INTERNATIONAL PACIFIC HALIBUT COMMISSION

Summary of the 2020 data and stock assessment, and decision table for 2021

Agenda items 5.3, 5.4

IPHC-2021-AM097-08

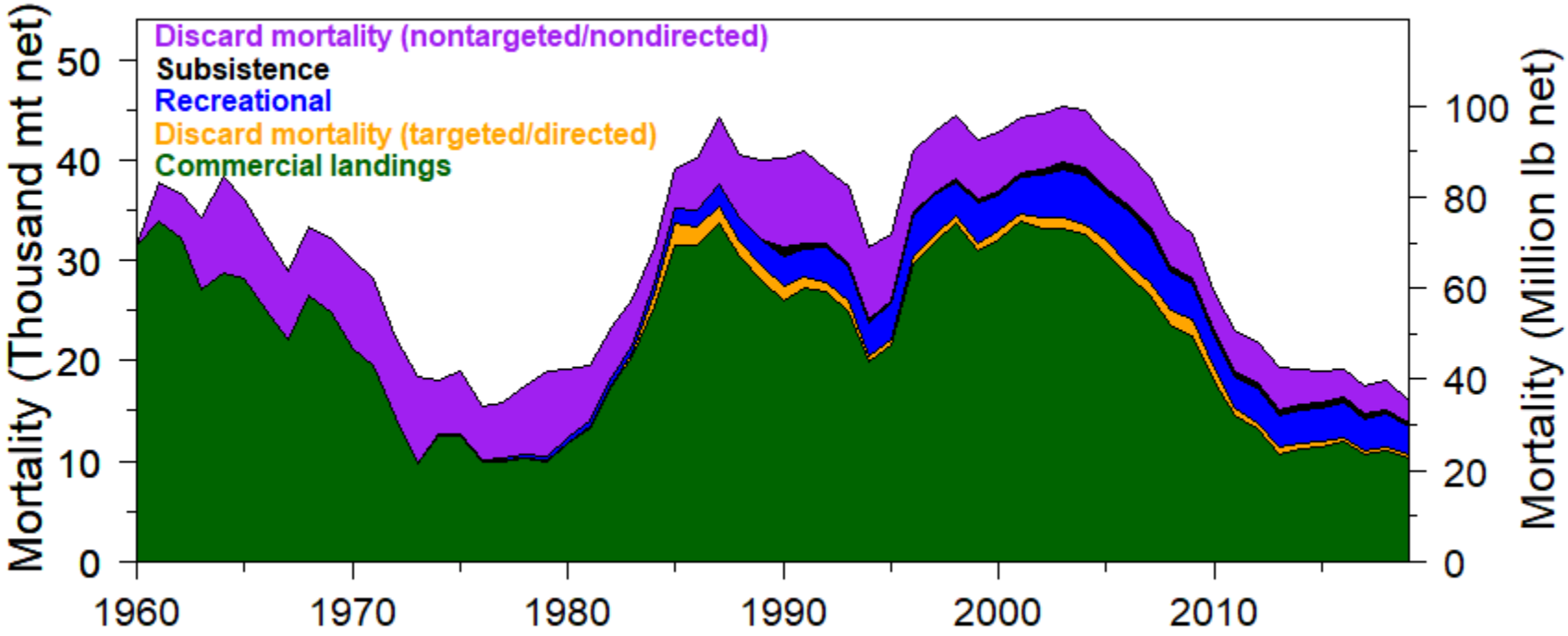
Summary

- 2011-2012 year classes were present in both the 2020 FISS and fishery data
- The strength of these year classes appears better than 2006-2010, but remains uncertain
- Further stock declines projected; however, change in the reference level of fishing intensity (to $F_{43\%}$) has buffered the change in the 2021 coastwide reference TCEY
- Stock distribution estimates in 2020 increased in Biological Region 3 and decreased in Biological Region 2

Outline

- Data sources
- Modelling results
- Projections and decision table
- Interim management procedure results

Historical mortality



Reductions across most sectors in 2020

2020 Mortality

Projected from AM096

Year	Commercial Landings	Commercial discards	Recreational	Subsistence	Non-directed discards	Total
2020	23.11	0.88	6.86	1.06	6.29	38.19
					(3-yr avg.)	

2020 Mortality

Projected from AM096

Year	Commercial Landings	Commercial discards	Recreational	Subsistence	Non-directed discards	Total
2020	23.11	0.88	6.86	1.06	6.29	38.19

(3-yr avg.)

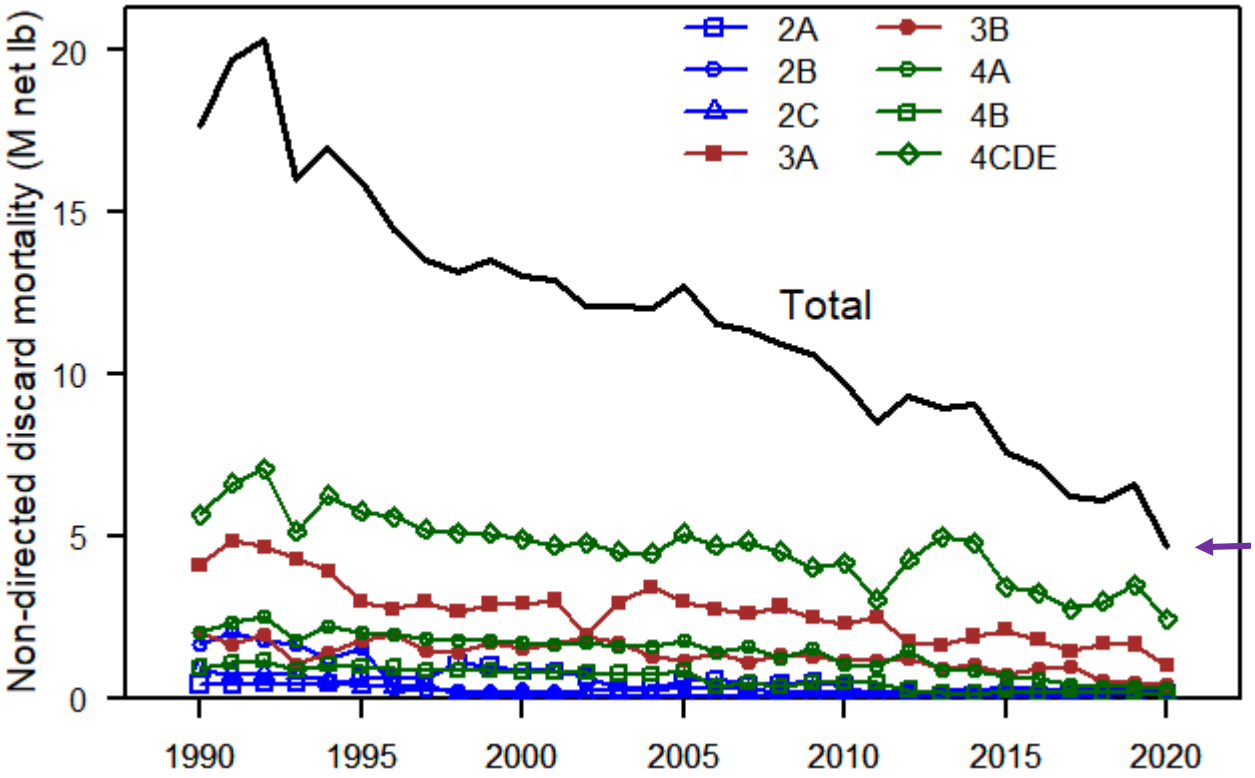
Estimated for this year's stock assessment analysis

Year	Commercial Landings	Commercial discards	Recreational	Subsistence	Non-directed discards	Total
2020	22.70	0.77	5.96	1.06	5.03	~~35.50~~

3-yr avg. = 5.90 35.03

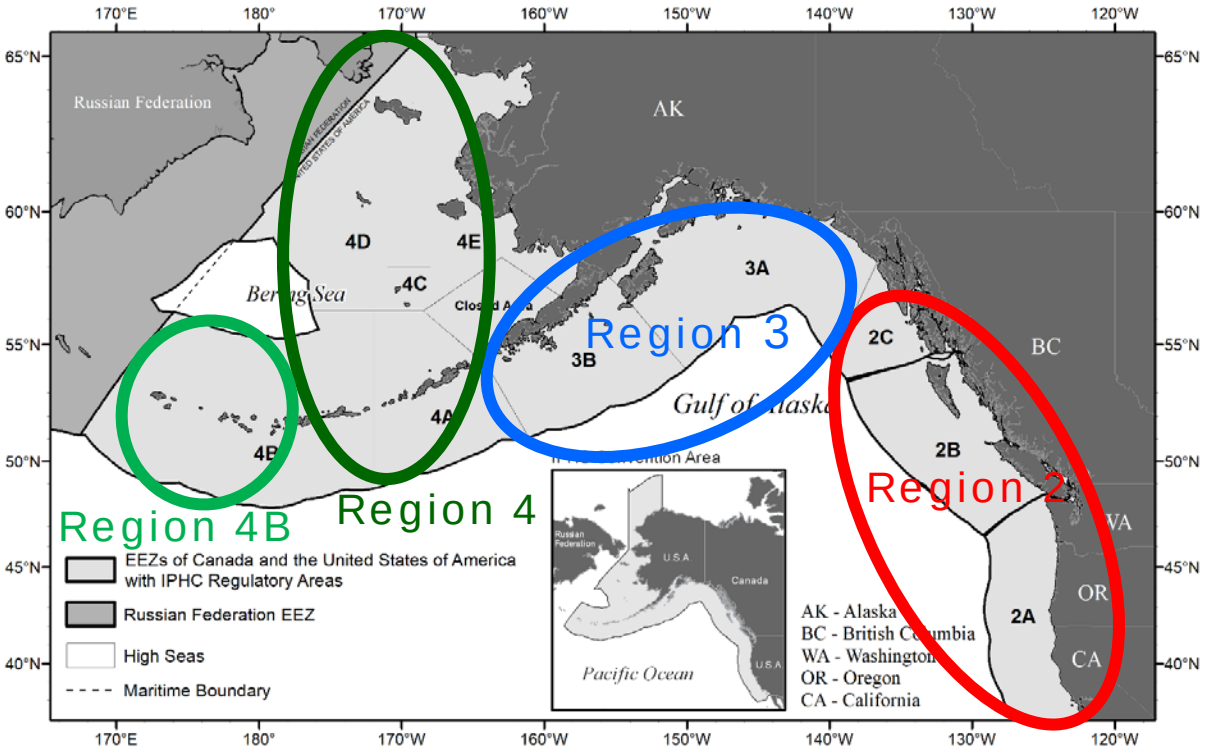
January updated 3-yr avg. for projections = 5.79

Recent non-directed discards (updated)

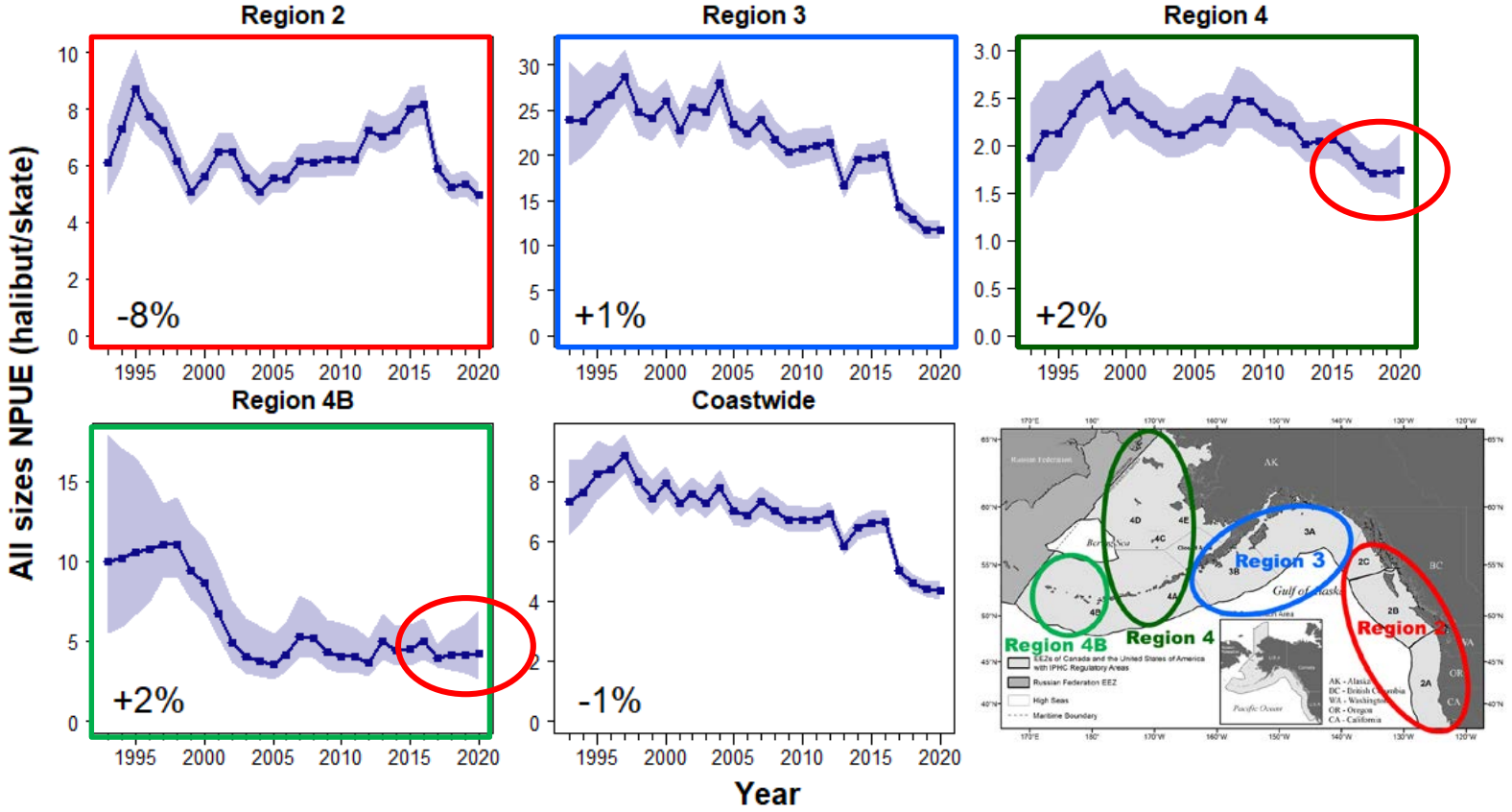


4.68 Mlb
(Down 29%
from 2019)

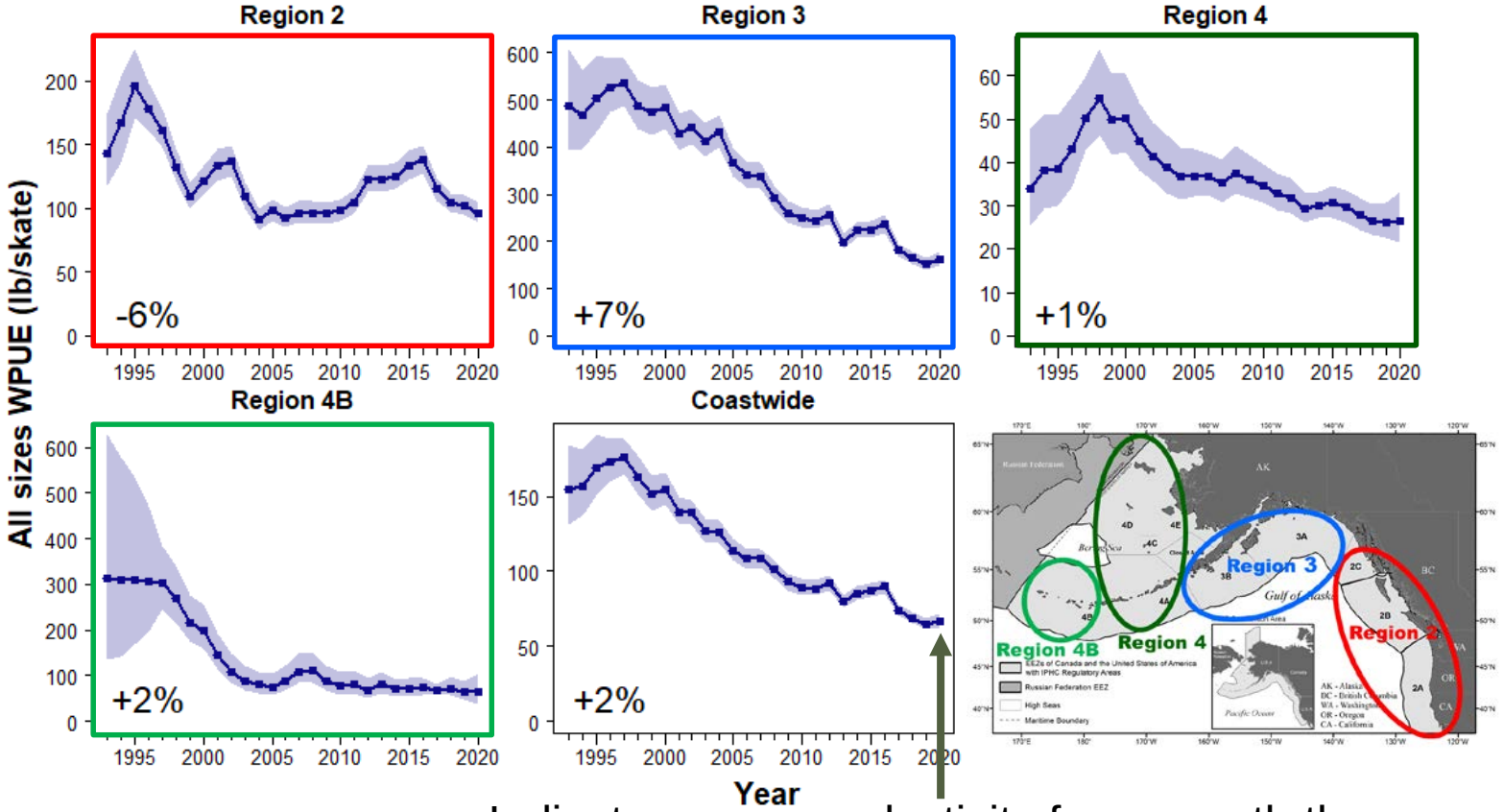
Biological regions



Modelled survey trends (Numbers)

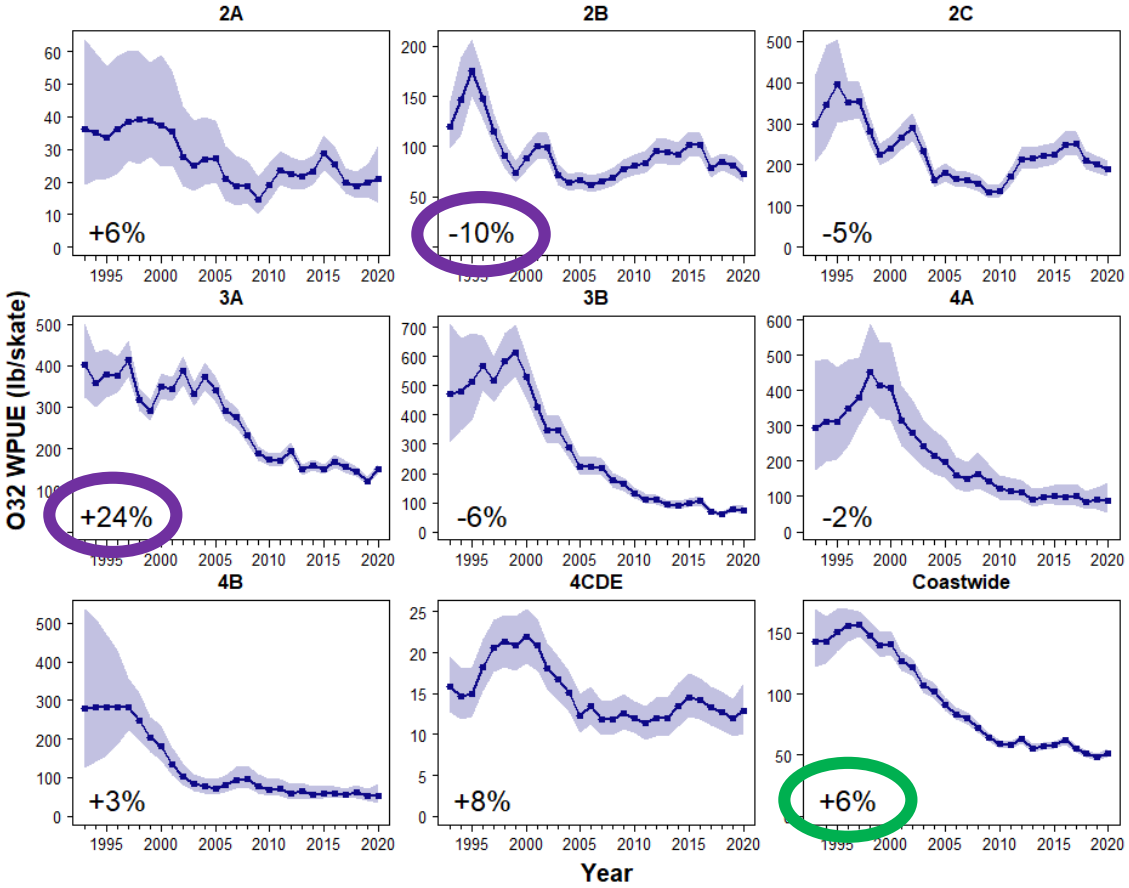


Modelled survey trends (all sizes WPUE)



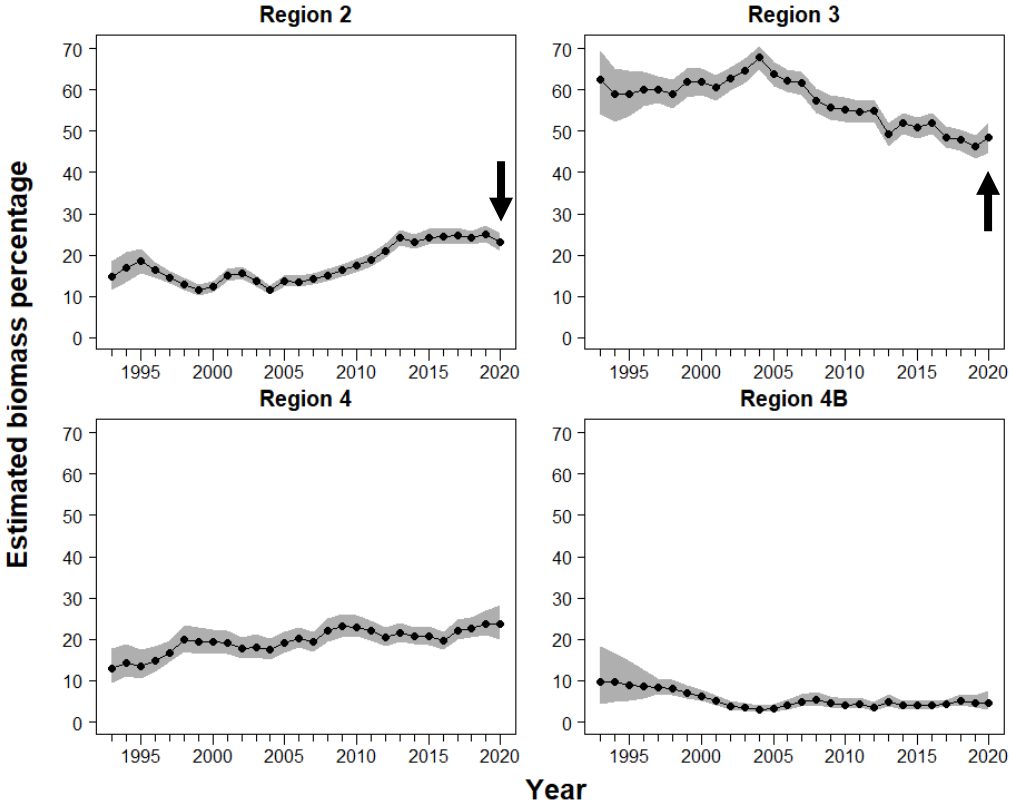
Indicates more productivity from growth than recruitment

Modelled survey trends (O32 WPUE)

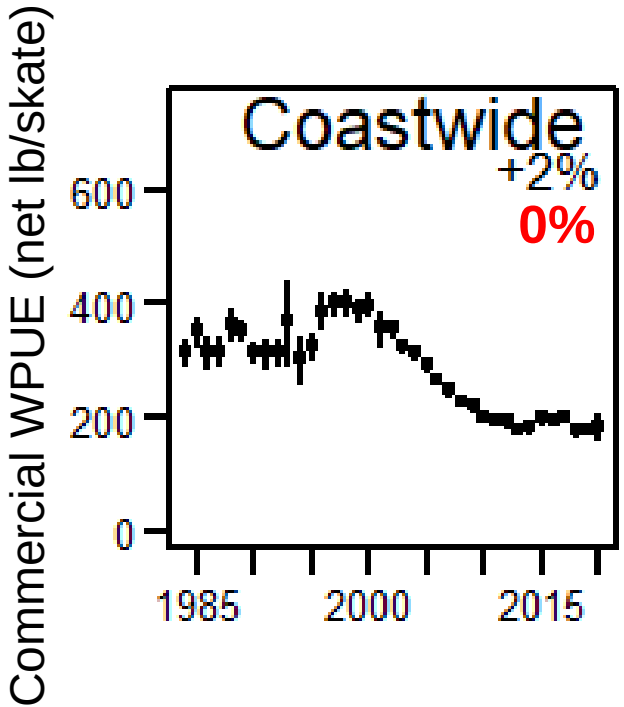


Indicates growth productivity is from O32 sizes

Biological stock distribution (all sizes)

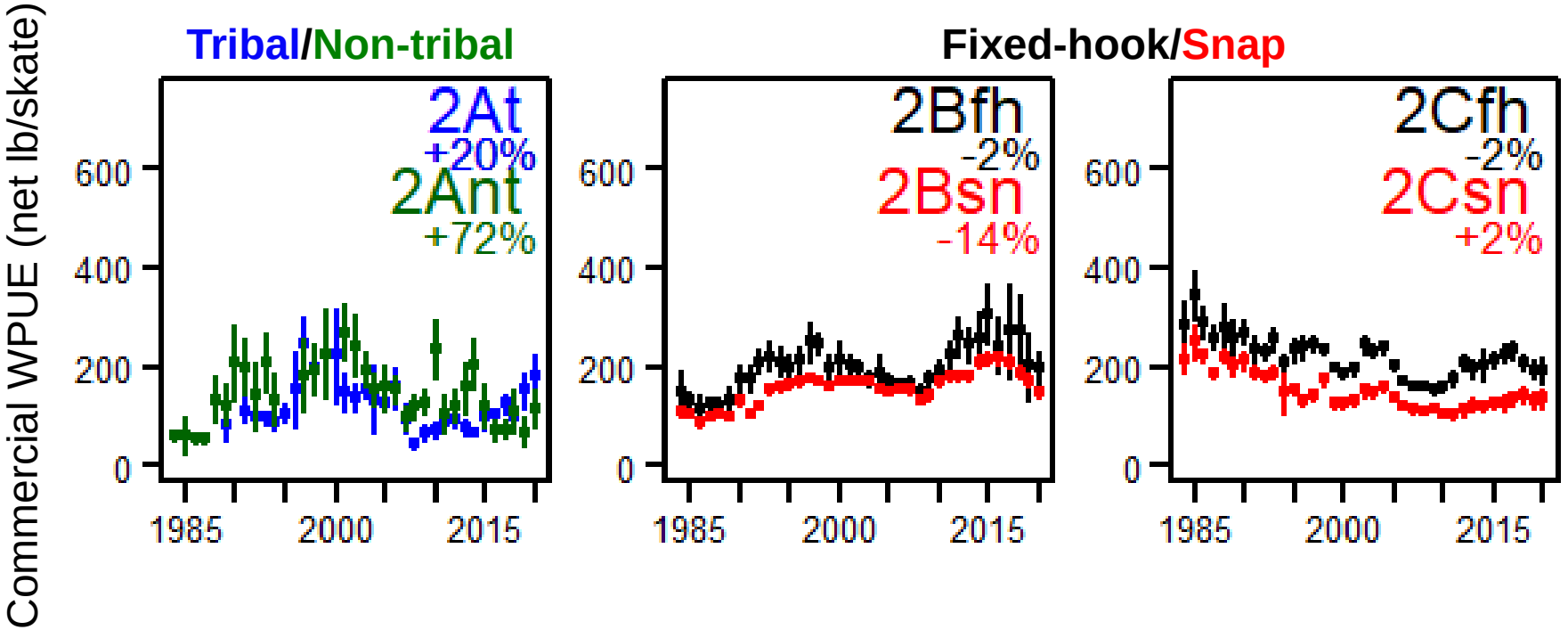


Fishery trends

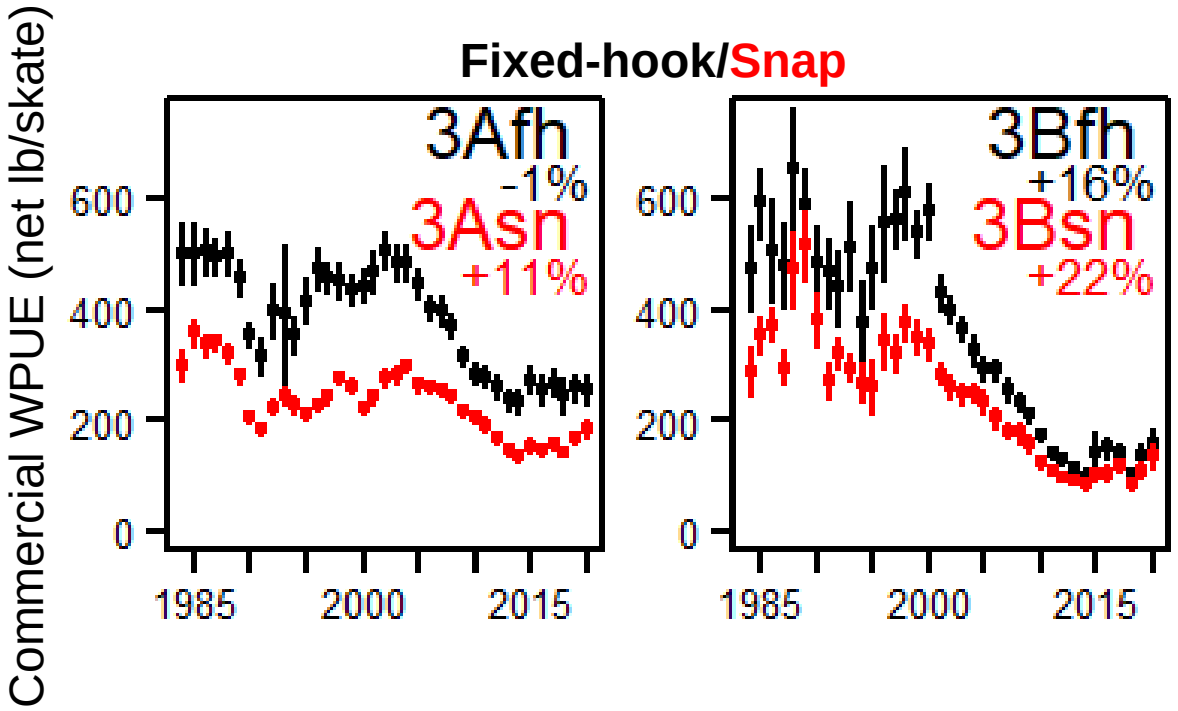


after accounting for logs not yet collected

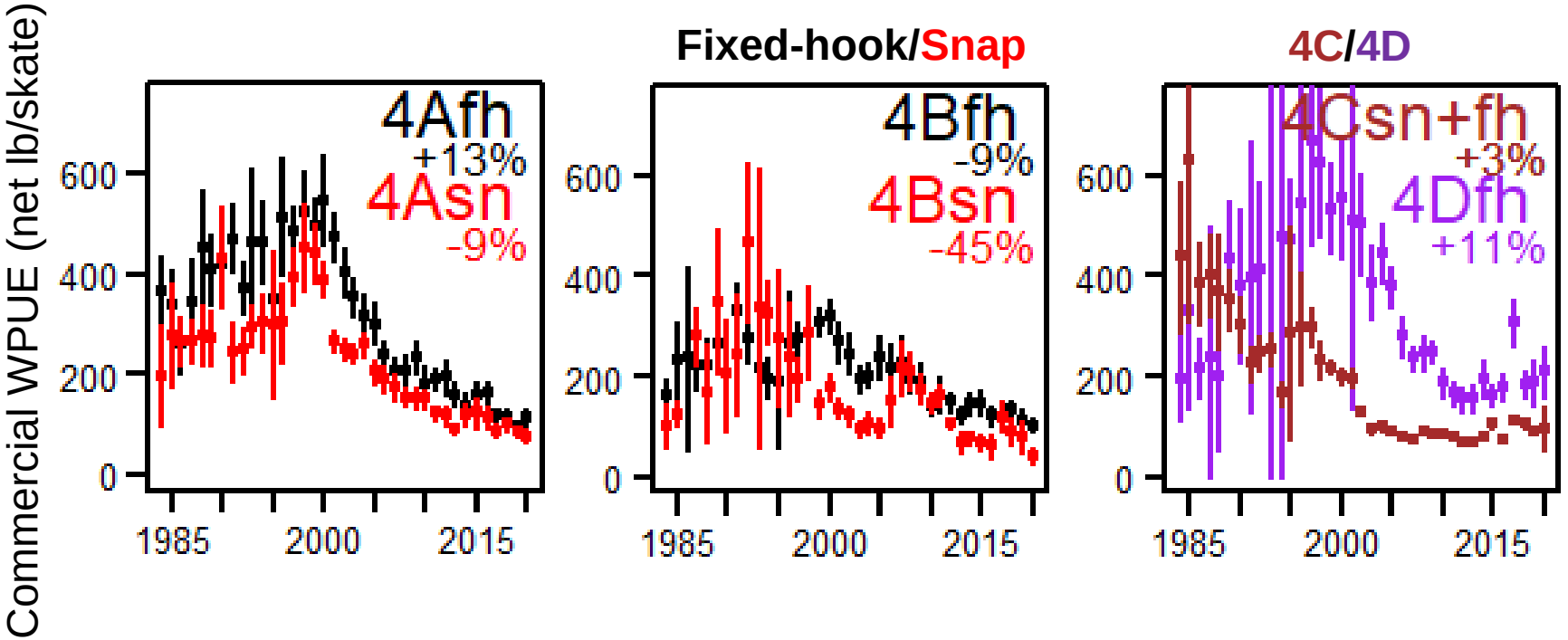
Fishery trends: Region 2



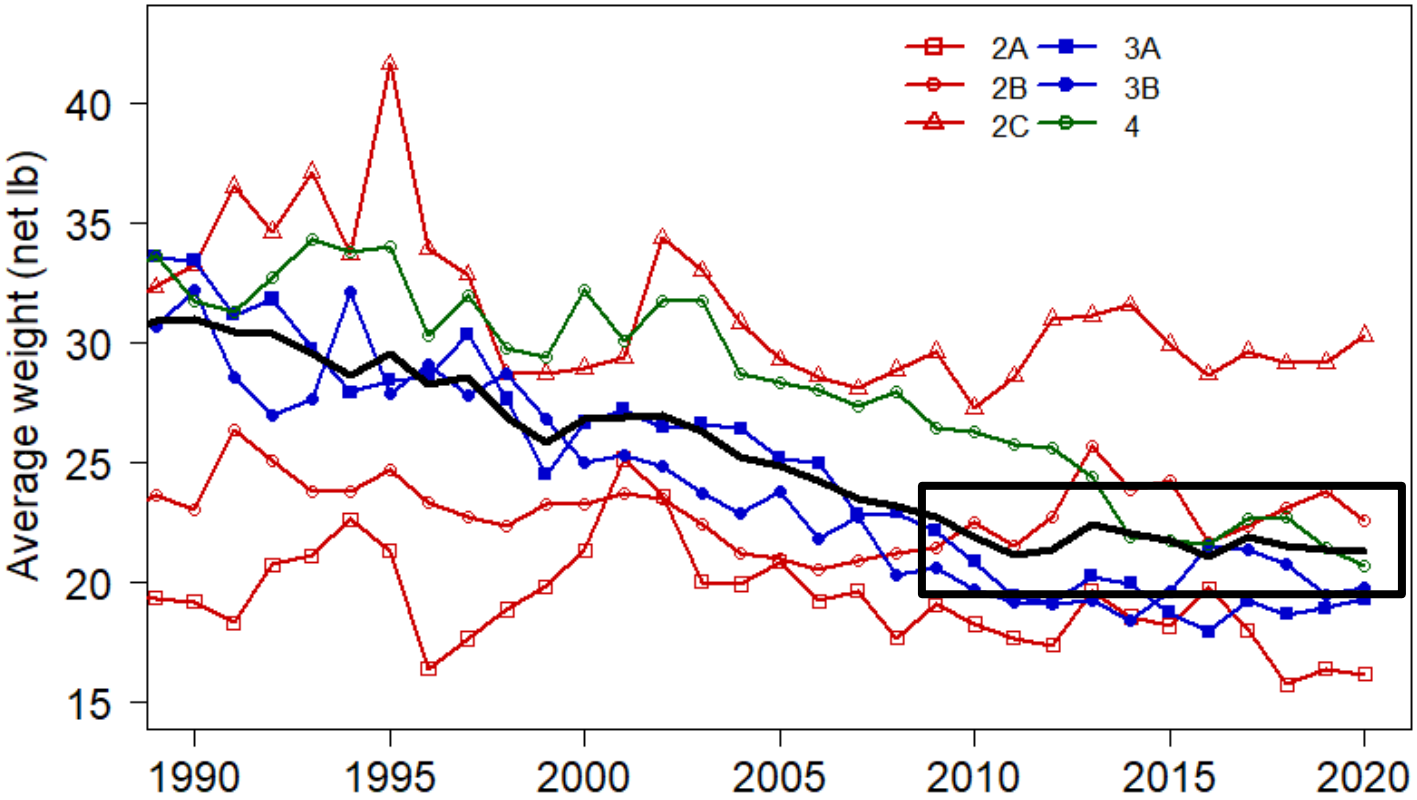
Fishery trends: Region 3



Fishery trends: Region 4

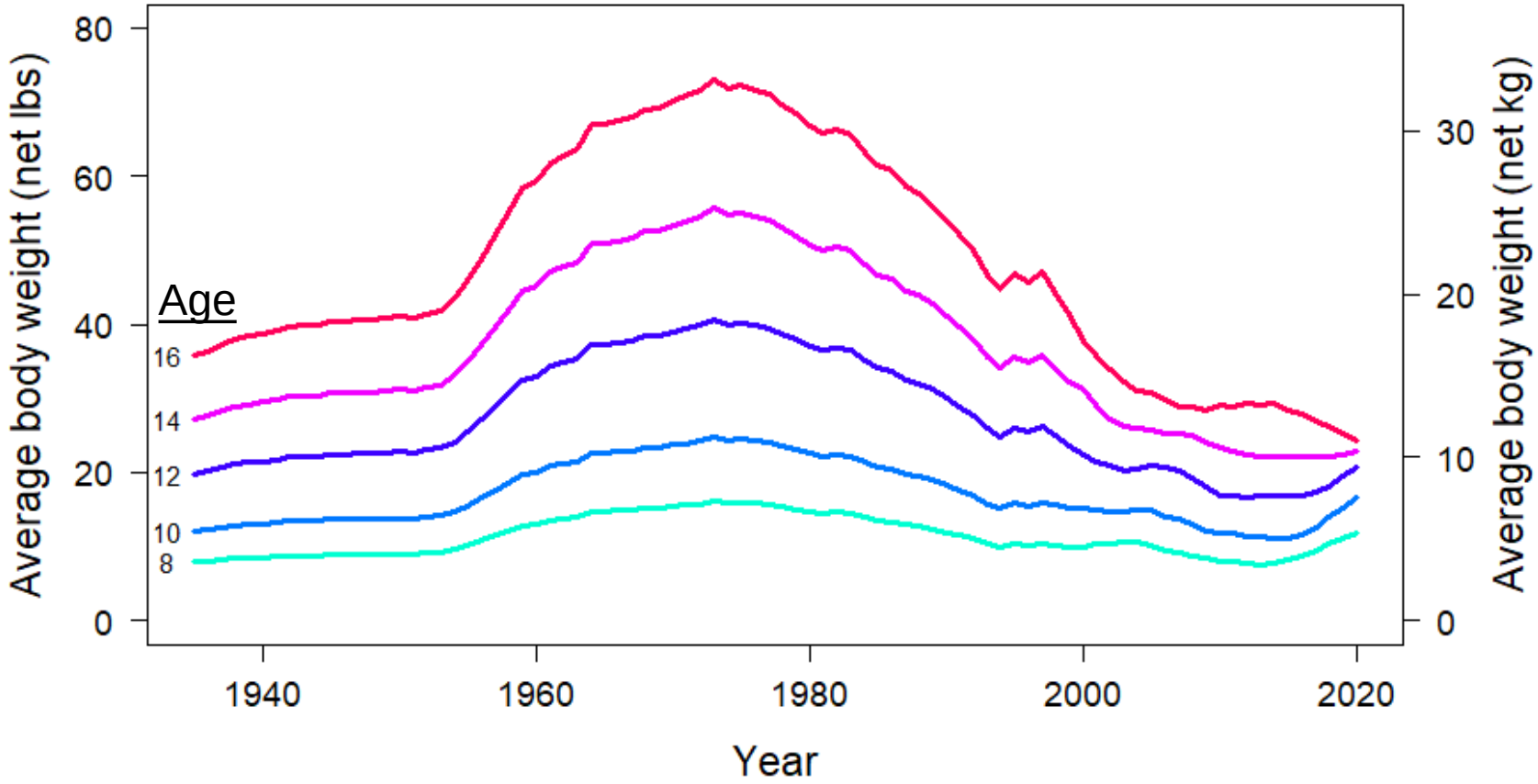


Average weight landed

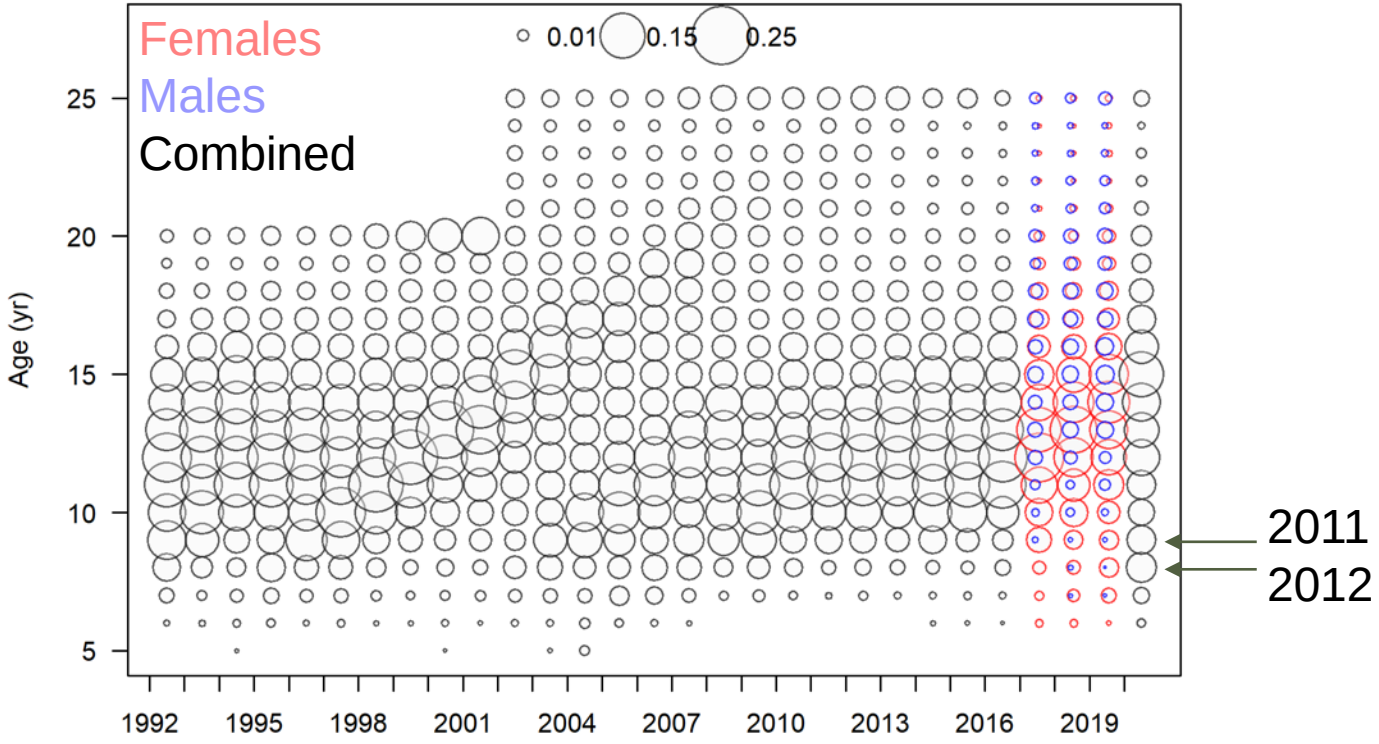


Coastwide

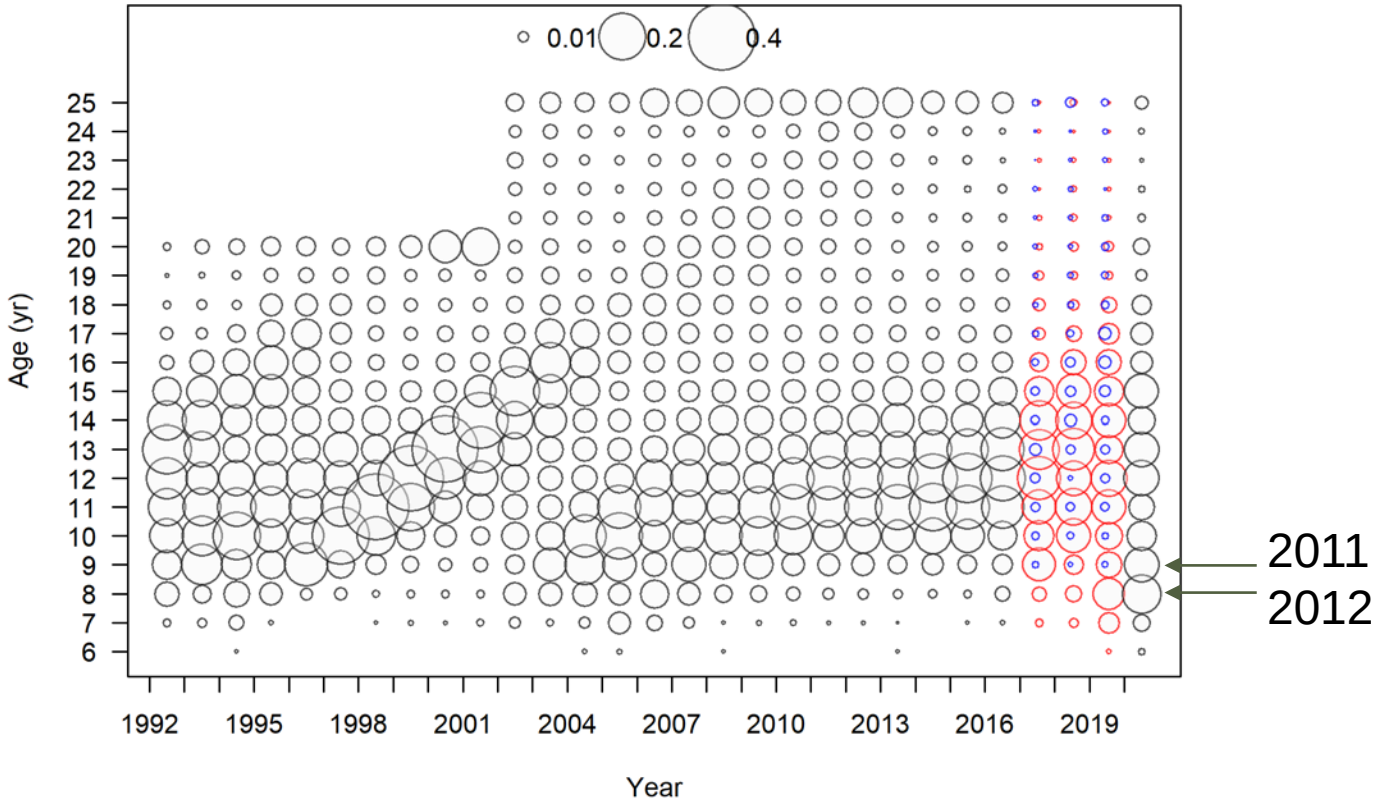
Reconstructed coastwide female weight-at-age



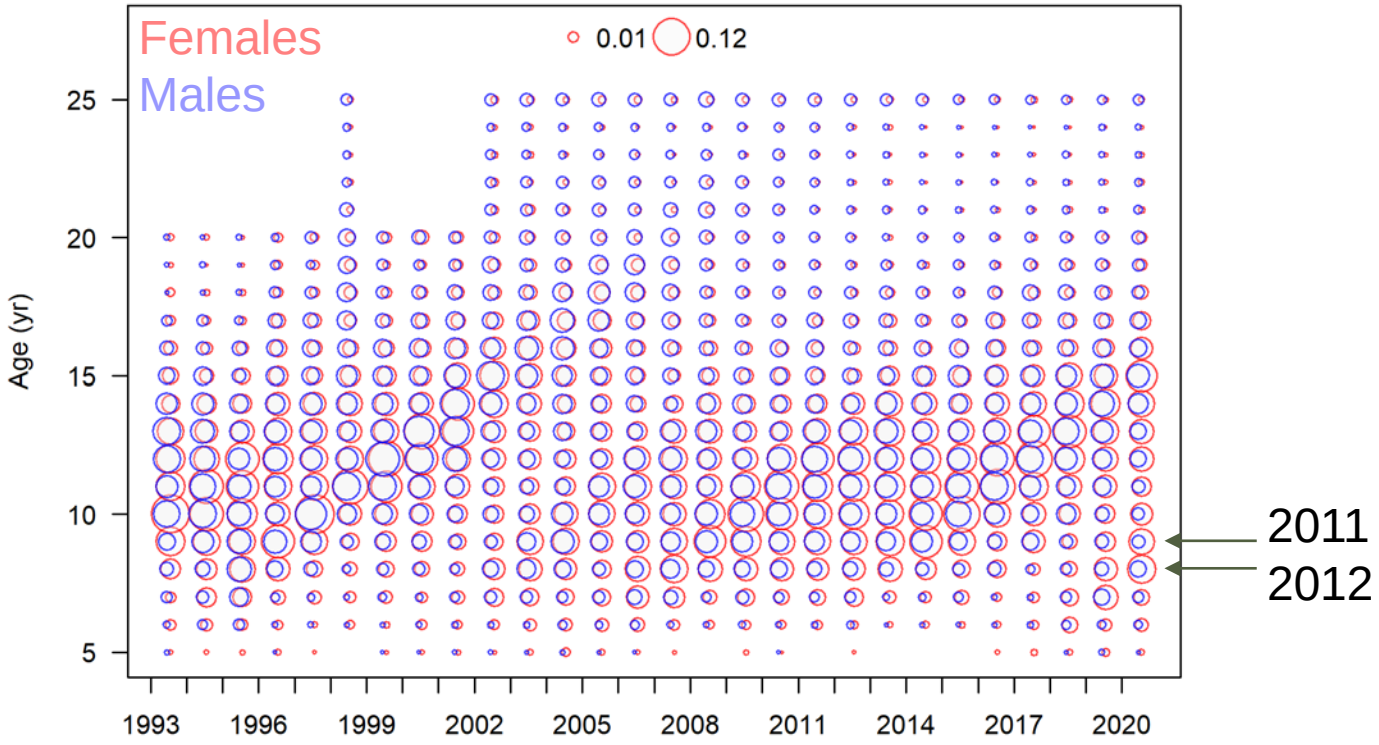
Recent fishery ages



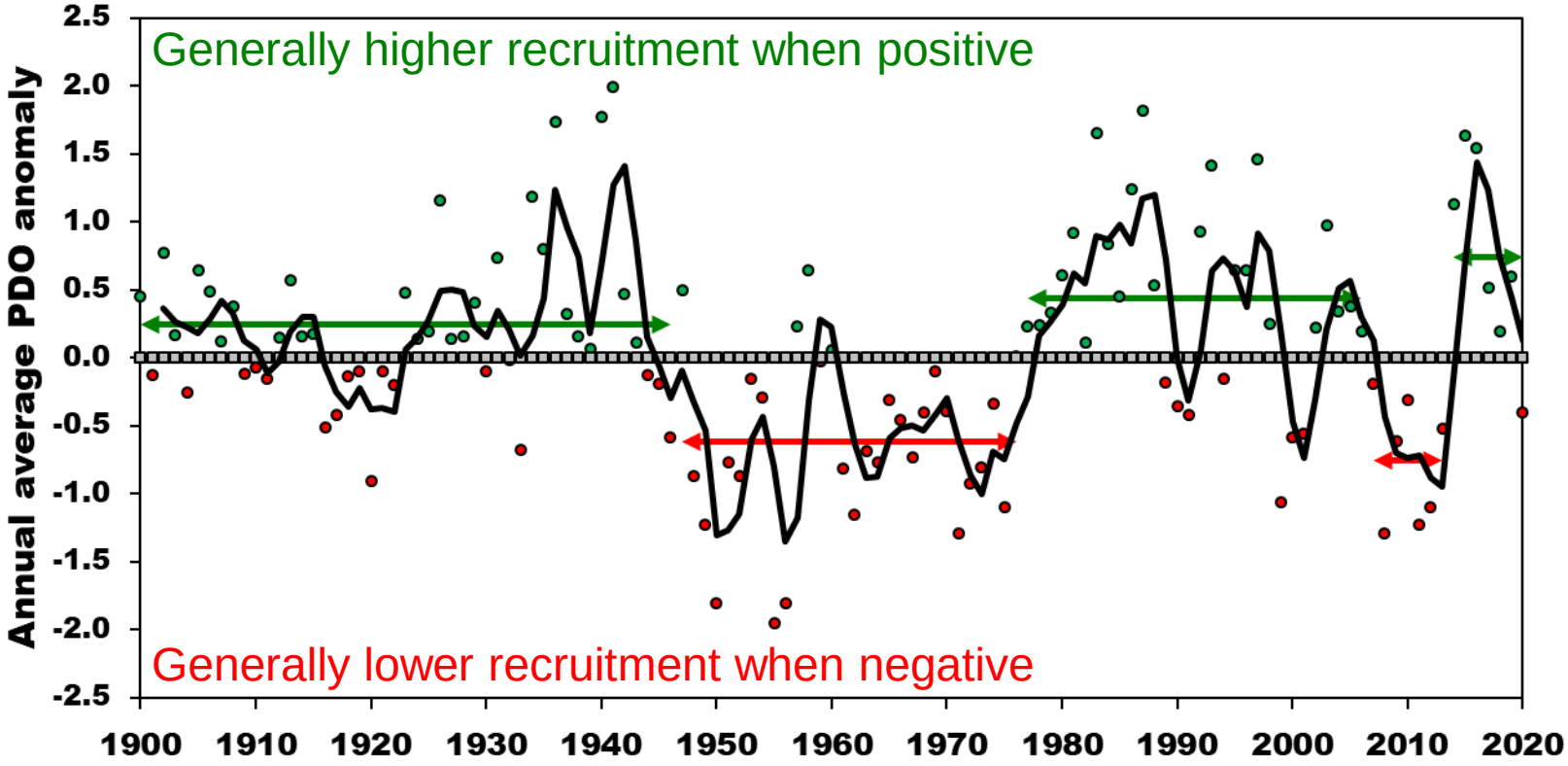
Recent fishery ages: Region 4



Recent FISS ages



Ecosystem conditions: Pacific Decadal Oscillation



Ecosystem conditions

- More normal ice conditions in the Bering Sea (2019/20 winter) than 2017/18 & 2018/19, but warmer-than-average conditions spring-fall
- Intermittent ‘heatwave’ conditions in the Gulf of Alaska during 2020 summer-fall

Reference

Ecosystem Status reports:

https://archive.fisheries.noaa.gov/afsc/refm/stocks/plan_team/2020/EBSecosys.pdf

https://archive.fisheries.noaa.gov/afsc/refm/stocks/plan_team/2020/GOAecosys.pdf

Data highlights

- 2011 and 2012 year-classes now present throughout the stock, fishery and survey
- Fishery and survey trends are consistent with individual growth within these year-classes
- Size-at-age may be starting to improve at younger ages

Outline

- Data sources
- Modelling results
- Projections and decision table
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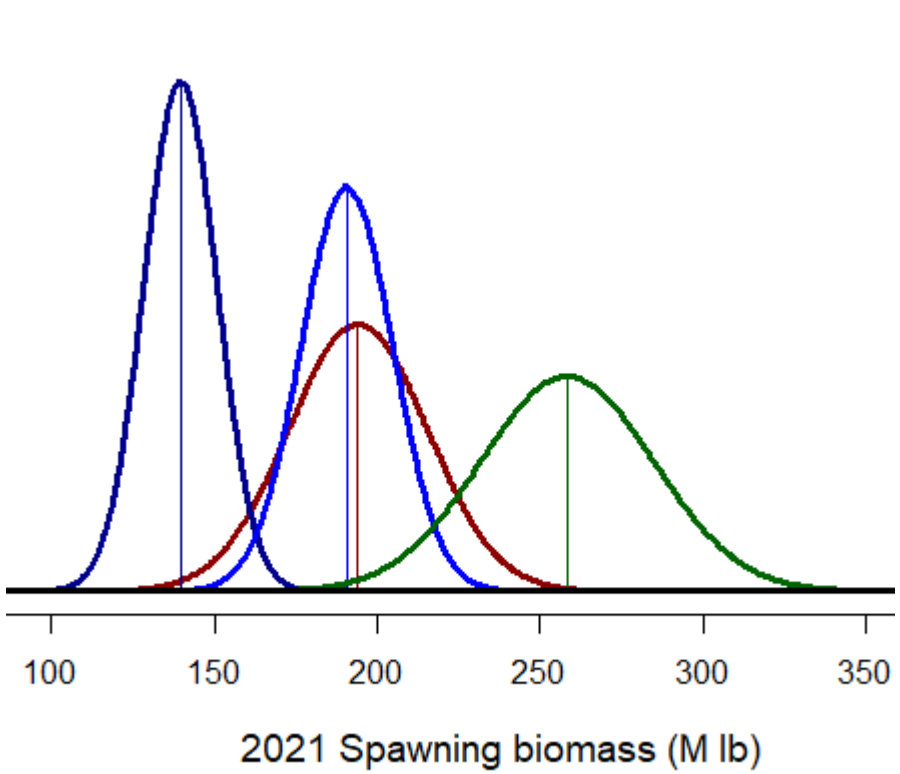
The 2020 assessment

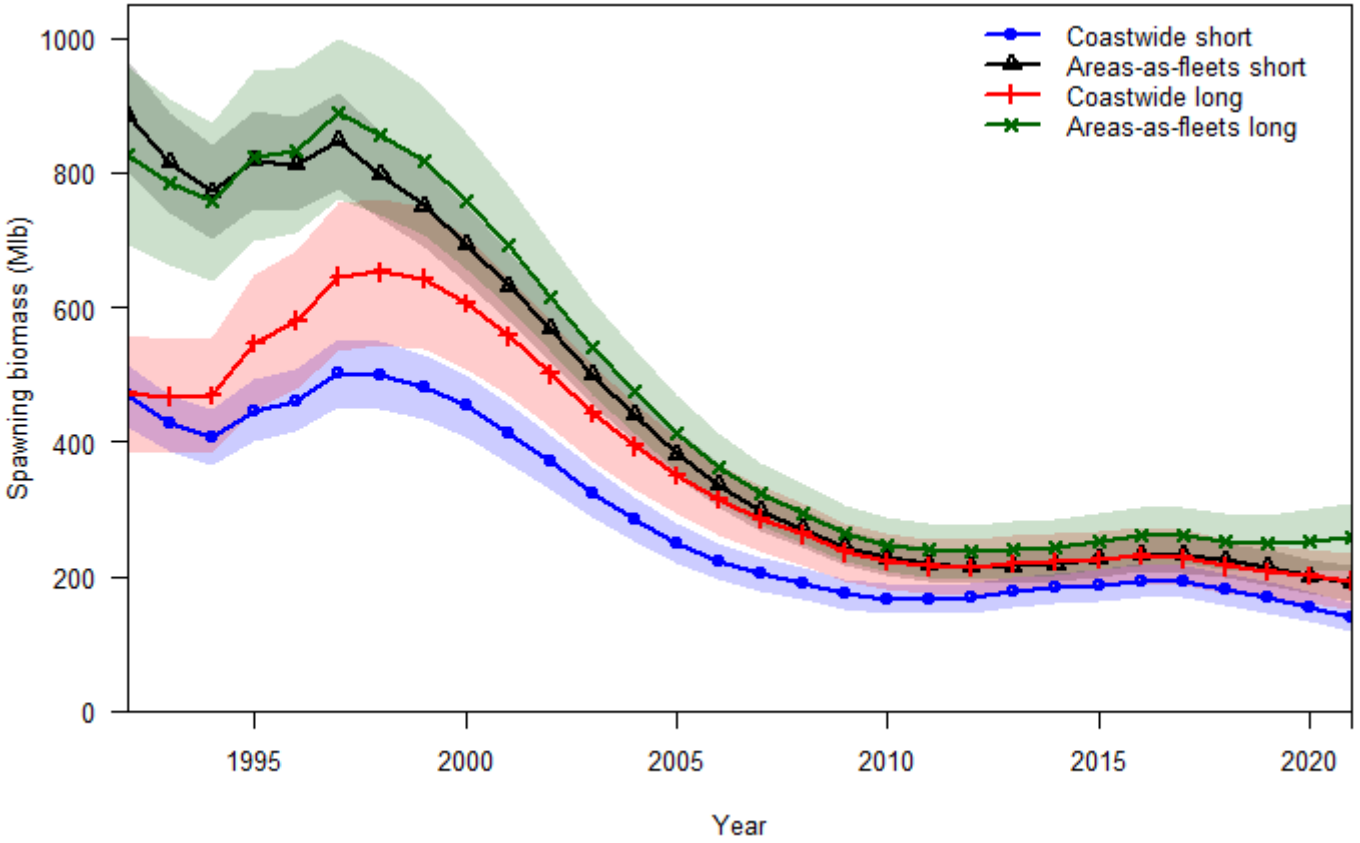
- Update to the full assessment in 2019
- No major changes in structure or methods
- Incremental changes reviewed by the SRB in June and September
- All data updated for 2019 (where needed) and added for 2020

Modelling summary: four individual models

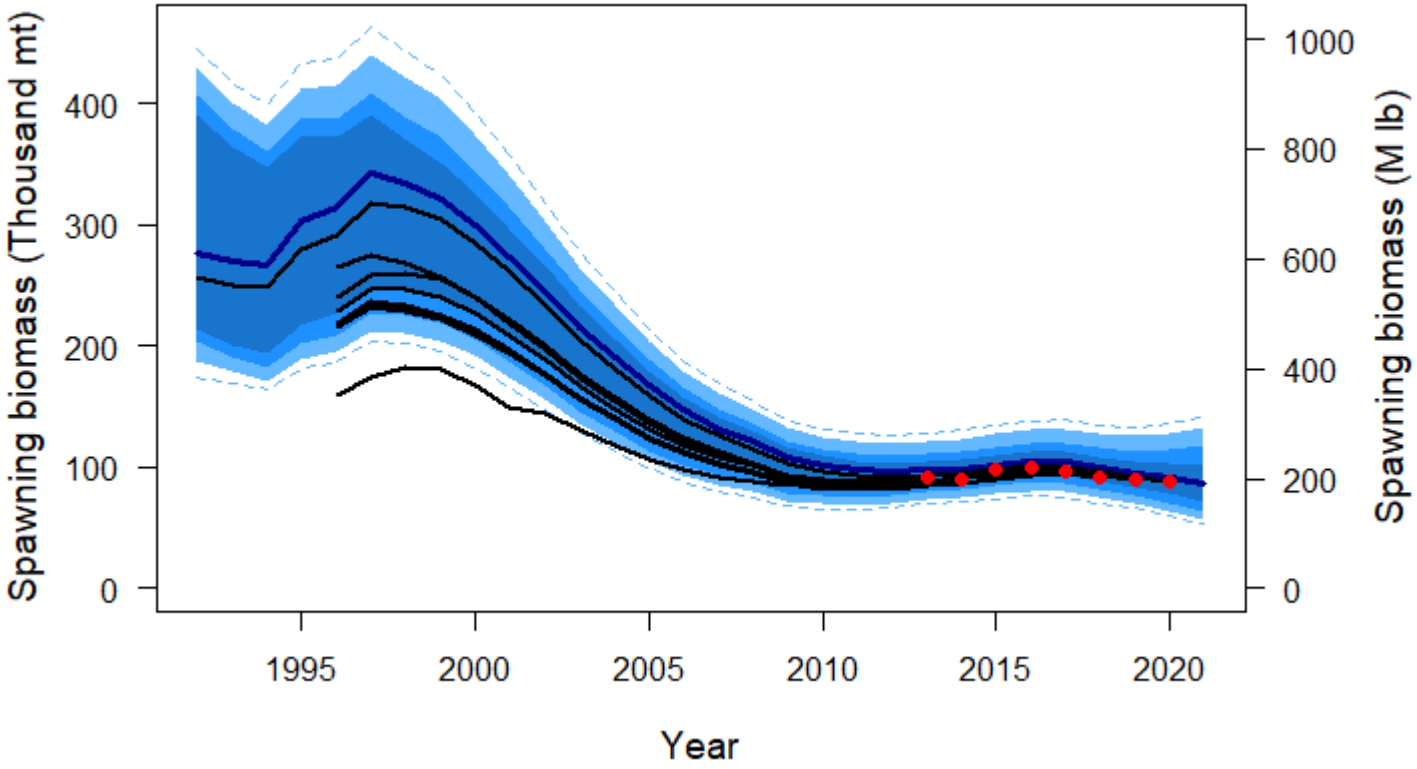


- Four ways to aggregate the data
- Respond differently to trend and age data by Region
- Provide stability from year to year as individual model results change

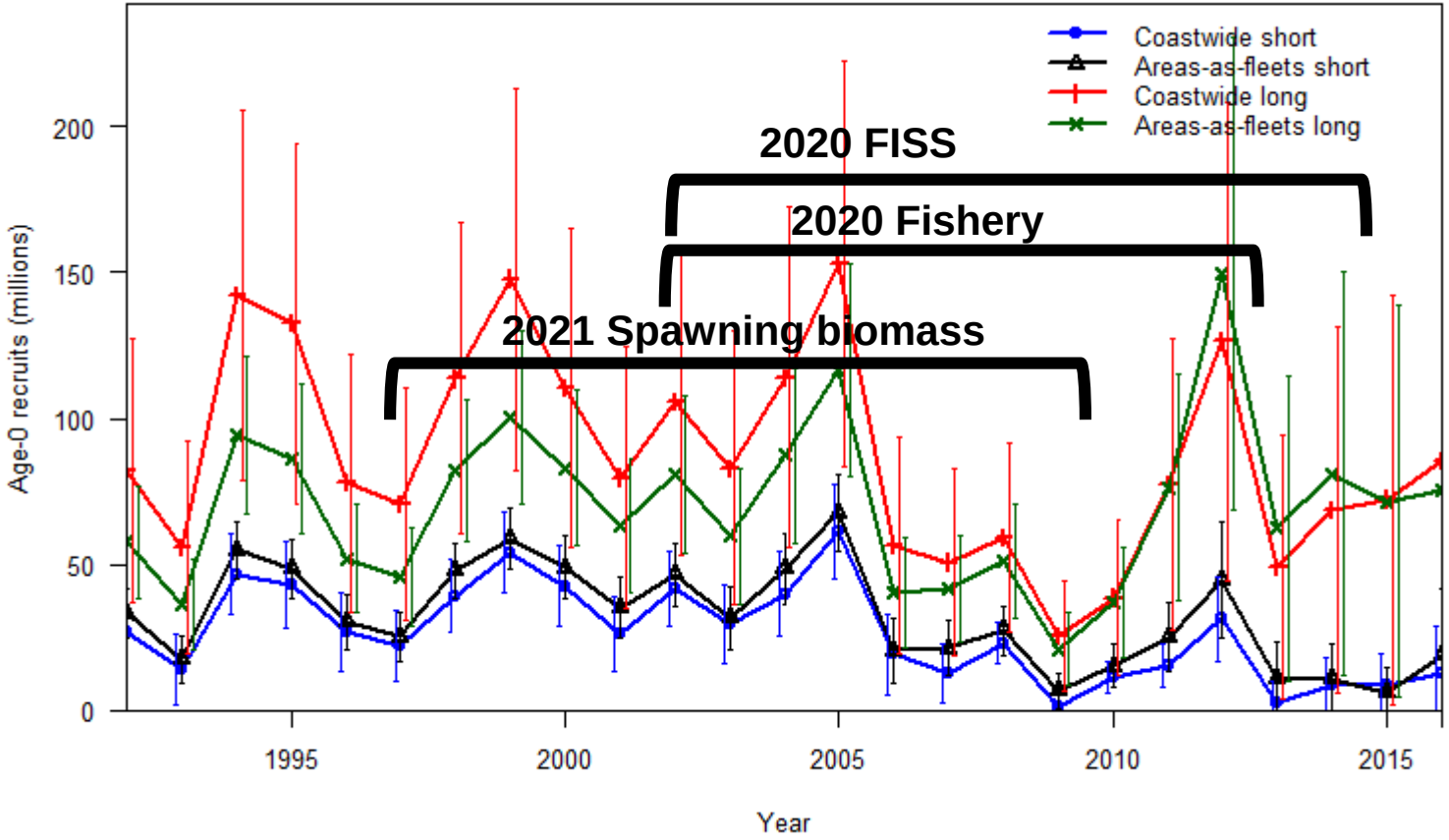
Modelling summary: four individual models



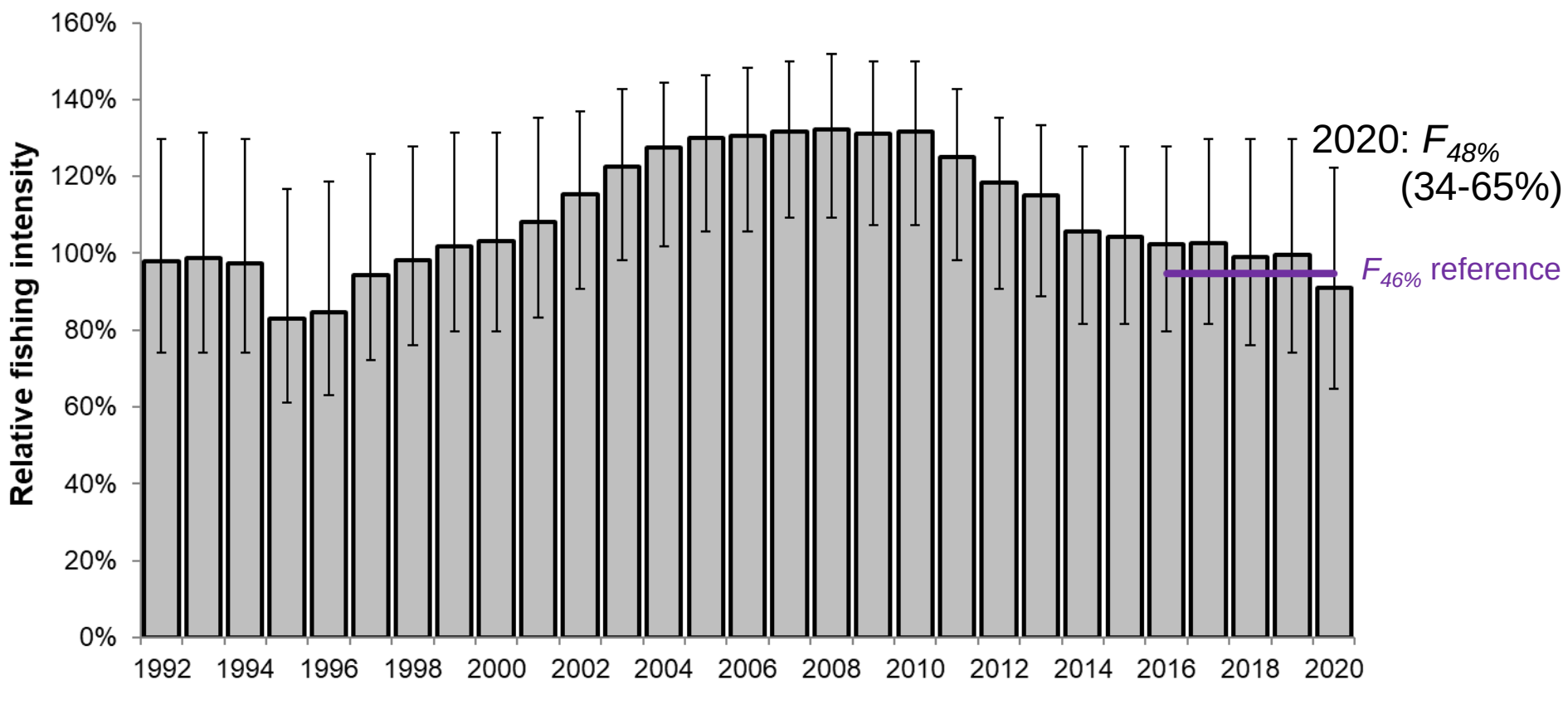
Comparison with previous assessments



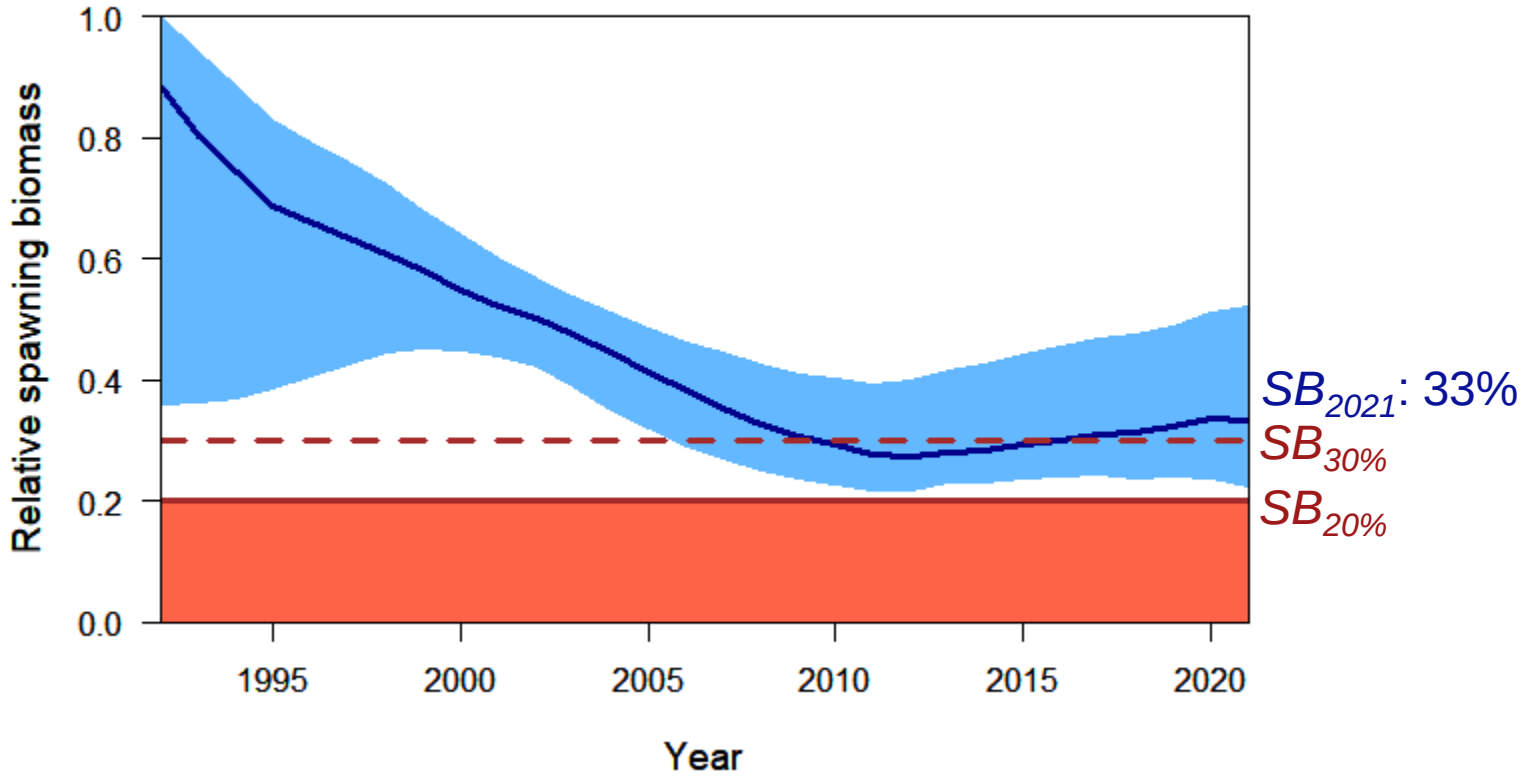
Recruitment estimates



Fishing intensity



Relative spawning biomass



Assessment summary table

Indicators	Values	Trends	Status
Total mortality 2020: Retained catch 2020: Average mortality 2016-20:	35.50 Mlbs, 16,103 t 29.65 Mlbs, 13,449 t 39.59 Mlbs, 17.959 t	Mortality decreased from 2019 to 2020	2020 mortality near 100-year Low
SPR_{2020}: P(SPR<43%): P(SPR<limit):	48% (34-65%) 38% Limit not specified	Fishing intensity decreased from 2019 to 2020	Fishing intensity below reference level
SB_{2021} (Mlb): SB_{2021}/SB_0: $P(SB_{2021}<SB_{30})$: $P(SB_{2021}<SB_{20})$:	192 Mlbs (125–292) 33% (22-52%) 41% <1%	SB decreased 17% from 2016 to 2021	Not overfished
Biological stock distribution:	See Tables and Figures	Region 4 increasing	Region 4 near historical high

Modelling highlights

- Strength of the 2011 and 2012 year-classes remains uncertain
- Reductions in mortality in 2020 resulted in slightly lower levels of fishing intensity than projected

Outline

- Data sources
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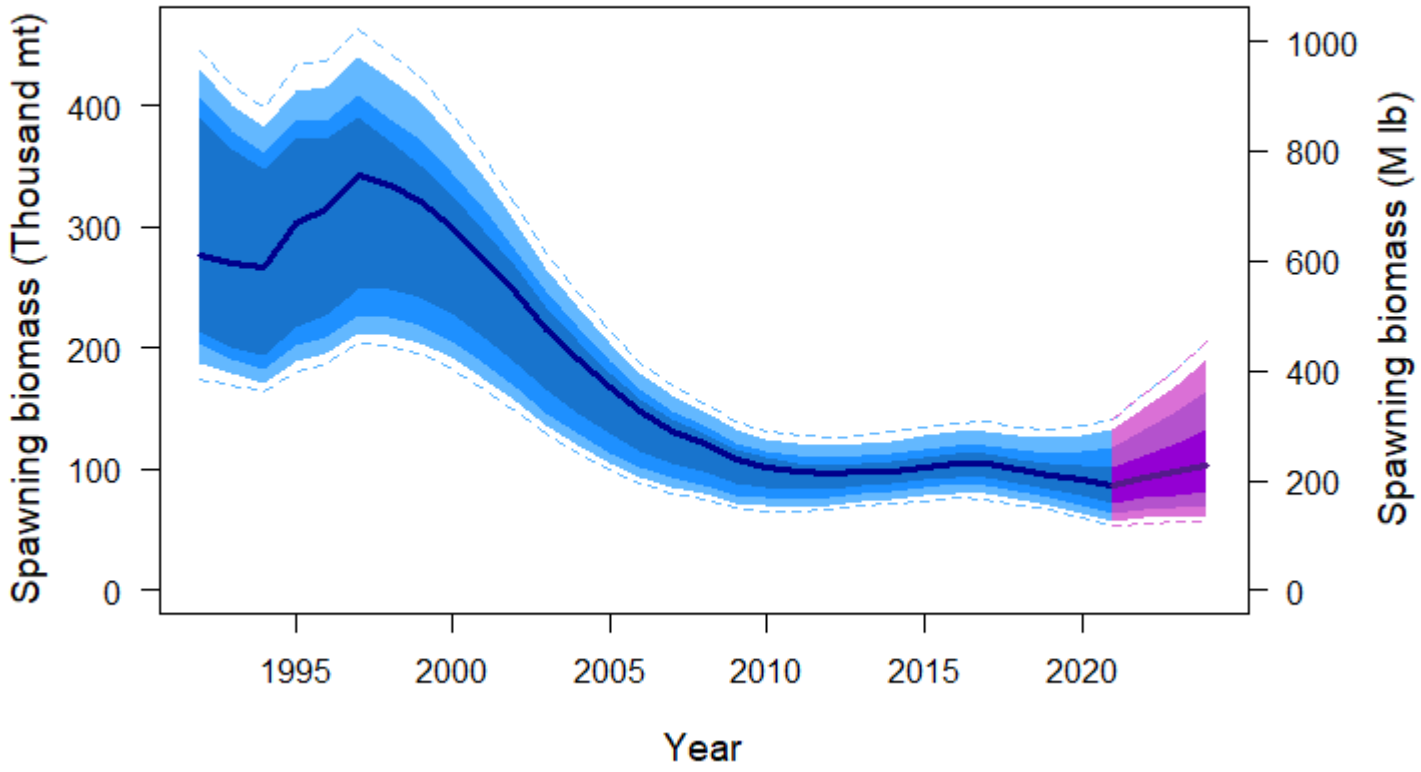
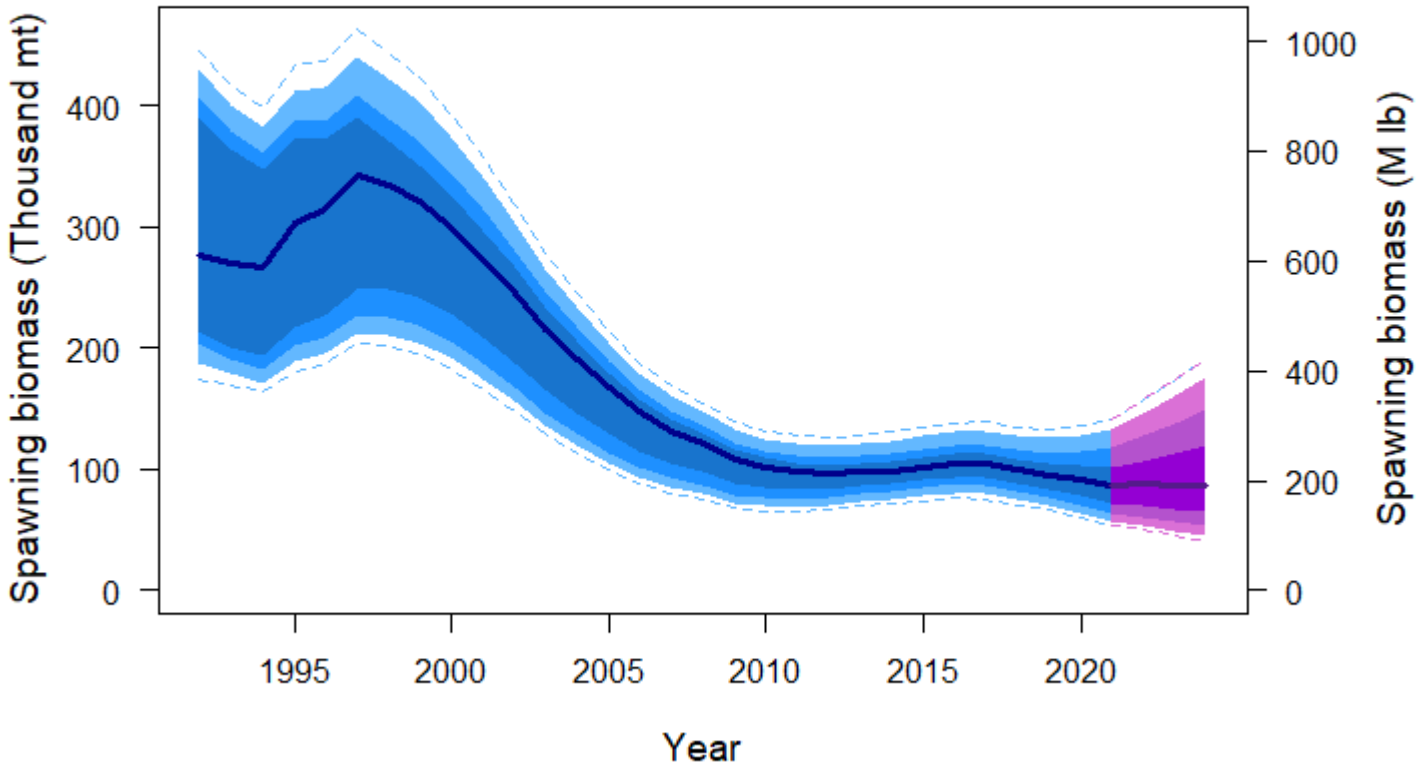
Projections and decision table

- Constant TCEY for the next three years
- Range of mortality, from no fishing mortality to 60 Mlb TCEY, with additional detail from $F_{40\%}$-$F_{46\%}$

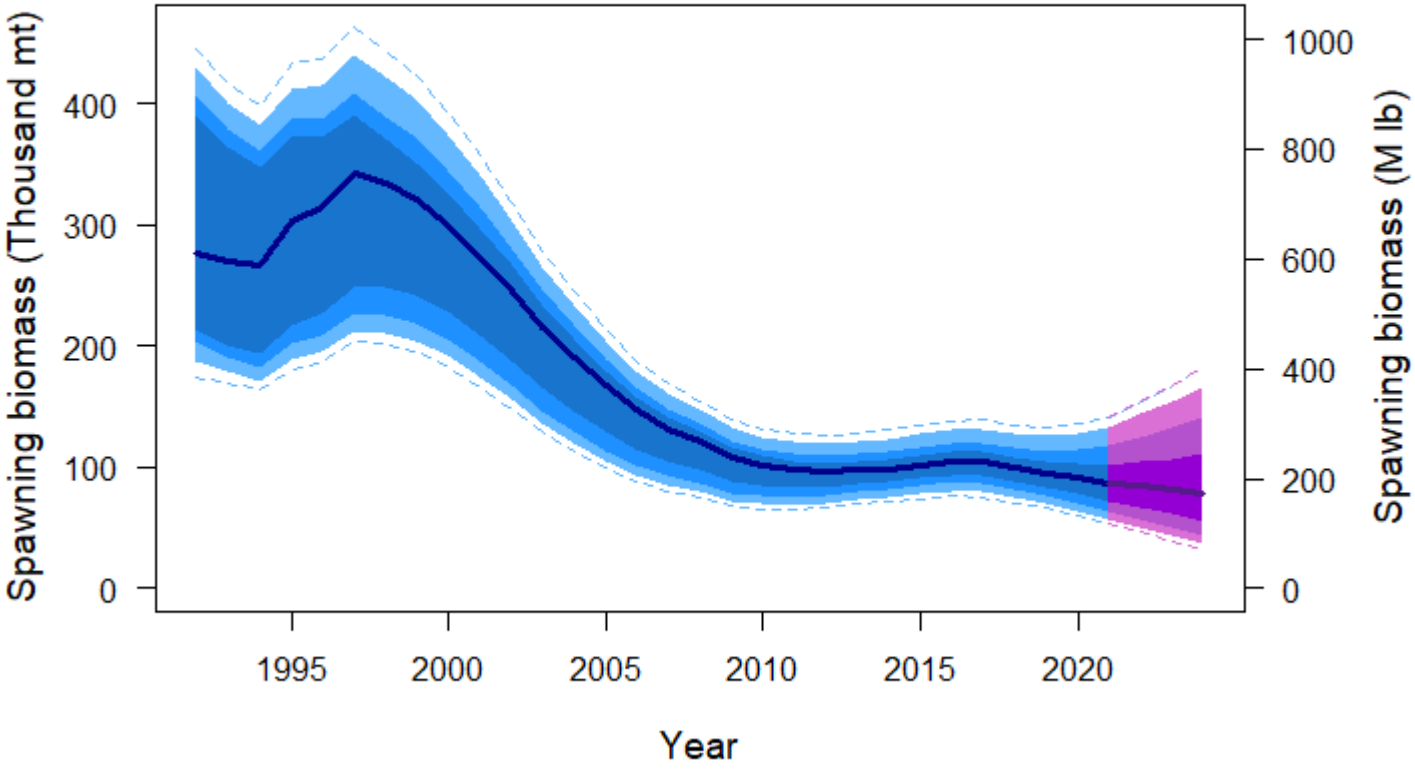
Projections: no fishing mortality



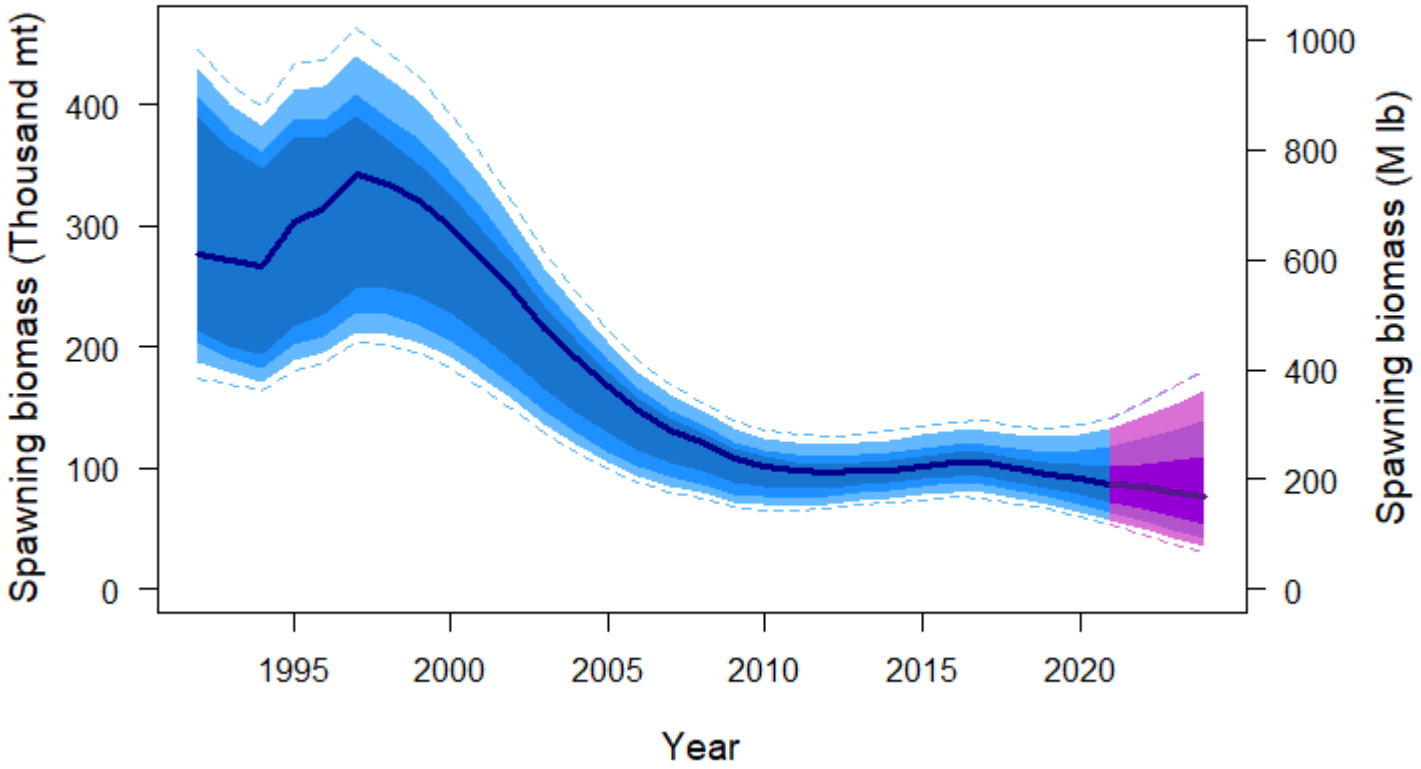
Projections: 3-yr surplus production (24.4. Mlb TCEY)



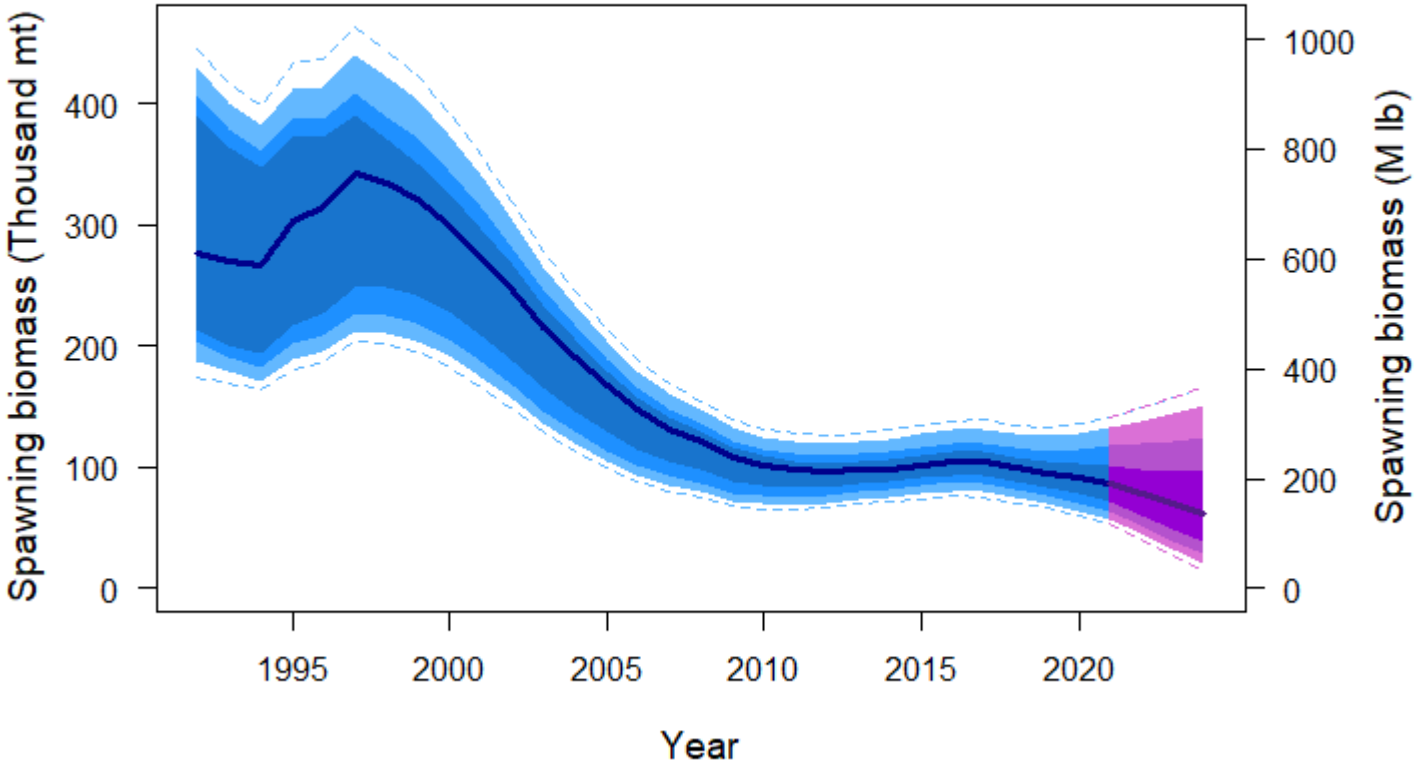
Projections: *status quo* (36.6 Mlb TCEY)



Projections: Reference level (39 Mlb TCEY)



Projections: 60 Mlb TCEY



Decision table

- Risk-benefit trade-offs:
  - Yield vs. probability of stock and fishery trend and status decreases
- Metrics relative to the interim management procedure
  - Now $F_{43\%}$ with 30:20 control rule

Decision table: Yield options

2021 Alternative		3-Year Surplus		Status quo		*Reference* $F_{43\%}$				
Total mortality (M lb)	0.0	25.7	36.8	37.9	39.1	40.3	41.5	42.9	44.1	61.3
TCEY (M lb)	0.0	24.4	35.5	36.6	37.8	39.0	40.3	41.6	42.8	60.0
2021 fishing intensity	$F_{100\%}$	$F_{58\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{30\%}$
Fishing intensity interval	--	39-76%	29-65%	29-64%	28-63%	27-62%	26-61%	26-60%	25-59%	18-49%

$F_{46\%}$-$F_{40\%}$

No fishing mortality

‘Break-even’ level

60 Mlb

Decision table: Stock trend

2021 Alternative				3-Year Surplus		Status quo		*Reference* $F_{43\%}$					
Total mortality (M lb)			0.0	25.7	36.8	37.9	39.1	40.3	41.5	42.9	44.1	61.3	
TCEY (M lb)			0.0	24.4	35.5	36.6	37.8	39.0	40.3	41.6	42.8	60.0	
2021 fishing intensity			$F_{100\%}$	$F_{58\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{30\%}$	
Fishing intensity interval			--	39-76%	29-65%	29-64%	28-63%	27-62%	26-61%	26-60%	25-59%	18-49%	
Stock Trend (spawning biomass)	in 2022	is less than 2021	<1	42	61	62	64	65	66	67	69	82	a
		is 5% less than 2021	<1	7	32	34	36	39	41	44	46	66	b
	in 2023	is less than 2021	<1	51	62	63	64	65	66	67	69	81	c
		is 5% less than 2021	<1	32	53	54	55	56	57	59	59	74	d
	in 2024	is less than 2021	<1	50	60	61	62	63	64	66	67	80	e
		is 5% less than 2021	<1	40	55	56	57	57	58	59	60	74	f

Approximately 2/3 chance of further stock decline

Decision table: Stock status

		2021 Alternative		3-Year Surplus		Status quo		*Reference* $F_{43\%}$					
		Total mortality (M lb)	0.0	25.7	36.8	37.9	39.1	40.3	41.5	42.9	44.1	61.3	
		TCEY (M lb)	0.0	24.4	35.5	36.6	37.8	39.0	40.3	41.6	42.8	60.0	
		2021 fishing intensity	$F_{100\%}$	$F_{58\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{30\%}$	
		Fishing intensity interval	--	39-76%	29-65%	29-64%	28-63%	27-62%	26-61%	26-60%	25-59%	18-49%	
Stock Status (Spawning biomass)	in 2022	is less than 30%	29	35	39	40	40	41	41	42	42	47	g
		is less than 20%	<1	<1	<1	<1	1	1	1	1	1	4	h
	in 2023	is less than 30%	23	32	39	40	40	41	42	43	43	49	i
		is less than 20%	<1	<1	2	2	3	3	4	5	5	19	j
	in 2024	is less than 30%	12	29	38	39	40	41	42	43	44	50	k
		is less than 20%	<1	<1	4	5	6	8	9	10	12	25	l

Less than a 50/50 chance of dropping below $SB_{30\%}$

Decision table: Fishery trend and status

2021 Alternative				3-Year Surplus		Status quo		*Reference* $F_{43\%}$					
Total mortality (M lb)			0.0	25.7	36.8	37.9	39.1	40.3	41.5	42.9	44.1	61.3	
TCEY (M lb)			0.0	24.4	35.5	36.6	37.8	39.0	40.3	41.6	42.8	60.0	
2021 fishing intensity			$F_{100\%}$	$F_{58\%}$	$F_{46\%}$	$F_{45\%}$	$F_{44\%}$	$F_{43\%}$	$F_{42\%}$	$F_{41\%}$	$F_{40\%}$	$F_{30\%}$	
Fishing intensity interval			--	39-76%	29-65%	29-64%	28-63%	27-62%	26-61%	26-60%	25-59%	18-49%	
Fishery Trend (TCEY)	in 2022	is less than 2021	0	17	48	49	50	50	50	51	51	77	m
		is 10% less than 2021	0	6	41	44	46	48	49	50	50	63	n
	in 2023	is less than 2021	0	21	49	50	50	50	50	51	51	75	o
		is 10% less than 2021	0	11	45	47	48	49	50	50	50	64	p
	in 2024	is less than 2021	0	23	49	50	50	50	50	51	51	74	q
		is 10% less than 2021	0	13	47	48	49	49	50	50	50	64	r
Fishery Status (Fishing intensity)	in 2021	is above $F_{43\%}$	0	15	48	49	50	50	50	51	51	78	s

Approximately a 50/50 chance of future TCEY cuts to remain at $F_{43\%}$

For more data and assessment information

- Assessment and data overview documents are available through the stock assessment page of the IPHC's website:
  - IPHC-2021-SA-01
  - IPHC-2021-SA-02

Outline

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2021 Mortality projection tool

- https://www.iphc.int/datatest/projection-tool
- Interactive tool to explore alternative scale and distribution of mortality limits for 2021
- Includes updated 2020 mortality estimates (post-season)
- Default values include all parts of the current Interim Management Procedure
- 2A and 2B adjustments automatically calculated
- See IPHC-2020-IM096-INF03 for more information

2021-2022 Interim management procedure

- Baseline: $F_{43\%}$, 30:20 control rule, O32 stock distribution, relative harvest rates of 1.0 (2A-3A), 0.75 (3B-4CDE)
- Adjustments:
  - 2A = 1.65 Mlb TCEY
  - Coastwide TCEY % in 2B = 0.7*20% + 0.3*baseline
  - 2B formula (above) +50% of 2B TCEY change due to accounting for U26 non-directed discard mortality in Alaska

(See IPHC-2020-IM096-INF03 for more information)

Interim Management Procedure: baseline

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O32 Stock Distribution	2.0%	10.5%	13.3%	36.3%	10.7%	8.6%	5.0%	13.6%	100%
HR	1.0	1.0	1.0	1.0	0.75	0.75	0.75	0.75	NA
TCEY Distribution	2.2%	11.6%	14.7%	40.1%	8.9%	7.1%	4.2%	11.3%	100%

Interim Management Procedure: adjustments

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O32 Stock Distribution	2.0%	10.5%	13.3%	36.3%	10.7%	8.6%	5.0%	13.6%	100%
HR	1.0	1.0	1.0	1.0	0.75	0.75	0.75	0.75	NA
TCEY Distribution	2.2%	11.6%	14.7%	40.1%	8.9%	7.1%	4.2%	11.3%	100%
Adjusted	1.65	17.5%	*Depends on total TCEY*						

Interim Management Procedure: adjustments

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O32 Stock Distribution	2.0%	10.5%	13.3%	36.3%	10.7%	8.6%	5.0%	13.6%	100%
HR	1.0	1.0	1.0	1.0	0.75	0.75	0.75	0.75	NA
TCEY Distribution	2.2%	11.6%	14.7%	40.1%	8.9%	7.1%	4.2%	11.3%	100%
Adjusted	1.65	17.5%	*Depends on total TCEY*						
Final % from total TCEY	4.2%	17.9%*	13.2%	36.2%	8.0%	6.4%	3.8%	10.2%	100%
TCEYs	1.65	7.00	5.16	14.12	3.12	2.51	1.47	3.98	39.00

*2B includes 0.18 Mlb accounting for U26 non-directed discards in AK

Reference TCEYs (from $F_{46\%}$, then $F_{43\%}$ in 2021)

	Region 2	Region 3	Region 4	Region 4B	Total
2018	10.08	14.63	5.08	1.21	31.00
2019	11.95	19.31	6.80	1.95	40.00
2020	12.41	12.74	5.48	1.27	31.90
2021	13.81	17.24	6.48	1.47	39.00

Adopted TCEYs

2018	14.76	15.81	5.36	1.28	37.21
2019	14.82	16.40	5.94	1.45	38.61
2020	14.33	15.32	5.65	1.31	36.60

Reference TCEYs

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
2018	0.59	3.84	5.65	12.07	2.56	1.69	1.21	3.39	31.00
2019	0.78	4.91	6.26	16.35	2.97	2.21	1.95	4.59	40.00
2020	1.65	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90
2021	1.65	7.00	5.16	14.12	3.12	2.51	1.47	3.98	39.00

Adopted TCEYs

2018	1.32	7.10	6.34	12.54	3.27	1.74	1.28	3.62	37.21
2019	1.65	6.83	6.34	13.50	2.90	1.94	1.45	4.00	38.61
2020	1.65	6.83	5.85	12.20	3.12	1.75	1.31	3.90	36.60

Interim Management procedure: detailed results

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial discards	0.03	0.17	NA	NA	0.11	0.15	0.05	0.08	0.59
O26 Non-directed discards	0.10	0.23	0.09	1.14	0.42	0.24	0.12	2.20	4.54
Recreational	NA	0.04	1.16	1.70	0.01	0.02	0.00	0.00	2.93
Subsistence	NA	0.41	0.37	0.19	0.02	0.01	0.00	0.03	1.02
Total non-FCEY	0.14	0.84	1.61	3.03	0.56	0.42	0.17	2.31	9.09
Commercial discards	NA	NA	0.06	0.24	NA	NA	NA	NA	0.30
Recreational	0.61	0.92	0.65	1.94	NA	NA	NA	NA	4.12
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial landings	0.87	5.23	2.84	8.91	2.56	2.09	1.29	1.67	25.46
Total FCEY	1.51	6.15	3.55	11.09	2.56	2.09	1.29	1.67	29.91
							4C FCEY	*0.74*	
							4D FCEY	*0.74*	
							4E FCEY	*0.19*	
TCEY	1.65	7.00	5.16	14.12	3.12	2.51	1.47	3.98	39.00
U26 Non-directed discards	0.00	0.03	0.00	0.29	0.06	0.08	0.01	0.78	1.25
Total	1.65	7.03	5.16	14.41	3.18	2.59	1.48	4.75	40.25

Recommendations

That the Commission:

a) **NOTE** paper IPHC-2021-AM097-08 which provides a summary of data, the 2020 stock assessment and the harvest decision table for 2021.

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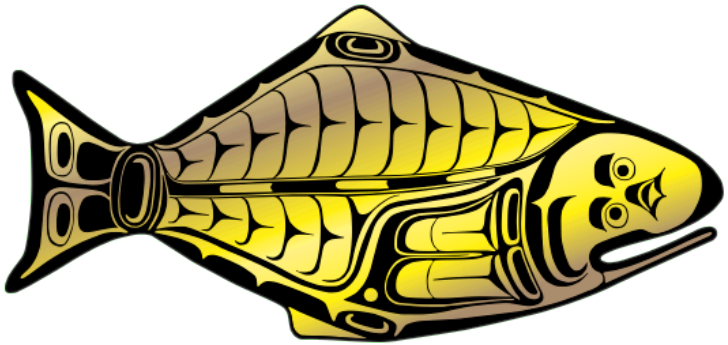

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