2015 Acadian Redfish Operational Assessment

Groundfish Assessment Peer Review Meeting

NOAA FISHERIES

NORTHEAST FISHERIES SCIENCE CENTER

Woods Hole, MA

September 14-18, 2015

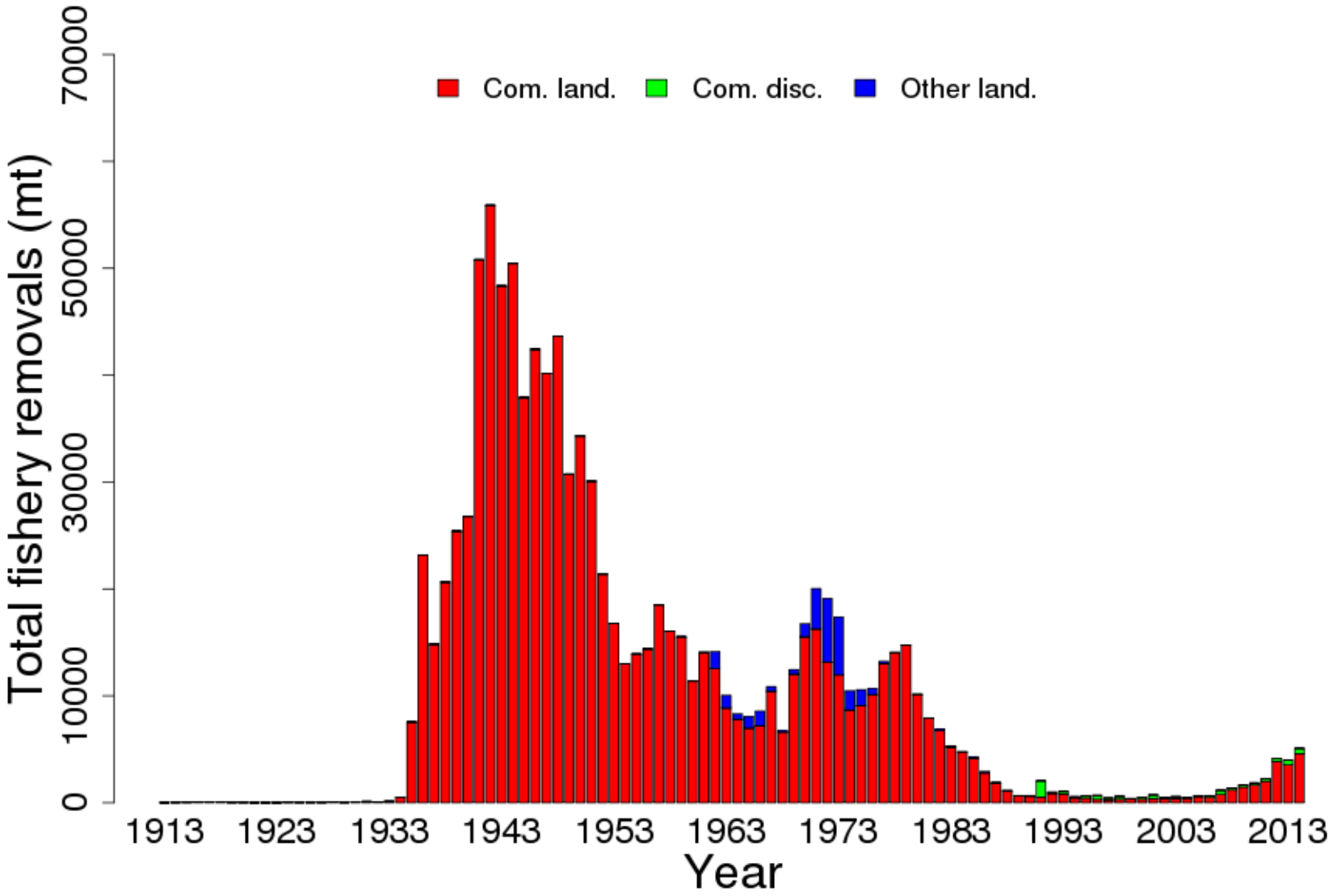
Background

- Last assessed in 2012 operational assessment with ASAP using data through 2010
  - Status: not overfished, overfishing is not occurring
- Last benchmark was in 2008 as part of GARM III with ASAP using data through 2007
  - Status: not overfished, overfishing is not occurring

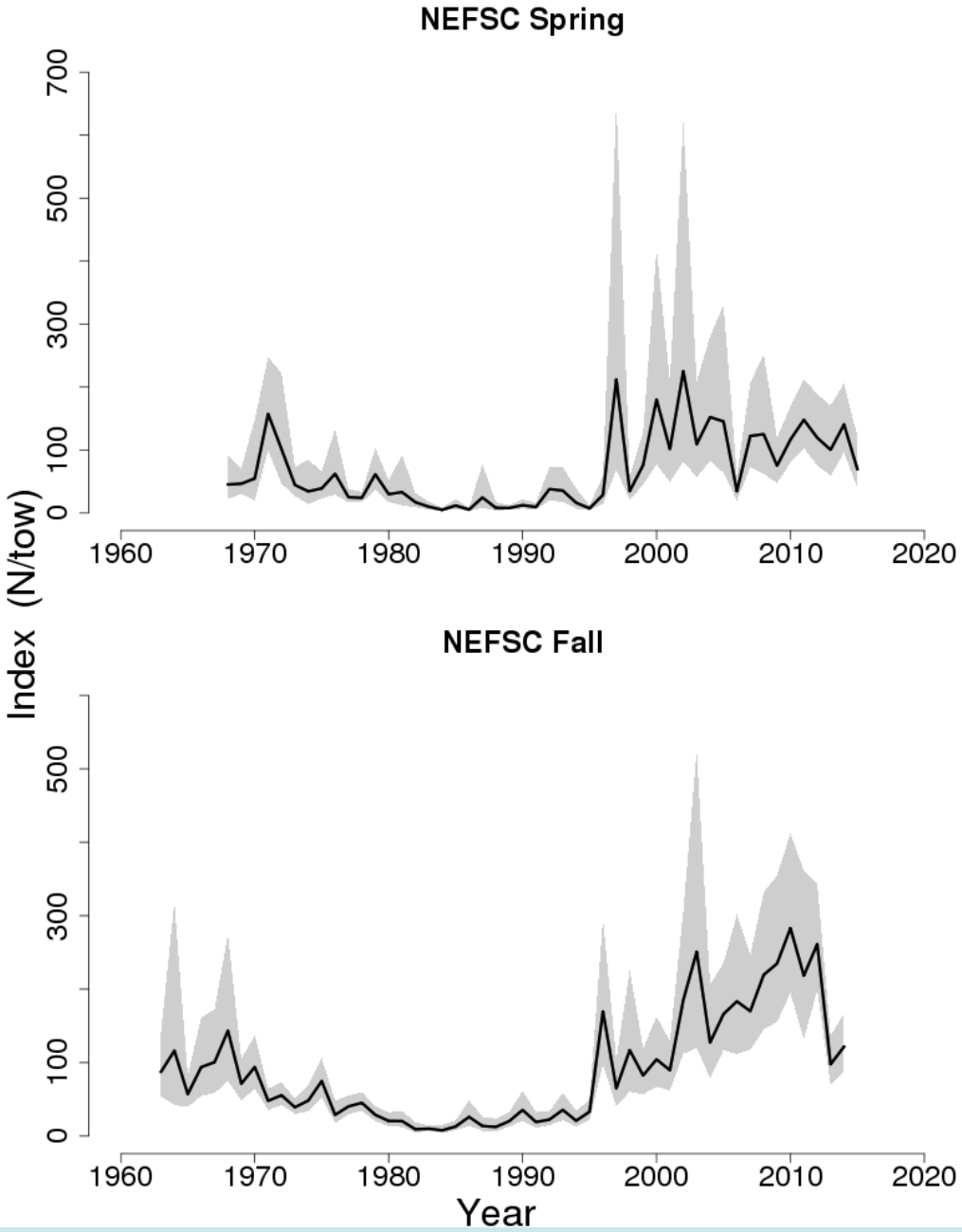
Data Inputs

Source	First Yr	Last Yr (2012)	Last Yr (2015)
Commercial Landings			
Total (mt)	1913	2010	2014
Numbers at age	1969	1985	1985
Commercial Discards			
Total (mt)	1989	2010	2014
NMFS Spring Survey Index			
Total (N/tow)	1968	2010	2014
N/tow at age	1975	1990	1990
NMFS Fall Survey Index			
Total (N/tow)	1963	2010	2014
N/tow at age	1975	2007	2013

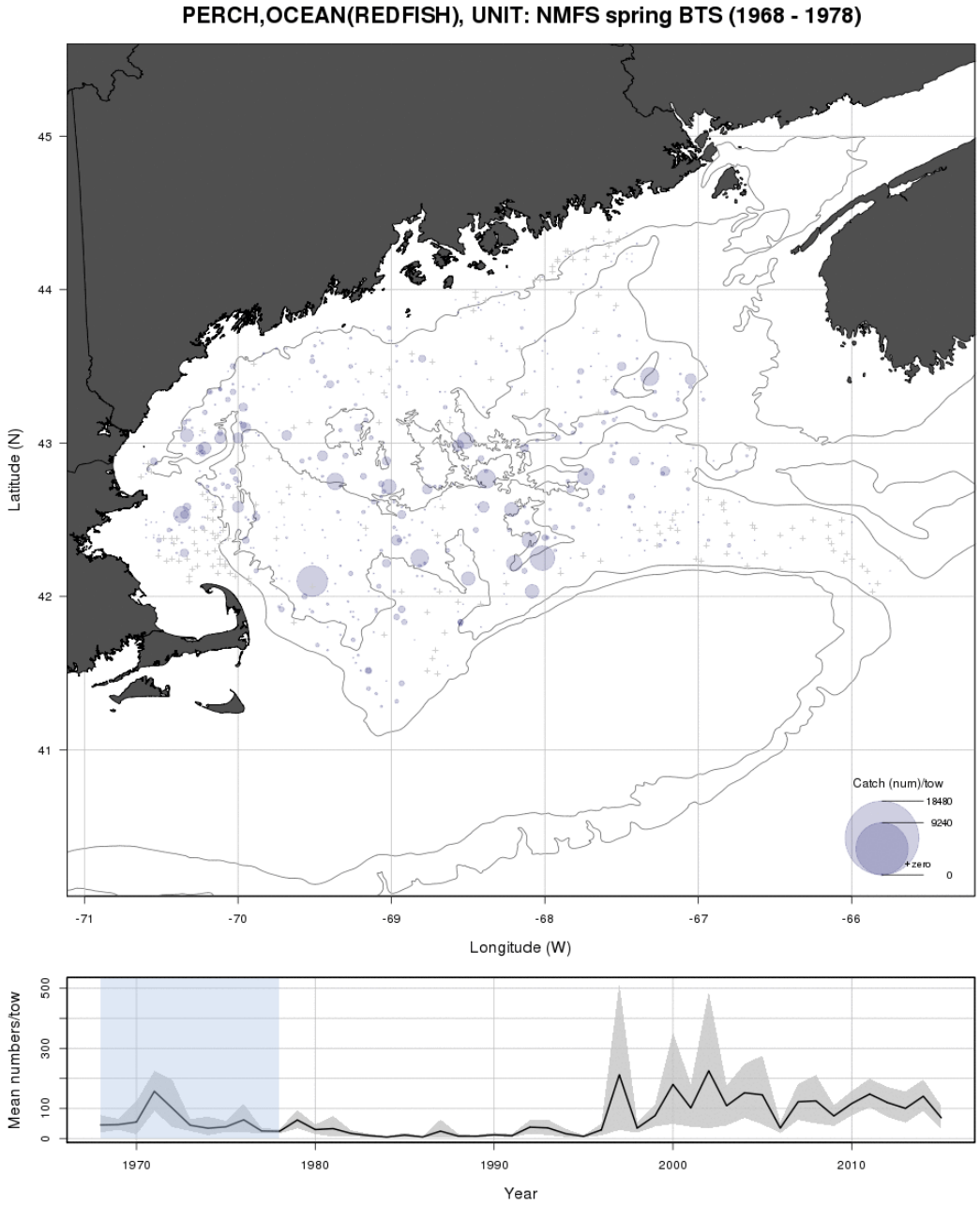
- Mean weight at age (pooled time series estimate)
- Maturity at age (pooled time series estimate)
- Natural mortality (0.05; not updated)

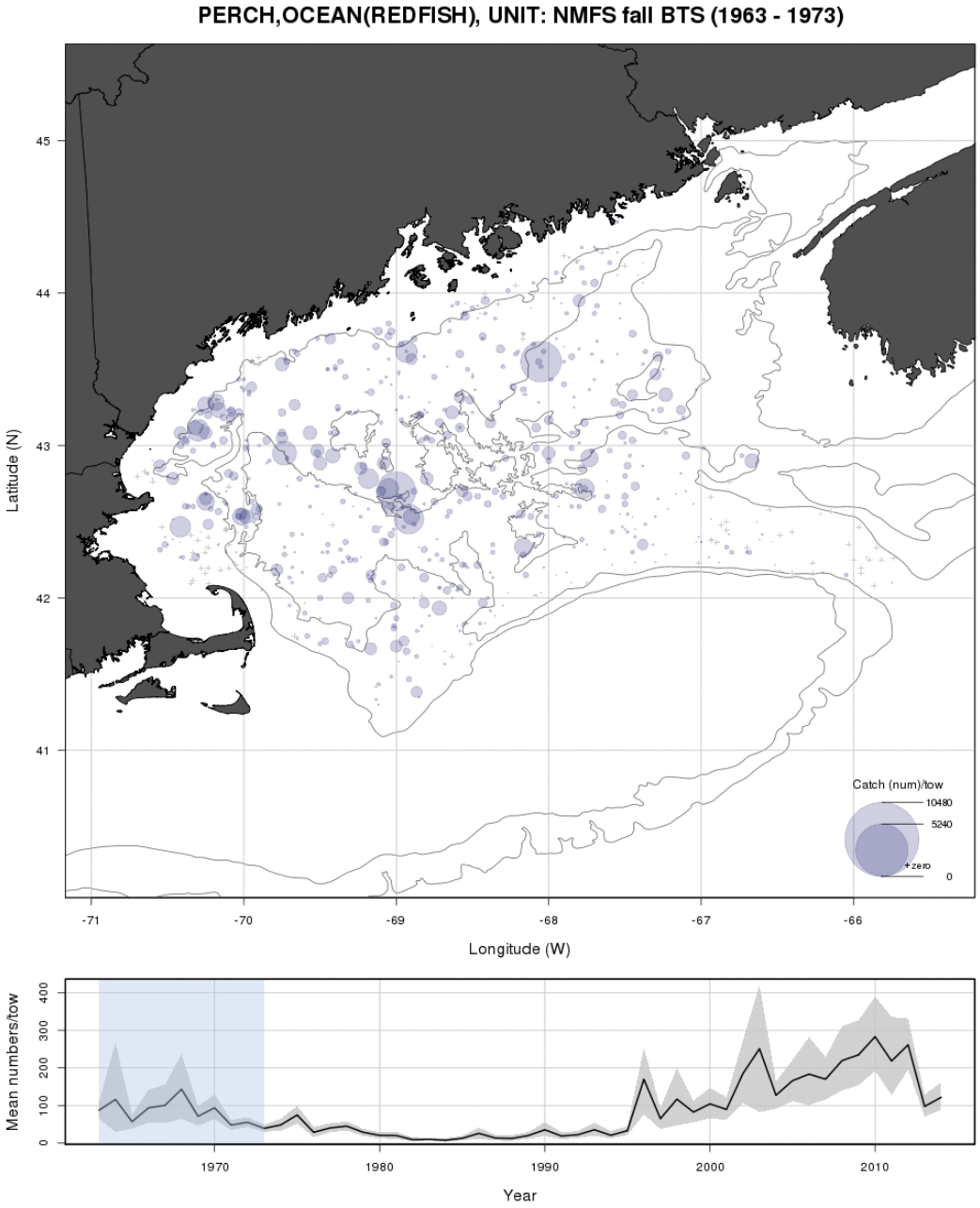


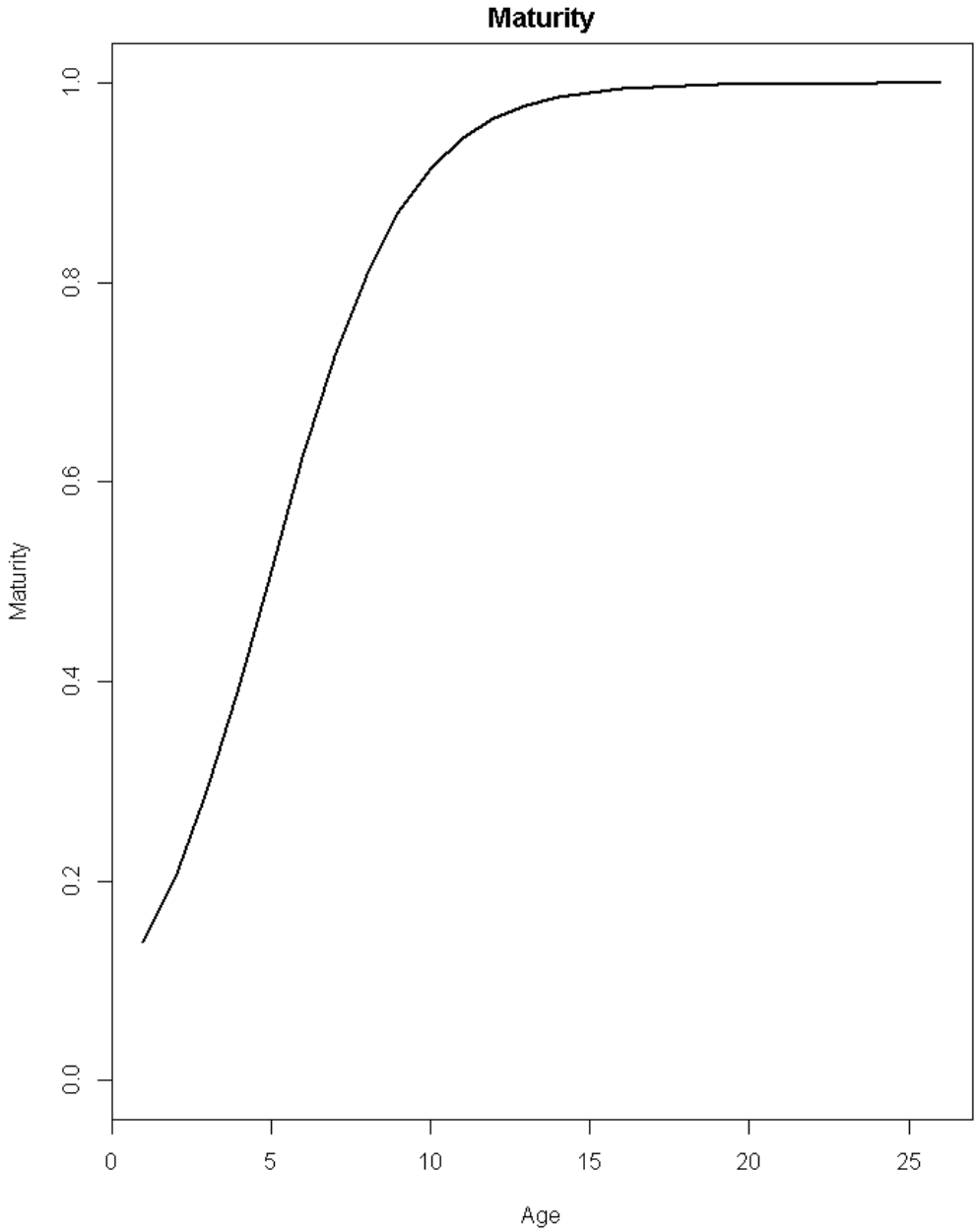
- Total removals in recent years have increased to early 1980s levels
- 1991 commercial discard estimate is uncertain (CV = 0.76)



- Change from SHG to TOGA for station selection had little effect on final indices
- 2013 Fall index value decreased 63% from 2012 value
- Decrease could represent interannual variability or a change in abundance


PERCH,OCEAN(REDFISH), UNIT: NMFS spring BTS (1968 - 1978)
Latitude (N)
45
44
43
42
41
-71
-70
-69
-68
-67
-66
Longitude (W)
Catch (num)/tow
18480
9240
+zero
0
Mean numbers/tow
0
100
300
500
1970
1980
1990
2000
2010
Year


PERCH,OCEAN(REDFISH), UNIT: NMFS fall BTS (1963 - 1973)
Latitude (N)
45
44
43
42
41
-71
-70
-69
-68
-67
-66
Longitude (W)
Catch (num)/tow
10480
5240
+zero
0
Mean numbers/tow
0
100
200
300
400
1970
1980
1990
2000
2010
Year



- 50% maturity around age 5
- 100% maturity around age 15

Model Configuration

- ASAP
- Years: 1913-2014
- Ages: 1-26+
- Model total removals (landings + discards) as a single fleet
- Survey catchability and fishery and survey selectivity are assumed to be constant over time
- Fishery and survey selectivity values are fixed at 1.0 for ages 10+

Model Configuration

- Recruitment CVs follow linear ramp up from 0.1 in 1964 to 0.8 in 1969, when age data are available

1964 = 0.1	1967 = 0.52
1965 = 0.24	1968 = 0.66
1966 = 0.38	1969 = 0.8

- Recruitment CVs ramp down from 0.8 in 2013 to 0.66 in 2014, when age data are not available

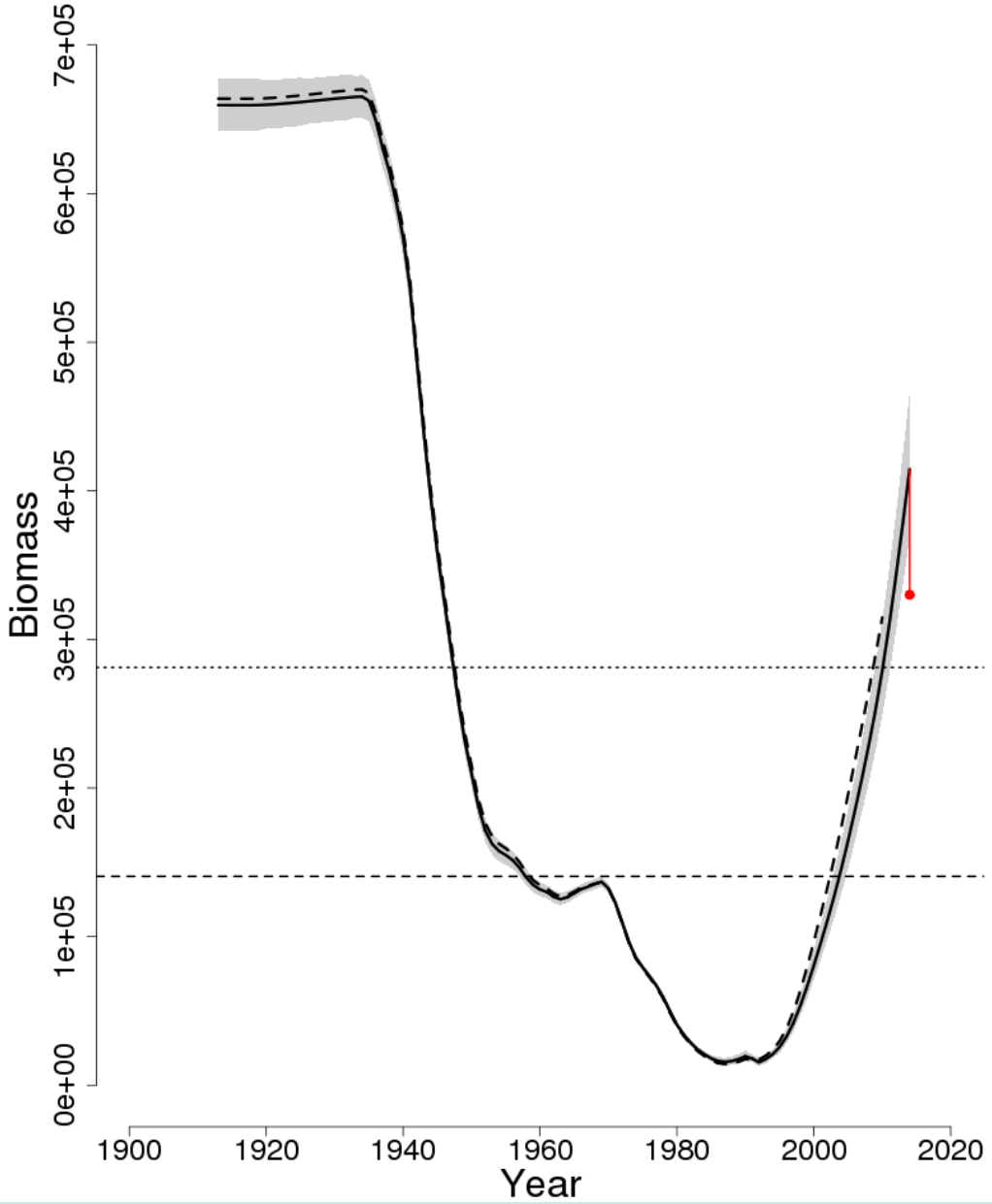
Model Changes

- 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

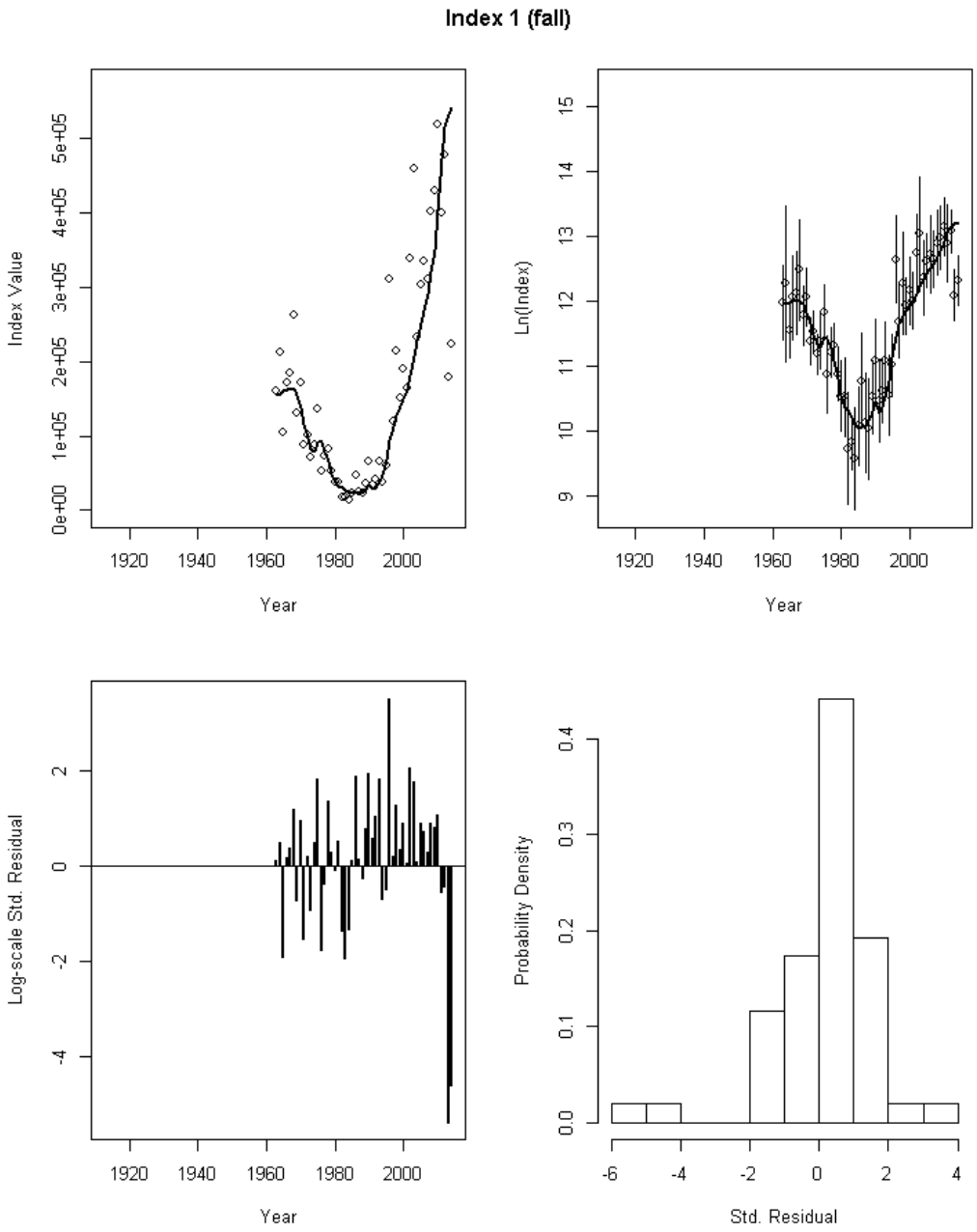
$$-\ln(L) = n_{rec}\frac{ln(2\pi)}{2} + \sum_{Y_f}^{Y_l} ln\left(\widehat{R_y}\right) + n_{rec}ln(\sigma) + \frac{1}{2}\sum_{Y_f}^{Y_l}\frac{\left(\ln\left(\widehat{R_y}\right) - \ln\left(\overline{R_y}\right)\right)^2}{\sigma^2}$$

Diagnostics

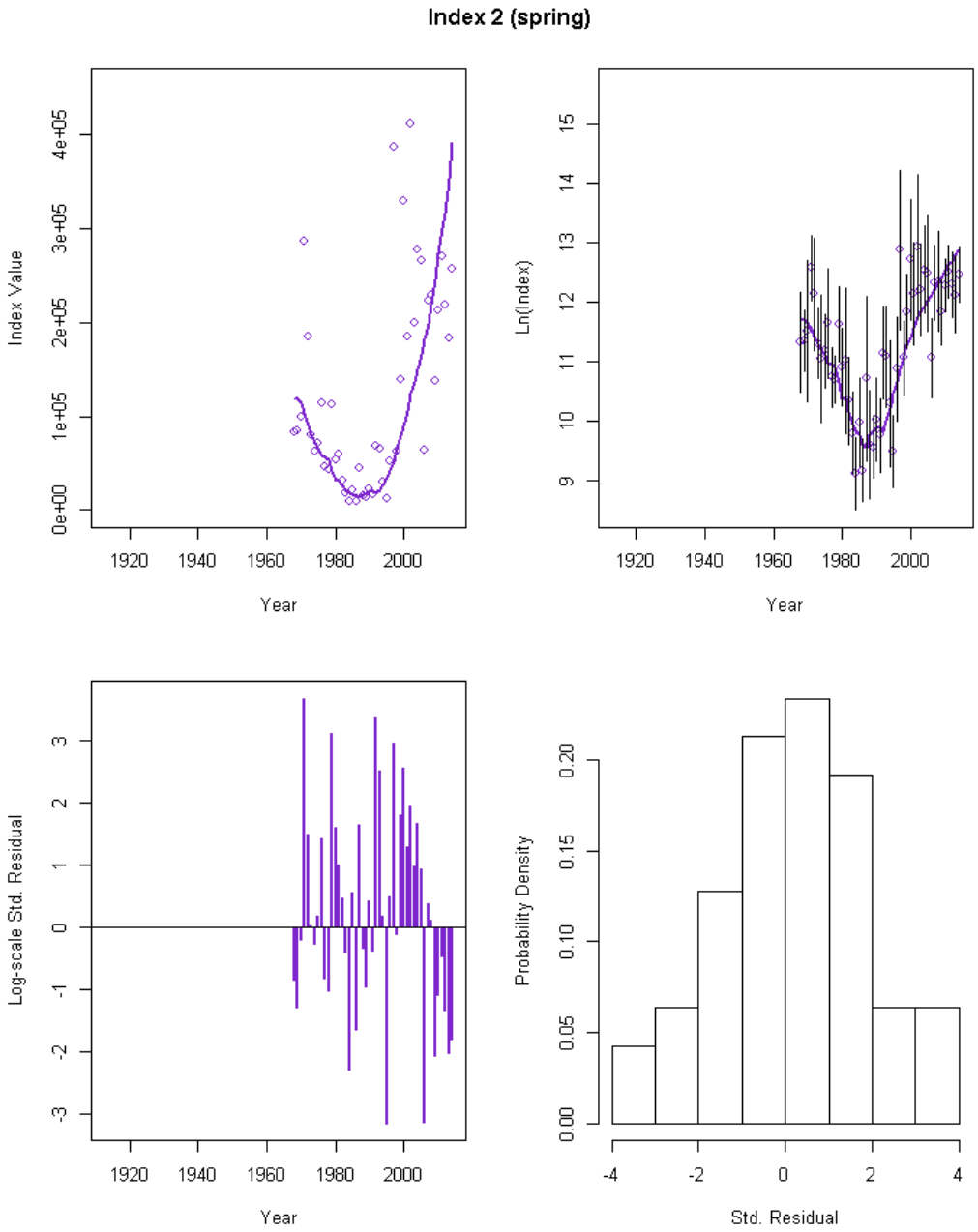
- In general, model fits and residual patterns were similar to those from the 2012 operational assessment



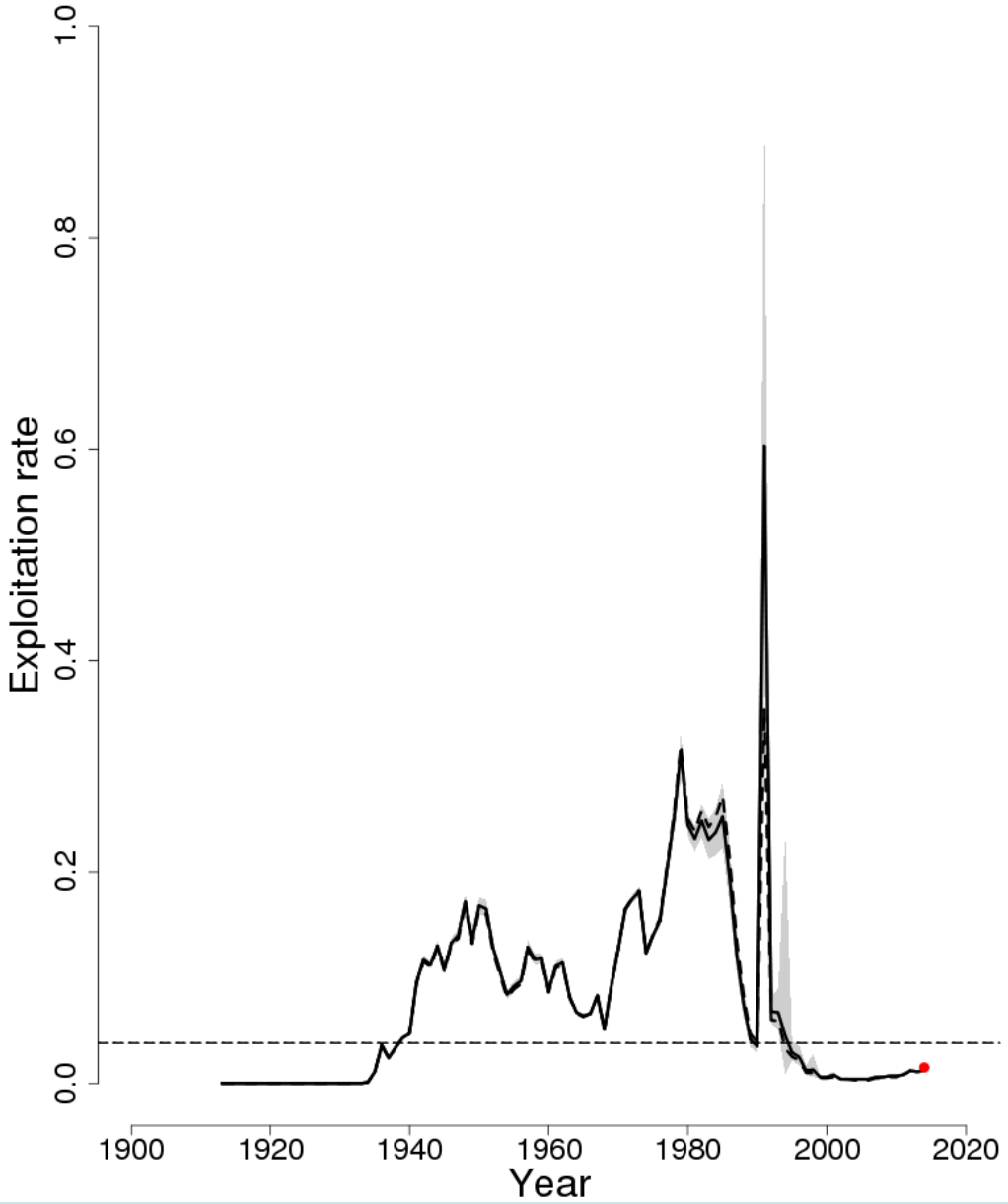
- Predicted SSB continues to increase
- Retro adjusted SSB is outside 90% CI



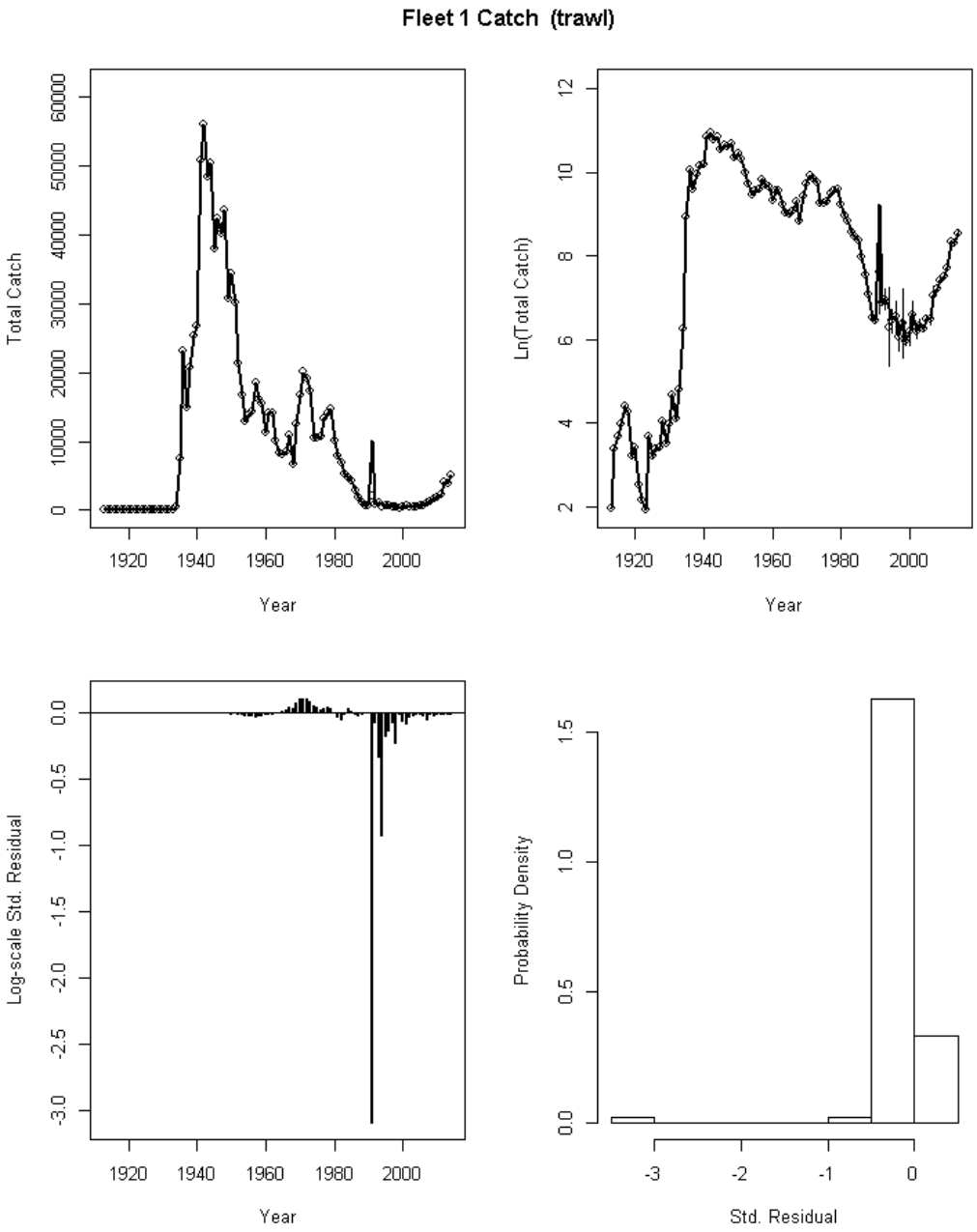
- Relatively large residuals for last two years of Fall index
- SSB trajectory may change abruptly, if future index values remain low
- May increase retrospective bias



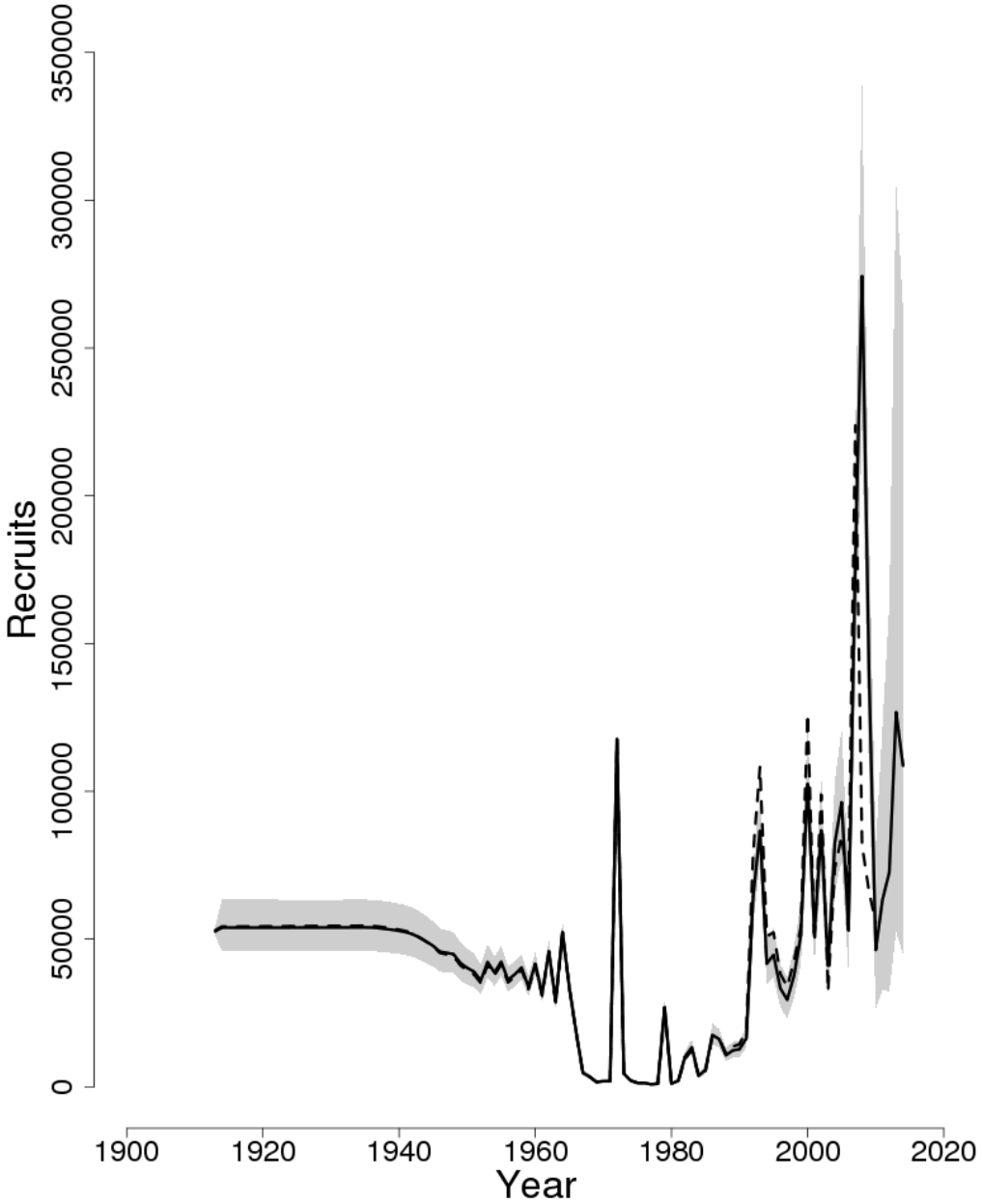
- Similar situation to Fall index, but to lesser extent



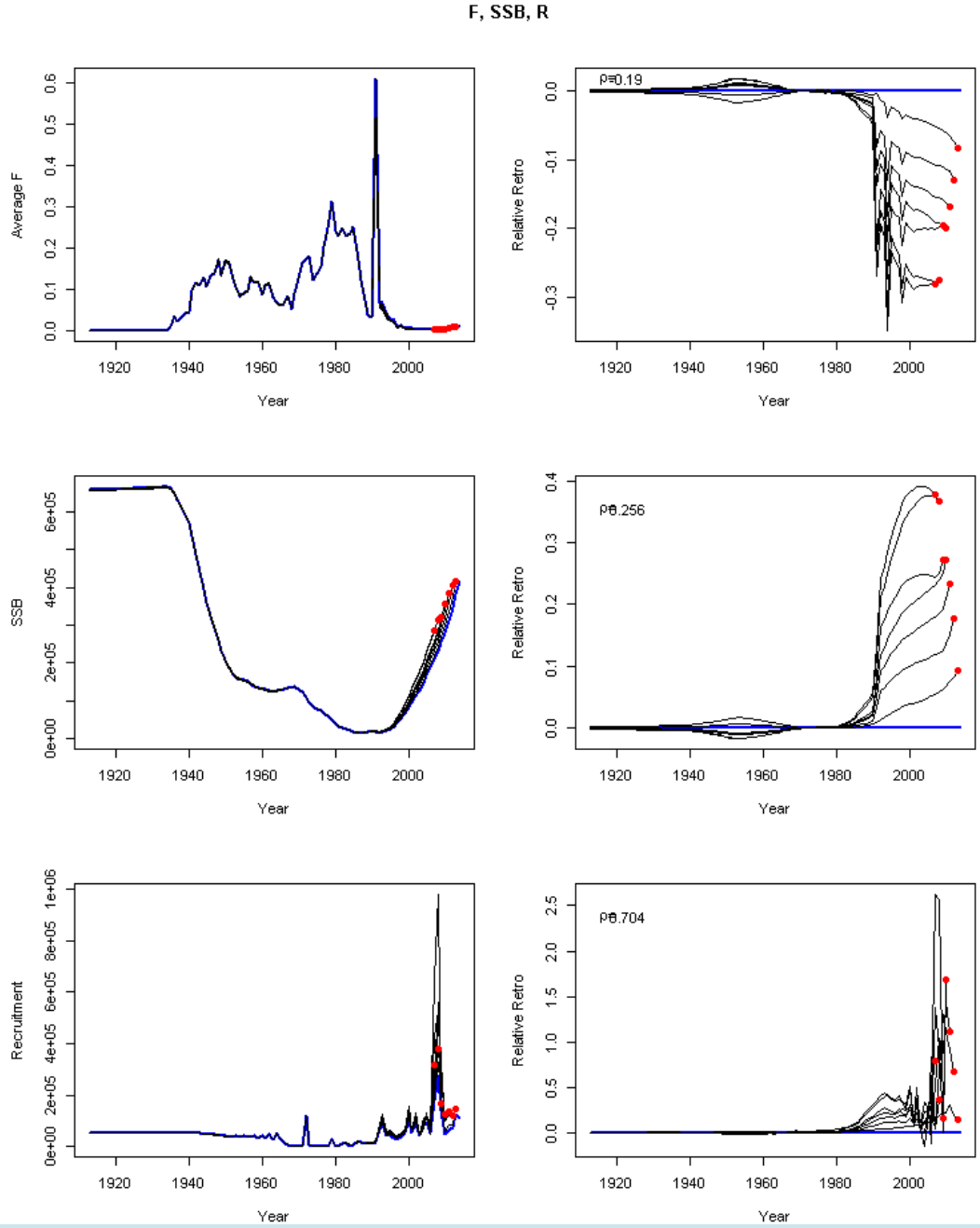
- Predicted F has doubled since 2008, but remains low
- Retro adjusted F is outside 90% CI
- Spike in F predicted in 1991
- Spikes in F were predicted in 1991 and 1996 in GARM III



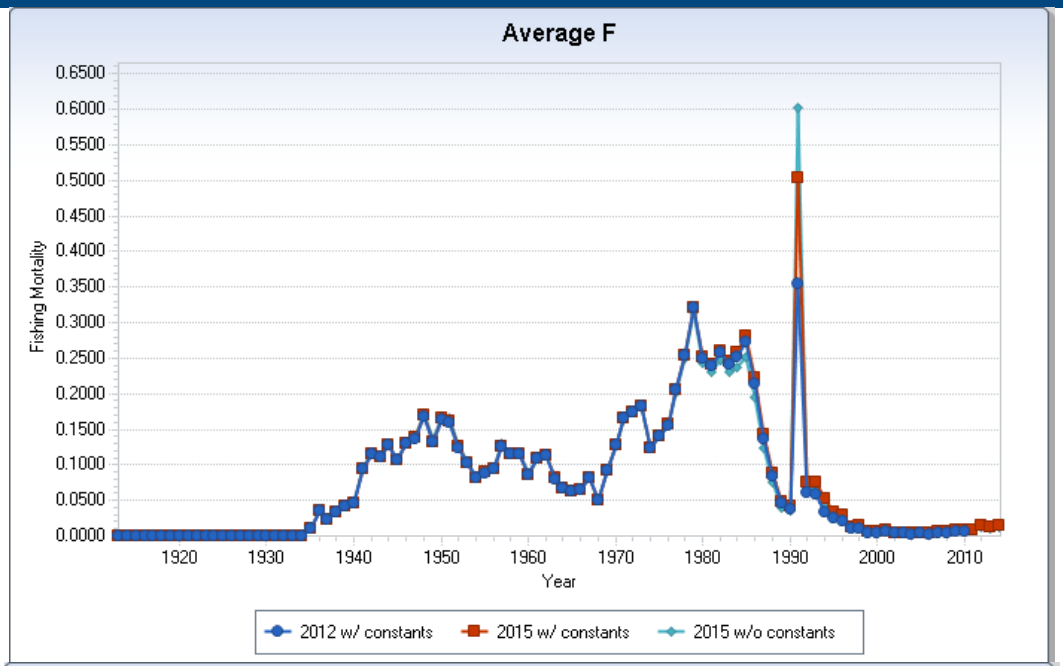
- Model overestimates 1991 total removals, due to associated uncertainty (CV = 0.57)
- Total removal CVs calculated using SDs of discards for 1989-2014

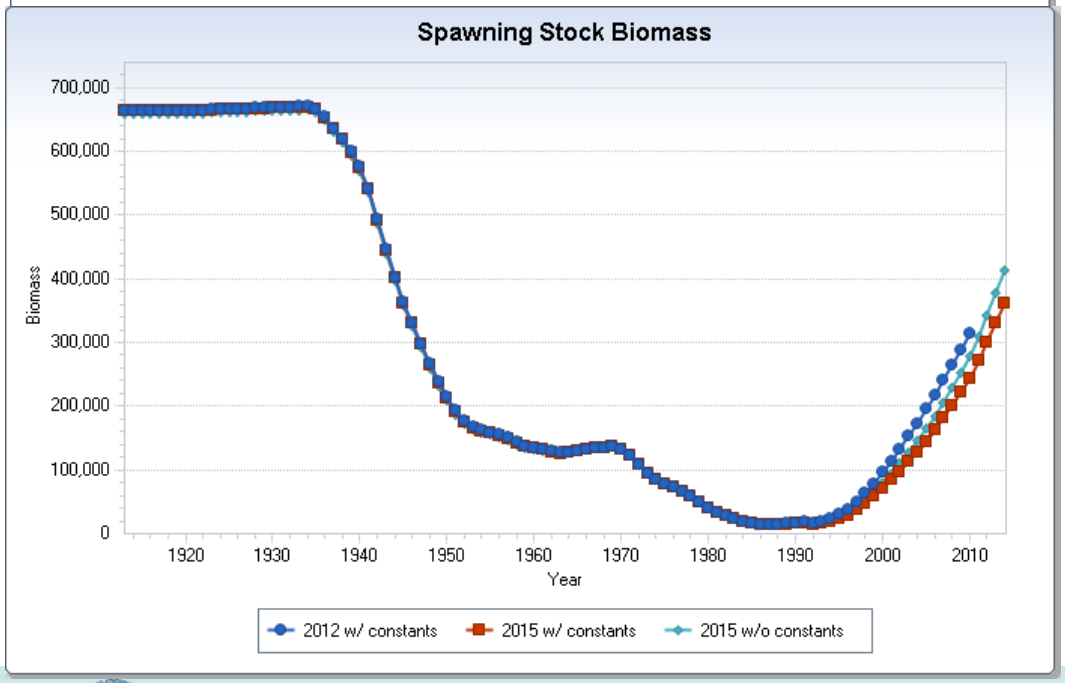


- General increase in predicted recruits since early 1980s
- 2007 year class predicted to be particularly strong, rather than the 2006 year class in 2012 assessment



- 2012 operational assessment had minimal retro bias
- GARM III assessment had retro bias requiring retro adjustment of projections





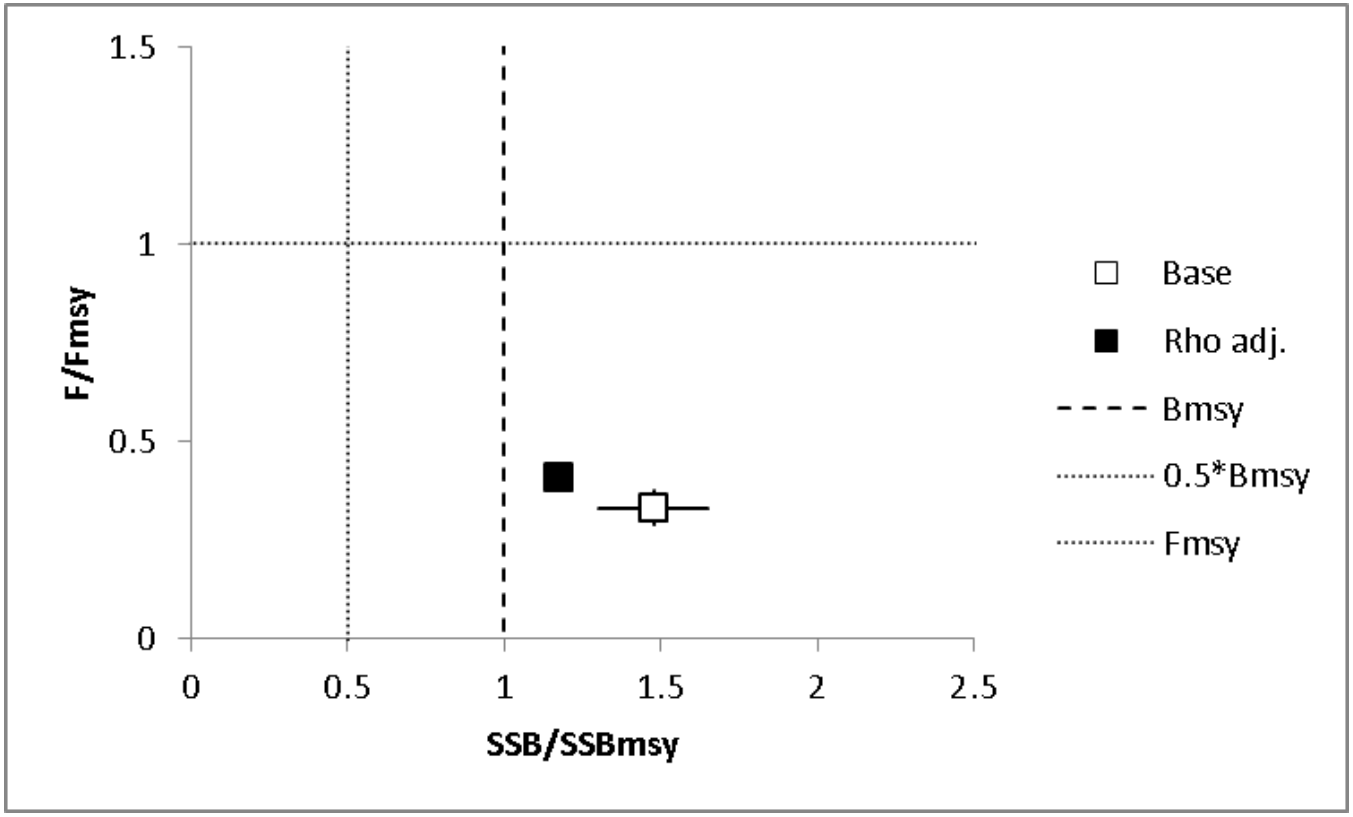
- Exclusion of likelihood constants had minimal effect on F
- Exclusion of likelihood constants led to slight increase in SSB in recent years

Biological Reference Points

- Used YPR to get F threshold
  - Same weights at age, natural mortality, maturity at age, and selectivity at age as from ASAP model
- Used AGEPRO to get biomass target
  - ASAP model values as with F threshold
  - F set equal to Fmsy proxy of F50%
  - Recruitments drawn from empirical CDF (1969-2014)

Biological Reference Points

	2012	Current
F_{MSY} *proxy*	0.038	0.038
SSB_{MSY} (mt)	238.000	281,112 (201,740 - 376,533)
MSY (mt)	8,891	10,466 (7,458 - 14,081)
Median recruits (age 1) (000s)	48,177	47,006
Overfishing	No	No
Overfished	No	No



- Retro adjusted F and SSB were inside 80% CIs in 2012 assessment
- Retro adjusted F and SSB were outside 80% CIs in GARM III assessment

Projections

- Used AGEPRO to forecast median spawning biomass and yield
- Same configuration as in biomass target determination
- 2015 total catch estimated to be 5,204 mt
- 2016-2018 F set equal to Fmsy proxy of F50%
- Retrospective adjustments applied to projections

Projections

Year	Catch (mt)	SSB (mt)	F_{Full}
2015	5,204	343,190	0.015
2016	13,723	367,307	0.038
2017	14,541	382,319	0.038
2018	15,007	393,124	0.038

Summary

- Acadian redfish stock is not overfished and overfishing is not occurring
- Major sources of uncertainty:
  - Lack of commercial age data in recent years
  - Dimorphic growth
- Spawning biomass trajectory may change abruptly, if future survey index values remain low
  - May lead to increase in retrospective bias
- Several issues from GARM III have returned:
  - Retrospective bias
  - Spike in 1991 F, due to uncertainty in 1991 catch