



Data overview and stock assessment for Pacific halibut at the end of 2023

Agenda item: 5.2 IPHC-2024-AM100-10 I. Stewart, A. Hicks, R. Webster & D. Wilson

Assessment summary

- Fishing mortality: down slightly in 2023
- Trends: FISS down 2-4% (numbers/pounds), fishery down 12%
- Important age classes:
 - 2012 and 2014 year-classes are estimated to be smaller than 2005
 - Weight-at-age: mixed, flat or increasing trends among areas
 - Possible 2016-2018 year-classes, but no clear information yet
- Biomass: spawning biomass trend is nearly flat, at 42% of the unfished level
- Fishing intensity: 2023 was the lowest in recent years



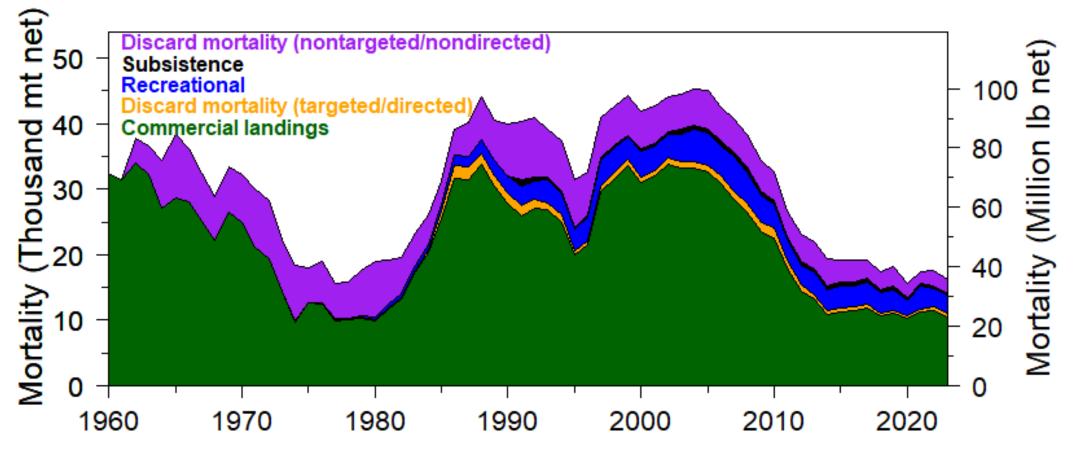
Outline

• Data sources

- Fisheries
- FISS
- Other sources
- Modelling
 - Review of process
 - Results in 2023



Historical mortality





2023 Mortality

Projected from AM099 based on adopted mortality limits

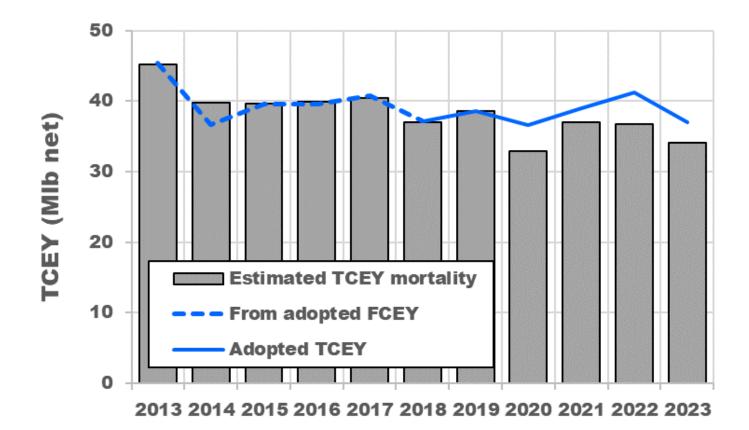
Year	0 0 1 1 1 0 1 0 1 0 1 0 1	Commercial discards	Recreational	Subsistence	Non- directed discards	
2023	24.90	1.39	6.59	0.96	4.50	38.34

Estimated for this year's stock assessment analysis

Year 2023	Commercial Landings 22.97	Commercial discards 1.31	Recreational 6.01	Subsistence 0.83	Non- directed discards 4.76	Total 35.87
			January update: 4.34 3-yr avg: 4.42			

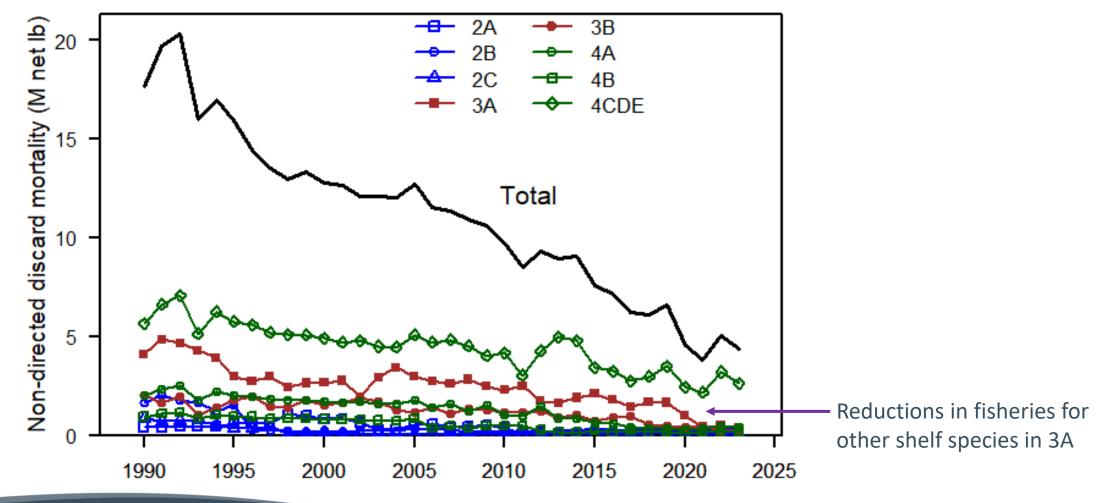


Recent TCEYs



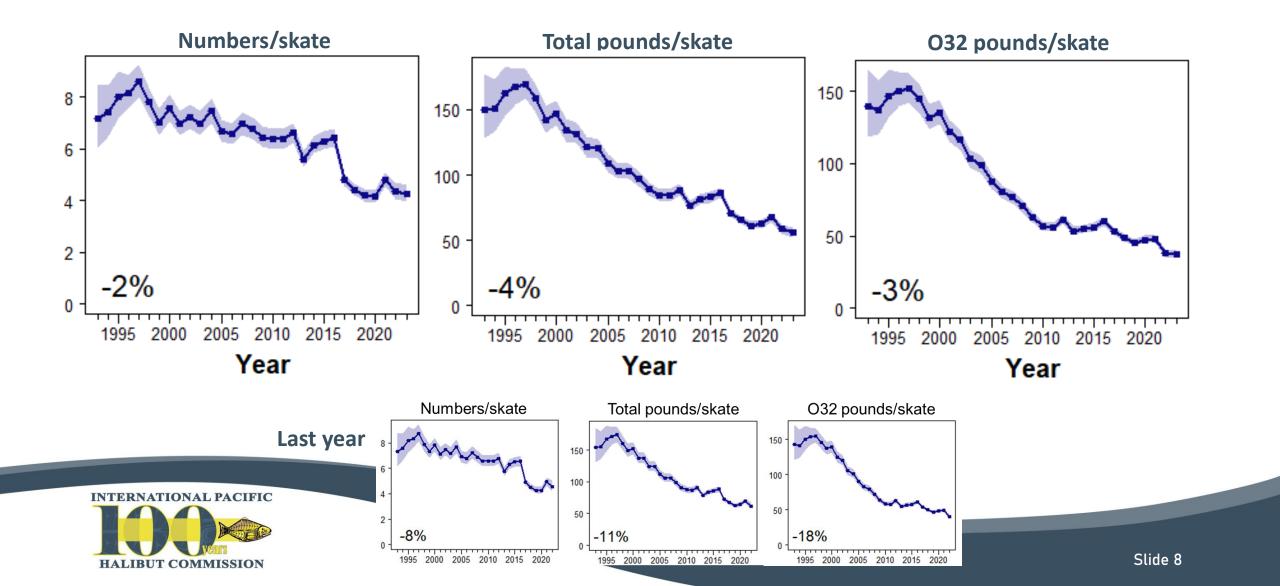


Recent non-directed discard mortality



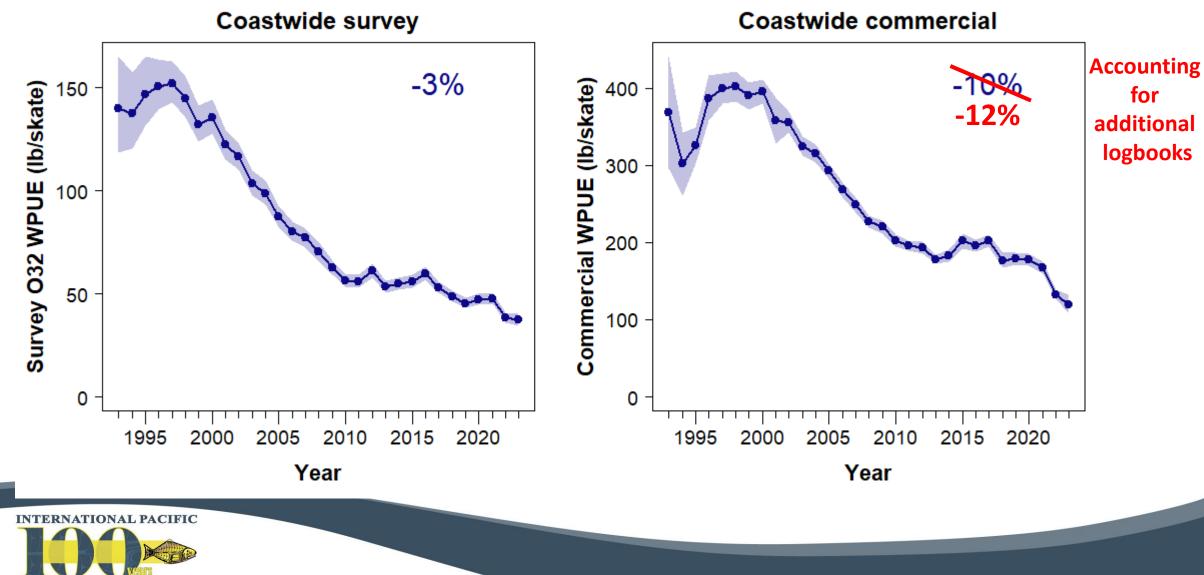
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Coastwide FISS trends



Fishery and FISS trends

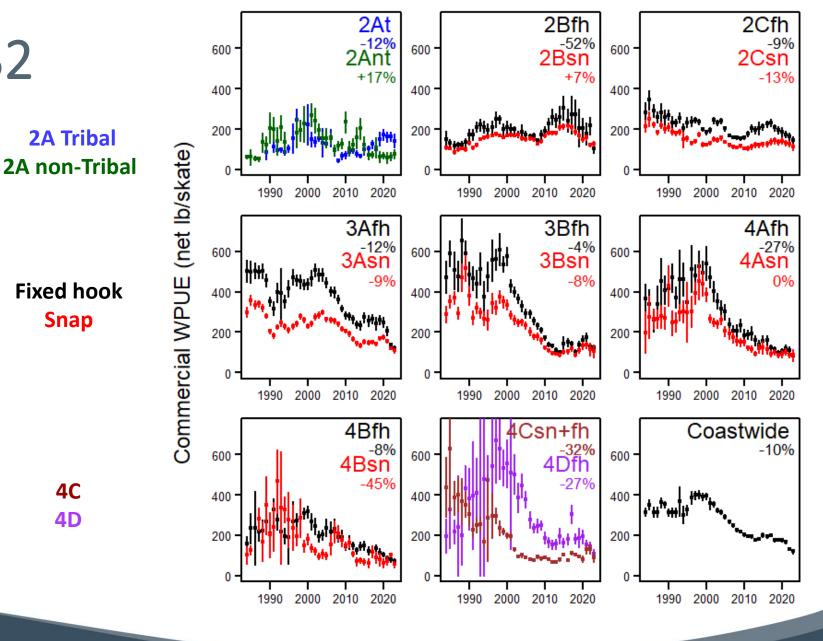
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Fishery trends: O32

4C

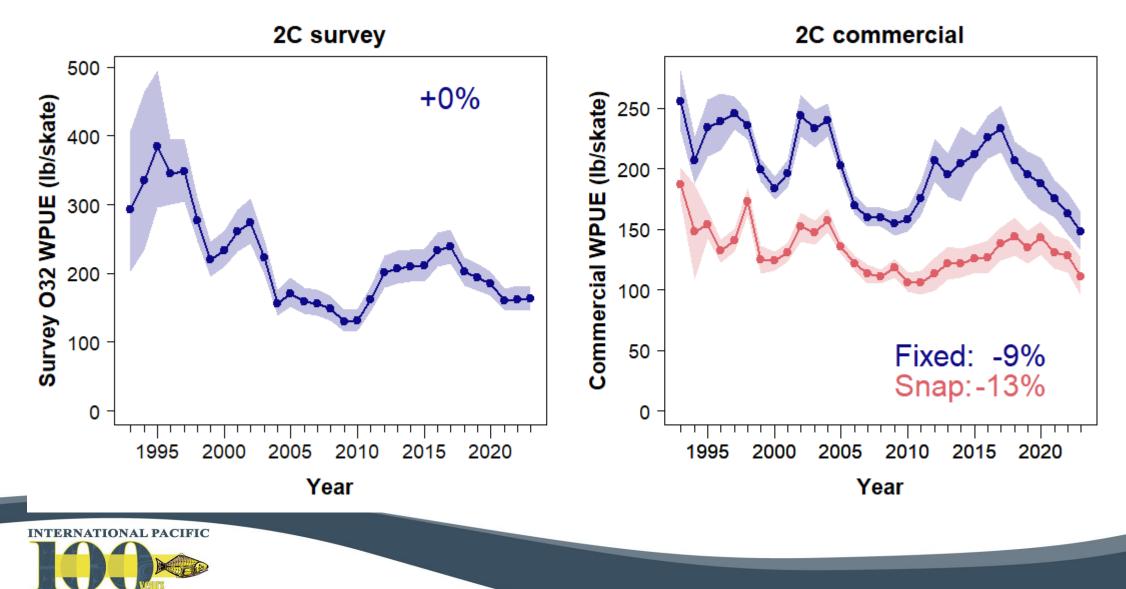
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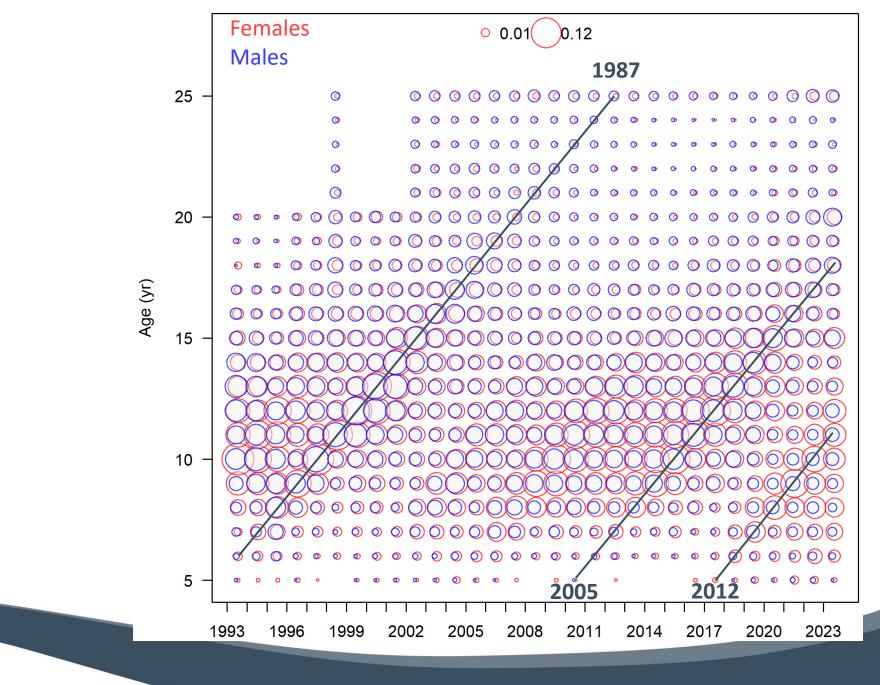
FISS and Fishery O32 catch-rates

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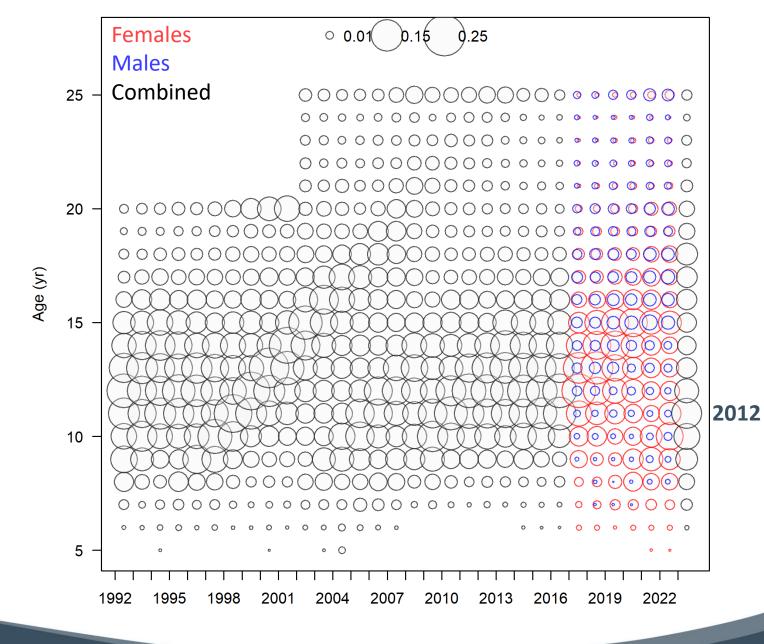
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FISS ages



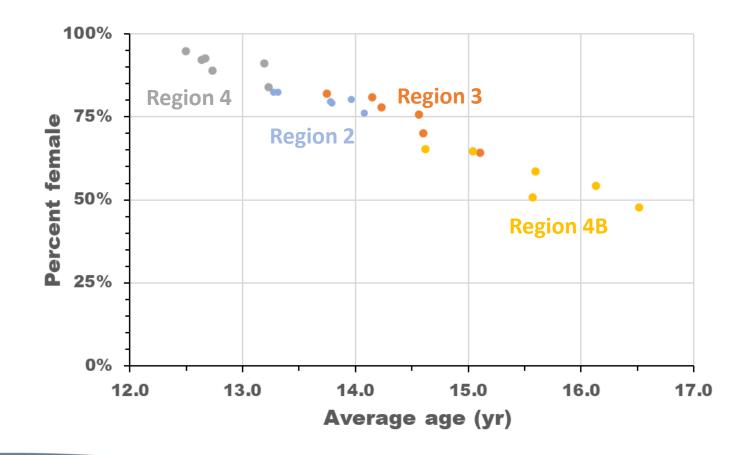
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Recent fishery ages



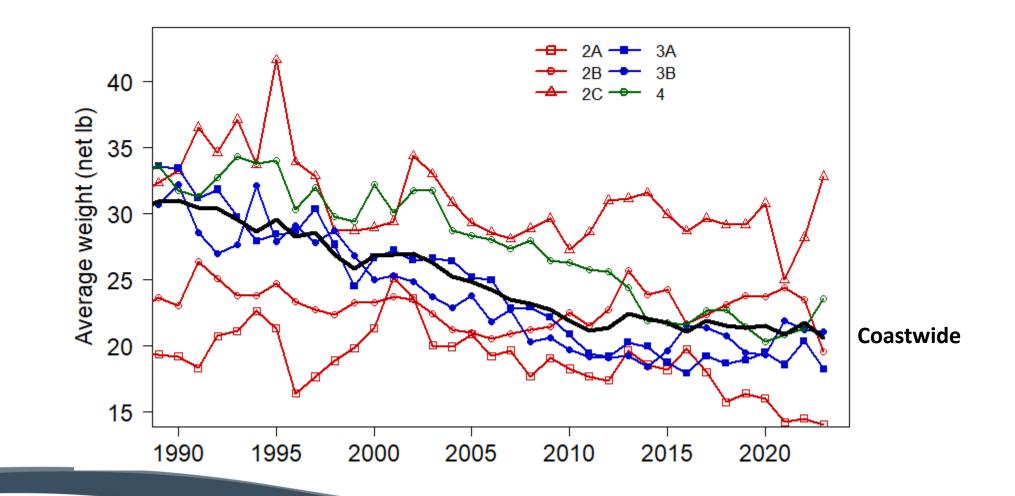


Fishery sex-ratios and average age 2017-2022





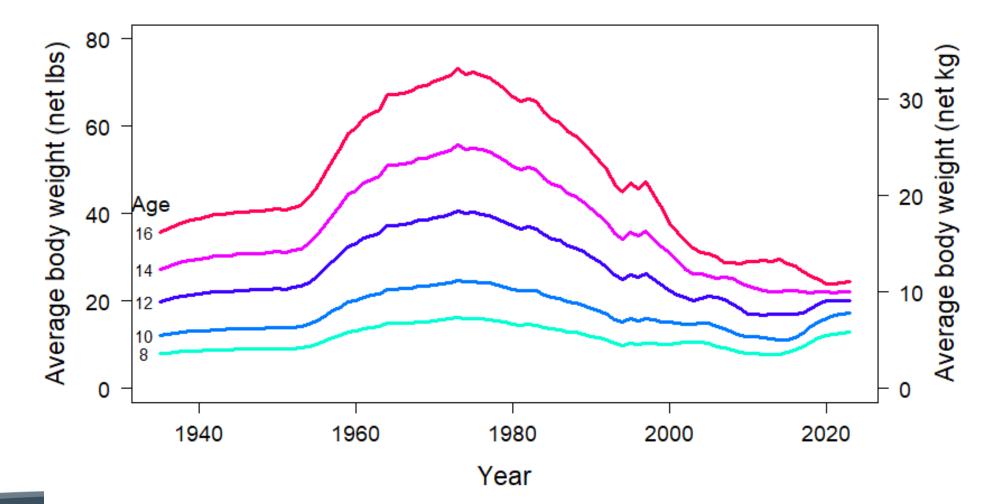
Average weight of landed fish



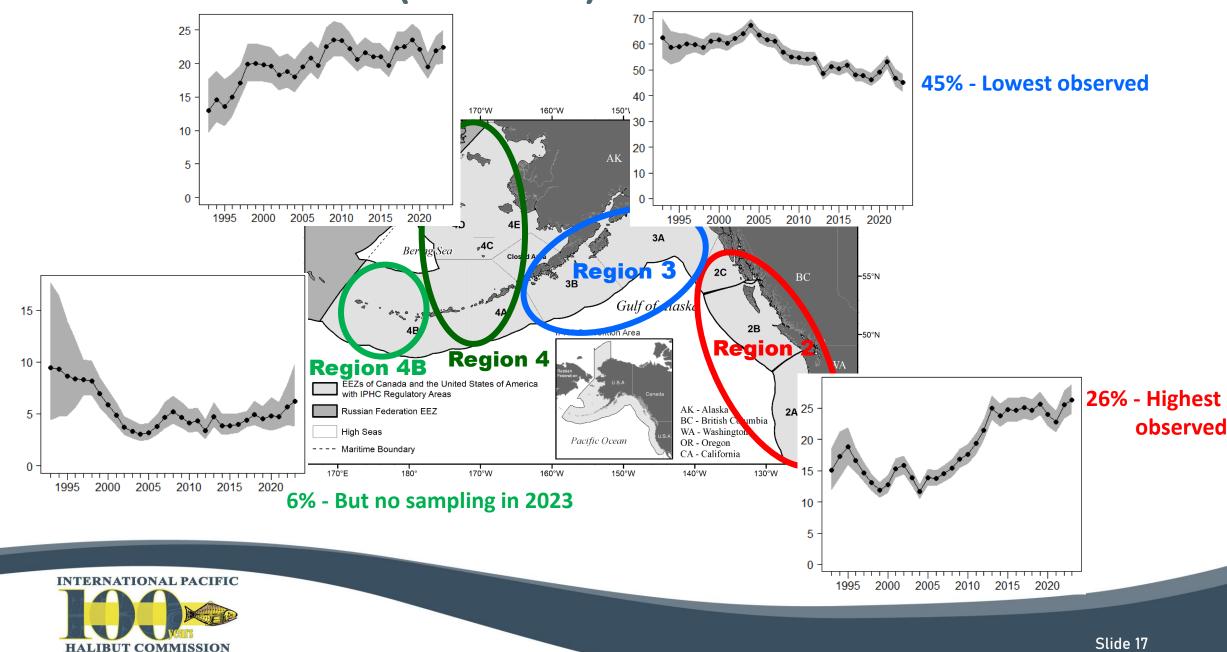
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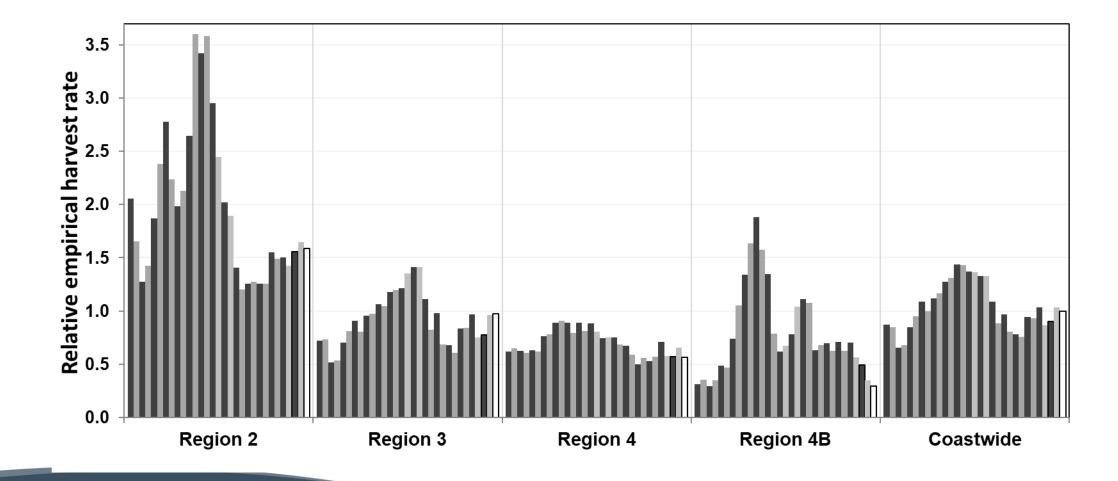
Female coastwide weight-at-age



Stock distribution (all sizes)

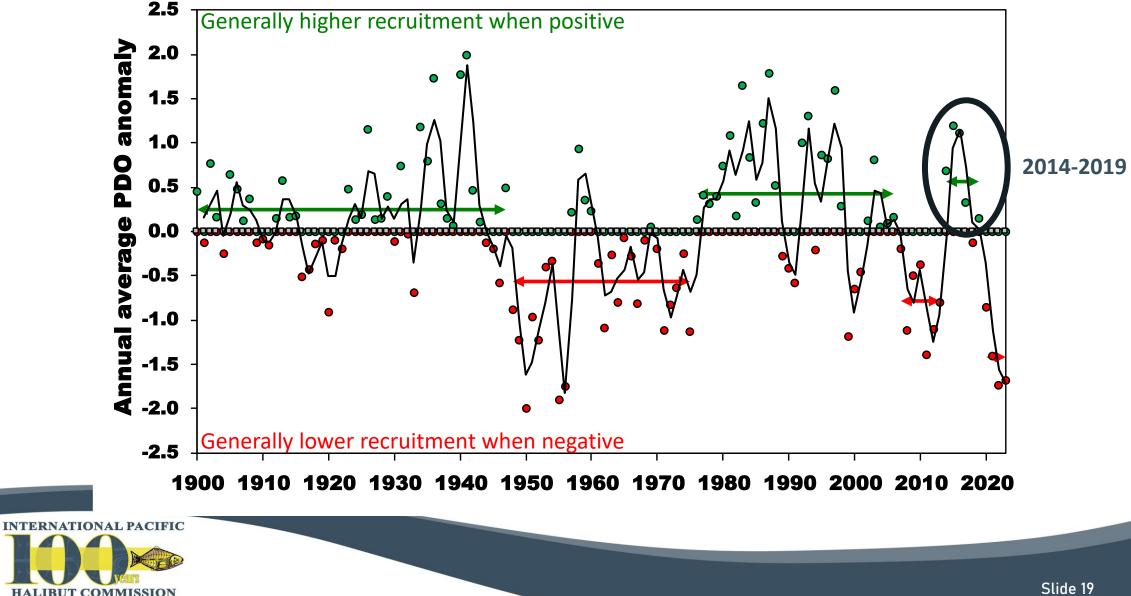


Empirical harvest rates (1993-2023): Mortality/survey index





Ecosystem conditions: Pacific Decadal Oscillation (PDO)



Recent ecosystem conditions

- <u>Bering Sea</u> (2023): Oceanography (e.g., temperature, ice cover) near-normal, but biology/species distributions remain in transition, crab stocks low
- <u>Aleutian Islands</u> (2023): Continued warm water (10+ years), changing relationships between key indicators (e.g., temperature and PDO)
- <u>GOA</u> (2023): No clear indicators, good or bad, for Pacific halibut
- <u>B.C.</u> (2022): Reduced upwelling, warmer waters than usual with negative PDO
- *California current* (2022/23): Marine heatwave, mixed productivity across species

Take-away: Continued change, low predictability

<u>References</u> (most recent reports): <u>Bering Sea</u>, <u>Gulf of Alaska</u>, <u>Aleutian Islands</u>, <u>B.C.</u>, <u>California current</u>

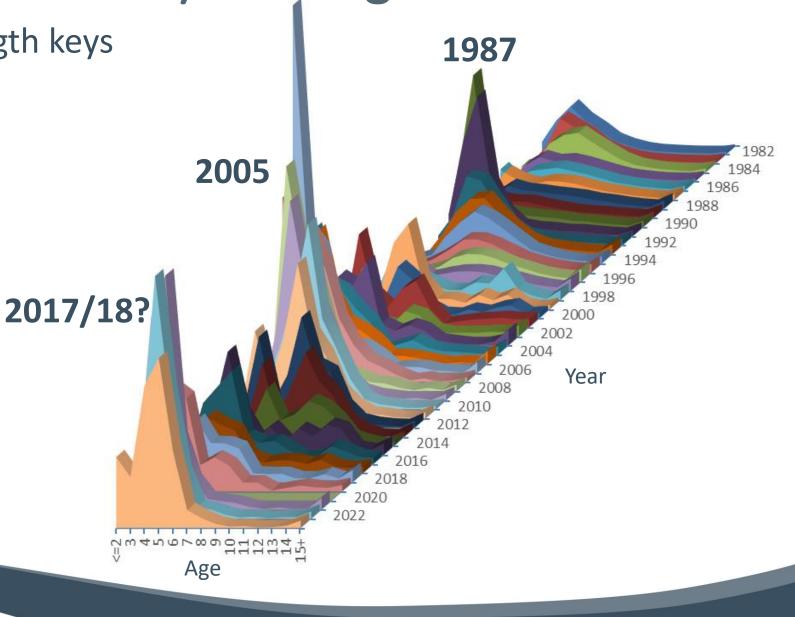


NOAA Fisheries trawl survey - Bering Sea

Numbers at age from age-length keys

Caveats:

- Not all Pacific halibut recruitment occurs in the Bering Sea
- 1987 was a much larger coastwide recruitment than 2005
- It will be 1-3 years before we get good direct estimates of the 2017/18 cohorts in the FISS and commercial fisheries



Outline

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Stock assessment development history

- 2015: Full assessment formalized 4-model ensemble methods
- 2016-2018: Updates
- 2019: Full assessment included new commercial fishery sex-ratio data
- 2020-2021: Updates
- 2022: Full assessment improved treatment of natural mortality, data weighting
- 2023: Update
 - SRB review of development in June (SRB022)
 - Final recommendations in September (SRB023)
- 2024: Update planned
- 2025: Full assessment planned



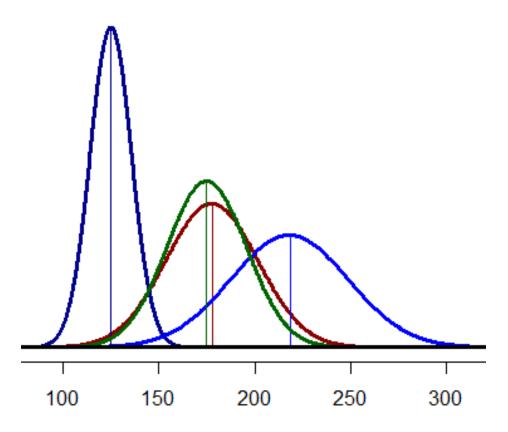
Whale depredation

- From logbooks and observer records:
 - Area 4 experiences the highest Orca depredation rates
 - Areas 2C and 3A experience the highest Sperm whale depredation rates
- Based on logbook-reported depredation rates and survey-estimated magnitude:
 - At least 1.4 Mlbs of lost yield since 1995
 - Adding this information to the assessment
 - Spawning biomass scales upward slightly (1-3%)
 - Projected yield larger, but loss to depredation subtracted off
 → No net change in mortality limits
- This analysis only represents the level of whale depredation reported in logbooks
- Whale depredation also affects fishery catch rates, and is not currently accounted for in the WPUE time-series



2023 stock assessment

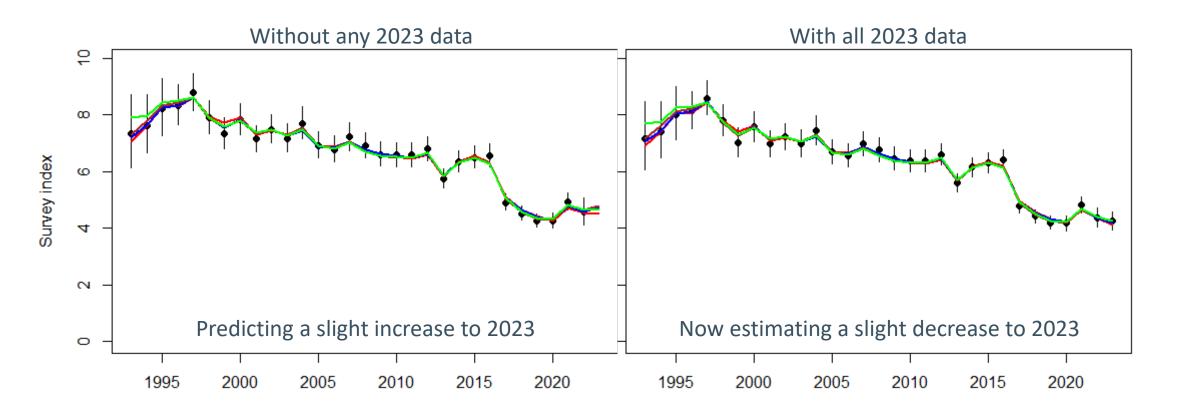
- Same 4 models as in recent assessments:
 - Long and short time-series
 - Aggregated, separate data by Region
- Equally weighted
- No changes to assessment or individual model structure for 2023



2024 Spawning biomass (M lb)

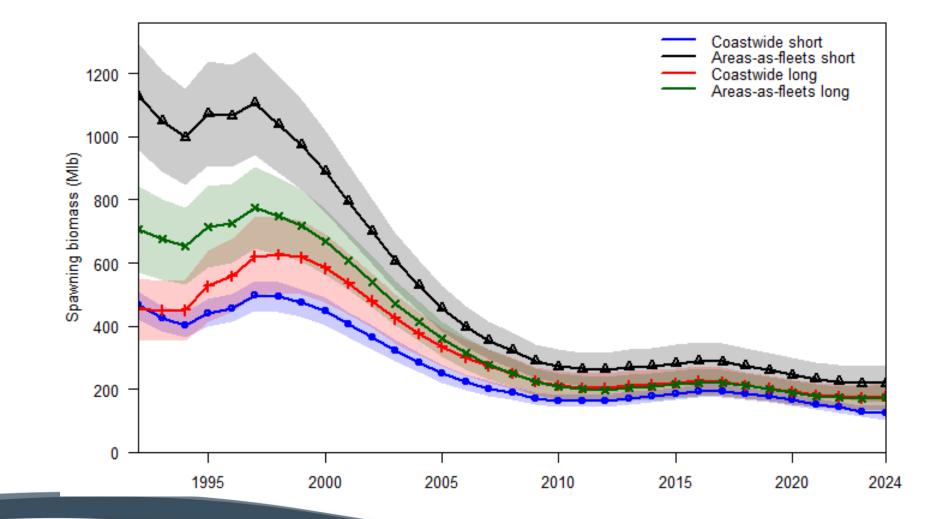


Fit to FISS index





Summary of four individual models

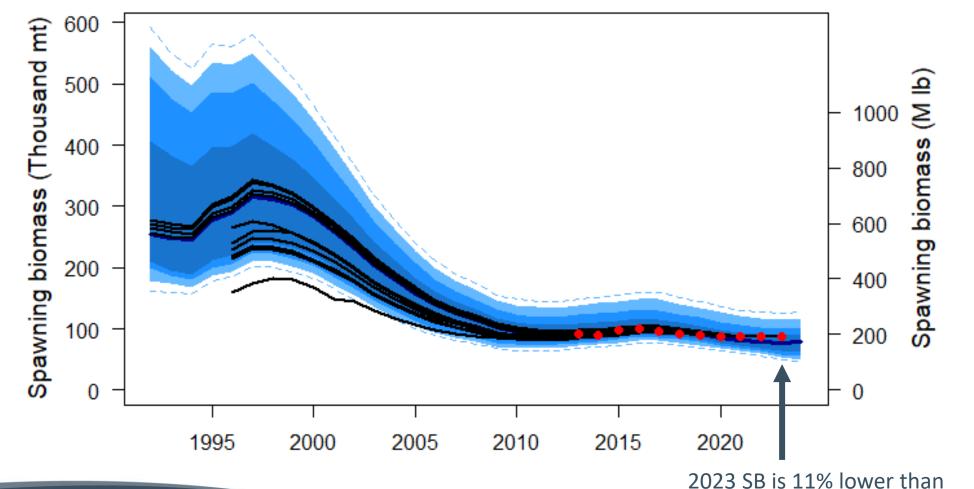


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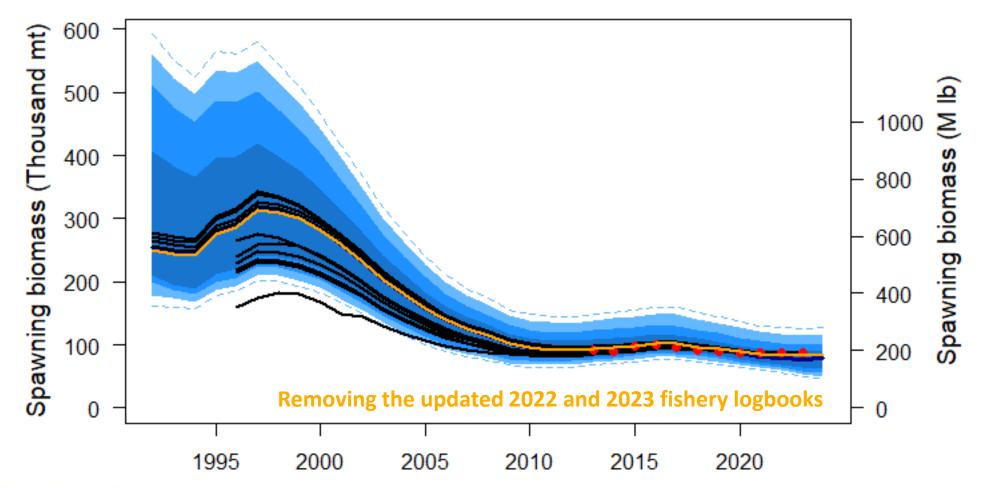
Comparison to previous assessments



it was estimated to be last year.

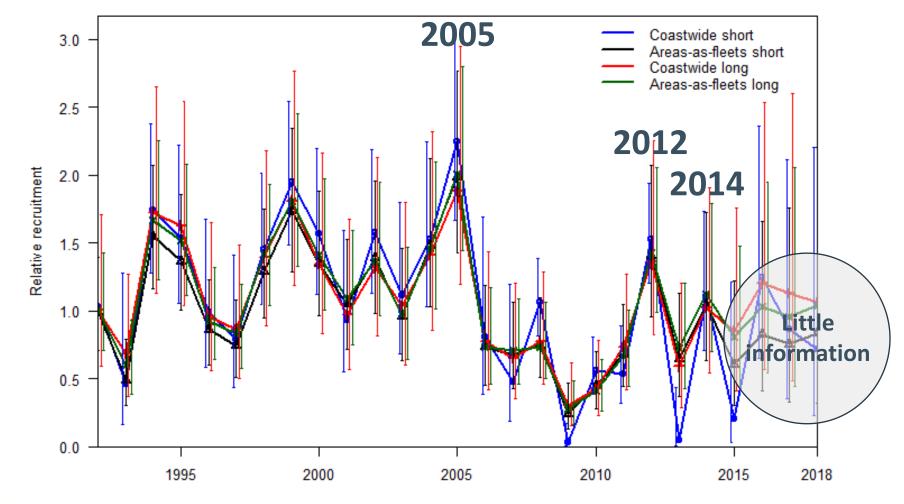


Effect of updated fishery CPUE



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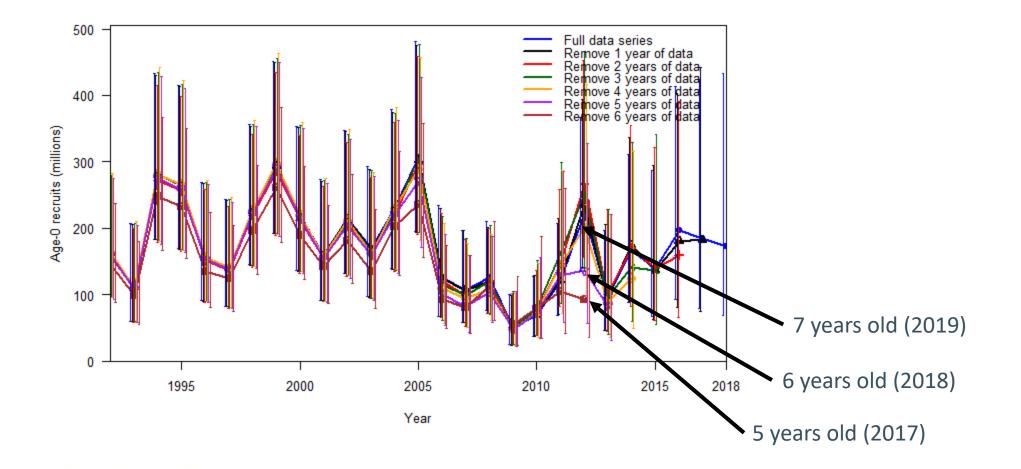
Relative recruitment estimates



Year

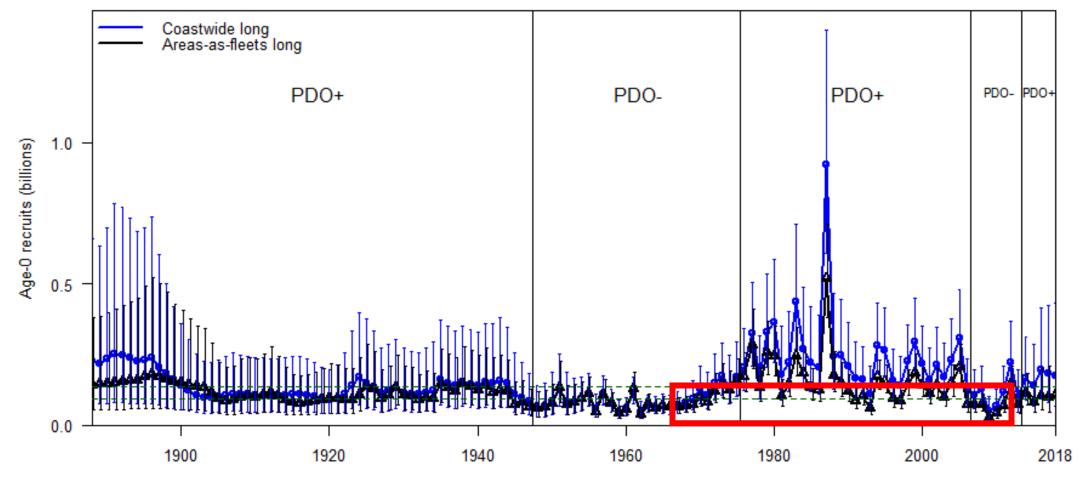
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Learning about year class strengths: 2012





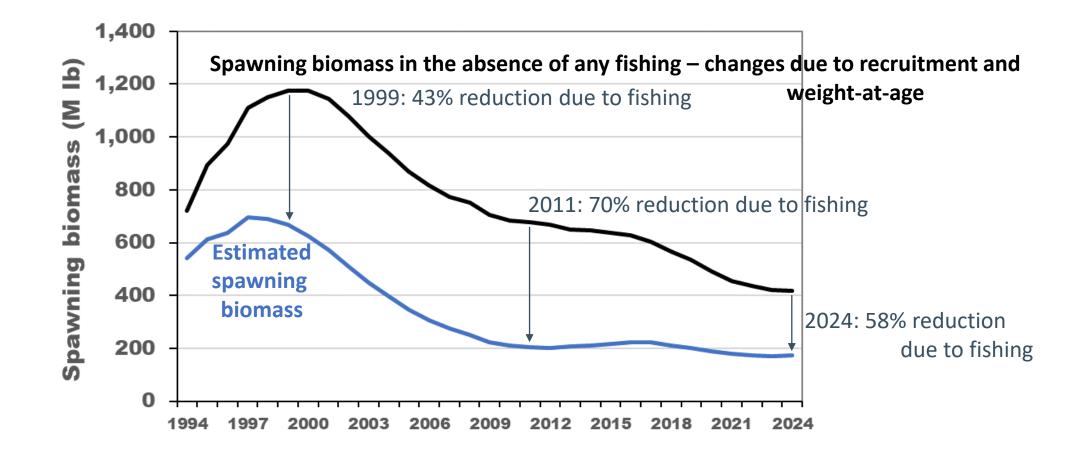
Historical recruitment estimates



Year

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Stock status – measuring the effect of fishing





Stock assessment summary table

Indicators	Values	Trends	Status					
BIOLOGICAL								
SPR ₂₀₂₃ :	52% (31-66%) ²	FISHING INTENSITY	FISHING INTENSITY					
P(SPR<43%):	27%	REDUCED FROM 2022	BELOW REFERENCE					
P(SPR <limit):< th=""><th>LIMIT NOT SPECIFIED</th><th>то 2023</th><th>LEVEL³</th></limit):<>	LIMIT NOT SPECIFIED	то 2023	LEVEL ³					
	20/0	SB INCREASED 2% FROM 2023 TO 2024	Not overfished ⁴					
Biological stock distribution:	See Tables and Figures	REGION 3 DECREASED, REGION 2 INCREASED FROM 2022 TO 2023	Region 3 at the LOWEST OBSERVED PROPORTION					
FISHERY CONTEXT								
Total mortality 2023:	35.87 Mlbs, 16,270 t ¹	Mortality	2023 MORTALITY					
Percent retained 2023:	83%	DECREASED FROM	NEAR 100-YEAR					
Average mortality 2019–23:	37.37 Mlbs, 16,951 t	2022 то 2023	Low					



Summary of results

- Fishery CPUE dropped more than expected in 2022 and 2023, this translated to an 11% decrease in the estimated 2023 spawning biomass compared to last year's assessment
- Neither the 2012 or 2014 year-classes are estimated to be large enough to provide for an appreciable stock or fishery increase at current biomass levels
- It will be 1-3 years before we have clear coastwide information on the potential 2016-2018 year-classes observed in trawl and other data



Recommendations

That the Commission:

1) NOTE paper IPHC-2024-AM100-10, which provides a summary of the data and the results of the 2023 stock assessment.



