



# TAKING STOCK

Progress towards ending overfishing  
in the European Union

Report produced by:  
Poseidon Aquatic Resource Management Ltd  
November 2017

**POSEIDON**  
AQUATIC RESOURCE MANAGEMENT

# Contents

Executive summary	3
1 Ending overfishing	4
1.1 Introduction	4
1.2 Managing European Union fish stocks	5
1.3 Objectives and structure of the report	7
2 Progress towards the CFP goal to end overfishing	8
2.1 Objective of this section	8
2.2 Methodology	8
2.3 Results	10
2.4 Observations	16
3 Progress towards the CFP goal to restore and maintain fish stocks above MSY	19
3.1 Objective of this section	19
3.2 Methodology	19
3.3 Results	21
3.4 Observations	23
4 Conclusions	24
5 References	26
Appendix A: Glossary	28
Appendix B: Regional analysis	29

## Disclaimer and report information

This report has been prepared for, and with the financial support of, The Pew Charitable Trusts. The views expressed in this report are purely those of the authors and do not necessarily reflect the views of The Pew Charitable Trusts, nor in any way anticipate its future policy or position in this area. The content of this report, or any part thereof, may not be reproduced without explicit reference to the source. The report findings are based on the data collected and knowledge during the time period of the study.

### Citation:

Nimmo, F., Cappell, R., 2017. *Taking Stock – Progress towards ending overfishing in the EU*.

Report produced by Poseidon Aquatic Resource Management Ltd for The Pew Charitable Trusts.

Photos: © Poseidon.

### Key contact:

Rod Cappell, Director, Poseidon Aquatic Resource Management Ltd

Email: [rod@consult-poseidon.com](mailto:rod@consult-poseidon.com) | Web: [www.consult-poseidon.com](http://www.consult-poseidon.com)

November 2017



# Executive summary

**This report by Poseidon Aquatic Resource Management Ltd was commissioned by The Pew Charitable Trusts as part of its ongoing campaign work to end overfishing in the waters of north-western Europe.**

Since 2014, the reformed Common Fisheries Policy (CFP) has included a legally binding commitment for fishing to achieve the Maximum Sustainable Yield (MSY) exploitation rate by 2015 where possible and for all stocks by 2020. However, it is well understood that many European Union (EU) fish stocks have been, and continue to be, fished above sustainable levels.

Exploiting fish stocks at or below MSY allows them to be maintained or recovered to healthy levels, providing food for consumers while contributing to important ecosystem and marine food web functions.

The objectives of this report are to:

- Establish the progress towards the CFP goal to end overfishing by comparing the maximum catch advised by scientists with the Total Allowable Catches (TACs) set by the Council of Ministers; and
- Establish the progress towards the CFP goal to restore and maintain fish stocks above levels that can produce MSY by assessing the status of fish stocks against biomass reference points.

This was undertaken by analysing two databases that provided TACs and scientific advice values, and spawning stock biomass and biomass reference points.

The research finds that, as in previous years, more than half the TACs set in 2017 are above scientific advice. However, significant recent improvements have greatly reduced how far above the advice the TACs are set (a reduction of 61% from 2016 to 2017). Nevertheless, the

overshoot in TACs in comparison to scientific advice in 2017 was 140,607 tonnes for pelagic species (representing 4% of all pelagic TACs), 96,564 tonnes for demersal species (11% of all demersal TACs) and 3,571 tonnes for deep-sea species (22% of all deep-sea TACs). Care is required when comparing excess tonnages across species groups or across regions (due to how bilateral or multilateral TAC negotiations with third party countries have been treated within the TAC database), with further details on the uncertainties provided within the report.

If trends measured from 2013 to 2017 continue, it is estimated that over half of TACs would still be set above advice in 2020. This is in clear contravention of CFP requirements and negates opportunities for earlier stock recovery. Strong management decisions and transparent decision-making processes are required if TACs are to be brought in line with scientific advice by 2020.

In terms of biomass, this study identifies the shortcomings of reference points that are used to determine progress towards the CFP biomass objective of stocks above MSY. Indeed, a fundamental finding of this research is that due to the lack of estimates for biomass at Maximum Sustainable Yield ( $B_{MSY}$ ), it is impossible to assess whether that CFP objective is being met. The International Council for the Exploration of the Seas (ICES) considers the reference point of  $MSY B_{trigger}$  to be the lower bound of a fluctuating  $B_{MSY}$ . Our analysis found 24% of stocks in 2016 had a spawning stock biomass below this lower level.

Alternative MSY reference points were explored within our analysis, resulting in either 40% or 56% of stocks found to have biomass below the benchmark reference points investigated in 2016.

Significant effort is required to model and estimate  $B_{MSY}$  reference points for EU stocks. In any event, a more appropriate MSY reference point should be adopted in the short term to help monitor progress.

# 1. Ending overfishing

## 1.1 INTRODUCTION

**The European Union (EU) reformed its Common Fisheries Policy (CFP) in 2013, with the objective to “restore and maintain populations of harvested species above levels which can produce the maximum sustainable yield” (EU, 2013). In agreeing the new CFP, all EU member states committed to achieve the Maximum Sustainable Yield (MSY) exploitation rate for fishing, by 2015 where possible, and no later than 2020 for all EU fish stocks.**

In 2013 the European Commission (henceforth referred to as the Commission) reported that within a decade the proportion of assessed stocks that were overfished had decreased from 94% in 2005 to 39% (EC, 2013). However, a 2017 report prepared by the Commission’s Scientific, Technical and Economic Committee for Fisheries (STECF, 2017) shows that progress has slowed, with 41% of assessed stocks overfished in 2015. With the 2020 deadline only a few years away, substantial efforts need to be made by decision-makers to meet the legal requirements of the CFP and to reap the many ecological, economic and social benefits that can be brought about by ending overfishing.

### 1.1.2 The benefits of ending overfishing

Managing fisheries sustainably is an adaptive process that relies on sound science, innovative management approaches, effective enforcement, meaningful partnerships, and robust public participation (NOAA Fisheries, 2016).

A recent Poseidon report commissioned by Pew (Nimmo *et al.*, 2016) explored examples of successful fisheries management showing that exploiting fish stocks at rates equal to or lower than MSY reference points allows them to recover to healthy levels, supporting provision of food for consumers while maintaining important ecosystem functions.

Well-managed fisheries result in a cascade of positive outcomes, including increased income to fishers and reduced impacts on the wider environment. As fish stocks recover from overfishing, the time and fishing effort required to catch the same amount of fish reduces and the ‘Catch Per Unit Effort’ (CPUE) increases. Greater catching efficiency reduces operating costs, which can improve and generate fleet profitability and a range of socio-economic benefits, including increased incomes for fishers and related positive consequences for dependent coastal communities.

A recent World Bank (2017) report quantified the substantial economic gains that can be delivered through more sustainable management of the world’s fisheries (up to US\$ 83 billion<sup>1</sup>), with 15% of that attributable to gains in Europe. The report highlights the importance of investing in the recovery of fish stocks, while tailoring the need for reform to regional conditions.

### 1.1.3 The study

This study analyses the decision-making around Total Allowable Catches (TACs) in European fisheries management in the waters of north-western Europe<sup>2</sup> since the CFP reform in 2013. The aim of the study is twofold: 1) to assess to what extent scientific advice is being followed in setting TACs for European fish stocks; and 2) to assess to what extent European fish stocks are at the biomass levels envisaged by the CFP.

Some recent reports explore the role individual member states play in the TAC-setting (Carpenter and Kleinjans, 2015), and the criteria used to allocate fishing opportunities at a national level (Carpenter and Kleinjans, 2017). However, this study analyses the maximum fishing mortality as advised by fisheries scientists (either as catch, for stocks fully subject to the landing obligation, or as landings) against the fishing limits agreed by fisheries ministers. It also assesses the status of European stock biomass as the CFP aims to “ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield”. The most direct indicator of progress towards achieving that goal is the biomass of targeted fish stocks relative to the biomass level at which MSY can be sustained.

In this report we collate and analyse information from the Commission’s own scientific advisers, the International Council for the Exploration of the Sea (ICES) and the STECF. This advice is produced by independent scientists (representing a cross-section of states with fishing interests) within specialist working groups and is subject to peer review and quality control processes. We also consider the appropriateness of the current stock status indicators used in identifying performance in relation to the CFP objective to restore and maintain populations above levels capable of producing the MSY.

1 Based on foregone economic benefits in 2012, compared with the optimal global scenario generated via bio-economic modelling.

2 Mediterranean stocks are not included in this analysis.





**“Managing fisheries sustainably is an adaptive process that relies on sound science, innovative management approaches, effective enforcement, meaningful partnerships, and robust public participation.”**

## 1.2 MANAGING EUROPEAN UNION FISH STOCKS

### 1.2.1 The commitments of the Common Fisheries Policy

A CFP was first formulated in the Treaty of Rome that established the European Economic Community (EEC). Initially linked to the Common Agricultural Policy, over time it became more independent as member states adopted Exclusive Economic Zones (EEZs) in marine areas and new member states with substantial fishing fleets joined what is now the EU (European Parliament, 2016). The CFP has since been reviewed and reformed approximately every 10 years under the Commission’s standard review process.

As a signatory to the Johannesburg Declaration in 2002, the EU committed to *“Maintain or restore stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015.”*(United Nations, 2002).

The EU has also committed to the United Nations’ Sustainable Development Goals under the 2030 Agenda for Sustainable Development (United Nations, 2017), including this target:

*“By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-*

*based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.”*

In 2013 the European Council and Parliament reached agreement on a reformed CFP (Regulation (EU) No 1380/2013) that sought the long-term environmental, economic, and social sustainability of fishing and aquaculture activities. It also stated a clear objective to ensure fish stocks are exploited at levels capable of producing MSY and to deliver the EU’s international commitment to end overfishing. The reformed CFP ((EU) No 1380/2013) Article 2, paragraph 2 states:

*“The CFP shall apply the precautionary approach to fisheries management, and shall aim to ensure that exploitation of living marine biological resources restores and maintains populations of harvested species above levels which can produce the maximum sustainable yield.*

*“In order to reach the objective of progressively restoring and maintaining populations of fish stocks above biomass levels capable of producing maximum sustainable yield, the maximum sustainable yield exploitation rate shall be achieved by 2015 where possible and, on a progressive, incremental basis at the latest by 2020 for all stocks”.*

A principle of good governance stated in Article 3 of the CFP regulation is that measures are *“in accordance with the best available scientific advice”.*



### 1.2.2 The importance of fishing limits to end overfishing

The size of a fish stock is determined by reproduction, growth and mortality. These elements are subject to natural fluctuations (e.g. in response to climatic conditions, food availability and competition, etc.), however, fishing pressure is the one element that can be managed. Managing fishing is therefore fundamental to ensuring the sustainable fish stock levels required by EU law.

There are several measures used to manage the amount of fish removed from a stock by fishing (termed ‘fishing mortality’). The main output measure for north-western European commercial fish stocks is setting a TAC and then allocating a proportion of that TAC (‘quota’) for member state fleets to fish. Other input measures used to manage fisheries include effort limits, minimum-landing sizes, closed areas and gear regulations (technical measures). The focus of this research is on output control, and specifically the level at which TACs are set.

Setting TACs in EU waters involves several different institutions that have scientific, management and political remits. An overview of the process is provided by Carpenter and Kleinjans (2015).

ICES is requested by the Commission to provide scientific advice on stocks in the North-East Atlantic.

ICES Working Groups, composed of fisheries scientists from member states that generally participate in the fisheries concerned, undertake stock assessments to formulate ICES’ scientific advice on recommended levels of fishing opportunities to achieve MSY and the CFP’s biological objectives<sup>3</sup>.

The Commission first formulates its approach on how it intends to propose fishing opportunities (TAC levels) for the following year. The Commission’s communication on fishing opportunities for 2017 confirms the need to set TACs in line with achieving MSY (EC COM 2016/396 (EC, 2016a)):

*“An important step towards achieving this is the Commission’s intention to propose TAC in line with achieving MSY in 2017. This will require a commitment by the Council to align its decisions to this approach... A delay in reaching MSY beyond 2017 would only be acceptable under well-substantiated circumstances where very large reductions of fishing opportunities would seriously jeopardize the social and economic sustainability of the fishing fleets involved. In these exceptional cases, the Commission expects member states concerned to provide tangible evidence of such social and economic impacts.”*

<sup>3</sup> For more details on the ICES advisory process see: <http://www.ices.dk/community/advisory-process/Pages/default.aspx>



**“The size of a fish stock is determined by reproduction, growth and mortality. These elements are subject to natural fluctuations (e.g. in response to climatic conditions, food availability and competition, etc.), however, fishing pressure is the one element that can be managed. Managing fishing is therefore fundamental to ensuring the sustainable fish stock levels required by EU law.”**

Based on this document, the Commission prepares proposals for fishing limits for the following year for the Baltic and North-East Atlantic and adjacent waters, and every other year (i.e. biennially) for stocks in deep waters (deep-sea species). These proposals are submitted to the Council of Ministers in late summer and autumn.

At its meetings in October and December each year (and biennially in November for deep-sea TACs), the Council of Ministers (consisting of all EU Agriculture and Fisheries Ministers) establishes regulations that set fishing opportunities for the following year. Experience shows that individual member state ministers will push for what looks like a ‘better deal’ in the short term, with a greater increase or a smaller reduction in quotas for fisheries that are important to their sector. The resulting decisions on TACs have often deviated from scientific advice provided by ICES, in some cases to a large extent e.g. the TAC for the cod stock in the Celtic Sea<sup>4</sup> was set 96% above advice in 2017, equating to an excess tonnage of 1,383 tonnes. Reasons for setting TACs above advice (e.g. to mitigate discards in the mixed demersal fisheries) and the extent to which these reasons may or may not be justified are not explored within this report.

Before the Council of Ministers meetings, an agreement is typically reached with Norway on quota shares for shared demersal and pelagic stocks, and between coastal states (e.g. Faroe Islands) for widely distributed stocks.

The annual TAC decisions are published in the EU’s Official Journal, typically four to six weeks after the Council of Ministers meeting. Quota shares of the total TACs are allocated to member states based on a fixed allocation key that was established early in the history of the CFP, reflecting fishing patterns in the early 1980s. Member states then each administer quotas to fishers according to their own governance system, for example, in the UK, management of quotas is handed to producer organisations (POs) (Scottish Government, 2016). Further details on the allocation of fishing opportunities to EU member states are provided in a New Economics Foundation report, *Who Gets to Fish? The Allocation of Fishing Opportunities in EU Member States* (Carpenter and Kleinjans, 2017).

---

4 Cod in 7b, 7c, 7e-k, 8, 9 & 10; EU waters of CECAF 34.1.1.

### **1.3 OBJECTIVES AND STRUCTURE OF THE REPORT**

While a range of factors and issues surround how decisions are made by the Council of Fisheries Ministers and how quotas are allocated to member states, this is not the focus of this study. Instead, we aim to take stock of progress towards meeting the CFP goals of ending overfishing (TAC analysis) and recovering fish stocks (biomass analysis).

Our analysis of progress to end overfishing differs from annual STECF monitoring of CFP performance which focuses on actual fishing mortality (i.e. reported catches), while we analyse whether permitted TACs are set consistent with advised fishing mortality.

Our analysis of recovering stocks also differs from recently published work by Froese *et al* (2016a) who explored this aspect by undertaking their own stock assessment modelling, while we rely on published information from ICES and STECF.

Specifically, the objectives of this report are to:

- Establish the progress towards the CFP goal to end overfishing by comparing the maximum catch advised by scientists with the TACs set by the Council of Ministers (Section 2); and
- Establish the progress towards the CFP goal to restore and maintain fish stocks above MSY by assessing the status of fish stocks against biomass reference points (Section 3).

The TAC analysis (Section 2) and biomass analysis (Section 3) are structured as follows:

- Objective
- Methodology
- Results
- Observations.

Section 4 summarises the report’s overall conclusions.

# 2. Progress towards the CFP goal to end overfishing

## 2.1 OBJECTIVE OF THIS SECTION

**The objective of this section is to establish the progress towards the CFP goal to end overfishing by comparing the maximum catch advised by scientists with the TACs set by the Council of Ministers.**

Maximum catch levels are based on total advised landings or catches, taking into account whether stocks and their associated TACs are (fully or partially) subject to the landing obligation.

## 2.2 METHODOLOGY

### 2.2.1 Data sources

The key information source used for assessing progress in setting appropriate TACs to achieve sustainable EU fish stocks was the TAC database developed by FishFix (Borges, 2017) for The Pew Charitable Trusts. This database includes data for 2010 to 2017 with fields for:

- Council TAC (in tonnes) (i.e. the TAC that is set by the Council of Ministers);
- Commission proposal (in tonnes) (i.e. the proposal that was put forward by the Commission to the Council);
- Maximum ICES advice (in tonnes);
- Calculation of the difference between Council TAC and maximum ICES advice (in tonnes); and
- Consideration of whether the stock is subject to the landing obligation and if so whether an adjustment is included within the TAC (for 2016 and 2017 only).

In order to analyse management decisions, the TAC database covers TACs, as opposed to fish stocks<sup>5</sup>.

### 2.2.2 Analysis

The analysis presented within this report reviews the scientific advice provided and the fishing limits set (TACs).

ICES provides catch (and/or landings) advice based on stock assessments that use a variety of approaches depending on the level of data available for the stocks assessed, including the ICES MSY or the precautionary

approaches. Further details of ICES' categorisation of stocks and its approach to advice is provided within ICES (2016a). This analysis covers all TACs where scientific advice is based on the precautionary approach and/or MSY approach, however, analysis is not further disaggregated to distinguish TACs where scientific advice is only based on MSY. It assumes that the assessment approach adopted by the relevant scientific bodies is appropriate to the information available for the stock.

A five-year period from 2013 to 2017 is analysed. When fishing limits were set for 2013 and 2014, the CFP reform was still to enter into force. These years can be regarded as benchmarks to analyse the impact the provisions of the reformed CFP had on the setting of fishing limits in line with scientific advice.

The analysis covers all TACs in the North-East Atlantic and Baltic Sea (see Table 2.1 for regional breakdown).

Species for which scientific advice cannot be compared to the Council decision (such as skates and rays) are excluded. In addition, some TACs from Annex IA of the TAC regulation (EU, 2017) are excluded: those not in EU waters (e.g. Barents Sea and Icelandic waters); TACs in Greenland and ultra-peripheral waters (e.g. Madeira waters); and/or TACs grouped as 'others' or 'industrial' species. Deep-sea species are included, although it is noted that TACs are set biennially for these species.

For TACs fully subject to the landing obligation, the total catch advice is compared to the TAC set to determine whether the TAC is in line with the scientifically advised catch.

For fisheries only partially subject to the landing obligation, the landings advice (minus discards)<sup>6</sup> is compared to the TAC set minus the adjustment applied.

The TAC database (Borges, 2017) from 2013 to 2017 was analysed to determine the extent to which the TACs set are consistent with ICES advice, based on the following categories:

- Above advice: TAC is set at a level that is higher than ICES maximum advice;

<sup>5</sup> Scientists report on the status of stocks based on stock assessments. TACs are a management measure decided by fishery managers.

<sup>6</sup> ICES terms this 'wanted catch'.





were explored for all stocks combined, grouped by species type (demersal, pelagic and deep-sea species) and for two individual TACs for cod and mackerel.

The final analysis performed using the TAC database focused on 2017: comparing advice with TACs for all individual species i.e. for each individual species advice and TACs were summed across all the stocks of that species in the waters of north-western Europe.

### 2.2.3 Additional considerations in TAC setting

In the EU, setting a TAC for a stock means that fishers can land the amount of fish permitted under their quota. As a result, any extra fish caught might be discarded i.e. thrown overboard. This is particularly the case in mixed fisheries or when quota species are caught as by-catch in other fisheries. The TAC is actually the Total Allowable Landings (the amount that can be kept on board and landed), but in many cases fishing mortality estimations also include the proportion of the catch that is discarded.

To tackle some of these problems, the 2013 reform of the CFP included a landing obligation, which is currently being implemented in phases. By 2019 all catches subject to quota will have to be landed. There are some *de minimis* allowances and exemptions for species with high survivability if returned to the sea, but the overall intent is to end the discarding of commercial fish species. For many fisheries subject to the landing obligation there has been an increase in TAC, whereby the amount that was previously discarded is added to the amount that must be landed. However, as the landing obligation is currently being phased in, it is often difficult to assess if the TAC adjustment is at an appropriate amount.

Some TACs during the period analysed were set as part of Long-Term Management Plans (LTMPs) that specified long-term objectives for specific fisheries (characterised by the species caught, the fishing gear used, and the area of operation). In one of the earliest examples, the recovery of North-East Atlantic cod has been managed under a LTMP since 2004. While the intention was for LTMPs to ensure that a longer-term view is applied to fisheries management, limiting the changes in TAC from year to year<sup>8</sup> limited the extent to which scientific advice can be adopted (for both increasing and decreasing TACs), thereby impacting the timeliness of management responses. In 2013 the CFP re-defined long-term plans as Multi-Annual Plans (MAPs), which are required to be in accordance with the CFP objective of ensuring stocks are above MSY. The Commission no longer follows LTMPs adopted before the CFP reform if these are seen to not be in line with the CFP's MSY objectives, and instead asks ICES to provide advice in line with the CFP's MSY objective.

- At advice level: TAC matches ICES maximum advice; including when ICES advice and TAC are set at zero;
- Below advice: TAC is set at a level that is lower than ICES maximum advice; and
- TAC set, no ICES advice: a TAC is set, but no ICES advice has been available to inform this level of TAC; or it has not been possible to assign advice to TAC areas<sup>7</sup>.

To account for small variations within the TAC database resulting from allocating advice across different TAC stocks and adjustments made due to the landing obligation, an allowance was provided for TACs set *just* above advice whereby TACs set <1% above and <10 tonnes above advice levels were considered to be at advice levels. When considering the percentage above or below advice, and when classifying excess tonnage category (e.g. <10%, 10–50%, 50–100%, >100%) the analysis was based on assessment of percentages to two decimal places.

The TAC database was further analysed for all TACs set above advice, by assessing the level of excess tonnage i.e. the quantity of TAC over and above scientific advice per stock. Trends in excess tonnage from 2013 to 2017

<sup>7</sup> It is noted that five TACs for skate/rays have scientific advice but are not included within the FishFix database due to difficulties with matching advice with TAC areas.

<sup>8</sup> In the case of cod, up to 20% change in TAC between years is permitted (EU Reg. 1243/2012).



## 2.2.4 Challenges in assessing progress towards ending overfishing

Efforts to measure progress faced several challenges, which are summarised below:

- Mismatch between TAC and reported catch: there can be TAC overshoots, misreporting and all the TAC may not be taken, which means that the reported catch does not match the TAC that was ultimately permitted. So the proportion of a TAC taken varies year to year and is influenced by fishing effort in other fisheries and market demand. This report focuses on the TAC that was ultimately set rather than on reported catches, as this is under the control of fisheries managers and can be directly compared to the advice given.
- Mismatch between TAC and stock areas: the geographical areas to which TACs apply and the stock distribution of that species often do not match<sup>9</sup>. Biological monitoring is undertaken at a stock level, while management is applied to TAC areas (ICES Divisions), which do not wholly take account of stock distribution. For example, *Nephrops* is set a single TAC in each sea area despite several functional units being identified that are separately assessed by ICES. So, there is a single TAC 'covering' the stocks, but it is not responsive to the status of each stock unit.
- 'Precautionary' TACs: these are set for stocks in the absence of adequate scientific advice (e.g. cod in 3a east and 5b, 6b, 12 & 14, anglerfish in 2a, 4, 5b, 6, 12, 14, 7 & 8abde and greater silver smelt in 2, 3, 4, 5, 6 & 7<sup>10</sup>). Such TACs are based on historic catches rather than the assessed status of the stocks in relation to reference points and so it is not known whether these are set at a precautionary level, let alone a MSY level.

9 For more details on this issue see <https://www.documents.clientearth.org/wp-content/uploads/library/2016-12-02-mismatch-between-tacs-and-ices-advice-ce-en.pdf>

10 Council Regulation 2017/127 Annex 1 specifies those TACs that are analytical and those that are precautionary. For the latter, ICES applies its framework for data limited stocks (ICES CM 2012/ACOM 68. 42 pp.).

- Multiple species TACs: a single TAC can be set that covers more than one species (e.g. turbot & brill, and lemon sole & witch-flounder) that does not reflect the status of each species.
- TAC adjustments: numerous and extensive adjustments to TACs can occur (often during the year) due to international swaps and deals with third countries.
- Landing obligation: it is often unclear how TAC adjustments to account for the landing obligation are calculated by the Council.
- Deep-sea species: TACs for deep-sea species are set every two years (e.g. black scabbardfish and roundnose grenadier).
- Level of transparency: there is no single source of information showing how the decisions on TACs evolve or explaining why scientific advice was not followed<sup>11</sup>. It is therefore a major task to 'join the dots'.
- Availability of data: there is no publicly accessible official database on TACs for EU-managed stocks; the Commission holds the official data, as does ICES, but this is not available to the public in a consolidated form. The ICES stock database consolidates its annual advice for each stock but this does not report the TACs set.

## 2.3 RESULTS

### 2.3.1 Number of TACs set above ICES advice

When ICES advice is compared to the TAC set by the Council it is found that:

#### **More than half of the TACs were set above the level advised by ICES.**

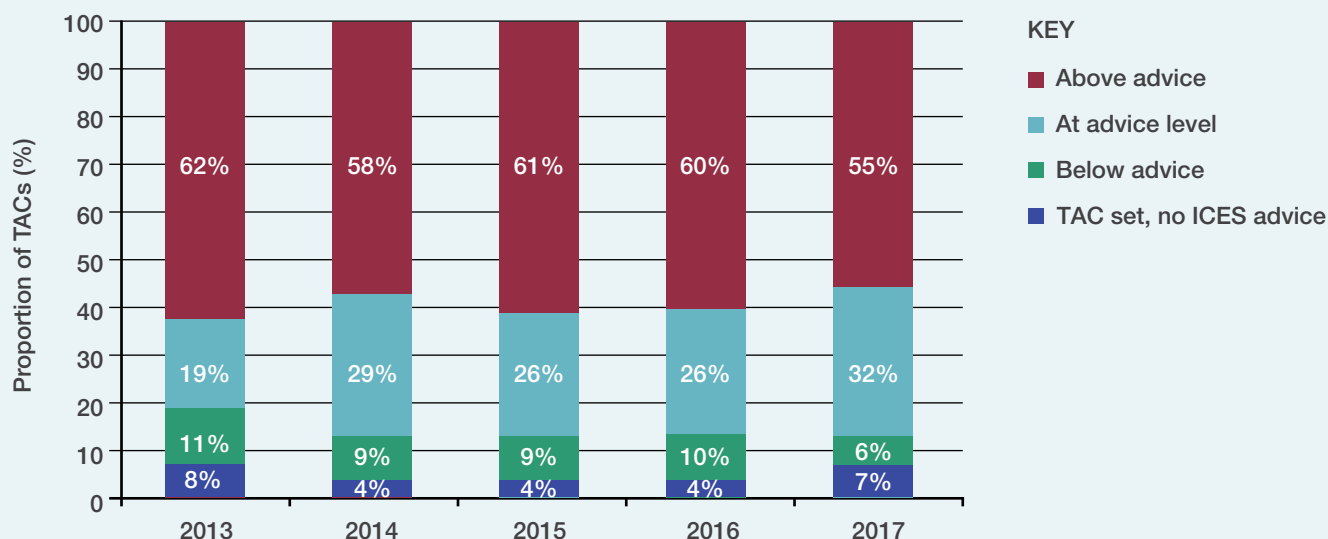
This is true for all five years analysed (Figure 2.1), indicating little improvement in the situation in the years from 2014 to 2016. 2017 sees some improvement, with the proportion of TACs set above advice falling by five percentage points (from 60% to 55%) and an increase in the number of TACs set at advised levels (26% to 32%)<sup>12</sup>.

#### **81 TACs (55%) were set above the ICES advice in 2017.**

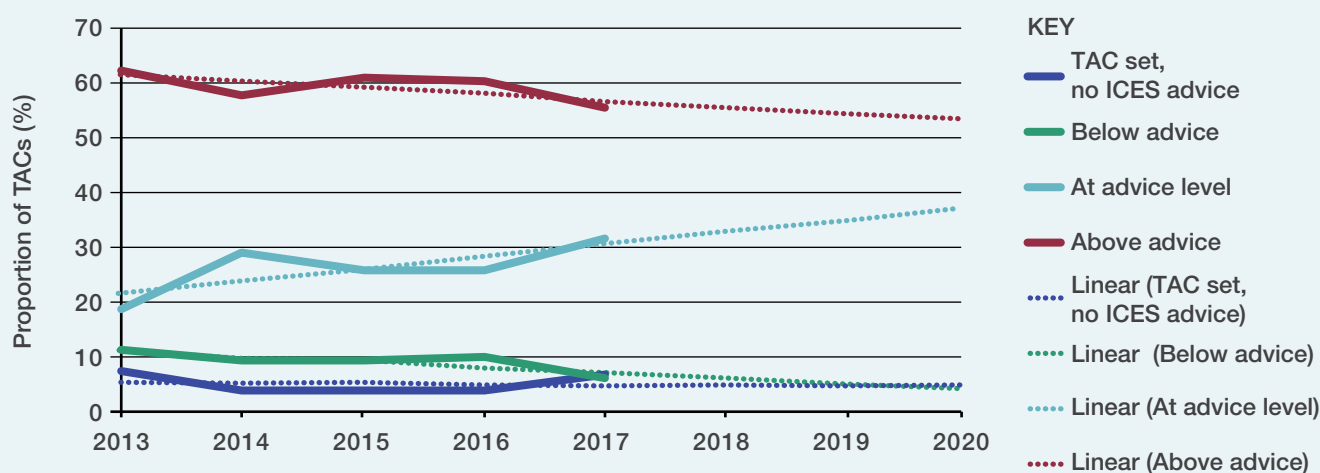
11 Clear socio-economic justification should be provided if the Commission or Council deviates from the scientific advice.

12 Results for 2016 and 2017 differ slightly from those presented within The Pew Charitable Trusts (2017) Analysis of Total Allowable Catches in the North-East Atlantic for 2017. This is due to Pew's 2017 analysis excluding certain stocks and our analysis combining results for North-East Atlantic, deep-sea species and the Baltic regions [http://www.pewtrusts.org/~media/assets/2017/03/20170307\\_pew\\_analysis\\_tac\\_2017.pdf?la=en](http://www.pewtrusts.org/~media/assets/2017/03/20170307_pew_analysis_tac_2017.pdf?la=en)

**Figure 2.1: Proportion of TACs set in relation to ICES advice from 2013 to 2017.**  
(Note: deep-sea species are excluded from the 2013 dataset.)



**Figure 2.2: Trend in proportion of TACs in relation to ICES advice and linear projections to 2020.**  
(Note: deep-sea species are excluded from the 2013 dataset.)



The highest number of TACs set above advice occurred in 2015 (92 TACs set above advice). A reduction within this category in 2017 came from seven more TACs being set at advice levels.

The number of TACs set without ICES advice dropped over the years 2013 to 2014, and has remained low since 2014, increasing slightly in 2017 when 10 stocks had TACs set in the absence of scientific advice (including five TACs that cover at least 10 species of skates and rays whose scientific advice could not be matched to TAC areas within the FishFix database). It should be noted that deep-sea species are excluded from the 2013 dataset, as information on scientific advice was not available in the FishFix database.

**By the CFP's 2020 deadline, over half of TACs would still be set above scientific advice if trends continue.**

The linear trends in TAC setting since the CFP reform (Figure 2.2) indicate that if these trends were to continue, over half of TACs would still be set above advice in 2020, in clear contravention of CFP requirements and negating opportunities resulting from earlier stock recovery.

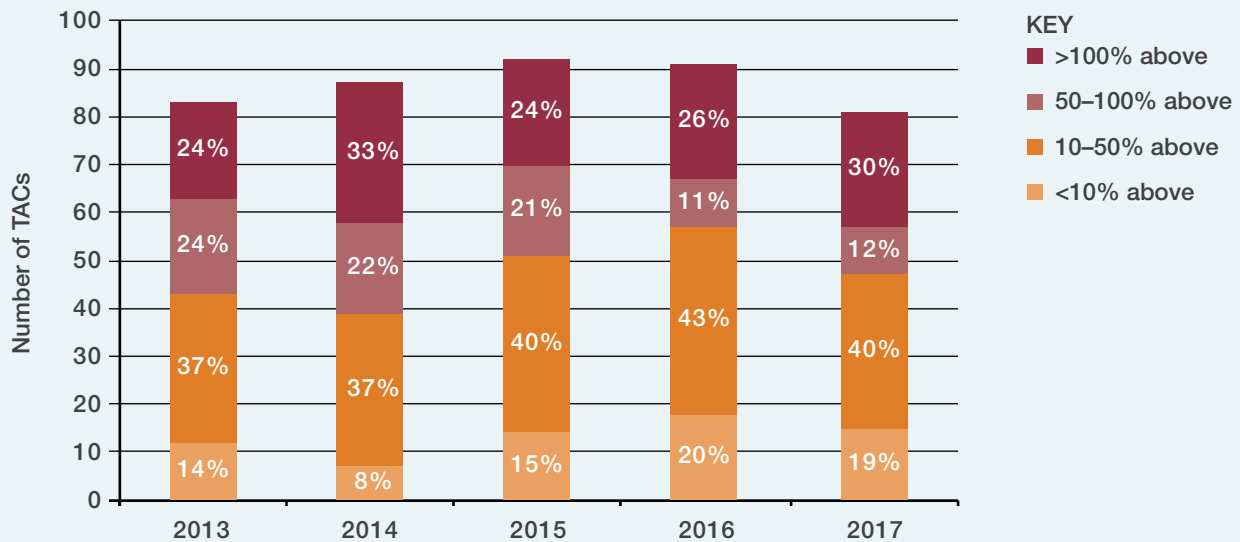
A five-year reference period is relatively short for linear trend analysis, and a longer reference period, were it analysed, may deliver different trajectories.

**In 2017 30% of TACs were more than double the scientific advice.**

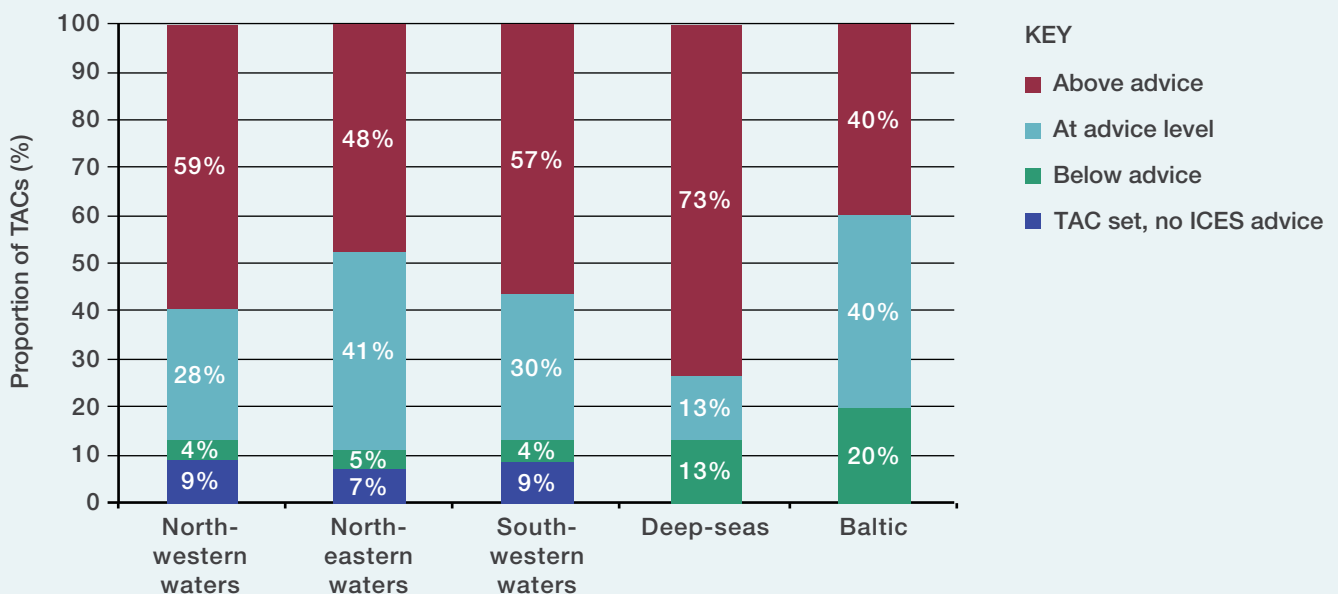
The number and proportion of TACs at which a TAC is set above advice is presented in Figure 2.3, indicating that in 2017 40% of TACs above advice were 10–50% above advice levels. Proportions within each band did not vary greatly from 2013 to 2017, with approximately



**Figure 2.3: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017.**



**Figure 2.4: Proportion of TACs set in relation to ICES advice by region, in 2017.**



one-quarter of all TACs above advice consistently being set at least 100% higher than advice levels<sup>13</sup>. In 2017, 11 TACs set >100% above advice related to TACs where zero catch was scientifically advised.

**The highest proportion of TACs set above advice are for deep-sea species.**

In 2017, TACs were set above advice in all regions analysed (Figure 2.4). The highest proportion of TACs above advice is seen for deep-sea species, followed by north-western and south-western waters. The highest proportion of stocks with TACs set at or below advice levels occurs in the Baltic (60%).

<sup>13</sup> The >100% above advice category includes TACs set when scientific advice is zero.

The regions discussed throughout this report are presented within Figure 2.5 and Table 2.1. Note that TACs for blue whiting and horse mackerel that extend across both the north-eastern and north-western regions are included within the north-western category as it accounts for the greater proportion of catches for both TACs/stocks.

**Table 2.1: Regions defined for the north-western, north-eastern, south-western, and Baltic Sea waters.**

Region	ICES areas and sub-divisions
North-eastern waters	2a, 3a, 4a-c
North-western waters	5a-b, 6ab, 7a-k, 12, 14a-b
South-western waters	8a-e, 9a-b, 10
Baltic Sea	22-32

**Figure 2.5: Geographic regions analysed: north-western, north-eastern, south-western, and Baltic Sea waters.**



### 2.3.2 How many tonnes of fish in excess TACs?

This section explores the excess tonnage, which is the quantity of fish that decision-makers allow to be landed over and above ICES advice. The figures in this section present only data for TACs that are set above advice (i.e. data for TACs set at or below advice is not included).

#### Exploring excess tonnage – important caveat

As Section 1.2.2 explains, bilateral or multilateral negotiations take place annually with third party countries (e.g. Norway, Iceland, Faroe Islands) to set the total TAC for stocks that are shared and/or jointly managed. The FishFix TAC database (Borges, 2017) records TACs in different ways in order to address the differing amounts of information available to the public. Most stocks are recorded as total TACs (i.e. TAC = EU quota plus all third country quota shares). However, for stocks where there is no agreement (i.e. third countries and EU act unilaterally in setting their respective fishing opportunities) the third country quota is removed. For example, in the Baltic, the estimated Russian shares (based on past agreements and historic catch shares; see Pew, 2016a) are removed. The totals should therefore be interpreted with care when

aggregating tonnages within species groups or across regions as the calculation of excess tonnage may differ<sup>14</sup>. The results are, however, indicative of the overall scale and trends in setting TACs above advice.

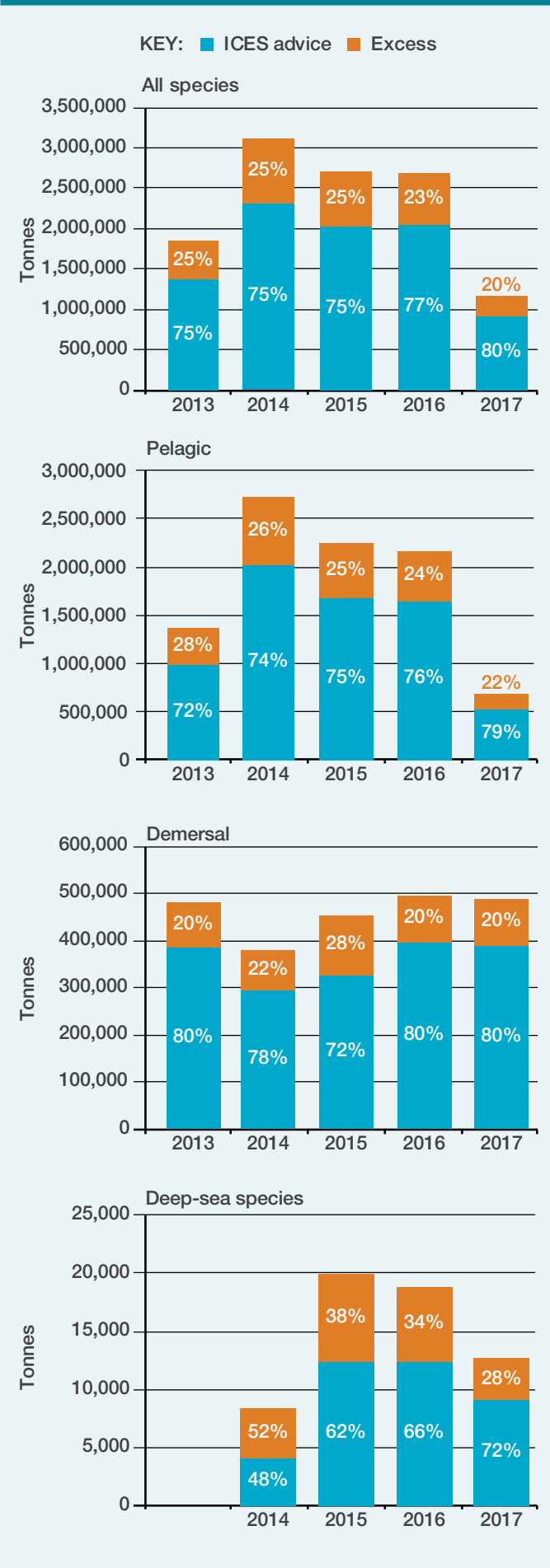
#### Results of excess tonnage analysis

**In 2017, the excess TAC for all species totalled 240,742 tonnes of fish, which is a reduction of 61% compared to 2016 when excess tonnage totalled 621,157 tonnes.**

The total annual tonnage for all TACs set above advice was similar from 2014 to 2016. A significant reduction is noted from 2016 to 2017 (Figure 2.6). The extent to which the tonnage for all species was above the scientific advice reduced to 20% in 2017, compared to 23% in 2016 and 25% in the previous three years. This improvement is mainly a result of the 2017 blue whiting TAC for EU and international waters of 1-7, 8abde, 12 & 14 being consistent with ICES advice for the first time since 2013.

<sup>14</sup> Specifically for Figures 2.6, 2.8, 2.9 and 2.10 and figures showing excess tonnage summed per species in Appendix B.

**Figure 2.6: Tonnage from TACs set higher than ICES advice, for all species combined and separated for pelagic, demersal and deep-sea species.**



The biggest differences in terms of total tonnage relate to pelagic species. This is to be expected as the catch volumes for pelagic species are far larger than for demersal or deep-sea species. An improvement (i.e. reduced excess TAC tonnage) is seen for pelagic species in the 2017 TACs; this is mainly due to the 2017 blue whiting TAC for EU and international waters of 1-7, 8abde, 12 & 14 being set in line with ICES advising a catch of 1.3 million tonnes, whereas the 2016 TAC was 48% above advice. The amount of excess tonnage for demersal species has been relatively constant. An increase in excess tonnage is noted for deep-sea species from 2014 to 2015, but decreases in excess tonnage are noted from 2016 to 2017.

A linear regression trend analysis was explored in relation to excess tonnage but the short time series, large inter-annual fluctuations and associated important caveat (provided above) made interpretation less meaningful than the analysis by numbers of TACs (as presented in Figure 2.2).

Trends for two stocks, cod in EU waters of 4 (North Sea), 2a (Norwegian Sea) and 3a (excluding Kattegat & Skagerrak), and mackerel in '5b, 6, 7 & 8abde' and 'international waters of 2a', are presented in Figure , illustrating the year-to-year variability for these stocks. The TAC for cod in the North Sea<sup>15</sup> and EU waters of the Norwegian Sea matched scientific advice in 2016, but was 7% higher than advice in 2017, although this represents an improvement from the 24% excess seen in 2015.

Scientific advice for mackerel in '5b, 6, 7 & 8abde' and 'international waters of 2a' has fluctuated over the five-year period examined. Despite scientific catch advice increasing by 120% from 2013 to 2014, the TAC has consistently remained above levels advised.

The trends noted for individual species and species groups are also evident at a regional level (Figure 2.8). There is a large variation in excess tonnage from 2013 to 2017 for north-western waters, which is primarily attributed to the blue whiting TAC<sup>16</sup> being set at advice levels in 2017. A significant reduction in excess tonnage is notable for the Baltic from 2016 to 2017. Total excess tonnage has decreased for north-eastern waters, specifically from 2014 to 2015, and for south-western waters from 2016 to 2017.

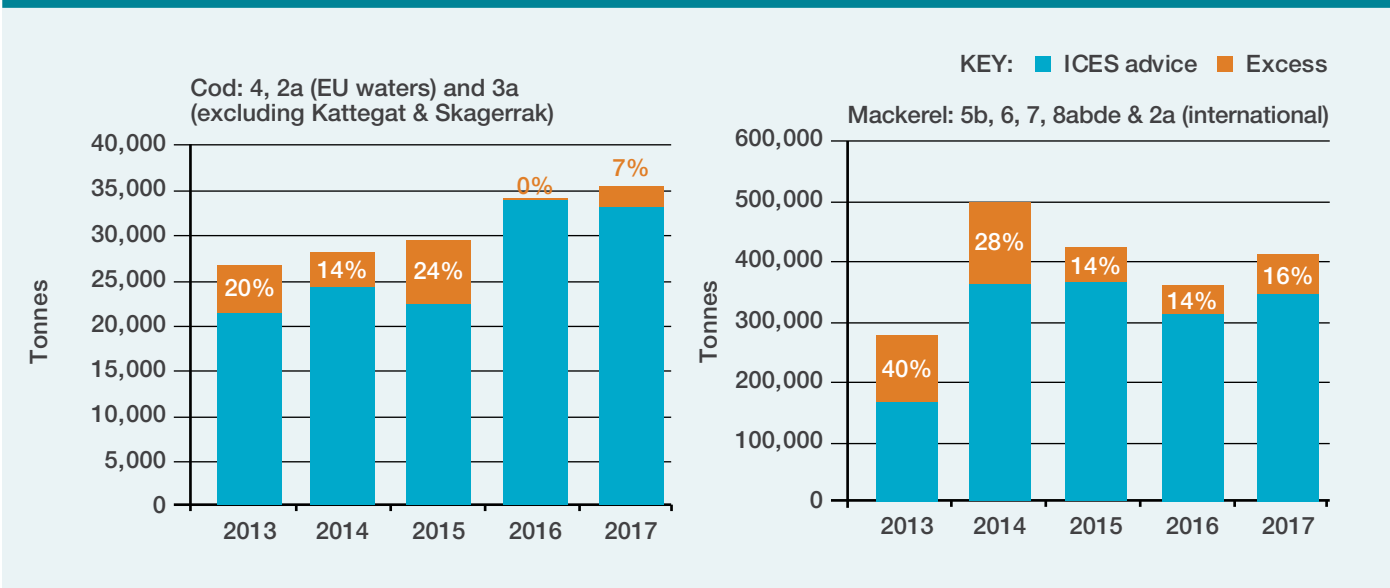
**Between 2013 and 2017 the average annual tonnage of fish permitted to be caught above scientific advice was approximately 562,000 tonnes.**

<sup>15</sup> Which is a shared stock between EU and Norway, and TAC analysis for this stock represents total TAC (i.e. EU plus Norway).

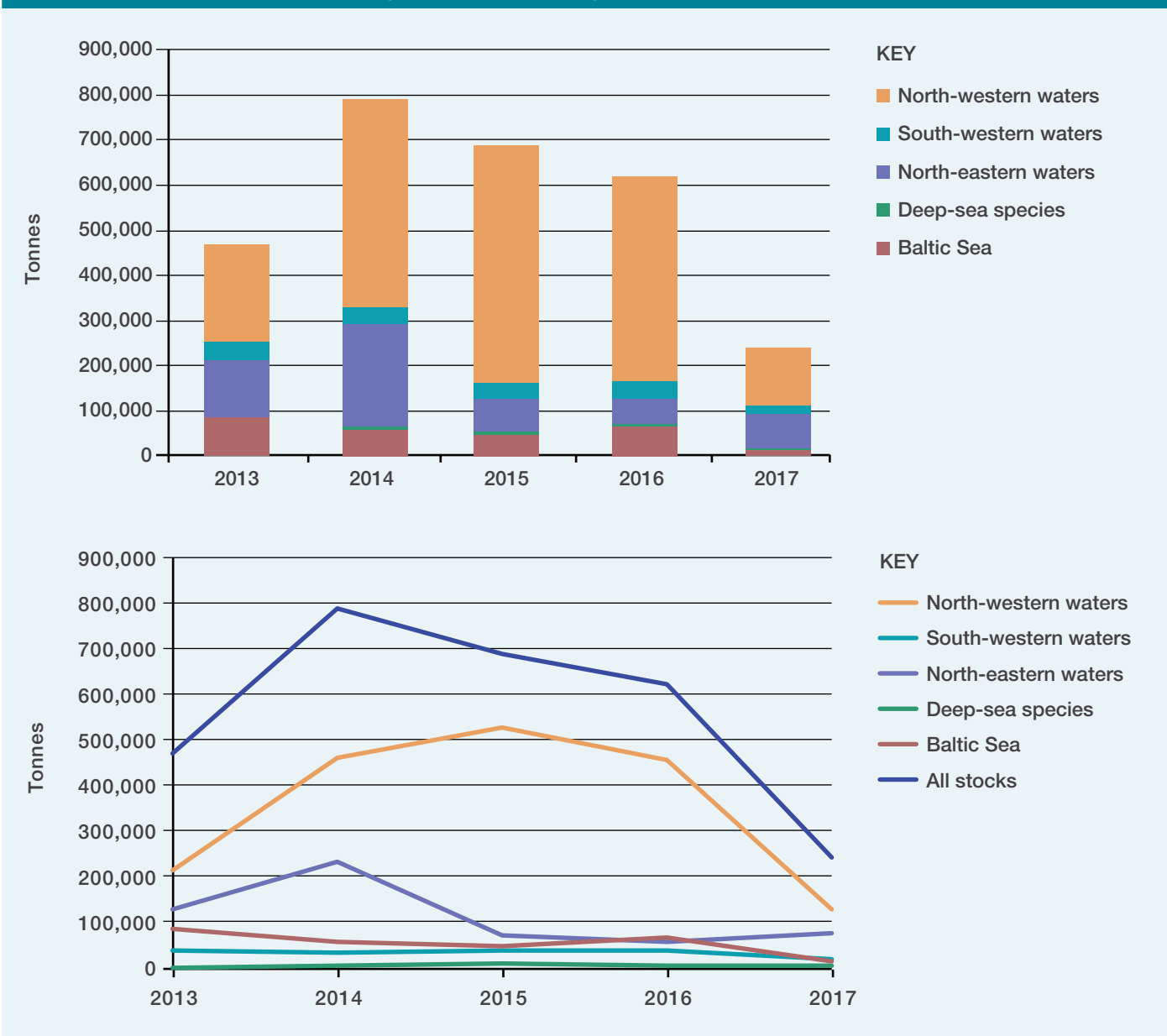
<sup>16</sup> For EU and international waters of 1, 2, 3, 4, 5, 6, 7, 8abde, 12 & 14.



**Figure 2.7: Tonnage from TACs set higher than ICES advice, for two species: cod in ICES Divisions 4, 2a (EU waters) & 3a (excluding Kattegat & Skagerrak); mackerel in 5b, 6, 7, 8abde & 2a (international waters).**



**Figure 2.8: Excess tonnage for TACs set above advice indicating region, presented as a combined total (top, bar chart) and for individual regions (bottom, line graph).**



**Figure 2.9: Tonnage of TACs set above advice categorised by the proportion of excess.**

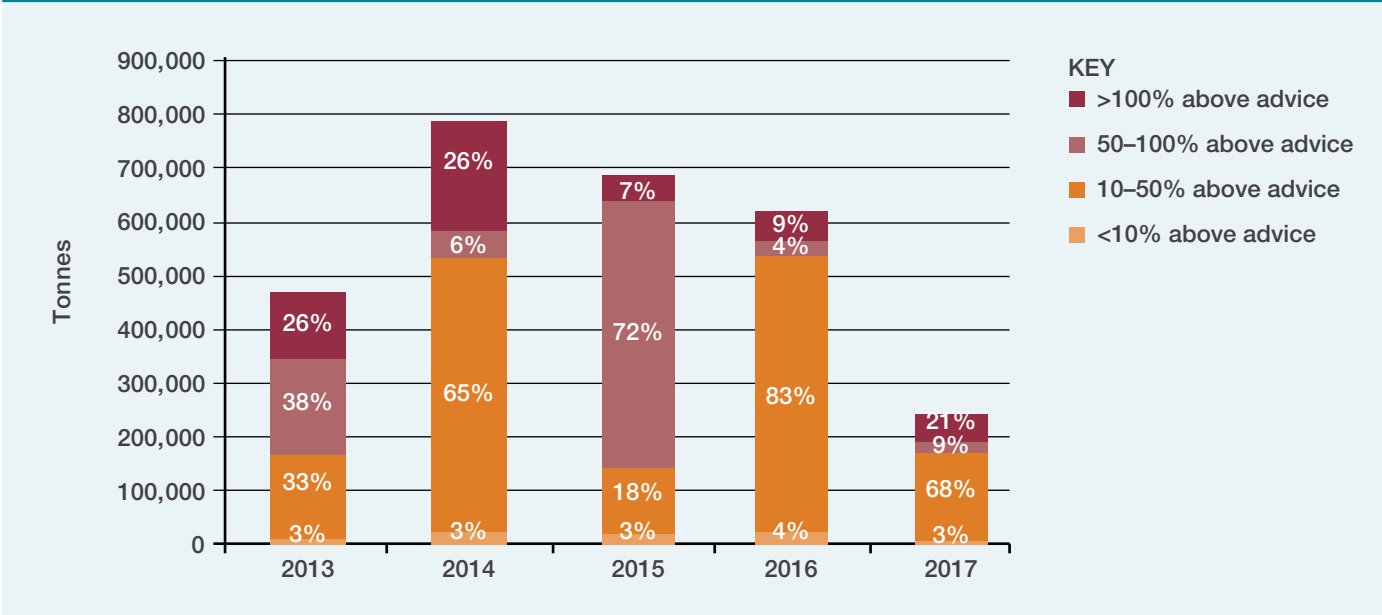


Figure 2.9 shows that in 2015, most TACs set above advice had an excess tonnage of 50–100% of the ICES-advised tonnage, while in 2017 most TACs that were set above advice had a tonnage that was 10–50% higher than that advised by ICES.

### 2.3.3 Advice and TACs for 2017

This section considers the current situation (2017) using the most recently available TACs and advice (used for setting those TACs).

#### In 2017, 81 TACs were set at levels above ICES advice (55% of stocks where advice was available, Figure 2.1).

46 TACs (32%) were set at the same level as scientific advice, nine (6%) were below advice and 10 TACs (7%) were set with no scientific advice available or advice that could not be matched to TAC areas (within the FishFix database)<sup>17</sup>. Figure 2.10 presents scientific advice and TACs in tonnes for individual species, for all stocks across the North-East Atlantic region.

For demersal stocks, species with notably higher TACs compared to ICES advice include plaice, cod, whiting, ling, dab and flounder, and pollack, while TACs for saithe and northern prawn are set below ICES advice (Figure 2.10). Some 2017 TACs have remained at zero, as advised by ICES (e.g. spurdog in the North Sea); others were set low for by-catch allowance (e.g. spurdog in north-western waters) or were prohibited (porbeagle and orange roughy).

#### Excess tonnage for demersal species amounted to 96,564 tonnes in 2017, 11% above scientific advice for all demersal species.

<sup>17</sup> It is noted that five TACs for skate/rays have scientific advice, but are not included within the FishFix database due to difficulties with matching advice with TAC areas.

For pelagic species in 2017 there is little difference between ICES advice and TACs (as Section 2.3.2 shows, the biggest recent reductions in excess TAC were for pelagic species, mainly blue whiting). Species that have TACs above ICES advice include mackerel, horse mackerel and sprat, with a total excess of 140,607 tonnes for all pelagic species, amounting to 4% above scientific advice for all pelagic species.

Most TACs for deep-sea species remain above advice, with the greatest discrepancies for roundnose/roughhead grenadier and greater forkbeard TACs. In total an excess of 3,571 tonnes were included within deep-sea species TACs. While this is a far lower tonnage than demersal and pelagic species, it represents a significantly larger discrepancy of 28% above scientific advice for all deep-sea species.

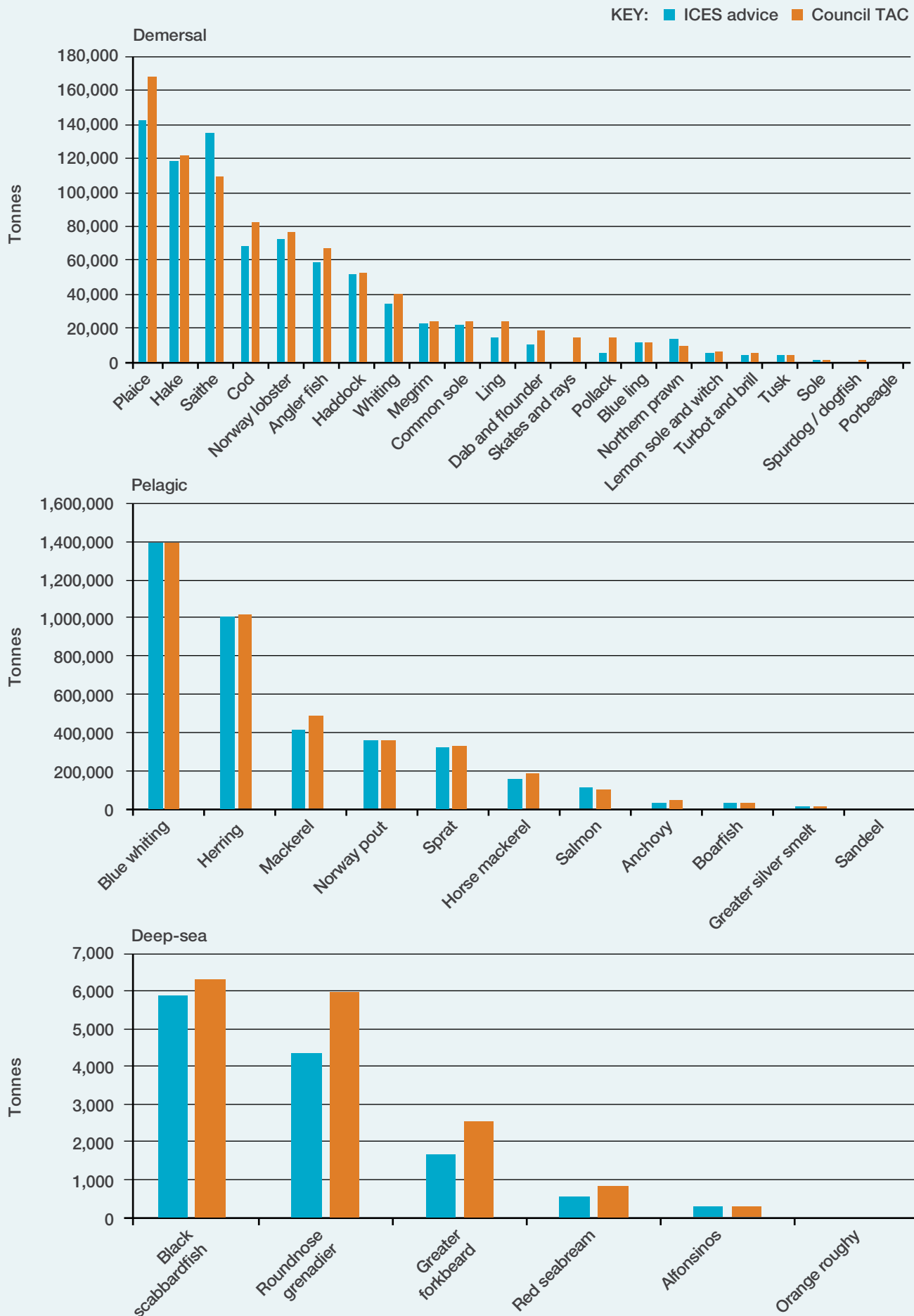
## 2.4 OBSERVATIONS

This analysis shows that since the reform of the CFP in 2013, when the objective of ending overfishing was set, more than half of European TACs in north-western waters have consistently been set above scientific advice.

This goes against CFP requirements that measures are “in accordance with the best available scientific advice” (Article 3c) and will mean that Europe foregoes benefits resulting from sustainable stocks.

The 2015 deadline to ensure stocks achieve MSY exploitation rate was missed (STECF, 2017) and current trends (see Figure 2.2) suggest nearly 60% of TACs will still be set above advice in 2020. The CFP will have failed in its objective and in the EU’s commitment to the UN Sustainable Development Goal:

**Figure 2.10: ICES advice and Council TACs for all stocks with TACs in 2017.**  
 (Note: includes TACs set below, at and above ICES advice.)





*“By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.”*

This stark forecast is consistent with the STECF (2017) report to the Commission that monitors the performance of the CFP based on observed fishing mortality rates: “...based on the set of assessed stocks included in the analyses, STECF notes that many stocks remain overfished and/or outside safe biological limits<sup>18</sup>, and that progress achieved until 2015 seems too slow to ensure that all stocks will be rebuilt and managed according to  $F_{MSY}$  by 2020.”

Across the five-year period analysed, the amount of quota fish that was allowed to be caught above scientific advice averaged 561,676 tonnes per year, which equates to 9% of the total EU catch<sup>19</sup>. The excess tonnage set via TACs has reduced in 2017 to 241,000 tonnes of fish, mainly due to the ICES catch advice for blue whiting showing a substantial increase to 1.3 million tonnes in 2017 from 0.8 million tonnes in 2016. The TAC set was then consistent with this advice for the first time since 2013.

Despite recent improvements in the North-East Atlantic, a major step change is required to reduce the proportion of TACs set above advice and reduce the number of TACs that are set without advice being available. There are opportunities for improved alignment of TACs with scientific advice across many demersal stocks, one pelagic species (mackerel) and numerous deep-sea species.

The STECF (2017) report recognises that “the majority of TACs are currently not supported by scientific advice based on  $B_{MSY}$  or  $B_{pa}$  reference values”, let alone  $B_{MSY}$  (see Section 3). In some cases, the scientific information to develop advice is lacking, which is partly due to scientific resources being prioritised towards the most important commercial species. This is understandable as resources for scientific assessment are limited. It may be too late to fully address these issues in time for the 2020 target, but increasing the resources available for fisheries science would help deliver the scientific advice required to adequately measure progress against the CFP objectives and will help to better manage Europe’s fish stocks.



The EU faces the dual challenge of the need to assess more stocks and the need for better information on all stocks to inform MSY-based stock assessments. Despite recent improvements, the scientific advice and subsequent management response falls short of that required by the CFP. There are several contributing factors.

The recent economic crisis put pressure on public spending for science, including the cost of fish stock assessments. The lack of cost recovery from industry is also limiting the scientific resources available

to deliver the better information that is required. In recovering the cost of fisheries management and science from the fishing industry, the EU is behind other areas of the world such as Iceland, New Zealand and Australia where cost recovery amounts to 65%, 39% and 36%, respectively (noting that the cost recovery in the EU is 0%) (Marchal *et al.*, 2016).

The mismatch between TAC and stock boundaries limits how the scientific advice can be applied: scientific advice is at the correct scale for species and stock boundaries, but the use of that advice is not accurate if TACs are set in relation to different boundaries. This prevents an appropriate and timely management response to the status of commercial species. For appropriate TAC-setting the EU should align stock management units with the known biological stock boundaries.

Some TACs have been set above advice when the advised reductions in TAC exceed the maximum annual variations set out in long-term management plans (e.g. North Sea plaice in 2017) or due to managers seeking to avoid closure of fisheries due to by-catch of a species facing zero catch advice (e.g. cod in the Kattegat which is primarily landed by the *Nephrops* fishery). While managers may consider this deviation from advice to be pragmatic, it risks hindering the recovery of stocks and goes against the CFP’s intended approach of following scientific advice. Clearer explanations of the reasons for deviating from advice would improve understanding and increase accountability.

There is a lack of transparency in the decision-making that occurs from scientific advice, through Commission proposals, to the TAC that is ultimately set. The analysis presented here is based on the FishFix database, which collated disparate information sources into a publicly accessible resource. Such aggregate information should be made available by European fisheries managers for them to determine performance in relation to CFP objectives and progress towards commitments.

<sup>18</sup> STECF defines “outside safe biological limits” as meaning that spawning stock biomass is less than  $B_{pa}$  (where  $B_{pa}$  is defined), or fishing mortality is greater than  $F_{pa}$  (where  $F_{pa}$  is defined) for the year in question.  
<sup>19</sup> Average of EU 28 catches 2013–15 (source: Eurostat [http://ec.europa.eu/eurostat/statistics-explained/index.php/Fishery\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Fishery_statistics)).

# 3. Progress towards the CFP goal to restore and maintain fish stocks above MSY

## 3.1 OBJECTIVE OF THIS SECTION

This section explores the progress towards the CFP goal to restore and maintain fish stocks above levels capable of producing MSY by assessing the status of fish stocks against biomass reference points.

## 3.2 METHODOLOGY

### 3.2.1 Biomass reference points

The reference point 'biomass of fish stocks at maximum sustainable yield' ( $B_{MSY}$ ) is a notional value around which stock size fluctuates when fished at  $F_{MSY}$  (ICES, 2016a). ICES may internally estimate  $B_{MSY}$  as part of biomass dynamic modelling for specific stocks, but this reference point is generally not available within scientific assessments. This is the key issue: how do you measure CFP progress when the appropriate measure is not available?

The biomass reference points<sup>20</sup> that are routinely reported by ICES include a limit point ( $B_{lim}$ , below which recruitment risks impairment), a precautionary approach point ( $B_{pa}$ , which offers a low probability of falling below  $B_{lim}$ ) and an MSY trigger point (MSY  $B_{trigger}$ , the lower bound of fluctuation around  $B_{MSY}$ ).

ICES considers that a sustainably fished stock will fluctuate

<sup>20</sup> Detailed definitions are provided in Appendix A.

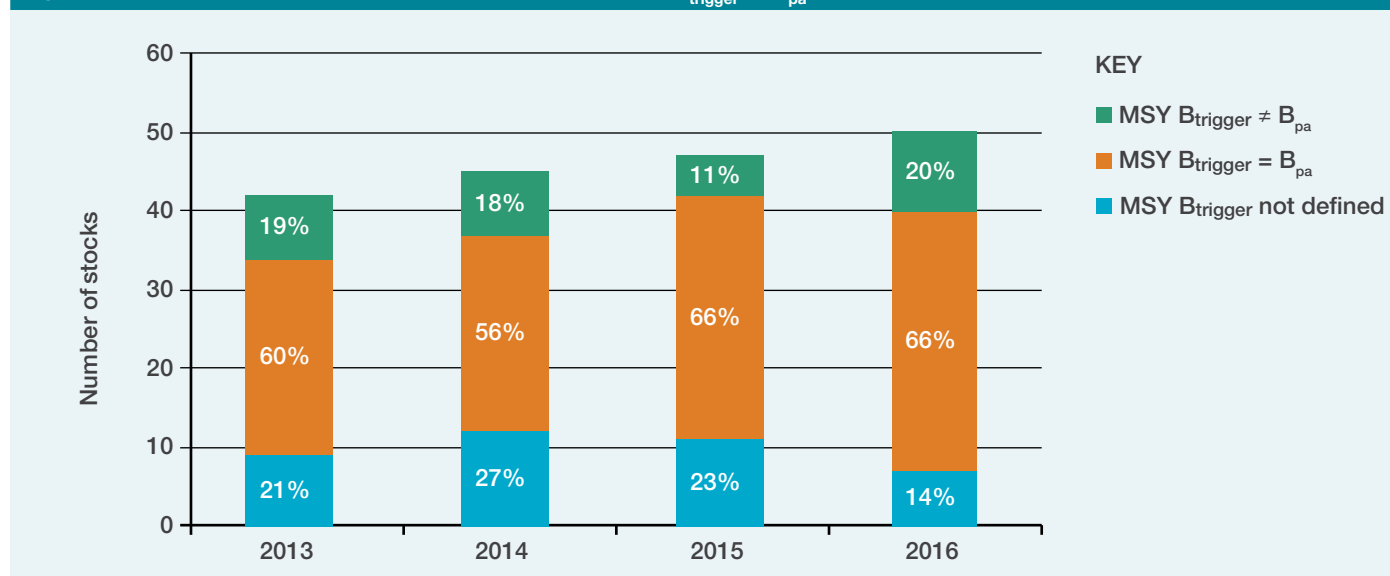
around  $B_{MSY}$ , so has defined MSY  $B_{trigger}$  as the point at which more restrictive management ( $F < F_{MSY}$ ) should be triggered. From a management perspective, this means action is taken when stock biomass is lower than  $B_{MSY}$ . Therefore, using MSY  $B_{trigger}$  (which is below  $B_{MSY}$ ) as a measure overestimates stock performance. Without  $B_{MSY}$  presented, the risk is that decision-makers and stakeholders consider MSY  $B_{trigger}$  to be a good enough reference for MSY, when in fact it is intended to be the lower bound of MSY.

Our analysis finds that two-thirds of the stocks have no MSY  $B_{trigger}$  estimates. In these instances, ICES uses  $B_{pa}$  as a proxy, and so measures stock status against the precautionary approach. In some instances this may be appropriate, however, generally  $B_{pa}$  is a lower bar than that required for the MSY, making it impossible to measure progress towards restoring stocks to above MSY. What is actually measured is the likelihood of whether stocks could fall below a point where recruitment begins to be impaired ( $B_{lim}$ ).

Figure 3.1 presents the number of stocks where MSY  $B_{trigger}$  equals  $B_{pa}$  from 2013 to 2016. Of the 50 stocks assessed in relation to MSY in 2016, for 66% of those stocks MSY  $B_{trigger}$  equals  $B_{pa}$ .

This research aims to present a measurement of stocks that is likely to be closer to the CFP commitment to biomass levels above MSY. In the absence of published official assessments, and the effort needed to assess

Figure 3.1: Number of assessed stocks where MSY  $B_{trigger} = B_{pa}$  from 2013 to 2016.





any stock-specific variations. It does, however, represent an approach to defining a reference point from which MSY can be benchmarked.

### When $B_{MSY}$ is modelled

When ICES applies the SPiCT (Stochastic Production model in Continuous Time) modelling method to a stock, the model generates an estimate of  $B_{MSY}$ . Further details on SPiCT modelling are provided within an ICES Workshop Report (ICES, 2015).

ICES uses this  $B_{MSY}$  estimate to calculate performance against the MSY  $B_{trigger}$  reference point, whereby MSY  $B_{trigger} = 0.5 B_{MSY}$ . Twelve stocks have SPiCT-generated values for  $B_{MSY}$ . These are:

- Anglerfish (*L. budegassa*): 7b-k & 8abd
- Anglerfish (*L. piscatorius*): 7b-k & 8abd
- Anglerfish (*L. piscatorius* and *L. budegassa*): 3a, 4 & 6
- Haddock: 7a
- Ling: 3a, 4a, 6-9, 12 & 14
- Megrin: 7b-k & 8abd
- Megrin: 6b
- Plaice: 7a
- Plaice: 7f-g
- Plaice: 7e
- Tusk: 3a, 4, 5b, 6a, 7-9 & 12b
- Tusk: 6b.

It would be useful to compare  $B_{MSY}$  for these 12 stocks against MSY  $B_{1.5}$  and MSY  $B_2$ . However,  $B_{pa}$  values (and often also spawning stock biomass (SSB) values) were not available for these stocks, preventing any such comparison.

### 3.2.2 Measuring progress

A biomass database was developed, primarily informed by ICES stock assessments. The analysis focused on a five-year period from 2013 to 2017. At the time of writing the 2017 ICES advice for 2018 was not available.

The database includes fields for:

- SSB (in tonnes)
- MSY  $B_{trigger}$  (in tonnes)
- $B_{lim}$  (in tonnes)
- $B_{pa}$  (in tonnes)
- MSY  $B_{1.5}$  (in tonnes) i.e.  $MSY B_{1.5} = 1.545 * B_{pa}$
- MSY  $B_2$  (in tonnes) i.e.  $MSY B_2 = 2 * B_{pa}$ .

Biomass (SSB, tonnes) and reference points for each year were obtained from the relevant annual ICES advice (2013–2016)<sup>22</sup>. This approach ensured that any changes in reference points across this period, (e.g. due to stock assessment model updates) can be identified. It also enables analysis of annual decision-making in relation

<sup>22</sup> i.e. as opposed to the approach of gaining SSB for all years (2013–2016) from only the latest ICES advice (2016) and comparing these to the latest reference points.

$B_{MSY}$  as the CFP requires, this analysis offers two alternative reference points for biomass: MSY  $B_{1.5}$  and MSY  $B_2$ . The basis for these is described below, but these alternatives are not scientifically derived from modelling and may under or overestimate  $B_{MSY}$ .

### MSY $B_{1.5}$

ICES applies a standard equation to  $B_{lim}$  to generate the  $B_{pa}$  reference point<sup>21</sup>. Our analysis considered this approach to find a standard multiplier between  $B_{pa}$  and an alternative MSY B reference point. Our multiplier of 1.545 for the sample of stocks under assessment was calculated as the median multiplier between  $B_{pa}$  and  $B_{lim}$  for all stocks from 2013 to 2016 i.e.  $B_{pa} = 1.545 * B_{lim}$ . To reflect a consistent step-change between reference points, this multiplier was applied to  $B_{pa}$  to generate an alternative MSY B reference point: MSY  $B_{1.5}$  i.e.

$$MSY B_{1.5} = 1.545 * B_{pa}$$

This method is straightforward but does not reflect any stock-specific variations, however, it does represent an approach that is expected to be closer to  $B_{MSY}$  than MSY  $B_{trigger}$ .

### MSY $B_2$

Froese *et al* (2016b) consider that a stock is fluctuating around MSY if biomass is at least twice the precautionary approach reference point ( $B_{pa}$ ).

A multiplier of 2 is therefore applied to  $B_{pa}$  to generate MSY  $B_2$  i.e.

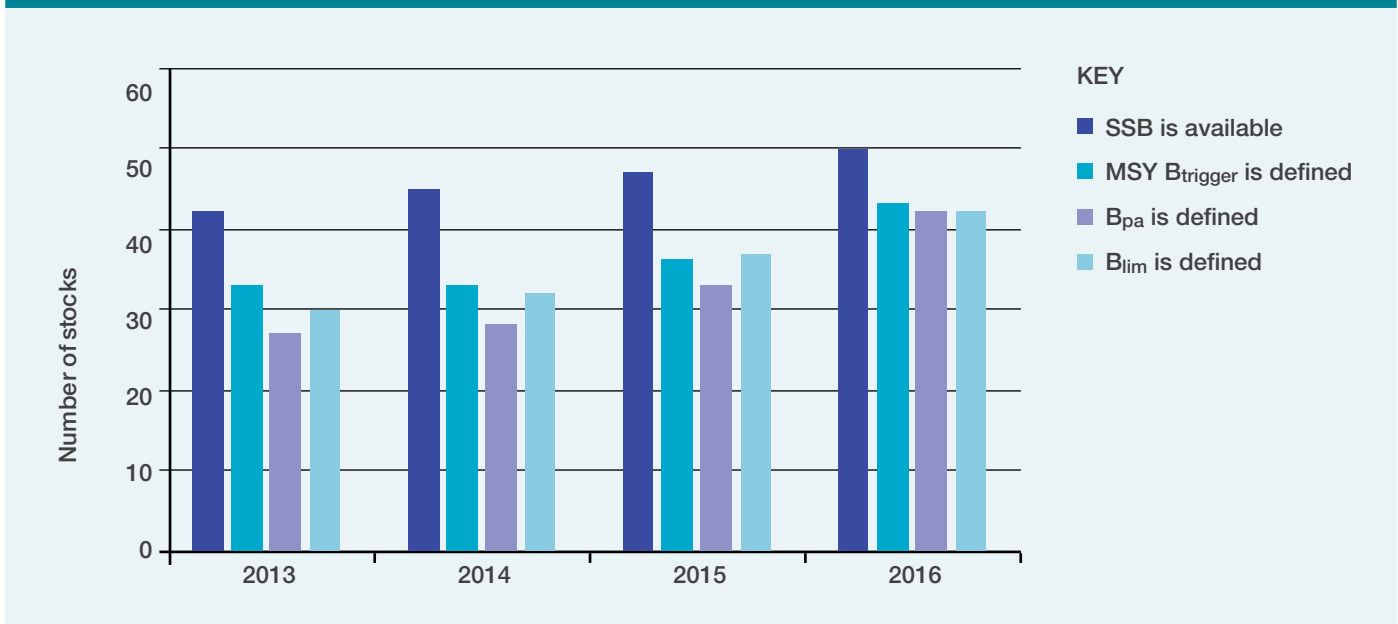
$$MSY B_2 = 2 * B_{pa}$$

Again, this method is straightforward but does not reflect

<sup>21</sup>  $B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$  where  $\sigma$  is the standard deviation of  $\ln(SSB)$  at the start of the year following the terminal year of the assessment. If  $\sigma$  is unknown 1.4 can be used as default for “ $\exp(1.645 \times \sigma)$ ”, equivalent to  $\sigma = 0.20$ . See: [http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/12.04.03.01\\_Reference\\_points\\_for\\_category\\_1\\_and\\_2.pdf](http://ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/12.04.03.01_Reference_points_for_category_1_and_2.pdf)



**Figure 3.2: Number of stocks where SSB, MSY  $B_{trigger}$ ,  $B_{pa}$  and  $B_{lim}$  are available, based on analysis of stock assessments for 146 stocks, noting that a stock falls into all or some of these categories at the same time.**



to the data available in that given year rather than retrospective changes.

The assessment focuses on the proportion of stocks that are at, below or above the three MSY reference points being considered i.e. MSY  $B_{trigger}$ , MSY  $B_{1.5}$ , and MSY  $B_2$ .

The following stocks were included in the analysis:

- Stocks that have a stock assessment, a SSB value and defined or undefined reference points.

The following were removed from the analysis:

- Stocks that have no stock assessment; and
- Stocks that have no SSB value.

### 3.3 RESULTS

#### 3.3.1 Biomass data available within stock assessments

In total, 146 stocks are included in the biomass database. These 146 stock assessments were analysed for each year from 2013 to 2016. Of these stocks, 50 had a defined quantity for SSB in 2016 and 42 had a defined reference point for MSY  $B_{trigger}$  (Figure 3.2).

**ICES has defined  $B_{MSY}$  for a small number of stocks through modelling, however this  $B_{MSY}$  data is not readily available from stock assessments, with MSY  $B_{trigger}$  reported as a factor of  $B_{MSY}$ .**

**Less than one-third of the fish stocks in the North-East Atlantic region can currently be assessed to determine their status in relation to MSY  $B_{trigger}$  and our alternative reference points of MSY  $B_{1.5}$  and MSY  $B_2$ .**

#### 3.3.2 Defining an appropriate reference point to determine MSY

As only one-third of North-East Atlantic stocks have biomass reference points estimated, the biomass analysis within this report section is only on this subset of stocks (i.e. not the full set of stocks assessed within the TAC analysis in Section 2)<sup>23</sup>. However, the reference points that are currently used for those stocks are not sufficient to measure whether the CFP objective is being met.

ICES assesses MSY based on the MSY  $B_{trigger}$  reference point, which represents the lower limit of  $B_{MSY}$ . The CFP commitment is to ensure stocks are “*above biomass levels capable of producing maximum sustainable yield*”.

To determine whether stocks are likely to be above MSY, it would be more appropriate to consider  $B_{MSY}$  reference points that are above the MSY lower bound of fluctuation (MSY  $B_{trigger}$ ) and certainly above a precautionary level ( $B_{pa}$ ).

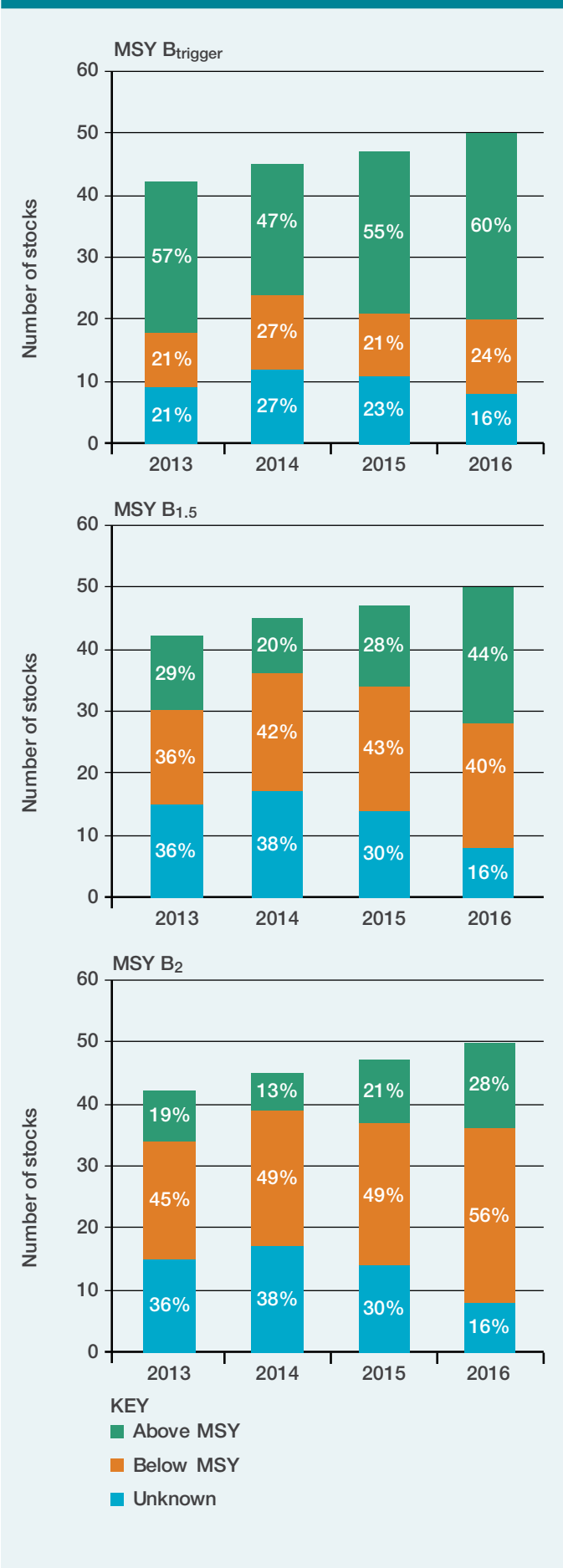
The trend in stock status in relation to these different biomass reference points (MSY  $B_{1.5}$  and MSY  $B_2$ ) is depicted in Figure 3.3. For the 50 stocks analysed in 2016, the number of stocks below each benchmark was as follows:

- 24% are below MSY  $B_{trigger}$  (12 stocks);
- 40% are below MSY  $B_{1.5}$  (20 stocks); and
- 56% are below MSY  $B_2$  (28 stocks).

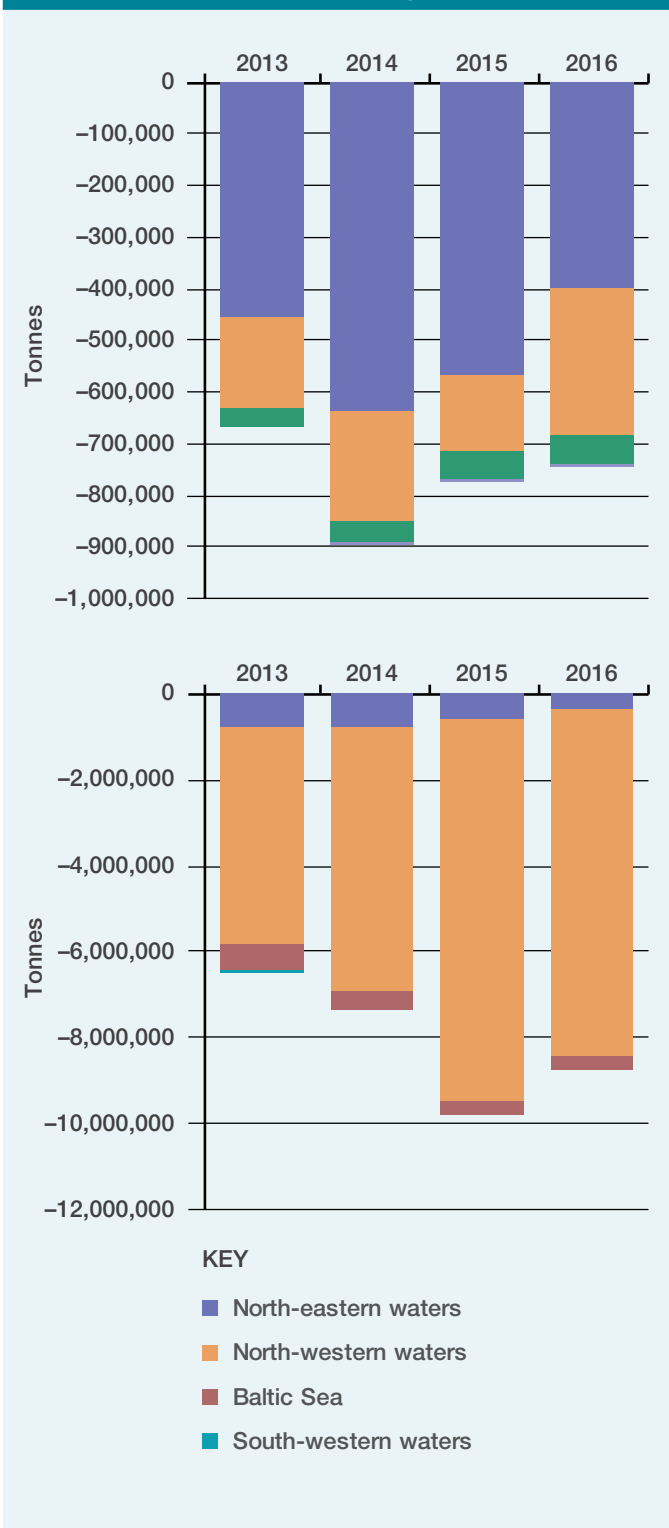
Using MSY  $B_2$  as the benchmark for assessing the status of stocks results in more than double the number of stocks not meeting the benchmark.

<sup>23</sup> This is due to a variety of reasons, including measuring and sampling but also methodology and the need for a longer time series of stocks being fished at FMSY to allow BMSY to be measured.

**Figure 3.3: Classification of biomass status by year: number of stocks above and below reference points for MSY  $B_{trigger}$  (top); MSY  $B_{1.5}$  (centre); and MSY  $B_2$  (bottom).**



**Figure 3.4: Tonnes of SSB below MSY  $B_2$  by region for demersal species (top) and pelagic species (bottom).**



The stocks analysed with an undefined reference point are described as 'unknown' within Figure 3.3, as its status relative to the reference value is unknown i.e. for the MSY  $B_{trigger}$  graph, MSY  $B_{trigger}$  is undefined and for the MSY  $B_{1.5}$  and MSY  $B_2$  graphs,  $B_{pa}$  is undefined.

Figure 3.4 shows the tonnage of SSB below MSY  $B_2$  by year, region and species group. It is mainly pelagic species that are found to have SSB greater than the MSY  $B_2$  alternative reference point.



### 3.4 OBSERVATIONS

This study highlights the uncertainties and shortcomings in the reference points that are used to determine progress towards the CFP biomass objective of restoring stocks above levels that can produce maximum sustainable yield. Most stocks lack the information to enable assessment and the reference points currently used are inadequate to properly measure MSY.

Less than one-third of the fish stocks in the North-East Atlantic region can currently be assessed to determine their status in relation to MSY  $B_{trigger}$ .

Adopting MSY  $B_{trigger}$  as the reference point for assessing stock status does not inform decision-makers that biomass is above levels capable of producing MSY, as required for the CFP objective, as MSY  $B_{trigger}$  is the lower bound of fluctuations around  $B_{MSY}$ . Conversely, reporting on this lower level presents a more positive picture than reality.

It is impossible for decision-makers (and others) to assess whether the CFP objective is being met as appropriate estimates of  $B_{MSY}$  are lacking.

For two-thirds (66%) of stocks that have a defined MSY  $B_{trigger}$ , the value used is the same as  $B_{pa}$ , which is concerning as  $B_{pa}$  simply relates to a low probability of recruitment impairment. This falls far short of an adequate measure of stocks in relation to MSY.

This research explored alternative MSY reference points, with the most conservative (MSY  $B_2$ ) advocated by other researchers (e.g. Froese *et al*, 2016b). Using this alternative MSY reference point for the few stocks with adequate information to enable an estimate, resulted in 56% of those stocks being considered likely to be below MSY.

Significant additional effort is required to model and estimate  $B_{MSY}$  reference points for EU stocks. A more appropriate MSY reference point should be adopted in the short term, such as MSY  $B_2$ , until actual  $B_{MSY}$  estimates become available.

**“This study highlights the uncertainties and shortcomings in the reference points that are used to determine progress towards the CFP biomass objective of restoring stocks above levels that can produce maximum sustainable yield.”**

# 4. Conclusions

**This report illustrates that, while there is progress towards the CFP objective of ending overfishing as a means to restore and maintain biomass above MSY levels, that progress is inadequate and too slow.**

The managed recovery of stocks to achieve the CFP objective is hindered by:

- (a) More than half of TACs continuing to be set above scientific advice;
- (b) A lack of scientific information to enable adequate assessment; and
- (c) Inadequate biomass reference points to measure progress towards MSY.

These are further detailed below.

## **a. TACs above scientific advice**

**In 2017, 81 TACs (55%) are set above ICES advice (down from 61% in 2015).**

2017 saw improvement, but still over half the TACs are set above the scientific advice provided by ICES. The 2015 deadline was missed and the slow progress suggests that the second 2020 deadline might not be met if decision-makers do not increase their efforts to set fishing limits in line with scientific advice.

**In 2017 nearly 30% of TACs set above advice were more than double the scientific advice.**

The greatest differences are seen in pelagic species, but the highest proportion of TACs set above advice is for deep-sea species. Annual variations in TACs in relation to scientific advice are also evident for individual stocks.

**Between 2013 and 2017 an average of 562,000 tonnes of quota fish per year were permitted by the Council of Ministers to be caught above scientific advice.**

Increased transparency in decision-making around TAC setting would lead to greater accountability.

## **b. A lack of scientific information**

**There are only 12 stocks (<10% of stocks with TACs set) for which ICES has developed a  $B_{MSY}$  estimate.**

When ICES applies the SPiCT modelling method to a stock, the model generates an estimate of  $B_{MSY}$ . However, for these 12 stocks,  $B_{pa}$  values (and often also SSB values) were not available, preventing comparison against  $MSY B_{1.5}$  and  $MSY B_2$ .

**In 2017, 10 TACs (7%) were set with no ICES advice (down from 19% in 2013), noting this includes five TACs for skates/rays whose advice could not be matched to TAC areas within the FishFix database.**

Additional resources must be applied in fisheries science to ensure appropriate management through TACs that are set based on scientific advice and for that advice to be adequate (see point c, below).

This research faced considerable challenges in collating and interpreting the data to enable this analysis of progress. There were also a variety of challenges in assessing CFP progress due to the complex process of TAC setting (see Section 2.2.4 for further details).

In addition to improved scientific information, the accessibility of that information could be improved. This will allow more effective monitoring of progress towards CFP objectives. It is also important that the complex subject of assessing stocks and setting TACs, which is fundamental to achieving sustainable fish stocks, is monitored and communicated more effectively.

## **c. Inadequate MSY reference points**

As the CFP objective is to restore and maintain stocks above MSY, it is not sufficient to measure progress towards this goal by using the lower limit of an estimated MSY range. This is certainly the case for most stocks where the MSY reference points are in fact the same as precautionary reference points.

Additional research effort is required to determine  $B_{MSY}$  for most stocks, which should be used as the basis for determining progress towards the CFP's goal.

**Only one-third of assessed stocks (42) have MSY advice relating to biomass.**

The progress to date, where 24% of stocks remain below  $MSY B_{trigger}$ , is in fact even more limited when more appropriate alternative reference points of  $MSY B_{1.5}$  or  $MSY B_2$  are used.

**Of the 50 stocks with SSB values, 56% are below MSY when  $MSY B_2$  is used as the MSY reference point.**

These findings highlight the inadequacy of both the information available and the progress being made towards the CFP objective.



**“In addition to improved scientific information, the accessibility of that information could be improved. This will allow more effective monitoring of progress towards CFP objectives. It is also important that the complex subject of assessing stocks and setting TACs, which is fundamental to achieving sustainable fish stocks, is monitored and communicated more effectively.”**





## 5. References

Borges, L., 2017. TAC Database for 2010 to 2017. Version dated 20 February 2017. <http://fishfix.eu/projects.html>

Carpenter, G. and Kleinjans, R., 2017. Who Gets to Fish? The Allocation of Fishing Opportunities in EU Member States. <http://neweconomics.org/wp-content/uploads/2017/03/Carpenter-Kleinjans-Who-gets-to-fish-16.03.pdf>

Carpenter, G. and Kleinjans, R., 2015. Landing the blame: Overfishing in EU waters 2001–2015. London: New Economics Foundation. Retrieved from: [https://www.researchgate.net/publication/281450725\\_Landing\\_the\\_blame\\_Overfishing\\_in\\_EU\\_waters\\_2001-2015](https://www.researchgate.net/publication/281450725_Landing_the_blame_Overfishing_in_EU_waters_2001-2015)

Client Earth, 2016. Mismatch between TACs and ICES advice: Why it is an issue and how to address it. [https://www.researchgate.net/publication/281450725\\_Landing\\_the\\_blame\\_Overfishing\\_in\\_EU\\_waters\\_2001-2015](https://www.researchgate.net/publication/281450725_Landing_the_blame_Overfishing_in_EU_waters_2001-2015)

European Commission, 2013. Ending overfishing: much to celebrate, much to do. [https://ec.europa.eu/dgs/maritimeaffairs\\_fisheries/magazine/en/policy/ending-overfishing-much-celebrate-much-do](https://ec.europa.eu/dgs/maritimeaffairs_fisheries/magazine/en/policy/ending-overfishing-much-celebrate-much-do)

European Commission, 2016a. Consultation on the fishing opportunities for 2017 under the Common Fisheries Policy. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016DC0396>

European Commission, 2016b. Establishing a mixed fishery multi-annual plan for demersal stocks and their fisheries in the North Sea.

European Parliament, 2016. The Common Fisheries Policy Origin: policies and development. [http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuld=FTU\\_5.3.1.html](http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuld=FTU_5.3.1.html)

European Union, 2012. Council Regulation (EU) No 1243/2012 of 19 December 2012 amending Regulation (EC) No 1342/2008 establishing a long-term plan for cod stocks and the fisheries exploiting those stocks. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R1243&from=EN>

European Union, 2013. Council 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. <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013R1380>

European Union, 2017. Council Regulation (EU) 2017/127 of 20 January 2017 fixing for 2017 the fishing opportunities for certain fish stocks and groups of fish stocks, applicable in Union waters and, for Union fishing vessels, in certain non-Union



waters. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0127&from=EN>

Eurostat, 2017. Fishery statistics. [http://ec.europa.eu/eurostat/statistics-explained/index.php/Fishery\\_statistics](http://ec.europa.eu/eurostat/statistics-explained/index.php/Fishery_statistics)

Froese, R., Garilao, C., Winker, H., Coro, G., Demirel, N., Tsikliras, A., Dimarchopoulou, D., Scarcella, G. and Sampang-Reyes, A., 2016a. Exploitation and status of European stocks. <http://oceanrep.geomar.de/34476/>

Froese, R., Coro, G., Kleisner, K. and Demirel, N., 2016b. Revisiting safe biological limits in fisheries. *Fish and Fisheries*.

ICES, 2015. Report of the Workshop to consider MSY proxies for stocks in ICES category 3 and 4 stocks in Western Waters (WKProxy), 3–6 November 2015, ICES Headquarters, Copenhagen. ICES CM 2015/ACOM:61. 183pp. <https://www.ices.dk/sites/pub/Publication%20Reports/Expert%20Group%20Report/acom/2015/WKProxy/01%20WKProxy%20Report.pdf>

ICES, 2016a. Advice Basis. [http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Introduction\\_to\\_advice\\_2016.pdf](http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Introduction_to_advice_2016.pdf)

ICES, 2016b. Report of the Workshop to consider FMSY ranges for stocks in ICES categories 1 and 2 in Western Waters (WKMSYREF4), 13–16 October 2015, Brest, France. ICES CM 2015/ACOM:58. 187pp.

Marchal, P., Andersen, J.L., Aranda, M., Fitzpatrick, M., Goti, L., Guyader, O., Haraldsson, G., Hatcher, A., Hegland, T.J., Le Floc'h, P., Macher, C., Malvarosa, L., Maravelias, C.D., Mardle, S., Murillas, A., Nielsen, J.R., Sabatella, R., Smith, A.D.M., Stokes, K., Thøgersen, T. and Ulrich, C., 2016. A comparative review of fisheries management experiences in the European Union and in other countries worldwide: Iceland, Australia, and New Zealand. *Fish Fish*, 17: 803–824.

Nimmo, F., Cappell, R. and Lowe, A., 2016. Management works – the benefits of ending overfishing. Report produced by Poseidon Aquatic Resource Management Ltd for The Pew Charitable Trusts.

NOAA Fisheries, 2016. Status of Stocks 2016 Annual Report to Congress on the Status of U.S. Fisheries.

OECD, 2001. Glossary: Total Allowable Catch. <https://stats.oecd.org/glossary/detail.asp?ID=2713>

Pauly, D., Christensen, V., Dalsgaard, J., Froese R. and Torres, F., 1998. "Fishing Down Marine Food Webs." *Science* 279(5352): 860–863.

Scottish Government, 2016. Allocating & Managing Scotland's Quota. <http://www.gov.scot/Topics/marine/Sea-Fisheries/management/17681>

STECF, 2017 Monitoring the Performance of the Common Fisheries Policy. <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/scientific-technical-and-economic-committee-fisheries-stecf-monitoring-performance-common-1>

The Pew Charitable Trusts, 2015. Turning the Tide - MSY Explained. [http://www.pewtrusts.org/~media/assets/2015/03/turning\\_the\\_tide\\_msy\\_explained.pdf](http://www.pewtrusts.org/~media/assets/2015/03/turning_the_tide_msy_explained.pdf)

The Pew Charitable Trusts, 2016a. Setting sustainable Baltic fishing opportunities for 2017 for further details on assumptions used for estimating Russian shares. <http://www.pewtrusts.org/~media/assets/2016/08/20160727pewpositionbaltictac2017.pdf?la=en>

The Pew Charitable Trusts, 2016b. Harvest Strategies Glossary. [http://www.pewtrusts.org/~media/assets/2016/07/harvestglossary\\_fs\\_v3.pdf](http://www.pewtrusts.org/~media/assets/2016/07/harvestglossary_fs_v3.pdf)

United Nations, 2002. Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26 August–4 September 2002.

United Nations, 2017. Sustainable Development Goals: Goal 14: Conserve and sustainably use the oceans, seas and marine resources. <http://www.un.org/sustainabledevelopment/oceans/>

World Bank, 2017. The Sunken Billions Revisited: Progress and Challenges in Global Marine Fisheries. Washington, DC: World Bank. Environment and Sustainable Development series.

#### **ICES advice:**

ICES advice for 2013 to 2017 for the following species: alfonosinos, anchovy, anglerfish, black scabbardfish, blue ling, blue whiting, boarfish, cod, dab and flounder, greater forkbeard, greater silver smelt, haddock, hake, herring, horse mackerel and associated by-catches, lemon sole and witch, ling, mackerel, megrim, northern prawn, norway lobster, norway pout and associated by-catches, orange roughy, plaice, pollack, porbeagle, red seabream, roughhead grenadier, roundnose grenadier, saithe, salmon, sandeel, skates and rays, sole, sprat and associated by-catches, spurdog/dogfish, turbot and brill, tusk, and whiting.

Available at: <http://www.ices.dk/community/advisory-process/Pages/Latest-Advice.aspx>

# Appendix A: Glossary

**Biomass (B):** This is the combined weight (in tonnes) of all the fish of one specific stock (including all ages and all genders of fish).

**B<sub>lim</sub>:** This is the limit biomass reference point, below which the stock has reduced reproductive capacity and an increased risk of stock collapse.

**B<sub>MSY</sub>:** This is the biomass reference point that enables a fish stock to deliver its Maximum Sustainable Yield. In theory, B<sub>MSY</sub> is the population size at the point of maximum growth rate. A fish stock can be expected to reach B<sub>MSY</sub> when fishing mortality is consistent with F<sub>MSY</sub> for a long period of time. It should be noted that ICES does not provide information on B<sub>MSY</sub> as part of its advice.

**B<sub>pa</sub>:** This is the precautionary biomass reference point designed to have a low probability of being below B<sub>lim</sub>. If the SSB is above this reference point, ICES considers that the stock has full reproductive capacity. ICES use a factor of B<sub>lim</sub> to define B<sub>pa</sub><sup>24</sup>.

**Fishing mortality (F):** This is the proportion of fish within a stock that are caught and removed from it by fishing. Figure A.1 depicts fishing mortality reference points, which are defined below.

**F<sub>lim</sub>:** This is the limit reference point for fishing mortality, representing the maximum level of fishing mortality, above which the capacity of self-renewal of the stock is impaired and there is risk of stock collapse.

**F<sub>MSY</sub>:** This is the maximum rate of fishing mortality allowing a population size to eventually reach or maintain B<sub>MSY</sub> within a single stock, usually across a long time frame. F<sub>MSY</sub> is set at a constant rate, which is different for each stock, and can be applied to any stock that is not impaired in its reproductive capacity.

**Maximum Sustainable Yield (MSY):** is the largest yield (catch, in tonnes) that can be taken from a specific fish stock over an indefinite period under constant environmental conditions (adapted from European Commission, 2016a).

**MSY B<sub>1.5</sub>:** A reference point defined within this research whereby  $MSY B_{1.5} = 1.545 * B_{pa}$ .

<sup>24</sup>  $B_{pa} = B_{lim} \times \exp(1.645 \times \sigma)$ . Where  $\sigma$  is the standard deviation of  $\ln(SSB)$  at the start of the year following the terminal year of the assessment. If  $\sigma$  is unknown 1.4 can be used as default for " $\exp(1.645 \times \sigma)$ ", equivalent to  $\sigma = 0.20$ . ICES, 2017. ICES fisheries management reference points for category 1 and 2 stocks.

**MSY B<sub>2</sub>:** A reference point defined within this research whereby  $MSY B_2 = 2 * B_{pa}$ .

**MSY B<sub>trigger</sub>:** ICES considers that a sustainably fished stock will fluctuate around B<sub>MSY</sub>, so has defined MSY B<sub>trigger</sub> as the lower bound of this fluctuation (ICES, 2016a) and the point at which management should be triggered. ICES measures the status of a stock against MSY B<sub>trigger</sub>. When MSY B<sub>trigger</sub> is not available, ICES often uses B<sub>pa</sub> as a proxy.

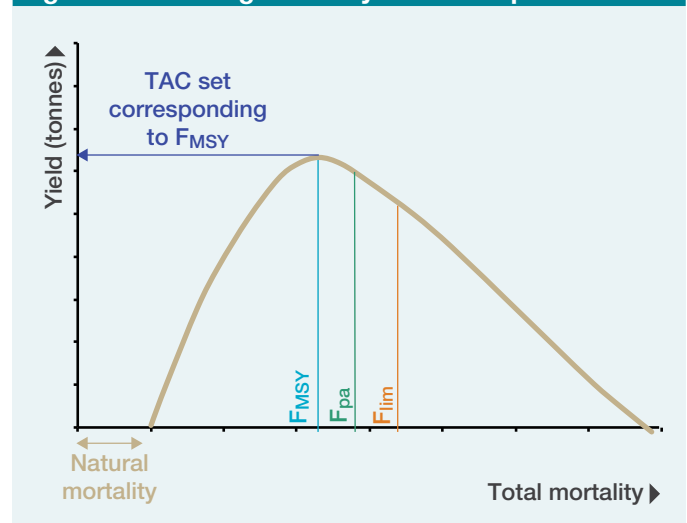
**Overfishing:** This takes place when more than the sustainable share, i.e. more than F<sub>MSY</sub>, is removed from a fish stock. This will reduce the population size and reduce the amount of recruitment into the stock<sup>25</sup>, leading to a decline in the overall size of the fish stock. In extreme cases, overfishing can lead to the complete collapse of a fish stock.

**Spawning Stock Biomass (SSB):** This is the combined weight (in tonnes) of all the fish of one specific stock that are capable of reproducing. It provides an indication of the status of the stock and the reproductive capacity of the stock.

**Total Allowable Catch (TAC):** This is a catch limit set for a particular fishery, generally for a year or a fishing season. TACs are usually expressed in tonnes of live-weight equivalent, but are sometimes set in terms of numbers of fish (OECD, 2001).

**Yield (Y):** This is the catch i.e. the fish removed from the water by fishing (in tonnes).

Figure A.1: Fishing mortality reference points.



<sup>25</sup> Recruitment overfishing occurs when adults are depleted to the point that they cannot replenish themselves (The Pew Charitable Trusts, 2016b).



# Appendix B: Regional analysis

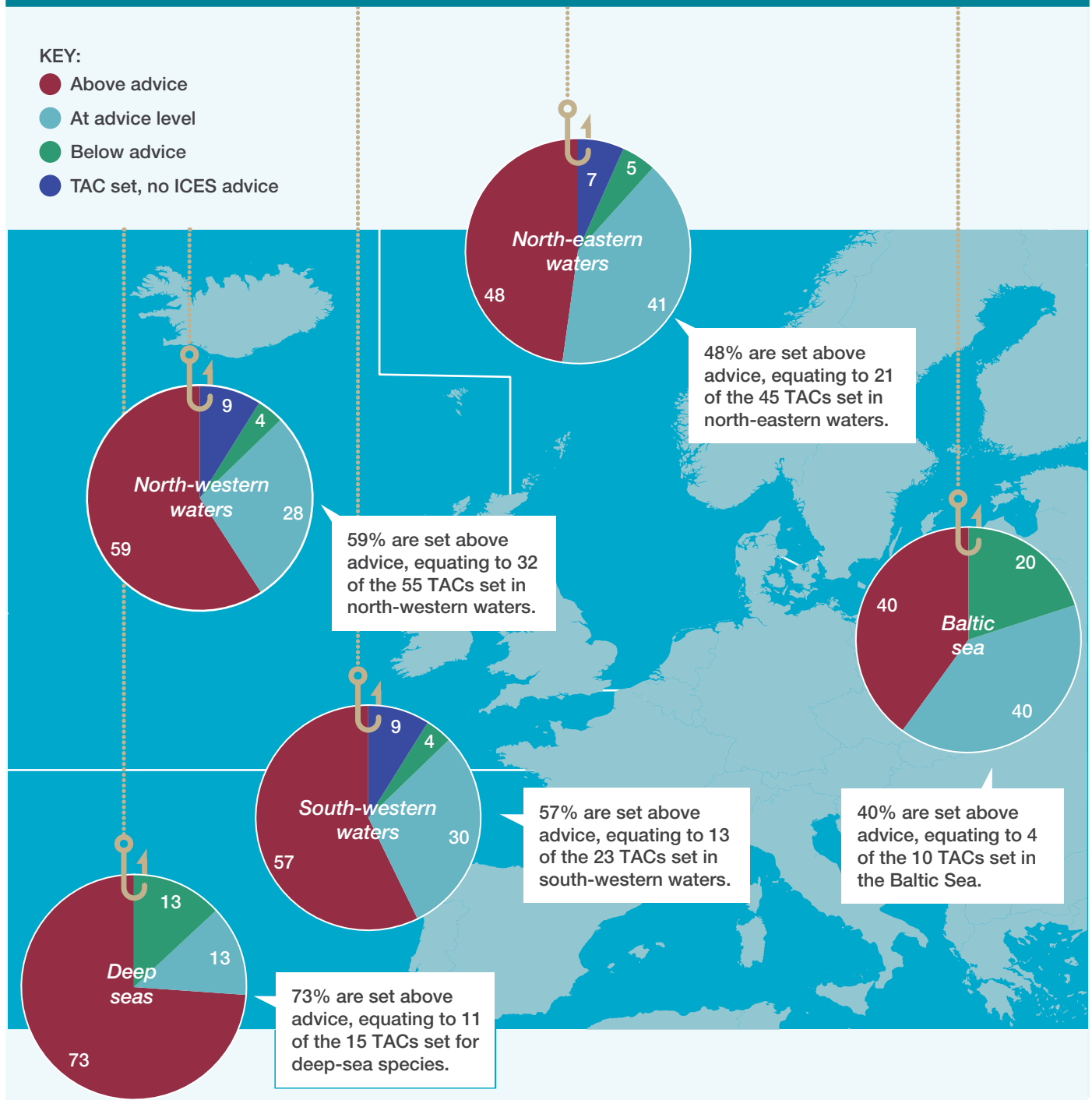
This Appendix presents a summary of the progress towards the CFP goal for fish stocks on a regional basis for the following regions:

- North-eastern waters;
- North-western waters;
- South-western waters;
- Baltic Sea; and
- Deep-sea species.

The map below depicts the proportion of TACs set in relation to ICES advice for four regions and deep-sea species, in 2017. The proportion of TACs set above advice ranges regionally from 40% to 59%, and is 73% for deep-sea species.

This appendix goes on to describe further details of the trends from 2013 to 2017 to demonstrate where improvements have been made, and to categorise how much above advice these TACs have been set.

Figure B.1: Proportion of TACs set in relation to ICES advice in 2017 per region (%).



## NORTH-EASTERN WATERS

For stocks in north-eastern waters the number of TACs set at levels exceeding scientific advice has decreased from 58% in 2013 to 48% in 2017. Since 2016 almost half of stocks have been set at levels consistent with (or below) advice (47% in 2016 and 45% in 2017).

For TACs set above scientific advice, approximately half were >50% above advice levels from 2013 to 2015, with a reduction in those set >50–100% seen in 2016 and 2017. In 2017 29% of TACs were >100%, including: blue ling in divisions 2, 4 & 3; cod in 3a (Kattegat only); northern prawn in 2a & 4; sprat in 3a; and whiting in 3a.

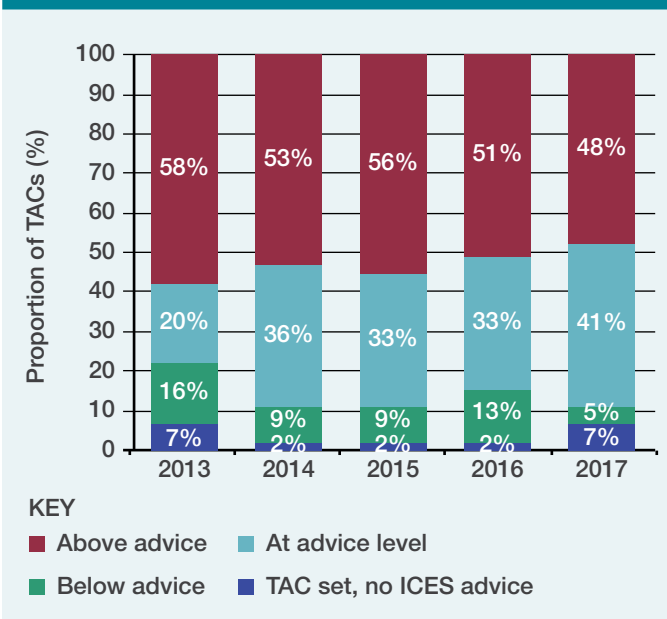
In north-eastern waters, sprat TACs have been consistently set at levels exceeding advice (related to Skagerrak TAC for all years, except 2013 when 2a & 4 TAC was also in excess), as have mackerel and dab/flounder.

High excess tonnage is noted for Norway pout, but only in 2014; herring excess tonnage was reduced significantly in 2015 and has been at zero since 2016. A significant spike in excess tonnage for North Sea and Skagerrak/Kattegat plaice occurred within the 2017 TACs, which may be linked to the top-up applied due to this stock being partially under the landing obligation.

In terms of the status of SSB for stocks in north-eastern waters, over half were above  $MSY B_{trigger}$  in 2017, however this drops to 36% when benchmarking against  $MSY B_2 (= 2 * B_{pa})$ .



**Figure B.2: Proportion of TACs set based in relation to ICES advice from 2013 to 2017 for north-eastern stocks.**



**Figure B.3: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017 for north-eastern stocks.**

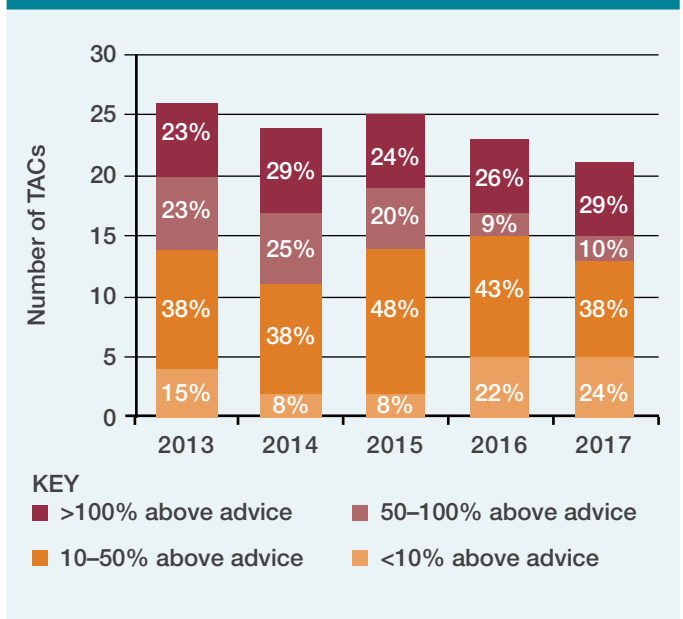


Figure B.4: Excess TAC tonnage, by species for north-eastern stocks.

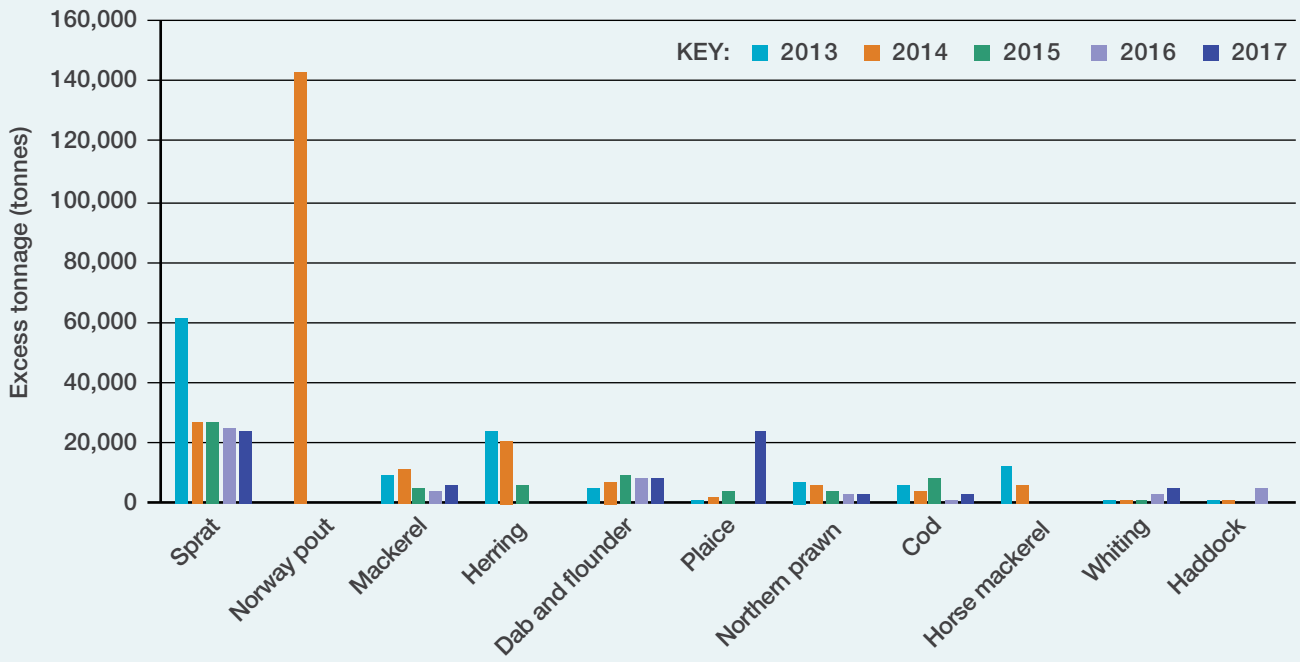


Figure B.5: Classification of biomass status by year: Number of stocks above and below reference points for  $MSY B_{trigger}$ ,  $MSY B_{1.5}$  and  $MSY B_2$ .



## NORTH-WESTERN WATERS

For stocks in north-western waters the number of TACs set at levels exceeding scientific advice has remained relatively consistent since 2013, and at 59% in 2017. The number of TACs set at levels consistent with (or below) advice has fallen from 2016 to 2017 (from 38% to 31%).

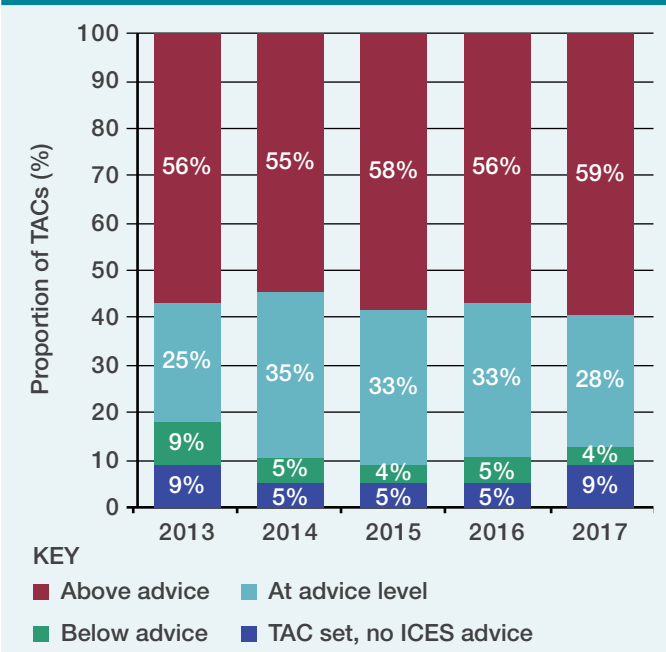
For TACs set above scientific advice, north-western stocks see a high proportion that are >100% over advice levels. Furthermore, the number of TACs in this category has grown from 32% in 2016 to 41% in 2017. Stocks in this >100% category in 2017 include: cod in 6b & 7a; sole in 7a; haddock in 7a; herring in 5b, 6b, 6aN, 6aS & 7b-c; plaice in 7a-c; pollack in 6, 5b, 12, 14 & 7; spurdog in 1, 5-8, 12 & 14; whiting in 6, 5b, 12, 14 & 7a.

In north-western waters, mackerel TACs have been consistently set at levels exceeding advice. Other stocks consistently set above advice include pollack, ling and Norway lobster. The large reduction in blue whiting excess TAC to bring it in line with advice in 2017 shows the most significant improvement.

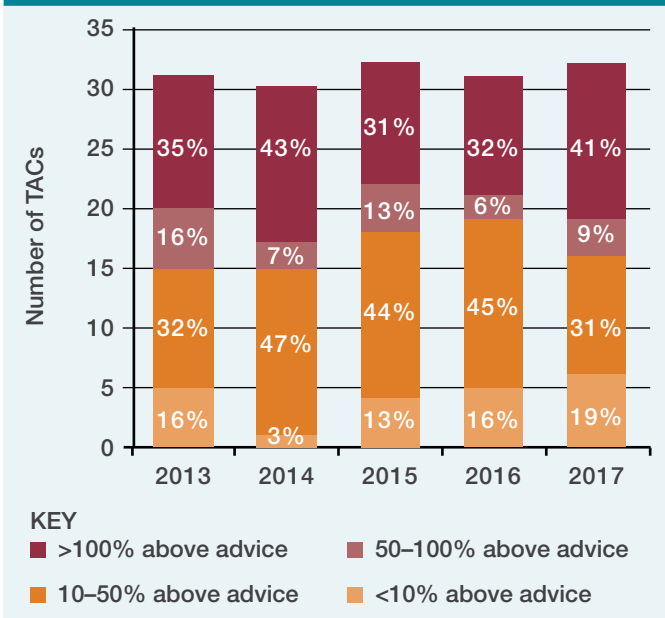
Although set in excess of scientific advice, there have been some reductions in the extent to which some TACs are being set above the advice from 2015 to 2017 for megrim, haddock, anglerfish and sprat.

In terms of the status of SSB for stocks in north-western waters, 58% were above  $MSY B_{trigger}$  in 2016, however this drops to 23% when benchmarking against  $MSY B_2 (= 2*B_{pa})$ .

**Figure B.6: Proportion of TACs set in relation to ICES advice from 2013 to 2017 for north-western stocks.**



**Figure B.7: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017 for north-western stocks.**



**Figure B.8i: Excess TAC tonnage, by species for north-western stocks, showing stocks up to 450,000 tonnes.**

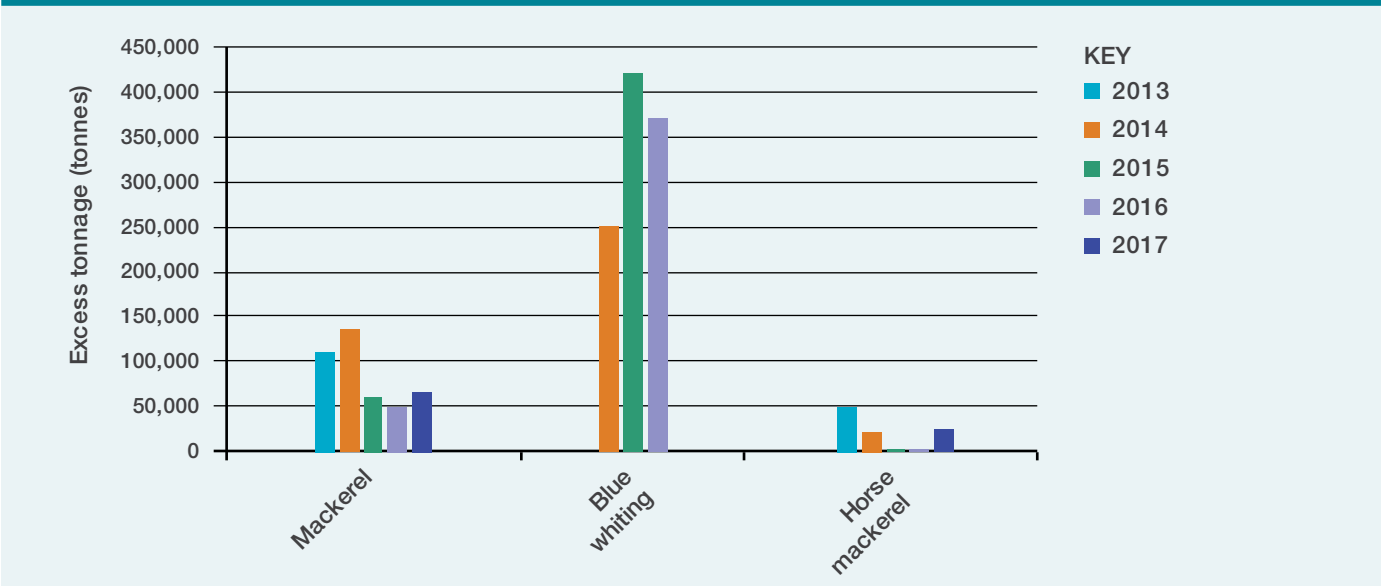




Figure B.8ii: Excess TAC tonnage, by species for north-western stocks, showing stocks up to 10,000 tonnes.

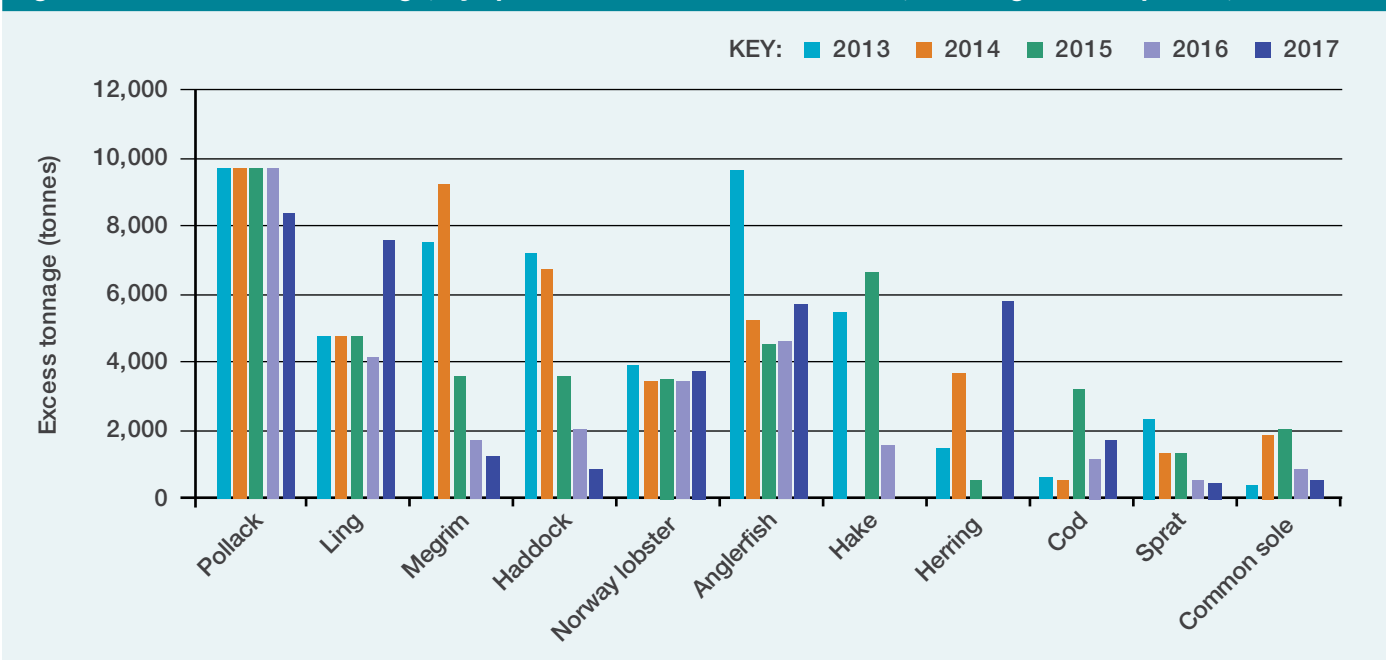


Figure B.9: Classification of biomass status by year: Number of stocks above and below reference points for  $MSY B_{trigger}$ ,  $MSY B_{1.5}$  and  $MSY B_2$ .



## SOUTH-WESTERN WATERS

For stocks in south-western waters the number of TACs set at levels exceeding scientific advice was very high from 2013 (83%) to 2016 (78%). Despite a significant decrease from 2016 to 2017, over half of TACs remain above advice.

For TACs set above scientific advice, >40% were set 50–100% higher from 2013 to 2015, though this proportion dropped in 2016 and 2017. In 2017 the highest proportion (85%) of TACs were set <50% above advice.

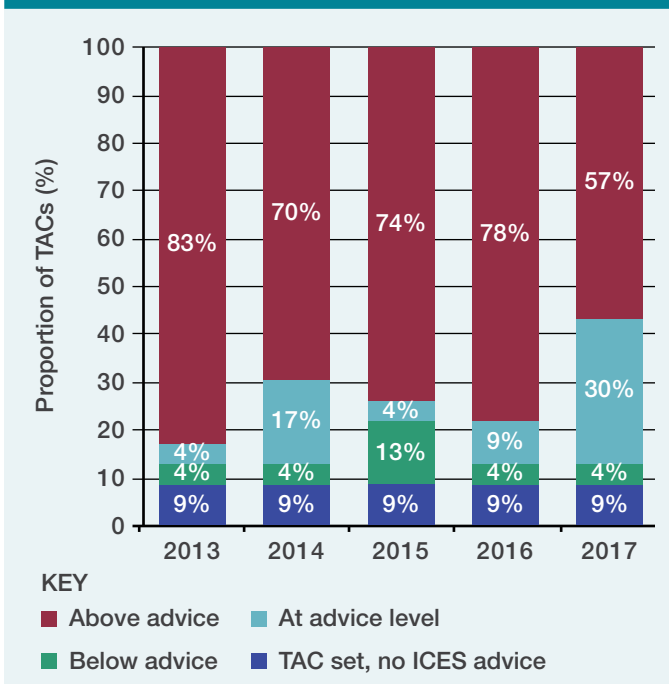
In south-western waters, mackerel TACs have been consistently set at levels exceeding advice.

High excess tonnage is noted for hake, although improvements are evident in 2017. Significant improvements for pelagic species are noted for blue whiting, horse mackerel and anchovy; while TACs for anglerfish, whiting and pollack remain at consistent quantities above advice.

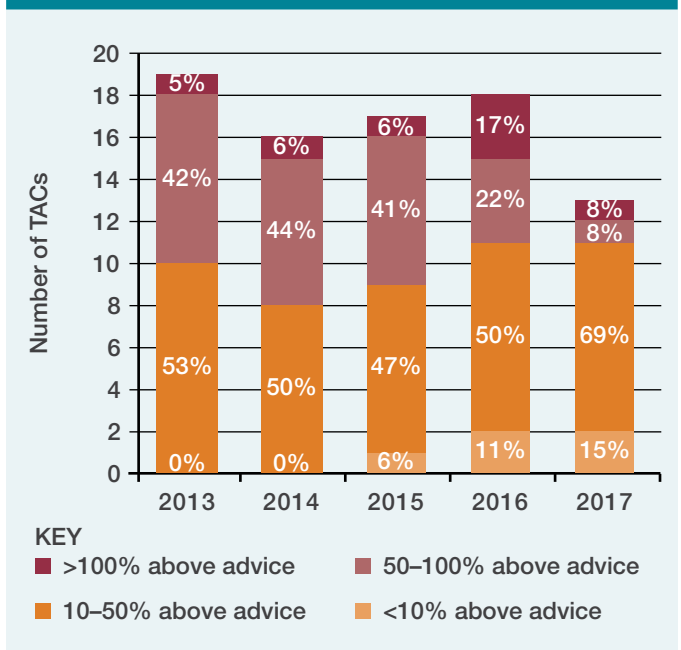
In terms of the status of SSB for stocks in south-western waters, 80% were above MSY  $B_{trigger}$  in 2016, which decreases to 60% when benchmarking against MSY  $B_2$  ( $= 2 * B_{pa}$ ).



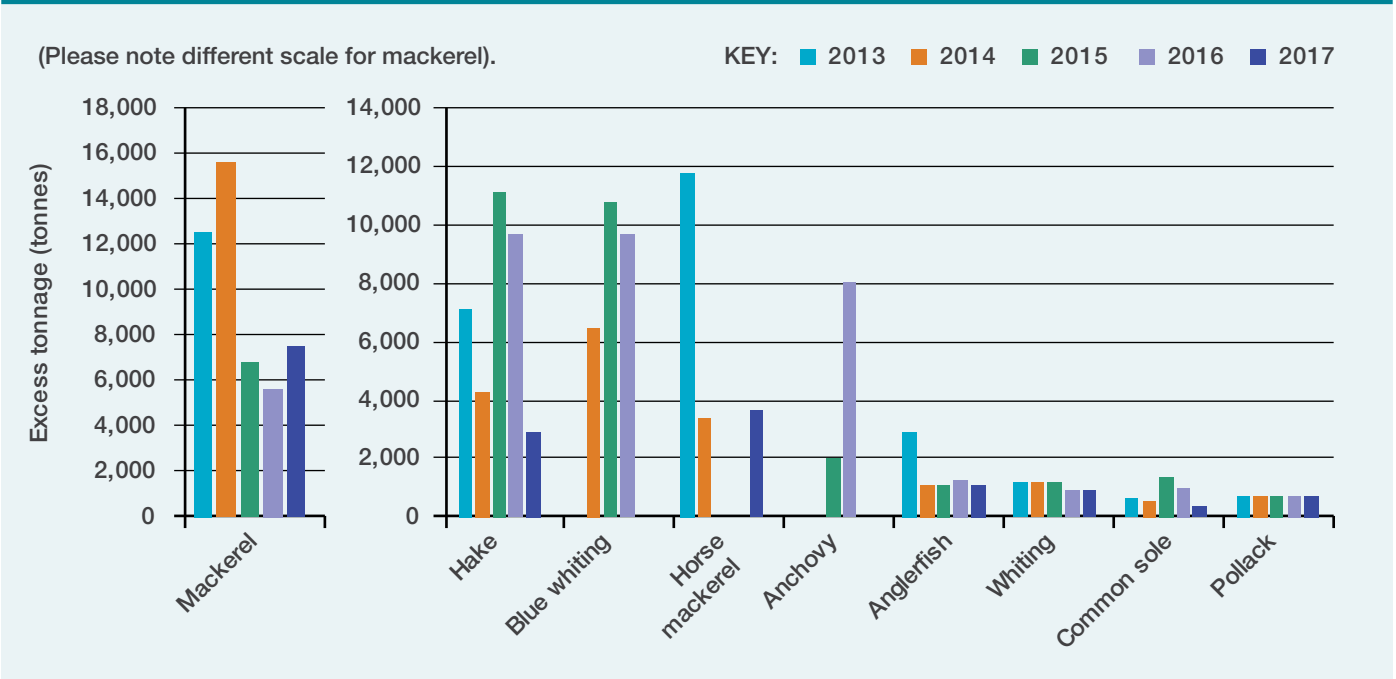
**Figure B.10: Proportion of TACs set in relation to ICES advice from 2013 to 2017 for south-western stocks.**



**Figure B.11: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017 for south-western stocks.**



**Figure B12: Excess TAC tonnage, by species for south-western stocks.**



**Figure B.13: Classification of biomass status by year: Number of stocks above and below reference points for MSY  $B_{trigger}$ , MSY  $B_{1.5}$  and MSY  $B_2$ .**



## THE BALTIC SEA

For stocks in the Baltic Sea the number of TACs set at levels exceeding scientific advice has decreased from 70% in 2013 to 40% in 2017. In 2017 60% of stocks were set at levels consistent with (or below) advice (which represents the most significant improvement of all regions analysed).

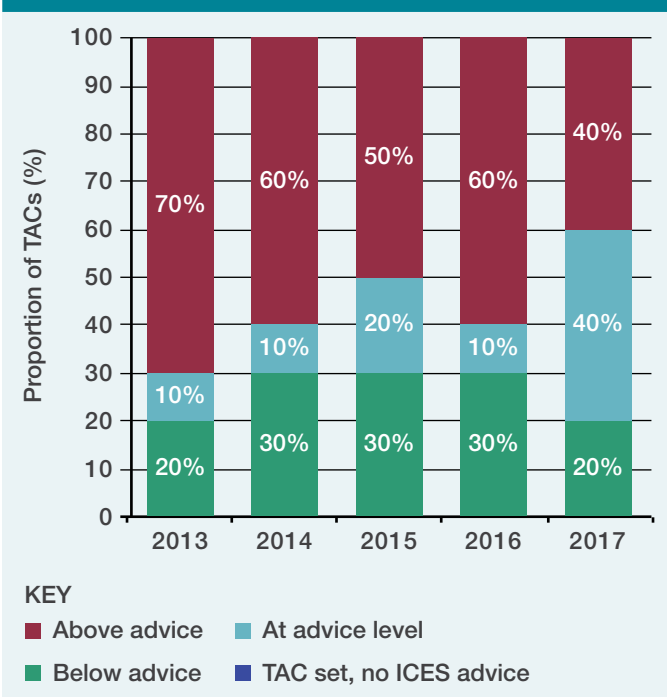
For the eight TACs set above advice in 2017, half were 10–50% above advice levels, and one (cod in 22-24) was >100% above advice levels.

In the Baltic Sea, significant reductions in excess numbers of salmon TACs were seen from 2014 to 2015, while excess tonnage for cod increased from 2014 to 2015, but dropped again in 2017. Sprat excess tonnage was consistent from 2014 to 2016, but improvements in 2017 mean that the TAC was set at the advised level. Trends in excess tonnage of herring are more sporadic, with a noticeable overshoot in 2016.

In terms of the status of SSB for stocks in the Baltic Sea, 80% were above  $MSY B_{trigger}$  in 2016, however this drops to zero when benchmarking against  $MSY B_2 (= 2*B_{pa})$ .



**Figure B.14: Proportion of TACs set in relation to ICES advice from 2013 to 2017 for Baltic Sea stocks.**



**Figure B.15: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017 for Baltic Sea stocks.**

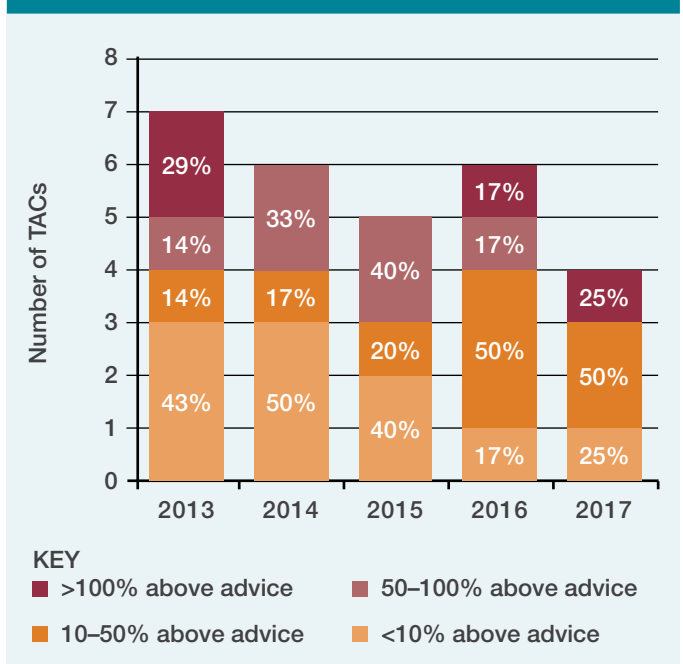




Figure B16: Excess TAC tonnage, by species for Baltic Sea stocks.

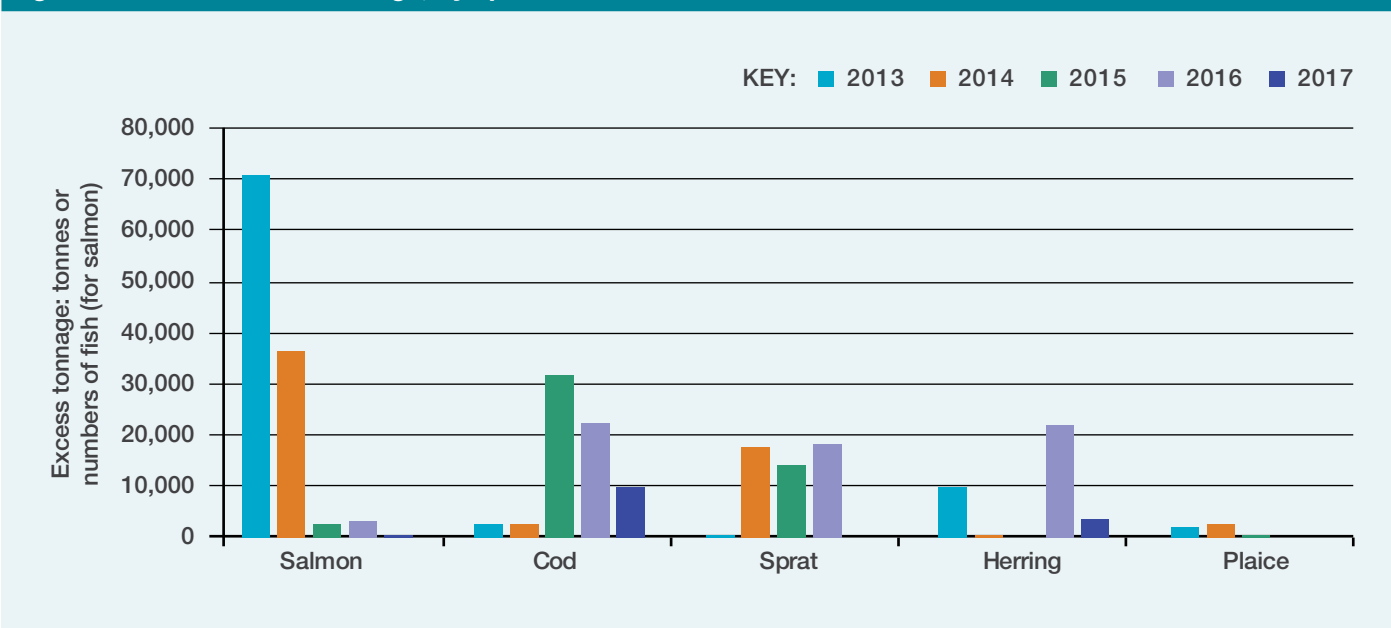
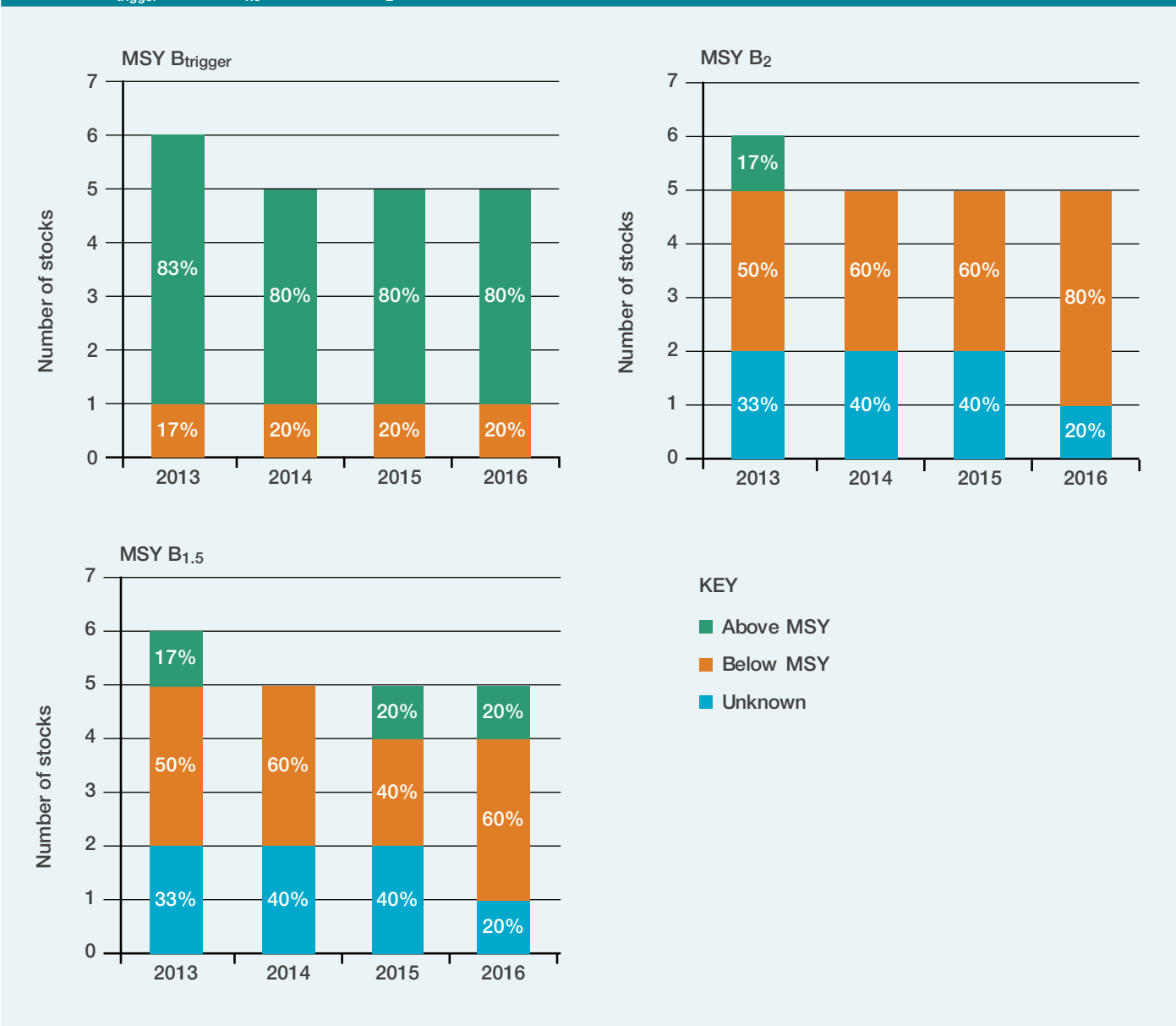


Figure B.17: Classification of biomass status by year: Number of stocks above and below reference points for MSY  $B_{trigger}$ , MSY  $B_{1.5}$  and MSY  $B_2$ .



## DEEP-SEA SPECIES

The majority of TACs for deep-sea species stocks are set at levels above scientific advice and this has been consistent since 2014. Data for 2013 is not included as it is not available within the FishFix database.

In 2014 the majority (73%) of TACs above advice exceeded advised levels by >100%. This improved from 2015 onwards, with 27% of stocks set >100% above advice in 2017. However, from 2016 to 2017 the number of TACs set 50–100% above advice increased markedly from 8% to 36%.

High excess tonnage is noted for roundnose grenadier, but this dropped significantly from 2016 to 2017. Indeed, the excess tonnage for all deep-sea species dropped from 2016 to 2017, with the exception of the greater forkbeard.

Three orange roughy TACs were set at zero from 2014–2016; in 2017 these TACs were removed as orange roughy has been defined as a prohibited species.

It is also noted that a combined TAC covers roundnose and roughhead grenadier, while separate scientific advice exists for each species. This makes assessing the excess TAC challenging for individual species.

Benchmarking deep-sea species against biomass reference points has not been possible as these species do not have a stock assessment and/or spawning stock biomass values are not known.

Figure B18: Proportion of TACs set in relation to ICES advice from 2013 to 2017 for deep-sea species stocks.

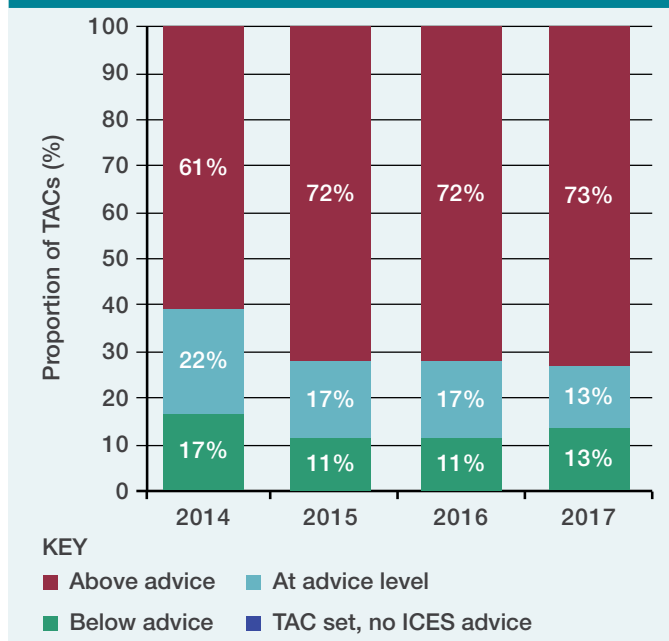


Figure B19: Number of TACs set above advice indicating proportion and scale of excess TAC from 2013 to 2017 for deep-sea species stocks.

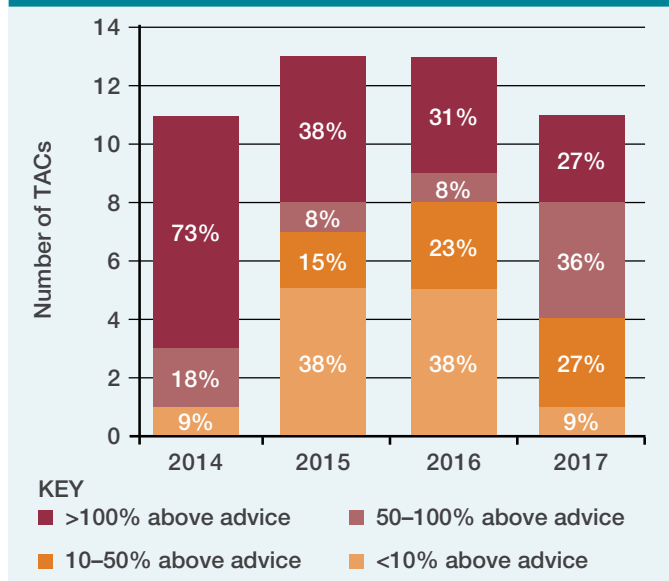
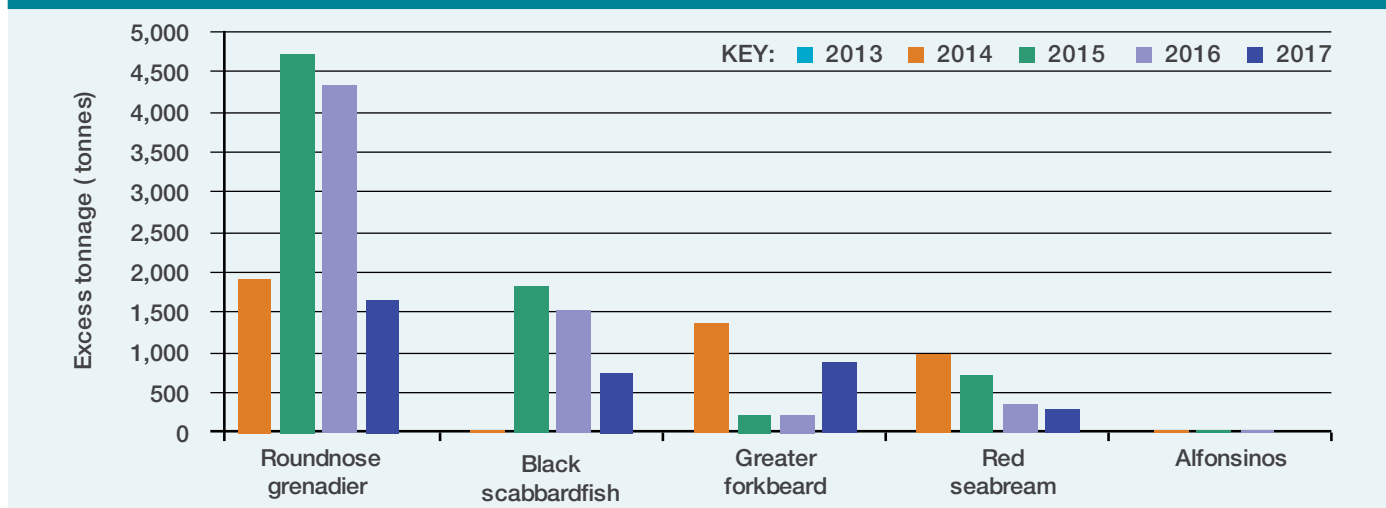


Figure B20: Excess TAC tonnage, by species, for deep-sea species stocks.





Poseidon Aquatic Resource Management Ltd  
Windrush, Warborne Lane, Portmore, Lymington,  
Hampshire, UK, SO41 5RJ  
Tel: +44 (0)1590 610168  
E: [main@consult-poseidon.com](mailto:main@consult-poseidon.com)  
W: [www.consult-poseidon.com](http://www.consult-poseidon.com)

The logo for Poseidon Aquatic Resource Management. It features the word "POSEIDON" in a large, bold, white, sans-serif font. The letter "P" is stylized with a white, curved, wave-like element extending from its left side. Below "POSEIDON" is the phrase "AQUATIC RESOURCE MANAGEMENT" in a smaller, white, all-caps, sans-serif font.

**POSEIDON**  
AQUATIC RESOURCE MANAGEMENT