SSC Constant/Average ABC Sub-Group

September 14, 2022
Baltimore, MD

Based on the trend in the OFL, what happens to the ABC under averaging?

If the OFL is increasing, the average in the first year will be higher than the year-specific ABC

If the OFL is decreasing, the average in the first year will be lower than the year-specific ABC

What should be expected of projected stock size and ABCs?

If the stock is above the Bmsy proxy, we should expect a decreasing OFL in projections

If the stock is at Bmsy, we should expect (approximately) no change in OFL in projections

If the stock is below Bmsy, we should expect an increase in the OFL in projections

Review of previous simulation work

We previously conducted an MSE to evaluate alternative potential control rules for responding to the 2006 changes to MSA

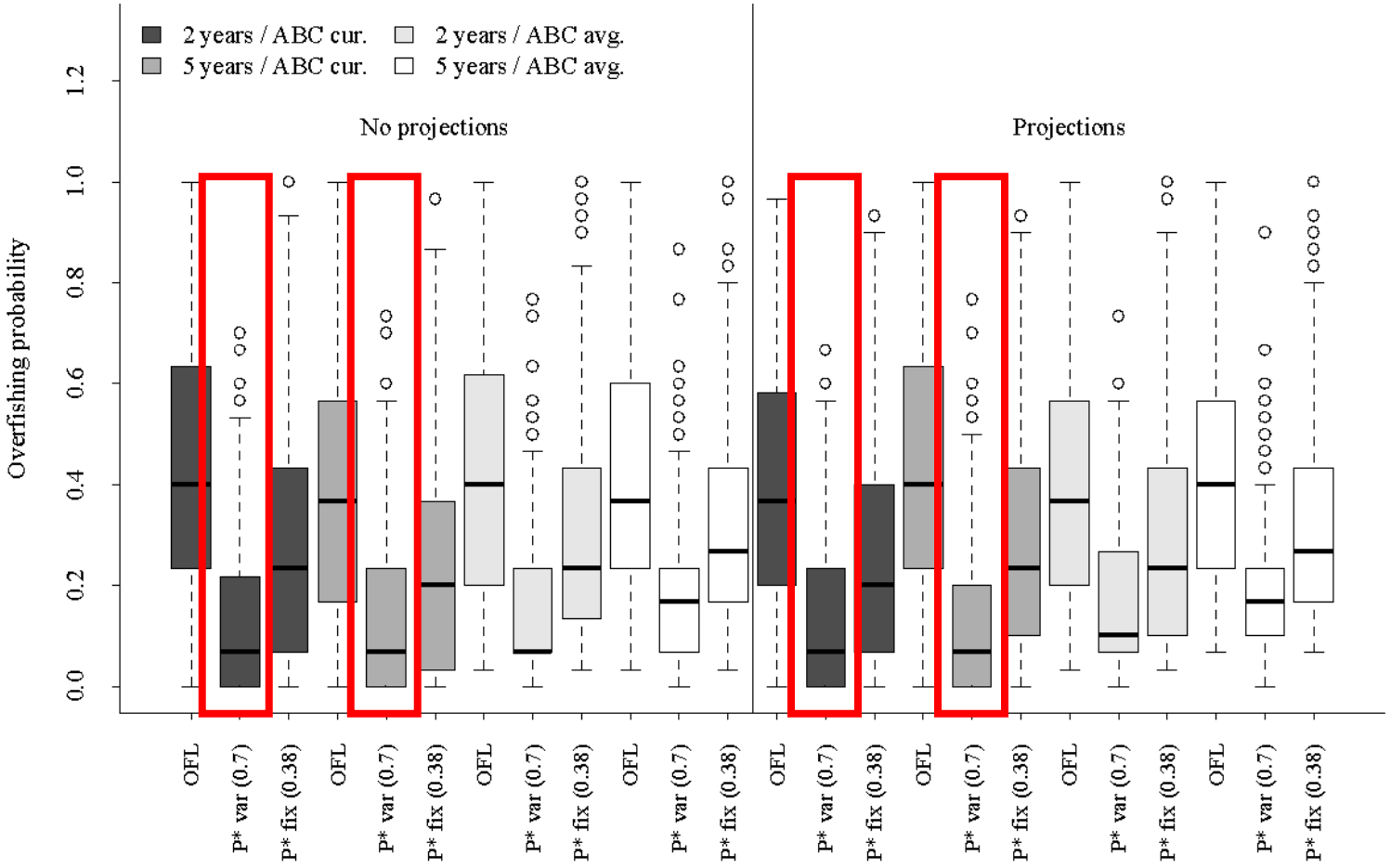
We tested our current control rule that uses projections for setting ABCs against an alternative that only projected to the first year and had the ABC be constant until the next assessment

Times between assessments were 2 or 5 years

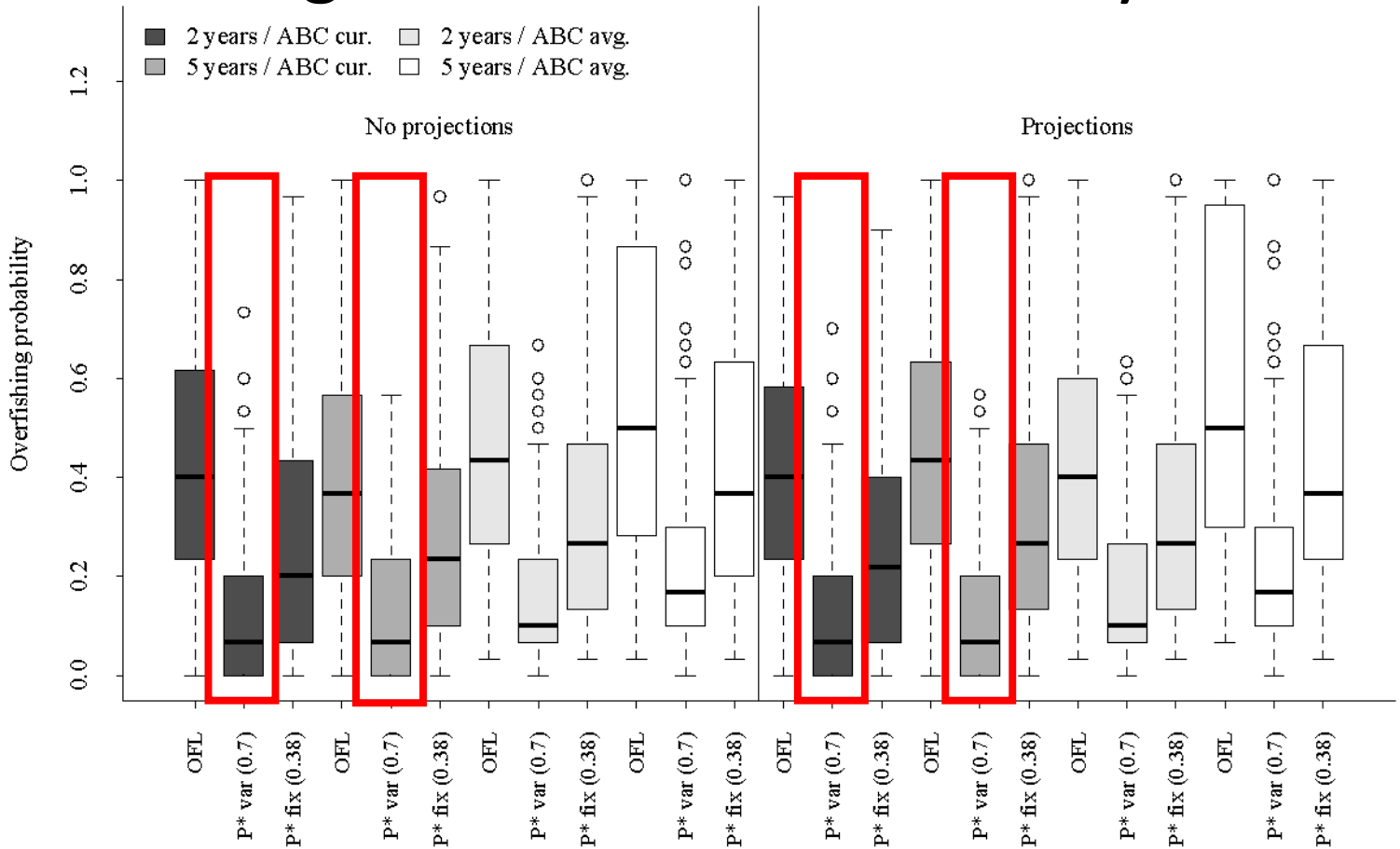
Simulations were conducted for the medium life history (fluke-like) that had high fishing pressure before P* control rule management

Note: these were done with the previous risk policies

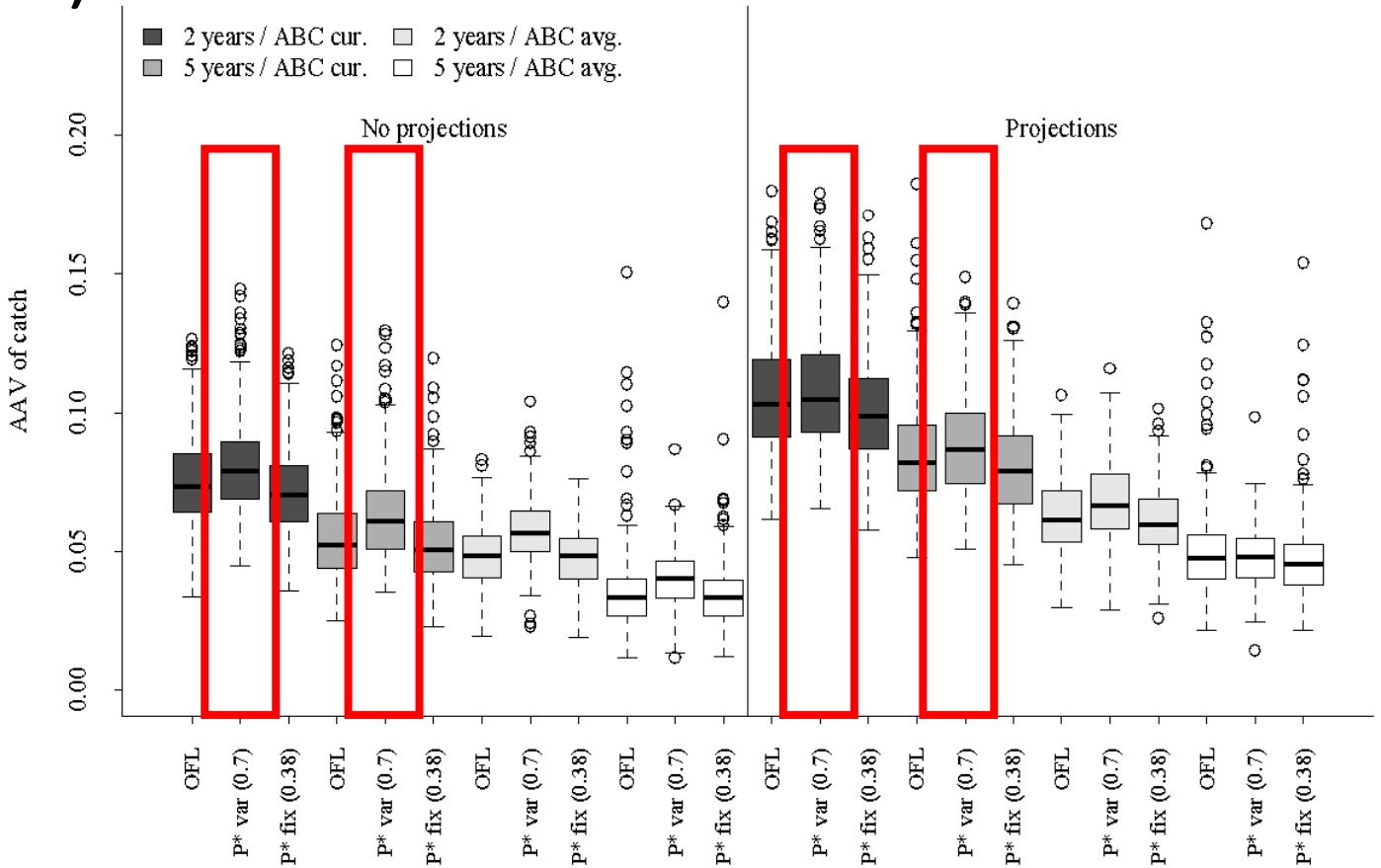
Results – low recruitment variability



Results – high recruitment variability



Results – average annual variability of catch (AAV)



Conclusions

Using a constant ABC without projecting for every year had similar (or better) performance than using projections for the probability of overfishing and annual catch variation.

Caveats

- Simulations were only done for one scenario.
- The stock was generally increasing

Simulation Framework

- Operating Model =Simple linear model
- B(t+1)=exp(-(F+M)) B(t) λ
  - B[0]=2 Bmsy
  - relB[t]=B[t]/Bmsy
  - OFL[t]=Fmsy/(Fmsy+M) (1-exp(-(Fmsy+M))) B[t]
  - ABC[t]=ABC(OFL[t], relB[t],CV), where ABC(...) is a function that applies SSC's OFL CV and Council's Risk Policy to find ABC
  - F associated with the ABC[t] is defined as Fabc[t] computed as the solution of
  - ABC[t] - Fabc/(Fabc+M)(1-exp(-(Fabc+M))) B[t] = 0
  - Average ABC computed for t=1, 2, …T
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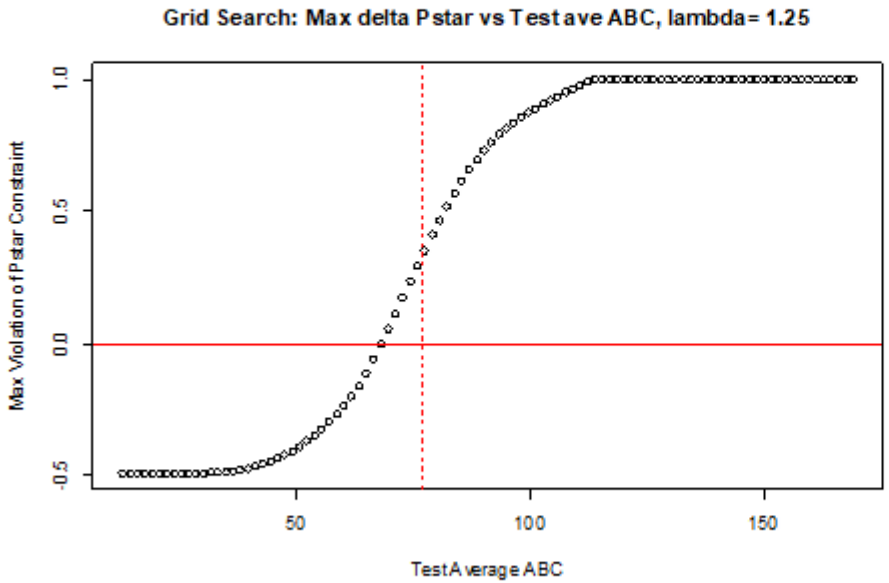
Optimization Framework

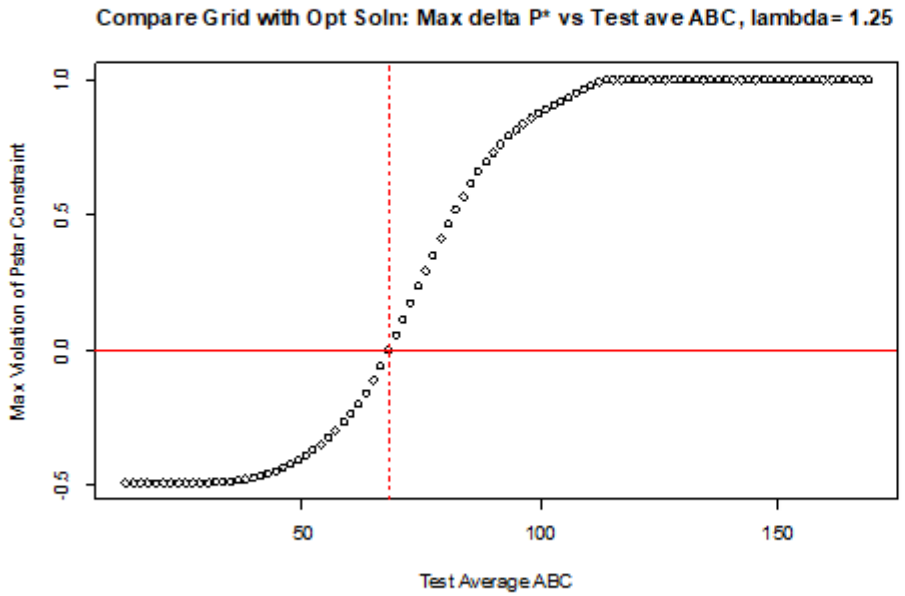
- Find maximum average catch over the period t=1,2,…,T subject to the following constraints. Call this value C_{opt}
  - 1. Pstar|Copt[t] <0.5 *Legal Constraint on Pstar*
  - 2. Fabc|Copt [t] <Fmsy *Avoid overfishing*
  - 3. Pstar|Copt[t] <Pstar|B[t] *Avoid violation of Council Risk Policy*
- Key unknown—How to apply Council's allowance for Pstar<0.5 during the averaging period? In other words, can we just drop constraint #3?

Grid Search Illustration

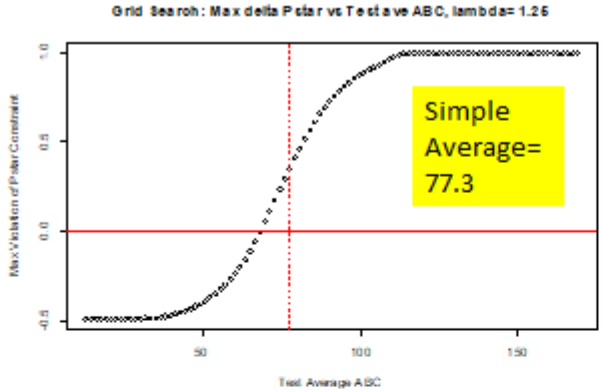


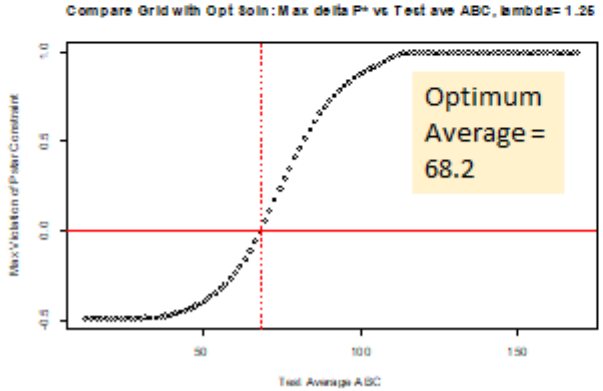
*The x axis is the test value of the average ABC. The y axis is the maximum value of the constraints across all constraints. There are 3*Tmax constraints. The optimum solution (horizontal red line) occurs when all of the constraints are satisfied, i.e., when none of the constraints exceed zero. The vertical dashed line in the above plot is the average of the ABC(t) based on P*. In this case the average ABC(t) results in violation of one or more constraints over the period t=1,…,Tmax.*

Optimum Ave Catch



*The x axis is the test value of the average ABC. The y axis is the maximum value of the constraints across all constraints. There are 3*Tmax constraints. The optimum solution (horizontal red line) occurs when all of the constraints are satisfied, i.e., when none of the constraints exceed zero. The vertical dashed line in the above plot is the OPTIMUM average ABC(t) based on nloptr algorithm. In this case the average ABC(t) is the maximum ABC that does not exceed any of the constraints over the period t=1,…,Tmax.*





Comparison:
Simple Average vs Optimal Average when population is declining.

Scenario Comparisons

Population Trend	Average C	Min C[t]	Optimum C	Max C[t]
Increasing	203	155	155	257
~Stable	164	155	155	172
Decreasing	77	26	68	157

When Pstar constraint is binding at each time period, then OPTIMUM average catch is equal to minimum catch admissible over the period t=1,2,..T. Pretty simple and boring. If population is decreasing, the optimum catch will be less than the simple average. The key unknown for problem setup is

What is limiting constraint over the planning horizon? Fabc<Fmsy for all t? Pstar<0.5 for all t?

Additional Considerations

Species	Assessment/ Spec Cycle	P* Applied (Y/N)
Golden Tilefish	3 years	Yes
Blueline Tilefish	NA / 3 years	No
Atlantic Mackerel	2 years	No
Butterfish	2 years	Yes
Longfin Squid	3 years	No
Illex Squid	3 years	No
Chub Mackerel	NA / 3 years	No

Species	Assessment /Spec Cycle	P* Applied (Y/N)
Bluefish	2 years	Yes
Summer Flounder	2 years	Yes
Scup	2 years	Yes
Black Sea Bass	2 years	Yes
Atlantic Surfclam	4 years	Yes
Ocean Quahog	6 years	Yes
Spiny Dogfish	4 years	Yes

Most species have relatively frequent assessment updates, short specification cycles

Additional Considerations cont.

Summer Flounder (B/Bmsy <1)

Variable	Value
Max ABC / P*	15,403 mt / 0.45
Min ABC / P*	14,639 mt / 0.44
Relative Difference	4.9%
Avg. ABC / P*	15,021 mt / 0.43, 0.46

Golden Tilefish (B/Bmsy ≅ 1)

Variable	Value
Max ABC / P*	917 mt / 0.45
Min ABC / P*	867 mt / 0.43
Relative Difference	5.4%
Avg. ABC / P*	891 mt / 0.44, 0.46

Black Sea Bass (B/Bmsy > 1)

Variable	Value (from 2019)
Max ABC / P*	7,123 mt / 0.40
Min ABC / P*	6,546 mt / 0.40
Relative Difference	8.1%
Avg. ABC / P*	6,835 mt / 0.38, 0.42

Differences between max/min ABC versus the avg/constant ABC
Differences in maximum and minimum ABC values across Council species generally range between 1% - 15%

Questions and Discussion