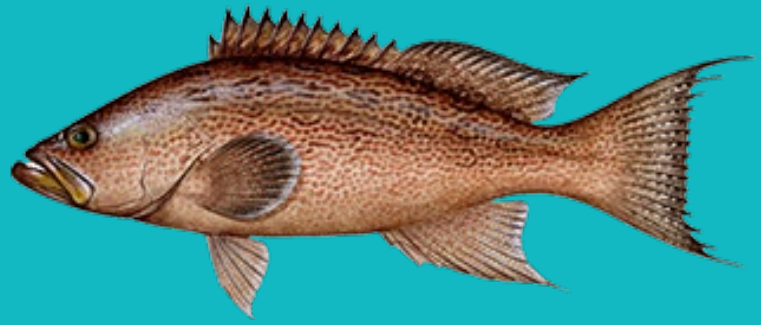
NOAA FISHERIES

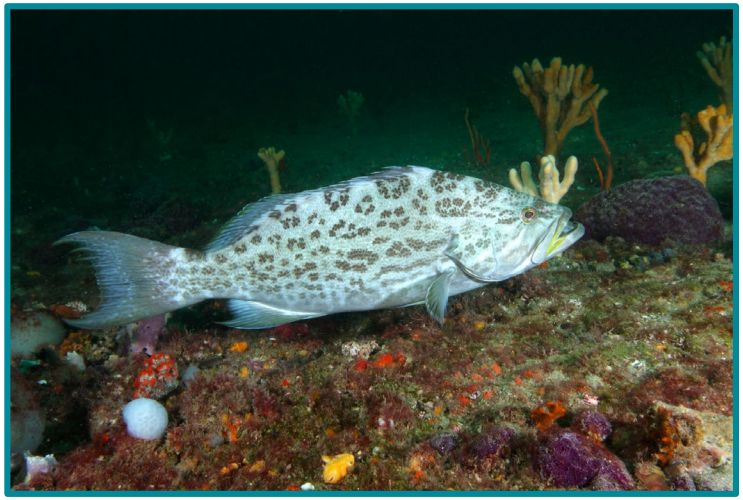
SEDAR 68 – U.S. Atlantic Scamp



Review Workshop
August 31st, 2021

Outline

- Data Review
  - Stock definition
  - Life history
  - Removals
  - Compositions
  - Index of abundance
- Catch-age model
  - Base run
  - Diagnostics
  - Sensitivities
  - Uncertainty analysis

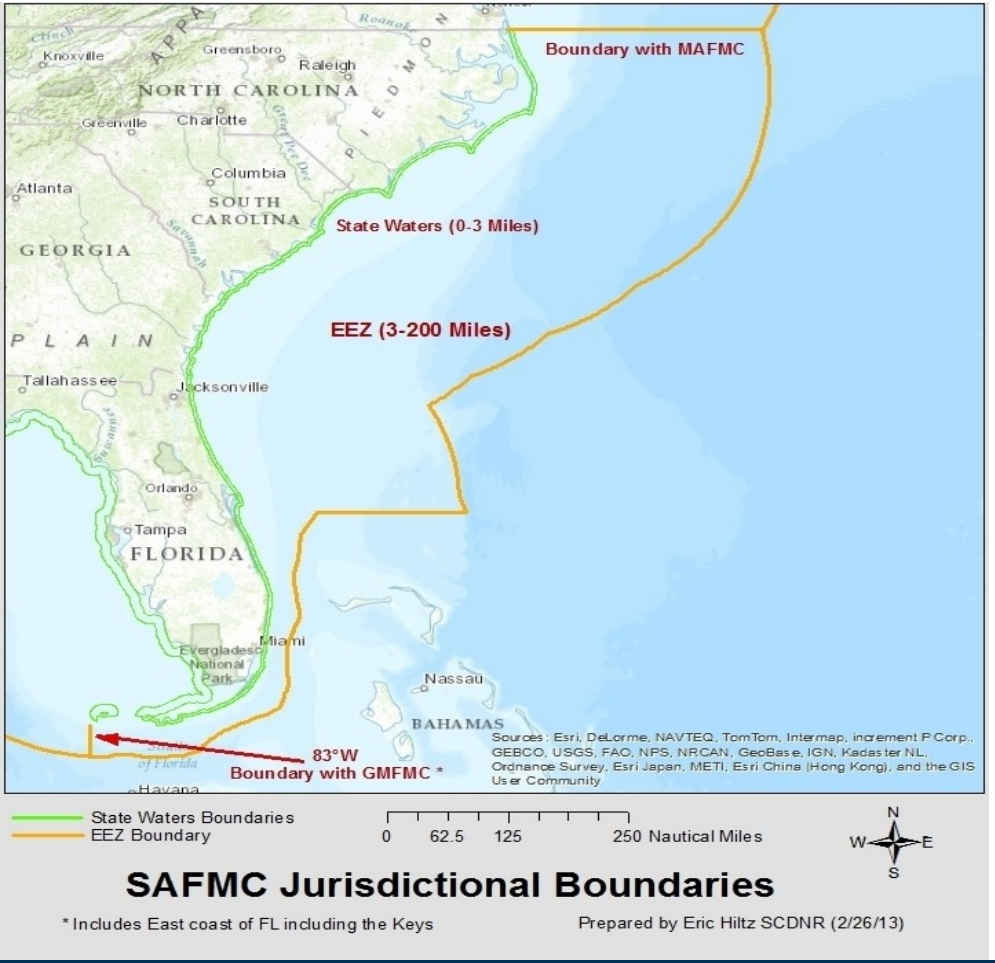


NOAA FISHERIES

Data Review

NOAA FISHERIES

Stock/Management Boundary

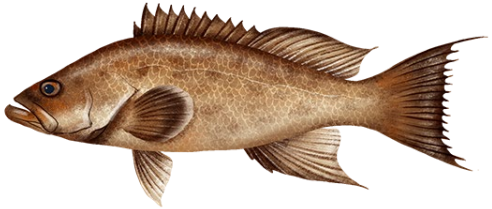


- South Atlantic stock is separated from the GoM at council boundary line
- Boundary – U.S. Highway 1 in the Florida Keys
- Supported by Stock ID workshop
- GoM size limit =16”
  SA size limit = 20”

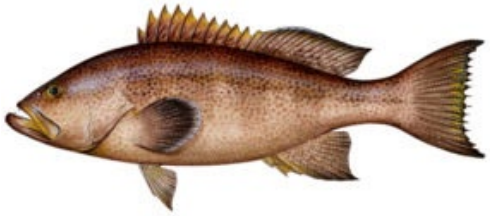
NOAA FISHERIES

Stock ID Workshop

- Scamp and yellowmouth grouper difficult to identify between two species
  - Very similar morphometrics and life history characteristics
  - Differentiation seen in gill raker counts, lateral line scales, and pectoral fin rays
- Recommendation by Life History WG to combine all data (landings, indices, comps etc.) for two species
- Scamp and yellowmouth treated as scamp complex



Mycteroperca phenax

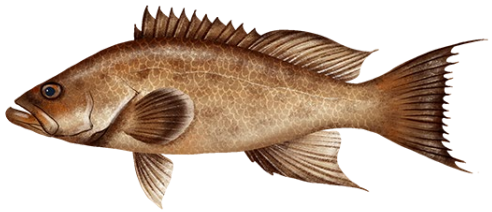


Mycteroperca interstitialis

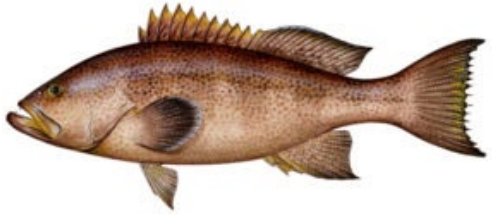
NOAA FISHERIES

Assessment History

- SEDAR 68 first formal assessment of scamp and yellowmouth grouper under SEDAR
- Scamp landing and size frequency data from 1986-1996 in SA used in separable virtual population analysis
  - Spawning potential ratio estimated between 30-52% (Manooch et al, 1998)
- Localized, retrospective assessment conducted in Fl keys
  - Average length of exploitable phase from visual surveys (1979-1996)
  - Spawning potential ratios of 3% for scamp and 22% for yellowmouth (Ault et al, 1998)



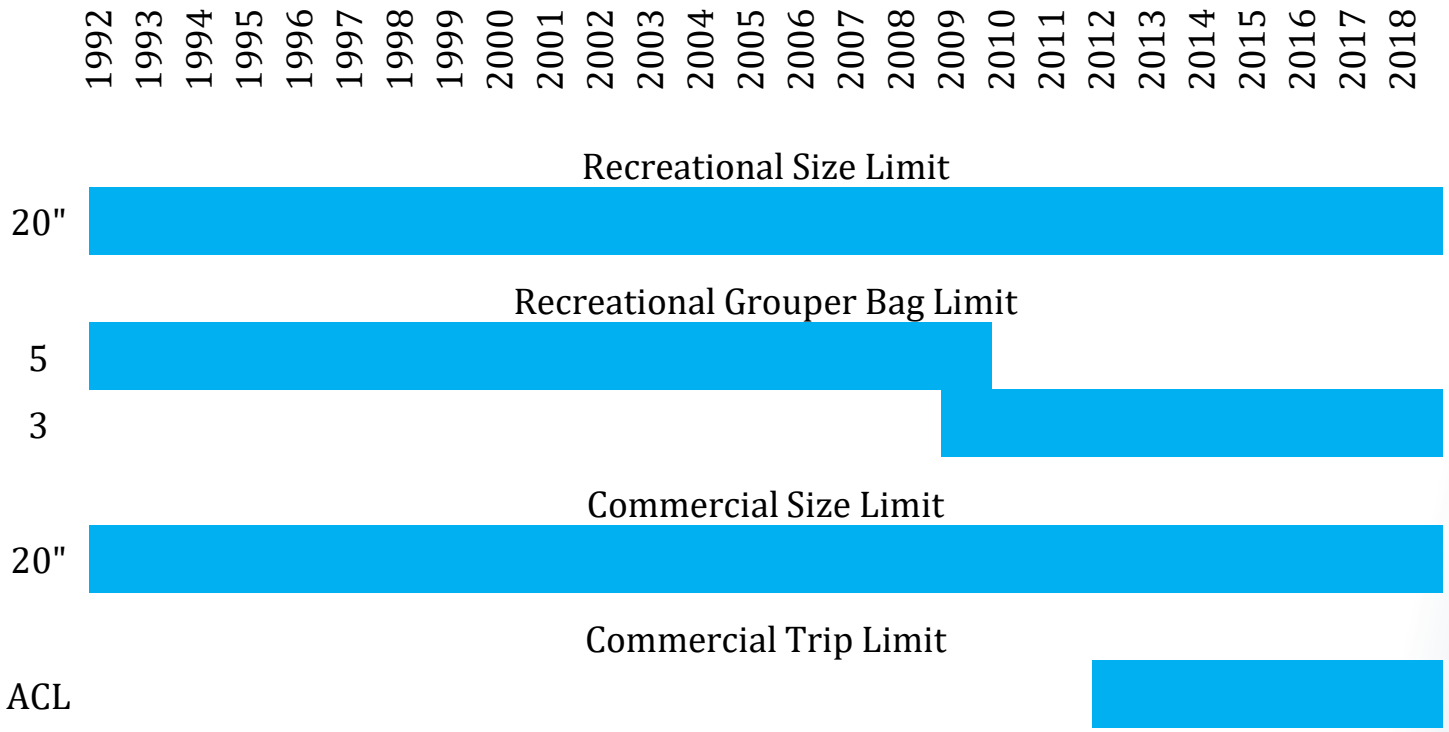
Mycteroperca phenax



Mycteroperca interstitialis

NOAA FISHERIES

SA Management Regulations



- Seasonal (SWG) closure began 2010:
  Closed: Jan. 1 – Apr. 30th
  Open: May 1 – Dec. 31st

NOAA FISHERIES

Life History

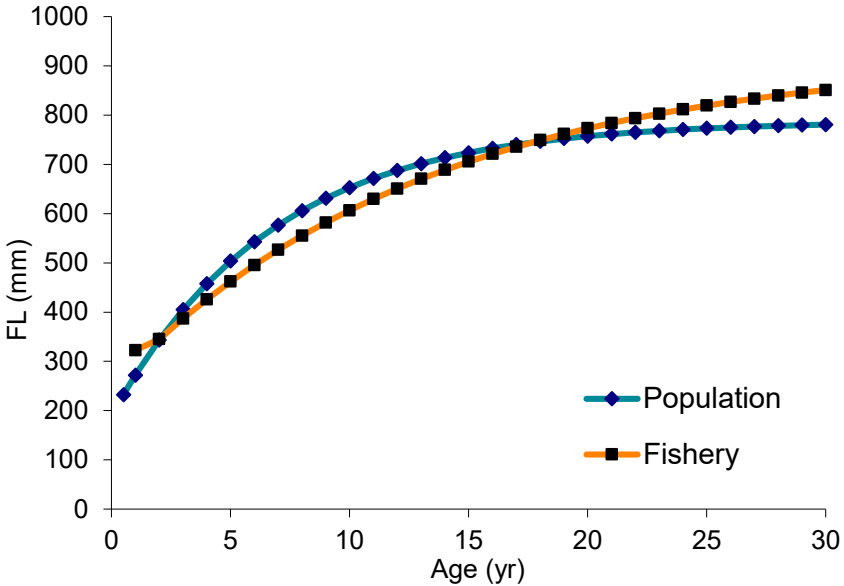
- Age and Growth
- Maturity
- Sex Transition
- Natural Mortality
- Discard Mortality

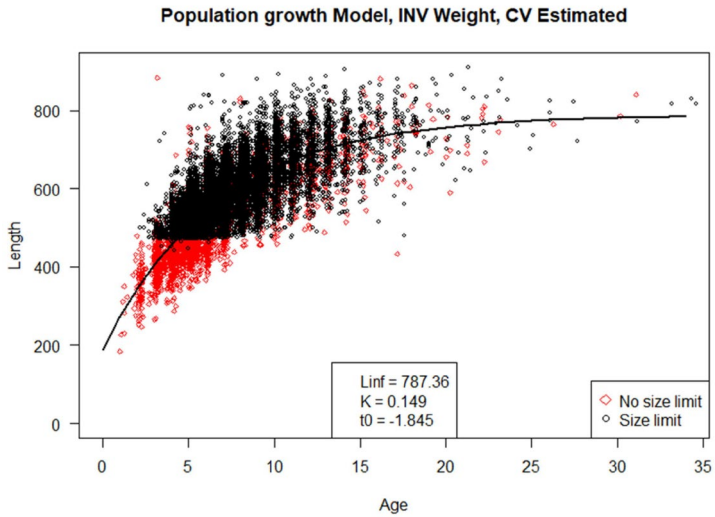
NOAA FISHERIES

Age and Growth

	L_∞ (FL, mm)	K	t_0	C.V.
Population model (n= 16778)	787.36 ± 26.35	0.149 ± 0.027	-1.85 ± 0.711	0.1 ± 2.685e-005
Fisheries Post 1992 model (n= 13690)	919.06 ± 17.48	0.076 ± 0.0042	-5.19 ± 0.288	0.1 ± 7.168e-008
Females only model (n= 3568)	761.51 ± 79.21	0.128 ± 0.051	-2.53 ± 1.42	0.118 ± 0.0199
Males only model (n = 333)	765.62 ± 63.11	0.145 ± 0.093	-3.34 ± 4.57	0.1 ± 0.00003

- Recommended growth models from DW
- Fisheries model applied to landings starting in 1992



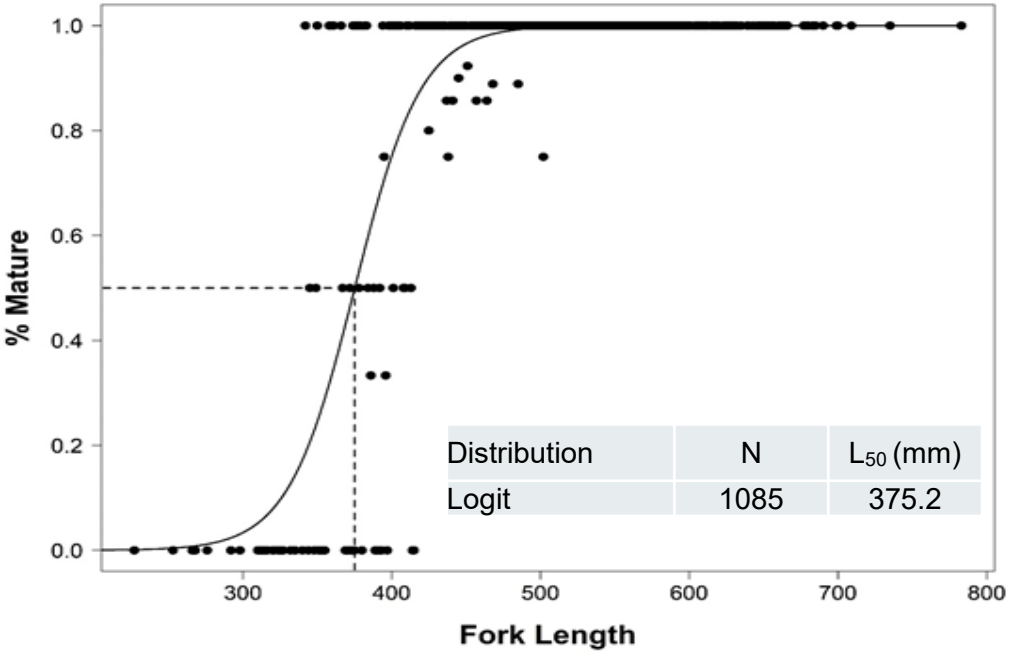


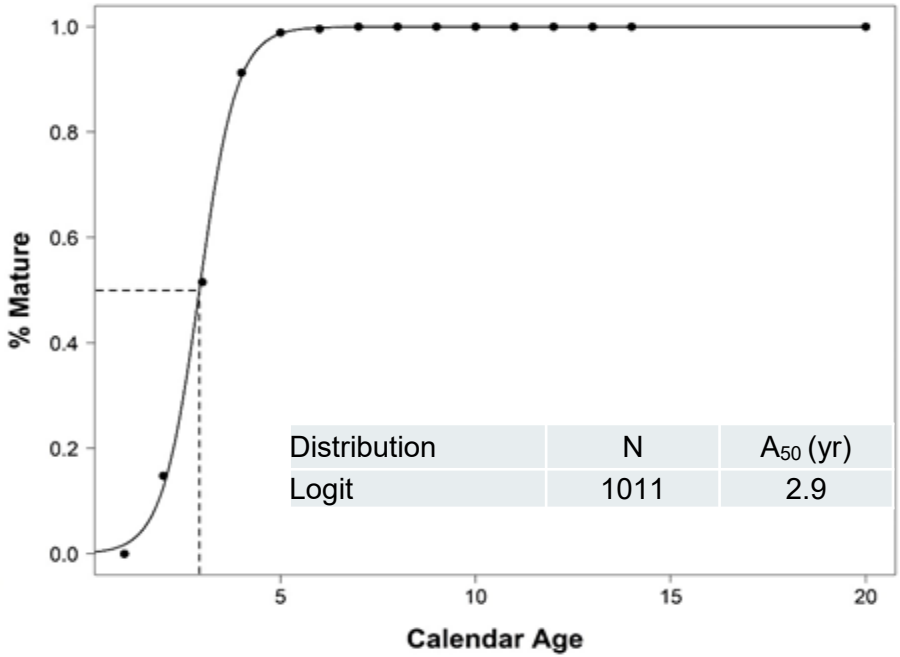
- Linf, K, t_0 fixed in BAM
- CV estimated in BAM

NOAA FISHERIES

Maturity

- Best fit for female age at functional maturity South Atlantic Scamp/Yellowmouth during period of 1979-2017



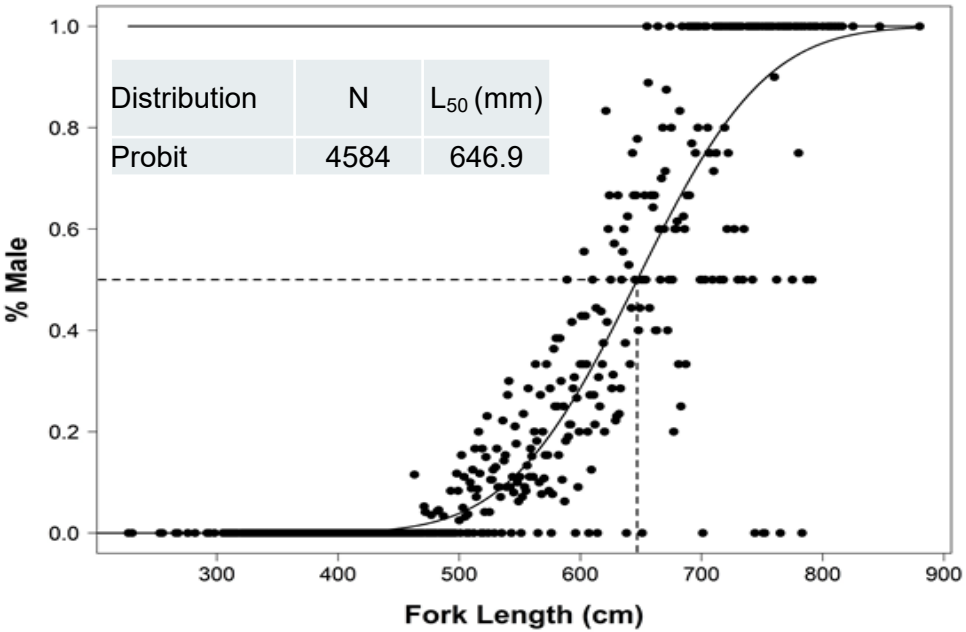


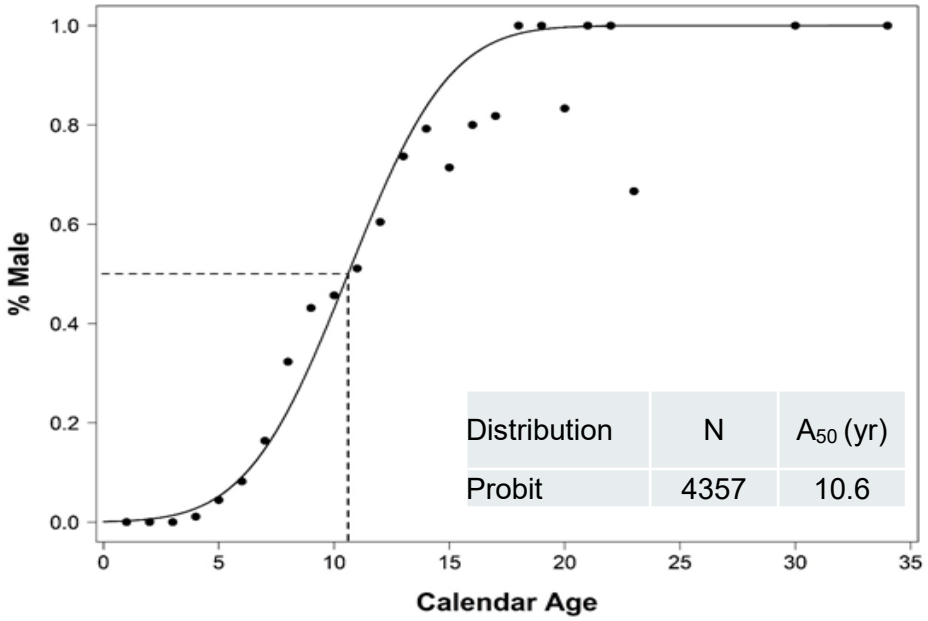
- Spawning frequency and batch fecundity presented and discussed at DW
  - Total SSB recommended by LH WG so not applicable

NOAA FISHERIES

Sex Transition

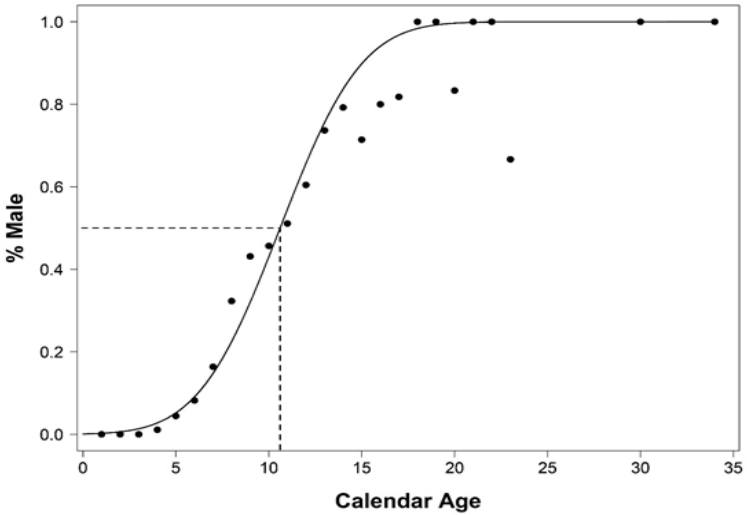
- Best fit for female age at sex transition in S. Atlantic Scamp/Yellowmouth Grouper during the period 1979-2017.
- All females (i.e., juvenile and adult) were included, but specimens undergoing sex transition were omitted.

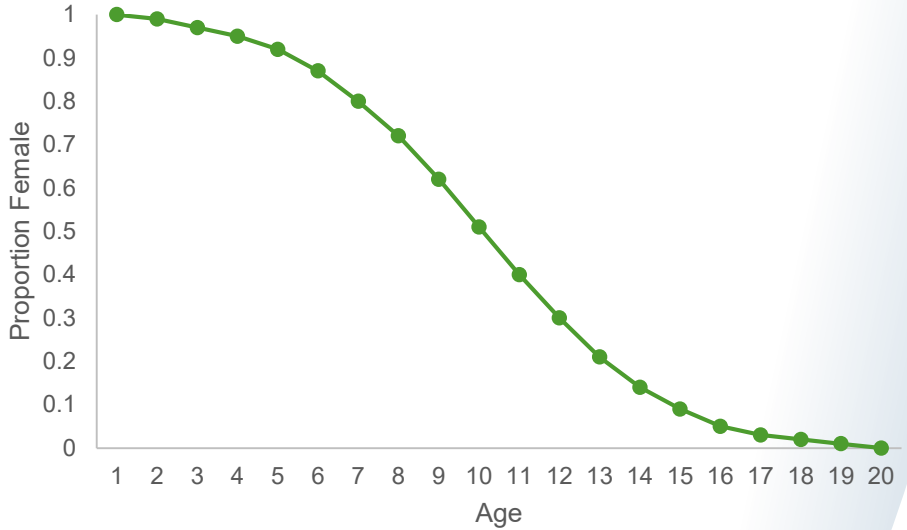




Hermaphroditism in BAM

- Proportion female at age included in data file as vector





NOAA FISHERIES

Meristics

Length - Length

Model: Y = a + bX	n	a	SE	b	SE	r2	Units	range of IV
FL = TL	1999	19.72	1.31	0.89	0	0.99	mm. mm	267 - 1003
TL = FL	1999	-15.01	1.51	1.11	0	0.99	mm. mm	252 - 898
TL = maxTL	152	-0.3	3.34	0.98	0	0.99	mm. mm	457 - 922
maxTL = TL	152	2.95	3.37	1.01	0	0.99	mm. mm	453 - 916
FL = maxTL	5213	23.03	0.7	0.88	0	0.99	mm. mm	193 - 922
maxTL = FL	5213	-20.42	0.83	1.13	0	0.99	mm. mm	184 - 847
FL = SL	5111	25.38	0.9	1.12	0	0.98	mm. mm	149 - 720
SL = FL	5111	-15.46	0.83	0.88	0	0.98	mm. mm	184 - 847
TL = SL	183	17	10.57	1.14	0.02	0.95	mm. mm	374 - 695
SL = TL	183	11.97	8.34	0.77	0.01	0.95	mm. mm	453 - 916
maxTL = SL	5321	5.9	1.18	1.26	0	0.98	mm. mm	149 - 750
SL = maxTL	5321	5.07	0.92	0.78	0	0.98	mm. mm	193 - 925

Whole Weight- Length

Model: Y = a + bX	n	a	SE	b	SE	r2	Units	range	MSE
Ln(WW) = Ln(FL)	17614	-16.51	0.04	2.75	0	0.92	kg, mm	178 - 1130	0.04
Ln(FL) = Ln(WW)	17614	6.03	0	0.34	0	0.92	kg, mm	0.083 - 20.98	0.00439
Ln(WW) = Ln(TL)	2847	-17.44	0.1	2.87	0.02	0.91	kg, mm	183 - 1003	0.04
Ln(TL) = Ln(WW)	2847	6.09	0	0.32	0	0.91	kg, mm	0.10 - 11.00	0.00427
Ln(WW) = Ln(maxTL)	4805	-18.25	0.06	3	0.01	0.95	kg, mm	193 - 922	0.0181
Ln(maxTL) = Ln(WW)	4805	6.11	0	0.32	0	0.95	kg, mm	0.083 - 15.50	0.0019
Ln(WW) = Ln(SL)	4749	-17.37	0.06	2.97	0.01	0.94	kg, mm	149 - 750	0.02
Ln(SL) = Ln(WW)	4749	5.86	0	0.32	0	0.94	kg, mm	0.083 - 15.50	0.0021

Whole Weight- Gutted Weight

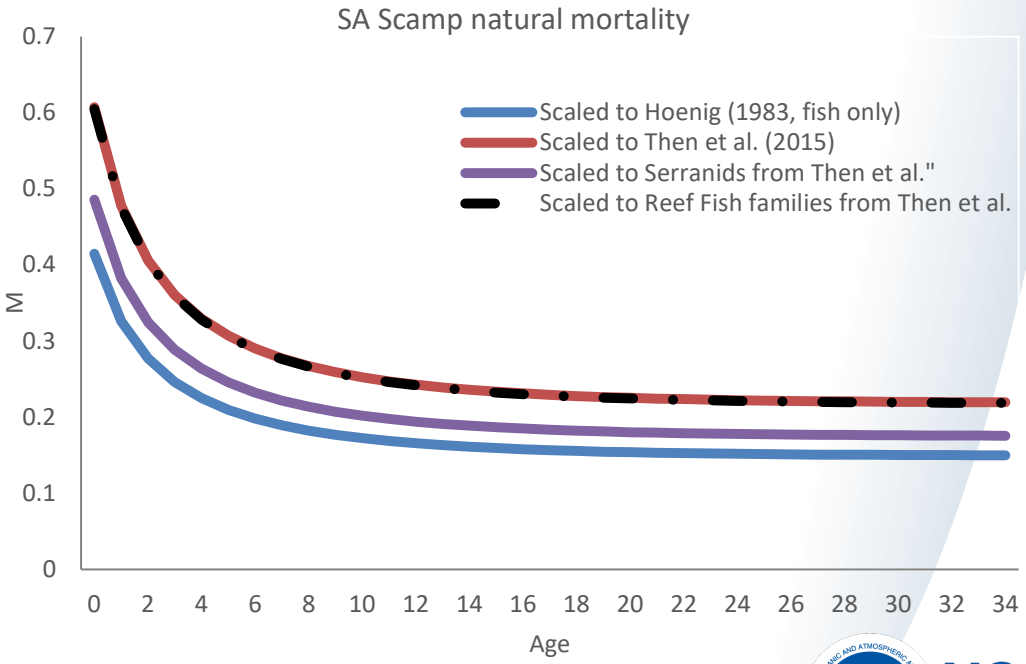
n	b	SE	r2	Units	range of IV
172	1.07	0	0.998	kg, kg	0.129 - 7.1

NOAA FISHERIES

Natural Mortality

- Target M (M = 0.155) determined using Serranid only data from Then et al. (2015), a maximum age of 34, based on Lorenzen

Method	Target M
Hoenig (1983, fish only)	0.132
Then et al. (2015)	0.194
Scaled to Serranids	0.155
Scaled to reef fish families	0.193



Discard Mortality

- Point estimate for total discard mortality found by combining immediate and delayed mortality

Region	Gear	Mean Depth (m)	Immediate – Not Vented	Immediate - Vented	Delayed Mortality	Total Discard Mortality
SA	VL	46.5	21% (17-25%)	16% (12-20%)	23% (15-34%)	39% (33-45%)

- Headboat:
  - Bootstrapped delayed mort. prediction at 30 m is 18% (7-33%)
  - Conditionally combining a 10% immediate and 18% delayed estimate results in point estimate of 26% (16-40%) for total mortality
- Methods used follow Pulver (2017) approach

NOAA FISHERIES

Removals

- Fleet Definition
- Landings
- Discards
- Discard Mortality

Surveys

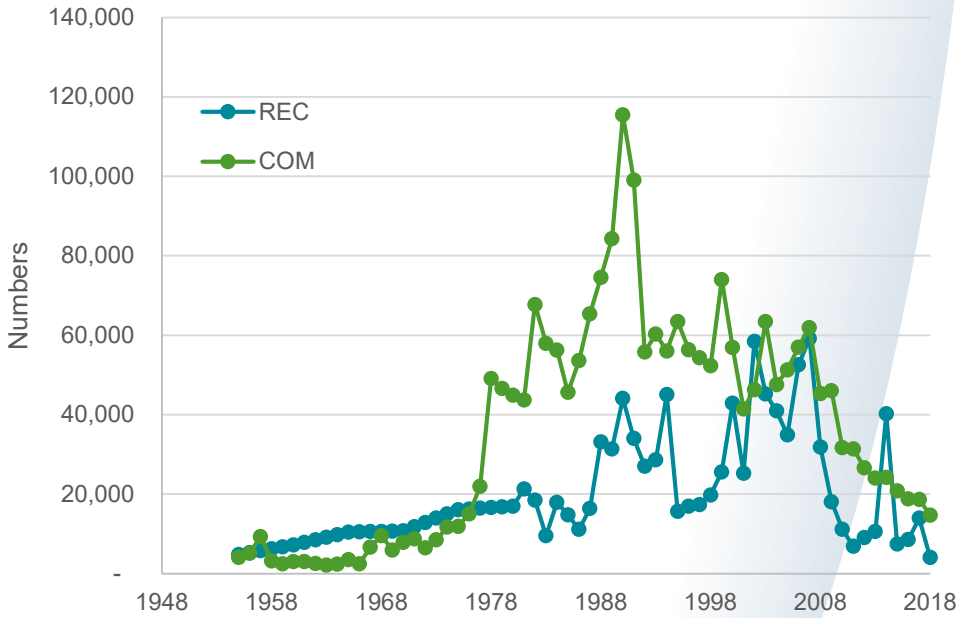
NOAA FISHERIES

Data Overview

Data	Units	CV/SE	Length Comps	Age Comps
Commercial				
- Vertical Line	Num/WW		1984-2018 (weighted)	2004-2018 (weighted)
- Other	Num/WW		1984-2018 (nominal)	2006-2018 (nominal)
Recreational				
- Headboat	Num.			1979-2018
- MRIP	Num.	Num		2001-2007,'09-'11,'13,'17
Rec Single Fleet	Num/WW	Num.	1972-2018	
Discards				
- Comm. VL	Num.	Num.	2007-2016	
- Comm. LL			**2010, 2012, 2015**	
- Rec HB	Num.		2005-2017	
- Rec MRIP	Num.	Num		
Indices				
- Comm. VL	lb kept/angler hr	✓	Mirror Fleet	
- Rec HB	N kept/angler hr	✓	Mirror Fleet	
- CVT	Num. caught	✓	Mirror Survey	1990-2018
- Video	Num. obs.	✓	Mirror CVT	

Removals – fleet structure

- Commercial Fleet:
  - Handline, longline, spear/diving and other
- Recreational Fleet:
  - Marine Recreational Information Program (MRIP) – private and charter
  - Headboat



NOAA FISHERIES

Commercial Landings

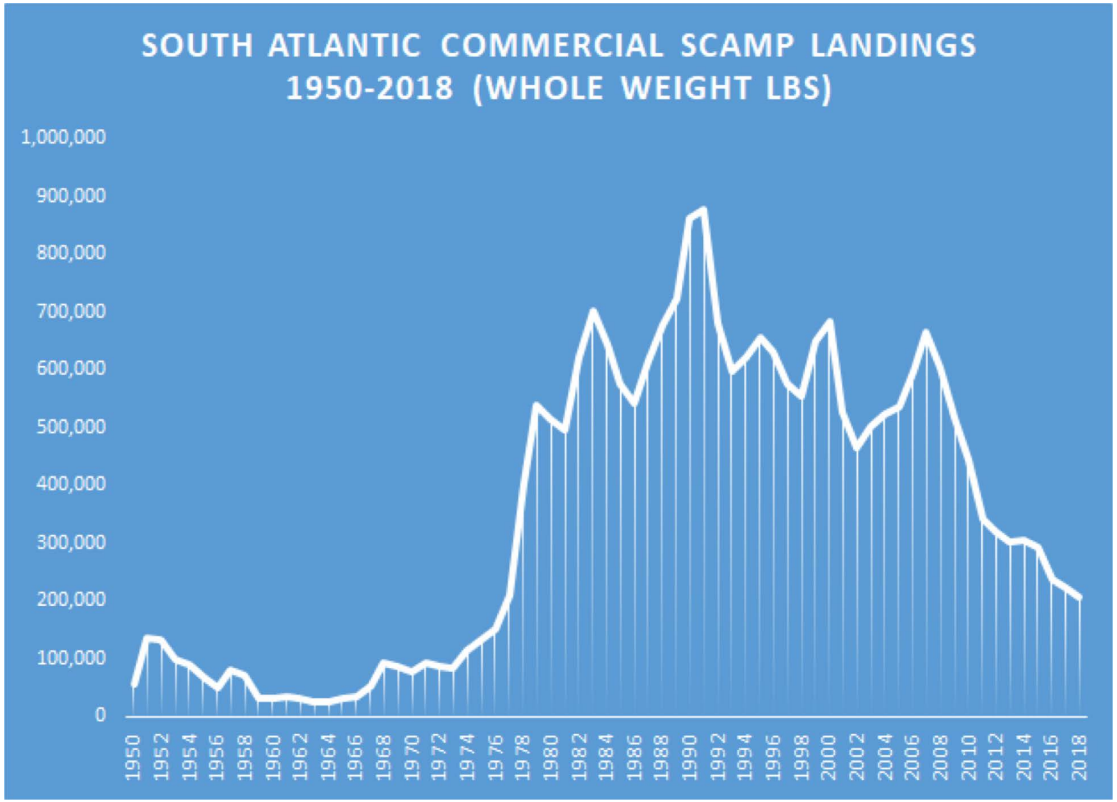
- Prior to 1980, all groupers reported as Unclassified groupers
- Proportioning required, consistent with previous SEDARs
  - Proportioned by year, state, and gear
  - Average proportions applied to grouper landings by state and year

$$\frac{Scamp\ and\ Yellowmouth\ grouper}{All\ Identified\ grouper\ species\ (excluding\ Warsaw\ and\ Goliath)}$$

- Landings reported in whole weights
- Underreporting likely highest earlier in time series
  - Landings collected annually from 1962-1977
  - Monthly landings collection start year varied by state

NOAA FISHERIES

Commercial Landings



Commercial landings aggregated by:

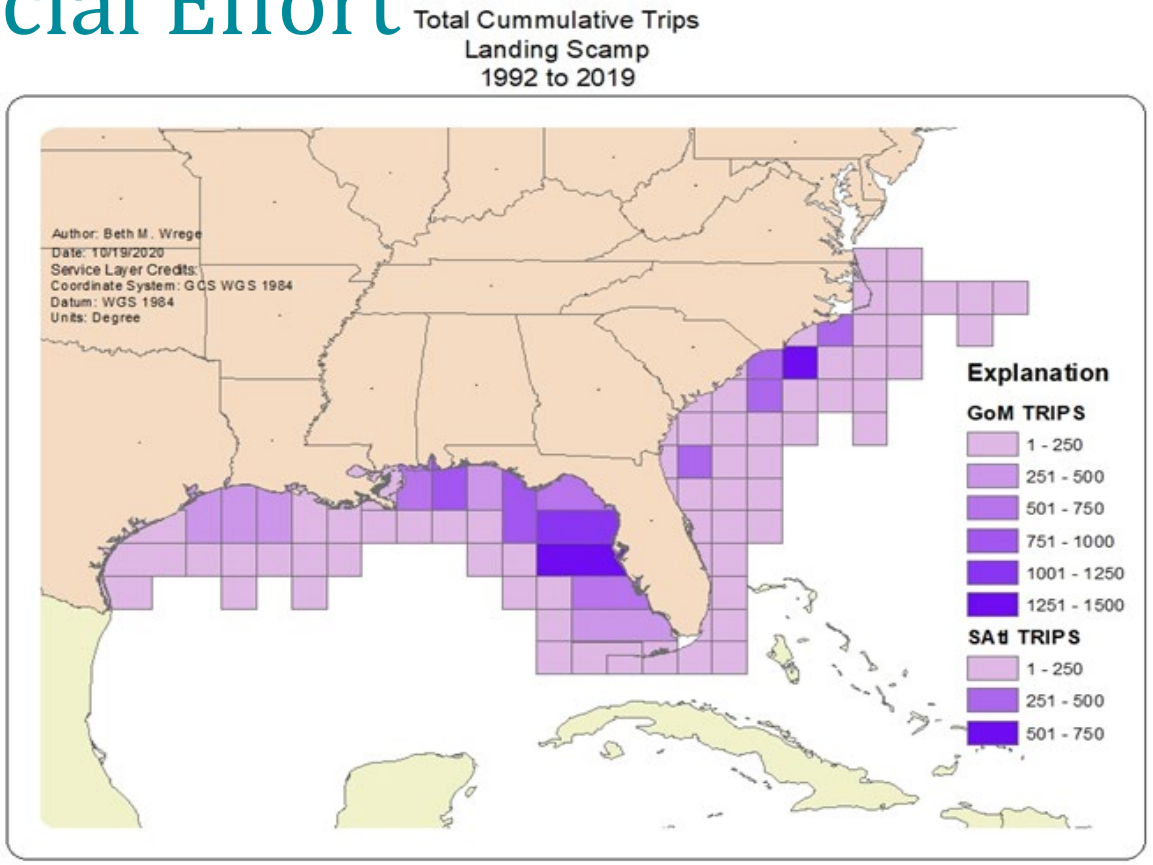
- Handline (vertical line)
- Longline
- Spear/Diving
- Other

Landings data source:

- GA: ACCSP
- SC: 1950-2003: ACCSP
  2004-2018: SCDNR
- NC: NCDMF
- FL: 1950-1985 ACCSP
  1986-2018 FLTT

NOAA FISHERIES

Commercial Effort



Coastal Fisheries Logbook Program

NOAA FISHERIES

Commercial Landings Uncertainty

- Consistent with previous assessments
- Estimates of reporting error, not CV

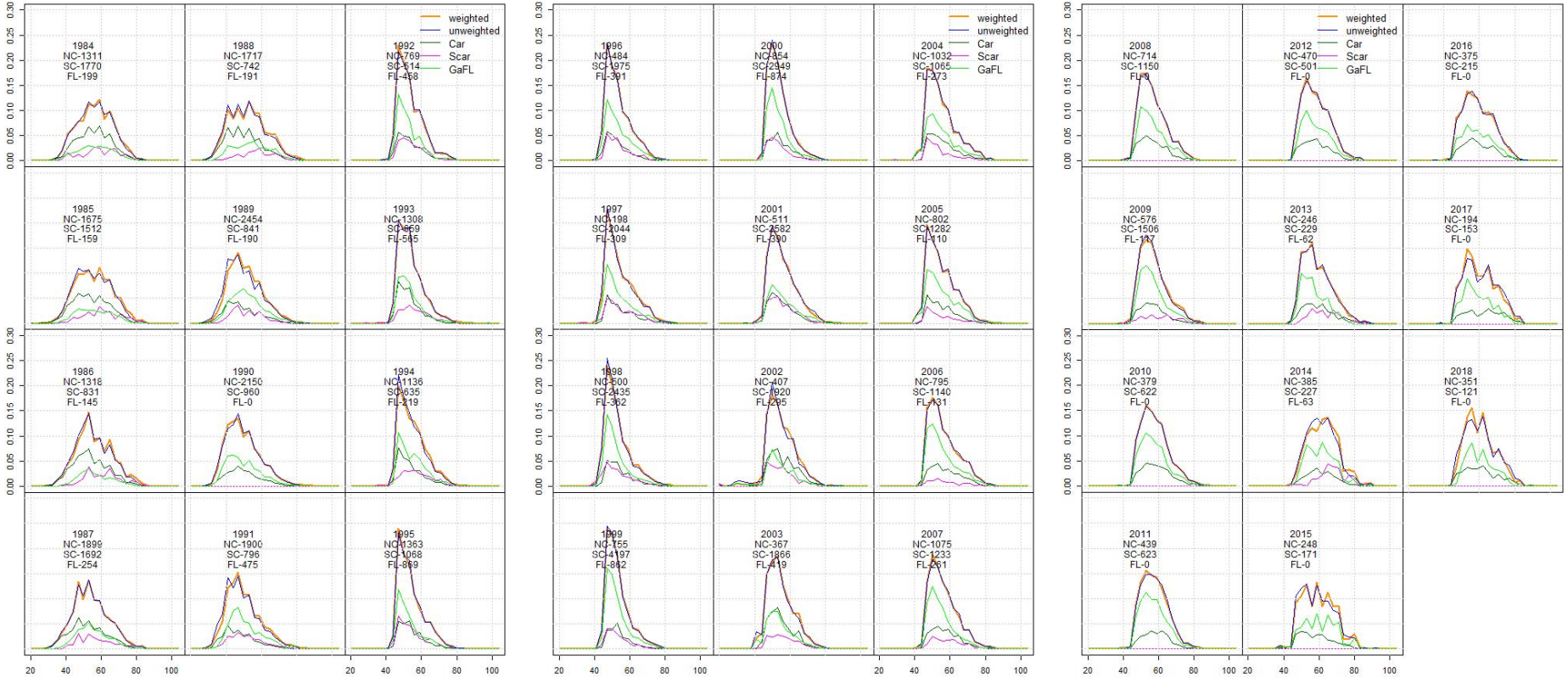
Year	NC	SC	GA	FL - Atl	Comments	South Atlantic
1950-1961	0.25	0.25	0.25	0.25	Annual state summaries, likely missed small scale dealers	weighted average
1962-1977	0.2	0.2	0.2	0.2	Annual state summaries, more inclusive General Canvas	
1978-1985	0.1	0.1	0.1	0.1	Monthly state summaries	
1986-1990	0.1	0.1	0.1	0.05	FL starts state trip ticket	
1991-1993	0.1	0.1	0.1	0.05		
1994-1995	0.05	0.1	0.1	0.05	NC starts state trip ticket	
1996-2000	0.05	0.1	0.1	0.05		
2001-2003	0.05	0.1	0.05	0.05	GA starts state trip ticket	
2004-2010	0.05	0.05	0.05	0.05	SC starts state trip ticket	
2011- present	0.05	0.05	0.05	0.05		

indicates break between upper and lower boundary in early years to upper boundary only in later years

NOAA FISHERIES

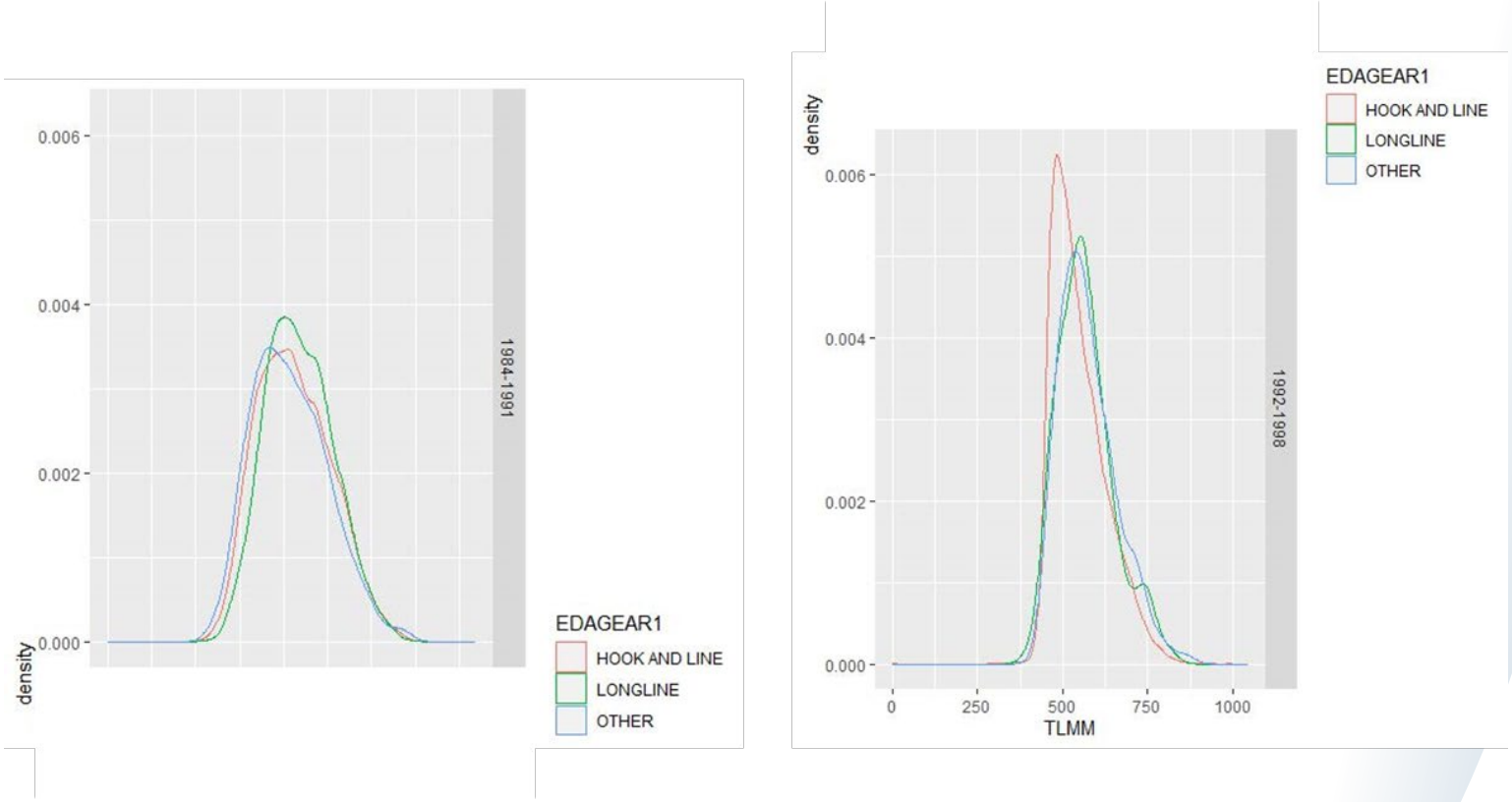
Commercial Length Composition across Years

- Comps provided: handline (VL) weighted and other gears (nominal)



NOAA FISHERIES

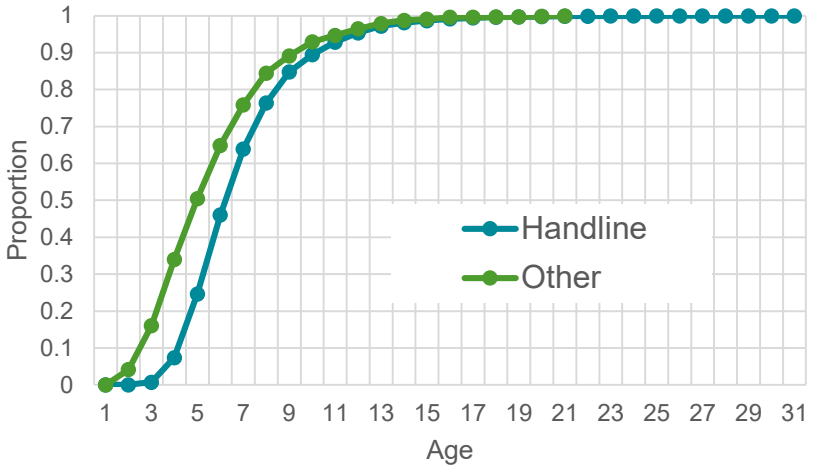
Commercial Length Composition all Years

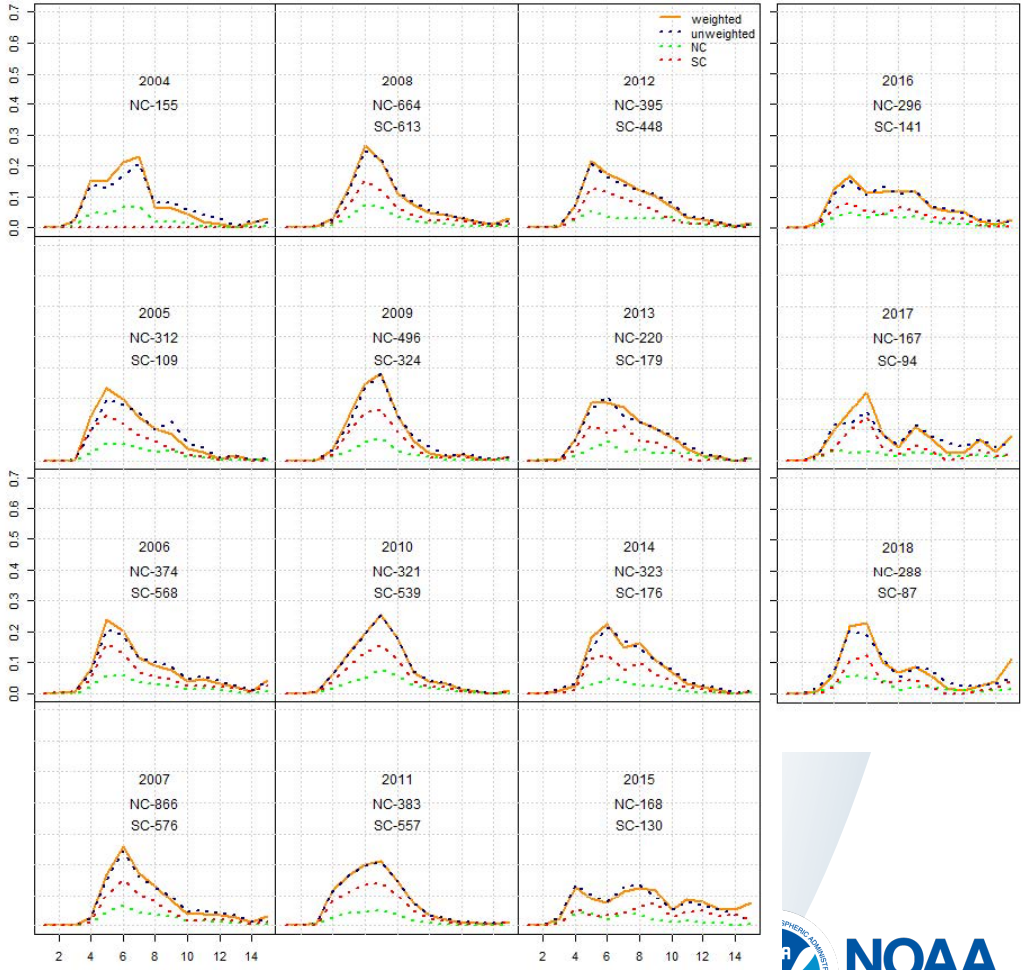


NOAA FISHERIES

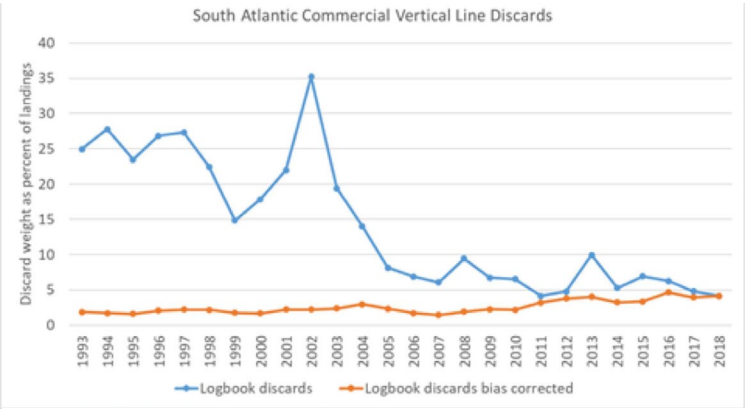
Commercial Age Composition all Years

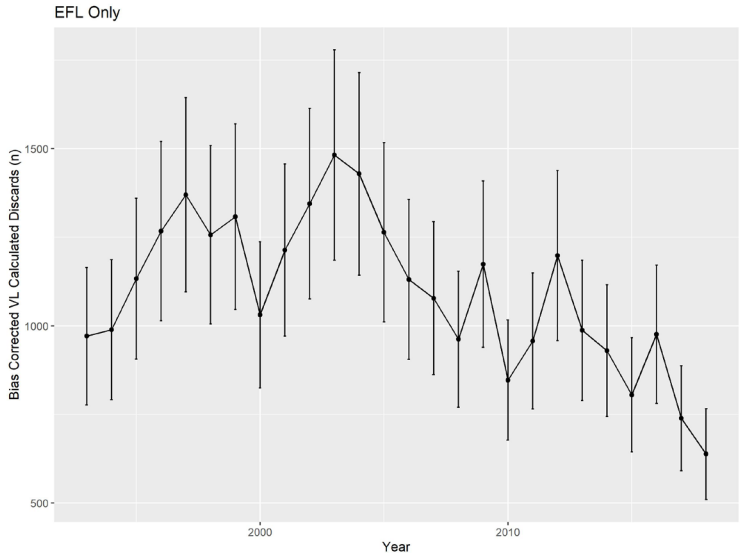
- Comps provided: handline (VL) weighted and other gears (nominal)
- 95% of age data occurs before 12yrs (handline and other)
- Plus group rec. at 15 yrs. (SEDAR68-DW-35)





Commercial Discards





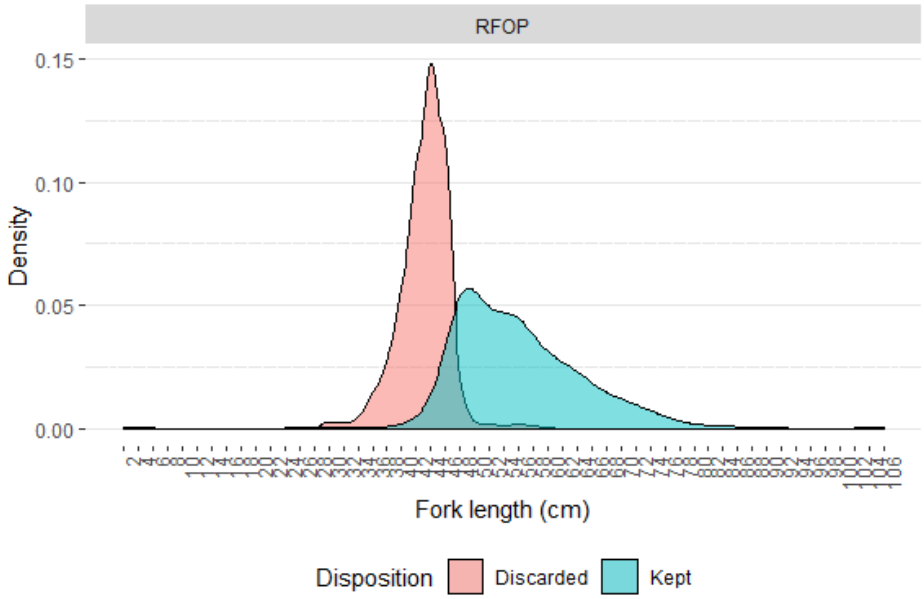
- Data available from two datasets:
  - Discard logbook (rate data)
  - Coastal logbook (effort data)
- Observer data insufficient to calculate discards for SA
- Logbook discards generally higher than what observers report
- Logbook discards (blue) estimates and logbook discards using bias correction factor (orange)

$$SA\ Discards\ RFOP = GOM\ Discards\ RFOP \times \frac{SA\ Discards\ DLP}{GOM\ Discards\ DLP}$$

- Bias corrected VL discards and associated SE (numbers)
  - Only available for FL east coast
- Bottom LL < 80 fish/yr with correction factor
  - Considered negligible effect on stock assessment

Commercial Discards Length Composition

Vertical Line	Discards		Kept	
Year	N	Trips	N	Trips
2007 - 2008	468	24	1,131	30
2009	33	4	220	7
2010 - 2011	26	6	250	12
2013 - 2015	7	5	246	13
2016	11	5	191	8



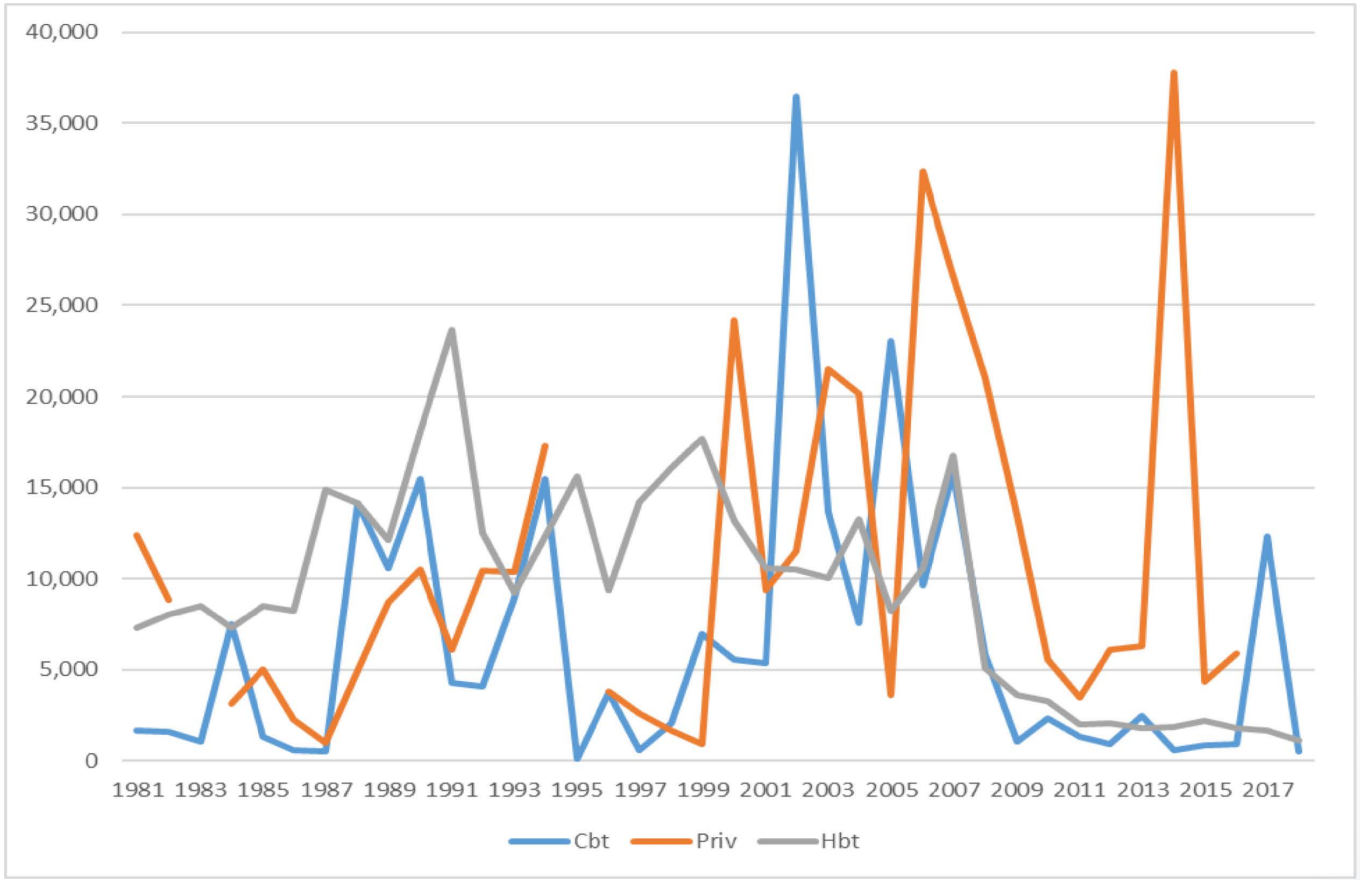
- LL discard length comps small sample size (4) (SEDAR68-DW-16)
- VL pooled for discard length composition

Recreational Landings

- SRHS (Headboat survey):
  - Landings for SEDAR 68 recommended to begin in 1981
    - Lack of full survey coverage prior to 1981
    - Uncertainty in species ID prior to 1981
- MRIP:
  - Began 1981
  - MRIP landings in Monroe allocated to SA region
  - Monroe County excluded from MRIP headboat mode (1981-1985)
  - General shore mode excluded

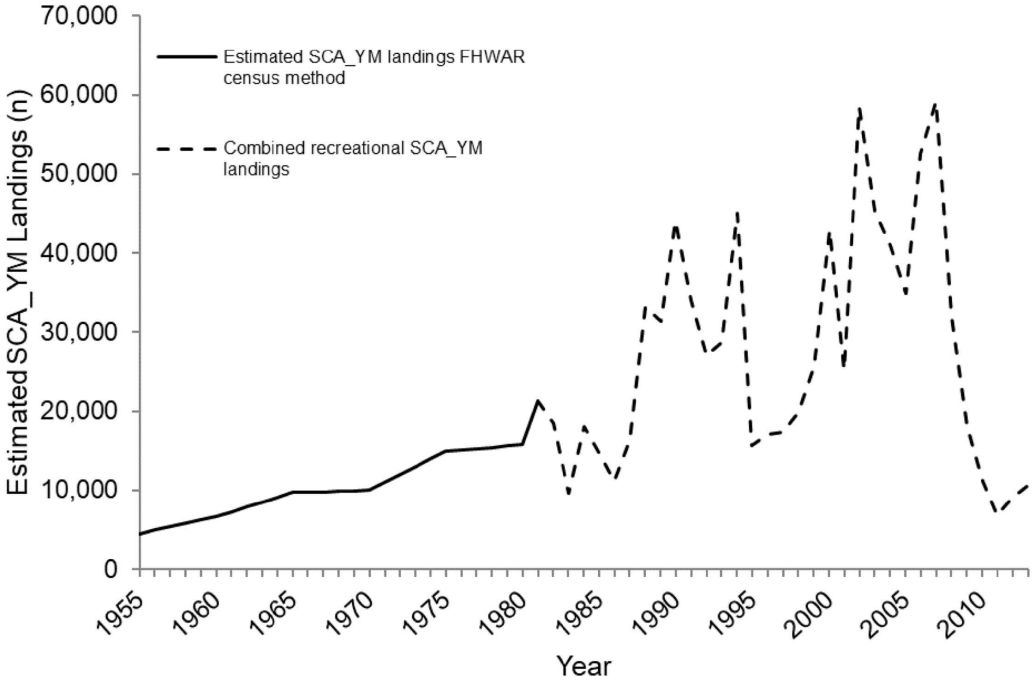
NOAA FISHERIES

Recreational Landings



NOAA FISHERIES

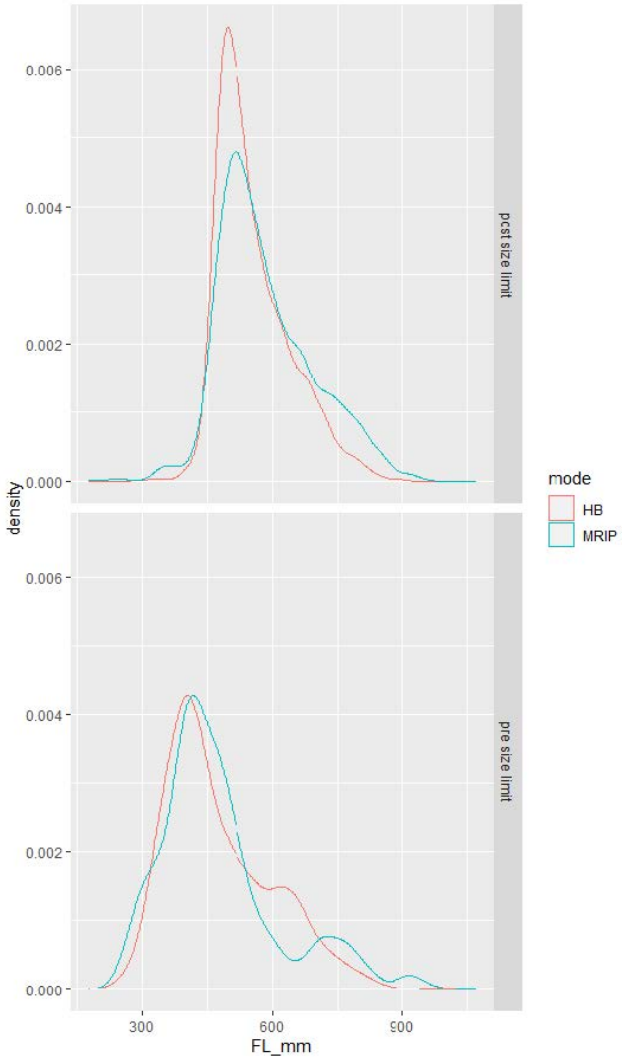
Recreational Historical Landings



- FHWAR (National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey)
- U.S. anglers and U.S. saltwater anglers - every 5 years since 1955
- Used to estimate recreational landings prior to 1981 (1955-1980)
- CV = 0.47
- Recommended for inclusion in SEDAR 68

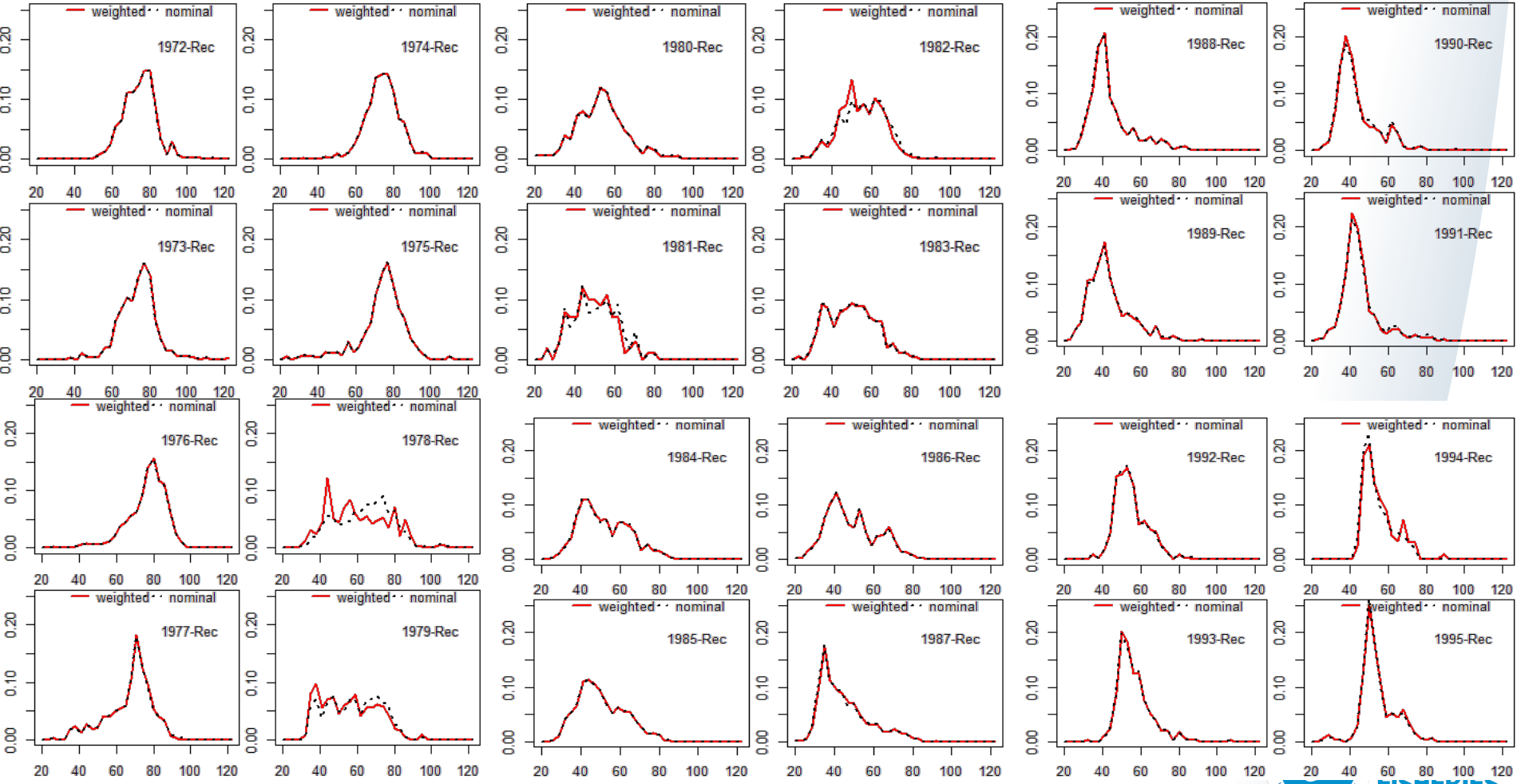
Recreational Length Composition

- SRHS Total samples 11,912
  - Approx 37% landings
  - 87% of rec lengths
- MRIP Total samples 1,821
  - Approx 63% landings
  - 13% of rec lengths
- **Considerations**:
  - Similar densities between headboat and charter/private modes
  - SRHS sampling more intense
- **Recommendations from Rec WG**: Single recreational fleet

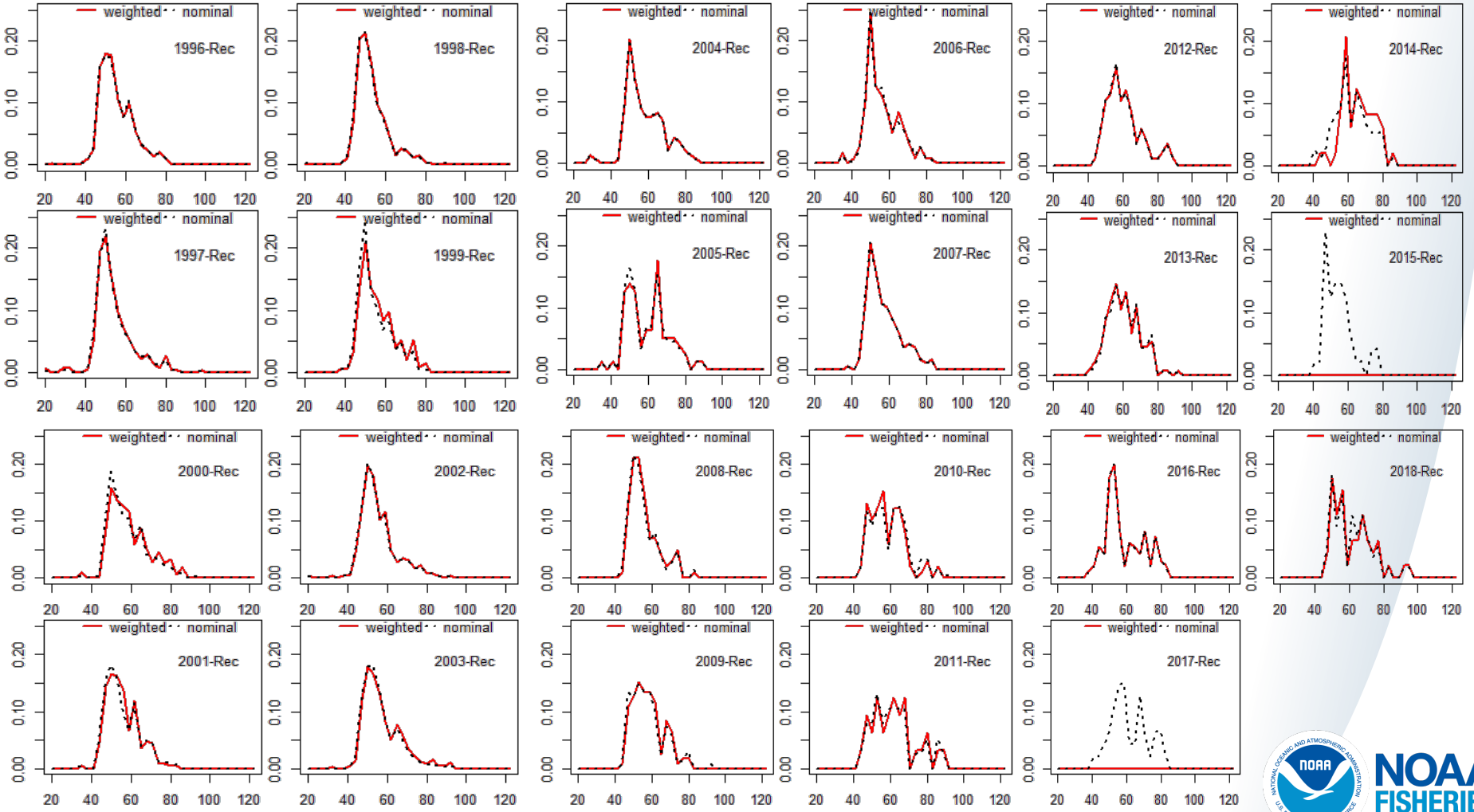


NOAA FISHERIES

Recreational Length Comp

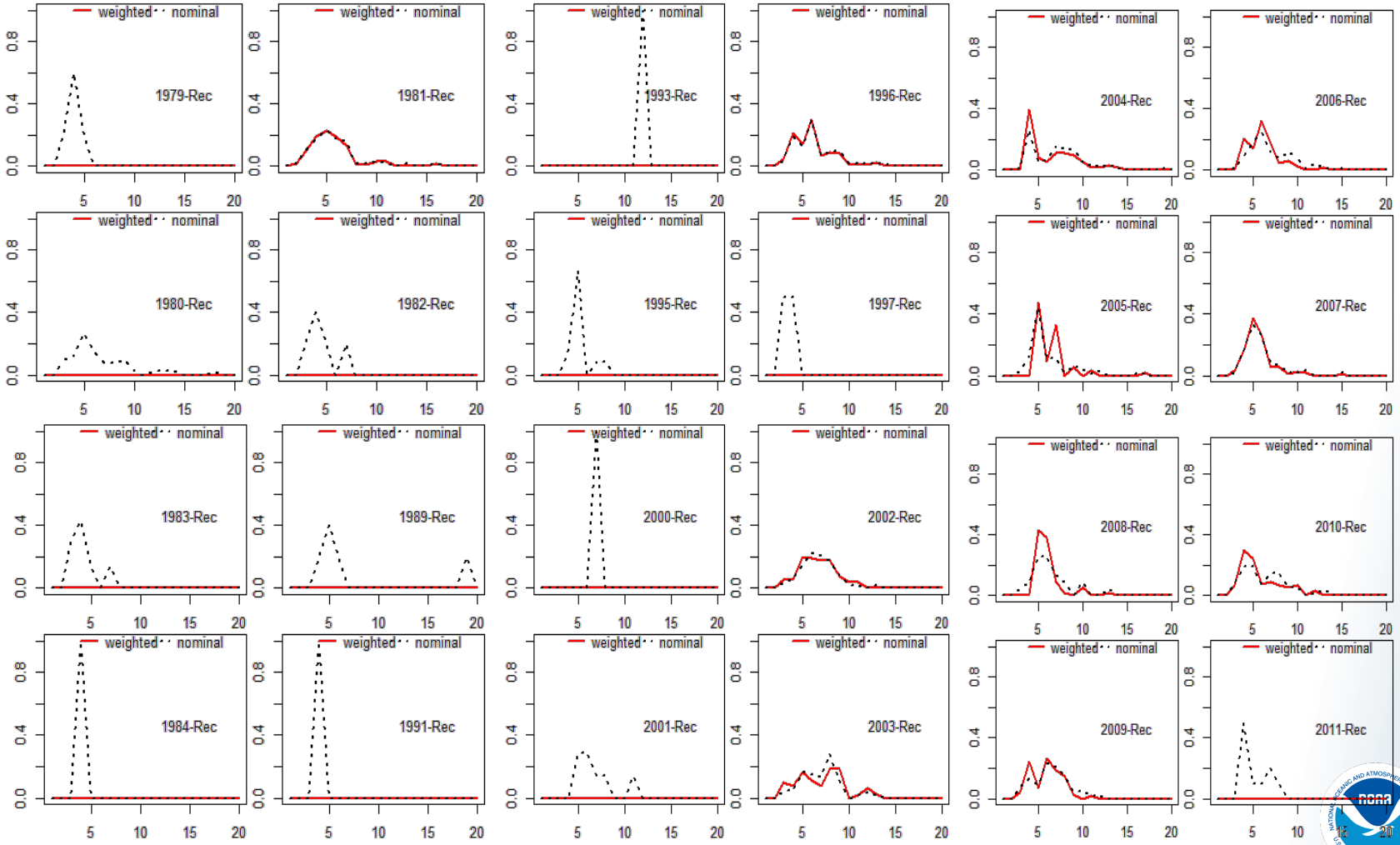


Recreational Length Comp



NOAA FISHERIES

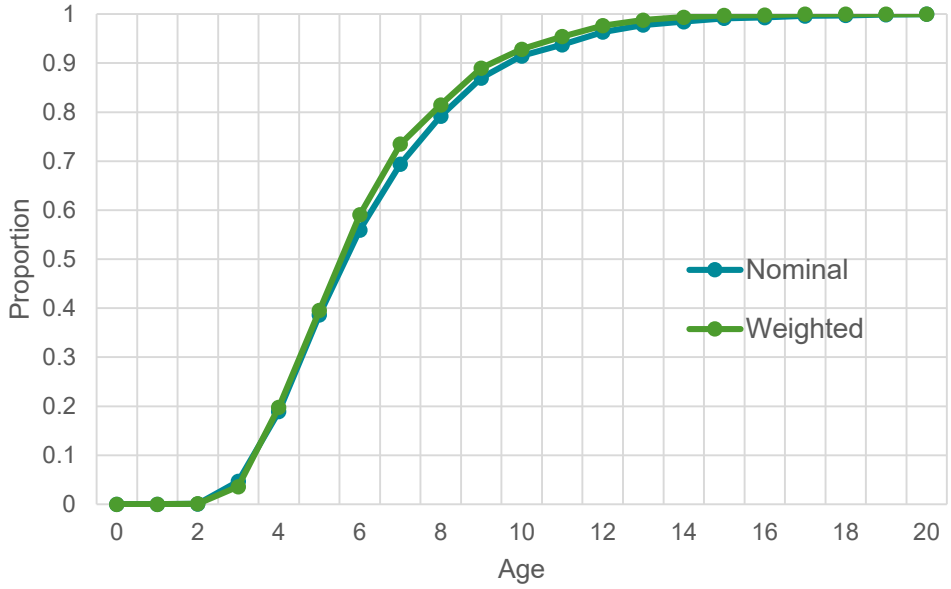
Recreational Age Comps

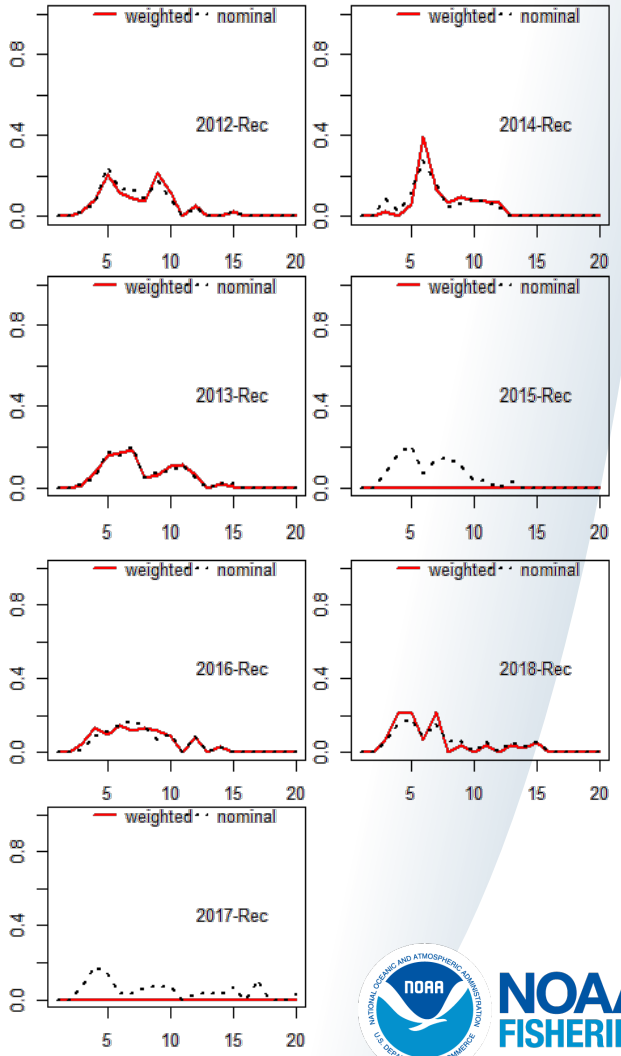


NOAA FISHERIES

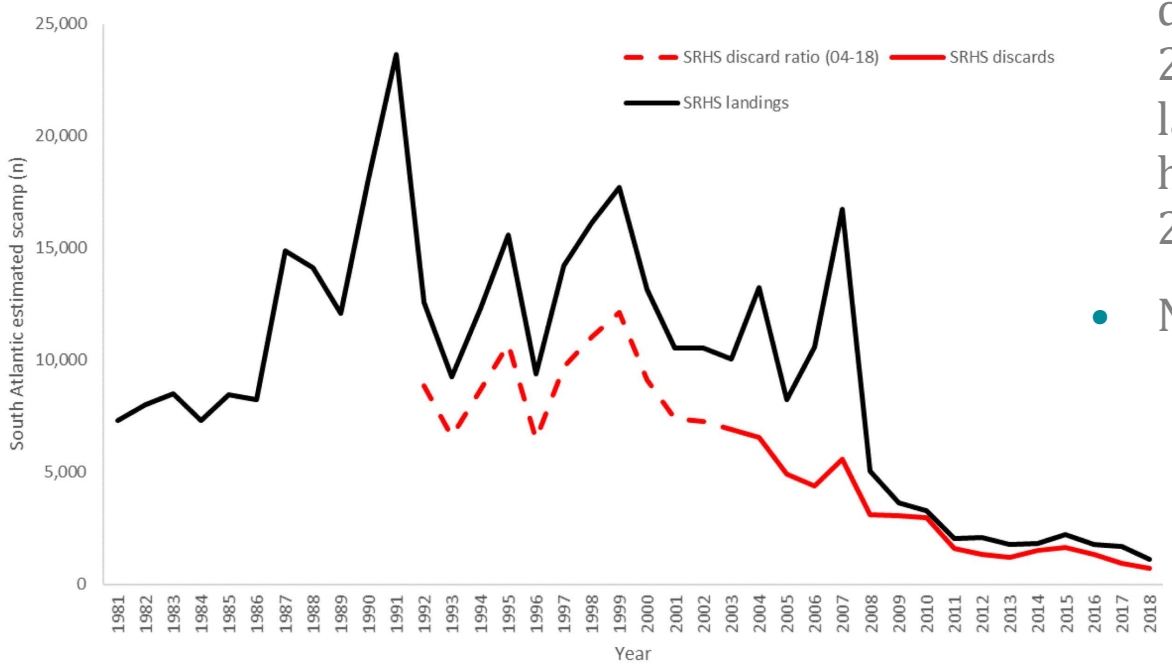
Recreational Age Comps

- 95% of age data occurs before 12yrs (weighted and nominal)



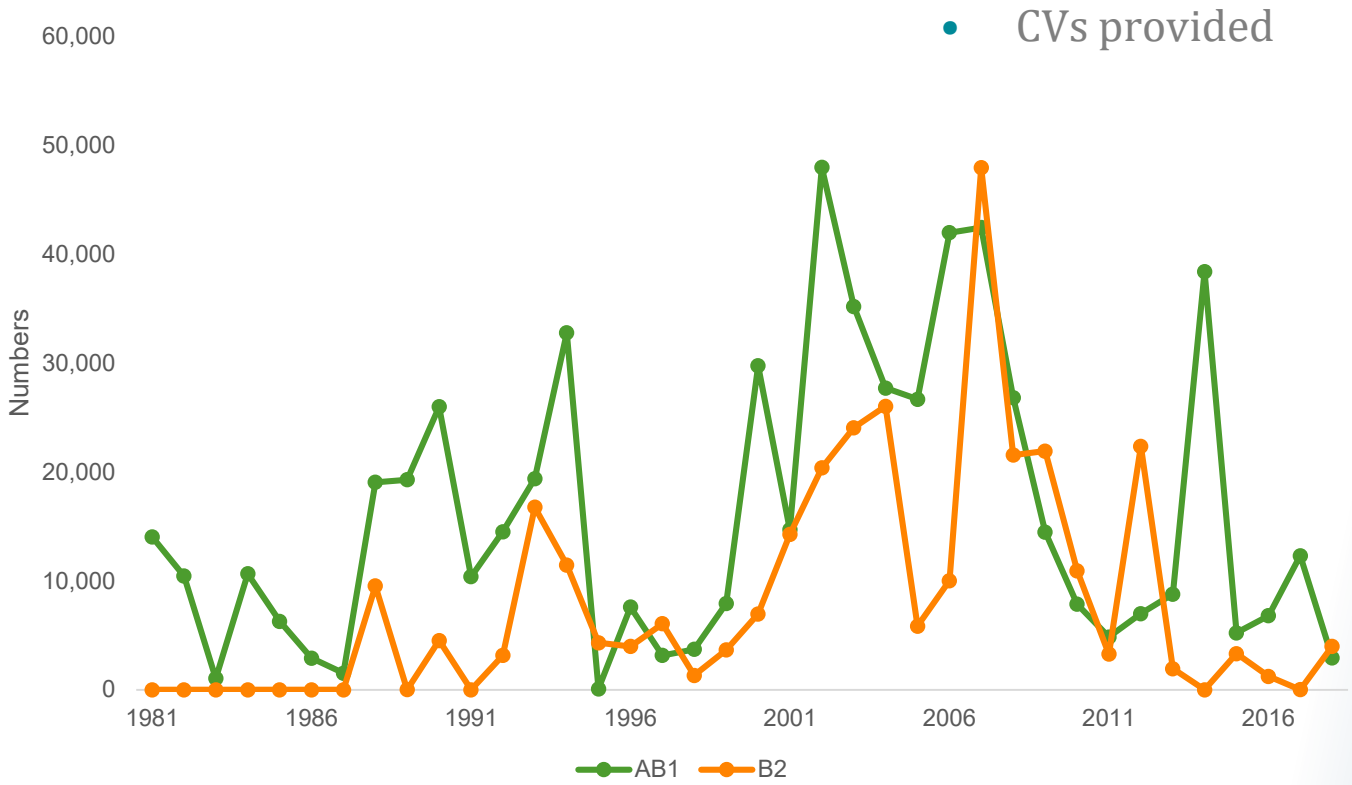


Recreational Discards Headboat



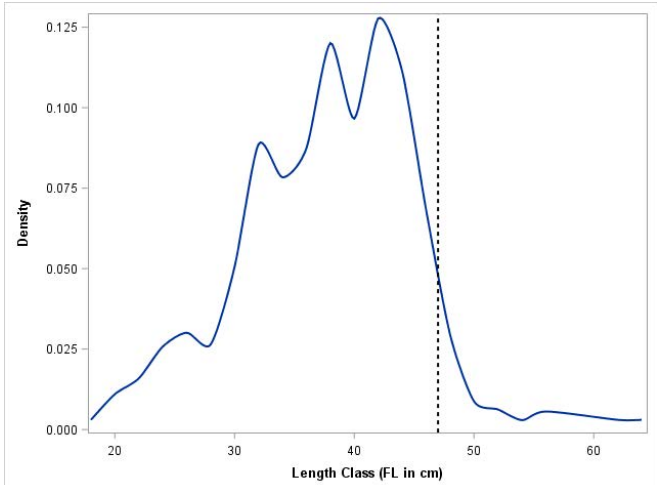
- Applied mean SRHS discard:landings ratio (2004-2018) to estimated headboat landings to estimate headboat discards prior to 2004
- No CVs provided

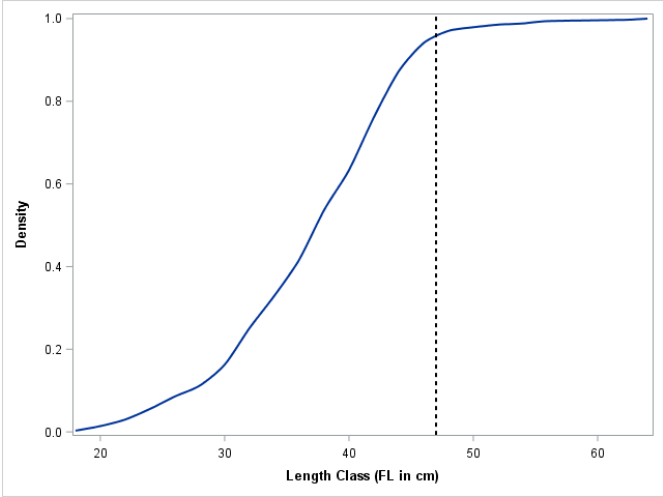
Recreational Discards MRIP



NOAA FISHERIES

Recreational Length Comps Discards





Recommendations:

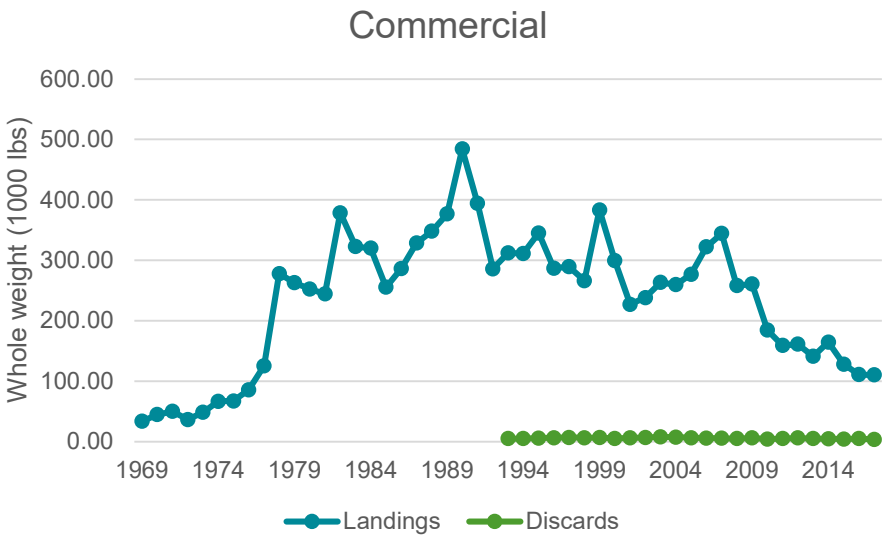
- Use headboat weighted length comp, when available to represent discard length frequencies
- Exclude Charter length comps (only represents Florida and has minimal samples)

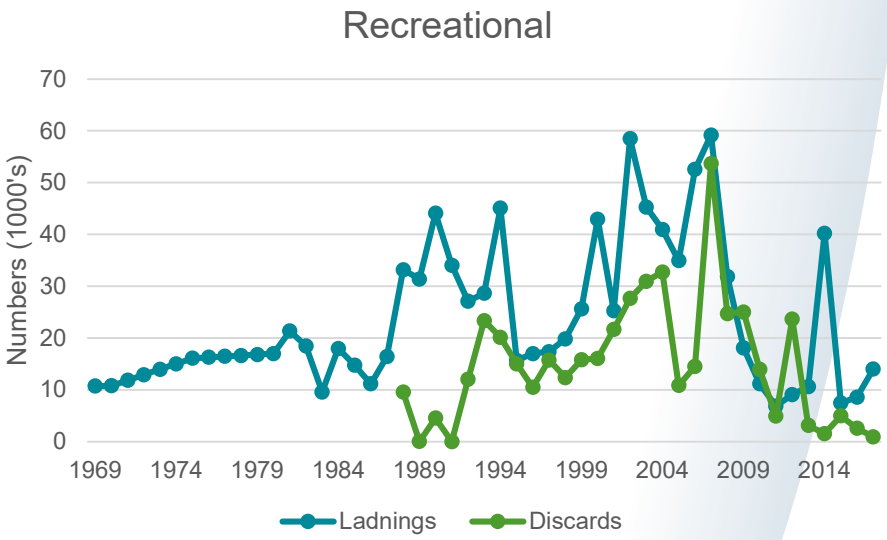
SEDAR68-DW-23

Fishing Mode	Mean	Variance	N
Charter	34.72	87.57	5
Headboat	39.44	51.73	230

NOAA FISHERIES

Total Removals





Creating Weighted Compositions

- Use a 30 fish minimum per year per state annually for length comps, and 10 fish per region annually for age comps.
  - These minimums prevent very small comp sample sizes to be scaled up by large landings.
- Dirichlet-multinomial used for likelihoods
  - Self-weighting
  - Allows for zeros in the data

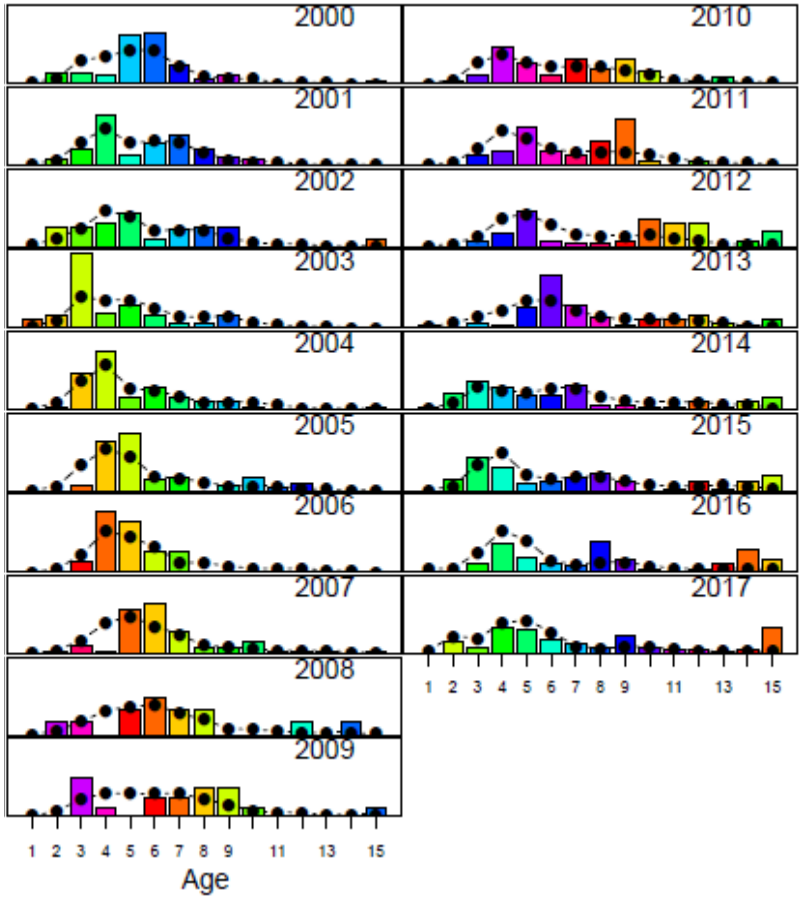
NOAA FISHERIES

Chevron Trap Data

- Survey conducted by MARMAP until 2009 (Marine Resources, Monitoring and Assessment Program
- 2009 SEAMAP joined program (Southeast Area Monitoring and Assessment Program
- SEFIS created in 2010 (Southeast Fisheries Independent Survey)
- Partnership program currently referred to as SERFS (Southeast Reef Fish Survey)
- Sampling coverage increased, particularly into Florida
- Chevron traps baited and randomly deployed at live bottom stations
  - Located on continental shelf and shelf edge
  - Soaked for 90 min

NOAA FISHERIES

Chevron Trap Data



- Older fish appearing beginning around 2010
- Represent an increase in proportion of older fish relative to younger?

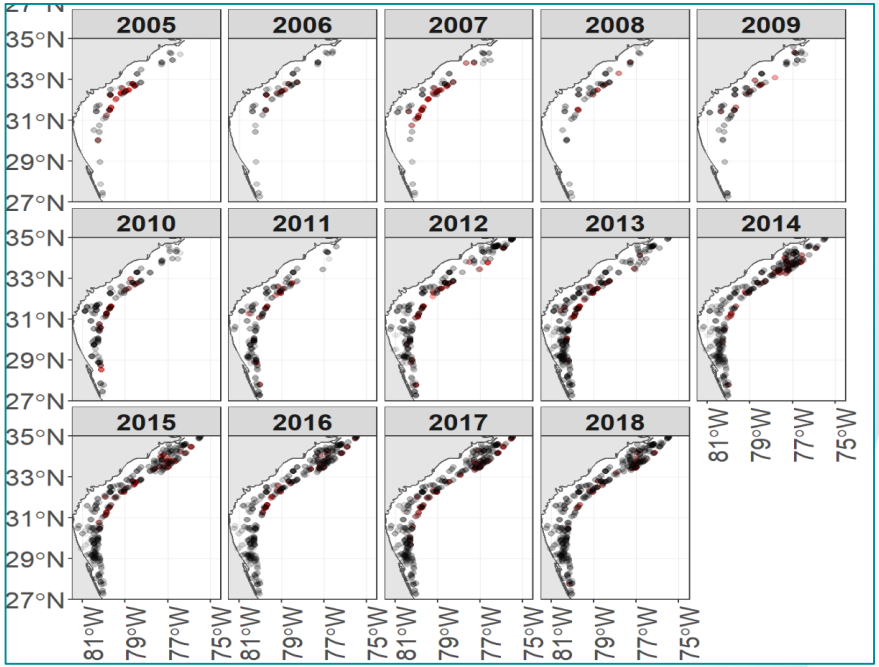
or

- Chevron traps sampling larger, older fish with SEFIS/SERFS formation in 2010?

NOAA FISHERIES

Chevron Trap Data

Year	Included Collections	Positive Collections	Proportion Positive	Total Fish
1990	313	32	0.1	63
1991	272	30	0.11	48
1992	288	29	0.1	49
1993	392	41	0.1	72
1994	387	71	0.18	127
1995	361	52	0.14	117
1996	361	41	0.11	69
1997	406	69	0.17	162
1998	426	51	0.12	120
1999	233	25	0.11	49
2000	298	43	0.14	60
2001	245	35	0.14	60
2002	244	25	0.1	37
2003	224	24	0.11	41
2004	282	36	0.13	54
2005	303	33	0.11	61
2006	297	10	0.03	15
2007	337	40	0.12	61
2008	303	10	0.03	13
2009	404	12	0.03	17
2010	725	31	0.04	47
2011	726	27	0.04	30
2012	1,174	42	0.04	58
2013	1,360	49	0.04	55
2014	1,472	53	0.04	72
2015	1,463	55	0.04	70
2016	1,484	41	0.03	51
2017	1,541	58	0.04	72
2018	1,736	29	0.02	39
Totals	18,057	1,094	0.06	1,789

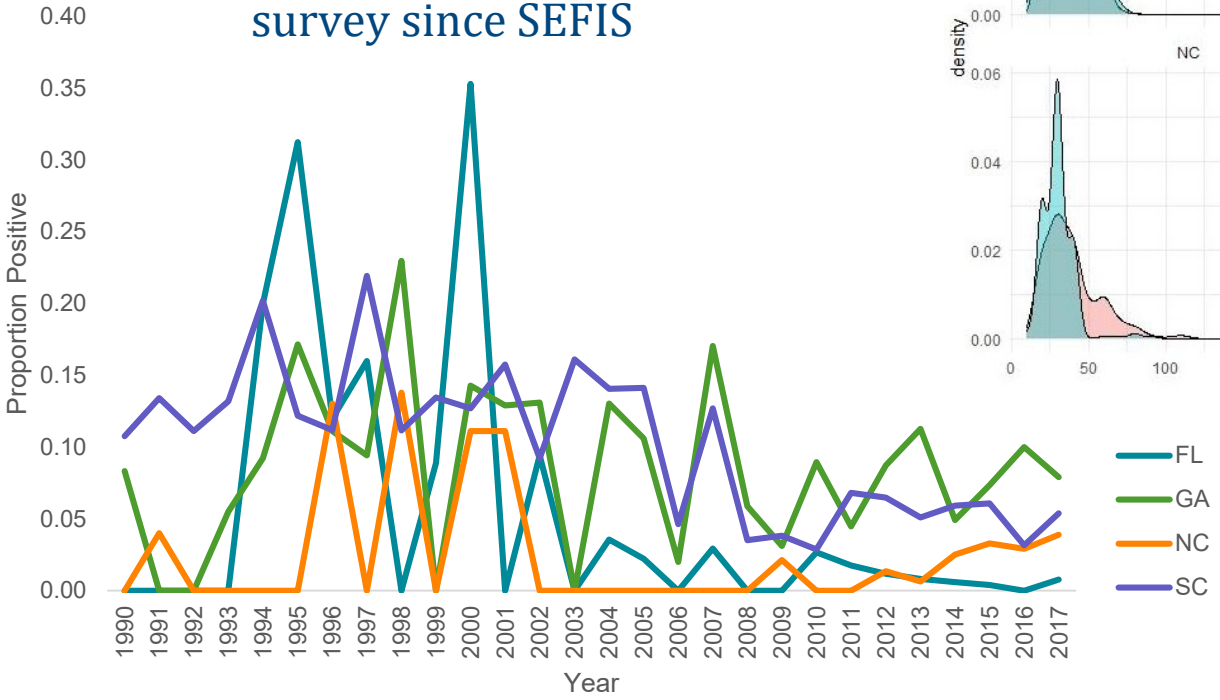


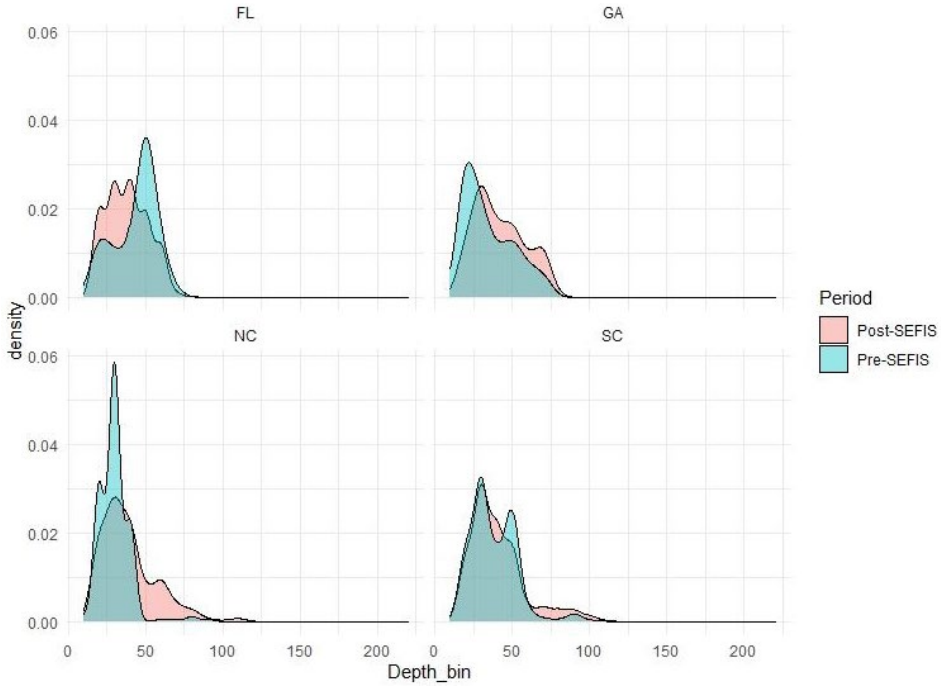
SEDAR68-DW-04

NOAA FISHERIES

Chevron Trap Data

- PP increases for NC
  - NC: 10% of catch for survey since SEFIS

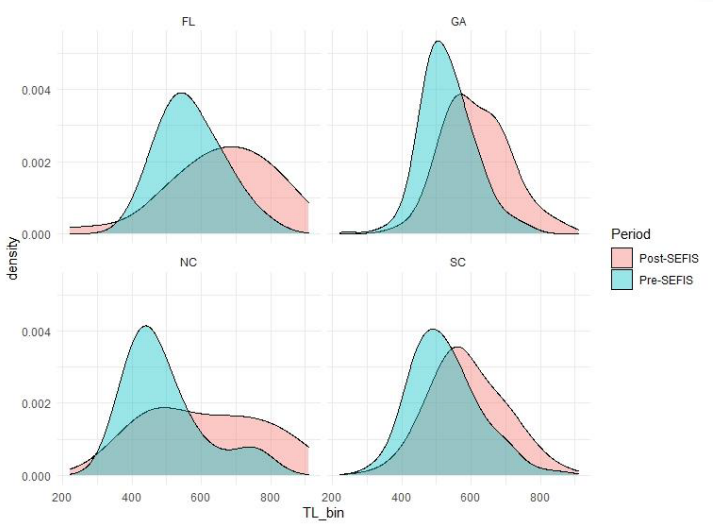


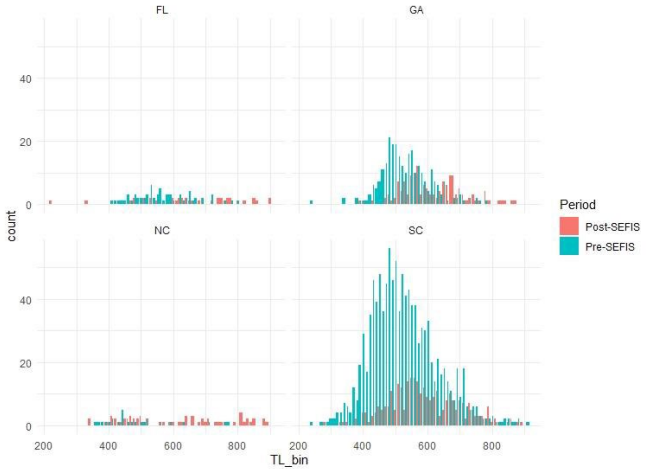


NOAA FISHERIES

Chevron Trap Data

- Length of scamp caught in MARMAP/SERFS survey increased
- Capturing older fish in new sampling?
- Proportion of large fish increasing due to decline in smallest fish? (Bacheler & Ballenger, 2018)





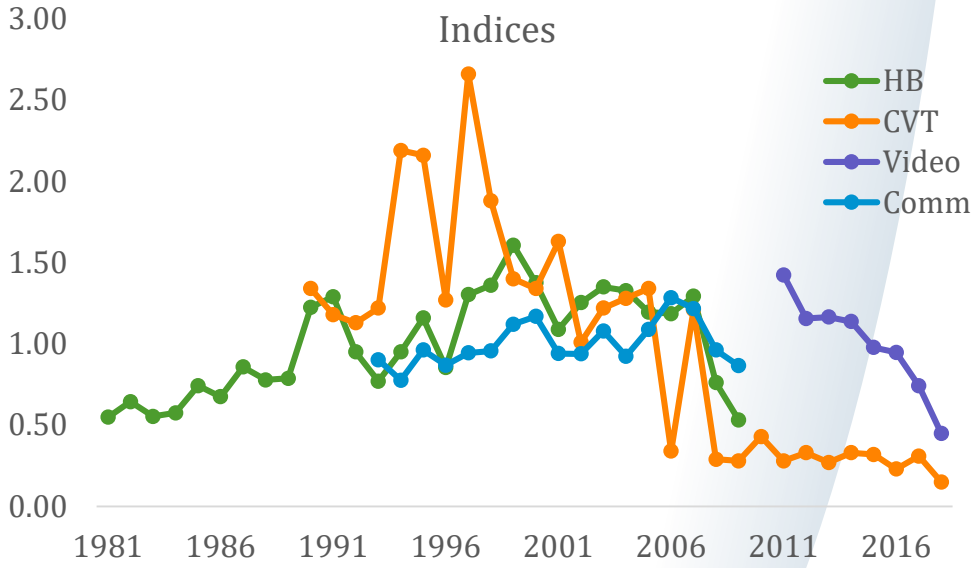
NOAA FISHERIES

Indices of abundance

NOAA FISHERIES

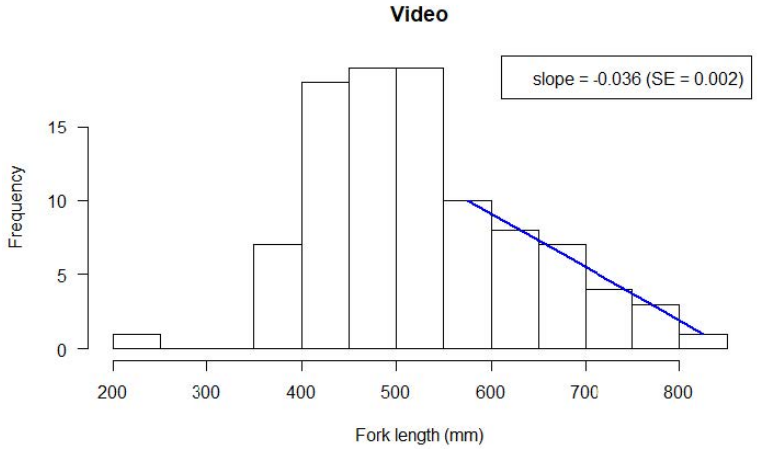
Indices of Abundance

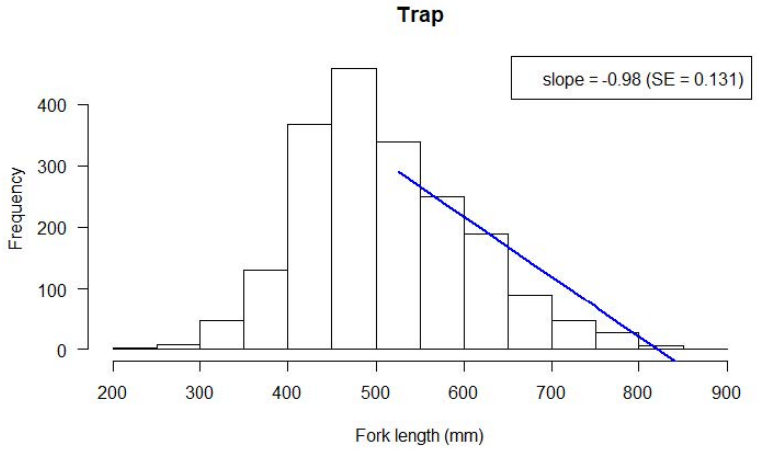
- Four recommended for use at Data Workshop
  - Commercial handline
  - Recreational headboat
  - SERFS chevron trap survey
  - SERFS Video Index
- Standard errors for FD indices scaled to a common mean of 0.2
- Used provided errors for FI indices
- COM and REC available thru 2017.
- Truncated in 2009 due to management concerns for COM and REC
  - Management changes beginning in 2010 influence subsetting method for data (Stephens & MacCall)



NOAA FISHERIES

Indices



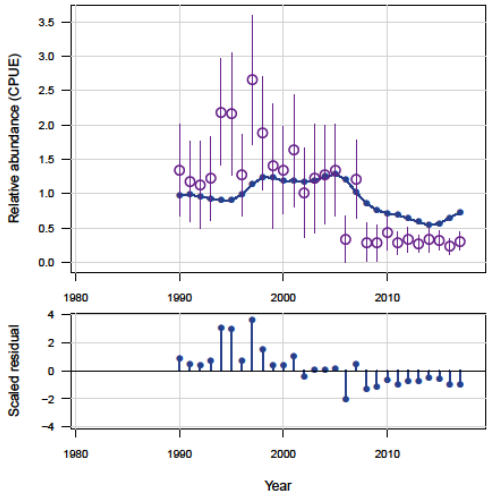


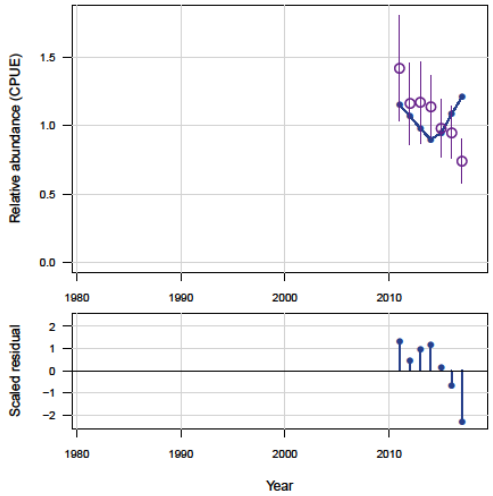
- Preliminary Recommendation from WG: Assume flat-top selectivity and borrow ascending limb from trap length information
- No comp data for video survey
- IWG recommended separate SERFS trap and video indices initially

NOAA FISHERIES

Indices of Abundance

- SERFS chevron trap survey and video index fit separately initially
  - Videos placed on top of traps, potential bias
  - No composition data associated with video index
  - Initial model runs showed a conflict between fitting the two indices
    - Alternately downweight or upweight the two (SDNR)



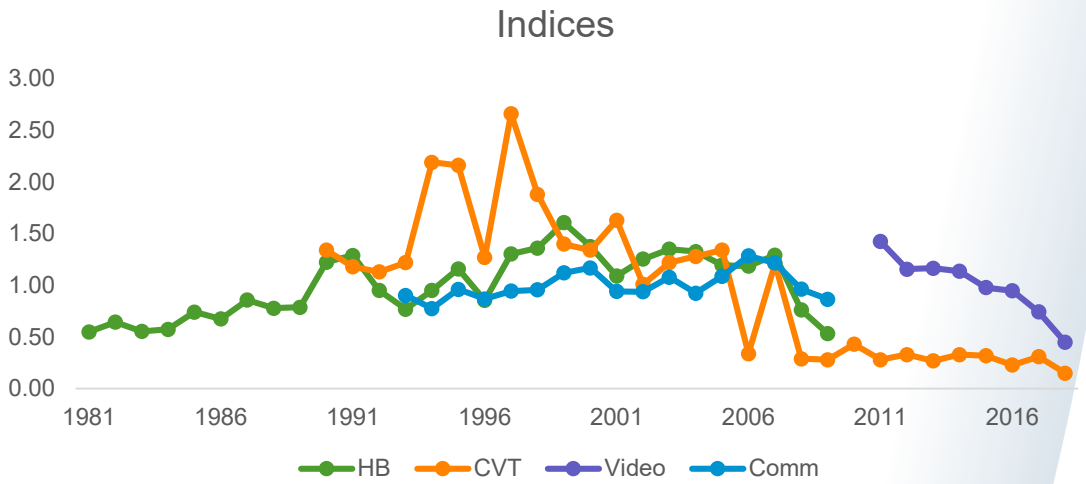


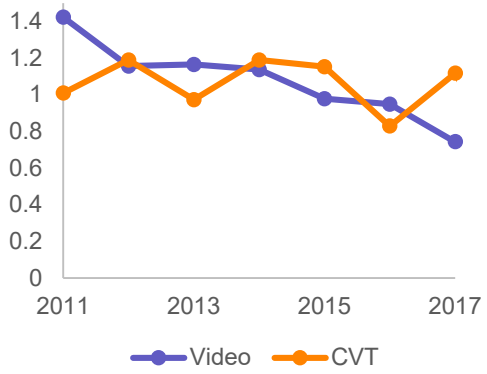
- Video and traps exhibited similar trend in abundance

NOAA FISHERIES

Indices

- Re-scaled CVT to 2011-2017 average
- Minimal difference between VID and CVT trends

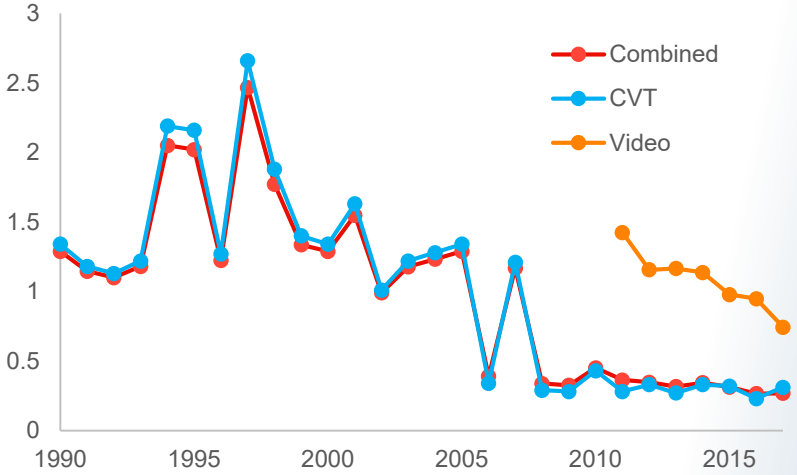




NOAA FISHERIES

Indices of Abundance

- SERFS chevron trap survey and video index combined using Conn model averaging method (Conn, 2010)
  - hierarchical framework for analyzing multiple indices to estimate single time series of abundance



NOAA FISHERIES

Start Year

- Set at 1969:
  - Historical landings data available from 1955
  - Length comps began 1972 REC
  - Set at 3 years before start of REC comps
  - Did not end up using length comps from 1972-1977
  - 1978 earliest length comp year
  - Age comps begin 1990 (CVT)

Questions about the data?

NOAA FISHERIES

Outline

- Data Review
  - Stock definition
  - Life history
  - Removals
  - Compositions
  - Index of abundance
- Catch-age model
  - Base run set-up
  - Diagnostics & model fits
  - Sensitivities
  - Uncertainty analysis

NOAA FISHERIES

Catch-age model

- Beaufort Assessment Model (Williams and Shertzer, 2015).
- Start year: 1969
- 1 area, 1 season model
- Combined SSB
- von Bertalanffy growth (fixed)
- Lorenzen natural mortality (fixed)
- Beverton-Holt spawner-recruitment relationship
- Two time blocks for selectivities
    - block 1: 1969-1991
    - block 2: 1992-2017

Catch-age model configuration cont'd

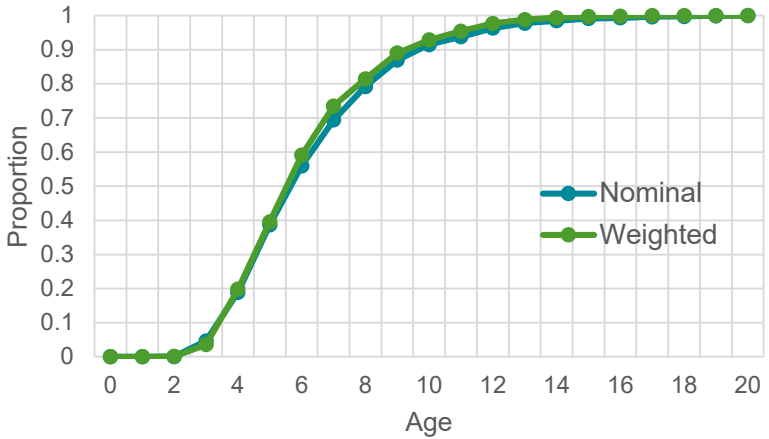
- Iteratively reweight the likelihood component for the index in order to achieve standard deviations of the normalized residuals (SDNRs) of 1. (Francis 2011)
- Constant catchability.
- Age based selectivity
- Plus group for compositions set to 15.
- Ages 1-20 modeled, with 15+ as a plus group.
  - Based on the saturation of the life history parameters.

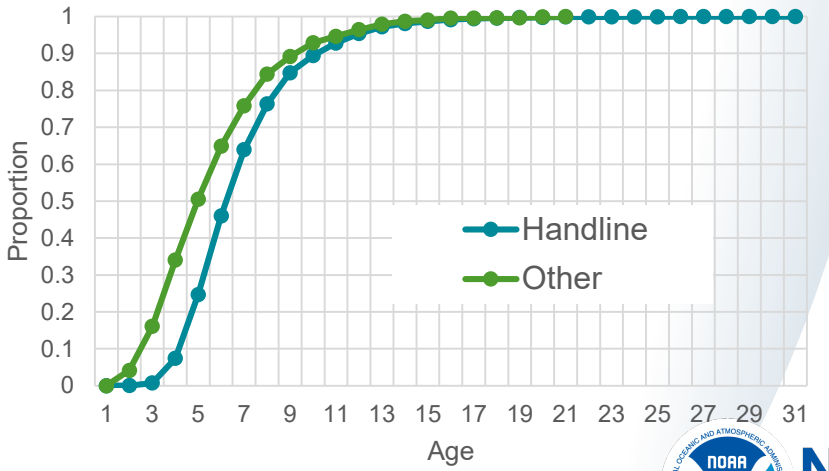
NOAA FISHERIES

Fitting Age Compositions

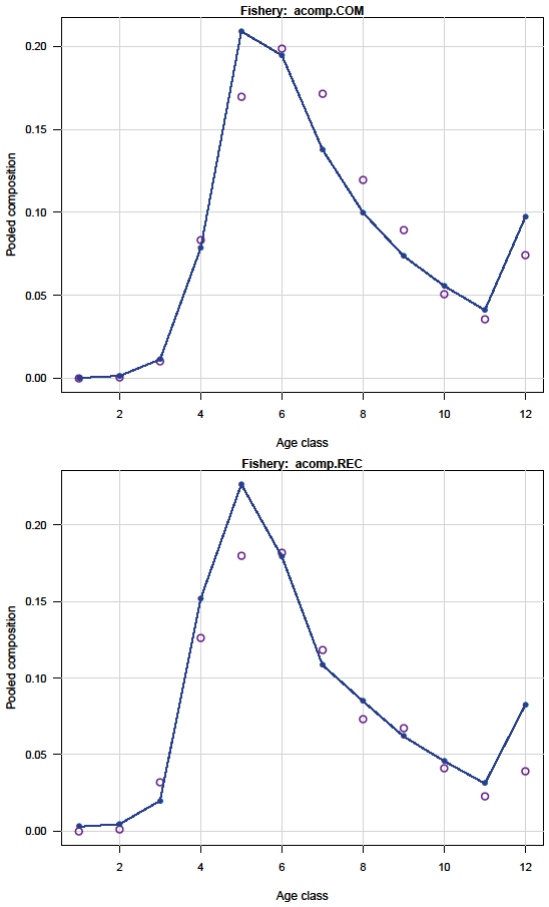
- Plus group initially proposed at 12:

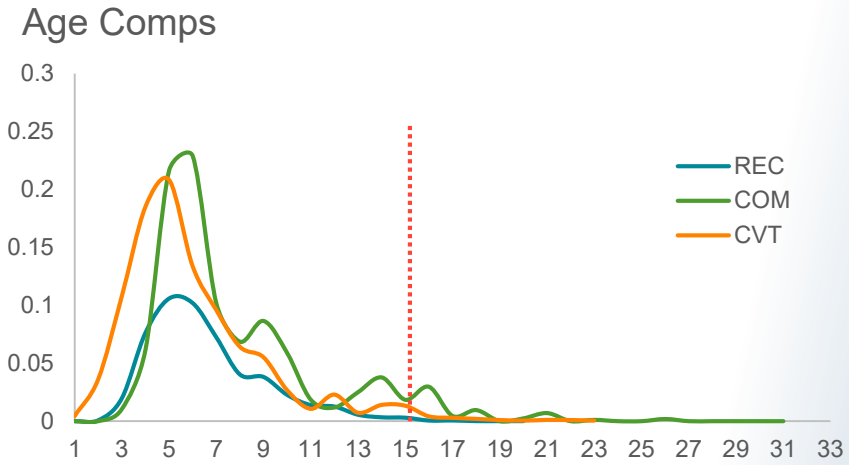
95% of age data occurs before 12yrs (weighted and nominal)





Fitting Age Compositions



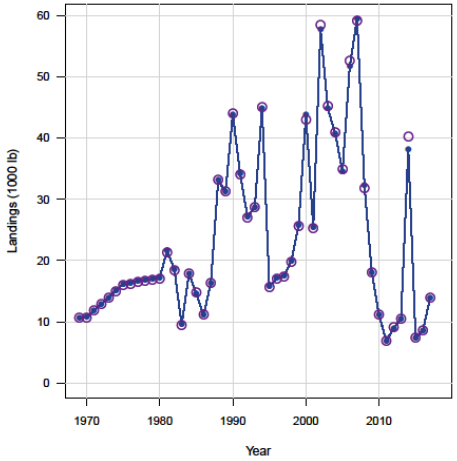


NOAA FISHERIES

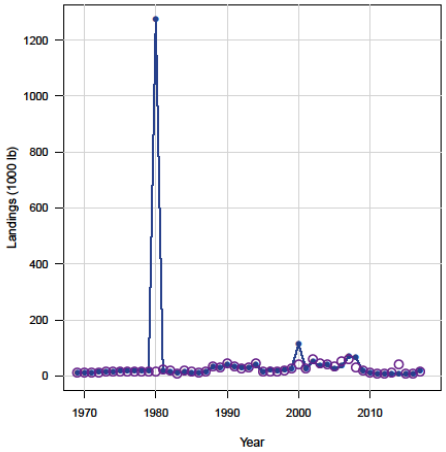
Recreational Landings CVs

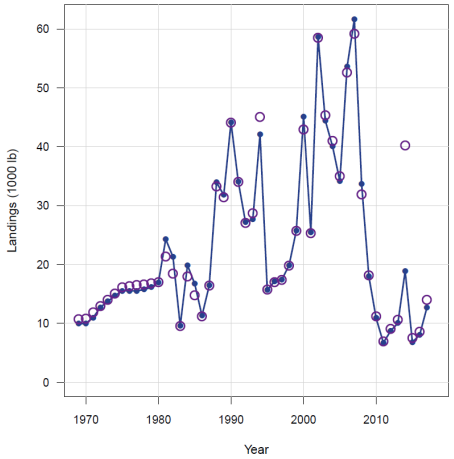
- Provided CV's cause model to greatly overestimate landings in 1980
- Placeholder CVs of 0.05 used
- Once model further developed, provided year specific CV's used

CV = 0.05



Provided CVs





NOAA FISHERIES

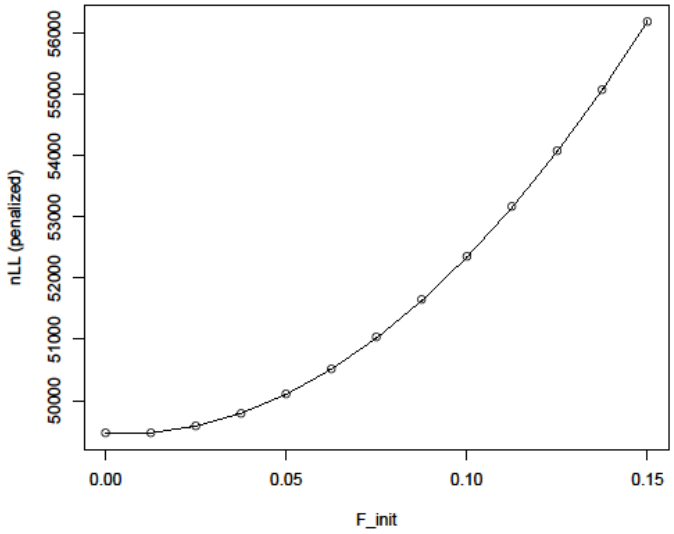
Parameters estimated: 223

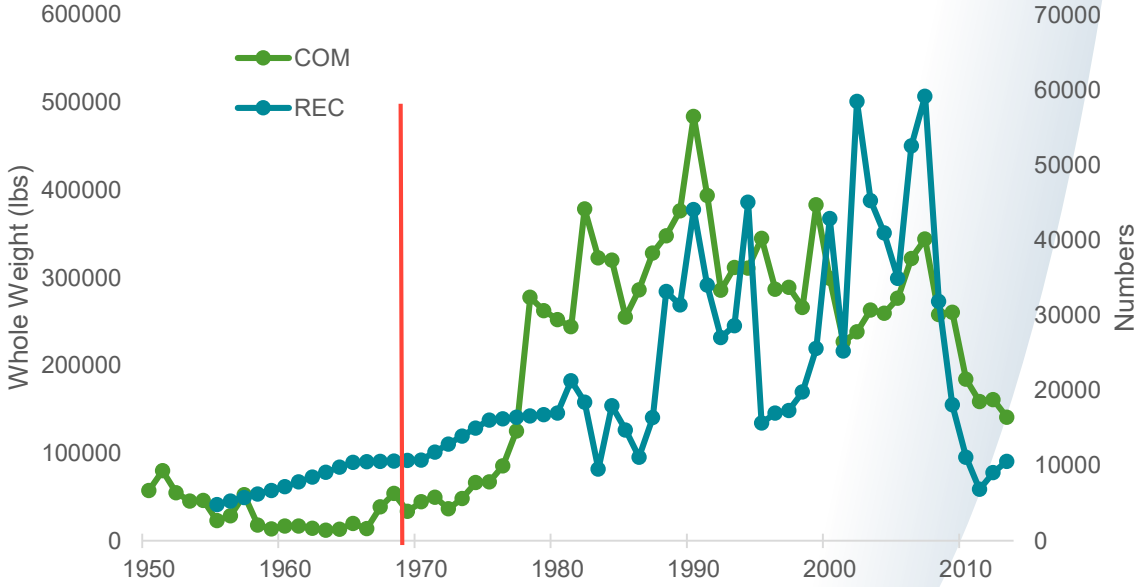
- Annual fishing mortality rates of each fleet (153 parameters)
- Average fishing mortality for each fleet (4 parameters)
- Selectivity parameters (14 parameters)
- Dirichlet-multinomial variance inflation factors (8 parameters)
- Catchability coefficient associated with the index (3 parameters)
- Recruitment parameters (3 parameters)
  - Sigma r, steepness and R0
- Annual recruitment deviations (36 parameters) - 1980-2015
- CV of size at age for the population and landings growth curves (2 parameters)

NOAA FISHERIES

F Initial Likelihood Profile

- Attempted to estimate F init
- Hitting lower bound of 0.0
- Equilibrium age conditions at first year



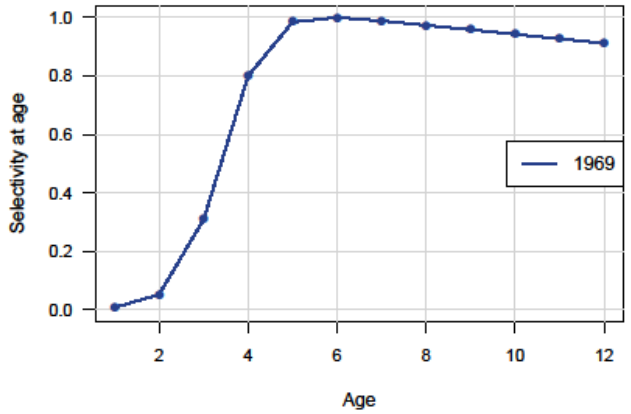


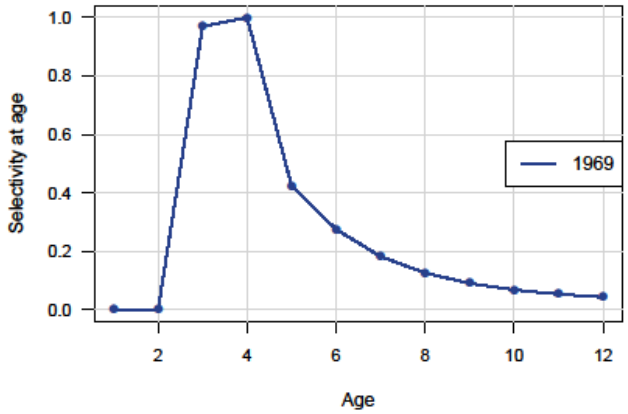
BAM likelihood components

- Landings: Lognormal with assumed CV=0.05 COM and provided CVs for REC
- Index: Lognormal with annual CVs
  - Fishery dependent indices weighted to common SE
- Age Composition: Dirichlet multinomial with annual N = number of sampled fish
- Length Composition: Dirichlet multinomial with annual N = number of sampled trips
- Recruitment deviations: Lognormal with estimated variance of rec devs (sigma-R)

Selectivities

- REC and COM both 2 parameter logistic
  - One selectivity for each time block
- CVT 2 parameter logistic,
  - Dome shaped attempted for CVT
  - A502 and descending slope hit bounds
- Discard selectivity double logistic (dome) estimated, previously fixed logit



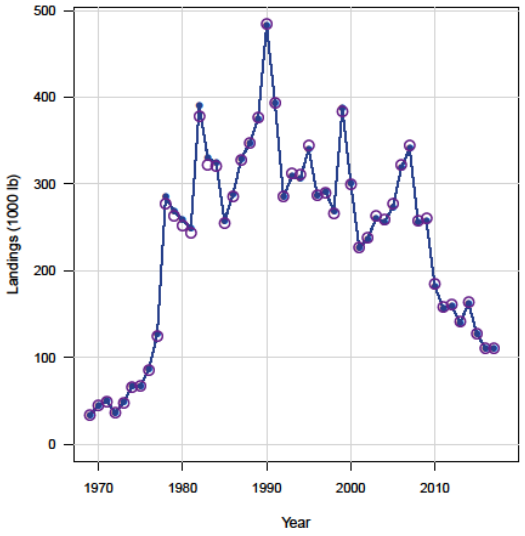


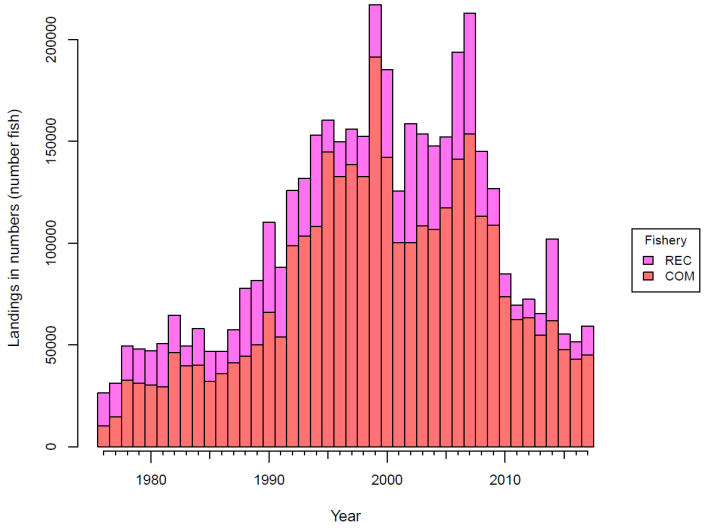
Model Fits

NOAA FISHERIES

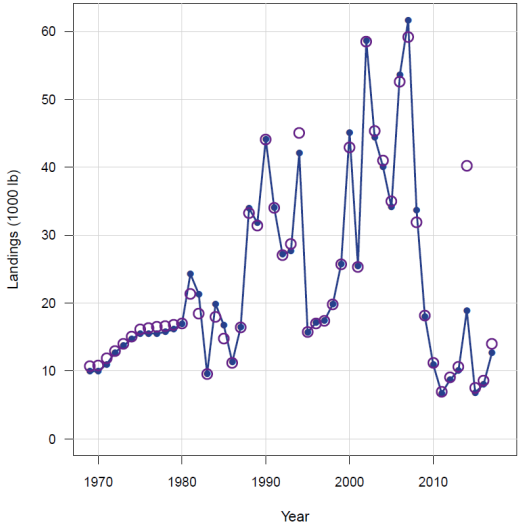
Landings

Commercial





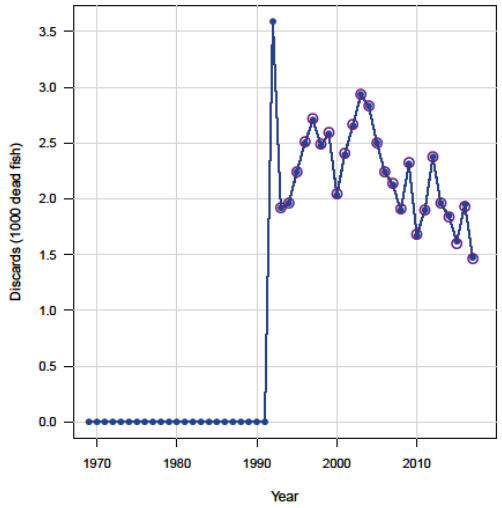
Recreational



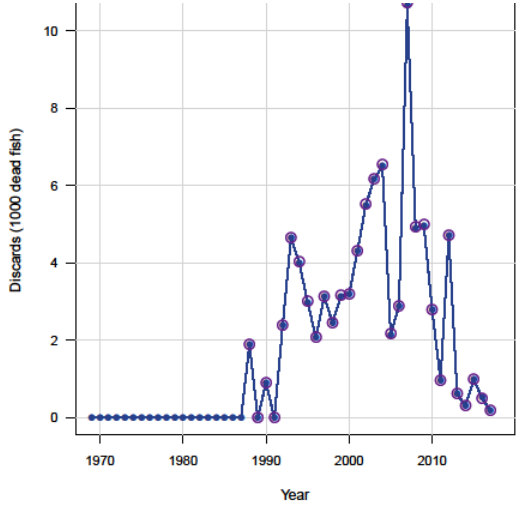
NOAA FISHERIES

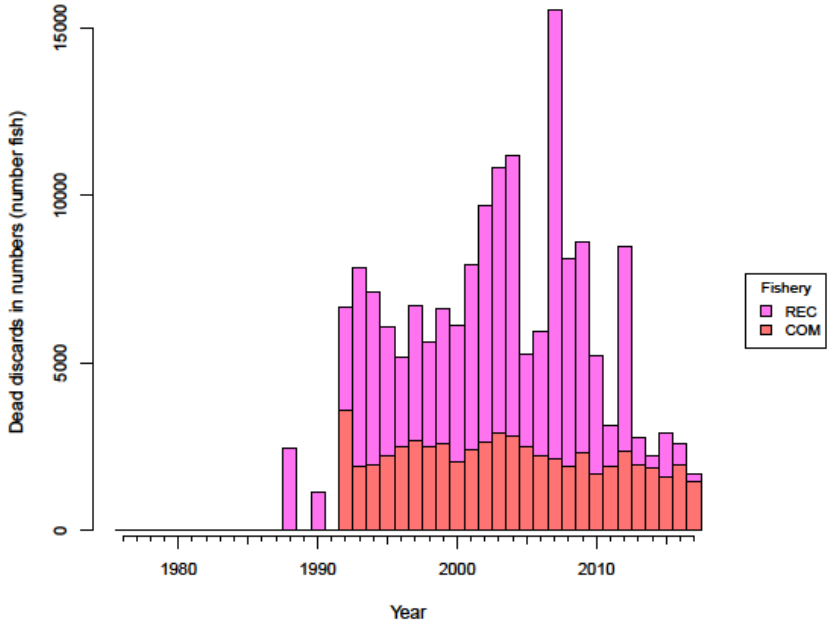
Discards

Commercial



Recreational





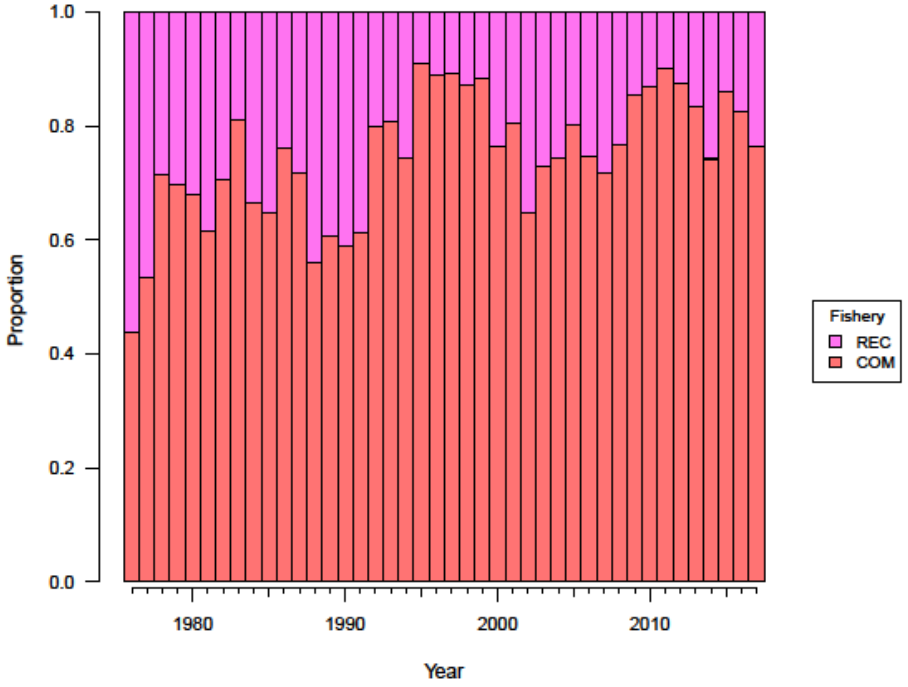
Discard mortality estimated at:

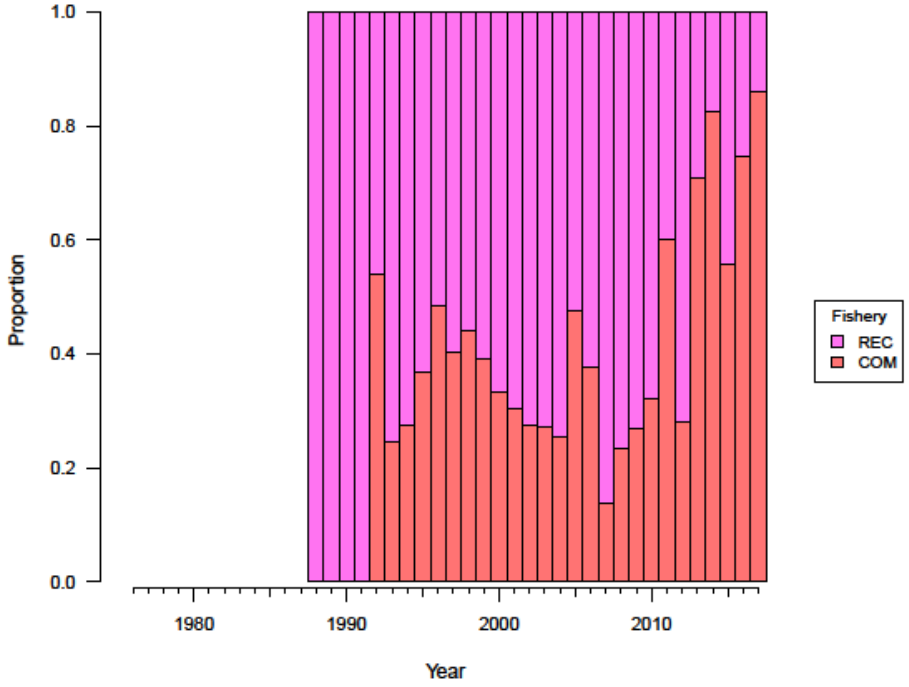
- 39% Commercial
- 26% Recreational

CVs at 0.5

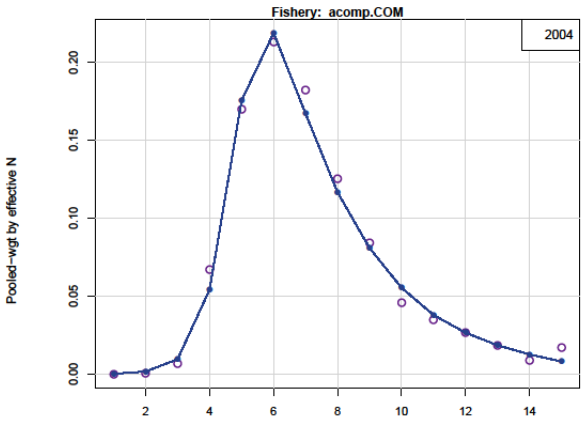
NOAA FISHERIES

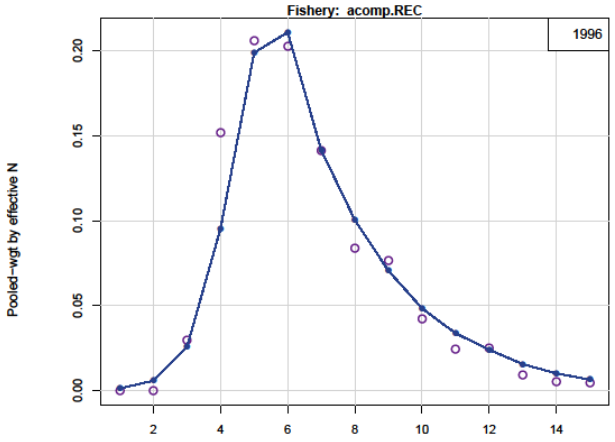
Landings and Discards

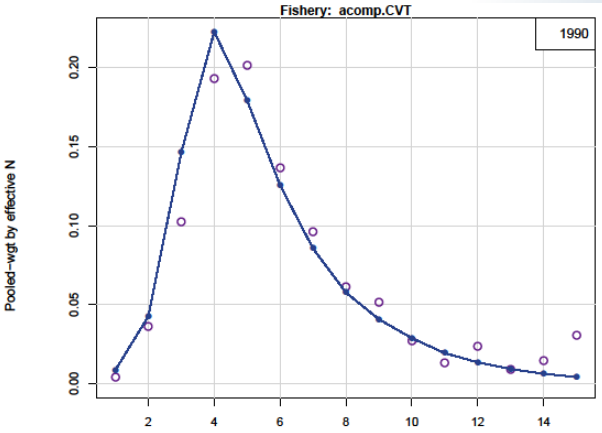




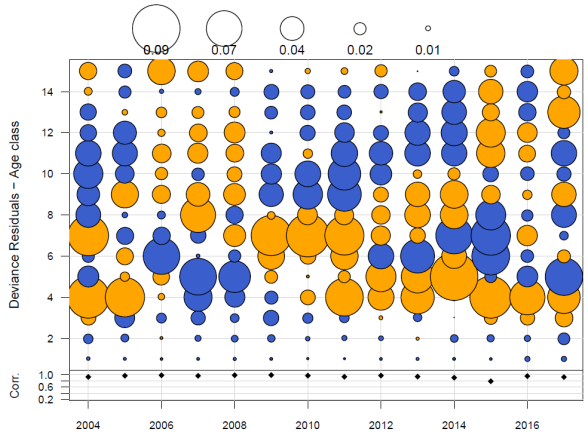
Age Comps

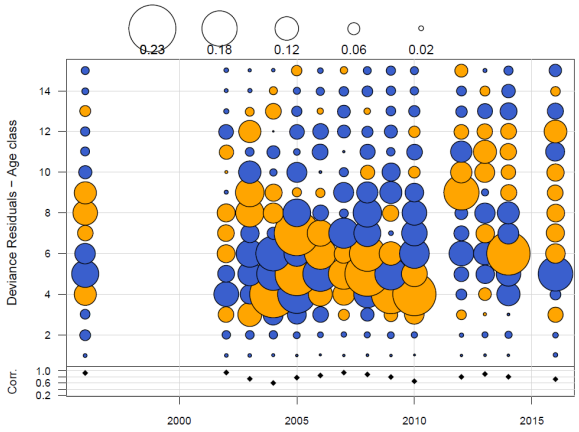




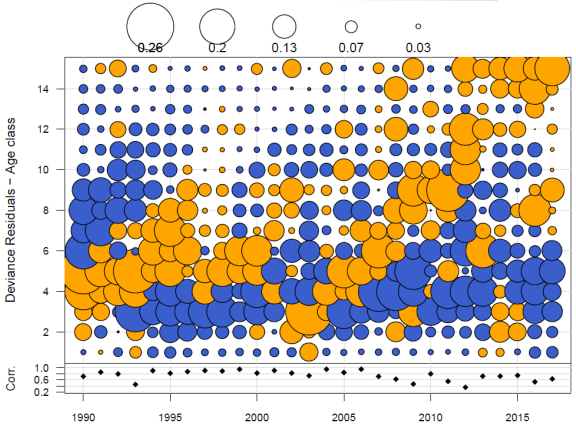


Commercial

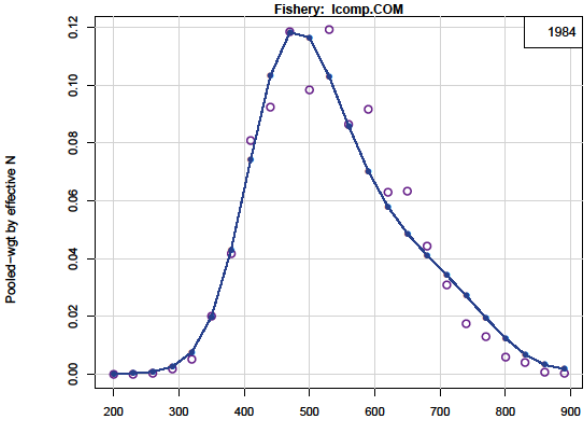


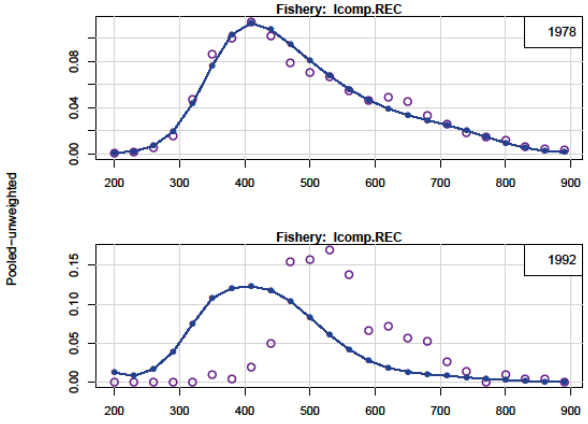


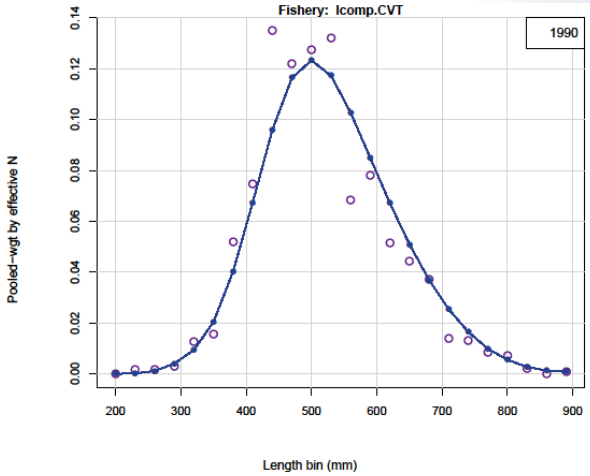
Chevron Trap

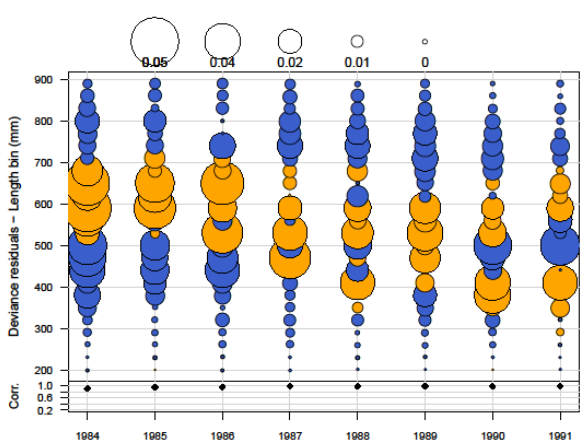


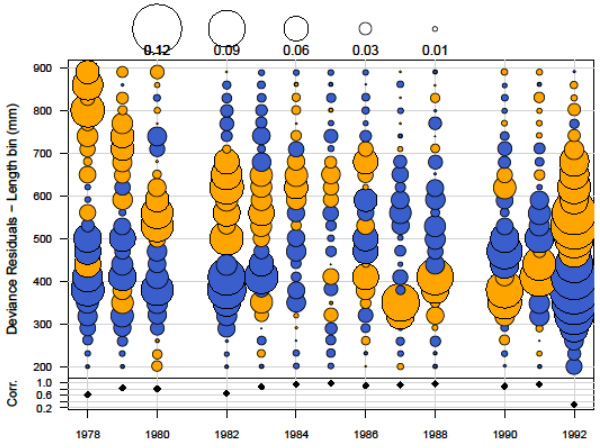
Length Comps

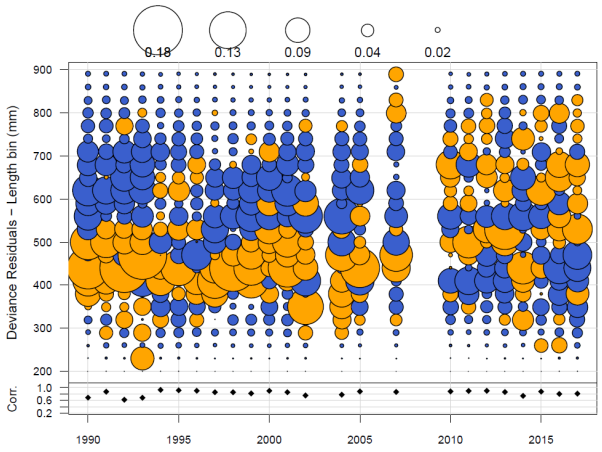






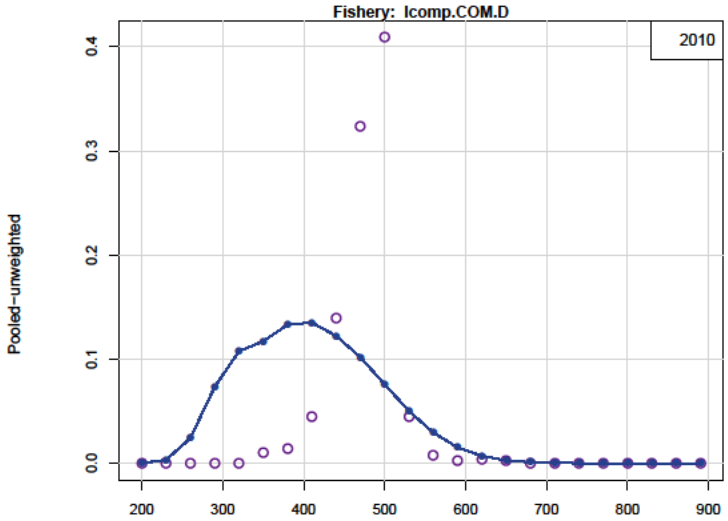


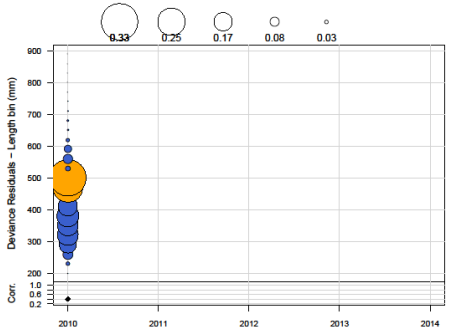


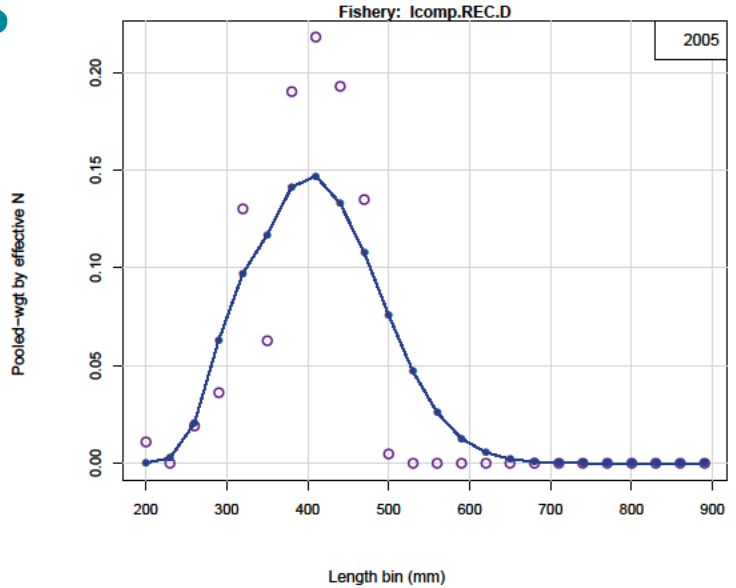


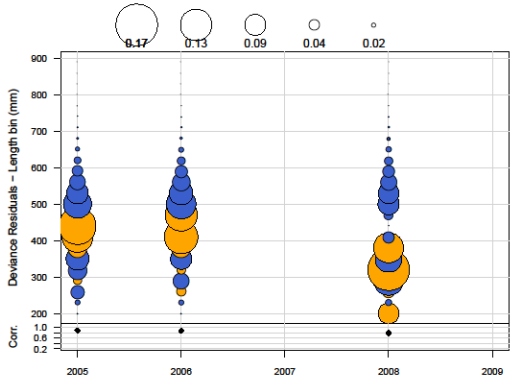
NOAA FISHERIES

Discard Length Comps





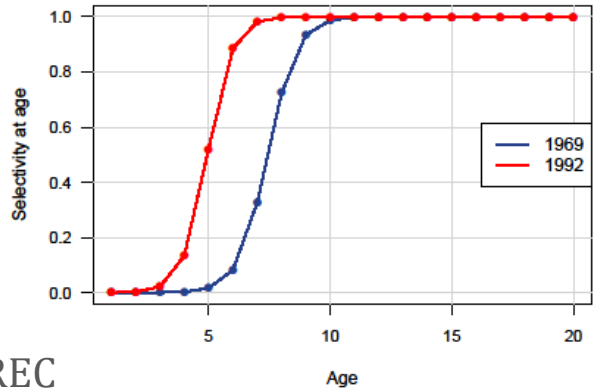




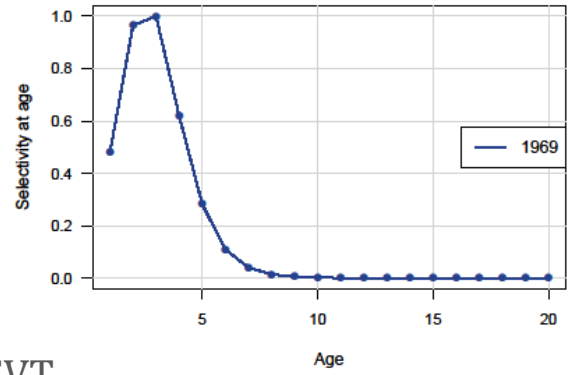
NOAA FISHERIES

Selectivity

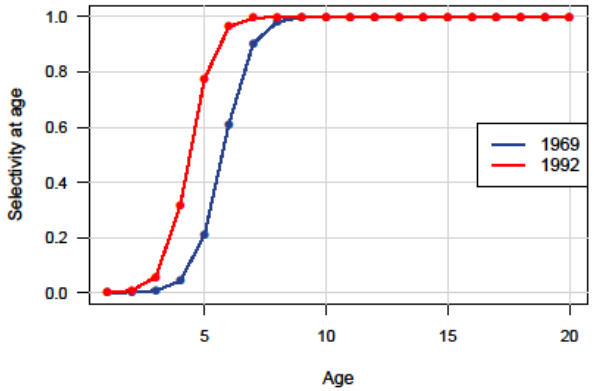
COM



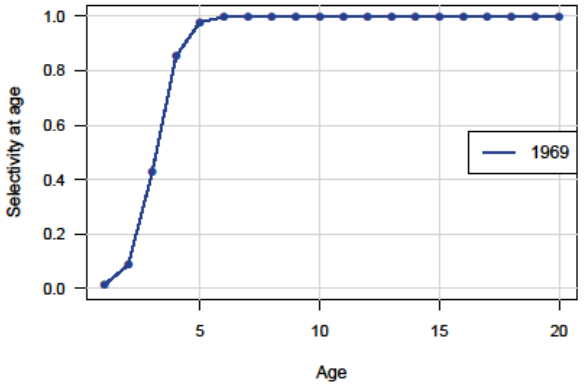
Discards (COM and REC)



REC



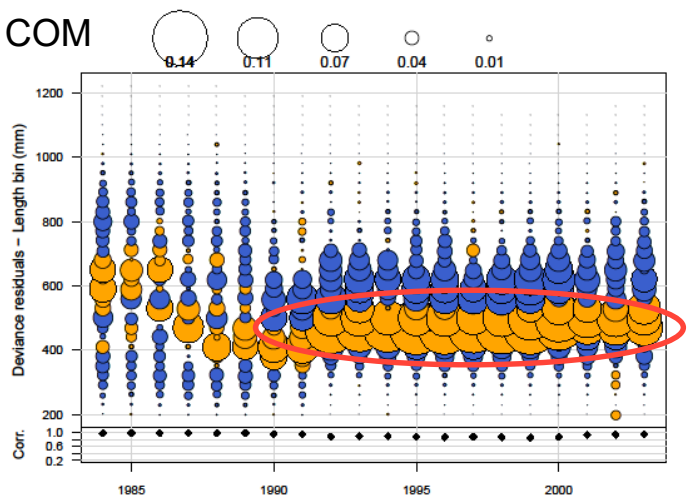
CVT

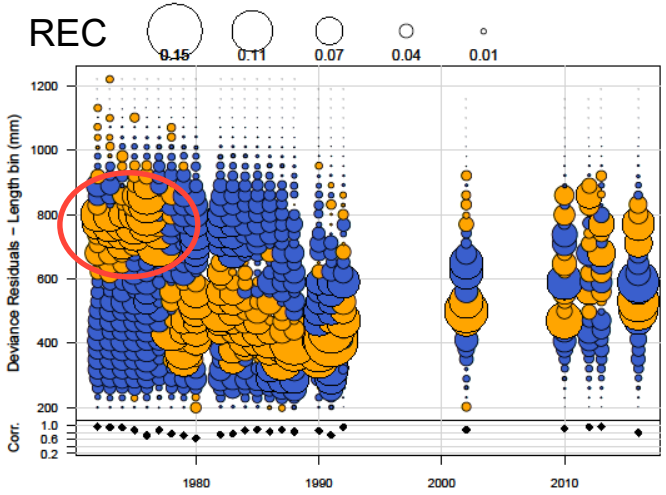


NOAA FISHERIES

Selectivity

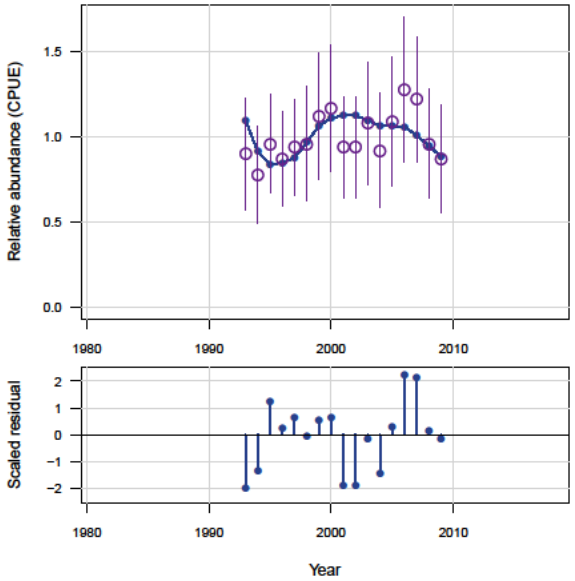
- Mismatch between length and age comps
- Poor initial fits to early length comps
- Pulled all length comps where age comps available



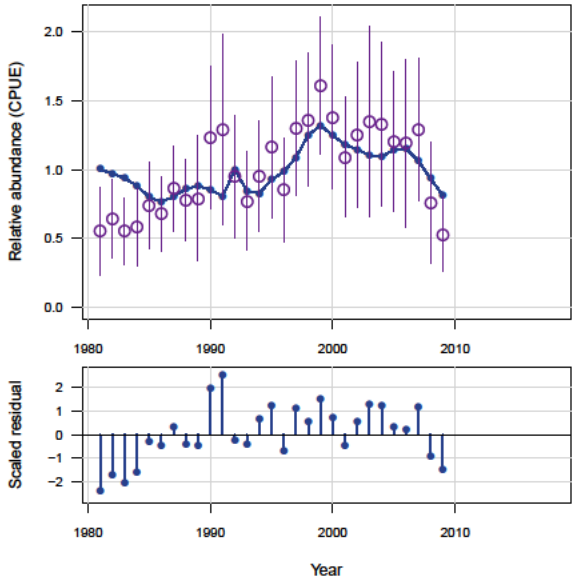


Indices

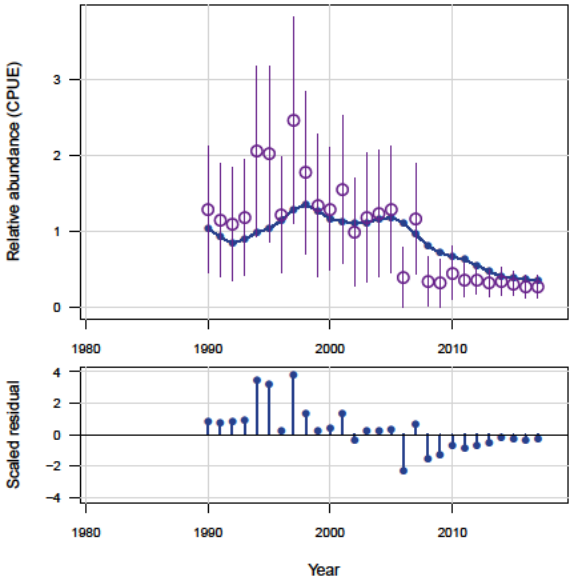
COM



REC



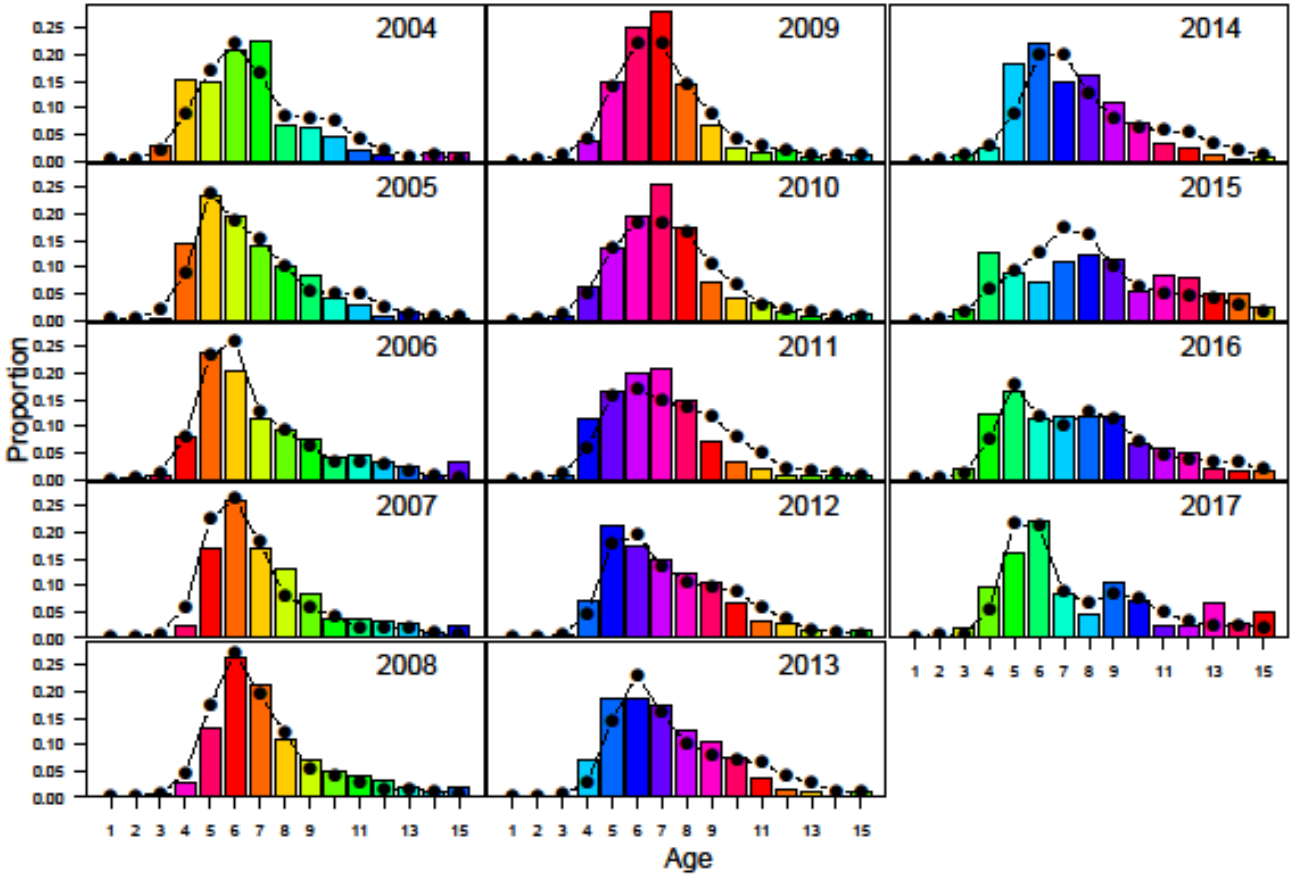
CVT/VID



	sdnr.U.COM	sdnr.U.REC	sdnr.U.CVT
Start	0.7	1.3	1.3
Final	0.9	1.1	1.1
Weight	**1.4**	**0.8**	**0.8**

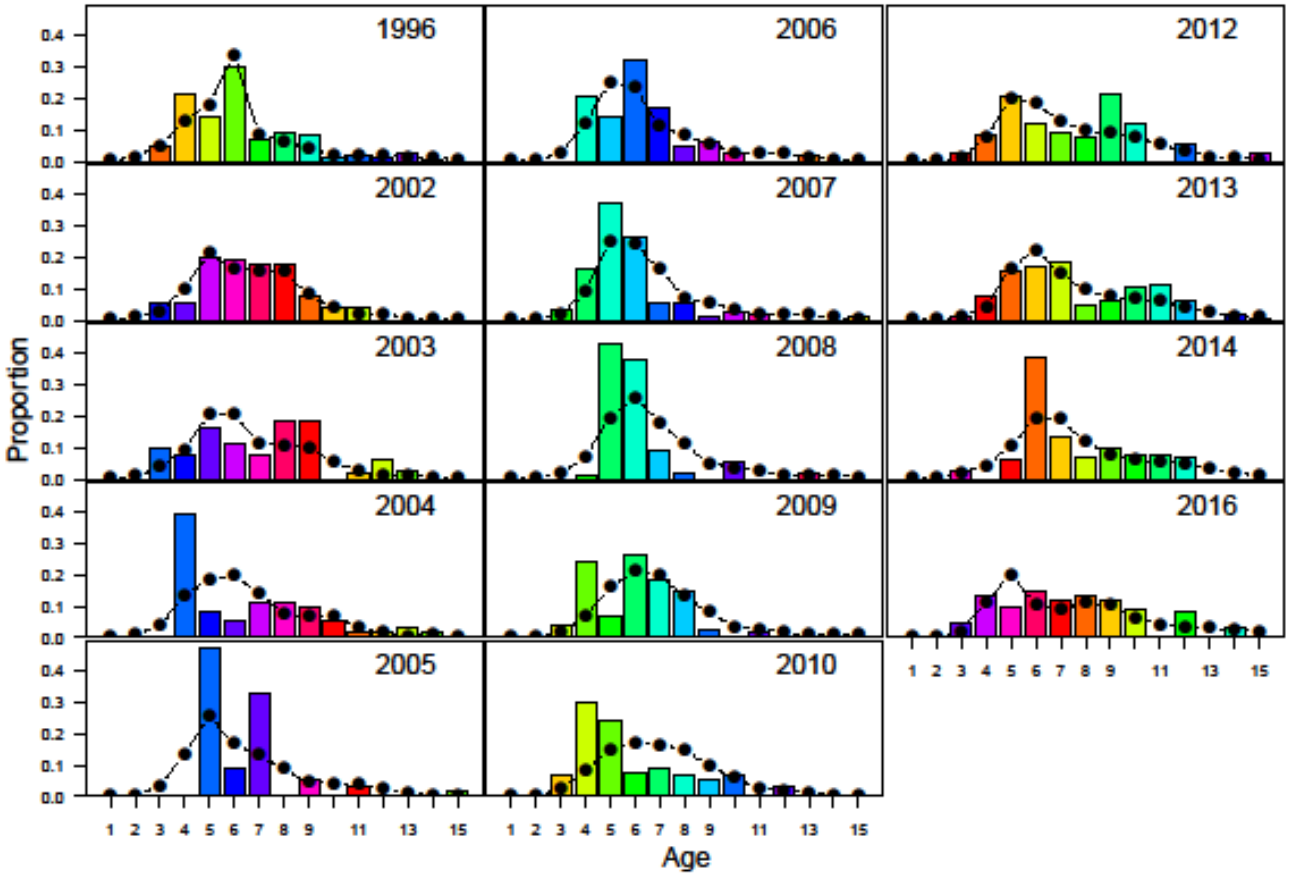
NOAA FISHERIES

Cohorts - Commercial



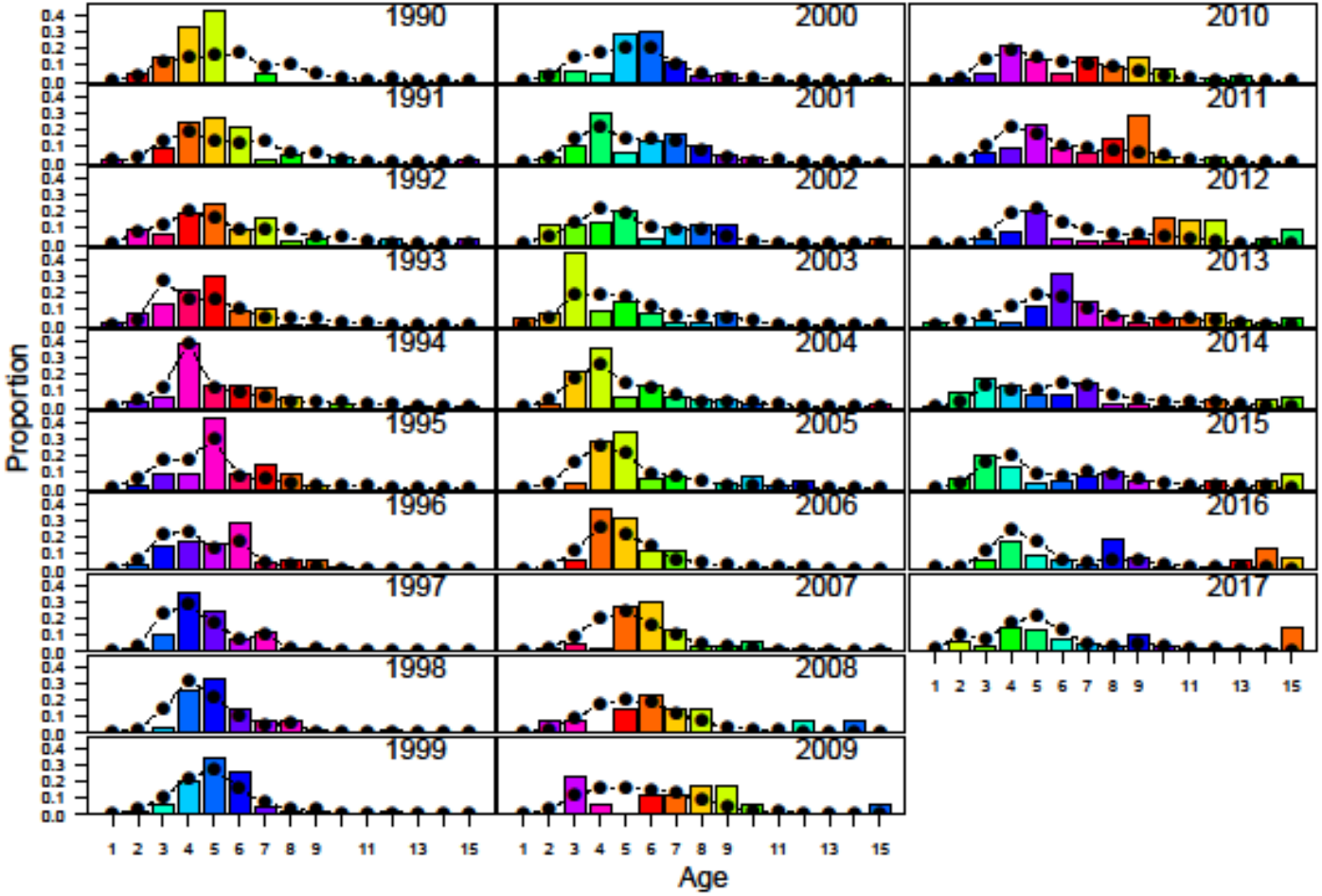
NOAA FISHERIES

Cohorts - Recreational



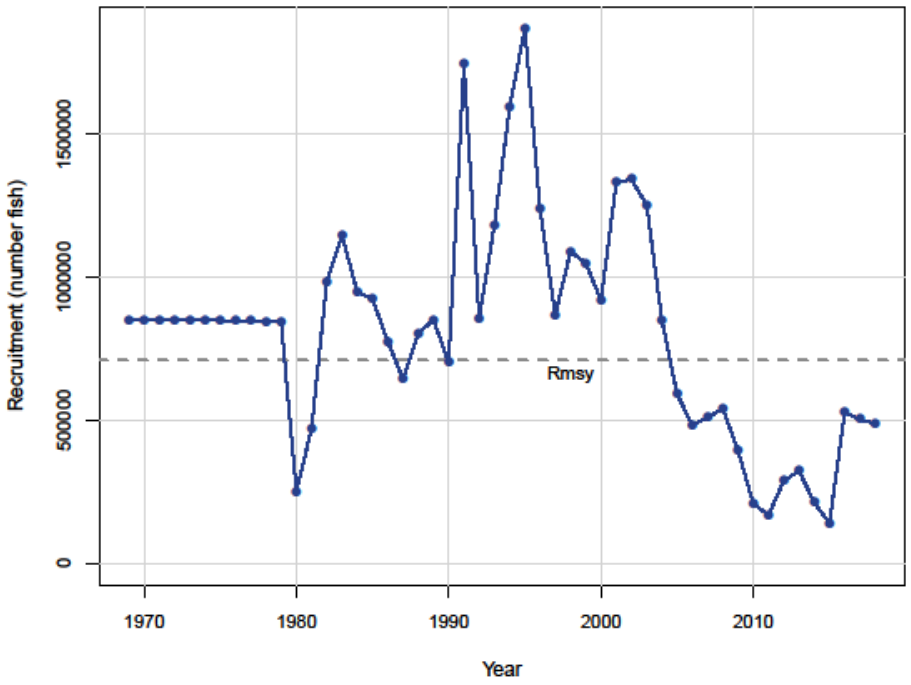
NOAA FISHERIES

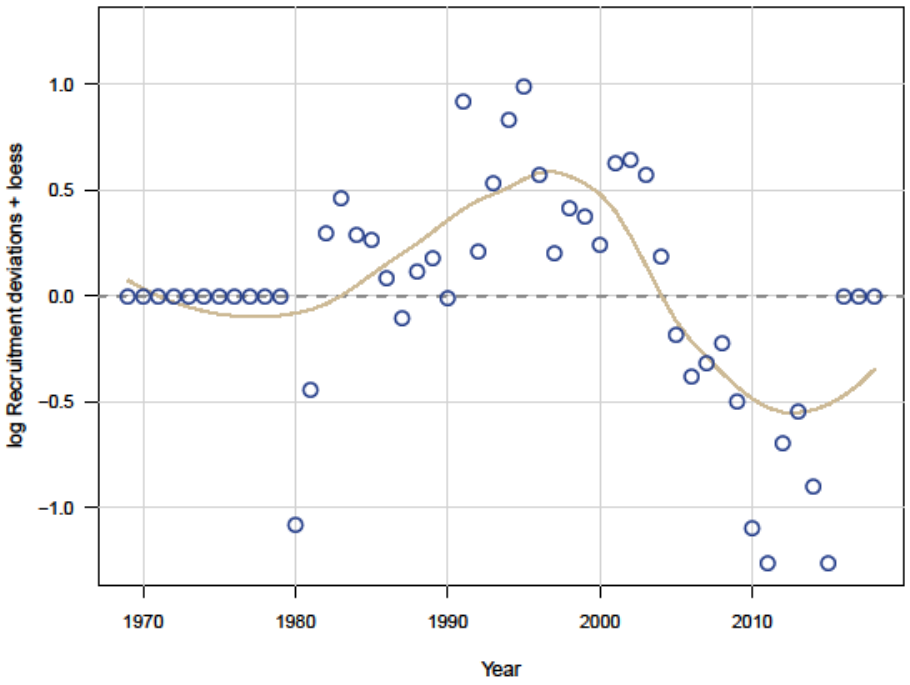
Cohorts - CVT



NOAA FISHERIES

Recruitment

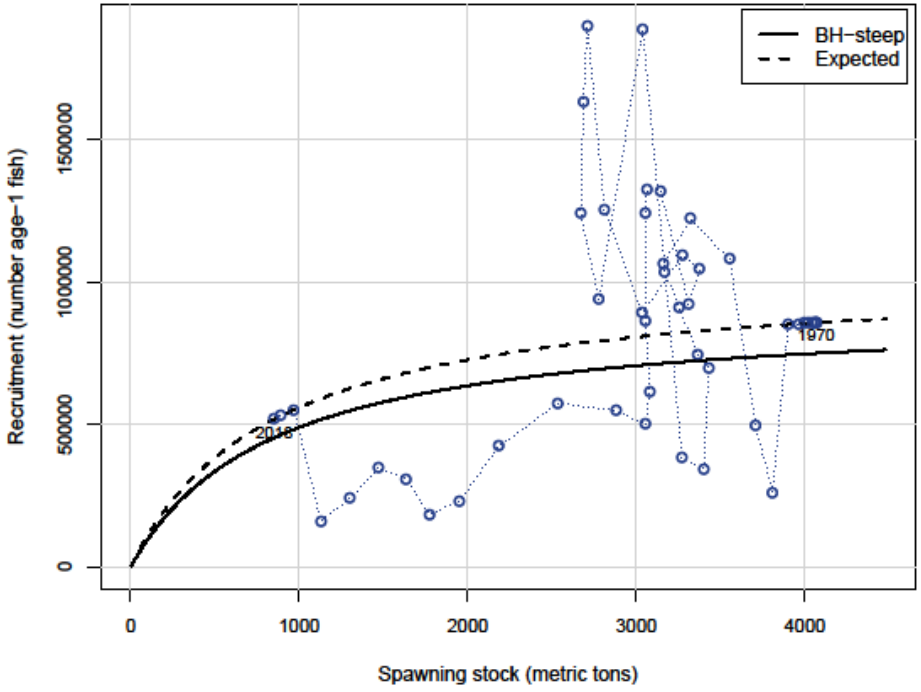


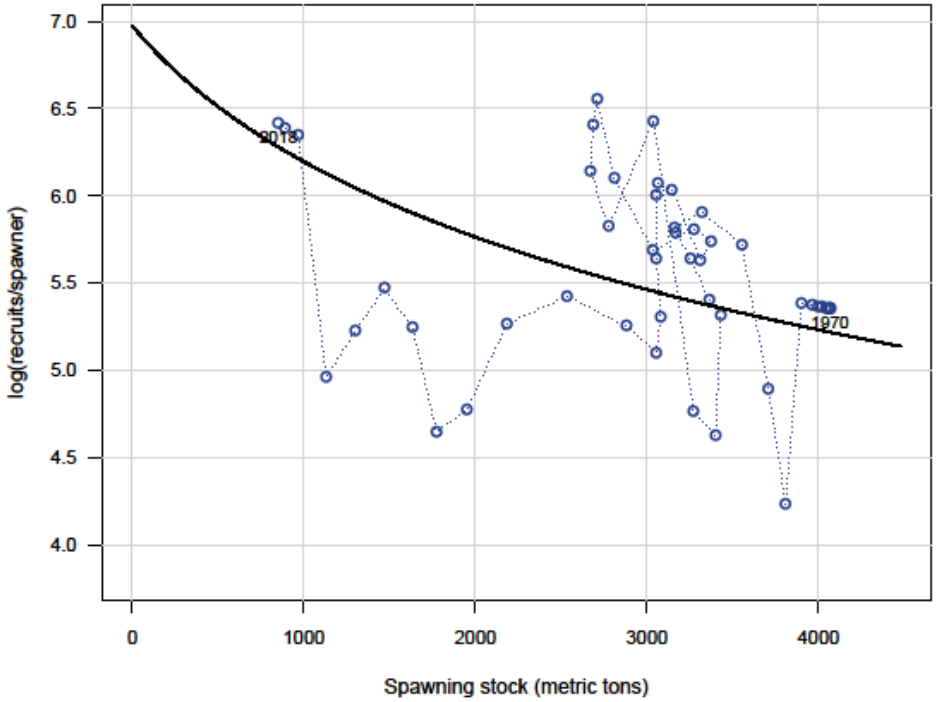


- 1980-2015 estimated

NOAA FISHERIES

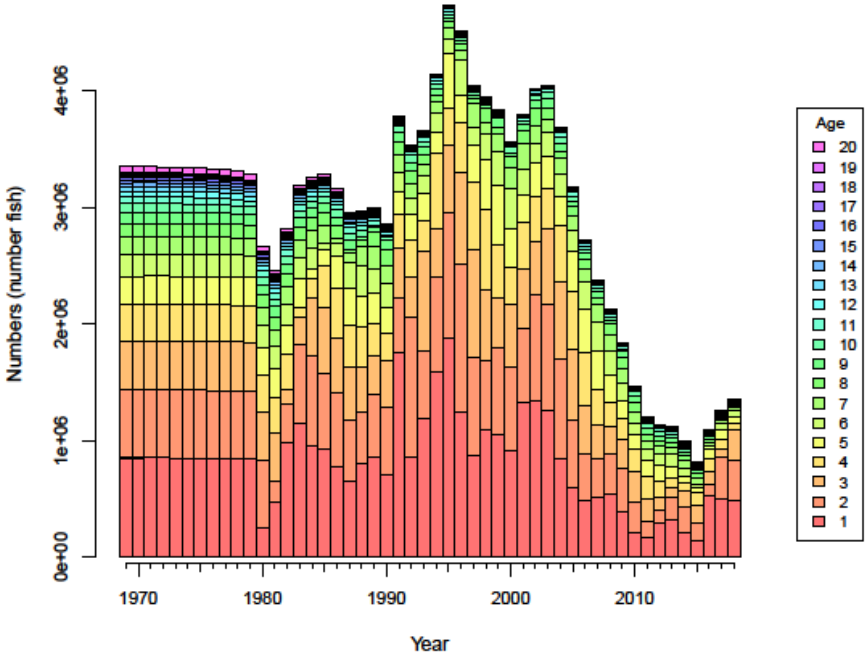
Recruitment

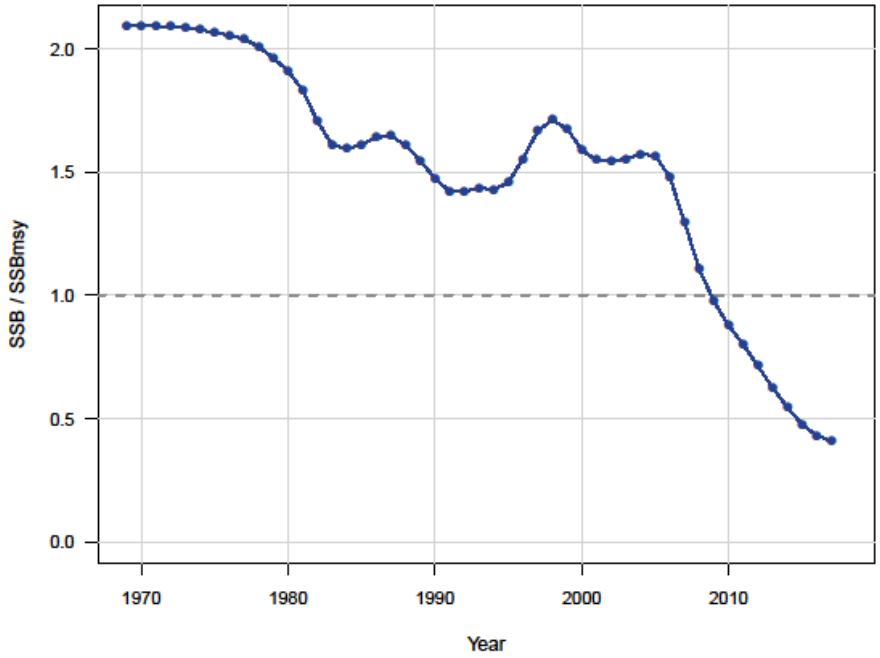




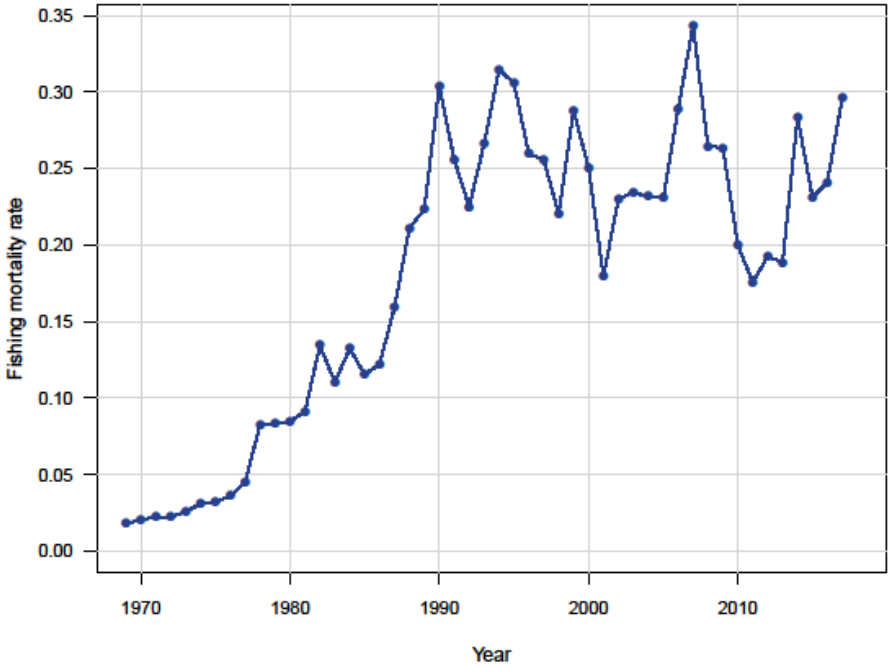
NOAA FISHERIES

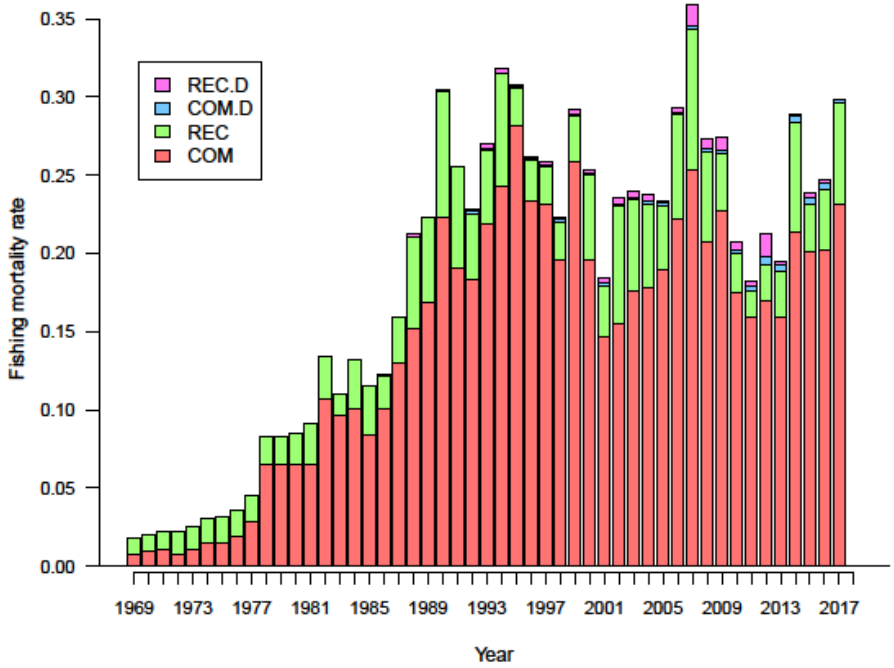
Numbers at age & SSB





Fishing Mortality



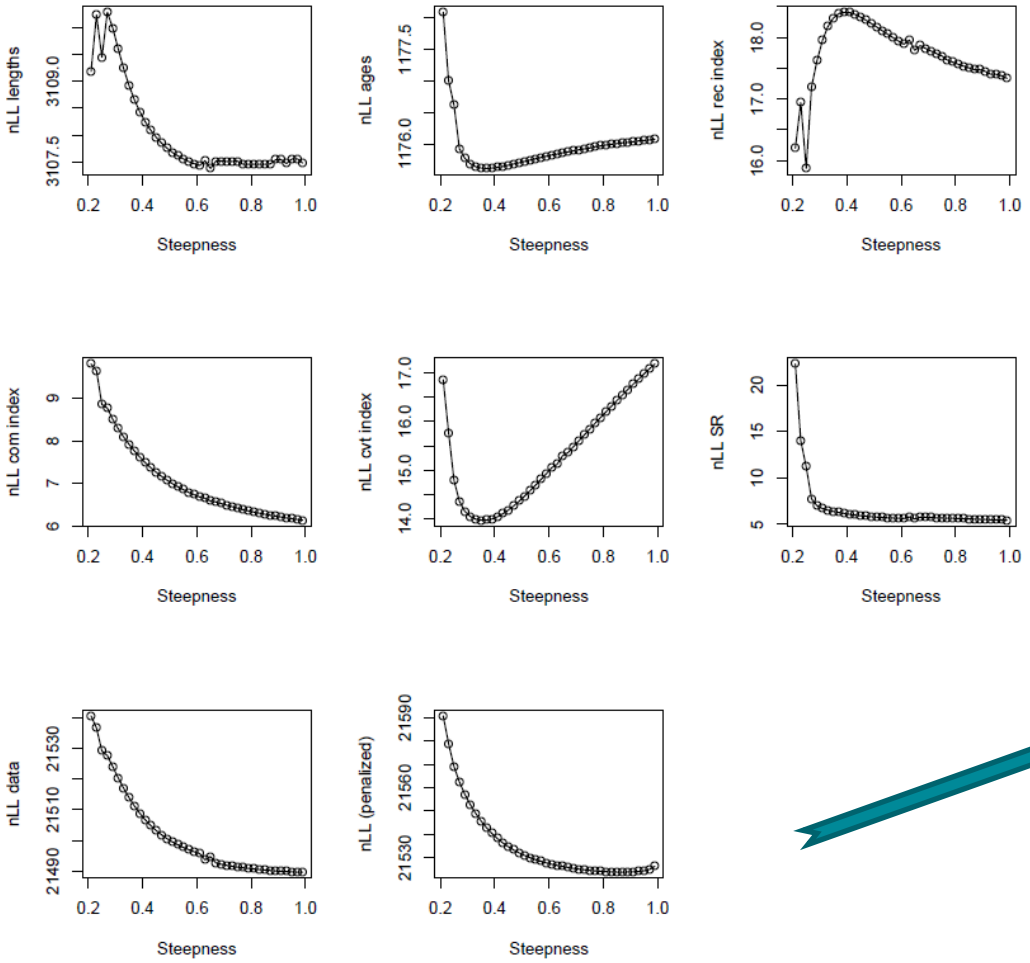


NOAA FISHERIES

Steepness

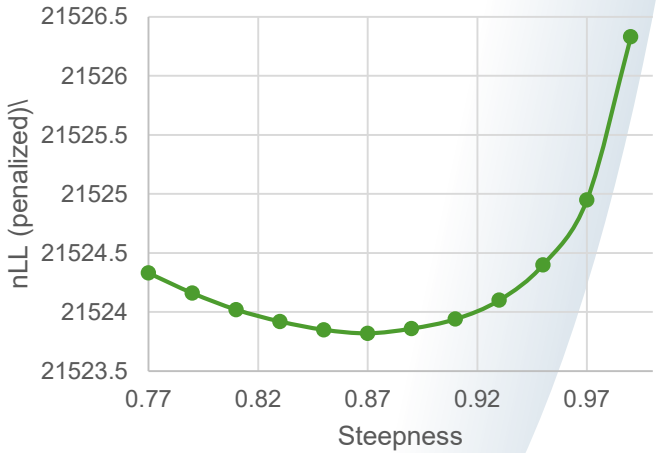
NOAA FISHERIES

Steepness Likelihood Profile

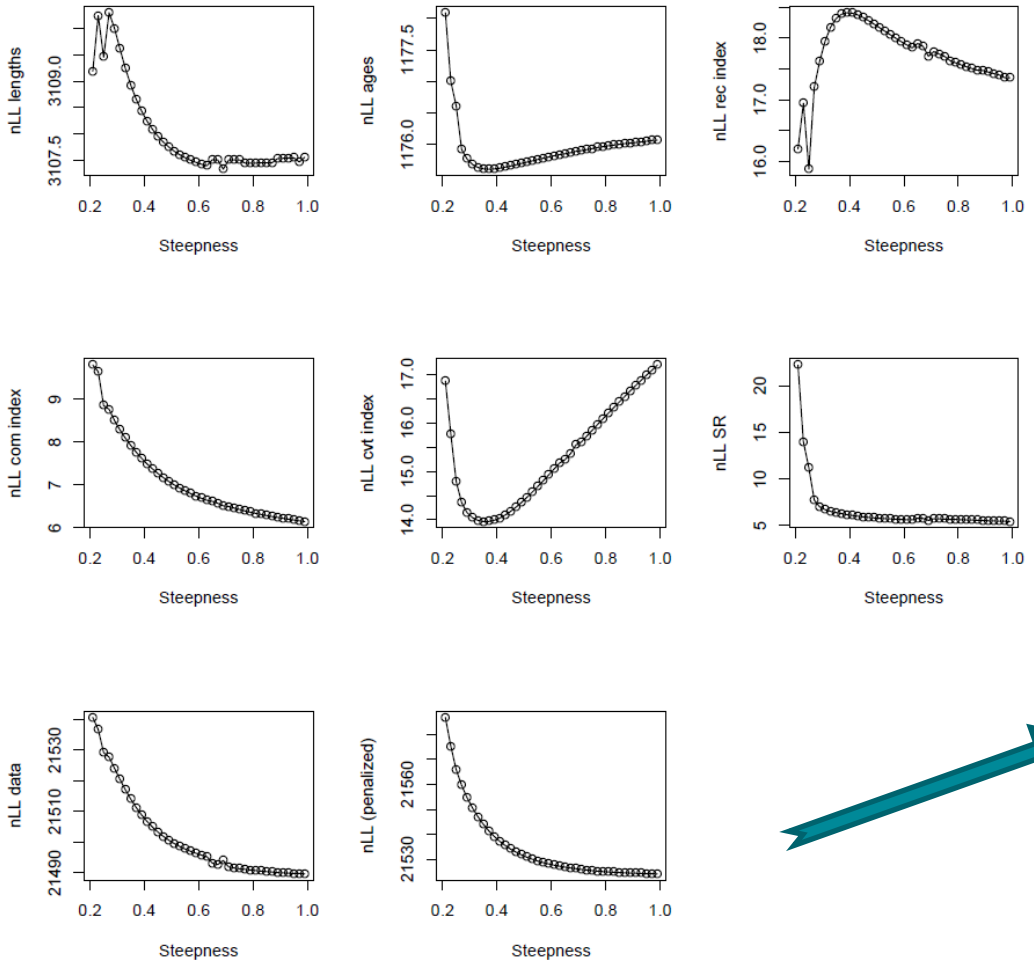


mu	var	prior	steepness
0.72	0.03	beta	0.86

- Likelihood profile with beta prior influence

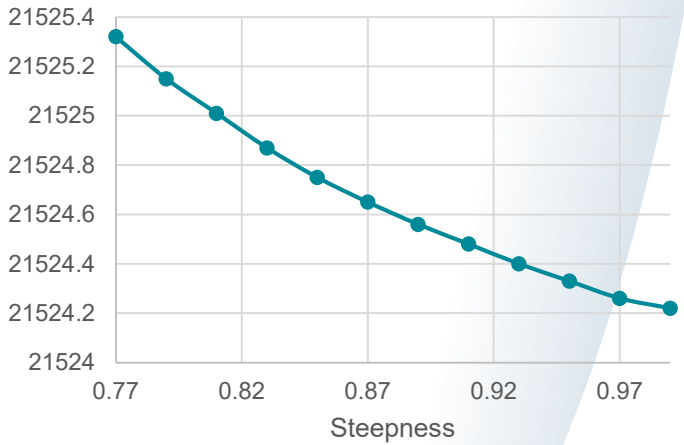


Steepness Likelihood Profile



mu	var	prior	steepness
0.72	0.03	none	0.99 (bound)

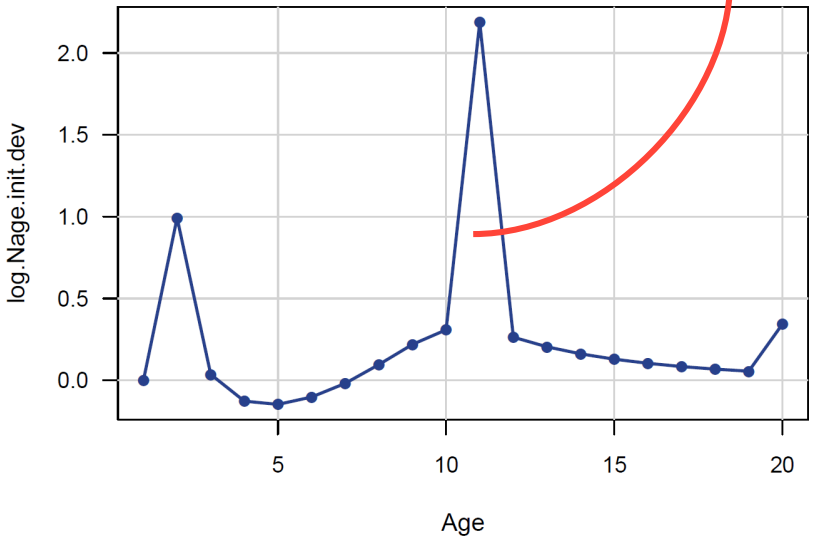
- Likelihood profile with no prior influence

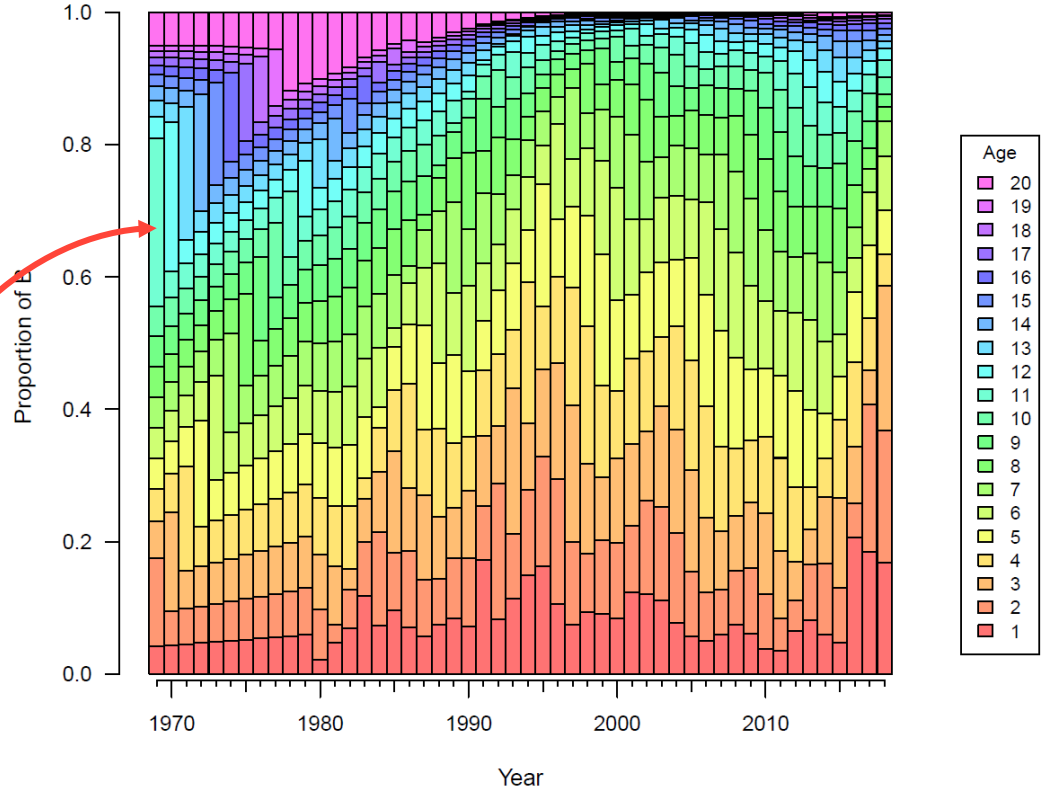


NOAA FISHERIES

Steepness

- Previously estimating N at age deviations
  - Poorly estimated at start of model due to lack of age and length comps

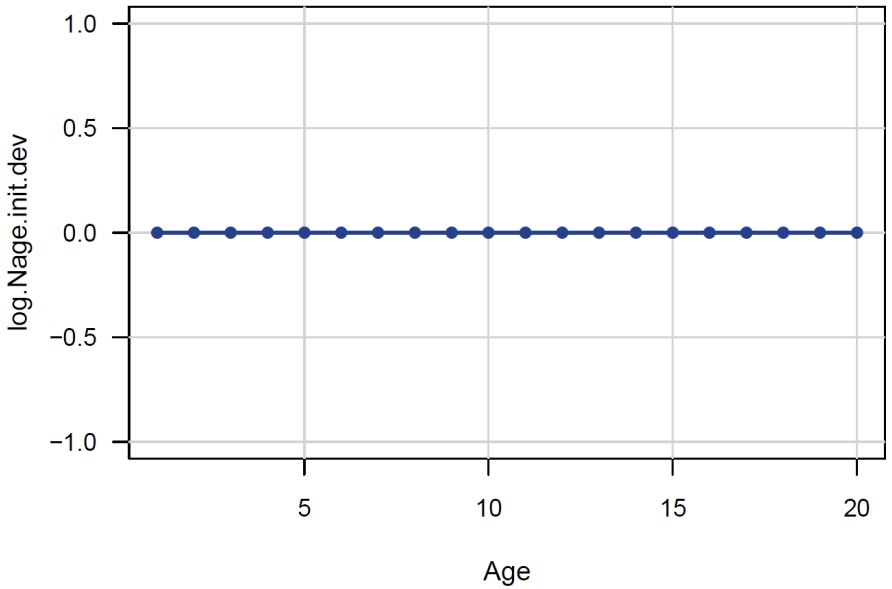


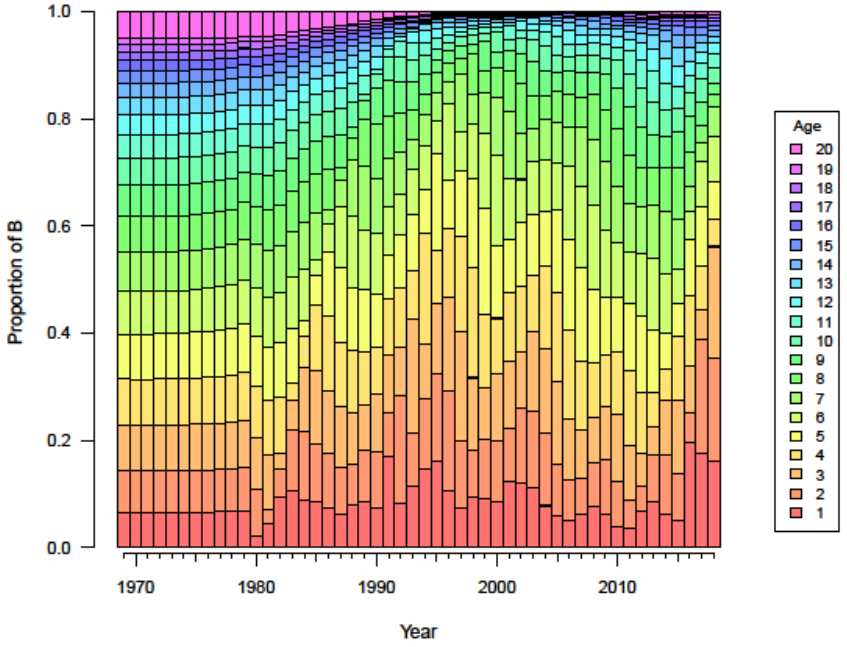


- Spike at age 11 corresponds to strong initial year class

NOAA FISHERIES

Steepness

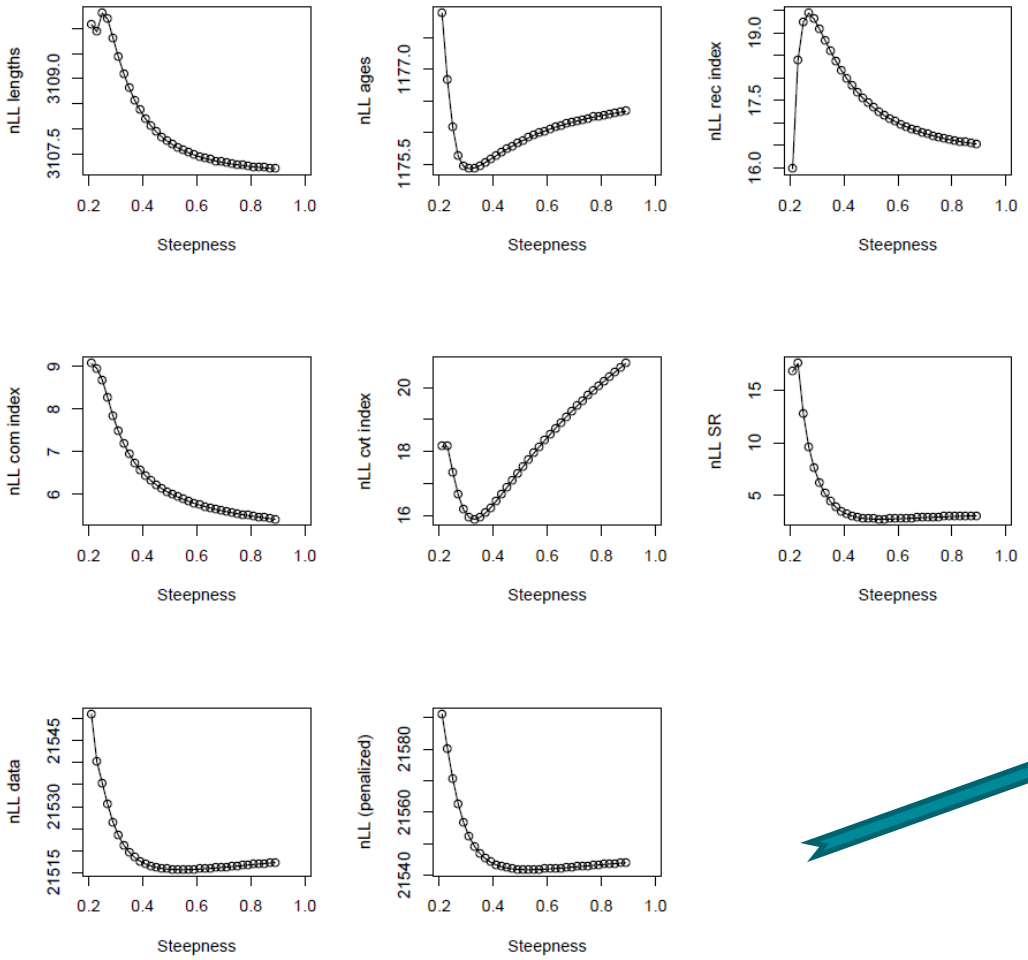




- Model begins with equilibrium N at age
  - Conditioned on M and F init

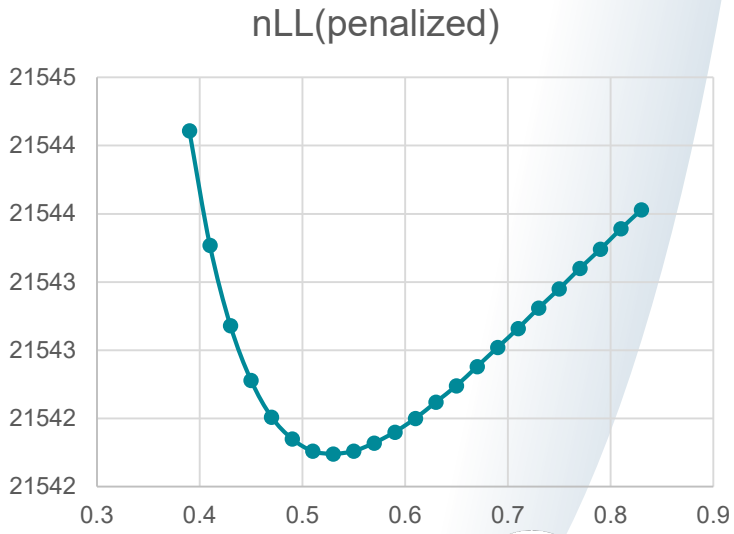
NOAA FISHERIES

Steepness Likelihood Profile



name	value	std.dev
steep	0.57	0.11

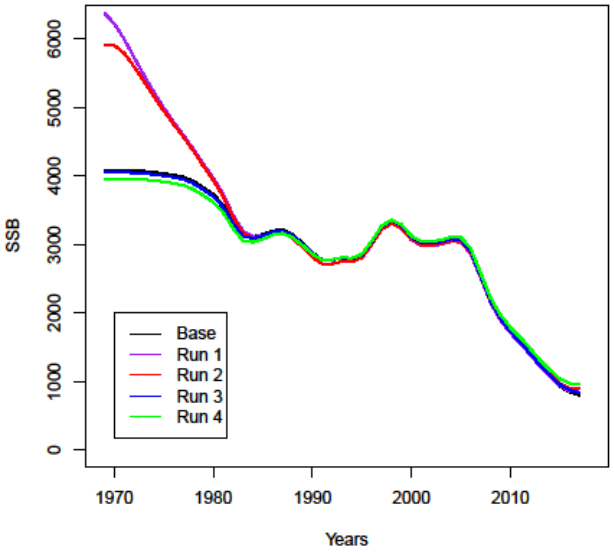
- Likelihood profile with no prior influence
- SDNR on indices applied

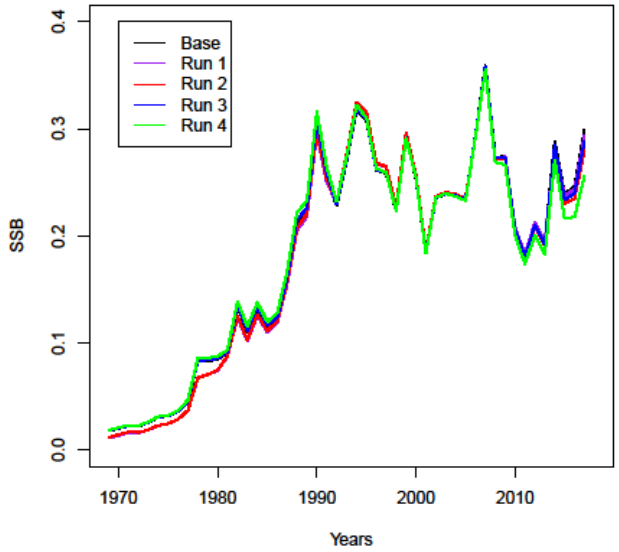


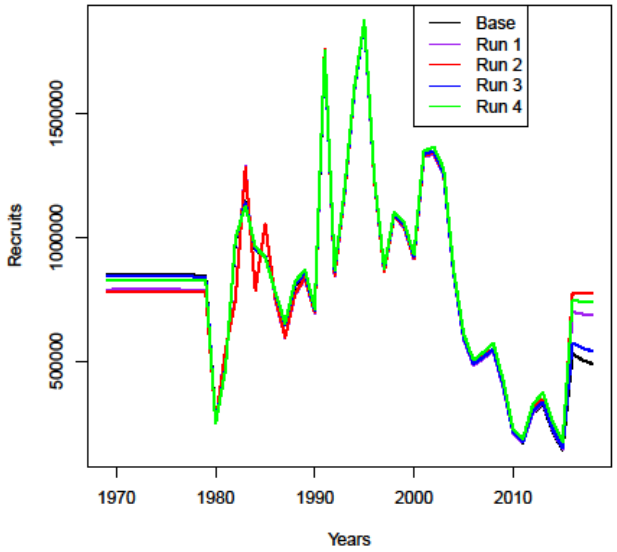
NOAA FISHERIES

Steepness Sensitivity

	Steepness	N age dev	Prior	Obj. Fun	Gradient
Base	0.57 - est.	Fixed	None	21,542	3.5E-04
Run 1	0.86 - est.	Est.	Beta	21,527	1.9E-04
Run 2	0.99 - est.	Est.	None	21,528	5.2E-04
Run 3	0.62 - est.	Fixed	Beta	21,540	7.4E-05
Run 4	0.86 - fix	Fixed	n/a	21,543	1.7E-04







NOAA FISHERIES

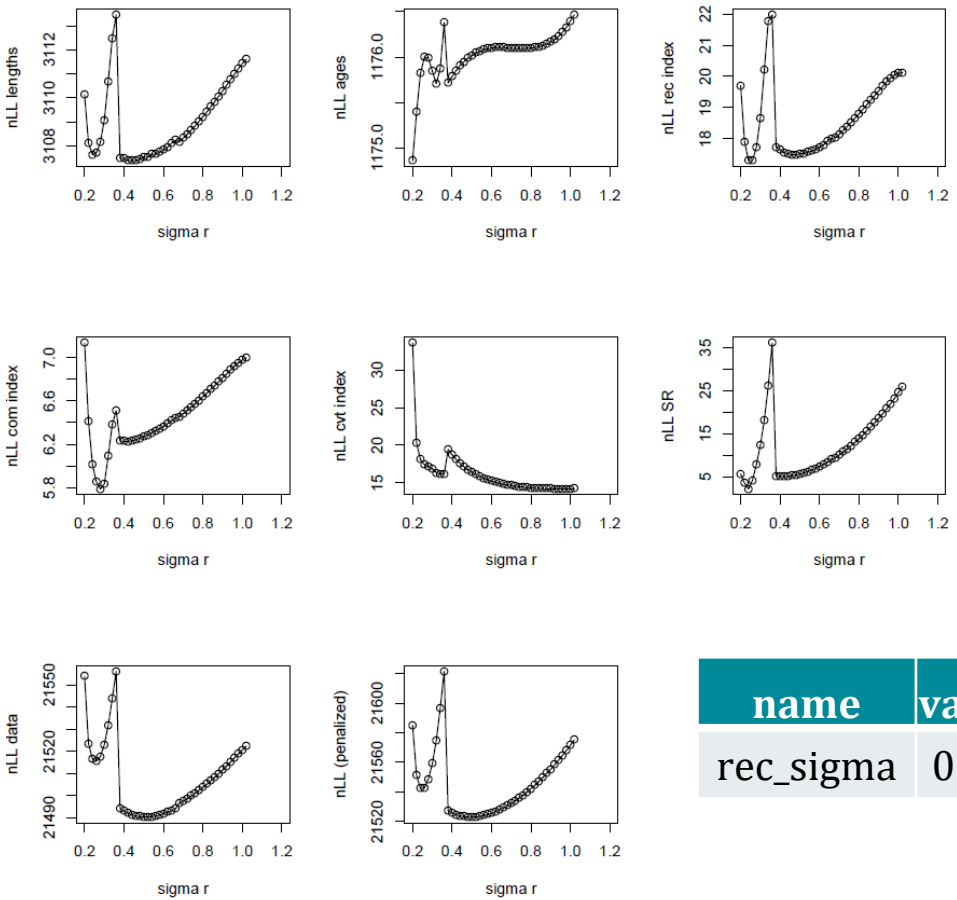
Likelihood Profiles

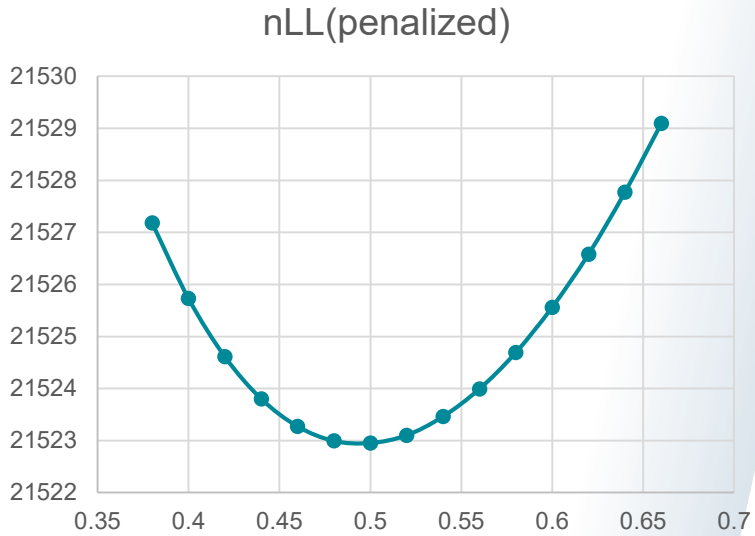
NOAA FISHERIES

Likelihood profiling

- Steepness (shown previously)
- Sigma R
- R0
- Selectivity parameters
- Dirichlet Multinomial

Sigma r Likelihood Profile

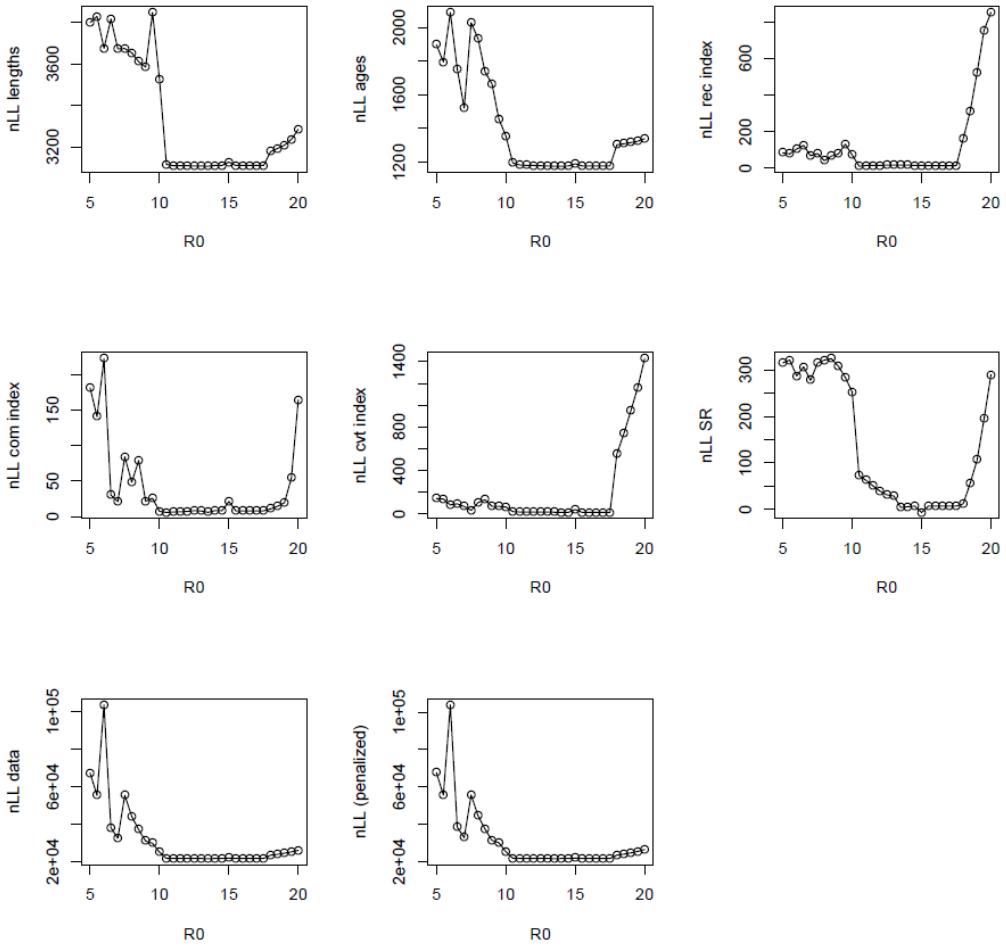




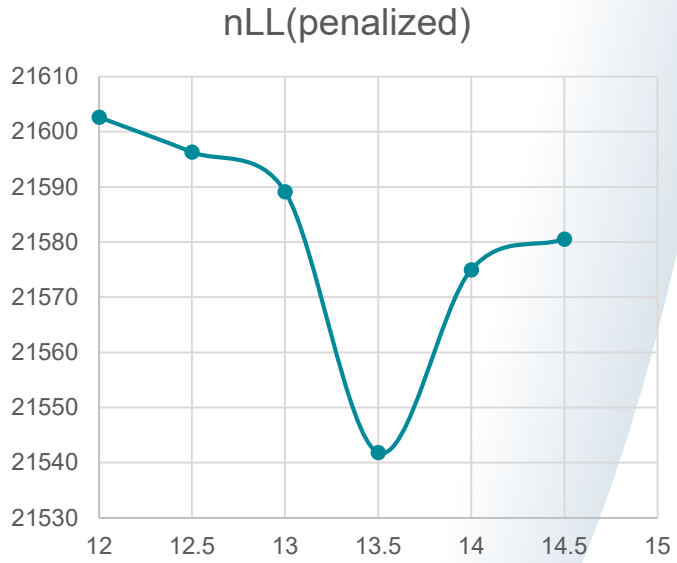
name	value	std.dev	prior	mean
rec_sigma	0.50	0.05	normal	0.1

NOAA FISHERIES

R0 Likelihood Profile



name	value	std.dev	prior	mean
log_R0	13.52	0.04	normal	12.9

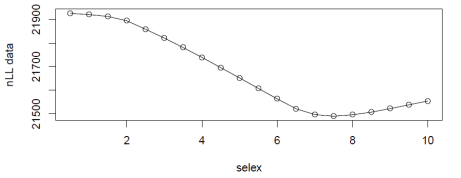


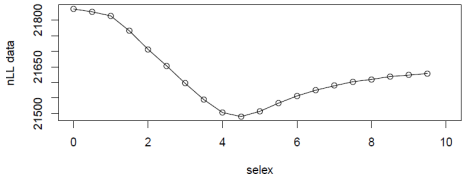
NOAA FISHERIES

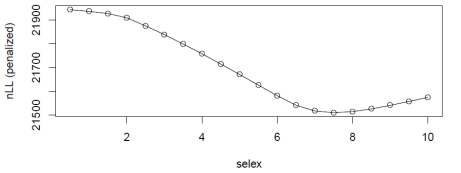
Likelihood Profiles – Commercial Selex

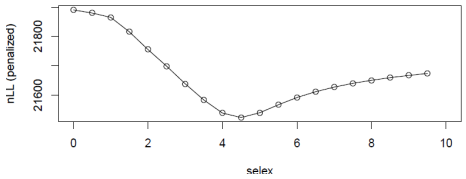
Block 1 Block 2

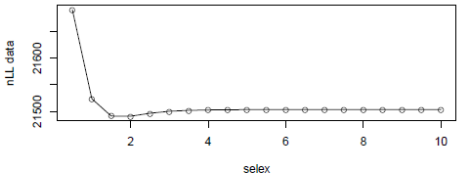
A50

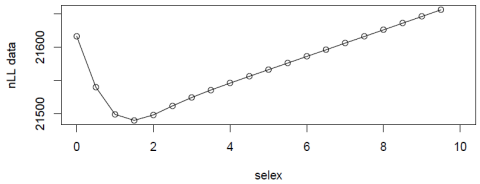




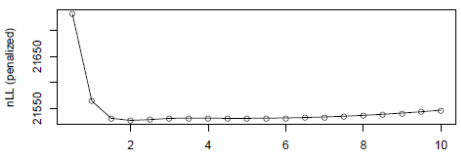


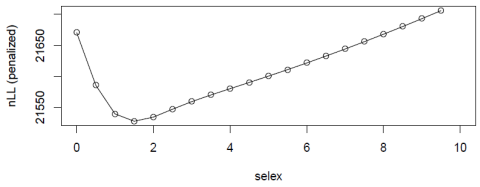






Slope





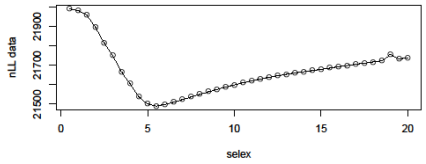
name	value	std.dev	prior	mean
selpar_A50_COM1	7.51	0.15	normal	2.0
selpar_slope_COM1	1.73	0.15	normal	0.8
selpar_A50_COM3	4.95	0.08	normal	4.5
selpar_slope_COM3	1.95	0.12	normal	3.0

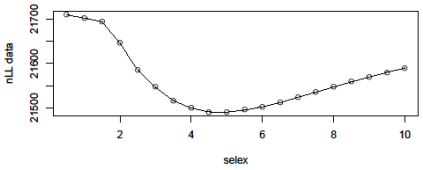
NOAA FISHERIES

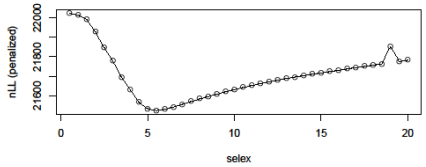
Likelihood Profiles – Recreational Selex

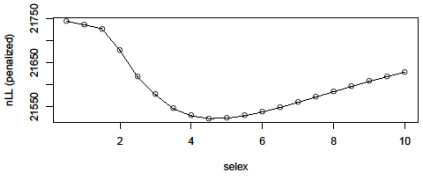
Block 1 | Block 2

A50

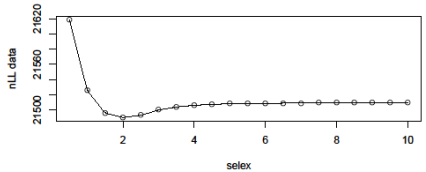


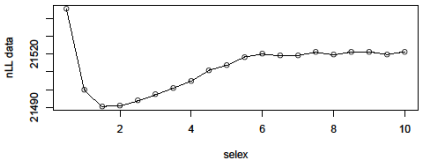


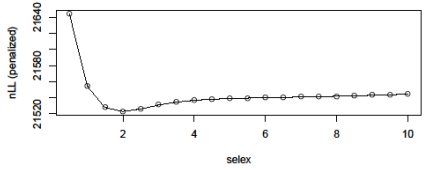


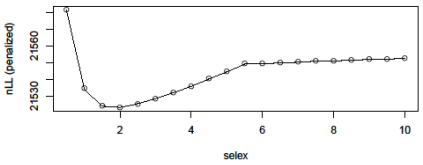


Slope









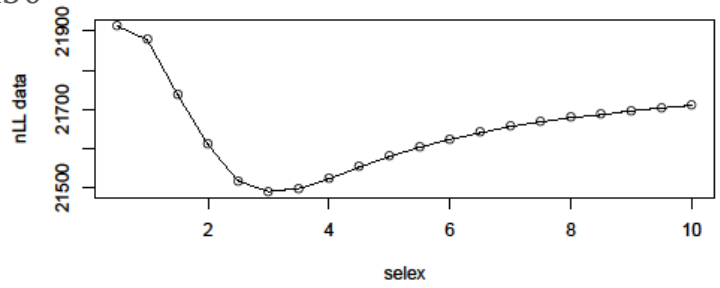
name	value	std.dev	prior	mean
selpar_A50_REC1	5.69	0.15	normal	5.0
selpar_slope_REC1	1.81	0.17	normal	4.0
selpar_A50_REC3	4.68	0.21	normal	5.5
selpar_slope_REC3	1.78	0.24	normal	5.0

NOAA FISHERIES

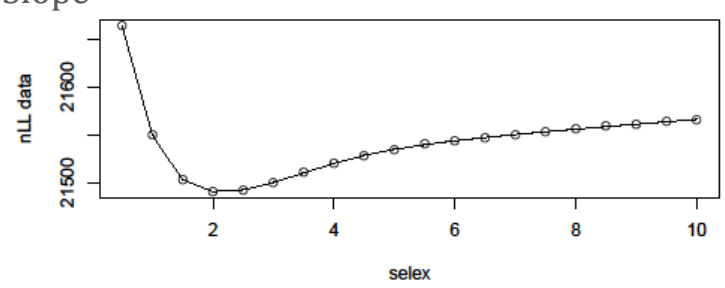
Likelihood Profiles – CVT Selex

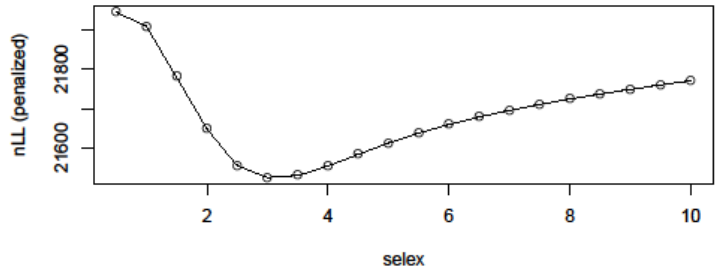
name	value	std.dev	prior	mean
selpar_A50_CVT	3.13	0.09	normal	2.0
selpar_slope_CVT	2.05	0.15	normal	1.5

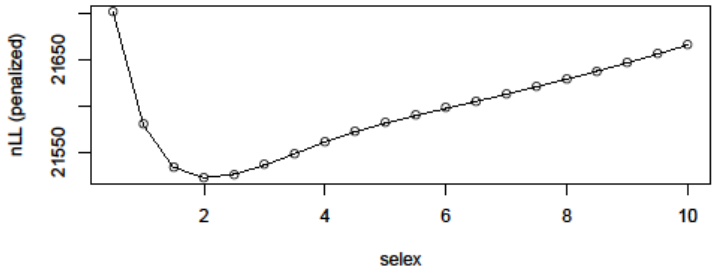
A50



Slope



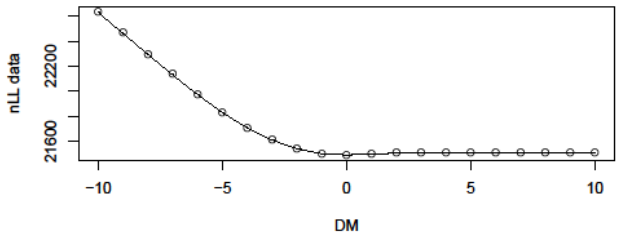


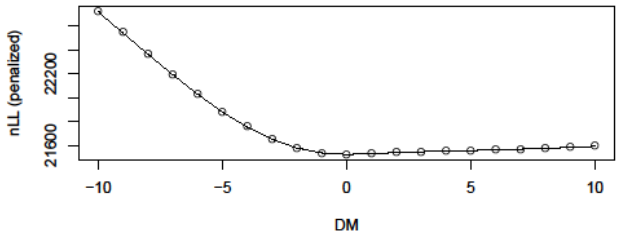


NOAA FISHERIES

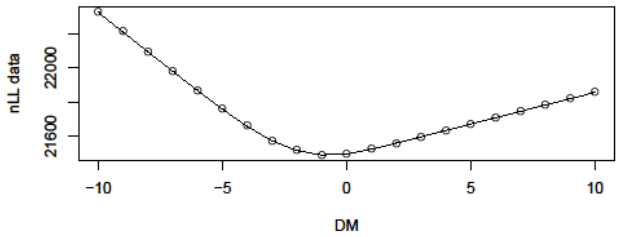
Dirichlet Likelihood Profile AC

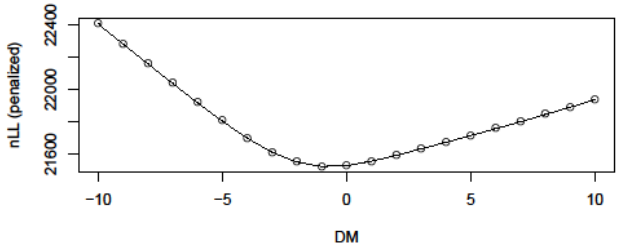
COM



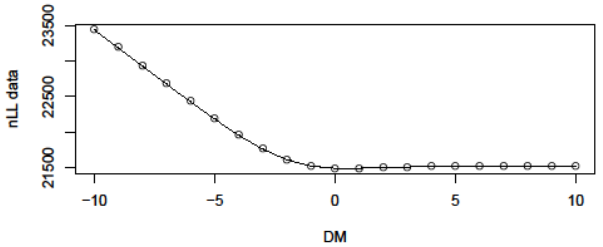


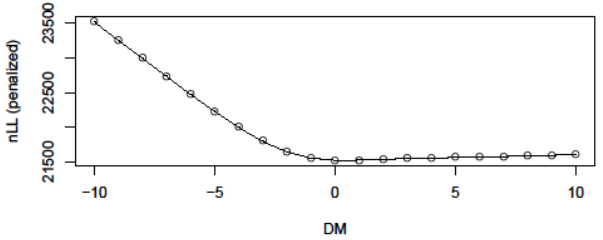
REC





CVT



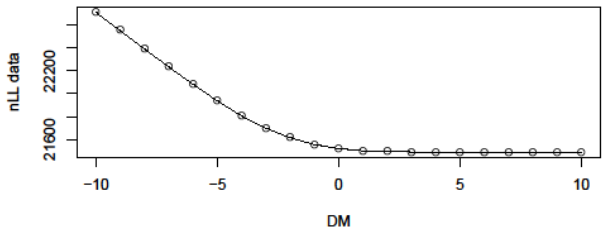


name	value	std.dev	prior	mean
log_dm_COM_ac	0.03	0.24	normal	0.0
log_dm_REC_ac	-0.69	0.18	normal	0.0
log_dm_CVT_ac	0.33	0.20	normal	0.0

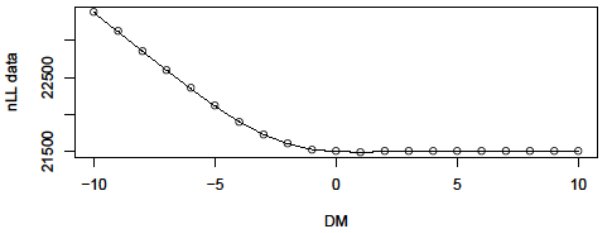
NOAA FISHERIES

Dirichlet Likelihood Profile LC

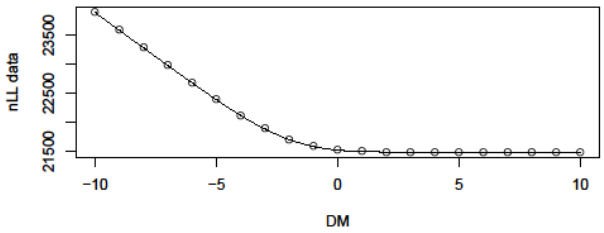
COM

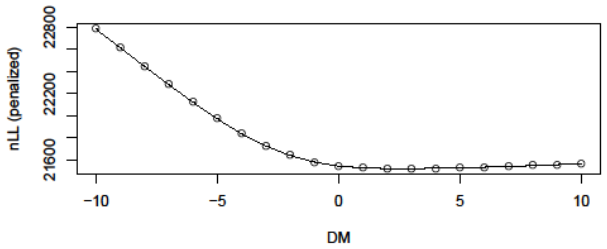


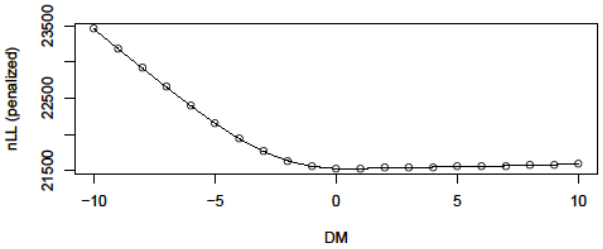
REC

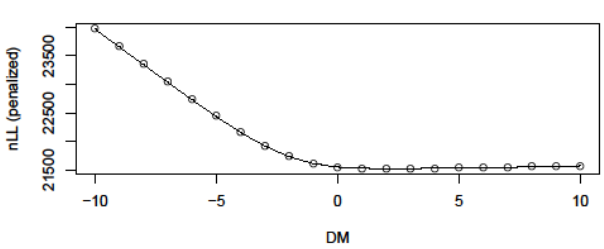


CVT









name	value	std.dev	prior	mean
log_dm_COM_lc	2.52	0.52	normal	0.0
log_dm_REC_lc	0.18	0.19	normal	0.0
log_dm_CVT_lc	2.09	0.46	normal	0.0

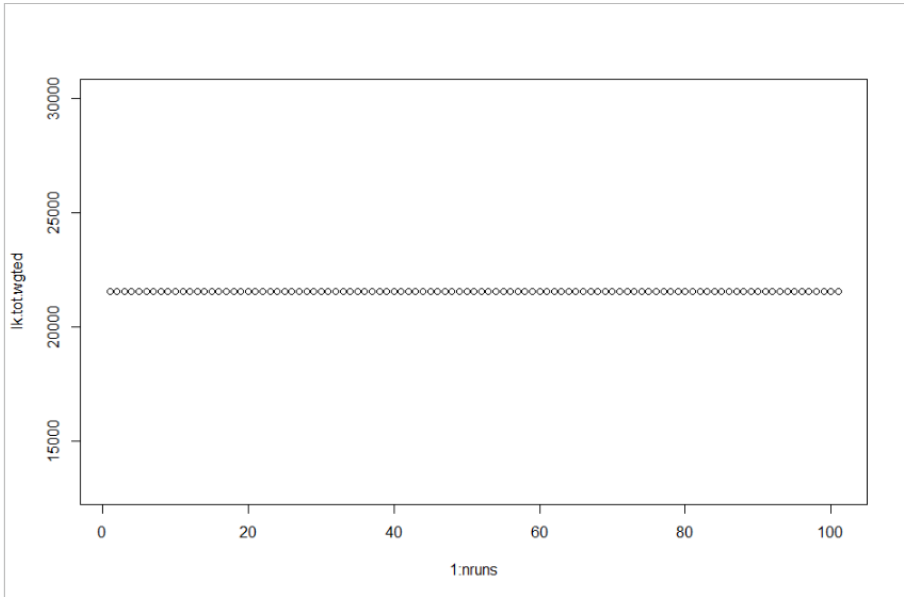
NOAA FISHERIES

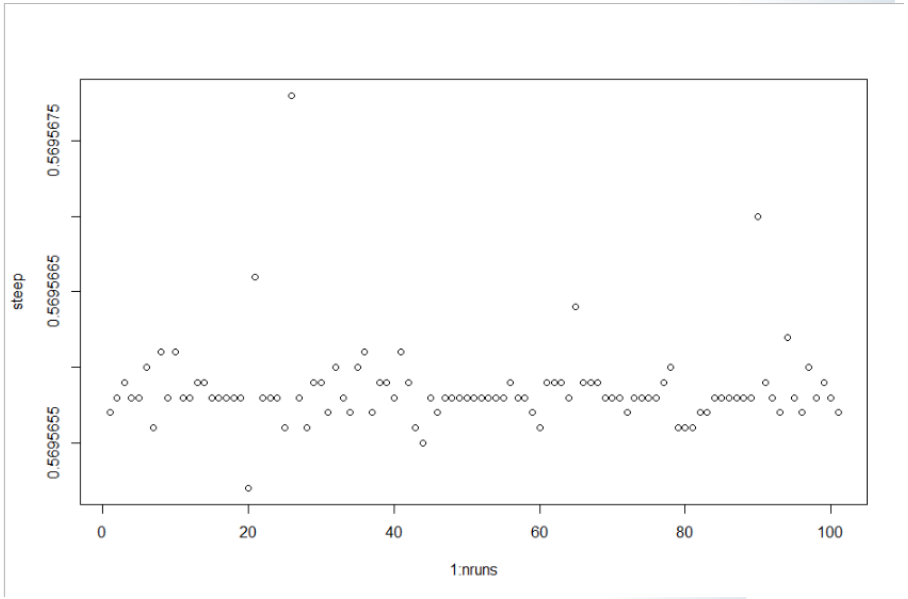
Jitter

NOAA FISHERIES

Starting Value Analysis (jitter)

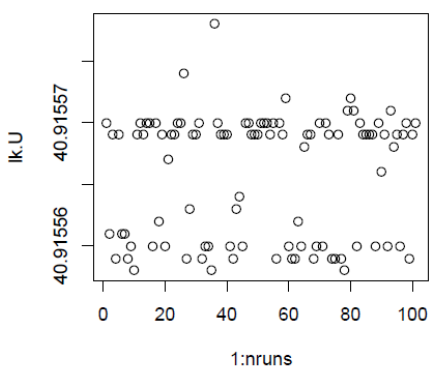
- 100 runs with 10% jitter applied to staring values
- Run 101 base run

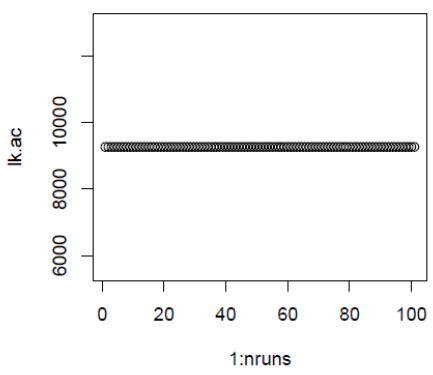


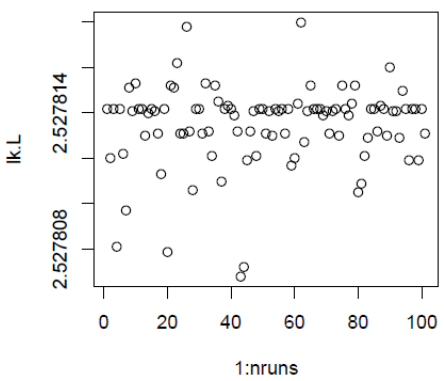


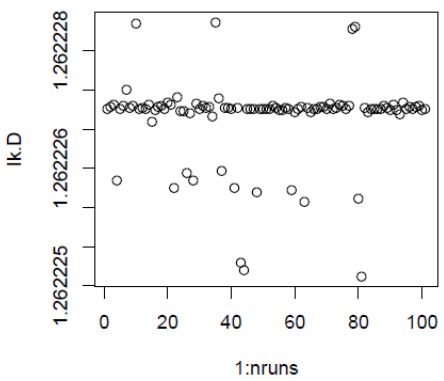
NOAA FISHERIES

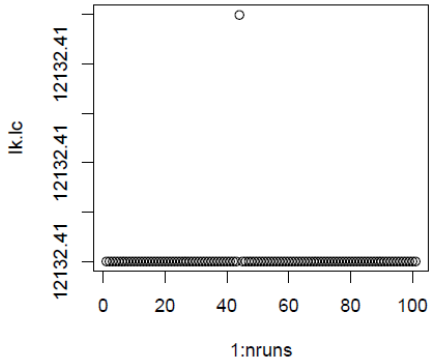
Starting Value Analysis: Likelihoods





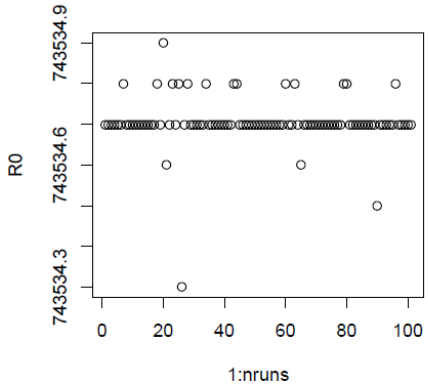


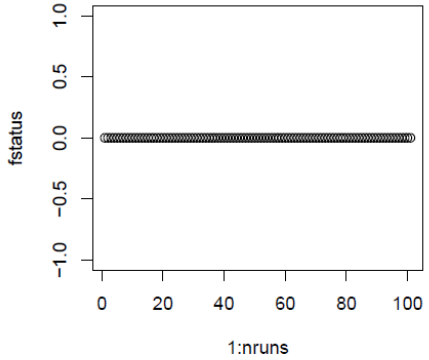


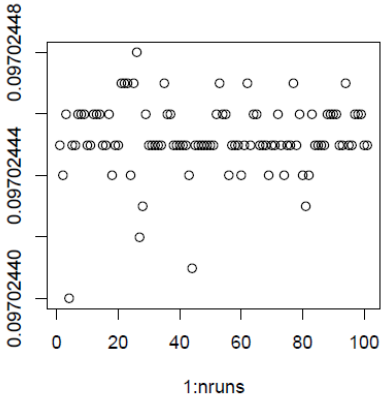


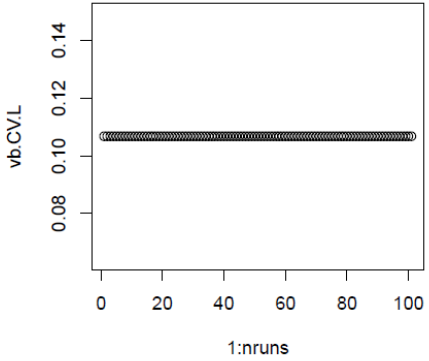
NOAA FISHERIES

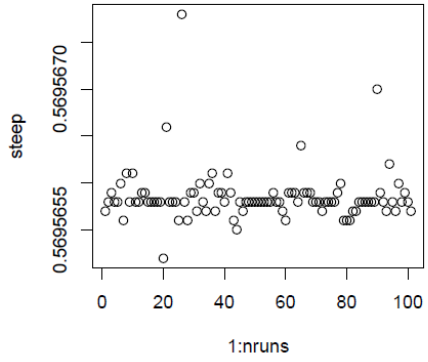
Starting Value Analysis

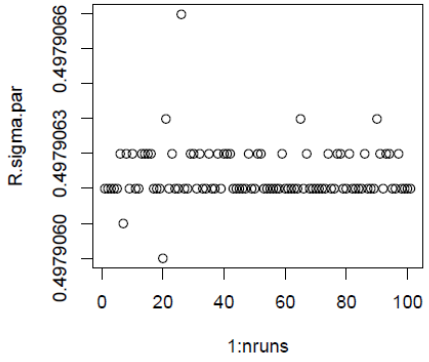






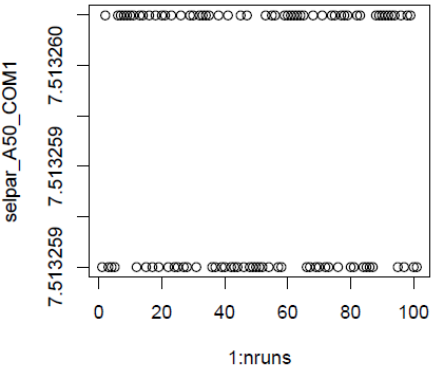


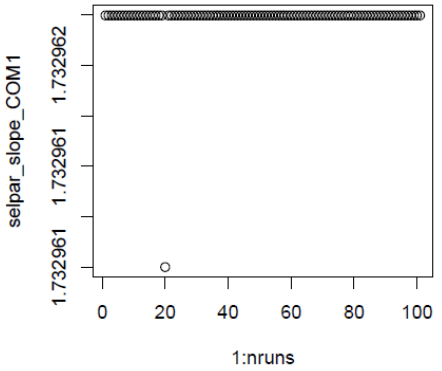


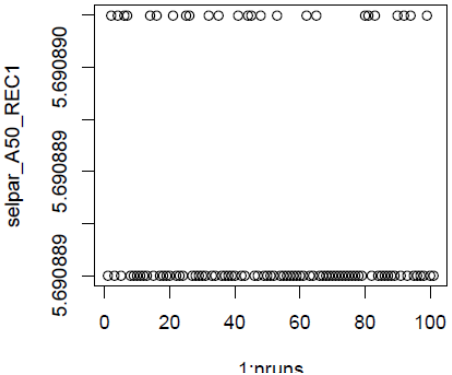


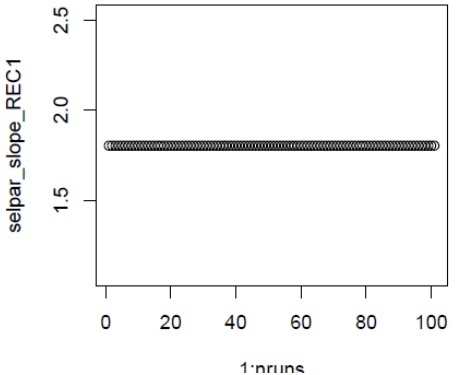
NOAA FISHERIES

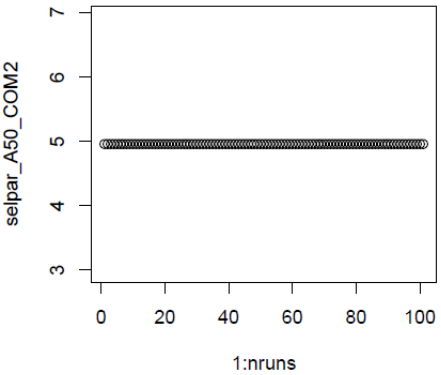
Starting Value Analysis: Sel. parms

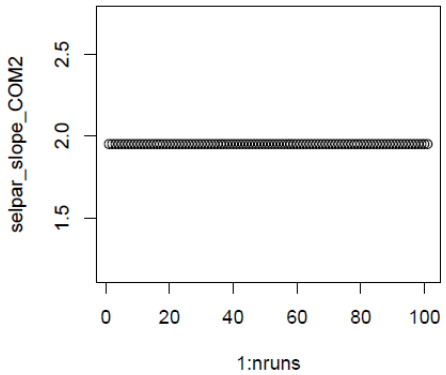


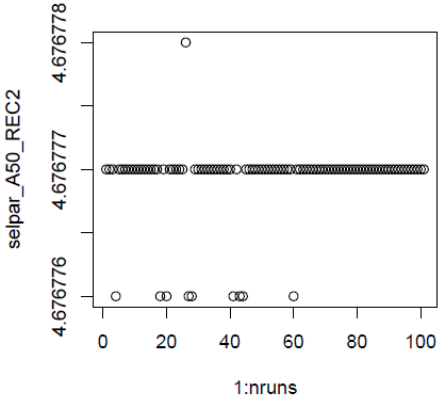


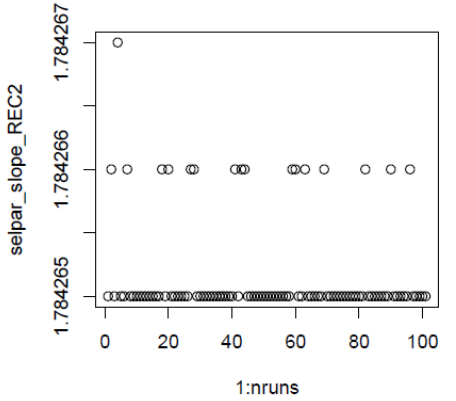










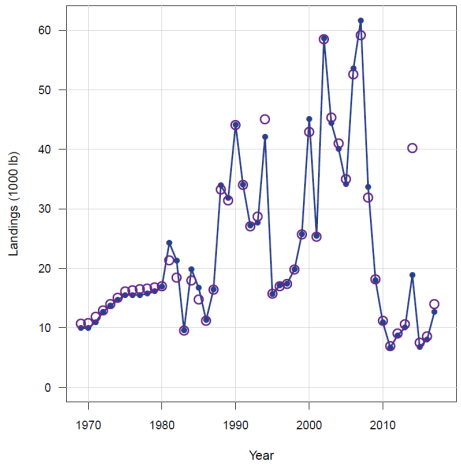


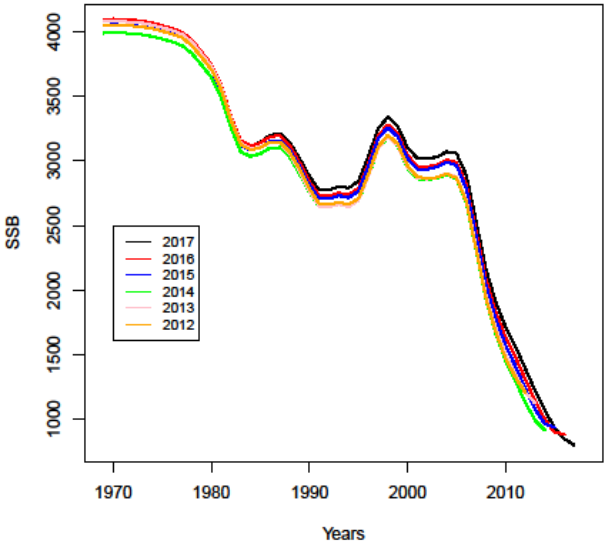
Sensitivity Runs

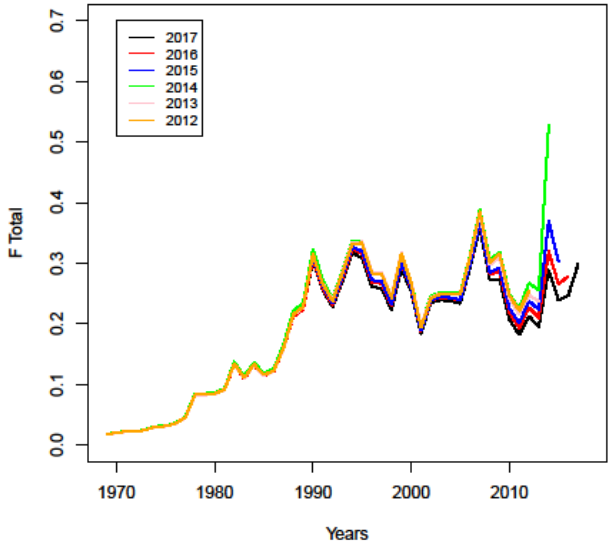
NOAA FISHERIES

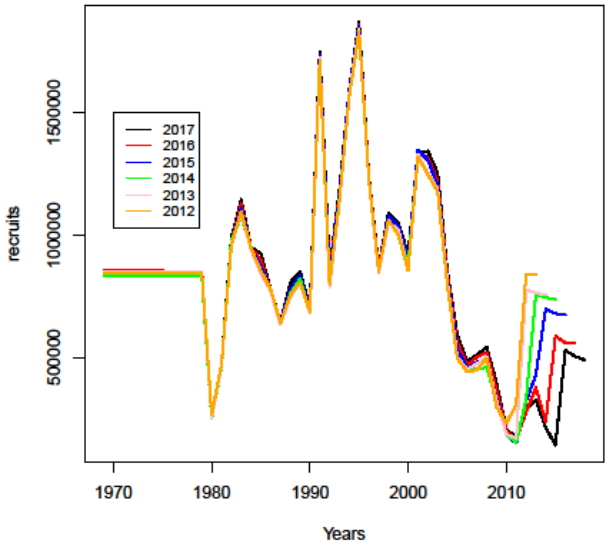
Retrospective

Model	Steepness
Base - 2017	0.569
2016	0.621
2015	0.758
2014	0.858
2013	0.833
2012	0.989







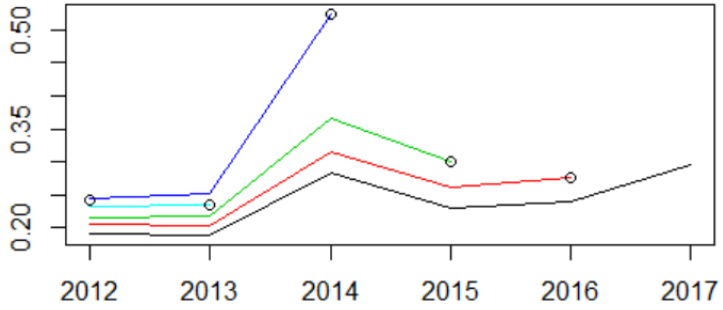


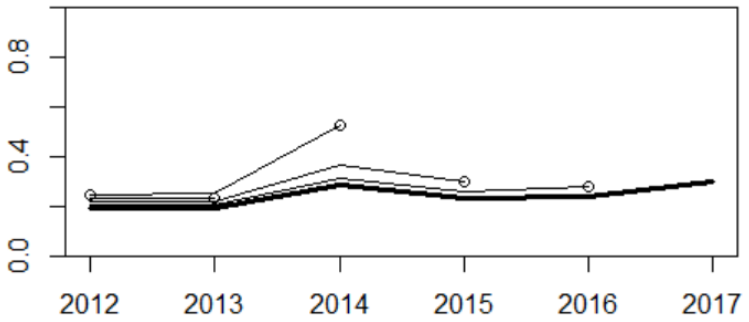
NOAA FISHERIES

Mohn's Rho - F

- 5 peels from 2017
- ρ = 0.359

	base	retro	relbias
2012	0.192	0.242	0.260
2013	0.189	0.234	0.241
2014	0.283	0.525	0.851
2015	0.231	0.300	0.300
2016	0.241	0.275	0.143



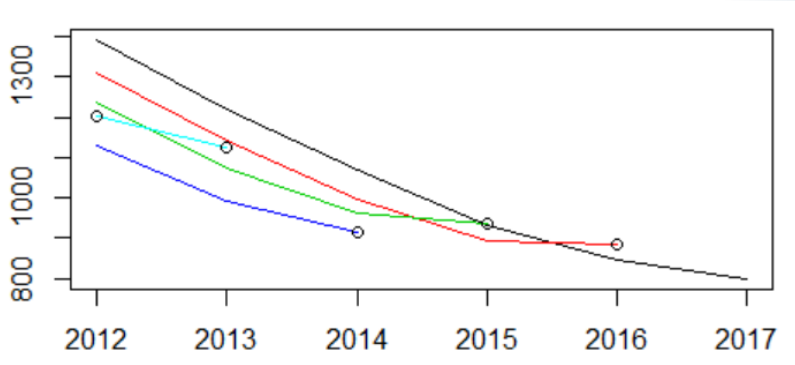


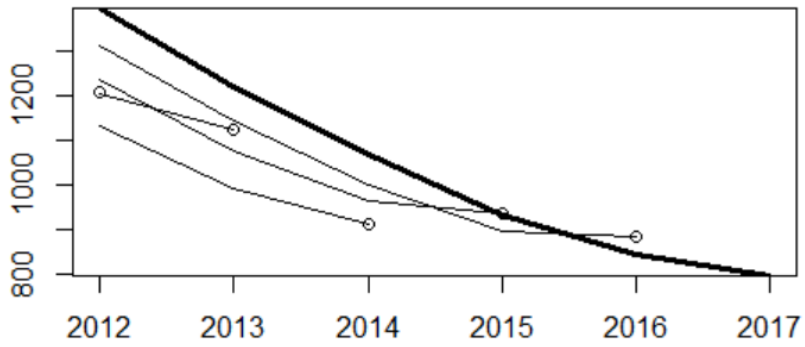
NOAA FISHERIES

Mohn's Rho - SSB

- 5 peels from 2017
- ρ = -0.062

	base	retro	relbias
2012	1,393.11	1,204.81	-0.135
2013	1,220.38	1,124.18	-0.079
2014	1,067.65	912.46	-0.145
2015	930.85	935.67	0.005
2016	845.61	882.77	0.044



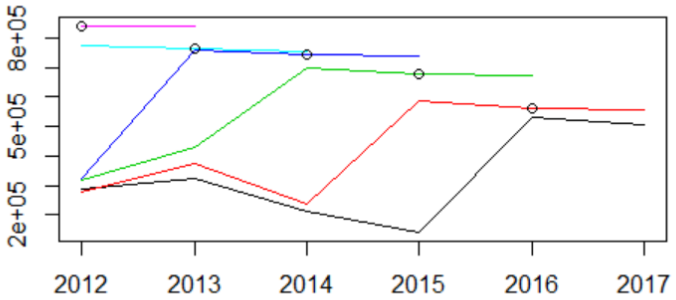


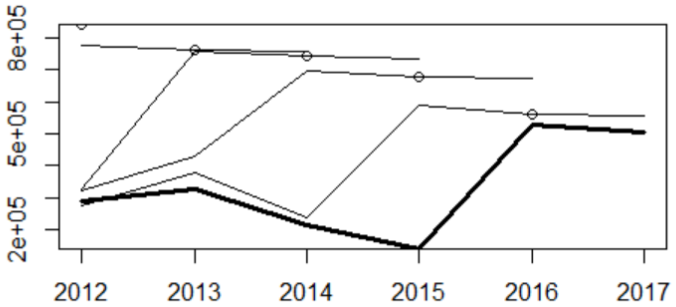
NOAA FISHERIES

Mohn's Rho - Recruits

- 5 peels from 2017
- ρ = 1.924

	base	retro	relbias
2012	289,834	840,642	1.900
2013	324,218	762,933	1.353
2014	213,922	744,806	2.482
2015	140,652	679,186	3.829
2016	528,915	560,094	0.059



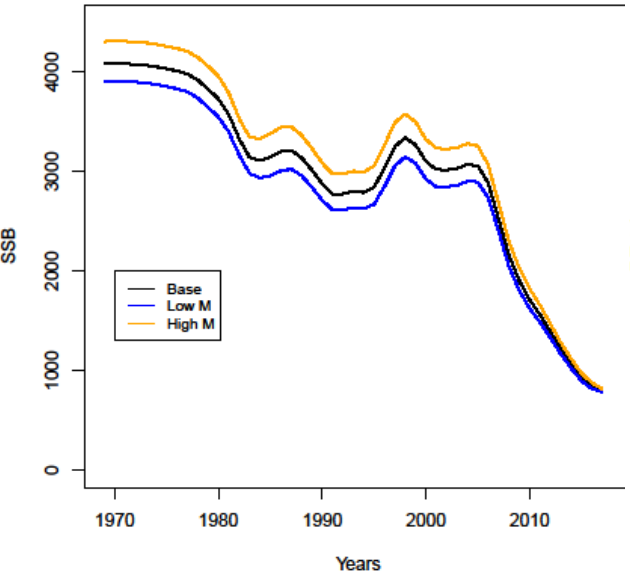


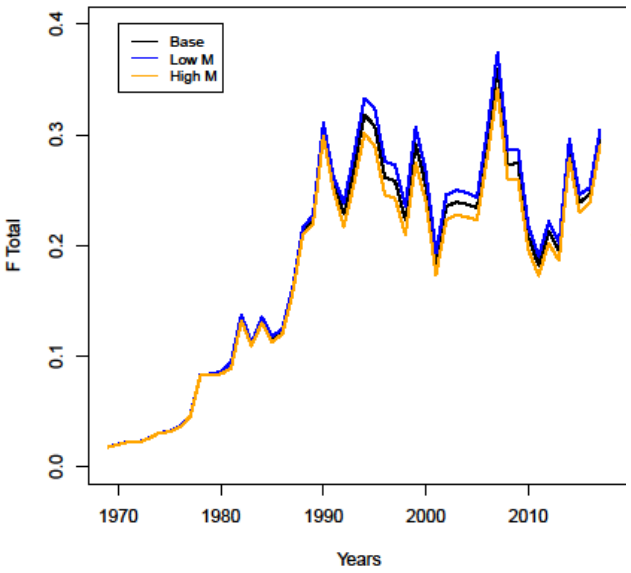
NOAA FISHERIES

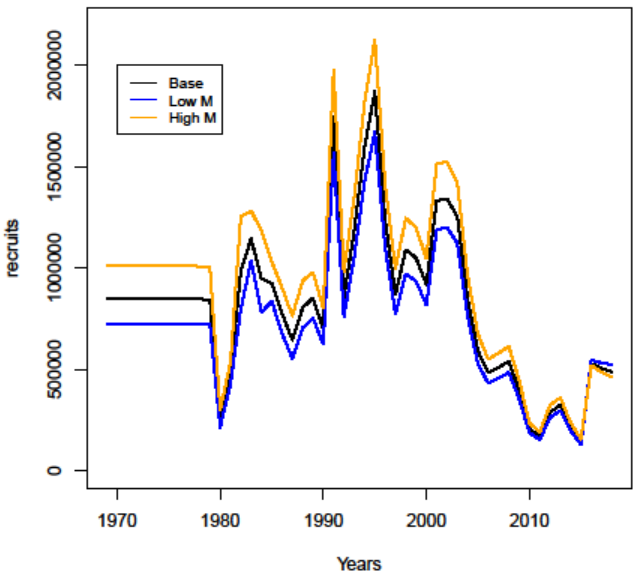
Low/High M

- Base: max age = 34 (0.155)
- Low M: max age =36 (0.147)
- High M: max age = 32 (0.164)

Model	Steepness
Base	0.57
Low M	0.71
High M	0.46

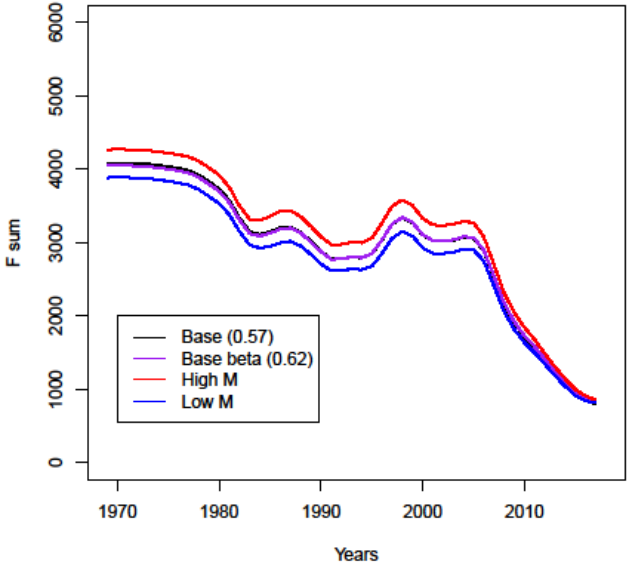


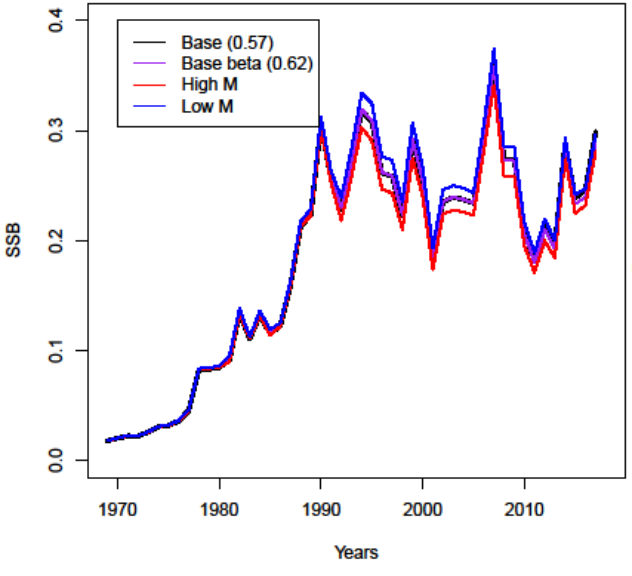


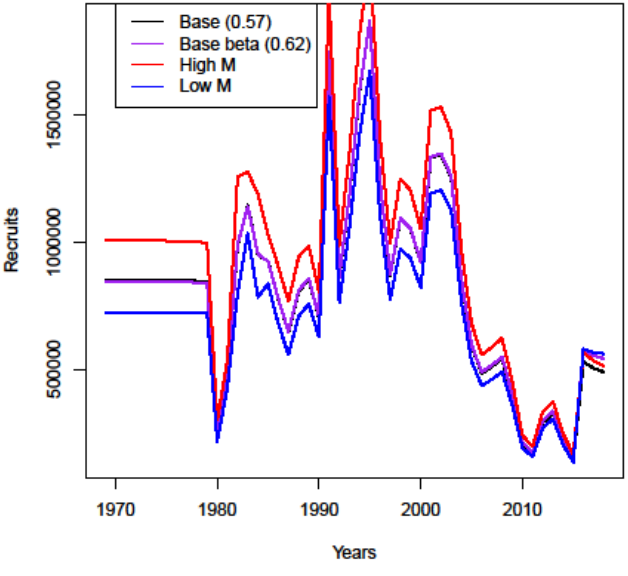


Steepness Sensitivity – Beta Prior

	Steepness	N age dev	Prior	Sigma r	R0
Base	0.57 (0.11)	Fixed	None	0.49 (0.04)	13.52 (0.04)
Base beta	0.62 (0.13)	Fixed	Beta	0.51 (0.05)	13.51 (0.04)
High M	0.49 (0.09)	Fixed	Beta	0.50 (0.05)	13.68 (0.04)
Low M	0.76 (0.15)	Fixed	Beta	0.50 (0.05)	13.36 (0.04)
Low M	0.71 (0.15)	Fixed	None	0.50 (0.04)	13.37 (0.04)
High M	0.46 (0.73)	Fixed	None	0.49 (0.05)	13.69 (0.04)



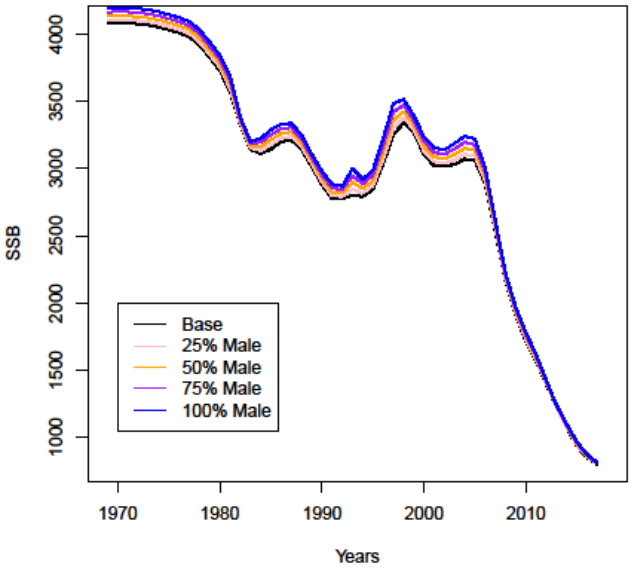


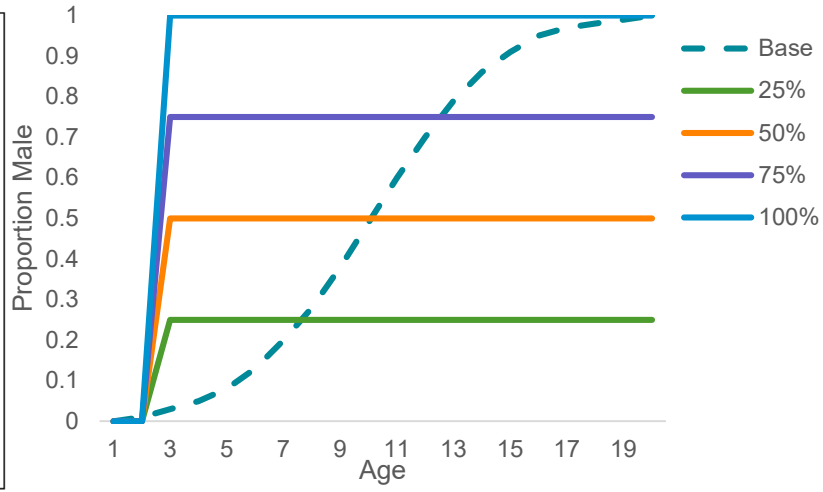


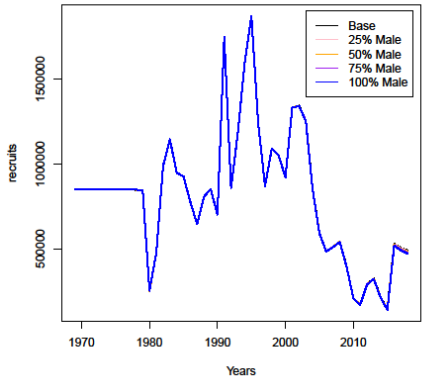
Male Contribution

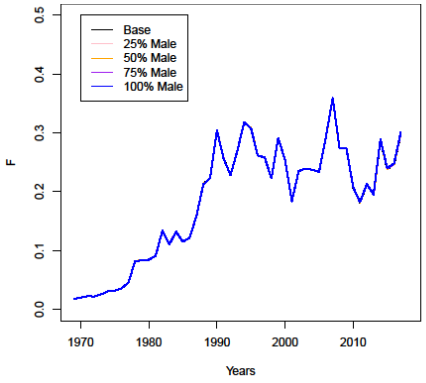
- 25%, 50%, 75% proportion male beginning at age 3 (100% female ages 1 and 2)

Model	Steepness
Base	0.569
25% male	0.566
50% male	0.561
75% male	0.556
100% male	0.551





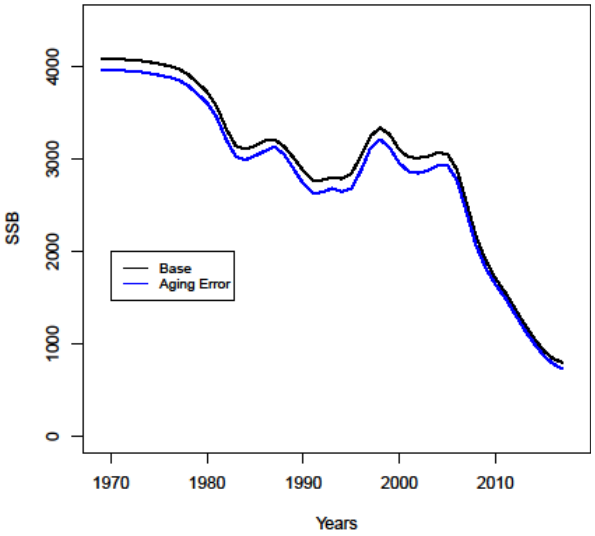


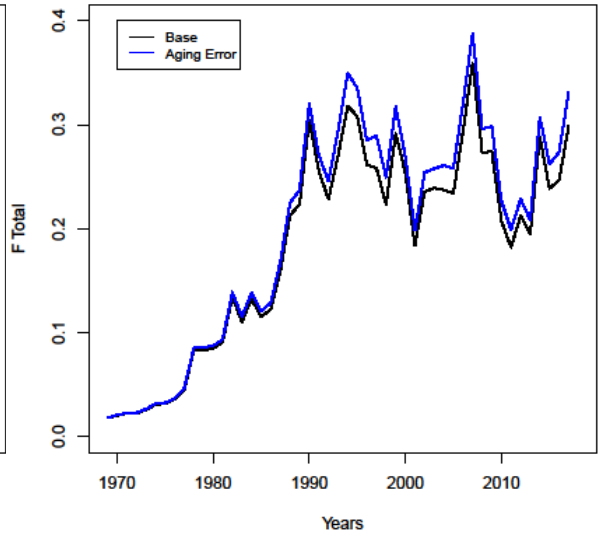


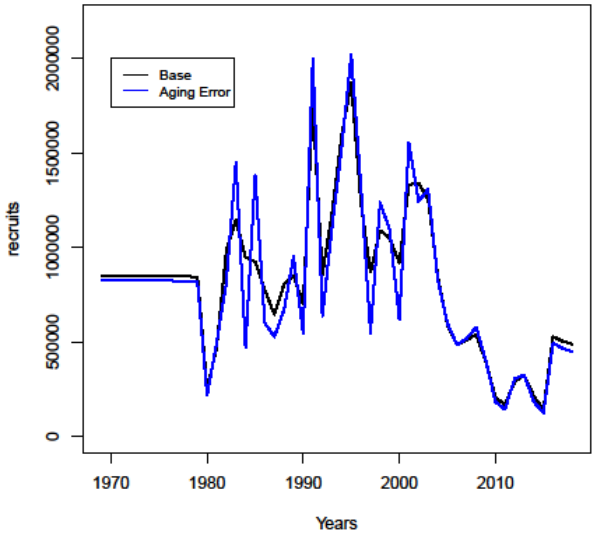
Aging error matrix

- Include aging error matrix in base run

Model	Steepness
Base	0.569
With aging err.	0.549







MCBE

NOAA FISHERIES

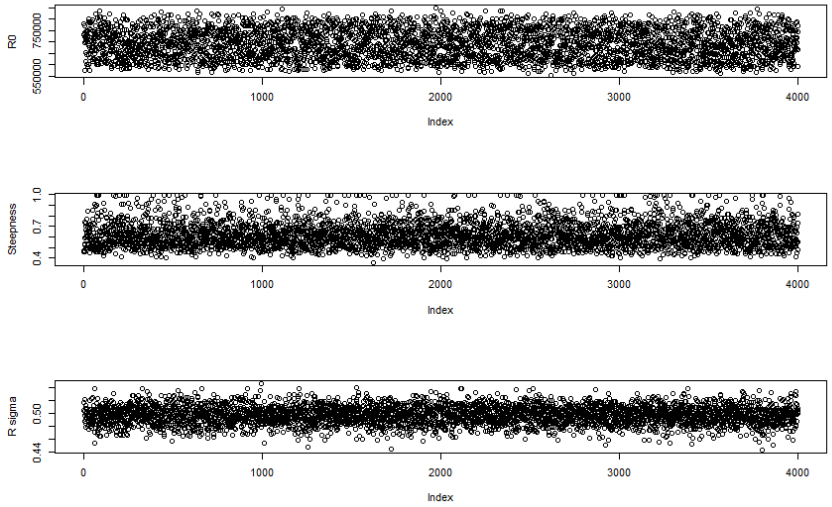
Monte Carlo Ensemble Modeling

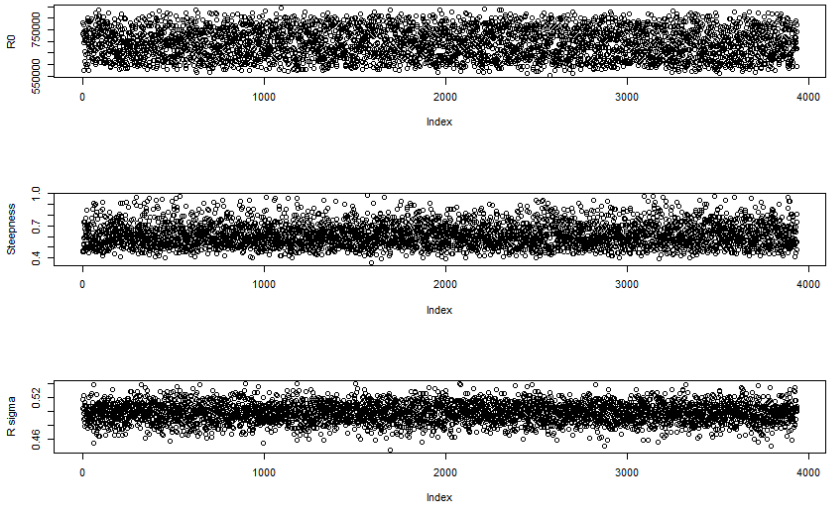
- Bootstrapping:
  - Indices
  - Landings and discards
  - Age and length comps
- Monte Carlo:
  - M: uniform draw from low to high maximum age (32-36 yrs)
  - Discard mortality: Uniform draw
    - 16-40% recreational (26%)
    - 33-45% commercial (39%)

NOAA FISHERIES

Monte Carlo Ensemble Modeling

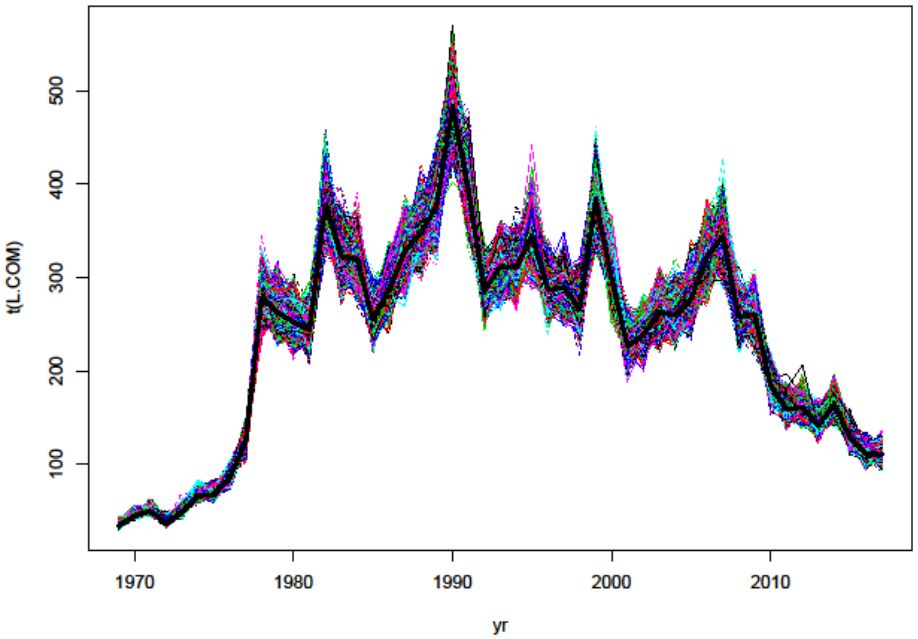
- Runs culled from ensemble modeling when R0, Fmsy, steepness and R sigma hit upper bound
- 4000 initial runs, 3934 after

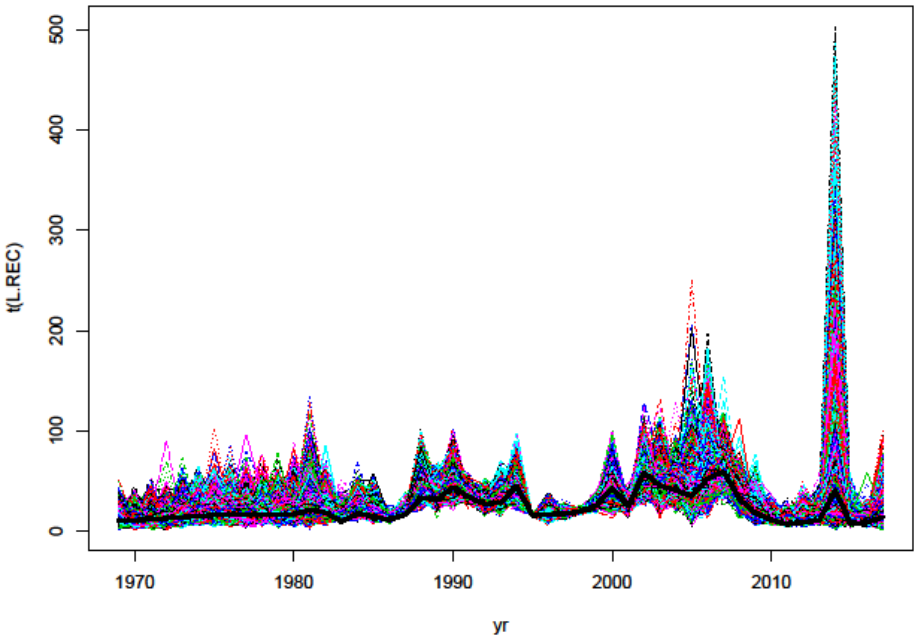




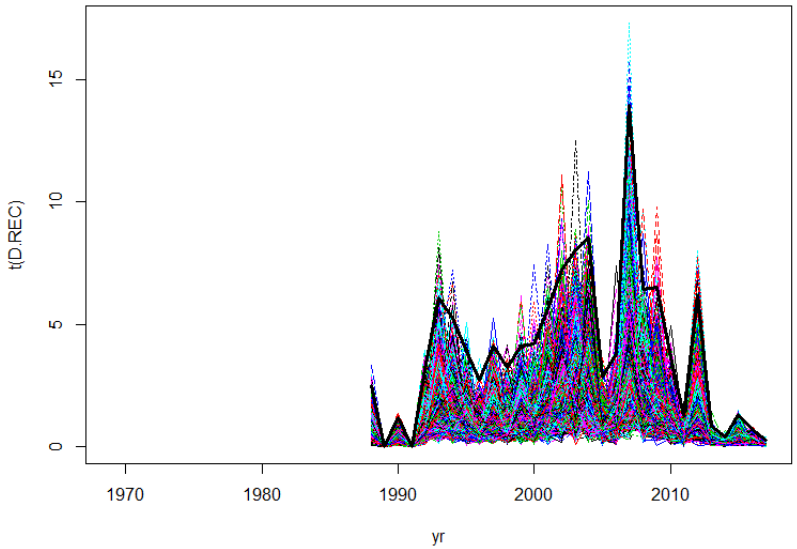
NOAA FISHERIES

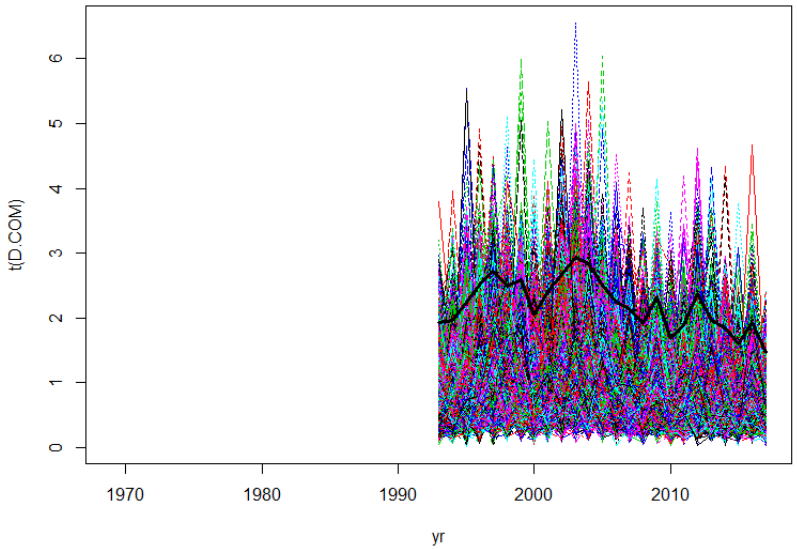
MCBE Results: Landings





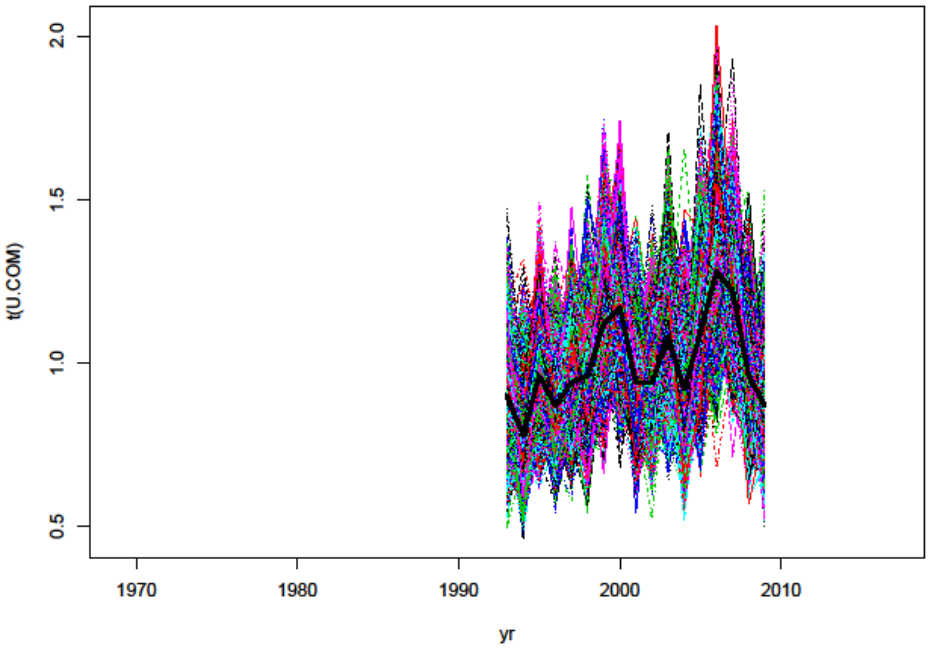
MCBE Results: Discards

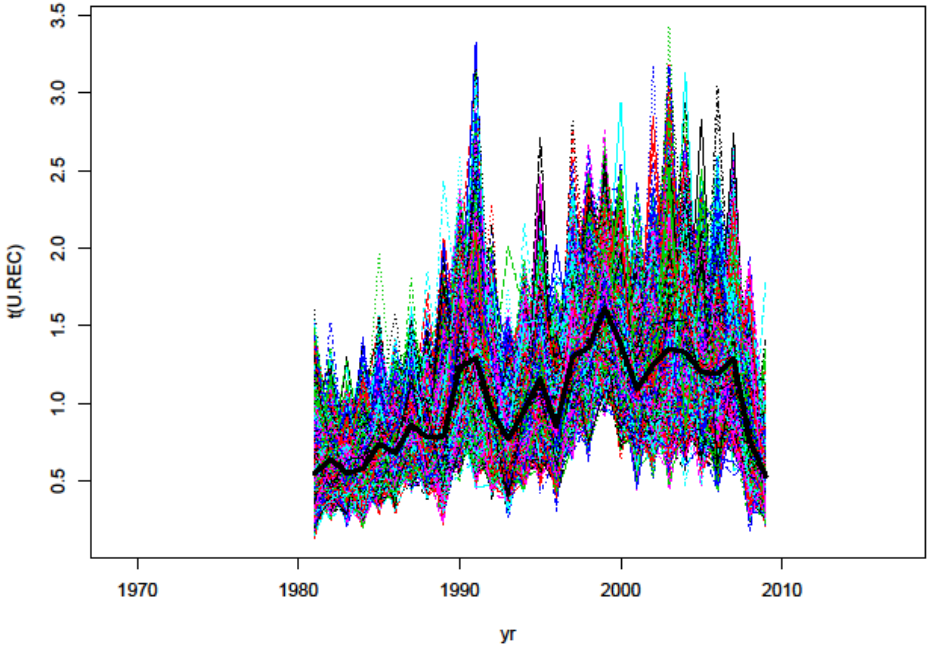




NOAA FISHERIES

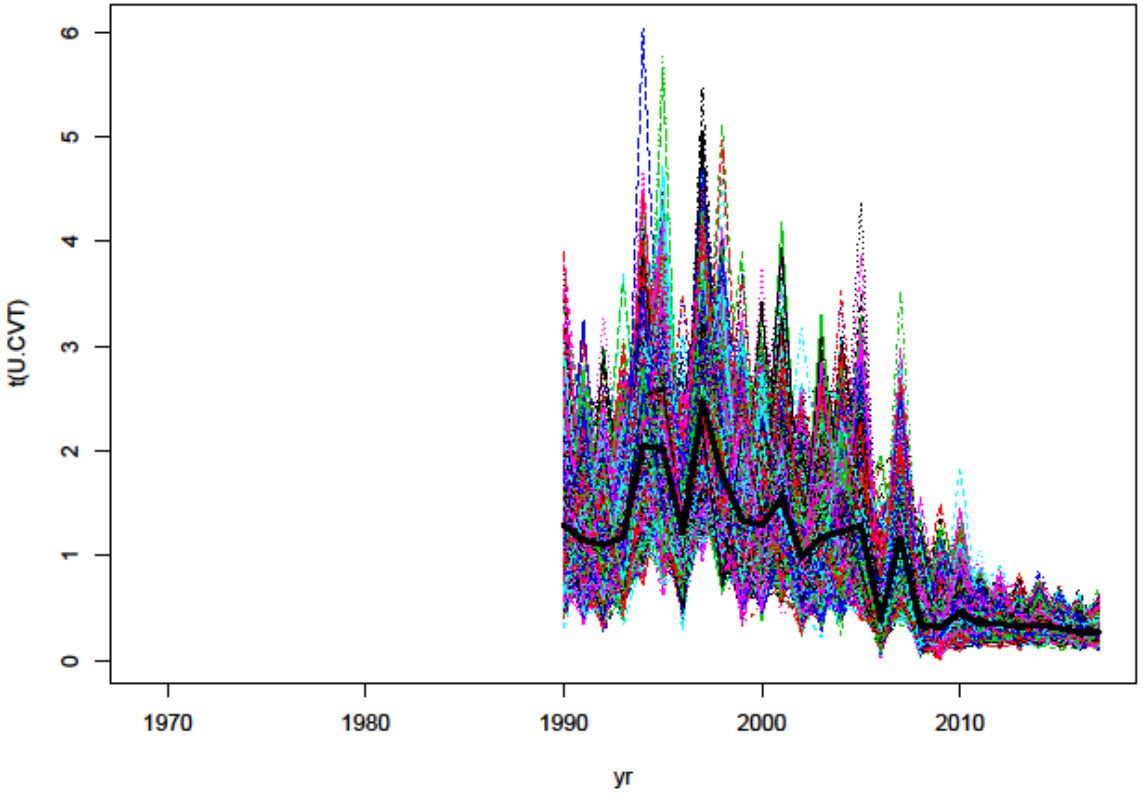
Ensemble Modeling: indices





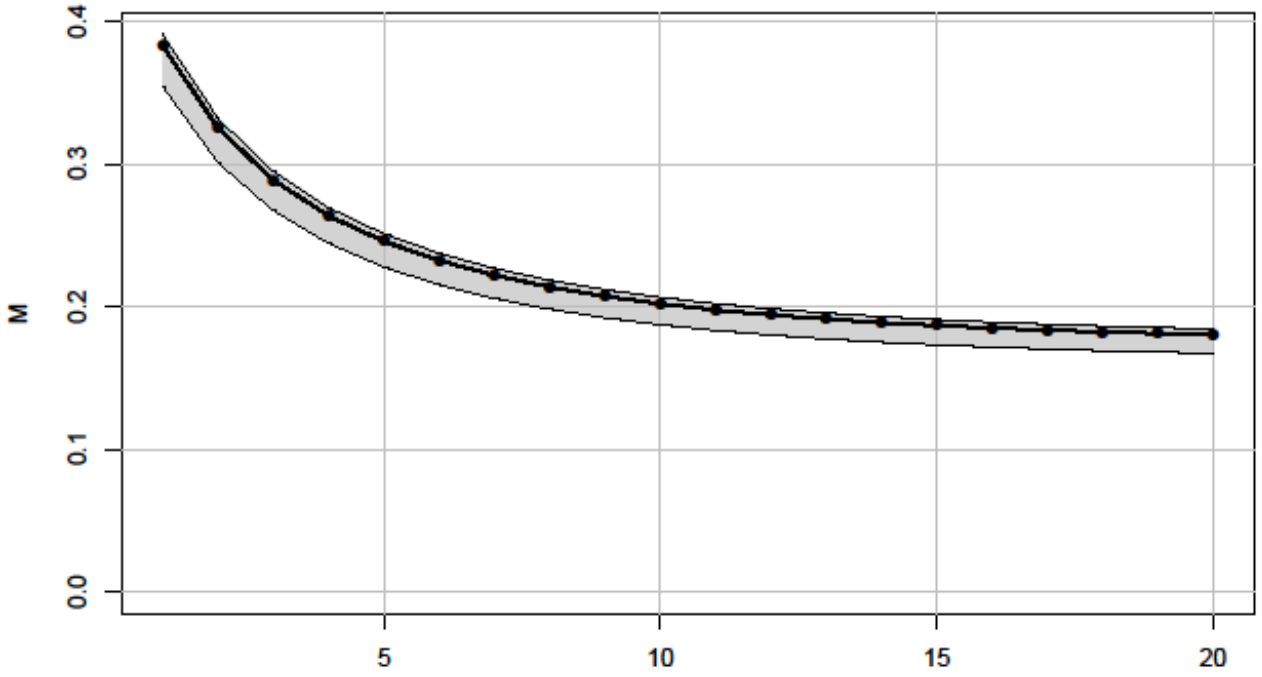
NOAA FISHERIES

MCBE Results: Indices



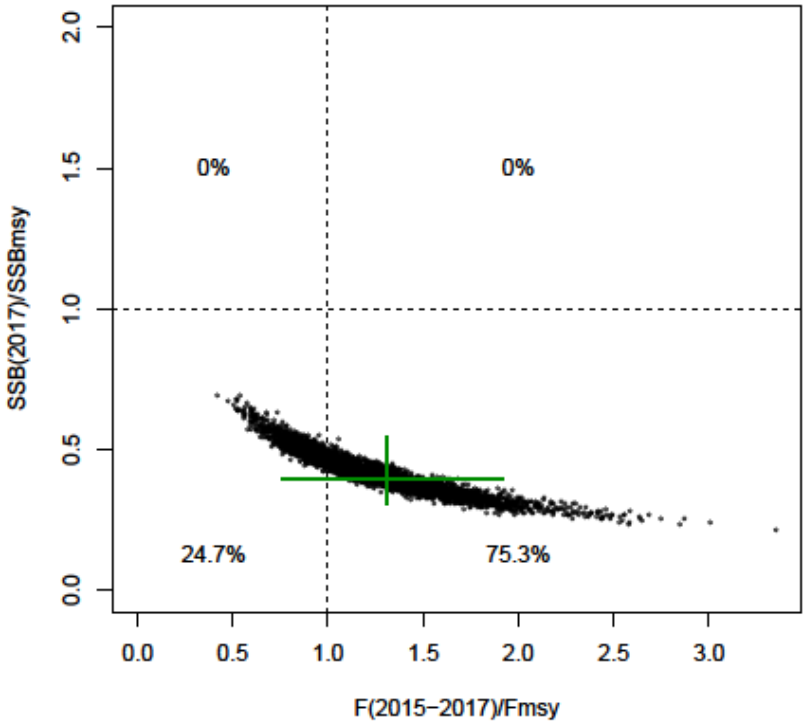
NOAA FISHERIES

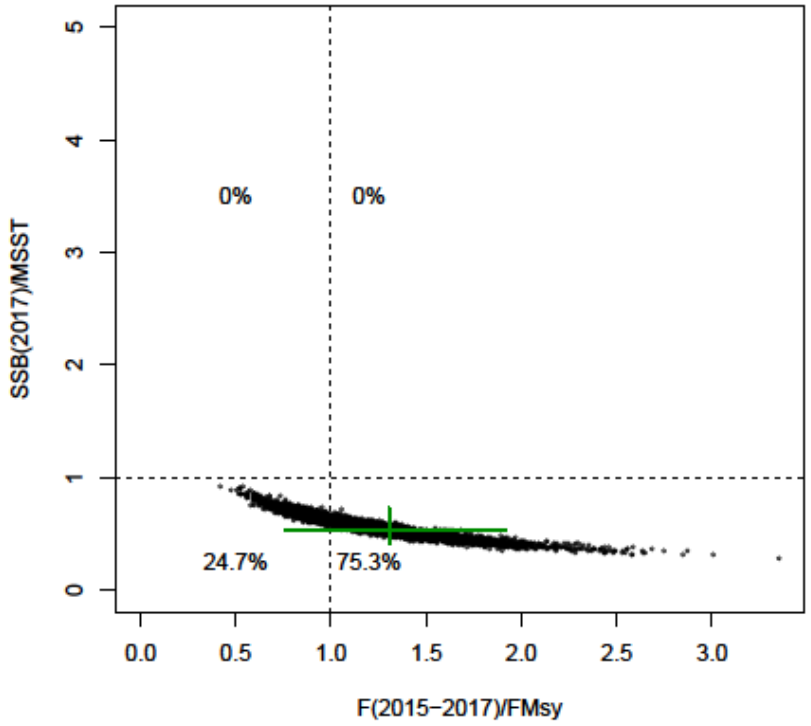
MCBE Results: Natural mortality



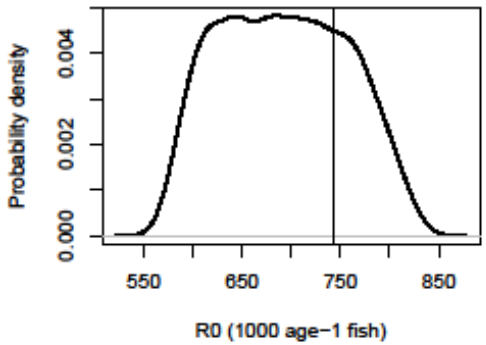
NOAA FISHERIES

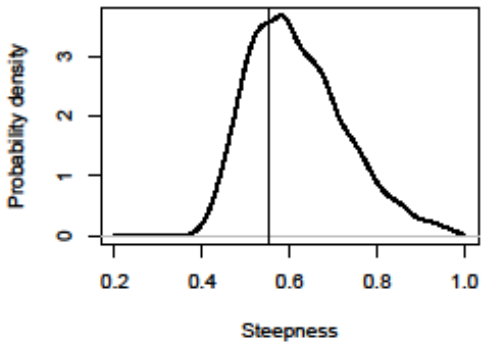
MCBE Results: Phase plots

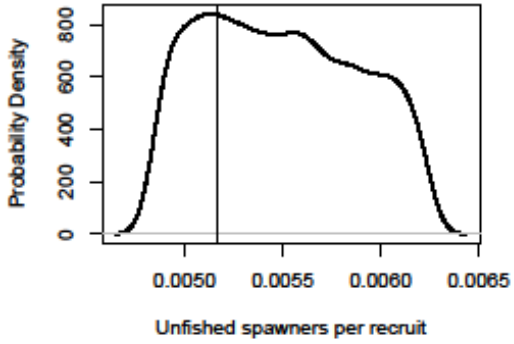


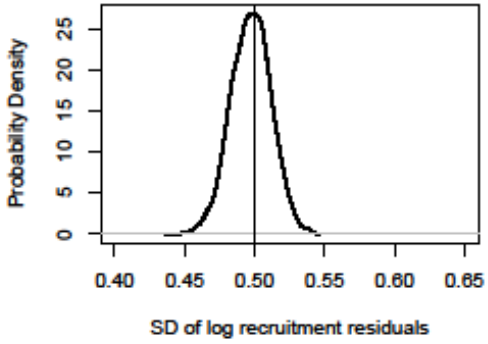


MCBE Results: Parameters



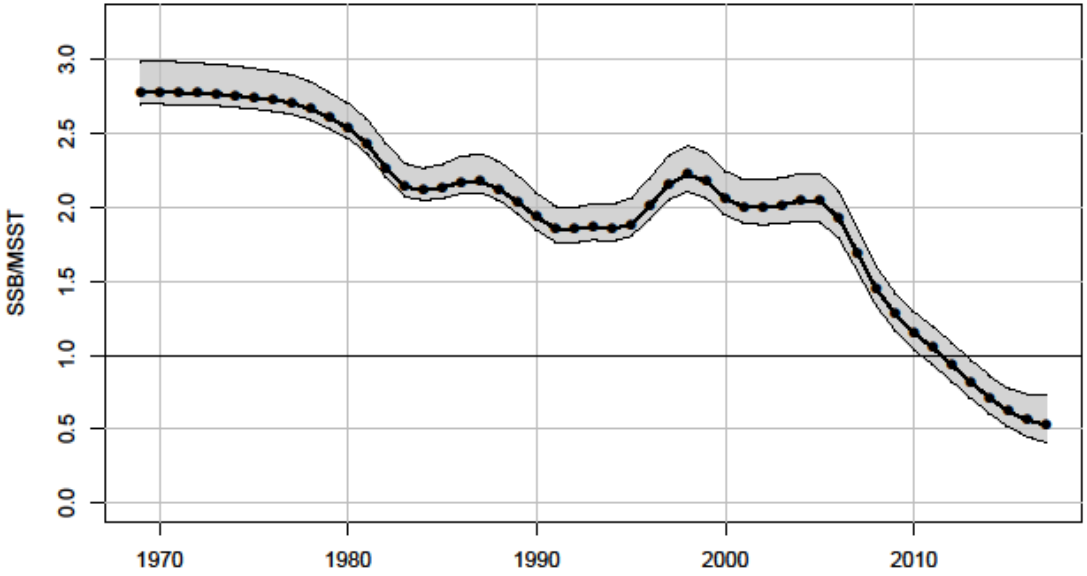


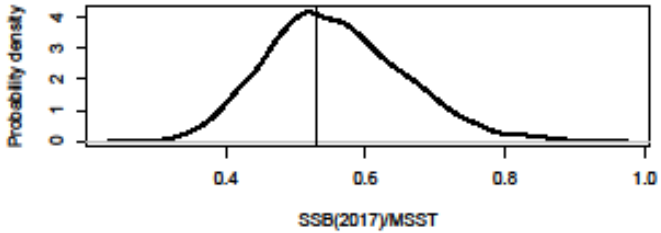


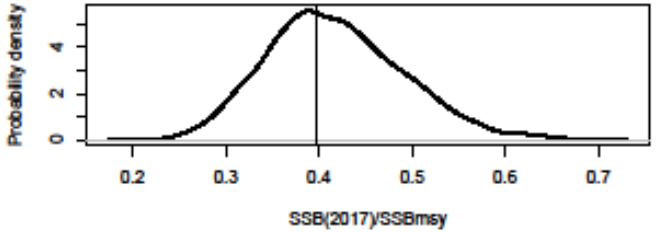


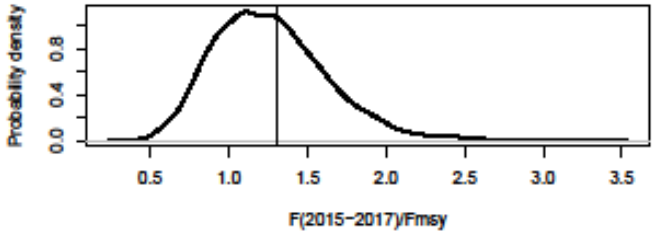
NOAA FISHERIES

MCBE Results: Stock status

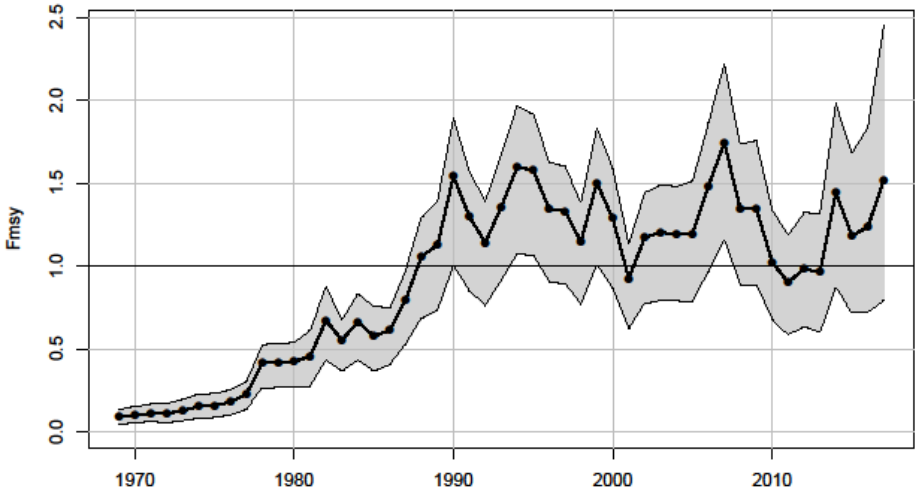


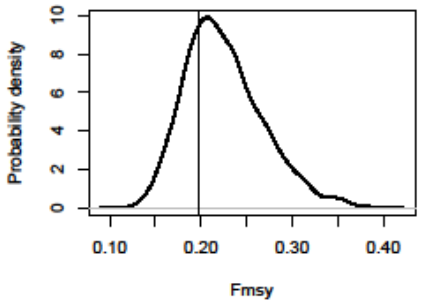


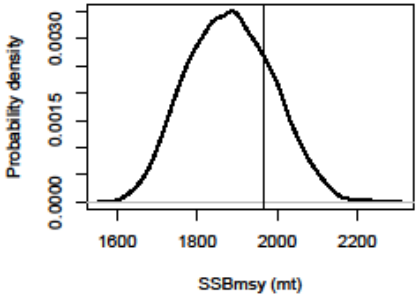


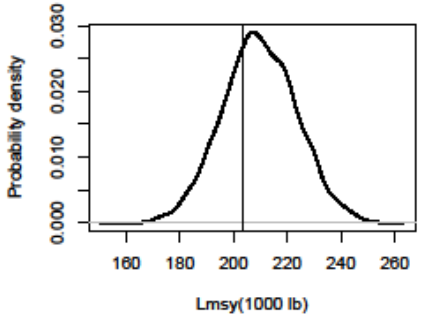


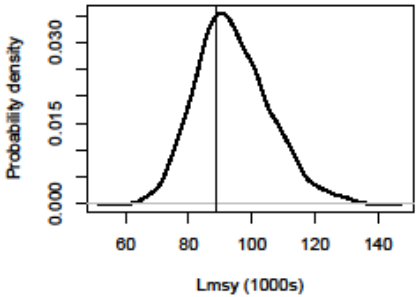
MCBE Results











NOAA FISHERIES

Questions?

NOAA FISHERIES