Golden Tilefish Management Strategy Evaluation (MSE)

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RUTGERS

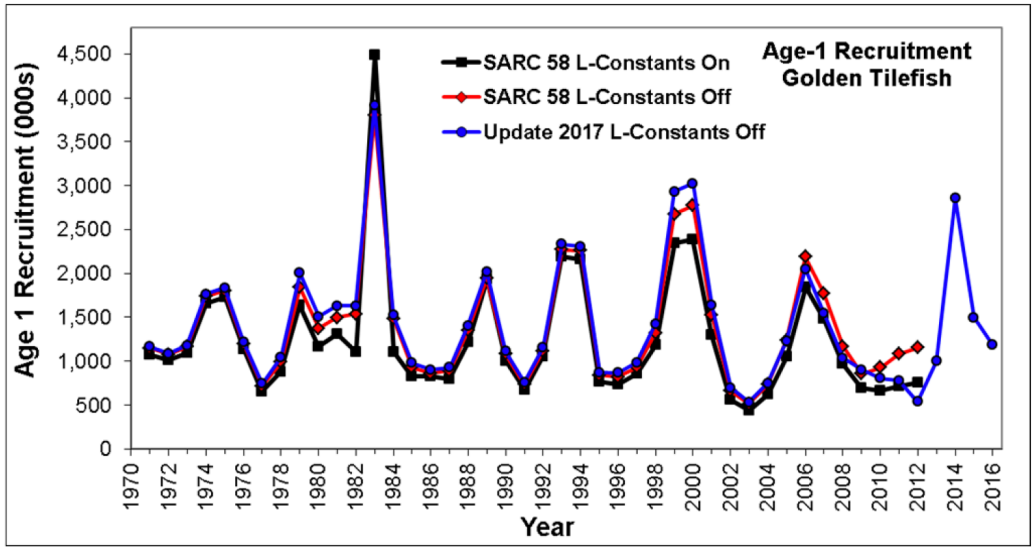
Collaborators

- Genny Nesslage (UMCES)
- Paul Nitschke (NEFSC)
- Erik Williams (SEFSC)
- Vyacheslav (Slava) Lyubchich (UMCES)
- Churchill Grimes (retired; SWFSC)

- Modification of model developed for Mid-Atlantic stocks (summer flounder, scup, butterfish) to test harvest control rules (HCRs)
  - Focus here is not on HCRs, but mostly on dealing with recruitment

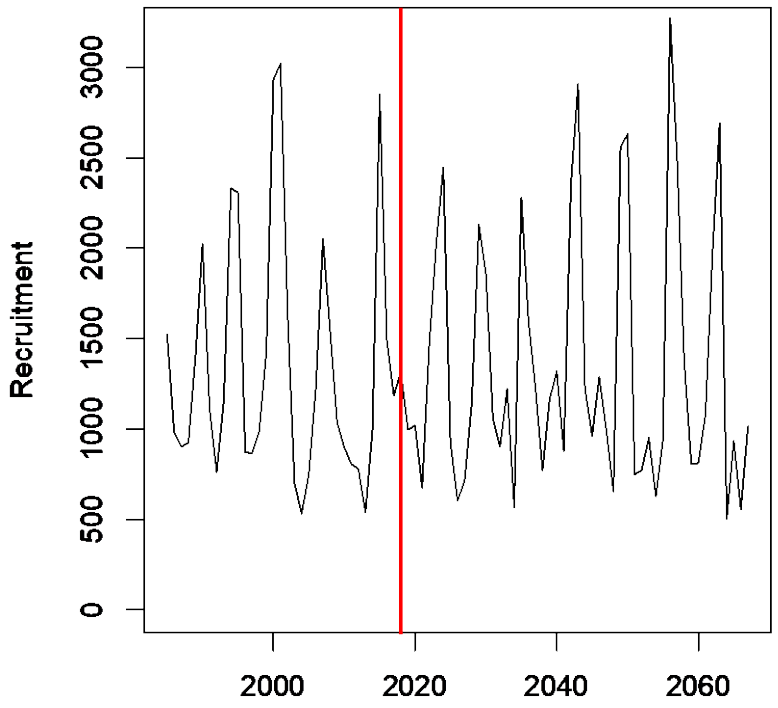
- Historical population and fishery dynamics based on assessment estimates

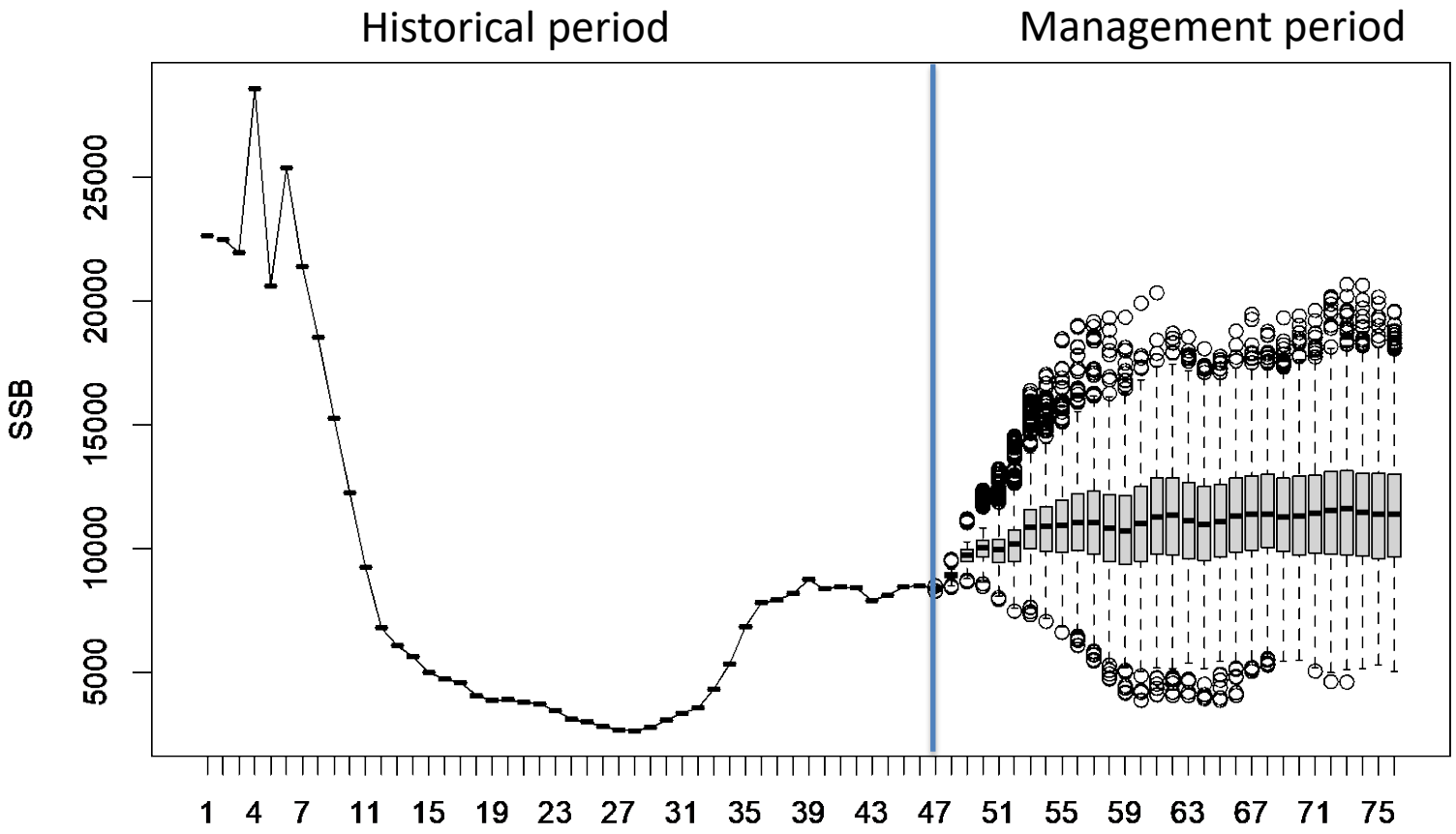
- Future dynamics based on variable recruitment and SCAA assessment uncertainty → OFL / ABC uncertainty.



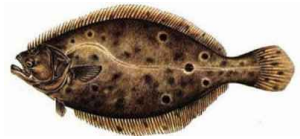
Modeling Recruitment

Recruitment modeled as a “boom / bust” independent of spawning stock biomass, with spikes in recruitment every 3-5 years based on historical recruitments.



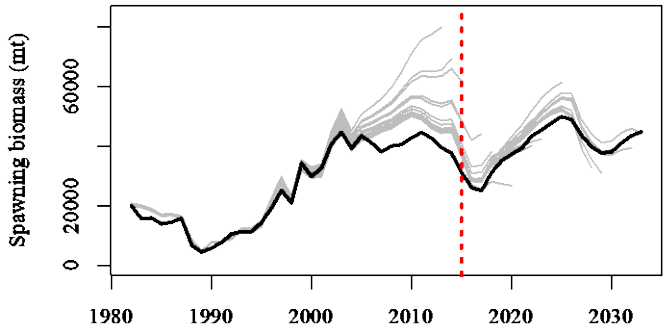

Historical period
Management period
SSB
5000
10000
15000
20000
25000
1
4
7
11
15
19
23
27
31
35
39
43
47
51
55
59
63
67
71
75

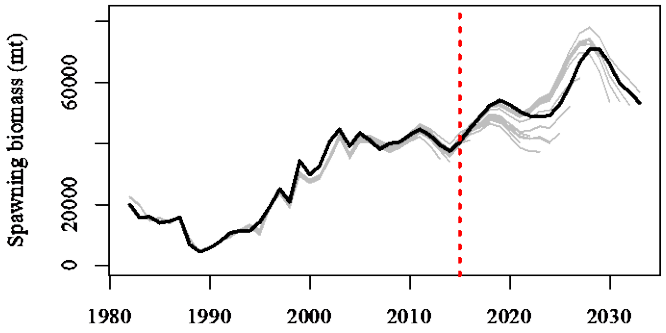
Example assessment estimates across model runs

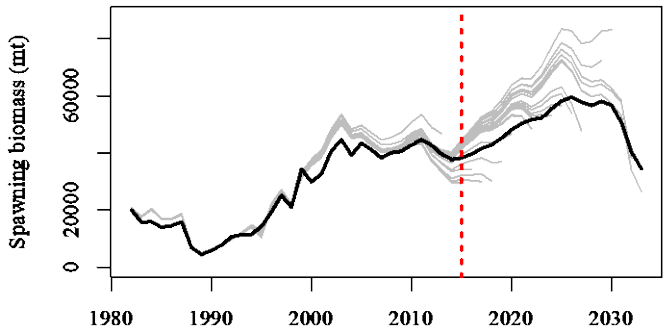


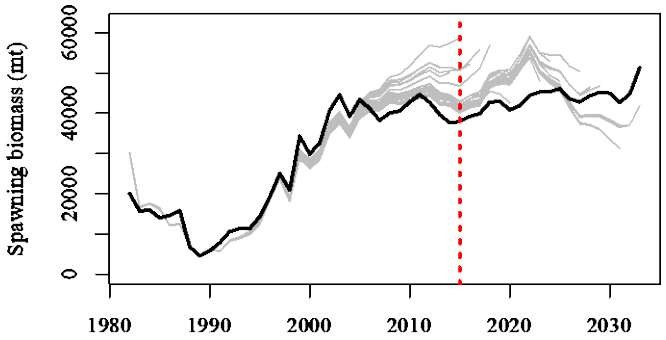
True biomass

Estimated biomass







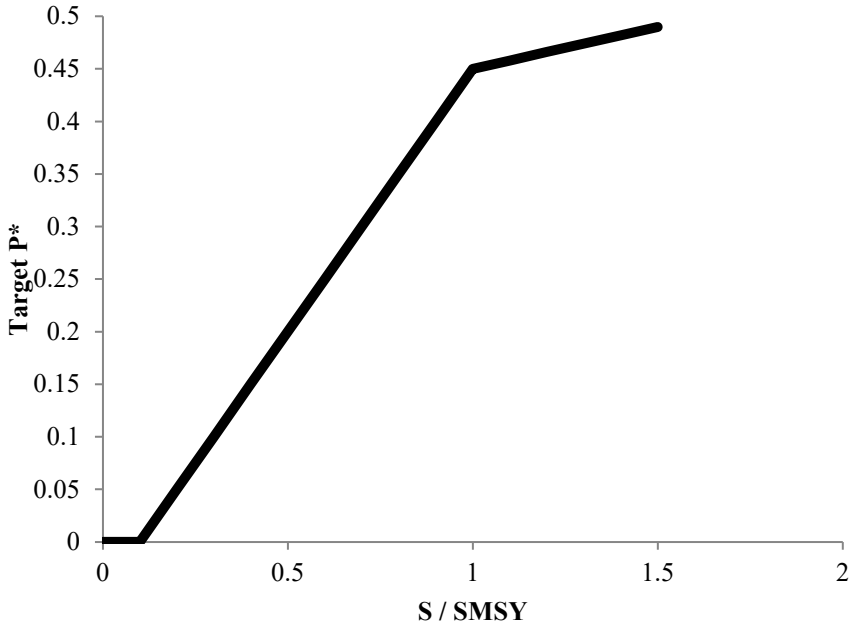


Target P* is biomass based, with assumed CV of the OFL distribution of 100%.

Explored:

- a time-varying ABC based on projections
- fixed ABC based on the average over the projection period.
- 3 or 5 years between stock assessments

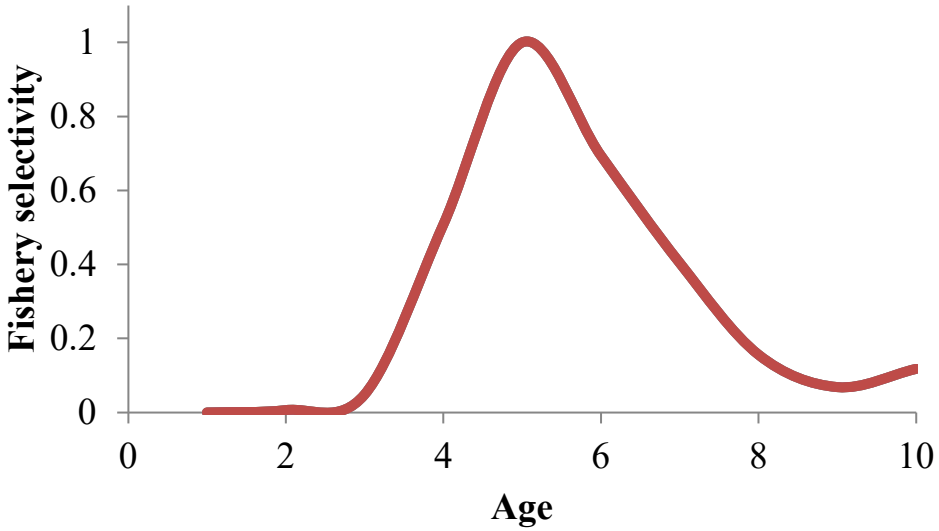
Actual catch = ABC* (i.e., no implementation uncertainty)



- Little information on age 1-3 in the fishery data.

- Recruitment (age-1) in the last three years of each assessment is estimated with a penalized likelihood as estimates deviate from the
  - The estimated mean of the time series
  - 80% of the estimated mean

- Also explored a situation where age-3 in the terminal years is estimated perfectly (best case scenario to explore benefits of sampling of younger ages).

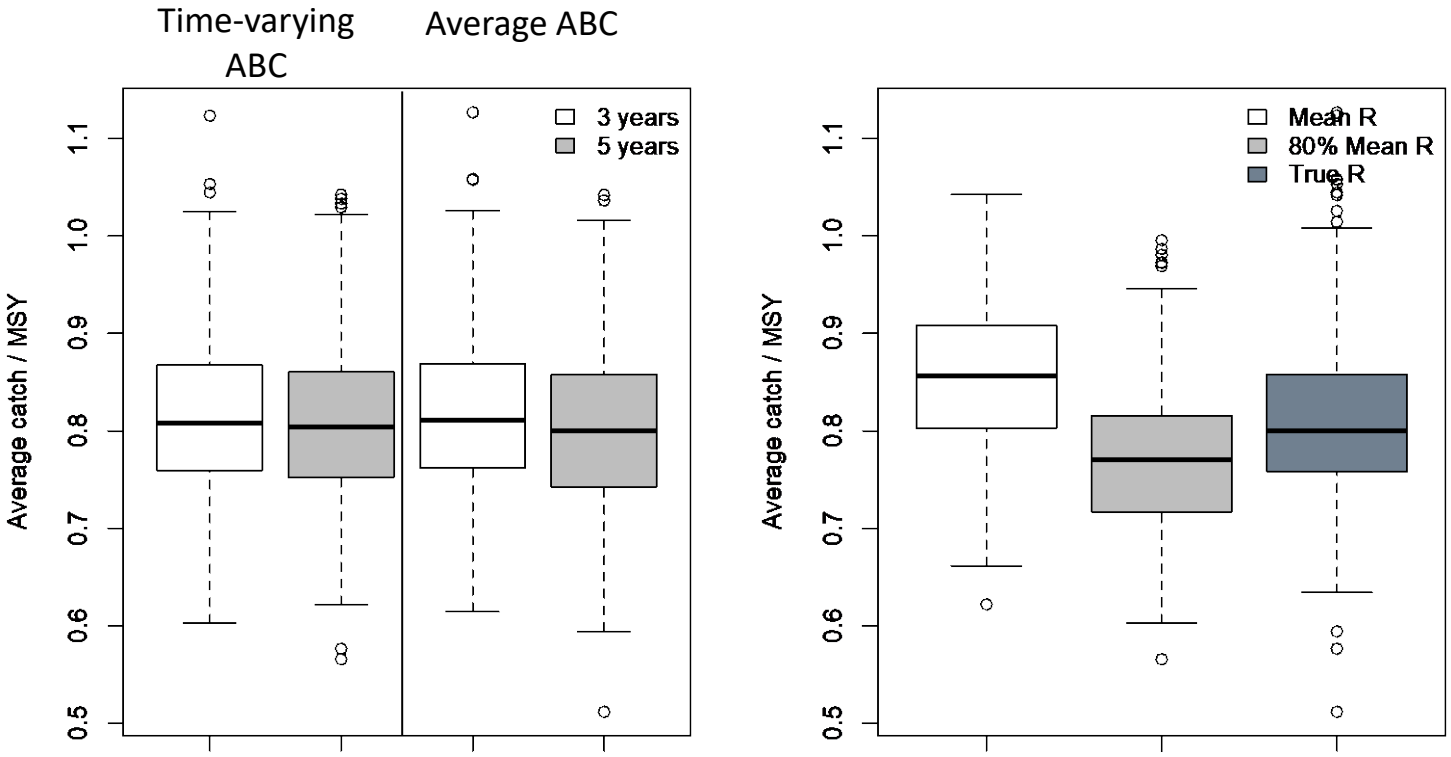


Recap (12 combinations explored):

- 2 assessment intervals (3 or 5 years)
- 2 ways for setting the ABC (time varying or averaged)
- 3 ways for dealing with recruitment
  - Penalty based on the mean of the time series
  - Penalty based on the 80% of mean of the time series
  - Perfect age-3 estimate in terminal year

- Performance measured over 30-year period
  - Average catch
  - Variability in catch
  - Average biomass
  - Probability of overfishing (years when $F > F_{MSY}$)
  - Mean F / F_{MSY} when overfishing occurs
  - Probability of becoming overfished ($SSB < 0.5\ SSB_{MSY}$)

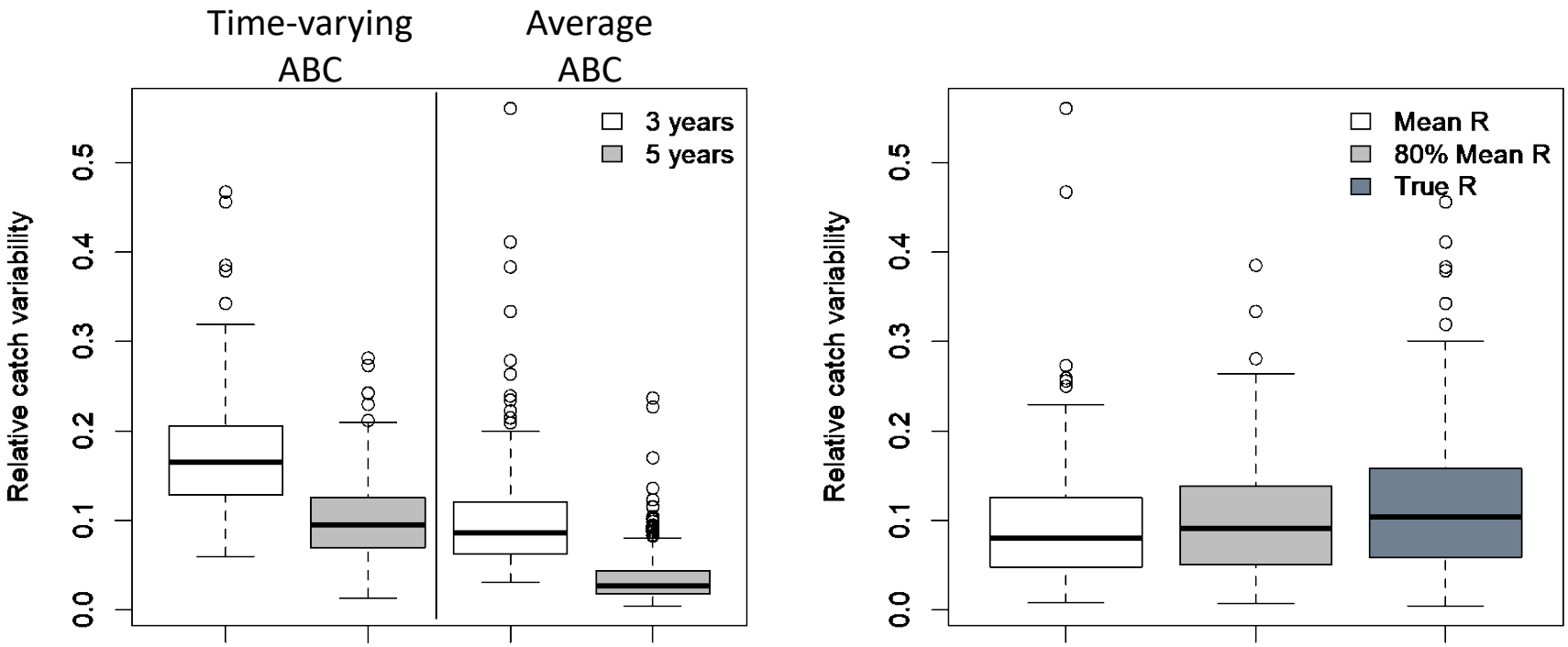
Average catch / MSY



Very little difference in average catch based on the ABC method / assessment interval (left panel).

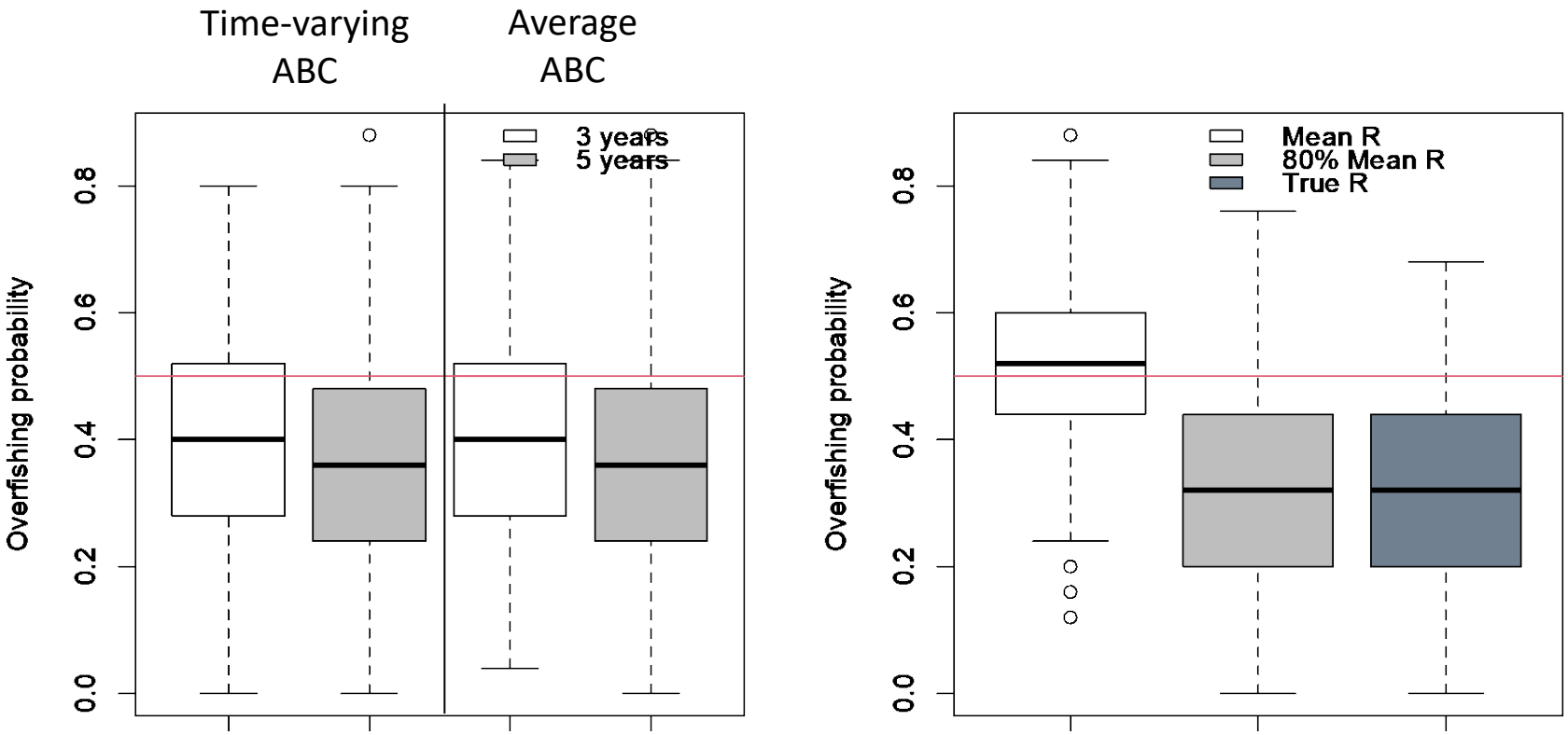
Recruitment assumptions had a much larger impact on average catch (right panel).

Variability in catch (avg. proportional change between years)



Reduced catch variability based on the average ABC and longer assessment interval (left panel).

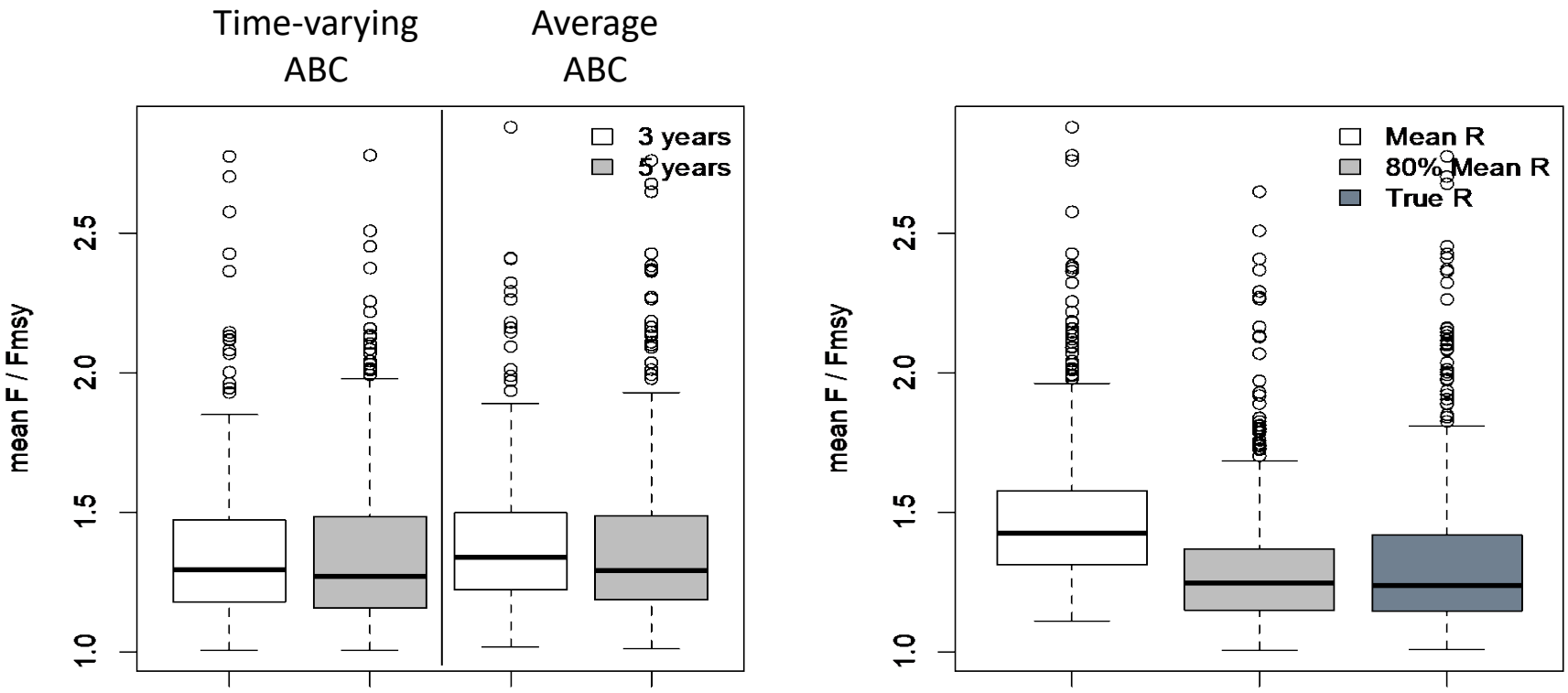
Probability of overfishing ($F > F_{MSY}$)



Reduced risk with longer assessment interval (left panel).

Using average recruitment had the highest risk of overfishing (> 0.5; right panel).

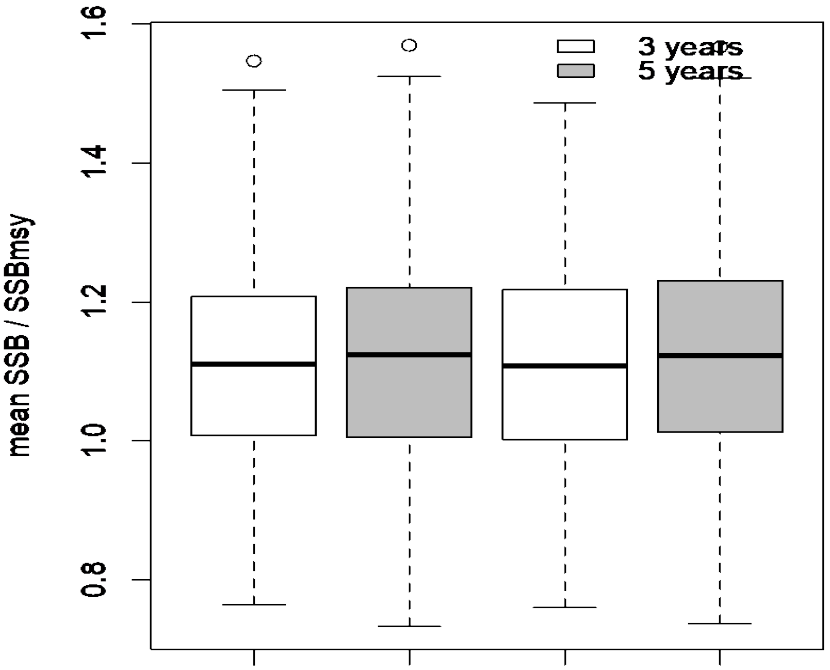
Average F / F_{MSY} when overfishing occurs

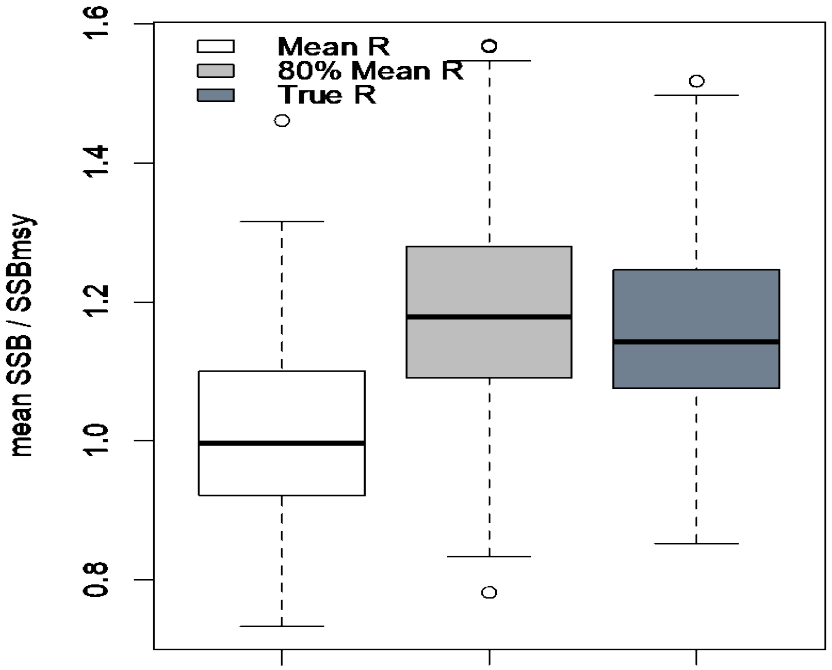


Very little difference in F / F_{MSY} based on the ABC method / assessment interval (left panel).

Using average recruitment had the highest magnitude of overfishing (right panel).

Average SSB / SSB_{MSY}





Very little difference in SSB / SSB_{MSY} based on the ABC method / assessment interval (left panel).

Using average recruitment had the lowest SSB (right panel), but the risk of becoming overfished was ~0 across model configurations.

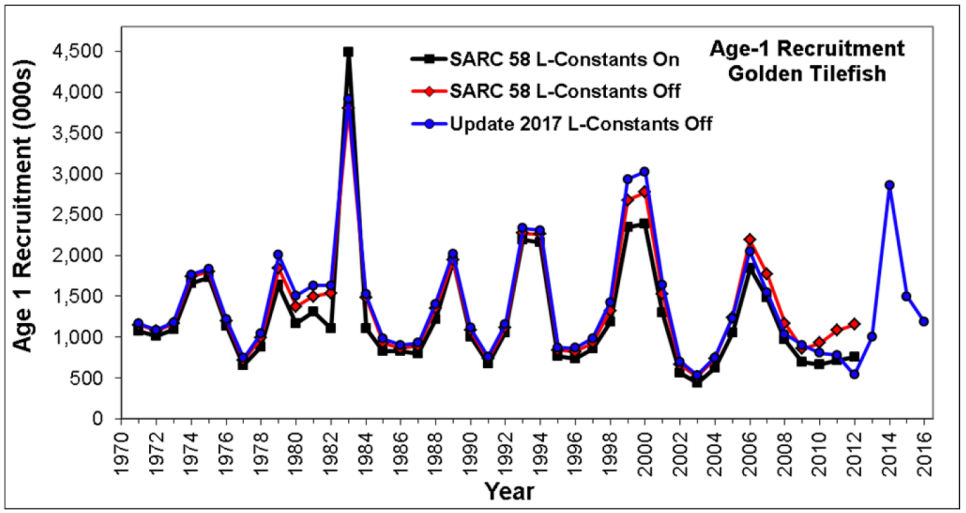
Summary

- ABC method (averaging vs. time varying) and assessment interval had little effect overall across most performance measures except catch variability (lower with averaging and longer interval)

- Method for estimating recent recruitments had more of an impact across performance measures
  - Assuming average recruitment had highest catch but lowest SSB, and a median risk of overfishing > 0.5

- Perfect estimate of age-3 recruitment increases yield without increases in overfishing risk.
  - Explored 80% of the mean recruitment, but other multipliers are possible and may perform more similarly to the perfect age-3 run

Caveats



- Recruitment independent of stock size keeps biomass high and stable regardless of method explored.

- Perfect estimate of age-3 in terminal year is unrealistic
  - doesn't account for uncertainty in estimates
  - Ignores implementation lag in how many years of a new survey it would take to start improving estimates