Importance of Calibrated Catch for Fishery Stock Assessments

MRIP APAIS Calibration Peer Review

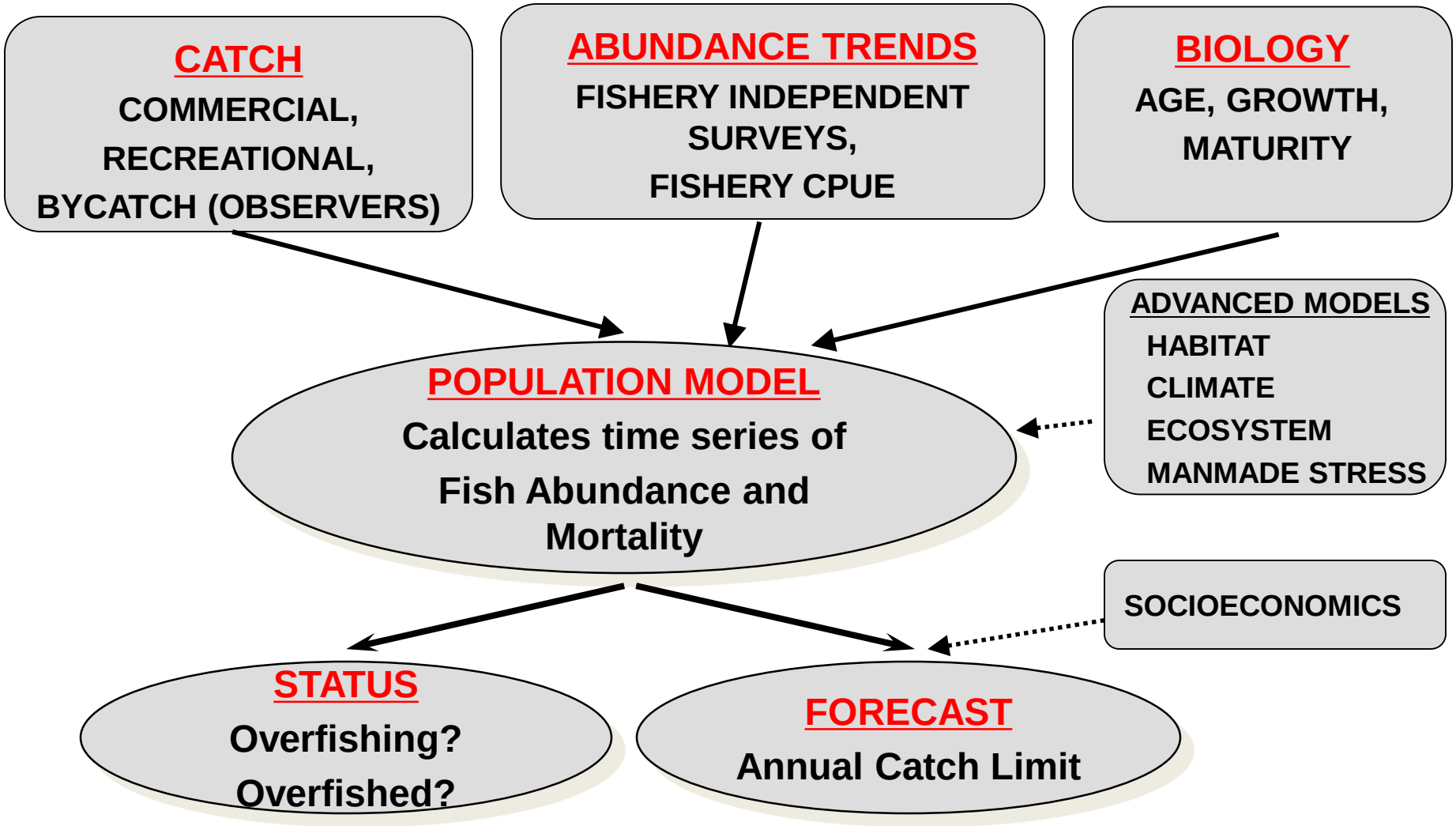
March 20, 2018

Katie Drew, ASMFC

Outline

- Overview of stock assessment models & basic assessment approach
- Importance of total catch and catch-at-age/size information
- Importance of MRIP data
- Conclusions

Stock Assessment



Basic Assessment Approach

- Cannot directly measure stock abundance
- Instead, models infer how large must the population have been in order to:
  1. Have exhibited the observed trend in relative abundance over time,
  2. While the observed absolute amount of catch was removed

Basic Assessment Approach

- Do a survey: 50 fish per tow
- Season opens: 3,000 MT caught
- Do the survey again: 25 fish per tow

- How large was the population at the beginning of the season?
  - 6,000 MT: the index declined by half when you removed 3,000 MT

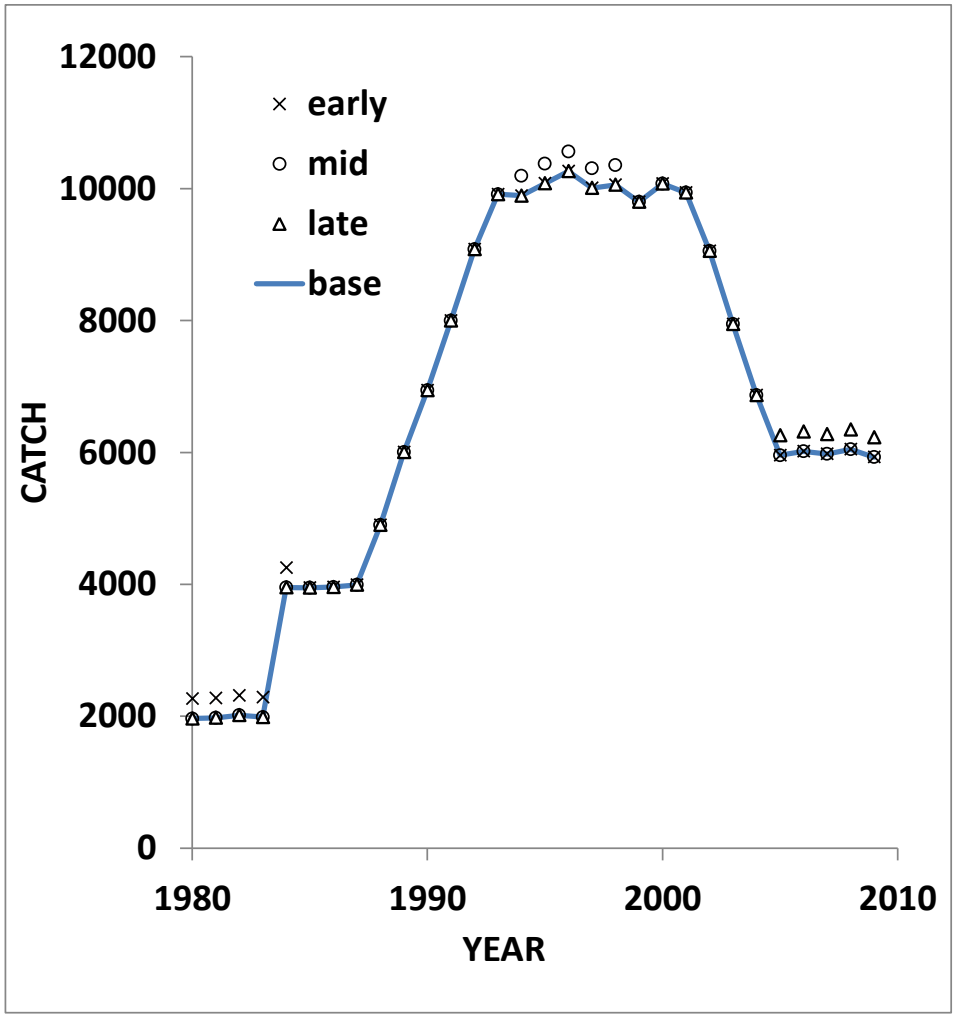
Importance of Catch

- Because surveys provide a time series index, not absolute biomass, the scaling of the assessment result is strongly influenced by the absolute level of catch

- Some models can account for imprecision in the catch data, but bias is a lot harder to deal with

Impact of Biased Catch Estimates

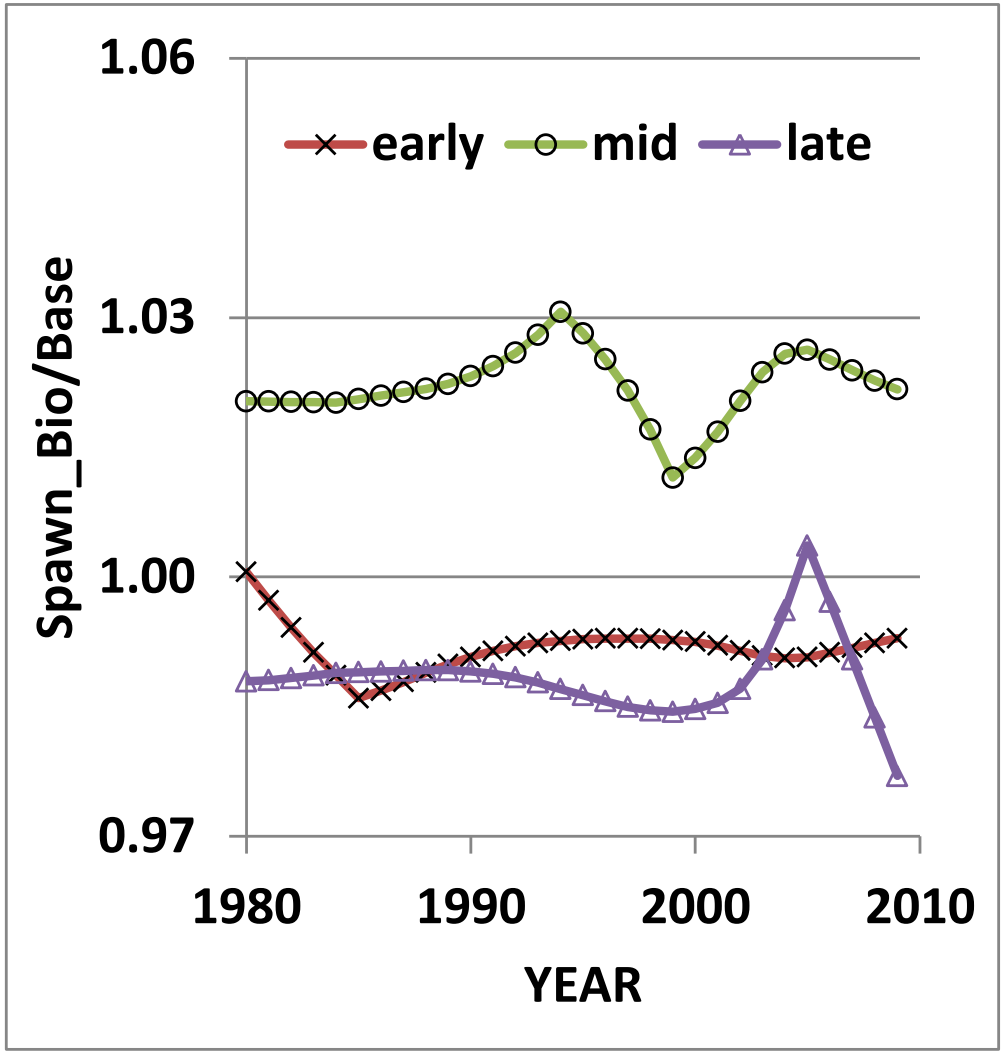
- Simulation analysis used to investigate impact of biased catch levels
- Base case, and three alternatives:
  - Early – add 300 mt per year for 5 years at beginning
  - Mid – same added level during peak catch period
  - Late – same added level for 5 years at end.



Slides from R. Methot, NOAA

Relative Changes in SSB

- Greatest decline during period of overestimated catch
- Mid has 3% +bias in catch and nearly the same in biomass estimate
- Early and Late had 10-15% +bias in catch, but negative bias in biomass



Slides from R. Methot, NOAA

Impact on BRPs

	Base	Early	Mid	Late
SSB_unfished	110561	110613	112528	109608
steepness	0.929	0.930	0.913	0.957
SSB_MSY	26004	25980	27245	24400
SSB_MSY/SSB_u	0.235	0.235	0.242	0.223
SPR_MSY	0.250	0.249	0.260	0.231
F_MSY	0.264	0.264	0.252	0.286
MSY	6821	6829	6833	6944
OFL_2010	3866	3845	3937	3774

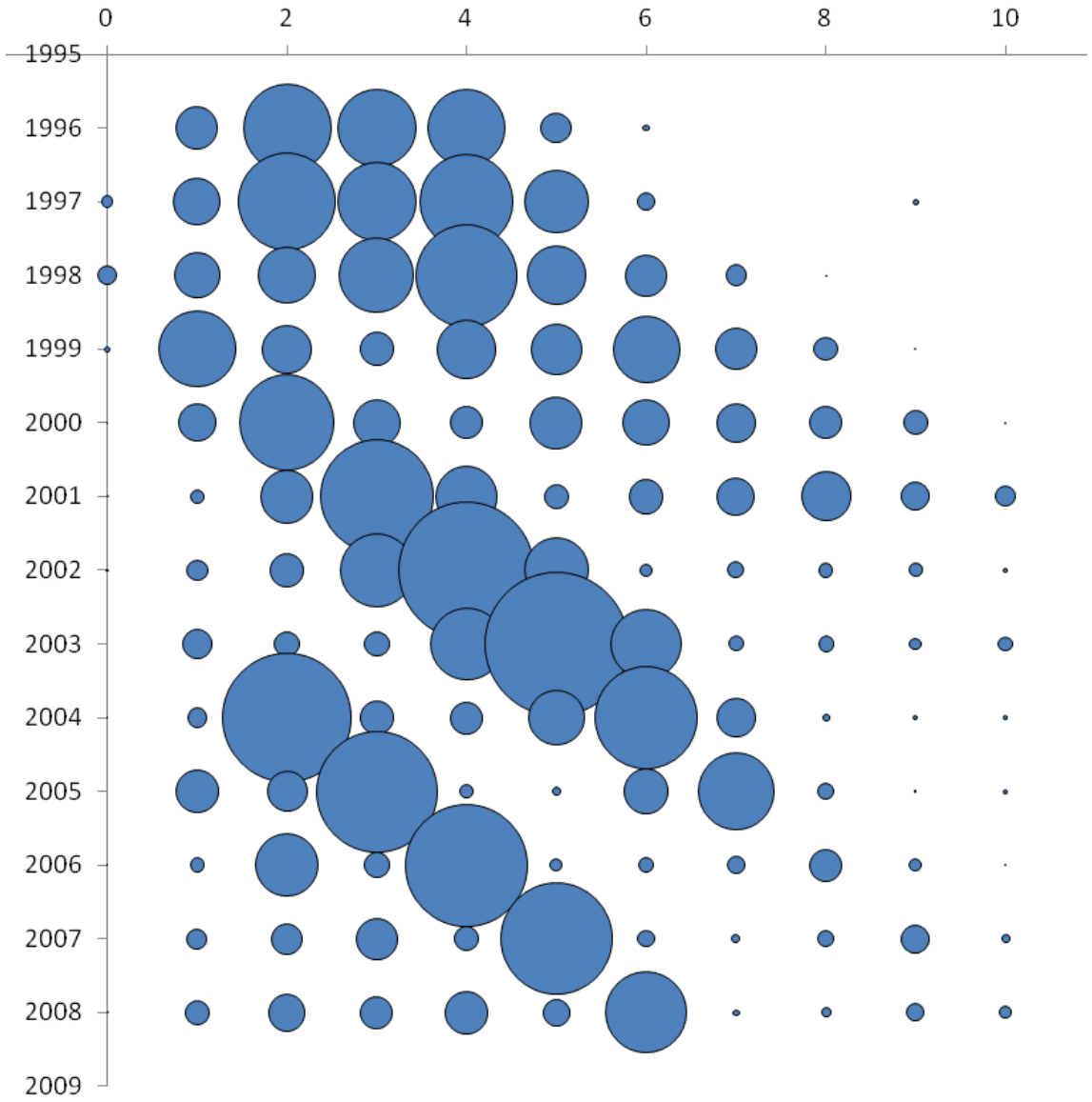
Speculation for Late alternative: the use of biased high catches needed higher recruitment near end of the time series to offset these catches and maintain good fit to the abundance index. The model achieves this higher recruitment by estimating a higher steepness. Because of this higher steepness, the stock is more resilient and the MSY is higher and the B_{msy} is lower.

Slides from R. Methot, NOAA

Age/Size Structure Data

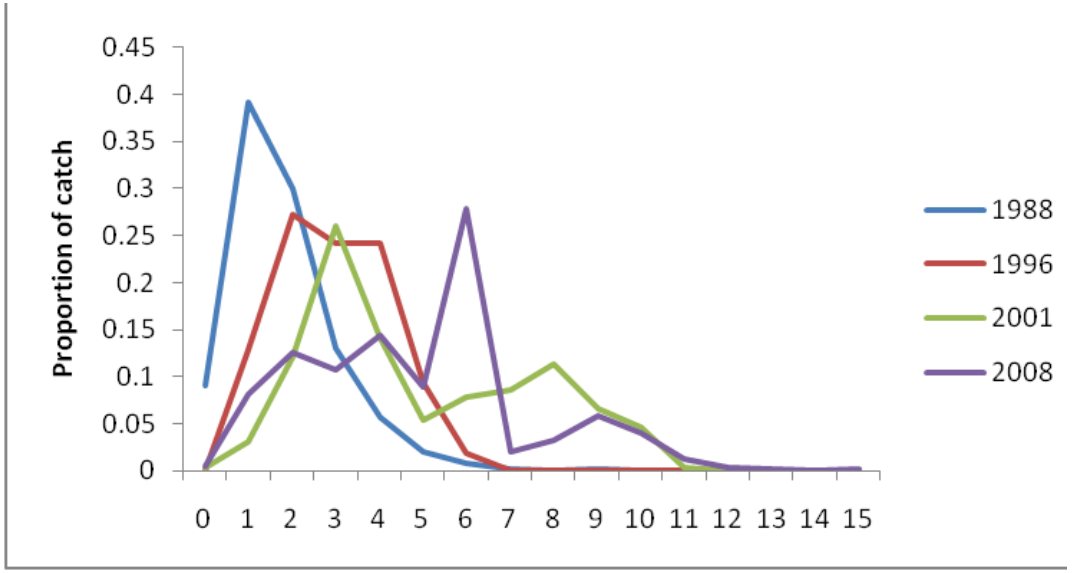
- Catch-at-age models (VPAs, statistical catch-at-age, Stock Synthesis) and catch-at-length models can incorporate information on the age or size structure of the catch

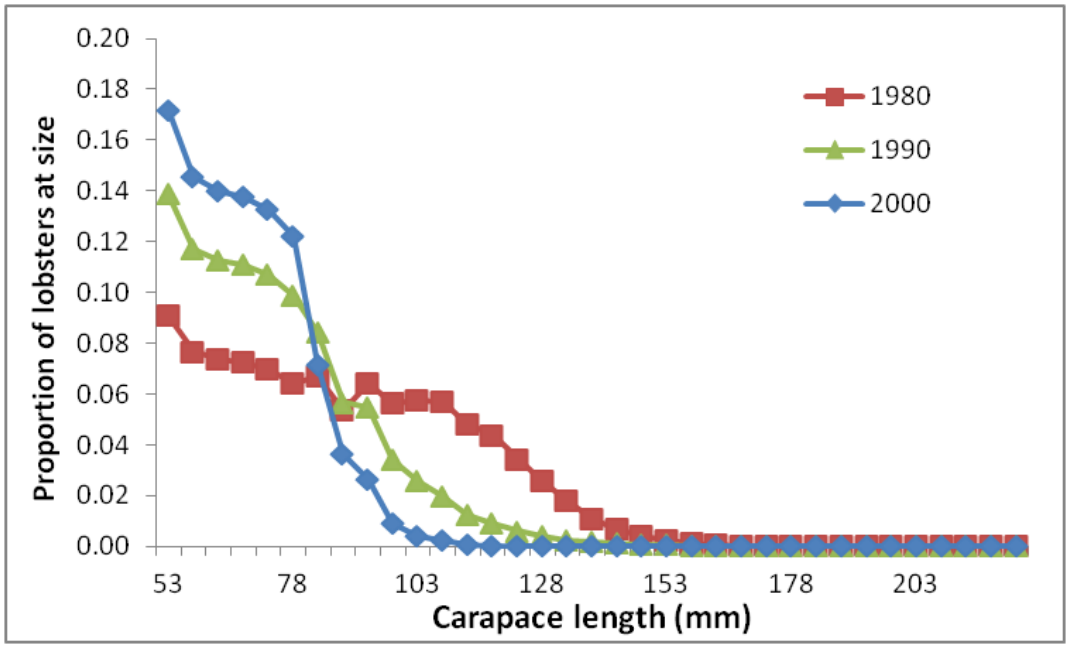
Catch-at-Age/Size Data



→ Track strong and weak year classes through the population

Catch-at-Age/Size Data





→ Observe expansions & contractions in age structure as a result of changes in fishing pressure

Important of CAA/CAS Data

- Fisheries often catch more of the largest/oldest fish than FI surveys
- CAA/CAS data helps us understand the impact of the fishery
  - A fishery that catches smaller, immature fish should have a lower quota than a fishery that catches fish after they spawn
- Conflicting or uninformative age/size structure data make models perform worse and give more unreliable outcomes

MRIP Input

- From the MRIP program, we get:
  - Recreational total catch
  - Recreational harvest length frequency & limited recreational release LFs (only from headboats)
    - Length frequency information is converted to age structure with age-length keys developed from other sampling sources
  - PSEs, which can be used to weight the importance of recreational catch in the model

→ All potentially affected by changes in the APAIS methodology

MRIP Importance

- Depends on the species
- Some species have very low/almost no recreational landings
  - Atlantic herring, Atlantic menhaden
- Some species are almost entirely recreational
  - Tautog, wahoo, some snapper/grouper stocks

→ The larger the component of MRIP catch in the total catch, the larger the impact of changes to MRIP estimates will be

Conclusions

- Absolute level of catch is important assessment input
  - Affects estimates of total biomass/abundance, reference points, and estimates of allowable catch

- Some models can deal with imprecise catch; biased catch is a more significant problem

Conclusions

- The timing of the bias affects the model results; even bias at the very beginning of a time series can impact the outcome

- Splitting the time-series (unbiased up to year X, biased afterwards) is not ideal

Conclusion

- Rick Methot feels a catch scalar similar to a survey q is feasible to implement
- Requires good quality data in non-catch inputs
- Puts the responsibility on the analysts for every assessment to develop a calibration factor for their species
  - Extra work
  - Inconsistency between assessments/species

Questions?