



Data overview and stock assessment at the end of 2023

Agenda Item 5.2
IPHC-2024-IM099-10 Rev_1
(I. Stewart, A. Hicks, R. Webster, & D. Wilson)



Outline

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

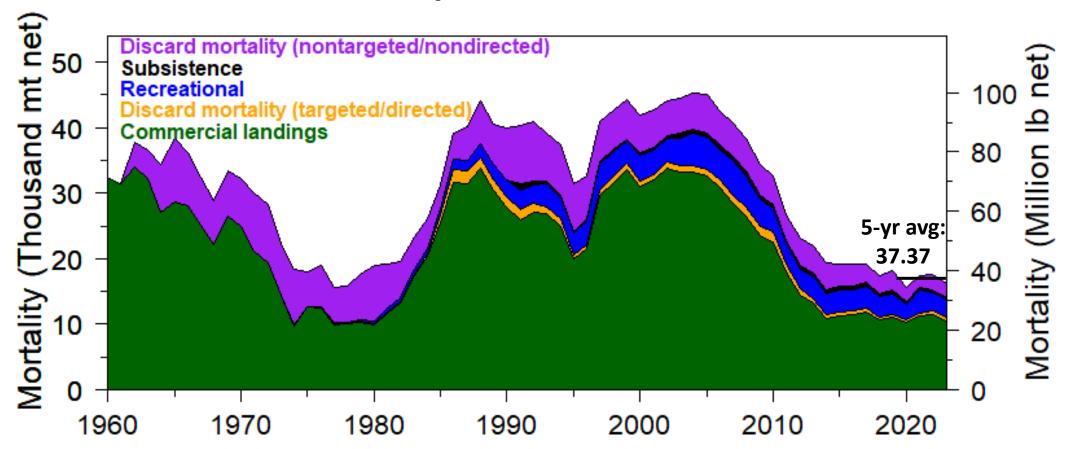


Summary

- Fishing mortality: down slightly in 2023
- Trends: FISS down 2-4% (numbers/pounds), fishery down 12%
- Existing age classes:
 - 2012 and 2014 moderately large not large enough to support a fishery increase at current biomass levels
 - Weight-at-age: mixed flat or increasing trends
- Upcoming age classes: possible 2017-2018 year-classes
- Biomass: spawning biomass trend is nearly flat, at 42% of the unfished level
- Fishing intensity: 2023 lowest in recent years



Historical mortality





2023 Mortality

Projected from AM099 based on adopted mortality limits

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

Estimated for this year's stock assessment analysis

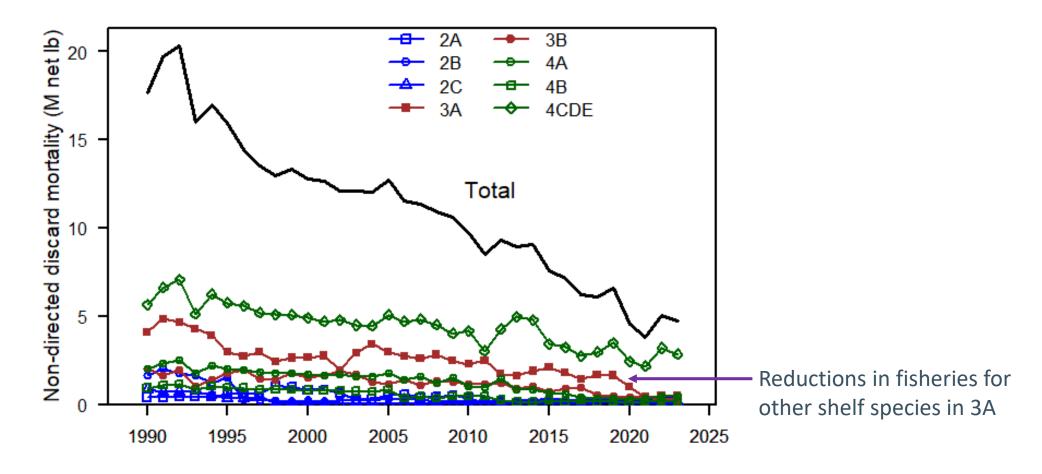
Year		Commercial discards	Recreational	Subsistence	Non- directed discards	Total
2023	22.97	1.31	6.01	0.83	4.76	35.87

3-yr avg: **4.56**

- Down 7% from 2022
- 1.64 Mlbs above 2020
- 83% utilized

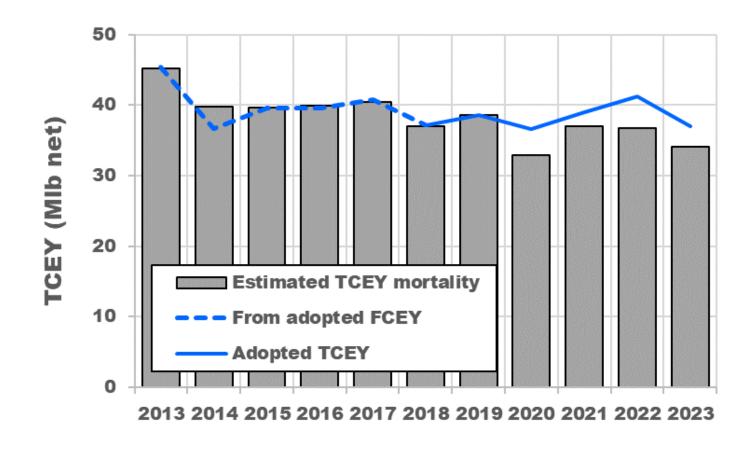


Recent non-directed discard mortality





Recent TCEYs



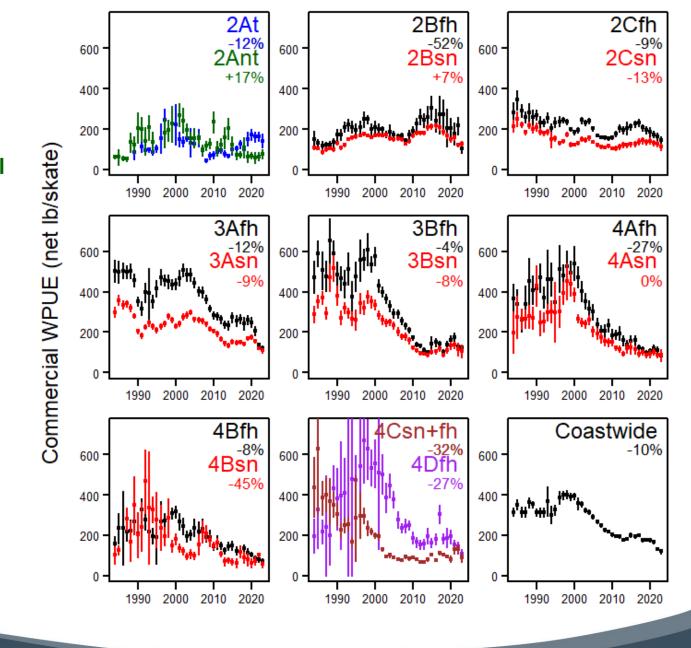


Fishery trends: O32

2A Tribal
2A non-Tribal

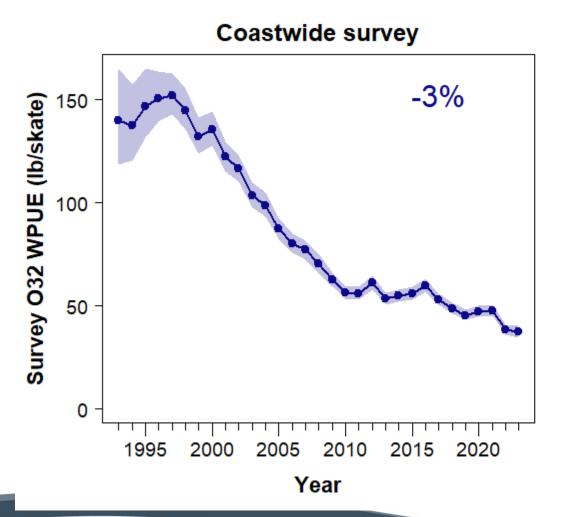
Fixed hook Snap

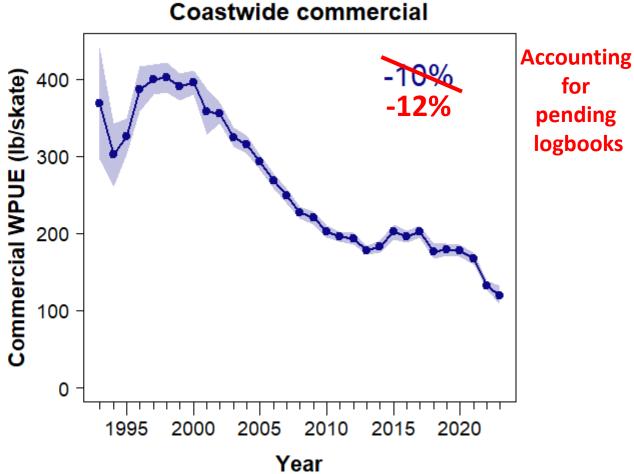
4C 4D





Fishery and FISS trends

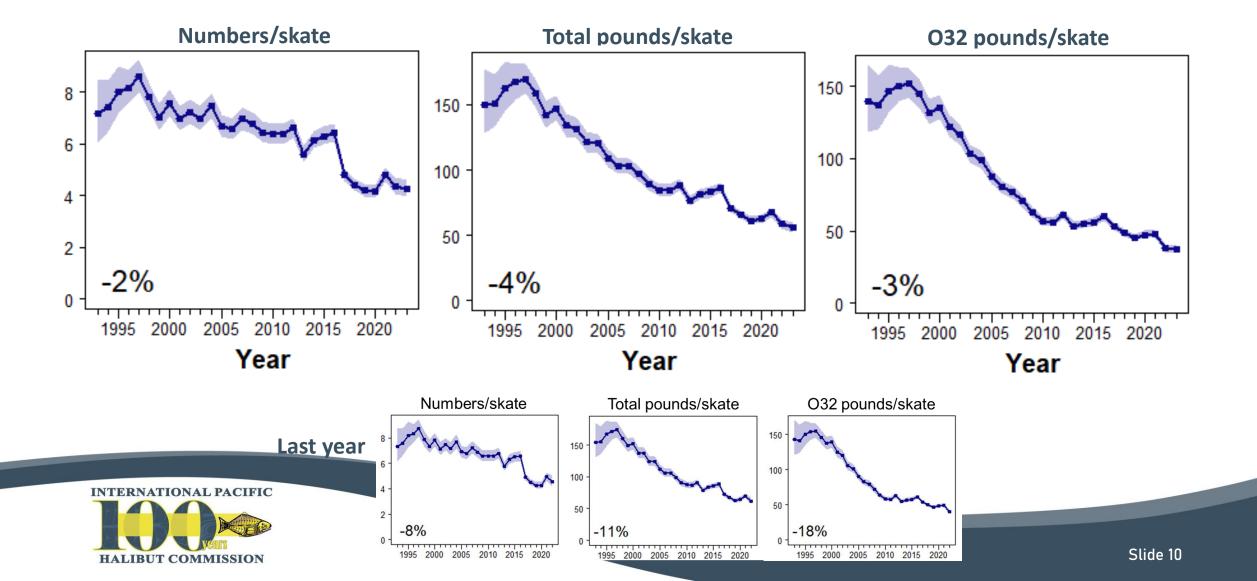




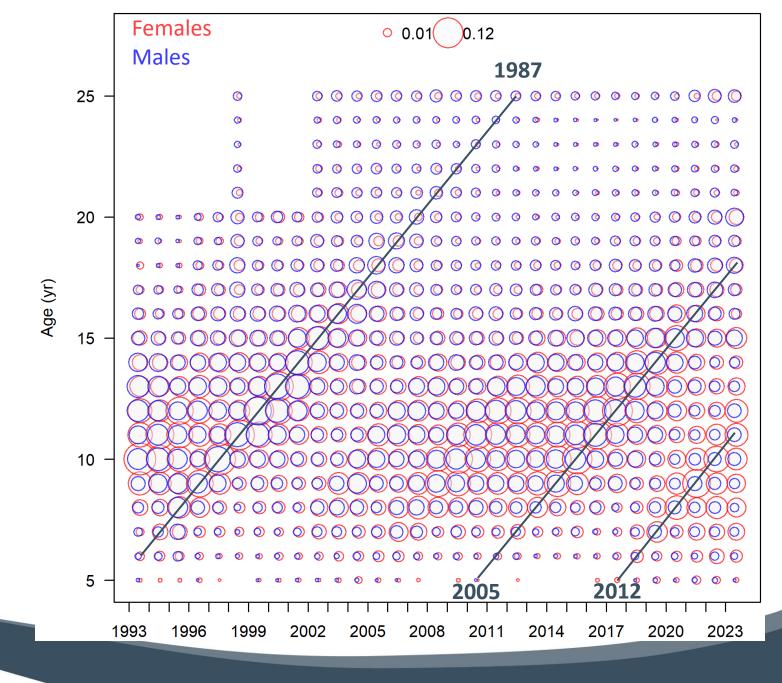


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Coastwide FISS trends

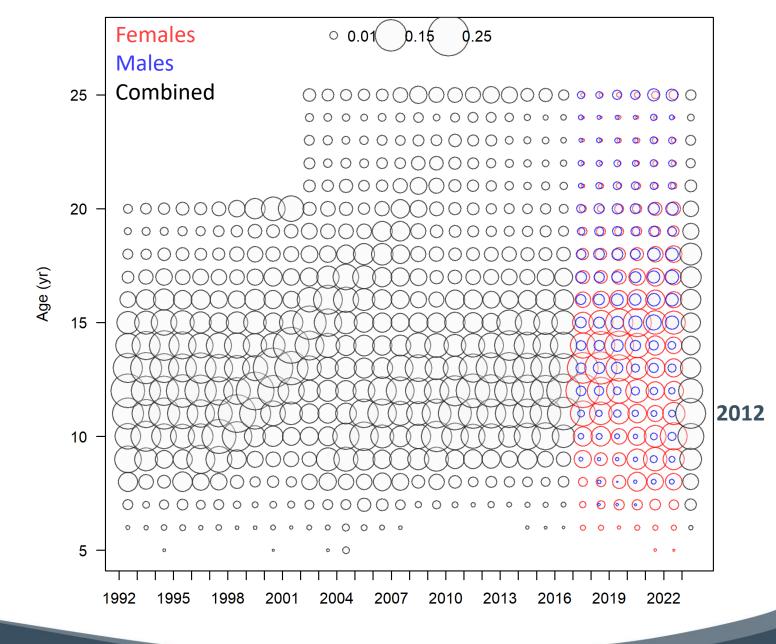


FISS ages



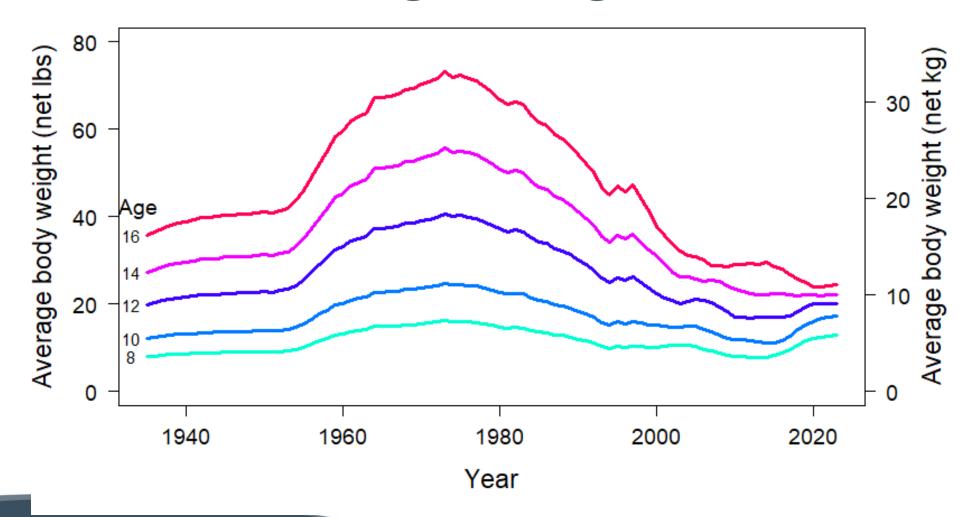


Recent fishery ages





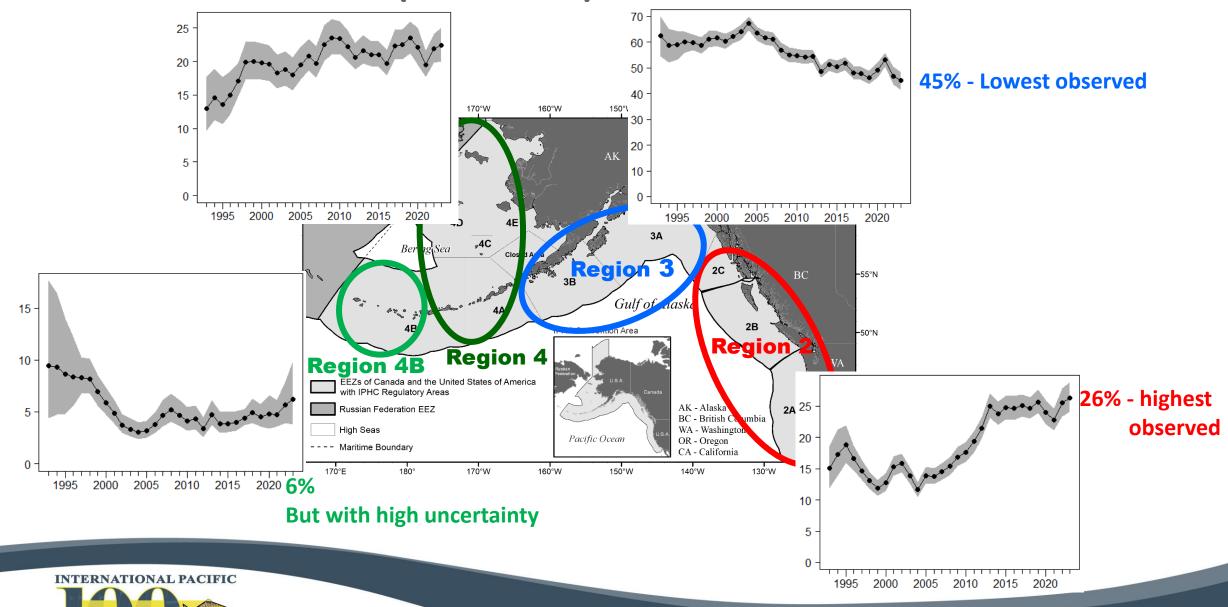
Female coastwide weight-at-age



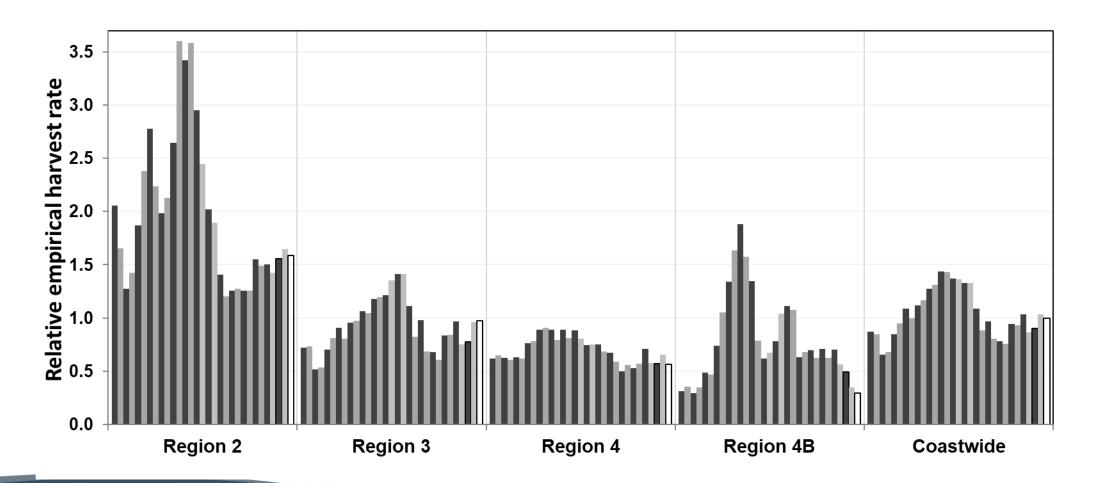


Stock distribution (all sizes)

HALIBUT COMMISSION

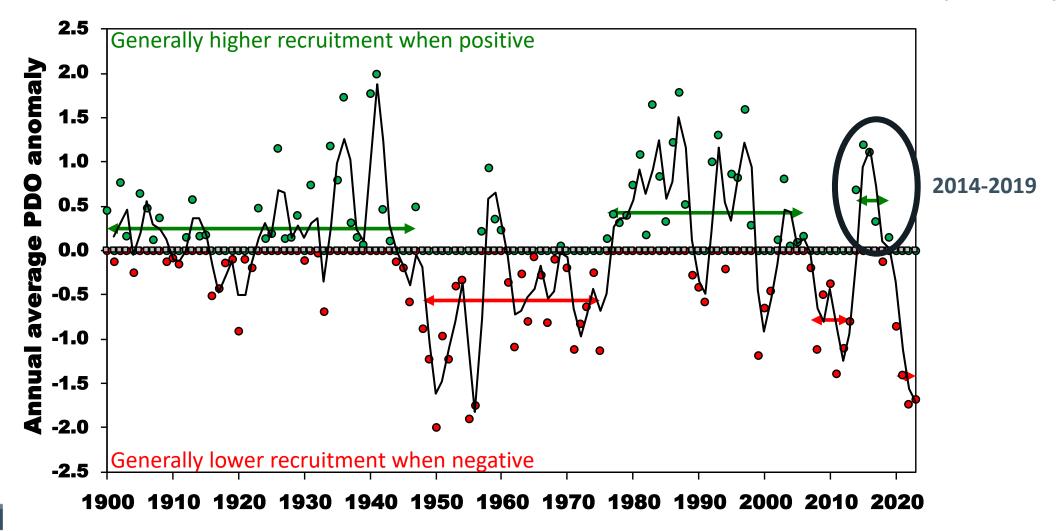


Empirical harvest rates (1993-2023): Mortality/survey index



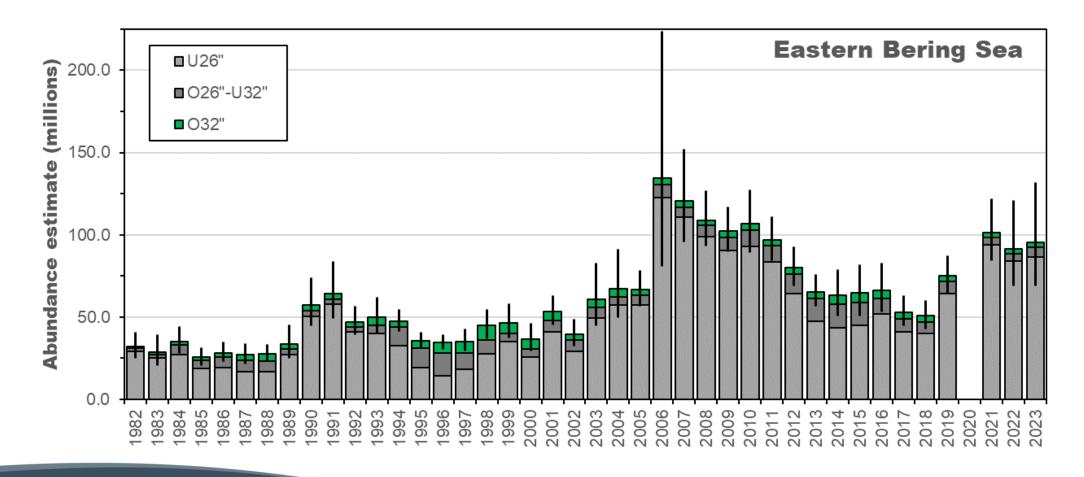


Ecosystem conditions: Pacific Decadal Oscillation (PDO)





NOAA Fisheries trawl survey - Bering Sea



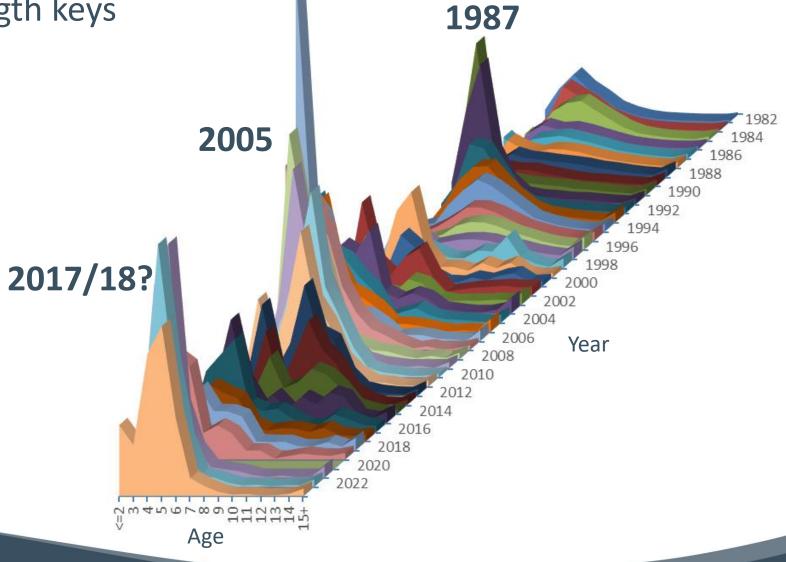


NOAA Fisheries trawl survey - Bering Sea

Numbers at age from age-length keys

Caveats:

- 1987 was a much larger recruitment coastwide than 2005
- It will be 2-4 years before we get direct estimates of the 2017/18 cohorts in the FISS and commercial fisheries





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)
- GOA (2023): No clear indicators, good or bad, for Pacific halibut
- B.C. (2022): Reduced upwelling, warmer waters than usual with negative PDO
- California current (2022/23): Marine heatwave, mixed productivity across species
- <u>Take-away</u>: Continued change, low predictability

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



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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



2023 Stock assessment development

- 2023: Update
 - SRB review of development options in June (SRB022)
 - Model weighting
 - → Continue using equal weighting
 - Frequency of commercial sex-ratio processing
 - Estimation of natural mortality
 - Whale depredation estimates from logbooks
 - Spatial population structure



2023 Stock assessment development

- 2023: Update
 - Final recommendations in September (SRB023)
 - Whale depredation (including observer data) affect on stock assessment
 - → Don't include for 2023
 - Model weighting
 - Frequency of commercial sex-ratio processing
 - → Continue annual analyses while stock is declining
 - → Investigate approaches to quantifying uncertainty via simulation testing
 - → Including simulation testing with alternative FISS designs



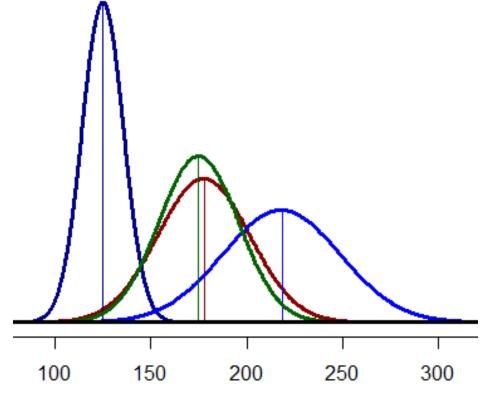
Whale depredation summary

- 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
 - Assessment model spawning biomass scales upward slightly (1-3%)
 - 0.20 Mlbs would have been projected for 2023 (deducted from the directed commercial landings and discard mortality)
 - The two effects nearly cancel: mortality limits to achieve the same SPR result in nearly identical net fishery limits (+0.02Mlbs)



2023 stock assessment ensemble

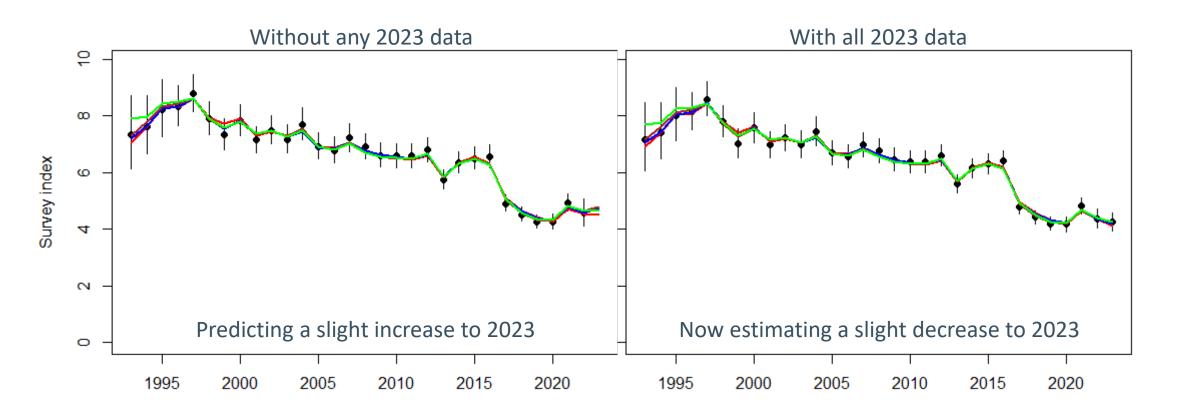
- Same 4 models as in recent assessments:
 - Long and short time-series
 - Aggregated, separate data by Region
- Equally weighted
- No changes to assessment or individual model structure for 2023



2024 Spawning biomass (M lb)

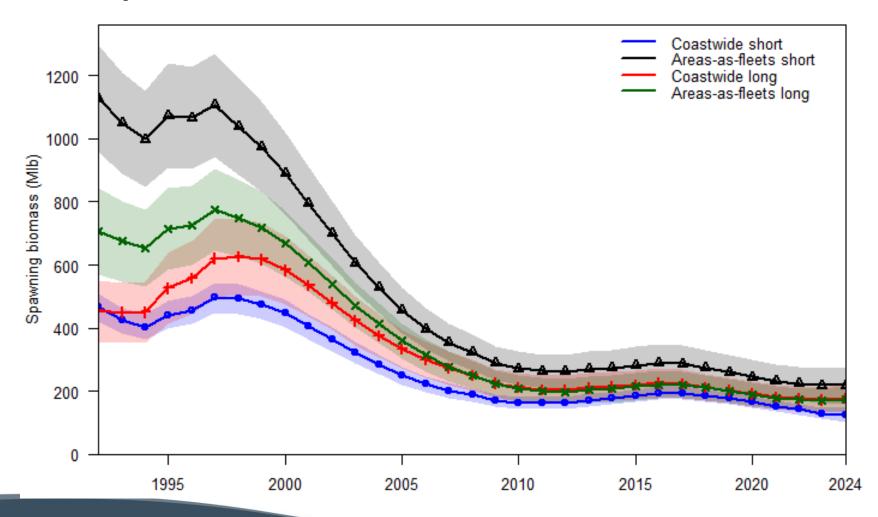


Fit to FISS index



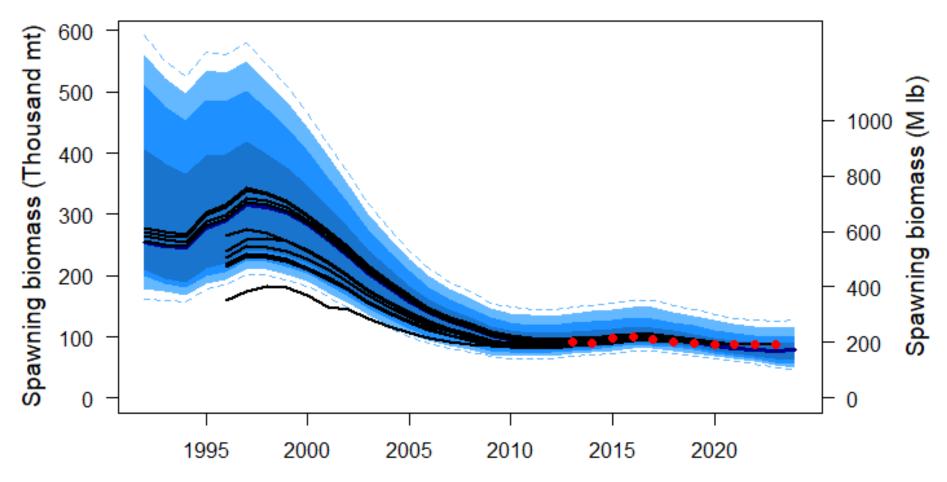


Summary of four individual models





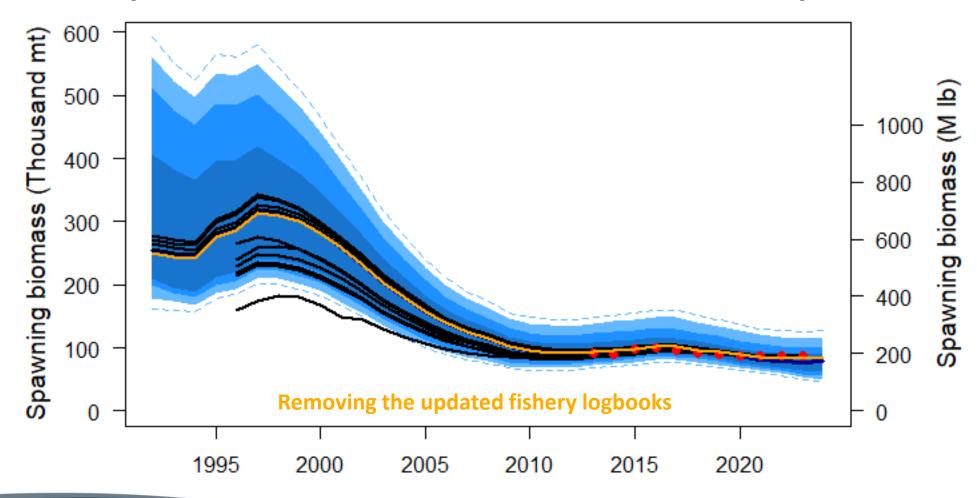
Comparison to previous assessments



2023 SB estimate is 11% lower than it was last year

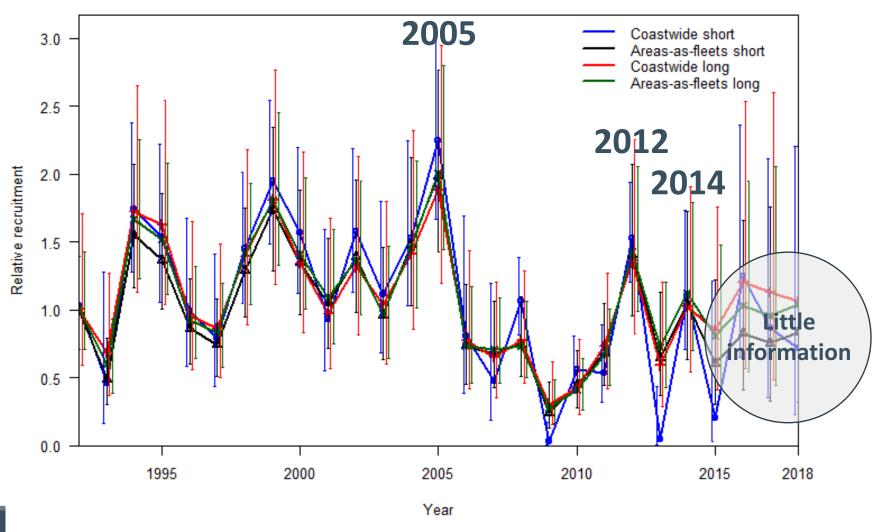


Effect of updated 2022 and 2023 fishery CPUE



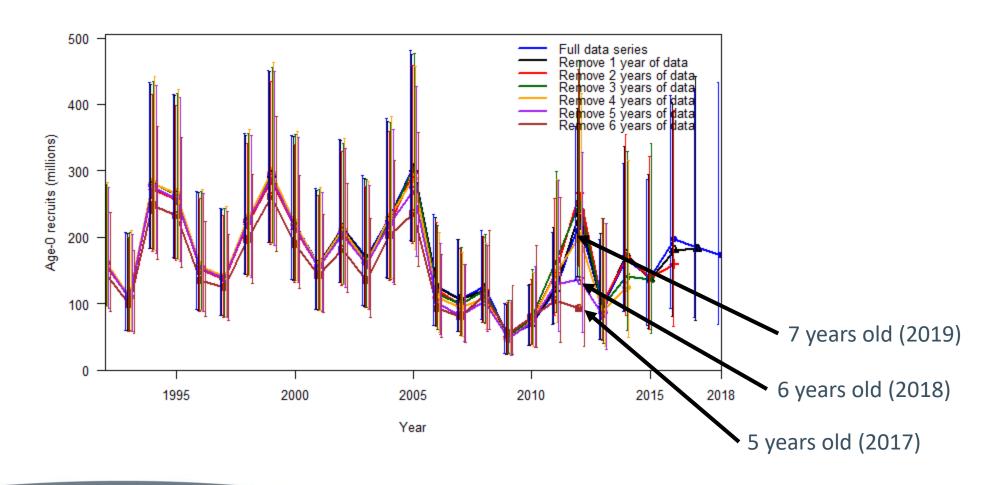


Relative recruitment estimates



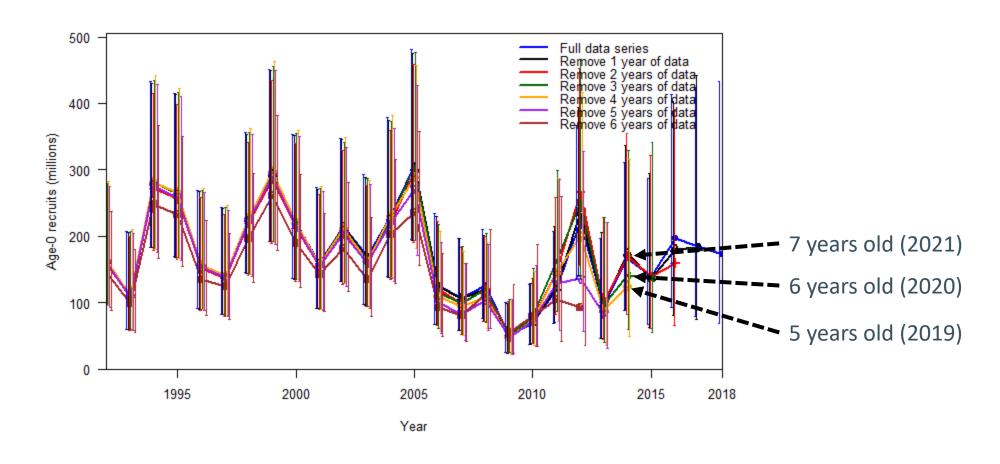


Learning about year class strengths: 2012



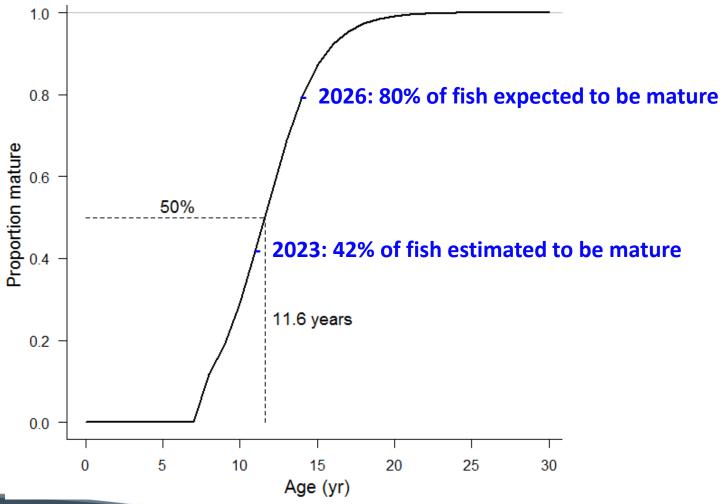


Learning about year class strengths: 2014



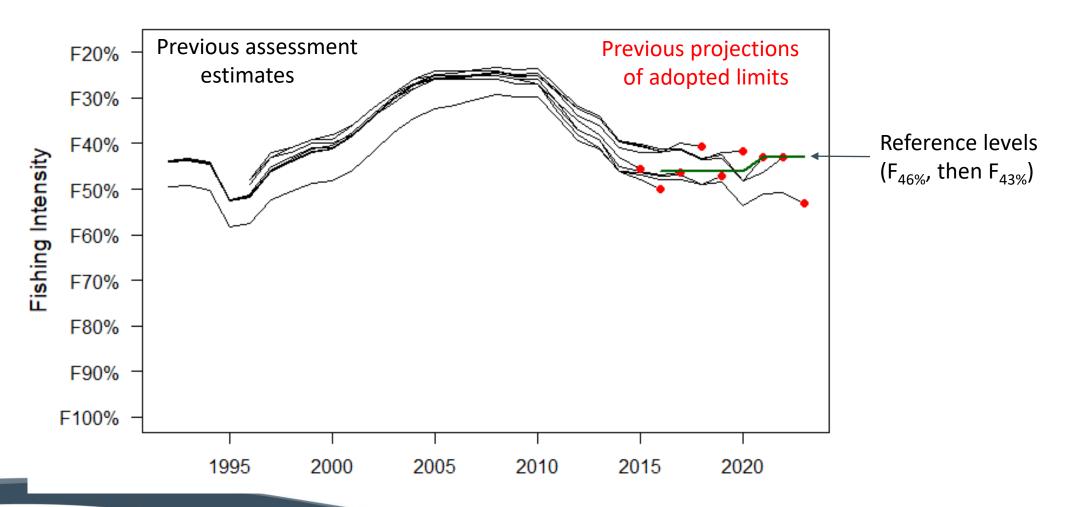


The 2012 year-class – still rapidly maturing



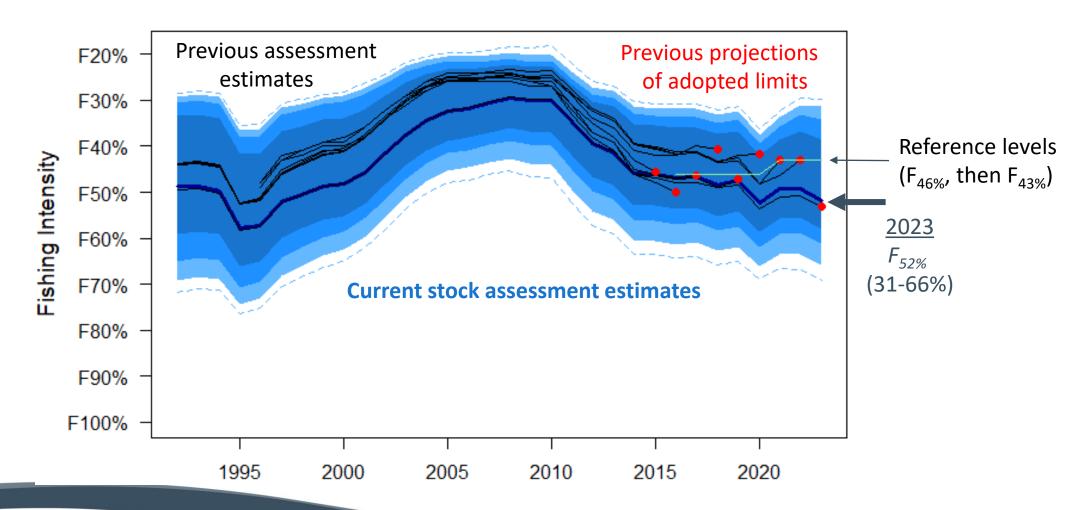


Estimated fishing intensity



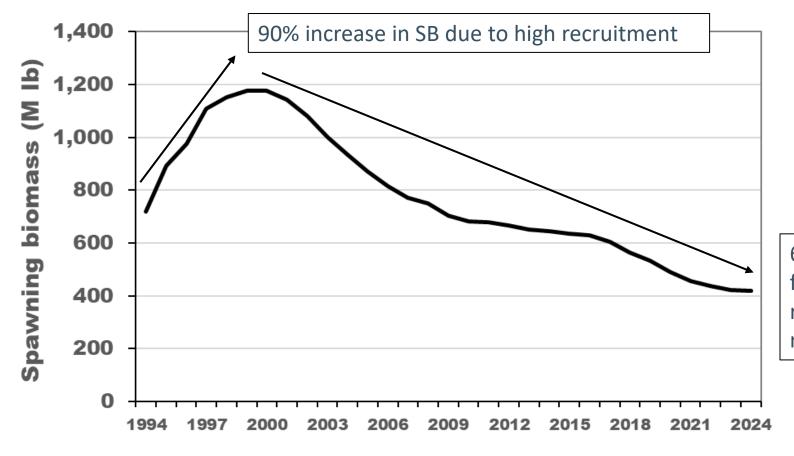


Estimated fishing intensity





Stock status – estimated unfished trend

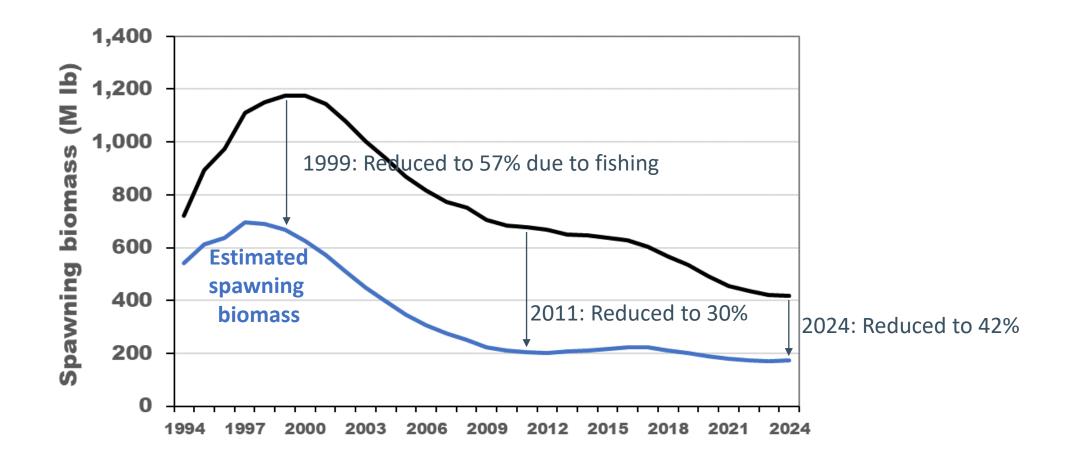


65% drop in SB due to factors other than fishing: reduced weight-at-age, low recruitment

Allowing for natural/normal stock variability (but not unique catastrophic events)

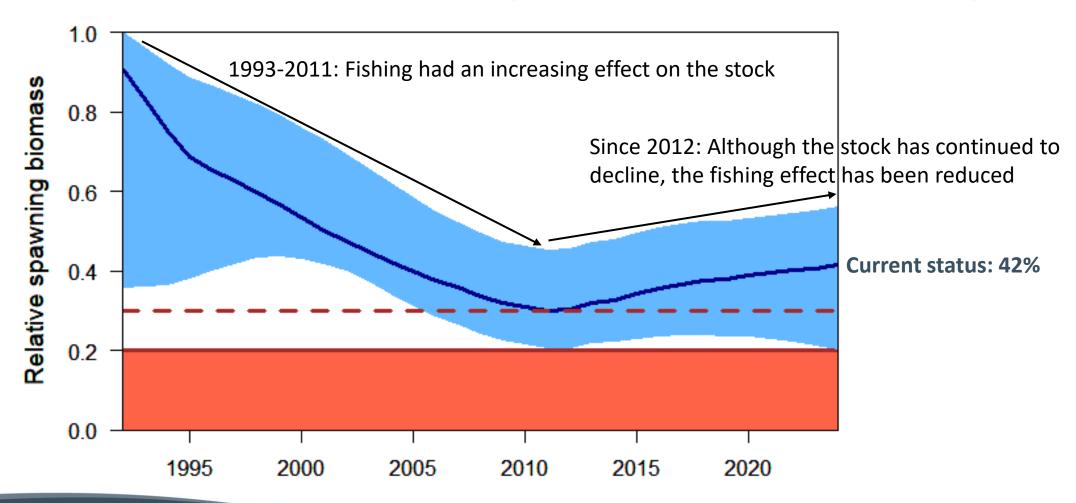


Stock status – measuring the effect of fishing





Stock status – measuring the effect of fishing





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 from last year's assessment
- Current spawning biomass trend is estimated to be nearly flat from 2022-2023
- The stock status is at 42% of the unfished level at the beginning of 2024
- 2012 and 2014 are both moderate year-classes, not 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 2017-2018 year-classes observed in trawl surveys



Recommendations

That the Commission:

1) NOTE paper IPHC-2023-IM099-10 Rev_1, which provides a summary of the data and the results of the 2023 stock assessment.



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