Ifremer

Assessment of the impact of the proposed management plan for sole fisheries in the Eastern Channel (7.d)

Alain Biseau, October 2017

Reminder of the request (DPMA email dated 19th of October, 2017):

"The management plan presented by the French professionals proposes that the TAC increase for 2018 be limited to 25% and does not follow the scientific advice that allowed for a 40% increase. The plan provides for this TAC value to be maintained until 2021.
An option of the plan proposes a minimal size increase from 24 to 25 cm.
Ifremer was requested to carry out an assessment of this plan and its compliance with the RSY approach"

Introduction

The ICES advice for sole in the Eastern Channel for 2018[1], following the MSY approach, recommends a maximum catch of 3866 tons in 2018, corresponding to a 40% TAC (catch) increase.

NB. Following the benchmark carried out for this stock at the beginning of 2017, the assessment and projections were carried out this year taking into account the total catch, rather than landings only (discards were added a posteriori). The landings/discards separation takes place downstream based on respective mortality for each age. The following simulations take only catch into consideration; the proportion of discards represents about 11% of catch.

Always following the 2017 benchmark, the estimate of the series of indicators (mortality, biomass, recruitment), as well as the reference point values, were revised.

The spawning stock biomass in 2018 being estimated[2] slightly below the MSY-$B_{trigger}$ threshold, the ICES MSY approach leads a fishing mortality slightly below F_{MSY} : F_{MSY} * SSB_{2018}/MSY-$B_{trigger}$), being recommended, i.e. F=0.243 rather than F_{MSY} (0.256).

The ICES advice is based on the results of the 2017 assessment (WGNSSK-2017[3]) and on the assumptions of a 2017 fishing mortality similar to the one of 2016 (F=0.23) and a future recruitment (2017 and 2018) equal to the geometric mean of the recruitment series (1982-2013) (GM), i.e. 29,196 thousands of individuals. Given these assumptions, the estimated catch for 2017 amounts to 3,596 tons.

[1] http://www.ices.dk/sites/pub/Publication%20Reports/Advice/2017/2017/sol-eche.pdf

[2] The spawning stock biomass is estimated on the 1st of January; the 2018 stock is therefore equal to the stock on the 31st of December 2017.

[3] ICES. 2017. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK), 26 April-5 May 2017, Copenhagen, Denmark. ICES CM 2017/ ACOM:21. 1077 pp.

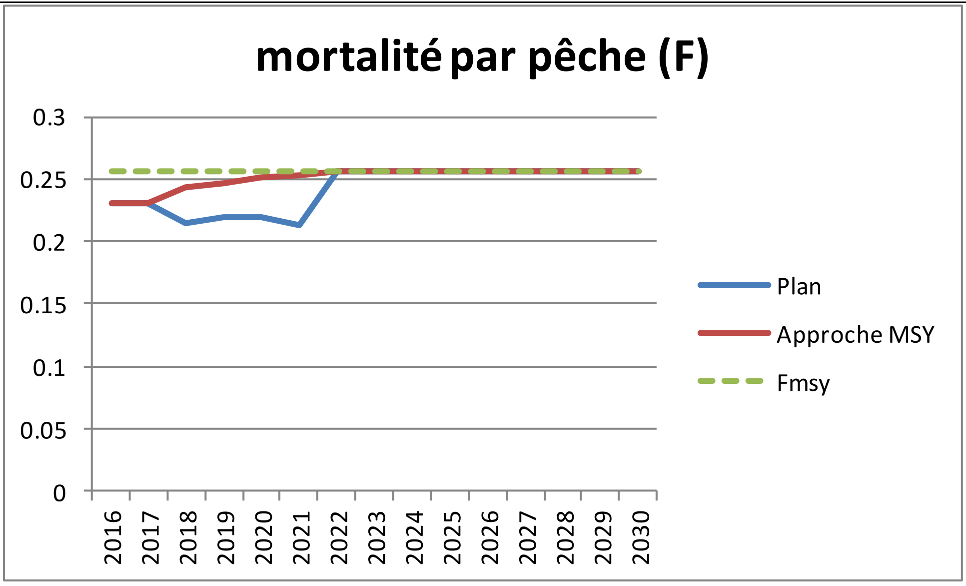
Equipment and method

The simulations carried out in this document are based on the same assumptions[4], except for recruitment, which, after 2018, results from a stock-recruitment relation that provides a level of recruitment equal to the geometric mean of the series (1982-2014), i.e. 29,196 thousands, when the spawning stock biomass is greater than or equal to B_{pa} (19,251 t) and reduced literally towards zero when the latter is below: $R=GM*B/B_{pa}$. The application of a stock-recruitment relation (simplified in this case) is considered to be prudent during mid-long term simulations in order to avoid an over estimate of the stock in the event of a collapse of the spawning stock. Currently, given the upwards evolution of spawning stock biomass, this assumption only (very slightly) affects short term recruitment, with a quasi negligible impact on catch forecasts.

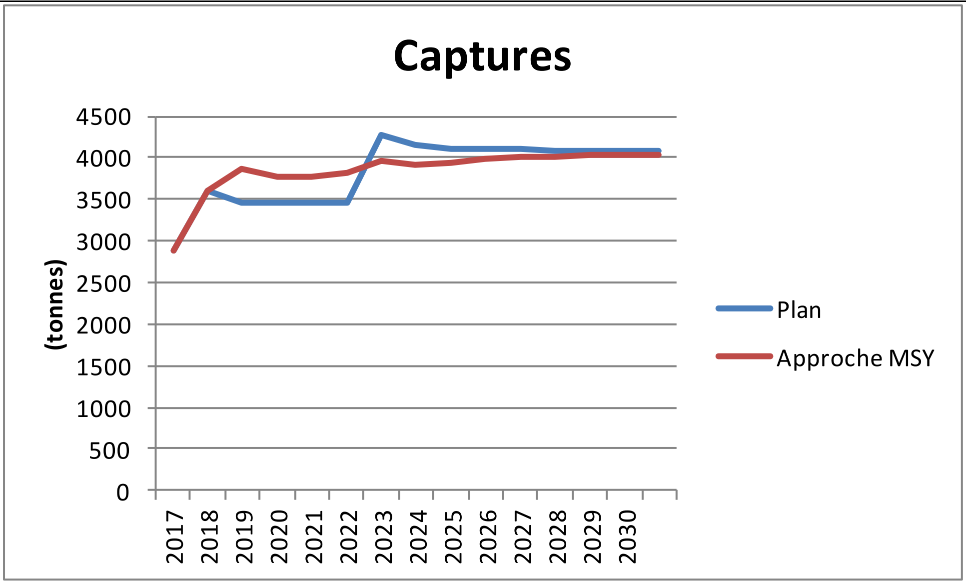
One should also note that the simulations carried out are deterministic (and in particular without taking into account the variability of recruitment around the median, variability that can be strong for sole), results must be considered as median values of a stochastic simulation.

Results

Figure 1 and Table 1 show the results of the management plan implementation, compared to the results of ICES MSY approach management ("MSY approach" in red), i.e. applying the mortality reduction when the biomass is below the MSY-$B_{trigger}$ threshold



[4] All the simulations are carried out with the accuracy of the input values being below the accuracy used by the ICES, which leads to slightly different results from those presented in the ICES advice sheet.



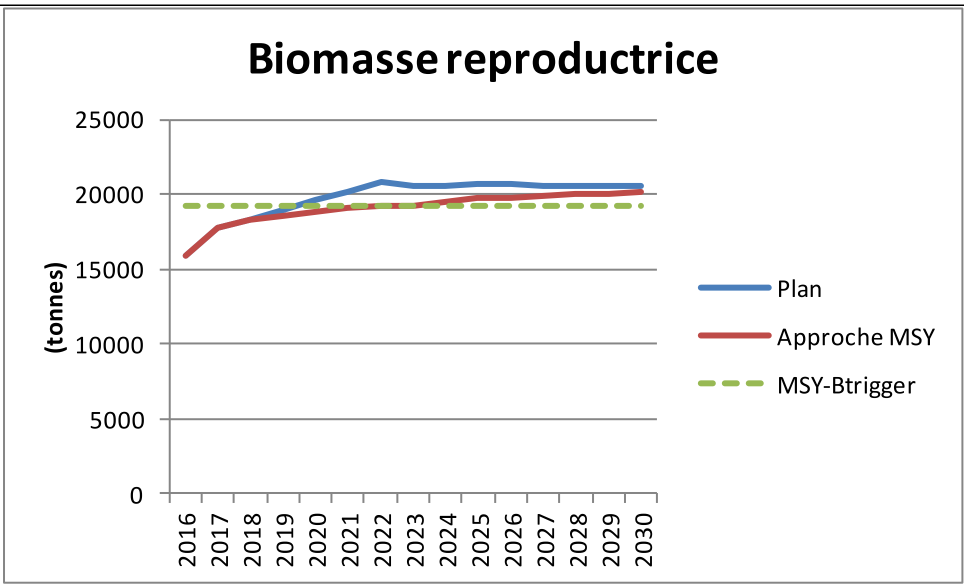


Figure 1. Sole 7.d. Evolution of fishing mortality, catch and spawning stock biomass according to 2 scenarios: application of the proposed plan or of the MSY approach.

The application of the plan would result in a fishing mortality below F_{msy} until 2021 due to catch limited by a constant TAC and lower than what could have been by following the ICES recommendation for 2018. Due to this lower fishing mortality, the biomass is higher if the plan is followed; when fishing mortality is increased again to the F_{msy} level in 2022, the catch will increase dramatically and will be more important for a few years than those resulting from a F_{msy} management over the whole period. Cumulated catch until 2030 are quasi identical in both scenarios (57,621 t in the case of the MSY approach, 57,417 t if the plan is applied).

Table 1: Results of simulations according to the scenarios

'MSY approach'

Year (y)	F	Catch (tonnes)	Landings (tonnes)	SSB* (tonnes)	R (age 1) (thousands)
2016	0.2311	2882	2538	15912	17198
2017	0.2311	3592	3117	17784	29196
2018	0.2428	3857	3434	18260	26972
2019	0.2472	3760	3331	18592	27693
2020	0.2511	3769	3329	18881	28196
2021	0.2532	3827	3380	19037	28634
2022	0.2560	3961	3502	19283	28872
2023	0.2560	3914	3451	19244	29196
2024	0.2560	3932	3465	19460	29186
2025	0.2560	3984	3514	19747	29196
2026	0.2560	4002	3531	19809	29196
2027	0.2560	4020	3549	19917	29196
2028	0.2560	4032	3561	19991	29196
2029	0.2560	4040	3569	20054	29196
2030	0.2560	4047	3576	20108	29196

* Estimated spawning stock biomass on January 1st of year Y

Application of the proposed management plan

Year (y)	F	Catch (tonnes)	Landings (tonnes)	SSB* (tonnes)	R (age 1) (thousands)
2016	0.2311	2882	2538	15912	17198
2017	0.2311	3592	3117	17784	29196
2018	0.2151	3461	3082	18260	26972
2019	0.2198	3461	3072	18997	27693
2020	0.2188	3461	3066	19617	28811
2021	0.2131	3461	3069	20140	29196
2022	0.2560	4273	3797	20869	29196
2023	0.2560	4153	3680	20599	29196
2024	0.2560	4112	3640	20614	29196
2025	0.2560	4117	3646	20729	29196
2026	0.2560	4097	3626	20627	29196
2027	0.2560	4092	3621	20612	29196
2028	0.2560	4088	3617	20579	29196
2029	0.2560	4085	3613	20549	29196
2030	0.2560	4082	3611	20523	29196

* Estimated spawning stock biomass on January 1st of year Y

Improvement of selectivity

If discards in weight are relatively limited (about 11%), proportions in numbers are very high for younger ages: 97% for age 1, 59% for age 2, however, fishing mortality for these younger ages remain low (figure 2).

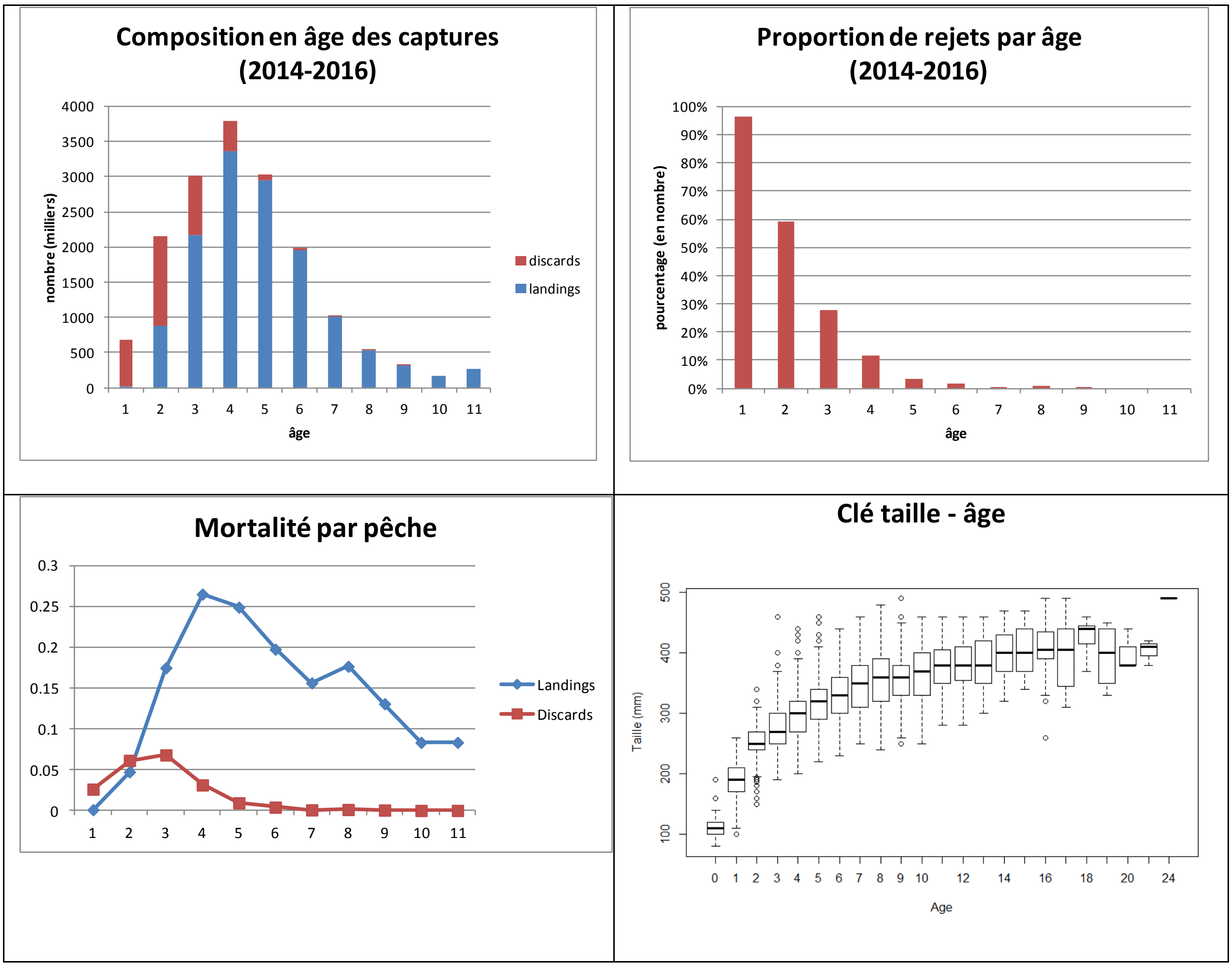


Figure 2. Sole 7.d. Structure in age of catch, proportion of discards and mortality per age. Correspondence between age and size

Figure 2 presents the correspondences between sizes and ages. The median size at age 1 is 17cm, at age 2, 25cm and 27cm at age 3.

What follows (figure 3) is based on the assumption that all age 1 & 2 soles caught today would be totally avoided. This is a theoretical scenario supposing that small soles are not caught anymore (rather than not landed anymore). Several scenarios are tested:

- ‘PlanSM’: that applies to the same mortality multipliers per age as those estimated for the carrying out of the plan in the absence of selectivity modification (catch = 3,461 t), except for ages 1 & 2;
- ‘PlanSC’: catch maintained at 3,461 tons until 2021;

- 'PlanSD': landings corresponding to the application of the initial plan (without selectivity modification) are maintained at 3,080 t until 2021.

The 'PlanSM' scenario applying a mortality multiplier (i.e. a fishing effort) similar to the one of the initial plan, leads to a 14% decrease of catch in 2018 since the age 1 & 2 individuals previously caught, are not caught anymore. Short-term landings are also affected, since part of age 2 individuals are landed today, but to a lesser extent (-7%).

The 'PlanSC' scenario leads to an increase of fishing mortality (for age 3 and above) since catch is maintained at 3,461 tons, which requires compensation for the fact that age 1 & 2 soles are not being caught anymore.

The 'PlanSD' scenario is the one that maintains landings at the same level as the level obtained in the absence of selectivity modification. It leads to a higher fishing mortality than following the application of the initial plan, but lower that the mortality resulting from the option here above.

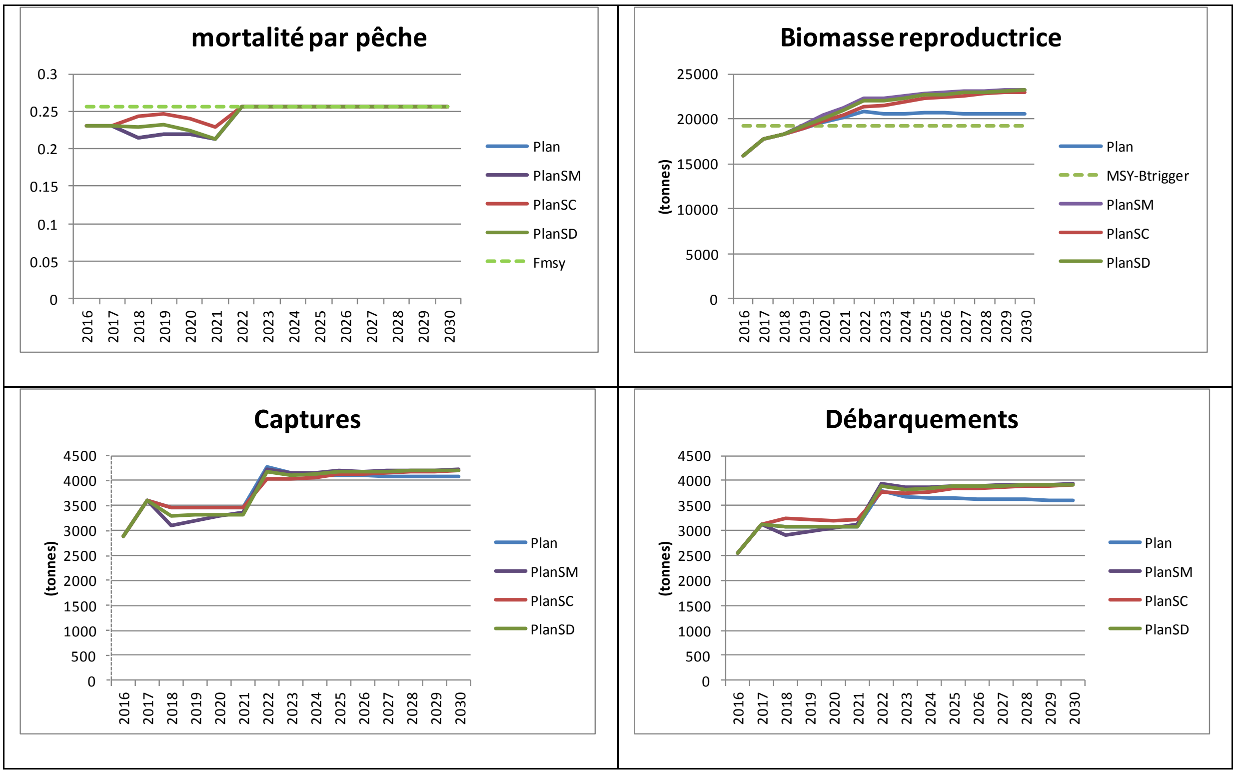


Figure 3. Sole 7.d. Evolution of fishing mortality, catch, landings and spawning stock biomass according to sacral scenarios.

The long-term impact of this modification of the exploitation pattern, though radical, is low in terms of catch (+3%). This low impact can be explained by very low fishing mortality estimated currently for ages 1 & 2. Given that following modification of the exploitation pattern, discards are lower since age 1 & 2 soles are not caught anymore, long-term benefits on landings are slightly higher (than those for catch), in the order of 9% (i.e. about 300 tonnes).

All scenarios eventually lead to a spawning stock biomass 13% above the one that would result from the application of the plan without selectivity modification. This higher value of spawning stock quantity constitutes, without any doubt in this case, the main benefit of an eventual improvement of selectivity.

Conclusion:

The application of the plan proposed by French professionals does not present any additional risk compared to the MSY approach since it leads to under fishing of the stock up to 2021. Nevertheless, this biological under fishing may correspond to economical optimisation (through a limited but well valorised by the market catch volume), even if this aspect was not analysed in this document. In the assumption of deterministic recruitment, it also leads to a faster increase of spawning stock quantity.

In addition, the simulations carried out (with available data) show that an improvement of the exploitation pattern (from improvement of selectivity) at constant fishing effort, would allow a slight increase of landings and a large increase in spawning stock quantity. Finally, one should remember that an increase of the minimal size,, envisaged as an additional measure of the management plan, is only interesting if it leads to the catch of individuals of a smaller size being avoiding, or if the survival rate of discards of these individuals is very high. Without any certainty regarding one or the other of these assumptions, the impact of a size increase from 24 to 25 cm was not assessed[5].

[5] The impact of increasing the landing size from 24 to 25 cm is a far less ambitious scenario than the one tested in this document (complete sparing of age 1 & 2 individuals), which showed relatively limited advantages.