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**Studies in the Field of the Common Fisheries Policy and  
Maritime Affairs**

**Lot 4: Impact Assessment Studies related to the CFP**

**Impact Assessment of Discard Reducing Policies**

**DRAFT FINAL Report**

**June 2011**

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

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# Table of Contents

Acronyms .....	i
Country codes .....	iii
AER Sector types .....	iii
Species codes .....	iv
1 Introduction .....	1
1.1 Problem Definition .....	1
1.1.1 Discarding in EU fisheries .....	1
1.2 General Methods .....	2
2 Research Phase .....	3
2.1 Discard rates in EU fisheries .....	3
2.2 International experience with discard bans .....	6
3 Analytical phase: Specification of the policy options .....	9
3.1 Discard reduction policy .....	9
3.1.1 The Large scale fleet operating outside of the Mediterranean .....	9
3.1.2 Small scale coastal fleet operating outside the Mediterranean .....	10
3.1.3 Mediterranean .....	11
3.2 CFP Reform Policy Option 1 and 1a .....	11
4 Biological and economic modelling .....	12
4.1 Categorisation of fleets .....	13
4.2 FLR (stock modelling) Assumptions .....	15
4.3 FLR methodology .....	20
4.3.1 Discard and landing selectivity .....	20
4.3.2 Stocks considered .....	21
4.4 Summary of FLR results .....	23
4.4.1 Haddock .....	23
4.4.2 Plaice .....	27
4.4.3 Whiting .....	28
4.4.4 Cod .....	31
4.5 EIAA assumptions .....	35
4.5.1 Changes to revenue .....	35
4.5.2 Changes to Investment .....	39
4.6 EIAA methodology .....	41
5 Impact Assessment .....	41
5.1 Discard reduction policy implemented to Policy Option 1 .....	41
5.1.1 Environmental Indicators .....	41

5.1.2	Economic Indicators: fishing operators receiving total value of landings (i) ....	46
5.1.3	Economic Indicators: fishing operators receiving 20% value of undersize landings (ii) .....	54
5.1.4	Social Indicators: fishing operators receiving total value of landings (i) .....	59
5.1.5	Social Indicators: fishing operators receiving 20% value of undersize landings (ii)	63
5.1.6	Governance Indicators .....	65
5.2	Discard reduction policy implemented to Policy Option 1a.....	70
5.2.1	Environmental Indicators .....	70
5.2.2	Economic Indicators: fishing operators receiving total value of landings .....	71
5.2.3	Economic Indicators: fishing operators receiving 20% value of undersize landings	78
5.2.4	Social Indicators: fishing operators receiving total value of landings .....	83
5.2.5	Social Indicators: fishing operators receiving 20% value of undersize landings	86
5.2.6	Governance Indicators .....	89
6	Summary of the impact assessment.....	90
6.1	Weighted Summary of Policy Performances .....	105
7	References .....	109

## List of Tables

Table 1	Key indicators of CFP performance used in this analysis .....	3
Table 2	Trends in discarding in EU waters .....	5
Table 3	Summary of policy Option 1 as defined in the CFP Phase II report.....	11
Table 4	EU gear types categorised by level of discarding and MS (High = red = 3, Medium = amber = 2, low = yellow = 1, green = no information).....	14
Table 5	Average fish price data 2007 – 2011 based on Danish vessels landing prices across Europe. All sorting grades are determined by weight (source: Danish Ministry of Fisheries website).....	15
Table 6	Fish price data 2008-2010 for Mediterranean fisheries landed in Spain, Andalucía (weekly prices of fishery products annual report, 2008-2010). .....	16
Table 7	Landings Prices per kg (Danish Kroner) for Cod Landed in North Sea EU ports (source: Danish Ministry of Fisheries website) Landings.....	17
Table 8	Landings of Cod for North Sea Member States Landed in Danish Ports (source: Danish Ministry of Fisheries website) .....	17
Table 9	Landings Prices per kg (Norwegian Kroner) for Cod Landed in Norway (source: Rafisklaget, pers. comm., 2011) .....	18
Table 10	Landings by kg for Cod Landed in Norway (source: Rafisklaget, pers. comm., 2011).....	18
Table 11	Estimated cost of gear investment to DTS and TBB segments .....	39

Table 12 Comparison of the proportion of large sized fish (top two age brackets) landed under the discard reduction policy and the no change Option 1 policy.....	42
Table 13 Proportion of MS fleet impact compared to total EU in terms of GT presented as level of impact expected from discard reduction policies (High = red, Medium = amber, low = yellow, green = no information).....	45
Table 14 Proportion of MS fleet impact compared to total MS in terms of GT presented as level of impact expected from discard reduction policies (High = red, Medium = amber, low = yellow, green = no information).....	46
Table 15 Results from EIAA model by MS for Option 1, sub-option i (retain value of all landings) .....	48
Table 16 Results from EIAA model by fleet size for Option 1, sub-option i .....	50
Table 17 Summary of number of fleet segments meeting the targets for economic indicators under Option 1, sub-option i.....	50
Table 18 Results from EIAA modelling comparing forecast for 2022 for Option 1 no discard reduction policy with sub-option i (discard reduction policy).....	52
Table 19 Projections of gross value added (mln €) by fleet segment for catching sector (option 1i).....	53
Table 20 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1i).....	53
Table 21 Projections of net profit margin by fleet segment for catching sector (option 1i)....	54
Table 22 Projections of return on investment by fleet segment for catching sector (option 1i) .....	54
Table 23 Results from EIAA model by MS for Option 1, sub-option ii (20% of value of undersized landings).....	56
Table 24 Results from EIAA model by fleet size for Option 1, sub-option ii.....	57
Table 25 Projections of gross value added (mln €) by fleet segment for catching sector (option 1ii).....	58
Table 26 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1ii).....	58
Table 27 Projections of net profit margin by fleet segment for catching sector (option 1ii)...	58
Table 28 Projections of return on investment by fleet segment for catching sector (option 1ii) .....	59
Table 29 Option 1i: Trends in social indicators by Member State (2012 percentage change are on option 1).....	61
Table 30 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1i).....	62
Table 31 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1i).....	62

Table 32 Option 1ii: Trends in social indicators by Member State (percentage changes in 2012 are on option 1).....	64
Table 33 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1ii).....	65
Table 34 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1ii).....	65
Table 35 Estimated observer costs in nominal terms for EU fleet segments applying €354/day.....	66
Table 36 Percentage of number of fish landed which have been measured in Iceland's fisheries.....	67
Table 37 Governmental fundings (millions IKR) to the Marine Research Institute (MRI) and the Directorate of Fisheries (DF) in 1990 to 2008.....	67
Table 38 Estimated cost of observing REM CCTV footage for the EU fleet.....	67
Table 39 Summary of management options and costs.....	68
Table 40 Cod equivalent of all species as published by Ministry of Fisheries – 2005-2011 (Source: Ministry of Fisheries, Iceland).....	69
Table 41 Results from EIAA model by MS for Option 1a, sub-option i (retain value of all landings).....	72
Table 42 Results from EIAA model by fleet size for Option 1a, sub-option i.....	74
Table 43 Summary of number of fleet segments meeting the targets for economic indicators under Option 1a, sub-option i.....	74
Table 44 Results from EIAA modelling comparing forecast for 2022 for Option 1a no discard reduction policy with sub-option i (discard reduction policy).....	76
Table 45 Projections of gross value added (mln €) by fleet segment for catching sector (option 1ai).....	77
Table 46 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1ai).....	77
Table 47 Projections of net profit margin by fleet segment for catching sector (option 1ai)..	77
Table 48 Projections of return on investment by fleet segment for catching sector (option 1ai).....	77
Table 49 Results from EIAA model by MS for Option 1a, sub-option ii (20% of value of undersized landings).....	80
Table 50 Results from EIAA model by fleet size for Option 1a, sub-option ii.....	81
Table 51 Projections of gross value added (mln €) by fleet segment for catching sector (option 1aai).....	82
Table 52 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1aai).....	82
Table 53 Projections of net profit margin by fleet segment for catching sector (option 1aai). 82	82

Table 54 Projections of return on investment by fleet segment for catching sector (option 1aii).....	82
Table 55 Option 1ai: Trends in social indicators by Member State (2012 percentage change are on option 1a).....	84
Table 56 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1ai).....	85
Table 57 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1a).....	85
Table 58 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1ai).....	86
Table 59 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1a).....	86
Table 60 Option 1aii: Trends in social indicators by Member State (percentage changes in 2012 are on option 1a).....	88
Table 61 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1aii).....	89
Table 62 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1aii).....	89
Table 63 Summary results of options for EIAA.....	90
Table 64 Summary results of options for BIRDMOD.....	91
Table 65 Summary of IA for all policies.....	92

## List of Figures

Figure 1 Price per kilogram (ISK/kg) for cod & haddock in real terms using prices indices for groundfish without iced fish 1990 – 2006 (STATICE, 2011). Discard ban introduced most notably in 1996 through greater legislation. ....	19
Figure 2: Fish sales value in Norway adjusted to consumer price index – 1945=4 ( <i>source: S. Johansen, pers. comm., 21 May, 2010</i> ). Original catch quota for cod and haddock in 1986 and a full discard ban in 2008. The prolonged drop in overall fish price between 1986 and 1992 may be explained by the cod harvesting moratorium in this period. ....	19
Figure 3. Selectivities of haddock catches with implementation of a discard reduction policy .....	22
Figure 4. Selectivities of plaice catches with implementation of a discard reduction policy..	22
Figure 5. Selectivities of whiting catches with implementation of a discard reduction policy	23
Figure 6. Selectivities of cod catches with implementation of a discard reduction policy .....	23
Figure 7. Changes in haddock over the projection period with a reduction in fishing mortality and no discard reduction policy .....	25
Figure 8. Changes in haddock over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 .....	25

Figure 9 Haddock stock biomass by age with no discard reduction policy .....	26
Figure 10 Haddock stock biomass by age with a discard reduction policy .....	26
Figure 11 Landings by age with no discard reduction policy .....	26
Figure 12 Landings by age with a discard reduction policy .....	26
Figure 13. Changes in plaice over the projection period with a reduction in fishing mortality and no discard reduction policy .....	27
Figure 14. Changes in plaice over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 .....	28
Figure 15. Changes in whiting over the projection period with a reduction in fishing mortality and no discard reduction policy .....	29
Figure 16. Changes in whiting over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 .....	30
Figure 17. Changes in whiting over the projection period with a reduction in fishing mortality, implementation of a discard reduction policy in 2012 and no restriction in TAC variation between years.....	31
Figure 18. Changes in cod over the projection period with a reduction in fishing mortality and no discard reduction policy, SAM model estimates .....	32
Figure 19. Changes in cod over the projection period with a reduction in fishing mortality and no discard reduction policy, B-ADAPT model estimates.....	33
Figure 20. Changes in cod over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 (B-ADAPT estimates).....	34
Figure 21. Changes in cod over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 (SAM estimates).....	35
Figure 22 Expected revenues for haddock quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo .....	37
Figure 23 Expected revenues for cod quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo. Additional curves are modelled to consider different model outputs possible for cod stock modelling (BADAPT and SAM).....	37
Figure 24 Expected revenues for plaice quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo. ....	38
Figure 25. Expected revenues for whiting quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo. ....	38
Figure 26 Icelandic investment in fishing gear for vessels >200GT nominal values 1997 – 2009 (STATICE, 2011) .....	39
Figure 27 Number of real-time closures in Icelandic fisheries (source: Ministry of Fisheries, Iceland) .....	40
Figure 28 Schematic diagram of the electronic monitoring system, which can record video data from up to four cameras per vessel. ....	41

Figure 29 Estimated changes in landings for North Sea cod 2009-2030 with the discard reduction policy in comparison to those estimated under option 1. This figure uses the BADAPT catch multiplier.....	42
Figure 30 Estimated changes in landings for North Sea haddock 2009-2030 with the discard reduction policy in comparison to those estimated under option 1. ....	43
Figure 31 Estimated changes in landings for North Sea whiting 2009-2030 with the discard reduction policy in comparison to those estimated under option 1. ....	43
Figure 32 Estimated changes in landings for North Sea plaice 2009-2030 with the discard reduction policy in comparison to those estimated under option 1. ....	44
Figure 33: Total Coastguard Expenditure including capital investment 1977-2006 (indexed 2006 = 1) ( <i>source: Statistics Norway, 2009</i> ).....	66
Figure 34 Performance of options by indicator group in 2017 .....	106
Figure 35 Performance of options by indicator group in 2022 .....	106
Figure 36 Performance of indicator groups by policy options in 2017 .....	107
Figure 37 Performance of indicator groups by policy options in 2022 .....	107
Figure 38 Summary of policy options' performance in 2017 .....	108
Figure 39 Summary of policy options' performance in 2022 .....	108

## Acronyms

ACFM	Advisory Committee on Fishery Management
ACP	African, Caribbean and Pacific
AER	Annual Economic Report
B	Maximum biomass
$B_{msy}$	Biomass of the population at which MSY is taken
$B_{pa}$	Target biomass set as a precautionary approach
CAP	Common Agricultural Policy
CFCA	Community Fisheries Control Agency
CFP	Common Fisheries Policy
CIF	Cost Insurance <i>and</i> Freight
DCR	Data Collection Regulation
DG MARE	Directorate-General for maritime Affairs and Fisheries
EC	European Commission
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EFF	European Fishing Fund
EPA	Economic Partnership Agreements
ERDF	European Regional Development Fund
ETC/BD	European Topic Centre on Biological Diversity
EU	European Union
F	Fishing mortality
$F_{msy}$	F giving maximum sustainable yield
$F_{max}$	F where total yield is highest
$F_{0.1}$	F where slope of yield per recruit is one-tenth of its value near the origin
FIFG	Financial Instrument for Fisheries Guidance
FPAs	Fisheries Partnership Agreements
FTE	Full Time Equivalent
GCFM	General Fisheries Commission for the Mediterranean
GDP	Gross Domestic Product
GT	Gross Tonnage
GVA	Gross Value Added
HACCP	Hazard Analysis and Critical Control Point
HCR	Harvest control rule
ICES	International Council for the Exploration of the Sea

IE	Individual Non-Transferable Effort Quotas
IMF	International Monetary Fund
IQ	Individual Non-Transferable Quotas
ITE	Individual Transferable Effort Quotas
ITQ	Individual Transferable Quota
ITR	Individual Transferable Right
IUU	Illegal, Unregulated and Unreported
JDP	Joint Deployment Plan of the CFCA
LTMP	Long term management plan
MAGP	Multi-annual Guidance Programmes
MPA	Marine Protected Area
MS	Member States
MSFD	Marine Strategy Framework Directive
MSY	Maximum Sustainable Yield
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
PCD	Policy Coherence for Development
PO	Producer organisations
RBM	Rights based management
ROI	Return on Investment
SAC	Special Areas of Conservation
SBL	Safe biological limits
SCI	Sites of Community Importance
SCM	Standard Cost Model
SGECA	Sub-Group on Economic Assessment
SMS	Stochastic Multi-Species Model
SPA	Special Protection Areas
SRP	Simplification Rolling Programme
SSB	Spawning Stock Biomass
STECF	Scientific, Technical and economic Committee for Fisheries
TAC	Total Allowable Catch
UNCLOS	United Nations Convention on the Law of the Sea
WTO	World Trade Organization

## Country codes

BE	BEL	Belgium	IT	ITA	Italy
CY	CYP	Cyprus	LT	LTU	Lithuania
DE	DEU	Germany	LV	LVA	Latvia
DK	DNK	Denmark	ML	MLT	Malta
ES	ESP	Spain	NL	NLD	Netherlands
EE	EST	Estonia	PO	POL	Poland
FI	FIN	Finland	PT	PRT	Portugal
FR	FRA	France	UK	GBR	United Kingdom
GR	GRC	Greece	SI	SVN	Slovenia
IE	IRL	Ireland	SE	SWE	Sweden

## AER Sector types

DFN	Drift nets and fixed nets	NONACTIVE	Non active vessels
DRB	Dredges	PG	Passive gears
DTS	Demersal trawl and demersal seiner	PGO	Other passive gears
FPO	Pots and traps	PGP	Polyvalent passive gears
HOK	Gears using hooks	PMP	Combining mobile & passive gears
MGO	Other mobile gears	PTS	Pelagic trawls and seiners
MGP	Polyvalent mobile gears	TBB	Beam trawl
VL0012	<12 m length vessels	VL2440	24-40 m length vessels
VL1224	12-24 m length vessels	VL40XX	>40 m length vessels

## Species codes

ALB	Albacore	MAC	Atlantic mackerel
ALF	Alfonsinos nei	NEP	Norway lobster
ANE	European anchovy	NOP	Norway pout
ANF	Anglerfishes nei	ORY	Orange roughy
ARU	Greater argentine	OTH	Others
BET	Bigeye tuna	PLE	European plaice
BFT	Atlantic bluefin tuna	POK	Saithe (=Pollock)
BLI	Blue ling	POL	Pollack
BSF	Black scabbardfish	POR	Porbeagle
CAT	Wolf fishes (=Catfishes) nei	PRA	Northern prawn
COD	Atlantic cod	RED	Atlantic redfishes nei
DGS	Picked dogfish	RNG	Roundnose grenadier
DWS	Deep-water sharks nei	SAL	Atlantic salmon
FLX	Flatfishes nei	SAN	Sandeels (=Sandlances) nei
GFB	Greater forkbeard	SBR	Blackspot (=red) seabream
GHL	Greenland halibut	SOL	Common sole
HAD	Haddock	SOX	Soles nei
HAL	Atlantic halibut	SPR	European sprat
HER	Atlantic herring	SQI	Northern shortfin squid
HKE	European hake	SRX	Rays, stingrays, mantas nei
HKW	White hake	SWO	Swordfish
JAX	Jack and horse mackerels nei	USK	Tusk (=Cusk)
LEZ	Megrims nei	WHB	Blue whiting(=Poutassou)
LIN	Ling	WHG	Whiting

# 1 Introduction

The Director-General for Maritime Affairs and Fisheries (DG MARE) has requested an impact assessment to be conducted on the implementation of discard policies to be implemented EU-wide.

This request has been made to compliment the CFP Reform Impact Assessment (*Impact Assessment Studies related to the CFP*) being conducted by DG MARE. The first phase of the impact assessment assessed the performance of the current CFP under a status quo scenario, whilst the second phase considered several policy reform options developed by DG MARE, from which expected results were forecast for each. These primary impact assessments will be referred to as the CFPIA

In this discard impact assessment requested by DG MARE, policy options for discard reductions are assessed against options 1 and 1a from the second phase of the current impact assessment will be considered for which results of the discard policies will be forecast. Policy Option 1 is defined in Table 3 and Policy Option 1b is identical with the exception to one detail; the option considers managing multi-species fisheries with  $F_{MSY}$  set for the ecosystem optimum.

The comparisons that will be made are as follows:

- Option 1 + discard reduction vs Option 1
- Option 1a + discard reduction vs Option 1a

## 1.1 Problem Definition

It is important to distinguish between by-catch and discards. By-catch is the unintended catch of organisms during fishing. It also refers to the catch of juveniles or undersize fish of the species targeted. By-catch can still hold economic value and may be kept on board to sell as a by-product. However, discards is a term specifically used for catch which is not kept but is thrown back, often dead, in to the sea. This may be either unwanted by-catch or target fish. It may occur for a number of reasons, including the perceived poor quality and lack of value of fish compared to others (high grading), or because landing or retention is prohibited by regulation. Globally, discarding is estimated to be 8% (6.8 million t) of the total volume of fish caught annually (Kelleher 2005). Kelleher (2005) also noted that 1.3 million tonnes of this discarding occurs in FAO area 27 which includes much of the EU's EEZ.

The level of uncertainty over total catches that arises from discarding can hamper efforts to accurately assess current stock levels. In an economic and social sense discarding is wasteful of the energy and cost used to catch the fish. It also represents a waste of wealth and resources, given the importance of fish as a source of protein.

### 1.1.1 Discarding in EU fisheries

Discarding occurs in EU fisheries sometimes at high levels, such as: 30-60% for the finfish fishery off the Iberian Peninsula (MRAG, 2007); 50% of the catch in North Sea beam trawl fleets (MRAG, 2007); between 20-98% in the North Sea nephrops trawl fleet (Enever et al, 2009); and 40% of most species through bottom-trawling in North east Atlantic fisheries (STECF, 2006).

High levels of discarding are often associated with trawl fisheries. However, given the influence of regulation and perverse market incentives, discarding at high levels can occur in fisheries targeted by any gear type. For example, the longline fishery for swordfish and albacore tuna in the Adriatic can reach discard levels of 50%.

Discarding does not only occur due to poor gear selectivity and the capture of unwanted fish. Undersize fish may be discarded due to the minimum landing size regulations, overquota fish can be discarded in a multi-species fishery due to quota exhaustion of one species. Both these issues are reported to be present in EU fisheries, although for those that are not managed by quota the biggest problem is minimum landing size discards. Finally, despite the high-grading ban for the North Sea implemented from 2008, there are still suggestions of high-grading occurring. Given that this form of discarding is purely the fisher's decision and not regulation-driven – to the contrary, it is illegal to do so – the persistence of illegal high-grading suggests a lack of incentives to voluntarily comply and/or a lack of suitable monitoring and control.

## **1.2 General Methods**

This study comprised two sections; a research phase, and an analytical IA phase.

1. In the research phase two separate streams were pursued.
  - a. A comprehensive review of discard rates across EU fisheries
  - b. A series of case studies reporting on other countries' experiences with discard reduction policies and/or pilot programs;
2. In the analytical phase, the information acquired in the first phase was combined with existing data e.g. ICES stock assessments, Commission data sources (e.g. FIGG and EFF expenditure, AER data), internal Commission documentation, other published reports of relevance, to undertake the analytical IA

In the research phase, case study information was collected through a combination of site visits and desk-study research. The case study list included EU MS and other international countries: Scotland, England, Germany, Denmark, Norway, Iceland, USA. Where data were lacking on the specific case studies, relevant administrations were contacted directly.

In the analytical phase, the impact of new discard reduction policies were assessed through a list of indicators (Table 1) which encompass environmental, economic, social, governance, and administrative burden principles; these indicators were developed in the CFPIA. Where possible, the indicators were analysed via quantitative methods through biological and bio-economic models (see section 4). Where quantitative methods were not available, qualitative assessments were used drawing on case study experiences and expert knowledge drawn from different EU regions.

This assessment analyses the possible impacts expected as a result of the discard reduction policies under option 1 and 1a for the years 2012, 2017 and 2022. Options 1 and 1a were previously defined in the Phase II report (see section 3.2).

**Table 1 Key indicators of CFP performance used in this analysis**

Principles	Indicators
<b>Environmental</b>	1) Stock situation in terms of fishing mortality in relation to MSY 2) Percentage of stocks and/or catches covered by LTMP 3) Average size (length and weight) of fish 4) Fleet evolution 6) Area covered by protection regimes (Natura 2000) or special measures EU EEZ.
<b>Economic</b>	7) Gross valued added 8) Economic sustainability: Ratio current revenue-Break even revenue point 9) Net profit margin 10) Economic performance: Return on investment 11) Fish prices, market orientation 12) Level of subsidies
<b>Social</b>	13) Employment 14) Status of fisheries dependent communities/regions/ MS/EU 15) Value added dependency levels 16) Social sustainability: Gross value added per employee 17) Attractiveness of the sector: Distribution of incomes 28) Safety
<b>Governance</b>	18) Departure from quotas by Council (scientific advices in decision making) 19) Management costs for the sector 20) Regions and MS having adopting RBM system 21) Data provided by MS 22) Rate of utilization of allocations (quotas) 23) Level of quotas exchanges 29) Time taken to reach a decision
<b>Coherence</b>	24) Level of coherence with WTO and other EC policy
<b>Administrative burden</b>	25) Impact for the private sector
<b>Simplification</b>	26) Level of implementation simplification process by MS and industry
<b>External*</b>	27) Governance of EC fishing activities in external waters
<b>Aquaculture</b>	30) Development of Aquaculture

## 2 Research Phase

### 2.1 Discard rates in EU fisheries

A literature review was conducted on the current level of discarding in the EU. Specific case studies were also produced on different regions in the Mediterranean. The following provides a summary of the results from these reviews. A brief summary and categorisation exercise is also available in Table 2 (see EU Discards Annex for further details).

Beam trawlers have some of the highest levels of discards in all of their active locations, regardless of whether they are targeting invertebrates or flatfish (Table 2). Other types of bottom trawlers also have high rates of discarding but these are reported to be more variable, ranging from 18-70% of total catch. No particular gear or regional differentiation appeared to explain the variability, but it is possible that the variability was due to the specific

characteristics of each gear such as mesh size and selectivity modifications which can significantly affect the level of bycatch (Catchpole and Revill, 2007). Mediterranean longlines and hydraulic dredges also had particularly high discard rates. Discards from these fisheries are notable as they include a number of endangered species and non-commercial benthic invertebrates.

Pelagic trawls are generally more targeted “cleaner” fisheries with lower levels of discards than trawl fisheries. In the Mediterranean these target predominantly anchovies and sardines, discarding target species due to high grading and MLS restrictions as well as discarding some non-commercial shark species. Pelagic trawl discard rates are even lower outside the Mediterranean where herring, mackerel, horse mackerel and blue whiting are targeted and the same species are discarded through high grading and minimum size restrictions.

Trammel nets in ICES regions generally have medium levels of discarding. These fisheries discard target species such as herring, horse mackerel, mullets and whiting which are below MLS and overquota. In the Mediterranean trammel nets have lower levels of discarding. Here, anchovies, striped red mullet and black scorpionfish are among species caught. A mixture of undersize target species and other low value species such as jack mackerel, sardines and macroinvertebrates are discarded, mainly due to high grading. Small scale coastal fisheries also have very low levels of discarding.

Overall, the majority of discards in ICES regions appear to be more due to MLS restrictions than to multispecies quota restrictions. To a lesser extent, market forces result in discards of fish with low commercial value (STECF, 2006; Catchpole *et al.*, 2005). In the North Sea, discarding of all species is generally related to MLS restrictions and quota constraints.

In the Mediterranean, fleet characteristics are very varied with multiple gear types and a wide range of vessel sizes fishing a variety of habitats such as seagrass beds and coral reefs. Discards are characterised by extremely high species diversity (there may be >100 species in a bottom otter trawl and of these >60 discarded) with a high percentage of non-commercial catch (commercial portion of catch may range from 30-80%) and high variability in total discard rate due to seasonality. Endangered species are frequently caught and benthic flora is often hauled up with catch, some of which is from vulnerable benthic habitats. Due to the effort based management regime in force in the Mediterranean, with exception of blue fin tuna, no over-quota discarding occurs. High-grading of small fish is a recent occurrence as traditionally smaller fish were eaten, but larger sized fish now fetch a higher market price, resulting in a high grading incentive (Fabio and Grati, 2005). In the Mediterranean discards include both species with no commercial value and marketable species (eg, those on Annex 3 of Council Regulation (EC) No 1967/2006). The latter are represented both by undersized specimens, considered unmarketable for their minimum landing sizes, and species discarded for their low market value, despite their legal size. This may reduce the level of impact on the Mediterranean fisheries if a discard reduction policy is only applied to managed species.

In conclusion, despite the differences in management approach, species composition and ecosystem complexities in different regions, discard rates of particular gear types and fishing strategies are remarkably similar across MS and regions. Therefore the main impact analysis will assess the impact of discard reduction policy measures on fisheries depending on their situation with regards to three levels of discard rates identified in Table 2.

**Table 2 Trends in discarding in EU waters**

**ICES regions**

	High Discards (>40%)		Medium Discards(15-39%)		Low Discards (<15%)
	Beam Trawls	Bottom trawls	Bottom trawls	Trammel nets	Pelagic trawls
Target species	Flatfish (sole, plaice)	<i>Nephrops</i> Horse mackerel, monkfish, megrim, hake Cod, haddock, Cephalopods mullet	Hake, <i>Nephrops</i> , sardines	Herring, horse mackerel, mullets, whiting	Herring, mackerel, horse mackerel, blue whiting
Discard species	Plaice, sole, cod, haddock, whiting, dab	Target species	Target species and dab, gurnards, plaice, lesser-spotted dogfish, whiting, boar fish, poor cod, gt silver smelt horse-mackerel and dragonets	Target species	Target species
Discard characteristics	Undersize target species	Undersize target species Over quota target species Low commercial value	Undersize target species Over quota target species Low commercial value	Overquota, high-graded herring, Whiting below MLS	High-grading of low value individuals, below MLS

**Mediterranean**

	High Discards (>40%)			Medium Discards (15-39%)		Low Discards (<15%)	
	Beam trawls	Longline	Hydraulic dredges	Bottom trawls	Bottom trawls	Pelagic trawls	Trammel nets/gillnets/lampara
Target species	Cephalopods and scallops (Adriatic)	Albacore, swordfish	Clams (Adriatic)	Mullet	Red mullet, red shrimp, octopus, horse mackerel	Anchovies, sardines, red mullet, jack mackerel, silver scabbards	Anchovies, striped red mullet, black scorpionfish
Discard species	Invertebrates, <i>Nephrops</i>	Swordfish, bluefin tuna, tope shark, turtles	Clams and other benthic invertebrates	Small commercial and non commercial invertebrates	Target species	Target species, sharks	Target species, Jack mackerel, sardines, macroinvertebrates
Discard characteristics	Undersize target species	Undersize target species, overquota (bluefin), endangered species	Undersize target species, species with low or no commercial value	Undersize target species Low commercial value High diversity (~135 spp. per trawl)	Under MLS, damaged or small	Below MLS, high grading of low values species and small individuals	High grading (small/damaged individuals), below MLS

## **2.2 International experience with discard bans**

### ***US Pacific Whiting Catch Shares***

The fishery was open only for short seasons given the high level of capacity in order to minimise the possibility of overfishing. Given the multi-species nature of the fishery (whiting, Atka mackerel, Aleutian Islands ocean perch, flathead sole, pacific cod, rock sole, and yellowfin sole) and the difference in demand for the different species, less valuable catch was discarded as a means to maximise catch under the limited time available. This was despite the fact that these discarded species were considered to hold reasonable market value.

In 2008, the pacific groundfish fishery moved to a catch share program as a means to stabilise the economic performance of the fleet and reduce discards as a result of high-grading. Under the catch share system, vessels were allocated proportions of the TAC based on their catch history from 1998-2004. As part of the measure, there is to 200% observer coverage for all trips as means to ensure that there is always at least an observer monitoring trip activity. This observer cost is estimated at \$500/day. The cost of observers is to be eventually covered 100% by industry, but is increasing in increments of 10% per year.

Discarding is negligible given the strict requirement for observer coverage. Total reported landings are now below allowed catch levels which indicates a conservative approach to exhausting catch shares. Although catch levels are not 100% of allowable catch, fishing revenue has increase from \$171 million in 2003 to \$200 million in 2008 (real term using 2008 = 1). Through the catch shares program, there has been a consolidation of the fleet as this was introduced as an economic measure in addition to an environmental one. The number of vessel participating has decreased from 28 to 23.

The success of this program, amongst others examples implemented throughout the US, has meant that NOAA has produced a catch share policy which allows any fishery to adopt a catch share policy. A fishery in the same region, operating on a larger scale, has adopted the same system as of 2011.

### ***Icelandic Discard Ban***

Decreasing stocks were a large driver for the introduction of a discard ban. The decreasing stocks were due to a combination of factors: levels of effort which were too high for the fishery, poor incentives to land all catch and poor legislative ability to prosecute previous attempts to reduce discards and control capacity. It was not until the introduction of the fisheries management act in 1990 when more legislative power was afforded to management authorities.

The discard ban initially started as a catch quota scheme for cod and haddock. That is, it was legal to continue discarding of all other species. Over time, the list of species to which the discard ban was applicable grew. Previous legislation had placed some emphasis on reducing discards, but it was until the 1996 legislation where the greatest advances in restricting discards were made.

The management system uses multiple measures to reduce juvenile catches. Real time closures are implemented in areas identified as supporting high proportions of juvenile fish. Length-based comparisons of observed catch and non-observed catch are used to identify incidents of discarding. Limits on the amount of juvenile catch which can be landed each before penalties are applied are also used.

In theory, each vessel must hold sufficient quota to catch all fish which is likely to be caught for each fishing trip. This will depend on the area and length of the proposed trip. To manage this, each vessel is able to access quota portfolio information in real time via a web database and participate in quota swapping to increase the necessary levels of quota for the relevant species.

In 1997 it was estimated that discard levels of haddock were greater than 20% of total haddock landings. In 2006, this figure was less than 5%. Cod information has only recently been recorded but figures for 2001-2006 suggest a discard rate of equal to or less than 1%. Stocks for both and haddock have shown an increasing trend since the introduction of the discard ban. Net profit has also been increasing from less than 0% in 1997 to greater than 15% in 2007, but this is probably mainly driven by fleet consolidation as of 1991 with the introduction of an ITQ system. Socially, greater awareness of discarding and its impacts to the fishery exists. Operators are now reporting each other if another operator is seen to be discarding and is not identified by patrolling authorities.

### ***Norwegian discard ban***

Poor catch levels for seven years prior to 1986 (the year discarding was banned for cod and haddock) were one of the key drivers for the discard ban in Norway. In addition to poor catch levels, it was estimated that a strong year class was due to be recruited into the adult stock. Given high-grading was not illegal but still a large issue to the level of accurate data available for stock assessments, management wanted to ensure that this strong year class was not poorly managed and its positive impacts not received. As with Iceland, this ban initially began as a catch quota system for cod and haddock, increasing in species numbers over time and since 2008 has become a ban on discarding of all species which hold commercial value.

Management measures to reduce juvenile catch include implementing real-time closures. Limits on the percentage of catch which can be juvenile is one method of establishing areas for closures. Norwegian authorities also monitor stock structure in areas through the use of their own inspection vessel using current gear technology. Gear restrictions also placed throughout the industry.

More at-sea patrol presence, through the coastguard, is placed in this fishery when compared to the Icelandic case. This is observed, through industry interviews, as a key deterrent to discarding. It is estimated that the coastguard conducts up to 2,200 inspections per year. The joint action between Norwegian and Russian authorities is also a key factor in the reduction of IUU catches. The cost of the coastguard is estimated to be approximately € 101 million, of which 70% could be attributable for fisheries patrol. It should be noted that the intense presence of the coastguard in Norwegian fisheries is an artefact of foreign policy interests and thus seen as an efficient use of resources.

Little data was recorded prior to the discard ban but it is estimated that the average across all fisheries was between 2-8%. Management states that no information exists on current levels as reporting discards would be admitting breaking the law. Industry surveys indicate that small amounts of discarding still occurs but only in very small volumes and little in frequency; there is the expectation that increased levels of discarding has a very high chance of being detected.

Cod stock in the Barent Sea has increased by 844% since 1988. This increase in cod stocks has led to an increasing trend in suggested TAC by ICES, generating increases in revenue

opportunity. Similar to the Icelandic case, net profit has also increased, but this appears to coincide more with the introduction of ITQs and subsidy removal in the late 1980's. Increase economic performance of the fleet has also been realised as increased attractiveness of the sector. Catches per employment FTE are now above those required to achieve the national average wage.

### ***North Sea catch quota management***

Cod discard rates in the North Sea are estimated to be 35% of total fishing mortality. This measurement by ICES is a key point to the level of additional quota made available to vessels participating in the CQM scheme.

The scheme was first piloted by vessel in Denmark in 2008-2009. All vessels participating in the scheme were not allowed to discard any cod catches over minimum size and all undersize was recorded; this was due to minimum landing size regulations in the EU. Instead of using observers to ensure there was not any discarding, a remote electronic monitoring (REM) system implemented. This system included the use of CCTV cameras, hydraulic sensors and VMS. The cameras were used to record hauling and sorting activities, the hydraulic sensors were used to identify at which points in the footage this activity occurred and VMS was used to cross-check against electronic logbook data. Only small samples of hauling footage was observed to further increase the efficiency of the system.

The success of the scheme led to a wider application amongst other MS fishing in the North Sea. In 2010, Scotland had 17 vessels participate in the scheme and in 2011 this number was 26. There have been slight adjustments to the scheme in Scotland, where all cod must be landed (but cannot enter human consumption markets) and as well as all above minimum size catches of quota-managed species.

Germany was also due to participate in 2010, but due to technical difficulties was only able to equip vessels to commence the program in 2011.

Early results indicate that vessels participating in the Scottish scheme are experiencing a €27/tonne (£24/tonne; 0.6%) decrease in fish price. Economic modelling also suggests that under the current quota additions a price decrease of around 18% could be experienced before the fleet would not benefit from the system.

### ***South West England Project 50%***

This case study is not an example of a strictly applied discard reduction policy. The purpose of the study was to attempt to reduce discards by 50% in the beam trawl fishery in SW England. This was due to the identified high levels of discarding having environmental impacts and large sorting times having economic impacts.

One major aspect to this case study was the key involvement of industry in the identification of solutions. Through the collaborating of industry and scientists, new beam trawl nets were designed for each participating vessel. This was to ensure that the net was not only effective environmental perspective but that it was also applicable practically by the vessel operators.

The new designed beam trawls were towed at the same time as the old designs in a twin rig set-up as a method to provide a control for assessment. In all by one case, the discard reduction was over 40% and in some cases the reduction increased to nearly 70%.

### **3 Analytical phase: Specification of the policy options**

The section defines the policy option defined by the Commission for a discard reduction system. They also describe some of the assumptions used in the modelling and qualitative analysis. Section 3.2 also describes the original policy options as defined in the Phase II report to which this discard reduction policy option (section 3.1) is compared.

#### **3.1 Discard reduction policy**

##### **3.1.1 The Large scale fleet operating outside of the Mediterranean**

The discard reduction policy considered in this impact assessment assumes a catch quota system will be implemented for all quota-managed species with

- a) A requirement that all fish of defined species (eg quota species) that are caught are landed and counted against quota, irrespective of size
- b) In the initial stages, additional quota is allocated on a metier basis depending upon current discard rates to compensate vessels and act as an incentive; similar to the current application method for Scotland and Denmark. Currently ICES advice for applicable stocks are where TAC consider a landings and discards component (TAC = landings + discards). The quota then made available is equal to landings. The additional quota would a proportion of the current discard levels and this would be added to the original quota. In the subsequent years, and once discarding has been eliminated, the catch quota scenario will be that TAC = landings = possible quota where the mortalities which used to be accounted for under discarding are now incorporated into the landings/possible quota. Therefore, the new landings figures will be larger when compared to those if under the status quo. However, it should be reiterated that under the catch quota scenario, landings will equal TAC (with an unchanged F) and this will always be aligned with harvest control rules – moving towards a scenario of  $F_{MSY}$  (see section 4.3).

The allocation of additional quota will be undertaken only on receipt of accurate data on current discard rates, to guard against un-expected increases in fishing mortality caused by only partial uptake of catch quota management (CQM; as shown in a paper presented to the project by Mogens Schou and Hans Frost, 21/2/11).

The catch quota policy defined by the Commission will be implemented gradually with pelagic species incorporated in Year 1 (2012) and demersal species in year 2 (2013). The bio-economic model provides output for 2012, 2017 and 2022. Consequently the bio-economic model assumes that the catch quota policy is implemented for all species in 2012. Assuming implementation in 2012 for demersal species, rather than 2013, allows for quantitative analysis of the short-term impacts of implementation of a catch quota policy for demersal species using the bio-economic model constructed and will have little effect on the model output in 2017 and 2022, compared to assuming introduction in 2013 as expected. In terms of modelling, the three categories of discards are assumed to have discard rates of 10% (low), 25% (medium) and 40% (high). The additional quota allocation to these sections has been assumed, in the models, to be equal to these proportions.

Through applying a variety of management measures and for the purpose of the impact assessment, 100% compliance to a discard reduction policy is assumed. These potential

management measures are described in brief in section 2.2 and in more detail in the Case Study Annex.

The following options are still being considered to deal with undersized landing:

- i. Only set reference sizes (ie no minimum landing size or minimum marketable size), and require all fish to be landed (i.e. a discard ban). and sold for human consumption irrespective of size. It may be assumed that any reduction in the catches of small fish is a result of market pressure based on the lower value of small fish. This assumption may not always hold, for instance in the Mediterranean where small fish have been prized in the past. This will be referred to as sub option i (ie option 1i or option 1ai)
- ii. Set a minimum marketable size (ie, no minimum landing size, as at present) where undersized fish can only go to non-human consumption and operators only realise 20% value of this sale, while the other 80% of the value being confiscated and pooled into a management fund. This will be referred to as sub option ii (ie option 1ii or option 1aii).

Under both of these options all undersized and over-quota landed count against quota 1kg:1kg.

There are several methods in which quota may be managed.

1. From the defined TAC, a percentage could be kept aside as global bycatch quota and individual quotas would be distributed as per the share owned. Once individual quota is exhausted, the global bycatch quota could be drawn down. Once this bycatch quota is exhausted, fishing would cease;
2. All quota could be allocated, and additional quota transfers dealt with under the anticipated ITR systems of Option 1.
3. Vessels could be allocated distributed mixed species quotas under a portfolio which is consistent with the current option 1 MSY policy.

Under either transferable quota approaches (points 1 or 2 above), it is assumed that the transferability of these quotas does not need to be a final transaction and that leasing or short-term swapping is possible. Also, it is expected that neither of all three quota management options will have an impact on the quantitative aspect of the impact assessment, but additional administration costs may need to be considered where appropriate.

### **3.1.2 Small scale coastal fleet operating outside the Mediterranean**

Under the proposed policy options, catch quotas will require some ability for quota swapping. However, option 1 and 1a propose that an ITR system is only voluntary for the small scale coastal sector.

The limited data available suggest that in the small scale coastal sector, discard rates are usually around the 10% level of total catch. Therefore, either under an effort or catch control system, the impact assessment assumes that the small scale coastal fleet will still require some incentive to move to a catch quota system and that this would result in applying the “low category” redistribution (see section 3.1.1) scenario.

Observers or REM control could not be easily implemented in the small scale coastal fleets given the high proportion of revenue this would represent and the physical constraints of

small vessels. Experience in other fisheries suggests increased logbook inspections coupled with length-based analysis of a small portion of observed catches would be an appropriate control for the small scale coastal fleet.

### 3.1.3 Mediterranean

Literature reviews indicate a significant level of discarding occurring of mainly undersize catch. The key difference in the policy proposed for the Mediterranean compared with elsewhere in the EU is that currently there is no intention to move away from an effort-based management system.

However, it is anticipated that the implementation of a discard reduction policy would have the same effect on overall revenue of vessels. Currently, most large Mediterranean vessel are limited not on hold capacity but on distance from markets for fresh fish. A discard reduction policy would therefore increase the quantity of fish retained and sold, and decrease its average price (depending on size-related prices), and also lead to some improvements in stock size. This is exactly analogous to the situation with the large scale northern EU fleet. However it should be noted that only species under Annex 3 of Council Regulation (EC) No 1967/2006 would be subject to the measure and discard levels of these species may be slightly lower than indicated in the literature review (see section 2.1).

The big difference is that there would be no need for the administrative mechanisms associated with quota swapping in the Mediterranean. All control and compliance measures in the Mediterranean would remain as they have been set for the fleets operating outside the Mediterranean.

## 3.2 CFP Reform Policy Option 1 and 1a

For the specifications of policy Option 1, please refer to the CFP IA Phase II report, *Fish / 2006 / 09, Lot 4: Impact Assessment Studies related to the CFP Part 2 - Impact Assessment Phase II (4 Options)*. For a summary of the policy, see Table 3 for a summary of the policy.

For the specifications of policy Option 1a, please refer to the Task 7 extension of the CFP IA Phase II report. The only difference in this policy option, compared to option 1, is the implementation of the ecosystem optimum proposed under policy option 2 in the CFP IA Phase II. This option proposes that in a multispecies fishery, quotas are to be defined based on the most biologically sensitive species.

**Table 3 Summary of policy Option 1 as defined in the CFP Phase II report**

	Policy	Option 1
Environmental sustainability	MSY policy	Move to Fmsy for all stocks over a period of 8 years
	Fleet policy	No EFF-2 scrapping fund. ITR on LSF compulsory. ITR on SSF voluntary. Transfers limited to within-MS.
	Discards	As Status Quo
Economic sustainability	Subsidies	No fleet subsidies (scrapping, modernisation), smart green subsidies and territorial development axes only.
	Markets	Large reform of the CMO

	Policy	Option 1
Social Sustainability	SSF Regime	EFF with some preferences for SSF. Axis 4 focus on heavily fishing dependent communities. Protection from over exposure to market forces for SSF on ITRS.
	Improved Safety	Improve safety legislation (largely beyond scope of CFP)
Governance	Regionalisation	Regional Bodies constructed with Executive of MS and Commission, advised by RACs
	Other policies (IUU, data collection)	As Status Quo
External	EU bilateral fishing agreements	Cost of access borne by EU ship owners
	EU involvement in RMOs	Enhanced participation including financial contribution of EU ship owners

## 4 Biological and economic modelling

The overall approach to the determination of quantitative impact assessment is as follows

1. Categorise the fleets into **high**, medium and low discard rates
2. Determine through simulations of 4 North Sea stocks, for which ICES assessments currently take discarding into account and for which discarding is in the **high** category, the impacts of reducing discarding of juveniles, and over-quota discarding, through a discard reduction policy on a) the stock and b) the catch over the period 2012-2022 according to the policy assumptions of Option 1 with a discard reduction policy and Option 1a with a discard reduction policy.
3. Determine the consequences for the value of the catch over the period 2012-2022, based on the results of the stock modelling in terms of catch volume and the proportion of fish of different sizes and therefore value
4. Make reasonable assumptions about the likely trend in catch value for medium and low discard rate fleets.
5. Determine the likely additional costs associated with the discard reduction policy, in particular the costs of increased compliance means (such as the CCTV system mentioned above).
6. Introduce the results from (4) and (5) into EIAA and Birdmod models of northern and Mediterranean stocks, drawing on the models set up during the CFP IA.

Greater detail for these sections is given below.

Results were determined for the follow categories:

- Fleets with high, medium and low discarding (see section 4.1)
- Two types of treatment of small fish; a reference size and a minimum marketable size (see section 3.1.1)

#### **4.1 Categorisation of fleets**

Using the information presented in Section 3 the types of fisheries likely to experience high, medium and low discard rates were identified in Table 2. AER data were analysed to assign anticipated discard rates by fleet segment (nationality, gear, size) and target species. All EU fisheries identified in EIAA or BIRDMOD models could thus be allocated high, medium or low discard rates, and the likely responses (in terms of costs and revenue) could then be assigned by fleet segment. For the application of the categories to the EIAA model, the average score across the fleet segment (rather than country) was used (see Table 4).

**Table 4 EU gear types categorised by level of discarding and MS (High = red = 3, Medium = amber = 2, low = yellow = 1, green = no information).**

Fleet Segment	BEL	CYP	DEU	DNK	ESP	FIN	FRA	GRC	IRL	ITA	LTU	LTV	MAD	MLT	NLD	POL	PRT	SWD	UK
DFN VL1224			2.5		2.0	2.0	2.2		2.0		2.0	2.0				2.0	2.4	2.6	2.2
DFN VL2440					2.0		2.4									2.0			2.0
DRB VL1224				2.6			3.0												1.0
DRB VL2440																			3.0
DTS VL1224		2.0	2.4	2.6	2.4		2.2	2.2	2.2	2.2		2.2		2.2	2.0	2.0	2.0	2.2	2.6
DTS VL2440			2.4		2.0		2.2	2.2	2.6	2.4	2.4	2.4			2.2	1.8	2.0	2.4	2.6
DTS VL40XX					2.2		2.2	2.2		2.6							2.4		2.4
FPO VL1224							1.0		1.0			1.0					1.0		1.0
HOK VL1224					1.8		2.3	2.0		2.0			2.3	2.0		1.0	2.5	2.3	
HOK VL2440					2.0												2.3		1.7
HOK VL40XX					2.5														
PGP VL1224				3.0															
PGP VL2440																			
PGP VL40XX																			
PMP VL1224				2.6			3.0	3.0		3.0						3.0			3.0
PMP VL2440							3.0												
PTS VL1224				1.8	1.0	1.0	1.0	1.0		1.0				1.0	1.0		1.0	1.4	1.0
PTS VL2440				1.4	1.0	1.0	1.0	1.0	1.0	1.0		1.0				1.0	1.0	1.4	1.0
PTS VL40XX				1.0	1.0		1.0		1.0		1.0	1.0			1.0			1.0	1.0
TBB VL1224	2.2		2.4	2.8				3.0		3.0					2.4				2.4
TBB VL2440	2.2		2.0					3.0	1.8	3.0		2.2			2.2				2.4
TBB VL40XX															2.4				2.8

## 4.2 FLR (stock modelling) Assumptions

The potential discard reduction policy will be implemented from 2012. Between 2013 and 2014, current landings selectivity curves are assumed to remain as the status quo, and catch which was previously discarded is simply landed. However, from 2015, it is assumed that through changes to fishing behaviour, target fishing areas and gear selectivity, the size structure of the total catch will alter to match the current size distribution of landings, effectively removing small sized fish (which are currently discarded) from catches. This change in selectivity is expected to be largely market-driven based on price and market drivers.

Data collected from several fish auction sites suggest that reducing the mean size of landed fish, which will be a result of a discard reduction policy will reduce the average price (see Table 5). One caveat to this assumption is that prices in Dutch market, depending on the species, can do the reverse.

This change in price situation is also present in the Mediterranean fisheries. In the past fish prices may not have increased necessarily with the size, but new market information suggests that consumer demand is shifting and requesting fish sizes which can easily be filleted (see Table 6). Anecdotal evidence suggests that this is occurring in the Spanish seafood market perhaps as an impact of the current economic downturn in Spain. In local tourism, small-sized fish are often consumed in local restaurants on the Spanish Mediterranean coast as starters or "tapas". With the current reduction in tourism, less people are eating in the restaurants and the demand for small sizes reduces. Additionally, the general trend of increased processed fillets and "ready meal" consumption may have an effect on this.

Throughout Italy, these trends such as these have also been observed through interviews with consumers and members of industry. With more people conscious of eating high levels of fried foods, there has been a decrease in the consumption of small fish as this is their typical method of preparation. Preference of fish without spines is also occurring as it is more easily cooked and eaten (F. Fiorentino, pers. comm., 2011).

**Table 5 Average fish price data 2007 – 2011 based on Danish vessels landing prices across Europe. All sorting grades are determined by weight (source: Danish Ministry of Fisheries website)**

Species	Sorting Grade	Average 2007-2011 (kr/kg.)
Whiting	1	11.29
	2	9.44
	3	8.51
	4	6.31
Plaice	1	15.58
	2	12.79
	3	11.30
	4	10.32
Haddock	1	16.04
	2	12.59
	3	8.24
	4	4.91

Species	Sorting Grade	Average 2007-2011 (kr/kg.)
	5	4.85
Cod	1	34.43
	2	31.66
	3	24.95
	4	22.32
	5	16.19
	6	10.43

**Table 6 Fish price data 2008-2010 for Mediterranean fisheries landed in Spain, Andalucía (weekly prices of fishery products annual report, 2008-2010).**

Species	Size	Year (€/kg)		
		2008	2009	2010
Anchovy	Small Medium	7.04	5.87	5.87
	Large	8.09	6.85	6.87
Hake	1-1.5 kg		8.15	6.95
	>1.5kg		9.20	8.16
Mullet	Small		12.06	12.47
	Large		17.50	16.18
Dab	Small		11.48	11.49
	Large		18.02	17.95
Clams	Small		7.09	6.89
	Medium		8.22	7.94
	Large		9.43	10.17

In the North Sea case (see Table 7), the variation in price with respect to sorting grade is clear. This sorting grade is based on those outlined by the Danish Ministry of Fisheries<sup>1</sup>. Given sorting grade five is categorised as cod between 0.3kg and 0.9kg, it is assumed that this is the smallest legal landings size in ports bound by EU minimum size landings regulations. Those in sorting grade seven are undersize and thus landed for non-human consumption – hence the small price per kg. This is corroborated by survey responses from the case studies conducted where it was stated fish meal prices for undersized cod are usually around 25% of the average landings price. The variation in price between sorting grades seven and five is 99.1%; from seven to four is 230%. It is also important to consider the price variation between the minimum legal size (sorting grade 5) and the maximum size (sorting grade 0: ≥7kg). Between these two sorting grades, there is still a 187% difference in price per kg. Based on these results, there is an incentive to fish more selectively if fish below a minimum size were only able to be landed in non-human consumption markets.

<sup>1</sup> Sorting Guide for all species: [http://webfd.fd.dk/stat/Landinger\\_dynamisk/sort.pdf](http://webfd.fd.dk/stat/Landinger_dynamisk/sort.pdf)

**Table 7 Landings Prices per kg (Danish Kroner) for Cod Landed in North Sea EU ports (source: Danish Ministry of Fisheries website) Landings.**

Sorting Grade	Year				Average ('07 – '10) (kr./kg.)
	2007 (kr./kg.)	2008 (kr./kg.)	2009 (kr./kg.)	2010 (kr./kg.)	
1.	39.11	33.08	27.16	30.95	32.58
2.	33.76	30.81	25.05	27.5	29.28
3.	29.99	27.24	21.4	23.84	25.62
4.	24.13	22.26	17	18.35	20.44
5.	15.02	13.37	8.85	10.96	12.05
7.	5.08	6.72	7.84	4.56	6.05

*NB: sorting grade (kg): 1 = >7, 2 = 4-7, 3 = 2-4, 4 = 1-2, 5 = 0.3-1, 7 = fishmeal*

**Table 8 Landings of Cod for North Sea Member States Landed in Danish Ports (source: Danish Ministry of Fisheries website)**

Sorting Grade	Year			
	2007 (Kg)	2008 (Kg)	2009 (Kg)	2010 (Kg)
1.	198,932	324,752	349,099	313,450
2.	479,119	490,583	503,178	555,306
3.	661,586	651,803	864,742	1,021,449
4.	615,369	735,861	791,268	909,209
5.	578,194	678,600	855,724	928,906
% of catch				
1.	7.85%	11.27%	10.38%	8.41%
2.	18.91%	17.02%	14.96%	14.89%
3.	26.12%	22.62%	25.71%	27.40%
4.	24.29%	25.54%	23.52%	24.39%
5.	22.82%	23.55%	25.44%	24.91%

*NB: sorting grade (kg): 1 = >7, 2 = 4-7, 3 = 2-4, 4 = 1-2, 5 = 0.3-1*

Under current market circumstances, the level of incentive to increase selectivity of fishing is expected to vary somewhat depending whether or not the final destination of undersize fish is human or non-human consumption. This is because when analysing two different markets, one where human consumption of small fish is allowable (Norway) and one where they are not (EU markets), it can be seen that there is a smaller positive differential in price by size as the size increases, albeit there is still an increase. Therefore, it is expected that while there is still an incentive to increase selectivity, this will be increased with the additional deterrent of penalties for landing too higher percentage of small fish. However, it is difficult to predict exactly which way the market will go in a free market. This is because the concept of a pure ability to land any fish for the human-consumption market, without regulation, is untried.

In the data available from landings of cod in Norway, it can be seen that the price increase between sizes is ~20% from the smallest size grade to the subsequent size. The increases in price per size are ~14-15% for the following “step-ups” in sizes (see Table 9). It could be argued that in comparison to the current situation of price differential for landings of fish into a non-human consumption market (see Table 7), that this would not indicate as great of an incentive to increase selectivity. However, when viewing Table 10, it is clear that there is a very small percentage of catch in the lowest sorting grade (sorting grade 1), despite the small increase in price from one size grade to the other. When comparing this proportion of catch in the lowest grade in Norwegian landings to the proportion of catch in lowest grade in North Sea landings – between 22% and 25% (see Table 8) – it can be argued that there is a difference in selectivity in the Norwegian case. It is this difference in selectivity despite the smaller price differentials which prompts the suggestion that the change in selectivity has been somewhat market driven but also in combination with sales penalties for high proportions of small-sized fish – the regulation limiting the proportion of small-sized fish allowable in catches (see section 2.2, Norwegian discard ban).

**Table 9 Landings Prices per kg (Norwegian Kroner) for Cod Landed in Norway (source: Rafisklaget, pers. comm., 2011)**

Sorting Grade	Year				Average ('07 – '10) (NOK/kg)
	2007 (NOK/kg)	2008 (NOK/kg)	2009 (NOK/kg)	2010 (NOK/kg)	
1.	12.10	11.05	7.89	8.96	10.00
2.	14.71	14.37	9.64	8.99	11.93
3.	16.34	16.47	11.94	9.57	13.58
4.	18.88	18.11	14.39	11.18	15.64

*NB: sorting grade (kg): 1 = <1, 2 = 1-2.5, 3 = 2.5-6.5, 4 = >6.5*

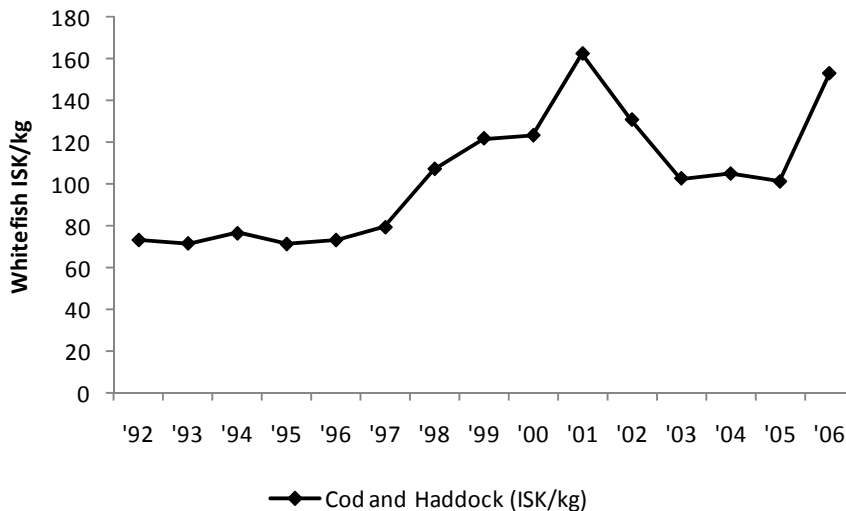
**Table 10 Landings by kg for Cod Landed in Norway (source: Rafisklaget, pers. comm., 2011)**

Sorting Grade	Year			
	2007 (Kg)	2008 (Kg)	2009 (Kg)	2010 (Kg)
1	20,573,077	19,037,721	18,496,170	13,120,479
2	93,555,212	73,361,362	96,874,377	104,978,581
3	134,845,547	121,041,605	108,483,836	147,494,686
4	1,950,276	23,355,583	31,963,839	19,643,005
% of catch				
1	8.20%	8.04%	7.23%	4.60%
2	37.28%	30.98%	37.87%	36.80%
3	53.74%	51.12%	42.41%	51.71%
4	0.78%	9.86%	12.49%	6.89%

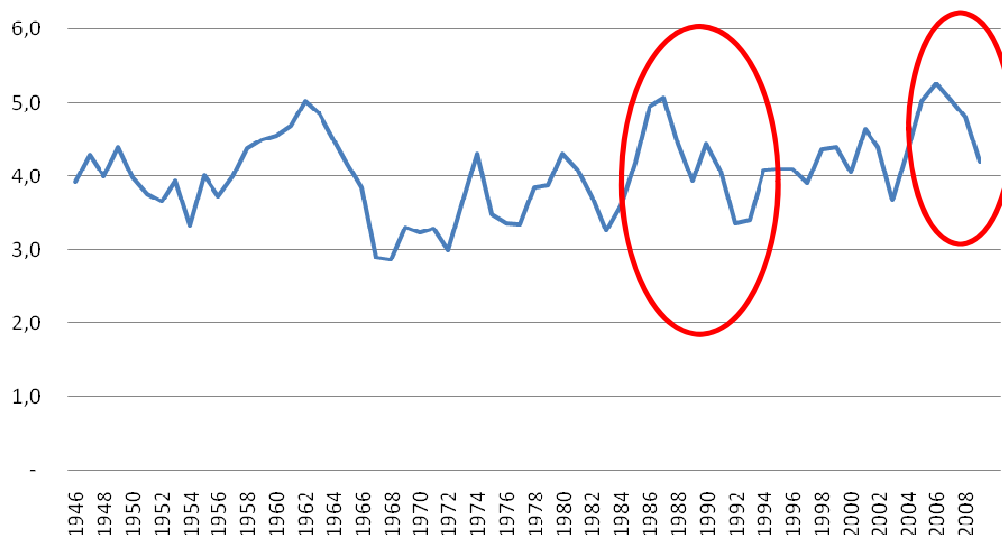
*NB: sorting grade (kg): 1 = <1, 2 = 1-2.5, 3 = 2.5-6.5, 4 = >6.5*

Therefore, under both the scenarios presented in Table 7 – Table 10, incentives to increase selectivity have been demonstrated under different scenarios.

The previous tables present an argument for estimating the price differentials of landing different sized fish. Meanwhile, the experiences noted in both the Icelandic and Norwegian fish markets (both countries having implemented a full discard ban), provide evidence of the change in selectivity which can be expected. Figure 1 and Figure 2 show that on the assumption that average fish price decreases with smaller sized fish in the catches and thus would increase with higher proportions of larger fish catch, market forces will drive a change in selectivity within a few years of introducing discard reducing policies. In both cases we see an increase in average fish price with a slight time lag corresponding to the point in time a discard reduction policy is introduced.



**Figure 1 Price per kilogram (ISK/kg) for cod & haddock in real terms using prices indices for groundfish without iced fish 1990 – 2006 (STATICE, 2011). Discard ban introduced most notably in 1996 through greater legislation.**



**Figure 2: Fish sales value in Norway adjusted to consumer price index – 1945=4 (source: S. Johansen, pers. comm., 21 May, 2010). Original catch quota for cod and haddock in 1986 and a full discard ban in 2008. The prolonged drop in overall fish price between 1986 and 1992 may be explained by the cod harvesting moratorium in this period.**

### 4.3 FLR methodology

A biological model was developed in FLR to reproduce stock and catch dynamics under the proposed management regimes. The fisheries were forward projected to 2030 using specific assumptions about recruitment, compliance, discarding and implementation of harvest control rules.

An age structured population model was set up, using numbers at age provided in the most recent ICES assessment, giving values for 2009. Recruitment was simulated using the geometric mean from the previous ten years with uncertainty represented through 200 bootstrap samples of the residuals around this estimate. For each bootstrap sample in each year the harvest control rule was applied to generate an expected catch for the following year, assuming perfect knowledge of the resource.

Catches and discards were estimated from the  $\bar{F}$  specified by the harvest control rule, as follows:

$$H_a^{TOT} = H_a^{LAND} + H_a^{DISC}$$

Where

$$C_a^{LAND} = \sum_{\alpha} \frac{F_a^{LAND}}{F_a^{TOT} + M_a} N_a W_a (1 - e^{-F_a^{TOT} - M_a})$$

$$C_a^{DISC} = \sum_{\alpha} \frac{F_a^{DISC}}{F_a^{TOT} + M_a} N_a W_a (1 - e^{-F_a^{TOT} - M_a})$$

The target fishing mortality was that specified by the harvest control rule for the stock up until 2012. From 2013 onwards  $\bar{F}_{TARGET} = F_{MSY} = F_{0.1}$  or otherwise, in accordance with the Option 1 F projects, implemented gradually over a four year period from 2013-2016, as described in the CFPIA.

It is important to note that it was assumed that ICES will provide advice consistent with  $F = F_{MSY}$  where all catches and discards control to  $F_{MSY}$ .

#### 4.3.1 Discard and landing selectivity

The harvest control rule specifies a target fishing mortality  $\bar{F}$ , which represents the mean  $F$  over appropriate age groups. Fishing mortality acts via selectivity curves  $S$ , to generate the fishing mortality at age.

For the selected stocks, from available data, it was possible to partition the total selectivity into landing and discard components for each age. The discard selectivity curves were generated from discard and stock numbers at age data from the ICES reports. The numbers of discards at age were multiplied by the average weight of discards at age to generate total discard biomass in each age group. These were divided by the mean total estimated stock biomass at age data to estimate harvest rate at age.

$$H_a^{DISC} = \frac{\text{Discard weight at age}}{\text{Stock weight at age}}$$

This was converted into fishing mortality at age:

$$F_a^{DISC} = -\ln(1 - H_a^{DISC})$$

This vector of  $F_a^{DISC}$  was then scaled so that the expected discard biomass equalled the total reported for a particular year

Landings selectivity was derived from discard mortality at age subtracted from the total fishing mortality at age:  $F_a^{TOT} = F_a^{LAND} + F_a^{DISC}$

This was repeated for the most recent 3 years of the assessment. Selectivities were then estimated in the usual way as:

$$S_a^{LAND} = \frac{1}{3} \sum_y \frac{F_{ay}^{LAND}}{F_y}$$

$$S_a^{DISC} = \frac{1}{3} \sum_y \frac{F_{ay}^{DISC}}{F_y}$$

The two selectivity curves were then scaled so that the mean of the sum was equal to one, across the appropriate age range. Thus for a given  $\bar{F}$  (used in the HCR) estimates could be derived for both landings and discards of the fishery as a whole. This ensured that multiplication by the fishing mortality  $F$  specified by ICES (across the designated age range) did not change the value of  $F$ , only the distribution of mortality across discards and landings. Thus for a given  $F$ , both landings and discards could be estimated. In all such cases, the harvest control rule is assumed to account for the expected level of discards when setting the TAC, thus ensuring the target  $F$  is reached (in the absence of implementation error).

A discard reduction policy was implemented by initially (years 2013-2014) simply summing the discard and landing biomass, under the assumption that vessels are required to land all catch, thereby increasing landings. From 2015 onwards, a change in selectivity was assumed, due to changes in gear and areas targeted and increased real time information allowing fishers to avoid areas with high juvenile abundance. Total fishing mortality remained dependent on the HCRs, however the discard selectivity curve was set to zero, and the landings selectivity increased by a corresponding amount.

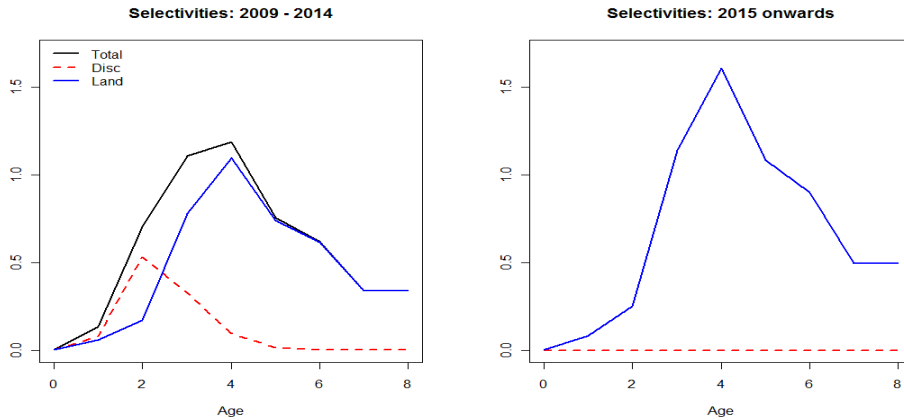
#### 4.3.2 Stocks considered

Four stocks from the North Sea were modelled; haddock, plaice, cod and whiting. These were the only stocks for which ICES data on discard numbers and weights at age were available, and economic data from these fisheries were relatively comprehensive. Fishing mortality was gradually reduced to reach the target mortality  $F_{MSY}$  by 2016, assuming TAC could not vary more than 25% interannually according to option 1 and 1a of the CFP IA.

Projections were run up to 2030, a period long enough to be able to observe the equilibrium level of catches and standing stock biomass reached.

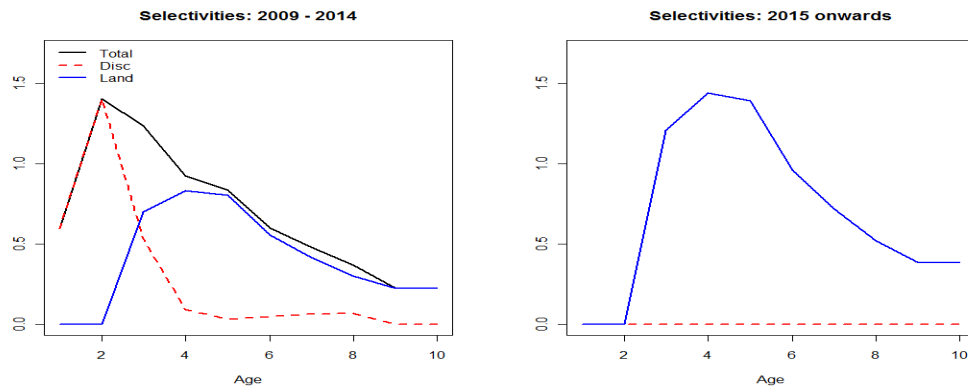
##### **Haddock**

Of total haddock catch, ICES assessments indicate that 34.26% is discarded, and of this, 63.39% are undersize (age 3 or below) in 2009. From 2012-2014 catch selectivity curves were assumed to be consistent with the current selectivities and landings were added to discards to provide total catch selectivity. From 2015 onwards, the total selectivity was adjusted so it was consistent with the current landing selectivity, assuming fishers avoid targeting juveniles which must be landed under the discard reduction policy (Figure 3). The target fishing mortality was set equal to  $F_{MSY}$  (0.17), which was reached by 2016.



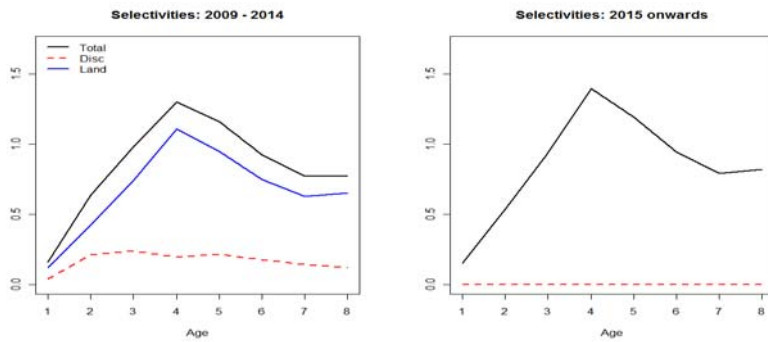
**Figure 3. Selectivities of haddock catches with implementation of a discard reduction policy**  
***Plaice***

Of total plaice catch, ICES estimates that 45.92% is discarded, and of this, 92.91% are undersize (age 5 or below) in 2009. With implementation of a discard reduction policy, total catches were made up of larger sizes (Figure 4). ICES (2010) specified that an annual 10% reduction in fishing mortality should take place until an  $F$  of 0.3 is reached. After this, the target fishing mortality was set equal to  $F_{MSY}$  (0.14), which was reached by 2016.



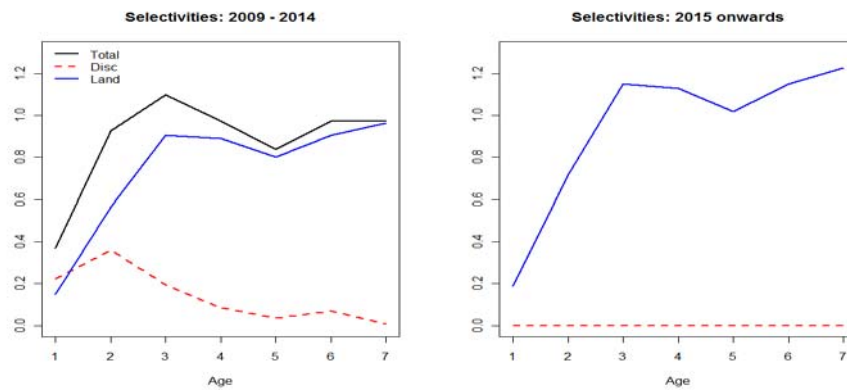
**Figure 4. Selectivities of plaice catches with implementation of a discard reduction policy**  
***Whiting***

Of total whiting catch, ICES estimated that 23.05% is discarded, and of this, 67.30% are undersize (age 2 or below) in 2009. No  $F_{MSY}$  was provided from the ICES 2010 working group report, which stated “ $F_{0.1}$  has historically been around 0.4 but due to the shape of the YPR curve a maximum is often not reached, so  $F_{max}$  has not been defined for several years. The estimate of  $F_{0.1}$  is therefore also very variable”. This stock was still modelled using the most conservative estimate of  $F_{0.1}$  (0.33) from preliminary analyses (0.33-0.45) by ICES.



**Figure 5. Selectivities of whiting catches with implementation of a discard reduction policy**  
**Cod**

Of total cod catch, ICES estimates that 42.06% is discarded, and of this, 65.15% are undersize (age 2 or below) in 2009.



**Figure 6. Selectivities of cod catches with implementation of a discard reduction policy**  
**Implementation error**

Unreported catches were considered to be negligible in all fisheries except cod, where the ICES working group report estimated a catch higher than that reported from available discard and landing logs. The mean overcatch of the previous 3 years was estimated as 70% by ICES using the B-ADAPT model and as 39% using the SAM model estimates. This was accounted for in the model by assuming catch was divided by this error to reduce TAC accordingly:

$$TAC_y = \frac{C_{LAND}}{\epsilon_y}$$

Therefore the TAC is a function of the landed catch accounting for discard mortality and implementation error. Unreported catches were considered to be negligible in all fisheries except cod, where the ICES working group report estimated a catch higher than that reported from available discard and landing logs.

## 4.4 Summary of FLR results

### 4.4.1 Haddock

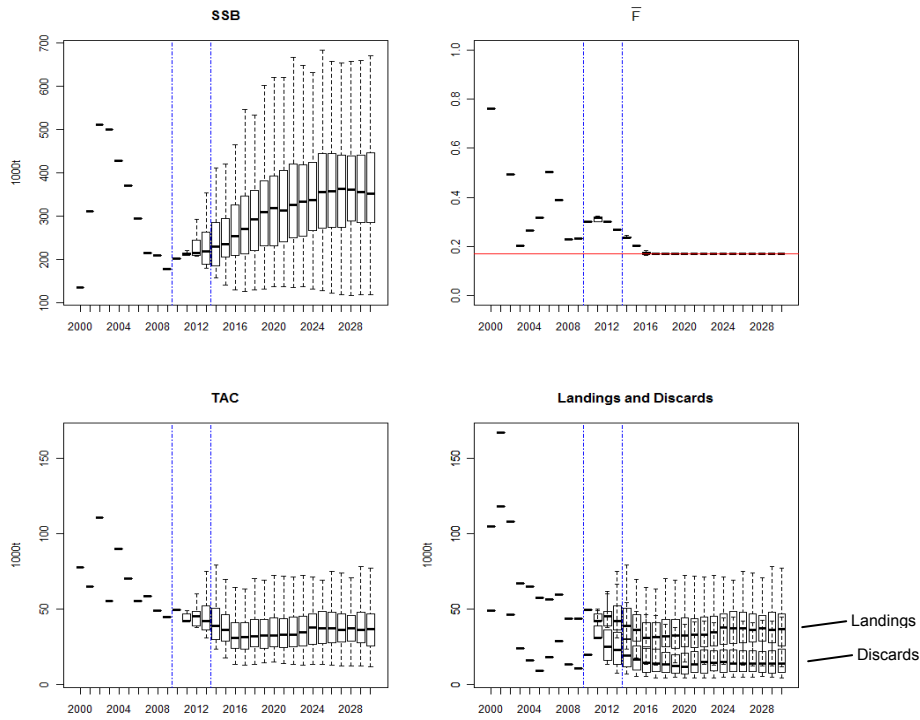
The figures below assume 100% compliance with the discard reduction policy. While imperfect compliance would lead to continued discarding, ICES' advice on  $F_{MSY}$  would remain the unchanged, so the scenarios below remain appropriate.

The setting of quotas at the different levels of compliance could be as follows. At 50% compliance, only 50% of the additional quota afforded due to discarding would be added. The remaining 50% would continue to be estimated as discarding and included in the setting of  $F_{MSY}$ .

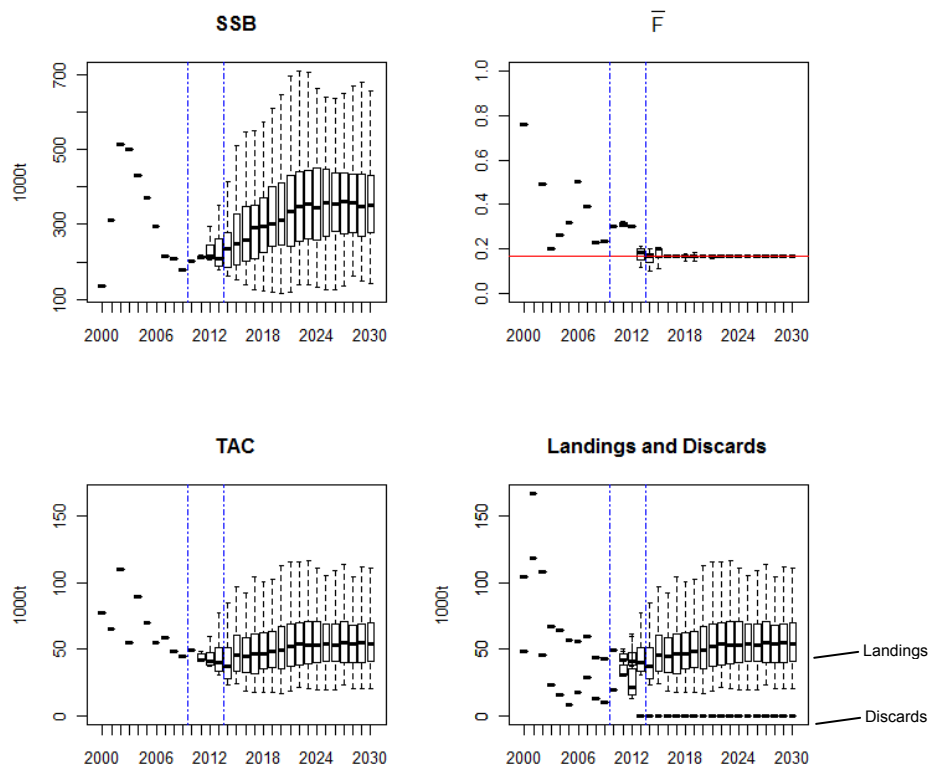
This variance in compliance (50% and 75%) was initially modelled for all stocks and the results for haddock were presented during the interim meeting to DG MARE. It was concluded that for clarity in reporting, only 100% was modelled through EIAA. This is because the compliance level made no change to stock size given that total mortality always reached  $F_{MSY}$  and the impact would have remained proportional with no variation in trend between the compliance levels with respect to revenue.

When stocks are projected forward over time for Option 1, fishing mortality is reduced to fall in line with the target  $F$ , which is reached by 2016 in line with the  $F_{MSY}$  management approach. Spawning stock biomass (SSB) increases with the reduction in fishing mortality as the stock recovers. TAC is reduced and so landings and discards decline and stabilise at a slightly lower level (Figure 7). For stock projections with implementation of a discard reduction policy, fishing mortality is reduced to the same target level so the SSB plateaus at the same level. The TAC increases, but due to the constraints on TAC fluctuations, fishing mortality is reduced to the target level more quickly and so there is a faster rate of stock recovery. The resulting landings increase due to the reduction in discards (Figure 8).

Under Option 1, the age structure of stock biomass adjusts slightly with stock recovery with a higher biomass of individuals in the oldest age class (Figure 9). This is due to the reduction in fishing mortality to target  $F$  and so does not alter with the implementation of a discard reduction policy (Figure 10). As stock recovery is more rapid under the discard reduction policy, the main difference is that the age structure reaches the new equilibrium more quickly. Although landings increased in total quantity, there was little difference in the age structure of the landings between the two policies due to the assumption that the same selectivity of landings as currently would apply (Figure 11 and Figure 12).



**Figure 7. Changes in haddock over the projection period with a reduction in fishing mortality and no discard reduction policy**



**Figure 8. Changes in haddock over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012**

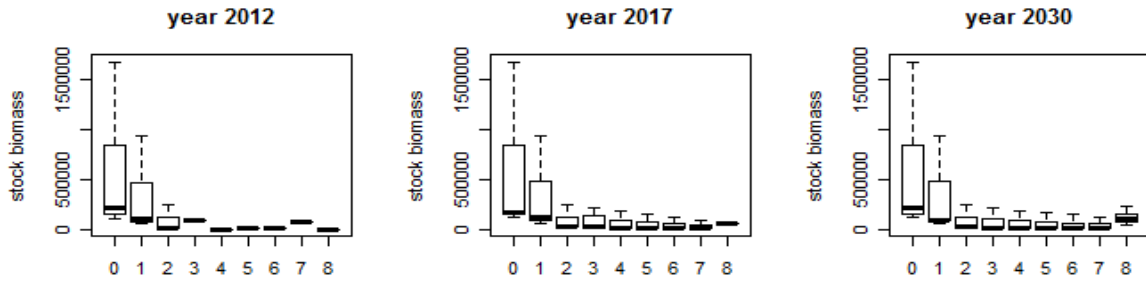


Figure 9 Haddock stock biomass by age with no discard reduction policy

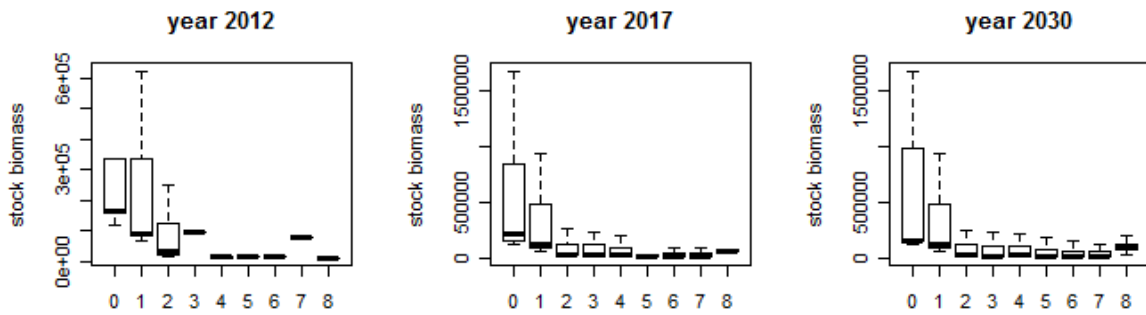


Figure 10 Haddock stock biomass by age with a discard reduction policy

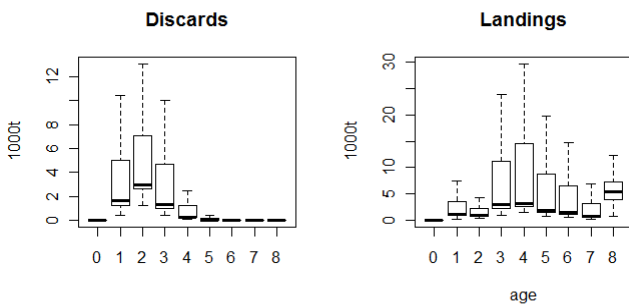


Figure 11 Landings by age with no discard reduction policy

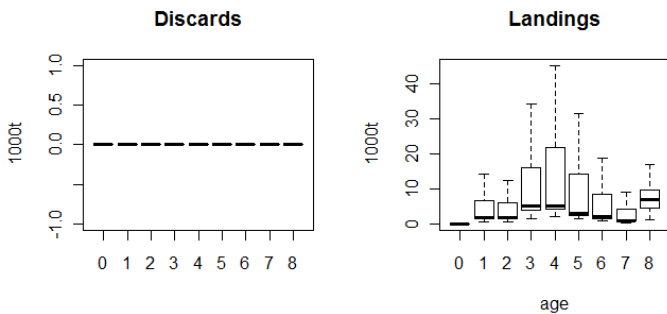
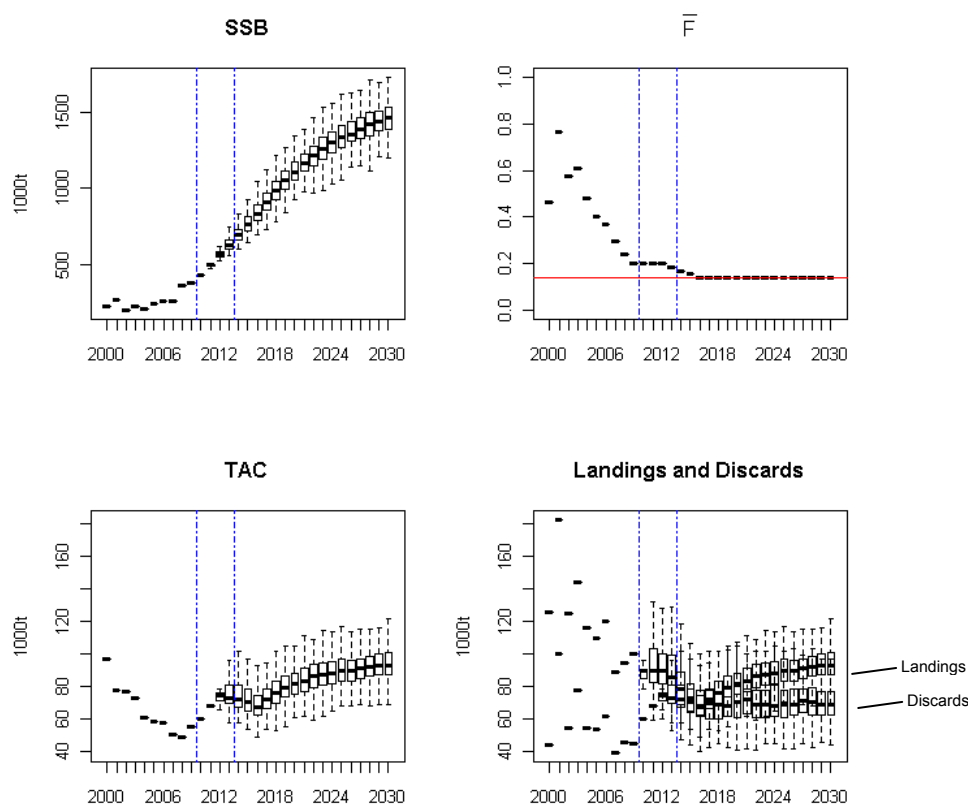


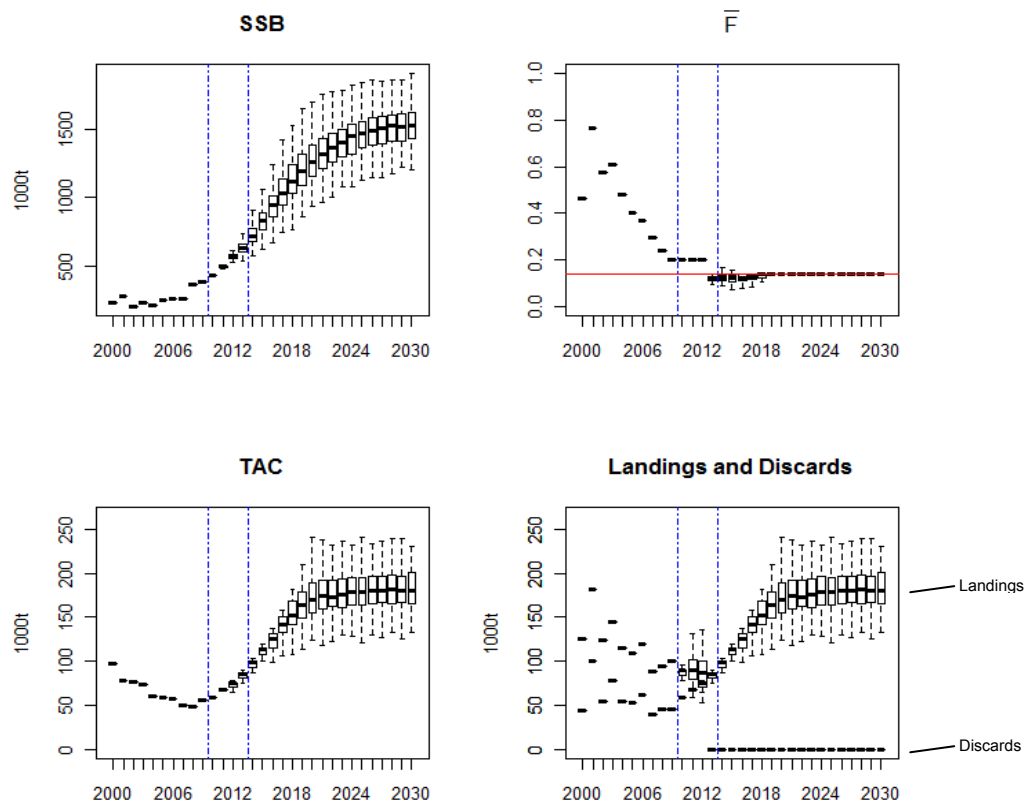
Figure 12 Landings by age with a discard reduction policy

#### 4.4.2 Plaice

Under Option 1, fishing mortality is also reduced to  $F_{MSY}$ , and so SSB increases. This increase is particularly steep due to the extremely high fishing mortality previously recorded in the fishery and the low level of SSB at the start of the projection period (Figure 13). TAC increases because of the large increase in SSB, so landings and discards also increase accordingly. With a discard reduction policy, fishing mortality is reduced to the target level more quickly due to the TAC fluctuation constraints. There is therefore a more rapid increase in SSB which reaches a plateau more quickly than under Option 1. TAC and landings increase by approximately 100% as discards reduce to zero (Figure 14). Further results on the age structure of stock biomass and catches are available in the FLR Annex. Under Option 1 age structure of the stock changes over time due to the reduction in fishing mortality, resulting in a stock with a slightly higher biomass of individuals in the higher age classes (FLR Annex, Figure 5). A discard reduction policy has little influence on age structure of stocks with only a slight reduction in the biomass of the highest age class (FLR Annex, Figure 6). Landings were similar in age composition between the two policies, with relatively more smaller sized individuals landed under the discard reduction policy, but higher landings overall (FLR Annex, Figures 7 & 8).



**Figure 13. Changes in plaice over the projection period with a reduction in fishing mortality and no discard reduction policy**



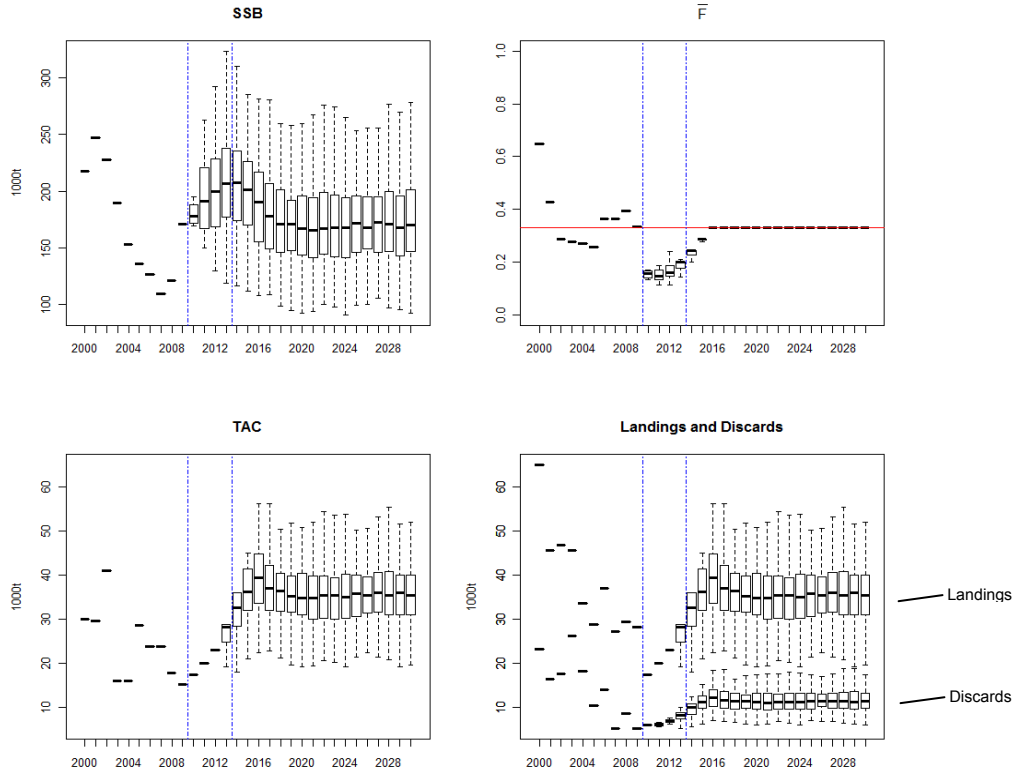
**Figure 14. Changes in plaice over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012**

#### 4.4.3 Whiting

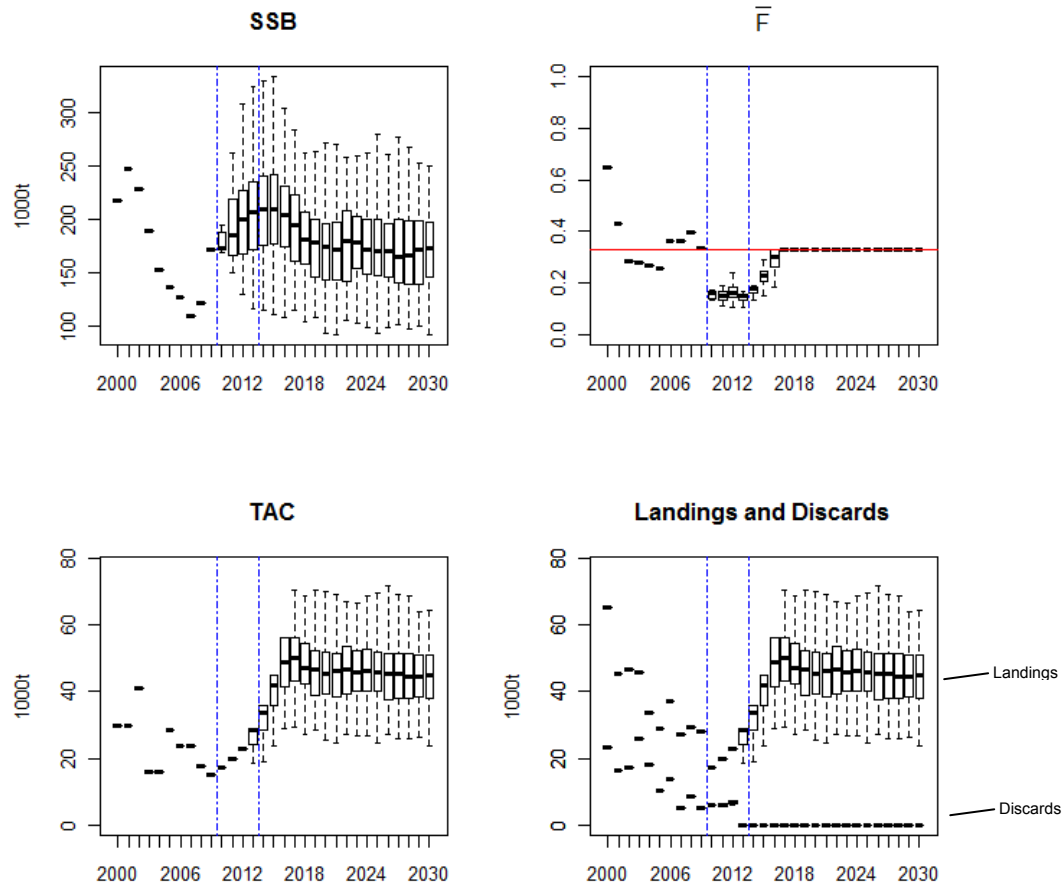
The  $F_{MSY}$  for whiting was uncertain from preliminary ICES analyses, however the most conservative estimate from preliminary analyses resulted in a fishing mortality similar to that currently occurring in the fishery. Under Option 1 model predictions associate target fishing mortality with a higher SSB than currently observed for the same value of  $F$  (Figure 15). This could be due to the extremely high recruitment variability in the fishery resulting in a lower than expected stock in some years. This high uncertainty is represented by the wide confidence limits. Under these projections, SSB decreased, but was associated with a higher TAC and therefore landings and discards. Implementation of a discard reduction policy resulted in the same trend in SSB, but with higher TAC and landings due to the reduction in discarding (Figure 16).

Under both policy options fishing mortality was reduced to below target  $F$ , which appears counterintuitive. However, this was due to the restricted interannual variation in TAC ( $\pm 25\%$ ). When this restriction was removed, there was no change in  $F$  and SSB, indicating that the stock is already being fished at what has been estimated to be a sustainable level of fishing mortality. The TAC and landings were predicted to reach equilibrium levels without any time lag, highlighting the discrepancy between the observed and predicted SSB for the same level of  $F$  (Figure 17).

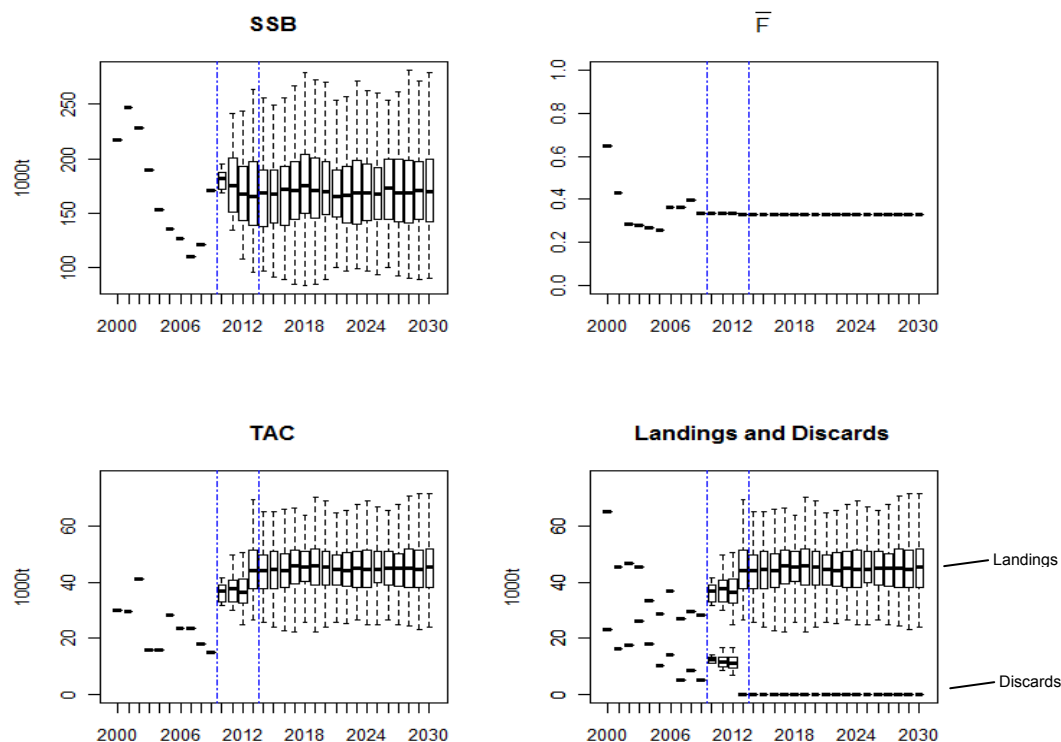
Under either option there was little change in stock structure due to the predicted level of fishing mortality being consistent with current levels (FLR Annex Figures 9 & 10). As such, there was also little change in age structure of landings (FLR Annex Figures 11 & 12).



**Figure 15. Changes in whiting over the projection period with a reduction in fishing mortality and no discard reduction policy**



**Figure 16. Changes in whiting over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012**



**Figure 17. Changes in whiting over the projection period with a reduction in fishing mortality, implementation of a discard reduction policy in 2012 and no restriction in TAC variation between years**

#### 4.4.4 Cod

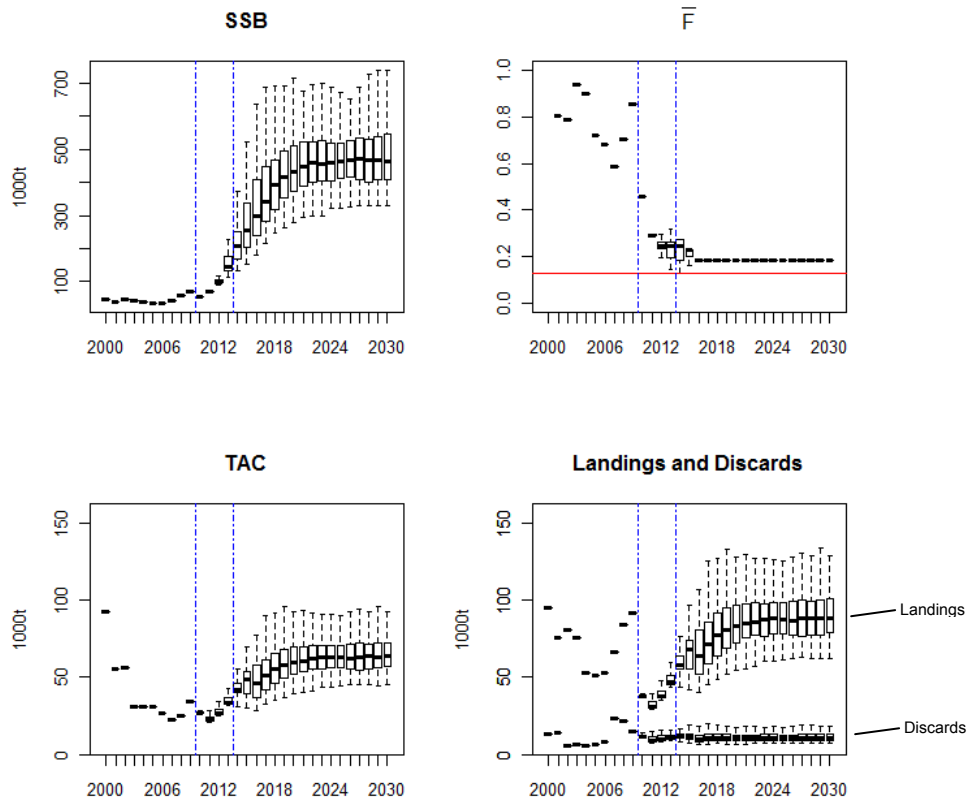
North Sea cod currently has a particularly low SSB. When stocks are projected forward over time under Option 1 fishing mortality is reduced to reach the target  $F$  by 2016 as with the other fisheries. However with cod stocks, unreported catches prevent the fishing mortality from reaching the target. ICES produced two estimates of this unreported catch based on two models; B-ADAPT and SAM. The reliability of both of these models has been questioned, B-ADAPT because the estimates are so high relative to the reported catches, and the SAM model because it is such a new model (Mike Park, pers comm).

Projections were made with each of the estimates in order to evaluate the outcomes in either case. Under Option 1, fishing mortality was reduced, SSB increased, and so landings and discards increased for both SAM and B-ADAPT model estimates. The increase in SSB is particularly notable due to the high fishing mortality previously recorded in the fishery in the region of  $F = 0.5-1.0$ . This  $F$  is lower when using the SAM estimates (Figure 18) and higher using B-ADAPT estimates (Figure 19) so SSB reached equilibrium at a lower level with B-ADAPT estimates and accordingly, TAC and landings were also slightly lower.

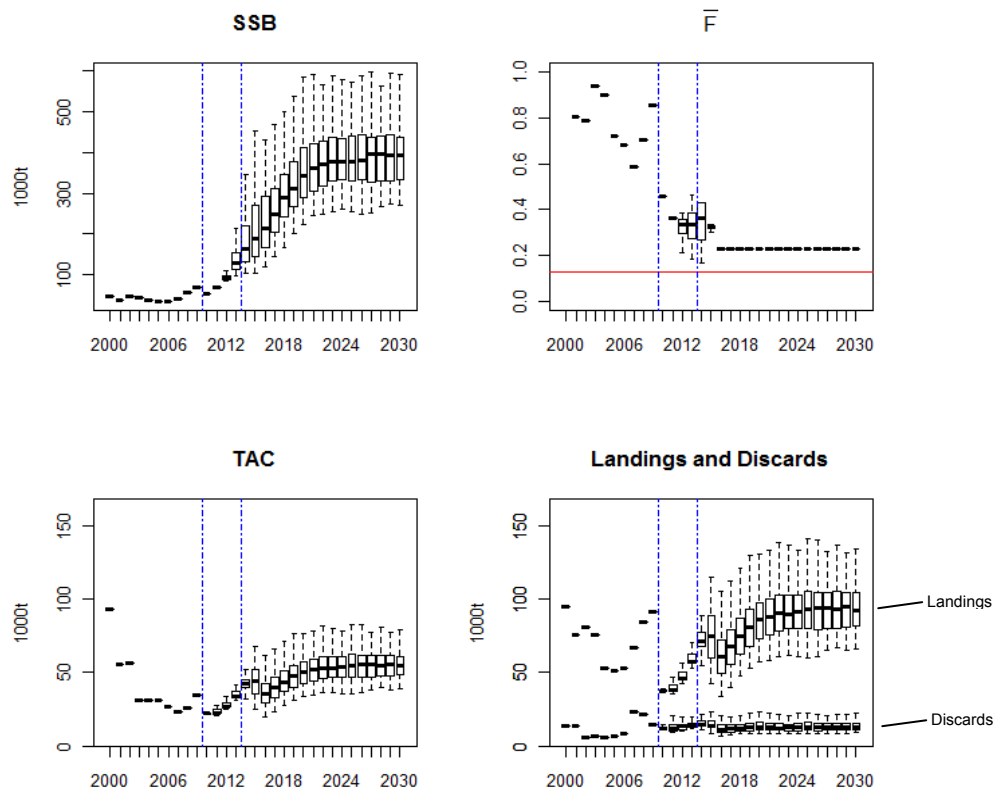
With implementation of a discard reduction policy under the assumption that due to the increased surveillance unreported catches are also eliminated,  $F$  reaches the target so a higher SSB is reached and TACs and landings are also higher (Figure 20 and Figure 21). Stocks not only have a higher final SSB, but also reach it more rapidly.

Stock structure changes over time under Option 1, being composed of a higher biomass of older age classes as SSB increases. This change in stock structure over time also occurs with implementation of a discard reduction policy, however the proportion of older fish

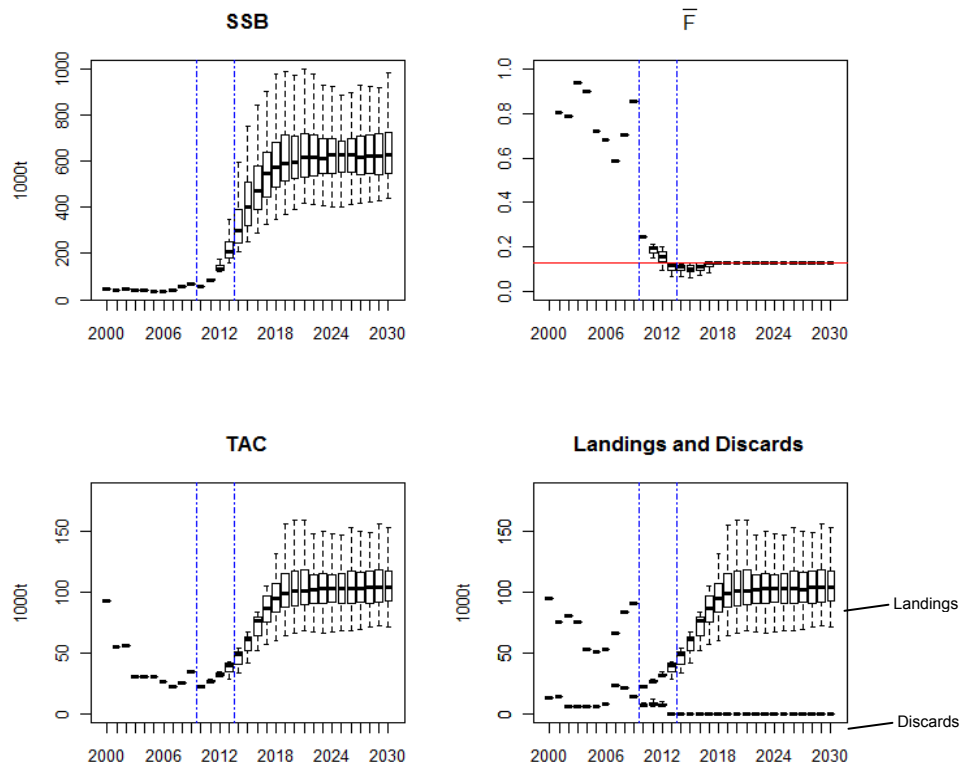
increases (FLR Annex, Figures 13-16). Size structure of landings changes accordingly with higher catches in the older age classes under a discard reduction policy.



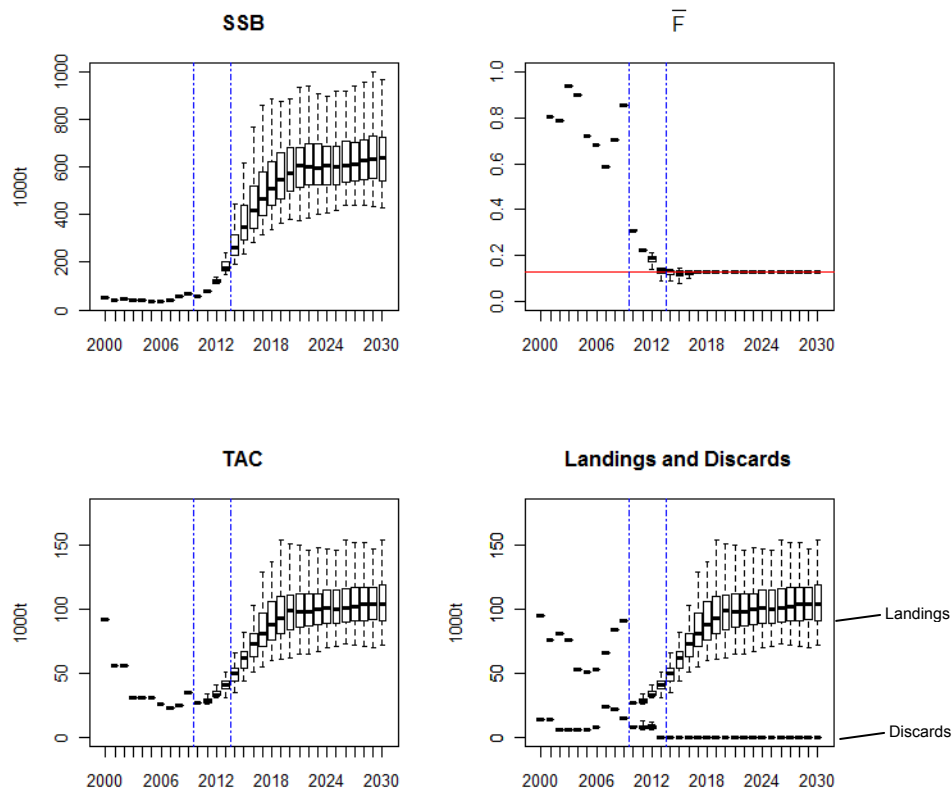
**Figure 18. Changes in cod over the projection period with a reduction in fishing mortality and no discard reduction policy, SAM model estimates**



**Figure 19. Changes in cod over the projection period with a reduction in fishing mortality and no discard reduction policy, B-ADAPT model estimates**



**Figure 20. Changes in cod over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 (B-ADAPT estimates)**



**Figure 21. Changes in cod over the projection period with a reduction in fishing mortality and implementation of a discard reduction policy in 2012 (SAM estimates)**

## 4.5 EIAA assumptions

### 4.5.1 Changes to revenue

A discard reducing policy will result in changes to catches and landings as described in the previous sections, assuming fisher behaviour changes in the way described. This is that the requirement to land all small fish, combined with the lower value of these fish (driven by market demand) and the availability of financing instruments proposed under option 1 in the CFPIA (green subsidies and ITRs) will drive the development of selective fishing gear and practices by 2015.

Given the FLR outputs of landings by age, and the data collected on price of fish by age (converted from weight using von-Bertalanffy curves with parameter estimates derived from Fishbase.org ), it is possible to plot the expected revenue by applying the summed product of price at age by landings at age. This helps form the assumptions of estimated revenue change. Two options are to be considered:

- i. All fish must be landed and there is no minimum marketable size. Operators receive best possible price for fish sizes. Catches of small fish count 1:1 against quota. This assumed that changes in landed sizes will be market-driven.
- ii. All fish must be landed but there is a minimum marketable reference size. All catches below this size must still be landed but operators will only receive 20% of value as a method to compensate for capture and storage cost. Catches of small fish count 1:1 against quota. This policy allows less for market-based changes and relies more on regulation to reduce small fish capture.

The previous assumptions are incorporated into the analysis below to produce expected revenue curves for total quota of cod, haddock and plaice. It is important to remember that there is the assumption that landings of juveniles will cease by 2015 (section 4.2).

The formulas used to construct these revenue curves were as follows:

1. Revenue no change and with discard reduction policy (option i)

$$= \sum_{a=0}^{a=a_{max}} l_a \cdot P_a$$

Using a basic formula of summing the products of landings weight at age ( $l_a$ ) with the price per kg at age ( $P_a$ ) and  $a_{max}$  is the maximum landed fish age. The prices were implemented as per Table 5.

2. With discard reduction policy 20% value of undersize (option ii)

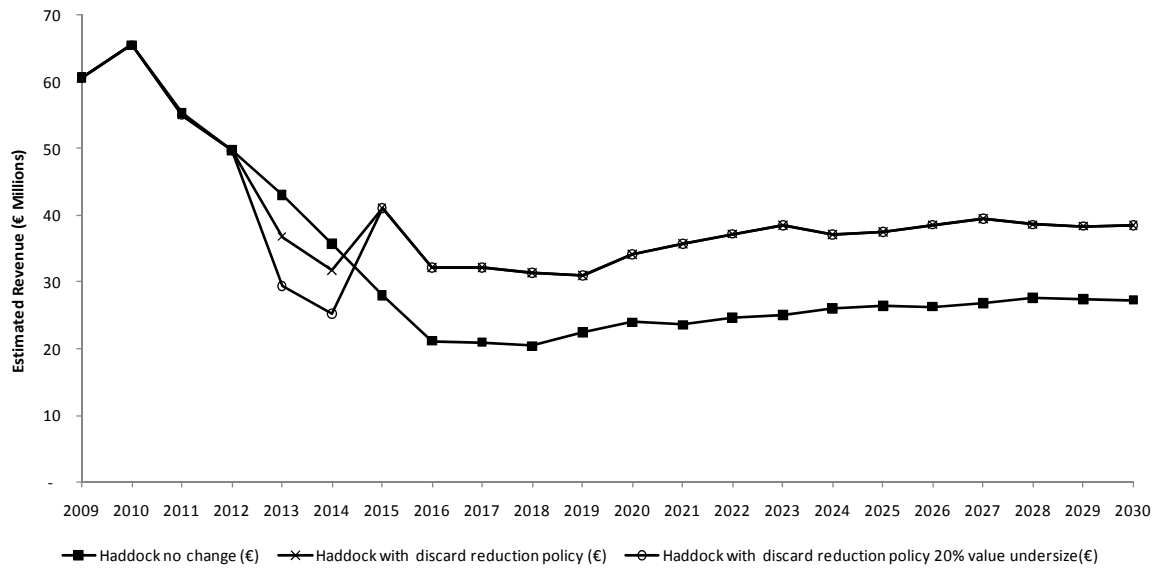
$$= \sum_{a=0}^{a=a_{max}} x_a \cdot l_a \cdot P_a \quad \text{where } x_a \begin{cases} 1 & \text{if } a > a' \\ 0.2 & \text{if } a \leq a' \end{cases}$$

Similar to the first equation, this differs by taking into account the 80% reduction (as a result of management measures) in expected revenue from catches which are below a reference size ( $a'$ ). The parameter  $a'$  varies from species to species depending on its age and the current minimum length landing sizes implemented through EU regulation<sup>2</sup>.

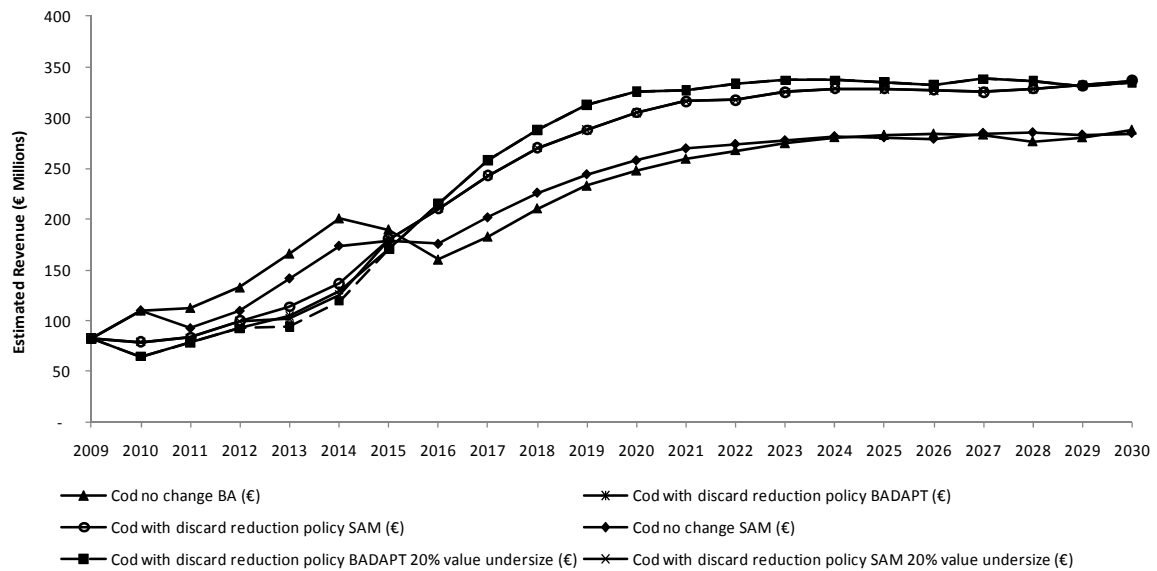
In the following figures, as expected, there is a decline in the initial years' revenue due to the landing and required sale of smaller sized fish. Also, as expected, this decline is more noticeable in the series indicating the revenue of the policy option where only 20% of below minimum marketable size value is received by the operator. The much larger increase in expected revenue for plaice (see Figure 24) is due to the current high levels of discards occurring in the fishery. This discarding occurs primarily due to the discarding in the sole fishery as opposed high discarding in the plaice fishery. Therefore, this very high change may not be characteristic of the results of a discard reduction policy in a general flatfish fishery.

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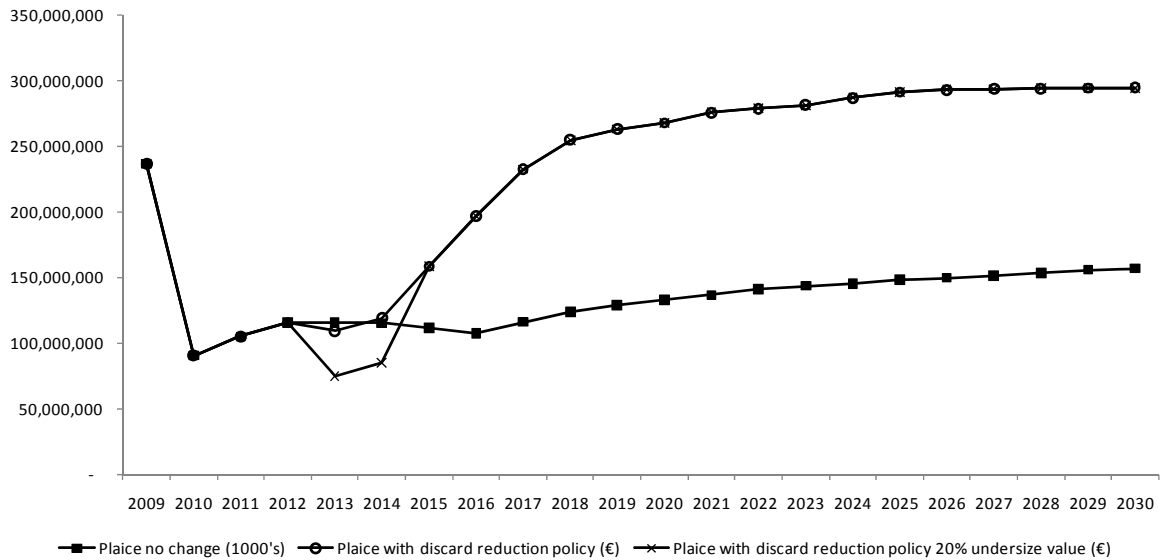
<sup>2</sup> Council Regulation (EC) No 850/98 and its amendments



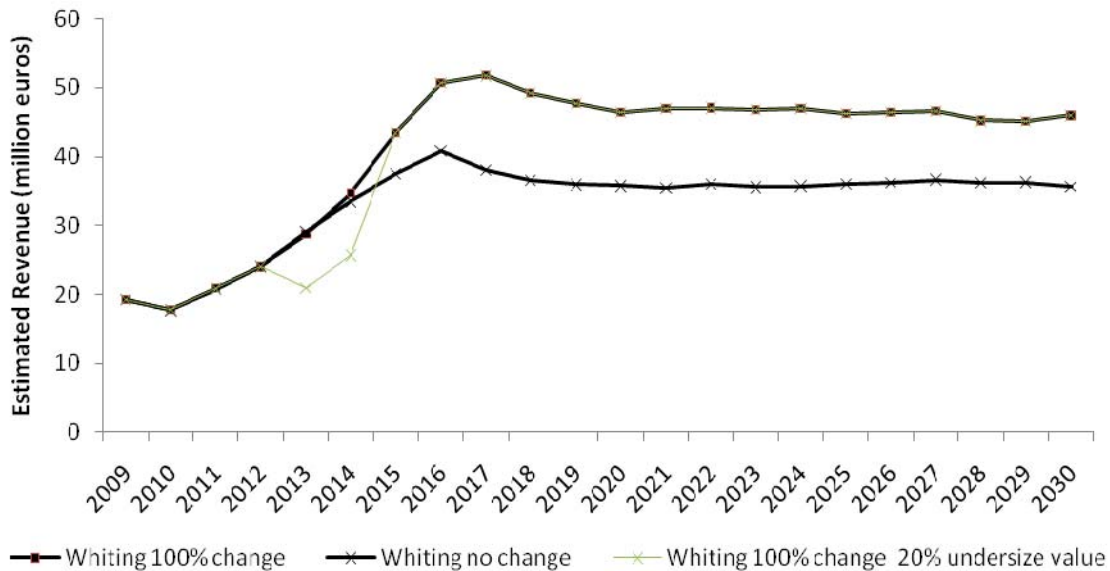
**Figure 22 Expected revenues for haddock quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo**



**Figure 23 Expected revenues for cod quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo. Additional curves are modelled to consider different model outputs possible for cod stock modelling (BADAPT and SAM).**



**Figure 24 Expected revenues for plaice quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo.**



**Figure 25. Expected revenues for whiting quota 2009 – 2030; 2012-2014 selectivity of small fish has not changed from status quo.**

Based on the findings from Figure 22, Figure 23 and Figure 24, EIAA modelling assumed the following changes to revenue for the 2 options (see the beginning of the section):

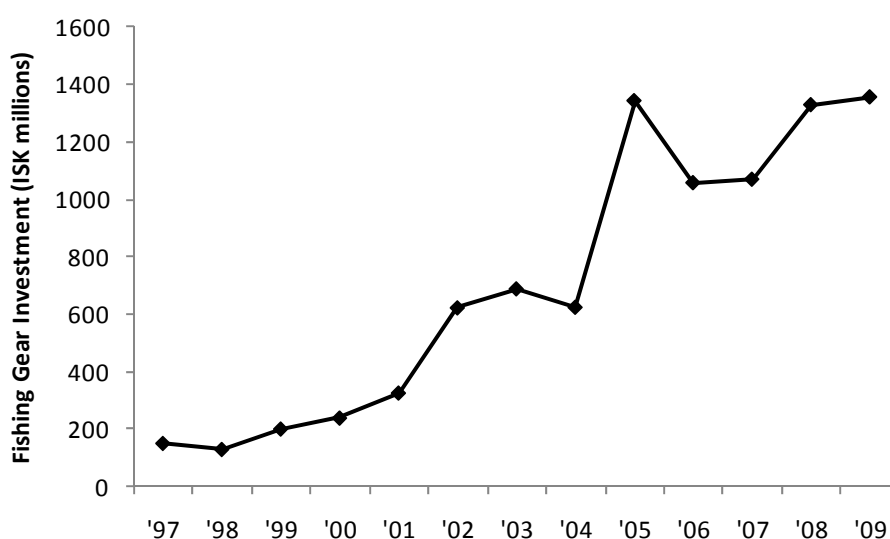
- i. No minimum marketable price:
  - a. 2012: 5% decrease in revenue compared to no change scenario
  - b. 2017: 10% increase in revenue compared to no change scenario
  - c. 2022: 20% increase in revenue compared to no change scenario
- ii. Minimum marketable size and 80% reduction value of small fish
  - a. 2012: 10% decrease in revenue compare to no change scenario
  - b. 2017: 10% increase in revenue compared to no change scenario
  - c. 2022: 20% increase in revenue compared to no change scenario

These changes in revenue are the base case for fleets which experience high levels of discarding. It is expected only to impact fleets proportionally to how each has been categorised through a literature review on studies of the level of discards in different fisheries. The proportion of changes in revenue based on 100% compliance with the discard reduction policy, for the different discard levels, were applied on the basis that the additional catch would reflect the existing discard rates. Note that this may seem a perverse result – effectively those fleets with high discard rates are more “rewarded”. But this may be required to provide incentives to these fleets. The above percentages were applied as follows:

1. High (40%) = 100% of percentage change
2. Medium (25%) = 62.5% of percentages change
3. Low (10%) = 25% of percentage change

#### 4.5.2 Changes to Investment

The changes in fishing behaviour, and the reduction of landing small fish, is largely expected to occur through gear modifications. This can be seen through the experiences of the Icelandic fleet with increases year on year of fishing gear investment coinciding with the introduction of the discard ban (see Figure 26 and Figure 1 for comparison of timing). Therefore in addition to the anticipated changes to revenue we also anticipate changes to vessel costs. These changes in gear cost are implemented in the EIAA model through the parameter “invested capital” once only at year 2017, to reflect the time lag in change of selectivity.



**Figure 26 Icelandic investment in fishing gear for vessels >200GT nominal values 1997 – 2009 (STATICE, 2011)**

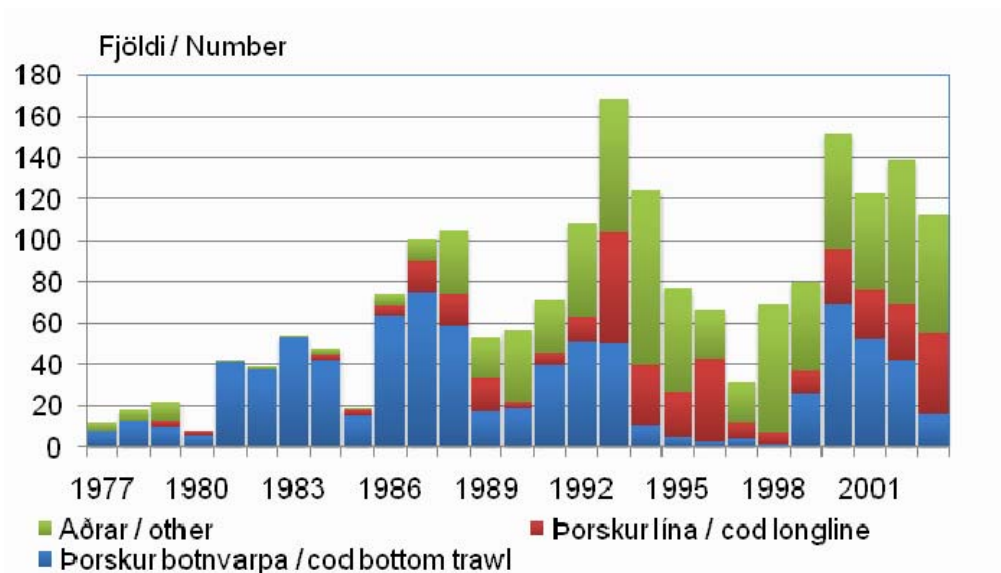
Research was conducted on the cost of replacing trawl gear in the Scottish whitefish and SW English flatfish fishery. It is understood that the price will vary from country and country but this serves as indication of the scale of cost for gear replacements. The costs considered as investment in the EIAA models are presented in Table 11.

**Table 11 Estimated cost of gear investment to DTS and TBB segments**

Vessel Length	Cost (€)
00-12	5,150

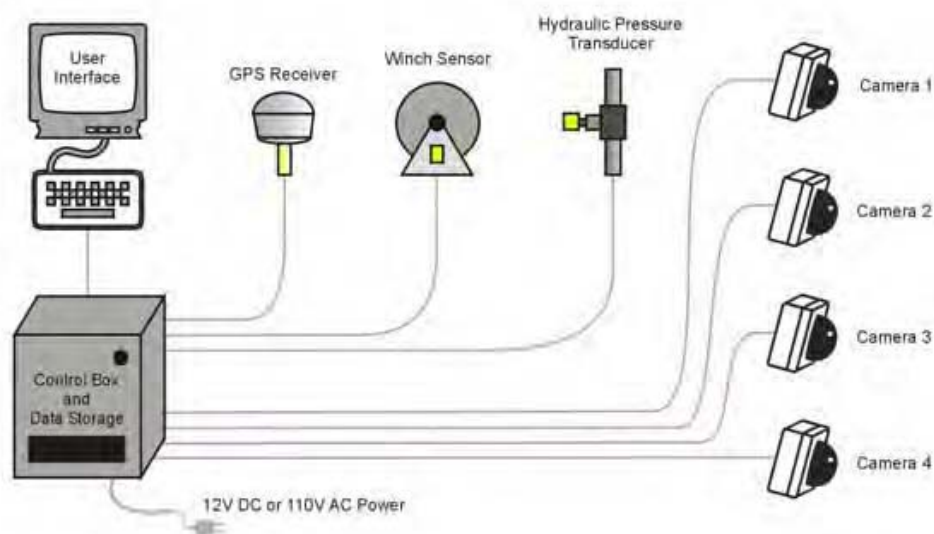
12-24	11,400
24-40	21,740
40+	31,460

Despite generally indicating a medium level of discarding (see Table 4) in the hook and line fisheries, it is not assumed that any gear will be replaced. This is based on the experience of the Icelandic and Mediterranean fisheries. In Iceland, more RTCs were implemented due to longline fisheries as opposed to trawls and these do not seem to be decreasing (see Figure 27). There is evidence of high investment in new gears in Iceland, which accounts for the reduction of RTCs due to trawl fisheries (K. Helgasson, pers. comm., 2011). This suggests that there may not be a suitable gear-based solution currently available in the longline fishery to increase selectivity of juvenile whitefish. The change in selectivity of the catch is therefore assumed to result from instruments such as RTCs. This is also the case in the swordfish fishery in the Mediterranean where 50% of catch is discarded due to undersize fish.



**Figure 27 Number of real-time closures in Icelandic fisheries (source: Ministry of Fisheries, Iceland)**

As a method of enhancing compliance in the fishery, with respect to a discard reduction policy, it is also anticipated that a series of remote electronic monitoring (REM) systems will be implemented (see Figure 1). These systems will also enhance the ability to collect data (see section 5.1.6). Research was conducted on the Scottish and Danish trial catch quota management which have already employed the use of and REM system. The estimated cost of installation and hardware was € 11,500. It is suggested that perhaps with a widespread installation this cost may reduce, but at this point in time the previously quoted figure is the best available estimate. For the purpose of this analysis, the model assumed that the cost of installation is met by industry under the investment line and will be implemented in 2012 with the commencement of the new policy. This will be applied to all EU vessels >12m.



**Figure 28 Schematic diagram of the electronic monitoring system, which can record video data from up to four cameras per vessel.**

## 4.6 EIAA methodology

With the exception of the above changes to revenue and investments, the methodology for EIAA modelling for option 1 and 1a was identical to the CFPIA. Please refer to this document for further information.

## 5 Impact Assessment

### 5.1 Discard reduction policy implemented to Policy Option 1

#### 5.1.1 Environmental Indicators

##### *Indicator 1 Stocks managed with a fishing mortality related to MSY*

The discard reduction policy does not stipulate any management changes to the level of stocks which are to be managed at  $F_{MSY}$ . There are to be no expected changes to this indicator as a result of the discard reduction policy.

##### *Indicator 3 Average size (weight) of fish*

Under the discard reduction policy, the modelling suggests that the average size of fish in the **stock** will decrease. With the removal of catching and discarding currently below minimum size fish, a higher proportion of smaller fish will now be present in the stock (see FLR Annex and Figure 9 and Figure 10 for comparison). The effect on the stock will be positive, however because the stock size is larger. Thus the reduction in size in the stock is not indicative of a decline in stock health.

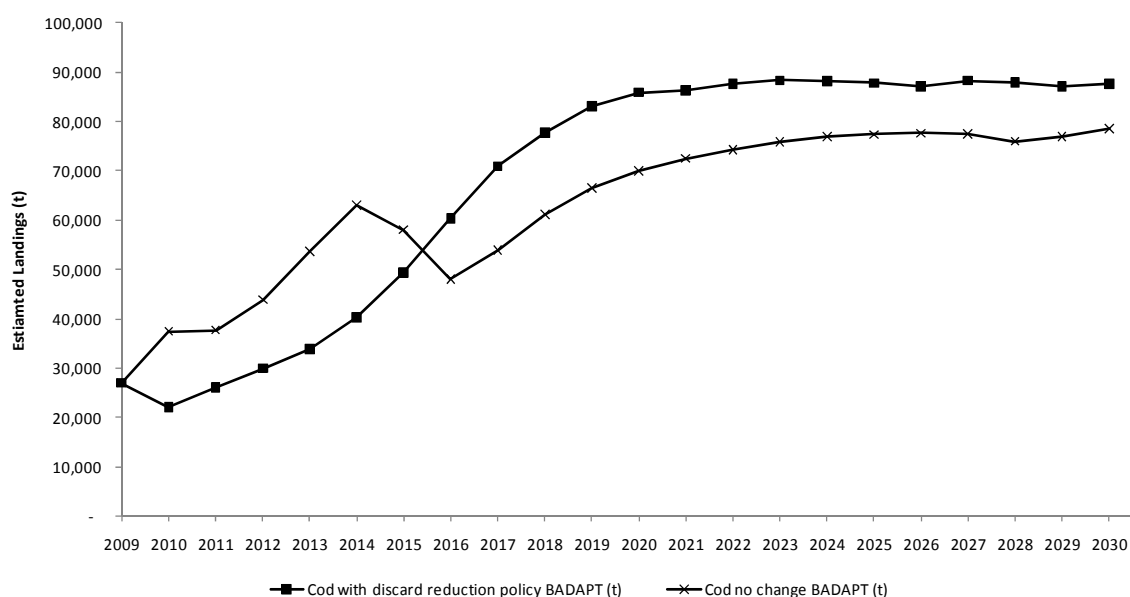
Because of the requirement to land all fish, the average size in the catch should decline. Even after 2015, there are still some residual incidental landings of smaller fish resulting also from the current reported landings size distribution. Therefore the proportion of larger sized fish landed under the discard reduction policy option is often lower than in option 1 (see Table 12). The actual volume of allowable catch, however, is larger (see Figure 29, Figure 30, Figure 31 and Figure 32).

The proportion of large fish in the catch, rather than in landings, will increase, however, because of the changes in selectivity assumed to take place from 2015.

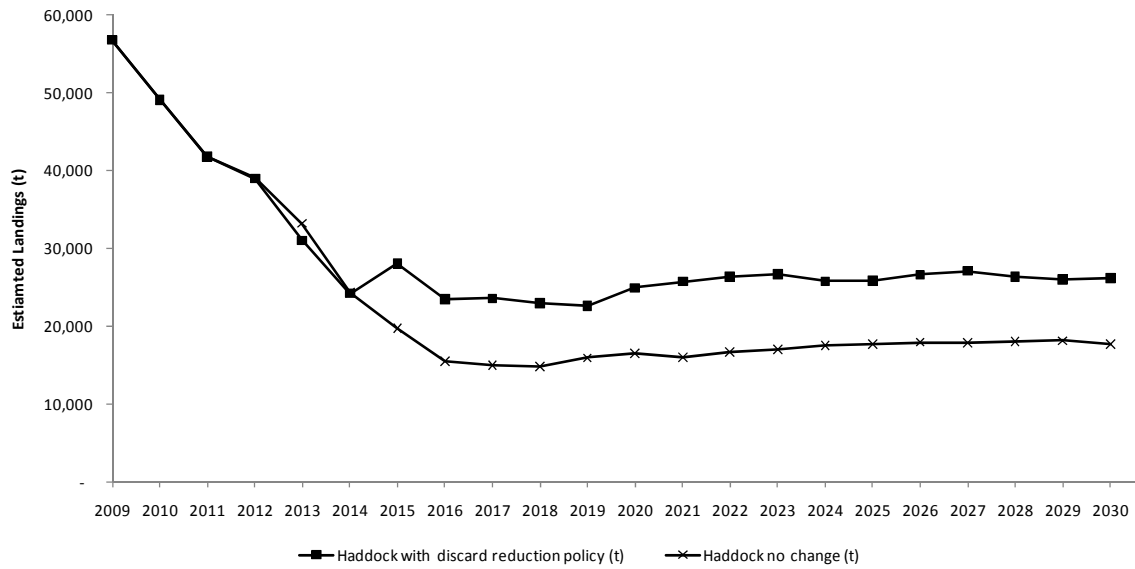
This is consistent with the Norwegian case as personally communicated information suggested that they were experiencing larger volumes of smaller average sized landings under the discard ban as opposed to the smaller volume of larger sized fish experienced prior to the ban. It also suggests that greater gear selectivity and more informed choices of fishing areas will be required to reduce the number of interactions with smaller-sized fish to achieve the results of catch selectivity experienced in the case studies considered.

**Table 12 Comparison of the proportion of large sized fish (top two age brackets) landed under the discard reduction policy and the no change Option 1 policy.**

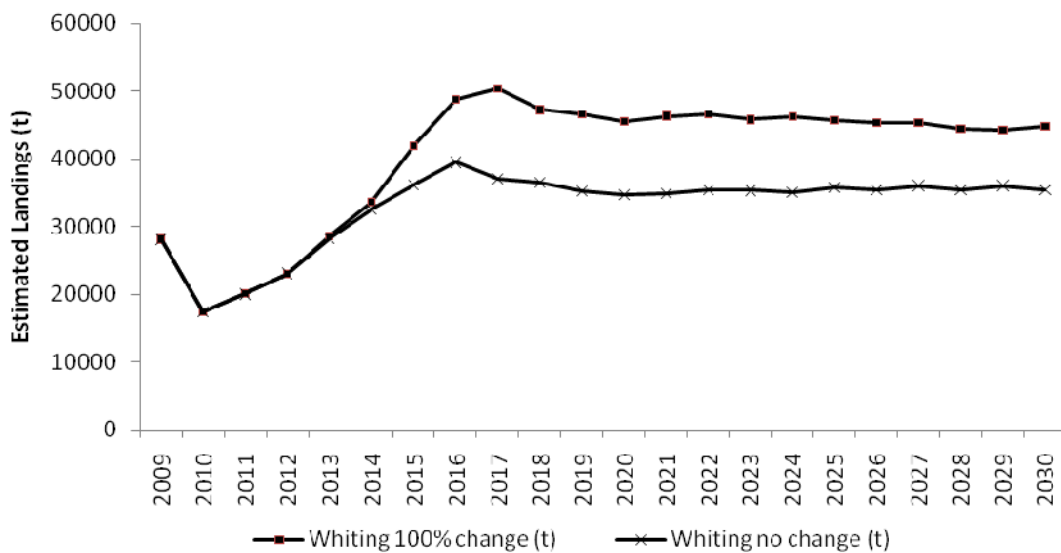
Species	Discard reduction policy			Option 1 (no change)		
	2012	2017	2022	2012	2017	2022
Cod	0.27	0.59	0.67	0.25	0.46	0.56
Haddock	0.28	0.31	0.33	0.28	0.34	0.42
Whiting	0.05	0.10	0.06	0.05	0.10	0.06
Plaice	0.10	0.17	0.22	0.10	0.19	0.26



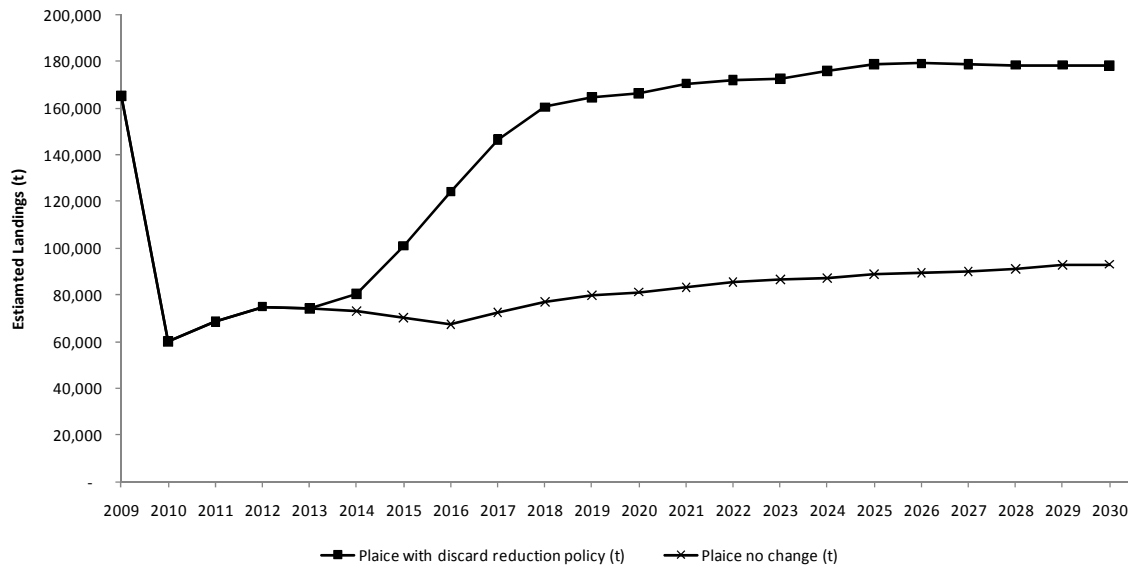
**Figure 29 Estimated changes in landings for North Sea cod 2009-2030 with the discard reduction policy in comparison to those estimated under option 1. This figure uses the BADAPT catch multiplier.**



**Figure 30** Estimated changes in landings for North Sea haddock 2009-2030 with the discard reduction policy in comparison to those estimated under option 1.



**Figure 31** Estimated changes in landings for North Sea whiting 2009-2030 with the discard reduction policy in comparison to those estimated under option 1.



**Figure 32 Estimated changes in landings for North Sea plaice 2009-2030 with the discard reduction policy in comparison to those estimated under option 1.**

Through this impact assessment we have assumed that option 1(i) and option 1(ii) behave the same in terms of their impact on the selectivity of the catch. There are two differing arguments which could be used to compare option 1(i) and (ii). In the first place, the lower value attached to the landed portion of the catch in option 1(ii) might arguably increase the move to a higher selectivity, thus having a more positive impact on stock health. On the other hand, again because of the lower value attached to the landed portion of the catch in option 1(ii), one might expect that compliance with the no discard requirement is lower and that therefore selectivity is unchanged. It was not possible to distinguish between these two potential outcomes and therefore, our assumption is that option 1 (i) and (ii) as modelled, produce identical outcomes in terms of stock health.

**Indicator 4 Fleet Impact**

Changes in fleet reduction are only expected under the reduced value of landings of undersized fish scenario, option 1ii. This is discussed in further detail in section 5.1.5. No further change is modelled to fleet evolution as a result of the discard reduction policy.

It is worth considering the level to which different fleets are expected to be impacted by the introduction of the discard reduction policy.

Table 13 categorises the EU fleet by discard level and indicates the percentage of fleets by gear type and MS against the total EU fleet in terms of GT. It indicates that the single most largely represented EU fleet, the Spanish DTS fleet, is likely to be the highest impacted fleet segment as a result of the discard reduction policy. This may also serve as a useful management tool when allocating effort to monitor compliance with the proposed policy.

**Table 13 Proportion of MS fleet impact compared to total EU in terms of GT presented as level of impact expected from discard reduction policies (High = red, Medium = amber, low = yellow, green = no information).**

MS	DFN	DRB	DTS	FPO	HOK	PGP	PMP	PTS	TBB
BEL	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%
CYP	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
DEU	0.1%	0.1%	1.1%	0.0%	0.0%	0.0%	0.0%	1.3%	0.6%
DNK	0.0%	0.1%	0.7%	0.0%	0.0%	0.1%	0.2%	2.8%	0.1%
ESP	0.0%	0.0%	12.8%	0.0%	4.9%	0.0%	0.0%	6.5%	0.0%
FIN	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%
FRA	6.8%	0.7%	9.0%	0.8%	2.4%	0.6%	1.0%	3.4%	0.2%
GRC	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.4%	1.1%
IRE	0.1%	0.1%	1.1%	0.1%	0.0%	0.0%	0.3%	2.0%	0.2%
ITA	0.0%	0.5%	6.3%	0.0%	0.4%	0.3%	0.0%	1.8%	0.3%
LTU	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%
LVA	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MAD	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
MAL	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%	0.0%	0.2%	0.0%
NLD	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	3.6%	2.6%
POL	0.1%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.7%	0.0%
PRT	0.2%	0.0%	2.1%	0.0%	0.8%	0.5%	0.1%	0.2%	0.0%
SWE	0.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%
GBR	0.2%	0.4%	4.7%	0.3%	0.3%	0.0%	0.0%	3.1%	0.7%

Table 14 provides the same level of impact but looks at a proportion of the fleet segments by the summed GT total its MS. That is, 53% of the Spanish fleet, in GT terms is considered to be DTS and is in the “high” category. This analysis provides a good indication of how certain MS’ fleets may be impacted by the introduction of the discard reduction policy. Finland, for example, are expected to have a low impact as a result of the policy given that 95% of their fleet is in the “low” category and under the EIAA assumptions, should expect a significant difference to their fishing income.

**Table 14 Proportion of MS fleet impact compared to total MS in terms of GT presented as level of impact expected from discard reduction policies (High = red, Medium = amber, low = yellow, green = no information).**

MS	DFN	DRB	DTS	FPO	HOK	PGP	PMP	PTS	TBB
BEL	1.4%	0.4%	6.0%	0.0%	0.0%	0.0%	0.0%	0.0%	92.3%
CYP	0.0%	0.0%	78.7%	0.0%	0.0%	19.0%	0.0%	2.3%	0.0%
DEU	2.5%	3.1%	35.0%	0.4%	0.0%	0.0%	0.0%	40.2%	18.8%
DNK	0.0%	1.4%	18.1%	0.0%	0.0%	1.9%	5.0%	71.5%	2.1%
ESP	0.0%	0.0%	53.0%	0.0%	20.3%	0.0%	0.0%	26.7%	0.0%
FIN	5.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	94.6%	0.0%
FRA	27.2%	2.9%	35.9%	3.2%	9.4%	2.6%	4.1%	13.7%	1.0%
GRC	0.0%	0.0%	0.0%	0.0%	10.6%	0.0%	1.5%	24.0%	63.9%
IRE	1.6%	1.6%	29.0%	2.1%	0.8%	0.1%	7.9%	52.2%	4.8%
ITA	0.0%	5.3%	65.4%	0.0%	3.9%	3.4%	0.5%	18.5%	3.0%
LTU	0.6%	0.0%	10.2%	0.0%	0.2%	0.0%	0.3%	88.7%	0.0%
LVA	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
MAD	0.0%	0.0%	0.0%	0.0%	90.3%	0.0%	0.0%	9.7%	0.0%
MAL	0.3%	0.0%	24.1%	0.0%	15.3%	4.6%	1.5%	54.3%	0.0%
NLD	0.3%	0.0%	5.8%	0.0%	0.0%	0.2%	0.0%	54.2%	39.5%
POL	9.6%	0.0%	42.9%	0.0%	0.0%	0.0%	0.0%	47.5%	0.0%
PRT	5.1%	0.4%	52.0%	0.0%	21.1%	12.2%	3.4%	5.9%	0.0%
SWE	3.3%	0.0%	45.0%	0.0%	0.8%	0.0%	0.0%	50.9%	0.0%
GBR	2.2%	4.6%	47.6%	3.1%	2.9%	0.1%	0.0%	31.9%	7.6%

### 5.1.2 Economic Indicators: fishing operators receiving total value of landings (i)

This section explores the impact of sub-option i (fishers receiving the full value of landings – including undersized fish) on Option 1 from the main impact assessment report. The impacts have been forecast using the EIAA model, which incorporates data on 15 EU Member States.

Table 15 presents the summary results for the economic indicators 7-10 which are GVA, Revenue/Break-even revenue, net profit margin and return on investment.

Compared to Option 1 without the discard reduction policy, introducing a discard reduction policy initially reduces all economic indicators (at 2012). This is a result of vessels having to land all fish including small and undersized fish against quota. As these small size classes of fish are assumed (with one or two exceptions) to achieve lower prices, the maximum possible returns on quota holdings are not achieved.

From year 2017 onwards, however, the economic indicators are more positive under a discard reduction policy than without this policy. Net profit margin for Option 1 averages 16% under the discard reduction policy compared to 15% without it. This is due to a number of factors expected by 2017:

- The catch profile will have moved towards the landing of larger size classes as market forces (smaller fish achieving lower prices) drive selectivity improvements & fishing patterns to avoid catching smaller fish;
- Stocks are predicted to have recovered to or close to  $B_{MSY}$  levels and therefore in many instances overall quota levels can increase but still catches under a discard

reduction policy are higher than without because all previously discarded large fish can be sold;

- Impacts on indicators such as Return on Investment resulting from the inclusion of capital costs from investment in more highly selective gear and Remote Electronic Monitoring (REM) are no longer felt.

By 2022 the net profit margin sits at 20% under a discard reduction policy compared to 18.3% for Option 1 without a discard reduction policy. The estimated GVA of €4,197m with a discard reduction policy is nearly 15% more than that forecast under Option 1.

For detailed comparisons to option 1, please see the CFPIA or section 6 for a summary comparison.

**Table 15 Results from EIAA model by MS for Option 1, sub-option i (retain value of all landings)**

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
BEL	80	14	0.93	-13%	-16%	91	48	0.94	-10%	-19%	111	74	0.95	-8%	-22%
DEU	133	94	1.48	27%	128%	183	154	1.71	39%	322%	219	194	1.78	42%	567%
DNK	288	168	1.30	3%	2%	380	272	1.41	15%	13%	413	311	1.45	19%	20%
EST	25	6	1.19	10%	13%	33	16	1.49	29%	58%	35	19	1.60	34%	75%
ESP	1366	409	1.02	-2%	-1%	1581	833	1.11	7%	4%	1896	1224	1.14	10%	8%
FIN	14	2	0.92	-43%	-47%	16	7	1.06	-18%	-27%	17	8	1.12	-11%	-18%
FRA	927	451	1.18	5%	5%	1114	700	1.29	15%	19%	1211	825	1.34	19%	28%
GBR	646	268	1.21	9%	4%	829	531	1.42	25%	16%	954	677	1.50	30%	27%
IRL	209	107	1.30	15%	11%	258	171	1.49	28%	30%	278	196	1.55	31%	41%
LTU	4	3	1.21	14%	24%	7	6	1.40	27%	89%	7	6	1.45	30%	158%
LVA	12	5	1.34	23%	52%	16	9	1.86	45%	184%	16	10	2.04	50%	238%
NLD	324	110	1.14	-2%	-3%	425	253	1.37	17%	35%	501	345	1.48	25%	69%
POL	30	16	1.40	21%	9%	42	29	1.62	34%	26%	45	33	1.68	37%	35%
PRT	244	134	1.35	17%	12%	301	201	1.30	17%	16%	321	228	1.30	17%	20%
SWE	58	24	1.42	19%	9%	76	43	1.74	37%	32%	78	48	1.82	40%	40%
<b>TOTAL</b>	<b>4360</b>	<b>1811</b>	<b>1.15</b>	<b>4%</b>	<b>3%</b>	<b>5351</b>	<b>3272</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>6102</b>	<b>4197</b>	<b>1.32</b>	<b>20%</b>	<b>21%</b>
	Increase over 2012					23%	81%	12%	11%	11%	40%	132%	15%	15%	19%
Option 1	<b>4469</b>	<b>1920</b>	<b>1.15</b>	<b>5.3%</b>	<b>3.1%</b>	5108	3029	1.27	15%	12%	5561.24	3657	1.31	18%	18%
Difference to Option 1	<b>-108</b>	<b>-108</b>	<b>0</b>	<b>-1.6pp</b>	<b>-0.1pp</b>	<b>243</b>	<b>243</b>	<b>0.01</b>	<b>0.9pp</b>	<b>1.2pp</b>	<b>540</b>	<b>540</b>	<b>0.01pp</b>	<b>1.5pp</b>	<b>3.3pp</b>

Table 16 presents the results from the EIAA model by fleet size. This shows that in 2012 all size bands of vessels show poorer economic performance in 2012 under sub-option i compared to Option 1 alone, but this improves by 2017 and outstrips performance forecast under Option 1 without a discard reduction policy. While all size segments are better performing with the discard reduction policy, the comparative improvement in performance is 7% greater in the 0-12m segment and over 10% in all other segments. This is to be expected with vessels >12m having a greater reliance on quota species that would be affected by the discard reduction policy.

Table 17 presents fleet size performance against assumed targets for profitability (5%), return on investment (15%) and revenue to break even ratio >1. Despite the slightly poorer economic performance under the discard reduction policy in 2012 there is no difference in the percentage of fleets achieving these targets compared to the absence of a discard reduction policy. By 2017 the comparative number of fleets achieving those targets have improved, with 6-7% more fleets achieving the targets (88% overall) under a discard reduction policy, compared to the Option 1 without a discard reduction policy (84% overall). By 2022 all SSF and 40+m vessels achieve the targets with nearly all (93%) of 12-24m segments also achieving the economic targets. The proportion of 24-40m segments achieving the targets improves to 69% under the discard reduction policy compared to 63% without it.

**Table 16 Results from EIAA model by fleet size for Option 1, sub-option i**

	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
SSF	727	440	1.39	18%	12%	856	604	1.55	29%	26%	918	681	1.60	31%	32%
1224*	1162	490	1.09	1%	1%	1477	934	1.21	13%	14%	1682	1186	1.26	17%	25%
2440	1213	344	1.02	-5%	-3%	1461	818	1.11	6%	5%	1789	1218	1.15	10%	12%
40XX	1259	537	1.24	9%	4%	1557	916	1.42	22%	14%	1713	1112	1.50	27%	21%
<b>TOTAL</b>	<b>4360</b>	<b>1811</b>	<b>1.15</b>	<b>4%</b>	<b>3%</b>	<b>5351</b>	<b>3272</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>6102</b>	<b>4197</b>	<b>1.32</b>	<b>20%</b>	<b>21%</b>
	Increase over 2012					23%	81%	12%	11%	11%	40%	132%	15%	15%	19%
Option 1	<b>4469</b>	<b>1920</b>	<b>1.15</b>	<b>5%</b>	<b>3%</b>	<b>5108</b>	<b>3029</b>	<b>1.27</b>	<b>15%</b>	<b>12%</b>	<b>5561</b>	<b>3657</b>	<b>1.31</b>	<b>18%</b>	<b>18%</b>
difference	-108	-108	0	-0.8pp	-0.6pp	243	243	0.01	0.9pp	1.2pp	540	540	0.01	1.5pp	3.3pp

**Table 17 Summary of number of fleet segments meeting the targets for economic indicators under Option 1, sub-option i**

	2012			2017			2022		
	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1
	SSF	60%	33%	93%	80%	73%	100%	93%	80%
1224*	33%	7%	87%	87%	67%	93%	93%	80%	93%
2440	38%	31%	56%	56%	50%	63%	56%	56%	75%
40XX	64%	18%	100%	100%	55%	100%	100%	73%	100%
<b>TOTAL</b>	<b>47%</b>	<b>23%</b>	<b>82%</b>	<b>79%</b>	<b>61%</b>	<b>88%</b>	<b>84%</b>	<b>72%</b>	<b>91%</b>
	Increase over 2012			32%	39%	5%	37%	49%	9%
Option 1	47%	28%	82%	77%	53%	88%	82%	70%	89%
Difference	0pp	-5pp	0pp	2pp	9pp	0pp	2pp	2pp	2pp

The impact on GVA differs between Member States depending on the proportion of a MS fleet assessed as experiencing a high, medium or low impact from the discard reduction policy (see Table 13 and Table 14). For example, the average impact across the EU is a 5% reduction in GVA in 2012 with a discard reduction policy compared to without it (see Table 15). For MS such as Poland the reduction in GVA in 2012 is as much as 15% and 14% for Belgium, while there is a negligible reduction for Finland as all its key fleet segments are expected to have relatively low impacts from a discard reduction policy.

By 2017, the improved performance that is seen across all MS again differs depending on the composition of MS fleets and the estimated scale of impact a discard reduction policy will have on each fleet segment. There is an EU average of a 44% improvement in GVA with the discard reduction policy; for Finland GVA more than doubles, while for Germany, France and Denmark there are still improvements but they are less dramatic at 32%, 34% and 35% respectively.

Table 18 shows that by 2022 the forecast performance of all economic indicators has improved with the implementation of the discard reduction policy compared with Option 1 without a discard reduction policy. At a Member State level profit margins improve by 1 or 2 percentage points for most Member States, but the improved performance is not sufficient to move the loss-making sectors of Belgium and Finland into profit, but losses are reduced. As Table 17 illustrates on a fleet size basis, performances improve so that more fleets do achieve the indicator targets.

The estimated impacts of a discard reduction policy on indicator 11 (fish prices) are limited as it is assumed that larger fish attract higher prices and therefore there is a market incentive to avoid catching small fish. Consequently new markets for small fish do not develop and the assumed price differentials by size grade presented in section 4.2 remain in place. There may be some impact on the local market prices for bait initially if undersized fish can be sold for human consumption, but more is landed rather than discarded, which would offset price increases for dependent segments such as long liners (HOK). This is therefore not expected to result in significant changes in the economic performance of these sectors as bait costs tend to represent a small fraction of total costs (e.g. bait costs represent 5% of total costs in the Gran Sol long line fishery).

Conversely it is the impact of price differentials associated with different size grades that drives the changes in fishing operations. This is evidenced in the Icelandic and Norwegian examples with improved gear selectivity even where 'undersized fish' can be sold into human consumption markets. The Scottish case study also shows that in addition to improved gear selectivity, vessels under a discard reduction policy are more likely to move grounds to avoid juvenile fish.

**Table 18 Results from EIAA modelling comparing forecast for 2022 for Option 1 no discard reduction policy with sub-option i (discard reduction policy)**

2022	Option 1					sub option i				
	Income (mln)	GVA (mln)	Revenue/ Break Even	Profit	ROI	Income (mln)	GVA (mln)	Revenue/ Break Even	Profit	ROI
Indicator		7	8	9	10		7	8	9	10
BEL	97	60	0.95	-8%	-20%	111	74	0.95	-8%	-22%
DEU	190	166	1.75	41%	482%	219	194	1.78	42%	567%
DNK	387	284	1.44	18%	17%	413	311	1.45	19%	20%
EST	31	15	1.49	29%	57%	35	19	1.60	34%	75%
ESP	1722	1050	1.13	9%	6%	1896	1224	1.14	10%	8%
FIN	16	7	1.10	-13%	-21%	17	8	1.12	-11%	-18%
FRA	1113	726	1.31	17%	23%	1211	825	1.34	19%	28%
GBR	876	599	1.48	28%	24%	954	677	1.50	30%	27%
IRL	259	176	1.53	30%	37%	278	196	1.55	31%	41%
LTU	7	6	1.43	29%	135%	7	6	1.45	30%	158%
LVA	16	9	1.95	48%	217%	16	10	2.04	50%	238%
NLD	438	283	1.43	22%	52%	501	345	1.48	25%	69%
POL	42	30	1.66	36%	32%	45	33	1.68	37%	35%
PRT	294	201	1.32	18%	19%	321	228	1.30	17%	20%
SWE	75	44	1.78	38%	36%	78	48	1.82	40%	40%
TOTAL	5561	3657	1.31	18%	18%	6102	4197	1.32	20%	21%
Increase over 2012	24%	90%	13%	13%	15%	40%	132%	15%	15%	19%

### ***Mediterranean economic indicators option 1i***

Table 19, Table 20, Table 21 and Table 22 present the modelled results for the Sicilian fleet under option 1i. As this fleet is expected to react to a discard reduction policy in much the same way as fleets outside the Mediterranean, the same trends can generally be seen as the for fleets outside of the Mediterranean.

It can be seen that for some fleet segments, the introduction of a discard reduction policy could reverse some decreasing trends. For example, in Table 19, purse seiners and small scale coastal fisheries are expected to see a GVA decrease for 2022 values compared to 2017 under option 1. However, under option 1i, these fleets experience constant increases in GVA. More notably is the positive increase in GVA for the demersal trawl sector. Under option 1, this sector experienced percentage decreases in 2017 and 2022 on the 2012 figure, whereas it has reached a 1% increase in 2017 and 12% in 2022.

Return on investment has experienced the largest impact. This indicator showed decreases from 30.4% in 2012 under option 1 to 26.2% under option 1i. There was an increase noted in 2017 but a much larger increase in 2022. Return on investment increased 59.6% under option 1 78.6% under options 1ii. This is driven by the large levels of investment required for large scale fleets in 2012 for the cameras and the gear cost increases for 2017 for high-medium impacted fleets. By 2022, larger increases in revenue and no assumed increase in investment have created this notable change.

**Table 19 Projections of gross value added (mln €) by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	47.25	45.45	46.13	51.07	1%	12%
Purse seiners	16.85	12.18	19.57	20.14	61%	65%
Small scale fishery	31.60	32.00	58.09	59.98	82%	87%
Polyvalent	0.53	0.16	0.38	0.75	140%	370%
Polyvalent passive	8.83	6.50	10.82	12.20	67%	88%
Longlines	21.62	14.70	23.52	26.32	60%	79%
<b>Total</b>	<b>126.68</b>	<b>111.00</b>	<b>158.51</b>	<b>170.46</b>	<b>43%</b>	<b>54%</b>
<b>Option 1</b>	<b>126.68</b>	<b>117.57</b>	<b>145.50</b>	<b>144.54</b>	<b>24%</b>	<b>23%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-6.57</b>	<b>13.19</b>	<b>25.92</b>		

**Table 20 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	1.18	1.11	1.38	1.48	24%	33%
Purse seiners	1.54	1.36	1.57	1.63	15%	20%
Small scale fishery	1.47	1.40	1.68	1.79	19%	28%
Polyvalent	1.17	0.92	1.04	1.36	13%	49%
Polyvalent passive	1.64	1.41	1.75	1.95	24%	38%
Longlines	1.65	1.42	1.69	1.84	19%	30%
<b>Total</b>	<b>1.33</b>	<b>1.24</b>	<b>1.56</b>	<b>1.67</b>	<b>26%</b>	<b>35%</b>
<b>Option 1</b>	<b>1.33</b>	<b>1.28</b>	<b>1.47</b>	<b>1.48</b>	<b>15%</b>	<b>16%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-0.02</b>	<b>0.03</b>	<b>0.06</b>		

**Table 21 Projections of net profit margin by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var</b>	<b>2022 var</b>
Demersal trawlers	-12.6%	-0.6%	18.9%	25.7%	19.5%	26.3%
Purse seiners	8.2%	2.8%	20.3%	24.2%	17.5%	21.4%
Small scale fishery	13.8%	28.6%	43.1%	47.0%	14.5%	18.4%
Polyvalent	-5.2%	-15.3%	0.5%	25.1%	15.8%	40.4%
Polyvalent passive	14.1%	13.7%	33.9%	41.5%	20.2%	27.7%
Longlines	21.1%	15.9%	32.8%	39.2%	16.8%	23.3%
<b>Total</b>	<b>0.7%</b>	<b>7.5%</b>	<b>29.2%</b>	<b>34.6%</b>	<b>21.7%</b>	<b>27.1%</b>
<b>Option 1</b>	<b>0.7%</b>	<b>10.4%</b>	<b>24.8%</b>	<b>26.4%</b>	<b>14.4%</b>	<b>16.0%</b>
<b>Difference to option 1</b>	<b>0.0pp</b>	<b>-2.3pp</b>	<b>1.5pp</b>	<b>3.8pp</b>		

**Table 22 Projections of return on investment by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var</b>	<b>2022 var</b>
Demersal trawlers	14.7%	14.7%	29.9%	41.9%	15.2%	27.3%
Purse seiners	31.6%	20.0%	45.3%	53.5%	25.3%	33.5%
Small scale fishery	54.1%	54.7%	117.6%	139.9%	62.9%	85.3%
Polyvalent	20.4%	3.4%	13.9%	44.0%	10.6%	40.7%
Polyvalent passive	43.6%	30.6%	63.9%	84.7%	33.3%	54.1%
Longlines	62.9%	41.9%	78.8%	101.4%	36.9%	59.5%
<b>Total</b>	<b>28.2%</b>	<b>26.2%</b>	<b>60.2%</b>	<b>78.6%</b>	<b>34.0%</b>	<b>52.4%</b>
<b>Option 1</b>	<b>28.2%</b>	<b>30.4%</b>	<b>54.2%</b>	<b>59.6%</b>	<b>23.8%</b>	<b>29.2%</b>
<b>Difference to option 1i</b>	<b>0.0pp</b>	<b>-2.9pp</b>	<b>2.8pp</b>	<b>11.4pp</b>		

### 5.1.3 Economic Indicators: fishing operators receiving 20% value of undersize landings (ii)

This section presents the EIAA model outputs for sub-option ii, which assumes only 20% of the value of undersized fish landed is returned to the fishing operation. This is seen as providing an additional incentive to reduce catching undersized fish.

Table 23 presents the results for the economic indicators 7 to 10 on GVA, revenue/break even, profit and return on investment. As would be expected, in 2012 the impact of the discard reduction policy with 20% return on value of undersized is more marked than where the full value of undersized fish is returned to the fleet. The additional reduction in income through sub-option ii is not, however, sufficient to significantly alter the overall economic performance of the fleets, compared to option 1.

One Member State difference of note is the comparatively larger impacts experienced by the Netherlands fleet in 2012 as much less income would be received for the small plaice taken in the sole fishery (a 12% difference between the two sub-options). For the Netherlands catching sector, which is estimated to be just above break-even levels in 2012 under Option 1, this results in the sector seeing a 4% net loss with sub-option ii compared to a 2% net loss with sub-option i. All other MS see a smaller GVA (around 6% less) with sub-option ii compared with sub-option i, but this does not move MS sectors into negative profit margins.

For sub-option ii, economic performance across all indicators has improved by 2017 and exceeds those estimated for Option 1 as in option 1(i).

It is expected that the reduced revenue from receiving only 20% of the value of undersized fish would create a strong incentive to change fishing operations through improved gear

selectivity and altered fishing areas. This change may occur more quickly under sub-option ii due to this stronger incentive, but by 2017 under both sub-options the fleets are expected to have made the necessary changes to avoid catching smaller fish. Results for sub-option ii are therefore the same as for sub-option I from 2017 onwards with both showing improved performance over Option 1 alone.

Overall the impact of sub-option ii only differs to sub-option i in terms of the further reduction in 2012 revenue levels. The price differential between size grades is assumed to be sufficiently large to drive industry change. By 2017 changes will therefore have been implemented, irrespective of whether operators receive 20% or 100% of the value of undersized. Additionally by 2017 a recovery in most stocks is expected to result in catch profiles that will include more of the larger size grades. The proportion of revenue from undersized will therefore have reduced to a point where differences in returns from this portion of the catch do not significantly impact upon economic performance.

**Table 23 Results from EIAA model by MS for Option 1, sub-option ii (20% of value of undersized landings)**

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	ROI	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	ROI	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	ROI
	7	8	9	10	7	8	9	10	7	8	9	10			
BEL	77	11	0.93	-13%	-16%	91	48	0.94	-10%	-19%	111	74	0.95	-8%	-22%
DEU	127	89	1.46	26%	119%	183	154	1.71	39%	322%	219	194	1.78	42%	567%
DNK	283	163	1.29	2%	1%	380	272	1.41	15%	13%	413	311	1.45	19%	20%
EST	24	6	1.17	8%	10%	33	16	1.49	29%	58%	35	19	1.60	34%	75%
ESP	1330	374	1.01	-3%	-1%	1581	833	1.11	7%	4%	1896	1224	1.14	10%	8%
FIN	14	2	0.92	-44%	-48%	16	7	1.06	-18%	-27%	17	8	1.12	-11%	-18%
FRA	906	430	1.17	5%	4%	1114	701	1.29	16%	20%	1211	827	1.34	19%	29%
GBR	631	254	1.20	8%	3%	829	531	1.42	25%	16%	954	677	1.50	30%	27%
IRL	205	103	1.29	15%	10%	258	171	1.49	28%	30%	278	196	1.55	31%	41%
LTU	4	3	1.20	14%	22%	7	6	1.40	27%	89%	7	6	1.45	30%	158%
LVA	12	5	1.32	22%	49%	16	9	1.86	45%	184%	16	10	2.04	50%	238%
NLD	312	98	1.12	-4%	-5%	425	253	1.37	17%	35%	501	345	1.48	25%	69%
POL	30	16	1.39	20%	9%	42	29	1.62	34%	26%	45	33	1.68	37%	35%
PRT	238	128	1.36	17%	12%	301	201	1.30	17%	16%	321	228	1.30	17%	20%
SWE	58	23	1.41	18%	9%	76	43	1.74	37%	32%	78	48	1.82	40%	40%
<b>TOTAL</b>	<b>4252</b>	<b>1703</b>	<b>1.14</b>	<b>4%</b>	<b>2%</b>	<b>5351</b>	<b>3274</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>6102</b>	<b>4199</b>	<b>1.33</b>	<b>20%</b>	<b>21%</b>
				Increase over 2012		26%	92%	12%	12%	11%	43%	147%	16%	16%	19%
Option 1	<b>4469</b>	<b>1920</b>	<b>1.15</b>	<b>5.3%</b>	<b>3.1%</b>	<b>5108</b>	<b>3029</b>	<b>1.27</b>	<b>15%</b>	<b>12%</b>	<b>5561.24</b>	<b>3657</b>	<b>1.31</b>	<b>18%</b>	<b>18%</b>
Difference to Option 1	<b>-216</b>	<b>-216</b>	<b>0.01</b>	<b>-1.6pp</b>	<b>-1.1pp</b>	<b>243</b>	<b>245</b>	<b>0.01</b>	<b>0.9pp</b>	<b>1.3pp</b>	<b>540</b>	<b>543</b>	<b>0.01</b>	<b>1.6pp</b>	<b>3.5pp</b>

Table 24 Results from EIAA model by fleet size for Option 1, sub-option ii

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
SSF	715	429	1.38	18%	12%	856	606	1.55	29%	26%	918	683	1.60	31%	32%
1224*	1128	456	1.08	0%	0%	1477	934	1.22	13%	14%	1682	1186	1.27	17%	25%
2440	1177	308	1.01	-5%	-3%	1461	818	1.11	6%	5%	1789	1218	1.15	10%	12%
40XX	1232	511	1.23	8%	3%	1557	916	1.42	22%	14%	1713	1112	1.50	27%	21%
<b>TOTAL</b>	<b>4252</b>	<b>1703</b>	<b>1.14</b>	<b>4%</b>	<b>2%</b>	<b>5351</b>	<b>3274</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>6102</b>	<b>4199</b>	<b>1.33</b>	<b>20%</b>	<b>21%</b>
				Increase over 2012		26%	92%	12%	12%	11%	43%	147%	16%	16%	19%
Option 1	<b>4469</b>	<b>1920</b>	<b>1.15</b>	<b>5%</b>	<b>3%</b>	<b>5108</b>	<b>3029</b>	<b>1.27</b>	<b>15%</b>	<b>12%</b>	<b>5561</b>	<b>3657</b>	<b>1.31</b>	<b>18%</b>	<b>18%</b>
Difference to option 1	<b>-216</b>	<b>-216</b>	<b>-0.01</b>	<b>-1.6pp</b>	<b>-1.1pp</b>	<b>243</b>	<b>245</b>	<b>0.01</b>	<b>0.9pp</b>	<b>1.3pp</b>	<b>540</b>	<b>543</b>	<b>0.02</b>	<b>1.6pp</b>	<b>3.5pp</b>

### **Mediterranean economic indicators for option 1ii**

The same reversal of trend in GVA for purse seiners and small scale coastal fleets are shown in Table 25 when comparing option 1ii to option 1. However, the overall performance in GVA for 2012 is much lower in option 1ii than option 1. This indicator decreases for the fleet from € 117.57 million in option 1 to €104.43 million under option 1ii.

Greater percentage increases in revenue to break even revenue are expected when comparing 2017 and 2022 to 2012. Under option 1 the increases are 15% and 16% for 2017 and 2022 respectively but for option 1ii, these are 21% and 24%. It should be noted that these are slightly drive by the lower economic performance of the fleet in 2012 when comparing the two options, but this is not a significant factor.

While under option 1i, demersal trawlers are expected to have a net profit margin of just under 0%, this decrease is even greater to -2.1% under option 1ii. This is worth noting considering the fleet is considered profitable under option 1 in 2012 but not for either of the discard reduction options.

**Table 25 Projections of gross value added (mln €) by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	47.25	42.14	46.13	51.07	9%	21%
Purse seiners	16.85	11.89	19.57	20.14	65%	69%
Small scale fishery	31.60	30.44	58.09	59.98	91%	97%
Polyvalent	0.53	0.11	0.57	0.75	420%	587%
Polyvalent passive	8.83	5.97	10.82	12.20	81%	104%
Longlines	21.62	13.87	23.52	26.32	70%	90%
<b>Total</b>	<b>126.68</b>	<b>104.43</b>	<b>158.69</b>	<b>170.46</b>	<b>52%</b>	<b>63%</b>
<b>Option 1</b>	<b>126.68</b>	<b>117.57</b>	<b>145.50</b>	<b>144.54</b>	<b>24%</b>	<b>23%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-13.14</b>	<b>13.19</b>	<b>25.92</b>		

**Table 26 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	1.18	1.12	1.32	1.36	18%	22%
Purse seiners	1.54	1.36	1.54	1.58	13%	16%
Small scale fishery	1.47	1.41	1.60	1.64	13%	16%
Polyvalent	1.17	0.91	1.15	1.25	27%	37%
Polyvalent passive	1.64	1.43	1.64	1.71	15%	20%
Longlines	1.65	1.41	1.63	1.71	16%	22%
<b>Total</b>	<b>1.33</b>	<b>1.24</b>	<b>1.50</b>	<b>1.54</b>	<b>21%</b>	<b>24%</b>
<b>Option 1</b>	<b>1.33</b>	<b>1.28</b>	<b>1.47</b>	<b>1.48</b>	<b>15%</b>	<b>16%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-0.03</b>	<b>0.03</b>	<b>0.06</b>		

**Table 27 Projections of net profit margin by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var</b>	<b>2022 var</b>
Demersal trawlers	-12.6%	-2.1%	14.9%	20.8%	17.0%	22.9%
Purse seiners	8.2%	1.4%	19.3%	22.2%	18.0%	20.9%
Small scale fishery	13.8%	28.7%	40.9%	42.8%	12.2%	14.1%
Polyvalent	-5.2%	-17.6%	10.7%	19.0%	28.3%	36.6%

Polyvalent passive	14.1%	13.3%	30.4%	35.0%	17.1%	21.7%
Longlines	21.1%	14.6%	30.8%	35.5%	16.2%	20.9%
<b>Total</b>	<b>0.7%</b>	<b>6.4%</b>	<b>26.3%</b>	<b>30.2%</b>	<b>20.0%</b>	<b>23.8%</b>
<b>Option 1</b>	<b>0.7%</b>	<b>10.4%</b>	<b>24.8%</b>	<b>26.4%</b>	<b>14.4%</b>	<b>16.0%</b>
<b>Difference to option 1</b>	<b>0.0pp</b>	<b>-4.0pp</b>	<b>1.5pp</b>	<b>3.8pp</b>		

**Table 28 Projections of return on investment by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var</b>	<b>2022 var</b>
Demersal trawlers	14.7%	14.4%	27.7%	36.9%	13.4%	22.5%
Purse seiners	31.6%	19.9%	44.0%	50.6%	24.1%	30.7%
Small scale fishery	54.1%	53.5%	112.2%	128.7%	58.8%	75.2%
Polyvalent	20.4%	2.4%	24.3%	36.6%	21.9%	34.2%
Polyvalent passive	43.6%	29.6%	59.2%	74.4%	29.6%	44.8%
Longlines	62.9%	39.8%	75.5%	94.0%	35.6%	54.2%
<b>Total</b>	<b>28.2%</b>	<b>25.6%</b>	<b>57.1%</b>	<b>71.1%</b>	<b>31.4%</b>	<b>45.4%</b>
<b>Option 1</b>	<b>28.2%</b>	<b>30.4%</b>	<b>54.2%</b>	<b>59.6%</b>	<b>23.8%</b>	<b>29.2%</b>
<b>Difference to option 1</b>	<b>0.0pp</b>	<b>-4.8pp</b>	<b>2.8pp</b>	<b>11.4pp</b>		

#### **5.1.4 Social Indicators: fishing operators receiving total value of landings (i)**

##### ***Indicator 13 Employment***

While the sorting time on board is expected to change with the implementation of a discard reduction policy, this is not expected to make any changes to the level of employment on board vessels. Personally communicated information from the Scottish case study (see Case Study Annex: Scotland) suggests that this has been the case when implementing a discard reduction policy on cod under the catch-quota management system being trialled by Scottish whitefish trawlers in the North Sea. This also indicates that there is not expected change in the employment cost to vessels also.

The number of employees (by FTE) is also not expected to change from the implementation of a discard reduction policy as there is not anticipated change in effort – to which FTE is linked.

##### ***Indicator 16 and 17 Social Sustainability Attractiveness of the sector***

The increase in GVA per employees is expected to increase over the standard option 1 when introducing option 1i. Compared to option 1 with 89% and 147% increase over 2012 for 2017 and 2022 respectively, option 1i indicates an increase of 116% and 200%. Given that there is no modelled change to FTE (the denominator of this indicator), any changes in this indicator are driven by changes to the numerator, GVA (see section 5.1.2).

The same degree of change can also be seen in the attractiveness of the sector indicator, crew wage per FTE. In option 1 this indicator produced increases of 76% and 131% over the 2012 figure in 2017 and 2022 respectively. Yet under the option 1i scenario, the expected increase in crew share is 101% and 180% over the 2012 figure in 2017 and 2022 respectively.

In addition to the expected increases in salary, many of the case studies have indicated that the attractiveness of the sector increase will go beyond monetary value. Case study findings indicate that, naturally, fishers do not enjoy having the poor social image which is synonymous with discarding. Additionally, as seen in the Icelandic case, there has been a

greater social responsibility (reporting each other) taken on by fishers and skippers. In cases where skippers have noted other skippers discarding, they have voluntarily reported them to the authorities.

Table 29 Option 1i: Trends in social indicators by Member State (2012 percentage change are on option 1)

Indicator	2012					2017					2022				
	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE
	a2	13	13a	16	17	a2	13	13a	16	17	a2	13	13a	16	17
BEL	81	457	6	30291	44048	59	294	5	163297	182604	49	251	5	296668	320527
DEU	317	688	2	137318	75168	244	510	2	302437	154166	205	447	2	434748	221057
DNK	400	1279	3	131650	79844	384	1132	3	240121	141909	347	1067	3	291437	170953
EST	800	2475	3	2611	966	752	2393	3	6558	1994	752	2278	3	8135	2391
ESP	10974	25799	2	15852	14979	9585	20362	2	40901	33396	9014	18520	2	66096	53340
FIN	1248	1640	1	1340	2086	1105	1338	1	4867	4168	1054	1242	1	6232	4798
FRA	2562	8643	3	52196	36100	2261	7184	3	97435	62492	2152	6634	3	124307	78191
GBR	2954	4930	2	54342	31916	2499	3888	2	136513	73242	2251	3624	2	186707	98407
IRL	1372	2437	2	43758	23755	1263	2197	2	77848	39282	1243	2089	2	93639	46287
LTU	19	40	2	70559	52289	14	35	2	160559	105320	12	33	3	193533	123978
LVA	737	1212	2	4033	1475	646	1160	2	7904	1567	611	1101	2	9190	1591
NLD	279	1454	5	75821	48753	245	1190	5	212748	117228	222	1088	5	317239	167652
POL	656	1396	2	11581	5315	557	1269	2	22891	10192	521	1194	2	27328	12119
PRT	2247	8412	4	15903	8400	1991	7803	4	25747	16841	1898	7325	4	31109	21037
SWE	793	1001	1	23528	6257	638	908	1	47876	12570	607	854	1	56116	14785
<b>TOTAL</b>	<b>25439</b>	<b>61863</b>	<b>2</b>	<b>29282</b>	<b>20248</b>	<b>22246</b>	<b>51664</b>	<b>2</b>	<b>63340</b>	<b>40728</b>	<b>20940</b>	<b>47746</b>	<b>2</b>	<b>87900</b>	<b>56596</b>
				Increase on 2012		-13%	-16%	-4%	116%	101%	-18%	-23%	-6%	200%	180%
Option 1	25439	61863	2	31030	21379	22,246	51,664	2	58,631	37,717	20,940	47,746	2	76,584	49,289
Difference	0	0	0	-1748	-1131	0	0	0	4708	3011	0	0	0	11316	7308

In the Mediterranean, similar improvements to the social indicators are expected under a discard reduction policy. As with the results presented in Table 29, GVA per employees in the Mediterranean is largely driven by the increase in economic performance. The GVA per employee indicator in 2012 under option 1i (Table 30) suggest that the Mediterranean GVA per employee will be lower than under option 1 (option 1i = €17.8thousand; option 1 = €18.9 thousand) given the initial reduction in average fish price. This is countered by greater increases in GVA per employee in the years 2017 and 2022 in option 1i compared with option 1 (option 1i 2017 = €30.09 thousand, 2022 = € 35.73 thousand; option 1 2017 = €27.54 thousand, 2022 = €30.19 thousand).

**Table 30 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	17.87	19.65	33.17	40.63	69%	107%
Purse seiners	30.62	22.14	41.30	47.04	87%	112%
Small scale fishery	12.48	12.97	25.15	28.73	94%	122%
Polyvalent	3.87	1.19	4.54	6.63	281%	456%
Polyvalent passive	18.76	14.16	25.20	31.45	78%	122%
Longlines	33.56	23.41	40.01	49.53	71%	112%
<b>Total</b>	<b>18.16</b>	<b>17.80</b>	<b>30.09</b>	<b>35.73</b>	<b>69%</b>	<b>101%</b>
<b>Option 1</b>	<b>18.16</b>	<b>18.90</b>	<b>27.54</b>	<b>30.19</b>	<b>46%</b>	<b>60%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-1.10</b>	<b>2.55</b>	<b>5.54</b>		

An increase in crew share in 2017 (option1i = €12.18 thousand; option 1 = €11.21 thousand) and 2022 (option1i = €14.34 thousand; option 1 = €12.23 thousand) in the Mediterranean fisheries is also experienced under option 1i. However, as can be seen in Table 31, and similar to that in GVA per employee, the 2012 value in option 1i (€7.74 thousand) is lower than option 1 (€8.17 thousand). The crew share figures in Table 29 and Table 31 are assuming a stable share of vessel profits based on 2005-2007 proportions.

**Table 31 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1i)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	9.58	10.42	16.78	20.30	61%	95%
Purse seiners	11.09	8.40	14.50	16.32	73%	94%
Small scale fishery	5.42	5.61	10.46	11.88	86%	112%
Polyvalent	1.32	0.55	1.52	2.12	178%	288%
Polyvalent passive	6.92	5.34	9.14	11.30	71%	112%
Longlines	9.82	7.26	11.55	14.12	59%	94%
<b>Total</b>	<b>7.87</b>	<b>7.74</b>	<b>12.18</b>	<b>14.34</b>	<b>57%</b>	<b>85%</b>
<b>Option 1</b>	<b>7.87</b>	<b>8.17</b>	<b>11.21</b>	<b>12.23</b>	<b>37%</b>	<b>50%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-0.43</b>	<b>0.97</b>	<b>2.11</b>		

### **Indicator 28 Safety at sea**

In option 1, the analysis suggested that the non-fatal accident rates would reduce to zero by 2022. This was linked to the increase in economic performance of vessels; the more profitable the activity of fishing, the fewer risks being taken by vessel operators. Nevertheless, it is difficult to assume that a percentage increase in profitability will automatically translate to the proportional decrease in non-fatal accidents. In option 1(i), there is a reduction in profitability in 2012. It may be that this slight reduction in performance could stall progress to reducing this number of non-fatal accidents.

Another factor is the introduction of ITRs and the positive impact this may have on safety at sea. In the US Pacific halibut fishery, the introduction of ITRs has changed the fishery from an Olympic style quota where the entire quota was fished within several days, to a system where the fishing season has increased to 250 days. This increase in time allowed to fish, and a slowing of competition to catch quota, led to fewer risk-taking practices and higher safety at sea. Therefore, with the introduction of ITRs proposed under option 1 and 1i, there is reason to suggest that, in fact, the reduction of non-fatal injuries will remain constant to approaching zero.

#### **5.1.5 Social Indicators: fishing operators receiving 20% value of undersize landings (ii)**

##### ***Indicator 13 Employment***

Little impact is noted across the entire fleet from an economic perspective, but for the French DFN 0012 and 1224m segment, there is an expected decrease in vessel numbers, effort and thus employment under option 1ii. This is due to the fact that poor economic performance for 2012 in these fleet segments, from the reduction in landings value policy, drives this segment below the 10% threshold and into further fleet consolidation through the ITR system in place under option 1. Table 32 indicates that vessel numbers decrease from 22,246 in option 1 to 22,190 in option 1ii for 2017 and from 20,940 to 20,843 respectively in 2022.

This decrease causes a total employment FTE decrease in 2017 of 51,664 in option 1 to 51,652 in option 1ii. The decreased number of employees is also experienced in 2022 from 47,746 in option 1 to 47,731 in option 1ii.

##### ***Indicator 16 and 17 Social Sustainability Attractiveness of the sector***

Compared to option 1i in section 5.1.4 (see Table 29), these indicators appear to show a greater performance through higher increases in 2017 and 2022 when compared to Table 29). This is in part due to the -6% decrease in performance of the indicators in 2012 resulting from the policy's expected decreased revenue (see section 4.5.1) but also through the reduction of crew as per discussed in the previous indicator.

In 2012 under the option 1ii scenario, performance of indicators 16 and 17 are expected to be 11.3% and 10.6% respectively less than option 1. In 2017, indicator 16 (GVA per employee) increases from € 58,631 under option 1 to € 63,380 under option 1ii. In 2022, this increase is from € 76,584 under option 1 to € 87,975 under option 1ii. For indicator 17 the increase from option 1 to option 1ii in 2017 is € 37,717 to € 40,740 respectively; in 2022 it is from € 49,289 to € 56,617.

This creates a mixed social result. There will be less FTE employment in the industry over the long term, but this will benefit the crew which are remaining.

**Table 32 Option 1ii: Trends in social indicators by Member State (percentage changes in 2012 are on option 1)**

Indicator	2012					2017					2022				
	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE
	a2	13	13a	16	17	a2	13	13a	16	17	a2	13	13a	16	17
BEL	81	457	6	23768	37137	59	294	5	163297	182604	49	251	5	296668	320527
DEU	317	688	2	129840	71297	244	510	2	302437	154166	205	447	2	434748	221057
DNK	400	1279	3	127784	77558	384	1132	3	240121	141909	347	1067	3	291437	170953
EST	800	2475	3	2303	894	752	2393	3	6558	1994	752	2278	3	8135	2391
ESP	10974	25799	2	14485	13910	9585	20362	2	40901	33396	9014	18520	2	66096	53340
FIN	1248	1640	1	1231	2014	1105	1338	1	4867	4168	1054	1242	1	6232	4798
FRA	2562	8643	3	49771	34711	2206	7172	3	97782	62610	2055	6619	3	124930	78391
GBR	2954	4930	2	51418	30366	2499	3888	2	136513	73242	2251	3624	2	186707	98407
IRL	1372	2437	2	42124	22956	1263	2197	2	77848	39282	1243	2089	2	93639	46287
LTU	19	40	2	67218	50278	14	35	2	160559	105320	12	33	3	193533	123978
LVA	737	1212	2	3905	1469	646	1160	2	7904	1567	611	1101	2	9190	1591
NLD	279	1454	5	67417	44620	245	1190	5	212748	117228	222	1088	5	317239	167652
POL	656	1396	2	11213	5141	557	1269	2	22891	10192	521	1194	2	27328	12119
PRT	2247	8412	4	15223	7779	1991	7803	4	25747	16841	1898	7325	4	31109	21037
SWE	793	1001	1	22790	6054	638	908	1	47876	12570	607	854	1	56116	14785
<b>TOTAL</b>	<b>25439</b>	<b>61863</b>	<b>2</b>	<b>27535</b>	<b>19117</b>	<b>22190</b>	<b>51652</b>	<b>2</b>	<b>63380</b>	<b>40740</b>	<b>20843</b>	<b>47731</b>	<b>2</b>	<b>87975</b>	<b>56617</b>
	increase over 2012					-13%	-17%	-4%	130%	113%	-18%	-23%	-6%	220%	196%
<b>Option 1</b>	<b>25439</b>	<b>61863</b>	<b>2</b>	<b>31030</b>	<b>21379</b>	<b>22,246</b>	<b>51,664</b>	<b>2</b>	<b>58,631</b>	<b>37,717</b>	<b>20,940</b>	<b>47,746</b>	<b>2</b>	<b>76,584</b>	<b>49,289</b>
<b>Difference</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-3495</b>	<b>-2263</b>	<b>-56</b>	<b>-11</b>	<b>0</b>	<b>4749</b>	<b>3023</b>	<b>-97</b>	<b>-15</b>	<b>0</b>	<b>11391</b>	<b>7329</b>

The Mediterranean results for indicators 16 and 17 have not changed for 2017 and 2022 under option 1ii. The only expected change is in 2012 where only 20% of the landed value for undersized fish is available to vessel operators. This results in a reduction of the 2012 figure to €16.69 thousand (decrease of 6%) for indicator 16 and €7.31 thousand (decrease of 6%) for indicator 17.

**Table 33 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	17.87	18.22	33.17	40.63	82%	123%
Purse seiners	30.62	21.61	41.30	47.04	91%	118%
Small scale fishery	12.48	12.33	25.15	28.73	104%	133%
Polyvalent	3.87	0.82	4.54	6.63	456%	712%
Polyvalent passive	18.76	13.02	25.20	31.45	94%	142%
Longlines	33.56	22.08	40.01	49.53	81%	124%
<b>Total</b>	<b>18.16</b>	<b>16.69</b>	<b>30.09</b>	<b>35.73</b>	<b>80%</b>	<b>114%</b>
<b>Option 1</b>	<b>18.16</b>	<b>18.90</b>	<b>27.54</b>	<b>30.19</b>	<b>46%</b>	<b>60%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-2.20</b>	<b>2.55</b>	<b>5.54</b>		

**Table 34 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1ii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	9.58	9.74	16.78	20.30	72%	108%
Purse seiners	11.09	8.23	14.50	16.32	76%	98%
Small scale fishery	5.42	5.36	10.46	11.88	95%	122%
Polyvalent	1.32	0.44	1.52	2.12	247%	385%
Polyvalent passive	6.92	4.95	9.14	11.30	85%	128%
Longlines	9.82	6.89	11.55	14.12	68%	105%
<b>Total</b>	<b>7.87</b>	<b>7.31</b>	<b>12.18</b>	<b>14.34</b>	<b>67%</b>	<b>96%</b>
<b>Option 1</b>	<b>7.87</b>	<b>8.17</b>	<b>11.21</b>	<b>12.23</b>	<b>37%</b>	<b>50%</b>
<b>Difference to option 1</b>	<b>0.00</b>	<b>-0.86</b>	<b>0.97</b>	<b>2.11</b>		

### **Indicator 28 Safety at sea**

As discussed, in relation to option 1(i), with a lower performance expected for 2012 under option 1ii, the rate at which non-fatal accidents decreases may slow more than under option 1i as vessels attempt to remain profitable.

### **5.1.6 Governance Indicators**

#### **Indicator 19 Management costs for the sector**

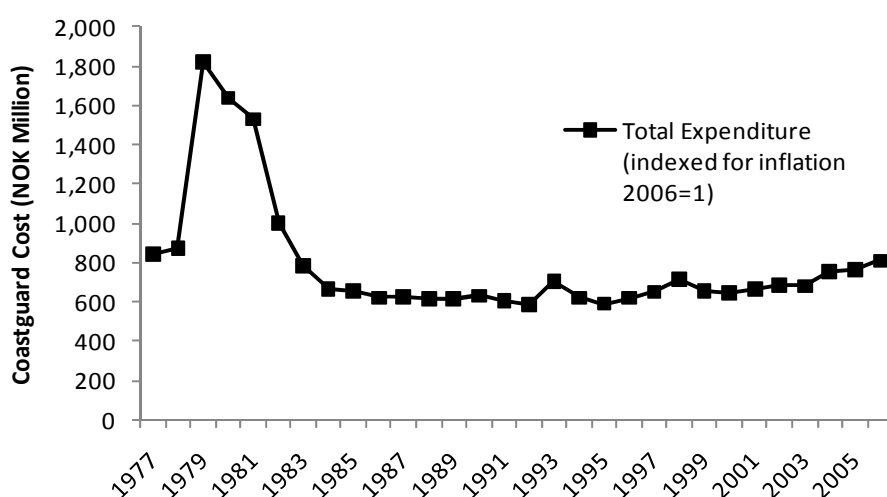
In order to achieve a fully documented catch fishery, multiple systems have been used internationally. In the US pacific whiting fishery, all landings are 100% monitored by a person onboard. The estimated cost of this observer is \$500/day (€354) for 7600 sea days per year (or \$380,000) according to the Pacific Fisheries Management Council. The rate is also consistent with MRAG (2006) but does not include initial set up costs. It is not necessarily the case that this observer is onboard every fishing vessel, as some vessels within the fishery operate by landing all catches onto a Mothership. This has been one way to improve efficiency of monitoring all catches, but may not be applicable to EU fleet as it does not operate in the same method. Applying this rate to the sea days used in the EIAA modelling gives an indication of the cost of this method of management for the EU (see Table 35). The fleet days are calculated assuming a reduction in fleet size as a result of option 1's

implementation of ITRs. This cost in the US pacific whiting fishery, and in many other examples of fisheries with observers, is recovered through a rent collection scheme operated by management.

**Table 35 Estimated observer costs in nominal terms for EU fleet segments applying €354/day**

Fleet Size Segment (m)	2012 (€ million)	2017 (€ million)	2022 (€ million)
1224	258.82	205.43	185.14
2440	85.67	64.82	58.27
40XX	29.46	26.19	24.58
<b>Total</b>	<b>373.96</b>	<b>296.44</b>	<b>267.99</b>

In the Norwegian fisheries, a combination of scientific inspection vessels and coastguard patrol vessels are used to determine the locations and length of time for RTCs and compliance to the discard ban scheme in place. The coastguard is estimated to conduct around 2,200 inspections of vessels per year. The presence of the coastguard is not purely as a fisheries task and the time spent on fisheries is not only enforcing the discard ban. However, Honneland (2000) indicates that the high level of coastguard presence is an influencing factor in the compliance to the discard ban. Each year the operating costs are estimated to be around NOK 800 million (€ 101 million), of which 70% of the time is used for patrolling fisheries. It is difficult to scale this to the EU situation, as the original presence of the Norwegian coastguard is not for fisheries patrol.



**Figure 33: Total Coastguard Expenditure including capital investment 1977-2006 (indexed 2006 = 1) (source: Statistics Norway, 2009).**

The Icelandic fisheries do not rely so heavily on at-sea patrol presence. The Ministry and Directorate of Fisheries consider logbooks and catch composition comparisons to be one of the most valuable methods of detecting non-compliance with the discard ban (K Helgasson, pers. comm., 2011). The Directorate of Fisheries regularly has observers onboard vessels and inspectors portside to analyse catch composition and catch-length frequencies. If it is noted that catches from two different operators are from the same area, but have very different length frequencies, it can be reasonably assumed that discarding has occurred. Statistics from the Marine Research Institute’s website indicate that the number of fish measured range between 0.06% and 0.29% of those caught and landed, depending on the species (see Table 36).

**Table 36 Percentage of number of fish landed which have been measured in Iceland's fisheries**

	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average
Cod	0.12	0.29	0.26	0.20	0.27	0.26	0.23	0.20	0.24	0.23
Haddock	0.06	0.19	0.20	0.11	0.09	0.12	0.17	0.09	0.12	0.13

It's not possible to gain specific budget figures to estimate the cost of this level of observer and port inspection coverage. However, after the implementation of the fisheries management Act in 1991 which provided a great improvement to the legislative authority to the government (allowing the implementation of the ITR and discard ban), large increases in total budget have been experienced for the Directorate of Fisheries (see Table 37). Furthermore, this method of monitoring catch does not provide real-time evidence of non-compliance and could only be used to enhance assessments of vessels considered to be high-risk of discarding. This may assist in allocating control effort, but may not assist in prosecutions.

**Table 37 Governmental fundings (millions IKR) to the Marine Research Institute (MRI) and the Directorate of Fisheries (DF) in 1990 to 2008**

Year	MRI	DF	MRI <sub>adj</sub>	DF <sub>adj</sub>	MRI <sub>adj</sub> %	DF <sub>adj</sub> %
1990	470	57	470	57		
1995	613	216	496	175	6%	207%
2000	833	369	594	263	26%	361%
2008	1431	652	706	322	50%	464%

NB: MRI<sub>adj</sub> and DF<sub>adj</sub> are adjusted for inflation, set at 1990 levels, MRI<sub>adj</sub> % and DF<sub>adj</sub> % are increase since 1995 in percentages, the 1990 and 1995 values for DF include fees the industry paid directly to DF, later paid directly to the government.

While the North Sea REM system is largely reliant on electronic gear and cameras, there is still the requirement for a human observer element – albeit a smaller proportion. The gear and installation cost is estimated to cost € 11, 500 per vessel which has been applied to 6,227 vessels in the fleet operating outside the Mediterranean which equates to € 71.6 million. In terms of the human element, the Danish system has estimated that monitoring 10% of haul times gives an indication of discarding compliance and also allows a suitable sample for logbook cross-checking. To monitor 10% of hauls of 21 vessels in the Danish trial, four observers (FTE) have been required – 5.25 per vessel. To scale this level of monitoring up to the full EU fleet (in 2012) which has been equipped with the REM system, this would require 1186 FTE observers. The results of applying a €25,000 and € 35,000 salary per observer are presented in Table 38. This analysis has also incorporated the anticipated reduction in vessel as a result of ITRs under option 1.

**Table 38 Estimated cost of observing REM CCTV footage for the EU fleet**

Salary	Fleet Size Segment (m)	2012 (€ million)	2017 (€ million)	2022 (€ million)
25, 000	1224	21.22	17.03	14.77
	2440	6.43	5.26	4.54
	40XX	2.00	1.76	1.59
	<b>Total</b>	<b>29.65</b>	<b>24.05</b>	<b>20.91</b>
35, 000	1224	29.71	23.84	20.68
	2440	9.00	7.36	6.36
	40XX	2.81	2.47	2.23
	<b>Total</b>	<b>41.51</b>	<b>33.67</b>	<b>29.27</b>

The level of monitoring and management costs is expected to increase with the introduction of a discard reduction policy. However, these options indicated do not necessarily need to equate to a rise in net management costs. Many of the case studies have demonstrated that under a higher economic performing fleet, these costs can be recovered via the industry. This is with the exception of the Norwegian system. Given the coastguard's multi-disciplinary nature, allocating concrete costs to industry has not been possible (P. Gullestad, pers. comm., 2010).

When considering the possibility of management costs and cost-recovery options, a candidate may be the 80% of undersized fish sale value confiscation from option 1(ii), although this is only likely to generate significant revenues in the first five years of the policy. Table 39 provides a summary of the costs of management and the estimated recovery of costs for management calculated by the change in income for the industry in 2012 as a result of option 1(ii).

**Table 39 Summary of management options and costs**

<b>Management Option</b>	<b>2012 (€mln)</b>	<b>2017 (€mln)</b>	<b>2022 (€mln)</b>
Change in income	€108	~0	~0
100% Observer Coverage	€374	€296	€268
Intensive At-Sea Presence (with no additional capital investment)	€70	€70	€70
REM CCTV Monitoring	€29.7 – 41.5	€24 – 33.7	€20.9 – 29.3

The risk to compliance is also higher in 2012 for option 1(ii) given the possible decreased value in undersized landings. It is difficult to quantify precisely how this will impact management costs. However, with a higher risk to compliance and the reduction of possible market incentives to no discard, it should be considered that these management costs may be higher under option 1(ii).

**Indicator 21 Data provided by MS**

Currently, under policy option 1, there will already be a greater requirement for data under the DCF due to option's intention to move more stocks to be managed under MSY. This requirement allows a greater accuracy of stock assessments and should lead to an increase in stock size, assuming a good level of compliance to TACs. Given that one of the greatest benefits to a discard reduction policy indicated through all case studies was an increase in stock assessment accuracy from the greater level of data required, it is possible to assume that the level of expected data provided by MS may not increase under a discard reduction policy. However, option 1(i) may provide more than just a legislative platform to request greater data.

With a discard reduction policy in place, there is an additional enforcement aspect available. If a vessel is discarding, and thus decreasing the accuracy of catch data, there is the possibility to prosecute which will also act as a deterrent to other vessels.

With reductions in discards as a result of new policies, landings data becomes full catch data. There is then a reduced requirement to make estimations discarding levels based on observed catches and landings records, as is currently done, to quantify discard levels. Therefore, it is reasonable to say that whilst the level of data provided by MS should not increase, the accuracy and quality of data should increase.

### **Indicator 22 Rate of Utilisation of quota allocations**

Under all discard reduction policy options, it is assumed that fishing effort will cease in a multi-species fishery once the quota of a species in that fishery has been exhausted. This means that fishing effort must cease even if quota is still available for other species. In the North Sea, it is considered that much of the discarding of non below minimum sized fish is due to overquota catches of cod. That is, fishing for haddock and other target species continues, with incidental catches of cod, despite quotas for cod being exhausted. This would suggest that with the current behaviour and the requirement for fishing effort to cease once a species' quota has been exhausted, the rate of quota utilisation may decrease in the initial stages of this discard reduction policy.

In many of the case studies researched, this same cessation of effort regulation has been applied. An outcome from the Norwegian, US, North Sea and Icelandic case study has been that fishing behaviour does change and quotas will be fully utilised. This is also due the ability to swap quota either with other operators or by transferring some of the individual's quota within their own portfolio using a "cod equivalents" (see Case Study Annex: Iceland).

The cod equivalents system allows individual operators to transfer up to 2% of their cod quota to other species which have been caught if they either have no quota or exhausted all their available quota of that species. This is transferred at a rate which is predefined by the managing authority each year (see Table 40).

**Table 40 Cod equivalent of all species as published by Ministry of Fisheries – 2005-2011 (Source: Ministry of Fisheries, Iceland)**

Species	Year					
	05/06	06/07	07/08	08/09	09/010	10/11
Cod	1	1	1	1	1	1
Haddock	0.75	0.81	0.82	0.69	0.76	0.95
Saithe	0.37	0.42	0.43	0.38	0.49	0.64
Demersal redfish	0.54	0.69	0.6	0.42	0.61	0.74
Ling	0.55	0.6	0.64	0.49	0.48	0.51
Tusk	0.35	0.37	0.38	0.33	0.37	0.34
Greenland halibut	2.04	1.98	1.67	1.23	1.94	2.21
Plaice	1.29	1.18	1.02	0.81	0.77	0.8
Atlantic catfish	0.68	0.71	0.68	0.6	0.71	0.87
Monk fish	1.6	1.8	1.76	1.34	1.65	1.92
Witch flounder	0.63	0.59	0.52	0.5	0.61	0.6
Dab	0.52	0.48	0.38	0.29	0.27	0.24
Long rough dab	0.45	0.46	0.29	0.26	0.34	0.34
Lemon sole	1.55	1.43	1.46	1.21	1.14	1.07
Herring	0.14	0.13	0.1	0.07	0.12	0.11
Capelin	0.06	0.1	0.09	0.09	0.12	0.17
Blue whiting	0.05	0.05	0.07	0.06	0.08	0.13
Silver smelt	0.4	0.44	0.36	0.32		
Offshore shrimp	0.68	0.67	0.57	0.49	0.6	0.63
Inshore shrimp	0.36	0.36	0.52	0.52	0.61	0.58
Nephrops tails	6.45	6.42	5.05	4.68	4.71	4.51
Pelagic redfish	0.51	0.73	0.69	0.41	0.56	0.86

Species	Year					
	05/06	06/07	07/08	08/09	09/010	10/11
Atlanto Scandian herring	0.15	0.23	0.14	0.09	0.16	0.16
Flemish Cap shrimp	0.84	0.75	0.44	0.44	0.75	0.44

Consideration will need to be made for vessels fishing for nephrops, for example, where cod and haddock are prevalent. Unless suitable quotas are made available to these fleets, and they are expected to cease fishing effort once they have exhausted their cod quota, a situation may arise where fishing ceases long before the nephrops quota has been utilised. An example of this is seen in the Scottish nephrops fleet when looking to enter into the catch quota scheme for cod in the north sea. Under all scenarios of different uptake rates of the system in the fleet, nephrops targeting vessels were not seen to realise any benefits from joining the scheme (see Case Study Annex: Scotland).

It is expected that given option 1's intention to implement ITRs for LSF and the ability to swap quota, that over time the rate of utilisation will increase to near or reach 100%. In the small scale coastal fleet there may large reductions of rate of utilisation if changes in fishing behaviour do not occur and they do not take on the ITR system. This is because without individual rights, the whole fleet may need to cease fishing effort if one species' quota is exhausted.

#### **Indicator 25 Administrative Burden**

Under a system where quota swapping is permitted, and fishing effort must cease if a species quota is exhausted, private firms should expect to see an increase in the administrative burden under policy option 1i. This is the experience of the Icelandic system where quotas can be monitored by individual operators via a web link established by the Directorate of Fisheries. As catches are landed and electronically recorded, these data are fed real-time into an online database which can be accessed by each vessel. This allows operators to view utilised proportions of their portfolio and determine if more quota are required of different species before commencing another fishing trip. Ensuring that vessels have sufficient quota for each species they are expected to encounter requires an increased level of planning and catch coordination, as opposed to the current system of only landing catch for which vessels hold quota.

Supplying this level of information for vessels in real-time and the additional management anticipated for the quota swapping system is costly for the public sector. Because of this, costs are recovered by the sector in the US pacific whiting case. Management currently collects a maximum 3% of the landings income in this fishery (and throughout much of the US) as a means to recover these costs (Pacific Fishery Management Council, 2008).

## **5.2 Discard reduction policy implemented to Policy Option 1a**

### **5.2.1 Environmental Indicators**

#### **Indicator 1 Stocks managed with a fishing mortality related to MSY**

The discard reduction policy does not stipulate any management changes to the level of stocks which are to be managed at  $F_{MSY}$ . There are to be no expected changes to this indicator as a result of the discard reduction policy.

### ***Indicator 3 Average size (weight) of fish***

The modelling process for estimating the stock age-structure through the implementation of the discard reduction policy is done on a single species basis. Therefore it is not possible to model any change and provide quantitative outputs to this indicator. However, some qualitative assessment can be provided.

Under the option 1 discard reduction policy, and current landings selectivity, there was expected to be a slight decrease in the average sized fish caught given the higher proportion of smaller fish not removed from the stock as a result of discards. This decrease in the proportion of larger catch should also be expected with discard reduction policy under option 1a. Therefore, there will be a reduction in the level of TAC and possibly (without fishing behavioural changes) a reduction in proportion of larger, more valuable fish in the catch.

### ***Indicator 4 Fleet Impact***

No further change is modelled to fleet evolution as a result of the discard reduction policy.

#### **5.2.2 Economic Indicators: fishing operators receiving total value of landings**

This section explores the impact of sub-option ii (fishers receiving the full value of landings – including undersized fish) on Option 1a from the main impact assessment report. The impacts have been forecast using the EIAA model, which incorporates data on 15 EU Member States.

Table 41 presents the summary results for the economic indicators 7-10 which are GVA, Revenue/Break-even revenue, net profit margin and return on investment.

Compared to Option 1a without the discard reduction policy, introducing a discard reduction policy reduces all economic indicators initially (at 2012). This is a result of vessels having to land all fish including small and undersized fish against quota. As these small size classes of fish are assumed (with one or two exceptions) to achieve lower prices, the maximum returns on quota holdings are not achieved.

From year 2017 onwards, however, the economic indicators are more positive under a discard reduction policy than without this policy. Net profit margin for Option 1a averages 16% under the discard reduction policy compared to 12.4% without it (as discussed in section 5.1.2).

By 2022 the net profit margin sits at 20% under a discard reduction policy compared to 16.2% for Option 1a. The estimated GVA of €4,025m under a discard reduction policy is nearly 15% more than that forecast under Option 1a.

**Table 41 Results from EIAA model by MS for Option 1a, sub-option i (retain value of all landings)**

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
BEL	77	13	0.93	-13%	-16%	87	45	0.94	-10%	-19%	106	70	0.95	-8%	-22%
DEU	129	92	1.48	27%	124%	178	150	1.71	39%	314%	212	188	1.78	42%	552%
DNK	285	167	1.30	3%	2%	377	269	1.41	15%	12%	410	308	1.45	19%	20%
EST	25	6	1.19	10%	13%	33	16	1.49	29%	58%	35	19	1.60	34%	75%
ESP	1295	383	1.01	-3%	-1%	1507	776	1.11	6%	3%	1789	1134	1.14	10%	7%
FIN	14	2	0.92	-43%	-47%	16	7	1.06	-18%	-27%	17	8	1.12	-11%	-18%
FRA	907	440	1.17	5%	5%	1089	680	1.29	15%	19%	1184	803	1.33	19%	27%
GBR	630	261	1.21	9%	3%	808	515	1.42	24%	16%	928	656	1.50	30%	26%
IRL	206	105	1.30	15%	11%	254	168	1.49	28%	29%	273	192	1.55	31%	40%
LTU	4	3	1.21	14%	24%	7	6	1.40	27%	89%	7	6	1.45	30%	158%
LVA	12	5	1.34	23%	52%	16	9	1.86	45%	184%	16	10	2.04	50%	238%
NLD	311	103	1.13	-3%	-4%	407	239	1.35	16%	31%	478	325	1.47	24%	63%
POL	30	16	1.40	21%	9%	42	29	1.62	34%	26%	45	33	1.68	37%	35%
PRT	244	134	1.35	17%	12%	300	201	1.30	17%	16%	320	227	1.30	17%	20%
SWE	58	24	1.42	19%	9%	76	43	1.74	37%	32%	78	48	1.82	40%	40%
<b>TOTAL</b>	<b>4229</b>	<b>1752</b>	<b>1.15</b>	<b>4%</b>	<b>2%</b>	<b>5198</b>	<b>3153</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>5898</b>	<b>4025</b>	<b>1.32</b>	<b>20%</b>	<b>20%</b>
				Increase over 2012		23%	80%	11%	11%	10%	39%	130%	16%	15%	18%
Option 1a	<b>4332</b>	<b>1856</b>	<b>1.15</b>	<b>5%</b>	<b>3%</b>	<b>4964</b>	<b>2919</b>	<b>1.27</b>	<b>15%</b>	<b>11%</b>	<b>5381</b>	<b>3508</b>	<b>1.3</b>	<b>18%</b>	<b>17%</b>
Difference to Option 1a	-104	-104	0	-0.9pp	-0.6pp	234	234	0.01	1pp	1pp	517	517	0.02	2pp	3pp

Table 42 presents the results from the EIAA model by fleet size. This shows that in 2012 all size bands of vessels show poorer economic performance in 2012 under sub-option i, but this improves by 2017 and outstrips performance forecast under Option 1 alone without a discard reduction policy. While all size segments are better performing with the discard reduction policy, the comparative improvement in performance is 7% greater in the 0-12m segment and over 10% in all other segments. This is to be expected with vessels >12m having a greater reliance on quota species that would be affected by the discard reduction policy.

Table 43 presents fleet size performance against assumed targets for profitability (5%), return on investment (15%) and revenue to break even ratio >1. Despite the slightly poorer economic performance under the discard reduction policy in 2012 there is no difference in the percentage of fleets achieving these targets compared to the absence of a discard reduction policy. By 2017 the comparative number of fleets achieving those targets has improved, with 6-7% more fleets achieving the targets (88% overall), compared to the Option 1a without a discard reduction policy (84% overall). By 2022 all SSF and 40+m vessels achieve the targets with nearly all (93%) of 12-24m segments also achieving the economic targets. The proportion of 24-40m segments achieving the targets improves to 75% under the discard reduction policy compared to 69% without it.

**Table 42 Results from EIAA model by fleet size for Option 1a, sub-option i**

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10		7	8	9	10		7	8	9	10	
SSF	720	435	1.39	18%	12%	848	597	1.55	29%	26%	909	673	1.60	31%	32%
1224*	1126	472	1.09	1%	1%	1434	900	1.21	12%	13%	1626	1140	1.26	17%	23%
2440	1135	313	1.01	-6%	-3%	1375	752	1.11	5%	4%	1670	1118	1.15	9%	11%
40XX	1248	532	1.24	8%	4%	1542	904	1.42	22%	13%	1693	1095	1.50	27%	21%
<b>TOTAL</b>	<b>4229</b>	<b>1752</b>	<b>1.15</b>	<b>4%</b>	<b>2%</b>	<b>5198</b>	<b>3153</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>5898</b>	<b>4025</b>	<b>1.32</b>	<b>20%</b>	<b>20%</b>
	Increase over 2012					23%	80%	11%	11%	10%	39%	130%	16%	15%	18%
Option 1a	4332	1856	1.15	5.1%	2.9%	4,964	2,919	1	15%	11%	5,381	3,508	1	18%	17%
Difference	-104	-104	0	-0.9pp	-0.6pp	234	234	.28	0.9pp	1.2pp	517	517	0.32	1.5pp	3.2pp

**Table 43 Summary of number of fleet segments meeting the targets for economic indicators under Option 1a, sub-option i**

	2012			2017			2022		
	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1	Prop prof > 0.05	Prop ROI > 0.15	Prop Rev/Break Even Rev > 1
SSF	60%	33%	93%	80%	73%	100%	93%	80%	100%
1224*	27%	7%	87%	80%	67%	93%	93%	80%	93%
2440	38%	25%	56%	56%	50%	63%	56%	56%	75%
40XX	64%	18%	100%	100%	55%	100%	100%	73%	100%
<b>TOTAL</b>	<b>46%</b>	<b>21%</b>	<b>82%</b>	<b>77%</b>	<b>61%</b>	<b>88%</b>	<b>84%</b>	<b>72%</b>	<b>91%</b>
	Increase over 2012			32%	40%	5%	39%	51%	9%
Option 1a	47%	25%	82%	77%	53%	88%	82%	70%	89%
Difference	-2pp	-4pp	0pp	0pp	9pp	0pp	2pp	2pp	2pp

GVA is the indicator that differs most between Option 1 and Option 1a, with 1a showing lower levels of GVA in each forecast due to more conservative setting of TACs against the most sensitive species. The impact of a discard reduction policy on both options is the same.

The impact on GVA differs between Member States depending on the proportion of a MS fleet assessed as experiencing a high, medium or low impact. For example, the average impact across the EU is a 5% reduction in GVA in 2012 with a discard reduction policy compared to without it (see Table 41). For MS such as Poland the reduction in GVA in 2012 is as much as 15% and 14% for Belgium, while there is a negligible reduction for Finland as all its key fleet segments are not expected to be impacted by a discard reduction policy.

By 2017, the improved performance that is seen across all MS again differs depending on the composition of MS fleets and the estimated scale of impact a discard reduction policy will have on each fleet segment. Therefore with an EU average of 44% improvement in GVA with the discard reduction policy, for Finland GVA more than doubles while for Germany, France and Denmark the comparative improvements are less dramatic at 32%, 34% and 35% respectively.

Table 44 shows that by 2022 the forecast performance of all economic indicators has improved with the implementation of the discard reduction policy compared with Option 1a without a discard reduction policy. At a Member State level the improved performance is not sufficient to move the loss-making sectors of Belgium and Finland into profit, but losses are reduced and profit margins improve by 1 or 2 percentage points for other Member States. As Table 43 illustrates on a fleet size basis, performances improve so that more fleets do achieve the indicator targets.

The estimated impacts of a discard reduction policy on indicator 11 (fish prices) are limited as it is assumed that larger fish attract higher prices and therefore there is a market incentive to avoid catching small fish. Consequently new markets for small fish do not develop and the assumed price differentials by size grade presented in section 4.2 remain in place. There may be some impact on the local market prices for bait initially if undersized fish can be sold for human consumption, but more is landed rather than discarded, which would offset price increases for dependent segments such as long liners (HOK). This is therefore not expected to result in significant changes in the economic performance of these sectors as bait costs tend to represent a small fraction of total costs (e.g. bait costs represent 5% of total costs in the Gran Sol long line fishery).

Conversely it is the impact of price differentials associated with different size grades that drives the changes in fishing operations. This is evidenced in the Icelandic and Norwegian examples with improved gear selectivity even where 'undersized fish' can be sold into human consumption markets. The Scottish case study also shows that in addition to improved gear selectivity, vessels under a discard reduction policy are more likely to move grounds to avoid juvenile fish.

**Table 44 Results from EIAA modelling comparing forecast for 2022 for Option 1a no discard reduction policy with sub-option i (discard reduction policy)**

2022	Option 1a					Sub option i				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
Indicator	7	7	8	9	10	7	7	8	9	10
BEL	93	57	0.95	-8%	-20%	106	70	0.95	-8%	-22%
DEU	185	161	1.76	41%	470%	212	188	1.78	42%	552%
DNK	383	281	1.44	18%	17%	410	308	1.45	19%	20%
EST	31	15	1.49	29%	57%	35	19	1.60	34%	75%
ESP	1627	971	1.13	9%	6%	1789	1134	1.14	10%	7%
FIN	16	7	1.10	-13%	-21%	17	8	1.12	-11%	-18%
FRA	1088	707	1.31	17%	22%	1184	803	1.33	19%	27%
GBR	853	581	1.48	28%	23%	928	656	1.50	30%	26%
IRL	254	173	1.52	30%	36%	273	192	1.55	31%	40%
LTU	7	6	1.43	29%	135%	7	6	1.45	30%	158%
LVA	16	9	1.95	48%	217%	16	10	2.04	50%	238%
NLD	419	266	1.41	20%	47%	478	325	1.47	24%	63%
POL	42	30	1.66	36%	32%	45	33	1.68	37%	35%
PRT	293	201	1.33	18%	19%	320	227	1.30	17%	20%
SWE	75	44	1.78	38%	36%	78	48	1.82	40%	40%
<b>TOTAL</b>	<b>5381</b>	<b>3508</b>	<b>1.31</b>	<b>18%</b>	<b>17%</b>	<b>5898</b>	<b>4025</b>	<b>1.32</b>	<b>20%</b>	<b>20%</b>
Increase over 2012	24%	89%	13%	13%	14%	39%	130%	16%	15%	18%

## Mediterranean economic indicators option 1ai

**Table 45 Projections of gross value added (mln €) by fleet segment for catching sector (option 1ai)**

Fleet segment	2008	2012	2017	2022	2017 var %	2022 var %
Demersal trawlers	47.25	45.45	2.05	2.25	-95%	-95%
Purse seiners	16.85	12.18	19.57	20.15	61%	65%
Small scale fishery	31.60	32.00	70.43	72.49	120%	127%
Polyvalent	0.53	0.16	0.58	0.77	268%	384%
Polyvalent passive	8.83	6.50	11.23	12.62	73%	94%
Longlines	21.62	14.70	23.87	26.72	62%	82%
<b>Total</b>	<b>126.68</b>	<b>111.00</b>	<b>127.73</b>	<b>135.01</b>	<b>15%</b>	<b>22%</b>
<b>Option 1a</b>	<b>126.68</b>	<b>117.57</b>	<b>117.77</b>	<b>115.69</b>	<b>0%</b>	<b>-2%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-6.57</b>	<b>9.96</b>	<b>19.32</b>		

**Table 46 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1ai)**

Fleet segment	2008	2012	2017	2022	2017 var %	2022 var %
Demersal trawlers	1.18	1.13	1.38	1.42	22%	25%
Purse seiners	1.54	1.37	1.54	1.58	13%	16%
Small scale fishery	1.47	1.43	1.64	1.68	15%	17%
Polyvalent	1.17	0.94	1.16	1.25	23%	34%
Polyvalent passive	1.64	1.46	1.65	1.72	13%	18%
Longlines	1.65	1.43	1.64	1.71	14%	20%
<b>Total</b>	<b>1.33</b>	<b>1.26</b>	<b>1.64</b>	<b>1.69</b>	<b>30%</b>	<b>34%</b>
<b>Option 1a</b>	<b>1.33</b>	<b>1.28</b>	<b>1.61</b>	<b>1.63</b>	<b>26%</b>	<b>27%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-0.02</b>	<b>0.03</b>	<b>0.06</b>		

**Table 47 Projections of net profit margin by fleet segment for catching sector (option 1ai)**

Fleet segment	2008	2012	2017	2022	2017 var	2022 var
Demersal trawlers	-12.6%	-0.2%	18.9%	24.4%	19.1%	24.5%
Purse seiners	8.2%	2.1%	19.3%	22.2%	17.3%	20.2%
Small scale fishery	13.8%	29.8%	43.1%	44.8%	13.3%	14.9%
Polyvalent	-5.2%	-13.3%	11.5%	19.6%	24.8%	32.9%
Polyvalent passive	14.1%	15.8%	31.1%	35.6%	15.3%	19.8%
Longlines	21.1%	16.4%	31.1%	35.8%	14.7%	19.4%
<b>Total</b>	<b>0.7%</b>	<b>8.1%</b>	<b>36.7%</b>	<b>39.2%</b>	<b>28.6%</b>	<b>31.1%</b>
<b>Option 1a</b>	<b>0.7%</b>	<b>10.4%</b>	<b>35.2%</b>	<b>36.3%</b>	<b>24.7%</b>	<b>25.9%</b>
<b>Difference to option 1a</b>	<b>0.0pp</b>	<b>-2.3pp</b>	<b>1.6pp</b>	<b>2.9pp</b>		

**Table 48 Projections of return on investment by fleet segment for catching sector (option 1ai)**

Fleet segment	2008	2012	2017	2022	2017 var	2022 var
Demersal trawlers	14.7%	15.6%	32.4%	42.8%	16.7%	27.1%
Purse seiners	31.6%	20.5%	44.0%	50.6%	23.5%	30.1%
Small scale fishery	54.1%	56.4%	136.7%	156.1%	80.4%	99.8%
Polyvalent	20.4%	4.6%	25.2%	37.8%	20.6%	33.1%
Polyvalent passive	43.6%	32.4%	61.5%	77.0%	29.2%	44.7%
Longlines	62.9%	42.4%	76.6%	95.5%	34.2%	53.1%

<b>Total</b>	<b>28.2%</b>	<b>27.5%</b>	<b>98.5%</b>	<b>115.1%</b>	<b>71.0%</b>	<b>87.7%</b>
<b>Option 1a</b>	<b>28.2%</b>	<b>30.4%</b>	<b>90.9%</b>	<b>98.2%</b>	<b>60.5%</b>	<b>67.8%</b>
<b>Difference to option 1a</b>	<b>0.0%</b>	<b>-2.9%</b>	<b>7.6%</b>	<b>17.0%</b>		

Table 45, Table 46, Table 47 and Table 48 present the modelled results for the Sicilian fleet under Option 1ai. The large reduction in effort and capacity required in the demersal trawl segment in order for the multispecies stock complex constraint to be achieved under Option 1a from CFPIA, *i.e.* the management of the multispecies stock complex in order to achieve MSY management of European hake. This explains the 95% decrease in gross value added for the demersal fleet segment, though performance for the other indicators is not so significantly impacted. Compared to option 1a, option 1ai increases the GVA percentage change from a 96% decrease to a 95% decrease.

Comparison of output for Option 1a and Option 1ai indicates that in general economic performance is increased with the implementation of the discard reduction policy by 2017 and 2022 with the most notable increases experienced by the polyvalent and passive polyvalent segments that are reliant on stocks with high discard levels. However in 2012 the economic performance of all fleet segments is worse with the discard reduction policy given the expected lower value of catch. This is most notable again for the polyvalent and passive polyvalent gear segments due to their reliance on stocks with high discard levels, and also the purse seine fleet due to investment in cameras.

### **5.2.3 Economic Indicators: fishing operators receiving 20% value of undersize landings**

This section presents the EIAA model outputs for sub-option ii, which assumes only 20% of the value of undersized fish landed is returned to the fishing operation. This is seen as providing an additional incentive to reduce catching undersized fish.

Table 49 presents the results for the economic indicators 7 to 10 on GVA, revenue/break even, profit and return on investment. Sub-option ii only differs to sub-option i with a further reduction in 2012 revenue levels. As would be expected, in 2012 the impact of the discard reduction policy with 20% return on value of undersized is more marked than where the full value of undersized fish is returned to the fleet. This additional reduction in income is not, however, sufficient to significantly alter the overall economic performance of the fleets.

One Member State difference of note is the comparatively larger impacts experienced by the Netherlands fleet in 2012 as much less income would be received for the small plaice taken in the sole fishery (a 12% difference between the two sub-options). For the Netherlands catching sector, which is estimated to be just above break-even levels in 2012 under Option 1a, this results in the sector seeing a 5% net loss with sub-option ii compared to a 2% net loss with sub-option i. All other MS see a smaller GVA (around 6% less) with sub-option ii compared with sub-option I, but this does not move MS sectors into negative profit margins.

For sub-option ii, economic performance across all indicators has improved by 2017 and exceeds those estimated for Option 1a without a discard reduction policy.

It is expected that the reduced revenue from receiving only 20% of the value of undersized fish would create a strong incentive to change fishing operations through improved gear selectivity and altered fishing areas. This could occur more quickly under sub-option ii due to the stronger incentive, but by 2017 under both sub-options the fleets are expected to have made the necessary changes to avoid catching smaller grade fish, including undersized fish.

Results for sub-option ii are therefore the same as for sub-option I from 2017 onwards with improved performance over Option 1 alone.

The price differential between human consumption markets for the smallest size grades is assumed to be sufficiently large to drive industry change. By 2017 changes will therefore have been implemented, irrespective of whether operators receive 20% or 100% of the value of undersized. Additionally by 2017 a recovery in most stocks is expected to result in catch profiles that will include more of the larger size grades. The proportion of revenue from undersized will therefore have reduced to a point where differences in returns from this portion of the catch should not significantly impact upon economic performance.

**Table 49 Results from EIAA model by MS for Option 1a, sub-option ii (20% of value of undersized landings)**

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
BEL	74	10	0.93	-14%	-16%	87	45	0.94	-10%	-19%	106	70	0.95	-8%	-22%
DEU	124	87	1.46	26%	116%	178	150	1.71	39%	314%	212	188	1.78	42%	552%
DNK	280	162	1.29	2%	1%	377	269	1.41	15%	12%	410	308	1.45	19%	20%
EST	24	6	1.17	8%	10%	33	16	1.49	29%	58%	35	19	1.60	34%	75%
ESP	1262	350	1.01	-4%	-1%	1507	776	1.11	6%	3%	1789	1134	1.14	10%	7%
FIN	14	2	0.92	-44%	-48%	16	7	1.06	-18%	-27%	17	8	1.12	-11%	-18%
FRA	887	420	1.17	4%	4%	1089	682	1.29	15%	19%	1184	805	1.34	19%	28%
GBR	616	247	1.20	8%	3%	808	515	1.42	24%	16%	928	656	1.50	30%	26%
IRL	202	101	1.30	15%	10%	254	168	1.49	28%	29%	273	192	1.55	31%	40%
LTU	4	3	1.20	14%	22%	7	6	1.40	27%	89%	7	6	1.45	30%	158%
LVA	12	5	1.32	22%	49%	16	9	1.86	45%	184%	16	10	2.04	50%	238%
NLD	300	91	1.11	-5%	-7%	407	239	1.35	16%	31%	478	325	1.47	24%	63%
POL	30	16	1.39	20%	9%	42	29	1.62	34%	26%	45	33	1.68	37%	35%
PRT	238	128	1.36	17%	12%	300	201	1.30	17%	16%	320	227	1.30	17%	20%
SWE	58	23	1.41	18%	9%	76	43	1.74	37%	32%	78	48	1.82	40%	40%
<b>TOTAL</b>	<b>4125</b>	<b>1649</b>	<b>1.14</b>	<b>3%</b>	<b>2%</b>	<b>5198</b>	<b>3154</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>5898</b>	<b>4027</b>	<b>1.33</b>	<b>20%</b>	<b>20%</b>
				Increase over 2012		26%	91%	12%	12%	11%	43%	144%	16%	16%	19%
Option 1a	<b>4332</b>	<b>1856</b>	<b>1.15</b>	<b>5%</b>	<b>3%</b>	4964	2919	1.27	15%	11%	5381	3508	1.3	18%	17%
Difference to Option 1a	-207	-207	-0.01	-1.6pp	-1.0pp	234	235	0.01	1pp	2pp	517	519	0.03	2pp	3pp

Table 50 Results from EIAA model by fleet size for Option 1a, sub-option ii

Indicator	2012					2017					2022				
	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return On Investment
	7	8	9	10	7	8	9	10	7	8	9	10			
SSF	709	424	1.38	18%	12%	848	599	1.55	29%	26%	909	675	1.60	31%	32%
1224*	1093	439	1.08	0%	0%	1434	900	1.21	13%	13%	1626	1140	1.26	17%	24%
2440	1101	280	1.01	-6%	-3%	1375	752	1.11	5%	4%	1670	1118	1.15	9%	11%
40XX	1221	505	1.23	7%	3%	1542	904	1.42	22%	13%	1693	1095	1.50	27%	21%
<b>TOTAL</b>	<b>4125</b>	<b>1649</b>	<b>1.14</b>	<b>3%</b>	<b>2%</b>	<b>5198</b>	<b>3154</b>	<b>1.28</b>	<b>16%</b>	<b>13%</b>	<b>5898</b>	<b>4027</b>	<b>1.33</b>	<b>20%</b>	<b>20%</b>
				Increase over 2012		26%	91%	12%	12%	11%	43%	144%	16%	16%	19%
Option 1a	4332	1856	1.15	5%	3%	4,964	2,919	1.27	15%	11%	5,381	3,508	1.31	18%	17%
Difference	-207	-207	0.01	-1.6pp	-1.0pp	234	235	0.01	0.9pp	1.2pp	517	519	0.02	1.6pp	3.4pp

## Mediterranean economic impacts option 1aii

**Table 51 Projections of gross value added (mln €) by fleet segment for catching sector (option 1aii)**

Fleet segment	2008	2012	2017	2022	2017 var %	2022 var %
Demersal trawlers	47.25	42.14	2.05	2.25	-95%	-95%
Purse seiners	16.85	11.89	19.57	20.15	65%	69%
Small scale fishery	31.60	30.44	70.43	72.49	131%	138%
Polyvalent	0.53	0.11	0.58	0.77	438%	607%
Polyvalent passive	8.83	5.97	11.23	12.62	88%	111%
Longlines	21.62	13.87	23.87	26.72	72%	93%
<b>Total</b>	<b>126.68</b>	<b>104.43</b>	<b>127.73</b>	<b>135.01</b>	<b>22%</b>	<b>29%</b>
<b>Option 1a</b>	<b>126.68</b>	<b>117.57</b>	<b>117.77</b>	<b>115.69</b>	<b>0%</b>	<b>-2%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-13.14</b>	<b>9.96</b>	<b>19.32</b>		

**Table 52 Projections of ratio of revenues to break even revenue by fleet segment for catching sector (option 1aii)**

Fleet segment	2008	2012	2017	2022	2017 var %	2022 var %
Demersal trawlers	1.18	1.12	1.38	1.42	23%	27%
Purse seiners	1.54	1.36	1.54	1.58	13%	16%
Small scale fishery	1.47	1.41	1.64	1.68	16%	19%
Polyvalent	1.17	0.91	1.16	1.25	28%	38%
Polyvalent passive	1.64	1.43	1.65	1.72	15%	20%
Longlines	1.65	1.41	1.64	1.71	16%	22%
<b>Total</b>	<b>1.33</b>	<b>1.24</b>	<b>1.64</b>	<b>1.69</b>	<b>32%</b>	<b>36%</b>
<b>Option 1a</b>	<b>1.33</b>	<b>1.28</b>	<b>1.61</b>	<b>1.63</b>	<b>26%</b>	<b>27%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-0.03</b>	<b>0.03</b>	<b>0.06</b>		

**Table 53 Projections of net profit margin by fleet segment for catching sector (option 1aii)**

Fleet segment	2008	2012	2017	2022	2017 var	2022 var
Demersal trawlers	-12.6%	-2.1%	18.9%	24.4%	21.1%	26.5%
Purse seiners	8.2%	1.4%	19.3%	22.2%	18.0%	20.9%
Small scale fishery	13.8%	28.7%	43.1%	44.8%	14.4%	16.1%
Polyvalent	-5.2%	-17.6%	11.5%	19.6%	29.0%	37.2%
Polyvalent passive	14.1%	13.3%	31.1%	35.6%	17.8%	22.3%
Longlines	21.1%	14.6%	31.1%	35.8%	16.5%	21.1%
<b>Total</b>	<b>0.7%</b>	<b>6.4%</b>	<b>36.7%</b>	<b>39.2%</b>	<b>30.4%</b>	<b>32.8%</b>
<b>Option 1a</b>	<b>0.7%</b>	<b>10.4%</b>	<b>35.2%</b>	<b>36.3%</b>	<b>24.7%</b>	<b>25.9%</b>
<b>Difference to option 1a</b>	<b>0.0pp</b>	<b>-4.0pp</b>	<b>1.6pp</b>	<b>2.9pp</b>		

**Table 54 Projections of return on investment by fleet segment for catching sector (option 1aii)**

Fleet segment	2008	2012	2017	2022	2017 var	2022 var
Demersal trawlers	14.7%	14.4%	32.4%	42.8%	18.0%	28.4%
Purse seiners	31.6%	19.9%	44.0%	50.6%	24.1%	30.7%
Small scale fishery	54.1%	53.5%	136.7%	156.1%	83.3%	102.7%
Polyvalent	20.4%	2.4%	25.2%	37.8%	22.8%	35.3%
Polyvalent passive	43.6%	29.6%	61.5%	77.0%	31.9%	47.4%
Longlines	62.9%	39.8%	76.6%	95.5%	36.8%	55.7%

<b>Total</b>	<b>28.2%</b>	<b>25.6%</b>	<b>98.5%</b>	<b>115.1%</b>	<b>72.9%</b>	<b>89.5%</b>
<b>Option 1a</b>	<b>28.2%</b>	<b>30.4%</b>	<b>90.9%</b>	<b>98.2%</b>	<b>60.5%</b>	<b>67.8%</b>
<b>Difference to option 1a</b>	<b>0.0pp</b>	<b>-4.8pp</b>	<b>7.6pp</b>	<b>17.0pp</b>		

Table 51, Table 52, Table 53 and Table 54 give the modelled output for Option 1aii. Improvements in long-term economic performance across all segments is equivalent to Option 1ai, but with a larger sacrifice in short-term economic performance due to the 80% reduction value of undersized landing. This is particularly the case for polyvalent and passive polyvalent vessels.

#### **5.2.4 Social Indicators: fishing operators receiving total value of landings**

##### ***Indicator 13 Employment***

There is no expected change under option 1ai (see section 0).

##### ***Indicator 16 and 17 Social Sustainability Attractiveness of the sector***

In the long-term, Table 55 demonstrates increases in GVA per employee is expected to increase over option 1a through option 1ai. In option 1ai, an increase of 113% in 2017 is expected over the 2012 compared to 86% in option 1a. When comparing to the two options in 2022, the change is expected to be 194% compared to 142%. As under section 0 and 5.1.5, this change in actual figures is driven by the increase in the fleet's GVA, as the employment FTE does not change. However, the percentage change is somewhat contributed to, but not significantly, by the decrease in indicator 16 for 2012 under option 1ai (5.6% decrease on the standard option 1a).

The same trends are seen in indicator 17. In option 1a this indicator produced increases of 73% and 125% over the 2012 figure in 2017 and 2022 respectively. Under option 1ai, the expected increase in crew share is 97% and 172% over the 2012 figure in 2017 and 2022 respectively.

Table 55 Option 1ai: Trends in social indicators by Member State (2012 percentage change are on option 1a)

Indicator	2012					2017					2022				
	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE
	a2	13	13a	16	17	a2	13	13a	16	17	a2	13	13a	16	17
BEL	80	445	6	28340	42180	59	290	5	154544	174073	49	247	5	284132	308241
DEU	317	671	2	136473	74386	244	502	2	298705	151297	205	440	2	427201	215602
DNK	400	1266	3	131699	79737	384	1125	3	239298	141160	347	1062	3	289729	169554
EST	800	2475	3	2611	966	752	2393	3	6558	1994	752	2278	3	8135	2391
ESP	10974	24531	2	15602	14853	9585	19859	2	39079	31820	9014	18038	2	62858	50528
FIN	1248	1640	1	1340	2086	1105	1338	1	4867	4168	1054	1242	1	6232	4798
FRA	2528	8488	3	51830	35942	2252	7093	3	95925	61716	2143	6540	3	122742	77411
GBR	2954	4812	2	54284	31903	2499	3826	2	134724	72153	2251	3564	2	183955	96712
IRL	1372	2402	2	43704	23717	1263	2178	2	77006	38780	1243	2072	2	92446	45579
LTU	19	40	2	70559	52289	14	35	2	160559	105320	12	33	3	193533	123978
LVA	737	1212	2	4033	1475	646	1160	2	7904	1567	611	1101	2	9190	1591
NLD	279	1418	5	72737	47636	245	1172	5	203703	113218	222	1072	5	302954	161214
POL	656	1396	2	11581	5315	557	1269	2	22891	10192	521	1194	2	27328	12119
PRT	2247	8409	4	15892	8388	1991	7803	4	25717	16813	1898	7324	4	31032	20967
SWE	793	1001	1	23528	6257	638	908	1	47876	12570	607	854	1	56116	14785
<b>TOTAL</b>	<b>25403</b>	<b>60204</b>	<b>2</b>	<b>29109</b>	<b>20113</b>	<b>22236</b>	<b>50950</b>	<b>2</b>	<b>61875</b>	<b>39637</b>	<b>20931</b>	<b>47062</b>	<b>2</b>	<b>85524</b>	<b>54791</b>
				Increase on 2012		-12%	-15%	-3%	113%	97%	-18%	-22%	-5%	194%	172%
<b>Option 1a</b>	<b>25403</b>	<b>60204</b>	<b>2.4</b>	<b>30832</b>	<b>21224</b>	22,236	50,950	2	57,282	36,710	20,931	47,062	2	74,536	47,728
<b>Difference to 1a</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-1723</b>	<b>-1111</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4593</b>	<b>2927</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10988</b>	<b>7063</b>

The same short term decreases but long term improvements are experienced in the Mediterranean. Comparisons between Table 56 and Table 57 demonstrates the GVA per employee indicator in 2012 under option 1ai will be lower than under option 1a (option 1ai = €17.8 thousand; option 1a = €18.9 thousand) given the initial reduction in average fish price. In 2017 and 2022 GVA per employee shows increases in option 1ai over option 1a. Option 1ai in 2017 is €29.9 thousand and €33.61 thousand in 2022. Option 1a is €26.75 thousand and €28.81 thousand in 2017 and 2022 respectively.

**Table 56 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1ai)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	17.87	19.65	37.73	45.93	92%	134%
Purse seiners	30.62	22.14	41.31	47.05	87%	112%
Small scale fishery	12.48	12.97	30.49	34.72	135%	168%
Polyvalent	3.87	1.19	4.70	6.83	294%	473%
Polyvalent passive	18.76	14.16	26.16	32.53	85%	130%
Longlines	33.56	23.41	40.61	50.29	73%	115%
<b>Total</b>	<b>18.16</b>	<b>17.80</b>	<b>29.00</b>	<b>33.61</b>	<b>63%</b>	<b>89%</b>
<b>Option 1a</b>	<b>18.16</b>	<b>18.90</b>	<b>26.75</b>	<b>28.81</b>	<b>42%</b>	<b>52%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-2.20</b>	<b>2.25</b>	<b>4.79</b>		

**Table 57 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1a)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	17.87	21.08	34.40	38.53	63%	83%
Purse seiners	30.62	22.67	39.77	43.74	75%	93%
Small scale fishery	12.48	13.60	28.13	29.75	107%	119%
Polyvalent	3.87	1.57	3.69	4.61	135%	194%
Polyvalent passive	18.76	15.30	23.01	25.66	50%	68%
Longlines	33.56	24.73	37.01	42.29	50%	71%
<b>Total</b>	<b>18.16</b>	<b>18.90</b>	<b>26.75</b>	<b>28.81</b>	<b>42%</b>	<b>52%</b>

Long term increases in crew share are also expected under option 1ai when compared to option 1a. In 2017 option1ai is €10.94 thousand while option 1a = €10.14 thousand and in 2022 in option1ai = €12.58 thousand while option 1a is €10.88 thousand (see Table 58 and Table 59). Short term decreases are expected in 2012 as with GVA per employee. The 2012 value in option 1ai (€7.74 thousand) is lower than option 1 (€8.17 thousand).

**Table 58 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1ai)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	9.58	10.42	18.92	22.79	82%	119%
Purse seiners	11.09	8.40	14.50	16.32	73%	94%
Small scale fishery	5.42	5.61	12.58	14.26	124%	154%
Polyvalent	1.32	0.55	1.56	2.18	186%	299%
Polyvalent passive	6.92	5.34	9.47	11.67	77%	119%
Longlines	9.82	7.26	11.71	14.33	61%	97%
<b>Total</b>	<b>7.87</b>	<b>7.74</b>	<b>10.94</b>	<b>12.58</b>	<b>41%</b>	<b>63%</b>
<b>Option 1a</b>	<b>7.87</b>	<b>8.17</b>	<b>10.14</b>	<b>10.88</b>	<b>24%</b>	<b>33%</b>
<b>Difference to option 1a</b>	<b>0.00</b>	<b>-0.43</b>	<b>0.80</b>	<b>1.70</b>		

**Table 59 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1a)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	9.58	11.09	17.35	19.30	56%	74%
Purse seiners	11.09	8.57	14.01	15.27	63%	78%
Small scale fishery	5.42	5.87	11.64	12.29	98%	109%
Polyvalent	1.32	0.65	1.27	1.53	94%	134%
Polyvalent passive	6.92	5.73	8.39	9.30	46%	62%
Longlines	9.82	7.63	10.74	12.17	41%	59%
<b>Total</b>	<b>7.87</b>	<b>8.17</b>	<b>10.14</b>	<b>10.88</b>	<b>24%</b>	<b>33%</b>

### **Indicator 28 Safety at sea**

The impacts of economic performance on safety at sea have been discussed thoroughly in sections 0 and 5.1.5. Under the assumptions that there is a correlation with increases in economic performance and increases in safety at sea, we could expect the pace at which fleets reach zero non-fatal accidents to be quicker under option 1ai than under option 1a.

### **5.2.5 Social Indicators: fishing operators receiving 20% value of undersize landings**

#### **Indicator 13 Employment**

The expected change in employment FTE is as a result of that discussed in section (see section 5.1.5). There is no change expected in 2012, but for 2017 employment FTE reduces from 50,950 in option 1a to 50,939 in option 1aii. In 2022, employment FTE has decreased also from 47,062 in option 1a to 47,047 in option 1aii.

#### **Indicator 16 and 17 Social Sustainability Attractiveness of the sector**

Indicators 16 and 17 under option 1ii also follow the same trends as in section 5.1.5. In 2012 these indicators are €27,386 for indicator 16 and (a decrease of 11.2% on option 1a) €19,003 for indicator 17 (a decrease of 10.5% on option 1a). There is the same expected

increase in 2017 and 2022 on the 2012 figures, which are accentuated through the reduction of employment FTE. In 2017, GVA per employee has increased from € 57,282 under option 1a to € 61,916 under option 1aii. In 2022, the increase is expected to be from € 74,536 under option 1a to €85,599 under option 1aii. Similar increases are also expected in crew wage per FTE. In 2017, crew wage increases from € 36,710 under options 1a to € 39,648 in option 1aii. For 2022, it increases from € 47,728 under option 1a to €54,811 under option 1aii.

**Table 60 Option 1a: Trends in social indicators by Member State (percentage changes in 2012 are on option 1a)**

Indicator	2012					2017					2022				
	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE	Fleet size (no)	Employment (FTE)	Employment (FTE) per vessel	Value added per employee (€)	Crew wage (€) per FTE
	a2	13	13a	16	17	a2	13	13a	16	17	a2	13	13a	16	17
BEL	80	445	6	21888	35335	59	290	5	154544	174073	49	247	5	284132	308241
DEU	317	671	2	129053	70575	244	502	2	298705	151297	205	440	2	427201	215602
DNK	400	1266	3	127843	77462	384	1125	3	239298	141160	347	1062	3	289729	169554
EST	800	2475	3	2303	894	752	2393	3	6558	1994	752	2278	3	8135	2391
ESP	10974	24531	2	14257	13807	9585	19859	2	39079	31820	9014	18038	2	62858	50528
FIN	1248	1640	1	1231	2014	1105	1338	1	4867	4168	1054	1242	1	6232	4798
FRA	2528	8488	3	49432	34567	2197	7082	3	96272	61832	2046	6526	3	123364	77607
GBR	2954	4812	2	51392	30375	2499	3826	2	134724	72153	2251	3564	2	183955	96712
IRL	1372	2402	2	42091	22931	1263	2178	2	77006	38780	1243	2072	2	92446	45579
LTU	19	40	2	67218	50278	14	35	2	160559	105320	12	33	3	193533	123978
LVA	737	1212	2	3905	1469	646	1160	2	7904	1567	611	1101	2	9190	1591
NLD	279	1418	5	64511	43575	245	1172	5	203703	113218	222	1072	5	302954	161214
POL	656	1396	2	11213	5141	557	1269	2	22891	10192	521	1194	2	27328	12119
PRT	2247	8409	4	15212	7767	1991	7803	4	25717	16813	1898	7324	4	31032	20967
SWE	793	1001	1	22790	6054	638	908	1	47876	12570	607	854	1	56116	14785
<b>TOTAL</b>	<b>25403</b>	<b>60204</b>	<b>2</b>	<b>27386</b>	<b>19003</b>	<b>22181</b>	<b>50939</b>	<b>2</b>	<b>61916</b>	<b>39648</b>	<b>20834</b>	<b>47047</b>	<b>2</b>	<b>85599</b>	<b>54811</b>
				Increase on 2012		-13%	-15%	-3%	126%	109%	-18%	-22%	-5%	213%	188%
<b>Option 1a Difference to 1a</b>	<b>25403</b>	<b>60204</b>	<b>2</b>	<b>30832</b>	<b>21224</b>	<b>22,236</b>	<b>50,950</b>	<b>2</b>	<b>57,282</b>	<b>36,710</b>	<b>20,931</b>	<b>47,062</b>	<b>2</b>	<b>74,536</b>	<b>47,728</b>
	<b>0</b>	<b>0</b>	<b>0</b>	<b>-3,446</b>	<b>-2,221</b>	<b>-56</b>	<b>-11</b>	<b>0</b>	<b>4,634</b>	<b>2,938</b>	<b>-97</b>	<b>-14</b>	<b>0</b>	<b>11,063</b>	<b>7,084</b>

The Mediterranean results for indicators 16 and 17 have not changed for 2017 and 2022 under option 1ii. This results in a reduction of the 2012 figure to €16.69 thousand (decrease of 6%) for indicator 16 and €7.31 thousand (decrease of 6%) for indicator 17.

**Table 61 Projections of GVA per employee (000 €) by fleet segment for catching sector (option 1aii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	17.87	18.22	37.73	45.93	107%	152%
Purse seiners	30.62	21.61	41.31	47.05	91%	118%
Small scale fishery	12.48	12.33	30.49	34.72	147%	182%
Polyvalent	3.87	0.82	4.70	6.83	475%	736%
Polyvalent passive	18.76	13.02	26.16	32.53	101%	150%
Longlines	33.56	22.08	40.61	50.29	84%	128%
<b>Total</b>	<b>18.16</b>	<b>16.69</b>	<b>29.00</b>	<b>33.61</b>	<b>74%</b>	<b>101%</b>
<b>Option 1a</b>	<b>18.16</b>	<b>18.90</b>	<b>26.75</b>	<b>28.81</b>	<b>42%</b>	<b>52%</b>
<b>Difference to 1a</b>	<b>0.00</b>	<b>-2.20</b>	<b>2.25</b>	<b>4.79</b>		

**Table 62 Projections of average crew wage per employee (000 €) by fleet segment for catching sector (option 1aii)**

<b>Fleet segment</b>	<b>2008</b>	<b>2012</b>	<b>2017</b>	<b>2022</b>	<b>2017 var %</b>	<b>2022 var %</b>
Demersal trawlers	9.58	9.74	18.92	22.79	94%	134%
Purse seiners	11.09	8.23	14.50	16.32	76%	98%
Small scale fishery	5.42	5.36	12.58	14.26	135%	166%
Polyvalent	1.32	0.44	1.56	2.18	257%	398%
Polyvalent passive	6.92	4.95	9.47	11.67	92%	136%
Longlines	9.82	6.89	11.71	14.33	70%	108%
<b>Total</b>	<b>7.87</b>	<b>7.31</b>	<b>10.94</b>	<b>12.58</b>	<b>50%</b>	<b>72%</b>
<b>Option 1a</b>	<b>7.87</b>	<b>8.17</b>	<b>10.14</b>	<b>10.88</b>	<b>24%</b>	<b>33%</b>
<b>Difference to 1a</b>	<b>0.00</b>	<b>-0.86</b>	<b>0.80</b>	<b>1.70</b>		

### **Indicator 28 Safety at sea**

There could be a negative impact on the fleet's rate of non-fatal accidents in 2012 for option 1aii compared to option 1ai. This is given the decreased economic performance of the policy option and based on the assumptions discussed in indicator 28 of section 0 and 5.1.5.

### **5.2.6 Governance Indicators**

Under the impact assessment for the standard option 1a, it was considered that greater management costs may occur given the stricter quota requirements. As TACs were reduced to implement the ecosystem optimum, higher levels of monitoring and compliance may have been required given the lower economic performance of the fleet. With the new management systems required for a discard reduction policy (see section 5.1.6), the increased level of monitoring will counter the expected increase level in management costs from option 1 to option 1a.

## 6 Summary of the impact assessment

The following tables in section 6 give a comparison of the modelled outputs across options 1, 1(i), 1(ii), 1a, 1a(i) and 1a(ii). As can be seen through Figure 38 and comparisons in Table 63 and Table 64, option 1(i) appears to be the best performing policy when considered across all indicators.

**Table 63 Summary results of options for EIAA**

Indicator	Stocks at Fmsy	Income (mln)	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Return on Investment	Fleet size (no)	Employment (FTE)	Value added per employee (€)	Crew wage (€) per FTE	Crew share (mln)
	1	7	8	9	10		a2	13	16	17	
Option 1											
2012	3	4469	1920	1.15	5.3%	3.1%	25439	61863	31030	21379	1323
2017	47	5108	3029	1.27	15.0%	11.9%	22246	51664	58631	37717	1949
2022	81	5561	3657	1.31	18.3%	17.8%	20940	47746	76584	49289	2353
Option 1 i											
2012	3	4360	1811	1.15	4.4%	2.5%	25439	61863	29282	20248	1253
2017	47	5351	3272	1.28	15.9%	13.1%	22246	51664	63340	40728	2104
2022	81	6102	4197	1.32	19.8%	21.2%	20940	47746	87900	56596	2702
Option 1 ii											
2012	3	4252	1703	1.14	3.7%	2.0%	25439	61863	27535	19117	1183
2017	47	5351	3274	1.28	15.9%	13.2%	22190	51652	63380	40740	2104
2022	81	6102	4199	1.33	19.9%	21.3%	20843	47731	87975	56617	2702
Option 1a											
2012	3	4332	1856	1.15	5.1%	2.9%	25403	60204	30832	21224	1278
2017	52	4964	2919	1.27	14.8%	11.4%	22236	50950	57282	36710	1870
2022	89	5381	3508	1.31	18.2%	17.1%	20931	47062	74536	47728	2246
Option 1a i											
2012	3	4229	1752	1.15	4.2%	2.3%	25403	60204	29109	20113	1211
2017	52	5198	3153	1.28	15.7%	12.6%	22236	50950	61875	39637	2020
2022	89	5898	4025	1.32	19.7%	20.4%	20931	47062	85524	54791	2579
Option 1a ii											
2012	3	4125	1649	1.14	3.4%	1.8%	25403	60204	27386	19003	1144
2017	52	5198	3154	1.28	15.7%	12.7%	22181	50939	61916	39648	2020
2022	89	5898	4027	1.33	19.8%	20.5%	20834	47047	85599	54811	2579

**Table 64 Summary results of options for BIRDMOD**

Indicator	GVA (mln)	Revenue/ Break Even Revenue	Net Profit Margin	Fleet size (no)	Employment (FTE)	Value added per employee (€)	Crew wage (€ per FTE)	Crew wage (mln)
	8	9	10	a2	13	16	17	
Option 1								
2012	118	1.28	10%	3062	6552	18898	8171	54
2017	145	1.47	25%	2697	5316	27541	11214	60
2022	145	1.48	26%	2438	4805	30190	12235	59
Option 1 i								
2012	111	1.26	8%	3062	6552	17796	7739	51
2017	159	1.50	26%	2697	5316	30088	12182	65
2022	170	1.54	30%	2438	4805	35726	14342	69
Option 1 ii								
2012	104	1.24	6%	3062	6552	16694	7308	48
2017	159	1.50	26%	2697	5316	30088	12182	65
2022	170	1.54	30%	2438	4805	35726	14342	69
Option 1a								
2012	118	1.28	10%	3062	6552	18898	8171	54
2017	118	1.61	35%	2399	3979	26748	10140	40
2022	116	1.63	36%	2169	3597	28813	10881	39
Option 1a i								
2012	111	1.26	8%	3062	6552	17796	7739	51
2017	128	1.64	37%	2399	3979	28996	10937	44
2022	135	1.69	39%	2169	3597	33606	12580	45
Option 1a ii								
2012	104	1.24	6%	3062	6552	16694	7308	48
2017	128	1.64	37%	2399	3979	28996	10937	44
2022	135	1.69	39%	2169	3597	33606	12580	45

**Table 65 Summary of IA for all policies**

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
1	Stock situation in terms of fishing mortality in relation to MSY	All stocks at MSY	<ul style="list-style-type: none"> <li>• Number of northern stocks at Fmsy increases from 3 (2009) to 81 by 2022; improvement in Mediterranean stocks 4 at Fmsy to 15 in 2022;</li> <li>• Only 40% (11) deep sea stocks reach Fmsy</li> <li>• 30% of stocks in multispecies complexes are overexploited</li> <li>• Discarding reduced by 50% due to quota pooling, regional body actions, technical measures</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• Number of northern stocks at Fmsy increases from 3 (2009) to 89 by 2022; improvement in Mediterranean stocks 4 at Fmsy to 18 in 2022;</li> <li>• Only 50% (14) deep sea stocks reach Fmsy</li> <li>• All stocks in multispecies complexes are at Fmsy</li> <li>• Discarding reduced by 50% due to quota pooling, regional body actions, technical measures</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>
2	% of stocks and/or catches covered by LTMP	All stocks with LTMP	<ul style="list-style-type: none"> <li>• All stocks covered by LTMPs of some sort by 2017.</li> <li>• LTMPs will be accepted by Council and EP due to actions of RegBod, although they will be more complicated to negotiate with this multispecies policy</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• All stocks covered by LTMPs of some sort by 2017.</li> <li>• LTMPs will be accepted by Council and EP due to actions of RegBod, although they will be more complicated to negotiate with this multispecies policy</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>• No change</li> </ul> <p style="text-align: center;">=</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
3	Average size (length and weight) of fish	Increase in mean size for all stocks	<ul style="list-style-type: none"> <li>Mean fish size increases significantly as a result a) increased number of stocks at Fmsy b) decreased discarding</li> <li>Smart Green fisheries subsidy (i.e. modernisation) will facilitate increased selectivity.</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>Mean fish size in the stock decreases but this is due to removal of discarding smaller fish.</li> <li>Mean size of total catches increases, but landings do not.</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>Mean fish size increases significantly as a result a) increased number of stocks at Fmsy b) decreased discarding; but undermined by high levels of underexploitation</li> <li>Smart Green fisheries subsidy (i.e. modernisation) will facilitate increased selectivity.</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>Mean fish size in the stock decreases but this is due to removal of discarding smaller fish.</li> <li>Mean size of total catches increases, but landings do not.</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>As Option 1a (i)</li> </ul> <p style="text-align: center;">-</p>
4	Fleet evolution	Decrease in fleet size to balance stock size, of at least 30% of 2007 levels by 2017 and 40% by 2022	<ul style="list-style-type: none"> <li>Until 2015, fleet reduces in line with Operational Plans.</li> <li>In 2022 following ITR introduction the total EU fleet has declined by 25% from 2007 levels, LSF 24% and SSF 25%.</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>Reduction in French DFN 0012 and 1224 as a result of economically driven further fleet consolidation</li> <li>Fleet size reduces to 22190 in 2017 and 20843 in 2022</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>Similar to Option 1, though reduction in fleets necessary to meet "conservation optimum" in multispecies situations</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>Reduction in fleets expected in French DFN 0012 and 1224 sector due to economically driven fleet consolidation</li> <li>Fleet numbers decrease to 22181 in 2017 and 20834 in 2022.</li> </ul> <p style="text-align: center;"><b>+</b></p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
6	Area covered by protection regimes	Increase in protected areas to a maximum of 30% of fishable area	<ul style="list-style-type: none"> <li>Slight improvement due to emphasis on smart green subsidy policies</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;"><b>=</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;"><b>=</b></p>	<ul style="list-style-type: none"> <li>Slight improvement due to emphasis on smart green subsidy policies</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;"><b>=</b></p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;"><b>=</b></p>
7	<ul style="list-style-type: none"> <li>Gross valued added</li> <li>Revenue to break even revenue &gt; 1</li> <li>Net profit margin (NPM)</li> <li>Return on investment</li> </ul>	<ul style="list-style-type: none"> <li>Increase in GVA</li> <li>All fleets have a ratio of &gt;1</li> <li>All fleets have NPM of &gt;5%</li> <li>All catching segments have Rol &gt;15%; and all processing sectors have Rol &gt;10%</li> </ul>	<ul style="list-style-type: none"> <li>Change of emphasis in subsidies towards innovation and common measures supporting positive improvement in long-term.</li> <li>Through ITRs increasing stocks, economic performance will increase for the remaining participants.</li> <li>GVA increases from 1.9 to 3.7 bn</li> <li>Overall profitability increases from 5.3% to 18.3%.</li> <li>Number of unprofitable segments decreases to 7% in 2022.</li> <li>Increase in profitability much greater in the LSF: +29% compared to +9% in the SSF in 2017.</li> </ul>	<ul style="list-style-type: none"> <li>All economic indicators decrease in performance in 2012 but have increase on option 1 by 2017.</li> <li>GVA increases to 4.2bn</li> <li>Profitability increases to 20%</li> <li>84% of all fleets are profitable</li> <li>ROI is higher but not to same proportion as other economic indicators given the increased investment requirement.</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>Economic trends are the same as option 1 (i) except for 2012</li> <li>All economic indicators decrease more significantly in 2012 due to 80% confiscations of undersized fish</li> <li>GVA in 2012 drops to 1.7bn</li> <li>Fleet profitability is 4% in 2012</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>Change of emphasis in subsidies towards innovation and common measures supporting positive improvement in long-term.</li> <li>Through ITRs increasing stocks, economic performance will increase for the remaining participants.</li> <li>GVA increases from 1.9 to 3.5 bn</li> <li>Overall profitability increases from 5.1% to 18.2%.</li> <li>Number of unprofitable segments decreases to 9% in 2022.</li> <li>Increase in profitability much greater in the LSF: +29% compared to +9% in the SSF in 2017.</li> </ul>	<ul style="list-style-type: none"> <li>All economic indicators decrease in performance in 2012 but have increase on option 1a by 2017.</li> <li>GVA increases to 4.03bn</li> <li>Profitability increases to 20%</li> <li>84% of all fleets are profitable</li> <li>ROI is higher but not to same proportion as other economic indicators given the increased investment requirement.</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>Economic trends are the same as option 1 (ii) except for 2012</li> <li>All economic indicators decrease more significantly in 2012 due to 80% confiscations of undersized fish</li> <li>GVA in 2012 drops to 1.6bn</li> <li>Fleet profitability is 3.4% in 2012</li> </ul> <p style="text-align: center;"><b>+</b></p>
8								
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	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
			++			++		
11	Fish prices, market orientation	Fish prices remain stable	<ul style="list-style-type: none"> <li>Fish prices will increase as a result of improved status of stocks, better perceived marine stewardship and mean fish size.</li> <li>Enhanced CMO policy and subsidies directed toward marketing and promotional measures are also likely to improve prices.</li> </ul> <p>++</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>Fish prices will increase as a result of improved status of stocks, better perceived marine stewardship and mean fish size.</li> <li>Enhanced CMO policy and subsidies directed toward marketing and promotional measures are also likely to improve prices.</li> </ul> <p>++</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>
12	Level of subsidies / value of landings	Reduced and more targeted 'good' subsidies	<ul style="list-style-type: none"> <li>Long- and short-term, positive impacts as "bad" subsidies are reduced and "good" subsidies increased</li> <li>Targeting of subsidies specifically on "smart green" issues, and removal of fleet subsidies, will be positive</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>Long- and short-term, positive impacts as "bad" subsidies are reduced and "good" subsidies increased</li> <li>Targeting of subsidies specifically on "smart green" issues, and removal of fleet subsidies, will be positive</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
13	Employment	Improved employment	<ul style="list-style-type: none"> <li>Reduction in TACs will have short-term impacts on employment</li> <li>Introduction of ITR reduces total employment in capture fisheries.</li> <li>Declines are less in SSF than in LSF: decline of 10% in 2017, SSF: decline of 20% in 2017, LSF</li> <li>Ancillary employment likely to decrease as fleet declines</li> <li>processing employment likely to increase with increasing catches</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>A small decrease expected given the reduction in fleet numbers</li> <li>Employment levels decrease to 51652 in 2017 and 47731 in 2022</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>As Option 1, but with slightly greater declines</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>A small decrease expected given the reduction in fleet numbers</li> <li>Employment levels decrease to 50939 in 2017 and 47047 in 2022</li> </ul> <p style="text-align: center;">-</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
14	Status of fisheries dependent communities	Reversal of declining importance of fishing	<ul style="list-style-type: none"> <li>There will be significant increases in stock status and catches, and knock-on impacts on the status of some areas.</li> <li>Small scale coastal Fleet safeguards and Axis 2 diversification funds would be available to support any negative impacts of intra-MS quota transfers on communities</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option1, but with slightly lower increases in catch in multispecies fisheries</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>
16	Social sustainability: GVA per employee	Increase in GVA per employee	<ul style="list-style-type: none"> <li>Significant improvement in LSF following large improvements in GVA per employee; no change in SSF</li> <li>Increases in GVA per employee significantly more in LSF than in SSF:</li> <li>Increase of 43% in 2017 for SSF; increase of 92% in 2017 for LSF</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>Significant improvements following increased GVA performance and no change to employment levels</li> <li>Increases by 200% on 2012 figure.</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>In the long term, greater increases in GVA are expected due to the reduction in employment</li> <li>GVA per employee down to €27535 in 2012</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>As Option1, but with less improvement for both SSF and LSF due to;</li> <li>Increase of 42% in 2017 for SSF; increase of 90% in 2017 for LSF</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>Significant improvements following increased GVA performance and no change to employment levels</li> <li>Increases by 213% on 2012 figure.</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>In the long term, greater increases in GVA are expected due to the reduction in employment</li> <li>GVA per employee down to €27386 in 2012</li> </ul> <p style="text-align: center;">++</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
17	Attractiveness of the sector	Income at least 100% of national average	<ul style="list-style-type: none"> <li>• Significant improvement in the LSF due to very significant improvements in average crew wage, no significant change in SSF</li> <li>• Increases in average crew wage significantly more in LSF than in SSF: increase of 38% in 2017, SSF; increase of 80% in 2017, LSF</li> <li>• Smart green increases attractiveness, as does environmental performance of fisheries</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>• Large improvements also in attractiveness of the sector assuming stable proportion of profit goes to crew.</li> <li>• Average crew wage up to €87,900 in 2022</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>• Greater improvements expected in 2017 and 2022 given the reduced number of crew</li> <li>• Similar to GVA per employee, 2012 will have lower levels than option 1 and option 1(i)</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>• As Option 1, but with less improvement for both LSF and SSF due to lower profitability, through multispecies approach leading to slightly lower catches.</li> <li>• Increases in average crew wage significantly more in LSF than in SSF: increase of 38% in 2017, SSF; increase of 77% in 2017, LSF</li> <li>• Smart green increases attractiveness, as does environmental performance of fisheries</li> </ul> <p style="text-align: center;"><b>++</b></p>	<ul style="list-style-type: none"> <li>• Large improvements also in attractiveness of the sector assuming stable proportion of profit goes to crew.</li> <li>• Average crew wage up to €85,524 in 2022</li> </ul> <p style="text-align: center;"><b>+</b></p>	<ul style="list-style-type: none"> <li>• Greater improvements expected in 2017 and 2022 given the reduced number of crew</li> <li>• Similar to GVA per employee, 2012 will have lower levels than option 1 and option 1a(i)</li> </ul> <p style="text-align: center;"><b>++</b></p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
28	Safety	The accident rate (accidents per FTE) should decrease to zero	<ul style="list-style-type: none"> <li>Positive for LSF because of reduced competition under ITR and significant improvements in profitability and GVA/vessel</li> <li>Smaller increase for SSF due to smaller improvements in profitability and GVA/vessel</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>Positive impact on the rate of decreasing non-fatal accidents due to overall increased economic performance</li> <li>May experience slight stalling in reduction of incidents in 2012 given the lower performance</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As with option 1(i) but perhaps greater stalling in rate of incidents decreasing due to lower economic performance in 2012.</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As Option 1</li> </ul> <p style="text-align: center;">++</p>	<ul style="list-style-type: none"> <li>Positive impact on the rate of decreasing non-fatal accidents due to overall increased economic performance compared to option 1</li> <li>May experience slight stalling in reduction of incidents in 2012 given the lower performance</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As with option 1a(i) but perhaps greater stalling in rate of incidents decreasing due to lower economic performance in 2012.</li> </ul> <p style="text-align: center;">+</p>
18	Departure of quotas from Scientific advice	Deviation from advice should decline to zero.	<ul style="list-style-type: none"> <li>Regional Bodies obliged to propose appropriate conservation, technical and effort measures to deliver EU Fmsy targets</li> <li>Much lower departure of quotas and scientific advice following improved agreement at EP/Co level</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>
19	Management costs for the sector	Management costs should decline	<ul style="list-style-type: none"> <li>Increased MS involvement in decision making process is likely to</li> </ul>	<ul style="list-style-type: none"> <li>Additional management costs expected to ensure</li> </ul>	<ul style="list-style-type: none"> <li>Same as option 1(i) with the exception that a portion of</li> </ul>	<ul style="list-style-type: none"> <li>As Option 1.</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>As Option 1(i).</li> </ul> <p style="text-align: center;">-</p>	<ul style="list-style-type: none"> <li>As Option 1(ii).</li> </ul> <p style="text-align: center;">--</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
			<p>increase both financial and time costs through additional meetings, particularly negotiating LTMPs under “socio-economic optima” for multispecies fisheries</p> <ul style="list-style-type: none"> <li>• Additional science costs estimated at €20 million</li> <li>• Reductions in management costs compared to Status Quo with larger decline in fleet size, and reduction therefore in MCS task,</li> <li>• Slightly offset by increase in number of landings (catch increases) and number of new MS fishing under EU ITR transferability.</li> </ul> <p>-</p>	<p>compliance with discard reduction policy</p> <ul style="list-style-type: none"> <li>• 10% observer coverage decreasing with number of vessels to €268m by 2022</li> <li>• At sea patrols estimated in Norway at €70m per year without capital investment</li> <li>• REM monitoring estimated as €20 – 29 mln in 2022</li> </ul> <p>-</p>	<p>management costs could be recovered through confiscation fund in 2012.</p> <ul style="list-style-type: none"> <li>• Changes in industry income suggest this to be €108 mln.</li> <li>• Perhaps higher costs given greater risk to compliance</li> </ul> <p>- -</p>			

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
20	Regions and MS having adopting RBM system	RBM systems uptake should increase to more than 50% [ITR uptake in 100% of unprofitable fleets]	<ul style="list-style-type: none"> <li>ITR uptake will be 100% in LSF.</li> <li>Uptake in SSF is likely to increase, although this is dependent on profitability.</li> <li>SSF: ITR uptake increase of 24% by 2017</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>
21	Data provided by MS	Full compliance by all MS with reporting obligations	<ul style="list-style-type: none"> <li>Increase in DCF data required to develop scientific advice for all stocks</li> <li>Compliance may increase with RegBod involvement of all parties, and with ITRs</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No expected increase in level of data submitted</li> <li>Increases in quality and accuracy of catch data expected</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As Option 1(i)</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As Option 1</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As Option 1(i)</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>As Option 1(i)</li> </ul> <p style="text-align: center;">+</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
22	Rate of utilization of allocations (quotas)	Utilisation increases to 100%	<ul style="list-style-type: none"> <li>Utilisation of quotas is likely to increase in those fleets which adopt ITR due to transfer/leasing of rights within MS</li> <li>Swaps will still be required and the inefficiencies introduced will maintain some under-utilisation</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>Slight decreases may occur with the requirement to cease fishing once one quota in a multispecies fishery has been exhausted.</li> <li>Expected to increase again with changes in behaviour</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1, though undermined by under-utilisation of stocks in multispecies complexes.</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p style="text-align: center;">=</p>
23	Level of quotas exchanges	decrease in quota swaps <sup>3</sup>	<ul style="list-style-type: none"> <li>Quota swaps will still be needed, but inter-MS transfers may lead to some easing of need for inter-EU swaps</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>As Option 1.</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>

<sup>3</sup>. A reduction in swaps implies efficiency of the quota allocation system and decreasing administrative burden. A need for swaps implies individual fleet specialisation and economic efficiency that is not realised by the current allocation system.

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
29	Time taken to reach a decision	Time taken should not increase significantly	<ul style="list-style-type: none"> <li>Regional Bodies will reduce the time taken to reach a decision</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>Regional Bodies will reduce the time taken to reach a decision;</li> <li>Implementation of “conservation optimum” for multispecies fisheries may lead to harder decision making in RegBods and Co/EP with many losers</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>
24	Level of coherence with WTO & other EC policy	All policies coherent with the EU’s WTO obligations	<ul style="list-style-type: none"> <li>Improved coherence with Marine Strategy Framework Directive and WTO</li> <li>Improved coherence with WTO subsidy rules</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>Improved coherence with Marine Strategy Framework Directive and WTO</li> <li>Improved coherence with WTO subsidy rules</li> </ul> <p style="text-align: center;">+</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p style="text-align: center;">=</p>

	Indicator	Ideal state	Option 1	Option 1i (against option 1)	Option 1ii (against option 1)	Option 1a	Option 1ai (against option 1a)	Option 1aii (against option 1a)
25	Impact for the private sector	Administrative cost and burden should decrease	<ul style="list-style-type: none"> <li>Trading of rights within industry is likely to increase administrative costs to the sector.</li> <li>Greater involvement of industry in Regional Bodies likely to increase sector administrative costs.</li> </ul> <p>-</p>	<ul style="list-style-type: none"> <li>Administrative burden expected to increase with requirement to monitor catches and quota portfolio</li> </ul> <p>-</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p>-</p>	<ul style="list-style-type: none"> <li>As Option 1.</li> </ul> <p>-</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p>-</p>	<ul style="list-style-type: none"> <li>As Option 1 (i)</li> </ul> <p>-</p>
26	Level of implementation simplification process by MS & industry	Simplification of implementation should increase	<ul style="list-style-type: none"> <li>Development of LTMPs by RegBods should improve simplification for industry and MS</li> <li>ITR will increase complexity</li> <li>Subsidies simplified</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>As Option 1.</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>
30	Aquaculture <sup>s</sup>	Aquaculture production / capture production	<ul style="list-style-type: none"> <li>Ratio should decline as capture fishery catches increase during recovery</li> </ul>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>As Option 1.</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>	<ul style="list-style-type: none"> <li>No change</li> </ul> <p>=</p>

Note: As Table 65 shows, the impacts on some of the indicators above are identical for the different management options analysed in this report, e.g. indicators 6, 11, 12, etc. These indicators have been left in the summary table for two reasons: firstly it is desirable to know what the impact of the different options is on an indicator, even if the impact does not vary between options; and secondly it is of interest that the impacts on an indicator are not dependent on the management option.

## 6.1 Weighted Summary of Policy Performances

The CFPIA currently has summary tables expressed in terms of “+” and “-“. In the final analysis these were allocated different “scores”. In this IA where a discard reduction policy was added, performances of each option were scored against their original option without the discard reduction policy implemented. The original scoring was used for each option 1 and option 1a as indicated in the CFP IA and the performances of the discard reduction option were scored with a number plus or minus of the original score. Where the CFPIA set a maximum limit of 4, this IA allowed a maximum of 5 to account for the increase in performance on the original option.

Averages of these values were plotted by Option and by indicator category (Environmental, Social, etc). The indicators were grouped according to those indicated in Table 1 on page 3. The graphs can be seen below (Figure 34, Figure 35, Figure 36, Figure 37, Figure 38 and Figure 39)

Of these indicators, (15) was not explicitly calculated because it was particularly difficult to assess, and the external and aquaculture indicators were not included in the final summary analysis.

Linear ranking was implemented through the following algorithm

- 1) Ranking was expressed from zero (no ranking) to MAX, where MAX = number of indicators in an indicator group.
- 2) Weighting for an indicator was then

$$W_i = R_g W_g / \text{sum}(R_g)$$

Where  $W_i$  = weighting for an indicator,  $R_g$  = rank of an indicator within an indicator group,  $W_g$  = weighting given to that group overall (eg 30 in the case of the environmental group)

By way of illustration, consider the environmental group, with priority order 1, 4, 2, 3. This delivers ranking according to the above scheme for indicators 1, 2, 3, 4, 6 of 4, 2, 1, 3, 0 (i.e. indicator 1 has rank 4).  $W_g = 30\%$ ,  $\text{Sum}(R_g) = 10$ . For indicator 1, the weighting therefore is  $4/10 * .3 = 0.12$ . This is its weighting in over the whole of the indicators being considered.

- 3) Average score for an indicator group was calculated using the weighted average; average score for the option over all indicators was calculated likewise.

The new indicator 13x17 was scored as an entirely new indicator after calculating catching sector employment x crew wage.

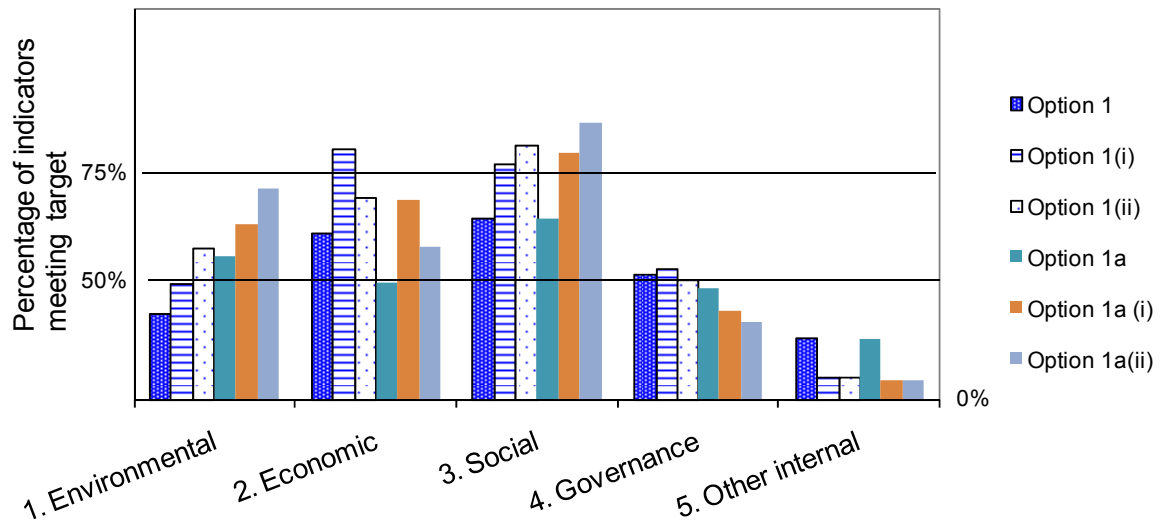


Figure 34 Performance of options by indicator group in 2017

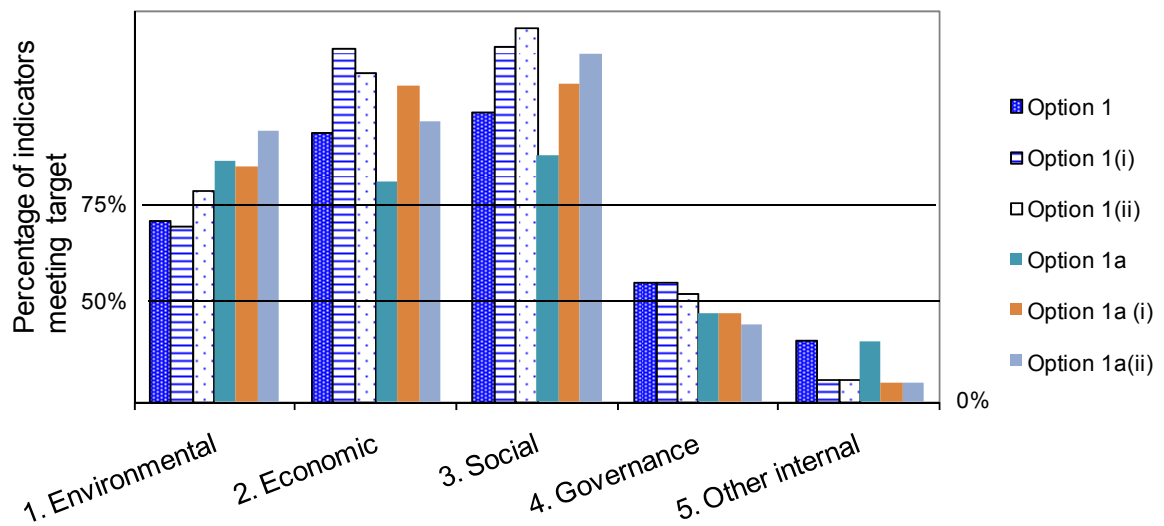
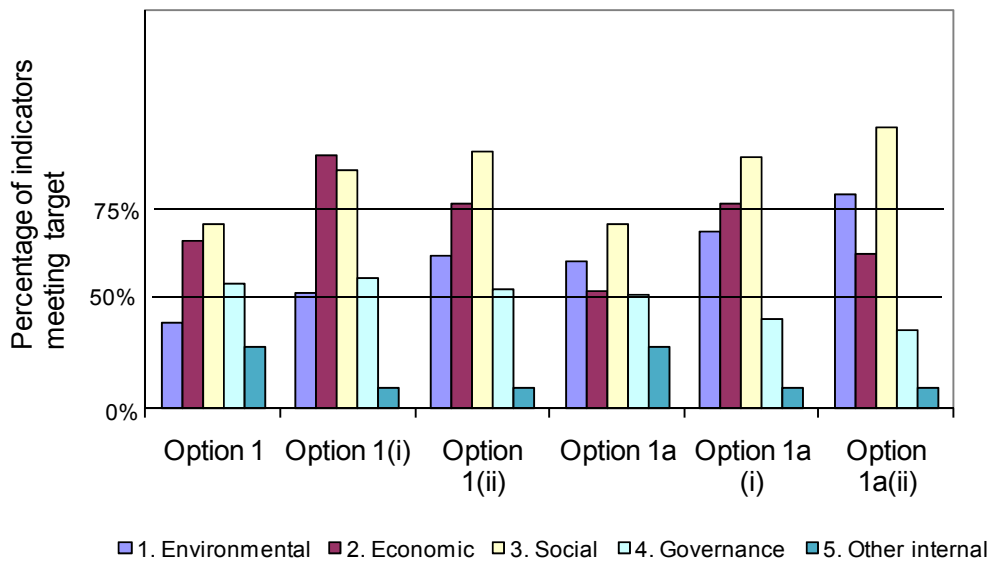
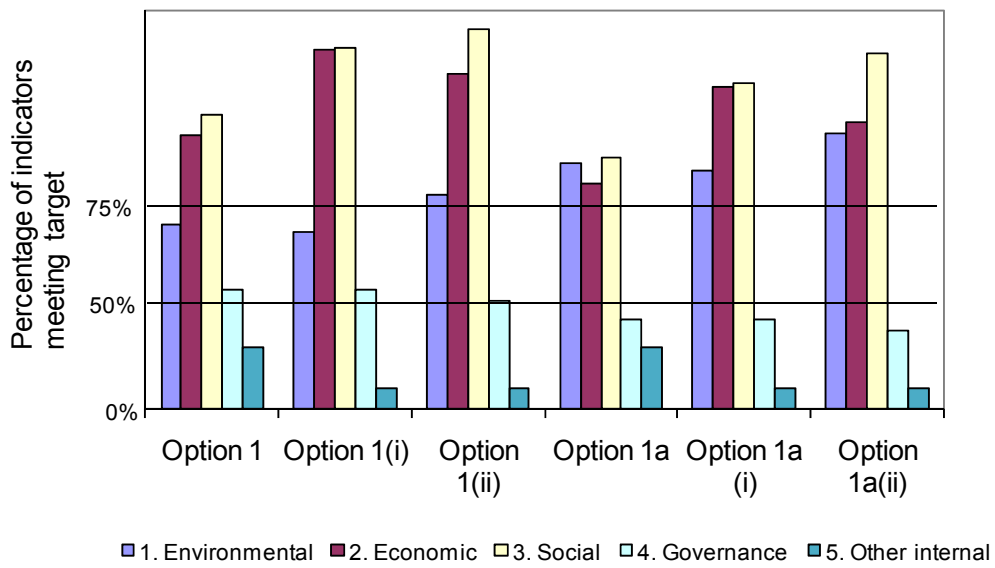


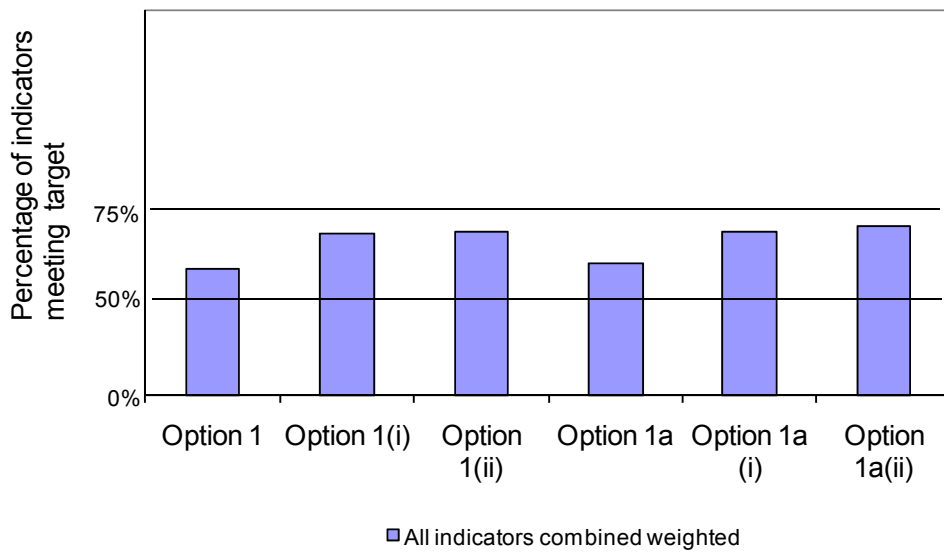
Figure 35 Performance of options by indicator group in 2022



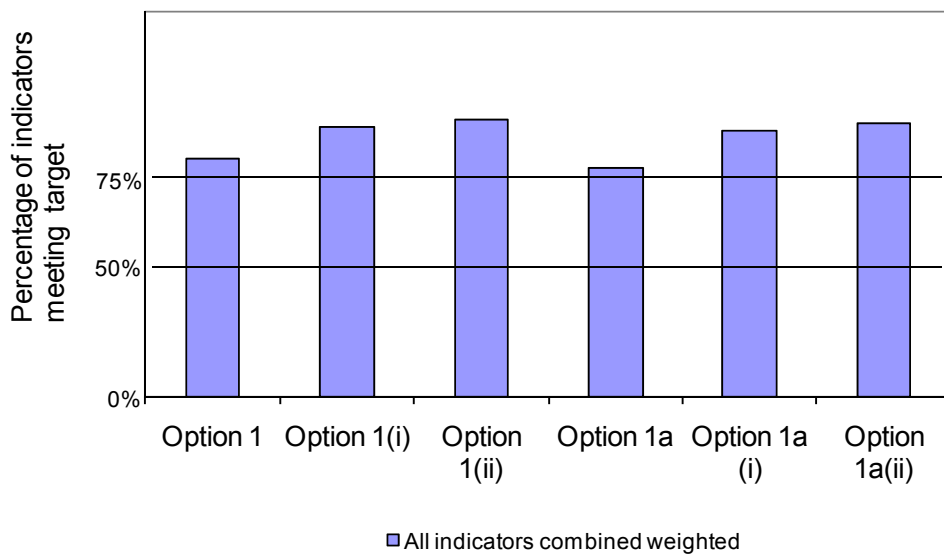
**Figure 36 Performance of indicator groups by policy options in 2017**



**Figure 37 Performance of indicator groups by policy options in 2022**



**Figure 38 Summary of policy options' performance in 2017**



**Figure 39 Summary of policy options' performance in 2022**

## 7 References

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