



W O R L D C O N F E R E N C E O N  
S T O C K A S S E S S M E N T M E T H O D S



**Steve Cadrin**  
SMAST and co-chair of WCSAM  
and Jon Deroba  
NEFSC and POPSIM lead analyst



# Georges Yellowtail as a Case Study

- Background on Strategic Initiative for Stock Assessment Methods
- Results for Georges Bank yellowtail flounder (*with thanks to Chris Legault*)
  - Application of multiple models to 2012 TRAC data
  - Application of multiple models to simulated data based on alternative possible realities
- Workshop Conclusions
- Discussion

# Strategic Initiative for Stock Assessment Methods

- The initiative is designed to assure that scientists can apply the best methods when developing management advice.
- Regional Fishery Management Organizations and national fishery organizations have a similar goal, so success will have benefits for the entire international fishery science community.



# Simulation Workshop

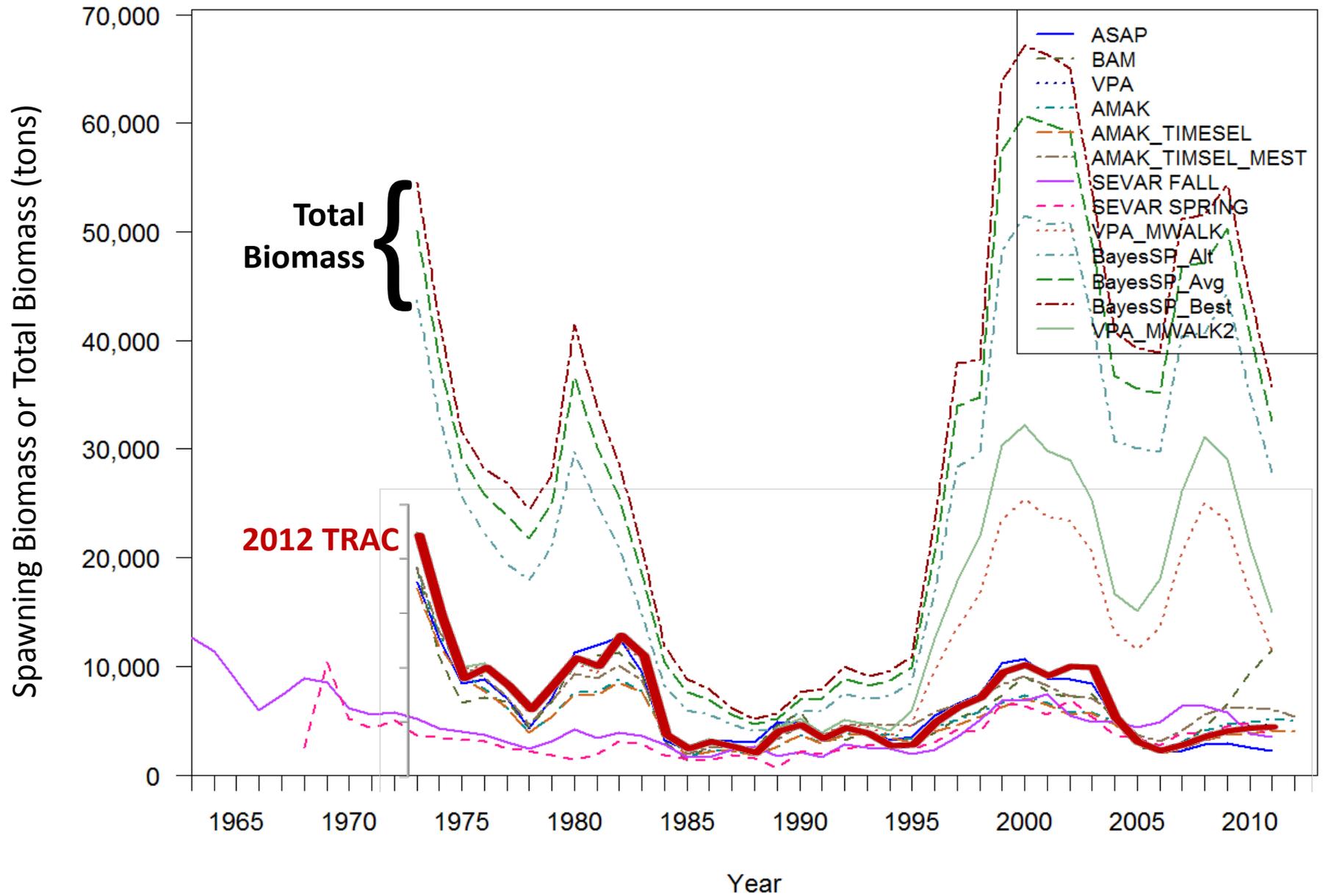
- Simulations were designed to form guidance in the selection of the most appropriate stock assessment methods for a particular application.
- Twelve case studies that characterize a wide range of life-history strategies, data quality, population dynamics, and assessment problems were used as the basis for analyses.
  - Multiple stock assessment models were applied to the data.
  - Results were used as virtual realities to evaluate the performance of methods for recovering the known stock size and fishing mortality.

# The George Yellowtail Case Study

- Fishery and survey data from the 2012 TRAC assessment were available to international model experts.
- Thirteen different estimation models were applied to the 2012 TRAC data:
  - Time Series Model
    - SEVAR with the fall survey
    - SEVAR with the spring survey
  - Surplus Production Model (3 alternatives)
  - Virtual Population Analysis
    - **VPA (split survey series model)**
    - VPA with 2 versions of time-varying natural mortality
  - Statistical Catch at Age
    - ASAP with time-varying survey catchability, BAM, AMAK, AMAK with time-varying selectivity, AMAK with time-varying selectivity and estimated natural mortality



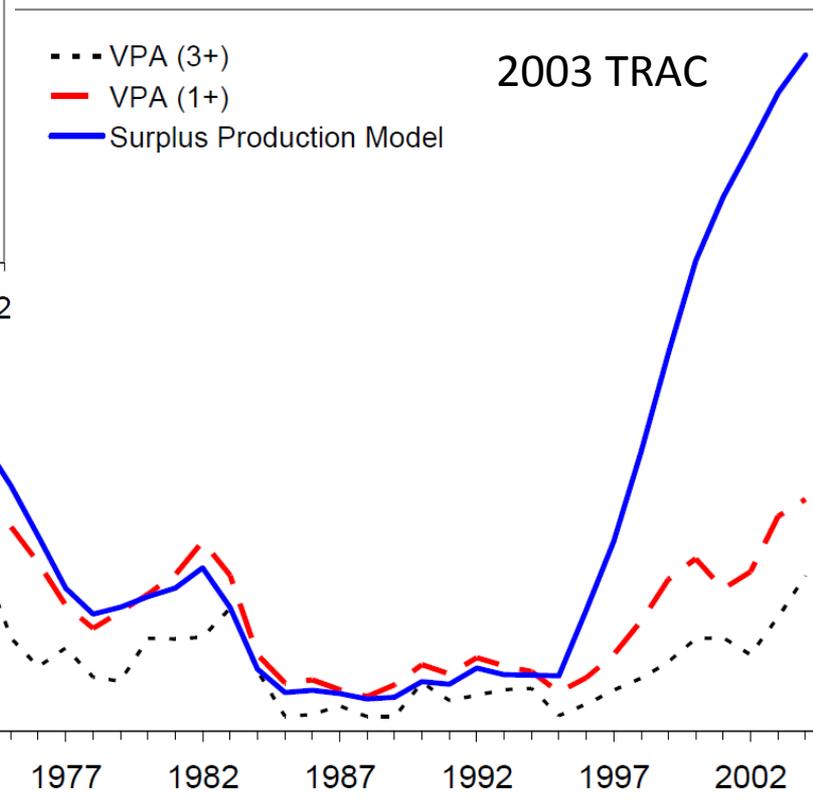
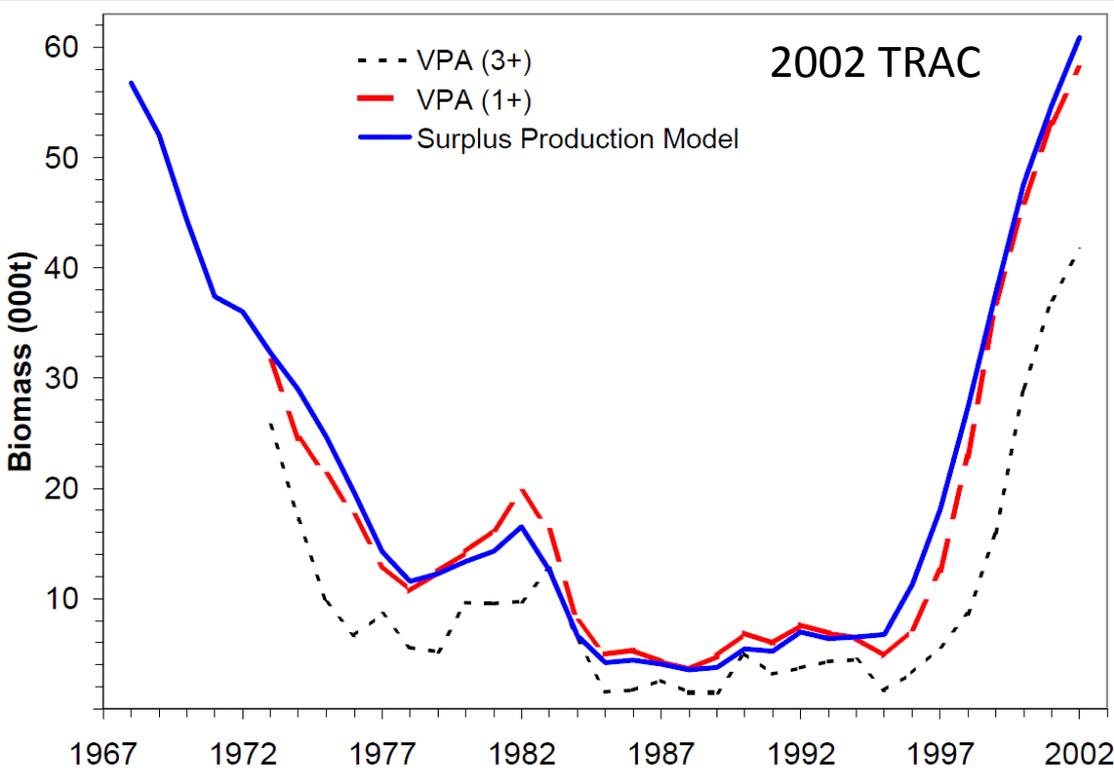
# GBYT FLOUNDER Fit to real data



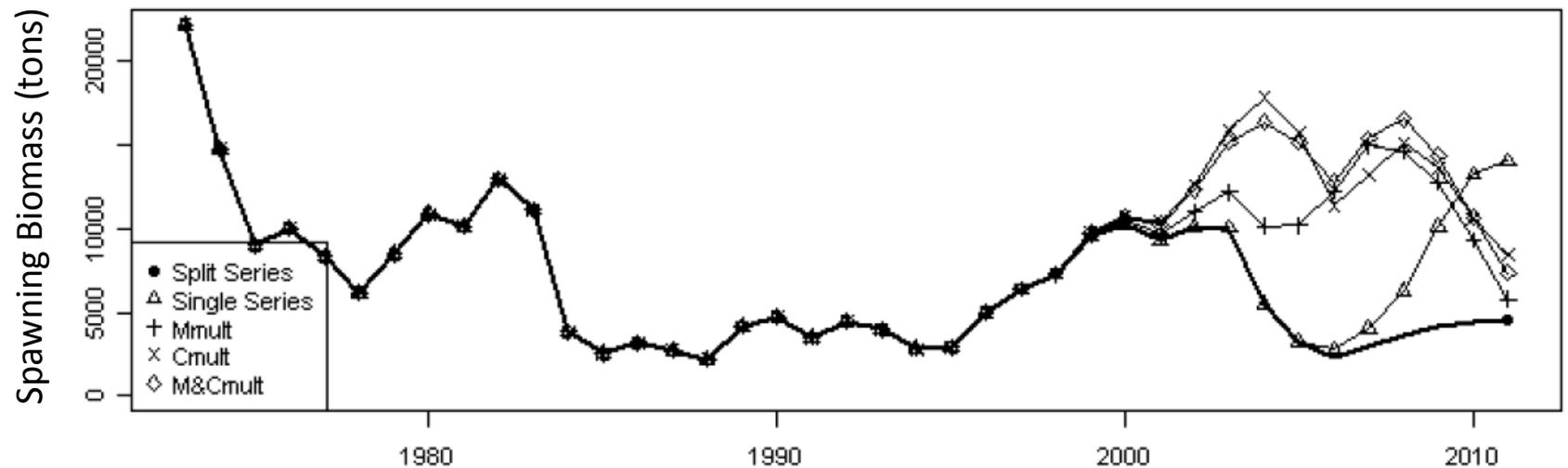
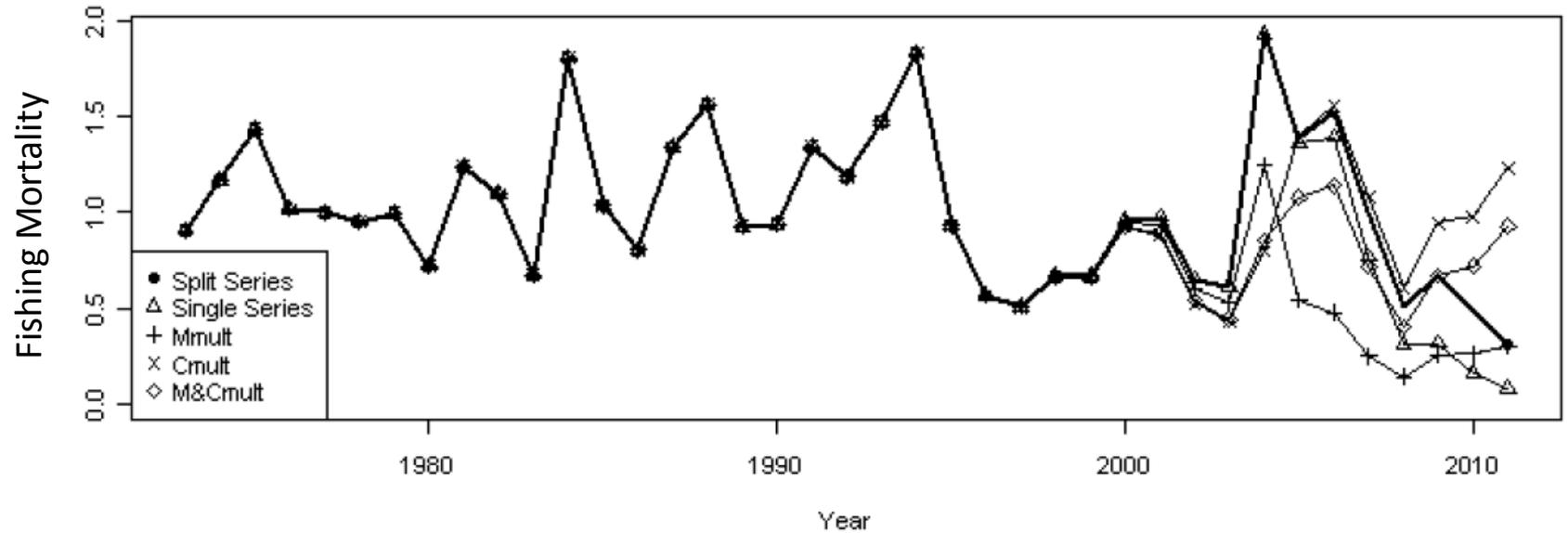




# Previous Experience with Model Divergence



# Alternative VPAs from 2012 TRAC

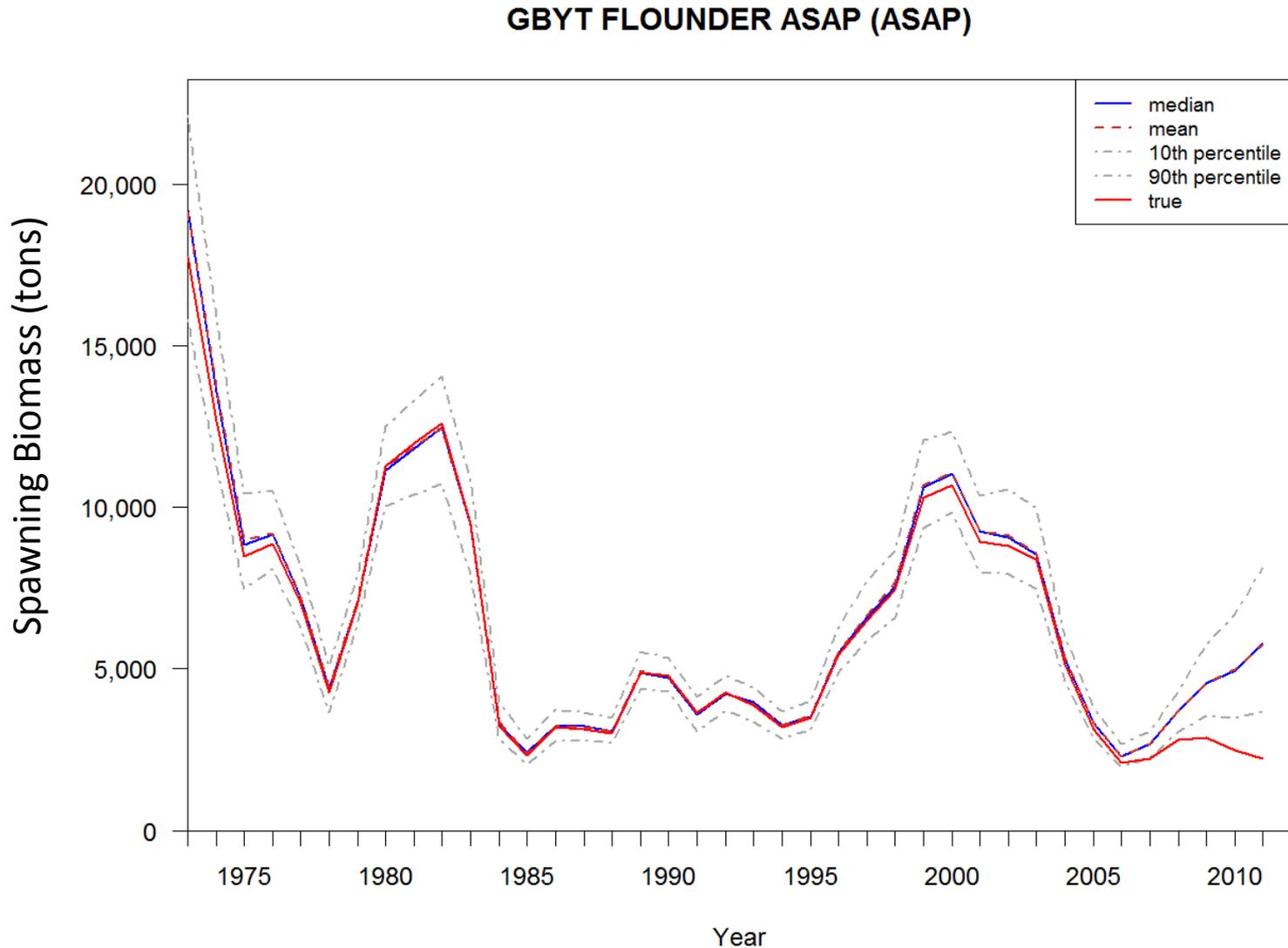


# Simulations

- Results from estimation models were used as ten possible realities for the Georges yellowtail stock and fishery.
- Typical fishery and survey data (with noise) were simulated from the ten virtual realities.
- Six different estimation models were applied to the simulated data to evaluate how well the results from estimation models reflected the virtual ‘truth’.
  - Time Series Model
    - SEVAR with the fall survey
    - SEVAR with the spring survey
  - Virtual Population Analysis
    - VPA with time-varying catchability
    - VPA with 2 versions of time-varying natural mortality
  - Statistical Catch at Age
    - ASAP with time-varying survey catchability

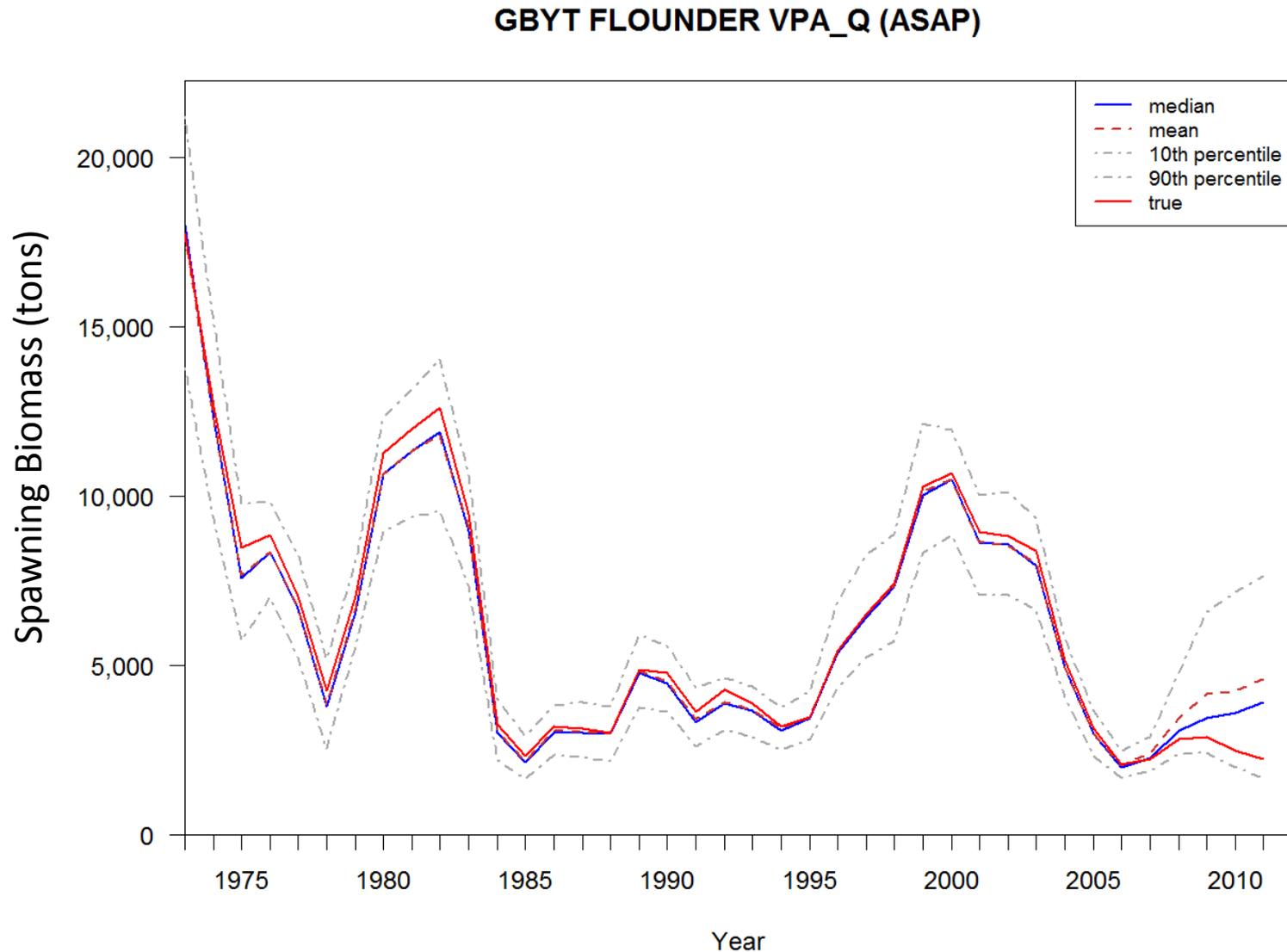
# 'Self-Test' Example

(same model used for 'reality' and estimation)



# 'Cross Test' Example

(different model used for 'reality' and estimation)



# Summary of Results

- Different models applied to Georges yellowtail (2012 TRAC data) produce widely different estimates of stock size and fishing mortality.
- Applying multiple models...:
  - helps to evaluate uncertainty in stock assessments,
  - but we don't know which is more accurate, and it
  - complicates management advice.
  - We should investigate the reason for differences.
- Simulation evaluations
  - Accuracy of models applied to simulated data varied.
    - *“Overall, none of the models performed well.”* (Groundfish PDT 2013)
  - Models that allowed time-varying survey catchability or natural mortality generally performed poorly against themselves and other such models.
  - Further simulations are needed to address specific questions.

# Discussion

- The simulation workshop had global objectives and was not intended to determine the best stock assessment method for Georges yellowtail.
- How can the differences between model results be considered for fishery management?

