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# White Hake Assessment

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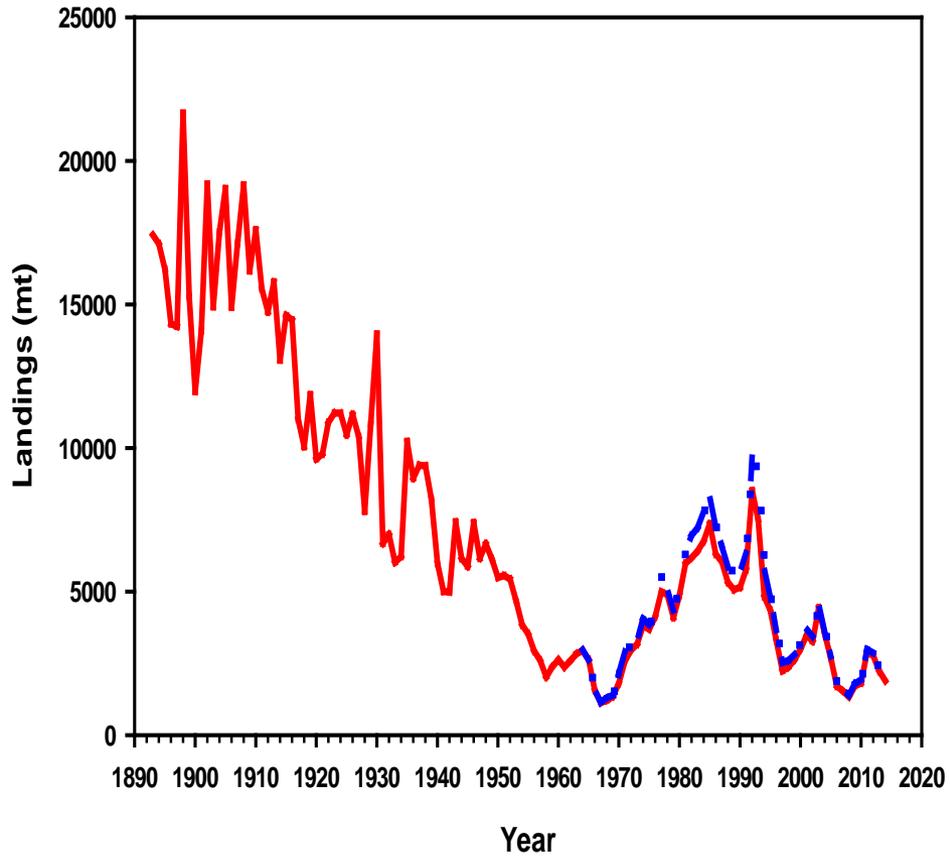
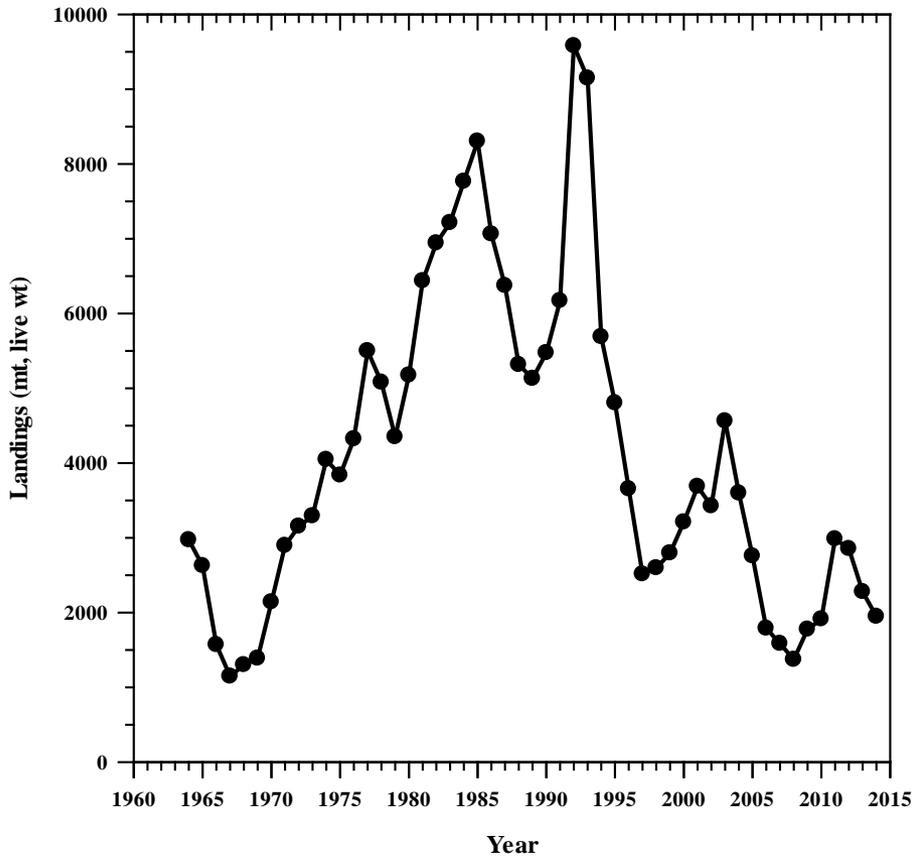
# Previous Assessment – SAW 56

- ASAP
- 1963-2011
- CAA 1989-2011
- Survey CAA 1963-2011
  - Pooled ALKS for 1963-1981, autumn 2003
- $F_{\text{msyproxy}} = F_{40} = 0.2$
- $SSB_{\text{msyproxy}} = 32,400$  mt
- $SSB_{2011} = 26877$ ,  $F_{2011} = 0.13$
- Not overfished, no overfishing

# Catch

- US Commercial Landings: Update 2011, Add 2012-2014, from AA tables by market category
- Split red/white market category using proportion by area fished and add to small/medium combined market category (2011-2014, most from southern areas so most red hake, 0.5-1.2 t white hake).
- New market category of extra-large hake combined with large hake since length samples were available from 2011 but no landings until June 2014.
- Foreign Landings: Assume same CAA as US landings

# Catch

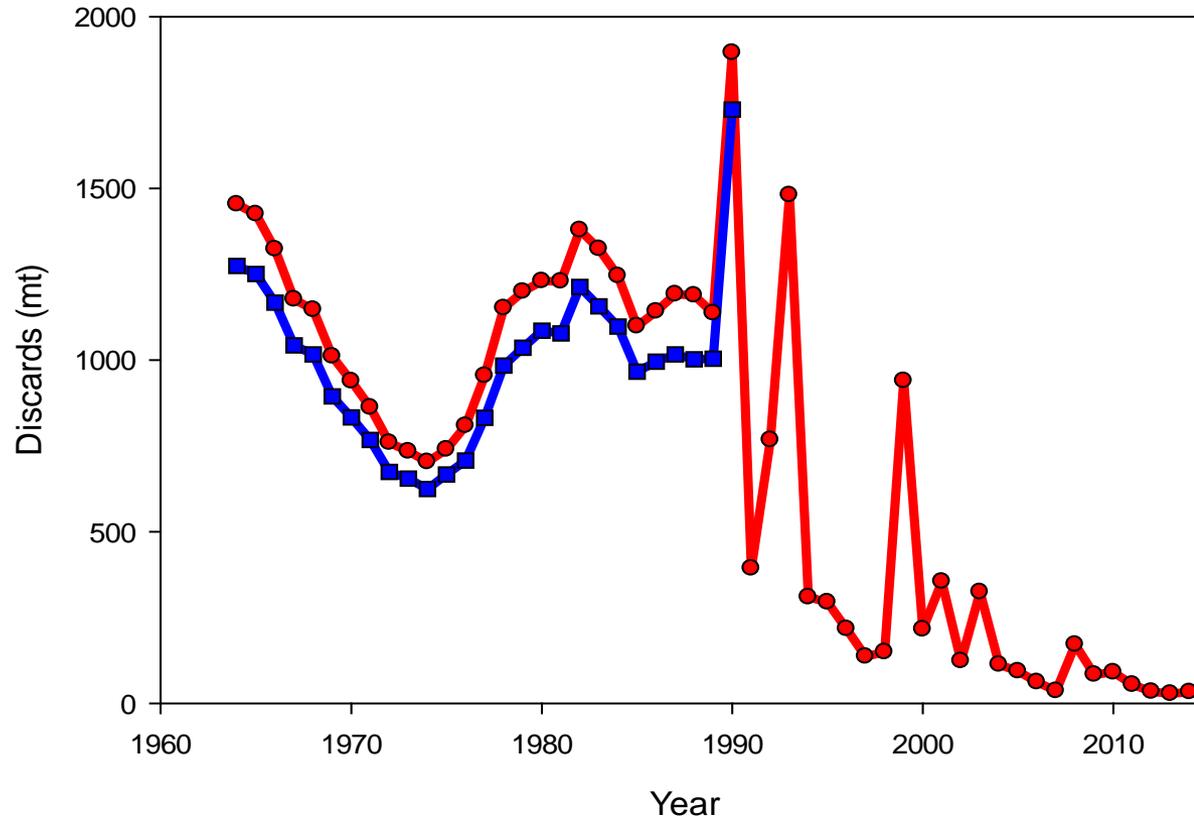


# Catch

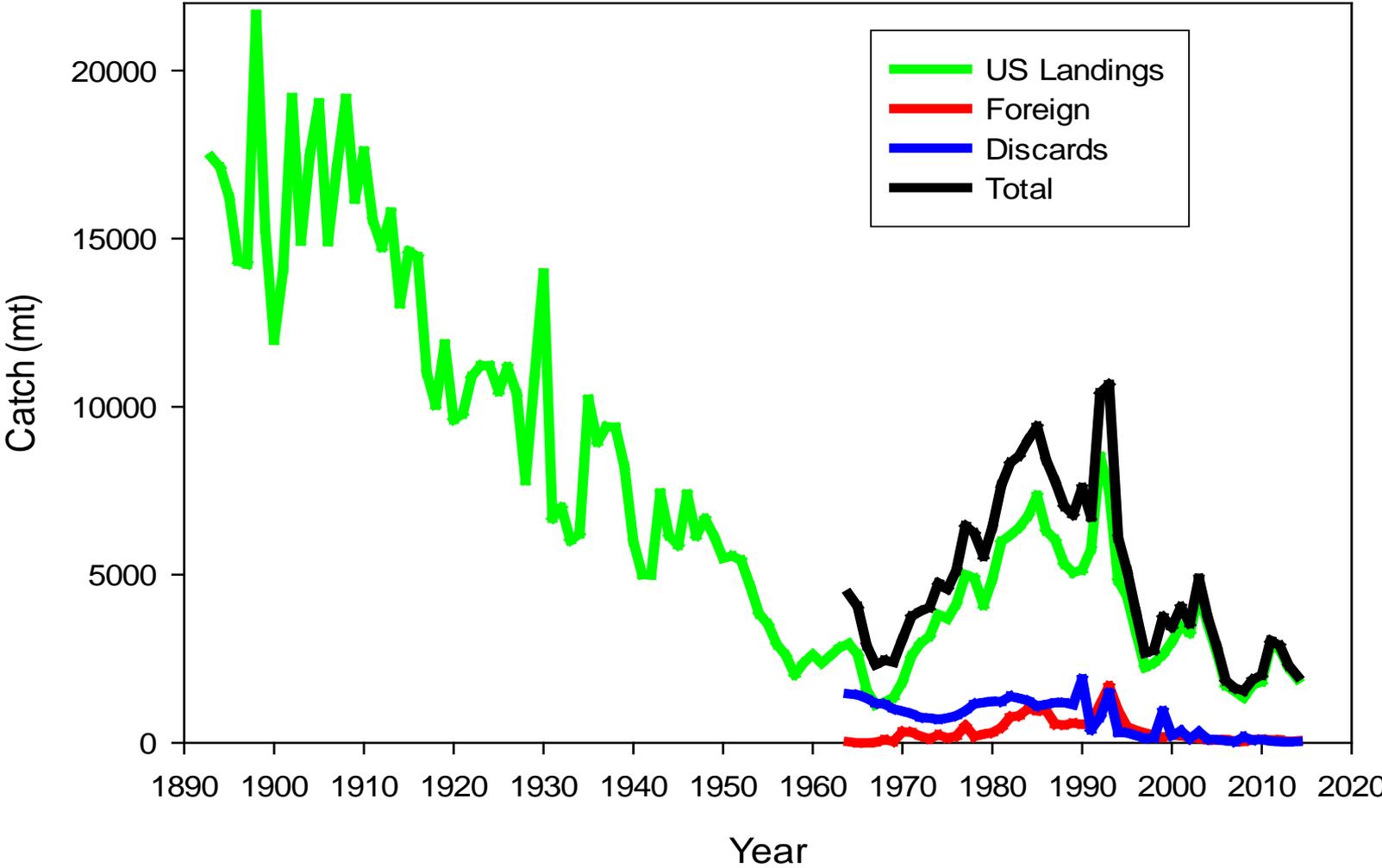
- US Commercial Discards: Update 2011, Add 2012-2014, SBRM approach by gear type (large mesh otter trawl, small mesh otter trawl, scallop dredge, longline and gillnet)
- Assume longline discards same CAA as large-mesh trawl discards
- Assume scallop dredge and shrimp trawl discards same CAA as small mesh discards
- Assume sink gill net discards same CAA as landings and discards combined
- CAA-use spring and fall age data from 2012-2014 except for spring 2014, use pooled ALK for first half of 2014

# Catch

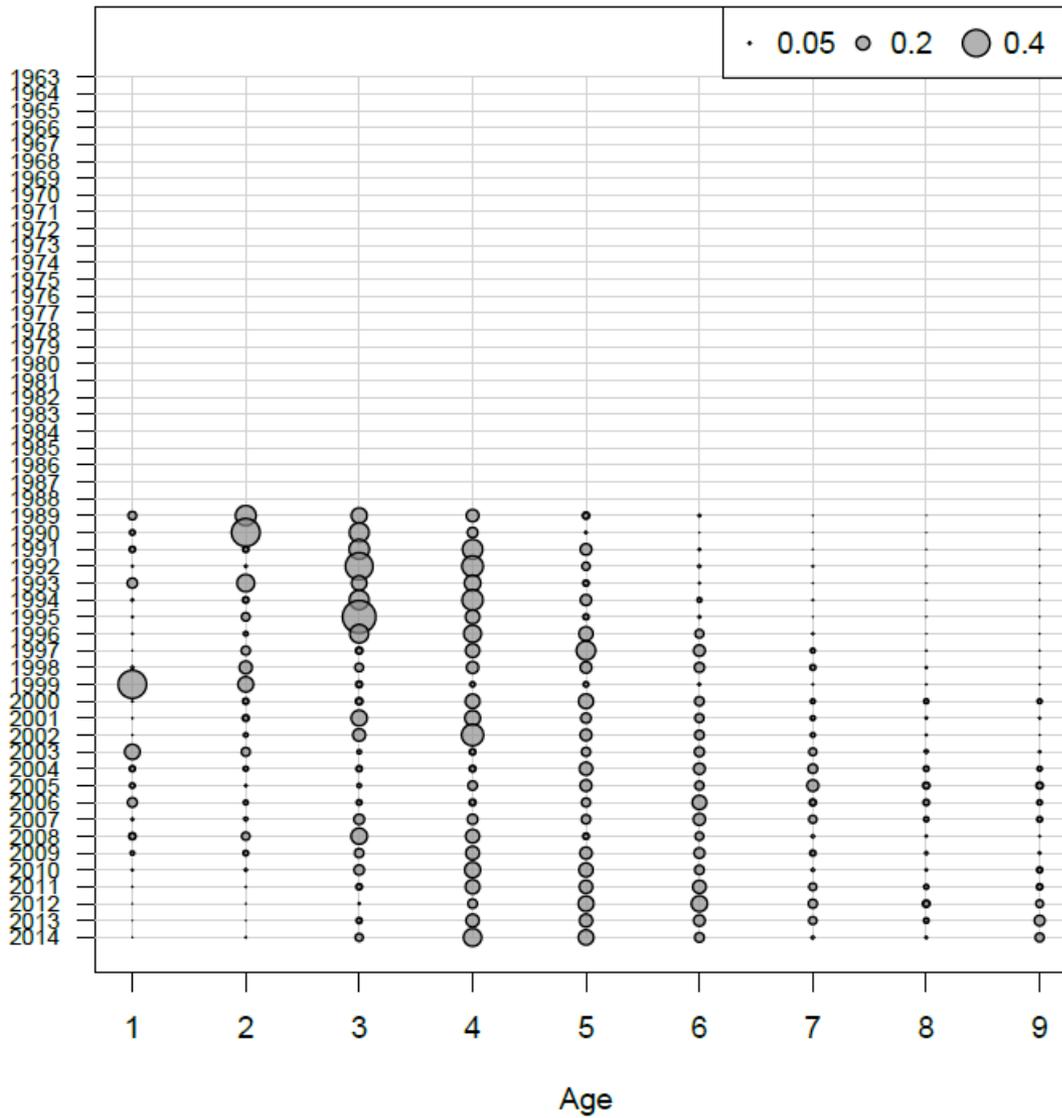
## White Hake Discards



# White Hake Catch

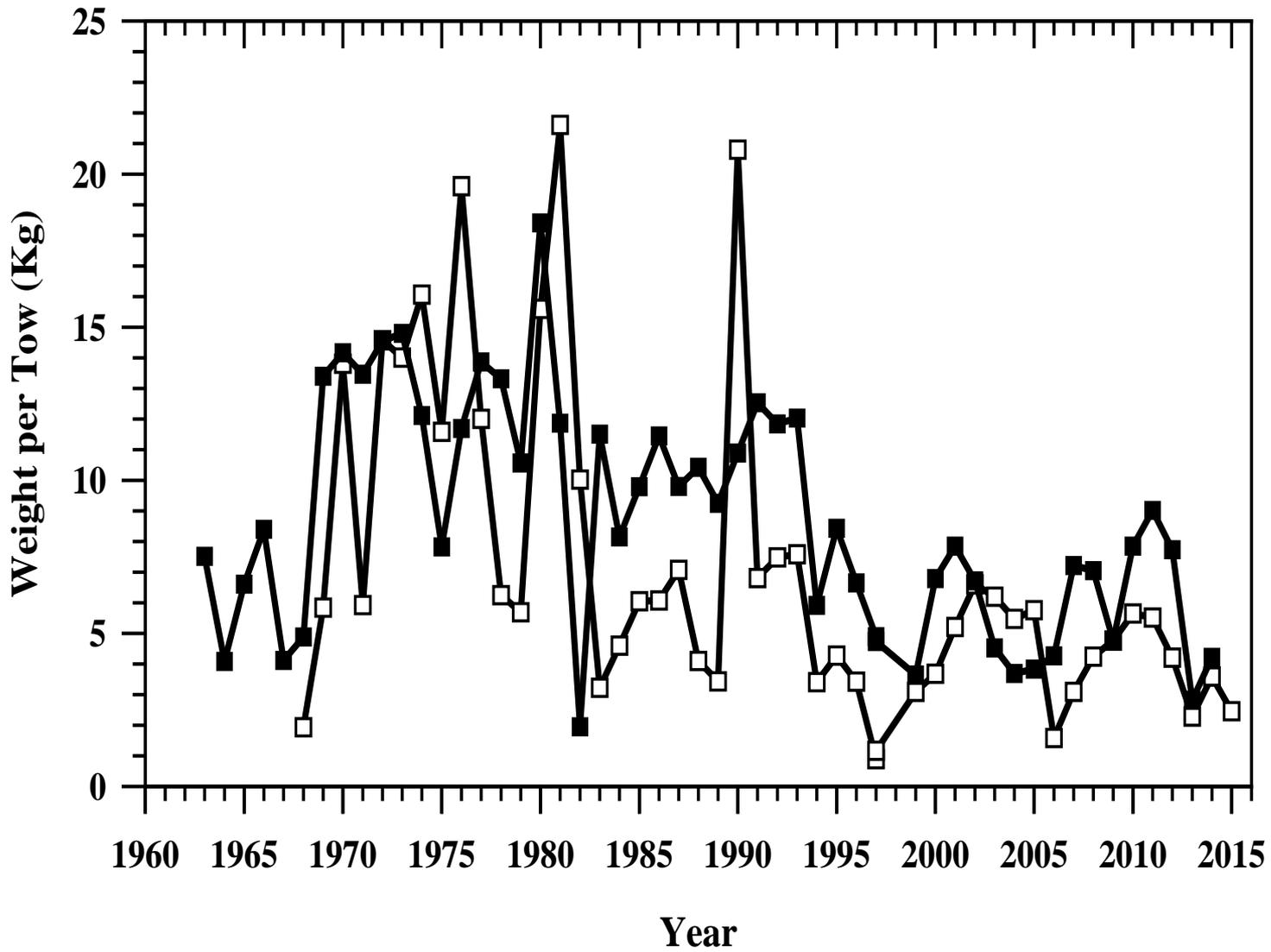


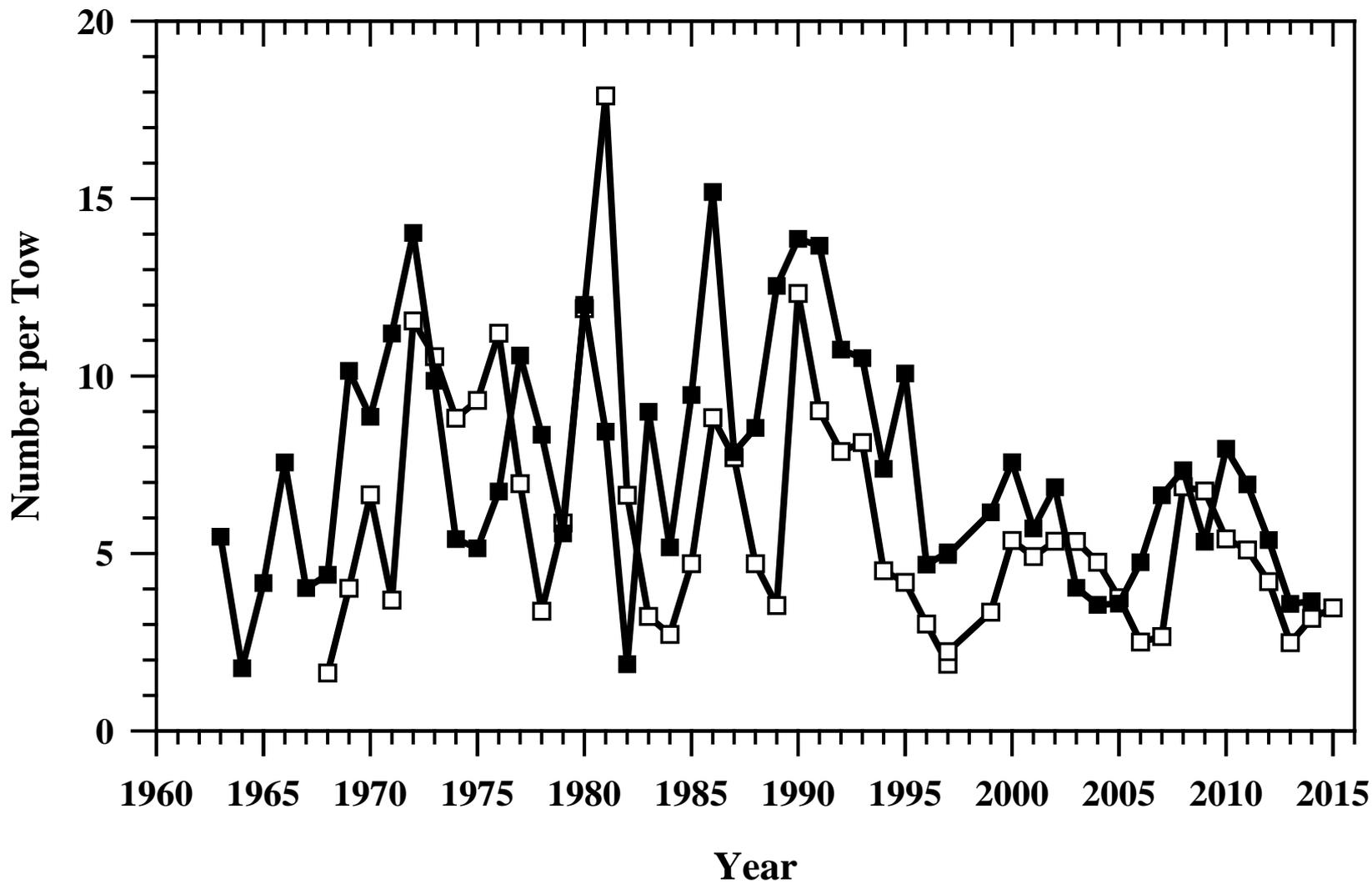
# Age Comps for Catch by Fleet 1 (FLEET-1)



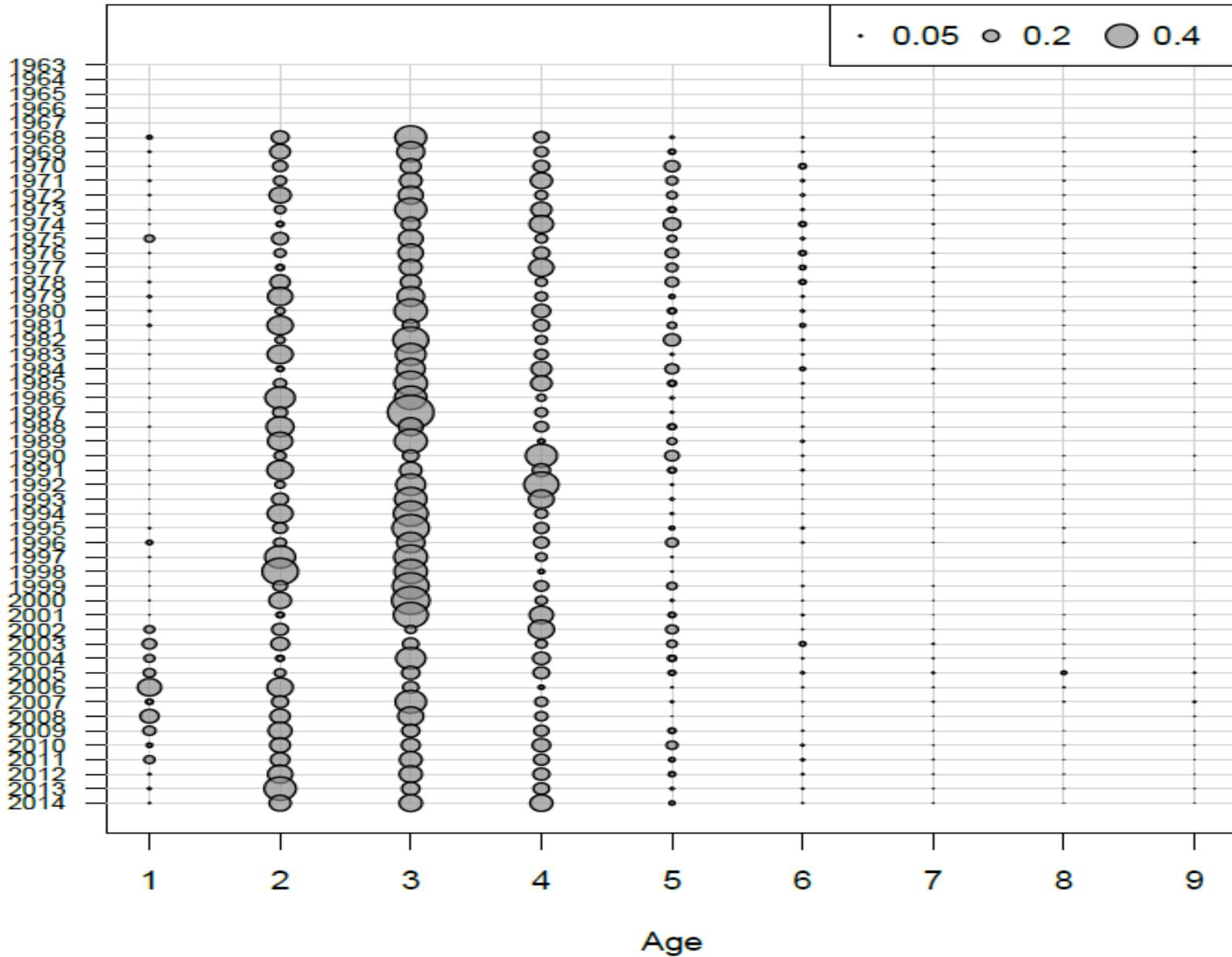
# Data updates-Survey

- NEFSC spring survey: Update 2013-2015
  - CAA update 2012-2013 with annual ALKS - 2014 with pooled
- NEFSC fall survey: Update 2012-2014
  - CAA update 2012-2013 with annual ALKs – 2014 with pooled

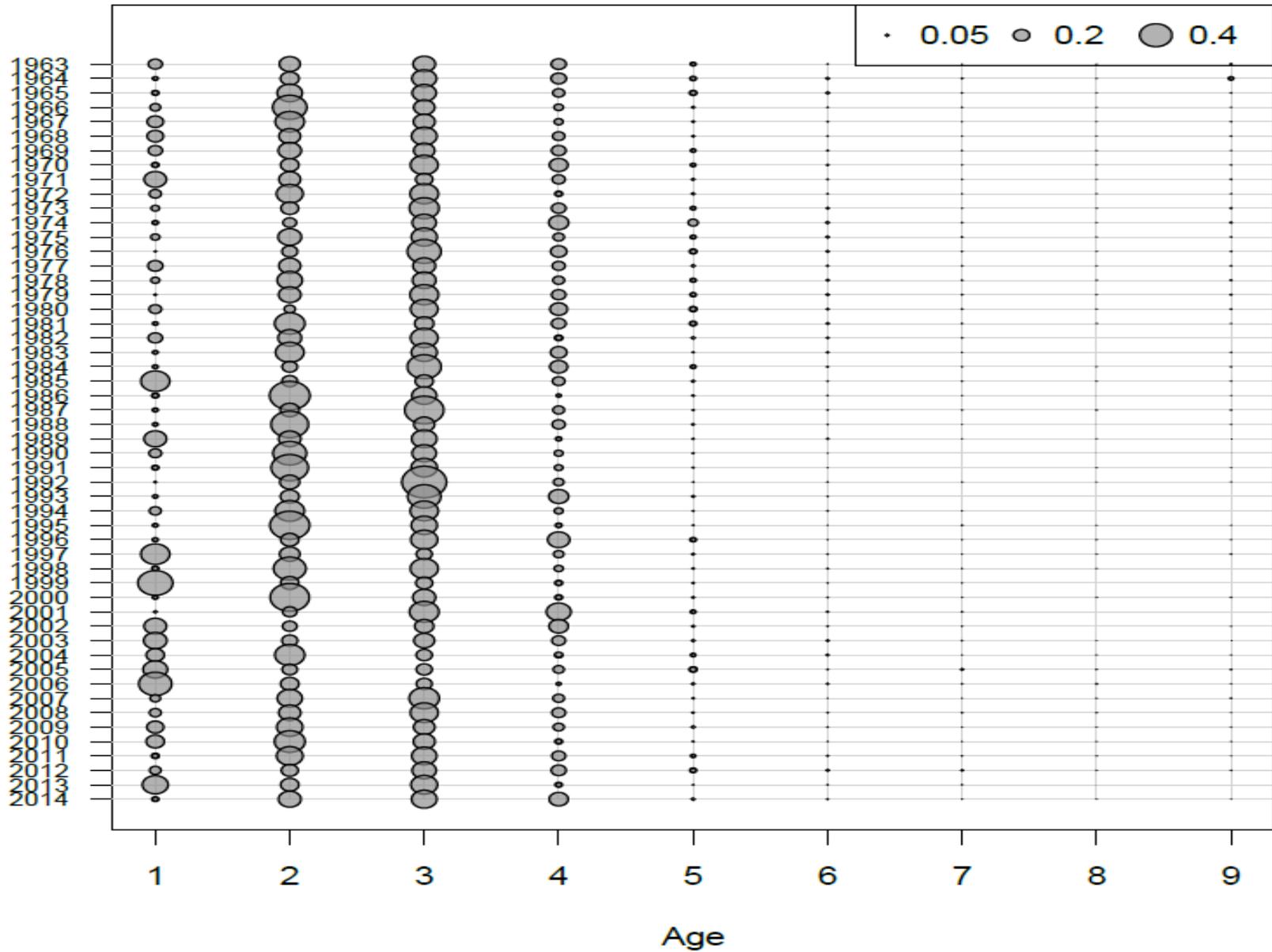




# Age Comps for Index 1 (FLEET-1)



# Age Comps for Index 2 (NA)



# Assessment model- ASAP

- Total catch - 1963-2014. CV 0.25 for 1963, 0.15 for 1964-1988, 0.05 for 1989-2014.
- CAA 1989-2014, second half of 2003 and all of 2014 pooled. Effective sample size set to 58 for 1989-2014 (numbers from benchmark).
- fall survey CAA 1963-2014, 1963-1981 and 2003 and 2014 pooled. Effective sample size set to 65 for 1963-1981 and 91 for 1982-2014 (numbers from benchmark). CVs  $-cv \text{ from survey} + 0.05$ .

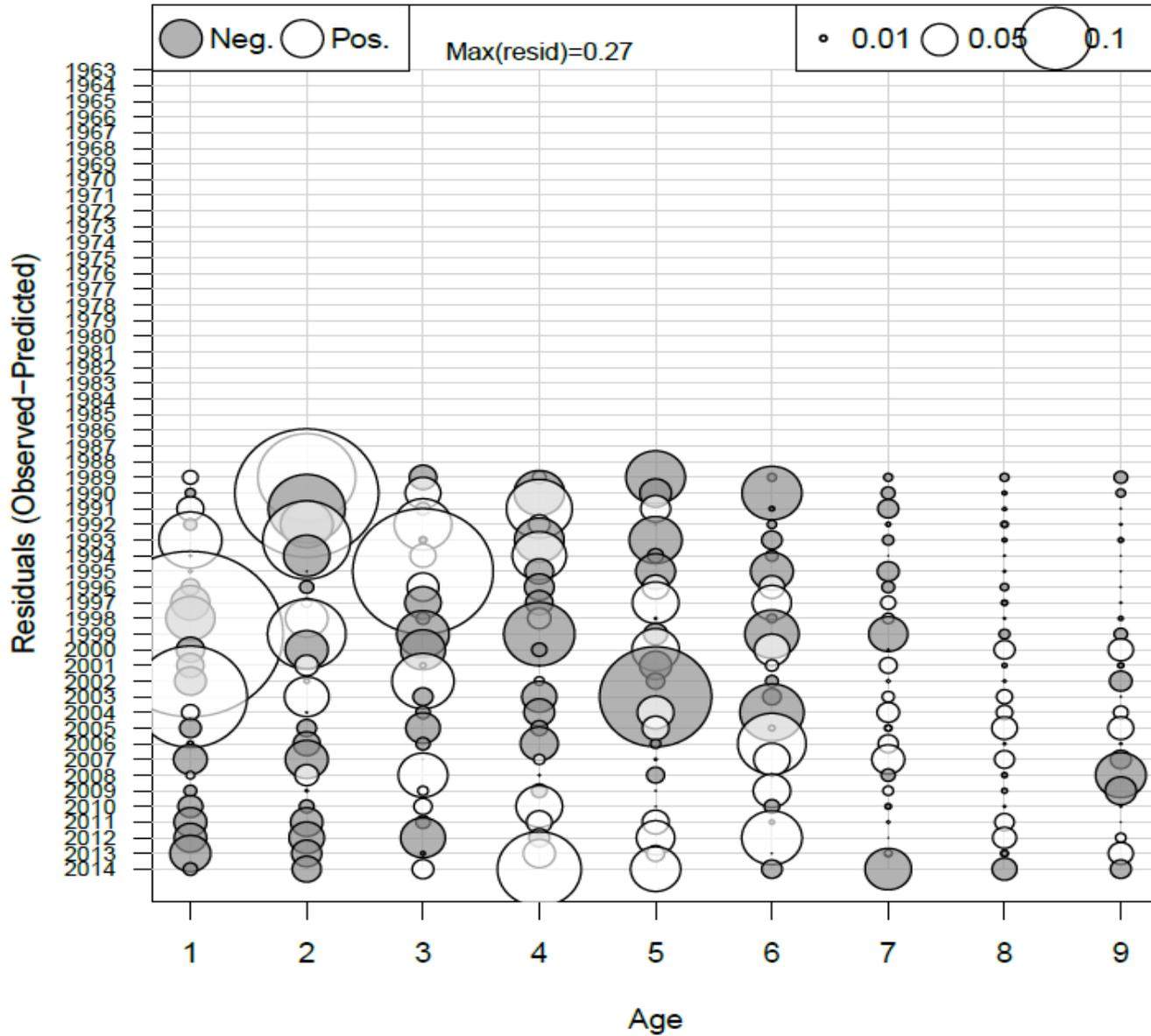
# Assessment model- ASAP

- spring survey CAA 1968-2014, 1968-1981 and 2014 pooled Effective sample size set to 29 for 1968-1981 and 42 for 1982-2014 (numbers from benchmark).  
CVs  $-cv$  from survey  $+0.15$ .
- surveys are not split
- Numbers at age in the first year were set to an exponential decline with a cv of 0.2 to address uncertainty in starting conditions.

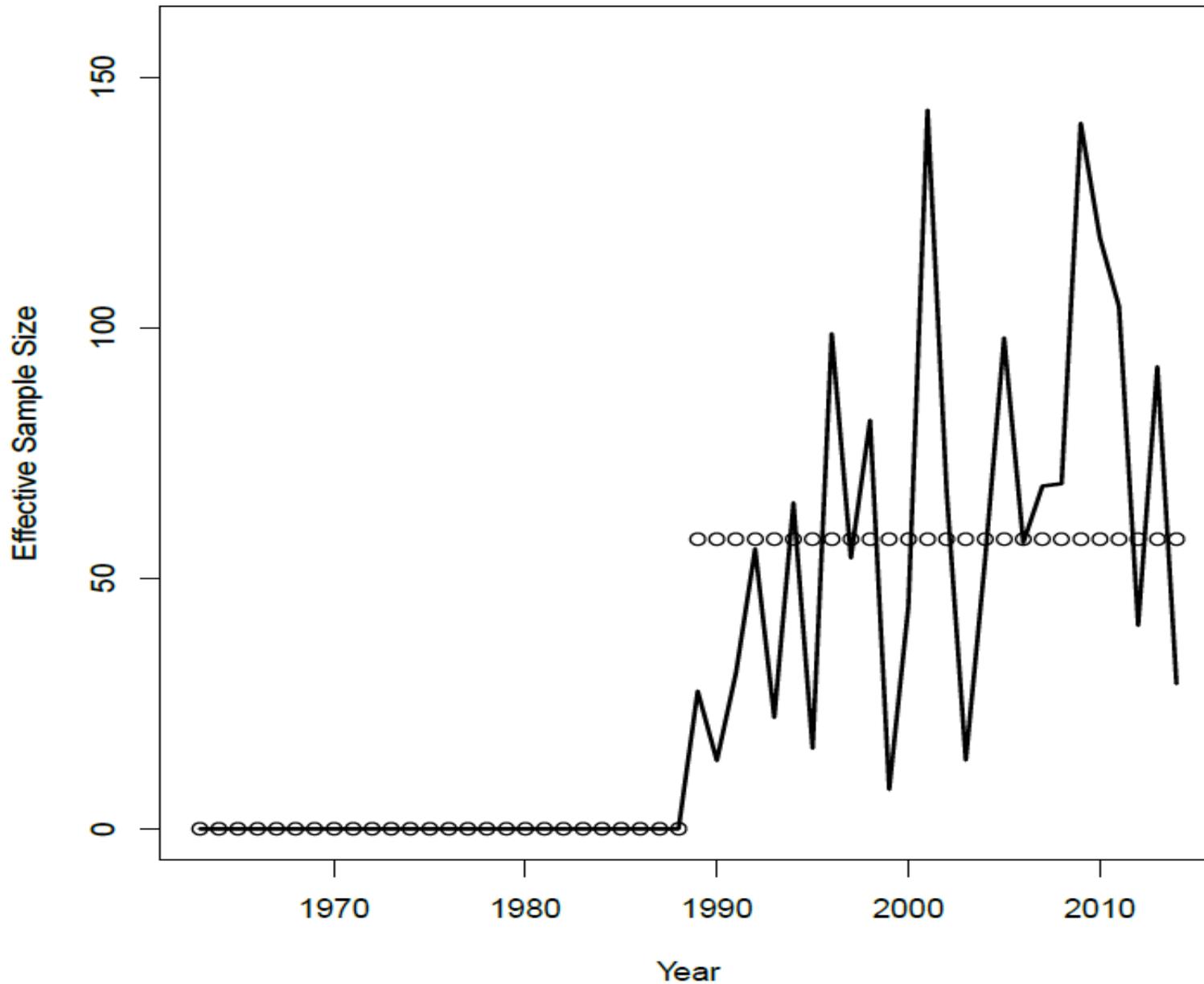
# Assessment model- ASAP

- Recruitment CVs set to 0.5
- Survey selectivities set to full at age 3 and other ages allowed to be estimated
- Fishery selectivity set to full for ages 6-9.
- Two selectivity blocks 1963-1997, 1998-2014.

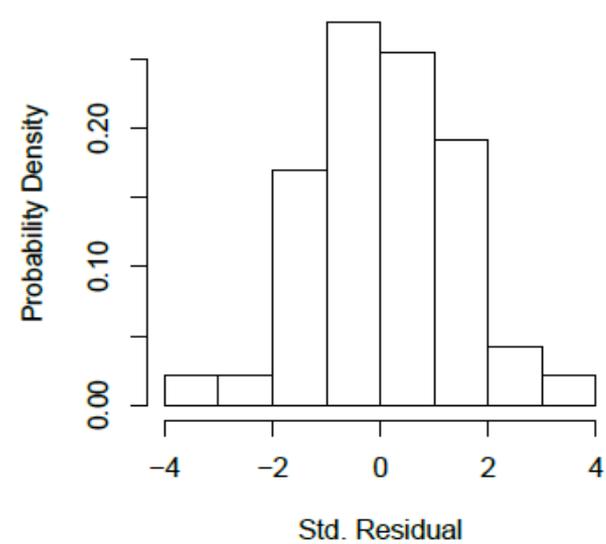
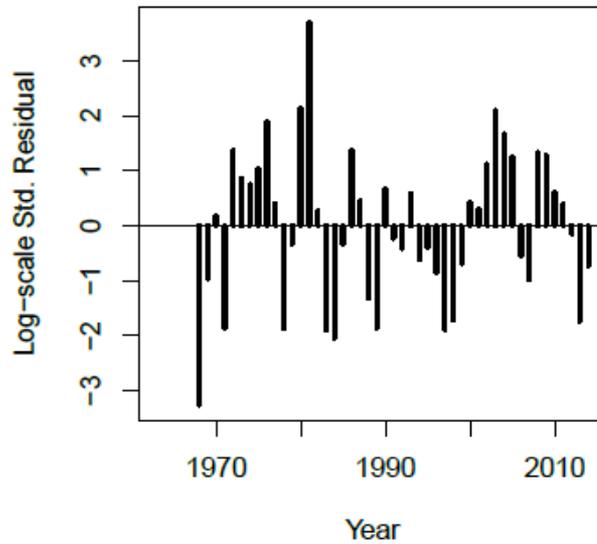
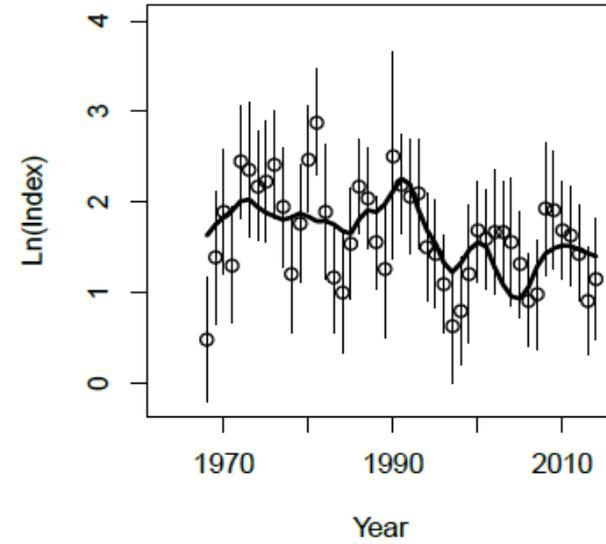
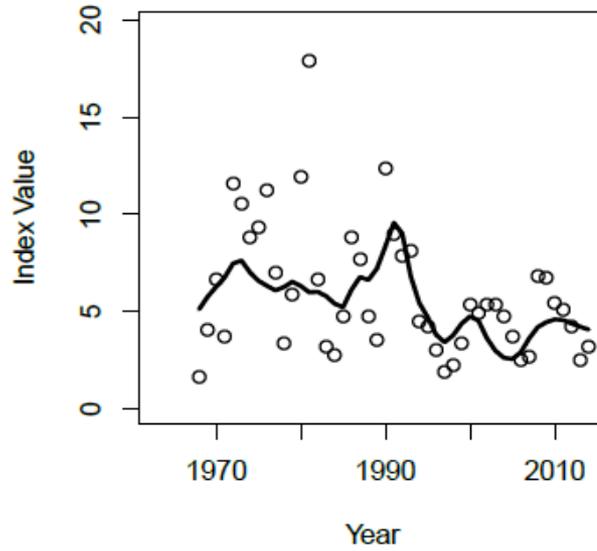
# Age Comp Residuals for Catch by Fleet 1 (FLEET-1)



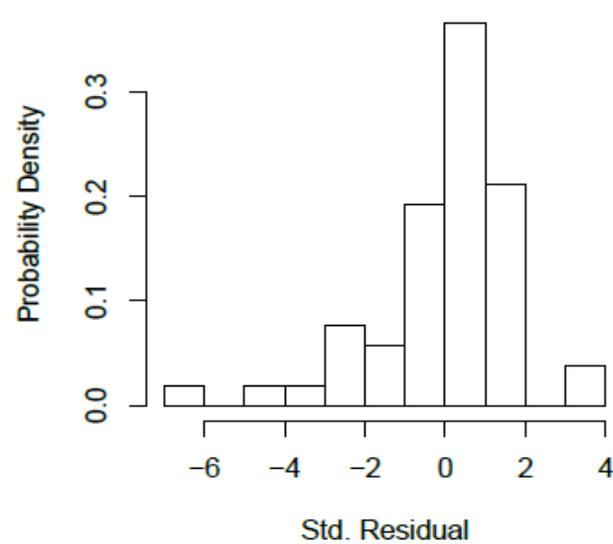
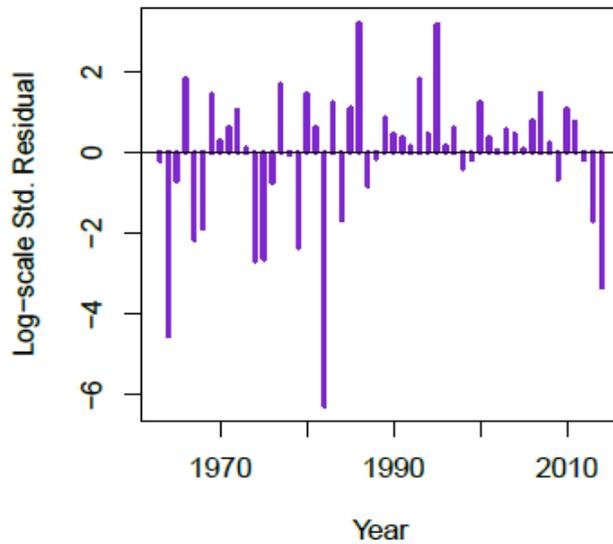
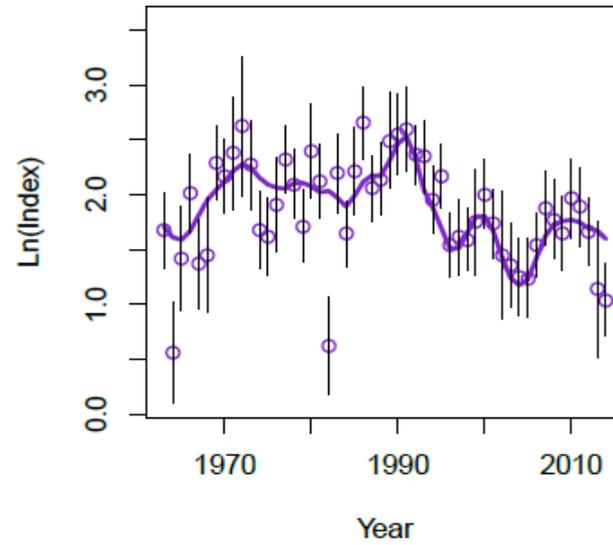
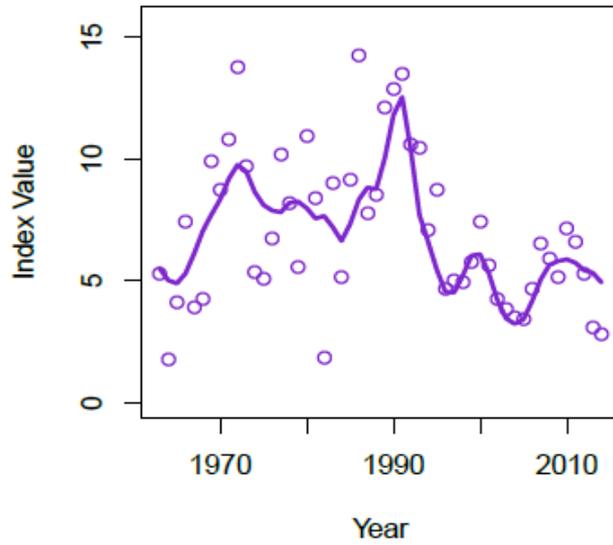
# Catch Neff Fleet 1 (FLEET-1)



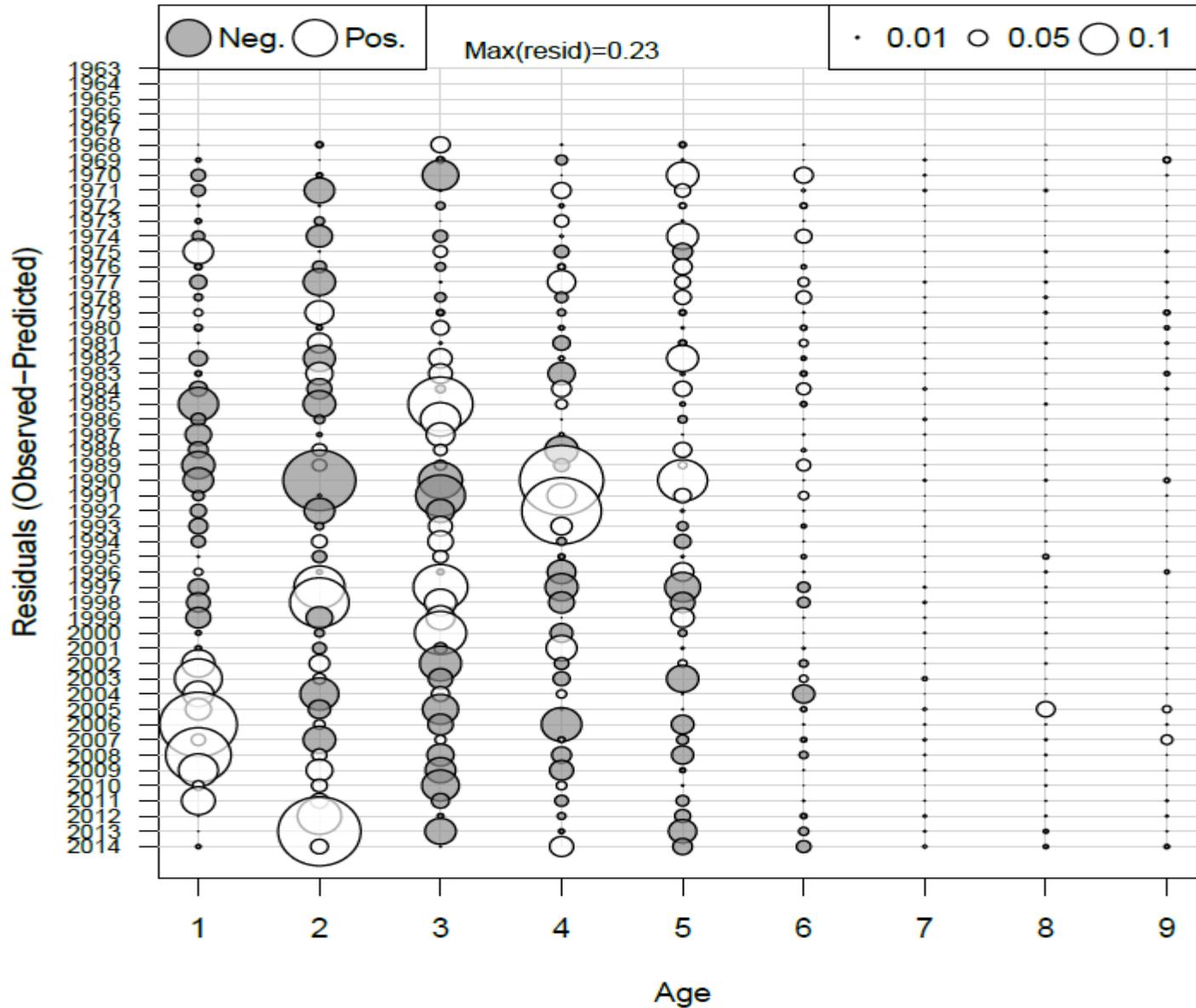
# Index 1 (INDEX-1)



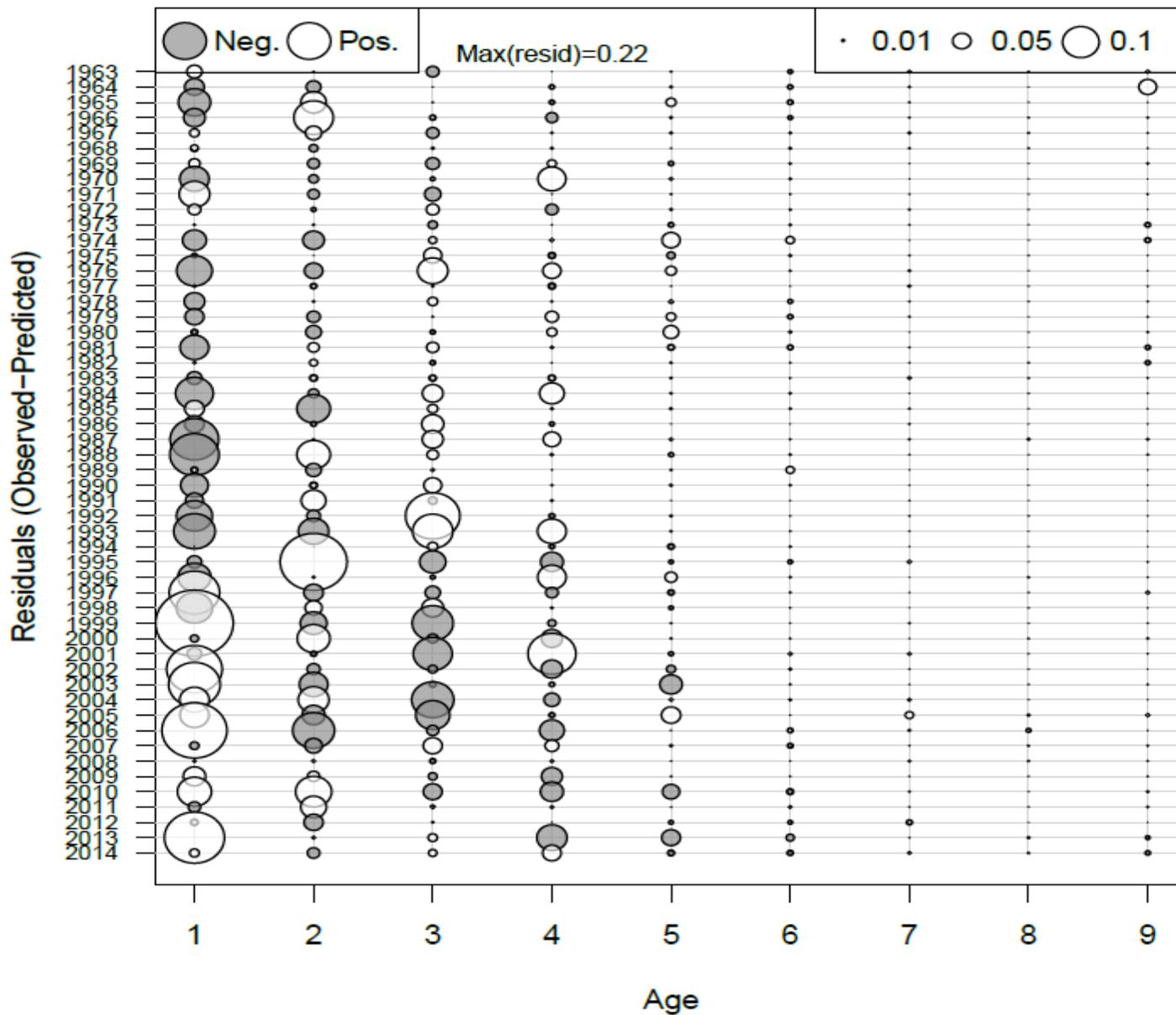
## Index 2 (INDEX-2)



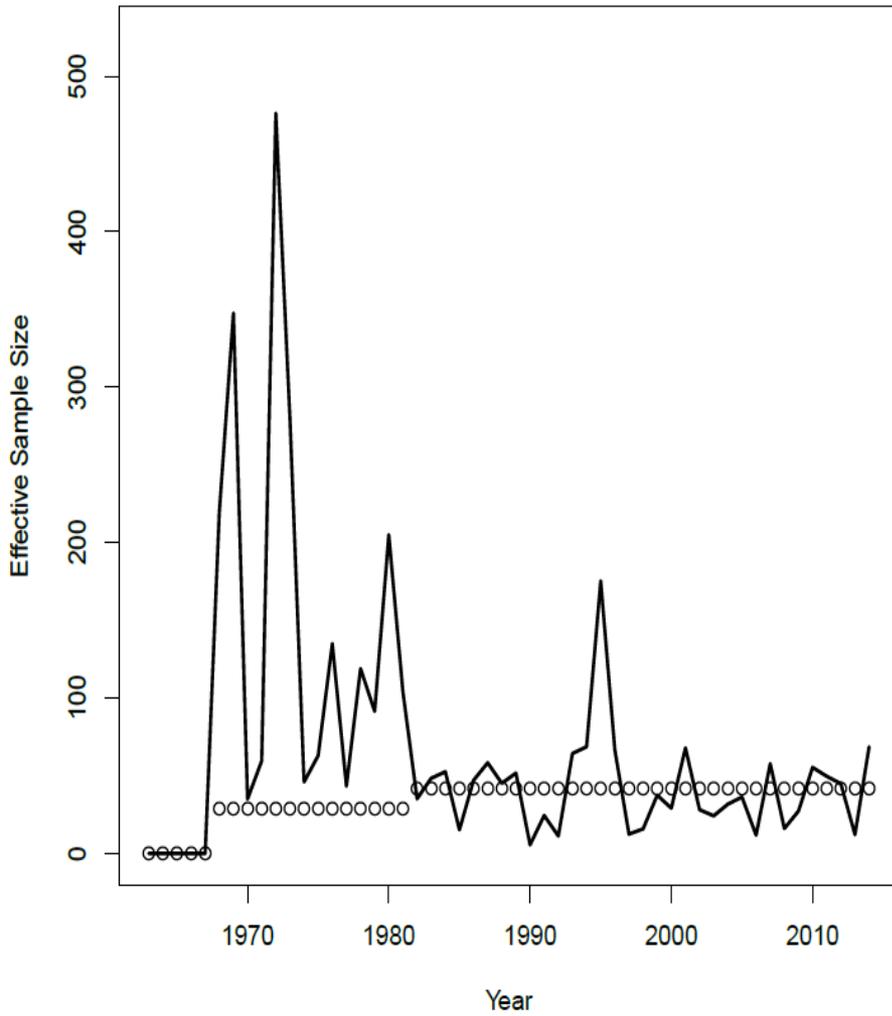
# Age Comp Residuals for Index 1 (INDEX-1)



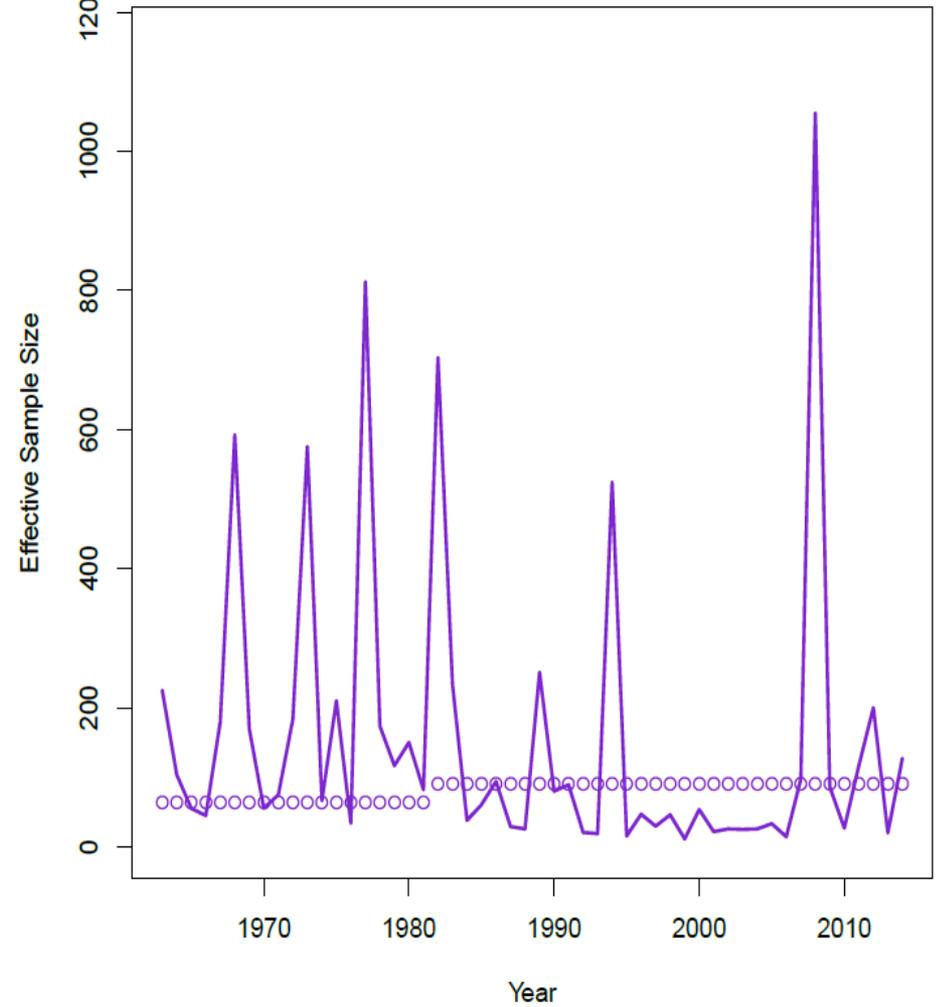
# Age Comp Residuals for Index 2 (INDEX-2)

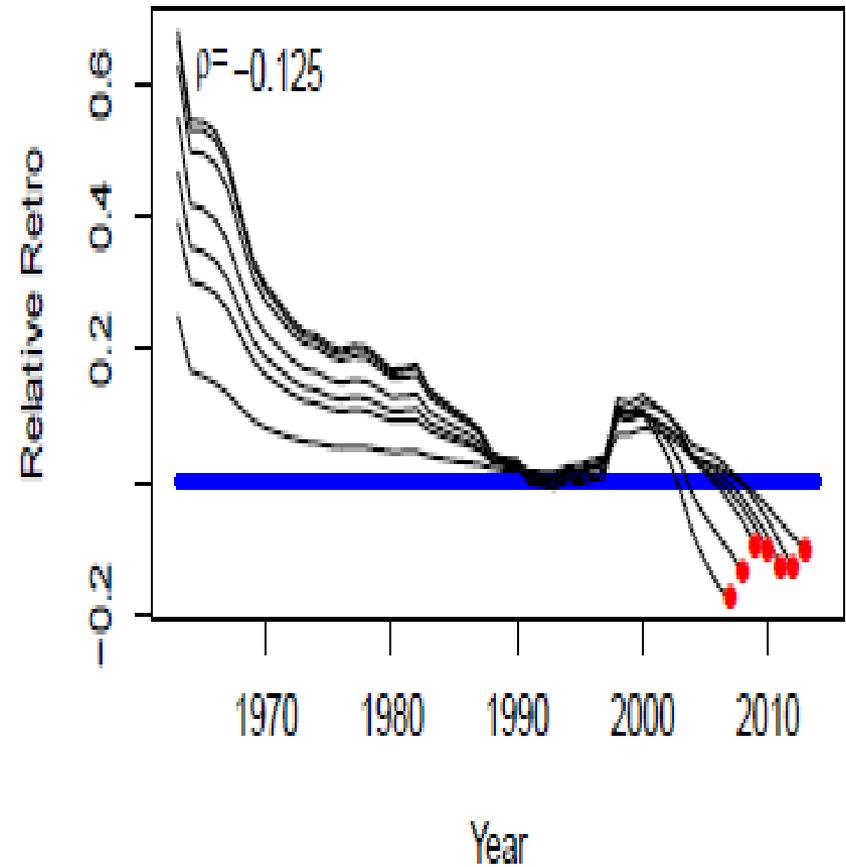
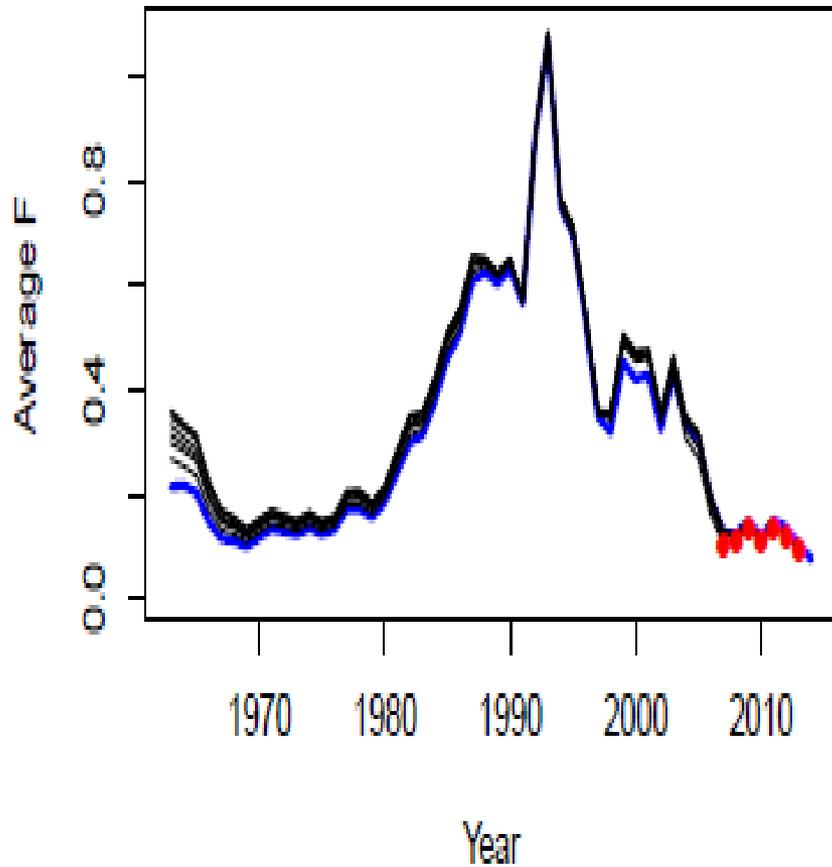


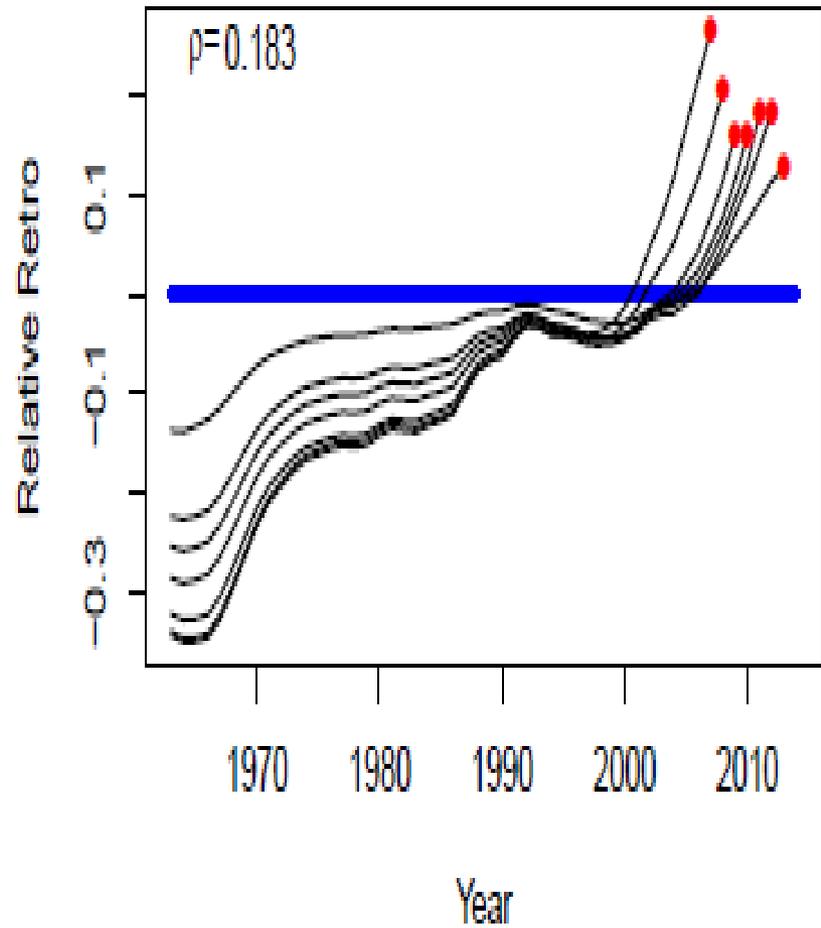
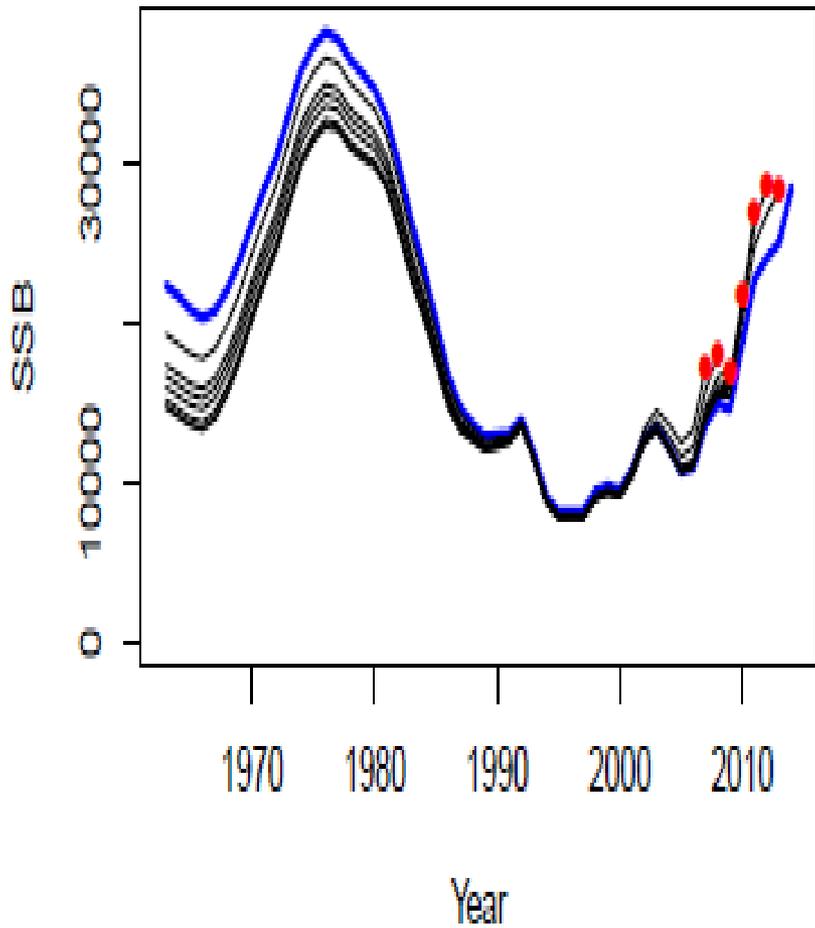
Index Neff 1 (INDEX-1)

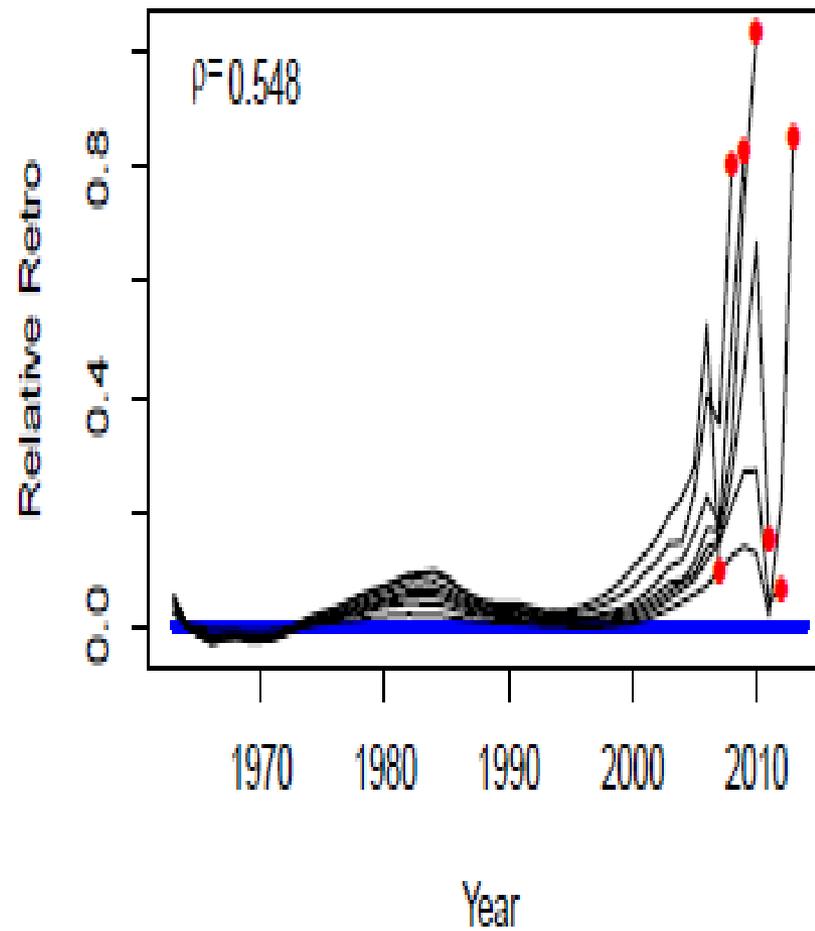
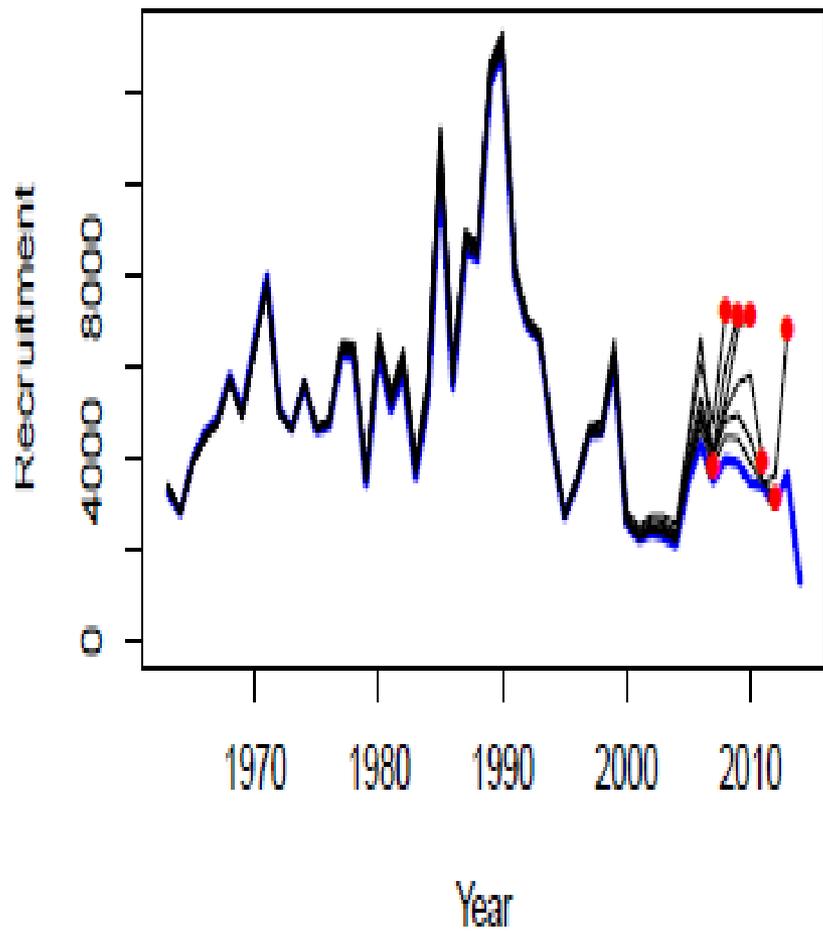


Index Neff 2 (INDEX-2)







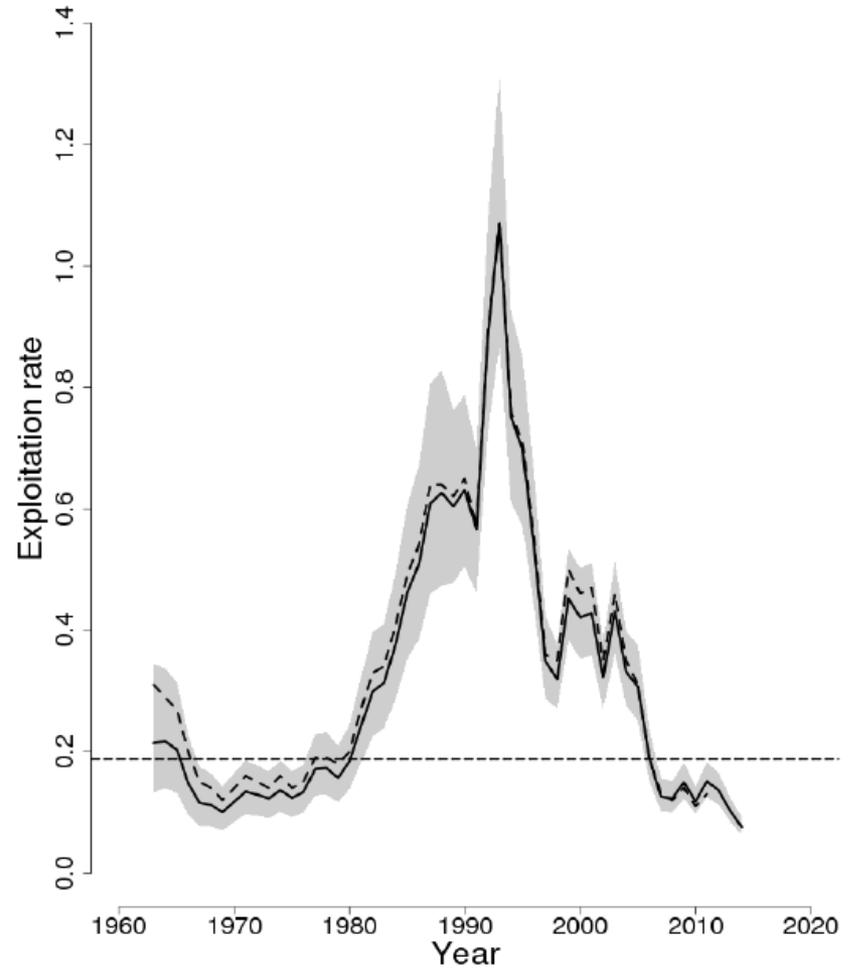
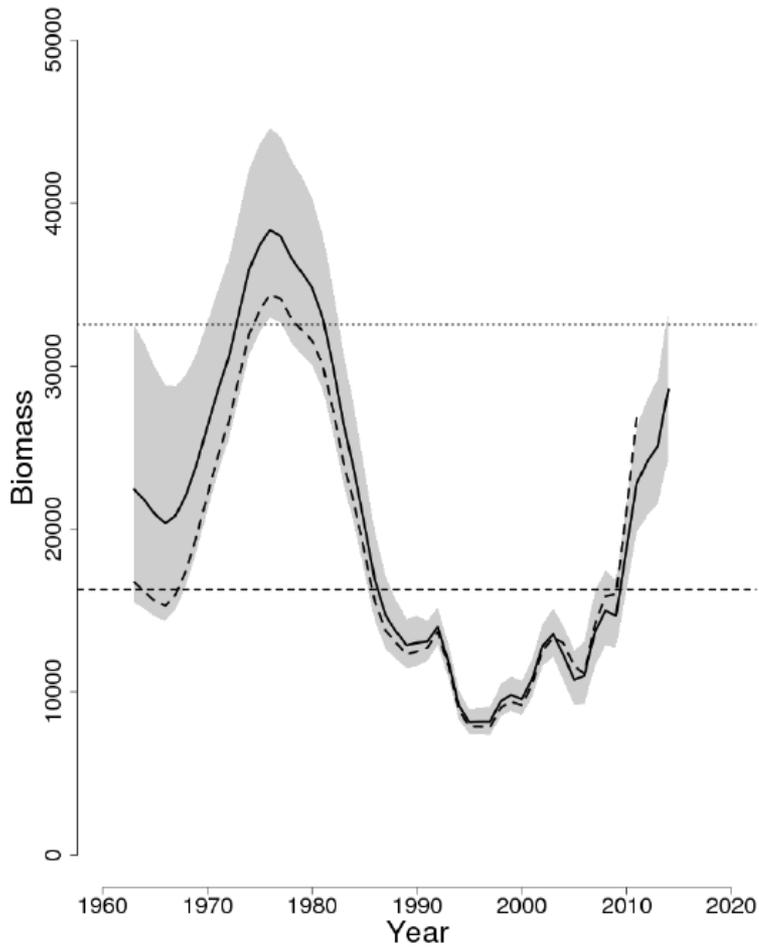


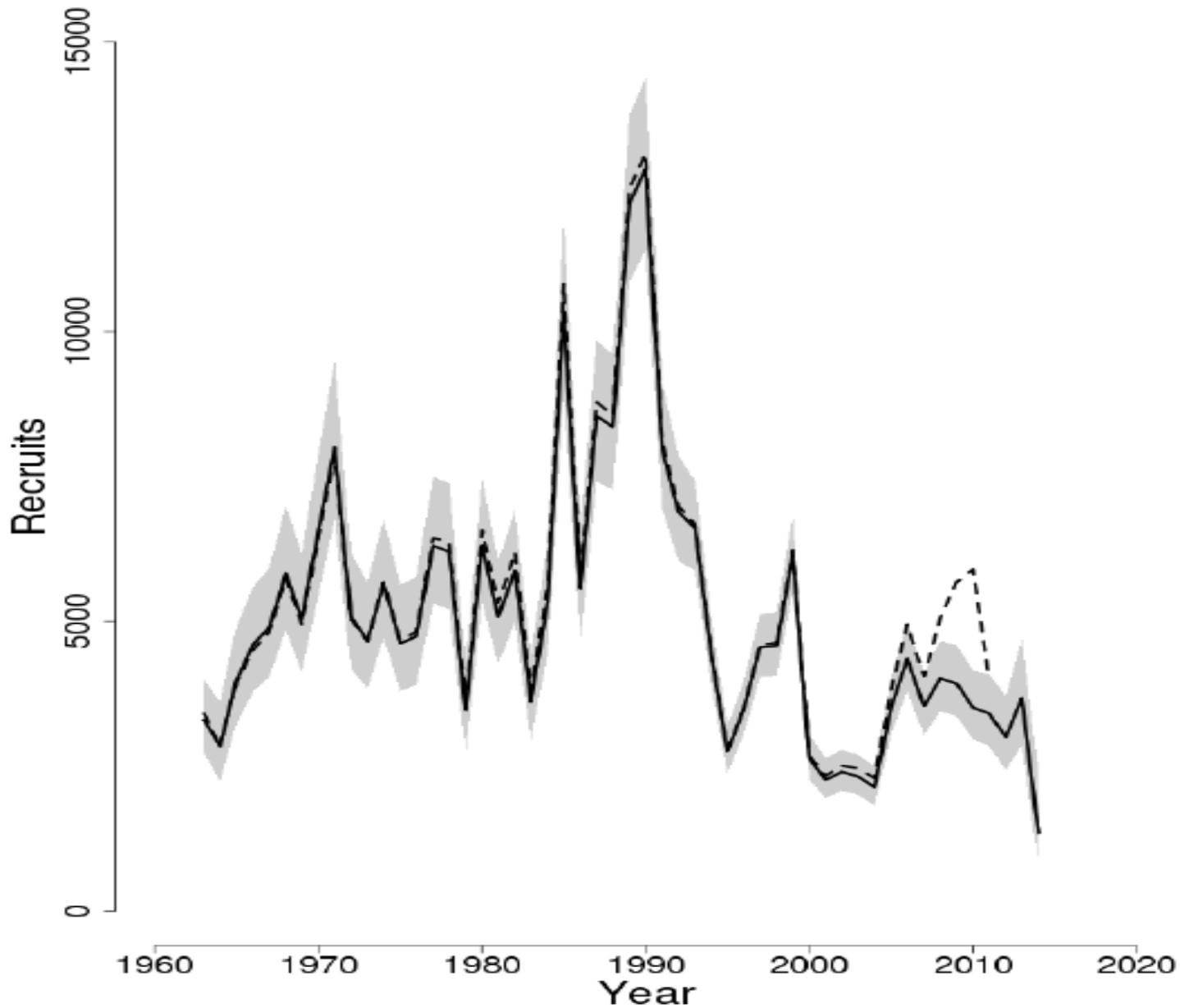
# Reference Points

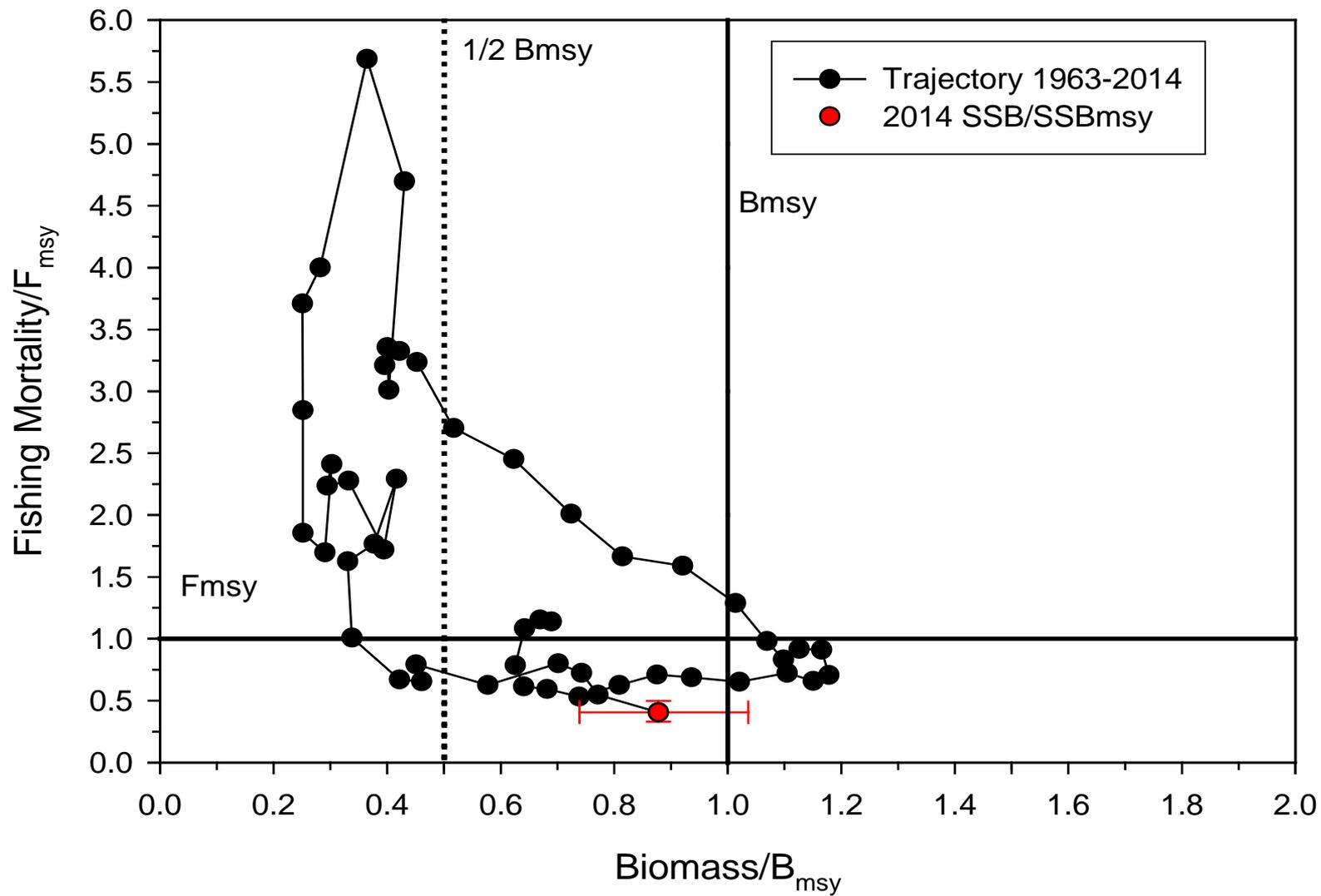
- Update F40 with updated 5-year average weights , selectivity and maturities
- Run 100-year projections with resampling from empirical CDF of recruitments from 1963-2012 above when SSB is above 8160 mt (lowest in the time series) and decining linearly to zero below that value.

# Reference Points

	2013	Current
FMSY proxy	0.2	0.188
SSBMSY (mt)	32,400	32,550 (26,323 - 40,771)
MSY (mt)	5,630	5,422 (4,589 - 6,470)
Median recruits (age 1) (000s)	4,948	4,608
Overfishing	No	No
Overfished	No	No







# Projections

- Assume catch in 2015 1759 mt
- Project Fmsy and 75% Fmsy for years 2016-2018
- Resample from empirical CDF of recruitments from 1995-2012 above when SSB is above 8160 mt (lowest in the time series) and decining linearly to zero below that value.

# Projections

## Fmsy

Year	Catch	SSB	5%	95%	F
2012	1759	28829	24458	33954	0.066
2013	4985	29304	24851	34376	0.188
2014	4627	27320	23386	31685	0.188
2015	4393	26119	22742	29940	0.188

## 75% Fmsy

Year	Catch	SSB	5%	95%	F
2015	1759	28829	24458	33954	0.066
2016	3816	29618	25114	34751	0.141
2017	3686	28708	24564	33315	0.141
2018	3621	28348	24648	32517	0.141

# Sources of Uncertainty

- 1. Catch at age information is not well characterized due to possible mis-identification of species in the commercial and sea sampling data, particularly in early years, low sampling of commercial landings in some years, and sparse discard data particularly in early years.
- 2. Since the commercial catch is aged primarily with survey age/length keys, there is considerable augmentation required, mainly for ages 5 and older. The numbers at age and mean weights at age in the catch for these ages may therefore not be well specified.
- 3. White hake may move seasonally into and out of the defined stock area.

# Sources of Uncertainty

- 4. There are no commercial catch at age data prior to 1989 and the catchability of older ages in the surveys is very low. This results in a large uncertainty in starting numbers at age.
- 5. Since 2005, dealers have been culling extra large fish out of the large category. However, there was no market category to input into the landings until June 2014. The length compositions are distinct from large and have been identified since 2011. This may bias the age composition of the landings, particularly in 2014 when 2000 of the 5000 large samples were these extra-large fish.
- 6. A pooled age/length key is used for 1963-1981, fall 2003 (second half of commercial key) and 2014. Age data were not available for 2014 in time for this assessment. The same pooled key that was used for 1963-1981 was used for 2014.

# Key Research Needs

- Complete ageing of the survey (fall 2003, 2014 on)
- Complete ageing of the observer samples from 2001 on.
- With the new market category of heads, encourage landing of heads and take age structures assuming an otolith length/total length relationship can be established.
- Complete aging of the other surveys (shrimp, MENH) and attempt to use as recruitment indices.
- Look at prices of large hake to see if the landings of sow can be teased apart.