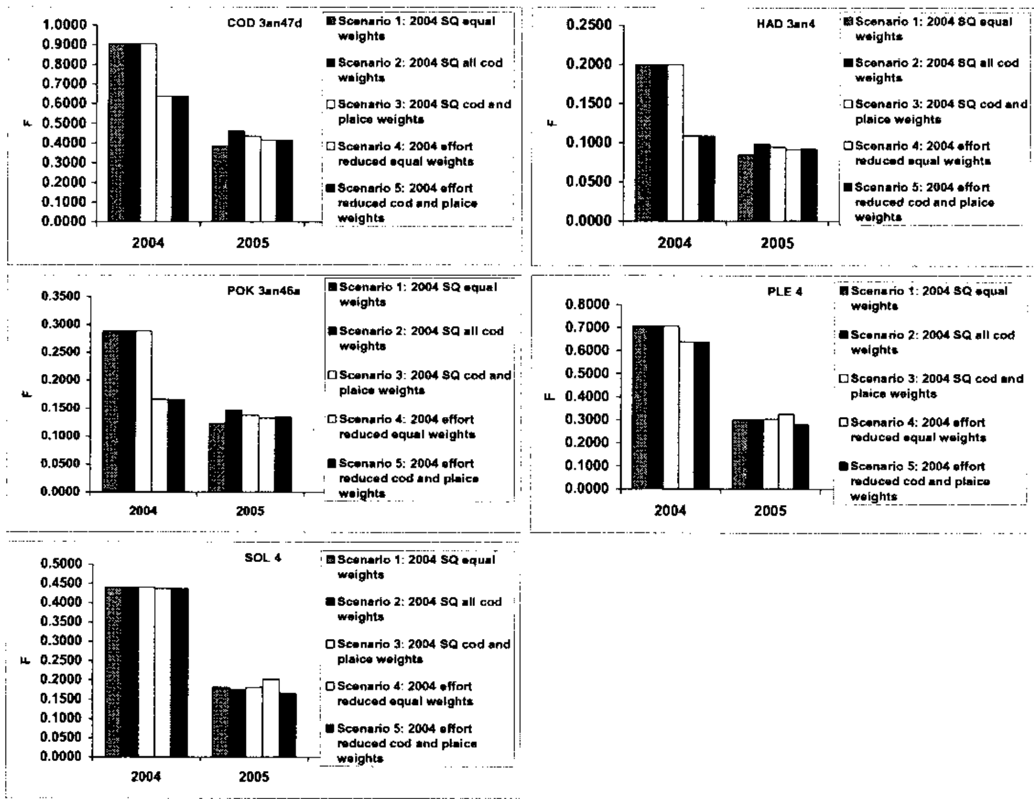

Fig. 3.1.6.3 SMP model results for mixed fisheries in the North Sea. F- trajectories in 2004 and 2005 of 5 stocks under 5 different scenarios.

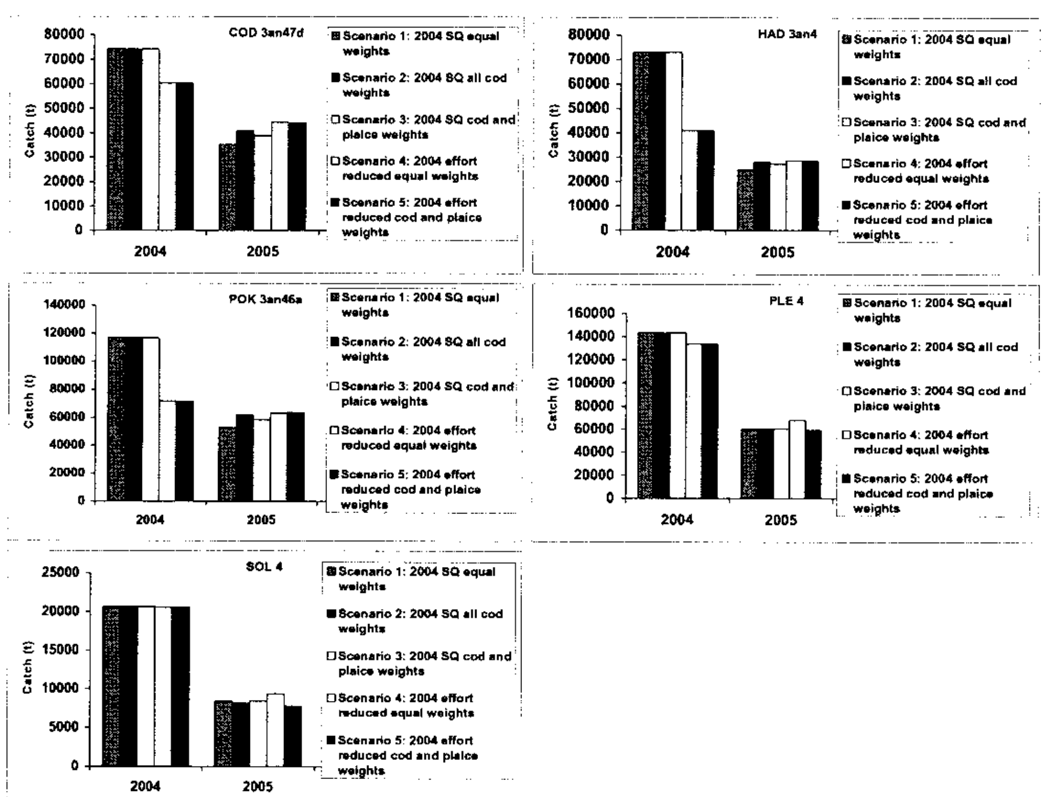

Fig. 3.1.6.4 SMP model results for mixed fisheries in the North Sea. Catch trajectories in 2004 and 2005 of 5 stocks under 5 different scenarios.

3.1.7. Additional request from the Commission:

Potential for management of fisheries independently

During the meeting the group were additionally requested to advise on the extent to which North Sea fisheries for plaice and sole can be managed independently from each other, and fisheries for Nephrops and haddock can be managed independently from fisheries catching cod. This request came in 24 hours before the meeting concluded which was too little time for any detailed analyses. A preliminary investigation was made using the data compiled in the STECF database of SGDFF formatted landings and discard data. Although this data set does not include spatial information, by examining landings and discard data at the lowest level of aggregation (individual *metiers* provided by each country), the data set provides the scope to identify fleets which may show the potential for independent management. Further examination of these fleets may provide information on spatial components of the fisheries.

Total annual removals for 2003 (landings plus discards) in both weight and numbers (for fish species) were extracted from the database for plaice, sole, cod, haddock and Nephrops for each of the fleets (defined by country, gear, mesh range and division). This resulted in 163 fleets for Division 4 (North Sea) and 50 fleets for Division 3 (Skagerrak and Kattegat).

For each of these fleets, the contribution to total catches of each species within the Division was calculated. From the landings of each fleet, the fraction of sole in the combination of plaice and sole was determined. The same calculation was done for haddock and cod, and Nephrops and cod. From this, it was possible to identify a number of fleets that either contributed more to the total catches of sole, haddock and Nephrops than to plaice or cod, or had ratios in the catches dominated by sole, haddock or Nephrops. The results are subject to the same caveats as other analyses based on the data in this database, in that where discards are not reported for a particular fleet, weighted average values from those fleets reporting discards are used. If these are not appropriate, then discard estimates for some fleets (and therefore also for the stock) may be poor.

The calculated fractions for Division 4 are shown in Figures 3.1.6.1 – 3. It is clear that when examined at this level of aggregation, there are fleets which target sole, haddock or Nephrops with low proportions of plaice or cod. Similar results were also found for Division 3. Some of this detail will be lost when fleets are aggregated to higher levels (i.e. the 7 fleets for which the Commission has requested MTAC runs are made). Time constraints at the present meeting have meant that this analysis has only been conducted on an annual basis, but quarterly information may provide more detail.

Management objectives are required to define acceptable levels of bycatch or allowable contributions to total mortality for cod and plaice. Once these levels have been defined then fleets that meet requirements can be examined further to determine the factors that could be used (gear, mesh, spatial coverage, seasonal timing) for independent fishery management.

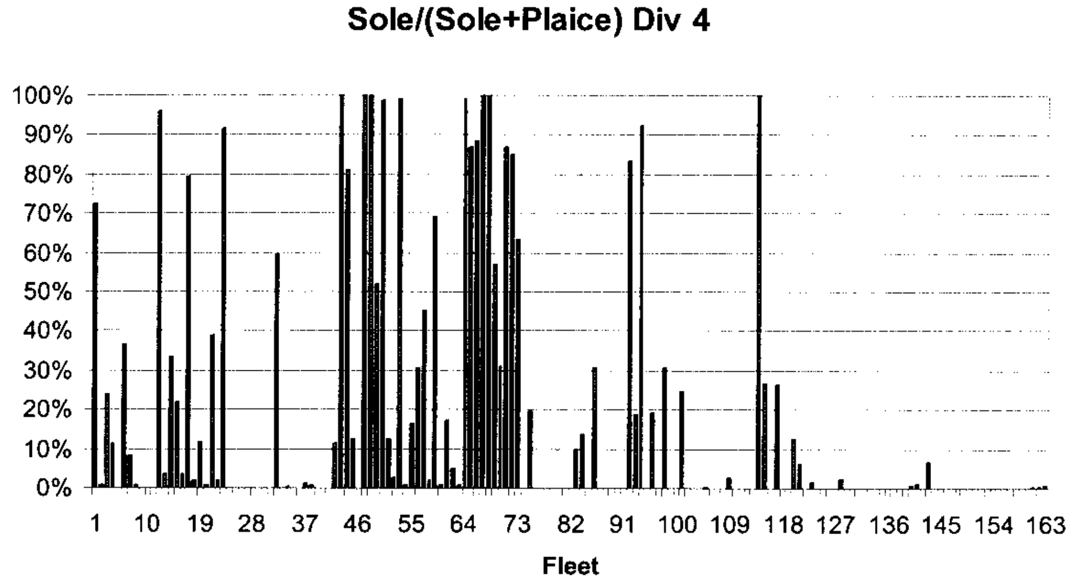

Figure 3.1.6.1. Sole removals weight as a percentage of sole + plaice for each of the North Sea fleets.

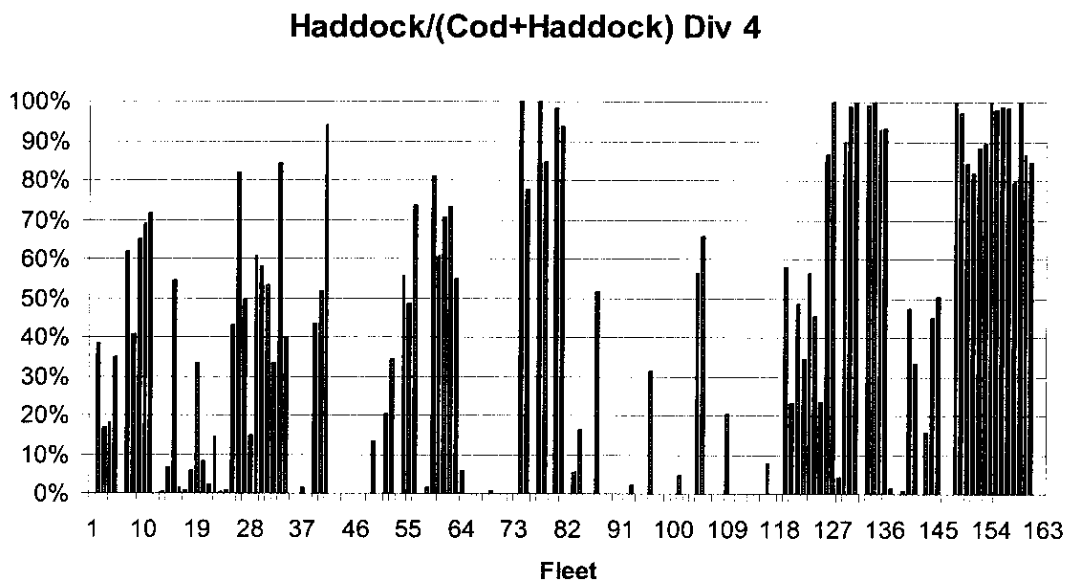

Figure 3.1.6.2. Haddock removals weight as a percentage of haddock + cod for each of the North Sea fleets.

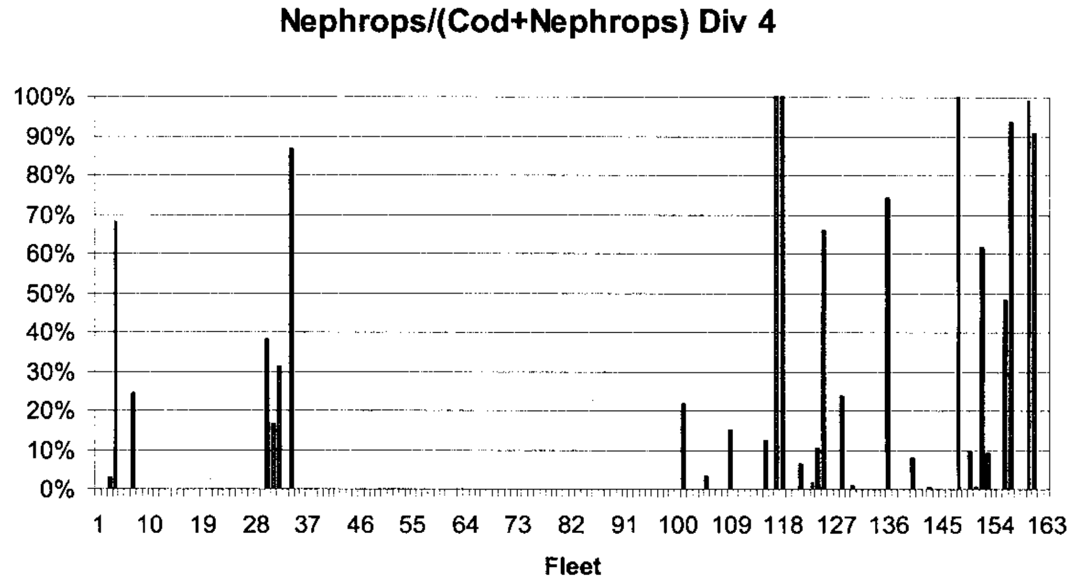

Figure 3.1.6.3. Nephrops removals weight as a percentage of Nephrops + cod for each of the North Sea fleets.

3.2. Irish Sea (ICES Division VIIa)

3.2.1. 3.2.1.Fleets and fisheries overview

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

3.2.2. Data availability

ICES Advice

The October 2004 ICES advice with regard to single-species exploitation boundaries for the principle demersal stocks in ICES Division VIIa is summarised in the table below.

Stock	State of the stock	ICES considerations regarding single stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landing in 2005 t)	ICES Assessment	Forecast
Cod in Division VIIa	Outside safe biological limits	A recovery plan implying zero catch in 2005	0	Ø	Ø
Haddock VIIa	Harvested outside of safe biological limits	Fishing mortality in 2005 should be reduced to less than F_{pa}	1 370	Ø	Ø
Nephrops FU 15 & FU 14 (Management area J)	Exploited at sustainable levels	The TAC from this Management Area in 2004 and 2005 be kept at the level recommended in 2001	9 550		
Plaice VIIa	Inside safe biological limits	Fishing mortality in 2005 should be less than F_{pa}	2 970	Ø	Ø
Sole VIIa	Harvested sustainably but with increased risk of reduced reproductive capacity	Fishing mortality in 2005 should remain below F_{pa}	1 000	Ø	Ø
Whiting in Division VIIa	Uncertain but thoughts to be outside of safe biological	A recovery plan implying zero catch in 2005	0	X	X

	Limits				

Fleet data

Landings data by fishery, as defined by SGDFF (2004), were available from Belgium, France, Ireland and UK for the main species. SGDFF (2004) highlighted the importance of parity of the input data of the mixed-species models and that this approach will be devalued if there is no consistency in the quality of the input data, in terms of discard estimates and misreporting by fishery/fleet. For this reason misreporting estimates for cod and haddock which had previously been made for a small number of fisheries operating in the Irish Sea, were removed

Population numbers and fishing mortalities at age were available for all stocks except Nephrops and whiting. No analytical assessment was available for whiting. Population numbers were taken from the ACFM inputs for stock forecasts.

Sampling levels and coverage were particularly poor in 2003 for a number of Irish Sea stocks. The fishing industry denied scientist access to sampling at a number of Irish Sea ports, necessary for estimation of landings and catch composition. Despite the limited sampling, the composition of cod for sampled fleets and quarters were quite similar across fleets and years enabling ICES to provide catch at age data for cod through appropriate inter- and extrapolations (WGNSDS 2004). No representative haddock and whiting international catch numbers-at-age could be provided for 2003, due to variable trends in the proportion of numbers at age over years, quarters and countries. Catch numbers at age used by ICES to provide single-species forecasts were available for plaice and sole. Problems with sampling coverage for plaice and sole were also apparent and are discussed in detail by ICES (WGNSDS 2004). Historical catch numbers at age, for inclusion in the MTAC model, were taken as the 2001-2003 average for cod, plaice and sole, and the 2000-2002 average for haddock. Since no analytical assessment was available for whiting, no catch numbers at age were included in the MTAC model for this stock.

No discard data were included for any of these stocks.

Fleet definitions

Fleets were defined in accordance to gear groupings used by the North Sea in this report, and the wishes of the Commission that gear groupings be "collapsed" across countries. The following fleet definitions were used:

DEM_FD = All mobile gear directed at roundfish
DEM_ND = All mobile gear directed at nephrops
TBB = All beam trawl fleets
ZZZ = All other fleets

In the North Sea, gill net and longline fleets were considered as separate fleets, but the contribution of these fisheries to the total Irish Sea catch is small in 2003. The landings of the ZZZ group in the Irish Sea are thus mainly composed of gill nets and longlines.

Individual fleet and fishery definitions for the Irish Sea are currently broadly based on gear type. Some division of fleets, however, were based on catch composition, where the relative proportion of Nephrops in the landings has been used to define Nephrops-directed (DEM_ND)or fish-directed (DEM_FD) fleets. The choice of threshold under which the mobile gears were divided into Nephrops and fish directed was a subjective decision, which led to inconsistency across countries. For Irelanda threshold of 20% Nephrops in the landings was used to allocate individual trips to the DEM_ND fleet. UK (E&W) and UK (NI), defined Nephrops fleets on the basis of gear type only where the proportion of Nephrops landings out of the total landings of assessed sppecies comprised 82 and 93% respectively.These inconsistencies in defining fleets inevitably produce very different species interactions, with the bycatch of cod by DEM_ND fleets ranging from 3-47% across nations. Similarly, the catch of cod by the fisheries defined under DEM_FD , comprise between 3 and 54% of the total landings of assessed species. If the interest is in preserving cod, combining fleets in such a manner is undesirable and inappropriate for a mixed fisheries approach.

One of the assumptions of the mixed fisheries approach is that of constant catch composition over time. Figure 3.2.2.1 shows the proportion of cod in the total landings of ICES assessed species for the main cod catching fisheries in the Irish Sea over the last 4 years (2000-2003). Clearly, the catch composition of fisheries in the Irish Sea does not remain constant over time. Most notably the recorded cod landings in the Irish gill net fishery were removed from the Irish Sea landings in 2003 due to suspected area misreporting. A similar interannual variation in catch composition can also be observed for the fleets used in the analysis in this report (Figure 3.2.2.2). These variations in catch composition within fisheries/fleets also result in interannual variations in the contribution of fisheries/fleets to the total cod catch in the Irish Sea. Considerable variation in catch composition within fisheries and fleets is evident, violating the primary assumption of constant catch composition within fleets in a mixed fisheries approach.

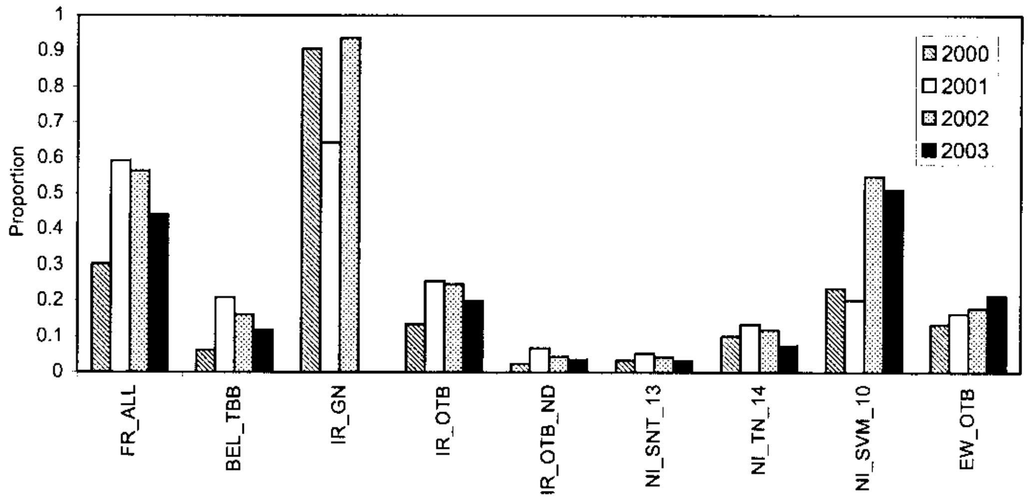

Figure 3.2.2.1 The proportion of cod in the total recorded landings of assessed species by fishery 2000-2003. Only fisheries that landed more than 5% of the total Irish Sea cod landings in any particular year are shown.

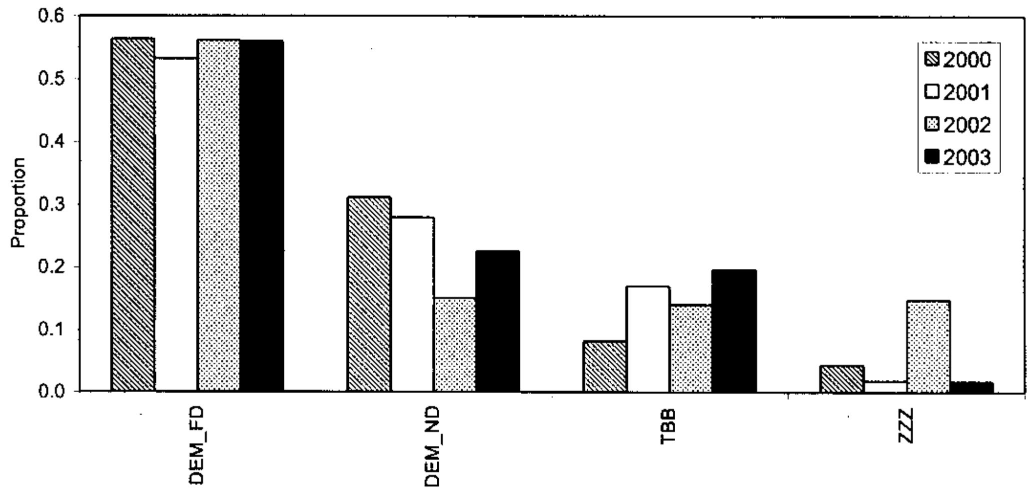

Figure 3.2.2.2 The proportion of cod in the total recorded landings of assessed species by fleet 2000-2003.

3.2.3 MTAC results.

The commission requested a scenario where there should be a 29% reduction in fishing mortality for the cod stock, where all the decision weighting in the MTAC run is given to cod. This is in line with the ACFM advice for the Irish Sea cod stock. A second scenario where there should be a 15% reduction in F for cod was also requested.

Scenario 1 – 29% reduction on F for cod will all decision weighting on Cod

A 29% reduction in F for cod with respect to the average $F_{2001\text{-}2003}$ with all decision weight on cod. Other species weighted according to latest ICES single species exploitation boundary advice, except for whiting ($F_{status\ quo}$). As the decision was weighted entirely on Cod, the difference between the results of MTAC runs using q=0 and q=1 are insignificant. Results given below are for q=0 only.

p=0	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.713	COD	1	0.988
DEM_ND	0.713	HAD	1.54	0.002
TBB	0.713	PLE	0.56	0.002
ZZZ	0.713	SOL	0.68	0.002

p=1	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.595	COD	1	0.988
DEM_ND	0.941	HAD	1.51	0.002
TBB	0.829	PLE	0.59	0.002
ZZZ	0.295	SOL	0.77	0.002

p=2	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.602	COD	1	0.988
DEM_ND	0.84	HAD	1.49	0.002
TBB	0.861	PLE	0.6	0.002
ZZZ	0.988	SOL	0.8	0.002

Scenario 2 – 15% reduction on F for cod will all decision weighting on Cod

A 15% reduction in F for cod with respect to the average $F_{2001\text{-}2003}$ with all decision weight on cod. Other species weighted according to latest ICES single species exploitation boundary advice, except for whiting ($F_{status\ quo}$).

p=0	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.852	COD	1	0.988
DEM_ND	0.852	HAD	1.74	0.002
TBB	0.852	PLE	0.66	0.002
ZZZ	0.852	SOL	0.8	0.002

p=1	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.79	COD	1	0.988
DEM_ND	0.97	HAD	1.72	0.002
TBB	0.912	PLE	0.67	0.002
ZZZ	0.635	SOL	0.84	0.002

p=2	q=0			
	Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.794	COD	1	0.988
DEM_ND	0.917	HAD	1.71	0.002
TBB	0.929	PLE	0.68	0.002
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By placing all the decision weight on cod, the single species f-multiplier for cod is always achieved. In all scenarios and management options, the single species haddock TAC is considerably overshot, whilst the plaice and sole single species TAC's appear undershot.

3.2.3. Conclusions.

Fishery-based advice requires well-defined fisheries based on complete and reliable catch data. This is clearly not the case for the Irish Sea as it lacks consistently defined fisheries with constant catch composition over time within fisheries/fleets. The data set also lacks discards for all species in the Irish Sea which is of primary concern, ACFM refering to the lack of discard data as a "fatal flaw" in a mixed fisheries context (ACFM 2004). Given the number and strength of these concerns, the group considers the MTAC results presented here for the Irish Sea to be misleading and totally unsuitable management purposes.

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3.3.1. 3.2.1.Fleets and fisheries overview

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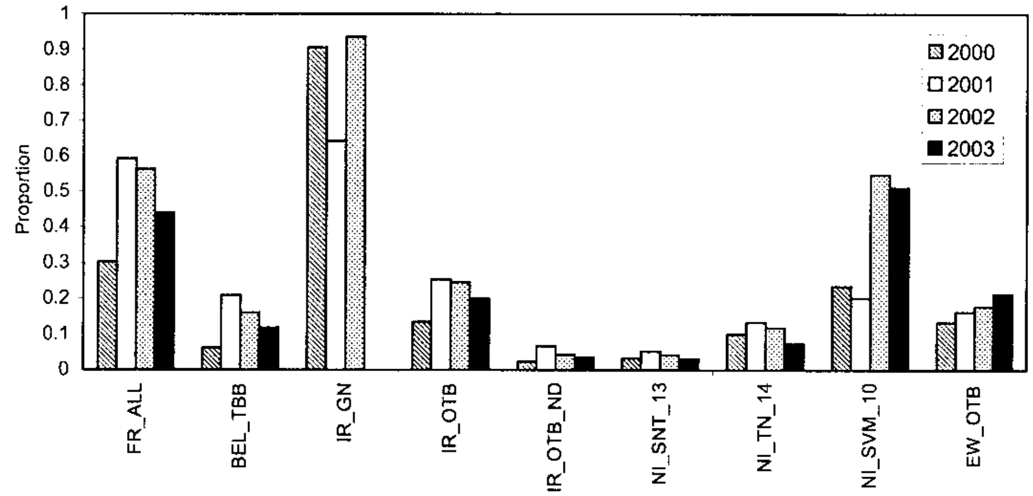

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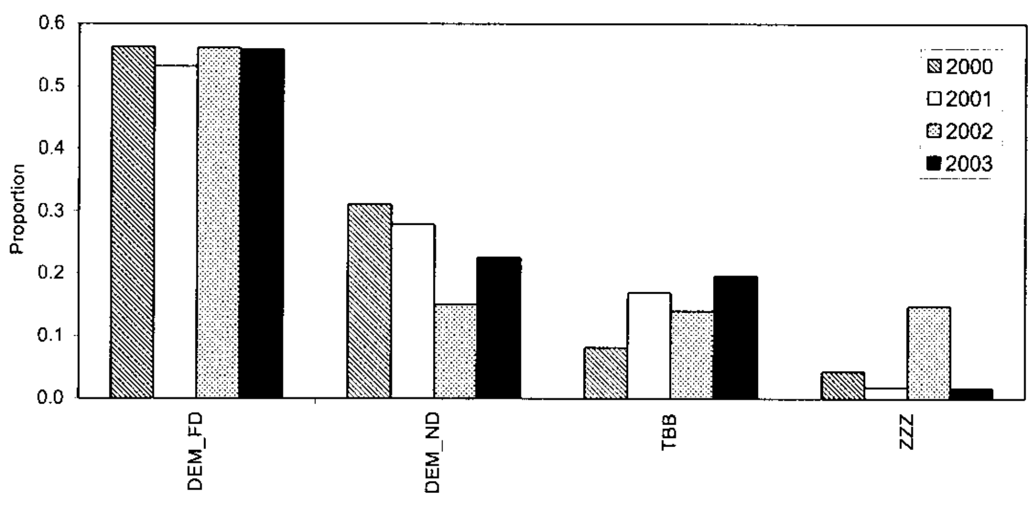

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p=0	q=0 Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.852	COD	1	0.988
DEM_ND	0.852	HAD	1.74	0.002
TBB	0.852	PLE	0.66	0.002
ZZZ	0.852	SOL	0.8	0.002

p=1	q=0 Fleet.Factor		MS_TAC/SS_TAC	Decision_w
DEM_FD	0.79	COD	1	0.988
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By placing all the decision weight on cod, the single species f-multiplier for cod is always achieved. In all scenarios and management options, the single species haddock TAC is considerably overshot, whilst the plaice and sole single species TAC's appear undershot.

3.3.3. Conclusions.

Fishery-based advice requires well-defined fisheries based on complete and reliable catch data. This is clearly not the case for the Irish Sea as it lacks consistently defined fisheries with constant catch composition over time within fisheries/fleets. The data set also lacks discards for all species in the Irish Sea which is of primary concern, ACFM refering to the lack of discard data as a "fatal flaw" in a mixed fisheries context (ACFM 2004). Given the number and strength of these concerns, the group considers the MTAC results presented here for the Irish Sea to be misleading and

3.4. Celtic Sea & Bay of Biscay (Southern Shelf)

3.4.1. Fleet overview

A broad description of the fleets, fisheries and metiers of the countries involved in the exploitation of hake, anglerfish and megrim are compiled in the SGDFF 2004 and WGHMM 2004 Reports.

New metiér definitions for Spanish trawl fishery operating in the Southern Shelf were presented during the SGDFF 2004. In addition some preliminary definitions of fisheries for UK and France were included. The correspondence of these fisheries to the traditional fishery units (FUs) are presented in the WGHMM 2004 Report in Section 2.2 (ICES, 2004d).

It was recognized that a better segmentation of these traditional FUs will more accurately reflect the actual fisheries occurring in the Celtic Sea and Bay of Biscay. However, for some countries, this process is still at a preliminary stage and needs further investigation before giving new definitions of the fisheries.

The traditional FUs no longer reflect the reality of the fisheries being deployed in the Southern Shelf. For example, in the case of the FUs 4 and 14 (trawling in medium to deep waters), five components have been aggregated into the same FU throughout the 80's and 90's: the baka-trawl, the bou-trawl (which was very important in the '80s and '90s, but disappeared in 2000), the traditional pair-trawl, the more recent bottom pair-trawl (operating with "Naberan" Very High Vertical Opening (VHVO) nets) since 1993, which is now the main gear used in the Bay of Biscay targeting hake, and, sporadically, boats operating with twin nets.

3.4.2. Data availability

During SGDFF held in February 2004, new trawl metiers, identified by multivariate analysis, were presented for Spanish fisheries operating in the European Southern Shelf (Castro *et al.*, 2004; Santurtún *et al.*, 2004; ICES, 2004a.). No new definition of long liners and gillnetters were carried out using these methodologies.

During the WGHMM 2004, Spanish landings data from 2003 were given by age and metier mentioned above for hake, anglerfish (both species), and megrim (*Lepidorhombus whiffiagonis*) following the SGLTA 2004 guidelines. As only Spain gave new definition for the fisheries it was therefore decided that the traditional FUs would be used, subdivided by country. Discard data were only available for one species, and they were not included in the MTAC analysis.

Table. 3.3.1 Fishery unit as described in STECF 1994

Fishery Unit	Description	Sub-area
FU1	Long-line in medium to deep water	VII
FU2	Long-line in shallow water	VII
FU3	Gill nets	VII
FU4	Non-*Nephrops* trawling in medium to deep water	VII
FU5	Non-*Nephrops* trawling in shallow water	VII
FU6	Beam trawling in shallow water	VII
FU8	*Nephrops* trawling in medium to deep water	VII
FU9	*Nephrops* trawling in shallow to medium water	VIII
FU10	Trawling in shallow to medium water	VIII
FU12	Long-line in medium to deep water	VIII
FU13	Gill nets in shallow to medium water	VIII
FU14	Trawling in medium to deep water	VIII
FU15	Miscellaneous	VII & VIII
FU16	Outsiders	IIIa, IV, V & VI
FU00	French unknown	

Table 3.3.2 ICES Advice

Stock	State of the stock	ICES considerations regarding single stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landing in 2005t)	Assessment	Prediction
Hake- Northern stock (Div. IIIa, Sub. IV, VI and VII, and Div. VIIIa, b, d)	At risk of reduced reproductive capacity and of being harvested unsustainably	Recovery plan implemented. To rebuild of SSB to Bpa in 2006, fishing mortality reduced to 0.19.	33 000	Accepted.	No accepted, new run with new recruitment
Megrim in Divisions VIIc-k and VIIIa,b,d	having full reproduction capacity and being harvested sustainable.	Bpa. A 12% reduction in F is needed to achieve a fishing mortality at Fpa (0.30).	22 600	Accepted.	No Appropriated , but accepted
Anglerfish in Divisions VIIb k and VIIIa,b (L. piscatorius)	having full reproduction capacity and harvested sustainably.	status quo fishing mortality, is well above fishing mortalities that would lead to high long-term yields and low risk of stock depletion	37 800	Assessment remains very uncertain and may be just acceptable.	No accepted. Requested a new forecast using the low mean weights at age of 2003

Anglerfish in Divisions VIIb k and VIIIa,b (L. budegassa)	having full reproduction capacity and harvested sustainably.	status quo fishing mortality, estimated at 0.18, is above fishing mortalities that would lead to high long-term yields and low risk of stock depletion		Accepted	Accepted

In the present Subgroup, 2003 international landings data by traditional FU were compiled for hake, megrim and both anglerfish. Data were aggregated over FUs and countries.

An attempt was also made to extend the number of species including 3 Functional Units of *Nephrops*. However, it was noticed that only one Functional Unit of the Southern Shelf was assessed during the last WGNEP (FU 23-24: Bay of Biscay). In addition there were some difficulties of assigning landings from the *Nephrops* Functional Units to their corresponding FUs. As a result of this problem, the group did not succeed in including Nephrops into the analyses.

The only stock for which there are discard data within the WGHMM of 2004 is megrim and estimates of discards are only available from one fleet. It was therefore decided not to include such partial information in a mixed fisheries analysis as it would only result in the disproportional penalisation of the one fleet which provided discard data.

So, in relation to data compilation, problems identified were:

- ✓ Not all species were taken into account.
- ✓ No discards were included.
- ✓ The species concerned have different distribution/assessment areas (Northern hake distribution include Northern Shelf, while the Northern Stocks of megrim and anglerfish are properly delimited to the Southern Shelf).
- ✓ New, more accurately disaggregated metiers were not available from all countries and fleets.

3.4.3. MTAC Settings

Fishing mortaltiy and survivor estimates (2003 Fsq and 2005 survivors) were taken from the most recent ICES assessment working groups. For Hake and Monkfish (*L. piscatorius*), 2005 survivors used in the analysis were the ones recalculated by the ACFM as a result of new recruitment estimates. These can be found in the Technical Minutes of the ACFM.

For a more detailed definition of the parameters used in the analysis see Annex 1.

A preliminary scenario used was the recently implemented Hake Recovery Plan in which the Hake TAC will correspond to F=0.25 which actually coincides with the Fsq. Hake is given the highest weight due to the Recovery Plan implemented from June 2004.

Table 3.3.4. Setting for the preliminar scenario

Species	Target F-multiplier	Decision weight on	Rationale
HKE	1	HKE (110)	Management Plan
MEG	0.88	0.25	ACFM recommendations
MON	1	0.25	Precautionary
ANK	1	0.25	Precautionary

Thus, the first Fmultiplier used for Hake was 1, for Megrim 0.88 and for the rest of the species Fmult. were 1. However, as it was suspected, under these MTAC settings, where the decision weight is all placed on a species with Fmult=1, all the other species achieve MS-TACs very close to their SS-TACs.

After this, the ACFM recommendations in relation to Fmultipliers for each species were taken into account for setting the objective of a mixed-species forecast. Again, Hake is given the highest weight due to the Recovery Plan implemented from June 2004.

Table 3.3.5 Setting for the final scenario

Species	Target F-multiplier	Decision weight on	Rationale
HKE	0.75	HKE (110)	Management Plan
MEG	0.88	0.25	ACFM recommendations
MON	1	0.25	Precautionary
ANK	1	0.25	Precautionary

Within this scenario, five runs were carried out combining different options of p and q.

	p	q
Run 1	1	0
Run 2	1	1
Run 3	2	0
Run 4	2	1
Run 5	0	0
Run 6	0	1

3.4.4. Results

Due to the high decision weight for Hake and low decision weights for the other species, there were almost no difference between the two q-settings (see Annexe 1 for an description of the effects of p and q settings). It was therefore decided to use q=0 in all further MTAC runs.

The final runs chosen for discussion were: run1 (p=1), run 3 (p=2) and run 5 (p=0).

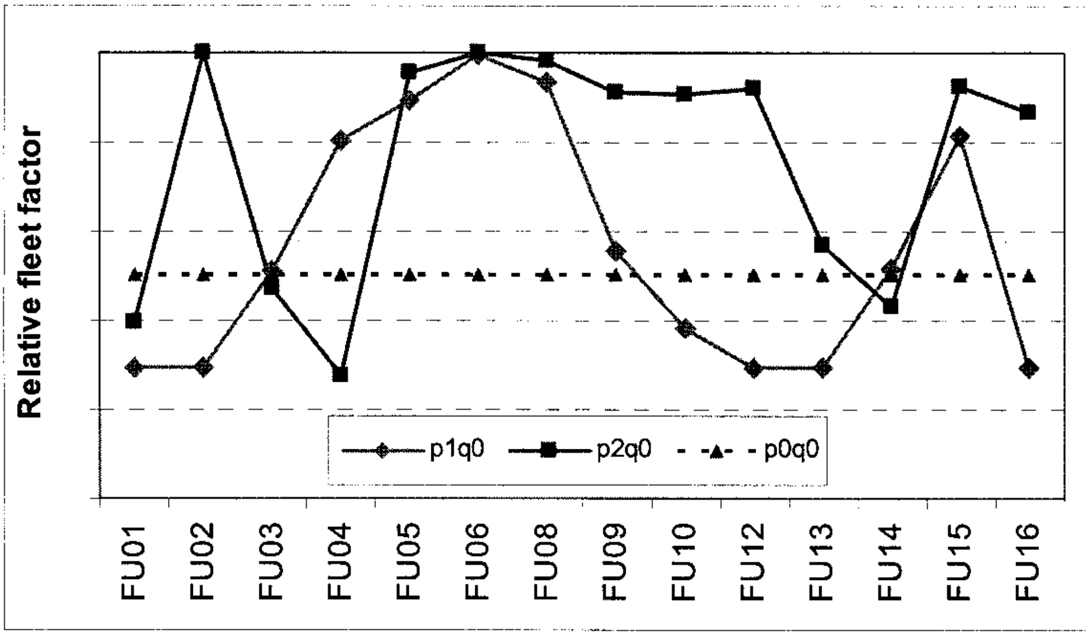


Figure 3.3.1. Fleet factors for each of the 16 traditional FUs used in the analysis. The line joining points is just used to facilitate the visualisation of the results as the factors of the FUs are independent one from the other and no sequence or continuity between them exists.

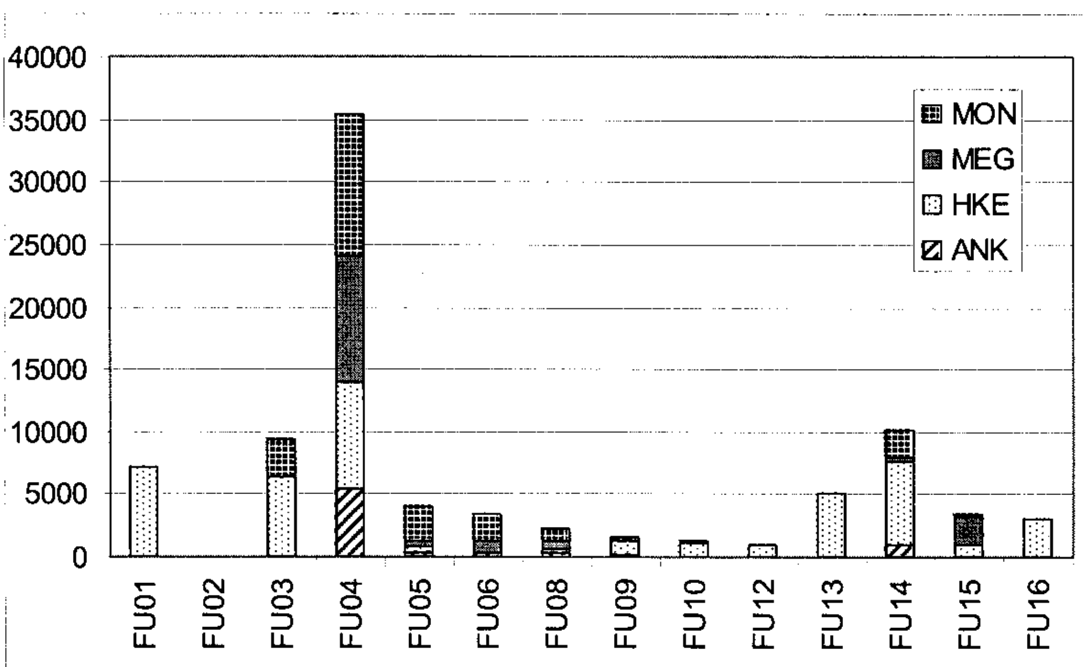


Figure 3.3.2. Species composition in the landings from the mixed fishery database for the 4 species included in the MTAC analysis by FU.

Table 3.3.5. Prediction results for the 16 traditional FUs in relation to the 4 species considered and the 3 p options studied. MS_TAC/SS_TAC (Ration between the mix species and the single species TAC. See Annex 1).

	MS_TAC/SS_TAC				
	HKE	MEG	ANK	MON	ANF
p=0	1	0,88	0,77	0,78	0,78
p=1	1	1,04	0,9	0,91	0,91
p=2	1	0,91	0,75	0,82	0,80

HKE: Hake (*Merluccius merluccius*); MEG: Megrim (*Lepidorhombus whiffiagonis*); ANK: Black Anglerfish (*Lophius budegassa*); MON: White Anglerfish (*Lophius piscatorius*); ANF: Anglerfish (*Lophius spp.*). (=: Mix Species_TAC = Single Stock TAC; +: Mix Species_TAC > Single Stock TAC; -: Mix Species_TAC < Single Stock TAC).

3.4.5. Discussion

Results are very sensitive to the p and q-option chosen. When p=0 all FUs are equally penalised, reducing the F to the level established by the limiting species, in this case Hake (Fmult =0.75). Under p=1, FUs targeting Hake (limiting species) are penalised (FU1, FU2, FU10, FU12, FU13). When p=2, FUs with the highest catches are penalised (FU1, FU3, FU4, FU13, FU14), as it weights the FUs reduction factor by their total catch composition which is largely determined by these FUs.

Of the three p-options, p=1 appears to result in the closest match of MS-TAC to SS-TAC over the range of species.

In conclusion the MTAC results presented in this section should be taken as very preliminary due to a) the lack of suitably disaggregated fishery data and b) the lack of inclusion of discard. The traditional fishery units should be re-examined and subdivided as a matter of priority in order to achieve a more precise monitoring of the mixed fisheries. Also, the inclusion of the discards should be contemplated by all countries involved in these demersal fisheries. These two matters have to be seriously considered if the work in mixed fisheries is required to be continued.

Thus, the Group strongly recommends that the results of these preliminary runs are not used for management purposes.

3.5. Celtic Sea (Cod Haddock Whiting Plaice sole and Nephrops VIIbk)

3.5.1. 3.4.1 Fleet overview

Fleet descriptions for demersal fisheries in the Celtic Sea have been given by ACFM as follows;

"Most of the demersal fisheries in this area have a mixed catch. Although it is currently possible to associate specific target species with particular fleets, various quantities of cod, whiting, hake, anglerfish, megrim, sole, plaice, and *Nephrops* are taken together, depending on gear type. Some fleets have also a large part of valuable non-TAC species in their catch (squids, cuttlefish, red mullet...). This is particularly the case for coastal fleets.

Since the 1930s, hake has been the main demersal species supporting trawl fleets on the Atlantic coasts of France and Spain. Spain took around 60% of the landings, France 30%, UK 5%, Denmark 3%, and Ireland 2%. Hake are caught throughout the year, the peak landings being made in spring-summer months. The three main gear types used by vessels fishing for hake as a target species are lines (England and Wales, Spain), fixed-nets and trawls (all countries), mostly bottom trawls, and recently also Very High Opening trawls (Spain).

In the Celtic Sea and Western Channel, fisheries for demersal species, mainly cod, whiting, sole and plaice, are conducted by Belgium, France, Ireland, and the UK. The principal gears used are otter trawls and beam trawls.

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

A trawl fishery for anglerfish by Spanish and French vessels developed in the Celtic Sea, on the shelf edge around the 200-m contour to the south and west of Ireland and Bay of Biscay in the 1970s and expanded until 1990. This fishery used single and twin rig otter trawls in medium and deep water in Divisions VIIb,c,e-k. Bycatch species include hake, megrim and to a lesser extent *Nephrops*. Although effort in most fleets appears to have declined since the early 1990s the increasing use of twin trawls may have increased the overall efficiency. In addition, a gillnet fishery targeting anglerfish developed in the Celtic Sea on the shelf edge around the 200-m contour to the south and west of Ireland in the 1990s.

Megrim in the Celtic Sea, west of Ireland and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 60% of the total landings, and by Irish and UK demersal trawlers. Most UK landings of megrim are made by beam trawlers fishing in Divisions VIIe,f,g,h. Otter trawlers account for the majority of Spanish landings from Subarea VII, prosecuting a mixed fishery for anglerfish, hake, and megrim on the shelf edge around the 200-m contour to the south and west of Ireland. Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole, and anglerfish. Megrim landings have remained fairly stable over the period 1986–2003.

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

3.5.2. 3.4.2 Data availability

Stock	State of the stock	ICES considerations regarding single stock exploitation boundaries	Upper limit corresponding to the exploitation limit (Landing in 2005 t)	ICES Assessment	Forecast
Cod in Division VIIe-k	Full reproductive capacity	17% reduction in F	5210	Ø	Ø
Haddock VIIb-k	unknown		25000	X	X
Nephrops VIIb-k	NA	NA	NA	X	X
Plaice VIIe	At risk of reduced reproductive capacity	75% reduction in F	170	Ø	Ø
Sole VIIe	At risk of reduced reproductive capacity	82% reduction in F	230	Ø	Ø
Whiting in Division VIIe-k	Full reproductive capacity	Fsq	10630	Ø	Ø
Plaice VIIf-g	At risk of reduced reproductive capacity	69% reduction in F	250	Ø	Ø
Sole VIIf-g	Full reproductive capacity	29% reduction in F	840	Ø	Ø

Catch by species gear quarter and area was available from France Ireland UK and Belgium. These fleets take the majority of the stocks considered here in a mixed fisheries context. These "stocks" (or groups of functional units in the case of Nephrops) were;

Cod VIIe-k =COD_CS
Haddock VIIb-k = HAD_CS

Whiting VIIe-k = WHG_CS
Nephrops VIIe-k = NEP_CS
Plaice VIIf-g = PLE_CS
Plaice VIIe = PLE_WC
Sole VIIf-g = SOL_CS
Sole VIIe = SOL_WC

For all these "stocks" except Nephrops population in numbers at age were available. These values were taken from the ICES ACFM inputs for predictions where available. In the case of HAD_CS even though the analytical assessment was not accepted by ACFM as the basis for a deterministic catch forecast these inputs were used as population values.

No discard data were included for any of these stocks.

Fleet Definitions

Fleets were defined in accordance gear groupings used by the North Sea in this report, and the wishes of the Commission that gear groupings be "collapsed" across countries the following fleet definitions were used;

DEM_FD = All mobile gear directed at roundfish
DEM_ND = All mobile gear directed at nephrops
GN = All Gill net fleets
TBB = All beam trawl fleets
LL = All longline fleets
ZZZ = All other fleets

The basis under which the mobile gears were divided into Nephrops and Fish directed was not consistent across countries. France used a threshold of 20% Nephrops in the catch to define DEM_ND. DEM_ND fleet for Ireland was based on a combination catch and gear with a spatial component.

In the case of France when the threshold was changed from 20% to 40% the relative catch composition was similar across stocks. However the magnitude of the catches of each stock was different.

These different bases produce very different species interactions when considered across nations. Fig 3.1 shows the relative catch composition in the DEM_NEP grouping between France UK and Ireland. In this case it can be seen that the French DEM_NEP grouping has a 20% bycatch of Cod while the bycatch of cod in the UK and Irish DEM_NEP group is 4%. If the interest is in preserving cod, combining fleets in such a manner is completely inappropriate given that the cod interaction between these fleets and within this group differ by a factor of 5.

Fleets which are directed at Hake Monk and Megrim (HMM) were included in the data for Ireland and France in the DEM_FD group, however there was no data available for Spain for these fleets. The bycatch of Cod is considered to be low in the HMM fisheries. Therefore the relative proportion of HMM directed fleets in the

DEM_FD grouping will affect the perception of cod interaction between the country components in this group. When "collapsed" across nation the perception of the cod interaction from the DEM_FD is most influenced by the Nation with the greatest magnitude of catches in this fleet group. Fig 3.2 shows the relative catch composition in the DEM_FD grouping between France UK and Ireland. In this case it can be seen that the French DEM_FD grouping has a 25% bycatch of Cod while the bycatch of cod in the UK and Irish DEM_FD group is 15% and 4% respectively. If the interest is in preserving cod, combining fleets in such a manner is completely inappropriate given that the cod interaction between these fleets and within this group differ by a factor of more than 6.

In Fig 3.3 it can be seen that the catch composition within the TBB group across nations was also very different. The French fleet catches Plaice and sole in the western channel while the Belgian and UK fleets target Sole and Plaice in the Celtic sea. The catch composition from the Irish TBB grouping looks very strange for beam trawls, with greatest proportions gadoids and relatively small catches of plaice and sole. This data should be checked

There was no fleet specific selection pattern available for any of the stocks or fleet groupings. Therefore a single selection pattern was assumed for all fleet groups based on the average catch at age over the past 3 years. A three-year average was also used for the catch weight.

In summary there are mismatches between the Fleet areas, stock areas and TAC areas considered in this analysis. It is not clear how this affects the outcome. In addition some fleets are inconsistently defined across nations and have very different species interactions. Even those fleets consistently defined have grossly different species interactions between nations. Under these circumstances it is impossible to see how the results can have any meaningful purpose, and they may even be misleading.

3.5.3. Celtic Sea MTAC results

Not withstanding the inappropriateness of using the input data (described above), solely in order to oblige the ToR's provided by the Commission, the MTAC analysis was conducted. The commission requested a scenario where there should be a 17% reduction in fishing mortality for the cod stock, where all the decision weighting in the MTAC run is given to cod (scenario 1). We have also considered the scenarios where decision weight is given equally to plaice (Celtic Sea and Western Channel stocks) and cod (scenario 2) and all the decision weight is given to plaice (scenario 3). The results demonstrate that even with no decision weighting given to cod, the cod stock is likely to be benefited more if higher decision weighting is given to stocks that require large reductions in fishing mortality.

Scenario 1 – All decision weighting on Cod

As the decision was weighted entirely on Cod, the difference between the results of MTAC runs using q=0 and q=1 are insignificant. Results given below are for q=0 only.

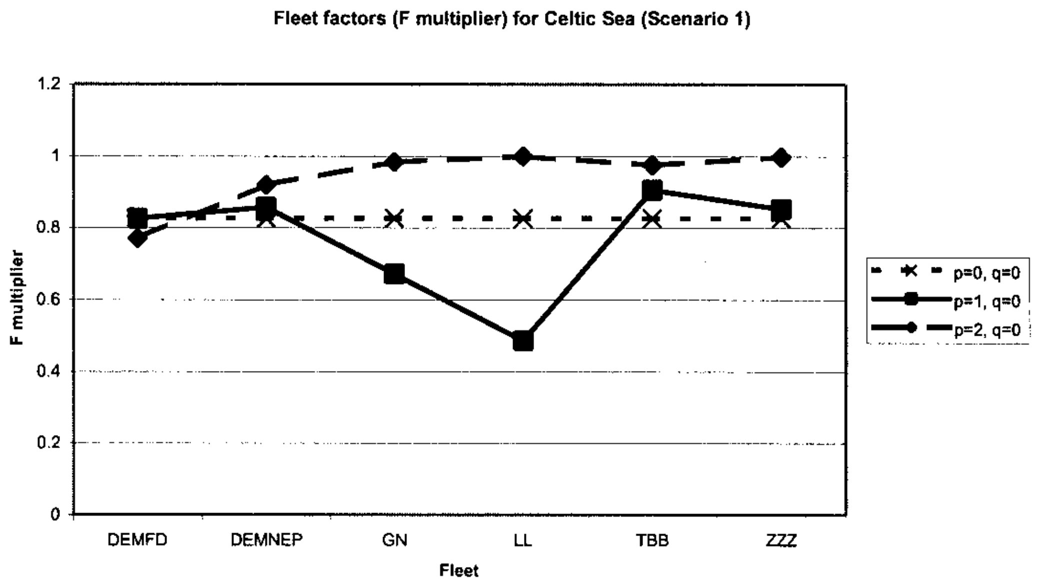


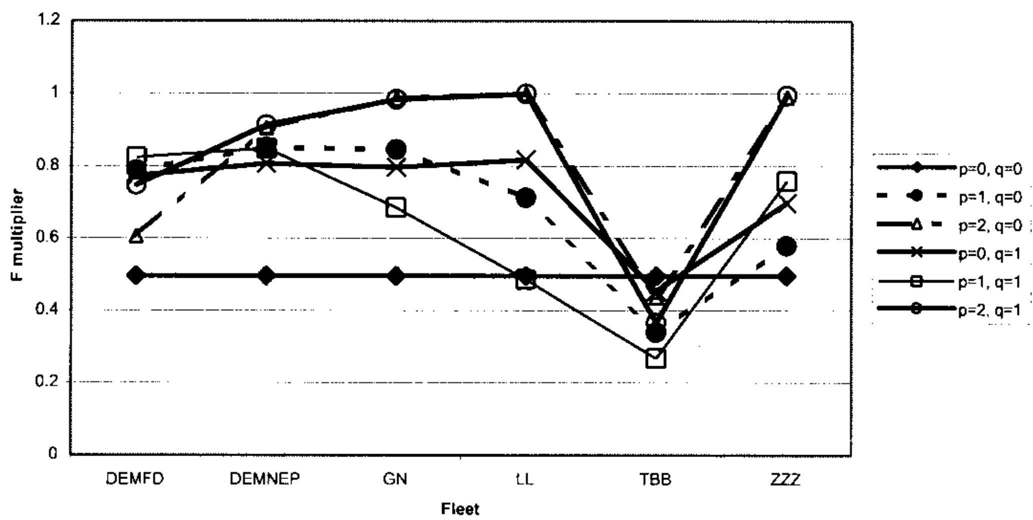
Figure 3.4.1 Fleet factors for Celtic Sea MTAC runs using a range of p-options. The lines are

DEMFD fleet group take the greatest volume of catch across species- hence they have to reduce in all p options. If you weight the F multipliers by proportion of the overall catch (P=2) then DEMFD is hit slightly harder. If the weighting is put on proportion within each fleet group (P=1) then the fleets with the greatest proportion of cod within its catch gets penalised more.

Scenario 2 – Equal decision weighting on Cod and Plaice

Although cod has all the weighting the stock would accrue lower F multipliers, if plaice (or SOLWC) was weighted highest because of the low F multipliers needed for these species. Equal weighting on CODCS PLEWC and PLECS

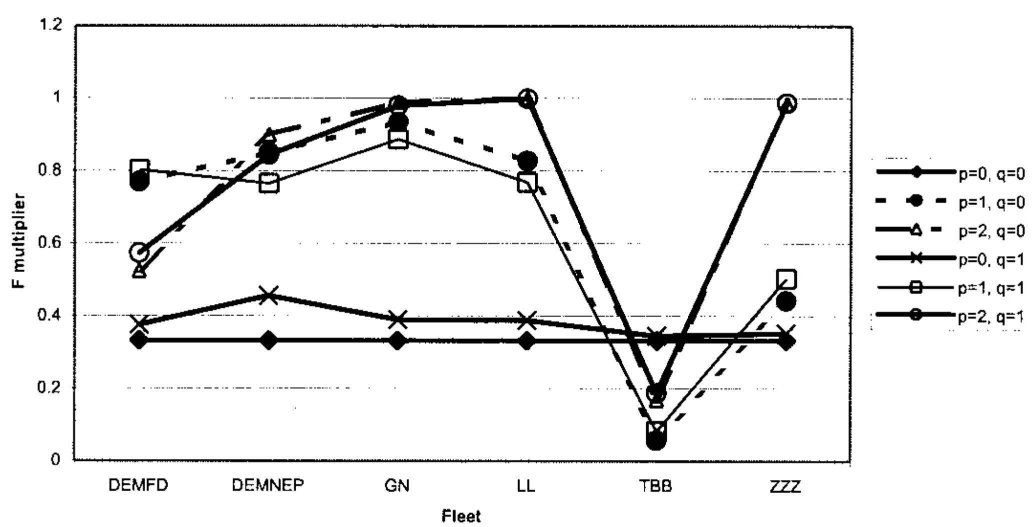
Fleet factors (F multiplier) for Celtic Sea (Scenario 2)



gives the same conclusion as scenario 1 – reduce F multipliers on the DEMFD fleet group to achieve cod targets. In addition as PLECS and PLEWC are included in the decision weighting this results in reduce F multipliers on the TBB fleet group to achieve PLEWC and PLECS targets.

Scenario 3 – All decision weighting on Plaice
Equal weighting on PLEWC and PLECS

Fleet factors (F multiplier) for Celtic Sea (Scenario 3)



CODCS gets lower F multipliers (than if only CODCS was in the decision weighing) with a decision weighting equally only on PLECS and PLEWC (as they have such a low recommended f multiplier). Similar qualitative results are obtained if the weight is put on SOLWC.

The Group again stresses that these conclusions are based on fleet groupings, which are internally inconsistent. This means that the national subsets of these fleet groups may not actually be catching stocks, which are decision weighted for F reductions, but still suffer penalties. This will always happen when fleet definitions are inconsistent or the fleet groupings so large that spatial heterogeneity in catch composition is ignored. Given the number and strength of these concerns, the group considers the MTAC results presented here for the Celtic Sea to be misleading and totally unsuitable management purposes.

3.6. Iberian Peninsula

3.6.1. Fleet overview

The Iberian Peninsula includes the Portuguese and Spanish Atlantic coasts (ICES Divisions VIIIc and IXa). The fisheries in the Atlantic Iberian region, trawl fishery in particular, are both multispecies and multifleet. No fleet segmentation of fishery units by statistical methods has been carried out and therefore, a project has been recently submitted to DGFISH for obtaining a suitable definition of fisheries and métiers.

For this reason, the analysis presented in this report uses the traditional fishery definition.

Spain

Spanish fisheries operating in the Atlantic Iberian Peninsula waters has been originally described in STECF (1994), and later revised in more detail only under a qualitative way (Lart, 2002; Velasco *et a*l., 2003; STECF, 2002; STECF 2003b; ICES, 2005). Table 3.5.1 (from ICES, 2005) summarizes the Spanish fleets operating in the Iberian Peninsula waters as they were previously described.

Table 3.5.1. Summary of the Spanish fleets operating in the Iberian Peninsula waters.

Fishery	**Area**	**Gear**	**Target species**	**Description**
Small gillnet "Beta"	Division VIIIc and IXa North	Fixed nets	Hake.	Mesh size of 60 mm.
Gillnet "Volanta"	Division VIIIc			Mesh size of 90 mm.
Gillnet "Rasco"			Anglerfish	Mesh size of 280 mm.
Long line fleet	Division VIIIc	Long line	Hake + Great Fork Beard + Conger	
North Spain Artisanal fleet		Miscellaneous		Miscellaneous fleet
Gulf of Cadiz Artisanal fleet	South of Division IXa			Miscellaneous fleet
Baca Otter Trawl Mixed Fishery	Divisions VIIIc and IXa North.	Trawl	Horse mackerel + Blue whiting+ Mackerel+ White fish	Mesh size of 65 mm Opening: 1.2-1.5 m
Pair Bottom Trawl Fishery			Blue whiting	Mesh size of 55 mm Vertical opening of 25 m.
VHVO Bottom Trawl Fishery	Divisions VIIIc West and IXa North		Horse mackerel	Mesh size of 65 mm Vertical opening of 5-5.5 m

Gulf of Cadiz_Trawl fleet (<35 GRT)	South of Division IXa		Sparids+ cephalopods+ sole+ hake + horse mackerel	
Gulf of Cadiz_Trawl fleet (>35 GRT)			Blue whiting+ shrimp+ horse mackerel+ hake+ Norway lobster	

Portugal

Although the Portuguese fisheries have been described in several reports, for the first time a full description of the traditional Portuguese fisheries in the Iberian continental shelf is given in this sub-group.

The Portuguese bottom trawl fishery comprises two fleet components (ICES, 2004a, 2005; STECF/SGMOS, 2003b):

- Demersal fish trawlers: This fleet is composed by 79 vessels fishing with bottom trawl for demersal fish in depths shallower than 500 m (mostly less than 200m), using a mesh-size of 65 mm or greater. They operate off the entire Portuguese coast and some of them extend their activities to the Spanish coasts of Galicia and Cadiz.
- Crustacean trawlers: fleet composed by 36 vessels licensed for shrimps with a mesh-size of 55 mm and for Norway lobster with a mesh-size >=70mm. The main crustacean fishing grounds are located in the southwest and southern coasts of Portugal, in depths from 200 to 700 m.

In average, the trawl fleet has 26 m of overall length, 175 GRT and 500 KW of engine power.

The main species landed by the trawl fishery are horse mackerel (*Trachurus trachurus*), mackerel (*Scomber scombrus*), blue whiting (*Micromesistius poutassou*), hake (*Merluccius merluccius*), spanish mackerel (*Scomber japonicus*), anglerfish (*Lophius piscatorius* and *L. budegassa*), megrim (*Lepidorhombus whiffiagonis* and *L. boscii*), rose shrimp (*Parapenaeus longirostris*) and Norway lobster (*Nephrops norvegicus*), yet landed species composition differs between the two trawl fleet components.

The artisanal fishery is composed by a large number of small boats operating mainly inshore and using a variety of gears as gillnets (the majority), seines, beam trawls, longlines, hooks, traps and dredges, some of them licensed for more than one type of gear. The main species landed are octopus (*Octopus vulgaris*), pouting (*Trisopterus luscus*), horse mackerel, hake, mackerel and sardine (*Sardina pilchardus*). The number of registered boats with an overall length larger than 12 m was 459, with an average GRT of 44.4 and 167 Kw. The number of boats smaller than 12 m was around 7400, with an average GRT of 1.4 and 15 Kw of engine power (INE, 2004).

There is a specific longline fishery, of artisanal nature, composed by 22 vessels targeting black scabbardfish (*Aphanopus carbo*) in a limited area (hard grounds along canyon slopes off Sesimbra). The by-catch of this fishery is mainly constituted by sharks. Fishing takes place at depths ranging from 800 to 1,200 m. The average overall length of the vessels was 16.4 m and the main engine power was 135 Kw (Gordon, 1998).

Another important fishery, the most important in landings volume, is composed by around 130 purse seiners. This fleet targets mainly sardine, which constitutes more than 80% of their landings, using a mesh size of 35 mm. Other pelagic species landed are horse mackerel and spanish mackerel. In average, these vessels have an overall length of 20 m, 48 GRT and 236 Kw of engine power (INE, 2004).

Tables 3.5.2 and 3.5.3 summarise the species composition of the described fleets for the period 2002-2003, with the data from the crustacean and fish trawlers combined in the demersal trawl category. The Table 3.5.4. summarizes the description presented.

Table 3.5.2. Species composition (in % of landed weight) of the demersal trawl (DT), artisanal (ART) and purse-seine (PS) fisheries in 2002 and 2003.

Species	2002			2003		
	DT	ART	PS	DT	ART	PS
Horse Mackerel	41.1	4.7	5.5	32.8	4.4	3.2
Mackerel	10.4	1.2	0.5	6.5	1.4	1.0
Blue Whiting	8.1	0.0	0.1	11.9	0.7	0.0
Hake	4.4	4.1	0.0	4.7	2.0	0.0
Pouting	4.4	5.4	0.0	6.0	4.4	0.0
Spanish Mackerel	2.0	3.3	4.7	6.5	5.4	6.1
Sardine	1.6	2.5	85.8	1.6	14.7	88.0
Monkfish	0.5	0.9	0.0	0.5	1.0	0.0
Megrim	0.5	0.1	0.0	0.7	0.1	0.0
Rose Shrimp	2.4	0.0	0.0	4.3	0.1	0.0
Norway Lobster	1.8	0.0	0.0	1.6	0.1	0.0
Red Shrimp	0.4	0.0	0.0	0.2	0.0	0.0
Octopus	2.7	18.5	0.0	3.4	17.0	0.0
Other	19.7	59.2	3.4	19.8	48.8	1.7
	100	100.0	100.0	100.0	100.0	100.0

Table 3.5.3. Partition of each species (in % of the landed weight) by the demersal trawl (DT), artisanal (ART) and purse-seine (PS) fisheries in 2002 and 2003.

Species	2002				2003			
	DT	ART	PS	Total	DT	ART	PS	Total
Horse Mackerel	56.9	13.1	29.9	100	58.7	21.2	20.1	100
Mackerel	70.0	16.5	13.5	100	47.2	27.4	25.4	100
Blue Whiting	96.9	0.3	2.8	100	86.2	13.6	0.2	100
Hake	34.8	64.9	0.3	100	46.0	53.9	0.0	100
Pouting	28.4	71.3	0.4	100	33.0	66.9	0.1	100
Spanish Mackerel	7.4	24.8	67.7	100	15.2	34.3	50.4	100
Sardine	0.5	1.5	98.0	100	0.4	11.4	88.2	100
Monkfish	21.5	78.3	0.2	100	14.6	85.3	0.1	100
Megrim	74.0	25.9	0.1	100	71.7	28.2	0.1	100
Rose Shrimp	99.9	0.1	0.0	100	95.8	4.2	0.0	100
Norway Lobster	98.5	1.5	0.0	100	88.1	11.9	0.0	100
Red Shrimp	100.0	0.0	0.0	100	93.3	6.7	0.0	100
Octopus	6.6	93.1	0.3	100	6.9	92.9	0.2	100
Other	12.9	78.5	8.7	100	12.5	83.6	3.9	100

Table 3.5.4. Summary of the Portuguese Fisheries in the Iberian Peninsula

Fishery	Area	Gear	Target Species	Characteristics
Demersal Fish Trawl	IXa	Bottom Trawl	Horse mackerel , mackerel, blue whiting, hake, spanish mackerel, anglerfish, megrims, rose shrimp and Norway lobster	Mesh size of 65-69 mm
Crustacean Trawl	IXa (S and SW - *Nephrops* Functional Units 28-29)			Mesh size of 55-59 mm for Rose and Red Shrimps and >70 mm for Norway Lobster
Artisanal	IXa	Miscellaneous (gillnets, seines, beam trawls, longlines, hooks, traps and dredges)	Octopus, pouting, horse mackerel, hake, mackerel, black scabbard and sardine	Miscellaneous
Purse-seine	IXa	Purse-seine	Sardine	Mesh size of 35 mm

3.6.2. Data availability

There are 10 demersal stocks involved in the Iberian mixed fisheries which are assessed in the ICES WG's:

- Hake (Southern stock: Divisions VIIIc and IXa)
- White Anglerfish (Southern stock: Divisions VIIIc and IXa)
- Black Anglerfish (Southern stock: Divisions VIIIc and IXa)
- Megrim (Southern stock: Divisions VIIIc and IXa)
- Four spot Megrim (Southern stock: Divisions VIIIc and IXa)
- *Nephrops*:
    - Functional Unit 25 (North Galicia)
    - Functional Units 26-27 (West Galicia and North Portugal)
    - Functional Units 28-29 (South-West and South Portugal)
    - Functional Unit 30 (Gulf of Cadiz)
    - Functional Unit 31 (Cantabrian Sea)

The ACFM advice with regard to single species exploitation boundaries for the main demersal stocks in ICES Divisions VIIIc and IXa is summarised in the Table 3.5.5.

Table 3.5.2. Summary of ACFM advice on demersal stock of the Divisions VIIIc and IXa (Iberian Peninsula)

<table>
<tr><th>Stock</th><th>State of the Stock</th><th>ICES considerations regarding single stock exploitation boundaries</th><th>Upper limit corresponding to the exploitation limit (Landings or effort in 2005)</th></tr>
<tr><td>Southern stock of hake (Div. VIIIc and Ixa)</td><td>Overfished</td><td>A recovery plan for this stock is under discussion and one of the objective consists in a 10% annual decrease on F , with a Ftarget of =0.15 ($F_{0.1}$)</td><td>In the absence of a recovery plan then zero catch is advised for 2005.</td></tr>
<tr><td>Megrim (L. boscii and L. whiffiagonis) in Div. VIIIc and IXa</td><td>Appropriate (whiffiagonis), Overfished (boscii)</td><td>No management plan. No evidence of reduced recruitment. Fishing at $F_{0.1}$ is estimated to give landings in 2005 of 240 t. (L. whiffiagonis) and 820 t. (L. boscii).</td><td>Less than 190 t for L. whiffiagonis and less than 870 t for L. boscii.</td></tr>
<tr><td>Anglerfish (L. piscatorius and L. budegassa) in Div. VIIIc and IXa</td><td>Unknown. Current biomass is under B_{MSY} and current fishing mortality is above F_{MSY}</td><td>No management plan. B_{MSY} and F_{MSY} points can be used a lower boundary for the biomass and an upper boundary for F</td><td>A recovery plan should be established that will ensure rapid and safe recovery of the SSB above B_{MSY}</td></tr>
<tr><td>Nephrops in Div. VIIIc – Cantabrian Sea (FU25-31) (Management Area O)</td><td>Overfished</td><td>The proposed recovery plan will be beneficial but given the severity of the recruitment failure, it is not evident that this will be sufficient to restore the stock.</td><td>Zero TAC is advised for this Management Area, until there is a substantial improvement of the recruitment.</td></tr>
<tr><td>Nephrops in Div IXa . Galician West and North of Portugal (FU26-27)</td><td>Overfished</td><td rowspan="2">A recovery plan for hake and Nephrops has been proposed but not so far adopted</td><td rowspan="2">ICES considers a continuation of the advice to stop the fishery to be the most adequate. Suitable technical measures together with effort reduction should be implemented at the earliest possible opportunity, in accordance to the already proposed recovery plan.</td></tr>
<tr><td>Nephrops in Div IXa – SW and South of Portugal (FU28-29)</td><td>Overfished</td></tr>
<tr><td>Nephrops in Div IXa – Cadiz (FU 30)</td><td>Overfished</td><td>The information is sparse, and the state of the stock is unclear. As the stock clearly is at least fully exploited, it is recommended not to increase the catches above the current level.</td><td>Not to increase the catches above the current level.</td></tr>
</table>

Landings numbers and weights by age disaggregated by Fishery Unit, needed for the MTAC inputs, were mostly obtained from the WG's reports (ICES, 2004d, 2004c). Discards data were not available for these stocks. For some fleets and some fish species, the respective ALK's (Piñeiro, pers. comm.; Pérez, pers. comm.) were applied to the length distributions by FU presented in the respective assessment WG report (ICES, 2004d). For *Nephrops*, males and females were considered as separate stocks and the age compositions collected from the WG report were obtained from slicing the length distributions using the respective growth parameters (ICES, 2004c). The following stocks had to be removed from the analysis due to lack of data by age:

- White Anglerfish and Black Anglerfish: the stocks of these both species are assessed together by ASPIC.
- *Nephrops* Functional Unit 30: a preliminary assessment of this stock was performed by LCA in the WGNEPH, for the first time in 2004.
- *Nephrops* Functional Unit 31: this stock was not assessed in 2004.

There was not possible to allocate the landings to each trawl specific fleet, therefore they were combined in 2 main trawl fleets: the Portuguese and the Spanish trawl fleets. Also, as data from the Gulf of Cadiz were not included in the last assessment of hake, the landings and fleets from this area had to be removed from the analysis. Finally, although they do not represent properly the complexity of the fishery, 7 fishery units were used in the analysis:

- Portuguese trawl
- Portuguese artisanal
- Spanish trawl
- Spanish small gillnet
- Spanish gillnet
- Spanish longline
- Spanish artisanal

3.6.3. MTAC settings

The Group ran 3 scenarios proposed by the Commission which are shown in the table below:

Species	Scenarios	Fmult	Decision weight	Rationale
HKE	1	0.9	100	Requested by the Commision
	2	0.7	100	
	3	0.4	100	

LDB	All scenarios	1	0.25	Precautionary
MEG	All scenarios	1	0.25	Precautionary
NEP FU25	All scenarios	1	0.25	
NEP FU26/27	All scenarios	1	0.25	
NEP FU 28/29	All scenarios	1	0.25	

HKE: Hake, *Merluccius merluccius*
LDB: Four-spot megrim, *Lepidorhombus boscii*
MEG: Megrim, *Lepidorhombus whiffiagonis*
NEP: Norway lobster, *Nephrops norvegicus* (FU: Functional Unit)

The first scenario requested by the Commission also corresponds to the recommendation for hake from the Recovery plan proposed by "STECF-SGMOS Recovery plans of Southern hake and Iberian Norway lobster stocks" group held in Lisbon, June 2003 (STECF, 2003).

Six runs for each scenario were carried out combining different options of the parameters p and q (see Annexe 1):

	p	q
Run 1	0	0
Run 2	0	1
Run 3	2	0
Run 4	2	1
Run 5	1	0
Run 6	1	1

3.5.4. Results.

All scenarios show a similar distribution of the fleet reduction factors among fleets, but at different levels directly related to limiting Hake Fmult. In relation to p and q options, fleets targeting hake result more penalised under p=1, and fleets with high levels of Hake catches in the total catch result more penalised when p=2.

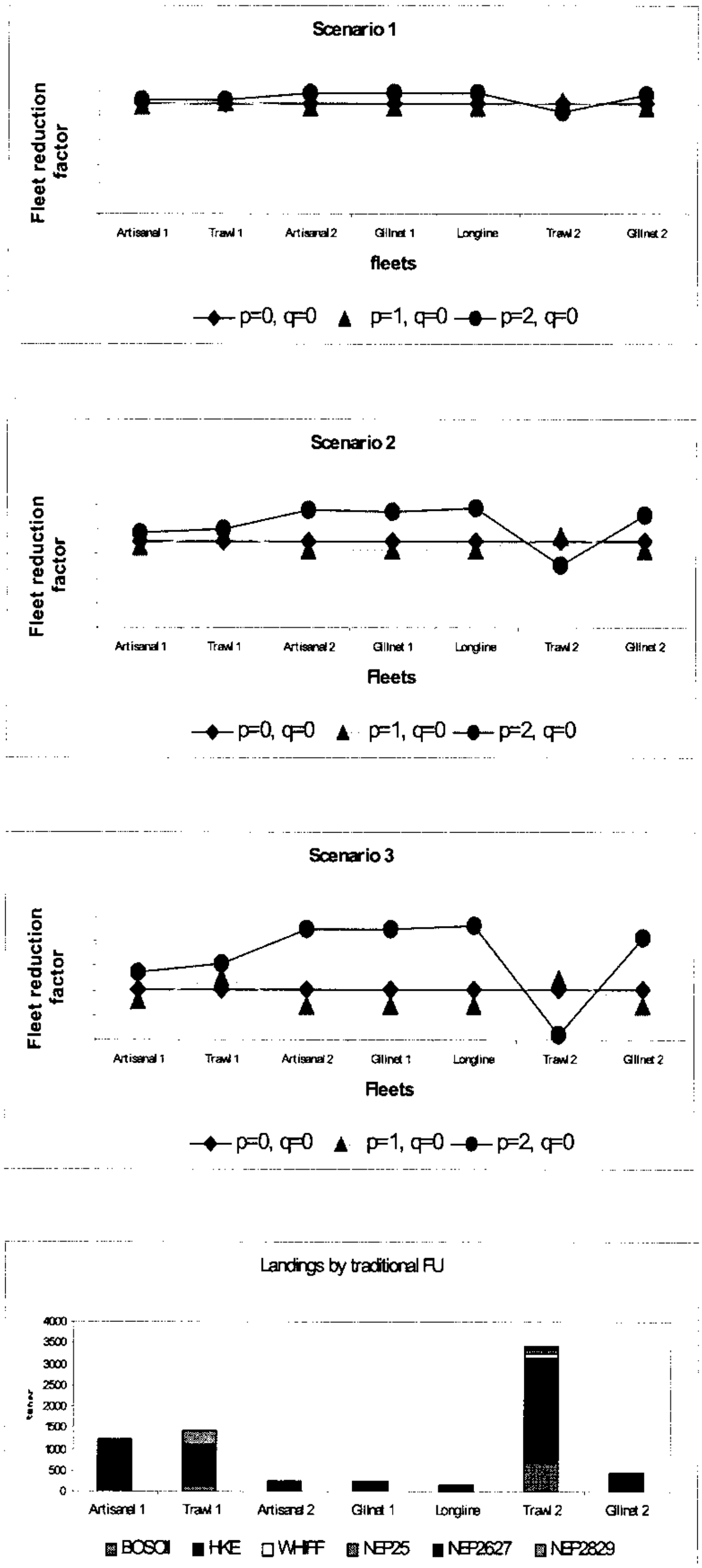


Figure 3.5.4.1. Fleet reduction factor for each fleet and scenario (scenario 1: hake Fmult = 0.9; scenario 2: hake Fmult = 0.7; scenario 3: hake Fmult = 0.4).

The MS-TAC/SS-TAC ratios show obviously the same value for Hake and a gradual reduction in the values for the rest of species in relation to the level of the hake Fmult used, and for every combination of p and q:

	MS-TAC/SS-TAC (from the three scenarios)					
	run1	run2	run3	run4	run5	run6
	p0q0	p0q1	p1q0	p1q1	p2q0	p2q1
HKE	=	=	=	=	=	=
LDB	-	-	-	-	-	-
MEG	-	-	-	-	-	-
NEP25	-	-	-	-	-	-
NEP2627	-	-	-	-	-	-
NEP2829	-	-	-	-	-	-

This results have to be considered as very preliminary and as an example. All the results obtained in the MTAC runs are considered not reliable due to the following reasons:

- The fleet definition is not appropriate. Particularly, the trawl fleet is a mixture of several fleets using different gears, mesh size and targeting different species.
- An important part of the area (Gulf of Cadiz) had to be excluded from the analysis. This area was not included in the last assessment of Southern hake.
- Data by age were not available for some stocks: black and white anglerfish (assessed by ASPIC and ALK's still in a preliminary stage); *Nephrops* from Functional Unit 30 (assessed by LCA); and *Nephrops* from Functional Unit 31 (not assessed in 2004).
- No discards were available for any species.
- No data from pelagic species (as horse mackerel, blue whiting and mackerel) were available. However, in some trawl fleets, pelagic species catches are greater (more than 90%) than the catches of the demersal species considered in this preliminary analysis.

The Group strongly recommends that the results of these preliminary runs are not used for management purposes.

3.7. Kattegat.

The commission requested the WG to execute a mixed fisheries analysis for the Kattegat demersal fisheries. Kattegat data had not been made available beforehand for the present meeting. However, it was concluded that the necessary data for a mixed fisheries analysis can be made available for use at next meeting of the WG.

3.7.1. Fleet overview.

Kattegat is exploited almost exclusively by two countries, Denmark and Sweden. The description of fisheries given below is extracted from the Baltic Fisheries Assessment Working Group (WGBFAS) Report 2004 .

The Danish fisheries in Kattegat

The Danish fisheries in Kattegat can be divided into trawling-, gillnetting- and Danish seine fleet categories by the gears and mesh sizes used as follows:

Danish Trawl fisheries in Kattegat. The trawl fisheries can be divided into four groups:

A) Industrial fisheries targeting mixed clupeids, sandeel and Norway pout. This fishery is carried out using a mesh size of 32 mm in the cod end. Most vessels in this fisheries are smaller trawlers (12-16 m).

B) A human consumption herring fishery using mesh sizes of 32 mm in the cod end. This fishery is mainly carried out by the larger trawlers (>20 m).

C) A trawl fishery targeting ***nephrops*** using a 90 mm mesh size. This fishery is mainly carried out by trawlers between 12-16 m. The major season for this fishery is the 2nd and 3rd quarter of the year but tent to be les seasonal in recent years.

D) A human consumption trawl fishery targeting mixed fishes but being mostly dependent on sole, cod and plaice. The mesh size in the cod end is at or above 90 mm. The size of vessel in this fishery are typically between 12 and 20 m. The human consumption fishery is mainly found in the 1st and 4th quarter of the year.

Danish Gillnet fisheries in Kattegat

Gillnets varying in mesh-sizes from 90 to about 200 mm are used in Kattegat. The species composition of the catches depends on the mesh size with the smaller mesh sizes (90 to 110 mm) being used when targeting sole and the larger mesh sizes (> 130 mm) for catching cod. Typically it is the smaller boats (<14 m) which engage in the gillnet fishery.

Danish Danish seines in Kattegat

The Danish seine fishery is of relatively limited importance in Kattegat accounting for a catch value of about a fifth of that taken by the human consumption trawling fleet. This fishery mainly target flatfish (plaice, flounder and dab) but also catches a fair amount of cod. The typical seiner is about 12 to 16 m.

Swedish cod and flatfish fleets in the Baltic.

The Swedish fishery for cod and flatfishes in the Baltic is carried out by four fleet categories, all fisheries are for human consumption:

1. Swedish Trawlers catching cod with a minimum mesh size of 120 mm (diamond mesh) or 105 mm (selection window). Flatfishes are caught as by-catches in this fishery.

2. Swedish Baltic gill netters/longliners fishing for cod with a minimum mesh size in the gillnets of 105 mm. Flatfishes are caught as by-catches in this fishery. Longlines are used only by a small number of boats, in this category.

3. Swedish Gill netters fishing for flatfishes. Cod is caught as by-catch in this fishery.

4. Swedish Coastal fishery with trap nets for eel and other species. Cod and flatfishes are caught in this fishery.

Gear	Fishery	Mesh Size	COD	PLAICE	SOLE
Not Known	Not Known	Not Known	265.92	328.92	55.24
DEMERSAL SEINE	Danish_seine	Not Known	0.03	0.14	
		80-99	145.60	677.56	2.00
		100-119	1.12	6.34	7.77
		>=120	26.48	30.66	0.13
GILL NET	Gill_net_flatfish	Not Known	0.43	10.83	0.63
		90-99	0.12	0.68	0.39
		100-119	1.12	6.34	7.77
		120-219	11.24	98.32	11.18
	Gill_net_roundfish	Not Known	0.20		
		100-119	4.27	0.04	0.12
		120-219	92.26	5.88	0.51
OTTER BOARD TRAWL	Dermersal_trawl	Not Known	0.41	0.22	0.01
		<16			0.08
		70-79			0.27
		80-99	554.12	543.86	78.18
		100-119	34.82	45.34	2.65
		>=120	38.67	60.24	1.13
	For_reduction	<16	3.69	1.31	0.01
		16-31	38.75	3.02	1.05
	Nephrops trawl	70-79	137.06	73.49	24.49
		80-99	49.31	47.92	9.38
	Pandalus trawl	32-54	2.79	0.68	0.08
		Total	1440.8	2040.4	195.56

Table 3.6.2.1. Danish Kattegat Landings of cod, plaice and sole in 2003 by fishery/mesh size.

Gear	Fishery	Mesh size	Monk Fish	Herring	Hake	Mackerel	Nephrops	Saithe	Whiting
Not Known	Not Known	Not Known		8040.6		414.01	32.2	16.8	
DEMERSAL SEINE	Danish seine	80-99	3.9		8.2			15.4	
		>=120						1.8	
OTTER BOARD TRAWL	Dermersal Trawl	80-99	4.1		14.1		550.2	216.8	15.1
		100-119					2.8		
		>=120						5.7	
	For_reduction	<16						8.1	
		16-31			2.3			97.7	
	Nephrops	70-79			7.2		538.5	6.6	16.0
		80-99			1.7		208.9	5.7	2.5
	Pandalus trawl	32-54						1.7	
	Trawl herring	32-54		46.4					
GILL NET	Gill net roundfish	120-219						4.8	
		Total	7.9	8087.0	33.7	414.01	1332.7	381.1	33.7

Table 3.6.2.2. Danish Kattegat Landings in 2003 by fishery/mesh size of species for which age distributions are not available.

3.7.2. Data availability for Kattegat.

The gears and fisheries defined for the Danish fishery in Kattegat are shown in Table 3.6.2.1 together with the landings of cod, plaice and sole in 2003, and in Table 3.6.2.2 together with species for which age distributions are not available. Similar Danish data can be made available for the years 2000-2002

Data are known to be available from the Swedish national database, as Swedish fleet based data has been made available for the Skagerak to the WGNSSK. Kattegat data from Sweden were requested during the meeting, but could not be made available. The catches of the two countries in 2003 are compared in the text table:

2003	Cod	Plaice	Sole	Nephrops
Denmark	1441	2040	196	1333
Sweden	603	253	11	224 [2)]
2) Swedish Catch in 2002				

Sole in Division IIIa and cod in the Kattegat are assessed by the Baltic Fisheries Assessment Working Group (WGBFAS), whereas the stock of Plaice in Division IIIa is assessed by WGNSSK, as is the cod in the Skagerrak, which are treated as part of the main North Sea stock. The *Nephrops norvegicus* in Division IIIa, is assessed by the *Nephrops* WG (WGNEPH).

Denmark delivered age distributed data in SGDFF-format for cod, plaice and sole. Data for Nephrops and some other species were total landings only. Also Danish effort data were available. Data were for 2003 only (the age-distribution database contained 206 records).

Assessment of cod (WGBFAS 2004),

The assessment and management areas are identical for the Kattegat cod stock. The key management tool is the annual TAC. The stock is assessed by XSA, and short term forecast is made.

Reference points are defined: Blim= 6400 tons, Bpa= 10500 tons, Fpa= 0.6, Flim= 1.0.

Some limited information on discarding has been obtained, but yet, no attempt has been made to estimate discards for this stock.

Assessment of sole (WGBFAS 2004).

The assessment covers Division IIIa (Kattegat and Skagerrak) whereas the management covers Division IIIa plus Sub-divisions 22-24 (the Western Baltic). Catches in the Western Baltic are low, approximately 10% of that in IIIa. The key management tool is the annual TAC.

The stock is assessed by XSA , and short term forecast is made. Reference points are considered by ICES: Blim = 770 t, Flim = 0.47. Some limited information on discarding has been obtained, but yet, no attempt has been made to estimate discards for this stock.

Assessment of plaice (WGNSSK 2004)

The assessment and management areas for IIIa plaice stock is IIIa (Skagerak and Kattegat).
The stock is assessed by XSA, and short term forecast is made.
Only one reference point is defined. **Fpa** = 0.73. Neither **Flim** nor **Blim** are defined.
Some limited information on discarding has been obtained, but yet, no attempt has been made to estimate discards for this stock.

Assessment of IIIa Nephrops (WGNEPH).
The WGNEPH made an assessment of the Skagerak-Kattegat stock (combined functional units 3 and 4) at it's 2003 meeting, whereas no assessment was made in 2004. The assessment was bases on "sliced length distributions ". The "slices" was then used as input to XSA. No short term forecast was made, and no reference points were defined.

Assessments methods and status of the Kattegat stocks are summarized in Table 3.6.2.3.

Stock	**State of the stock**	**Management**	**Analytical assessment**	**Short term forecast**
Kattegat Cod	Outside safe biological limits. At risk of reduced reproductive capacity and of being harvested unsustainably	TAC. Recovery plan.	XSA	Yes
IIIa Plaice	Outside safe biological limits	TAC. No management objectives.	XSA	Yes
IIIa+22+24 Sole	Inside safe biological limits	TAC. No management objectives.	XSA	Yes
IIIa Nephrops	Inside safe biological limits	TAC. No management objectives.	XSA	No

Table 3.6.2.3. Summary of assessments methods and status of the Kattegat stocks.

3.8. West of Scotland (ICES Division VIa)

3.8.1. Fleets and fisheries

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

The majority of the vessels in the demersal fishery are locally-based Scottish trawlers using 'light-trawls' (otter trawlers >27.4m, 90 feet), but trawlers from

Ireland, Northern Ireland, England, France, and Germany also participate in this fishery. Scottish trawlers also take part in fisheries for *Nephrops* on inshore grounds, and in recent years Irish vessels have also been targeting *Nephrops*, mainly on offshore grounds. A more detailed description is given in the ACFM report of October 2004.

3.8.2. Data Availability

ICES Advice

The October 2004 ICES advice with regard to single-species exploitation boundaries for the principle demersal stocks in ICES Division VIa is summarised in the table below.

Stock	**State of the stock**	**ICES considerations regarding single stock exploitation boundaries**	**Upper limit corresponding to the exploitation limit (Landing in 2005 t)**	**Accepted assessment**	**Forecast**
Cod West of Scotland	Uncertain but thought to be at historical low	Recovery plan implemented. No gain in long term yield with fishing mortality above 0.19. No recovery has been observed in the stock.	0	×	×
Hake – Northern stock (Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa, b, d)	At risk of reduced reproductive capacity and of being harvested unsustainably	Recovery plan implemented. To rebuild of SSB to Bpa in 2006, fishing mortality reduced to 0.19	33 000	✓	✓
Haddock West of Scotland	Inside safe biological limits	To maintain SSB above B_{pa} fishing mortality should be less than 0.39	7 600	✓	✓
Whiting West of Scotland	Unknown	Exploitation should not be allowed to increase	1 600	×	×
Megrim in Subarea VI (West of Scotland and Rockall)	Uncertain	Catches in 2005 no more than the recent (2002-2003) landings in Divisions VIa and VIb and unallocated landings in IV	2 200	×	×
Anglerfish in Division IIIa, Subarea IV, and Subarea VI	Unknown	Effort should not be allowed to increase		×	×
Nephrops in Division VIa (Management Area C)	Exploited at sustainable levels	A Management Area TAC of 11 300 t for 2004 and 2005	11 300	✓	×

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

Fleet Data

Landings data by gear type or some other defined *metier* are available from Scotland, Ireland, Northern Ireland, England & Wales, France and Germany for the main species. Discard data are also available from Scotland for cod, haddock, whiting, saithe and *Nephrops*. Much of this data has previously been provided to the WGNSDS.

4. Spatial Management of Scottish West Coast Fisheries.

Assessment of 'Scottish West Coast Fisheries: Scottish management proposal for *Nephrops*, cod, and haddock fisheries.': Paper presented to STECF Mixed Fisheries Working Group.

4.1. Synopsis

This paper presents proposals generated by the Scottish fishing industry aimed at protecting cod stocks while simultaneously allowing increased exploitation of haddock and nephrops stocks. With regard to nephrops, the current seasonal closure of the Firth of Clyde will continue (details still to be finalised but existing measures and 'a shorter, more targeted closure to all gears' included in options), while a seasonal closure of the South Minch area is expected to reduce the total cod landings by nephrops fleets by 11%. This is expected to allow increased exploitation of nephrops outside the closed area. With regard to haddock, the paper suggests that, as the year-round 'windsock' area closure has been relatively ineffective, it should be made a seasonal closure without reducing the benefit to cod significantly. Furthermore, a suggested mesh size increase is claimed to reduce the effective effort on cod by 5-10%. The arguments presented in the paper are drawn from an analysis of the spatial distribution of the landings data.

4.2. Assessment

Nephrops / South Minch closure:
Further data are needed on effort allocation/reallocation and discarding before we can accept that the area closure will produce any benefit to the cod stock.
In theory, any measure that will reduce cod bycatch is a good thing. However, as the expected benefits to the cod stock are so small, any benefit will be difficult to measure and hard to distinguish from noise in the data.

Haddock / 'windsock' closure / mesh size:
Given the data provided, it is not possible to detect any beneficial effect of either the annual or seasonal 'windsock' closure on the cod stock. Additional data sources may give more information, but any beneficial effects are likely to be so small that it will be hard to distinguish these from noise in the data.
In theory, increasing the mesh size should have some benefit to the cod stock, but in previous experience, this magnitude of mesh increase has not produced the expected benefits.

The STECF mixed fisheries subgroup suggests that for any beneficial effects of area closures to be observed in cod and other mobile stocks, larger area closures covering whole statistical rectangles over several years are likely to be required.

5. Conclusions and recommendations.

5.1. The use of F_{pa} as a target fishing mortality.

The scenarios requested by the Commission use the maximum fishing mortalities recommended by ACFM in terms of singles species precautionary exploitation boundaries. These are given as limits beyond which the stock is at increased risk of impaired recruitment and not as an optimal fishing mortality for the maximisation of long term yield. In situations where current fishing mortality is above F_{pa}, decreasing fishing mortality to F_{pa} is a sensible first step to stock rebuilding or the prevention of overfishing. The use of F_{pa} as a target for those stocks where fishing mortality is already lower is not a good, long term strategy. Such a move will probably result in an increase in yield in the short term, but this is at the expense of long term yield and will increase the probability of driving the stock towards the boundaries of unsustainability. For those stocks where current fishing mortality is lower than F_{pa}, a better target F would be one leading to optimal yield.

5.2. Further MTAC development.

Although there are no plans to add more complexity to the current MTAC model the Group nevertheless identified some important adaptations which the program would benefit from.

There is no distinction between landing and discard fishing mortality in the input to MTAC and hence the TAC's (single species and mixed species) are determined as total catch. Current management procedures utilise TACs for landings and therefore TAC output from MTAC is limited direct use.

5.3. Spatial resolution within the mixed fishery databases.

The request from the Commission regarding the ability to independently manage sole from plaice, and haddock & Nephrops from cod highlighted a potential shortcoming of the data input to the mixed fishery database. Although fleet definition can include a reference to a particular spatial component, the data format only allows for ICES division as a data field. There are cases, particularly for *Nephrops* fisheries, where it is possible to define the fishery at a much finer spatial scale and therefore an additional field for spatial resolution may be appropriate. This does, however, considerably increase the number of strata within the database and therefore increases the complexity of the task of "filling in" or interpolating data for missing strata. Further work is required into the feasibility of increasing the spatial scale and the consequences for data quality.

5.4. Timing of the meeting.

The timing of this meeting, in particular with reference to the proximity to ACFM and STECF is unfortunate and does not allow sufficient time to permit changes in draft ACFM advice to make it through the Group's calculations. There is also insufficient time to review and check the work undertaken by the Group before submitting its report to STECF. This has been compounded this year by relatively few members of the Group able to contribute to the finalisation of the report immediately after the meeting. The Group acknowledges that relatively little can be done regarding the timing of the meeting, but as such must point out that the results can not be checked as thoroughly as they would like.

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7. Annex 1 on the terminology of MTAC settings and output

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

MTAC needs as input:

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

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

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

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

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

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

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

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

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

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

8. Annexe 2. Full results from MTAC runs on North Sea data.

Run 1. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.001	2.8	0.968	1.38	0.999	0.053
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.664	2.8	0.982	1.38	0.999	0.680
LONGLINE	0.875	2.8	1.000	1.38	1.000	0.877
NETS	0.533	2.8	0.981	1.38	0.991	0.538
TBB_80+	0.684	2.8	0.804	1.38	0.889	0.692
ZZZ	0.807	2.8	0.991	1.38	0.998	0.726

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.391	35	1.04	0.980
HAD	0.200	2.80	99	0.189	7	0.07	0.002
PLE	0.706	0.85	107	0.600	82	0.77	0.002
POK	0.288	1.38	153	0.162	21	0.14	0.002
SOL	0.464	0.90	17	0.665	13	0.79	0.002

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Run 2. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.001	2.8	0.881	1.38	0.999	0.053
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.664	2.8	0.935	1.38	0.999	0.680
LONGLINE	0.875	2.8	1.000	1.38	1.000	0.877
NETS	0.533	2.8	0.932	1.38	0.991	0.538
TBB_80+	0.684	2.8	0.278	1.38	0.889	0.672
ZZZ	0.807	2.8	0.969	1.38	0.998	0.726

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.389	35	1.03	0.980
HAD	0.200	2.80	99	0.189	7	0.07	0.002
PLE	0.706	0.45	64	0.586	81	1.26	0.002
POK	0.288	1.38	153	0.162	21	0.14	0.002
SOL	0.464	0.90	17	0.648	13	0.77	0.002

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Run 3. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.498	2.8	0.968	1.38	0.999	0.535
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.831	2.8	0.982	1.38	0.999	0.843
LONGLINE	0.937	2.8	1.000	1.38	1.000	0.939
NETS	0.765	2.8	0.981	1.38	0.991	0.768
TBB_80+	0.841	2.8	0.804	1.38	0.889	0.841
ZZZ	0.903	2.8	0.991	1.38	0.998	0.800

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	53	0.694	53	1.01	0.980
HAD	0.200	2.80	99	0.598	23	0.23	0.002
PLE	0.706	0.85	107	0.796	102	0.96	0.002
POK	0.288	1.38	153	0.583	72	0.47	0.002
SOL	0.464	0.90	17	0.827	16	0.94	0.002

Run 4. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.498	2.8	0.881	1.38	0.999	0.534
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.831	2.8	0.935	1.38	0.999	0.843
LONGLINE	0.937	2.8	1.000	1.38	1.000	0.939
NETS	0.765	2.8	0.932	1.38	0.991	0.768
TBB_80+	0.841	2.8	0.278	1.38	0.889	0.821
ZZZ	0.903	2.8	0.969	1.38	0.998	0.800

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	53	0.692	53	1.01	0.980
HAD	0.200	2.80	99	0.598	23	0.23	0.002
PLE	0.706	0.45	64	0.782	100	1.57	0.002
POK	0.288	1.38	153	0.583	72	0.47	0.002
SOL	0.464	0.90	17	0.810	15	0.92	0.002

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Run 5. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.001	2.8	0.968	1.38	0.999	0.467
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.664	2.8	0.982	1.38	0.999	0.853
LONGLINE	0.875	2.8	1.000	1.38	1.000	0.878
NETS	0.533	2.8	0.981	1.38	0.991	0.764
TBB_80+	0.684	2.8	0.804	1.38	0.889	0.797
ZZZ	0.807	2.8	0.991	1.38	0.998	0.852

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.661	51	1.53	0.496
HAD	0.200	2.80	99	0.547	21	0.21	0.001
PLE	0.706	0.85	107	0.759	98	0.92	0.496
POK	0.288	1.38	153	0.531	66	0.43	0.001
SOL	0.464	0.90	17	0.789	15	0.90	0.001

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Run 6. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.001	2.8	0.881	1.38	0.999	0.428
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.664	2.8	0.935	1.38	0.999	0.826
LONGLINE	0.875	2.8	1.000	1.38	1.000	0.878
NETS	0.533	2.8	0.932	1.38	0.991	0.738
TBB_80+	0.684	2.8	0.278	1.38	0.889	0.302
ZZZ	0.807	2.8	0.969	1.38	0.998	0.841

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.583	46	1.36	0.496
HAD	0.200	2.80	99	0.505	19	0.19	0.001
PLE	0.706	0.45	64	0.405	57	0.89	0.496
POK	0.288	1.38	153	0.495	62	0.41	0.001
SOL	0.464	0.90	17	0.366	7	0.44	0.001

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Run 7. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.498	2.8	0.968	1.38	0.999	0.731
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.831	2.8	0.982	1.38	0.999	0.923
LONGLINE	0.937	2.8	1.000	1.38	1.000	0.939
NETS	0.765	2.8	0.981	1.38	0.991	0.877
TBB_80+	0.841	2.8	0.804	1.38	0.889	0.806
ZZZ	0.903	2.8	0.991	1.38	0.998	0.891

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	53	0.816	59	1.12	0.496
HAD	0.200	2.80	99	0.768	29	0.30	0.001
PLE	0.706	0.85	107	0.813	103	0.97	0.496
POK	0.288	1.38	153	0.760	92	0.60	0.001
SOL	0.464	0.90	17	0.815	15	0.92	0.001

Run 8. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.498	2.8	0.881	1.38	0.999	0.691
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.831	2.8	0.935	1.38	0.999	0.896
LONGLINE	0.937	2.8	1.000	1.38	1.000	0.939
NETS	0.765	2.8	0.932	1.38	0.991	0.851
TBB_80+	0.841	2.8	0.278	1.38	0.889	0.311
ZZZ	0.903	2.8	0.969	1.38	0.998	0.880

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	53	0.737	54	1.02	0.496
HAD	0.200	2.80	99	0.725	28	0.28	0.001
PLE	0.706	0.45	64	0.459	63	0.98	0.496
POK	0.288	1.38	153	0.724	88	0.58	0.001
SOL	0.464	0.90	17	0.391	8	0.46	0.001

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Run 9. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.014	2.8	0.968	1.38	0.999	0.065
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.668	2.8	0.982	1.38	0.999	0.684
LONGLINE	0.877	2.8	1.000	1.38	1.000	0.879
NETS	0.539	2.8	0.981	1.38	0.991	0.544
TBB_80+	0.688	2.8	0.804	1.38	0.889	0.696
ZZZ	0.810	2.8	0.991	1.38	0.998	0.728

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	47	0.399	49	1.04	0.980
HAD	0.200	2.80	99	0.200	7	0.07	0.002
PLE	0.706	0.85	107	0.605	83	0.78	0.002
POK	0.288	1.38	153	0.173	22	0.15	0.002
SOL	0.464	0.90	17	0.670	13	0.79	0.002

Run 10. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.014	2.8	0.881	1.38	0.999	0.065
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.668	2.8	0.935	1.38	0.999	0.684
LONGLINE	0.877	2.8	1.000	1.38	1.000	0.879
NETS	0.539	2.8	0.932	1.38	0.991	0.544
TBB_80+	0.688	2.8	0.278	1.38	0.889	0.676
ZZZ	0.810	2.8	0.969	1.38	0.998	0.727

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	47	0.397	49	1.03	0.980
HAD	0.200	2.80	99	0.199	7	0.07	0.002
PLE	0.706	0.45	64	0.591	81	1.27	0.002
POK	0.288	1.38	153	0.173	22	0.15	0.002
SOL	0.464	0.90	17	0.652	13	0.77	0.002

Run 11. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.504	2.8	0.968	1.38	0.999	0.541
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.833	2.8	0.982	1.38	0.999	0.845
LONGLINE	0.938	2.8	1.000	1.38	1.000	0.940
NETS	0.768	2.8	0.981	1.38	0.991	0.771
TBB_80+	0.843	2.8	0.804	1.38	0.889	0.843
ZZZ	0.904	2.8	0.991	1.38	0.998	0.801

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	74	0.698	74	1.01	0.980
HAD	0.200	2.80	99	0.603	23	0.23	0.002
PLE	0.706	0.85	107	0.799	102	0.96	0.002
POK	0.288	1.38	153	0.588	73	0.48	0.002
SOL	0.464	0.90	17	0.829	16	0.94	0.002

Run 12. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	0.25
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.504	2.8	0.881	1.38	0.999	0.541
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.648
DEM_70-99	0.833	2.8	0.935	1.38	0.999	0.845
LONGLINE	0.938	2.8	1.000	1.38	1.000	0.940
NETS	0.768	2.8	0.932	1.38	0.991	0.771
TBB_80+	0.843	2.8	0.278	1.38	0.889	0.823
ZZZ	0.904	2.8	0.969	1.38	0.998	0.801

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	74	0.696	74	1.01	0.980
HAD	0.200	2.80	99	0.603	23	0.23	0.002
PLE	0.706	0.45	64	0.784	101	1.58	0.002
POK	0.288	1.38	153	0.588	73	0.48	0.002
SOL	0.464	0.90	17	0.812	15	0.92	0.002

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Run 13. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.014	2.8	0.968	1.38	0.999	0.474
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.668	2.8	0.982	1.38	0.999	0.855
LONGLINE	0.877	2.8	1.000	1.38	1.000	0.879
NETS	0.539	2.8	0.981	1.38	0.991	0.767
TBB_80+	0.688	2.8	0.804	1.38	0.889	0.797
ZZZ	0.810	2.8	0.991	1.38	0.998	0.853

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	47	0.665	72	1.52	0.496
HAD	0.200	2.80	99	0.553	21	0.21	0.001
PLE	0.706	0.85	107	0.760	98	0.92	0.496
POK	0.288	1.38	153	0.537	67	0.44	0.001
SOL	0.464	0.90	17	0.790	15	0.90	0.001

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Run 14. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.014	2.8	0.881	1.38	0.999	0.434
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.668	2.8	0.935	1.38	0.999	0.828
LONGLINE	0.877	2.8	1.000	1.38	1.000	0.879
NETS	0.539	2.8	0.932	1.38	0.991	0.741
TBB_80+	0.688	2.8	0.278	1.38	0.889	0.302
ZZZ	0.810	2.8	0.969	1.38	0.998	0.842

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	47	0.587	64	1.36	0.496
HAD	0.200	2.80	99	0.511	19	0.20	0.001
PLE	0.706	0.45	64	0.407	57	0.89	0.496
POK	0.288	1.38	153	0.501	63	0.41	0.001
SOL	0.464	0.90	17	0.366	7	0.44	0.001

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Run 15. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.504	2.8	0.968	1.38	0.999	0.734
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.833	2.8	0.982	1.38	0.999	0.924
LONGLINE	0.938	2.8	1.000	1.38	1.000	0.940
NETS	0.768	2.8	0.981	1.38	0.991	0.878
TBB_80+	0.843	2.8	0.804	1.38	0.889	0.806
ZZZ	0.904	2.8	0.991	1.38	0.998	0.891

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	74	0.818	83	1.12	0.496
HAD	0.200	2.80	99	0.771	30	0.30	0.001
PLE	0.706	0.85	107	0.813	103	0.97	0.496
POK	0.288	1.38	153	0.763	93	0.60	0.001
SOL	0.464	0.90	17	0.815	15	0.92	0.001

Run 16. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of a TAC constraint plus an additional 40% unallocated removals.

Species	STAC	Fmult	decision.weight
COD	-1	0.70	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.504	2.8	0.881	1.38	0.999	0.695
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.833	2.8	0.935	1.38	0.999	0.897
LONGLINE	0.938	2.8	1.000	1.38	1.000	0.940
NETS	0.768	2.8	0.932	1.38	0.991	0.853
TBB_80+	0.843	2.8	0.278	1.38	0.889	0.311
ZZZ	0.904	2.8	0.969	1.38	0.998	0.881

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.70	74	0.739	76	1.03	0.496
HAD	0.200	2.80	99	0.728	28	0.28	0.001
PLE	0.706	0.45	64	0.460	63	0.99	0.496
POK	0.288	1.38	153	0.727	89	0.58	0.001
SOL	0.464	0.90	17	0.391	8	0.46	0.001

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Run 17. p=0, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.4	2.8	0.45	1.38	0.9	0.444
DEM_16-31	0.4	2.8	0.45	1.38	0.9	0.295
DEM_70-99	0.4	2.8	0.45	1.38	0.9	0.437
LONGLINE	0.4	2.8	0.45	1.38	0.9	0.403
NETS	0.4	2.8	0.45	1.38	0.9	0.427
TBB_80+	0.4	2.8	0.45	1.38	0.9	0.447
ZZZ	0.4	2.8	0.45	1.38	0.9	0.428

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.437	36	1.08	0.496
HAD	0.200	2.80	99	0.441	17	0.18	0.001
PLE	0.706	0.45	64	0.444	63	0.99	0.496
POK	0.288	1.38	153	0.441	56	0.37	0.001
SOL	0.464	0.90	17	0.445	9	0.55	0.001

Run 18. p=0, q=0.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.4	2.8	0.45	1.38	0.9	0.431
DEM_16-31	0.4	2.8	0.45	1.38	0.9	0.431
DEM_70-99	0.4	2.8	0.45	1.38	0.9	0.431
LONGLINE	0.4	2.8	0.45	1.38	0.9	0.431
NETS	0.4	2.8	0.45	1.38	0.9	0.431
TBB_80+	0.4	2.8	0.45	1.38	0.9	0.431
ZZZ	0.4	2.8	0.45	1.38	0.9	0.431

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.431	36	1.06	0.496
HAD	0.200	2.80	99	0.431	17	0.17	0.001
PLE	0.706	0.45	64	0.431	62	0.96	0.496
POK	0.288	1.38	153	0.431	55	0.36	0.001
SOL	0.464	0.90	17	0.431	9	0.53	0.001

Run 19. p=1, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.459	2.8	0.936	1.38	1.000	0.696
DEM_16-31	0.975	2.8	1.000	1.38	1.000	0.641
DEM_70-99	0.337	2.8	0.874	1.38	0.999	0.655
LONGLINE	0.000	2.8	1.000	1.38	1.000	0.004
NETS	0.000	2.8	0.719	1.38	0.964	0.370
TBB_80+	0.684	2.8	0.291	1.38	0.891	0.314
ZZZ	0.940	2.8	0.990	1.38	0.999	0.905

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.575	44	1.31	0.496
HAD	0.200	2.80	99	0.684	26	0.27	0.001
PLE	0.706	0.45	64	0.410	58	0.91	0.496
POK	0.288	1.38	153	0.685	84	0.55	0.001
SOL	0.464	0.90	17	0.343	7	0.42	0.001

Run 20. p=2, q=1.

Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.45	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
-2	0.775	2.8	0.970	1.38	0.999	0.882
BEAM>=120	0.992	2.8	1.000	1.38	1.000	0.997
BEAM100-119	0.999	2.8	1.000	1.38	1.000	1.000
DEM_SEINE-1	0.999	2.8	0.999	1.38	1.000	1.000
DEM_SEINE>=120	0.672	2.8	0.961	1.38	1.000	0.836
DEM_SEINE100-119	0.993	2.8	0.995	1.38	1.000	1.003
DEM_SEINE32-54	1.000	2.8	1.000	1.38	1.000	1.088
DEM_SEINE55-69	1.000	2.8	1.000	1.38	1.000	1.776
DEM_SEINE70-79	1.000	2.8	1.000	1.38	1.000	1.049
DEM_SEINE80-99	0.965	2.8	0.996	1.38	1.000	0.985
DREDGE-1	1.000	2.8	1.000	1.38	1.000	1.000
DREDGE80-99	1.000	2.8	1.000	1.38	1.000	1.000
GILL-1	0.984	2.8	1.000	1.38	0.999	0.987
GILL>=220	0.998	2.8	1.000	1.38	1.000	0.999
GILL10-30	1.000	2.8	1.000	1.38	1.000	1.000
GILL100-119	0.986	2.8	0.998	1.38	0.998	0.993
GILL120-219	0.215	2.8	0.907	1.38	0.999	0.579
GILL50-70	0.999	2.8	1.000	1.38	1.000	0.999
GILL90-99	0.961	2.8	0.999	1.38	0.995	0.971
LARGE_BEAM-1	0.999	2.8	0.997	1.38	1.000	0.997
LARGE_BEAM>=120	0.908	2.8	0.927	1.38	1.000	0.925
LARGE_BEAM100-119	0.660	2.8	0.926	1.38	0.999	0.838
LARGE_BEAM16-31	1.000	2.8	1.000	1.38	1.000	1.000
LARGE_BEAM32-54	1.000	2.8	1.000	1.38	1.000	0.000
LARGE_BEAM80-99	0.869	2.8	0.148	1.38	0.883	0.160
LONGLINE-1	0.771	2.8	1.000	1.38	1.000	0.773
OTHER-1	1.000	2.8	1.000	1.38	1.000	0.000
OTHER32-54	1.000	2.8	1.000	1.38	1.000	0.000
OTTER-1	0.981	2.8	0.993	1.38	1.000	0.990
OTTER<16	0.998	2.8	1.000	1.38	1.000	0.379
OTTER>=120	0.000	2.8	0.913	1.38	0.999	0.354
OTTER>120	0.995	2.8	1.000	1.38	1.000	1.003
OTTER100-119	0.935	2.8	0.963	1.38	1.000	0.971
OTTER16-31	0.999	2.8	1.000	1.38	1.000	0.655
OTTER32-54	0.924	2.8	1.000	1.38	1.000	0.932
OTTER55-69	1.000	2.8	1.000	1.38	1.000	1.009
OTTER70-79	0.960	2.8	0.998	1.38	1.000	0.976
OTTER80-99	0.458	2.8	0.914	1.38	0.999	0.735
PEL_SEINE32-54	1.000	2.8	1.000	1.38	1.000	1.287
PEL_TRAWL100-119	1.000	2.8	1.000	1.38	1.000	1.000
PEL_TRAWL32-54	1.000	2.8	1.000	1.38	1.000	1.026
PEL_TRAWL80-99	0.999	2.8	1.000	1.38	1.000	0.999
POTS-1	0.989	2.8	1.000	1.38	1.000	0.991
SMALL_BEAM-1	1.000	2.8	1.000	1.38	1.000	1.000
SMALL_BEAM>=120	0.998	2.8	0.999	1.38	1.000	0.999
SMALL_BEAM100-119	1.000	2.8	1.000	1.38	1.000	1.000
SMALL_BEAM16-31	1.000	2.8	1.000	1.38	1.000	1.000
SMALL_BEAM80-99	0.985	2.8	0.983	1.38	0.996	0.983
ZZZ-1	0.997	2.8	0.998	1.38	1.000	0.998

Run 20 continued.

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.605	48	1.43	0.496
HAD	0.200	2.80	99	0.572	21	0.21	0.001
PLE	0.706	0.45	64	0.404	56	0.87	0.496
POK	0.288	1.38	153	0.574	71	0.47	0.001
SOL	0.464	0.90	17	0.296	6	0.34	0.001

Run 21. p=0, q=0.

Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.4	2.8	0.85	1.38	0.9	0.629
DEM_16-31	0.4	2.8	0.85	1.38	0.9	0.629
DEM_70-99	0.4	2.8	0.85	1.38	0.9	0.629
LONGLINE	0.4	2.8	0.85	1.38	0.9	0.629
NETS	0.4	2.8	0.85	1.38	0.9	0.629
TBB_80+	0.4	2.8	0.85	1.38	0.9	0.629
ZZZ	0.4	2.8	0.85	1.38	0.9	0.629

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.629	48	1.45	0.496
HAD	0.200	2.80	99	0.629	24	0.25	0.001
PLE	0.706	0.85	107	0.629	84	0.79	0.496
POK	0.288	1.38	153	0.629	78	0.51	0.001
SOL	0.464	0.90	17	0.629	12	0.74	0.001

Run 22. p=0, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.4	2.8	0.85	1.38	0.9	0.625
DEM_16-31	0.4	2.8	0.85	1.38	0.9	0.304
DEM_70-99	0.4	2.8	0.85	1.38	0.9	0.667
LONGLINE	0.4	2.8	0.85	1.38	0.9	0.403
NETS	0.4	2.8	0.85	1.38	0.9	0.632
TBB_80+	0.4	2.8	0.85	1.38	0.9	0.824
ZZZ	0.4	2.8	0.85	1.38	0.9	0.618

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.642	50	1.48	0.496
HAD	0.200	2.80	99	0.630	25	0.25	0.001
PLE	0.706	0.85	107	0.767	99	0.93	0.496
POK	0.288	1.38	153	0.625	78	0.51	0.001
SOL	0.464	0.90	17	0.795	15	0.91	0.001

Run 23. p=1, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.459	2.8	0.983	1.38	1.000	0.717
DEM_16-31	0.975	2.8	1.000	1.38	1.000	0.641
DEM_70-99	0.337	2.8	0.966	1.38	0.999	0.708
LONGLINE	0.000	2.8	1.000	1.38	1.000	0.004
NETS	0.000	2.8	0.923	1.38	0.964	0.474
TBB_80+	0.684	2.8	0.807	1.38	0.891	0.800
ZZZ	0.940	2.8	0.997	1.38	0.999	0.909

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.661	50	1.50	0.496
HAD	0.200	2.80	99	0.715	28	0.28	0.001
PLE	0.706	0.85	107	0.763	99	0.93	0.496
POK	0.288	1.38	153	0.711	87	0.57	0.001
SOL	0.464	0.90	17	0.767	15	0.89	0.001

Run 24. p=2, q=1.
Input data for cod uses intermediate (2004) assumption of Fsq.

Species	STAC	Fmult	decision.weight
COD	-1	0.40	100
HAD	-1	2.80	0.25
POK	-1	1.38	0.25
PLE	-1	0.85	100
SOL	-1	0.90	0.25

Factors for species specific fleet effort changes and weighted factor

	COD	HAD	PLE	POK	SOL	Fleet.Factor
DEM_100+	0.001	2.8	0.968	1.38	0.999	0.467
DEM_16-31	1.000	2.8	1.000	1.38	1.000	0.656
DEM_70-99	0.664	2.8	0.982	1.38	0.999	0.853
LONGLINE	0.875	2.8	1.000	1.38	1.000	0.878
NETS	0.533	2.8	0.981	1.38	0.991	0.764
TBB_80+	0.684	2.8	0.804	1.38	0.889	0.797
ZZZ	0.807	2.8	0.991	1.38	0.998	0.852

Prediction results

	Fsq	SS_F_mult.	SS_TAC	MS_F_mult	MS_TAC	MS_TAC/SS_TAC	Decision_w
COD	0.906	0.40	34	0.661	51	1.53	0.496
HAD	0.200	2.80	99	0.547	21	0.21	0.001
PLE	0.706	0.85	107	0.759	98	0.92	0.496
POK	0.288	1.38	153	0.531	66	0.43	0.001
SOL	0.464	0.90	17	0.789	15	0.90	0.001

9. Annex 3. Full contact details of participants.

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