Proposed Jack Mackerel rebuilding plan

Between 2008 and 2012 the Science Working Group (SWG) supporting international meetings and preparatory conferences for the establishment of a South Pacific Regional Fisheries Management Organisation (SPRFMO) made an important progress in estimating the stock status of jack mackerel (*Trachurus murphyi*) over the whole south east Pacific Ocean.

Results showed that the jack mackerel stock experienced high fishing mortalities in the 1990s when catches peaked at more than four million tonnes and also in the 2000s with almost two million tonnes of catch. Current assessments estimate that during these periods fishing mortalities were well above F_{MSY}. Consequently, the spawning stock biomass (SSB) was depleted to the lowest level of the time series by 2010. Subsequent measures by SPRFMO contributed to the reversal of this trend by constraining catches since 2011. This action resulted in fishing mortalities that have decreased substantially and the current (2013) level is estimated to be below estimates of F_{MSY}. The spawning stock biomass appears to be responding and the SSB is rebuilding but remains low (estimated at around 51% of B_{MSY} in 2013). As with most stock assessments, projections are highly uncertain. In this case, there also appears to be environmental effects resulting in low recruitments since 2000. This situation, should it continue, impacts the rate at which the stock is expected to rebuild to the target and adds to the uncertainty.

The near-term objective of this rebuilding plan is to ensure continued growth of the jack mackerel spawning stock biomass (SSB) at least until 80% of B_{MSY} (or suitable proxy). In 2013, the Scientific Committee (SC) provided provisional estimates of F_{MSY} and B_{MSY} as directed by the Commission. From this, the basis for a rebuilding and conservation plan can be designed to fulfil the objectives of the Commission. For a default harvest control rule, the Commission has provided a preliminary set of conditions for future jack mackerel TAC specifications as detailed below. The Commission encourages further refinements and testing of this control rule and development of alternatives as time allows by the SC for future Commission consideration.

The current rebuilding and conservation plan shall apply to jack mackerel over the whole southeast Pacific Ocean. There are important uncertainties regarding the stock structure of jack mackerel and the definition of management areas should be based on biological criteria. Therefore, and until more scientific information is available regarding the most likely stock structure the SC will continue to consider both stock structure hypotheses and cover the whole geographical distribution of jack mackerel over the South East Pacific Ocean.

The SC is requested to review and evaluate the Rebuilding and Conservation plan presented below by:
- Implementing a default Harvest Control Rule (HCR) following the guidelines specified below
- Develop an operating model to test the performance of this HCR under unknown and uncertain conditions/realities
- Alternative HCRs can be entertained to set annual catch limits to evaluate as part of the rebuilding plan
- Propose performance statistics which will enable the Commission to evaluate this and other HCRs. Performance statistics should allow to evaluate:
    1. The rate of biomass growth during a certain time frame
    2. Expected catch and catch variability
    3. Risks of biomass decline, and
    4. Expected time to reach X% of unfished SSB (a proxy representing 80% of B_{MSY})

The Commission recommends the default HCR have the following set of conditions to allow for future fishing opportunities:

Stock status	TAC calculation method

$SSB_t \leq 80\%$ of B_{MSY} (or proxy)	1) Compute yield (C_{trial}) at estimated F_{2013} 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)

$SSB_t > 80\%$ of B_{MSY} (or proxy)
and
$SSB_t \leq B_{MSY}$ (or proxy)
	2) Compute yield (C_{trial}) at estimated F_{MSY} (or proxy)
	If $C_{trial} < C_{replacement}$
	    Set catch at or below C_{trial}
	    (the stock will increase)
	Else if $C_{trial} > C_{replacement}$
	    Use method 1)

$SSB_t > B_{MSY}$ (or proxy)	3) Set catch at or below value based on F_{MSY}

Note that SSB_t is the estimated spawning stock biomass in the next year, $C_{replacement}$ is the catch in a future year which would keep SSB the same. For example, if the catch in 2014 resulted in 2014 SSB being equal to subsequent 2015 SSB then that catch is defined as the replacement yield.

The SC should test this HCR in 2014 along with alternatives that they may wish to include for both near-term performance and relative to long-term trends. Evaluating rules specific to alternative stock structure hypotheses may be developed as time permits but priority will be toward the accepted assessment used for advice.