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Report of the Working Group on balance between resources and their exploitation (SGBRE)

Northern hake long-term management plan impact assessment (SGBRE-07-05)

Brussels, 3-6 December 2007

Edited by Luc van Hoof & Franz Hölker

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SCIENTIFIC, TECHNICAL AND ECONOMIC COMMITTEE FOR FISHERIES (STECF)

STECF COMMENTS ON THE REPORT OF THE WORKING GROUP ON BALANCE BETWEEN RESOURCES AND THEIR EXPLOITATION (SGBRE)

NORTHERN HAKE LONG-TERM MANAGEMENT PLAN IMPACT ASSESSMENT (SGBRE-07-05)

3-6 DECEMBER 2007, BRUSSELS

STECF OPINION BY WRITTEN PROCEDURE

January 2008

1. Background

Following concerns in the late 1990s about the low level of the stock biomass and the possibility of recruitment failure a range of technical measures were introduced (Council Regulations N°1162/2001, 2602/2001 and 494/2002) aimed at improving the selection pattern and protecting juveniles. Subsequently a recovery plan was introduced (Council regulation EC Reg. No 811/2004).

The technical measures comprise a 100 mm minimum mesh size for otter-trawlers when Hake comprises more than 20% of the total amount of marine organisms retained onboard, with a dispensation for those vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Further, two areas have been defined, one in Sub area VII and the other in Sub area VIII, where a 100 mm minimum mesh size is required for all otter-trawlers, irrespective of the proportion of Hake caught.

The recovery plan consists of setting a TAC equivalent to a target F of 0.25 (F_{pa}), or a lower F to prevent decline in SSB, and with the constraint that annual change in TAC should not exceed 15%.

Since the end of 2005, the French vessels involved in the *Nephrops* fishery in the Bay of Biscay are regulated by licence. This licence is given only for vessels using a square mesh panel allowing 20-30% escapement of undersized Hake.

In order to advise the Commission on the potential impact of the proposed management plan for Northern hake, an Expert Working Group (STECF/SGBRE-07-03) was convened from 18-22 June 2007 to evaluate the potential biological consequences of the plan. STECF has already commented on the findings of that Group (5-9 November 2007, STECF/PLEN-07-03). A second Expert group (STECF/SGBRE-07-05) was then convened in Brussels from 3 - 6 December 2007 with the following Terms of Reference:

Terms of Reference

The general objective of the tasks to be carried out is to produce a solid analysis of the socioeconomic impact of the different management scenarios, implying an evaluation of the potential economic performance for the EU fleets involved in the fishery comparing the different management scenarios, with the following terms of reference.

1. For each Member State, what is the economic and social baseline situation for the fishing fleets, onshore industries and communities that depend on fisheries for Hake (e.g. size, turnover, employment in 2005)?
2. What is the baseline situation in biological and environmental terms of the fishery (state of the stocks concerned, discards, impact on wider marine environment, etc)?
3. Given expected stock recoveries under the long term proposal, for each Member State, what economic impacts (e.g. costs, revenues) can be expected during:
   a. the first 1-3 years,
   b. after 5, 10 and 15 years,

   compared with continuing to fish at current mortality rates ("no policy change"), in the catching sector and onshore sector?
4. Given expected stock recoveries under the long term proposal, for each Member State, what social impacts (e.g. employment) can be expected during:
   a. the first 1-3 years,
   b. after 5, 10 and 15 years,

   compared with continuing to fish at current mortality rates ("no policy change"), in the catching sector and onshore sector?
5. Given expected stock recoveries under the long term proposal, what biological and environmental impacts (e.g. sea bed, other species) can be expected during:
   a. the first 1-3 years,
   b. after 5, 10 and 15 years,

   compared with continuing to fish at current mortality rates ("no policy change")?
6. As a robustness test (taking into consideration the various sources of uncertainty), assess the economic, social, biological and environmental consequences of plausible alternative exploitation patterns that might arise due to the implementation of management measures.

Identify any needs for long term data collection from the sector in support of future impact assessments or for monitoring purpose.

2. Approach of the Expert Group

In undertaking the impact assessment, the Expert Working Group (STECF/SGBRE 07-05) considered two main scenarios:

- A "*no policy change*" scenario based on the current fishing mortality; also referred to as the *status quo* scenario ($F_{sq)}$; it implies fishing at the level of $F_{pa.}$ Hereafter referred to as F_{pa} scenario.
- A scenario which assumes a reduction in fishing mortality (F) from the current level to Fmax, which is used as a proxy for the target reference point Fmsy. The scenario assumes annual reductions in F of 5%, 10% or 15%. Hereafter referred to as the Fmax scenario.

In addition, taking into account the findings from the STECF/SGBRE-07-03 report, that the outcome of the management plan is influenced by the assumptions on the level of discarding, the two main scenarios were undertaken with and without including estimates of discarding.

3. STECF observations and conclusions

The report of the STECF/SGBRE Expert group on the impact assessment of the long-term management plan for Northern hake is attached at ANNEX I. STECF reviewed the report by Correspondence in December 2007 and January 2008 and endorses the findings of the Expert Group and draws the following main conclusions:

1. The predicted impact of the management plan is heavily influenced by the assumptions regarding discards. However, the available data on discards are not considered very reliable; discard rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way. The evaluations undertaken including discards therefore illustrate the sensitivity of the predicted outcome to the assumptions about discarding practices.
2. Comparing the results of the F_{pa} and F_{max} scenarios without taking discards into consideration indicates that over the period analysed there the predicted outcomes are essentially the same.
3. Comparing the results of the F_{pa} and F_{max} scenarios while taking estimates of discards into consideration, indicates that the short term losses (in terms of landings and revenues) under the F_{max} scenario are higher than continuing to fish at $F_{pa.}$ However in the long run, the benefits of reducing F to F_{max} are much higher and continue to be higher than continuing to fish at F_{pa} .
4. The precise effect of the different scenarios in terms of costs and benefits between the different fleet segments depends on the relative share of Hake catches in terms of total revenue. As the present analysis does not take into account differences in exploitation patterns between fleets, the model is unable to account for any effect on fleets of the size composition of hake catches. The potential redistribution of catches and hence Gross Value Added between fishing fleets and segments is variable.
5. Whereas the EIAA model used did not account for price changes resulting from changes in landings, based on the general characteristics of fish markets (*ceteris paribus*) large increases in landings may cause only relatively small falls in price and the total revenues of the fleets will increase as landings rise.
6. Qualitatively, it is possible to conclude that the impacts on the fleets will be magnified on shore in the processing industry. Noting however the low degree of processing taking pace in the Hake marketing chain this knock-on effect is expected to be of relatively minor importance
7. Indirect change in selection pattern could result as a consequence of changes in the fleet structure because the selection patterns for each fleet segment may be different. In the runs of the EIAA model any such change has not been accounted for. However, an attempt has been made using different selectivity patterns by gears to simulate restructuring of the fleet.
8. The simulations showed that improving the exploitation pattern by reducing catches of smaller sized Hake could lead to better long-term yields. Without such an improvement in exploitation pattern, the overall reduction in F required to achieve the same long-term economic benefits would be much greater.
9. STECF is of the opinion that a change in the age and size structure of the stock is unlikely to have any noticeable socio-economic impacts e.g. on employment.

STECF/SGBRE-07-05 WORKING GROUP REPORT ON
NORTHERN HAKE LONG-TERM MANAGEMENT PLAN IMPACT ASSESSMENT
Brussels, 3-6 December 2007

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

1 INTRODUCTION

1.1 Background of Northern Hake long-term management plans

A working group met in Brussels December 3-6 2007 to perform an impact assessment of the proposed management plan for Northern Hake. The working group consisted of biologists and economists. This report represents the economical analysis of the biological evaluation as represented in the SGBRE-07-03 report of a proposed long term management plan for Northern Hake.

Following concerns in the late 1990s about the low level of the stock biomass and the possibility of recruitment failure a range of technical measures were introduced (Council Regulations N°1162/2001, 2602/2001 and 494/2002) aimed at improving the selection pattern and protecting juveniles. Subsequently a recovery plan was introduced (Council regulation EC Reg. No 811/2004).

The technical measures comprise a 100 mm minimum mesh size for otter-trawlers when Hake comprises more than 20% of the total amount of marine organisms retained onboard, with a dispensation for those vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Further, two areas have been defined, one in Sub area VII and the other in Sub area VIII, where a 100 mm minimum mesh size is required for all otter-trawlers, irrespective of the proportion of Hake caught.

The recovery plan consists of setting a TAC equivalent to a target F of 0.25 (F_{pa}), or a lower F to prevent decline in SSB, and with the constraint that annual change in TAC should not exceed 15%.

Since the end of 2005, the French vessels involved in the *Nephrops* fishery in the Bay of Biscay are regulated by licence. This licence is given only for vessels using a square mesh panel allowing 20-30% escapement of undersized Hake.

2 TERMS OF REFERENCE

The general objective of the tasks to be carried out is to produce a solid analysis of the socioeconomic impact of the different management scenarios, implying an evaluation of the potential economic performance for the EU fleets involved in the fishery comparing the different management scenarios, with the following terms of reference.

2. For each Member State, what is the economic and social baseline situation for the fishing fleets, onshore industries and communities that depend on fisheries for Hake (e.g. size, turnover, employment in 2005)?
3. What is the baseline situation in biological and environmental terms of the fishery (state of the stocks concerned, discards, impact on wider marine environment, etc)?
4. Given expected stock recoveries under the long term proposal, for each Member State, what economic impacts (e.g. costs, revenues) can be expected during:
    a. the first 1-3 years,
    b. after 5, 10 and 15 years,

    compared with continuing to fish at current mortality rates ("no policy change"), in the catching sector and onshore sector?
5. Given expected stock recoveries under the long term proposal, for each Member State, what social impacts (e.g. employment) can be expected during:
    a. the first 1-3 years,
    b. after 5, 10 and 15 years,

    compared with continuing to fish at current mortality rates ("no policy change"), in the catching sector and onshore sector?
6. Given expected stock recoveries under the long term proposal, what biological and environmental impacts (e.g. sea bed, other species) can be expected during:
    a. the first 1-3 years,
    b. after 5, 10 and 15 years,

    compared with continuing to fish at current mortality rates ("no policy change")?

    7. As a robustness test (taking into consideration the various sources of uncertainty), assess the economic, social, biological and environmental consequences of plausible alternative exploitation patterns that might arise due to the implementation of management measures.
8. Identify any needs for long term data collection from the sector in support of future impact assessments or for monitoring purpose

3 SUMMARY OF FINDINGS

Concerning the assessment of the impact of the Long Term Management plan for Northern Hake the main conclusions are:

- The Impact Assessment has been considering two main sets of scenarios:
  - A "*no policy change*" scenario based on the current fishing mortality; also referred to as the *status quo* scenario (F_{sq}); it implies fishing at the level of $F_{pa.}$ Hereafter referred to as F_{pa} scenario
  - Reducing the current fishing mortality to F_{max}, being a good proxy for the target reference point F_{msy}, in steps of an annual reduction of F with 5%, 10% or 15%. Hereafter referred to as F_{max} scenario
- In commenting on the work of SGBRE-07-03 (analysing the biological assessment of the long term Northern Hake management plan) STECF noted the following:
  - there is little difference, in terms of long-term yields, between F_{max} and F_{pa}/F_{sq} scenarios. STECF noted however that reducing F to F_{msy} as opposed to F_{pa} would lead to higher SSB and thus give the stock more stability, reducing the risk of getting back to an unsafe situation. This could also improve economic efficiency.
  - inclusion of discard estimates in the analysis creates a stronger positive effect on yield and SSB when F is reduced. Furthermore, inclusion of discards in simulations where the selection pattern is changed to reduce F on younger ages produces positive benefits of similar magnitude to reductions in overall F. These analyses are based on preliminary and incomplete estimates of discards quantities, nevertheless, STECF is aware that discarding takes place and considered, therefore, that the output gives a better representation than when discards are excluded. STECF recommended that in any management plan involving a move towards an F_{max} target, measures which improve the selection pattern should be included.
- The outcome of the Impact Assessment is affected by the discards. However, the data on discards are not considered very reliable; discard rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way. Taking the STECF observation on the SGBRE-07-03 report into consideration however, two sets of analysis have been implemented: with and without taking discards into consideration.
- Analysing the F_{pa} and F_{max} scenarios without taking discards into consideration results in a situation wherein over the period analysed hardly significant differences between the scenarios exist.
- If the two scenarios are compared while taking discards into consideration the short term losses (in terms of landings and revenues) under the F_{max} scenario are higher, however in the long run the benefits of the F_{max} scenario are much higher and continue to be higher.
- The precise effect of the different scenarios in terms of costs and benefits between the different fleet segments depends on the relative share of Hake catches in total revenue. As this analysis does not account for differences in exploitation patterns between fleets, the model does not account for the effect of different scenarios on fleets catching different sized Hake. The potential redistribution of catches and hence Gross Value Added between fishing fleets and segments is variable.

- Whereas the EIAA model used did not account for price changes resulting from changes in landings, based on the general characteristics of fish markets (*ceteris paribus*) large increases in landings may cause only relatively small falls in price and the total revenues of the fleets will increase as landings rise.
- Qualitatively, it is possible to conclude that the impacts on the fleets will be magnified on shore by the multiplier process but that the employment and output multipliers will be low.
- Indirect change in selection pattern could be expected as a consequence of changes in the fleet structure, each fleet segment having different selection patterns. In the runs of the EIAA model this change has not been included. However, an attempt has been made using different selectivity patterns by gears to simulate restructuring of the fleet.
- The simulations showed that changing the exploitation pattern by reducing catches of smaller sized Hake could lead to better long-term yields while the reduction in overall effort would be smaller. Reducing catches of smaller sized Hake would imply a lesser overall reduction of F yet obtaining full economic benefits.
- It is not thought likely that a change in the age and size structure of the stock will have socio-economic impacts like i.a. employment.

4 BASELINE SITUATION OF THE FISHERY IN BIOLOGICAL TERMS

4.1 Description of the fishery

Northern Hake is taken as part of catches in mixed demersal fisheries. Historically, a set of different Fishery Units (FU) was defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985, in order to study the fishing activity related to demersal species (ICES, 1991). To take into account the Hake catches from other areas, a new Fishery Unit was introduced in the beginning of the nineties (FU 16: Outsiders). This Fishery Unit was created on the basis of combination between mixed areas and mixed gears (trawl, seine, long line, and gill net). The FU have been defined as follows:

Table 4.1.1: Fishery Units in Northern Hake Fisheries

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	

The main part of the fishery (close to 90% of the total landings) is currently conducted by six Fishery Units, three operating in Sub-area VII: FU 1 (Long-line in medium to deep water in Sub-area VII), FU 3 (Gill nets in Sub-area VII) and FU 4 (Non-Nephrops trawling in medium to deep water in Sub-area VII), two in Sub-area VIII: FU 13 (Gill nets in shallow to medium water) and FU 14 (Trawling in medium to deep water in Sub-area VIII) and one in Sub-areas IIIa, IV, V and VI, representing respectively 22%, 13%, 20%, 8%, 13% and 15% of total landings in 2006.

Spain accounts for the main part of the landings with 59% of the total in 2006. France is taking 26% of the total, UK 6%, Denmark 3%, Ireland 3% and other countries (Norway, Belgium, Netherlands, Germany, and Sweden) contributing small amounts.

Total landings from the Northern stock of Hake by area for the period 1961-2006 as used by the WG are given in Table 4.1.2. They include landings from Divisions IIIa and IVa,c, Sub-areas IV, VI and VII, and Divisions VIIIa,b,d, as reported to ICES. Except in 1995, landings decreased steadily from 66 500 t in 1989 to 35 000 t in 1998. Up to 2003, landings have fluctuated around 40 000 t. In 2004 and 2005, an important increase in landings had been observed with 47 123 t and 46 300 t of Hake landed respectively. In 2006, the total landings decreased to 41,810 t.

Table 4.1.2: Estimates of catches ('000 t) for Northern Hake by area for 1961–2006.

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.3	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.0	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2
2002	2.9	21.1	15.9	0	40.1	0.3	40.4
2003	2.8	23.7	15.3	0	41.9	-	41.9
2004	4.4	27.2	15.5	0	47.1	-	47.1
2005	5.3	26.7	14.4	0	46.4	-	46.4
2006	6.1	24.9	10.8	0	41.8	-	41.8

(1) Spanish data for 1961–1972 not revised, data for Sub area VIII for 1973–1978 include data for

Divisions VIIIa,b only. Data for 1979–1981 are revised based on French surveillance data.

Includes Divisions IIIa, IVb,c from 1976.

There are some unallocated landings moreover for the period 1961–1970.

(2) Discards have been estimated from 1978 and only for Divisions VIIII a,b.

(3) From 1978 total catches used for the Working Group.

4.2 Discards

Information available suggests that the discards rate could be high (up to 95% for age 0) in some years, areas and for some fleets. Some improvement in discard data availability (number of fleets sampled and area coverage) has been observed in recent years. However, sampling does not cover all fleets contributing to Hake catches, discard rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way.

4.3 The assessment

The XSA assessment of this stock is based on estimates of landings at age and trends in abundance given by commercial CPUE data and four series of French, UK and Spanish trawl survey data. As said above, data on discards are presently inadequate for inclusion in the assessment. Due to low confidence in the estimate of age 0 in the landings because of inconsistencies in the data for this age group in recent years, age 0 was removed from the catch at age matrix (replaced with 0 landings) and from the commercial fleet data. However, age 0 is still used in the assessment because indices for age 0 are available from surveys in age 0.

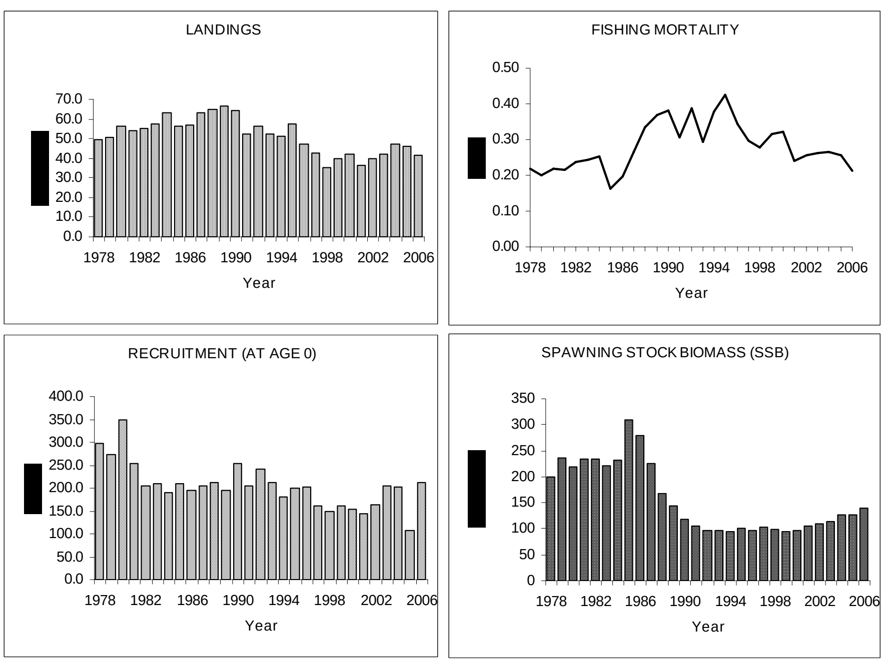
There are several sources of uncertainties for this stock:

- CPUE indices on the earlier year of the series.
- Non validated ageing criteria.
- Substantial uncertainty associated with total catches, particularly on small ages.
- Estimation of recruitment in recent years due mainly to inconsistencies in younger age indices from the FR-EVHOES survey. As this survey is thought to provide a reliable age 0 index, this may reveal an ageing problem

Alternative runs conducted by the ICES working group in 2006 (ICES, 2006) indicated that results are very sensitive to each of these uncertainties.

The assessment summary (ICES, 2007) is presented in Figure 4.3.1. SSB appears to have been very close to B_{pa} over the last 3 years, and F has been around F_{pa} since 2001. The increase in SSB since the low values estimated in the 90s appears to be due to a combination of good recruitment and moderate fishing mortality. As the growth rate and thus the age determination and productivity of Northern Hake stocks are uncertain, absolute estimates of SSB and F have to be considered with caution.

Figure 4.3.1: Summary plots for Northern Hake stock as obtained from the XSA assessment.



5 MAIN FINDINGS AND CONCLUSIONS FROM THE LISBON MEETING (SGBRE-07-03)

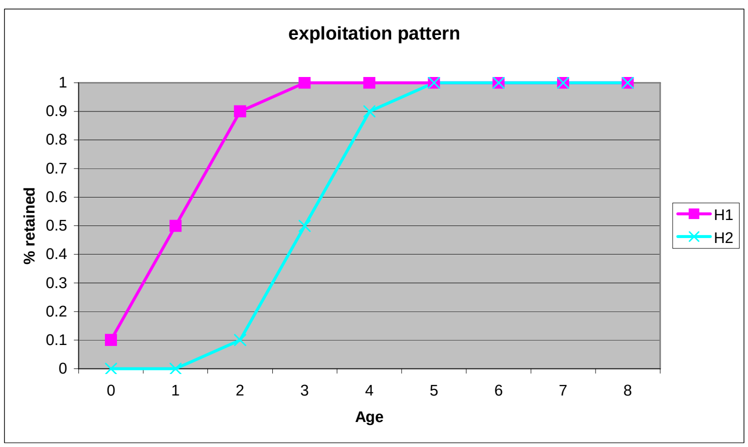
The European Commission has asked STECF to provided scientific advice regarding several possible scenarios to be considered in the future long-term management plan. The analysis conducted by SGBRE-07-03 during the Lisbon meeting included both single-species management and multi-species management considerations.

5.1 SGBRE-07-03 Assumptions

The stock-recruitment relationship is not well estimated for the northern stock of Hake and the group decided to use an Ochkam model. Using the Ockham model in favour of other S-R gave a more conservative perspective of the stock development.

The current assessment for Northern Hake is conducted without accounting for discards as discards rates of several fleets are simply not known and even where data are available, it is not possible to incorporate them in a consistent way. The Group considered that in aiming for an optimum long-term management of this stock the issue of discards should not be ignored. Hence, simulations based on an ad-hoc rebuilding of historical discards were also carried out. In these simulations, two scenarios of improvement in the selection pattern were also tested.

Figure 5.1.1: Example exploitation patterns.



For illustrative purposes, two different exploitation patterns have been assumed:

- H1: assumed than 90% of Hake at age 0 are spared, 50% at age 1 and 10% at age 2.
- H2: assumed no catch at age 0 and 1, 10% at age 2, 50% at age 3 and 90% at age 4, compared to the current one.

5.2 Main findings of SGBRE-07-03

F_{max} (0.17) is well defined for this stock and was considered a good proxy for the target reference point F_{msy}.

Decreasing F to F_{max} will result in a higher and more stable biomass and higher catch per unit effort compared to fishing at F_{pa} (which is close to F status quo). The probability of SSB being below B_{pa} increases from 0.38 in 2007 to 0.55 in 2015 in the F_{pa} scenario and decreases to 0 in the rest of the scenarios. In terms of CPUEs, they remain almost constant in the F_{pa} strategy and increase by 200%, 170% and 150% in the case of 0.8*F_{max}, F_{max} and 120% F_{max} strategies respectively.

The faster the decrease in F the faster the SSB stabilizes. This leads however to larger losses in yields in the short term.

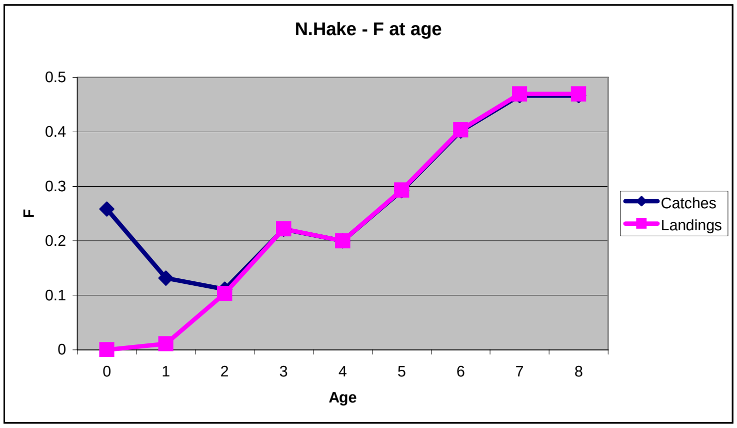
Reductions in F towards F_{max} results in short term losses if the reductions in F are greater than 5% per year.

F_{target} will be achieved in all scenarios by 2015, except in the scenario that reduces F to 0.8*F_{max} at a rate of 5% per year.

A decrease in F in the fleets catching Hake will also affect the Fs on other species associated in the catch like monkfish and megrim. However, the magnitude of the decrease in F on such species will be lower.

Taking discards into account leads to a different perception of the stock. Current F is equal to 0.24 and F_{max} is equal to 0.12.

Figure 5.2.1: Hake F at age



The pink line is the F given by the 'current' assessment based on landings only. The blue line gives F at age from XSA with Catches. F are F_{sq} mean 2004-2006.

The expected gains in long-term yields are larger in this scenario but reductions in F to reach F_{max} would then need to be larger. If the reduction in F is coupled with changes in the selection pattern (by decreasing F in younger ages), this would increase further the maximum expected yields and at the same time reduce the decrease in F needed to get to F_{max}.

Changing current F to 0.8*F_{msy} or 1.2*F_{msy} would lead to similar yield at long-term but to different levels of SSB and CPUE.

5.3 STECF main comments and conclusions on the results of the Lisbon meeting.

STECF noted that there is little difference, in terms of long-term yields, between F_{max} and F_{pa}/F_{sq} scenarios. STECF noted however that reducing F to F_{msy} as opposed to F_{pa} would lead to higher SSB and thus give the stock more stability, reducing the risk of getting back to an unsafe situation. This could also improve economic efficiency.

STECF noted that a 5% decrease in F would lead to F_{max} before 2015 without significant loss in yields at short term.

Finally, STECF noted that inclusion of discard estimates in the analysis creates a stronger positive effect on yield and SSB when F is reduced. Furthermore, inclusion of discards in simulations where the selection pattern is changed to reduce F on younger ages produces positive benefits of similar magnitude to reductions in overall F. These analyses are based on preliminary and incomplete estimates of discards quantities, nevertheless, STECF is aware that discarding takes place and considered, therefore, that the output gives a better representation than when discards are excluded. STECF recommended that in any management plan involving a move towards an F_{max} target, measures which improve the selection pattern should be included.

5.4 Selected Management scenarios

Following the results presented above and recommendations made by STECF, the current group SGBRE-07-05 decided to carry out the analysis of the socio-economic impacts only on a selection of the management scenarios tested during the Lisbon meeting. This includes two sets of simulations:

- One set of simulations is based on the "base-case" assessment (i.e., without accounting for discards) conducted by ICES (2007) and includes:
  - A status-quo or F_{pa} scenario in which F is kept constant at 0.25.
  - 5, 10 and 15% decrease on a yearly basis towards F_{max} (0.17).
  - same scenario with decrease of F towards $0.8*F_{max}$ and $1.2*F_{max}$
- Another set is based on an alternative assessment conducted with an ad-hoc rebuilding of historical discards. In this set, improvement in selection patterns have also been investigated. It thus includes.
  - A status-quo F simulation
  - A 10% decrease in F towards F_{max}
  - A drastic improvement in selection pattern (H2, see above) at constant F
  - A drastic improvement in selection pattern with a 10% decrease in F towards F_{max}.

5.5 No policy change

It is important to note that the so-called F_{pa} scenario tested by SGBRE-07-03 corresponds to a status quo (or no policy change scenario) as the current value of F estimated by ICES (2007) is very close to the F_{pa} defined for this stock.

6 BASELINE SITUATION FOR EACH MS OF THE FISHERY IN ECONOMIC AND SOCIAL TERMS

6.1 Spain

The Northern Hake catches made by the Spanish fleet are concentrated on a single fleet named the "300 fleet" (this fleet accounts for all the Spanish catches of Northern Hake). It is captured in a wide area covering the Western Atlantic Waters (ICES sub-areas VI-VII and Divisions VIIIabd). The different métiers existing in this fleet catch Hake sometimes as a single species fishery (longliners and pair trawlers), as a target species in a mixed fishery context, where up to 30 species are captured (netters and part of the bottom single trawlers), and finally fisheries targeting some other species (mainly anglerfish and megrim) which is the case of the remaining bottom single trawlers.

By the end of the 70's this fleet consisted of more than 500 vessels but the situation changed in 1986. When Spain entered the EEC, the fleet authorized to fish in these waters was composed of 300 boats with the following mean technical characteristics:

Table 6.1.1: Capacity indicators of the Spanish "300 Fleet" in 1986

Gear	Nº of Boats	GRT	HP
Trawl	201	234	796
Fixed gears	100	207	699
Total	300	225	759

Source: Adhesion Treaty of Spain to the EEC (1985) Fixed gears: long-line and gill net.

After Spain entered the EEC the different Multi Annual Guidance Programmes (MAGP) implemented had a great impact on this fleet, reducing the number of vessels. In 2000 this fleet consisted of 199 units (Table 6.1.2).

Table 6.1.2: Capacity indicators of the Spanish "300 Fleet" in 2000

Gear	Nº of Boats	GRT	Length (m)	HP	KW
Trawl	115	210	29	685	504
Fixed gears	84	188	28	664	489
Total	199	201	29	676	497

Source: Secretaría General de Pesca Marítima (SGPM). Spanish Ministry of Agriculture, Fish and Food (2003) Fixed gears: long-line and gill net.

The distribution of the effort (in days) of this fleet by sub-units (modality) and sea area in that year is presented in Table 6.1.3.

Table 6.1.3: Geographical effort distribution of the Spanish fleet catching Northern Hake

Sub-unit	**VI**	**VII**	**VIIIabde**	**Total**
Otter Bottom Trawl	2218	16216	4226	22660
Pair Bottom Trawl	0	1538	5912	7450
Long line	2926	8252	1342	12520
Gill net	6	2046	1087	3139
Total	5150	28052	12567	45769

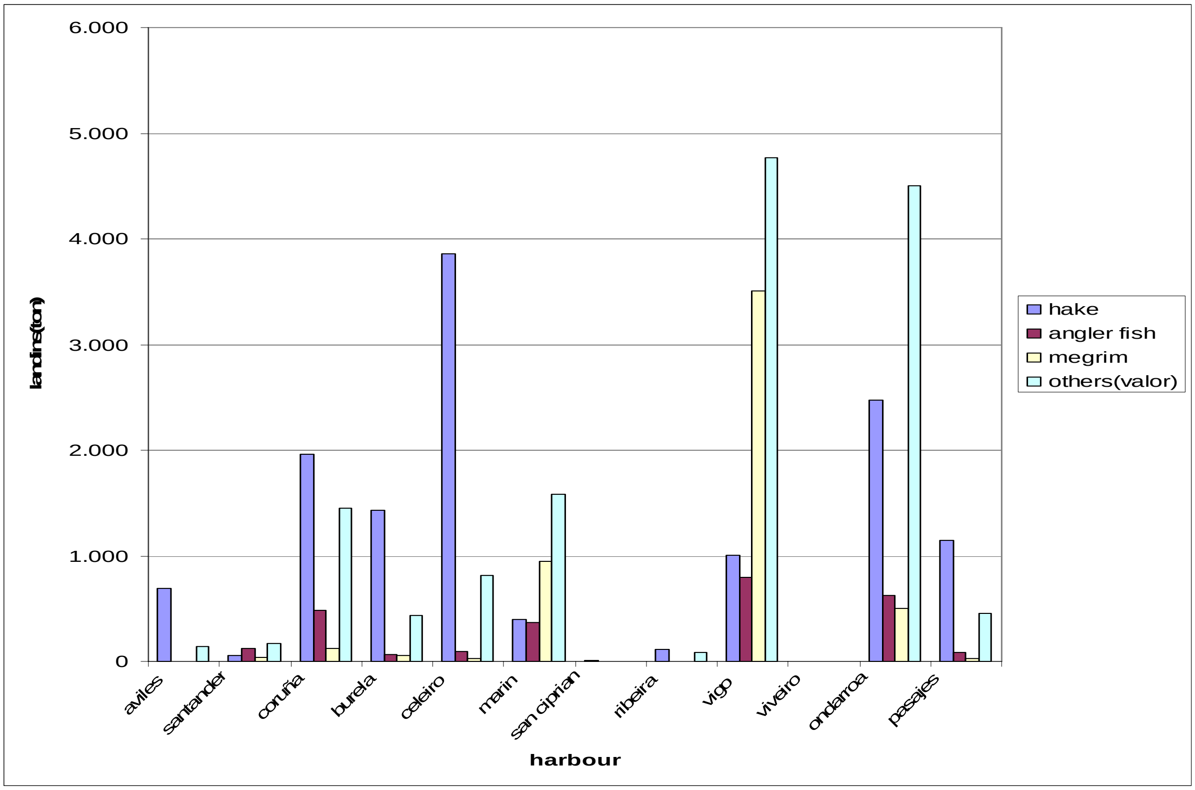
Source: SGPM. Spanish Ministry of Agriculture, Fish and Food (2003)

Big differences can be observed between sea areas, with effort representing about 10% (sub-area VI), 60% (sub-area VII) and 30% (Div. VIIIabde). This heterogeneous distribution of the fishing effort between sea areas is partly due to the existing Spanish Quota allocation by sea area on demersal fish, that practically are reduced to Hake, Anglerfish, Megrim and *Nephrops* (between the species submitted to the TACs and Quotas regime) in the mentioned sea areas. It is to be noted that not always the same ship operate in the same sea area throughout the year, depending on its tactical decisions but also on having available the access rights to each sea area.

Some 29% of Northern Hake landings in 1999 in Spain by Spanish vessels were made into the port of Celeiro, in Galicia, and 19% to Ondarroa, in Basque Country. Other important ports of Hake landings are Coruña (15%), Burela (11%), Pasajes (9%) and Vigo (8%).

Also in terms of enforcement in the Northern Hake emergency and recovery plans (Council Regulation (EC) 811/2004; Commission Regulation (EC) 1162/2001, 2602/2001 and 494/2002). it was stated that, if the vessel has more than 500 Kg. of Hake inside, it has to be communicated to the authorities of the MS and the landing ports have to be listed by the MS and reported to Commission. These ports (besides above ones) are: Santoña (Cantabria), Santander (Cantabria), Avilés (Asturias), Gijón (Asturias), Riveira (Galicia), Cariño (Galicia) and Marín (Galicia).

Figure 6.1.1: Spanish Hake landings in volume per harbour (1999)



Others: Norway lobster, whiting, horse mackerel, blue whiting.   Source: OECD (2004): Further examination of economic aspects relating to the transition to sustainable fisheries: A case of study, AGR/FI(2004)5/PART6.

In 2004 the main fishing units found for the Spanish fleet are summarised in table 6.1.4.

Table 6.1.4: Spanish Hake landings in volume per segment (2004)

Spain -Relative Hake catches (2004)		Hooks	Nets	Hooks	Nephrops Trawl	Fish Trawl	Other	
DCR Segment Fleet	**Length Class**	**FU 1**	**FU 3 + FU 13**	**FU 2 + FU 12**	**FU 8 + FU 9**	**FU 4 + FU 5 + FU 10 + FU 14**	**FU 16 + FU 00**	**Total Métier**
DTS - Targeted Nephrops	12-24m							
DTS - Targeted Fish	12-24m							
DTS	24-40m					37.97 %		**37.97%**
Pair DTS	24-40m					18.01%		**18.01%**
Hook	24-40m	29.00%		15.02%				**44.02%**
Netters	12-24m							
Netters	24-40m							
Other	-							
Total Segment Fleet		**29.00%**		**15.02%**		**55.98%**		**100%**

Source: AZTI (SEAS) and UVIGO   Netters are included in the longliners segment (fixed gears).

Table 6.1.5: Total Spanish Hake landings in volume and Value per segment (2004)

Spain (2004) – Hake catches in volume and Value

Segment Fleet	Length Class	Number of vessels catching at least 1 tonne Hake per year	Tonnes (2004)	1000 € (2004)	% Tonnes	% Value
Demersal Trawlers - Targeted Nephrops	12-24m					
Demersal Trawlers - Targeted Fish	12-24m					
Demersal Trawlers	24-40m	93	12 793	24 460	44.06 %	20.29%
Pair Demersal Trawlers	24-40m	20	2 190	6 967	7.54%	5.78%
Hook	24-40m	84	14 056	89 151	48.40%	73.94%
Netters	12-24m					
Netters	24-40m					
Other	-					
Total			29 039	120 578	100%	100%

Source: AZTI (SEAS) and UVIGO   Netters are included in the longliners segment (fixed gears).

Three types of fishing gears can be found in the Spanish fleet catching the northern stock of Hake, bottom trawlers, longliners and netters. For the case of Bottom trawlers these can be divided into two categories, single otter trawlers, that face a pure multi-species fishery, and very high vertical opening pair trawlers for which catches are composed mainly of Hake.

After analyzing the Spanish fleet data for 2003-05 from DCR data, the following problems have been detected:

- Some Spanish *sword-fisher* vessels are included in the long-liners segment with similar length.
- There is not a differentiation between trawlers form the Atlantic and Mediterranean Sea.

In consequence, the economic concepts are including figures from very different fisheries. Taking account these problems and specially that the economic Development was different for pelagic and demersal species in that period, we have not used the DCR data. Hence the data sources are those collected under the Concerted Action for the period 2002-2004 and those collected by AZTI (SEAS) .The Development of the main economic and social indicators for the period 2002-2004 for Spain are shown in Table 6.1.6.

Table 6.1.6: Economic and social indicators. 2002-2004 Spain.

Total Spanish fleet	**2002**	**2003**	**2004**
Value of landings	189998318	197382447	212056742
Fuel costs	24973512,06	27692260,56	31625389
Other running costs	19767722,52	23295065	35969018,65
Vessel costs	24150554	23171644,29	18174103
Crew share	86119392,05	87679071,67	92902552,24
Gross cash flow	34987137,37	35544405,49	33385679,12
Depreciation	23901903,64	24802801,39	26202051,86
Interest	1985390,25	2103863,322	1932882,812
Net profit	9099843,476	8637740,776	5250744,447
Gross value added	121106529,4	123223477,2	126288231,4
Invested capital	190245817,8	188652916,8	167483649,3
Employment on board	2332	2224	2199
days at the sea	50652	50562	51425
number of vessels	201	199	197

Source: AZTI (SEAS) and Dpt of Applied Economics, Univ of Vigo. Constant Euros of 2005

The following is emphasized about the economic and social indicators.

- The Gross Value Added (GVA) was increased by 1% in that period.
- The net profit, however, declined by 26% due to increasing fuel costs and other running costs.
- The crew share grew by 1% in the period 2002-04.
- The Gross cash flow (GCF) decreased by 5% in the period.
- The employment on board declined by 3%.
- The number of vessels in the fishery decreased by 1%.

Given that due to the data collecting procedure we cannot separate longliners and netters we consider only three segments: Longliners (24-40m), Demersal trawlers (24-40m) and Pair demersal trawlers (24-40m). The relevant economic and social indicators are showed in the Tables 6.1.7-6.1.9.

Table 6.1.7: Economic and social indicators. Longliners segment Spain. €

Longliners 24-40m	**2002**	**2003**	**2004**
Value of landings	83394114	83417385	90970320
Fuel costs	5856600	6124335	7300860
Other running costs	11674844	12125845	20030640
Vessel costs	8942968	8846205	3794784
Crew share	**43798768**	**44043685**	**44804508**
Gross cash flow	**13120934**	**12277315**	**15039528**
Depreciation	10536290	10413775	10711260
Interest	964318	980475	859236
Net profit	1620326	883065	3469032
Gross value added	**56919702**	**56321000**	**59844036**
Invested capital	73274924	80342340	69892704
Employment on board	**1204**	**1190**	**1176**
Days at the sea	22188	22100	21924
Number of vessels	**86**	**85**	**84**

Source: AZTI (SEAS) and Dpt of Applied Economics, Univ of Vigo

The following conclusions can be drawn regarding the longliners segment:

- The GVA was increased by 1% in that period.
- The net profit grew notably due to decreasing vessel costs, crew share, interests and depreciation costs for this segment.
- The crew share decreased by 2% in the period 2002-04.
- The GCF was increased by 4% in the period.
- The employment on board declined by 1%.
- The number of vessels in the fishery decreased by 1% in this period.

Table 6.1.8: Economic and social indicators. Demersal trawling segment Spain. €

Trawlers (S) 24-40m	**2002**	**2003**	**2004**
Value of landings	94523204	96056062	101914422
Fuel costs	17386710	18886480	21182889
Other running costs	5906584	7107810	12071121
Vessel costs	12971906	12796878	11783379
Crew share	**37869404**	**36417480**	**40876476**
Gross cash flow	**20388600**	**20847414**	**16000557**
Depreciation	12044032	12044032	12938904
Interest	894128	989632	879594
Net profit	7450440	7813750	2182059
Gross value added	**58258004**	**57264894**	**56877033**
Invested capital	116875464	107057070	97351470
Employment on board	**1128**	**1034**	**1023**
Days at the sea	24346	24064	25389
Number of vessels	**94**	**94**	**93**

Source: AZTII (SEAS) and Dpt of Applied Economics, Univ of Vigo

In relation with the trawlers, the following trends are emphasized:

- The GVA decreased by 4% in that period.
- The net profit declined due to increasing fuel costs and other running costs.
- The crew share grew by 1% in the period 2002-04.
- The GCF decreased by 14% in the period.
- The employment on board declined by 5%.
- The number of vessels in the fishery decreased by 1%.

Table 6.1.9: Economic and social indicators. Pair demersal trawling segment Spain. €

Trawlers (P) 24-40m	2002	2003	2004
Value of landings	12081000	17909000	19172000
Fuel costs	1730202,06	2681445,556	3141640
Other running costs	2186294,52	4061410	3867257,647
Vessel costs	2235679,997	1528561,29	2595940
Crew share	**4451220,055**	**7217906,667**	**7221568,235**
Gross cash flow	**1477603,368**	**2419676,487**	**2345594,118**
Depreciation	1321581,641	2344994,389	2551887,859
Interest	126944,2501	133756,3222	194052,8118
Net profit	29077,47647	-59074,22366	-400346,5529
Gross value added	**5928823,423**	**9637583,154**	**9567162,353**
Invested capital	95429,84386	1253506,8	239475,2941
Employment on board	**252**	**240**	**239**
Days at the sea	4118	4398	4112
Number of vessels	**21**	**20**	**20**

Source: AZTI and Dpt of Applied Economics, Univ of Vigo

Finally, regarding on the pair trawlers, the following is emphasized:

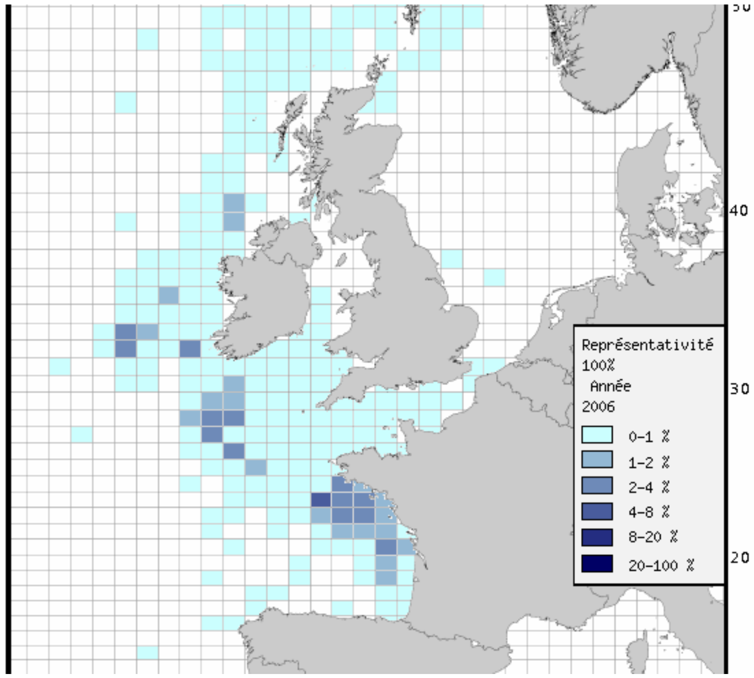
- The GVA grew by 23% in the period 2002-04.
- The net profit declined due to increasing costs.
- The crew share increased by 24% in this period.
- The GCF decreased by 22% in the period.
- The employment on board declined by 1% in this period.
- The number of vessels in the fishery decreased by 1% in this period.

6.2 France

In 2006, the French annual catches of Northern Hake (excluding catches from the Mediterranean Sea) amounted to 9,797 tonnes which represented a total value of 40.7 million euros. Northern Hake accounts for one of the major species landed by the French fishing vessels at national level and contributes to around 5% of the fresh total landings in value. If we consider the Atlantic coast vessels (excluding North Sea, Channel and Mediterranean), the Northern Hake is the 4th landed species in value behind the Common sole, Nephrops and Sea bass.

The Hake catches are mainly concentrating in the ICES fishing areas VIII (Bay of Biscay) and VII (West of Ireland) with major spots in the “Grande Vasière” (VIIIab), the Great Sole and Porcupine Bank (VIIj, VIIc).

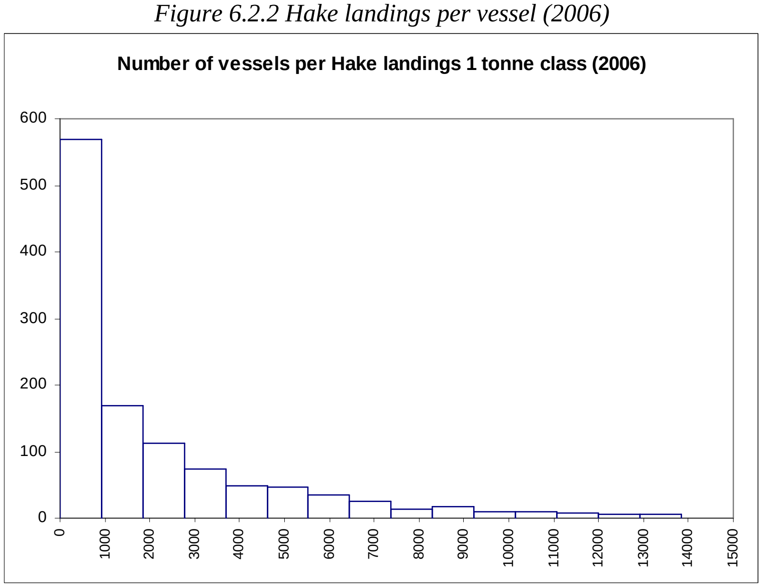
Figure 6.2.1: Geographical distribution of the French Hake catches (2006) – Northern and Southern Stock



Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

In 2006, 658 vessels could be considered as belonging to the Hake fishery. The following figure shows the huge number of vessels catching less than 1 tonne of Hake per year in 2006 (almost 600 vessels) and leads to consider in this impact assessment only vessels catching at least 1 tonne of Hake annually.

Figure 6.2.2 Hake landings per vessel (2006)



Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

The French Hake fleet represents a global capacity of 220,173 kW and 67,994 GT that is to say 32% of the total kW deployed by the French North Sea – Channel – Atlantic vessels. The employment on board (including skipper) amounts to 3,077 persons contributing to 30% of the direct employment on the French North Sea – Channel – Atlantic coast (measured in FTE).

These vessels (catching at least 1 tonne of Hake per year) are heterogeneous in terms of gears used and size of the hull. This heterogeneity generates variability of economic indicator, therefore vessels were assigned to more homogeneous sub segments. The DCR segmentation criteria (dominant gear * Length class) has been retained for the gathering of vessels into homogeneous segments regarding economic indicators. On this basis, 5 segments are considered: Demersal Trawl (12-24m), Demersal Trawl (24-40m), Hook (24-40m), Netters (12-24m), Netters (24-40m).

Moreover, a deeper analysis of the Demersal Trawl (12-24m) segment shows two different groups of vessels regarding their catch composition and their exploitation patterns (length distribution of the Hake landings, discards). This is the consequence of practising two different "métiers" (or combination of gear*target species). Based on their individual fishing calendars, the vessels belonging to the DT segment (12-24m) have been subdivided into two sub-segments: DTS "targeting Nephrops" for vessels targeting Nephrops at least 4 months per year and DTS "targeting Fish" for the others.

Finally, 6 segments are retained for the analysis and they contribute to around 90% in volume and value to the total Northern Hake landings of the French vessels registered in the North Sea, Channel and Atlantic fishing harbours.

Table 6.2.1: Northern Hake landings France per segment fleet (2006)

			Hake landings			Segment Contribution	
DCR Segment Fleet	**Length Class**	**Number of vessels**	**Tonnes (2006)**	**1000 € (2006)**	**Price €/kg**	**% Tonnes**	**% Value**
Demersal Trawl Segment – Targeting Nephrops	12-24m	204	952	3 888	4.08	10%	10%
Demersal Trawl Segment - Targeting Fish	12-24m	106	420	1 866	4.44	4%	5%
Demersal Trawl Segment	24-40m	55	1 111	4 308	3.88	11%	11%
Hook	24-40m	5	728	2 995	4.11	7%	7%
Netters	12-24m	60	1 747	7 585	4.34	18%	19%
Netters	24-40m	18	3 775	15 370	4.07	39%	38%
Other	-	210	1 063	4 734	4.45	11%	12%
Total		**658**	**9 797**	**40 745**	**4.16**	**100%**	**100%**

Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

Netters are the major contributors to the French Hake landings (57% in volume and value) with 78 vessels in 2006. Particularly, the large netters (24-40m) contribute to almost 40% of the Hake total landings in France. The Demersal trawler segment (DTS) contribute to 26% to the total landings with 365 vessels catching at least 1 tonne of Hake in 2006.

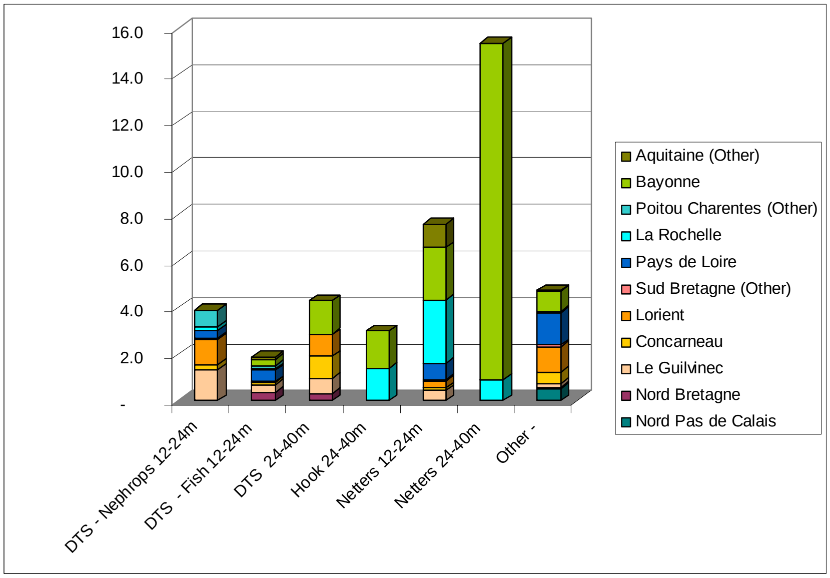
Table 6.2.2: Geographical distribution of the vessels (2006)

	DTS - Nephrops 12-24m	DTS - Fish 12-24m	DTS 24-40m	Hook 24-40m	Netters 12-24m	Netters 24-40m	Other -	Total
Nord Pas de Calais							8	**8**
Nord Bretagne		21	11		2		6	**40**
Le Guilvinec	105	26	9		3		16	**159**
Concarneau	14	8	13		2		38	**75**
Lorient	38		7		7		20	**72**
Autres Sud Bretagne (Douarnenez, Audierne, Auray, Vannes)	5	2	1		4		7	**19**
Pays de Loire	13	22	2		15		76	**128**
La Rochelle	9	6		2	4	2	2	**25**
Oléron, Marennes	20	4			3		4	**31**
Bayonne		7	12	3	9	16	30	**77**
Arcachon		10			11		3	**24**
TOTAL	**204**	**106**	**55**	**5**	**60**	**18**	**210**	**658**

Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

The large netters are registered in the South Atlantic harbours (Bayonne mostly) and benefit from the proximity of Spain in terms of market opportunities. On the other side, trawlers are mostly located in the South Brittany fishing harbours (Le Guilvinec, Concarneau and Lorient).

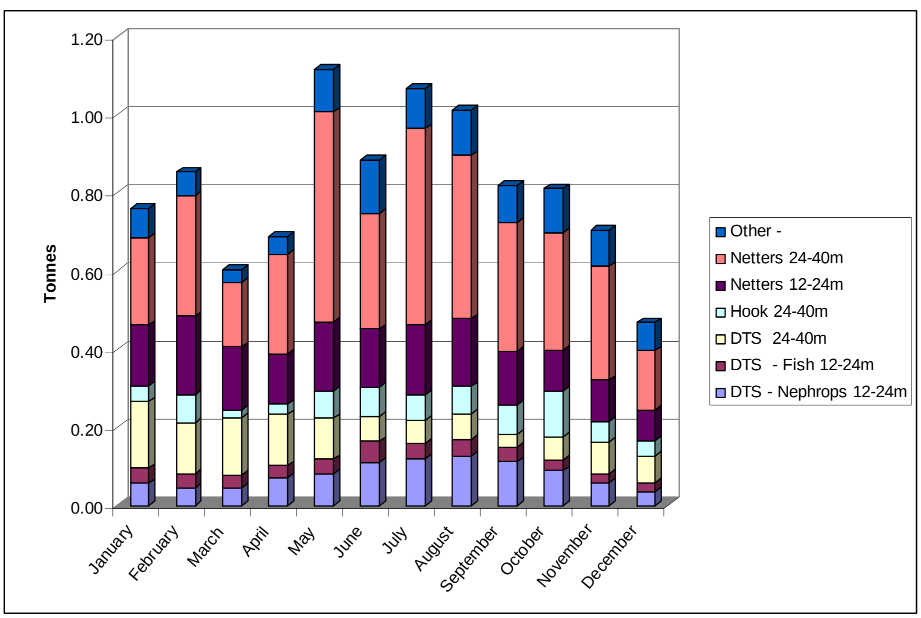
Figure 6.2.3: Geographical distribution of Hake landings (2006)



Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

Due to the geographic location of vessels, the Hake landings are mainly concentrated in the ports of the French South Atlantic. More than 50% of the 2006 landings (in value) come from vessels registered in the port of Bayonne; 13% in the port of La Rochelle. In total, the whole South Brittany harbours accounts for 21% of the total production of Hake in value.

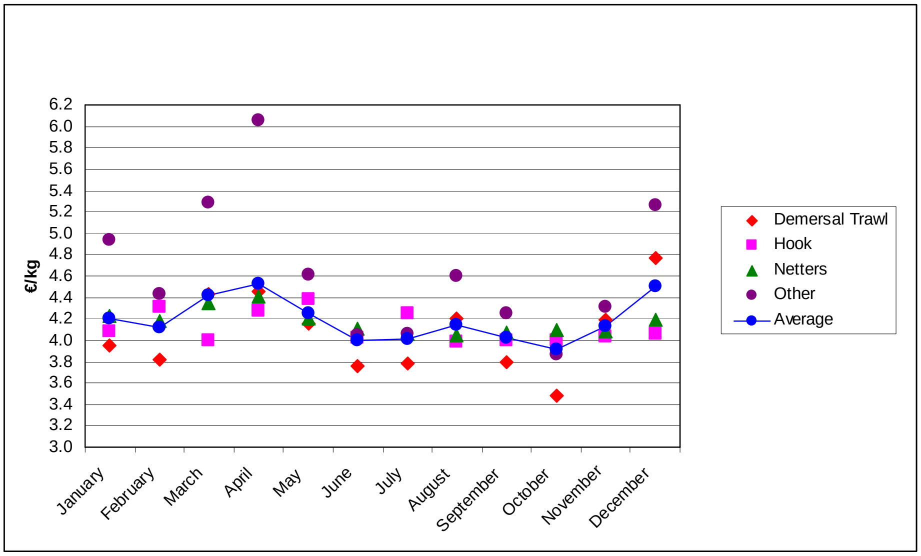
Figure 6.2.4: Seasonality of Hake landings (2006)



Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

The analysis of landings per month doesn't show a marked seasonality in Hake landings. Based on 2006 data, Hake landings occur all along the year actually between 600 to 800 tonnes per month with the exception of the period from May to August where the large netters are increasing their contribution to the total landings.

Figure 6.2.5: Seasonality of Hake landing prices (2006)



Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

The Hake quayside price varies between 4.0 and 4.6 €/kg in average. The price correlates with the seasonality of landings. An increasing trend is observed from January to April, followed by a decrease from April to July. This period is corresponding to an increase in landings particularly due to the contribution of large netters. Then, the price remains quite stable between July and October and observes again an increasing trend from October to December.

In general, prices registered by trawlers are below the average and prices registered by the category "Other" are much higher than average. As it will be seen in the description of vessels per segment, the average size of vessels belonging to this "Other category" is lower and these very coastal vessels are expected to land fresh fish with higher value.

The contribution per segment fleet to the total landings of Hake can be refined using the fleet*métier (or fleet*FU) based approach in order to implement more detailed bio economic analysis. For convenience, the different FUs considered in the biological analysis were gathered into larger FUs (ICES 2007).

*Table 6.2.3: The French Hake landings in volume (the fleet * métier based approach) (2006)*

		Nets	**Hooks**	**Nephrops Trawl**	**Fish Trawl**	**Other**	
DCR Segment Fleet	**Length Class**	**FU 3 + FU 13**	**FU 2 + FU 12**	**FU 8 + FU 9**	**FU 4 + FU 5 + FU 10 + FU 14**	**FU 16 + FU 00**	**Total Métier (FU)**
DTS - Targeting Nephrops	12-24m			952 (10%)			**952 (10%)**
DTS - Targeting Fish	12-24m				420 (4%)		**420 (4%)**
DTS	24-40m				1 111 (11%)		**1 111 (11%)**
Hook	24-40m		728 (7%)				**728 (7%)**
Netters	12-24m	1 747 (18%)					**1 747 (18%)**
Netters	24-40m	3 775 (39%)					**3 775 (39%)**
Other	-					1 063 (11%)	**1 063 (11%)**
Total Segment Fleet		**5 523 (56%)**	**728 (7%)**	**952 (10%)**	**1 531 (16%)**	**1 063 (11%)**	**9 797 (100%)**

Source: IFREMER (SIH-ISIH) - Ministry of Agriculture (DPMA-BCS)

This fleet-métier based approach could be very useful for the definition of specific management measures rather then aiming for a general objective of Global Fishing Mortality reduction. As fleets (or métiers) do not have identical or even similar exploitation patterns targeting F tailored to the specific fleet segment/métier would account for these differences and would be more effective and efficient in the management set up.

The following table gives an indicator of Hake dependency of each segment measured with the contribution of Hake in their total landings in volume and value. A very strong dependency on Hake is observed for both netters 24-40m (for which Hake landings represent more than 80% of the total landings) and Hook 24-40m (77% of the total gross earnings). This dependency is much lower for all trawlers.

Table 6.2.4: Hake and other specie dependency per segment fleet, France (2006)

DCR Segment Fleet	Length Class	Number of vessels	% Tonnes	% Value
HAKE				
Demersal Trawl Segment - Targeting Nephrops	12-24m	204	5%	4%
Demersal Trawl Segment - Targeting Fish	12-24m	106	2%	2%
Demersal Trawl Segment	24-40m	55	5%	6%
Hook	24-40m	5	71%	77%
Netters	12-24m	60	29%	20%
Netters	24-40m	18	81%	84%
NEPRHOPS				
Demersal Trawl Segment - Targeting Nephrops	12-24m	204	24%	45%
ANGLERFISH				
Demersal Trawl Segment - Targeting Nephrops	12-24m	204	11%	12%
Demersal Trawl Segment - Targeting Fish	12-24m	106	17%	27%
Demersal Trawl Segment	24-40m	55	17%	27%
SOLE				
Netters	12-24m	60	29%	46%

Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

A brief analysis of the catch composition of each fleet segment shows the relative importance of Nephrops and Anglerfish for the DTS 12-24m “targeting Nephrops” (respectively 45% and 12% of the total earnings), Anglerfish for the DTS 12-24m “targeting fish” and DTS 24-40m (27% of the total earnings for each) and Sole for the Netters 12-24m (46% of the total earnings).

The analysis of contribution and dependency is fundamental for the impact assessment. It must be supplemented with a presentation of the total and average capacity and fishing effort deployed by each segment. Despite their low level of dependency towards Hake, trawlers deploy an important capacity and effort which could be an issue as it concerns mixed fisheries.

Table 6.2.5: Capacity and Employment per fleet segment (2006)

DCR Segment Fleet	Length Class	Number of vessels	Total kW	Total GT	Total Days at sea	Total Employment (FTE)
DTS - Targeting Nephrops	12-24m	204	60 260	14 028	32 290	759
DTS - Targeting Fish	12-24m	106	39 694	11 440	21 470	490
DTS	24-40m	55	32 342	13 030	14 471	389
Hook	24-40m	5	2 648	1 191	1 118	62
Netters	12-24m	60	17 177	4 810	10 299	351
Netters	24-40m	18	9 168	4 464	4 499	223
Other	-	210	58 884	19 031	20 278	803
Total		**658**	**220 173**	**67 994**	**104 426**	**3 077**

Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

Table 6.2.6: Average features of vessels (capacity, effort, employment) per fleet segment (2006)

DCR Segment Fleet	Length Class	Number of vessels	Average kW	Average GT	Average length (m)
DTS - Targeting Nephrops	12-24m	204	295	69	17
DTS - Targeting Fish	12-24m	106	374	108	20
DTS	24-40m	55	588	237	30
Hook	24-40m	5	530	238	32
Netters	12-24m	60	286	80	18
Netters	24-40m	18	509	248	30
Other	-	210	280	91	15

DCR Segment Fleet	Length Class	Average crew	Average Days at sea	Average age of vessels	Average Age of skipper (if vessel owner)
DTS - Targeting Nephrops	12-24m	4	158	19	42
DTS - Targeting Fish	12-24m	5	203	18	42
DTS	24-40m	7	263	20	-
Hook	24-40m	12	224	34	-
Netters	12-24m	6	172	19	43
Netters	24-40m	12	250	27	-

Source: Ministry of Agriculture (DPMA-BCS) - IFREMER SIH-ISIH

Trends in economic indicators during the period 2004-2006 are analysed fleet by fleet. Data used are coming from the IFREMER SIH dataset and partly contribute to the calculation of the French Annual Economic Indicators for the Module J of the DCR. Insofar as the DCR historical economic indicators do not distinguish running costs from vessels costs within operational costs, they cannot be used for the EIAA model.

Table 6.2.7: The French sample for the calculation of Economic indicators

		Number of vessels			Economic sample	
DCR Segment Fleet	**Length Class**	**Total**	**Hake fishery**	**%**	**Total**	**%**
DTS - Targeting Nephrops or Fish	12-24m	447	310	69%	42	9%
DTS	24-40m	82	55	67%	16	20%
Hook	24-40m	6	5	83%	4	67%
Netters	12-24m	136	60	44%	28	21%
Netters	24-40m	19	18	95%	8	42%

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

The fleet segments considered in this impact assessment are subsets of large DCR segments for which economic data are collected. The average cost structure of larger segments is assumed to be valid for subsets of the segment

*** Demersal Trawl Segment - Targeting Nephrops 12-24m**

- Between 2005 and 2006, despite the increase in fuel costs, increase in GVA due to increase in value of landings and decrease in other operational costs:
- Between 2005 and 2006, slight decrease in employment and nominal effort while capacity indicators remained quite the same, increase in invested capital.
- No major change in profitability during the period (near zero).

Table 6.2.8: Economic Indicators for the DTS Targeting Nephrops segment 12-24m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Demersal Trawl Segment - Targeting Nephrops 12-24m**		
	2004	**2005**	**2006**
Economic indicators			
Value of landings	98.4	95.1	98.1
Fuel costs	16.5	18.5	20.2
Other running costs	11.7	10.3	9.7
Vessel costs	23.7	23.1	22.9
Crew share	34.9	32.5	32.1
Gross cash flow	11.6	10.7	13.2
Depreciation	9.4	9.2	8.8
Interest	1.3	1.4	1.6
Net profit	0.9	0.1	2.8
Gross value added	46.5	43.2	45.4
Other economic indicators			
Employment on board (FTE)	873	816	759
Invested capital (mEUR)	146.5	130.5	141.9
Effort (1000 days at sea)	34.5	33.1	32.3
Capacity indicators			
Volume of landings (1000t)	23.7	21.3	20.1
Fleet - number of vessels	211	202	204
Fleet - total GRT (1000)	9.9	9.6	9.6
Fleet - total GT (1000)	14.4	13.8	14
Fleet - total kW (1000)	61.4	59.3	60.3

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

*** Demersal Trawl Segment - Targeting Fish 12-24m:**

- Between 2005 and 2006, strong decrease in capacity and nominal effort while a minor increase appeared between 2004 and 2005

NB: In this particular segment where Hake is not a major species, the threshold of 1 tonne for Hake could be the reason for the important inter-annual variation of nominal effort.

Table 6.2.9: Economic Indicators for the DTS Targeting Fish segment 12-24m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Demersal Trawl Segment - Targeted Fish 12-24m**		
	2004	**2005**	**2006**
Economic indicators			
Value of landings	89.8	98.4	77.6
Fuel costs	15.1	19.2	15.9
Other running costs	10.7	10.6	7.7
Vessel costs	21.6	23.9	18.1
Crew share	31.8	33.6	25.4
Gross cash flow	10.6	11.1	10.5
Depreciation	8.6	9.5	7.0
Interest	1.2	1.5	1.3
Net profit	0.8	0.1	2.2
Gross value added	42.4	44.7	35.9
Other economic indicators			
Employment on board (FTE)	658	696	490
Invested capital (mEUR)	92.4	93.0	73.7
Effort (1000 days at sea)	28.6	30.9	21.5
Capacity indicators			
Volume of landings (1000t)	29.9	31.6	22.5
Fleet - number of vessels	133	144	106
Fleet - total GRT (1000)	9.4	10.2	7.8
Fleet - total GT (1000)	13.7	14.8	11.4
Fleet - total kW (1000)	49.5	52.9	39.7

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

*** Demersal Trawl Segment 24-40m**

- Decrease in capacity of effort during the period but mainly between 2005 and 2006
- Fuel costs and running costs remain high while a strong decrease in the value of landings is observed in 2006
- Net profits are negative or around 0 during the period.

Table 6.2.10: Economic Indicators for the DTS 24-40m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Demersal Trawl Segment 24-40m**		
	2004	2005	2006
Economic indicators			
Value of landings	75.8	79.5	67.5
Fuel costs	14.0	16.8	15.4
Other running costs	9.1	7.8	7.1
Vessel costs	21.8	19.9	16.2
Crew share	23.5	24.2	20.1
Gross cash flow	7.5	10.8	8.7
Depreciation	9.4	9.4	8.1
Interest	1.5	1.3	1.6
Net profit	-3.4	0.1	-1.0
Gross value added	30.9	35.0	28.9
Other economic indicators			
Employment on board (FTE)	549	499	389
Invested capital (mEUR)	89.4	73.0	66.3
Effort (1000 days at sea)	18.6	18	14.5
Capacity indicators			
Volume of landings (1000t)	29.2	29	22.3
Fleet - number of vessels	68	66	55
Fleet - total GRT (1000)	12.4	11.9	10.2
Fleet - total GT (1000)	15.9	15.3	13
Fleet - total kW (1000)	40.5	38.9	32.3

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

* Hook 24-40m

- No vessels in this segment before 2006
- Profitability around 7% of the capital invested

Table 6.2.11: Economic Indicators for the Hook segment 24-40m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Hook 24-40m**		
Economic indicators	**2004**	**2005**	**2006**
Value of landings	0.0	0.0	3.9
Fuel costs	0.0	0.0	0.5
Other running costs	0.0	0.0	0.4
Vessel costs	0.0	0.0	0.7
Crew share	0.0	0.0	1.5
Gross cash flow	0.0	0.0	0.8
Depreciation	0.0	0.0	0.3
Interest	0.0	0.0	0.2
Net profit	0.0	0.0	0.3
Gross value added	0.0	0.0	2.3
Other economic indicators			
Employment on board (FTE)	0	0	62
Invested capital (mEUR)	0	0	4.4
Effort (1000 days at sea)	0	0	1.1
Capacity indicators			
Volume of landings (1000t)	0	0	1
Fleet - number of vessels	0	0	5
Fleet - total GRT (1000)	0	0	1
Fleet - total GT (1000)	0	0	1.2
Fleet - total kW (1000)	0	0	2.6

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

*** Netters 12-24m**

- Slight decrease in capacity and effort between 2005 and 2006 after a strong increase between 2004 and 2005.
- Between 2005 and 2006, strong decrease in GCF and Net profit due to increase in fuel costs and vessel costs while value of landings remains quite stable
- Decrease in profitability between 2005 and 2006 but remains positive.

Table 6.2.12: Economic Indicators for the Netters segment 12-24m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Netters 12-24m**		
Economic indicators	**2004**	**2005**	**2006**
Value of landings	29.9	37.3	37.9
Fuel costs	1.6	2.2	3.0
Other running costs	2.6	3.2	3.1
Vessel costs	7.4	7.6	9.7
Crew share	12.1	14.9	15.0
Gross cash flow	6.2	9.5	7.1
Depreciation	2.4	2.4	2.8
Interest	0.3	0.5	0.6
Net profit	3.6	6.6	3.7
Gross value added	18.3	24.4	22.2
Invested capital	24.6	31.2	30.8
Other economic indicators			
Employment on board (FTE)	345	364	351
Invested capital (mEUR)	24.6	31.2	30.8
Effort (1000 days at sea)	10	11.1	10.3
Capacity indicators			
Volume of landings (1000t)	5.6	6.6	6
Fleet - number of vessels	56	62	60
Fleet - total GRT (1000)	3	3.4	3.2
Fleet - total GT (1000)	4.7	5.1	4.8
Fleet - total kW (1000)	16.5	18.2	17.2

Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

* Netters 24-40m

- Slight decrease in capacity and effort between 2005 and 2006 (move to the "hook fleet" after change in the fishing strategy) after an increase between 2004 and 2005.
- Decrease in profitability between 2005 and 2006 but remains high.

Table 6.2.13: Economic Indicators for the Netters segment 24-40m. (2004-2006). m€

Population of vessels landing at least 1 tonne of Hake per year	**Netters 24-40m**		
Economic indicators	**2004**	**2005**	**2006**
Value of landings	20.7	25.5	18.3
Fuel costs	1.8	2.4	1.7
Other running costs	2.2	2.4	1.5
Vessel costs	3.9	4.3	3.8
Crew share	6.0	10.0	7.3
Gross cash flow	6.8	6.4	4.0
Depreciation	2.4	1.9	1.4
Interest	0.3	0.6	0.4
Net profit	4.1	3.9	2.2
Gross value added	12.8	16.4	11.3
Invested capital	28.2	21.8	17.2
Other economic indicators			
Employment on board (FTE)	241	266	223
Invested capital (mEUR)	28.2	21.8	17.2
Effort (1000 days at sea)	5.2	5.4	4.5
Capacity indicators			
Volume of landings (1000t)	5.2	6.7	4.6
Fleet - number of vessels	20	21	18
Fleet - total GRT (1000)	3.6	3.9	3.2
Fleet - total GT (1000)	4.7	5.2	4.5
Fleet - total kW (1000)	10.4	10.8	9.2

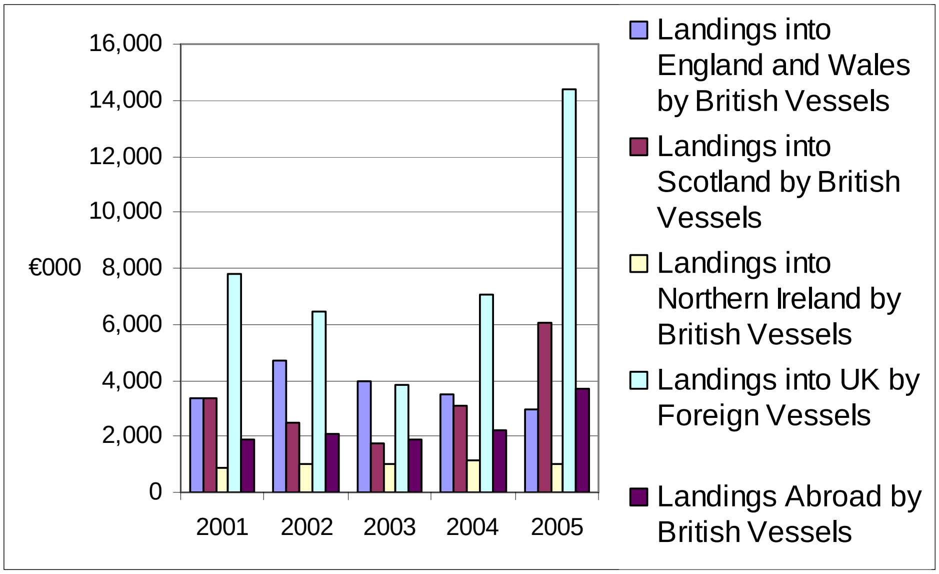
Source: IFREMER SIH – Ministry of Agriculture (DPMA/BCS)

6.3 The British Fishery for Northern Hake

Geographical Importance of the Fishery

British registered vessels receive 10.7% of the European Union's Total Allowable Catch (TAC) of Northern Hake. In 2005, landings of Hake into the United Kingdom and abroad by British vessels were worth some €13.5m and amounted to 3,600 tonnes, only 87% of the quota. This represents 1.6% of the value of all landings of fish and shellfish into the United Kingdom and abroad by British vessels and 3.9% of demersal landings. Hake is thus the ninth most important demersal species to the British fleet.

Figure 6.3.1: Landings into UK and Abroad by British Vessels and Landings into UK by Foreign Vessels, 2005

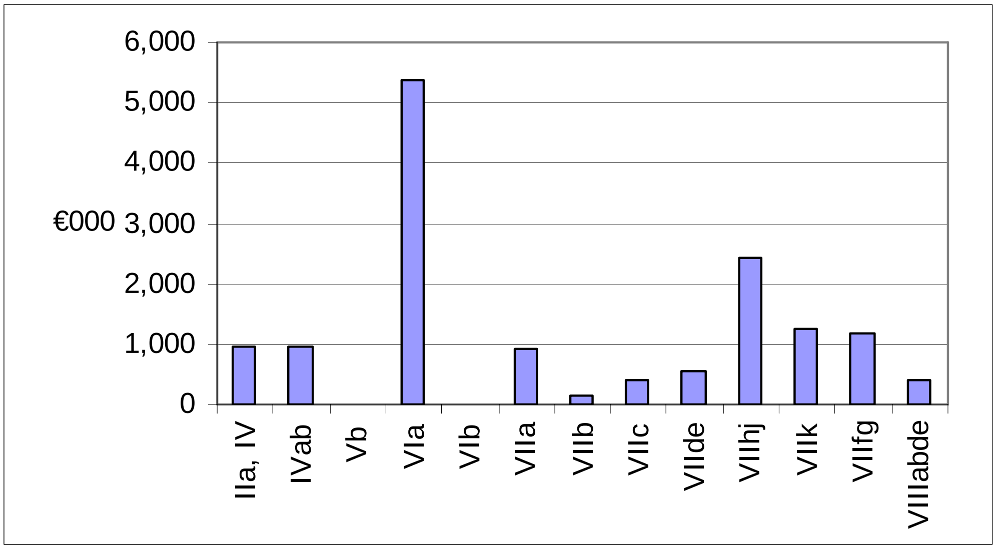


Source: MFA

The bulk of the quota is allocated to the large group of ICES sea areas off the west and south coasts of Great Britain. Only 6% of the British quota is allocated to the North Sea (0.6% of the EU TAC). This is reflected in the location of landings.

In 2005, 40% of landings by value were sourced from ICES sub-area VIa off the west coast of Scotland. Of the sea areas off the south-west coast of England, sub-areas VII h and j provided 18%, VIIk 9%, and VII f and g 9%. The Irish Sea, sub-area VIIa provided 7% of landings. Thus while the fishery is to be found right round the British Isles, it is concentrated off the west coast of Scotland and is of local importance to the south west of England. Figure 6.3.2 shows the sources by ICES subarea.

Figure6.3.2: Source of Hake Landings by Value into the UK and Abroad by British Vessels, 2005

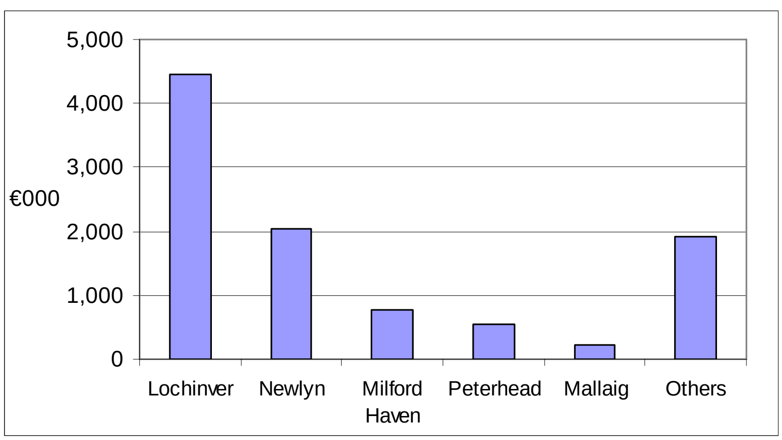


Source: MFA

The source of landings is reflected in the location of landings around the British coast, although it is worth bearing in mind that the ICES sub-areas are not of equal size. Sub-area VIa is comparatively large while the opposite is true of the combined sub-areas VI h and j.

Some 45% of landings in 2005 into the United Kingdom by British vessels were made into the port of Lochinver on the west coast of Scotland. 20% were landed into Newlyn in the south-west of England, and 8% to Milford Haven in the south-west of Wales. 6% were landed at Peterhead on the north east coast of Scotland bordering the North Sea. The value of landings of Hake into the major receiving ports is shown in Figure 6.3.3.

Figure 6.3.3: Value of Landings of Hake into the United Kingdom by British Vessels, by Port, 2005



Source: MFA

Hake landings into Lochinver contributed 39% of the value of landings there and 51% of demersal landings. Many of the vessels fishing for Hake are Spanish-owned and, while carrying the British flag and subject to the British rules relating to economic links, land directly into Spain or land into the UK for their catches to be trans-shipped. As such the potential value-added is lost to the British economy although there is little demand for Hake among British consumers. Hence the reliance on Hake on-shore in Britain is low.

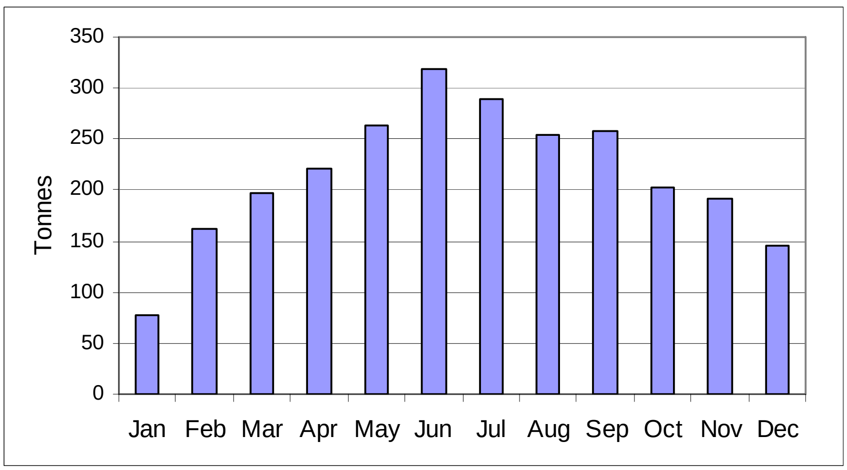
83% of landings abroad by British-registered vessels were into Spain and 14% into the Republic of Ireland. In total, landings abroad were worth €3.6m in 2005.

Foreign registered vessels also land into the United Kingdom, Spain offering some 78% and France 22% of landings by foreign vessels. The total value of these landings in 2005 was €14m.

Newlyn, England's most important port by value of landings, represents a partial exception to the general pattern. The local fleet is British owned and Hake is the fourth most important species landed, after megrims, monks, and soles, providing 9% of landings by value. The fish is landed and sent through the local auction and from there most is sent to Spain. There are 10 to 12 vessels of between 12m and 20m registered length with crews of 3 to 5, fishing by gill nets. These vessels are approximately 50% dependent on Hake for their earnings. This implies that of the approximately 50 jobs at sea, some 25 are dependent on the Northern Hake. Scaling this figure up implies that about 200 jobs in the UK fishery out of a total of 11,500 full-time equivalent jobs owe their existence to Hake fishing.

Although the fishery takes place throughout the year, springtime and summer see the greatest volume and value of landings. The pattern of landings for 2005 is shown in Figure 6.3.4.

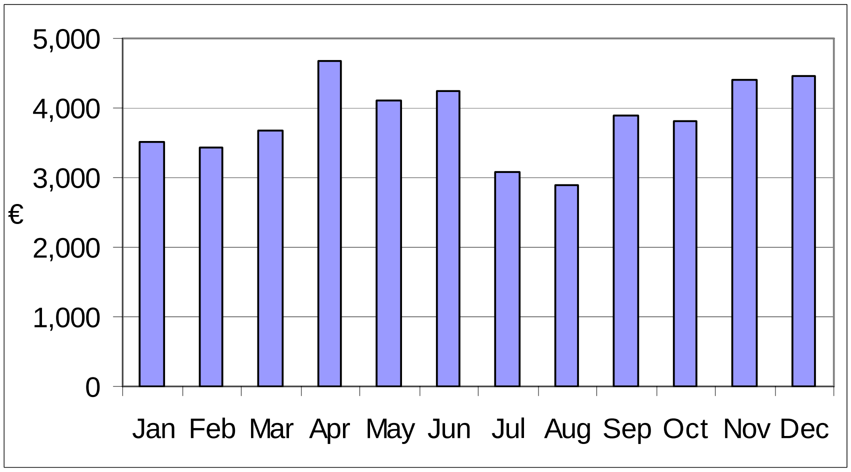
Figure 6.3.4: Seasonality of Hake Landings demonstrated by the monthly landings by British vessels into the United Kingdom for 2005



Source: MFA

Prices also reflect some seasonality, being best when the quality of the fish is at its best in the late spring and responding to fewer landings in winter. The prices obtained in 2005 by month are shown in figure 6.3.5. These averages disguise considerable volatility related to supplies from around the world.

Figure 6.3.5: Monthly Prices of Hake landed into the United Kingdom by British Vessels, 2005.



Source: MFA

The Management System

The British fishery for Hake is carried out under the framework of rules set by the Common Fisheries Policy. These include a national quota subdivided from the European Union's Total Allowable Catch (TAC), limitations on days at sea, and technical conservation measures, most importantly governing mesh sizes for fishing nets and minimum landing sizes for individual fish.

Quota in the United Kingdom is managed in a number of ways. Where vessels of 10 metres and over registered length are members of a Producer Organisation (PO) a quota is allocated to their PO according to the vessels' track record in the years up to 1999 when the system, known as Fixed Quota Allocation was introduced. It is then up to the PO to manage the quota as its members agree. In effect this has become an Individual Transferable Quota System since vessels can exchange their quota among themselves. POs may also exchange quota for other quota or cash.

Vessels of 10 metres registered length and over which are not members of a Producer Organisation receive an allocation of quota based on their track record.

Vessels under 10m registered length fish from a pool of the quota, usually 10% of the total, set aside for them.

There are currently no limitations on the number of days a vessels may spend at sea fishing for Hake. The minimum mesh size permitted on nets is 120mm (diamond).

A minimum landing size of 27cm is in place. This is generally lower than for most *gadoids* but reflects market demand in Spain which is for smaller fish which are considered to be better flavoured.

Fleet Costs and Earnings

The returns for the fleet segment most commonly fishing for Hake is shown in Table 6.3.1.

Table 6.3.1: Summarised Costs and Earnings for British Demersal Trawlers, Average 2003 to 2005. m€

	Average 2003-2005
Demersal trawl and seine 12-24 m	
Value of landings	149.3
Crew share	75.5
Gross cash flow	-52.5
Net profit	-78.9
Gross value added	23.0
Operating profit margin	-52.8%

Source: Concerted Action

Unfortunately, no data exists to explain the importance of Hake within the landings of this fleet beyond the general comment above. The demersal trawl fleets in Britain have been under considerable pressure in recent years because of cut backs in quota, most notably but by no means exclusively, for North Sea cod. It is probable that the fleets fishing off the west of Scotland and the south west of England have suffered less than their compatriots fishing exclusively in the North Sea, but many of the larger Scottish trawlers fish in both the North Sea and off the Scottish west coast.

6.4 The Irish Fishery for Northern Hake

The geographical Importance of the Fishery

Hake are taken by vessels fishing all round the Irish coast but it is of most importance in the South West, notably to Castletownbere and Dingle, but there is little demand for Hake among Irish consumers and most is transported to Spain with minimal processing. Thus, despite being the sixth most important species to the Irish whitefish fleet, little value-added is derived on-shore.

Most fish is caught by the larger polyvalent vessels using seine nets or gill-nets as well as demersal trawl, generally as a bycatch along with megrims, anglerfish, and other whitefish.

Recent Irish Quotas for the Hake, megrim, and anglerfish are shown in table 6.4.1.

Table 6.4.1: Irish Quotas for Hake, Megrim and Anglerfish, 2005 to 2007

Species	**2005**	**2006**	**2007**
Hake	1,318	1,358	1,629
Megrims	3,562	3,402	3,362
Anglerfish	2,370	2,474	2,644

Source: European Commission

The Management System

The Irish fisheries fall under the scope of the Common Fisheries and the quotas allocated to Ireland are currently operated as a pool available to all. When a quota is deemed to have been reached the authorities may close the fishery.

There are also limitations to fishing effort which are similarly operated as a pool system. The minimum mesh permitted in the fishery is 100mm and the minimum landings size is the EU 27cm limit.

Fleet Costs and Earnings

The Irish whitefish fleet does not target Hake, but the species is the sixth most valuable whitefish landed in Ireland by Irish vessels. The average price of Hake from 2000 to 2004 was €3,420 per tonne. It is therefore one of the more valuable species and this would value the Irish quota at some €5.5m. It has not been possible to obtain data on the contribution of each species to the fleet segments analysed. An average of the performance of Irish whitefish vessels over the three year 2002 to 2004 is shown in Tables 6.4.2 a and b.

Table 6.4.2: Summarised Costs and Earnings for Irish Whitefish Vessels, Average 2003 to 2005. m€

a)

	Average 2003-2005
Demersal trawl and seine 12-24 m	
Value of landings	63.5
Crew share	15.8
Gross cash flow	9.4
Net profit	7.9
Gross value added	25.2
Operating profit margin	12.4%

Source: Concerted Action

b)

	Average 2003-2005
Demersal trawl and seine 24-40 m	
Value of landings	32.9
Crew share	7.5
Gross cash flow	7.3
Net profit	6.4
Gross value added	14.8
Operating profit margin	19.4%

Source: Concerted Action

The profit margins shown for both fleet segments appear rather higher than might have been expected. The whitefish fishery is acknowledged to have been experiencing significant levels of overcapacity and the Irish government has introduced a de-commissioning scheme intended to reduce capacity to the level of fishing opportunities. Severe excess capacity in a fleet means that the fleet is unlikely to be covering its depreciation charges and is therefore effectively making losses. It would appear that these segments are currently operating in a niche which is more profitable than the whitefish fishery as a whole.

7 ECONOMIC IMPACTS FOR EACH MS BASED ON MODEL PREDICTIONS OF THE LONG TERM PLAN AND CURRENT MANAGEMENT

7.1 Methodology

The economic impact is assessed by use of a special version of the EIAA model that has been developed and used for assessment of economic repercussions of TAC/quota changes since 2002. The EIAA model is explained in SEC (2004) 1710[1].

The model is calibrated by using data for three years that are averaged to level out natural variation. This is named the base period. The data originates from different sources and the model combines the data. The required data input is costs and earnings information and landings compositions of species per fleet segment, see section 4. Further the model is calibrated by use of the agreed initial TAC/quotas for the base period, see Council Regulations about TAC,

http://ec.europa.eu/fisheries/legislation/other/conservation2003_en.htm#tacs .

The originally developed model calculates the economic repercussions for two years each by use of proposed future TAC/quotas and spawning stock biomasses plus a long run case in which it is assumed that stocks are recovered. By nesting a series of models is possible to make projection for more years.

A ten years period is normally enough to capture the recovery period for fish stocks subjected to management plans. If a longer time horizon is required it is assumed that the situation in year ten is describing the subsequent years. In this way the model calculates the economic result for number of years that is specified be it 15, 20, or maybe 30 years.

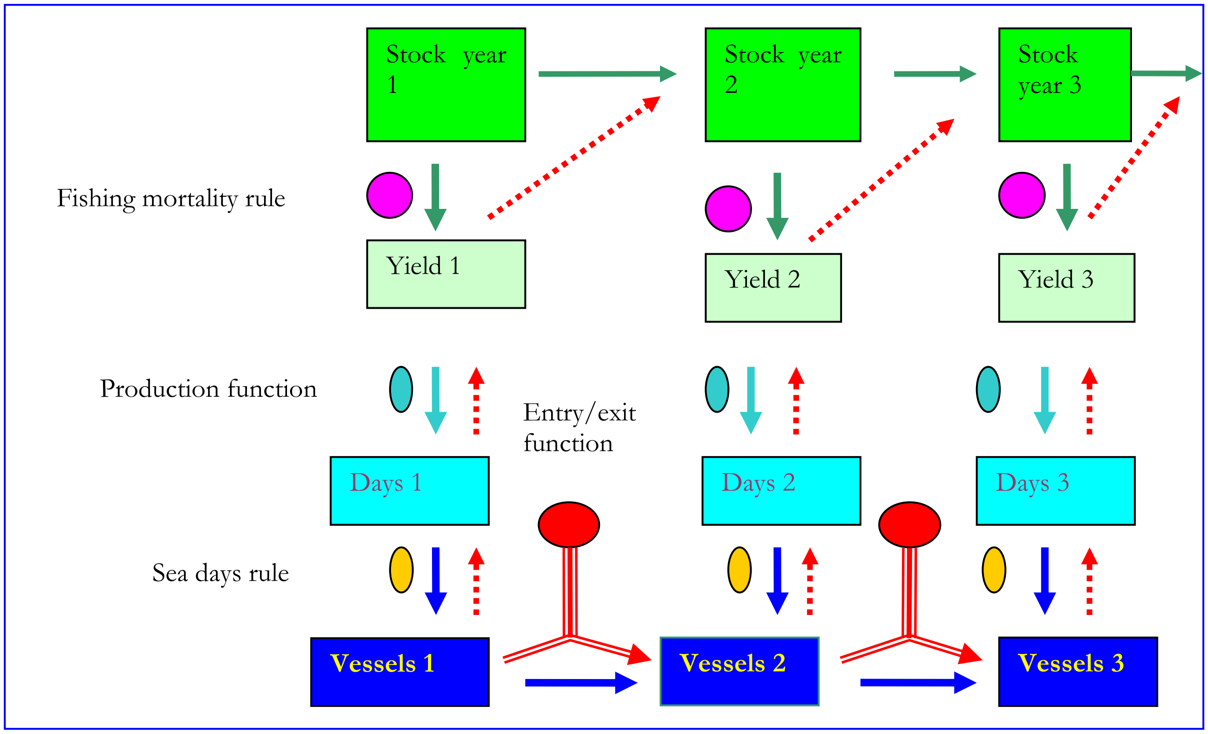
In most cases long time horizons are not of interest because the task is to compare scenarios aiming at selecting the best management plan. Longer time horizons than 10 years will not change the rank of the scenarios only the magnitude of the economic benefit.

The calculations are then carried out by use of the base period information as input to calibrate the model and then the projected stock biomasses and yield in terms of landings where landings is the yield minus the discard. If discard information is not available the projected yield is used as a proxy for the landings.

The procedure used in the calculation of the Hake Recovery plan is shown in flow chart 1. The rectangles are variables and the ovals are control rules. The solid arrows show the causal direction in an output based approach while the dotted lines show the causal direction in an input based approach.

[1] SEC (2004) 1710 "The Potential Economic Impact on Selected Fishing Fleet Segments of TACs Proposed by ACFM for 2005 (EIAA-model calculations). Report of the Scientific, Technical and Economic Committee for Fisheries (STECF), Subgroup on Economic Assessment (SGECA) (Brussels 27-29 October 2004). Commission Staff Working Paper, Brussels, 23.12.2004. http://ec.europa.eu/fisheries/publications/factsheets/legal_texts/sec_2004_1710_en.pdf

Figure 7.1.1: The working procedure of the EIAA model.



The output based approach is used as the stocks and yield are calculated simultaneously by use of a harvest control rule for the fishing mortality rate. Stock and yield are used simultaneously in the production function to calculate the required number of sea days to catch the yield of the stocks. Finally, the number of vessels is kept constant or alternatively calculated by use of a sea day rule concerning the number of sea days per vessels. The dependant (flexible) variable in the system that secures a solution is the sea days variable. If the fishing mortality rule and the sea days rule do not match, the system cannot be "solved" in one step and an iterative procedure must be applied where all the other variables are changed.

An input based system is shown by the dotted lines. In this system the number of vessels is controlled both by use of a sea days control rule specifying sea days per vessel; the landings and the yield are calculated. Hence the stock size can be calculated. In this system the dependant variables are the yield and the stocks that fluctuate over time.

Finally, both approaches can be supplemented by and entry/exit function that determines the number of vessels. Entry/exit can be controlled by use of restriction on the number of vessels and decommissioning programmes.

The output and the input approach cannot be used at the same time unless rather complex models are used. These models are able to distinguish between which of the harvest control rules is the most restrictive and then chose whether the causality goes along the solid lines or the dotted lines. The EIAA model uses the output based approach taken the harvest control rule for fishing mortality and hence the projection of the stocks and the yields as given.

7.2 Selected scenarios and assumptions

The scenarios selected for further investigation are derived from the working group of Northern Hake long-term management plans, Lisbon 4-8- June 2007.

The baseline is the scenario for the precautionary fishing mortality rate (F_{pa}) i.e. fishing mortality rate fixed according to the precautionary principle. The value of F_{pa} is 0.25 (Lisbon report page 19). This value is close to the status quo fishing mortality rate.

The baseline has been compared to a number of scenarios, nine in total. In the first group, F has been reduced annually down to F_{max} by 5%, 10% and 15% respectively. In the second and third group the same procedure has been used down to 80% of F_{max} and 120% of F_{max} respectively, see the following text table 7.2.1.

Table 7.2.1: The nine scenario tested against the baseline scenario

Fmax (0.17)	80% of Fmax (0.136)	120% of Fmax (0.204)
5%	5%	5%
10%	10%	10%
15%	15%	15%

For Spain three segments have been investigated. The base period is 2002-2004 as regards costs and earnings. The quotas for 2005 and 2006 are the agreed quotas. From 2007 all quotas except for Hake are the quotas for 2006. For Hake the projected stock biomasses and yield is used from 2007.

For France four segments have been investigated. The base period is 2004-2006 as regards cost and earnings. The quotas for 2007 are equal to the agreed quotas for 2006 except for Hake where the projected stock biomasses and yield is used from 2008.

The period over which discounting takes place is nine years. The net present value is calculated in fixed base period prices at January 1'st 2007 for Spain and January 1'st 2008 for France.

These differences between countries are not important however as emphasize is placed on comparison of scenarios. What is important, however, is that the scenarios within each country are evaluated for the same period.

Further the most important model assumptions are

1. Landings and stock biomass of Northern Hake are the ones calculated by the "Lisbon WG"
2. Landings and stock biomasses of all other species are kept constant on 2007 level forward
3. The relative stability between Member States is adhered to
4. The uptake ratio (landings/quota) is calculated for the base period and used forward
5. The share of the quota per fleet segment is constant and is calculated in the base period, that implies that the landings composition per fleet segment will change over time
6. Prices of the species have been kept constant over time but varies across fleet segments according to the prices recorded for the base period
7. No account is taken for FU (fleet segments) exploiting different age groups, which develops differently over the recovery period
8. The effort in terms of sea days is calculated as a function of landings and stock biomass by use of an inverse Cobb-Douglas function linked to the landings and the stock biomass development
9. Effort varies proportionately (exponent 1) with the landings but less than proportionately with stock biomass (exponent 0.6). Effectively this implies increasing

returns to scale i.e. landings increase more than proportionately with the increase in effort and stock biomass.

10. Effort is driven by all the species in the landings composition of each fleet segment
11. Fishing costs is a linear function of sea days
12. Crew share is a fixed proportion of the landing value
13. Fixed costs are kept constant i.e. the number of vessels in each segment is kept constant
14. Discount rate is 5% and 10%
15. Number of years for which discounting has been performed is 9 years i.e. it is assumed that the recovery period is less than 10 years.

The costs and earnings information used in the model appears from section 6. It is assumed that there are no major changes in the fleet cost structure between the base period and the projection period starting form 2007.

The agreed quotas for Hake in the relevant management areas are shown in Table 7.2.2. There are differences between the agreed quotas and the projected yield from the Lisbon working group. This difference is not important however as the assessment is made for 2007 and onwards.

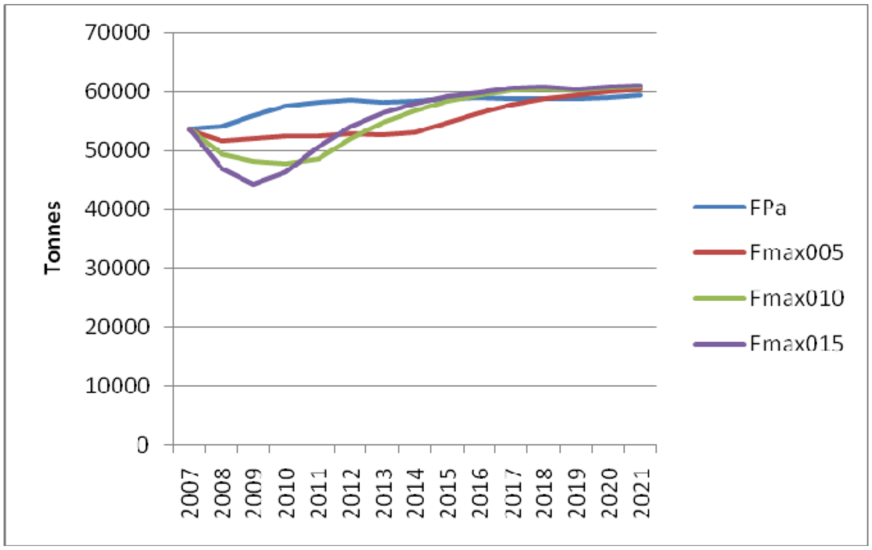
Table 7.2.2: Hake quotas as agreed by the Council of Ministers in December

Management area	*2002*	2003	2004	2005	2006	2007
Vb,VI,VII,XII,XIV	15118	16823	21926	23888	24617	29541
VIIIabde	10083	11220	14623	15932	16419	19701
Total	25201	28043	36549	39820	41036	49242

Source: http://ec.europa.eu/fisheries/legislation/other/conservation2003_en.htm#tacs.

The projections commence with 53 600 tonnes in 2007. The data input for landings is shown in figure 7.2.1 for the case where F is reduced down to F_{max}. It is noticed that the current fishing mortality, indicated by the F_{pa}, shows that landings increase slightly to a level at around 60 000 tonnes. The scenarios showing the adjustments to F_{max} are developing differently with the highest present reduction in landings for the 15% annual decrease down to F_{max} but also with the fastest recovery.

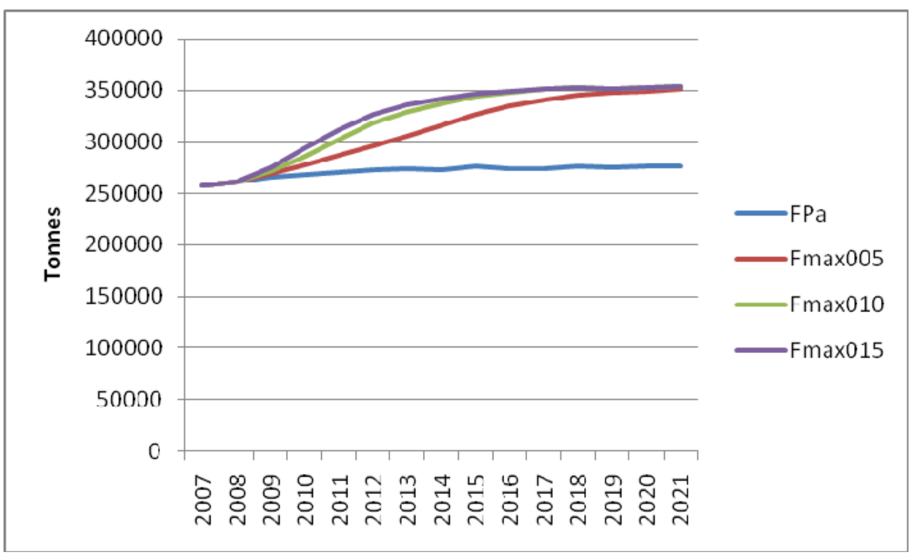
Figure 7.2.1: Projected yield (landing) for the Fmax case



In general terms costs will decrease when landing go down and increase when landings go up. However costs will also be influenced by the stock density. Higher stock density will increase catch per unit effort and hence decrease costs relative to landings.

The impact of the stock density is shown in figure 7.2.2. All scenarios in the F_{max} case converge towards 350.000 tonnes biomass, however at different speed.

Figure 7.2.2: Projected stock biomass for the Fmax case



The results of the calculations are shown country by country below. Five indicators are used to show the result. The indicator "gross value added" encompasses the remuneration of labour and capital and is a proxy for the contribution to GDP. In general it is noticed that the differences between the scenarios are not large. This is mainly caused by the fact that Hake constitutes only a fraction of the total landing value and all other species are kept constant.

The scenario F_{pa} is chosen as the baseline scenario. The scenario F_{pa} is the best. The reason for this result is, mainly, that there is no reduction in landings in the early years and the stock biomass does not decline. For the other scenarios the negative impact of the reduction in short term landings is not counterweighted by the increase in stock biomasses.

In the table below the summary of the base line situation in the relevant Hake fisheries as have been used in the model runs is presented.

Table 7.2.3: Summary characteristics fleet segments included in evaluation

			Hake landings		Hake dependency (% of Hake in total landings per segment fleet)		Present in EIAA modelling
		Number of vessels	tonnes	millions €	volume	value	
Spain (2004)							
Demersal Trawlers	24-40m	93	12,793	24,460	21%	24%	YES
Pair Demersal Trawlers	24-40m	20	2,190	6,967	43%	36%	YES
Hook	24-40m	84	14,056	89,151	97%	98%	YES
Total Spain		**197**	**29,039**	**120,578**	**35%**	**59%**	
France (2006)							
Demersal Trawl Segment - Targeted Nephrops	12-24m	204	952	3,888	5%	4%	YES
Demersal Trawl Segment - Targeted Fish	12-24m	106	420	1,866	2%	2%	NO
Demersal Trawl Segment	24-40m	55	1,111	4,308	5%	6%	YES
Hook	24-40m	5	728	2,995	71%	77%	NO
Netters	12-24m	60	1,747	7,585	29%	20%	YES
Netters	24-40m	18	3,775	15,370	81%	84%	YES
Other	-	210	1,063	4,734	-	-	NO
Total France		**658**	**9,796**	**40,746**			
UK (2005)							
Scottish demersal fleet	12-40m.			4,500			NO
Demersal Trawlers	12-40m.			2000		50%	NO
Total UK			**3,600**	**13,500**			
Ireland			n.a.	n.a.			

7.3 France

The result presented in table 7.3.1 show the combined result for four French fleet segments including netters 12-24m and 24-40m, demersal trawl 12-24m targeting *nephrops*, and demersal trawl 24-40m. The period considered in this first analysis is from 2008 to 2016 and the scenarios do not take discards into account.

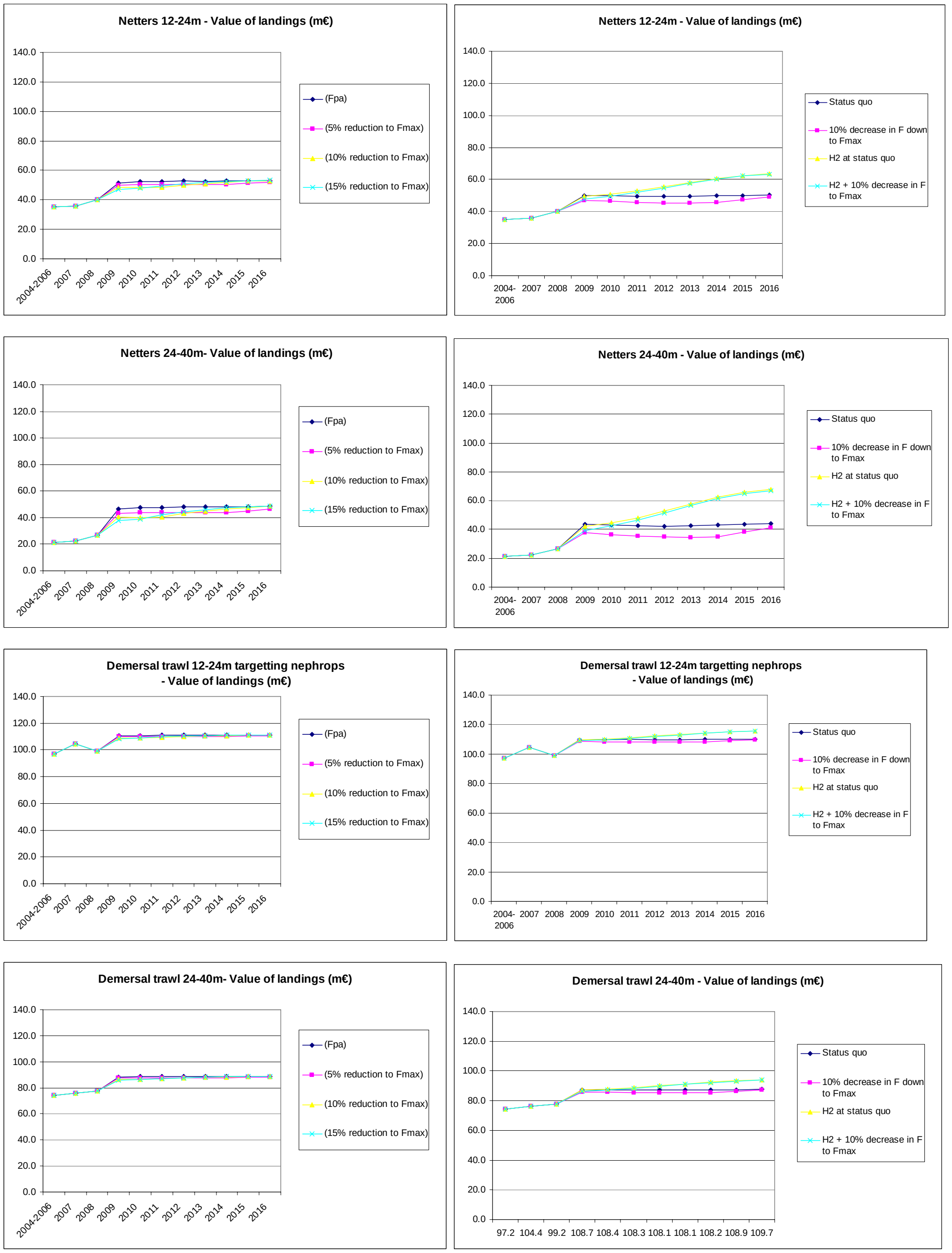
With emphasizes on the indicator “gross value added” and taking account the uncertainty in the input data of the model, there is no significant difference between the 4 following scenarios: F_{pa}, 120% of the F_{max} and adjustment of F with 5%, 10% or 15% per year until the F target has been reached. However, the slope of the trend slightly differs in the case of the Netters 24-40m. The increase in value of landings and in GVA is slower under the 120% of F_{max} scenario and with the 15% reduction per year scenario at the beginning of the period but develops to a higher value at the end than we see for the other fleet segments. Under a constant price assumption, this implies lower landings of Hake on the market at the beginning of the period for this scenario.

Table 7.3.1: Net present value at 5% and 10% discount rates for four fleet segments for the period 2008 – 2016. m €

	5%	**10%**	**5%**	**10%**	**5%**	**10%**
Baseline (F_{pa})						
Value of landings	2077	1674	2077	1674	2077	1674
Crew share	699	564	699	564	699	564
Gross cash flow	394	317	394	317	394	317
Net profit	207	165	207	165	207	165
Gross value added	**1093**	**880**	**1093**	**880**	**1093**	**880**
	To Fmax		***To 80% of Fmax***		***To 120% of Fmax***	
5% reduction						
Value of landings	2032	1639	2026	1635	2054	1655
Crew share	686	553	684	552	693	558
Gross cash flow	383	308	381	306	391	313
Net profit	196	156	194	154	203	161
Gross value added	**1069**	**861**	**1065**	**858**	**1084**	**871**
10% reduction						
Value of landings	2027	1633	1994	1608	2057	1656
Crew share	685	552	674	543	694	559
Gross cash flow	385	308	373	299	393	314
Net profit	197	156	186	147	205	163
Gross value added	**1070**	**859**	**1047**	**842**	**1087**	**873**
15% reduction						
Value of landings	2029	1633	1989	1602	2059	1659
Crew share	686	552	673	542	695	560
Gross cash flow	387	309	374	299	394	316
Net profit	199	157	187	147	207	164
Gross value added	**1073**	**861**	**1047**	**841**	**1089**	**876**

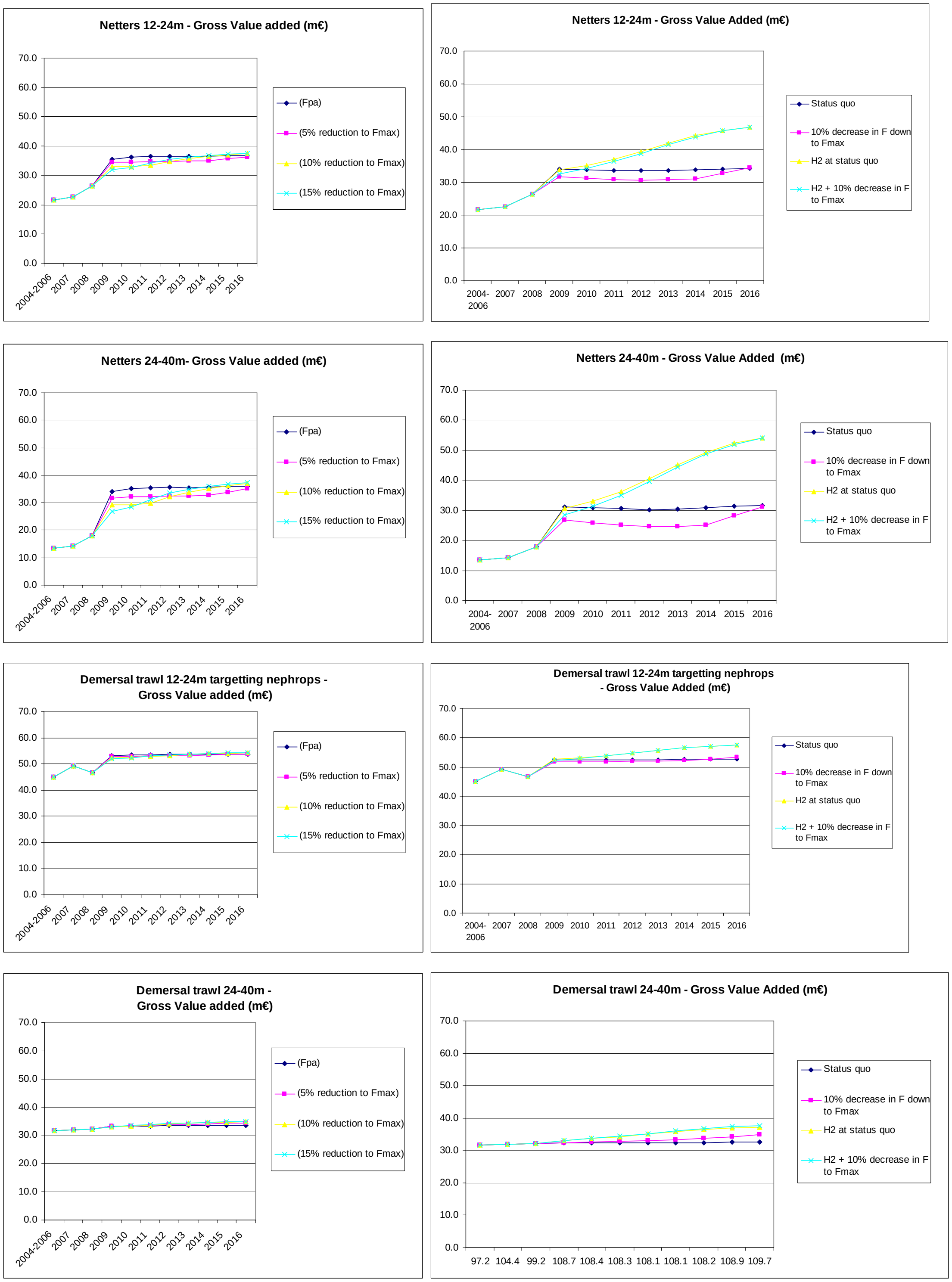
Looking at the economic impact of different scenarios (with and without discards) using the EIAA Model, in the figure below the trends in value of landings per fleet show that the best scenarios are obviously the ones based on change in exploitation patterns. These scenarios will be largely more beneficial for netters and large netters in particular.

Figure 7.3.1: The trends in value of landings per fleet



The increase in gross value added observed within the segments of "netters 24-40m." and "netters 12-24m." confirms the benefits of changes in exploitation patterns scenarios, as shown in the figure below.

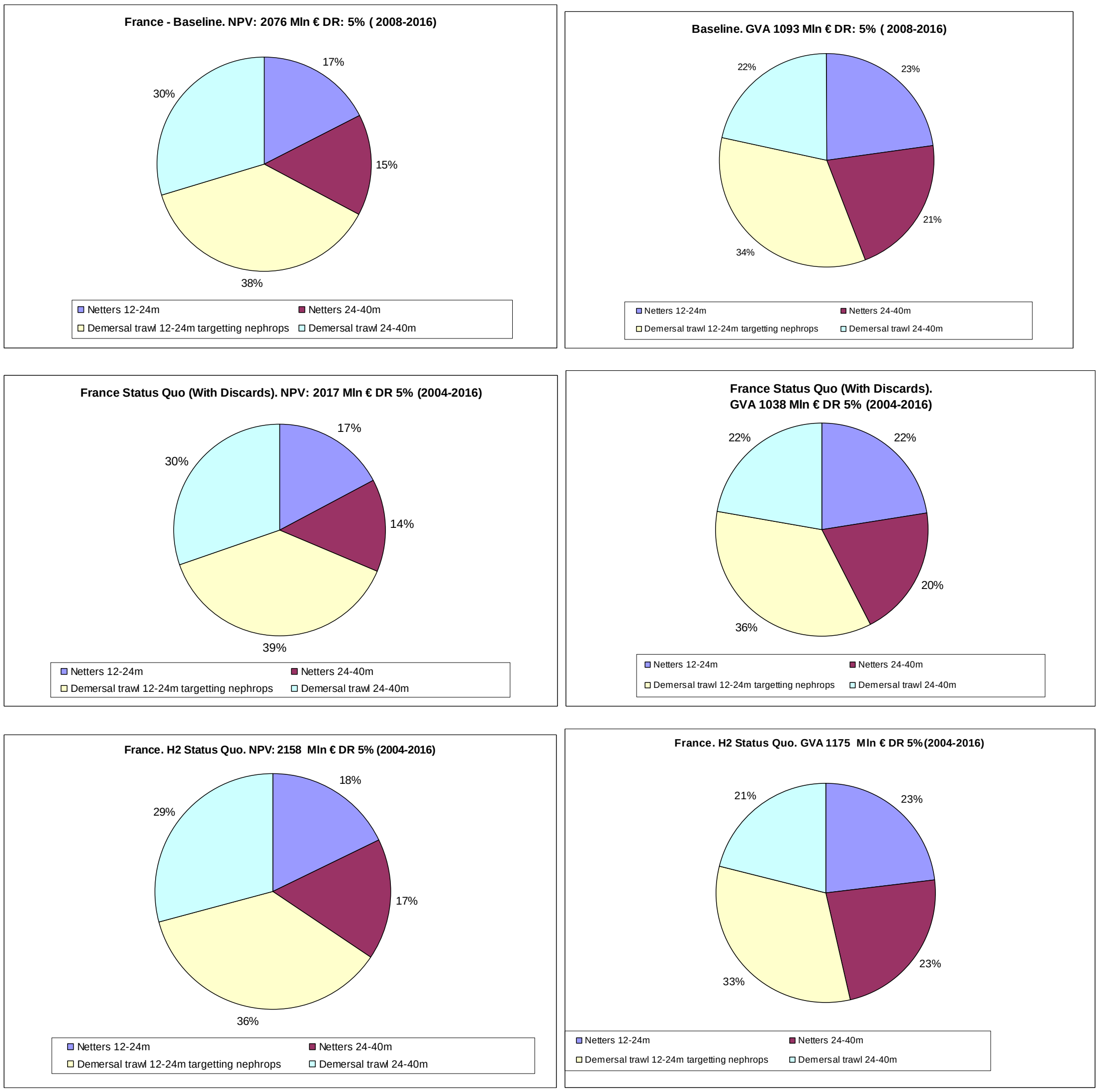
Figure7.3.2: The trends in Gross Value Added



In the figure below the results of the different scenarios indicated as share per fleet are presented. The discounting rate is assumed to be 5%. The figure presents both the Net Present Value and the Gross Added Value. The calculation of the net present values confirms that the best scenario is the scenario consisting of improving drastically the exploitation pattern by reducing catches of smaller sized Hake. Compared to the baseline situation (without discards), the expected net present value of landings is 3% higher and the expected gross value added some 8%. Moreover, this scenario will lead to a modification of the structure of the hake fishery with an increased share devoted to netters. This conclusion is even more notable with the analysis of the gross value added due to the current cost structure of this fleet and the lower impact of the rise of fuel price for this fleet.

Figure 7.3.3 The trends in Net Present Value of landings and Gross Value Added under different scenarios for the French Fleet

Net Present Value of landings **Gross Value added**



7.4 Spain

The results presented in table 7.4.1 show the combined result for three Spanish fleet segments comprising long liners 24-40m, trawlers (S) 24-40m, and trawlers (P) 24-40m.

As mentioned in the chapter for France, there is no significant difference between the different scenarios. With emphasize on the indicator "gross value added" the best scenario seems to be a continuation of the way the fishery is conducted currently i.e. at the level of F_{pa}. The second best solution is to aim at 120% of F_{max} and adjust with 15% per year until the target has been reached; however, the result is almost the same whether the adaptation is carried through quickly or slowly.

Table 7.4.1: Net present value at 5% and 10% for three Spanish fleet segments for the period 2006 – 2014. m €

	To Fmax		**To 80% of Fmax**		**To 120% of Fmax**	
	5%	**10%**	**5%**	**10%**	**5%**	**10%**
Baseline (Fpa)						
Value of landings	1823	1469	1823	1674	1823	1469
Crew share	837	674	837	564	837	674
Gross cash flow	372	299	372	317	372	299
Net profit	181	144	181	165	181	144
Gross value added	**1210**	**973**	**1210**	**880**	**1210**	**973**

	To Fmax		To 80% of Fmax		To 120% of Fmax	
5% reduction						
Value of landings	1759	1421	1757	1635	1782	1436
Crew share	807	652	806	552	818	659
Gross cash flow	360	289	359	306	365	293
Net profit	168	134	167	154	174	138
Gross value added	**1167**	**941**	**1165**	**858**	**1183**	**953**
10% reduction						
Value of landings	1735	1401	1696	1608	1779	1433
Crew share	797	642	778	543	817	658
Gross cash flow	356	286	345	299	366	294
Net profit	164	131	154	147	174	138
Gross value added	**1153**	**928**	**1123**	**842**	**1183**	**951**
15% reduction						
Value of landings	1731	1396	1677	1602	1778	1432
Crew share	795	640	769	542	817	657
Gross cash flow	357	286	343	299	366	294
Net profit	165	131	151	147	175	138
Gross value added	**1152**	**926**	**1112**	**841**	**1184**	**951**

The NPV decreases by 4% and 5% for Spanish fleet in the three scenarios, respectively, compared to the baseline situation. The GVA diminishes by 1% and 5%, respectively in the three scenarios. By segments, the longline is the most affected segment in terms of NPV and GVA (5% and 7% for NPV and 5% and 6% for GVA, respectively). The NPV decreases by respectively 2 and 3 per cent for the trawler segment; and the GVA decreases by respectively 2 and 3 per cent, for the trawlers (S) and trawlers (P).

Table 7.4.2: Results by FU for Spain for the different scenarios (without considering discards)

2006-2014	Baseline(Fpa)		Fmax 5%		Fmax 10%		Fmax 15%	
FU	NPV	GVA	NPV	GVA	NPV	GVA	NPV	GVA
FU 1 Longlines 24-40m	946	689	899	657	882	646	879	645
FU 2 Trawlers (S) 24-40m	739	447	725	438	720	435	719	435
FU 3 Trawlers (P) 24-40m	137	73	134	72	133	72	133	72
	1823	1210	1759	1203	1735	1153	1731	1152

If the discards are considered in the analysis, NPV and GVA decrease by 7% in the *F_{max} 10%* scenario in comparison with the baseline situation. By segment, the longline is the most affected fleet (10 and 9%, respectively, for the NPV and GVA). The NPV decreases by 4 and 5% in the trawler (S) and trawler (P) segments, respectively; and the GVA decreases by 4 and 1%, respectively in each segment.

In the *H2 at status quo* scenario, the NPV and GVA, respectively, increase by 6 and 10 per cent for the fleet; by 9 and 13% in the longline segment; by 3 and 6% in the trawler (S); and by 4 and 9% in the trawler (P).

In the last scenario (H2+10% decrease in F to F_{max}), NPV and GVA, respectively, increase by 4 and 8% in the fleet; by 6 and 11% in the longliners segment; by 2 and 4% in the trawlers (S); and by 2 and 7% in the trawlers (P).

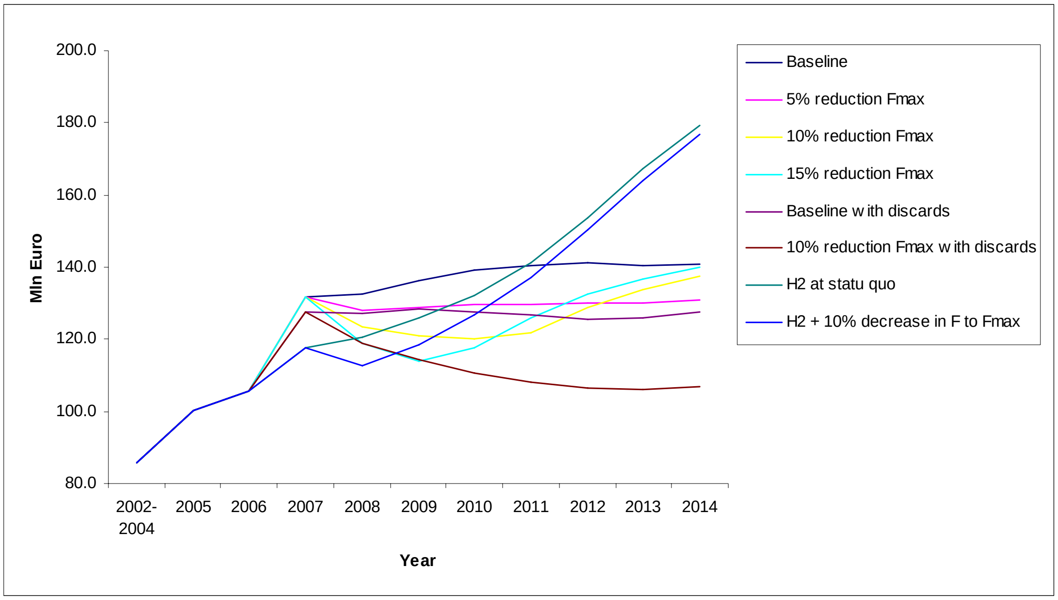
The best economic results hence are obtained under the *H2 at status quo* scenario.

Table 7.4.3: Table Results by FU for Spain for the different scenarios (considering discards)

2006-2014	Baseline (discards)		Fmax 10% (discards)		H2 at Status quo		H2 + 10% decrease in F to Fmax	
FU	NPV	GVA	NPV	GVA	NPV	GVA	NPV	GVA
FU 1 Longlines 24-40m	883	628	797	570	**962**	**712**	935	694
FU 2 Trawlers (S) 24-40m	722	430	696	414	**743**	**454**	735	448
FU 3 Trawlers (P) 24-40m	133	69	127	68	**138**	**75**	136	74
	1737	1127	1620	1052	**1843**	**1241**	1807	1217

The following figures show the trends of the different management strategies under the different assumptions about discards in the time period between 2006 and 2014.

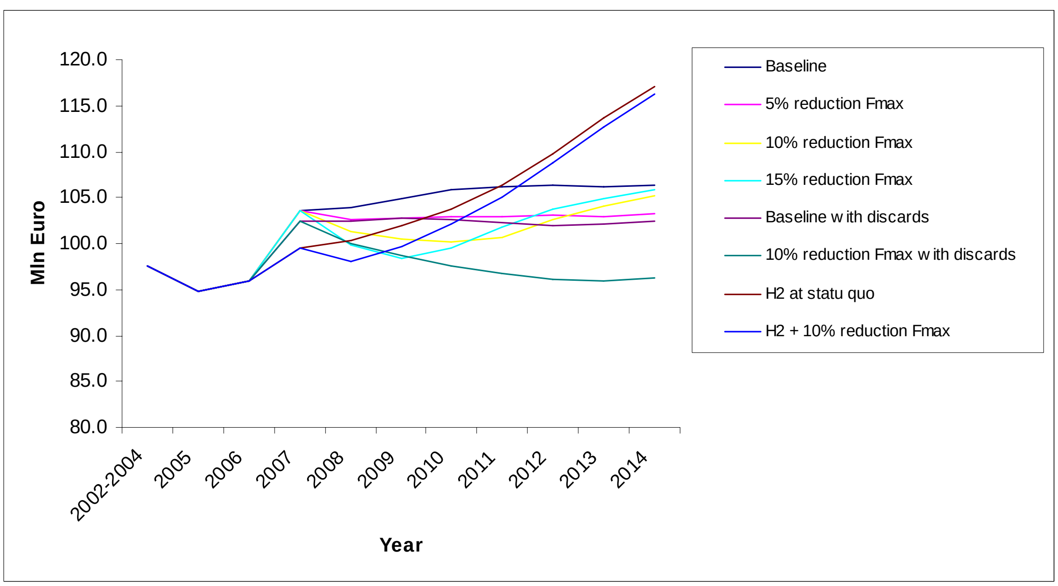
Figure 7.4.1: Development of profit for FU 1 Longlines 24-40m. (2006-2014)



Results show that the F_{PA} scenario, when not considering discards, shows the best results This result is maintained from the initial period till the end of the simulation. The short term impact is bigger the higher the degree of allowed reduction. The level of profit recovers to similar values as the baseline scenario.

If discards are taking into account a policy that changes the selection pattern to H2 gives the best results. In fact it gives the best results in the long run, even if the short term negative impact is one of the highest.

Figure 7.4.2: Development of profit for FU 2 Trawlers (S) 24-40m. (2006-2014)



The conclusions presented for FU1 are also valid for the rest of the FU for Spain in terms of NPV. In terms of GVA again results show that the best alternative is a scenario in which the selection pattern is changed, even if in the short term the reduction of the GVA is severe.

A different result is obtained if discards are not considered. Then the simulation predicts a higher value of landings for the last year of the simulations in the case of long-liners and pair trawlers (those that face a mono species - Hake - fishery). Even if this result is likely to be maintained in the next year, this is not always the case (see Robustness section).

Figure 7.4.3: Development of profit for FU 3 Trawlers (P) 24-40m. (2006-2014)

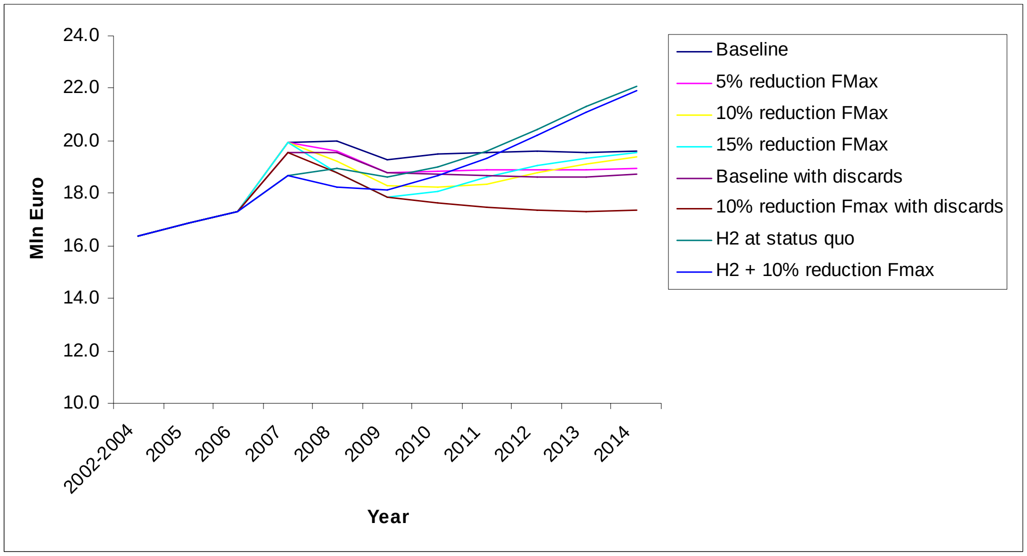


Figure 7.4.4: Development of GVA for FU 1 Longlines 24-40m. (2006-2014)

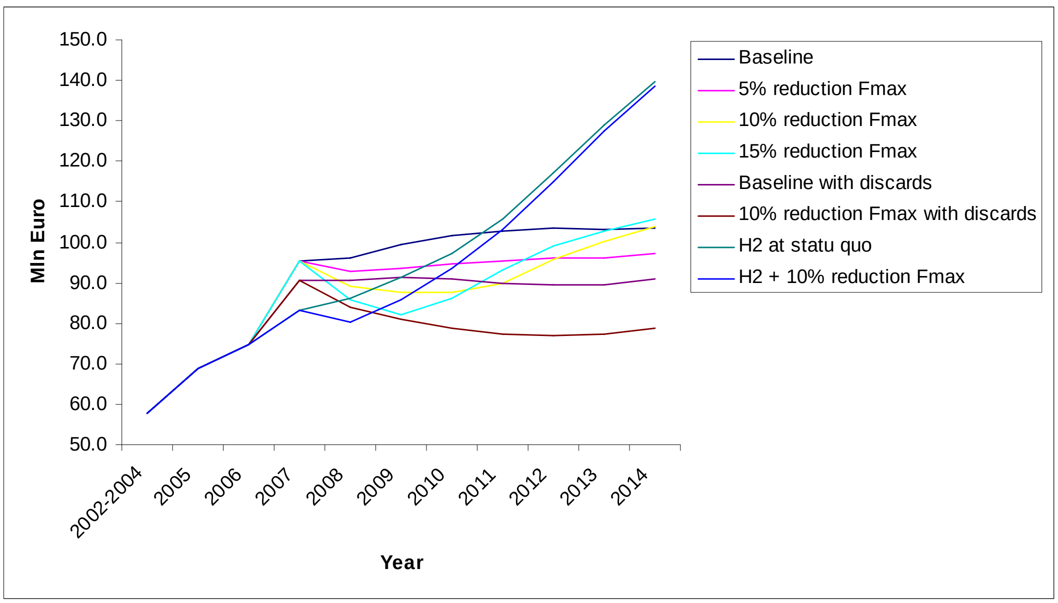


Figure 7.4.5: Development of GVA for FU 2 Trawlers (S) 24-40m. (2006-2014)

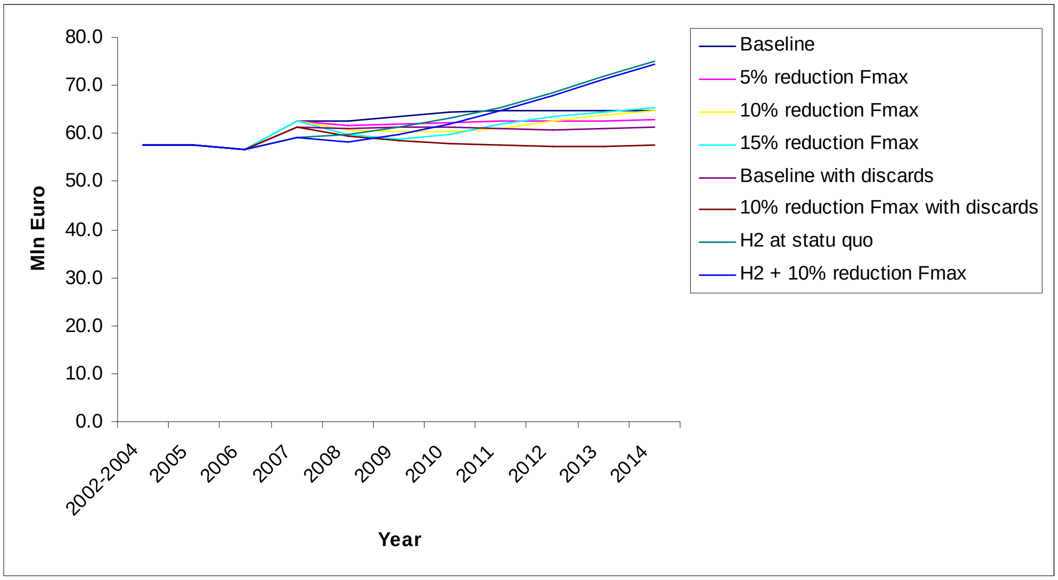
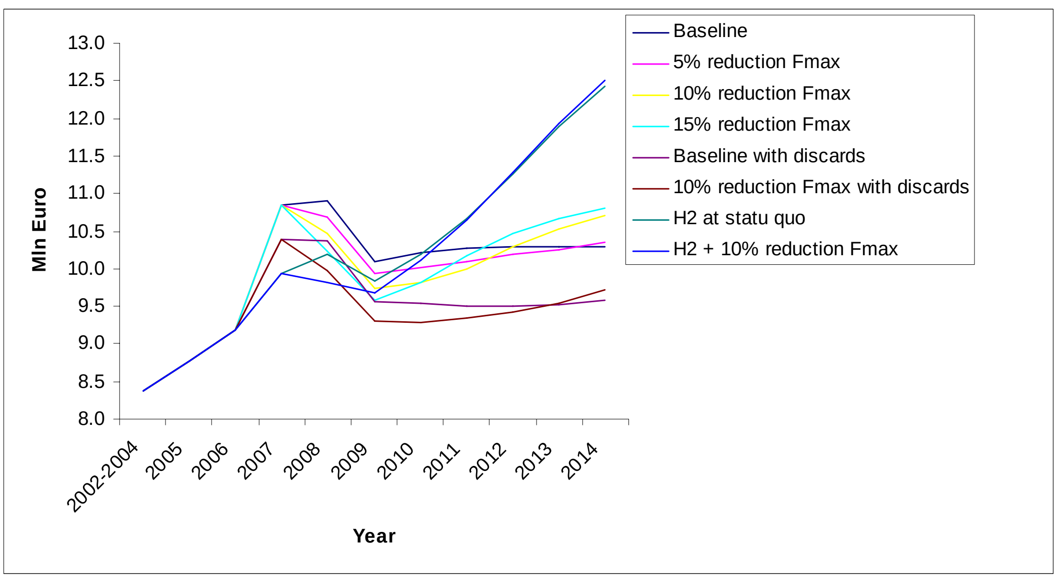


Figure 7.4.6: Development of GVA for FU 2 Trawlers (P) 24-40m. (2006-2014)



Finally in terms of changes in the share of both the GVA and the NPV between the different FUs, results show that there are no major changes occurring. This result is rather unexpected since what is likely to happen is an increase especially in terms of the share of GVA of those segments targeting Hake (FU1 and FU2). This could be due to the fact that in the case of Spain (and especially if we compare it with the results obtained with the FUs from France) the model has been conditioned using data from 2001 and 2003. It has reduced the last year to the simulation to 2014 where the Hake stock has not completely recovered and hence long-liners and pair trawlers cannot completely benefit from this improved situation.

Figure 7.4.7: Baseline: 1823 m€ (2004-2014) NPV of Landings (Discount Rate : 5%)

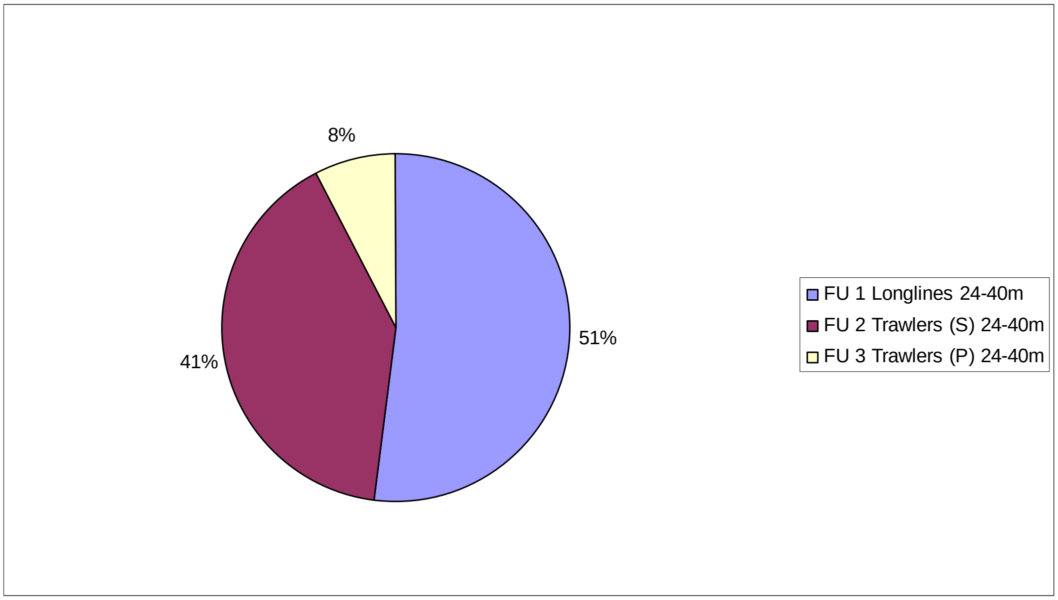
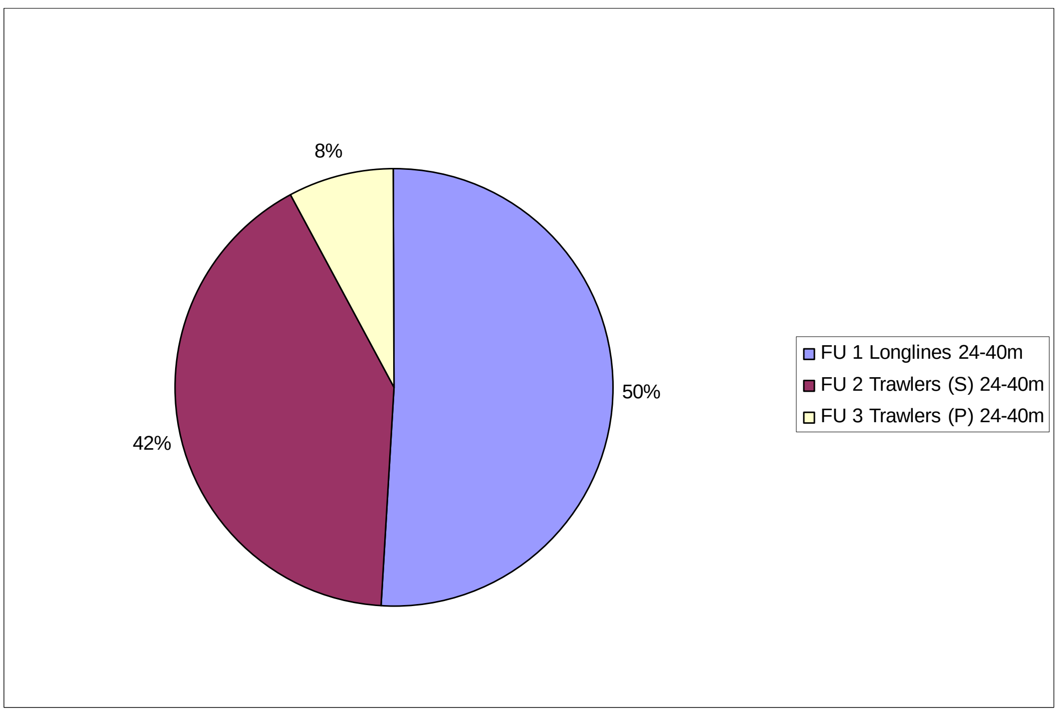


Figure 7.4.8: 15% Reduction to F_{Max}: 1731 m€ (2004-2014) NPV of Landings (Discount Rate : 5%)



7.5 UK

Economic theory provides a useful benchmark for validating the thrust of the results from the financial model.

The British fleet of vessels over 10m registered length, like the Danish over 10m segment and Dutch beam trawlers, run under a reasonably economically efficient management system. The British under 10m fleets again with those in Denmark and the Netherlands and fleets in the remainder of member states fishing Northern Hake operate with fishing rights which serve as a common pool and as such are not precisely allocated. Economic theory tells us that the British fleets examined in the EIAA model therefore share an open access fishery for Hake. That is, at the aggregate level there are no economic institutions which internalise the social cost of the catch because the fishing rights are ill-defined. This means that the whole fishery is open access albeit with distortions. Licensing is not an effective economic constraint on fishing as it does not stop the race to fish.

The fishery should therefore be producing an aggregate zero profit at present (allowing for a normal return to capital). That is, it should be producing a minimum financial profit consistent with the return the investment would have made if placed in undated government bonds plus a risk premium, but historic over-investment in capacity means that it is unlikely that in fact even depreciation is being covered. British demersal trawlers and seiners are thus operating within this context.

In the long-run (10 years plus) we can expect the British fleet to be operating in a fishery shared with other member states which continues to show zero aggregate profitability but there will be a shift in capacity away from the economically constrained sectors in the UK, Denmark and the Netherlands to the under 10m sectors. In addition, the contraction in the British fleet will be counter-balanced by attempts to purchase fishing enterprises in the economically inefficient fleets. By and large, however these effects on the fleet will be slight, because of the relative unimportance of Hake to most of the whitefish vessels.

Generally, the British fleet can expect to face a short run stock recovery and improved sales revenues which peter out as factor substitution occurs to replace the machine-time constraints of effort limitation. The most serious consequence could be that if ownership of the fishing rights by enterprises is not clarified and the stock recovery falters then the authorities may impose increasingly restrictive effort controls on all fleets.

Hence, the impact will fall mostly on the fleet fishing off the west coast of Scotland. Even there, however, Hake while important is not a primary target. The fleet most significantly affected by the impact of the recovery plan will be those fishing out of Newlyn in the south west of England.

7.6 Ireland

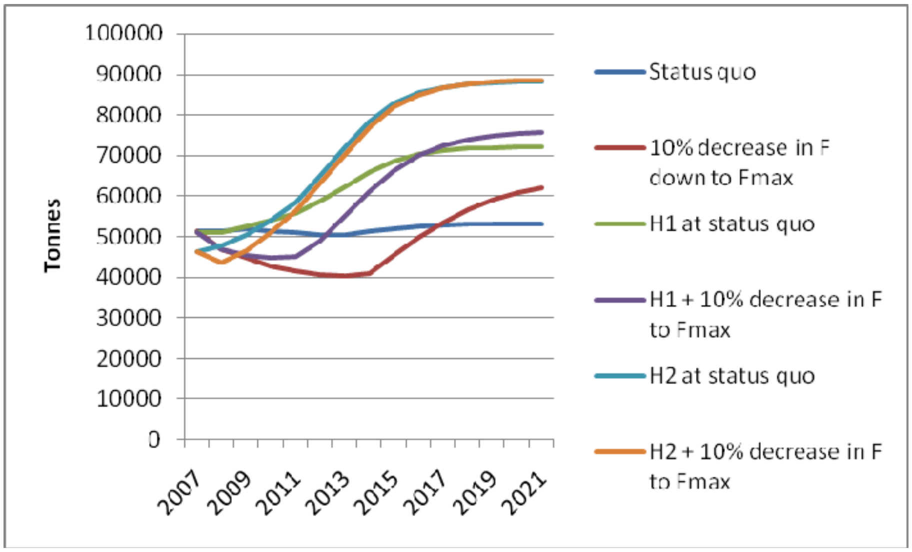
There is insufficient data available to enable the EIAA model to be used to make an assessment of the impact of the recovery plan.

The Irish whitefish fleet currently operates under a system where the fishing rights remain in a quota pool. The fleet will, without doubt, benefit from increased landings should the stock recover from its current position, but it is not clear that any economic benefit would be derived from this. The exception is that more jobs might be created as the fleet tries to expand. However, the Irish fisheries management system is presently being reviewed and the economic outcome for the Irish fleet will depend on the management system instituted rather than the stock recovery programme. Hake is, however, a significant provider of income to the Irish fleet and if any new management system clarifies the rights to the Hake quota then the fleet stands to enjoy the potential economic benefits of a stock recovery.

7.7 Discard scenarios

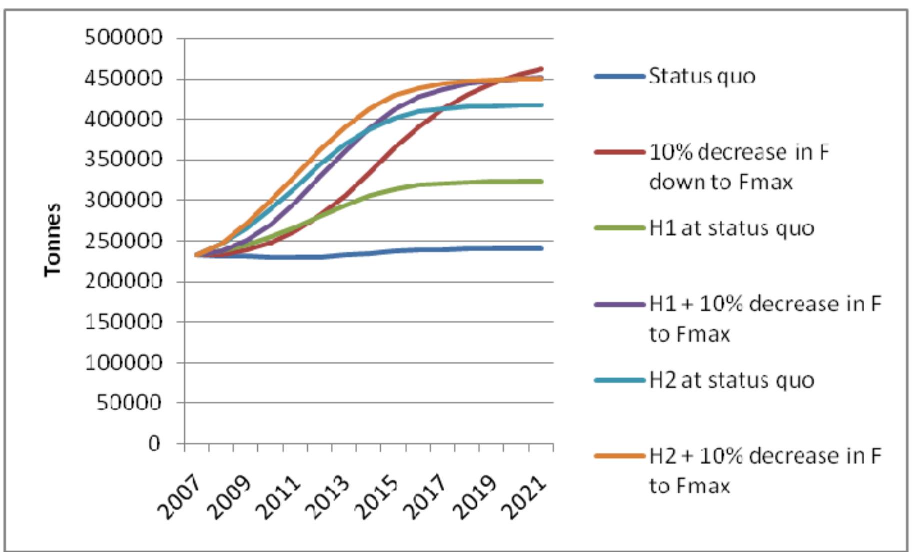
As presented above, taking discards into account does have a large bearing on the result of the analysis. Figure 7.7.1 shows the yield in terms of landings for different scenarios concerning reduction of discards. Compared to the status quo and the F_{pa} scenario it is noticed that it would be possible to increase landings significantly.

Figure 7.7.1: Projected yield (landing) for the scenarios with reduced discarding



If discards could be reduced the stock biomass increases significantly as well compared to the status qou scenario, see figure 7.7.2.

Figure 7.7.2 Projected stock biomass for the scenarios with reduced discarding



For the scenarios tested in this section the *status quo* scenario is serving as base line and the *H2 at status quo* and the *H2 + 10%* decrease in F down to F_{max} serve as alternate scenario. The calculations are carried out for the same French and Spanish fleet segments as in the paragraphs above.

The result is shown in table 7.7.1. Compared to the status quo scenario/no policy change the scenario H2 is now best followed by scenario H2+10. These two scenarios are also better than the F_{pa} scenario shown in the analysis above.

Table 7.7.1 Net present value at 5% and 10% discount rate for Spanish and French fleet segments. m€

	Spain		France	
	5%	10%	5%	10%
	2006-2014	2006-2014	2008-2016	2008-2016
Status quo				
Value of landings	1737	1404	2017	1628
Crew share	792	640	676	546
Gross cash flow	335	271	362	292
Net profit	788	638	175	140
Gross value added	971	785	1038	837
H2 at status quo				
Value of landings	1843	1473	2158	1730
Crew share	850	679	732	587
Gross cash flow	390	309	443	350
Net profit	199	154	255	199
Gross value added	1241	987	1175	937
H2 + 10% decrease in F to F_{max}				
Value of landings	1807	1444	2140	1714
Crew share	833	665	727	582
Gross cash flow	383	303	439	347
Net profit	191	148	251	195
Gross value added	1217	968	1166	929

Beneath this result there is a significant increase in landings. This means that it may be impossible for the current number of vessels to catch all the fish. An indication of this is provided by information about the required number of sea days produced by the existing fleet. The result is shown in table 7.7.2.

The number of average sea days per vessel is varying from around 170 for the 12-24m to 295 for the 24-40m for the French segments. For the Spanish segments all of which are 24-40m the average number of sea days per vessel is from 207 for trawler (P) to 260 for the two other segments.

Table 7.7.2 Number of sea days per fleet segment required to catch the projected yield.

Spain

	2002-2004	2005	2013	2014
Status quo				
FU 1 Longlines 24-40m	22071	25631	30462	30660
FU 2 Trawlers (S) 24-40m	24600	22151	25549	25602
FU 3 Trawlers (P) 24-40m	4209	4240	4668	4684
H2 at status quo				
FU 1 Longlines 24-40m	22071	25631	32404	33818
FU 2 Trawlwers (S) 24-40m	24600	22151	26074	26457
FU 3 Trawlers (P) 24-40m	4209	4240	4858	4982
H2 + 10% decrease in F to Fmax				
FU 1 Longlines 24-40m	22071	25631	30996	32408
FU 2 Trawlwers (S) 24-40m	24600	22151	25692	26075
FU 3 Trawlers (P) 24-40m	4209	4240	4745	4868

France				
	2004-2006	2007	2015	2016
Status quo				
Netters 12-24m	10467	10204	14656	14705
Netters 24-40m	5033	5042	9974	10032
Demersal trawl 12-24m targeting nephrops	33300	35611	37535	37556
Demersal trawl 24-40m	18600	19009	22867	22895
H2 at status quo				
Netters 12-24m	10467	10204	15986	16172
Netters 24-40m	5033	5042	11468	11680
Demersal trawl 12-24m targeting nephrops	33300	35611	38113	38194
Demersal trawl 24-40m	18600	19009	23777	23892
H2 + 10% decrease in F to F_{max}				
Netters 12-24m	10467	10204	15576	15776
Netters 24-40m	5033	5042	10979	11209
Demersal trawl 12-24m targeting nephrops	33300	35611	37934	38022
Demersal trawl 24-40m	18600	19009	23570	23694

It is noticed that for Spanish longliners the required increase in order to maintain their share of the higher yield is around 30%, and for French netters 24-40m is around 50% from the base period to ten years later. This is probably not possible even taking into account productivity increases and an increase in number of vessels. For the rest of the segments no such problems would arise.

For the particular fleet segments for which high increases in sea days required are calculated the results for the scenarios, except for the *status quo,* are overestimated, as new investments in vessels are required. However, there are many ways to adjust the fleet over ten years. Therefore this path is not pursued further here.

8 IMPACTS ON FISHING COMMUNITIES OF EACH MEMBER STATE OF THE LONG TERM PLAN AND CURRENT MANAGEMENT

8.1 France

It is not possible to produce a quantitative analysis of the socio economic impacts of the different scenarios. Based on the trends in the value of landings, gross value added and net profits provided by the EIAA model, the different scenarios are leading to better and increasing economic performance for netters. For trawlers, the same trends are expected with the exception of the first year where there are some slight losses.

Taking the current structure of the fleets and its geographical location into account, these increasing economic results, particularly for netters, would likely benefit employment and economic activity in the French south Atlantic harbours.

Moreover, the model used does not consider fishermen behaviour i.e. the entry and exit processes in reaction to profitability. Npoting the recovery of Hake and the expected profits, a major issue to be addressed is the regulation of access to the fishery in order to avoid overcapacity and rent dissipation.

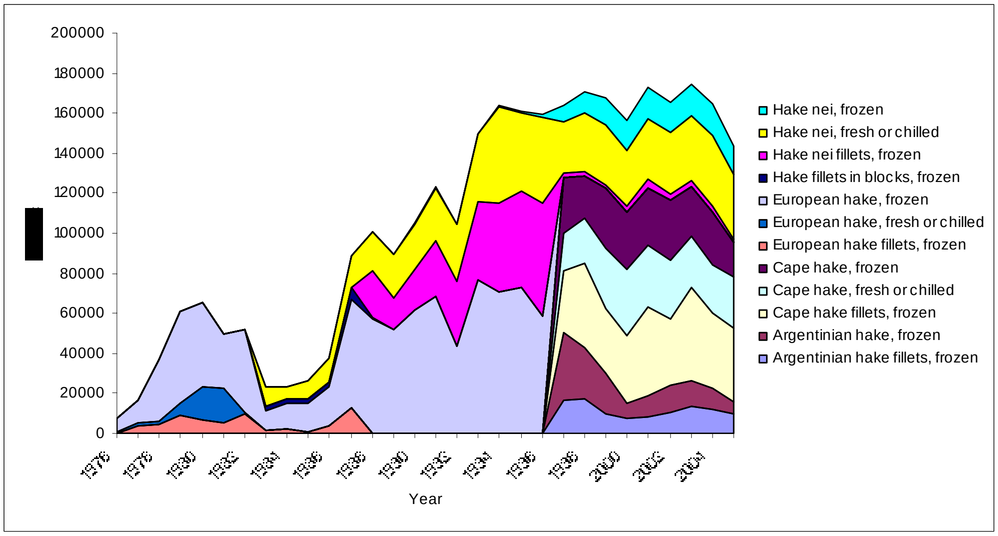
8.2 Spain

Hake is an important fishery for Spain, given that it is a highly demanded fish by Spanish consumers. In this sense the long term management plan will have a positive effect on the Spanish fishing communities.

The main ports that account for the mayor part of Hake landings are: A Coruña, Burela, Celeiro, Vigo, Avilés, Ondarroa and Pasajes. It is not easy to determine the size of the impact on these regions. The direct impact will be derived from the direct effect on fleets (size and activity level) and hence on the value added and crew share obtained from them. In addition there is an expected effect on the processing and auxiliary industry. Concerning the effect ion the processing industry it should be noted that Hake is sold fresh, without any relevant processing activity.

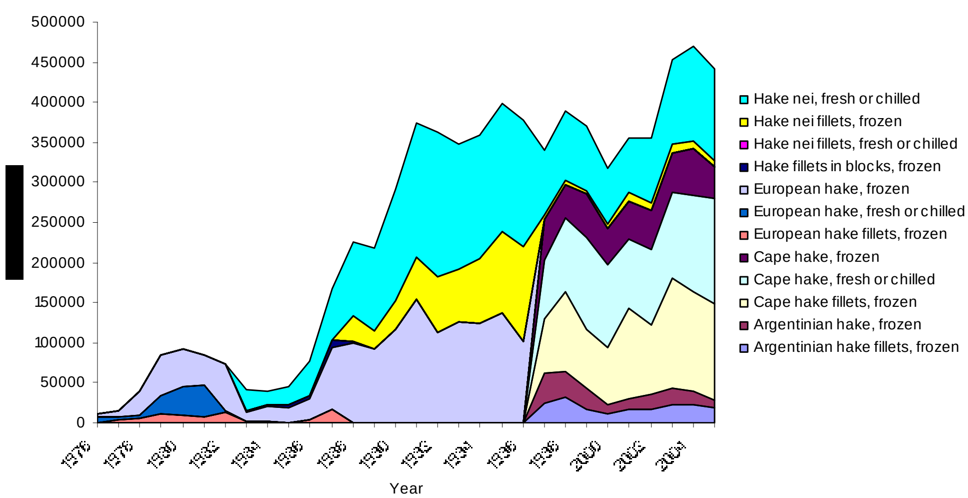
In the case of Hake it is important also to remark that there is also another important stock of the same species (*Merluccius merluccius*) (Southern stock of Hake) that is captured by different fleets but that belong to the same communities. Furthermore in Spain there is another factor affecting the communities which are the Hake imports (see Figure 8.2.1 and 8.2.2).

Figure 8.2.1: Imports of Hake to Spain in volume (Tonnes)



Source: FAO

Figure 8.2.2: Imports of Hake to Spain in value (US Dollars x 1000)



Source: FAO

The high demand of this species in Spain has pushed the imports of Hake in the last ten years. Even if these imports are not from the same species it has had a great impact on the first selling prices of Hake, reducing the performance of the Spanish fleets and also reducing the dependence of the local communities to this species. In fact, locally, airports are the main entrance of Hake in many regions of Spain.

8.3 UK

It is unlikely that the Hake long term management plan will have much total impact on employment either in the fleet or on-shore. Being ninth in importance, an improved stock is simply likely to contribute to a higher crew share. Little value is added to Hake as it is mostly sent with minimal processing to Spain. Hence there will be little effect on processors or employment in processing. Even in Lochinver and Newlyn, the impact on employment will be minimal.

8.4 Ireland

Hake is not a favourite among Irish consumers and most is transported to Spain with minimal processing. It is unlikely that the Hake long term management plan will have any significant effect on employment off-shore or onshore.

9 Biological Impacts of the Long Term Plan and Current Management

9.1 Long term catch and SSB as a function of fishing mortality under equilibrium conditions.

The study group calculated the long term landings and SSB under several hypothesis on recruitment using a long term yield model (Thompson and Bell, 1934).

Input parameters are from the ICES averages 2004-2006 for maturity at age, natural mortality, F at age, mean weight at age in the stock and in the catch. S/R relationship have been estimated using historical series of SSB and recruitment.

Figure 9.1.1: Equilibrium yield and SSB estimated under various S/R relationship and in the base-case (without discards)

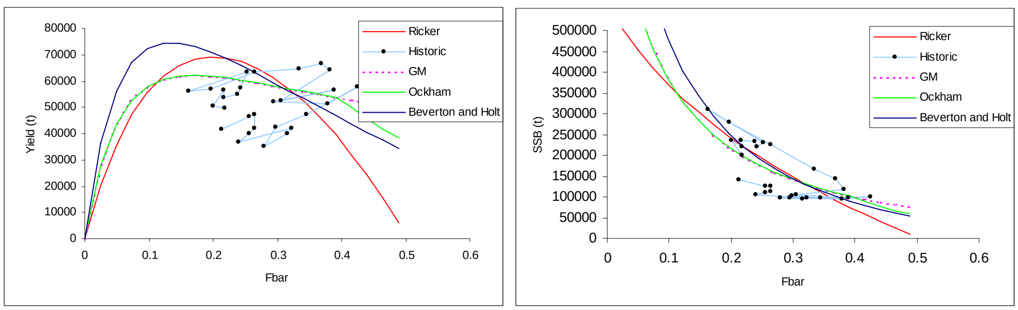
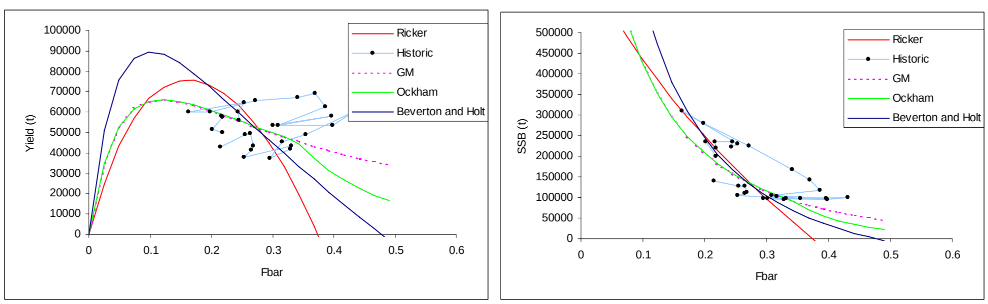


Figure 9.1.2: Equilibrium yield and SSB estimated under various S/R relationship with discards



Figures 9.1.1 and 9.1.2 show the development of equilibrium landings or catch and SSB with increasing exploitation rates for various hypothesis on S/R relationship and using data from assessments with and without discards.

Table 9.1.1: Model results

	Without discards			With discards		
	Ricker	*Ockham*	*Beverton*	*Ricker*	*Ockham*	*Beverton*
MSY (t)	69288	62114	74475	73629	64764	87965
Fmsy	0.20	0.17	0.13	0.16	0.12	0.09
mF	0.82	0.70	0.55	0.65	0.48	0.40

If an Ockam S/R relationship is used, in comparison with the unchanged fishing scenario, the application of the management plan indicates a long term relative increases of Hake landings by 3% as compared to the equilibrium catch and by 44% as compared with the current landings. This would mean a 30% reduction in F from 0.25 to 0.17.

When discards are included, the application of the management plan would lead to a 20% increase in yield as compare to the unchanged fishing scenario and a 57% as compared to the current situation. This would mean a 52% reduction in F from 0.25 to 0.12

9.2 Medium term implications

During the June meeting in Lisbon, SGBRE-07-03 conducted a series of medium term simulations. The main results have already been presented above (see chapter 4). For detailed information we refer to SGBRE-07-03 report.

10 UNCERTAINTY AND ROBUSTNESS TESTS

10.1 Uncertainty in Biological Simulation

The algorithm used to simulate the scenarios in the Lisbon meeting is a Management Strategy Evaluation (MSE) algorithm which simulates the real biological population, the fishery and the management process of Northern stock of Hake. The population and the fishery are simulated in the so called operating model and the management process is mimicked by means of the observation model, the assessment model (XSA), a Harvest Control Rule and the implementation model. The links between the operating model and management procedure are the observation model, which samples the population, and the implementation model, which put into practice the management advice obtained when applying the HCR.

Only two sources of biological uncertainty were introduced into the model; the initial population and the recruitment variability. The initial population was obtained through bootstrapping the XSA for 100 iterations, adding a lognormal random error to the abundance indices in each iteration. In the projection the recruitment was obtained using the stock recruitment relationship and a multiplicative lognormal random error.

In the observation model a lognormal error was introduced in the observed indices and the catch-at-age matrix was sampled without error. The catch at age matrix and the abundance indices observed were then used by the XSA to estimate an observed population, which, in principle, should not correspond with the real one. This discrepancy between the real and observed populations was a source of uncertainty, which made the real fishing mortality performed by the fishery different to the F_{target} chosen for advice.

10.2 Robustness of the Impact assessment

The EIAA model simulates the progress of the finances of the fleet segments selected in response to exogenous annual changes in the aggregate stock size. The model was originally built in order to predict the immediate impact on fleet segments of TAC levels proposed. This and other considerations need to be borne in mind in reading the results obtained from the model.

The Time Horizon

The rank of scenarios has been found to be dependent on the length of the time period considered. A time horizon of 10 years is normally enough for stocks to recover to a steady state level. However, the model shows that in the case of Hake the steady state of the yields in the *Fpa* and *status quo* scenarios converge at a long term level that is around 2,000 tonnes lower (59,000 tonnes against 61,000 tonnes) than the cases where the fishing mortality rate is reduced. To take that into account, calculations have been made where the net profit in the last year of the projection period (for France 2016 and for Spain 2014) has been used as input for the subsequent years.

The two best scenarios in the projections period 2007-2016 respectively have been compared (2005-2014 for Spain owing to a lack of two years' data) and the net present value for longer periods has been computed. The best option for this period is the F_{pa} scenario.

The result is that if the period considered is prolonged from 2007 to 2023 for the French case and 2005 to 2021 for the Spanish case the two scenarios (F_{pa} and the 15% reduction to F_{max}) are of equal benefit. For longer time periods, the *15%* reduction to F_{max} is then the best. The results for the F_{pa} and the *15%* reduction to F_{max} scenarios are presented in table 10.2.1 for two fleet segments. Other scenarios have been computed and in general the same result appears.

Table 10.2.1: Comparison of two scenarios for different time periods by use of net present value of net profit at a 5% interest rate, m€.

France	*Netters 12-24m*			
Fmax				
Time period - 2007 to		2023	2031	2046
Fpa 2016; net profit	36.7			
15% reduction 2016; net profit	37.6			
Difference	-0.9			
NPV for additional years		3	6	9
NPV 2008-2016 Fpa	83.2	83.2	83.2	83.2
NPV 2008-2016 15% red.	79.8	83.0	85.6	88.4

Spain	*Longlines 24-40m*			
Fmax				
Time period - 2005 to		2021	2029	2044
Fpa 2014; net profit	18.8			
15% reduction 2014; net profit	21.0			
Difference	-2.2			
NPV for additional years		8	15	22
NPV 2006-2014 Fpa	116.3	116.3	116.3	116.3
NPV 2006-2014 15% red.	105.2	113.6	120.2	127.4

Some conclusions with respect to robustness in terms of time periods can now de drawn. From a very short term perspective (i.e. up to 3 years) the most attractive solution seems to be to apply F_{pa} fishing mortality rates or even higher mortality rates. The reason for this being a possible increases in landings and a short term limited negative effects on the stock biomass.

From a medium term perspective of up to ten years the best approach is to use the F_{pa} fishing mortality continued as hitherto. In the very long run i.e. around 20 years or more the prefered scenario is reduction in the fishing mortality rate of 15% per year until the F_{max} or the 120% of the F_{max} (of almost equal importance) is reached. Reducing the fishing mortality rate to 80% of the F_{max} is not a preferred solution.

The Effect on Quayside Prices

The European market is likely to be integrated, with the Law of One Price (allowing for transport costs) holding. Thus, similar induced changes in the quayside price will be experienced in all the countries fishing Northern Hake. It does not follow that an increase in landings will automatically mean an increase in sales revenue or profits since changes in landings may induce an inverse response in prices. The relative magnitude of these changes will determine the effect on total revenue. No studies exist where the price elasticity of demand for Hake has been estimated but demersal species throughout Europe enjoy elastic responsiveness of demand to changes in price. If Hake adheres to this pattern, the implication is that large increases in landings will cause only relatively small falls in price and that the total revenues of the fleets increase as landings rise.

On-Shore Effects

The remaining consideration is that the magnitude of the on-shore effects is not examined in detail. Qualitatively, it is possible to conclude that the impacts on the fleets will be magnified on shore by the multiplier process. The Hake market in Spain prefers a product with little value-added on-shore and so the multiplier effects might be expected to have a value lower than those associated with demand- and supply-driven output and employment multipliers in other fisheries.

10.3 Reflections on the propensity of the Socio-Economic Analysis

The EIAA model simulates the progress of the finances of the fleet segments selected in response to exogenous annual changes in the aggregate stock size. The model was originally built in order to predict the immediate impact on fleet segments of TAC levels proposed two years ahead. The model used has been extended to run over a period of ten years. Making projections for such a long time comprises a number of difficulties and uncertainties.

First, the *ceteris paribus* assumption enables the impact of proposed measures to be separated from other changes that may occur in a fishery but as time progresses such an assumption becomes progressively less acceptable in that the changing condition of the fishery will inevitably affect the level of capital invested and the amount of fishing. The Northern Hake fishery may be considered an open access fishery because at least some of the fleets participating in the fishery enjoy fishing without a clear proprietary right in quota which would create a market in it. While the model itself is immune from the difficulties of quota enforcement the problems existing will determine whether the results predicted by the model materialise. A successful programme to re-build the stock may be accompanied by capital stuffing induced by the associated improving profitability of fishing which in the longer term will result in such profits (which include the resource rent) being dissipated. In the long run, the fishery might be expected to show a re-emergence of problems of overfishing and overcapacity accompanied by a failure to provide for depreciation but the possibility of entry or exit of vessels to the fishery is excluded. The question of entry/exit may have important consequences for the modelling exercise.

The impact on other catches of the fleet segments has not been displayed because the relationship between each species as a target is not known. It is conceivable that a healthy Hake stock would reduce pressure on other stocks by changing the relative catches per unit of effort. Alternatively, should the fishery invite more fishing through increased profitability there may be an adverse effect on complementary stocks. These effects may exhibit inter-temporal variation. Their net impact is therefore indeterminate and has been omitted from the analysis.

The approach using fleet segments is of mixed virtue but has been dictated by the use of the EIAA model which is the only model with any track record in ex ante socio-economic analysis of proposed management measures. The benefit of this is that concentration is focussed on those fleet segments to which the Northern Hake is most important. No overall assessment for the fishery as a single unit has been possible because the basic data is not available.

However, it is possible to make a qualitative assessment of the overall impact and this can offer important insights for managing the fishery. Although the economic condition of the fishery does not indicate a notable decline, there is clear biological evidence of over-fishing which is reducing the average age of the stock. This is also evidence of economic overcapacity.

A key economic characteristic of the fishery is that the rights to quota are not sufficiently clear for a secondary market to have developed to enable quota to be exchanged between fishing enterprises. In order to control the economic incentives to overinvest and overfish, therefore, measures which address this problem are needed. The right to clarify the quota rights lies with the member states which possess the quotas.

Constrained changes in TACs will not in themselves produce the benefits of future larger stocks. Rather, any short term benefit risks being eroded as improved profitability encourages increased investment when just the opposite is needed. Attempts to control overfishing by reducing the number of days at sea available to vessels could also ultimately be fruitless because increased profitability will encourage substitution of factors of production in an event known to fishery economics as capital-stuffing. This does not deny that there could be short term benefits for the stock but in the long run it frustrates attempts to reduce the inputs to fishing such as machinery controls, days limitations and closed seasons. Worse, it leads to profitability being lost through excessive investment by the fleets in a vain attempt to obtain even more profits in the presence of a congestion externality. The externality means that increased activity by one reduces the average earnings of all (including the initiator).

The economic results might be expected to show little or no improvement in the returns from the resource rent to society. However, the benefits in increased security for the economic activity founded on Northern Hake arising from a larger stock, if one emerges, must not be overlooked.

11 EFFECTS ON EXPLOITATION PATERNS AS A RESULT OF IMPLEMENTATION OF THE LONG TERM MANAGEMENT PLAN

Decreases in Fishing Mortality

If it is only a decrease in overall F (i.e., on all ages) as was requested in the ToR of the SGBRE-07-3 Lisbon meeting, then there is no direct change in the selection pattern per se. However, indirect change in selection pattern could be expected as a consequence of changes in the fleet structure, each fleet segment having different selection patterns. The current economic simulations do not consider effects of changes in the fleet structure. It is thus not possible for the Group to quantify how such changes may impact the overall selection pattern. It should be noted that, with the currently available models with an additional effort it is possible to incorporate any restructuring of the fleet in the analysis, however this would require a wider data set and additional time available for the analysis.

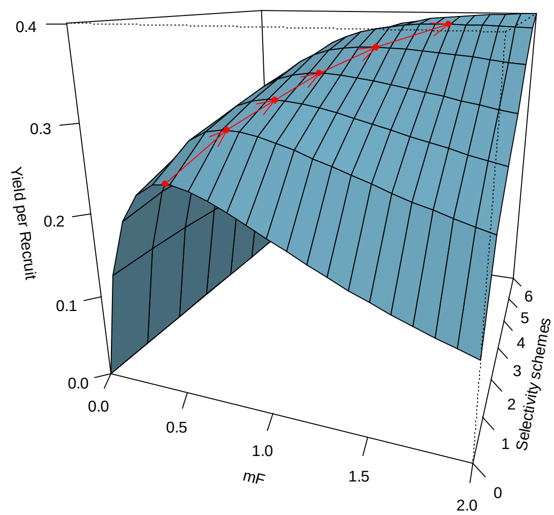
Changes in Gear Selectivity

If the management plan includes explicit measures to improve the selection pattern, as was tested in the simulations including discards, two points can be made:

First, it should be kept in mind that the simulated improvement of the selection pattern tested by the Group cannot easily be linked to any existing devices or practices. However, this shows the way management of the fishery should aim, given in mind that an improvement of the exploitation pattern can be achieved not only by an increase in the mesh-size. A similar result can be obtained by selection devices in existing gear (like square mesh panels in trawls), by using different kinds of gear or by changing fishing areas or periods to avoid those for which there is a high proportion of small fish in the catch.

Secondly, the simulations showed that improving the exploitation pattern could lead to better long-term yields while the reduction in overall effort would be smaller. Furthermore, it should be noted that given the current state of the stock, the changes in the exploitation pattern postulated would not lead to absolute losses of catch in the short term. The Group is well aware that such results remain very theoretical. Nevertheless, it is considered that this is an important issue to be considered in any long term management plan: the more the exploitation pattern is improved, the greater would be the yield and the less the necessary reduction in overall effort, as shown by the figure 12.1 below:

Figure 12.1 Yield per recruit values for various combinations of overall F multiplier and selection patterns. The red points show what would be F_{max} for given selection pattern.



Economic Considerations Regarding Alternative Exploitation Patterns

These scientific results remain problematic in economic terms. An improved exploitation pattern in what is, according to economics, an open access fishery will mean a larger stock of larger fish. For any given volume of landings (TAC), this would mean a higher total sales revenue from the fishery. It would also mean an improved catch per unit of fishing activity implying lower costs. However, open access causes increased profitability quickly to be dissipated. The result would be capital stuffing raising costs to a level which reduced economic profits to zero. The benefits of a more secure fishery should not be understated, but clearly, whether benefits accruing to the stock can be translated into benefits for the fleets depends on the management systems in each member state for TACs and quota and not on the existence of TACs and quotas themselves.

Additional Effort Regulations

Finally, the management plan could include effort regulations on specific fleet segments or on specific métiers. As the group did not investigate such plans, it is not possible to draw more than very general conclusions regarding this issue. As the different métiers have not the same selection patterns, a management plan leading to changes in the fleet structure is likely to result in change in the overall selection pattern. As mentioned above, current models do not allow for the inclusion of fleet or métier restructuring.

Feedback Effects: Entry and Exit

The question of entry/exit may have important consequences for the modelling exercise.

Trying to estimate the effect of modifying selection patterns in order to investigate different scenarios more detailed than a variation in total F, in order to simulate how changes in financial profits will affect the selection patterns in the future it is necessary to build a model with endogenous entry and exit.

Feedback Effects: Gear Selectivity

However, it is possible to calculate the effect of redistributing the fishing mortality among gears on the selection patterns. In particular, we are interested in simulating the effect of the introduction of changes in the trawl technology in order to reduce the impact of the trawl gears on Hake juveniles.

Table 12.1: Partition of landings-at-age by gear

Gear	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
Trawl	0.9990	0.9790	0.9232	0.8535	0.7028	0.4510	0.2856	0.2050	0.1215
Gill.	0.0000	0.0108	0.0491	0.0727	0.0854	0.1666	0.2795	0.3490	0.4211
Long.	0.0000	0.0000	0.0003	0.0083	0.0763	0.2314	0.2812	0.2914	0.2884
Others	0.0010	0.0102	0.0274	0.0655	0.1356	0.1510	0.1537	0.1546	0.1690

Source: Report SGBRE-07-03

To explore the effects of a more selective policy, first we built a simple model for a multi fleet fishery. Second, the model was calibrated in order to reproduce the partition of landings-at-age by gear provided in table 12.1. Finally, the calibrated model was used to calculate catches and spawning stock biomass for the different selection patterns, by gear, induced by changes in quotas. figure 12.1 shows, given the initial conditions of the stock.

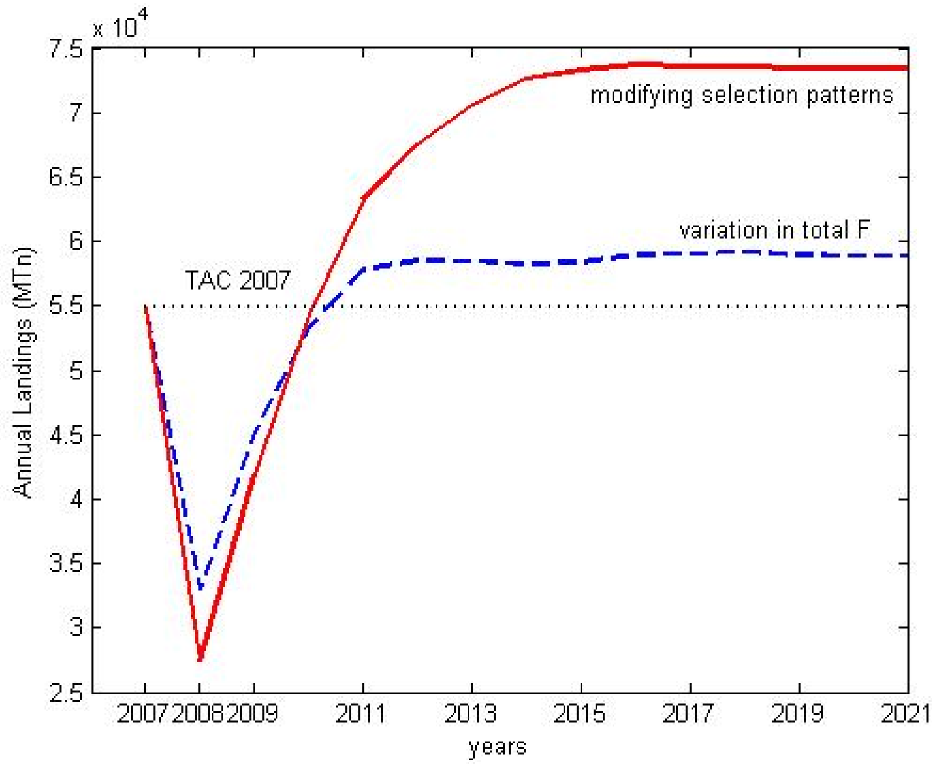
The optimal trajectory associated with a policy which changes the implicit gear quotas (which are assumed proportionately constant) to allow a more selective exploitation of the resource (Improved Gear Selectivity),

- the optimal trajectory proposed keeps the quotas constant, and
- the effect of continuing to fish at current mortality rates (“no policy change").

The last of these is related to an improved gear selectivity policy associated with the selective scheme which reaches the higher MSY. The main finding is that a redistribution of quotas from trawls to the rest of the fleet generates a higher F_{msy}, more stable biomass and higher catch compared to fishing with the actual selection patterns. Both results are related to the changes that more selective gear will induce on the age distribution of the stock. Increasing the quotas of more selective gears raises the number of spawners and the average weight of the individual fish in the landings increases. In the long run, higher SSB and Yield are compatible with the present levels of fishing effort.

These benefits will not be enjoyed unless a Pareto solution to the problem of ownership of fishing entitlements is instituted. From the technical point of view, this solution could be implemented through a system of individual transferable quota (ITQ) or some similar system which captures the resource rent. If the quota is transferable and divisible, each holder could sell or lease part or all. Allowing the less selective fleets to sell their quota and receive the discounted future profit from its use by a more selective fleet should lead to higher landings and a financially secure fleet enjoying increased profits. Moreover, as the use of more selective gear usually also implies the use of a technology more intensive in labour and less dependent on fuel consumption, it is possible that a redistribution of quotas between gears will increase employment, reduce consumption and improve the fleets' carbon footprint.

Figure 12.2: Change in selection patterns, red (solid) line; Variation in total F, blue (dashed) line



Feedback Effects: The Effects on Size

A further consideration relates to the impact of the proposed measures, which are essentially biological rather than economic, on the size of individual fish in the fishable stock. Changing the age structure of the stock by using, for example, larger mesh sizes may result in a larger stock of older fish, especially of spawners. However, the market for Hake is primarily driven by demand in Spain, to where most of the landings in Europe are sent. The Spanish consumer is sometimes said to prefer the flavour of smaller fish but it is not easy to observe differences in demand according to size. The smaller fish are more normally caught by trawlers. The quality of larger fish provided by netters and hookers is better, so any premiums for quality may be counter-balanced by a discount for size. In addition, the different fleets operate different sales methods, some sending their catches through the auction while others sell by contract locally and others yet again trans-ship directly to Spain. In general, it is not thought likely that a change in the age and size structure of the stock will have a socio-economic impact.

MSY

MSY is in part dependent on the fishing method employed because a reduction in discards or other losses of small fish might have an impact on the number of fish surviving to sexual maturity and might also therefore have an impact on the size of the fishable stock. This could lead to an increase in landings per unit of fishing activity.

12 FUTURE NEEDS OF DATA, IMPACT ASSESSMENT AND MONITORING

With respect to the economic information, the EU member states collect economic data within lines specified in the Data Collection Regulation (DCR)[2]. Collection of data is on a yearly basis for the specified fleets within the regulation. It covers information on 1) income, 2) variable costs related to crew, fuel, repair and maintenance and other operational costs, 3) fixed costs, 4) investments, 5) prices per species, 6) employment and 7) fleet characteristics in form of tonnage, engine power, age and gear used.

Nevertheless the segmentation that DCR proposes does not distribute costs parameters among seas. It has implication in the economical assessment of the Northern Hake. For example in the segment covering trawlers 24-40 m in Spain, vessels from the Atlantic and the Mediterranean are mixed, which results in data collected under the DCR to be used carefully, given that the Mediterranean and the Atlantic are two different fishing realities, in terms of costs. In this report none of the data provided under the DCR have been used for the Spanish fleets due to this definition dilemma.

Going into more detail about the more specific data requirements, a distinction can be made between two types of analysis.

1) Simple projections of stock biomass and landings based on simulated stock dynamics using parameters estimated by the current stock assessment procedure. The results on landings and F would then be used to calculate revenue and costs.

2) An integrated approach where the determination of catches takes into account the behaviour of fishermen. The determined catches then feed into the biological part of the bio economic model, which then calculates the stocks for the forthcoming period. Sources of discrepancies between those catches predicted by the biological part and the "real" ones have, at least the following sources:

1. The use of a production function more close to the economical rationality.
2. Effort should be driven by any of the species involved in the fisheries; in fact a management alternative could evoke a shift as to the main species driving the effort (change in métier).
3. Effort regulations.
4. Effort of enforcement and compliance.
5. Over or under catches in relationship to the TAC/quota implemented.
6. Capital investment decisions taken by the firms.

The applied EIAA model is taking item 1 and 2 into account and implicitly item 5 and 6, although these results are not used. Effort of enforcement and compliance cost are not included but could be if the data is available

This integrated approach could result in an impact assessment of a management measure showing both biological an socio-economic reality in light of reaching the target desired (i.e., F_{MSY}). It could be the case that some of the alternatives with desirable biological results (in terms of time for obtaining the target and the risk of the alternative) are simply unachievable when the economic rationality is included in the analysis. It opens the chance to find management alternatives designed to reach economic and biological targets simultaneously while being more robust to the (chance of) behaviour of vessels and/or firms.

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[2] See for instance Council Regulation (EC) No 1543/2000.

To improve the economic part of the impact assessment of recovery plans a comprehensive bio-economic model founded firmly in sound economic theory is needed. This should have as its objective the maximisation of benefits to society and employ constraints for demand, production, and the stock. This is partly done in the EIAA model. In the EFIMAS project work is underway to expand in that area.

In order to build this, there is a distinct need for consistent time series of data of revenues and quantity of landings by species by country by fleet. In addition there is a need for time series of data on the factors of production – quantities used and opportunity cost – labour, capital, days at sea, kW, kW-days, licence prices, all by country by fleet, and quota prices by country by species. In addition there is a need for time series data on stocks at the aggregate level by stock by species.

Current impact assessments do not account for differences in selection pattern between métier. So there is a need to carry out simulations by fleet/métier. For this the appropriate model needs to be devised.

Concerning the data needs of an impact assessment, especially when the analysis covers several countries, fleets and métiers, there is a need for a proper definition of the métiers and data on effort also required by segment. In addition data on a spatial scale are required, especially when selectivity differs between areas.

Concerning data for monitoring management measures, time series of fishing effort and fishery landings and discards for appropriate fleet units, available at the spatial and temporal resolution are required.

Adequate assessment of discarding is required in order to get better information on the changes in selectivity. Valuable information to serve this purpose could be derived from discard sampling programmes carried out in close collaboration with the fishing industry. Improve survey information is also required

Knowledge of fishermen’s tactical decisions in response to the management measures is required. Especially long term individual behaviour, such as the choice for entry/exit, fishing strategy and capital investment choices are of prime importance for the long run analysis.

13 OBSERVATIONS AND RECOMMENDATIONS

Given that fishing is an economic activity, the question to be asked is what economic institutions are to be used to produce the stock recovery? Under the management plan the institutions to be used are quota constraints and days limitations. Neither of these has an economic component in the plan though whether they do in practice varies by member state and fleet. They are both merely legal except in those fleets operating under ITQs, where there is an economic component.

The stock recovery predicted by the biological model will be achieved only if Member State governments set in place the necessary economic institutions and ensure that the quota rights are clarified. Otherwise the short-term gains promoted by the scientific measures are unlikely to be sustained. Effort controls are of only short run effectiveness because of the ability of the fleet to circumvent them by increased investments in more efficient vessels and gear, known as capital stuffing.

In order to implement a true socio-economic impact assessment not only focussing on the fleets but also the processing and ancillary industry, data on these should be available.

Taking a restructuring of the fleet through entry-exit strategies, change of métier and/or change of fishing and selection pattern, into account is important to predict the impact of any set of management measures. The time available for the current analysis has not allowed for the implementation of this analysis in full detail.

As mentioned in the report, for Spain the data set currently available under the DCR has fleet definition problems. As a result DCR data do not present a true picture of Hake fleets. Consequently the years over which the base data were available did differ for the countries included in the analysis. Although on a country by country basis this does not pose a large problem, as long as scenario's are analysed country by country, comparison of the results of the analysis between countries becomes difficult as the time periods differ.

In addition, although in general the DCR does cater for economic data, current DCR segmentation does not allow linking specific fleets, métiers and species to landings and effort.

It is recommended to, in the future to have the analysis be focused more on fleets and fleet segments than on the impact of specific management measures for specific countries.

Having the opportunity to produce a draft version of the current report prior to the final working group meeting by allocating working days to the experts is highly appreciated. The time allocated has allowed for a proper preparation of the draft report, which greatly improved the efficiency of the final meeting.

However, it is observed that the process would gain efficiency and effectivity if the process could start off with a kick off meeting in which the main structure of the report is agreed upon and tasks are shared between the experts. Using correspondence is not the most effective way of communication at the start of this process. The process of this particular working group gained momentum at the moment three of the members were able to, in the margin of another meeting, take decisions on issues that were being discussed between the experts.

Further, the Impact Assessment currently is a stand alone exercise after the biological analysis has been implemented. As the general strive is to arrive at a single integrated analysis, for which yet the appropriate instruments need be developed, it is recommended in future to have the biological assessment and the socio-economic Impact Assessment be implemented simultaneously.

A further integration with wider socio-economic consequences and taking on board in the analysis changes in fleet composition and consequent changes in fishing behaviour is recommended. Integration of analytical models and the development of appropriate models is in this a requirement.

14 REFERENCES

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15 APPENDIX I WORK GROUP PARTICIPANTS

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16 APPENDIX II COMPARISON OF SCENARIOS

Table II.1 Comparison of two scenarios for different time periods by use of net present value of net profit at a 5% interest rate, m€.

France	*Netters 12-24m*			
Fmax				
Time period - 2007 to		2023	2031	2046
Fpa 2016; net profit	36.7			
15% reduction 2016; net profit	37.6			
Difference	-0.9			
NPV for additional years		3	6	9
NPV 2008-2016 Fpa	83.2	83.2	83.2	83.2
NPV 2008-2016 15% red.	79.8	83.0	85.6	88.4
08Fmax				
Time period - 2007 to		2023	2031	2046
Fpa 2016; net profit	36.7			
15% reduction 2016; net profit	37.1			
Difference	-0.4			
NPV for additional years		1	3	4
NPV 2008-2016 Fpa	83.2	83.2	83.2	83.2
NPV 2008-2016 15% red.	75.7	77.1	78.2	79.4
12Fmax				
Time period - 2007 to		2023	2031	2046
Fpa 2016; net profit	36.7			
15% reduction 2016; net profit	37.4			
Difference	-0.7			
NPV for additional years		3	4	7
NPV 2008-2016 Fpa	83.2	83.2	83.2	83.2
NPV 2008-2016 15% red.	82.5	85.0	87.0	89.1

Spain *Longlines 24-40m*

Fmax

Time period - 2005 to		2021	2029	2044
Fpa 2014; net profit	18.8			
15% reduction 2014; net profit	21.0			
Difference	-2.2			
NPV for additional years		8	15	22
NPV 2006-2014 Fpa	116.3	116.3	116.3	116.3
NPV 2006-2014 15% red.	105.2	113.6	120.2	127.4

08Fmax

Time period - 2005 to		2021	2029	2044
Fpa 2014; net profit	18.8			
15% reduction 2014; net profit	19.5			
Difference	-0.7			
NPV for additional years		3	5	7
NPV 2006-2014 Fpa	116.3	116.3	116.3	116.3
NPV 2006-2014 15% red.	95.4	98.1	100.3	102.7

12Fmax

Net present value of net profits for different time periods

Time period - 2005 to		2021	2029	2044
Fpa 2014; net profit	18.8			
15% reduction 2014; net profit	20.7			
Difference	-1.9			
NPV for additional years		7	13	19
NPV 2006-2014 Fpa	116.3	116.3	116.3	116.3
NPV 2006-2014 15% red.	112.2	119.3	124.9	131.0

17 APPENDIX III OUTLINE OF THE EIAA MODEL

Extract from SEC(2004) 1710.

1. EIAA model equations

The EIAA model computes future landings value and costs by use of recorded baseline information, which is a three years average, and future TACs as proposed by the EU Commission, ICES et. al.

1.1. Landings of quota species in future periods:

The landing of quota species in future periods per fleet segment is calculated by taking the quota share of the country of the total EU-TAC and distribute that by use of the fleet segments share of the national share in the baseline period. The degree to which the quota is exhausted is taken into account by use of an up-take-ratio:

1.1 $$L_{t,i,j,m} = \left(\sum_a Q_{t,i,a} \cdot ns_{i,a,m} \right) \cdot nu_{i,m} \cdot \left(\frac{L_{0,i,j,m}}{L_{0,i,m}} \right)$$

where $nu_{i,m}$ can be changed and is defined as:

1.2 $$nu_{i,m} = \frac{\sum_j L_{0,i,j,m}}{\sum_a Q_{0,i,a,m}}$$

$L_{0,\ i,\ m,\ j}$	Member State *m* landings at base years of species *i* by fleet segment *j* (exogenous variable)
$L_{t,\ i,\ j,\ m}$	Member State *m* landings at year *t* of species *i* by fleet segment *j* (endogenous variable)
$Q_{t,\ i,\ a}$	Quota at year *t* of species *i* in area *a* (exogenous variable)
$ns_{i,\ a,\ m}$	Relative stability i.e. Member State *m* share of species *i* in area *a* (parameter)
$nu_{i,\ m}$	Member State *m* quota uptake ratio of species *i* (parameter, calculated by the model). Can be changed for future years
$Q_{0,\ i,\ a,\ m}$	Member State *m* quota in base years of species *i* (exogenous variable)

The following is described on Member State level. Therefore *m* is omitted.

1.2. Prices in future periods

After the calculations of future landings prices are calculated. First the baseline prices are calculated from the landings value and the landings volume. Then, assuming that the price of each species in the future is a function of the total EU-TACs, future prices are calculated. The function includes a price flexibility rate which is fixed at –0.2 as a default rate:

2.1 $$P_{0,i,j} = \frac{TR_{0,i,j}}{L_{0,i,j}}$$

2.2 $$P_{t,i,j} = P_{0,i,j} \cdot \frac{\left(\sum_a Q_{t,i,a}\right)^{\alpha_i}}{\left(\sum_a Q_{0,i,a}\right)^{\alpha_i}}$$

$\alpha_i \leq 0$

$P_{0,i,j}$	Fish prices in base years of species *i* by fleet segment *j* (endogenous variable)
$L_{0,i,j}$	Landings of quota species *i* in base years by fleet segment *j* (exogenous variable)
$TR_{0,i,j}$	total revenue of quota species in base years of species *i* by fleet segment *j* (exogenous variable)
$P_{t,i,j}$	Fish prices year *t* of species *i* by fleet segment *j* (endogenous variable)
α_i	Price flexibility of quota species *i*. Can be changed

1.3. Gross revenue in future periods

Gross revenue (total revenue) in future periods is calculated by the computed landings and prices for the future period. The value of non-quota species are calculated from baseline information and added to the computed future value of quota species. Finally the computed gross revenue for the future period is adjusted with a coefficient to account for income outside fisheries etc.:

3.1 $$TR_{t,j} = \left(\sum_i P_{t,i,j} \cdot L_{t,i,j} + K_{t,j}\right) \cdot \frac{GR_{0,j}}{\sum_i P_{0,i,j} \cdot L_{0,i,j} + K_{0,j}}$$

where $K_{t,j}$ is defined as:

3.2 $$K_{t,j} = TR_{0,j} - \sum_i P_{0,i,j} \cdot L_{0,i,j}$$

and $GR_{0,j}$ is defined as:

3.3 $$GR_{0,j} = TR_{0,j} + O_{0,j}$$

$TR_{t,j}$	Total revenue at year *t* by segment *j*
$K_{t,j}$	Landings value at year *t* of other species than quota species of segment *j*

$GR_{0,j}$	Gross revenue including non-fisheries specific income of segment *j*
$O_{0,j}$	Income from non-fisheries specific activities of fleet segment *j*

1.4. Variable costs in future periods

A fleet activity variable *A* is calculated and used in the model to adjust variable costs. Changes are considered only within fleet segments, not between segments. The calculation of the fleet activity variable consists of three steps. The rationale behind this procedure is the (well known) Cobb-Douglas type production function where an explicit functional form a fleet segment and a single species is:

4.1 $$A = a * \frac{p(TL)L^{\chi}}{SSB^{\beta}}$$

where

A: fleet activity

a: coefficient

p: price as a function of aggregate landings TL on EU level

L: landings per segment

SSB: spawning stock biomass

chi and beta are parameters (flexibilities)

Expanding this expression in terms of time, species and fleet segment one gets the expression that is applied in the model:

4.2 $$A_{t,j} = \sum_i \left(\frac{L_{0,i,j} \cdot P_{t,i,j}}{\sum_i L_{0,i,j} \cdot P_{0,i,j}} \cdot \left(\frac{L_{t,i,j}}{L_{0,i,j}} \right)^{(\chi_{i,j})} \cdot \left(\frac{SSB_{t,i}}{SSB_{0,i}} \right)^{(-\beta_i)} \right)$$

$\chi \geq 0$; and $\beta \geq 0$

4.3 $$RC_{t,j} = RC_{0,j} \cdot A_{t,j}$$ function of quota species only, or

4.4 $$RC_{t,j} = RC_{0,j} \cdot AA_{t,j}$$ function of all species

where

4.5 $$AA_{t,j} = A_{t,j} \cdot \frac{\sum_i P_{t,i,j} \cdot L_{t,i,j}}{TR_{t,j}} + \frac{TR_{t,j} - \sum_i P_{t,i,j} \cdot L_{t,i,j}}{TR_{t,j}}$$

$A_{t,j}$ — 'Activity coefficient' as a function of quota species at year t of fleet segment j; $A_{0,j}$ = 1 (endogenous variable) calculated for the baseline

$L_{t,i,j}$ — Landings in volume in baseline period 0, and TAC in period t of species i by fleet segment j

$P_{t,i,j}$ — Prices in period t of species i by fleet segment j

$SSB_{t,i}$ — Spawning stock biomass at year t of species i (exogenous variable)

$AA_{t,j}$ — 'Activity coefficient' as a function of quota and non quota species at year t of fleet segment j; (endogenous variable)

$\chi_{i,j}$ — 'Technology flexibility rate' of quota species i by fleet segment j

β_i — 'Stock – effort' flexibility rate of quota species i

$RC_{t,j}$ — Running costs at year t of fleet segment j, includes fuel and other fishing days dependent costs (endogenous variable)

$RC_{0,j}$ — Running costs at base years of fleet segment j, includes fuel and other fishing days dependent costs (exogenous variable)

The *'P-element'* account for incentives to reallocate effort as a function of changes in relative prices. Note that future prices depend on the price flexibility rates, see equation 2.1 and 2.2.

The *'L-element'* accounts for technological accessibility. If χ is zero the fish is easily accessible, and when χ increases if accessibility becomes harder. The default value in the model is χ = 1. The inclusion of the element makes it possible to distinguish between different accessibilities in particular for demersal and pelagic species and different fishing technologies.

The *SSB-element* accounts for accessibility caused by stock abundance. β = 0 implies there is no stock abundance effect on activity. With full effect β = 1. Default values are between 0.6 and 0.8 for demersal species and between 0.1 and 0.2 for pelagic species

When the A-variable is calculated for each fleet segment the recorded variable costs $RC_{0,j}$ for the baseline period is multiplied with A to obtain variable cost for the future period. A numerical example in appendix table III.1 shows the calculation of A_t in the lower right hand cell.

The model contain to options for calculating A. One option takes into account only the effect of changes in the quota species. The second options denoted AA is adjusted for the share of the value of the quota species relative to the total landings value.

By use of that procedure it is assumed that each species in the landings composition could be caught separately which makes it possible to add the cost share oh each species. However in many fisheries joint production prevails entailing that species are caught in fixed proportions. These fixed proportions are however changed in future periods by change of the quota compositions.

Further to the variable costs the crew share is calculated in the model for the baseline period by taking the costs of the crew relative to the gross revenue.

4.6 $$CC_{t,j} = cc_{0,j}\, TR_{t,j}$$

where $cc_{0,j}$ is defined as:

4.7 $$cc_{0,j} = \cdot \frac{CS_{0,j}}{GR_{0,j}}$$

$CC_{t,j}$	Crew share at year *t* of fleet segment *j* (endogenous variable)
$CC_{0,j}$	Crew share coefficient in base years of fleet segment *j* (endogenous variable)
$CS_{0,j}$	Crew share in base years of fleet segment *j* (exogenous variable)

1.5. Fixed costs

Fixed costs are assumed constant i.e. transferred from the baseline period to the future period. The model distinguish between fixed costs related to the operation of the vessel and fixed capital costs

5.1 $$FC_{t,j} = FC_{0,j}$$

5.2 $$DC_{t,j} = DC_{0,j}$$

FC_j	Fixed costs, fleet segment *j*, other than *DC* and *RC*
DC_j	Depreciation and interest costs, fleet segment *j*

1.6. Indicators of economic performance:

A number of economic indicators are calculated as shown by the subsequent expressions.

Cash Flow:

6.1 $$GF_{t,j} = TR_{t,j} - (RC_{t,j} + CC_{t,j} + FC_{t,j})$$

Net profit:

6.2 $$NP_{t,j} = TR_{t,j} - (RC_{t,j} + CC_{t,j} + FC_{t,j} + DC_{t,j})$$

Operating profit margin:

6.3 $$OPM_{t,j} = \frac{TR_{t,j} - (RC_{t,j} + CC_{t,j} + FC_{t,j} + DC_{t,j})}{TR_{t,j}}$$

Gross value added:

6.4 $$GV_{t,j} = NP_{t,j} + CC_{t,j} + DC_{t,j}$$

$GF_{t,j}$	Gross cash flow at year *t* of fleet segment *j*
$NP_{t,j}$	Net profit at year *t* of fleet segment *j*
$OPM_{t,j}$	Operating profit margin at year *t* of fleet segment *j*

1.7. Break even and 'over capacity'

The EIAA model contains information that makes it possible to calculate the gross revenue that is required to cover fixed costs exactly with the given variable costs. That is denoted the Break-even revenue. With salary to the owner/skipper of the vessel included in the variable cost the Break-even revenue is the revenue that equals net profit at zero.

Break-even Revenue = (Depreciation + Interest) * Revenue / (Revenue - (Fuel C. + Running Costs + Vessels Costs + Crew Share)) or BeR = Fixed costs * Revenue / Gross Cash Flow if vessels costs are included in fixed costs.

If Break-even revenue and the actual revenue is compared an indication of the change of the fixed costs in order to comply with break-even is obtained. Assuming that fixed costs are a proxy for capacity an indication of over and under capacity is provided. The result does not indicate whether a required change in fixed cost actually is possible, only that it is necessary.

Further it is possible with the information in the model to estimated remuneration of the fish stocks i.e. include resource rent. Required resource rent is include in the fixed costs of a fleet segment, and the obtained result indicates the level of capacity if the 'capital' fish resources is remunerated in the same way as the capital invested in fishing vessels.

7.1 $$BR_{t,j} = \frac{(DC_{t,j} + [FC_{t,j}]) \cdot TR_{t,j}}{GF_{t,j}}$$

Note: Inclusion of $FC_{t,j}$ is subject to consideration; therefore in bracket

Definition: Over-capacity = 1- Revenue / Break-even Revenue

7.2 $$OC_{t,j} = 1 - \frac{TR_{t,j}}{BR_{t,j}}$$

The value share of the fish stocks subject to quotas of each fleet segment and Member State is calculated:

7.3 $$SSBLC_{t,i,j,m} = rl \cdot P_{t,i,j,m} \cdot \left(\sum_a SSB_{t,i,a} \cdot ns_{i,a,m} \right) \cdot nu_{i,m} \left(\frac{L_{t,i,j,m}}{L_{0,i,m}} \right)$$

Break-even with quota fish stock value included (subsequently Member State i.e. *m* is omitted):

7.4 $$BRLS_{t,j} = \frac{(DC_{t,j} + \sum_i SSBLC_{t,i,j} + [FC_{t,j}]) \cdot TR_{t,j}}{GF_{t,j}}$$

7.5 $$OCLS_{t,j} = 1 - \frac{TR_{t,j}}{BRLS_{t,j}}$$

Calculation of other species excl. quota species are calculated:

7.6 $$SSBNC_{t,j} = rn \cdot \frac{\sum_i SSBLC_{t,i,j}}{rl} \cdot \frac{TR_{0,j} - \sum_i P_{0,i,j} \cdot L_{0,i,j}}{\sum_i P_{0,i,j} \cdot L_{0,i,j}}$$

7.7 $$BRTS_{t,j} = \frac{(DC_{t,j} + \sum_i SSBLC_{t,i,j} + \sum_i SSBNC_{t,i,j} + [FC_{t,j}]) \cdot TR_{t,j}}{GF_{t,j}}$$

Note: Inclusion of $FC_{t,j}$ is subject to consideration; therefore in bracket

7.8 $$OCTS_{t,j} = 1 - \frac{TR_{t,j}}{BRTS_{t,j}}$$

$BR_{t,j}$	Break-even at year *t* of fleet segment *j*. It is optional to include *FC*
$OC_{t,j}$	Over capacity at year *t* of fleet segment *j*
$SSBLC_{t,i,j}$	Spawning stock biomass costs of quota species at year *t* of species *i* by fleet segment *j*
rl	Remuneration percentage of the quota fish stocks
$BRLS_{t,j}$	Break-even at year t of fleet segment *j* including remuneration of quota species
$OCLS_{t,j}$	Over capacity at year *t* of fleet segment *j* taking stock remuneration (resource rent) of quota species into account
rn	Remuneration percentage of the non quota fish stocks
$SSBNC_{t,i,j}$	Stock biomass costs of non quota species at year *t* of species *i* by fleet segment *j*
$BRTS_{t,j}$	Break-even at year t of fleet segment j including remuneration of quota species
$OCTS_{t,j}$	Over capacity at year *t* of fleet segment *j* taking stock remuneration (resource rent) of quota and non quota species into account.

Fixed costs are divided between fixed operational costs on one-hand and depreciation and interest payments on the other. These are maintained constant throughout time.

Table III.1: Numerical example of the calculation of fleet activity A

	Landings and quotas											**Stock abundance SSB**				**Total**
	Base year			Year t								Base	Year t			Year t
Species	Landings/quotas	Price	Revenue	Quota	Price flexibility	Price	Revenue	'Price effect'	Chi (χ)	'Volume effect'	Total effect	SSB	SSB	Beta (β)	'SSB effect'	Total effect
1	50	12.0	600	50	-0.2	12	600	0.308	1	1	0.308	200	200	1	1.000	0.308
2	40	10.0	400	30	-0.2	10.5	420	0.215	1	0.75	0.162	150	100	1	1.500	0.242
3	30	5.0	150	45	-0.2	4.5	135	0.069	1	1.5	0.104	100	200	1	0.500	0.052
4	10	70.0	700	15	-0.2	63	630	0.323	1	1.5	0.485	50	75	1	0.667	0.323
5	5	20.0	100	7.5	-0.2	18	90	0.046	1	1.5	0.069	50	75	1	0.667	0.046
Total	135		**1950**	147.5			1875	0.962			1.12692					0.971

The activity variable *A* for period *t* is in this example 0.971.

18 ANNEX I. EXPERT DECLARATIONS

Declarations of invited experts are published on the STECF web site on https://stecf.jrc.ec.europa.eu/home together with the final report.

European Commission

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Abstract

SGBRE-08-05 was held on 3-6 December 2007 in Brussels. The meeting was a follow up of the SGBRE-08-03 meeting, held in Lisbon (4-8 June 2007) focusing on the assessment of the impact of long-term management plans on northern hake stocks. STECF expressed its opinion on the report by written procedure in January 2008.

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