

# Evaluation of the French proposal for TAC of 27.7.d Sole 2018-2020

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## Executive Summary

The French Administration have constructed a proposal for management of the fisheries on Sole (*Solea solea*) in ICES area 27.7.d, that would see the quota increase for 2018 limited to 25% but then maintained for 2019 and 2020.

This paper explores the potential impact of using such an approach on the Fishing Mortality, Spawning Stock Biomass and Catch through each of the three years. The French proposal is contrasted with some alternative suggestions originating from UK policy officials in order to provide reference for interpreting the results of the French proposal.

Six scenarios were explored,

1. the French proposal of a 25% increase in quota in 2018 giving total catch of 3323t, followed by a constant 3323t quota in 2019 and 2020
2. Fishing remains at the same level as currently estimated (Fishing mortality in 2018-2020 is the same as ICES assumes for 2017).
3. a quota increase of 20% for 2018 giving a total catch of 3318, followed by fishing at Fmsy in 2019 and 2020.
4. A quota increase of 20% for 2018 giving a total catch of 3318 followed by a further 10% increase in 2019 (to 3653) and then constant TAC.
5. A quota increase of 25% for 2018 giving a total catch of 3457 followed by a further 15% increase in 2019 (to 3978) and then constant TAC.
6. Fishing mortality in 2018 follows the ICES MSY approach, followed by fishing at Fmsy in 2019 and 2020.

The French proposal has a low probability (4%) of fishing mortality rising above Fmsy by 2020, and a probability of being above MSY Btrigger that is not worse than might be expected following the ICES MSY rule.

Total landings over the three years is maximised using the ICES MSY rule, the French proposal gives the lowest of all scenarios explored with around 1300t less over the time-period.

Catch volatility is minimised using the French proposal, the ICES MSY rule giving the greatest contrast in inter-annual catches.

Of the other scenarios explored, none perform better than the two extremes (French or ICES MSY rule) when viewed over all of the performance metrics. Staggering a TAC rise by 20% then 10% achieves only marginally higher cumulative landings but increases the probability of fishing above Fmsy by 2020 to 11%.

## Introduction

The ICES advice released in June 2017 for fishing opportunities on Sole (*Solea solea*) in area 27.7.d in 2018 is for 3866t of catch. Were this catch to be agreed by the 2017 December council as the TAC for 2018 TAC it would represent a 40% increase in quota compared to that agreed for 2017.

The French Administration have constructed a proposal for management of the fisheries on Sole (*Solea solea*) in ICES area 27.7.d, that would see the quota increase for 2018 limited to 25% but then maintained for 2019 and 2020.

ICES advice in June 2017 for TAC setting in 2018 implies that in order to return the stock to safe biological limits by 2019 (i.e. above MSY Btrigger) any quota increase would need to be limited to no more than 20%.

This analysis explores the development of the stock under a range of potential management scenarios suggested by policy officials and evaluates the risk of the stock being below the ICES reference points MSY  $B_{trigger}$  and  $B_{lim}$  in each of 2019, 2020 and 2021.

## Method

The short-term forecast script that was used by WGNSSK in producing the 2017 advice was adapted for these analyses. The script uses the FLR framework, picking up the results of the final 2017 assessment and forecasting the stock development under a range of scenarios. Settings for the reference points, and assumptions of fishing and recruitment in 2017 matched those used for the generation of the June 2017 ICES advice.

The short term forecast framework used by ICES lacks the facility to adjust the management measures in line with future stock situations as would be required if undertaking a full Management Scenario Evaluation. This means that for scenarios where target fishing mortalities are being applied, should an advice rule require a reduction in target fishing mortality (such as when the stock is below MSY Btrigger), this cannot be replicated and instead the target fishing mortality remains unchanged in such situations.

Recruitment values (age 1) for each of 2017-2020 were drawn at random from the time-series of recruit estimates from the assessment model, excluding 2014-2016 (to mirror the dataset used to estimate the Geometric Mean as used by ICES).

For each scenario 250 iterations were made to capture the uncertainty surrounding future recruitments. For each iteration, the SSB, Fishing Mortality and Catch were recorded. Finally, the median catch levels along with the probabilities of being below MSY Btrigger (19251t) or above Fmsy (0.256) were calculated.

Six scenarios were explored,

1. the French proposal of a 25% increase in quota in 2018 giving total catch of 3323t, followed by a constant 3323t quota in 2019 and 2020
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## Results

The summary results from the six scenarios are presented in a table below. “F>Fmsy” is the probability that fishing mortality is greater than Fmsy, likewise “SSB<Btrigger” is the probability that the spawning stock biomass at the start of the year is below MSY Btrigger. “Catch” is the median catch (not wanted landings, but total catch) from the bootstrapped runs and “% quota change” is the difference from the previous year’s catch.

| Scenario | 2018           | 2019 | 2020 | 2021 | Total landings 2018-2020 |
|----------|----------------|------|------|------|--------------------------|
| 1        | F>Fmsy         | 0%   | 0%   | 4%   |                          |
|          | SSB<Btrigger   | 100% | 49%  | 28%  | 29%                      |
|          | Catch          | 3457 | 3459 | 3458 | <b>10,374</b>            |
|          | % quota change | 25%  | 0%   | 0%   |                          |
| 2        | F>Fmsy         | 0%   | 0%   | 0%   |                          |
|          | SSB<Btrigger   | 100% | 60%  | 34%  | 27%                      |
|          | Catch          | 3621 | 3520 | 3665 | <b>10,806</b>            |
|          | % quota change | 31%  | -3%  | 4%   |                          |
| 3        | F>Fmsy         | 0%   | 0%   | 0%   |                          |
|          | SSB<Btrigger   | 100% | 34%  | 30%  | 27%                      |
|          | Catch          | 3318 | 3930 | 4002 | <b>11,250</b>            |
|          | % quota change | 20%  | 18%  | 2%   |                          |
| 4        | F>Fmsy         | 0%   | 0%   | 11%  |                          |
|          | SSB<Btrigger   | 100% | 36%  | 30%  | 27%                      |
|          | Catch          | 3318 | 3653 | 3652 | <b>10,623</b>            |
|          | % quota change | 20%  | 10%  | 0%   |                          |
| 5        | F>Fmsy         | 0%   | 62%  | 46%  |                          |
|          | SSB<Btrigger   | 100% | 57%  | 42%  | 36%                      |
|          | Catch          | 3457 | 3978 | 3977 | <b>11,412</b>            |
|          | % quota change | 25%  | 15%  | 0%   |                          |
| 6        | F>Fmsy         | 0%   | 0%   | 0%   |                          |
|          | SSB<Btrigger   | 100% | 76%  | 47%  | 38%                      |
|          | Catch          | 3932 | 3782 | 3945 | <b>11,659</b>            |
|          | % quota change | 42%  | -4%  | 4%   |                          |

The probability of the stock being below MSY Btrigger is 100% in all scenarios, matching the ICES advice from June 2017.

All scenarios explored which have some fixed TACs (1,3,4 &5) give non-zero probabilities of fishing above Fmsy in 2020. Scenario 1 (the French proposal) has the smallest of these probabilities. Non-zero probabilities arise because some iterations will have poor recruitment in both 2018 and 2019 which in combination with a fixed TAC will lead to fishing mortality in excess of FMSY.

The scenario with the highest risk to stock levels falling below MSY Btrigger in 2018 is scenario 6 (following ICES MSY advice). Given that the other options all look to have lower fishing rates in 2018 this is to be expected. All scenarios have a probability of being below MSY Btrigger in 2021 of between 29% and 38%.

Scenarios 2 and 6 which have Fishing mortality targets (rather than quota targets) both see a negative quota change (on average) in 2019, implying these are the most volatile approaches.

Scenario 1 (the French proposal) has the lowest overall expected landings for the 2018-2020 period.

Scenarios 3 and 4 appear to be contradictory, in that scenario 3 gives higher mean landings for 2018 but a lower probability of being below MSY Btrigger

Scenarios 4 and 5 have a higher likelihood of needing to decrease quota during the 3 year period following substantial rises. Scenario 2 appears to allow two increases of around 20% followed by stability.

In terms of total landings over the three year period, the French proposal would generate the lowest landings, followed by the 20% then 10% strategy. The 25% then 15% strategy has the second highest level of landings but with a sizeable probability of fishing above Fmsy. The MSY strategy has the highest level of landings (offset by greater volatility) with nearly 1300t more than the French strategy.

#### Discussion.

These analyses suggest that the French proposal has a low probability of generating fishing mortalities greater than Fmsy. In addition, the probability that the 2020 SSB is less than MSY Btrigger is not lower than following the ICES MSY rule. There is, however, a consequence to total fishery removals with around 1300t less catch than might be expected over the 3 years. Alternative management strategies might be able to provide a similar reduction in catch volatility whilst increasing the total yield that this stock could generate.

Within these analyses the 2017 recruitment value was fixed to the geometric mean to match the ICES forecast. This impacts the uncertainty estimation in the future as the 2017 recruitment forms a significant part of the SSB in 2019 and 2020.

The inability of the approach used here to modify F-values where stock status falls below MSY Btrigger is likely to over-estimate the probability of a stock falling below MSY Btrigger in later years. This does not affect the evaluation of the French proposal, but would affect the other scenarios.