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## **CERT**

Comité d'évaluation des  
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Document de travail 2014/ 01

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## **TRAC**

Transboundary Resources  
Assessment Committee

Working Paper 2014/01

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# Overview of Diagnostic Problems in the Current Benchmark Assessment Formulation for Georges Bank Yellowtail Flounder

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Ce document est disponible sur l'Internet à :

<http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html>

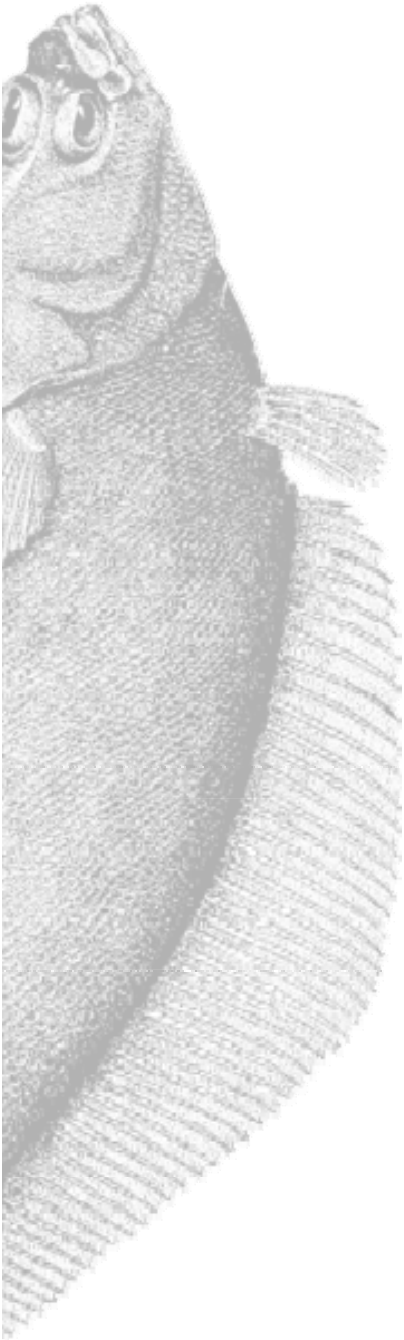
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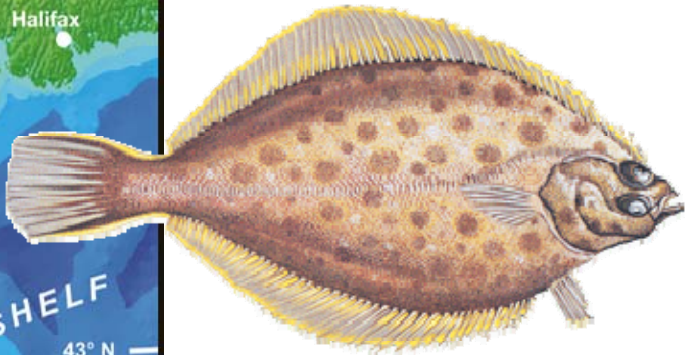
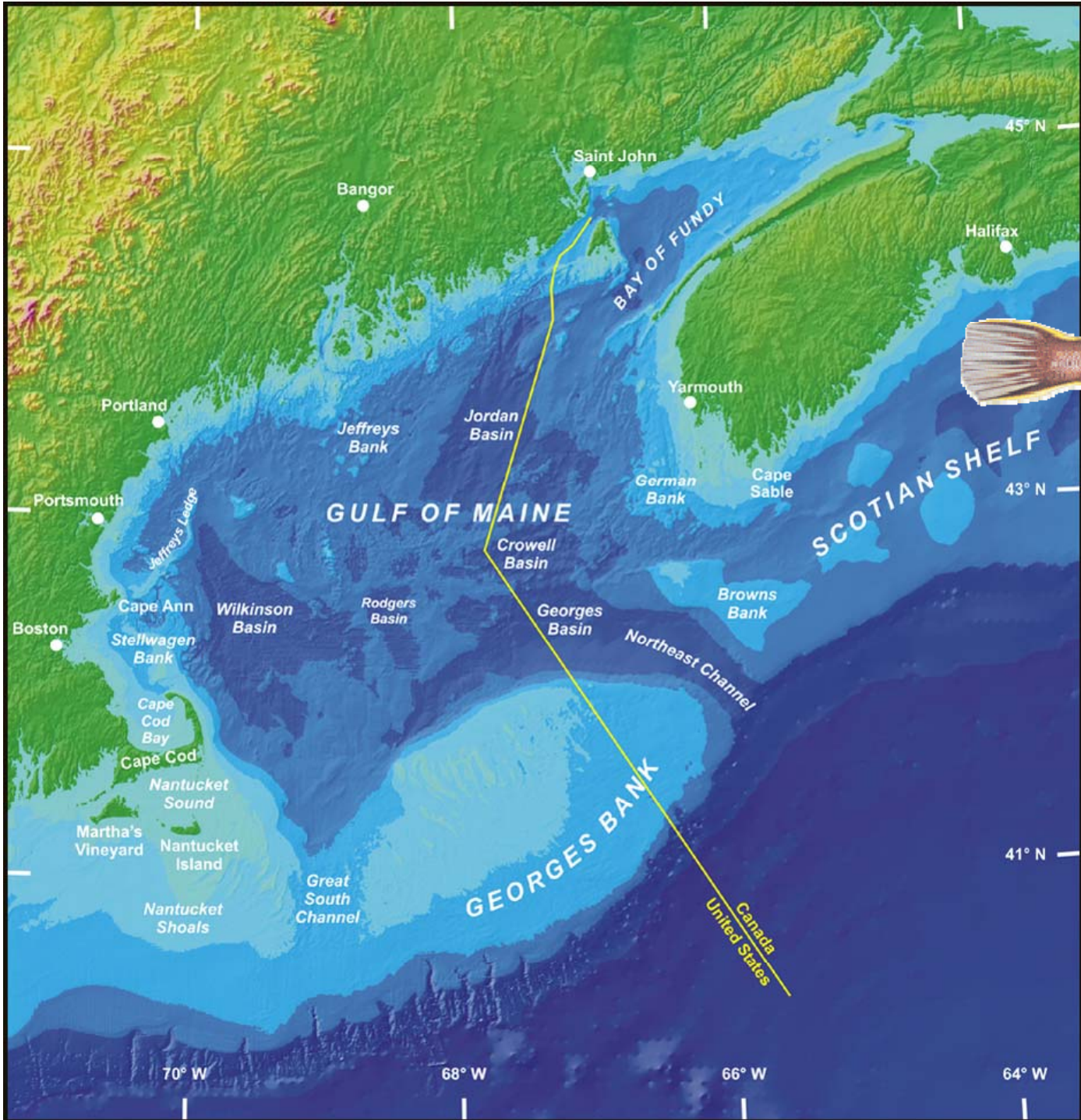
Canada



# Overview

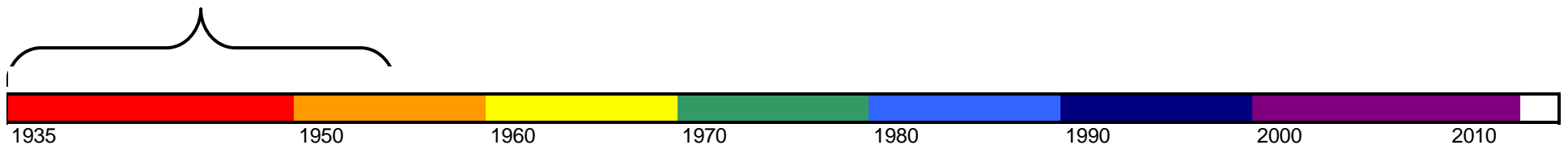
- How did we get here?
  - Brief historical progression
- What is a diagnostic benchmark?
  - Issues with current assessment
- What will we be doing this week?
  - Thumbnail sketch of topics





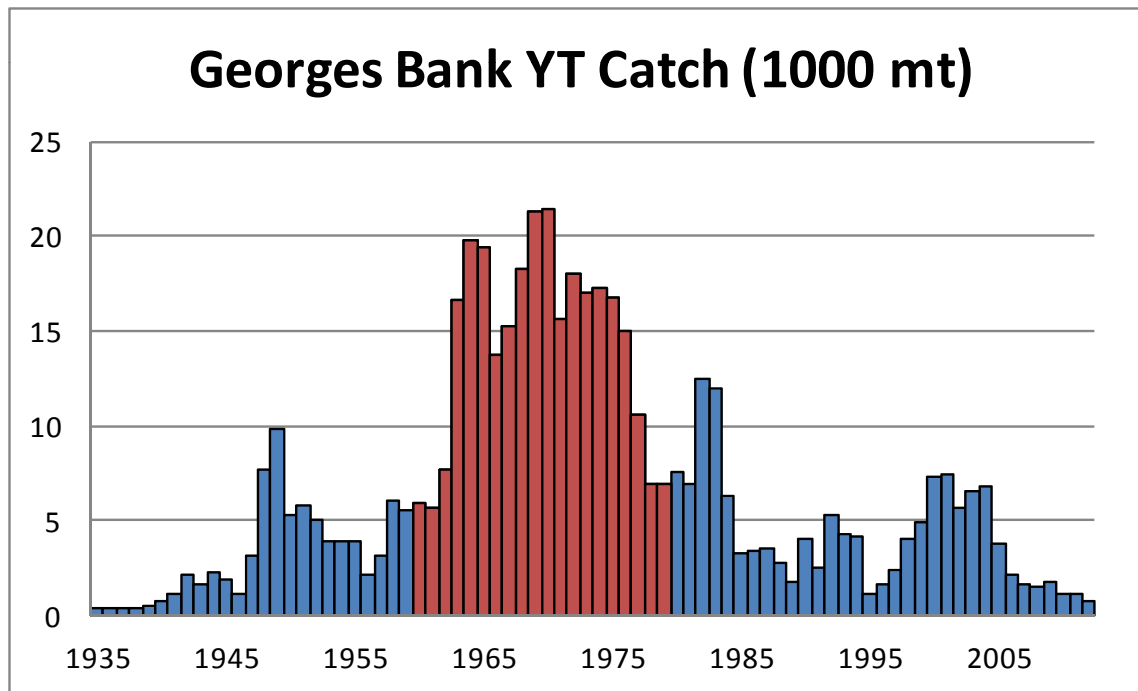
# In the Beginning...

- Yellowtail fishery began 1935 Southern New England
  - Small mouths, no hook
  - Winter flounder ↓ yellowtail flounder ↑
- Total YT catches ↑ early 1940s then ↓ mid 1940s
  - Georges Bank increased in importance
  - Royce et al. 1959 “Decline of the yellowtail flounder off New England”



# Expansion and Decline

- GB catches increased dramatically 1960s
  - Discarding an issue (mesh too small)
  - Lux estimated  $Z=1$  for early 1960s



# Collapse!

- SAW 18 Special Advisory for Georges Bank Cod, Haddock and Yellowtail
- Yellowtail and haddock 'collapsed'
- Yellowtail and cod F 'should be reduced to as low a level as possible, approaching zero'





# TRAC

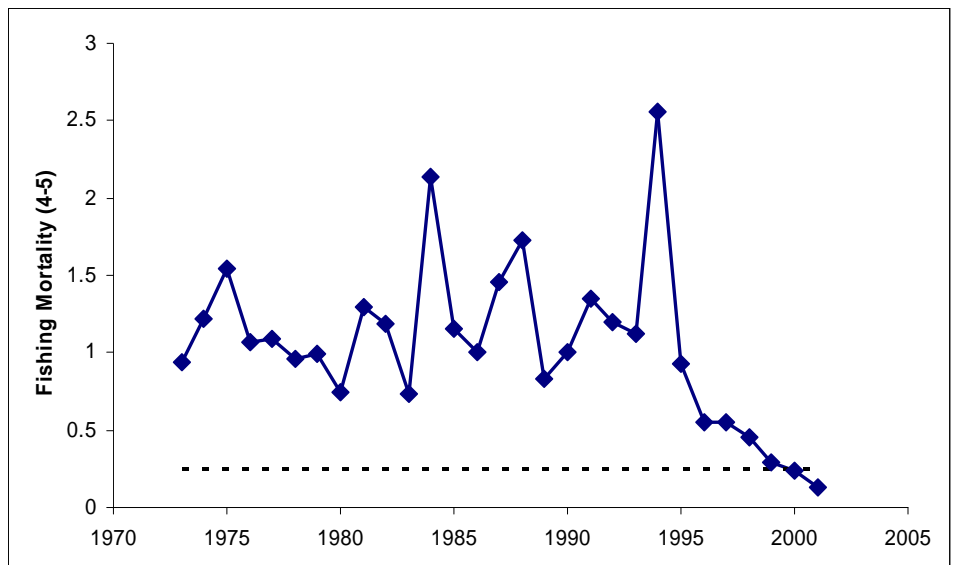
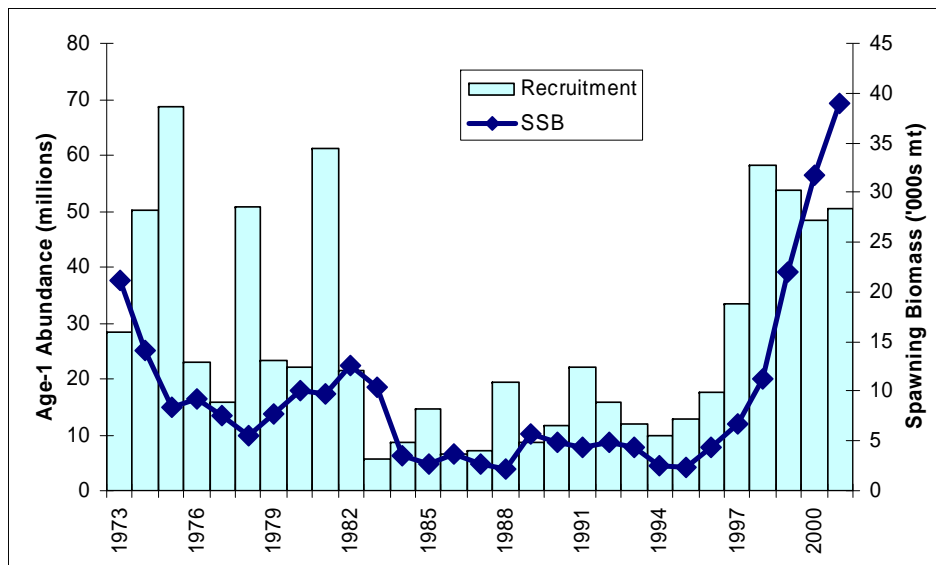
(Transboundary Resource Assessment Committee)

- Formed in 1998
- Review stock assessments for shared resources on Georges Bank
- Consistent management of cod, haddock, and yellowtail on Georges Bank
  - Quota sharing agreement

# Success by 2002

- “Population biomass has increased 12 fold since 1995 and is at the highest observed level since 1973”
- “Exploitation rates on ages 4+ have been near or below  $F_{0.1}$  since 1999”

Quotes from Canadian Stock Status Report



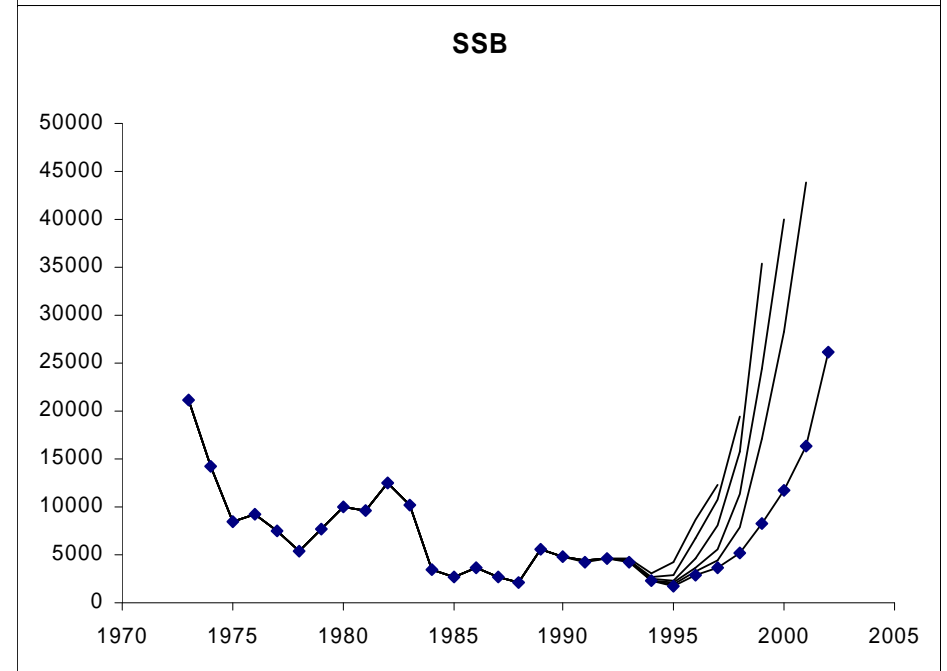
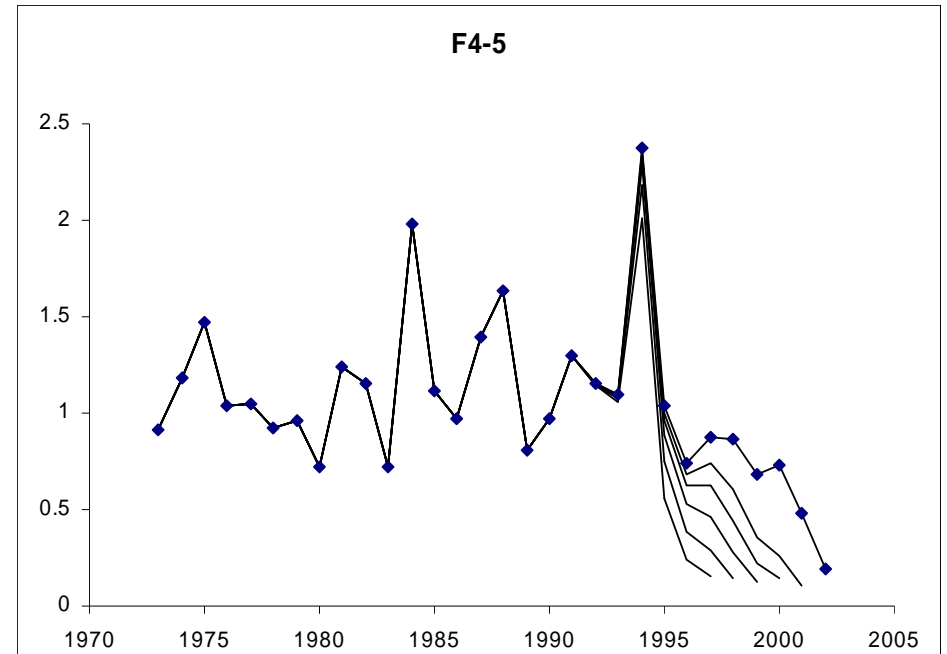
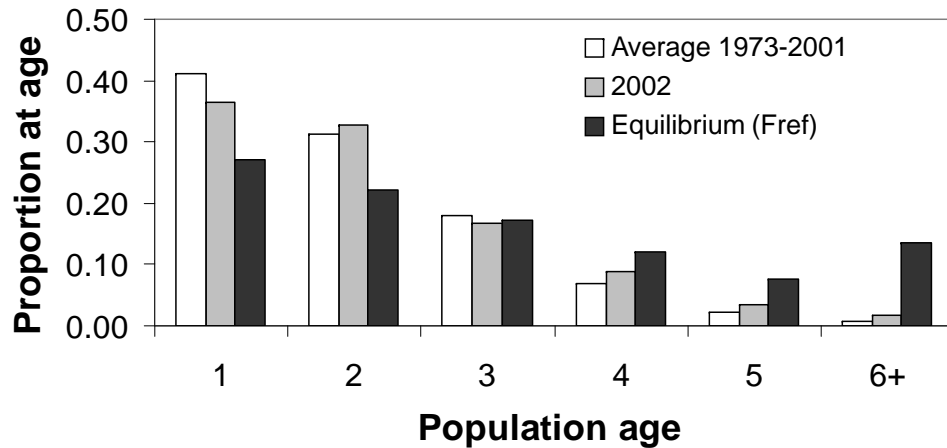


# 2002 Summary

- GB YT stock healthy
  - Neither overfished nor overfishing
  - Victory!
- Good news overshadowed by
  - New BRP
  - Trawl mark offsets
- Words of caution
  - Age structure not filled out
  - Retrospective pattern

# 2003 Assessment

- Retrospective Worse
- No old fish

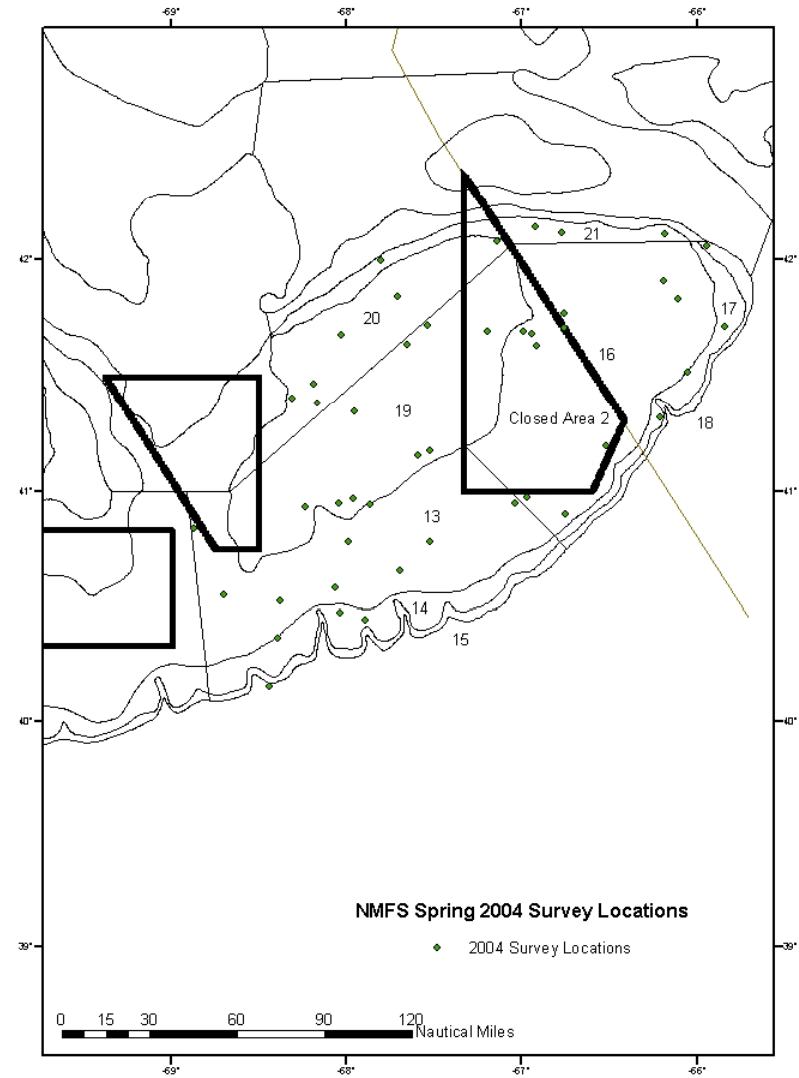
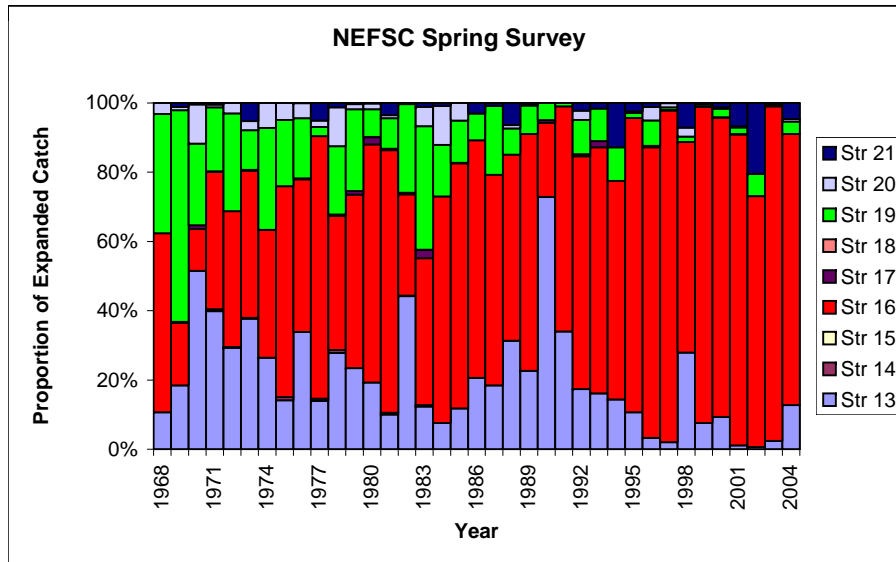
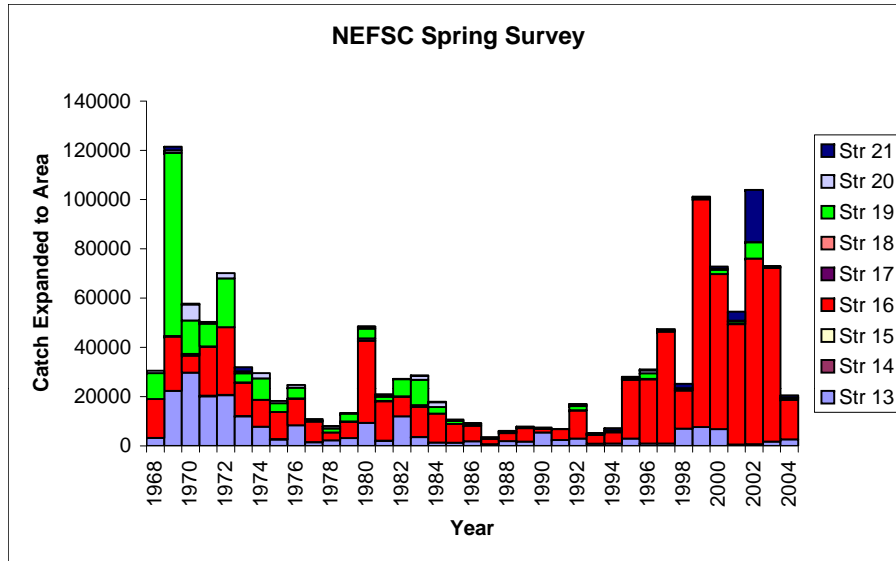


# 2003 Assessment

## Bottom Line

- If  $F$  decreased since 1994 due to management, where are the old fish?
- If  $F$  did not decrease since 1994 despite management, why not?

# 2004: Space the Final Frontier?

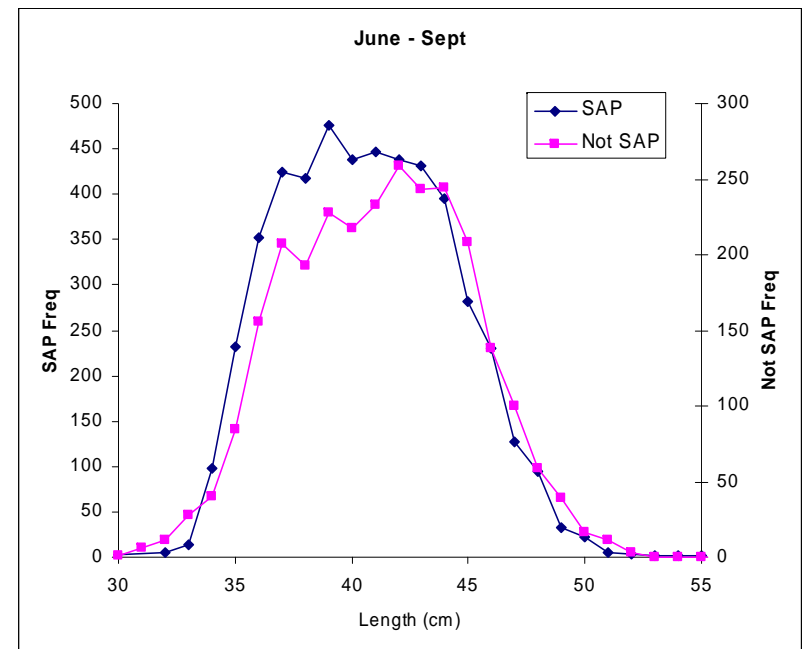


# 2004 Summary

- VPA
  - Overfished and Overfishing
  - Strong Retrospective and Residual Patterns
  - Projected 2005 Quota ~ 4000 mt
- ASAP
  - Domed Selectivity (CAII Effect)
  - Retrospective Pattern Present
  - Projected 2005 Quota ~ 8000 mt
- 2005 Quota 6000 mt
- Need a Benchmark Assessment!
- Closed Area II SAP June-Sept 2004

# Closed Area II SAP

- 13 million pounds yt (5.7 kt)
- 3 months (June 1 – Sept 3)
- 320 trips
- Prices Plummeted
- Size Freq Same In & Out CAII
  - No Dome



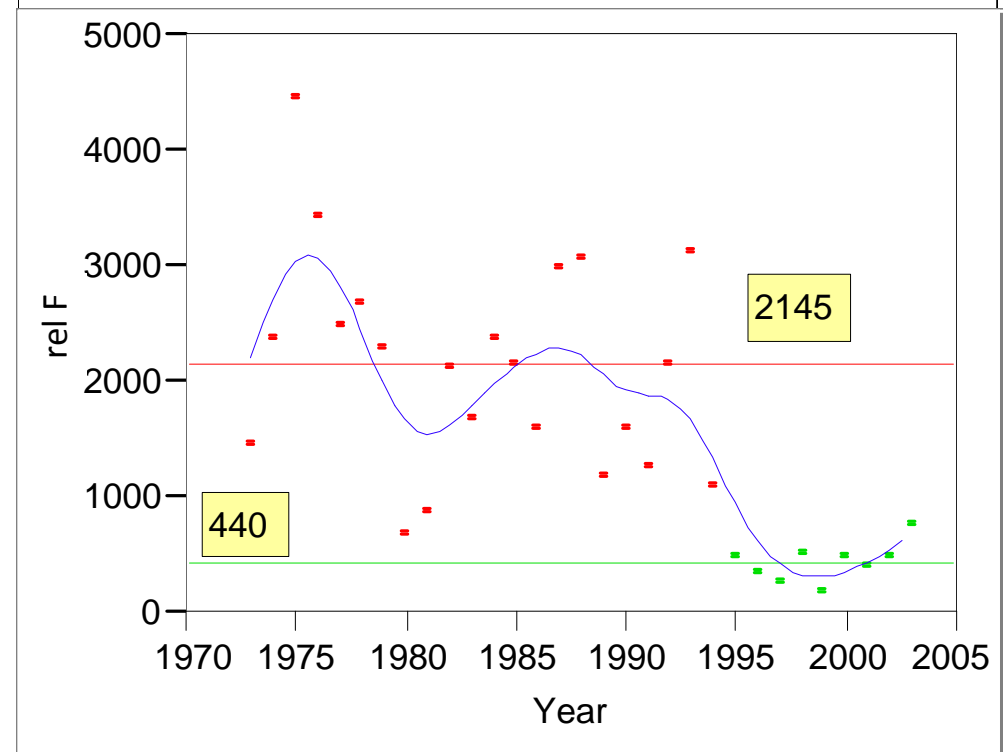
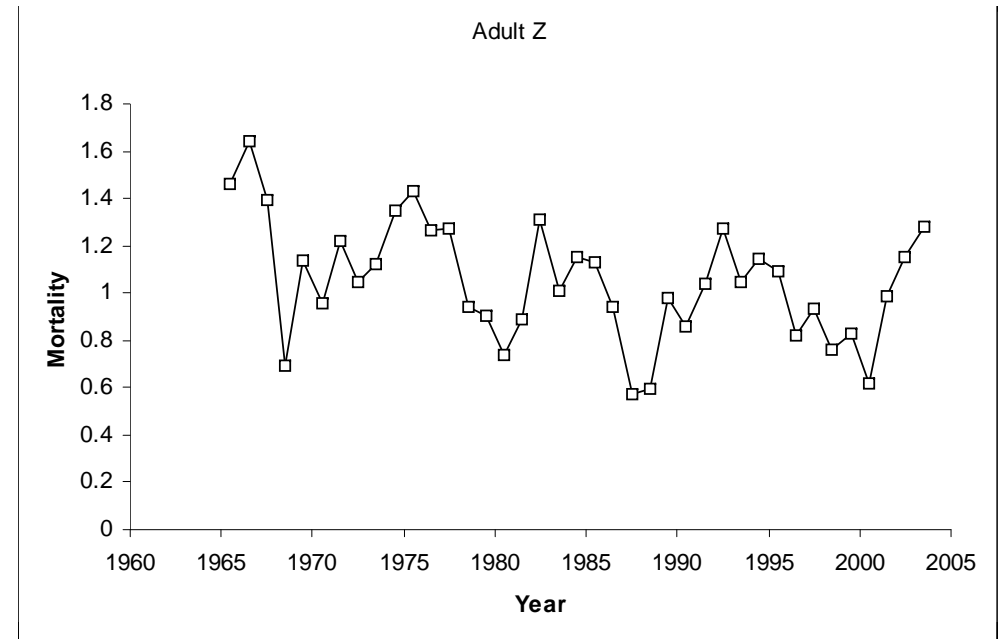
# 2005 Benchmark

- Data Meeting (Jan 25-26)
  - Blizzard
  - Relatively minor revisions except inclusion of Canadian scallop discards
- Modeling Meeting (April 26-29)
  - Threw the Book at It
    - Basic Data
    - Retrospective
    - Statistical Catch at Age models
    - Alternative VPA Configurations



# Basic Data

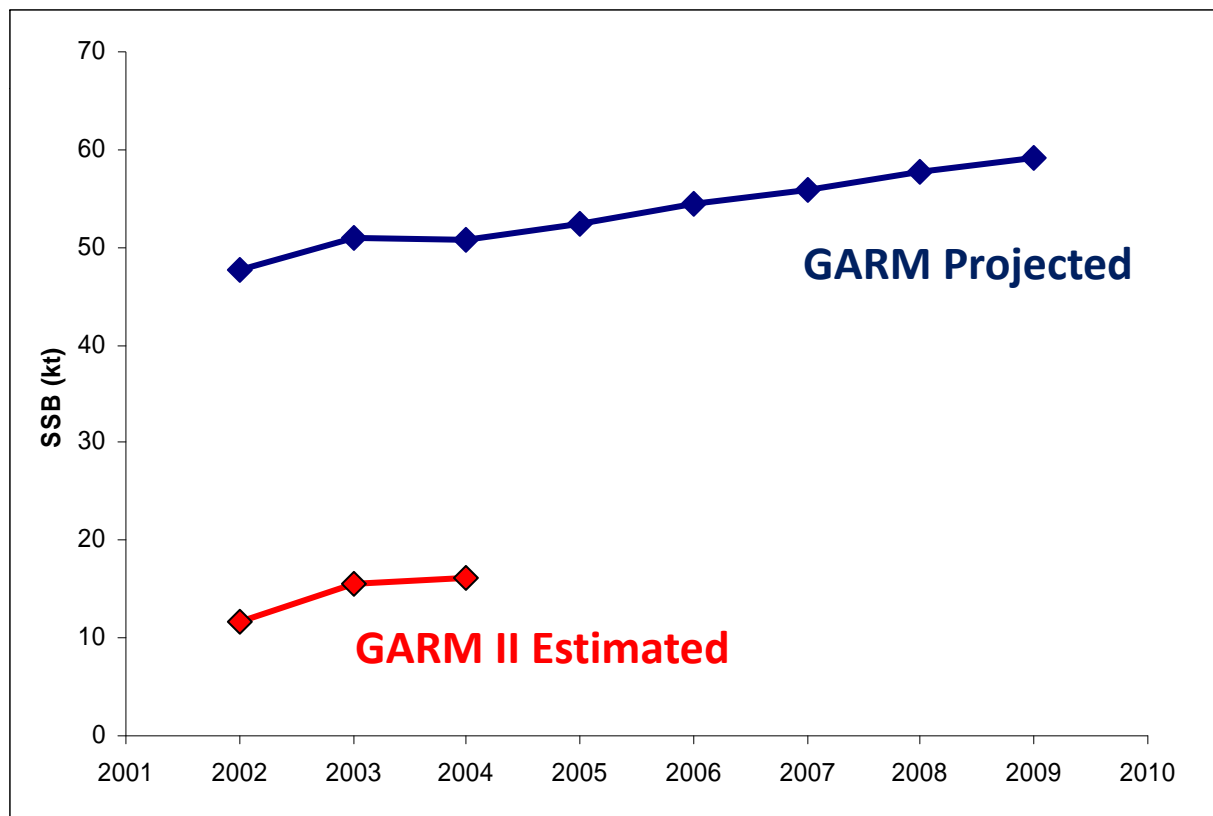
- Survey Z's are high and variable
- Catch/Survey (rel F) decline since 1995
- Did M change?
- High surveys at young ages don't show up in catch or surveys at older ages





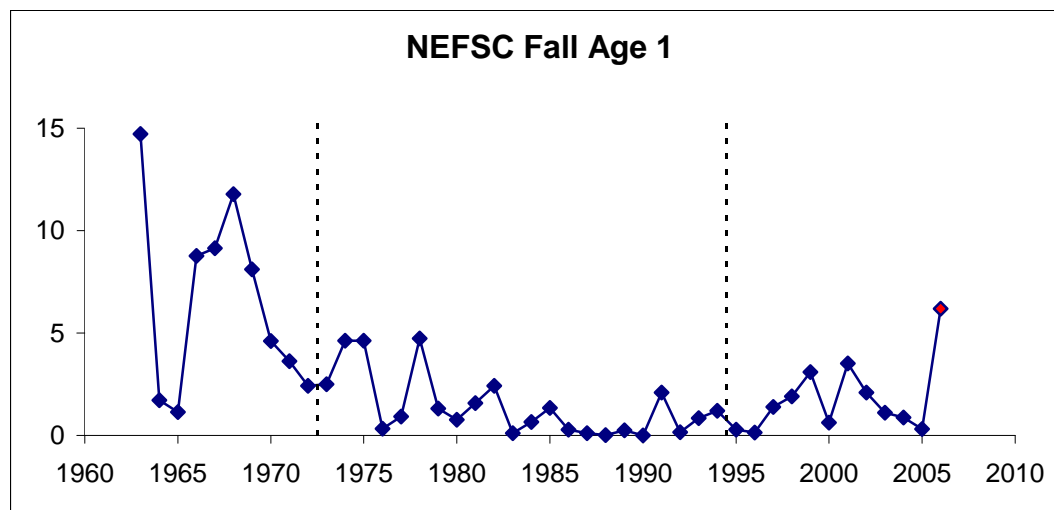
# GARM II (Aug 2005)

- Same Data and Results as TRAC



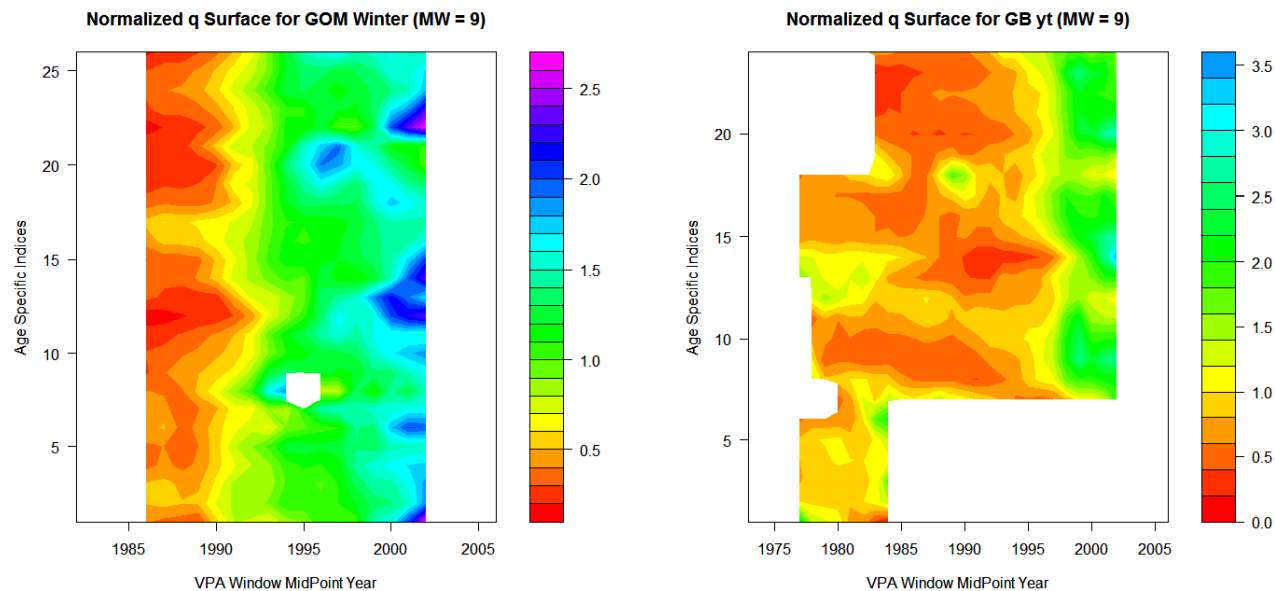
# 2007 Assessment: R Saves the Day

- Continued examining Base Case (strong retro) and Major Change (little retro)
- 2005 year class moderate-strong in all surveys
- Catch advice increased
  - Depends on strength of 2005 year class



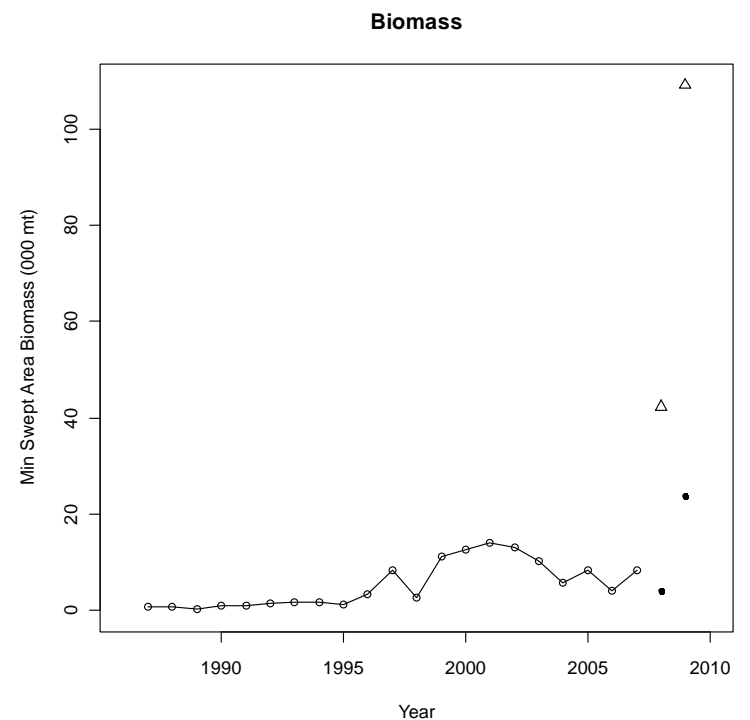
# 2008 GARM III

- Moving window analysis detected change in numerous stocks in mid 1990s
- Used to justify splitting survey series
  - “aliasing unknown mechanisms”



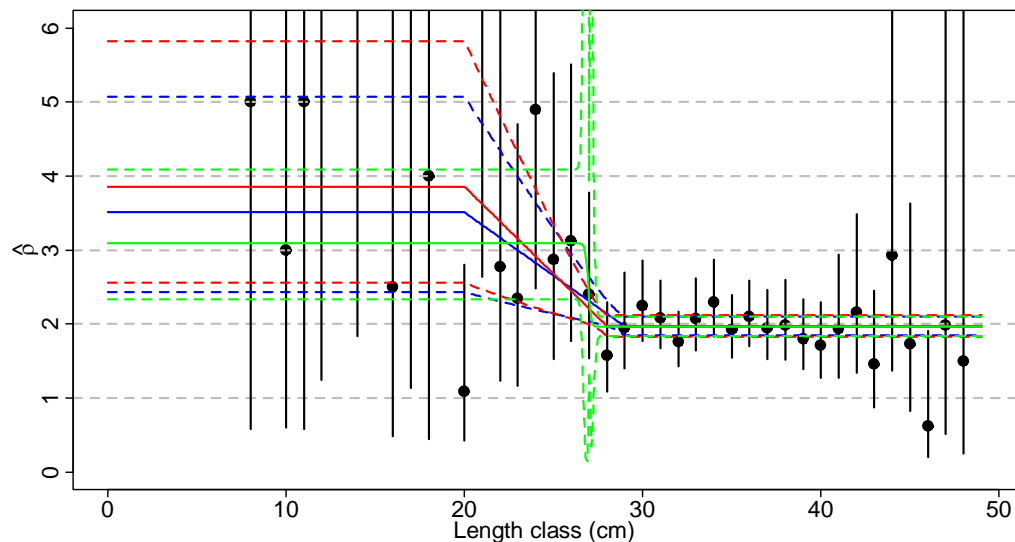
# 2008 & 2009: Deck Tows

- DFO survey in 2008 and 2009 had individual tows of 7.5 mt and 5.2 mt, respectively
  - For comparison, the sum of yt catch in the other 56 tows in 2008 was ~0.5 mt
- Excluded and Included runs conducted
  - A number of other sensitivity runs done as well



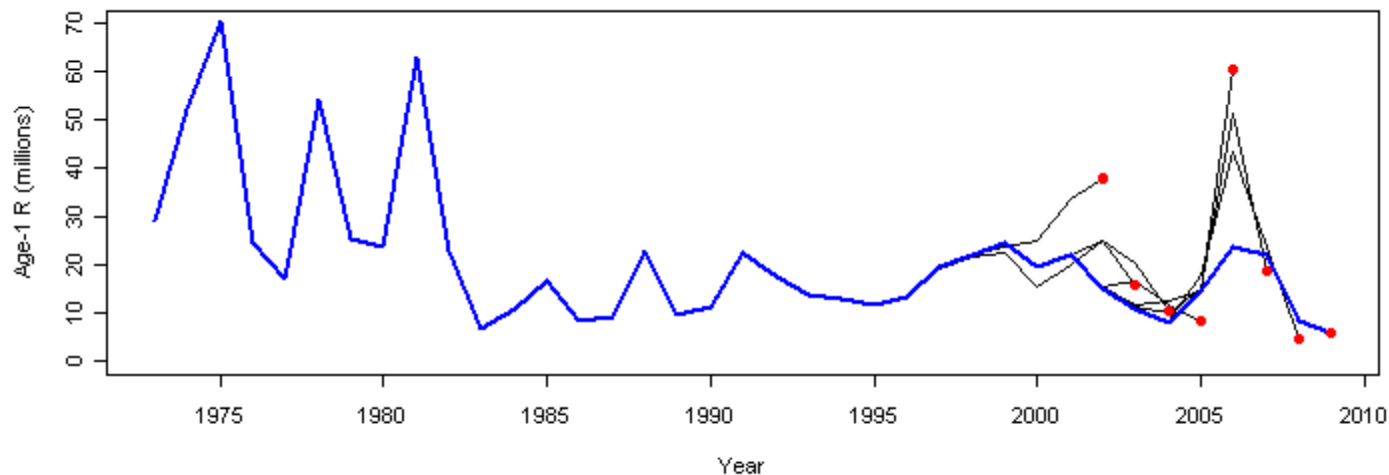
# 2009 New US Survey Vessel

- Albatross IV replaced by Henry B. Bigelow
- New net, doors, tow length, everything!
- Calibrations not immediately available
- By 2010 had length-based calibrations



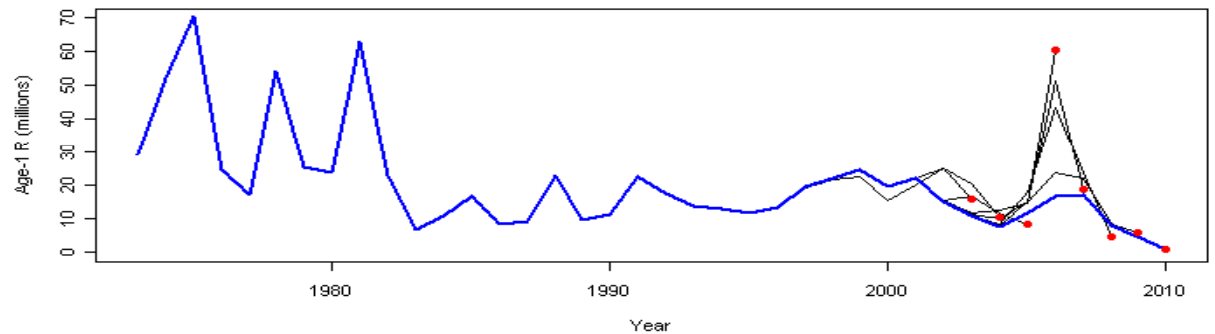
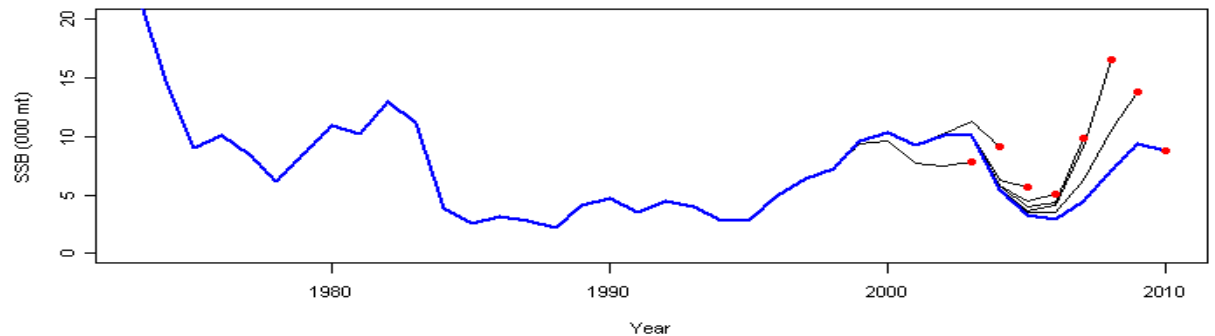
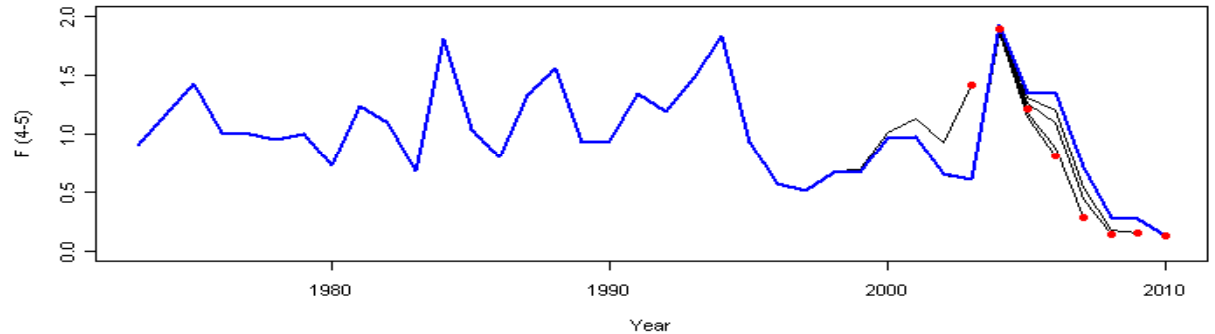
# 2010: Downweighting

- DFO 2008 & 2009 survey values downweighted to reflect higher uncertainty due to deck tows
- 2005 year class now estimated as average
  - Where did it go?



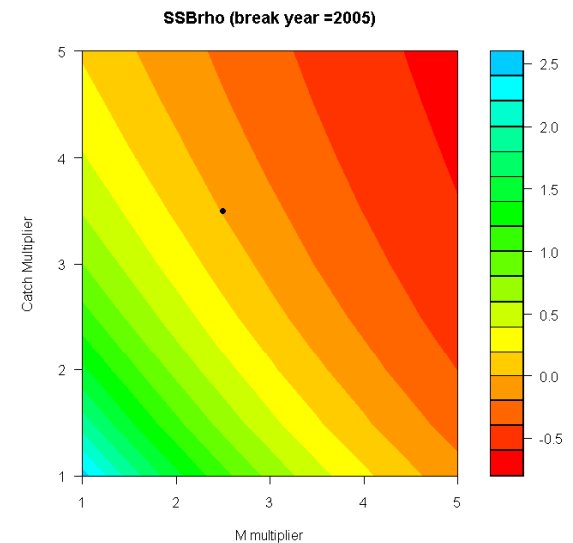
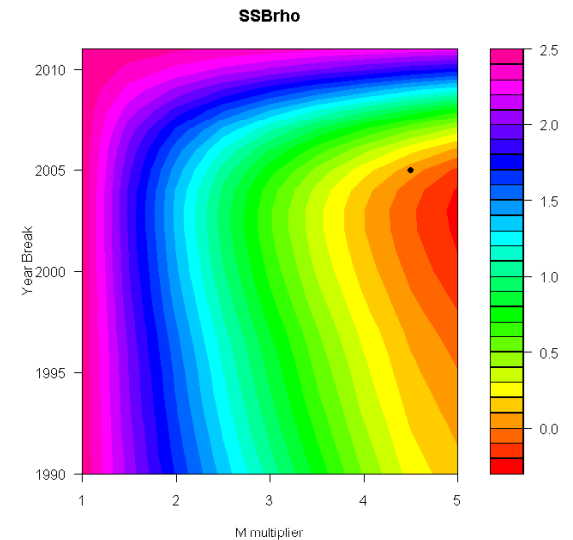
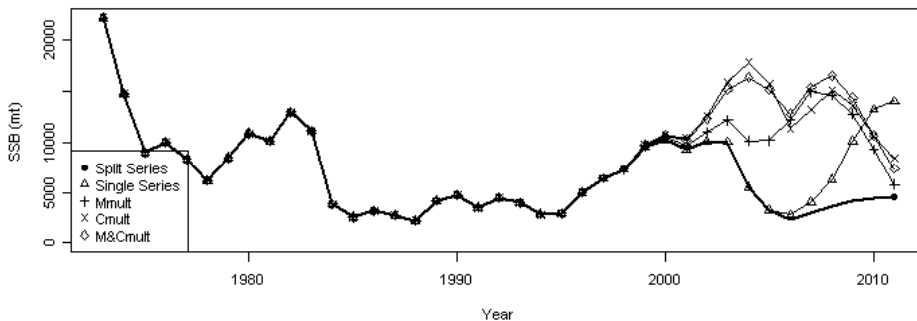
# 2011: It's baaaaack!

- Retrospective pattern strong in Split Series model, though not as strong as in Single Series
- Examined rho adjustments for projections



# 2012: Retro fixes

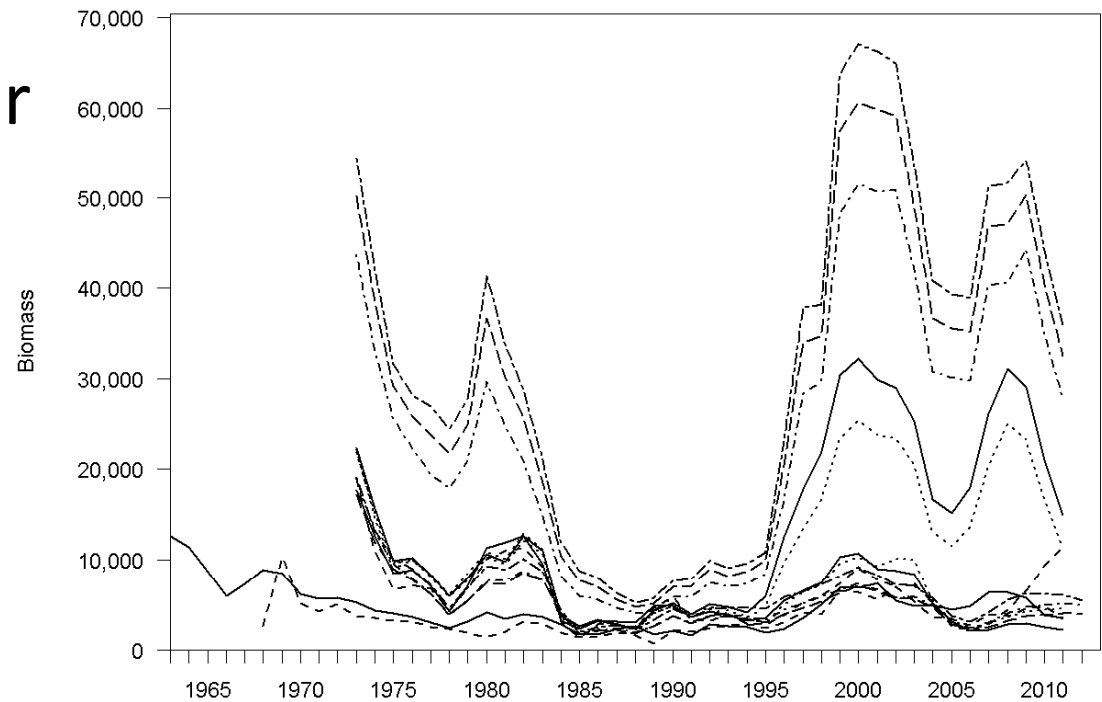
- Examined rho adjustments, missing catch, increased M, both missing catch and increased M as means to “fix” the retro
- Resulted in similar catch advice





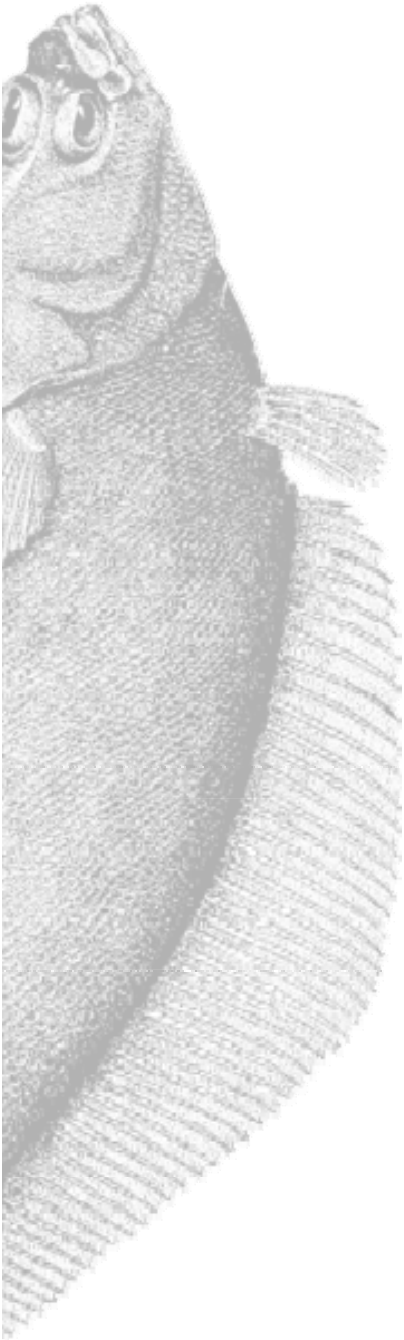
# 2013: WCSAM Bake-off

- 2012 data made available to scientists worldwide
- 12 models applied
- None were the silver bullet



# Overview

- How did we get here?
  - Brief historical progression
- What is a diagnostic benchmark?
  - Issues with current assessment
- What will we be doing this week?
  - Thumbnail sketch of topics



# Current Assessment (TRAC 2013)

- VPA Split Series
  - Single Series also examined
  - Age specific tuning indices
- $M=0.2$
- 2012 Catch <1000 mt for first time since 1940
  - Canadian fishermen unable to find commercial densities of yellowtail since 2004
- Surveys declined or flat
  - Recent recruitment low

# Issues

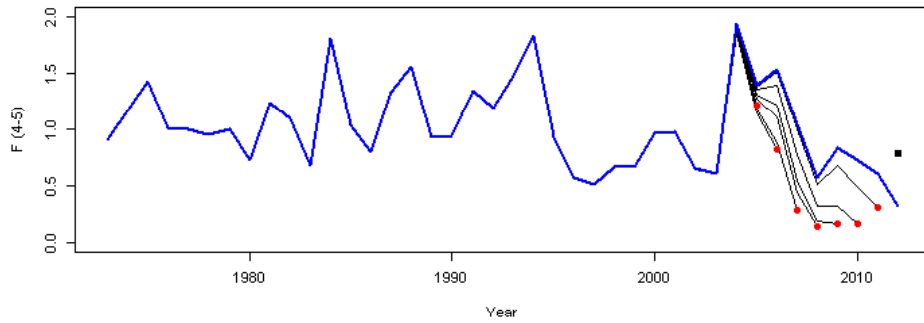
- Retrospective
  - Scale
  - Trend
  - Concentration
  - Age structure
  - Relative F vs survey Z
- 
- Same problems identified in 2005 Benchmark

Note y-axes differ for SSB and R between Split Series and Single Series

### Split Series

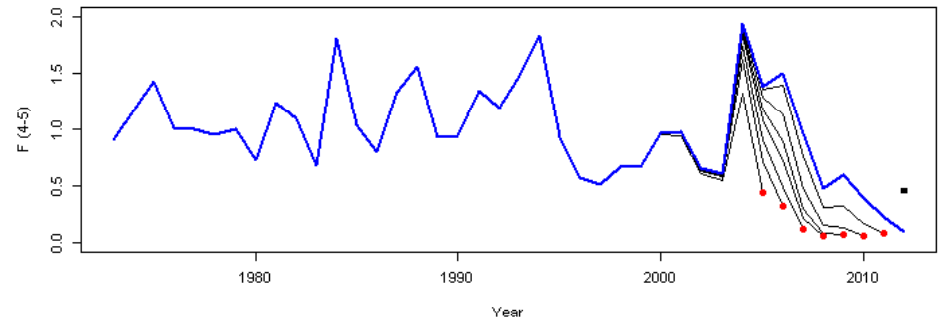
Split Series

rho adjusted F2012 >> Fref

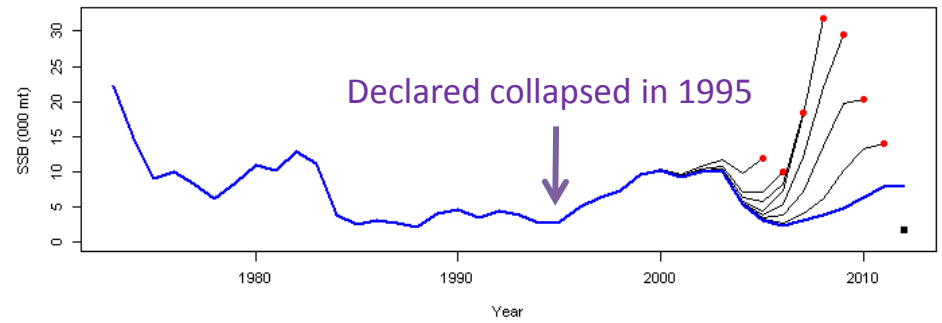
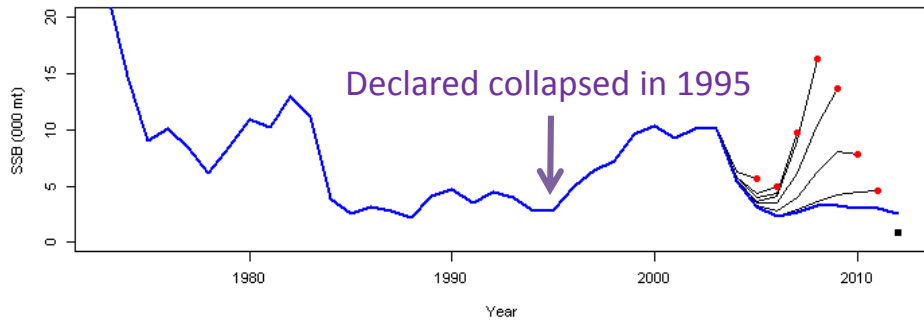


### Single Series

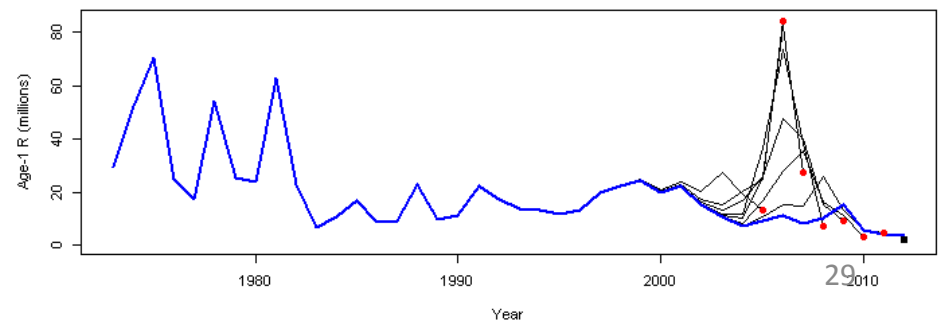
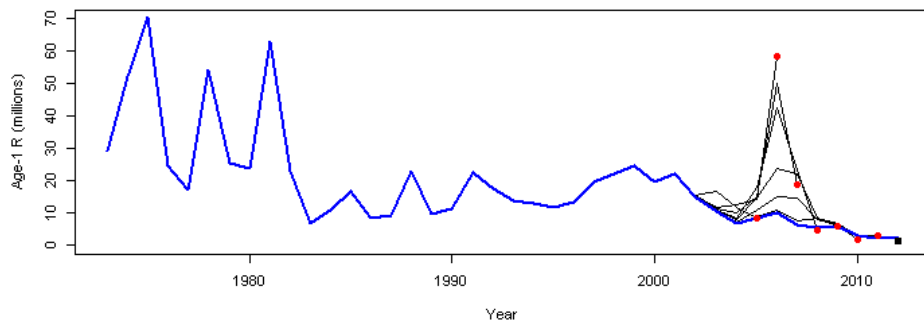
Single Series



rho adjusted SSB2012 lowest in time series

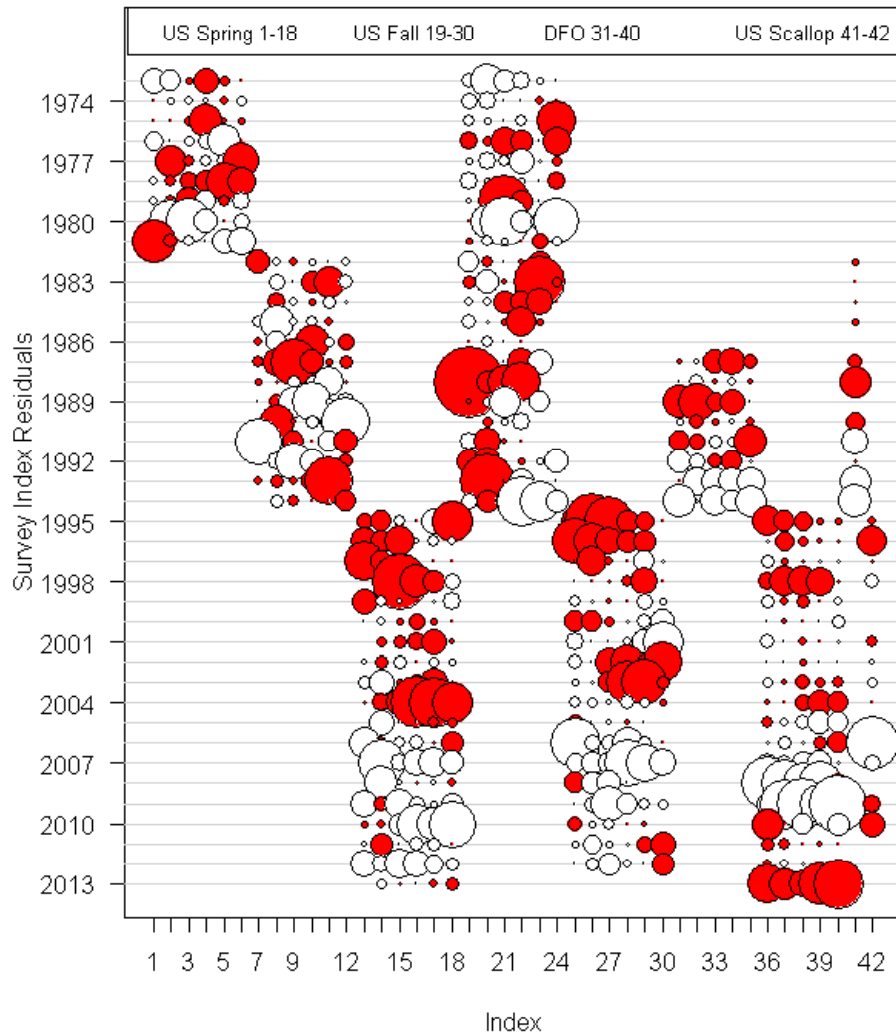


Recent 3 recruitments lowest in time series

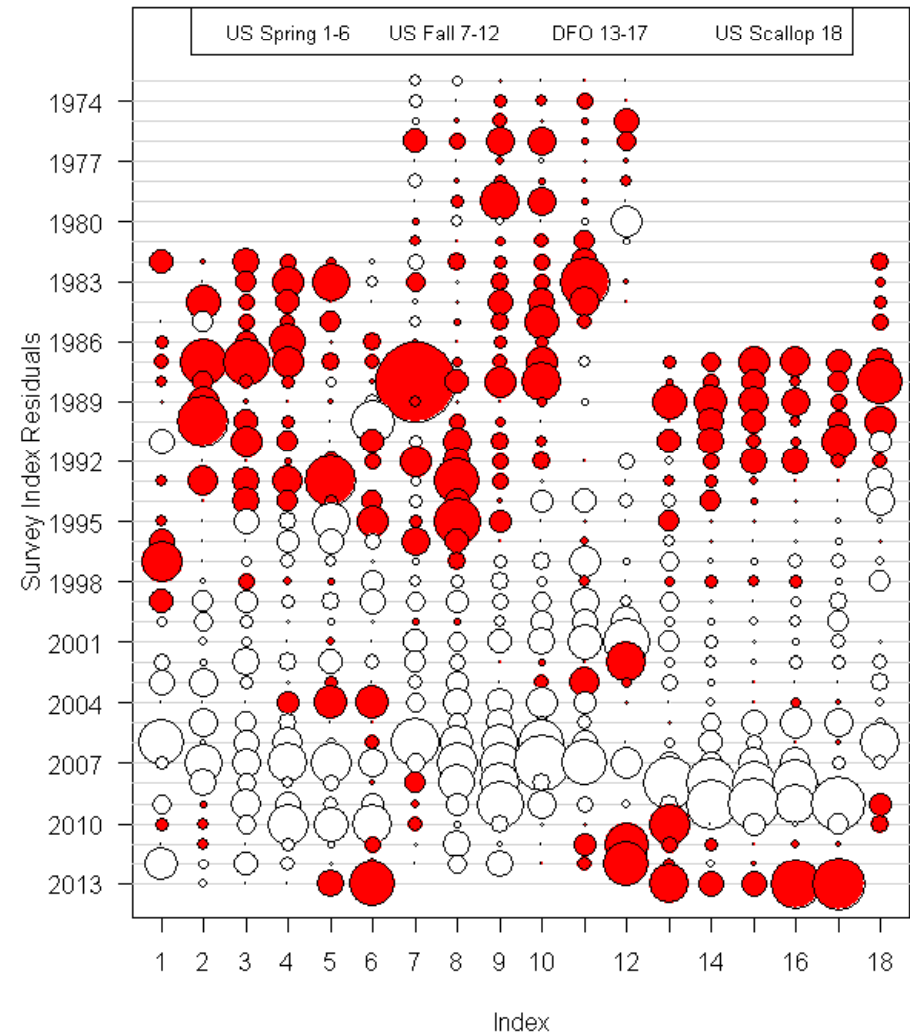


# Survey Residuals

**Split Series**



**Single Series**



# How has rho adjustment performed?

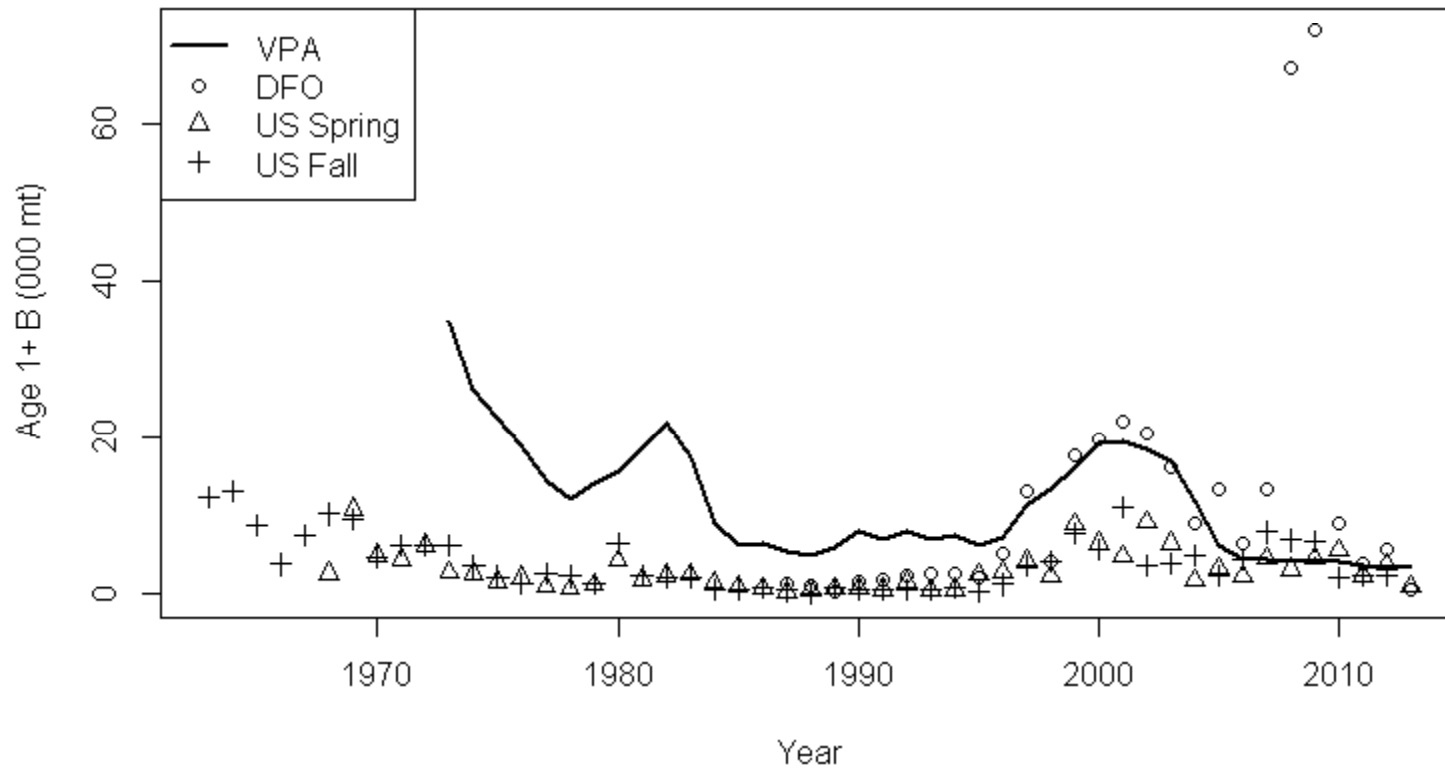
## Split Series VPA

	2012 TRAC		2013 TRAC
	Estimated	rho adj	Estimated
<b>2011 F</b>	0.31	0.62	0.60
<b>2011 SSB</b>	4,600	1,700	2,988

	2011 TRAC		2013 TRAC
	Estimated	rho adj	Estimated
<b>2010 F</b>	0.13	0.14	0.73
<b>2010 SSB</b>	8,802	5,165	3,004

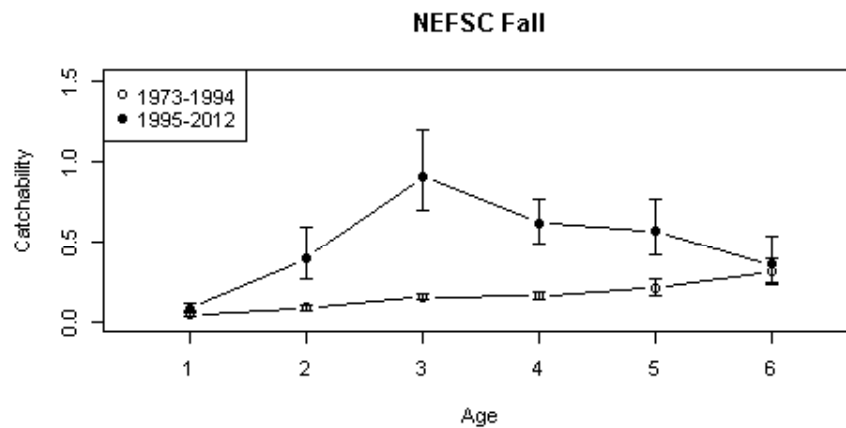
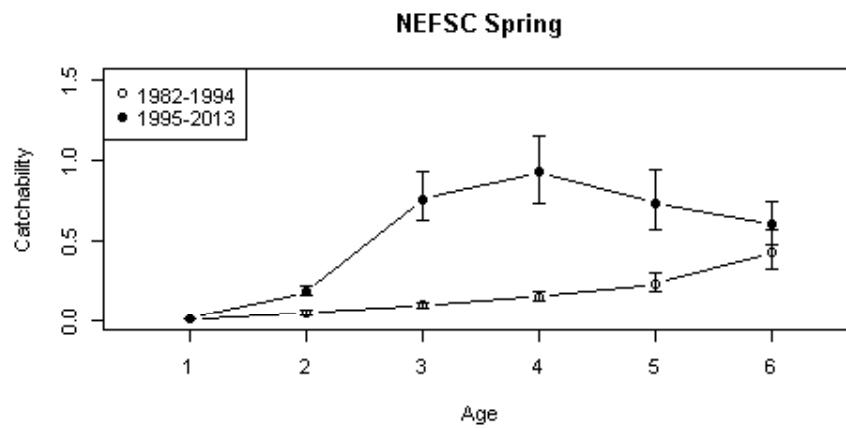
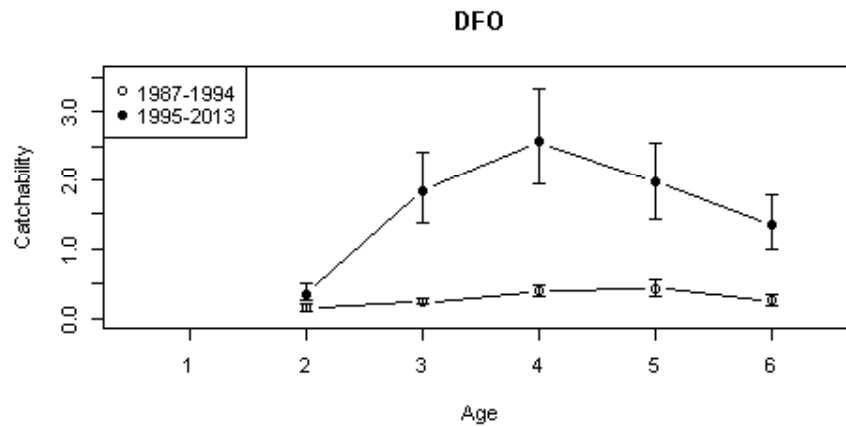
# Scale

## Split Series



Also a number of WP present abundance estimates > VPA estimates

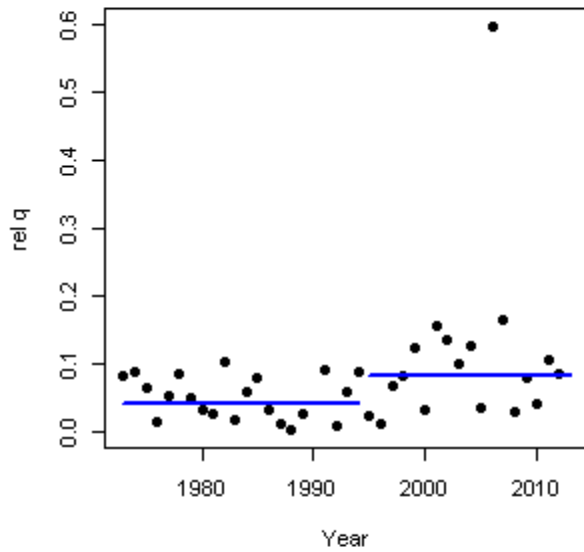




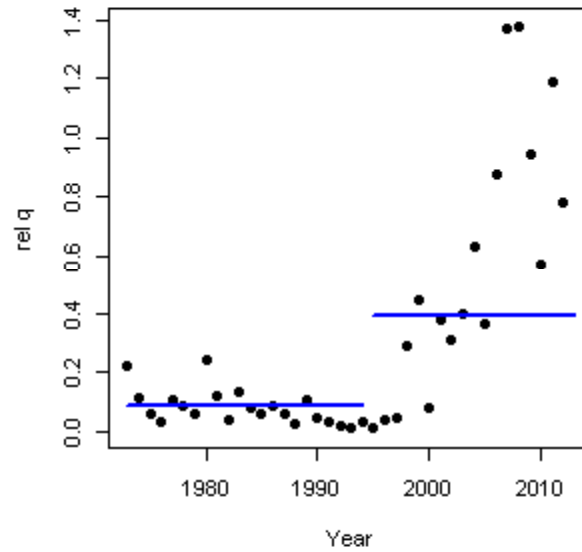
Survey q from Split Series VPA show large change between early and recent periods, values > 1 partially due to using wing spread, but see WPs on catchability

Rel q = survey observation / VPA estimate of population abundance at age, no adjustment for timing of survey

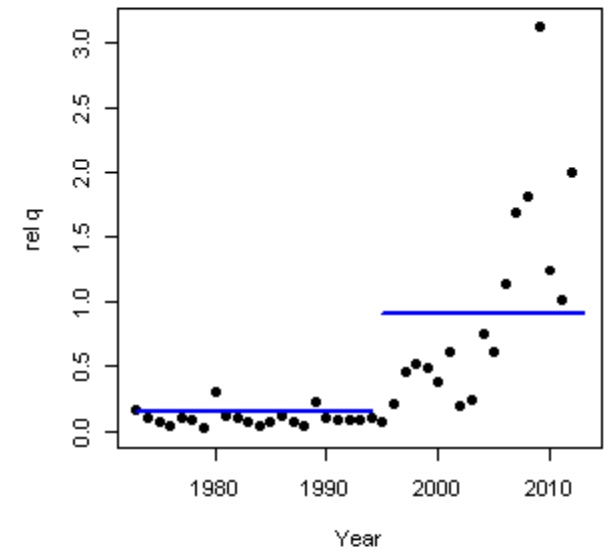
NEFSC Fall Survey Age 1



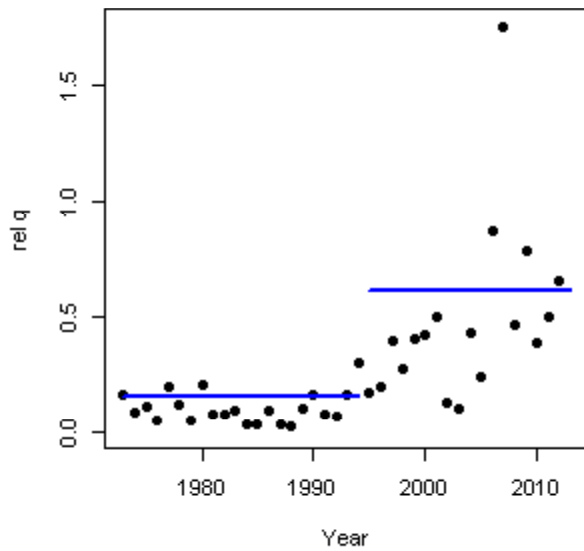
NEFSC Fall Survey Age 2



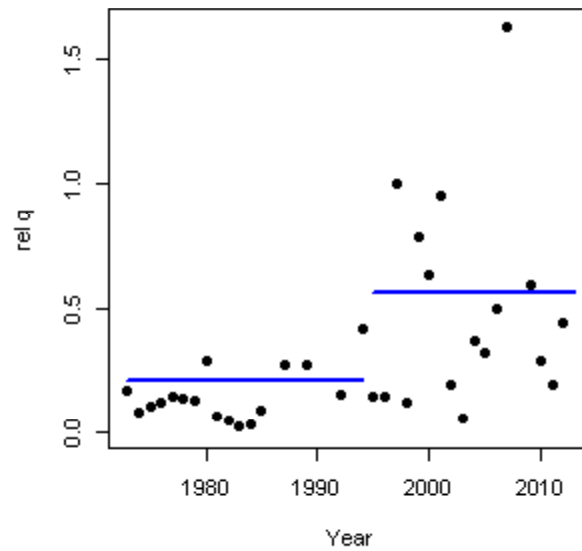
NEFSC Fall Survey Age 3



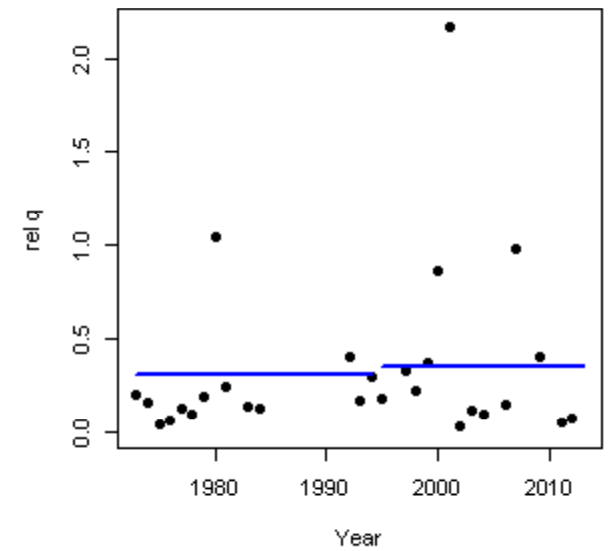
NEFSC Fall Survey Age 4



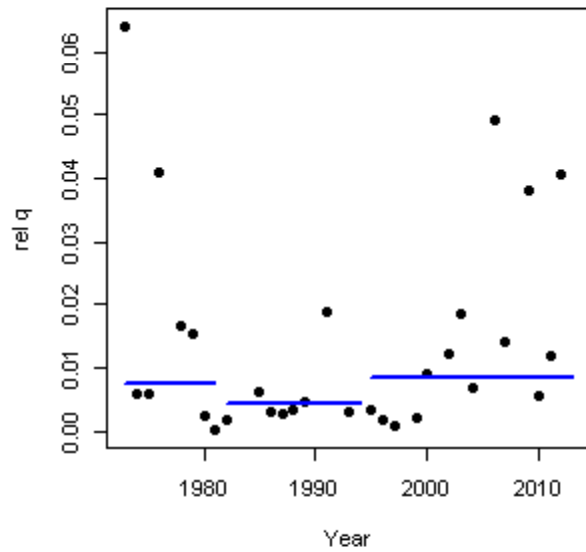
NEFSC Fall Survey Age 5



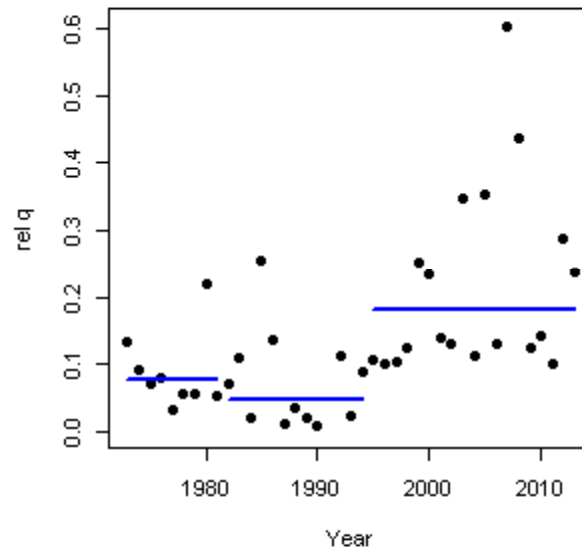
NEFSC Fall Survey Age 6+



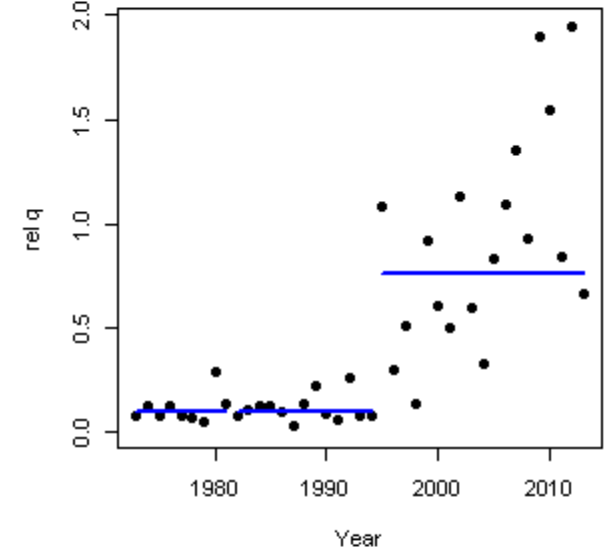
NEFSC Spring Survey Age 1



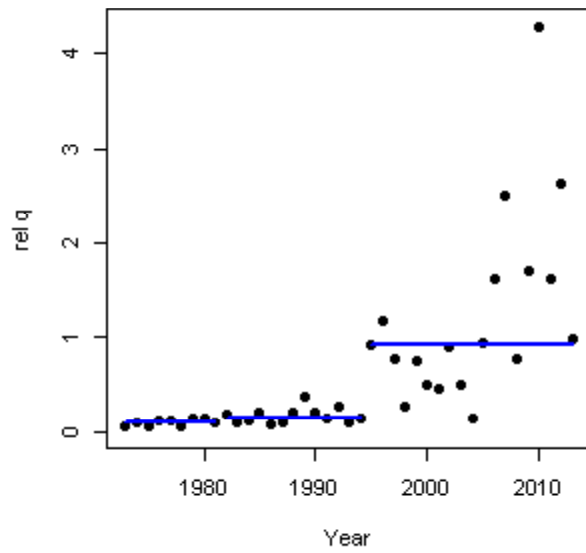
NEFSC Spring Survey Age 2



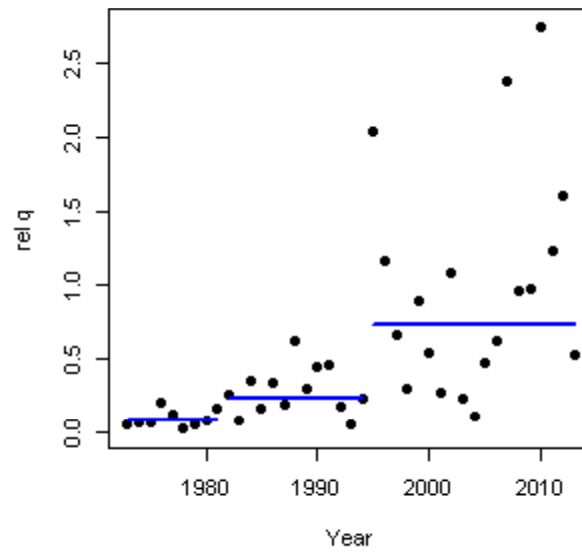
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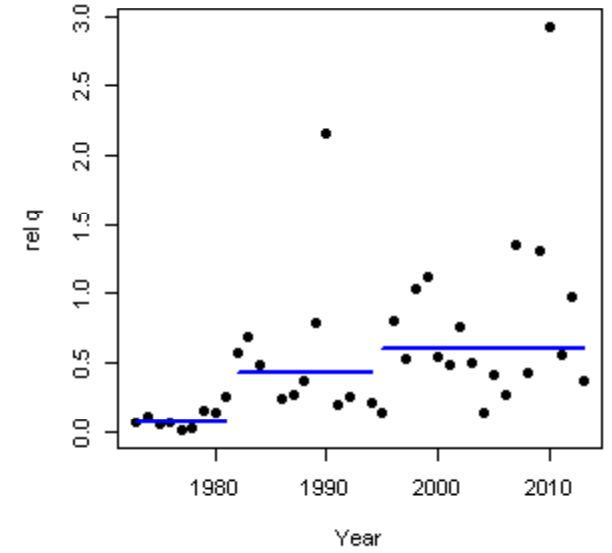
NEFSC Spring Survey Age 4



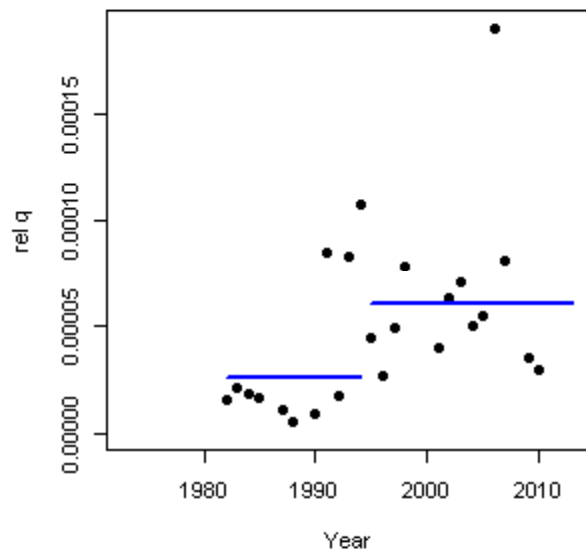
NEFSC Spring Survey Age 5



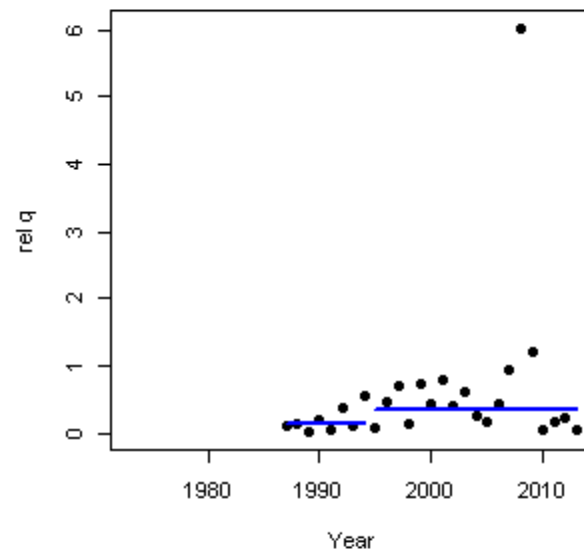
NEFSC Spring Survey Age 6+



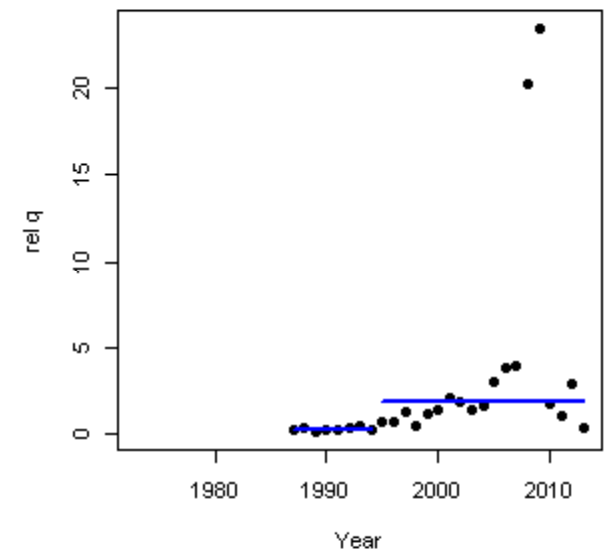
NEFSC Scallop Survey Age 1



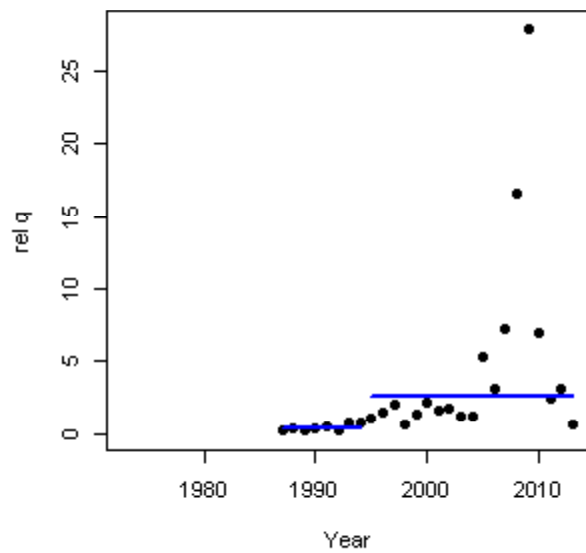
DFO Spring Survey Age 2



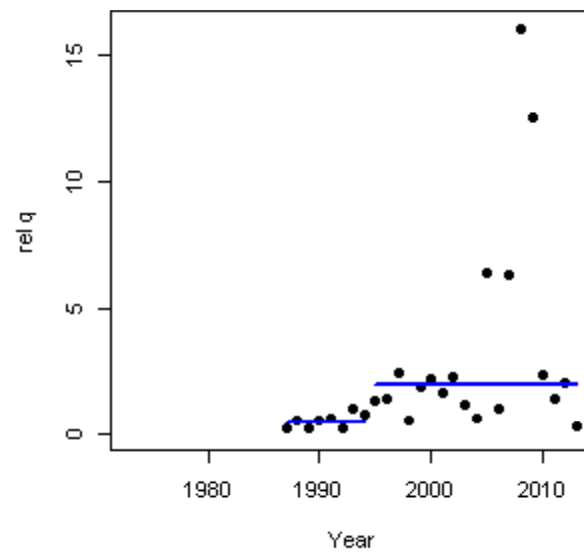
DFO Spring Survey Age 3



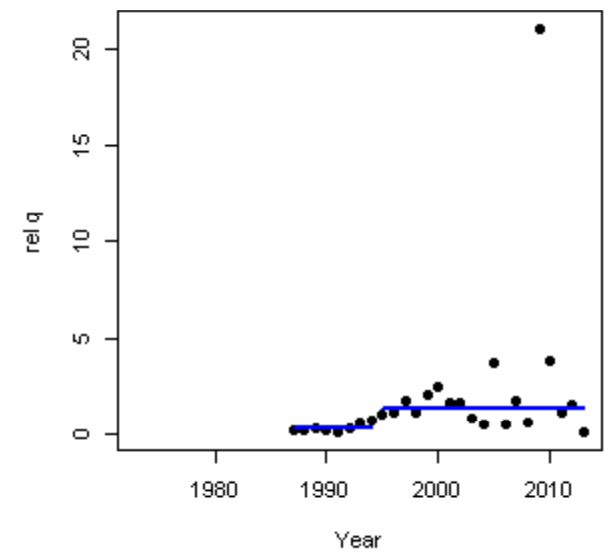
DFO Spring Survey Age 4



DFO Spring Survey Age 5



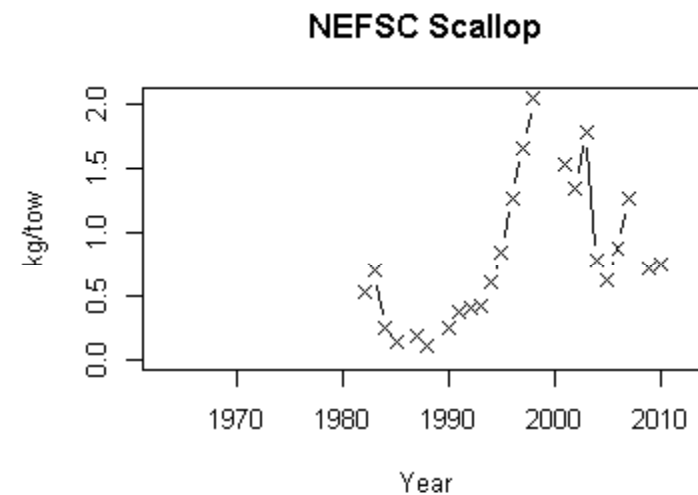
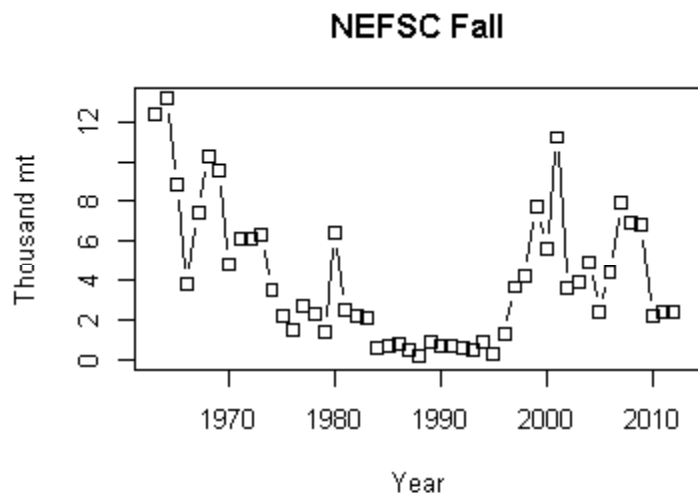
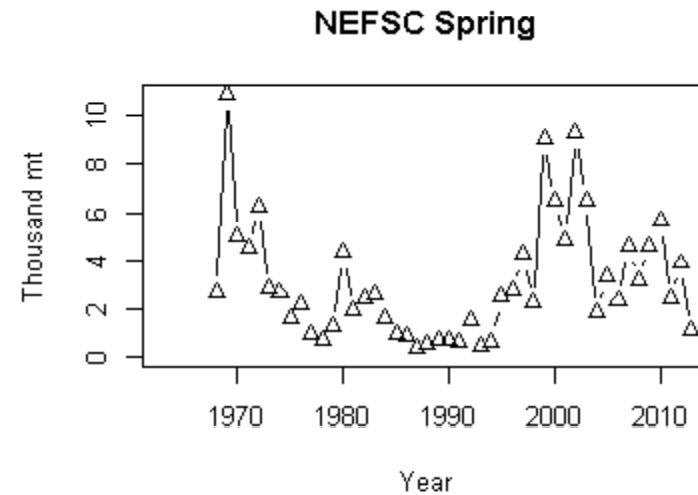
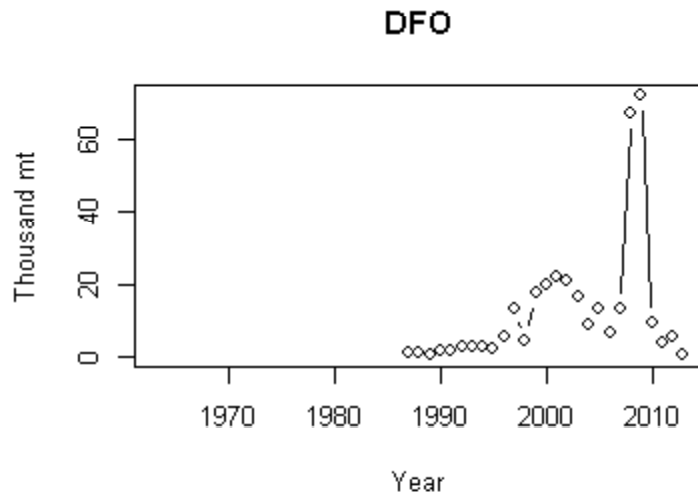
DFO Spring Survey Age 6+



# Surveys

DFO 2<sup>nd</sup> lowest in time series

NEFSC Spring lowest since 1994



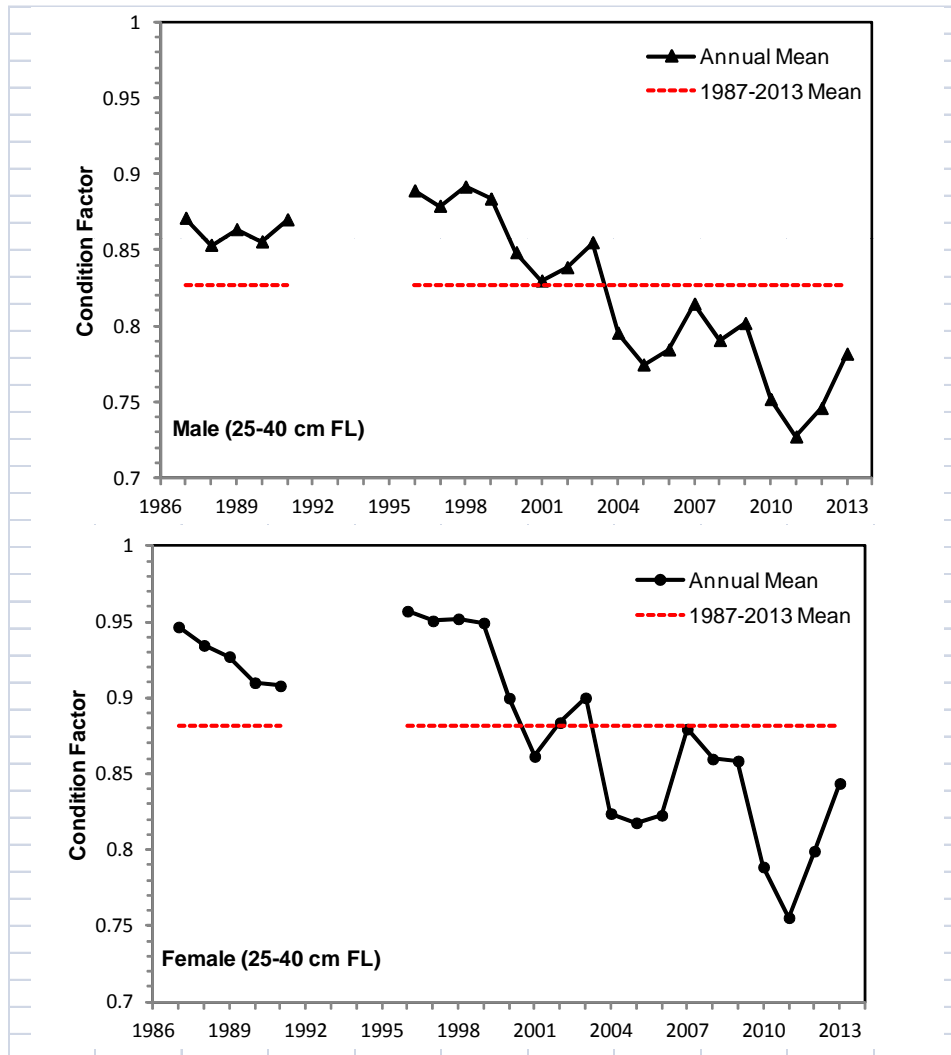
NEFSC Fall same past 3 years  
Low relative to recent 15 years  
High relative to mid-80s-90s

NEFSC Scallop did not sample  
Canadian waters in 2011 or 2012

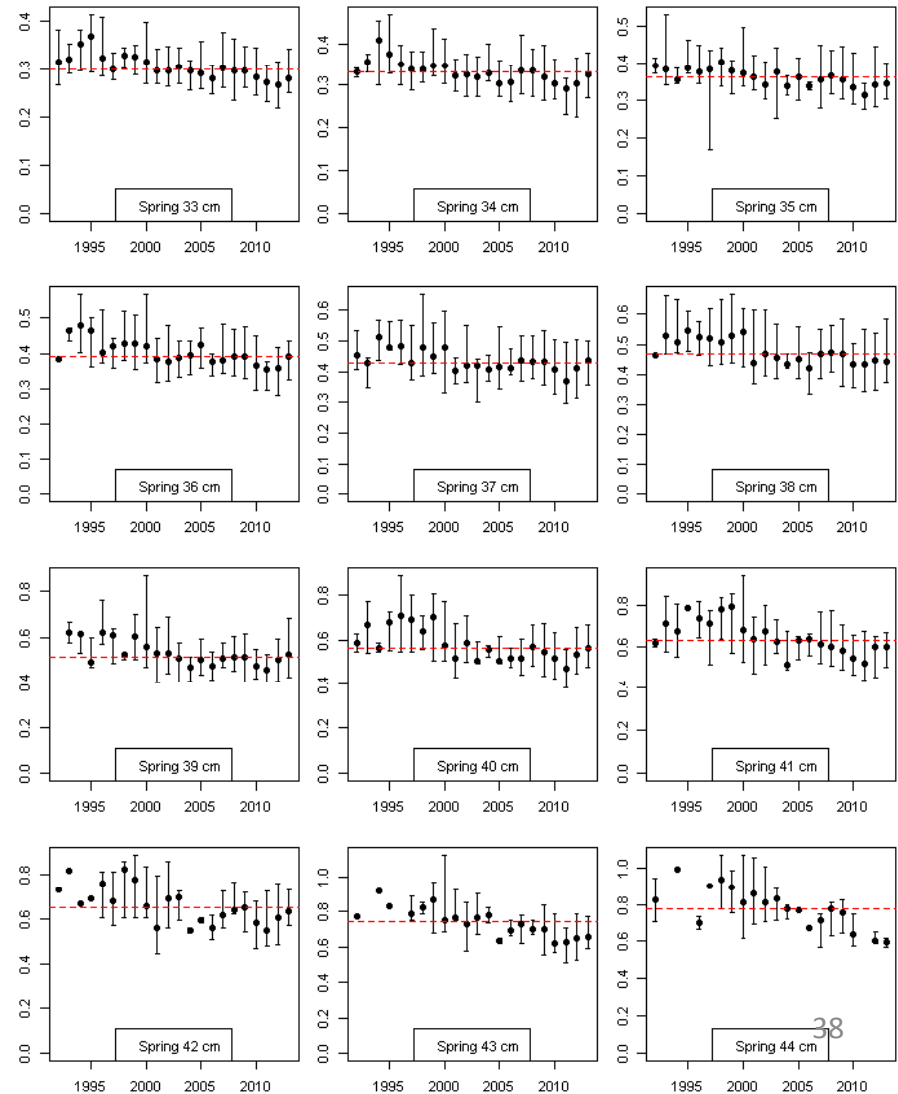
# Biology

- Condition returning towards mean

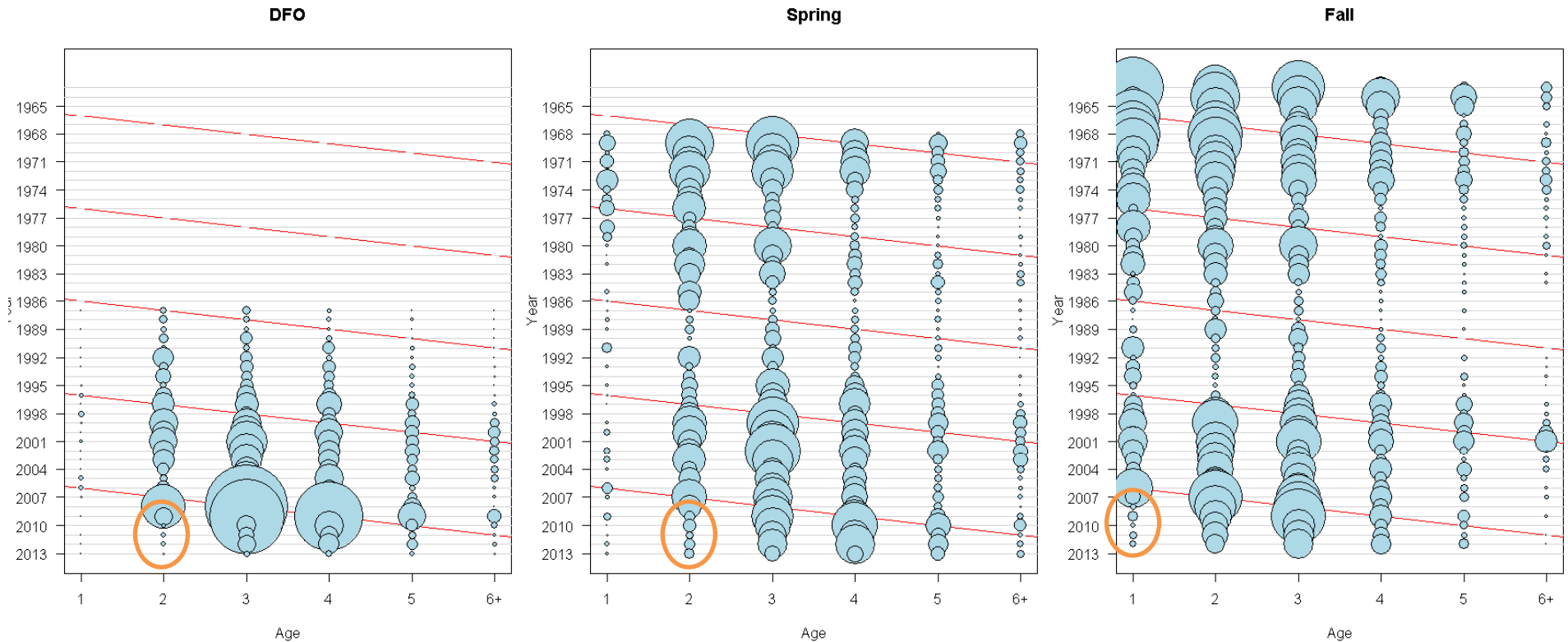
DFO



NEFSC Spring



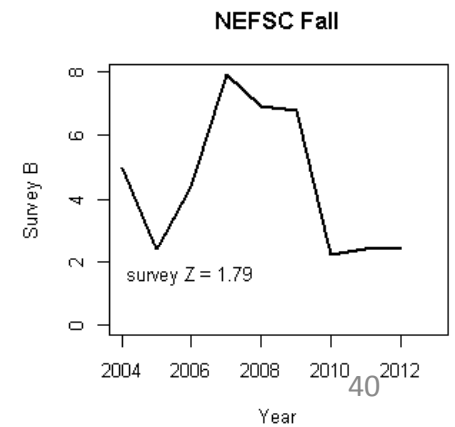
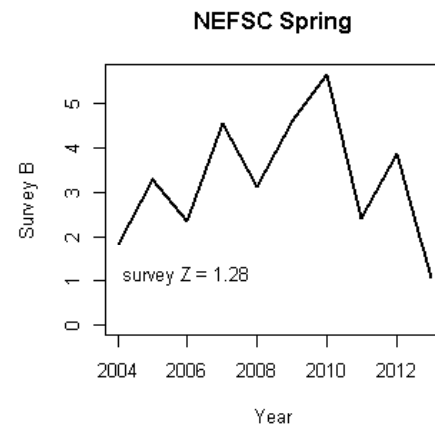
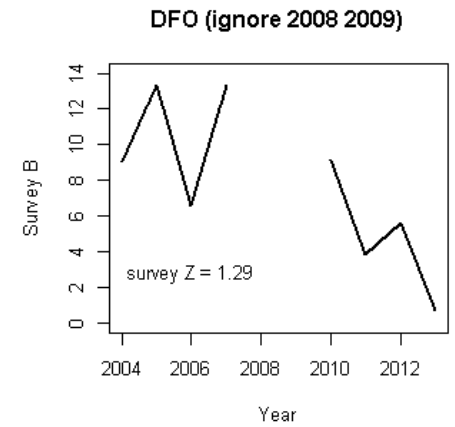
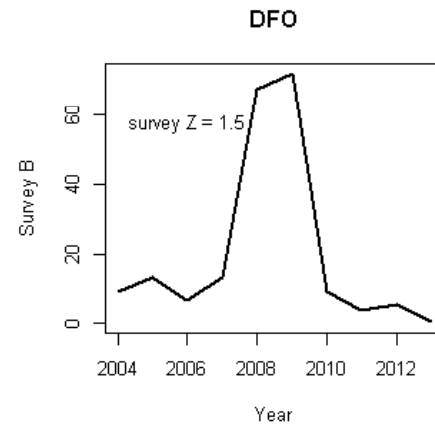
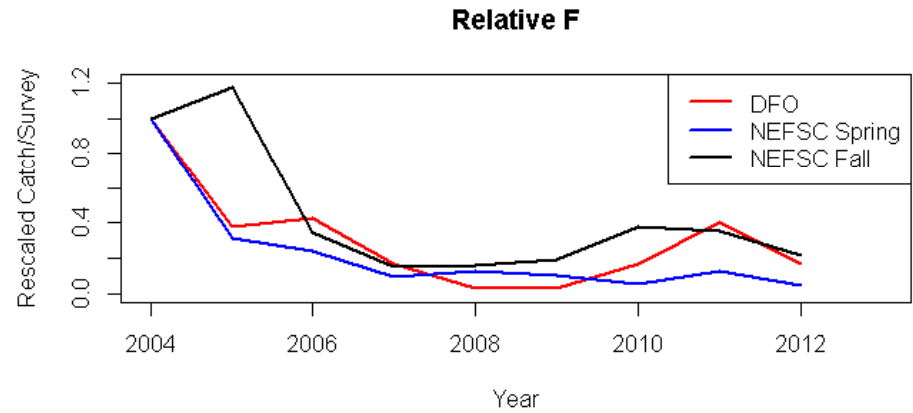
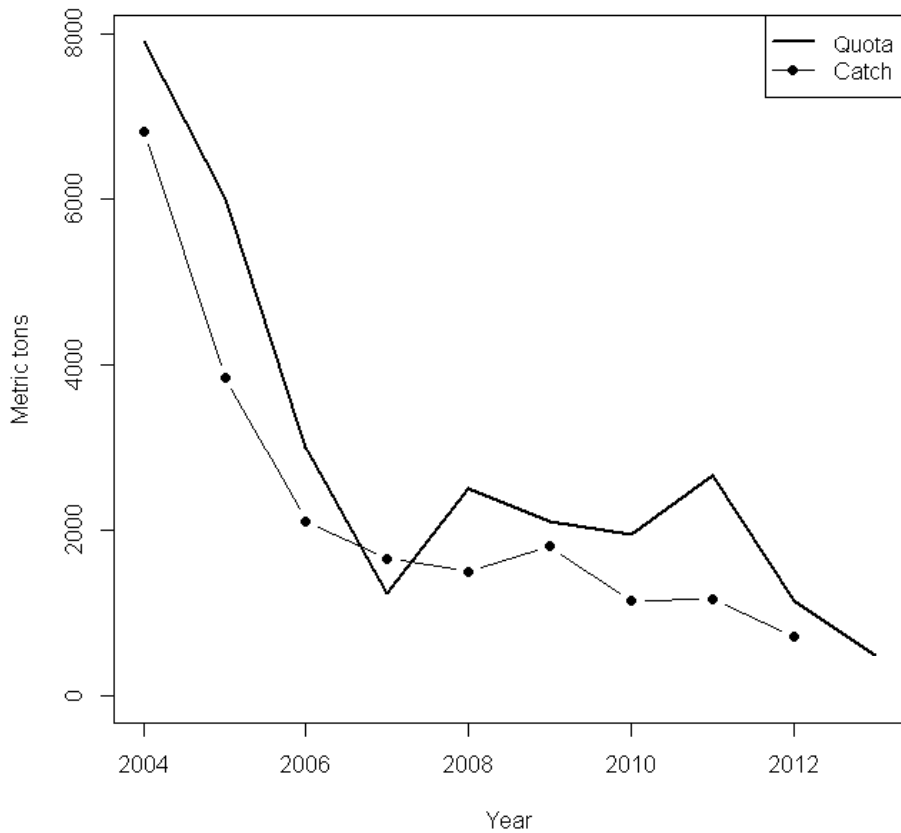
# Survey Recruitment



DFO Age 2 in 2010-2013 the four lowest in time series (27 years, 2013 the lowest)  
NEFSC Spring Age 2 in 2010-2013 ranked 14, 5, 10, 9 lowest out of 46 years  
NEFSC Fall Age 1 in 2009-2012 ranked 16, 5, 10, 9 lowest out of 50 years

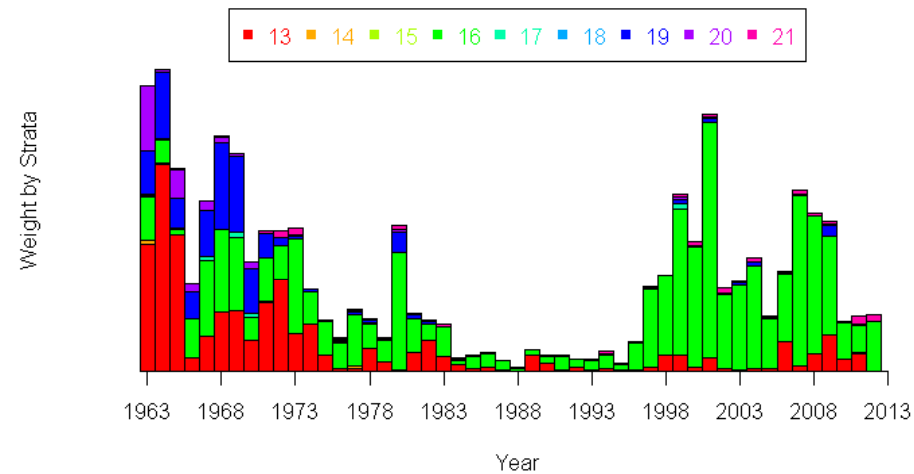
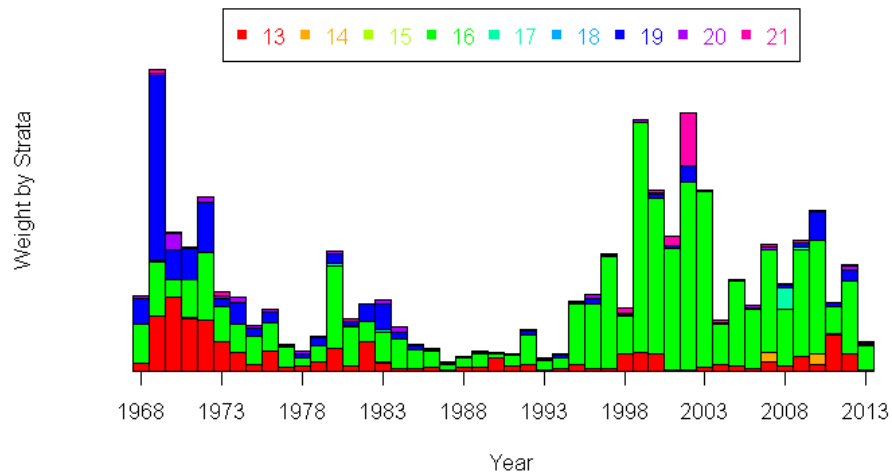
# A look back

How has quota management performed?

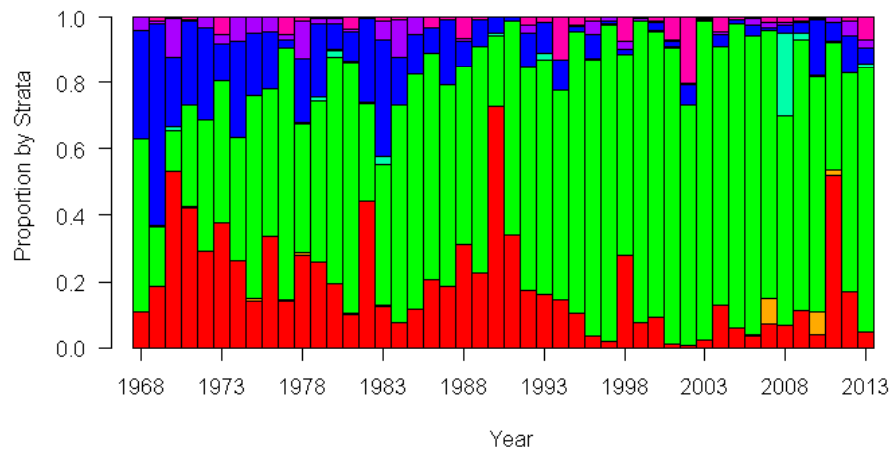




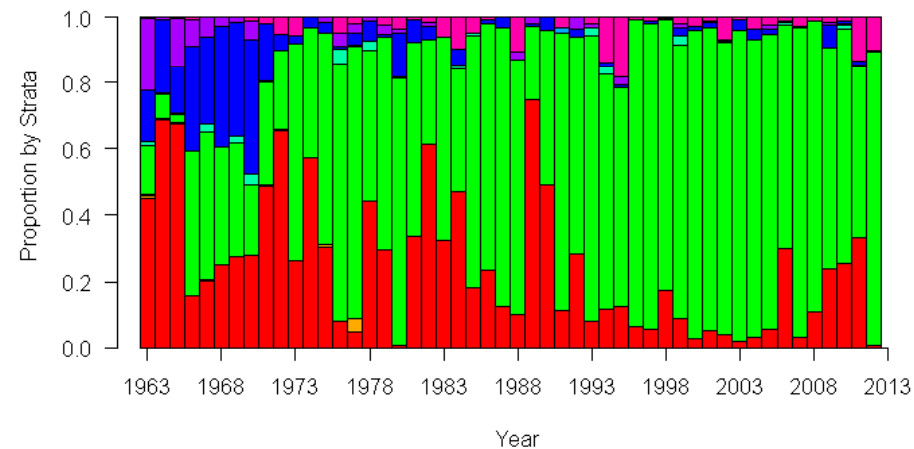
# Concentration in Stratum 16



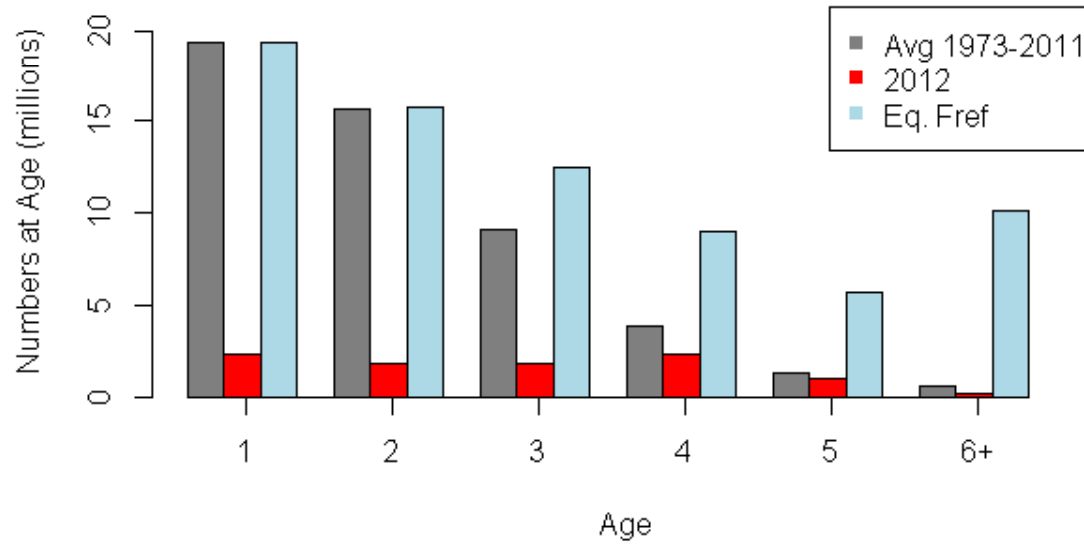
**NEFSC Spring**



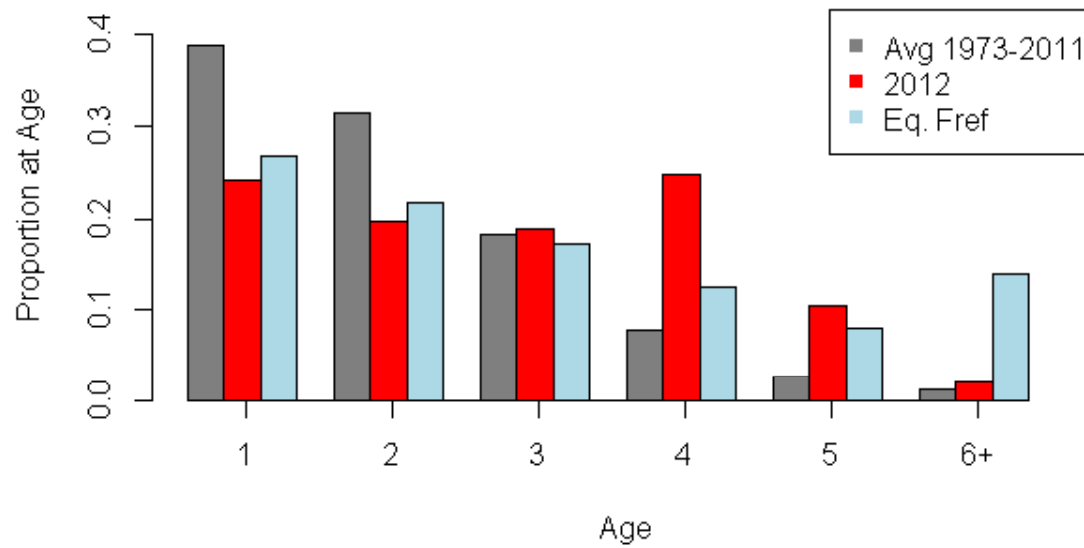
**NEFSC Fall**



### Split Series



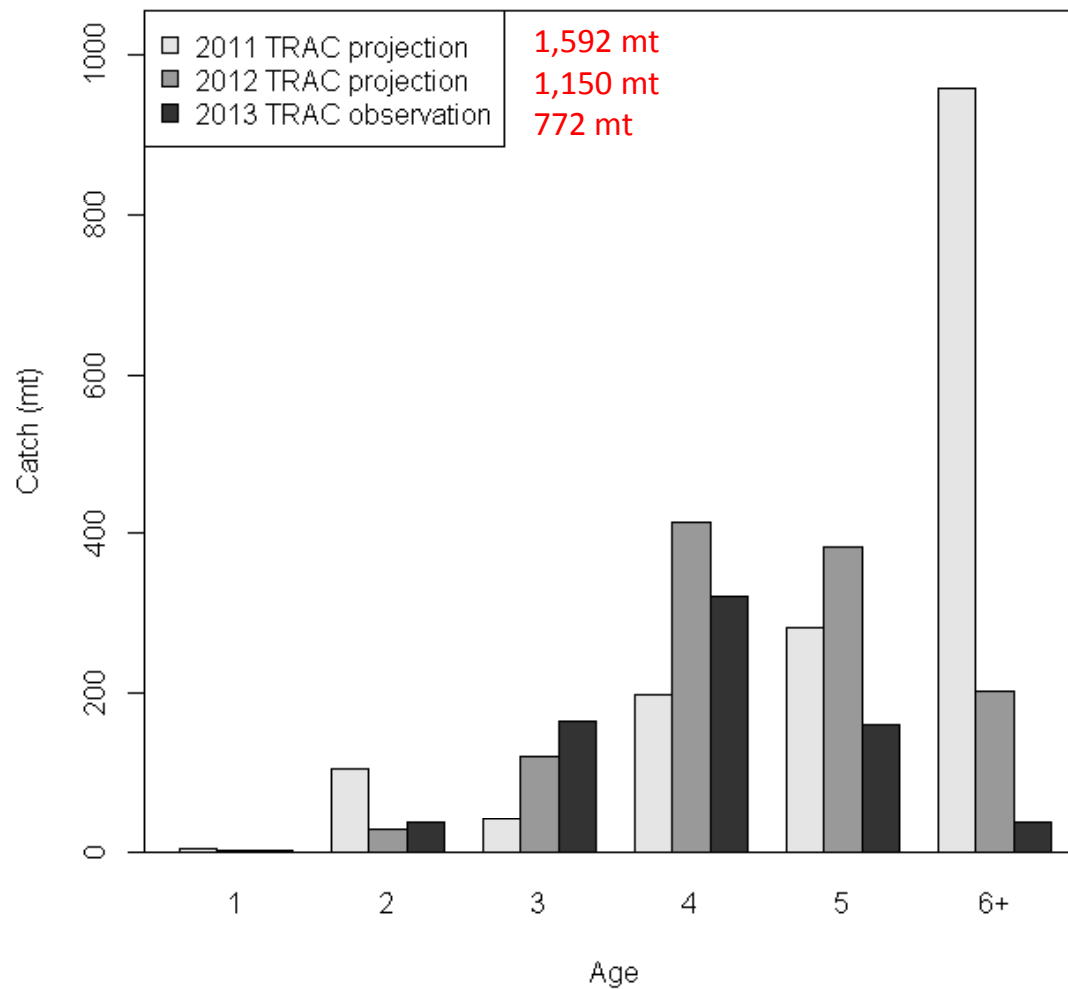
See WP 12 also



# More past performance

Split Series (no rho adjustment)

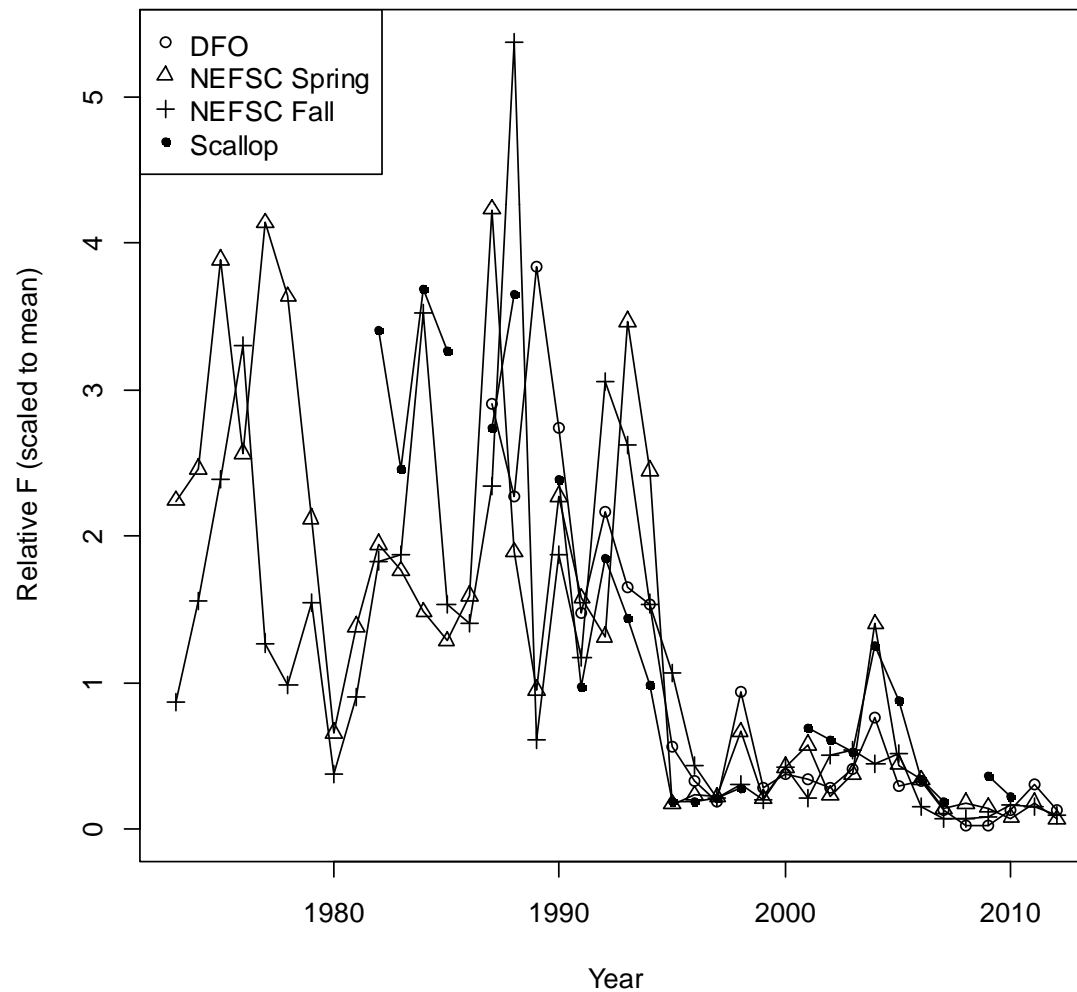
2012 Catch at Age



What happened to old fish?

# Relative F

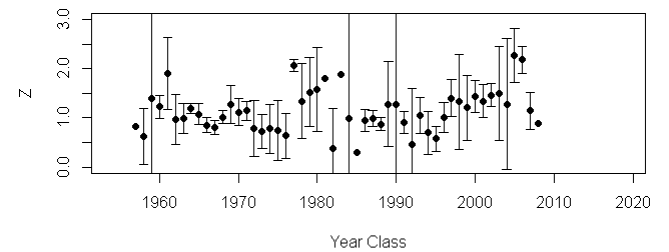
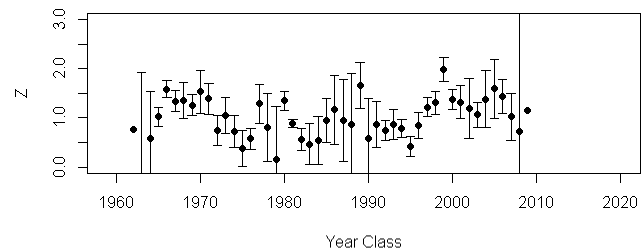
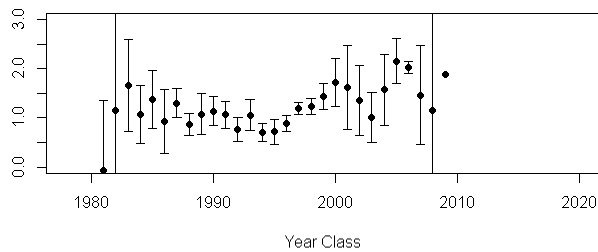
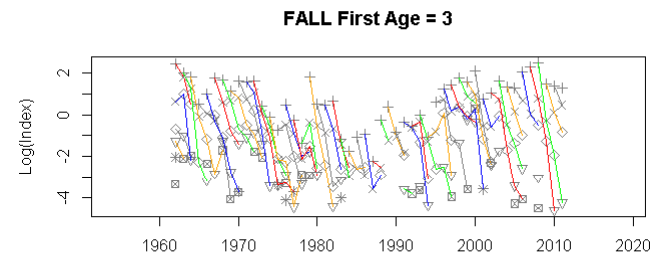
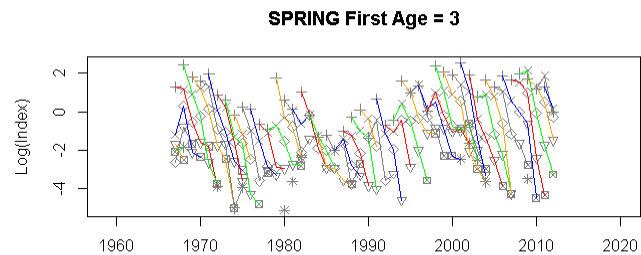
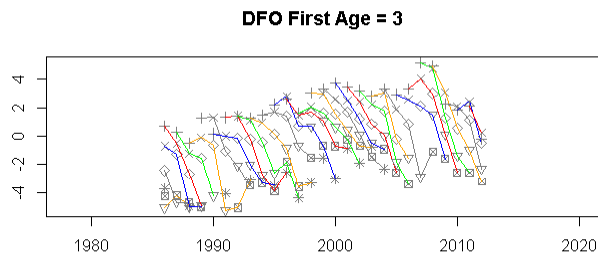
- Continued disagreement with survey Z
- If F has been low since 1995, where are the old fish?



Missing catch?  
Missing M?  
Missing F?

# Survey Z by Cohort

- Generally well above  $Z_{ref}=0.45$
- Flat or increasing trend in Z over time



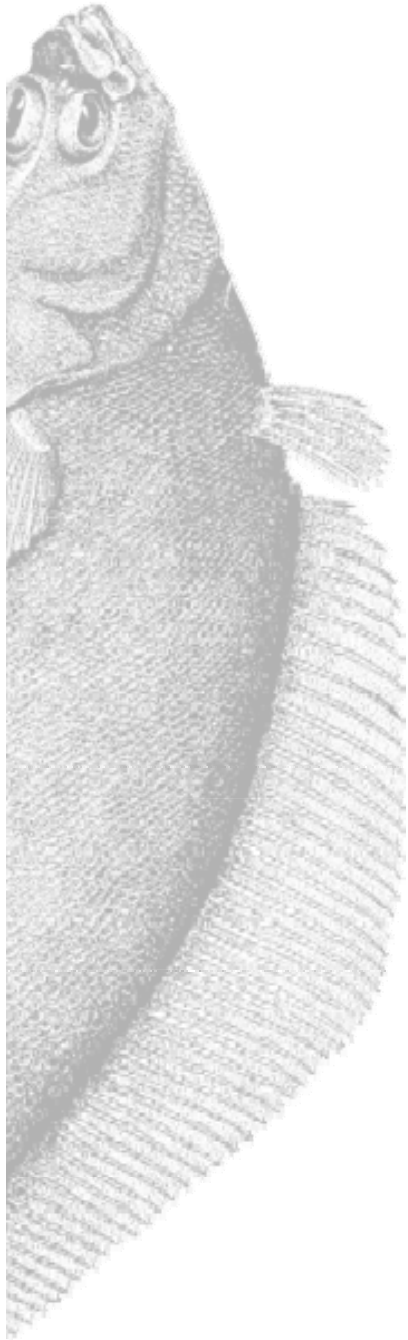
# Retro “fixes”

- Increase catch recent years
  - or decrease catch early years
- Increase M recent years
  - or decrease M early years
- Split surveys again
- Spatial modeling (not done)
- Selectivity changes (not done, but see WP 17)

# Catch Advice under Retro “fixes”

	Split	adjSp	Single	adjSi	Cmults	Mmults	M&C
<b>Fref = 0.25</b>							
Catch	882	190	3183	744	319	331	232
Adult Jan-1 B	4163	881	14900	3441	7497	1931	4270
delta B	20%	56%	-10%	-5%	61%	86%	69%
P(B inc)	1	1	0.001	0.127	1	1	1
P(B inc 10%)	0.974	1	0	0.001	1	1	1
<b>F75%Fref = 0.1875</b>							
Catch	679	146	2454	573	245	253	178
Adult Jan-1 B	4163	881	14900	3441	7497	1931	4270
delta B	25%	61%	-5%	-1%	66%	89%	73%
P(B inc)	1	1	0.045	0.494	1	1	1
P(B inc 10%)	0.998	1	0	0.016	1	1	1

From 2012 TRAC assessment



# Overview

- How did we get here?
  - Brief historical progression
- What is a diagnostic benchmark?
  - Issues with current assessment
- **What will we be doing this week?**
  - **Thumbnail sketch of topics**



# Summary Stats

- 47 papers
- 84 authors (46 unique)
- 10 organizations
- Many, many pages

# What will we be doing this week?

- Movement and Distribution
- Life History
- Catchability
- Biomass
- Reference Points
- Synthesis

# Backgrounders

- WP28 guided tour of yellowtail lit
- WP29 movement in seasonal bycatch survey
- WP30 intrinsic rate of increase
- WP31 disease
- WP32 maturity
- WP33 fecundity
- WP34 prey
- WP35-37 catchability
- WP38-40 missing catch
- WP41 Scotian Shelf survey
- WP42 surplus production from VPA
- WP43 time series of yellowtail prey and predators
- WP44 growth and size structure
- WP47 management

# Things to Think About

- Fitting pieces together
  - Follow hypotheses to conclusion
- Big picture
  - Is stock doing well or in trouble?

# Retro Yellowtail



by Julien Legault