LENGTH COMPOSITION DATA IN THE WCPFC WCPO BIGEYE STOCK ASSESSMENT, AND THE SENSITIVITY OF ASSESSMENT RESULTS TO THE ESTIMATED L_∞ VALUE

MATTHEW VINCENT

OUTLINE

- Background
- Length composition used in assessment
- Fits to models using different growth curves

MFCL BACKGROUND

- MFCL uses the mean length at age to model growth
- Assumes a von Bertanffy growth between the age first observed and last observed in the model
- Can estimate parameters for ages less than specified age (a*)
- Penalties on deviations from von Bertalanffy estimates

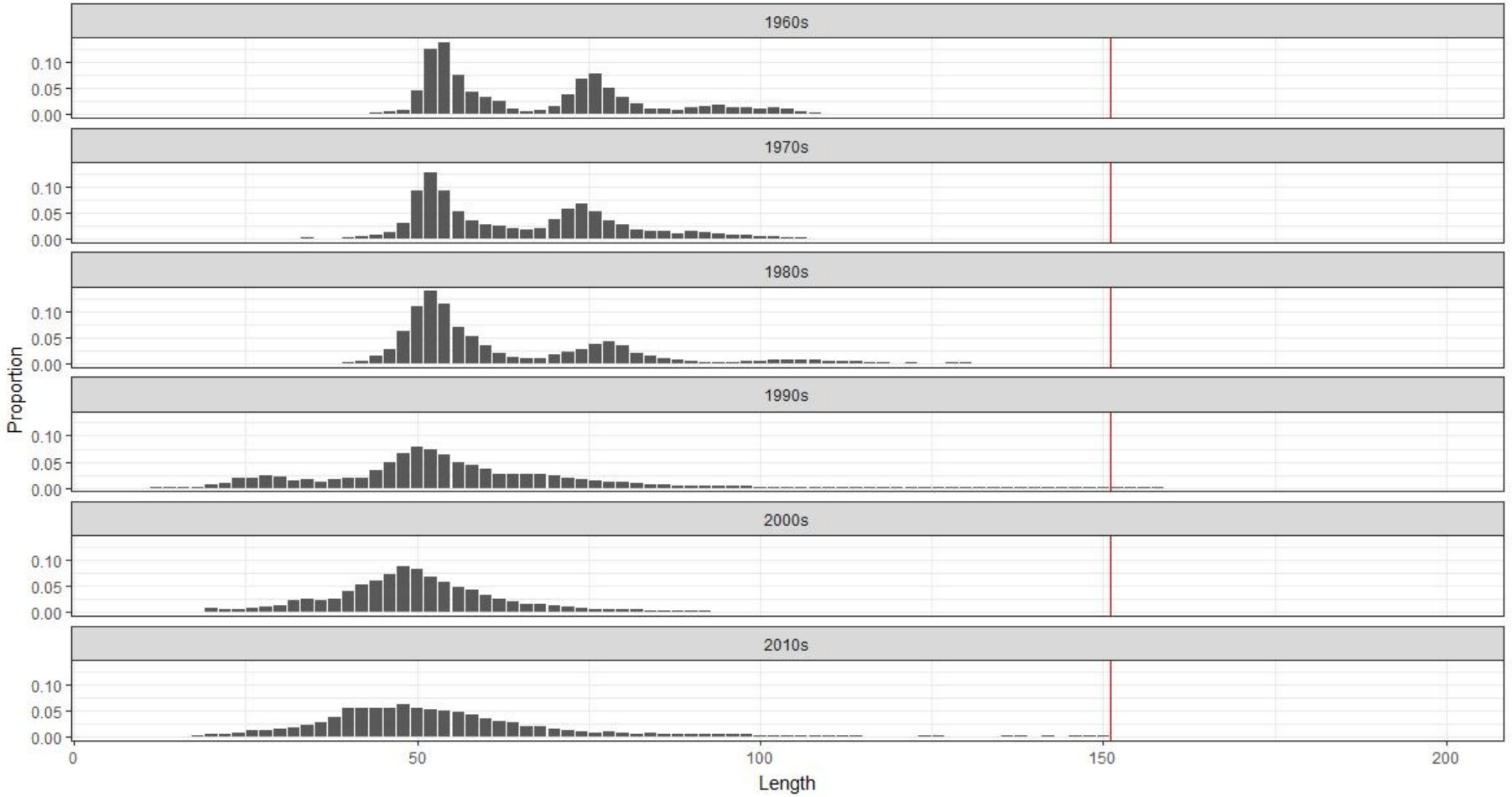
MFCL MODEL EQUATIONS

- $\mu_a \begin{cases} L_a & \text{for a} < a^* \\ L_1 + (L_2 - L_1)\left[\frac{1-e^{-k(a-1)}}{1-e^{-k(A-1)}}\right] & \text{for a} \geq a^* \end{cases}$
- L1 mean length first age class
- L2 mean length oldest age class (A) for bigeye this is 10 years
- $\sigma_a = \lambda_1 \exp\left(-\lambda_2 \left[1 - 2\frac{\mu_a - L_1}{L_2 - L_1}\right]\right)$

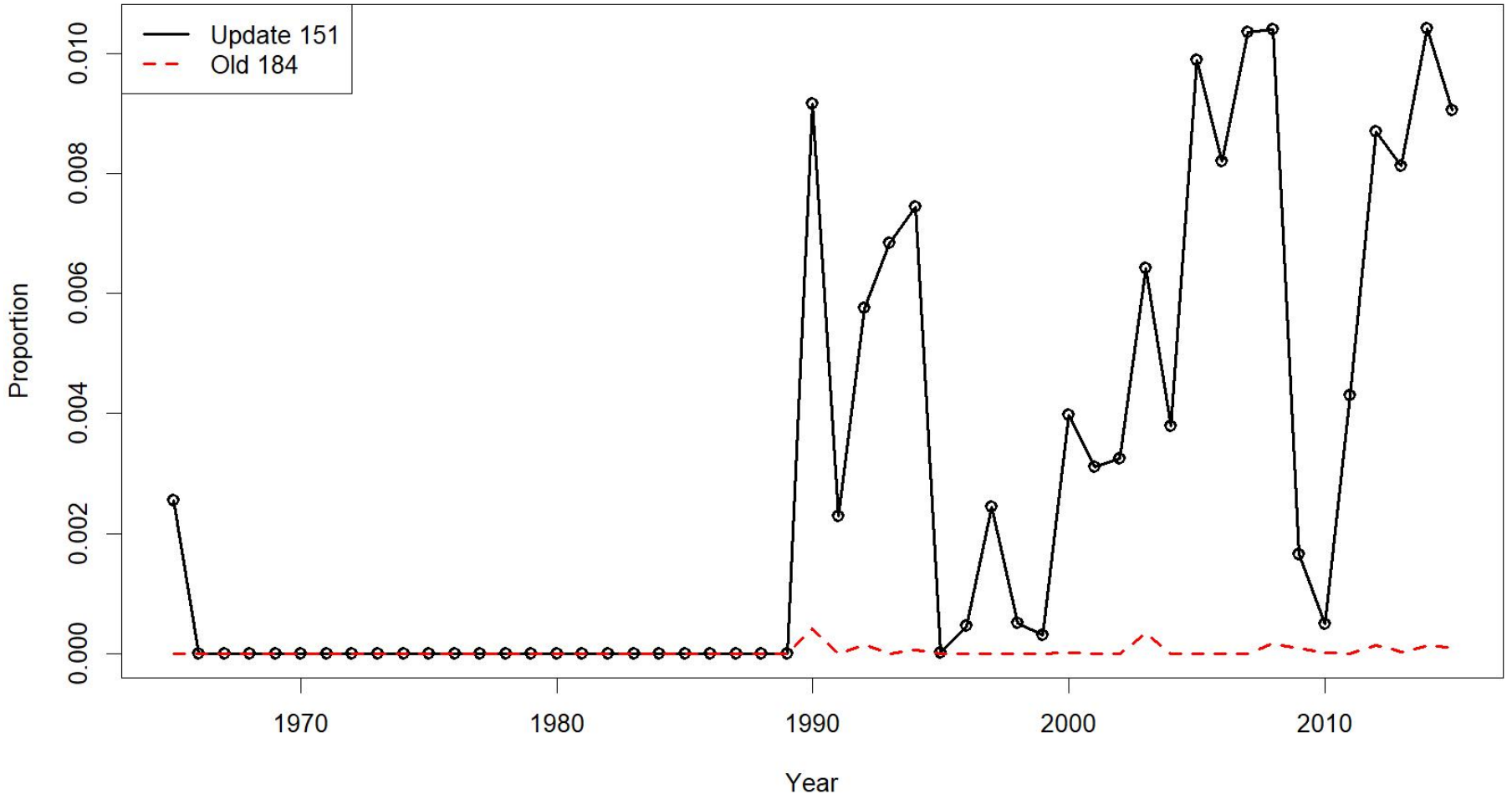
WCPFC BIGEYE HISTORICAL GROWTH CURVES

- Historical assessments used size composition to estimate growth function of bigeye
- 2014 assessment fixed L2 at 184 cm, based on examination of the likelihood profile
- In 2018 otolith length-at-age data became available from samples collected between 2009 and 2016
  - Resulted in an estimated L2 of 150.7 cm

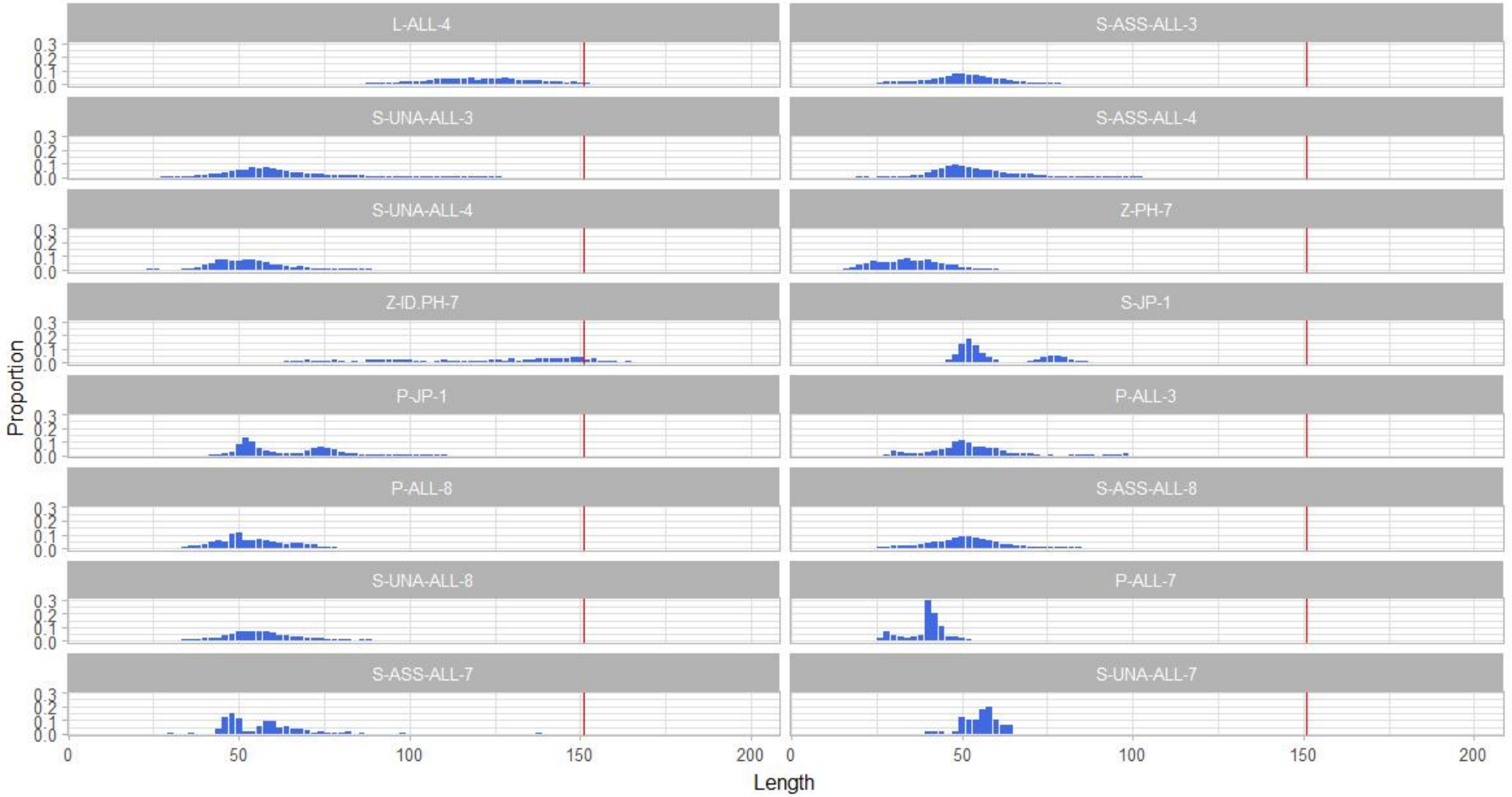
LENGTH COMPOSITION BY DECADE



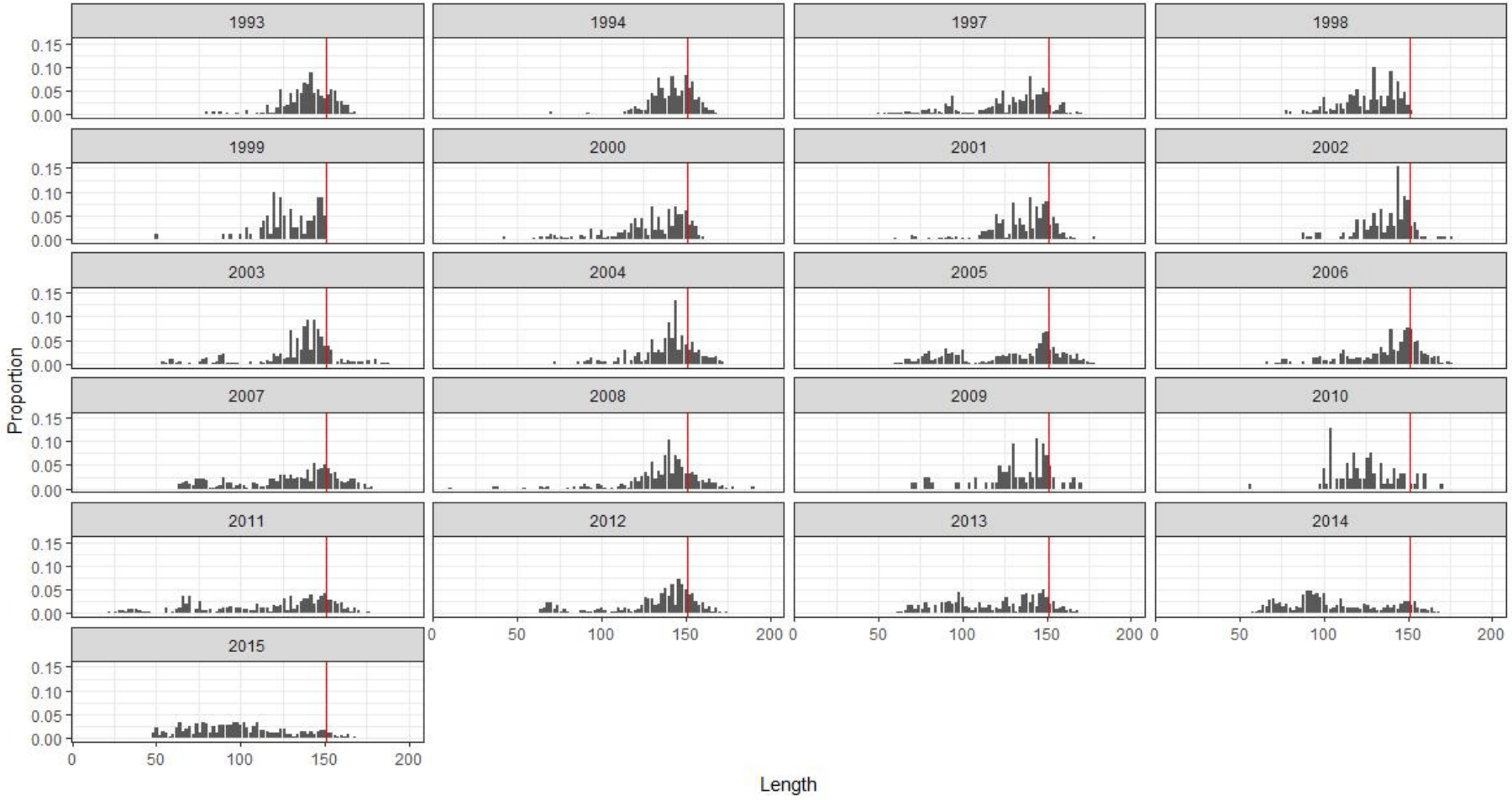
PROPORTION > L2 FROM ALL SAMPLES



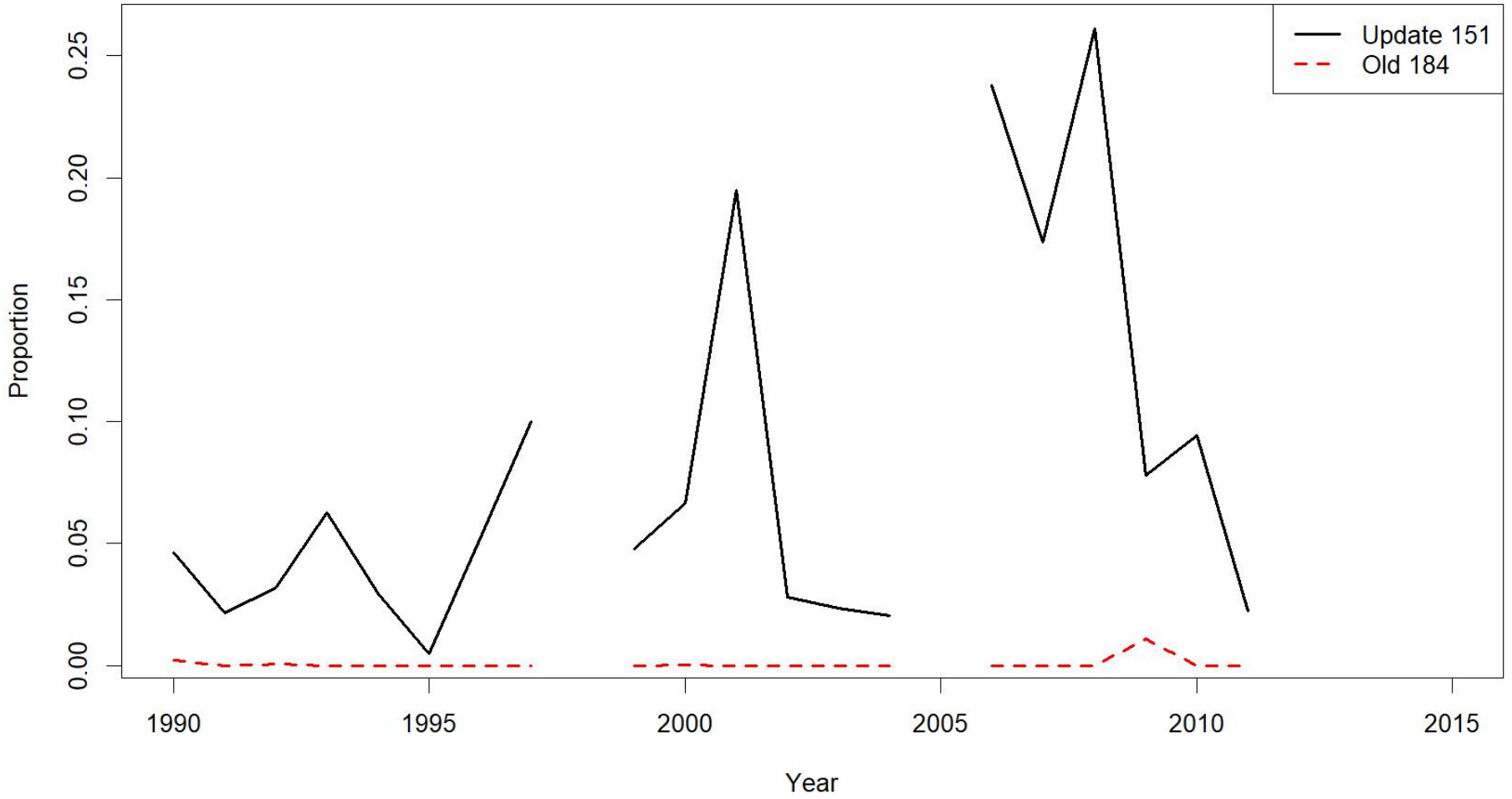
LENGTH COMPOSITION BY FISHERY



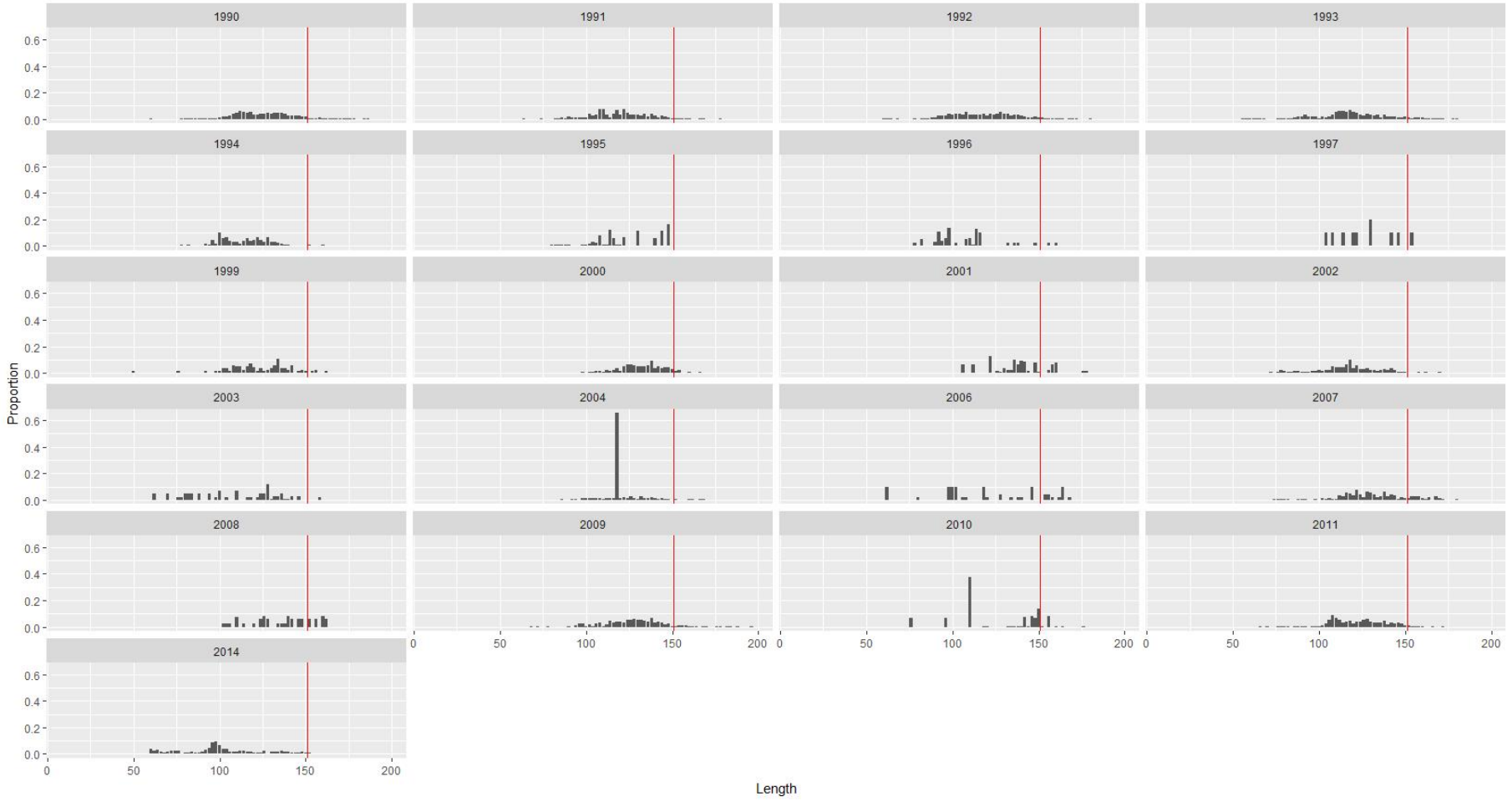
PHILIPPINES HANDLINE LENGTH FREQ



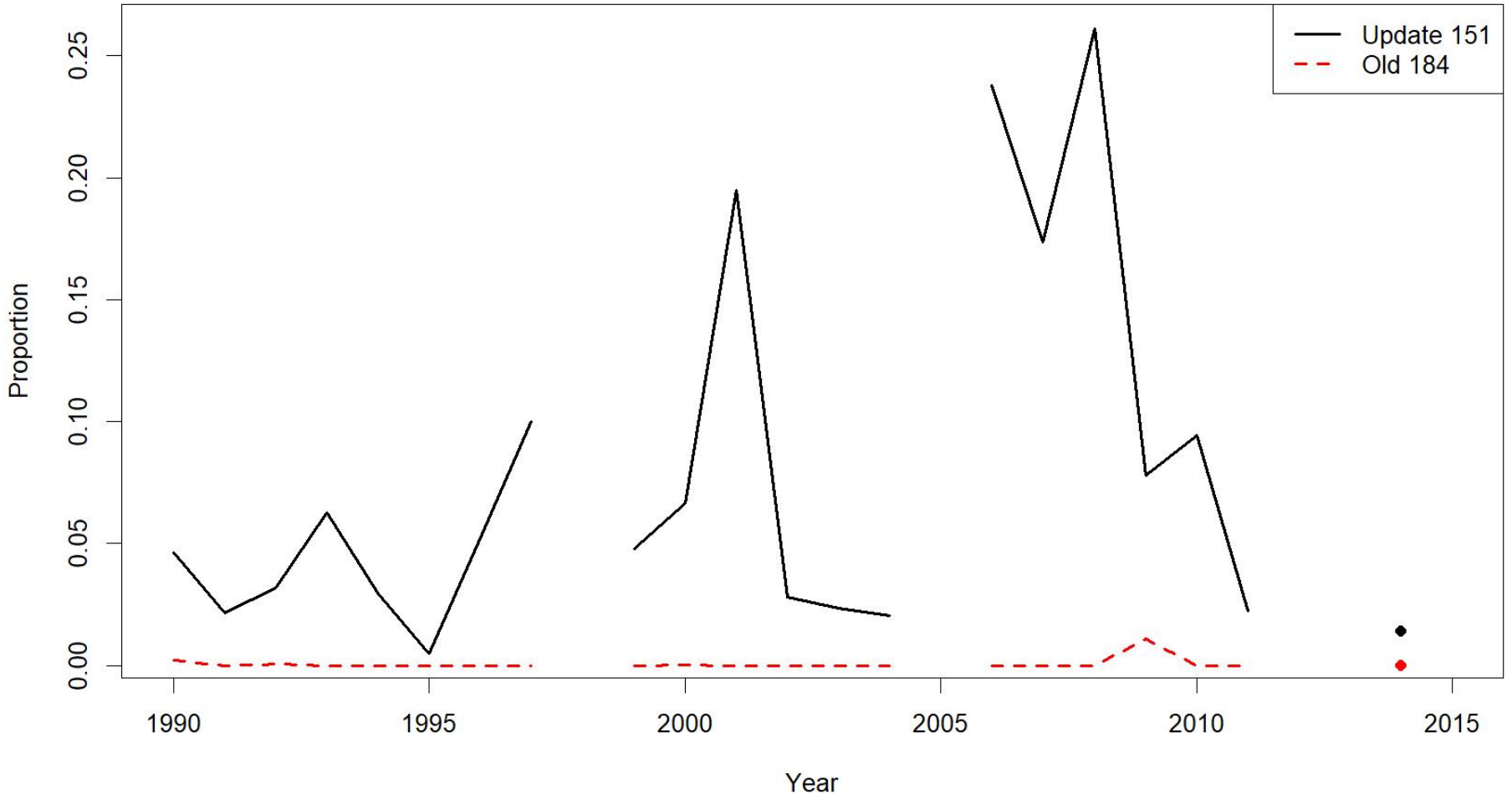
PROPORTION PHILIPPINE HANDLINE > L2



LONGLINE REGION 4 LENGTH FREQ



PROPORTION LONGLINE REGION 4 > L2

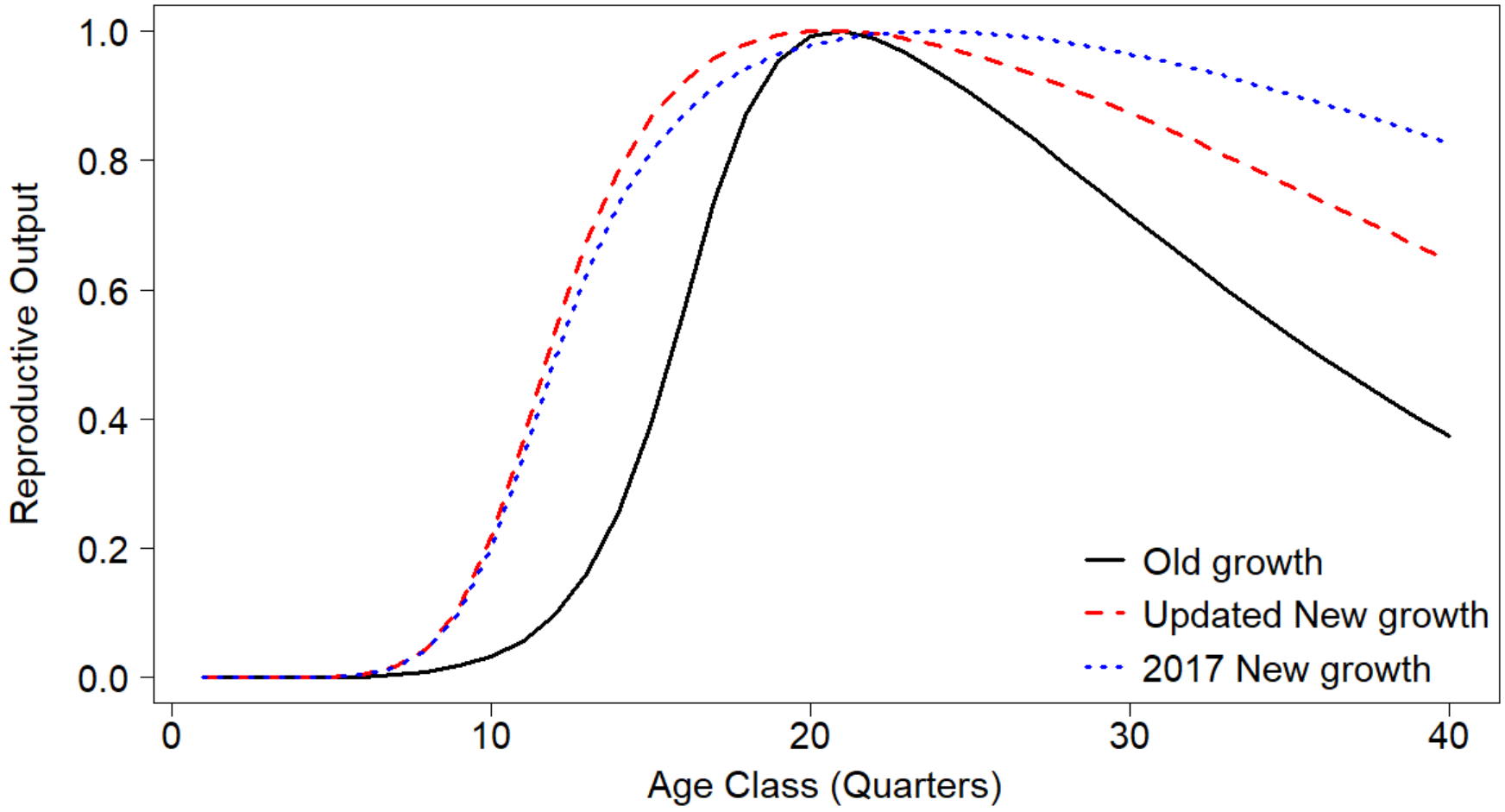


FITS TO ASSESSMENT MODEL USING DIFFERENT L_∞

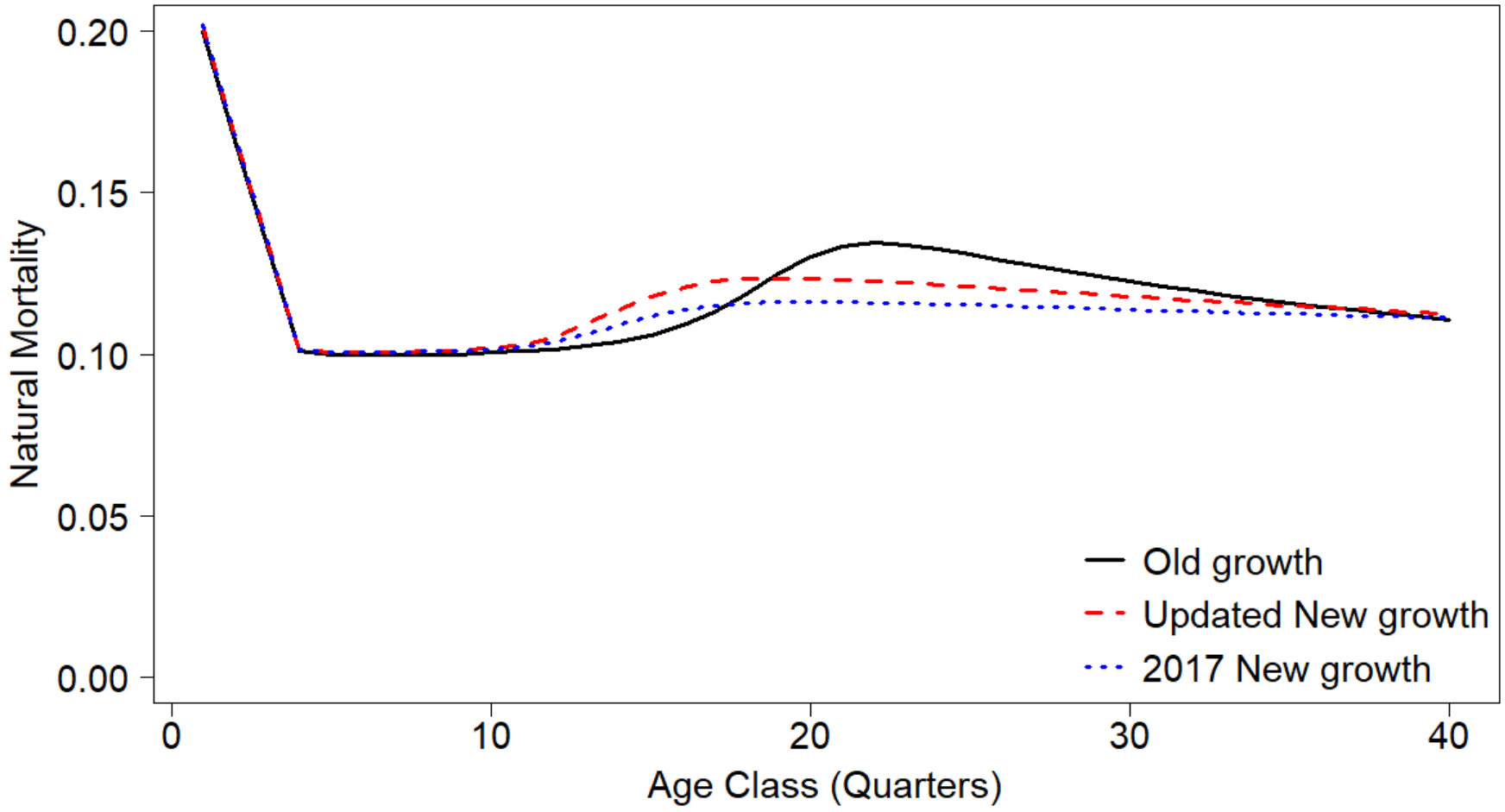
TWO GROWTH MODELS

- Old Growth
  - Fix L2 at 184
  - Estimate k, L1, and standard deviations at length
  - Estimate independent mean lengths for first 8 quarters with penalties
- Updated Growth
  - Uses transformed estimates from otolith only von Bertalanffy
  - Fix L2 at 150.702 and k at 0.0757389
  - Estimate L1 and standard deviations at length

MATURITY AT AGE



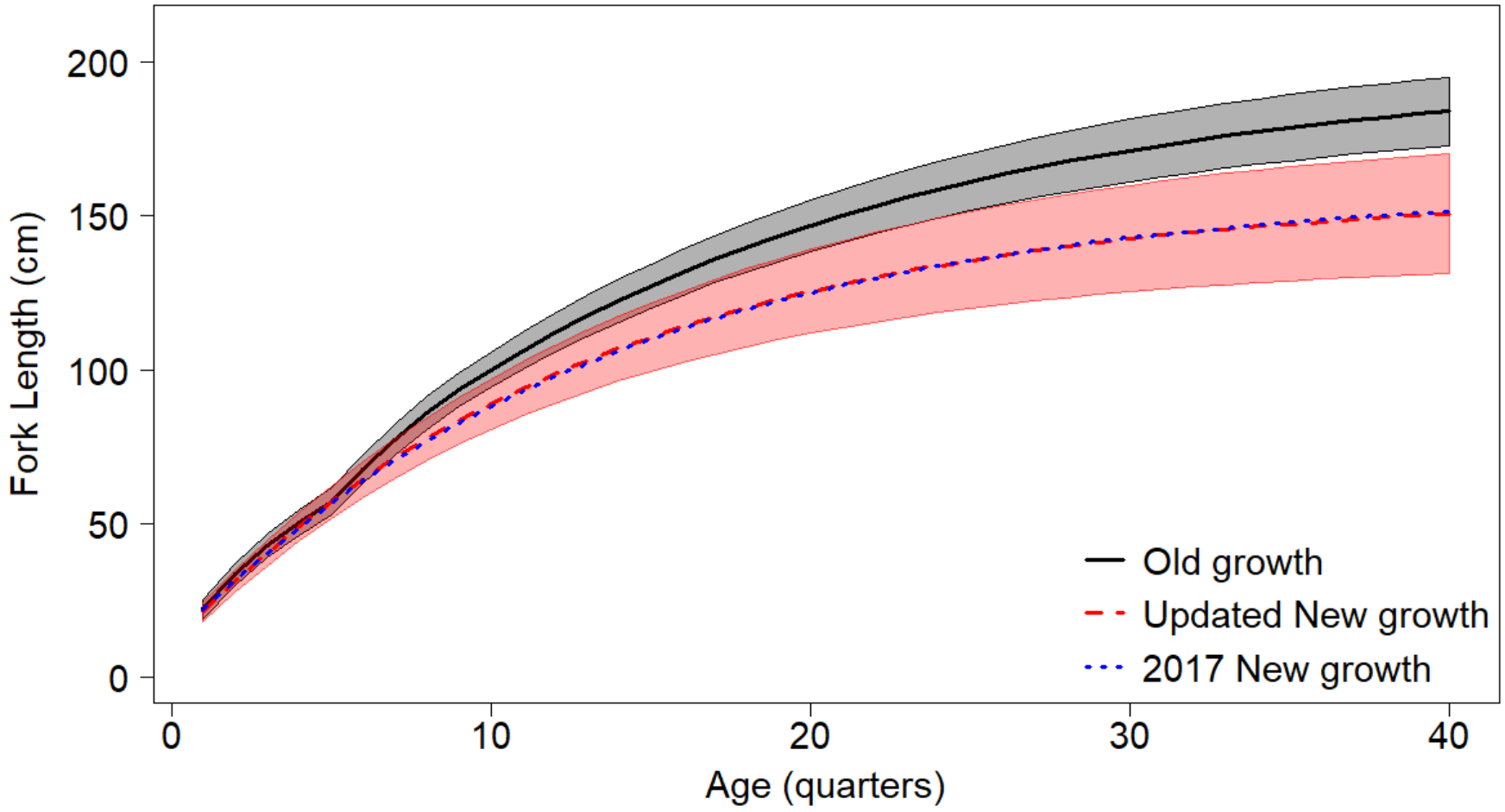
NATURAL MORALITY AT AGE



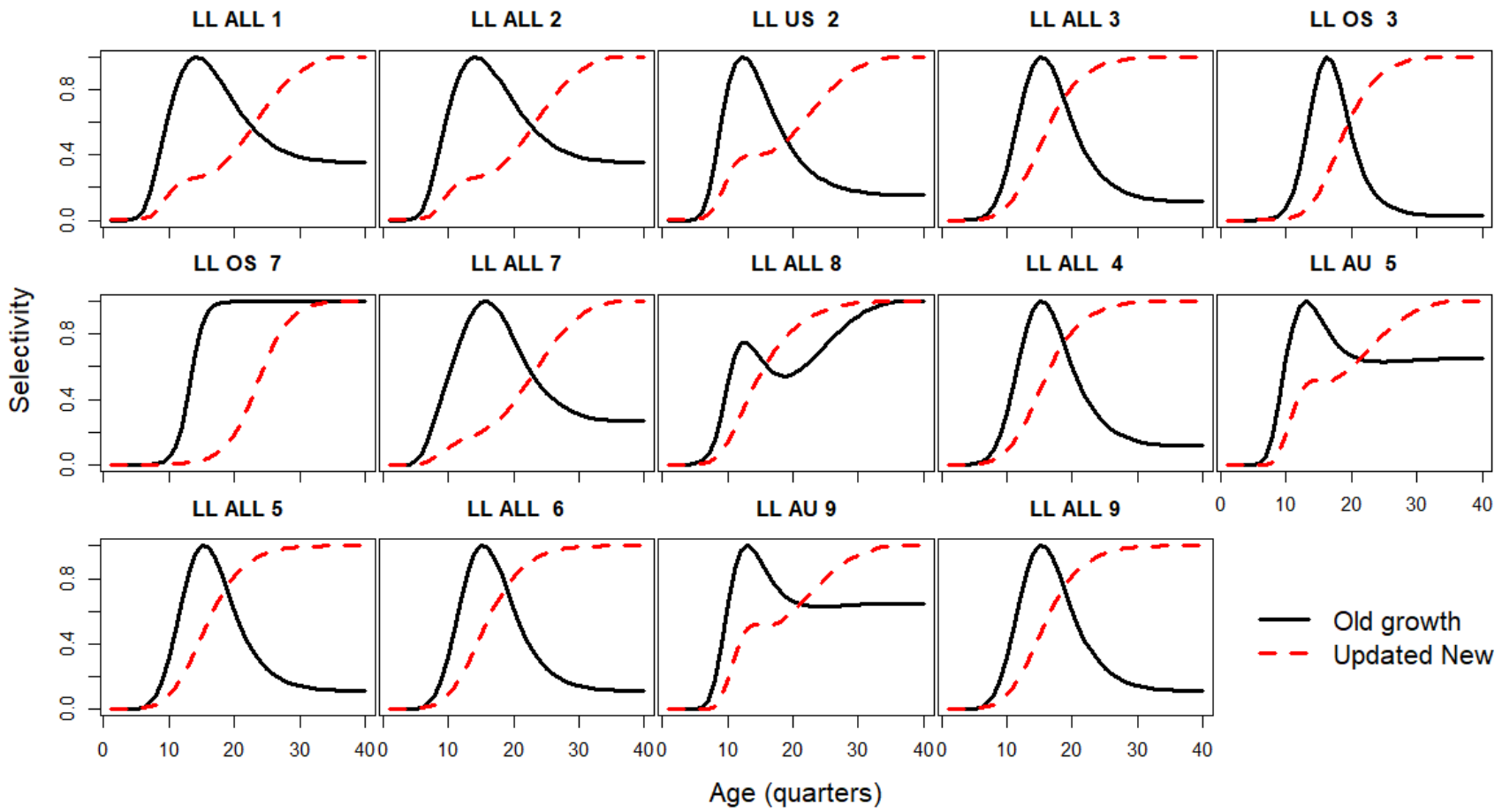
MODEL COMPARISON

	Old Growth	New growth
Objective function value	1087753.1	1086553.4
L1 (Length in first quarter)	22.2	21.4
L2 (Length at 40 quarters)	184 (fixed)	150.702 (fixed)
k	0.0651	0.0757
SD1 (Base SD length at age)	5.96	7.88
SD2 (Exponential SD at length)	0.626	0.8999

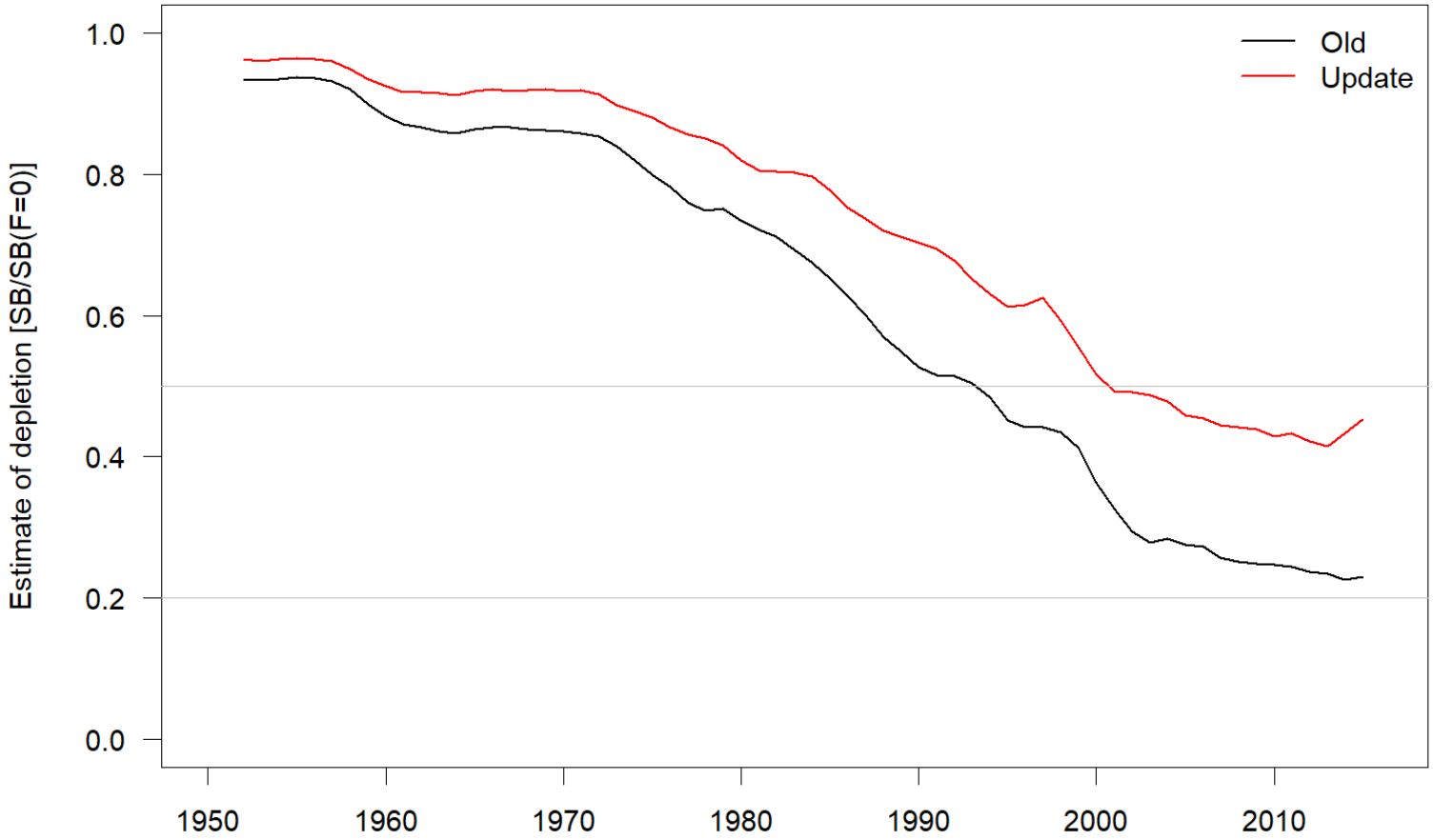
MEAN LENGTH AT AGE CURVES



LONGLINE SELECTIVITY



DEPLETION PLOTS

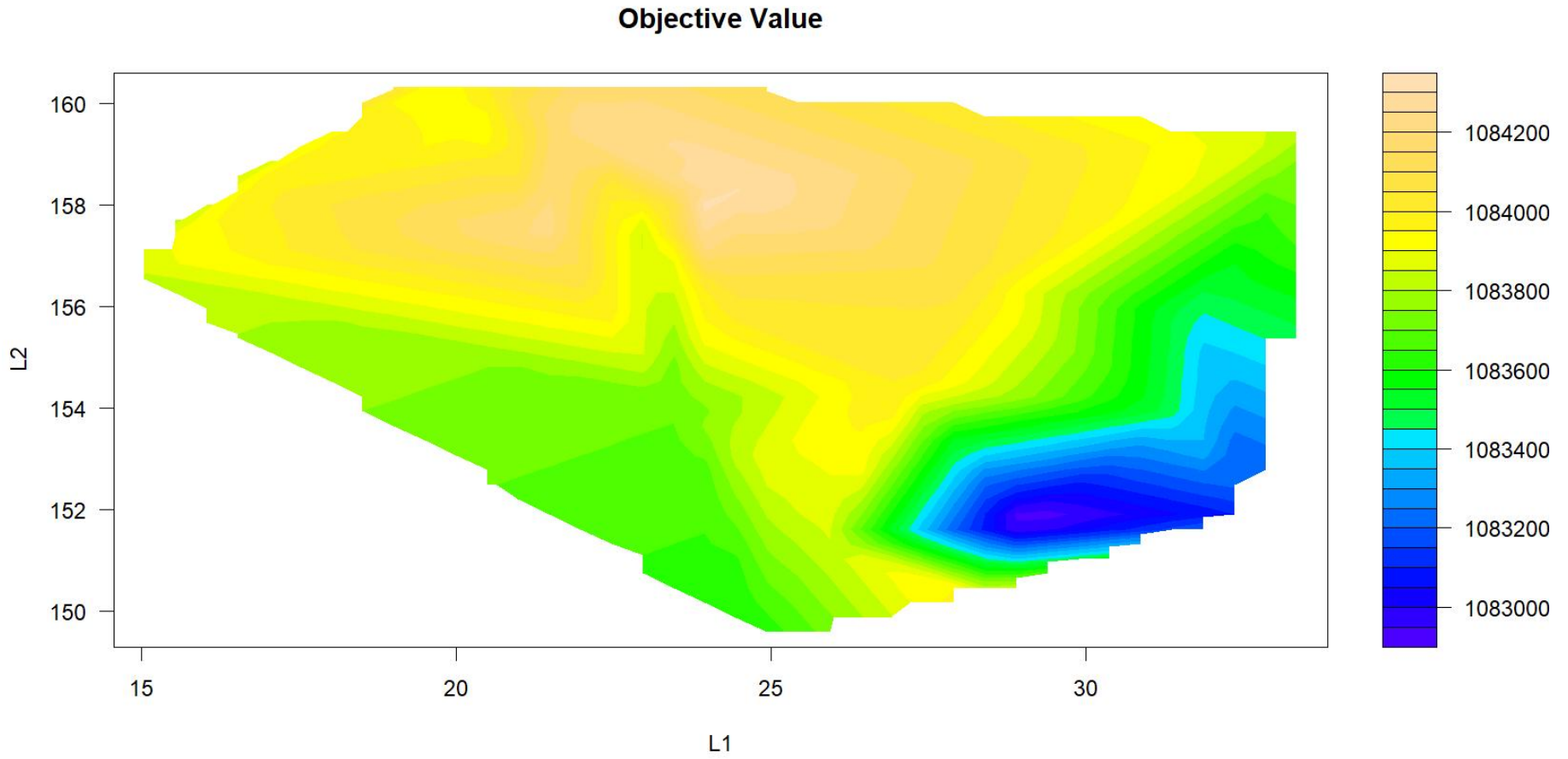


CONDITIONAL LENGTH AT AGE MODEL

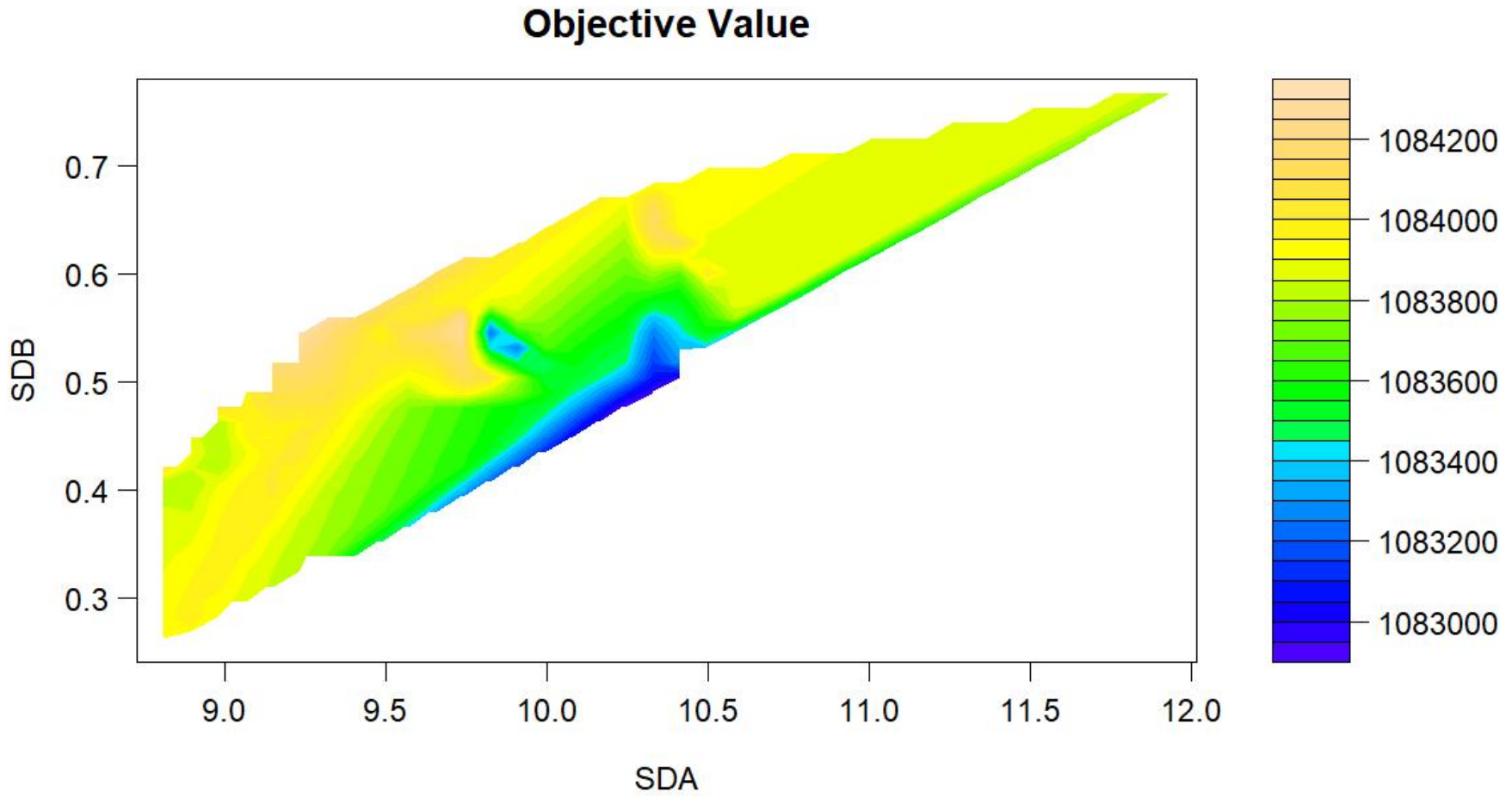
CONDITIONAL AGE MODEL

- Conducted a gridded search of different starting values of L1 and L2
- L1 ranges between 15 and 35 by 5
- L2 ranges between 155 and 180 by 5

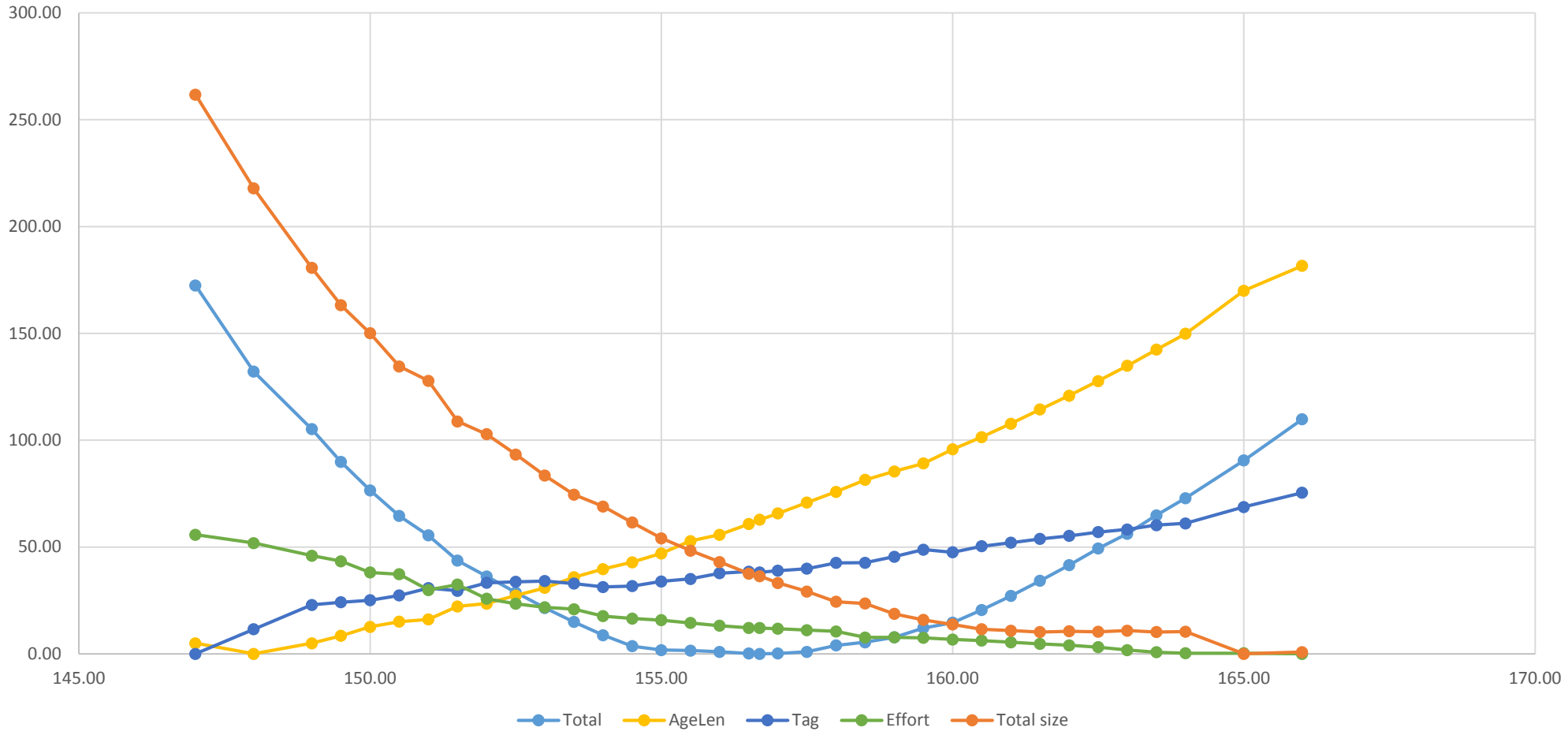
ESTIMATED L1 AND L2 VALUES AGAINST OBJECTIVE FUNCTION VALUE



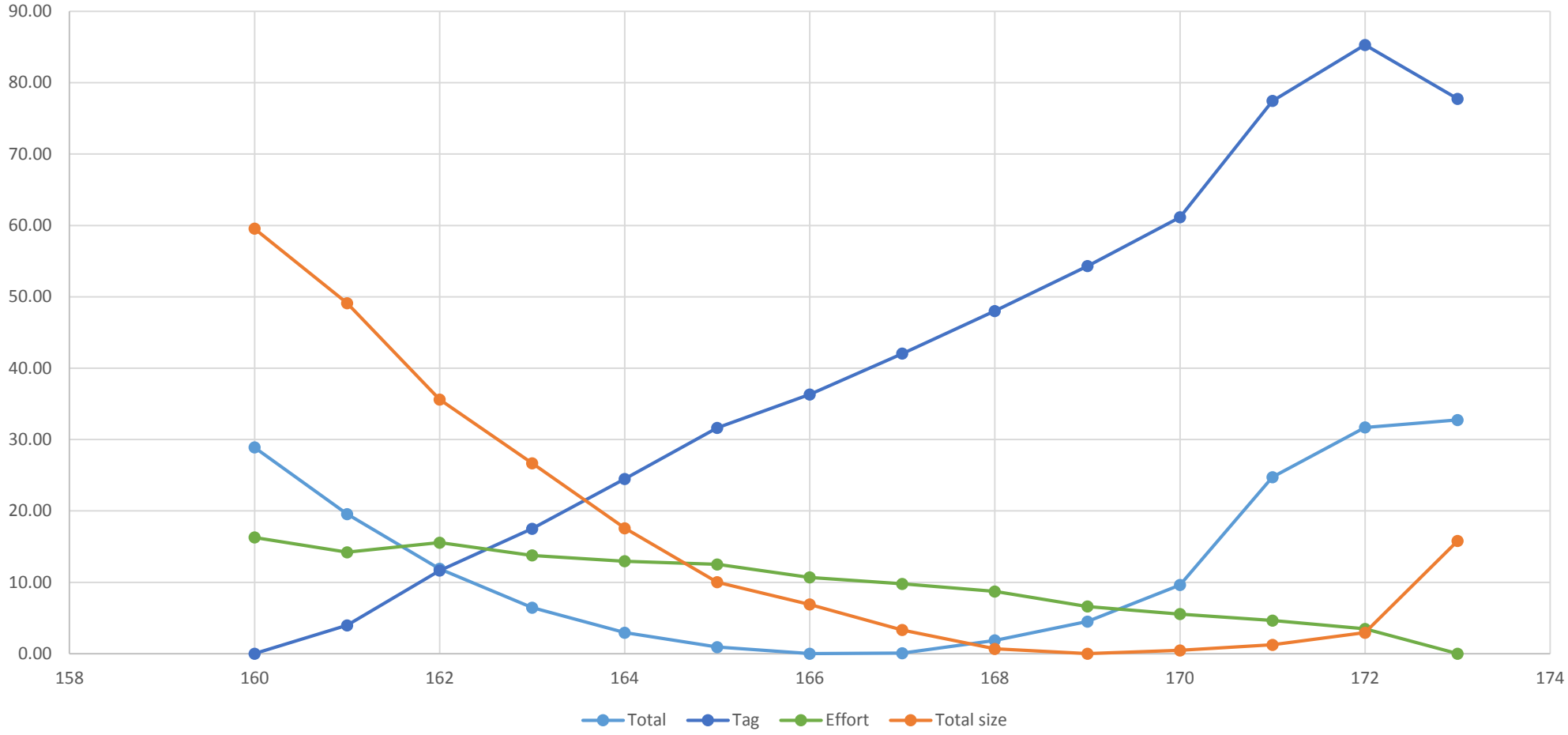
ESTIMATED STANDARD DEVIATIONS AGAINST OBJECTIVE FUNCTION VALUE



L2 PROFILE WITH CONDITIONAL LENGTH



L2 PROFILE WITHOUT AGE LENGTH DATA



CONCLUSIONS

- The L_∞ parameter in the assessment model has a very large impact on the estimated status of bigeye in the WCPO
- The assumed length at age influences the natural mortality and maturity at age calculations
  - Maturity at age can now be estimated internally to MFCL
- Preliminary analyses of a conditional length-at-age model shows the starting value of the parameters are influential