

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

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

Agenda item 6.4

IPHC-2020-IM096-08 Rev_1

INTERNATIONAL PACIFIC



HALIBUT COMMISSION

RESEARCH

IPHC Secretariat acknowledgement

- Despite the challenges in 2020, data sets are nearly as complete and precise as in recent years
- The extra work at each step from sampling to finalizing these data has allowed for a normal stock assessment process and the calculation of all standard results



Photo credit: D. Jackson



Summary

- 2011-2012 year classes present in both the IPHC Fishery-Independent Setline Survey (FISS) (3rd observation) and fishery (1st observation)
- Strength of these year classes remains uncertain
- Further stock declines projected
- Change in reference level of fishing intensity (to $F_{43\%}$) has buffered the change in the 2021 coastwide reference TCEY
- Stock distribution estimates increased in Biological Region 3 and decreased in Biological Region 2

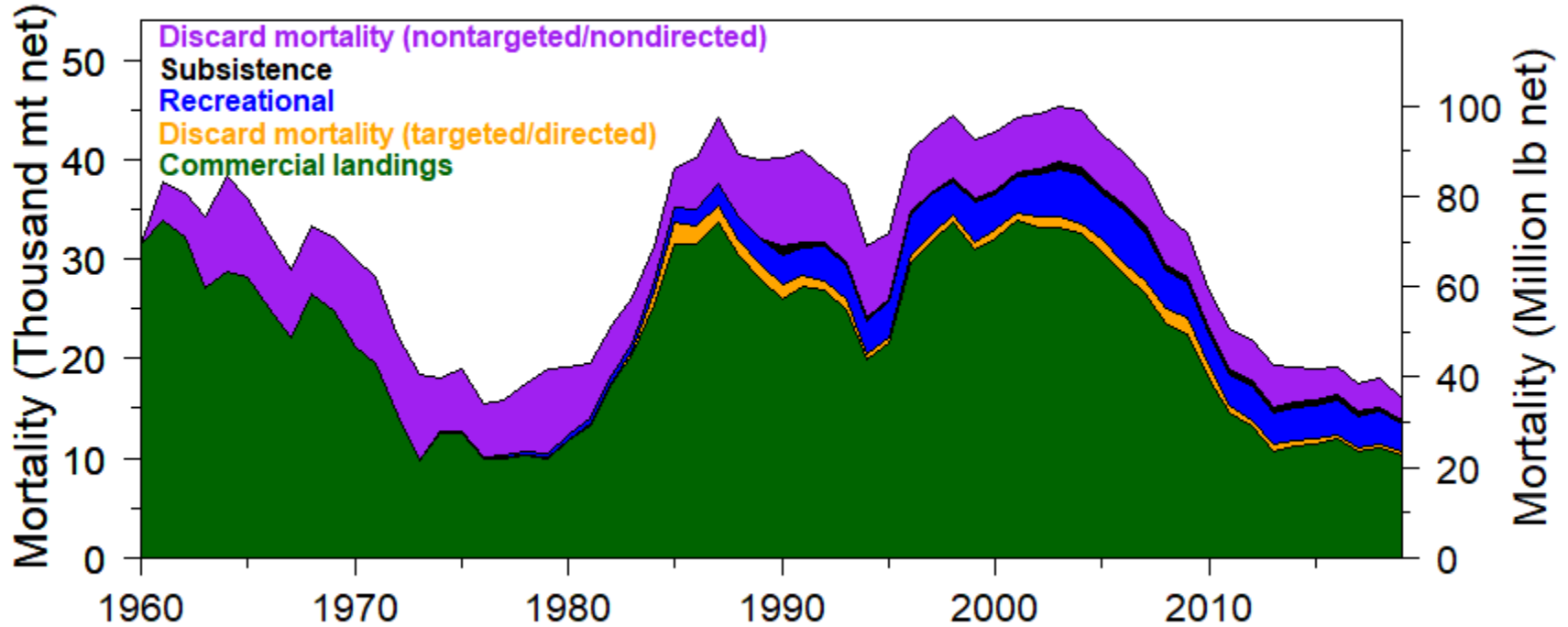


Outline

- 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

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2020	23.11	0.88	6.86	1.06	6.29	38.19

(3-yr avg.)

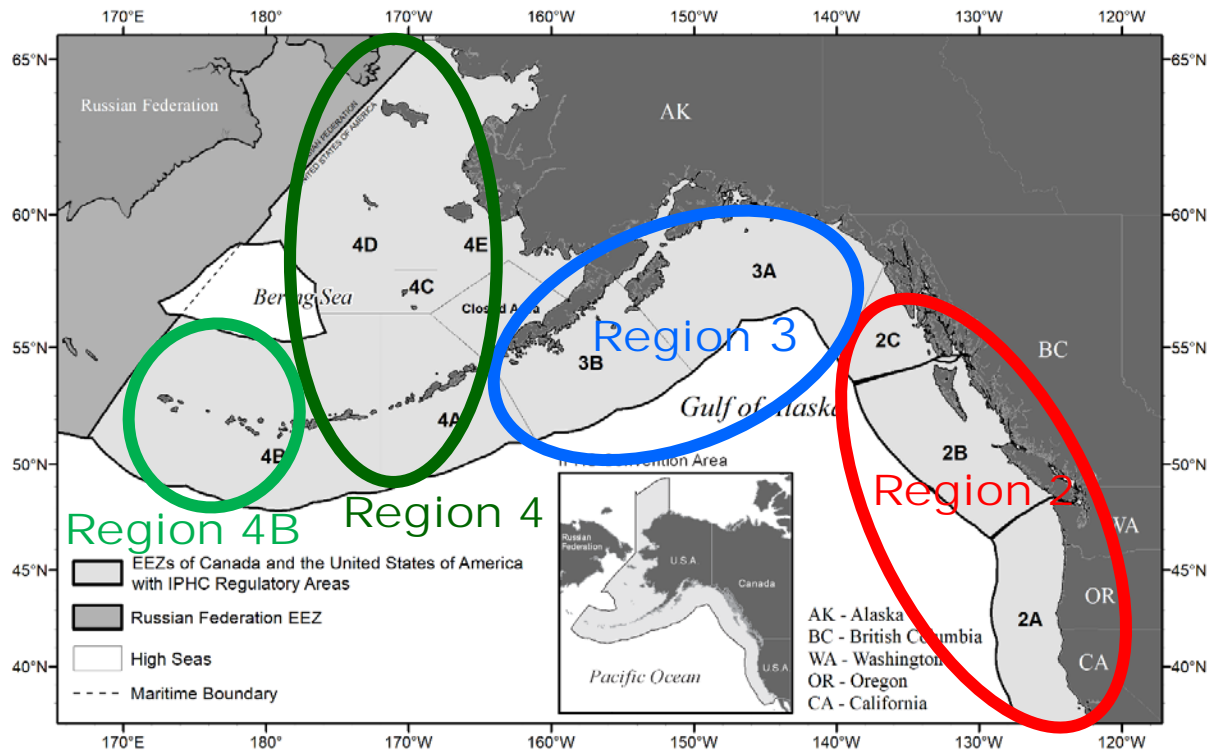
Estimated this year

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

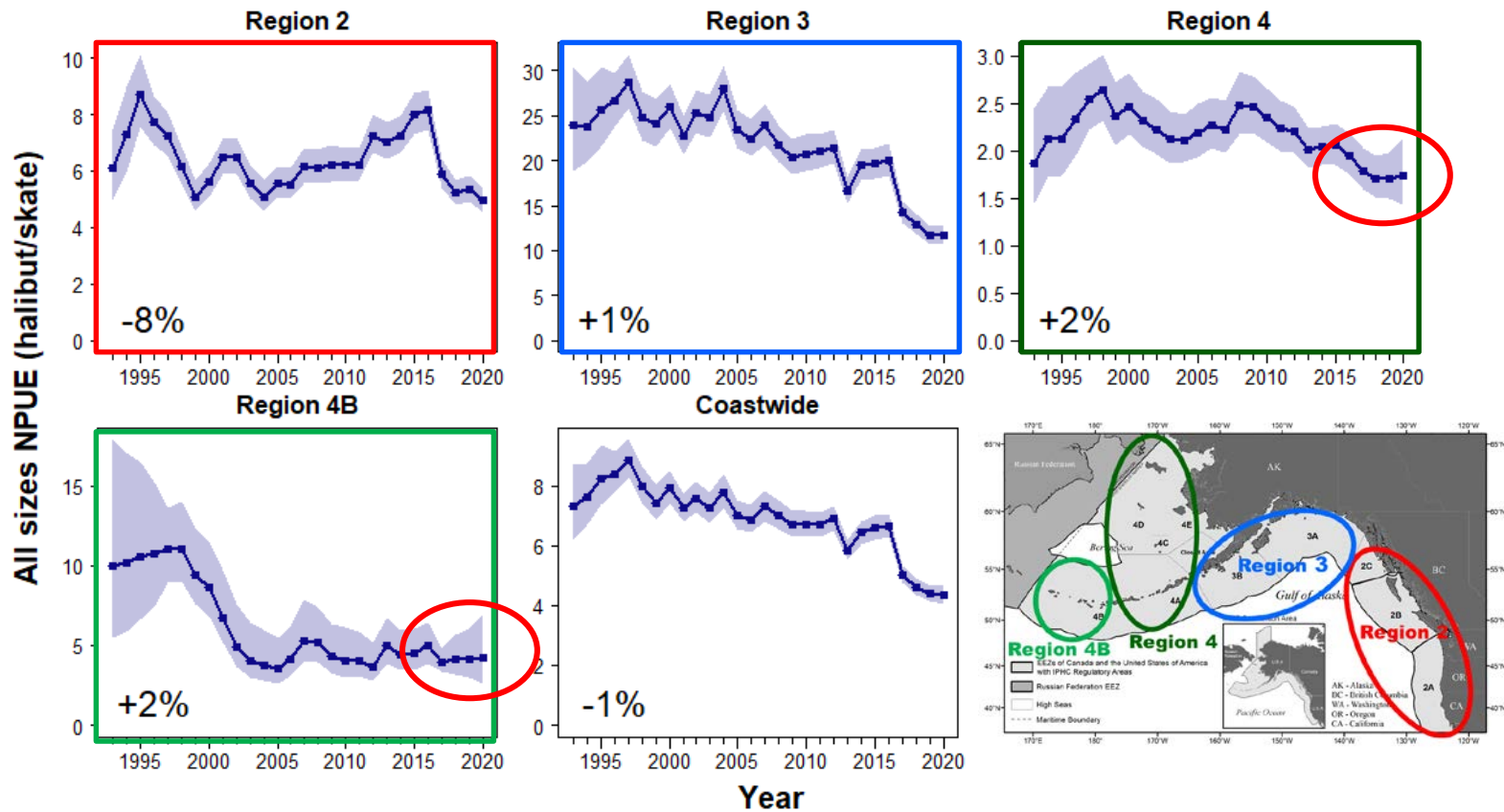
3-yr avg. = 5.90



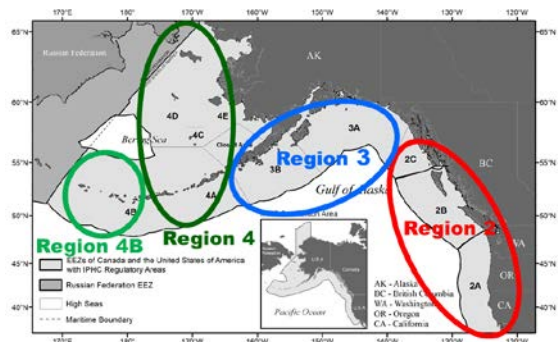
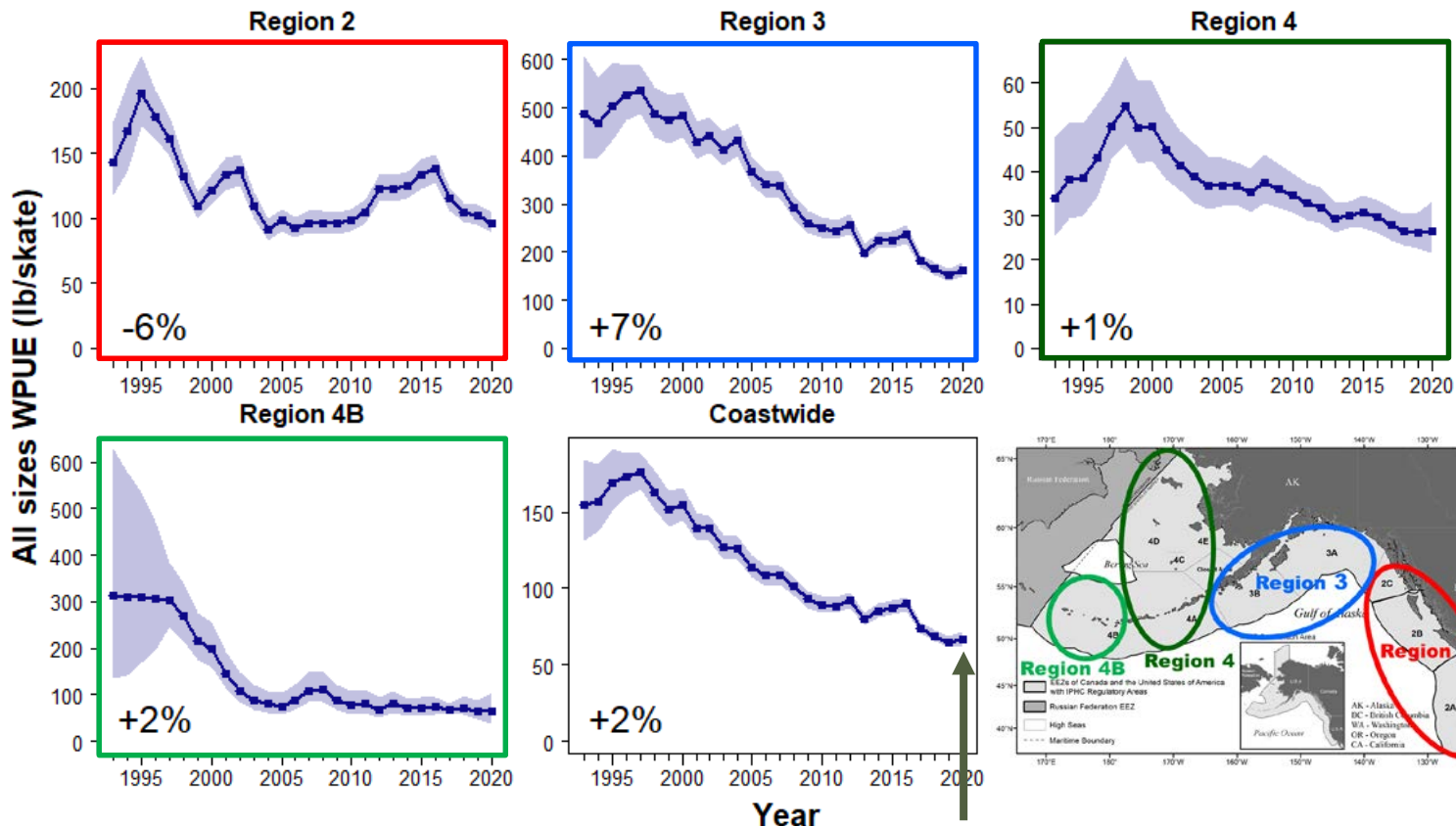
Biological regions



Modelled survey trends (Numbers)



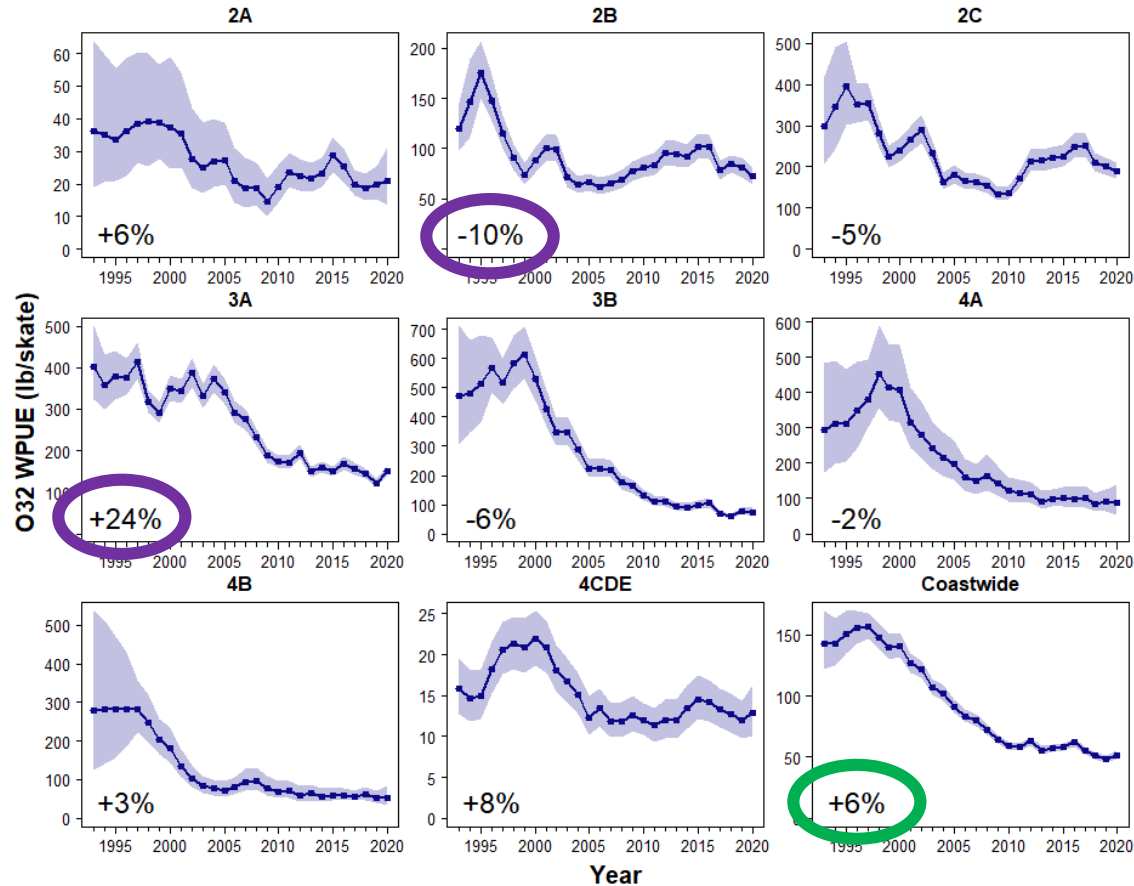
Modelled survey trends (all sizes WPUE)



Indicates more productivity from growth than recruitment



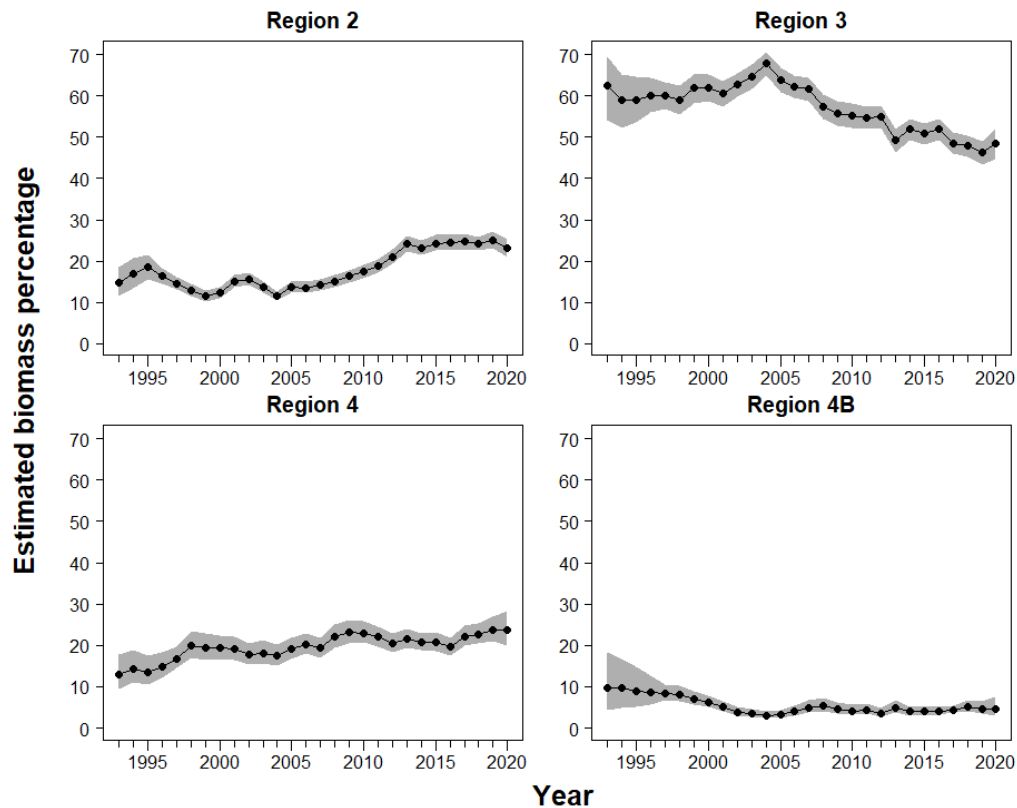
Modelled survey trends (O32 WPUE)



Indicates growth productivity is from O32 sizes



Biological stock distribution (all sizes)

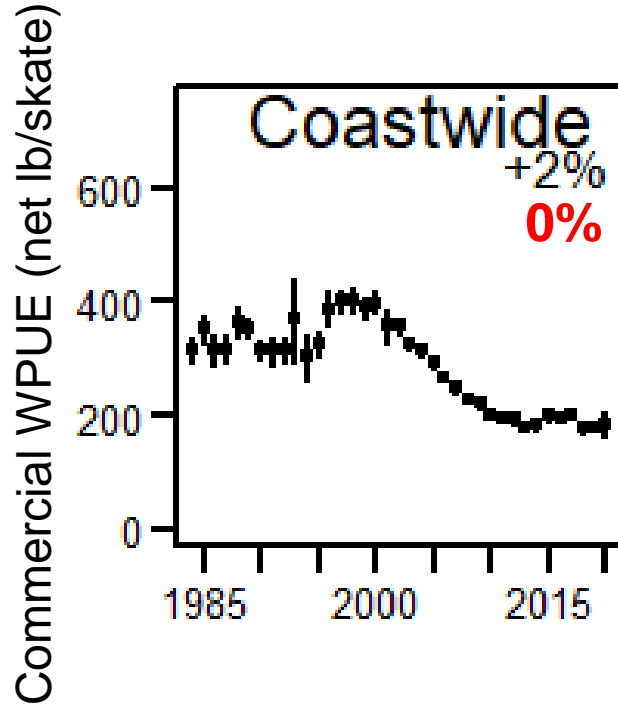


Biological stock distribution (all sizes)

Year	Region 2 (2A, 2B, 2C)	Region 3 (3A, 3B)	Region 4 (4A, 4CDE)	Region 4B
2016	24.4%	51.9%	19.6%	4.1%
2017	24.7%	48.6%	22.3%	4.5%
2018	24.2%	47.9%	22.8%	5.2%
2019	25.0%	46.4%	23.9%	4.7%
2020	23.1%	48.5%	23.6%	4.7%



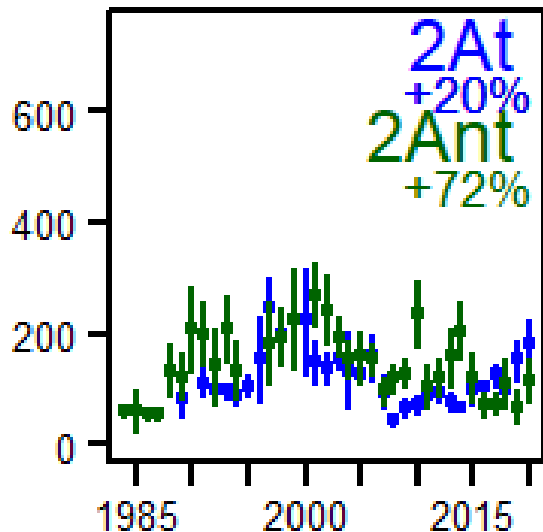
Fishery trends



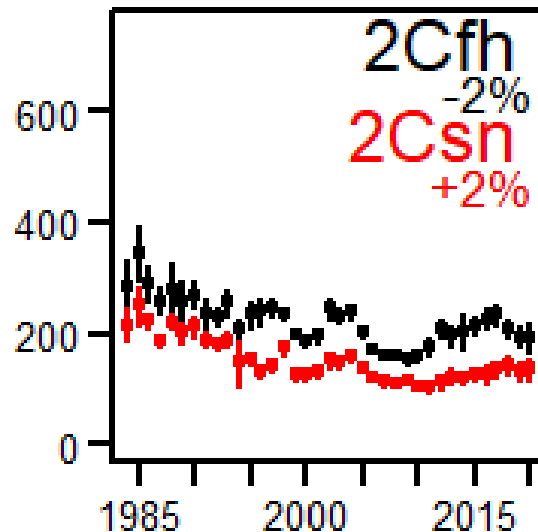
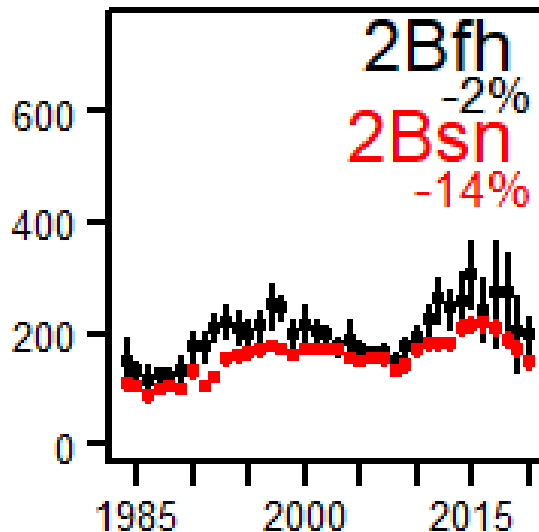
Fishery trends: Region 2

Commercial WPUE (net lb/skate)

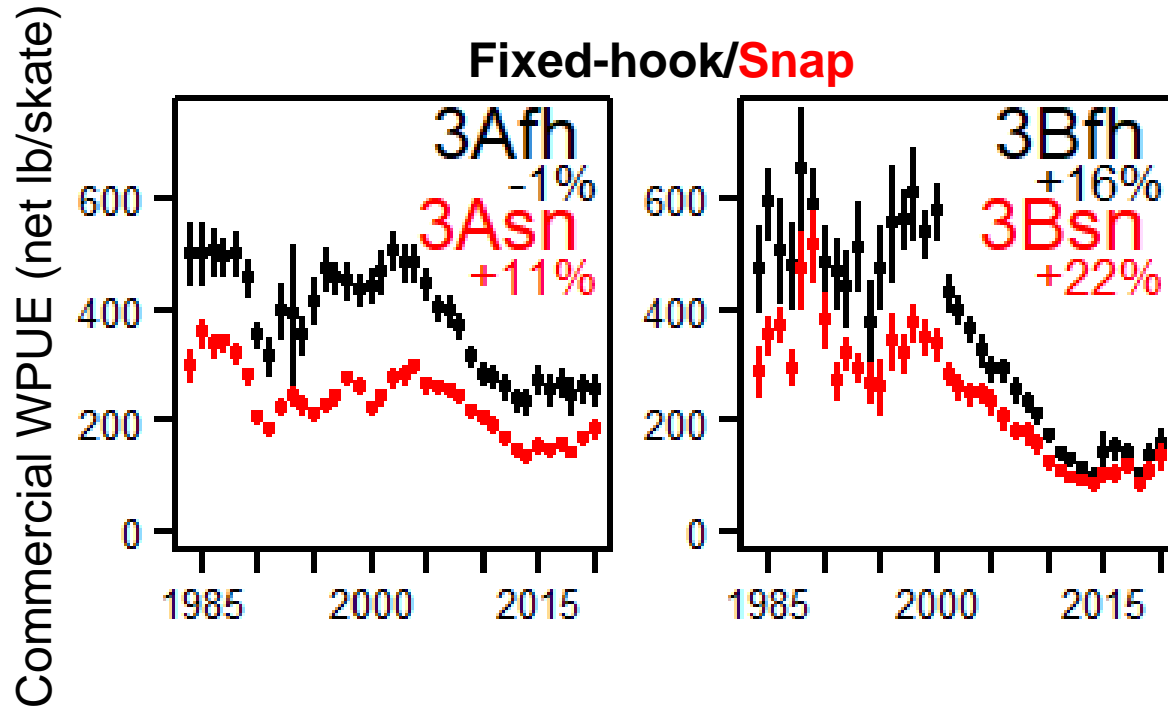
Tribal/Non-tribal



Fixed-hook/Snap



Fishery trends: Region 3

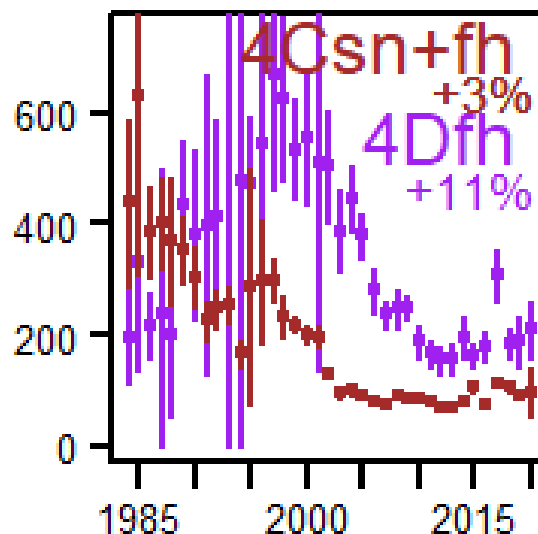
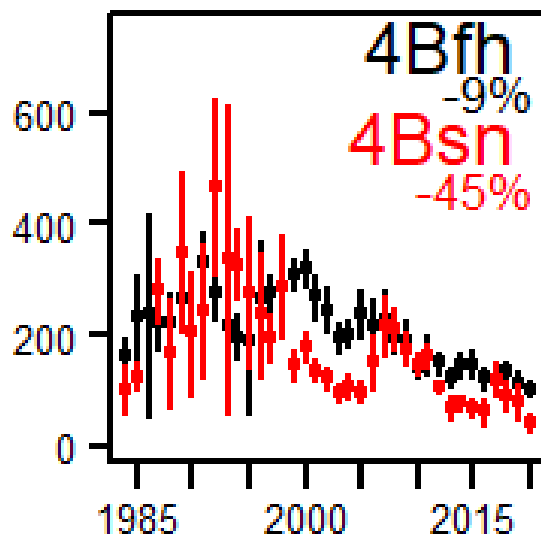
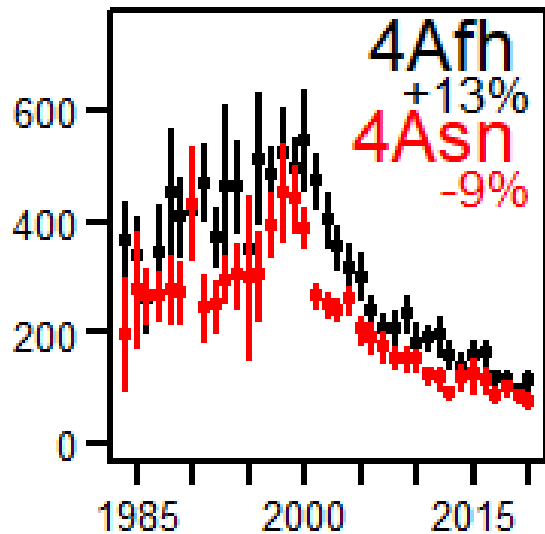


Fishery trends: Region 4

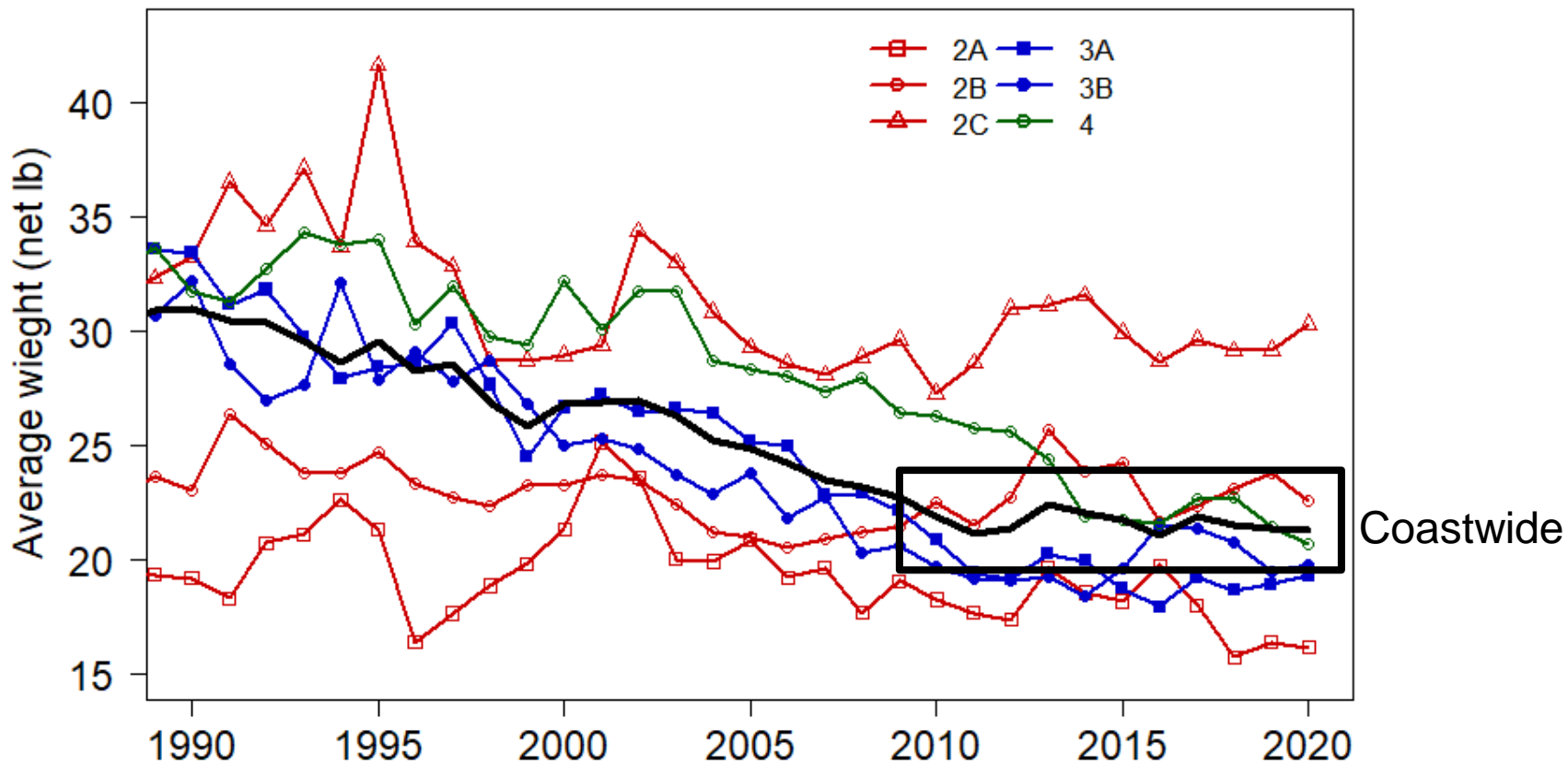
Commercial WPUE (net lb/skate)

Fixed-hook/Snap

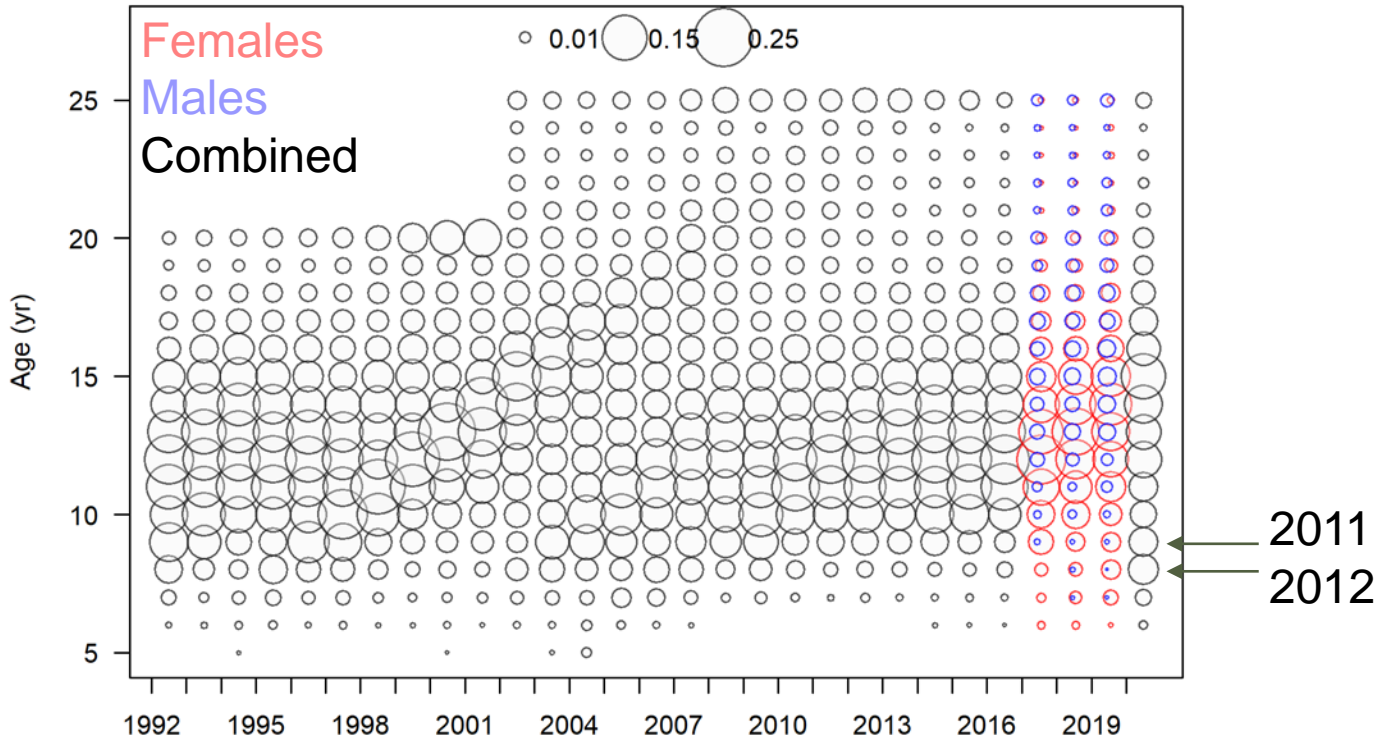
4C/4D



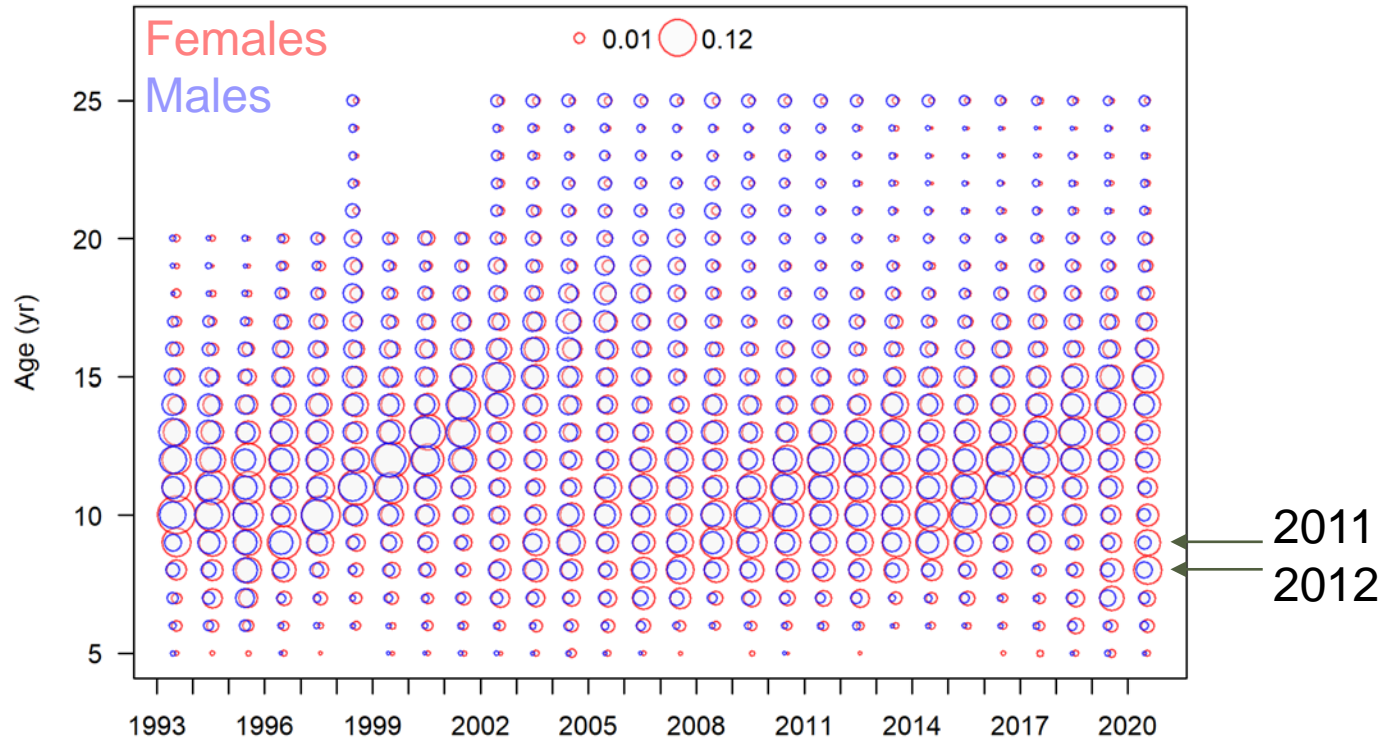
Average weight landed



Recent fishery ages



Recent FISS ages

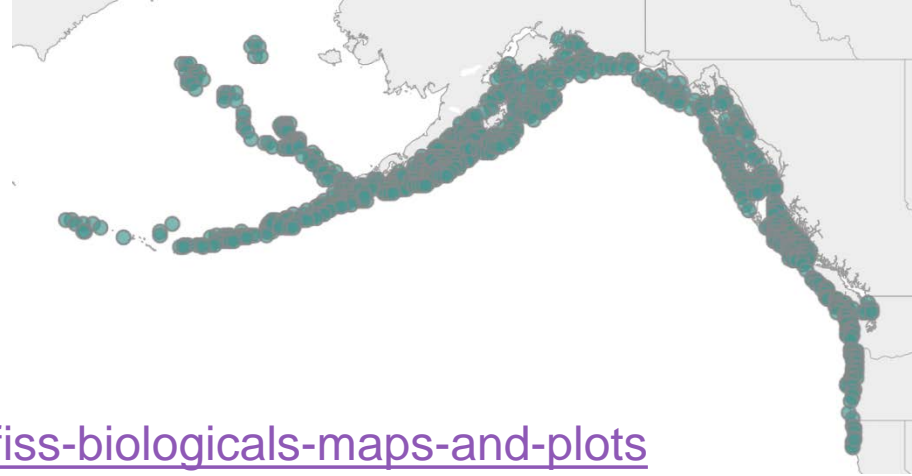


FISS interactive: Tracking cohorts

2005 cohort at age 6



2005 cohort at age 9

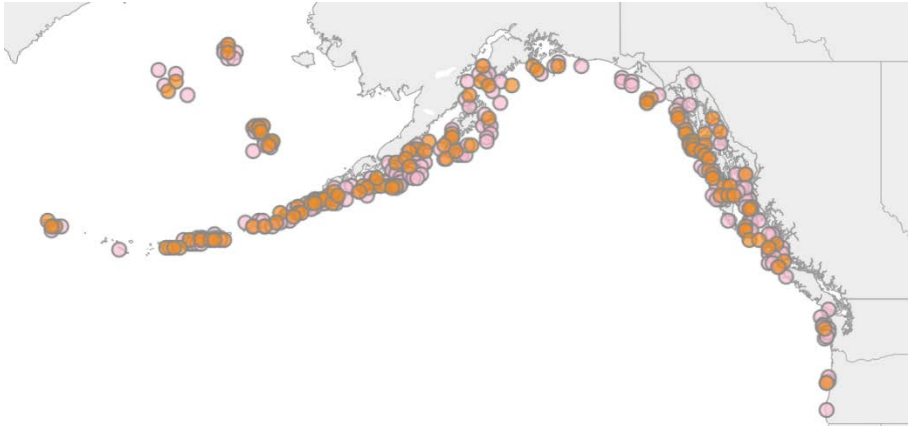


See: <https://www.iphc.int/data/fiss-biologicals-maps-and-plots>

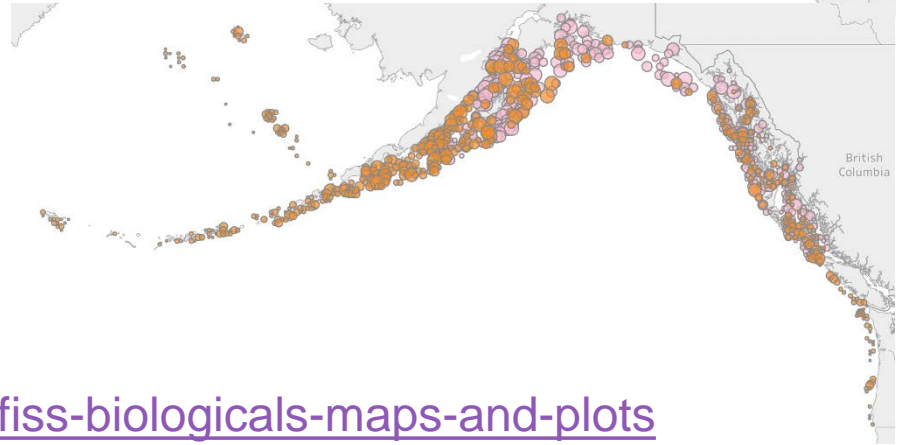


FISS interactive: Tracking cohorts

2011-2012 cohorts at age 6



2011-2012 cohorts at age 8

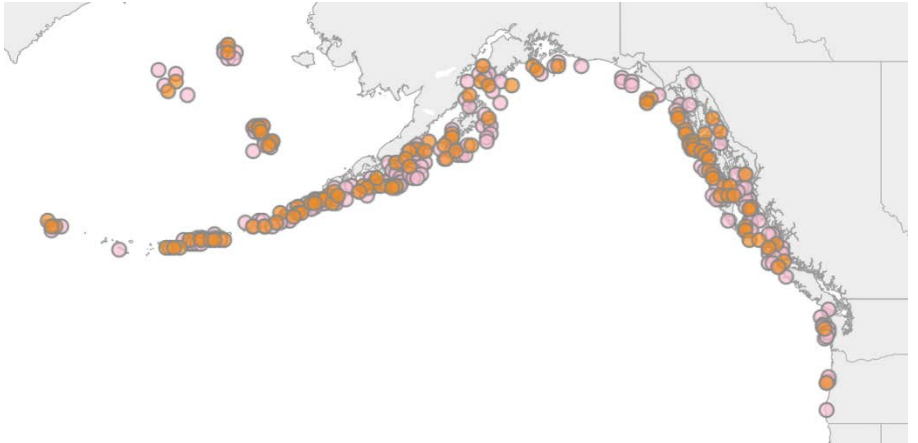


See: <https://www.iphc.int/data/fiss-biologicals-maps-and-plots>

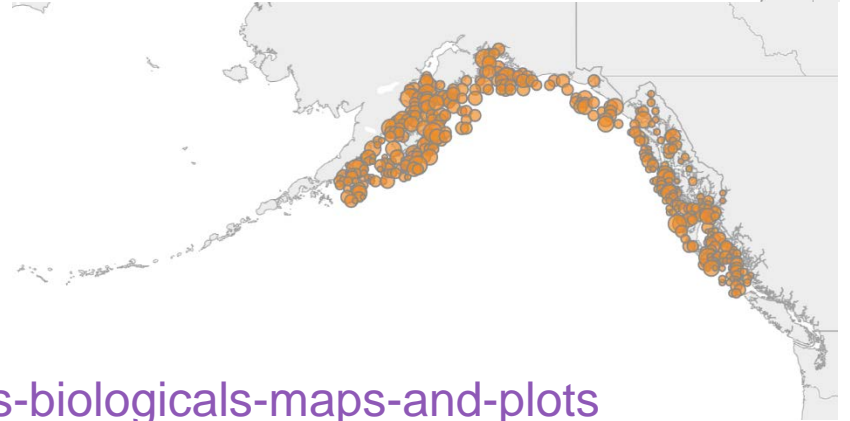


FISS interactive: Tracking cohorts

2011-2012 cohorts at age 6



2011 cohort at age 9

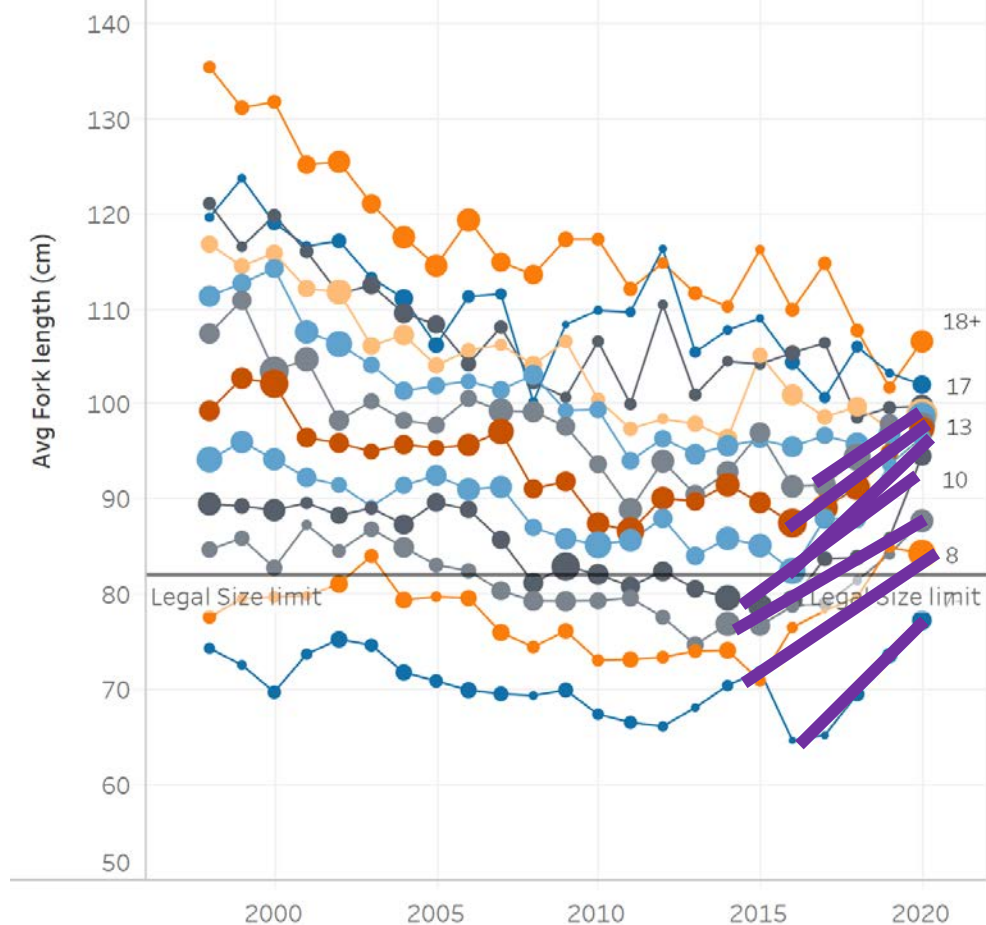


See: <https://www.iphc.int/data/fiss-biologicals-maps-and-plots>



FISS interactive: Length-at-age

Female Pacific halibut in 3A:
5-year increasing trend ages <14



See: <https://www.iphc.int/data/fiss-biologicals-maps-and-plots>



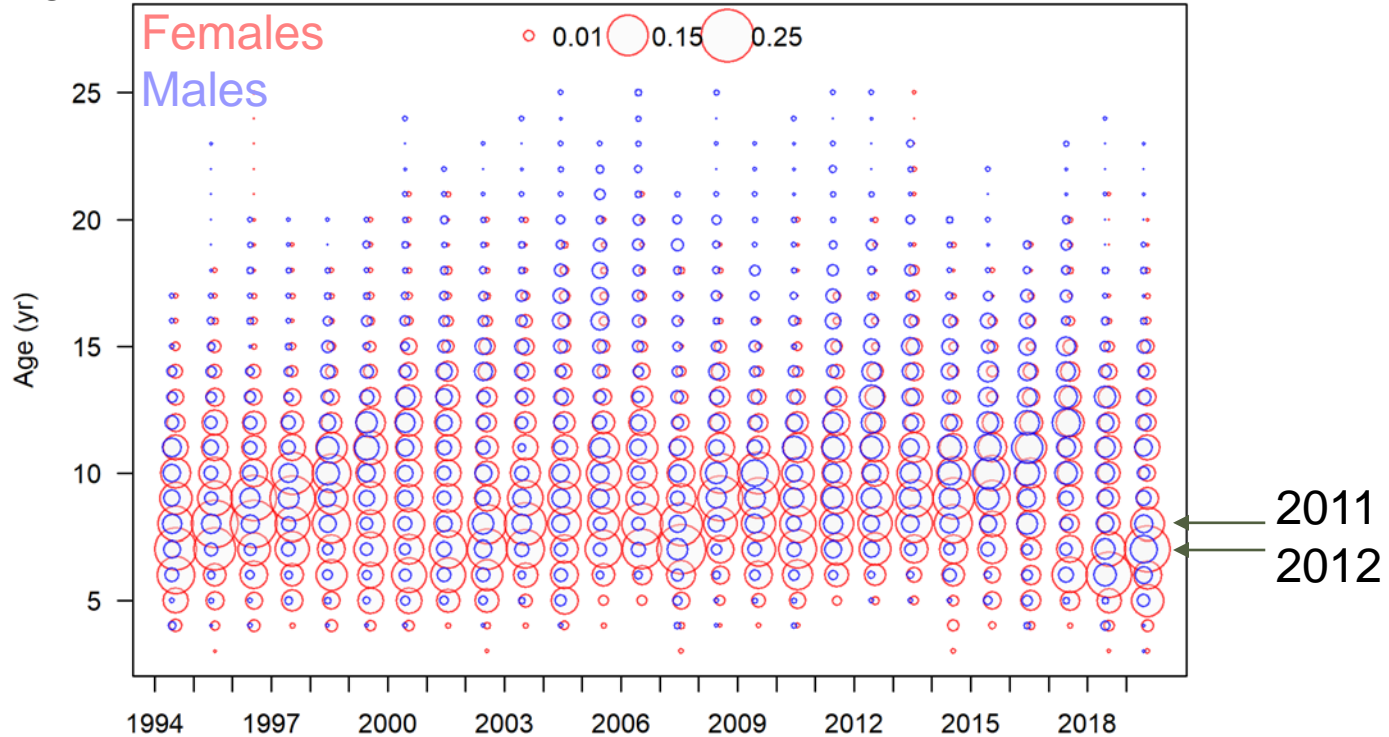
New biological data for 2020

- Sex-specific age composition information from the recreational fishery in 3A
- Sex-specific age composition information from the 2019 directed commercial fishery



Recreational age data

Average: 72% female



Thanks to Sarah Webster (ADFG)

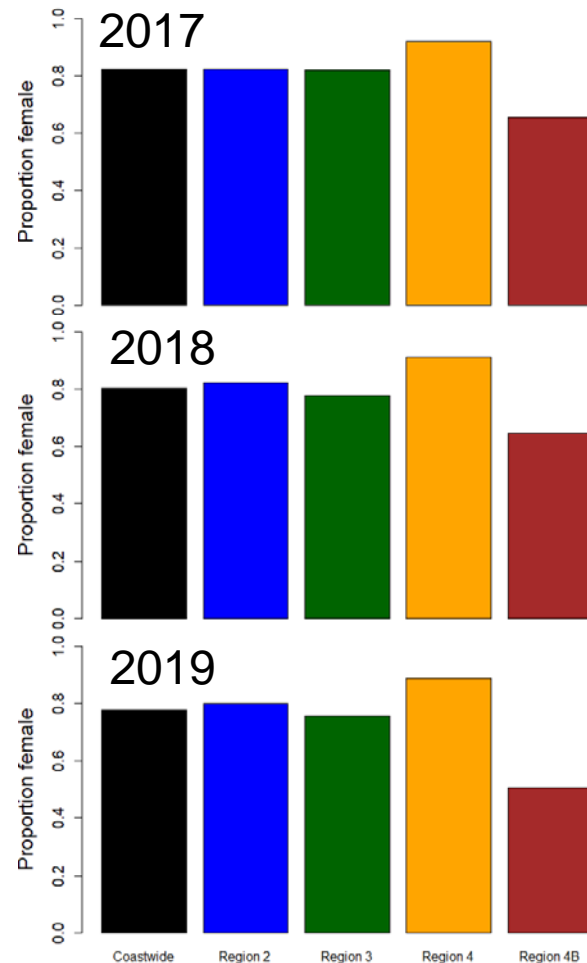


Directed commercial fishery sex-ratios

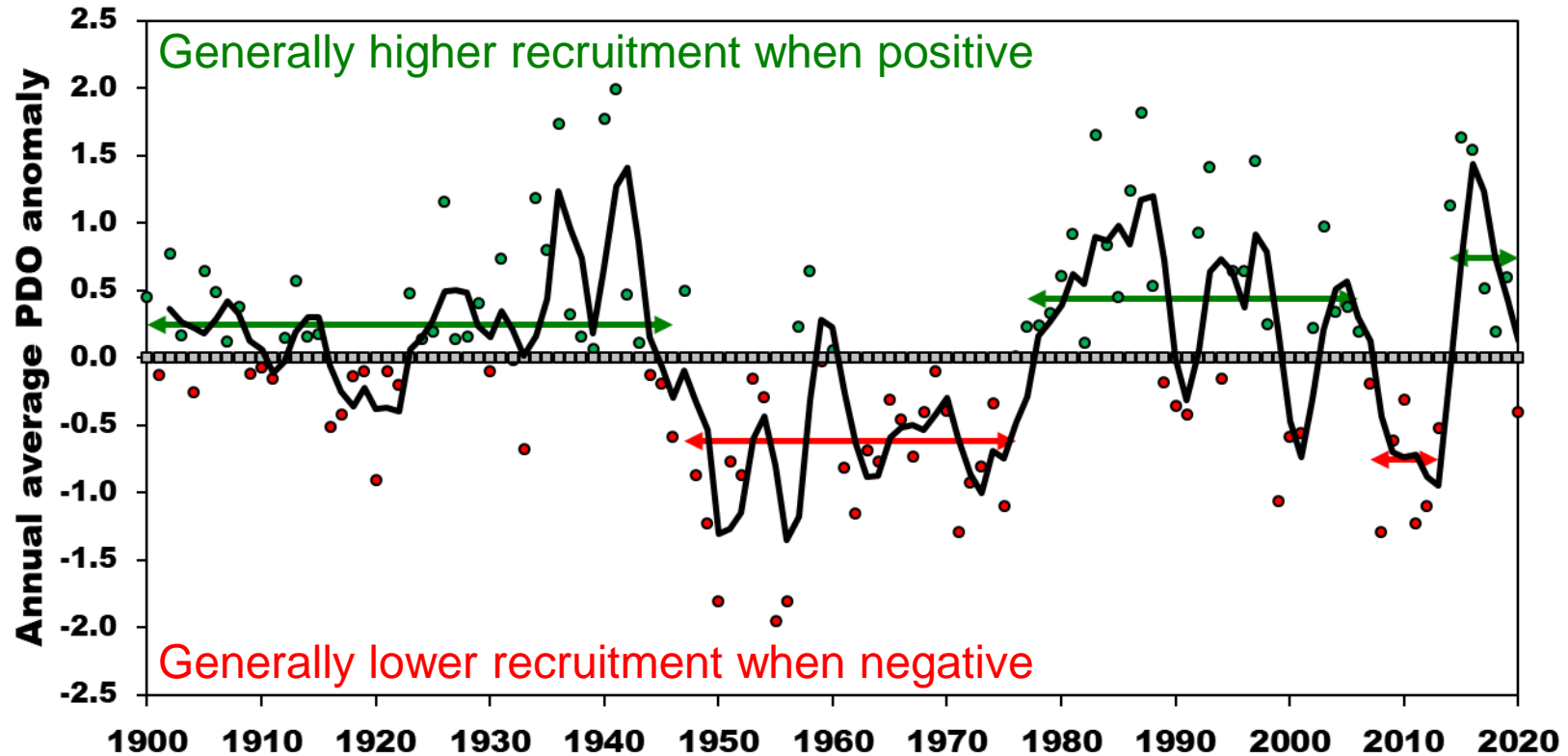
Percent female

	Coastwide	Region 2	Region 3	Region 4	Region 4B
2017	82%	82%	82%	92%	65%
2018	80%	82%	78%	91%	65%
2019	78%	80%	76%	89%	51%

(Note small sample sizes in 4B: ~ 10-17 trips per year)



Ecosystem conditions: Pacific Decadal Oscillation



Ecosystem conditions

- More normal ice conditions in the Bering Sea (2019/20 winter) than 2017/18 & 2018/19
- Intermittent 'heatwave' conditions in the Gulf of Alaska during 2020 summer

Reference

Ecosystem Status report - preview: <https://meetings.npfmc.org/Meeting/Details/1566>



Data highlights

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



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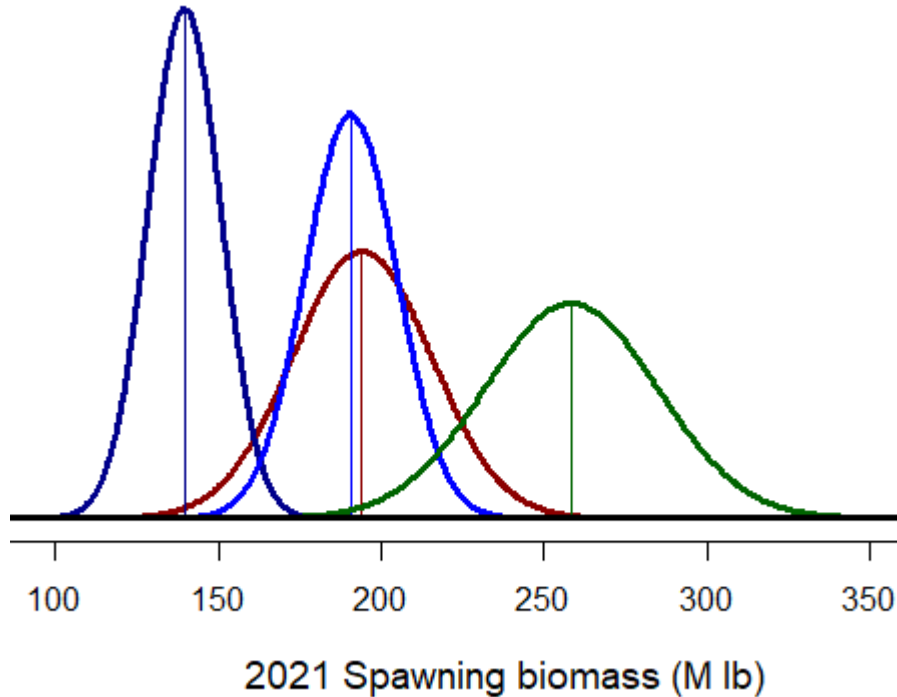


The 2020 assessment

- 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



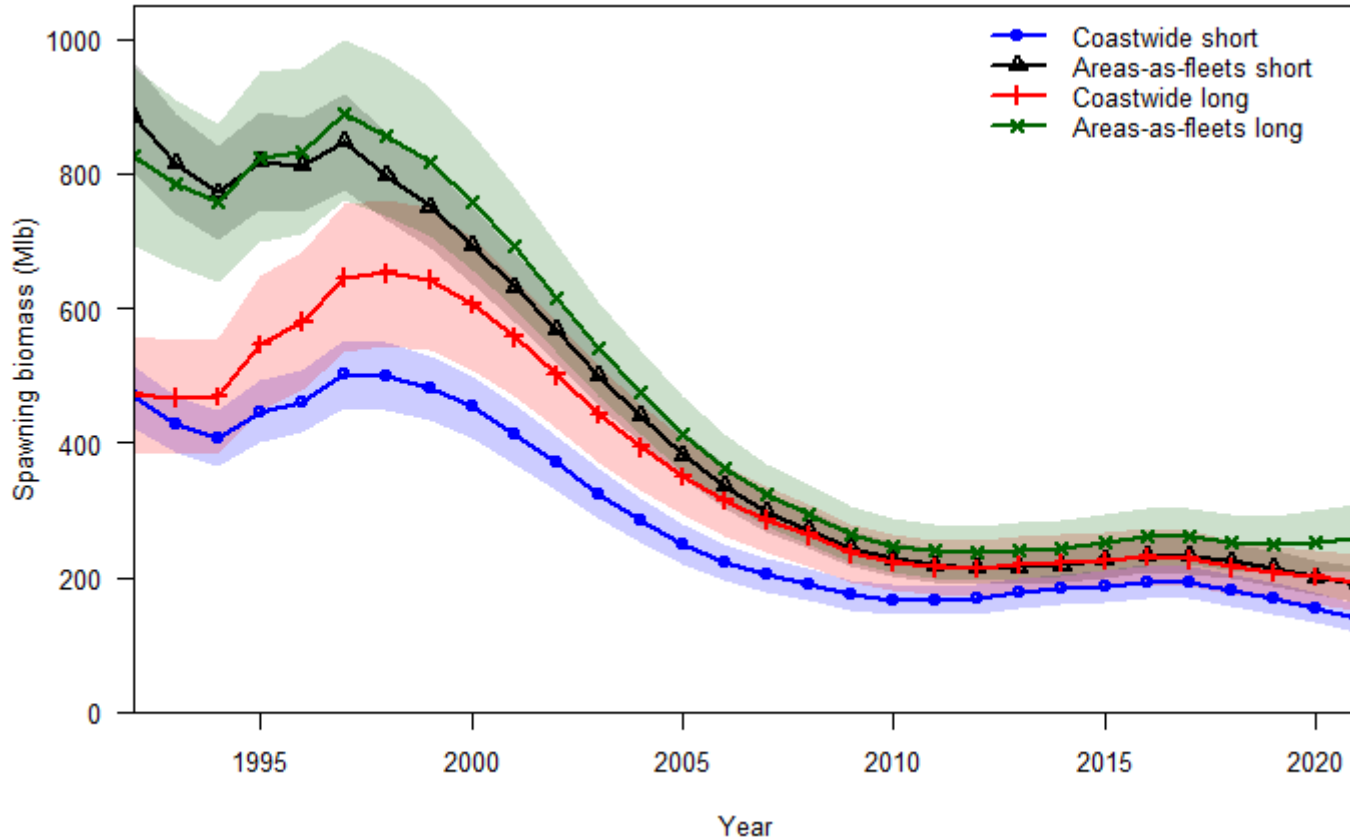
Modelling summary: four individual models



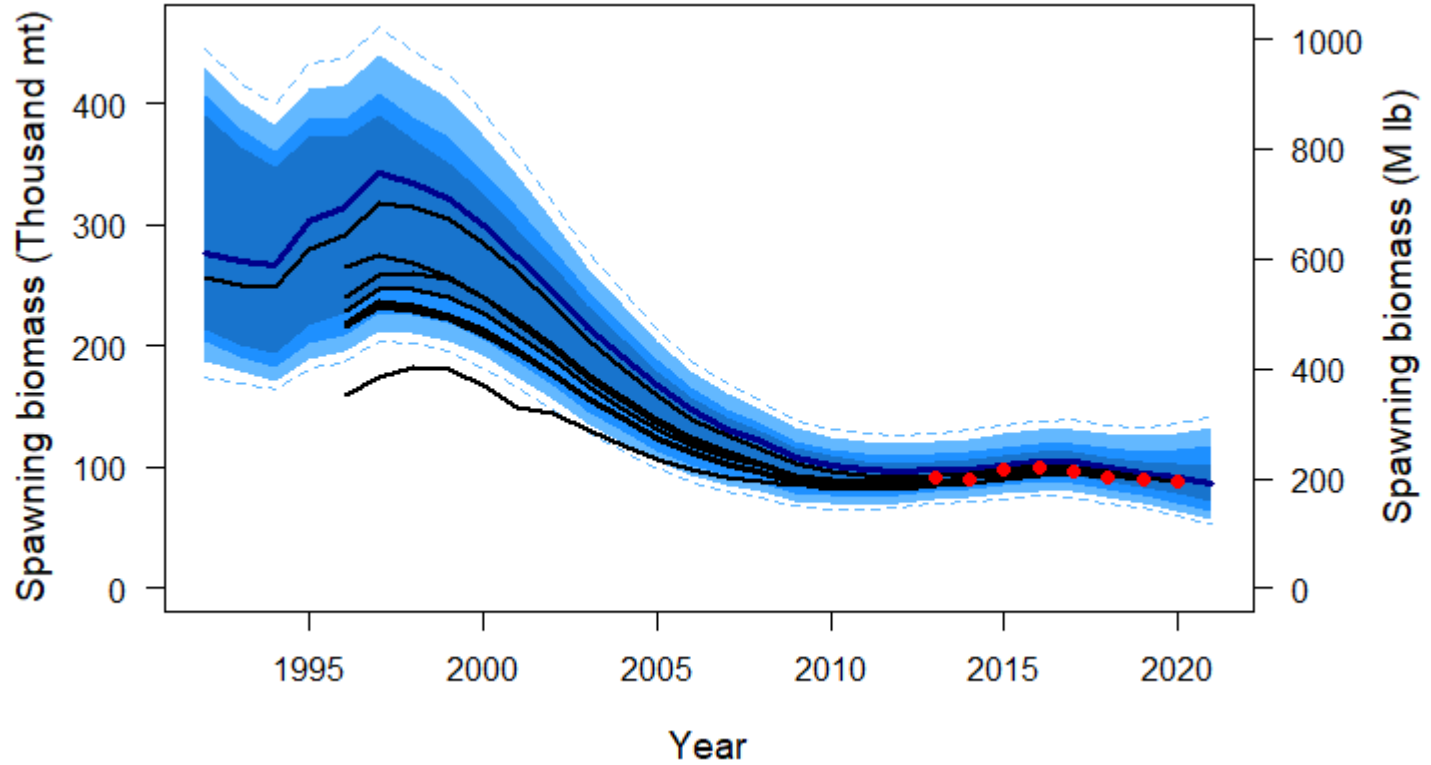
- Four ways to aggregate the data
- Respond differently to trend and age data by Region
- Provide stability from year to year as individual model results change



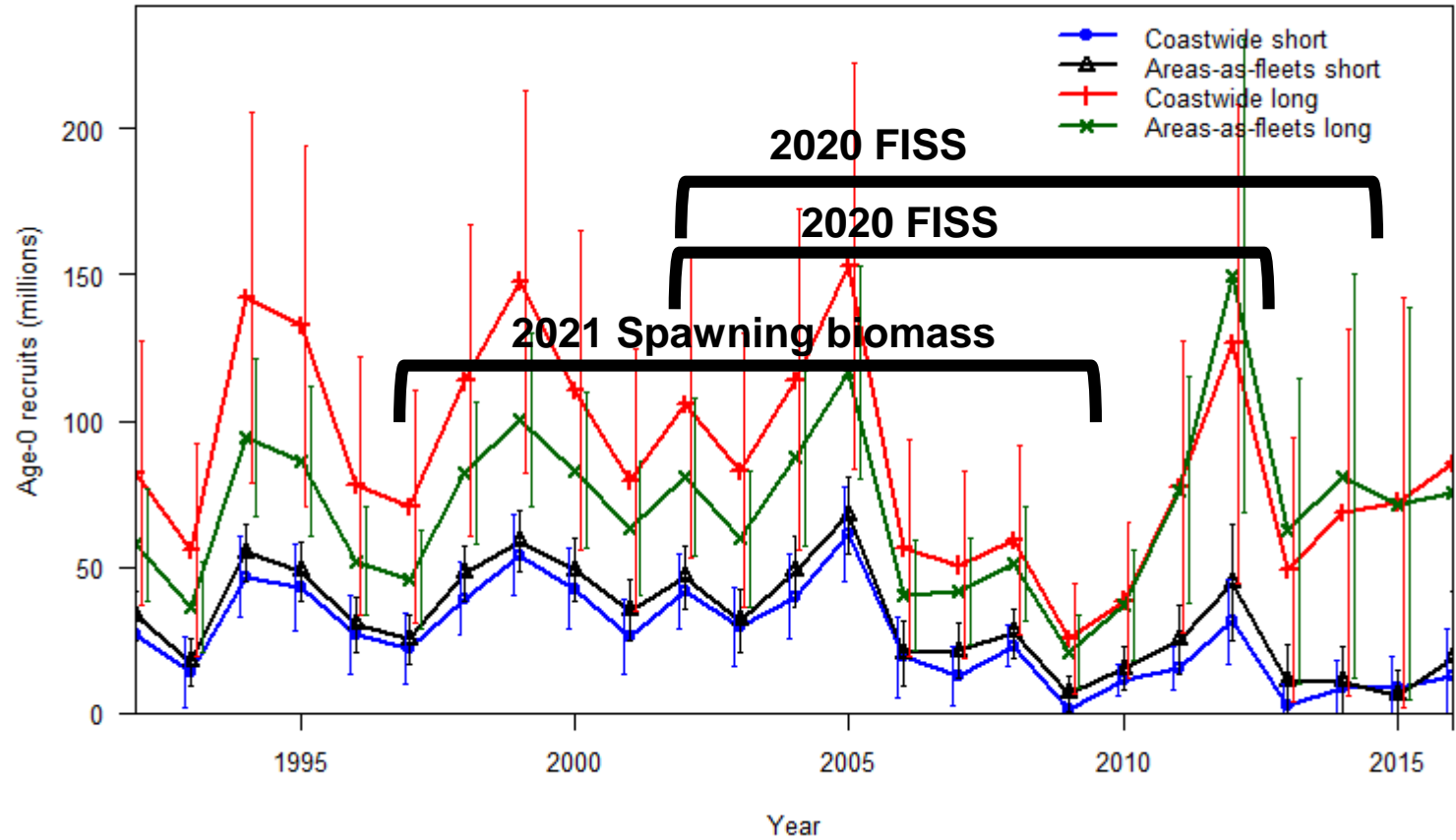
Modelling summary: four individual models



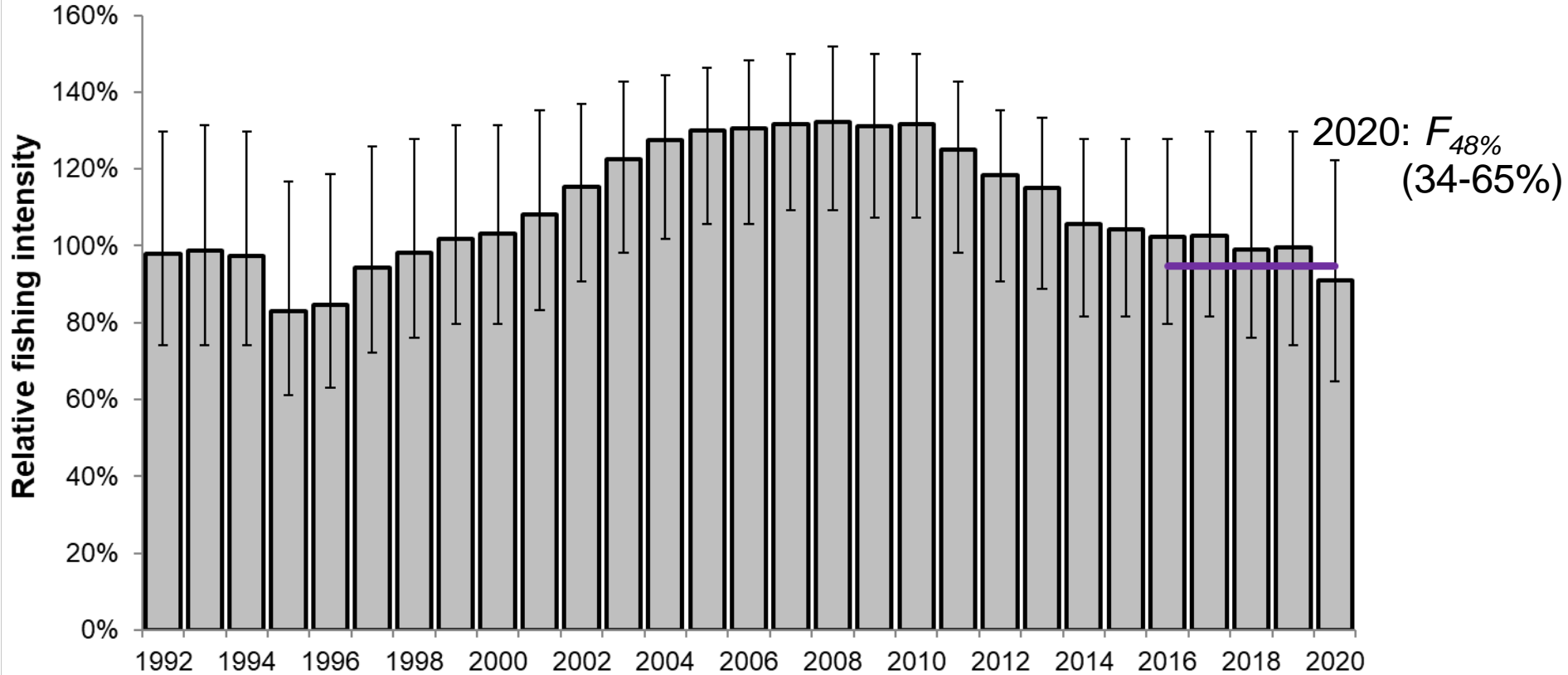
Comparison with previous assessments



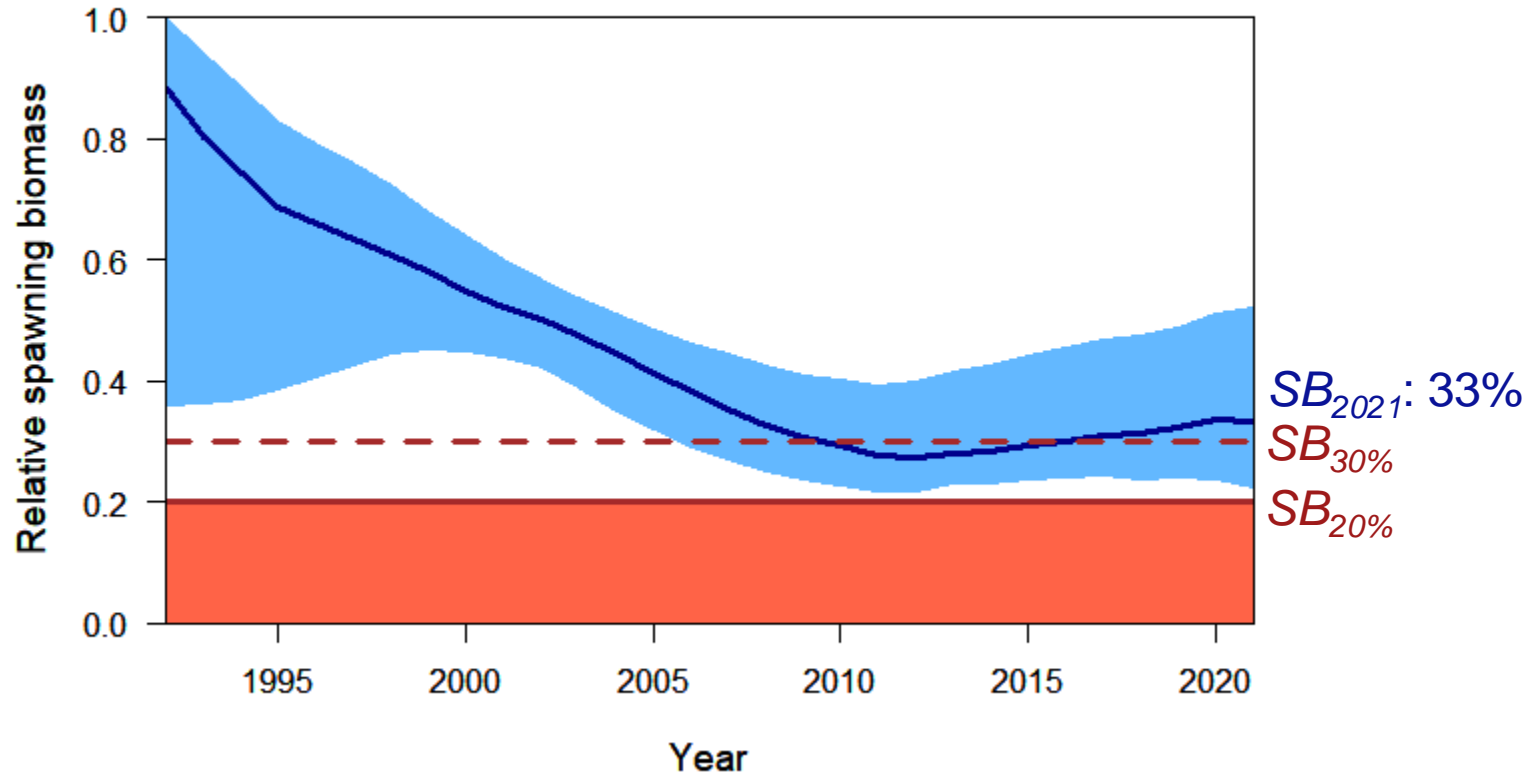
Recruitment estimates



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



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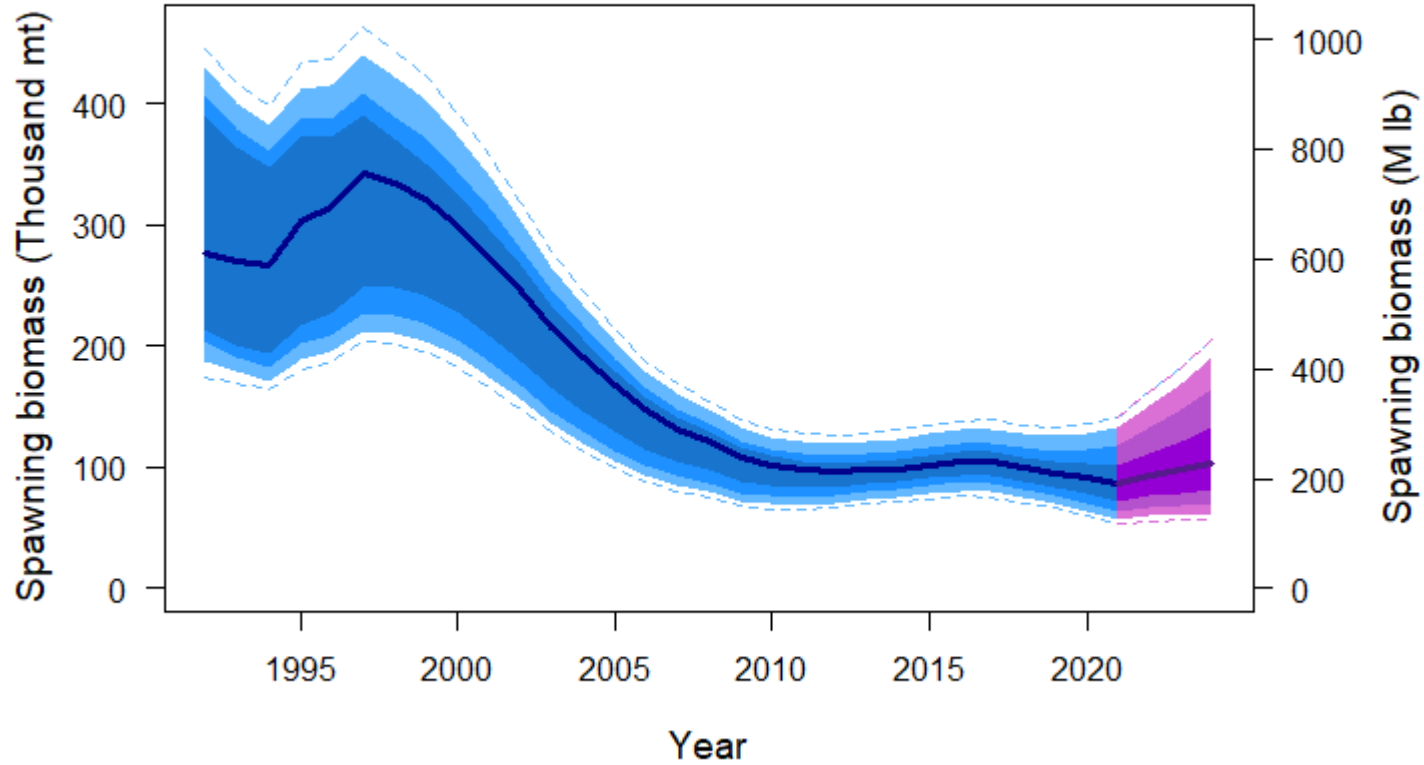


Projections and decision table

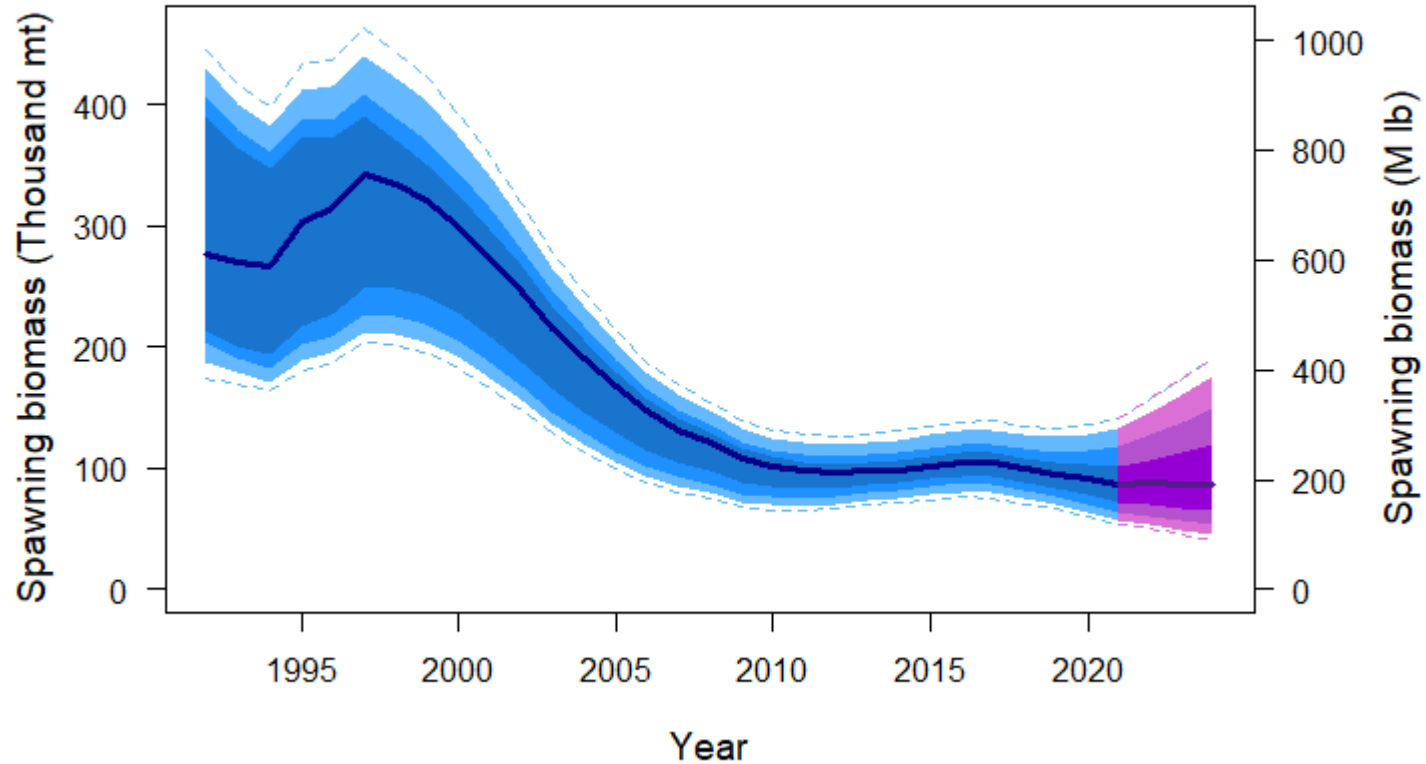
- Constant TCEY for the next three years
- Range of mortality, from no fishing mortality to 60 Mlb TCEY, with additional detail from $F_{40\%}$ - $F_{46\%}$



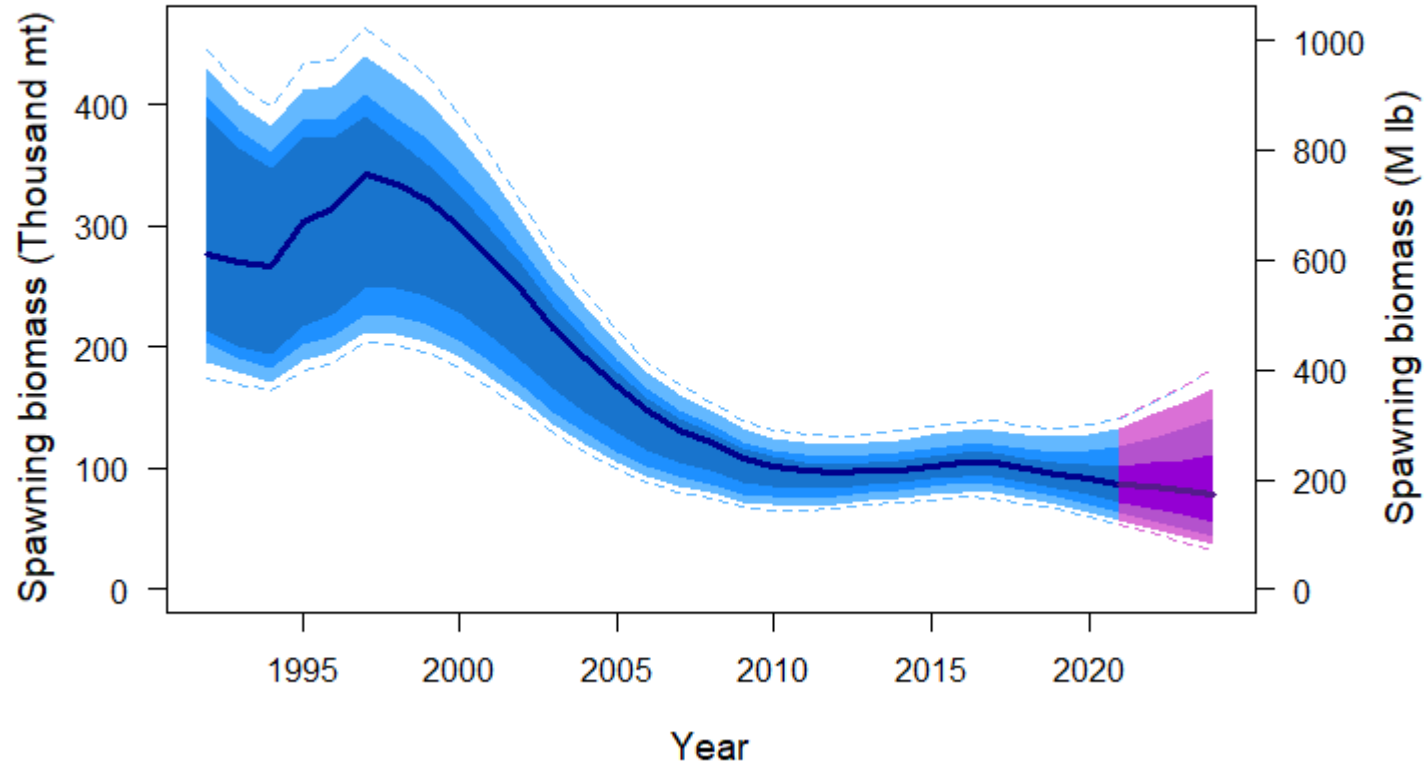
Projections: no fishing mortality



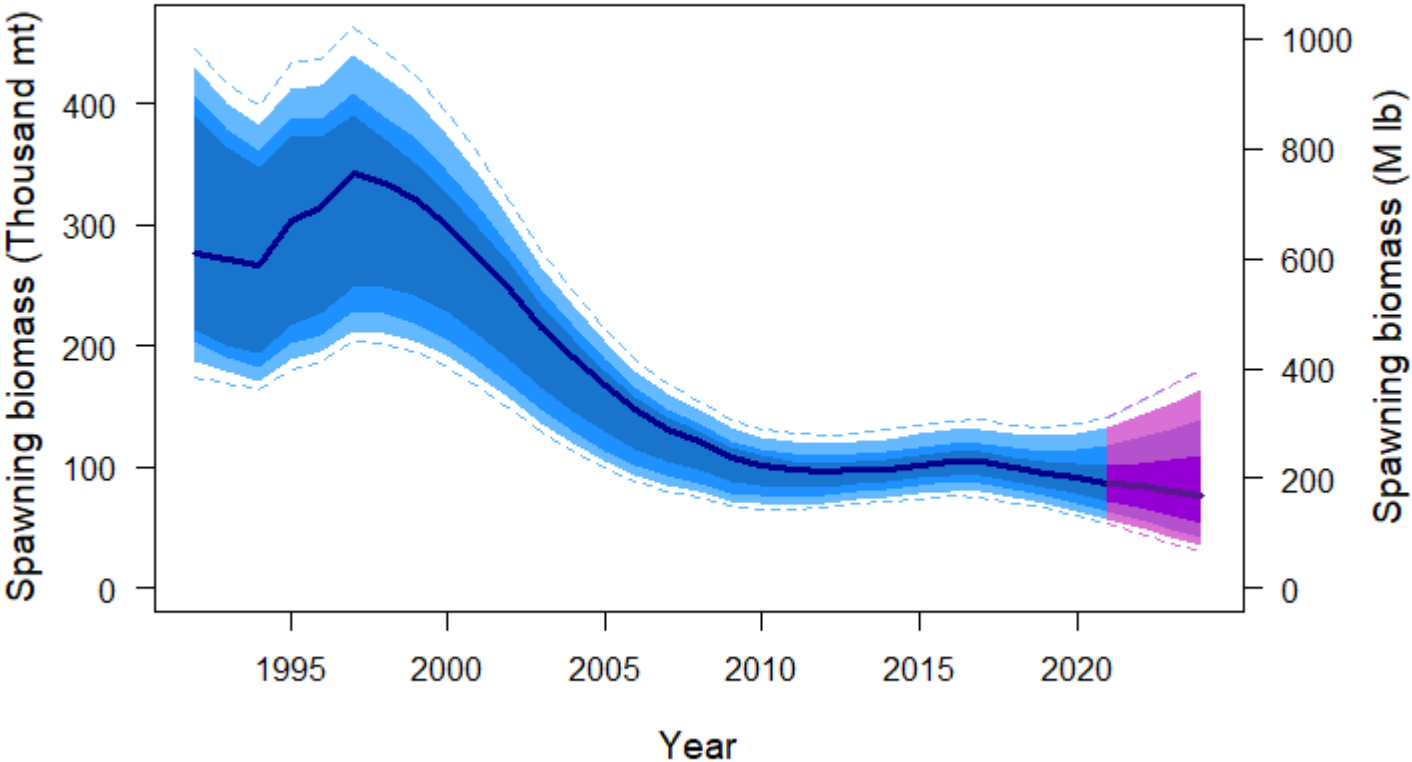
Projections: 3-yr surplus production (24.4. Mlb TCEY)



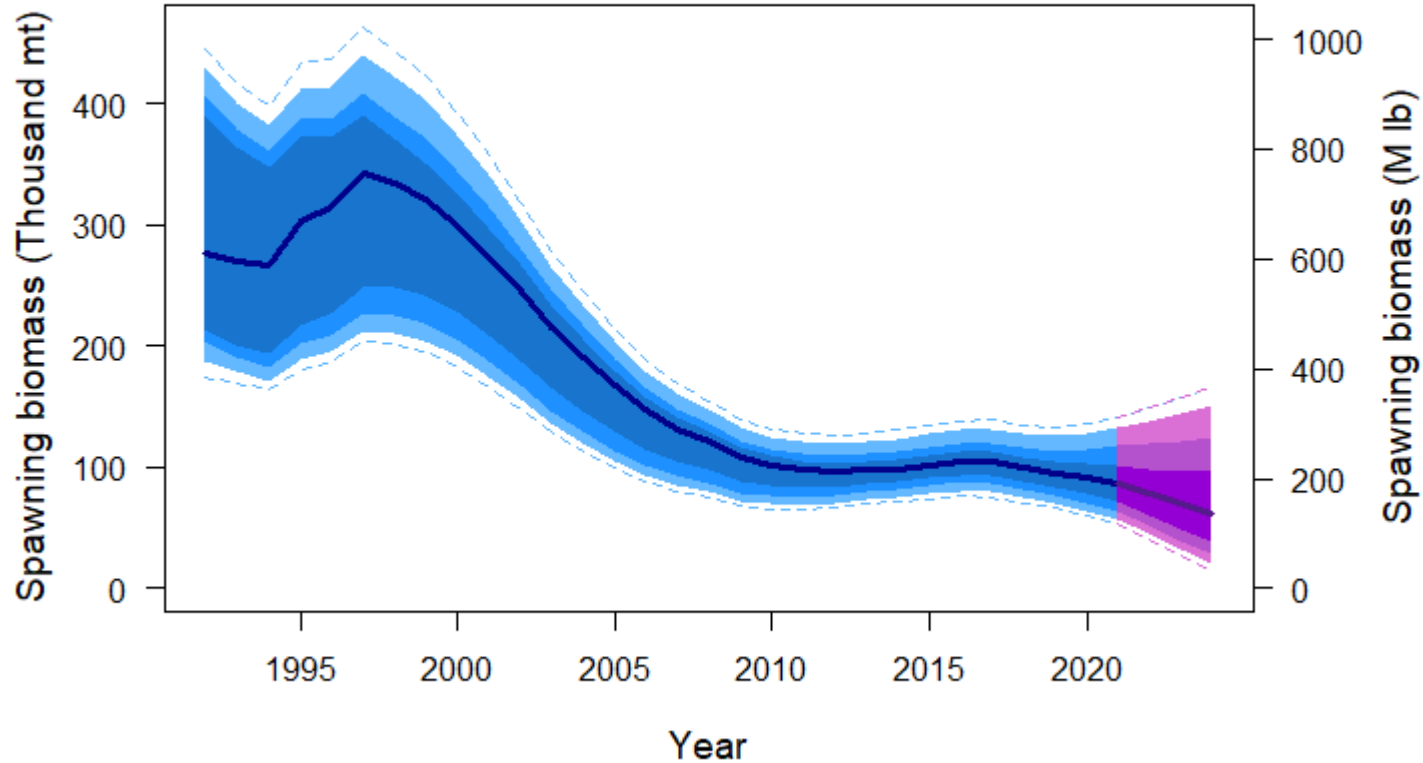
Projections: *status quo* (36.6 Mlb TCEY)



Projections: Reference level (39 Mib TCEY)



Projections: 60 Mlb TCEY



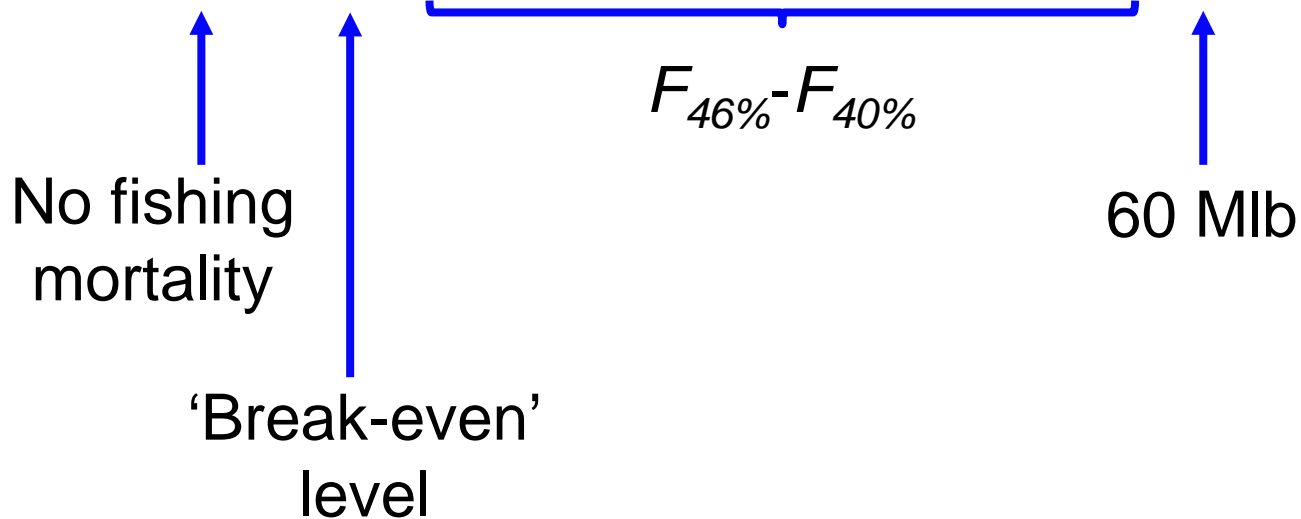
Decision table

- 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%



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
		is less than 20%	<1	<1	<1	<1	1	1	1	1	1	1
	in 2023	is less than 30%	23	32	39	40	40	41	42	43	43	49
		is less than 20%	<1	<1	2	2	3	3	4	5	5	19
	in 2024	is less than 30%	12	29	38	39	40	41	42	43	44	50
		is less than 20%	<1	<1	4	5	6	8	9	10	12	25

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 further TCEY cuts to remain at $F_{43\%}$



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- **Interim management procedure results**



2021 Mortality projection tool

- Interactive tool to explore alternative scale and distribution of mortality for 2021
- Will be finalized in January with post-season 2020 mortality estimates
- 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 = $0.7 \cdot 20\% + 0.3 \cdot \text{baseline}$
 - 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

	<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%	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

	<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%	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%	<i>Depends on total TCEY</i>						



Interim Management Procedure: adjustments

	<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%	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%	<i>Depends on total TCEY</i>						
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	14.11	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

	<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	5.80	4.97	9.80	2.94	2.26	1.27	3.22	31.90
2021	1.65	7.00	5.16	14.11	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

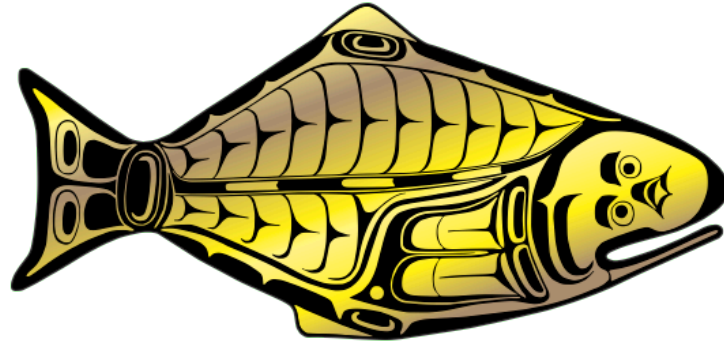


Interim Management procedure: detailed results

	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
U26 Non-directed discards	0.10	0.23	0.09	1.19	0.43	0.24	0.12	2.22	4.63
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	0.85	1.61	3.08	0.57	0.42	0.17	2.33	9.18
Commercial discards	NA	NA	0.06	0.24	NA	NA	NA	NA	0.30
Recreational	0.61	0.92	0.65	1.93	NA	NA	NA	NA	4.11
Subsistence	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Commercial landings	0.87	5.23	2.84	8.86	2.55	2.09	1.29	1.64	25.38
Total FCEY	1.51	6.15	3.55	11.04	2.55	2.09	1.29	1.64	29.82
							<i>4C FCEY</i>	<i>0.76</i>	
							<i>4D FCEY</i>	<i>0.76</i>	
							<i>4E FCEY</i>	<i>0.12</i>	
TCEY	1.65	7.00	5.16	14.11	3.12	2.51	1.47	3.98	39.00
U26 Non-directed discards	0.00	0.03	0.00	0.30	0.06	0.08	0.01	0.78	1.27
Total	1.65	7.03	5.16	14.42	3.18	2.59	1.48	4.76	40.27



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