

Linking the law to biological reference points used in scientific advice when setting Total Allowable Catches (TACs)

This briefing is for decision-makers at European Union (EU) level who are setting Total Allowable Catches (TACs) to limit how much fish can be caught to sustainable levels. These include people working at the European Commission (which proposes TACs) and people representing EU Member States at the Council of the EU (which decides on catch limits).

The EU's Common Fisheries Policy (CFP) contains a number of key objectives and requirements that decision-makers have to implement when setting TACs. However, the link between the legal wording and concrete scientific catch figures can be difficult to understand, and different stakeholders often reach different conclusions.

The International Council for the Exploration of the Sea (ICES) has developed a framework to translate legal requirements into concrete scientific catch advice figures.¹ In order to understand this translation from law into science, we need to get to grips with both the legal wording and the scientific terminology used. Biological reference points on the level of exploitation and on the size of the stocks, such as F_{MSY} or B_{pa} , are a key part of the vocabulary decision-makers need to understand.

This document provides an overview of relevant reference points, to help draw clear links between law and science. It is part of a series of ClientEarth briefings explaining (among other things):

- why ICES catch advice constitutes the '[best available scientific advice](#)';²

¹ ICES Advice basis. 20 December 2019. https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/Introduction_to_advice_2019.pdf

² ClientEarth (2020). What is the 'best available scientific advice' for setting Total Allowable Catches (TACs)? December 2020. <https://www.clientearth.org/latest/documents/what-is-the-best-available-scientific-advice-for-setting-total-allowable-catches-tacs/>

- which of the [different catch scenarios](#) presented should be followed;³ and
- what the [CFP's precautionary approach](#) and [ecosystem-based approach to fisheries management](#) mean in practice,^{4,5} especially in terms of TAC-setting.

ICES advice on fishing opportunities

ICES advice follows the principles and approaches outlined in detail in the 'ICES Advice basis' paper, most recently published on 20 December 2019.⁶ ICES' approach when developing advice depends:

- a) on the available knowledge and data for the stock in question; and
- b) on whether a precautionary management plan or strategy has been agreed by the relevant management parties (e.g. the EU and third countries).

The two key approaches used to prepare an advice are the 'ICES Maximum Sustainable Yield (MSY) approach' (when available data allow for a full assessment of what fishing levels will allow the stock to deliver the MSY), and the 'ICES precautionary approach' (when data about a particular stock are too limited for the MSY approach).

Key provisions in the CFP for TAC-setting

ClientEarth's briefing series explains the relevant key provisions in the CFP Basic Regulation in the context of TAC-setting and shows that ICES headline advice constitutes the '[best available scientific advice](#)' for this purpose.^{7,8} As a reminder, the CFP Basic Regulation contains the following legal obligations:⁹

- The requirement to '*apply the [precautionary approach to fisheries management](#)*';
- The objective to '*ensure that exploitation of living marine biological resources restores and maintains populations of harvested stocks **above** levels which can produce the maximum sustainable yield*' (emphasis added);
- The requirement that for this purpose '*the maximum sustainable yield exploitation rate [...] be achieved by 2015 where possible and, on a progressive, incremental basis **at the latest by 2020 for all stocks***' (emphasis added).

What are the biological reference points used by ICES?

Biological reference points are numerical figures. Like bolts and screws, they allow EU decision-makers to turn the flatpack of ICES advice into the fully functional furniture of CFP-compliant catch limits. Like the bolts and screws in a flatpack, we tend to lose sight of them, but they are crucial. This section shows how they work.

3 ClientEarth (2020). Ask the right question, get the right answer: Scientific advice for bycatch or non-targeted stocks that have zero catch advice. July 2020. <https://www.documents.clientearth.org/library/download-info/ask-the-right-question-get-the-right-answer-scientific-advice-for-bycatch-or-non-targeted-stocks-that-have-zero-catch-advice/>

4 ClientEarth (2020). Caution! A TAC-Setter's Guide to the 'Precautionary Approach'. December 2020. <https://www.clientearth.org/latest/documents/caution-a-tac-setter-s-guide-to-the-precautionary-approach/>

5 ClientEarth (2020). How (not) to implement the ecosystem-based approach when setting Total Allowable Catches (TACs). December 2020.

<https://www.clientearth.org/latest/documents/how-not-to-implement-the-ecosystem-based-approach-when-setting-total-allowable-catches-tacs/>

6 ICES Advice basis. 20 December 2019. https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2019/2019/Introduction_to_advice_2019.pdf

7 See references in footnotes 2 and 4.

8 Articles 2(2), 2(3) and 3(c) of Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy

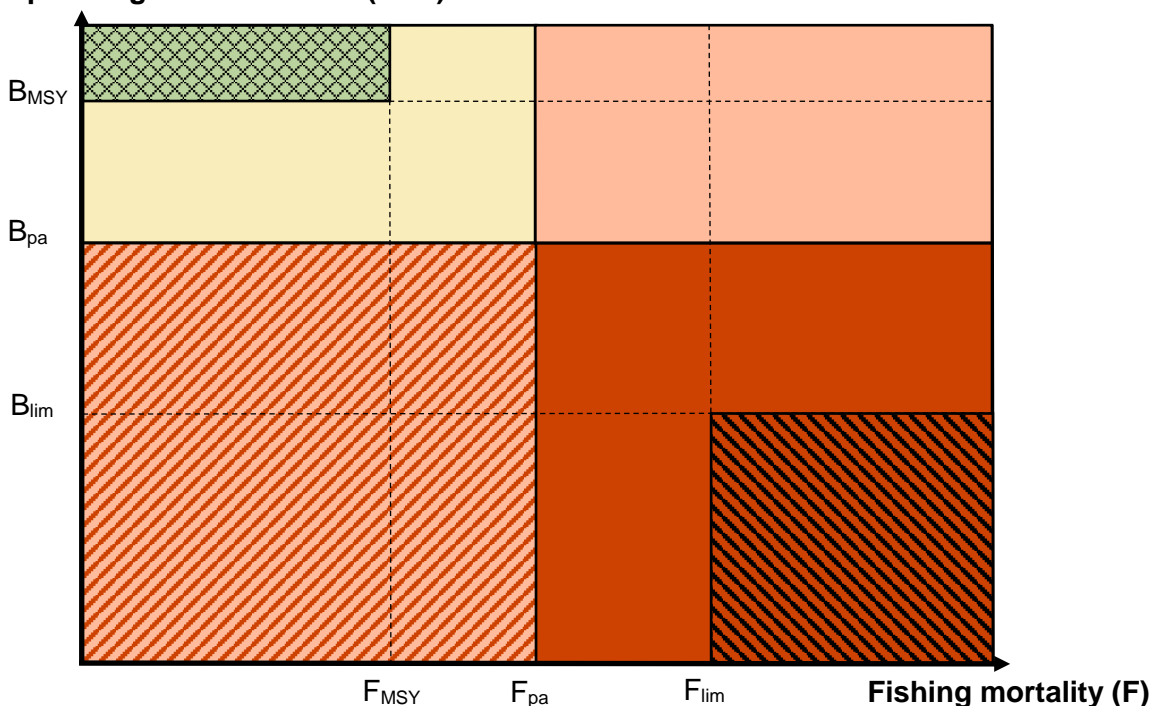
9 *Ibid.*, Article 2(2)

The two main biological indicators of the exploitation and state of fish stocks assessed and presented in the ICES advice are:

1. the mortality caused by fishing, 'fishing mortality' (F), and
2. the size of the stock, 'spawning stock biomass' (SSB or B).

F is a measure of the fishing pressure, and SSB (or B) refers to adult fish which can contribute to the reproduction of the stock. In order to assess whether the stock is in a healthy, productive state and whether it is being exploited sustainably, different numerical reference points are established to measure where F and SSB are in relation to where you do (not) want them to be (see Figure 1 for an illustration).

Spawning stock biomass (SSB)









-  = Both biomass (SSB) and fishing mortality (F) are in line with the CFP's Article 2(2) MSY objective (i.e. stock is above a 'biomass level[...] capable of producing the MSY' (B_{MSY}) and fishing pressure is in line with (i.e. at or below) the 'MSY exploitation rate' (F_{MSY}).
-  = The stock is within safe biological limits (i.e. $SSB \geq B_{pa}$ and $F \leq F_{pa}$), i.e. the risk of the stock falling below B_{lim} (where reproduction is impaired), or F exceeding F_{lim} is low.
-  = The stock is outside safe biological limits, because fishing mortality is too high ($F > F_{pa}$), meaning the stock is exploited unsustainably, even though the biomass is still above B_{pa} .
-  = The stock is outside safe biological limits, because the biomass is too low ($SSB < B_{pa}$), meaning the stock is at a higher risk of impaired reproduction, even though fishing mortality is below F_{pa} .
-  = The stock is outside safe biological limits, because the biomass is too low ($SSB < B_{pa}$) and fishing mortality is too high ($F > F_{pa}$), meaning there is an increased risk of impaired reproduction as well as of the stock declining further.
-  = The stock is far from safe biological limits, because the biomass is so low that reproduction is likely to be impaired ($SSB < B_{lim}$) and fishing mortality is unsustainably high ($F > F_{lim}$), maintaining the stock at this low level.

Figure 1 This is a schematic visualisation of biological reference points used in fisheries science, for example by ICES, when providing scientific catch advice. Note that the distances between the points and the area-sizes displayed are not intended to be proportionate. For reasons of simplicity, MSY $B_{trigger}$ (the lower boundary of the fluctuation around B_{MSY} at which point action must be taken) is not depicted, but it would be found between B_{pa} and B_{MSY} . Note that the graph is open-ended on the right and at the top.

ICES uses two 'limit' reference points (F_{lim} and B_{lim}) to mark the critical boundaries outside of which the stock is at a high risk of impaired reproduction and thus potential collapse. So when F is higher than F_{lim} , and/or SSB is below B_{lim} , the stock is in a very bad, risky state.

Precautionary ('PA') reference points (F_{pa} and B_{pa}) mark the 'safe biological limits'.¹⁰ So if F is smaller than F_{pa} and SSB is above B_{pa} , the stock is not at immediate risk of impaired reproduction or collapse, though not at its most productive level either. These PA reference points are formulated in the face of uncertainty about the true stock size. When F is smaller than F_{pa} and SSB is above B_{pa} , there is a low probability of the stock actually being below B_{lim} .

MSY reference points (F_{MSY} and B_{MSY}) refer to the fishing mortality and biomass expected to deliver MSY. '*ICES interpretation of MSY is maximizing the average long-term yield from a given stock while maintaining productive fish stocks*'.¹¹ It is basically the peak of the 'surplus production' of a stock, i.e. of the catch that can be harvested without changing the stock's average production in the long-term.

B_{MSY} is not yet known for most stocks. You need to have fished at or below F_{MSY} for a long enough time to establish this reference point precisely, which has not been the case for most stocks. For these stocks, ICES uses 'MSY $B_{trigger}$ ', which marks the lower boundary of the natural fluctuation around B_{MSY} , as a key reference point in its advice on catch limits. In most cases this point is still set at B_{pa} , because the necessary information to establish the true MSY $B_{trigger}$ as a standalone value is not yet available either.

If ICES assesses a stock to have fallen below the MSY $B_{trigger}$ biomass, this 'triggers' ICES to use a more cautious approach regarding its catch advice, namely '*to reduce fishing mortality in order to allow a stock to rebuild to levels capable of producing MSY*'.¹² So, when the stock is in a worse state (i.e. below MSY $B_{trigger}$), ICES' catch advice will be lower than if it is in a better state (i.e. above MSY $B_{trigger}$), because the fishing pressure needs to be decreased to restore the stock.

Using biological reference points to build legally sound TACs

The CFP's MSY objective¹³ can be translated into biological reference points as follows:

1. the '*level[...] which can produce the maximum sustainable yield*' is B_{MSY} , with MSY $B_{trigger}$ as the lower boundary of the natural fluctuation around B_{MSY} .
2. The '*MSY exploitation rate*' corresponds to the F_{MSY} point value, since this is the fishing mortality the scientists expect to deliver the MSY.

In short, the MSY objective means that stocks are to be restored and maintained above B_{MSY} . In the absence of B_{MSY} , stocks shall be maintained or restored at least above MSY $B_{trigger}$. In order to restore stocks which are currently below MSY $B_{trigger}$, decision-makers need to adopt catch limits that keep fishing mortality below F_{MSY} .¹⁴

Importantly, applying the '*precautionary approach to fisheries management*' in Article 2(2) of the CFP Basic Regulation is not the same as merely using the precautionary reference points F_{pa} and B_{pa} in setting TACs.

¹⁰ The corresponding definition provided in Article. 4(18) of the CFP basic regulation is: '*stock within safe biological limits*' means a stock with a high probability that its estimated spawning biomass at the end of the previous year is higher than the limit biomass reference point (B_{lim}) and its estimated fishing mortality rate for the previous year is less than the limit fishing mortality rate reference point (F_{lim})

¹¹ ICES Advice basis, p. 6, see footnote 1 for full reference.

¹² *Ibid.*

¹³ See Article 2(2) of the CFP Basic Regulation, full reference in footnote 8.

¹⁴ Note that the multiannual plans provide for the use of F_{MSY} ranges under certain circumstances. However, as outlined in this briefing, F_{MSY} must indeed be treated as a limit, not a target, in order to restore stocks in line with the CFP's MSY objective.

[ClientEarth's briefing on the 'precautionary approach'](#) sheds more light on this confusing issue.¹⁵ In summary, there is an important distinction between:

- a) setting TACs based on ICES advice following the 'ICES precautionary approach'; and
- b) setting TACs corresponding to the PA reference points F_{pa} and B_{pa} found in ICES advice.

Scenario a) refers to a situation where information is too limited to provide MSY-based advice. Reference points – the bolts we need to build solid TACs – are often simply not available. In such situations ICES factors the uncertainty about the true state of the stock and/or its exploitation into its advice based on the limited information available, for example by applying a precautionary buffer. In this scenario, the stock might be in a good or bad state; we simply do not know enough.

Scenario b) refers to a situation where – rather than the stock situation being unknown – we know that if the PA points are transgressed,¹⁶ the stock will be outside of safe biological limits.

Setting TACs deliberately at a level that results in $F = F_{pa}$ and/or B_{pa} , (merely within safe biological limits) merely keeps the stock from collapsing. The CFP demands more: setting TACs based on MSY reference points, which correspond to a lower fishing mortality and a larger stock size (see Figure 1).

Conclusion

The scientific catch advice provided by ICES is a translation of the objectives and requirements in the CFP Basic Regulation. This follows the ICES MSY approach (where the available data allow for a full, MSY-based stock assessment), or the ICES precautionary approach (when data are more limited and the true state of the stock and its exploitation is uncertain).

The MSY wording of the CFP Basic Regulation translates directly into MSY reference points. However, the precautionary approach mentioned in the CFP Basic Regulation does not correspond to ICES' precautionary (PA) reference points – which, for certain stocks, may be all we have. Indeed, the CFP does not allow TACs to be based on F_{pa} and/or B_{pa} where MSY-based advice is available. Such an approach would fall short of the CFP's binding obligation to maintain and restore harvested stocks above levels that can produce MSY.

Jenni Grossmann

Science and Policy Advisor

+44 (0)303 050 5943

jgrossmann@clientearth.org

www.clientearth.org

Beijing

Berlin

Brussels

London

Los Angeles

Luxembourg

Madrid

Warsaw

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¹⁵ [ClientEarth \(2020\)](#). See footnote 4 for full reference.

¹⁶ i.e. $F > F_{pa}$ and/or $SSB < B_{pa}$.