2025 Quillback Rockfish in California
STAR Presentation 2



Model, Results, Diagnostics

June 23, 2025

Stock Assessment Team:

Brian Langseth (NWFSC), Melissa Monk (SWFSC), Julia Coates (CDFW)

brian.langseth@noaa.gov, melissa.monk@noaa.gov, julia.coates@wildlife.ca.gov

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GMT representative: Thompson Banez

GAP representative: Tim Klassen

STAR panel chair: Cheryl Barnes

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Outline

1. Model Summary
2. Fits to the Data
3. Model Time Series
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections



Outline

1. Model Summary
   a. 2025 summary
   b. What's changed since 2021
   c. Bridging analysis
2. Fits to the Data
3. Model Time Series
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections



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Modeling Background

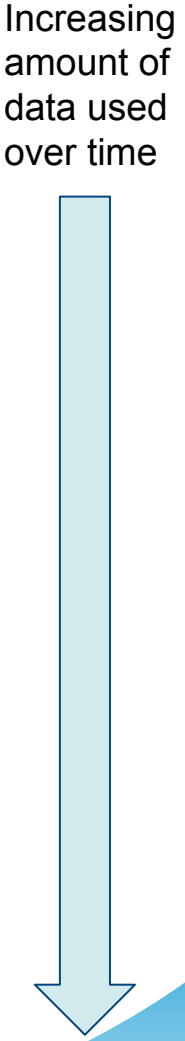
2010: First assessed as coastwide stock using catch data only
- Catch and depletion assumptions (no stock status determination)
- Depletion-Based Stock Reduction Analysis (DB-SRA)

2021: Assessed as state-specific populations using catch and length
- Stock Synthesis 3
- California quillback rockfish estimated below minimum stock size threshold
  - Reviewed in June, August, September of 2021
- Rebuilding analysis done in 2021

2023: Quillback rockfish declared overfished in December
- No retention in state waters August 2023
- Rebuilding analysis updated

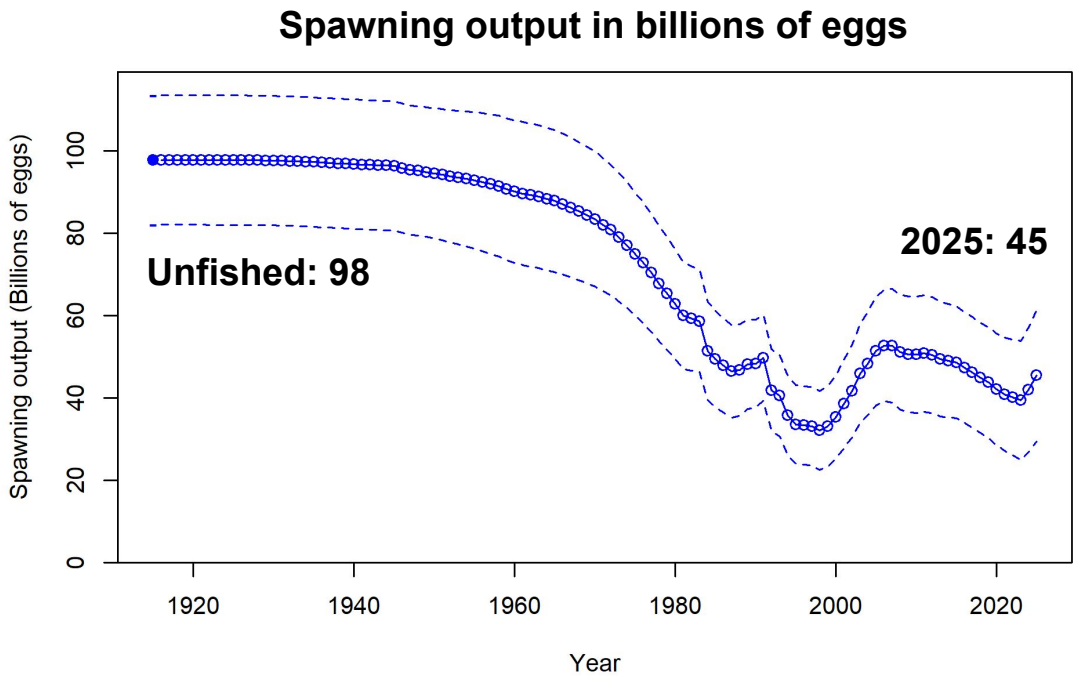
2024: Further review of assessment assumptions in January 2024

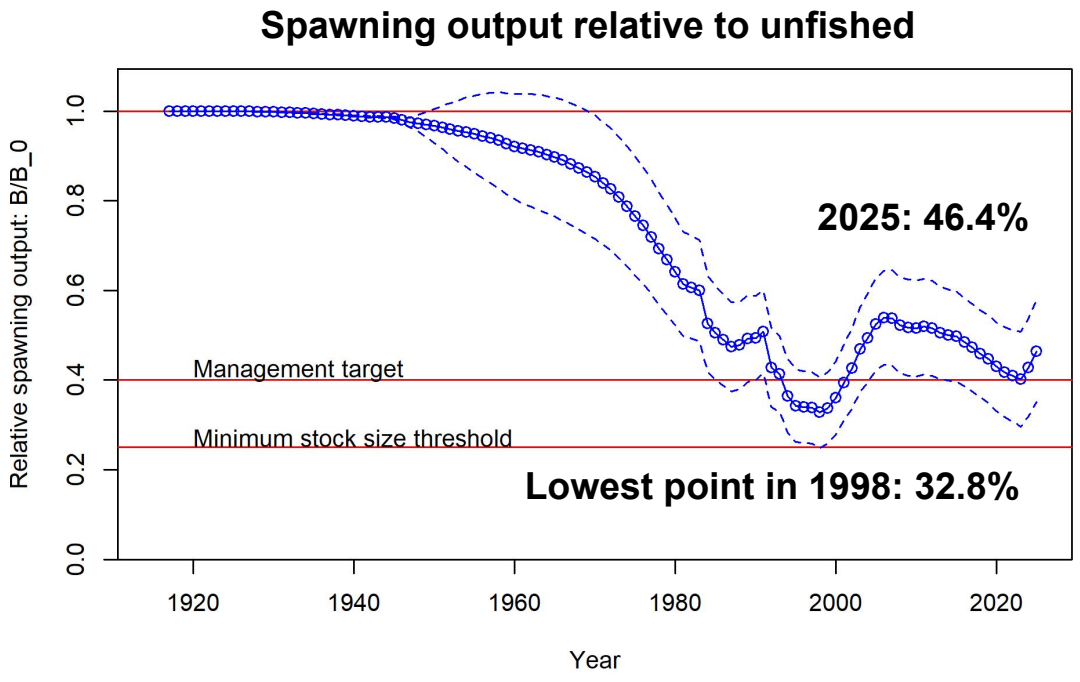
2025: Current full assessment
- Stock Synthesis 3; California only



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Summary of Model Results





- Catch + length + age + indices integrated model (Stock Synthesis 3)
- Major uncertainties are parameters affecting productivity of the stock

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Model Summary: What's changed from 2021

Data or Parameter	2021 length-based data moderate		2025 benchmark	
Maximum age and natural mortality (*M*)	Fixed	*M* = 0.057 yr^{-1} (95 years) sd = 0.438	Fixed	*M* = 0.068 yr^{-1} (80 years) sd = 0.310
Steepness	Fixed	h = 0.72	Fixed	h = 0.72
Growth	Fixed single-sex OR/WA/CA data	$L_{age = 1}$ = 8.23 cm (CV = 0.1) $L_{age\ max}$ = 43.04 cm (CV = 0.1) k = 0.199	Estimated single-sex CA data	$L_{age = 1}$ = 9.80 cm (CV = 0.18) $L_{age\ max}$ = 42.75 cm (CV = 0.09) k = 0.126
Maturity	Fixed OR/WA data	$L_{50\%}$ = 29.23 cm slope = -0.80	Fixed CA data	$L_{50\%}$ = 28.96 cm slope = -0.606
Fecundity	Fixed Dick et al. 2017	a = 3.93e-7 b = 3.702	Fixed CA data	a = 4.216e-8 b = 4.44
Length-weight	Fixed OR/WA/CA data	a = 1.963e-5 b = 3.016	Fixed CA data	a = 1.578e-5 b = 3.080

Grey color means values unchanged

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Model Summary: What's changed from 2021

Data or Parameter	2021 length-based data moderate		2025 benchmark	
Fishing fleets	Two	1 recreational 1 commercial	Two	1 recreational (added private/rental index) 1 commercial
Survey fleets	None		Two	CDFW ROV (index + lengths) CCFRP (index + lengths)
Selectivity	Asymptotic		Asymptotic and domed	Survey fleets: asymptotic Recreational: asymptotic Commercial: asymptotic with 1 time block domed
Time blocks	None		Fishery fleets	Recreational: 1916-2016, 2017-2024 Commercial: 1916-2002, 2003-2013*, 2014-2021, 2022-2024*
Lengths and ages	Lengths only		Lengths and ages	Added: Survey fleet lengths Commercial ages Growth fleet ages

*Mirrored selectivity

Grey color means values unchanged

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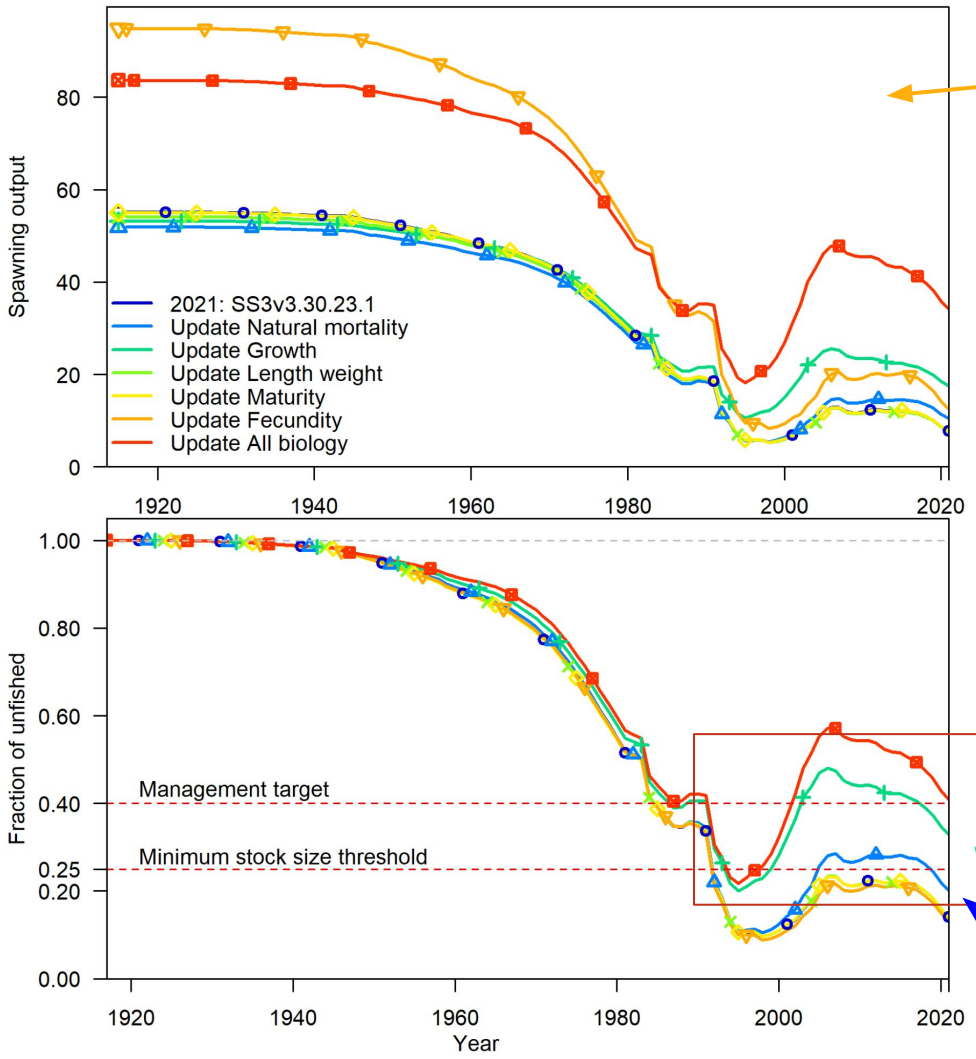
Model Bridging Steps

Purpose of bridging is to see effect of changes (updated data or updated assumptions) from the last assessment

1. Update Biology ⟸ Biggest changes due to updated productivity based on new data
2. Update Data
3. Update selectivity, weighting, and other changes

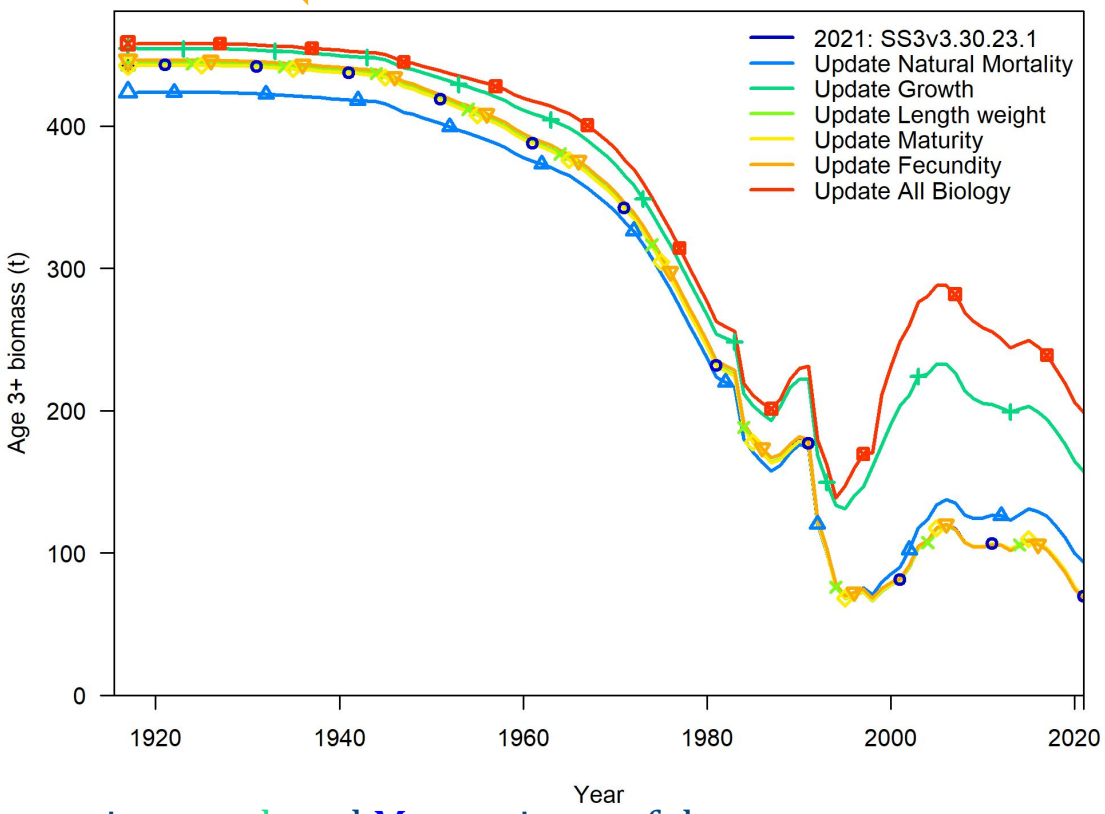
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Bridging: Update Biology



Change in fecundity less impactful when looking at biomass

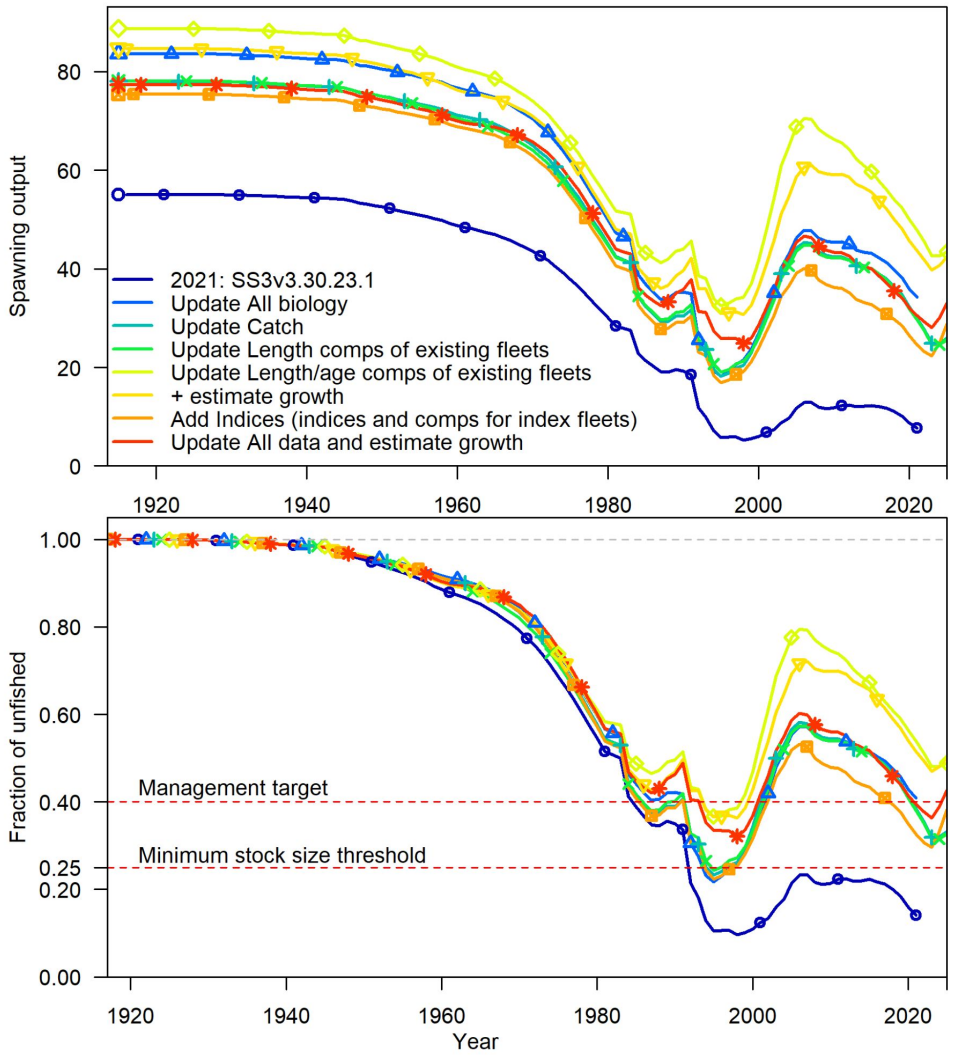
Steps done independently except Update All



Changes in growth and M most impactful

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Bridging: Update Data

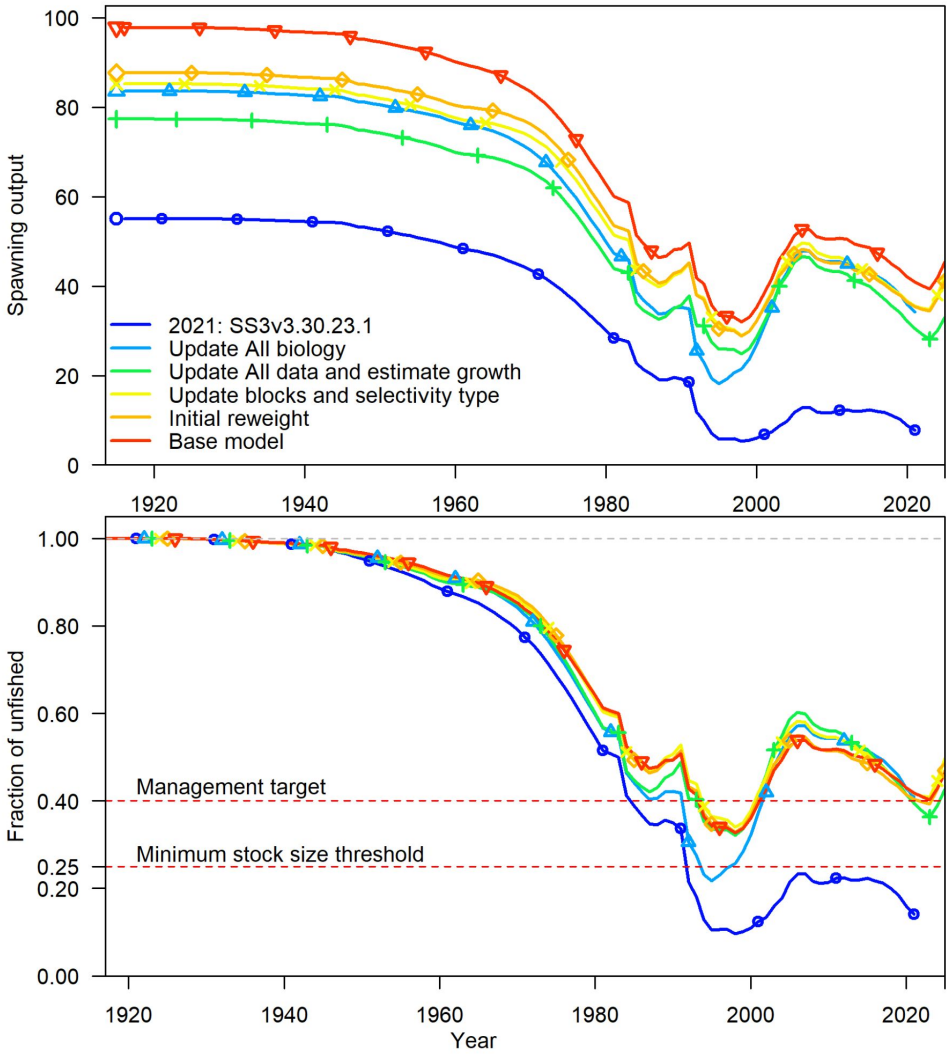


Steps build from Update Catch independently except + estimate growth and Update All

Individual data steps change trajectory (especially ages)

Collectively updating data across all steps results in similar trajectory

Bridging: Update selectivity, weighting, etc.



Remaining steps result in little relative change

Steps are cumulative, building off the previous step

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Modeling History

Scale changed since last assessment

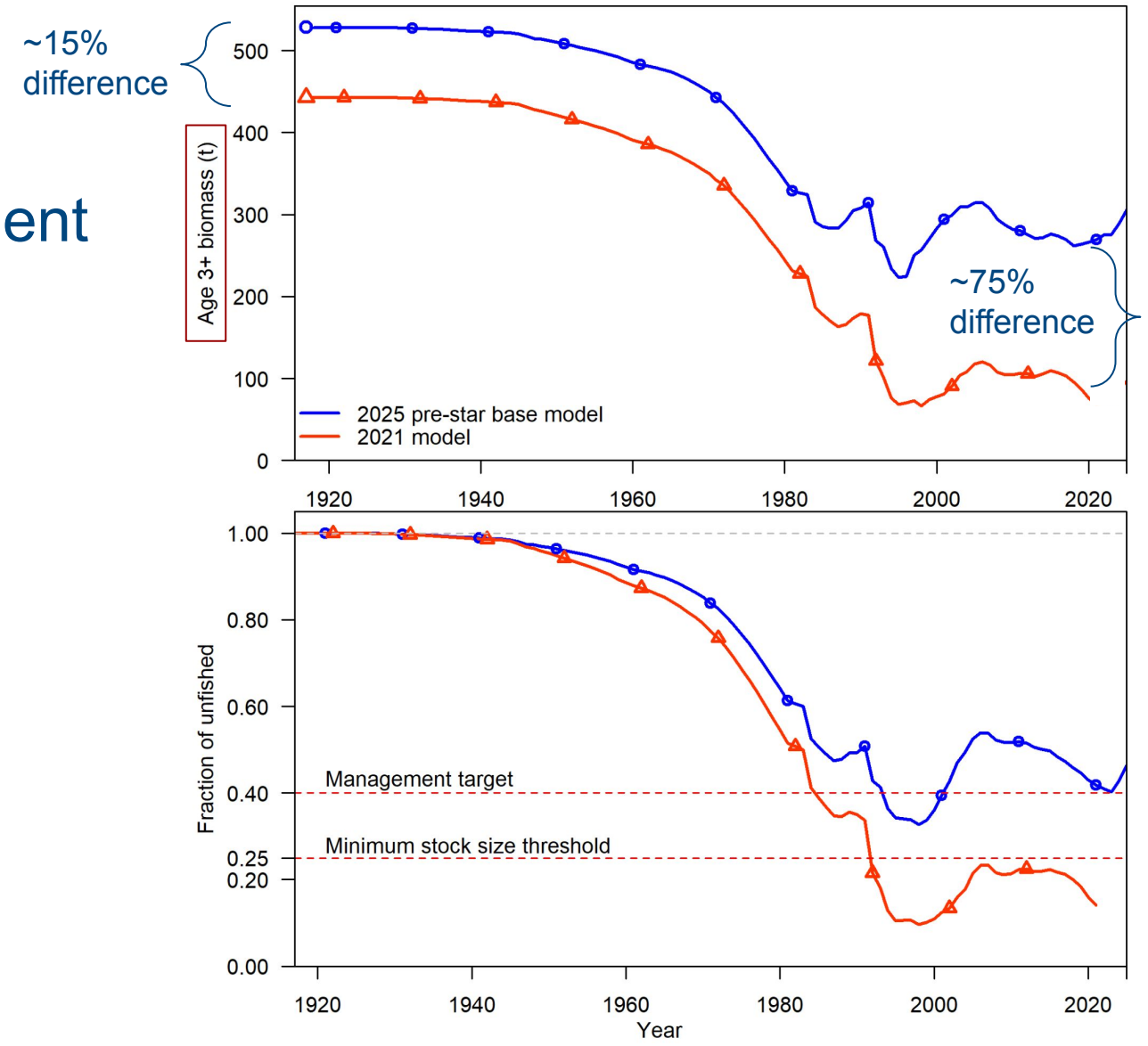
Age 3+ biomass in 2021

New 2021: 269.2 mt

Previous 2021: 69.4 mt

Age 3+ biomass in 2025

New 2025: 305.5 mt



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Questions on the Model Summary?



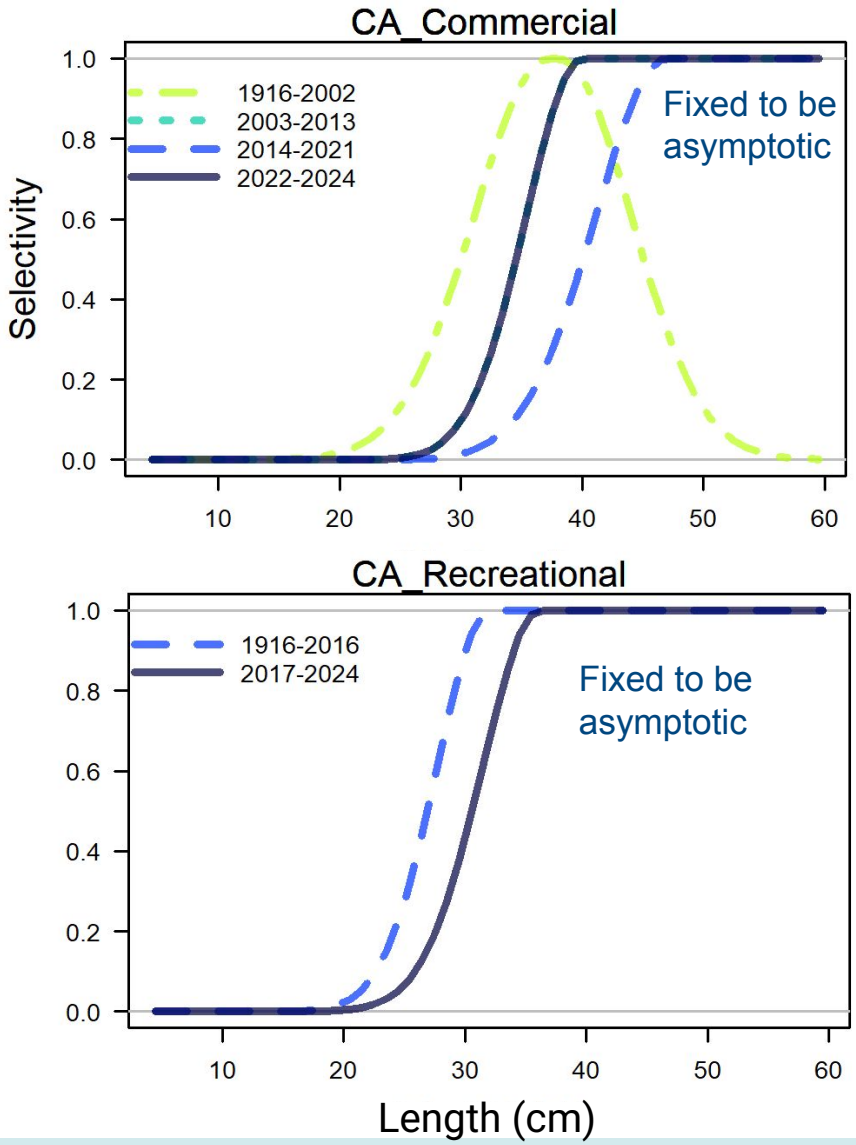
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Outline

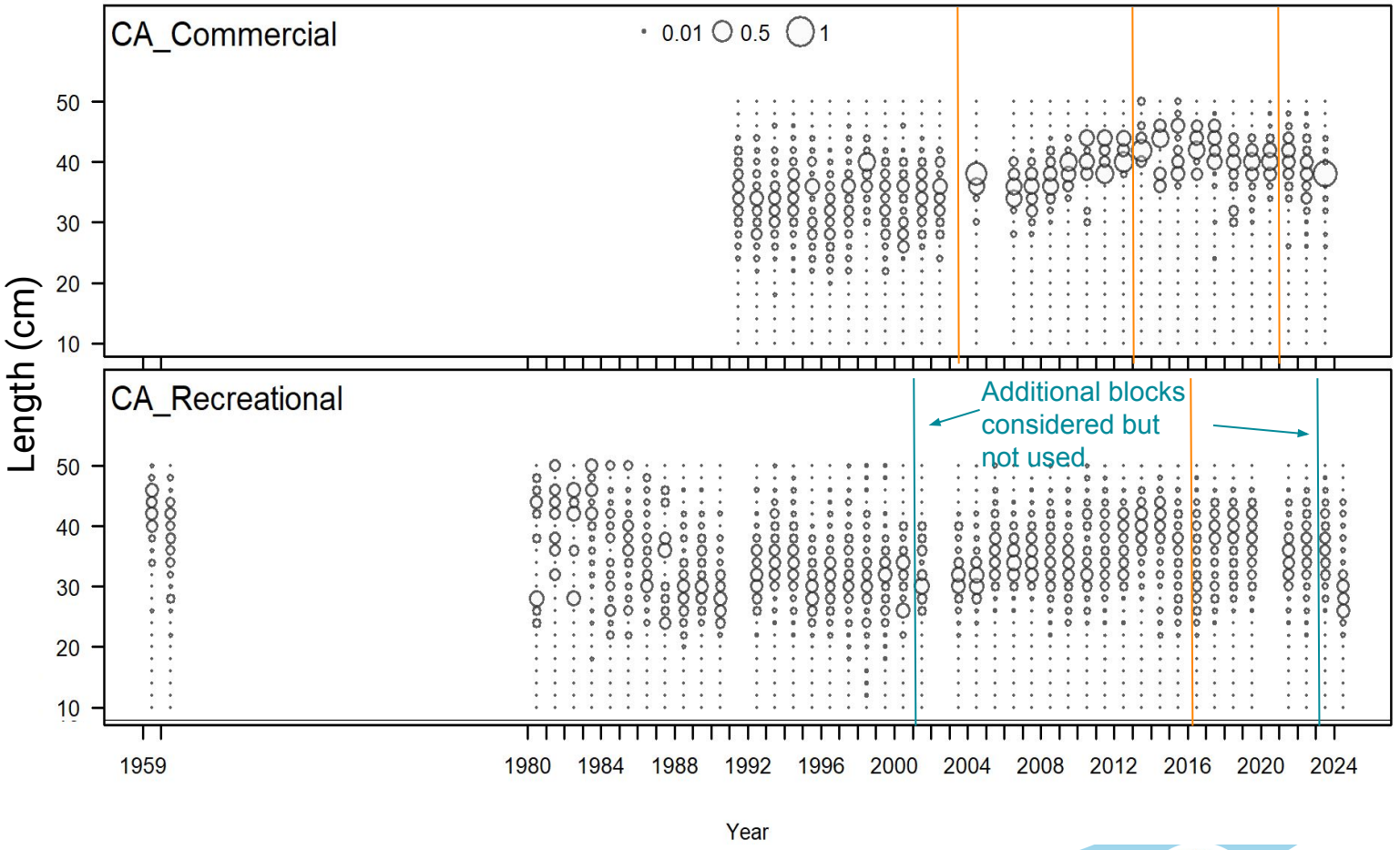
1. Model Summary
2. Fits to the Data
   a. Selectivity
   b. Compositions
   c. Indices
3. Model Time Series
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections



Length-based Selectivity: Fisheries

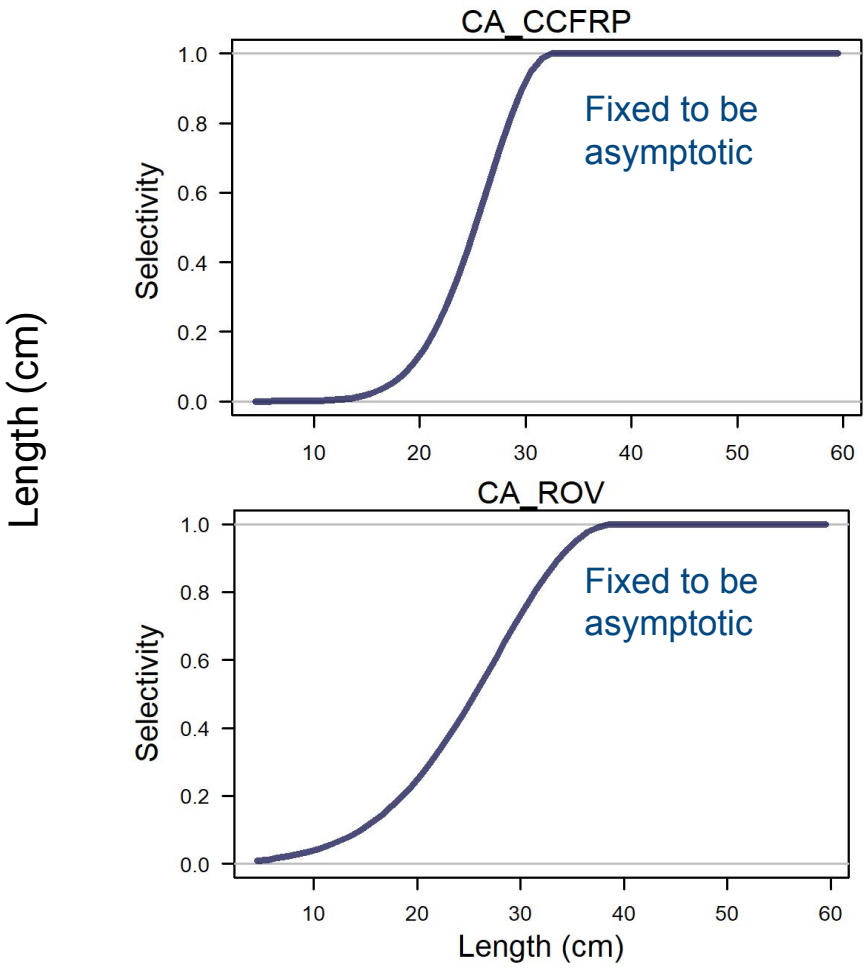


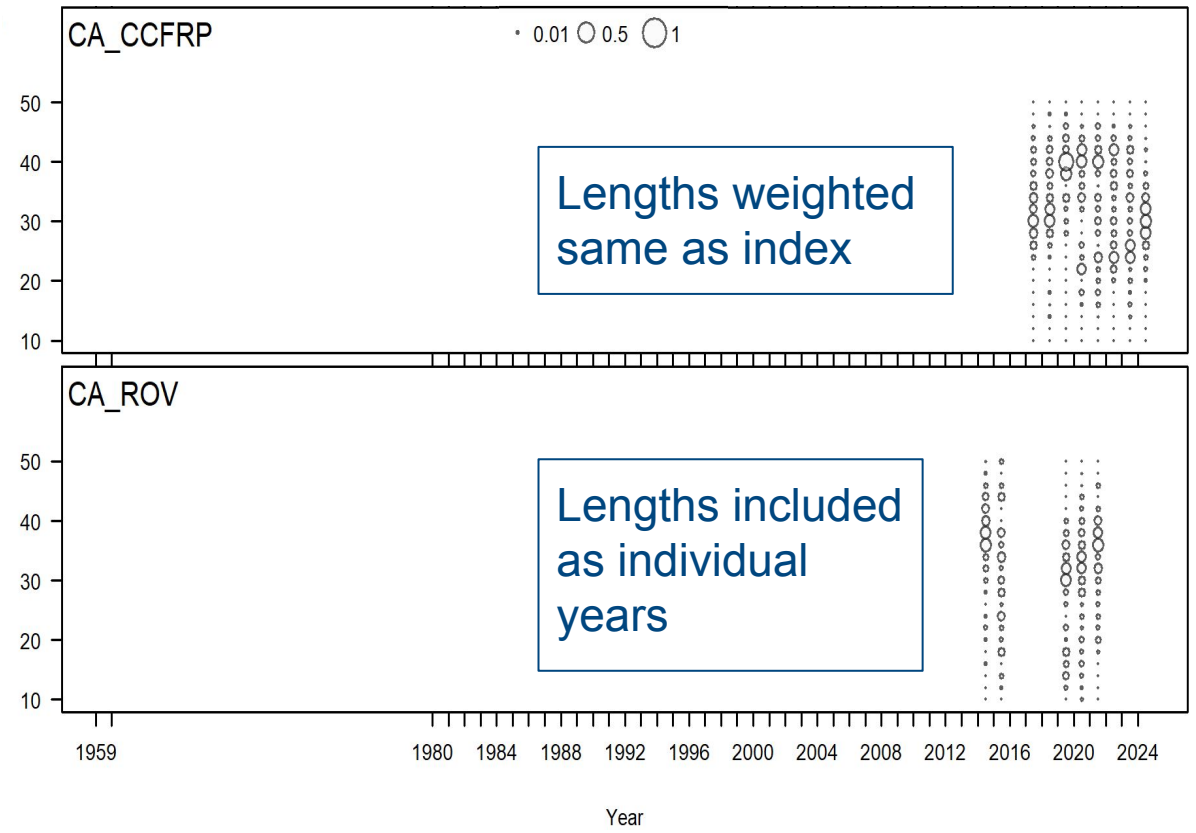
Commercial: 2022-2024 mirrored to 2003-2013
Orange bars represent final time blocks



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Length-based Selectivity: Surveys





Data Weightings

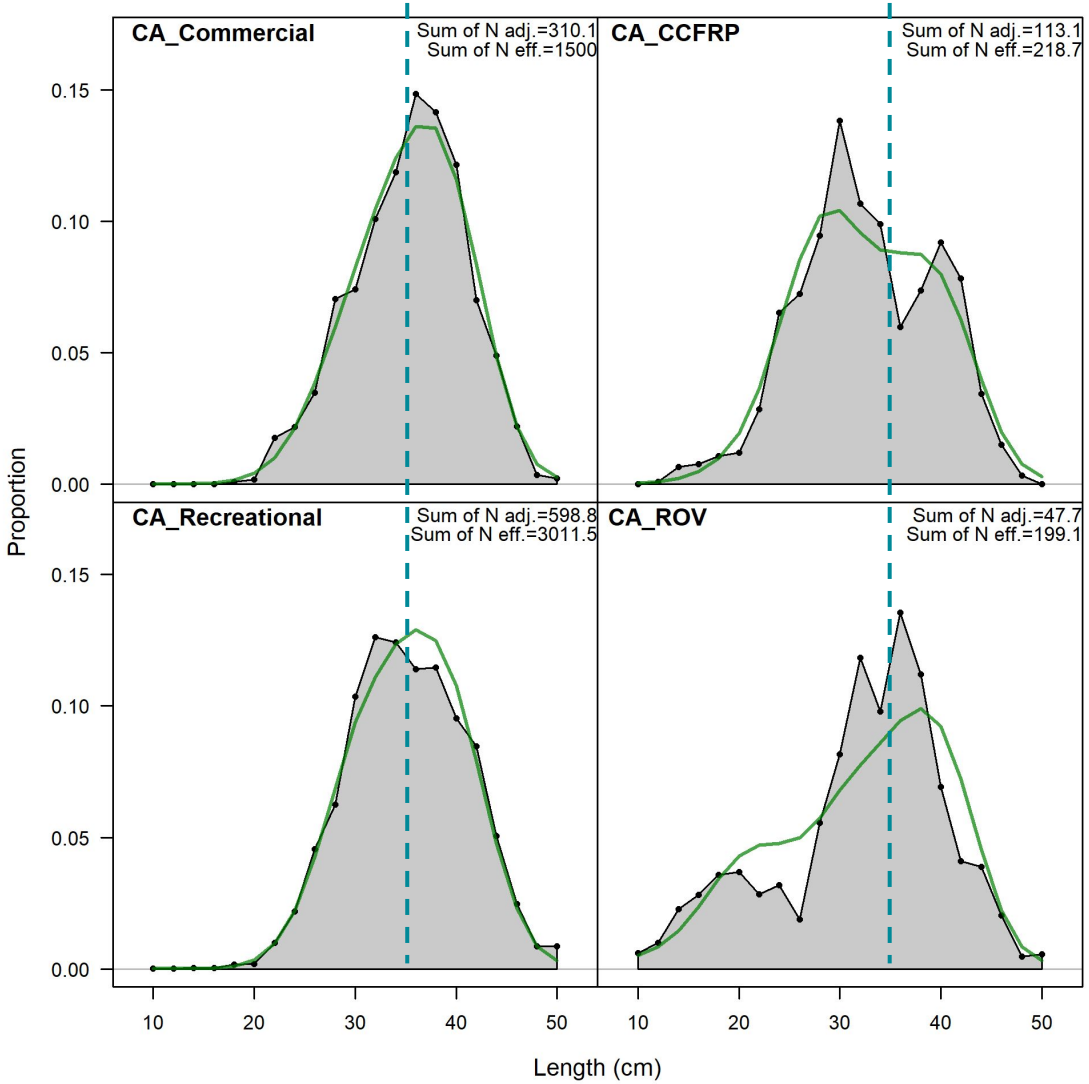
- Francis (2011) algorithm but others explored
  - Francis accounts for correlation and performed better than McAllister and Ianelli (Punt 2017)



Type	Fleet	Francis	McAllister and Ianelli	Dirichlet Multinomial
Length	Commercial	0.377	0.423	0.992
Length	Recreational	0.180	0.400	0.984
Length	CCFRP	0.236	0.337	0.794
Length	ROV	0.170	0.580	0.553
CAAL	Commercial	0.081	0.375	0.996
CAAL	Growth	0.612	0.384	0.999

Aggregate Length Fits

Fits overall are reasonable



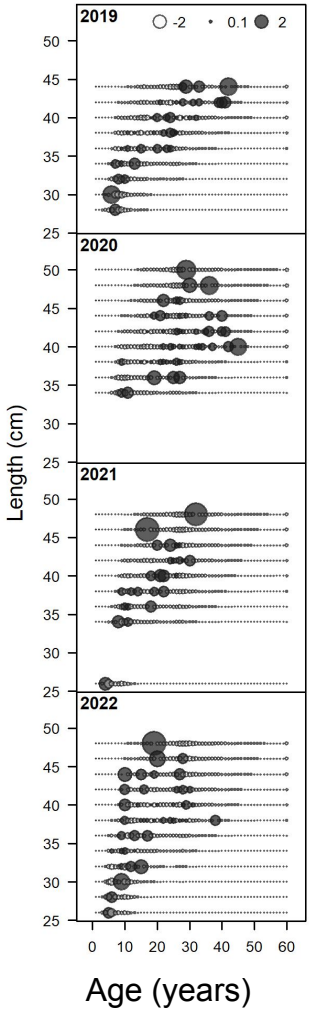
Vertical line is at approximately 35 cm to make comparisons among fleets easier

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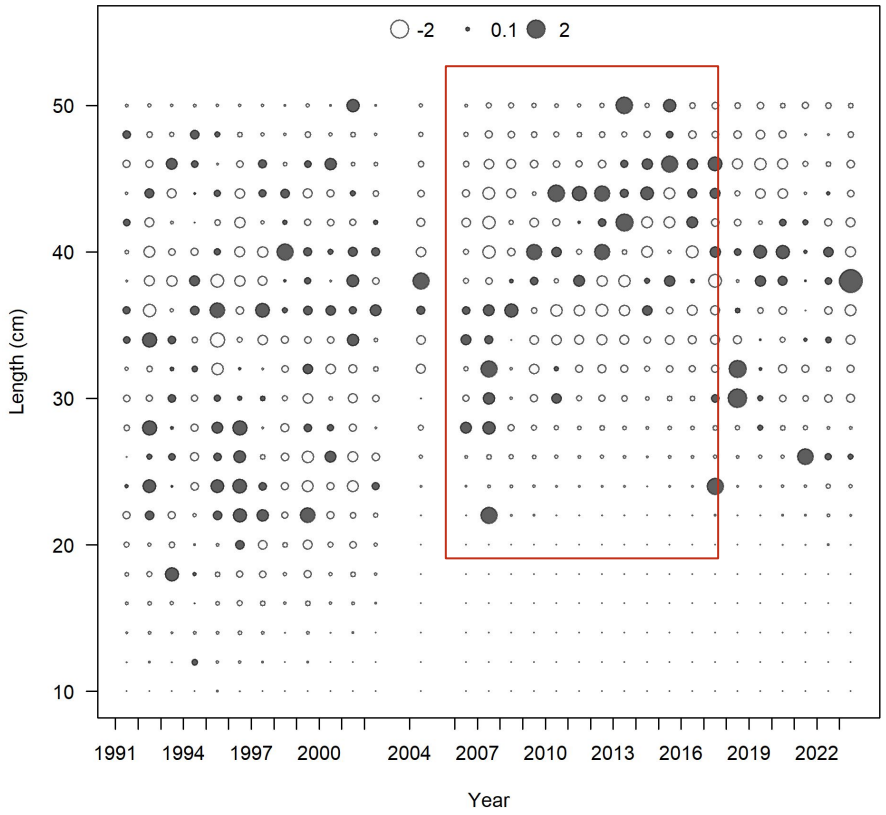
Fits to Commercial Data

Fits overall are reasonable

Pearson residuals*: Ages

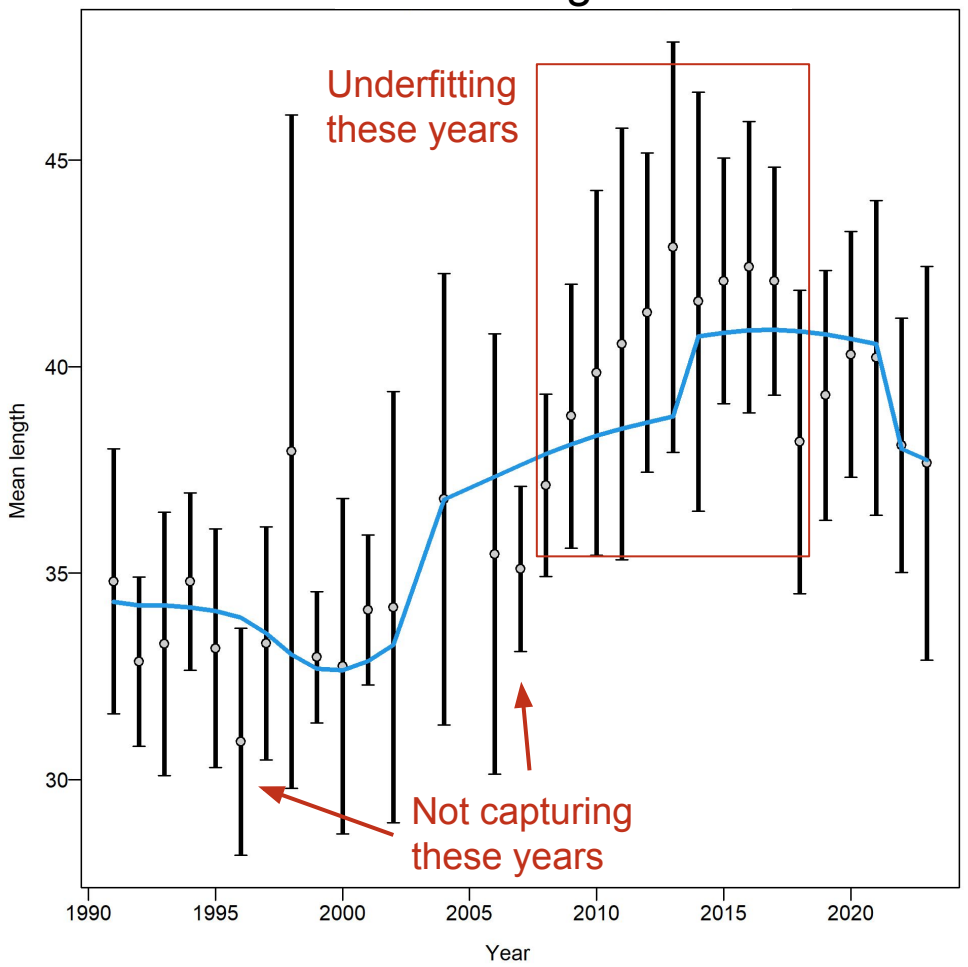


Pearson Residuals*: Lengths



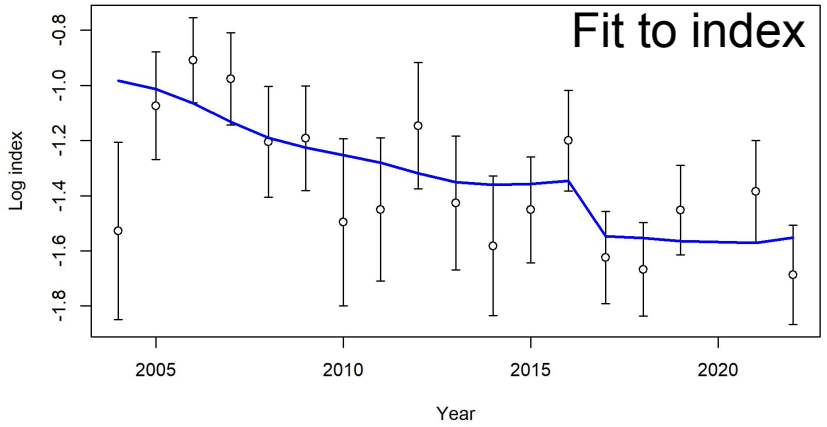
*Filled bubbles mean underfit (expected < observed)
Open bubbles mean overfit (expected > observed)

Mean Length Fits

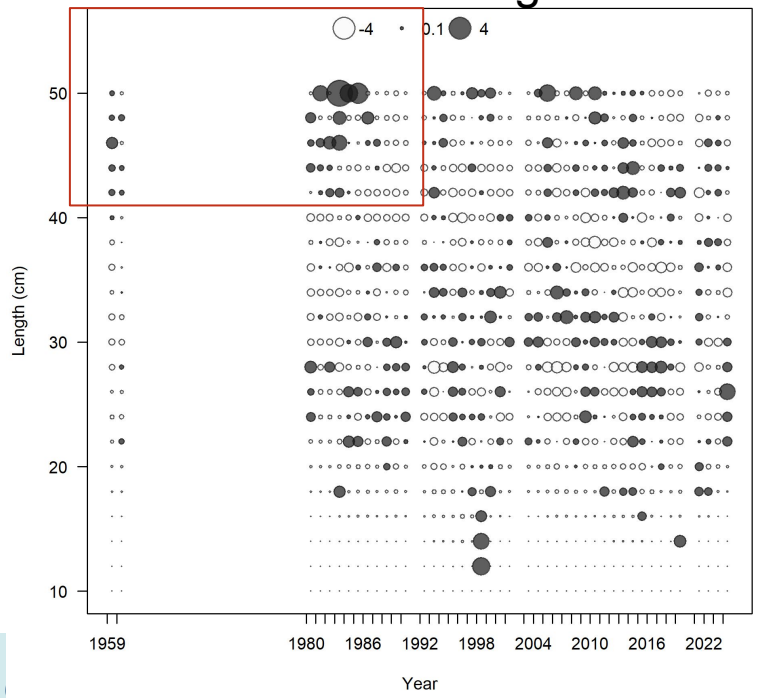


Fits to Recreational Data

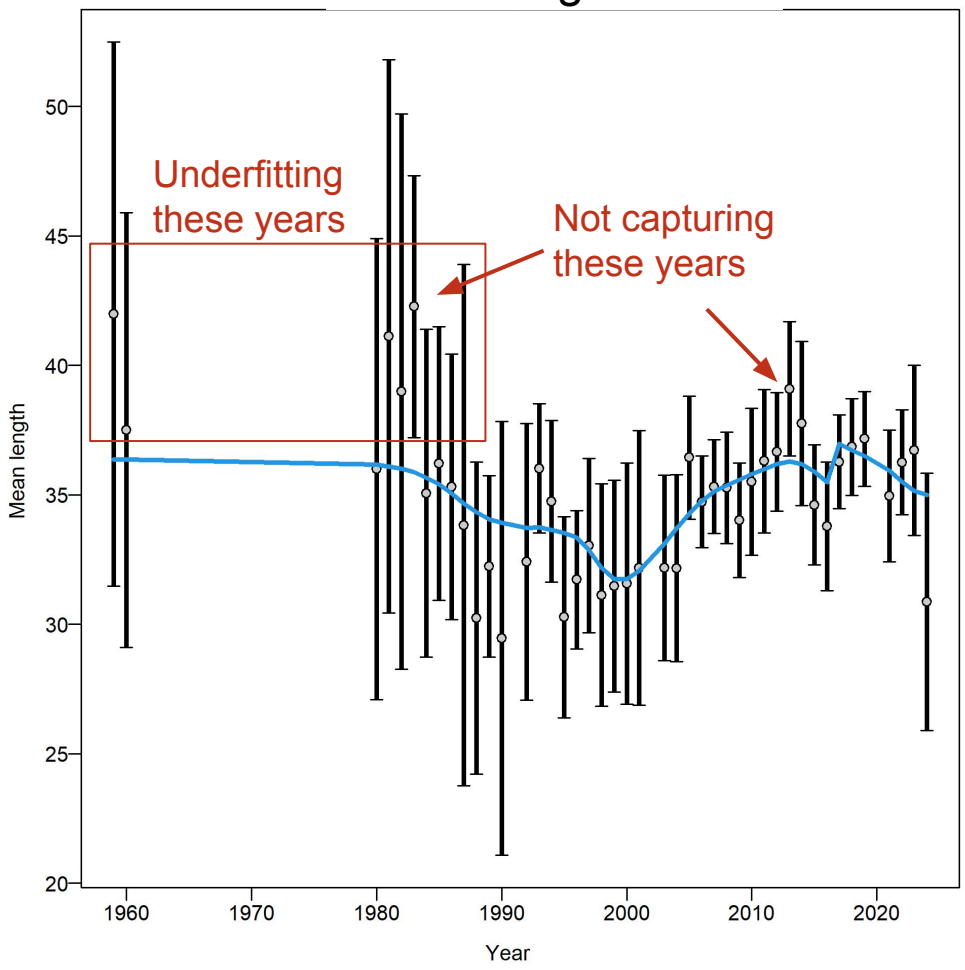
Fits overall are reasonable



Pearson Residuals*: Lengths



Mean Length Fits



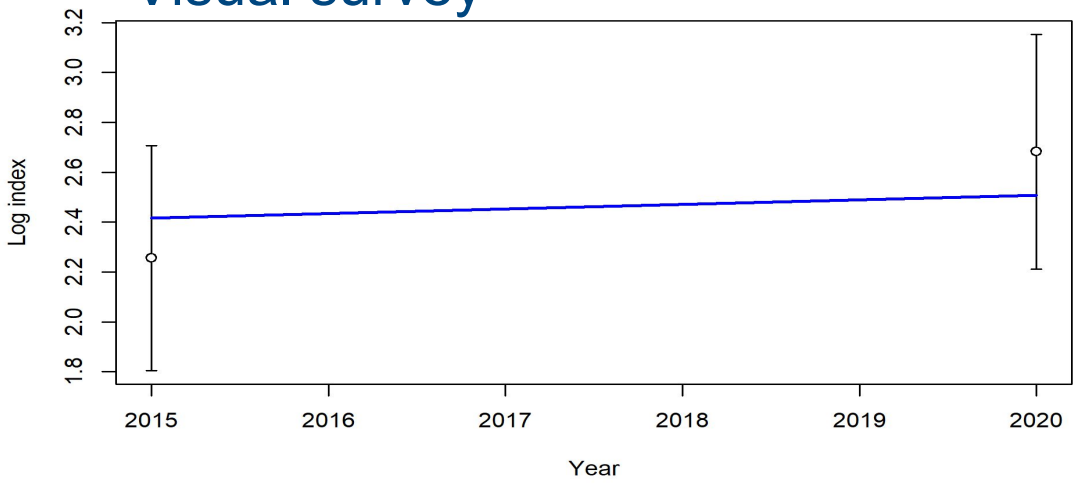
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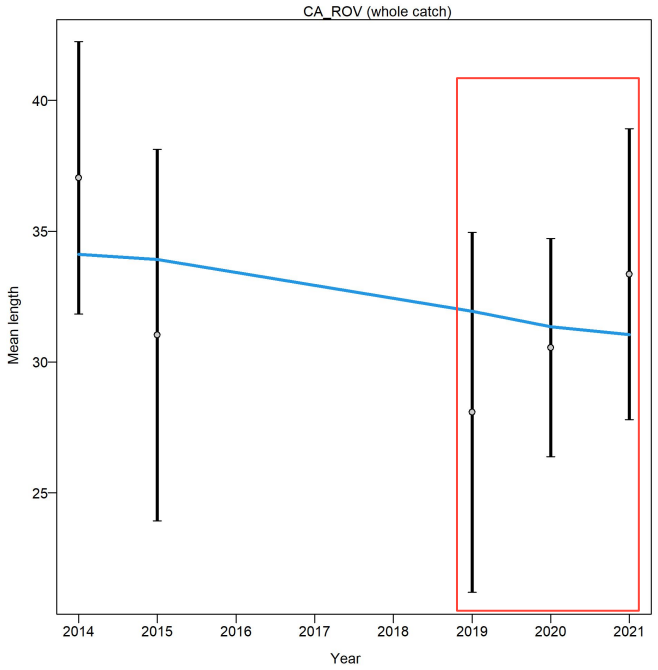
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Fits to Survey Data

CDFW ROV

Visual survey

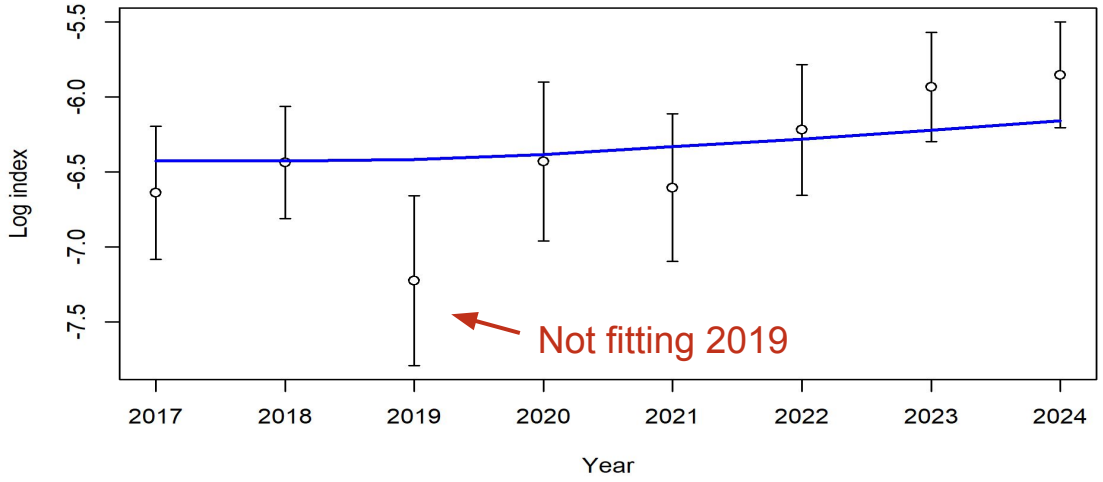


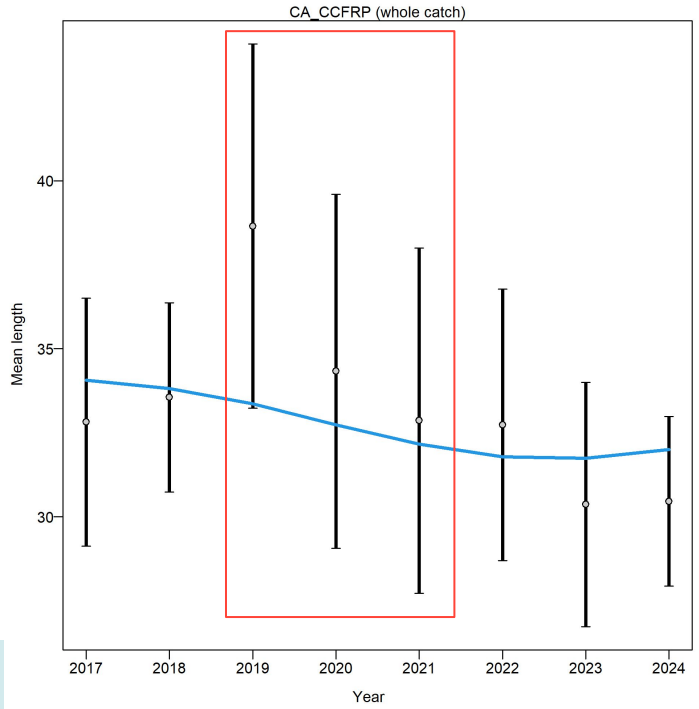


Overlapping survey years

CCFRP

Hook-and-line





Questions on fits to the data?



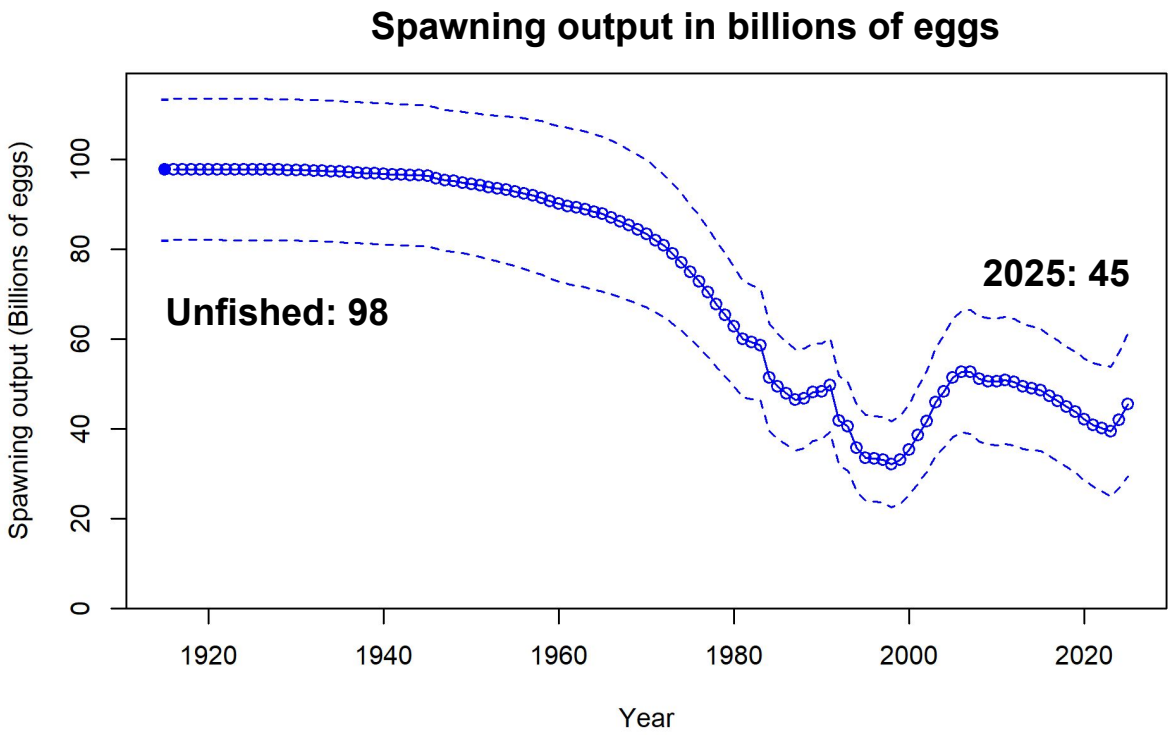
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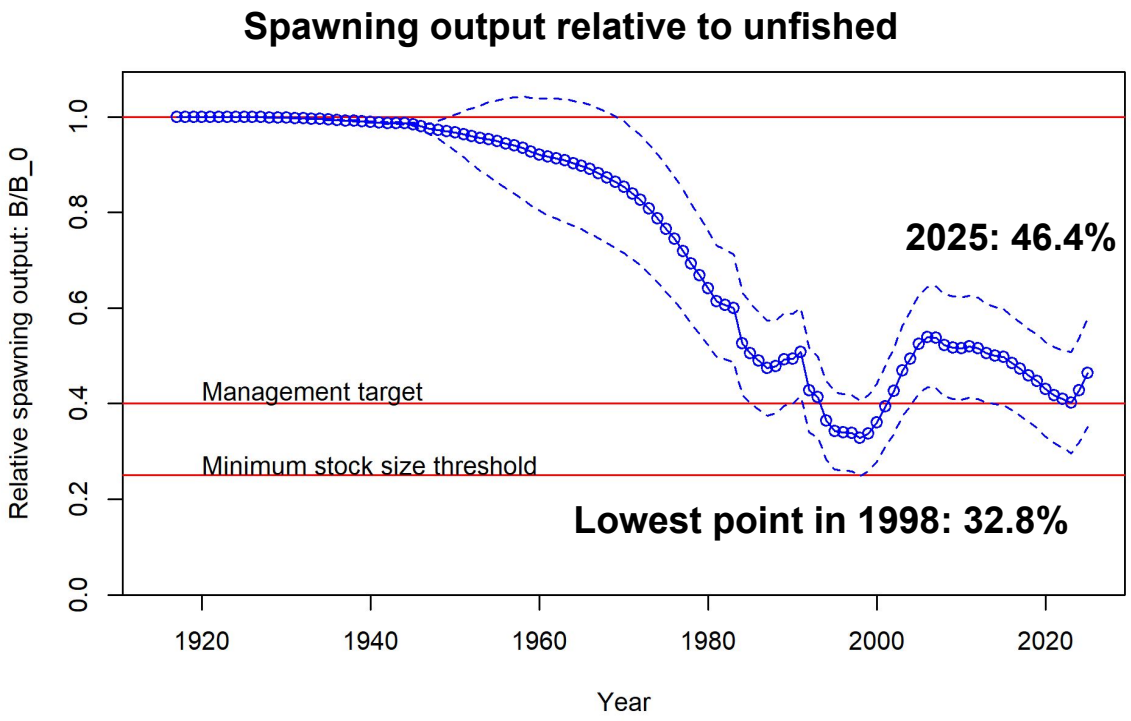
Outline

1. Model Summary
2. Fits to the Data
3. Model Time Series
   a. Spawning Output
   b. Recruitment
   c. Fishing Intensity
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections



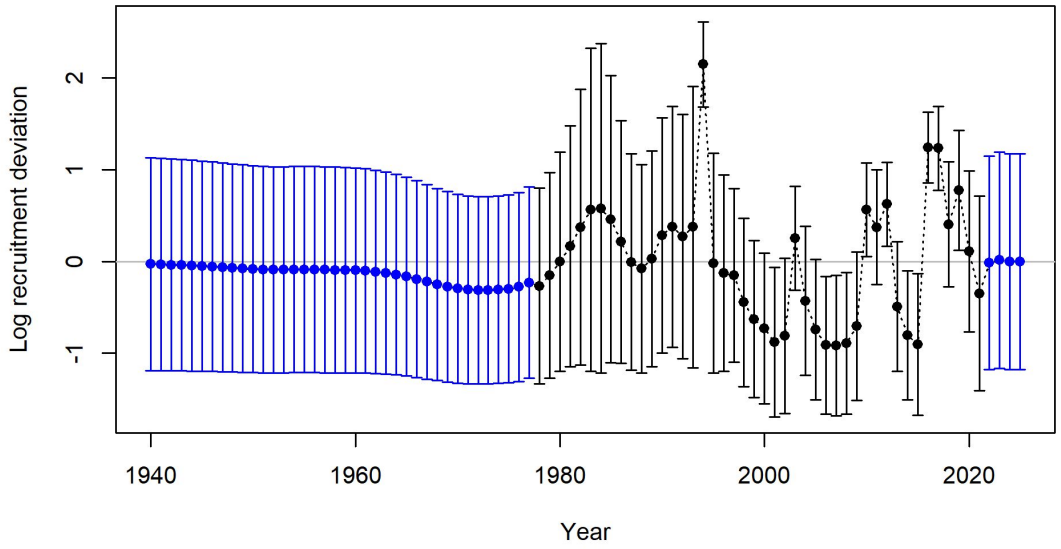
Estimated Spawning Output and Fraction Unfished

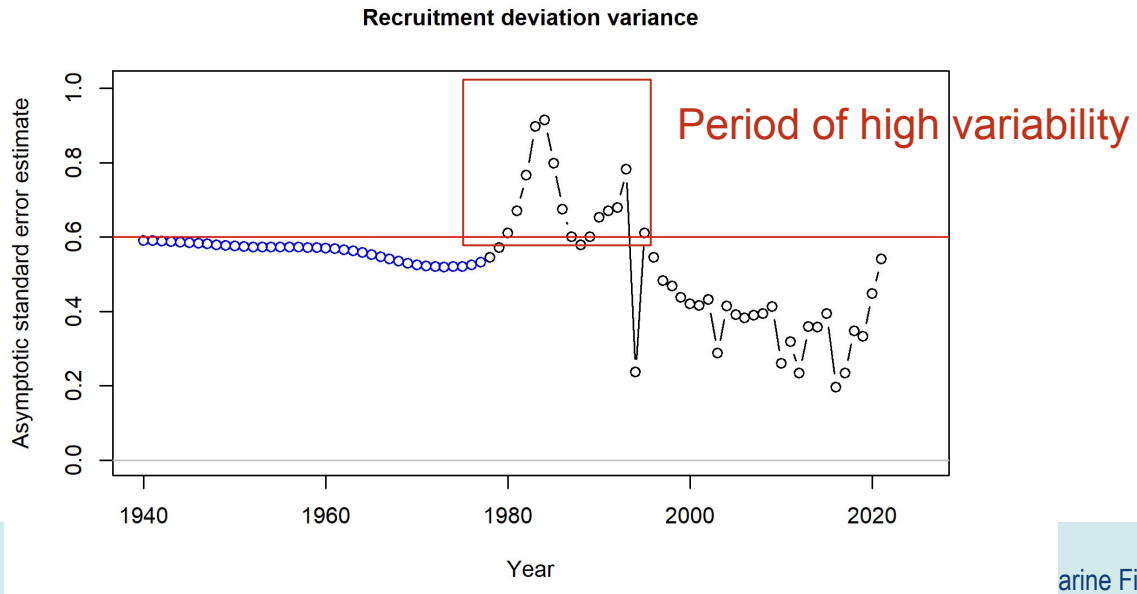


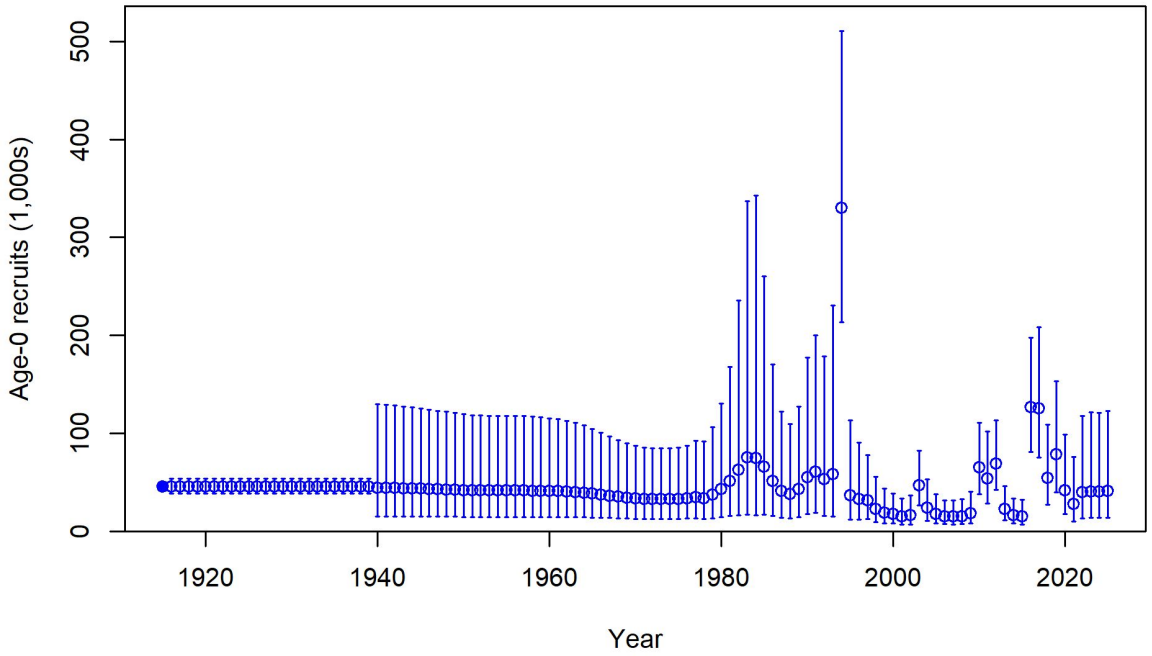


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Recruitments and Deviations

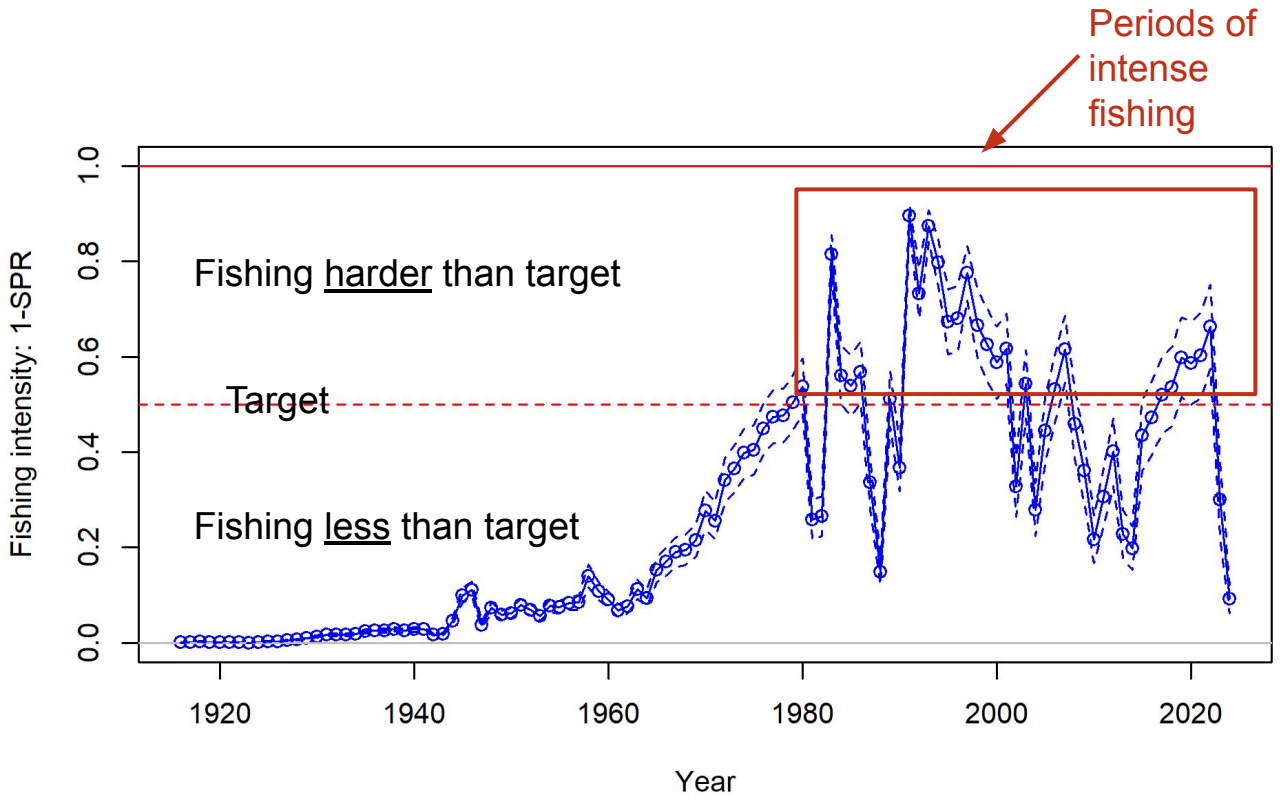


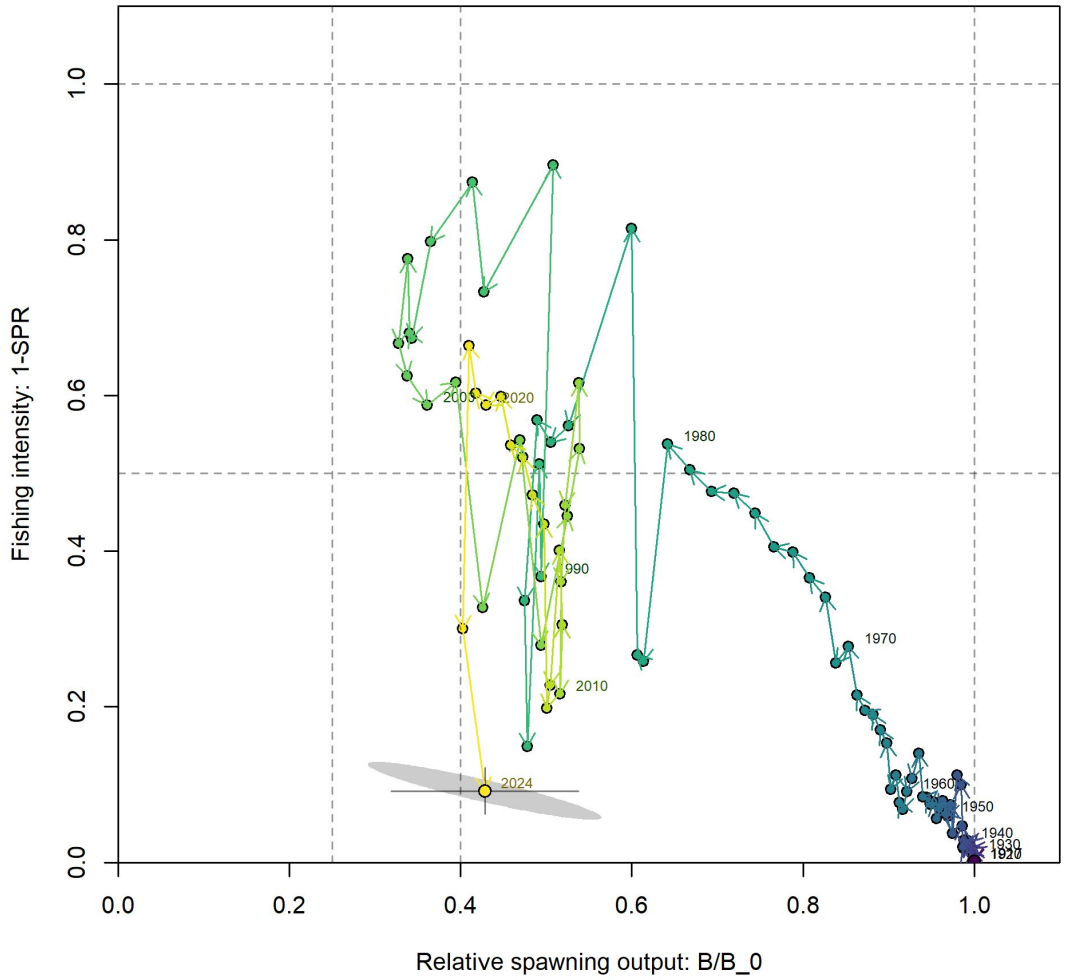




Strong year class (1994) due to inclusion of age data.
Length data year class more spread out from late 1980s-1999

Fishing Intensity and Phase Plot





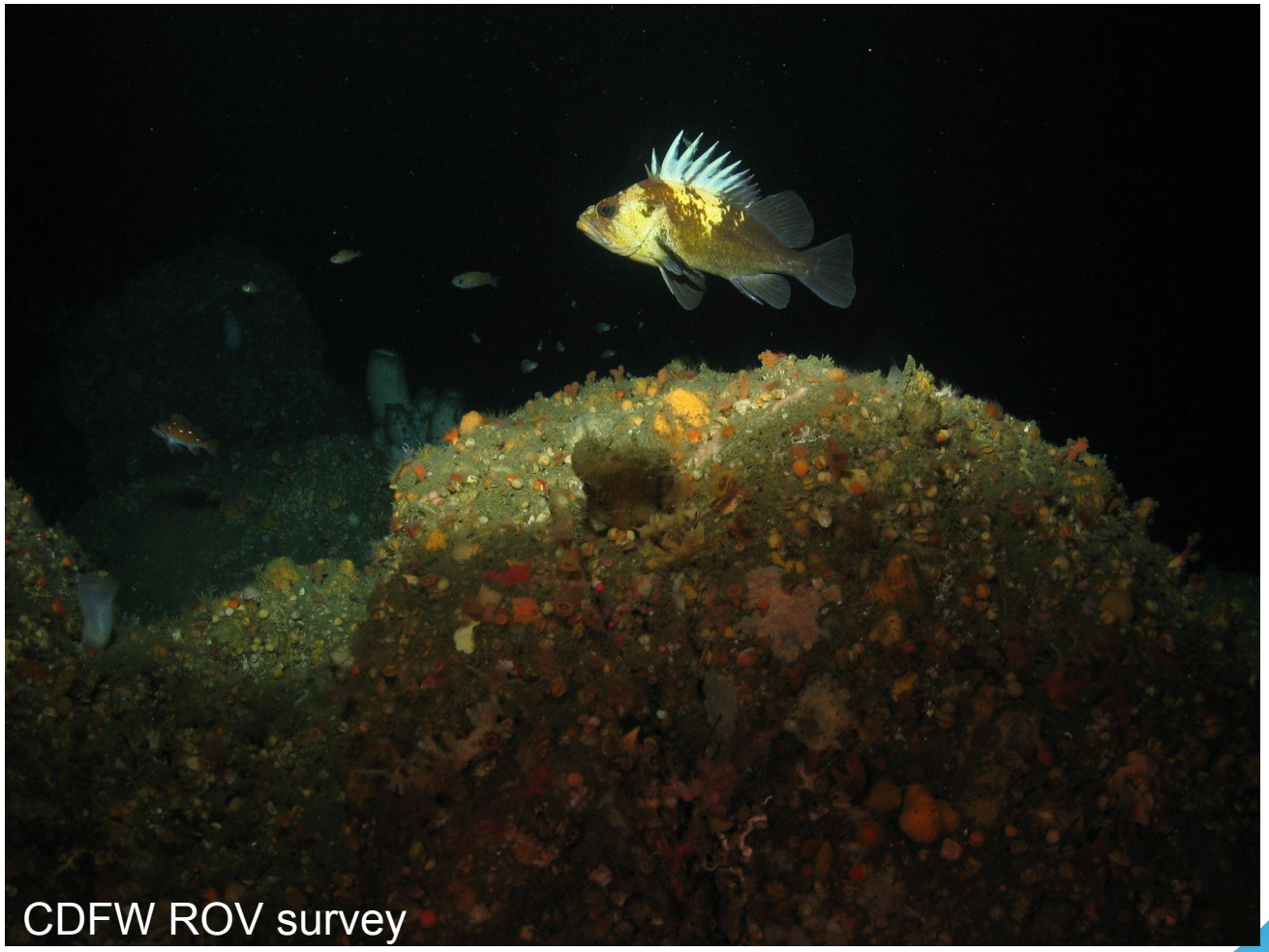
Questions on model time series?



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Outline

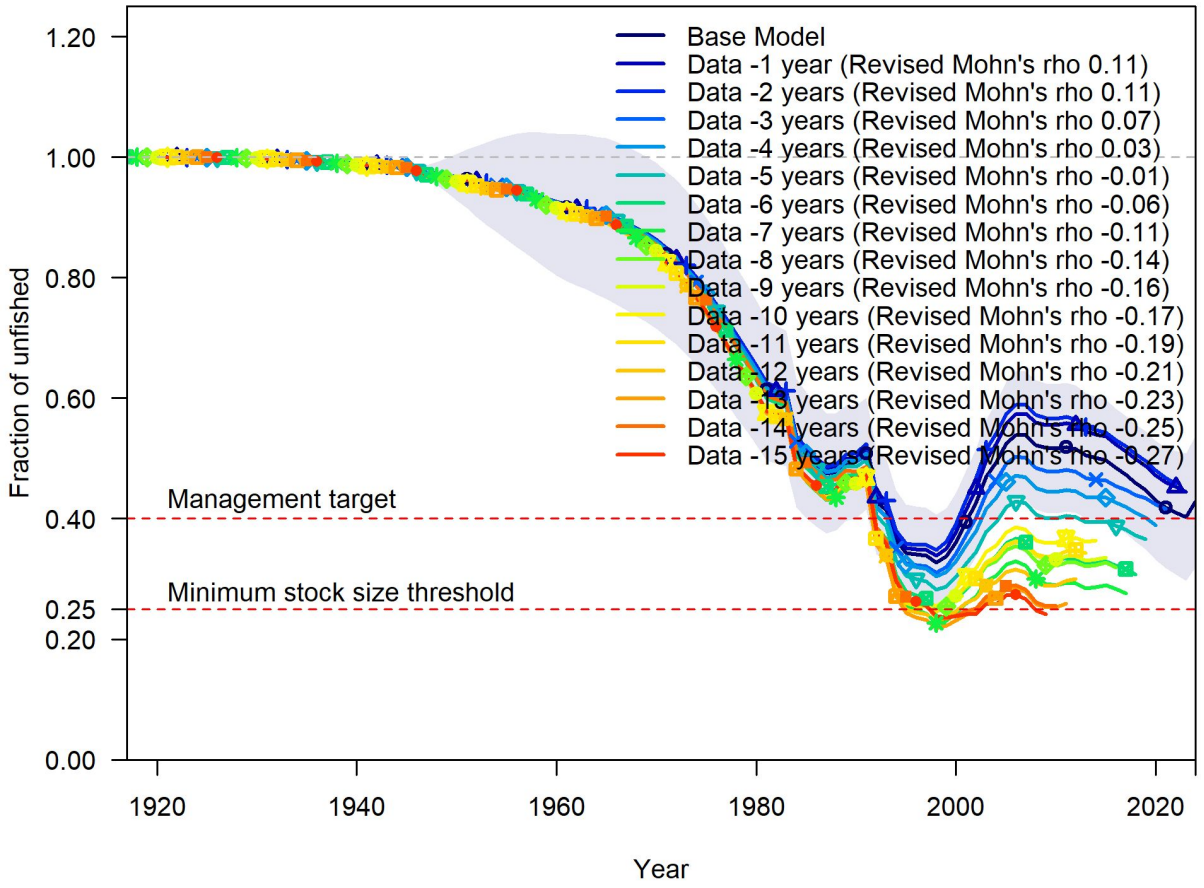
1. Model Summary
2. Fits to the Data
3. Model Time Series
4. Model Diagnostics
   a. Retrospective Patterns
   b. Parameter Profiles
   c. Sensitivities
5. Uncertainties, Risk Table
6. Projections

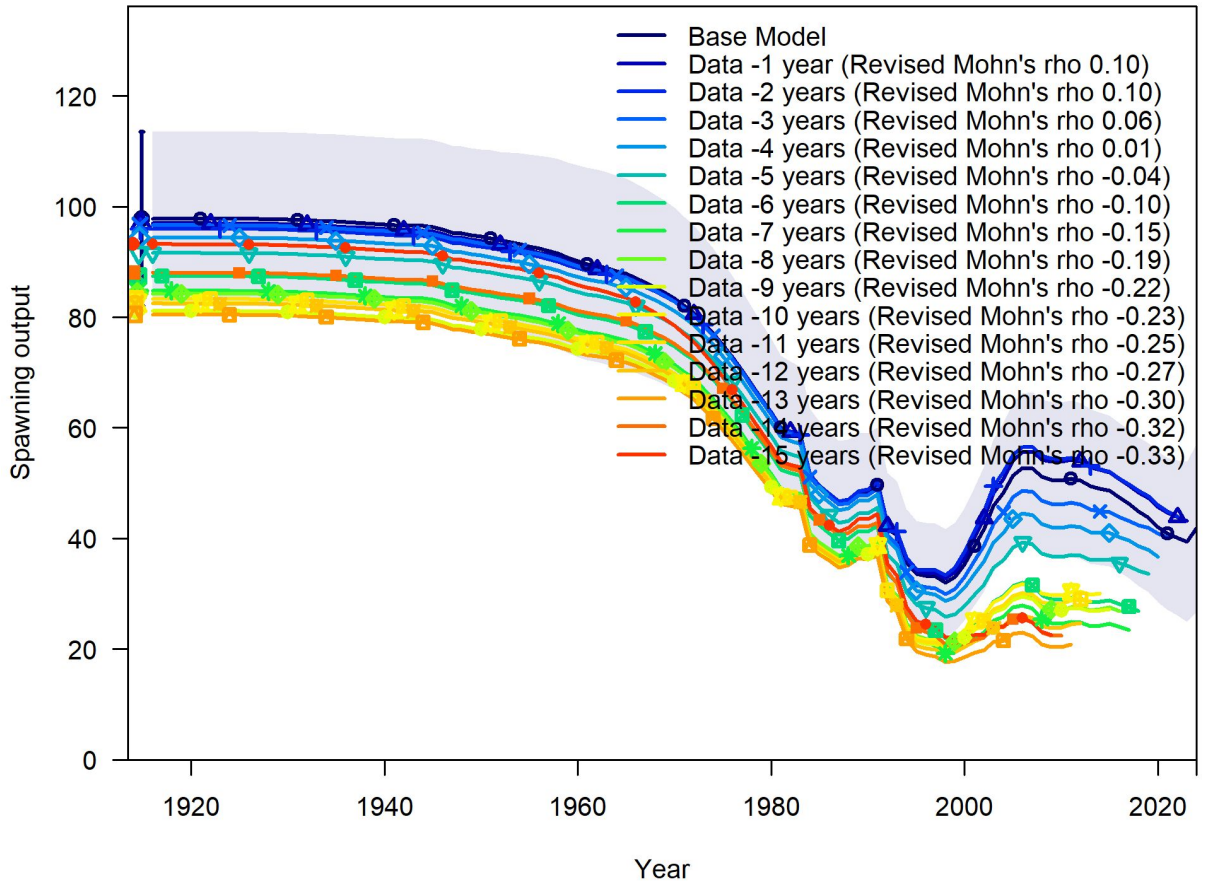

CDFW ROV survey

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Retrospective Pattern

Pattern aligns with removal of age data and recent recruitment





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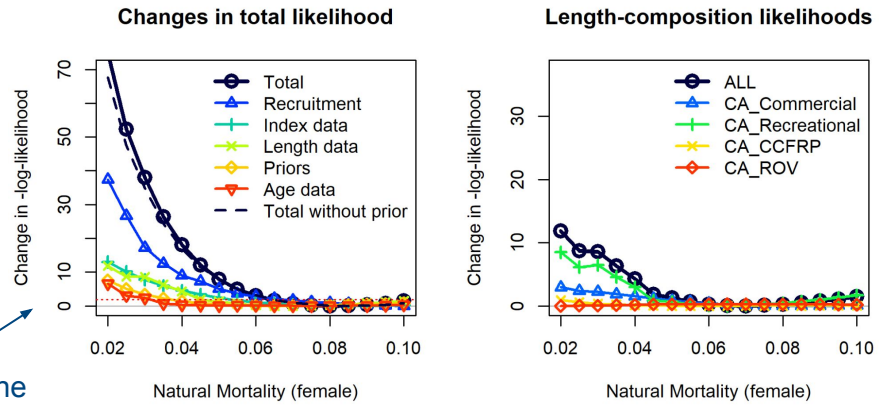
Profile Summary

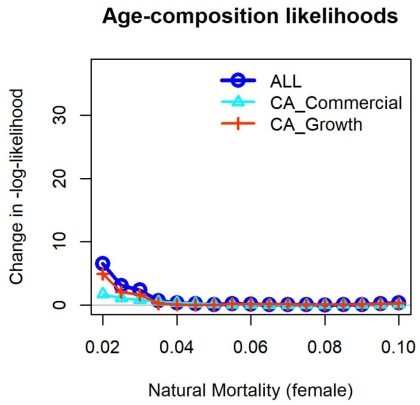
- Profile over M, h, R_0, L_∞, K
- Range of ‘reasonable’ values for M and h based on change in likelihood
  - Natural mortality affects trajectory more than steepness
- Age data informs growth parameters

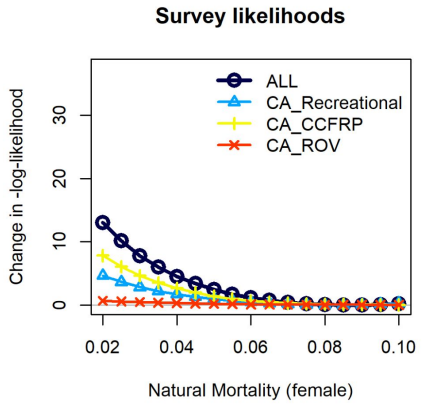
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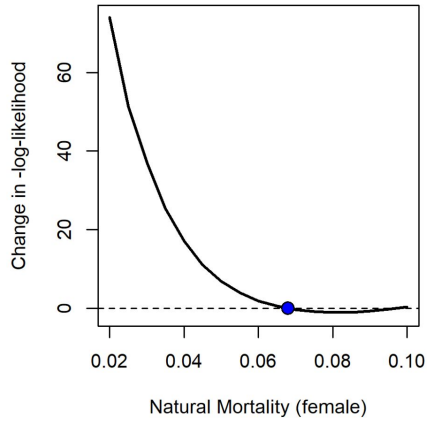
Profile: Natural Mortality (M) - Fixed

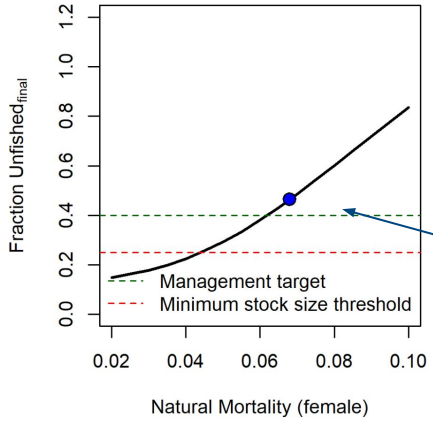
red
dashed line
95% profile CI

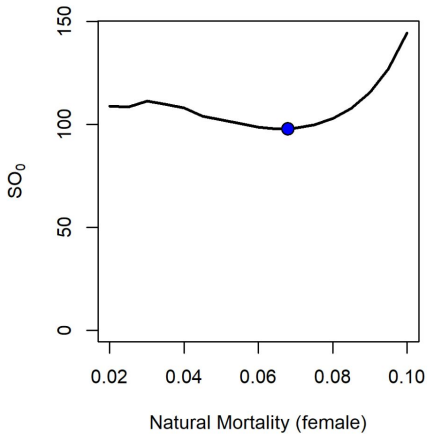


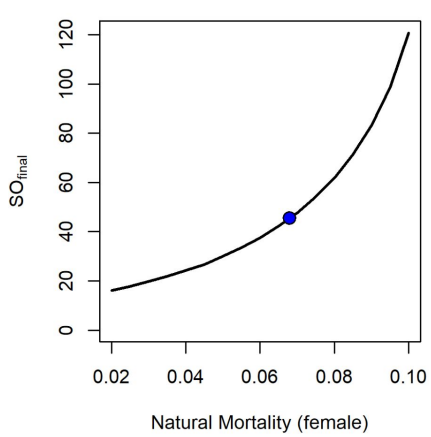












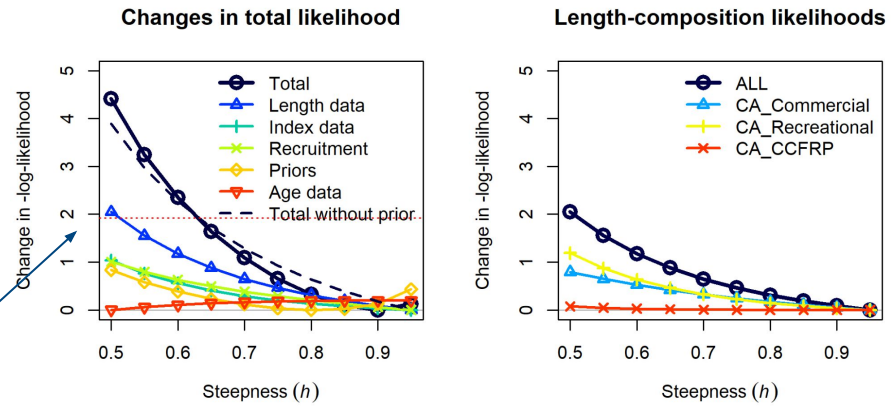
Blue point is the base model value

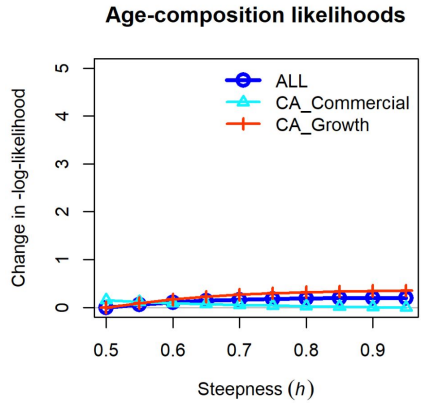
- M minimized at higher values, but profile is flat above 0.065
- Consistent pattern across data sources

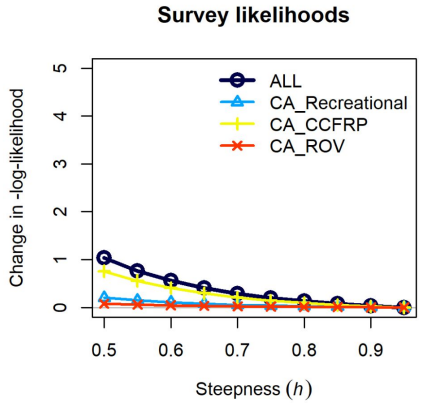
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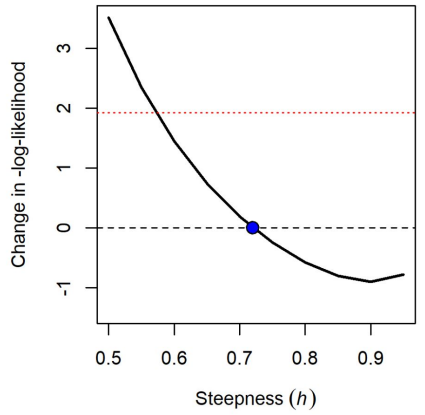
Profile: Steepness (h) - Fixed

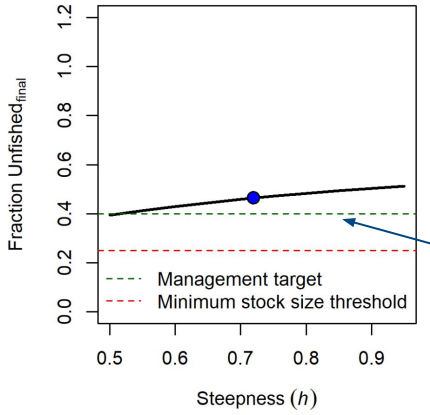
red
dashed line
95% profile CI

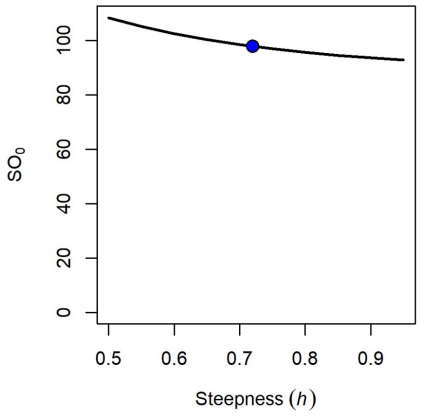


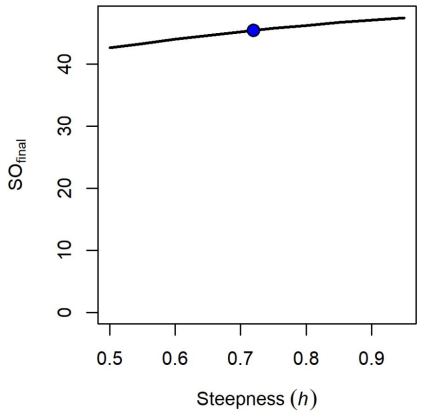








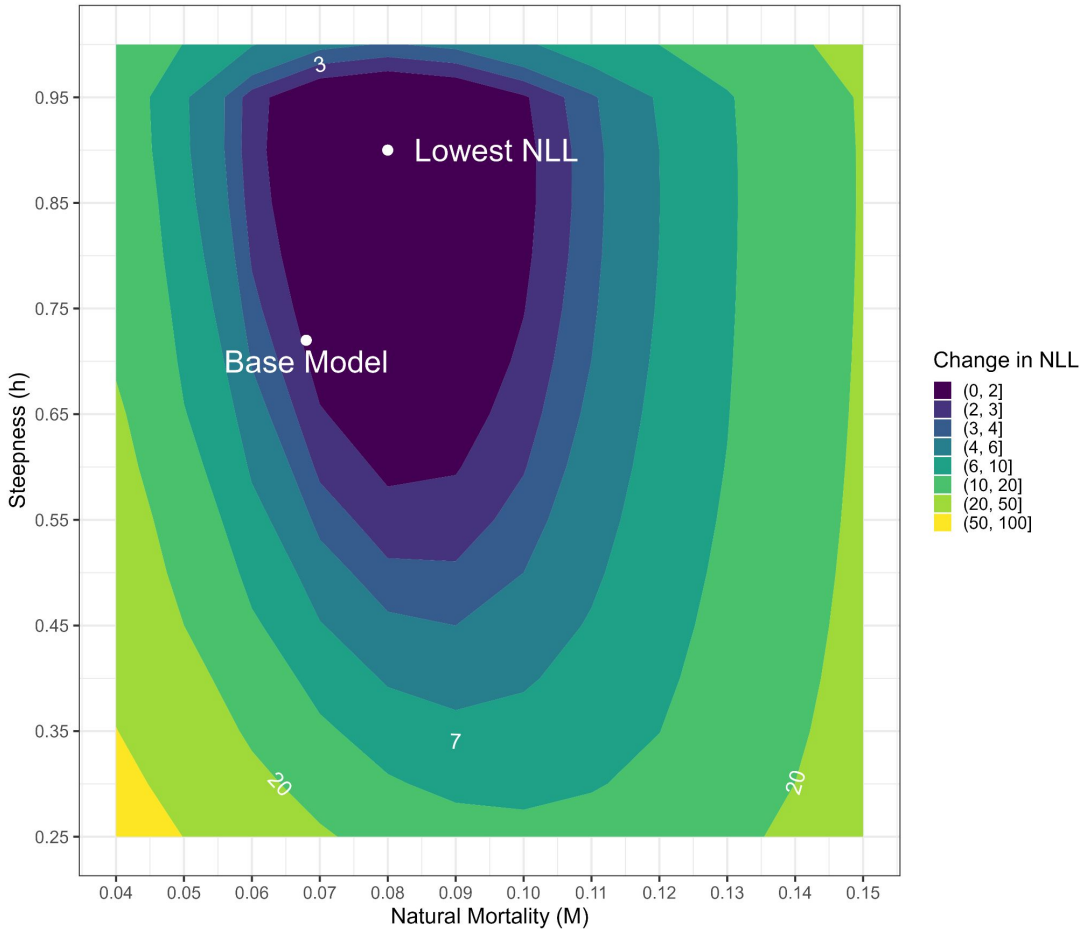


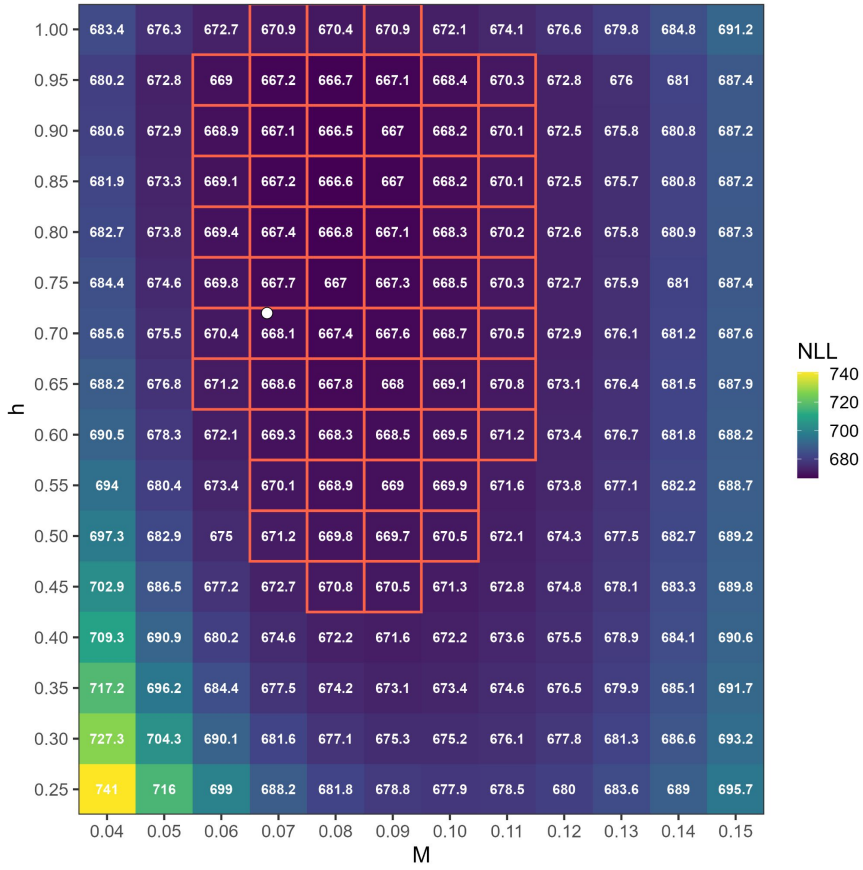


Blue point is the base model value

- Minimized at higher values, but profile is flat above 0.65.
- Age data suggest lower steepness values

Profile: Natural Mortality and Steepness





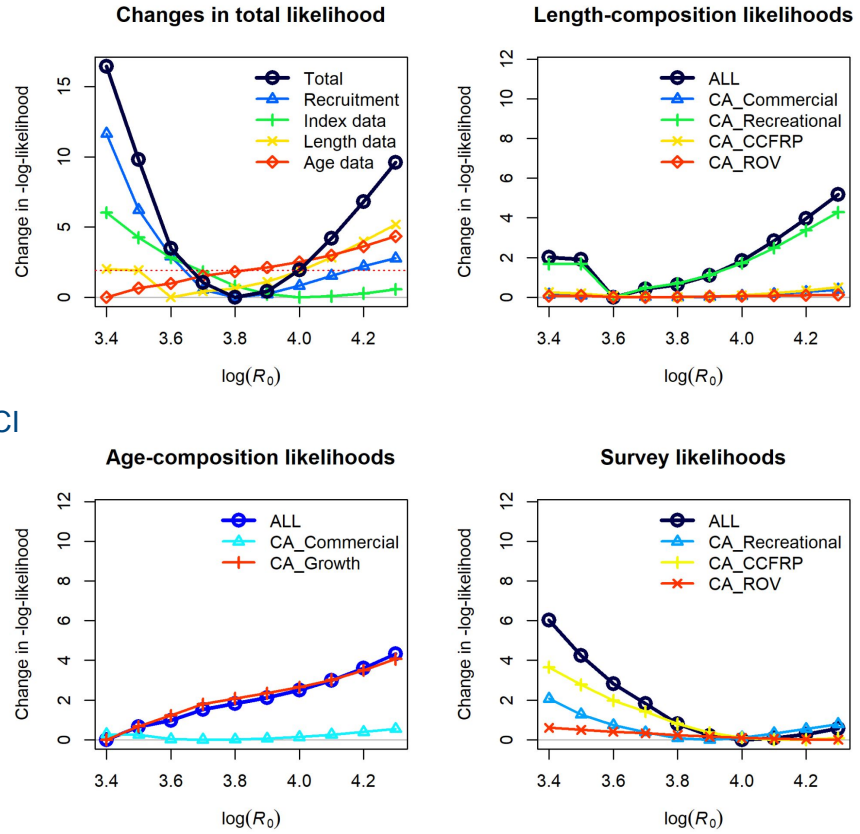
Flat likelihood surface around minimum. Base within 2 likelihood units

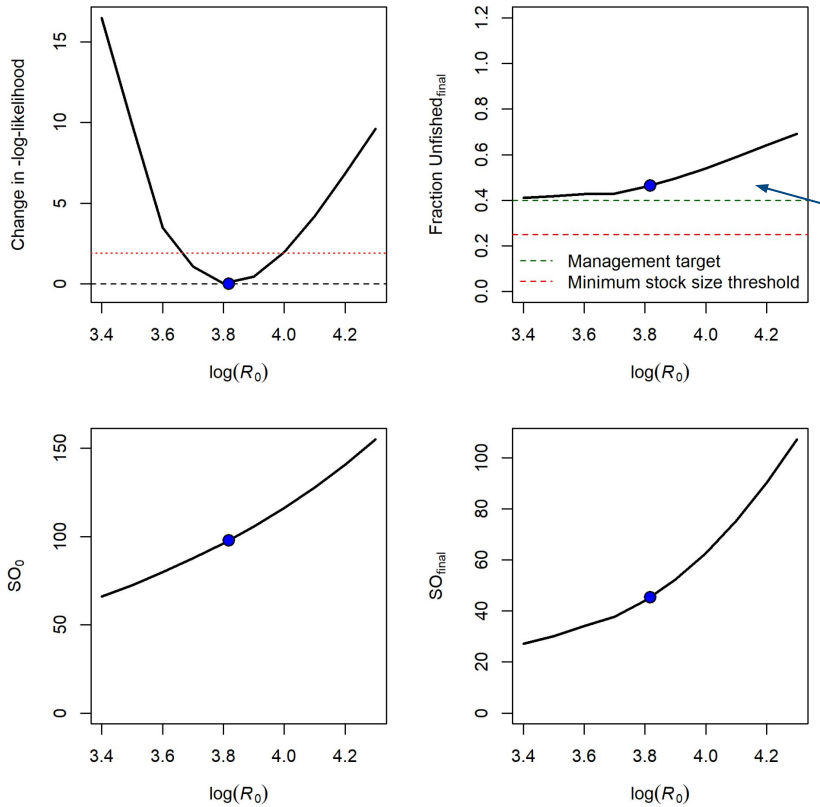
NLL: Negative log likelihood

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Profile: Unfished Recruitment (R0) - Estimated

red
dashed line
95% profile CI



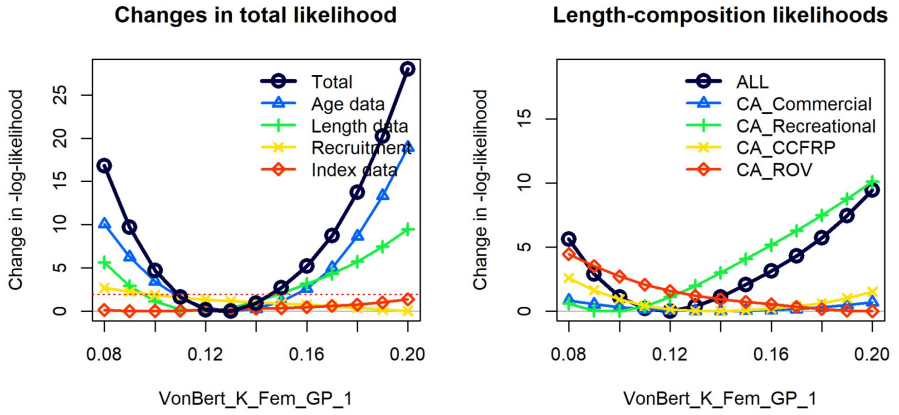


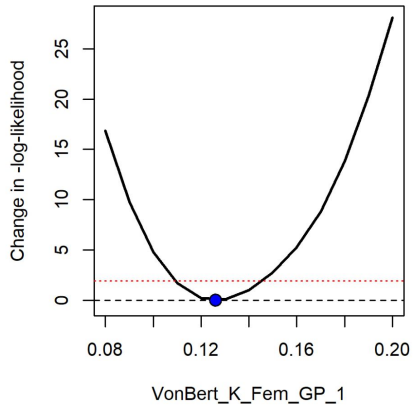
Blue point is the base model value

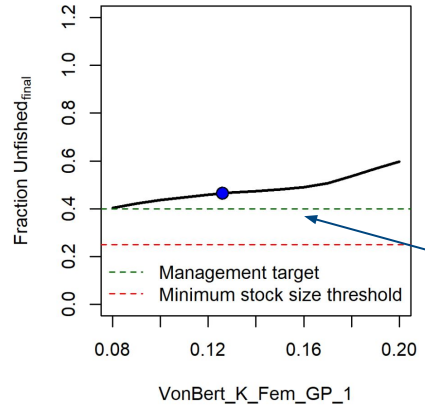
- Clear minimum at MLE
- Age data suggest lower value

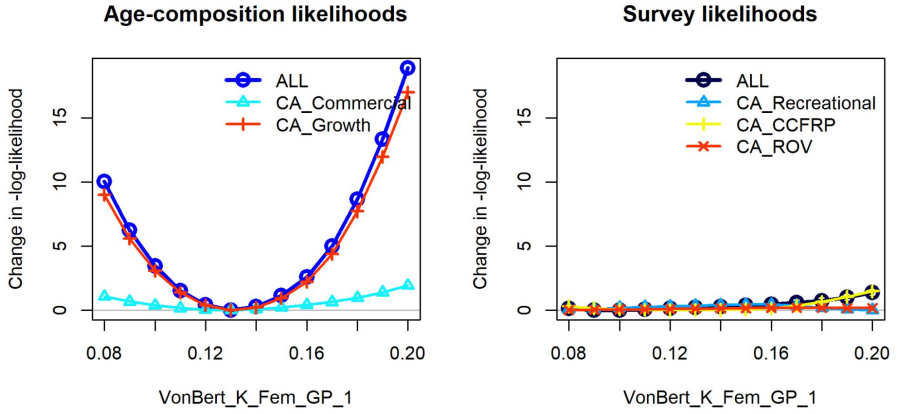
Profile: Growth parameter (*K*) - Estimated

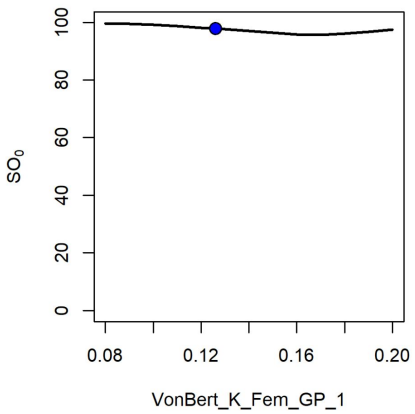
red
dashed line
95% profile CI

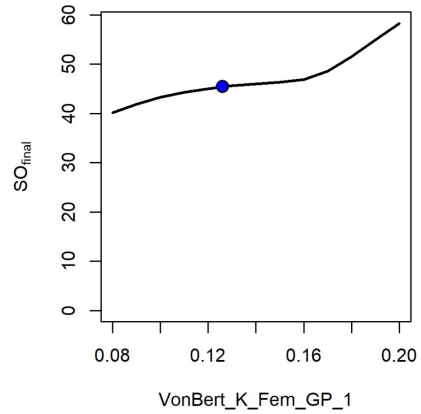












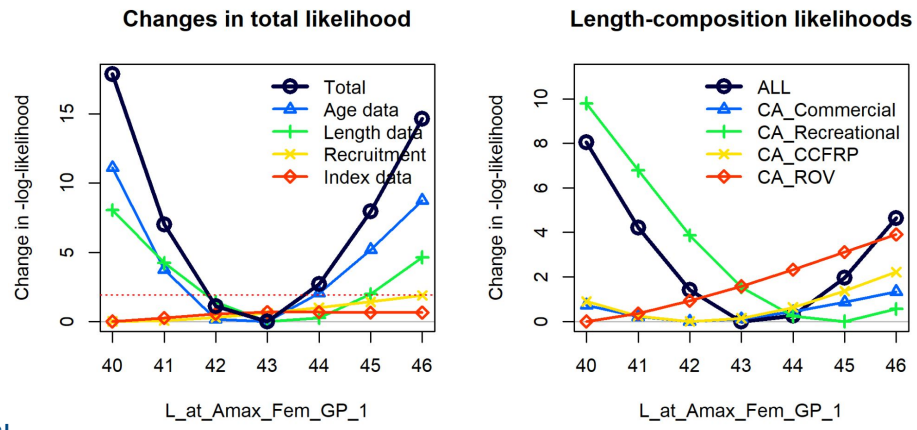
Blue point is the base model value

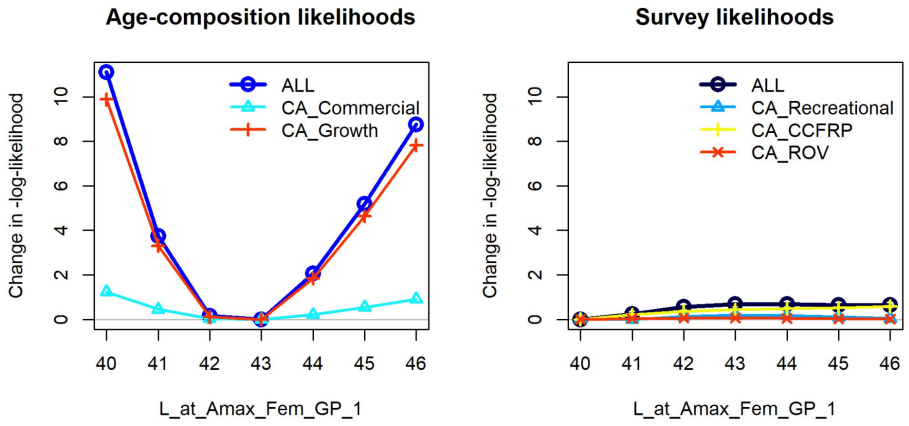
- Minimized at MLE. Age data (growth) and then length (rec) informative
- Some contrast among length data sources

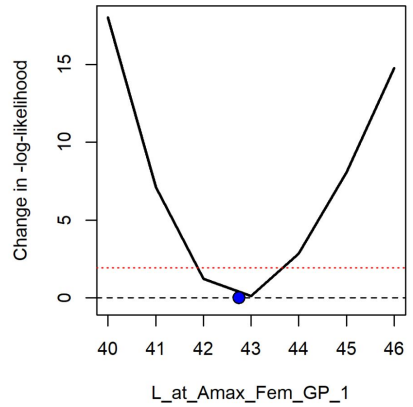
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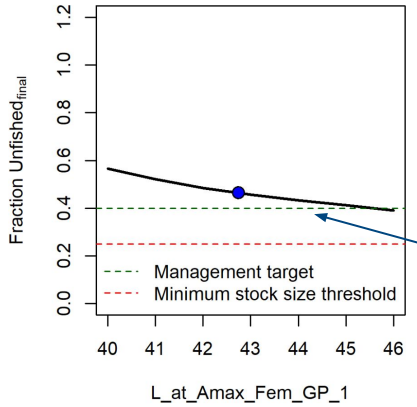
Profile: Maximum Average Length (L_∞) - Estimated

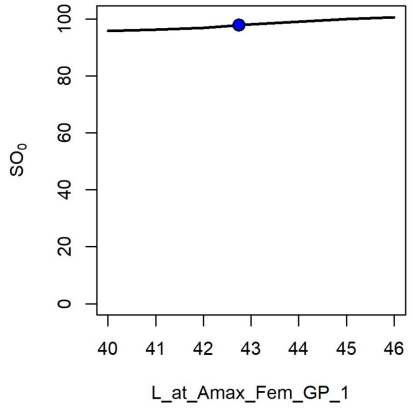
red dashed line 95% profile CI

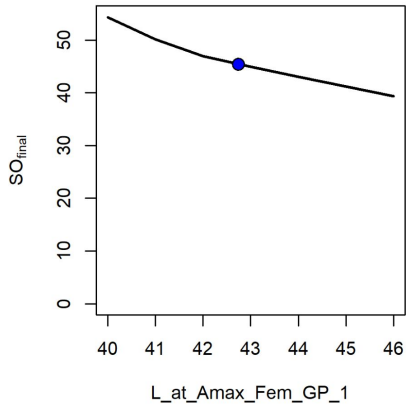












Blue point is the base model value

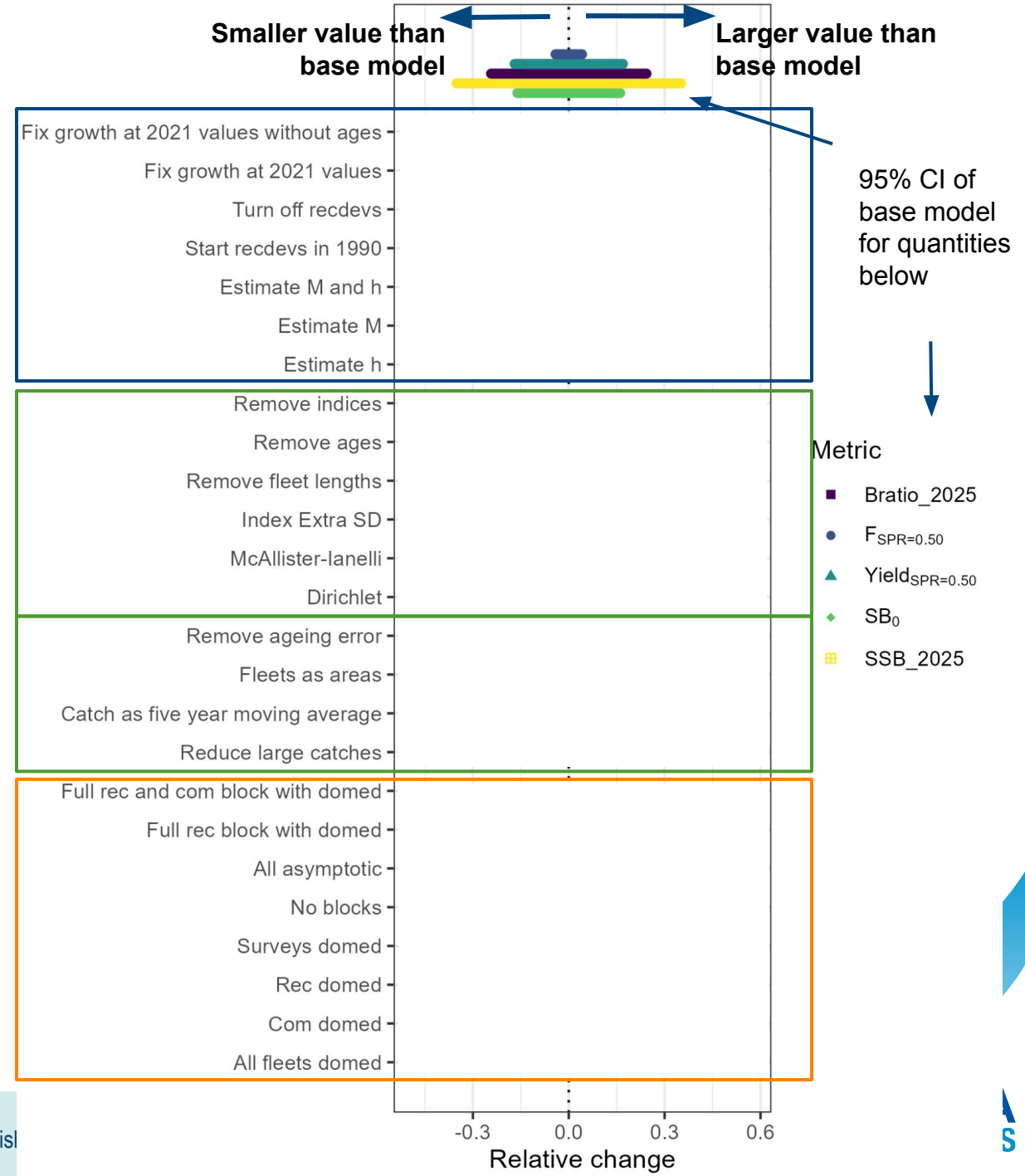
- Minimized at MLE. Age data (growth) and then length (rec) informative
- Some contrast among length data sources

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Sensitivity Takeaways

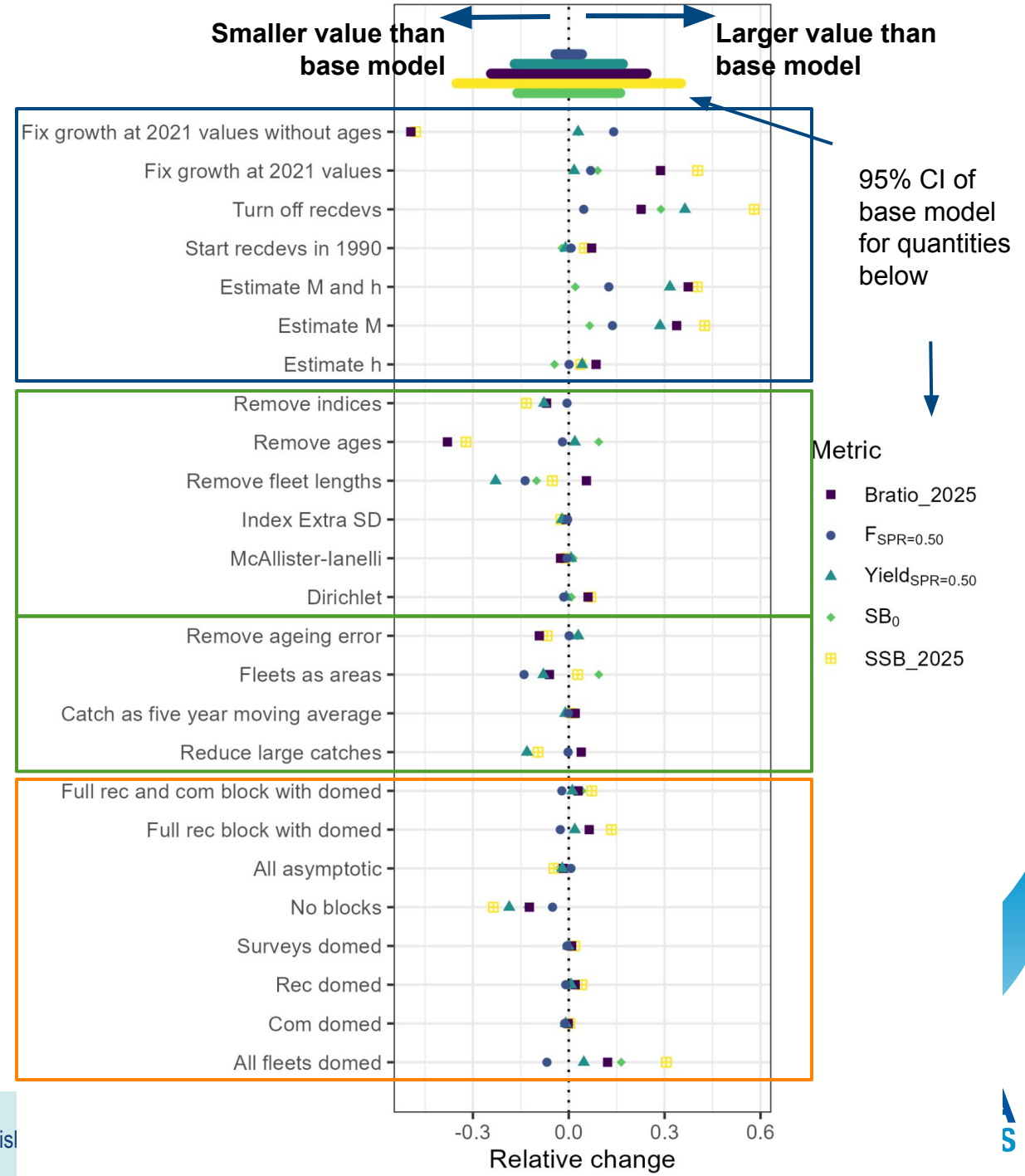
Sensitivity Takeaways

- Productivity (largest influence)
  - Growth and ages, natural mortality (M), and steepness (h) move the needle
- Data weighting and contributions
  - Ages and then lengths have a larger effect than the indices
- Data choices
  - Alternative catch and fleet structure affects scale
- Selectivity assumptions
  - Removing time block decreases all metrics in 2025
  - All fleets domed increases 2025 metrics



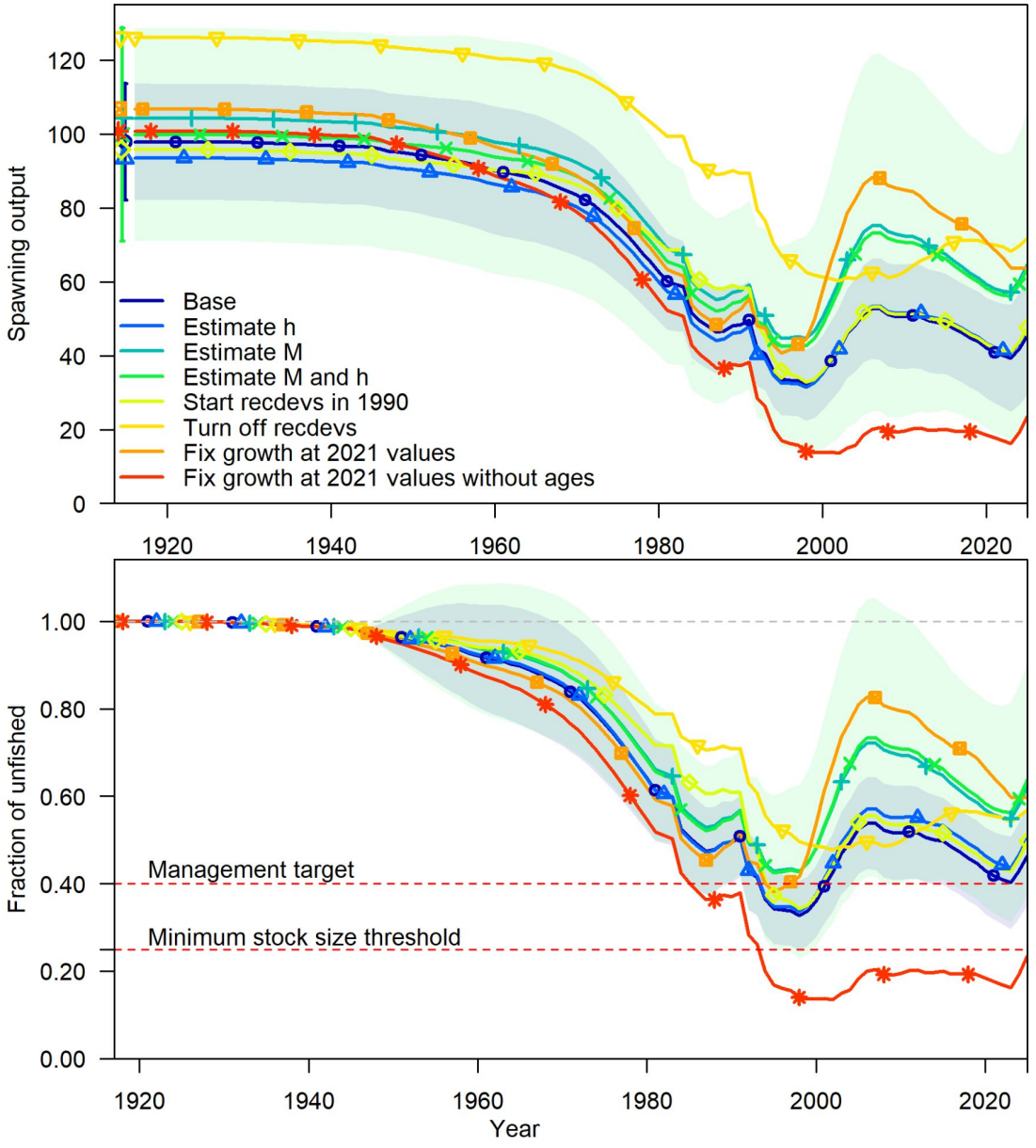
Sensitivity Takeaways

- Productivity (largest influence)
  - Growth and ages, natural mortality (M), and steepness (h) move the needle
- Data weighting and contributions
  - Ages and then lengths have a larger effect than the indices
- Data choices
  - Alternative catch and fleet structure affects scale
- Selectivity assumptions
  - Removing time block decreases all metrics in 2025
  - All fleets domed increases 2025 metrics



Sensitivities: Productivity

- Estimating M had largest influence (M = 0.082)
- Turning off recdevs affected scale and recent pattern
- Age data influences productivity interpretation



recdevs: Recruitment deviations from the Beverton-Holt curve

Sensitivities: Productivity

Table 13: Productivity sensitivities. Values of negative log-likelihood, estimates of key parameters, and estimates of derived quantities between the base model and several alternative models (columns) relative to productivity. See main text for details on each sensitivity analysis.

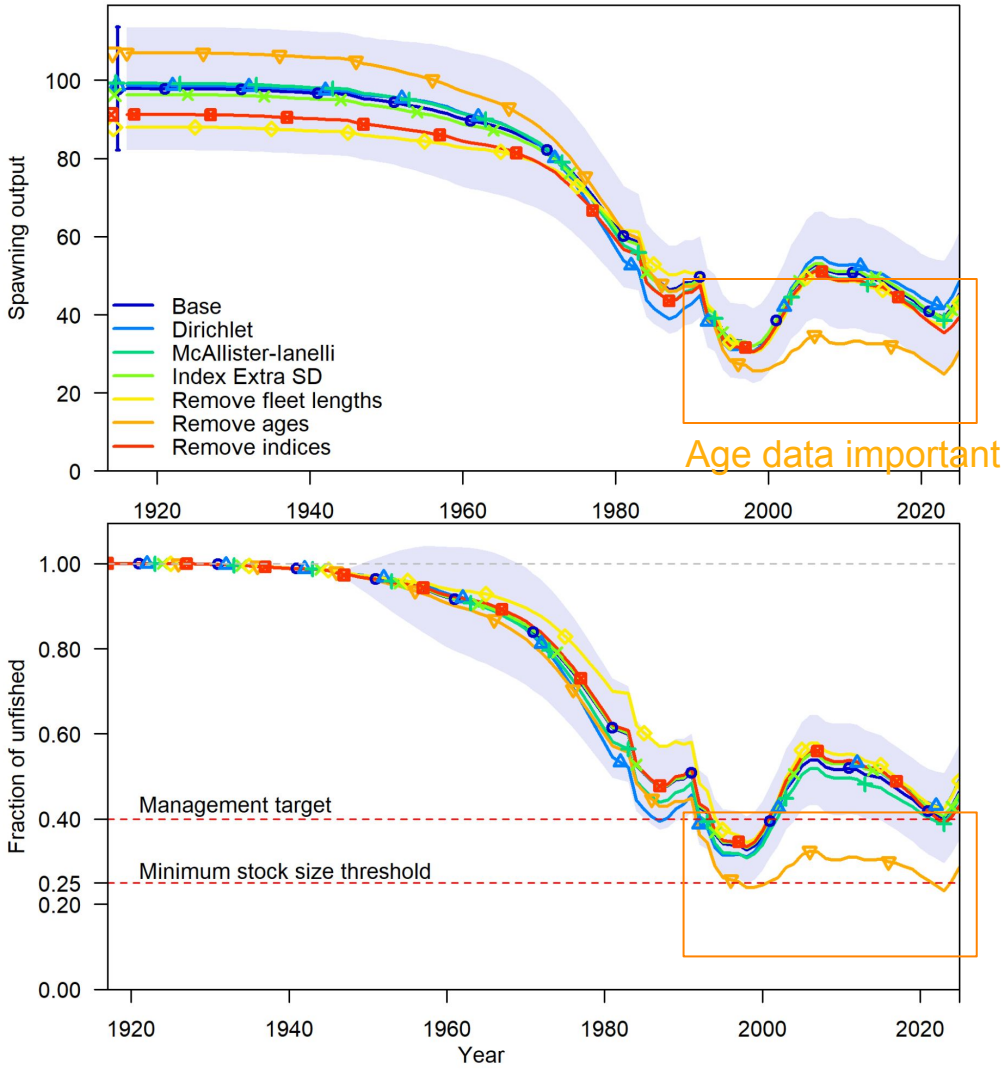
	Base	Estimate h	Estimate M	Estimate M and h	Start recdevs in 1990	Turn off recdevs	Fix growth at 2021 values	Fix growth at 2021 values without ages
TOTAL_like	668.238	667.333	667.198	666.535	674.787	835.608	912.006	153.810
Survey_like	-26.349	-26.569	-26.836	-26.902	-26.837	-4.675	-10.250	-31.400
Length_comp_like	174.184	173.691	174.521	174.165	180.530	216.518	238.755	172.382
Age_comp_like	500.121	500.147	500.076	500.051	504.338	623.762	655.005	NA
Recruitment_like	20.280	19.991	19.237	19.018	16.753	0.000	28.412	12.824
Forecast_Recruitment_like	0.001	0.001	0.000	0.000	0.000	0.000	0.080	0.002
Parm_priors_like	0.001	0.070	0.197	0.201	0.001	0.001	0.001	0.001
Recr_Virgin_thousands	45.520	43.416	68.817	63.817	45.020	60.135	35.787	33.794
SR_LN(R0)	3.818	3.771	4.231	4.156	3.807	4.097	3.578	3.520
SR_BH_steep	0.720	0.905	0.720	0.895	0.720	0.720	0.720	0.720
NatM_uniform_Fem_GP_1	0.068	0.068	0.082	0.080	0.068	0.068	0.068	0.068
L_at_Amax_Fem_GP_1	42.749	42.763	42.819	42.817	42.584	42.003	43.040	43.040
VonBert_K_Fem_GP_1	0.126	0.126	0.126	0.126	0.127	0.135	0.199	0.199
SSB_Virgin	97.832	93.480	104.233	99.843	95.761	126.053	106.677	100.738
SSB_2025	45.426	47.110	64.742	63.691	47.644	71.786	63.754	23.656
Bratio_2025	0.464	0.504	0.621	0.638	0.498	0.569	0.598	0.235
SPRratio_2024	0.092	0.089	0.056	0.058	0.088	0.057	0.068	0.177

Similar likelihood

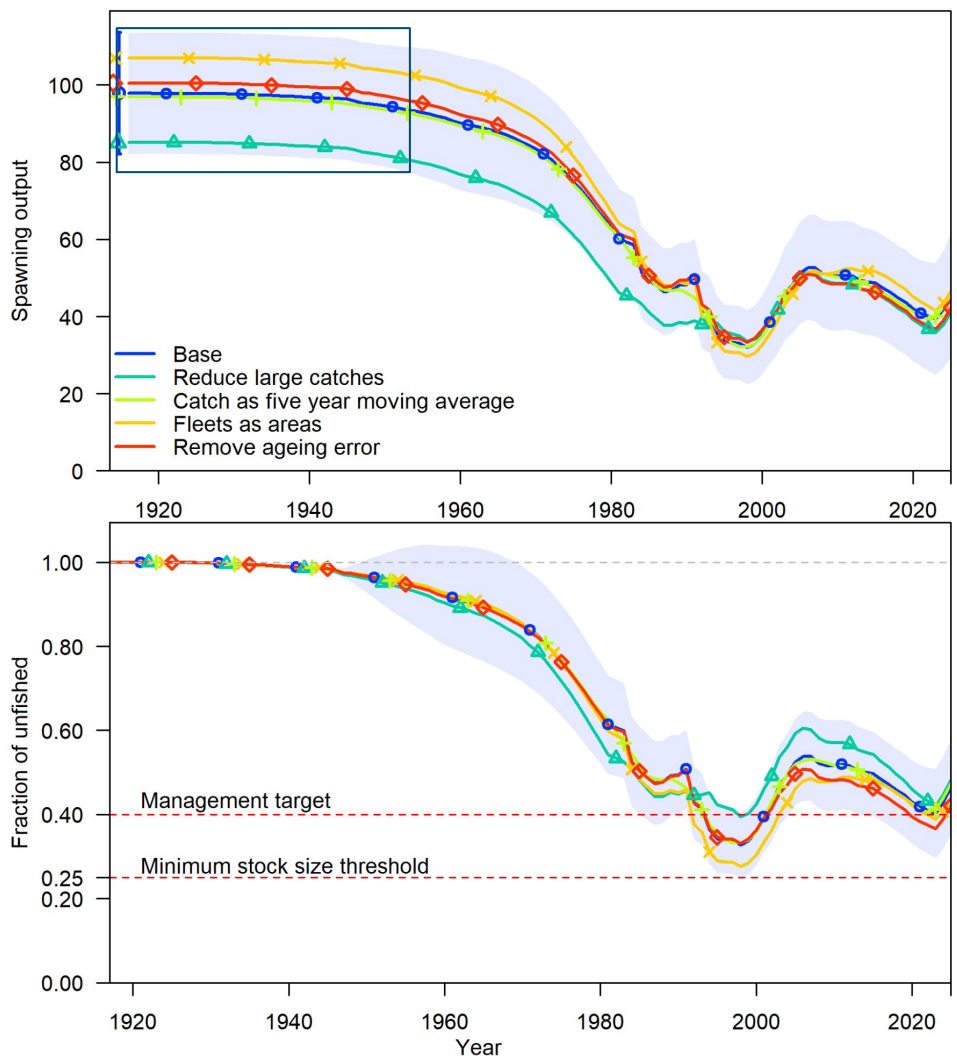
Estimated M ~ 0.08 implies longevity is 65

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Sensitivities: Data



Catch and fleet structure affect estimates of R0



Sensitivities: Data related sensitivities

Table 14: Data weighting and contribution sensitivities. Values of negative log-likelihood, estimates of key parameters, and estimates of derived quantities between the base model and several alternative models (columns) relative to data weighting. See main text for details on each sensitivity analysis. Because of differences in the relative contributions of data for these sensitivities, likelihoods are generally not comparable.

	Base	Dirichlet	McAllister-Ianelli	Index Extra SD	Remove fleet lengths	Remove ages	Remove indices
TOTAL_like	668.238	3459.920	732.540	663.147	523.152	146.259	693.216
Survey_like	-26.349	-27.104	-27.019	-30.498	-26.971	-26.817	0.000
Length_comp_like	174.184	1990.460	302.462	174.371	39.883	165.269	174.457
Age_comp_like	500.121	1444.480	434.361	500.125	495.365	0.000	500.451
Recruitment_like	20.280	34.110	22.733	19.146	14.859	7.798	18.301
Forecast_Recruitment_like	0.001	0.050	0.001	0.001	0.000	0.008	0.004
Parm_priors_like	0.001	17.918	0.001	0.001	0.001	0.001	0.001
Recr_Virgin_thousands	45.520	45.267	45.623	44.591	43.495	41.789	42.019
SR_LN(R0)	3.818	3.813	3.820	3.798	3.773	3.733	3.738
SR_BH_steep	0.720	0.720	0.720	0.720	0.720	0.720	0.720
NatM_uniform_Fem_GP_1	0.068	0.068	0.068	0.068	0.068	0.068	0.068
L_at_Amax_Fem_GP_1	42.749	43.070	42.846	42.759	41.614	43.850	42.759
VonBert_K_Fem_GP_1	0.126	0.121	0.125	0.127	0.146	0.134	0.128
SSB_Virgin	97.832	98.635	99.195	96.296	87.966	107.007	91.196
SSB_2025	45.426	48.566	44.879	44.314	43.099	30.822	39.403
Bratio_2025	0.464	0.492	0.452	0.460	0.490	0.288	0.432
SPRratio_2024	0.092	0.088	0.094	0.094	0.093	0.142	0.104

Without ages interpretation of productivity different

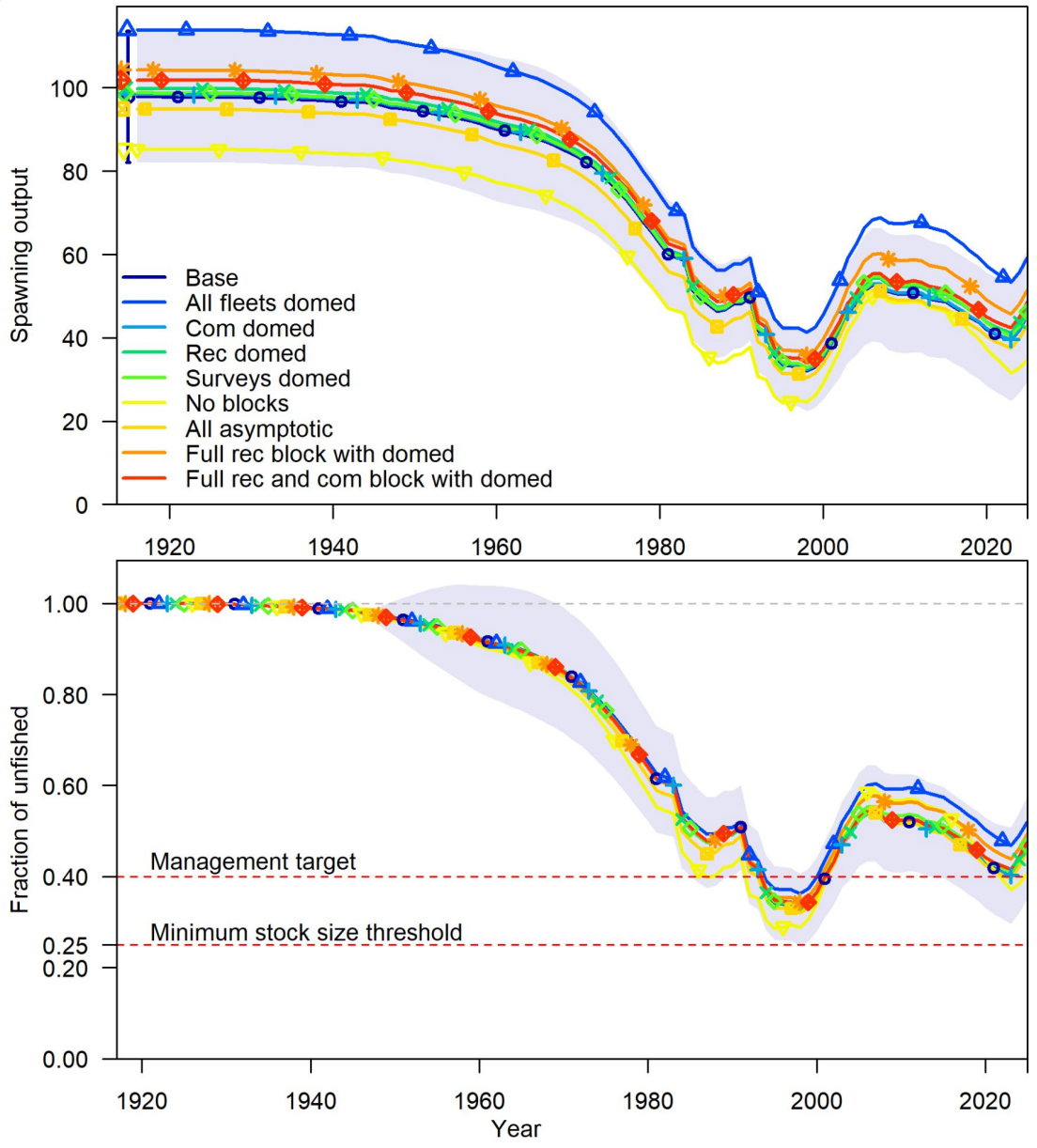
Table 15: Data choice sensitivities. Values of negative log-likelihood, estimates of key parameters, and estimates of derived quantities between the base model and several alternative models (columns) relative to alternative data choices. See main text for details on each sensitivity analysis. Because of differences in data for these sensitivities, likelihoods are generally not comparable.

	Base	Reduce large catches	Catch as five year moving average	Fleets as areas	Remove ageing error
TOTAL_like	668.238	671.190	667.976	624.899	663.455
Survey_like	-26.349	-25.492	-26.486	-16.802	-26.059
Length_comp_like	174.184	175.546	174.229	256.027	175.167
Age_comp_like	500.121	499.942	500.123	368.917	496.127
Recruitment_like	20.280	21.190	20.107	16.751	18.217
Forecast_Recruitment_like	0.001	0.001	0.001	0.000	0.001
Parm_priors_like	0.001	0.001	0.001	0.001	0.001
Recr_Virgin_thousands	45.520	39.694	45.031	48.162	46.949
SR_LN(R0)	3.818	3.681	3.807	3.875	3.849
SR_BH_steep	0.720	0.720	0.720	0.720	0.720
NatM_uniform_Fem_GP_1	0.068	0.068	0.068	0.068	0.068
L_at_Amax_Fem_GP_1	42.749	42.691	42.752	43.795	42.737
VonBert_K_Fem_GP_1	0.126	0.127	0.126	0.112	0.125
SSB_Virgin	97.832	85.120	96.895	107.025	100.488
SSB_2025	45.426	41.067	45.898	46.686	42.358
Bratio_2025	0.464	0.482	0.474	0.436	0.422
SPRratio_2024	0.092	0.100	0.091	0.087	0.098

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Sensitivities: Selectivity

- Selectivity choices less influential
  - Assuming no blocks (all asymptotic) or current blocks all domed most influential
    - Current block and types supported by likelihood



Sensitivities: Selectivity

Table 16: Selectivity sensitivities. Number of parameters, values of negative log-likelihood, estimates of key parameters, and estimates of derived quantities between the base model and several alternative models (columns) relative to selectivity. See main text for details on each sensitivity analysis.

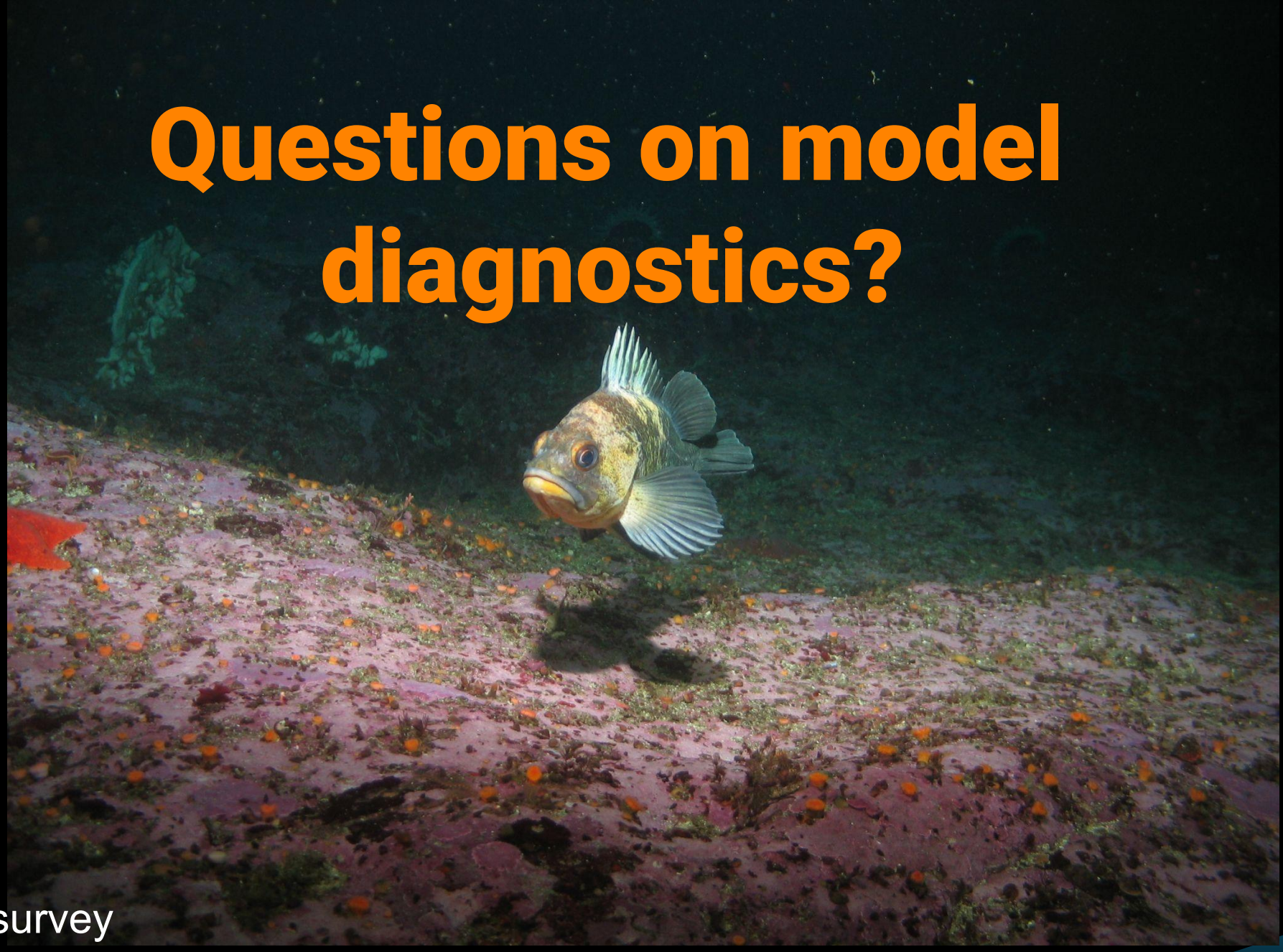
Change in likelihood per parameter suggests limited benefit

	Base	All fleets domed	Com domed	Rec domed	Surveys domed	No blocks	All asymptotic	Full rec block with domed	Full rec and com block with domed
Npar	121.000	127.000	123.000	123.000	123.000	114.000	120.000	130.000	134.000
TOTAL_like	668.238	665.915	667.625	668.172	667.582	696.889	670.733	666.874	666.980
Survey_like	-26.349	-26.587	-26.354	-26.385	-26.381	-20.142	-26.108	-26.455	-26.520
Length_comp_like	174.184	171.780	173.276	174.117	173.890	195.220	176.403	173.283	172.565
Age_comp_like	500.121	500.439	500.398	500.092	499.770	498.913	499.287	499.620	500.609
Recruitment_like	20.280	20.280	20.301	20.340	20.299	22.895	21.149	20.421	20.316
Forecast_Recruitment_-like	0.001	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001
Parm_priors_like	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Recr_Virgin_thousands	45.520	49.273	45.562	46.110	45.452	38.735	44.543	46.852	46.593
SR_LN(R0)	3.818	3.897	3.819	3.831	3.817	3.657	3.796	3.847	3.841
SR_BH_steep	0.720	0.720	0.720	0.720	0.720	0.720	0.720	0.720	0.720
NatM_uniform_Fem_-GP_1	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
L_at_Amax_Fem_GP_1	42.749	43.749	42.830	42.853	42.888	43.021	42.553	43.183	43.009
VonBert_K_Fem_GP_1	0.126	0.121	0.125	0.125	0.126	0.126	0.129	0.125	0.124
SSB_Virgin	97.832	113.883	98.387	99.827	98.772	85.248	94.879	104.238	101.886
SSB_2025	45.426	59.306	45.597	47.286	46.274	34.705	43.311	51.501	48.690
Bratio_2025	0.464	0.521	0.463	0.474	0.468	0.407	0.456	0.494	0.478
SPRratio_2024	0.092	0.075	0.092	0.089	0.090	0.117	0.095	0.082	0.087

Many other selectivity choices explored

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Questions on model diagnostics?



CDFW ROV survey

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Outline

1. Model Summary
2. Fits to the Data
3. Model Time Series
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections



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Uncertainties

Increase in population trajectory in recent years (productivity)

Growth

- Variability in length at a given age
- Few older fish
- >1,000 age available, but majority in growth fleet
- Greater population increase in recent years (along with age data)

Natural Mortality

- Unknown true maximum age for California
- Oldest observed age 57 (from 2018 CCFRP)
- Lack of historical ages
- Limited information in data to estimate yet values matter

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STAT Proposed Risk Table

Ecosystem and environmental conditions	Assessment data inputs	Assessment model fits and structural uncertainty
• There is limited information on factors affecting quillback recruitment, habitat, prey and predators, and competitors.	• Catch reconstruction has uncertainty in some historical years due to periods of high and low estimates of sampled catch rates and when rockfish were not always sorted to species	STAR panel discussion
	• Not captured in bottom trawl surveys. Indices based on fishery-dependent and other fishery-independent sources. Limited effect on population trends.	
	• Age data is limited compared to some other groundfish species and primarily occurs in the most recent 5-10 years. Covers commercial sector and suitable for growth estimation. Young fish remain sparse.	
	• Fewer samples of length data from fishing in recent years due to non-retention	
	• Length and age data are generally fit well across many assumptions.	
	• Species-specific maturity and fecundity with both being collected from most recent years	
	• Generally not a directly targeted species but most catch is landed.	
Level is Unknown	Level 3: Medium agreement, Limited Evidence (in Table)	Level is to be determined

Neutral to Unfavorable Level (higher uncertainty)

STAR Panel discussion

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Outline

1. Model Summary
2. Fits to the Data
3. Model Time Series
4. Model Diagnostics
5. Uncertainties, Risk Table
6. Projections
    a. Projection Table
    b. Decision Table



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Projections* and Decision Table

*Draft version

- Current Projection Table

Table vii: Potential OFLs (mt), ABCs (mt), ACLs (mt), the buffer between the OFL and ABC based on a category 1 sigma of 0.5 and P^* of 0.45, estimated spawning output (billions of eggs), and fraction of unfished spawning output with adopted OFLs and ACLs and assumed catch for the first two years of the projection period.

Year	Adopted OFL (mt)	Adopted ACL (mt)	Assumed Catch (mt)	OFL (mt)	Buffer	ABC (mt)	ACL (mt)	Spawning output (Billions of eggs)	Fraction Unfished
2025	1.50	1.30	1.30	—	—	—	—	45	0.464
2026	1.80	1.50	1.50	—	—	—	—	49	0.501
2027	—	—	—	13.52	0.935	12.64	12.64	53	0.537
2028	—	—	—	13.89	0.930	12.92	12.92	54	0.550
2029	—	—	—	14.13	0.926	13.09	13.09	55	0.559
2030	—	—	—	14.27	0.922	13.16	13.16	55	0.564
2031	—	—	—	14.31	0.917	13.12	13.12	55	0.567
2032	—	—	—	14.29	0.913	13.04	13.04	55	0.567
2033	—	—	—	14.21	0.909	12.92	12.92	55	0.565
2034	—	—	—	14.11	0.904	12.75	12.75	55	0.562
2035	—	—	—	13.99	0.900	12.59	12.59	55	0.558
2036	—	—	—	13.87	0.896	12.42	12.42	54	0.554

STAR Panel discussion

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Thank you to everyone who shared, collected and processed data

Age reads: Jamie Hale, Patrick McDonald
Maturity reads: Melissa Head
Fecundity counts: Buddy Pendergast, Jessica Choi
Mapping and data wrangling: Rebecca Miller, E.J., Dick, Tanya Rogers, Rachel Brooks

CDFW for additional age samples
CDFW & MARE: ROV survey data

CCFRP for continued survey data and fish processing

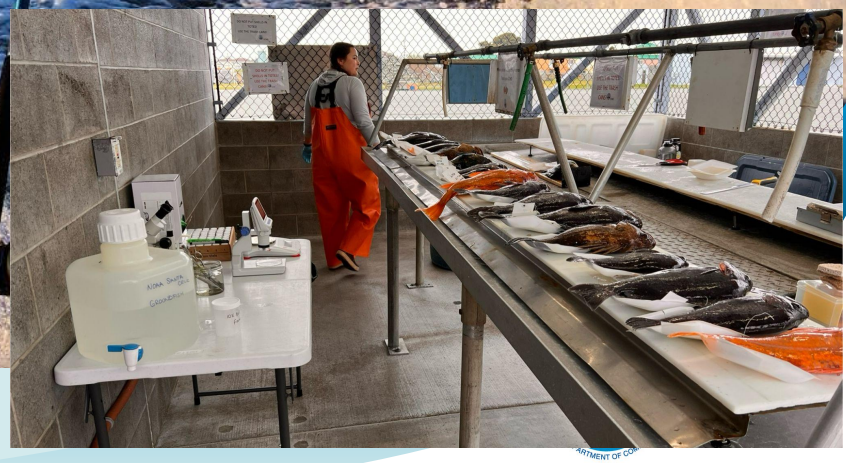
CCFRP and SWFSC vessel/operators:
Crescent City Fishing Charters - Steve Huber, F/V Out of the Box
Stella's Adventures - Harry Adams, F/V Onyx
Northwind Charters - Matt Dallam, F/V Fishy Business
Reel Steel Sportfishing - Tim Klassen, F/V New Reel Steel
Coastline Fishing Charters - Mark Schmidt, F/V Scrimshaw
Fort Bragg Sportfishing - Kurt Akin, F/V Kyndall Lynn
Bodega Bay Sportfishing - Rick Powers, F/V New Sea Angler
Salty Lady Sportfishing - Jared Davis, F/V Salty Lady
Sea Wolf Sportfishing - Jon Yokomizo, F/V Sea Wolf
Huli Cat Sportfishing - Tom Mattusch. F/V Huli Cat
New Captain Pete Sportfishing - Mike Cabanas, F/V New Captain Pete

Pre-STAR reviews: Marlene Bellman, Cheryl Barnes, Owen Hamel
Guidance: Tim Klassen, Thompson Benez



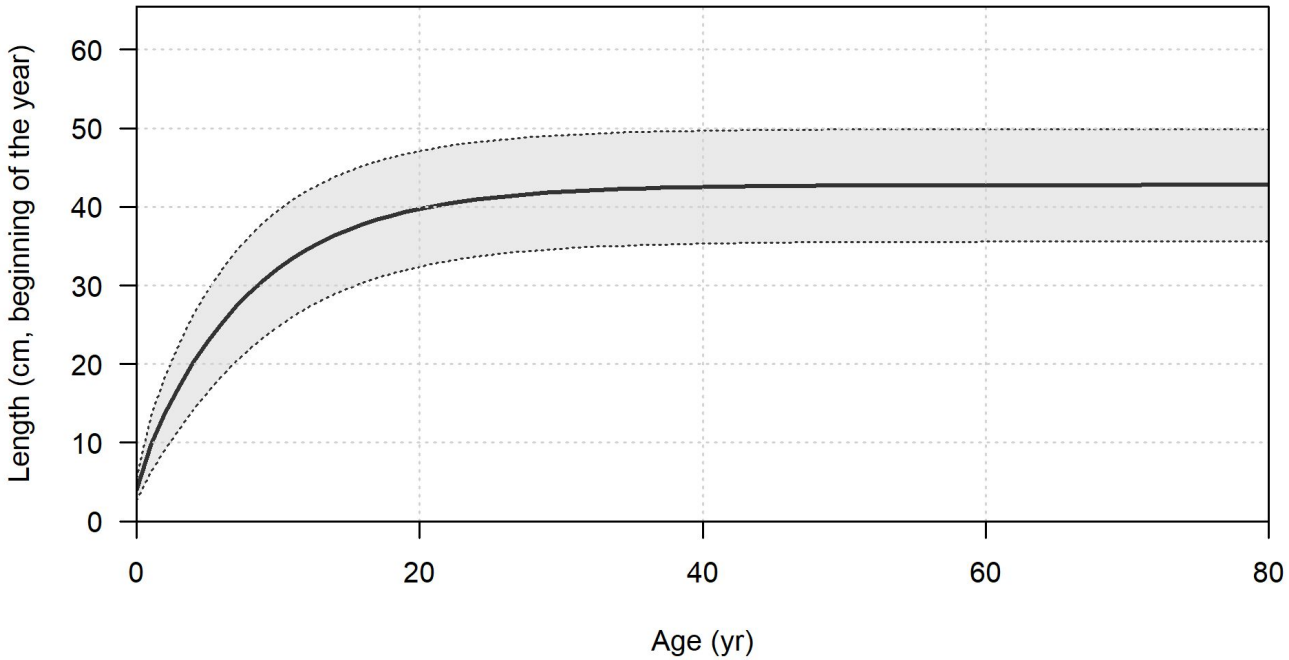
PC: Rachel Brooks


PC: Rachel Brooks



Extra Slides

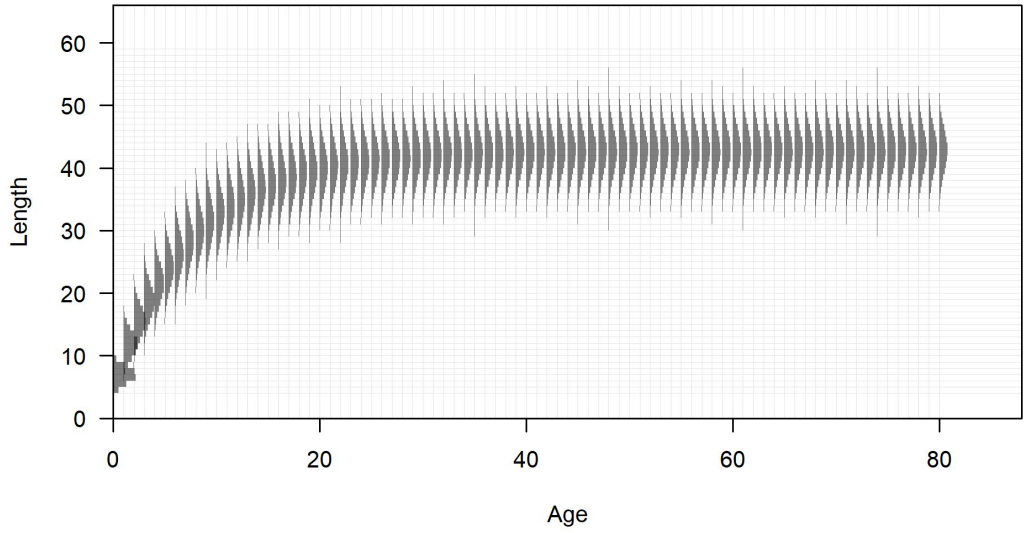
Estimated Biological Parameters



$L_{age = 1}$ = 9.8 cm (CV = 0.18)

$L_{age\ max}$ = 42.7 cm (CV = 0.09)

k = 0.126



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Base Model Parameters

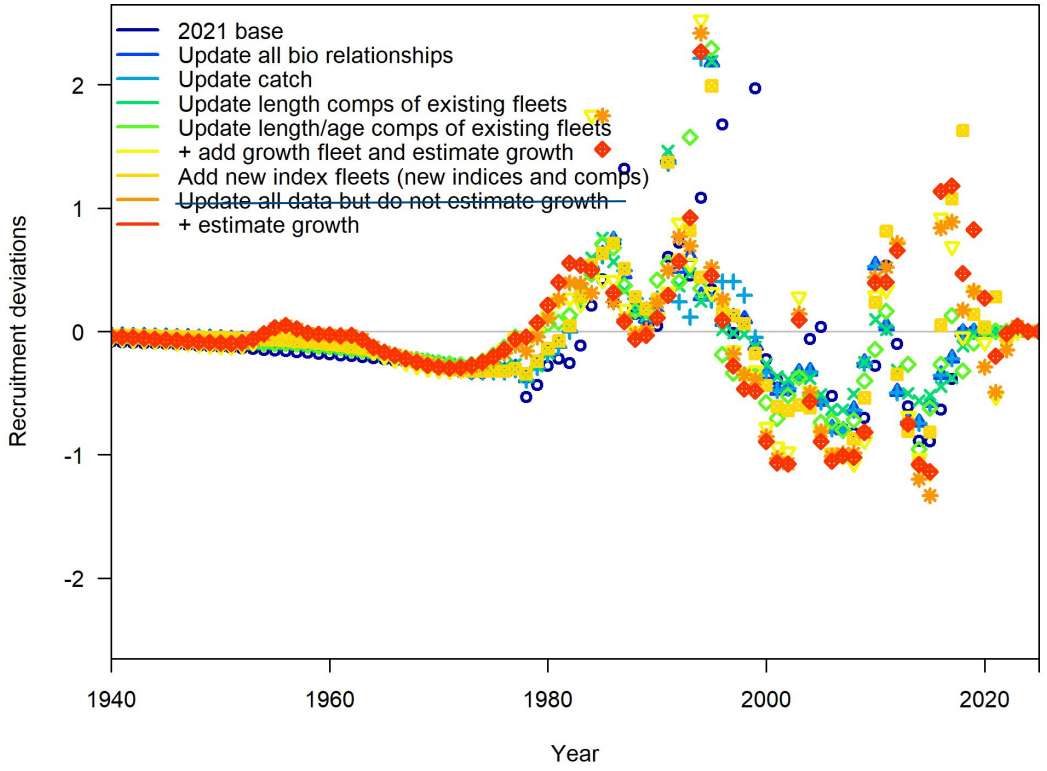
Total parameters: 121

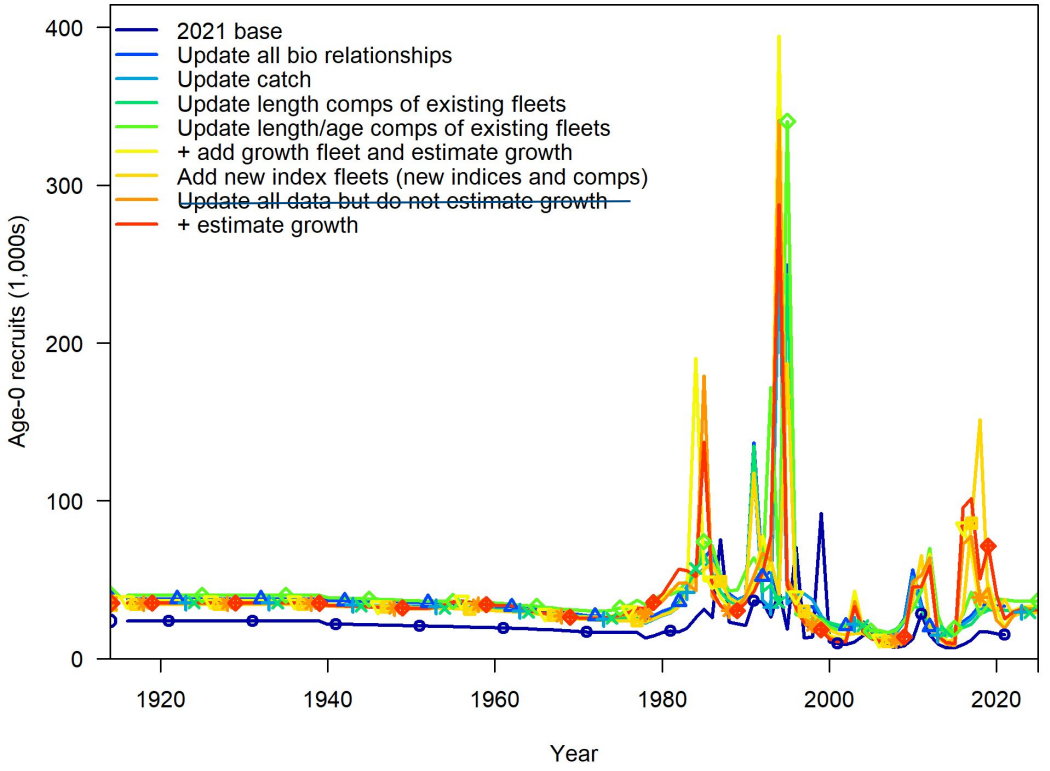
- Recruitment ln(R0): 1
- Recruitment devs: 97: 85 plus 12 (forecast)
- Growth: 5: 3 (mean) 2 (variability)
- Selectivity and blocks: 15: 8 (main) 7 (time-varying)
- Survey: 3

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Model Bridging: Data Recruitment Results

Steps build from Update Catch individually except '+' and last one

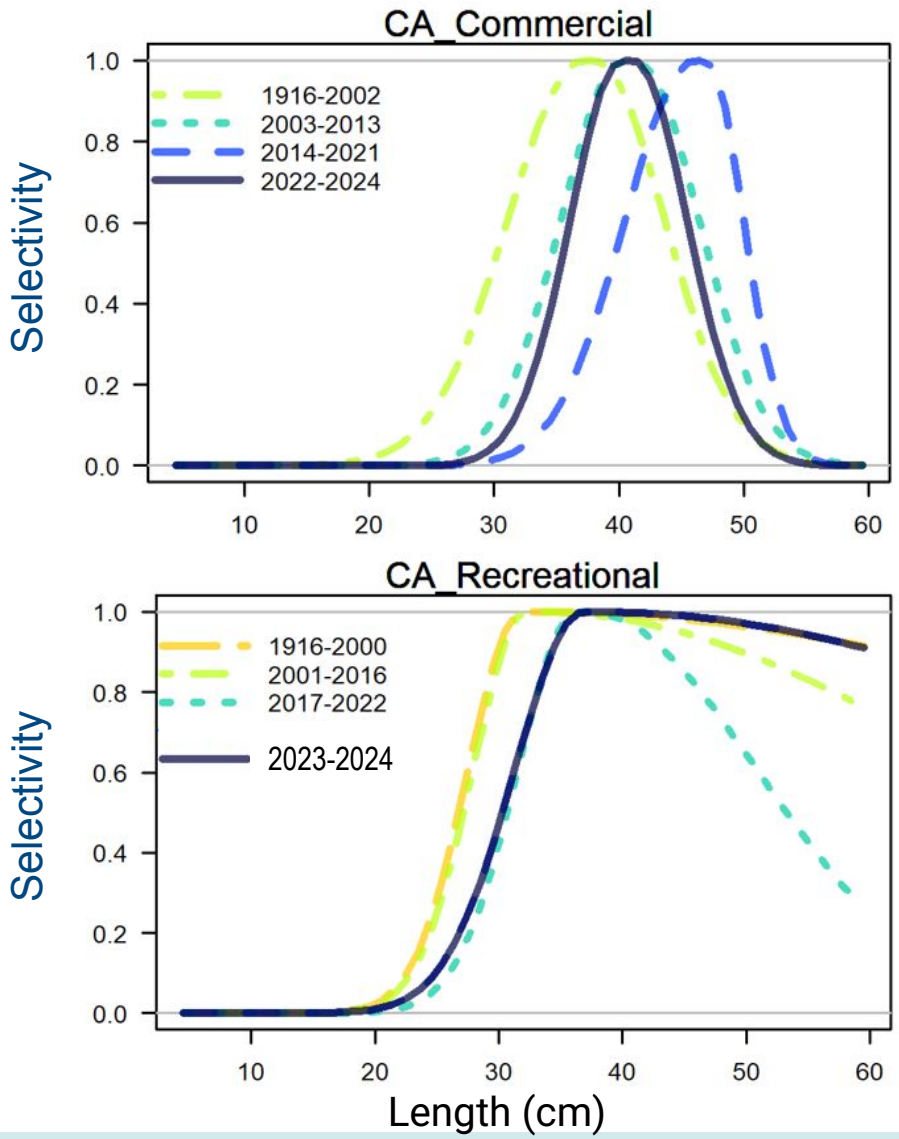




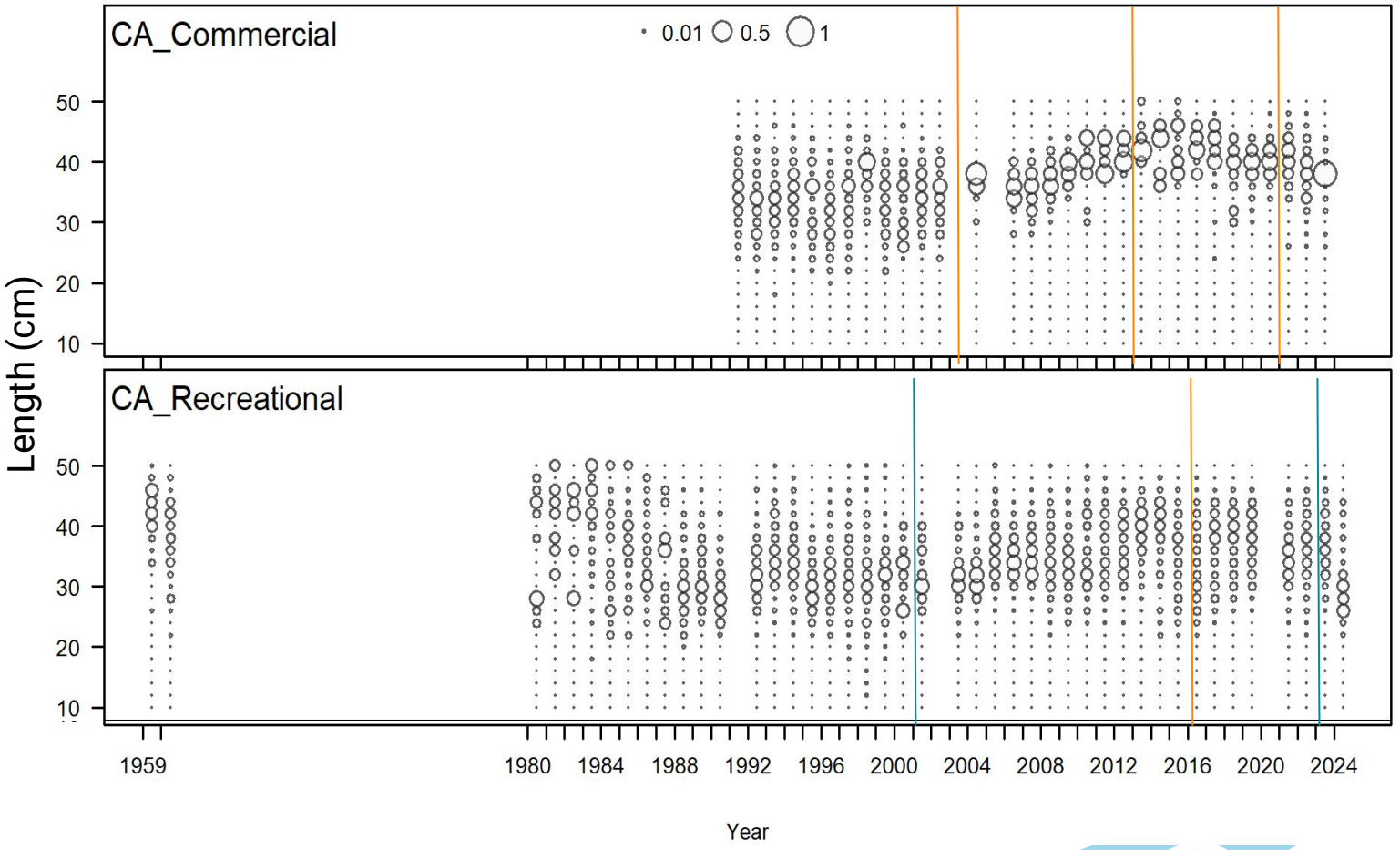
— Crossed out run not shown in report figures

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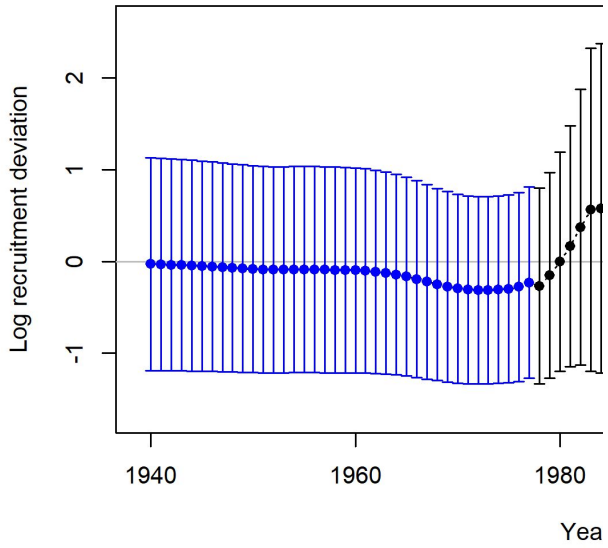
Length-based Selectivity: Full exploration with Dome

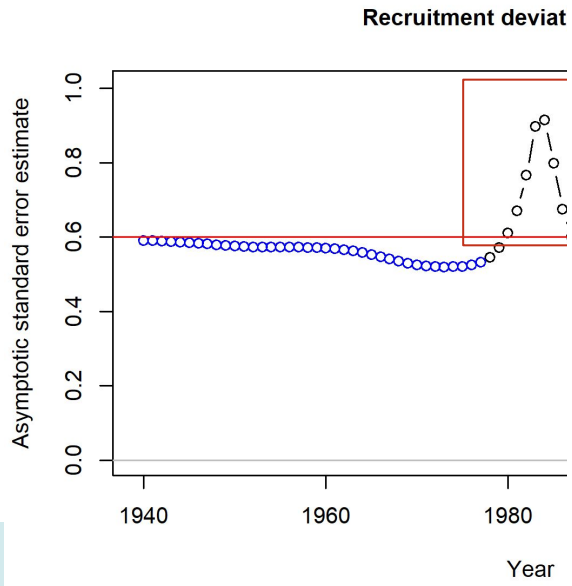


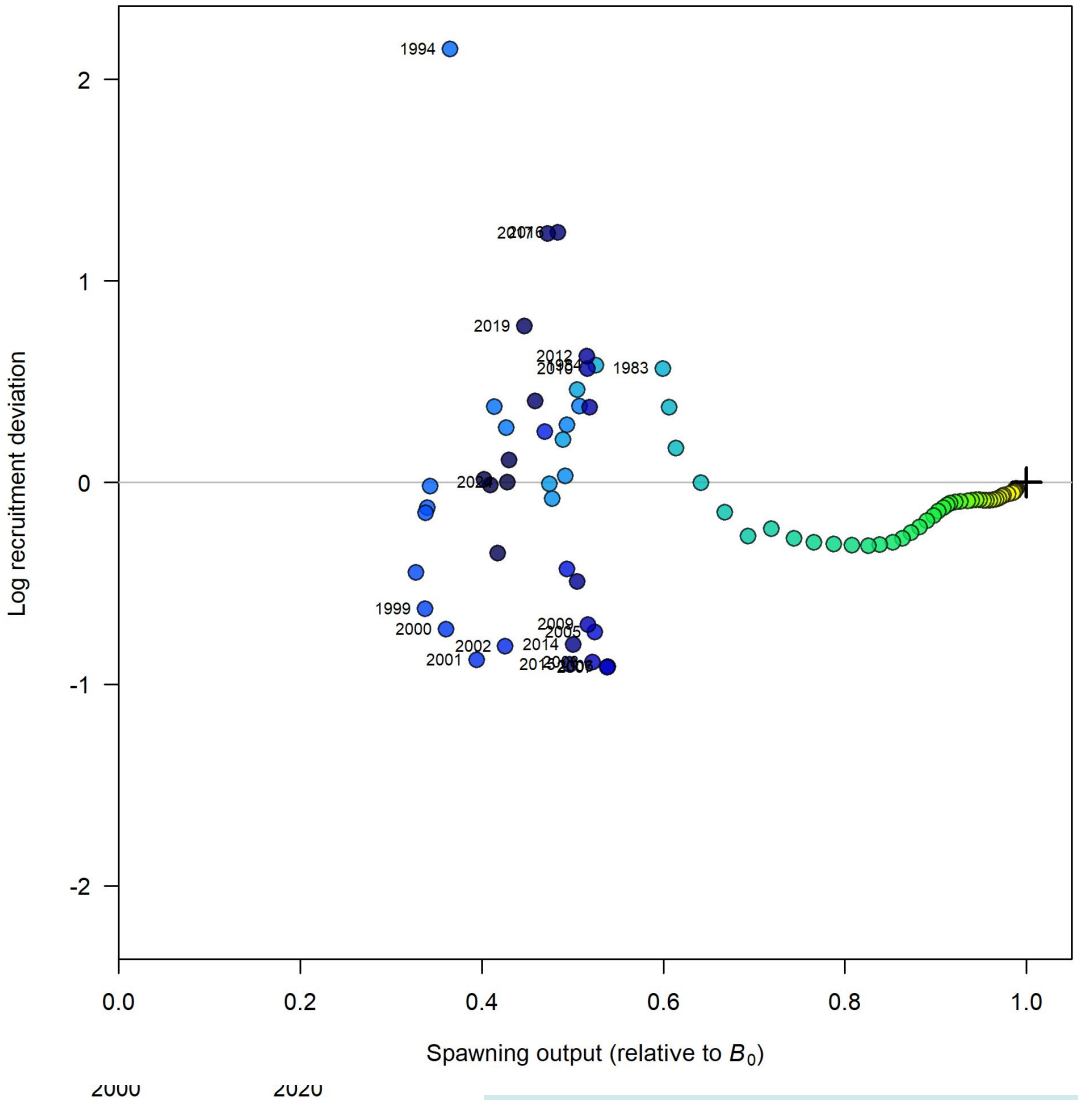
Commercial: 2022-2024 mirrored to 2003-2013
Orange bars represent time blocks

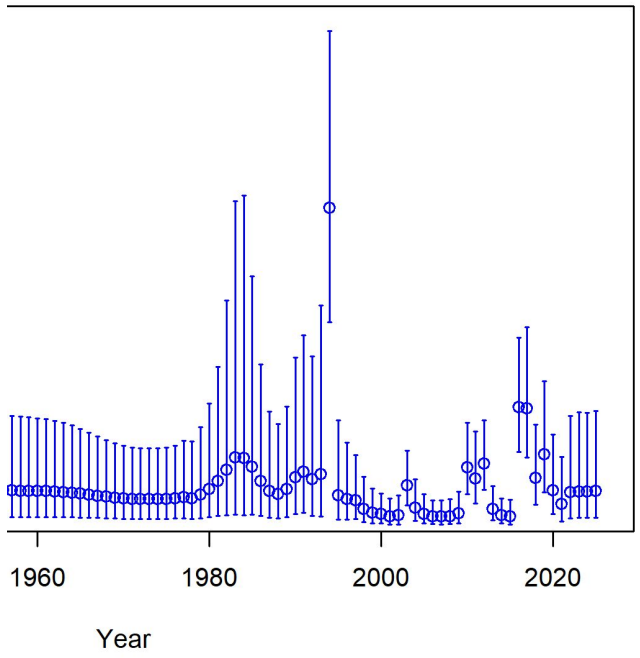


Recruitments and Deviations







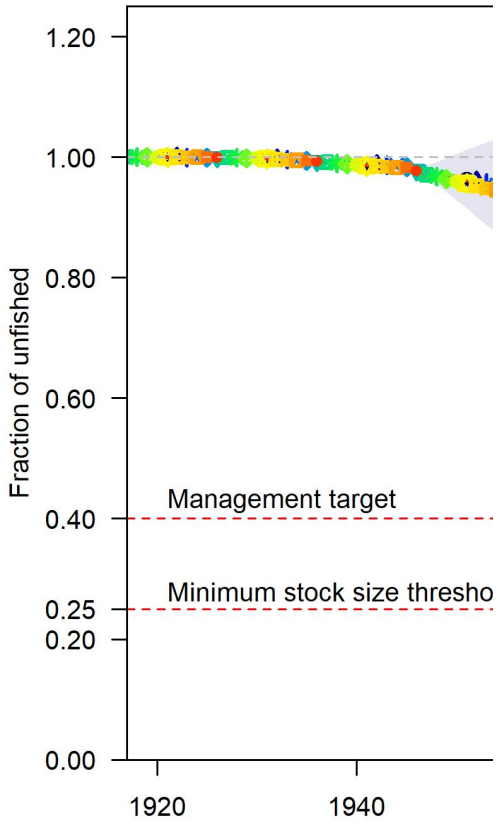


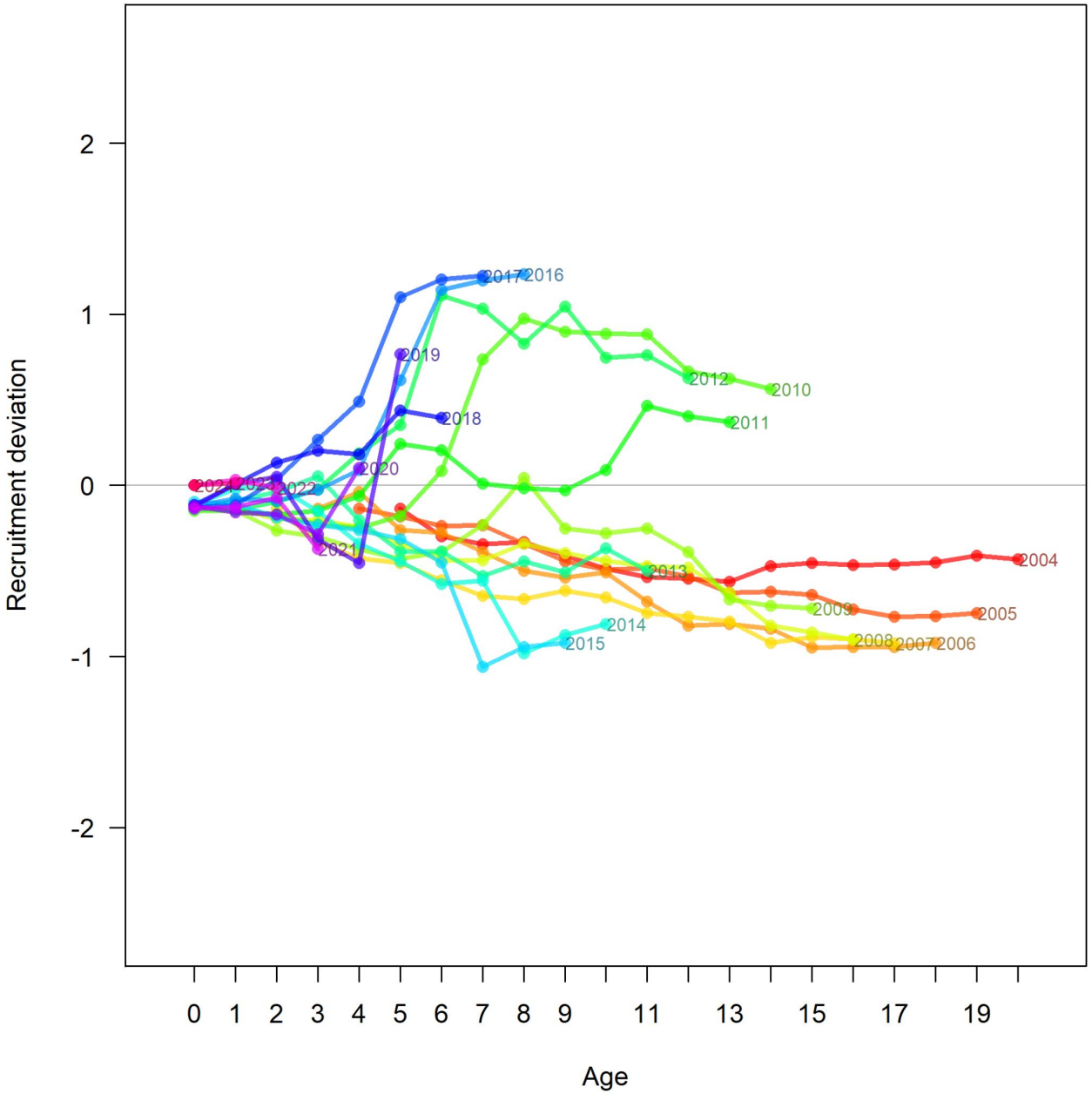
class (1994) due to
age data.
year class more
rom late 1980s-1999

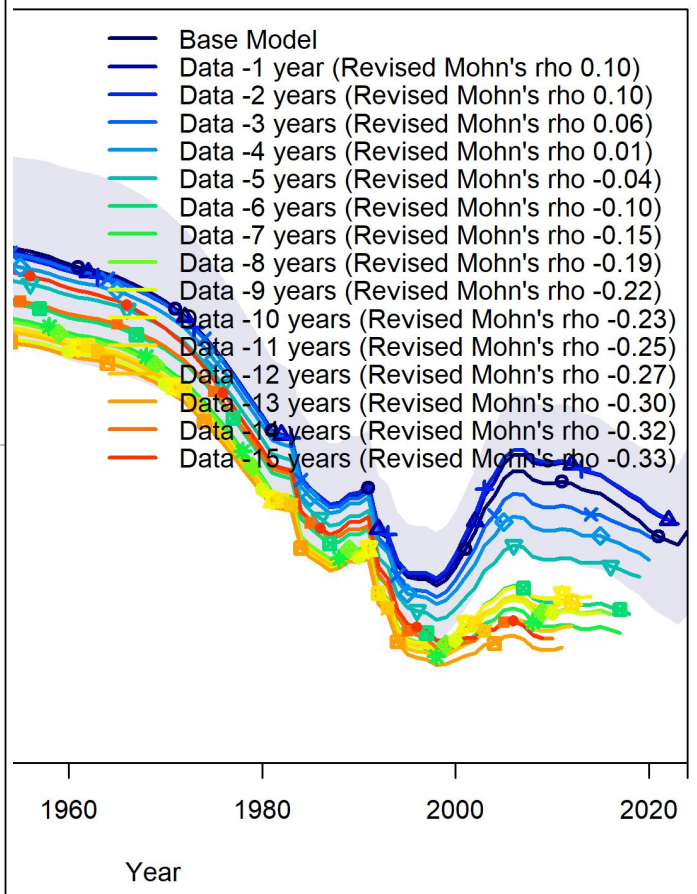
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Retrospective Pattern

Pattern follows removal of age
cent recruitment







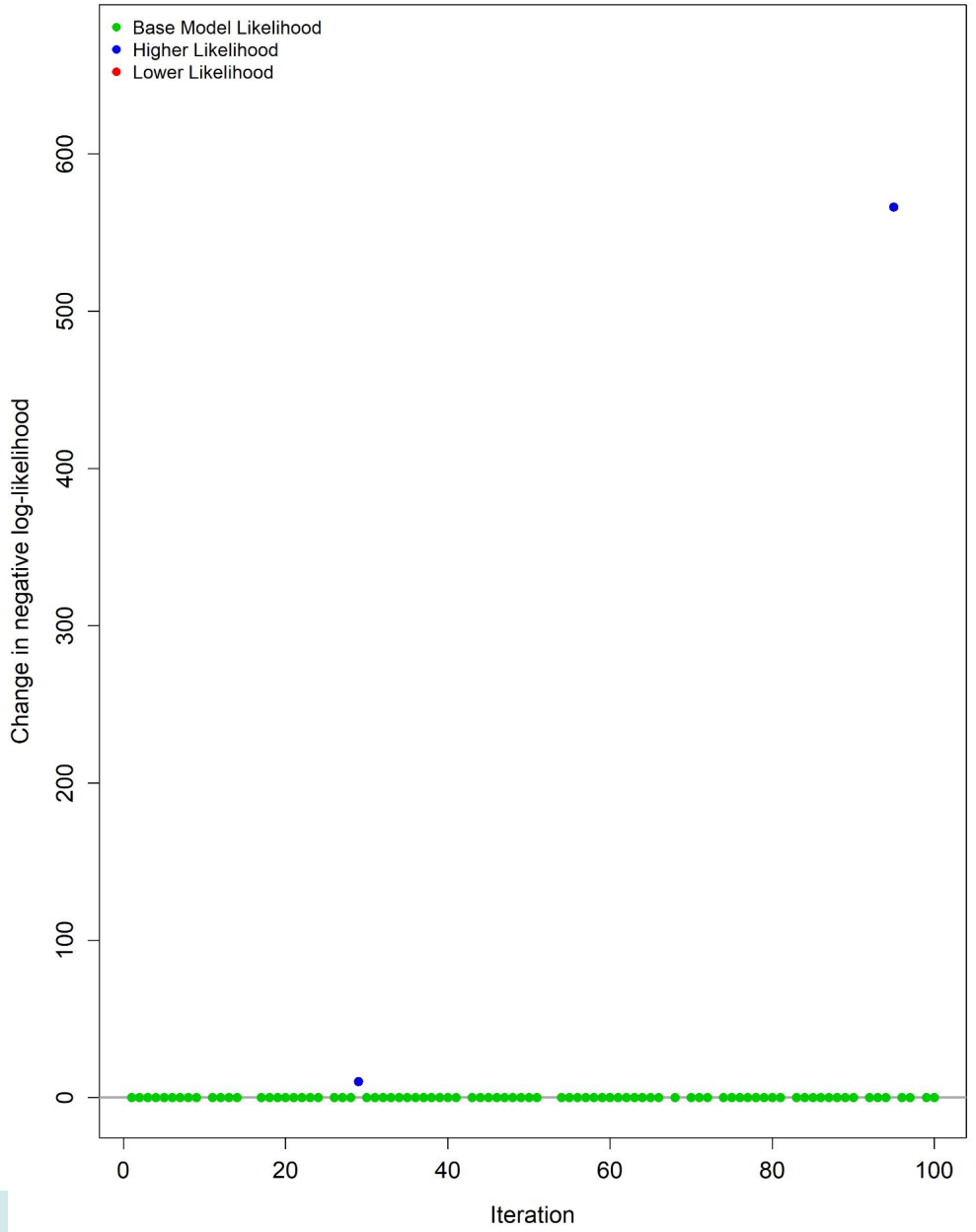
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Convergence

- Jitter fraction 0.5
  - Typically use 0.1 or 0.05

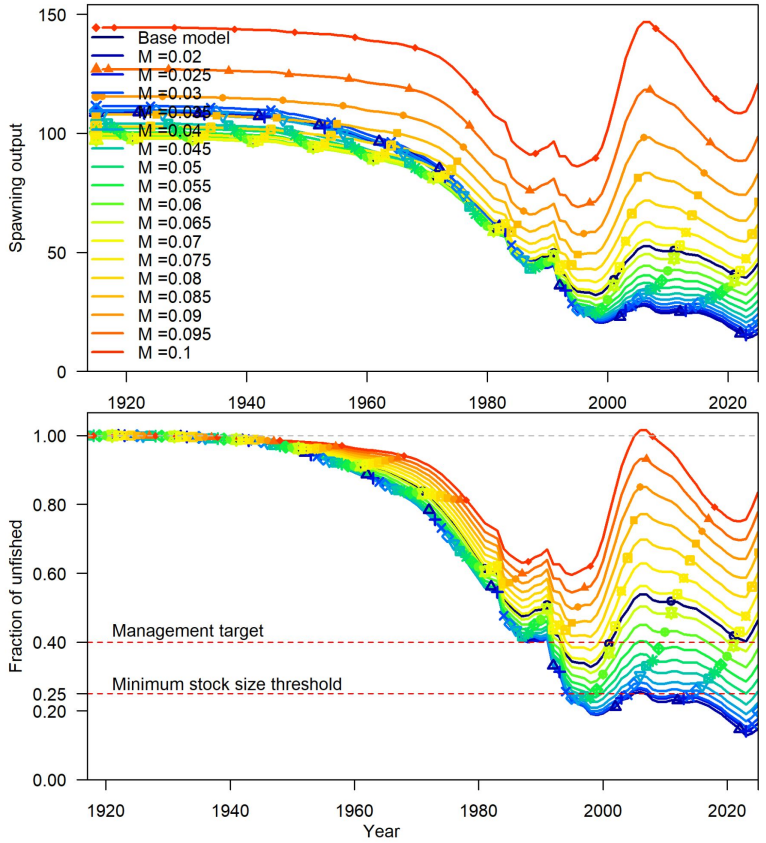
- Convergence at 4.46×10^{-4}
  - -hess_step to minimum gives no difference in estimates

- MCMC runs suggest reasonable estimation

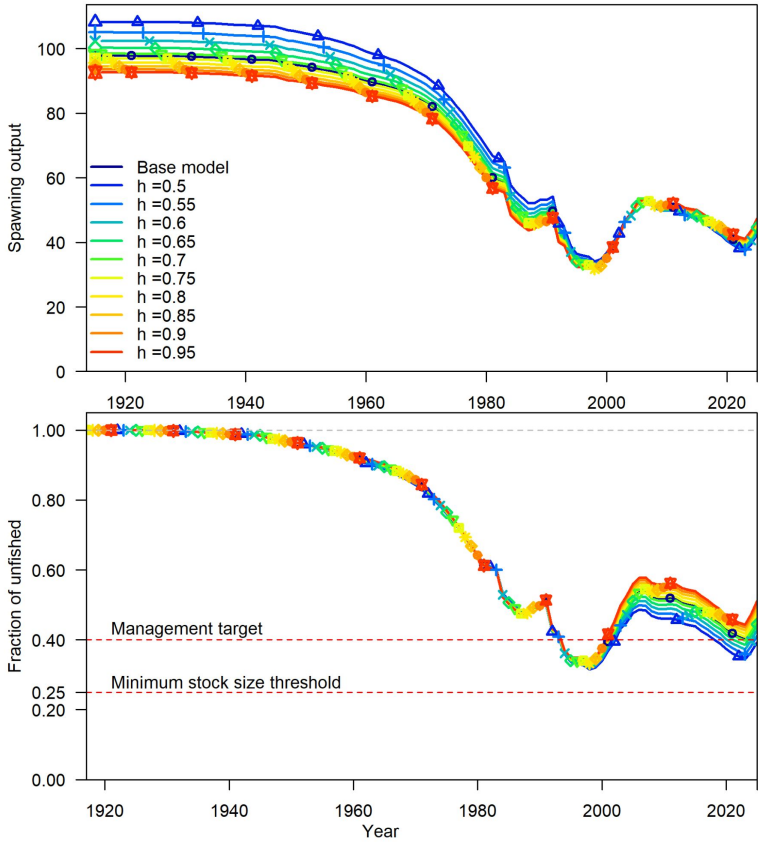


Profile trajectories

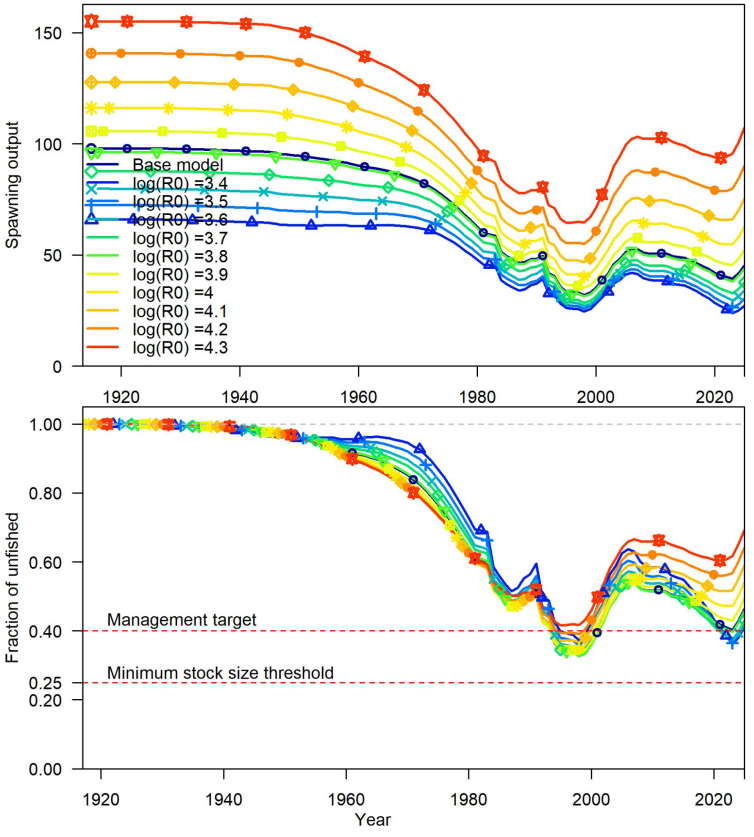
Natural Mortality



Steepness



Equilibrium Recruitment

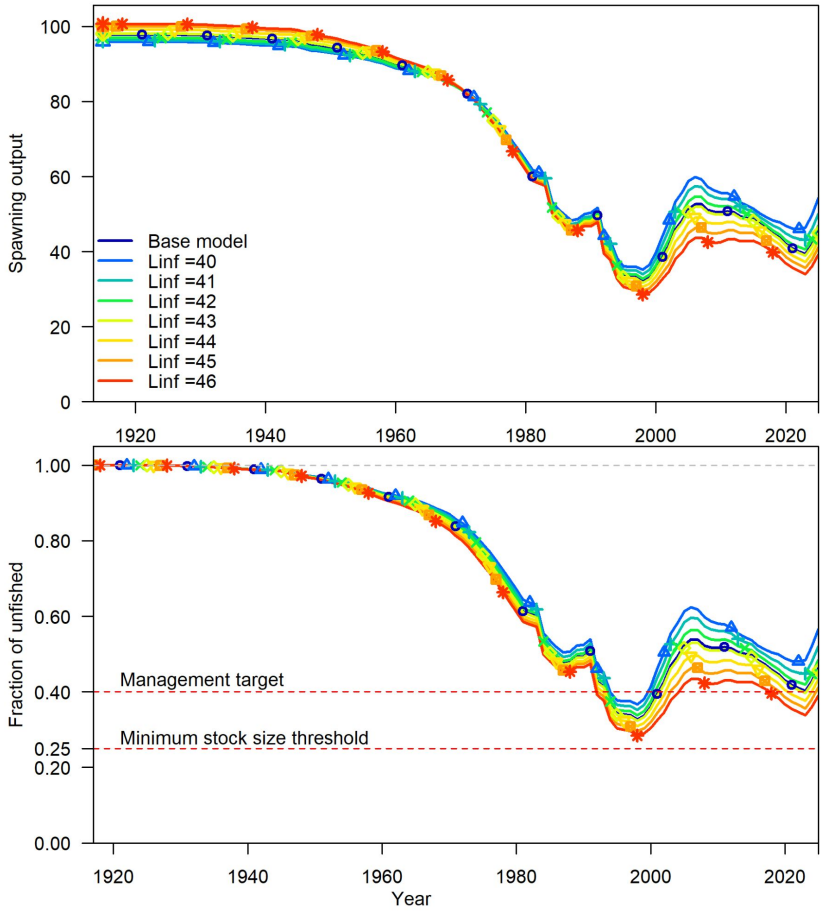


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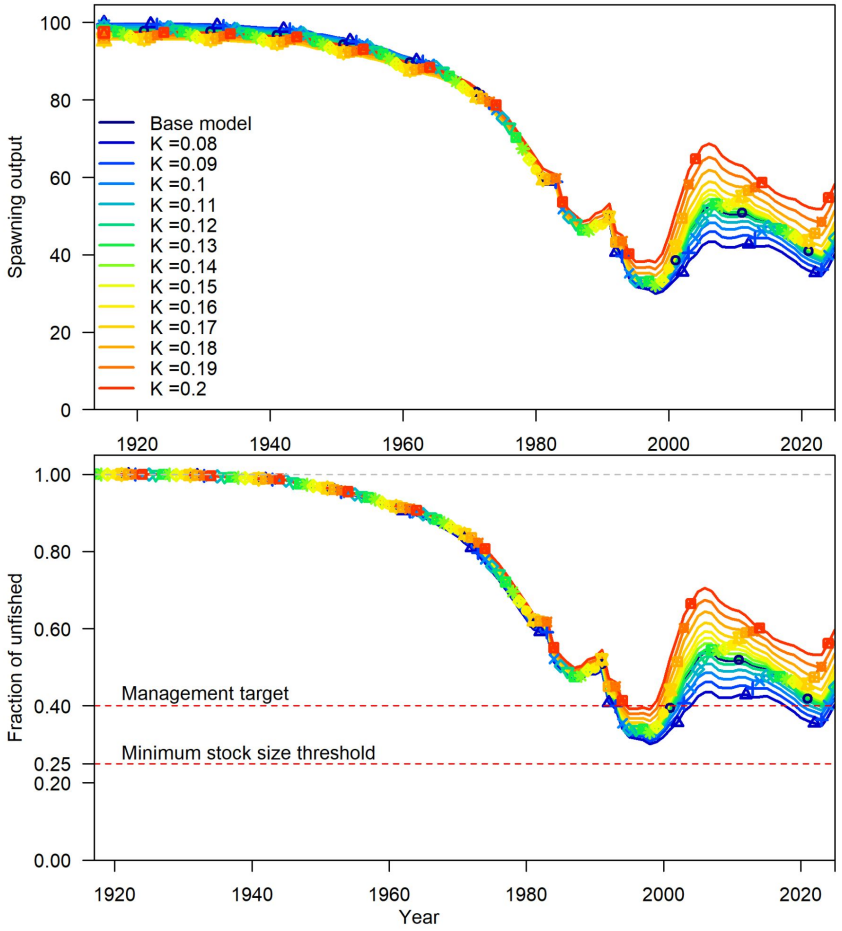
Profile trajectories

These are profiled while still estimating other growth parameters

Maximum Average Length (L_∞)



Growth Coefficient (K)

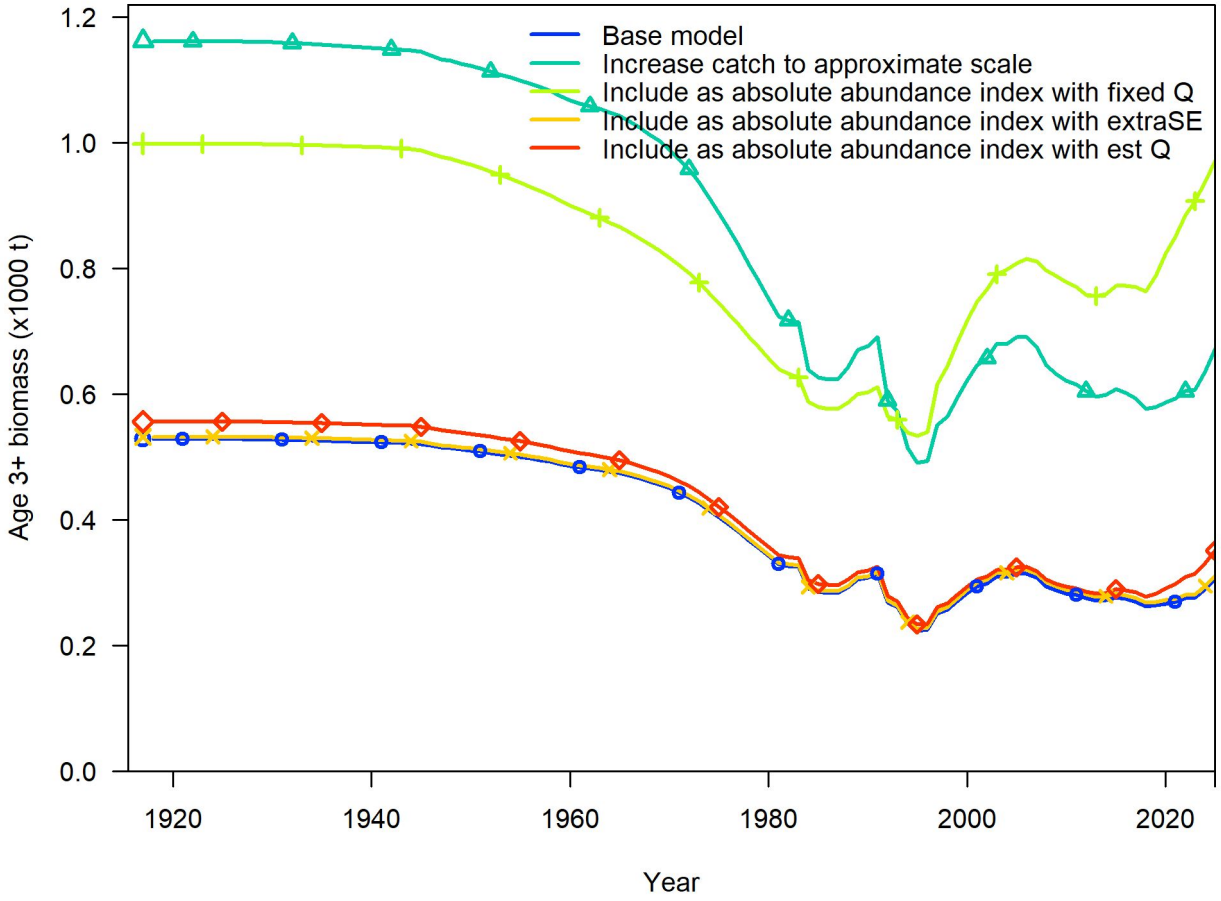


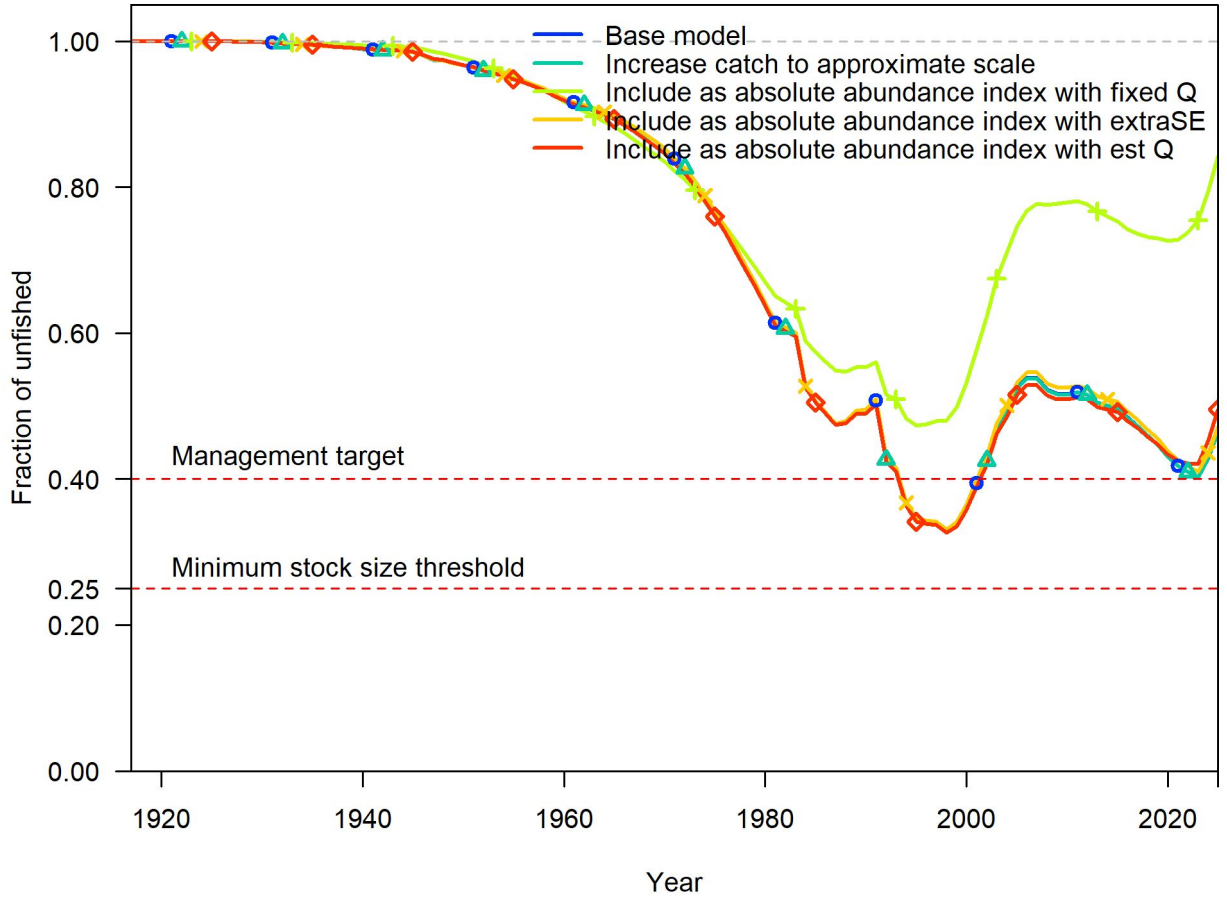
Sensitivity to ROV absolute abundance (extra explorations)

- Catch multiplier
  - ROV estimate of # fish is 2.18 times model estimate
  - Mid-year summary biomass in 2015
  - Expanding estimate inside MPAs to whole stock based on 80/20 inside/outside
  - Multiply catch by same factor as difference between ROV & assessment model difference
- Absolute abundance index
  - # fish inside MPAs
  - fixed q=0.2, fixed q with extra SE, estimated q

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Sensitivity to ROV absolute abundance inside MPAs

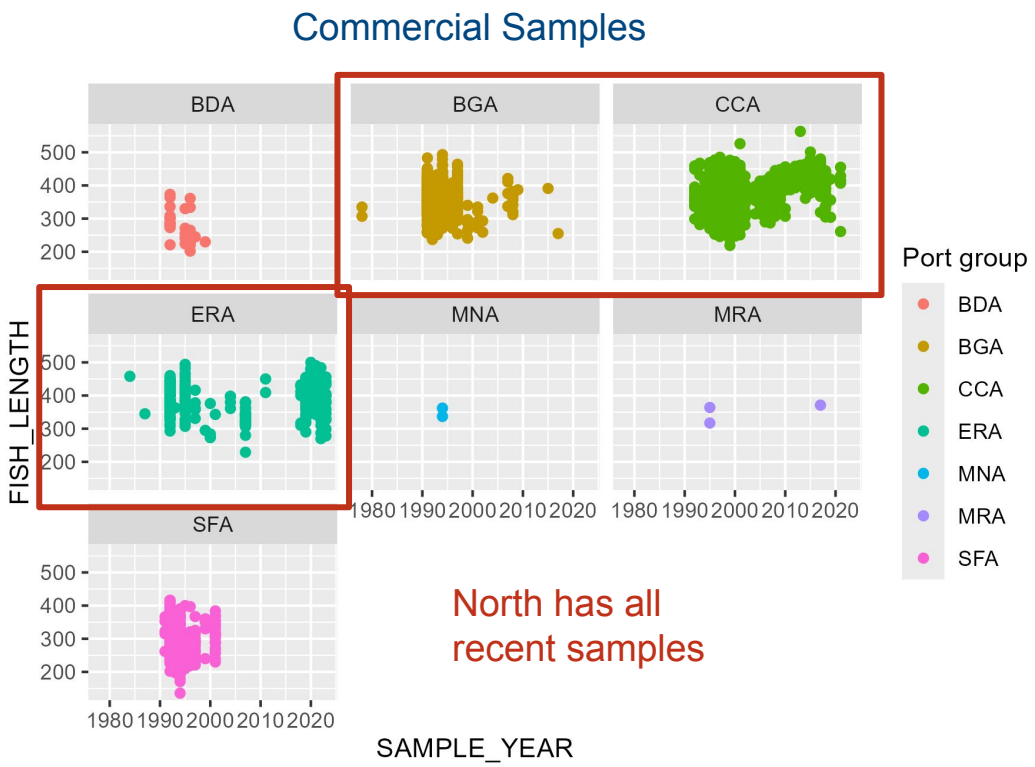




Sensitivity: areas-as-fleets

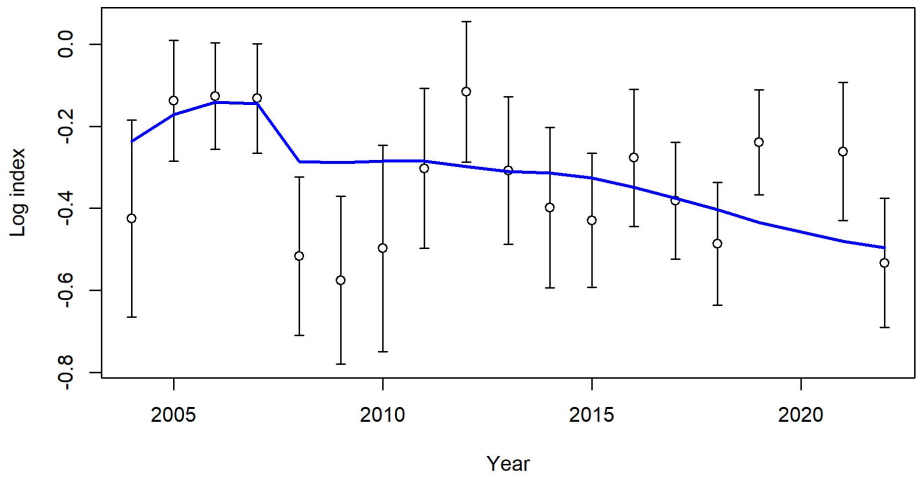
Take Home: Accounting for differences in sizes did not greatly change results

- Pattern of larger lengths in northern region
  - Divided recreational fleet into North and South region
  - Lengths and index divided
- All other fleets unchanged
  - Sparse spatial distribution for commercial
  - Other fleets are surveys intended to track population (we still assume one underlying population with areas-as-fleets)

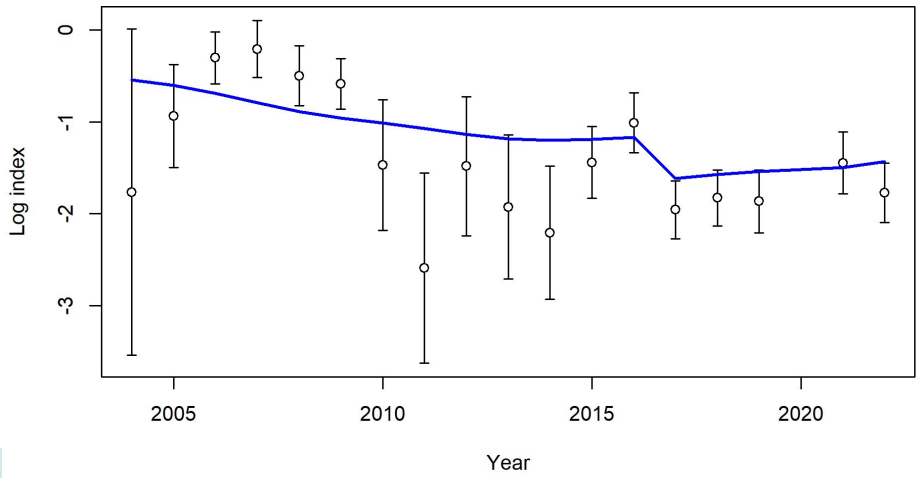


Sensitivity: areas-as-fleets

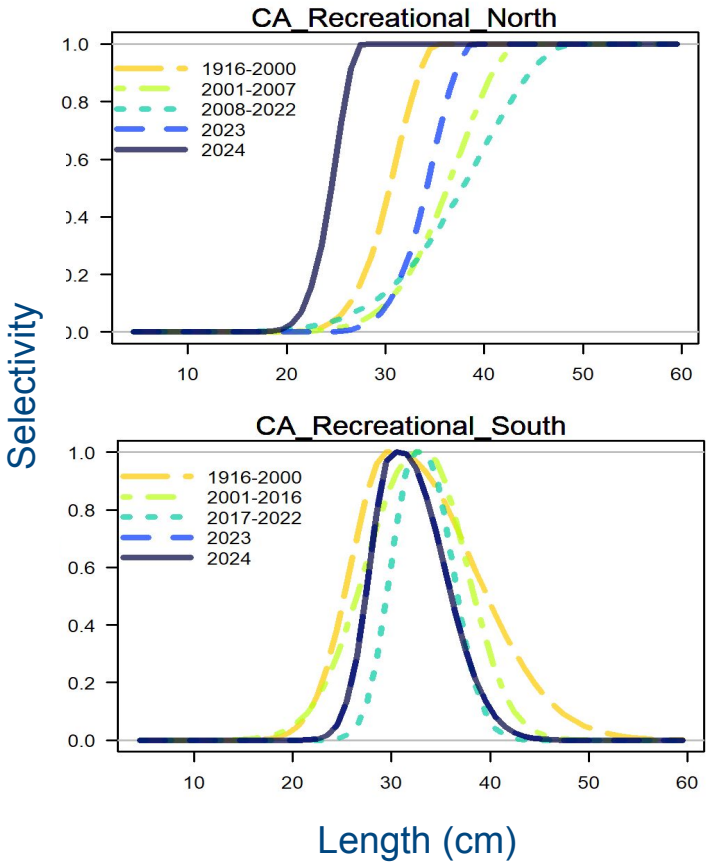
Recreational North Index



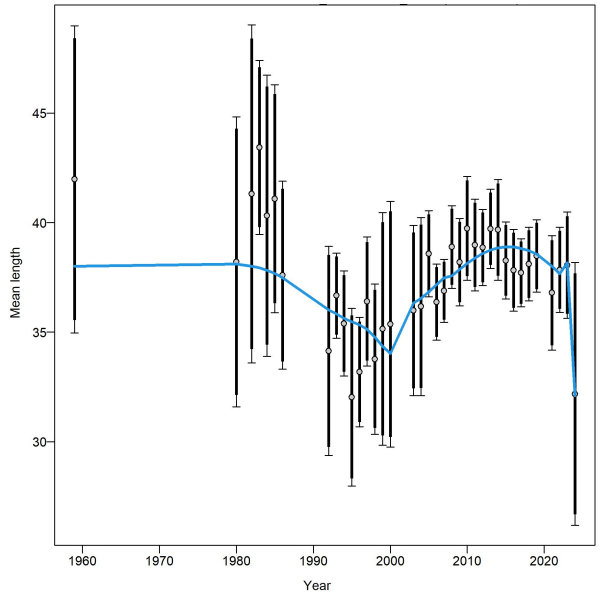
Recreational South Index



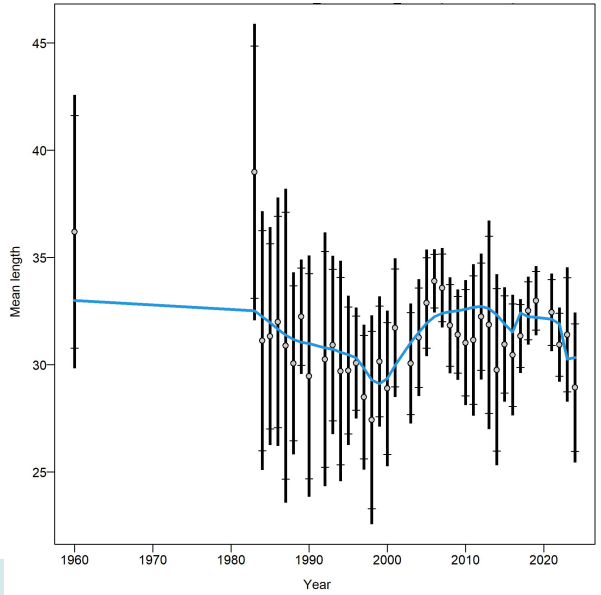
Selectivity



Recreational North Index



Recreational South Mean Length



Risk Table

Table viii: Risk Table for California quillback rockfish to document ecosystem and environmental factors, as well as data driven factors potentially affecting stock productivity and uncertainty or other concerns arising from the stock assessment. Level 1 is a favorable ranking, Level 2 neutral, and Level 3 unfavorable.

Ecosystem and environmental conditions	Assessment data inputs	Assessment model fits and structural uncertainty
• There is limited information on factors affecting quillback recruitment, habitat, prey and predators, and competitors.	• Catch reconstruction has uncertainty in some historical years due to periods of high and low estimates of sampled catch rates and when rockfish were not always sorted to species • Not captured in bottom trawl surveys. Indices based on fishery-dependent and other fishery-independent sources. Limited effect on population trends. • Age data is limited compared to some other groundfish species and primarily occurs in the most recent 5-10 years. Covers commercial sector and suitable for growth estimation. Young fish remain sparse. • Fewer samples of length data from fishing in recent years due to non-retention • Length and age data are generally fit well across many assumptions. • Species-specific maturity and fecundity with both being collected from most recent years • Generally not a directly targeted species but most catch is landed.	WILL BE FILLED IN AFTER THE STAR PANEL
Level is Unknown	Level 3: Medium agreement, Limited Evidence	Level is to be determined

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