

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

Summary of the data, stock assessment and management quantities at the end of 2019

Agenda items 6.4, 6.5

IPHC-2020-AM096-09 Rev_2





INTERNATIONAL PACIFIC



HALIBUT COMMISSION

Additional material on IPHC website:
Science and Research → Stock
assessment → Most recent stock
assessment

Full data overview and stock
assessment documents

Summary

- Modelled survey trends down: numbers and WPUE
- Fishery CPUE trends mixed but flat coastwide
- Estimated spawning biomass decreased from 2018-2019 (as predicted); this is projected to continue for all 2020 TCEYs greater than 18.4 Mlb
- Interim management procedure indicates that lower yields needed to achieve a reference fishing intensity of $F_{46\%}$

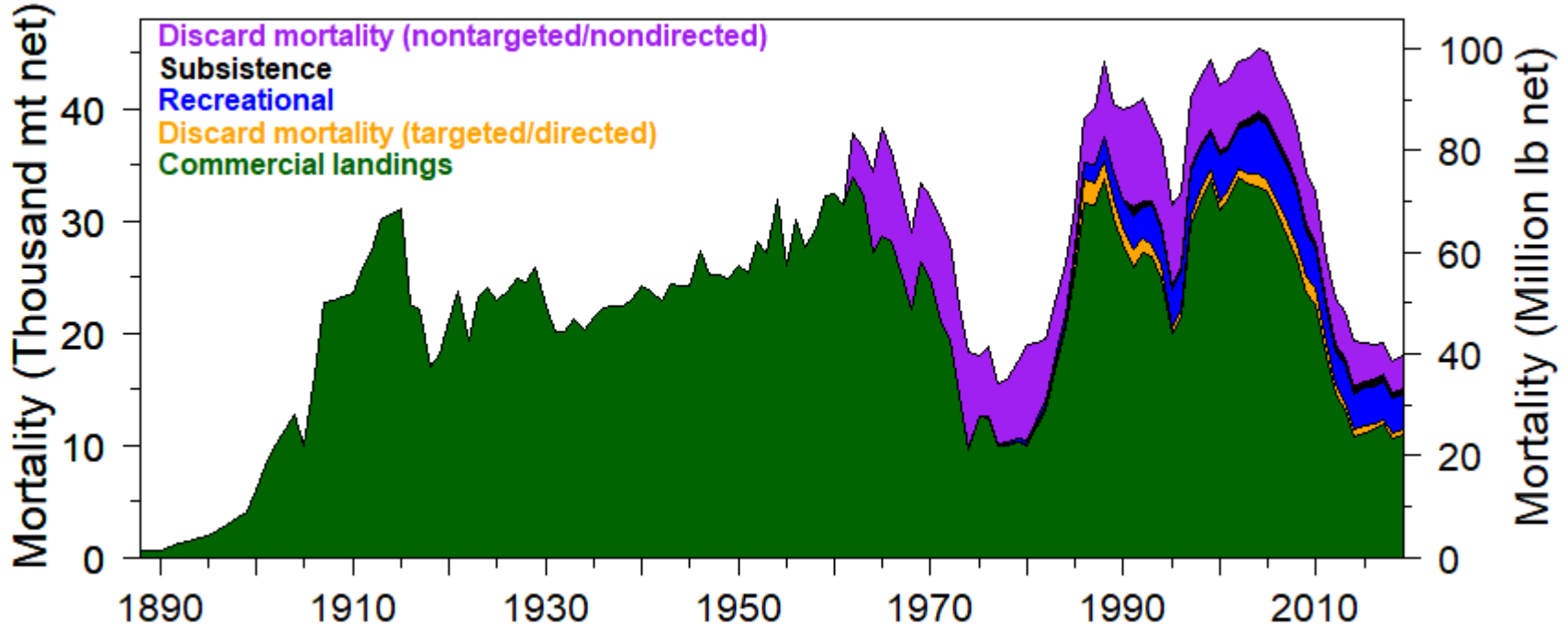


Outline

- Data sources
- Modelling results
- Projections
- Reference points
- Decision table
- Interim management procedure results



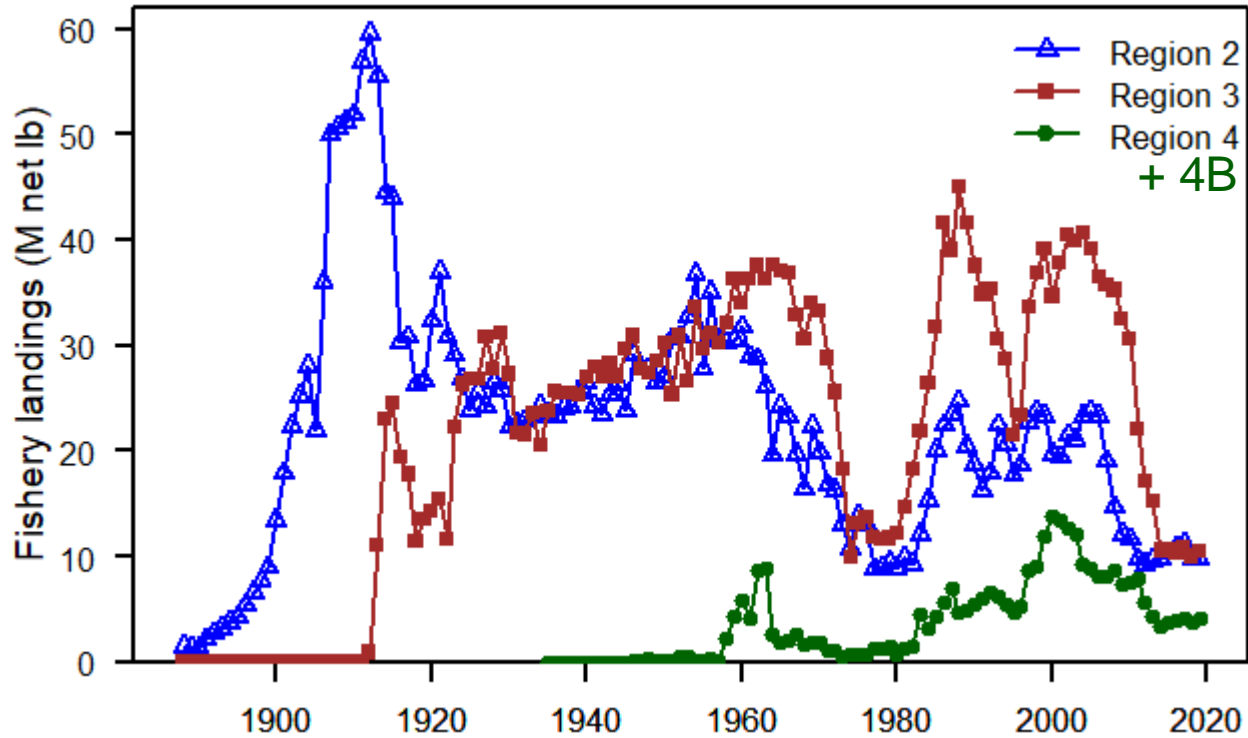
Historical mortality



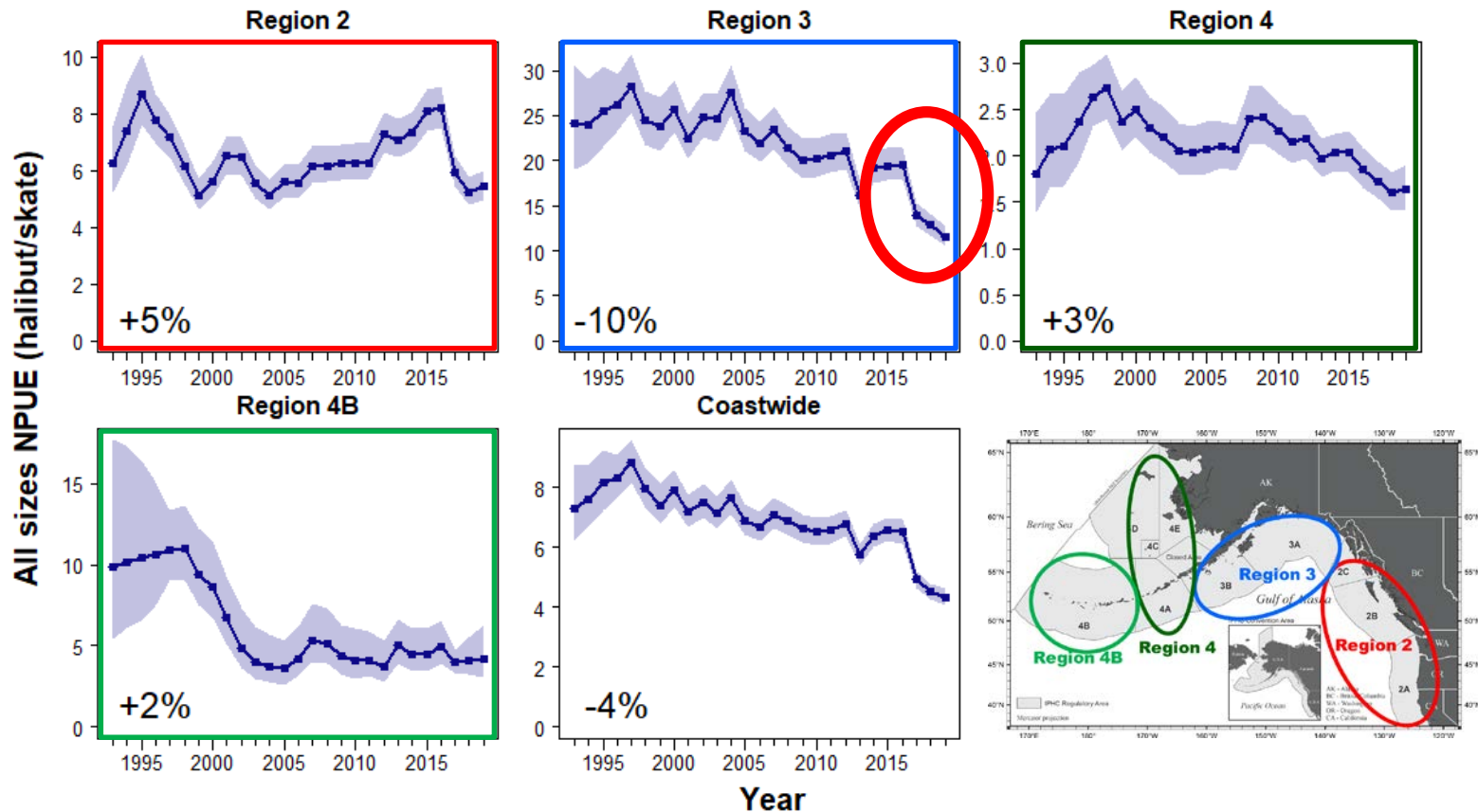
Last 100 years: Average = 63 Mlb, range = 34-100 Mlb



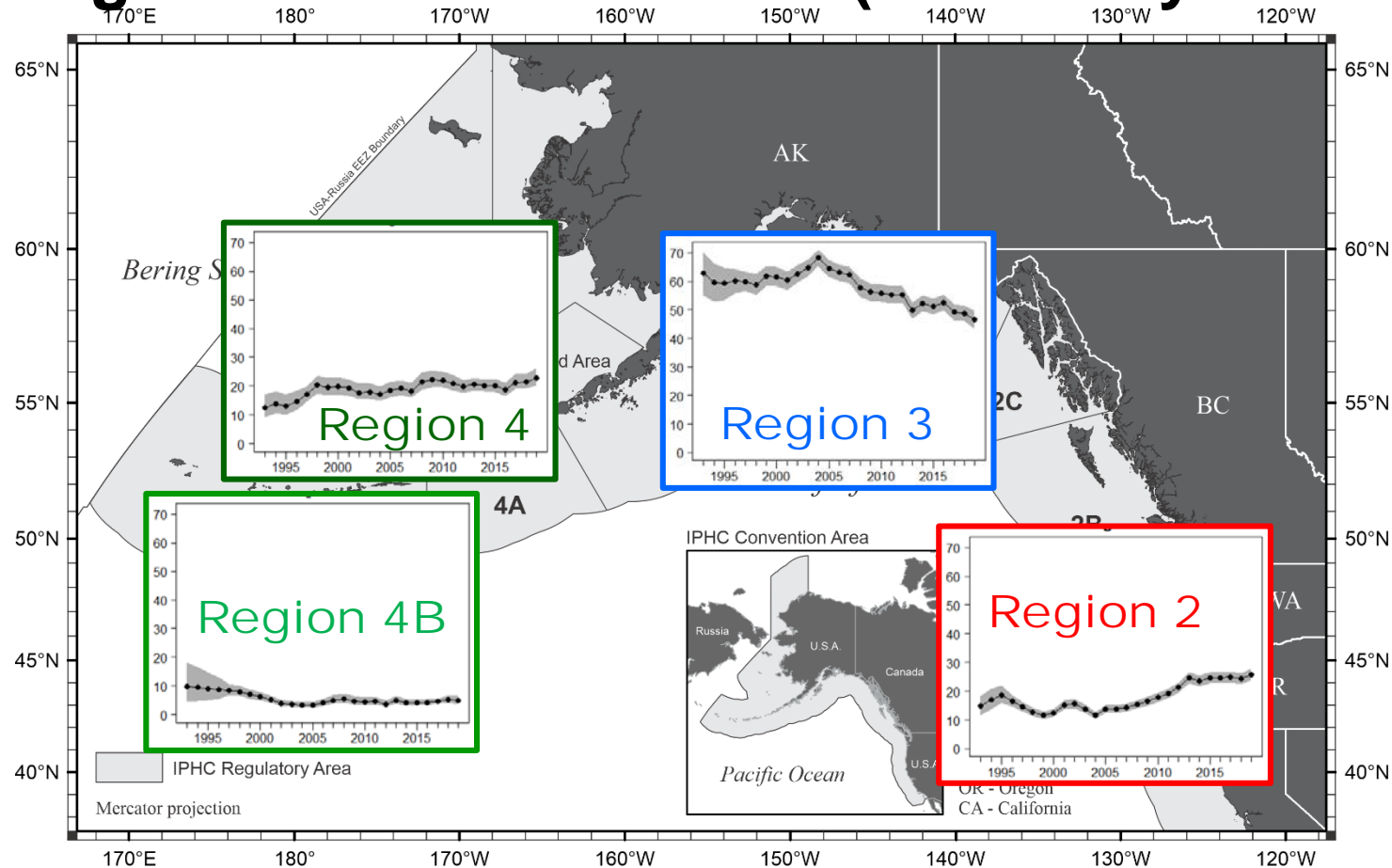
Historical landings by Region



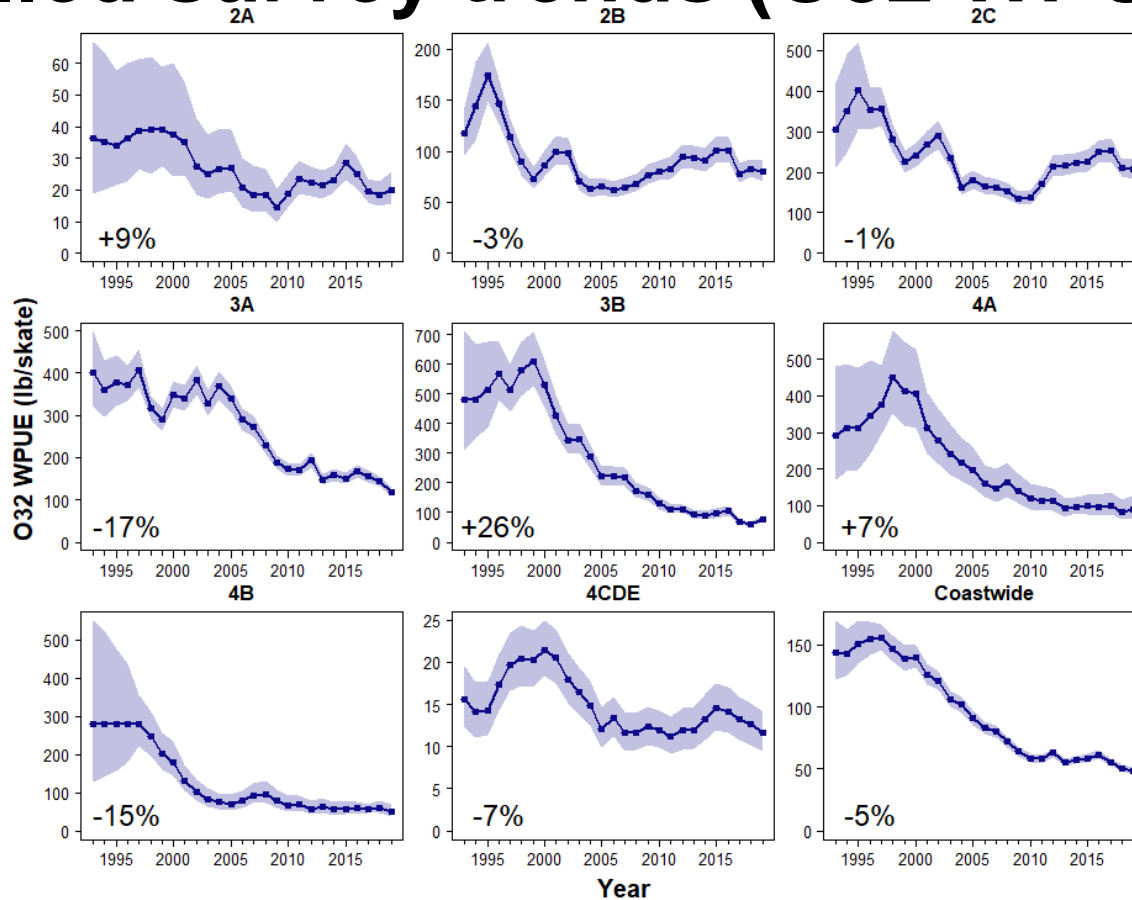
Modelled survey trends (Numbers)



Biological stock distribution (All survey WPUE)

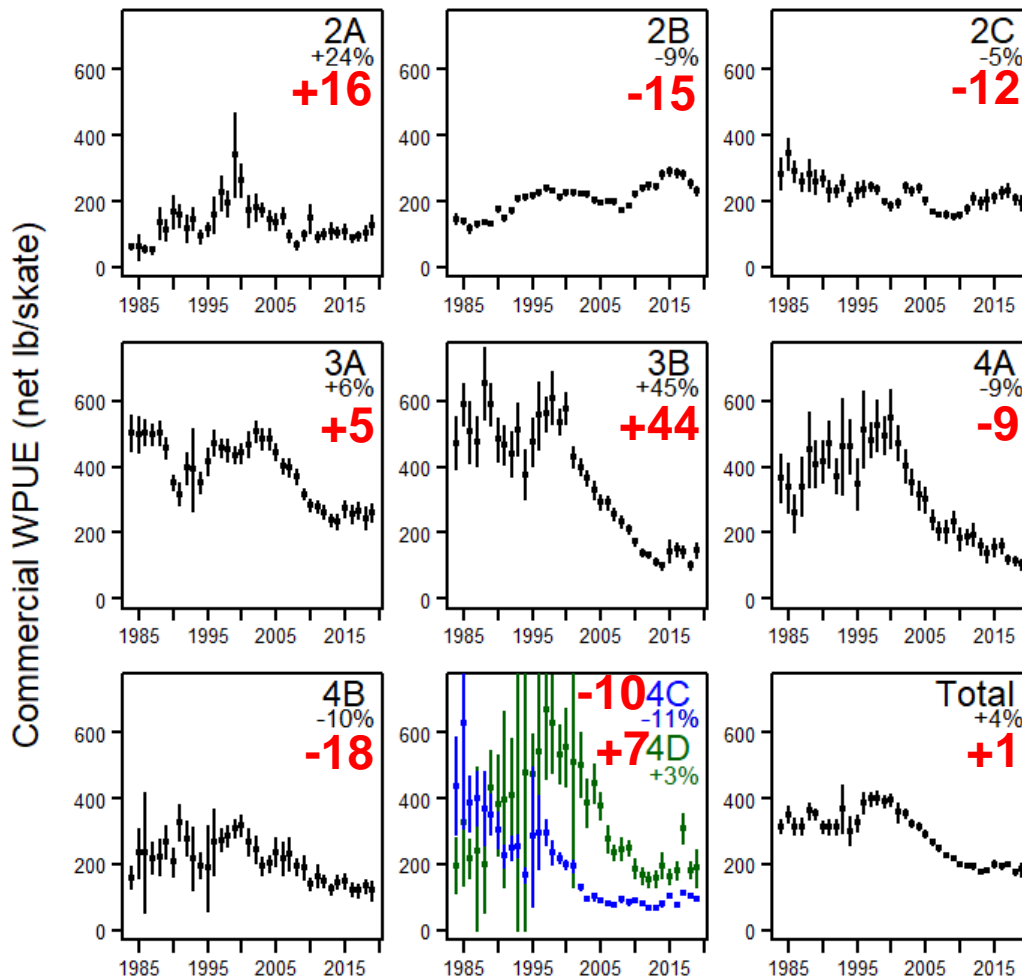


Modelled survey trends (O32 WPUE)

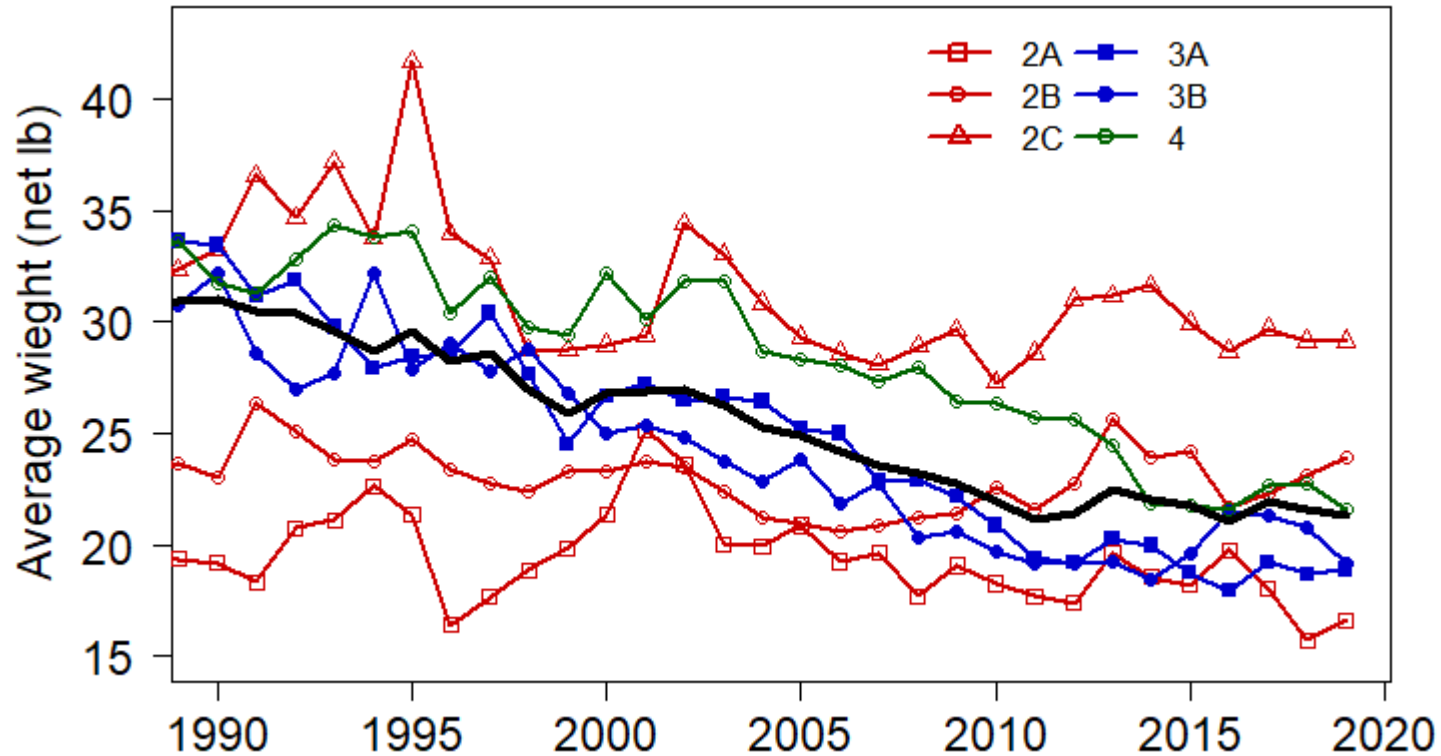


Fishery trends

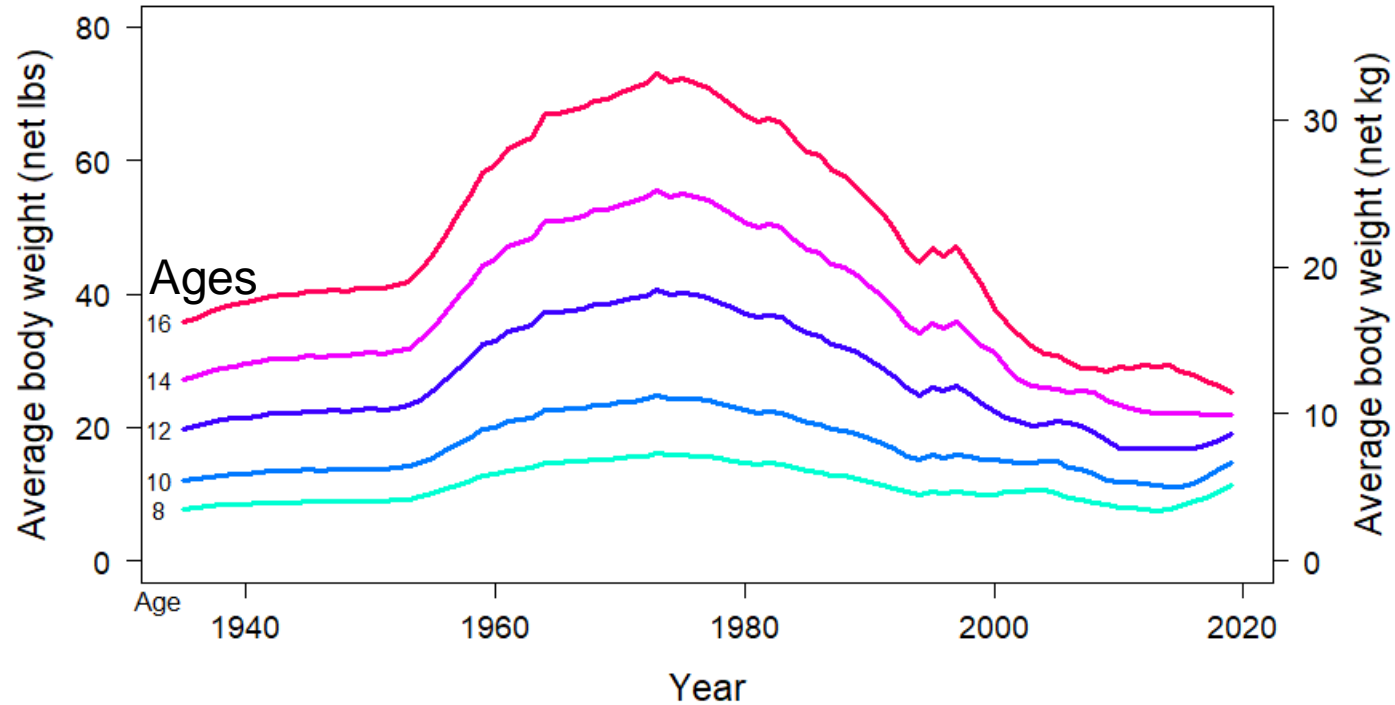
Predicted when logs complete



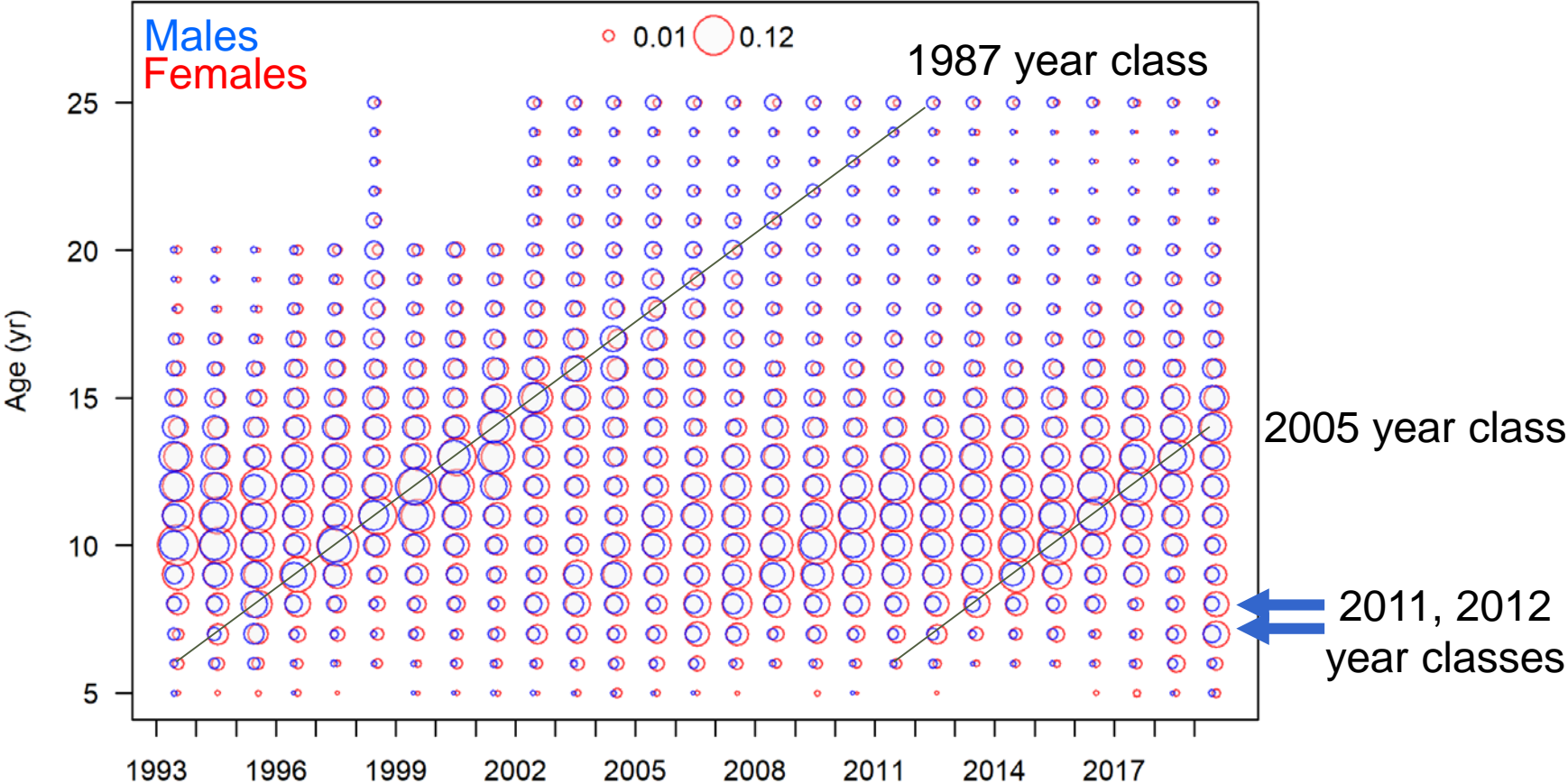
Average weight (Fishery)



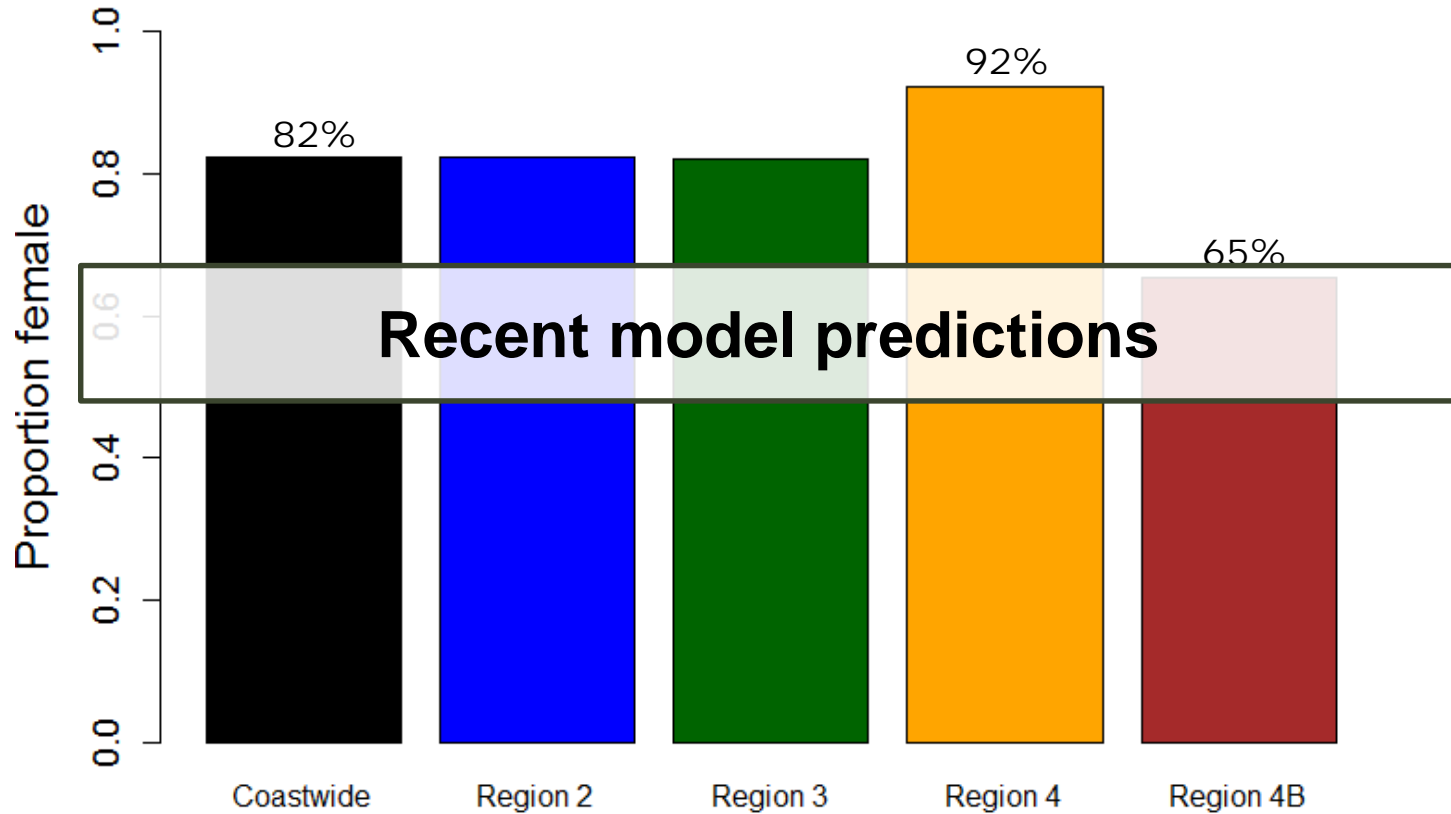
Smoothed female weight-at-age



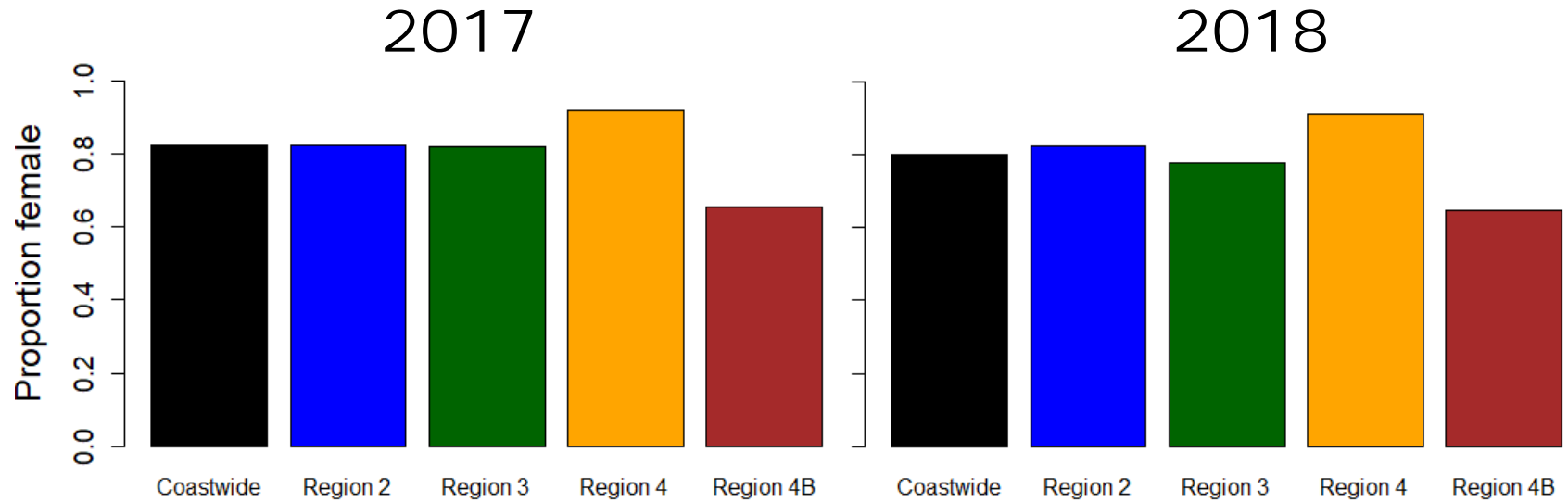
Recent survey ages



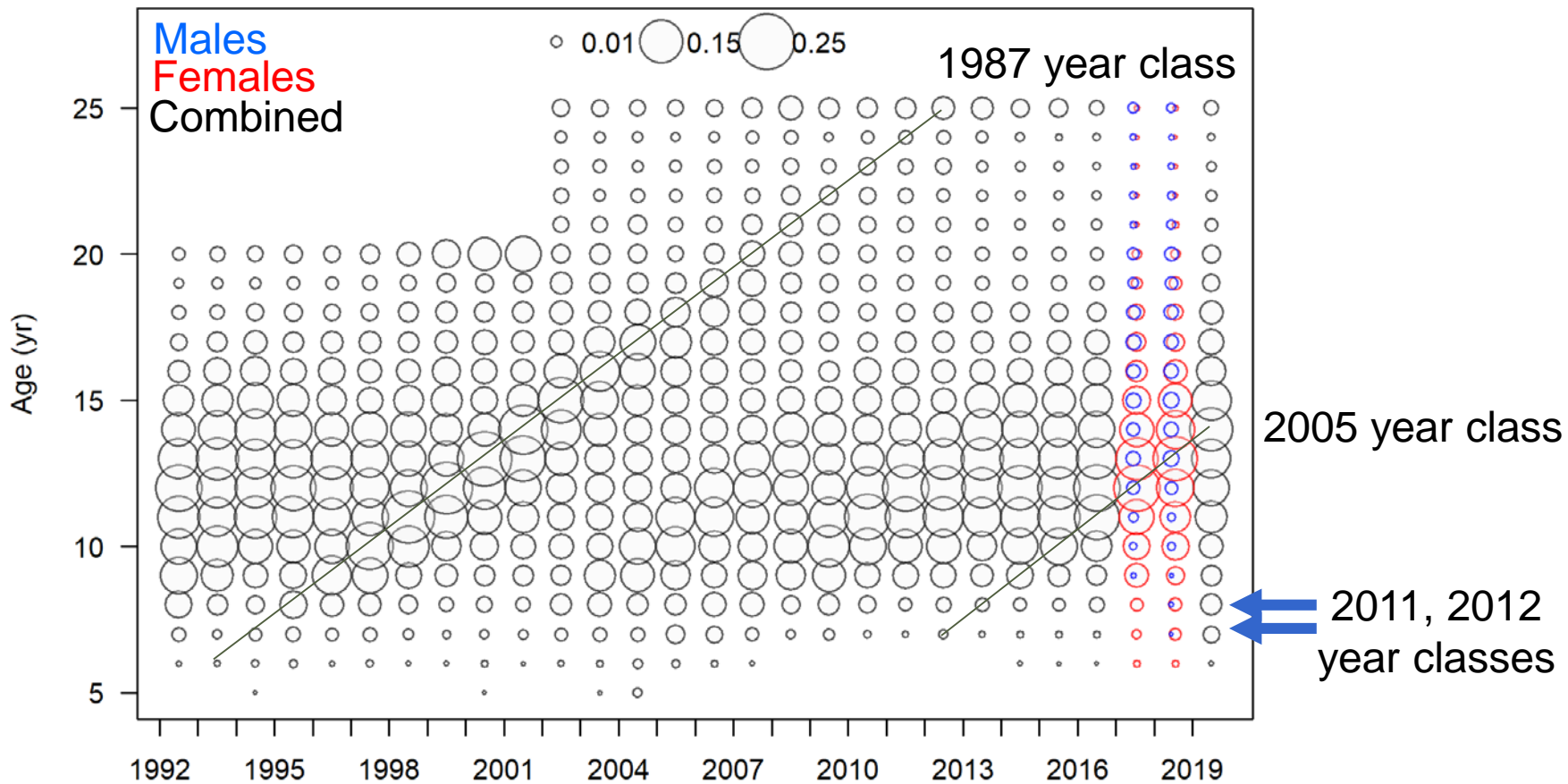
New Data: Sex ratios 2017 Commercial fishery (numbers)



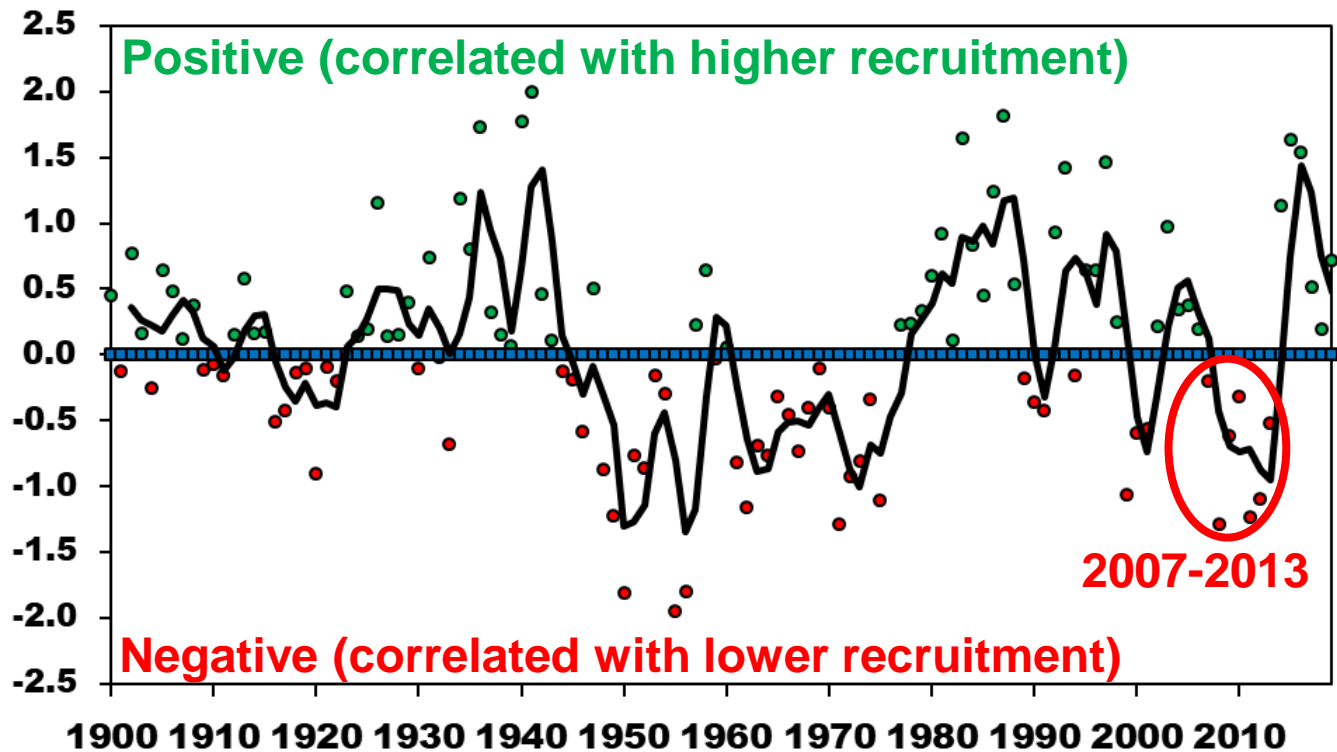
New Data: Commercial sex ratios



Recent fishery ages



Ecosystem conditions: Pacific Decadal Oscillation

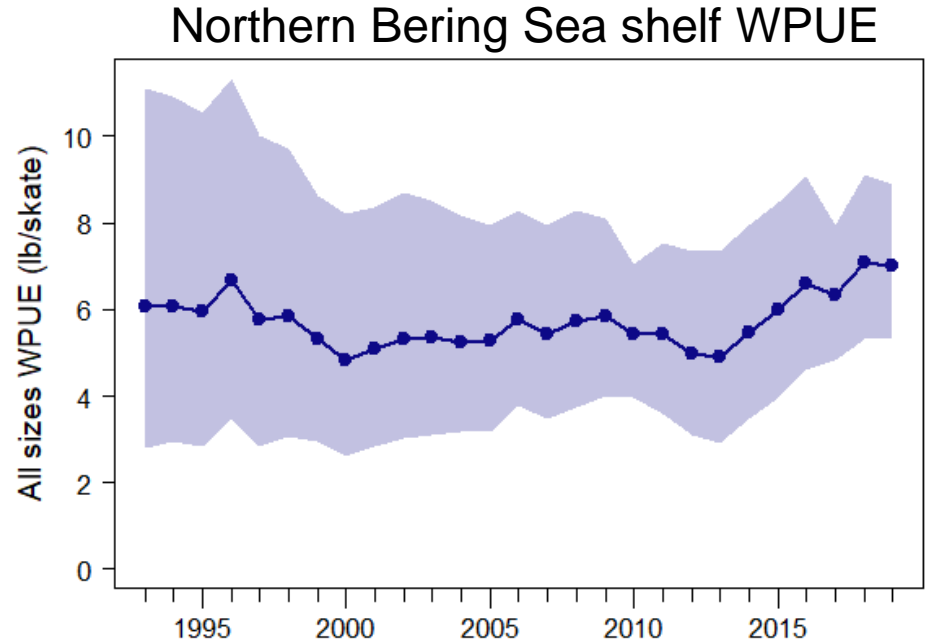


(Data: https://oceanview.pfeg.noaa.gov/erddap/tabledap/cciea_OC_PDO.htmlTable?time,PDO)



Ecosystem conditions

- Very low sea-ice in the Bering Sea: 2017/18 & 2018/19
- Continued northward distribution of cod
- Bird, salmon and marine mammal mortality events



Reference: AFSC Ecosystem reports to NPFMC
(<https://meetings.npfmc.org/Meeting/Details/823>)



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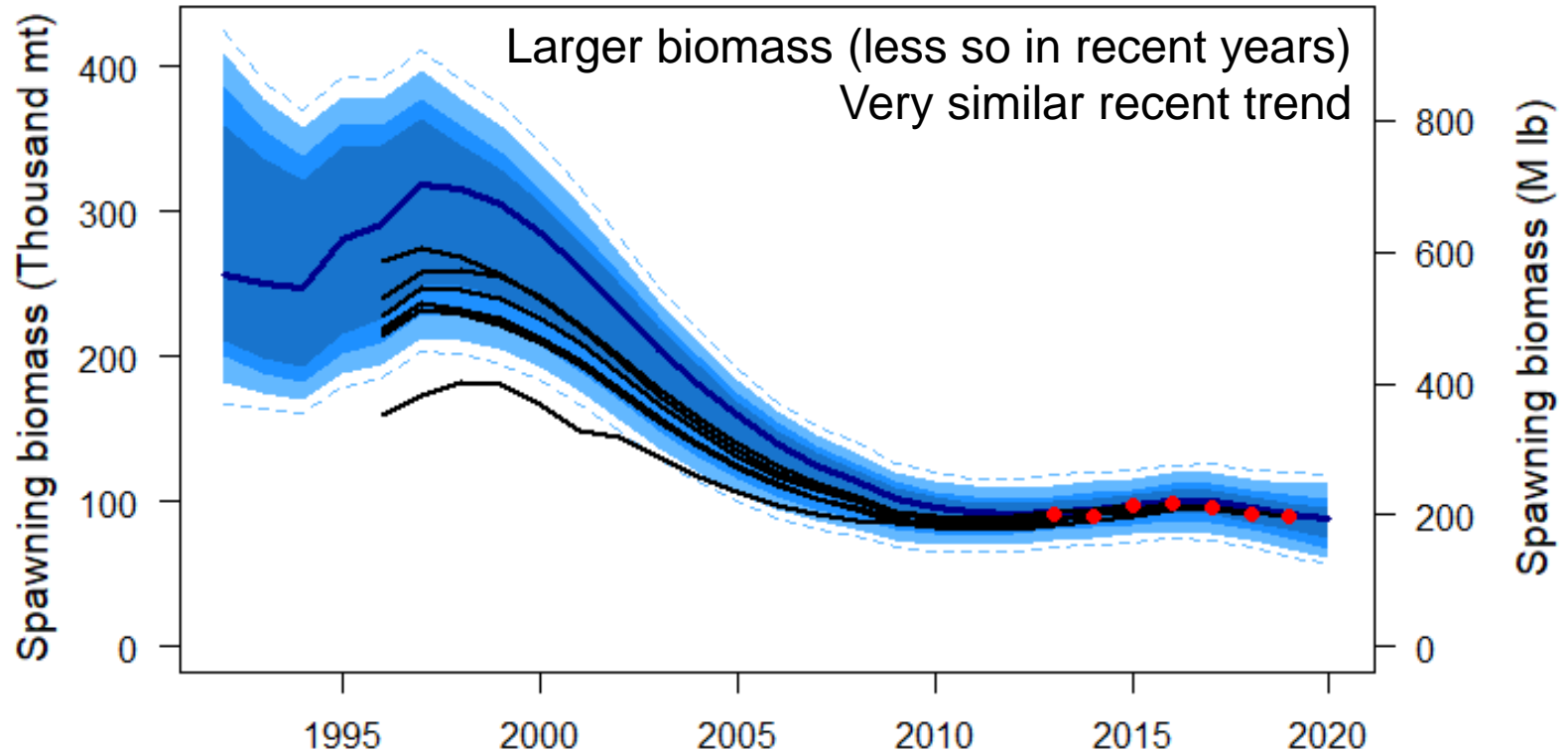


Modelling for 2019

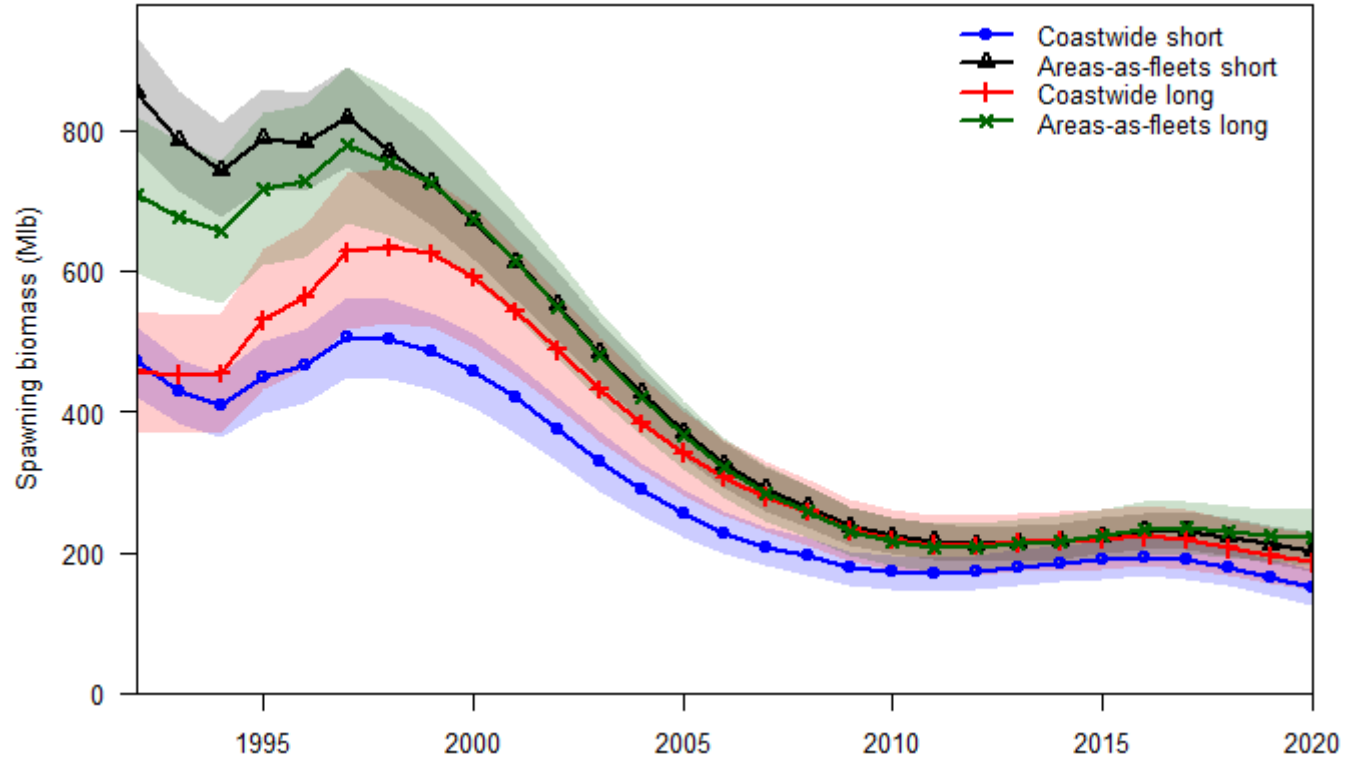
- All aspects of data and models revisited
 - New data
 - Modelled survey index updates (increased precision)
 - New commercial sex-ratio data
 - Model structure improved to use commercial sex-ratio data
- Two-part 2019 review process
 - Independent expert
 - IPHC Scientific Review Board



Comparison with previous assessments



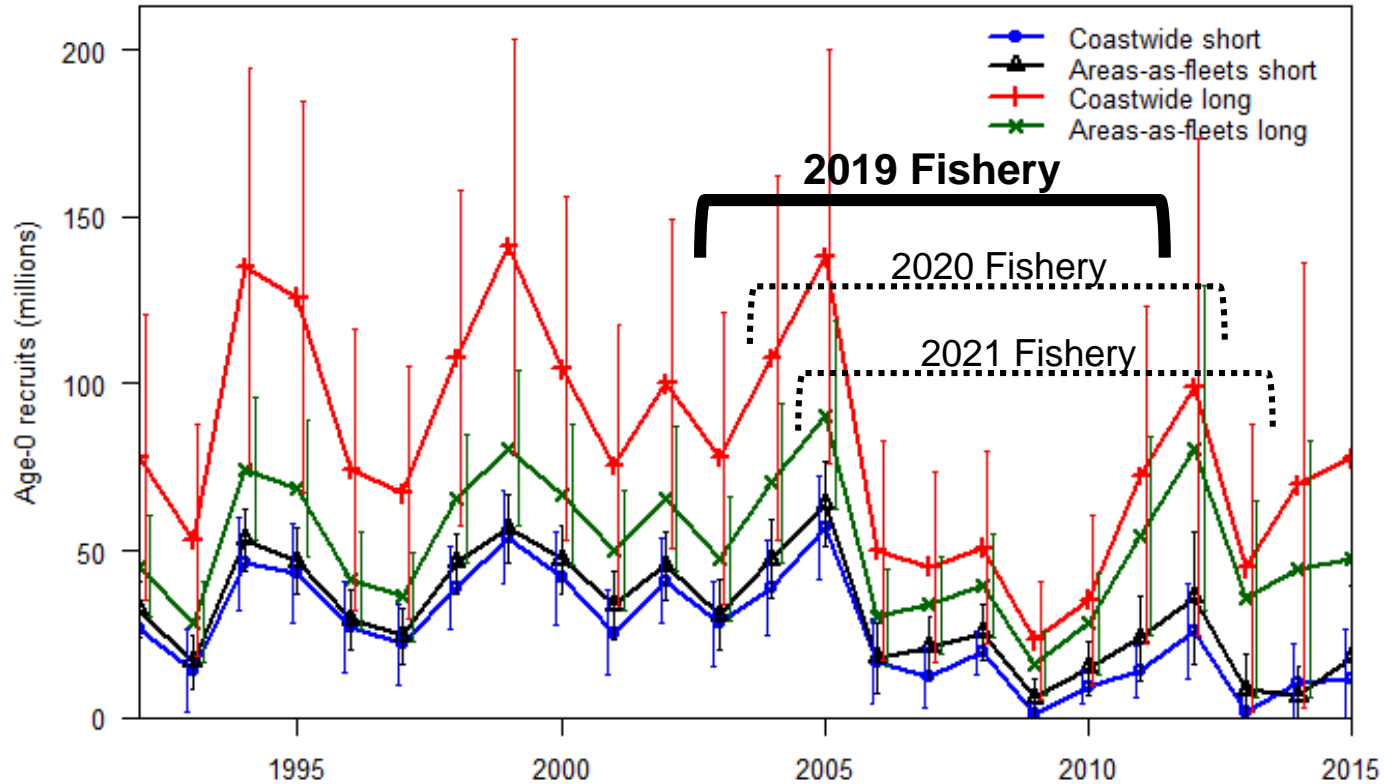
Four individual models



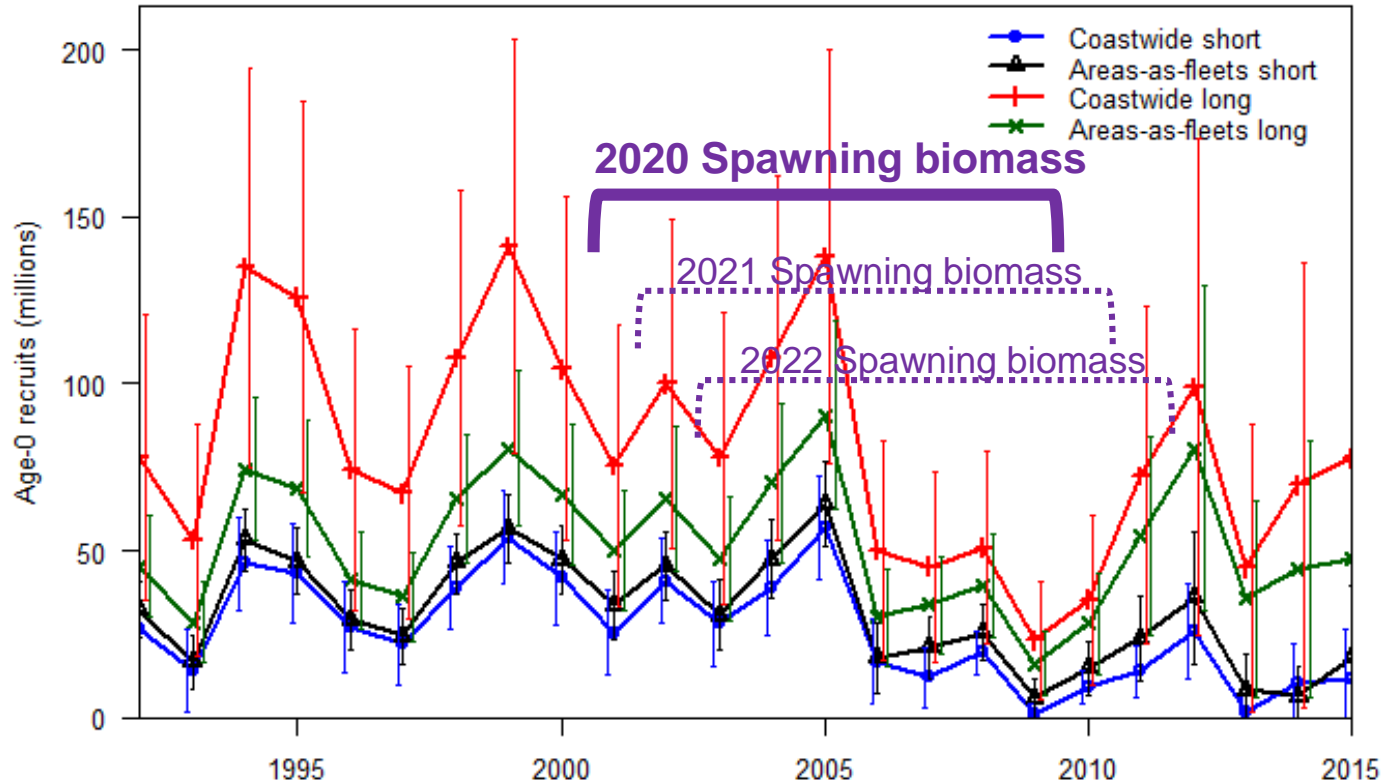
Closer correspondence than in last year's assessment



Recruitment estimates



Recruitment estimates



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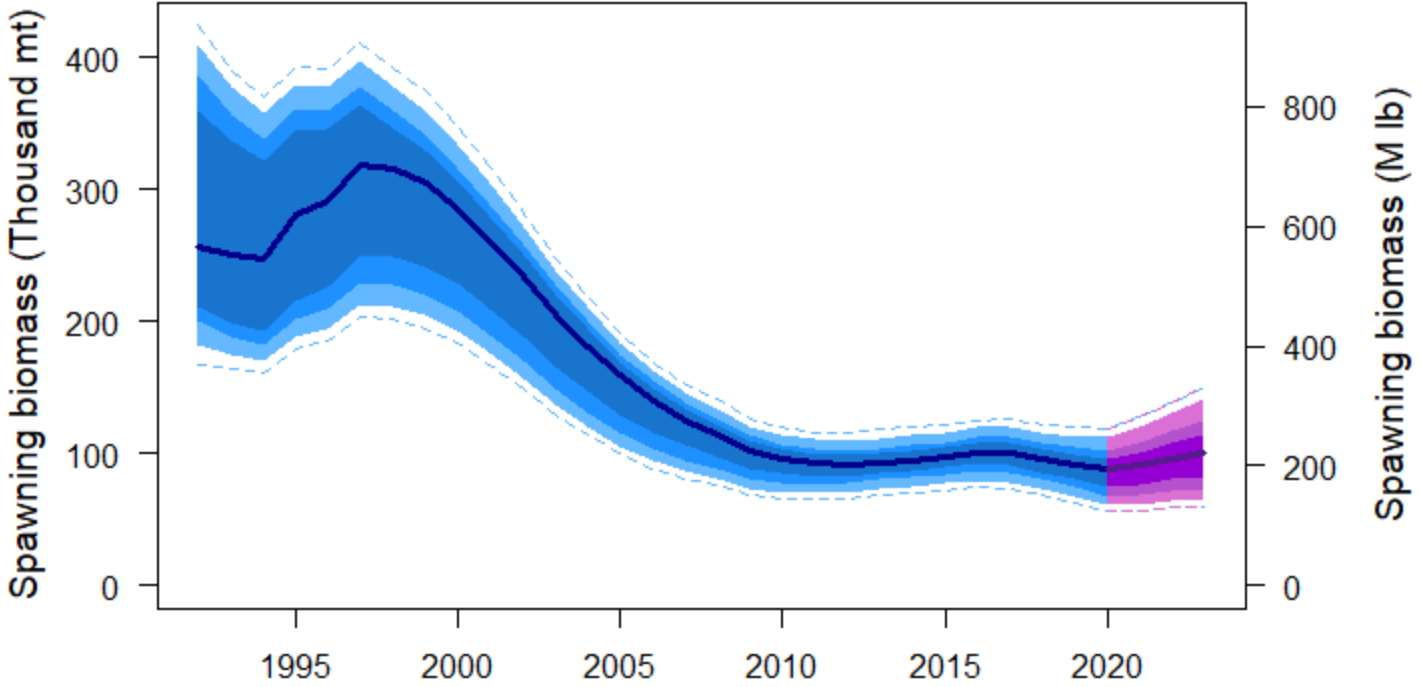


Projections

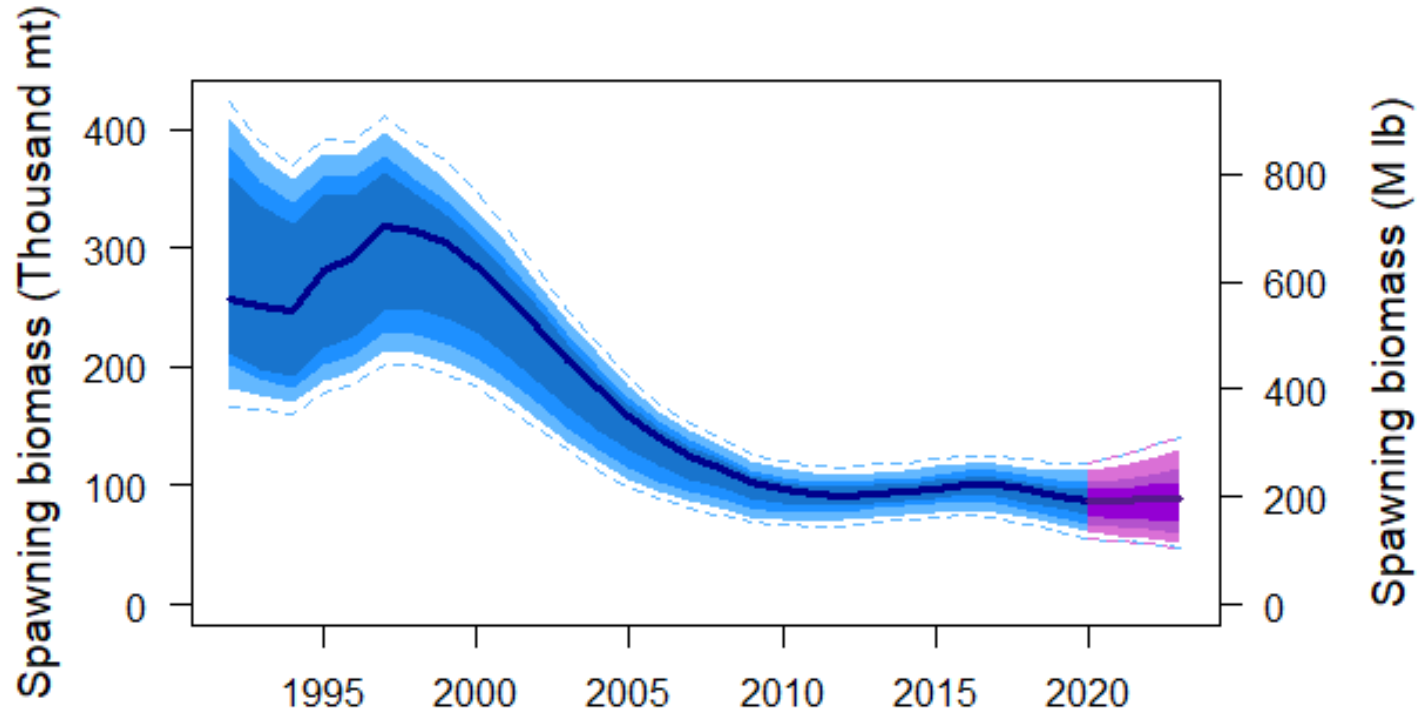
- Constant mortality limits (not SPR) over three years
- Include current estimates of incoming 2011 and 2012 year classes
- Based on the Interim management procedure mortality distribution (more later)



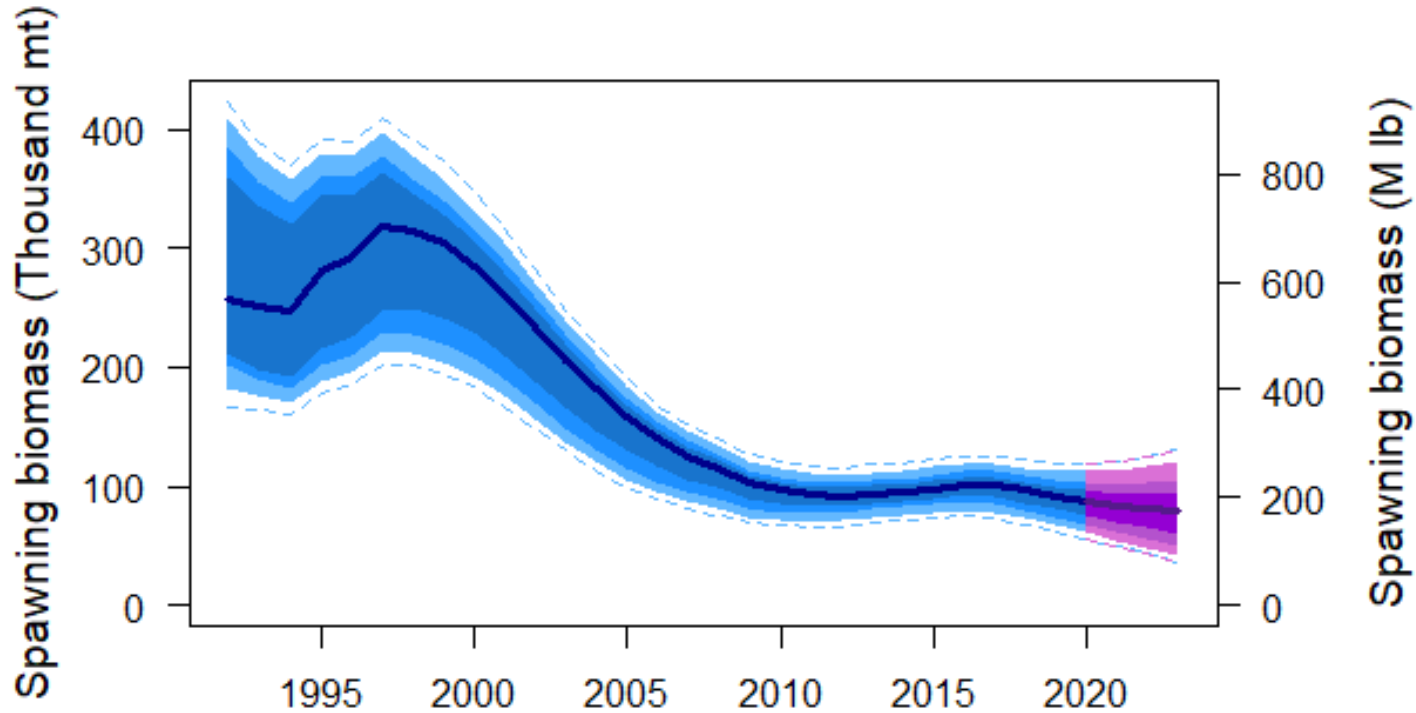
No fishing – Approximately back to 2016 levels in 3 years



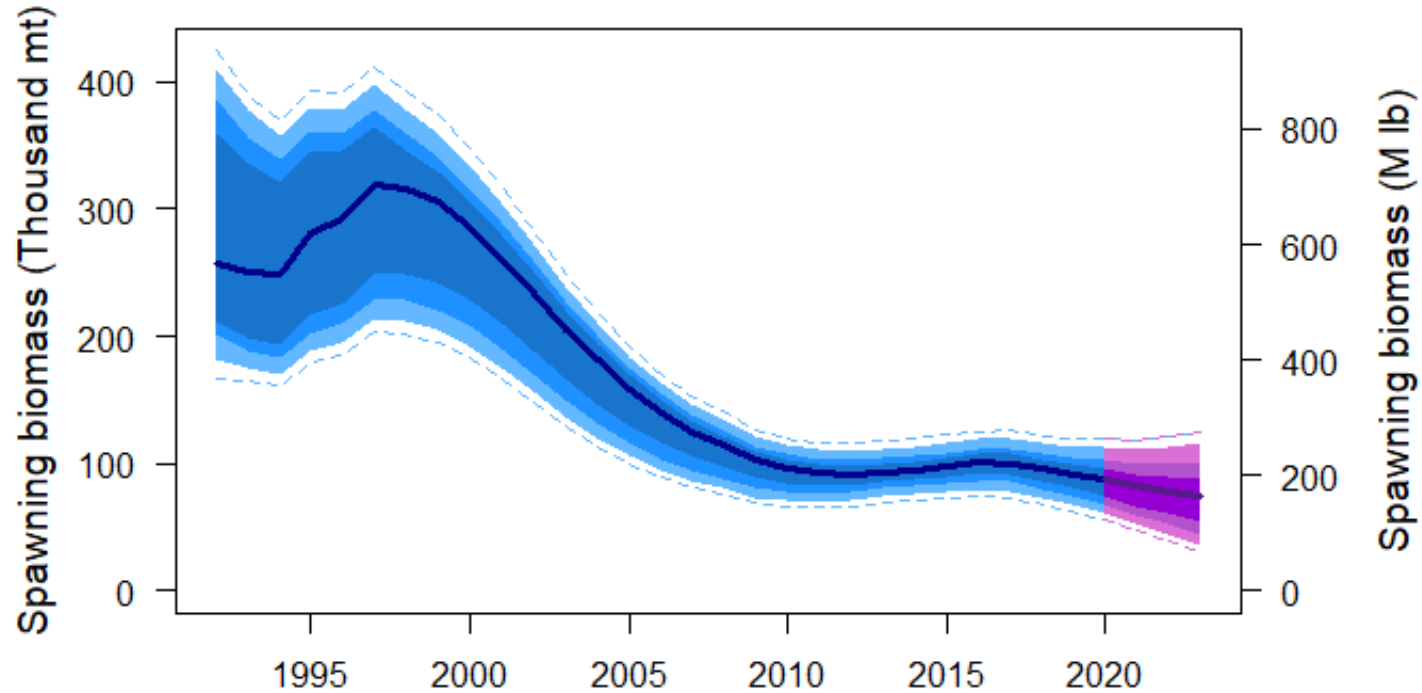
3-year surplus: 18.4 Mlb per year



Reference level $F_{46\%}$ - continued decline



Status quo TCEYs ($F_{40\%}$)



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Reference points

Interim management procedure:

Relative spawning biomass (compared to unfished)

- $SB_{20\%}$ Biological Limit
- $SB_{30\%}$ Fishery Trigger
- SB_{Target} – Currently not specified

Fishing intensity

- $F_{46\%}$ Reference level
- F_{limit} – Currently not specified

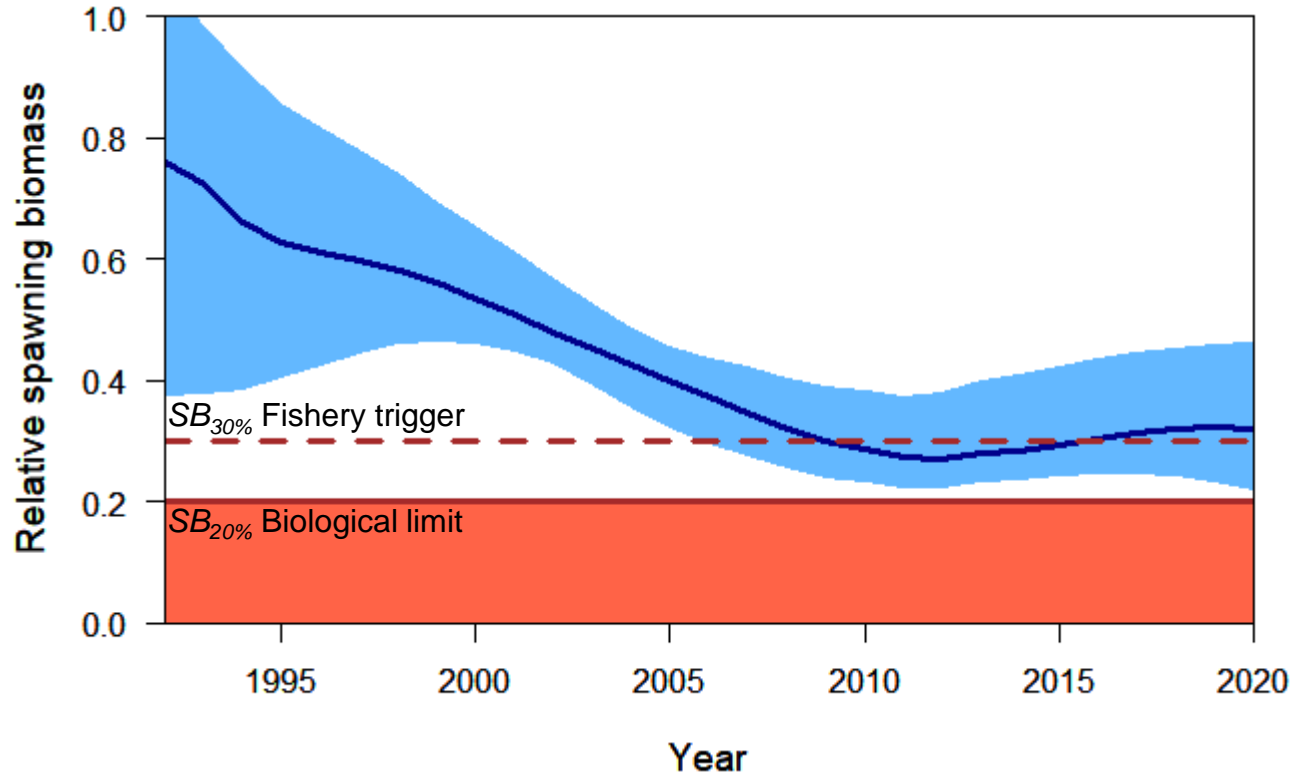


Relative spawning biomass

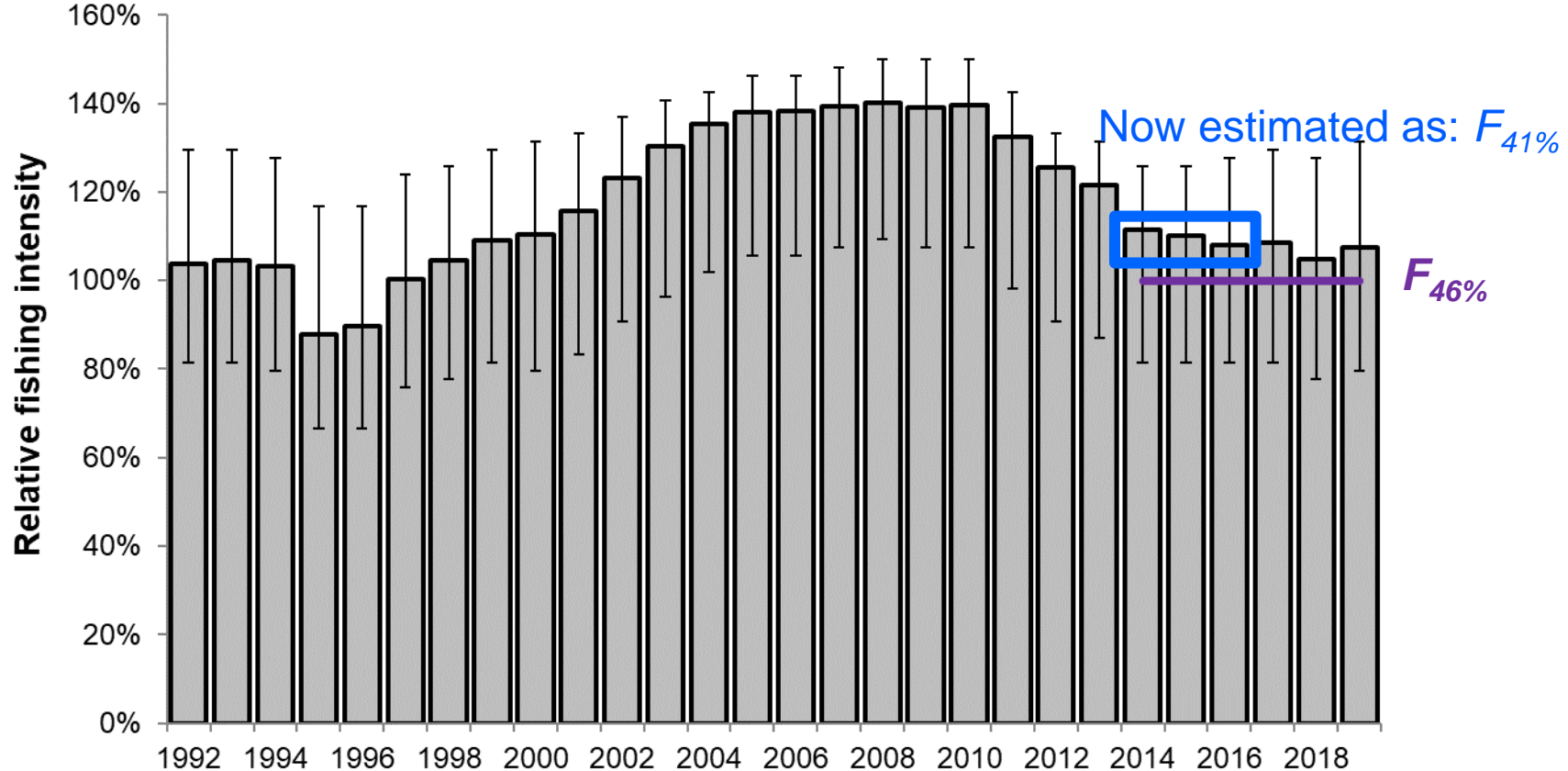
	2018 Assessment	2019 Assessment
	<u>'Historical' relative SB</u>	<u>'Dynamic' relative SB</u>
2019	43% (27-63%) P(SB<SB30%) = 11%	32% (23-46%) P(SB<SB30%) = 44%
2020	38% (22-51%) P(SB<SB30%) = 25%	32% (22-46%) P(SB<SB30%) = 46%



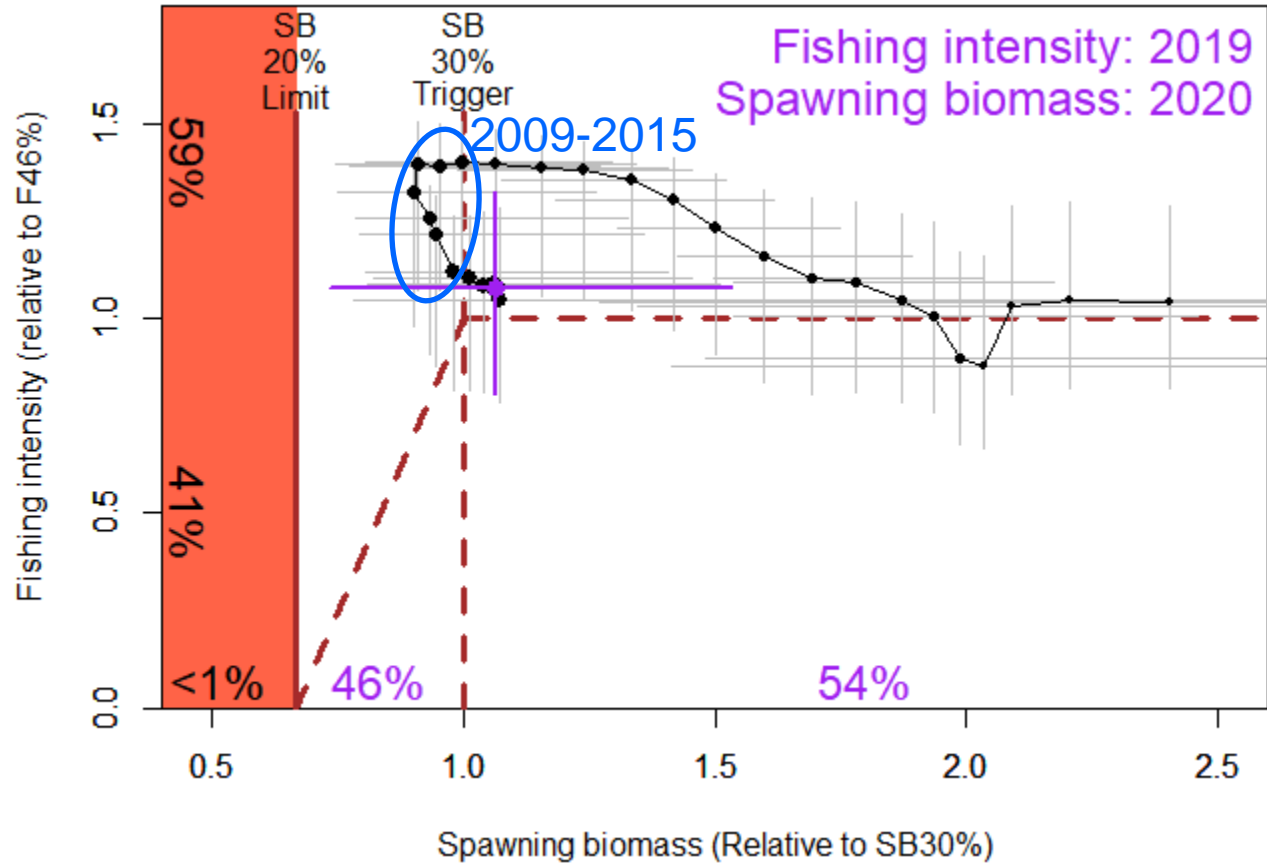
Relative SB (compared to unfished)



Fishing intensity (compared to reference $F_{46\%}$)



New: Status plot



Assessment summary table

Indicators	Values	Trends	Status
Total mortality 2019: Retained catch 2019: Average removals 2015–19:	39.67 MLBS, 17,996 T 32.21 MLBS, 14,608 T 40.93 MLBS, 18,567 T	MORTALITY INCREASED FROM 2018 TO 2019	2019 MORTALITY NEAR 100-YEAR LOW
SPR ₂₀₁₉ : P(SPR<46%): P(SPR<limit):	42% (29-57%) 59% LIMIT NOT SPECIFIED	FISHING INTENSITY INCREASED FROM 2018 TO 2019	FISHING INTENSITY ABOVE REFERENCE LEVEL
SB ₂₀₂₀ (MLBS): SB ₂₀₂₀ /SB ₀ : P(SB ₂₀₂₀ <SB ₃₀): P(SB ₂₀₂₀ <SB ₂₀):	194 MLBS (133–248) 32% (22-46%) 46% <1%	SB DECREASED FROM 2016 TO 2020	NOT OVERFISHED
Biological stock distribution:	SEE TABLES AND FIGURES	REGION 3 DECREASING	REGION 2 AND 4 AT HISTORICAL HIGHS



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- **Decision table**
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Decision table

2020 Alternative
Total mortality (M lb)
TCEY (M lb)
2020 fishing intensity
Fishing intensity interval

Benefits (yield)

Risk



Decision table

2020 Alternative			3-Year Surplus	<i>Reference</i> <i>SPR=46%</i>									Status quo	
Total mortality (M Ib)	0.0	11.6	20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6
TCEY (M Ib)	0.0	10.0	18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0
2020 fishing intensity	F _{100%}	F _{78%}	F _{63%}	F _{58%}	F _{53%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{27%}
Fishing intensity interval	--	59-87%	44-75%	39-71%	35-67%	31-62%	30-61%	29-60%	28-59%	28-58%	27-57%	26-56%	25-56%	17-43%

Stock Trend (spawning biomass)	in 2021	is less than 2020	1	29	61	71	79	87	89	91	93	94	95	96	97	>99
		is 5% less than 2020	<1	<1	11	23	30	42	46	50	54	58	61	64	67	98
	in 2022	is less than 2020	<1	16	50	60	68	77	79	81	83	85	87	89	90	>99
		is 5% less than 2020	<1	1	23	33	45	59	61	64	66	68	69	71	74	99
	in 2023	is less than 2020	1	22	50	58	65	73	75	77	79	81	83	85	87	>99
		is 5% less than 2020	<1	6	33	43	53	62	64	66	67	69	71	73	75	99

50/100 chance of spawning biomass decline over 3 years



Decision table

2020 Alternative		3-Year Surplus		Reference SPR=46%										Status quo
Total mortality (M Ib)	0.0	11.6	20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6
TCEY (M Ib)	0.0	10.0	18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0
2020 fishing intensity	F _{100%}	F _{78%}	F _{63%}	F _{58%}	F _{53%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{27%}
Fishing intensity interval	--	59-87%	44-75%	39-71%	35-67%	31-62%	30-61%	29-60%	28-59%	28-58%	27-57%	26-56%	25-56%	17-43%

Stock Trend (spawning biomass)	in 2021	is less than 2020	1	29	61	71	79	87	89	91	93	94	95	96	97	>99
		is 5% less than 2020	<1	<1	11	23	30	42	46	50	54	58	61	64	67	98
	in 2022	is less than 2020	<1	16	50	60	68	77	79	81	83	85	87	89	90	>99
		is 5% less than 2020	<1	1	23	33	45	59	61	64	66	68	69	71	74	99
	in 2023	is less than 2020	1	22	50	58	65	73	75	77	79	81	83	85	87	>99
		is 5% less than 2020	<1	6	33	43	53	62	64	66	67	69	71	73	75	99

89/100 chance of further spawning biomass decline in 2020



Decision table

2020 Alternative				3-Year Surplus				Reference <i>SPR=46%</i>				Status quo				
Total mortality (M lb)	0.0	11.6	20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6		
TCEY (M lb)	0.0	10.0	18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0		
2020 fishing intensity	F _{100%}	F _{78%}	F _{63%}	F _{58%}	F _{53%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{27%}		
Fishing intensity interval	--	59-87%	44-75%	39-71%	35-67%	31-62%	30-61%	29-60%	28-59%	28-58%	27-57%	26-56%	25-56%	17-43%		
Stock Trend (spawning biomass)	in 2021	is less than 2020	1	29	61	71	79	87	89	91	93	94	95	96	97	>99
		is 5% less than 2020	<1	<1	11	23	30	42	46	50	54	58	61	64	67	98
	in 2022	is less than 2020	<1	16	50	60	68	77	79	81	83	85	87	89	90	>99
		is 5% less than 2020	<1	1	23	33	45	59	61	64	66	68	69	71	74	99
	in 2023	is less than 2020	1	22	50	58	65	73	75	77	79	81	83	85	87	>99
		is 5% less than 2020	<1	6	33	43	53	62	64	66	67	69	71	73	75	99

97/100 chance of further spawning biomass decline in 2020



Decision table

2020 Alternative				3-Year Surplus				Reference $SPR=46\%$				Status quo		
Total mortality (M lb)	0.0	11.6	20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6
TCEY (M lb)	0.0	10.0	18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0
2020 fishing intensity	F _{100%}	F _{78%}	F _{63%}	F _{58%}	F _{53%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{27%}
Fishing intensity interval	--	59-87%	44-75%	39-71%	35-67%	31-62%	30-61%	29-60%	28-59%	28-58%	27-57%	26-56%	25-56%	17-43%

in 2021	is less than 30%	35	39	43	44	46	47	48	48	48	48	48	49	49	51
	is less than 20%	<1	<1	<1	<1	1	1	1	1	2	2	2	3	3	16
in 2022	is less than 30%	26	31	40	43	46	48	48	49	49	49	49	50	50	54
	is less than 20%	<1	<1	<1	1	2	6	7	8	9	11	12	14	15	27
in 2023	is less than 30%	18	27	37	41	45	48	49	49	49	49	50	50	50	60
	is less than 20%	<1	<1	<1	2	6	13	15	17	18	20	21	22	23	40

Just under 50/100 chance of dropping below $SB_{30\%}$ across a wide range of alternatives



Decision table

2020 Alternative

Total mortality (M lb)

TCEY (M lb)

2020 fishing intensity

Fishing intensity interval

3-Year Surplus		Reference SPR=46%										Status quo
20.0	23.6	27.6	32.3	33.5	34.6	35.7	36.8	37.8	38.9	40.2	61.6	
18.4	22.0	26.0	30.7	31.9	33.0	34.1	35.2	36.2	37.3	38.6	60.0	
F _{63%}	F _{58%}	F _{53%}	F _{47%}	F _{46%}	F _{45%}	F _{44%}	F _{43%}	F _{42%}	F _{41%}	F _{40%}	F _{27%}	
44.75%	39.71%	35.67%	31.62%	30.61%	29.60%	28.59%	28.58%	27.57%	26.56%	25.56%	17.43%	

Stock Trend (spawning biomass)	in 2021	is less than 2020	1	29	61	71	79	87	89	91	93	94	95	96	97	>99
		is 5% less than 2020	<1	<1	11	23	30	42	46	50	54	58	61	64	67	98
	in 2022	is less than 2020	<1	16	50	60	68	77	79	81	83	85	87	89	90	>99
		is 5% less than 2020	<1	1	23	33	45	59	61	64	66	68	69	71	74	99
	in 2023	is less than 2020	1	22	50	58	65	73	75	77	79	81	83	85	87	>99
		is 5% less than 2020	<1	6	33	43	53	62	64	66	67	69	71	73	75	99
Stock Status (Spawning biomass)	in 2021	is less than 30%	35	39	43	44	46	47	48	48	48	48	48	49	49	51
		is less than 20%	<1	<1	<1	<1	<1	1	1	1	2	2	2	3	3	16
	in 2022	is less than 30%	26	31	40	43	46	48	48	49	49	49	49	50	50	54
		is less than 20%	<1	<1	<1	1	2	6	7	8	9	11	12	14	15	27
	in 2023	is less than 30%	18	27	37	41	45	48	49	49	49	49	50	50	50	60
		is less than 20%	<1	<1	<1	2	6	13	15	17	18	20	21	22	23	40
Fishery Trend (TCEY)	in 2021	is less than 2020	0	<1	11	24	36	50	51	52	54	57	59	63	67	>99
		is 10% less than 2020	0	<1	1	12	25	40	44	46	48	50	51	52	53	>99
	in 2022	is less than 2020	0	<1	11	25	39	50	51	52	54	56	59	62	66	>99
		is 10% less than 2020	0	<1	2	14	27	43	46	48	49	50	51	52	54	>99
	in 2023	is less than 2020	0	<1	13	27	41	50	51	52	54	56	58	61	65	>99
		is 10% less than 2020	0	<1	4	16	30	45	47	48	49	50	51	52	54	>99
Fishery Status (Fishing intensity)	in 2020	is above F _{46%}	0	<1	7	22	31	48	50	51	53	55	57	60	64	>99



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Interim management procedure

- Based on:
 - Reference fishing intensity
 - O32 stock distribution
 - Relative Area-specific harvest rates
- Adjusted to include AM095 agreements:
 - 2A = 1.65 Mlb TCEY
 - Percent of coastwide TCEY in 2B =
 $0.7 * 20\% + 0.3 * \text{Interim Management Procedure calculation}$
- Further adjusted to mitigate for U26 effects on 2B TCEY
IM095-Req.03 ([para. 49](#))



Interim Management Procedure

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
O32 Stock Distribution	2.0%	12.5%	15.3%	30.3%	12.1%	9.3%	5.2%	13.2%	100%
HR	1.0	1.0	1.0	1.0	0.75	0.75	0.75	0.75	NA
TCEY Distribution	2.2%	13.9%	17.0%	33.6%	10.1%	7.7%	4.3%	11.0%	100%



Adjusted Interim Management Procedure

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
O32 Stock Distribution	2.0%	12.5%	15.3%	30.3%	12.1%	9.3%	5.2%	13.2%	100%
HR	1.0	1.0	1.0	1.0	0.75	0.75	0.75	0.75	NA
TCEY Distribution	2.2%	13.9%	17.0%	33.6%	10.1%	7.7%	4.3%	11.0%	100%
Adjusted	1.65	18.2%	Depends on total TCEY						
% for 31.9 Mlb	5.2%	18.2%	15.6%	30.7%	9.2%	7.1%	4.0%	10.1%	100%
TCEYs	1.65	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90



Mitigating for U26 non-directed discards in AK

1. Solve for Interim management procedure (including the AM095 adjusted 2A and 2B measures)
2. Remove all U26 non-directed discards in AK (1.59 Mlb)
3. Recalculate TCEYs at reference SPR
4. Compare to (1) to find yield gain in 2B
5. Add yield gain in 2B to (1) and recalculate AK TCEYs to again achieve the reference SPR



Mitigating for U26 non-directed discards in AK

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
Base	1.65	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90
%	5.2%	18.2%	15.6%	30.7%	9.2%	7.1%	4.0%	10.1%	100.0%



Mitigating for U26 non-directed discards in AK

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
Base	1.65	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90
%	5.2%	18.2%	15.6%	30.7%	9.2%	7.1%	4.0%	10.1%	100.0%
Without U26	1.65	6.22	5.35	10.56	3.17	2.43	1.37	3.47	34.21
Gain	0.00	0.42	0.39	0.76	0.23	0.18	0.10	0.25	2.32

Calculation also depends on Total TCEY (SPR):
 At *status quo* 38.61 Mlb ($F_{40\%}$), yield gain = 0.44



Mitigating for U26 non-directed discards in AK

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
Base	1.65	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90
%	5.2%	18.2%	15.6%	30.7%	9.2%	7.1%	4.0%	10.1%	100.0%
Without U26	1.65	6.22	5.35	10.56	3.17	2.43	1.37	3.47	34.21
Gain	0.00	0.42	0.38	0.76	0.23	0.17	0.10	0.25	2.31
Adjusted	1.65	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90
Adjusted %	5.2%	19.5%	15.3%	30.2%	9.1%	7.0%	3.9%	9.9%	100%



Reference TCEYs

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
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	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90

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



Detail for reference TCEYs

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial Discard Mortality	0.03	0.12	NA	NA	0.15	0.12	0.04	0.03	0.48
O26 Non-Directed Discard Mortality	0.12	0.22	0.09	1.37	0.42	0.20	0.15	2.40	4.97
Recreational	NA	0.04	1.15	1.66	0.00	0.01	0.00	0.00	2.87
Subsistence	NA	0.41	0.37	0.19	0.02	0.01	0.00	0.04	1.03
Total non-FCEY	0.15	0.78	1.61	3.22	0.59	0.35	0.19	2.47	9.36
Commercial Discard Mortality	NA	NA	0.05	0.21	NA	NA	NA	NA	0.26
Recreational	0.60	0.80	0.60	1.21	NA	NA	NA	NA	3.21
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	4.64	2.62	4.99	2.30	1.87	1.06	0.69	19.04
Total FCEY	1.50	5.44	3.28	6.41	2.30	1.87	1.06	0.69	22.54
							4C FCEY	0.32	
							4D FCEY	0.32	
							4E FCEY	0.05	
TCEY	1.65	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90
U26 Non-Directed Discard Mortality	0.00	0.02	0.00	0.27	0.06	0.15	0.01	1.09	1.61
Total mortality	1.65	6.24	4.88	9.91	2.95	2.37	1.25	4.26	33.51



Projection using 3-year average discard mortality in non-directed fisheries: IM095-Req.02 ([para. 37](#))

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
<u>O26</u>									
2017	0.13	0.23	0.05	1.11	0.73	0.28	0.20	1.72	4.46
2018	0.11	0.27	0.08	1.39	0.44	0.19	0.14	2.05	4.66
2019	0.12	0.22	0.09	1.37	0.42	0.20	0.15	2.40	4.97
3-year average	0.12	0.24	0.07	1.29	0.53	0.22	0.16	2.06	4.70
<u>U26</u>									
2017	0.00	0.02	0.00	0.32	0.22	0.15	0.01	1.03	1.75
2018	0.00	0.03	0.00	0.28	0.07	0.14	0.01	0.93	1.45
2019	0.00	0.02	0.00	0.27	0.06	0.15	0.01	1.09	1.61
3-year average	0.00	0.02	0.00	0.29	0.12	0.14	0.01	1.02	1.61



Projection using 3-year average discard mortality in non-directed fisheries: IM095-Req.02 ([para. 37](#))

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial Discard Mortality	0.03	0.12	NA	NA	0.14	0.12	0.04	0.04	0.49
O26 Non-Directed Discard Mortality	0.12	0.24	0.07	1.29	0.53	0.22	0.16	2.06	4.69
Recreational	NA	0.04	1.15	1.66	0.00	0.01	0.00	0.00	2.87
Subsistence	NA	0.41	0.37	0.19	0.02	0.01	0.00	0.04	1.03
Total non-FCEY	0.15	0.80	1.59	3.14	0.69	0.37	0.20	2.14	9.08
Commercial Discard Mortality	NA	NA	0.05	0.21	NA	NA	NA	NA	0.26
Recreational	0.61	0.79	0.60	1.23	NA	NA	NA	NA	3.23
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.87	4.62	2.64	5.05	2.20	1.85	1.05	1.02	19.29
Total FCEY	1.50	5.41	3.30	6.49	2.20	1.85	1.05	1.02	22.82
							4C FCEY	0.47	
							4D FCEY	0.47	
							4E FCEY	0.07	
TCEY	1.65	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90
U26 Non-Directed Discard Mortality	0.00	0.02	0.00	0.29	0.12	0.14	0.01	1.02	1.60
Total mortality	1.65	6.24	4.88	9.92	3.01	2.36	1.26	4.18	33.50

-0.10

+0.33



Projection using a relative harvest rate of 1.0 in IPHC Regulatory Area 4CDE: IM095-Req.04 ([para. 50](#) a)

- This request adjusts the relative distribution of the TCEY within Alaskan waters, but does not affect 2A or 2B.



Projection using a relative harvest rate of 1.0 in IPHC Regulatory Area 4CDE: IM095-Req.04 ([para. 50](#) a)

Reference TCEYs

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
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	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90

Alternative

2020	1.65	6.22	4.68	9.23	2.77	2.13	1.19	4.04	31.90
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Projection using a relative harvest rate of 1.0 in IPHC Regulatory Area 4CDE: IM095-Req.04 ([para. 50 a](#))

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial Discard Mortality	0.03	0.12	NA	NA	0.14	0.11	0.04	0.07	0.50
O26 Non-Directed Discard Mortality	0.12	0.22	0.09	1.37	0.42	0.20	0.15	2.40	4.97
Recreational	NA	0.04	1.15	1.66	0.00	0.01	0.00	0.00	2.87
Subsistence	NA	0.41	0.37	0.19	0.02	0.01	0.00	0.04	1.03
Total non-FCEY	0.15	0.78	1.61	3.22	0.58	0.34	0.19	2.51	9.38
Commercial Discard Mortality	NA	NA	0.05	0.19	NA	NA	NA	NA	0.24
Recreational	0.60	0.80	0.56	1.13	NA	NA	NA	NA	3.10
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	4.64	2.46	4.67	2.19	1.79	1.01	1.53	19.15
Total FCEY	1.50	5.44	3.07	6.00	2.19	1.79	1.01	1.53	22.52
							4C FCEY	0.71	
							4D FCEY	0.71	
							4E FCEY	0.11	
TCEY	1.65	6.22	4.68	9.23	2.77	2.13	1.19	4.04	31.90
U26 Non-Directed Discard Mortality	0.00	0.02	0.00	0.27	0.06	0.15	0.01	1.09	1.61
Total mortality	1.65	6.24	4.68	9.50	2.83	2.27	1.20	5.13	33.51



Projection adding total TCEY pounds for 2A and 2B adjustments: IM095-Req.04 ([para. 50](#) b)

This request requires several steps:

- Find the TCEYs associated with the unadjusted interim management procedure for 2C-4CDE.
- Increase the total TCEY until the 2C-4CDE TCEYs are unchanged after the 2A (1.65%) and 2B (18.2% + U26 mitigation) adjustments are met.



Projection adding total TCEY pounds for 2A and 2B adjustments: IM095-Req.04 ([para. 50](#) b)

Reference TCEYs

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
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	6.22	4.88	9.63	2.89	2.22	1.25	3.16	31.90

Alternative

2020	1.65	6.83	5.44	10.72	3.22	2.47	1.39	3.52	35.24
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Results in a projected fishing intensity of $F_{43\%}$



Projection adding total TCEY pounds for 2A and 2B adjustments: IM095-Req.04 ([para. 50](#) b)

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
Commercial Discard Mortality	0.03	0.13	NA	NA	0.17	0.13	0.04	0.05	0.55
O26 Non-Directed Discard Mortality	0.12	0.22	0.09	1.37	0.42	0.20	0.15	2.40	4.97
Recreational	NA	0.05	1.15	1.66	0.00	0.01	0.00	0.00	2.88
Subsistence	NA	0.41	0.37	0.19	0.02	0.01	0.00	0.04	1.03
Total non-FCEY	0.15	0.80	1.61	3.22	0.61	0.36	0.19	2.49	9.43
Commercial Discard Mortality	NA	NA	0.06	0.24	NA	NA	NA	NA	0.30
Recreational	0.60	0.89	0.70	1.42	NA	NA	NA	NA	3.61
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial Landings	0.86	5.15	3.07	5.84	2.61	2.11	1.20	1.03	21.87
Total FCEY	1.50	6.03	3.83	7.50	2.61	2.11	1.20	1.03	25.81
							4C FCEY	0.48	
							4D FCEY	0.48	
							4E FCEY	0.07	
TCEY	1.65	6.83	5.44	10.72	3.22	2.47	1.39	3.52	35.24
U26 Non-Directed Discard Mortality	0.00	0.02	0.00	0.27	0.06	0.15	0.01	1.09	1.61
Total mortality	1.65	6.85	5.44	11.00	3.28	2.62	1.39	4.61	36.85

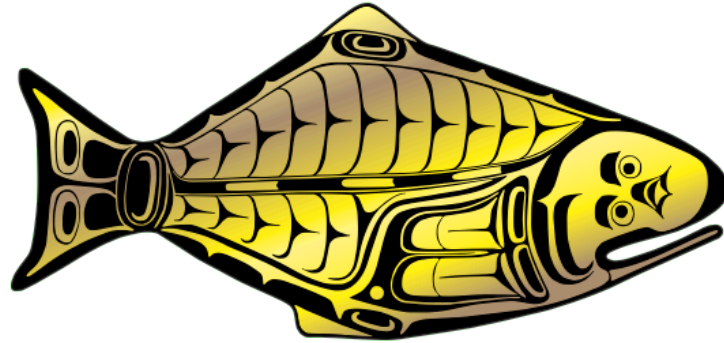


2020 Mortality projection tool

- Interactive tool to explore alternative scale and distribution of mortality for 2020
- Updated with 2019 estimates and rates
- Default values based on Interim management procedure
- Adjusted to include AM095 agreements:
 - 2A = 1.65 Mlb TCEY
 - Percent of coastwide TCEY in 2B =
 $0.7 * 20\% + 0.3 * \text{Interim Management Procedure calculation}$
- Further adjusted to mitigate for U26 effects on 2B TCEY
IM095-Req.03 ([para. 49](#))



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