Report of the Workshop on Marine Strategy Framework Directive1 – Descriptor 3+ (WKMSFD1 D3)

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1   Introduction

This is a short report of the first workshop in a process leading to a technical/scientific ICES report aiming to support EU Member States (MS) in the implementation of the Marine Strategy Framework Directive (MSFD). The process will focus on Descriptor 3 (D3), commercially exploited fish and shellfish, but   fisheries-related information relevant for the other Descriptors will also be identified and reported on. The work is led by a small Core Group of experts and, outputs of this and a second workshop involving regional case studies undertaken by the Core Group, will be used in preparing a final report. The final report will describe the process, assessment methodologies and the key issues and decisions, as well as their implications for defining GES and environmental targets and indicators for D3.

ICES is undertaking this work on its own initiative. The output will not be ICES advice but, based on the best data and science available to ICES, will show worked examples on how the requirements of the MSFD with respect to D3 can be fulfilled. The final report will be prepared by the Core Group.

The first workshop was attended by 34 participants representing 12 countries and the European Commission (EC), the European Environment Agency (EEA), the Joint Research Centre (JRC) and the Regional Seas Conventions (RSC), HELCOM and OSPAR. One NGO was also represented. A list of participants is provided in Annex 1.

The objective of the first Workshop was to scope the relevant approaches and concepts in relation to D3. In addition, it initiated discussions and considered the relevance of using fisheries data, surveys and science when assessing the status of other descriptors, in particular D1, D4 and D6, in relation to GES.

The terms of Reference (ToRs) were:

- Review how assessments, indicators and targets based on the best available science can be developed regarding MSFD Descriptor 3 on a regional seas basis;

    - Identify which fish stocks come under the scope of Descriptor 3

    - Select an assessment scale for each stock identified

    - For these stocks, prepare an initial assessment as described in the MSFD Directive § 8

    - Referring to the initial assessment propose a set of characteristics for good environmental status (GES) based on Descriptor 3 as described in the MSFD Directive § 9. This will include consideration and advice on how to aggregate indicators.

    - Referring to the initial assessment, propose a comprehensive set of environmental targets related to the indicators set out in the Commission Decision and as described in the MSFD Directive § 10

- Review how fisheries and fish community data such as those collected through the Data Collection Framework (DCF) including the fisheries ecosystem impact indicators of the DCF can contribute to assessments and indicators for other MSFD Descriptors on a regional basis, notably Descriptors 1, 4 and 6.

- Propose a core set of indicators which other users could use to report on fisheries. The set of indicators will be used by ICES for the annual reporting but may also serve the purposes of the DCF Appendix XIII, EEA and Eurostat.

The regional case studies are for the purpose of testing concepts, identifying gaps in data and knowledge, identifying the important decisions and the implication of different options and to document this in the form of guidance. This will be provided to MSs, RSCs and the EC as independent scientific support from ICES.

The EC reiterated that it is the responsibility of the MSs to define and achieve GES and that this should be co-ordinated through the Regional Seas Conventions. They recognised that ICES is providing scientific support on how to do this for commercial fish stocks and pointed out that we are embarking on a significant task and we will learn by doing. It might not be perfect the first time but this will improve during subsequent iterations. It was also pointed out that the Commission Decision 2010/477/EU is guidance and if there are justifiable reasons for a member state not using the indicators or modifying them or using new ones then that is acceptable but should be documented.

It is important not to stall the process on the grounds of lack of data. Gaps in the data should be identified and progressively filled in subsequent iterations of the MSFD process. For the moment we should use whatever appropriate information is available. The approach is designed to accommodate and should allow the assessment of stocks in both data rich and data poor regions. At present there appears to be about 2/3 of the stocks in the different ICES regions that are not subject to full assessments which may necessitate the use of proxies for the reference levels or the secondary indicators. However any assessment information that is used to give ICES advice should be used.

This report is intended as a summary progress report to identify the issues raised and discussed in the Workshop, the information provided in the presentations and the agreed roadmap for the ICES Core Group work.

The final report will be prepared by the Core Group after the next Workshop, 5-7 October 2011. This will include the scientific guidance developed during the case studies. This report closely follows the structure of the meeting. Following presentations and discussions on the overarching topics such as selection criteria for species, indicators and reference points for both assessed and non assessed species and on other fisheries ecosystem indicators, a number of subgroups were formed to consider region-specific issues and to develop detailed workplans for each region. The regional breakout groups covered:

- Baltic Sea;
- Celtic Sea and Bay of Biscay-Iberian Coast;
- Mediterranean Sea;
- North Sea;

2   Commercially exploited (shell)fish populations

The first issue to be addressed is what are considered the commercially exploited (shell)fish populations for each MSFD (sub)region. The main criterion for inclusion of populations should be based on their contribution to commercial landings in each (sub)region. For this several sources were considered and the FAO Fishstat database was chosen as probably being the most comprehensive, covering all (sub)regions. However, other candidates can still be suggested if considered to be better sources of information.

One possible candidate is the DCF (see Appendix VII Commission Decision 2008/949) where the following species groups are considered: 1) Species that drive the international management process including species under EU management plans or EU recovery plans; 2) Other internationally regulated species and major non-internationally regulated by-catch species; 3) All other by-catch (fish and shellfish) species. However, this is still not comprehensive and not based on the actual logbook information. Fishstat is based on this information and probably provides a more consistent and longer-term source of information as the DCF may be modified and has only recently become established.

The following issues need to be considered:

- Choosing the appropriate areas to extract data from the database for each (sub)region. The use of different regional boundaries is an issue. The ICES Data Centre gave a brief presentation on the ICES EcoRegions and the MSFD regions and work by the EEA and ICES on defining the MSFD regions. This is current being discussed by the EEA and MSs and the latest draft was presented. This should be the basis for the selection of stocks for assessment in each region and as such should become available as soon as possible. The Fishstat and ICES assessment areas need to be mapped against these MSFD (sub)regions.

- Threshold for inclusion of species. There was a discussion on how species could be selected for the assessment under MSFD descriptor 3. One suggestion was to consider all species that contributed more than a specific threshold. Initially 1% of the landings was suggested. However, for the Baltic it was decided to use 0.1% as the threshold in order to include salmon which is considered an important commercial species but which contributes less than 1% to the landings. It was also pointed out that the relative contribution of pelagic/demersal/benthic species would change as you increase the number of species. Whatever the threshold chosen, it is important that the list is comprehensive and includes most of the landings in the region. Whether this should be >99%, > 95% or even 90% should be decided. In practice it may turn out that for part of those species no information is available. The minimum proportion of the landings that need to be covered by stocks for which information exists is another decision issue that needs to be discussed.

- It could be relevant to distinguish different categories for which to determine the relative proportions, e.g. pelagic, demersal and benthic, so as to avoid important species of a relatively small category falling below the threshold due to high catches of species in another category.

- There is the possibility for other (e.g. socio-economic) considerations than the suggested weight of landings for inclusion of a particular species. The

reason for only considering weight of landings is the fact that this information is at least readily and consistently available for all MSFD regions.

- The Fishstat database is not up-to-date. This needs to be considered as well as how many of the last years need to be included. In the ICES/JRC Task Group 3 report this was arbitrarily set at the last 5 years for which the database was up-to-date (i.e. 2003-2007) but for the initial assessment and future GES assessments this is to be decided.

- The relevance of stocks may be considered from a regional or a member state perspective. "Regional" stocks are those that fall under Common Fisheries Policy (CFP) or support international fisheries and which occur more or less throughout the region. Their inclusion into the GES assessment is necessary and determined by their importance as reflected by the catches in the table extracted from the Fishstat database. In contrast a "member state" stock may only be important from a member state perspective because it supports a sufficiently important national fishery or because it occurs in a relatively large part of the national waters. In some cases, however, a regionally important stock may occur almost exclusively in one member state's national waters or support a national fishery. Member states may decide to include one or more stocks in addition to the regionally important stocks for which a regional approach applies. In case of member state-specific stocks the best national source of information needs to be used.

3 Species covered by stock assessments

3.1 Introduction

The main reason for distinguishing assessed from non-assessed stocks is that stock assessments usually calculate two primary indicators (F and SSB) and their reference levels covering respectively the first two criteria of the descriptor:

- Criterion 3.1 Level of pressure of the fishing activity:
- Criterion 3.2 Reproductive capacity of the stock

What do we consider an "assessed" stock? Within ICES there is a continuum from analytical assessments providing estimates of F and SSB (with or without reference levels), to analytical assessments providing only indicative trends in F and SSB (normally without reference levels), to empirical indicators used as indicative of stock trends. The list will be either everything on which ICES gives advice on or some subset of this depending on agreed criteria. Possible criteria for inclusion in this section are whether or not (and which) indicators are given (i.e. level of exploitation (F) and reproductive capacity (SSB)) and whether or not one (or more) reference levels are given (i.e. MSY-based, lim or pa, the latter two corresponding to the ICES precautionary approach).

What stocks should be considered for the (sub)region? For this it is important to adopt a practical and common sense approach to the mapping of stocks to areas. This could involve 3 basic principles:

1) stocks entirely within an area map to that area,
2) straddling or highly migratory stocks appear within the areas they straddle or migrate and are fished through,
3) stocks which partially extend into another area will be placed in the area in which they are primarily distributed and fished.

Pertaining to the choice of reference levels it is important here to note that neither the ICES workshop WKMSFD nor anyone helping prepare the example assessments are going to put forward any Descriptor 3 reference levels which are not consistent with ICES advice (i.e. ACOM for fisheries advice) or equivalent bodies in the Mediterranean and Black Sea (e.g. GFCM, ICCAT) in order to avoid generating "noise" between the MSFD and the CFP.

Reference levels are supposed to be scientific (non judgemental) values. The setting of MSY-based reference values for all important stocks in the face of a variable and uncertain environment is the objective and we should be continually moving towards that. Stock status summary sheets could be a useful starting point but do not provide reference points for all stocks in many regions. The use of the pristine concept is not useful for commercial (shell)fish as these stocks will never return to such conditions. When making a comparison with the past care needs to be taken that exceptional historic conditions (e.g. the gadoid outburst) affect our perspective of what "good" conditions look like when working with trends and trying to pick a period of years as a reference.

3.1.1 Fishing mortality (F)

For the indicator on Fishing mortality (F) the following reference levels may exist:

- Flim - the fishing mortality level above which, over the long- term, the stock will be reduced to levels at which it suffers severely reduced reproductive capacity

- Fpa - because of uncertainties in the assessment process, Fpa is defined as a precautionary fishing mortality (lower than Flim) designed to result in avoidance of exceeding Flim when F is estimated to be below Fpa

- F_{MSY} - the level of fishing mortality that achieves maximum sustainable yield over the long term based on growth and natural mortality rates, the selection pattern of the fishery and recruitment changes associated with the level of adult biomass (stock-recruitment relationship)

- Fmax - the level of fishing mortality that maximises the long-term average yield per recruit; based on the same quantities as F_{MSY} but without using a stock-recruitment relationship

- F0.1 - a more conservative (lower) fishing mortality reference level than Fmax; as for Fmax, F0.1 is based on the long-term average yield per recruit; F0.1 is often used when Fmax is not well defined or when a more conservative reference level than Fmax is sought

Fishing mortality reference levels Flim and Fpa have been used by ICES as indicators of stock status since the introduction of the Precautionary Approach in 2005. In general terms, fishing mortality rates are specified for thresholds (e.g. Flim, Fpa) which define "safe" levels of exploitation (below the threshold) and targets (e.g. F_{MSY}, F0.1, Fmax) for achieving a high long-term yield from the stock. Some issues may need to be resolved: e.g. DGMARE uses F_{MSY} as a target while Commission Decision 2010/477/EU states that F_{MSY} is a limit.

F_{MSY}, Fmax and F0.1 are defined on the basis of single species analysis which does not include predator-prey interactions or linkages to ecosystem productivity. The reference levels are also dependent on the selection pattern of the fishery (the distribution of fishing mortality at length or age); for example recent measures to reduce discarding of small fish, if successful, will change the selection pattern of the fishery and, hence, the F_{MSY} reference value. Consequently, the reference levels are unlikely to be stable in the long-term and will require recalculation as stocks rebuild and the balance of predators and prey changes over time.

Given the variability and uncertainty inherent in the estimation of fishing mortality reference levels and the difficulty (impossibility!) of simultaneously maintaining all stocks in a mixed fishery at their optimum exploitation rate, a range within which the exploitation rate is maintained (e.g. F_{MSY} +/- x%) may be considered appropriate rather than using the exact reference levels as limit or target values. It must be noted that the Commission Decision 2010/477/EU states that "in mixed fisheries and where ecosystem interactions are important, long term management plans may result in exploiting some stocks more lightly than at F_{MSY} levels in order not to compromise the exploitation at F_{MSY} of other species". The implications of this will be considered during the regional case studies and discussed in the final report.

For application of the above reference levels the following applies:

- In order to ensure a low risk of stock depletion fishing mortality should be maintained below the stock specific Precautionary Approach fishing mor-

tality limit Flim. In practical terms, this means that estimates of fishing mortality should be below Fpa.

- To achieve sustainable levels of exploitation consistent with GES, fishing mortality should also be maintained at levels consistent with the <u>stock specific</u> value of F_{MSY}.

3.1.2 Spawning stock biomass (SSB)

For the indicator on Spawning Stock Biomass (SSB) the following reference levels may exist:

- Blim - A minimum level of SSB defined such that below Blim there is a high risk that the stock suffers from severely reduced reproductive capacity or the stock dynamics are unknown.

- Bpa - Because of uncertainties in the assessment process, a precautionary level of SSB (higher than Blim) designed to result in avoidance of going below Blim

- $B_{MSY-trigger}$ - A threshold level below which the stock is outside the range of SSB values associated with MSY. An appropriate choice of $B_{MSY-trigger}$ requires contemporary data with fishing at F_{MSY} to experience the normal range of fluctuations in SSB. Until this experience is gained, Bpa has, for the time being, been adopted for many stocks assessed by ICES as $B_{MSY-trigger}$ even though Bpa and $B_{MSY-trigger}$ correspond to different concepts.

The reference level for spawning stock biomass given by the commission decision 2010/447/EU is SSB_{MSY} ie. the spawning stock biomass that would achieve MSY under fishing mortality equal to F_{MSY}. Due to natural variability and species interaction a fixed point is difficult to attain and highly theoretical.

Blim and Bpa have been used by ICES to define stock status in terms of reproductive capacity since the introduction of the Precautionary Approach in 2005. SSB reference levels are often used to define change points at which fishing mortality is reduced if SSB falls below them or increased if SSB recovers, within harvest control rules that form the basis of stock management plans.

As with the fishing mortality reference levels a problem of SSB reference levels is that they have been defined on the basis of single species stock theory, without including predator-prey interactions or linkages to ecosystem productivity. As a consequence they are unlikely to be stable in the long-term and will require recalculation as stocks rebuild and the balance of predators and prey changes over time. This is also implicit in the Commission Decision 2010/477/EU, which states that "Further research is needed to address the fact that a SSB corresponding to MSY may not be achieved for all stocks simultaneously due to possible interactions between them".

There is a direct linkage between the fishing mortality targets defined previously and the SSB targets described in this section. They must be estimated and applied simultaneously, if used together to manage a stock.

The lack of SSB reference levels should not prevent the definition of GES for a stock. If fishing mortality is at a level consistent with F_{MSY} over the long-term then that should be sufficient to define GES for stocks where SSB estimates are impractical, for instance the less abundant but commercially important finfish species and the majority of shellfish stocks. This approach, however, relies strongly on getting appropriate estimates of F_{MSY} and ensuring that fishing exploitation is consistent with F_{MSY} in the long term.

For application of the above SSB reference levels the following applies:

- In order to avoid a reduced reproductive capacity and thus ensure a low risk of stock depletion SSB should be maintained above the stock specific Precautionary Approach limit Blim. In practical terms, this means that SSB estimates should be above Bpa.

- To achieve sustainable levels of exploitation consistent with GES, SSB should be maintained at or above the stock specific reference level $B_{MSY\text{-trigger}}$. If SSB falls below the $B_{MSY\text{-trigger}}$, the current ICES MSY harvest control rule proposes that fishing mortality be reduced proportionately below F_{MSY} to allow the stock to rebuild.

3.2   Regional break-out groups

3.2.1   Baltic Sea

The Baltic Sea subgroup was attended by experts from Finland, Sweden, Germany and Helsinki Commission (HELCOM). Therefore the vision and discussion provided in the Baltic Sea part of the report is based on expertise of those four persons only representing about 3/5 of the Baltic area, but only 3 out of 8 MS round the Baltic Sea. Most of the information provided in these sections must be further discussed by MS representatives and much more analyses and data should be made available from national laboratories, MS administrations and international organizations and technical bodies such as ICES, HELCOM, Baltic RAC and NGOs. The Baltic Sea parts of the document represents the vision and ideas of those experts who joined the meeting and it is not the official position of their MS. Each MS is free to adopt this framework to ensure consistency at the Baltic Sea level.

1) Identification commercially exploited (shell)fish populations per MSFD region and possible sub-regions

In order to assess the representativeness of the commercially exploited fish stocks for the Baltic Sea we agreed to use the estimate of what proportion of all landed fish and shellfish consisted of assessed stocks. For this we used the ICES catch statistics in the Baltic from 1983-2007 as they occur in the FAO Fishstat database (Anon 2009; ICES/JRC Task Group 3 report). The subareas used were ICES sub-divisions 22-32 except for western Baltic herring where also Division IIIa (i.e. Kattegat) was included to get the full coverage. Over the 5 years period (2003-2007) there were about 70 different species- or species-groups landed and reported. The exact number is very difficult to determine as there was overlap between groups and some overlapping of areas as well as different species aggregated in one group (e.g. Freshwater species). In the period 2003-2007 there were 22 species (21 fish, 1 invertebrate) that contributed more than 0.1% of the total landings. Together these species made up 82% of the landings consisting of approximately 95% fish and about 5% invertebrates. About 90 % of the landed species consists of assessed species (Table 3.2.1.1), comprising almost entirely (>95%) of sprat, herring and cod .

Table 3.2.1.1 All major species- and species-groups in the Baltic (>0.1% of the total landings, period 2003-2007), their total landings and relative contribution. Indicated is whether the species are assessed (A) or non-assessed (NA) as well as fish (F) or invertebrate (I).

Number	Species	Assessed	Type	Landings 2003-2007	Relative
1	European sprat	A	F	1842928	50.6
2	Atlantic herring	A	F	1132720	31.1
3	Atlantic cod	A	F	301634	8.3
4	Blue mussel	NA	I	111388	3.1
5	European flounder	NA	F	71924	2.0
6	European perch	A	F	26057	0.7
7	Roach	NA	F	12490	0.3
8	Northern pike	NA	F	11234	0.3
9	Freshwater bream	NA	F	8517	0.2
10	European plaice	NA	F	8467	0.2
11	Vendace	A	F	7952	0.2
12	Pike-perch	NA	F	6966	0.2
13	Common dab	NA	F	5172	0.1
14	Flatfishes (others)	NA	F	4997	0.1
15	European whitefish	NA	F	4775	0.1
16	Whiting	NA	F	3765	0.1
17	Atlantic horse mackerel	NA	F	3576	0.1
18	European smelt	NA	F	3166	0.1
19	Freshwater fishes (others)	A	F	2612	0.1
20	Cyprinids (others)	NA	F	2415	0.1
21	Sea trout	NA	F	1949	0.1
22	Baltic Salmon	A	F	1878	0.1

Depending on national requirements and the relative importance of various commercial fish species, the Baltic Sea could/should be divided into smaller MSFD units. How to do this is naturally dependent on the final commercial species list, but one possibility is to use Baltic Integrated Assessment areas by ecosystems such as Western Baltic Sea (WBS, ICES SD 22-24), Central Baltic Sea (CBS, ICES SD 25-29, Gulf of Riga (GOR, SD 28.1), Gulf of Finland (GOF, ICES SD 32), Bothnian Sea (BOS, ICES SD 30) and Bothnian Bay (BOB, SD 31). This division follows also commercial fish stocks assessment unit/areas, which are Sub-division based as shown in Figure 3.2.1.1. However, how to allocate information for MSFD should be decided by MS to be coherent for other descriptors as well.

CENTRAL BALTIC HERRING (SD 25-29+32 excl. Gulf of Riga)

GULF OF RIGA HERRING (SD 28 E)

BOTHNIAN SEA HERRING (SD 30)

BOTHNIAN BAY HERRING (SD 31)

Western Baltic herring SD 22-24 and IIIa

WESTERN BALTIC COD (SD 22-24)

EASTERN BALTIC COD (SD 25-32)

BALTIC SPRAT (SD 22-32)

Baltic salmon Main Basin and Gulf of Bothnia SD 22-31

Baltic salmon Gulf of Finland SD 32

Flatfishes in the Baltic (plaice, flounder, dab, brill and turbot) SD 22-32
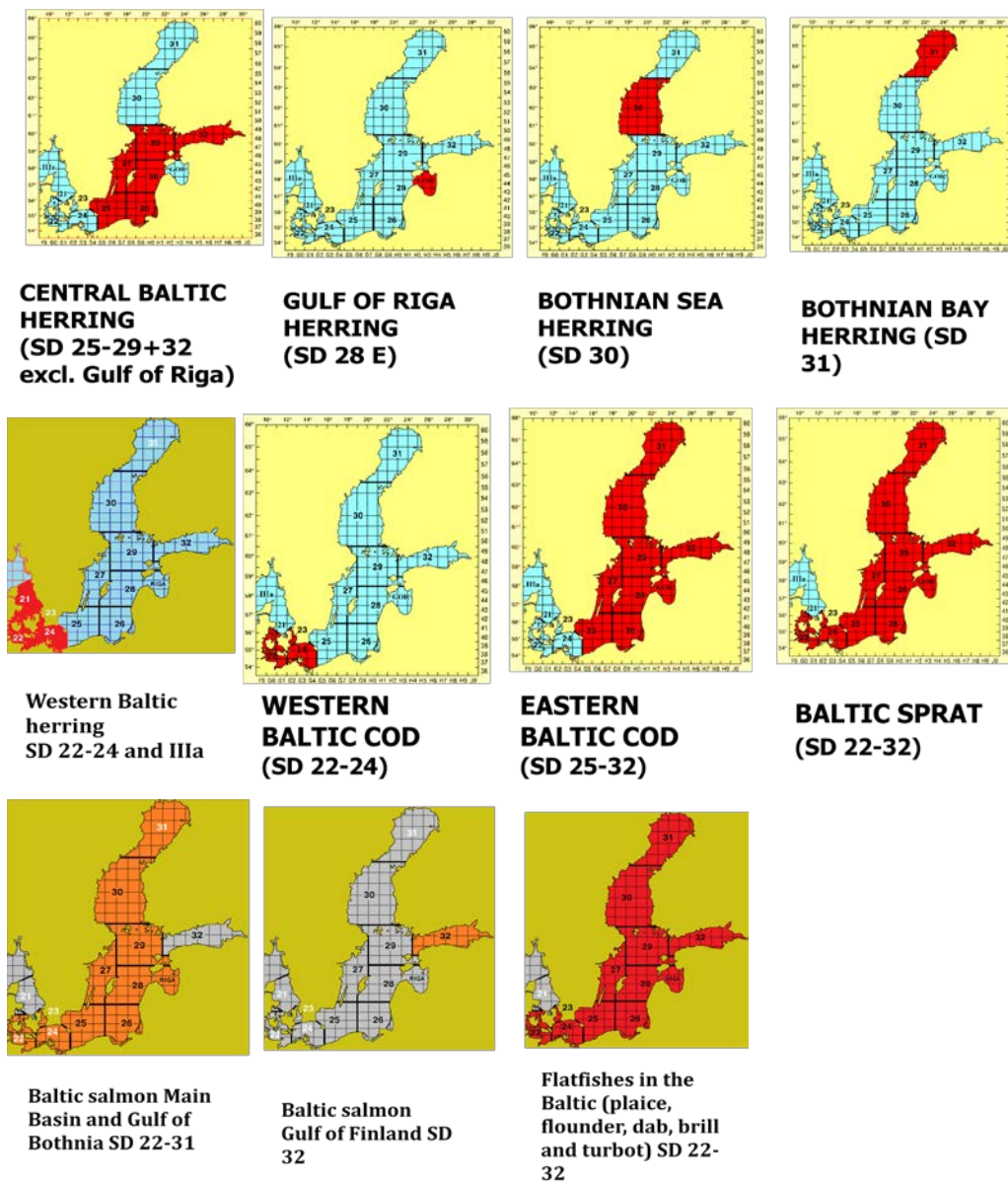
Figure 3.2.1.1. Stock assessment units in use in ICES for the main internationally managed commercial species in the Baltic Sea

The species list in Table 3.2.1.1 was discussed by the sub-group and modified by using the stocks units, stock assessments available and using expertise knowledge of their spatial distribution patterns and national interests. The group agreed to have the following list of species (Table 3.2.1.2):

Table 3.2.1.2 All major commercial species considered relevant for MSFD in the Baltic Sea including stock main distribution/assessment area, ICES Sub-divisions covered, assessed or not assessed, countries (all = all Baltic MS), research vessel surveys, monitoring data and time series of data. Green shaded species are considered highly relevant for MSFD D3 and purple shaded species are considered relevant for other descriptors.

Species	Stock	ICES SDs	A=assessed NA=not assessed, countries, descriptor	Research vessel surveys & monitoring	Time series
Cod	Western Baltic	22 – 24	A(all) D3	BITS	1980-2010
Cod	Eastern Baltic	25 – 32	A(all) D3	BITS	1980-2010
Baltic herring	Western Baltic, spring spawners	22 – 24	A (all) D3	BITS, Acoustic surveys	1980-2010
Baltic herring	Baltic Main Basin	25 - 29 & 32 excluding GoR	A (all) D3	BITS, Acoustic surveys	1980-2010
Baltic herring	Gulf of Riga	28.1	A (all) D3	BITS, Acoustic surveys	1980-2010
Baltic herring	Bothnian Sea	30	A (all) D3	Acoustic surveys	2007-2010
Baltic herring	Bothnian Bay	31	A (all) D3	Acoustic surveys	2007-2010
Sprat	Whole Baltic	22 – 32	A (all) D3	BITS, Acoustic surveys	1980-2010
European flounder	Whole Baltic	22-32	A (all) (D3)	Survey 24,25, BITS	1980-2010
Salmon	Baltic Main Basin and Gulf of Bothnia	22 – 31	A, all (D3)	None	1987-2010
Salmon	Gulf of Finland	32	A, all (D3)	None	1987-2010
Sea trout	Whole Baltic	22-32	NA, all (D3)	None	1980-2010
European plaice	Western Baltic	22-24	NA , D3, DEN, GER,SWE,POL	BITS	1980-2010
Common dab	Western Baltic	22-24	NA (DEN, GER, SWE) D3	BITS	1980-2010
Whiting	Western Baltic	22-24	A (GER), D3	BITS	1980-2010
Vendace	Bothnian Bay	31	A (FIN, SWE), D3	Monitoring survey	1991-2010
Pike-perch	Northern Baltic	28, 29,30, 32	A (FIN, SWE, EST, LAT) D3	SD 29, 30, 32 FIN monitoring	1980-2010
Perch	Northern Baltic	28, 29-32	A (FIN, SWE, EST, LAT) D3	SD 29, FIN, SD 29-30 SWE, monitoring	1980-2010
Turbot	Whole Baltic	22-32	NA (DEN, SWE, GER, POL) D3	BITS	1980-2010
European whitefish	Northern Baltic	SD 29-32	A (FIN, SWE), D3	monitoring SD 30, 31	1980-2010

Species	Stock	ICES SDs	A=assessed NA=not assessed, countries, descriptor	Research vessel surveys & monitoring	Time series
Atlantic horse mackerel	Western Baltic	SD 22-24	NA ,(D1, D4), DEN, GER	??	??
Blue mussel	Western Baltic	22-24	NA (DEN) (D3, D5)	??	??
Cyprinids (others)	Northern Baltic	SD 29, 32	NA (D4) FIN, SWE	Monitoring	1980-2010
European smelt	Northern Baltic	SD 29-32	NA, (D1, D4) FIN, SWE, EST)	Acoustic surveys SD 29, 32	1989-1990, 2006-2010
Freshwater bream	Northern Baltic	SD 29,30 and 32	NA(D1, D4,) D5), FIN SWE	None	
Freshwater fishes (others)	Northern Baltic	SD 29-32	NA (D1, D4), FIN, SWE	Monitoring	
Northern pike	Northern Baltic	SD 29-32	NA (D4) , FIN, SWE	None	
Roach	Northern Baltic	SD 29-32	NA (D1, D4,) D5) FIN		

2) Primary indicators (criteria 3.1 & 3.2): Stocks for which stock assessments are conducted

The following table 3.2.1.3 gives a list of those Baltic Sea commercial stocks, which are assessed annually and have at least some of MSFD primary indicators ready for use:

Table 3.2.1.3 The existing biological reference points for the main commercial fish stocks in the Baltic (ACOM 2011)

Species	Stock	ICES SD	Precautionary				MSY Approach		Target	Management
			B_{lim}	B_{pa}	F_{lim}	F_{pa}	F_{msy}	MSY Btrigger	SSB_{MGT}	F_{mgt}
Cod	Western Baltic	22 - 24	Not defined	3 000 t MBAl	Not defined	Not defined	0.25	23 000	Undefined	0.6
Cod	Eastern Baltic	25 - 32	Undefined	Undefined	0.96	0.6	0.3	Undefined	Undefined	0.3
Baltic herring	Western Baltic, spring spawners	22 - 24	Not defined	Not defined	Not defined	Not defined	0.25	110 000	Not defined	Not defined
Baltic herring	Baltic Main Basin	25 - 29 & 32 excluding GoR	Not defined	Not defined	Not defined	0.19	0.16	Not defined	Not defined	Not defined
Baltic herring	Gulf of Riga	28.1	Not defined	Not defined	Not defined	0.4	0.35	60 000	Not defined	Not defined
Baltic herring	Bothnian Sea	30	290 000	Not defined	0.3	0.21	0.19	200 000	Not defined	Not defined
Baltic herring	Bothnian Bay	31	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Not defined	Not defined
Sprat	Whole Baltic	22 - 32	Not defined	Not defined	Not defined	0.4	0.35	Not defined	Not defined	Not defined
European flounder	Whole Baltic	22-32	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Not defined	Not defined
Salmon	Baltic Main Basin and Gulf of Both	22 - 31	Unknown	Unknown	Unknown	Unknown	75% of PSPC	Unknown	Not defined	Not defined
Salmon	Gulf of Finland	32	Unknown	Unknown	Unknown	Unknown	75% of PSPC	Unknown	Not defined	Not defined
Sea trout	Whole Baltic	22-32	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Not defined	Not defined

3.2.2 Celtic Seas / Bay of Biscay and Iberian Coast

For the selection of commercially important stocks in this area, it is intended to extract the landings data from Fishstat and to create a species table with ranked landings by weight. The following were the agreed steps to create such a species table:

- The 5 year average of landings is taken to avoid changes in the table due to noise.
- The most updated map version of the MSFD regions will be used, which includes the west of Scotland.
- Pelagic/ migratory stocks will be included in the list, if they have a stage in their life cycle in these two regions.
- There can be stocks in the table that are not fished by adjoining MS, but other countries. These stocks will still be included in the regional assessment.
- If pelagic stocks are included, it looks like the list with up to 1% landings is not inclusive enough, it probably needs to be more around 0.1 %, as the proportion of catches by the pelagic are very high. Alternatively determining the percentages per category (i.e. pelagic, benthic, demersal) may resolve this.
- There might be some catches that are not in EU waters but in international waters. The proportion of international versus EU waters catches cannot be determined in cases where the catches are reported by ICES division (for ICES divisions that include international waters eg VIIb,c,k).
- Stocks that are mainly by-catch species and for which there is little information can be assessed under D1 and D4 using the criterion of "*species vulnerable to human activities*".

1) <u>Primary indicators (criteria 3.1 & 3.2): Stocks for which stock assessments are conducted</u>

The following action points were agreed for the case study:

- Map stock areas to MSFD regions (adopt most recent) and allocate stocks to regions, identify problematic stocks. Straddling/migrating stocks will often be an issue, these can be considered part of several regions.

- Identify per stock which indicators and reference levels are available, consider potential proxies if reference levels are not available. If there is agreement by ICES or other scientific bodies (e.g. ICCAT) on reference points, these will be adopted for the case study.

Some issues were identified which will need further discussion:

- Multispecies considerations - how can they affect reference levels? - the problem is that ICES advice does not include multispecies interactions.

- Targets versus limits for MSY, in how far is there a conflict between trying to reach the level of MSY within fisheries management to maximise yield and not go above it for the MSFD?

3.2.3 Mediterranean Sea

The Geographical Sub-Areas (GSAs) of the GFCM encompass 4 MSFD subregions: Western Mediterranean Sea, Adriatic Sea, Ionian and Central Mediterranean Seas and Aegean-Levantine Sea. The number of stocks assessed in the Mediterranean Sea based on the STECF report: Review of scientific advice for 2010 consolidated advice on stocks of interest to the EC (2009), is limited. In total 18 stocks are assessed - of these 6 are small pelagics stocks (2 species) in 3 GSAs and 12 are demersal stocks (7 species) in 8 GSAs.

Bluefin tuna is the only species managed with TAC (by ICCAT) but other large pelagics (2) are assessed in the Mediterranean Sea (also by ICCAT).

The main problems are:

- Small number of stocks are formally assessed and not necessarily on a yearly basis. Some reference points are available, e.g. Fmsyor proxies of Flim

- Need to use mainly secondary indicators for GES evaluation at this stage for most of the Mediterranean stocks

- Consistency between the spatial domain of GSAs in the Mediterranean Sea and MSFD subregions

- Geographical domain of GES evaluation (up to national waters – 12 nautical miles (6 nautical miles for Greece)– or beyond to be consistent with the stock spatial distribution)

- Difficult to establish when stocks are overexploited

Selection of stocks:

- Based on landings per MS (1% catch threshold ?) (National level for each sub-area; FAO and GFCM statistics);

- DCF (Annex VII);

- A list is provided in the JRC/ICES TG 3 report

What to do when stocks are shared with third (non-EU) Countries?

1) see assessments at the GFCM level (SAC)

2) Difficulties in defining GES issues

3) Establish cooperation for common data collection?

4) Management strategy at MS level might not allow to reach GES! What to do?

Vulnerable and threatened species must be considered under D1.

3.2.4 North Sea

For the North Sea the use of the Fishstat database appeared sensible. Mapping of ICES areas (and thus stocks) to the MSFD sub-region, however, turned out to be very sensitive to the definition of the MSFD region as the definition that was initially applied was quite different from the latest version that was presented at the meeting.

The Fishstat database is intended as the source to determine the importance of the various commercial species and thus whether or not they should be included in the regional assessment. As it is about commercial species it is appropriate that landings are used as opposed to catches (i.e. including discards).

Considering the difficulty in exactly determining F_{MSY} (e.g. because of species interactions) it is probably appropriate to use the F_{MSY} reference value as a range, within which F_{MSY} would fall.

4   Species covered by monitoring programs

4.1   Introduction

For those species that are relevant from a commercial perspective but for which no stock assessments are available the first two criteria need to be assessed by two secondary indicators:

- 3.1.2 Ratio between catch and biomass index
- 3.2.2 Biomass indices

that require data from monitoring programs for their calculation. Additionally, the indicators for the third criterion (Criterion 3.3 Population age and size distribution) also require data from monitoring programs for their calculation. These indicators are:

- 3.3.1 Proportion of fish larger than the mean size of first sexual maturation
- 3.3.2 Mean maximum length across all species found in research vessel surveys
- 3.3.3 95% percentile of the fish length distribution observed in research vessel surveys
- 3.3.4 Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation

Each of those indicators is discussed below in some more detail and with background information.

4.1.1   Ratio between catch and biomass index

Calculation of this indicator for each specific species requires catch information and a biomass index (i.e. CPUE of a research vessel survey or an appropriately standardised CPUE of the commercial fishery). The main requirement is that the catch data and biomass index need to match as closely as possible in terms of area covered and possibly other criteria.

4.1.2   Biomass indices

Calculation of biomass indices is described above. Applying some transformation (e.g. log) to improve the signal-to-noise ratio can be considered. It should be noted that the Commission Decision 2010/477/EU states that for biomass indices to be appropriate indicators of stock reproductive capacity they must refer to the fraction of the population that is sexually mature. Hence, the biomass index considered as an indicator for criterion 3.2 would normally refer to a different fraction of the population than the biomass index considered for the application of criterion 3.1. In order to make that distinction, however, some indication of size at maturity should be available. If this is not available total biomass can be used as a proxy of the stock reproductive capacity.

4.1.3   Proportion of fish larger than the mean size of first sexual maturation

This indicator can be calculated at a population and community/assemblage level

> Population: At the population level it can be calculated as proportion of biomass > mean size of first sexual maturation. This mean size should be

based on an agreed list that may differ between (sub)regions. Using bio-mass instead of numbers has the advantage that this puts a larger weight-ing on the older size-classes improving the signal-to-noise ratio.

- Community or Assemblage: At this level it is the sum of the biomass > mean size for each species across a suite of species divided by the total biomass of that suite of species. Composition of this suite of species needs to be agreed at a regional level and requires a regional list of mean size of first sexual maturation for the selected species

4.1.4 Mean maximum length across all species found in research vessel surveys

This indicator is part of the DCF indicators to measure the effects of fisheries on the marine ecosystem. According to (EC 2008) the Mean maximum length indicator (MMLI) can be calculated for the entire assemblage that is caught by a particular gear or a subset based on morphology, behaviour or habitat preferences (e.g. bottom-dwelling species only). Mean maximum length is calculated as:

$$\overline{L_{\max}} = \sum_j (L_{\max j} N_j) \Big/ N$$, where $L_{\max j}$ is the maximum length obtained by species j,

N_j is the number of individuals of species j and N is the total number of individuals. Asymptotic total length (L_∞) is preferred to maximum recorded total length if an es-timate is available, but it is recognised that such data may not be available for many species. The work presented in this report is based on (ICES 2009).

This indicator describes the fish community species composition and does not reflect size characteristics of individual species. The indicator is therefore considered not appropriate for this criterion. It is best evaluated under descriptor 1 Biodiversity and/or descriptor 4 Marine Foodwebs.

4.1.5 95% percentile of the fish length distribution observed in research vessel surveys

According to (Rochet *et al.* ICES CM 2007 / D:16), this indicator provides a good summary of the size distribution of fish with an emphasis on the large fish and is expected to be sensitive to fishing and other human impacts. For a species i and per-centile q=0.95, the indicator is calculated as

$$L_{q,i} = l_{q,i} \left| \frac{\sum_{l=1}^{l_q} y_{l,i}}{y_i} = q \right.$$

where $y_{l,i}$ = numbers caught in length class l, y_i = total numbers caught, $l_{q,i}$ = length corresponding to length class l_q for species i.

The L0.95 can be based on any standard survey that provides a length-frequency distribution. However, if more surveys are available it is recommended to choose the survey that samples the larger sizes best. Even though commercial catches (landings) in general sample the larger sizes better than surveys (that often target the smaller sizes), there is an issue with consistency because the fishery is more likely to have changed over time.

4.1.6 Size at first sexual maturation

This indicator is supposed to reflect the extent of undesirable genetic effects of exploitation. The most likely candidate for this is the so-called probabilistic maturation reaction norm indicator (PMRNI). According to (EC 2008) this indicator reflects the probability of maturing at age a and length s and is calculated as:

$$m(a,s)=(o(a,s)-o(a\text{-}1,\ s\text{-}\Delta s(a)))/(1\text{-}o(a\text{-}1,s\text{-}\Delta s(a))),$$

where $o(a,s)$ is the maturity ogive (i.e. the probability of being mature) and $\Delta s(a)$ is the length gained from age a-1 to a. Estimation of the probabilistic maturation reaction norm thus requires (i) estimation of maturity ogives, (ii) estimation of growth rates (from length at age), (iii) estimation of the probabilities of maturing, and (iv) estimation of confidence intervals around the obtained maturation probabilities. However, pertaining to the latter two points: (iii) is "$m(a,s)$" derived from (i) and (ii), while confidence intervals are still required and are typically calculated from bootstrapping.

This indicator is also part of the DCF indicators to measure the effects of fisheries on the marine ecosystem. A major disadvantage is that it requires large sample sizes (at least 100 specimen). A recent paper in press by Wright et al (2011), however, shows that a sample size of 50 fish per age class can be sufficient for calculation of the probabilistic maturation reaction norm.

4.2 Regional break-out groups

4.2.1 Baltic Sea

The first step the sub-group considered was an identification of the most appropriate monitoring programs and surveys. Two sources of information were considered: Firstly ICES DATRAS database and secondly the data collection framework (DCF). For the Baltic Sea the most appropriate surveys are BITS surveys for demersal stocks, which cover the main distribution areas of main demersal stocks and secondly BIAS surveys (Baltic International Acoustic Survey), which cover Baltic herring and sprat.

4.2.2 Celtic Sea/Bay of Biscay and Iberian Coast

Specific issues for the region:

- There is large number of non assessed stocks (ca 2/3 of the stocks)
- Applicability of the existing assessments may vary with full analytical assessments with established reference points to exploratory assessments indicative of trends that have not gone through benchmark system.
- ICES is currently going through a time of transition whereby the expert groups are in the process of establishing MSY reference points and proxies. At this point in time these are often only proposals. As a starting point, indicators and reference points proposed by ICES expert groups will be included in the case study if they formed the basis for advice.
- Development of reference levels for these stocks should be a priority for ICES
- The transition to MSY can also affect management plans which were set up within the PA framework.
- There is a move towards mixed fisheries management plans. These can potentially influence the MSY reference points.

Secondary indicators (criteria 3.1 & 3.2) for non assessed stocks

- Lack of data should not become a loop hole for member states and stop them to come up with some reference levels.

- In choosing a reference level there may be different options: pristine, sustainable or some points in the past? Pristine conditions are probably not the best given the objective of sustainable exploitation at high yields.

- The example of the gadoid outburst can be used to demonstrate how the perception of reference levels depends on the time period chosen.

- The trend method can be chosen to show whether there is a degradation.

- For trends based methods, it is necessary to consider the choice of transformation, e.g. logs, the time period needed to detect a trend, what methods are used to detect a trend, i.e. linear regression/others and how the significance of this is tested. The UK is using methods based on deviations further than 1SD from the mean.

- The discussions covered the need within the MSFD to see the indicators in a holistic fashion and not be too focused on quantitative targets setting, especially when relationships are not fully understood e.g. between pressures and state. The MSFD is about a six year cycle that gives an ecosystem check to see how fisheries relate to the environment.

- For the relevance of the indicators, there needs to be a clear relationship to human pressures, i.e. examine if the indicator responds to a change in pressure.

- It should be considered how the indicators and their implications can be taken into the scientific advice.

- It is worth examining if the indicators can also indicate changes in species clusters, hence try also to calculate them by functional group.

As an initial scoping exercise the following should be mapped:

- ICES eco-regions versus MSFD sub-regions
- Which stocks are covered in the sub-region
- Surveys that potentially provide data for the different stocks. This should include a quality statement about the surveys and if they have been used as a basis for advice in the past.

When choosing the surveys (including industry surveys) the following criteria should be applied:

- Whether the survey is already used as a basis for advice for the particular stock
- The length of a time series
- The spatial representativeness (i.e. area of the MSFD sub-region covered by the survey)
- Size selectivity they sample

In the long-term, the survey working groups are the best expert groups to take ownership of the data and the calculation of indicators; hence this work should be given as a TOR for the survey WGs that are producing the data to calculate this annually and to decide which stocks are well represented by the surveys.

For the calculation of the secondary indicators for 3.1 and 3.2 (catch/biomass ratio and biomass index) a two tier approach is recommended:

The first step is to calculate the biomass indicators – looking at the noise/variability of the data and if there are any signals in the data, also a judgement needs to be made on the representativeness of the survey for the stock in terms of spatial and temporal coverage and a quality check of whether the survey has good selectivity for the species.

Secondly, the catch to biomass ratio can be applied. The catch/biomass ratio proxy for exploitation is applied in fisheries management for example for Icelandic cod in division Va, whereby the harvest ratio is based on the ratio of landings to biomass trends of the 4+ age group. The harvest rate is estimated to be consistent with MSY.

The setting of reference points is supposed to be based on expert judgement.

A problem with reference periods of the survey versus the fishery is that often the time series of the surveys are much shorter than the fishery itself.

There are methods based on survey data to allow the estimation of biological reference points including proxies for MSY, e.g. methods developed in North America by Paul Rago. The Celtic Sea sub group plans to apply some of these methods to a small number of stocks and present them at the next MSFD D3 workshop.

Population indicators (3.3) for non-assessed stocks:

For the population diagnostics indicators there were the following discussion points:

Regarding the indicator "*Proportion of fish larger than the mean size of first sexual maturation*", there are problems with some stocks as maturity data are often only collected every three years. Maturity data is collected by member states – are these joint together to calculate maturity ogives? The ICES PGCCDBS and the subsidiary workshops could be working together with the survey groups to coordinate the data input for these indicators in the long term. Look at whether they have already come up with weighing schemes for combining information from different labs/surveys.

Regarding the indicator *"Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation"*, this indicator is dependent on having a long time series, and it is questionable whether there are time series long enough to monitor any changes in the Celtic Sea.

Overall for the population diagnostics indicator, the relationship between pressures and the indicators are not clearly understood, i.e. how the indicators respond to a change in pressure, whether there is a lag period etc. So the two aspects (pressures and indicators response) need to be tracked together. For the first reporting phase, it is advisable to show the development of trends of the indicators without attempting to set quantitative targets /thresholds.

It is also important to be transparent in the calculations of the indicators and document the details, so that a third party can repeat the process and come up with the same answer.

4.2.3 Mediterranean Sea

There is an international bottom trawl survey in the Mediterranean (MEDITS) providing basic information on benthic and demersal species. There is also a study group (SGMED) under STECF.

In principle data should be available for all secondary indicators.

There is a need for inter-calibration of survey methods.

Guidance is required on how to establish reference levels and how to assess trends.

4.2.4 North Sea

The first step considered for the North Sea was an identification of the most appropriate surveys. Two sources were considered: DATRAS and DCF. Possible characteristics of surveys that determine their suitability are: area covered, gear applied, length of the time-series and season. For the North Sea the most likely surveys is the IBTS as this covers most of the region but this survey is probably less appropriate for e.g. flatfish species for which beam trawl surveys (i.e. DBTS) could potentially be used.

When calculating indicators two issues were considered: the aggregation of survey data (e.g. mean per haul or aggregate hauls first across rectangles and then determine mean over rectangles) and how the indicator is calculated. Below are some considerations per indicator:

- *3.1.2 Ratio between catch and biomass index:* Important to make sure there is an adequate match between the catch- and survey-based information.

- *3.2.2 Biomass indices*: Calculation should be straightforward. When choosing between numbers and biomass the latter is probably preferred as this puts more emphasis on the larger fish that determine SSB. Log-transformation may increase the signal-to-noise ratio.

- *3.3.1 Proportion of fish larger than the mean size of first sexual maturation*: The best source of information for the mean size per species needs to be identified so that the indicator can be calculated.

- *3.3.2 Mean maximum length across all species found in research vessel surveys:* This was considered not appropriate as an indicator reflecting the population age-/size distribution as it is a fish community indicator supposed to reflect changes in species composition.

- *3.3.3 95% percentile of the fish length distribution observed in research vessel surveys:* Useful indicator that can be easily calculated.

- *3.3.4 Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation:* Recent work on the probabilistic maturation reaction norm indicator (PMRNI) has decreased the required amount of samples by half (approximately 50 specimen) and this is now determined for the major commercial species (e.g. cod, haddock, herring, Norway pout, plaice and sole).

Opinion among North Sea experts was that Criterion 3.3 is probably redundant and that if Criteria 3.1 and 3.2 are fulfilled this probably applies to Criterion 3.3 as well. However, the data to populate the Criterion 3.3 indicators are available so this information can relatively easily be made available to be used as additional "surveillance" indicators that GES for the commercial (shell)fish is not compromised.

5   Other indicators

5.1   Introduction

The following list of indicators is used by various organisations (Eurostat, EEA, DG MARE and ICES) to report on the impact of fishing activities on the marine environment and was provided for discussion at the ICES MSDF D3+ workshop. The idea is to review these indicators, trying to establish whether they might be useful for characterising certain aspects of the MSFD Descriptors 1, 3, 4 or 6 analyses and to identify potential redundancies between them.

	Indicator	Issue	Involvement	Regulation/ legal basis
EUROSTAT	Conservation of fish Stocks	Fish catches taken from stocks outside safe biological limits	ICES *EUROSTAT may be flexible to revision of indicator*	EU Sustainable Development Strategy
	Fishing capacity	Size of fishing fleet	Not ICES	
EEA	Status of marine fish stocks (CSI 032)	-Total catch in ICES and GFCM[1] fishing regions of Europe -Status of the fish stocks in ICES and GFCM fishing regions -State of commercial fish stocks in N E Atlantic and Baltic Sea -State of commercial fish stocks in Mediterranean Sea	*ICES tasked to develop revised indicator methodology*	
	Fishing fleet capacity (CSI 034)	-Changes in European fishing fleet capacity -European fishing fleet capacity: Engine power … -Country ratio in European fishing fleet capacity: Engine power … -European fishing fleet capacity: Tonnage … -Country ratio in European fishing fleet capacity: Tonnage … -European fishing fleet capacity: Number of vessels … -Country ratio in European fishing fleet capacity: Number of vessels …	*ICES tasked to develop revised indicator methodology*	

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[1] GFCM: General Fisheries Commission for the Mediterranean

	Indicator	Issue	Involvement	Regulation/legal basis
DG MARE 1	Conservation status of fish species	Indicator of biodiversity to be used for synthesising, assessing and reporting trends in the biodiversity of vulnerable fish species	ICES	Data Collection Framework annex XIII
2	Proportion of large fish	Indicator for the proportion of large fish by weight in the assemblage, reflecting the size structure and life history composition of the fish community.	ICES. In progress	
3	Mean maximum length of fishes	Indicator for the life history composition of the fish community	ICES. In progress	
4	Size at maturation of exploited fish species	Indicator of the potential 'genetic effects' on a population	ICES. In progress	
5	Distribution of fishing activities	Indicator of the spatial extent of fishing activity. It would be reported in conjunction with the indicator for 'Aggregation of fishing activity'.	ICES. Depends on new VMS database	
6	Aggregation of fishing activities	Indicator of the extent to which fishing activity is aggregated. It would be reported in conjunction with the indicator for 'Distribution of fishing activity'.	ICES. Depends on new VMS database	
7	Areas not impacted by mobile bottom gears	Indicator of the area of seabed that has not been impacted by mobile bottom fishing gears in the last year. It responds to changes in the distribution of bottom fishing activity resulting from catch controls, effort controls or technical measures (including MPA established in support of conservation legislation) and to the development of any other human activities that displace fishing activity (e.g. wind farms)	ICES. Depends on new VMS database	
8	Discarding rates of commercially exploited species	Indicator of the rate of discarding of commercially exploited species in relation to landings.	ICES. In progress	
9	Fuel efficiency of fish capture	Indicator of the relationship between fuel consumption and the value of landed catch. It will provide information on trends in the fuel efficiency of different fisheries.	Not ICES	

	Criteria	Indicator[i]	Involvement	Regulation/legal basis
DG ENV **MSFD** **Descriptor 3** Commercially exploited fish and shellfish	Level of pressure of the fishing activity	Fishing mortality (F) Ratio between catch and biomass index (catch/biomass)	ICES	Marine Strategy Framework Directive and Commission Decision
	Reproductive capacity of the stock	Spawning stock biomass (SSB) Biomass indices	ICES	
	Population age and size distribution	Proportion of fish larger than the mean size of first sexual maturation Mean maximum length across all species found in research vessels surveys 95% percentile of the fish length distribution observed in research vessel surveys Size at first sexual maturation, which may reflect the extent of undesirable genetic effects of exploitation	ICES	
Related MSFD descriptors:	**D1** Biodiversity **D4** Food webs **D6** Sea-floor integrity			
ICES Advisory report (section 1.6)	General trends of fish stocks in the Northeast Atlantic	Time series length (in years) by stocks	ICES	No
		Number of stocks within each of the categories: benthic, demersal and pelagic stocks. Accumulative plot.		
		Fraction of stocks with F below Fmsy by category of stocks.		
		Trends in fishing mortality by type of stock. Calculated as mean value of F by year and type of stock.		

Fish species that are under pressure from high levels of by-catch but not of commercial value are not relevant for this descriptor but should be identified and can be considered under D1 (Threatened or vulnerable) or D4.

The VMStools project (EU tender No MARE/2008/10 Lot 2) and the outcome of the ICES SGVMS Workshop held earlier in 2011 is a valuable starting point for coordinating the use of VMS data. VMS confidentiality issues may prevent access to the data.

Combining Surveys: The ICES WGECO did some work on combining survey data and it is difficult. If surveys are designed or modified to ensure compatibility of the data then the data could be combined and used to monitor indicators. If not, it is

wiser to monitor indicators using individual survey data and to analyse the outcomes at that stage. The Core Group will try to provide guidance on this issue.

It was decided to use the most recent data available as progress to MSY is ongoing.

5.2 Regional break-out groups

5.2.1 Baltic Sea

Below are the remarks per indicator as they apply to the Baltic Sea region.

1. *Conservation status of fish species:*
   - *This is not the best indicator for the Baltic Sea, where the total number of species is rather low*
2. *Proportion of large fish*
   - *This is not the best indicator for the Baltic Sea,as the Baltic Sea fish community almost entirely consists of three species of which only one is demersal.*
3. *Mean maximum length of fishes*
   - *In the Baltic Sea there are too few species in the surveys to be useful indicator*
4. *Size at maturation of exploited fish species*
   - *Data should be available from DCF, but target by species should be defined*
5. *Distribution of fishing activities*
   - *VMS data may be useful for the open sea areas and logbook data in a coarse scale (by statistical squares) for coastal and archipelago fisheries. A large number of vessels are outside VMS recording (<15 m in length)*
6. *Aggregation of fishing activities*
   - *perhaps good pressure indicator on local scale*
7. *Areas not impacted by mobile bottom gears*
   - *usefulness of VMS data should be checked*
8. *Discarding rates of commercially exploited species*
   - *In International Baltic Sea Sampling programs (1 & 2) and DCF data for background information to evaluate discarding rates and their usefulness*

5.2.2 Celtic Sea / Bay of Biscay and Iberian Coast

DG MARE indicators (DCF Appendix XIII):

1 Conservation status of fish species:

The European research project MEFEPO has already carried out a comparison between different surveys and regions for this indicator including the Celtic Sea and the Bay of Biscay/Iberian Coast. The problem is that the time series of several surveys in the area are too short for this indicator. There are some issues with this indicator when species are so depleted that they are not included in the initial list and therefore not tracked by the indicator. Results depend on whether the selection of stocks is based on the abundance in the first years.

2 Proportion of large fish

Work on applying this ecosystem indicator to the Celtic Sea has been carried out and results are documented in MEFEPO and WGECO 2010 & 2011. There are some regional differences in terms of the optimal size cut off point used. There is also the question of whether in the Celtic Sea, pelagic species should be included in this indicator. Potential reference levels have been proposed in WGECO. Again there is a problem in this region with several surveys of different gears and time series covering the area.

5 Distribution of fishing activities.

6 Aggregation of fishing activities

7 Areas not impacted by mobile bottom gears

The three VMS related indicators are considered together. These only have a regional meaning if the methods applied to the scaling and aggregation of data are the same. Hence regional co-ordination on this based on recommendation by published literature (Piet & Quirijns 2009) and or the outcome of the ICES SGVMS should take place.

8 Discarding rates of commercially exploited species

These are readily available but it has to be seen how they can be directly related to the MSFD as a pressure indicator. It will have relevance to D3 and also the abundance indicators of species related to human pressures in D4.

5.2.3   Mediterranean Sea

All data should be available through the DCF. Data exists from 2003/2004.

There is a problem with the VMS data caused by the fact that there are many small vessels (< 15 m) which are not sampled. Analysing data at a regional level may be difficult as there is often a confidentiality issue preventing access to what are considered national data. The indicators, however, can be calculated based on anonymous and aggregated data. Whether MSs are willing to deliver such data for regional calculation of indices needs to be explored. Italian VMS data exist from 2006 and Greek data from 2009 onwards. There has been an ICES meeting (SGVMS) on VMS and logbook data recently and the report is soon out.

Regarding the LFI reference levels: these are survey and, thus, (sub)region-specific.

5.2.4   North Sea

The Eurostat indicator "*Conservation of fish Stocks*" was considered not to be suitable as it could easily give the wrong signal. An example would be any fishery that constitutes a marked proportion of the catch and is outside safe biological limits (SBL). As the catches of this fishery decline due to the overexploitation of the stock the indicator would suggest an improved situation as less fish are caught outside SBL.

The Eurostat and EEA indicators on "*Fishing fleet capacity*" are supposed to provide information on the fishing pressure on the ecosystem but this is better captured by information on catches and/or mortality (F) together with indicators describing the impact on the seafloor (DGMARE indicators 5, 6, 7). If that information is available fleet capacity expressed as number of vessels (even when weighted by tonnage or engine-power) or even effort expressed in terms of days-at-sea become redundant. Moreover, reporting on this was not considered an ICES task.

The *DGMARE indicators 1-3* can be calculated based on the IBTS or any other survey that provides numbers at length for a suite of species. This with a proviso that there are issues pertaining to the calculation of the first indicator that need to be considered.

For DGMARE indicator 4 recent work on the PMRN has decreased the required amount of samples by half (approximately 50 specimen per age class) and this is now determined for the major commercial species (e.g. cod, haddock, herring, Norway pout, plaice and sole).

The *DGMARE indicators 5-7* can be calculated in a standardized manner through the software form the VMS-Tools project (http://code.google.com/p/vmstools/downloads/list). Member states can easily calculate the indicators for their national waters but in order to calculate the indicators at a regional level confidentiality issues need to be resolved in order to make international datasets available.

Discarding rates (DGMARE indicator 8) can be calculated from the DCF data. To what extent this can be considered an ICES task was unclear. There are many issues (e.g. pertaining to data, method of calculation and what the indicator is supposed to reflect) that need to be resolved before this indicator can be calculated.

6   The way forward

The roadmap presented at the workshop was used as the framework to identify the process and work ahead. This consisted of a part that needs to be done prior to the 2nd workshop and a part supposed to take place at the workshop itself.

Prior to 2nd workshop four case studies will be conducted which cover the MSFD regions of the Baltic Sea, the North Sea, the Celtic Sea and the Mediterranean Sea. For each case study, the following steps will be carried out:

1) Identify commercially exploited (shell)fish populations per MSFD (sub)region:
   – FAO Fishstat database or whatever source is considered most comprehensive and appropriate
      • Appropriate selection of last 5? years that are up-to-date
      • Identify regional and member state specific species

2) Primary indicators (criteria 3.1 & 3.2): Identify stocks for which stock assessments are conducted
   – List of assessed stocks and their areas (based on ICES, GFCM, ICCAT areas)
   – Map stock areas to MSFD regions (adopt most recent) and allocate stocks to regions, identify problematic stocks. Straddling stocks will often be an issue, these can e.g. be considered part of several regions. How this was resolved should be discussed at the meeting as the outcome should be defensible and transparent.
   – Identify per stock which indicators and reference levels are available, consider proxies if missing

3) Secondary indicators (criteria 3.1 & 3.2) and all indicators (criterion 3.3): Identify commercially exploited (shell)fish populations for which data from monitoring programs exist
   – List surveys occurring in the region and consider suitability per species: based on gear, area, period etc.
   – Determine which indicators it can deliver
   – Identify reference levels, if not, then trends (issues of time period, method, significance etc.)

At the 2nd workshop:

   – Consider information available per region in terms of commercial species covered by assessments/surveys and their quality, identify gaps
   – Consider issues of reference levels and identifying trends (or any scientific method that allows us to distinguish GES from sub-GES)
   – Consider how this information can be used to determine GES:
      – provide options and evaluate
      – Identify targets that distinguish GES from sub-GES

Evaluate consequences of aggregation across indicators within criteria and across criteria

Specifically for the Mediterranean a step-wise workplan was drafted to prepare for the upcoming workshop according to the above roadmap (see Annex 2)

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Annex 2

Ensuring consistency in the GES assessment for the MSFD Descriptor 3+ (Commercial (shell)fish) in the Mediterranean Sea

Mediterranean Subgroup (ICES WK MSFD-D3+ meeting)
Copenhagen, 5th-7th July 2011

Introduction to the subgroup meeting activities

This report provides insight on the outcomes of the activities of the Mediterranean Subgroup meeting carried out in the framework of the WKMSFD-D3+ (Copenhagen, 5th-7th July 2011). The meeting was held in order to ensure consistency in the MSs approach towards the definition of GES and related targets for the implementation of the MSFD regarding Descriptor 3. Common plenary meetings were followed by subgroups meetings according to different regions and sub-regions, as foreseen in the MSFD (Art. 4).

The Mediterranean subgroup was attended by experts from Spain, Greece, Italy and Slovenia as well as EEA, ICES and DG MARE representatives. Therefore, outcomes of discussions included in this report are based on the consultation of experts belonging to the aforementioned MSs whose national waters are covering, partially at least, all the marine sub-regions in the Mediterranean Sea (*i.e.*, Western Mediterranean Sea, Adriatic Sea, Ionian Sea, and Aegean-Levantine Sea). It became evident that information collated in this report should be further expanded by gathering the available documentation and data from MSs' administrations, research institutes, international organizations and technical bodies (*e.g.*, FAO - GFCM, STECF, etc.). Outcomes from this meeting, and the following one scheduled to take place in early October, will contribute to drawing up a provisional framework aiming to ensure consistency of the approach for the successful implementation of the MSFD at the Mediterranean level. It should be pointed out that this document represents the vision of the experts who joined the meeting and not the official position of the respective MS.

Step by step activities to ensure consistency

1) **Spatial consistency between MSFD and DCF (or other) data sources**

a) Consistency between MSFD and GSAs (Geographical Subunit Area, according to FAO and DCF subdivisions) should be considered by each MS, in order to clearly identify the GSA that falls within the four Mediterranean Sub-regions.

b) In case of a spatial mismatch, each MS should proceed in making a proposal on how to couple data requirements for proceeding with assessments in each of the MSFD Marine sub-regions with data availability per GSA.

c) When more than one GSA falls under the same Marine sub-region, points related to data aggregation should be tackled. The latter might be a substantial problem in cases when intercalibration activities have

not been carried out at national or international level (e.g., MEDITS trawl-surveys).

2) **Species/stocks selection for the purposes of GES assessment**

Species/Stocks selection for the purposes of GES assessment should take into account several issues, including the cumulative percentage values of each species in the MS landings, data availability according to DCF and the presence of vulnerable species that could be considered in other descriptors (i.e., D1, D4, D6).

The following approach is proposed:

a) Use the most comprehensive source of landings statistics (e.g. either at international level, the FAO-GFCM data, provided per GSA zone, (Fishstat Database), or from National official statistics according to each MSFD sub-region that falls within the MS national jurisdiction);

b) Split landings into major group categories (i.e. small-medium pelagics, large pelagics, demersals) and then for each species of those groups, in each Marine Sub-region, calculate the average landings percentage related to the last 5 ys (to reduce possible noise in the data);

c) Assess the cumulative % composition and select those species that contribute up to the 99% of the total landings in the selected area; however, other important species for a MS's fishery not included in the aforementioned threshold, could be also incorporated in the final list for conducting the Initial Assessment (IA).

d) For the species included in the IA list , and according to data availability and existing stock assessment efforts, primary indicators (or proxies), and/or secondary indicators for D3 will be quantified; due to the exploratory nature of this exercise, it is suggested that another threshold is also considered (99.9% of cumulative landings) and thus to extend the analysis to all species included within this threshold in order to account for politically important (flagship) and/or 'vulnerable' species.

e) Vulnerable species (according to the recently updated IUCN assessment, for instance for the Mediterranean Sharks) and species listed in the Habitats Directive fall under Descriptor 1 (biodiversity), Descriptor 4 (food-web) or 6 (seafloor integrity).

Please note that a comparison of the application of different approaches (*e.g.*, thresholds limit set at 99 or 99.9% cumulative landings percentiles; subdivision of species according to main functional groups, *e.g.,* small-medium pelagics, etc.) and a final decision on the best method to be applied will be carried out in the next MSFD-D3+ meeting in October.

3) **Primary indicators (assessment of available stock assessments, and related thresholds and limits, and proxies)**

The group acknowledged that for most of the Mediterranean stocks a formal stock assessment is lacking. TAC quotas for management purposes exist only for Bluefin Tuna, whose assessment is carried out by ICCAT.

A first analysis of the STECF report (2009) on consolidated stock assessment in EU waters shows that formal assessments are available for 6 pelagic stocks (3 GSAs; 2

species) and 12 demersal stocks (8 GSAs; 7 species) in the Mediterranean Sea. Probably the methodologies adopted for these assessments might not be always consistent with those applied in Northern Europe. Other possible sources on stock assessment for Mediterranean stocks are the FAO-GFCM Scientific Advice Committee (where all Mediterranean Countries are represented: www.gfcm.org) and the SGMED (Study Group on the Mediterranean: https://stecf.jrc.ec.europa.eu/about-stecf). The former group in 2009 completed the assessment of 26 stocks (of which 22 in European waters), while in 2010 it completed the assessment of 70 stocks in European GSAs based on trawl survey data (Cardinale *et al.*, 2010).

The following approach is proposed:

a) Collate information on existing stock assessments for each Marine Sub-region (and GSA) from the available sources (FAO – SAC; STECF and SGMED; National Administrations).

b) Identify the investigated period, area (check the consistency within Marine sub-regions and GSAs), the assessment methodology, the availability of reference levels/thresholds (*e.g.*, MSY, SSB, Bmsy, Flim Fmsy, Fpa) or proxies (*e.g.*, Exploitation rate);

c) When different stock assessments are available for the same stock/area from different sources, select the one based on the most robust methodology using an approach that provides quantitative reference levels/thresholds;

d) If stock assessments are not available, check the possibility to derive proxies with respective reference points by a simplified, but sound, approach based on the available data. For this purpose consider the guidelines on stock assessment in situations of data shortage (provided by STECF SGMED-10-01 WG, Martin and Ceilari, 2010) or methodologies proposed by ICES for data poor stocks.

e) Update the species' list table with the above mentioned information.

4) Secondary indicators based on monitoring programs

These indicators should be applied when stock assessments are not available and data availability to derive even proxies is lacking. Data required for estimating these indicators include those referring to abundance and biomass, length structure of the catches, size at maturity.

These data are usually available through fishery-independent surveys that take place under the DCF. In the Mediterranean Sea, for demersal species the MEDITS otter-trawl survey has been carried out in most MSs (and even other third Countries) since 1994 (the only exceptions are: Malta where it started in 2000; Slovenia in 1995; Croatia and Albania in 1996) onwards (only in Greece this sampling activity was interrupted in 2008, while in Croatia in 1999 the sampling activity was not carried out). MEDITS is carried out on a yearly basis during the II quarter. No intercalibration process has been carried out so far between the MSs joining this survey, although a standard fishing gear is used. Longer time-series can be available from the GRUND trawl-survey (1985-2008) in Italian waters. However, it is necessary to recall that sampling was carried out by using commercial otter-trawl gears that differed among each other in different GSAs. The survey was conducted on a yearly basis, during the III quarter. Another trawl-survey (SOLEMON) was established in 2005 in the Adriatic Sea, using the rapido trawl (a sort of beam trawl), with the aim to assess the common sole (*Solea solea*) and other flatfish stocks.

The major stocks of small pelagics (mainly anchovies and sardines) in the Mediterranean European Union waters (Iberian coast, Gulf of Lions, Adriatic Sea, Sicilian channel, and Aegean Sea), are the target of assessments carried out by means of acoustic surveys in the framework of the project MEDIAS (MEDIterranean Acoustic Survey; Various Authors, 2010).

When data from fishery independent surveys are not sufficient for quantifying specific indicators, the possibility to use Biological Data collected under the DCF from landings or onboard sampling (fishery-dependent data) should be also considered.

An example of using trends of the "so-called" secondary indicators at the Mediterranean level can be found in the MEDITS 2007 report. This report also provides some guidelines and the rationale for trend analyses, as well as the formal estimation of the indicators.

The Mediterranean group expressed some concern related to the fact that the response of certain indicators to specific management practices (e.g., reduction of F) might not be straightforward, as well as to the fact that changes in environmental conditions might also influence stock status, and thus have an impact on secondary indicators values, obscuring the evaluation of the results.

Moreover, no reference levels are available for setting targets/thresholds for secondary indicators, although from a theoretical approach it is possible to define the expected trend for some of the above mentioned indicators (MEDITS, 2007)

The following approach is proposed:

1) check data availability to estimate the secondary indicators for each species included in the list within each Marine Sub-region (see, for instance, DCF Appendix XIII and reports to DCF, as well as MEDITS and MEDIAS specifications);

2) check for spatial consistency between available data and stocks spatial range;

3) when data belong to more than one GSA within the same Mediterranean sub-region, check data availability for all GSAs comprised in the sub-region itself (similar approach as above);

4) check the possibility to merge data from different GSA at the sub-region level (and, if this is the case, how to merge them);

5) when specific data from fishery independent surveys are not available, check if using fishery-dependent data (from DCF, being consistent with sub-region and GSA) is appropriate;

6) fill the species' table list showing those indicators that can be estimated within each sub-region and GSA;

7) for those stocks that some indicators cannot be estimated, it is recommended to specify what data are missing;

At this stage it is also recommended to summarize the information collected in the species' table list by providing the following short summary:

- number of stocks for each Regional sub-area (and GSA) for which the quantification of primary indicators is possible (specify which indicators);

- number of stocks for each Regional sub-area (and GSA) for which the application of proxies for specific primary indicators is possible (specify which proxies);

- number of stocks for each Regional sub-area (and GSA) for which the quantification of secondary indicators is possible (specify which indicators);

- number of stocks for each Regional sub-area (and GSA) for which the quantification of indicators falling in any of the above categories (primary and proxies, secondary) is not possible.

Integrate this summary providing the cumulative percentage of landings (stocks) that can be covered by applying different indicators for each Regional sub-area (and GSA).

5) Other indicators

Regarding indicators provided by EEA and Eurostat, they are estimated at MS level and not at sub-region level. Moreover, they are estimated on the basis of GFCM landing statistics and stock assessment data. The group felt that more information on the process for estimating these indicators is needed to assess their usefulness in the framework of MSFD for Mediterranean countries. Moreover, to prevent a spatial mismatch, it was envisaged these indicators to be estimated at a sub-regional level (consistent with MSFD) rather than exclusively at national level. The EEA will work in the future (2012) towards preventing such a spatial mismatch on the regional aggregation of national data in its indicators. This is now done in terms of GFCM fishing areas and should be done at the level of MSFD-sub-regions[2]. It has also already provided the WGD3+ Core Group (Claus H from ICES) with information to evaluate redundancy, complementarity and/or added value at the European level of its 2 fisheries indicators. In relation to the DCF environmental indicators listed in Annex XIII, almost all data needed should be available in all Mediterranean MSs from 2003 onwards, excluding Greece where, as already stated, activities related to the DCF were interrupted in 2009. Regarding spatial indicators (5, 6, and 7) that summarize the area impacted by fishing, they can be estimated by using VMS data. This process was carried out in Italy in the period 2006-2009. The use of VMS data also started in Greece (data available for 2009-2010, while in this country the other DCF data were not collected after 2008) and Spain (at least in the framework of some Pilot studies). No other information to trace progress in other Mediterranean EU countries was available in the subgroup. Regarding the methodology for using/estimating such indicators, the need to coordinate the approach at least at the Mediterranean level, was highlighted in order to ensure consistency in this marine region. For this purpose, delegates will contact research groups in their countries, working on this subject, and ask for guidance and advice. Moreover, the possibility to couple VMS data with other information relevant to biodiversity and seabed integrity issues might contribute to estimate indicators falling under Descriptors 1, 4 and 6. A consistent approach between MSs could facilitate interpretation and analysis in the Mediterranean regional and subregional areas. Finally, indicator 8 (Discarding rate of commercially exploited species) can be also estimated on the basis of DCF data available in all EU MS countries. Moreover, the Greek representative highlighted that results of the EU MariFish

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[2] Following from the presentation by Hans Mose from the EEA's European Topic Centre on Inland, Coastal and Marine waters/(ICES at the 1st WGD3+ workshop in July 2011.

project BADMINTON, developing indicators relevant to discarding issues, can be also used to provide further insight into the perspective on determining appropriate GES targets under the MSFD framework.

It is also envisaged that the Mediterranean Group considers the possible need for development at national/regional level of further indicators based on DCF or other data, which could help to define targets that distinguish GES in relation to Descriptors 1, 4, 6, since it is evident there are close links between D3 and Ds 1, 4 and 6. In order to fulfil this: a) Group members will make efforts to come up with examples of cases where the DCF indicators may not provide a sufficient contribution to other Descriptors with regards to 'fish community' or 'fishing impacts' issues (e.g. discard rates of non-commercial exploited species); and b) the Group will raise the issue – based on these examples - at the next meeting of WG D3+ in October 2011 in order to reach a consensuated decision on how to proceed with regards to possible indicator development.

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