Directed sardine TAC updates using the 2020 recruit survey estimate

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Abstract

The "straightforward approach" of FISHERIES/2020/JUL/SWG-PEL/60 is used to provide directed sardine TACs which are correspond to those made before the 2020 sardine recruitment survey result became available in terms of four "consequence" measures.

The results presented here follow the identical approach to FISHERIES/2020/JUL/SWG-PEL/60, but have been developed using the consequence tables from Table 5a of FISHERIES/2020/AUG/SWG-PEL/70 to inform on possibly revising the total sardine catch (TAC). Some points to note:

- The consequence values from Table 5a of PEL/70 show "multiplicative and additive change in west component effective spawning biomass and additive change in west component total biomass from November 2019 to 2020 under alternative large sardine west and south coast catch options and alternative November 2019 recruitment scenarios".
- The updated TAC values are calculated so that the same Ccrit values arise when the consequence values are given a weighted average across the five recruitment values using the updated non-uniform prior as was the case for the Ccrit value for the original TAC recommendation of 34.05 mt with the original uniform prior (for which each recruitment value was given the same weighting). The TAC values for 34.05 mt used here to calculate that Ccrit have been taken from Table 2 of PEL/70.
- Results are shown for two updated priors, arising from two regression analyses where the November assessment recruitment is regressed against the survey estimate:
    a) all data, but the sigma value (*sig*) assumed for the updated prior is the same as for (b) where data from 2005 onwards only are used (namely 0.635)[2], and
    b) data from 2005 onwards.

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[2] For the motivation for the use of this sigma value, see FISHERIES/2020/AUG/SWG-PEL/71.

Table 1: The panels below lists the values of the assessment estimates of recruitment, **R(i)**, values (note that these refer to the November of the year prior to the one in which the recruitment survey takes place) from the last five years, the uniform prior and its normalised value, the expected recruitment survey result (surv_hat) given the regression equation (4), the likelihood of each surv_hat value given the actual June 2020 survey recruitment value (7.01), and the updated prior taking this likelihood into account. Note that for (a), the sigma (*sig*) value used to calculate **L(i|survey)**[3] is the same as for (b), namely 0.635, thus the values in the last three columns are different to those reported in Table 2(a) of FISHERIES/2020/JUL/SWG-PEL/60. Section (b) is the same as Table 2(b) of FISHERIES/2020/JUL/SWG-PEL/60.

(a) All data points				Surv(2020)	7.01	
R(i)	**P(R,i)**	**P(R,i) normalized**	**surv_hat**	**L(i|survey)**	**P*L**	**Pup(R,i)**
14.1447	1.000	0.2000	4.7013	0.515	0.103	0.406
11.5935	1.000	0.2000	3.8534	0.403	0.081	0.317
8.10899	1.000	0.2000	2.6952	0.203	0.041	0.159
6.98689	1.000	0.2000	2.3223	0.139	0.028	0.109
3.47028	1.000	0.2000	1.1534	0.011	0.002	0.009

(b) Excluding points for y<2005				Surv(2020)	7.01	
R(i)	**P(R,i)**	**P(R,i) normalized**	**surv_hat**	**L(i|survey)**	**P*L**	**Pup(R,i)**
14.1447	1.000	0.2000	5.6766	0.594	0.119	0.359
11.5935	1.000	0.2000	4.6527	0.510	0.102	0.308
8.10899	1.000	0.2000	3.2543	0.303	0.061	0.183
6.98689	1.000	0.2000	2.8040	0.222	0.044	0.134
3.47028	1.000	0.2000	1.3927	0.025	0.005	0.015

Table 2: Updated total sardine TACs for different consequence matrices for the two options. The values show the total TAC in mt, i.e. are comparable to the original recommendation of 34.05 mt. The consequence tables leading to these updated results assume a bycatch component of 10.4 mt.

	(a) All data points			(b) Exclude y<2005		
Updated TAB	5%	20%	50%	5%	20%	50%
Multiplicative delta in effSSB	50.1	61.0	58.5	48.4	55.9	54.9
Additive delta in effSSB	69.2	55.2	69.2	59.6	51.3	59.6
Additive delta in B	41.8	41.5	39.8	40.8	38.9	38.6
Relative Multiplicative delta	37.6	36.7	37.0	37.2	36.2	36.7

[3] This likelihood is calculated as L(i|survey)=$\frac{1}{\sigma\sqrt{2\pi}}\exp\left(-\frac{1}{2}\left(\frac{\ln(7.01)-\mu_i}{\sigma}\right)^2\right)$, where μ_i is the log of the expected survey result (surv_hat) for recruitment value *i*, given the regression results, and σ (named sigma or *sig* elsewhere in the text) is the standard deviation of the residuals for the regression using data from 2005 onwards, i.e. $\sigma = 0.635$.

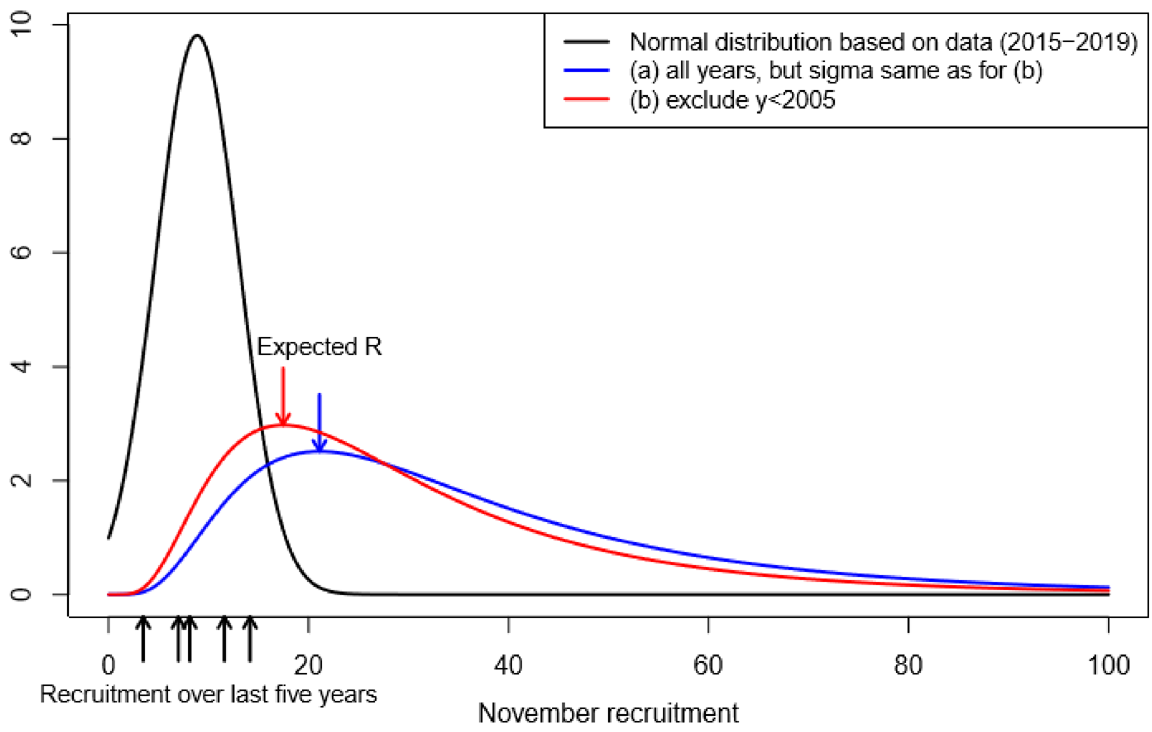

Figure 1: Probability density function plots for November recruitment for first the normal distribution corresponding the last five data points from 2015-2019 (marked by the black arrows on the horizontal axis). These equally weighted values provide the prior for the updating procedure which then also incorporates the 2020 recruitment survey estimate through use of the regression of historical survey vs assessment model November recruitment estimates. The probability density functions shown for the 2020 recruitment survey estimates follow from use of the regression equation given the survey result of 7.01, with the results transformed from the log-space of the regression to normal space. The expected values for those distributions are indicated by the coloured arrows.

The means and standard deviations for the three curves are as follows:

Black: mean = 8.86, sd = 4.14

Blue: mean = 35.13, sd = 19.83

Red: mean = 30.17, sd = 18.15