Proposed Jack Mackerel Harvest Control Rule
2022

Harvest Control Rule

Stock status	TAC calculation method
$B_{t+1} < B_{lim}$	Set TAC to zero; directed jack mackerel fishing prohibited

$B_{t+1} \leq$ 80% of B_{MSY} (or proxy)	1) Compute trial catch (C_{trial}) at estimated F_t or F_{MSY} (whichever is smaller)
	
	If $C_{trial} < C_{replacement}$
	   Set catch at or below C_{trial}
	   (the stock will increase)
	Else if $C_{trial} > C_{replacement}$
	   Set catch at or below $C_{replacement}$
	   (the stock remains stable)

$B_{t+1} >$ 80% of B_{MSY} (or proxy) and $B_{t+1} \leq B_{MSY}$ (or proxy)	2) Compute trial catch (C_{trial}) at estimated F_{MSY} (or proxy)
	If $C_{trial} < C_{replacement}$
	   Set catch at or below C_{trial}
	Else if $C_{trial} > C_{replacement}$
	   Use method 1).
	   The TAC will not be allowed to vary by more than 15% between years

$B_{t+1} > B_{MSY}$ (or proxy)	3) Set catch at or below value based on F_{MSY} The TAC will not be allowed to vary by more than 15% between years

Table 1: Proposed harvest control rule for jack mackerel, as adjusted during the 2022 benchmark workshop (SCW14).

Note that all instances of B refer to spawning stock biomass and not total biomass. B_t is the estimated spawning stock biomass in the current year, $C_{replacement}$ is the catch in a future year which would keep spawning stock biomass the same. For example, if the catch in 2022 resulted in B_{2022} being equal to subsequent B_{2023} then that catch is defined as the replacement yield.

Explanation [from SPRFMO SCW14-Report - JM Benchmark]

Since 2014, the Commission has used biological reference points as specified in Annex K of COMM02-Report. At the 2nd Scientific Committee meeting in 2014, Annex K was adjusted to include a rule to create more stability in total allowable catches (TACs); this subsequently became known as "adjusted Annex K". In 2022, SCW14 reviewed these biological reference points and introduced a limit reference point (B_{lim}; where B refers to spawning biomass). The

proposed 2022 harvest control rule (HCR; based on Annex K of the COMM02-Report, the "adjusted Annex K" HCR defined in the SC2 Report, and discussions at SCW14) is thus as follows:

a) if the biomass in the coming year is estimated to be below B_{lim} then the TAC is set to zero and directed fishing for jack mackerel is prohibited. B_{lim} is to be computed from the ratio $\gamma_{lim} = \min(B_t/B_{0,t})$; that is, the lowest ratio of historical spawning biomass relative to unfished. So, for the 2022 stock assessment, $B_{lim} = \gamma_{lim} B_{0,2023}$.

b) If B is below 80% B_{MSY} (or a proxy), the trial catch for next year would be based on the minimum of the current F or F_{MSY}, which would mean that in theory B would not go down. If the trial catch is greater than the replacement yield (i.e., the catch level that would result in the same B for the subsequent year) then the TAC would be set at the replacement yield. This would mean that at a minimum the biomass would remain stable and would not decrease.

c) If B is above 80% B_{MSY} (or a proxy), the trial catch for the next year would be based on the estimated F_{MSY}. If the trial catch is less than the replacement yield, the TAC will be set at or below the trial catch. If the trial catch is above the replacement yield, the method outlined in the previous bullet point should be used. The TAC will not be allowed to vary by more than 15% between years.

d) If B is above B_{MSY} (or a proxy), then the TAC would be set based on F_{MSY}. The TAC will not be allowed to vary by more than 15% between years.

The workshop proposed setting B_{lim} as a function of the ratio γ_{lim} which is based on unfished biomass estimates. Here, unfished biomass is defined as the estimated spawning biomass that would have occurred had there been no fishing. That is, it is the biomass based on the estimated recruitment adjusted by the stock-recruit relationship under no fishing.