



NOAA
FISHERIES

NORTHEAST FISHERIES
SCIENCE CENTER

2015 Pollock Operational Assessment

Groundfish Assessment Peer Review Meeting

Woods Hole, MA
September 14-18, 2015

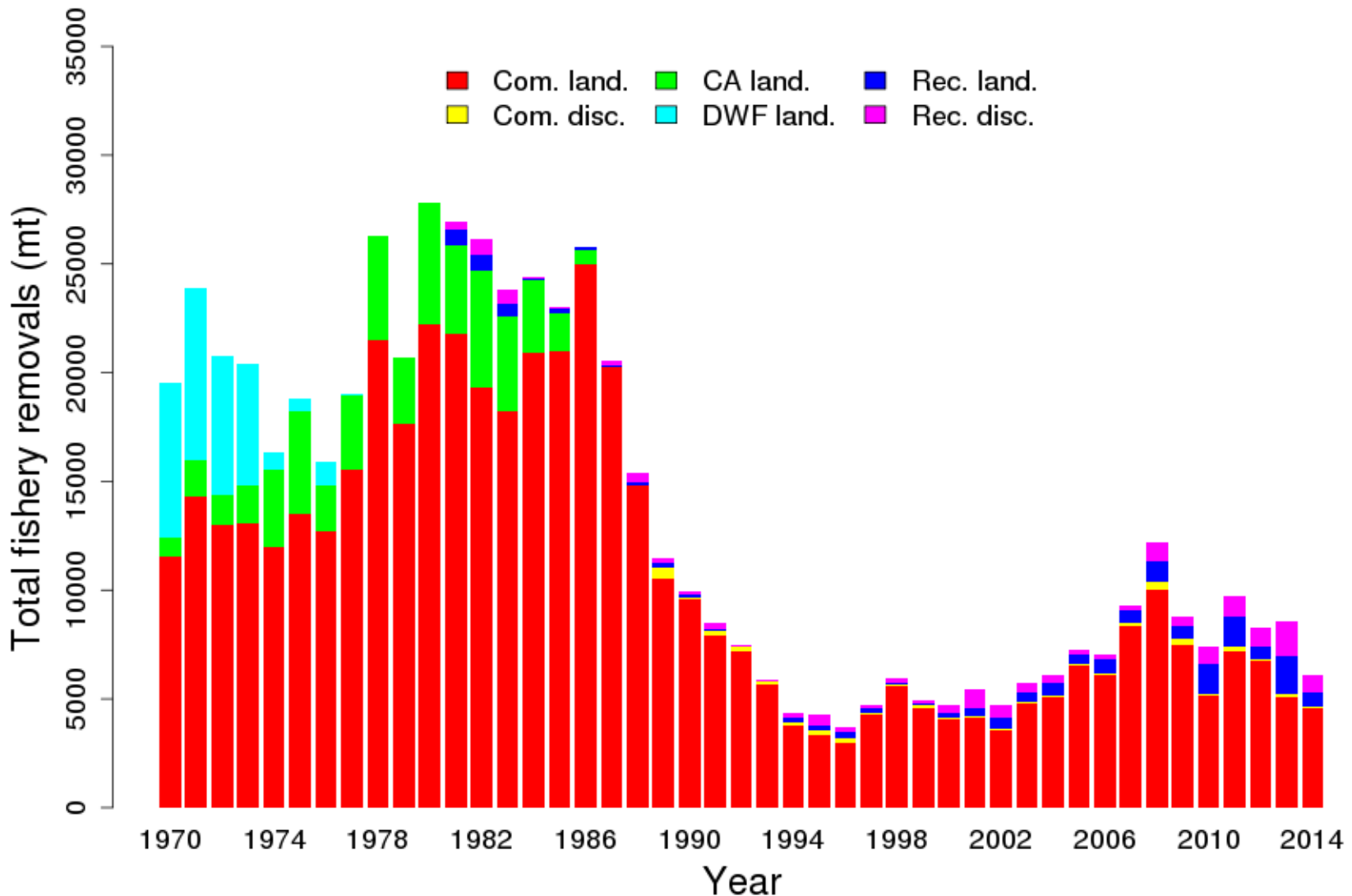
Background

- Last assessed in 2014 operational assessment with ASAP using data through 2013
 - Status: not overfished, overfishing is not occurring
- Last benchmark was in 2010 as part of SARC 50 with ASAP using data through 2009
 - Status: not overfished, overfishing is not occurring

Data Inputs

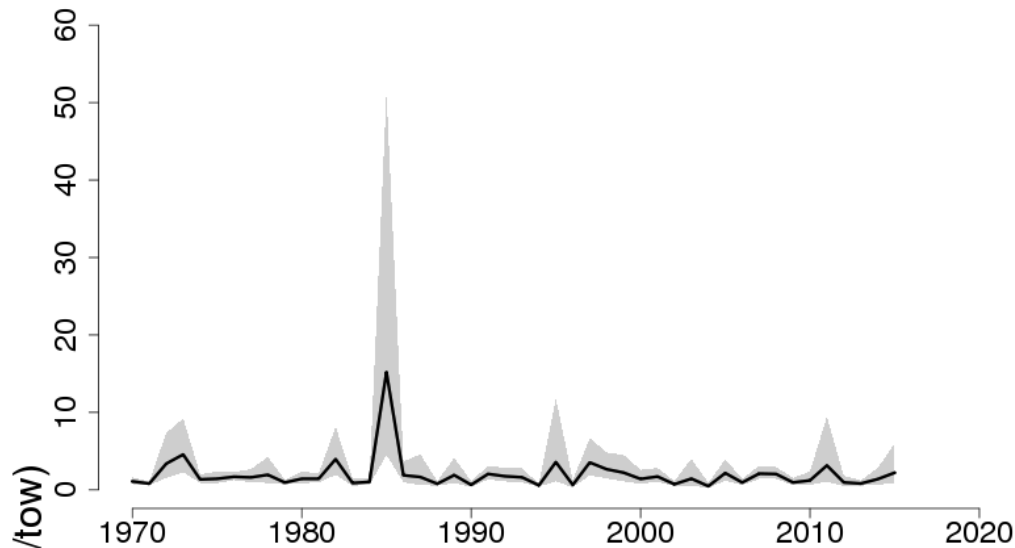
Source	First Yr	Last Yr (2014)	Last Yr (2015)	Source	First Yr	Last Yr (2014)	Last Yr (2015)
Commercial Landings				Spring Survey Index			
Total (mt)	1970	2013	2014	Total (N/tow)	1970	2013	2014
Numbers at age	1970	2013	2014	N/tow at age	1970	2013	2014
Commercial Discards				Fall Survey Index			
Total (mt)	1989	2013	2014	Total (N/tow)	1970	2013	2014
Numbers at age	1989	2013	2014	N/tow at age	1970	2013	2014
Recreational Landings				Mean weight at age			
Total (mt)	1981	2013	2014	Start of year	1970	2013	2014
Numbers at age	1981	2013	2014	Mid-year	1970	2013	2014
Recreational Discards							
Total (mt)	1981	2013	2014				
Numbers at age	1981	2013	2014				

- Maturity at age (pooled time series estimate using 1970-2014)
- Natural mortality (0.2; not updated)



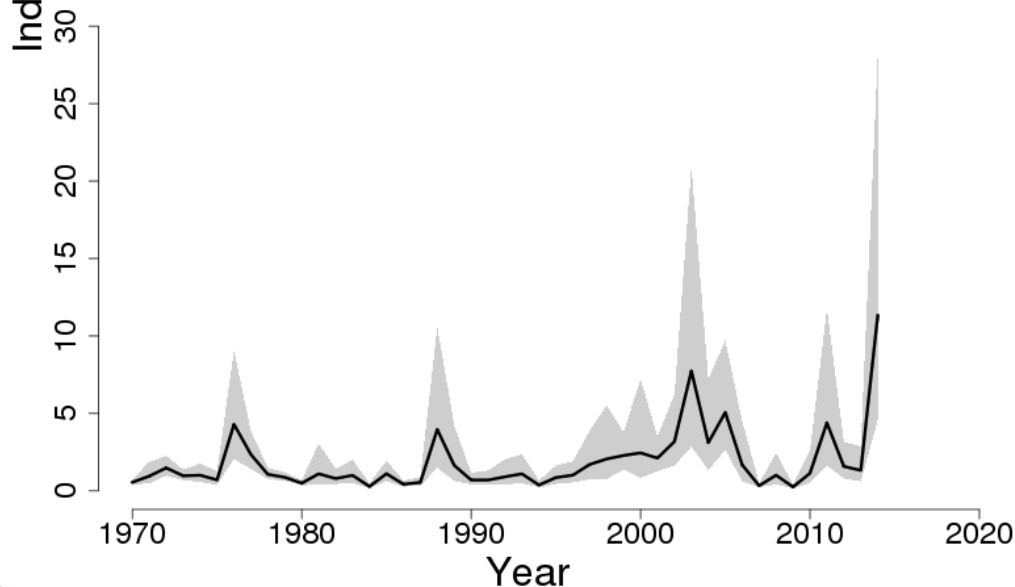
- Total removals have decreased in recent years
- Recreational landings and discards have increased in recent years

NEFSC Spring



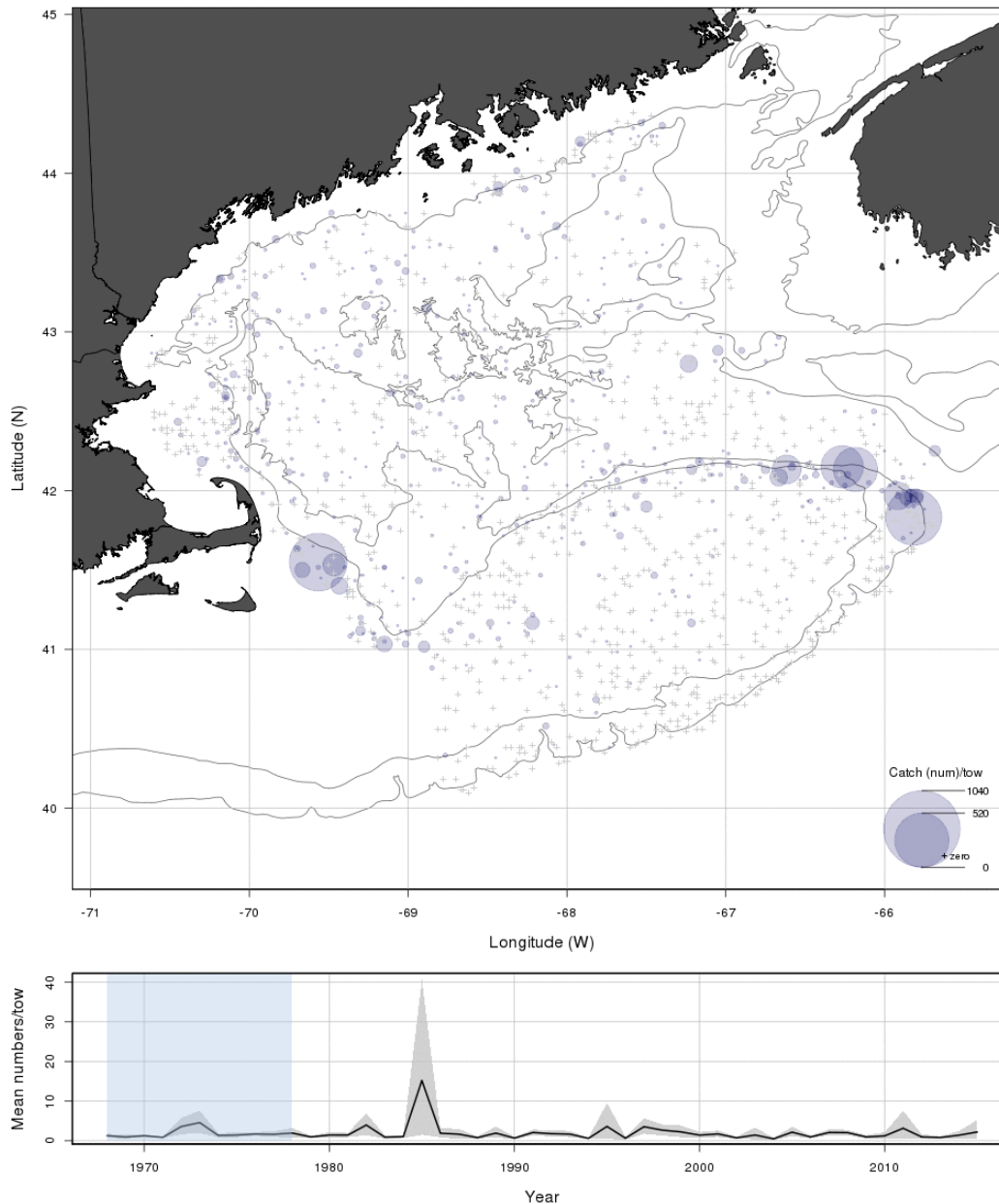
- Change from SHG to TOGA for station selection had little effect on final indices

NEFSC Fall

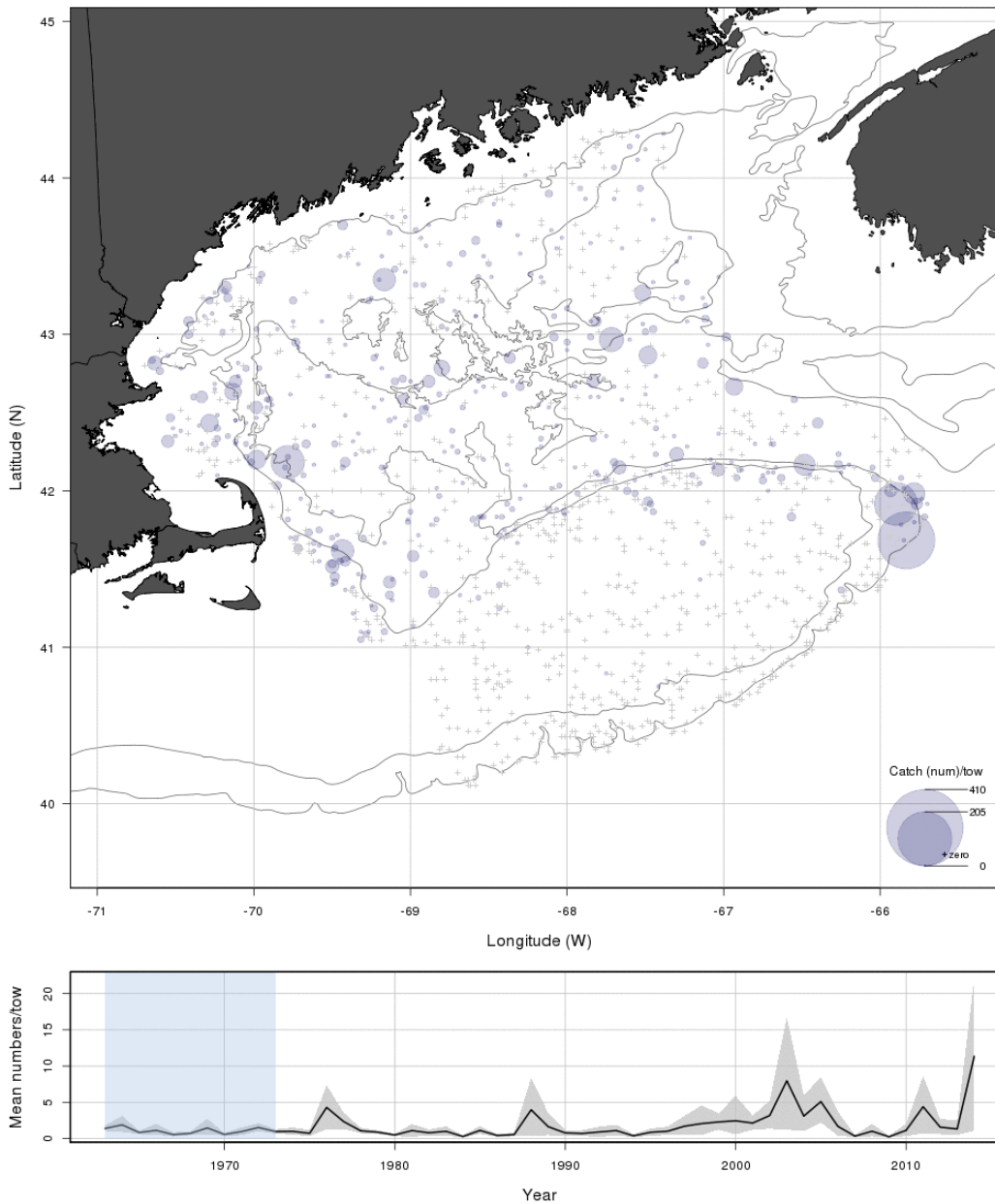


- 2014 Fall index value driven by 2 tows with high pollock catches

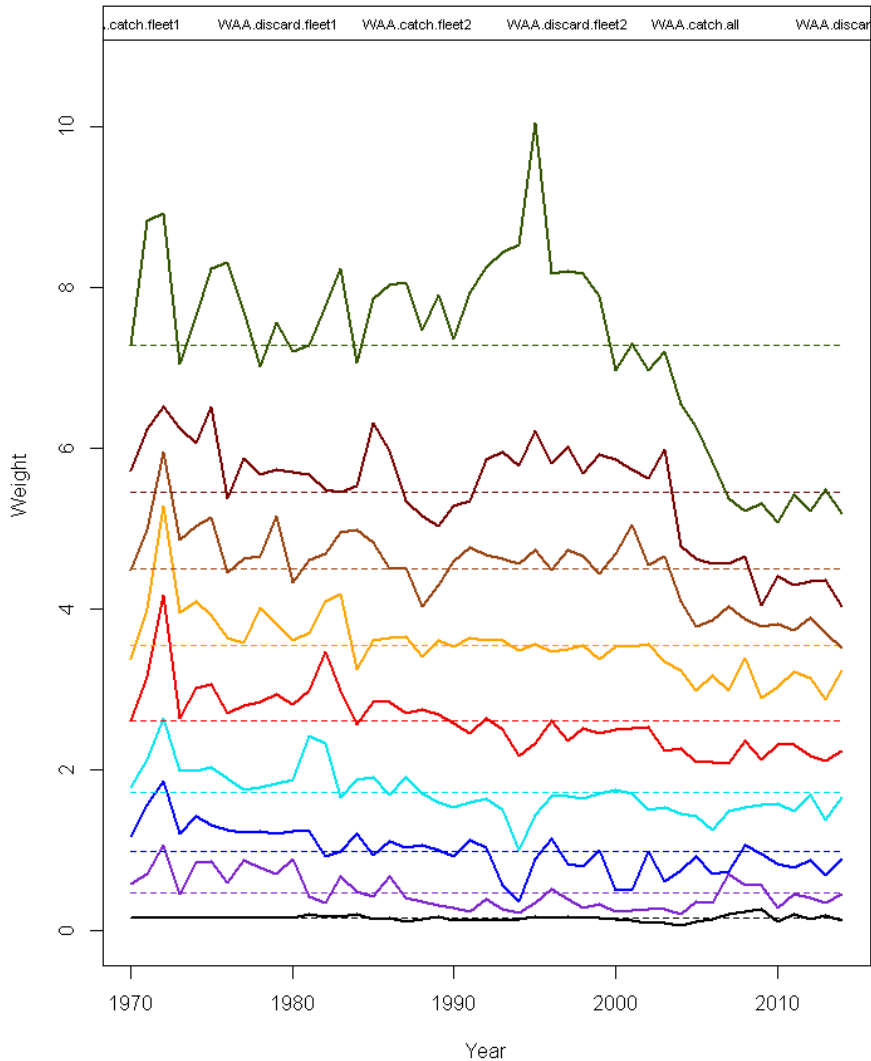
POLLOCK, ATLANTIC, UNIT: NMFS spring BTS (1968 - 1978)



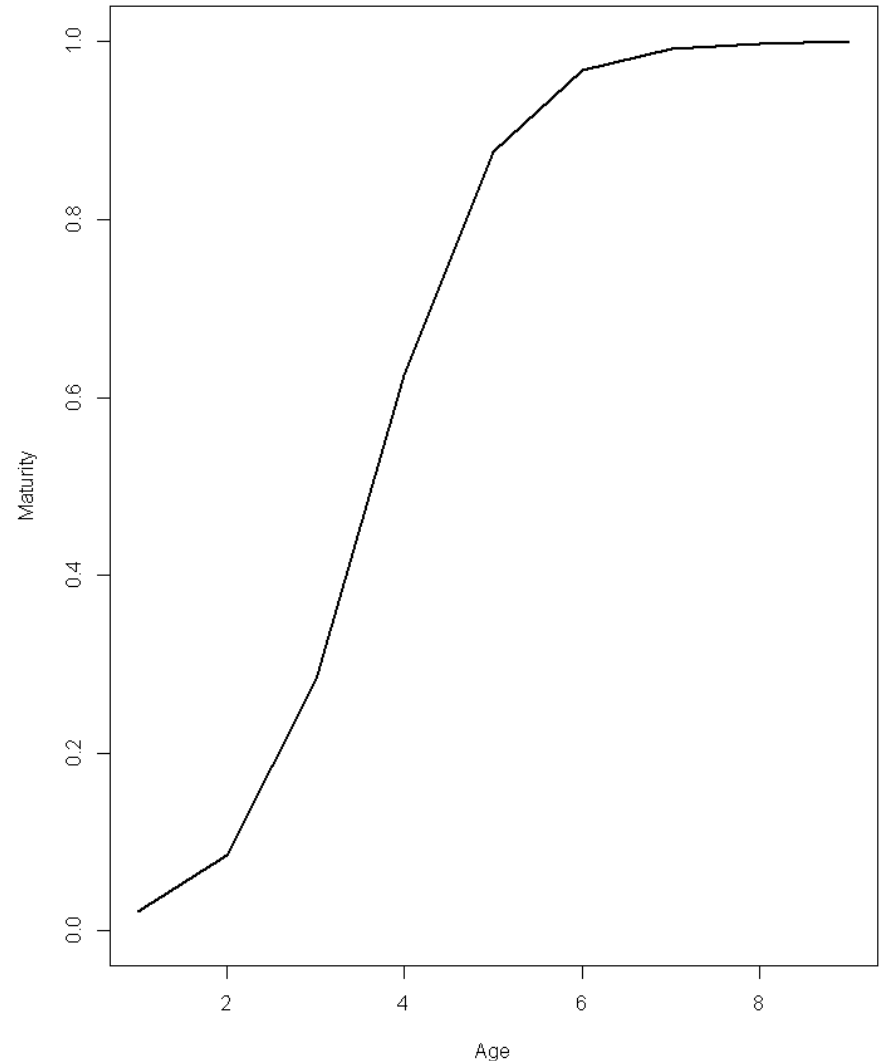
POLLOCK, ATLANTIC, UNIT: NMFS fall BTS (1963 - 1973)



WAA matrix 1



Maturity



- Mean weights of older ages have decreased in recent years
- 50% maturity occurs around age 3 and 100% maturity around age 6

Model Configurations

- ASAP
- Years: 1970-2014
- Ages: 1-9+
- Commercial and recreational fisheries modeled as separate fleets
- Base model: dome-shaped fishery and survey selectivity
- Flat Sel sensitivity model: dome-shaped fishery selectivity and flat-topped survey selectivity

Model Configurations

- 4 Commercial selectivity time blocks
 - 1970-1985, 1986-1993, 1994-2003, 2004-2014
- 3 Recreational selectivity time blocks
 - 1970-1993, 1994-2001, 2002-2014
- Base model: survey selectivity for age 9+ fixed at 0.5
- Flat Sel model: survey selectivity for ages 6-9+ fixed at 1.0

Model Changes

- Likelihood constants were excluded from likelihood calculations in ASAP to avoid potential bias caused by one of the recruitment likelihood “constants”, which is the sum of the log-scale predicted recruitments

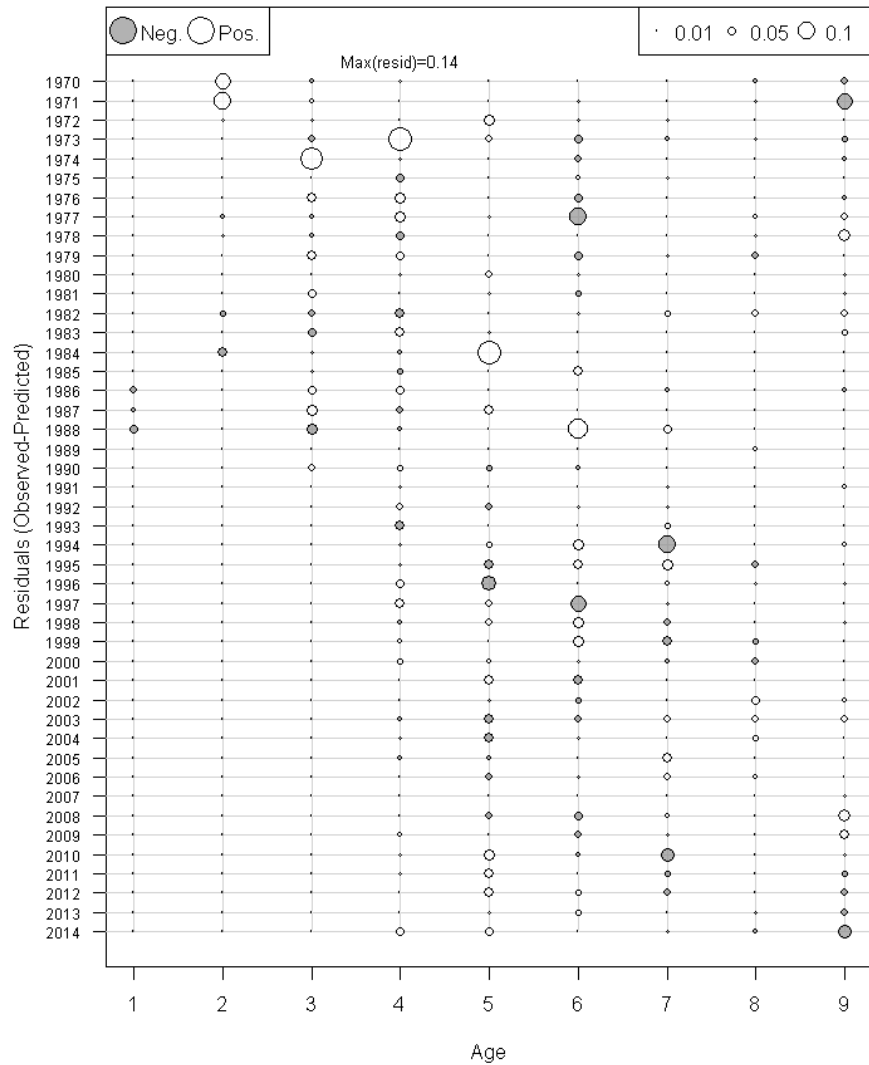
$$-\ln(L) = n_{rec} \frac{\ln(2\pi)}{2} + \sum_{Y_f}^{Y_l} \ln(\widehat{R}_y) + n_{rec} \ln(\sigma) + \frac{1}{2} \sum_{Y_f}^{Y_l} \frac{(\ln(\widehat{R}_y) - \ln(\overline{R}_y))^2}{\sigma^2}$$

Diagnostics

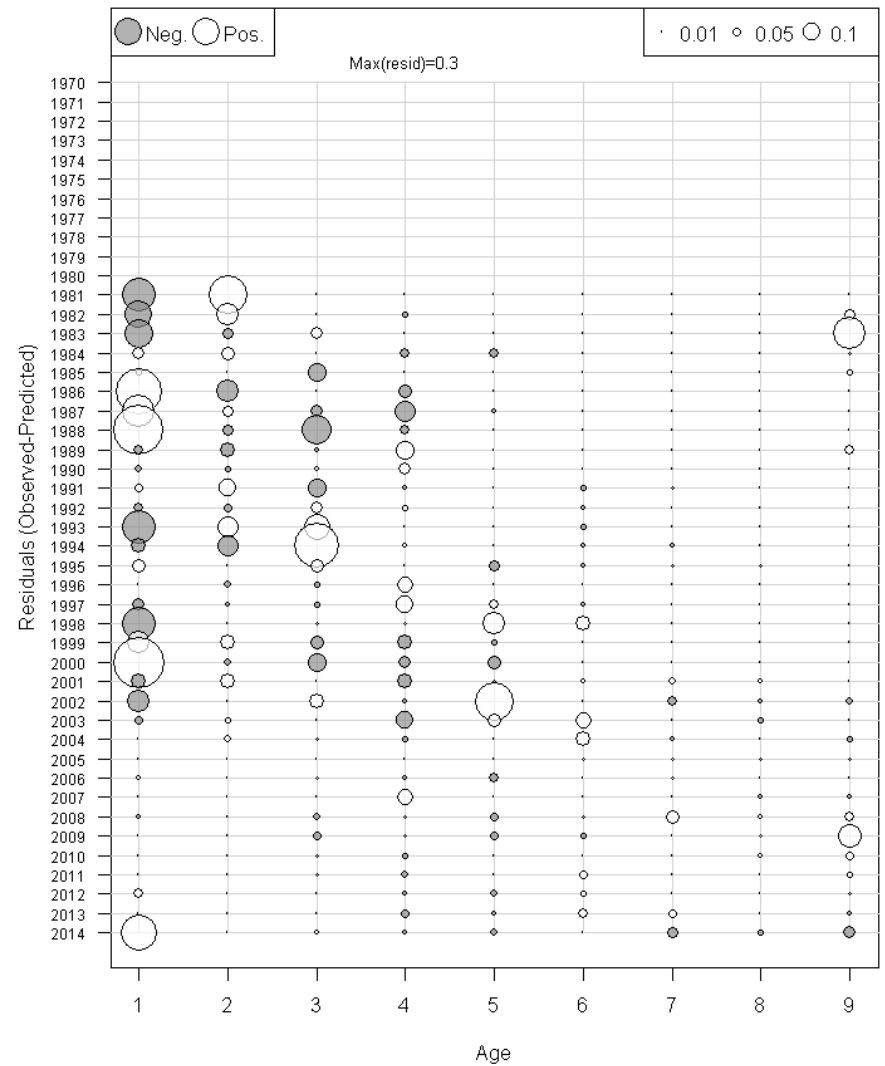
- In general, model fits and residual patterns were similar to those from the 2014 operational assessment
- Commercial and recreational age comp residuals indicated no need for additional selectivity time blocks

Base

Age Comp Residuals for Catch by Fleet 1 (commercial)

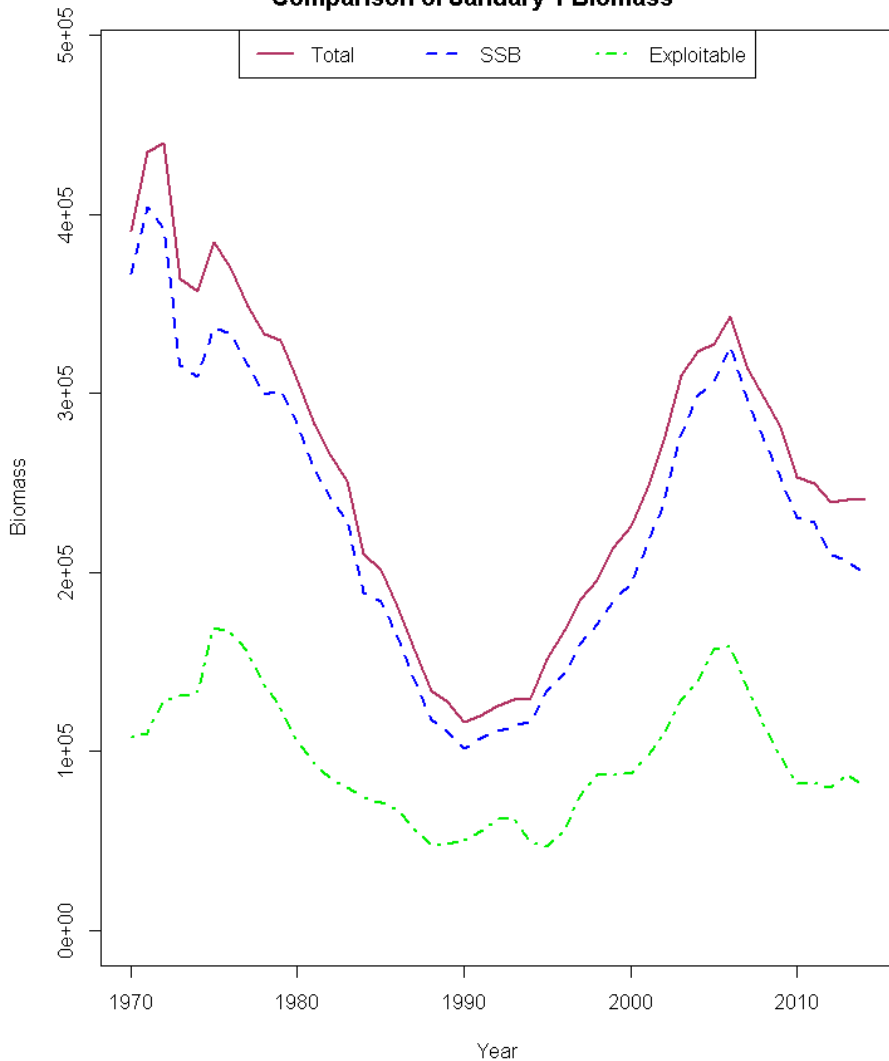


Age Comp Residuals for Catch by Fleet 2 (recreational)



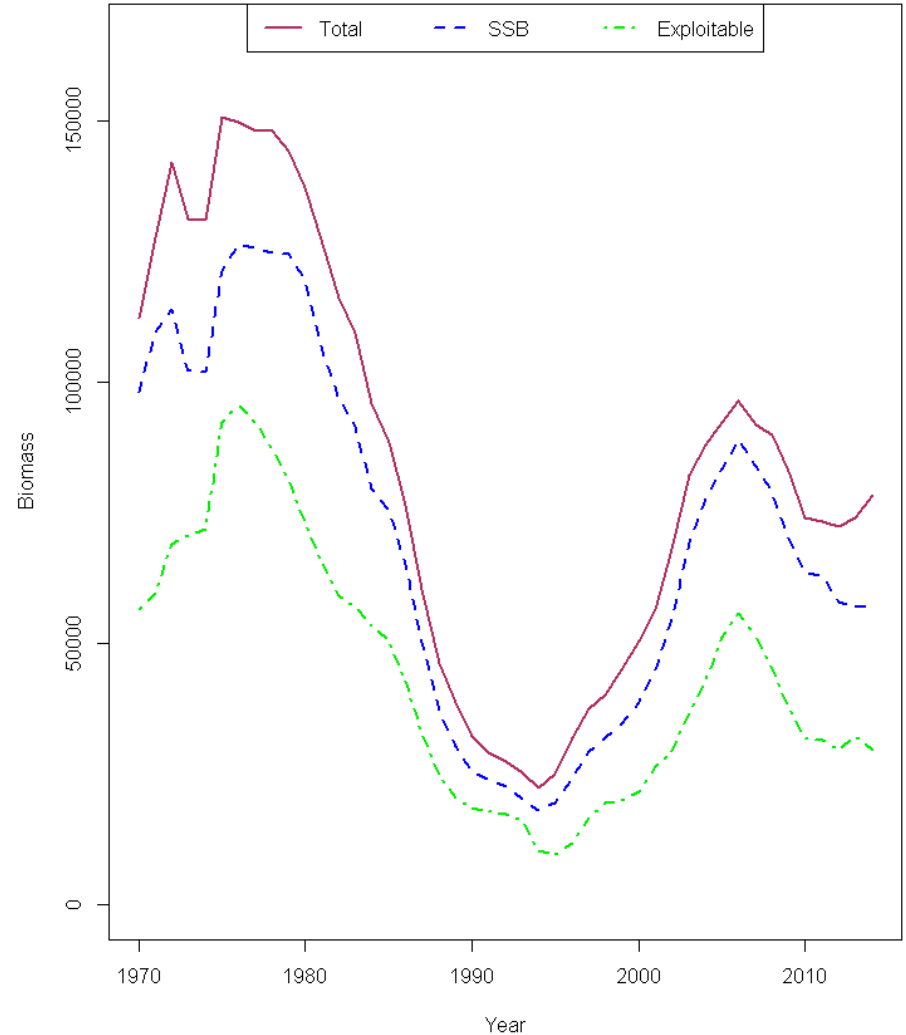
Base

Comparison of January 1 Biomass



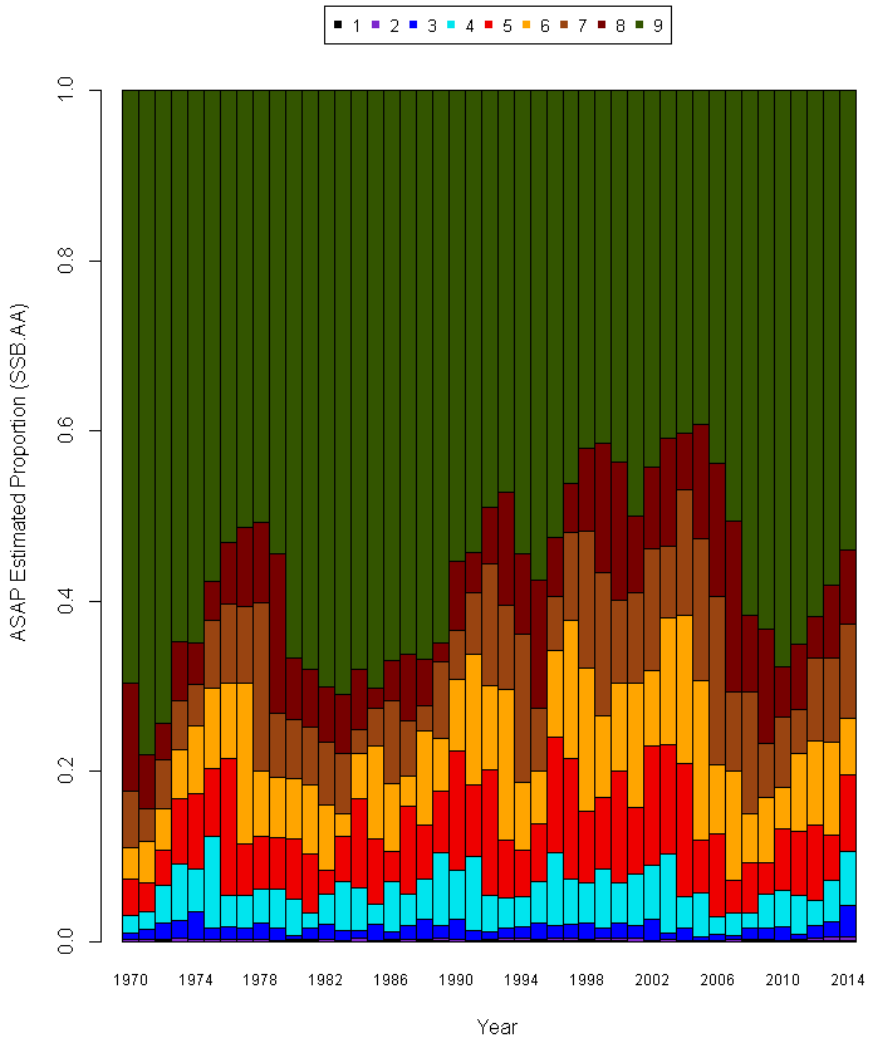
Flat Sel

Comparison of January 1 Biomass

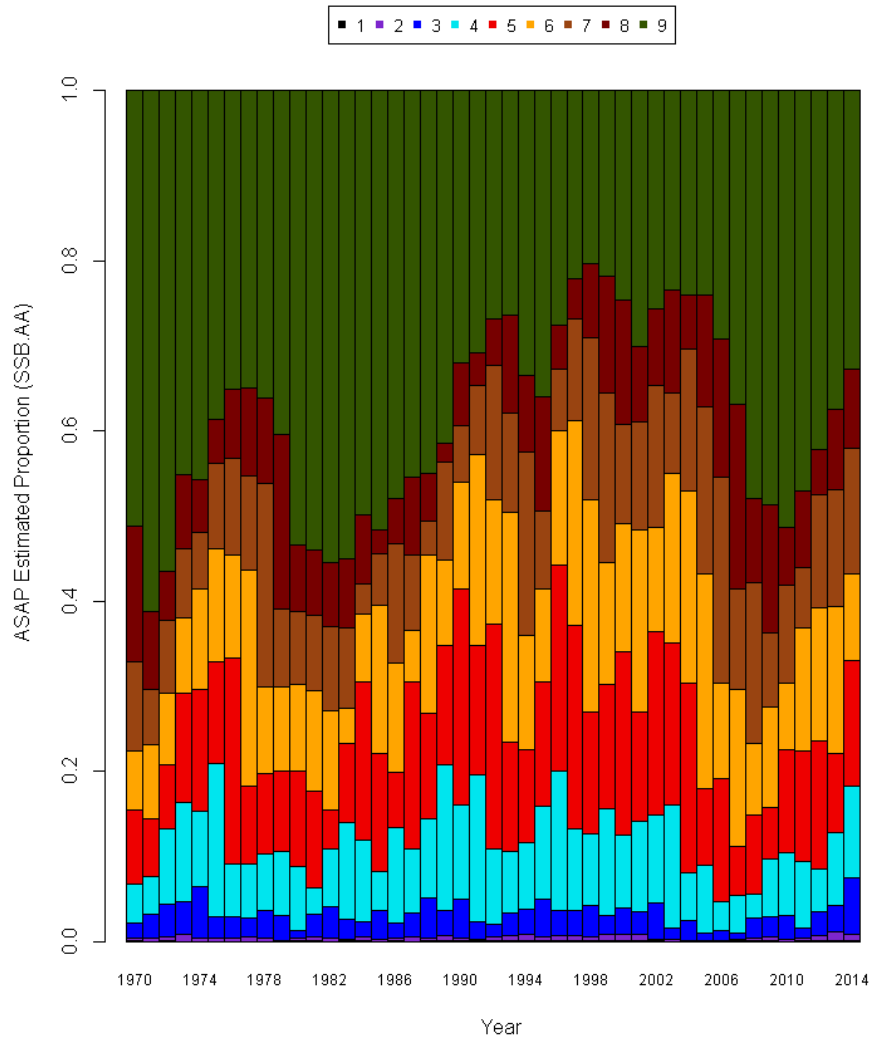


- Base model predicts substantial cryptic biomass
- Flat Sel total biomass is of similar magnitude as Base exploitable biomass

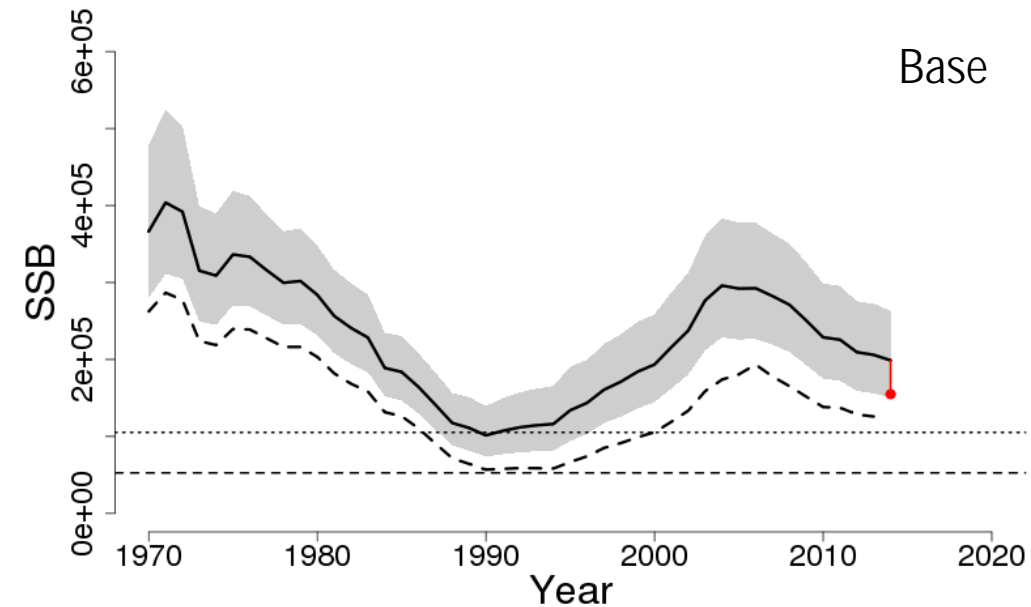
Base



Flat Sel



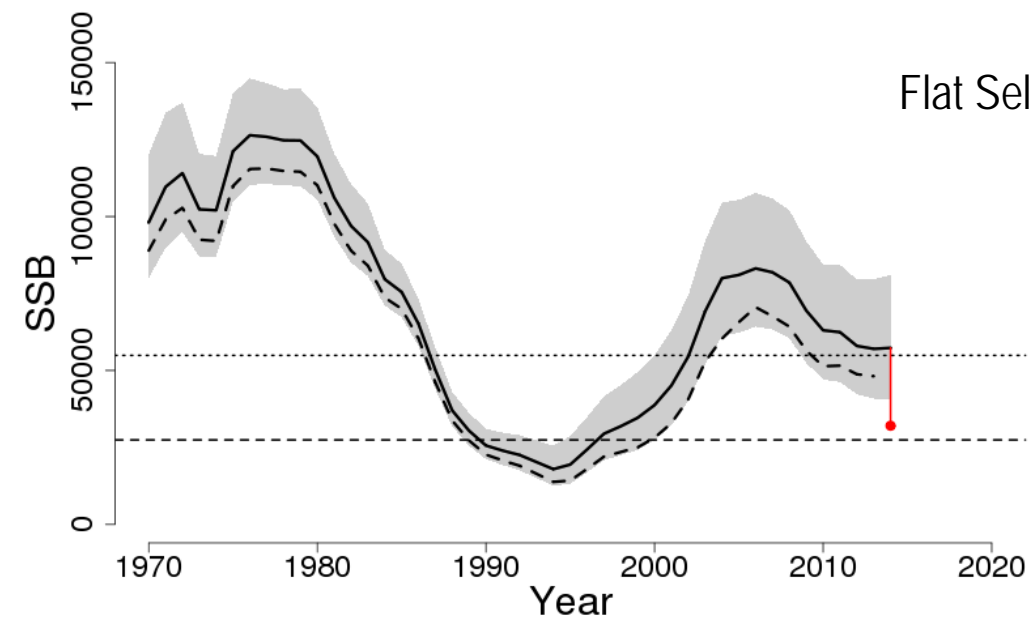
- Base model cryptic biomass composed primarily of age 9+ fish (50-70% of biomass in recent years)

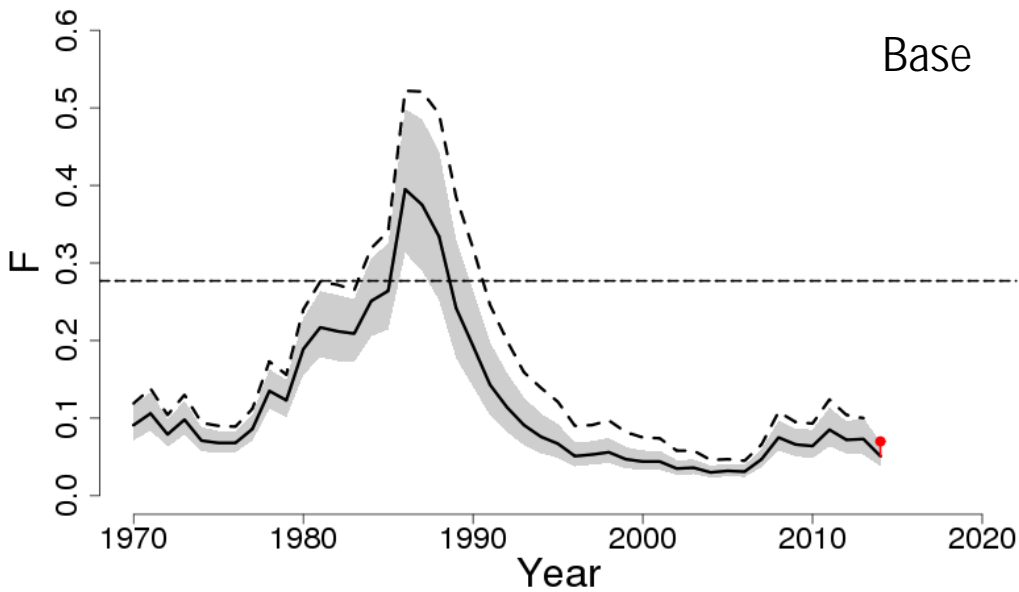


- Scaling up of SSB primarily due to exclusion of likelihood constants

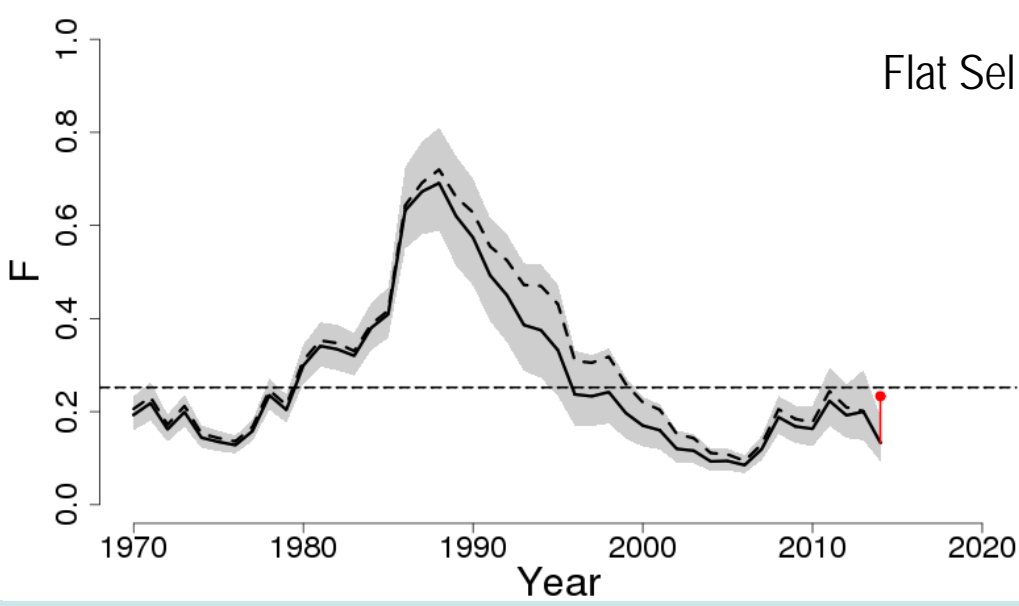
- Base model retro adjusted SSB is within 90% CI

- Flat Sel model retro adjusted SSB is outside 90% CI

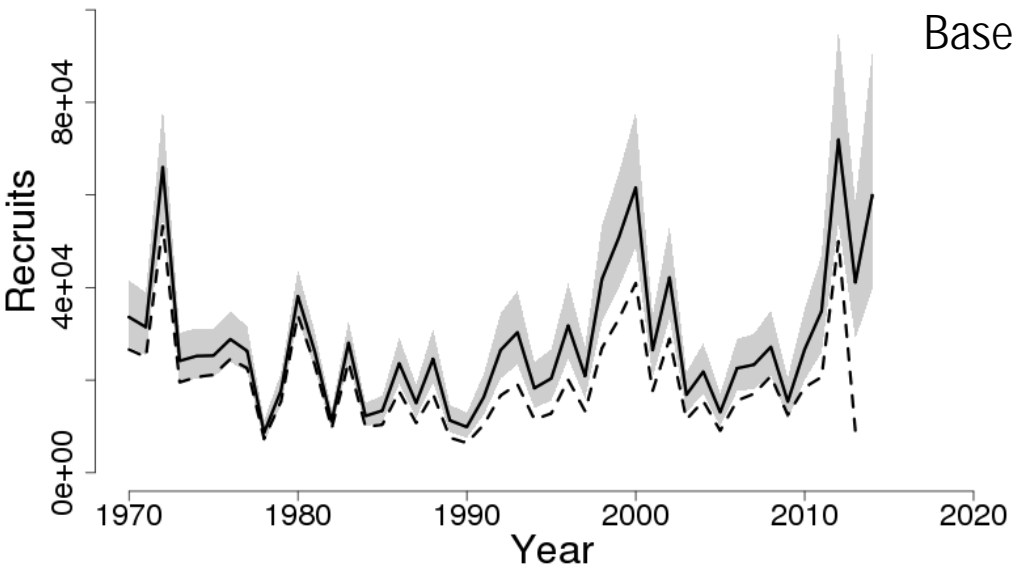




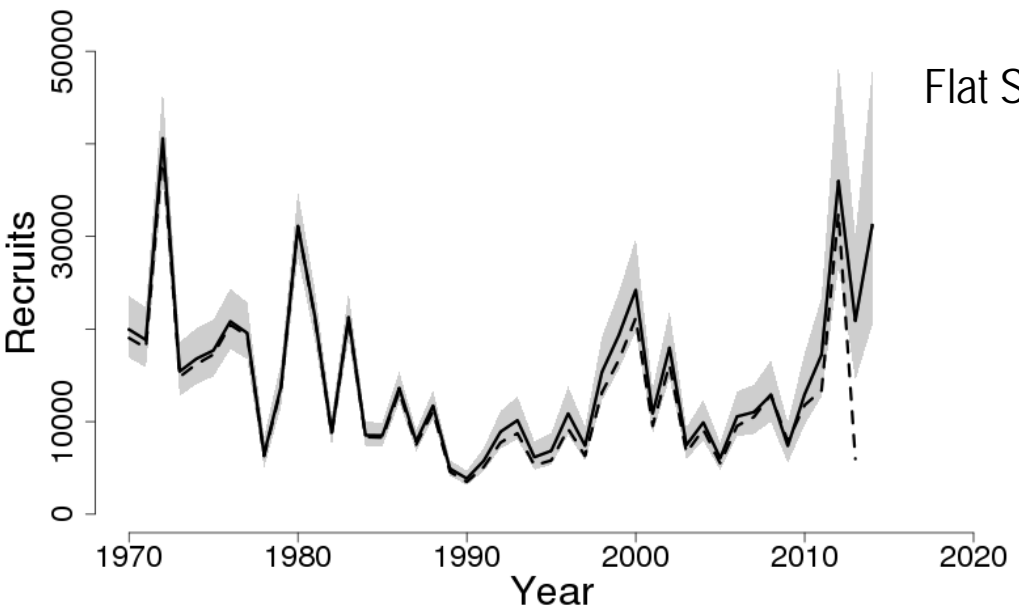
- Scaling down of F primarily due to exclusion of likelihood constants



- Base model retro adjusted F is outside 90% CI
- Flat Sel model retro adjusted F is outside 90% CI



- 2011 year class still predicted to be relatively strong



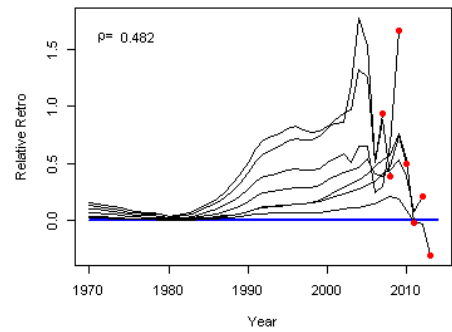
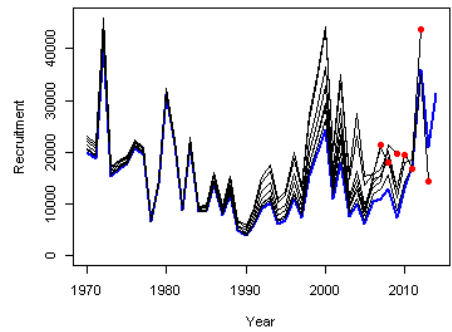
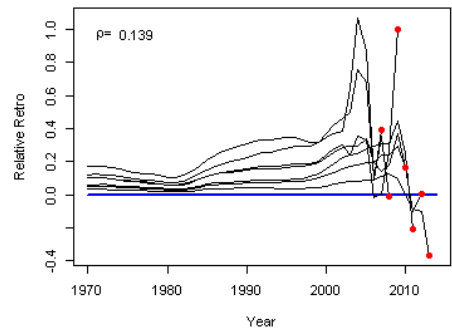
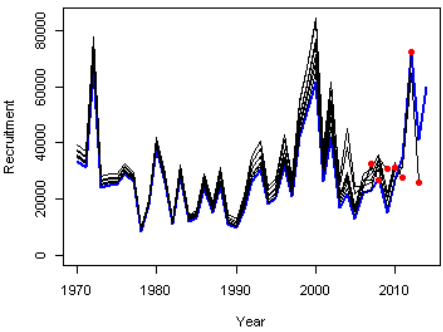
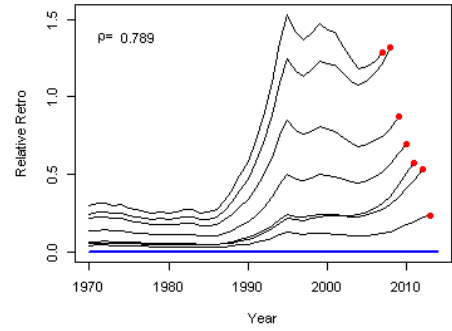
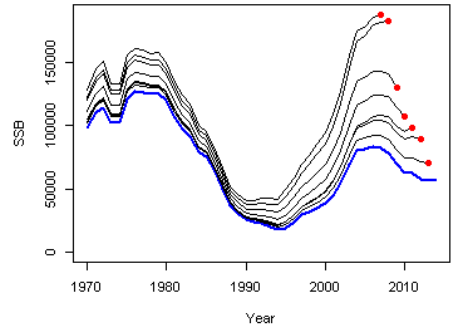
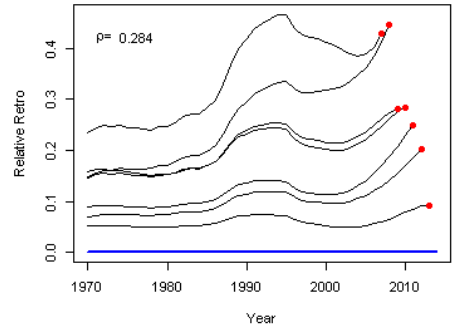
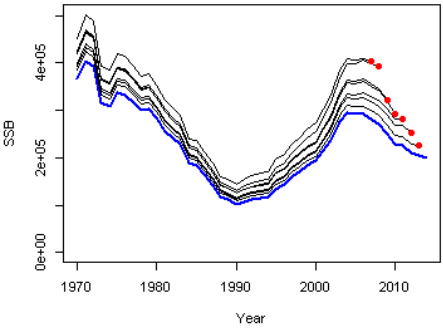
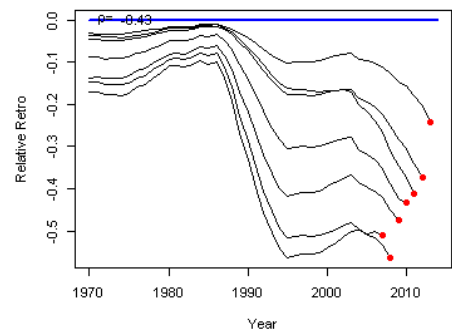
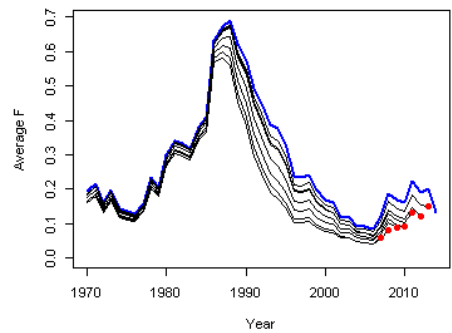
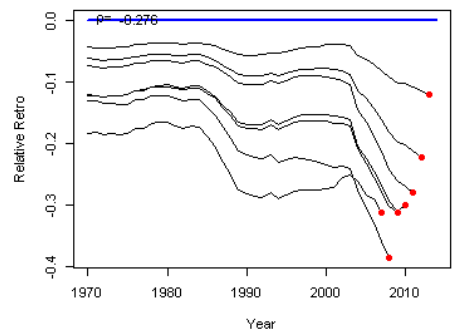
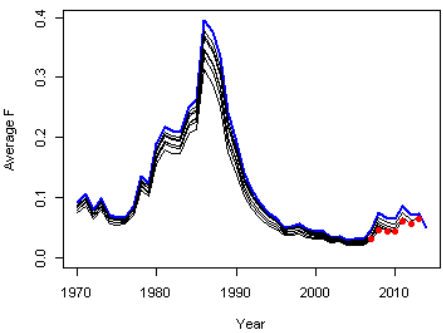
- 2012 and 2013 year classes also predicted to be relatively strong

Base

F, SSB, R

Flat Sel

F, SSB, R



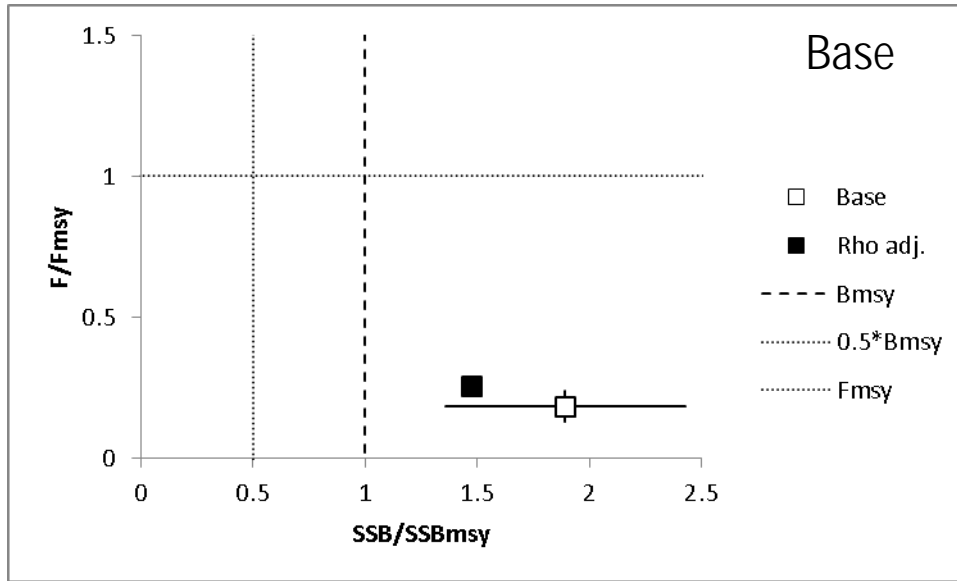
- Flat Sel model has stronger retrospective bias

Biological Reference Points

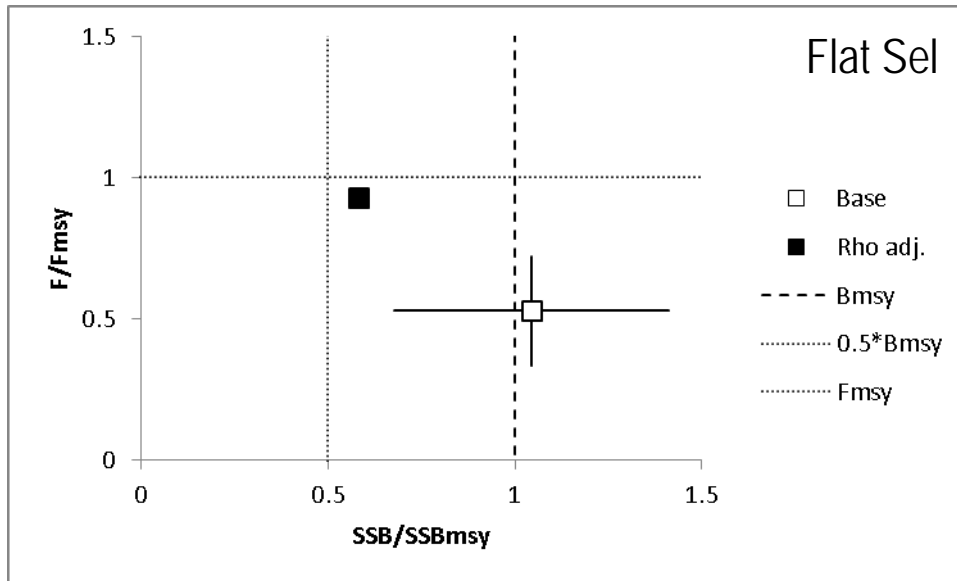
- Used YPR to get F threshold
 - Average of most recent 5 years (2010-2014) for weights at age, natural mortality, maturity at age, and selectivity at age
- Used AGEPRO to get biomass target
 - 5 year averages as with F threshold
 - F set equal to F_{msy} proxy of F40%
 - Recruitments drawn from empirical CDF (1970-2012)

Biological Reference Points

	2014 base	2014 flat sel	base	flat sel
F_{MSY}	0.273	0.245	0.277	0.252
SSB_{MSY} (mt)	76,879	51,140	105,226 (81,994 - 139,721)	54,900 (40,655 - 74,922)
MSY (mt)	14,791	10,491	19,678 (14,443 - 28,533)	10,995 (7,757 - 15,975)
Median recruits (age 1) (000s)	17,622	10,806	25,299	12,879
<i>Overfishing</i>	No	Yes	No	No
<i>Overfished</i>	No	No	No	No



- Base model retro adjusted F and SSB were just within 90% CIs in 2014 assessment



- Flat Sel retro adjusted F and SSB were outside 90% CIs in 2014 assessment

Projections

- Used AGEPRO to forecast median spawning biomass and yield
- Same configuration as in biomass target determination
- 2015 total catch estimated to be 5,208 mt
- 2016-2018 F set equal to Fmsy proxy of F40%
- Retrospective adjustments applied to base and flat sel projections

Projections

Year	Catch (mt)	SSB (mt)	F_{AVG}	Catch (mt)	SSB (mt)	F_{AVG}
		<i>base</i>			<i>flat sel</i>	
2015	5,208	160,581	0.056	5,208	42,924	0.167
2016	27,668	178,534	0.277	9,154	51,426	0.252
2017	30,704	176,077	0.277	11,303	56,807	0.252
2018	31,327	168,611	0.277	12,572	58,890	0.252

Other Issues

- Convergence issues with some of the retrospective peels
- Models may be over-parameterized, due to commercial and recreational fleets being modeled separately
- Could explore modeling single fleet during next benchmark

Summary

- Pollock stock is not overfished and overfishing is not occurring
- A major source of uncertainty is the shape of survey selectivity curve
 - Base model predicts a large cryptic biomass that cannot be confirmed by fisheries or surveys
- Stock status is insensitive to shape of selectivity curve at older ages