2023 GOA Pcod assessment

September 2023 Plan Team

Overview

- Housecleaning (CAAL minimum sample size)
- Review of environmental link
  - Refresher on CFSR
- Link for Longline survey catchability
  - Retrospective comparison w/ and w/o environmental link (PT request)
  - Revaluation of CFSR index
- Link for growth
  - Individual growth parameters: determining most appropriate CFSR index
  - Combined growth model & comparison with base model
  - Path forward
- Recommendations for November 2023

Housecleaning:

- Minimum sample size issue
- Historical assessments removed CAAL data with minimum sample size less than 1 (i.e., weight)
- 1,812 of 2,825 (64%) CAAL length-age data removed
- Model 2019.1b corrects minimum sample size so all CAAL data included

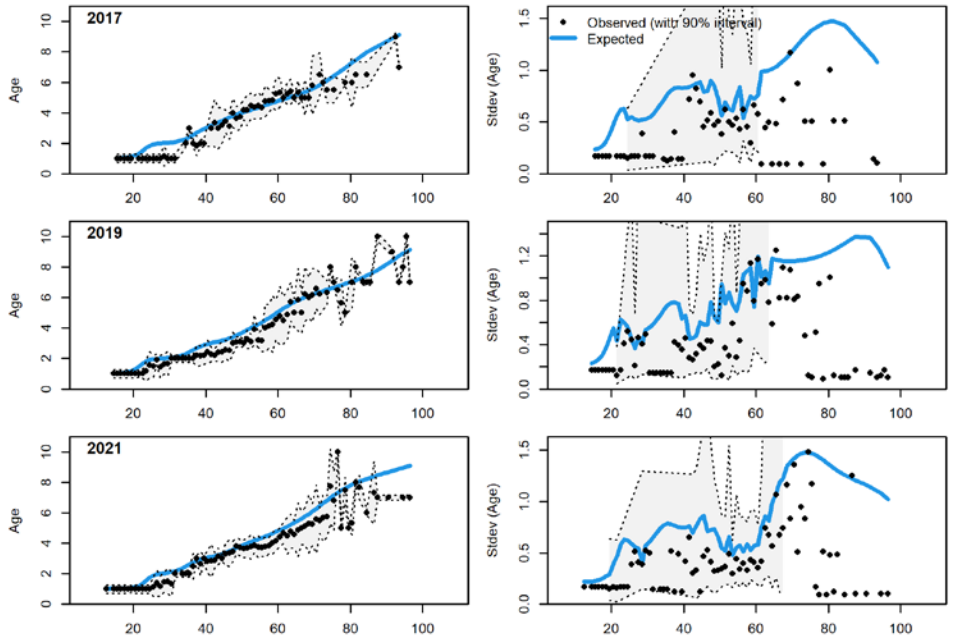
Housecleaning:

- Likelihoods & Fits

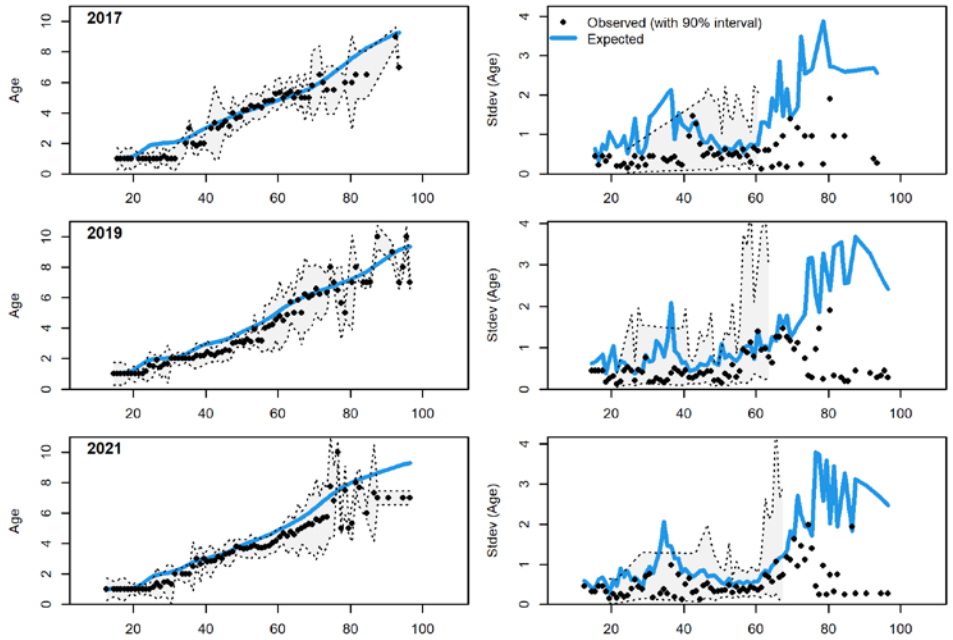
Likelihood	2019.1a	2019.1b	Difference
TOTAL	3841.5	2780.1	-1061.4
Catch	1.12E-12	6.65E-13	0.0
Survey	-15.4	-12.8	2.6
Length_comp	1715.6	1712.8	-2.8
Age_comp	2124.9	1062.9	-1062.0
Recruitment	3.9	4.4	0.5
InitEQ_Regime	2.4	2.5	0.1
Forecast_Recruitment	2.3	2.6	0.4

Age comp Likelihood	2019.1a	2019.1b	Difference
ALL	2124.9	1062.9	-1062.0
FshTrawl	456.6	140.4	-316.2
FshLL	486.7	234.3	-252.4
FshPot	419.7	183.5	-236.3
Srv	761.9	504.7	-257.2

2019.1a (recent trawl survey)



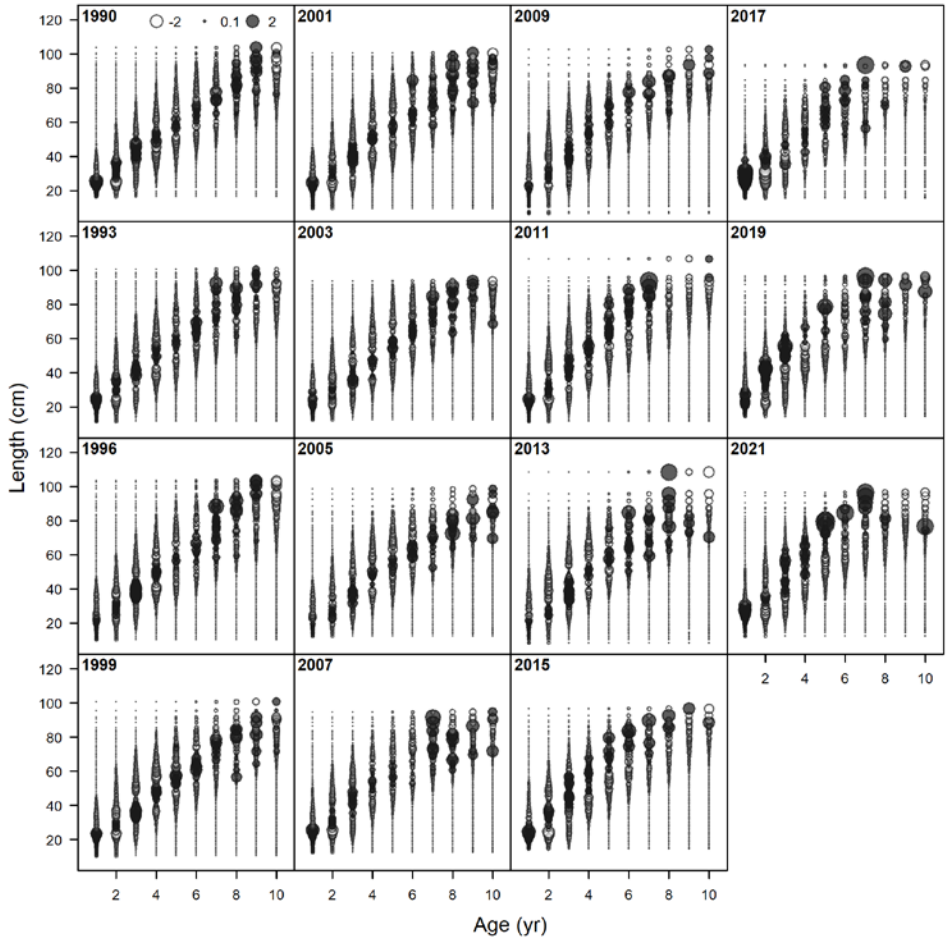
2019.1b



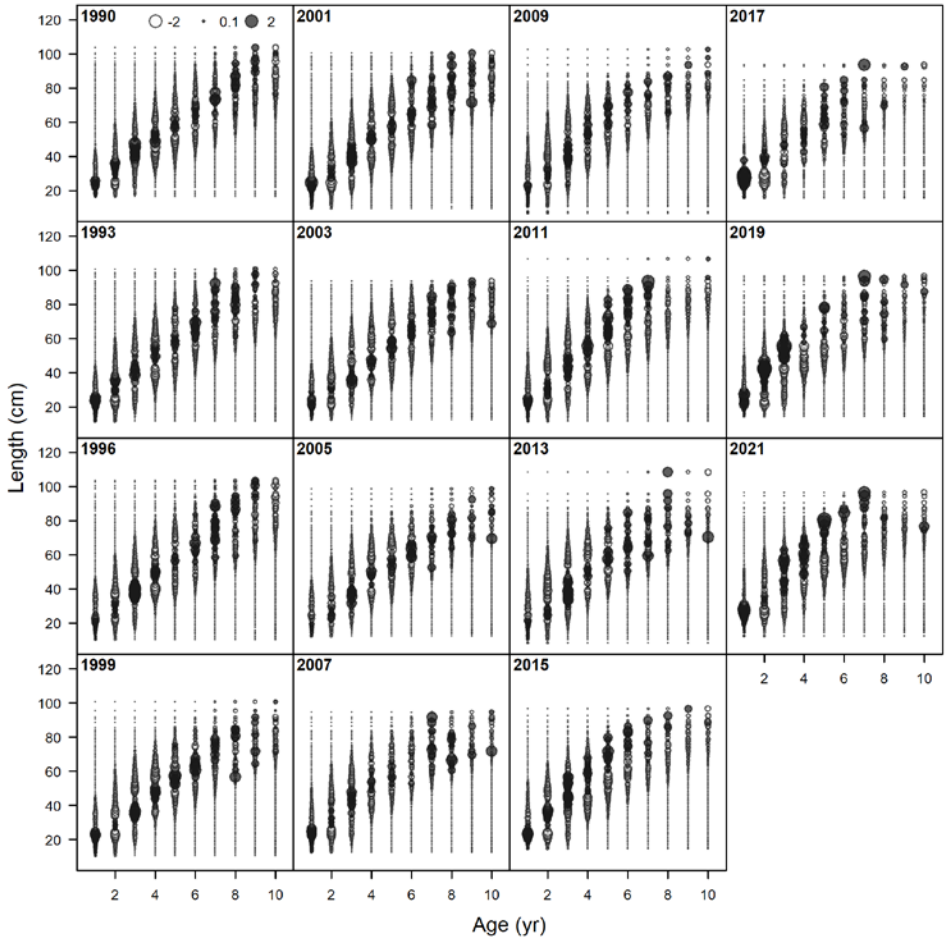
Housecleaning:

- Pearson resids: trawl survey

2019.1a

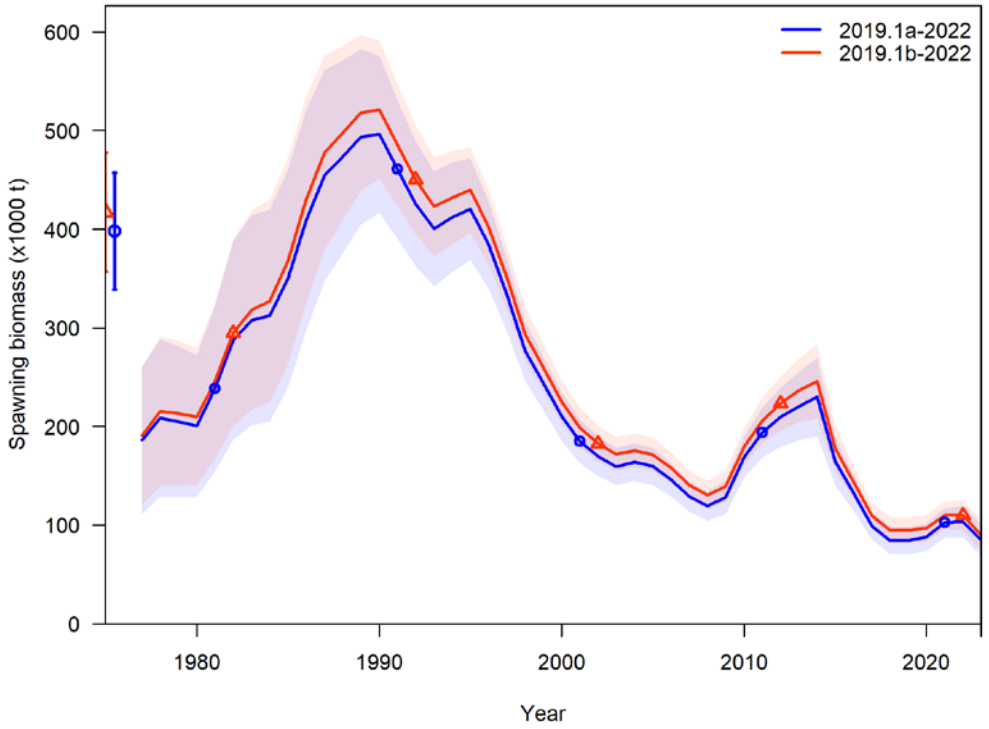


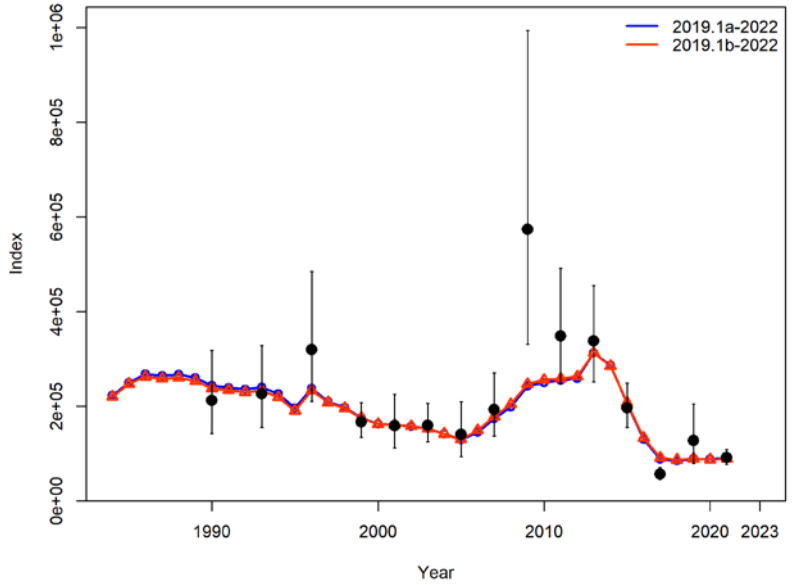
2019.1b

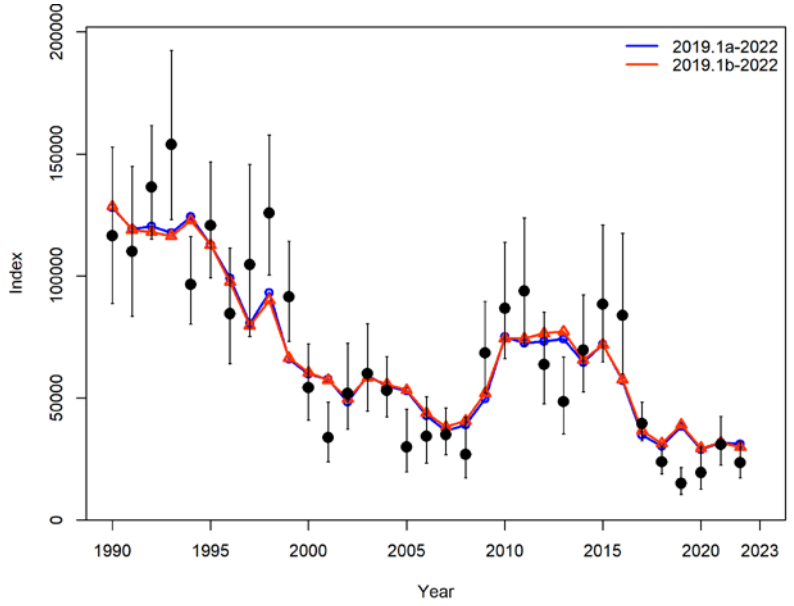


Housecleaning

- Recommendation: Correct minimum sample size and use this as new base model (2019.1b)
  - 6% increase in 2022 SSB







Environmental index

- Refresher of Climate Forecast System Reanalysis (CFSR)
  - Provides temperature-at-depth
  - Depths determined from Bottom trawl survey for 0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, and 80+cm

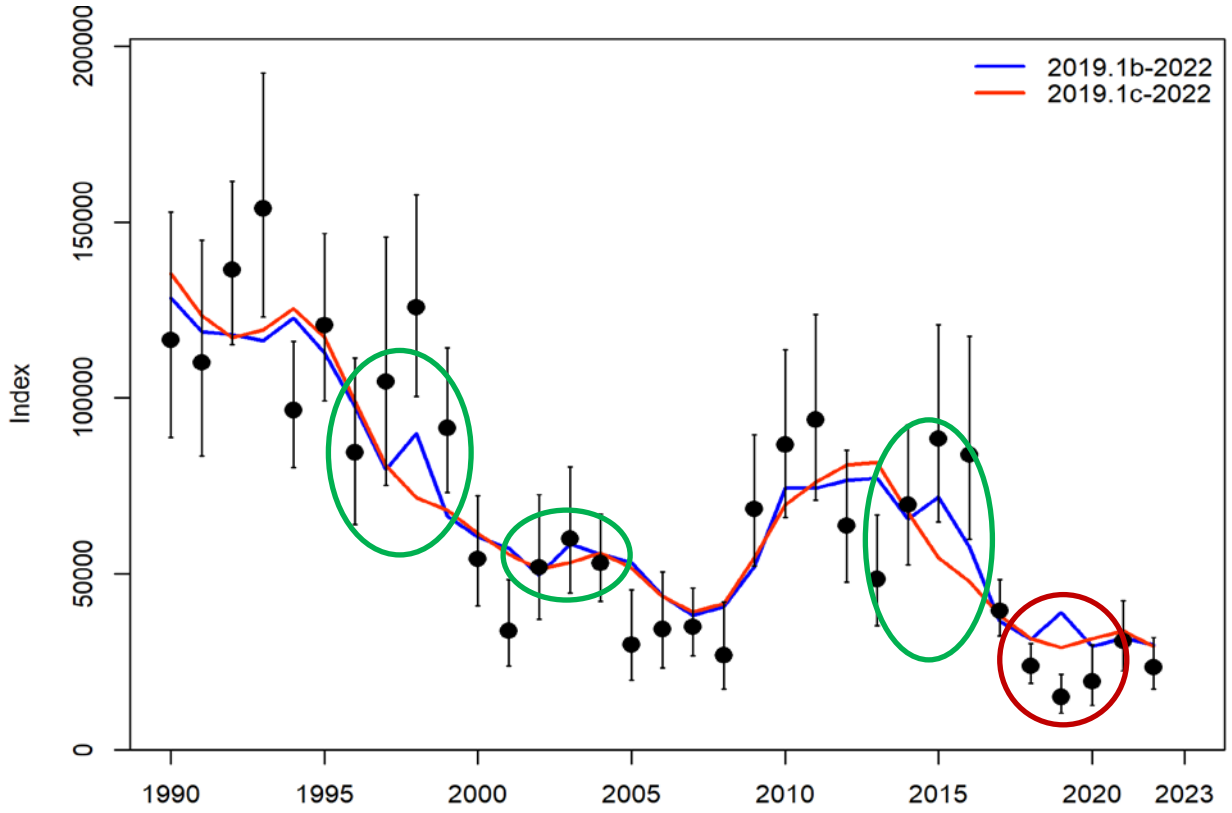
- Temperature-at-depth available by length bin and month
  - Index computed as difference from mean value from 1982-2012 (has been considered as ‘baseline’ for ‘normal’ conditions)

Environmental Link for LL survey catchability

- PT request to evaluate whether link still appropriate (first added to model in 2017)
- Construct model with no environmental link to LL survey q (2019.1c)
- Added... re-evaluate CFSR index used (2019.1d)
  - Step 1: Evaluated q env link across length bin and month
  - Step 2: Select best from Step 1 as new env link model
- Performance metrics: current year AIC and model fits, retrospective AIC and performance

Link for LL survey q: no link comparison

- Fit to LL survey index:



Link for LL survey q: no link comparison

- In every retrospective year, model with link preferred over model without link
- Mohn's rho 2019.1b = -0.0727
- Mohn's rho 2019.1c = -0.0722

Retro Year	2019.1b	2019.1c	ΔAIC
2022	2780.1	2787.2	12.2
2021	2669.7	2677.9	14.4
2020	2503.0	2511.0	14.0
2019	2400.7	2408.0	12.6
2018	2251.6	2271.7	38.0
2017	2181.8	2204.3	43.0
2016	2046.8	2060.7	25.8
2015	1903.3	1919.4	30.1
2014	1769.5	1780.4	19.7
2013	1648.3	1661.3	23.9

Link for LL survey q: no link comparison

- Recommendation: continue with model that includes environmental link for LL survey q

- Continue to monitor with retro AIC table in SAFE

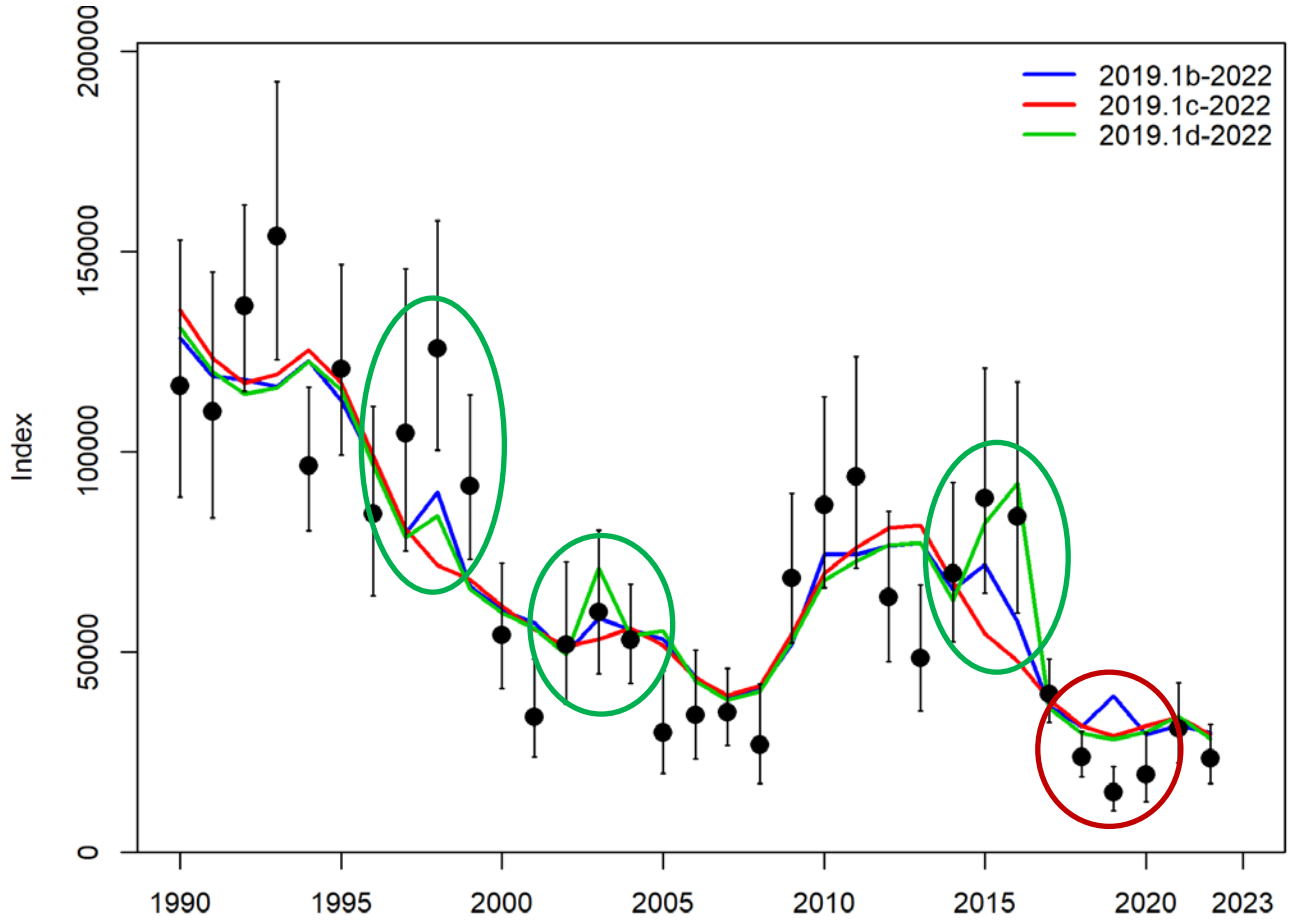
Link for LL survey q: re-evaluation

- Step 1: AIC difference = base model (2019.1b) – new env link model (2019.1d)

Month	0-20	20-40	40-60	60-80	80plus
Jan	0.2	6.66	8.46	7.94	8.82
Feb	-9.82	-7.7	-1.86	-6.62	-0.9
Mar	-12.84	-10.4	-16.28	-12.22	-15.74
Apr	-0.02	9.32	0.56	7.82	0.4
May	-4.72	8.26	5.8	7.88	5.44
Jun	0	7.8	6.7	7.56	7.14
Jul	0.08	8.12	9.26	8.38	9.86
Aug	6.58	6.72	9.82	7.56	10.5
Sep	5.24	7.34	10	8.04	10.5
Oct	13.52	6.64	8.56	6.96	9.24
Nov	3.52	6.06	7.16	6.08	8
Dec	14.16	10.18	4.42	9.46	3.52

Link for LL survey catchability, re-evaluation

- Fit to LL survey:



Link for LL survey catchability, re-evaluation

Likelihood		2019.1b	2019.1d	Difference
TOTAL		2780.1	2772.0	-8.1
Catch		6.65E-13	4.08E-13	0.0
Survey		-12.8	-19.2	-6.4
	Srv	-9.6	-9.1	0.6
	LLSrv	-3.1	-10.2	-7.0
Length_comp		1712.8	1711.9	-0.9
Age_comp		1062.9	1062.8	-0.2
Recruitment		4.4	4.1	-0.3
InitEQ_Regime		2.5	2.2	-0.3
Forecast_Recruitment		2.6	2.6	-0.1
Parm_priors		1.1	1.1	0.0

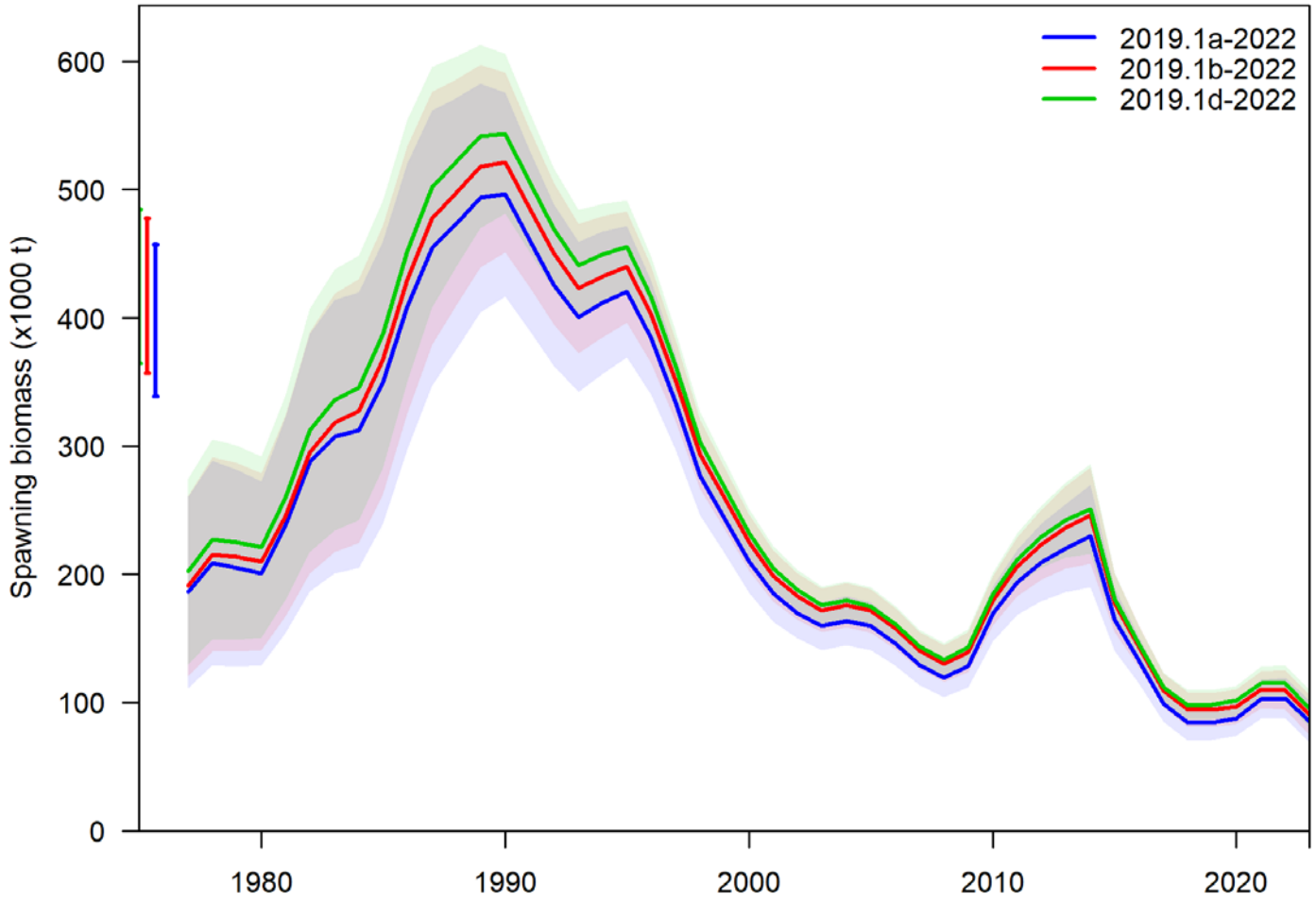
Link for LL survey, re-evaluation

- Retro Total likelihood and mohns rho:
- Mohn's rho 2019.1b = -0.0727
- Mohn's rho 2019.1d = -0.0579

Retro Year	2019.1b	2019.1d	Difference
2022	2780.1	2772.0	-8.1
2021	2669.7	2662.6	-7.1
2020	2503.0	2496.7	-6.3
2019	2400.7	2394.1	-6.7
2018	2251.6	2258.0	6.4
2017	2181.8	2189.0	7.2
2016	2046.8	2055.9	9.1
2015	1903.3	1912.8	9.5
2014	1769.5	1779.1	9.6
2013	1648.3	1658.0	9.6

Link for LL survey, re-evaluation

- 11% increase in 2022 SSB compared to 2019.1a



Link for LL survey, re-evaluation

- Recommendation: Bring forward 2019.1d, with new CFSR index, as alternative model in November

- Food for thought:
  - Evaluation of environmental links is a fluid and iterative process
  - Will be evaluating new indices, will be evaluating links, will continually be evaluating model to find improvements
  - What is our ‘burden of proof’ when it comes to mechanistic processes as it pertains to a specific index (i.e., one month’s temperature as compared to another)

Environmental link for growth

- Step 1:
  - Evaluated Linf and kappa across length bin and month
  - Evaluated Lzero across month for 0-20 cm length bin
- Step 2:
  - Select best from Step 1, and run model with env link for all 3 growth parameters
- Step 3:
  - Compare with base model
  - Statistics: current year AIC and model fits, retrospective AIC and performance

Link for growth

- Step 1: difference in AIC with base model (EnvLnk – base, so negative number means EnvLnk model better)

kappa

Month	0-20	20-40	40-60	60-80	80plus
1	8.2	-13.9	-13.3	-14.8	-11.6
2	34.1	22.5	26.3	23.1	26.5
3	31.3	21.8	31.0	23.6	32.6
4	28.2	17.2	23.4	18.3	24.3
5	30.6	20.5	24.3	21.2	24.8
6	28.3	24.6	28.6	25.5	28.5
7	22.3	25.4	28.7	26.0	28.4
8	13.9	23.0	27.3	23.7	26.8
9	16.4	21.5	30.2	23.1	30.2
10	22.1	28.4	39.0	30.7	39.0
11	19.8	33.3	39.3	34.4	38.7
12	39.1	30.7	38.2	31.8	38.9

Linf

Month	0-20	20-40	40-60	60-80	80plus
1	-5.7	-35.6	-26.6	-35.2	-21.4
2	29.5	6.5	9.3	6.7	10.2
3	29.4	12.3	20.3	13.7	22.5
4	26.2	4.8	7.5	5.1	8.1
5	27.5	11.9	14.6	12.3	14.7
6	25.3	19.0	24.0	20.0	23.8
7	19.9	22.3	28.4	23.5	28.3
8	10.9	21.9	30.4	23.5	30.4
9	12.2	22.9	35.4	25.3	35.7
10	14.9	31.4	45.1	34.6	45.4
11	13.7	37.7	47.2	40.0	47.1
12	34.5	35.2	48.2	38.3	48.8

Lzero

Month	0-20
1	-6.0
2	-10.5
3	-5.3
4	5.1
5	2.6
6	5.5
7	4.6
8	7.0
9	5.9
10	-24.3
11	-15.8
12	-8.2

- Linf > Lzero > kappa for model improvement

Link for growth

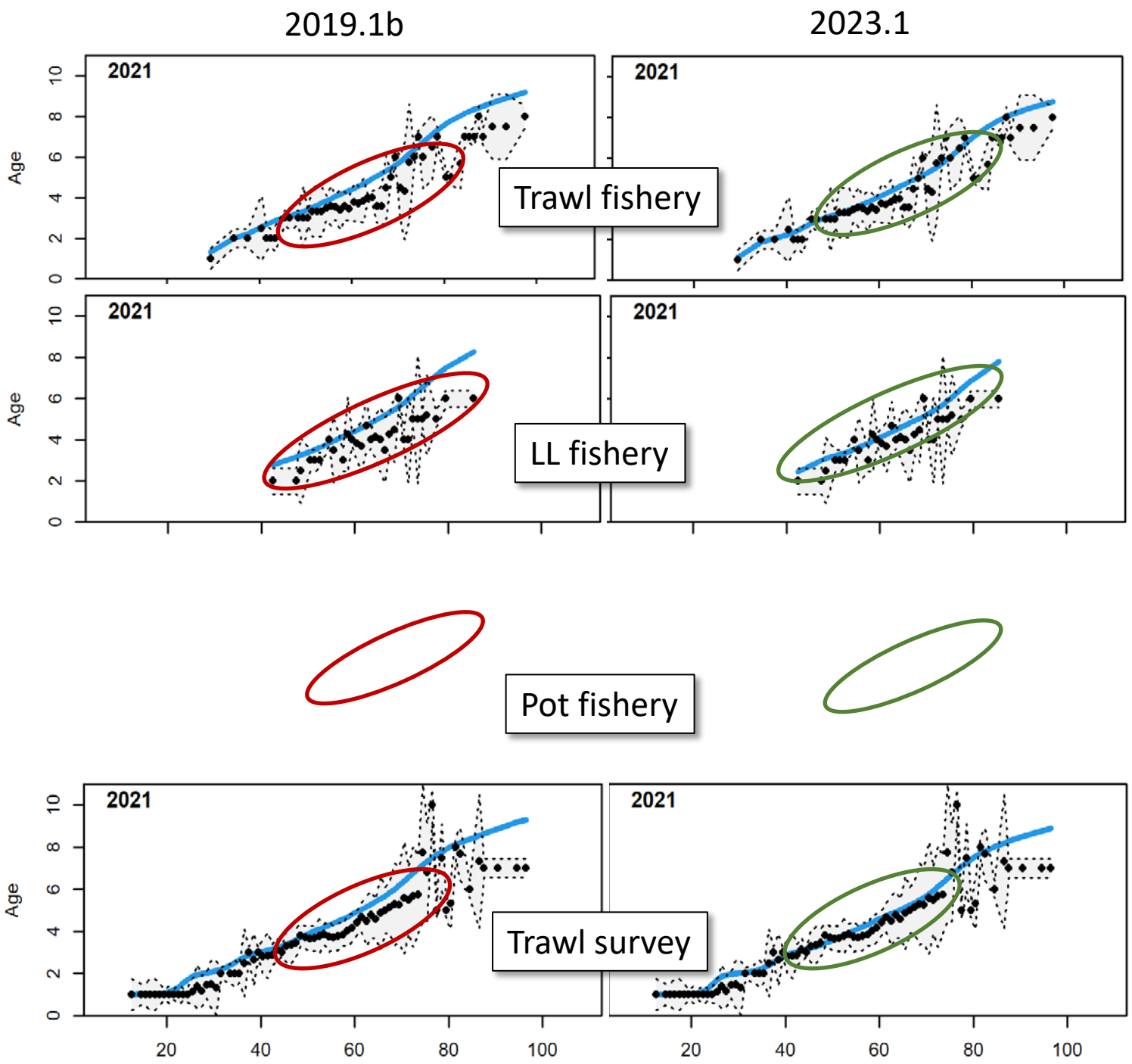
- Step 2: AIC & likelihoods

Model	Total Like	# params	AIC
2019.1b	2780.1	211	5982.2
2023.1	2736.0	214	5900.0

Likelihood	2019.1b	2023.1	Difference
TOTAL	2780.1	2736.0	-44.1
Catch	6.65E-13	1.54E-12	8.70E-13
Survey	-12.8	-14.5	-1.7
Length_comp	1712.8	1688.6	-24.2
Age_comp	1062.9	1042.1	-20.9
Recruitment	4.4	6.8	2.3
InitEQ_Regime	2.5	2.8	0.3
Forecast_Recruitment	2.6	2.7	0.1
Parm_priors	1.1	1.4	0.3

Link for growth

- Step 2: Example fits
  - Improvement to lack of fit identified in last assessment cycle



Link for growth

- Step 2: Retrospective AIC

Retro Year	2019.1b	2023.1	ΔAIC
2022	2780.1	2736.0	-82.2
2021	2669.7	2625.8	-81.9
2020	2503.0	2475.6	-48.8
2019	2400.7	2378.7	-38.1
2018	2251.6	2242.3	-12.6
2017	2181.8	2179.8	2.0
2016	2046.8	2049.5	11.5
2015	1903.3	1896.6	-7.3
2014	1769.5	1756.3	-20.5
2013	1648.3	1643.8	-3.2

- Mohns rho:
  - 2019.1b = -0.073
  - 2023.1 = -0.022

Link for growth

- Things to consider:
  - What growth do we use in projections? (Most recent environmental conditions? Some time period of historical?)
  - Is there another, better, index?

- Moving forward:
  - Not going to recommend an environmentally linked model for growth this cycle
  - Have a post doc (Krista Oke) that will be investigating environmental links over the next 2 years, will look to her results for guidance in future assessments

Overall summary

- Recommended model changes for November:

1. Correct minimum sample size issue

2. Use different CFSR index for LL survey q environmental link

- Questions?