



# Yellowtail Flounder

(*Limanda ferruginea*)

## Cape Cod–Gulf of Maine

Larry Alade and Chris Legault

2015 Groundfish Operational Assessment  
Updates

Northeast Fisheries Science Center

Woods Hole, MA

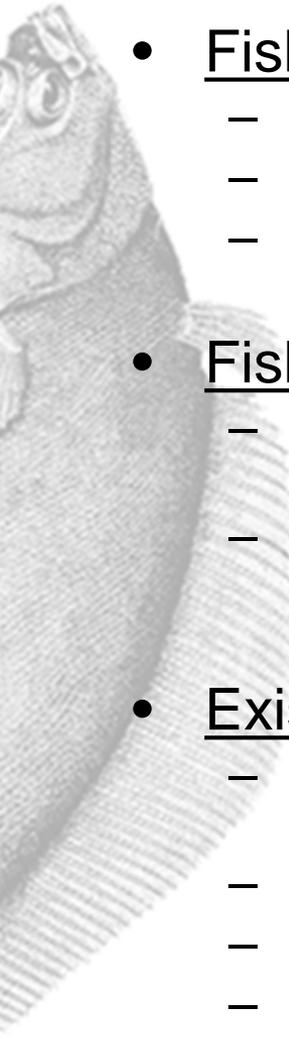
Sept. 14-18<sup>th</sup> 2015

# Previous Assessment

- Groundfish Operational Assessment in 2012
- Emergence of retrospective patterns
- 2012 CCGOM Stock status:
  - Stock was considered Overfished with Overfishing occurring



# Summary of Data and Model Update

- 
- Fishery dependent data (Commercial)
    - Updated Landings (Trip Based allocation) through 2014
    - Updated Discards (SBRM) through 2014
    - Updated Catch #'s and wt. through 2014
  - Fishery Independent data – Surveys swept area estimates)
    - NEFSC and Inshore state surveys (MADMF and MENH) Spring Survey updated through 2015
    - NEFSC and Inshore state surveys (MADMF and MENH) Fall Survey updated through 2014
  - Existing VPA model (Accepted GARM III)
    - Maintained the same formulation from GARM III and changes in 2012 update
    - Catch-at-age and Catch WAA updated through 2014
    - Survey age comp updated through 2014
    - Biological data (M, maturity and Fecundity) maintained from GARM III
    - Persistence of retrospective patterns from the 2012 update
    - Terminal year estimates (F and SSB) were retro adjusted

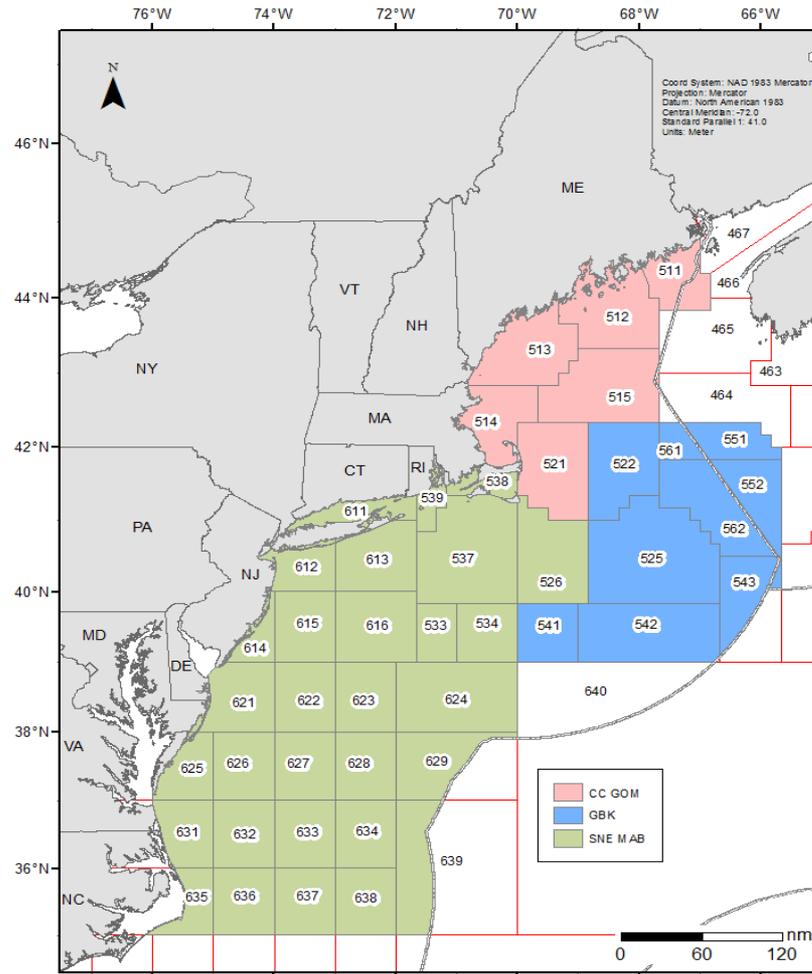


# 2015 CCGOM yellowtail Stock Status

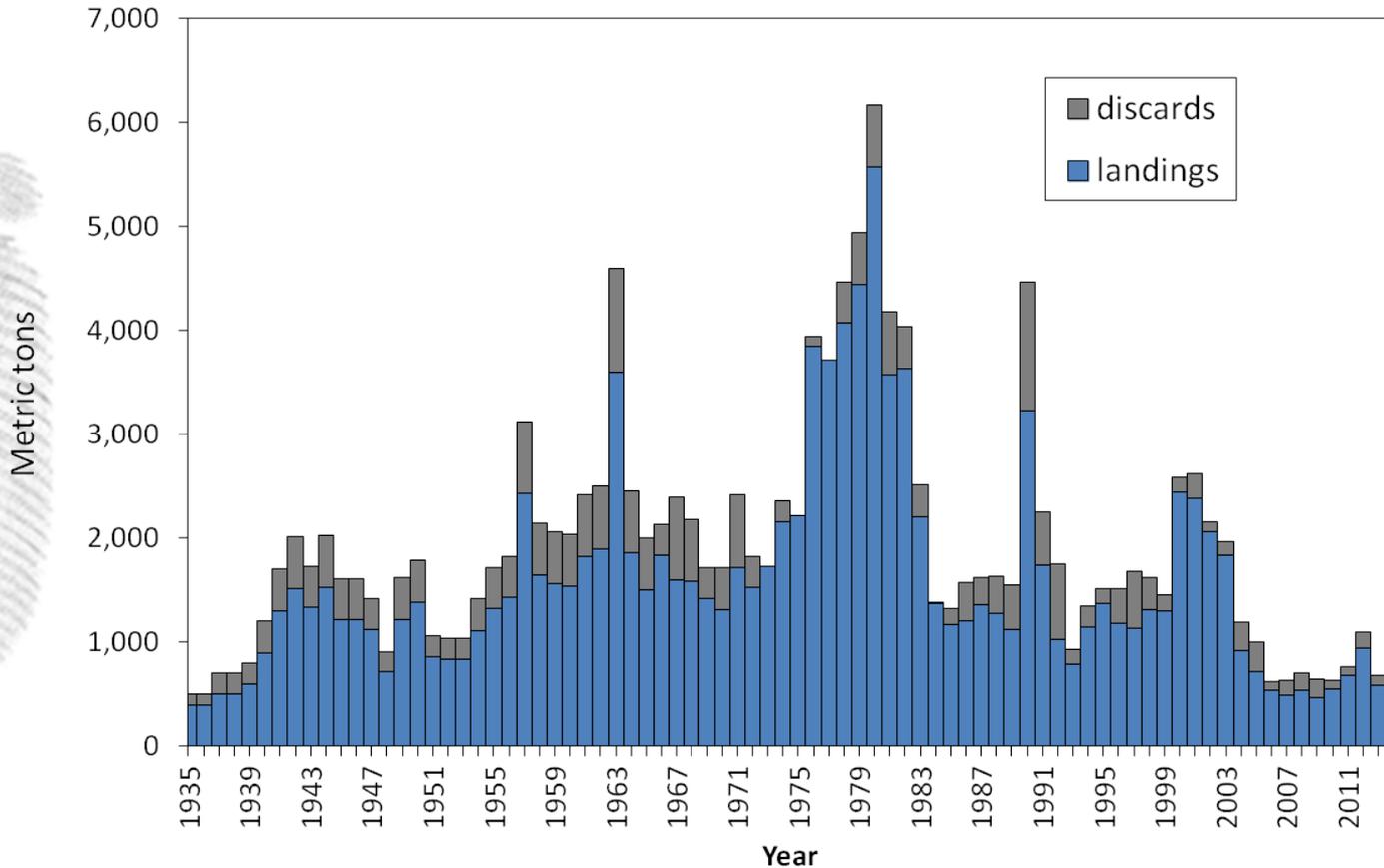
- Current assessments indicate that Southern New England-Atlantic Yellowtail flounder is **overfished** and **overfishing** is occurring.

NO CHANGE IN STOCK STATUS FROM  
THE PREVIOUS 2012 ASSESSMENT  
UPDATE

# Fishery Dependent data



# CCGOM YT Total Catch (mt) (1935-2014)



2014 catches = 421 mt (23% decrease since 2010)

Relative contribution of discards to total catch has been relatively stable (10-14%)

# CV's Landings at Age

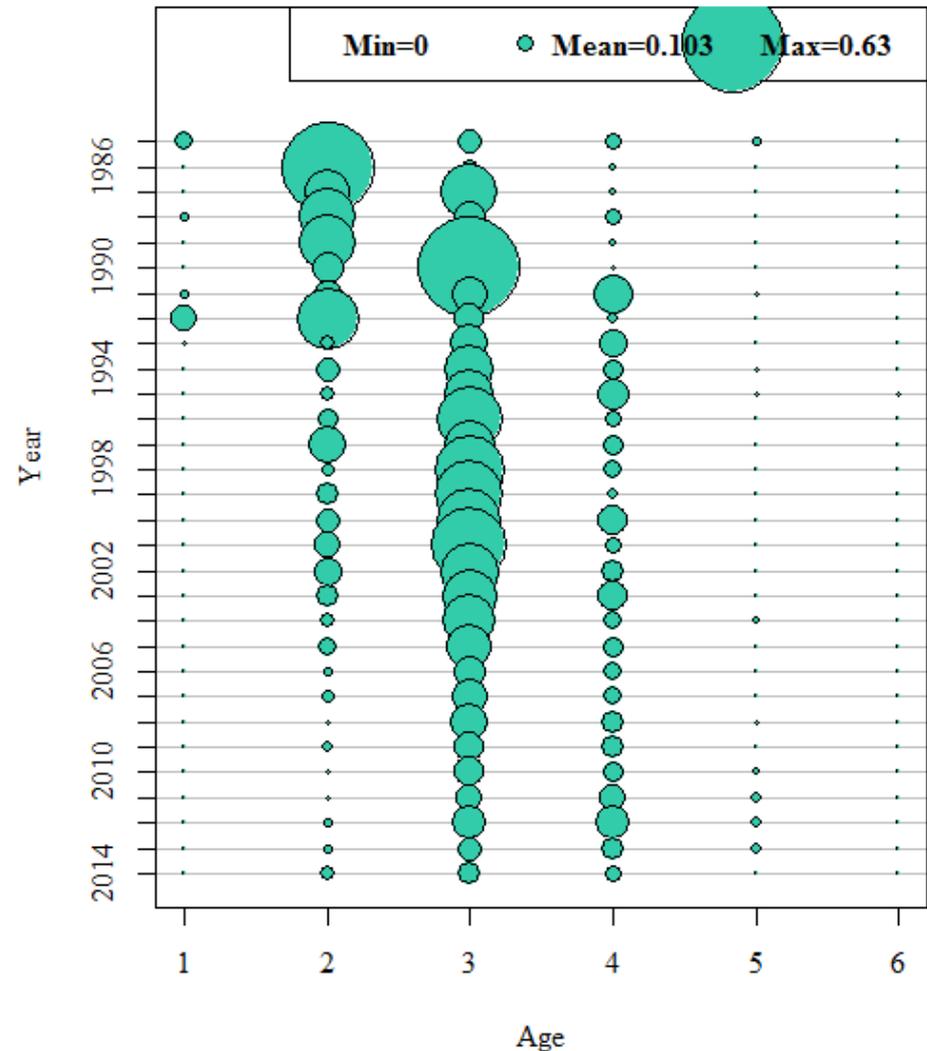


Year	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6+
1994		46%	11%	17%	33%	22%
1995		53%	18%	15%	31%	51%
1996		32%	7%	18%	51%	76%
1997		15%	10%	14%	30%	47%
1998		54%	6%	21%	33%	
1999		53%	13%	22%	111%	128%
2000		13%	5%	7%	27%	41%
2001		19%	5%	17%	30%	48%
2002	73%	13%	6%	11%	26%	55%
2003		16%	6%	8%	21%	30%
2004		28%	8%	8%	19%	28%
2005		20%	6%	8%	18%	32%
2006		15%	9%	9%	35%	25%
2007		10%	4%	7%	24%	31%
2008		26%	5%	6%	19%	33%
2009	135%	21%	6%	6%	15%	54%
2010	138%	21%	8%	7%	11%	43%
2011		18%	3%	2%	2%	10%
2012	21%	6%	3%	1%	1%	4%
2013	20%	7%	4%	3%	3%	10%
2014	33%	7%	6%	2%	11%	14%

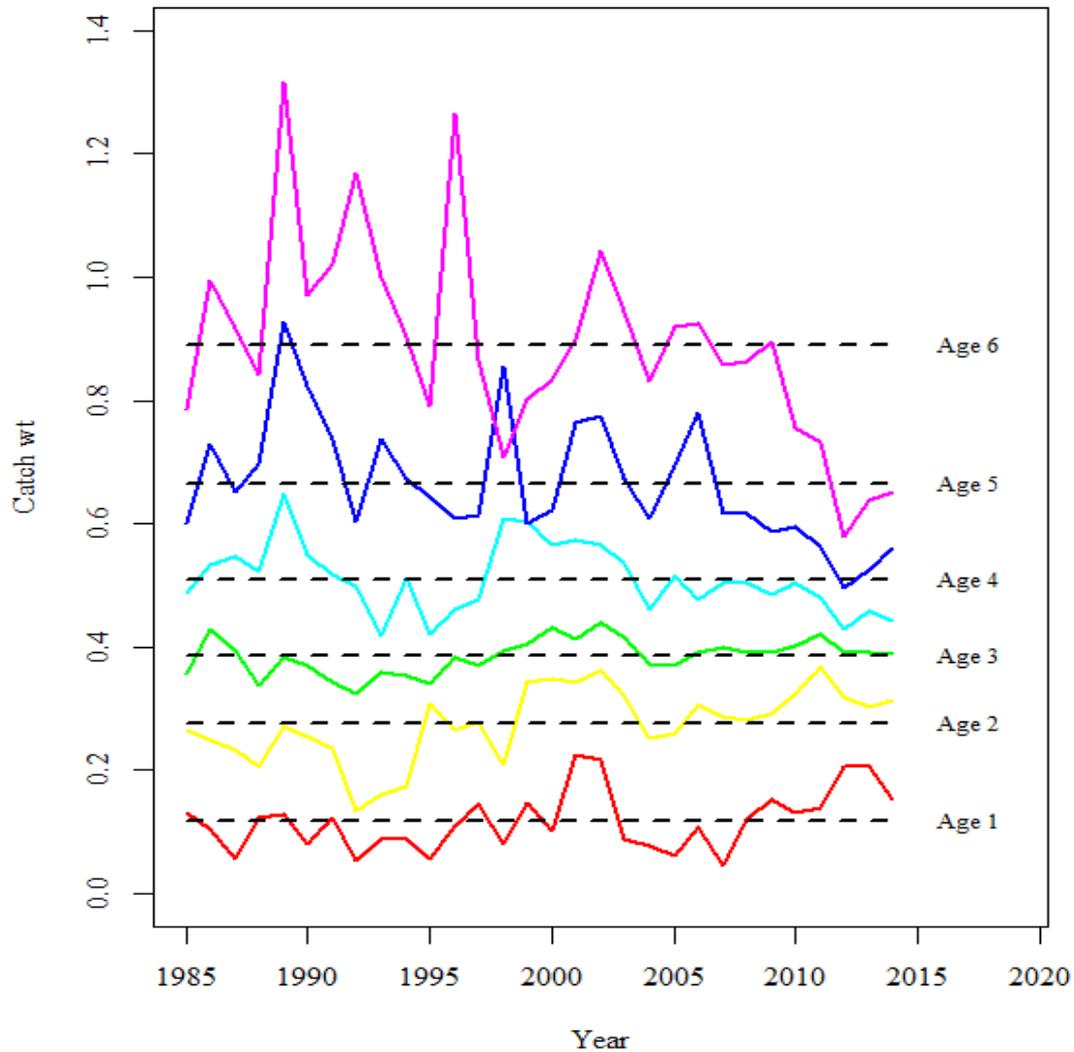
# Catch at Age

- Ages-3 & 4 continue to dominate majority of the catches
- Decline of age-3 contribution over time
- Minimal catches at the older ages (ages 6+)

Commercial Catch-at-Age

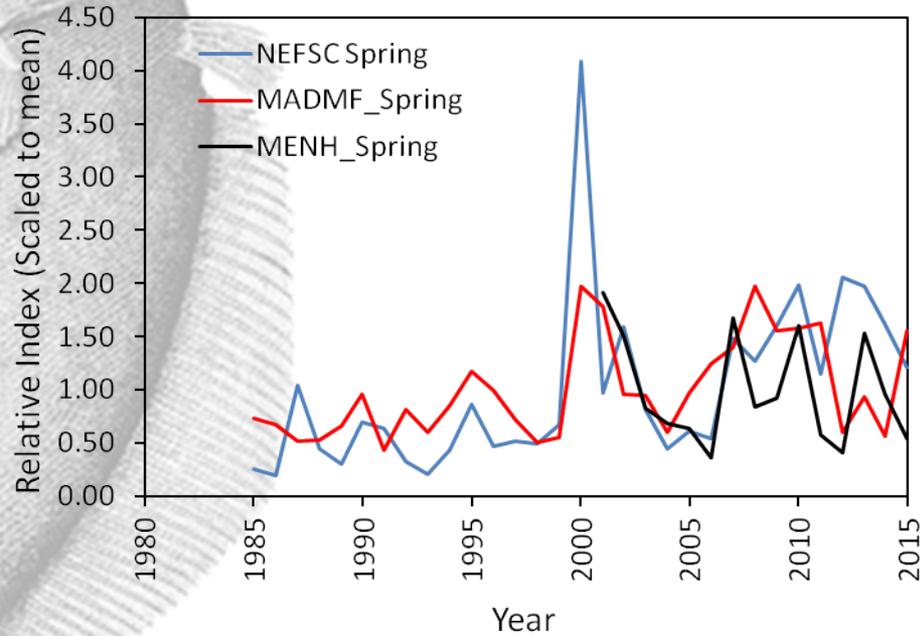


# Weights At Age Plots

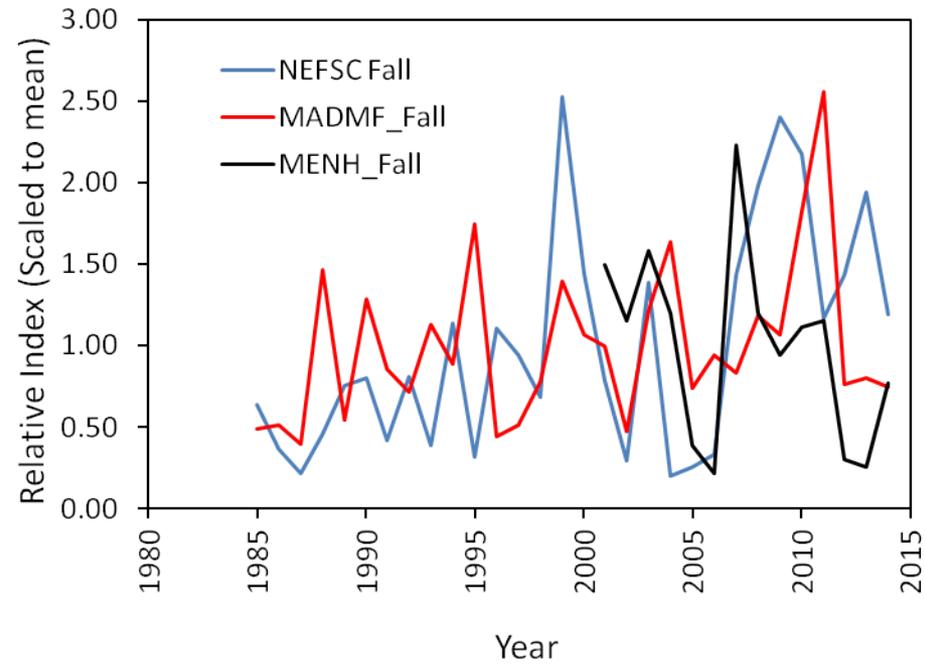


# Trends in Survey Biomass

## Spring



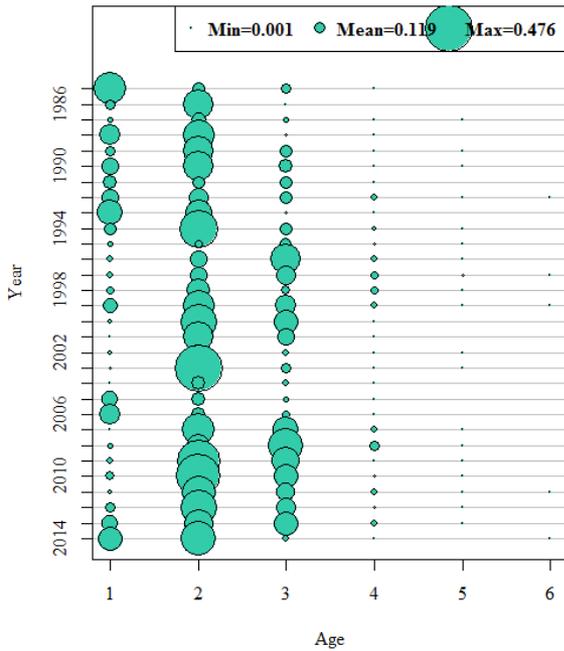
## Fall



# FALL Survey Age Composition

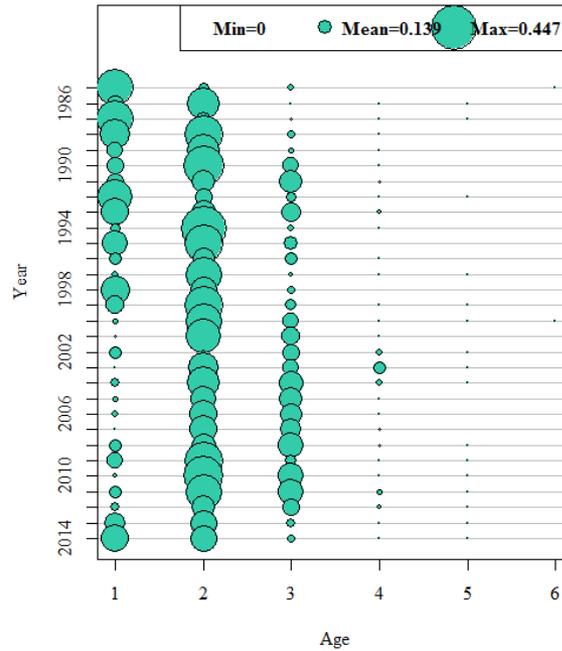
## FALL NEFSC (85-14)

NEFSC Fall Survey



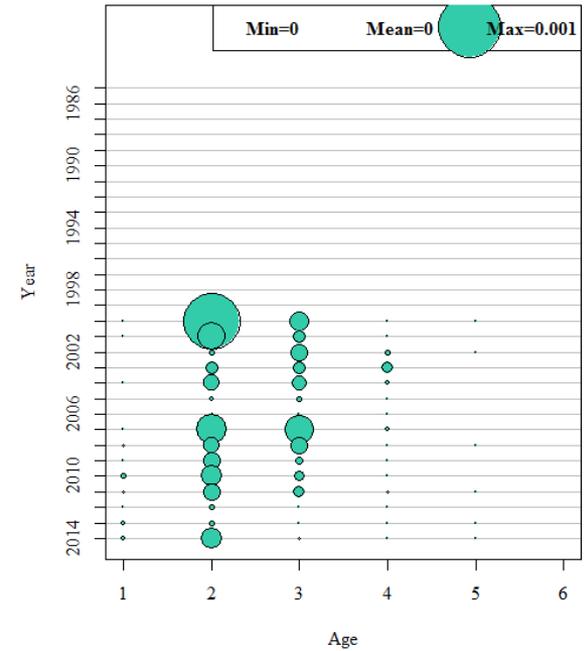
## FALL MADMF (85-14)

MADMF Fall Inshore State Survey



## FALL MENH (00-14)

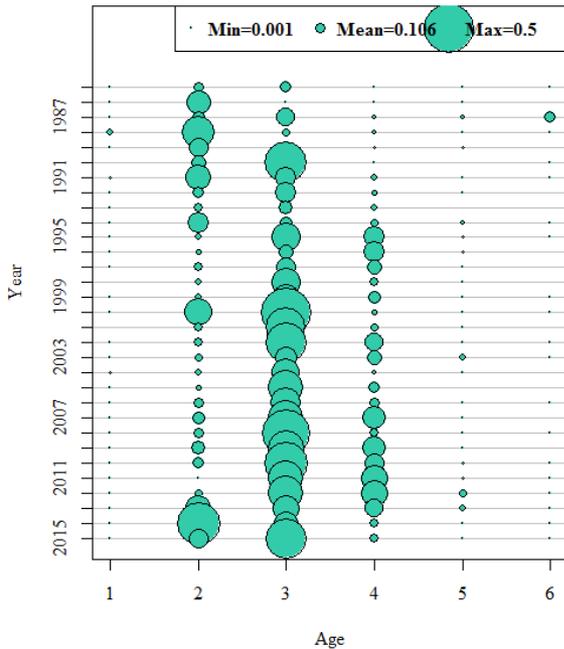
MENH Fall Inshore State Survey



# Spring Survey Age Composition

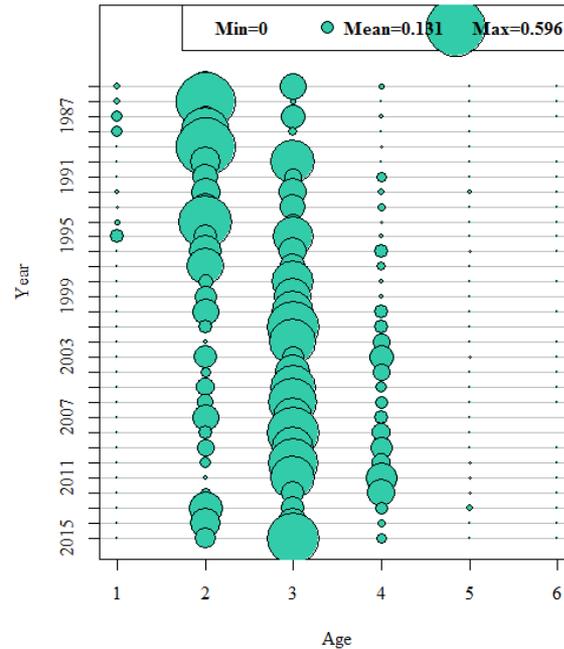
## SPRING NEFSC (85-15)

NEFSC Spring Survey



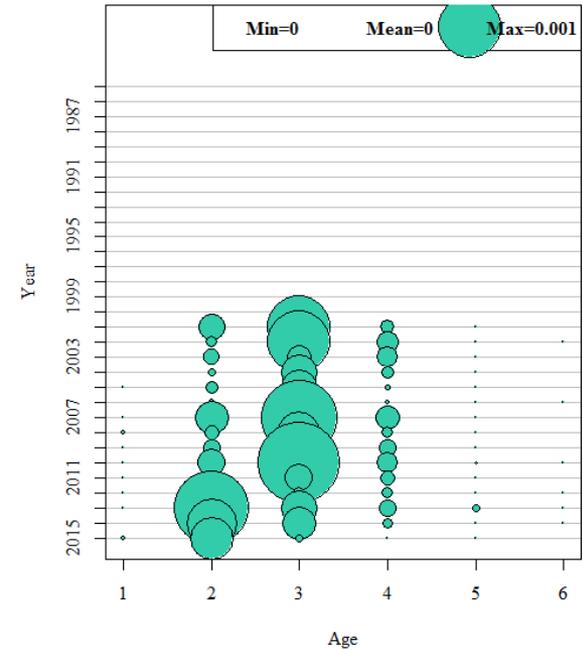
## SPRING MADMF (85-15)

MADMF Spring Inshore State Survey



## SPRING MENH (01-15)

MENH Spring Inshore State Survey



# VPA Model Formulation

- Based on the accepted GARM III Benchmark assessment model
- VPA model (1985-2014); Ages 1-6+
- Commercial catch-at-age (landings + discards)
- VPA tuned to six age-specific surveys
  - NEFSC and Mass DMF (Spring 1-6+; Fall 1-5)
  - ME/NH surveys (Spring 2-5; Fall 2-4)
- Constant  $M = 0.2$
- Commercial Catch and catch weights at age (landings plus discards)
- Bootstrapped to evaluate precision of 2014 SSB and fully selected average  $F$
- Retrospective analyses (Mohn's  $Rho$  – 7yr peel)

# VPA Results

- *Diagnostic for VPA Update*
  - *Stock Numbers Predicted in Terminal Year +1*

Age	Estimate	S.E.	CV
2	8384	3173	0.38
3	5086	1463	0.29
4	2006	529	0.26
5	611	174	0.28

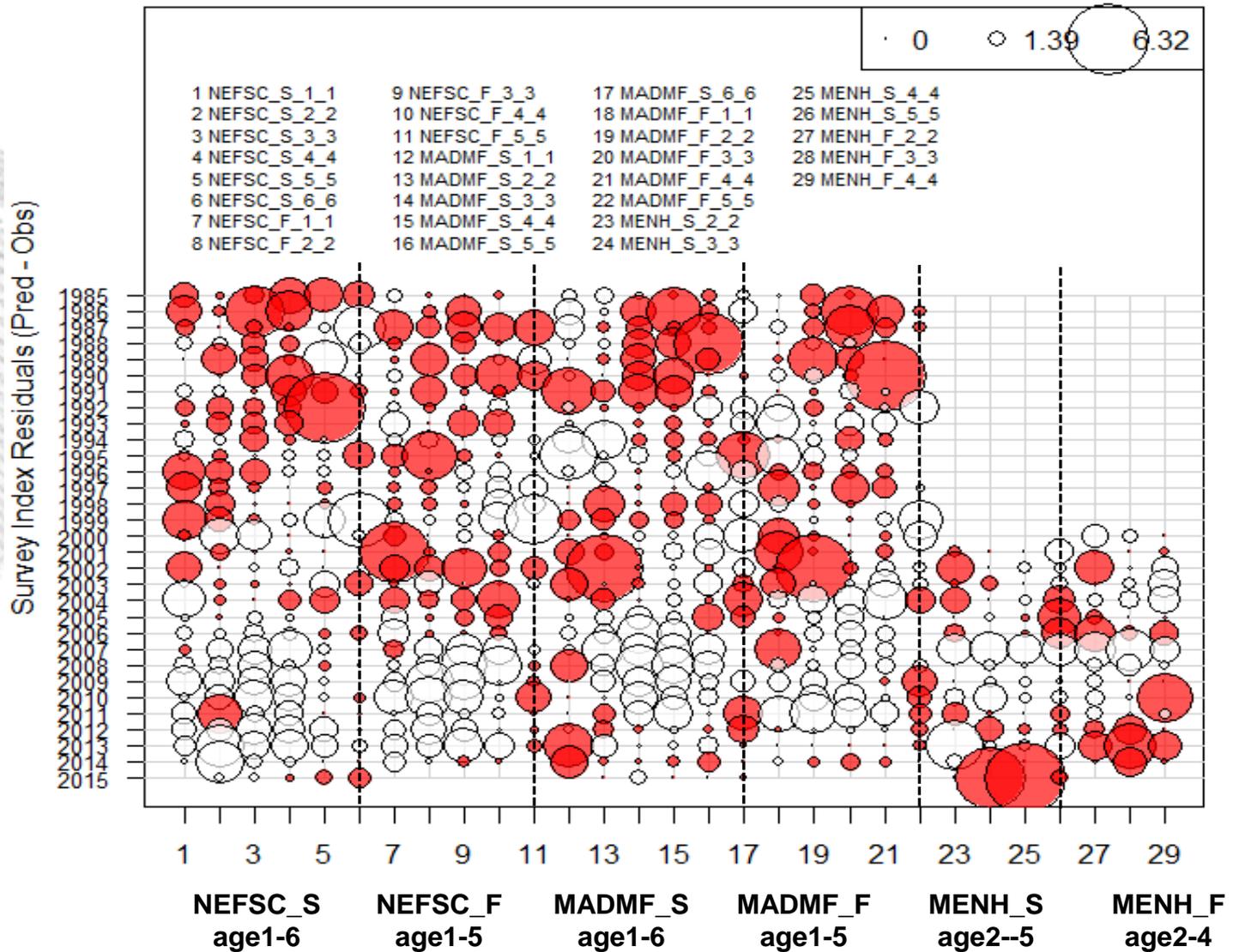
- *Diagnostic for VPA Update*
  - *CV Catchability coefficients for each survey used*

Spring Survey	Min_CV	Max_CV	Fall Survey	Min_CV	Max_CV
NEFSC_SPR	0.15	0.28	NEFSC_SPR	0.13	0.37
NEFSC_FALL	0.16	0.32	NEFSC_FALL	0.14	0.40
MA_SPR	0.12	0.24	MA_SPR	0.13	0.31
MA_FALL	0.13	0.30	MA_FALL	0.13	0.41
ME_SPR	0.15	0.30	ME_SPR	0.13	0.37
ME_FALL	0.17	0.45	ME_FALL	0.21	0.33

# VPA Results

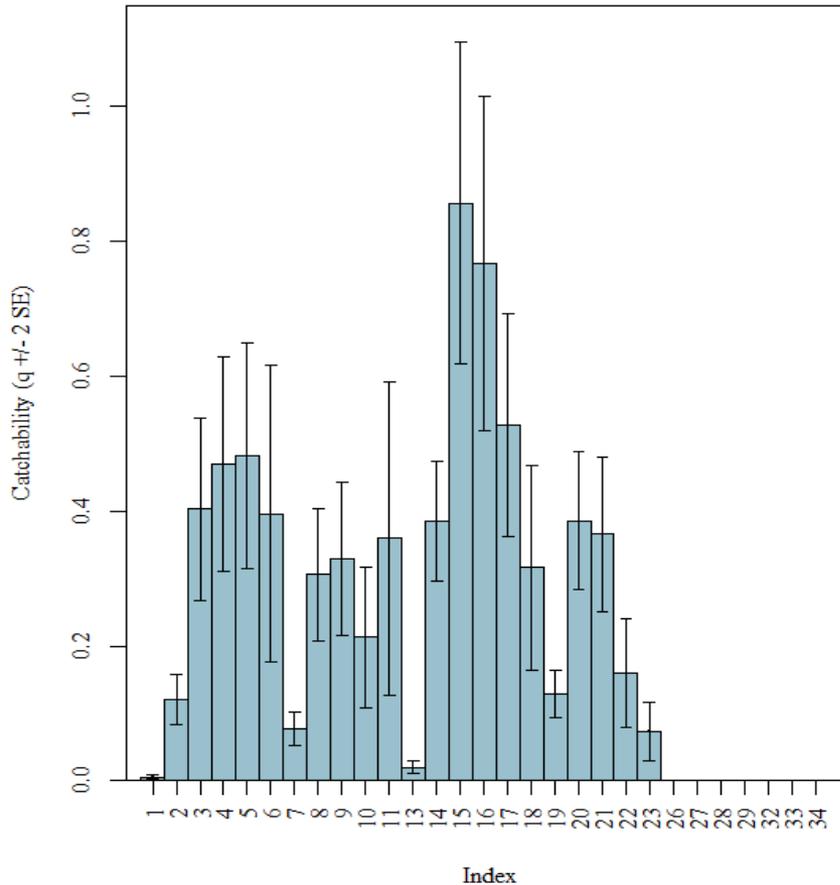
## Survey Residuals

Survey Residuals (Pos=white, Neg=red)



# VPA Results

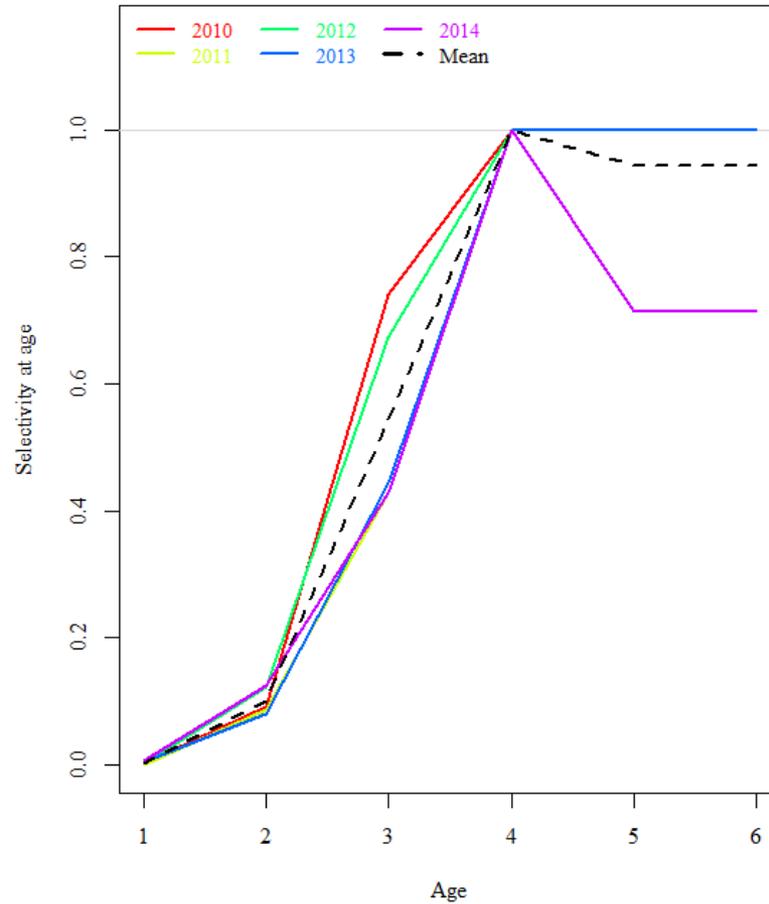
- *Diagnostics for VPA Update*
  - Q plots and 90% CI



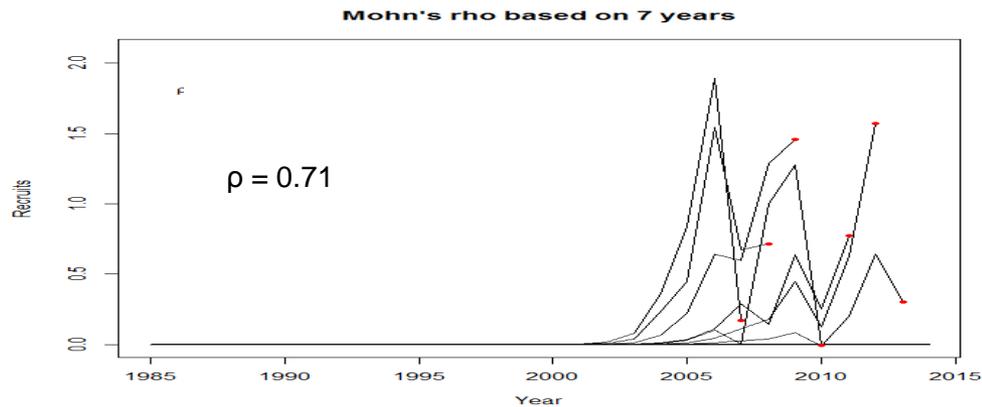
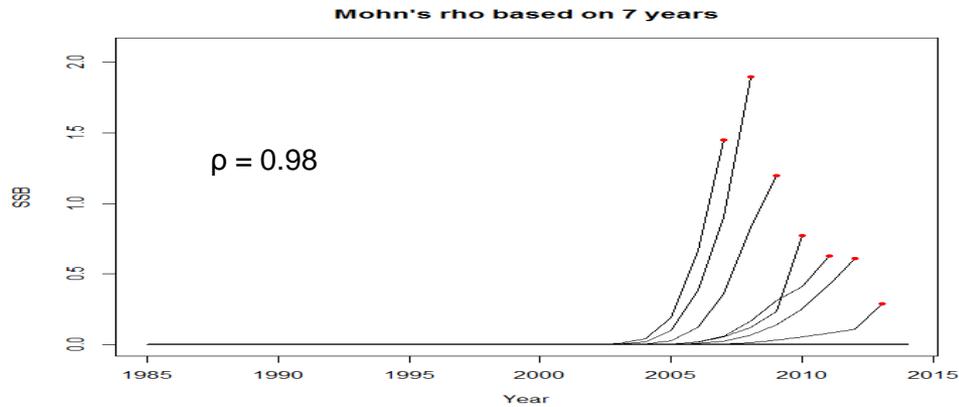
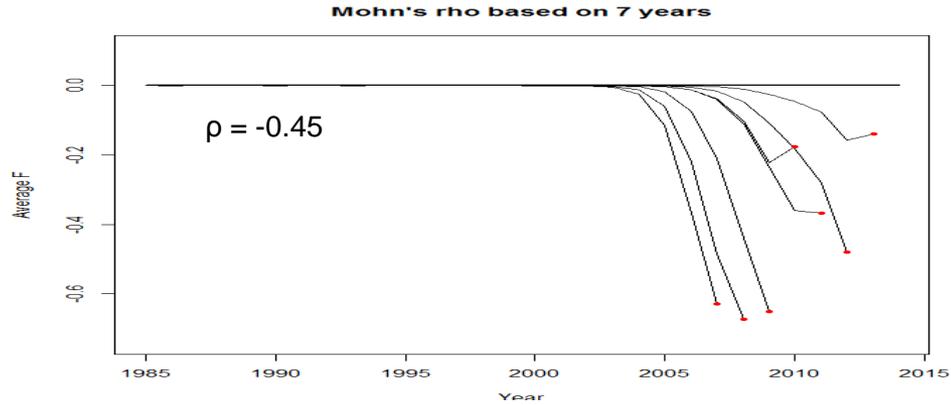
1-6 = NEFSC\_Spr  
7-11 = NEFSC\_Fall  
13-18 = MADMF\_Spr  
19-23 = MADMF\_Fall  
26-29 = MENH\_Spr  
32-34 = MENH\_Fall

# VPA Results

- *Diagnostics for VPA Update*
  - PR or selectivity at age



# Retrospective Analyses

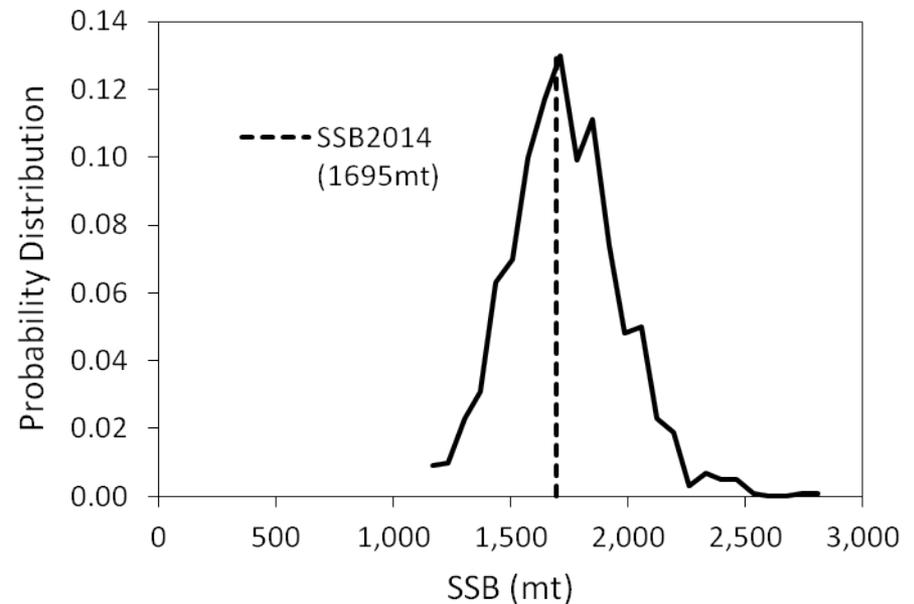
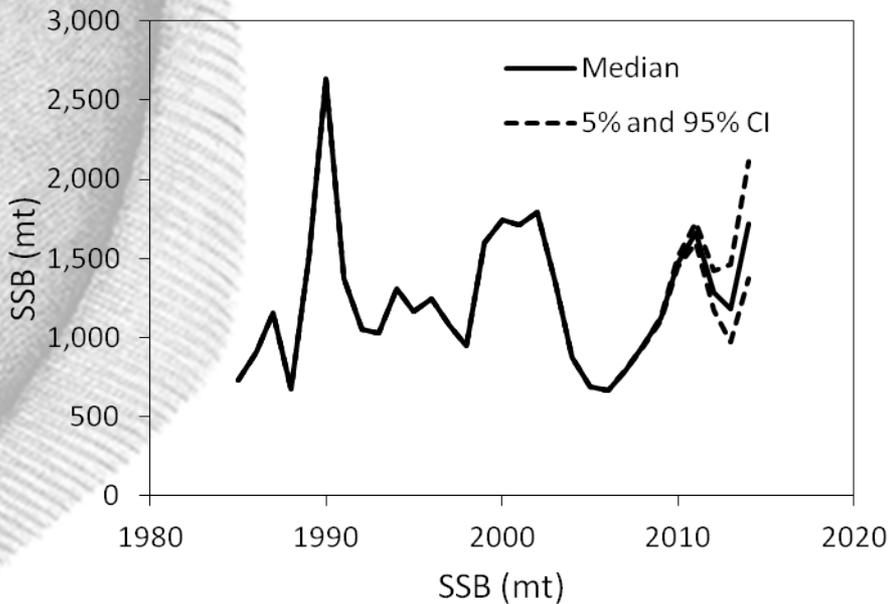


# VPA Bootstrap Results

- *VPA Model Update*

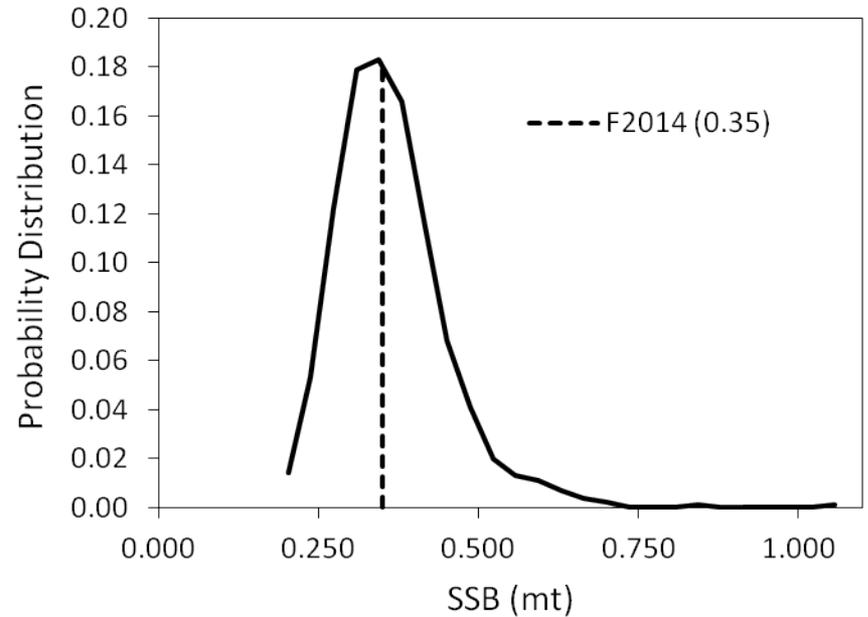
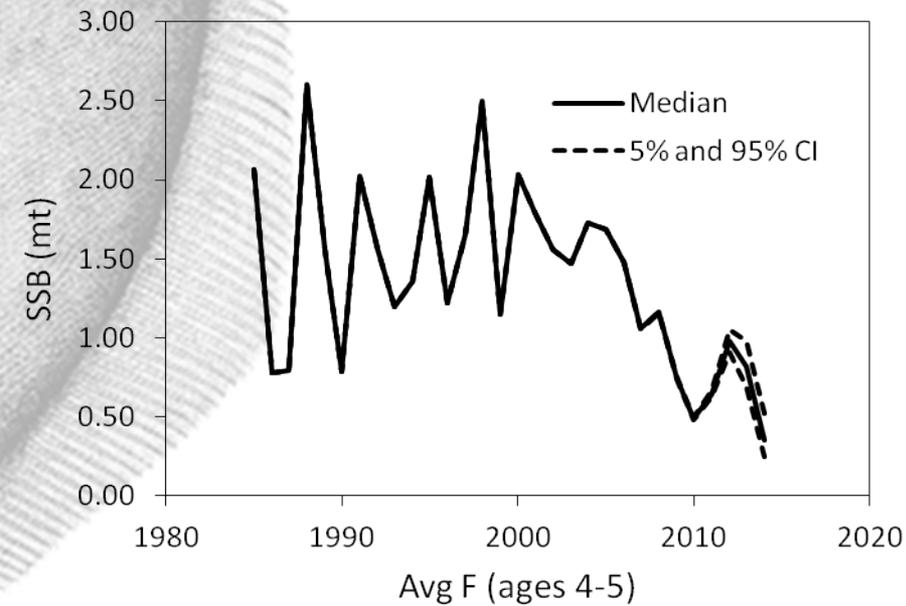
- Results: Spawning Biomass

- Point estimates range from 697 mt (2006) to 2,632 mt (1990)
    - 2014 SSB = 1,695 mt (90% PI = 1,395 – 2,111 mt).



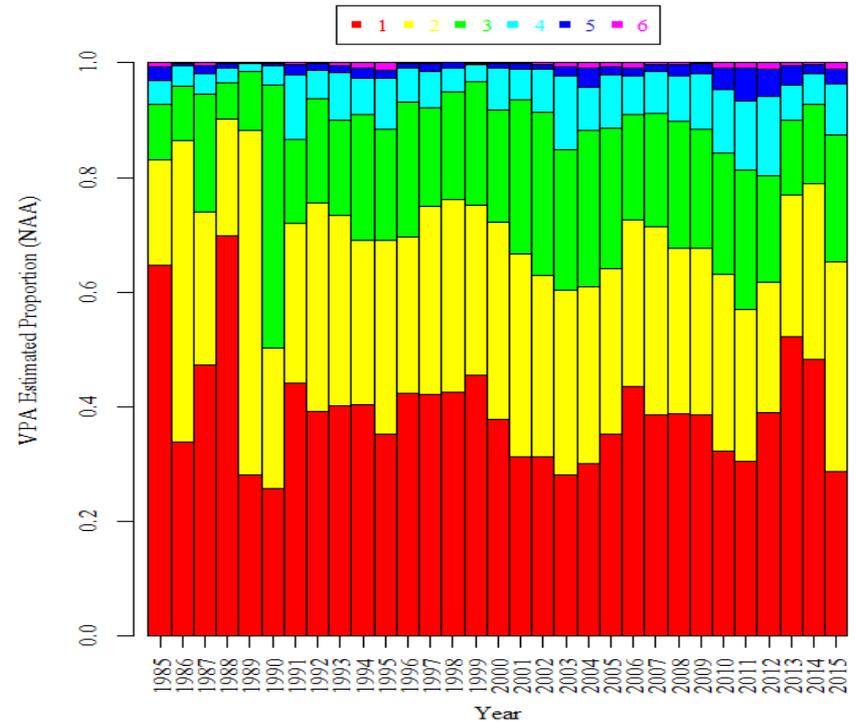
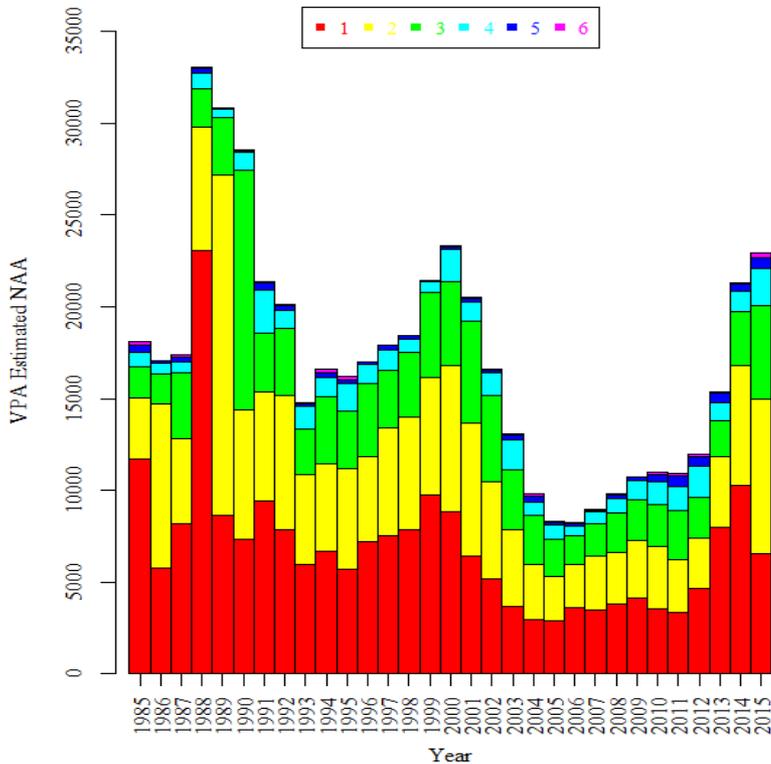
# VPA Bootstrap Results

- *VPA Model Update:*
  - Results: Fully selected fishing mortality
    - Point estimates range from 0.35 (2014) to 2.60 (1988)
    - Current SSB = 0.355 (95% PI = 0.246 – 0.524).



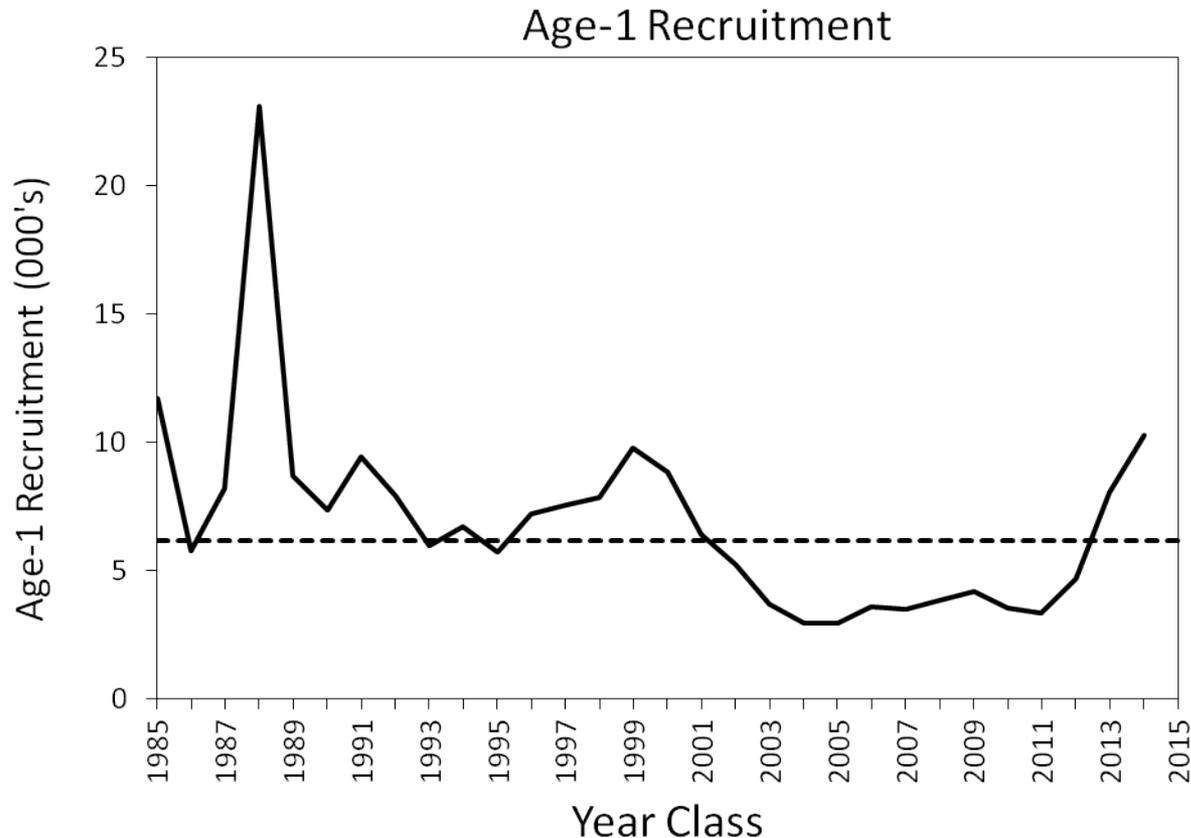
# VPA Estimate of Abundance-at-age

- VPA Model Update:
  - Results: Current population structure is comprised primarily of ages 1-3 (87%)
  - Approximately 13% of the population is made up of ages 4 and older



# VPA Estimate of Age-1 Recruitment

- *VPA Model Update:*
  - Results: Geometric mean of age 1 recruitment = 6.1 million fish
  - Recent recruitment is above the long-term mean

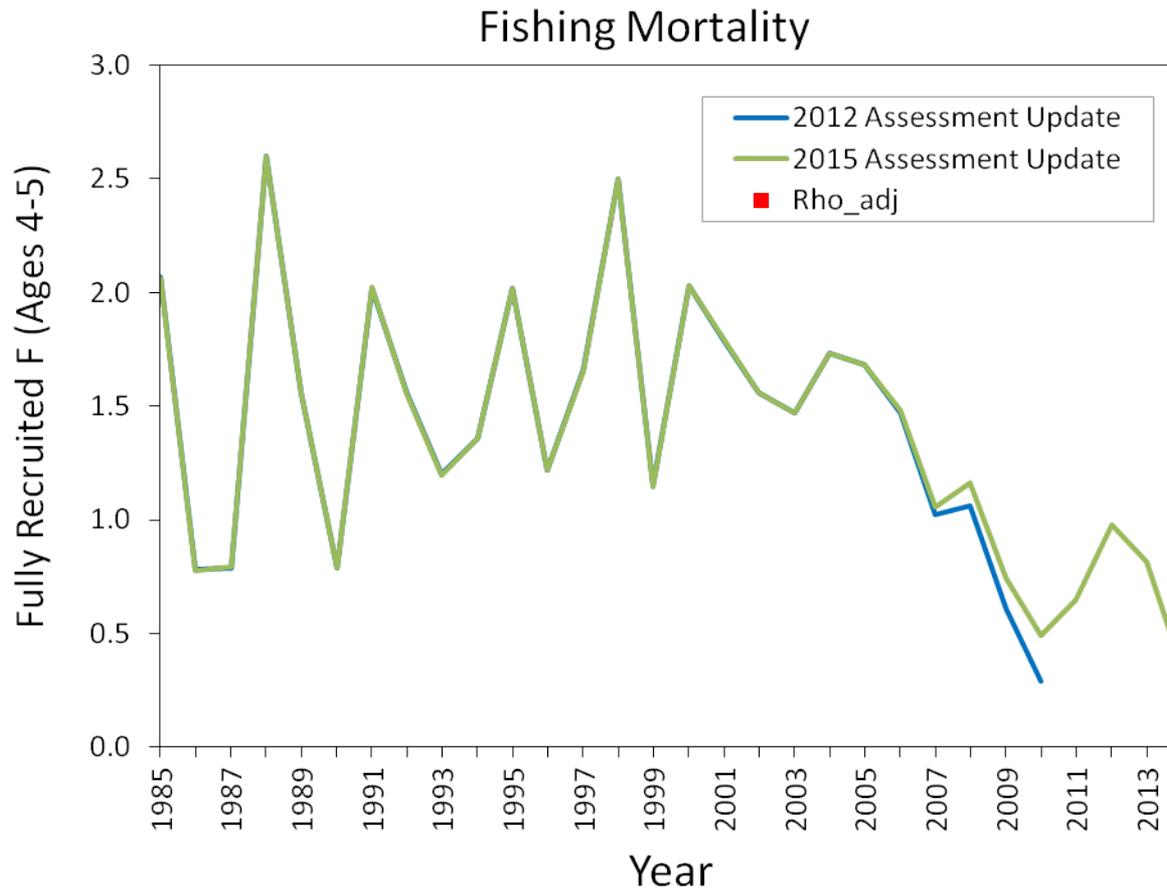


# Historical retrospective performance

## Fishing Mortality

*Historical performance of assessment model (Fishing Mortality)*

- Highly consistent with previous assessment especially in the early part of the time series
- Divergence begins to occur around the mid-2000's with higher F's in this assessment.

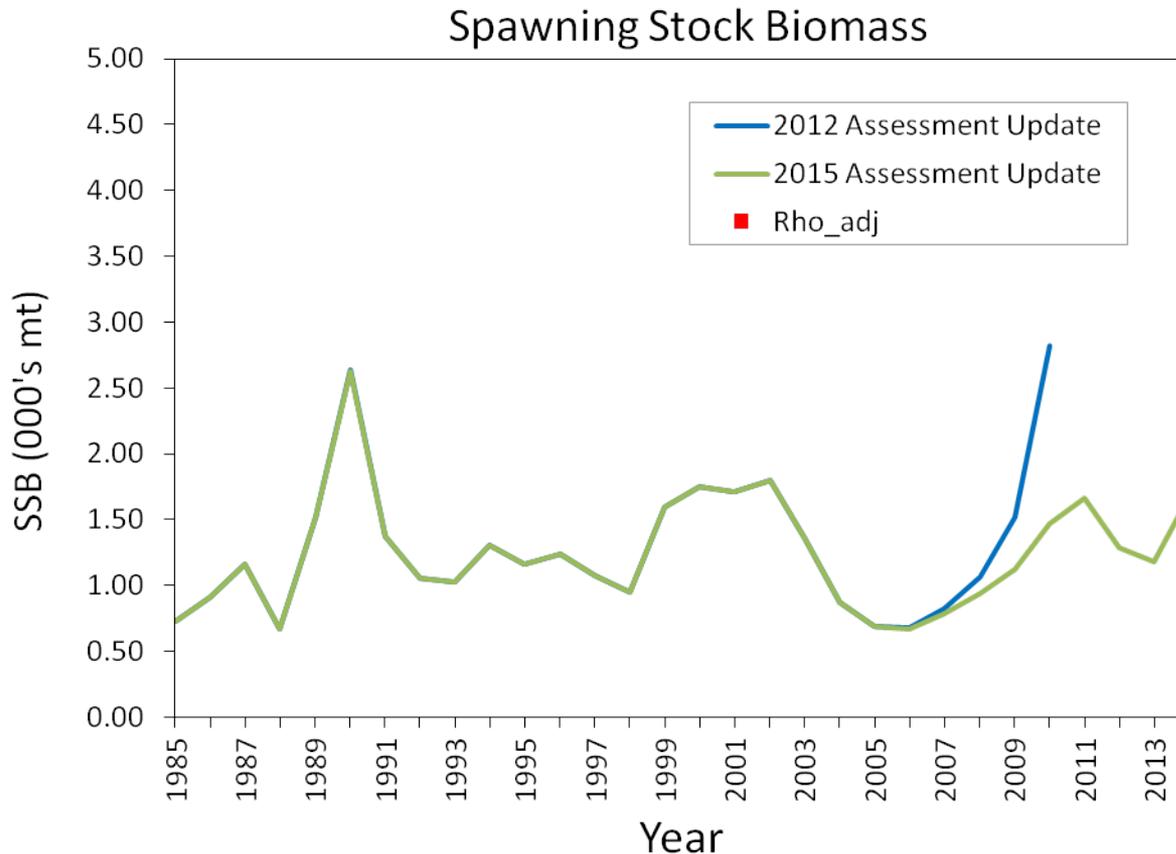


# Historical retrospective performance

## Spawning Stock Biomass

*Historical performance of assessment model (SSB)*

- SSB also **shows** high consistency relative to previous **assessments**
- The two high peaks in SSB during the 1980's are scaled lower in the recent assessment, likely due to changes in natural mortality for ages 2-4

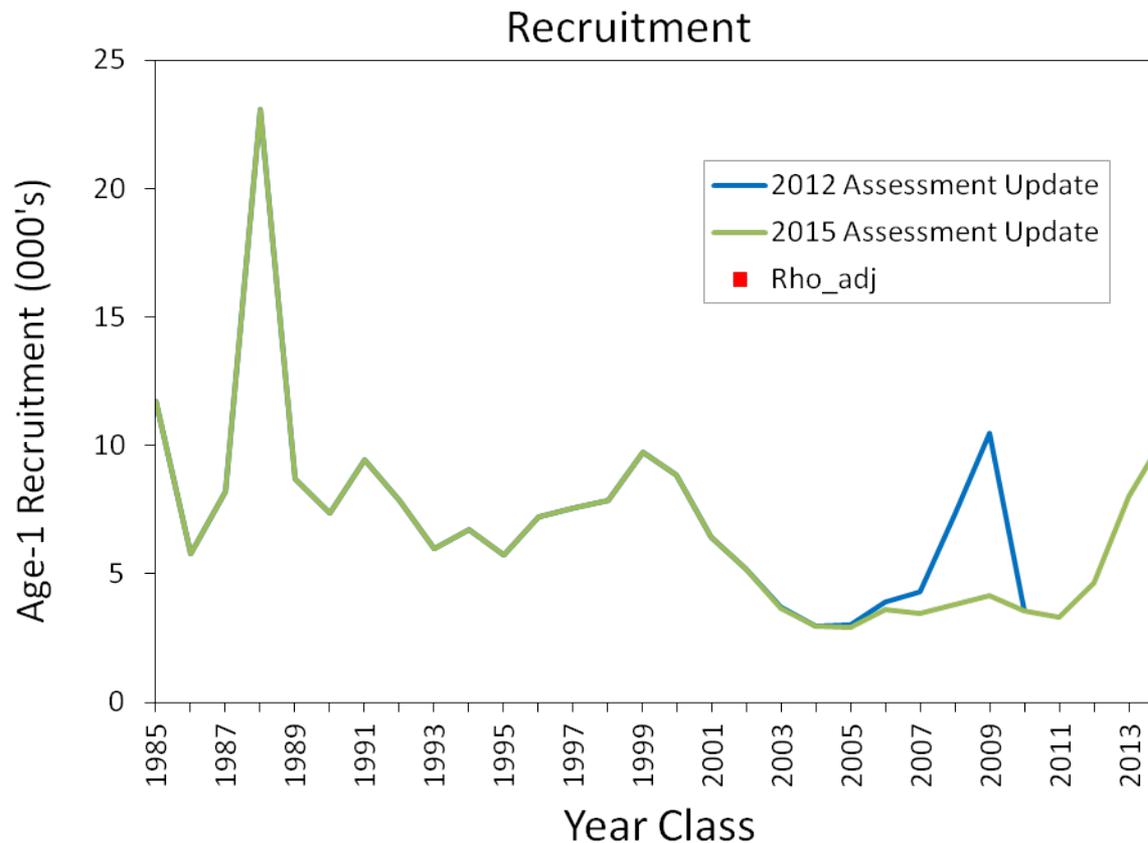


# Historical retrospective performance

## Age-1 Recruitment

*Historical performance of assessment model (Age-1 Recruitment)*

- Age-1 recruitment also shows a similar trend and magnitude in abundance
- Again divergence in the trends is apparent in the mid 2000's.



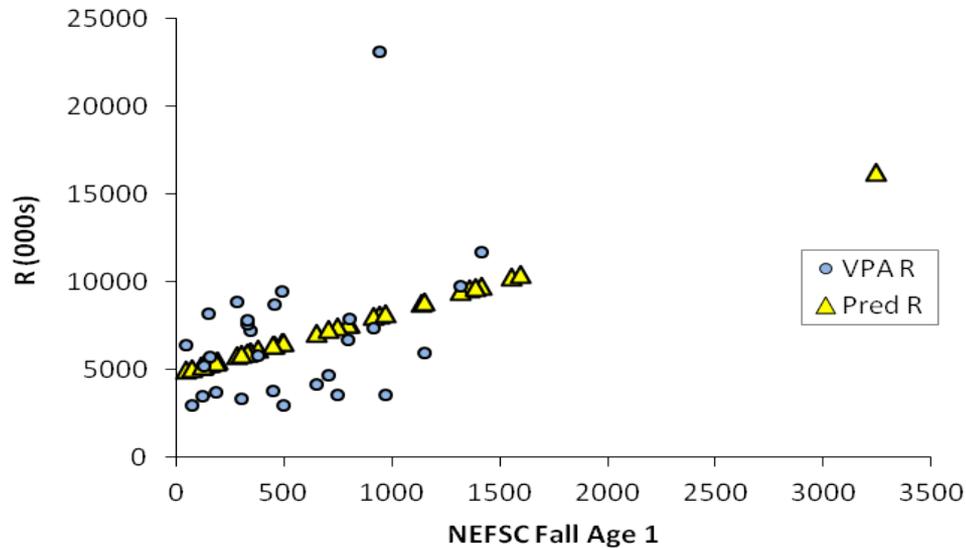
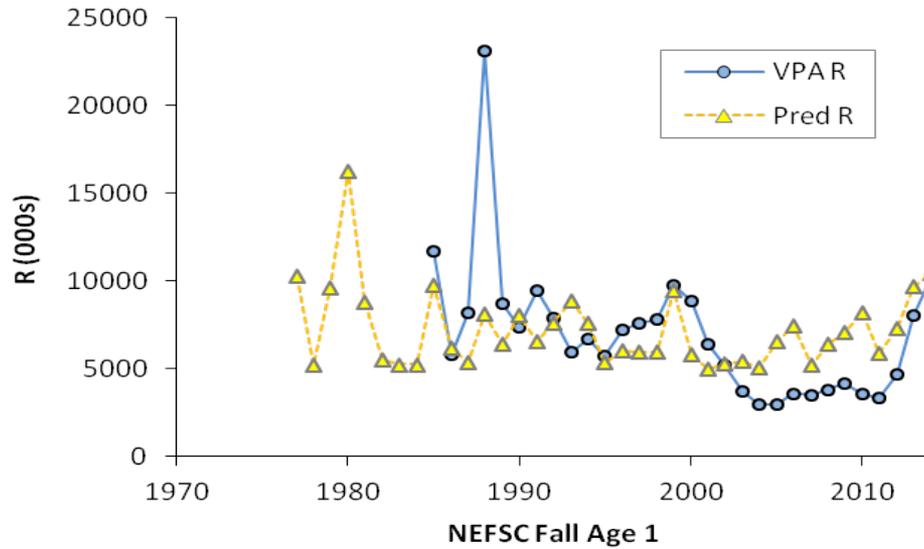
# Biological and Fishery Inputs – BRP's



Age	F_Selectivity	M_Selectivity	Catch weights	Maturity
Age1	0.003	1.000	0.167	0.000
Age2	0.100	1.000	0.325	0.171
Age3	0.543	1.000	0.398	0.833
Age4	1.000	1.000	0.463	0.977
Age5	1.000	1.000	0.548	1.000
Age6+	1.000	1.000	0.671	1.000

- Based on recent five year averages
- Starting NAA inputs for 2015 were derived from 1,000 estimates from the bootstrap estimates
- $F_{40\%MSP}$  as proxy for  $F_{MSY}$  in Yield per recruit analyses
- $SSB_{MSY}$  and  $MSY$  based on 100yrs stochastic projections and cdf sampling of recruitment from a non-parametric distribution.
- Recruitment series :
  - Hindcast recruitment: Simple regression NEFSC Fall age-1 and VPA age-1
  - Hindcast estimates (1977-1984) and VPA age-1 recruit (1985-2013)

# Hindcast Recruitment



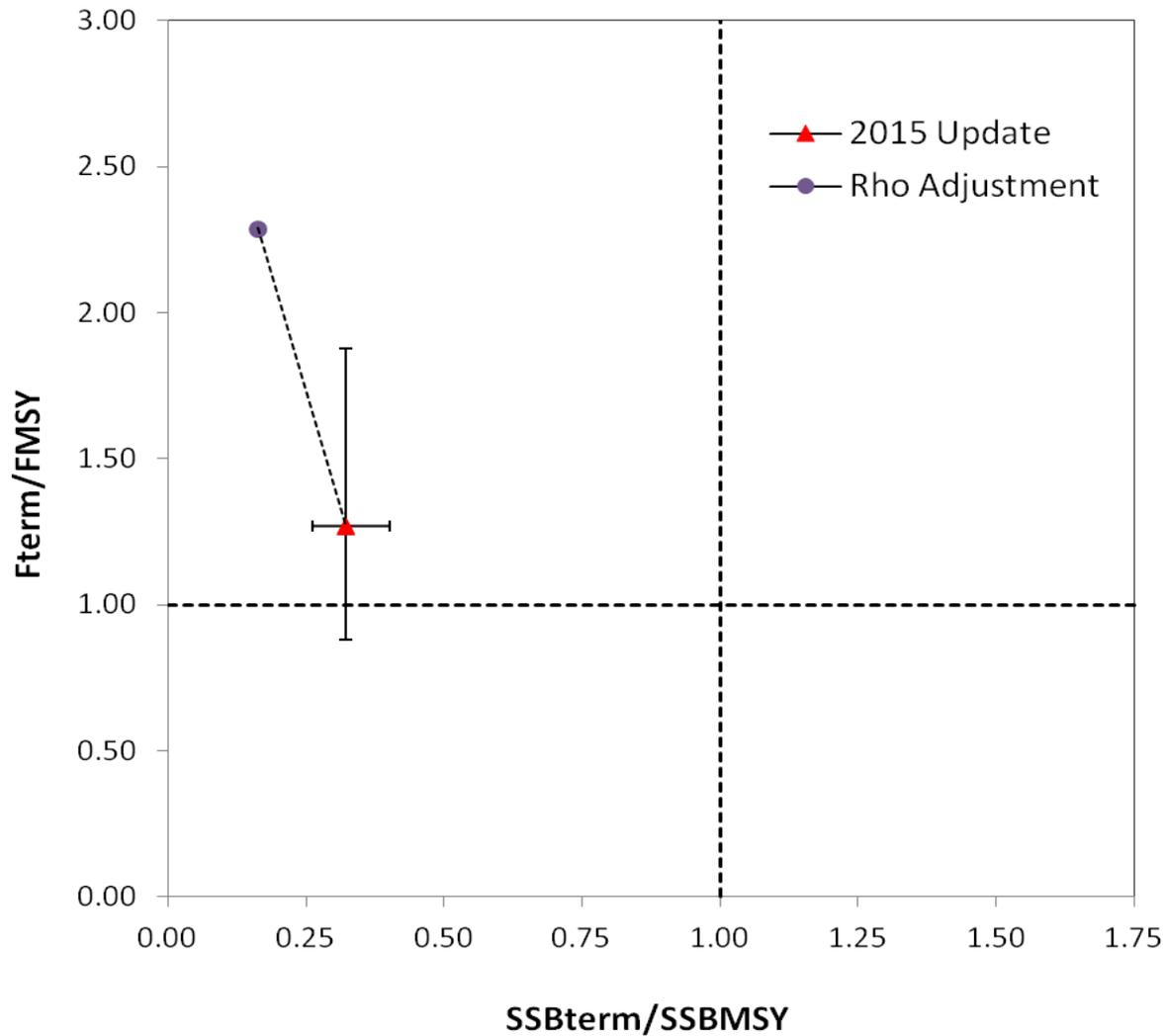
# Biological Reference Points

## Reference Points

	2012 Update	2015 Update
FMSY	0.26	0.28
SSBMSY (mt)	7,080	5,259
MSY (mt)	1,600	1,285



# CCGOM YT Stock Status



# Short-Term Projections

- Starting NAA inputs for bridge year 2015 based on estimates from the bootstrap estimates
- Recruitment series :
  - Hindcasted and VPA estimates
- Future Rec. Sampling empirical cumulative distribution
- 2015 catch assumption = 376 mt (GARFO)
- WAA, PR, Maturity same as defined in the BRP setup
- Projections for years 2016-2018 were **conducted** under two F assumptions:
  - FMSY Proxy = 0.279
  - 75%FMSY Proxy = 0.209

# Projection Results



FS	<u>Fmsy = 0.279</u>		<u>75%Fmsy = 0.210</u>	
	rho adjust		rho adjust	
	<u>Unadj.</u>	<u>NAA</u>	<u>Unadj.</u>	<u>NAA</u>
	100%	100%	100%	100%

## Median Catch (mt)

Year				
2015	376	376	376	376
2016	1056	555	813	427
2017	1238	680	998	547
2018	1284	814	1075	672

## Median Spawning Stock Biomass (mt)

Year				
2015	3183	1762	3183	1762
2016	4636	2429	4739	2483
2017	5068	2847	5400	3026
2018	5250	3518	5792	3820

# Summary of 2015 CCGOM Yellowtail flounder Assessment

- Precision of model estimates were relatively reasonable however, the persistence of the retrospective bias is a major source of uncertainty
- Retrospective adjustment (mohn's rho)
  - Resulted in SSB decrease by 49% and 85% increase in fishing mortality
- $F_{2014} = 0.35$  (0.64): 125% or 229% above  $F_{MSY}$  proxy
- $SSB_{2014} = 1,695$  mt (857 mt): 32% or 16% of  $SSB_{MSY}$
- Projections show that the projected biomass from the last assessment is outside of the confidence bounds of the recent assessment.
- The stock is overfished and Overfishing is occurring