

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT
STRUCTURAL AND COHESION POLICIES **B**



Agriculture and Rural Development

Culture and Education

Fisheries

Regional Development

Transport and Tourism

**WORKSHOP ON A NEW
TECHNICAL MEASURES
FRAMEWORK FOR THE NEW
COMMON FISHERIES POLICY**

STUDY



DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**WORKSHOP ON A NEW TECHNICAL
MEASURES FRAMEWORK FOR THE NEW
COMMON FISHERIES POLICY**

STUDY

This document was prepared for the European Parliament's Committee on Fisheries.

RESPONSIBLE ADMINISTRATOR

Marcus Breuer and Carmen-Paz Martí
Policy Department B: Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Adrienn Borka and Lyna Pärt

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2015.
© European Union, 2015

Print	ISBN 978- 92-823-8101-4	doi:10.2861/993505	QA-04-15-677-EN-C
PDF	ISBN 978- 92-823-8100-7	doi:10.2861/650920	QA-04-15-677-EN-N

This document is available on the Internet at:
<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.
Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.

CONTENTS

WORKSHOP PROGRAMME

SHORT BIOGRAPHIES OF EXPERTS

IN-DEPTH ANALYSES:

- I. LESSONS FROM THE PAST FOR THE FUTURE OF TECHNICAL MEASURES**
- II. TECHNICAL MEASURES IN THE BALTIC SEA – AN ALTERNATIVE TO OVER-REGULATION AND THE BRACE-AND-BELT APPROACH**
- III. TECHNICAL MEASURES IN THE ATLANTIC AND THE NORTH SEA – WORKING WITH STAKEHOLDERS TOWARDS MEANINGFUL REVISION**
- IV. FISHING MANAGEMENT BASED ON TECHNICAL MEASURES - THE NEED OF A NEW FRAMEWORK FOR THE MEDITERRANEAN SEA**



Европейски парламент Parlamento Europeo Evropský parlament Europa-Parlamentet Europäisches Parlament
Euroopa Parlament Ευρωπαϊκό Κοινοβούλιο European Parliament Parlement européen Parlaimint na hEorpa
Europski parlament Parlamento europeo Eiropas Parlaments Europos Parlamentas Európai Parlament
Parlament Ewropew Europees Parlement Parlament Europejski Parlamento Europeu Parlamentul European
Európsky parlament Evropski parlament Euroopan parlamentti Europaparlamentet

WORKSHOP

Directorate General for Internal Policies
Policy Department B: Structural and Cohesion Policies

A new Technical Measures Framework for the new CFP

- PROGRAMME -

Tuesday, 13 October 2015, 16h00 – 18h30
ASP 1E-2, European Parliament, Brussels

- 16h00 **Welcome and opening remarks to the Workshop:**
Mr Alain CADEC, Chair of the Committee on Fisheries
- 16h05 ***Lessons from the past for the future of Technical measures***
Speaker: Mr Stuart REEVES, Cefas, UK
- 16h25 *Questions and Answers*
- 16h40 ***Technical measures in the Baltic Sea – An alternative to over-regulation and the brace-and-belt approach***
Speaker: Mr Daniel STEPPUTTIS, Thünen Institut, DE
- 17h00 *Questions and Answers*
- 17h15 ***Technical measures in the Atlantic and the North Sea – Working with stakeholder towards meaningful revision***
Speaker: Ms Nathalie STEINS; IMARES, NL
- 17h35 *Questions and Answers*
- 17h50 ***Fishing management based on Technical measures – The need of a new framework for the Mediterranean Sea***
Speaker: Mr Jose María BELLIDO, IEO/UA, ES
- 18h10 *Questions and Answers*
- 18h25 **Closure of the Workshop:**
Mr Alain CADEC, Chair of the Committee on Fisheries

SHORT BIOGRAPHIES OF EXPERTS

Stuart Reeves

Stuart Reeves, PhD, is a fisheries scientist with over twenty five years' experience, which has included looking a diverse range of fisheries issues from research, advisory and policy perspectives. He started his career in the Marine Laboratory in Aberdeen, Scotland where he initially worked on the selectivity of fishing gear before moving on to stock assessment and management advice for roundfish fisheries. He then moved to the Danish fisheries institute where he worked mainly on scientific advice for cod in the Baltic Sea and on mixed fisheries in the North Sea. In 2006 he moved to Cefas in Lowestoft, UK to continue his work on mixed fisheries. Since then he has also worked on a range of other topics, and also spent three years on secondment with DG-MARE of the European Commission where he worked mainly on multi-annual plans for North Sea and Baltic stocks.

Daniel Stepputtis

Daniel Stepputtis, PhD, is senior scientist at the Thünen Institute of Baltic Sea Fisheries in Rostock (Germany). At this institute, he is head of the gear - and survey technology working group. This group works on the improvement of fishing gears with respect to sustainability. Most recently, the group developed several new concepts to obtain multi-species selectivity in trawl gears, which are highly relevant within the context of the introduction of the landing obligation. Other areas of research include e.g. alternative selectivity approaches (to protect small and very large fish in trawls), as well as pulse fishery.

Nathalie Steins

Nathalie Steins, PhD, has been head of the Fisheries Department of IMARES Wageningen UR since July 2013. She worked at the Centre for Coastal Zone Management in Portsmouth (GB), where she carried out research into the integration of coastal fisheries and nature conservation values in England, Ireland and the Dutch Wadden Sea. Nathalie then worked at the Dutch Fish Product Board for almost 10 years. At the Fish Product Board she mainly worked with the flatfish fishery in the North Sea and in the context of the North Sea Advisory Committee. In July 2008, Nathalie moved to the Marine Stewardship Council (MSC), the international certification programme for sustainable and well-managed fisheries. As MSC Manager Benelux she was responsible for the development of the MSC programme in The Netherlands and Belgium. In this role, she actively worked with the fisheries, the processing industry, retailers, NGOs, government and research. In April 2014, Nathalie became member of the Advisory Committee (ACOM) of the International Council for the Exploration of the Seas (ICES).

José Maria Bellido

Jose María Bellido, PhD. He acquired his PhD at the Department of Zoology, University of Aberdeen, Scotland (1997/2002). The title was recognised by the University of Alicante. The research he carried out was on the Use of Geographic Information Systems (GIS), Spatial and Environment-based models to study ecology and fishery of the veined squid in Scottish waters. During his career he acquired skills on Statistics, particularly spatial statistics, GIS and mapping tools and he has a solid background in fisheries ecology. He developed related skills, and reached a high expertise in discards and bycatch research. During the last few years, discards became his main research field. His expertise is also requested in spatial modelling and stock assessment in the Mediterranean as well as in the Atlantic stocks on small pelagic species. He has been the Director (Head of Unit) of the Oceanographic Centre of Murcia (IEO) from 2009 to 2014. Now he is focussing on various research projects at the same IEO Centre and he is teaching at the University of Alicante, mainly to Master students in fisheries and marine sciences and supervises PhD students.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

LESSONS FROM THE PAST FOR THE FUTURE OF TECHNICAL MEASURES

WORKSHOP

IN-DEPTH ANALYSIS

This document was requested by the European Parliament's Committee on Fisheries.

AUTHORS

Stuart A. Reeves

RESPONSIBLE ADMINISTRATOR

Marcus Breuer
Policy Department B: Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Adrienn Borka

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2015.
© European Union, 2015

This document is available on the Internet at:
<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

LESSONS FROM THE PAST FOR THE FUTURE OF TECHNICAL MEASURES

WORKSHOP

IN-DEPTH ANALYSIS

Abstract

Historically, technical measures in EU fisheries have been mostly concerned with improving selectivity, reducing discarding and protecting the marine environment. The reformed CFP should reinforce their role in protecting the marine ecosystem but remove the need for them in relation to selectivity and discarding.

IP/B/PECH/IC/2015_140

October 2015

PE 563.407

EN

CONTENTS

LIST OF ABBREVIATIONS	5
LIST OF TABLES	6
LIST OF FIGURES	6
EXECUTIVE SUMMARY	7
1. INTRODUCTION	9
1.1. Terms of Reference	10
1.2. Background	10
1.3. Report Structure	10
2. TECHNICAL MEASURES IN EU FISHERIES	11
2.1. Technical measures and their uses	11
2.2. Types of Technical Measure	12
2.3. Existing legislation	14
3. LESSONS FROM THE PAST: TECHNICAL MEASURES IN 2008	15
3.1. Terms of reference	15
3.2. Methodology	15
3.3. Results	16
4. THE FUTURE: TECHNICAL MEASURES AFTER 2015	17
4.1. Context: the Reformed CFP	17
4.2. Possible elements of a technical measures framework	18
4.3. The future of different types of technical measure	20
4.4. Towards a framework for future technical measures	22
REFERENCES	24
ANNEX: THE 2008 STUDY ON TECHNICAL MEASURES	25

LIST OF ABBREVIATIONS

AC	Advisory Council
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CECAF	FAO Fisheries Committee for the East & Central Atlantic
CFP	Common Fisheries Policy
FAO	United Nations Food & Agriculture Organisation
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
IOTC	Indian Ocean Tuna Commission
MCRS	Minimum Conservation Reference Size
MLS	Minimum Landing Size
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
NAFO	North-West Atlantic Fisheries Organisation
RAC	Regional Advisory Council (now Advisory Council, AC)
RFMO	Regional Fisheries Management Organisation
SEAFO	South-East Atlantic Fisheries Organisation
STECF	EC Scientific Technical and Economic Committee for Fisheries
TAC	Total Allowable Catch
WCPFC	West-Central Pacific Fisheries Commission
WSSD	United Nations World Summit on Sustainable Development

LIST OF TABLES

Table 1

Categories of technical measure used in the current study 12

Table 2

Elements which would contribute to an effective implementation of technical measures as identified by Reeves et al (2008) 16

Table 3

Council Regulations containing technical measures which were reviewed by Reeves et al (2008) 27

LIST OF FIGURES

Figure 1

Numbers of technical measure by type in different sea areas/RFMOs 14

EXECUTIVE SUMMARY

Technical **conservation measures** which are intended to influence how and where fishing takes place. In EU fisheries they have mainly been used to encourage **selective** fishing and thus reduce **discarding**, or to protect parts of the **marine ecosystem**.

Technical measures are here classified into a number of different types:

- 1) **Catch composition** rules;
- 2) rules on **gear handling** and use;
- 3) **gear construction** regulations;
- 4) **area closures** to protect **ecosystem** components;
- 5) **areas closures** for **other**, stock-related, reasons and
- 6) other measures related to **ecosystem** protection.

EU technical measures legislation is **complex** and spread across many different regulations. Compared to other areas where EU vessels fish, such as the Northwest Atlantic and Antarctic waters, EU legislation contains a high number of **gear construction** measures and stock-related **area closures**.

The current study builds on the results of a previous study which took place in 2008 and performed a **detailed review** of the technical measures that were in place in EU legislation at that time. Based on the analysis of the measures that were in place and their performance, the 2008 study identified a number of elements that would help contribute to an effective implementation of technical measures. The current study uses those '**lessons learnt**' from the review of past technical measures to help consider how technical measures might be implemented in the future.

In recent years the main changes in the context for technical measures arise from the recent **reform** of the Common Fisheries Policy. The key element of this policy of relevance to technical measures is a move towards a **landing obligation** for fish which would previously have been discarded. **Regionalisation** and the move towards an **ecosystem-based approach** to fisheries management will also be important. The achievement of Maximum Sustainable Yield (**MSY**) is also an important element of the reformed CFP, but this but catch limits such as **TACs** will be the main tool for achieving this objective.

The changes to the context for technical measures resulting from the reformed CFP are mostly consistent with those identified by the 2008 study as contributing to a more effective implementation of technical measures. In particular, the move to a results-based system where the **objective** - eliminating discards - is defined **instead of the measures**, allows for a more flexible, **bottom-up approach** to achieving the objective.

Many of the existing technical measures which are connected with **selectivity and discarding**, particularly catch composition and gear construction measures, should become unnecessary once the landing obligation becomes fully effective as it will then be illegal to discard undersized fish. Measures related to **ecosystem protection** are likely to still be relevant so should be retained.

A possible framework for future technical measures would consist of a **central regulation** containing measures which would apply in all regions and to all EU fishing vessels, and a series of **regional regulations** containing measures relevant only to that region. The measures in the central regulation would be mostly gear-handling measures intended to protect aspects of the marine ecosystem, and possibly also a list of protected species. The framework would also need a time component to allow for the phasing-out of catch composition and gear construction measures and for the review of stock-related area closures. The measures in the regional regulations would be mostly spatial measures.

1. INTRODUCTION

The context for the current study, as described in the tender document is as follows:

The Common Fisheries Policy (CFP) of the EU has recently been overhauled. In December 2013, the European Parliament and the Council agreed on a comprehensive CFP reform. It is now enshrined in a new legislative framework, the so-called '**new CFP basic regulation**' ([Regulation \(EU\) No 1380/2013](#)). As far as the conservation of marine biological resources is concerned, it repeals and replaces the former 'basic fisheries management framework', laid down by the Council in 2002 ([Regulation \(EC\) No 2371/2002](#)).

Thus the **main objectives** to be accomplished by this reformed CFP are the following:

- to achieve the **maximum sustainable yield** exploitation by 2015 , or at the latest by 2020,
- to implement the **ecosystem-based approach** to fisheries management and
- to gradually **eliminate discards** through the landing obligation.

In the follow-up to the CFP reform the European Commission is gradually issuing new legislative proposals aiming to align the partly outdated EU Regulations from before 2013. One of the major post-reform projects of the European Commission is the **general overhaul** of the set of existing rules for **technical measures**.

The Commission announced a new **legislative proposal** for a general technical measures Regulation for the late autumn of this year. This new Union Regulation shall replace the old general framework Regulation for technical measures from 1998 ([Council Regulation \(EC\) No 850/98](#)).

The existing set of technical measures in the Union is a complex, heterogeneous and disorganized system of provisions. They are frequently inconsistent and even contradictory. They have often been criticised as over-prescriptive and too complex, as they contain numerous exceptions and derogations. This is due in part to their origin and evolution. Some of them, for example, have been transposed into EU law from the provision of Regional Fisheries Management Organisations (RFMOs).

Other measures were adopted by the Council as part of the annual negotiations in the context of setting Total Allowable Catches (TACs) and quotas. Some of the technical measures are, thus, the fruit of negotiation. This weakens their scientific basis and can generate unjustified differences among sea basins. All the legal texts containing technical measures have been subject to a number of modifications. These have increased their complexity, and sometimes even resulted in deviation from the original aim of the measure.

Against this background the Committee on Fisheries of the European Parliament wishes to commission an in-depth analysis on "**A new technical measures framework for the new CFP - The general scope**".

The analysis shall be presented and discussed with Members during a **workshop** entitled "A new technical measures framework for the new CFP", which is due to take place in the European Parliament premises in Brussels on the **13/10/2015** from 15h30 to 18h00.

1.1. Terms of Reference

To address this general topic, the specific terms of reference for the study are as follows:

1.1.1. Overall Objectives

The in-depth analysis shall perform three distinct functions:

- A. **Review** of the existing technical measures in EU fisheries legislation.
- B. **Assessment and evaluation** of the main existing technical measures in view of the above mentioned new CFP objectives as well as the regionalisation¹ aspect of the new CFP and the announced simplification of technical measures for the protection of marine organisms.
- C. **Conclusions and recommendations** shall be proposed to the Members of the committee on how to rationalise the complex set of general technical measures in view of the above-mentioned CFP objectives for all Union fishing areas.

1.1.2. Research Questions

With the regard to the general objectives outlined above, the following questions pertaining to rules for technical measures shall be addressed in the in-depth analysis:

- 1. Summarise **knowledge** of technical measures in EU fisheries legislation;
- 2. **Discuss** the role of technical measures in EU fisheries management;
- 3. On the basis of 1 and 2, **identify** elements for a framework for the future implementation of technical measures in EU fisheries.

1.2. Background

The main EU technical measures regulation has been in place since 1998 even though there have been two subsequent attempts to review and replace it. These took place in 2002 and 2008. As part of the 2008 review the European Parliament commissioned a review of technical measures in the Common Fisheries Policy and their success in achieving policy objectives. This study (Reeves et al, 2008) was led by the author of the current report and was presented to the Fisheries Committee of the Parliament on 7 October 2008. That study included a detailed summary of the technical measures in place in EU fisheries legislation at that time. The current study uses the results of that earlier study and places them in the context of subsequent developments in EU fisheries policy and management.

1.3. Report Structure

In order to address the objectives and research questions outlined in Section 1.1, Chapter 2 gives a brief overview of the types of technical measure in place in EU fisheries legislation and of their uses. This addresses research questions 1 and 2. Chapter 3 summarises the context, methodology and conclusions from the 2008 study in order to further address research questions 1 and 2. Chapter 4 uses the conclusions from the 2008 study to look at the impacts of the reformed CFP on the context for technical measures and to identify possible elements of a framework for their future implementation.

¹ See Article 18 of the Regulation (EU) No 1380/2013

2. TECHNICAL MEASURES IN EU FISHERIES

KEY FINDINGS

- The main management measure in EU fisheries is Total Allowable Catches (TACs) which determine how much fish can be caught. Technical measures are used alongside TACs to influence how fishing takes place.
- Historically, technical measures were mainly used to try and improve the selectivity of fishing gears and reduce the amount of fish that is discarded. They are now used more and more to reduce the impact of fishing on other aspects of the marine ecosystem.
- Different types of technical measure are used in different ways. Here we classify measures into six different types:
 1. Catch composition rules;
 2. rules on gear handling;
 3. gear construction measures;
 4. area closures to protect ecosystem components;
 5. areas closures for other, stock-related, reasons and
 6. other measures related to ecosystem protection.
- EU technical measures legislation is complex and spread across many different regulations. Compared to other areas where EU vessels fish EU legislation contains a high number of gear construction measures and stock-related area closures.

2.1. Technical measures and their uses

Traditional fisheries management has focused on individual fish stocks where the main objective has been to ensure the sustainable exploitation of that stock. In that simple case, all that management has to do is ensure that the quantity of fish harvested from the stock each year is limited in some way in order that sufficient fish are left in the stock to grow and reproduce so that the stock can be replenished. In principle this is quite straightforward to achieve by either specifying a limit on the total amount of fish that can be caught or by limiting the number of boats and/or the amount of time they can spend fishing.

In practice, catch limits, in the form of Total Allowable Catches (TACs) are used widely as a management measure for fish stocks. They are of particular importance for EU fisheries where they serve a dual purpose, partly as limit on overall catches but also as a quantity which can be divided-up in order to allocate fishing opportunities between Member States according to the principle of relative stability. However, while TACs, and to a lesser extent restrictions on fishing effort, are the primary management measures in place for EU fisheries, a wide variety of other management measures are also in place. These are known as technical conservation measures, or just technical measures.

It is useful to consider the fisheries in an area as consisting of a number of different fleets using different gears in different areas and at different seasons, in order to capture different species, or mixtures of species. A TAC can thus be interpreted as a measure which is set for a stock, in order to protect that stock. Similarly, fishing effort restrictions would

apply at the level of the individual fleet. From this perspective, the term 'technical conservation measures' can be considered as measures that apply at other levels of the system. For instance, mesh size regulations apply to specific gears, minimum landing sizes apply to particular species, and area/seasonal closures capture the spatial and temporal aspects of the fisheries.

While TACs and effort restrictions have clear uses as primary management measures contributing towards sustainability objectives, the linkages between technical conservation measures and policy areas are less clear. The individual contribution of such measures to overall sustainability is potentially rather limited when compared with what could be achieved using limitations on fleet capacity or fishing effort for instance. As the contributions tend to be through e.g. improving gear selectivity or reducing discards, it is more instructive to view these as the policy areas that technical measures are intended to address. Since 2002 the Common Fisheries Policy (CFP) has incorporated an increased commitment to ensure integration of environmental concerns into fisheries management, and this has been further strengthened in the most recent reform of the CFP. It is in this context, particularly in relation to the protection of marine habitats and ecosystems, that technical measures have a greater role to play.

2.2. Types of Technical Measure

In the earlier study, Reeves *et al* (2008) classified EU technical measures into **six categories**. These categories, which are also used in the current study, are listed in Table 1 and described in more detail below.

Table 1: Categories of technical measure used in the current study

	Measure type	Description
1	Catch composition	Rules on which species can be landed and sold, and at what size and proportion. Includes minimum landing sizes (MLS)
2	Gear handling and use	Rules on where and how specific gear types may be carried and used
3	Gear construction	Rules which restrict how specific gear types can be constructed
4	Closure – ecosystem	An area closure intended to protect a specific area of habitat or ecosystem feature
5	Closure – 'other'	An area closure intended to protect a specific target species or for other reasons not relating to ecosystem protection
6	Ecosystem	A measure intended to provide some protection to the ecosystem but which does not fit into any of the above categories.

2.2.1. Catch composition rules (Type 1)

For some areas, EU fisheries legislation includes rules on the species composition that can be landed with different types of fishing gears and mesh sizes. Such rules are intended to ensure a linkage between the gear in use and the target species in order that the former is

appropriate for the latter. These catch-composition measures are concerned with which species may be landed and sold, and in what proportions, and at what size. They are important in determining **what species and sizes of organisms are discarded from fishing vessels**. This category includes minimum landing sizes as a catch composition measure, rather than as a separate type of measure.

2.2.2. Gear measures (Types 2 and 3)

In the categorisation adopted here, the distinction is made between measures concerned with the **handling and use of fishing gears (Type 2)**, and those concerned with **how fishing gears are constructed (Type 3)**. This distinction is useful due to the differences in scale and intent between the two categories. To give an example, measures on handling and use include measure such as a complete ban on fishing with explosives, and also rules on how specific gear types should be used in order to minimise by-catch of seabirds or cetaceans. In contrast, gear construction measures often involve fine details about how a codend should be constructed for use in a specific fishery in a specific area.

2.2.3. Closed areas and/or seasons (Types 4 and 5)

Any zonal restriction on fishing activity will have both a spatial and seasonal component, i.e. any regulation will need to specify both the area concerned and the time period involved. The purpose of measure of this type can be divided into two broad categories; either, protection of a particular marine habitat or seabed feature (**Type 4**) or protection of particular species at a vulnerable stage in their life cycle (**Type 5**). In cases where the intention of the closure is to protect a seabed feature such as a seamount, the regulations will usually restrict the use of gears which come into contact with the seabed, such as demersal trawls. In the case of closures intended to protect individual species, the area may correspond to a spawning or nursery area, in which case the closure will typically apply to vessels using gears which would normally be used to target the species concerned. Alternatively, the closure might apply to an area where the species forms a by-catch in a fishery for a separate species. In these circumstances, the closure will affect the fishery for the second species in order to reduce the by-catch of the first.

Restrictions on fishing in specific areas may also be imposed for reasons other than fisheries management including, for example, the prevention of damage to underwater pipelines or installations associated with oil rigs. Increasingly, restrictions on certain aspects of fishing may also form part of nature conservation legislation. Such closures may be referred to as, for example, marine nature reserves, Marine Protected Areas (MPAs) or no-take zones. The terminology in use in these cases varies between areas, and with the nature and extent of any restrictions. This study considers only those area/seasonal closures that are contained within the EU fisheries legislation and can thus be considered as technical conservation measures.

Within EU legislation area closures which involve ecosystem considerations are readily identifiable but the intention of other closures is not always immediately apparent from the legislation. For the reason, area closures are sub-divided in to the two categories 'ecosystem' and 'other'.

2.2.4. 'Ecosystem' measures (Type 6)

Most of the technical measures intended to protect particular habitats or other aspects of the marine ecosystem involve area closures or rules on the handling and use of fishing gear. However, in a small number of cases, measures are defined in the regulations which are intended to protect some aspect of the ecosystem, but which do not fit into any of the

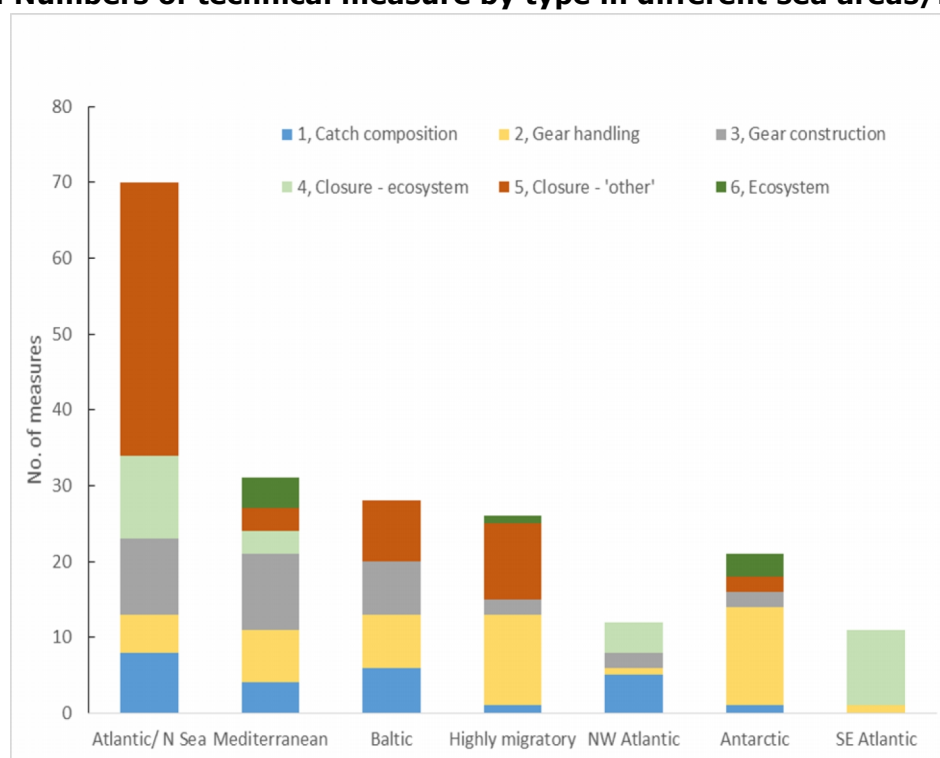
above categories. These concern topics like disposal of waste at sea, which do not involve any aspect of the catch or fishing gear, but which nonetheless influence the marine ecosystem in some way. These are here classified as 'Ecosystem' measures.

2.3. Existing legislation

Existing EU technical measures can be found in a wide range of different regulations and contexts. Reeves *et al* (2008) summarised the technical measure that were in place at the time of their study and this included measures from nineteen different regulations. These are summarised in a table in the Annexe to this report and include area-specific technical measures regulations, regulations transcribing technical measures from other RFMOs into EU law, measures associated with recovery plans for species including cod, hake and bluefin tuna, and regulations addressing specific issues such as shark finning and cetacean bycatch.

Figure 1 is based on the results of Reeves *et al*, 2008, and gives an overview of the relative proportions of different types of measure that are in place in different sea-areas covered by EU fisheries legislation. Figure 1 shows the numbers of measure of each type in the different sea areas of the EU as well as in other areas where the measures of other RFMOs (i.e. NAFO, CCAMLR, ICCAT and other tuna RFMOs) have been transcribed into EU legislation. Compared with other areas, the EU legislation shows a much greater use of gear construction measures and of stock-related 'other' closures, and relatively few gear handling measures.

Figure 1: Numbers of technical measure by type in different sea areas/RFMOs



3. LESSONS FROM THE PAST: TECHNICAL MEASURES IN 2008

KEY FINDINGS

- This study builds on the results of a previous study conducted when technical measures legislation was reviewed in 2008. That study conducted a detailed review of the technical measures that were in place at that time.
- The 2008 study identified a number of elements which would contribute to a more effective implementation of technical measures. These are here used as 'lessons learnt' for the future implementation of technical measures.

The current study builds on a previous study which was commissioned by the Parliament as part of the review of a previous proposal to revise EU technical measures legislation. Among other things, the previous study (Reeves *et al*, 2008) provided a detailed summary of the technical measures that were in place at that time. In order to provide context for the current study, the purpose, methodology and results of the 2008 study are outlined in the following section.

3.1. Terms of reference

The requirements of the 2008 study included a detailed inventory of the measures that were in place at that time, and an evaluation of their performance in relation to objectives related to the improvement of selectivity, the reduction of discards, the protection of marine habitats and the implementation of the MSY approach. The study was also required to discuss a number of policy questions including the merits of a bottom-up versus top-down implementation of technical measures, the effectiveness of minimum landing sizes as a conservation measure and the usefulness of closed areas as a conservation instrument.

3.2. Methodology

In order to address the requirements listed above, Reeves *et al* (2008) first gave a brief introduction to the different policy objectives under consideration (gear selectivity, discarding, protection of marine habitats and ecosystems, and implementing the Maximum Sustainable Yield approach), and how they are implemented in technical measures regulations. They then reviewed and summarised all of the technical measures in place in EU fisheries legislation at that time. The regulations they reviewed are listed in a Table in the Annex in order to demonstrate how extensive and diverse the existing EU technical measures are. For each of these regulations they allocated every measure contained in the regulation to one of the categories listed in Table 1 and tabulated the results in order to give an overall summary of the measures in place in EU legislation. These detailed summaries can be found in the original report and are not repeated here.

Once the existing technical measures had been summarised, the next step was to compare the summaries against the policy objectives in order to evaluate how well the existing measures were performing in meeting the objectives. After then addressing some of the additional policy questions, the report then went on to identify a set of elements which would be likely to contribute to an effective implementation of technical measures. These criteria, which are summarised in Table 2, were then used to help evaluate the 2008

proposal and to inform a discussion of possible future developments of EU technical measures.

3.3. Results

The 'Lessons learnt' from the 2008 study are listed in Table 2. A more detailed summary of the findings from that study are given in the Annexe to this report.

Table 2: Elements which would contribute to an effective implementation of technical measures as identified by Reeves *et al* (2008)

1	"Bottom up" establishment, with extensive stakeholder involvement to ensure legitimacy
2	Clearly stated objectives and associated monitoring plans
3	Routine deployment of scientific observers on fishing vessels
4	Minimum landing sizes for a limited subset of key species only
5	Sufficient flexibility to address problems as they arise, e.g. specific ecosystem impacts or concentrations of undersized fish.

4. THE FUTURE: TECHNICAL MEASURES AFTER 2015

KEY FINDINGS

- The key elements of the reformed CFP policy of relevance to technical measures are the landing obligation and regionalisation. The move to an ecosystem-based approach to fisheries management and the wider use of area closures will also be important.
- The changes to the context for technical measures resulting from the reformed CFP are mostly consistent with the 'lessons learnt' from the 2008 study suggesting that they will contribute to a more effective implementation of technical measures.
- The biggest change in technical measures will be the move to a results-based system where the objective - eliminating discards - is defined instead of the measures. This will allow for a more flexible, bottom-up approach to achieving the objective.
- Many of the existing technical measures which are connected with selectivity and discarding, particularly catch composition and gear construction measures, should become unnecessary once the landing obligation becomes fully effective.
- Measures related to ecosystem protection are likely to still be relevant so should be retained.
- A future framework for technical measures should include both central and regional components. The central component would contain mostly gear handling measures and the regional component would include mostly spatial measures.
- A transition period should be considered to allow for the landing obligation to become fully effective and for existing area closures to be reviewed.

The 2008 study summarised above provided a comprehensive review of the technical measures that were in place at that time. It also developed a framework for categorising technical measures and identified a number of elements likely to contribute to an effective implementation of technical measures. Since then, the context for the implementation of technical measures has changed considerably due mainly to the subsequent reform of the Common Fisheries Policy (CFP). In order to take a forward look at the implementation of technical measures in EU fisheries, this study here revisits the findings of the 2008 study against the background of the changed context resulting from the reformed CFP.

4.1. Context: the Reformed CFP

While there have been some additions and modifications to technical measure regulations since 2008, the key development over this period has been the reform of the Common Fisheries Policy. This changes the context for the implementation of technical measures in a number of ways. It is beyond the scope of this study to describe the reformed policy in detail, but some key elements of particular relevance to technical measures are summarised below.

Article 15 of the reformed CFP (Parliament and Council Regulation 1380/2013) introduces a landing obligation which will, under most circumstances, make discarding of most commercial species illegal. In the past, discarding has been closely linked with technical measures regulations as it has been illegal to land fish under a specified minimum landing size for that species and area, hence such undersized fish have had to be discarded. Gear selectivity, which is closely linked to gear construction, is also an important factor as, in mixed fisheries, fishing gears are often rigged so that they retain most legally-sized individuals of the smallest commercial species caught and as a result, also retain undersized individuals of larger species that are caught in the same fishery. As a result, the introduction of a landing obligation has substantial implications for existing catch composition and gear construction measures.

Article 18 of the reformed CFP sets out a process for regional co-operation on conservation measures so that, provided they meet certain criteria, conservation measures will be developed on a regional basis rather than by the Commission. This is a clear step away from the traditional top-down approach of implementing technical measures towards a more bottom-up, participatory way of implementing such measures.

In addition to these key elements, various other aspects of the new CFP have implications for technical measures. These include Article 8 on the establishment of fish stock recovery areas, which foresees the establishment of a wider range of area closures to support fisheries management; and the requirement noted in Article 2 that the CFP shall implement an ecosystem-based approach to fisheries management in order to minimise the negative impacts of fishing on marine ecosystems.

4.2. Possible elements of a technical measures framework

Reeves *et al* (2008) identified a list of elements which would contribute to an effective approach to the implementation of technical measures in European fisheries management. These are summarised in Table 3. These elements were identified based on the analysis of the technical measures that were in place at the time and also by answering a number of questions relating to various policy areas (discarding, selectivity etc.) that the authors were asked to consider at that time. As such they may not be entirely relevant to the current situation. Nonetheless, it is useful to revisit these points in order to gain insight into how the context for technical measures has changed and how it might further evolve. The sections below consider each of the elements lists in Table 3 against the background of the reformed CFP.

4.2.1. “Bottom-up” Implementation

One of the requirements of the 2008 study was to provide a “Discussion of the better approach to establish technical measures in the EU; bottom-up or a top-down”. The study identified a bottom-up approach as likely to be much more effective as developing regulations in this way leads to them being seen to be legitimate by stakeholders, which in turn results in greater compliance with the regulations. The introduction of a regionalised process for the development of conservation measures is clearly a step towards a more bottom-up implementation of technical measures. Such a move was also explicit in the 2008 cod management plan (Council Regulation 1342/2008) which made reference to cod avoidance and discard reduction schemes being more likely to succeed if they were developed in co-operation with the fishing industry.

4.2.2. Objectives and Monitoring Plans

The conclusion that technical measures should have clearly stated objectives and associated monitoring plans was based on the fact that there had been little or no evaluation of the performance of existing technical measures. This was partly because it is often not clear what effect they were supposed to have and also because of a lack of relevant data to use to evaluate the performance. The introduction of the landing obligation has to large extent addressed this by turning the question around. Rather than implementing a technical measure without specifying the intended result, the landing obligation has a clear intention - the elimination of discarding – but does not specify the measure to be used to achieve that. This represents a major change in the way technical measures are used, and is discussed further in Section 4.2.6, below. The potential requirement for clear objectives and associated data collection would still apply in the case of area closures.

4.2.3. Routine deployment of scientific observers

In some fisheries outside of European waters, the carriage of scientific observers by fishing vessels is mandatory. In some cases these observers have a regulatory as well as a scientific function, but in Europe, where coverage is relatively limited their work is entirely scientific. As with the recommendation that technical measures should have clearly defined objectives, this recommendation was motivated at least partly by the need to ensure that it is possible to evaluate the effects of technical measures, so again this recommendation is made partially redundant by the introduction of the landing obligation. Sending observers to sea on board fishing vessels will remain an effective way to obtain essential data on catches although the fact that discarding of commercial species will become illegal means that careful consideration will have to be given to how observer data are collected and used in the future.

4.2.4. Minimum landing sizes

The 2008 report concluded that minimum landing sizes are not generally an effective management measure in their own right, but that there might be some merit in retaining them for a subset of the more important commercial species. Under the revised CFP minimum landing sizes (MLS) will be replaced by minimum conservation reference sizes (MCRS). In many cases the new MCRS will correspond to the same sized fish as the old MLS, but the meaning will be different. Previously, it was illegal to land any fish which were smaller than the MLS for that stock so most such fish were discarded. Under the landing obligation, all such fish will have to be landed, but it will be illegal to sell fish below the MCRS for human consumption. As such the MCRS serves to incentivise fishing in such a way that the undersized fish are not caught in the first place, hence it serves a rather different function from the MLS that it will replace.

4.2.5. Flexibility

The need for flexibility to adapt and implement measures at relatively short notice was identified largely in relation to potential impacts of fishing on marine habitats and other aspects of the marine ecosystem. Such problems typically arise from the use of a particular gear in a particular area, and as a result, each such problem needs specific measures to be implemented once the problem has been identified. It may sometimes be desirable to implement any such measure rapidly in order to prevent further damage from occurring. The key development in terms of flexibility is the introduction of regionalisation. The existence of regional bodies who can propose measures for adoption by the European Commission as delegated or implementing acts, means that, in principle, such conservation measures can enter into legislation much more quickly than if they had to go through the

normal legislative process involving both the Council and the Parliament. In practice, this process may still not be quick enough in some cases, so for some issues it may still be desirable that measures can be adopted voluntarily before they enter into force in the legislation.

4.2.6. Discussion

If the elements listed above can be regarded as 'lessons learnt' from the earlier experience with technical measures, then it is clear that, whether by accident or design, these lessons have also been learnt more widely. The substantial changes in policy that have resulted from the reform of the CFP have contributed to a context where technical measures are likely to be much more effective. This stems largely from the combination of regionalisation and, in particular, the landing obligation.

In the past, discarding has to an extent resulted from the conflict between gear construction and catch composition measures intended to promote selective fishing, and the reality of mixed fisheries where different species of different size are caught at the same time. By making discarding illegal, there is also a need to change the way in which technical measures, particularly gear construction and catch composition measures, are applied. Where previously a set of measures applied to each fishery, some of which contributed to discarding, there is now a need to recognise that every fishery is different and will need different approaches in order to eliminate discarding. This can only be achieved by a bottom-up, results-based approach where fishers have flexibility to develop and apply approaches that will work in their specific fisheries. Regionalisation will be a component of this fundamental change in the way technical measures will be used.

4.3. The future of different types of technical measure

At present, there is a substantial body of technical measures in force in EU legislation; Reeves et al (2008) summarised measures from nineteen different regulations. Some of these are transcribed into EU law from the regulations of other RFMOs so will remain unchanged, but for other measures the question will arise whether the measure should remain in force under any new technical measures framework, and if so where and how. The following sections discuss these questions in relation to each of technical measure types discussed in Section 2.2.

4.3.1. Catch composition rules

With a few exceptions the catch composition rules in place in EU fisheries legislation at the time of the 2008 study are either rules on the relative proportions of different species that could be landed when using a specific gear, or minimum landing sizes. Of these, the landings composition rules are mainly intended to ensure a correspondence between mesh size and species targeted, so that small meshes are only used to target small species and so on. In the longer term, the introduction of the landing obligation should remove the need for most, if not all of these measures as it will become illegal to discard undersized individuals of commercial species. The fact that such small fish cannot be sold for human consumption should act as an incentive for fishers to avoid catching them if possible. In practice, it is very difficult to anticipate how fishers will respond to the landing obligation and for this reason there may be some reason to retain some elements of the landings composition rules in the interim.

As noted in Section 4.2.4, Minimum Landing Sizes will be replaced by Minimum Conservation Reference Sizes. These will have a rather different function than the old MLS and will form a key component of the conservation measures in place in each region.

In some cases it is prohibited to land some species which are particularly vulnerable to exploitation hence all individuals that are caught should be returned to the sea immediately. These protected species include some shark species and common skate. These species should remain protected under any new legislation. In some cases the protection may only be regional, but in many cases the protection could apply throughout EU waters.

4.3.2. Gear measures

The categories of technical measures used here make the distinction between gear handling measures and gear construction measures. This distinction is particularly important for the future implementation of technical measures because of the different ways in which these two types of measure are used. A high proportion of gear handling measures involve issues such as the banning of the use of explosives or poisons, or fishing in a way that avoids the capture of sea turtles or dolphins. As a result, such measures are not so much about fisheries management but more about the broader policy objective of minimising damage to the wider marine environment through fishing. In contrast, gear construction measures often specify small details about how a fishing gear must be constructed, such as the mesh size and number of meshes around a trawl codend. These measures thus represent detailed instruction to fishers.

This clear distinction between the two types of gear measure also helps to suggest if and how such measures should be retained in the future. As they are in effect broad policy decisions about the wider impacts of fishing, most gear handling measures should be retained in some over-arching position so that they apply in all areas. In contrast, under the landing obligation, most gear construction measures should become redundant.

4.3.3. Closed areas/seasons

There are a large number of closed areas/seasons in existing EU technical measures legislation. They are here divided into 'ecosystem' closures which are intended to protect, for instance, a vulnerable marine habitat or other aspect of the marine ecosystem, and 'other' closures. The latter category is used for closures which are generally related to the protection of particular fish stocks in some way, but the purpose of these closures is not always apparent from the legislation, hence the 'other' designation. The intentions behind 'ecosystem' closures are usually clear from the legislation, so it should be straightforward to confirm whether each closure is still relevant and hence whether it should be retained. Such a process would be rather more difficult for the 'other' closures given the lack of clarity about the intended purpose of the closures and the absence of data to evaluate their effects that is typically the case for these closures. In addition, in contrast to habitat features, fish stocks are mobile so static closed areas do not always remain effective, hence there is a greater need to keep these closures under review.

4.3.4. Ecosystem measures

The category 'ecosystem measures' is intended to account for some miscellaneous measures that are intended to protect some aspect of the marine ecosystem but which do not fit into any of the above categories. There are relatively few such measures and by nature they will need to be reviewed on a case by case basis.

4.3.5. Discussion

This brief review of the possible future of the various types of technical measure has identified that two types of measure, that is catch composition and gear construction, will

have a limited, if any role to play under any new technical measures framework. Historically, these types of measure have been used in combination to try and ensure that the fishing gears in use are relatively selective and thus do not lead to large quantities of fish being discarded. In effect, this role will now be performed by the ban on discarding acting as an incentive for fishers to use selective gears in order to avoid catching undersized fish.

Once the measures that are concerned with selectivity and discarding are accounted for, the remaining measures in the legislation can be placed into two broad groups: measures intended to protect some element of the ecosystem, or area closures which are related to protection of fish stocks in some way. By their nature, ecosystem protection measures, particularly those intended to protect specific areas or habitat, are intended to remain in place indefinitely, in order that these habitats remain protected. The future roles of many of the stock-based area closures are rather less clear, partly because their original intent is often less than clear, but also because fish stocks are by nature less static than benthic habitat features.

4.4. Towards a framework for future technical measures

The analysis summarised here has revisited the results of the more comprehensive 2008 study by Reeves et al in the light of the reformed Common Fisheries Policy. From discussion of both the 'lessons learnt' from the 2008 study (Section 4.2.6) and of the possible future roles of different types of technical measure (Section 4.3.5), it is apparent that the introduction of the landing obligation will result in a major change in the context for technical measures. In principle, all of the measures which historically have been intended to promote selective fishing and to reduce discarding, will become unnecessary once fishers are given the flexibility to achieve the specified objective (minimising or eliminating discards) instead of being subject to detailed rules with a similar intention. In practice, the situation may not be quite so straightforward, as a lot will depend how individual fishers respond to the changes in rules and fishing opportunities that will arise with the advent of the discard ban. With so many complex, mixed-species fisheries across EU waters, it is impossible to predict what problems individual fishermen will encounter and how they will respond. There are also questions of enforcement in relation to the landing obligation. While in the long term most of the existing catch composition and gear construction measures should not be necessary, it may be appropriate to keep some elements of these regulations in place in the interim while the landing obligation comes into force in order to provide some additional incentives for compliance with the new regulations.

The reformed CFP introduces a commitment to implement an ecosystem-based approach to fisheries management which implies an increased reliance on ecosystem protection measures in the future. Many of these are likely to have a spatial component, i.e. they involve the closure of a particular area to some types of fishing. The reformed CFP also envisages the implementation of a wider range of area closures to support fisheries management, including so-called fish stock recovery areas. Together with developments in other spatial measures such as Marine Protected Areas, this implies a move towards a wider use of spatial management measures in EU fisheries and marine conservation. This increasing complexity of spatial measures, some of which are national rather than EU measures, will require some degree of regional co-ordination to ensure coherence. It will also be prudent to review existing measures to see if it is appropriate to retain them. This applies particularly in the case of stock-related spatial closures.

The analysis above leads to an outline of a possible framework for future technical measures. This would consist of a central regulation containing mainly gear handling measures together with a set of regional regulations. Many of the existing gear handling measures are indicative of broad policy decisions about fishing such as the use of non-destructive gears and not fishing in ways that will risk capture of, for example, sea turtles or cetaceans. As a result these would apply to all EU waters, and to EU vessels fishing anywhere. Protected species could also be listed here, although in some cases the protection may only apply in some regions. The other component of the framework would be a set of regional regulations. The content of these would include Minimum Conservation Reference Sizes for the main target species in that region as well as details of all EU area closures in the region. There would also be a time component to the framework to allow for phasing-out of gear construction and catch composition rules once the landing obligation was fully implemented, and also to allow for review of stock-related areas closures.

REFERENCES

Reeves, S.A., Revill, A.S., Hutton, T.P. & Pinnegar, J.K. (2008) *Technical Measures in the CFP and the reform of Council Regulation 850/98*. Directorate General for Internal Policies of the Union, Policy Department B: Structural and Cohesion Policies, Study IP/B/PECH/IC/2007/090

ANNEX: THE 2008 STUDY ON TECHNICAL MEASURES

In order to provide a brief overview of the 2008 study by Reeves *et al*, the following is summary is adapted from the executive summary of the report. Table 3 lists the regulations that were summarised during the study.

1. The study reviewed current EU fisheries legislation and its effectiveness in achieving objectives related to a number of policy areas. The main policy objectives are increasing gear selectivity, reducing the impact of discarding, protecting marine habitats and ecosystems and implementing the MSY approach. In addition, the study also reviewed the effectiveness of minimum landing sizes and area closures as conservation instruments, and also discussed the relative merits of top-down and bottom-up approaches to establishing technical measures.
2. Technical measures are used as fisheries management tools alongside more direct restrictions on fishing activity such as Total Allowable Catches, or restrictions on fishing effort. The main types of technical measure considered in the study are rules concerning catch composition, the handling of fishing gear, the construction of fishing gear, and closed areas/seasons.
3. The selectivity of fishing gear determines which fish that enter the gear are retained. This is important as unselective gear results in the capture of undersized and other non-marketable fish which have to be discarded so are lost to the population and the fishery. Selectivity is mostly determined by aspects of the construction of the gear, particularly the codend of towed gears such as trawls.
4. Discarding is closely linked to selectivity as less selective gears retain more undersized fish that will have to be discarded. In addition to measures to improve selectivity, discarding could also be reduced by avoiding fishing on concentrations of undersized fish, e.g. through area closures.
5. There is no single technical measure that will work in all aspects of the ecosystem impacts of fishing. Instead, their development tends to be reactive. Once a problem is identified, case-specific measures can be developed based on a knowledge of the gears, areas and species involved.
6. Progress in implementing the MSY approach will be achieved mostly through measures that restrict the overall amount of fishing effort. The role of technical measures in this will be minor, though measures which improve selectivity or restrict the size of fishing gears might make some contribution.
7. European Union fisheries legislation includes technical measures in place for fisheries in areas including the Antarctic, South-east Atlantic, and the Pacific. However, the main fisheries regulations apply to European waters of the North-east Atlantic, Baltic, Mediterranean and adjacent waters.
8. Measures related to gear selectivity form a relatively high proportion of the EU fisheries legislation. Most involve restrictions on ways of constructing gears that reduce their selectivity. Most demersal fisheries involve a mix of different species with different growth characteristics so specifying selectivity objectives is problematic, and there can be an incentive for fishers to reduce the selectivity of their gear.
9. Apart from measures relating to gear selectivity and catch composition the main measures in place at the time of the study that were intended to reduce discarding were the restrictions on access to a nursery area for North Sea plaice, and a ban on

the carriage of automatic grading machines in pelagic fisheries. Neither of these measures appeared to have much impact on discarding.

10. Most of the measures in European fisheries legislation that are intended to protect marine habitats and other components of the ecosystem involve area closures. In contrast to other areas, there are relatively few measures intended to minimise by-catch of, for example, seabirds but at the time of the study this had not been highlighted as a serious issue for European fisheries.
11. Compared to other areas, the legislation for European waters included a relatively high number of closed areas intended to protect target species. Relatively few of these had been demonstrated to have a clear conservation benefit. Area closures do have a role as a fisheries management measure, but it would be desirable that they are set-up with clear objectives and monitoring plans.
12. The minimum landing size rules in place at the time of the study were not effective as a conservation measure for the great majority of fish species, largely due to the problem of different species being caught together in the same fishery. There was no clear biological basis for setting minimum landing sizes, and market practices would make it difficult to adjust the existing landing sizes. There may still be a role for a reduced set of minimum landing sizes, perhaps applying only to the most valuable and/or vulnerable species in a given area.
13. A bottom-up approach, with much greater involvement by stakeholders in establishing technical measures, is likely to be more effective than the top down approach that was in place at the time of the 2008 study. This is particularly true for objectives related to gear selectivity and discarding which are dependent on making fishing gear work effectively and are thus unlikely to be achieved without much greater involvement by the fishing industry.
14. Any implementation of technical measures should include both clearly specified objectives and a monitoring plan to ensure that appropriate data are collected to enable the evaluation of the technical measures. This would be likely to involve routine use of scientific observers on board fishing vessels. It would also be desirable for there to be sufficient flexibility for measures to be introduced rapidly to address short-term problem such as concentrations of undersized fish.

Table 3: Council Regulations containing technical measures which were reviewed by Reeves et al (2008)

Regulation	Date	Title
850/1998	30/3/1998	for the conservation of fishery resources through technical measures for the protection of juveniles of marine organisms
1434/1998	29/6/1998	specifying conditions under which herring may be landed for industrial purposes other than direct human consumption
2549/2000	17/11/2000	establishing additional technical measures for the recovery of the stock of cod in the Irish Sea (ICES Division VIIa)
1162/2001	14/6/2001	establishing measures for the recovery of the stock of hake in ICES sub-areas III, IV, V, VI and VII and ICES divisions VIII a, b, d, e and associated conditions for the control of activities of fishing vessels
2056/2001	19/10/2001	establishing additional technical measures for the recovery of the stocks of cod in the North Sea and to the west of Scotland
494/2002	19/3/2002	Establishing additional technical measures for the recovery of the stock of hake in ICES sub-areas III, IV, V, VI and VII and ICES divisions VIIa,b,d,e.
2371/2002	20/12/2002	on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy
1185/2003	26/6/2003	on the removal of fins of sharks on board vessels
423/2004	26/2/2004	establishing measures for the recovery of cod stocks
600/2004	22/3/2004	laying down certain technical measures applicable to fishing activities in the area covered by the Convention on the conservation of Antarctic marine living resources
811/2004	21/4/2004	establishing measures for the recovery of the Northern hake stock
812/2004	26/4/2004	laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) No. 88/1998
2187/2005	21/12/2005	for the conservation of fishery resources through technical measures in the Baltic Sea, the Belts and the Sound, amending Regulation (EC) No 1434/98 and repealing Regulation (EC) No 88/98
1967/2006	21/12/2006	concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94
41/2007	21/12/2006	fixing for 2007 the fishing opportunities and associated conditions for certain fish stocks and groups of fish stocks, applicable in Community waters and, for Community vessels, in waters where catch limitations are required
520/2007	7/5/2007	laying down technical measures for the conservation of certain stocks of highly migratory species and repealing Regulation (EC) No 973/2001
643/2007	11/6/2007	amending Regulation (EC) No 41/2007 as concerns the recovery plan for bluefin tuna recommended by the International Commission for the Conservation of Atlantic Tunas
1098/2007	18/9/2007	establishing a multiannual plan for the cod stocks in the Baltic Sea and the fisheries exploiting those stocks, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 779/97
1386/2007	22/10/2007	laying down conservation and enforcement measures applicable in the Regulatory Area of the Northwest Atlantic Fisheries Organisation

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**TECHNICAL MEASURES
IN THE BALTIC SEA –
AN ALTERNATIVE TO OVER-REGULATION
AND THE BRACE-AND-BELT APPROACH**

WORKSHOP

IN-DEPTH ANALYSIS

This document was requested by the European Parliament's Committee on Fisheries.

AUTHORS

Thünen Institute of Baltic Sea Fisheries, Germany:

Daniel Stepputtis, Christopher Zimmermann, Uwe Krumme, Christian von Dorrien

RESPONSIBLE ADMINISTRATOR

Marcus Breuer

Policy Department B: Structural and Cohesion Policies

European Parliament

B-1047 Brussels

E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Adrienn Borka

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2015.

© European Union, 2015

This document is available on the Internet at:

<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**TECHNICAL MEASURES
IN THE BALTIC SEA –
AN ALTERNATIVE TO OVER-REGULATION
AND THE BRACE-AND-BELT APPROACH**

WORKSHOP

IN-DEPTH ANALYSIS

Abstract

All major technical regulations applying to Baltic Sea fisheries were reviewed and categorised with respect to the CFP reform's objectives, into rules to be maintained, altered, removed and newly developed. We propose that most rules relating to gears and catch composition could and should be removed at the time when new rules (e.g. the landing obligation) are in force. Compliance with the new rules remains critical. The Baltic Sea seems to be an ideal area to test more progressive approaches.

IP/B/PECH/IC/2015-137

October 2015

PE 563.404

EN

CONTENTS

LIST OF ABBREVIATIONS	5
LIST OF TABLES	6
LIST OF MAPS	6
EXECUTIVE SUMMARY	7
1. INTRODUCTION	9
1.1. Objectives of the study	10
1.2. Research questions	10
1.3. What is a technical measure?	11
1.4. Classification of technical measures	12
1.5. Special features of the Baltic Sea	12
1.6. Report structure	13
2. TECHNICAL MEASURES IN THE BALTIC SEA - OVERVIEW	15
2.1. Regulations relevant for the Baltic Sea	15
2.2. Gear and catch measures	17
2.3. Temporal and spatial closures	21
2.4. Species' size limits	23
2.5. Mitigation of ecosystem impacts	24
2.6. Compliance and control measures	26
3. ASSESSMENT AND EVALUATION	29
3.1. Introduction	29
3.2. Technical measures to be maintained	30
3.3. Technical measures to be removed	32
3.4. Technical measures to be altered	33
3.5. Technical measures to be developed	34
3.6. Others	36
4. CONCLUSIONS AND RECOMMENDATIONS	39
4.1. Recommendations	39
4.2. Applicability to other areas	40
REFERENCES	41

LIST OF ABBREVIATIONS

ADDs	Acoustic Deterrent Devices (pingers)
CFP	Common Fisheries Policy
CBD	Convention on Biological Diversity
CCTV	Closed Circuit Television
DCF	Data Collection Framework
EM	Electronic Monitoring
FAO	Food and Agriculture Organisation of the United Nations
ICES	International Council for the Exploration of the Sea
IPOA sharks	International Plan of Action for the conservation and management of sharks
MPA	Marine Protected Area
MLS	Minimum Landing Size
MCRS	Minimum Conservation Reference Size
MSY	Maximum Sustainable Yield
RAC	Regional Advisory Council (now Advisory Council, AC)
RTC	Real time closure
ICES SD	ICES Subdivision
STECF	Scientific Technical and Economic Committee for Fisheries
VMS	Vessel Monitoring System
TAC	Total Allowable Catch

LIST OF TABLES

Table 1

EU regulations defining current technical measures applicable for the Baltic Sea fisheries 15

Table 2

EU regulations defining management measures which are not technical measures in a strict sense – but also relevant for this study 16

Table 3

Current Minimum Sizes for Baltic Fish Species 24

LIST OF MAPS

Map 1

The Baltic Sea and adjacent waters with limits of ICES Sub-Divisions indicated 14

EXECUTIVE SUMMARY

Technical measures provide a qualitative framework of management tools to meet **management objectives**. The existing set of technical measures for marine fisheries in the European Union is a heterogeneous system of provisions. They are frequently inconsistent, sometimes even contradictory, and have often been criticised as over-prescriptive and too complex. The efficiency of technical measures in achieving the management goals has rarely been tested.

In the follow-up to the **Common Fisheries Policy** (CFP) reform, the European Commission is gradually issuing new legislative proposals aiming at aligning the partly outdated EU Regulations from before 2013. One of the major post-reform projects is the general overhaul of the set of existing rules for technical measures ("*new rules*").

In this report, we interpreted technical measures in a wider sense, accounting for the overlapping and interacting character of many measures. The main technical measures applicable to Baltic Sea fisheries were reviewed and categorized into: i) Gear and catch measures, ii) Temporal and spatial closures, iii) Species' size limits, iv) Mitigation of ecosystem impacts, v) Compliance and control measures.

Based on the review, we assessed which of the rules for technical measures in the Baltic Sea should be (i) **maintained** (e.g. closures and pingers to avoid harbour porpoise bycatch, maximum immersion time of passive gears), (ii) **removed** (e.g. all gear and catch composition measures, minimum sizes in their current meaning), (iii) **altered** (e.g. evaluate efficiency of spawning and nursery closures and adapt where necessary; mitigation measures to prevent bycatches of marine mammals; control and enforcement needs to cover the entire fleet, including small vessels), or (iv) **developed further** (e.g. electronic monitoring systems, recreational fisheries). This assumes that enforcement and compliance is reasonable.

We highlight that the relatively simple structure of the **Baltic Sea** ecosystem and its fisheries may be an **ideal area to test novel management approaches**, including a more progressive or even radical approach to the deregulation possible after the implementation of the landing obligation (proof of concept). Lessons learnt could be used to see where amendments to the rules are required to make the CFP reform work, i.e. if the new rules do not work in the Baltic Sea, they are unlikely to work elsewhere.

The **CFP reform** should be used to **deregulate** and make a visible move towards a **result-based management**. All rules should be evaluated periodically and removed if they have not proven to be effective. The focus should always be on creating the right incentives but minimise disruption of the fishery.

Special care should be taken to avoid the introduction of new rules while keeping the old ones ("*belt-and-braces*" approach). Several current measures are in direct conflict with the new management approach and need to be removed immediately. Control and enforcement is crucial for the success of the CFP reform, and sticking to old control approaches is not advisable.

The question which of the new or amended rules should then be part of a **wider EU framework** and which should be **area specific** can only be answered after a decision is made on whether the Baltic Sea could lead the way to a result-based management, or

whether consistency of rules across the different seas has priority. In the first case, most of the rules would be specific to the Baltic Sea, while in the latter more rules could be part of an EU framework. We recommend the first option (most rules Baltic specific) and thus an approach where an EU framework only sets the wider possibilities (e.g. principles and a very general set of technical measures) which would then be refined according to the needs of the region. A similar regionalisation approach has been applied for the implementation of the landing obligation and is planned for the new data collection framework. A tailored regional set of rules would also ensure that these are parsimonious – and thus easier to understand, enforce and obey.

1. INTRODUCTION

KEY FINDINGS

- The relatively simple structure of the Baltic Sea ecosystem and the fishing fleet offers a **good opportunity to efficiently implement the new CFP**
- Technical measures provide a **qualitative framework** of management tools to meet management objectives
- A **categorization of technical measures** is given (in a wider sense) as follows:
 - o i) Gear and catch measures
 - o ii) temporal and spatial closures
 - o iii) Species' size limits
 - o iv) Mitigation of ecosystem impacts
 - o v) Compliance and control measures

This report was prepared for the workshop "*A new technical measures framework for the new CFP*" held by the European Parliament in October 2015. The background, objectives and research questions for this analysis were given in the terms of reference.

The Common Fisheries Policy (CFP) of the EU has recently been overhauled. In December 2013, the European Parliament and the Council agreed on a comprehensive CFP reform. It is now enshrined in a new legislative framework, the so-called '**new CFP basic regulation**' ([Regulation \(EU\) No 1380/2013](#)). As far as the conservation of marine biological resources is concerned, it repeals and replaces the former 'basic fisheries management framework', laid down by the Council in 2002 ([Regulation \(EC\) No 2371/2002](#)).

Thus the **main objectives** to be accomplished by this reformed CFP are the following:

- to ensure that fishing and aquaculture activities are **environmentally sustainable** in the long-term,
- to achieve the **maximum sustainable yield** exploitation by 2015, or at the latest by 2020,
- to implement the **ecosystem-based approach** to fisheries management and
- to gradually **eliminate discards** through the landing obligation.

In the follow-up to the CFP reform, the European Commission is gradually issuing new legislative proposals aiming at aligning the partly outdated EU Regulations from before 2013. One of the major post-reform projects of the European Commission is the **general overhaul** of the set of existing rules for **technical measures**.

The Commission announced a new **legislative proposal** for a general technical measures Regulation for the late autumn of 2015. This new Union Regulation shall replace the old general framework Regulation for technical measures from 1998 ([Council Regulation \(EC\) No 850/98](#)).

The existing set of technical measures in the Union is a complex, heterogeneous and disorganized system of provisions. They are frequently inconsistent and sometimes even contradictory. It is rarely tested whether a technical measure in fact helps to achieve the management goals. They have often been criticised as over-prescriptive and too complex, as they contain numerous exceptions and derogations. This is due in part to their origin and evolution. Some of them, for example, have been transposed into EU law from the provisions of Regional Fisheries Management Organisations (RFMOs).

Other measures were adopted by the Council as part of the annual negotiations in the context of setting Total Allowable Catches (TACs) and quotas. Thus, some of the technical measures are the fruit of negotiation. This weakens their scientific basis and can generate unjustified differences among sea basins. Over the years, all legal texts containing technical measures have been subject to a number of modifications. These have increased their complexity, and sometimes even resulted in a deviation from the original aim of the measure.

Against this background the Committee on Fisheries of the European Parliament wished to commission an in-depth analysis on ***"A new technical measures framework for the new CFP - The Baltic Sea"***.

The analysis shall be presented and discussed with Members during a workshop entitled "A new technical measures framework for the new CFP".

1.1. Objectives of the study

The in-depth analysis shall perform three distinct functions:

- **Review** of the main existing technical measures in the Baltic Sea prescribed through either the general technical measures Regulation ([Council Regulation \(EC\) No 850/98](#)) or the specific technical measures Regulations for the Baltic Sea.
- **Assessment and evaluation** of the main existing technical measures applicable in the Baltic Sea in view of the above mentioned new CFP objectives as well as the regionalisation aspect of the new CFP and the announced simplification of CFP governance.
- **Conclusions and recommendations** shall be proposed to the Members of the committee on how to rationalise the complex set of specific and general technical measures in view of the above-mentioned CFP objectives for the Baltic Sea.

1.2. Research questions

The research paper requested is expected to provide a detailed analysis of the situation on technical measures in the Baltic Sea.

With regard to the general objectives outlined above, the following questions pertaining to **rules for technical measures** shall be addressed in the in-depth analysis:

- Improve the **knowledge** of the main existing technical measures in the Baltic Sea;
- Investigate which of the rules for technical measures in the Baltic Sea should be **maintained** either in a general EU framework Regulation or in a specific EU Regulation for conservation measures;

- Review experiences made in the past and examine the rules for technical measures in the Baltic Sea which should be **removed** either from the general EU framework Regulation or from a specific EU Regulation for conservation measures;
- Evaluate which of the rules for technical measures in the Baltic Sea should be **altered** either in a general EU framework Regulation or in a specific EU Regulation for conservation measures;
- Explore which new rules for technical measures in the Baltic Sea might be **developed** and explore if they should be integrated in a reviewed general EU framework Regulation for technical measures or in a specific EU Regulation for conservation measures.

1.3. What is a technical measure?

The fishery management uses different regulatory tools to improve the sustainable exploitation of living aquatic resources, and to limit the negative impacts on the environment by fisheries.

There are several definitions and classifications of such management tools in the literature which renders it difficult to provide one widely accepted definition of a technical measure in a strict sense.

One of the basic definitions of management measures was given by FAO (2002):

"A management measure is the smallest unit of the fishery manager's tool kit and consists of any type of control implemented to contribute to achieving the objectives. Management measures are classified as technical measures, input (effort) and output (catch) controls, and any access rights designed around input and output controls".

Sometimes input and output measures are also referred to as primary management measures which directly limit fishery (quantitatively), such as TAC and effort regulations (e.g. (European Commission, 2014; STECF, 2012).

However, the *"CFP does not simply lay down rules which limit the **quantity** of what fishers can catch to what the underlying biological systems can sustainably provide. It also provides a **qualitative** framework to protect fish stocks and the ecosystems in which they live, by encouraging certain kinds of fishing practice, and discouraging, or banning, others. These qualitative rules are collectively known as technical measures. ... In other words, they guide and channel fishing effort, so that it is applied in ways which both maximise the economic return to fishers, and minimise unwanted damage to the common resource on which all fishers depend."* (European Commission, 2009)

In line with the above given definitions of management tools, the EU Commission (2014) defines technical measures as a management framework of technical aspects of fishing operations. This technical framework regulates the exploitation pattern and uses *"instruments which define where, when and how a fishing enterprise can exploit and interact with marine resources and the wider marine ecosystem"*.

A definition of technical measures is also given in the basic CFP regulation ([Regulation \(EU\) No 1380/2013](#), Art. 4)): *" 'technical measure' means a measure that regulates the composition of catches by species and size and the impacts on components of the ecosystems resulting from fishing activities by establishing conditions for the use and structure of fishing gear and restrictions on access to fishing areas."*

Nevertheless, a sound evaluation and discussion of management strategies to meet the objectives of the reformed CFP ([Regulation \(EU\) No 1380/2013](#)) requires a wider view on management measures, rather than the interpretation of technical measures in a strict sense. Such a restrictive interpretation of technical measures does not take into account the inherent interlinkages between many management tools. In fact, many measures operate at different levels and can hardly be discussed separately from others. Consequently, technical measures are used in a wider sense in this report, including other management tools, such as control and effort regulations.

1.4. Classification of technical measures

Several classification schemes for technical measures have been used (European Commission, 2014; Reeves *et al.*, 2008), and the number of classes defined varies between different approaches. The classification scheme given in [Regulation \(EU\) No 1380/2013](#) (Art.7) is rather complex and not suitable for the purpose of this study.

A basic and – for our purposes – appropriate classification of technical measures is given in [Regulation \(EU\) No 2371/2002](#) (Art. 4; in addition to a list of other management measures). This classification uses four categories [*headings in square brackets were added by the authors of this study for convenience; (iii) adapted to include Minimum conservation reference sizes (MCRS)*]:

- (i) measures regarding the structure of fishing gear, the number and size of fishing gear on board, their methods of use and the composition of catches that may be retained on board when fishing with such gear [**Gear and catch measures**]
- (ii) zones and/or periods in which fishing activities are prohibited or restricted including for the protection of spawning and nursery areas [**Temporal and spatial closures**]
- (iii) minimum size of individuals that may be retained on board and/or landed and/or sold [**Species' size limits**]
- (iv) specific measures to reduce the impact of fishing activities on marine ecosystems and non-target species [**Mitigation of ecosystem impacts**]

We use this classification of technical measures within this study and add a fifth one:

- (v) measures ensuring compliance and an appropriate implementation [**Compliance and control measures**]

The above mentioned groups potentially overlap to some extent or have linkages. For instance, measures to mitigate the ecosystem impact of fisheries are often associated with the fishing gear and its use, or limit the accessibility of given areas for fisheries. Nevertheless, the classification used in this report should reasonably account for both the required clarity in terminology and the underlying high complexity.

1.5. Special features of the Baltic Sea

The Baltic Sea (Map 1) is different from most other EU waters. It is one of the largest brackish water areas in the world. While the terrestrial (freshwater) runoff into the Baltic Sea is significant, saline water would have to enter from the North Sea. The Baltic Sea is eutrophic (nutrient-rich), and in the deeper basins large zones with low or without oxygen

(hypoxic or anoxic) occur frequently. Bottom water in these basins usually has a much higher salinity than surface water. The density stratification is strong and vertical mixing does not affect the bottom water. Thus, the oxygen supply for bottom water usually comes with lateral inflows of saline water (of higher density) from the North Sea (Feistel *et al.*, 2008).

Both salinity and oxygen content severely influence the distribution and development of marine fish species in the Baltic Sea. There are a few marine species and a few freshwater species, both more tolerant against the reduced and partly variable salinities. In the Baltic Sea, environmental factors have a much greater impact on the status of commercially exploited fish stocks than in most other European seas. Due to the importance of the environmental conditions for the system, not only the fauna of the Baltic Sea is simpler than in most other regions, but also the interactions between those species are simpler than e.g. in the adjacent North Sea (Hammer *et al.*, 2008).

In addition, also the structure of the fishery is relatively simple. There are only fisheries nine nations exploiting the marine living resources of the Baltic Sea (eight EU member states and Russia). The fisheries can be broadly separated into active and passive fleets. They all exploit adult fish and are pretty similar across nations. Bycatches of target species' juveniles and of protected fish species rarely occur. Also, compliance appears to be reasonable, at least in most nations and in recent years.

Given the relatively simple structure of the ecosystem and its fisheries, the **Baltic Sea is an ideal area to test novel management approaches**, including a more progressive or even radical approach to the deregulation possible after the implementation of the landing obligation. The implementation of the new approach in a simply structured system could be used as a proof of concept. Lessons learnt could be used to see where amendments to the rules are required to make the CFP reform work. In other words: If the new rules do not work in the Baltic, it is unlikely that they will work elsewhere.

1.6. Report structure

The report is structured in four major sections:

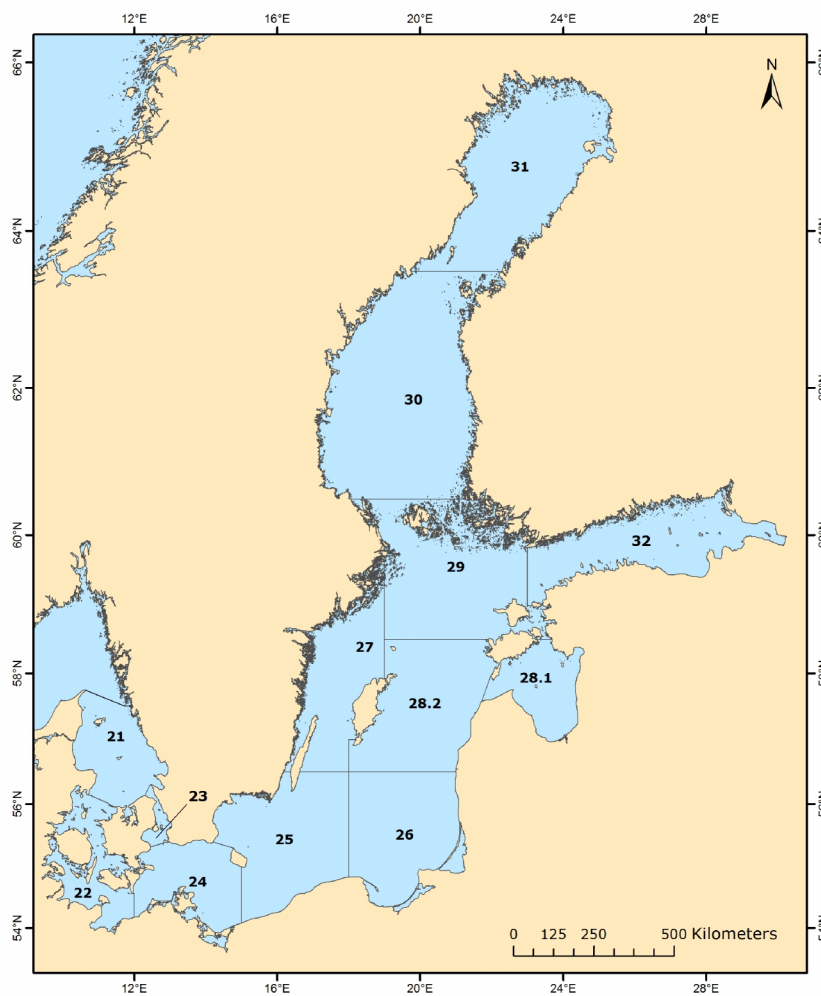
Chapter 1 provides the introduction, terms of reference, definitions and a brief on the characteristics of the Baltic Sea.

In **chapter 2**, the main technical measures applicable to Baltic Sea fisheries are provided. This forms the basis for further assessment of the technical measures, and for the development of recommendations for a future regulatory framework.

In **chapter 3**, we review the functioning of these rules in the past and assess whether they are in line with the objectives of the reformed CFP. We use the classification given in chapter 1.4 to generalise our findings.

In **chapter 4**, recommendations on changes in the technical measure framework for the Baltic Sea are given in the light of the previous assessment. These include existing technical measures, but also recommendations for technical measures in support of the general objectives of the reformed CFP ([Regulation \(EU\) No 1380/2013](#)). Additionally, it is discussed to what extent the recommendations derived for the Baltic Sea are transferable to other European waters.

Map 1: The Baltic Sea and adjacent waters with limits of ICES Sub-Divisions (SD) indicated



Sources: ArcView and ICES.

2. TECHNICAL MEASURES IN THE BALTIC SEA - OVERVIEW

KEY FINDINGS

- Several regulations are in use which define a **variety of technical measures** for the Baltic Sea fisheries
- regulations and main technical measures are listed, grouped into 5 categories (as defined in chapter 1.4), along with information on the likely intended aim and interactions with other technical measures.

This chapter gives an **overview about the main technical measures** currently applying to Baltic Sea fisheries. Some of the technical measures are described in more detail to give an impression of the complexity of the present regulatory system.

The list of technical measures makes **no claim to be exhaustive**, and simplification in the description was necessary and intended. For a complete list of technical measures relevant for Baltic Sea fisheries and the full text of each measure, please refer to the official EU Regulations and their amendments (hyperlinks are given in the text).

2.1. Regulations relevant for the Baltic Sea

Technical measures applicable for the Baltic Sea can be found in a series of EU regulations (and their amendments). Table 1 provides an overview over the main technical regulations, Table 2 over those regulations not considered technical regulations in a strict sense, but considered important in the context of the establishment of a new regulatory framework in support of the reformed CFP.

Table 1: EU Regulations defining current technical measures applicable for the Baltic Sea fisheries

	EU regulation	Title
1	2187/2005	Council Regulation (EC) No 2187/2005 of 21 December 2005 for the conservation of fishery resources through technical measures in the Baltic Sea, the Belts and the Sound, amending Regulation (EC) No 1434/98 and repealing Regulation (EC) No 88/98
2	1098/2007	Council Regulation (EC) No 1098/2007 of 18 September 2007 establishing a multiannual plan for the cod stocks in the Baltic Sea and the fisheries exploiting those stocks, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 779/97
3	686/2010	Commission Regulation (EU) No 686/2010 of 28 July 2010 amending Council Regulation (EC) No 2187/2005 as regards specifications of Bacoma window and T90 trawl in fisheries carried out in the Baltic Sea, the Belts and the Sound
4	1237/2010	Regulation (EU) No 1237/2010 of the European Parliament and of the Council of 15 December 2010 amending Council Regulation (EC) No 2187/2005 as regards the prohibition of highgrading and restrictions on fishing for flounder and turbot in the Baltic Sea, the Belts and the Sound
5	1396/2014	Commission Delegated Regulation (EU) No 1396/2014 of 20 October 2014 establishing a discard plan in the Baltic Sea
6	2015/812	Regulation (EU) 2015/812 of the European Parliament and of the Council of 20 May 2015 amending Council Regulations (EC) No 850/98, (EC) No 2187/2005, (EC) No 1967/2006, (EC) No 1098/2007, (EC) No 254/2002, (EC) No 2347/2002 and (EC) No 1224/2009, and Regulations (EU) No 1379/2013 and (EU) No 1380/2013 of the European Parliament and of the Council, as regards the landing obligation, and repealing Council Regulation (EC) No 1434/98

Table 2: EU Regulations defining management measures which are not technical measures in a strict sense – but also relevant for this study

	EU regulation	Title
1	812/2004	Council Regulation (EC) No 812/2004 of 26.4.2004 laying down measures concerning incidental catches of cetaceans in fisheries and amending Regulation (EC) No 88/98
2	1224/2009	Council Regulation (EC) No 1224/2009 of 20 November 2009 establishing a Community control system for ensuring compliance with the rules of the common fisheries policy, amending Regulations (EC) No 847/96, (EC) No 2371/2002, (EC) No 811/2004, (EC) No 768/2005, (EC) No 2115/2005, (EC) No 2166/2005, (EC) No 388/2006, (EC) No 509/2007, (EC) No 676/2007, (EC) No 1098/2007, (EC) No 1300/2008, (EC) No 1342/2008 and repealing Regulations (EEC) No 2847/93, (EC) No 1627/94 and (EC) No 1966/2006
3	404/2011	Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy
4	1380/2013	Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC
5	1221/2014	Council Regulation (EU) No 1221/2014 of 10 November 2014 fixing for 2015 the fishing opportunities for certain fish stocks and groups of fish stocks applicable in the Baltic Sea and amending Regulations (EU) No 43/2014 and (EU) No 1180/2013

2.2. Gear and catch measures

2.2.1. Description of technical measure(s)

This category covers a variety of technical measures which are related to the construction and the use of fishing gears, and intended to influence the catch composition – or combinations and interlinkages of those. Therefore, three sub-categories within this broad category can be distinguished (Reeves *et al.*, 2008):

- measures related to **catch composition**
- measures related to the **use and handling of the gear**
- measures related to the **construction of the gear itself**

2.2.2. Likely intended aim of the technical measure

The primary objective of technical measures related to gear specifications, gear use and catch composition is to avoid or reduce catches of unwanted non-target fish species or unwanted size classes of the target fish species (which are usually discarded under the old management approach, i.e. prior to the implementation of [Regulation \(EU\) No 1380/2013](#)). Measures defining gear specifications aim to regulate and promote the use of species- and size-selective gears.

2.2.3. Interactions with other technical measures

Interaction with Species' Size Limit: Gear specifications and species' size limits have often the same aim, i.e. to avoid or significantly reduce the catch of unwanted non-target fish species and/or sizes of target species.

Interaction with measures to mitigate ecosystem impacts: Since the use of fishing gears can have unwanted impacts on the marine environment, measures to mitigate such impacts often deal with the gear modifications and the usage of gears. A very strict example is the prohibition of specific fishing gears and practices (see chapter 2.5.4)

2.2.4. Specific regulations in the Baltic Sea

2.2.4.1. Measures related to catch composition

Landing obligation / discard ban: The central measure of the most recent CFP reform is an obligation to land all catches ("*the landing obligation*") of species which are subject to catch limits ([Regulation \(EU\) 1380/2013](#), Art. 15). The main objective of the landing obligation was defined as "*to reduce the current high levels of unwanted catches and to gradually eliminate discards*". This landing obligation should be gradually implemented in all relevant European Union fisheries on a fishery-by-fishery basis. Together with the landing obligation, a number of additional provisions were introduced in [Regulation \(EU\) 1380/2013](#), amongst several others:

- the conversion of Minimum Landing Sizes (MLS) into Minimum Reference Conservation Sizes (MCRS) for stocks under the provision of the landing obligation;
- the prohibition to sell specimens below MCRS for human consumption;

- several potential exemptions from the landing obligation, such as a) *de minimis* exemptions and b) an exemption for species with high survival rates.

The [Regulation \(EU\) 1380/2013](#) was implemented in the Baltic Sea with [Regulation \(EU\) 1396/2014](#). This regulation defines the following rules for Baltic Fisheries:

- Time schedule for the implementation of the landing obligation:
 - from 1 January 2015 as regards fisheries for herring, sprat, salmon and cod
 - from 1 January 2017 as regards plaice in all fisheries
- Implementation of a Minimum Reference Conservation Size (MCRS) of 35 cm for cod.
- Implementation of survival exemption rules for cod and salmon caught with a few selected passive gears. Cod and salmon caught with these gears may be released back into the sea.

Definition of Target Species and minimum mesh sizes: For the different areas (ICES SDs) and target species assemblages, the corresponding mesh sizes (either defined as mesh size range or as minimum mesh size) are defined ([Regulation \(EU\) 2187/2005](#), Art. 3-4, Annex II-III, amended by [Regulation \(EU\) No 1380/2013](#)) for active gears, as well as for passive gears. For each of the combinations of target species assemblage and mesh size, the minimum percentage of target species finally retained onboard is specified.

For example, vessels fishing for pelagic fish species (Sprat, Herring and sandeel) in ICES SD 22–23 with trawls of 32-90mm mesh size (in the codend, i.e. the aft end of the trawl) must have at least 90 % of target species onboard, while the catch retained onboard may consist of up to 40 % of whiting (live weight), but not more than 3 % of cod (live weight).

This is only one example out of seven complex scenarios for trawls and five complex scenarios for passive nets (i.e. gillnets, entangling nets and trammel nets).

Prohibition of highgrading: For all species which are subject to a quota, highgrading is prohibited ([Regulation \(EC\) No 2187/2005](#), Art. 15, amended by [Regulation \(EU\) No 1237/2010](#)). I.e. fish of such species above Minimum Landing Size must be landed and counted against the quota, provided the vessels' quota is not exhausted. Since the landing obligation entered into force for herring, sprat, salmon and cod in the Baltic in 2015, this rule applies no longer, except for plaice (until plaice also falls under the landing obligation in 2017).

Restriction on fishing for specific fish species:

For some fish species, it is defined where and when they may be retained onboard and landed ([Regulation \(EC\) No 2187/2005](#), Art. 17 - 18, amended by [Regulation \(EU\) No 1237/2010](#)):

- *Eel*: no retention onboard when caught with active gears (all year, all areas)
- *Sea trout, flounder and turbot*: specific areas and specific seasons

This measure is different from the temporal and spatial closures (see chapter 2.3), since the fishing activity itself is not restricted.

2.2.4.2. Measures related to catch composition

Use of passive gears (gillnets, entangling nets or trammel nets):

The maximum immersion time of passive nets is limited to 48 h (except when fishing under ice) ([Regulation \(EC\) No 2187/2005](#), Art. 8).

Conditions for use of gear:

[Regulation \(EC\) No 2187/2005](#), Art. 13 specifies that gears (including replacement gears) have to be stowed away in some areas. It is also defined in detail how the gears have to be stowed away onboard.

One-Net-Rule:

([Regulation \(EC\) No 2187/2005](#), Art. 13) If a vessel uses a gear for which cod (*Gadus morhua*) is defined as target species ([Regulation \(EC\) No 2187/2005](#), Annex II and Annex III), no other type of gear shall be kept onboard.

2.2.4.3. Measures related to catch composition

Specification of active gears (trawls, Danish seines): The design of active gears is specified in overwhelming richness of details ([Regulation \(EC\) No 2187/2005](#), Art. 5-7, Annex II, amended by [Regulation \(EU\) No 686/2010](#)). Each of the two regulations uses 8 pages to describe the gear specifications of active gears.

At the time of publishing the two EU Regulations, it was widely assumed that most of the selectivity of a trawl takes place in the last part of the trawl, the codend, where the catch accumulates. Therefore, emphasis was placed on the specification of codend characteristics. Of the defined specifications, the mesh size is the most important factor determining the selectivity of towed gear (but is by far not the only one). Additional specifications are related to permitted attachments and codend-modifications or those which are prohibited. To give an impression about the number of specifications (Art. 5 and 6), some are summarized below:

- Permission
 - of protection (canvas, netting etc.) in the lower half of the codend to protect the gear against wear,
 - of an outer net bag (strengthening bag) for small mesh codends for protection purposes, while the mesh size of the outer netting must be large enough. Several other specifications are given how this strengthening bag has to be designed and attached,
 - to use non-return net / flapper (including specifications), catch sensors, lifting straps (including specifications), floats at the sides of the codend.
- Prohibition
 - of codends with increasing number of meshes in the circumference,
 - of extension pieces (connection between trawl belly and codend) with fewer meshes in circumference than in the codend,
 - of other mesh types than diamond mesh and square mesh,
 - of codends where upper and lower net panel are unequal,
 - of devices that obstruct or otherwise diminish the mesh in the codend (some exemptions are given below).

- Restriction of
 - methods to attach the codend to the rest of the trawl,
 - codend circumference.

Special emphasis was placed on trawls for the mixed demersal trawl fishery (i.e. the fishery which also targets cod). Two different codend types are permitted for this fishery. The description of both codend types ([Regulation \(EU\) No 2187/2005](#), Annex II) consists of several pages with a number of detailed specifications (incl. how to repair a square mesh panel as used in one of the codends). With [Regulation \(EU\) No 686/2010](#), the minimum mesh size in these codends was increased from 110 mm to 120 mm.

Specification of passive gears (e.g. gillnets, entangling nets or trammel nets): In comparison to towed gears, passive gears are much simpler in design and are regarded as being more selective. Therefore, the structure of passive gears is much less regulated and specified than the structure of towed gears.

The maximum length ([Regulation \(EU\) No 2187/2005](#), Art. 8) and the mesh size ([Regulation \(EU\) No 2187/2005](#), Annex III) of the net are defined, depending on the size of the vessel and the target species assemblage, respectively.

2.3. Temporal and spatial closures

2.3.1. Description of technical measure(s)

Closures restrict the fishing possibilities of the fleet (or a part of the fleet) within a given area. An important part of the definition of a spatial closure is the regulation of the temporal aspect of such closure (i.e. how long this closure is applied and in which season).

Since different gears might have different impact on the specific species or the specific habitat, temporal and spatial closures are typically defined for specific gears or target species assemblages.

2.3.2. Likely intended aim of the technical measure

Closures are used as technical measure to (i) protect specific species at a specific life stage (e.g. at nursery or spawning sites) or (ii) to protect other vulnerable marine elements of the ecosystem, such as endangered species or vulnerable marine habitats (European Commission, 2014; Reeves *et al.*, 2008).

2.3.3. Interactions with other technical measures

Interaction with measures related to gear and catch: Closures are often defined for specific gears. Exemptions often exist for gears with expected lower impact on the vulnerable marine elements of the ecosystem.

Interaction with measures to mitigate ecosystem impacts: Based on the aims, as described above (chapter 2.3.2), temporal and spatial closures also can be applied to mitigate the impact of fishery on the ecosystem in general, e.g. to protect other vulnerable

marine elements of the ecosystem, such as endangered species or vulnerable marine habitats.

2.3.4. Specific regulations in the Baltic Sea

Spatial-temporal closures as defined in the multi-annual plan for cod (part 1): ([Regulation \(EC\) No 1098/2007](#), Art. 8) With the objective to protect spawning aggregations of the Baltic cod stocks, two temporal/spatial closures were introduced with the multiannual plan for the cod stocks in the Baltic Sea applicable for most of the distribution area of this species (several ICES SDs). This measure comprises several rules, such as:

- It is only applicable for gears (active and passive) with mesh sizes equal to or larger 90mm and other passive gears (bottom set lines, longlines, jigging), but not including the recreational fishery. Gears with other mesh sizes are allowed, if the proportion of cod in the catches does not exceed certain limits.
- Two different periods are defined for different areas, in an attempt to account for different spawning seasons of the two cod stocks. A scientific evaluation of the temporal fit of the closures was presented by STECF (STECF, 2010) and is discussed in chapter 3.4.
 - April 1st–April 30th in the Western Baltic Sea (ICES SD 22–24)
 - July 1st–August 31st in the Central Baltic Sea (ICES SD 25–28)
- Exemptions are granted for vessels with an overall length below 12 meter. These exemptions comprise a complex subset of rules, where the objectives are not clearly identifiable: The vessels are permitted to fish during 5 days per month, divided into periods of at least two consecutive days, while the immersion of nets and landing of fish is only allowed between Monday 06:00 hrs and Friday 18:00 hrs.

Spatial-temporal closures as defined in the multi-annual plan for cod (part 2): ([Regulation \(EC\) No 1098/2007](#), Art. 9) Apart from the spatio-temporal closures, as described above, the multiannual plan for the cod stocks in the Baltic Sea further defines three smaller closures in the historic main spawning areas of the eastern Baltic cod stock. The duration of these closures is from May 1st–October 31st. Furthermore, these closures cover more fishing gears than the shorter spatial-temporal closures defined in [Regulation \(EC\) No 1098/2007](#), Art. 8, with no active gears permitted.

Spatial closure as defined in Regulation (EC) No 2187/2005 (Art. 16): This is an example for a closure of an area for only a part of the fleet. On the Oderbank Plateau (SD 24), all fishing with active gears is banned; however in the current [Regulation \(EU\) No 2187/2005](#) no justification for this ban is given. Originally, a ban for all trawls *"in order to protect spawning turbot and other juvenile flatfish"* was formulated and adopted by the International Baltic Sea Fishery Commission in 1991. However, in all newer Council Regulations (Regulations (EC) No [88/98](#), No [289/2005](#) and No [2187/2005](#)) the trawl ban was included, but the original intention was not mentioned anymore. Therefore, this is an example how specific measures might be carried over from one regulation to another over many years, without (re-)evaluating or even mentioning the original intention or objectives.

Other closures: See chapter 2.5 (Mitigation of ecosystem impacts) for further closures, related to the protection of vulnerable species and habitats.

2.4. Species' size limits

2.4.1. Description of technical measure(s)

Since minimum sizes are an integral part of the technical measures framework in many jurisdictions (STECF, 2015a), they are defined for a number of species in European waters. Two types of minimum sizes are defined.

Minimum Landing Size (MLS): The MLS sets a size limit for a given species and in a given area. Individuals below MLS are not allowed to be retained onboard, landed and sold. Individuals caught must be returned to sea, which forces the fisher to discard.

Minimum Conservation Reference Size (MCRS): With the introduction of the landing obligation for some species in the Baltic Sea, it is required to land undersized specimens of some species. Therefore, the term *Minimum Landing Size* was no longer applicable for such species. The Minimum Conservation Reference Size (MCRS) defines the size of a marine species below which restrictions or incentives apply. At present, fish below MCRS cannot be sold for human consumption.

2.4.2. Likely intended aim of the technical measure

Minimum Sizes aim to restrict the catch and sale of fish below such sizes. The protection of juveniles is often considered the main objective, and hence is related to the length at first spawning.

Furthermore, the defined Minimum Sizes should serve as incentive to adapt the fishing strategy to reduce the catch of individuals below Minimum Sizes by using more selective gears, or avoiding those areas and seasons where small individuals are accessible for the gear. However, prior to the introduction of the landing obligation, undersized specimens had to be discarded, without any effects on the quota. Thus, part of the catch was not used but had to be returned to the sea, even when the discard survival was low.

The objective for the definition of stock specific minimum sizes is often unclear, and biological or ecological objectives or a combination of both could be the basis for individual decisions (STECF, 2015a).

2.4.3. Interactions with other technical measures

While the defined Minimum Sizes regulate which individuals can be landed (MLS) or sold for human consumption (MCRS), there are several technical measures implemented which define the catch pattern – and hence which species and which length classes are caught with the fishing gear. Amongst others, such regulations are the detailed specifications of codends in trawl fishery (see chapter 2.2). Consequently, the flexibility of fishers to adapt their fishing activity to minimise the catch of undersized fish is limited.

2.4.4. Specific regulations in the Baltic Sea

For eight different fish species, a minimum size is defined within the framework of the CFP, whereas for some species this size differs between areas (Table 3). Since cod is currently the only species in the Baltic with a TAC and a size limit, the minimum size for cod is transferred to a Minimum Conservation Reference Size (MCRS). For some species, minimum sizes specified from national state authorities (responsible within the near shore zone) may slightly differ from the sizes given here.

Table 3: Current Minimum Sizes for Baltic Fish Species.

Species	Geographical area ICES Subdivision	Minimum size
Cod (<i>Gadus morhua</i>)*	22-32	35 cm*
Flounder (<i>Platichthys flesus</i>)	22 to 25	23 cm
	26 to 28	21 cm
	29 to 32, south of 59° 30' N	18 cm
Plaice (<i>Pleuronectes platessa</i>)	22 to 32	25 cm
Turbot (<i>Scophthalmus maximus</i>)	22 to 32	30 cm
Brill (<i>Scophthalmus rhombus</i>)	22 to 32	30 cm
Eel (<i>Anguilla anguilla</i>)	22 to 32	35 cm
Salmon (<i>Salmo salar</i>)	22 to 30 and 32	60 cm
	31	50 cm
Sea trout (<i>Salmo trutta</i>)	22 to 25 and 29 to 32	40 cm
	26 to 28	50 cm

* Minimum Conservation Reference Size (MCRS) is given only for cod, as this species falls under the landing obligation – Regulation (EC) No [2187/2005](#) and No [1396/2014](#)

2.5. Mitigation of ecosystem impacts

2.5.1. Description of technical measure(s)

This group of technical measures can be quite diverse and less specified than the other groups – and often overlaps with other technical measures from other groups. For example, common measures to protect vulnerable marine habitats or non-target species (such as marine birds or marine mammals) involve spatial closures or the restricted use of specific fishing gears in certain areas.

2.5.2. Likely intended aim of the technical measure

The general aim is the mitigation of ecosystem impacts caused by a fishery. This includes especially the protection of vulnerable marine species and/or vulnerable marine habitats,

while the definition of such vulnerable elements is rather diverse and imprecise in many cases.

The following groups can include protected species (European Commission, 2014), however, not all groups are relevant in the Baltic Sea:

- Marine species listed under Appendix 4 of the Habitat Directive, including all cetaceans, certain marine turtles and some fish species like sturgeons;
- Seabird species, specified in the Bird Directive ([Directive 2009/147/EC](#)) and other international commitments (CBD, Bonn Convention) or soft law (IPOA Seabirds by FAO);
- Some elasmobranchs (sharks and rays), in particular following the IPOA-sharks adopted by FAO.

According to the EU's Habitat Directive ([Council Directive 92/43/EEC](#)), member states have to protect certain defined types of habitats in the waters of their jurisdiction (territorial waters as well as the exclusive economic zone). Among the habitat types relevant in the Baltic Sea are reefs, sand banks and seagrass beds. Once designed, member states have to implement specific management measures for fisheries with negative impacts on the conservation objectives defined for the species and habitats in those areas.

2.5.3. Interactions with other technical measures

See description of the technical measure related to gears (chapter 2.2) and temporal and spatial closures (chapter 2.3).

2.5.4. Specific regulations in the Baltic Sea

Prohibition of specific fishing gears and practices: According to ([Regulation \(EU\) No 2187/2005](#), Art. 23) the use of several destructive fishing techniques is prohibited in the Baltic Sea. Such practices are methods involving the use of explosives, poisonous or stupefying substances, electric current or any kind of projectiles. The mentioned methods are seen as destructive in general. A more specific objective was the basis to ban drift nets in the Baltic Sea after 01.01.2008 (Regulations (EU) No [812/2004](#) and No [2187/2005](#), Art. 9, 10), mainly aiming at a reduction of the incidental bycatch of seabirds and marine mammals by this gear type.

Bycatch of small cetaceans – use of acoustic deterrent devices (ADD) and monitoring requirements: [Regulation \(EU\) No 812/2004](#) lays down measures aimed at mitigating incidental catches of cetaceans by fishing vessels in EU waters, including the Baltic Sea. The Regulation also prohibits the use of driftnets from 1 January 2008 onwards. In the Baltic, bycatch of small cetaceans concerns almost exclusively the bycatch of harbour porpoise (*Phocoena phocoena*); seals are rarely caught.

According to the regulation, it is prohibited for vessels of 12 meter or larger in overall length to use certain types of fishing gear (defined in the Regulation) without the simultaneous use of active acoustic deterrent devices (ADDs), in ICES subdivision 24 as well as in other small areas off the coast of Sweden. The masters of the Community fishing vessels have to ensure that the acoustic deterrent devices are fully operational when setting the gear.

ADDs used shall comply with one set of the technical specifications and conditions of use as defined in the Regulation. Member States may authorise the temporary use of acoustic deterrent devices which do not fulfil the defined technical specifications, provided that their effect on the reduction of incidental catches of cetaceans has been sufficiently documented. Such an authorisation shall be valid for no more than two years.

Member States shall design and implement monitoring schemes for incidental catches of cetaceans using observers on board the vessels flying their flag and with an overall length of 15 meter or larger using two types of gears and operating in Baltic Sea areas as stated:

- *Pelagic trawls (single and pair)*: ICES subareas IIIa, b, c, IIIId south of 59° N, IIIId north of 59° N (only from 1 June to 30 September).
- *Bottom-set gillnets or entangling nets using mesh sizes equal to or greater than 80 mm*: ICES sub area IIIB, c, d, [excluding the areas where the use of ADDs is mandatory].

For vessels with an overall length of less than 15 meter, Member States shall take the necessary steps to collect scientific data on incidental catches of cetaceans for involved fisheries by means of appropriate scientific studies or pilot projects. Member States shall take necessary steps to monitor and assess, by means of scientific studies or pilot projects, the effects of pinger use over time in the fisheries and areas concerned.

The [Regulation \(EC\) No 812/2004](#) even requires in very much detail the qualification of personnel deployed as onboard observers.

Limit of fishing possibilities in the Gulf of Riga: ([Regulation \(EC\) No 2187/2005](#), Art. 22). Special regulations apply to the Gulf of Riga. Apart from a system to limit the access of fishing vessels to this area and to limit the overall effort (in terms of overall engine power of the fleet) ([Regulation \(EC\) No 2187/2005](#), Art. 20.21), areas with a water depth less than 20 m are closed for trawling. The objective stated for this measure is that the Gulf of Riga is a unique and rather sensitive marine ecosystem which requires special measures to ensure sustainable exploitation of its resources and to minimise the impact of fishing activities.

2.6. Compliance and control measures

2.6.1. Description of technical measure(s)

While compliance and control measures are not technical measures in a strict sense, they (and their further development) are **essential for a successful implementation of the reformed CFP** ([Regulation \(EU\) No 1380/2013](#)), especially with respect to the landing obligation. Examples are given in chapter 2.6.4.

2.6.2. Likely intended aim of the technical measure

The overall aim is to establish a Community control system for ensuring compliance with the rules of the Common Fisheries Policy.

2.6.3. Interactions with other technical measures

As the control measures are (amongst others) defined to ensure compliance with the current technical measures, as described in chapter 2.2-2.5, there are obvious interlinkages between them.

But on the other hand, the future technical measure framework will require new strategies and measures for control. Consequently, the further development of compliance and control systems can have a significant influence on which technical measures can be implemented in the future. This aspect will be further discussed in chapter 3, especially 3.5.

2.6.4. Specific regulations in the Baltic Sea

Measures defined in control regulations: Two EU regulations are most relevant for the Baltic Sea Fisheries in terms of compliance and control ([Regulation \(EU\) No 1224/2009](#), [Regulation \(EU\) No 404/2011](#)). Since both documents are rather comprehensive and cover a very wide range of control measures, few key points will be highlighted, relevant for the further discussion. It is important to note that most of these measures are not applicable to small vessels and the recreational fishery – and hence do not cover a significant part of catches and fishing effort of the fishing fleets.

Measures and tools to monitor the fishing activity and catches are for instance:

- The vessel monitoring system (VMS) to track the position of fishing, for vessels with a length of 12 meter and more.
- Logbooks and electronic logbooks to monitor the catch and landings for vessels with length of 8 meter and more.
- Landing declarations to monitor the landings for all vessels. In many countries, vessels shorter than 8 meter and part-time fisheries need to declare their landings only once per month.
- Inspections at sea to control fishing licenses, correct gear specification, as well as catch retained onboard.
- Inspections at port to control landings.

Measures defined in the multiannual plan for the cod stocks in the Baltic Sea: In addition to the rules defined by [Regulation \(EC\) No 1224/2009](#) and by [Regulation \(EC\) No 404/2011](#), the multiannual plan for the cod stocks in the Baltic Sea ([Regulation \(EC\) No 1098/2007](#)) sets out several regulations for Monitoring, Inspection and Surveillance (Art. 10-22) (some of them only apply to vessels equal or larger than 8m). Amongst others, this regulation sets rules for

- a special permit for fishing for cod in the Baltic Sea;
- the need for logbook and electronic logbook and details on how to record and transmit data, as well as error margins for logbook entries;
- restrictions in fishing in different areas of the Baltic Sea in one fishing trip (detailed rule)
- prohibition on transiting (crossing closed areas with cod onboard) and transshipment.

3. ASSESSMENT AND EVALUATION

KEY FINDINGS

- A proper implementation of the CFP reform could lead to a **significant reduction of technical measures**, i.e. deregulation.
- An assessment of technical measures in the Baltic Sea is presented. Under the assumption of a full implementation of the landing obligation and sufficient compliance to the rules, technical measures are grouped into technical **measures to be maintained**:
 - a) most measures to mitigate the impact of fishery on the ecosystem (such as specific types of closures and acoustic deterrent devices (pingers) for the avoidance of harbour porpoise bycatch),
 - b) Very few gear and catch measures, such as the maximum immersion time of passive gears (related to food safety and animal welfare),
 - c) control and enforcement rules to sufficiently document the fishery (whereas current systems needs to be further developed).
- Technical **measures to be removed**: Special care needs to be taken to avoid the introduction of new rules while keeping the old ones ("*belt-and-braces*" approach). Several current measures are in direct conflict with the new management approach and need to be removed immediately. For instance:
 - a) all gear and catch composition measures,
 - b) Minimum Sizes (MLS and MCRS) in their current meaning,
 - c) most of the current control and enforcement rules if a more efficient monitoring of fishery is implemented.
- Technical **measures to be altered**:
 - a) while spawning and nursery closures might be meaningful measures, their efficient implementation needs to be evaluated and adapted where necessary,
 - b) implementation of mitigation measures to prevent bycatch of marine mammals needs to be adapted,
 - c) the control and enforcement needs to cover the entire fleet – even those relatively small vessel yet poorly covered.
- Technical **measures to be developed**:
 - a) further development of control measures, preferable using the advantages of electronic monitoring systems (EM-systems),
 - b) new and efficient approaches to monitor bycatches of marine mammals, especially harbour porpoises, incl. EM-systems,
 - c) measures to monitor and regulate recreational fishing.

3.1. Introduction

The reform of the Common Fisheries Policy (CFP) in 2013 is considered by many as the most ambitious policy change in this sector since the formal introduction of the CFP in 1983. One of the key mechanisms to achieve the objectives is to create the right incentives for fishers to comply with the rules. This can be accomplished by moving towards a result-based management approach, with simple and consistent rules, such as the landing obligation. If properly implemented, these rules would allow for a deregulation: A large number of the present technical regulations could be removed, e.g. those describing details of the gears to be used. In the longer term, a result-based management is expected to improve compliance, increase fisher's participation and ultimately ensure the sustainable use of the resource.

The Scientific, Technical and Economic Committee for Fisheries (STECF) identified strategic elements for the future development of technical measures within the light of a result-based management (STECF, 2013, 2012):

- (1) Output control versus input control, creates an incentive to develop technology supporting the achievement of agreed aims, resulting in acceptable levels of negative impacts.
- (2) Burden of proof is shifted from managers to the industry.
- (3) Enforcement is based more on the concept of commitment than compliance, and the monitoring of enforcement includes elements from peer pressure.
- (4) The management approach and the incentive structure can have a significant impact on the effectiveness of technical measures.
- (5) Positive incentives with rewards for doing certain things may work better than prohibition and penalties.

We have evaluated the present technical measures applying to Baltic Sea fisheries under this aspect and identified which measures should be maintained, removed or altered, and which would have to be developed. We assume as baseline that the CFP reform is fully implemented (i.e. all species regulated by a quota are falling under the landing obligation, 2019 at the latest) and that compliance with the new rules is sufficient.

Some rules might have to be maintained for an interim period, specifically when there are indications that compliance is reduced. However, if old input management rules are kept, the signal to the fishery that the approach has changed is largely reduced. Hence, such a decision has to be carefully evaluated. **We propose to remove rules which are not absolutely necessary**, specifically when there is doubt that they have been effective under the old management scheme, but define a policy which involves the definition of level of non-compliance requiring that additional measures are taken. This would also solve the problem that a number of these regulations are **too complex** and often **over-prescriptive**, and thus **difficult** to understand, to control and to enforce (European Commission, 2014).

3.2. Technical measures to be maintained

Some of the technical measures described in Section 2 are not affected by the new management approach introduced with the CFP reform. Others are affected but can still be considered useful.

Rules in the category **"mitigation of ecosystem impacts"** would belong to this category, as long as they have been proven to be effective. An example for these rules is the obligation to use **acoustic deterrent devices (ADDs, pingers) for the avoidance of harbour porpoise bycatch**, which should even be extended to other areas (see under recommendations). ICES (2010) advised that acoustic deterrents are the most efficient measure to reduce harbour porpoise bycatch in static nets if it is not possible to cease using static nets. ADDs are currently only mandatory in areas with low densities of harbour porpoises (in SD24). The regulation, however, also contains elements of data collection on bycatches, which should be amended as they have been largely unsuccessful (see section 3.4). Also, ICES has evaluated the regulation (ICES, 2013) and concluded that it should not be overly descriptive for the technical details of the deterrent devices, as this could inhibit the development of more effective devices.

Regulations on **spatial or temporal closures** should be maintained if the aim of these rules is the protection of vulnerable habitats, migrating seabirds, etc. Those closures are obviously effective if properly enforced: a habitat cannot be negatively impacted by fishing if fishing is banned. Special cases are **spawning closures** or **closures to protect aggregations of juveniles**, aiming at improving the recruitment of stocks exploited by the fisheries. These are further discussed under *"rules to alter"*, section 3.4.

The most important set of rules to maintain are recently introduced **rules detailing the landing obligation**. They still need to be elaborated, and a recent study for the European Parliament demonstrated that the landing obligation can be implemented without the need for exemptions, at least in the Baltic Sea (Zimmermann *et al.*, 2015). The regional management high-level group, Baltfish, recommended not allowing for a *de-minimis* exemption in the Baltic Sea. Exemptions for species with demonstrated high survival rates are currently discussed. The authors of the EP study argue that this exemption could largely remove the incentives for the use of more selective gear (and thus be in conflict with the objectives of the CFP reform), that present knowledge would not provide scientific evidence for high survival rates, and that measures already exist to avoid unwanted bycatch of flatfish species. Therefore, this exemption should not be an option in the Baltic discard plans.

While the landing obligation will cover most major marine commercially exploited species in the Baltic Sea (cod, herring, sprat, plaice, salmon), two flatfish species (flounder and dab) making up a significant part of the mixed demersal catches in the western part of the area (SD22-25) are currently not regulated by a TAC and thus can still be discarded after the full introduction of the landing obligation. This creates *inter alia* potential problems in distinguishing between those flatfish which must be landed and those which could still be discarded, at least if automatic species detection systems are used. Further, it seems difficult to defend why such a large fraction of the catch should not be covered by the new rules, specifically if these species are TAC-regulated in the neighbouring North Sea. Thus it could be considered to put flounder and dab also under the landing obligation, with or without a quota regulation.

Very few **gear and catch measures** should be maintained, such as the limit on immersion time of passive nets – their aim is apparently food safety and animal welfare, both not affected by the new management approach.

Some rules on **control and enforcement**, which are considered as technical measures here, would need to remain: A proper documentation of catch can be achieved with records in logbooks. The obligation to submit Vessel Monitoring System (VMS) - or AIS positions is

useful to verify whether closed areas have been entered. However, there are now more modern methods available to verify fisher's activity. These Electronic Monitoring (EM) systems are discussed under "*rules to develop*" (section 3.5), and once fully implemented, they could replace the VMS and improve the compliance to the new management framework, especially when a fully documented fishery is implemented. At present, only larger vessels are obliged to keep logbooks and submit positions, so a large number of smaller boats is only sporadically observed, which needs to be adapted.

3.3. Technical measures to be removed

A large number of rules become obsolete under the new management approach and a result-based management. Some of them are even in immediate conflict with the new rules and thus need to be removed or altered immediately.

If a reasonable compliance is assumed, all regulations describing the **gear specifications and catch composition** could be removed. These rules are in conflict with a result-based management; they are overly complex and thus difficult to enforce. They also create (or rather maintain) the wrong incentives: fishers invest a lot of energy in finding ways to bend the rules rather than improving the selectivity of their gear. The landing obligation should incentivise selective fishing reasonably well, so that additional rules are not required. At present, trawl definitions only regulate details of the rear part of the net (including the repair!), while the front part is as important for the selectivity but largely unregulated anyway. Gear definitions inhibit the creativity of fishers and the development of more selective gear. Additionally, even simple amendments as the increase in mesh size in the legal demersal trawls in the Baltic had adverse effects: (STECF, 2010) demonstrated that the increase in codend mesh size resulted in unwanted harvest patterns, including higher discard rates, increased fishing pressure on larger individuals and huge losses of commercial catch.

Minimum sizes were meant to protect juveniles. With the introduction of the landing obligation, they are usually converted in Minimum Conservation Reference Sizes at an identical length. MLS/MCRS are problematic when they were derived in-transparently – which holds for most of them. There is a scientific debate whether such sizes are defined correctly, or in general whether such sizes – coupled to the age of first spawning – are meaningful at all. In addition, there is often neither a correlation between MLS and biological parameters of the species nor to the optimal selectivity of the legal gear. Fish below MCRS must now be landed and counted against the quota, but cannot be sold for human consumption. This should avoid that a fishery develops targeting juvenile/undersized fish. However, it is unclear whether this would happen in reality, i.e. if a market for undersized fish would exist, as small fish usually already has a low landing value. But the "*not for human consumption*" rule creates unintended difficulties – undersized fish must be stored and transported separately from fish for human consumption. Moreover, the environmentally sound disposal of these fish must be ensured and paid. If the aim is to increase the cost of catching small fish, then means exist that are simpler than excluding a specific use: Fish below a certain size could be counted against the quota with a certain factor. In case of Baltic cod, fish above 35 cm could have the factor 1, fish between 28 and 34 cm the factor 1.5, and fish below 28 cm the factor 2. These rules could be automatically implemented if the amount of "*undersized*" fish in a national fishery passes a certain threshold. However, the verification of these thresholds would require a solid monitoring system and thorough control at sea – see section 3.5.

Most of the present rules related to **control and enforcement** could be removed, namely one-net-rules (obsolete if no gear description exists) or the landing in designated ports. However, this can only happen if the present control is replaced by a more effective monitoring, as described in section 3.5 below.

It should be noted that the removal of these rules sends a strong message to the fishery. It seems very important to make the change in management approach boldly visible, even risking that compliance may deteriorate for a while. The alternative would be to keep the old rules (if they are not immediately conflicting) until the new rules have proven to be efficient. This is a "*belt-and-braces*" approach which carries the risk that fishers just continue with their present habits instead of adopting and supporting the management change.

3.4. Technical measures to be altered

A variety of **spawning closures** or **closures to protect aggregations of juveniles** are in place in the Baltic Sea, aiming at improving the recruitment of commercially exploited stocks. Most of these apply to demersal species and salmonids (see Section 2.5.2). The effectiveness of most of these closures has rarely been evaluated. Closures may reallocate fishing effort of the fleet (or part of the fleet) from one area to another and/or from one season to another, which might result in unintended adverse effects on stocks or ecosystem components in neighbouring areas. Additionally, inappropriate areas or times of a closure may reduce the efficiency and perception of the measure. It is therefore pivotal that closures are regularly evaluated, and ideally considered reasonable and supported by the fishers.

STECF (2010) concluded during its review of the Baltic cod management plan in 2010 that the present cod spawning closures were not required to harvest both cod stocks sustainably, provided the fishing mortality would be kept low enough. Further, the period of the closure for the western Baltic cod (April) was not very effective: too late to protect the most productive repeat spawners (older mature cod) in the Belt Sea (SD22), too early in the Arkona Sea (SD24). To maximise the intended effect of such a spawning closure, it would have to be extended and placed at a different time, i.e. to early February through late March in SD22 (and possibly SD23, the Sound) and beginning of June through mid of July in SD24. At the time of publication in 2011, both cod stocks were thought to develop positively. The latest ICES advice (ICES, 2015) demonstrates that this is not the case: Fishing pressure on both cod stocks is too high and biomass at least for the western stock too low. In this situation, additional measures to help rebuilding the stocks seem to be useful, and thus spawning closures at an appropriate time are again discussed. An extension of the closure in SD22 would have severe effects on the coastal fishery, as these vessels are not able to move to a fishing ground outside of the closed area. As western Baltic cod is known to spawn almost exclusively in areas deeper than 20 meter, an exemption could be granted for vessels that can prove that they are only fishing in shallower waters. It should also be noted that presently the closure only applies to the commercial fishery, while the recreational fishery is not affected. In the light of the significant catches of anglers from this stock (Strehlow *et al.*, 2012), it can be argued that this is not justified and the closure should also apply to the recreational fishery.

An alternative approach of closures to protect juvenile fish or vulnerable species was applied in some EU waters (outside the Baltic Sea) in the recent past. Real-time closures (RTCs) give the possibility to close an area for a limited period if high abundances and thus

catches of unwanted species or juveniles occur in a given area. The information about such unwanted high catches is usually provided by the fishery. Rules have to be defined under which conditions the area will be reopened – monitoring is usually difficult in closed areas. Most RTCs are therefore reopened after a certain period of time.

Even rules for the **mitigation of ecosystem impacts** might require amendments. For example, regulation 812/2004 on acoustic deterrent devices (ADD) aims at avoiding harbour porpoise bycatch, but some articles are formulated too strict (e.g. the required level of monitoring could not be achieved at all), others too loose to be fully effective (e.g. a large proportion of fleets does not need to deploy ADDs as mitigation measures). STECF (2015b) observed that in the period since the introduction of the regulation, mitigation measures have been employed in some fisheries, but not all Member States are implementing it as described. The regulations do not mandate that the ADDs must actually work (they must only be physically present), and there is information that some were deployed with old batteries and thus did not function (ICES, 2013; STECF, 2015b). In addition, STECF (2015b) concluded that the regulation has neither been effective in (i) providing monitoring data on cetacean bycatch for some fisheries where there is a high risk of cetacean bycatch nor in (ii) consistently providing data on sampling methods, sampled effort and bycatch for fleet segments in a way that allows to derive total bycatch estimates for the fleet segments. However, as mitigation measures as well as better monitoring of bycatch of all protected species are needed, this regulation should be amended along with the implementation of a more holistic monitoring system (see next paragraph and section 3.5).

For **control and enforcement**, it is obvious that a much improved monitoring of effort data is required, specifically from the huge number of small vessels. These vessels currently only report their catches in form of a landings declaration once a month, while their overall effort is high. The impact on the ecosystem, specifically on bycatches of seabirds and mammals, are likely significant. Thus, current logbook regulations should be altered in a way that fishing effort data and reliable catch data will be collected for vessels of all sizes, independent of the gear and for each fishing operation:

- Type of gear used, including mesh size, total length of net deployed as well as net height and water depth
- Geographic position of fishing operation
- Soaking or trawling time (time of setting and hauling)
- Target species and catch
- Bycatch of protected species in numbers (mammals, sea bird, fish)

To reduce any costs and handling effort for the fishers, modern technology like electronic monitoring devices or the use of smartphone apps should be considered.

3.5. Technical measures to be developed

The most important set of rules to develop relates to **control and enforcement**. We suggest that the present rules in this category are not sufficient to ensure compliance with the new management approach, mostly with the requirements of the landing obligation. If properly set up, a new control and enforcement system could have plenty of synergies beyond the determination of volume and composition of catch.

We favour the use of modern electronic monitoring (EM) systems, as they (i) have proven to be effective, (ii) are much less costly, and (iii) provide a much better coverage of fishing activities than other means of control or data collection (at-sea inspections, onboard observers), (iv) are not too easy to circumvent/manipulate, and (v) can be used on vessels of almost all sizes and for various purposes (Kindt-Larsen *et al.*, 2012, 2011; Oesterwind and Zimmermann, 2013; Ulrich *et al.*, 2013). Capabilities of the various system on the market differ greatly, but there are systems available which could detect bycatches of rare species (i.e. birds and mammals) in longlines and gill nets, which could verify the catch composition by species (or species group) and even give an indication of weight of the different species. One unresolved problem is the automated evaluation of the huge data sets acquired, specifically if closed circuit television (CCTV) is used on such EM systems. At present, similar species (like different flatfish species) cannot be determined automatically, but the available species recognition systems are sufficient to e.g. provide an independent estimate of the accuracy of the recordings in the logbook or landing slips. The information obtained may not be sufficient for legal purposes but could provide hints for noncompliance, so that additional control measures could be applied (higher observation rate, onboard observers). On the flip side, continued compliance could lead to reduced observation effort and thus fishers could be acknowledged for desired behaviour. Further, it can be expected that the rapid technical development in image processing will lead to reliable species recognition within a few years.

To be effective, most vessels would have to be equipped with EM systems, regardless of the size. It appears sufficient that CCTV cameras are only installed on a statistically sound subset of vessels representative of specific fleets or métiers. There could be a rotation system so that every vessel has a similar chance to be equipped with CCTV, while most other vessels would only record position and activity (speed, winch rotation, hydraulic pressure) and only few video data. This would reduce costs and effort for the data evaluation. Moreover, if cameras are moved from vessel to vessel it would also share the perceived burden to be observed. The level of observation depends on the frequency of occurrence of the objects to be monitored – rare bycatches of harbour porpoises require a much higher sampling effort than the determination of a catch composition in demersal trawl fisheries. In fact, these rare bycatches can only be detected statistically valid if the monitoring effort is multiplied compared to the present situation which will only be possible with EM.

It seems crucial for a successful implementation of the tool that it strictly contributes to a result-based approach and the reversal of the burden of proof: Fishers should be responsible for the functioning of the EM at any time, not the control authority.

For science, the wealth of data collected by EM would greatly improve the assessment of stock developments and ecosystem impacts. For fishers, the introduction of EM would create fairness and a level playing field. It would also allow for novel approaches, like the possibility to exempt vessels fishing shallower than 20 meter water depth from the suggested amended spawning closure for western Baltic cod (see 3.4). For control authorities and the society, the use of EM would significantly reduce inspection cost and allow for the introduction of a risk-based inspection scheme, i.e. increasing the control frequency on suspicious vessels.

While we stated above that most regulations dealing with **ecosystem impacts** could remain in place, one could use the opportunity to create the specific regulation for **monitoring and mitigating harbour porpoise bycatches** from scratch. As ICES noted (ICES, 2013), present sampling under the Data Collection Framework (DCF) can contribute to the assessment of bycatch of cetaceans and other species, but is not sufficient on its

own as currently implemented by Member States. Not all fisheries are adequately covered and many issues, including design and sampling protocols, would need to be modified or extended if DCF monitoring was to be the sole source of information.

The current EU-wide [Council Regulation \(EC\) No 812/2004](#) on incidental catches of cetaceans could be replaced by regional technical measures tailored for the Baltic Sea and the main species of small cetaceans occurring there, the harbour porpoise. Rather than solely focusing on vessel size, the gear type should be used as a measure to determine whether vessels should be obliged to use Acoustic deterrent devices (ADDs, pingers). To harmonize the protection of harbour porpoise, national measures should be implemented through regional procedures.

A stepwise approach needs to be developed to collect sufficient data about potential negative effects on "*rare*" components on the ecosystem. Such an approach is the only way to verify that agreed environmental bycatch limits for protected species are not exceeded. Again, only a certain proportion (number of vessels) of the metiers would need to be covered by CCTV, as long as data on the total fishing effort and the spatio-temporal distribution of these metiers is known sufficiently (e.g. through electronic monitoring without CCTV) to raise the collected data. In this respect, (STECF, 2015b) concluded that harmonisation of the fleet segments and effort measurements used for cetacean bycatch and fishing effort monitoring would greatly increase the probability that sampled bycatch rates reported by Member States could be raised to derive total bycatch estimates for the fleet segments. To improve assessment of bycatch rates and identification of priorities for mitigation, STECF (2015b) concluded that any such harmonisation would need (1) to be progressed in a way that encourages accurate and timely reporting by Member States and (2) to include effective bycatch monitoring of all fleet segments where bycatch rates or absolute bycatch numbers are likely to be high. These findings are not only relevant for the bycatch of small cetaceans, but are also valid for the bycatch of other protected species. STECF (2015b) also noted that the effectiveness of future bycatch monitoring could be increased if monitoring effort were risk-based (i.e. focused on fisheries where bycatch rates or absolute bycatch numbers are likely to be high). This would involve proportionately more monitoring of bycatches by smaller vessels (< 15 meter, and other fleet segments that pose high risk). For the proposed necessary amendment of the current logbook regulations with a view to cover also small vessels, see section 3.4.

As mentioned above, **recreational fishing** is currently not consistently monitored and regulated in the Baltic Sea. While efforts for an improved data acquisition have been successfully made, angler's catches are still not predictable as they depend more on the accessibility of the resource (incoming strong year classes) than on stock status. A total allowable catch system as in commercial fisheries is not feasible, as it cannot be sufficiently controlled and would have severe unintended economic impacts – a large number of anglers would simply not travel to the coast any more. A maximum daily allowance ("*bag limit*") has been discussed recently, as a means to share the burden of recovering specifically the western Baltic cod stock, which is intensively exploited also by recreational fishers. Restrictions should aim at capping very high catches, but at the same time anglers should not be discouraged to conduct their hobby and spend money at the coasts – mainly for economic reasons. These interests would have to be carefully balanced. One solution would be to introduce a bag limit only in periods where the target stock is in poor condition, and lift it after recovery. In any case, measures such as spawning closures should not only apply to the commercial fishery but also to the recreational fishery, potentially with the same exemptions if recreational fisher's vessels can document that they are not fishing below 20 meter.

3.6. Others

Last but not least, we would like to mention two more important issues related to this study, however with lower direct relevance.

Firstly, **effort restrictions** like those described in the cod management plan for the Baltic ([Council Regulation \(EC\) 1098/2007](#)) are not in line with the intention to move towards a result-based management approach and should be removed. Effort restrictions are usually not considered a technical measure and thus out of scope for the present study; the reason why we mention it here is that it supports our point that fishers should get something in turn for the implementation of the landing obligation. The removal of the Baltic Sea effort restrictions could be used to demonstrate that a fundamental policy change takes place, and that fishers will profit from this chance, not only in the longer term (through improved fishing possibilities), but also immediately (through simplification of the regulatory framework). We consider that the communication around the removal of effort restrictions (which is already decided) could be much improved.

Secondly, technical measures on the **engine power** of fishing vessels (maximum kW or effort restrictions in terms of kW days) have never been implemented in the Baltic Sea and thus do not need to be considered here. Nevertheless, these descriptions are a good example for a technical regulation which is useless because it cannot be controlled at sea, specifically in times of electronic power management and if the regulation concerns power at the shaft and not of a certified engine. Rules like this established the notion of an all too complex, impenetrable and largely ineffective set of technical regulations in EU fisheries management, and the reform of the CFP should be used to remove them.

4. CONCLUSIONS AND RECOMMENDATIONS

In the previous section, we reviewed existing rules and concluded that a large number of them are dispensable in the Baltic Sea – provided enforcement is reasonable at the end of the transition period. Some of the old rules might have to be retained for a limited period of time, but it should always be communicated that the new set of rules will not just be added to the old set. Tagging old rules with an expiry date not later than 2019 could ease communication and ensure that fishers understand that the reform is in their interest, and that they will be given more choices but also more responsibility.

The possibility to remove most old rules should be seen in combination with the introduction of a new control and enforcement system. For example, gear descriptions are only dispensable when a fully documented fishery is in place. Such a system is likely to be beneficial for fishers, the environment, control authorities, the society and the precision of the scientific advice, but it needs an open-minded and cooperative implementation phase. Problems and unintended effects of the new rules will certainly occur, but we do not see a major risk of failure.

4.1. Recommendations

All rules detailing the **construction or handling of gear and the composition of the catch** should be removed and replaced with a parsimonious set of rules. The **landing obligation** is the core of the development towards a result-based management and should be retained and implemented with as few exemptions as possible. Exemptions are not required to make the discard ban work in Baltic Sea fisheries.

A new system for **monitoring, control and enforcement** should be established. This should be based on a fully documented fishery with electronic monitoring systems of different kinds, placed on vessels of all sizes. The monitoring should not only aim at verifying compliance, but also to detect the catch composition and bycatches of rare or protected species.

Most rules aimed at **mitigating ecosystem effects** of fishing activities should be maintained. Those for the avoidance of bycatches of harbour porpoise should be expanded to cover the whole fleet and to cover areas where the density of harbour porpoise is higher; the rules should be less prescriptive with respect to the functioning of the acoustic deterrent devices, to allow for the development of more effective deterrent devices; and data collection requirements should be amended.

Spawning closures for western Baltic cod (Belt Sea, ICES SD22 and the Sound, ICES SD23) should be maintained but extended and moved to early February through late March. To mitigate the effects on small-scale coastal fisheries which are not able to move to alternative fishing grounds outside the closed period, an exemption should be granted to vessels which could verify that they are not fishing below 20 meter (the depth where spawning takes place). The closed period should also apply to recreational fishers. A spawning closure in the Arkona Sea (SD24) is currently not required. Spawning closures for eastern Baltic cod should be maintained until the stock has recovered. All other closures to protect spawners or juveniles should be evaluated and removed if not proven effective.

Rules defining **minimum sizes** could be removed, but it should be monitored whether a fishery targeting small fish develops and if so, a system should be implemented where small fish counts against the quota with a specific factor (>1). This approach is considered

more effective and has less unintended adverse effects than the present system which does not allow to market fish below MCRS for human consumption.

For the introductory period (until 2019) and beyond, a **decision system** should be developed where non-compliance would result in the temporary (re-)introduction of additional measures.

Currently non-regulated human users of the resource, namely **recreational fishers**, should take a share in the efforts to rebuild overfished stocks. These rules could be temporary, and they must take account of the specifics of this activity, i.e. the high economic value.

4.2. Applicability to other areas

The rules we reviewed in this study are specific to the Baltic Sea, but the principles we applied to judge whether existing rules should be maintained, removed, altered or newly developed may also be appropriate for other EU waters. These principles are:

- the CFP reform should be used to deregulate and make a visible move towards a result-based management. All rules should be evaluated periodically and removed if they have not proven to be effective. The focus should always be on creating the right incentives while minimising a disruption of the fishery.
- it should be obvious that replacing a large number of complex rules with a parsimonious set of simple rules is beneficial for the individual fisher. It seems necessary that old rules are removed even before new rules have been proven effective. A gradual and thus almost invisible removal of dispensable rules does not serve the purpose to involve fishers and to make them more responsible for a sustainable use of the resource. A *"braces and belt"*-approach might appear safer but risks that fisher's support is lost in the process, especially since *"old"* rules and *"new"* management objectives often counteract.
- control and enforcement is crucial for the success of the CFP reform, and sticking to old control approaches might not be the best solution.

It has to be acknowledged that the Baltic ecosystem and the structure of Baltic Sea fisheries are less complex than in most other European Seas. This is why we think the Baltic region could serve as a test ground for an almost radical approach where all measures which have not been proven to be effective are removed and replaced by a very limited, simple set of new rules, consistently applied with as little exemptions as possible.

The question which of the new or amended rules should then be part of a **wider EU framework** and which should be **area specific** can only be answered after a decision is made on whether the Baltic Sea could lead the way to a result based management, or whether consistency of rules across the different seas has priority. In the first case, most of the rules would be specific to the Baltic Sea, while in the latter more rules could be part of an EU framework. We recommend the first option (specific rules for the Baltic region) and thus an approach where an EU framework only sets the wider possibilities (like: principles and a very general set of technical measures) which would then be refined according to the needs of the region. A similar approach has been applied for the implementation of the discard ban, where it is already obvious that the rules will be handled much stricter in the Baltic Sea than in other EU waters. A tailored regional set of rules would also ensure that these are parsimonious – and thus easier to understand, enforce and obey.

REFERENCES

- European Commission, 2014. A study in support of the development of a new technical conservation measures framework within a reformed CFP; Lot 2: Retrospective and prospective evaluation on the common fisheries policy, excluding its international dimension.
- European Commission, 2009. The Common Fisheries Policy.
- FAO, 2002. A fishery manager's guidebook. Management measures and their application, FAO Fisheries Technical Paper. FAO.
- Feistel, R., Nausch, G., Wasmund, N. (Eds.), 2008. State and evolution of the Baltic Sea, 1952 - 2005: a detailed 50-year survey of meteorology and climate, physics, chemistry, and marine environment. Hoboken, NJ: Wiley-Interscience.
- Hammer, C., Dorrien, C., Ernst, P., Gröhsler, T., Köster, F., MacKenzie, B., Möllmann, C., Wegner, G., Zimmermann, C., 2008. Fish stock development under hydrographic and hydrochemical aspects, the history of Baltic Sea fisheries and its management, in: Feistel R, Nausch G, Wasmund N (eds.) State and Evolution of the Baltic Sea, 1952 - 2005 : A Detailed 50-Year Survey of Meteorology and Climate, Physics, Chemistry, and Marine Environment. Hoboken, NJ: Wiley-Interscience. pp. 543–581.
- ICES, 2015. Advice on Baltic Sea stocks, published online 30 May 2015.
- ICES, 2013. ICES Advice Section 1.5.1.1 Special request, April 2013 "*Request from EU concerning monitoring of bycatch of cetaceans and other protected species*", ICES Advice 2013. International Council for the Exploration of the Sea.
- ICES, 2010. ICES Advice Section 1.5.1.7 Special Request Advice October 2010 "EC request on cetacean bycatch Regulation 812/2004, Item 5" ICES Advice 2010, International Council for the Exploration of the Sea, Palaegade 2-4 DK 1261 Copenhagen K Denmark.
- Kindt-Larsen, L., Dalskov, J., Stage, B., Larsen, F., 2012. Observing incidental harbour porpoise *Phocoena phocoena* bycatch by remote electronic monitoring. *Endanger. Species Res.* 19, 75–83. doi:10.3354/esr00455
- Kindt-Larsen, L., Kirkegaard, E., Dalskov, J., 2011. Fully documented fishery: a tool to support a catch quota management system. *ICES J. Mar. Sci.* 68, 1606–1610. doi:10.1093/icesjms/fsr065
- Oesterwind, D., Zimmermann, C., 2013. Big brother is sampling ... rare seabird and mammal bycatch in Baltic Sea passive fisheries – automated data acquisition to inform MSFD indicators. *ICES CM* 2013/G:23, 1.
- Reeves, S.A., Revill, A.S., Hutton, T.P., Pinnegar, J.K., 2008. Technical measures in the CFP and the reform of council regulation 850/98. EU Parliament.
- STECF, 2015a. Technical Measures part III (STECF-15-05). Publications Office of the European Union, Luxembourg, EUR 27223 EN, JRC 95832.
- STECF, 2015b. 49th Plenary Meeting Report (PLEN-15-02). Publications Office of the European Union, Luxembourg.

- STECF, 2013. Different Principles for defining selectivity under the future TM regulation (STECF-13-04). Publications Office of the European Union, Luxembourg, EUR 25973 EN, JRC 81584.
- STECF, 2012. Different Principles for defining selectivity under the future TM regulation (STECF-12-20). Publications Office of the European Union, Luxembourg, EUR 27223 EN, JRC 95832.
- STECF, 2010. Report of the Sub Group on Management Objectives and Strategies (SGMOS 10-06). Part e) Evaluation of multi-annual plan for Baltic cod. Publications Office of the European Union, Luxembourg, EUR 27223 EN, JRC 95832.
- Strehlow, H.V., Schultz, N., Zimmermann, C., Hammer, C., 2012. Cod catches taken by the German recreational fishery in the western Baltic Sea, 2005-2010: implications for stock assessment and management. ICES J. Mar. Sci. 69, 1769–1780. doi:10.1093/icesjms/fss152
- Ulrich, C., Dalskov, J., Egekvist, J., Håkansson, K.B., Olesen, H.J., Storr-Paulsen, M., 2013. Behind the shine: An appraisal of five years of Danish CCTV trials. ICES CM 2013/J:21, 2.
- Zimmermann, C., Kraak, S., Krumme, U., Santos, S., von Nordheim, L., 2015. Handling of and possible solutions for choke species within the reformed CFP – Example of plaice in the Baltic Sea. European Parliament. DG IPOL, Policy Dep. B Structural and Cohesion Policies; Study IP/B/PECH/IC/2015-124, 89 pp. (to be published in 10/2015).

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**TECHNICAL MEASURES IN THE
ATLANTIC AND THE NORTH SEA –
WORKING WITH STAKEHOLDERS
TOWARDS MEANINGFUL REVISION**

WORKSHOP

IN-DEPTH ANALYSIS

This document was requested by the European Parliament's Committee on Fisheries.

AUTHORS

IMARES Wageningen UR: Marloes Kraan, Ruben Verkempynck, Nathalie A. Steins

RESPONSIBLE ADMINISTRATOR

Marcus Breuer
Policy Department B: Structural and Cohesion Policies
European Parliament
B-1047 Brussels
E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Lyna Pärt

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2015
© European Union, 2015

This document is available on the Internet at:
<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES
FISHERIES

**TECHNICAL MEASURES IN THE
ATLANTIC AND THE NORTH SEA –
WORKING WITH STAKEHOLDERS
TOWARDS MEANINGFUL REVISION**

WORKSHOP

IN-DEPTH ANALYSIS

Abstract

This report gives an overview of existing technical measures (TM) in the Atlantic and North Sea and a reflection on the need for and process of their revision in light of two core revisions of the CFP, the landing obligation and regionalisation. To achieve positive results, more is needed than a 'TM clean up'. The approach taken in the Dutch case studies presented in this report is recommended as part of an inclusive TM revision process in Europe.

CONTENTS

LIST OF ABBREVIATIONS	4
LIST OF TABLES	5
LIST OF FIGURES	5
EXECUTIVE SUMMARY	7
1. INTRODUCTION	11
1.1 Structural and methodological aspects	11
1.2 Limitation of this report	12
2. OVERVIEW OF THE TECHNICAL MEASURES OF THE NORTH EAST ATLANTIC AND NORTH SEA	13
2.1 The use of Technical measures	14
2.2 Technical measures in the North East Atlantic and the North Sea	14
2.3 An overview of the current technical measures for the North East Atlantic and the North Sea	17
3. ON THE REVISION OF THE TECHNICAL MEASURES	23
3.1 A governance shift for technical measures	23
3.2 Results based management	27
4. CASE STUDIES OF THE DUTCH DEMERSAL FLEET	29
4.1 A stakeholder-oriented approach to revising the technical measures	29
4.2 Technical measures that should be changed due to the landing obligation	30
4.3 Technical measures that could be changed due to the landing obligation	31
4.4 Interviews with fishermen about rules blocking innovation and contributing to discards	37
5. GENERAL CONCLUSION	41
6. REFERENCES	43

LIST OF ABBREVIATIONS

TM Technical Measures

TAC Total Allowable Catch

CFP EU Common Fisheries Policy

DAS Days at Sea

MCRS Minimum Conservation Reference Sizes

MLS Minimum Landing Sizes

RBM Results Based Management

LIST OF TABLES

Table 1	
Overview of Regulations for TM for the NEA and NS, the amendments and replacements from 1980-2012	16
Table 2	
The main elements in the 5 scenario's	26
Table 3	
Overview of all articles that should be changed because of the landing obligation	30
Table 4	
Overview of all articles that could be changed because of the landing obligation	31
Table 5	
Overview of other rules and discussion on whether they should be kept or not	33

LIST OF FIGURES

Figure 1	
Management measures for the Regulation of exploitation pattern and exploitation rate	14
Figure 2	
Cumulative number of TM introduced since 1980 in the EU	15
Figure 3	
Map of the North East Atlantic (FAO Area 27) showing the ICES statistical area's	17

EXECUTIVE SUMMARY

Background

The Common Fisheries Policy (CFP) of the EU has recently been overhauled. In December 2013, the European Parliament and the Council agreed on a comprehensive CFP reform. It is now enshrined in a new legislative framework, the so-called 'new CFP basic Regulation' (Regulation (EU) No 1380/2013). As far as the conservation of marine biological resources is concerned, it repeals and replaces the former 'basic fisheries management framework', laid down by the Council in 2002 (Regulation (EC) No 2371/2002).

In the follow-up to the CFP reform, the European Commission is gradually issuing new legislative proposals aiming to align the partly outdated EU Regulations from before 2013 with the new CFP. One of the major post-reform projects of the European Commission is the general overhaul of the set of existing rules for technical measures.

The Commission announced a new legislative proposal for a general technical measures Regulation for the late autumn of this year. This new Union Regulation shall replace the old general framework Regulation for technical measures from 1998 (Council Regulation (EC) No 850/98).

Aim

The aim of the present study is to provide an in-depth analysis on the existing technical measures (TM) in the Atlantic and the North Sea performing three functions: (1) review of the main existing TM; (2) present an assessment and evaluation of (a) the TM in view of new CFP objectives (elimination of discards and ecosystem management); (b) the regionalisation aspect of the new CFP and (c) the simplification of CFP governance; and (3) conclusions and recommendations.

Results

Technical measures (TM) influence where, when and how marine resources are exploited, and therefore **impact fishing activity in many ways**. Besides supporting stock and ecosystem management, they can contribute positively to establishing a level playing field. For these reasons, they are considered to be a useful tool for the management of marine resources.

Since the 1980ies the number of **TM in the EU have grown exponentially**. These TM are aimed at targeting the structure of fishing gears and how to operate these; defining zones and/or periods where fishing can be restricted; specifying measures to reduce the impact of fishing activities on the marine ecosystem; and imposing minimum landing sizes on caught commercial resource. The current set of TM for the Atlantic and the North Sea are, however, not unanimously successful.

The general objective of **TM affecting the structure of fishing gears** is to avoid catches that are unwanted. These TM tend to focus on mesh sizes. The huge diversity in fisheries has resulted in numerous exceptions to mesh size regulations, provided fishermen comply with the catch composition rules that reflect the specificity and species mix of that fishery. Catch composition rules can be very restrictive for certain fisheries and may induce obligatory discarding. While static gears are also regulated by mesh size and catch composition rules, there are no regulated prescriptions on the deployment of pots, traps, hooks, or other passive gear that are not a net in the North Atlantic and the North Sea.

TM imposing spatial and temporal restrictions on fishing activities are mainly aimed at protecting particular species or for protection of marine habitats. It is difficult to effectively quantify the performance of these measures. While some closures appear to have been beneficial, some are maintained simply because they at least contribute to some extent to decreasing fishing pressure. For some current closures, evaluations suggest they could be more effective if they were adapted to changing patterns in the distribution of stocks and fishing patterns.

TM regulating minimum landing sizes (MLS) are closely related to TM affecting the structure of fishing gears. Many MLS are complemented by common market standards for a certain fisheries, where species are defined in size categories to be adhered to when products are landed. For some species there is a mismatch between MLS and maturity indicators. Increasing the MLS to match maturity size to protect juveniles of target species is ineffective without adjusting the selectivity patterns of the fishing gears accordingly, as these fish would appear in the catches and become prone to discarding.

While the aforementioned TM in general are aimed at regulating the direct operational management of the fisheries in relation to the fish stocks, some include ecosystem management components. These include TM aimed at reducing non-commercial by-catch or protect spawning or nursery grounds. Management measures directly targeted at protecting vulnerable marine habitats or protected, endangered and threatened species are generally taken outside the scope of the Common Fisheries Policy. **An evaluation of technical measures as part of ecosystem conservation is outside the scope of this study.**

With the introduction of the landing obligation the need to evaluate the TM has become more urgent than ever. **TM that force fishers to discard or limit the possibilities to innovate are in direct contrast to the main aim of the landing obligation:** creating incentives towards more selective fishing practices. For the landing obligation to be successful, the abolishment of such rules is one of the prerequisites. **Compliance with rules** that remain after the revision, is a fundamental factor in fostering a real change of TM, for instance towards **results based management**.

However, more is needed than only a 'spring cleaning'. Only if the changes to the TM are embedded in a greater shift in European fisheries governance, they will have positive social, economic and ecological outcomes. Real meaningful change requires four key changes. One, it implies a move from centralised governance to regional management. Second, it requires a greater co-management role for stakeholders. Third, it needs a focus on adaptive and **results based management** that is, a focus on outcome rather than the measures themselves. And finally, it requires that rules are set contextually, fitting the practice of fishing, per fishery, season, area etc.

These more general issues with respect to the various types of TM currently in operation, are also illustrated by the **case studies of the Dutch demersal fleet in chapter 4** of this report. These studies are relevant as an example of how technical measures can be re-assessed in the light of the reformed CFP. TM were evaluated by scientists in close cooperation with stakeholders, who have in-depth knowledge of the practice of fishing and whole acceptance of rules and regulation is crucial for the success of TM. In this process many TM were identified that should be revised to increase selectivity, reduce discards and foster innovation. Some existing rules are even regarded as counterproductive to the CFP objective of reducing discards. Tables 3, 4 and 5 provided an assessment of the different

TM in relation to a revision due to the landing obligation. A number of these TM also apply to North Sea demersal fisheries by other Member States.

Our **literature and case study analysis** reaffirms that the current set of TM in the EU are too complex, difficult to understand, control and enforce. With the revision of the CFP and the introduction of the landing obligation, the need for a re-evaluation of EU's technical measures has become more urgent. The current TM regulations are not effective in preventing catches of unwanted species and in some cases hinder innovations towards more selective gear and management strategies. They should be adapted to the context of specific fisheries with measures devised at regional levels. There is wide stakeholder support (NGO's, Member States, fishing industry) for fundamental change of the TM. The main question is *how to change the TM*; which is strongly linked to the question how to organise it (governance).

In this light, the process described in the **Dutch case study** is an illustration of how policy-makers, fishermen and representatives worked jointly on evaluating the technical measures for the North Sea demersal fishery. Nevertheless, the case study should be seen as a theoretical study as success can only be measures after the proposed changes have been introduced. This inn fact applies to any revision of the technical measures before the landing obligation is implemented. This is also why **adaptive management** is so important as part of the operational implementation of the landing obligation and revised TM. Adaptive management includes monitoring of the effects of the revisions on the catch composition, socio-economics impacts and compliance; it also demands that rules and regulations can be changed swiftly on the basis of the monitoring results. As part of this process, it should be clear how the landing obligation will be implemented in practice and how enforcement and control will be effectuated.

A governance framework of **regionalised** and **results-based management**, demands a focus on joint fact finding, **joint** problem solution and joint responsibilities. This requires a **change of culture** for all actors; managers, scientists and the industry. The approach taken in the Dutch case study is recommended as a tool to foster an inclusive TM revision process in Europe. Even though time is short and the sense of urgency is high, we recommend a careful stakeholder-oriented process over a fast centralised process. After all, outcomes that can count on stakeholder support and fit the everyday reality of the fisheries will in the end be the best investment in responsible management of our fisheries and marine ecosystem resource.

1. INTRODUCTION

1.1 Structural and methodological aspects

First a brief **overview** of the main TM in the Atlantic and the North Sea is given (Chapter 2).

Then follows some general reflections on the need for and process of **revision of the TM** in the light of two core revisions of the CFP: (i) the landing obligation and (ii) regionalisation (Chapter 3). These chapters have been written based on a desk study of available literature.

Then follows analysis based on **two case studies** conducted by IMARES Wageningen UR (hereafter: IMARES), which included interviews with fishermen and joint discussions of TM by industry and government stakeholders, to be used as an illustrative case (Chapter 4).

The methodology applied in these studies is briefly described here. In the first report (Kraan *et al.*, 2014) a **quick scan** was done of the technical measures (Council Regulation (EC) No. 850/98) in relation to the landing obligation:

- Which rules **should** be removed? – because they will be in **direct** contrast with the landing obligation;
- Which rules **could** be removed? – because they cause discarding and thus are **indirectly** in contrast with the landing obligation.

The outcomes of this quick scan were partly based on a short series of in depth **interviews** we held with 6 innovative **demersal fishermen in the Netherlands** in order to get a better understanding of the rules and regulations that cause discarding practices. These interviews also shed light on how innovation in the fishing fleet – which is needed to prepare for the landing obligation – is impacted by rules and regulations. Furthermore, we were interested in the role fishermen saw for the fishing industry to contribute to management – in the light of increased stakeholder participation as aimed for with the regionalisation of the CFP.

In the second report (Kraan *et al.*, forthcoming) we have done an **analysis** of the current technical measures (TM) relevant **for the Dutch demersal fishing sector** (Council Regulation (EC) NO 850/98; Council regulation (EC) 2056/2001; Council regulation (EC) 3440-1984) based on **expert judgement** of scientists, policy officers and a fishermen representative following three questions:

- Which rules will impact on selectivity?
- Why was the rule developed, what does it aim to regulate?
- Can it be removed when the landing obligation will be implemented?

Then, we developed an extensive table of all relevant articles (for the demersal fleet) – 82 articles in total (out of 87), which have been clustered in 12 topics:

1. Percentage rules;
2. Length of the beam;
3. Mesh size;
4. Undersized fish;

5. One net rule / storage of the net at sea;
6. Net construction (twine);
7. Panels;
8. Electric fishing;
9. Plaice box;
10. Processing on board;
11. Scientific research;
12. Zonation.

Topics 1,3,4,8 and 10 were already discussed in the Kraan *et al.*, 2014 report, so in the **current report we focus on the remaining** topics (2, 5, 6, 7, 9, 11, and 12).

The procedure followed was as follows. Scientists of IMARES did a first assessment per article whether or not the rule could be removed when the landing obligation was in place. An extra column was developed to assess what would happen if the landing obligation was not complied with and the rule would be cancelled. A second column indicated whether in the current science-industry research, to prepare for the landing obligation, these rules currently impacted on the research. This table then was discussed with the policy officers of the ministry and the fisheries representative.

Prime attention was given to **Council Regulation (EC) No 850/98**. This was done in two sessions, the first was held at the *ministry in September 2014*, the second was held at the PO office with the *fisheries representative in April 2015* and via email with the *ministry in September 2015*. One of the policy officers (P. Roos – who had just retired) and the fisher representative (G. Meun) have been working on this topic for more than thirty years and together have a wealth of knowledge on when and why the rules were introduced and on how they currently impact on the fleet.

This consultation process, whereby policy officers, fisher representatives and scientists *together* discuss the rules and regulations with respect to implications for management, fishing and research, has proven to be very useful.

1.2 Limitation of this report

The time period between commissioning of this report to IMARES and the delivery date was just over one workweek. In a vast region of the Atlantic and the North Sea, many different types of fisheries take place: pelagic and demersal, small scale and large scale, artisanal and industrial. The TM that are part of their governing framework, are sometimes similar but more often fishery and region specific. Assessing the TM for each of these fisheries in this vast region - which would also require the input of expertise of scientists, policy makers and fishermen representatives knowledgeable about those specific fisheries - was not viable in the short time frame allowed for this report. Thus, choices had to be made. This report therefore presents a process undertaken in the Dutch demersal fleet and it is meant as an illustrative case. It should be noted that its conclusions could only be seen in the context of a specific situation.

Due to the aforementioned limitations, an exploration of new rules and TM for the Atlantic and the North Sea, and how/if it should be integrated in a new general EU framework was not undertaken. However, we do propose methods for the development of new measures and the structuring of those measures in a framework based on the lessons learnt in the Dutch demersal fishery case study.

2. OVERVIEW OF THE TECHNICAL MEASURES OF THE NORTH EAST ATLANTIC AND NORTH SEA

KEY FINDINGS

- **Technical measures impact** fishing activity at the level of when, how and where it can take place.
- **TM in the North East Atlantic and North Sea** have known a **long history with many revisions**. Since the 1980ies, the number of TM in the EU have grown exponentially.
- In the EU, **TM are aimed at targeting** the structure of fishing gears and how to operate these; **defining** zones and/or periods where fishing can be restricted; **specifying** measures to reduce the impact of fishing activities on the marine ecosystem; and **imposing** minimum landing sizes on caught commercial resources.
- Current **TM have not been unanimously successful** in meeting their objectives in the North East Atlantic and North Sea.
- The **general objective of TM** affecting the structure of fishing gears is to avoid catches that are unwanted. These TM tend to focus on mesh sizes. The huge diversity in fisheries has resulted in numerous exceptions to mesh size regulations, provided fishermen comply with the **catch composition rules** that reflect the specificity and species mix of that fishery. Catch composition rules can be very restrictive for certain fisheries and may induce obligatory discarding.
- While **static gears** are also regulated by mesh size and catch composition rules, there are no regulated prescriptions on the deployment of pots, traps, hooks, or other **passive gear** that are not a net in the North Atlantic and the North Sea.
- **TM imposing spatial and temporal restrictions** on fishing activities are mainly aimed at protecting particular species or for protection of marine habitats. It is difficult to effectively quantify the performance of these measures. While some closures appear to have been beneficial, some are maintained simply because they at least contribute to some extent to decreasing fishing pressure. For some current closures, evaluations suggest they could be more effective if they were adapted to changing patterns in the distribution of stocks and fishing patterns.
- **TM regulating minimum landing sizes (MLS)** are closely related to TM affecting the structure of fishing gears. Many MLS are complemented by common market standards for a certain fisheries, where species are defined in size categories to be adhered to when products are landed. For some species there is a mismatch between MLS and maturity indicators. Increasing the MLS to match maturity size to protect juveniles of target species is ineffective without adjusting the selectivity patterns of the fishing gears accordingly, as these fish would appear in the catches and become prone to discarding.
- **TM in the CFP** are generally aimed at fish stock conservation, but **may include ecosystem management components**.

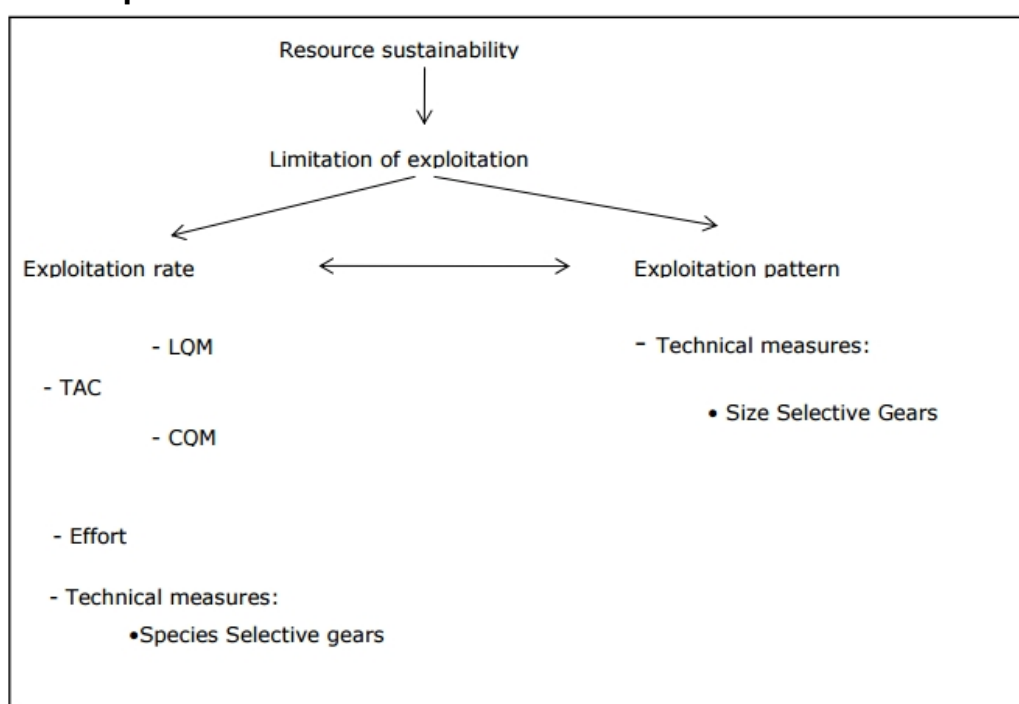
2.1 The use of Technical measures

One of the **basic tasks of fisheries management** is to regulate the amount and composition of fish species caught. The rules in fact centre around two general goals; first making sure that reproduction of commercially exploited fish stocks is not jeopardised and secondly minimizing negative impacts on the marine ecosystem (STECF, 2012).

Scientifically one can say that the exploitation of the fish stocks is limited in two ways; by looking at the **exploitation rate** (the proportion of fish being removed) and the **exploitation pattern** (selectivity) (see **Figure 1**). **Technical measures can both impact** the exploitation rate and the pattern, influencing *when, how and where* fishermen can fish. TM regulate aspects in relation to: the design and characteristics of the gear; minimum landing sizes; and spatial and temporal measures (seasonal closures, limited/closed areas) (STECF 2012).

Next to technical measures, **other measures** are also in place regulating the exploitation rate of fish stocks such as via input (i.e. days at sea (DAS) or horse power limitations) and output controls (i.e. total allowable catches (TACs)).

Figure 1: Management measures for regulation of exploitation pattern and exploitation rate



Source: STECF 2012:15.

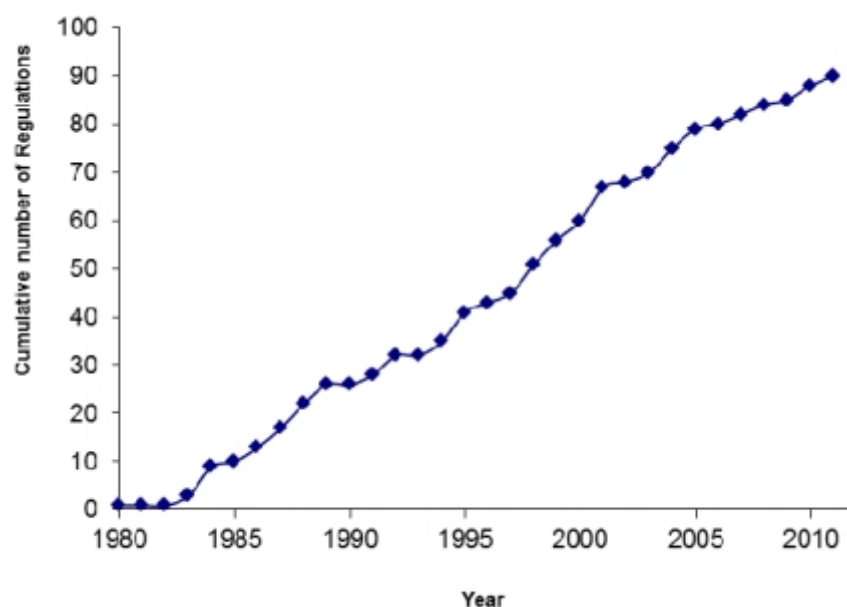
2.2 Technical measures in the North East Atlantic and the North Sea

TM have a **long history** in the North East Atlantic and North Sea. Records exist from as early as **1376**, when mesh sizes were discussed in the English Parliament (Burd, 1986 in STECF 2012:17). The real take off of the development of TM were raising concerns in the **first decades of the 20th century** in relation to the greatly increased efficiency of the steam powered fishing vessels in the North East Atlantic. A series of International Conventions on technical measures for the protection of juvenile fish were held, forming the base of formal management frameworks and regulations:

- International Convention for the Regulation of the Meshes of Fishing Nets and the Size Limits of Fish” (**1937**);
- Draft Convention Relating to the Policing of Fisheries and Measures for the Protection of Immature Fish (**1943**);
- Convention for the Regulation of Meshes of Fishing Nets and the Size Limits of Fish (**1946**) (STECF 2012).

In **1963**, the North East Atlantic Fisheries Commission (NEAFC) was formed, under whose guidance a number of TM were developed between **1964-1974**. The first technical measures regulation for EU fisheries in the North East Atlantic and the North Sea was introduced in **1980** under regulation (EEC) No. 2527/80, prior to agreement of the first CFP in 1983 (STECF 2012:18). Since the **1980ies** the number of TM for the whole EU have grown exponentially (see **Figure 2**).

Figure 2: Cumulative number of Technical measures introduced since 1980 in the EU



Source: STECF 2012:18.

The technical measures for the North East Atlantic and the North Sea were first regulated in 1980 under Regulation (EEC) No. 2527/80. Since 1980 these were amended 37 times and replaced four times (see **Table 1**).

Table 1: Overview of Regulations for TM for the NEA and NS, the amendments and replacements from 1980-2012.

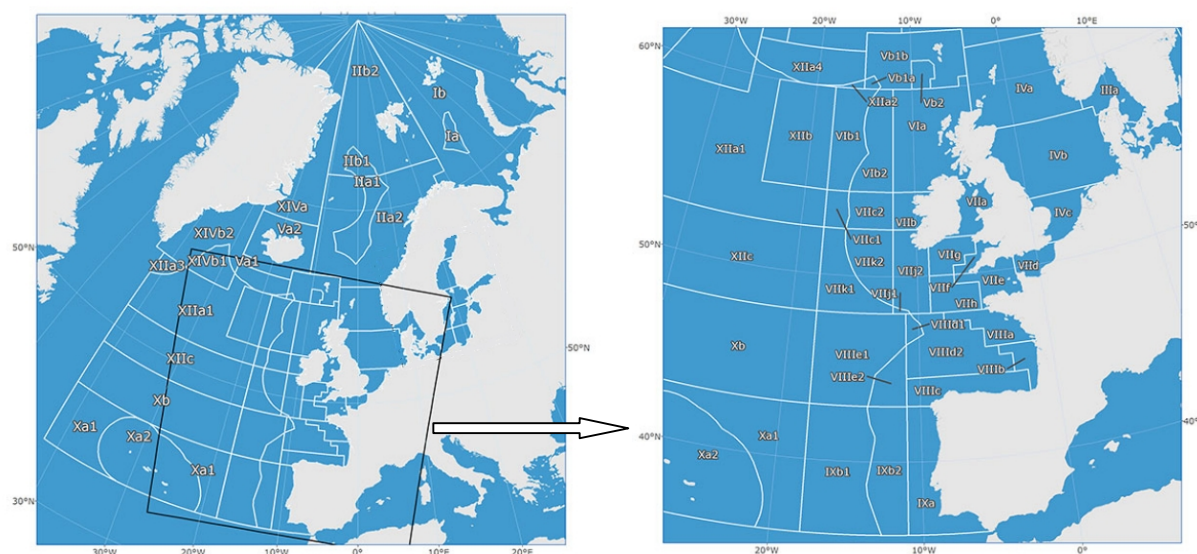
Year	Regulation No.	Amendments	About
1980	Regulation (EEC) No. 2527/80		Definitions of areas, mesh size, catch composition regulations, minimum landing sizes, prohibitions on certain gears, closed area/seasons, gear restrictions, the legal basis for the establishment of emergency measures
1983	Regulation (EEC) No 171/83	Consolidated the measures of Regulation (EEC) No. 2527/80	
		Amended 6 times; including amendments in relation to accession of Spain and Portugal in 1985	Included specific regional provisions in certain fisheries (i.e. restrictions on the length of beam trawls, changes in mesh sizes, new closed areas)
1986	Regulation (EEC) No 3094/86	Repealing and replacing Regulation (EEC) No 171/83	Contains all the elements of Regulation (EEC) No 171/83, plus all of the amendments plus several new elements on scientific research and restocking and transplantation
		Amended 19 times	Increasing minimum mesh sizes or introducing new minimum landing sizes or closed areas/gear restrictions plus new elements such as: allowing the use of selective gears as derogation from MMS (4056/89 & 345/92); mitigation measures to reduce bycatch of marine mammals & seabirds (2251/92); detailed rules for the use of static nets (MMS and catch composition rules) (3071/95).
1997	Regulation (EC) No. 894/97	Replaced Regulation (EEC) No 3094/86 and its associated amendments	
		Amended once	Regulation (EC) No. 1239/98 - introducing more restrictive measures on the use of driftnets following global debates on the use of such gears
1998	Regulation (EC) No. 850/98	Replaced Regulation (EC) No. 894/97 as the measures contained a number of inconsistencies and were unduly complex	First real attempt to adapt technical measures to the diversity of fisheries and the need for homogeneous rules across regions. New measures to improve the selectivity of towed gears by applying detailed rules on the construction of fishing gears (e.g. cod end circumference, twine thickness), making the use of square mesh panels mandatory in certain fisheries, additional closed areas/seasons and gear restrictions as well as maintaining the legal architecture for emergency measures and the development of local measures for inshore fisheries within MS territorial waters
		Amended 10 times	

Source: Table developed by authors based on STECF (2012).

Technical measures of relevance for the North Sea and the Atlantic are also found in a number of other Regulations including Regulations 2549/2000 & 2056/2001 (cod measures), 494/2002 (hake measures) and 812/2004 (specific ecosystem protection measures on cetaceans) (STECF 2012).

Since the Treaty of Lisbon went into force in 2009, the Council adopted Regulation (EC) No 1288/2009 to ensure that the temporary technical measures (before 2009 taken up under the Fishing Opportunities Regulation) would remain in place. These transitional technical measures were extended in 2011 under Regulation (EU) No 579/2011 until 31 December 2012 (STECF 2012). Recently, the EU adopted Regulation (EU) No 227/2013 to definitely incorporate these measures into Regulation (EC) 850/98 (DG MARE 2014).

Figure 3: Map of the North East Atlantic (FAO Area 27) showing the ICES statistical areas



Source: <http://www.fao.org/fishery/area/Area27/en> (adapted by author).

2.3 An overview of the current technical measures for the North East Atlantic and the North Sea

Above we explained how TM affect the fishing activity by influencing when, where and how commercial fish resources are exploited at sea and how fishing activities interact with the marine ecosystem. Current TM included in relevant regulations (i.e. CFP basic Regulation (EC) No. 2371/2002 and the revision of Article 7 of the new Basic Regulation) have the following intentions:

- Targeting the **structure of fishing gears** and how to operate these;
- defining **zones and/or periods** where fishing can be restricted;
- specifying measures to reduce the impact of fishing activities on the **marine ecosystem**; and
- imposing **minimum landing sizes** on caught commercial resources.

The following sections present a general overview of the technical measures contained in the EU legislation for the North Atlantic and the North Sea.

2.3.1 Technical measures affecting the structure of fishing gears

These TM mainly focus on the structure of fishing gears. Measures found in Regulation (EC) No. 850/98 and other relevant Regulations somehow largely concentrate on active towed bottom gears (trawls, seines, etc.). However, the structures of passive gears are also regulated. The **general objective** of these measures is to **avoid unwanted catches**. They are intended to regulate and promote the use of selective (for species and size) fishing gears.

2.3.1.1 Active gears

In **towed gears** fish enter the net and usually end up at the back of the net where they get caught in a netting bag, i.e. the cod end. The size of the meshes in the cod end and how they are held open or can be actively opened by the fish, determine how small fish escape through the meshes and larger fish can be retained. This means that the selectivity of the net is largely, but not only, determined by how this cod end is constructed, by defining its mesh size, twine thickness, cod end circumference, etc.

Mesh size (in the cod end) is the most important factor determining the selectivity pattern of active gears, but it is not the only factor. However, in many Regulations the focus is mainly set on mesh sizes and they are used to determine the definition of métiers in the Data Collection Framework. The métier concept associates vessels and gear characteristics (i.e. horse power range and mesh size) and target fisheries (species, areas, and periods). In practice, fishing vessels use more than one mesh size range and specific combinations of mesh sizes are permitted with associated conditions that determine a related catch composition.

There is a **huge diversity of fisheries** in Western waters and thus there are also numerous exceptions whereby the mesh sizes are often smaller or bigger than the "standard" meshes as defined in the métiers in the Regulations. Vessels are, for instance, allowed to use smaller mesh sizes during 24 hours for target species they cannot catch with the regulated "standard" mesh size, as long as they comply with the catch composition rules that reflect the specificity and species mix of that fishery. There is even a legal obligation to discard any catches in excess of the permitted percentages within the designated catch composition. **Catch composition rules can be very restrictive** for certain fisheries.

TM also regulate other factors determining selectivity in the gear configuration. These include measures for mesh shape, twine thickness, cod end circumference, attachments to the cod end, and mesh sizes in other parts of the gear. Technical measures regulate these parameters and influence the performance of towed gears accordingly. Also square mesh panels and sorting grids, or other net adaptations aimed at reducing unwanted catch, are introduced in some Regulations (DG MARE 2014).

2.3.1.2 Passive gears

Contrary to active gears, somehow **passive gears are much less regulated** than towed gears. Some say this is because their configuration is much more straightforward and they are more selective than trawls in general. However, they are also regulated by mesh sizes and catch composition rules. There are very few other measures on other characteristics of static nets. There is a general ban on the use of driftnets for targeting certain species and static nets are not allowed in waters at depths greater than 200m. In the full EU legislation for the North Atlantic and the North Sea, there are no regulated prescriptions on the deployment of pots, traps, hooks, or other passive gear that are not a net.

2.3.1.3 Performance of technical measures affecting the structure of fishing gears

TM affecting the structure of fishing gears are appropriate in some instances (for some target species), but not always (not for species caught during the same fishing operations). While sometimes fishing activities target a specific stock (mainly pelagic fisheries), the majority of EU fisheries use towed gears that target a mixed composition of species and catch a broad range of species, including commercial by-catch fish. The latter often is equally important for the fishery as these species increase the landed value of the total catch.

For a certain target species the **selectivity pattern** and of the regulated gear and mesh size may be appropriate. At the same time, it may be inappropriate for many other associated species that are caught with the same gear. However, if mesh sizes are increased to protect undersized individuals of those associated species, the marketable value of landings in the fishery would be reduced because of losses in the catches of the main target species (Quirijns *et al.*, 2007).

Catch compositions also introduce an apparent compliance issue under current technical measures when fishing activities are confronted with exhausted fishing opportunities. Although it is not quantifiable, it has been seen that **TM regulating towed demersal gears** may induce obligatory discarding of both undersized and marketable fish species as a consequence of MLS and catch composition rules (DG MARE 2014).

2.3.2 Time and area closures

The purpose of measures spatially and temporally restricting fishing activities are **mainly for protection of particular species** either directly or indirectly or for protection of marine habitats. TM imposing such spatial and temporal restrictions on fishing activities for such protection are commonly used in EU legislation.

Closures intended for the protection of particular species commonly overlap with a spawning or nursery areas where that particular species is more vulnerable to fishing activities. Sometimes, only vessels using gears that target such particular species are restricted from the area but other vessels could still be allowed in the area. When the closures are intended to protect a sensitive habitat, the closure is usually permanent and all gears are restricted from operating in that area.

Real-time closures are a recent concept in EU legislation that introduced the possibility of closing areas to fishing activities as soon as relatively high abundances of vulnerable (juvenile) species are caught by fishing vessels in those areas. A trigger level of the proportion of vulnerable species in the catches is set before closures occur. They are generally closed for a limited period and obligate fishing vessels to “move on” to other grounds and additionally fine-tune quota uptake in multi-species fisheries.

It is **difficult to effectively quantify** the performance of TM imposing closures. This being said, some closures appear to have been beneficial. For others, the main recommendations from relevant scientific bodies such as ICES and STECF are to maintain them simply because they contribute to some extent to decreasing fishing pressure on (overexploited) stocks. For some current closures, evaluations suggest that they could be more effective if they were adapted to changing patterns in the distribution of stocks and fishing patterns (DG MARE 2014).

2.3.3 *Minimum landing sizes*

Minimum landing sizes (MLS) are another important concept within the current technical measures and they are closely related to TM affecting the structure of fishing gears. They lie at the basis of another disposition of the EU legislation that actually impose discarding. At the moment, there are ca. 35 species of commercial importance that hold a MLS.

When any given species caught on board holds a MLS, it is illegal to retain it on board and land or sell it when it is smaller than the MLS. However, it is not illegal to catch the individuals of that species that are smaller than the MLS. In case species under the MLS are caught they have to be returned to sea right away. This way, MLS are supposed to act as an incentive for the fishermen to rig their gear in a way that undersized fish are not caught in the first place, e.g. by choosing an appropriate mesh size.

MLS are not only defined for the species themselves, but also for different presentations in which they may be found on board (i.e. whole or tailed). Along with the **definitions** of the MLS, the TM also define how the organisms should be measured. Many MLS are also **complemented** by common market standards for a certain fishery, where species are defined in size categories to be adhered to when products are landed.

In general, **MLS remain fairly stable**. The most recent increase in MLS was seen in 2001, for plaice. Member States can, however, adopt higher MLS than those stipulated in EU legislation, for their national fleet. Also, many local producers' organisations make arrangements for their local market, inducing higher MLS.

MLS have in general been set as a **compromise between (a) size**, resulting from the selectivity characteristics of the most common gears targeting a certain species, and **(b) market forces** demanding that species, without necessarily taking important biological characteristics into account. This explains the mismatch between MLS and maturity indicators for some important commercial species where the MLS has been set below the size at first maturity. As it stands now, it would be ineffective to increase the MLS to try to match maturity size to protect juveniles of target species without adjusting the selectivity patterns of the fishing gears accordingly, as these fish would appear in the catches and become prone to discarding (DG MARE, 2014).

2.3.4 *Ecosystem measures*

For fishers and fishery managers, the health of the target stock is often the most important driver in management. Fishing activities can, however, not be seen in isolation from the ecosystem in which they take place. While the TM in general are aimed at regulating the direct operational practices of the fisheries in relation to the fish stocks, **some of the aforementioned types of TM include ecosystem management components**.

Technical measures affecting the structure of the fishing gear are aimed at reducing unwanted by-catch. Such measures do not only relate to the target stock and commercial, but also to **reducing non-commercial by-catch** of fish, sharks and rays, benthic fauna, marine mammals and birds. For example regulation 812/2004 lays down requirements to use acoustic deterrent devices or pingers in gill net fisheries to avoid harbour porpoise bycatch. Fisheries TM relating to time and area closures also have a strong ecosystem component, in that they aim to **protect spawning or nursery grounds** or other assemblies of juvenile fish. Some examples in the Atlantic and North Sea are the Plaice Box, the Shetland Box and the Norway Pout Box

Measures such as the above are also (or will be) included in **ecosystem conservation regulations** that are **outside of the scope of the CFP**, such as the Natura 2000 network. Many Member States around the North Sea have already established, Natura 2000 sites under national jurisdiction in their 12 miles zone. Examples include temporal area closures for fisheries during the foraging season of migrating seabirds, closed areas to protect nursery and resting grounds for seals and closures of vulnerable habitats for (bottom) trawl fisheries. **Natura 2000** management plans for sites designated outside the 12 miles zone, are currently under the development, an example being a joint Dutch, German and United Kingdom management initiative for the Dogger Bank. Another example is the 2003 closure to deep-sea bottom trawling of the cold-water corals of the Darwin Mounds to the north west of Scotland in 2003 (EU Habitats Directive). As part of the European **Marine Strategy Framework Directive**, indicators defining Good Environmental Status are being developed that also relate to fisheries. These include descriptor 3 on commercially exploited fish and shellfish species; descriptor 4 on marine food web indicators; descriptor 6 on seafloor integrity and descriptor 11 on underwater noise. An evaluation of technical measures as part of nature conservation is **outside the scope of this study**.

3. ON THE REVISION OF THE TECHNICAL MEASURES

KEY FINDINGS

- **TM are an important tool** in the toolbox of fisheries managers. Besides supporting stock and ecosystem management, they can contribute positively to establishing a level playing field.
- The current set of TM in the EU are **too complex, difficult to understand, control and enforce**. With the revision of the CFP and the introduction of the landing obligation, the need for a re-evaluation of EU's technical measures has become more urgent.
- The current TM Regulations are **not effective** in preventing catches of unwanted species and in some cases **hinder innovations towards more selective** gear and management strategies. TM should be adapted to the context of specific fisheries with measures devised at regional levels.
- There is **wide support** (NGO's, Member States, fishing industry) **for fundamental change** of the TM.
- The **question is how** to change the TM; which is strongly linked to the question how to organise it (governance).
- For positive results, **more is needed than only a cleaning up** of the TM in relation to the landing obligation. For the change to be meaningful – to have positive social, economic and ecological outcomes – the change of the **TM needs to be embedded in an overall change of fisheries governance** within the EU. This change implies a move from the centre to the region with a greater role for stakeholders; with a focus on **adaptive and results based management** (focus on outcome rather than the measures themselves); and with contextual rule setting, fitting the practice of fishing, per fishery, season, area etc. All this will require a **change of culture** for all actors; managers, scientists and the industry, with special attention to the different drivers of all stakeholders.
- The challenge lies in the fact that **this governance change is fundamental** – and even more so, combined with another revolutionary change: the landing obligation – while **time is short**.
- The **success of the landing obligation** is strongly linked to (i) the abolishment of TM that force fishers to discard, (ii) the removal of nitty gritty rules with no clear link to outcomes and which often in effect limit the possibilities for fishermen to innovate; and (iii) compliance with remaining TM rules. A real change of TM (for instance towards results based management) is only possible if the landing obligation is complied with.

3.1 A governance shift for technical measures

By defining how, when and where fishing vessels can interact with the marine environment TM are important tools in the toolbox of fisheries managers. From a scientific perspective, TM are relevant and can contribute to managing fisheries. Also TM contribute positively to

establishing a uniform set of technical rules across the EU fisheries by defining common rules applicable to all fishing vessels exploiting the same resources in the same areas (DG MARE, 2014). However, the European Commission has indicated that the current set of TM are too complex, difficult to understand, control and enforce (European Commission 2014a).

In the consultation document on the development of a new framework for technical measures in the reformed CFP (European Commission, 2014a), a couple of challenges have been indicated and it is suggested, as a way of starting the debate¹, to let the new approach to TM focus on the following **four principles**:

1. **simplification** and enabling regionalisation;
2. creation of **incentives** for the industry to take more responsibility;
3. elimination, reduction and avoidance of **unwanted catches**;
4. minimisation of the **ecosystem** impacts of fishing gears.

Related to these 4 points, the consultation document poses 12 questions for consultation, which took place between 24 January and 16 May 2014 to which Advisory Councils, Member States administrations, civil society organisations, industry organisations, interest groups, stakeholder organisations and a couple of individuals (general public) responded (European Commission 2014b). The paragraph summarising the general comments is illustrative of the current situation:

*"There is general support across stakeholders and Member States for the broad approach outlined in the consultation paper (i.e. **move away from micro-management** and towards a **regionalised, results-based approach**). It is clear that the **complexity** of the current Regulations and their multiple amendments should serve as an **example of "what not to do"**. Many respondents also point to **enforcement issues** with the current Regulations and the **lack of compliance** with the complex rules. The current Regulations are highlighted as having produced a range of **unintended consequences** that have in fact **forced fishermen to discard** and run counter to the principal objective of the measures (i.e. to protect juveniles). There is a generalised, clear message that this should not be repeated in any new framework for technical measures, given the **change of approach** (i.e. principle of management by result) within the new CFP and the introduction of the landing obligation. There is overwhelming support for a **complete overhaul** of technical measures not limited to just a re-casting or cleaning-up of the current measures" (European Commission 2014b) [the bold highlights are of the authors of this report, showing the main points of critique with the current situation and what should be done].*

With the revision of the CFP and the introduction of the **landing obligation**, the need for a **re-evaluation of EU's technical measures** has become more urgent. Yet there are **other reasons why** this is a good idea;

- the precise effectiveness of technical measures (rule per rule) can hardly be quantified;

¹ The document clearly states: The sole purpose of this consultation is to collect relevant evidence and information from stakeholders to help the Commission develop its thinking in this area. This document does not necessarily reflect the views of the European Commission, and should not be interpreted as a commitment by the Commission to any official initiative in this area.

- overall the TM prove not to be effective in achieving the overarching objective of reducing unwanted catches;
- the introduction of TM has suffered from implementation error either by being formed as a result of political negotiation or by the fact that they were developed in laboratories under idealised circumstances. However, this is not the case for all TM;
- many rules can be seen 'catch-up' regulation in response to previous responses by fishers to Regulations as a 'technological and regulatory arms race';
- the rules have become so detailed and complex that many struggle with understanding them;
- some rules seem to be focused on regulatory design elements rather than on desired outcomes;
- many TM are impossible or difficult to control;
- many rules and Regulations are not supported by industry;
- lack of flexibility;
- the decision making process is not fully transparent and does not take into account stakeholder input (STECF 2012; Suuronen and Sardà 2007; Kraan *et al.* 2014, DG MARE 2014).

The key question is *how* to do this in practice. In volume 2 of DG MARE's study (2014) **five policy options** are presented and evaluated:

1. *Baseline situation*;
2. *Consolidation and simplification* of technical measures rules: No use of regionalisation, consolidation and simplification of TM rules;
3. *Splitting common and regional rules*: No change in existing technical measures but splitting between common and regionalised measures;
4. *TM framework*: Extensive use of regionalisation, simplified and minimal framework Regulation, reduced technical measures;
5. *TM through regionalisation*: No technical measures in framework Regulation (objective based management).

The **main differences** between the 5 scenarios for policy options are listed in **Table 2**.

Table 2: Policy options for a governance shift in the field of Technical measures

(1) Baseline	(2) Consolidation and simplification	(3) Splitting common and regional rules	(4) TM framework	(5) TM through regionalisation
<ul style="list-style-type: none"> • No change in governance of TM; • Omnibus Regulation (alignment of LO; including MCRS replace MLS); • Multiannual plans not in short term. 	<ul style="list-style-type: none"> • No change in governance of TM; • a level of simplification of the current TM; • deletion of redundant articles; • incorporation of recent changes; • one single Regulation. 	<ul style="list-style-type: none"> • Change in the governance structure; • elements of simplification included under option 2; • Split between: <ul style="list-style-type: none"> – a set of common rules for all fishermen under a co-decision Regulation; – the creation of separate Commission Acts containing existing regionally specific rules (Regionalisation, Commission led). <p>=> It would represent a substantive change in governance but little or no change in the substance of the current rules.</p>	<ul style="list-style-type: none"> • A (slim!) framework Regulation with a limited set of common rules (e.g. definitions, prohibited gears or fishing methods, conservation reference sizes); • relevant permanent ecosystem measures (closed area's); • basic standards such as reference gears, selectivity baselines, or targets. • the framework would be adopted under the ordinary legislative procedure; • Regionalisation via Multiannual plans; • for the time being work with regional annexes as part of the framework. 	<ul style="list-style-type: none"> • Substantive change in governance; • speedy development of regionalised, tailor-made multiannual management plans; • MS and stakeholders can choose between prescriptive rules at a regional level or results based management approach where outputs rather than the inputs are managed; • implemented through a Commission delegated/implementing act; • maintain the existing TM as amended in the baseline scenario & repeal them as plans are adopted.

Source: Table by author based on DG MARE 2014:37-40.

The DG MARE study continues with a qualitative evaluation of the five scenarios; describing “the potential expected direction of change (i.e. will things get worse, stay the same, or get better under the different options) in terms of key evaluation questions (e.g. acceptability, effectiveness), and criteria (e.g. on economic, social, environmental and administrative costs and burden)” (DG MARE, 2014:42).

As a result of the analysis, **options 4 and 5** have been identified as the **preferred options**, since they:

- address the **shortcomings** of the current TM in terms of effectiveness, coherence and acceptability;

- are most likely to produce **impacts** on sustainability of exploitation;
- will contribute to a decrease in **administrative costs** and burden;
- will likely result in **simplification** of the rules; and
- will have **increased acceptability**, due to the involvement of the fishing industry in the development of the rules.

Option 4 has the slight preference over 5 due to less risk of delayed regionalisation (DG MARE 2014). Also the outcomes of option 2 are evaluated to be the same of option 1 (status quo); which are negative.

Based on the current study, it has become clear that positive results are only to be expected if the **change of the TM is embedded in an overall change of governance** in the EU; from the centre to the region with a greater role for stakeholders; with adaptive management; results based (focus on outcome rather than the measures themselves); with rules as much as possible contextual (fitting the practice of fishing, per fishery, season, area etc.).

The **main shortcoming of the TM Regulations** is that they are not effective in preventing catches of unwanted species. Fisheries in the North East Atlantic have an average discard rate of 13% (Kelleher 2005). In the North Sea this is up to one third of the total weight landed; with the main fleet segments contributing to discarding being the flatfish beam trawl fishery targeting sole and plaice, otter trawls targeting Nephrops and demersal fish otter trawl fisheries targeting cod, haddock and whiting (Catchpole *et al.*, 2005). Yet these fisheries are all *“heavily regulated by a set of EU technical measures that includes prescriptions on fishing gears (mesh sizes, use of additional selectivity devices like square mesh panels) and seasonal or permanent closures of certain areas with high densities of juveniles individuals like the plaice box”* (DG MARE, 2014:9).

From discards research we know that discard rates are highly variable between gears and or regions (Uhlmann *et al.*, 2013). Thus *“EU technical measures should be adapted to the context of specific fisheries with measures devised at regional levels instead of using the current centralised top-down approach to better take into account regional specificities”* (DG MARE, 2014:9).

3.2 Results based management

Option 5 provides a choice for Member States and stakeholders to work with prescriptive rules at the regional level or with a more results based framework. The latter has been subject of study of the STECF in 2013. In such a case the need for TM would be minimal as it is expected that fisheries will minimise unsalable catches and focus their exploitation patterns towards catch compositions that are economically viable. However, compliance with the landings obligation is critical; if this is not the case there will be negative unintended consequences due to free-rider effects; unless the ban is adequately controlled and enforced (STECF, 2013).

Another challenge, which has been highlighted, is that with RBM there is a need for catch-based targets (with still need for scientific work on setting such targets and how it can all work out), whereby the industry then can make choices as to how to reach those targets. This is however dependant on understanding of the goals at an individual business level and goal setting that is achievable (STECF 2013). It should not be forgotten that such a change in driving the system, from a top-down system to bottom-up system with

considerable responsibility being shifted from management to fleet cannot be done overnight. It will require a change of culture for all actors; managers, scientists and the industry, with special attention to the different drivers of all stakeholders.

Furthermore in the current system technical Regulations are used also as a given, as a way to define fleets (mesh size and gear type) – as a basis for management. The main management ‘button’ is the exploitation rate (e.g. TAC), whereas there are also opportunities to use the exploitation pattern as a management tool (an issue which also needs more research). Practically this will, however, have implications for how to describe the different management units if gear characteristics will become variable (STECF, 2013).

Concluding, the need for change is broadly felt. The TM need change for many reasons, but this has become more urgent with the introduction of the landing obligation. It is clear that for the change to be meaningful (e.g. to have positive social, economic and ecological outcomes) more is needed than only a cleaning up of the TM in relation to the landing obligation. A change in governance structure towards more regionalisation is needed, with a good reassessment of the TM in the different regional seas.

The challenge, however, lies in the fact that this governance change is fundamental – and even more so combined with another revolutionary change: the landing obligation itself - while time is short. In addition, the success of the landing obligation is strongly linked to (i) the abolishment of TM that force fishers to discard, (ii) to the removal of nitty gritty rules with no clear link to outcomes and which often in effect limit the possibilities for fishermen to innovate; and (iii) compliance with remaining TM rules. A real change of TM (for instance towards RBM) is only possible if the landing obligation is complied with.

4. CASE STUDIES OF THE DUTCH DEMERSAL FLEET

KEY FINDINGS

- Studies in preparation for the revision of the TM in light of the landing obligation for the demersal fleet in The Netherlands are relevant as an example of **how technical measures can be re-assessed in the light of the reformed CFP**. In these studies, TM were evaluated by scientists in close cooperation with stakeholders, who have in-depth knowledge of the practice of fishing and whole acceptance of rules and Regulation is crucial for the success of TM.
- The **studies for the Dutch demersal fleet identified many TM** that should be revised to increase selectivity, reduce discards and foster innovation. Some existing rules are even counterproductive to the CFP objective of reducing discards. Tables 3, 4 and 5 provided an assessment of the different TM in relation to a revision due to the landing obligation. A number of these TM also apply to North Sea demersal fisheries by other Member States.
- The **process described** in this case study, where policy makers, fishermen and representatives discuss the technical measures together **proved to be very useful**. As part of the revision of the TM, this approach should be adopted for other fisheries and regions.
- **Any revision** of the technical measures **before that the landing obligation is implemented** can in fact be regarded as a **theoretical exercise**. Adaptive management (see chapter 4) is needed as part of its operational implementation.

4.1 A stakeholder-oriented approach to revising the technical measures

This chapter describes the outcomes of **two studies**, which recently have been undertaken and are taking place in the **Netherlands** as a preparation for the revision of the technical measures in the light of the landing obligation. They focus on the **demersal fleet**. For two reasons, these studies can prove to be relevant as an example of how technical measures can be re-assessed in the light of the reformed CFP.

Firstly, as many technical measures have been developed for preventing the catches of juvenile fish of commercial fish species, improve selectivity and reduce discards (STECF, 2012), it is likely that the introduction of the **landing obligation will impact the technical measures**. Secondly, the approach taken in these studies is **stakeholder oriented**. The measures have been evaluated by scientists in close cooperation with fishermen, industry representatives and policy officers. This is a valuable approach as the industry has in-depth **knowledge** of the practice of fishing, and their **acceptance of rules** and Regulations is crucial for the success of TM (Suuronen *et al.*, 2007). At the same time, there is still a need for **objective scientific proofing** of the functionality of (new) gears.

In these studies the **focus has been on the core TM Regulation (850/98)** to limit the scope of the research. In some cases reference is made to other Regulations such as the cod recovery plan (2056/2001). In the next section we will describe all the rules and

Regulations that should be changed because they force fishermen to discard, which is not allowed anymore under the landing obligation and the rules and Regulations that could be changed as they contribute to discarding.

4.2 Technical measures that should be changed due to the landing obligation

In this section we will give an **overview of articles** or parts of the text of **Regulation (EC) No. 850/98 that need to be changed** because they force fishermen to discard or contribute to discarding.

In general all articles or parts of the text referring to catches 'retain(ed) on board' need to be changed. With the landing obligation all catches of regulated species will need to be retained on board. The more detailed remarks are listed in **Table 3**.

Table 3: Overview of all articles that should be changed because of the landing obligation

Title	Chapter	Article	Comment
II	I	4.4 Catches retained on board and taken in each of the regions or geographical areas mentioned in Annexes I to V, X and XI may not be landed unless their percentage composition complies with conditions laid down in the relevant Annex.	'May not be landed' is in contrast to the landing obligation
		7.5 Notwithstanding paragraph 1(a), the retention on board of any quantity of crustaceans of the genus Pandalus caught with any demersal towed net having a mesh size lying in the range 32 to 54 millimetres shall be prohibited , unless the net is equipped with a square-meshed panel or window having a mesh size equal to, or greater than, 70 millimetres.	'Retention on board of Pandalus prohibited is in contrast to the landing obligation.
	II	15.1 Quantities of marine organisms caught in excess of permitted percentages specified in Annexes I to VII, X and XI shall be returned to the sea prior to return to port.	'Shall be returned to the sea' is in contrast to the landing obligation for those species under Regulation.
III		19.1 Undersized marine organisms shall not be retained on board or be transhipped, landed, transported, stored, sold, displayed or offered for sale, but shall be returned immediately to the sea . <i>Also holds true for the articles 19.2, as it refers to 19.1.</i>	'Shall be returned immediately to the sea' is in contrast to the landing obligation for those species under Regulation.
V		32.1 The carrying or use on board a fishing vessel of equipment, which is capable of automatically grading by size or by sex herring or mackerel or horse mackerel , shall be prohibited .	This equipment might be allowed when the landing obligation is in place. [Note: if income from processing of juvenile fish exceeds costs, this might create negative incentives regarding selectivity.]

Title	Chapter	Article	Comment
VII		42.1 The carrying out on board a fishing vessel of any physical or chemical processing of fish to produce fish-meal, fish-oil, or similar products, or to tranship catches of fish for such purposes shall be prohibited. This prohibition shall not apply to the processing or transhipment of offal.	This equipment might be allowed when the landing obligation is in place. [Note: if income from processing of juvenile fish exceeds costs, this might create negative incentives regarding selectivity.]

Source: Author, based on Kraan et al., 2014:12-14.

4.3 Technical measures that could be changed due to the landing obligation

In the next table an overview is presented of all **articles that could be changed because they cause discarding practices** in some way, and are therefore in contrast with the landing obligation.

All of these articles identified refer to the **percentage composition rules**, which regulate what is retained on board but not what is caught. The original intention of such rules was to **classify fishing activity** into broad métiers for management purposes and not as a means of controlling fishing mortality (STECF 2012:44). In practice, however, these rules have resulted in fishermen **discarding parts of their catch** on day 1 of the fishing trip (as the rules are per 24 hours), whereas at the end of the fishing trip they would not have exceeded the equivalent of 5 days times catch per 24 hours.

Table 4: Overview of all articles that could be changed because of the landing obligation

Title	Chapter	Article	Comment
II	I	4.4 Catches retained on board and taken in each of the regions or geographical areas mentioned in Annexes I to V, X and XI may not be landed unless their percentage composition complies with conditions laid down in the relevant Annex.	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.
		4.5 The percentage of target species and of other species shall be obtained by aggregating all quantities retained on board, or transhipped, of target species and other species as set out in Annexes I to V.	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.
		5.1 The percentages referred to in Annexes I to V, X and XI shall be calculated as the proportion by live weight of all marine organisms on board after sorting or on landing.	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.

Title	Chapter	Article	Comment
	II	15.2 At all times prior to return to port, the percentage of target species as defined in Annexes I to VII, X and XI retained on board shall be at least half of the minimum percentages of the target species referred to in the said Annexes.	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.
		15.3 After the first 24 hours of a fishing voyage has expired, the minimum percentage of target species as set out in Annexes I to VII, X and XI shall be met at the time of the daily completion of the logbook in accordance with conditions laid out in Article 6 of Regulation (EEC) No 2847/93.	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.
IV		<i>Articles 20-29 discuss special provisions relating to fishing for certain marine organisms, including percentages of catch composition.</i>	Percentage composition rules, especially in mixed fisheries often in practice contribute to discarding.

Source: Author, based on Kraan et al., 2014:15.

In addition to the above mentioned more obvious rules that need to be changed in the light of the landing obligation, we discuss the other rules in **Table 5** below. We tried to establish the **reason why these rules were introduced** and then considered **whether or not they would be needed** when the landing obligation was in place (see the methodology section for how we have done this).

It should be noted that we reasoned from the ideal typical situation that the **landing obligation would be fully complied with** by the fishing industry. It is also important to reiterate that the scheme below is filled in with the **Dutch demersal fleet** in mind. It is likely that the outcomes and context will be different for other fleets and countries.

Table 5: Overview of other rules and discussion on whether they should be kept or not

Topic	Articles	Background	Remove? y/n
Length of the beam	29.2a-f, 30.1	<p>These rules (max 12 m beam) have been introduced with support of the Netherlands in the 1980ies. The Netherlands at that time had to reduce fleet capacity, next to scrapping part of the fleet three other measures were proposed at the national level: maximising the length of the beam at 12 m, maximising engine power at 2000HP and banning electric fishing. These were national rules at first and became EU rules later (in order to ensure a level playing field). The reason why fishermen were increasing their beam length was to catch more fish. Due to the need to limit the capacity this was reduced. As a reaction fishermen started to increase the weight of their gear, this lead to an increased oil consumption. The fishermen ended this in the early years of 2000 when the oil price increased. Less chains and lighter were used, the sumwing was developed and the pulse gear became important again (also see Haasnoot, 2015).</p> <p>The max 4.5-meter beam has probably been developed by the EU commission as a means to limit fishing activity in the spawning and nursery areas. Netherlands and Germany have exempted the shrimp fishery from these rules (as this fishery is managed at the national level) and developed a licence system, creating room for shrimp fishermen to have longer beams (max 9m per beam), whereas eurocutters (vessels <300HP) fishing sole and shrimp are limited to max 9 m. Some fishermen catching both shrimp and sole can use 9m beams, but then more than 50% the previous year should be shrimp catches.</p>	<p>Y, possible; by removing this rule, fishermen can increase the length of their beam and catch more fish in shorter time, with less fuel, making them more efficient. This need not be a problem as quota is limiting. Lowering towing speed may need to be considered. There is a technical limit to the length of the beam. The longest was 17.60m (was a vessel with 3200 HP). Currently tests are being done in the UK with beams of 14 m. Effect studies on Catch per Unit of Effort for target and non-target species and swept area should be included as part of such tests.</p> <p>For eurocutters the beam probably cannot be longer than 2x9m, as a technical limit. Removing this rule was not discussed.</p>

Topic	Articles	Background	Remove? y/n
Net construction	6.1	<p>This rule has been introduced because fishermen started to use increasingly more meshes in the cod end, so that the meshes became longer and were less open, so the selectivity decreased.</p> <p>However the reason why fishermen do this in the beam trawl fishery is to prevent the cod end from spinning (the beam trawl fishes quit fast). By increasing the meshes at the top of the cod-end, there is less pull on the top.</p>	<p>N, as it decreased the selectivity.</p> <p>Y, in some fisheries fishermen need a bit more flexibility due to the fishing practice, but care has to be taken that selectivity is not substantially decreased.</p>
	6.2	This is the so-called ballooning-rule. In the Dutch fisheries this rule works counterproductive. Fishermen want to lose some benthos and juveniles and can accomplish this by increasing the number of meshes from the front to the end.	Y , as it will likely increase the selectivity in Dutch demersal fisheries. Recommendation is to verify this with scientific observations.
	9.1	The reason that this rule is there, is to prevent fishermen to use meshes that become too narrow. Rules like this can block innovation (such as finding new net material that performs better).	Y/N , rules like these prevent that fishermen use meshes that will be too closed and become non-selective. Rules can block innovation. If the landing obligation is complied with fully in principle there is no need for these detailed rules.
	16	The reason that this rule is there, is to prevent fishermen to block their nets. Rules like this can block innovation (such as using sorting grids and sieve netting).	Y/N rules like these prevent that nets become non-selective. Rules can block innovation. Only if the landing obligation is complied with fully there is no need for these detailed rules.
	5.1 iv	Fishermen in the NL would like to make their net from Dyneema (lighter) and the cod end from Nylon (as it is more flexible than Dyneema). This rule blocks that. Possibly to make it easier for the inspection agencies. No reason can be thought of that impacts the selectivity. Blocks innovation.	Y

Topic	Articles	Background	Remove? y/n
	5.1 v	This rules in inconvenient for flyshoot and twinrig fisheries. This rule was probably introduced for the benefit of the inspection agencies. Is linked to having more than one net on board with different mesh sizes. Fishermen would like to be more flexible and change their nets at sea when the fishery asks for it. But this is not possible.	Y
Panels	7.1a, b, 7.2a-e, 7.3, 7.4, 7.5	<p>In the Commission Regulation (EC) No. 2056/2001 the <i>may</i> be have often been changed in <i>must</i> and the at least 80mm in 90mm (i.e. 7.1a in 850 -> 2056 article 4.5).</p> <p>The idea of many square net panels is to let undersized roundfish escape better, yet research has shown that escape panels in the top of the net, works for whiting and haddock but less so for cod.</p> <p>For cod lowering the headline was more effective, a measure that fishermen at a certain point took voluntarily.</p> <p>Some detailed rules (i.e. 7.4 and 7.5) have entered legislation because of political negotiation.</p>	Y, N The idea of having square mesh panels in nets is good in itself. Such panels can be useful to select particular roundfish (whiting, haddock) but are less effective on flatfish, depending on mesh size (Van Marlen, pers.comm.). However, the detailed descriptions in the TM are overly prescriptive and the rules become an end in itself instead of directed to positive outcomes. The working of square mesh panel is dependent on many factors. It is much more effective to have fishermen and gear technicians come up with good solutions per métier, per goal.
Plaice box	29.1a-c, 29.3,4,5	The plaice box was installed to protect juvenile plaice, and juvenile sole was expected to profit as well. <i>"Contrary to the expectation, plaice landings and biomass declined. (...)Currently catches of both plaice and sole from within the PB are lower than in the late 1980s and the exemption fleet often prefers to fish outside the Plaice Box alongside much larger competitors. It is concluded that the observed changes are most likely related to changes in the North Sea ecosystem, which may be related to changes in eutrophication and temperature"</i> (Beare et al., 2013).	Y , the goal of the PB was to protect juvenile plaice, as they are not present in the PB anymore and the North Sea plaice stock is doing extremely well, there is no real reason to keep the PB.

Topic	Articles	Background	Remove? y/n
Zonation	30.2a	This area has been described as an exemption on the general idea to have two main mesh sizes: 120 + above the 56°, and 80 below. The Netherlands pushed for an in between area where 100 was allowed, to fish with the beam trawl at the Doggerbank with (but only if bycatch of cod is less than 5%).	Y, N see minimum mesh size discussion with fishers above. One could argue that if the landing obligation is fully complied with, fishermen can make the optimum choice themselves.
Scientific research	43	It is good to keep a provision that rules don't apply for situations of scientific research. Increasingly fishermen will need to experiment themselves (as is the case now in preparation for the landing obligation), this should however always be guided by scientists to ensure for proper monitoring and analysis.	N , although good definition of scientific research should be made.

Source: Author, based on Kraan and Molenaar, forthcoming.

In conclusion, policy makers and fishery representatives agreed that technical measures that could foster more selectivity should be kept and if possible up-dated and that room should be made in the framework for the quick adaption of demonstrated improvements to fishing gear.

4.4 Interviews with fishermen about rules blocking innovation and contributing to discards

The fishermen we have interviewed gave **eight examples** of rules and Regulations that either **block innovation** or **(in)directly contribute to discards**.

Two examples were mentioned of how current **regulations block gear innovations**. **First**, Dutch fishermen have been experimenting with **separator panels** in the 80mm beam trawl net, to separate sole from plaice, in order to get rid of the undersized plaice whilst retaining the sized sole. The ideal mesh size for that panel was 4 cm but this size was prohibited in panels, it should be 8 cm. The fishermen wanted it to be 4 cm in order to prevent it from being blocked which happens with the 8 cm. Using 4 cm, the net is so small that not a lot gets in. Another separator panel that was tried out in the beam trawl fishery resulted in a discards reduction of up to 26% without significant loss of revenue (Van Marlen, 2013). However, once the experimentation period was finished, the fishermen had to remove the panels as their exemption license had terminated and the panel was not allowed under current TM. This also prevented further introduction in the fleet.

The **second** example mentioned is the precise descriptions of the **square mesh panels**. More flexibility with applying them would make it easier for fishermen to experiment (Kraan *et al.*, 2014).

Fishermen also highlighted **five examples** of rules that have **contributed (in)directly** to discarding:

- One net rule;
- Minimum mesh size;
- Cod recovery plan and days at sea limited for TR 120+;
- % Regulations;
- Ballooning.

A **first example of a rule (in)directly contributing to discarding** is the one net rule. Fishermen explained that the **one net rule** forced them to make the choice to use 80 mm mesh over 120 mm. Because they are not allowed to have a 120 mm (for cod) and 80 mm (for flatfish) on board, they have to go back to port to change nets to pursue the 80 mm fishery if they do not succeed in finding cod. If it would be possible to carry and use two nets they would start with the 120 mm mesh and change if they were unsuccessful without having to return to the harbour (van Helmond *et al.*, in prep.).

Second, the **sole fishery** in the Netherlands with **beam trawls and pulse trawls** using 80 mm nets is an example of a mixed fishery, which will struggle with the landing obligation (Verkempynck *et al.*, forthcoming). The bycatch of undersized plaice and dab in the sole directed fishery is considerable (Quirijns and Pastoors, 2014). Preventing the catch of plaice (MMS 27 cm) would mean that a mesh size of 100+ would be needed, but then most of the marketable small size sole (MMS 24 cm), which is an important part (in size and value) of the current catch, will be lost (see also Quirijns and Hintzen 2007). The fishermen explained in the interviews that if the **mesh size rule** would be cancelled, they could fish sole with a mesh size of 75 mm instead of 85 mm as they now often do. While

the rule is 80 mm, to be compliant during inspection, fishermen often have to use a bit larger nets at first, as during initial use they shrink to the legal size. As a consequence, the current situation is that many fishermen (out of bad economic circumstances and/or out of competition with co-fishermen) often use illegal net applications such as blinders, meaning that many *de facto* fish with much smaller mesh sizes (i.e. 50 mm) than the allowed 80 mm. The fishermen reason that by lowering the minimum mesh size, the fishermen could legally make a choice for a net that is suitable to retain most of the sizeable sole (most likely just less than 80 mm) (Kraan *et al.*, 2014).

As a fisherman explains: *"It is a small difference, but it will be accepted much easier, which will rid us from all those malpractices that people invent to keep the sole in the cod end. You will be rid of all those forbidden net adjustments, it will also be easier for the inspection agencies"* (Kraan *et al.*, 2014:22).

One of the fishermen realizes that this is not a simple message: *"but yeah, ..., how should you.... you should be able to have confidential conversations with Euro-parliamentarians and explain to them 'Guys, this is the reality in the sector'"* (Kraan *et al.*, 2014:22).

It should be noted that other fishermen we spoke as part of our research about the landing obligation expressed the **importance of the social context for compliance**. Technical solutions are only real solutions if they are accepted by the fisher group as a whole (Trapman *et al.*, forthcoming, see also Suuronen *et al.*, 2007). Also it is important to evaluate the **level of compliance with the landing obligation**. In the Netherlands the measure is highly contested, with many fishermen opposing the idea of a landing obligation and thus expressing that they will not (and can't) comply (Kraan and Verweij forthcoming).

The **third example** of how TM can contribute to discarding has been mentioned elsewhere (Kraak *et al.*, 2013), and that is the limitation of days at sea (DAS) for so-called TR gears using 120+ mesh. This limitation is related to the cod recovery plan. In the Dutch context, where there are plaice directed fisheries with TR gear (twinrig and flyshoot), this rule works as perverse incentive for fishermen to fish with a smaller mesh to catch plaice which increases their discards. If they would choose the 120+ mesh for the directed plaice fishery with otter trawls, the DAS allocation associated with it would not be sufficient to catch their plaice quota (Kraan *et al.*, 2014). This same perverse incentive also applied to other North Sea fisheries that use the TR gear for other fisheries than cod.

The **fourth example** fishermen gave was that of the **percentage catch composition** rules (discussed above already).

The **last example** fishermen gave was the **'ballooning' rule** (Article 6(3) of Regulation (EC) 850/1998). In the Dutch fishery it means in practice that fishermen fish less wide in the back end of their nets in order to make the proper connection with the 80mm cod ends, as described in the rules. If this rule would not be there, they would use wider meshes in the net, resulting in less discards.

As a fisherman explains: *"So now they [the fishermen] are all changing the net here [pointing at the link between net and cod end]. But in the past they would all have a mesh size of 100mm here, with a cod end of 80mm, but now because of this rule they are all changing the 100mm into 80mm. So they all decrease the size of their meshes because it has to be one on one the same amount of meshes. These are all stupid examples."* (Kraan *et al.*, 2014:27)

The fishermen would like to change this as they think it would improve the flow of water through the net, better quality fish and will protect the net better (less tear). Studies into these effects are not known. In addition to this it appears that control agencies in the United Kingdom and the Netherlands read the rules differently resulting in conflicts of interpretation.

5. GENERAL CONCLUSION

Technical measures (TM) **impact fishing activity on many levels**, influencing where, when and how marine resources are exploited. Therefore they are a necessary tool for the management of marine resources. However, current TM have not been unanimously successful in meeting their objectives.

The current **TM are in real need of revision** as they are too complex, often ambiguous, sometimes counterproductive and hindering innovations, difficult to control and enforce. The **landing obligation makes the revision even more urgent**. There is wide support for a fundamental change of the technical measures.

The **success of the landing obligation** is strongly linked to (i) the abolishment of TM that force fishers to discard, (ii) the removal of nitty gritty rules with no clear link to outcomes and which often in effect limit the possibilities for fishermen to innovate. **Compliance with rules** that remain after the revision, is a fundamental factor in fostering a real change of TM, for instance towards **results based management**.

To achieve positive results, more is needed than only a cleaning up of the TM in relation to the landing obligation. For the change to be meaningful – to have positive social, economic and ecological outcomes - the change of the **TM needs to be embedded in an overall change of fisheries governance** within the EU. This change implies a move from the **centre to the region** with a **greater role for stakeholders**; with a focus on **adaptive and results based management** (focus on outcome rather than the measures themselves); and with **contextual rule setting**, fitting the practice of fishing, per fishery, season, area etc.

In this context, the process described in the **Dutch case study**, where policy makers, fishermen and representatives discuss the technical measures together, **proved to be a very useful**. Nevertheless, the case study should be seen as a theoretical study. In fact, any revision of the technical measures before that the landing obligation is implemented can merely be seen as a **theoretical exercise**. **Adaptive management** is needed as part of its operational implementation, tuning the rules and regulations as part of continuous joint evaluation. This requires monitoring of the effects of the revisions on the catch composition, socio-economics impacts and compliance. Additionally, it is important to know **how the landing obligation will be set in practice** and how **enforcement and control** of the landing obligation will be effective in the future.

In a governance framework of **more regionalised and results-based management**, **joint** fact finding, joint problem solution and joint responsibilities, are key. All this will require a **change of culture** for all actors; managers, scientists and the industry. As part of the revision of the TM, the approach taken in the Dutch case study is recommended for other fisheries and regions as part of an **inclusive TM revision process in Europe**. While time is short and the sense of urgency is high, a **careful process** with outcomes that have the support of the **stakeholders** and fit the **operational situation in the fisheries** will ultimately be the best investment in sound management of our fisheries resource. In this process, it is important **not to focus narrowly on conservation of fish stocks, but also to take into account wider ecosystem management considerations**. Ultimately this will require a further tuning and integration of fisheries policy and nature and environment policies.

6. REFERENCES

- Beare, D, Rijnsdorp, A, Blaesberg, M, Damm, U, Egekvist, J, Fock, H, Kloppmann, M, Röckmann, C, Schroeder, A, Schulze, T, Tulp, I, Ulrich, C, Van Hal, R, van Kooten, T, Verweij, M. (2013), *Evaluating the effect of fishery closures: Lessons learnt from the Plaice Box*. Journal of Sea Research 84: 49-60.
- Catchpole, T, Feekings, J, Madsen, N., Palialexis, A., Vassilopoulou, V., Valeiras, J., Garcia, T., Nikolic, N., Rochet, M.-J., 2014, *Using inferred drivers of discarding behaviour to evaluate discard mitigation measures*. ICES Journal of Marine Science, 71:1277-1285.
- DG MARE (2014), *A study in support of the development of a new Technical conservation measures framework within a reformed CFP. Lot 2: Retrospective and prospective evaluation on the common fisheries policy, excluding its international dimension*. Final report. Project number: ZF1455_S02.
http://ec.europa.eu/information_society/newsroom/cf/mare/itemdetail.cfm?item_id=17475
- European Commission (2014a), Consultation Document. Development of a new framework for technical measures in the reformed CFP.
http://ec.europa.eu/dgs/maritimeaffairs_fisheries/consultations/technical-measures/documents/consultation-paper-tm_en.pdf
- European Commission (2014b), Consultation Summary. Reporting on the results of the public consultation on the development of a new framework for technical measures in the new CFP.
http://ec.europa.eu/dgs/maritimeaffairs_fisheries/consultations/technical-measures/contributions/
- Haasnoot, T. (2015). *Lessons learned from the transition towards an innovative fishing technique – A case study on the introduction of the pulse trawl technique in the Dutch flatfish fishery*. Master's Dissertation ENP-80436, Wageningen University
- Kelleher, K., 2005, *Discards in the world's marine fisheries. An update*. FAO Fisheries Technical Paper. No. 470. Rome, FAO. 2005. 131p.
- Kraak, S, (et al), (2013), *Lessons for fisheries management from the EU cod recovery plan*. Marine Policy 37:200-213.
- Kraan, M. (2014), *Imagine all the people; Implications of an increasing role of stakeholders (fishers) in fisheries governance and research*. Keynote speech at the FAO in Rome on 6 March 2014. <http://www.imr.no/prosjektsiter/fdi/presentations/en>
- Kraan, M, Pastoors, M, Verroen, S, Nijman R. (2014), *Herziening GVB: gevolgen voor Technische Maatregelen (TM)*. Rapport C032.14. IMARES.
<https://www.wageningenur.nl/nl/Publicatie-details.htm?publicationId=publication-way-343532353637>
- Kraan, M, Molenaar, P. (forthcoming), *Vorbereiding herziening technische maatregelen in verband met de aanlandplicht*. IMARES report.
- Kraan, M, Verweij, M. (forthcoming), *Implementing the landing obligation in the Netherlands; an analysis of the gap between fishery and the ministry*. In P. Holm, M. Hadjimichael and S. Mackinson, (eds.) *Bridging the gap: Collaborative research practices in the fisheries*. Springer.

- STECF (2012), Different principles for defining selectivity under the future TM regulation (STECF-12-20). Edited by Norman Graham and Hendrik Doerner. JRC Scientific and Policy Reports.
http://stecf.jrc.ec.europa.eu/documents/43805/432011/2012-11_STECF-12-20+Defining+selectivity+under+TM+regulation_JRC76897.pdf
- STECF (2013), Different principles for defining selectivity under the future TM regulation (STECF-13-04). Edited by Norman Graham and Hendrik Doerner. JRC Scientific and Policy Reports.
http://stecf.jrc.ec.europa.eu/documents/43805/501879/2013-04_STECF+13-04+-+Defining+selectivity+under+TM+regulation_JRC81584.pdf
- Suuronen, P, Sardà, F. (2007), *The role of technical measures in European fisheries management and how to make them work better*. ICES Journal of Marine Science, 64:751-756.
- Trapman, B, Kraan, M. (forthcoming) *Aanpassingen visserijgedrag en -techniek*. IMARES report.
- Quirijns, F, Hintzen, N. (2007), *Effect van de maaswijdte op de vangstsamenstelling in de boomkorvisserij*. IMARES report C122/07.
- Quirijns, F, Pastoors, M. (Eds) (2014), *Discard Atlas of North Sea fisheries*. IMARES report.
- Uhlmann, S., van Helmond, A., Stefansdottir, E., Sigurðardottir, S., Haralabous, J., Maria Bellido, J., Carbonell, A., 2014. *Discarded fish in European waters: general patterns and contrasts*. ICES Journal of Marine Science, 71: 1235–1245.
- Van Helmond, A.T.M., Ch. Chen, B. Trapman, M. Kraan, J.J. Poos (in prep.), *Creating incentives for a catch quota management system*. Manuscript in preparation.
- Van Marlen, B. R. Bol, K. Groeneveld, R. Nijman, G. Rink, E. Buyvoets (2013). *Vermindering discards door technische aanpassingen in de netten (VIP-VDTN)*. IMARES report C127/13.
- Verkempynck, R., Machiels, M., van der Reijden, K., van Overzee, H., (forthcoming) *Discarding in the Dutch demersal fleet: results from the national monitoring programme*. CVO report.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

**FISHING MANAGEMENT BASED ON
TECHNICAL MEASURES -
THE NEED OF A NEW FRAMEWORK FOR
THE MEDITERRANEAN SEA**

WORKSHOP

IN-DEPTH ANALYSIS

This document was requested by the European Parliament's Committee on Fisheries.

AUTHORS

Instituto Español de Oceanografía, Universidad de Alicante – Unidad Mixta IEO/UA:

- Jose M^a Bellido Millán, Jose Luis Sánchez Lizaso

Instituto Español de Oceanografía, Centro Oceanográfico de Baleares:

- Ana Carbonell Quetglas

Instituto Español de Oceanografía, Centro Oceanográfico de Málaga:

- Teresa Garcia Jimenez, Jorge Baro Domínguez

Instituto Español de Oceanografía, Centro Oceanográfico de Vigo:

- Julio Valeiras Mota

RESPONSIBLE ADMINISTRATOR

Carmen-Paz Martí

Policy Department B: Structural and Cohesion Policies

European Parliament

B-1047 Brussels

E-mail: poldep-cohesion@europarl.europa.eu

EDITORIAL ASSISTANCE

Adrienn Borka

LINGUISTIC VERSIONS

Original: EN

ABOUT THE PUBLISHER

To contact the Policy Department or to subscribe to its monthly newsletter please write to:
poldep-cohesion@europarl.europa.eu

Manuscript completed in October 2015.

© European Union, 2015

This document is available on the Internet at:

<http://www.europarl.europa.eu/studies>

DISCLAIMER

The opinions expressed in this document are the sole responsibility of the author and do not necessarily represent the official position of the European Parliament.

Reproduction and translation for non-commercial purposes are authorized, provided the source is acknowledged and the publisher is given prior notice and sent a copy.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

FISHERIES

FISHING MANAGEMENT BASED ON TECHNICAL MEASURES - THE NEED OF A NEW FRAMEWORK FOR THE MEDITERRANEAN SEA

WORKSHOP

IN-DEPTH ANALYSIS

Abstract

This study provides an analysis of the main existing technical measures in the Mediterranean, in view of the new CFP objectives and taking into account the regional aspects of the Mediterranean management system which is based mainly in technical measures. The analysis identifies the types of technical measures and proposed which of them should be maintained, removed, altered or developed. Finally, some conclusions and recommendations are suggested to the Members of the committee on how to rationalise the set of specific and general technical measures in view of the above-mentioned CFP objectives for the Mediterranean Sea.

CONTENTS

LIST OF ABBREVIATIONS	5
LIST OF TABLES	6
LIST OF MAPS	6
LIST OF FIGURES	6
EXECUTIVE SUMMARY	7
GENERAL INFORMATION	11
1. TECHNICAL MEASURES FOR FISHING MANAGEMENT	15
1.1. What we understand by “technical measures”	15
1.2. European Mediterranean Fishing Management System	16
2. REVIEW OF THE MAIN EXISTING TECHNICAL MEASURES IN THE MEDITERRANEAN SEA	19
2.1. A classification of Technical Measures	19
2.2. EU Technical Measures in the Mediterranean (in force)	22
3. ASSESSMENT AND EVALUATION OF THE MAIN EXISTING TECHNICAL MEASURES APPLICABLE IN THE MEDITERRANEAN SEA	25
3.1. Assessment of the Technical Measures based on the technical characteristics of fishing vessels	26
3.2. Assessment of the Technical Measures based on the technical and operational characteristics of fishing gears	27
3.3. Assessment of the Technical Measures based on the control of fishing effort exerted, limitations of fishing time	28
3.4. Assessment of the Technical Measures based on spatial and/or seasonal restrictions to fishing in specific areas or seasons of the year	28
3.5. Assessment of the Technical Measures based on catch composition: allowed, vulnerable and prohibited species.	30
3.6. Assessment of the Technical Measures based on commercial minimum sizes (MLS and/or MCRS).	30
3.7. Assessment of the Technical Measures based on quotas & catch limits	31
4. CONCLUSIONS AND RECOMMENDATIONS	33
REFERENCES	37

LIST OF ABBREVIATIONS

EC	European Commission
EU	European Union
EEC	European Economic Community
CFP	Common Fishery Policy
RFMO	Regional Fisheries Management Organisations
FAO	Food and Agriculture Organization of the United Nations
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical Sub-Area
ICCAT	International Commission for the Conservation of Atlantic Tuna
MLS	Minimum Landing Size
MCRS	Minimum Conservation Reference Size
EP	European Parliament
MPA	Marine Protected Area
MR	Marine Reserve
MS	Member State
EAF	Ecosystem Approach to Fisheries
IUCN	International Union for Conservation of Nature
STECF	Scientific Technical Economical Committee for Fisheries
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch
HP	Horse Power
VMS	Vessel Monitoring System

LIST OF TABLES

Table 1

List of National Management Plans in Spanish Mediterranean from 2006 to 2017	24
--	----

Table 2

Maximum limits of landings (AAA/2808/2012) for the small pelagic target species	32
---	----

LIST OF MAPS

Map 1

Geographical Sub-Areas (black) and FAO Statistical Divisions (red) in the Mediterranean	17
---	----

LIST OF FIGURES

Figure 1

Landings by Mediterranean country (in Tons) during the last decade	12
--	----

EXECUTIVE SUMMARY

Background

The Common Fisheries Policy (CFP) of the EU has recently been overhauled. In December 2013, the European Parliament and the Council agreed on a comprehensive CFP reform. It is now enshrined in a new legislative framework, the so-called '**new CFP basic regulation**' ([Regulation \(EU\) No 1380/2013](#)). As far as the conservation of marine biological resources is concerned, it repeals and replaces the former 'basic fisheries management framework', laid down by the Council in 2002 ([Regulation \(EC\) No 2371/2002](#)).

Thus the **main objectives** to be accomplished by this reformed CFP are the following:

- to achieve the **maximum sustainable yield** exploitation by 2015, or at the latest by 2020,
- to implement the **ecosystem-based approach** to fisheries management and
- to gradually **eliminate discards** through the landing obligation.

In the follow-up to the CFP reform the European Commission is gradually issuing new legislative proposals aiming to align the partly outdated EU Regulations from before 2013. One of the major post-reform projects of the European Commission is the **general overhaul** of the set of existing rules for **technical measures**.

The Commission announced a new **legislative proposal** for a general technical measures Regulation for the late autumn of this year. This new Union Regulation shall replace the old general framework Regulation for technical measures from 1998 ([Council Regulation \(EC\) No 850/98](#)). The existing set of technical measures in the Union is a complex, heterogeneous and disorganized system of provisions. They are frequently inconsistent and even contradictory. They have often been criticised as over-prescriptive and too complex, as they contain numerous exceptions and derogations. This is due in part to their origin and evolution. Some of them, for example, have been transposed into EU law from the provision of Regional Fisheries Management Organisations (RFMOs).

Other measures were adopted by the Council as part of the annual negotiations in the context of setting Total Allowable Catches (TACs) and quotas. Some of the technical measures are, thus, the fruit of negotiation. This weakens their scientific basis and can generate unjustified differences among sea basins. All the legal texts containing technical measures have been subject to a number of modifications. These have increased their complexity, and sometimes even resulted in deviation from the original aim of the measure.

Against this background the Committee on Fisheries of the European Parliament wishes to commission an in-depth analysis on "**A new technical measures framework for the new CFP - The Mediterranean Sea**". The analysis shall be presented and discussed with Members during a **workshop** entitled "A new technical measures framework for the new CFP", which is due to take place in the European Parliament premises in Brussels on the **13/10/2015**.

Aim

The aim of the present study is to provide a detailed analysis of the situation on technical measures through [Council Regulation \(EC\) No 850/98](#). With the regard to the general objectives outlined above, the following questions pertaining to **rules for technical measures** shall be addressed in the in-depth analysis:

1. Improve the **knowledge** of the main existing technical measures in the Mediterranean Sea;
2. Investigate the rules for technical measures in the Mediterranean Sea as well as identifying
 - ✓ which of them should be **maintained**,
 - ✓ which should be **removed**,
 - ✓ which should be **altered**,
 - ✓ which new rules for technical measures might be **developed**,

either in a general EU framework Regulation or in a specific EU Regulation for conservation measures.

The methodology used in this in-depth analysis followed a progressive approach:

- First of all, we define **what technical measures are** in a fishery context and **why technical measures are so important in the Mediterranean Sea**.
- We provide an **inventory of the main existing technical measures** in the Mediterranean and review them by making a classification of technical measures.
- We **assess the main existing technical measures** applicable in the Mediterranean Sea **in view of the above mentioned new CFP objectives as well as the regionalisation aspect of the new CFP and the announced simplification of CFP** governance.
- We **provide conclusions and propose some recommendations** to the Members of the committee on how to rationalise the complex set of specific and general technical measures in view of the above-mentioned CFP objectives for the Mediterranean Sea.

This in-depth analysis is based on desk research, it makes use of scientific and technical material from a number of sources, such as academic studies, websites, databases, EU Institutions, authorities of the Members States or think tanks among others.

Main findings

In a Mediterranean context the new technical measures regulation is crucial, as Mediterranean management system leans mainly in Technical Regulations, opposite to Atlantic where catch quota plays a major role in his management system.

Technical measures are also considered instruments of **input controls**, i.e. mechanisms which regulate the fishing effort going into the fishery. Opposite, quotas and limitations of catch are considered **output controls**, i.e. mechanisms which limit the harvest coming out of the fishery.

Technical measures are quite related to technological innovations. Fishing is a very dynamic activity which evolves continuously, searching the maximum efficiency. This

include improvements in the detection and chase of fish, access to previously non-accessible areas, better selectivity of fishing gear, new materials, new devices, etc... As a result, technical measures have to be "linked to the reality" of fishing operations. They have the risk to become obsolete quite soon, being useless in some cases or even harmful in the worst cases.

The core of EU Mediterranean fisheries management measures are set out in the EU **Regulation 1343/2011 of the European Parliament and of the Council**. This regulation establishes certain provisions for fishing in the GFCM (General Fisheries Commission for the Mediterranean) Area of application, High seas and National waters. It amended **Council Regulation (EC) No. 1967/2006** concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.

Technical measures **regulations can be grouped according to different levels:**

- **Regulations of fleet characteristics and technical characteristics of the gears**
 - Based on the technical characteristics, length and engine power of fishing vessels.
 - Based on the technical and operational characteristics of fishing gears.
- **Regulations of fleet access to fishing grounds**
 - Based on the control of fishing effort exerted, limitations of fishing time by day and by week among others.
 - Based on spatial and/or seasonal restrictions to fishing in specific areas or seasons of the year.
- **Regulations of what can be retained onboard**
 - Based on catch composition: allowed, vulnerable and prohibited species.
 - Based on commercial minimum sizes (Minimum Landing Size (MLS), now named Minimum Conservation Size (MCS).
 - Based on quotas and catch limits.

There is a general consensus on the over exploited state for almost all Mediterranean target species, with intense fishing pressure, low daily catches based quite often on small sizes specimens (Caddy, 2015). On the other hand, although there is a complete set of technical and biological measures for Mediterranean fisheries, **more effective management is needed to reverse this situation.**

In this in-depth analysis we provided a detailed assessment of the technical measures currently in force, suggesting **some recommendations mainly based on fishing selectivity, spatio-temporal closures and protection of vulnerable sizes and vulnerable species**. Also it is suggested a better involvement of fishers into management to comply in a better manner with technical measures.

Given the characteristics and peculiarities of each region, local action plans are needed as solutions for management need to be setup in a regional context. Some of these solutions are **improvements of control of fishing effort, better fishing selectivity, spatio-temporal fishing restrictions for vulnerable sizes and/or areas, effective enforcement and finally an agreement of the fishing sector to comply with the rules and regulations.**

GENERAL INFORMATION

KEY FINDINGS

- **Mediterranean fisheries** represent an important and vital sector of European Union fisheries, accounting for **46% of total EU fishing vessels**. They comprise up to **22% of the EU fleet in terms of tonnage and 34% in terms on engine power**.
- Landings in the Mediterranean represent a relatively small proportion, around **12 % of total EU landings**.
- A clear **decreasing trend in number of trawlers** is apparent since the last 20 years in the Mediterranean. **Fishing power is usually underestimated** in the entire region **and fishing technology has improved greatly** over the last decades.
- The existing set of **technical measures in the Union is a complex, heterogeneous and disorganized system of provisions**. They become **obsolete when any new technical development appears**. Unfortunately they are source of a **number of enforcement conflicts**, and even in many cases the degree of **compliance is inadequate**.
- There is a need to update the EU provisions for technical measures. **In a Mediterranean context this new Regulation is crucial, as Mediterranean management system leans mainly in Technical Regulations**.

European Mediterranean fisheries

Mediterranean fisheries represent an important and vital sector of European Union fisheries, **accounting for 46% of total EU fishing vessels**. They comprise up to **22% of the EU fleet in terms of tonnage and 34% in terms on engine power**. On average, fishing vessels in the Mediterranean are smaller than the rest of the Community. Almost 33,000 vessels are smaller 12mm length, i.e. **about 80% of Mediterranean boats are small-scale boats**, giving the Mediterranean fleet many characteristics of artisanal fisheries (Bellido et al., 2014).

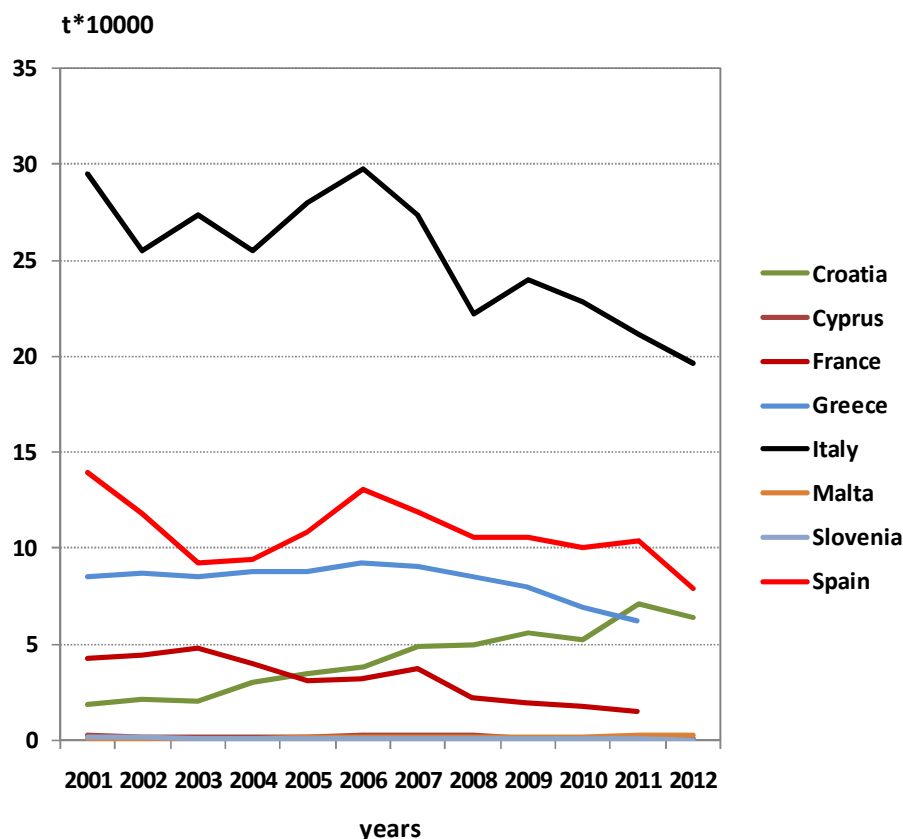
Landings in the Mediterranean represent a relatively small proportion, around 12 % of total EU landings. Overall, the Mediterranean fleet land an average of 500,000 t per year , of which 48 % are in Italy , 20% in Spain , 16% in Greece, 8% in Croatia, 6% in France and Slovenia , Malta and Cyprus contributing each one with less than 1 % (Fig. 1).

A general trend of declining catches is observed in the last 10 years, except in Croatia. In general, both catch rates and the total amount of daily catches in the Mediterranean are low in comparison with those from other seas. However, the economic value of landings is much higher. This may be explained by the fact that most of the Mediterranean catches are fresh market used for human consumption, generating high market values.

The trawl fishery is the second largest in landings in the Mediterranean, after small pelagic fisheries. A clear decreasing trend in number of trawlers is apparent since the last 20 years in the Mediterranean. However the fishing capacity and fishing power do not follow the same decreasing trend, although recently a decreasing trend in effort is present particularly for Italy and Spain (Abella et al., 2013). Samy-Kamal et al. (2014) reported a recent

decrease not only in the number of boats and fishing days but also in the average size of Mediterranean trawlers in Spanish waters off the Gulf of Alicante. However, **unfortunately fishing power is usually underestimated in the entire region** and **fishing technology has improved greatly** over the last decades (Anon, 2010).

Figure 1: Landings by Mediterranean country (in Tons) during the last decade



Fleets with economic importance are the bottom trawling focused on red mullets (*Mullus surmuletus* and *Mullus barbatus barbatus*), European hake (*Merluccius merluccius*) on the shelf, Norway lobster (*Nephrops norvegicus*) and red shrimp (*Aristeus antennatus* or *Aristaemomorpha foliacea*) in the slope, purse seiners fishing anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) on the shelf and artisanal fisheries, , fishing dozens of species such common dolphinfish (*Coryphaena hippurus*), cephalopod species (*Octopuses* and *Sepia* spp.), and spiny lobster (*Palinurus elephas*) among others on shelf coastal zones. Fleets shows an increase in total official engine power, e.g in the Balearic Sea (Western Mediterranean) for all fleets (bottom trawl, purse seine and artisanal fisheries) there was an increase from 6,360 hp in 1950 year to 29,561 hp in 2010 year, and a decrease in vessel numbers from 1,265 to 408 (Carreras et al., 2014).

The new CFP and technical measures for Mediterranean fishing management

The new CFP encompasses great challenges to improve European fisheries management. Among the main objectives to be accomplished by the CFP are to achieve the maximum sustainable yield exploitation by 2015 or at the latest by 2020; to gradually eliminate discards by a progressive implementation of a discard ban; and to implement the ecosystem-based approach to fisheries management.

For this purpose a new set of measures for the conservation and the sustainable exploitation of marine biological resources have been adopted in the CFP. Among them, different types of conservation measures, referring to "Technical measures", are to be implemented through a regionalised approach.

As aforementioned, the existing set of technical measures in the European Union is a complex, heterogeneous and disorganized system of provisions. They are frequently inconsistent and even contradictory. Because their origin, they pretend to be efficient and dynamic to regulate a sector which is evolving continuously. However, in fact they become obsolete when any new technical development appears. Unfortunately they are source of a number of enforcement conflicts, and even in many cases the degree of compliance is inadequate.

Thus, **there is a need to update the EU provisions for technical measures**, replacing the old general framework Regulation for technical measures from 1998 ([Council Regulation \(EC\) No 850/98](#)). These new provisions should simplify some rules and, obviously, develop some other new rules. This is one of the most important items of the new CFP as technical measures are basic rules for fishing operations, something like "user-guides" for fishers. According to the calendar suggested by the Commission, the new legislative proposal for a general technical measures Regulation will be launched for the late autumn of this year.

In a Mediterranean context this new Regulation is crucial, as Mediterranean management system leans mainly in Technical Regulations, opposite to Atlantic where catch quota plays a major role in his management system. Regionalisation should be a major concern on this Regulation, which should take into account the characteristics and peculiarities of each region (Uhlmann et al., 2013). A balance between regionalisation and integrative European management should be found. In some cases, solutions that have been shown useful and effective in the Atlantic, or Baltic or Mediterranean maybe do not necessarily fit for all fisheries in the European Union. However, it will be worthy of taking into account the experience from the different seas and then tuning the management systems according the needs of each fishing area (Johnsen and Eliassen, 2011).

1. TECHNICAL MEASURES FOR FISHING MANAGEMENT

KEY FINDINGS

- Technical measures as **“a broad set of rules which govern how, where and when fishermen may fish”**.
- Technical measures are **instruments of input and output controls**. **Input controls** are the **mechanisms which regulate the fishing effort** going into the fishery. **Output controls** are the **mechanisms which limit the harvest** coming out of the fishery.
- **Technical measures are quite related to technological innovations**. They have to be **“linked to the reality” of fishing operations**. They have the **risk to become obsolete quite soon, being useless in some cases or even harmful** in the worst cases.
- The Mediterranean Sea is divided into **Geographical Sub-Areas (GSAs)**. These **“national” GSAs boundaries** do not match in some cases the natural barriers of stocks as they are **rather based on geo-economic or political aspects**.
- Opposite to the Atlantic fishing management system, **there are no TACs and quotas in Mediterranean fisheries**, with the **exception of the bluefin tuna and some national regulations establishing some catch daily limits** for small pelagic and certain bivalves local fisheries.

The use of technical measures to contribute to the conservation of stocks and to the management of fishing activities is not a new feature under the CFP. The first Community Regulation on technical measures was adopted in 1980, before even what is considered as the first 'CFP basic regulation'⁹ - Nonetheless, it is worth highlighting that most of the fisheries technical rules currently applicable were decided either by the Council or by the European Commission under the former 'comitology procedures'. With the exception of partial amendments to pieces of legislation or based on the need to prolong some temporary measures, the EP has only on a few occasions been in a position to exercise its co-legislator role on these issues, nor has it yet been party to a significant review of the majority of existing technical rules.

1.1. What we understand by “technical measures”

The EU fisheries website defines **Technical measures as “a broad set of rules which govern how, where and when fishermen may fish.”** (http://ec.europa.eu/fisheries/cfp/fishing_rules/technical_measures/index_en.htm). This is a quite good definition, basic and right to the point. However, a more formal definition can be found in the current EU Regulation 1380/2013 (Art.4. Definitions):

(20) 'technical measure' means a measure that regulates the composition of catches by species and size and the impacts on components of the ecosystems resulting from fishing activities by establishing conditions for the use and structure of fishing gear and restrictions on access to fishing areas;

The measures may include:

- Minimum landing sizes and minimum conservation sizes
- specifications for design and use of gears

- minimum mesh sizes for nets
- requirement of selective gears to reduce unwanted catches;
- closed areas and seasons;
- limitations on by-catches (catches of unwanted or non-target species)
- measures to minimize the impact of fishing on the marine ecosystem and environment.

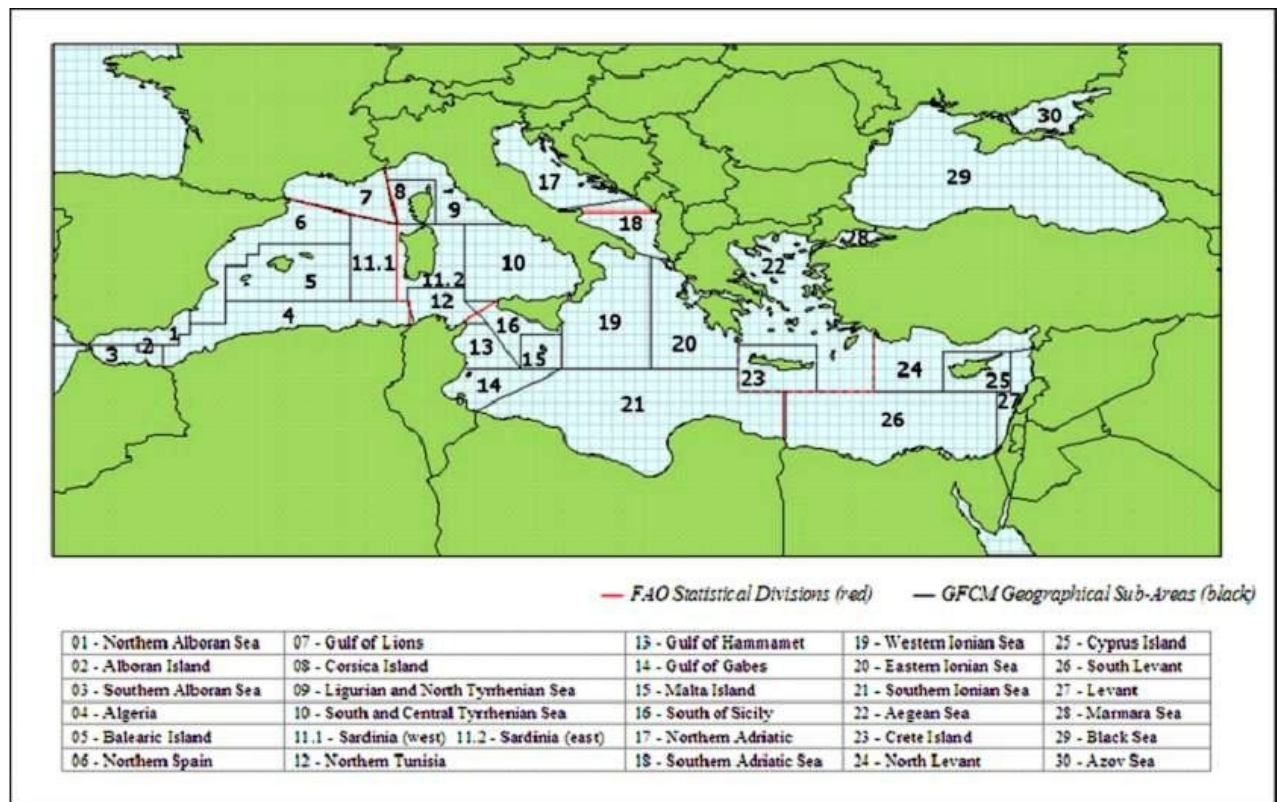
Technical measures are also considered instruments of **input controls**, i.e. mechanisms which regulate the fishing effort going into the fishery. Opposite, quotas and limitations of catch are considered **output controls**, i.e. mechanisms which limit the harvest coming out of the fishery.

Technical measures are quite related to technological innovations. Fishing is a very dynamic activity which evolves continuously, searching the maximum efficiency. This include improvements in the detection and chase of fish, access to previously non-accessible areas, better selectivity of fishing gear, new materials, new devices, etc... As a result, technical measures have to be “linked to the reality” of fishing operations. They have the risk to become obsolete quite soon, being useless in some cases or even harmful in the worst cases.

1.2. European Mediterranean Fishing Management System

In general, Mediterranean fisheries are rather similar in their characteristics. Western and Central basins are really similar to each other, while in the eastern are more prevalent artisanal fleets, comprising a majority of small-scale boats. The target species vary between metiers (Bellido et al., 2014). The same species can be target by one gear and considered also bycatch in others gears. The major fisheries in the Mediterranean in volume of landings are purse seine fisheries and demersal and pelagic trawl. However, small-scale fisheries are much larger in number of vessels and they use usually more selective gears (gillnets, longlines, traps).

The **Mediterranean Sea is divided into Geographical Sub-Areas** in order to compile data, monitor, assess and manage fisheries resources (Map 1).

Map 1: Geographical Sub-Areas (black) and FAO Statistical Divisions (red) in the Mediterranean

The Mediterranean fishery usually has recognised borders among and within the countries stocks at the GFCM Mediterranean Geographical Sub areas (GSAs) for trawl and small pelagic fisheries. However, these “national” GSAs boundaries do not match in some cases with the natural barriers of stocks as they are rather based on geo-economic or political aspects (Quetglas et al., 2012). In the Mediterranean Sea there are few GSA shared stocks among countries (e.g. Hake in the Gulf of Lions, shared for Spanish and French trawl fishery). Therefore Mediterranean fishery management model contrasts with the Atlantic stocks management model where fish stocks are usually shared among different countries and joint management rules to deal with the conservation are regularly established. With the exception of bluefin tuna and some few shared stocks that are assessed together with all the countries that share the same stock. The results of this geographical/national distribution of Mediterranean GSAs makes that stock assessments have a marked national role for each GSA and for each of the Mediterranean countries.

Technical measures are established for all European sea basins, but they differ considerably from one basin to another, in accordance with the regional conditions. However, **opposite to the Atlantic fishing management system, there are no TACs and quotas in Mediterranean fisheries**, with the exception of the bluefin tuna and some national regulations establishing some catch daily limits for small pelagics (sardine and anchovy) in Spain and certain species of bivalves, in some regional inner waters of Spain.

Apart from the general absence of TACs, in all other respects the region is subject to the same type of EU management measures as the rest of the EU, including requirements relating to the EU vessel register, licensing, monitoring and control arrangements, and new data collection measures.

1.2.1. Why are technical measures so important in the Mediterranean?

The Mediterranean Sea is characterised by high biological diversity and, excluding the Adriatic Sea, Gulf of Lion and some other particular areas. It has a narrow continental shelf therefore about 90 per cent of fishing in the region can be described as coastal.

For these reasons, EU fisheries management in the Mediterranean tends to focus on coastal fisheries, through EU measures regulating or prohibiting certain fishing practices. Alongside there are regulations initiated at national, regional and local levels. The EU has also made efforts to strengthen international cooperation, notably within the General Fisheries Commission for the Mediterranean and the International Commission for the Conservation of Atlantic Tunas. However, there are continuing concerns over the effectiveness of these initiatives and the impact of the EU fisheries sector on the Mediterranean environment.

The core of EU Mediterranean fisheries management measures are set out in the EU **Regulation 1343/2011 of the European Parliament and of the Council**. This regulation establishes certain provisions for fishing in the GFCM (General Fisheries Commission for the Mediterranean) Agreement area and amending **Council Regulation (EC) No. 1967/2006** concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.

2. REVIEW OF THE MAIN EXISTING TECHNICAL MEASURES IN THE MEDITERRANEAN SEA

KEY FINDINGS

- Regulations can be grouped **according to three different levels** in the Mediterranean: Regulations of fleet characteristics and technical characteristics of the gears; Regulations of fleet access to fishing grounds and Regulations of what can be retained onboard. Among these three different levels, we can distinguish technical measures:
- Based on the **technical characteristics, length and power of fishing vessels.**
- Based on the **technical and operational characteristics of fishing gears.**
- Based on the **control of fishing effort exerted, limitations of fishing time by day and by week among others.**
- Based on **spatial and/or seasonal restrictions to fishing in specific areas or seasons of the year.**
- Based on **catch composition: allowed, vulnerable and prohibited species.**
- Based on **commercial minimum sizes (Minimum Landing Size (MLS), now named Minimum Conservation Size (MCS).**
- Based on **quotas and catch limits.**
- **The core of EU Mediterranean fisheries management** measures are the **Council Regulation (EC) No. 1967/2006** and the **EU Regulation 1343/2011**. Regardless the new CFP **Regulation (EU) No 1380/2013 of 11 December 2013 on the Common Fisheries Policy**, which is the basis of all European fishing management.
- An **inventory of technical measures in force** is provided.

2.1. A classification of Technical Measures

The technical measures for fisheries management in the Mediterranean are comprised by a complex set of European, national and regional regulations, several of them at a local and specific level. Such a set of **regulations can be grouped according to different levels.**

Current regulations in the Mediterranean Sea can be grouped into technical vessels characteristics; technical operational gear characteristics, effort control regulations; spatial and temporal restrictions; biological conservations measures and protection of vulnerable endangered species. Moreover, for artisanal fisheries and small pelagic purse seiners Total Allowable Catches (TAC) are implemented for regional zones management regulations and for purse seine and longline tuna fisheries for which the International Commission for the Conservation of Atlantic Tunas (ICCAT) establish annual TACs in fishing regions and fleets. In the present document we review the technical and biological regulation measures for fleet under EU and National regulations, excluding the Tuna fishery under the international regulations.

Hence, according to the measures needed, the technical measures can be grouped in the following groups:

- **Regulations of fleet characteristics and technical characteristics of the gears**

- Based on the technical characteristics, length and power of fishing vessels.
- Based on the technical and operational characteristics of fishing gears.
- **Regulations of fleet access to fishing grounds**
 - Based on the control of fishing effort exerted, limitations of fishing time by day and by week among others.
 - Based on spatial and/or seasonal restrictions to fishing in specific areas or seasons of the year.
- **Regulations of what can be retained onboard**
 - Based on catch composition: allowed, vulnerable and prohibited species.
 - Based on commercial minimum sizes (Minimum Landing Size (MLS), now named Minimum Conservation Size (MCS)).
 - Based on quotas and catch limits.

The selective technical measures aim essentially reducing the catch of juvenile fish or unwanted species, limiting the catches of small fish, or preventing the catches in nursery or recruitment areas. Size and shape of the mesh codend are the main factors influencing the selectivity of the gears. However, mesh size and net shape is not the only parameters which determines gear selectivity and catch retention, which depend also on the tensions exerted on the net, such as the strength of currents or the speed of the vessel and the twine material who also influence the selectivity.

There are some locally important commercial categories by species or groups of species such as for curled octopus (*Eledone cirrhosa*) which is marketed in two different size categories. Small specimens, generally <50 mm ML, have great economic value and, in some regions, being the target of the multispecies trawl fishery in spring and coinciding with the recruitment period of the targeted species. This fishery of juveniles, known locally as “popets” in Catalonia and “moscardini” in Tuscany is an important activity, particularly in three western Mediterranean areas: the Catalan coast, the Ligurian Sea, and the northern Tyrrhenian Sea, where the species is more abundant. Even though there is no minimum legal size applied to *E. cirrhosa* catches, this form of trawling is restricted by the present EC regulations on mesh size (Jereb et al., 2015). Cephalopod landings in the European Union are not subject to quota limits. Most octopuses are landed by small-scale fisheries, and the activity is mainly regulated at the regional level. Recent studies on the selectivity of diamond, hexagonal, and square-mesh codends (Tosunoğlu et al., 2009) confirmed that the current legal minimum mesh size and codend configurations for demersal trawling are not suitable for regulating fishing on these cephalopod species.

One of the main figures of protection in fishery management are Marine Reserves (MR), i.e. areas that given their special characteristics are deemed adequate for the regeneration of fishing stocks and marine protected areas (MPA) where the exploitation of live marine resources are limited in one way or another, either to increase the fish nursery and to promote the proliferation of marine species subject to exploitation, or to protect marine ecosystems with differentiated ecological characteristics. Most extractive activities are prohibited in these reserves and recreational and commercial fishing are regulated more strictly than in areas open to fishing.

EU regulations prohibit fishing with trawl nets, dredges, purse seines, boat seines and other seines nets above seagrass beds (particularly *Posidonia oceanica*), coralligenous habitats

and maërl beds other marine phanerogams. However, to come these measures in force adequately will be necessary to map these habitats (by projects mapping seabed habitats) in shelf and slope zones. There are also specific local dredges developing some fisheries of great economic value, targeting scallops and flat fishes known locally as “rastrell” in northern Spanish coast and “rapido” in north central Adriatic Italian coasts. This type of fisheries operates over sandy bottom in shallow shelf coastal areas (between 20-40 m depth) and under National and EC Regulations.

Reduction of effort by means of temporal and spatial closures and limitations of fishing time per day, weekly or seasonally can be adopted at regional scales under regional management plans.

Based on biological aspects of phenology (the life cycle) of species, Minimum Conservations Reference Sizes (MCRS) have been established for the Mediterranean Sea target species. Setting minimum sizes for commercial species to prevent in the first instance to catch undersized fish, however they have been also established with regards to the gear selectivity and the associated species that are caught simultaneously as important bycatch to complete the incomes of the fishery. About 40 different commercial species have established MCRS, however some target species such red shrimp (*Aristeus antennatus*) or Giant red shrimp (*Aristaeomorpha foliacea*) targeted of the deepwater trawl fishery developed in the slope have not defined MCRS. Moreover, other important bycatch species for the fisheries may not have defined MCRS at EU legislation level but they have it at National legislation level, e.g. blue whiting in Spain. There also a lack of MCRS for small chondrichthyan species (small sharks and rays).

Although TACs are not applicable to the Mediterranean, with the aforementioned exception of bluefin tuna, there are some successful examples of limits of catch in the Mediterranean, most of them daily/weekly limits for landing certain fish species. Some of those examples for the bottom trawl and purse seine Spanish regulations are the following:

- The limit landing proportion of small pelagic catches (sardine and anchovy) for the trawl fishery in the Gulf of Lion. Current regulations only permit landing 10% of the total trawl capture of the trip on pelagic species, with a obligation to discard the excess on these small pelagic captures.
- Limit of catches for small pelagic in the Spanish purse seiner fishery in GSA 1, 5, 6 and 7 of between 5000 and 15 000 kilos per week.
- For some artisanal fisheries mainly regulated at the regional level. Case of bivalves in Andalucía (Spain).
- For large pelagic species regulated under the International Commission for the Conservation of Atlantic Tunas (ICCAT) each year, the ICCAT Secretariat produces a “Compendium of the Management Recommendations and Resolutions adopted by ICCAT for the Conservation of Atlantic Tunas and Tuna-Like Species”. The Compendium generally includes the Recommendation and Resolutions that are currently in force (even if only part of a particular measure is still in effect), as well as those that while they may no longer be in force, but have a direct bearing on a current measure.

2.2. EU Technical Measures in the Mediterranean (in force)

The basis of technical measure management of European fisheries is the **Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea**, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94¹.

Other two regulations complete the general framework of Mediterranean European basic regulation:

- **Council Regulation (EU) No 1343/2011 of 13 December 2011 on certain provisions for fishing in the GFCM** (General Fisheries Commission for the Mediterranean) Agreement area and amending Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea.
- Council Regulation (EC) No 520/2007 of 7 May 2007 laying down technical measures for the conservation of certain stocks of highly migratory species and repealing Regulation (EC) No 973/2001. Official Journal L 123 12.05.2007 p.3.

Of course, we must remark the current CFP Regulation, which is the framework for all European fisheries management. **Council Regulation (EU) No 1380/2013 of 11 December 2013 on the Common Fisheries Policy**, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC

Numerous fisheries regulations include a number of technical measures and a number of them have been amended over the years and CFP programs. Some other previous legislation, which was amended by the Regulation listed above are the following:

- Council Regulation (EC) No 1626/94 of 27 June 1994 laying down certain technical measures for the conservation of fishery resources in the Mediterranean. Official Journal L 171 6.07.94. p.1
- Council Regulation (EC) No 1075/96 of 10 June 1996 amending Regulation (EC) No 1626/94 laying down certain technical measures for the conservation of fishery resources in the Mediterranean. Official Journal L 142, 15.6.1996, p. 1–2
- Council Regulation (EC) No 782/98 of 7 April 1998 amending Regulation (EC) No 1626/94 laying down certain technical measures for the conservation of fishery resources in the Mediterranean .Official Journal L 113, 15.4.1998, p. 6–7
- Council Regulation (EC) No 1448/1999 of 24 June 1999 introducing transitional measures for the management of certain Mediterranean fisheries and amending Regulation (EC) No 1626/94. Official Journal L 167, 2.7.1999, p. 7–8
- Council Regulation (EC) No 2550/2000 of 17 November 2000 amending Regulation (EC) No 1626/94 laying down certain technical measures for the conservation of marine resources in the Mediterranean. Official Journal L 292, 21.11.2000, p. 7–8
- Council Regulation (EC) No 813/2004 of 26.4.2004 amending Regulation (EC) No 1626/94 as regards certain conservation measures relating to waters around Malta. Official Journal L 150, 30.4.2004, p. 32–41

On the other hand, MSs usually transpose and sometimes extend European legislation into their national laws. The following are some examples from different EU Mediterranean countries.

Some examples for France are:

- R 586/14: It establishes an exception to the application of the R 1967/06 as for the prohibition of working over protected habitats and at the minimal distance of the coast and the depth of the trawlers "ganguil" that go fishing in certain territorial waters of France (Provence — Alps — Côte d'Azur). Exception in force even 8/25/2018, adopted by means of R 2015/1421
- R 587/14: An exception establishes to the application of the R 1967/06 in relation to the minimal distance of the coast and the depth of the fishing with certain seines in certain territorial waters of France (Languedoc-Rosellón and Provence-Alpes-Costa Azul).

Some examples in Italy are:

- The temporary restrictions have been a traditional management tool in the Italian fishing. Annually, a temporary closing is established for the pelagic and bottom dragging. The duration of the closing is a variable from one year to other. A Ministerial Circular letter of October 7, 2004 established a plan of reduction of the fishing effort, particularly in the fishing ones that use dragging networks at least of 6 nautical miles of the coast. The dragging is subject to an interruption on Saturdays and Sundays, but no restriction is at present in force for other fleet segments.
- A limit of 10 TRB in the capacity of the vessels targeting the fishing of bivalves and the "Bianchetto" (juveniles of *Sardine pilchardus*).

Some examples in Slovenia :

- R 277/14. An exception to the Reg EC 1967/06 in relation to the minimal distance of the coast and the minimal marine depth in case of the trawlers of *volantina* operating in the territorial waters of Slovenia.

Some examples in Spain:

- There are minimum authorized conservation sizes on board for small pelagic species, in the Annex II of the Royal Decree 560/1995 modified by the Royal Decree 1615/2005, in force since January 20th, 2006, afterwards modified for the Council Regulation (EC) 1967/2006 (Table 3).
- The Ministry Order ARM/2529/2011 established a more restrictive legislation does not allow fishing in such habitats when they are classified as sites of Nature 2000 special areas protected or specially protected areas of Mediterranean Importance (ZEPIM) or if the areas are subject to any other form of protection (local or national).
- Vessel monitoring systems: Regulatory effort monitoring, has been established by EU vessel over 12 m length since First of January of 2012 (Council Regulation 1224/2009). A Spanish National Ministry Order ARM 3145/2009 has been launched to develop the EU before mentioned Regulation. However Spain regulation is already covered by the Council Regulation (EC) No 1224/2009, that may exempt community vessels of less than 15 meters overall length, operate exclusively within the territorial seas and never spend more than 24 hours at sea.

- Spanish Ministry Order of 21 December 2012 (Orden AAA/2808/2012), which establishes a Management Plan in the Mediterranean for the conservation of fishery resources affected by purse seines , trawling and small scale fishing gears for the period 2013-2017.
- With Regards to the Council Regulation (EC) No 1967/2006 biannual National Management Plans were established for all gears in Spanish Mediterranean (Table 1).

Table 1: List of National Management Plans in Spanish Mediterranean from 2006 to 2017

Ministry Regulation	Official Diary	Period
Order APA/79/2006 (January 19th, 2006)	DO 22, 26-01-2006	2006-2007
Order APA/254/2008 (January 31st, 2008)	DO 33, 07-02-2008	2008-2009
Order ARM/143/2010 (January 25th, 2010)	DO 27, 01-02-2010	2010-2013
Order AAA/2808/2012 (December 21st, 2012)	DO 313, 29-12-2012	2013-2017

An extensive list of specific EU Regulations for technical conservation measures is proposed in Appendix 1 and Appendix 2 of a report commissioned by DG MARE from 2014: A study in support of the development of a new technical conservation measures framework within a reformed CFP (http://ec.europa.eu/fisheries/documentation/studies/technical-conservation-measures/doc/final-report_en.pdf)

3. ASSESSMENT AND EVALUATION OF THE MAIN EXISTING TECHNICAL MEASURES APPLICABLE IN THE MEDITERRANEAN SEA

KEY FINDINGS

- **The vessels capacity is certainly a technical measure that should be strengthened.** Capacity is easy to measure and easy to control. **Improvements to control the real power** of the fleet should be made as in some cases vessels power (HPs) are over dimensioned.
- **Technology should help in fishing** and it should be used in a positive manner, increasing effort by **technology creep is an important risk.**
- Various **technical modifications** can be applied, such as **separator panels or sorting grids** in order to **reduce the quantity of discards and catches of juveniles and/or spawners.**
- Particular attention should be made to **some highly specialised gear or fishing tools that target with huge efficiency** as the **functionality of the fishery ecosystems** should not be affected.
- **The regulation of fishing time is one of the most important technical measures,** although they are quite problematic and they use to produce great conflicts. A general recommendation of last assessment Working Groups is the **reduction of fishing effort.** Some studies estimated that a **reduction of 1 day per week is rather more positive than a reduction of fishing hours by day.**
- A better **spatial marine planning** is needed. **Fishery management** has to be also **mobile and dynamic** in some extend. Mediterranean needs still **more Marine Reserves and particularly in offshore waters.**
- The **prohibition of fishing beyond 1000 m should be maintained** and **enforcement should guarantee this measure** is complied. Additional **mapping of deep marine habitats** could be needed.
- The **prohibition of trawl fishing below 50 m or over sensitive habitats** (seagrass beds, corraligenous and maërl) is maybe **one of the best technical measures** in fisheries. We also consider **useless the "3 miles exception",** when the 50m platform extends beyond 3 miles off the coast.
- **Protecting spawners mean to protect the fecundity strength of the population** and this is really important is all wild stocks. We consider **spawners should be protected with a good planning of temporal (seasonal) closures.** These **temporal closures should be for all metiers at the same.**
- **IUCN red lists can be used as an indication of the status of vulnerable species** for the Mediterranean Sea. Rare, endangered, threatened or protected species should be **mapped and their captures avoided.**
- **MCRS** need to be updated and better **fitted to the biology of the species,** since in the Mediterranean there are many examples of **mismatch between MCRS and size of sexual maturity.** Some technical measures to **protect spanners** can be the **mechanism of double selectivity** (similar to turtle excluder devices, sorting grid, squared panels, etc...).
- Particular **attention should be paid to the development of the obligation to land** and the **implementation of the discard ban** (art. 15, new CFP basic

Regulation EU No 1380/2103). Measures to **avoid illegal commercialization of juveniles as well as to protect juveniles at sea** should be maintained. New rules have to **care and foster all progress we have done** in the last years.

- **Mediterranean fishing management system based on technical measures is a good management system and we consider an annual TAC system should not be applied to the Mediterranean.** Another discussion is whether the system has been properly managed. In that case we **consider there is a great room for improvement.**
- However **daily/weekly catch limits are good technical measures that should be explored.** The **case of small pelagic regulation in Spain is a successful example and managers and operators agree to apply these measures.** Such technical measures should be **explored for other countries and maybe for other fisheries** (demersal, longliners and small-scale fishing).
- The **limits should be agreed by fishers, operators and managers, in a bottom-up process.** The price of fish products is rather stable for the last 15 years whilst operational costs have increased hugely. **Fishers need better price for fishery products.**
- Fishers and Fishing Producers Organizations should **control the fish supply to play with demand laws.** Together with a good and realistic legislation, some **auto-limitations of daily catch could help to get better prices for fresh fish.** A better **self-organization and co-management** of the supply of fresh fish to markets is needed.

The fishery management measures are often referred to as input and output controls. **Input controls apply to capacity, tools, areas, seasons and time of fishing** to be exerted. Opposite, output controls rule the outcomes of the fishery, i.e. **output controls apply to the catch that results** from the fishing effort, among them catch composition, allowed sizes and species and quotas or catch limits. In the following section we provide a detailed assessment of every type of technical measures, identifying what should be maintained, removed, altered and which new technical measures can be developed.

3.1. Assessment of the Technical Measures based on the technical characteristics of fishing vessels

Technical characteristics of the fishing vessels are commonly referred as capacity and they are one of the first input controls in a fishery. The technical characteristics of the fishing vessels are really important in fishing management. Depending on their capacity, fishing vessels can access to different fishing grounds and can carry out different fishing operations. Capacity controls aims to regulate which vessels can access to different fisheries and fishing grounds, in some cases restricting the total size of the fleet, both in numbers of boats and by length and engine power. Capacity controls have a great potential for an effective fishing management.

3.1.1. What should be in and what should be out

Vessels capacity is for sure a technical measure that should be strengthened. **Capacity is easy to measure and easy to control.** Most of the parameters are technical and subject to engineering protocols, so they have no room to be interpretable. **Improvements to control the real engine power of the fleet should be made as in some cases vessels power (HPs) are over dimensioned.**

These input controls are quite related to the overall pressure on the ecosystem as they direct the access to the different fishing grounds depending on the distance to coast and the depth. More powerful vessels can access to more distance and deeper waters. On the other hand, better vessels increasing efficiency and safety in fishing, but this increase in efficiency should be monitored and controlled as it can produce increases of fishing effort. **Technology should help in fishing and it should be used in a positive manner.** For instances, some technological progress such as development of echo-sounders and satellite navigation may also enable fishermen to direct more of their effort towards the target species and sizes, thus diminish the impact on non-target species and making fishing more selective and efficient.

3.2. Assessment of the Technical Measures based on the technical and operational characteristics of fishing gears

In Mediterranean bottom trawl fishery, selectivity is focused on the mesh geometry and mesh size. The minimum mesh size of bottom trawlers is 40 mm square or 50 mm diamond. Spain, Italy and Malta have used the derogation to maintain the old mesh size of 40 mm diamond up to June 2010.

Pelagic trawl nets targeting sardine and anchovy, (where these species account for at least 80 % of the catch in live weight after sorting), have a minimum mesh size of 20 mm. For surrounding nets the minimum mesh size is 14 mm. Bottom-set gillnets shall not have a mesh size opening smaller than 16 mm.

3.2.1. What should be in and what should be out

For purse seines fisheries, the Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, establish that the use of purse seines shall not be deployed at depths less than 70 % of the overall drop of the purse seine itself. In practice this rule is very difficult to enforce since purse seines only are prohibited within 300 meters of the coast or within the 50 metres isobath (where that depth is reached at a shorter distance from the coast) and, for instance in Spanish legislation, it is allowed a maximum net drop of 82 m which is higher than most of allowed bottom depths.

In trawl nets the selectivity is mainly determined by the size and geometry of the codend mesh size. The European Council decided to adopt the square mesh of 40 mm as main technical solution for the improvement of bottom trawl selectivity. Although, there are other **various technical modifications that can be applied, such as separator panels or sorting grids, in order to reduce the quantity of discards and catches of juveniles**, there is not any regulation on these devices. The positive aspects of the square mesh codend have been reported for several authors (Bahamón et al., 2007; Baro and Muñoz de los Reyes, 2007; Guijarro and Massutí, 2006). Nevertheless the usefulness of the same mesh size in the codend in different otter trawl métiers is doubtful since trawling activity takes place from very shallow waters to deepwater. This usefulness is even less evident when, in addition, the same gear is used at different depths. Hence a more specific regulation is needed for this item.

Finally, a warning on the **hyper selectivity** should be made. We agree improvements on selectivity are really needed in certain gears. However we must also watch the **functionality of the fishery marine ecosystems**. Particular **attention should be made to some high specialised gear or fishing tools that target with huge efficiency** certain species or certain sizes of a species. In those cases, these highly selective gears

must be controlled mainly with other fishing effort measures, such as spatial/temporal restrictions or restrictions of the fishing time.

3.3. Assessment of the Technical Measures based on the control of fishing effort exerted, limitations of fishing time

Limitations of time of fishing aims to restrict the fishing activity of fleets and hence reduce fishing effort and then fishing mortality. They seem simple technical measures, but this is not true. In fact **they are quite problematic and they produce great conflicts** between the different métiers and even between different operators of the same métier.

Fishing times are not usually the same for trawlers, purse seiners, longliners and/or small-scales boats. They target different resources and probably they have to go to different fishing grounds with different navigation time to the fishing ground. However they compare one to each other, generating comparisons and conflict sometimes quite difficult to manage.

Fishing time are usually around 12h by day for trawlers and purse seiners. Some operators think they are scarce and ask for extension of fishing time. However other operators ask for a reduction of fishing time by day around 8 or 9 hours by day. Even in some cases some operators are regulating themselves and come back to port before expiring the allowed fishing time. However, in these cases they usually claim for a general rule for reduction of fishing time which obliges equally all operators.

3.3.1. What should be in and what should be out

Fishing time regulation is one of the most important technical measures. Generally for the whole Mediterranean, **a decrease in the number of daily hours has been put in practice from the last years**, which obliged the vessels return earlier to the harbours to rest at port during night time. In Spain, the fishing time allowed is generally 5 days a week and 12 hours by day.

According to the last WGs assessment of STECF and GFCM, most of the fish stocks in the Mediterranean are overexploited (Abella et al., 2014). A general recommendation of such WGs is reduction of fishing effort. This fishing effort reduction can be made by fleet reduction (Capacity) or fishing time. Samy et al. (2015) estimated that a **reduction of one day per week is rather more positive than a reduction of fishing hours by day**. They argue that a reduction of fishing hours favours the most powerful vessels (in terms of HP) as they can access quicker the fishing ground and make full operations even in that reduced time. With a reduction of fishing hours they also argue there is a translation of fishing effort to more coastal fishing ground, increasing the exploitation of those more coastal waters.

3.4. Assessment of the Technical Measures based on spatial and/or seasonal restrictions to fishing in specific areas or seasons of the year

Spatial closures are applied in coastal Mediterranean regions under local management plans through Marine Protected Areas MPA for coastal fisheries (artisanal fisheries). Certain habitats are also protected from towed gears (Fishing Marine Reserves) to protect both sensitive and essential fish habitats, with particular attention to juvenile phases to important commercial demersal species. Fishing with trawl nets, dredges, purse seines, boat seines, shore seines or similar nets above seagrass beds of, in particular, *Posidonia*

oceanica or other marine phanerogams is prohibited. Furthermore fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats and maerl beds is also prohibited. For the Deep water species fishery legislation is prohibited fishing beyond 1000 m. In addition trawling cannot take place within 3 miles of the coast or in area where the seabed is less than 50 m depth.

Temporal closures has usually been implement in several countries (Spain, France, Italy), during some period of the year (e.g. recruitment or spawning periods in spring or autumn), under local management plans.

3.4.1. What should be in and what should be out

Fishery management needs to consider spatial issues in much more detail. Fish populations lives in a spatial scenario and such a scenario has to be included in the management. On the other hand, the fish resources, as well as the fishing fleets which chase them, are mobile and dynamic and then management has to be also mobile and dynamic in some extend.

Generally, **Mediterranean needs still more MR and MPA** and particularly in offshore waters MPA are almost absent. They are both nurseries for juveniles and reservoir for spawners. Particularly for small scale fisheries, MPA are considered a source or recruitment to the fishery and in many cases the fishers demand more waters to be protected. There are many studies on coastal MPA and some progress can be made in this issue.

Regarding deep water fisheries, **legislation prohibiting fishing beyond 1000 m should be maintained and enforcement should guarantee this measure is complied.** Additional scientific **mapping of deep marine habitats** could be needed for better protection of these important areas.

Trawling cannot take place within 3 miles of the coast or in area where the seabed is less than 50 m depth. **This prohibition of trawl fishing bellow 50 m or over sensitive habitats (seagrass beds, coralligenous and maërl) is maybe one of the best technical measures** in fisheries. These littoral waters are usually reservoirs of small fish. Protection of these waters will ensure future fish production. **We also consider useless the "3 miles exception", when the 50m platform extends beyond 3 miles off the coast.** We consider that exception should be removed. Fishing boats have nowadays enough power to make that distance without major inconveniences to fishing time.

Some considerations to spawners areas and spawning seasons should be made. Nowadays it is quite clear we have to protect juveniles, but unfortunately it is not so widespread the importance to protect spawners. **Protecting spawners mean to protect the fecundity strength of the population** and this is really important is all wild stocks. We consider **spawners should be protected with a good planning of temporal (seasonal) closures.** These **temporal closures should be for all metiers at the same**, or at least the metiers targeting the same species. Otherwise the spawners not taken by a metier will be taken by other metier, making useless the temporal closure. Unfortunately this is the case of some current temporal closures, in some cases trawlers targeting hake stop activity for two months, but longliners and small scale are targeting hakes in those two months.

3.5. Assessment of the Technical Measures based on catch composition: allowed, vulnerable and prohibited species.

Regarding vulnerable species, an important part of the vulnerable species correspond to elasmobranch species (chondrichthyans: sharks and rays). IUCN red lists can be used as an indication of the status of vulnerable species for the Mediterranean Sea. The red list assessments are currently revised and updated. The IUCN red lists has the Shark Specialist Group which is currently assessing the status of all the chondrichthyans regionally and worldwide, drawing upon a number of scientific and fisheries information sources in order to place species within the appropriate categories of the IUCN Red List of Threatened Species (www.redlist.org). Some 'threatened and declining' species of elasmobranch include the basking shark, common skate, and spotted ray *Raja montagui*. Cat sharks (*Scyliorhinus canicula* and *Galeus melastomus*) and skates (*Raja* spp) are commercialized under categories locally known with different names as e.g. "Moxina" for sharks or "Bastina" for skates in Western Mediterranean (Carreras et al., 2014).

3.5.1. What should be in and what should be out

IUCN red lists can be used as an indication of the status of vulnerable species for the Mediterranean Sea. In support of management measures to mitigate bycatch and discard of vulnerable species, distributions and ranges of these species taken as bycatch, in particular **rare, endangered, threatened or protected species should be mapped and their captures avoided.**

3.6. Assessment of the Technical Measures based on commercial minimum sizes (MLS and/or MCRS).

Ideally Minimum Conservations Reference Sizes (MCRS) should correspond to avoid catching the undesired sizes of target species on the basis of its biological and/or environmental features (e.g. size of sexual maturity, protection of some particular small sizes in certain areas). However they have been also established with regards to the gear selectivity and the associated species that are caught simultaneously as important bycatch to complete the incomes of the fishery. **About 40 different commercial species have established MCRS, however some target species** such red shrimp (*Aristeus antennatus*) or Giant red shrimp (*Aristaeomorpha foliacea*) targeted of the deepwater trawl fishery developed in the slope **have not defined MCRS.** Moreover, **other important bycatch species for the fisheries may not have defined MCRS at EU legislation level but they have it at National legislation level**, e.g. blue whiting in Spain. There also a lack of MCRS for small chondrichthyan species.

Regarding protection of particular sizes, **we must again highlight the importance to protect spawners as they are also vulnerable sizes for the future of the population.** Current stocks suffer of a very low proportion of older fish classes, which diminish their reproductive power. One of the most important conservation rules for wild stocks (both terrestrial and marine) is to maintain and/or strengthen a high reproductive power. In fisheries we use to refer to the Spawning Stock Biomass (SSB). However we often ignore the quality of such a SSB, which is more and more comprised of younger matures.

Finally **we must warn about a possible negative effect of the discard ban, the possible increase of the commercialization of juveniles on the black market.** The obligation to land can facilitate the illegal commercialization of juveniles as hitherto juveniles discards are more accessible to illegal trade and not subjected to previous

enforcement rules. By the way, **these previous enforcement rules have proved their efficiency, together with good awareness campaigns**. For a more detail analysis, we refer to a **previous in-depth analysis focused in this topic (Bellido et al., 2014)**.

3.6.1. What should be in and what should be out

MCRS was the first management measure aimed to reduce the commercialization of juveniles. Presumably, MCRSs have been established based on biological aspects of life cycle of species, mainly taking into account the size of sexual maturity. Nevertheless, **according to better knowledge of exploitation patterns they need to be updated and better fitted to the biology of the species, since in the Mediterranean there are many examples of mismatch between MCS and size of sexual maturity**. This conflict is even greater in cases where there is not a solid scientific agreement on the size at first sexual maturity of some species (e.g. *Engraulis encrasicolus*).

As suggested in the TM on selectivity and spatial areas, **some technical measures to protect spanners can be the mechanism of double selectivity** (similar to turtle excluder devices, sorting grid, squared panels, etc...). Mechanisms classifying sizes and allowing escapement both the biggest and the smallest sizes should be explored. We realize these measures can imply losses at the short term, but we also estimate gains can be obtained at medium term. On the other hand, a consideration for the market, it is important to note **the most commercial sizes are medium sizes**.

Particular attention should be paid to the development of the obligation to land and the implementation of the discard ban (art. 15, new CFP basic Regulation EU No 1380/2103). Measures to protect juveniles should be maintained and new rules have to care and foster all progress we have done in the last years.

3.7. Assessment of the Technical Measures based on quotas and catch limits

Catch controls are aimed at directly reducing fishing mortality on target species (Weissenberger, 2014). They have proven successful in some cases, including in multi-species fisheries, but have sometimes also led to undesirable outcomes (high-grading, increased discarding, illegal commercialization of excess of quota, misidentification of catch, etc.).

Opposite to other European fishing management system, there is not quota management in the Mediterranean (with the exception of blue fin tuna). To avoid misunderstanding, we refer quota as the Total Allowable Catch (TAC) for certain species, ordinary in an annual basis. **However, there is indeed some catch limitation in the Mediterranean, although most of them are included in the National legislation and not in the European legislation.**

The Article 11 of the **Spanish Ministry Order (AAA/2808/2012) establishes maximum landings for sardine and anchovy (Table 2)**. The same article 11 regulates daily landing by vessel permitted in their ports, two daily landing for GSA 1 and 5 and one for GSA 6 and 7.

Table 2: Maximum limits of landings (AAA/2808/2012) for the small pelagic target species

GSA	Species	Maximum Landings (kg)	By Period
1,5	Anchovy	7000	By week
1,5	Sardine	5000	daily
6,7	Anchovy	15000	By week
6,7	Sardine	5000	daily

Additionally, there are some small scale bivalves fisheries operating in inner waters with catch limits, particularly the case of South Spain (Andalucia regional waters). This fishery is regulated mainly under regional andalucian legislation.

3.7.1. What should be in and what should be out

The Mediterranean fishing management system based on technical measures is a good management system and we consider a TAC system should not be applied to the Mediterranean. Another discussion is whether the system has been properly managed. **In that case we consider there is a great room for improvement.**

However **we consider catch limits as a good technical measure that should be explored.** As aforementioned there are some bivalves fisheries with catch limits in inner waters of South Spain. They are artisanal fisheries exploiting resources well located spatially and relatively isolated. In these cases, catch limits can be an effective measure to maintain the fisheries in safe biological limits.

The case of small pelagic regulation in Spain is a successful example and managers and operators agree with those measures. Even in some cases operators are asking to reduce the daily/weekly limits to increase prices in the market. **These technical measures should be explored for other countries and maybe for other fisheries** (demersal, longliners and small scale).

However these **limits should be agreed by fishers, operators and managers, in a bottom-up process.** Fishing is an economic activity and commercialization measures should be in agreement with technical management measures. **The price of fish products is rather stable for the last 15 years** whilst operational costs have increased hugely. **Fishers need better price for fish products.** Fishers and Fishing Producers Organizations should control the fish supply to play with demand laws. Together with a good and realistic legislation, some **auto-limitations of daily catch** could help in this aim to get better prices of fresh fish. Market drives the prices and fishers have to deal with the market law. **A better self-organization and co-management of the supply of fresh fish to markets is needed.** We still mean the Mediterranean fresh fish is highly appreciated and in some cases the prices for the primary operators (fishers) are really low in the first sales.

4. CONCLUSIONS AND RECOMMENDATIONS.

KEY FINDINGS

- The **EU Fisheries Policy is facing major challenges** in the near future as, according to the latest annual reports of the STECF, **up to 85% of the Mediterranean fish stocks in European waters are classified as overfished.**
- **Technical Measures are particularly important in the Mediterranean, with a fisheries management system not based on quotas unlike the Atlantic.**
- **Input controls are key measures for fishing management in the Mediterranean Sea.** Input controls are **easy to measure as they are quantifiable** (Fishing capacity, dimension of gears, mesh, hooks, fishing times, access to fishing ground, etc...). Another advantage of **input controls is that they are previous to fishing activity.**
- **Output controls are also useful technical measures for fishing management.** They are **post-activity** measures and **they should act as preventive measures.** **Fishers must comply** these output measures, established as certain limits (allowed size, allowed catch, etc...), **otherwise they will be fined. If this preventive role is not ensured, output controls do not work.** Enforcement is very important to avoid bad practices.
- A **clear definition and determination on fishing capacity and effort exerted in every fishing ground** are needed. Excess of capacity and increase of effort lead to overexploitation in the medium term, unfortunately this is the current situation. **Improvements to control the real engine power of the fleet should be made. Technological developments of the boating industry can produce significant increases of fishing effort.** We have to assume progress is already incorporated in fishing. However this **progress must be well regulated and also included in the technical measures as well as in the enforcement** rules.
- **Protection of particularly vulnerable sizes** (considering **juveniles** but also **spawners**) and **vulnerable species** (endangered, threatened or protected species) should be maintained and even fostered. **Mechanisms and devices of double selectivity** should be explored, **allowing escapement** of specimens of small size (juveniles) and big size (spawners, sharks, dolphins and other species of big size).
- A progress should be made for **a spatial planning in fisheries.** It is necessary the **use of flexible spatial/temporal closures**, highly dynamic if necessary, to reduce bycatch problems and/or to protect species or sizes of interest in particular seasons.
- **The prohibition of trawl fishing bellow 50 m or over sensitive habitats is maybe one of the best measures** to safeguard species and ecosystems. We also consider **useless the "3 miles exception" off the coast and we mean it should be removed**, when the 50m platform extends beyond 3 miles off the coast.
- **To strengthen enforcement** and ensure fulfilment of rules. **Poverty of available infrastructure for control** and surveillance are likely **influencing the level of compliance** of regulations.
- **Legislations must be clear to avoid misunderstandings as well as minimise law gaps.** Technological development both for enforcement and the post harvest sector should be also made. **Remote sensing monitoring, real time control, camera devices, vessel control navigation and position systems should be**

explored to ensure the adequate compliance of technical measures and fishing operations.

- **Fishers need better price for fish products.** Fishers and Fishing Producers Organizations should control the fish supply to play with demand laws. Some **auto-limitations of daily catch could help** to get better prices of fresh fish. **Market.**
- **Mediterranean fishing management system based on technical measures is a good management system and we consider an annual TAC system should not be applied to the Mediterranean.**
- However **daily/weekly catch limits are good technical measures that should be explored.** The **case of small pelagic regulation in Spain is a successful story and managers and operators agree with those measures.** These technical measures should be **explored for other countries and maybe for other fisheries** (demersal, longliners and small scale).
- **Self-organization and co-management** together with **incentives for fishers to comply with fishing management measures.** If they understand, agree and participate with the management measures they are more likely to comply. The **implementation of co-management and community-based management plans** is always very positive.

There is a broad acceptance on the over exploited state for almost all Mediterranean target species, with intense fishing pressure, low daily catches based quite often on small sizes specimens (Caddy, 2015). On the other hand, although there is a complete set of technical and biological measures for Mediterranean fisheries, **more effective management is needed to reverse this situation.**

Technical measures are restrictive by nature. They establish some standardization in fishing practices, usually adding extra costs to fishing operations. Moreover, economical gains to fishers are not ensured in many cases but they may generate economic losses at the short and medium term. **Implementation of technical measures becomes even more complicated when fish stocks are overexploited and particularly in those cases where fishery is not either economically sustainable.** In this case managers use to have a difficult dilemma in fisheries management ... What should be protected? Fish populations or fisher populations?

It should be also taken into account that, unfortunately **many times, technical measures are quite far away to be successful.** Every new technical measure (particularly those not really accepted by fishers) prompts **a reaction on new developments to circumvent the rule, or at least to limit its effect. Then... in an endless story, managers need to readapt** the rules or complete them with new additional sets of, prescriptive or derogative, provisions.

The new reformed Common Fisheries Policy Regulations (EU N° 1380/2013) and Marine Strategy Framework Directive (2008/56/EC) require the implementation on an Ecosystem Approach to Fisheries (EAF). These two regulations are the cornerstones of the European marine policy, however some other regulations are also important such as the Council Directive 92//43/EEC on the conservation of natural habitats and of wild fauna and flora and the Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds.

One of the deals of Marine Strategy Framework Directive is to preserve marine biodiversity and ecosystems health based on ecosystem approach which requires the development of marine management plans in each Mediterranean region by fishing tactic and based on scientist advice, with the collaboration of stakeholders and being suitable to be regularly assessed.

Development of new and existing EU technical measures is an issue where there is scope for improvement, with important challenges to overcome. **Some conclusions and recommendation** for this process are the following:

- **Input controls are the key measures for fishing management in the Mediterranean Sea.** Input controls are easy to measure as they are quantifiable (Fishing capacity, dimension of gears, mesh, hooks, fishing times, access to fishing ground, etc...). Another advantage of input controls is that **they are previous to fishing activity**, so both fishers and managers can plan their respective operations according to well-known rules. As a disadvantage, **input controls have to be clearly defined** for all fishing process and **enforcement rules should be well-known and fulfil**.
- **Output controls are also useful technical measures for fishing management.** However by nature **they are post-activity measures and they should act as preventive measures. Fishers must comply** these output measures, established as certain limits (allowed size, allowed catch, etc...), **otherwise they will be fined. If this preventive role is not ensured, output controls do not work.** In such a case the fishery is difficult to control, difficult to monitor and difficult to assess as some outcomes can be derived to other ways of commercialization (black market, change of name of the species, juveniles commercialization, etc...). **Enforcement is very important to avoid these practices.**
- **A clear definition and determination on fishing capacity and effort exerted in every fishing ground are needed.** Excess of capacity and increase of effort lead to overexploitation in the medium term, **unfortunately this is the current situation. Improvements to control the real engine power of the fleet should be made.** Power of marine engines and other **technological developments of the boating industry can produce significant increases of fishing effort.** Innovation and technology is in our lives and we have to assume progress is also present in fishing. However this progress must be well regulated and also included in the technical measures as well as in the enforcement rules.
- Regarding selectivity, **there is a number of technological measures to reduce bycatch and discards.** Among them we can mention changes on the gear design (mesh shape and size, hook shape and size); **bycatch reduction devices** (e.g. turtle excluder devices, sorting grids, square mesh panels, tori lines on longlines); **improvement of fishing manoeuvres to increase survival** (and release) of unwanted catch.
- **It should be highlighted the importance to protect particularly vulnerable sizes (considering juveniles but also spawners) and vulnerable species** (endangered, threatened or protected species). Mechanisms and devices of double selectivity should be explored, **allowing escapement of specimens of small size (juveniles) and big size** (spawners, sharks, dolphins and other species of big size). Turtle excluder devices, sorting grids, square mesh panels are devices to progress in this way.
- **A progress should be made for a spatial planning in fisheries.** Although there are a number of MPAs, it is still essential further identification as well as to establish

areas where the use of all or certain gears is limited or prohibited, based on the best available scientific information. **It is necessary the use of flexible spatial closures, highly dynamic if necessary**, to reduce bycatch problems and/or to protect species or sizes of interest in particular seasons.

- The **prohibition of trawl fishing bellow 50 m** or over marine phanerogams bed is maybe **one of the best measures** to safeguard species and ecosystems. These littoral waters are usually reservoirs of small fish. Protection of these waters will ensure future fish production. **We also consider useless the of "3 miles exception" off the coast, when the 50m platform extends beyond 3 miles off the coast**. Fishing boats have nowadays enough power to make that distance without major inconveniences to fishing time.
- **To strengthen enforcement and ensure fulfilment of rules**. One of the biggest challenges in fisheries management lies in the implementation and enforcement of regulations. **Poor available infrastructure for control and surveillance are likely influencing the level of compliance of regulations**.
- **Compliment is essential for any fishery management. However legislations must be clear to avoid misunderstandings as well as minimise law gaps**. Technological development both for enforcement and the post harvest sector should be also made. **Remote sensing monitoring, real time control, camera devices, vessel control navigation and position systems should be explored to ensure the adequate compliance of technical measures** and fishing operations. On the other hand this remote monitoring may also increase the safety of vessels at sea.
- Commercialization measures should be in agreement with technical management measures. **The price of fish products is rather stable for the last 15 years whilst operational costs have increased hugely. Fishers need better price for fish products**. Fishers and Fishery organizations should **control the fish supply to play with demand laws**. Some **auto-limitations of daily catch** could help in this aim to get better prices of fresh fish. **Market**.
- Limits and/or quotas on catches. As aforementioned there are no TACs and quotas in Mediterranean fisheries, with the exception of the bluefin tuna and some national **regulations establishing daily limits for sardine and anchovy (Spain)** and daily limits of certain species of bivalves (inner waters, Spain). In this context, **some limits on catch could be studied and applied. Spanish examples are successful**. However these **limits should be agreed by fishers, operators and managers, in a bottom-up process**. Self-organization and co-management of the supply of fresh fish to markets.
- Incentives for fishers to comply with fishing management measures. **Fishers are more likely to comply with management measures if such measures improve their revenue, the quality of their catch, their operational efficiency and/or safety**. In other words, if they understand and agree the management measures. The **implementation of co-management and community-based management plans, based on the best scientific and technical information** available taking into account **fishers' knowledge, is always very positive**.
- **A major challenge in Fisheries Management is the implementation of the Marine Strategy Directive**. It is necessary to increase the scientific knowledge of the elements that define the status of the marine environment and how affect both fishing to marine environment and vice versa, marine environment to fisheries.

REFERENCES

- Abella, A., Cardinale, M., Martin, P., Scarcella, G., Bitetto, I., Carpi, P., Cikes, K., Colloca, F., De Felice, A., Fiorentino, F., Guijarro, B., Jadaud, A., Knittweis, L., Mannini, A., Maynou, F., Murenu, M., Quetglas, A., Recasens, L., Rouyer, T., Sbrana, M., Spedicato, M. T., Vrgoc, N., Charef, A. Osio, C. G & Millar, C., M. 2013. Report of the Scientific, Technical and Economic Committee for Fisheries (STECF). 2013 Assessment of Mediterranean Sea stocks part 1 and 2 (STECF-13-05).
- Anon., 2009. Report of the ninth meeting of focal point for Special Protected Areas MEDITERRANEAN ACTION PLAN. Ninth Meeting of Focal Points for SPAs Floriana (Malta), 3-6 June 2009 . REPORT OF THE UNEP(DEPI)/MED WG.331/16.
- Anon., 2010. *Draft final report of the 20th Century evolution of Mediterranean exploited demersal resources under increasing fishing disturbance and environmental change*. EVOMED. Open call for tenders nº MARE/2008/11
- Bahamon, N., Sardá, F. and Suuronen, P., 2007. Potential benefits from improved selectivity in the northwest Mediterranean multispecies trawl fishery. *ICES Journal of Marine Science*, 64: 757-760.
- Baro J. and I. Muñoz de los Reyes, 2007. *Comparación de los rendimientos pesqueros y la selectividad del arte de arrastre empleando mallas cuadradas y rómbicas en el copo*. *Informes Técnicos del Instituto Español de Oceanografía*, 188:1- 23.
- Bellido JM, A Carbonell, M Garcia, T Garcia, M González, 2014. *The obligation to land all catches – consequences for the Mediterranean*. In-depth analysis. European Parliament, Policy Department B: Structural and Cohesion Policies, Brussels 52 pp, Publication year: 2014 <http://bookshop.europa.eu/en/the-obligation-to-land-all-catches-consequences-for-the-mediterranean-pbQA0114340/> , ISBN: 978-92-823-5604-3, DOI: 10.2861/59268
- Caddy J.F. 2015. Criteria for sustainable fisheries on juveniles illustrated for Mediterranean hake: control the juvenile harvest, and safeguard spawning refugia to rebuild population fecundity. *Sci. Mar.* 79(3): 287-299. doi: <http://dx.doi.org/10.3989/scimar.04230.06A>
- Carreras, M., Coll, M., Quetglas, A., Goñi, R., Pastor, X., Cornax, M J., Iglesias, M., Massutí, E., Oliver, P., Aguilar, R., Au, A., Zyllich, K., Pauly, D. 2014. Estimates of total fisheries removal for the Balearic Islands (1950-2010). Working paper available by the Fisheries Centre, University of British Columbia, Vancouver, BC, V6T 1Z4, Canada.
- Dulvy N. K., Jennings S., Goodwin N. B., Grant A. and Reynolds J.D. 2005. Comparison of threat and exploitation status in North-East Atlantic marine populations. *Journal of Applied Ecology* 42 , 883–891.
- EC, 2006. Council Regulation (EC) Nº 1967/2006 of 21 December 2006 concerning *management for the sustainable exploitation of fishery resources in the Mediterranean Sea*, amending Regulation (EEC) Nº 2847/93 and repealing Regulation (EC) Nº 1626/94
- EU, 2013. Regulation (EU) Nº 1380/2013 of the European Parliament and of the Council on 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) Nº 1954/2003 and (EC) Nº 1224/2009 and repealing council

Regulations (EC) N° 2371/2002 and (EC) N° 639/2004 and Council Decision 2004/585/EC.

- Guijarro B. and E. Massuti, 2006. *Selectivity of diamond- and square-mesh codends in the deepwater crustacean trawl fishery off the Balearic Islands (western Mediterranean)*. ICES Journal of Marine Science;63:52-67.
- Jereb, P., Allcock, A.L., Lefkaditou, E., Piatkowski, U., Hastie, L.C., and Pierce, G.J. (Eds.) 2015. Cephalopod biology and fisheries in Europe: II. Species Accounts. ICES Cooperative Research Report No. 325. 360 pp.
- Johnsen, J. P., and Eliassen, S. 2011. *Solving complex fisheries management problems: what the EU can learn from the Nordic experiences of reduction of discards*. Marine Policy, 35: 130–139.
- Quetglas, A., Guijarro, B., Ordines, F., Massutí, E. 2012 Stock boundaries for fisheries assessment and management in the Mediterranean: the Balearic Islands as a case study. Scientia Marina 76(1).17-28
- Samy-Kamal, M., A. Forcada, J.L. Sánchez-Lizaso, 2014. Trawling fishery of the western Mediterranean sea: métiers identification, effort characteristics, landings and income profiles. Ocean Coast. Manag. 102 (2014) 269–284.
- Samy-Kamal, M., A. Forcada, J.L. Sánchez-Lizaso, 2015. Daily variation of fishing effort and ex-vehicle prices in a western Mediterranean multi-species fishery: Implications for sustainable Management. Marine Policy 61(2015) 187–195.
- Tosunoğlu, Z., Aydin, C., Salman, A., and Fonseca, P. 2009. Selectivity of diamond, hexagonal and square mesh codends for three commercial cephalopods in the Mediterranean. Fisheries Research, 97: 95–102.
- Uhlmann, S. S., van Helmond, A. T. M., Stefánsdóttir, E. K., Sigurðardóttir, S., Haralabous, J., Maria Bellido, J., Carbonell, A., et al. 2013. *Discarded fish in European waters: general patterns and contrasts*. ICES J. Mar. Sci. doi: 10.1093/icesjms/fst030.
- Weissenberger, J., 2014. *Fisheries: why technical measures matter*. In-depth Analysis. European Parliamentary Research Service, Brussels, Feb 2014. 36p.

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT STRUCTURAL AND COHESION POLICIES **B**

Role

The Policy Departments are research units that provide specialised advice to committees, inter-parliamentary delegations and other parliamentary bodies.

Policy Areas

- Agriculture and Rural Development
- Culture and Education
- Fisheries
- Regional Development
- Transport and Tourism

Documents

Visit the European Parliament website:

<http://www.europarl.europa.eu/supporting-analyses>

PHOTO CREDIT: iStock International Inc., Photodisk, Phovoir



ISBN 978-92-823-8101-4 (paper)
ISBN 978-92-823-8100-7 (pdf)

doi: 10.2861/993505 (paper)
doi: 10.2861/650920 (pdf)