

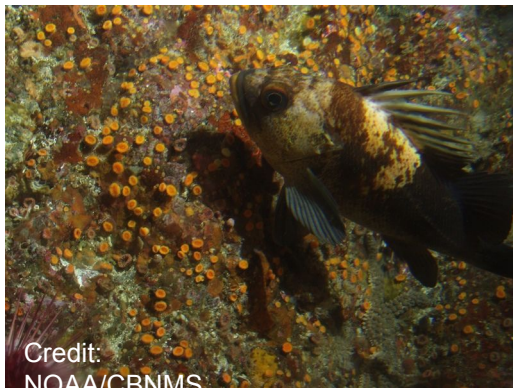
**NOAA
FISHERIES**

California Quillback Rockfish Rebuilding Analysis

**Mop Up Panel
September 29-30, 2021**

**Dr. Brian Langseth
Dr. Chantel Wetzel**

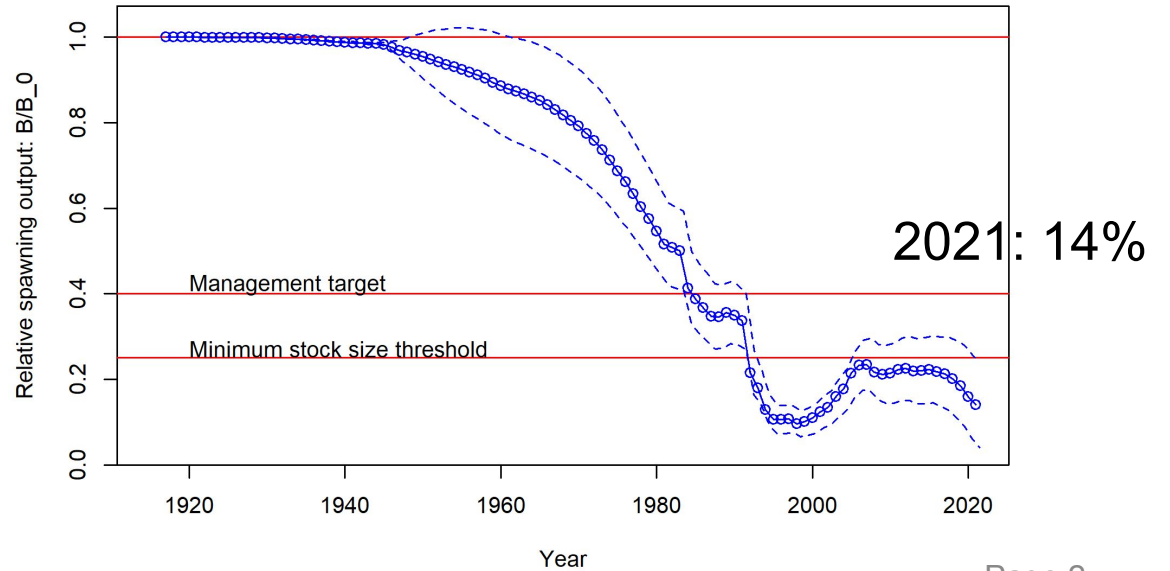
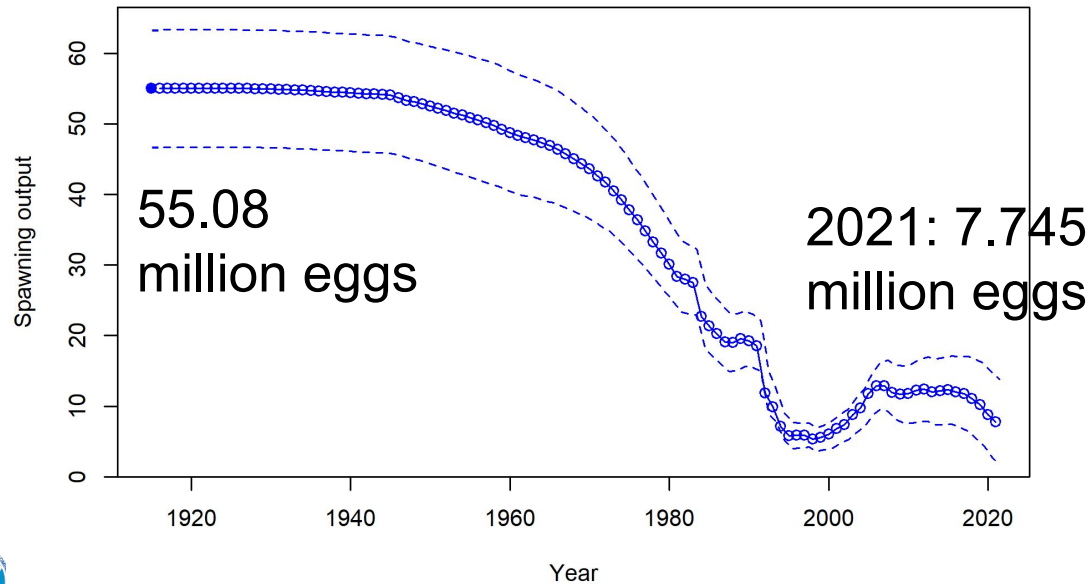
**NOAA Fisheries
Northwest Fisheries Science Center**



Credit:
NOAA/CBNMS

Rebuilding specifications

- Based on approved CA base model
- Rebuilding software version 3.12h (August 2021)
- 2021-2022 catches pre-specified at GMT recommended values (13.5 mt)



Applicable rebuilding alternative strategies

Dark text = Specified in the TOR

Light text = Additional strategies

Asterisk (*) = Requires $SPR < 0.5$ so not done

- 1) Eliminated all harvest beginning in the next management cycle (i.e. estimate $TF=0$), the same as setting a constant SPR harvest rate of 1.0
- * 2) Applied the harvest rate that would generate the ACL contributions specified for the current year
- 3) Apply a range of SPR values (0.5, 0.6, 0.7, 0.8, 0.9)
- 4) Applied the harvest rate that is estimated to lead to a 50% probability of recovery by alternative target years
 - * a) by T MAX from the current cycle
 - b) by T MID from the current cycle
- 5) Applied the 40-10 harvest policy based on category 2 $\sigma = 1.0$ and $P^* = 0.45$
- 6) Applied the ABC harvest rate based on category 2 $\sigma = 1.0$ and $P^* = 0.45$

Rebuilding alternative strategies not done

Specified in TOR but not applicable

- A) Applied the spawning potential ratio or relevant harvest control rule in the current rebuilding plan
- B) Applied the harvest rate that is estimated to lead to a 50% probability of recovery by the current T TARGET
- C) Applied the harvest rate that is estimated to lead to a 50% probability of recovery by the T MAX from the previous cycle

Rebuilding alternative strategies

- All runs assume full attainment
- All runs include uncertainty in starting values based on M states of nature
 - 25% of simulations from low state ($M = 0.0464$)
 - 50% of simulations from base ($M = 0.057$)
 - 25% of simulations from high state ($M = 0.0744$)

Rebuilding Reference Points

Table 1: Summary of the base rebuilding reference points.

Quantity	2021 Assessment Values
SB0 (millions of eggs)	55.08
SB40 (millions of eggs)	22.035
SB2021 (millions of eggs)	7.745
Year rebuilding begins	2023
Current year	2021
Tmin	2040
Mean generation time (years)	26
Tmax	2066
TF=0	2040
Ttarget	TBD
SPRtarget	TBD
Current SPR (2021)	0.1165

Alternative Rebuilding Strategies

Table 2: Results of base rebuilding alternatives based on alternative SPR targets for 50 percent probability of recovery based on the assumed removals for 2021-22. SPR for the ABC and 40-10 strategies is provided as a dash (-) because these strategies do not have a constant SPR value

	SPR=.500	SPR=.600	SPR=.700	SPR=.800	SPR=.900	Yr=Tmid F=0	40-10 rule	ABC Rule
2021 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2022 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2023 ACL (mt)	2.05	1.42	0.94	0.56	0.25	1.52	0	1.79
2024 ACL (mt)	2.24	1.57	1.05	0.63	0.29	1.68	0	1.95
SPR	0.5	0.6	0.7	0.8	0.9	0.581	1	-
Ttarget	2065	2051	2046	2043	2042	2053	2040	2051
Tmax	2066	2066	2066	2066	2066	2066	2066	2066
Probability of recovery by Tmax	0.525	0.897	0.979	0.999	1	0.852	1	0.821

- Time series of quantities in Table 3-6, Figures 1-4

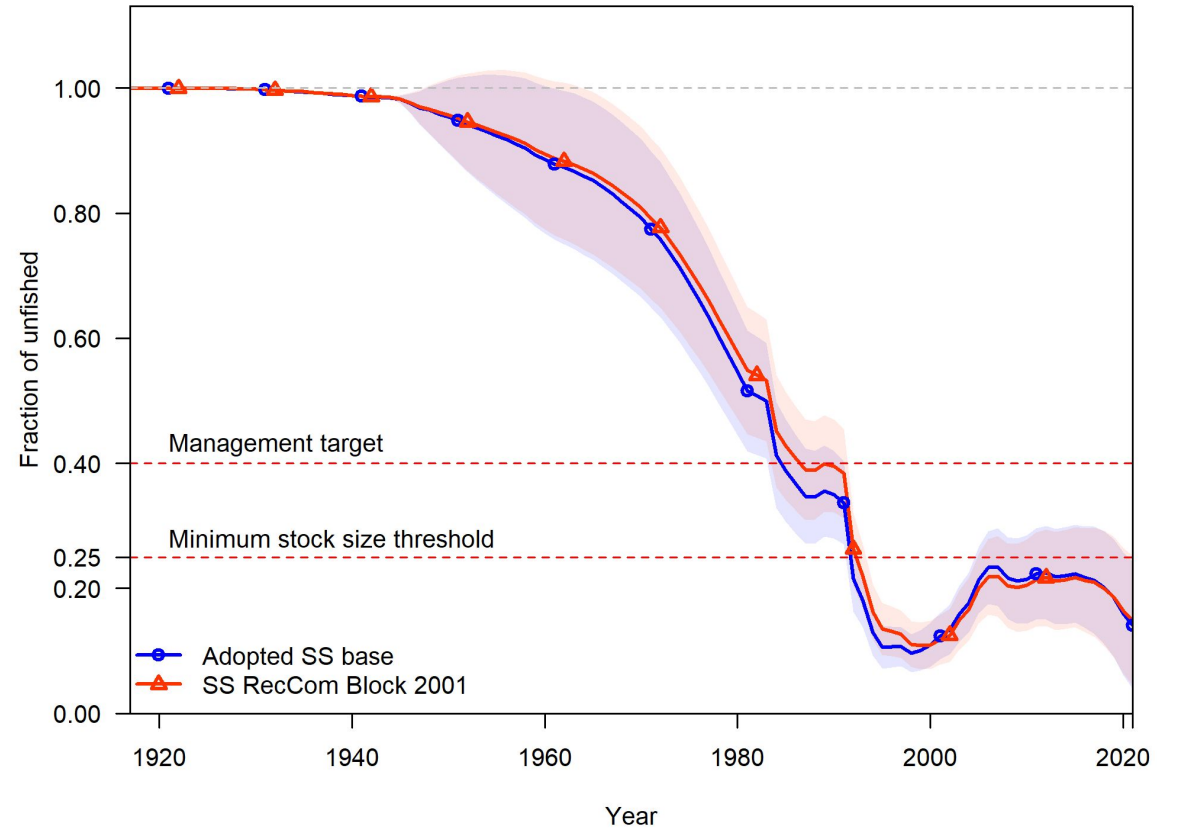
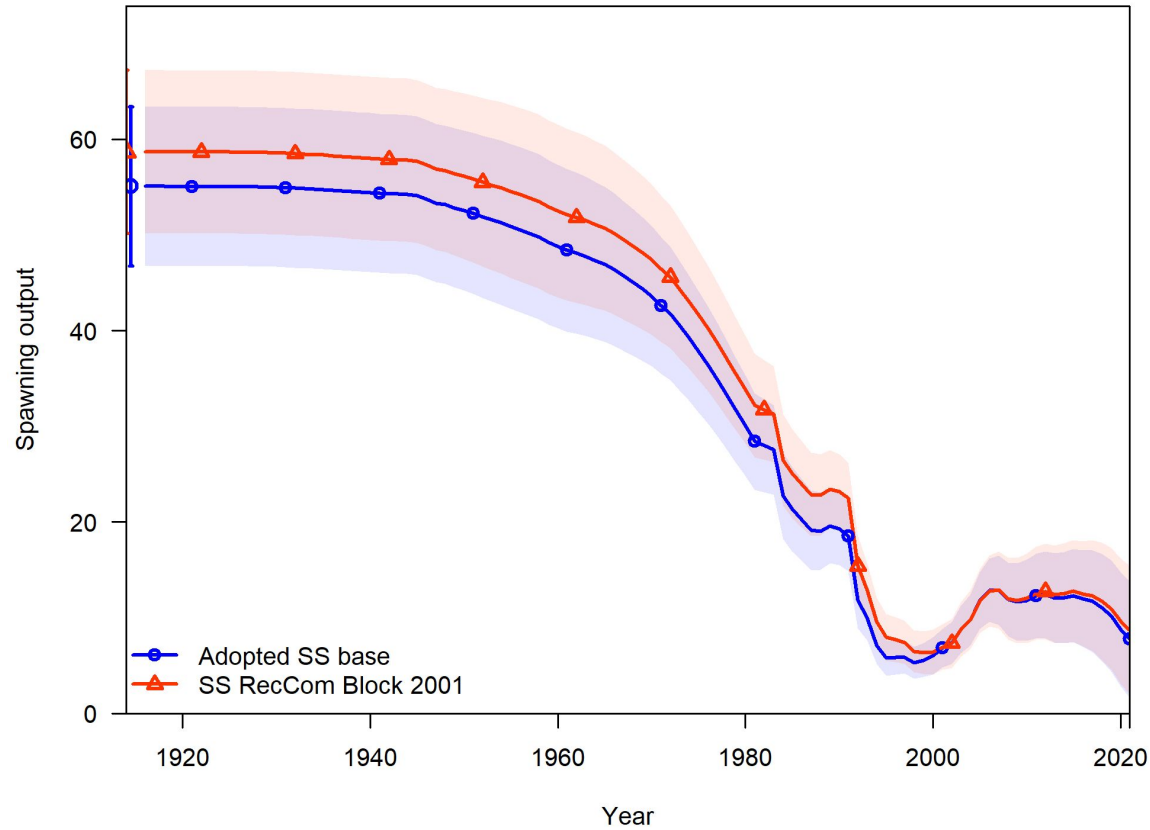
Rebuilding sensitivity run

Rebuilding sensitivity run

- Repeat rebuilding analysis on sensitivity run
 - Rec/Comm selectivity blocked at 2001 with asymptotic selectivity (1916-2000) and dome shape selectivity (2001-2020)
- Alternative states of nature not applied

- SS sensitivity model is similar to adopted SS base model
 - Does not warrant a change to base model

Comparing Sensitivity SS results



Sensitivity Reference Points

Base

Table 1: Summary of the base rebuilding reference points.

Quantity	2021 Assessment Values
SB0 (millions of eggs)	55.08
SB40 (millions of eggs)	22.035
SB2021 (millions of eggs)	7.745
Year rebuilding begins	2023
Current year	2021
Tmin	2040
Mean generation time (years)	26
Tmax	2066
TF=0	2040
Ttarget	TBD
SPRtarget	TBD
Current SPR (2021)	0.1165

Sensitivity

Table 7: Summary of the rebuilding sensitivity reference points

Parameter	2021 Assessment Values
SB0 (millions of eggs)	58.69
SB40 (millions of eggs)	23.475
SB2021 (millions of eggs)	8.71
Year rebuilding begins	2023
Current year	2021
Tmin	2039
Mean generation time (years)	27
Tmax	2066
TF=0	2039
Ttarget	TBD
SPRtarget	TBD
Current SPR (2021)	0.1367

← 1 year difference →

← Due to applying alternative M values →

Sensitivity Rebuilding Strategies

ACLs and probabilities higher than base due to starting at higher SB and nearer to SB40

Base	SPR=.500	SPR=.600	SPR=.700	SPR=.800	SPR=.900	Yr=Tmid F=0	40-10 rule	ABC Rule
2021 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2022 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2023 ACL (mt)	2.05	1.42	0.94	0.56	0.25	1.52	0	0.04
2024 ACL (mt)	2.24	1.57	1.05	0.63	0.29	1.68	0	0.33
SPR	0.5	0.6	0.7	0.8	0.9	0.581	1	-
Ttarget	2065	2051	2046	2043	2042	2053	2040	2051
Tmax	2066	2066	2066	2066	2066	2066	2066	2066
Probability of recovery by Tmax	0.525	0.897	0.979	0.999	1	0.852	1	0.821

Ttargets 1-3 years earlier than base

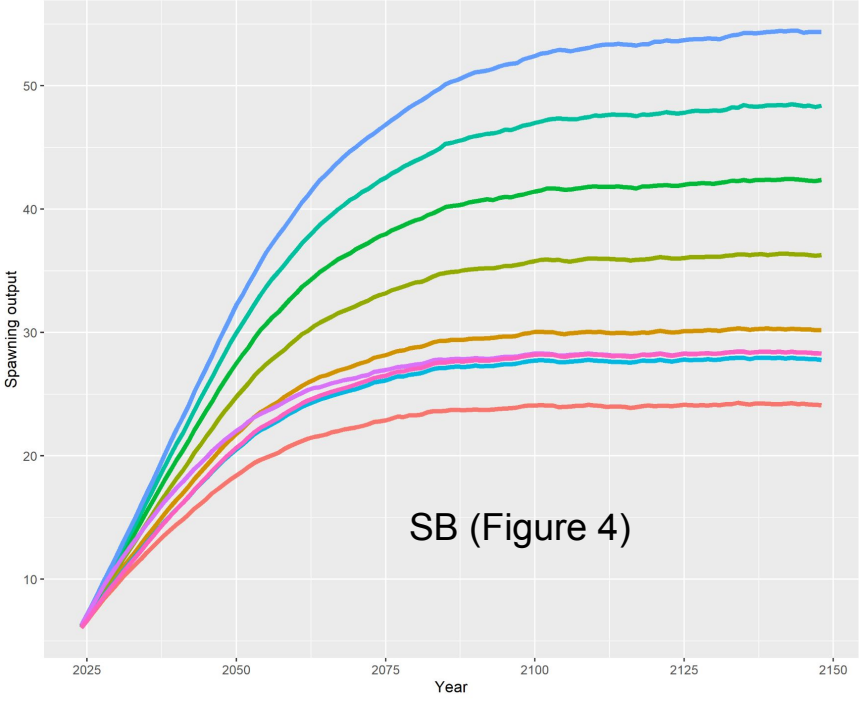
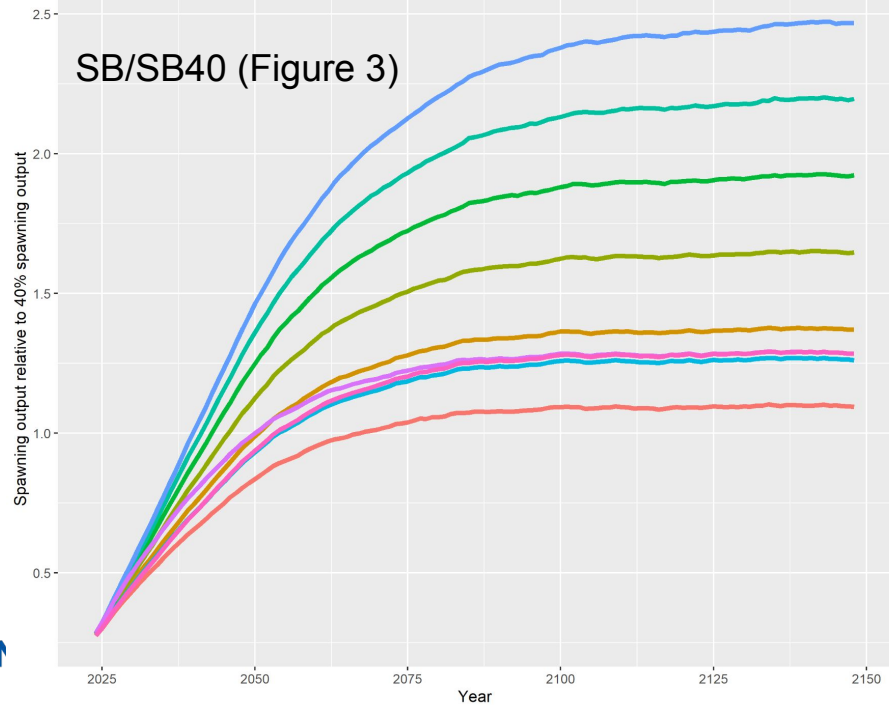
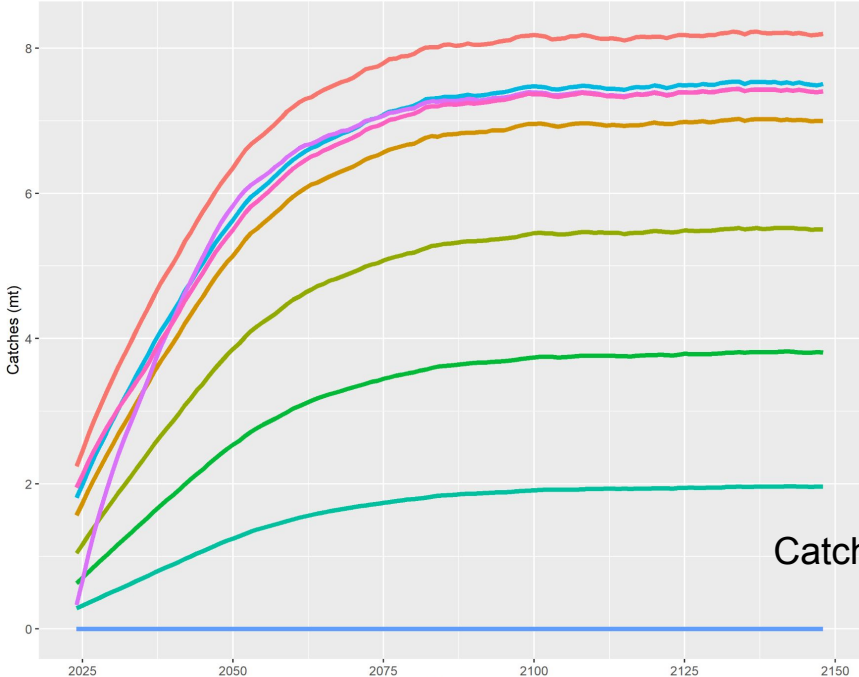
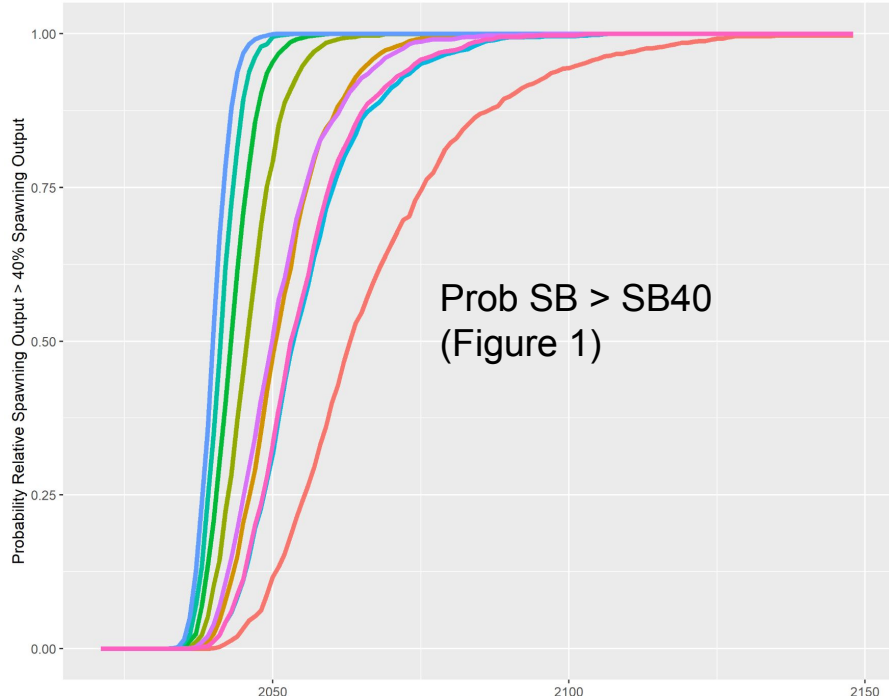
Sensitivity	SPR=.500	SPR=.600	SPR=.700	SPR=.800	SPR=.900	Yr=Tmid F=0	40-10 rule	ABC Rule
2021 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2022 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2023 ACL (mt)	2.45	1.69	1.12	0.67	0.3	1.71	0	0.38
2024 ACL (mt)	2.66	1.86	1.24	0.75	0.34	1.88	0	0.7
SPR	0.5	0.6	0.7	0.8	0.9	0.597	1	-
Ttarget	2062	2050	2045	2042	2040	2050	2039	2049
Tmax	2066	2066	2066	2066	2066	2066	2066	2066
Probability of recovery by Tmax	0.608	0.96	0.997	1	1	0.956	1	0.901

Ttargets are 1-2 year earlier than base if base done without states of nature

Questions/Comments?

Extra slides

Base rebuilder slides



Tables for base without states of nature

Table 1: Summary of the base rebuilding reference points.

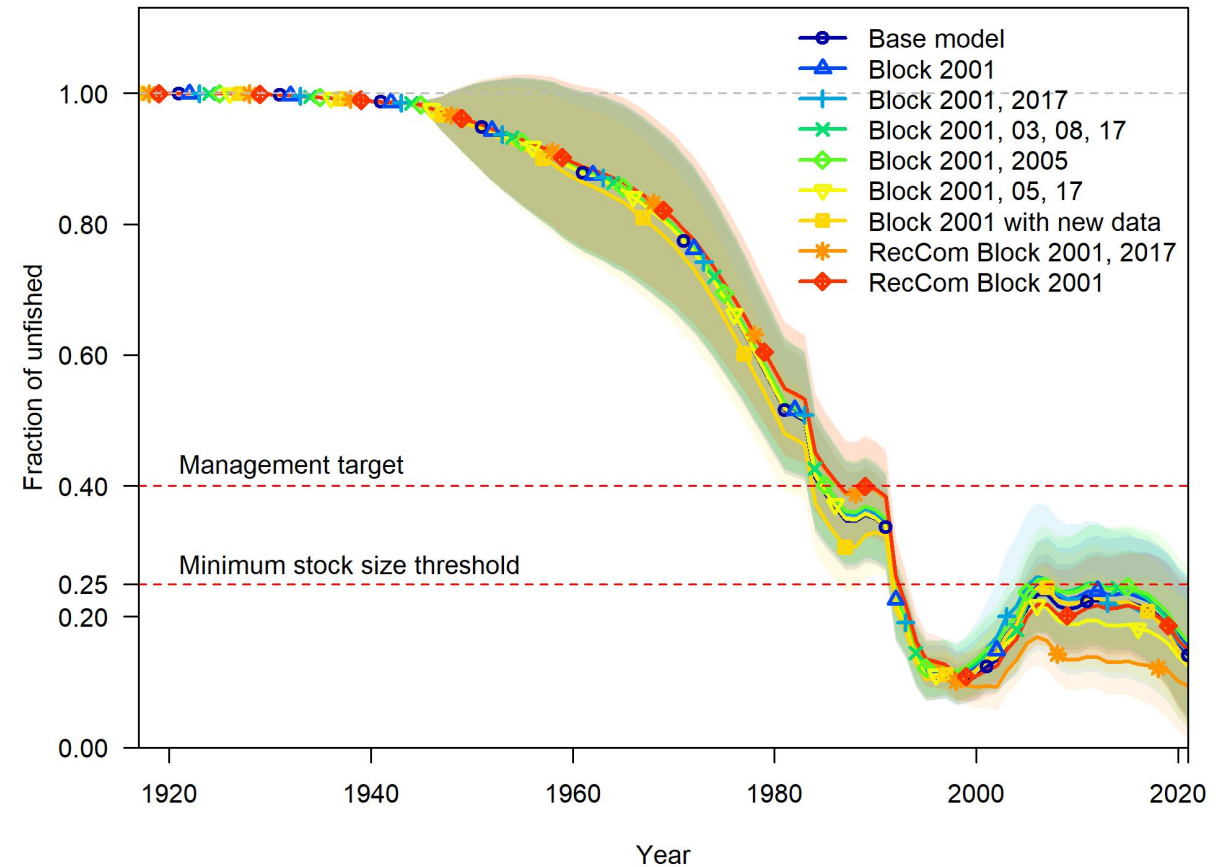
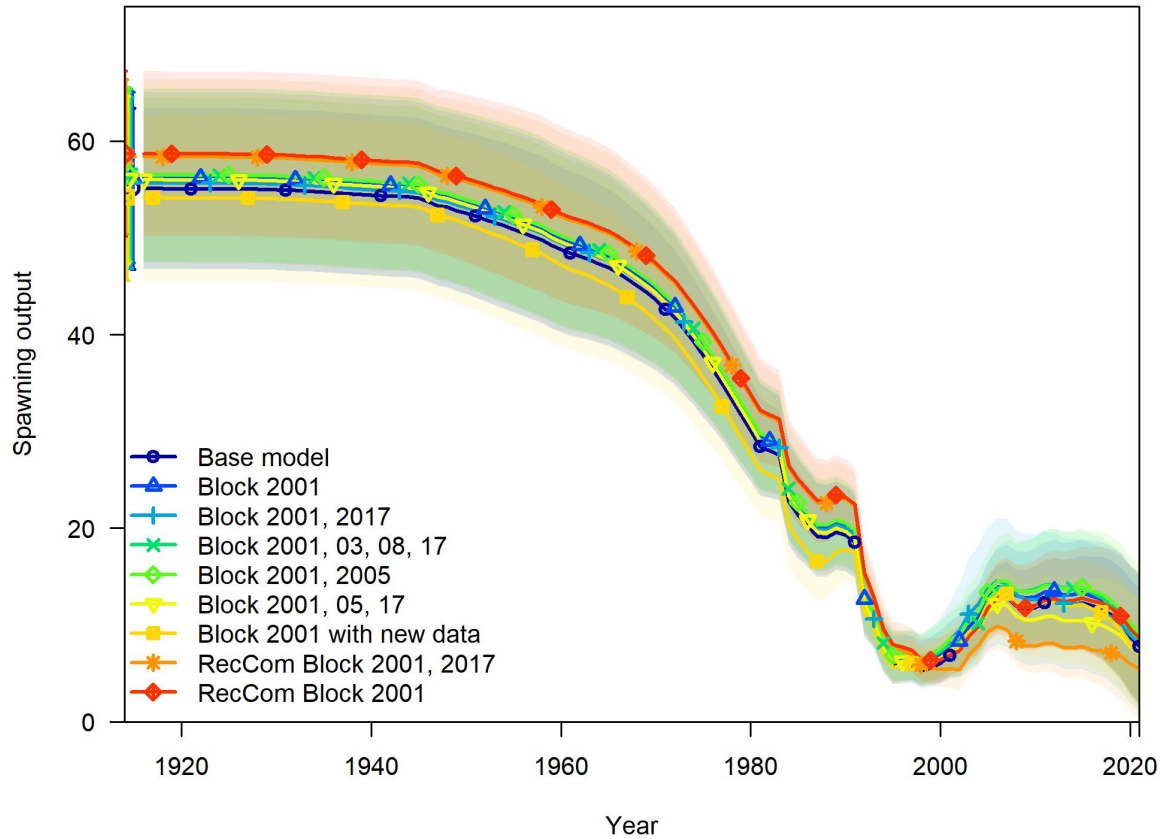
Quantity	2021 Assessment Values
SB0 (millions of eggs)	55.08
SB40 (millions of eggs)	22.035
SB2021 (millions of eggs)	7.745
Year rebuilding begins	2023
Current year	2021
Tmin	2040
Mean generation time (years)	27
Tmax	2067
TF=0	2040
Ttarget	TBD
SPRtarget	TBD
Current SPR (2021)	0.1165

Table 2: Results of base rebuilding alternatives based on alternative SPR targets for 50 percent probability of recovery based on the assumed removals for 2021-22. SPR for the ABC and 40-10 strategies is provided as a dash (-) because these strategies do not have a constant SPR value

	SPR=.500	SPR=.600	SPR=.700	SPR=.800	SPR=.900	Yr=Tmid F=0	40-10 rule	ABC Rule
2021 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2022 Assumed Removals (mt)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
2023 ACL (mt)	2.05	1.42	0.94	0.56	0.25	1.64	0	1.79
2024 ACL (mt)	2.24	1.57	1.05	0.63	0.29	1.81	0	1.95
SPR	0.5	0.6	0.7	0.8	0.9	0.561	1	-
Ttarget	2064	2051	2046	2043	2042	2054	2040	2050
Tmax	2067	2067	2067	2067	2067	2067	2067	2067
Probability of recovery by Tmax	0.596	0.959	0.997	1	1	0.881	1	0.894

Model results from SS model used as rebuilder sensitivity

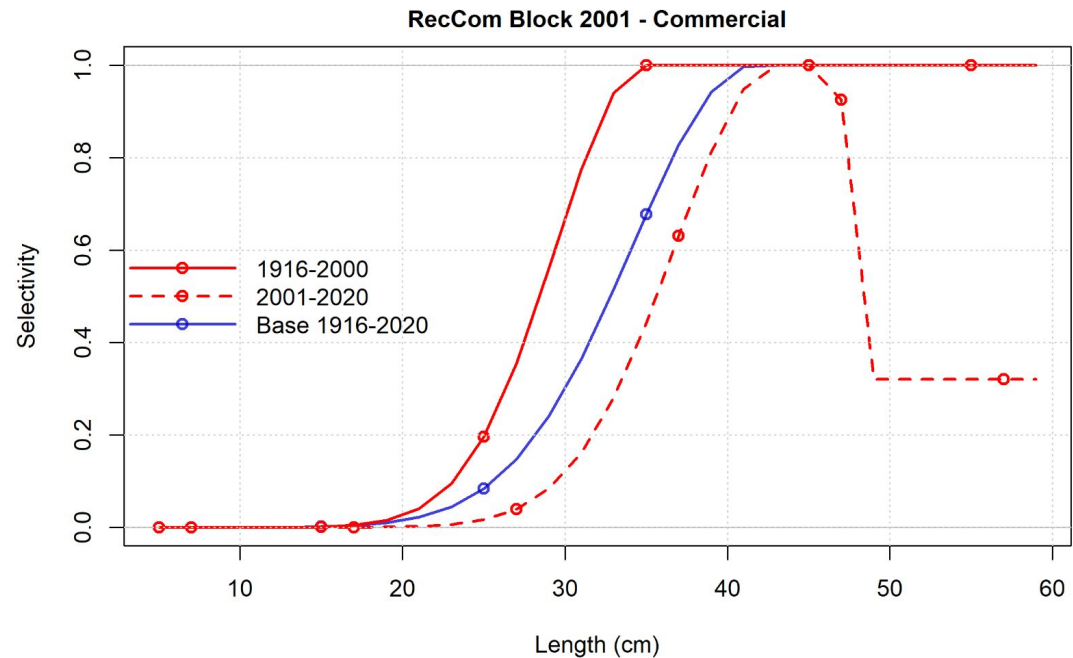
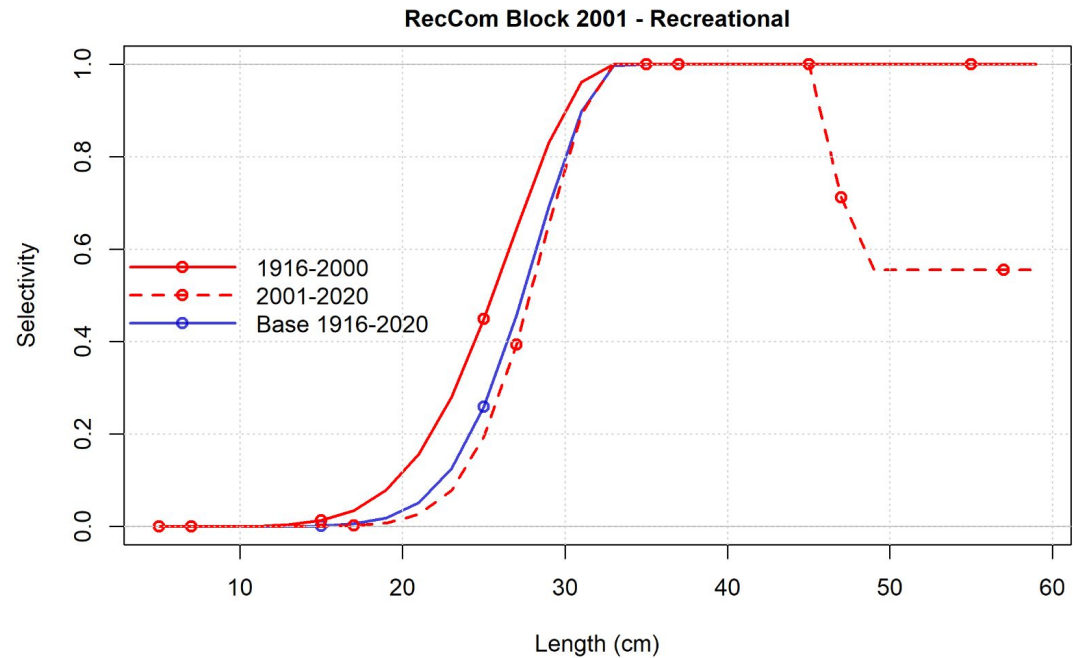
Sensitivity not very different from other blocking sensitivities



No different

Compare Sensitivity Selectivity

- Recreational selectivity has moderate dome. Generally similar sizes.
- Commercial selectivity has greater dome. Large size shifted, with narrower size selection in recent years



Parameter Table

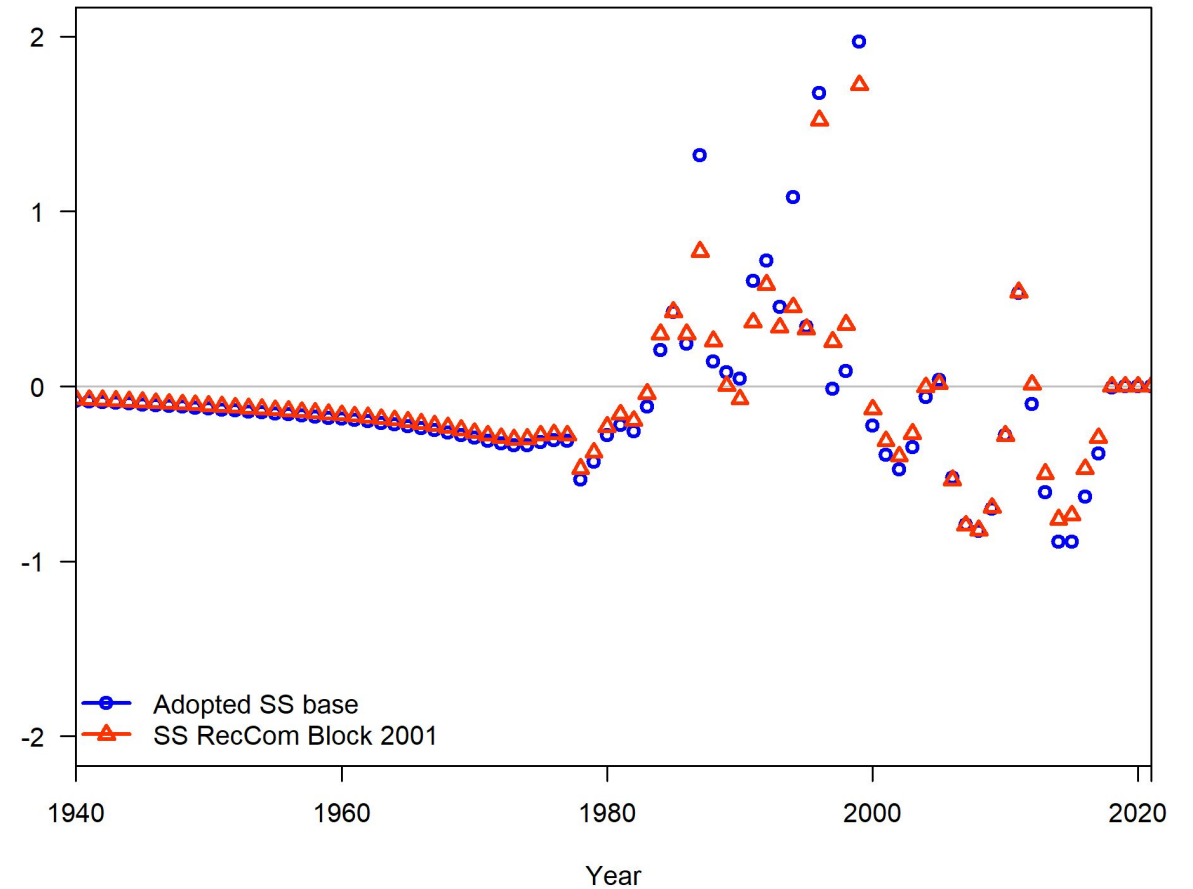
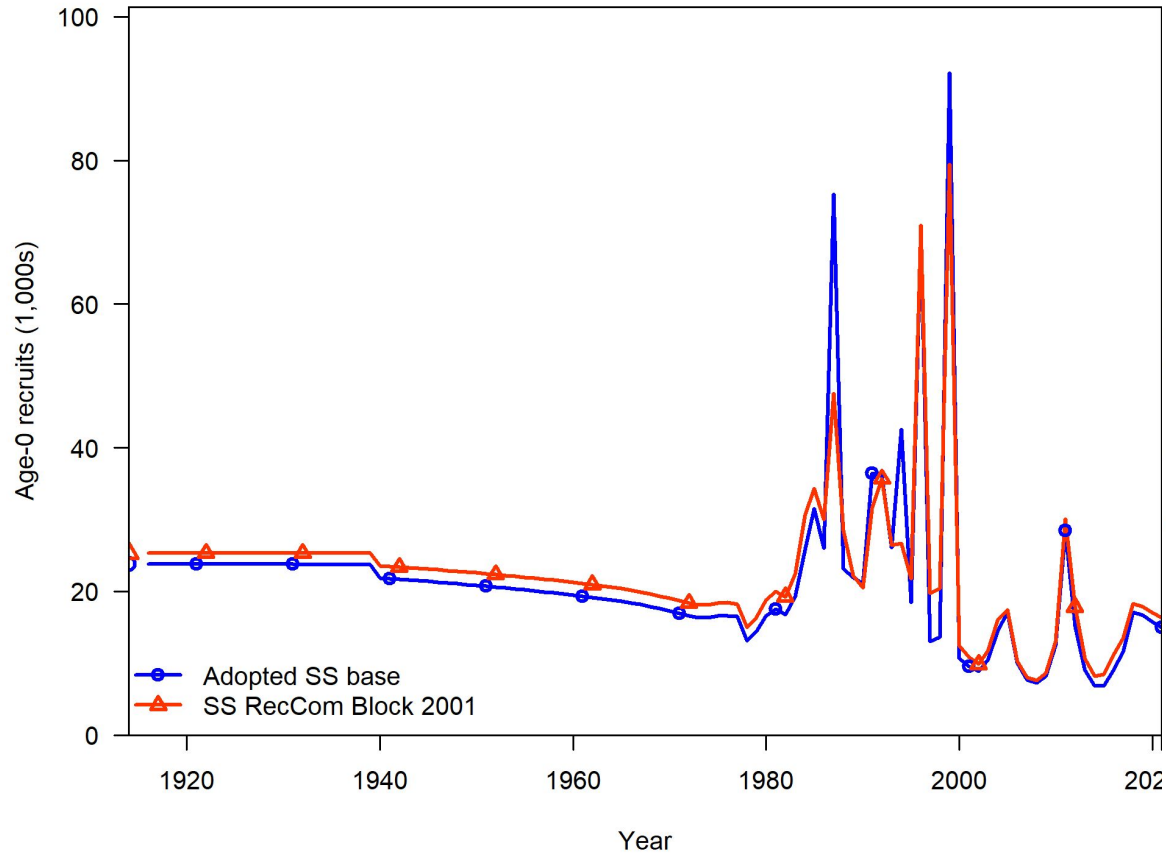
If added to Table 5
from Aug 17 report



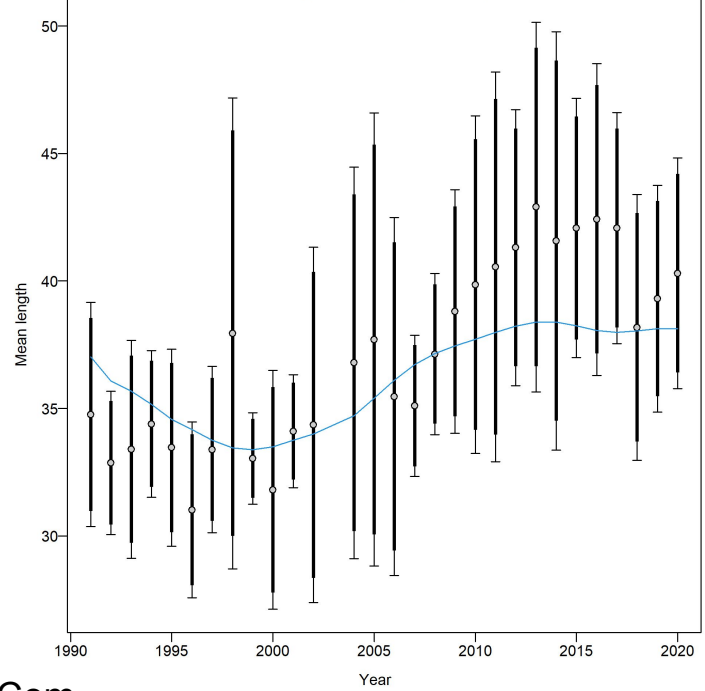
Table 5: Parameter values and derived quantities from requested explorations for adding CPFV central California length data, and blocking of recreational selectivity, and the adopted base model.

	Base model	DebWV	DebWV reweight	DebWV, Block 2001	Block 2001	Block 2001, 2017	Block 2001, 03, 08, 17	Block 2001, 2005	Block 2001, 05, 17	RecCom Block 2001, 2017	SS RecCom Block 2001
Total Likelihood	186.85	210.52	231.63	194.87	181.16	176.78	167.37	179.26	176.09	159.10	168.92
Length Likelihood	163.10	178.14	195.73	165.89	158.82	153.37	146.66	157.20	153.77	144.03	152.53
Recruitment Likelihood	23.75	32.39	35.90	28.98	22.35	23.40	20.71	22.05	22.31	15.07	16.39
Parameter Bounds Likelihood	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
N parms	98.00	98.00	98.00	103.00	103.00	107.00	118.00	108.00	113.00	118.00	108.00
AIC	569.70	617.04	659.27	595.74	568.33	567.55	570.74	574.51	578.17	554.20	553.84
delta AIC	0.00	NA	NA	NA	-1.38	-2.15	1.04	4.81	8.47	-15.50	-15.86
ln(R0)	3.17	3.12	3.10	3.15	3.19	3.18	3.19	3.19	3.18	3.23	3.23
SB Virgin	55.08	52.40	51.54	54.16	56.23	55.66	56.48	56.54	56.01	58.38	58.69
SB 2021	7.75	6.31	6.42	6.88	8.58	8.13	8.36	9.12	6.98	5.47	8.71
Fraction Unfished 2021	0.14	0.12	0.12	0.13	0.15	0.15	0.15	0.16	0.12	0.09	0.15
Total Yield at SPR 50	8.41	8.00	7.89	8.10	8.38	8.64	8.34	8.38	8.78	10.02	8.79
Peak commercial selex	41.57	42.72	43.03	41.78	40.79	40.80	40.58	40.49	41.58	45.57	43.06
Ascend se commercial selex	4.71	4.76	4.78	4.73	4.67	4.65	4.68	4.66	4.73	3.86	4.38
Peak recreational selex 2020	33.36	32.71	32.81	32.65	32.64	40.31	32.12	32.63	44.14	45.81	33.13
Ascend se recreational selex 2020	3.95	3.89	3.90	3.64	3.64	4.68	3.11	3.67	5.04	4.94	3.70

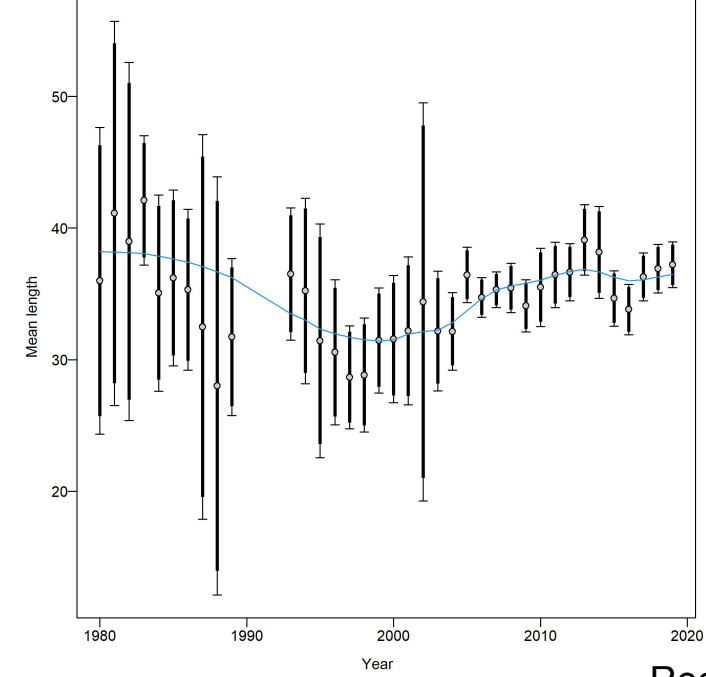
Compare sensitivity recruitment



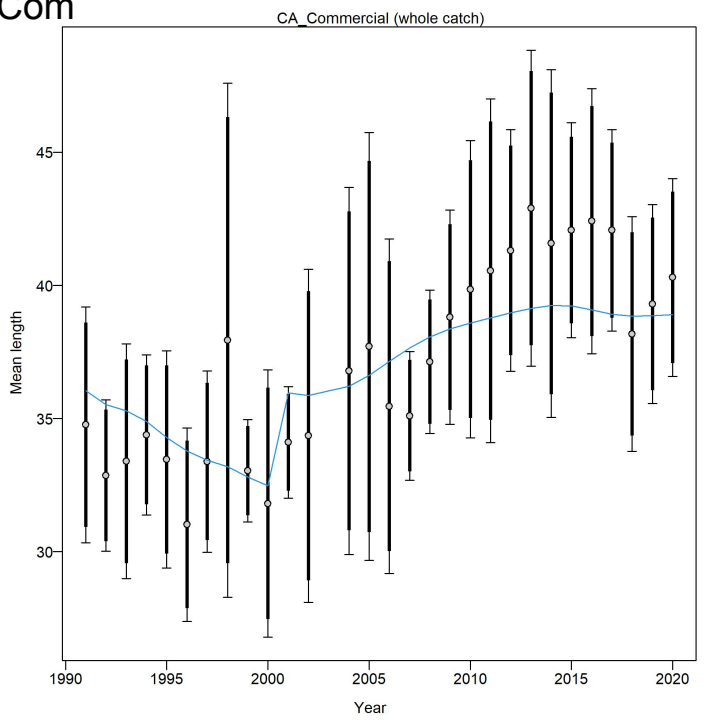
Commercial base



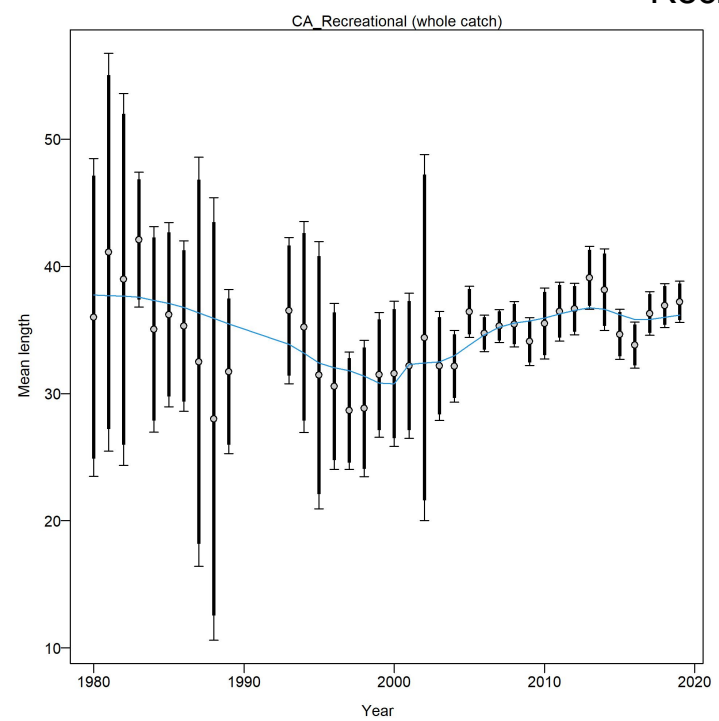
Recreational base



Commercial RecCom
Block 2001

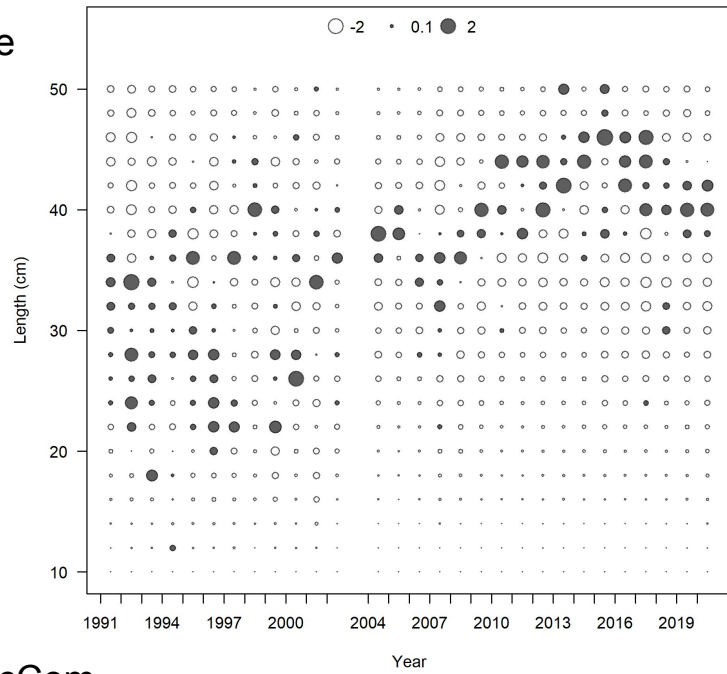


Recreational RecCom
Block 2001

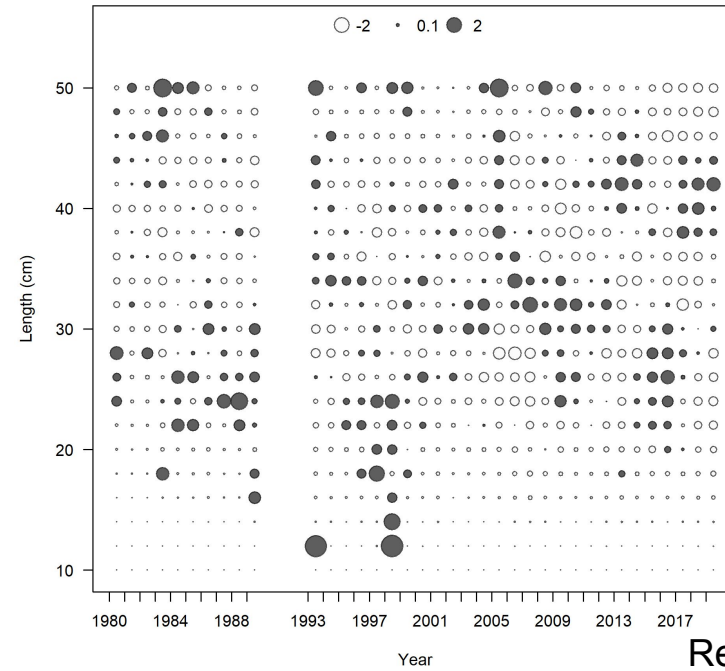


Block in 2001
not well-aligned
with change in
data

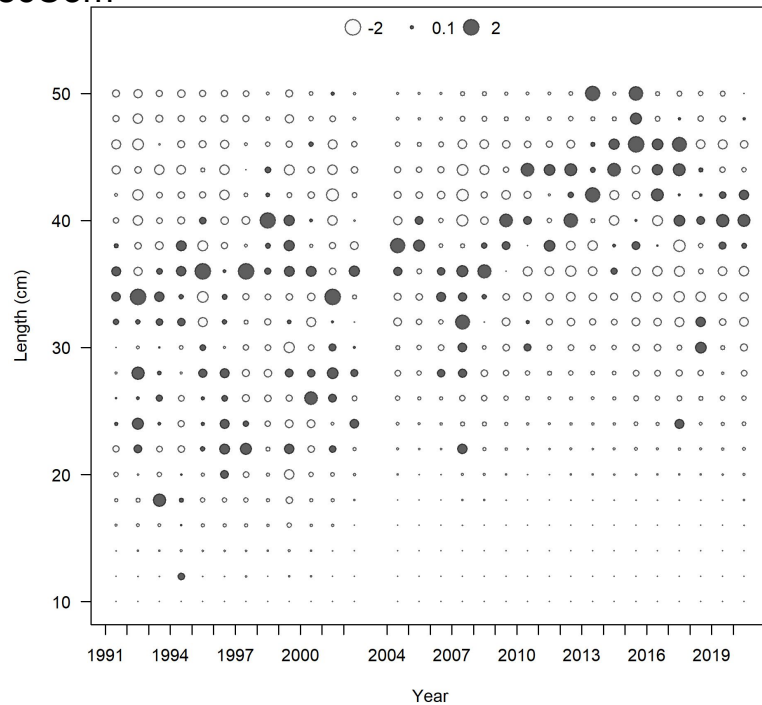
Commercial base



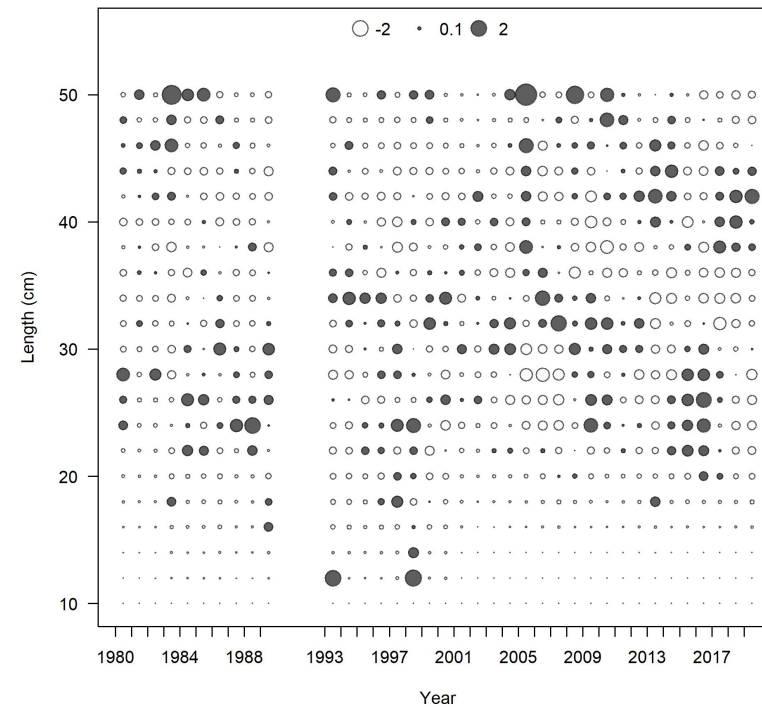
Recreational base



Commercial RecCom Block 2001

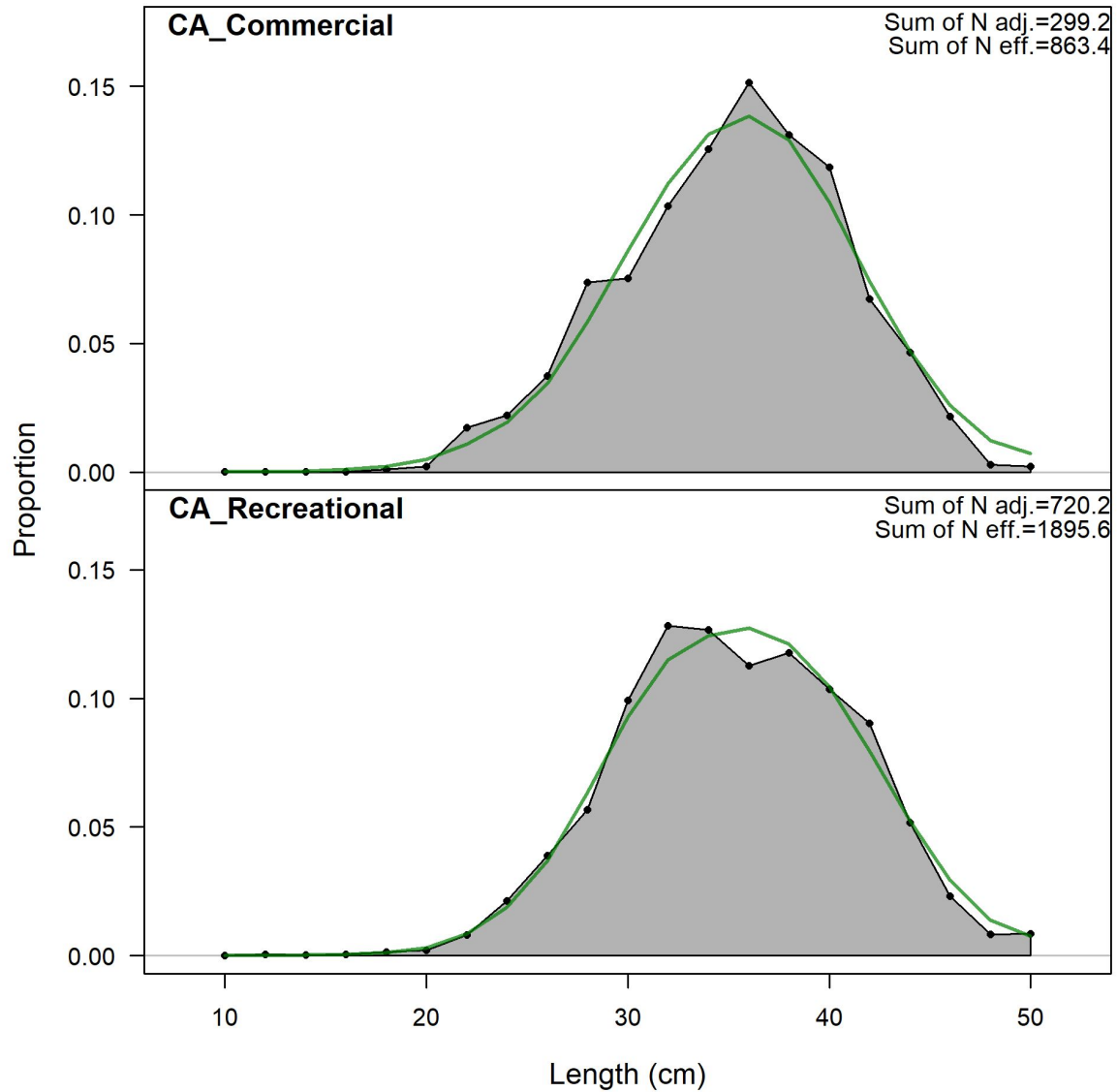


Recreational RecCom Block 2001



Closed bubbles indicate positive residuals (obs > exp)

Base



Sensitivity - RecCom Block 2001

