SOCIO-ECONOMIC BENEFITS

OF A BOLD EU FISHERIES REFORM

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A discussion paper

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October 2012

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BACKGROUND TO THE REPORT

The current approach to fisheries management in the EU is, in general, unsustainable. Fish stocks are depleted, reproduction levels are falling and as a result fish numbers are much lower than the natural ecosystem can sustain. In other words we are taking too much from the sea.

Past attempts to evaluate the cost of unsustainable fisheries practices, indicate that a shift to sustainable fisheries in Europe would offer great financial and environmental benefits. The Sunken Billions report, published by the World Bank in 2009, estimates that economic losses due to poor management of marine fisheries amount to US$50 billion (bn) annually. In addition, several other studies have tried to calculate the potential revenue being lost in Europe, although most have focused on individual stocks (e.g. cod) and do not provide the broader picture at EU level nor do they consider the potential socio-economic benefits in terms of jobs or increased societal wellbeing for the catching sector, etc.

WWF commissioned Framian BV to examine several scenarios that highlight the potential socio-economic benefits of bold and effective Common Fisheries Policy (CFP) reform - i.e. reform leading to stock recovery and contributing to healthy marine ecosystems - and to compare these reform scenarios with certain losses that will accrue if current trends are allowed to continue.

This discussion paper aims to help inform EU decision-makers who need to make smart policy reform choices, to ensure that fish stocks recover over the next ten years; and because healthy stocks are fundamental to the future of the fisheries sector in terms of both jobs and income.

LIST OF ABBREVIATIONS

bn	billion
CFP	Common Fisheries Policy
DCF	Data collection framework
EFRD	European Fund for Regional Development
EMFF	European Maritime and Fisheries Fund
ESF	European Social Fund
EU	European Union
F	Fishing mortality
F_{mp}	Maximum F under the management plan
FTE	Full-time equivalent
GDP	Gross domestic product
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical sub-area
GVA	Gross value added
ICES	International Council for the Exploration of the Sea
I(T)Q	Individual (transferable) quota
m	million
MS	Member State
MSC	Marine Stewardship Council
MSY	Maximum sustainable yield
$MSYB_{trigger}$	Spawning stock biomass at MSY level
NA	Not available
NE	North East
NPV	Net present value
RAC	Regional Advisory Councils
RBM	Rights-based Management
SSB	Spawning stock biomass
STECF	Scientific, Technical and Economic Committee on Fisheries
TAC	Total allowable catch
TFC	Transferable fishing concessions
TURF	Territorial user rights in fisheries

GLOSSARY

Fishing mortality - fraction of a fish stock that is removed each year because of fishing activities.

F_{MSY} - the fishing mortality that in the long-term will maximise yield

Gross value added (GVA) - sum of remuneration of labour (wages, crew share) and capital (profit) plus depreciation and interest on capital. GVA is the total income generated by an economic activity. For a country, the sum of the GVA of the economy is equal to the gross domestic product (GDP). In the text the terms GVA and income are used interchangeably.

Historical trend - average annual change of an indicator in the period 1995-2009. This period was selected on the basis of the EU landings from NE Atlantic waters, which peaked at 4.8 million tons in 1995 and declined by 4.2% per year in the subsequent 14 years.

Maximum sustainable yield (MSY) - The maximum yield of a specified fish stock that may be fished year after year without harming the fish stock.

$MSYB_{trigger}$ - a biomass reference point that elicits a cautious biomass triggering action to maintain a stock within a desirable stock size range.

Net present value (NPV) - NPV is an approach to measure value of future income. It allows different income streams to be compared. The interest rate used for discounting expresses a time preference. High interest rates favour the short term over the long term. It means that revenues further in the future are not valued as much as those realized in the short term. A low interest rate (e.g. the 2% used in this study) means that long-term considerations (like ecosystem recovery) get priority. For example: a cash flow of €100 in year five at a discount rate of 2% means that the present value is €90. If it were discounted at 10%, the present value would be €59. Thus by using a low discount rate, a greater loss of income in the short run (by for example introducing catch restrictions) is easily compensated by higher income in the future.

Calculation of net present value should not be confused with deflating, i.e. accounting for inflation. Calculation of NPV is usually based on an estimation of revenues and costs using constant prices. If current prices are used, than the discount rate must be a sum of inflation and time preference. The scenarios in this study are based on constant prices.

Spawning stock biomass (SSB) - stock population capable of reproducing.

EXECUTIVE SUMMARY AND CONCLUSIONS

Objective and main conclusions

The objective of the study is to highlight the socio-economic benefits of an ambitious reform of the Common Fisheries Policy (CFP); a reform leading to healthy fish stocks and fisheries, sustainable incomes for fishermen and improvement in the quality of their employment.

Over the past 15 years, EU fisheries have been in continuous decline. Landings and employment have been falling at a steady rate of 4% per year and fishermen's incomes have stagnated. Although fishing mortality has been reduced, a sustainable balance between fishing effort and fishing opportunity has yet to be achieved.

The scenarios elaborated in this study lead to some stark conclusions. If the status quo continues, by 2022 the EU fishing fleets will land 1.4 million (m) less tons of fish. For example, Spanish fleet landings could shrink by 26%, French by 20% and Polish by 27%. Furthermore, 50,000 fishermen will have lost their jobs across the EU. On the other hand, if CFP reform restores sustainable landings, by 2022 the EU could produce 1.4m-2.8m more tons of fish and up to 35,000 jobs could be saved. This could boost the EU fisheries' income by up to €2.1 billion (bn) by 2022 in comparison with maintaining the present course (as indicated by the observed historical trends). Furthermore, income per fisherman would be 30%-50% higher than at present.

Method of the study

The study reviews EU landings trends, the scientific evidence concerning the status of the 118 main EU fish stocks and the economic performance of the EU fishing fleet.

The EU fisheries' future is then explored using scenario analysis. Each scenario is based on a set of assumptions and relations between the fish stock size and the socio-economic performance of the fishing fleet. The present study explores and compares possible future scenarios but it does not attempt to forecast the future, recognising the inherent uncertainties of such forecasts.

Specifically, four scenarios have been developed to assess the future of EU fisheries.

The two deterioration scenarios are based on a continuation of the current trend of decreased landings. They assume that without further CFP reform, fish stocks and the fishing industry will continue to decline:

- The slow deterioration scenario assumes a fall in total EU landings of 1.8% per year, which is half of the rate of decline observed between1995-2009.
- The fast deterioration scenario assumes a full continuation of the fall in landings, i.e. 3.7% per year for the total EU catch. Assumptions about the decline of the fleet and employment are also based on the historical trends observed during the period 1995-2009.

The two recovery scenarios assume that sustainable fisheries will be achieved through a 15% reduction in landings over the first three years of the next ten-year period:

- The slow recovery scenario allows for a gradual increase in landings in the subsequent seven years of the next CFP decade, rising to landings which are 20% above 2009 levels, by 2022.
- In the fast recovery scenario landings increase, by 2022, to 40% above the 2009 level.

In each of the recovery scenarios, both fleet and employment are assumed to decline over the first three years (2013-2015) and then to remain constant until 2022.

Achieving sustainability is not a cost-free process. Higher revenues in the long run are achieved through short-term investments (such as catch restrictions). The different benefit streams are comparable with the net present value method, using a low discount rate which is an economic expression of the priority given to the long-term recovery of the stock.

The scenarios are elaborated for the EU as a whole, as well as for several key Member States.

The four scenarios map-out the future development boundaries for EU fisheries – on one hand, a pessimistic scenario whereby historical trends are continued, and on the other hand, an optimistic scenario leading to 40% higher landings by 2022. It is likely that in 2022 the actual situation will be somewhere between these two eventualities.

The final part of the study outlines measures which should be supported by the future European Maritime and Fisheries Fund (EMFF). The EMFF will be the primary funding instrument for fisheries policy in the period 2014-2020.

Stock status

The 2011 assessment by the International Council for the Exploration of the Sea (ICES) of the 118 most important fish stocks in EU waters (representing landings of 3.8m tons) leads to a number of important conclusions:

1. Five fish stocks (landings of 0.2m tons or 5.3% of the total landings) can be classified as sustainable in terms of fishing mortality and biomass.
2. Three stocks (landings of 4,000 tons or 0.1% of the total landings) are sustainable in terms of fishing mortality, but their biomass is too low.
3. Eight stocks (landings of 1.5m tons or 39.5% of the total landings) are fished too intensively, but their biomass is considered at a sustainable level.
4. A full evaluation of sustainability in terms of fishing mortality and biomass is feasible only for 22 stocks, (representing landings of 1.8m tons or 47.4% of the total landings). For the other 17 stocks (landings of 1.2m tons or 31.6% of the total landings), the required information on either fishing mortality or on biomass is lacking, so their sustainability status can only be partially evaluated.
5. Sustainability cannot be evaluated at all for 79 stocks (landings of 0.8m tons or 21.1% of the total landings), as neither of the two indicators has been quantified by the ICES.

Current fishing mortality and biomass are available for 33 stocks (representing landings of 2.9m tons or 76% of the total landings). Average mortality has fallen from 0.33 in 2002 to 0.21 in 2010. This trend can be discerned for both pelagic and demersal species. The average fishing mortality of demersal stocks is still at a relatively high level of 0.3, so further management measures are required.

EU outlook

Over the past 20 years the CFP has failed to stop, let alone reverse, the negative trends observed in EU fisheries. EU landings have been falling on average by 3.7% per year, whereas other important fish producers like Iceland and Norway have managed to maintain their production at relatively constant levels. The size of the EU fleet and on-board employment declined by 2.2% and 3.7% per year, respectively.

The socio-economic performance of the fisheries sector has not improved at all over the past decade. The real value of landings has been falling in line with the rate of inflation and the deflated income per employed has just about remained constant. Earnings in the EU marine fisheries are only around a third of the average for the general EU economy. These developments undoubtedly diminish the attractiveness of employment in the fisheries industry and pose a fundamental threat to the future of the sector.

The difference between landings by 2022 under the recovery and deterioration scenarios amounts to 1.4m-2.8m tons or €1.1bn-€2.1bn in annual income. Compared with 2009 figures, the recovery scenarios imply that landings would increase by between 0.6m-1.4m tons and that income would increase by €0.5bn-€1.1bn.

Over the 10 year period, the recovery scenarios generate an income which is between €2bn-€6bn higher than that of the deterioration scenarios. This is equivalent to €200m-€600m per year or a 7%-17% increase on the 2009 level.

In all scenarios, it can be expected that the size of the fleet and employment will decrease in the coming decade, although under the deterioration scenarios between 14,000-35,000 more jobs would be lost than under the recovery scenarios. It is also likely that higher landings in the recovery scenarios would help to safeguard employment in the fish processing industry and possibly even lead to some job increases.

Table A. Scenarios for EU-27

	Situation 2009	Deterioration scenarios in 2022	Recovery scenarios in 2022
Landings (million tons)	5.1	3.7-4.3	5.7-6.5
Employment (1000)	149	102-123	137
Generated income (€ bn)	3.6	2.6-3.0	4.1-4.7
Income / fisher (€1000)	23	25-26	30-34

Sources: FAO, DCF, EU Fleet Register

Member States

Some Member State fishing fleets are highly dependent on species managed through Total Allowable Catch (TAC) (e.g. the UK), which is not the case for others (e.g. Spain). This implies that any measures taken under a reformed CFP will have widely different consequences for Member States in terms of generated income and employment.

Under the recovery scenarios, Spanish fisheries could provide 7,000-9,000 more jobs and generate €130m-€280m more than if the stocks continue deteriorating. France and the United Kingdom could also make significant gains, with additional income of between €120m-€250m for each of them and the creation of between 1,000-3,000 jobs. In case of Germany and Poland the benefits are somewhat smaller due to the much smaller size of their respective catching sectors.

Table B. Selected EU Member States – Income and employment under different scenarios and the situation in 2009

	Employment (1000)			Income (million euro)		
	2009	Deterioration scenarios in 2022	Recovery scenarios in 2022	2009	Deterioration scenarios in 2022	Recovery scenarios in 2022
Spain	34	23-25	32	750	525-615	741-804
France	13	9-11	12	476	398-448	565-640
United Kingdom	11	8-9	10	377	278-319	451-527
Germany	2	2	2	60	60-59	64-73
Poland	2	2	2	21	16-14	23-25

Source: DCF + own calculations

Policy recommendations

The diversity of the EU's fisheries calls for equally diversified fishery-by-fishery management. Appropriate measures can be selected from a common policy toolbox. The study highlights specific measures subdivided into number of areas:

- Long-term management plans
- Regionalisation
- Rights-based management
- Mitigation of social consequences
- Role of science

The financial resources available under the future EMFF, including national contributions, will amount to approximately €1.5bn per year. Effective and efficient use of these resources (please see Chapter 4.4 for more information) can be achieved if:

- Policy makers exploit synergies between measures and constructively resolve possible conflicts between them.
- Arrangements are made for cooperation and pooling of resources between individual Member States to promote fishery-by-fishery management.
- EMFF initiatives and results are broadly communicated so that best practices and lessons can be shared and EU-wide synergies are created.

1. INTRODUCTION

Background

The next ten-year phase of the Common Fisheries Policy (CFP) begins in 2013. Although the final decisions have yet to be taken, the new CFP policy is expected to ensure that by 2015 populations of harvested species are above biomass levels needed to produce maximum sustainable yield (MSY), as mandated at the World Summit on Sustainable Development in Johannesburg, South Africa, in 2002. This will require major political commitment as some stocks are still being fished at well above sustainable levels. Rigorous measures will be only adopted if there are strong socio-economic arguments demonstrating that the costs of imposing constraints in the short run will be more than off-set by the long-term benefits in terms of stability and quality of employment and income. The CFP reform is thus a once-in-a-decade opportunity to lock-in the needed structural measures.

The economic benefits of sustainability, on a global level, have been demonstrated in the widely publicised World Bank study Sunken Billions. At EU level, the benefits of sustainable fishing have been confirmed by the 2011 CFP Impact Assessment carried out by the European Commission (EC, 2011).

Objective

The objective of the present study is to highlight the socio-economic benefits of a meaningful reform of the CFP: achieving healthy fish stocks will lead to healthy fisheries, i.e. higher income for the industry, sustainable incomes for fishermen and higher quality employment.

The study provides a quantitative estimation of income and employment which can be created and maintained over the long term once EU fish stocks are subject to a sustainable level of exploitation. It also accounts for the costs related to the short-term restrictions needed to get there.

Approach

Following the introductory chapter, the present study is composed of three main parts.

Chapter 2 evaluates the past performance of the CFP on the basis of FAO data on landings and stock; status data provided by the ICES for the Atlantic and the General Fisheries Commission for the Mediterranean (GFCM)[1]. The economic data is drawn from the Scientific, Technical and Economic Committee on Fisheries (STECF, 2011c).

Chapter 3 presents four scenarios, two of which are deterioration scenarios based on historical trends and two are recovery scenarios which assume that an effective sustainable fisheries policy is in place[2]:

1. The slow deterioration scenario assumes that in the years 2013-2022 the fall of EU landings and fleets will be half that of the historical trend observed between 1995-2009, i.e. about 1.8% per year.
2. The fast deterioration scenario assumes that the historical trend of 1995-2009 will be maintained over the next ten-year phase of the CFP, meaning that EU landings would continue to fall by 3.7% per year.

[1] STECF, 2011a,b
[2] Details of the scenario assumptions are presented in annex A.

3. The slow recovery scenario assumes that sustainable fisheries are achieved in 2022 and that landings are 20% above the 2009 level.
4. The fast recovery scenario also assumes that sustainable fisheries are achieved in 2022 and that landings are 40% above the 2009 level.

The scenarios are elaborated for the EU as a whole, as well as for a number of individual Member States. The deterioration scenarios indicate the range of further deterioration which may occur if the CFP continues in its current form ('business as usual'). The recovery scenarios show the extent of potential improvements if effective fisheries management is in place. Comparison of the deterioration and recovery scenarios indicates the potential gains to be realised if sustainability is achieved.

Chapter 4 outlines policy measures which will require financial support from the future European Maritime and Fisheries Fund (EMFF).

It must be stressed that the present study does not attempt to forecast the future. Rather, it explores different policy options using scenario analysis, based on specific assumptions and analyses of their consequences. The study is based on a set of clearly defined assumptions about future development. In this way full transparency is provided about how the results have been obtained.

The study covers the totality of the EU fisheries, making a distinction between landings from Atlantic TAC and non-TAC stocks, the Mediterranean area and other waters, primarily due to differences in the landings trends. Furthermore, these areas are characterised by different approaches to fisheries management and stock assessment.

Interpretation of sustainability

In the spirit of the declaration of the 2002 World Summit on Sustainable Development, the EU, in principle, pursues, "restoration of stocks to levels that can produce the maximum sustainable yield." However, at present, these levels have yet to be quantified. While the ICES does not provide any MSY estimates, it has set values for the sustainable fishing mortality rate (Fmsy) for a significant number of stocks.

In this study, sustainability is used in the sense of the Brundtland Commission: "sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[3] Applying the Brundtland definition to EU fisheries means that catches should not exceed recruitment in order to allow the biomass to grow or maintain itself at an optimum level.

Limitations of the study

Ideally, a study dealing with the benefits of sustainability would be based on an integrated bio-economic model. Bio-economic modelling of multi-species and multi-fleet fisheries has a number of evident merits[4]. The implementation of such an approach at EU level would demand significantly more time and resources than are available for the purpose of this study. However, the results of this study are in various respects well aligned with the World Bank's Sunken Billions report. (Annex C).

[3] United Nations General Assembly (1987) Report of the World Commission on Environment and Development: Our Common Future
[4] Salz, 2010

2. STATUS OF EU FISHERIES AND PERFORMANCE OF THE CFP

2.1. Trends in landings

Despite continued effort under the CFP to improve fish stock status and stabilise the EU fishing sector performance, the trends have been largely negative over the past 10 years[5]:

- Between 2000 and 2009 EU-27 landings have declined by over 22%, from 6.6 to 5.2 million tons[6]. This decline has affected most, though not all, species managed by TAC, and cod in particular. The production of species not managed by TAC has fallen significantly less, which shows that the vessel operators look for alternatives to compensate for TAC reductions for their traditional target species.
- In parallel with the decline in landings, the size of the fleet has been reduced by almost the same percentage. The number of vessels in the EU-15[7] dropped from about 98,000 in 2000 to 77,000 in 2010, i.e. by 21%. The similarity of the decline of landings and fleet size (coupled with relatively constant fish prices and increasing fuel costs) seems to indicate that the reduction of the fleet is a consequence of decreasing landings.
- Smaller fleets imply lower employment. While in 2001 on-board employment was estimated for the EU-15 to be some 216,000 fishermen[8], by 2009 this number had fallen to about 152,000[9], a decrease of 30%. In some of the new Member States the decline was even more dramatic, due to the required restructuring from centrally-planned to market economies. In 2001, the Polish fishing sector employed about 7,600[10] people, but by 2009 only about 2,200[11] were still employed.
- The total value of landings has remained relatively constant, between €7bn and €8bn. Despite decreased employment, average earnings per fisherman have not increased because of higher costs and especially due to the rise in fuel prices[12].

The EU has failed to reverse the negative landings trends particularly for demersal species. Figure 1 presents a comparison of EU and several other countries with a well-developed fisheries management policy. Although all countries faced significant fluctuations in their landings over the past 20 years, overall the non-EU countries do not show evidence of negative long term trends. The EU's landings of demersal species have fallen by 50% and pelagics by 15%-20%.

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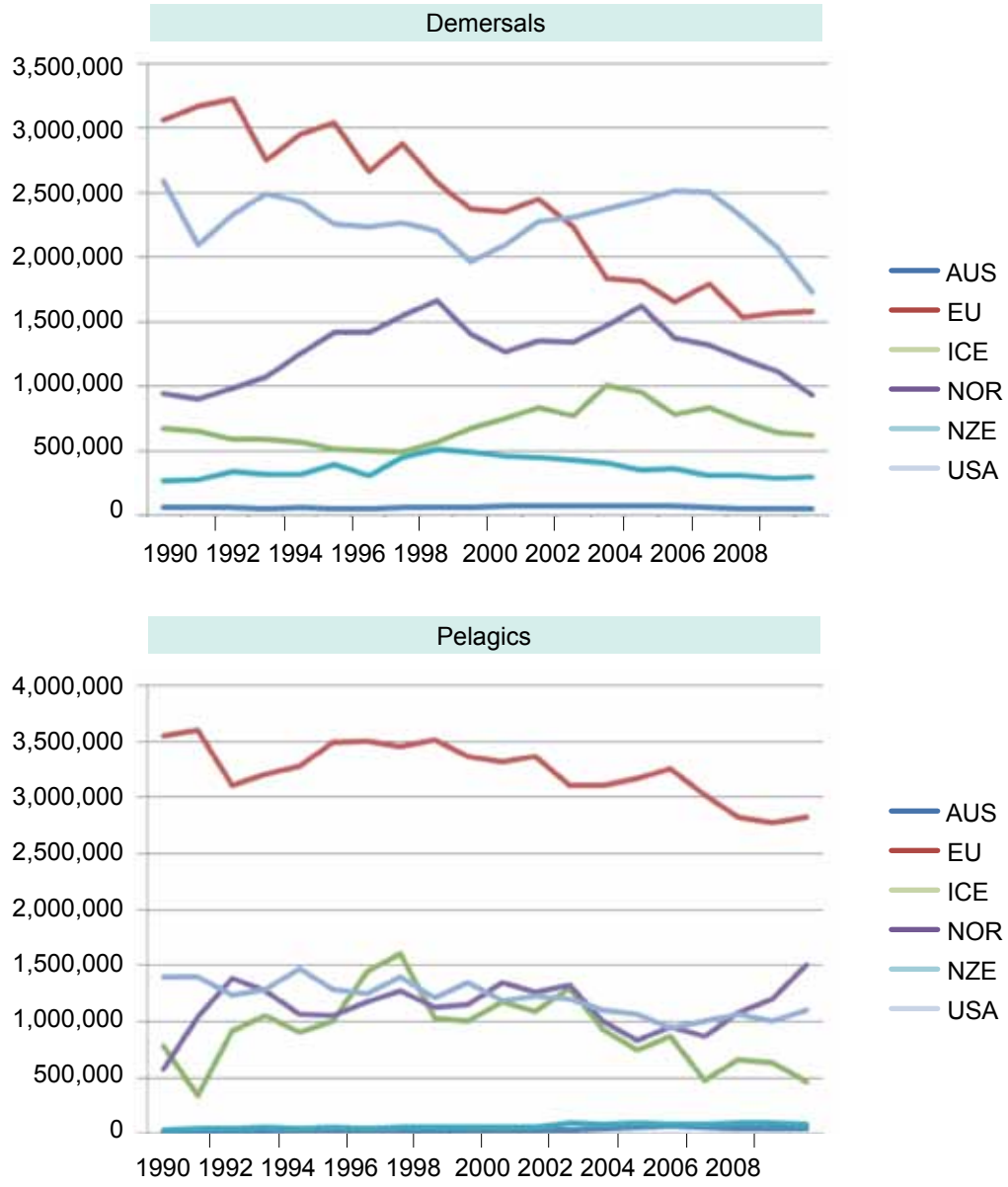
[5] Period 2000-2009 is presented in the following bullets, as comprehensive data on fleet is not available on 1995.
[6] FAO FishStatJ 2011
[7] Data on fleets in the new MS are available in the EU Fleet Register only since the year of their accession (2004 resp. 2008). Consequently, longer time series are only available for EU-15.
[8] Economic performance of selected European fishing fleets, Annual report 2002, December 2002, p.15
[9] DCF data 2009, plus own estimate for Greece.
[10] AER 2002, p.233
[11] DCF 2009
[12] http://www.indexmundi.com/commodities/?commodity=crude-oil-brent&months=240

Figure 1. Landings of demersal and pelagic species – international comparison, 1990-2009



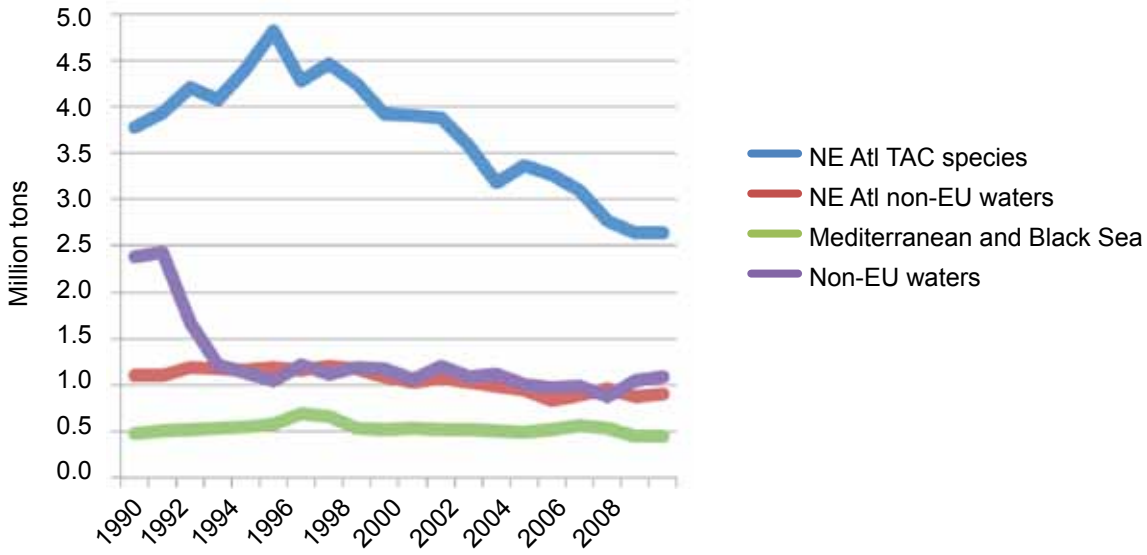
Source: FAO, FishStatJ 2011

The EU fishing fleet's landings are composed of four distinct groups of species which have different historical trends and which are influenced differently by the CFP:

- stocks in EU Atlantic waters directly governed by the CFP through TAC and other management measures (e.g. herring, mackerel, cod);
- species caught in NE Atlantic (mostly EU) waters, but not subject to TAC (e.g. boarfish, crustaceans and bivalves);
- landings made in the Mediterranean and the Black Sea (e.g. sardine, hake, anchovy);
- landings made in other parts of the world (e.g. tunas, (horse) mackerel, sardine).

The composition and trends of these four groups is presented in Figure 2. It is evident that landings of the thirty selected TAC species have fallen since 1993. However, landings from all other areas have been relatively constant at little over 1m tons from other stocks in the NE Atlantic and from non-EU waters. The Mediterranean production fluctuates around 500,000 tons. The CFP's TAC and quota policy thus affected little over 50% of the EU total landings by 2009[13].

Figure 2. Landings of EU fleet according to area of origin



Source: FAO FishStatJ 2011

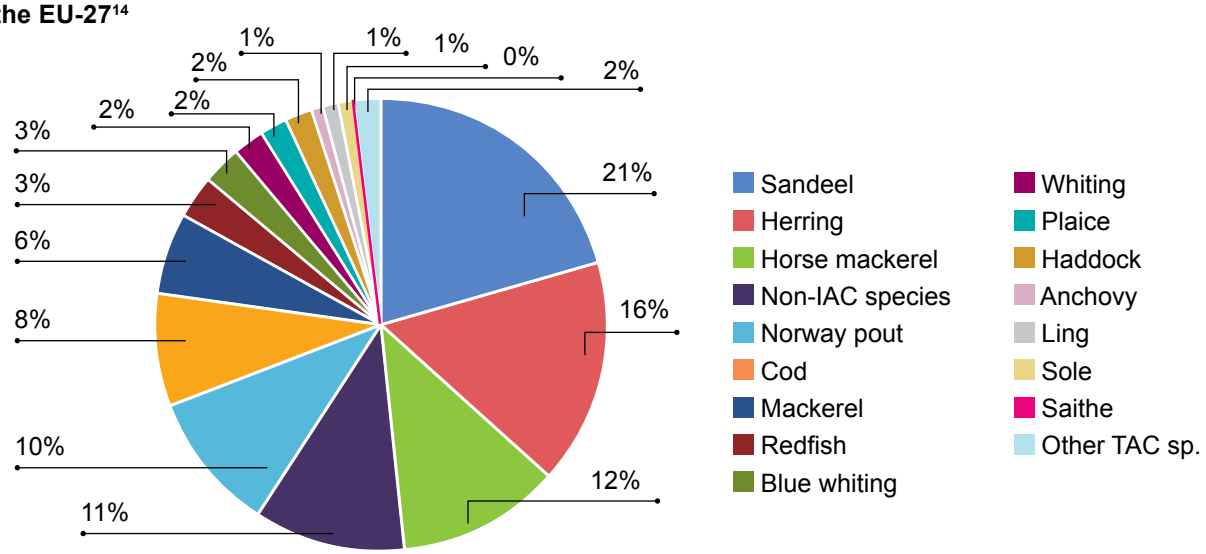
The fall in TAC species landings is mainly the consequence of decreases in cod, several small pelagic species (herring, horse mackerel and mackerel) and species used for industrial processing (Sandeel and Norway pout). Most demersal TAC species play a relatively modest role (see Table 1 and Figure 3).

[13] 52% considering the 30 selected species, plus some TACs in the NE Atlantic, outside EU waters.

Table 1. EU-27 - Landings of TAC species caught in the NE Atlantic, 1995-2009 (tons and % change)

Species	1995	2009	Change in tons	Change in %
Sprat	523,679	538,409	14,730	3%
Herring	922,804	531,358	-391,446	-42%
Sandeel	862,258	338,712	-523,546	-61%
Mackerel	476,664	338,430	-138,234	-29%
Horse mackerel	451,397	161,097	-290,300	-64%
Cod	321,751	124,647	-197,104	-61%
Blue whiting	143,762	80,931	-62,831	-44%
Plaice	119,613	65,966	-53,647	-45%
Nephrops	55,889	63,842	7,953	14%
Saithe	58,672	53,247	-5,425	-9%
Hake	54,427	53,146	-1,281	-2%
Haddock	105,082	52,296	-52,786	-50%
Anglerfish	53,607	43,984	-9,623	-18%
Whiting	87,176	28,151	-59,025	-68%
Dab / flounder	21,937	27,265	5,328	24%
Sole	44,133	27,011	-17,122	-39%
Norway pout	262,759	19,927	-242,832	-92%
Megrim	21,577	16,761	-4,816	-22%
Redfish	75,282	10,235	-65,047	-86%
Prawn	12,236	10,186	-2,050	-17%
Lemon sole	10,023	9,619	-404	-4%
Ling	28,849	8,918	-19,931	-69%
Greenland halibut	5,555	7,573	2,018	36%
Turbot/brill	10,585	7,322	-3,263	-31%
Rays / skates	19,374	7,117	-12,257	-63%
Pollack	11,070	6,973	-4,097	-37%
Blue ling	4,972	3,654	-1,318	-27%
Grenadier	10,846	3,608	-7,238	-67%
Anchovy	37,012	3,498	-33,514	-91%
Non-TAC species	1,188,690	911,857	-276,833	-23%
Total	6,003,676	3,557,749	-2,445,927	-41%

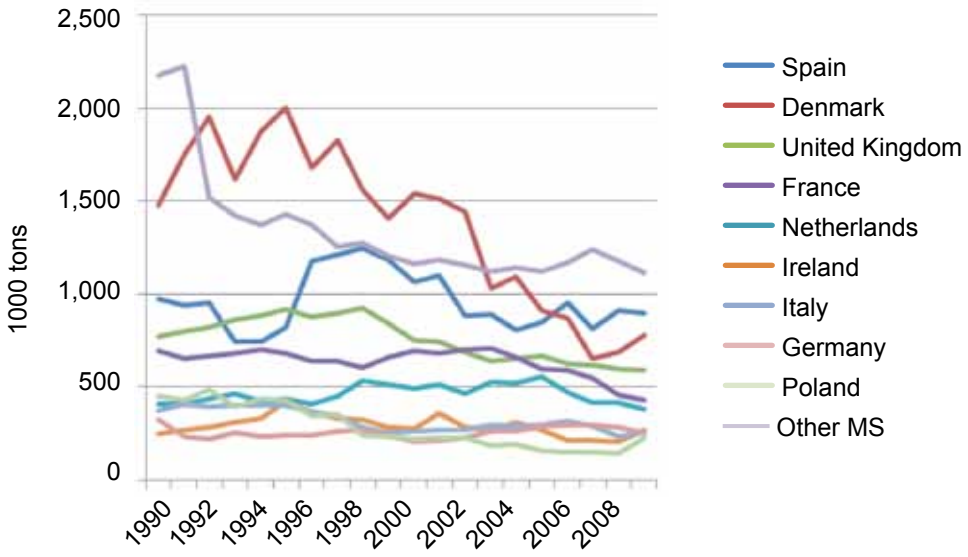
Figure 3. Decrease in TAC species landings from the NE Atlantic between 1995 and 2009 for the EU-27[14]



Source: FAO FishStatJ 2011, presentation of column 'Change in tons' of table 1.

The overall trend at the EU level is barely representative of individual Member State development, due to overwhelming differences as regards dependence on TAC species and non-EU waters. TAC landings account for 80%-90% of the total volume in some Member States, e.g. in Denmark or Sweden. Others Member States rely on non-EU waters (e.g. Spain). The fall in total EU landings has therefore various causes. In Denmark, landings for industrial processing (fish meal) have dropped significantly. Spain was affected by limitations to its access to third-country waters, in particular the waters of Morocco[15]. Among other Member States, Lithuania, Latvia and Estonia have restructured their distant fleets due to market pressure. The United Kingdom was particularly affected by reduced landings for TAC species. The French fleet, on the other hand, faced lower landings of non-TAC species and in non-EU waters. Within Member States, fleet segments are affected differently, according to their specific activities. This implies that any measures taken under a reformed CFP will have widely differing consequences for Member States and their fishing fleets.

Figure 4. Landings by Member State, 1990-2009



Source: FAO FishStatJ 2011

[14] Catches have increased for only a few species, in particular sprat, nephrops. They are not accounted for in the figure.
[15] Spanish catches in East Central Atlantic fell from 340,000 tons in 1996-98 to 110,000 tons per year in 2007-9.

2.2. Status of stocks in the Atlantic areas

Some signs of stock recovery are becoming apparent in the 2011 ICES assessments, although they are not obvious from the above data. Table 2 (based on Annex B) summarises the ICES information for the 118[16] most important stocks in EU waters, related to some 130 EU TACs. A number of important conclusions can be made:

1. Only 5 stocks (catches of 176,000 tons, 5% of total) can be classified as 'sustainable', their fishing mortality being below Fmsy and biomass being above MSYBtrigger.
2. Fishing mortality is below Fmsy for 13 stocks (or 631,000 tons of landings, 17% of total).
3. Spawning stock biomass (SSB) is above MSYBtrigger for 15 stocks (or 1,788,000 tons of landings, 47% of total).
4. A full sustainability evaluation is only feasible for 22 stocks, representing 1,870,000 tons of landings (50% of total). For the other 96 stocks, the required information on either fishing mortality or on biomass is lacking.
5. The status of 79 of the stocks cannot be assessed at all because the available data on both fishing mortality and biomass and their sustainability reference points is not available. These 79 stocks account for 755,000 tons of landings, i.e. 20% of the total of 3.8m tons.
6. For 53 stocks, representing 80% of the ICES landings, at least some biological information is available, i.e. either related to fishing mortality or to biomass or both.

Table 2. Volume of the ICES landings* according to sustainability indicators

	Number of stocks				Landings (1000 tons)			
	F<Fmsy	F>Fmsy	Uncertain	Total	F<Fmsy	F>Fmsy	Uncertain	Total
SSB >MSYBtrigger	5	8	2	15	176 (5%)	1,475 (39%)	136 (4%)	1,788 (47%)
SSB < MSYBtrigger	3	6	1	10	4 (0%)	215 (6%)	0 (0%)	219 (6%)
Uncertain	5	9	79	93	450 (12%)	592 (16%)	755 (20%)	1,798 (47%)
Total	13	23	82	118	631 (17%)	2,282 (60%)	892 (23%)	3,805 (100%)

Source: ICES 2011 assessments (see annex B)
*This is the sum of landings of the various stocks specified in the ICES assessments.

Table 2 presents the status of the stocks in 2011. Table 3 compares fishing mortality and spawning stock biomass for 2002[17] and 2010. It reflects the changes seen over the past decade of the CFP and it leads to a number of important conclusions:

1. SSB has increased while fishing mortality has fallen for 18 stocks, which represent a catch of 2,118,000 tons, i.e. 55% of the ICES landings under consideration.
2. The status of four stocks has deteriorated in relation to both indicators – mortality has increased and the biomass has fallen.
3. Similarly to Table 2, the trends can be determined for neither mortality nor biomass for 81 of the stocks, which together represent 20% of the landings under consideration.

[16] Eight stocks of annex B have not been included in the table as the ICES does not provide any landings data.
[17] Year 2002 was selected as it immediately precedes the start of the 2003-2012 CFP decade, i.e. it reflects the situation which the present CFP inherited.

Table 3. Change in F and SSB from 2002 to 2010, number of stocks and the ICES landings

Trend in SSB	Trend in F							
	Number of stocks				Landings (1000 tons)			
	$F_{2010}<F_{2002}$	$F_{2010}>F_{2002}$	Uncertain	Total	$F_{2010}<F_{2002}$	$F_{2010}>F_{2002}$	Uncertain	Total
SSB2010 >SSB2002	18	4	1	23	2,118 (56%)	281 (7%)	0	2,399 (63%)
SSB2010 <SSB2002	9	4	0	13	151 (4%)	472 (12%)	0	623 (16%)
Uncertain	1	0	81	82	50 (1%)	0	732 (19%)	782 (21%)
Total	28	8	82	118	2,319 (61%)	753 (20%)	732 (19%)	3,805 (100%)

Source: ICES 2011 assessments (see annex B)

The change between 2002 and 2010 in spawning stock biomass and fishing mortality points to a gradual recovery. Some 50%-60% of landings are of stocks where mortality has fallen and biomass has increased. Only 12% of the landings come from stocks with negative changes for both parameters.

Annex B contains 33 stocks for which current fishing mortality and SSB are available for 2002 and 2010. These stocks represent a catch of 2.9m tons in 2010, i.e. about 75% of the landings of all included stocks. This allows an overall weighted average fishing mortality to be calculated, using the SSB data. This weighted average mortality has decreased from about 0.33 in 2002 to 0.21 in 2010. This is a very significant reduction[18]. The same trend can be observed for both 11 pelagic and 22 demersal stocks, where average mortality dropped respectively from 0.30 to 0.19 and from 0.44 to 0.30. The 2011 ICES data shows clear signs of a reduction in exploitation rates, when compared to 2002, for the Atlantic stocks for which sufficient data is available (see Annex B[19]).

2.3. Status of stocks in the Mediterranean

Evaluation of the fish stocks in the Mediterranean is, for the time being, constrained by the nature and the large numbers of these stocks. Large numbers of relatively small stocks are defined on a detailed spatial scale of the GSAs (Geographical Sub-areas). The STECF[20] concludes that:

Of the 24 stocks assessed by the EWG, 21 were classified as being subject to overfishing, while only 3 stocks were found [to be] sustainably fished in relation to the proposed management reference points consistent with high long-term yields (F_{MSY}).

In its latest stock assessments, the GFCM provides quantitative indications of overfishing levels for 28 stocks.

[18] This reduction can be compared to the conclusions of the Gulland (1990) and Lassen (1995) reports which suggested that there should be reductions of fishing mortality of around 40%.
[19] Annex B also shows that most Fmsy values are about 0.2 or higher.
[20] STECF, 2011b, p.27

Table 4. Exploitation status of 28 Mediterranean stocks

GSA	Species	Ratio Fcur/F0.1
GSA 01 Northern Alboran Sea	Merluccius merluccius	6,65
GSA 05 Balearic islands	Merluccius merluccius	7,56
	Mullus surmuletus	2,11
	Aristeus antennatus	3,93
GSA 06 Northern Spain	Mullus barbatus	3,6
	Aristeus antennatus	4,75
	Parapenaeus longirostris	3,8
GSA 07 Gulf of Lion	Merluccius merluccius	7,52
	Mullus barbatus	1,88
GSA 09 Ligurian and North Tyrrhenian Sea	Merluccius merluccius	9,09
	Mullus barbatus	1,14
	Mullus surmuletus	2
	Galeus melastomus	3,5
	Aristeus antennatus	1,93
	Nephrops norvegicus	1,66
	Parapenaeus longirostris	0,37
GSAs 12, 13 Northern and Eastern Tunisia	Shpyraena sphyraena	In overfishing
GSAs 12-16 Strait of Sicily	Parapenaeus longirostris	1,27
GSA 15, 16 Strait of Sicily	Mullus barbatus	1,73
	Pagellus erythrinus	2
	Aristaeomorpha foliacea	2,5
GSA 17 Southern Adriatic	Solea solea	4,61
GSA 18 Southern Adriatic Sea	Merluccius merluccius	4,14
GSA 25 Cyprus island	Mullus barbatus	1,39
	Mullus surmuletus	2,13
	Spicara smaris	1,54.
	Boops boops	1,54
South	Pagellus erytrinus	2,4

Source: GFCM, 2012, Report on intersessional activities for 2011, Recommendations and workplan for 2012 of the SAC and its subsidiary bodies, Report of the meeting in Mara

Although these stocks represent only a small part of the total landings in the Mediterranean, Table 4 shows that for some stocks and fisheries a very significant reduction of fishing mortality may be required.

2.4. Socio-economic performance of the fisheries in the EU-15[21]

The European fisheries sector is in continuous decline. In Table 5, the indicators fall at very similar rates, with the exception of the nominal value of landings. The volume of landings has declined by about 1.5m tons, or 25%, between 2000 and 2009. About half of this decline is a consequence of decreasing Danish landings for fishmeal.

Both fleet size and employment have fallen by 20%-30% in the EU-15 since 2000. Considering that the Danish fishmeal fleet does not employ many crewmen, on-board employment in the EU fleet has declined about twice as fast as have landings for human consumption[22]. This more rapid decline in employment is at least partly a consequence of the introduction of labour-saving technologies on board, which are necessary to maintain productivity and income[23].

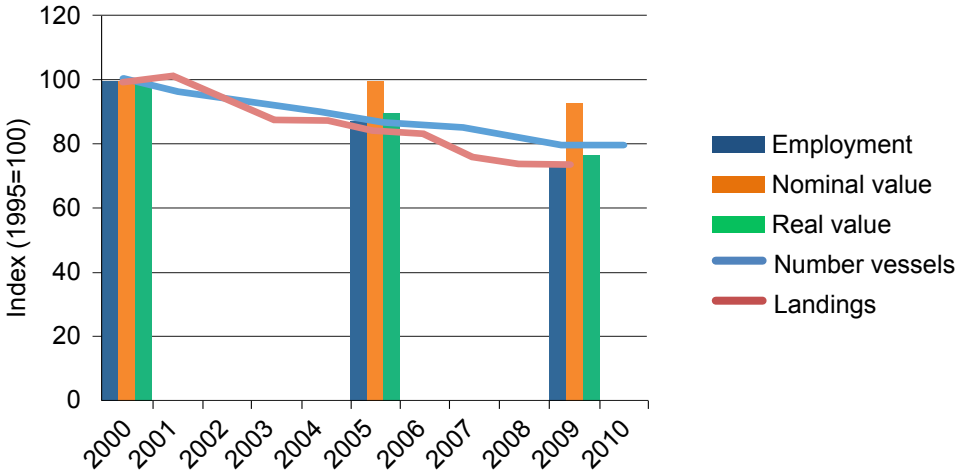
The nominal value of landings remains relatively constant, between €6.5bn and €7bn per year. This means that nominal price increases compensate for the lower total landings. When inflation is accounted for, however, the real value of landings has fallen by over 20% in the last 10 years. The real prices of fish (after inflation) remain quite constant, a phenomenon witnessed for many primary products.

Input costs (particularly fuel) have risen, especially since the fuel crises of 2007. Consequently, an increasing share of the value generated is required to cover production costs, while the proportion of gross income in production value is falling. Whereas in 1995 about 55% of the landed value represented income[24] to the fishing sector, by 2009 this percentage had decreased to about 45%.

The nominal gross value added (GVA) per fisherman has been gradually rising, although the rate of increase has clearly slowed down since 2005, as a consequence of the fuel crisis. The real value added per employed has remained relatively constant at around €20,000[25] until the fuel crisis of 2008. In 2009, the average was about €16,000. Large income differences exist between the various Member States, ranging from less than €10,000 per man in Greece to some €50,000 per man in Denmark or the Netherlands. It must be stressed that these are not personal incomes, but a value comparable to GDP per employed. In 2009, an average GDP per employed in the EU-15 amounted to about €63,000[26]. This shows that GVA in fisheries per employed is only about one third of the EU-15 average. In other words, those employed in the catching sector contribute significantly less to the national economy than other sectors, unless a large majority are part-time fishermen.

[21] Economic performance is evaluated on the basis of EU 15, as there is insufficient data for the newer Member States prior to their accession.
[22] A big part of the decrease in EU landings is due to Denmark's fish meal fleet which employs very few people.
[23] It must be noted that statistics on fisheries employment are not equally reliable for all Member State. Definitions differ and change over time, especially when accounting for full-time and part-time employment.
[24] Income means gross value added, being the sum of labour remuneration, profit, depreciation and interest.
[25] At 2009 prices.
[26] Eurostat: employment (lfsi-emp-a), gdp (nama-gdp-c)

Figure 5. Selected fisheries indicators - EU-15 (index, 2000=100)



Sources: EU Fleet Register, DCF, Salz (2006), Salz and Macfadyen (2007)

A general trend in most economies, is that as labour productivity rises, employment in primary sectors falls (in absolute and relative terms) and that there is a shift towards secondary and in the EU especially, tertiary sectors[27]. In the past decade, crewing vessels has become more difficult, partly as a consequence of lower earning opportunities and job insecurity. Other factors play a role as well – social status of the profession or limited life-long career opportunities. There are indications that high labour costs in the EU-27 are leading to increased hiring of non-EU fishermen on larger vessels, particularly on-board distant fleets and in the Mediterranean area – e.g. Moroccans in southern Spain, Tunisians in Italy and Egyptians in Greece. In 2005, some 5,000-10,000 foreigners were estimated to work in fisheries[28]. The fisheries' socio-economic role for EU coastal communities is already relatively limited[29] and will deteriorate even further if the current trends are not reversed.

Table 5. Selected fisheries indicators – EU-15

	1995	2000	2005	2009
Number vessels (1000)	104	96	83	77
Landing (1000 t)	6,953	6,094	5,145	4,513
Employment (1000)	241	193	168	140
Nominal value (€ m)	6,652	7,094	7,060	6,593
Real value (€ m in 2009)	8,581	8,614	7,740	6,593
Nominal GVA /employed (€1000)	15	18	20	21
Real GVA /employed (€1000 of 2009)	20	21	19	16

Sources: EU Fleet Register, DCF, Salz (2006), Salz and Macfadyen (2007)

Although fishing fleet profitability varies from fishery to fishery, there are clear indications that, overall, the sector operates at just above 'break-even' point, i.e. over a longer period, profits are low in relation to revenues and capital costs (STECF, 2011c, chapter 5.4-5.6).

[27] Primary sectors are agriculture, fishing and mining. Secondary sectors are industry and construction, etc. Tertiary sector are services.
[28] Salz (2006) The number includes also EU citizens working in a different EU Member States.
[29] Salz 2006; Salz and Macfadyen, (2007).

Added to low profitability, the EU fishing fleet is getting older every year. The level of investment in new vessels has dropped dramatically since 2004, when subsidies for new vessel construction were abolished. Whereas in 2008-2009 a total of about 1,200 new vessels were added to the EU fleet, in the years 1996-2005, on average, more than 3,200 new vessels were added for any 2-year period. With low levels of fleet investment, today's average vessel age of about 25 years is expected to rise to well over 30 years by 2023. This will probably negatively impact the (energy) efficiency, productivity and competitiveness of the sector. The possibilities of modernising old vessels with new equipment are not unlimited.

2.5. Conclusions regarding the CFP performance

Over the past 20 years the CFP has not managed to reverse or at least contain negative trends in the EU fisheries sector, even if the rate of deterioration does seem to be slowing down. The 2011 ICES assessments indicate that the status of some important stocks is improving and that overall fishing mortality is systematically falling, although it has not yet achieved a sustainable level.

TAC policy directly affects little more than half the total EU fisheries sector production. The dependence on TAC among Atlantic coastal states differs widely, which consequently has implications for the potential benefits of the TAC policy.

The socio-economic performance of the fisheries sector has not improved at all. The real value of landings has been falling with the rate of inflation and the deflated GVA per employed has just about remained constant. However, it is only about one third of the average GDP per employed achieved by the general EU economy. This undoubtedly reduces the attractiveness of employment in the fisheries sector and poses a fundamental threat to the future of European fisheries.

3. SCENARIO ANALYSIS

3.1. Outline of the scenarios

Noting the limitations in mankind's understanding about interactions within the ecosystem in general and among fish stocks in particular, it is not possible to forecast exactly what will be sustainable fish production levels, when they can be achieved and which short-term restrictions are required to reach them. Scenario analysis[30] is therefore a method to explore future options, replacing a lack of knowledge with explicit assumptions[31]. The potential benefits of an ambitious pursuit of sustainability are illustrated by comparing the results of four scenarios.

The two deterioration scenarios used in the following analysis are based on EU landings trends observed between 1995-2009. If fisheries management does not become more successful, the historical trends are likely to continue. The period 1995-2009 was selected on the basis of the statistically very high significance of the downward trend[32]. The selection of a shorter period was tested and the results had a gradual decrease in statistical significance. The selection of a longer period (e.g. 1990-2009) led to a rapid decrease in the statistical significance (correlation coefficient -R2) because of the opposite trends observed in the years before 1995.

Evaluation of the status of stocks in section 2.2 indicates that at least some improvements may be looming over the horizon and that continuation of the present policies may lead to a slower decline than that evidenced over the past decade. This justifies the use of a slow deterioration scenario. The fast deterioration scenario is justified on the basis of historical evidence.

The decrease in the number of vessels and employment is also based on the historical trends for these two indicators.

The two recovery scenarios assume that the CFP reform will be ambitious and effectively implemented. During the first three years, landings would be reduced by 5% per year and recruitment will exceed landings by 2015, allowing stocks to grow. A reduction of the fishing mortality by a total of 15% is considered appropriate as section 2.2 and annex B demonstrate that a weighted average mortality for 33 of the most important stocks amounted to 0.21 in 2010. A further reduction of 15% would bring this value to about 0.18, which is well below the acceptable value of 0.2[33]. Subsequently landings will be allowed to increase gradually, along with the growth of the stocks. As present knowledge does not allow an estimation of future potential landings, it was assumed that by 2022 they will be 20% and 40% respectively above the 2009 level. Average landings for the period 1995-2009 were about 22% above the 2009 production. These assumptions are within the range of the results of Salz et.al. (2010)[34]. The assumed increase in landings by 20% and 40% respectively is relatively modest compared to the 2012 study by the NEF[35].

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[30] The scenario analysis is based on Schwartz, 1991.
[31] Buisman, 1997 and Alder, 2007
[32] Fitting exponential function to the data of 1995-2009 gives the result of Y=4.96*e^-0.042 with R2=0.962.
[33] Fishing mortality has to be reduced primarily on demersal stocks and especially on North Sea cod.
[34] This study estimated recovery for seven specific fisheries using an advanced bio-economic model. It confirms that increase of landings can be expected after three years of effective restrictions. The extent of these restrictions and the subsequent increase of landings in the following years vary widely according to fishery and the fishery management approach.
[35] NEF expects MSY level of landings about 80% above 2010 level for some 30 stocks relevant to the EU. However, NEF does not indicate when this production level could be reached.

The fall in landings in the first three years will be accompanied by an elimination of overcapacity, i.e. a reduction in the number of vessels by a total of about 10% in three years. Consequently, employment is assumed to fall at the same rate during this period. Neither fleet capacity nor employment is assumed to increase again, despite the subsequent rise in landings. Capacity increases are undesirable, to avoid renewed creation of overcapacity. A rise in employment does not seem likely as higher profitability will lead to investments in labour-saving technologies. Furthermore, the relatively low level of earnings in fisheries (see section 2.4) is at least partly caused by part-time employment. With improving earning opportunities, full-time employment will become more common.

The four scenarios can be summarised as follows (see Figure 6):

- The slow deterioration scenario assumes that in the years 2013-2022 the reduction in EU landings and fleets will be half the historical trend seen between 1995-2009, i.e. about 1.8% per year.
- The fast deterioration scenario assumes that the trend observed from 1995-2009 will continue over the next decade of the CFP, i.e. about 3.7% per year.
- The slow recovery scenario assumes that, after an initial 5% fall in landings, per year, in the period 2013-15, sustainable fisheries will, by 2022, produce landings 20% above 2009 levels.
- The fast recovery scenario assumes that, after an initial 5% fall in landings per year, in the period 2013-15, sustainable fisheries will, by 2022, produce landings 40% above 2009 levels.

Figure 2 shows that landings from different origins have developed at different rates. This is an important conclusion, as EU Member States depend on these origins to varying degrees. Therefore, the four scenarios also distinguish between four types of landings:

- TAC species from NE Atlantic
- Non-TAC species from NE Atlantic
- Landings in the Mediterranean and Black Sea
- Landings from other waters.

Specific assumptions are made regarding the changes in the size of the fleet, employment and income (i.e. gross value added, GVA). The real prices of fish are assumed to remain constant[36]. The scenario analysis assumes that the cumulative net effects of all other phenomena, e.g. availability of fishermen or climate change, are not of decisive importance[37].

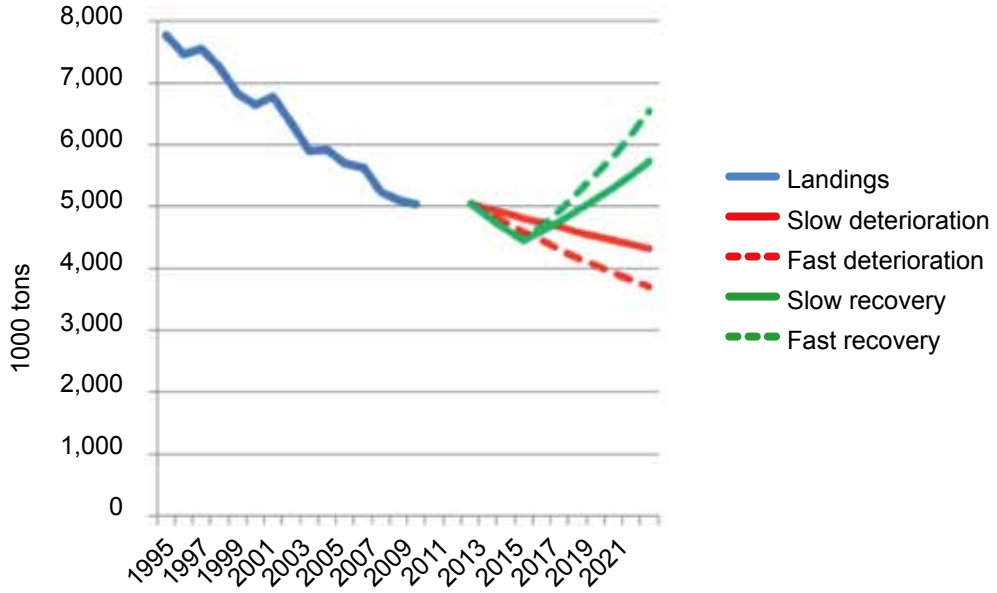
The scenario results are compared on the basis of GVA and employment. The report does not make a distinction between labour income and profit as for EU fisheries such a distinction is not relevant. In 2005, the EU-27 fleet consisted of 95,000 vessels with a crew of 84,000 owners and 124,000 deckhands[38]. These numbers illustrate that about 90% of the fleet is skipper-owned and 40% of the employed persons are also owners. Consequently, what matters is the change in total income per man and not only profit.

The final comparison of the scenarios is based on the net present value (NPV) of the income generated during the next CFP decade. A relatively low discount rate of 2% is used, as an expression of the priority given to long-term recovery over the short-term benefits.

[36] This assumption is supported by historical evidence for primary products in general. In the future, higher demand can be expected due to growth of population and income, but higher supply is also likely from aquaculture as new species are domesticated.
[37] This is the so-called 'ceteris paribus' assumption, i.e. all other things remaining equal.
[38] Salz, 2006 p.15

The details of the scenarios are presented in Annex A. Figure 6 shows the assumed development of landings under the four scenarios in relation to the historical landings of 1995-2009. In combination, the four scenarios provide ranges of possible results.

Figure 6. Historical landings of EU-27 in relation to the scenarios (1000 tons)



Source: FAO FishStatJ, 2011 and own calculations

3.2. EU-27 scenarios

Deterioration scenarios

By 2022, total landing may be 15%-27% lower than in 2009. If EU fish consumption remains at the 2009 level, this would increase the EU market dependence on imported fish to some 70%-75%. The value of landings and, more importantly, the GVA, as a contribution to the EU's GDP (Gross Domestic Product) will decrease by the same percentage.

The size of the fishing fleet will further decrease by 10%-20%, while employment may fall by 15%-30%. The danger of such a negative development is clearly present in light of the recent trends for the sector, as described in chapter 2. Real earnings may increase by 4%-9%, as employment is expected to fall faster than the value of landings.

Recovery scenarios

It is evident that if past trends are reversed and landings gradually increase in the years 2016-2022, the economic performance of the sector can be expected to improve in all respects.

In the recovery scenarios, by 2022, the volume and value of landings, as well as the GVA is 20%-40% above 2009 levels. Employment is expected to fall by 8% compared to 2009. Consequently, income per employed person would rise by 25%-50% to about €31,000-€33,000. It must be pointed out that this amount includes all components of GVA, i.e. labour remuneration, profits and capital costs, so that this is not disposable income. It is still significantly lower than the average GDP per employed in the EU-27, which amounts to about €57,000. Although it would be more appropriate to relate GDP per employed in fisheries to comparable

sectors, it does indicate that earnings in the fisheries are and will remain relatively low compared to the rest of the society. This has been highlighted in greater detail in earlier studie[39].

Comparison of the scenarios

The difference in landings by 2022 between the recovery and deterioration scenarios, amounts to about 1.4m-2.9m tons or €1bn-€2.1bn in generated gross income. Compared to 2009, the recovery scenarios imply that landings would increase by 0.7m to 1.5m tons and their value by €1.2bn-€2.6bn euro.

In all scenarios it can be expected that the size of the fleet and employment will decrease, although in the deterioration scenarios, employment would fall by 14,000-35,000 jobs more than in the recovery scenarios.

Achieving sustainability is not a cost-free process. Apart from the cost of fisheries management, control and research, which are discussed in chapter 4, revenues are decreased in the short run, due to the reduced TAC necessary to let the fish stock recover. The scenarios assume a 5% overall reduction in landings per year, during the years 2013-2015[40]. Subsequently, there is a recovery towards the greater assumed landings by 2022. The revenues (GVA) generated during this recovery path can be compared to the revenues which would be obtained under the deterioration scenarios. The comparison of the net present values of gross value added (NPV GVA) shows that recovery scenarios generate over the 10-year period €2bn-€6bn more than the deterioration scenarios. This represents an additional income of €200m-€600m per year, or a 7%-17% increase over the 2009 level. The comparison of scenarios is presented in Table 6 and Figure 7.

Table 6. Scenarios for EU-27

	Situation 2009 (=2013)	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	5,051	4,318	3,695	5,731	6,546
Landings value (€ m)*	7,442	6,438	5,572	8,679	10,041
Fleet (1000 vessels)	84.7	75.9	67.8	78.0	78.0
Employment (*1000)[41]	148.8	123.5	102.1	137.0	137.0
Gross value added (€ m)	3,498	3,026	2,619	4,079	4,720
GVA / employed* (€1000)	23.5	24.5	25.7	29.8	34.4
NPV GVA 2013-2022 (€ m)		29,101	26,991	31,121	33,067

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

There is trade-off between employment and the income per employed. In the scenarios all economic benefits have been allocated to the income per fisher. If under the fast recovery scenario in 2022, the income per fisher was to be reduced by 8%, then total employment could be maintained at the 2009 level.

[39] Salz (2006), statistical annex.
[40] Although this is only an assumption, it is supported by a comparison of weighted averages Fmsy to F2010 presented in chapter 2.
[41] Estimates based on DCF 2009, extrapolated for the difference between EU Fleet Register and fleet covered in the DCF. Greece assumed 25,000 employed. Employment in FTE can be estimated at 120,000-130.000, depending on definitions.

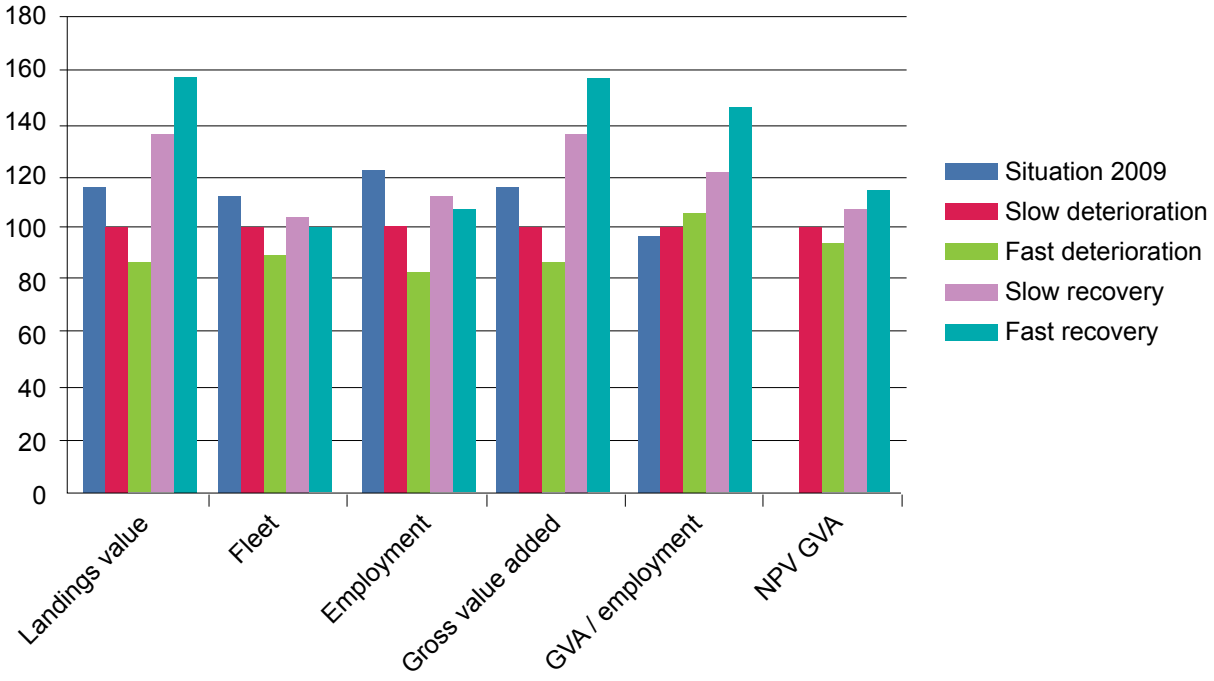
Effects on fish processing

Consequences on employment and income in fish processing have not been explicitly included in the scenario analysis. In 2002-2005 there were about 100,000-120,000 people working in fish processing in the EU-15 and further 30,000 in the new Member States[42]. EU fish processing is undergoing a continuous consolidation process, with introduction of labour-saving technologies and transfer of labour-intensive activities to low-wage countries.

It is certain that the decrease in raw materials under the deterioration scenarios will reduce employment in fish processing. On the other hand, the significantly greater availability of raw materials in the recovery scenarios, will possibly create new jobs or at least save some of the jobs which would otherwise be lost.

Figure 7. EU-27 Comparison of the four scenarios with the 2009 situation

(index, slow deterioration scenario = 100)



3.3. Scenarios for Spain

In 2009, Spain produced about 900,000 tons of fish, of which about 100,000-150,000, i.e. 11%-16%, originated from TAC species managed directly by the EU[43]. Approximately 50% of landings were taken from non-EU waters. The rest of the landings are either non-TAC species in the NE Atlantic (22%-27%) or from the Mediterranean (11%). This implies that achieving sustainability in relation to EU's Atlantic waters would have a relatively smaller positive effect on the Spanish fishing industry than for Member States which heavily depend on the Atlantic fisheries. On the other hand, Spain would potentially benefit from strong EU positioning in achieving sustainability in non-EU waters where the Spanish fleet is involved.

[42] Salz et.al. 2006 and Salz and Macfadyen 2007, excl. Romania and Bulgaria.
[43] The precise number depends on the inclusion or exclusion of landings of 'jack and horse mackerel nei' and 'mackerels nei'. Landings of these species amount to 47,000 tons, but it is not clear whether or not they are subject to TAC.

The scenarios generate the following results:

- Should the historical trends continue for the coming decade, Spanish landings will be reduced by 14%-26% compared to 2009. Catch value may decrease by €330m-€550m. Employment may fall by between 8,000-10,000 jobs.
- If sustainability is achieved, Spanish landings could increase by 40,000-130,000 tons, compared to 2009. In that case, employment falls may be limited to 2,000 jobs, i.e. 6%. The GVA per employed would be €1,000-€3,000 higher than in 2009; i.e. 5%-14%,. The total GVA will only increase under the fast recovery scenario, due to the Spanish dependence on non-EU waters.
- The NPV of GVA is €0.3bn-€1bn higher in the recovery scenarios than for the deterioration scenarios. Achieving sustainability would generate between €30m-€100m per year extra in GVA.

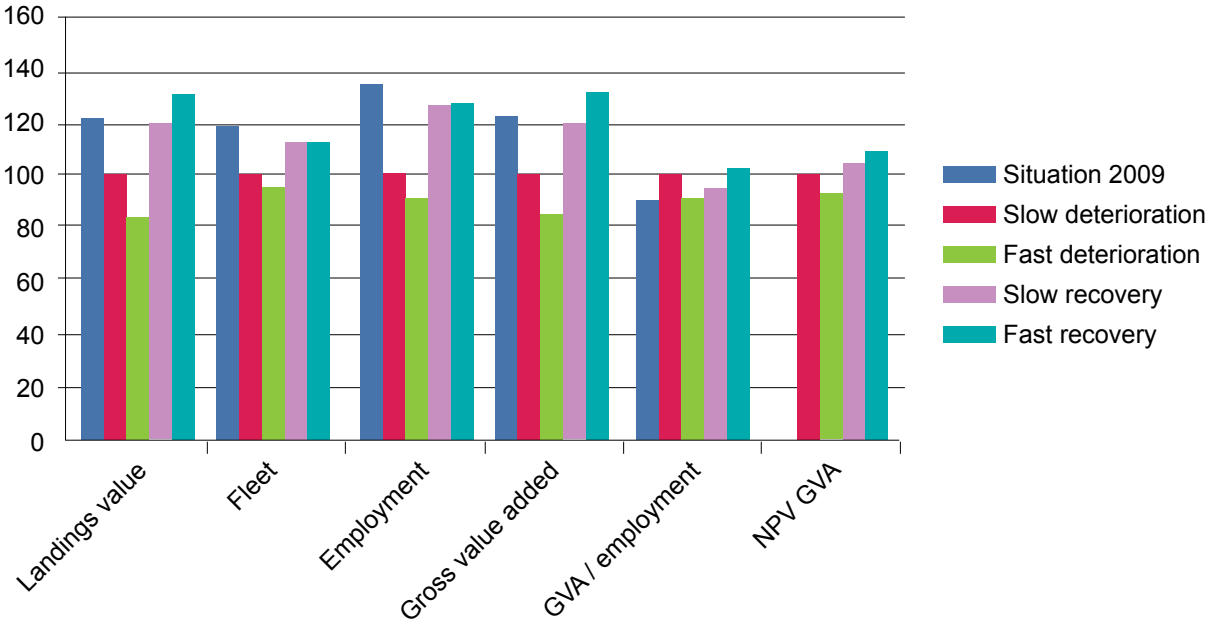
Table 7. Spain – Scenario results

	Situation 2009	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	898	772	663	942	1,033
Landings value (€ m)*	1,846	1,515	1,293	1,824	1,979
Fleet (1000 vessels)	11.1	9.3	8.9	10.5	10.0
Employment (1000)	33.8	25.1	23.2	31.9	31.9
Gross value added (€ m)	750	615	525	741	804
GVA / employed* (€1000)	22	25	23	23	25
NPV GVA 2013-2022 (€ m)		5.95	5.48	6.26	6.45

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

Figure 8. Spain - Comparison of the four scenarios in 2022 with the 2009 situation

(index, slow deterioration scenario = 100)



3.4. Scenarios for France

The French fishing fleet depends for some 30% of its catch on TAC species, while 40% of its landings from the NE Atlantic is composed of non-TAC species. The remaining 30% is caught either in the Mediterranean or in non-EU waters. This implies that improving the status of TAC species alone will have a limited effect on economic performance. The scenario analysis assumes that the policy will increase all landings, except those from non-EU waters outside the NE Atlantic.

The scenarios generate the following results:

- Should the historical trends continue over the coming decade, French landings will be reduced by 10%-20% compared to 2009. Employment may fall by as much as 2,000-4,000 jobs.
- If sustainability is achieved, French landings could increase by 50,000-120,000 tons, compared to 2009. In that case, employment may fall by only 8%. The GVA per employed would be €10,000-€17,000, i.e. about 30%-45%, higher than in 2009.
- In the recovery scenarios the NPV of GVA is €0.2bn-€0.7bn higher than the deterioration scenarios. This means that achieving sustainability would generate between €20m-€70m per year.

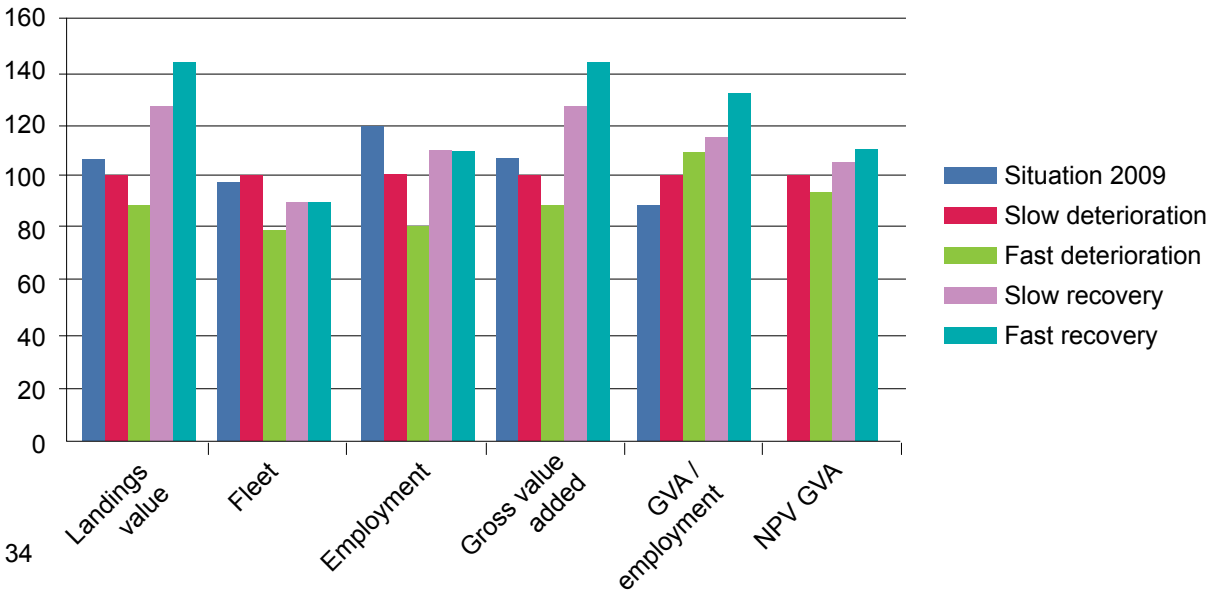
Table 8. France – Scenario results

	Situation 2009	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	408	366	328	462	526
Landings value (€ m)*	1,008	949	842	1,196	1,355
Fleet (1000 vessels)	7.3	7.5	5.9	6.8	6.5
Employment (*1000)	12.9	10.8	8.8	11.9	11.9
Gross value added (€ m)	476	448	398	565	640
GVA / employed* (€1000)	37	41	45	48	54
NPV GVA 2013-2022 (€ m)		4.26	4.00	4.46	4.69

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

Figure 9. France - Comparison of the four scenarios in 2022 with the 2009 situation

(index, slow deterioration scenario = 100)



3.5. Scenarios for the United Kingdom

The UK fleet depends on TAC species for about 78% of its landings, while another 17% came from other landings from the NE Atlantic. Only 5% of the UK landings originate from non-EU waters. The UK fleet therefore has a major interest in the sustainable management of EU waters.

The scenarios generate the following results:

- Should current trends continue over the coming decade, UK landings will be reduced by 12%-16% compared to 2009. Employment may fall by between 1,700-3,500 jobs.
- If sustainability is achieved, UK landings could increase by 110,000-225,000 tons, compared to 2009. In that case, employment may fall by only 10%. The GVA per employed would be €10,000-€19,000, i.e. 30%-54%, higher than in 2009.
- The net present value of GVA is €0.3bn-€0.7bn higher under the recovery scenarios than under the deterioration scenarios. This means that achieving sustainability would generate €30m-€70m more per year in gross value added.

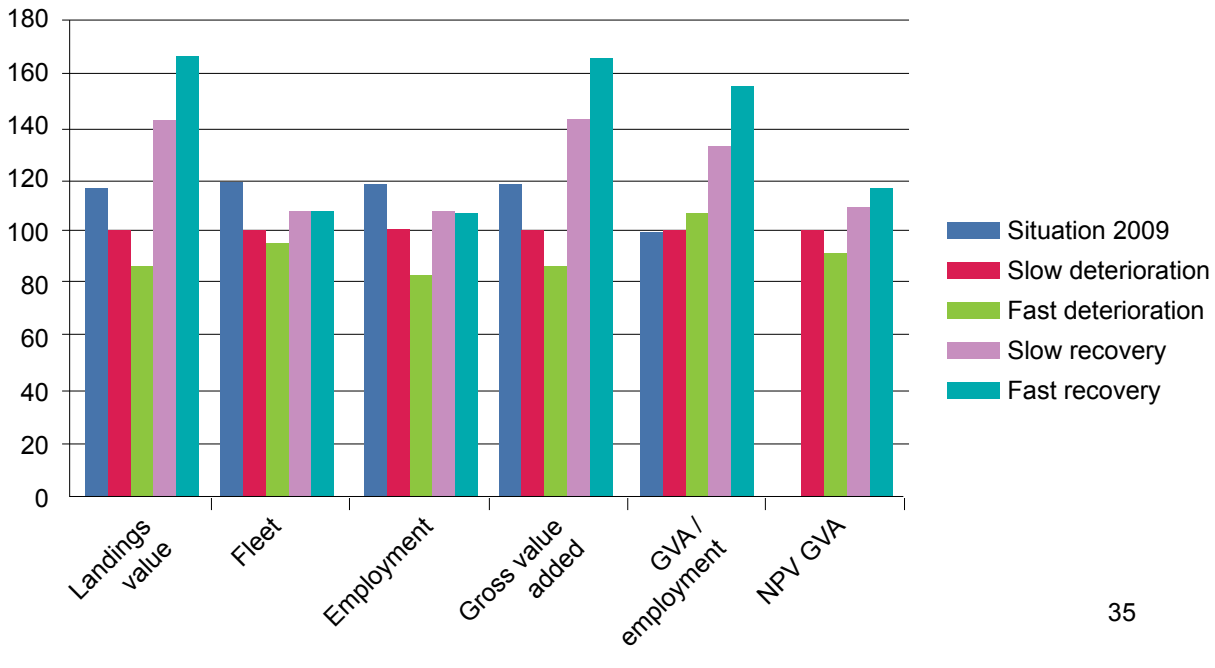
Table 9. United Kingdom - Scenario results

	Situation 2009	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	588	518	495	698	814
Landings value (€ m)*	755	640	557	902	1,056
Fleet (1000 vessels)	6.5	5.5	5.2	5.9	5.8
Employment (*1000)	11.2	9.5	7.7	10.2	10.2
Gross value added (€ m)	377	319	278	451	527
GVA / employed* (€1000)	34	34	36	44	52
NPV GVA 2013-2022 (€ m)		3.10	2.86	3.37	3.60

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

Figure 10. United Kingdom - Comparison of the four scenarios in 2022 with the 2009 situation

(index, slow deterioration scenario = 100)



3.6. Scenarios for Germany

The German fleet depended in 2009 for about 77% of its landings on TAC species, while only 8% came from other landings from the NE Atlantic. About 15% of the German landings originated from non-EU waters. The German fleet has a major interest in sustainable management of EU waters.

Fisheries production in Germany was relatively stable over the past 10-15 years. It means that the deterioration scenarios are not much different to the 2009 situation.

The scenarios generate the following results:

- Should the current trends continue over the coming decade, German landings and their value will remain at almost 2009 levels. However, employment may fall by 300-700 jobs.
- If sustainability is achieved, German landings could increase by 35,000-75,000 tons, compared to 2009. In that case, employment may fall by only 200 jobs. The GVA per employed would increase by €4,000-€9,000.
- The NPV of GVA does not differ significantly between the various scenarios. This is a consequence of historical trends, which would not lead to a major reduction in landings.

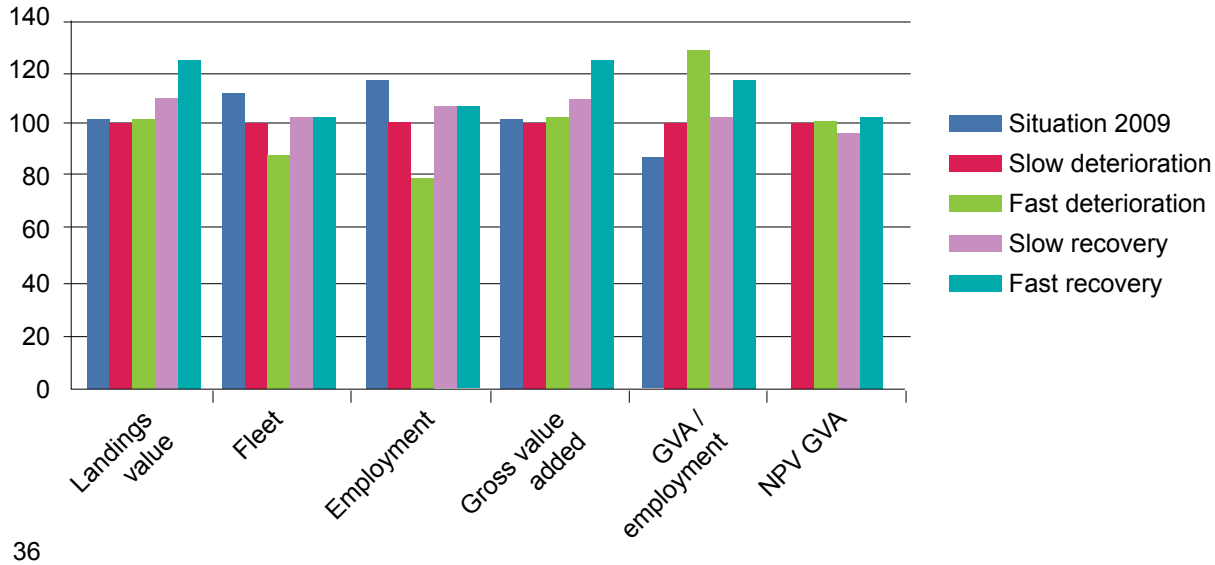
Table 10. Germany – Scenario results

	Situation 2009	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	227	233	240	262	301
Landings value (€ m)*	198	195	199	214	242
Fleet (1000 vessels)	1.8	1.6	1.4	1.6	1.6
Employment (*1000)	2.3	2.0	1.6	2.1	2.1
Gross value added (€ m)	60	59	60	64	73
GVA / employed* (€1000)	26	30	38	30	35
NPV GVA 2013-2022 (€ m)		0.52	0.53	0.51	0.53

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

Figure 11. Germany - Comparison of the four scenarios in 2022 with the 2009 situation

(index, slow deterioration scenario = 100)



3.7. Scenarios for Poland

The Polish fleet depended in 2009 for about 64% of its landings on TAC species, while only 36% came from non-EU waters. Consequently, the Polish fleet has a major interest in sustainable management of both EU waters and stocks exploited elsewhere.

Over the past 15-20 years the Polish fishing industry has gone through major restructuring as a consequence of market forces and EU policies; its distant-water fleet has largely disappeared.

The scenarios generate the following results:

- Should the current trends continue over the coming decade, Polish landings will be reduced by about 27% and their value by about 30%, compared to 2009. Employment may fall by between 500-700 jobs.
- If sustainability is achieved, Polish landings could increase by 20,000-45,000 tons, compared to 2009. In that case, employment may fall by only 5%. The GVA per employed would increase by between €1,000-€2,000 euro, i.e. 10%-20% above the 2009 level.
- The net present value of GVA is €60m higher in the recovery scenarios than in the deterioration scenarios. This means that achieving sustainability would generate €6m more per year extra in GVA.

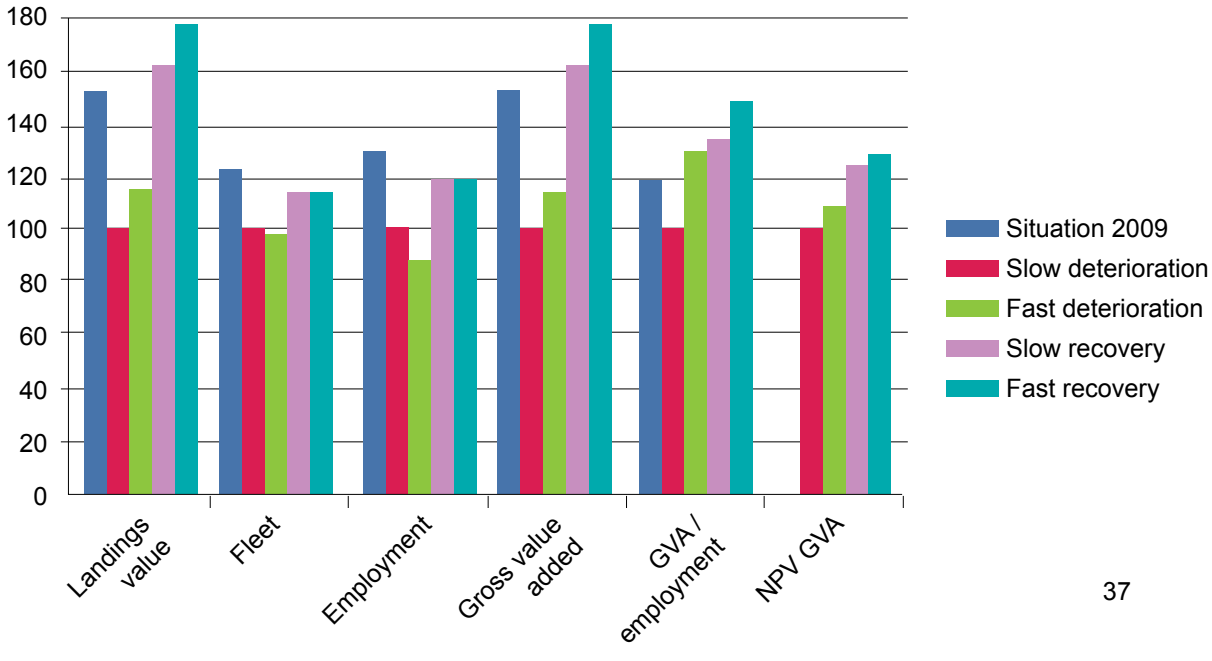
Table 11. Poland – Scenario results

	Situation 2009	Deterioration scenarios in 2022		Recovery scenarios in 2022	
		Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
Landings (1000 t.)	202	147	148	221	248
Landings value (€ m)*	69	45	52	73	80
Fleet (1000 vessels)	0.9	0.7	0.7	0.8	0.8
Employment (*1000)	2.2	1.7	1.5	2.1	2.1
Gross value added (€ m)	21	14	16	23	25
GVA / employed* (€1000)	10	8	11	11	12
NPV GVA 2013-2022 (€ m)		0.15	0.16	0.19	0.19

Sources: FAO, DCF, EU Fleet Register,
* in constant prices of 2009

Figure 12. Poland - Comparison of the four scenarios in 2022 with the 2009 situation

(index, slow deterioration scenario = 100)



4. POLICY IMPLICATIONS

WWF's vision is one of healthy marine ecosystems supporting abundant fish stocks, which in turn provide sustainable livelihoods for the fishing industry and fish-dependent communities. This can be achieved through a regionalised fishery-by-fishery approach, allowing diversified and locally appropriate approaches and measures. Our scenario analysis shows that sustainability will deliver real socio-economic benefits.

Fisheries where a relatively small number of larger vessels target a limited number of species cannot be managed in the same manner as fisheries with large number of small vessels, exploiting a variety of species with seasonal variations. Fisheries policy must pursue and achieve sustainability of all stocks, but measures are likely to be effective only if they are tailored to specific situations and allow sufficient flexibility. While there is one common CFP toolbox, the choice of policy tools should be fishery-specific.

The future Common Fisheries Policy should be built around four pillars
1. Long-term management plans on fishery-by-fishery basis;
2. Regionalised decision-making, assuring broad stakeholder support;
3. Appropriate rights-based management tools and use of economic incentives.
4. Coherence between EU fleet policies within EU waters and beyond.

The European Maritime and Fisheries Fund (EMFF) will be the main instrument to finance and support transition to sustainable fisheries. Considering that most EU fisheries cannot be managed on a national level, the EMFF should explicitly account for and promote regional cooperation.

The four pillars are mutually related and form the total policy context. Only a well-balanced composition of measures in each of these areas is likely to deliver the desired results of environmental and socio-economic sustainability. A balanced policy will have to account for and resolve conflicts of interest (e.g. short- versus long-term, use versus protection, user conflicts, etc.) and it should equally identify and exploit synergies between different measures.

Below we briefly outline the potential contribution of the EMFF to the three policy pillars and related measures.

4.1. Long-term management plans

Long-term management plans (LTMPs) provide the overarching principle to be applied to most (if not all) fisheries. They should be formulated on a fishery-by-fishery basis. LTMPs formulate goals regarding the level of fish stocks and the environmental impact of fisheries, as well as defining the processes and measures needed to achieve them. LTMPs should be SMART[44] formulated. LTMPs will require continuous monitoring, evaluation and adjustment to changing conditions and improving knowledge.

[44] SMART = Specific, Measurable, Attainable, Relevant and Timely

The EMFF can contribute to the design of LTMPs through provision of resources thereby making the required input from all stakeholders feasible. Furthermore, LTMPs may contain various measures which will require financial support:

- Development and introduction of selective fishing gear, including pilot projects as well as commercial testing. As many fisheries face comparable problems, a platform for active collection and dissemination of information on gear selectivity and new projects should be established and widely publicised.
- Real-time closures have proved to be an effective way to protect juvenile fish and avoid discarding. For this purpose a monitoring system needs to be established as well as a set of appropriate rules by region or fishery.
- Marine protected areas are being defined within Natura 2000. Systematic monitoring of these areas will be essential to determine their value and potential role.
- Environmental protection is also a matter of awareness. Education campaigns, public meetings and media engagement may create greater understanding about sustainable behaviour, which is an important condition in achieving a sustainable environment, especially as the effectiveness of command and control measures has been limited.

4.2. Regionalised decision-making

LTMPs will be formulated at regional level. It has been clearly demonstrated that public-private cooperation through various co-management schemes is indispensable for effective fisheries management. It is the only way to involve stakeholders and to design tailor-made measures that respond to the specific characteristics of the various fisheries and which will attract the support of the fishing industry. Although co-management should not create a new level of bureaucracy, some additional resources will be required, in particular to cover the costs of staff responsible for the implementation of the new management approach.

Funding to support the current Regional Advisory Councils RACs is available from the European Commission and this is likely to be maintained. The EMFF can play an important role in funding development and initial operation of fisheries-based co-management (including Advisory Committees and stakeholder engagement) and fishery or regional-based schemes to design and implement LTMPs.

4.3. Rights-based management and management through economic incentives

Fishing is an economic activity and fishing firms respond to economic incentives in their pursuit of income and profit and continuation of their business. The wrong incentives (e.g. subsidies) lead to undesirable developments like creation of overcapacity. It is fundamental that incentives are introduced that stimulate environmental as well as socio-economic sustainability. There exists a broad spectrum of economic incentives ranging from the introduction of rights-based management systems through to support for ‘green investments’ (e.g. selectivity). The EMFF can play an important role in facilitating and creating the necessary incentives.

Effective implementation of RBM (Rights-based Management)

The principle of rights-based management is to assign well-defined rights and responsibilities to individual fishermen or their organisations, which allow and oblige them to operate sustainably. The EMFF can promote effective RBM:

- The design, development and introduction of appropriate rights-based systems, such as TFCs, I(T)Qs, TURFs[45] and others[46] is needed by fishery or by region[47].
- In case of tradable rights, efficient trading instruments need to be designed, developed and implemented.

Dealing with overcapacity

- Overcapacity is one of the most persistent problems in the sector. The EU Court of Auditors concluded that: "...measures taken to date to reduce fishing overcapacity by adapting the fishing fleet to fishing resources have been unsuccessful." Therefore new, more effective measures need to be introduced. RBM systems have been discussed above.
- Investments in additional fishing capacity are not desirable, but technological innovation does provide a broad spectrum of opportunity, such as promoting selectivity, improving energy efficiency, reducing production costs or improving hygiene, the safety of working conditions and product quality. Funding for fleets, vessels and gears improvement should be made conditional upon adequate assessment of fishing capacity in relation to available fishing opportunities. At present many Member States fail to comply with the legal requirement to report on their efforts to balance fleet capacity in relation to fishing opportunities. Fleet capacity assessment should be the minimum basis to spend modernisation aid in a more targeted and time limited manner.

Sustainable market measures

- Product development is another area where significant advances are possible. Fish passes through different phases of processing and (re-)packaging, some of which could be already done on-board. Freshness is one of the strong selling points of EU landings, being close to consumer market, and it can be further improved by appropriate handling as soon as fish is caught. Fish is a valuable source of nutrition. Waste should be reduced in all stages before it reaches the consumer. According to the FAO about two-thirds of food losses occur after primary production and fish products are unlikely to be an exception. Elimination of post-harvest losses should be promoted through better preservation and supply chain integration for both economic as well as ethical reasons. Waste at consumer level should also be addressed.

In the end consumers determine which products will be bought and at which price. Information exchange between consumers, retailers and the fleet needs to be strengthened: consumers need to trust the value of eco-labels and other product information and information about the demand for specific species can guide at least some fleets towards demand-orientated fishing.

[45] Territorial user rights
[46] E.g. effort rights
[47] Bonzon, 2010

Obstacles to economic diversification need to be eliminated, in line with policies to reduce administrative costs and red tape.

- Financing the transition to sustainability has been addressed by the OECD[48] and others. A recent publication by Rangeley[49] proposes setting up a, "financial institution for the recovery of marine ecosystems" (or FIRME). FIRME would be a public-private initiative providing loans to bridge the period of restrictions required to allow stock recovery. Considering the significant resources available under the EMFF, the practical feasibility of such new ideas should be further explored. The concept of FIRME can be even applied on a fishery-by-fishery basis, as in some situations it may be more suitable than in others.

4.4. Mitigation of social consequences

Regardless of the analysis scenario, it is likely that employment will further decrease in the catching sector. It is essential to offer fishermen education and (re-)training which will allow them to pursue new careers outside the fisheries, if necessary. At the same time, in many areas there has been shortage of crews for many years. The EMFF should support the following measures to strengthen the social resilience of fishermen and their communities:

- Fisheries education should be further broadened towards 'blue education', to improve young fishermen's position on the labour market, in particular in relation to other marine industries.
- Training and retraining of fishermen in the context of the EU's "blue growth" policy, including development of entrepreneurial skills.
- Obtaining credit for SMEs is often difficult, particularly during the present credit crisis. It should be explored whether the EMFF could play an active role in this context either through a revolving fund for the provision of limited loans (against commercial conditions), or by providing guarantees to commercial banks. Such financial engineering should be seriously considered in order to attract investors and to develop new instruments to finance the required adaptations towards sustainability.

4.5. Role of science

With the introduction of LTMPs there will be an even greater need for more detailed and timely data and analysis. Resources for data collection will be brought under the EMFF. Its sufficiency will be viewed in the context of the funding that will be allocated to:

- Data collection, analysis and research are indispensable for environmental monitoring.
- Development and application of scientific methods to deal with data poor fisheries.
- Cooperation between science and industry: Considering the large numbers of fishing vessels which are daily at sea, their capacity to collect environmental and fisheries data should be further strengthened. While this is undoubtedly a cost-efficient way to collect the required data, such activity can offer be an option for income diversification. In this way fishing fleets can provide environmental services, as the data collection does not have to solely concern fish stocks, but could also include physical and chemical sampling and pollution monitoring.

[48] OECD, 2000
[49] Rangeley, 2012

4.6. Concluding remarks

The proposal for the European Maritime and Fisheries Fund (EMFF) allocates €6.5bn to the, "sustainable development of fisheries, aquaculture and fisheries areas." This budget will be matched by a somewhat lower amount from the national contributions. This means that between, €10bn - €11bn will be available, i.e. approximately €1.5bn annually. These are very significant resources, at a time when all EU governments are forced to cut public spending. Efficient and effective use of these resources must be assured.

The EMFF funds are allocated on a country-by-country level. However, fishery-by-fishery management implies that these national allocations should be pooled to a certain extent to address common problems which arise across various countries involved in one fishery. Furthermore, EU-wide access to information on the results of specific national initiatives and projects should be facilitated to avoid overlap and to strengthen synergies.

Finally, with proper policies in place, an increasing number of sustainable fisheries 'success stories' can be expected. These success stories should be exploited as a source of inspiration and learning.

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ANNEX A

Details and assumptions of the scenario calculations

There are two main scenarios and two scenarios as means of sensitivity analysis.

Common assumptions:

- Calculations are for the period 2012-2022.
- The situation in 2012 is assumed equal to the situation in 2009 for which FAO and DCF data exist.

The main assumptions are the following:

Deterioration scenarios:

- Slow deterioration landings from the NE Atlantic decrease at 50% of the rate, observed between 1990-2009.
- Fast deterioration landings from the NE Atlantic decrease at the rate observed, between 1990-2009 (i.e. a pessimistic scenario).

Recovery scenarios:

- Slow recovery landings from the NE Atlantic decrease 5% per year during the first three years and increase thereafter, reaching a level 20% above the 2012 situation by 2022.
- Fast recovery landings from the NE Atlantic decrease 5% per year during the first three years and increase thereafter, reaching a level 40% above the 2012 situation by 2022.

Comments:

All values and percentages indicated below refer to the EU-27. Long-term fleet trends are based on EU-15.

Country specific scenarios are based on national variables, trends and prices.
Fleet and employment trends are based on the period 1995-2009 (for employment) and 1995-2010 (for fleet).

Table A.1 Deterioration scenarios - Detailed assumptions

	Slow deterioration	Fast deterioration
Landings (1000 ton)	**Sum of 4 groups below**	
- TAC NE Atl	Landings fall by 50% of the trend observed between 1995-2009	Landings fall in line with the historical trend observed between 1995-2009
- Non-TAC NE Atl		
- Mediterranean		
- Non-EU waters	Annual decrease by 1%.	
Landings value	Prices per species as of 2009, acc. to DCF, 33 TAC species plus 'Others'	
Fleet	Reduction rate is 50% of the trend observed between 1995-2009	
Employment	Employment falls in line with the trend observed between 1995-2009	
Gross value added	Based on DCF average ratio GVA/Value of landings 2007-9	
NPV GVA [a)]	Calculated at 2% discount rate	
GVA / employed [b)]	GVA/employment	

a) Relatively low discount rate is used, implying a low time preference, or high priority for restoration of stocks.
b) As landings are valued at constant prices, income is also calculated at constant prices.

Table A.2 Recovery scenarios - Detailed assumptions

	Slow deterioration	Fast deterioration
Landings (1000 ton[c])	Sum of 4 groups below	
- TAC NE Atl	First 3 years decrease by 5%, subsequent growth rate 5.5%	First 3 years decrease by 5%, subsequent growth rate calculated to reach to the long-term average
- Non-TAC NE Atl		
- Mediterranean		
- Non-EU waters	Annual decrease by 1%	
Landings value	Prices per species of 2009, acc. to DCF, 33 TAC species plus 'Others'	
Fleet	Decreases at about half the rate of total landings reduction, but once at lowest level does not increase again	
Employment	Follows the trend established for the fleet	
Gross value added	45% of value of landings, based on DCF average 2007-9	
NPV GVA [a)]	Calculated at 2% discount rate	
GVA / employed [b)]	GVA/employment	

a) Relatively low discount rate is used, implying a low time preference, or high priority for restoration of stocks.
b) As landings are valued at constant prices, income is also calculated at constant prices.
c) These are landings for 2009.

Table A.3 Annual changes applied by the scenarios to the EU total*

	Slow deterioration	Fast deterioration	Slow recovery	Fast recovery
	50% historical trend	Historical trend	20% above 2009	40% above 2009
Landings (1000 ton)		-3.7%		
- TAC NE Atl	-2.1%	-4.1%	4.9%	7.3%
- Non-TAC NE Atl	-1.4%	-2.8%	4.9%	7.3%
- Mediterranean	-1.0%	-2.0%	4.9%	7.3%
- Non-EU waters	-0.7%	-1.4%	-1%	-1%
Landings value (€ m, nominal)	0.0%	0.0%		
Landings value (€ m, real)		-2.1%		
Fleet (no. of vessels)	-1.1%	-2.2%		
Employment	-1.9%	-3.7%		
Gross value added (income, € m)	-0.8%	-1.6%		
Income / employed** (nominal, €)		0.0%		
Income / employed** (real, €)		-3.8%		

*Empty cells are calculated according to the indicated assumptions.
**These are the growth rates applied to the period 2016-2022. During 2013-2015 there is annual fall of landings by 5%.

ANNEX B

Table. B.1 Biological indicators of main EU stocks

Species name	Region	Fmsy	MSY Btrig.	Bpa	F2002	Flatest	SSB2002	SSB latest	ICES Landings 2010
Anchovy	9a								3,210
Anchovy	8		33000	33000	0.47	0.08	37,180	98,450	10,317
Blue ling	All								4,373
Brill	22-32								82
Brill	3a,4,7de								1,800
Boarfish	All								139,389
Cod	6a	0.19	22000	22000			7,840	8,720	239
Cod	6b								61
Cod	7a	0.4	10000	10000	1.57	1.19	6,223	947	460
Cod	7e-k	0.4	8800	8800	0.9551	0.5112	9,236	3,229	3,236
Cod	3a,4,7d	0.19	150000	150000	0.922	0.676	43,827	54,721	53,336
Cod	22-24	0.25			1.2	0.58	23,790	29,144	14,120
Cod	25-32	0.3			1.1	0.25	82,992	308,787	50,277
Cod	3aK	0.4	6400	10500					155
Dab	22-32								1,041
Dab	3a,4								10,464
Flounder	22-32								16,582
Flounder	3a,4								2,895
Gr. halibut	5,6,12,14								25,995
Haddock	6a	0.3	30000	30000	0.447	0.288	56,055	15,868	3,000
Haddock	6b	0.3	9000	9000	0.46	0.15	7,344	13,036	3,405
Haddock	7a								936
Haddock	7b-k								22,233
Haddock	3a,4	0.3	140000	140000	0.23	0.23	523,367	182,559	39,612
Herring	7aN			9500					4,894
Herring	7aS,7g-k	0.25		44000	0.29	0.08	43,584	114,319	8,370
Herring	6aN	0.25		50000	0.357	0.266	132,036	80,998	18,508
Herring	6aS,7bc	0.25		110000					10,241
Herring	3a,4,7d	0.25		1300000	0.23	0.12	1,658,085	1,801,092	187,600
Herring	30	0.19	200000	?	0.11	0.13	377,204	571,339	71,726
Herring	31								2,075
Herring	22-24	0.25	110000		0.4	0.3	203,513	95,152	55,200
Herring	25-29,32	0.16			0.35	0.32	371,625	535,120	136,700
Herring	28.1	0.35	60000		0.482	0.43	99,587	75,748	30,174
Hake	3a,4,6,7,8abd	0.24			0.78	0.39	37,888	131,075	73,100
Hake	8c,9a	0.24			0.75	0.52	10,400	27,700	16,900
Horse mac.	3a,4bc,7d								22,255

Horse mac.	2a,4a,5b,6a,7a-c,ek,8a-e	0.13			0.06	0.13	1,629,840	1,848,580	204,000
Horse mac.	9a				0.08	0.09	294,960	238,339	27,217
Lemon sole	3a,4,7d								3,976
Ling	All								37,300
Mackerel	All	0.22	2200000	2300000	0.45	0.257	1,682,344	2,907,519	869,000
Megrim	6b								139
Megrim	4a,6a								1,499
Megrim	8c,9	0.18			0.29	0.34	3,703	4,818	1,297
Megrim	8c,9a	0.17			0.14	0.07	919	962	83
Megrim	7bce-k,8abd								19,239
Anglerfish	7b-k,8abd	0.28			F/Fmsy=0.76	F/Fmsy=0.85	B/Bmsy=0.16	B/Bmsy=0.23	29,700
Anglerfish	7b-k,8abd	0.43			F/Fmsy=1.49	F/Fmsy=0.39	B/Bmsy=0.16	B/Bmsy=0.23	1,604
Anglerfish	8c,9a	0.28			F/Fmsy=0.76	F/Fmsy=0.85	B/Bmsy=0.19	B/Bmsy=0.91	751
Anglerfish	8c,9a				F/Fmsy=1.15	F/Fmsy=0.39	B/Bmsy=0.19	B/Bmsy=0.64	1,604
Anglerfish	2a,3a,4,6								13,120
Nephrops	3a	0.079							5,123
Nephrops [1.]	4								959
Nephrops [1.]	4								1,443
Nephrops [1.]	4								12,825
Nephrops [1.]	4								1,871
Nephrops [1.]	4								1,032
Nephrops [1.]	4								38
Nephrops [1.]	4								407
Nephrops [1.]	4								806
Nephrops [1.]	5								757
Nephrops [1.]	9a								
Nephrops [1.]	6a								2,263
Nephrops [1.]	6a								3,725
Nephrops [1.]	6a	2 separate areas with different evaluations							5,701
Nephrops [1.]	7								563
Nephrops [1.]	7								8,929
Nephrops [1.]	7								917
Nephrops [1.]	7								1,000
Nephrops [1.]	7								846
Nephrops [1.]	7								4,636
Nephrops [1.]	8c								
Nephrops [1.]	8ab								
Redfish	5,6,12,14								38,695
Nor. pout	3a,4		150000	150000	0.509	0.42	159,675	319,202	126,000
Nor. pout	6a								0
N. shrimp	4aW								0
N. shrimp	3a,4aE								8,300
Plaice	7fg								1,133
Plaice	3a			24000					9,100
Plaice	7a								2,893
Plaice	7d								3,177
Plaice	7e	0.19	2400		0.67	0.45	2,507	3,371	1,227
Plaice	22-32								1,948
Plaice	7hk	0.24							154
Plaice	7bc								33

Plaice	4	0.25	230000	230000	0.57	0.24	200,800	522,891	60,674
Plaice	8,9a								291
Pollack	3a,4								1,551
Pollack	8,9a								1,292
Pollack	6,7								4,142
Saithe	3a,4,6	0.3	200000	200000	0.255	0.383	222,900	169,000	102,500
R. grenadier	All								
Sandeel	3a,4								
Sandeel	6a								0
Skates/rays	4								2,500
Skates/rays	8,9a								2,400
Skates/rays	6,7								9,500
Sole	3a,22-24	0.38	2000		0.314	0.339	2,955	1,944	538
Sole	7a	0.16	3100	3100	0.35	0.27	3,814	1,276	275
Sole	7d	0.29	8000	8000	0.3747	0.453	8,569	14,982	4,391
Sole	7e	0.27	2800		0.36	0.247	3,078	2,571	688
Sole	7fg	0.31	2200	2200	0.4345	0.2597	4,101	4,187	862
Sole	8ab	0.26	13000	13000	0.825	0.391	9,836	13,391	3,966
Sole	4	0.22	35000	35000	0.574	0.339	31,000	36,550	12,600
Sole	7h-k	0.31							225
Sole	7bc								43
Sole	8c,9a								385
Sprat	3a								11,000
Sprat	22-32	0.35			0.403	0.408	880,000	722,000	341,500
Sprat	4								143,000
Sprat	7de								4,407
Sprat	6,7a-c,f-k								8,140
Turbot	22-32								295
Turbot	3a,4								3,405
Tusk	3a,4,5b,6a,7,8,9,12b								6,770
Blue whiting	1-9,12,14	0,18	2250000	2250000	0.462	0.182	1,556,950	3,043,490	539,539
Whiting	3a								500
Whiting	6a			22000					1,200
Whiting	6b								18
Whiting	7a			7000					120
Whiting	7e-k			21000					8,400
Whiting	4,7d								22,000
Whiting	8,9a								2,258
Witch	3a,4,7d								1,488

[1] Nephrops stocks in various management units

(source: ICES assessment 2011)

ANNEX C

Comparison of the present study with the World Bank's Sunken Billions study

The World Bank's Sunken Billions is a benchmark for any study investigating the potential economic benefits of achieving sustainable fisheries. Therefore below there follows a brief comparison of approach and results of the present study with the World Bank study.

The objective of both studies is to estimate economic benefits of sustainable fisheries. However, the main indicators are different. The World Bank study's focuses on the resource rent while the present study uses the gross value added (see table below).

Table C.1 General comparison

World Bank	Present study
Sources	
Data and estimates from FAO and large number of different statistics and studies.	Biologic data: ICES Economic data: EU/DCF.
Baseline year	
2004	2009
Main indicator	
Resource rent (RR) The resource rent is defined as 'supernormal profit' or the difference between the price at which an output from a resource can be sold and its respective extraction and production costs, including normal return to capital.	Gross value added (GVA) Gross value added is defined as the sum of the remuneration of labour (wages) and capital (profits), depreciation and interest. Gross value added can be directly compared to GDP.
In an approach using GVA, any RR is contained in the remuneration of labour and capital, while the resource itself is not remunerated. GVA reflects fully the contribution of the fisheries sector to an economy. The RR concerns the remuneration of the resource and as such its contribution to the GDP. Thus the RR only partially reflects the contribution of the fisheries sector to an economy.	
Approach to sustainability	
Based on a single stock - single fleet bio-economic optimisation model for the whole world. The model generates inter alia: • MSY biomass (2-2.5 times higher than present) • MSY landings (95m tons, about 20% higher than in 2009) • MEY landings (economic optimum, 80m tons, about 2009 global landings)	Based on 4 'groups of stocks' (Atlantic TAC, Atlantic non-TAC, Mediterranean/Black Sea and non-EU waters) and a single fleet, with assumed sustainable landings at 20% and 40% above 2009 level. • Estimates of MSY biomass and landings are not available from ICES and therefore above assumptions had to be made. • MEY is not considered.
Economic benefits	
• Economic benefits are related to the rent, which is reflects only a part of gross value added. • Higher productivity due to greater biomass allows significant decrease of fishing effort and related costs. This decrease is about 50%.	• Economic benefits are related to the increase of gross value added (total income), which is assumed to be a fixed proportion of the value of landings. • Fleet is reduced by about 10% under the recovery scenarios. • Productivity gain due to increase of biomass is not considered and does not directly impact total effort.
Social consequences	
• Social consequences are not explicitly considered. However, reduction of effort by 50% implies an approximately proportionate reduction of employment.	• Employment is considered explicitly. The study argues that a reduction of capacity becomes increasingly unlikely (or costly to treasuries) with improving profitability.

Table C.2 (on the next page) derives the GVA for the EU from the World Bank study and compares it to the GVA estimated in the present study. This was done as follows:

- The figures in italics in columns A-D are drawn directly from the World Bank study, expressed in Euro instead of US$. All other figures in columns A-D have been estimated through extrapolation.
- Column A:
  presents data from table 4 (p.28) of the World Bank study.
- Column B:
  - Landings and profit are drawn from table 5 (p.32) of the World Bank study.
  - Costs are 50% of the 2004 situation, based on the effort index in table 5.
- Column C-D:
  EU landings in 2004-9 were approximately 6.5% of the global landings (based on FAO data). The EU values are assumed to be 6.5% of the global estimates. This is the basis for the extrapolation of the economic data from global to EU level.
- Columns E-G:
  show the results of the present study, which does not calculate the specific cost components and assumes that GVA/VoL is constant at 47%.

Comments on estimates used in columns C-D:

- The VoL in column C is too low. EU value of landings in 2004 was about €6.7bn (AER, p.11) .
- Ratio GVA/VoL was in 2004 about 50% (AER, p.20), which means that GVA amounted to about €2.8bn .
- Consequently, the extrapolation of the year 2004 significantly underestimates the GVA generated by EU catching sector. The GVA in optimum situation (column D) is also therefore underestimated, although it cannot be indicated by how much, as the GVA/VoL ratio of 71% is certainly too high. About 45-55% would be more consistent with historical data.

Table C.2 Comparison of EU gross value added in the World Bank and present study

	WB study - World totals		Extrapolation from WB - EU		Present study - 2009 and Recovery scenarios		
Column name	**A**	**B**	**C**	**D**	**E**	**F**	**G**
Future situation		Optimum		Optimum		Slow	Fast
Year	2004	Year not defined	2004	Year not defined	2009	2022	2022
Landings (mln tons)	85.5	81.0	5.6	5.3	5.0	5.7	6.5
Value of landings (VoL)	61	68	3.9	4.4	7.4	8.7	10.0
Fuel costs	17	9	1.1	0.6			
Labor costs	17	9	1.1	0.6			
Other operating costs	22	11	1.4	0.7			
Total cost of capital	8	4	0.5	0.3			
Resource rent	-4	35	-0.3	2.3			
Gross value added (GVA)	22	48	1.4	3.1	3.5	4.0	4.7
GVA/VoL	36%	71%	36%	71%	47%	47%	47%

Note: The values in the World Bank study are in US$. Values above have been recalculated to euro with an exchange rate of €1 = $1.3

Similarities between the two studies:

- World Bank estimates global MSY landings at 95m tons, about 20% above the 2009 level. In the present study the slow recovery scenario assumes that sustainable landings would be 20% above the 2009 level.
- Landings levels in columns D and F are at a comparable order of magnitude. Landings in the column G is higher, but it could be argued that EU stocks have been more heavily (over)exploited and that recovered stocks would therefore allow a greater increase in landings compared to 2004 or 2009. EU landings have been falling, while global landings have remained fairly constant.

Differences between the studies:

- The World Bank expects the maximum benefit would accrue from a reduction of fishing effort by about 50% and consequently from the reduction of all related costs. Reduction of effort is not explicitly considered in the present study for two reasons: a) this would require further far-reaching assumptions regarding catchability and size of stocks in the coming 10 years; and b) as profitability recovers, the incentive for the vessels to stop fishing due to low earnings disappears. Policy measures aimed at fleet reduction, e.g. decommissioning, would be extremely costly.
- In the present study, most benefits arise from higher revenues based on larger landings.

- The present study explicitly considers the recovery path and its related costs and benefits. The World Bank study does not consider the path to recovery, comparing only present and optimum (MEY) situations.
- The present study is based on four different scenarios, which facilitates comparison of different future eventualities. The World Bank evaluation is based on a stochastic model.

Conclusions

Comparing the results on the basis of the GVA, the World Bank study indicates a potential increase of €1.7bn (from €1.4bn in 2004 to €3.1bn in the MEY situation) while the present study finds a potential increase of €0.5bn-€1.2bn in 2022 compared to 2009.