



Current developments in marine policy and treaties

Progress towards ending overfishing in the Northeast Atlantic

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ABSTRACT

The reformed Common Fisheries Policy of the EU, in force since 2014, stipulates that overfishing by the fleets of its member states has to end latest in the year 2020. This study examines exploitation and status of 119 stocks fished by 20 countries in the Northeast Atlantic. In the year 2018, about 40% of the stocks were still subject to overfishing ($F > F_{msy}$), about 34% of the stocks were outside safe biological limits ($B < B_{pa}$) and about 68% of the stocks were too small to produce maximum sustainable yields ($B < B_{msy}$). Reduction in the number of overfished stocks has stalled, possible because of an agreement between the European Commission (EC) and the International Council for the Exploration of the Seas (ICES), its advisory body for total allowed catches (TACs), wherein the EC requests ICES to give TAC advice leading to overfishing for many stocks. Scientific advice is often overruled or ignored by politicians/fisheries ministers, whose main objective is to get as much quota as possible for their country. As a result, of the TACs set for 2020, about 46% exceeded scientific advice, suggesting that the goal of ending overfishing in 2020 will not be met.

1. Introduction

International conventions and agreements as well as regional and national laws stipulate that fished stocks have to be managed such that they are large enough to produce maximum sustainable yields (MSY). The member states of the EU in particular have agreed to end overfishing in the year 2020. Specifically, the Common Fisheries Policy [1] of the European Union calls for rebuilding all commercially used fish stocks above levels that are capable of producing MSY as its explicit objective of the legally binding Basic Regulation (December 11, 2013). As a first step to achieve this goal, fishing pressure had to be reduced to the maximum sustainable level by 2015, latest by 2020. Moreover, the CFP asserts that member states have to put in place measures to adjust the fishing capacity of their fleet to their fishing opportunities, with the objective of achieving a stable and enduring balance between them. At the same time, the Marine Strategy Framework Directive (MSFD) aims for good environmental status of European Seas, including the requirement that all commercial fish and shellfish are not subject to overfishing and exhibit a population, age and size distribution that is indicative of a healthy stock, by 2020.

For the Northeast Atlantic, which is mainly managed by output control (TAC) for most of the species, this can be done by setting TACs such that the related fishing mortality does not exceed the target value F_{msy} (Table 1). In the European Union (EU), TACs are proposed by the

European Commission (DG MARE) and decided annually by the Council of European Ministers in charge of fisheries. EU member states thus have a say (up to a *veto*) on the TACs decided for the stocks targeted by their national fisheries and for which they have a special responsibility under the Law of the Sea [2]. The purpose of this study is to explore progress towards ending overfishing in 2020 in the Northeast Atlantic and to identify possible obstacles. Also, the potential impact of reduced fishing caused by the COVID-19 pandemic is explored [3]. see [4,5].

2. Material and methods

2.1. Definitions and data

The definitions of fisheries reference points used in this study are given in Table 1.

Biomass and fishing mortality for 2017 or 2018 as well as recent B_{pa} and F_{msy} reference points were obtained from the ICES Stock assessment graphs database [6]. Some missing stocks such as spurdog (*Squalus acanthias*) were added using the information given in the advice documents [7] if their assessments provided estimates or allowed approximations (see Definitions) of stock status.

If ICES advice documents included time series of catches by country, such as, for instance, the 2018 advice for spurdog [8], these catches were used to assign stocks to countries. Otherwise, fisheries nominal catch

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Table 1
Definitions of fisheries reference points used in this study.

MSY	The maximum sustainable yield, i.e., the maximum yearly catch that a stock can support in the long term.
F_{msy}	The fishing mortality that will, after several generations, lead to catches equal to MSY and to a stock size equal to B_{msy} .
B_{msy}	The biomass level around which stock size fluctuates when fishing at F_{msy} [4]. It is the lowest biomass level that can produce maximum sustainable yields in the long term.
B_{pa}	A lower biomass threshold constituting the border of safe biological limits. It indicates a 5% probability that recruitment may be impaired. Given that B_{pa} is a proxy for MSY $B_{trigger}$ this study also assumes an approximate relation between B_{pa} and B_{msy} with $B_{pa} = 0.5 B_{msy}$.
MSY $B_{trigger}$	A parameter in the ICES MSY framework, which triggers advice on a reduced fishing mortality relative to F_{msy} . MSY $B_{trigger}$ is considered the lower bound of spawning–stock biomass fluctuation around B_{msy} . If the observation on fluctuation in biomass is insufficient to estimate MSY $B_{trigger}$, the reference point is normally set at B_{pa} [4]. Following ICES advice for Greenland halibut [5], this study assumes an approximate relation between MSY $B_{trigger}$ and B_{msy} with MSY $B_{trigger} = 0.5 B_{msy}$.
B_{lim}	The lowest biomass reference point. It indicates a 50% probability that recruitment may be impaired. This study assumes an approximate relation between B_{lim} and B_{msy} as $B_{lim} = 0.3 B_{msy}$ [5].

statistics 2006–2017 for the Northeast Atlantic [9] were used to assign stocks to the countries fishing them. No assignment was made if zero catches were reported for all years since 2006.

2.2. Methods

In some stocks, ICES did not provide absolute estimates of stock status or exploitation but rather ratios for B/B_{msy} and F/F_{msy} (e.g. plaice (*Pleuronectes platessa*) in the Bristol Channel and Celtic Sea, [10]). These relative estimates were used directly for the purpose of this study.

For the stocks where no estimate of B_{msy} but an estimate of B_{pa} was available, proxy $B_{msy} = 2 * B_{pa}$ was used (see Table 1, Definitions).

In some stocks, ICES only provided qualitative assessment of stock status. For the purpose of including such stocks in the Kobe plot of Fig. 1, qualitative assignments of stock status by ICES were turned into approximately corresponding numbers for the purpose of this study. For example, in herring (*Clupea harengus*) West of Scotland and West of Ireland current biomass is described as “below possible reference points” [11]. This qualitative assessment was translated into a proxy $B/B_{msy} = 0.25$, i.e., below the approximate $B_{lim} = 0.3 B_{msy}$ (see Table 1). Some stocks such as European eel (*Anguilla anguilla*) [8] were described as so strongly depleted that their status was set to $B/B_{msy} = 0.1$ for the purpose of this study.

In some stocks, ICES did not make a statement about stock size but advised strongly reduced catches relative to the maximum catch in the time series (e.g. roundnose grenadier *Coryphaenoides rupestris* in the Northeast Atlantic and Arctic Ocean, [12]), suggesting indirectly that the stock was below levels that can produce maximum sustainable yields. In these cases B/B_{msy} was set to 0.5 (3 stocks) or to 0.25 (one stock) for the purpose of this study.

Note that all translations of qualitative assessments into ratios were done for the purpose of including the respective stocks approximately correctly in Fig. 1. The qualitative assessments were in themselves sufficient to classify stocks as being above or below the thresholds defined by the CFP [1]. This was done for the latest years with available data (2017 or 2018), for which the percentage of stocks where fishing pressure exceeded F_{msy} or biomass was less than B_{pa} or less than proxy B_{msy} were determined.

The data behind the Tables and Figures are made available as part of the online material.

3. Results

Altogether 119 stock assessments published by ICES (114 in 2019

and 5 in 2018, with reference year 2018 and 2017 respectively) for the Northeast Atlantic were analyzed for the purpose of this study. Ninety-one of these (4 in 2017) contained information about stock size and 71 (3 in 2017) contained information about exploitation. Of these, 29 stocks (31.9%) had stock sizes at or above the minimum size required to produce maximum sustainable yields ($B \geq B_{msy}$) and 42 stocks (59.2%) were exploited at or below the maximum sustainable level ($F \leq F_{msy}$). Only 23 stocks (34%) had sustainable sizes and exploitation rates as required by the CFP [1]. The statistics for stocks not fulfilling the prescriptions of the CFP [1] are given in Table 2.

Fig. 1 shows the 67 stocks for which information on both stocks size and exploitation was available.

Table 3 shows for the 20 northern European countries the number of stocks that were fished by them between 2006 and 2018 and the percentages of their stocks that, in 2018 (3 in 2017), were overfished, outside safe biological limits, or smaller than the minimum biomass required to produce MSY. The binding targets for these percentages according to the Law of the Sea [2] and the Common Fisheries Policy of the EU [1] are zero. Note that most countries fish, in addition, outside of the area considered here, so their global ranking will be different from the ranking for the Northeast Atlantic presented here. For example, Mediterranean stocks are known to be in particularly bad shape [13,14] and are fished by France and Spain but not considered in Table 3. It should be noted here however that the southern countries exploit far more stocks compared to the northern countries, a large proportion of which are un-assessed, especially those countries that are extended in the Mediterranean Sea.

4. Discussion

The purpose of this study was to provide a recent update of exploitation and status of stocks fished by northern European countries in the Northeast Atlantic before the year 2020 when the Common Fisheries Policy of Europe [1] and its Marine Strategy Framework Directive [15], in accordance with the Law of the Sea [2] and the United Nations Fish Stock Agreement [16], demands an end of overfishing and the rebuilding of stocks sizes above the level that can produce maximum sustainable yields. The results for 2018 (3 stocks for 2017) are still far away from the target: 40.8% of the stocks were subject to ongoing overfishing, 34.1% of the stocks were outside safe biological limits and 68.1% of the stocks had stock sizes below the level that can produce maximum sustainable yields. Only 34% of the stocks were, both, of sufficient size and fished sustainably (green zone in Fig. 1).

Note that the results for overfishing and safe biological limits match very well with those found by the Scientific, Technical and Economic Committee for Fisheries (STECF), which advises the EU on fishing matters, and which found close to 40% of the stocks in the Northeast Atlantic to be overfished and around 35% to be outside safe biological limits in 2017 [14]. STEFC notes that it did not evaluate “the number or proportion of stocks above/below B_{msy} [...], because an estimate of B_{msy} is only provided by ICES for very few stocks” ([14], p. 7). This limitation is overcome in the present study by applying approximate relations between MSY $B_{trigger}$, B_{pa} and B_{msy} as used by ICES (see Table 1).

The results of this study confirm for the year 2018 the observation by STEFC that “progress until 2017 has been too slow to allow all stocks to be maintained or restored to at least B_{pa} & MSY $B_{trigger}$, and managed according to F_{msy} by 2020” ([14], p. 8).

A reason for this slow progress towards the CFP targets for 2020 may be found in the “Administrative Agreement (AA) between the European Commission and the International Council for the Exploration of the Sea” [17], referred to as “Agreement” hereafter. The Agreement recognizes in its introduction that the EC “in the context of the CFP shall aim to ensure that for the exploitation of the resources that restores and maintains populations of harvested species above levels which can produce the Maximum Sustainable Yield (MSY), the MSY exploitation rate shall be achieved by 2015 where possible and at the latest by 2020 for all stocks

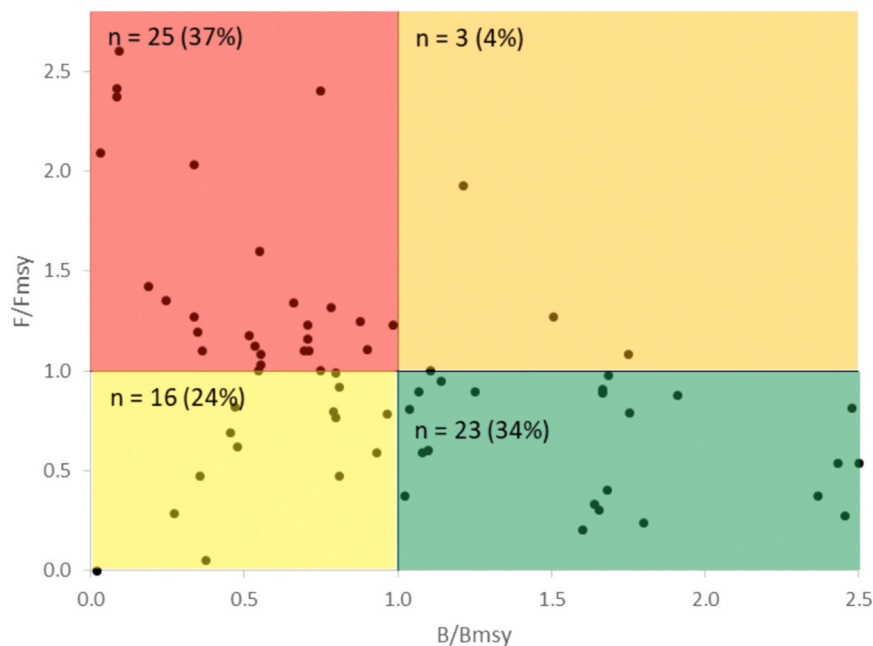


Fig. 1. Kobe for 67 stocks with available information on relative stock size (B/B_{msy}) and relative exploitation (F/F_{msy}) in the Northeast Atlantic for the year 2018 (3 stocks for 2017). Red area: stocks that are being overfished or are outside of safe biological limits; Orange area: overfished stocks that still maintain healthy stock biomass; Yellow area: recovering stocks; Green area: stocks subject to sustainable fishing pressure and of a healthy stock biomass. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 2

Summary of stocks not fulfilling the prescriptions of the Common Fisheries Policy of the EU for the last year with available data (mostly 2018, some in 2017).

	n	%
$F > F_{msy}$	29	40.8
$B < B_{msy}$	62	68.1
$B < B_{pa}$	31	34.1

[bold font applied for emphasis].” However, this agreement contains an Annex IIB which lists all stocks to be assessed by ICES and specifies “... the policy basis to be used when computing figures included in the management advice” ([17], p. 15). Annex IIB lists 200 stocks for which ICES is requested to give advice on total allowable catches (TAC). It prescribes that ICES is to give TAC advice based on F_{msy} for only 43 (21.5%) of the stocks; ICES is to advise TACs with ranges around F_{msy} (including overfishing) for 58 (29.0%) of the stocks; and ICES is to advise TACs that may constitute overfishing and may reduce stock sizes to the border of safe biological limits (B_{pa}) for 99 (49.5%) of the stocks, a policy named “precautionary approach” (PA).

An example of the implementation of this agreement can be seen for plaice in the western Baltic [18], which is one of the species for which the Agreement requests TAC advice according to PA. Consequently, the advice given by ICES for catches in 2020 reads: “In the context of the EU multiannual plan for the Baltic, which considers this stock to be by-catch, the EC has requested that ICES provide advice based on the precautionary approach. ICES advises that catches of up to 10,636 tonnes are considered to be precautionary.” TAC according to the legally binding MSY exploitation rate is given in Table 3 of the advice document as 5675 tonnes. In other words, the precautionary TAC advised by ICES on request by the EC for consideration by the Council of Ministers is nearly twice as high as the TAC that would result from the MSY level prescribed by the CFP [1].

As quoted above, the EC recognizes in the Agreement that under the CFP [1] all stocks have to be managed according to the MSY exploitation rate. There is no special clause for by-catch species in UNCLOS [2],

Table 3

Northern European countries with number of assessed stocks fished by them between 2006 and 2018 (out of a total of 119 stocks; data for 3 stocks only until 2017), percentage of stocks that were subject to overfishing in 2018/2017 ($F > F_{msy}$, used for ranking), percentage of stocks that were outside of safe biological limits ($B < B_{pa}$), and percentage of stocks that were below the level that can produce maximum sustainable yields ($B < B_{msy}$). For all columns with percentages, the target value prescribed by UNCLOS and by the CFP is zero.

Rank	Country	Stocks	$F > F_{msy}$ %	$B < B_{pa}$ %	$B < B_{msy}$ %
1	Portugal	20	25.0	21.4	57.1
2	Spain	37	30.0	19.2	57.7
3	Iceland	24	33.3	26.3	52.6
4	Russian Federation	24	35.7	30.0	60.0
5	Ireland	31	36.0	44.0	64.0
6	United Kingdom	70	37.8	27.8	59.3
7	France	65	39.5	27.5	60.8
8	Norway	49	42.3	25.0	61.1
9	Belgium	44	47.1	31.4	65.7
10	Faeroe Islands	30	50.0	25.9	66.7
11	Netherlands	41	50.0	34.5	69.0
12	Germany	41	50.0	34.1	70.7
13	Denmark	57	50.0	40.0	77.5
14	Greenland	17	54.5	20.0	53.3
15	Sweden	40	55.0	41.9	83.9
16	Lithuania	15	71.4	42.9	85.7
17	Finland	10	75.0	62.5	87.5
18	Poland	18	80.0	50.0	81.3
19	Estonia	10	80.0	55.6	100
20	Latvia	11	80.0	60.0	100

UNFSA [16], or the CFP [1], and such treatment would make no sense, because many by-catch species such as sharks and rays (all marked for PA management in the Agreement) are threatened by extinction and require more (and not less) protection from overfishing than the target species. The prescriptions for ecosystem-based fisheries management in the Marine Strategy Framework Directive of the EU [15] and in the CFP [1] call for minimization of fisheries impact on non-target species. In summary, the Agreement between the EC and ICES, which requests from ICES ‘PA’ advice for half of the exploited stocks, is probably the main reason for the lack of progress in reducing overfishing in the Northeast

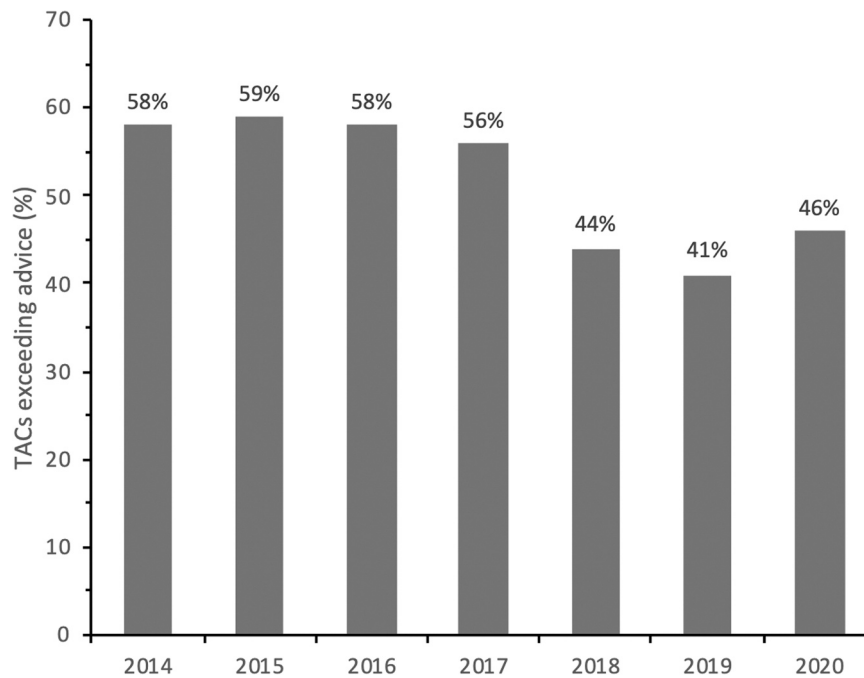


Fig. 2. Percentage of stocks with available data where the total allowed catches (TAC) exceeded the scientific advice given by ICES [19].

Atlantic and the likely massive failure of ending overfishing in 2020.

Fisheries management in the Northeast Atlantic remains strongly influenced by national interests, either by independent countries or by the Ministers in charge of fisheries in the EU member states, who decide the TACs for the next year in annual joint meetings in Brussels. In this context it is instructive to look at the information in Table 3. Numbers of fished and assessed stocks range from 10 in Estonia and Finland to 70 in the UK. The percentage of overfished stocks ranges from 25% in Portugal to 80% in Estonia, Latvia and Poland. The increase in percentages of depleted ($B < B_{pa}$) and underperforming ($B < B_{msy}$) stocks is roughly aligned with the percentage of overfished stocks, demonstrating clearly the fallacy of thinking that overfishing is good for the national fisheries. Ministers should understand that overfishing shrinks the stocks as well as future catches, and that the short term gain in catch obtained from overfishing is only a small fraction of the loss in catch in subsequent years. Countries that have sustainably managed their stocks and reduced overexploitation seem to have understood this lesson much better than those that are still far from sustainable fisheries and stock rebuilding (Table 3). A first indication of the willingness of Ministers to end overfishing in 2020 was given by the TACs decided for stocks in the Baltic Sea on 14 November 2019: 2020 TACs for western Baltic herring (*Clupea harengus*) and western and eastern Baltic cod (*Gadus morhua*) exceeded scientific advice for maximum catch and fishing mortality (F) corresponding to the TAC decided for Baltic sprat (*Sprattus sprattus*) in 2020 exceeds the official estimate of F_{msy} .

An independent analysis [19] of TACs is shown in Fig. 2. In 2014 when the reformed CFP [1] went into force, 58% of the stocks with available data had total allowed catches (TACs), which exceeded the scientific advice for maximum catch given by ICES. That number dropped to 41% in 2019 but increased again to 46% for the catches allowed for 2020 when, according to the CFP [1], this number should have been zero.

5. Conclusions

International conventions and agreements [2,16] require northern European countries to manage the stocks fished by them such that they can produce maximum sustainable yields. Specifically, the CFP [1] obliges EU member states to end overfishing latest in 2020. However,

efforts to reduce the number of overfished stocks are stalling at 40%, probably because the EC has requested ICES to advise TACs that constitute overfishing for many stocks.

As this paper was prepared for submission, the COVID-19 pandemic had reduced demand for fish in Europe and elsewhere [3] and there was a chance that fishers may not fully fish out their TACs, thus potentially ending overfishing in 2020 as prescribed by the CFP [1]. In that case, stocks may grow and allow the setting of sustainable TACs in 2021 without the need for drastic reductions in catch, thus offering a chance to end overfishing in northern Europe for good.

CRedit authorship contribution statement

Rainer Froese: Conceptualization, Formal analysis, Writing - original draft preparation. **Athanassios C. Tsikliras:** Writing- reviewing & editing. **Giuseppe Scarcella:** Writing - reviewing & editing. **Didier Gascuel:** Writing - reviewing & editing.

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