



Pacific
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Evaluation of harvest control rules for the tropical purse seine skipjack fishery

SC12-MI-WP-06

WCPFC-SC-12, Bali, Indonesia

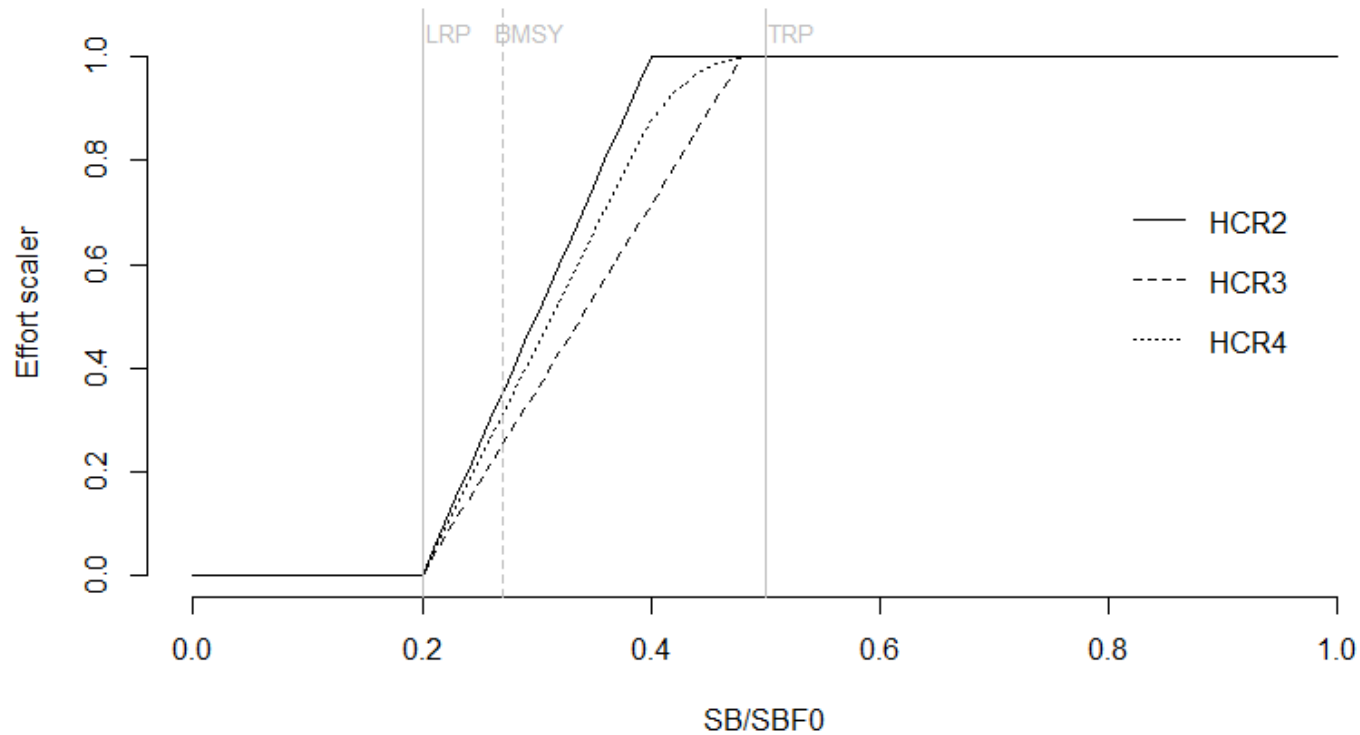
August 2016

Objectives

- Evaluate 4 candidate HCRs that apply to the tropical skipjack PS fishery
 - PS in EEZs of regions 2, 3 and 5
 - excluding AW, but including high seas in regions 2 & 3
- Primary objectives of the HCRs
 - To maintain the stock at biomass levels close to the TRP.
 - To minimise risk of falling below the LRP.
 - To maintain stability in fishing effort in the short to medium term (10 yrs)

| HCR Control Parameters | | | | |
|------------------------|----------------------|----------------------|-----------|---------------------------------------|
| | SB/SB _{F=0} | SB/SB _{F=0} | Catch (t) | Comments |
| HCR1 | 0.3 | 0.2 | - | Not considered in this report |
| HCR2 | 0.4 | 0.2 | - | - |
| HCR3 | 0.48 | 0.2 | - | - |
| HCR4 | 0.48 | 0.2 | - | Non-linear decline to control param 2 |
| HCR5 | 0.48 | 0.2 | 1,400,000 | Additional catch constraint |

Harvest Control Rules



HCR5 is the same as HCR3 but includes an additional effort reduction in the event that catches exceed 1,400,000 tonnes for two consecutive years

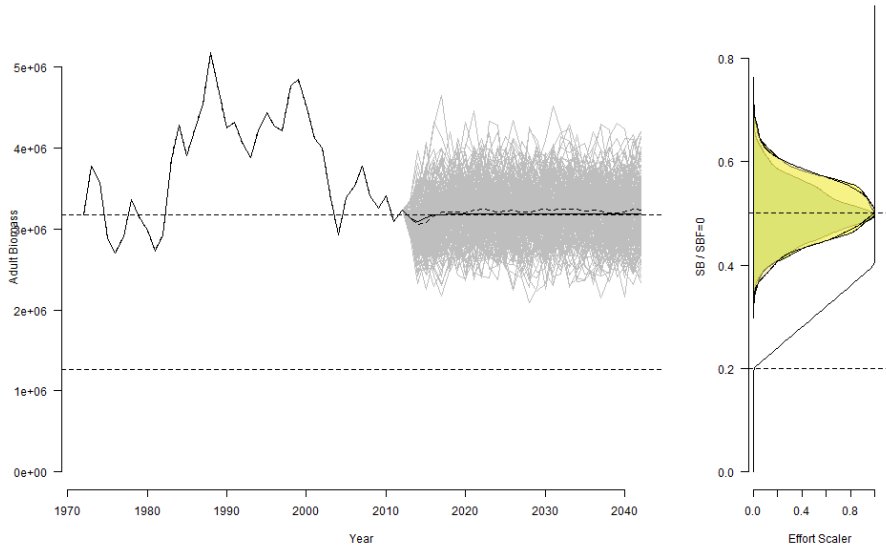
Evaluation Framework



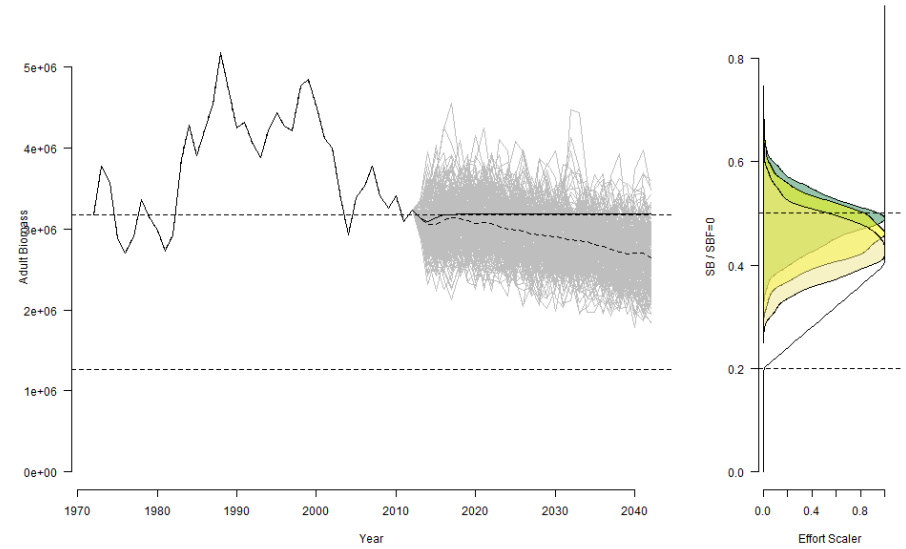
- Stochastic projections with future effort levels determined from the HCRs
 - 30 year simulation period
 - 3 year management time period
 - 2014 reference case assessment model
 - Recent 10yrs recruitment residuals
 - 200 simulations for each HCR and effort creep scenario
- Application of effort scalers
 - Applied only to the PS fisheries in EEZs of regions 2, 3 and 5.
 - excluding AW, but including high seas in regions 2 & 3
- Uncertainty
 - Recruitment error applied as deviates to the SRR
 - 10% error applied to terminal biomass estimates
 - $N(0, 0.1)$

Results

No Effort Creep



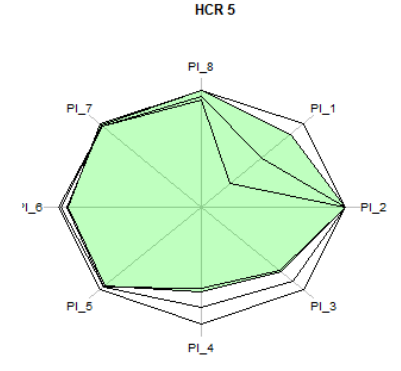
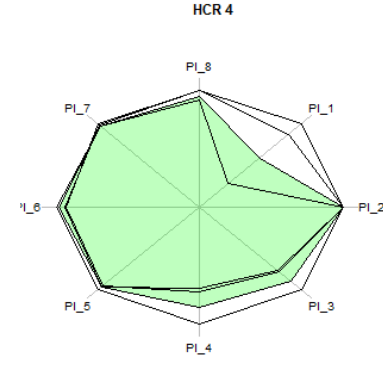
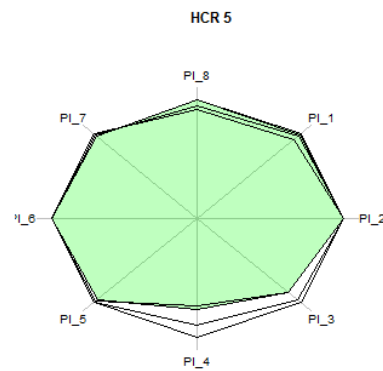
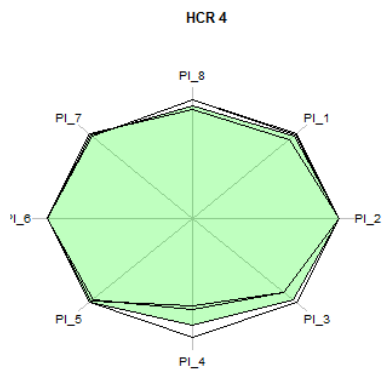
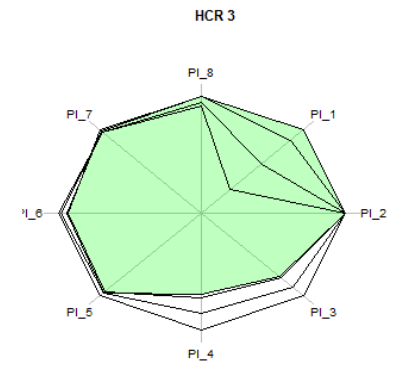
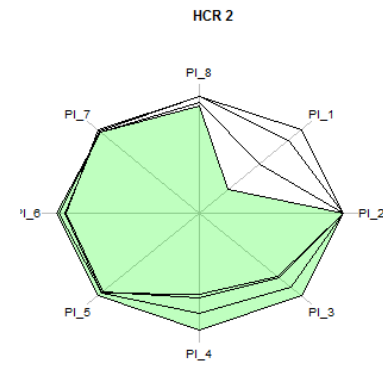
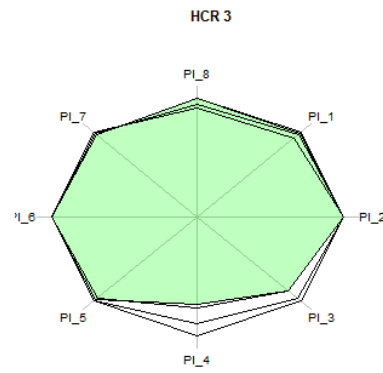
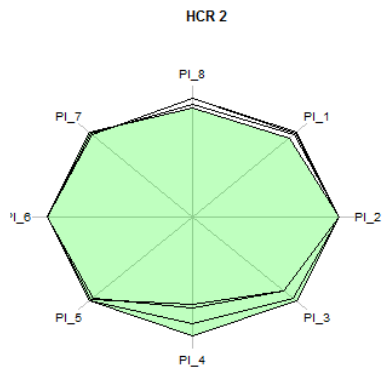
2% Effort Creep



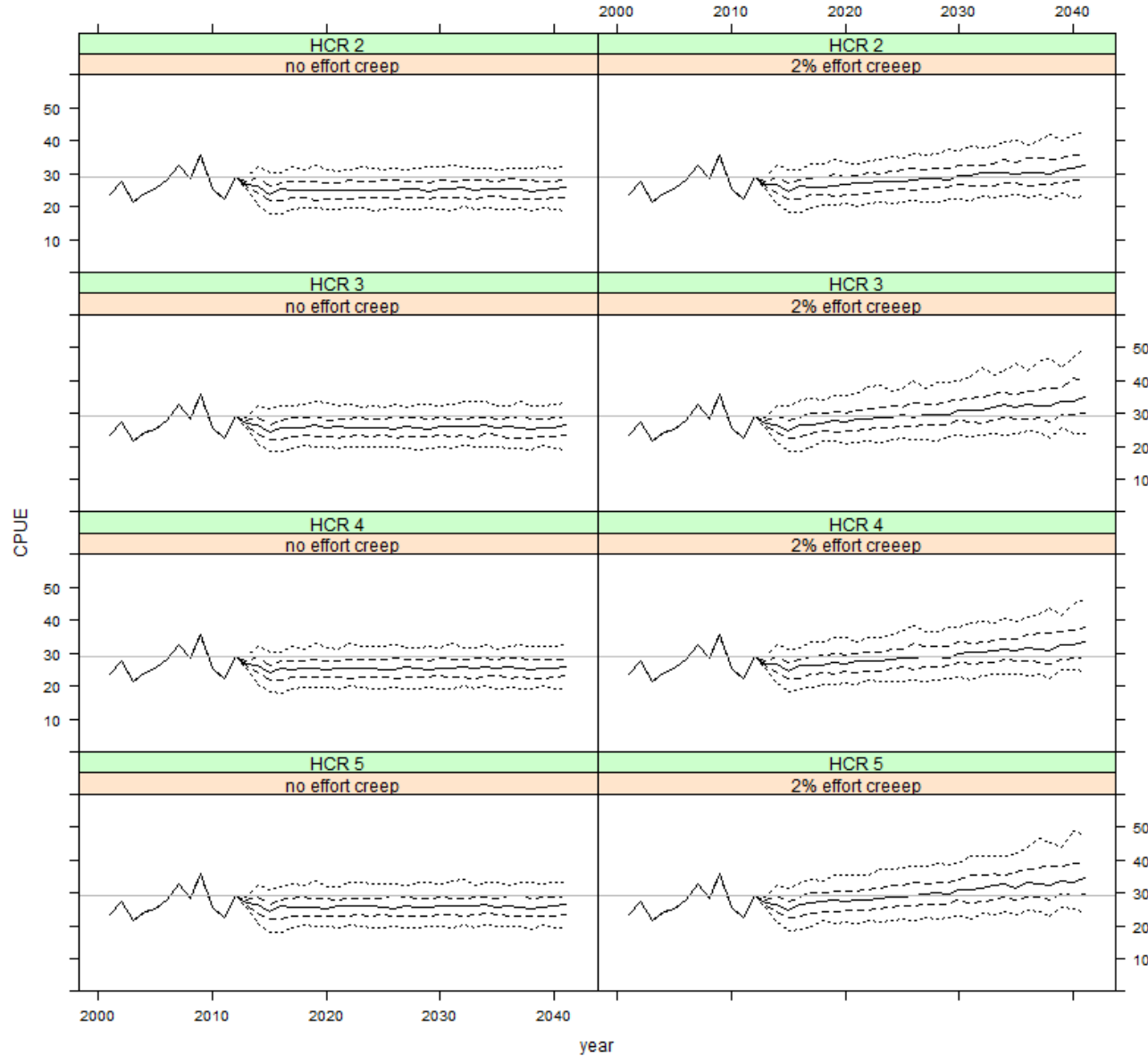
Results

No Effort Creep

2% Effort Creep



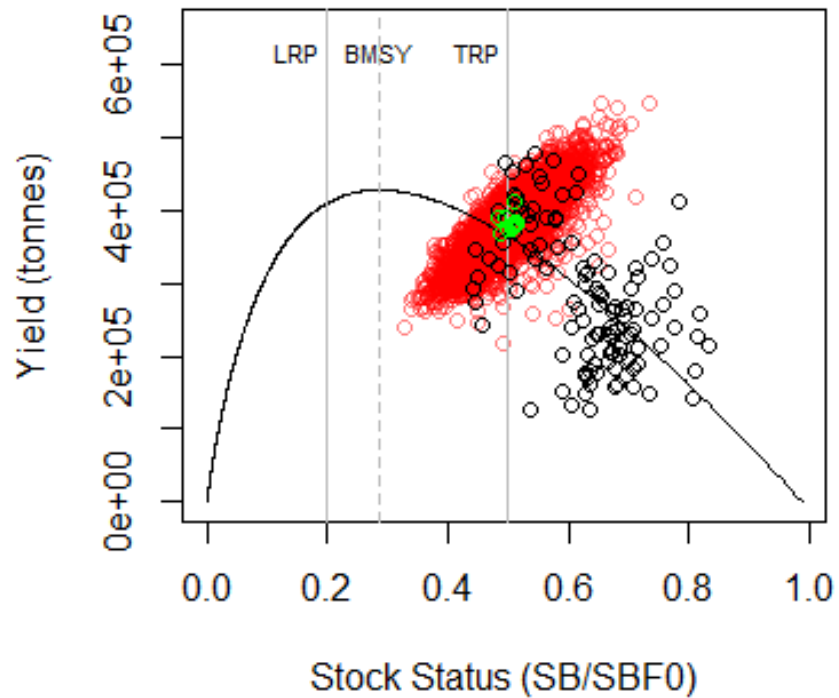
Results



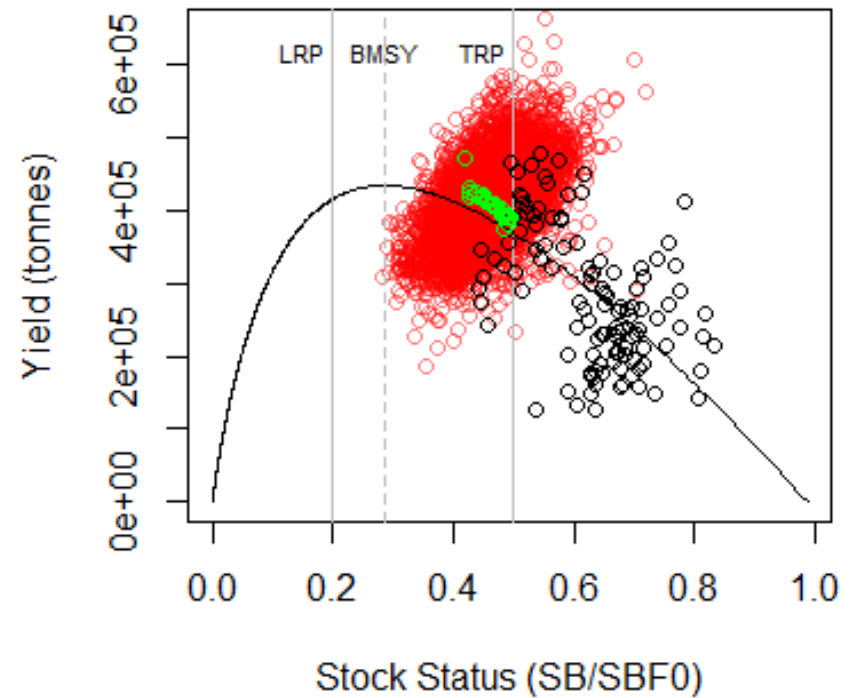
CPUE

Results

No Effort Creep

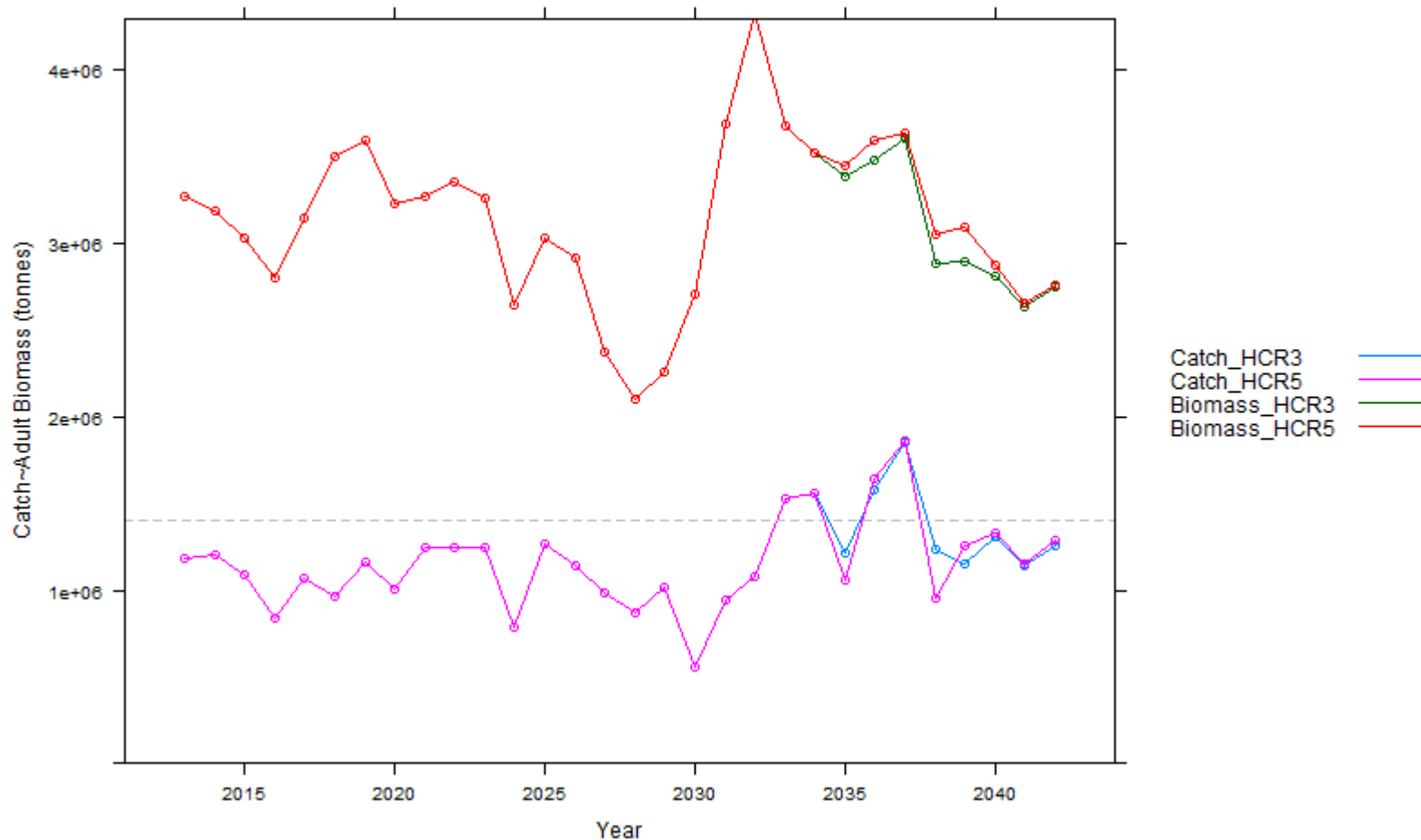


2% Effort Creep



HCR3 vs HCR5

Single iteration without assessment error – projection period
Two instances of exceeding the “high catch limit”
Very short-term effect on biomass and catches



Conclusion

Short-term

- No effort creep
 - HCRs 2 & 4 good at maintaining effort around 2012 levels
 - HCRs 3 & 5 good at maintaining biomass around the TRP
- With effort creep
 - Similar to above but none of the HCRs maintain biomass close to TRP
 - HCR2 good for effort in first 10 years but very bad for long-term biomass

Long-term

- HCRs 2 & 4 good at maintaining effort around 2012 levels
- Difficult to identify a best performer in terms of adult biomass
- Very little variation among HCRs in terms of median catch, CPUE etc. in the last 10 years of the simulations.
- All performed similarly well or badly depending on the effort creep scenario

Caveats

- Modelling framework falls short of a full MSE
 - Insufficient account of uncertainty
 - Based on reference case assessment
 - Assessment model settings are replicated exactly in projections
 - No outcome uncertainty (ie. assumes perfect implementation)
 - Only 2 alternative scenarios considered
- Alternative estimation methods should be investigated
 - Empirical or model based
- Improved metrics for performance indicators necessary in some cases
 - e.g. terminal biomass

Conclusions

The choice of HCR depends on

- The extent to which effort creep is considered to be occurring
- The period of time the HCR is expected to be in place

Clear trade-off between

- Short-term stability in effort but risk of depleted stock in the long-term
- Larger short-term effort reductions but less stock depletion

We invite WCPFC-SC to:

1. Consider the technical approach used to conduct the evaluations and the suggestions for future work.
2. Note the range of uncertainties examined and consider what additional sources of uncertainty should be considered.
3. Consider what performance metrics may be more appropriate/informative
4. Note the importance of effort creep in evaluating the performance of HCRs such as these.