STOCK ASSESSMENT OF ALBACORE TUNA IN THE NORTH PACIFIC OCEAN IN 2020

Albacore Working Group (ALBWG)
of the
International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)

IATTC SAC, 26 – 28 October 2020, Web Meeting

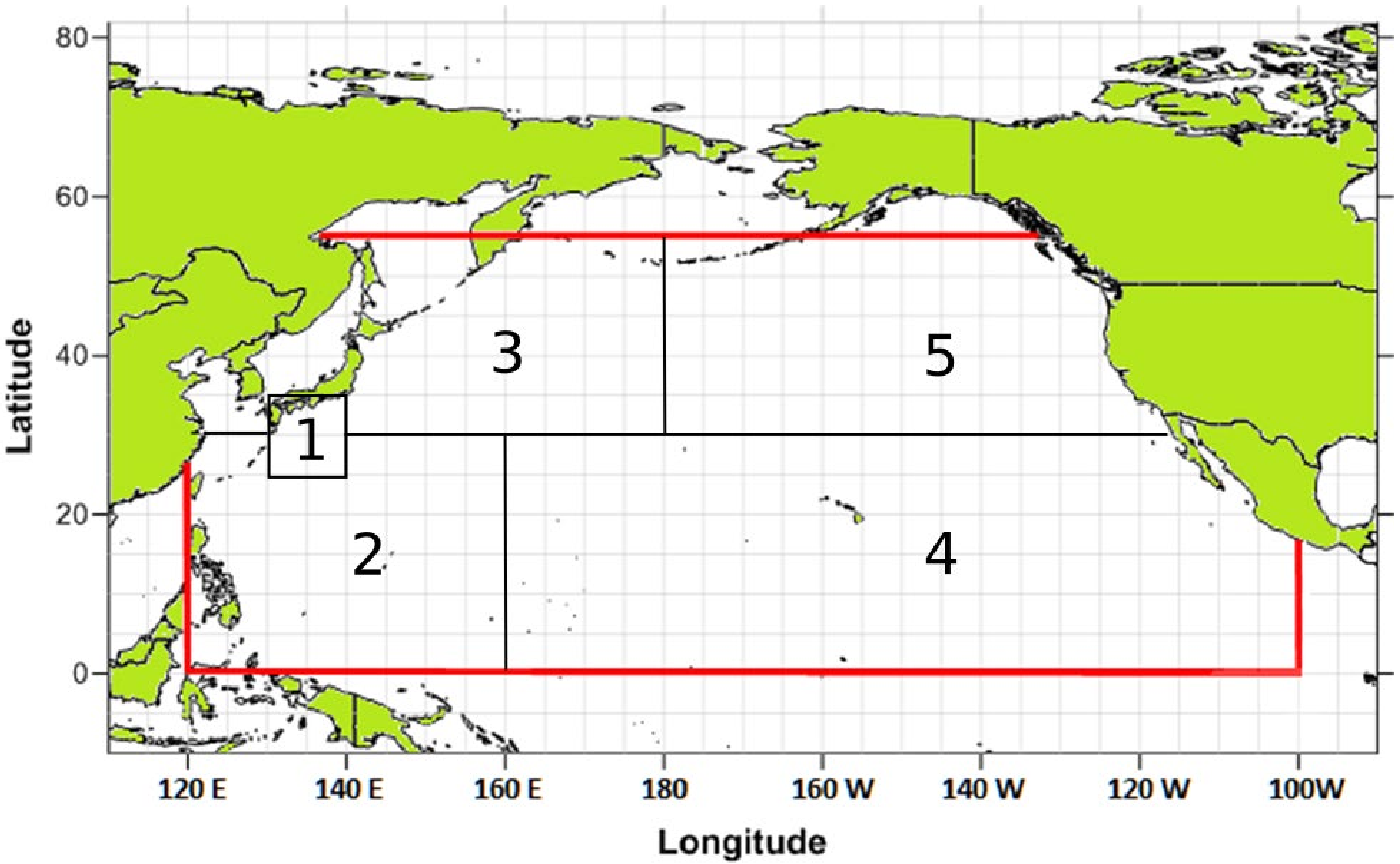
Acknowledgements

- 2020 North Pacific albacore assessment is the result of a collaborative team effort by the ALBWG, including:
- Hidetada Kiyofuji (Chair), Akiko Aoki, Carolina Minte-Vera, Chiee-Young Chen, Daichi Ochi, Desiree Tommasi, Hirotaka Ijima, Hui-hua Lee, Kelsey James, Kevin Piner, Ko Fujioka, Mi Kyung Lee, Naoto Matusbara, Peter Kuriyama, Steve Teo (Lead modeller), Yoshinori Aoki, and Zane Zhang
- Also thanks to IATTC and WCPFC for providing data for non-ISC members

North Pacific Albacore Stock Assessment

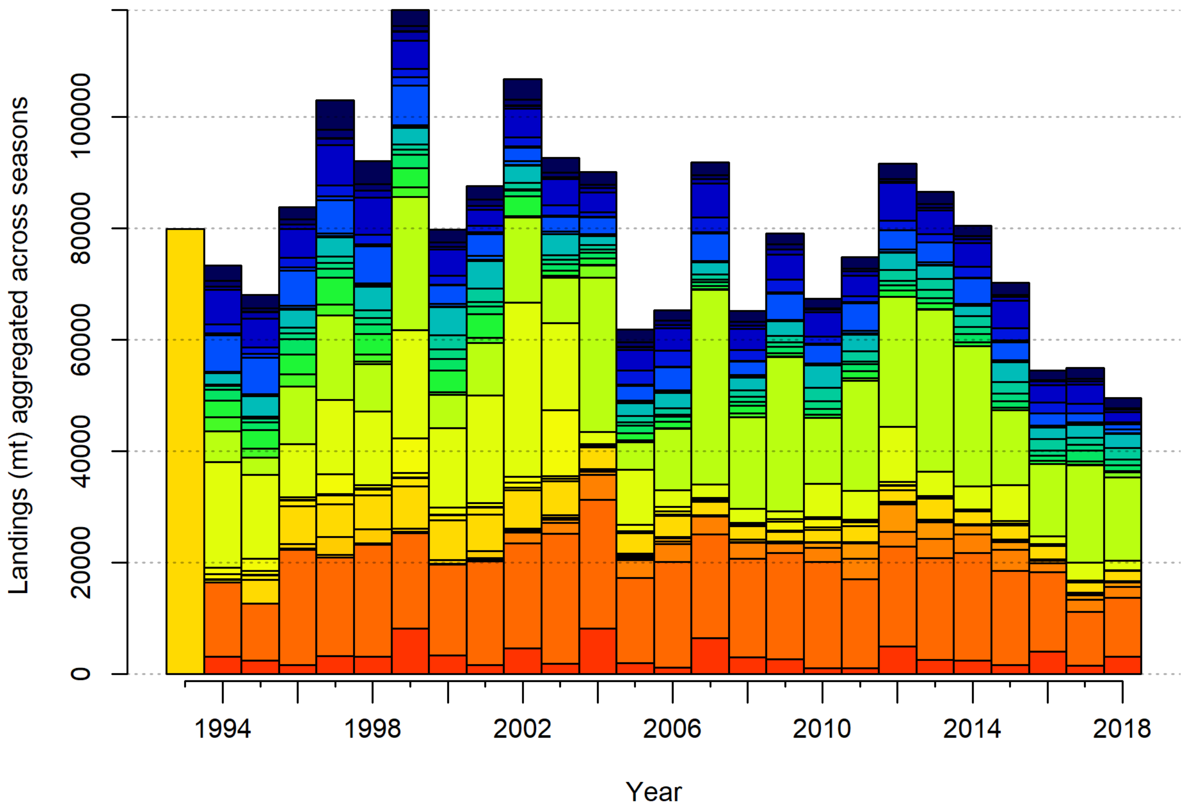
- 3 year assessment cycle
- Last assessment in 2017
- Data prep meeting in Shimizu, Nov 2019
- Assessment conducted as web meeting in Apr 2020 due to COVID-19
- Biological assumptions same as for 2017
- Improved data weighting process
- More seasonal fisheries and flexible selectivity patterns that improved model fit to JPLL and JPPL fisheries

Spatial Domain & Area Definitions



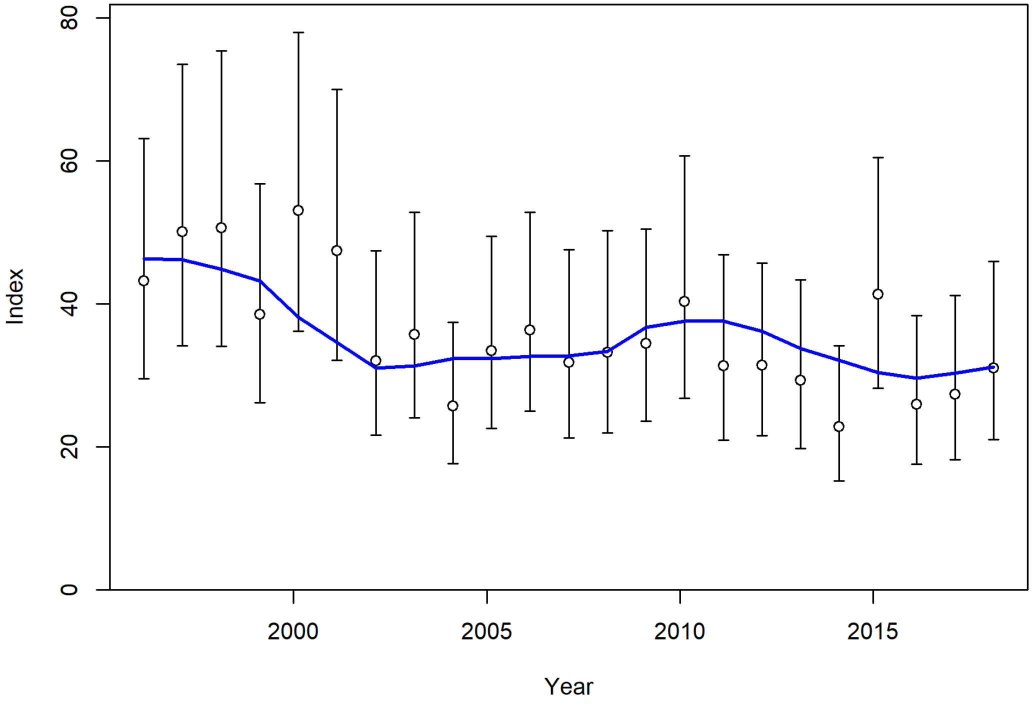
- Area definitions based on cluster analysis of size compositions of US and JP longline fisheries
- Same as 2017 assessment
- 35 fisheries were defined based on gear, area, season, and unit of catch

Data - Catch

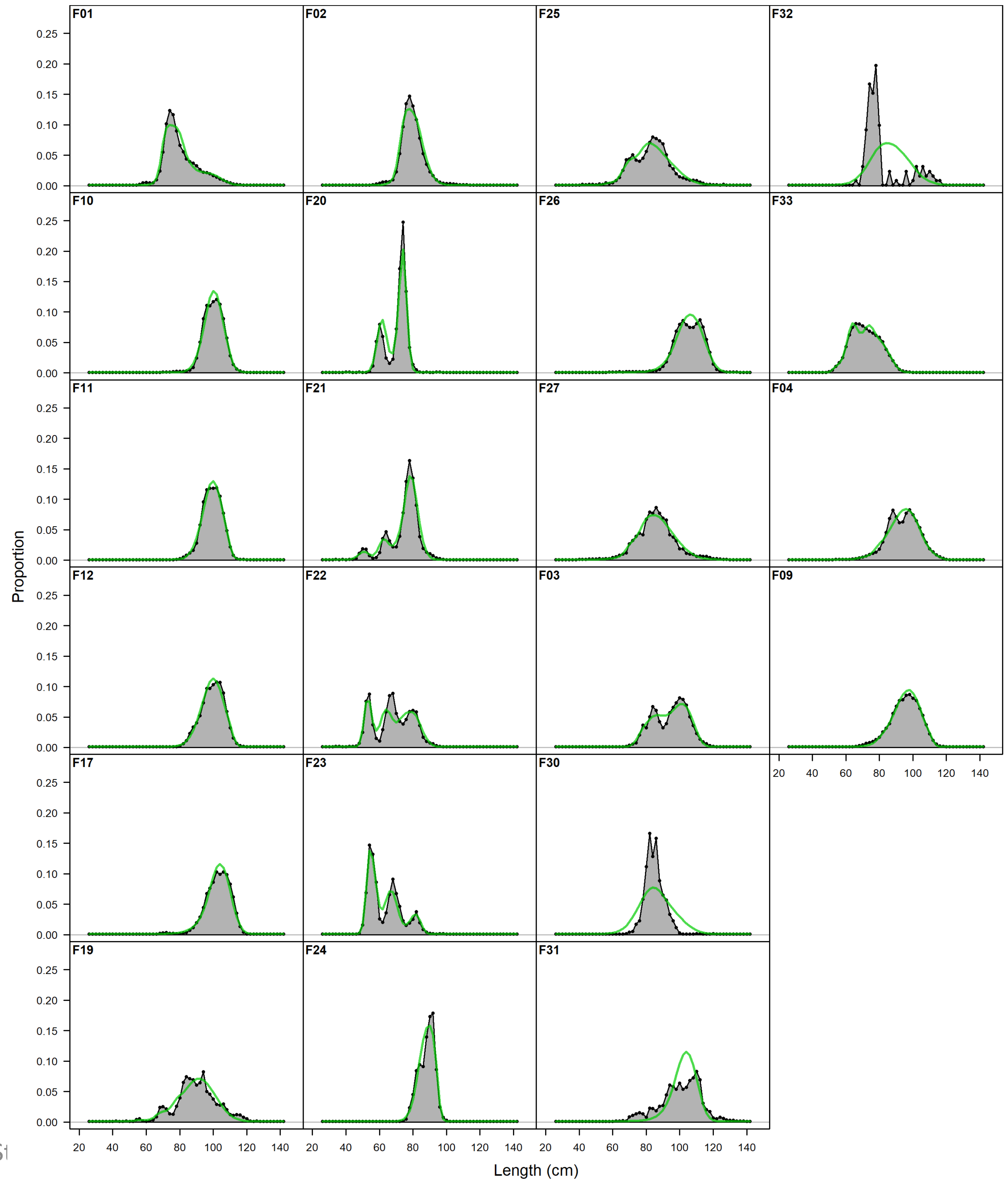


- Largest fisheries are on juvenile fish: JP pole-and-line (PL; F21 & F22) and EPO Surface (F33)
- Lowest catches in 2016 – 2018
- F17 (JPLL_A4_wt) and F34 (JPKRTW_DN) have zero catch throughout 1994 – 2018 period.

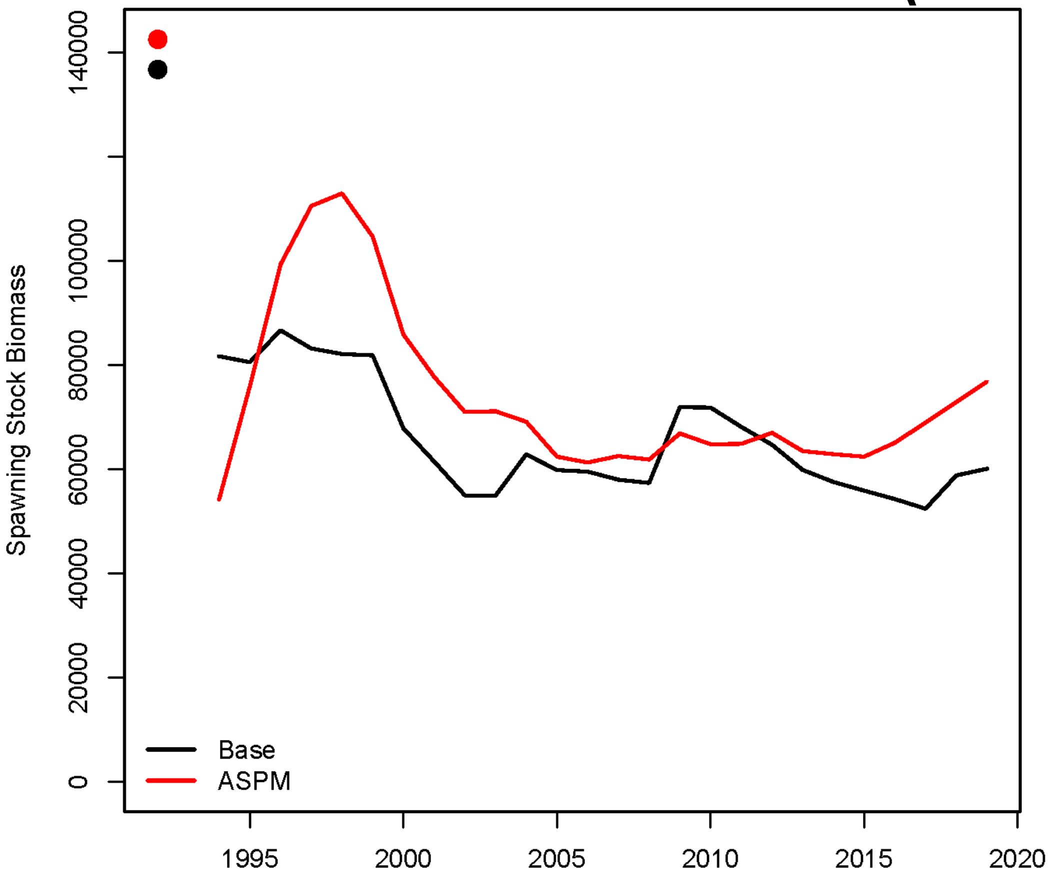
Base Case Model Fit

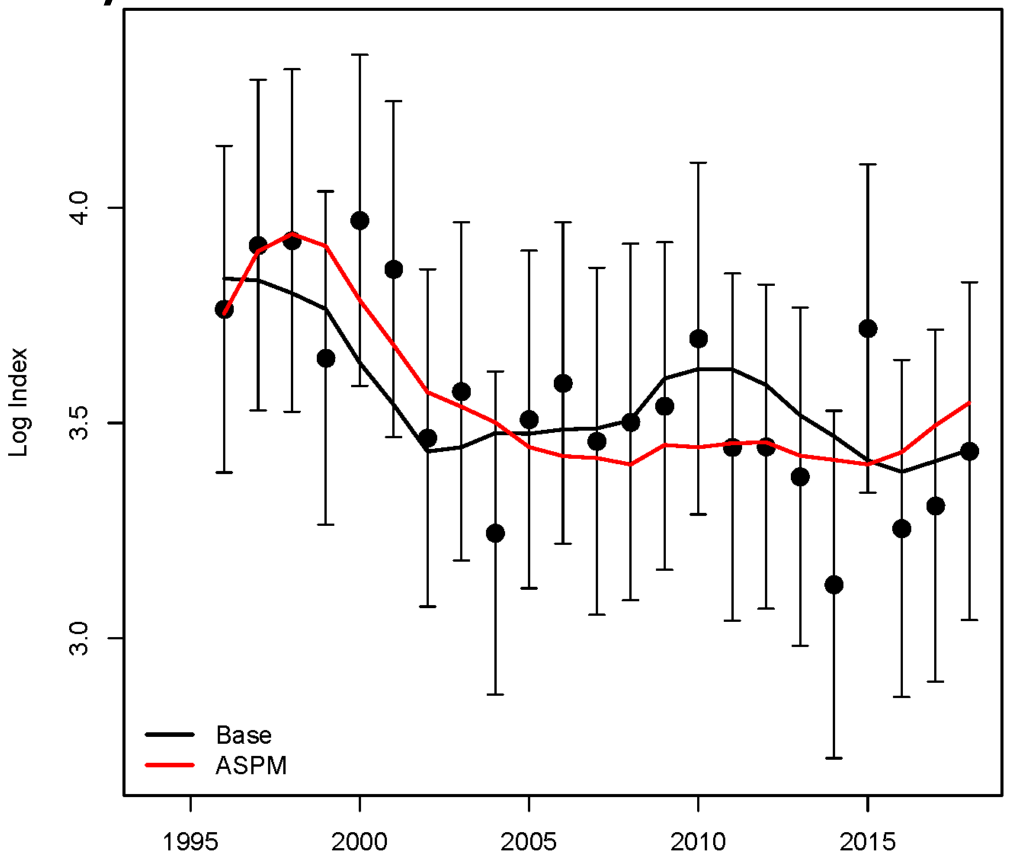


- Model fit was good for F09 index (RMSE=0.169).
- Overall fit to size composition data was good with reasonable weights (Harmonic mean effN / mean input N all ≥2 and Francis multipliers were all ≥1).



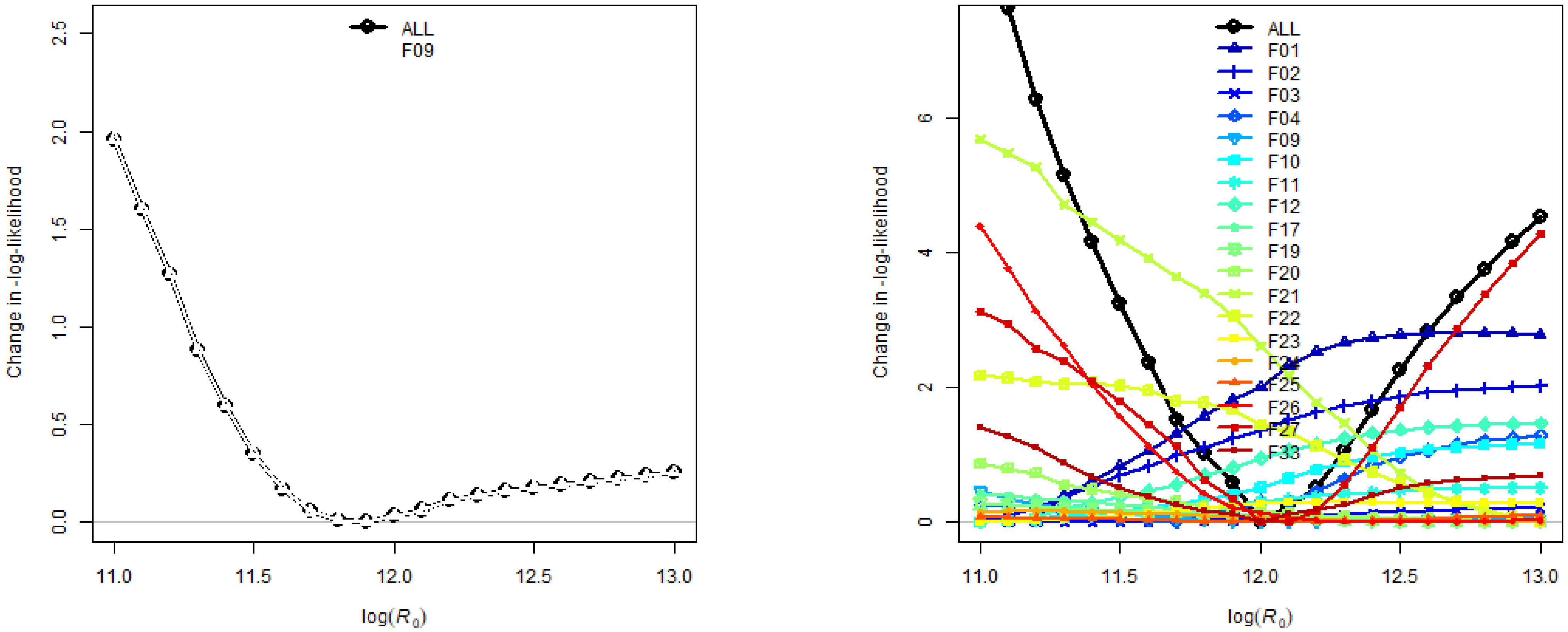
Model Diagnostics – Age-Structured Production Model (ASPM)





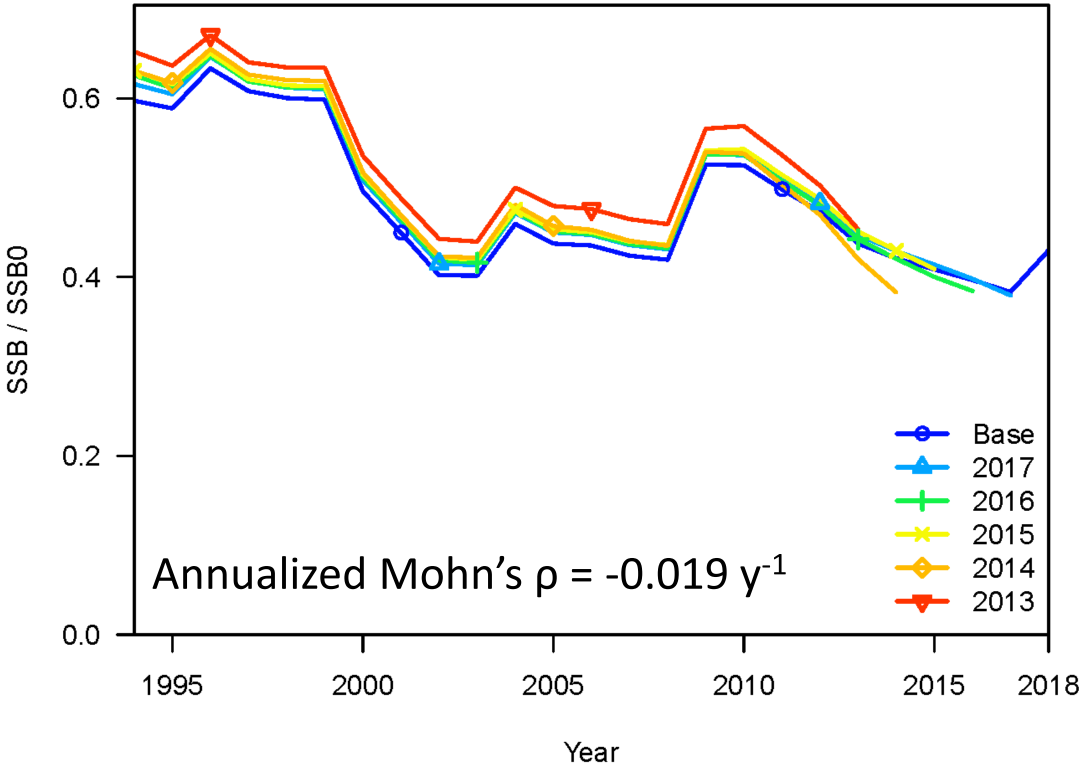
Base case model modified into an ASPM (i.e., no recruitment deviates; fixed selectivity; no fit size comps). ASPM had similar scale and trends to base case model, with similar fit to index.
Conclusions: 1) Catch-at-age and productivity parms can explain changes in index without process variability (i.e., recruitment deviates). 2) Catch-at-age and index are informative and model is able to estimate the production function of stock, population scale, and the effects of fishing on population.

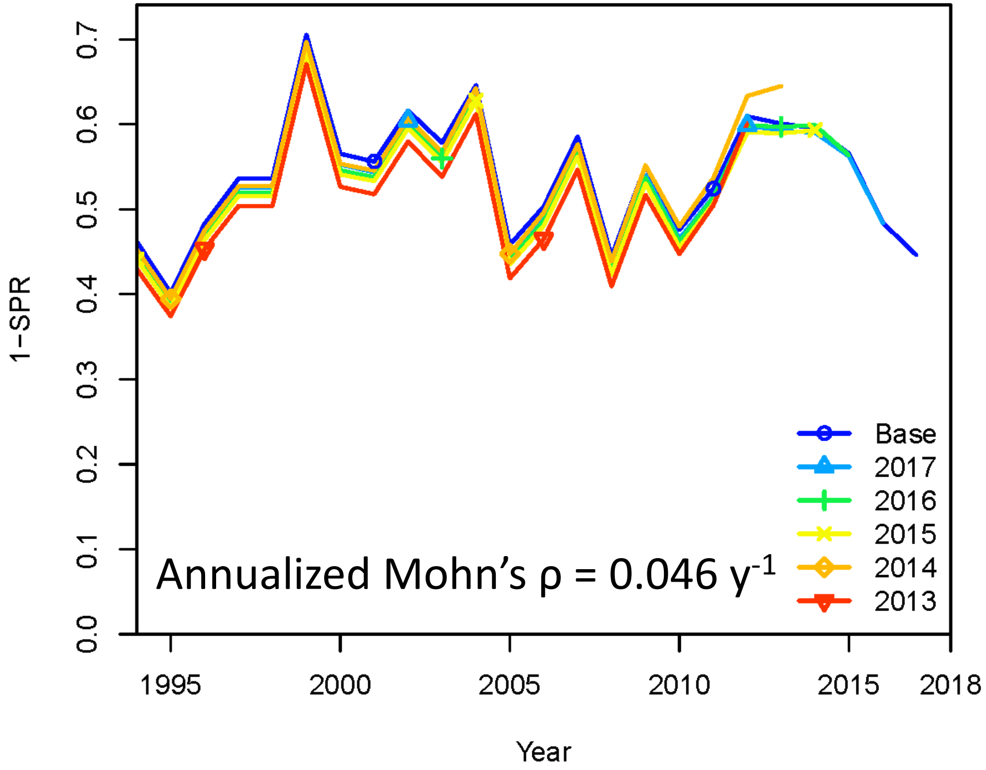
Model Diagnostics – Likelihood profile on R0



Changes in likelihood of data components on R0 indicate how informative each component is on the estimated population scale. Changes in likelihood of F09 index were relatively small (~2 log-likelihood units) over the range of log(R0) investigated due to moderate exploitation levels, which indicates higher uncertainty in the estimated population scale. Likelihood profile of F09 index was asymmetrical and indicates that the index is more informative on whether the population is higher than a certain level, which is the main objective of this assessment. Information from size data relatively consistent with index.

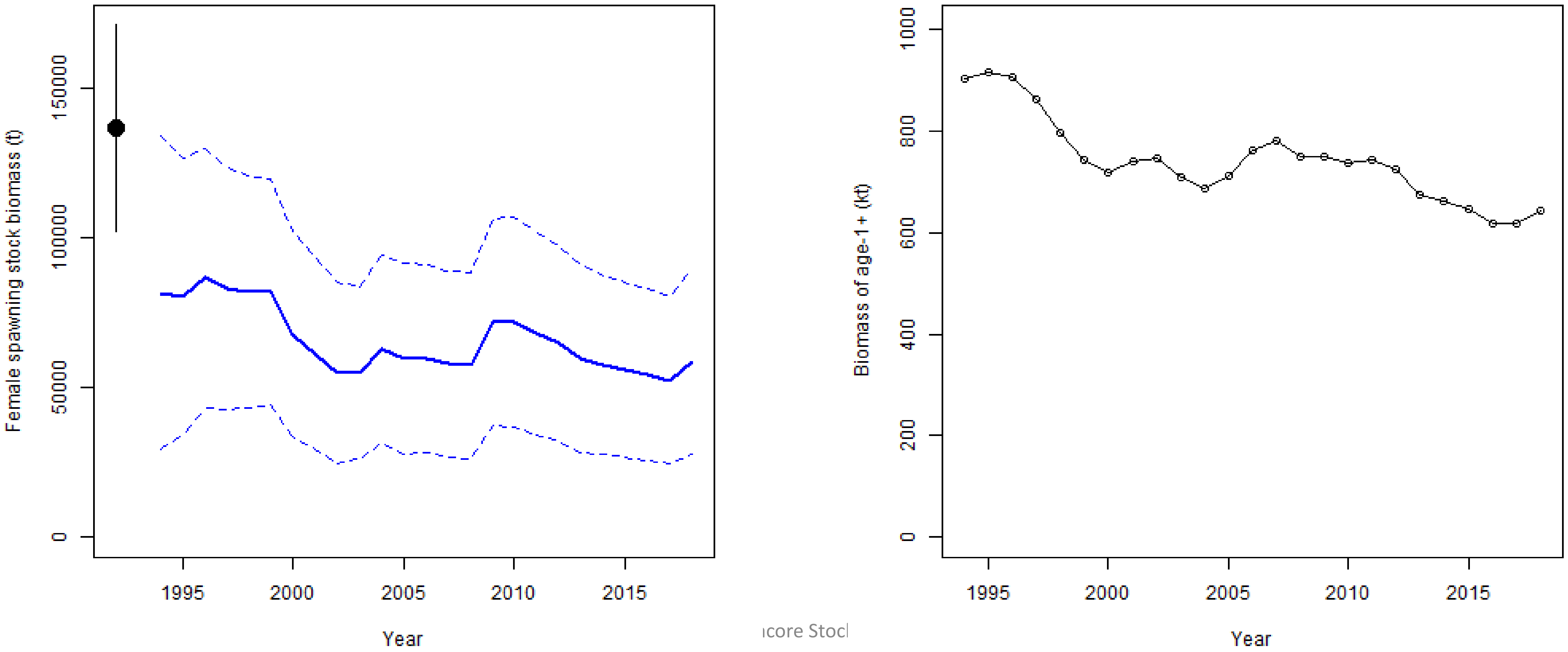
Model Diagnostics - Retrospective





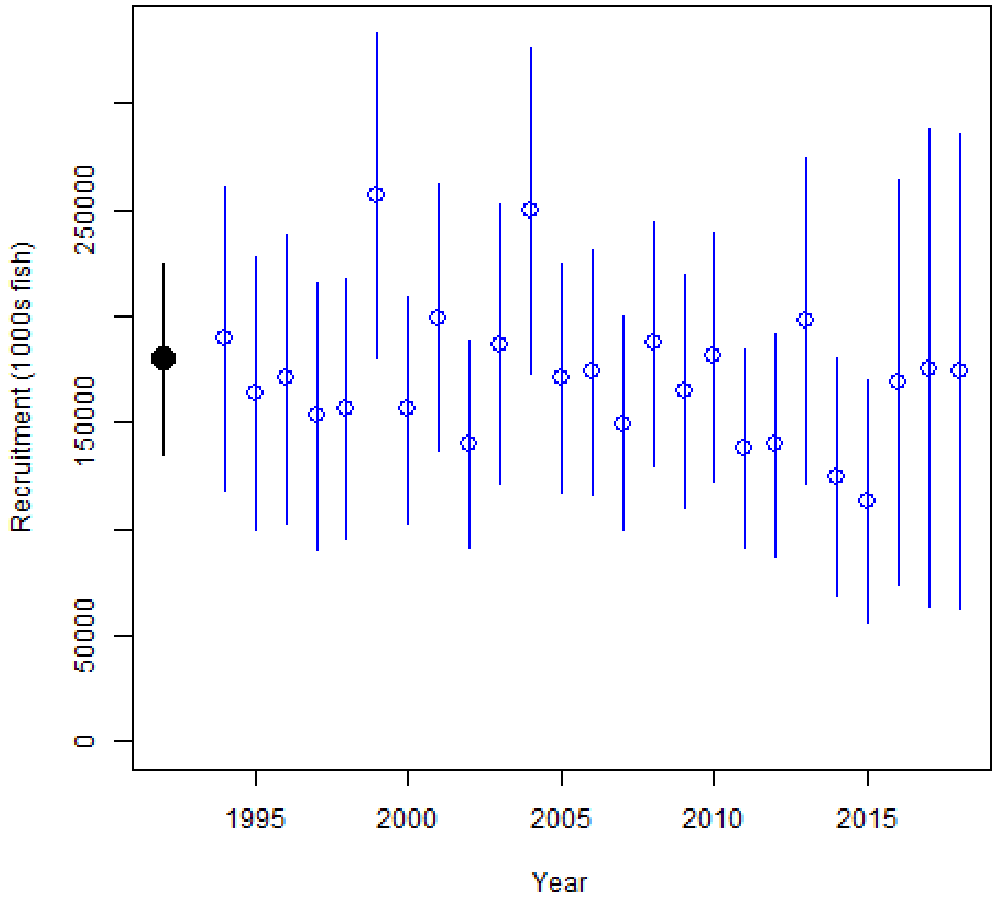
Negligible retrospective pattern for all management quantities

Model Results – Total and Spawning Biomass



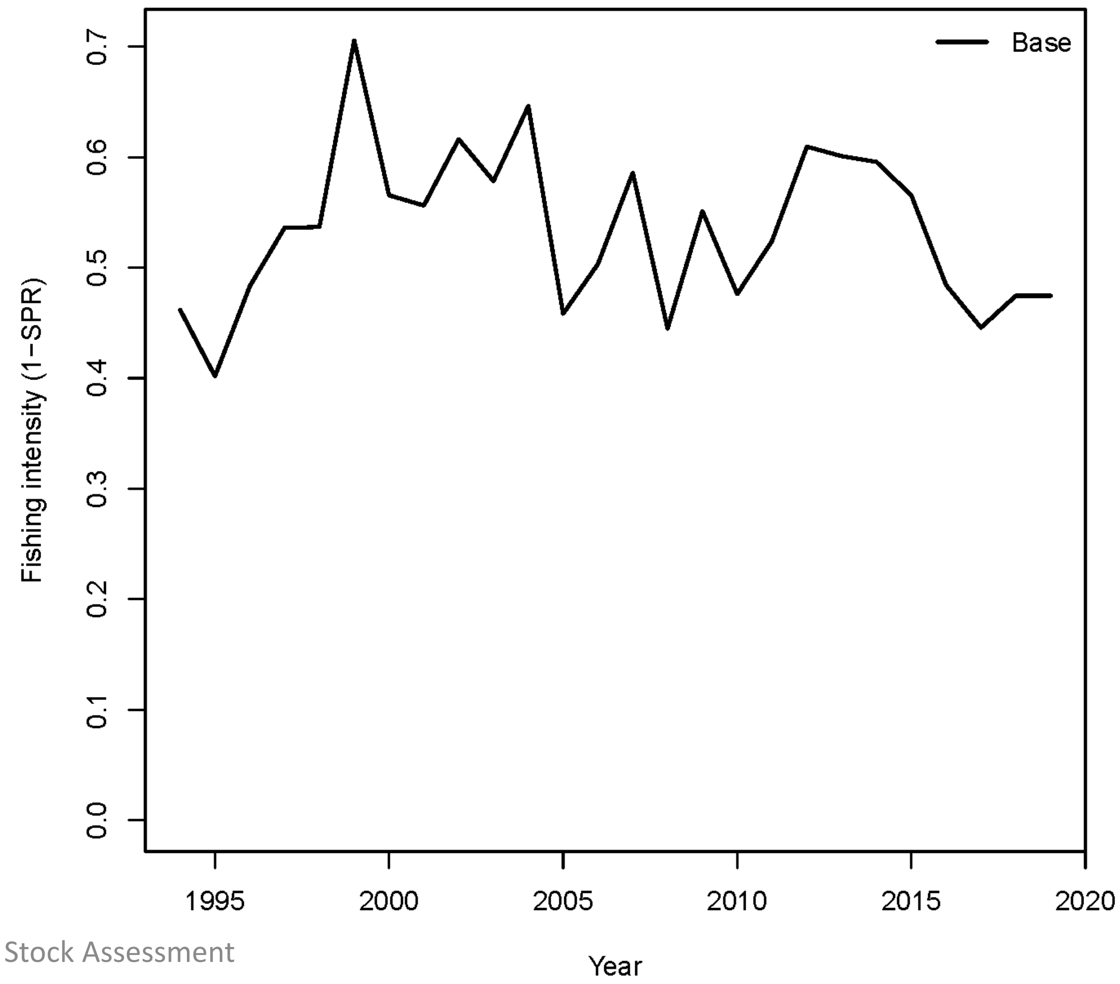
Model Results - Recruitment

- Low recruitment estimated in 2014 and 2015
- Recruitment in 2016 – 2018 considered to be poorly estimated due to lack of information

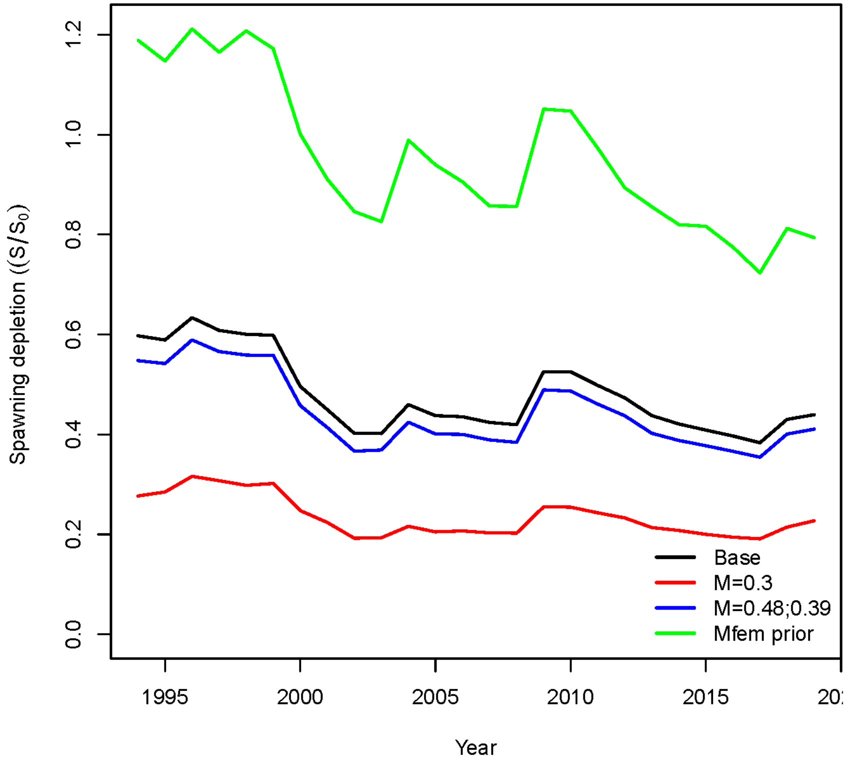


Model Results – Fishing Intensity

- Fishing intensity, calculated as 1-SPR, is a measure of fishing mortality expressed as the decline in spawning biomass produced by each recruit, relative to the unfished state
- For example, a fishing intensity of 0.8 will result in a SSB approx. 20% of SSB0 over the long run
- Fishing intensity is used as a proxy for fishing mortality

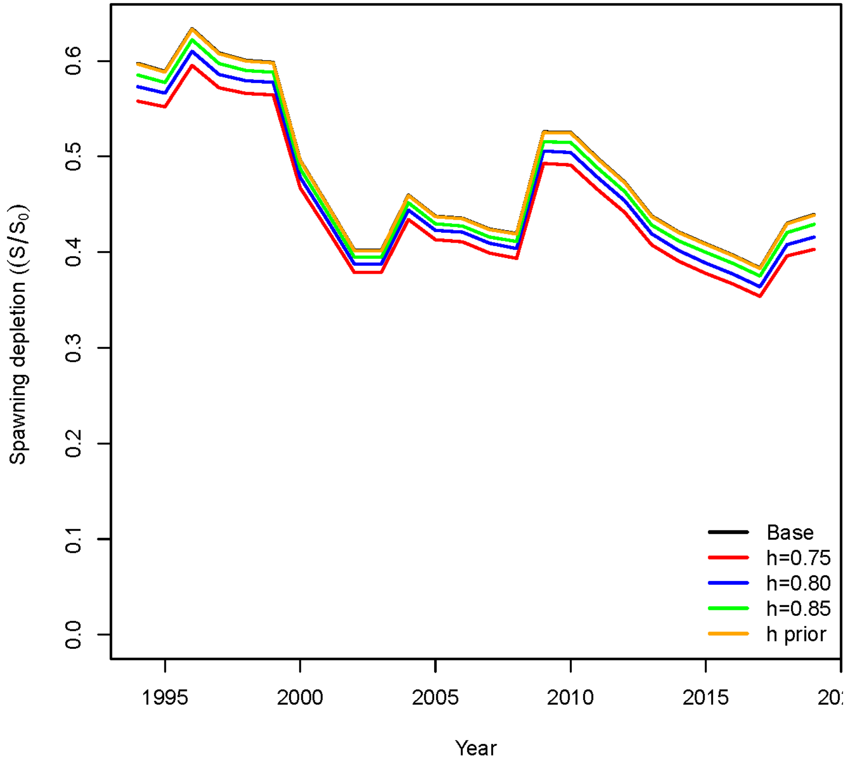


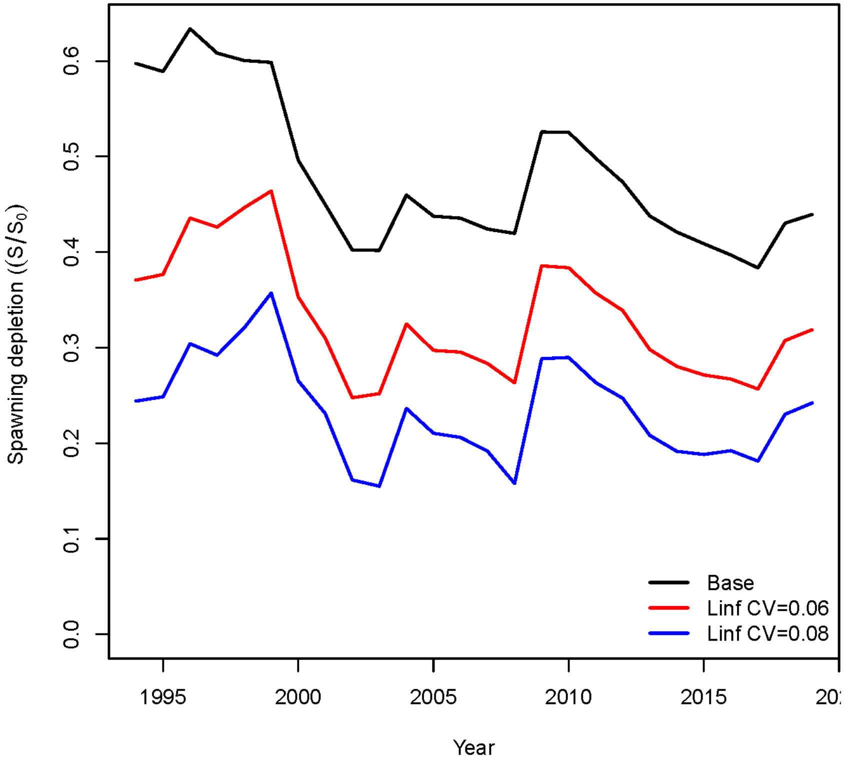
Model Sensitivity: M, h, and CV of Linf



Natural mortality (M)

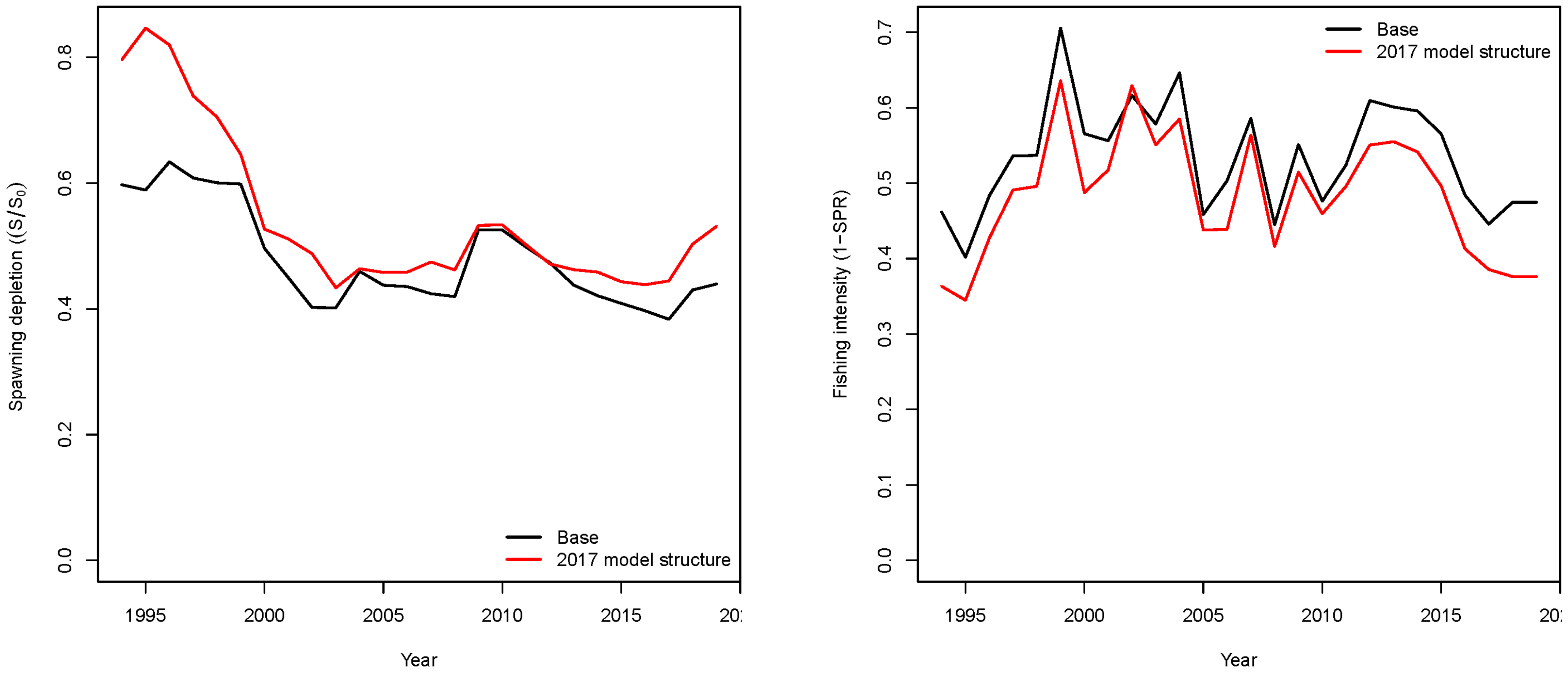
Steepness (h)





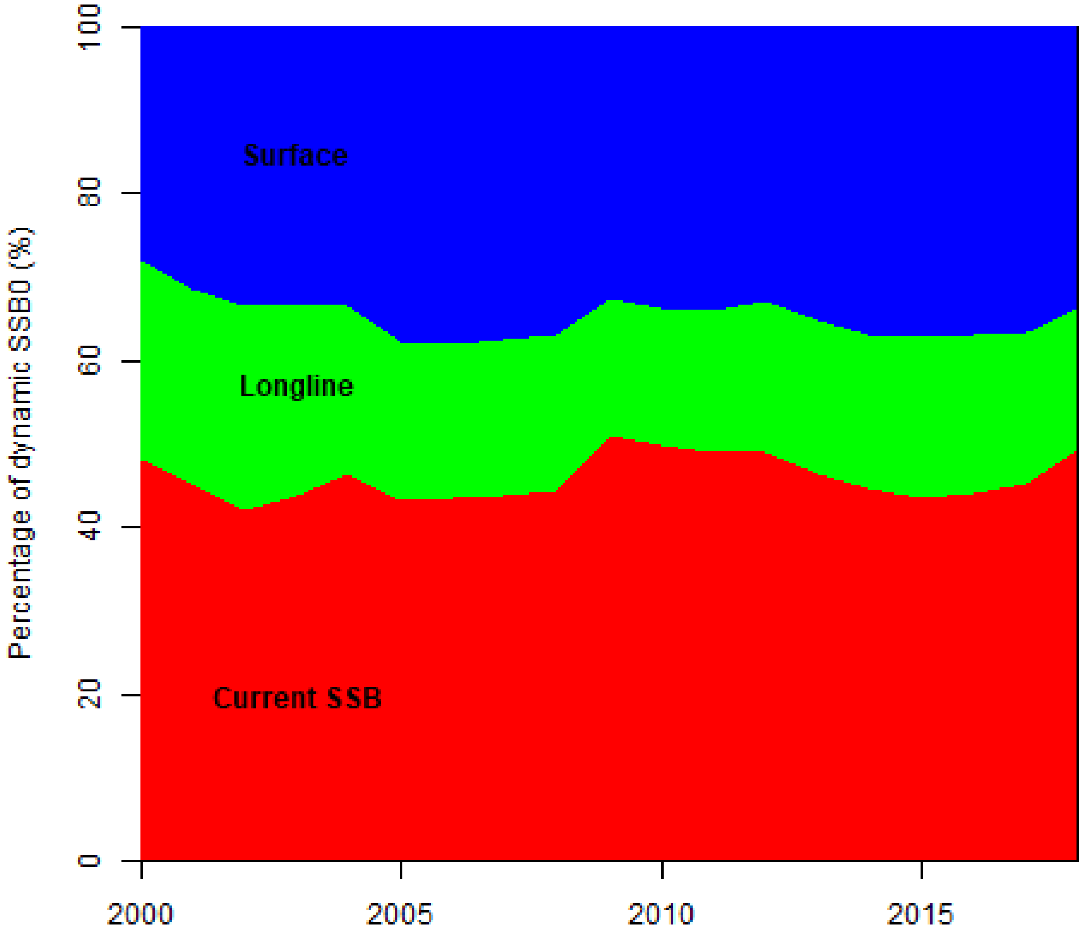
CV of Linf

Bridging Analysis – 2017 Model Structure



Fishery Impact Analysis

- Approximately 2/3 of catch and impact related to surface fisheries, primarily troll and pole-and-line gears



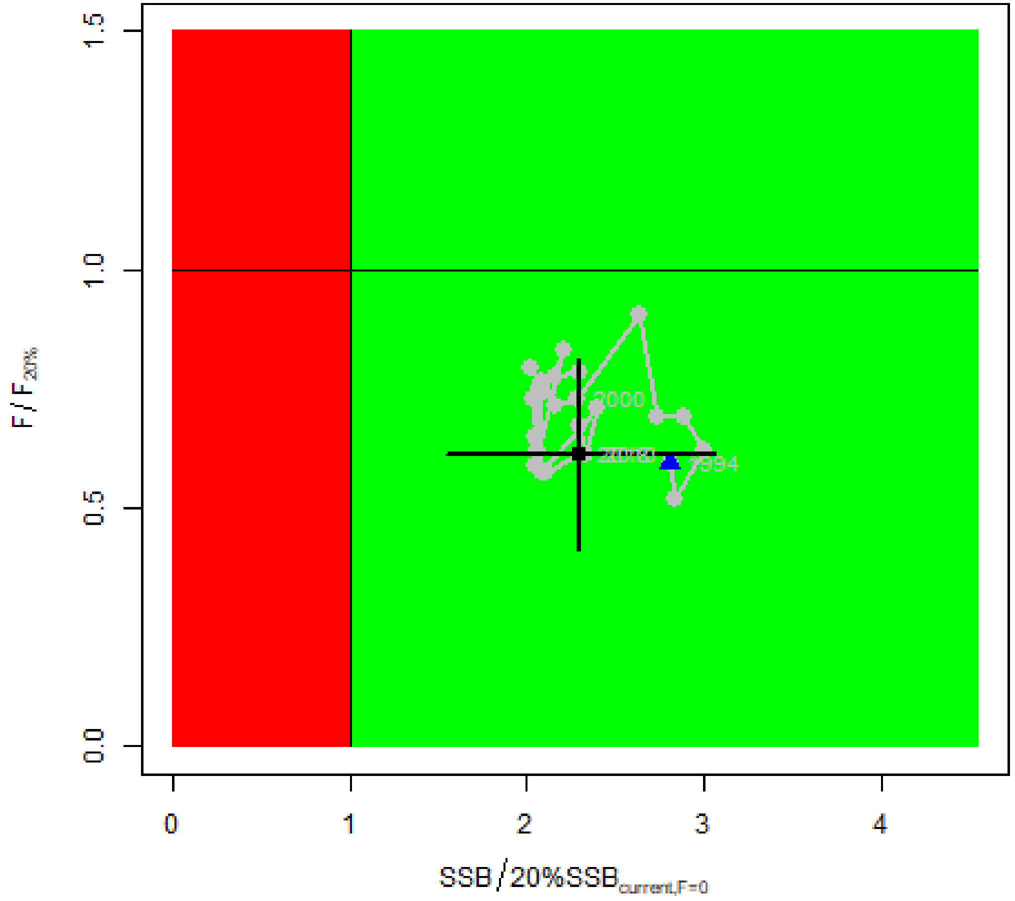
Model Results – Reference Points

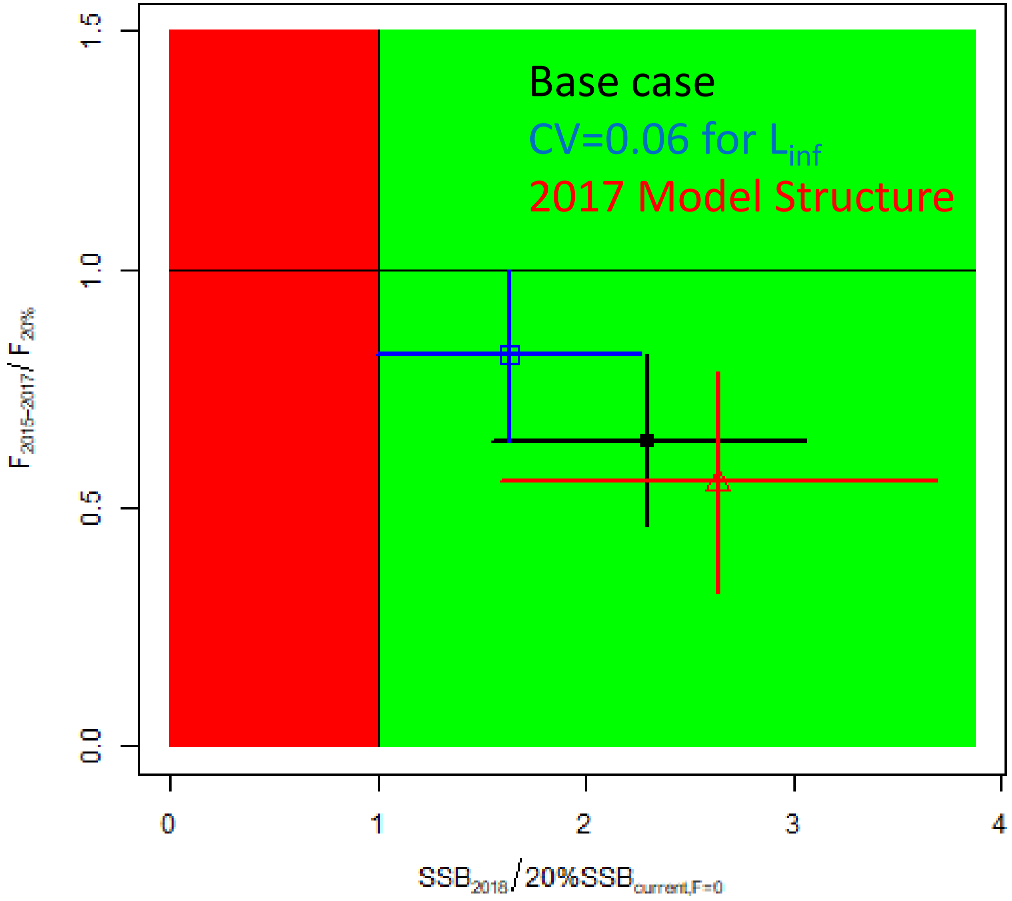
Quantity	Base Case	Growth CV = 0.06 for L_{inf}	Update of 2017 base case model to 2020 data	Results from 2017 assessment (Base Case)
MSY (t) [A]	102,236	84,385	113,522	132,072
SSB_{MSY} (t) [B]	19,535	16,404	21,431	24,770
SSB_0 (t) [B]	136,833	113,331	152,301	171,869
SSB_{2018} (t) [B]	58,858	34,872	77,077	SSB_{2015} = 80,618
$SSB_{2018}/20\%SSB_{current, F=0}$ [B]	2.30	1.63	2.63	SSB_{2015}/LRP = 2.47
$F_{2015-2017}$	0.50	0.64	0.43	$F_{2012-2014}$ = 0.51
$F_{2015-2017}/F_{MSY}$	0.60	0.77	0.52	$F_{2012-2014}/F_{MSY}$ = 0.61
$F_{2015-2017}/F_{0.1}$	0.57	0.75	0.49	$F_{2012-2014}/F_{0.1}$ = 0.58
$F_{2015-2017}/F_{10\%}$	0.55	0.71	0.48	$F_{2012-2014}/F_{10\%}$ = 0.56
$F_{2015-2017}/F_{20\%}$	0.62	0.80	0.54	$F_{2012-2014}/F_{20\%}$ = 0.63
$F_{2015-2017}/F_{30\%}$	0.71	0.91	0.62	$F_{2012-2014}/F_{30\%}$ = 0.72
$F_{2015-2017}/F_{40\%}$	0.83	1.06	0.72	$F_{2012-2014}/F_{40\%}$ = 0.85
$F_{2015-2017}/F_{50\%}$	1.00	1.27	0.86	$F_{2012-2014}/F_{50\%}$ = 1.01

A – MSY includes male and female juvenile and adult fish

B – Spawning stock biomass (SSB) in this assessment refers to mature female biomass only.

Model Results – Kobe Plots





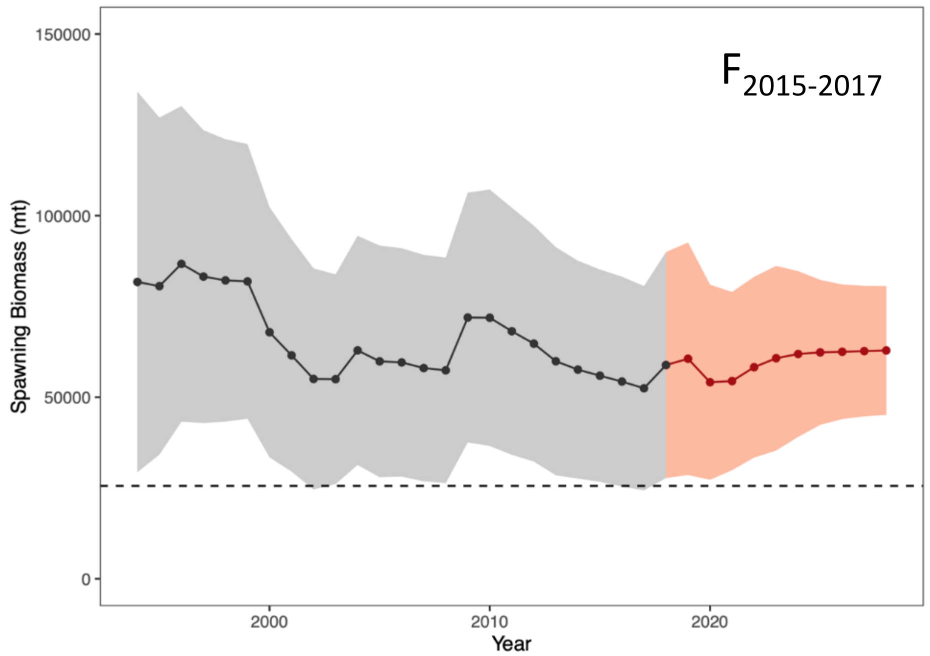
Stock Status of North Pacific Albacore

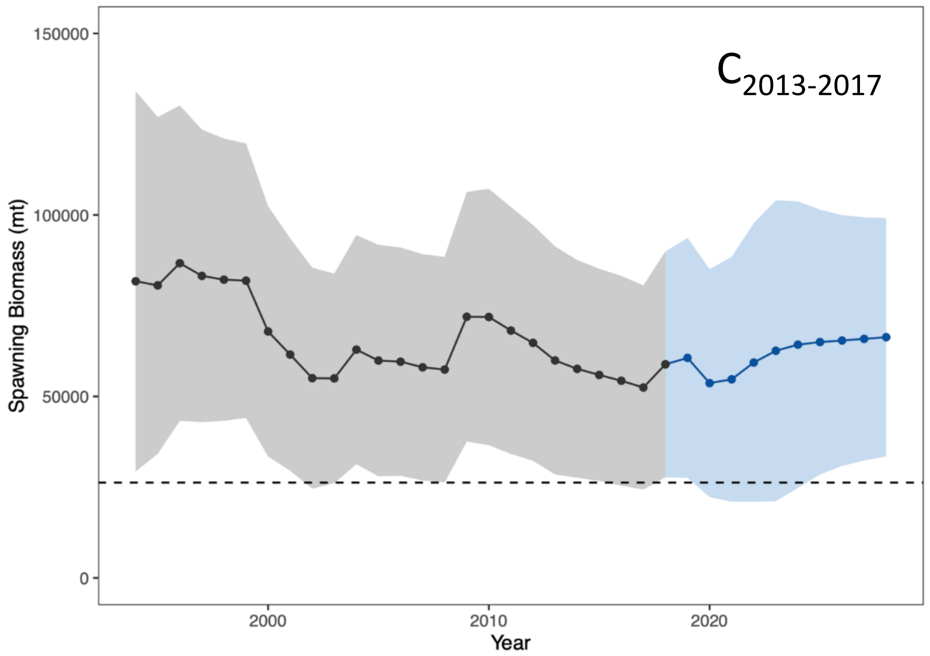
Based on these findings, the following information on the status of the north Pacific albacore stock is provided:

1. The stock is likely not overfished relative to the limit reference point adopted by the Western and Central Pacific Fisheries Commission ($20\%SSB_{current,\ F=0}$), and
2. No F-based reference points have been adopted to evaluate overfishing. Stock status was evaluated against seven potential reference points. Current fishing intensity ($F_{2015\text{-}2017}$) is likely at or below all seven potential reference points (see ratios in Table ES1).

Future Projections

- 10 year projections (2019 – 2028) of constant F ($F_{2015\text{-}2017}$) and constant catch ($C_{2013\text{-}2017}$) scenarios
- Future recruitment randomly sampled from a distribution consistent with historical recruitment variability (σ_R = 0.3)
- Uncertainties in projections only from N-at-age in terminal year and future recruitment; and appears to be underestimated
- Low probabilities of breaching LRP for both scenarios but constant catch scenario has a higher probability
- Constant catch scenario is inconsistent with current management measures for WCPFC and IATTC





Conservation Information for North Pacific Albacore

Although the projections appear to underestimate the future uncertainty in female SSB trends, the probability of breaching the LRP in the future is likely small if the future fishing intensity is around current levels.

Based on these findings, the following information is provided:

1. If a constant fishing intensity ($F_{2015\text{-}2017}$) is applied to the stock, then median female spawning biomass is expected to increase to 62,873 t and there will be a low probability of falling below the limit reference point established by the WCPFC by 2028.
2. If a constant average catch ($C_{2013\text{-}2017}$ = 69,354 t) is removed from the stock in the future, then the median female spawning biomass is also expected to increase to 66,313 t and the probability that SSB falls below the LRP by 2028 will be slightly higher than the constant fishing intensity scenario.

Key Uncertainties

- Lack of sex-specific size and age data
- Uncertainty in growth
- Simplified treatment of spatial structure

Research Recommendations

1. Further investigation of the F01 fishery (JPLL_A13_Q1) because there appears to be a mixture of two fisheries one on juveniles and one adults in this fishery;
2. Evaluate adult indices from the Japanese longline fisheries in southern areas (Areas 2 and 4), especially with respect to incorporating size data into the standardization process using a spatiotemporal process and/or data from alternative seasons;
3. Evaluate potential juvenile indices from the Japanese longline fisheries in northern areas (Areas 1, 3 and 5), the Japanese pole-and-line and/or EPO surface fisheries;
4. Collect sex-specific age-length samples using a coordinated biological sampling plan to improve current growth curves, and examine regional and temporal differences in length-at-age;
5. Collect sex ratio data by fishery using a coordinated biological sampling plan; and
6. Evaluate and document historical high seas drift gillnet catch by member countries.

Questions?