

NORTHERN ROCK SOLE

BY

WILDERBUER, IANELLI AND NICHOL



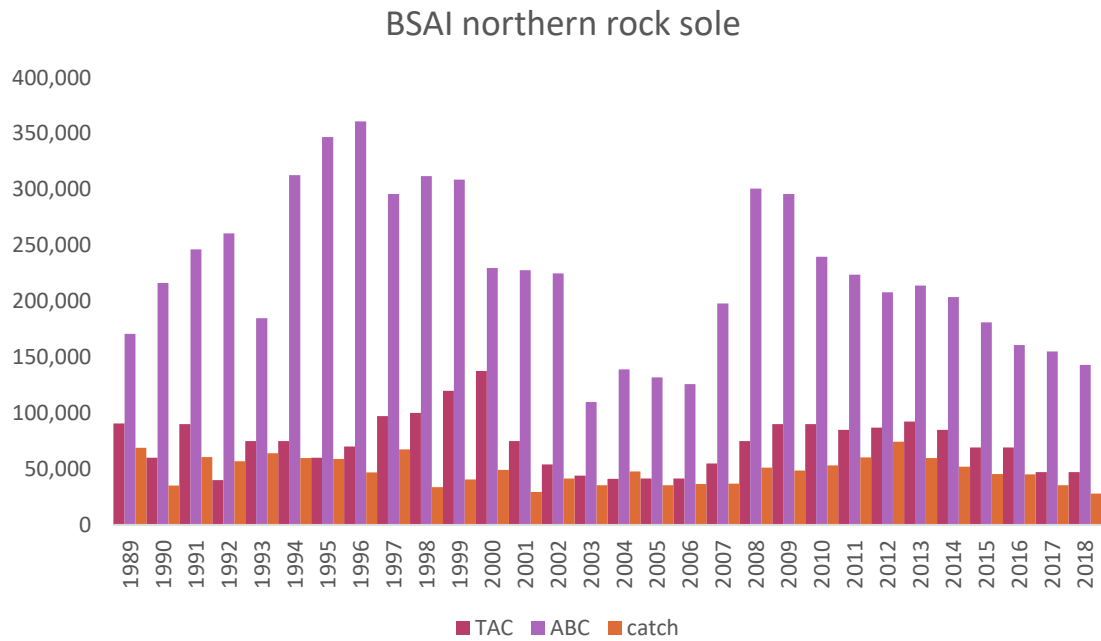
CHANGES IN THE ASSESSMENT BETWEEN 2016 AND 2018

The assessment model was run to include the new 2017 and 2018 catch and survey biomass and 2016 and 2017 age composition information from both the survey and fishery.

Ensemble methodology was explored.

Survey biomass decreased 21% increased from 2017 to 2018.

Catch, ABC and TAC



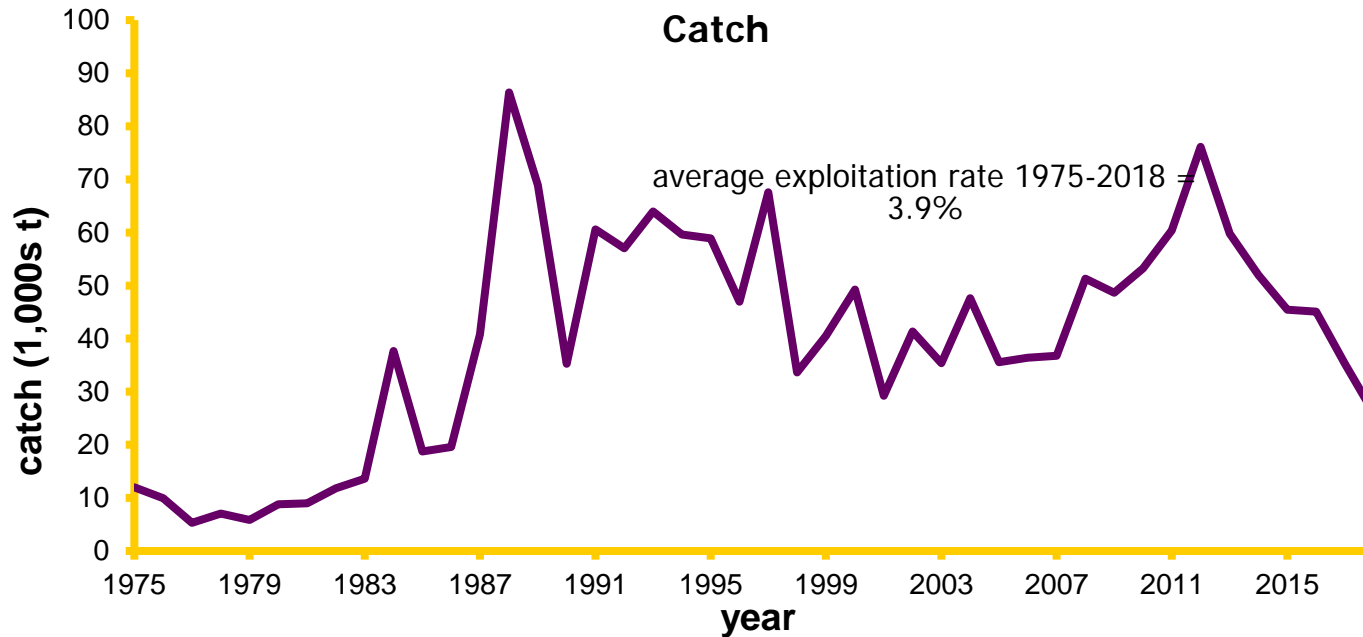
SUMMARY

Model 15.1

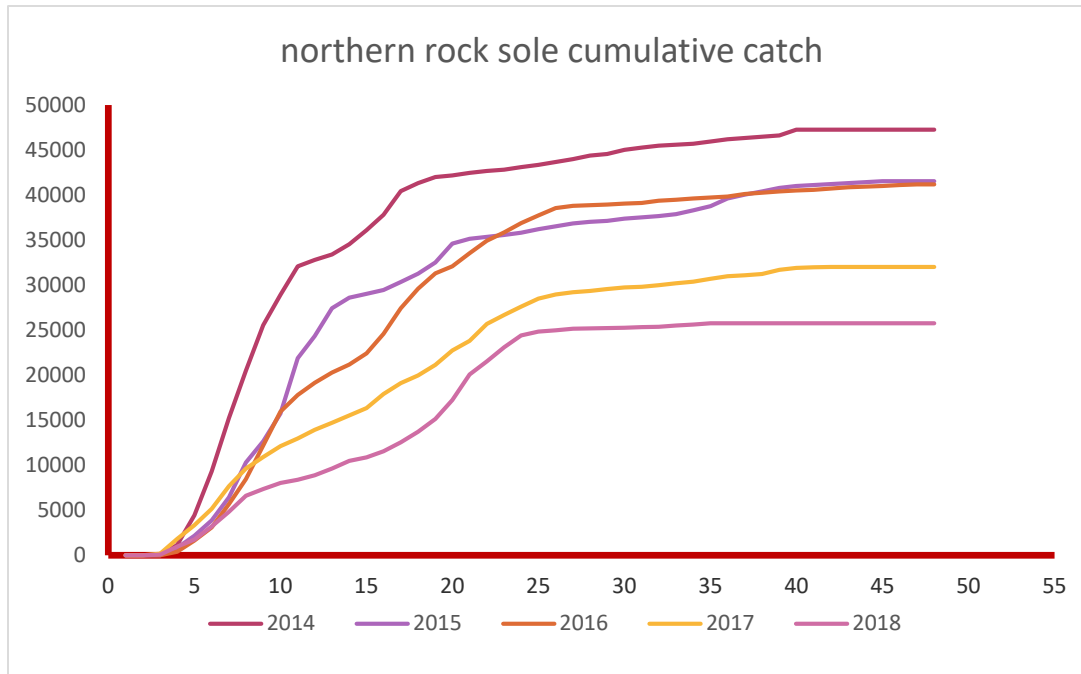
Quantity	As estimated or specified last year for:		As estimated or recommended this year for:	
	2018	2019	2019	2020
M (natural mortality rate)	0.15	0.15	0.15	0.15
Tier	1a	1a	1a	1a
Projected total (age 6+) biomass (t)	923,200	852,000	828,000	1,001,400
Female spawning biomass (t)	472,200	413,300	417,800	338,300
Projected				
B_0	678,310		515,680	
B_{MSY}	257,000	257,000	186,000	186,000
F_{OFL}	0.16	0.16	0.147	0.147
$\max F_{ABC}$	0.155	0.155	0.144	0.144
F_{ABC}	0.155	0.155	0.144	0.144
OFL (t)	147,300	136,000	122,000	147,500
$\max ABC$ (t)	143,100	132,000	118,900	143,700
ABC (t)	143,100	132,000	118,900	143,700
Status	As determined last year for:		As determined this year for:	
	2016	2017	2017	2018
Overfishing	No	n/a	No	n/a
Overfished	n/a	No	n/a	No
Approaching overfished	n/a	No	n/a	No

2018 CATCH = 28,219 T (THROUGH 11/3/18)

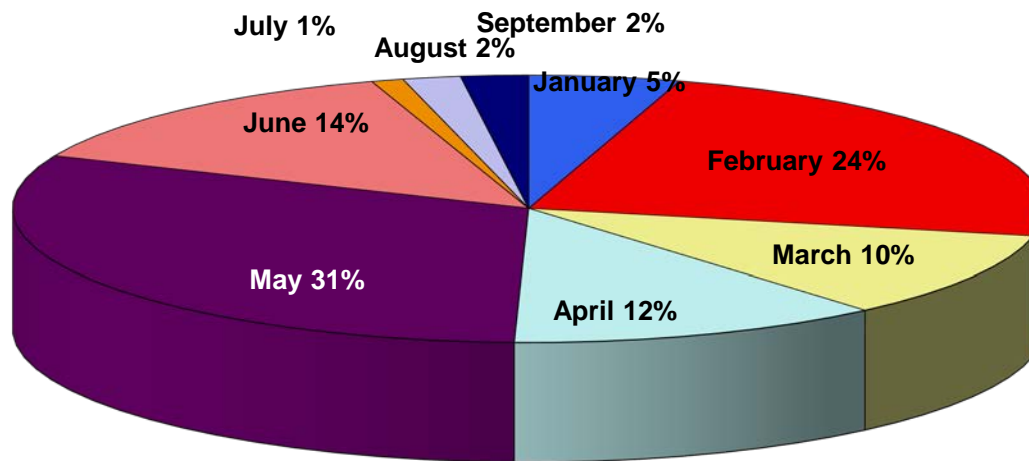
AVERAGE 1975-2018 EXPLOITATION RATE = 3.9%



NORTHERN ROCK SOLE



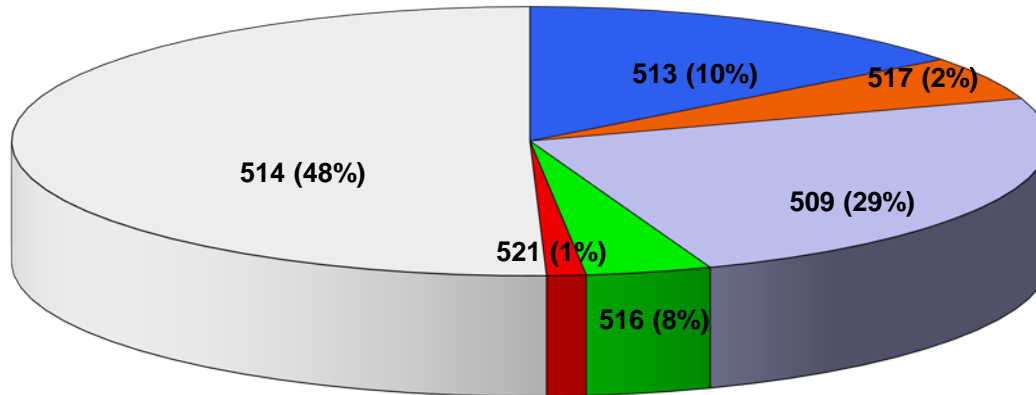
NORTHERN ROCK SOLE CATCH BY MONTH IN 2018



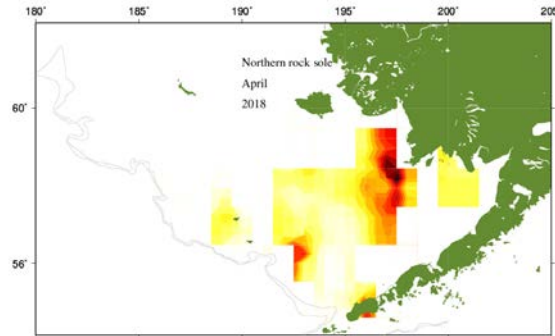
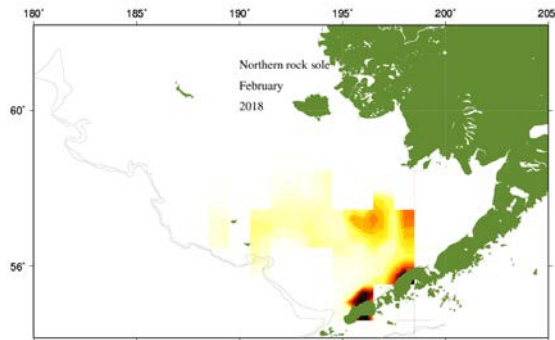
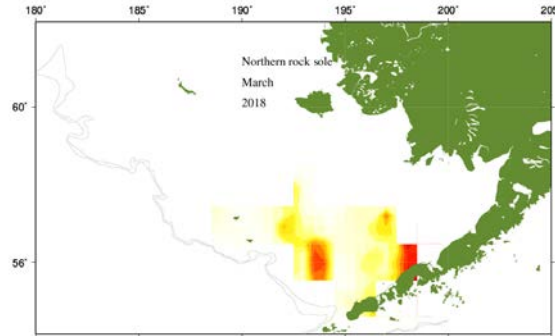
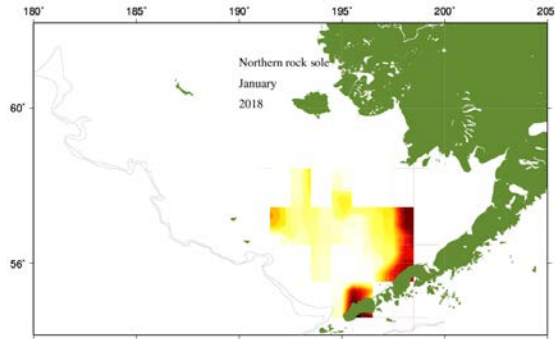
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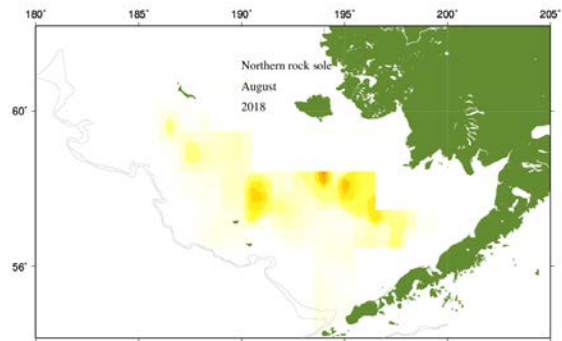
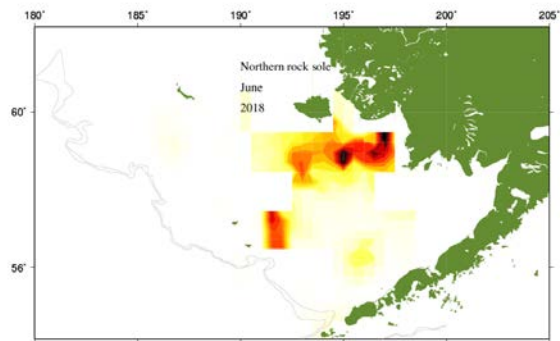
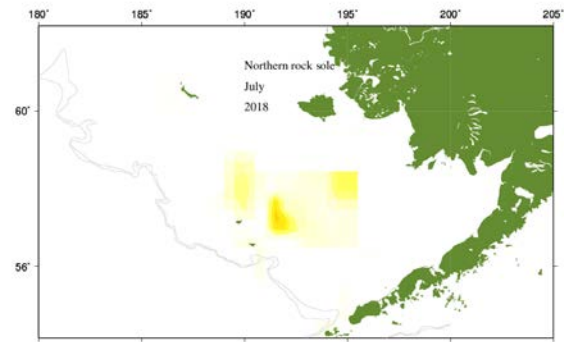
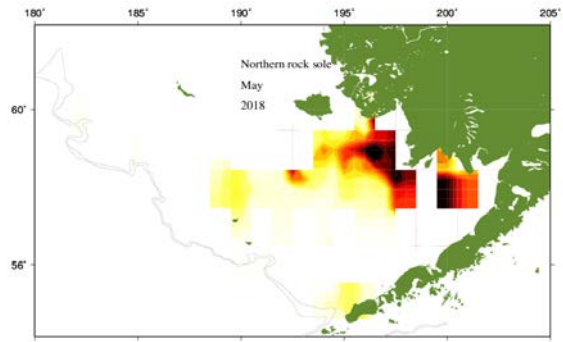
CATCH BY AREA IN 2018

catch by area in 2018

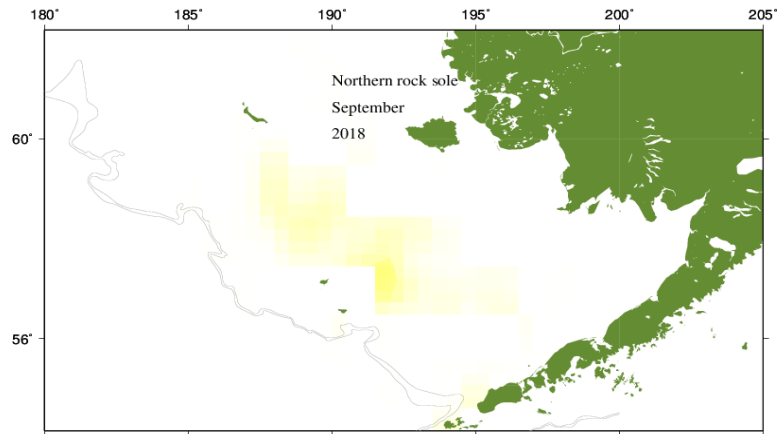


CATCH BY MONTH

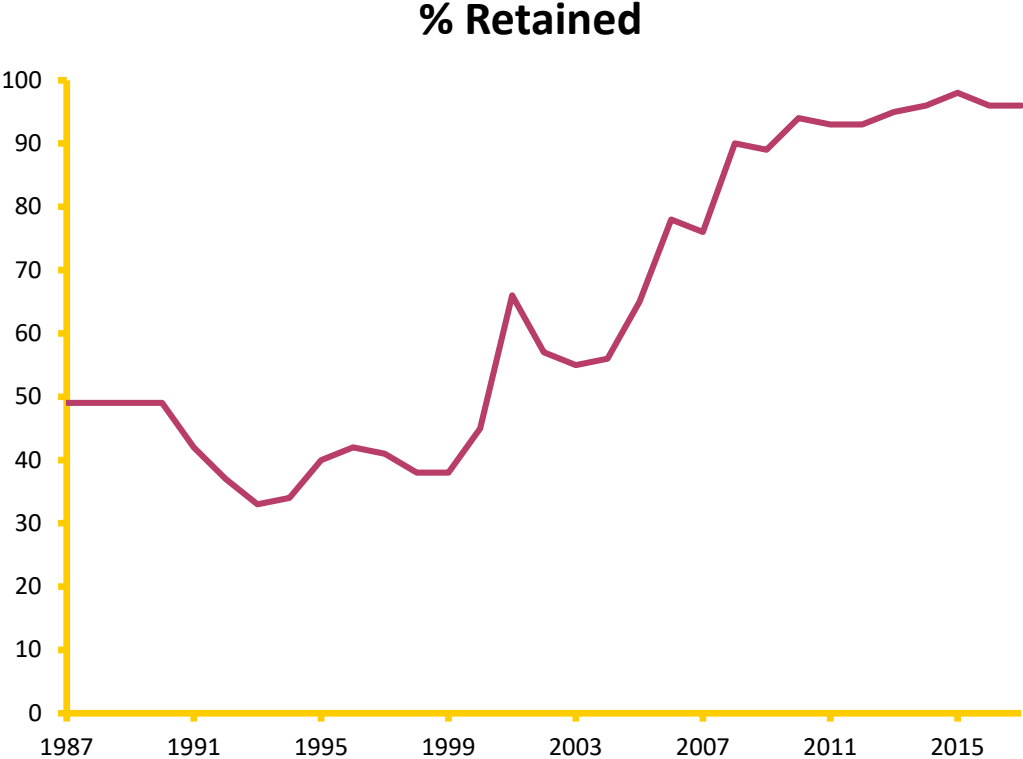




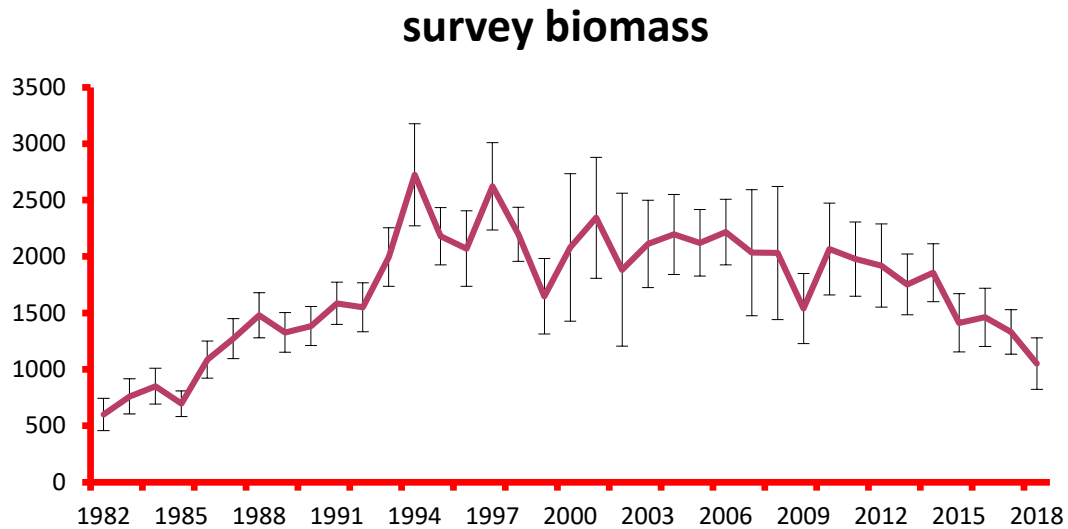
Catch by month (continued)



96% RETAINED IN 2017

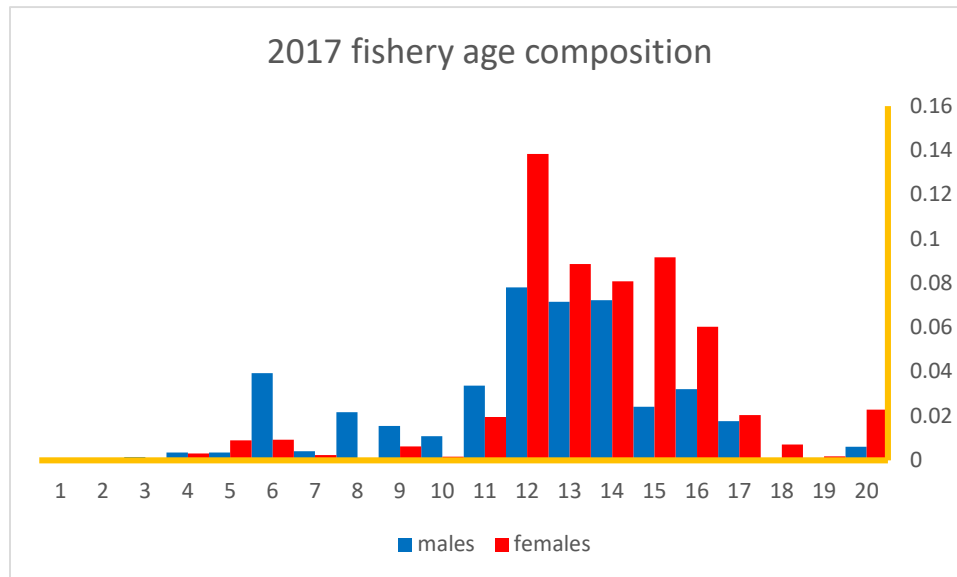


SURVEY BIOMASS: 21% DECREASE FROM 2017 TO 2018

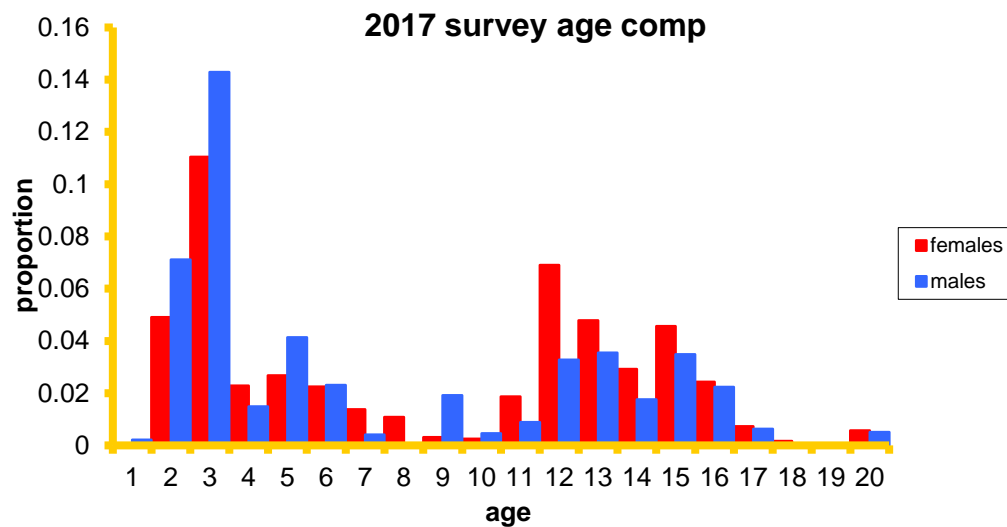


2018 was lowest survey biomass
estimate since 1985

2017 AGE COMPOSITIONS

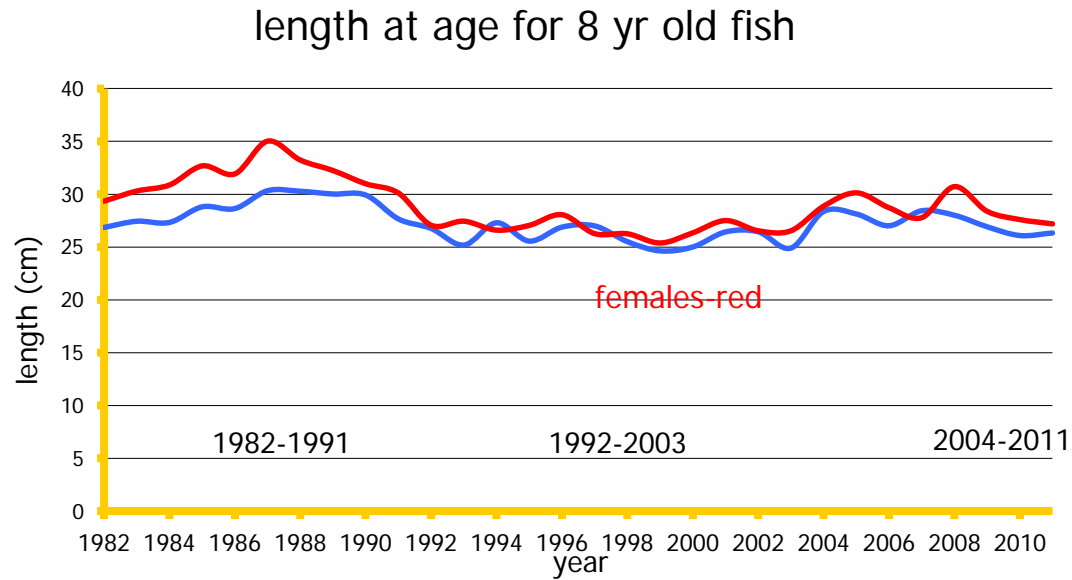


Average age in catch:
females 13.3, males 13.0

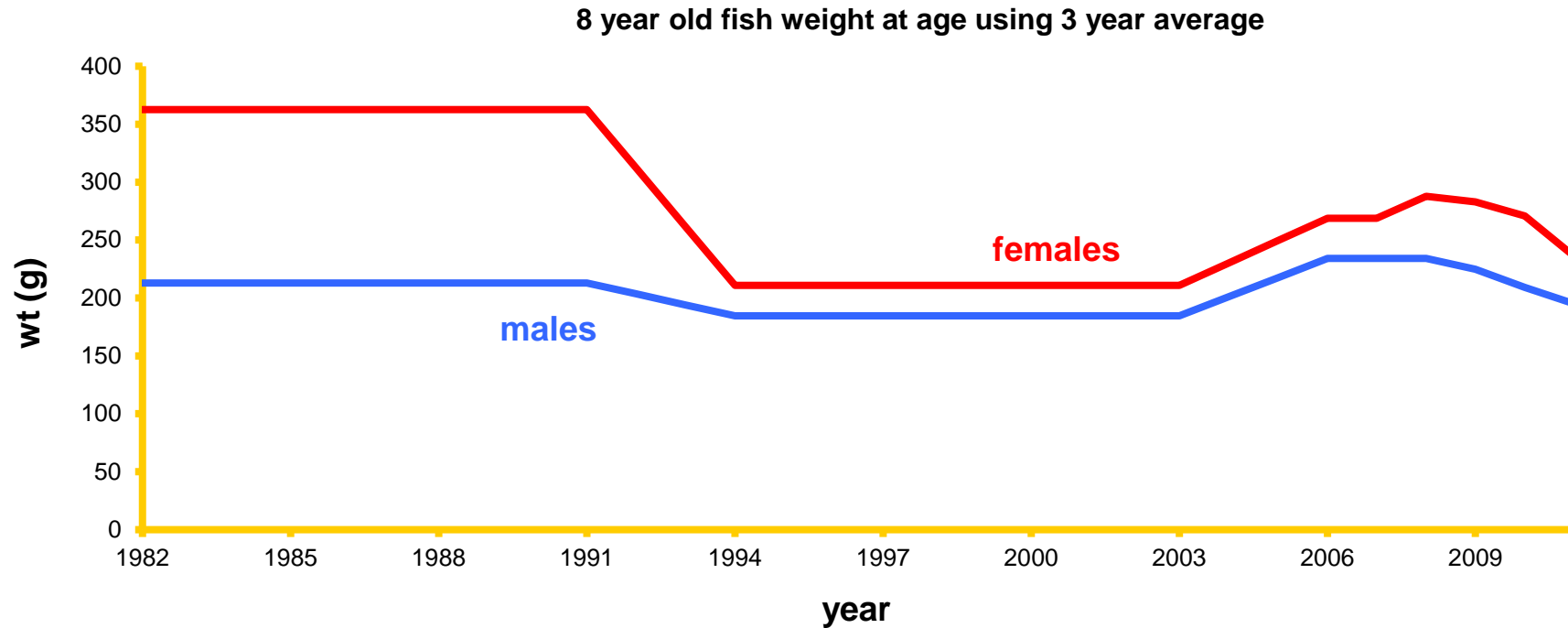


Average age in
population= 4.9
males and females

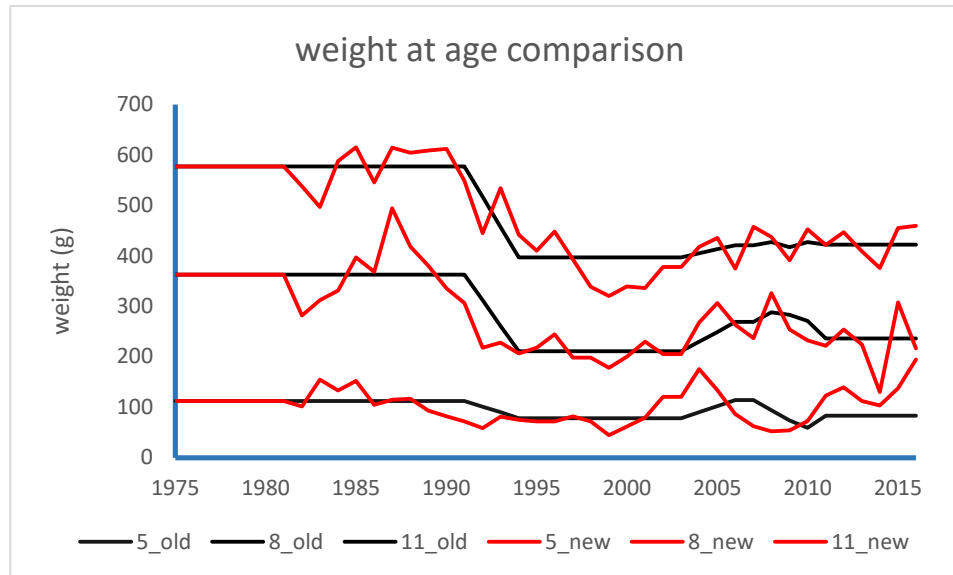
LENGTH AT AGE FROM SURVEY AGE COMPOSITIONS



WEIGHT AT AGE FROM SURVEY AGE COMPOSITIONS USING A THREE YEAR MOVING AVERAGE

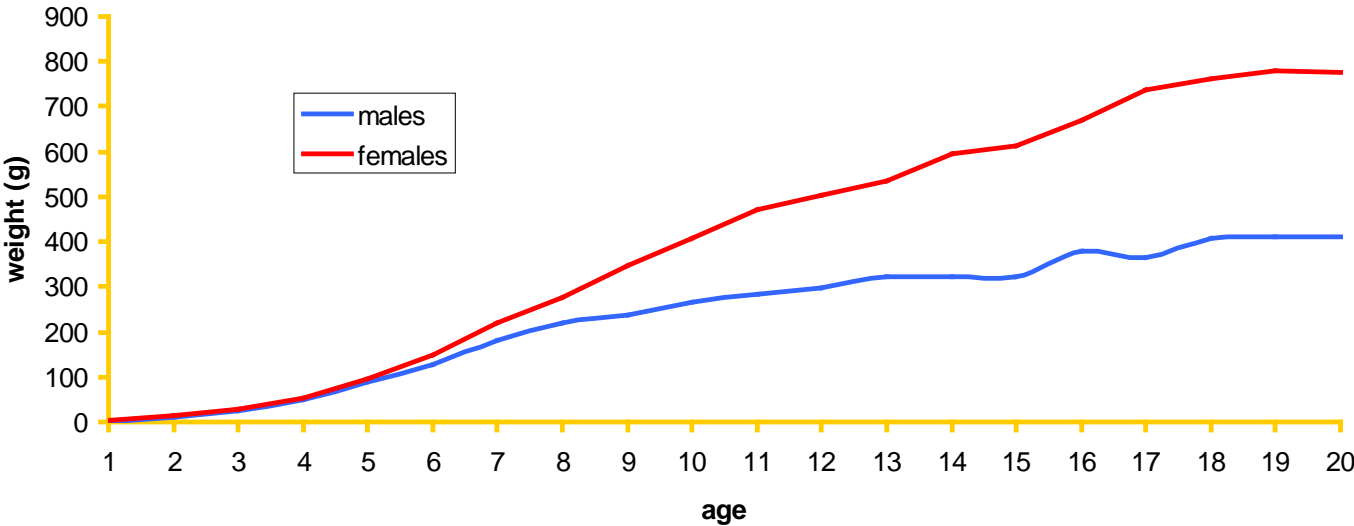


EMPIRICAL DATA ONLY FOR 2018



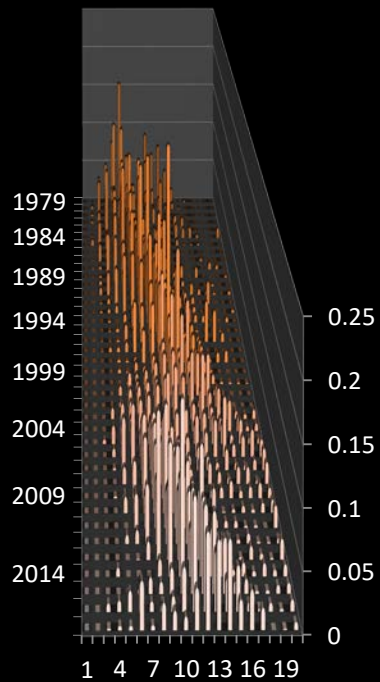
WEIGHT AT AGE FROM SURVEY AGE COMPOSITIONS

average of all years wt at age

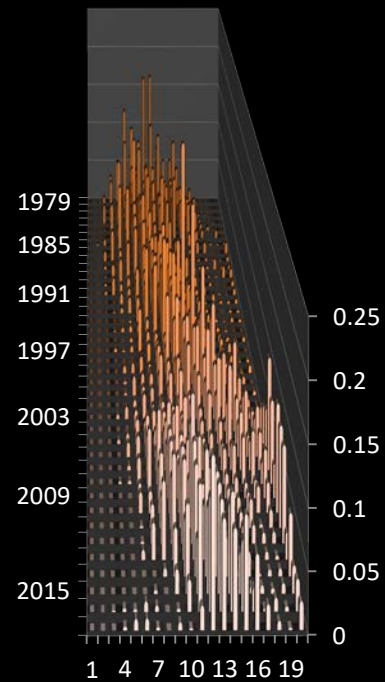


FISHERY AGE COMPOSITION

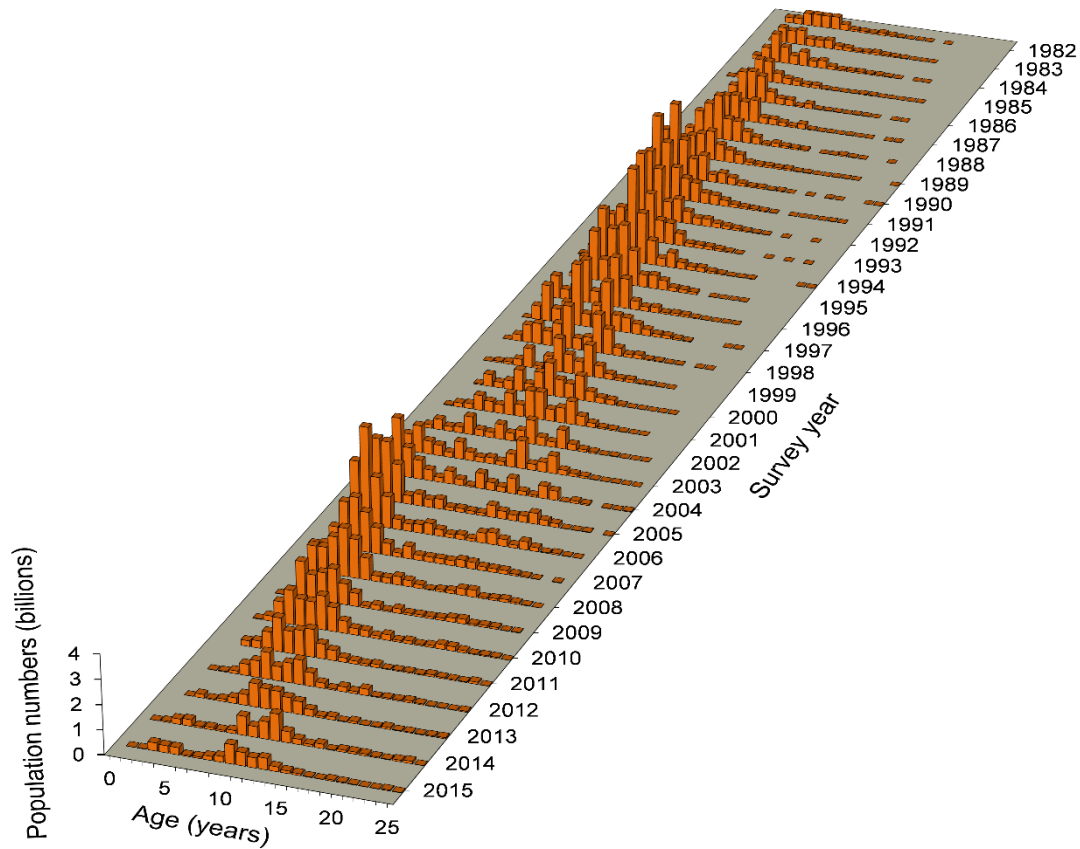
males



females



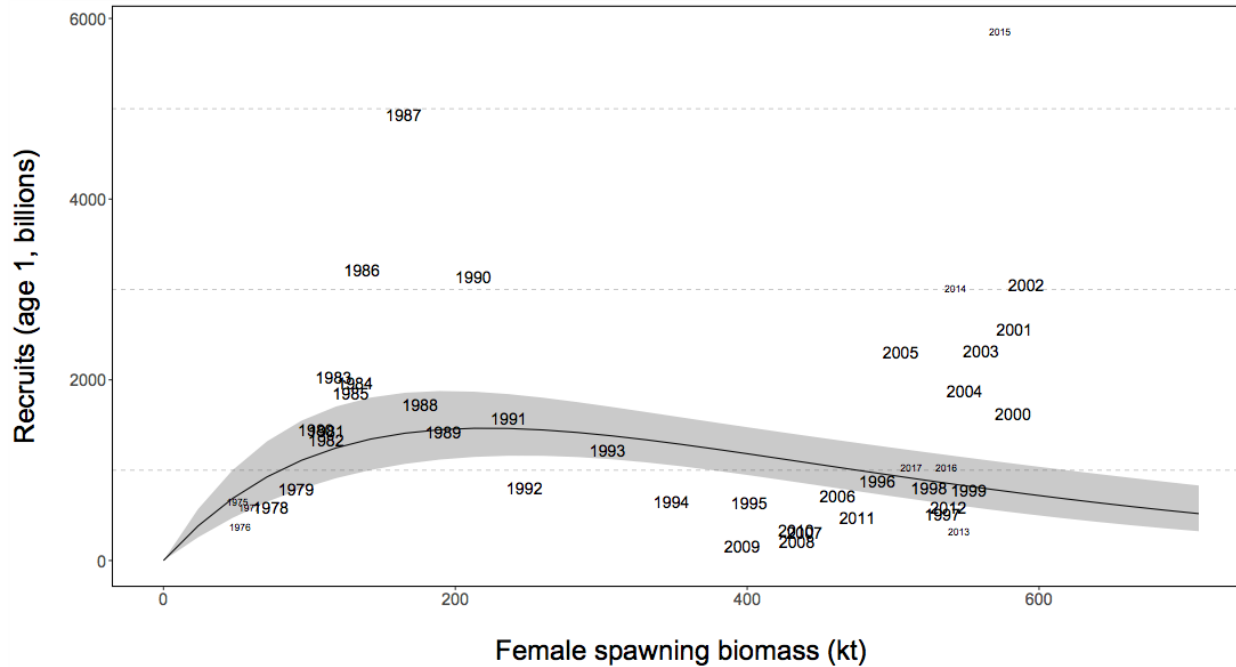
Survey age composition



STOCK ASSESSMENT MODEL

- ⦿ Data components include fishery and trawl survey age compositions and survey biomass and standard error
- ⦿ Split-sex model, selectivity is fixed asymptotic for older fish
- ⦿ Ricker form of the stock-recruitment curve is fit inside the model
- ⦿ Gender-specific time-variant fishery selectivity
- ⦿ Catchability (q) is constrained to a value near the estimate of q from a trawl herding experiment using the shelf survey trawl (Somerton and Munro 2001)
- ⦿ Natural mortality is estimated as free parameters in some model runs and fixed at 0.15 in other runs

RICKER SPAWNER-RECRUIT FIT



Data fit: 1978-2012

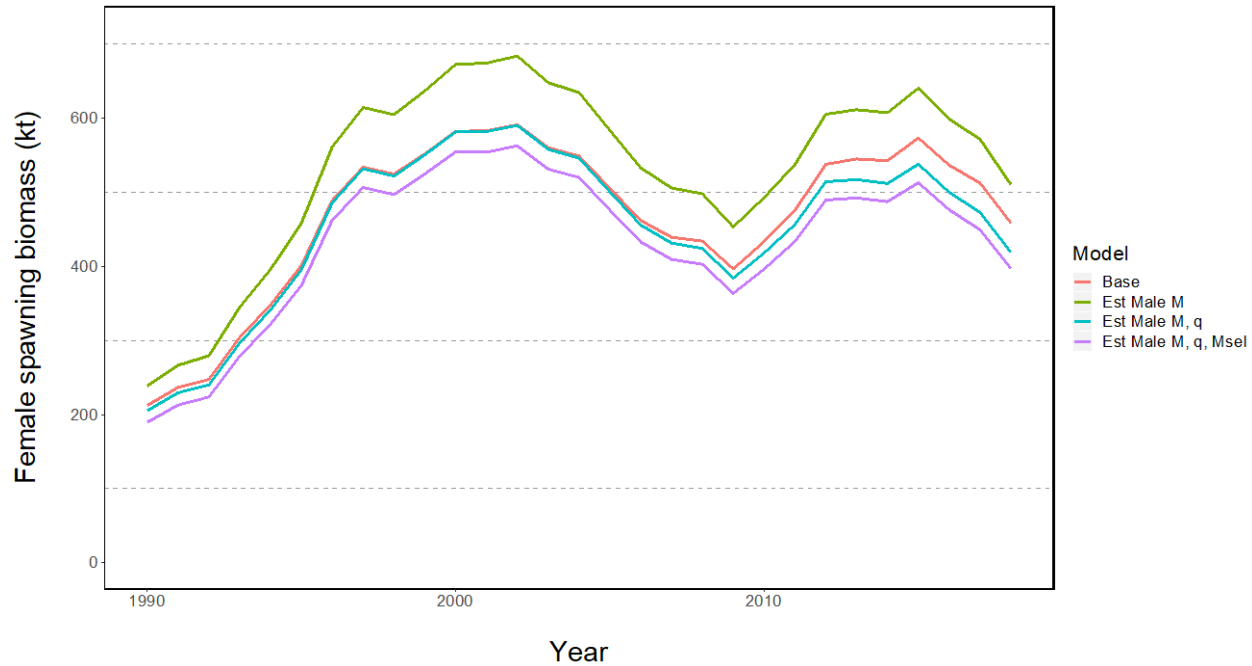
Bmsy=186,000 t

MODEL EVALUATION

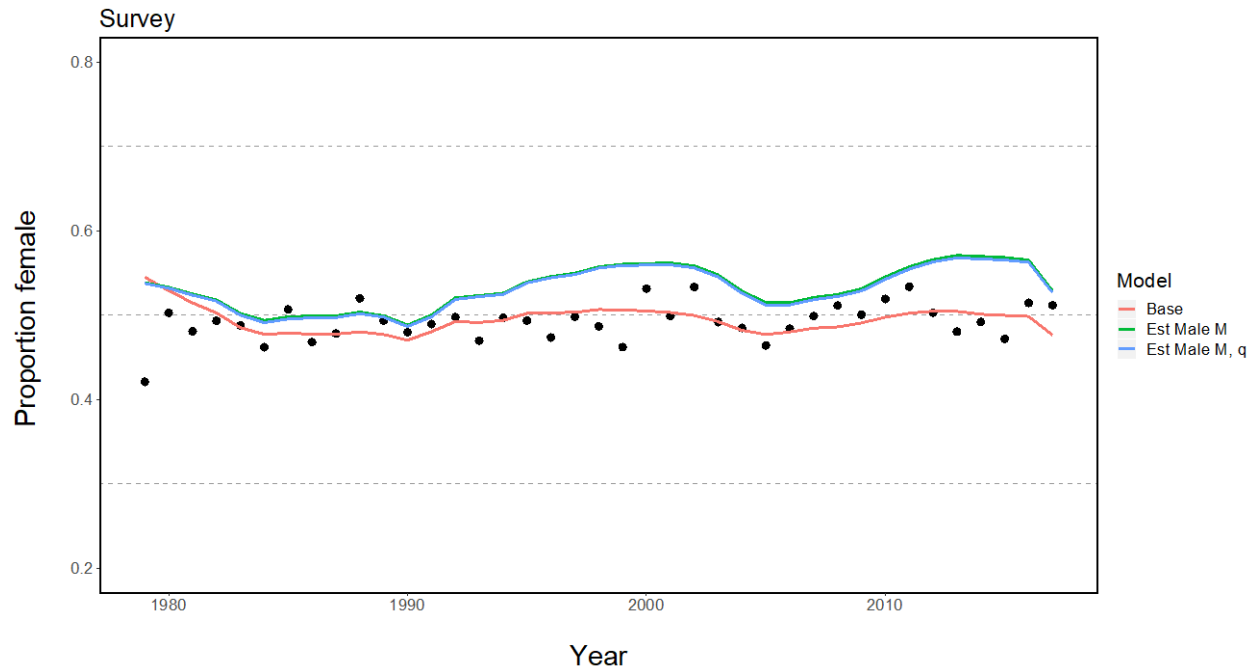
Model	Description	Number of parameters	Fishery	Survey	Survey	Priors	Total
			age	age	biomas s		
15.1	Base	366	138	0	17	0	125
18.1	Est. male M	367	14	16	6	0	25
18.2	Est. male M, q	367	3	11	0	9	11
18.3	Est. male M, q, and male sel.	368	0	1	1	10	0
18.4	Ensemble	NA	39	7	6	5	40

model	ABC	OFL
15.1	118,900	122,000
18.1	118,500	121,200
18.2	90,700	92,700
18.3	103,500	105,700
18.4	107,900	110,400

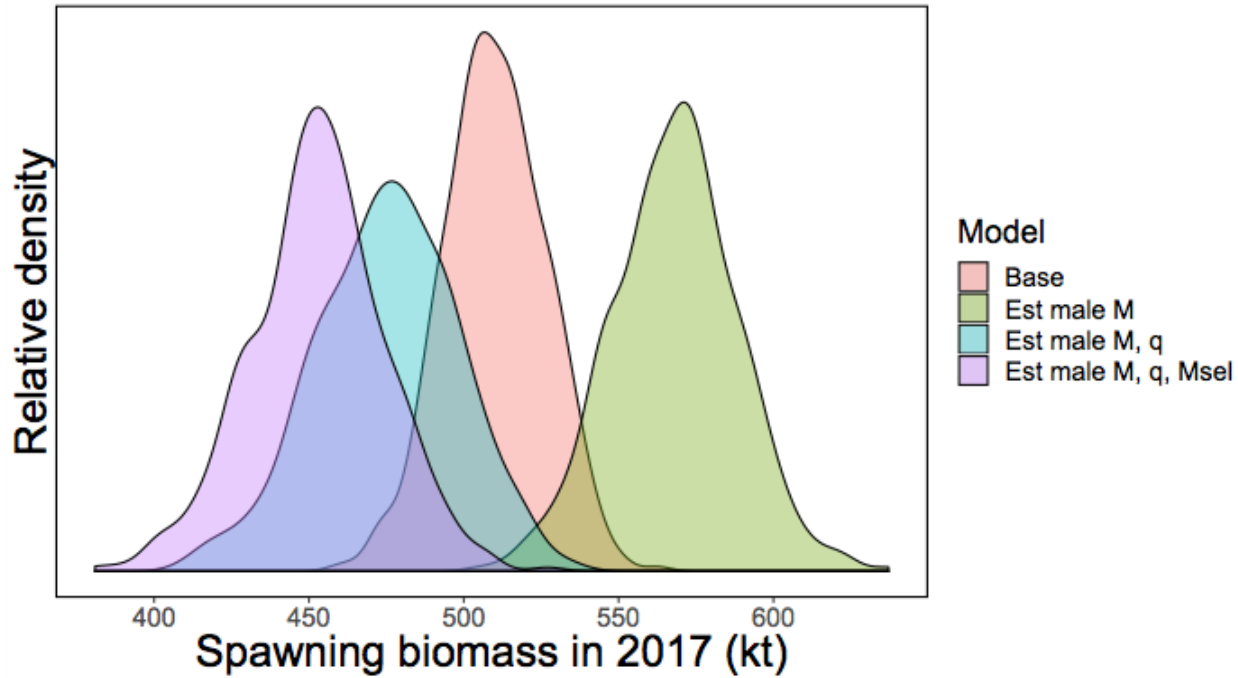
MODEL ESTIMATES OF FSB



FITS TO SURVEY SEX RATIO



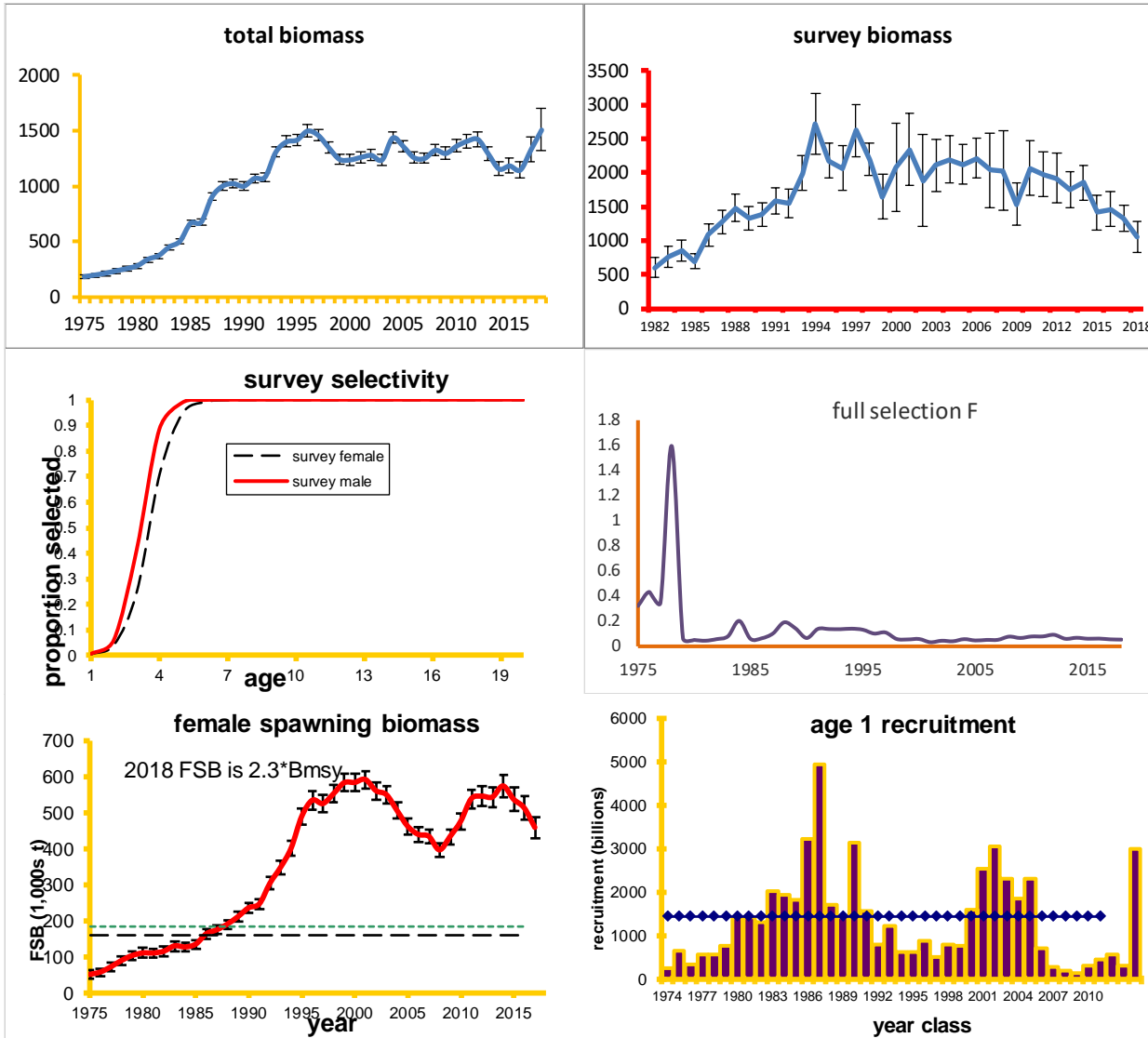
POSTERIOR DISTRIBUTIONS



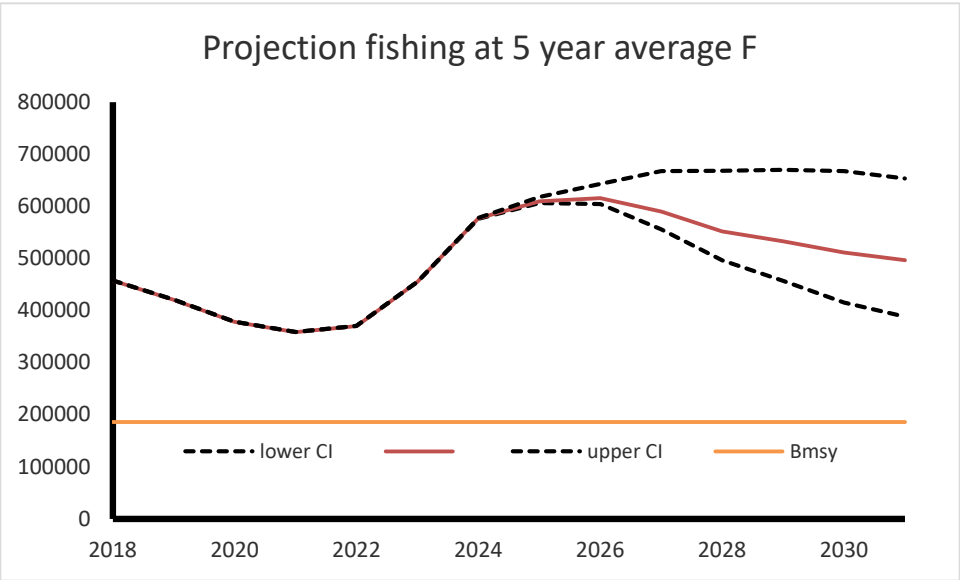
Reasons to continue using Model 15.1 for 2019 fishing season.

- 1) Has been the accepted model for 4 years
- 2) Provides estimates of FSB, ABC and OFL close to the other model runs
- 3) Has a better fit to survey and population sex ratio and survey age composition
- 4) Since northern rock sole is a biennial assessment it would give more time to consider the ensemble model and model 18.3, models that may be more appropriate for future assessments

Model 15.1 Results

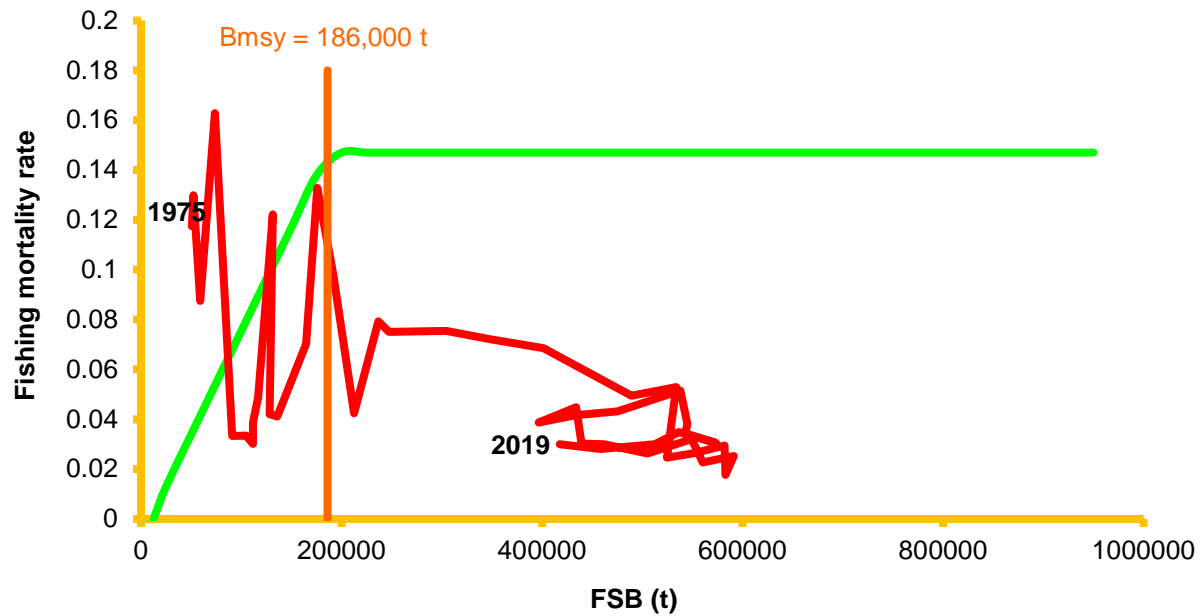


PROJECTED FEMALE SPAWNING BIOMASS

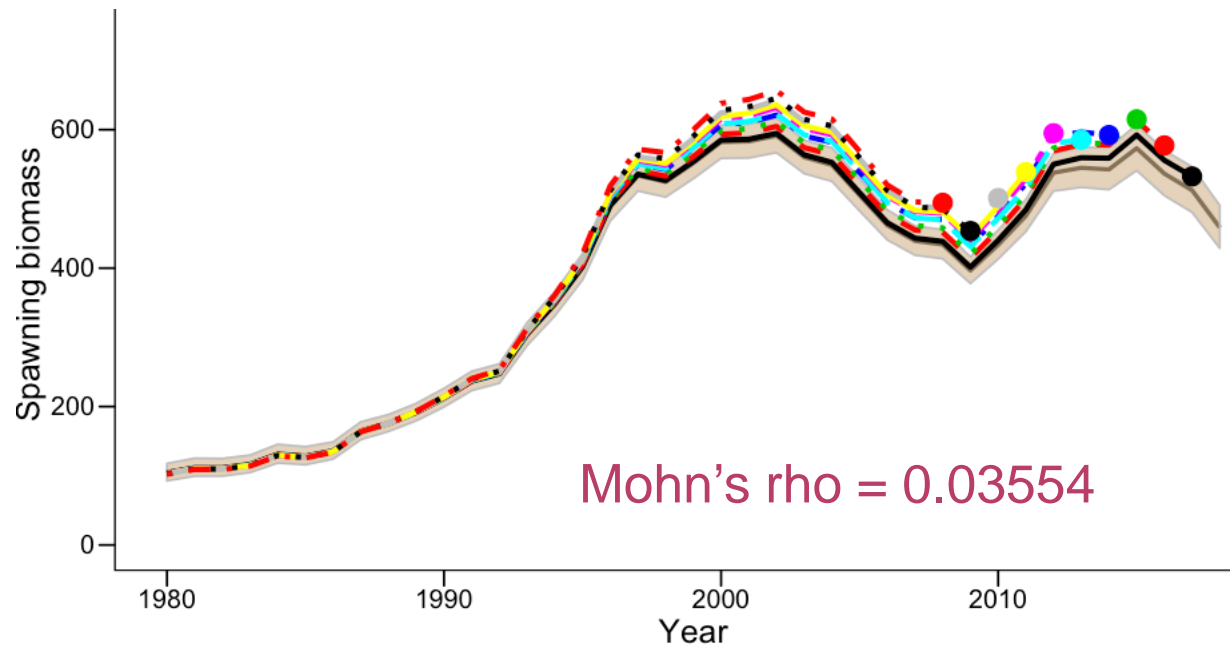


FSB AND F HISTORY RELATIVE TO B_{MSY}

phase plane diagram for northern rock sole



BSAI NORTHERN ROCK SOLE



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