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ICES ADVISORY COMMITTEE

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Report of the Workshop on Data Collection - Assessments of non-fishery impacts (WKDCF-NF)

8 -10 October 2013

ICES Headquarters, Copenhagen, Denmark

ICES International Council for the Exploration of the Sea

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Executive summary

The Workshop on Data Collection for assessments of non-commercial-fish impacts (WKDCF-NF) took place in and in Copenhagen, 8-10 October 2013 was chaired by Peter Heslenfeld. This workshop was an initiative to a non-recurrent request from the European Commission concerning the collection of data relevant to the impacts of commercial fisheries on the ecosystem.

The aim of the workshop was to assist in the identification of new data to be collected in support of the implementation of the Common Fisheries Policy (CFP) and the Marine Strategy Framework Directive (MSFD).

Fishing pressure continues to have a considerable impact on marine ecosystems and many problems remain despite efforts to improve management. Certain types of fishing gear physically disturb or damage the seabed and so affect benthic habitats and communities, including those which have been listed as threatened and/or declining.

An inventory was made of the main fisheries per region to describe this fishing pressure. A division of was made of the fishing gears used in each of the marine regions Baltic Sea, North Sea, Atlantic, and Mediterranean and Black Sea. At the base of this inventory an identification was made of which fisheries/gear pose the main threats to the environment. However, it is not possible to identify the relative degree of threat from different fisheries to the ecosystem. After all, how to choose the relative importance of say a 1000 drowned sea birds and the loss of 1000 m^2 of cold water coral?

The MSFD includes reporting requirements for the member states. The regional seas conventions have the role to act as coordinating platforms for the regional implementation of the MSFD. To assess good environmental status according to the MSFD, a number of indicators have been proposed and developed. An overview has been made of the biodiversity indicators of HELCOM, OSPAR and the Barcelona Convention, including the data needed to fully implement these indicators. There was hardly information on the Black Sea available, because there was nobody of this region was participating in this workshop.

Further, an overview was made how the current Data Collection Framework (DCF) might contribute to the data collection for non commercial fisheries issues.

A gap analysis was made on the base of the desired information for biodiversity indicators of the Regional Seas Conventions and the data available in the current DCF. Trawl surveys may provide additional data on threatened species and current bottom trawl-survey may provide a platform for the collection of additional data on benthic species and habitats.

Observers on fishing vessels may have a role in collection of new data. In the past they have provided the best source of data for example for estimating by-catch of sea mammals. In recent years remote or recorded observations have become much more feasible due to the improvement of digital cameras and data recording systems. CCTV cameras would obviously provide higher fleet coverage and may reduced costs. Both types of observation have their advantages. This has resulted in a list of recommendations to obtain the desired new data to assess the environmental impact of fisheries on specific parts of the ecosystem and to fulfil the commitments of the MSFD.

1 Introduction

1.1 Request on identification of new data in support of CFP and MSFD

The Workshop on Data Collection for assessments of non-commercial-fish impacts (WKDCF-NF), chaired by Peter Heslenfeld, the Netherlands, met in ICES HQ, Copenhagen, 8-10 October 2013.

This workshop advised on a non-recurrent request from the European Commission concerning the collection of data relevant to the impacts of commercial fisheries on the ecosystem.

A list of participants is given at Annex 1. The Terms of Reference are given at Annex 2.

Much of the work was accomplished in small groups, with plenary sessions for discussion and agreement on major issues.

The aim of the workshop was to assist in the identification of new data to be collected in support of the implementation of the Common Fisheries Policy (CFP) and the Marine Strategy Framework Directive (MSFD).

The DG Environment has requested ICES to provide further scientific advice on data collection issues, as follows:

1) assist in the identification of new data to be collected in support of the implementation of the Common Fisheries Policy and the Marine Strategy Framework Directive (MSFD) [question 1].

2) assist in the review of the existing environmental indicators to measure the effects of fisheries on the marine ecosystem (2010/93/EU, Appendix XIII) [question 2] and

3) in the selection and development of new indicators to measure the impacts of fisheries on the marine ecosystem, including by-catch[1] of non-target species and damage to the seafloor and its biological communities, for each MSFD marine region or sub-region and finally make proposals in time for the new DC-MAP 2014-2020 review [question 3].

4) Indicators for impacts on the ecosystem from fisheries can contribute to assessments for MSFD Descriptors 1, 4 and 6. As such they would need to be integrated with assessments of non-fishery impacts in order to provide an overall assessment for these descriptors in each (sub-) region. This will require discussion with Member States (via the Regional Sea Conventions) on how to incorporate such indicators. ICES should provide recommendations on how this can be included in the MSFD assessment and reporting process, as well as the implementation of the EU Biodiversity Strategy, including the periodic assessment of the data and access to the data and assessments [question 4]

[1] By-catch is used by this workshop as "Non-target non-commercial species (typical discarded at sea), including damage to seafloor – both physical and species which are damaged/die on the seafloor but which may not arrive to the surface for any counting process".

Advice from ICES to the European Commission responding to question 1-3 was provided in June 2013. ICES assessed the capacity of 8 indicators of the EU Data Collection Framework to detect and measure the effects of fisheries on the marine ecosystem.

WKDCF-NF aimed to focus on the fourth question.

ICES interpretation of the request is based on the understanding that DG Environment wants to explore the data needs on ecosystem impacts under CFP that can be a contribution to MSFD data needs – and not to describe all data needs for CFP and MSFD.

1.2 Scope of the workshop

The scope of the workshop was:

- recommendations should be generically applicable in the marine environment (e.g. European wide), but with regional specification where possible and relevant (e.g. Baltic Sea, North Sea, etc);
- recommendations should be not theoretical, but focused on practical implementation (taking account of feasibility and affordability) so that it can be used to support the data collection to be included in the new DC-MAP. However, it is recognised that further discussion will be needed on operational solutions to best meet overall aims of data collection on ecosystem impacts;
- no further indicators to be developed but rather the workshop should focus on the priority data needs from which indicators can be developed.

The workshop took account of existing information, for example ICES advice, overviews of fishing activities by region (EU DCF Fisheries consultation document), overviews of biodiversity indicators of Regional Seas Conventions.

The workshop noted various related initiatives that are relevant for this workshop. Examples are the ICES expert group on by-catch (WGBYC), ICES workshop on by-catch of sea birds (WKBYCS) (October 2013) and on food webs (April 2014).

2 Fisheries impacts

Fishing pressure continues to have a considerable impact on marine ecosystems and many problems remain despite efforts to improve management. Exploitation of many stocks continues to be beyond the levels they can sustain, while the status of a large number of stocks cannot be fully assessed due to poor data. Habitat destruction and the depletion of key predator and prey species and consequent food web effects are of concern.

Fisheries have a range of direct and indirect effects on marine ecosystems that have been extensively analysed by several ICES WGs including, among others the WGECO (1993-2013). Fishing causes the death of many species including those being targeted and a range of other species such as non-targeted invertebrates and fish (including sharks and rays), seabirds, turtles and marine mammals (seals and small cetaceans). Excessive fishing pressure on targeted species may lead to impaired reproductive capacity and a risk of stock collapse. Deep-water species have been shown to be particularly sensitive to fishing pressure. Some unwanted by-catch is discarded at sea. Discard rates have been high in some fisheries. Discards have been shown to affect the structure of biological communities.

Certain types of fishing gear physically disturb or damage the seabed and so affect benthic habitats and communities, including those which have been listed as threatened and/or declining.

Fishing causes changes in community structure and marine food webs, which may be irreversible. The depletion of larger predatory species has strong effects on fish community structure. Recent research has shown that impacts from fishing on the abundance of fish can be transmitted into deep offshore areas below the maximum depth of commercial operations. While certain impacts of fishing are inevitable, one challenge of sustainable fisheries management is to minimise long-term negative effects on ecosystems while seeking long-term economic and social viability of the fisheries.

Fish stocks are an integral part of ecosystems and, as such, are both strongly dependent on, and support, the good health of the ecosystem. Altered community structure and marine food webs therefore affect commercial fish stocks, particularly during periods of environmental change. In combination with other environmental impacts, such as pollution, climate change and ocean acidification, the effects of fishing may increase the vulnerability of ecosystems (OSPAR 2010, UNEP-MAP RAC/SPA 2010).

3 Fisheries/Gears used by Region and their Impact on the Ecosystem (including by-catch)

3.1 Introduction

This section gives an inventory of the main fisheries per region (including most important fishing gears, demersal as well as pelagic). Further, it identifies the main by-catch issues per fishery for birds, mammals, reptiles, fish and benthic habitats.

The inventory of the fishing gears used in each of the marine regions Baltic Sea, North Sea, Atlantic, and Mediterranean and Black Sea was identified following "EU Data Collection for Fisheries 2014-2020. Consultation Document, 4 June 2013", Annex VI.

This inventory was used as the base to assess the presence of factual (i.e. evidence-based) or potential (i.e. inferred) threats posed by fishing activities on marine fauna and benthic habitats in terms of by-catch/fisheries induced mortality and direct effects on the integrity of seafloor habitats. In order to make this task tractable the vertebrate fauna were considered at the taxonomic Class level (e.g. birds, mammals, reptiles, elasmobranchs and bony fish) while benthic habitats were grouped into structurally similar groups that respond in an analogous manner to physical pressures.

The level 4 metier was considered for fishing activity classification as well as the relevant information available from ICES WGs, literature, international bodies and projects reports were considered to characterise the threats posed by different fishing activities. The analysis was focussed on highlighting the presence or absence/negligibility of impacts of fishing activities on birds, mammals, turtles, elasmobranchs and bony fish in terms of by-catch production (Section 3.2) or impact on benthic habitats (Section 3.3). The groups scored potential interactions on a four point scale:

1) NA indicating that the fishing metier was not employed in that habitat or would take that by-catch,

2) N – indicating that the fishing metier does not impact on the ecosystem component/habitat,

3) Y where evidence or clear inference would indicate a potential impact,

4) ? indicates that the fishing metier and ecosystem component are likely to overlap in space and time but that there was insufficient information to make a judgement.

This approach resulted in the production of matrices (Tables 3.1-3.8)) that report, by region and fishing metier the presence of threats in terms of by-catch production and benthic impact.

3.2 By-catch impact on birds, mammals, reptiles, elasmobranches, bony fish

3.2.1 Atlantic

As fishing gears are optimised to catch fish it is not surprising that by-catch of non-target fish is common. However in the Atlantic region by-catch of all other vertebrate groups does occur with at least some fishing metiers (Table 3.1).

3.2.2 Baltic Sea

As fishing gears are optimised to catch fish it is not surprising that by-catch of non-target fish is common. However in the Baltic region by catch of all other vertebrate groups does occur with at least some fishing metiers (Table 3.2).

3.2.3 Mediterranean and Black Sea

As fishing gears are optimised to catch fish it is not surprising that by-catch of non-target fish is common. However in the Mediterranean and Black Sea region by catch of all other vertebrate groups does occur with at least some fishing metiers (Table 3.3).

3.2.4 North Sea

As fishing gears are optimised to catch fish it is not surprising that by-catch of non-target fish is common. However in the Mediterranean and Black Sea region by catch of all other vertebrate groups does occur with at least some fishing metiers (Table 3.4).

Table 3.1 Fishing metiers employed in the Atlantic region and their potential impact by direct by-catch mortality on vertebrate groups (Based on ICES WG BYC 2013; Anderson et al, 2011; Cosgrove and Browne, 2007). Cells colors of fishing gear symbolise level of activity: orange- common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known.

Gear groups	Gear type	Seabirds	Mammals	Reptiles	Elasmos	Bony Fish
Dredges	Boat dredge [DRB]	N	N	N	N	Y
	Mechanised / Suction dredge [HMD]	N	N	N	N	N
Bottom trawls	Bottom otter trawl [OTB]	N	N	?	Y	Y
	Multi-rig otter trawl [OTT]	N	N	N	Y	Y
	Bottom pair trawl [PTB]	N	N	N	Y	Y
	Beam trawl [TBB]	N	N	N	Y	Y
Pelagic trawls	Midwater otter trawl [OTM]	N	Y	N	Y	Y
	Midwater pair trawl [PTM]	N	Y	N	Y	Y
Rods and Lines	Hand and Pole lines [LHP] [LHM]	N	N	N	N	N
	Trolling lines [LTL]	N	(Y Azores)		N	N
NLonglines	Drifting longlines [LLD]	Y		N	N	
	Set longlines [LLS]	Y		N	N	N
NTraps	Pots and Traps [FPO]	N	Y whales	Y	N	N
	Fyke nets [FYK]	?	? otters	N	N	N
	Stationary uncovered pound nets [FPN]	N	N	N	N	N
Nets	Trammel net [GTR]	Y	Y	N	Y	Y
	Set gillnet [GNS]	Y	Y		?	Y
	Driftnet [GND]	Y	Y		?	N
NSurrounding nets	Purse seine [PS]	N	Y	N	N	Y
Seines	Fly shooting seine [SSC]	N	N	N	Y	Y
	Anchored seine [SDN]	N	N	N	Y	Y
	Pair seine [SPR]	N	N	N	Y	Y
	Beach and boat seine [SB] [SV]	N	Y	N	N	N
Recreational fisheries		N	N	N	N	N

Table 3.2 Fishing metiers employed in the Baltic region and their potential impact by direct by-catch mortality on vertebrate groups (Based on ICES WG BYC 2013; Anderson et al, 2011; Cosgrove and Browne, 2007;). Cells colors of fishing gear symbolise level of activity: orange- common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known.

Gear groups	Gear type	Birds	Mammals	Reptiles	Elasmobranch	Bony fish
Bottom trawls	Bottom otter trawl [OTB]	Yes	Yes	N/A	Yes	Yes
	Multi-rig otter trawl [OTT]	No	?	N/A	Yes	Yes
	Bottom pair trawl [PTB]	NO	?	N/A	Yes	Yes
Pelagic trawls	Midwater otter trawl [OTM]	?	Yes	N/A	No	Yes
	Midwater pair trawl [PTM]	No	Yes	N/A	No	Yes
Rods and Lines	Hand and Pole lines [LHP] [LHM]	No	No	N/A	Yes	No
Longlines	Drifting longlines [LLD]	?	No	N/A	?	No
	Set longlines [LLS]	?	No	N/A	?	No
Traps	Pots and Traps [FPO]	No	Yes	N/A	No	No
	Fyke nets [FYK]	No	Yes	N/A	No	No
	Stationary uncovered pound nets [FPN]	No	Yes	N/A	No	No
Nets	Trammel net [GTR]	Yes	Yes	N/A	Yes	Yes
	Set gillnet [GNS]	Yes	Yes	N/A	Yes	Yes
Surrounding nets	Purse seine [PS]	?	No	N/A	No	No
Seines	Fly shooting seine [SSC]	No	No	N/A	?	Yes
	Anchored seine [SDN]	No	No	N/A	?	Yes
	Pair seine [SPR]	No	No	N/A	?	Yes
	Beach and boat seine [SB] [SV]	No	No	N/A	?	?
Recreational fisheries		Yes	No	N/A	?	No

Table 3.3. Known, inferred and unknown negligible (green) or non-negligible (red) interactions between Mediterranean and Black Sea main fisheries (metier level 4) and taxonomic groups in terms of by-catch production (Casale 2011; GFCM, 2008; ICES, 2013; Tudela, 2004; Cebrian Menchero, 2010).

Gear groups	Gear type	Seabirds	Mammals	Reptiles	Elasmos	Bony fish
Dredges	Boat dredge [DRB]	N	N	N	N	Y
Bottom trawls	Bottom otter trawl [OTB]	Y	Y	Y	Y	Y
	Multi-rig otter trawl [OTT]	?	?	Y	Y	Y
	Bottom pair trawl [PTB]	?	?	Y	Y	Y
	Beam trawl [TBB]	N	N	N	Y	Y
Pelagic trawls	Midwater otter trawl [OTM]	?	?	Y	Y	Y
	Pelagic pair trawl [PTM]	?	Y	Y	Y	Y
Rods and Lines	Hand and Pole lines [LHP] [LHM]	N	?	?	?	?
	Trolling lines [LTL]	Y	?	?	?	?
Longlines	Drifting longlines [LLD]	Y	Y	Y	Y	Y
	Set longlines [LLS]	Y	Y	Y	Y	Y
Traps (d)	Pots and Traps [FPO]	N	Y	N	N	N
	Fyke nets [FYK]	?		?	?	?
	Stationary uncovered pound nets [FPN]	?		?	Y	?
Nets	Trammel net [GTR]	Y	Y	Y	Y	Y
	Set gillnet [GNS]	Y	Y	Y	Y	Y
	Driftnet [GND]	Y	Y	Y	Y	Y
Surrounding nets	Purse seine [PS]	?	Y	Y	?	Y
	Lampara nets [LA]	?	?	?	?	Y
Seines	Fly shooting seine [SSC]	N	N	?	N	Y
	Anchored seine [SDN]	N	N	?	N	Y
	Pair seine [SPR]	N	N	?	N	Y
	Beach and boat seine [SB] [SV]	N	N	?	?	?
Recreational fisheries		?	Y	?	Y	?

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Table 3.4 Fishing metiers employed in the North Sea region and their potential impact by direct by-catch mortality on vertebrate groups(Based on ICES WG BYC 2013). Cells colors of fishing gear symbolise level of activity: orange- common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known.

Gear groups	Gear type	Birds	Mammals	Reptiles	Elasmos	Bony fish
Dredges	Boat dredge [DRB]	N	N	NA	N	Y
	Mechanised / Suction dredge [HMD]	N	N	NA	N	N
Bottom trawls	Bottom otter trawl [OTB]	Y Guillemots in sandeel (minor)	N	NA	Y	Y
	Multi-rig otter trawl [OTT]	N	N	NA	Y	Y
	Bottom pair trawl [PTB]	N	N	NA	Y	Y
	Beam trawl [TBB]	N	N	NA	Y	Y
Pelagic trawls	Midwater otter trawl [OTM]	N	Y	NA	N	N
	Midwater pair trawl [PTM]	N	Y	NA	N	N
Rods and Lines	Hand and Pole lines [LHP] [LHM]	N	N	NA	N	N
Longlines	Set longlines [LLS]	?	N	NA	N	N
Traps (c)	Pots and Traps [FPO]	N	Y (whales on lines, seals in traps)	NA	N	N
	Fyke nets [FYK]	N	N	NA	?	?
Nets	Trammel net [GTR]	N	Y	NA	Y	Y
	Set gillnet [GNS]	N	Y	NA	Y	Y
	Driftnet [GND]	Y	?	NA	N	N
Surrounding nets	Purse seine [PS]	N	N	NA	N	N
Seines	Fly shooting seine [SSC]	N	N	NA	Y	Y
	Anchored seine [SDN]	N	N	NA	Y	Y
	Pair seine [SPR]	N	N	NA	Y	Y
	Beach and boat seine [SB] [SV]	N	N	NA	N	N
Recreational fisheries		N	N	NA	N	N

Table 3.5 Fishing metiers employed in the Atlantic region and their potential impact on benthic habitat groups. Cells colors of fishing gear symbolise level of activity: orange-common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known.

Gear groups	Gear type	Hard Biogenic Reefs (*Lophelia*, carbonate mounds maerl etc.)	*Sabellaria* reefs	Sea-grasses	Mud	Sea pens	Sand	Gravel	Muddy Gravel	Mixed Sediments	Kelp forests	Circa-littoral reefs inc coral gardens, sponges	Bivalve reefs (*Modiolus, Musculus, Ostrea*)	Deep Water Sponges	
Dredges	Boat dredge [DRB]	Y - maerl	Y	Y	Y	Y	Y	Y	Y	Y	NA	NA	Y	?	
	Mechanised / Suction dredge [HMD]	N	N	N	N	N	Y	?	Y	Y	NA	NA	NA	NA	
Bottom trawls	Bottom otter trawl [OTB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Multi-rig otter trawl [OTT]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Bottom pair trawl [PTB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Beam trawl [TBB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Pelagic trawls	Midwater otter trawl [OTM]	NA		NA		NA		NA		NA		NA		NA	
	Midwater pair trawl [PTM]	NA		NA		NA		NA		NA		NA		NA	
Rods and LinesNA	Hand and Pole lines [LHP] [LHM]	N	N	N	N	N	N	N	N	N	N	N	N	N	

	Trolling lines [LTL]	NA		NA		NA		NA		NA		NA		NA	
LonglinesNA	Drifting longlines [LLD]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	Set longlines [LLS]	Y	Y	Y	?	?	?	?	?	?	Y	Y	?	Y	
Traps	Pots and Traps [FPO]	Y	Y	Y	?	?	?	?	?	?	Y	Y	?	Y	
	Fyke nets [FYK]	NA	?NA	?NA	NA	NA	Y	Y	Y	Y	NA	NA	NA	NA	
	Stationary uncovered pound nets [FPN]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Nets	Trammel net [GTR]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Set gillnet [GNS]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
	Driftnet [GND]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Surrounding nets	Purse seine [PS]	N	N	N	N	N	N	N	N	N	N	N	N	N	
Seines	Fly shooting seine [SSC]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y	
	Anchored seine [SDN]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y	
	Pair seine [SPR]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y	
	Beach and boat seine [SB] [SV]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y	
Recreational fisheries		Y (Maerl)	?	?	N	?	N	N	N	N	Y	Y	Y	NA	

Table 3.6 Fishing metiers employed in the Baltic Sea region and their potential impact on benthic habitat groups Cells colors of fishing gear symbolise level of activity: orange-common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known..

Gear groups	Gear type	Hard Biogenic Reefs (*Lophelia*, carbonate mounds maerl etc.)	*Sabellaria* reefs	Sea-grasses	Mud	Sea pens	Sand	Gravel	Muddy Gravel	Mixed Sediments	Kelp forests	Circa-littoral reefs inc coral gardens, sponges	Bivalve reefs (*Modiolus*, *Musculus*, *Ostrea*)	Deep Water Sponges
Bottom trawls	Bottom otter trawl [OTB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Multi-rig otter trawl [OTT]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Bottom pair trawl [PTB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pelagic trawls	Midwater otter trawl [OTM]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Midwater pair trawl [PTM]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rods and Lines	Hand and Pole lines [LHP] [LHM]	N	N	N	N	N	N	N	N	N	N	N	N	N
Longlines	Drifting longlines [LLD]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Set longlines [LLS]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Traps	Pots and Traps [FPO]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y

Gear groups	Gear type	Hard Biogenic Reefs (*Lophelia*, carbonate mounds maerl etc.)	*Sabellaria* reefs	Sea-grasses	Mud	Sea pens	Sand	Gravel	Muddy Gravel	Mixed Sediments	Kelp forests	Circa-littoral reefs inc coral gardens, sponges	Bivalve reefs (*Modiolus*, *Musculus*, *Ostrea*)	Deep Water Sponges
	Fyke nets [FYK]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	NA
	Stationary uncovered pound nets [FPN]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nets	Trammel net [GTR]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Set gillnet [GNS]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Surrounding nets	Purse seine [PS]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seines	Fly shooting seine [SSC]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Anchored seine [SDN]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Pair seine [SPR]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Beach and boat seine [SB] [SV]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Recreational fisheries		Y	?	?	N	?	N	N	N	N	Y	Y	Y	NA

Table 3.7 Fishing metiers employed in the North Sea region and their potential impact on benthic habitat groups Cells colors of fishing gear symbolise level of activity: orange- common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known..

Gear groups	Gear type	Hard Biogenic Reefs (*Lophelia*, carbonate mounds maerl etc.)	*Sabellaria* reefs	Sea-grasses	Mud	Sea pens	Sand	Gravel	Muddy Gravel	Mixed Sediments	Kelp forests	Circa-littoral reefs inc coral gardens, sponges	Bivalve reefs (*Modiolus, Musculus, Ostrea*)	Deep Water Sponges
Dredges	Boat dredge [DRB]	Y (Maerl		?	NA	Y	Y	Y	Y	Y	Y	NA	NA	Y – Kaiser & Spencer, heriot-Watt)
	Mechanised / Suction dredge [HMD]	NA	NA	NA	NA	?	Y	NA	NA	Y	NA	NA	NA	NA
Bottom trawls	Bottom otter trawl [OTB][1]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Multi-rig otter trawl [OTT]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Bottom pair trawl [PTB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Beam trawl [TBB]	Y	Y	NA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pelagic trawls	Midwater otter trawl [OTM]	NA		NA		NA		NA		NA		NA		NA

	Midwater pair trawl [PTM]	NA		NA		NA		NA		NA		NA		NA
Rods and LinesNA	Hand and Pole lines [LHP] [LHM]	N	N	N	N	N	N	N	N	N	N	N	N	N
Longlines	Set longlines [LLS]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Traps (c)	Pots and Traps [FPO]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Fyke nets [FYK]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	NA
Nets	Trammel net [GTR]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Set gillnet [GNS]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Driftnet [GND]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Surrounding nets	Purse seine [PS]	N	N	N	N	N	N	N	N	N	N	N	N	N
Seines	Fly shooting seine [SSC]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Anchored seine [SDN]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Pair seine [SPR]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
	Beach and boat seine [SB] [SV]	Y	Y	Y	?	?	N	?	?	?	Y	Y	?	Y
Recreational fisheries		Y (Maerl)	?	?	N	?	N	N	N	N	Y	Y	Y	NA

ASSUMED TO INCl. ROCK HOPPER RIGS

Table 3.8 Fishing metiers employed in the Mediterranean and Black Sea region and their potential impact on benthic habitat groups (Tudela, 2004; UNEP-MAP RAC/SPA 2010). Cells colors of fishing gear symbolise level of activity: orange- common fishing gear/activity in this ecoregion; green – negligible or nonexistent; white – not known.

		INFRALITTORAL					CIRCALITTORAL			BATHYAL			ABYSSAL
Gear groups	**Gear type**	**Fine sands with mor or less mud**	**Coarse sands in very shallow waters**	**Stones and pebbles (incl. Biogenic Reefs: maerl, Rhodolites etc.)**	***Posidonia oceanica* meadows**	**Hard beds and rocks**	**Muds**	**Sands**	**Hard beds and rocks (coralligenous)**	**Muds**	**Sands**	**hard rocks (incl. deep sea corals)**	**Muds**
Dredges	Boat dredge [DRB]	Y	NA	?	NA	NA	Y	Y	Y	NA	NA	NA	NA
Bottom trawls	Bottom otter trawl [OTB]	Y	NA	Y	Y	NA	Y	Y	Y	Y	Y	Y	NA
	Multi-rig otter trawl [OTT]	Y	NA	?	Y	NA	Y	Y	?	Y	Y	Y	NA
	Bottom pair trawl [PTB]	Y	NA	?	Y	NA	Y	Y	?	Y	Y	Y	NA
	Beam trawl [TBB]	Y	NA	?	NA	NA	Y	Y	Y	NA	NA	NA	NA
Pelagic trawls	Midwater otter trawl [OTM]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pelagic pair trawl [PTM]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rods and Lines	Hand and Pole lines [LHP] [LHM]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Trolling lines [LTL]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Longlines	Drifting longlines [LLD]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Set longlines [LLS]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
Traps (d)	Pots and Traps [FPO]	Y	?	Y	?	Y	Y	Y	Y	NA	NA	NA	NA
	Fyke nets [FYK]	Y	?	Y	?	?	Y	Y	Y	NA	NA	NA	NA
	Stationary uncovered pound nets [FPN]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
Nets	Trammel net [GTR]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
	Set gillnet [GNS]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
	Driftnet [GND]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surrounding nets	Purse seine [PS]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lampara nets [LA]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Seines	Fly shooting seine [SSC]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
	Anchored seine [SDN]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
	Pair seine [SPR]	?	?	?	?	?	?	?	?	NA	NA	NA	NA
	Beach and boat seine [SB] [SV]	?	?	NA	Y	?	NA	NA	NA	NA	NA	NA	NA
Recreational fisheries		?	?	?	?	Y	?	?	?	NA	NA	NA	NA

3.3 Impact on benthic habitats

3.3.1 Atlantic

Most bottom contact gears exert some impact on benthic habitats. Heavy and towed gear impact to some extent in all habitats in which they operate. Lighter and static gears impact only the more sensitive habitats. Pelagic gears that have no ground gear and are worked with no bottom contact do not impact directly seabed habitats. In Atlantic region all benthic habitat types are potentially impacted by at least some fishing metiers (Table 3.5).

3.3.2 Baltic Sea

Most bottom contact gears exert some impact on benthic habitats. Heavy and towed gear impact to some extent in all habitats in which they operate. Lighter and static gears impact only the more sensitive habitats. Pelagic gears that have no ground gear and are worked with no bottom contact do not impact directly seabed habitats. In Baltic Sea region all benthic habitat types are potentially impacted by at least some fishing metiers (Table 3.6).

3.3.3 Mediterranean and Black Sea

Most bottom contact gears exert some impact on benthic habitats. Heavy and towed gear impact to some extent in all habitats in which they operate. Lighter and static gears impact only the more sensitive habitats but the extent of such impact is largely unknown. Pelagic gears that have no ground gear and are worked with no bottom contact do not impact directly seabed habitats. In Mediterranean and Black Sea region all benthic habitat types are potentially impacted by at least some fishing metiers (Table 3.3).

3.3.4 North Sea

Most bottom contact gears exert some impact on benthic habitats. Heavy and towed gear impact to some extent in all habitats in which they operate. Lighter and static gears impact only the more sensitive habitats. Pelagic gears that have no ground gear and are worked with no bottom contact do not impact directly seabed habitats. In North Sea region all benthic habitat types are potentially impacted by at least some fishing metiers (Table 3.7).

3.4 General observations on fishing metier impacts matrices

The assessment of the matrices show that sufficient information is not available to quantitatively describe, in detail, the interactions between all the fishing activites and all taxonomic groups. In some cases such information is available at coarser fishing activity resolution (e.g. metier level 3) or related to data referred to small areas ,and therefore the relevance at Regional level of such impact is not clear.

In some cases it was necessary to infere the possible presence/absence of interactions according to fishing activites and species' groups ecology, although field based evidence were not available.

It is not possible to complete a ranking of the threat posed by by-catch production by different fishing activities and/or to make a quantitative comparison between fishing activities due to lack of quantitative data both on by-catch/discard rate and the abundance of species. Indeed in some cases small discard rate could have large impact on

population of small size. At the same time high or increasing discard rate could by erroneously interpreted, since an increase on such parameter might only reflect an increase in population size

Accordingly, while the matrix allow the highlighting, as a first approximation, those metier that affects/interacts with the selected taxonomic groups while an in depth assessment would need more detailed field evidence.

3.5 Identification of which fisheries/gear pose the main threats to each of these groups

Tables 3.1-3.8 clearly identify which gears potentially impact on each ecosystem component and benthic habitat group. However in many cases there is insufficient information to make even an inference about such effects (identified by '?' in the cells). These conditions clearly represent a knowledge gap.

However, even if all the cells were populated with a clear indication of existence or not of an impact it would still not be possible to identify the relative degree of threat from different fisheries to the ecosystem. It is a complex, and societal, choice as to the relative importance of say a 1000 drowned sea birds and the loss of 1000 m^2 of cold water coral? In future such decisions may be aided by economic valuations based on the delivery of ecosystem services, including the cultural value of species and habitat features (Solan *et al*. 2012).

ICES expert groups have over many years advised on the relative size of threats to particular groups e.g. WGBYC, WGSE, WGFE, WGECO.

Solan, M., R.J. Aspen & D.M. Paterson (eds) (2012). Marine Biodiversity and Ecosystem Functioning: Frameworks, methodologies, and integration. OUP, Oxford 240pp

4 Reporting Requirements on Non Commercial Fisheries Issues for MSFD

There are several reporting requirements for member states concerning data collection. The most relevant ones are mentioned here: the CFP Data requirements under the current DCF and the Marine Strategy Framework Directive (MSFD). The Regional Seas Conventions play an important role in implementing the MSFD.

CFP Data requirements under the current DCF in relation the effects of fishing on the environment:

Under the current DCF, member states are required to calculate nine environmental indicators to measure the effects of fisheries on the marine ecosystem. These indicators are specified in appendix XIII of regulation 2010/93/EU and include three fish community state indicators based on fish survey data (XIII 1 to 3), one indicator on genetic effects of fishing on fish species (XIII 4), three pressure indicators based on VMS data (XIII 5 to 7), one pressure indicator on discard rates (XIII 8) and one indicator on fuel efficiency (XIII 9). These indicators have been reviewed in relation to their qualities and their future utility in part 1 of the ICES advice on data collection issues in June 2013.

Reporting requirements under the MSFD

EU Member States have to report under the requirements of Art. 5 of the MSFD beyond others regularly on the Status of the environment (Art. 8 report), on how to define the good environmental status (Art. 9 report), their national environmental targets on how to achieve the good environmental status (Art. 10 report), on their marine monitoring programmes (Art. 11 report), and on their programme of measures (Art. 13 report) to maintain or restore the good environmental status of their sea. Neighbouring Member States are obliged to do this coherent, coordinated and harmonized within their sea region.

Example: ICES advice on Integrity of the Seabed

For a practically and locally applicable criteria and methodological standards ICES and JRC have made advices to the European Commission (European Union, 2010). This has resulted in the Commission Decision on criteria and methodological standards on the Good Environmental States of marine waters.

One example is the JRC/ICES Task Group considering (Rice et al 2012) the Seabed Integrity descriptor of 'good environmental status' in 2009. This group concluded that consideration of 8 attributes of the seabed system would provide adequate information to meet requirements of the MSFD:

(i) substratum,

(ii) bioengineers,

(iii) oxygen concentration,

(iv) contaminants and hazardous substances,

(v) species composition,

(vi) size distribution,

(vii) trophodynamics and

(viii) energy flow and life history traits.

The Task Group concluded that there are a few components of the sea-floor which are functionally significant, easily damaged by impacts, and very slow to recovery. These were primarily biogenic habitats such as cold-water coral reefs. For these components, only very small levels of impact would be sustainable, and the goal of management should always be to prevent impacts on those components. Similarly, for contaminants and hazardous substances it is a reasonable management standard to expect no releases into the sea-floor. For both such features, the standard for GES can be pristine conditions. The latter will be assessable by national water quality monitoring programmes while changes in the extent and condition of biogenic habitats vulnerable to fisheries should be subject to reporting.

For all other ecosystem features, some amount of impact is sustainable. A variety of methodologies are available for identifying sustainable levels of use of populations exploited by fisheries (FAO, 2006). There is no reason why these methodologies cannot be applied, if suitable data are available, to any population, while for many indicators of ecosystem processes and functioning analogous approaches should be possible (Rice, 2009). The degree to which DCF can or should provide the required data will be dependent on the indicators selected. For example, changes in marine mammal populations are already assessed and the data come from research projects e.g. Hammond *et al* 2013)).

The above mentioned advice of Rice *et al* (2010) is taken into account by developing the EU Commission Decision. This document has been used by Regional Seas Conventions to develop indicators.

Biodiversity indicators of Regional Seas Conventions

The regional seas conventions have the role to act as coordinating platforms for the regional implementation of the MSFD. To assess Good environmental status (GES) according to the MSFD, a number of indicators have been proposed and developed through the conventions by different working groups and projects. These indicators have a different status. Some indicators are adopted by its Regional Seas Convention, some are under development and others are only proposed. Fisheries data collection should be important for some of these indicators.

In the HELCOM area a first set of 16 core indicators covering descriptor 1, 4 and 6 were agreed in in June 2013 (HELCOM HOD 41/2013, HELCOM 2013). In OSPAR, adoption of a first set of common indicators for the same indicators also took place in June 2013 (OSPAR 13/21/1-E). A total of 15 common indicators were adopted although unevenly distributed in the OSPAR regions. Through the Barcelona convention 11 indicators have been proposed for descriptor 1 so far (UNEP(DEPI)/MED WG.386/3) while other indicators (including fiosheries related indicators) are now under development. To our knowledge, no indicators have been proposed through the Bucharest convention.

Out of the proposed biodiversity indicators both HELCOM and OSPAR have proposed two indicators that are directly linked to impacts by fishery (Table 4.1);

- By-catch of mammals and, in the case of HELCOM, also by-catch of waterbirds[2]

[2] An indicator for by-catch of marine birds has also been proposed in the OSPAR area but it has not been adopted as common OSPAR indicator.

- Indicators that reflect the impacts of bottom disturbing gears on the benthic habitats.

An overview of the proposed biodiversity indicators of HELCOM and OSPAR is given in Table 4.1. An complete overview of the proposed biodiversity indicators of HELCOM, OSPAR and the Barcelona Convention is given in Annex 4. This working group had no information on proposed biodiversity indicators for the Black Sea.

Data collected under DC-MAP could possible provide the data needs for these indicators. This will be further elaborated in the next chapters.

It is worth noting that information on the fishing distribution of fishing activities (by metier) should be also available pertaining those metier impacting on by-catch species in order to allow to overlay information on species'distribution, bycatch rates and fishing effort. The same details recommended above for benthic impacting fisheries should be considered although for bycatch species, taking into account their inherent migration pattern, it would be needed the fishing effort distribution to be assessed at least a seasonal bases.

Table 4.1 Agreed and prioritized indicators of HELCOM and OSPAR that are directly linked to impact from fishery.

Abbreviations used for status of indicators: A=agreed, Pre=pre-core in the HELCOM area, Prio=prioritized in the OSPAR area.

Abbreviations used for area: NS=North Sea, CS=Celtic sea

	HELCOM			OSPAR		
	Indicator	Species and habitats	Gear	Indicator	Species and habitats	Gear
Mammals	Number of drowned mammals in fishing gears (A)	Grey seal Harbour seal Ringed seal Harbour porpoise	Trawls: Bottom otter, Midwater otter, Midwater pair Traps: Pots and Traps, Stationary uncovered pound nets Nets: Trammel, Set gillnet	Numbers of individuals [mammals] within species being bycaught in relation to population (A in NS)	Grey seal Harbour seal Harbour porpoise Inshore bottlenose dolphin Common dolphin	Trawls: Midwater otter, Midwater pair Traps: Pots and Traps Nets: Trammel, Set gillnet
Birds	Number of drowned waterbirds in fishing gears (A)	Watersbirds: Not defined, but long-tailed-duck (*Clangula hyemalis*) and scaup (*A. marila*) identified as having high-by catch rates.	Trawls: Bottom otter Nets: Trammel net Set gillnet Long-lines	-[3]	-	-
Benthic habitats	Cumulative impact on benthic habitats (Pre)	NA. GIS-based information on fishing activity is one of the desired data layers.	Bottom disturbing gears	Physical damage of predominant and special habitats (Prio)	NA. GIS-based information on fishing activity is one of the desired data layers.	Bottom disturbing gears

[3] By-catch of birds has been proposed but not agreed as a common indicator in OSPAR.

5 How the DCF currently covers the Effects of Fishing on the Ecosystem in relation to the Ecosystem

In the previous sections the impacts on non commercial fisheries issues and the development of biodiversity indicators for implementation of the MSFD are described. This section describes how DCF can contribute to data collection for non commercial fisheries issues.

5.1 Fish species

5.1.1 Bycatch of "common" and "threatened and declining species" in commercial fisheries:

The DCF requires a sampling programme of commercial fisheries which includes sampling of landings on shore and sampling of total catches (including discards) at sea. Fish species are categorised into three groups according to their management, whereby species in group 1 are subject to management, recovery or conservation plans, species in group 2 are other internationally regulated species and major non-internationally regulated by-catch species and group 3 are all other fish and shellfish species (2010/93/EU). The list of all species, i.e. group 3 is defined by region in the DCF regional coordination meetings. As part of the sampling at sea programme, catches and discards on board fishing vessels have to be recorded for all species in group 3 for selected fishing trips. Catch weight, length data and the collection of other biological variables are required for species in group 1 and 2. The list of stocks of group 1 and 2 species are specified in Annex VII of the DCF by area with sampling parameters and sampling frequencies (annual or triennial).

The DCF sampling programme of commercial fisheries is using fishing metiers. Sampling effort is stratified according to the relative contribution of a particular metier to overall landings, value of landings and fishing effort. As a consequence, the sampling effort might not be at an adequate resolution to provide sufficient data on fisheries which have particular high bycatch of certain protected, threatened and declining fish species.

Tables 1a to c show the fish species that are part of the lists of threatened and declining species from the regional sea conventions and whether they are sampled for biological variables in commercial fisheries under the DCF.

Table 1a: HELCOM list of threatened and declining species and DCF biological sampling requirements for the same species in the HELCOM convention area (includes ICES division IIIa)

Species Latin	Species common name	DCF Appendix VII HELCOM
*Acipenser oxyrinchus**	American Atlantic Sturgeon	n
Anarhichas lupus	Atlantic wolf-fish	n
Anguilla anguilla	European Eel	y
Aspius aspius	Asp	n
Coregonus maraena	Whitefish	y
Cyclopterus lumpus	Lumpsucker	n
Dipturus batis	Common skate	Y
Enchelyopus cimbrius	Four-bearded rockling	n
Gadus morhua	Cod	y
Galeorhinus galeus	Tope shark	y*
Lamna nasus	Porbeagle	y (NEA)
Lebetus guilleti	Guillet´s goby	n
Lebetus scorpioides	Diminutive goby	n
Lesueurigobius friesii	Fries's goby	n
Lota lota	Burbot	n
Lycodes gracilis	Checker eelpout	n
Melanogrammus aeglefinus	Haddock	y (IIIa)
Merlangius merlangus	Whiting	y (IIIa)
Merluccius merluccius	European hake	y (IIIa)
Molva molva	Ling	y (IIIa)
Phrynorhombus norvegicus	Norwegian topknot	n
Pomatoschistus norvegicus	Norway goby	n
Pomatoschistus pictus	Painted goby	n
Raja clavata	Thornback ray	y
Salmo salar	Salmon	y
Salmo trutta	Trout	y
Scophthalmus maximus	Turbot	y
Squalus acanthias	NEA Spurdog	y (NEA)
Thymallus thymallus	Grayling	n
Zeugopterus punctatus	Topknot	n
Zoarces viviparus	Eelpout, viviparous	n

Table 1b: OSPAR list of threatened and declining species, details on OSPAR region(s) where the threatened and declining criteria apply and DCF biological sampling requirements for the same species in the different OSPAR regions;*fish species also included in Annex II of the Habitats directive 92/43/EEC.

Species Latin	Species common name	OSPAR Area where criteria of T&D species apply	Sampled under DCF Appendix VII with OSPAR subregion
Centrophorus squamosus	Leafscale gulper shark	All OSPAR	All OSPAR
Centroscymnus coelolepis	Portuguese dogfish	All OSPAR	All OSPAR
Cetorhinus maximus	Basking shark	All OSPAR	All OSPAR
Dipturus batis	Common skate	All OSPAR	OSPAR III,IV,V
Lamna nasus	Porbeagle	All OSPAR	All OSPAR
Squalus acanthias	NEA Spurdog	All OSPAR	All OSPAR
Thunnus thynnus	Bluefin tuna	OSPAR V	OSPAR V
Centrophorus granulosus	Gulper shark	OSPAR VI,V	All OSPAR
Anguilla anguilla	European Eel	OSPAR I, II, III, IV	All OSPAR
Petromyzon marinus*	Sea lamprey	OSPAR I, II, III, IV	n
Salmo salar	Salmon	OSPAR I, II, III, IV	All OSPAR
Hoplostethus atlanticus	Orange roughy	OSPAR I, V	OSPAR I,V
Coregonus lavaretus oxyrinchus*	Houting/Whitefish	OSPAR II	n
Alosa alosa*	Allis shad	OSPAR II, III, IV	n
Rostroraja alba	White skate	OSPAR II, III, IV	All skates and rays
Squatina squatina	Angel shark	OSPAR II, III, IV	All OSPAR
Hippocampus guttulatus (synonym: Hippocampus ramulosus)	Long-snouted seahorse	OSPAR II, III, IV, V	n
Hippocampus hippocampus	Short-snouted seahorse	OSPAR II, III, IV, V	n
Acipenser sturio*	Sturgeon	OSPAR II, IV	n
Gadus morhua	Cod	OSPAR II,III	OSPARI,II,III,IV

Table 1c: Barcelona Convention list of endangered and threatened species and DCF biological sampling requirements for the same species in the Mediterranean Region. References to the Annexes of the Habitats Directive 92/43/EEC and consolidated version 1.1.2007: an asterisk (*) before the name of a species indicates that it is a priority species; (o) species that appears in Annex II but does not appear in either Annex IV or Annex V; (V) species which appears in Annex II and also appears in Annex V but does not appear in Annex IV.

Species Latin	Species common	Sampled under DCF Appendix VII with Mediterranean and Black Sea
* *Acipenser naccarii*	Adriatic sturgeon	n
* *Acipenser sturio*	Sturgeon	n
Aphanius iberus (o)	n.a.	n
Aphanius fasciatus (o)	Spanish toothcarp	n
Carcharias taurus	Sand tiger shark	All areas
Carcharodon carcharias	White shark	All areas
Cetorhinus maximus	Basking shark	All areas
Dipturus batis	Blue skate	All areas
Galeorhinus galeus	Tope shark	All areas
Gymnura altavela	Spiny butterfly ray	All areas
Hippocampus guttulatus (synon. *Hippocampus ramulosus*)	Long-snouted seahorse	n
Hippocampus hippocampus	Short-snouted seahorse	n
Huso huso	Beluga	n
Isurus oxyrinchus	Shortfin mako	All areas
Lamna nasus	Porbeagle	All areas
Lethenteron zanandreai (V)	Po brook lamprey	n
Leucoraja circularis	Sandy ray	All areas
Leucoraja melitensis	Maltese skate	All areas
Mobula mobular	Devil fish	n
Odontaspis ferox	Smalltooth sand tiger	All areas
Oxynotus centrina	Angular roughshark	All areas
Pomatoschistus canestrini (o)	Canestrini's Goby	n
Pomatoschistus tortonesei	Tortonese's goby	n
Pristis pectinata	Smalltooth sawfish	All areas
Pristis pristis	Common sawfish	All areas
Rhinobatos cemiculus	Blackchin guitarfish	All areas
Rhinobatos rhinobatos	Common guitarfish	All areas
Rostroraja alba	White skate	All areas
Sphyrna lewini	Scalloped hammerhead	All areas
Sphyrna mokarran	Great hammerhead	All areas
Sphyrna zygaena	Smooth hammerhead	All areas
Squatina aculeata	Sawback aculeata	All areas

Squatina oculata	Smoothback angelshark	All areas
Squatina squatina	Angelshark	All areas
* ***Valencia hispanica***	Valencia toothcarp	n
* ***Valencia letourneuxi (Valencia hispanica)***	Corfu toothcarp	n

The abovementioned tables indicate that threatened and declining elasmobranches species are mostly covered under the current DCF biological sampling programme. There are a number of inshore/coastal and anadromous listed fish species which are currently not part of the DCF biological sampling programme in the HELCOM and the OSPAR convention area.

5.2 Status of "common" and "threatened and declining" fish species:

Abundance and catch data of fish species are collected on scientific fish surveys which are listed in Appendix IX of the DCF. A detailed gap analysis would be required to assess whether common and/or threatened and declining fish species are adequately sampled by DCF funded fish surveys to provide abundance and other state indicators. A preliminary review indicates that pelagic commercial species as well as demersal shelf communities are well sampled under the current programme. The main gaps for "common fish species" are coastal and inshore fish communities as well as non commercial pelagic and mesopelagic species. Pelagic and mesopelagic species are important components of marine foodwebs as they are major foraging species. The gaps indentified for threatened and declining fish species are coastal and inshore listed species, pelagic sharks and demersal deepwater species south of ICES subarea VI.

5.3 Agreed and prioritized HELCOM and OSPAR fish indicators

The agreed and prioritised HELCOM indicators on fish biodiversity are abundance of key (coastal) fish species, i.e. perch and flounder and the abundance of key functional fish groups, i.e. piscivores and cyprinids. There is an OSPAR agreed indicator on the population abundance/biomass of a suite of selected species in the Celtic Sea and the North Sea. Both conventions also agreed on the proportion of large fish in the community. The calculation of the proportion of large fish in the community is already a requirement under the current DCF and data requirements are sufficiently met with the current DCF funded bottom trawl surveys in the HELCOM and OSPAR convention areas. The population abundance of a suite of selected species is also based on data which is currently collected on existing DCF funded fish trawl surveys.

5.4 Marine mammals, seabirds and reptiles

5.4.1 Bycatch of marine mammals, seabirds and reptiles in commercial fisheries:

In the current DCF, there is no obligation to record the bycatch of marine mammals,seabirds or reptiles. This means that the current DCF does not fulfill the requirements of agreed and prioritised RSC indicators on the number of drowned mammals and water birds in fishing gears (HELCOM) and the numbers of individual mammals within species being bycaught in relation to population (agreed as OSPAR indicator in the North Sea).

Some Member States use the DCF sampling at sea programme to record incidental bycatches of these species groups. Bycatch of cetaceans in selected fisheries are reported under regulation Reg. 812/2004. As the sampling effort for metiers is stratified according to landings, economic value and fishing effort on commercial stocks, fisheries, which have potentially high bycatch of marine mammals, seabirds and/or reptiles might not be sampled with the required intensity to provide by-catch data with sufficient precision (WGBYC 2013).

Conclusion: there is a gap on by-catch data on marine mammals, seabirds and reptiles, with adequate sampling effort for high risk metiers.

5.5 Status of marine mammals, seabirds and reptiles

There are no sampling programmes funded under the current DCF which are specifically designed to provide data to assess the status of marine mammals, seabirds and reptiles. Some member states use DCF funded fish surveys as platforms of oppurtunity to collect sightings data of these species.

5.6 Benthos

5.6.1 Collection of data on fishing pressure

The collection of spatial position of fishing vessels by VMS is compulsory for all vessels over 12m (EU Regulation 1224/2009). Indicators 5, and 6 of appendix XIII of the DCF (2010/93/EU) require the calculation of the distribution and aggregation of fishing activities, which are indicators of the extent to which fishing activity is distributed and aggregated. Indicator 7 of apendix XIII, "the areas not impacted by mobile bottom gears", is an indicator of the area of seabed that has not been impacted by mobile bottom fishing gears in the last year. These three indicators are linked to level 6 for the metier classification and include details on fishing gear, the target species group and the mesh size by area. The data required to carry out these DCF indicator calculations, i.e. spatial VMS data linked to fishing metier, should also provide the necessary information for the agreed RSC indicators on cumulative impact on benthic habitats (HELCOM) and physical damage of predominant and special habitats (OSPAR) for vessels above 12m. Experience shows that access to data with a sufficient resolution is often difficult.

Conclusions:

1) 1. It is for the working group currently no clear if there are extra data required for these RSC indicators that are currently not met by the DCF.

2) 2. There is currently a gap on spatial distribution of fishing activities collected for vessels under 12m (in some regions (e.g. Mediterranean Sea), according to specific circumstances, VMS data of FFVV below 15 m are not available).

5.7 Bycatch of benthic invertebrate species in commercial fisheries

Commercial shellfish species are listed under Annex VII of the DCF and require the collection of biological data. These include edible crab *(Cancer pagurus*), lobster (*Homarus_gammarus*), norway lobster (*Nephrops norvegicus*)and common scallop (*Pecten maximus*). All shellfish species are included in group 3 of the DCF samling programme, but the definite list of shellfish collected in this group depends on DCF region.

5.7.1 Status of benthic invertebrate species

There are a number of designated surveys funded under the DCF, which provide state indicators, eg abundance and/or biomass of commercial shellfish stocks. There are no sampling programmes funded under the current DCF which are specifically designed to provide state indicators of non commercial benthic invertebrates. Some member states use fish surveys as platforms of opportunity to collect data on these species.

6 Gap Analysis and Data Needs

6.1 Introduction

In the previous sections the environmental impacts of fisheries are described and is an overview given of existing data (including biodiversity indicators). This section gives an overview of gaps and which data are still needed.

Further, this section provides an overview on information of the currently (to a various degree) adopted lists of species and habitats which are protected under relevant European legislative drivers or listed as of specific interest for monitoring or measures under the Regional Seas Conventions. Many of the none legal binding assessment features of the Regional Sea Conventions become an obligation due to the implementation of the MSFD in 2008.

Annex III, table 1 of the MSFD provides an indicative list of the characteristics for the marine environment. In this list biological features are grouped in plankton, macrophytes and macrofauna, fishes, marine mammals and reptiles, sea birds and non indigenous species. For all of these groups except for plankton and non-indigenous species as it is in principle difficult to assess the status of ecological in homogenous higher taxonomic groups

6.2 Gap analysis on data collection

Sensitive species:

The approach to analyse the to data existing gap on the impact of fishery on the specific species was to compare a compilation of the species protected under EU legislation, selected or adopted for the list of threatened and declining species under OSPAR (OSPAR 2008/6) and on the HELCOM red list of species (HELCOM 2013), and the BARCOM list of endangered and threatened species (BARCOM, 2012, IG.20/5, Annex II) for the Mediterranean sea with actual requirements to collect data under the DCF regulations until 2012. The comparison was based on three questions:

- Is their a requirement to collect data by onboard observers programmes independent on the method used to record any information of the specific species?
- Do the fishery independent scientific survey programmes have the requirement to record data of the specific species?
- Will any programme record the effort distribution of the parts of the fishing fleet which may have an impact in the specific species?

Such a comparison was not possible for the Black Sea as such adopted lists under the Bucarest Convention are missing or their existing was not known by the group.

In a second step it was analysed by expert opinion for which of the species groups information collected by the future development of DC-MAP are assessed as significantly supportative for the required assessments of the status and the impact on the status of the specific species. Based on the three original questions above three additional question were analysed:

- Can the collection of data by the fishery dependent programmes in principle support for the specific species significantly the assessment requirements? If yes, data collection was recommended.

- Can the fishery independent survey programmes significantly add to the existing data collection programmes for the specific species? If yes, it was recommended to add the species to such a programme.
- Can data collected of the fishing distribution effort significantly support the required analyses of the impacts of the status of the specific species? If yes, data collection was recommended.

For the same reasons as above it was not possible to answer the question for the Black Sea.

Catch data for specific species

Under the DCF requirements fishery dependent observations are only required for fish species and commercially used invertebrates (shellfish). Thus, useful data for the species are currently collected only for a minority of the species. Information for each of the species on the location caught by which gear type, and the frequency and amount of the caught animals is considered as significantly support the data requirement of all listed species. Therefore, it was recommended for fisheries dependent data, catch data, including by-catch and discards, that these should be collected for all species listed under the Habitats and Birds Directives, and also listed under the Regional Seas conventions.

Data from fishery independent scientific surveys

Under the DCF requirements fishery independent scientific surveys are only required for fish species and commercially used invertebrates (shellfish). Although many countries provide the ship cruises as platform of opportunity for other monitoring programmes, e.g. sea birds at sea monitoring, there is no general obligation to do so. Additional, these fisheries cruises are not designed as a specific programme for other species than fish and the results can only support species specific monitoring programmes. This means that when under DCF-MAP species specific data would be collected for almost all other species than fish, specific sampling programmes have to designed and to added to the fish species programmes. As this was not considered as an option, it was recommended that data from the fisheries scientific surveys, could provide an additional source for data for some species, in particular fish species, however, we do not recommend to design new specific scientific survey programmes for non-fish species.

Data on fisheries effort distribution

Currently requirement exist to collect data of fisheries distribution effort, e.g. VMS data. However, this requirements have significant gaps, e.g. because of exceptions for small fishing boats which can have an significantly impact on some species. This is gap is of mayor importance as the MSFD requires coherent, coordinated and harmonised monitoring and assessments within each of the biogeographic regions, i.e. the Baltic Sea or the North Sea. Therefore, for all group of species to data the fishery effort can not be analysed thoroughly. Therefore it is recommended that information on fisheries activity and effort of all fishing boats independent of their size or gear is necessary to analyse the impact of fisheries on all species and should be made accessible for all EU Member State reporting obligations.

The result of the analysis is summarised in Table 6.1

Table 6.1 Table summarising the information from the existing DCF programme and recommendations for the DC-MAP for sensitive species grouped by legislative driver and species type. Yes= information is currently available for all; No= No information available; Partial= Information only for some species; Recommended = DC-MAP should be supporting data collection as this kind of information is needed for MSFD implementation; Potential = Information is needed by DC-MAP could only make data collected as part of the fish surveys available; N/A= it is not applicable for the requirements, but in some cases fish independent surveys could be used as platforms of opportunity for additional data collection (see section 5)

DCF period	DCF until 2012	DC-MAP	DCF until 2012	DC-MAP	DCF until 2012	DC-MAP
Type of data collection	**Catch** (incl. by-catch and discard; Fishery depended data)	Catch (incl. by-catch and discard; Fishery depended data)	**Data** from fish independent surveys	Data from fish independent surveys	**Activity:** fishing effort distribution	Activity: fishing effort distribution
Species of Annex II, IV and V of the Habitats Directive	Partial	Recommended	Partial	Potential	Partly	Recommended
All Birds species according to the Birds Directive	No requirement	Recommended	No requirement	N/A	Partly	Recommended
OSPAR t&d species						
Invertebrates	Partly (*Ostreaedulis*)	Recommended	Partly	N/A	Partly	Recommended
Birds	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Fish	Partly (commercial sp)	Recommended	Partly (commercial sp)	Recommended	Partly	Recommended
Mammals	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Reptiles	No requirement	Recommended	No requirement	N/A	Partly	Recommended
HELCOM red lists of species						
Macrophytes	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Invertebrates	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Fish	Partly (commercial sp)	Recommended	Partly (commercial sp)	Recommended	Partly	Recommended
Birds	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Mammals	No requirement	Recommended	No requirement	N/A	Partly	Recommended
BARCELONA LIST OF ENDANGERED OR THREATENED SPECIES						
Macrophytes	No requirement	Recommended	No requirement	N/A	Partly	Recommended

Invertebrates	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Fish	Partly (commercial sp.)	Recommended	Partly (commercial sp)	Recommended	Partly	Recommended
Birds	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Mammals	No requirement	Recommended	No requirement	N/A	Partly	Recommended
Macrophytes	No requirement	Recommended	No requirement	N/A	Partly	Recommended
BUCAREST	?	?	?	?	?	?

***Species included under the RCSs indicator development.**

Explanation of the terms used in Table 6.1:

Catch means any haul out of the species of the list, and other species, independently of the further procedure such releasing or made use of it. It can provide information on presence and location of sensitive species, and presence of associated fauna

Data from fish surveys means that data were collected from fish stock surveys that can contribute to status assessment of sensitive species.

Activity, fishery distribution effort means the analysis of information on the location, intensity and frequency of fishing activities by metier which could have an impact on the species. Additional information showing the spatial distribution of activities, such as the location and length of the nets, will provide more accurate information to analyse the potential effects of activities in particular on sensitive species.

Habitat types

The approach to analyse the to data existing gap on the impact of fishery on the specific habitats and for which of the habitat groups information collected by the future development of DC-MAP are assessed as significantly supportative for the required assessments of the status and the impact on the status of the specific habitat, was based on the same six questions as for the species. The results were grouped for the three groups of habitats required under Annex III, table 1 of the MSFD. The results are in principal the same as for the species analysis.

Table 6.2 Table summarising the information form the existing DCF programme and recommendations for the DC-MAP for all habitat types. Yes= information is currently available for all; No= No information available; Partial= Information only for some habitats; Recommended = DC-MAP should be supporting data collection as this kind of information is needed for MSFD implementation; Potential = Information is needed by DC-MAP could only make data collected as part of the fish surveys available

DCF period	DCF until 2012	DC-MAP	DCF until 2012	DC-MAP	DCF until 2012	DC-MAP
Type of data collection	Catch (incl. by-catch and discard; Fishery depended data)	Catch (incl. by-catch and discard; Fishery depended data)	Data from fish independent surveys	Data from fish independent surveys	Activity: fishing effort distribution	Activity: fishing effort distribution
Habitat type						
Predominant	No requirement	Potential	No requirement	Potential	Partially by VMS	Recommended
Special	No requirement	Recommended	No requirement	Potential	Partially by VMS	Recommended
Strategic importance	N/A	N/A	N/A	N/A	Partially by VMS	Unsure

Under the DCF there is not a requirement to collect data as such for predominant and special habitats. However, for some shellfish, such as brown shrimp (*Crangoncrangon*), Scallops (*Pecten*) or Norway lobster (*Nephropsnorvegicus*) information is routinely collected as there are part of stock assessments. The information from shellfish surveys could be useful as a data source for predominate habitats, as there is a close association between the some species and the habitat were they are found, e.g. *Nephrops* are closely associated with sub-tidal mud and the habitat listed under OSPAR T&D 'Seapens and burrowing megafauna'. Further, in the Mediterranean Sea, bottom trawl survey (MEDITs) and beam trawl survey (SoleMON) already collects data on megaepifauna composition in the catches, on an experimental basis.

Within the context of this advice 'predominant habitats' are all habitats classified at the level of abiotic characteristics, equivalent to the EUNIS level 3, however, the abiotic and associated biological communities are being considered for the purposes of the data collection.

Special habitats includes those protected under Annex I of Habitats Directive, identify under OSPAR T&D, and the HELCOM Red List of Baltic biotopes and habitats. The Barcelona convention has adopted a list with the prioritisation of Mediterranean habitats - UNEP (OCA)/MED WG. 149/5 Annex IV - based on a set of criteria to identify those habitats of conservation interest, for the purpose of this advice the prioritised habitats are considered under special habitats. With regards to the Black Sea, information on habitats identified for further protection was not available for this workshop. For some countries, habitats identified and protected under national legislation are also included under this category.

Strategic important habitats are those named under the MSFD Annex III. At present the definition of this type of habitat is not clear, and a list of such habitat types has not been produced.

Catch means the recording of all the macro-invertebrates captured by the fishing gears independently of their sensitivity or protection status. It can provide for exam-

ple information on the level of disturbance by measuring number of species, distribution, abundance and biomass affected for a specific habitat by a specific gear type or metier.

Other data from fish surveys means that data were collected from fish stock surveys that can contribute to status assessment of these habitats, e.g. abundance and biomass of associated species. But we are not expecting the DC-MAP to be the main source of data for status assessments.

Activity means the analysis of information on the location, intensity and frequency of fishing activities by gear type/metier which could have an impact on the species. The information will be used as part of the underlining data to assess the different levels of pressure.

6.3 Conclusions and possibilities for data collection

6.3.1 Threatened species

Trawl surveys already provide data on threatened species according to the specification of the DCF (Reg. 93/2008 and further implementation) of sampling protocols. For instance in the MEDITs survey in the Mediterranean Sea, about 50 species of elasmobranches are now included on the target species' list in the survey.

No particular change in the sampling protocol should be needed to collect data on caught threatened species, apart from the revision of the list of species for which the collection of data is mandatory. However, it would be necessary to define the level of information needed, e.g. total number/weight vs. individual data (length, maturity, etc.) according to the species taken into account. Moreover the catchability of species should be assessed and/or taken into account.

The scale of surveys most often implies that collected data could be used only to collect preliminary information for assessing the status of threaten species while their contribution might be more useful for information on the spatial distribution of some species.

Potentially it would be possible to the increase the effort to collect data on threatened species, for instance by observing the presence of mammals, birds, etc. during fishing and steaming time.

It is worth noting that:

- The scale of surveys most often implies that collected data could be useless for assessing the status of threaten species.
- At the same time for some species these are the only large scale data on species distribution and abundance
- The catchability of species should be assessed and/or taken into account.

6.4 Bentic Species and Habitats

Current bottom trawl-survey activities provide a platform for the collection of additional data on benthic species and habitats.

Mega-epifaunal data can be collected from the analysis of the total catch to describe benthic species and habitat spatial distribution: experiences on an experimental (not

mandatory) basis on such activities exists in several trawl surveys both in the North Sea (IBTS) and the Mediterranean Sea (MEDITs, SoleMON).

Further operational options may include the collection of infaunal data by means of grab samples, or the use of UW cameras. It is worth noting that the collection of grab samples implies increased time at sea for sample collection and sieving; moreover samples analysis are quite time consuming.

Both mega-epifaunal and infaunal analysis requires increased taxonomic skills compared to the skills needed for the current data collection activities.

It is worth noting that the spatial dimension of trawl surveys and available time at sea (and economic support) does not allow to have high spatial resolution for a proper representation of benthic habitat distribution. Despite these limitations, data from survey might be used to set ad hoc experimental activities on the analysis of pressure-state relationship of the impact of trawling on benthic communities, validate/establish predictive models of benthic habitat distribution. At the same time an agreed list of species indicators directly impacted by fishing is not available.

6.5 Possibilities for data collection

At present, most observations of catch on fishing vessels are conducted using onboard observers. These observers have provided the best source of data for estimating by-catch (ICES WGBYC 2013). However, regarding Regulation (EC) 812/2004 (cetaceans), observer programmes are not covering sufficiently the fishing fleet or different metiers to support accurate estimates of by-catch of cetaceans. In recent years remote or recorded observations have become much more feasible due to the improvement of digital cameras and data recording systems. CCTV cameras would obviously provide higher fleet coverage (and will most probably reduce costs).

Both types of observation have their advantages and disadvantages. Human observers may be better at rapidly identifying species and recognising unusual or rare occurrences. Specimens that are partly obscured can be distinguished or examined more closely. Humans are undoubtedly more flexible in undertaking multiple tasks. Conversely human observers can only be accommodated on larger vessels and cannot work throughout day and night. Records by humans may not be repeatable. Cameras can be mounted on smaller vessels, but do carry risks of malfunction. Analysis of photographs can be time consuming, so the saving in cost of human resource with the use of cameras is not necessarily great.

6.6 Biological Sampling by observers (fishery dependent observations)

Biological sampling relies on the collection of data onboard on fishing vessels by trained observers. The sampling scheme (metier to be sampled, frequency and intensity of sampling) are defined according to several criteria including landings of commercial species, value of the catches, fishing effort). In general terms such stratification approach could not be aligned to the sampling needs for properly addressing threads posed by different fishing gear on by-catch. However biological sampling represent a sampling platform that could allow collecting data on by-catch of threatened species and, potentially, benthic habitats.

Commercial-fisheries observation schemes seem likely to evolve towards a mixed approach, especially if the new CFP landings obligation ("discard ban") leads to greater use of dockside monitoring and a lower use of on-board monitoring. From the point of view of data collection that will be useful for understanding ecosystem status

and effects of fishing pressure, it is important that this mixed approach be designed not solely for recording commercial catch but also with other purposes in mind. Thus for example, a proportion of marine mammal by-catch falls out of gillnets before being hauled on board. Marine mammal by-catch observers are alert to this risk and will watch the sea near the net being hauled for such corpses. A camera set to record catch as it comes on board will miss such incidents. Seabirds that are drowned in fishing gear can become waterlogged and not easily recognised – collection and examination of the specimen is usually required to determine the species affected. An onboard observer can carry out this activity reliably.

Recommendation: The detailed design of catch and by-catch observation schemes needs to integrate the needs for data both for fish stock assessment and for ecosystem purposes.

This includes the assessment of the sampling intensity (% of fishing vessels/days at sea monitored) to proper monitor the by-catch incidence. Moreover a prioritization scheme according to available information should be needed in order to ensure at least the most impacting metier would be monitored according to a robust sampling approach

The collection of data to describe/characterise the impact of fishing on benthic habitats and or benthic habitat distribution is not included in the DCF. Due to the large amounts of catch data that observers needs to collect it is hardly conceivable that further data on benthos might be collected.

Possibly, this activity could be restricted to the analysis of presence/absence of threatened species in the catch. Further methods that could allow to collect data to identify the presence of certain benthic species and/or characterize the benthic communities might include the collection of photographs of discard or the use of CCTV to be later analysed.

Recommendation: The adoption of sampling activities to identify habitats where benthic impacting activities are carried out including the identification of presence/absence of threatened/endangered/sensitive species.

The inclusion of benthic taxa to be assessed by onboard observation need the development of guides and to increase the taxonomic skills of onboard observers.

6.6.1 On board CCTV camera's

On smaller vessels (e.g. < 15 m) it is difficult to have observers on board. Instead, electronic monitoring can take place with CCTV camera's. In several countries are experiments to register by-catch by these camera's.

In the Netherlands IMARES and Marine Science & Communication (MS&C) run, since 2012, a 3-year project for investigating the by-catch of harbour porpoises in Dutch set net fisheries, where monitoring is not required under EC812/2004. Twelve fishermen with vessel under 15m voluntarily participate into the project which involves the implementation of CCTV on their vessels for three years. Additionally, two of these vessels are also be equipped with pingers. The vessels concerned will likely be fishing in the eastern part of IVc, within 30-40 km to the Dutch coast (ASCOBANS, 2013). Similar projects with fisherman takes other countries like Denmark, making use of earlier experiences of a project with fisherman in Norway (Bjørge *et al*, 2013).

Conclusions of these studies are that it is important that fisherman are convinced to participate in the research project. Further, information on relevant parameters should be collected.

Recommendation: To use CCTV camera's on board of smaller vessels it the following should be taken into account:

- vessel with gears that cause most by-catch have priority (see session 3);
- if possible, fishermen should be selected random (fishing federations may act as mediator);
- camera's should be focussed on the nets to guarantee the privacy of the fishermen;
- relevant parameters should be collected, such as technical features of the fishing gear, location, frequency of the fishing activities, etc;
- dead animals should be taken aboard for research and to avoid double catch and counting;
- if possible, fishermen should be paid for their participation in the project and their activities should regular (random) be inspected.

Recommendation: The adoption of sampling activities to identify habitats where benthic impacting activities are carried out including the identification of presence/absence of threatened/endangered/sensitive species.

The use of cameras/CCTV is envisaged to support for this need although experimental protocols should be established.

6.6.2 Logbook data

Fishery logbooks, could represent a further source of data to characterize the by-catch of threatened species. Electronic logbooks have been already tested to the purpose of collecting catch data and may be integrated to GPS in order to gain spatial information on fishing activities. Moreover electronic logbook are used to report main catches under the control regulation and fishermen are obliged to report catches of the most important species on a daily basis. Thus, one technical possibility to collect further data on by-catch might be to request fishermen to report on by-catch species caught on a daily basis.

This approach could applied to a restricted number of fishing vessels belonging to different fishing metier, whose number should be selected according to the effort need to be enforced in order to have representative by-catch data. Further, fishermen could be requested to report by-catches of threatened species.

Recommendation: Current obligation of reporting commercial catches from fishing vessels could be extended including a selected number of by-catch species. The association of position (from integration of electronic logbook to GPS) could provide spatial details on the area where species were caught. The technical feasibility of such approach might be experimentally tested on portions of the fleets.

While the assessment of the impact of fishing on the benthic communities deserves ad hoc research programs to assess the pressure-state relationship, it would be suggested to better characterize the spatial footprint of benthic impacting fishing gear (see section 6).

To this purpose, beyond the need of increasing the frequency of data and the range of fishing vessels where VMS data are collected (small vessels), it would be needed to

have detailed information of technical features of the fishing gear (width) to assess the swept area.

This data could be somehow easy to access for beam-trawlers and dredges (and could be derived from the fishermen logbooks), while for other kind of gears like otter-trawls the estimation of the gear width is less straightforward. Accordingly empirical relationship between some gear or fishing vessel parameters needs to be established to allow an estimation of fishing gear width. This activity would be not related/integrated with DCF, although fishing fleet data to be collects could include parameters to estimate fishing gear width.

Recommendation:

Ad hoc research activities should be devoted to the establishment of empirical relationship to assess the gear width (and swept area) of benthic impacting fishing gear basing on fishing vessels or gear predictors, taking into account technical differences in the gears in different marine regions.

Analysis of fishing effort distribution under DCF should also provide estimates of the swept area by metier within cells at high spatial resolution (e.g. 1 km* 1km) by year.

Recommendation: For the fisheries dependent data, catch data, including by-catch and discards, should be collected for all species listed under the Habitats and Birds Directives, and also listed under the Regional Seas conventions.

Recommendation: Data from the fisheries scientific surveys, could provide an additional source for data for some species, and habitats, however, we do not recommend broadening the number of species in the survey programmes.

Recommendation: To serve the purpose of the proposed indicators by HELCOM and OSPAR on extent of seabed physical damage and loss by human activities, in particular data for the assessment of surface and sub-surface pressures disturbance by bottom contact gears is needed. Therefore, for all vessels, fishing activity information needs to be provided, containing information on the fishing spatial distribution including: location, gear width, vessel speed and fishing effort (hrs). The outputs need to be provided as GIS-based data layers by metier including gear type at levels 4 and 5, and containing all the above information. For vessels, without VMS, the minimum amount of information required on the fishing effort is the spatial location and intensity of activities (frequency and number of vessels).

Table 6.3 Currently reporting and monitoring programmes for ecosystem components impacted by EU fisheries

Ecosystem Component	High level objectives set under	Current Monitoring
Marine mammals	Habitat Directive, ASCOBANS	Often in place but needs improvement in some regions
Sea birds	Birds Directive	Often in place but needs improvement regions
Marine reptiles	Habitat Directive	Often in place but needs improvement regions
Fish	CFP, MSFD and (for certain anadrome species) Habitat Directive	Often in place but could be improved
Benthos	MSFD	Not in place

International programmes to monitor and report on the status of marine mammals, sea birds and marine reptiles are in place in all regions, under commitments made as part of the regional seas conventions and EU Directives.

However, the monitoring of species and habitats is not always well defined and carried out and several member states did not put adequate and/or complete monitoring into place.

Fish stocks are subject to detailed reporting for the purposes of stock assessment and fisheries management but only in recent years has attention expanded include the wider fish assemblage. This is an area where further reporting and analysis would assist in meeting MSFD objectives and is needed to bring parity between regions.

Benthic ecosystems remain an area of concern. There have been a limited number of systematic surveys of North sea benthos but nothing equivalent in other regions and while there have been nearly as many 'indices of benthic helth' proposed as their are benthic laboratories none has met the requirements of a management tool. Both WGECO and BEWG have grappled with this challenge over many years and the view from WGECo, with specific consideration of fisheries ecosystem impacts, is that monitoring of the pressure, understanding the pressure state relationship and knowledge of the match of pressure to benthic habitat types will provide the best pragmatic solution at this time.

ICES has been considering the ecosystem impacts of fisheries since the early 1990s and has on a number of occasions provide detailed advice on the shape of monitoring programmes to consider these impacts (e.g. ICES 2000, 2006). In the North Sea and NE Atlantic many of these were incorporated into monitoring programmes developed under the OSPAR EcoQO framework e.g. harbour porpoise mortality. It is impossible to operate a fishery with no ecological impacts, every fishery causes mortality on the target species and will alter food web dynamics (by potentially reducing pressure on the food resource, altering competitive relationships for that resource and altering prey availability for other predators of the captures species). Mortality of non-target species and physical changes to habitats and geochemical process add further ecosystem changes.

The wide spread nature of the alteration in food web dynamics and the extremely plastic nature of marine food webs makes monitoring of such effects extremely difficult, while the alteration in geochemical processes are linked to both changes in species composition and direct physical effects on the environment (e.g. turnover bottom sediments). Habitats vary in their susceptibility to such effects while different fishing metiers (DCMAP level ….) impose different physical effects. WGECO has repeatedly advised that as a first order assessment of the impacts of fisheries on benthic ecosystems can be achieved through an assessment of the spatial congruence of the pressure and the sensitivity of the habitat, informed by knowledge of the pressure state relationship (ICES 2010).

The DCF currently collects data from research vessel surveys, fisheries observers on commercial fishing vessels, fisher's data returns (VMS, electronic log books etc) and market data. This includes by-catch monitoring is already in place for a number of fisheries and regions under the Habitats Directive, ASCOBANS and fisheries regulations. However, at present effort is stratified by perceived need and it is clear it provides a patchy of total incidental mortality on non-landed components of the ecosystem due to the limited and uneven sampling coverage. Indeed it is worth noting that the WGBYC (2013) in reviewing and commenting on the EU Member States' reports under council Regulation 812/2004 to assess the status of information on re-

cent by-catch estimates and evaluate the extent of the implementation of by-catch mitigation measures noted theat "(by-catch) estimates are still very patchy, and several EU member states have not fulfilled their monitoring obligations. By-catch monitoring remains less than optimally directed in many cases. Observer effort may not be representative of fleet effort and any extrapolated numbers derived solely in this report are uncertain and should be treated with caution".

Furthermore, the utility of by-catch data in assessing ecosystem impacts of fisheries requires knowledge of the population dynamics of the species involved. Difficulties exist in both measuring by-catch and assessing population size in a sufficiently high degree of accuracy to draw conclusions, and in combining data originating from different regions for an overall assessment of GES (OSPAR BDC 13/4/2/r2; WGBYC 2013).

We conclude that marine mammals, birds and to the extent that they are relevant marine reptiles are not fully covered by other monitoring programmes (ASCOBANS, reference) at least on some regions/Sea. The current programme of monitoring by DCF is optimised on fisheries data collection and the data are well utilised in support of both fisheries management and fish biodiversity reporting (REF). To date we lack are robust, regular, reporting of the status/abundance of some mammals, birds and marine reptiles impacted by fishing as well as benthos by individual worm and clam.

Recommendation: The revised DCF include by-catch assessment for sensitive species listed in the HD and Birds Directive as well as species listed as declining/threatened/endangered in the Regional Sea conventions for the most impacting fishing gear and revise sampling stratification in order to fulfil the requirement for sound statistical estimated of by-catch rates.

Recommendation: To support the commissioning of assessment on the actual data coverage (match/mismatch) for estimating populations size/distribution declining/threatened/endangered species at European scale.

Following previous considerations by WGECO (1991-2013 inclusive) consideration of the ecosystem effects of fisheries are best considered at the level of gear metier and major ecosystem component (see Tables 3.1-3.8 for such a regional appraisal). In considering the data gaps that a reformed DCF could fill we begin by assessing the current provision of data by DCF and other monitoring programmes.

Previous consideration of the impacts of fishing activities on benthic ecosystems have concluded that consideration of benthic habitats provides a robust means of dealing with this issue in the face of the logistics and technical challenges of mounting benthic sampling campaigns at the necessary scale. To that end WKDCF-NF concludes that useful information on the impacts of fisheries on benthic ecosystems can be provided by;

- Spatially resolved data on fishing pressure - this should be reported for the whole fleet as part of the DCF reporting.
- Commissioning research to further understand habitat specific 'pressure-state' relationships
- Benthic habitat/sensitivity maps (either observed or predicted).

Recommendation: To include spatially explicit data on the pattern and intensity of fishing pressure by each metier at a scale appropriate for us with habitat sensitivity maps, including information of the fishing gear width and swept area.

Recommendation: To support the commissioning on research to better understand the 'fishing pressure – benthic state' relationship and develop predictive tools for this means.

Recommendation: To work continue to be supported to further develop and refine benthic habitat maps based on observations and predictive models.

7 Recommendations

On the base of the analysis made in this report the following recommendations can be made:

Recommendation: The detailed design of catch and by-catch observation schemes needs to integrate the needs for data both for fish stock assessment and for ecosystem purposes.

This included the assessment of the sampling intensity (% of fishing vessels/days at sea monitored) to proper monitor the by-catch incidence. Moreover a prioritization scheme according to available information should be needed in order to ensure at least the most impacting metier would be monitored according to a robust sampling approach

Recommendation: The adoption of sampling activities to identify habitats where benthic impacting activities are carried out including the identification of presence/absence of threatened/endangered/sensitive species.

The inclusion of benthic taxa to be assessed by onboard observation need the development of guides and to increase the taxonomic skills of onboard observers.

Recommendation: To use CCTV camera's on board of smaller vessels it the following should be taken into account:

- vessel with gears that cause most by-catch have priority (see session 3);
- if possible, fishermen should be selected random (fishing federations may act as mediator);
- camera's should be focussed on the nets to guarantee the privacy of the fishermen;
- relevant parameters should be collected, such as technical features of the fishing gear, location, frequency of the fishing activities, etc;
- dead animals should be taken aboard for research and to avoid double catch and counting;
- if possible, fishermen should be paid for their participation in the project and their activities should regular (random) be inspected.

Recommendation: The adoption of sampling activities to identify habitats where benthic impacting activities are carried out including the identification of presence/absence of threatened/endangered/sensitive species.

The use of cameras/CCTV is envisaged to support for this need although experimental protocols should be established.

Reccomendation: Current obligation of reporting commercial catches from fishing vessels could be extended including a selected number of by-catch species. The association of position (from integration of electronic logbook to GPS) could provide spatial details on the area where species were caught. The technical feasibility of such approach might be experimentally tested on portions of the fleets.

Reccomendation:

Ad hoc research activities should be devoted to the establishment of empirical relationship to assess the gear width (and swept area) of benthic impacting fishing gear basing on fishing vessels or gear predictors, taking into account technical differences in the gears in different marine regions.

Analysis of fishing effort distribution under DCF should also provide estimates of the swept area by metier within cells at high spatial resolution (e.g. 1 km* 1km) by year.

Recommendation: For the fisheries dependent data, catch data, including by-catch and discards, should be collected for all species listed under the Habitats and Birds Directives, and also listed under the Regional Seas conventions.

Recommendation: For the fisheries dependent data, catch data, including by-catch and discards, should be collected for all species listed under the Habitats and Birds Directives, and also listed under the Regional Seas conventions.

Recommendation: Data from the fisheries scientific surveys, could provide an additional source for data for some species, and habitats, however, we do not recommend broadening the number of species in the survey programmes.

Recommendation: To serve the purpose of the proposed indicators by HELCOM and OSPAR on extent of seabed physical damage and loss by human activities, in particular data for the assessment of surface and sub-surface pressures disturbance by bottom contact gears is needed. Therefore, for all vessels, fishing activity information needs to be provided, containing information on the fishing spatial distribution including: location, gear width, vessel speed and fishing effort (hrs). The outputs need to be provided as GIS-based data layers by metier including gear type at levels 4 and 5, and containing all the above information. For vessels, without VMS, the minimum amount of information required on the fishing effort is the spatial location and intensity of activities (frequency and number of vessels).

Recommendation: The revised DCF include by-catch assessment for sensitive species listed in the HD and Birds Directive as well as species listed as declining/threatened/endangered in the Regional Sea conventions for the most impacting fishing gear and revise sampling stratification in order to fulfil the requirement for sound statistical estimated of by-catch rates.

Recommendation: To support the commissioning of assessment on the actual data coverage (match/mismatch) for estimating populations size/distribution declining/threatened/endangered species at European scale.

Recommendation: To include spatially explicit data on the pattern and intensity of fishing pressure by each metier at a scale appropriate for us with habitat sensitivity maps, including information of the fishing gear width and swept area.

Recommendation: To support the commissioning on research to better understand the 'fishing pressure – benthic state' relationship and develop predictive tools for this means.

Recommendation: To work continue to be supported to further develop and refine benthic habitat maps based on observations and predictive models.

Recommendation: Fishing activity and effort information of all fishing boats independent of their size or gear (including estimated of the fishing ear and related swept area) is necessary to analyse the impact of fisheries on all habitat and species and should be made accessible for all EU Member State reporting obligations.

Recommendation: The revised DCF include spatially explicit data on the pattern and intensity of fishing pressure by each metier at a scale appropriate for us with habitat sensitivity maps, including information of the fishing gear width and swept area.

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Annex 1 – List of participants

Workshop on Data Collection and Non-Fisheries

08 - 10 October 2013

List of Participants

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Annex 2 OSPAR List of Threatened and/or Declining Species and Habitats

(Reference Number: OSPAR Agreement 2008-6)

Part 1: Species

SCIENTIFIC NAME	English name
INVERTEBRATES	
Arctica islandica	Ocean quahog
Megabalanus azoricus	Azorean barnacle
Nucella lapillus	Dog whelk
Ostrea edulis	Flat oyster
Patella ulyssiponensis aspera	Azorean limpet
BIRDS	
Larus fuscus fuscus	Lesser black-backed gull
Pagophila eburnea	Ivory gull
Polysticta stelleri	Steller's eider
Puffinus assimilis baroli (auct.incert.)	Little shearwater
Puffinus mauretanicus	Balearic shearwater
Rissa tridactyla	Black-legged kittiwake
Sterna dougallii	Roseate tern
Uria aalge – Iberian population (synonyms: *Uria aalge albionis, Uria aalge ibericus*)	Iberian guillemot
Uria lomvia	Thick-billed murre
FISH	
**Acipenser sturio*	Sturgeon
**Alosa alosa*	Allis shad
**Anguilla anguilla*	European eel
**Centroscymnus coelolepis*	Portuguese dogfish
**Centrophorus granulosus*	Gulper shark
**Centrophorus squamosus*	Leafscale gulper shark
**Cetorhinus maximus*	Basking shark
Coregonus lavaretus oxyrinchus (Linnæus, 1758)	Houting
**Dipturus batis* (synonym: *Raja batis*)	Common Skate
**Raja montagui* (synonym: Dipturus montagui)	Spotted Ray
**Gadus morhua*– populations in the OSPAR regions II and III[4]	Cod
Hippocampus guttulatus (synonym: *Hippocampus ramulosus*)	Long-snouted seahorse
Hippocampus hippocampus	Short-snouted seahorse
**Hoplostethus atlanticus*	Orange roughy

[4] That is, the populations/stocks referred to in ICES advice as the North Sea and Skagerrak cod stock, Kattegat cod stock, Cod west of Scotland, Cod in the Irish Sea, Cod in the Irish Channel and Celtic Sea.

**Lamna nasus*	Porbeagle
Petromyzon marinus	Sea lamprey
**Raja clavata*	Thornback skate / ray
**Rostroraja alba*	White skate
**Salmo salar*	Salmon
**Squalus acanthias*	[Northeast Atlantic] spurdog
**Squatina squatina*	Angel shark
**Thunnus thynnus*	Bluefin tuna
REPTILES	
Caretta caretta	Loggerhead turtle
Dermochelys coriacea	Leatherback turtle
MAMMALS	
Balaena mysticetus	Bowhead whale
Balaenoptera musculus	Blue whale
Eubalaena glacialis	Northern right whale
Phocoena phocoena	Harbour porpoise

Fish species affected by fishing in this list are marked with an asterisk (*).

Part 2: Habitats

DESCRIPTION
HABITATS
Carbonate mounds
Coral Gardens
Cymodocea meadows
Deep-sea sponge aggregations
Intertidal *Mytilus edulis* beds on mixed and sandy sediments
Intertidal mudflats
Littoral chalk communities
Lophelia pertusa reefs
Maerl beds
Modiolus modiolus beds
Oceanic ridges with hydrothermal vents/fields
Ostrea edulis beds
Sabellaria spinulosa reefs
Seamounts
Sea-pen and burrowing megafauna communities
Zostera beds

Annex 3 BARCELONA CONVENTION List of Endangered and Threatened Species of the Mediterranean Sea -last amendments of the Annexes according to the decision IG.20/5 of the 17th meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) and its Protocols (Paris, France 8 - 10 February 2012)

Part 1- Species

SCIENTIFIC NAME
PLANTAE
MAGNOLIOPHYTA
Cymodocea nodosa (Ucria) Ascherson
Posidonia oceanica (Linnaeus) Delile
Zostera marina Linnaeus
Zostera noltii Hornemann
CHLOROPHYTA
Caulerpa ollivieri Dostál
HETEROKONTOPHYTA
Cystoseira genus (except *Cystoseira compressa*)
Fucus virsoides J. Agardh
Laminaria rodriguezii Bornet
Sargassum acinarium (Linnaeus) Setchell
Sargassum flavifolium Kützing
Sargassum hornschuchii C. Agardh
Sargassum trichocarpum J. Agardh
RHODOPHYTA
Gymnogongrus crenulatus (Turner) J. Agardh
Kallymenia spathulata (J. Agardh) P.G. Parkinson
Lithophyllum byssoides (Lamarck) Foslie (Synon. *Lithophyllum lichenoides*)
Ptilophora mediterranea (H. Huvé) R.E. Norris
Schimmelmannia schousboei (J. Agardh) J. Agardh
Sphaerococcus rhizophylloides J.J. Rodríguez
Tenarea tortuosa (Esper) Lemoine
Titanoderma ramosissimum (Heydrich) Bressan & Cabioch (Synon. *Goniolithon byssoides*)
Titanoderma trochanter (Bory) Benhissoune et al.
INVERTEBRATES
SPONGES
Aplysina sp. plur.
Asbestopluma hypogea Vacelet & Boury-Esnault, 1995
Axinella cannabina (Esper, 1794)

Axinella polypoides Schmidt, 1862
Geodia cydonium (Jameson, 1811)
Petrobiona massiliana (Vacelet & Lévi, 1958)
Sarcotragus foetidus (Schmidt, 1862)* (synon. *Ircina foetida*)
Sarcotragus pipetta (Schmidt, 1868)* (synon. *Ircinia pipetta*)
Tethya sp. plur.
CNIDARIANS
Astroides calycularis (Pallas, 1766)
Errina aspera (Linnaeus, 1767)
Savalia savaglia Nardo, 1844 (synon.*Gerardia savaglia*)
BRYOZOANS
Hornera lichenoides (Linnaeus, 1758)
MOLLUSCS
Charonia lampas (Linnaeus, 1758) (= *Ch. Rubicunda* = *Ch. Nodifera*)
Charonia tritonis variegata (Lamarck, 1816) (= Ch. Seguenziae)
Dendropoma petraeum (Monterosato, 1884)
Erosaria spurca (Linnaeus, 1758)
Gibbula nivosa (Adams, 1851)
Lithophaga lithophaga (Linnaeus, 1758)
Luria lurida (Linnaeus, 1758) (= *Cypraea lurida*)
Mitra zonata (Marryat, 1818)
Patella ferruginea (Gmelin, 1791)
Patella nigra (Da Costa, 1771)
Pholas dactylus (Linnaeus, 1758)
Pinna nobilis (Linnaeus, 1758)
Pinna rudis (= *P. pernula*) (Linnaeus, 1758)
Ranella olearia (Linnaeus, 1758)
Schilderia achatidea (Gray in G.B. Sowerby II, 1837)
Tonna galea (Linnaeus, 1758)
Zonaria pyrum (Gmelin, 1791)
CRUSTACEANS
Ocypode cursor (Linnaeus, 1758)
Pachylasma giganteum (Philippi, 1836)
ECHINODERMS
Asterina pancerii (Gasco, 1870)
Centrostephanus longispinus (Philippi, 1845)
Ophidiaster ophidianus (Lamarck, 1816)
VERTEBRATES
FISH
Acipenser naccarii (Bonaparte, 1836)
Acipenser sturio (Linnaeus, 1758)
Aphanius fasciatus (Valenciennes, 1821)
Aphanius iberus (Valenciennes, 1846)
Carcharias taurus (Rafinesque, 1810)
Carcharodon carcharias (Linnaeus, 1758)

Cetorhinus maximus (Gunnerus, 1765)
Dipturus batis (Linnaeus, 1758)
Galeorhinus galeus (Linnaeus, 1758)
Gymnura altavela (Linnaeus, 1758)
Hippocampus guttulatus (Cuvier, 1829) (synon. *Hippocampus ramulosus*)
Hippocampus hippocampus (Linnaeus, 1758)
Huso huso (Linnaeus, 1758)
Isurus oxyrinchus (Rafinesque, 1810)
Lamna nasus (Bonnaterre, 1788)
Lethenteron zanandreai (Vladykov, 1955)
Leucoraja circularis (Couch, 1838)
Leucoraja melitensis (Clark, 1926)
Mobula mobular (Bonnaterre, 1788)
Odontaspis ferox (Risso, 1810)
Oxynotus centrina (Linnaeus, 1758)
Pomatoschistus canestrini (Ninni, 1883)
Pomatoschistus tortonesei (Miller, 1969)
Pristis pectinata (Latham, 1794)
Pristis pristis (Linnaeus, 1758)
Rhinobatos cemiculus (E. Geoffroy Saint-Hilaire, 1817)
Rhinobatos rhinobatos (Linnaeus, 1758)
Rostroraja alba (Lacépède, 1803)
Sphyrna lewini (Griffith & Smith, 1834)
Sphyrna mokarran (Rüppell, 1837)
Sphyrna zygaena (Linnaeus, 1758)
Squatina aculeata (Dumeril, in Cuvier, 1817)
Squatina oculata (Bonaparte, 1840)
Squatina squatina (Linnaeus, 1758)
Valencia hispanica (Valenciennes, 1846)
Valencia letourneuxi (Sauvage, 1880)
REPTILES
Caretta caretta (Linnaeus, 1758)
Chelonia mydas (Linnaeus, 1758)
Dermochelys coriacea (Vandelli, 1761)
Eretmochelys imbricata (Linnaeus, 1766)
Lepidochelys kempii (Garman, 1880)
Trionyx triunguis (Forskål, 1775)
BIRDS
Calonectris diomedea (Scopoli, 1769)
Ceryle rudis (Linnaeus, 1758)
Charadrius alexandrinus (Linnaeus, 1758)
Charadrius leschenaultii columbinus (Lesson, 1826)
Falco eleonorae (Géné, 1834)
Halcyon smyrnensis (Linnaeus, 1758)
Hydrobates pelagicus (Linnaeus, 1758)

Larus armenicus (Buturlin, 1934)
Larus audouinii (Payraudeau, 1826)
Larus genei (Breme, 1839)
Larus melanocephalus (Temminck, 1820)
Numenius tenuirostris (Viellot, 1817)
Pandion haliaetus (Linnaeus, 1758)
Pelecanus crispus (Bruch, 1832)
Pelecanus onocrotalus (Linnaeus, 1758)
Phalacrocorax aristotelis (Linnaeus, 1761)
Phalacrocorax pygmeus (Pallas, 1773)
Phoenicopterus ruber (Linnaeus, 1758)
Puffinus mauretanicus (Lowe, PR, 1921)
Puffinus yelkouan (Brünnich, 1764)
Sterna albifrons (Pallas, 1764)
Sterna bengalensis (Lesson, 1831)
Sterna caspia (Pallas, 1770)
Sterna nilotica (Gmelin, JF, 1789)
Sterna sandvicensis (Latham, 1878)
Sterna albifrons (Pallas, 1764)
Sterna bengalensis (Lesson, 1831)
Sterna caspia (Pallas, 1770)
Sterna nilotica (Gmelin, JF, 1789)
Sterna sandvicensis (Latham, 1878)
MAMMALS
Balaenoptera acutorostrata (Lacépède, 1804)
Balaenoptera borealis (Lesson, 1828)
Balaenoptera physalus (Linnaeus, 1758)
Delphinus delphis (Linnaeus, 1758)
Eubalaena glacialis (Müller, 1776)
Globicephala melas (Trail, 1809)
Grampus griseus (Cuvier G., 1812)
Kogia simus (Owen, 1866)
Megaptera novaeangliae (Borowski, 1781)
Mesoplodon densirostris (de Blainville, 1817)
Monachus monachus (Hermann, 1779)
Orcinus orca (Linnaeus, 1758)
Phocoena phocoena (Linnaeus, 1758)
Physeter macrocephalus (Linnaeus, 1758)
Pseudorca crassidens (Owen, 1846)
Stenella coeruleoalba (Meyen, 1833)
Steno bredanensis (Cuvier in Lesson, 1828)
Tursiops truncatus (Montagu, 1821)
Ziphius cavirostris (Cuvier G., 1832)

Annex 4 Habitats of conservation interest of the Mediterranean Sea (Source: Barcelona Convention 1998 -UNEP (OCA)/MED WG. 149/5). Supralittoral and mediolittoral habitats are excluded from the table.

INFRALITTORAL	
Eurhialine and eurythermal biocenosis	
	Association with *Rupia cirrhosa* and /or *Rupia maritime*
	Association with *Potamogeton pectinatus*
	Association with *Zostera noltii*
	Association with *Zostera marina*
	Association with *Halopitys incurva*
Biocenosis of well sorted fine sands	
	Association with *Halophila stipulacea*
Biocenosis of superficial muddy sands in sheltered waters	
	Facies with *Loripes lacteus*, *Tapes* spp.
	Association with *Zostera noltii*
	Facies with hydrothermal oozes with *Cyclope neritea* and nematodes
Biocenosis of coarse sand and fine gravels mixed by waves (inf)	
	Association with rhodolites
Biocenosis of coarse sand and fine gravels under bottom currents (inf)	
	Maerl facies (*Lithotamnion coralloides* & *Phytomatolithon calcareum*)
	Association with rhodolites
Posidonia oceanica meadows	
	Ecomorphosis of striped meadows
	Ecomorphosis of “barrier-reef” meadows
Biocenonsis of infralittoral algae	
	Association with *Cystoseira amentacea* (var. *amentacea*, var. *stricta*, var. *spicata*)
	Facies with vermetids
	Association with *Cystoseira tamariscifolia* and *Saccorrhiza polyschides*
	Facies with *Claodcora caespitosa*
	Association with *Cystoseira brachycarpa*
	Association with *Cystoseira crinita*
	Association with *Cystoseira crinitophylla*
	Association with *Cystoseira sauvageauana*
	Association with *Cystoseira spinosa*
	Association with *Sargassum vulgare*
	Association with *Cystoseira compressa*
	Facies and associations of Coralligenous biocenosis
CIRCALITTORAL	
Biocenosis of the coastal detritic bottom	
	Facies with large Bryozoa
Coralligenous biocenosis	
	Association with *Cystoseira zosteroides*
	Association with *Cystoseira usneoides*

	Association with *Cystoseira dubia*
	Association with *Cystoseira corniculata*
	Association with *Sargassum* spp. (indigenous)
	Association with *Laminaria ochroleuca*
	Association with *Rodriguezella strafforelli*
	Facies with *Eunicella cavolinii*
	Facies with *Eunicella singularis*
	Facies with *Lophogorgia sarmentosa*
	Facies with *Raramuricea clavata*
	Coralligenous platforms
Semi-dark caves	
	Facies with *Corallium rubrum*
BATHYAL	
Biocenosis of bathyal muds	
	Facies of soft muds with *Funiculina quadrangularis* and *Aporrhais seressianus*
	Facies of compact muds with *Isidella eleongata*
Biocenosis of deep sea corals	
Caves and ducts in total darkness (in inclusion in the uppert stages)	

Annex 5. Overview of biodiversity indicators of Regional Seas Conventions

Indicators of HELCOM, OSPAR and the Barcelona convention that are influenced by fishery.

Abbreviations used for status of indicators: A=agreed, Pre=pre-core in the HELCOM area, Prio=prioritized in the OSPAR area, Prop=Proposed by the Barcelona convention

Abbreviations used for area: NS=North Sea, CS=Celtic sea

	HELCOM		OSPAR		Barcelona convention		Impact from fishery
	Indicator	Species and habitats	Indicator	Species and habitats	Indicator	Species and habitats	
Mammals	Population growth rates, abundance and distribution of marine mammals (A)	Grey seal Harbour seal Ringed seal Harbour porpoise	Abundance of grey and harbour seal at haul-out sites & within breeding colonies (A in NS)	Grey seal Harbour seal	Distributional range Population abundance Population density Population demographic characteristics (All Prop)	Recommendation: Fin whale Common dolphin Long-finned pilot whale Monk Seal Sperm whale Striped dolphin Bottlenose dolphin	By-catch
			Abundance at the relevant temporal scale of cetacean species regularly present (A in NS)	Harbour porpoise Inshore bottlenose dolphin Common dolphin			By-catch

	HELCOM		OSPAR		Barcelona convention		Impact from fishery
Birds	Abundance of waterbirds in the wintering season and in the breeding season (A)	Proposed species list exists (HELCOM Core indicator sheet for water-birds)	Species-specific trends in relative abundance of non-breeding and breeding marine bird species (A in NS)	Shorebirds: ducks, geese and swans divers and grebes Seabirds: petrels and shearwaters gannets and cormorants skuas, gulls, terns and auks	Distributional range Population abundance Population density Population demographic characteristics (All Prop)	Recommendation: *Calonectris diomedea* *Chroicocephalus genei* *Hydrobates pelagicus* *Larus audouinii* *Phalacrocorax aristotelis* *Puffinus mauretanicus* *Puffinus yelkouan* *Sterna bengalensis* *Sterna nilotica* *Sterna sandvicensis*	By-catch
Reptilles	-	-	-	-	Population abundance Population density Population demographic characteristics Distributional pattern of certain coastal and marine habitats listed under SPA protocol (All Prop)	No proposal.	By-catch

	HELCOM		OSPAR		Barcelona convention		Impact from fishery
Benthic habitats	Extent, distribution and condition of benthic biotopes (Pre)	Proposed habitat list exists (HELCOM Core indicator sheet for Red-listed biotopes)	Typical species composition (Prio)	Selection of sensitive habitats (Special habitats)	Potential/ observed distributional range of certain coastal and marine habitats listed under SPA protocol Distributional pattern of certain coastal and marine habitats listed under SPA protocol Condition of the habitat-defining species and communities (All Prop)	Biocoenosis of infralittoral algae Hard beds associated with photophilic algae, Meadows of the sea grass Posidonia oceanica, Hard beds associated with Coralligenous biocenosis and semi dark caves, Biocoenosis of shelf-edge detritic bottoms (facies with Leptometra phalangium), Biocoenosis of deep-sea corals, Seeps and biocoenosis of bathyal muds (facies with Isidella elongata).	Bottom-disturbing gears
Benthos	State of the soft-bottom macrofauna communities (A)	NA	Multi-metric indices (A, all OSPAR regions)	Selection of benthic habitats (predominant and special habitats)	-	-	Bottom-disturbing gears
	Population structure of long-lived macrozoobenthic species (A)	e.g. *Mytilus edulis/trossulus,* and possibly *Arctica islandica*	-[5]		-	-	Bottom-disturbing gears

[5] Size-frequency distribution of bivalve or other sensitive/indicator species has been proposed but not agreed as a common indicator in OSPAR.

	HELCOM		OSPAR		Barcelona convention		Impact from fishery
Fish	Abundance of key (coastal) fish species (A)	perch, flounder	Population abundance/biomass of a suite of selected species (A in CS and NS)	Not defined	-	-	Catch/by-catch
	Proportion of large fish in the community (A)	NA	OSPAR EcoQO for proportion of large fish (LFI) (A in CS and NS)	NA	-	-	Catch/by-catch
	Abundance of key functional fish groups (A)	piscivores, cyprinids	-	-	-	-	Catch/by-catch
	-	-	Mean maximum length of demersal fish and elasmobranchs (Prio)	Not defined	-	-	Catch/by-catch
	Abundance of sea trout spawners and parr (A)	sea-trout	-	-	-	-	Catch/by-catch
	Abundance of salmon spawners and smolt (A)	salmon	-	-	-	-	Catch/by-catch

Review of ICES Report of the Workshop on Data Collection

Assessments of non-fishery impacts (WKDCF-NF) 8 -10 October 2013

Reviewers: Mattias Sköld (chair)

Alf Norkko

Anna Rindorf

Leonie Robinson

Chair WG: Peter Heslenfeld

Secretariat: Claus Hagebro, Michala Ovens

General comments

The WS report has focused on the impacts from fisheries and how the ecosystem indicators and data collection carried out under the DCF, contributes and could increasingly contribute under the DC-MAP, to the assessment of the MSFD.

Overall we found that the report was quiet difficult to follow in certain sections and much clearer in others. There is a requirement for edits throughout in terms of any information going forward to Advice. The workshop was unable to provide any information on the Black Sea in their regionally specific assessments, but we suspect this was because of missing representation at the WS rather than this information being completely lacking.

In interpreting the Tor. the report refers to the Advice provided by ICES on questions 1-3 in June. Reading the June advice by ICES we recognize that some of the conclusions and recommendations by the WS report has already been clearly addressed by ICES in that advice.

The report does not cover other descriptors than 1 (biodiversity), 4 (food webs) and 6 (seafloor integrity. The scientific platforms considered in this report, i.e. the scientific fishery independent surveys that the DCF/DC-MAP provides are unique in their spatial and temporal coverage and the potential additional sampling at relatively low costs that can be carried out to support the MSFD seem not to be addressed here or in the June advice. Work on integrating surveys by ICES has been carried out in the expert group WGISUR, and current surveys aiming at ecosystem monitoring have been evaluated by WKECES.

Comments by section:

Section 2

This section reads well and seems comprehensive other than perhaps lacking references to key reports and literature.

Section 3

The tables are confusing because the definitions of codes used are not clear and seem to have been applied differently for the different ecosystem components (e.g. mobile species versus habitats tables). It is impossible to correct this throughout without all

the reports at hand and without knowing what the group interpreted the codes to mean. Some of the text in this section very repetitive and unnecessary.

Section 4

Section 4 is hard to follow in terms of what the main point is. We recommend a thorough revision of this section.

Section 5

This section provides a useful review of what is currently covered under the DCF and what is not covered.

Section 5.6.1 Collection of data on fishing pressure

The report does not mention the importance of collecting VMS at higher frequency. Current resolution (2h ping rate) is not enough to capture the patchy nature of trawling. We recommend to extend resolution to at least 30 min ping rate (see e.g. Lamberth *et al* 2013). To cover all fisheries mandatory use of AIS introduces an option.

Section 6

The text in this section quite difficult to follow and the sub-sections confusing in terms of how they are organised. Why is there a switch to only considering data gaps for threatened and declining species (habitats are dealt with differently)? The MSFD does not only ask for information on threatened or declining components, and it seems that this section could have instead focused on data gaps using the component categories used for example in Section 3 of the report (thus making it possible to easily relate back to the fishing impacts information). However, given the focus, the recommendations are broadly sensible, although it is unclear why there might be more resource available to add more jobs to the fishery observer programmes (fishery dependent data) than to the scientific fish stock surveys.

A problem with only focusing on threatened and declining species on the lists of EU, OSPAR and HELCOM is that these species are very rare and because of that likely difficult to monitor and thus of little help as indicators for GES. Other components of benthic fauna, e.g. larger fauna (large mussels, sea-pens, sponges, sea-stars) that are sampled in trawls might well indicate trends and thus reflect status of the seafloor (see Rice *et al* 2012 and the report by TG6 http://ec.europa.eu/environment/marine/pdf/6-Task-Group-6.pdf).

The suggestion of new projects to work with fishermen on use of CCTV, particularly for smaller vessels (Section 6.6.1) is promising. Obviously the information summarised in Section 3 could be used to help target which metiers and areas to target and this was also suggested.

It is a good idea to suggest use of ad-hoc experimental and descriptive survey work on-board the routine fish stock surveys (fishery independent methods) to test pressure-state relationships for impact of fisheries and to ground truth habitat maps. We acknowledge that this would require significant resource to do this regularly and so targeted questions would need to be put forward periodically to address data and knowledge gaps.

On page 42 the section seems to move into some sort of summary (no sub-heading given) and actually this text is very clear and the most useful bit of the whole section. The recommendations given at the end of this section seem sensible and well ex-

plained. Much of what comes earlier in this section is confusing and not really necessary given what is covered in the last few pages.

Section 6.2, heading Data from fishery independent scientific surveys

Under the DCF the species list apply but in practice all fish species are sampled under the obligations from the manuals developed by the survey working groups. It is unclear what additional source data is referred to in this text with regard to fish?

During surveys simple hydrographical data are generally collected which could be a platform to serve other descriptors by including e.g. oxygen in the Baltic to produce maps of oxygen deficiency. Potentially extensions relating to other descriptors are temporal and spatial data on nutrients, phyto- and zooplankton. This had been explored in the expert group WGISUR.

Section 7

Overall the recommendations picked out are sensible, but there is a lot of repetition/overlap and the total number could be cut down considerably. Also more could be said on how to target some of this work.

However, increasing the ambitions on observer programmes as well as CCTV observations of by-catch and discards need to be considered under the perspective of the ambitions of EU to introduce a discard ban and the needs for future monitoring of total catches.

Detailed comments and edits to the text and all recommendations are made by Dr Leonie Robinson on the draft WG report itself (attached to this review).

Reference

Lambert, G. I., Hiddink, J. G., Hintzen, N. T., Hinz, H., Kaiser, M. J., Murray, L. G., and Jennings, S. Implications of using alternative methods of vessel monitoring system (VMS) data analysis to describe fishing activities and impacts. – ICES Journal of Marine Science, doi:10.1093/icesjms/fss018.