Georges Bank Yellowtail Flounder Related Investigations

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Related Investigations

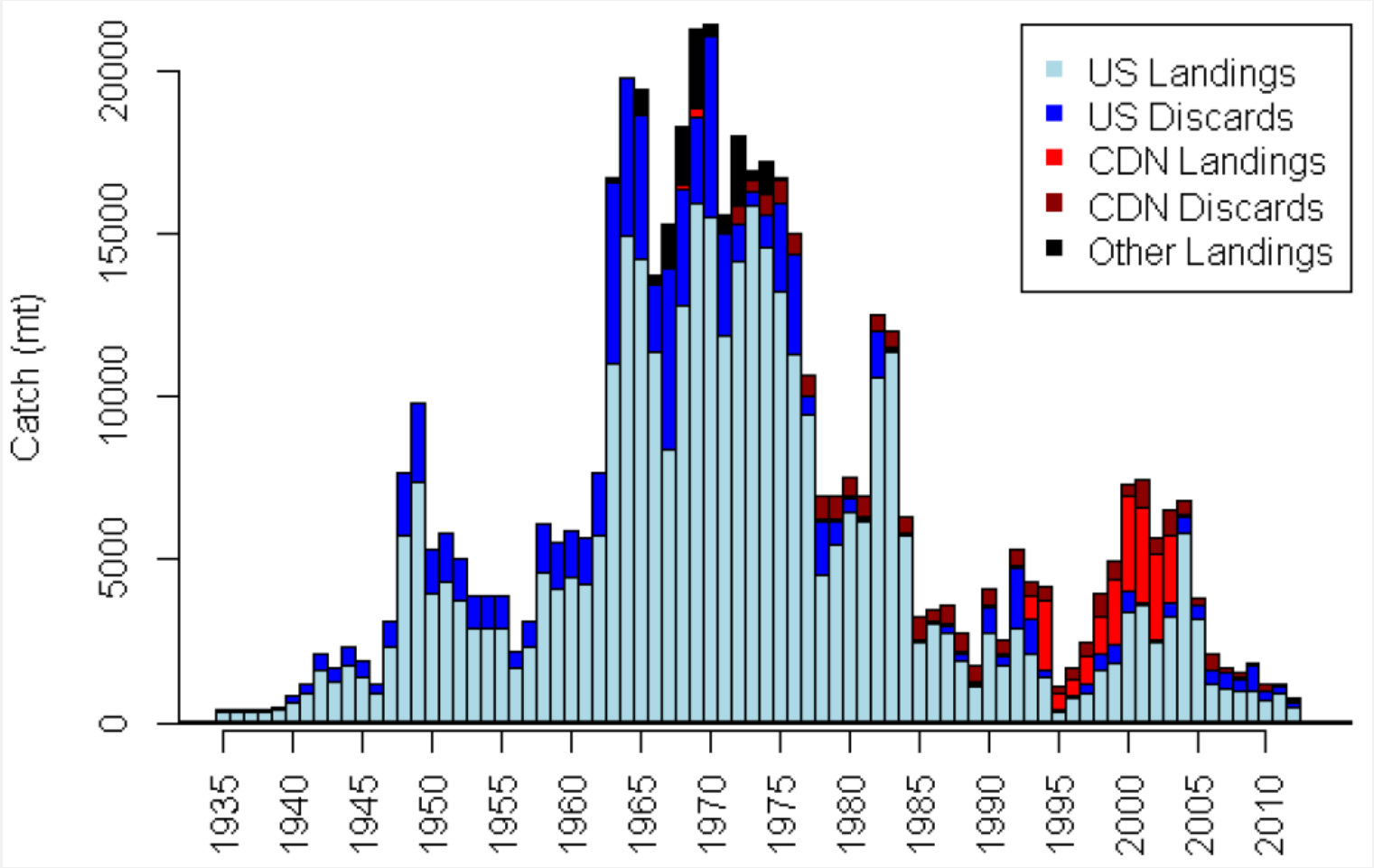
- Motivation – Severe uncertainties in the TRAC assessment suggest that independent estimates of abundance are needed.
- Independent estimates of stock size:
  - 2008 tagging experiment (Melgey 2010, TRAC 2010, TRAC 2013)
  - NEFSC dredge survey efficiency (Shank et al. 2013)
  - 2012 bycatch survey (TRAC 2013)
- Conclusions:
  - Information from the TRAC assessments and some independent estimates suggest that the models are underestimating stock size.
  - A new benchmark is needed to resolve the problems with the 2005 benchmark methods.

The 2013 TRAC Assessment

- "The Split Series VPA, which splits the survey indices between 1994 and 1995, was used for the stock assessment, **but a retrospective adjustment** (denoted rho adjustment) **was applied** to the terminal year estimates for both status determination and when providing catch advice."
  - "The TRAC acknowledges that **the assumptions made about population dynamics in the model do not fully capture the trends in the data**."
  - "Adult population biomass (age 3+) at the start of 2013 and spawning stock biomass in 2012 are both estimated to be the **lowest values in the time series when the rho adjustment is applied**."

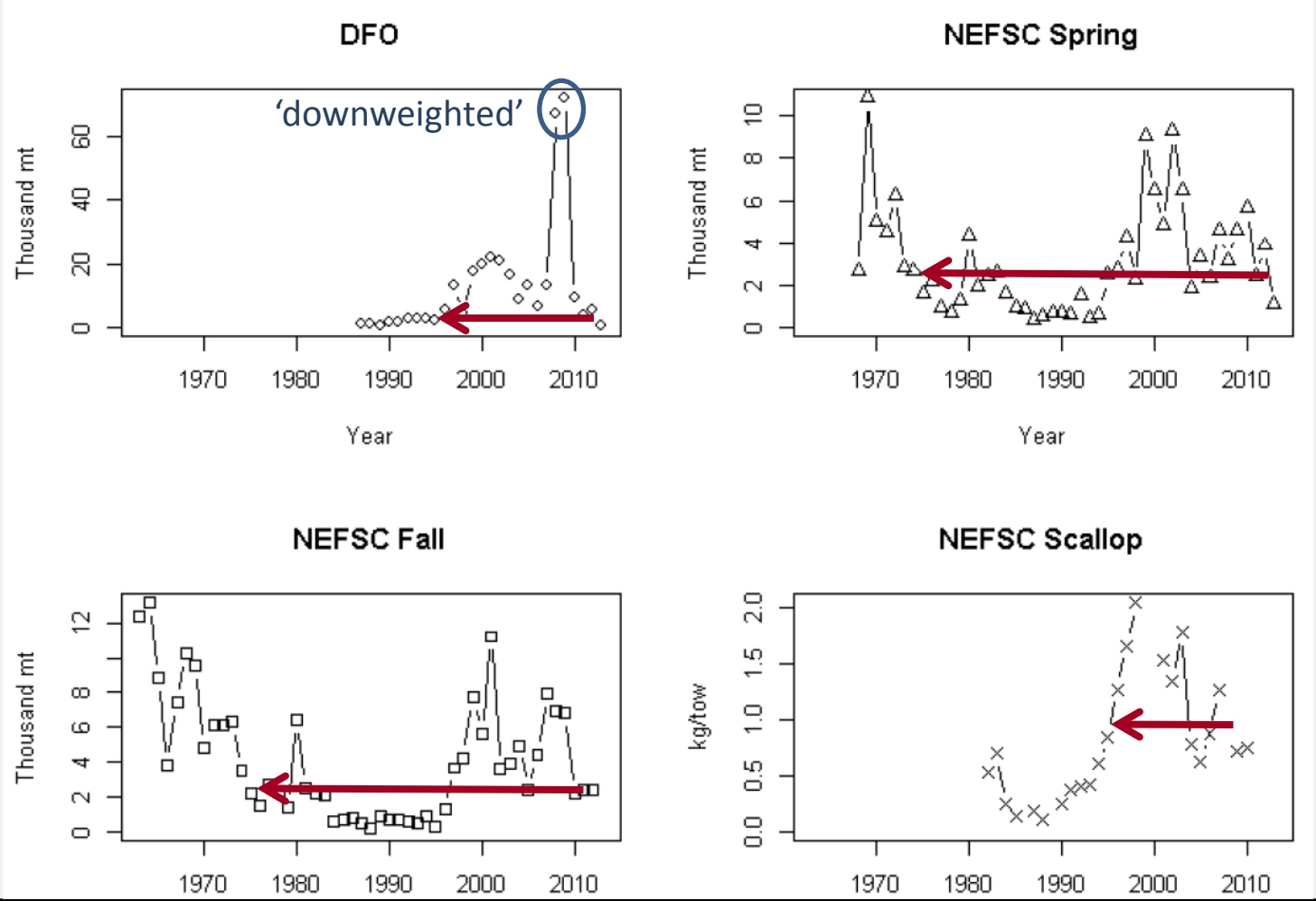
The Data: Fishery Catch

- Recent catch is as low as the late 1930s, when the fishery was first developing.



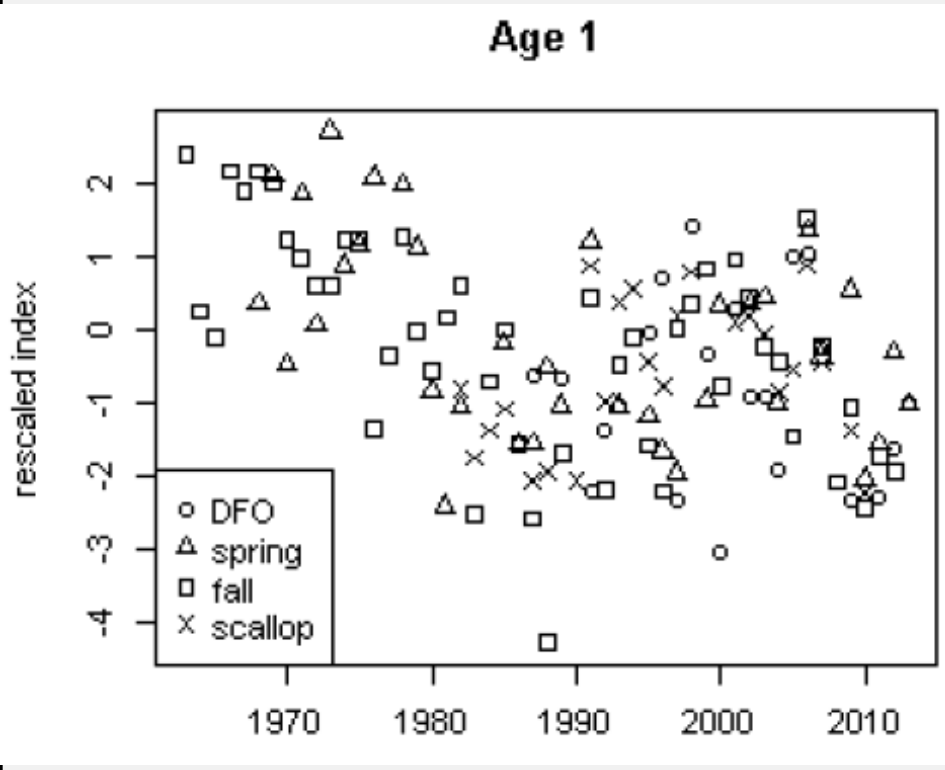
The Data: Survey Trends

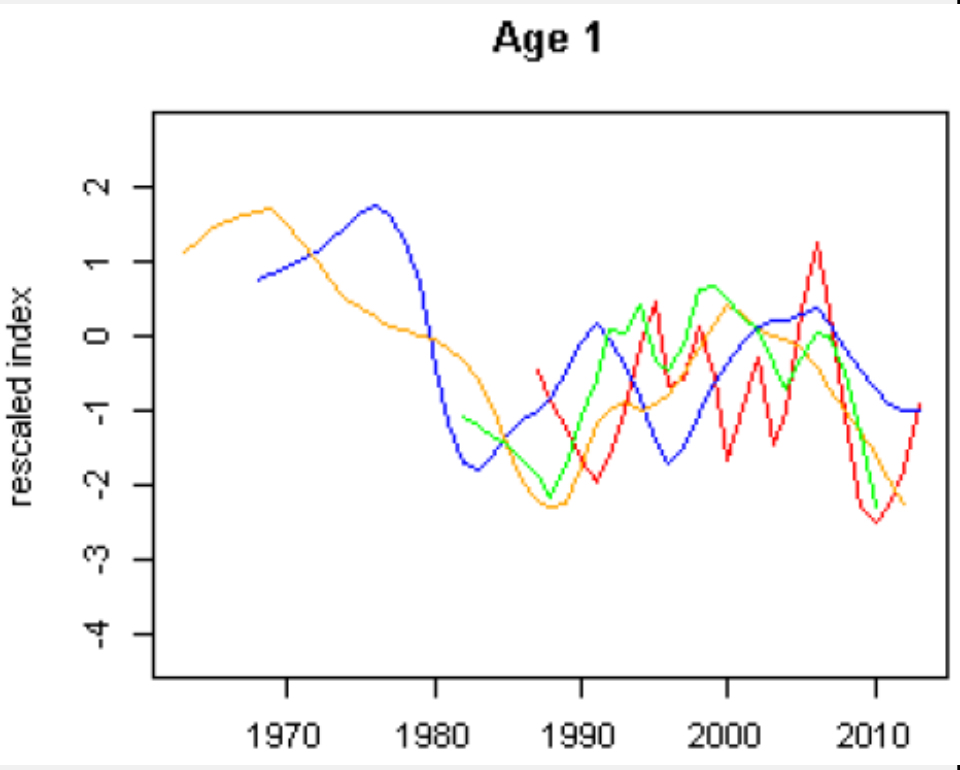
- Surveys have generally decreased over the last decade **to levels similar to the late 1990s and late 1970s-early 1980s**.

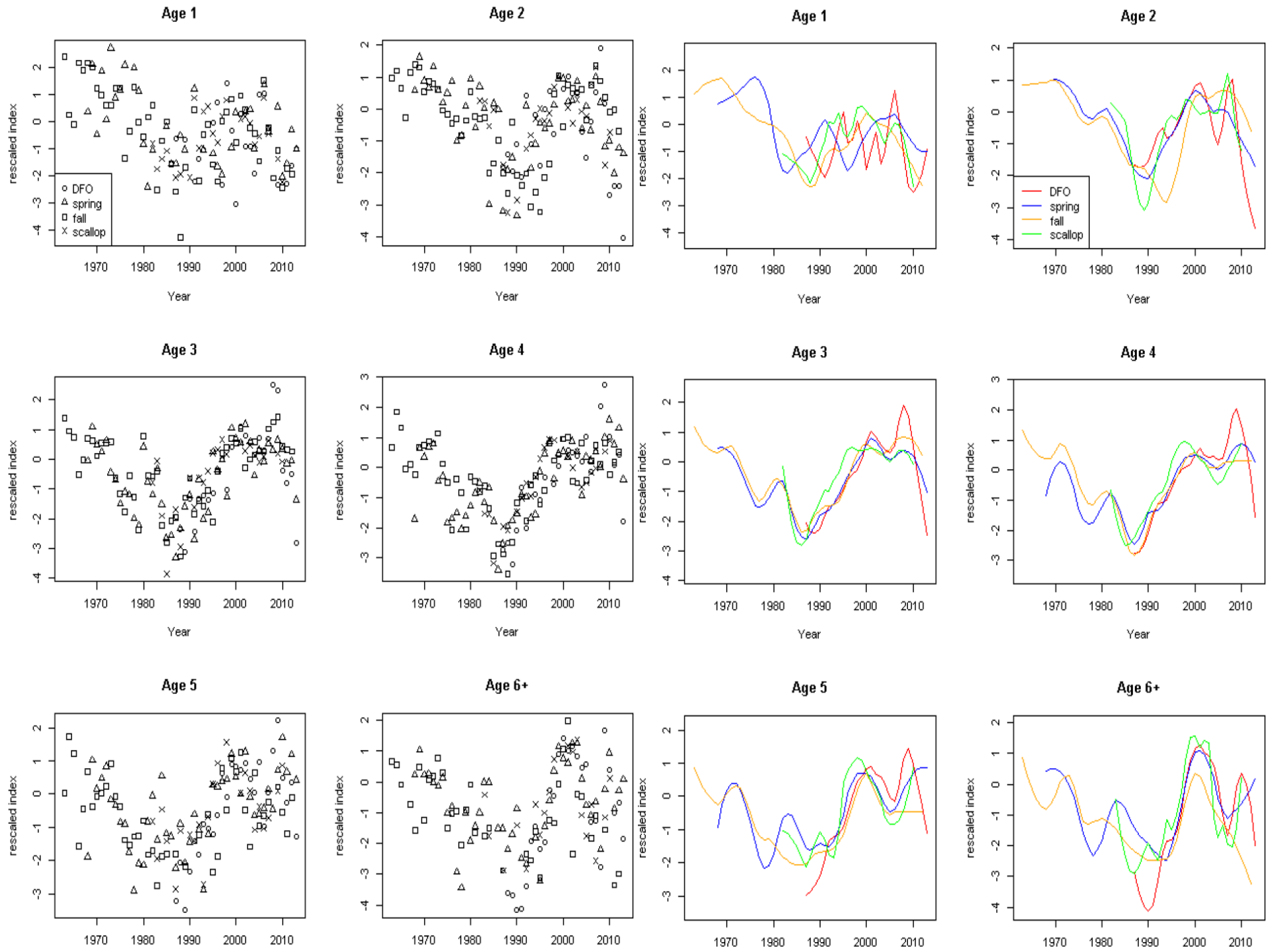


The Data: Survey Recruitment Indices

- Survey trends for young fish are noisy, suggesting relatively constant recruitment in the last 20 years, with some 3 of 4 decreasing in the last 3 years.

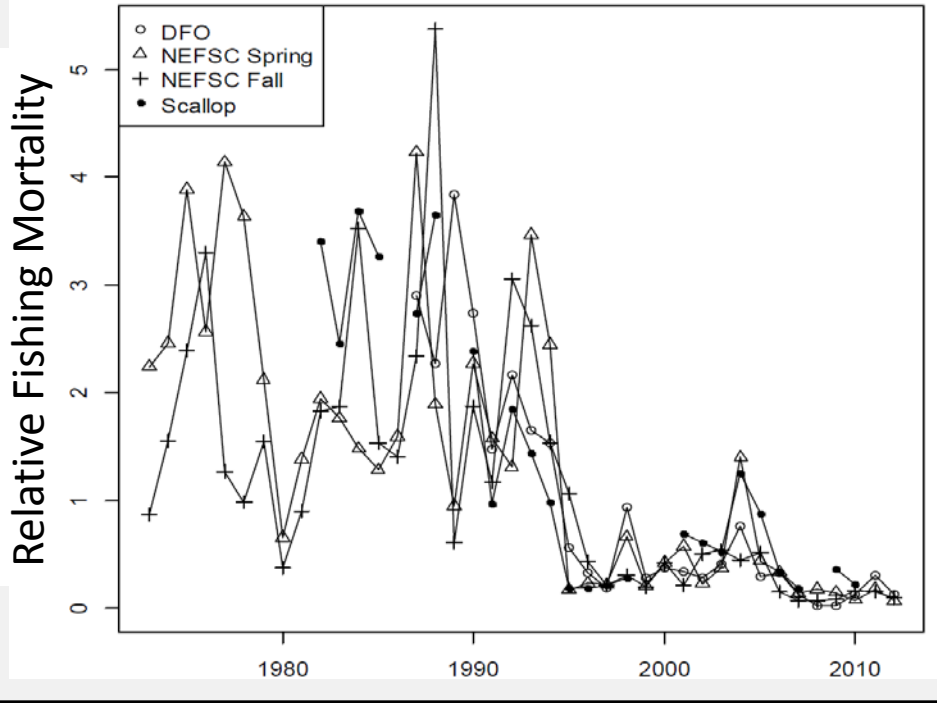


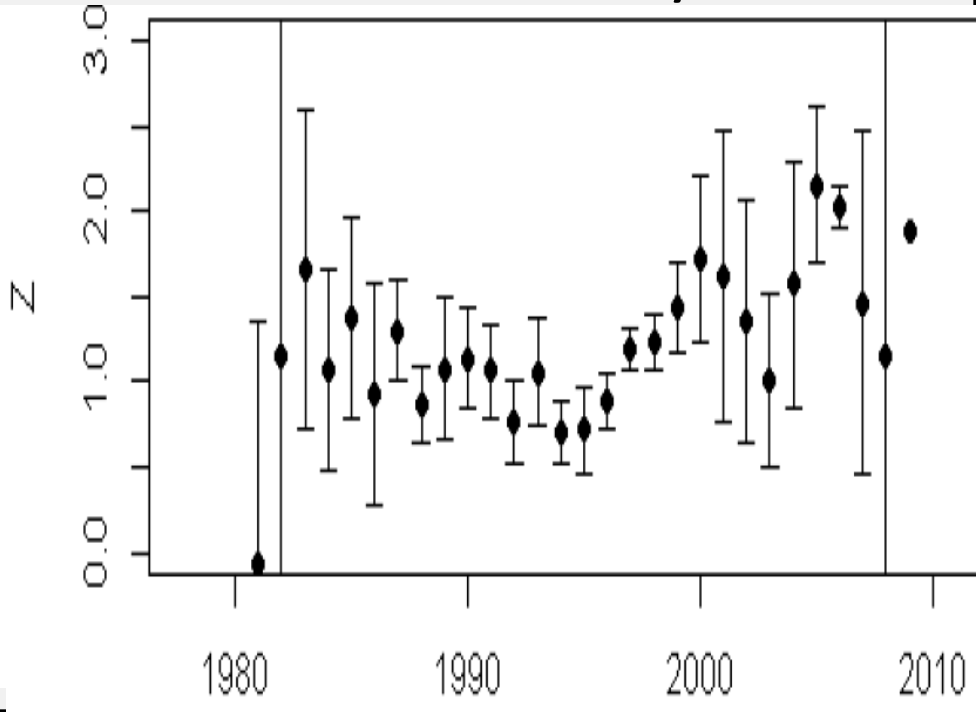



Age 1
Age 2
Age 1
Age 2
Age 3
Age 4
Age 3
Age 4
Age 5
Age 6+
Age 5
Age 6+
rescaled index
Year
DFO
spring
fall
scallop

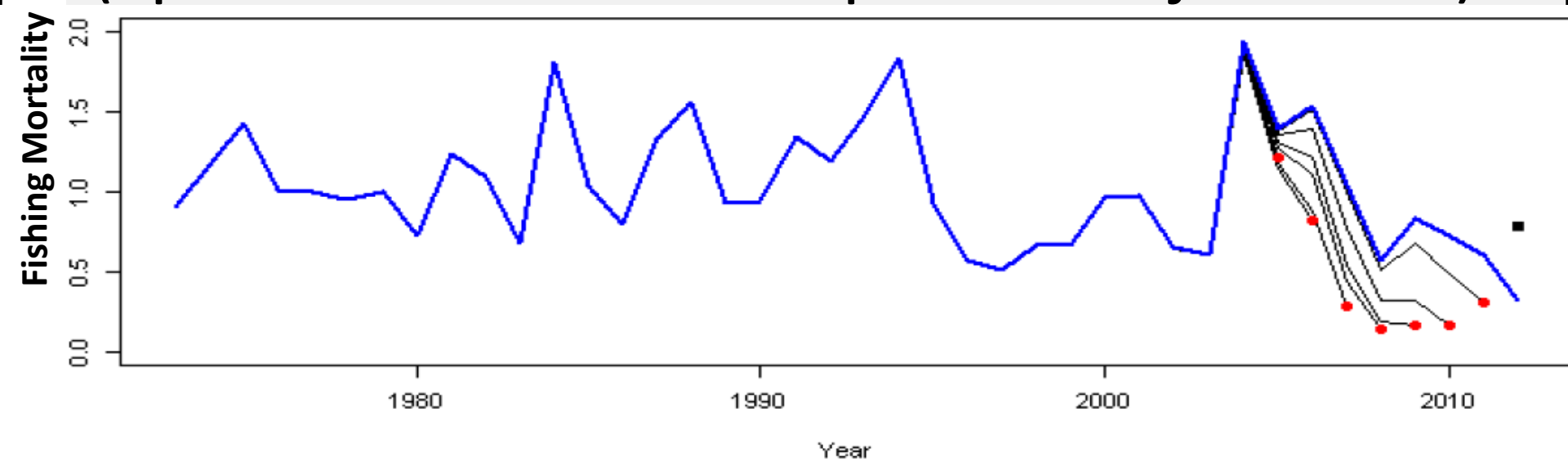
Simple Models

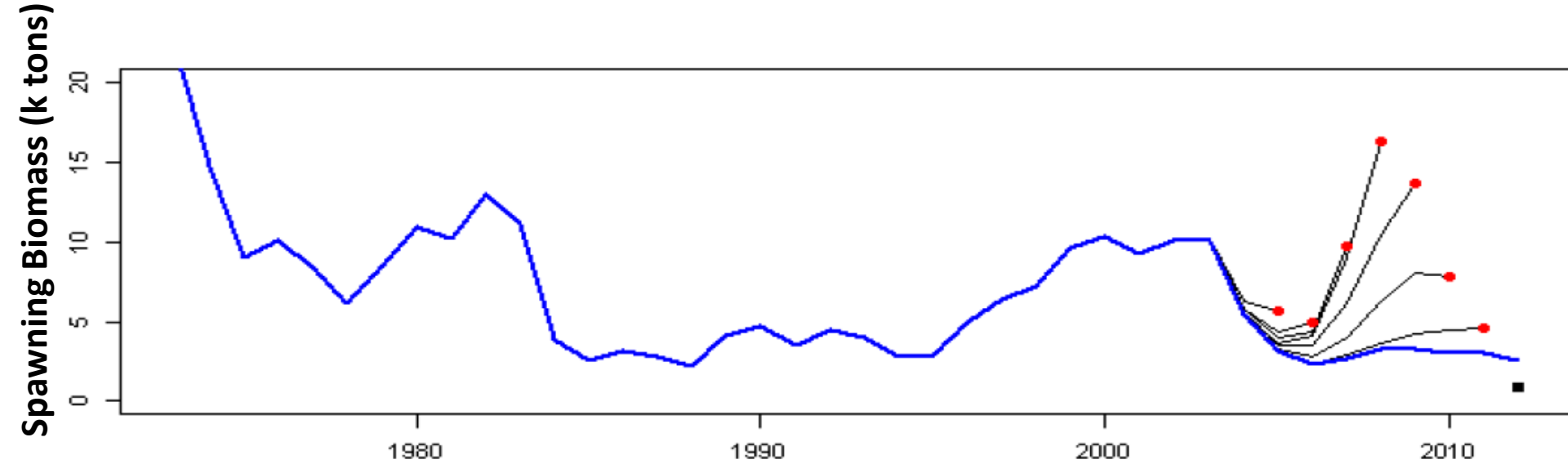
- The ratio of catch to survey biomass indicates that fishing mortality has been low since 1995, and extremely low since 2005. **Is overfishing occurring?**
- Total mortality estimated from the decrease in survey abundance at age have not decreased, but are too noisy to provide realistic estimates in some years.





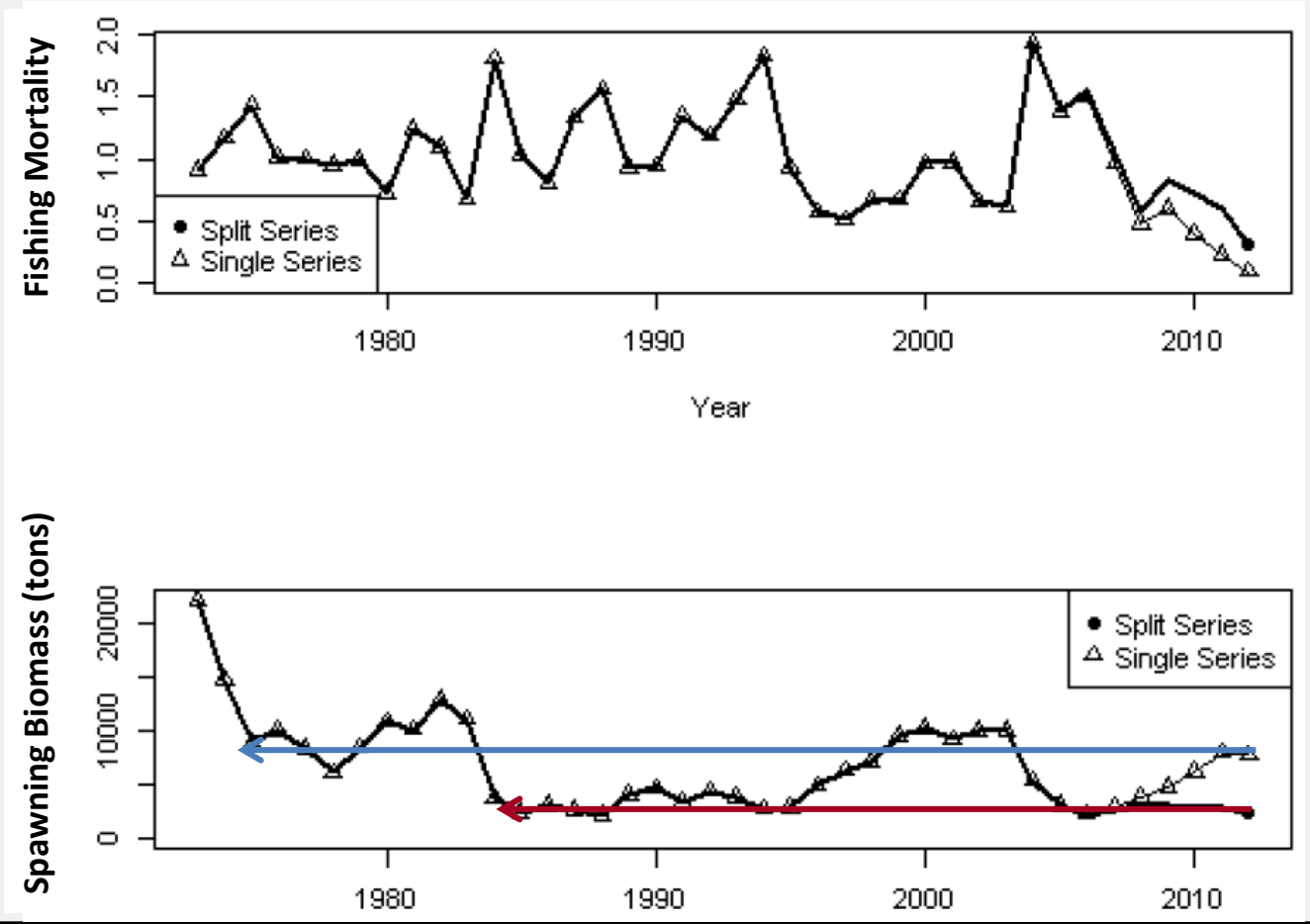
Complex Model
(Split Model with retrospective adjustment)





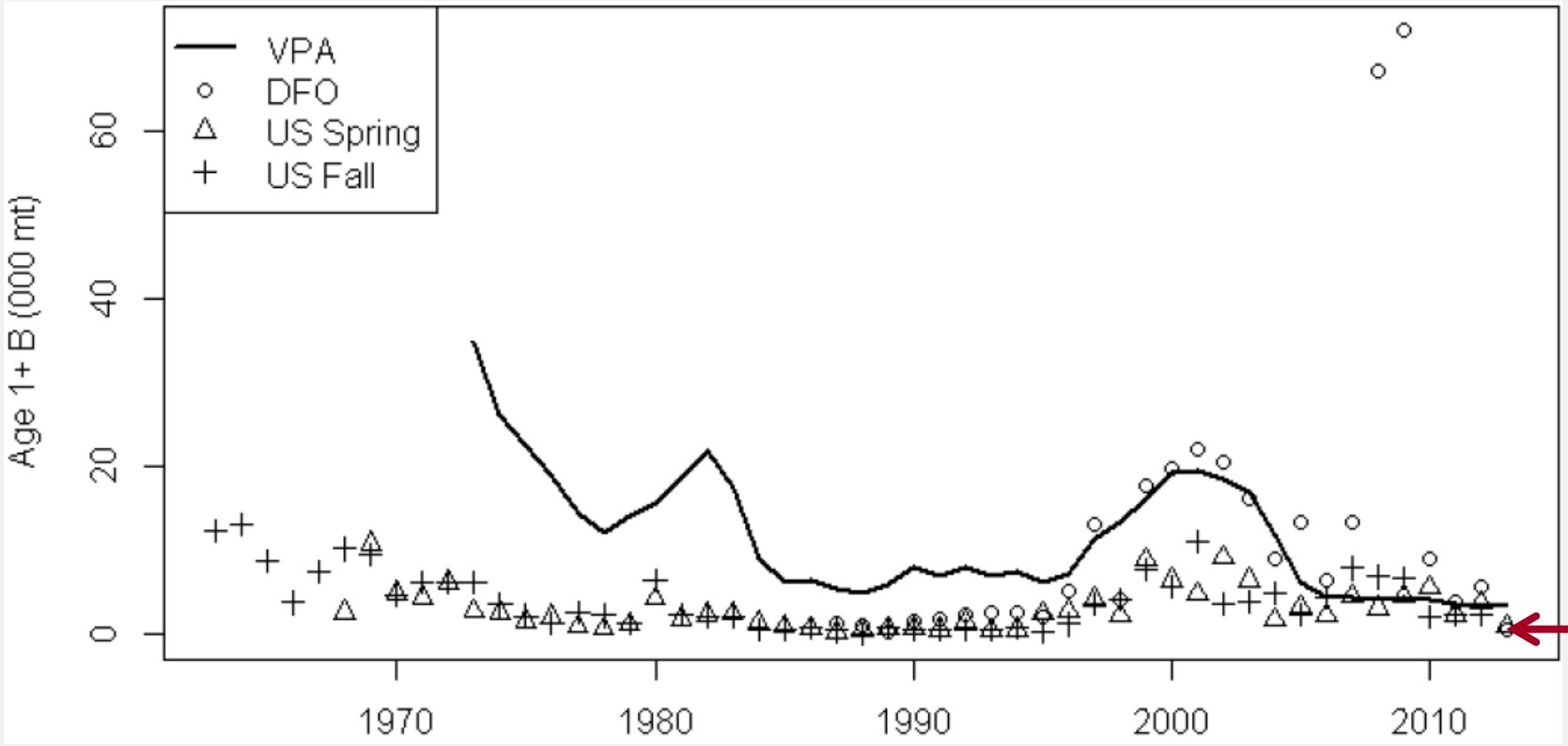
Model Divergence

- Treating surveys as a single series or artificially splitting them has large influence on the estimates of recent stock size.



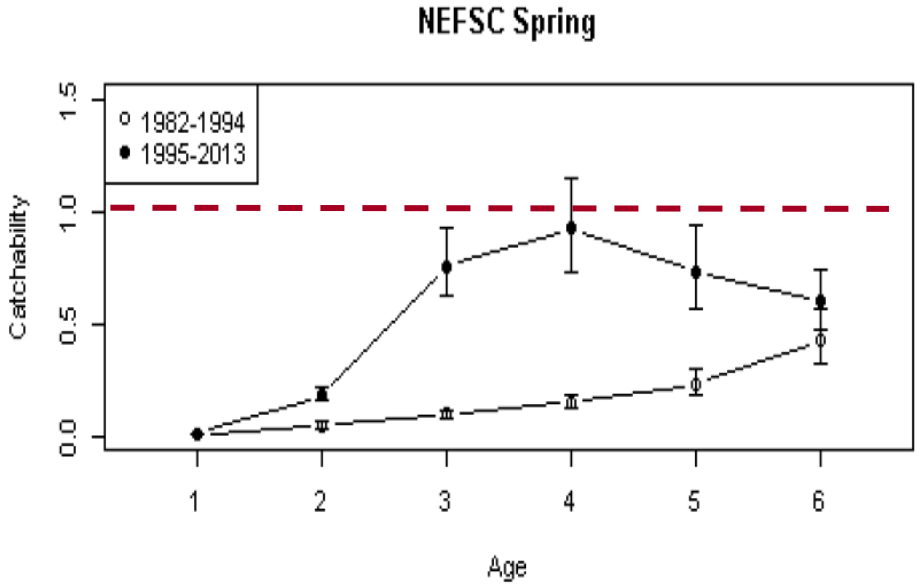
Models vs. Data

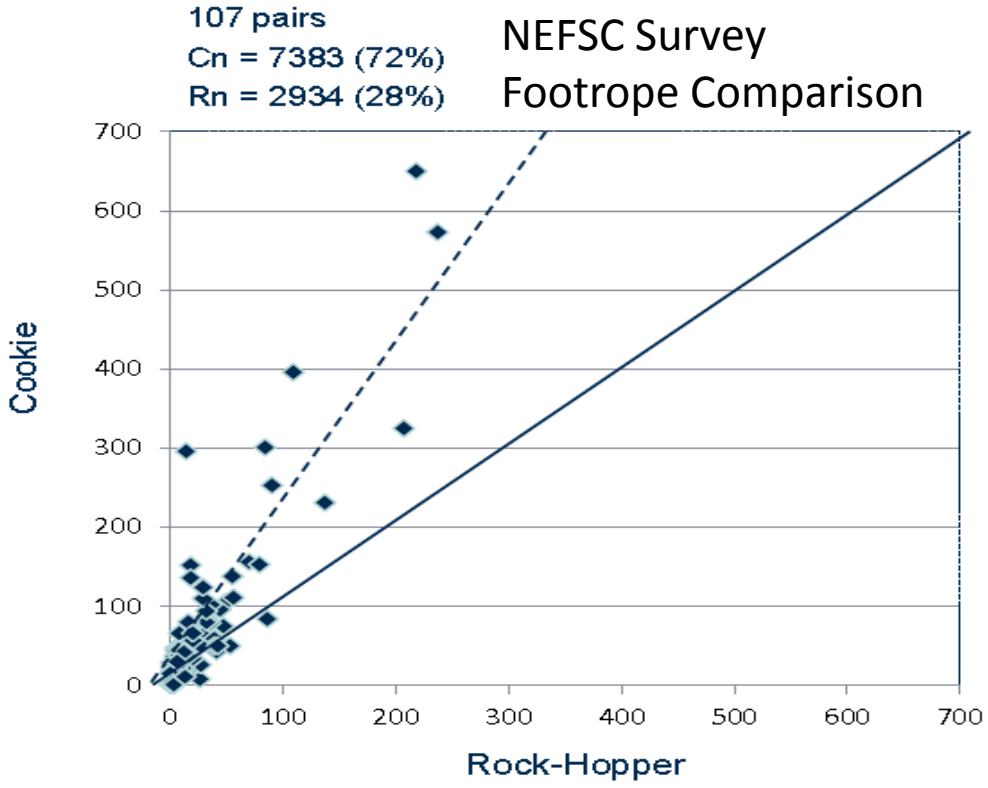
- As an initial ‘fix’ to the retrospective pattern, the ‘split model’ assumes that survey efficiency changed in the mid 1990s, so that the model no longer fits the long-term trends in the surveys.

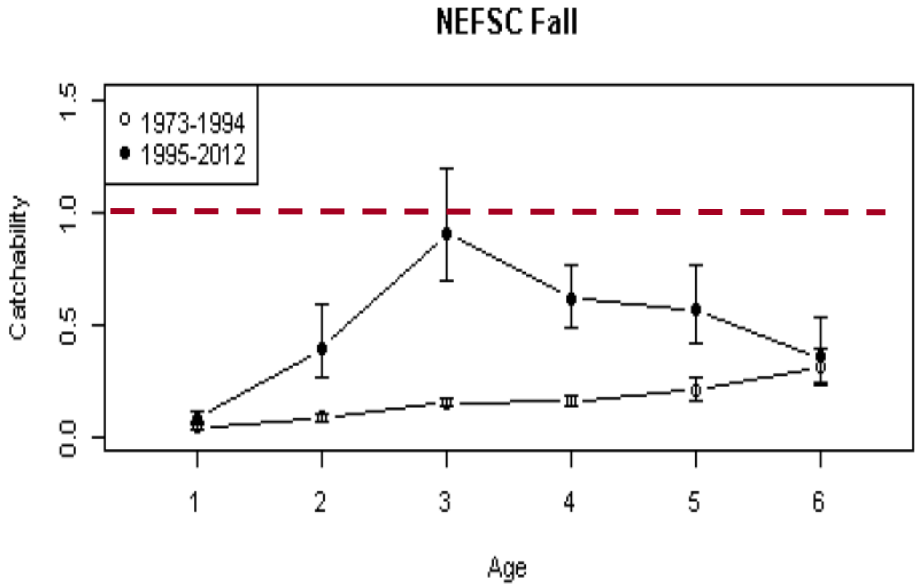


Inconceivable Results

- The assessment model estimates that since 1995, surveys have been >100% efficient.





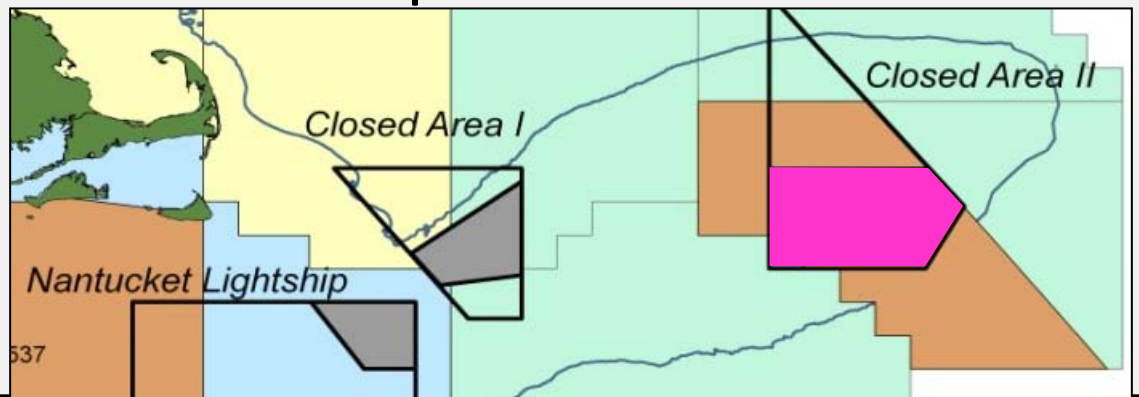


Problems with TRAC Assessment

- LARGE retrospective inconsistency (the split model estimate of 2008 spawning biomass decreased from 17,000 tons to 3,000 tons when the assessment was updated).
- The split-series model does not fit the data, and the retrospective adjustment moves the estimate even further from the data.
- Estimates of survey catchability are greater than 100%.
- The retrospective adjusted stock size is less than survey estimates of biomass.
- MFI concluded that independent estimates of stock size were needed to improve the basis of fishery management.

Tagging Estimate of Abundance

- In spring 2008, the Mass MFI collaborated with yellowtail fishermen and NEFSC to conduct a short-term tagging experiment to estimate abundance of yellowtail in the access area of Closed Area 2.
- The results were peer-reviewed as a graduate student's Master's thesis with two NEFSC scientists on the graduate committee (Melgey 2010).
- Results were also reviewed by the 2010 TRAC and the 2013 TRAC to address subsequent concerns.



A Simple Tagging Model

- Sample 1 - Tag and release a large number of fish randomly throughout the study area.
- Sample 2 - Representatively survey the study area to sample the ratio of tagged fish to untagged fish.

$$Abudance = \frac{number\ of\ fish\ in\ sample\ 2}{number\ of\ tagged\ fish\ in\ sample\ 2} \times number\ of\ fish\ tagged$$

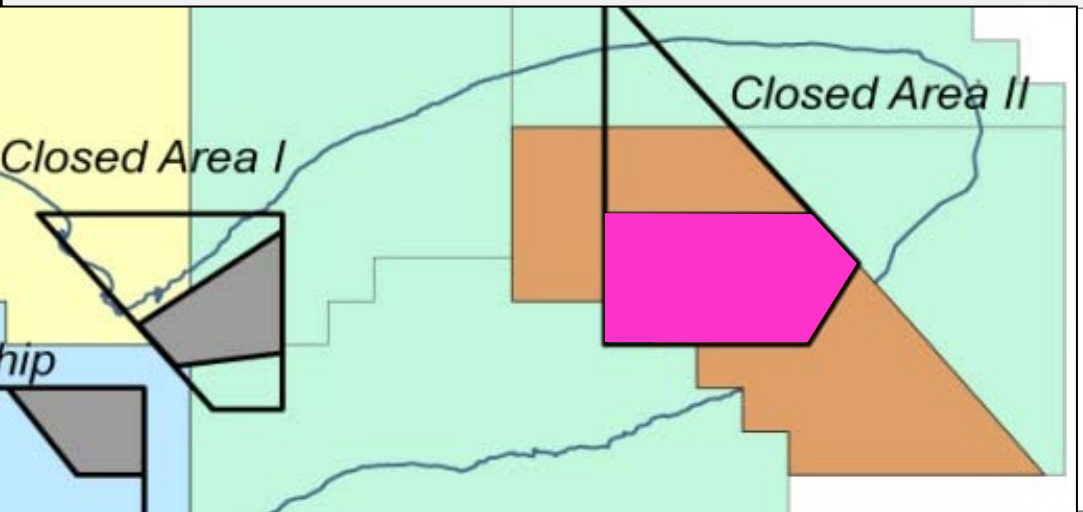
$$17.938\ million = \frac{43{,}588}{177} \times 72{,}938$$

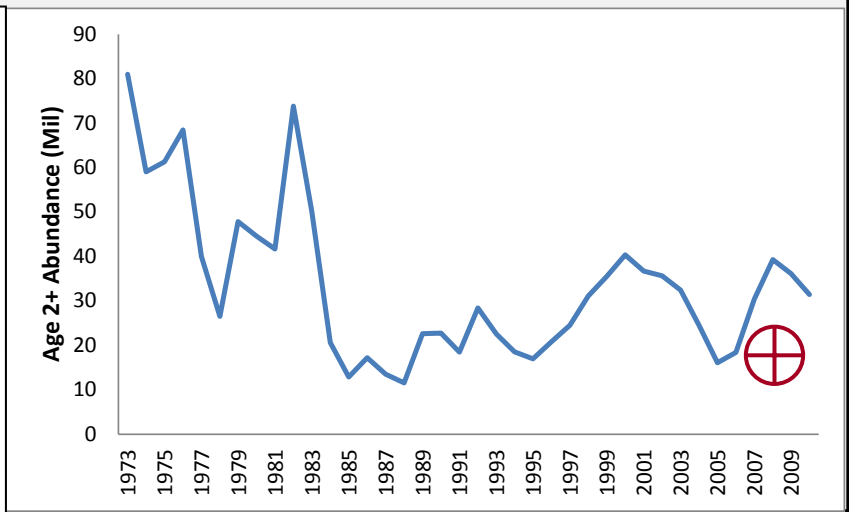
Adjusted Estimates

- *Adjusted Estimate for Recaptures* - The number of tagged fish that were recaptured in the first stage was 100, and the adjusted estimate of abundance was 17.937 million (15.313 to 20.703 million).
- *Adjusted Estimates for Recaptures and Immigration*
  - The estimate of immigration to the study area during the 10-day experiment was approximately 200,000 fish, which reduces the estimate of age-2+ in June 2008 to 17.737 million (15.439 to 20.823 million).
  - When an extreme estimate of emigration (325,000 fish) was assumed, the abundance estimate decreased to 17.612 million (15.313 to 20.703 million).

2010 TRAC

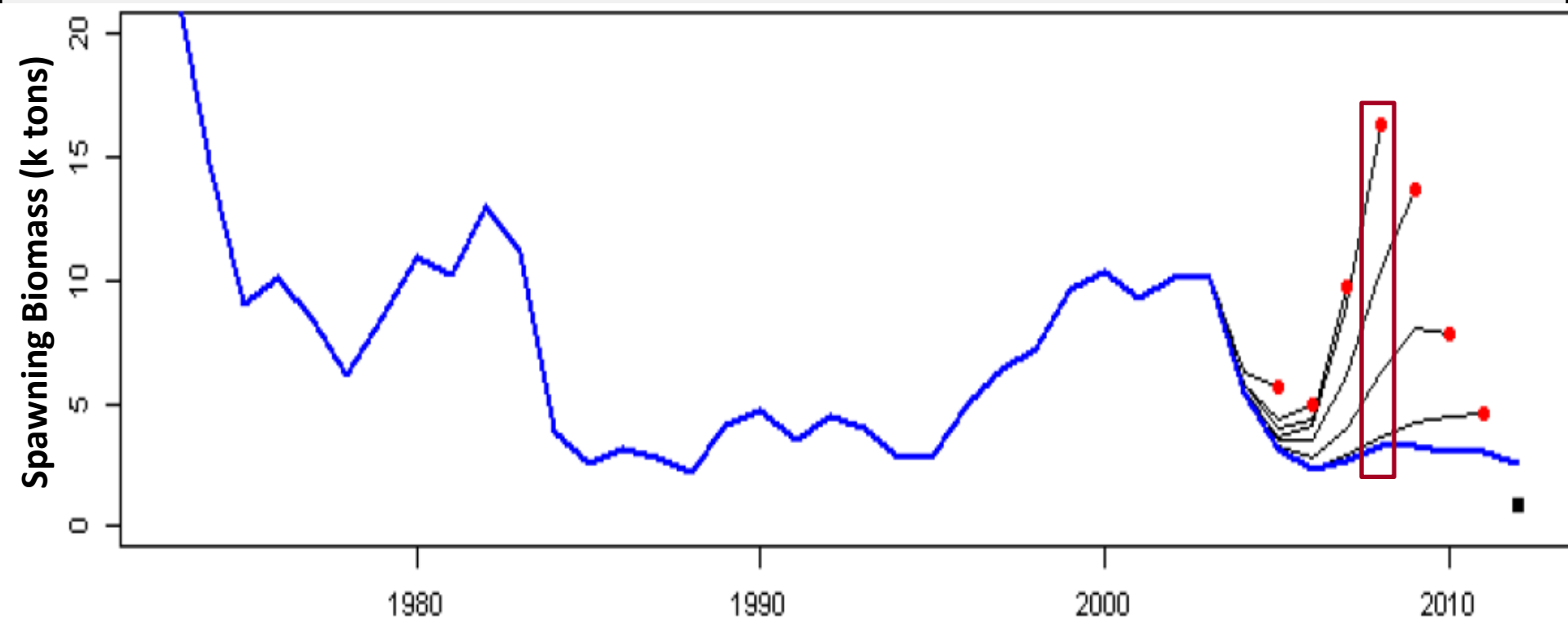
- The tagging estimate of abundance in 2008 was a large portion of the VPA estimate of abundance.
- The 2010 TRAC reviewed the results and concluded that the study could not be used to reliably estimate the abundance of yellowtail on all of Georges Bank, but that the Petersen estimate for the study area would be relevant as a point of comparison to the scale of the assessment estimates of total abundance.





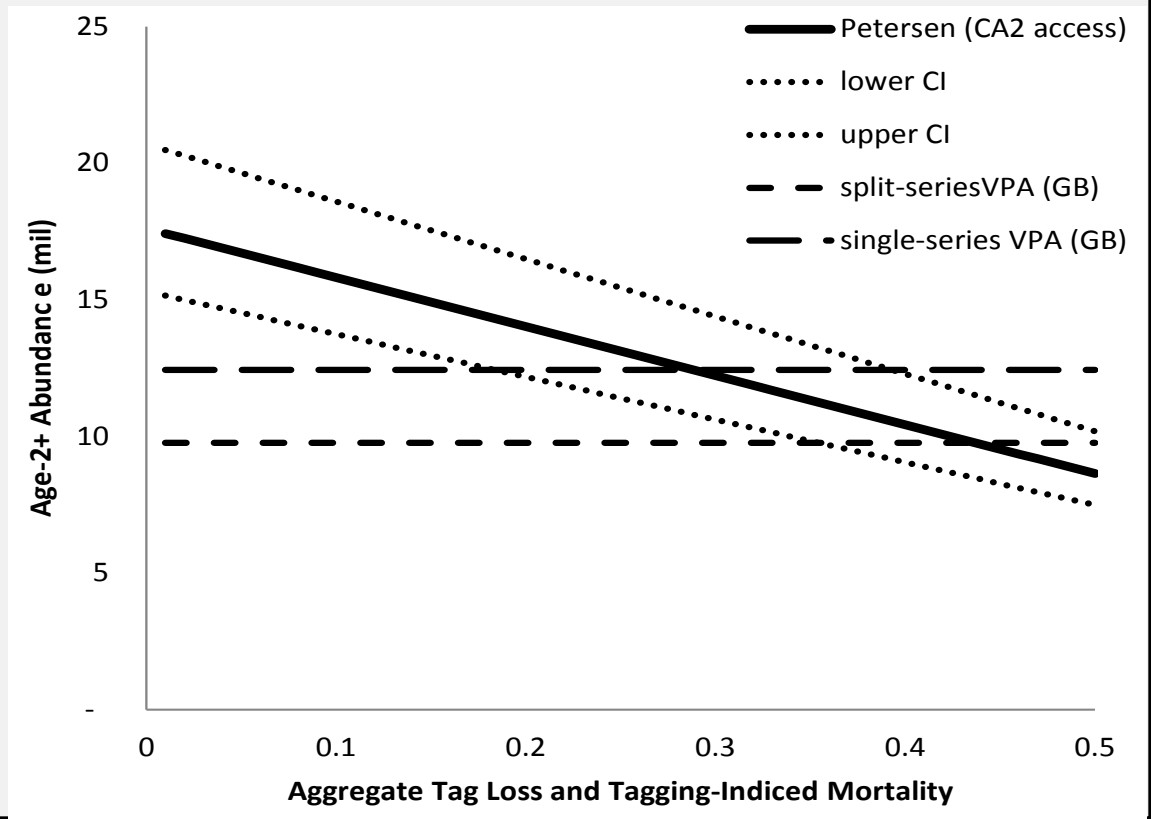
2013 TRAC

- The tagging estimate (~18 million) in the access area is now much greater than the 2013 TRAC estimate of abundance in 2008 on all of Georges Bank (~10 million).



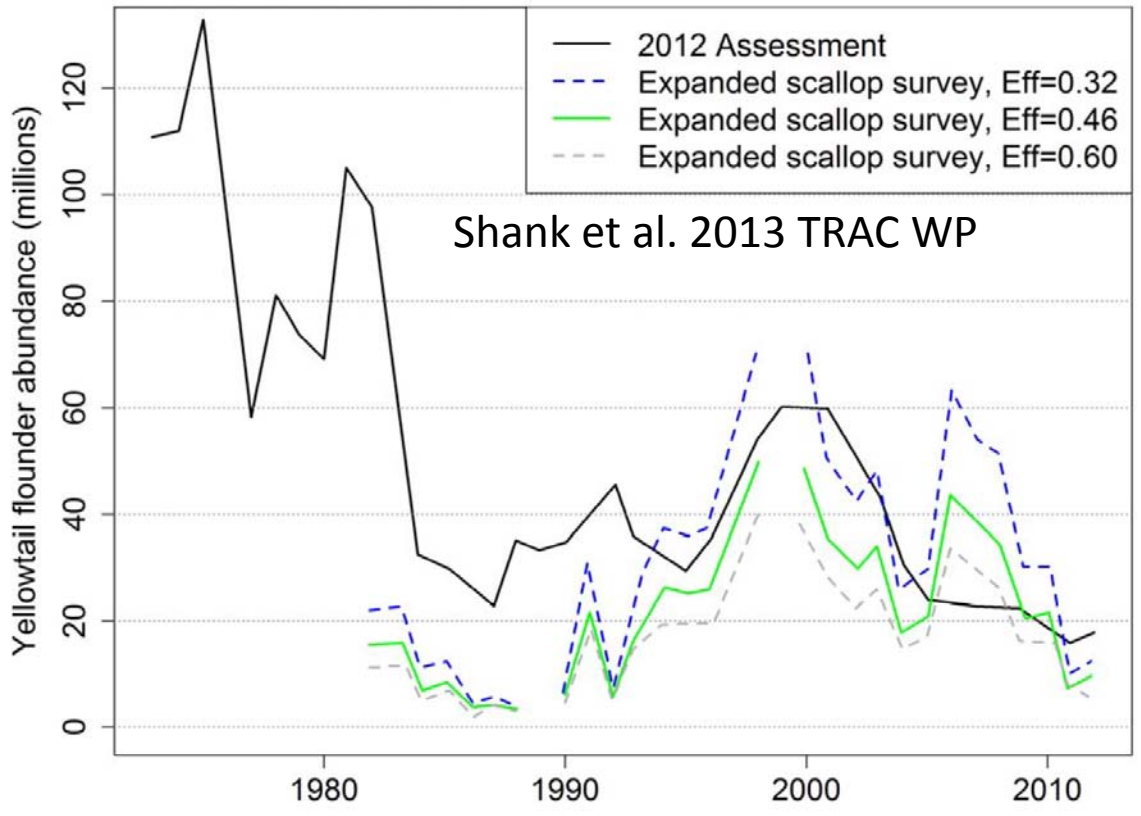
2013 TRAC

- Sensitivity analyses indicate that tagging mortality and tag loss during the 10-day experiment would have to be greater than 45% to reduce the adjusted Petersen estimate to be less than the TRAC estimates.



NEFSC Dredge Survey

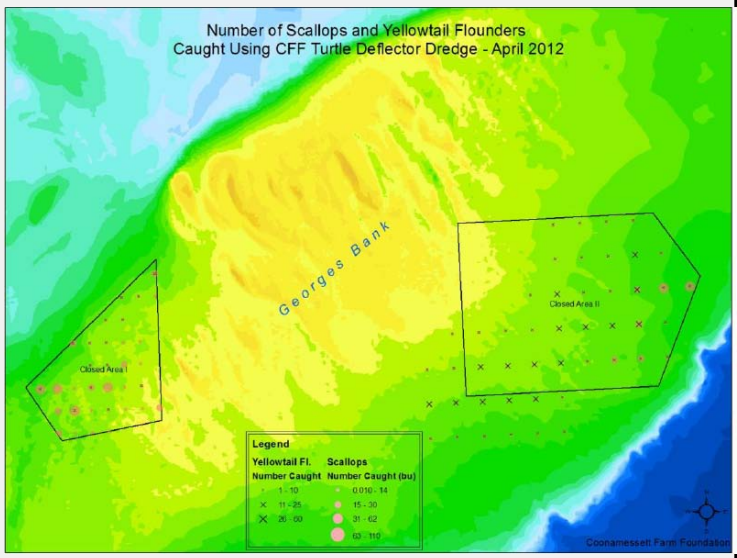
- The NEFSC survey dredge was estimated to be 46% efficient based on comparisons to the HABCAM sled surveys.
- Estimates of survey biomass are similar to recent TRAC estimates but less than TRAC estimates before 1994.



Bycatch Dredge Survey

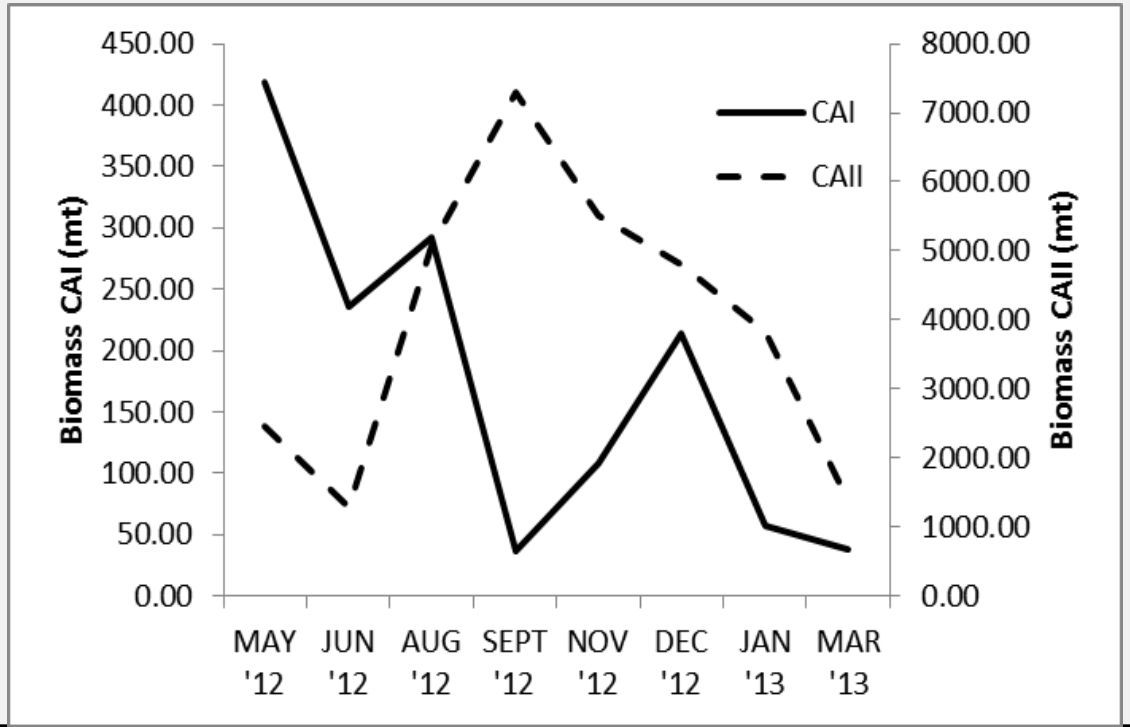
- A survey was designed to monitor seasonal and spatial patterns of scallops and yellowtail flounder using the NEFSC survey dredge.
- Estimates of biomass in and around closed areas are greater than TRAC estimates of biomass for the entire Bank (TRAC 2013 WP).

Year	Month	CAI	CAII	Total	TRAC B_{2012}
2012	5	418.47	2445.14	2863.61	85%
	6	235.31	1276.37	1511.68	45%
	8	292.74	5079.61	5372.35	159%
	9	36.90	7291.96	7328.85	217%
	11	107.58	5505.30	5612.88	166%
	12	213.68	4796.61	5010.29	148%
2013	1	57.24	3827.08	3884.32	115%
	3	37.56	1383.71	1421.27	42%
Average	-	174.94	3950.72	4125.66	122%



Bycatch Dredge Survey

- Seasonal patterns from the bycatch survey also support information from observers and bycatch avoidance reports of increased yellowtail in closed area 2 in August, precluding comparisons of August 2012 and July 2010 HABCAM surveys.



Conclusions

- Diagnostic information from the TRAC assessment indicates underestimation of stock size.
- The 2008 tagging estimate of abundance in the access area of closed area 2 is much greater than the updated TRAC estimate of 2008 abundance.
- Area-swept biomass from the bycatch dredge survey in and around closed areas are greater than the 2012 estimate of biomass from the 2013 TRAC.

Recommendations

- A new benchmark workshop is needed as soon as possible to develop a more reliable stock assessment.
- Until new benchmark methods are developed, catch advice should be limited to unintentional bycatch, similar to previous recommendations from the SSC for Georges bank yellowtail flounder and other stocks.
- There is insufficient basis for more restrictive recommendations in the 2013 TRAC assessment.