Issues with the assessment of the quillback stock off California that need to be addressed before it is used for management advice

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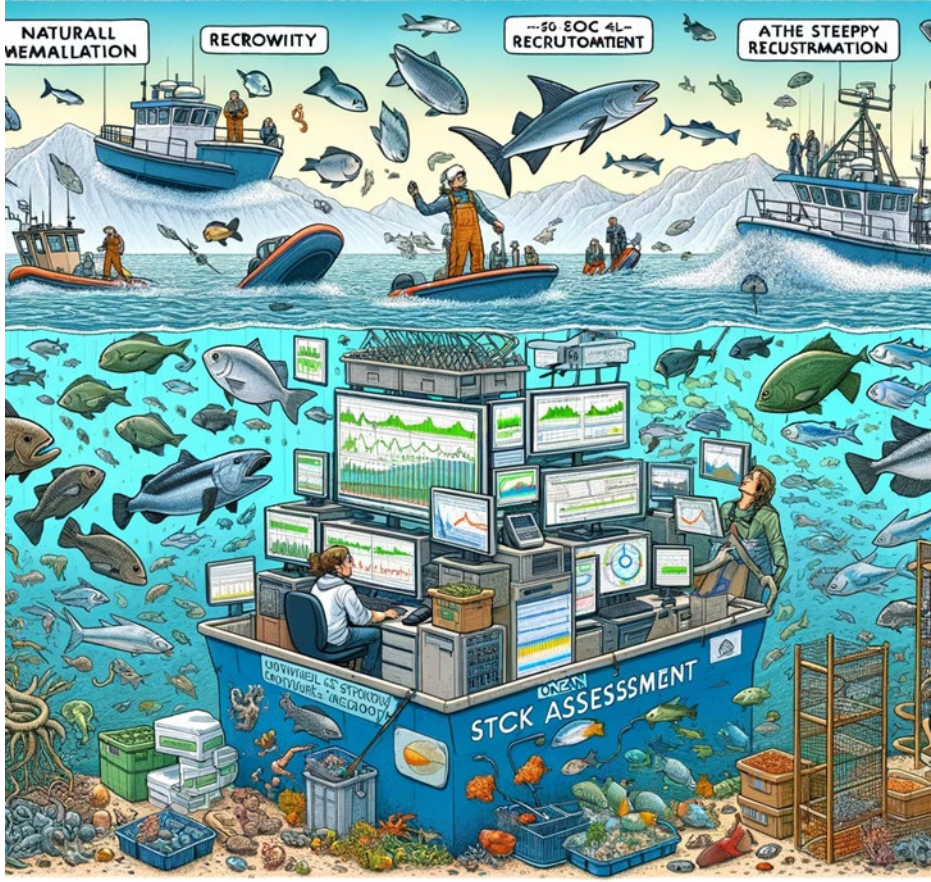
Introduction



- Integrated age-structured stock assessment model (Stock Synthesis)
- Fit to the length composition data “conditioned” on the catch
- Most appropriate approach
  - Makes all the assumptions explicit
  - Allows the inclusion of other data
  - Can easily be used to investigate alternative assumptions
- Comprehensive assessment
  - Many sensitivity analyses
  - Diagnostics
- The assessment is uncertain
  - Lack of a reliable index of relative abundance
  - Lack of information on growth, natural mortality, steepness of the stock-recruitment relationship, and the form of selectivity and how it changes over time.
- Assessment advice is based on conservative assumptions about all the model’s fixed parameters compared to that supported by the data
- The assessment assumes that the selectivity is asymptotic and invariant for both the commercial and recreational fisheries

Fixed parameters

- All the likelihood profiles suggest a less depleted stock than under the base assumptions

Parameter	Fixed	Profile	Depletion
Steepness	0.72	1	Less
M	0.057	0.12	Less
L@Amax	43.04	42	Less
K	0.199	0.13	Less
CV@Amax	0.1	0.08	Less

- K and asymptotic length influence the max depletion level obtained
- M and steepness influence the rate of rebuilding

R0 likelihood component profile: M

- Fixed M = 0.057
- Data ≈ 0.12
- Commercial = > 0.12
- Recreational = 0.07

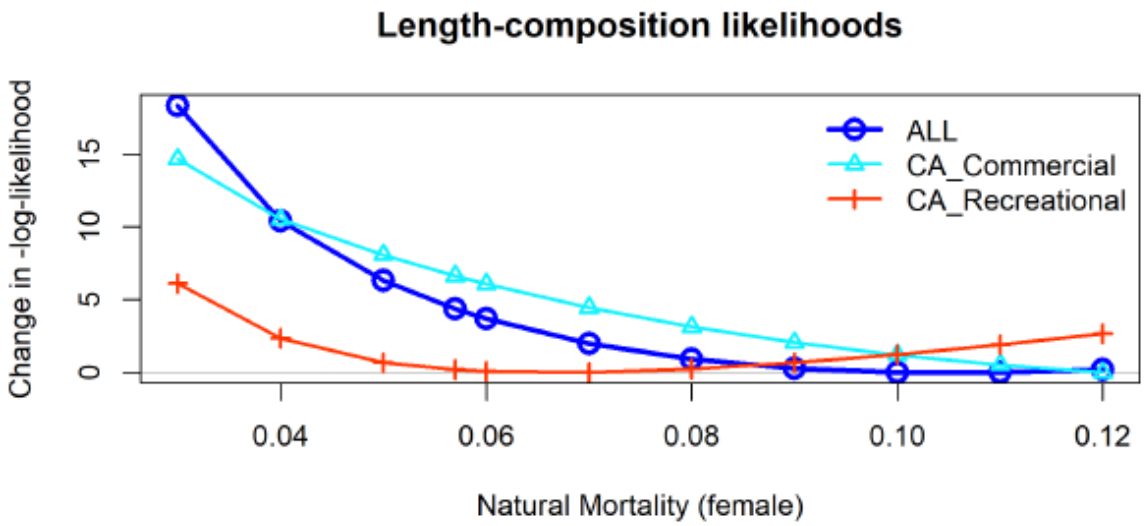


Figure 32: Change in the negative log-likelihood across a range of natural mortality values.

R0 likelihood component profile: M

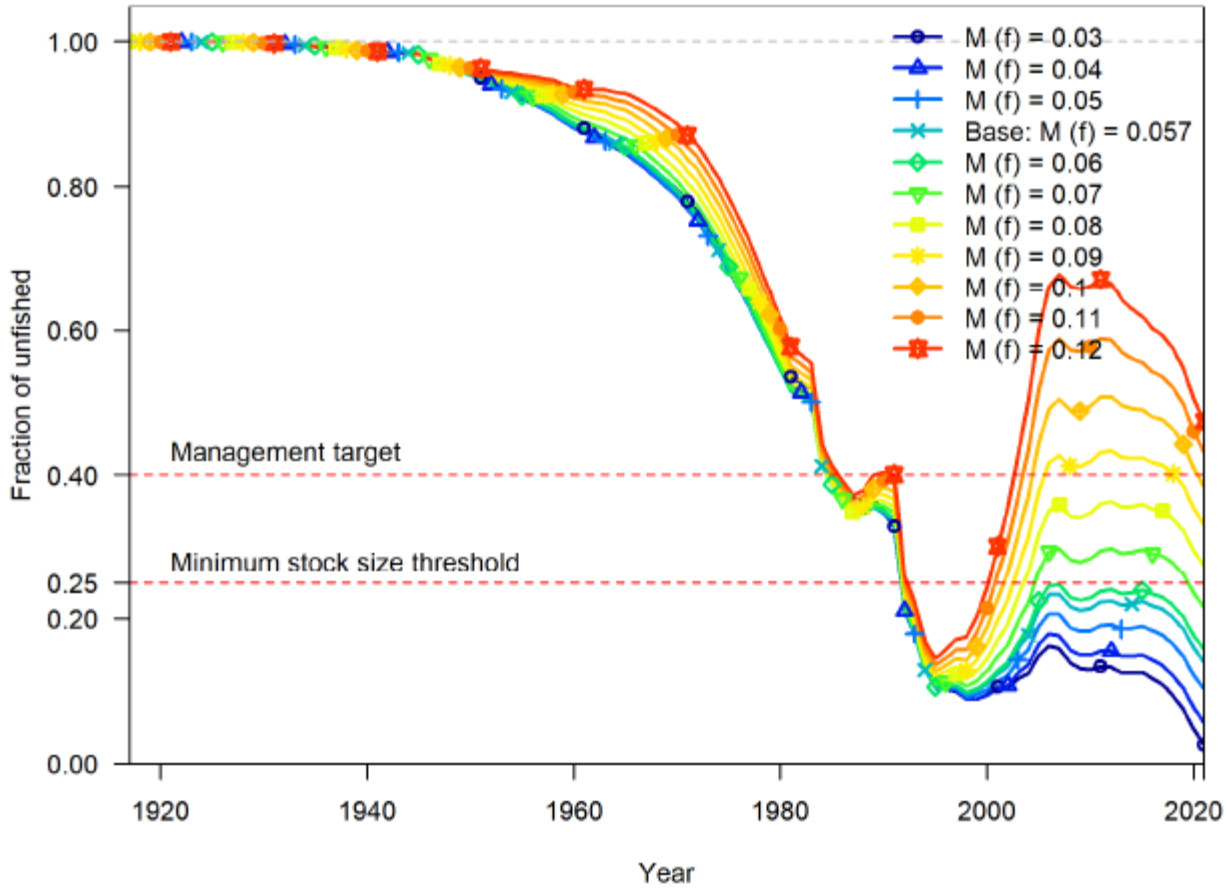


Figure 34: Change in the estimate of fraction unfished across a range of natural mortality values.

Support for fixed values

- Steepness
  - Meta-analysis that was rejected
  - Default steepness = 1 has recently been recommended (Brooks 2024)
- M
  - Based on a maximum age of 95 (90) years for a female
  - For stocks of British Columbia (Alaska)
  - Data use in the assessments for the US stocks were 73, 70, and 69
  - From the Washington stock
  - Make natural mortality a function of length

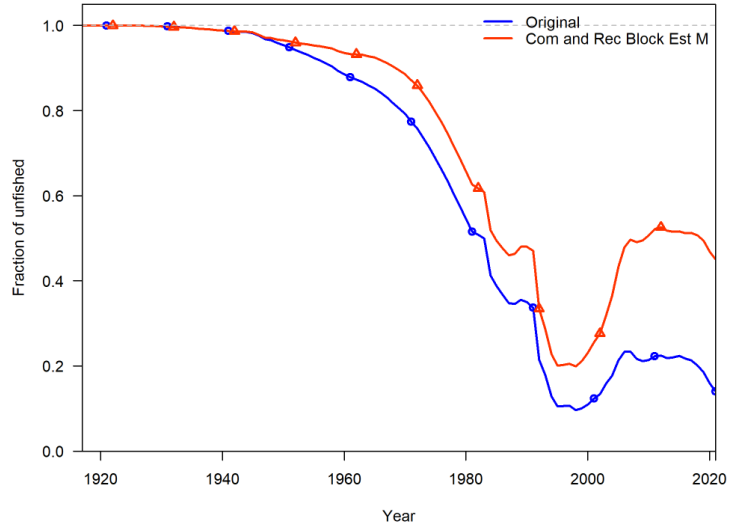
Max age	M
95	0.057
76	0.071
73	0.074

Support for fixed values

- L@Amax
  - Data mainly from Oregon and Washington
  - The CA data not used in the assessment supported the Linf used possibly a slightly higher one
- K
  - The growth model does not appear to fit the age-length data well
  - Very little age-length data from California used to estimate the growth curve used in the assessment below age 10.
  - The data for all areas, and the new data for California, supports a lower K.
  - The literature values of K cited in the assessment report are not for the California stock.
- A more flexible growth curve is also probably warranted.

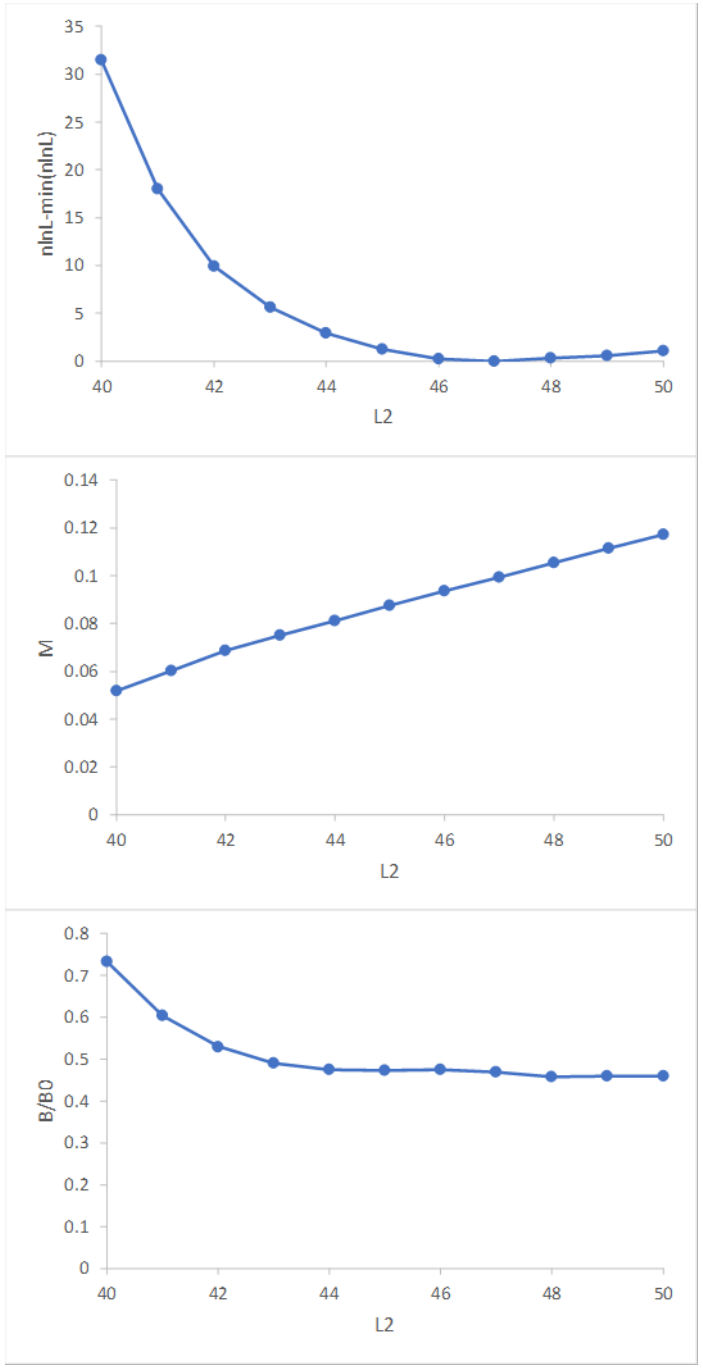
Selectivity

- There have been substantial management changes (e.g. depth restrictions) that could influence the size of both the recreational and commercial effective selectivity
- Commercial length composition data indicate that the selectivity differs before and after 2003, with before being dome shaped.
- A comprehensive set of selectivity scenarios but not
  - Commercial time block in 2003
  - Dome shaped commercial selectivity in the early period (or both)
  - A recreational time block in 1994
  - Dome shape recreational selectivity in the latter period.
- Estimate M
  - M = 0.093
  - 25 negative log-likelihood units less
  - Much less depleted stock
  - Very similar to that obtained by the assessment authors when they estimated natural mortality

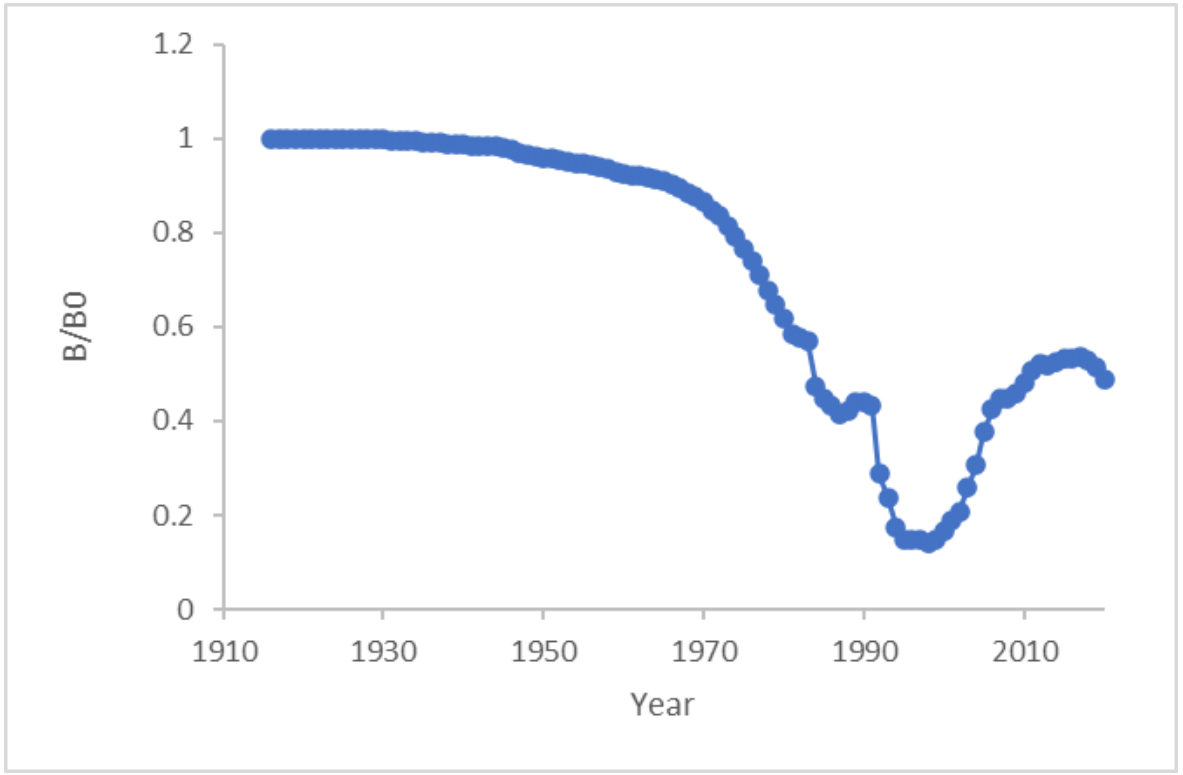


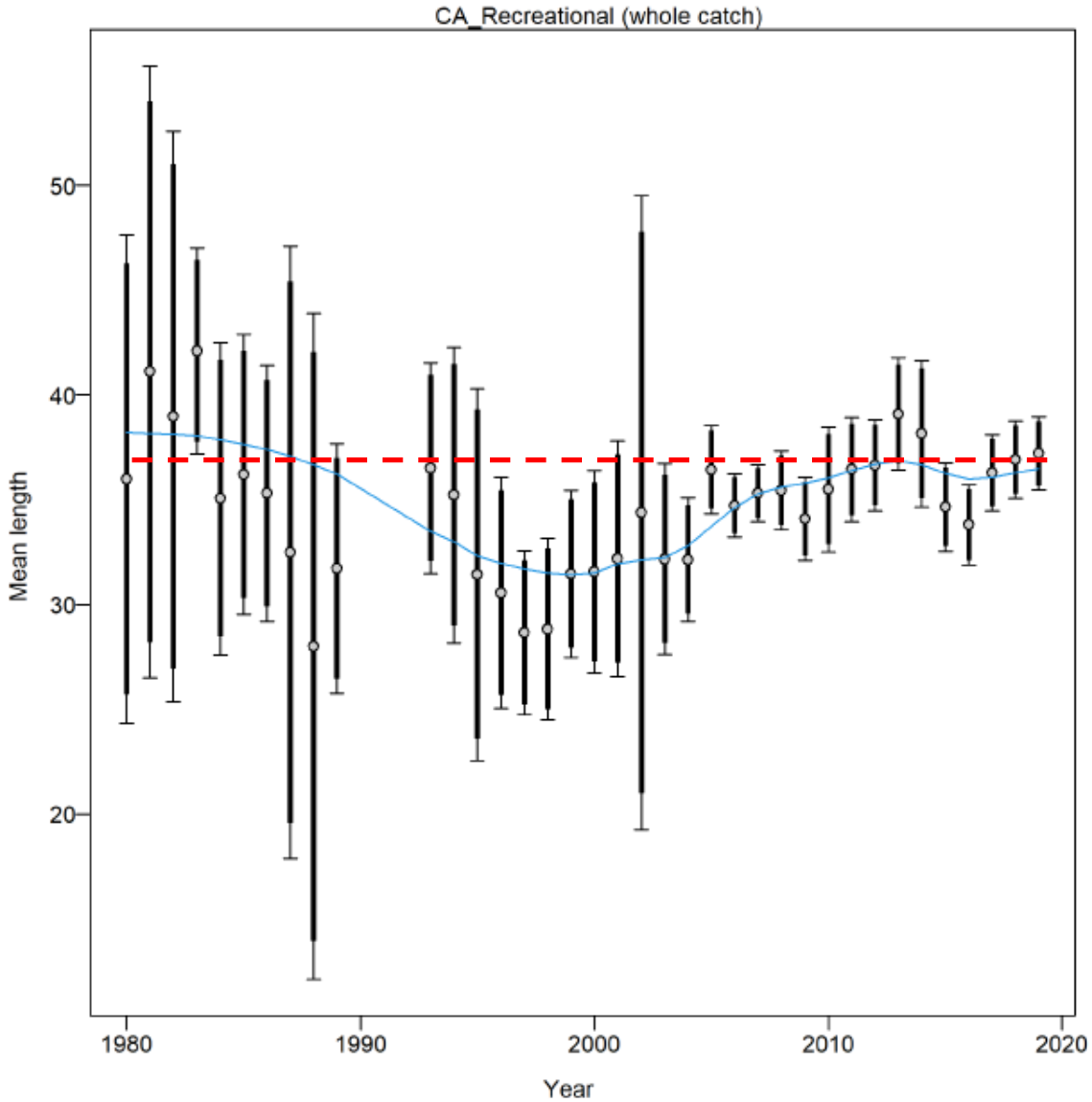
Example model

- Steepness = 0.95
- K = 1.5
- M estimated
- Profiles over L@Amax
- CV@Amax original value
- Selectivity
  - Commercial selectivity block at 2003
  - Early commercial selectivity dome shaped
  - Recreational selectivity block at 1994
  - Later recreational selectivity dome-shape.



Example model





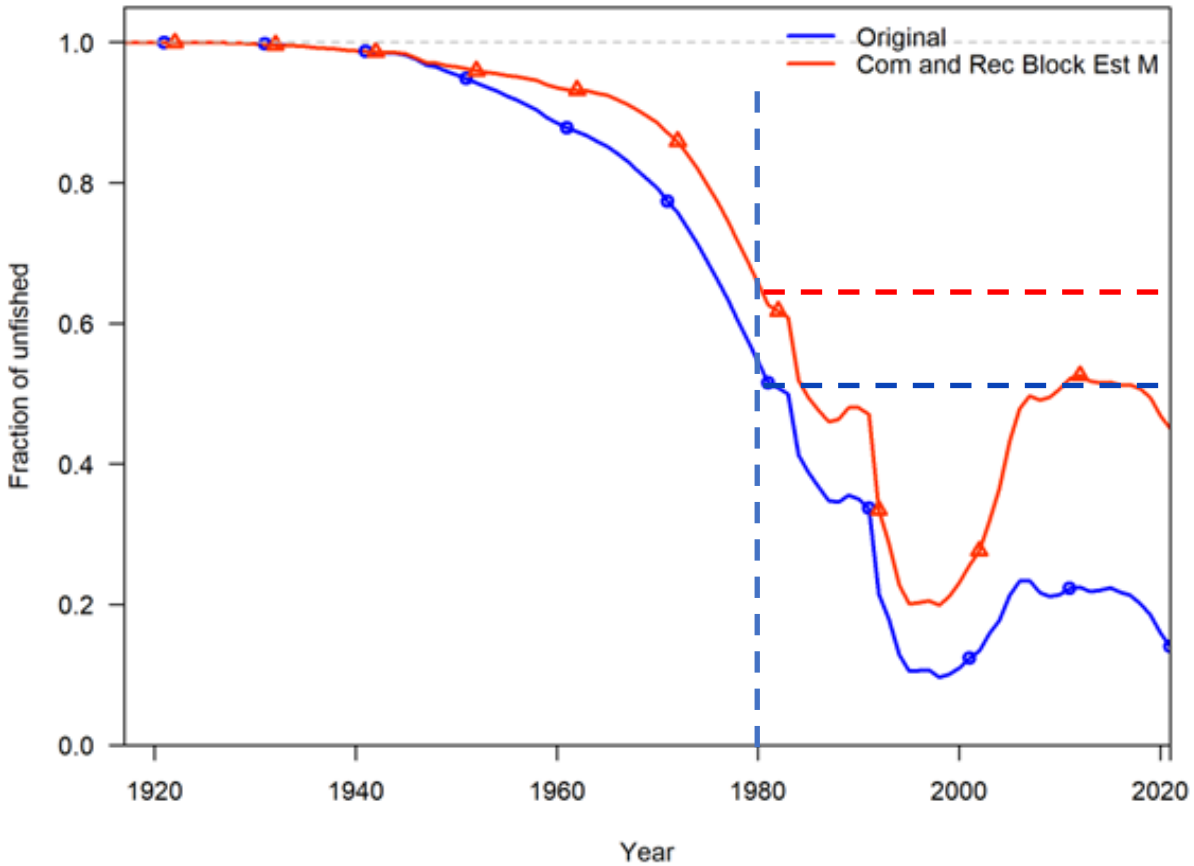
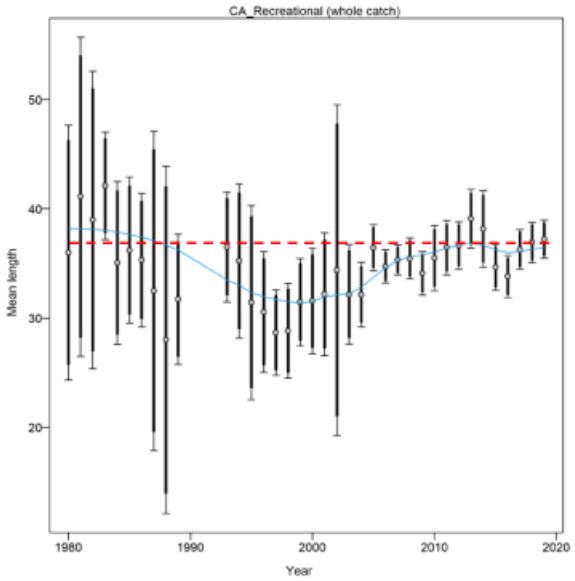
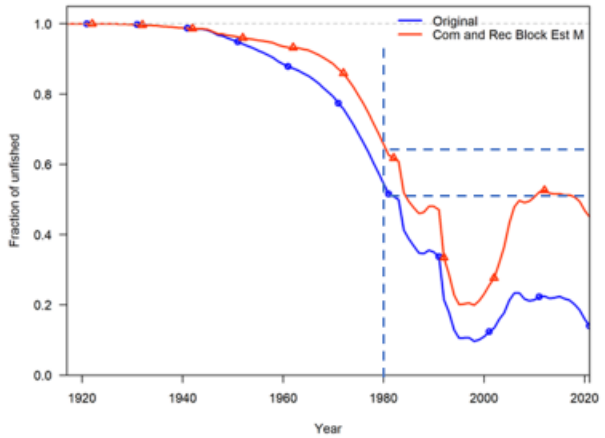


Figure 20: Model estimated mean length in cm (blue line) overlaid on mean length for recreational lengths (gray circles) with 95 percent confidence intervals (thick bars) based on current samples sizes. The thin bars indicate the confidence interval if Francis weighting were used instead.





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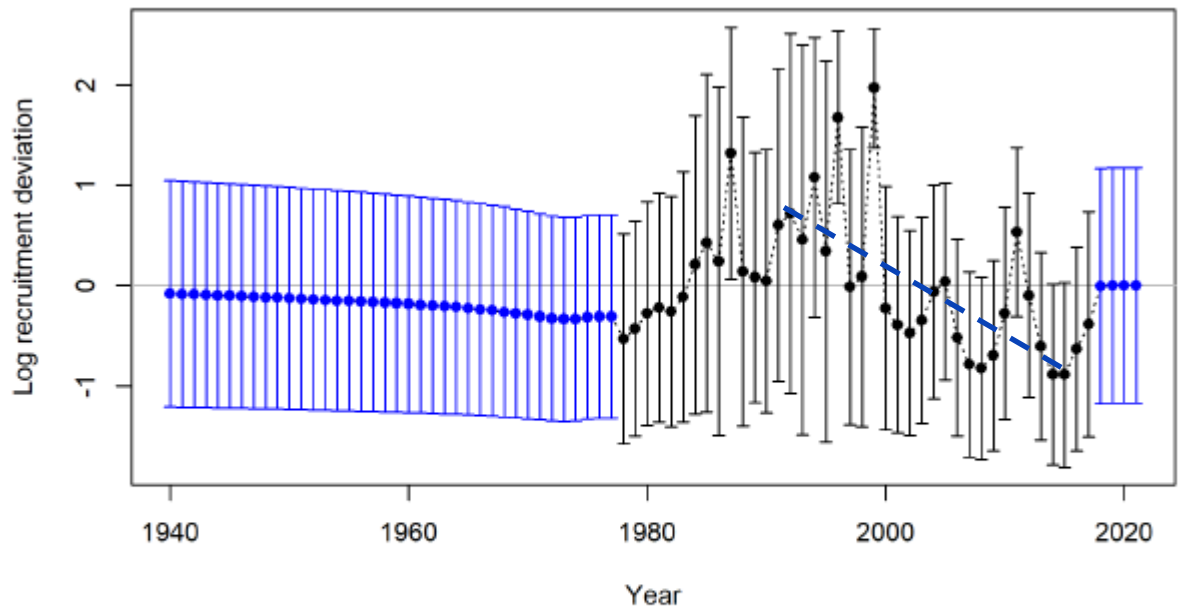

Figure 15: Estimated time series of recruitment deviations.

Conclusions

- The assessment is uncertain
- Several assumptions leading to a more depleted stock are not supported by the data
- Further evaluation of the assessment is recommended before it is used for management advice.
- The assessment should be the Best Available Science and precaution should be included management decisions
- If the conservative assumptions can't be changed in the stock assessment model, no additional precautionary measures should be included in the management action


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