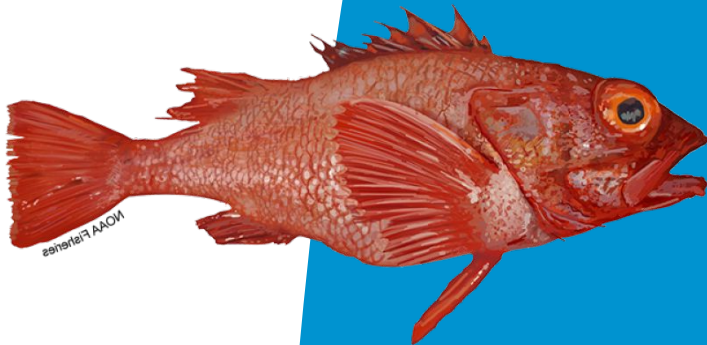




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Northwest Fisheries
Science Center



SHORTSPINE THORNYHEAD

(Sebastolobus alascanus)

2023 Pre-Assessment Workshop

*Madison Heller-Shipley, Joshua Zahner
Haley Oleynik, Jane Sullivan*

March 20, 2023

Team Members



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Shortspine Thornyhead (*Sebastolobus alascanus*)



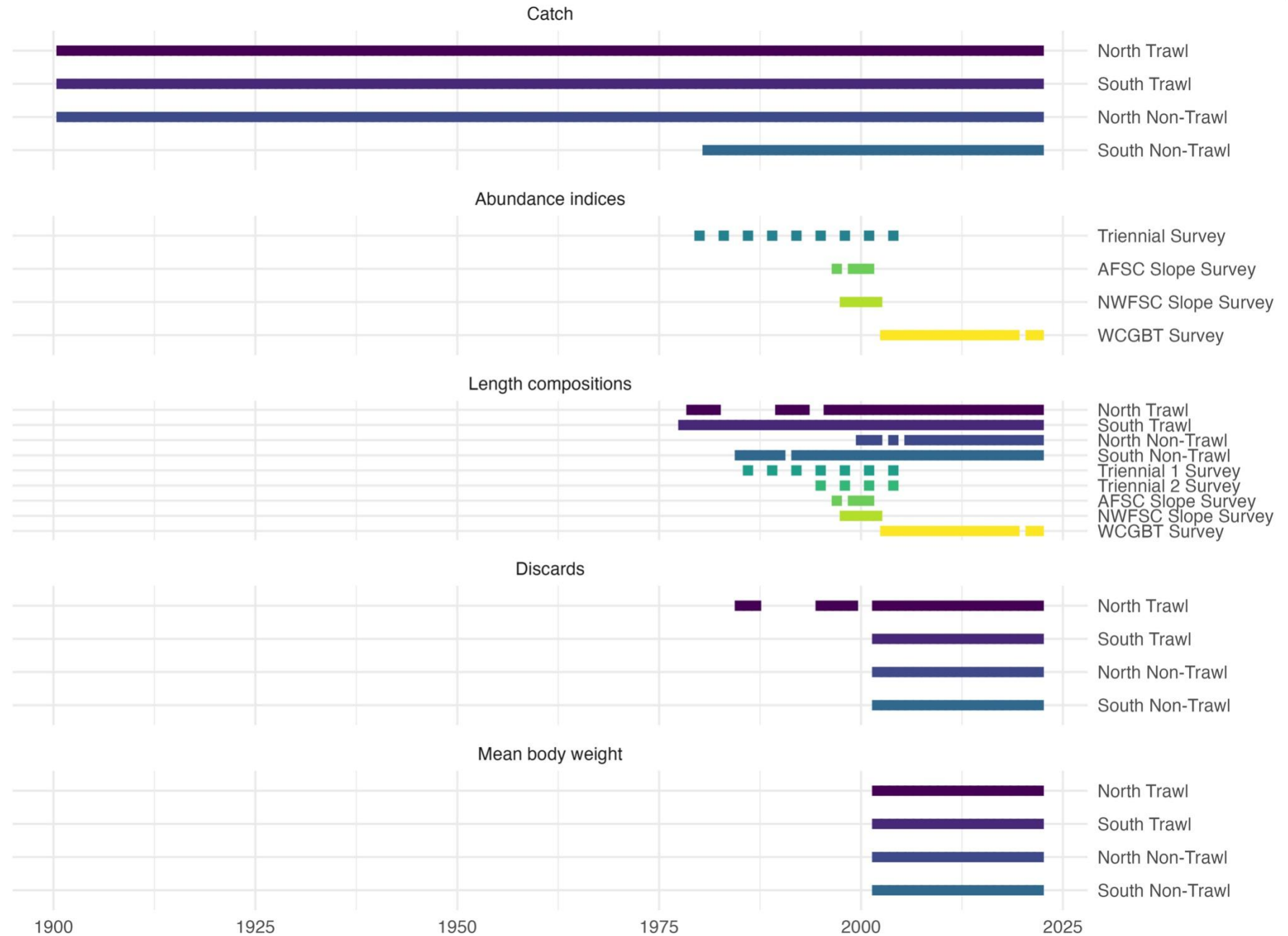
- West Coast of US (Baja to Bering Sea); 20-1500 m depth range
- Tend to settle 100-400 m → ontogenetic movement to greater depths
- Long lived species (max age ~100 years)
- Historically caught alongside Dover Sole and Sablefish
- *Last assessed in 2013; original benchmark in 2005*

2013 Research and Data Needs

- Additional research into ageing methods and maturity
- A comprehensive catch reconstruction pre-1981
- Exploration of simpler assessment methods



Data Overview



Fisheries Dependent Data



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Fishery Dependent Data

Type	Source	Abbrev.
Landings	Pacific Fisheries Information Network State Reconstructions	PacFIN
Discards	West Coast Groundfish Observer Program Enhanced Data Collection Project Pikitch et al., 1988 Groundfish Expanded Mortality Multiyear	WCGOP EDCP Pikitch GEMM
Lengths	PacFIN for landings, WCGOP and Pikitch for discards	
Ages	<i>None Available</i>	



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Landings Data Overview

Landings Data

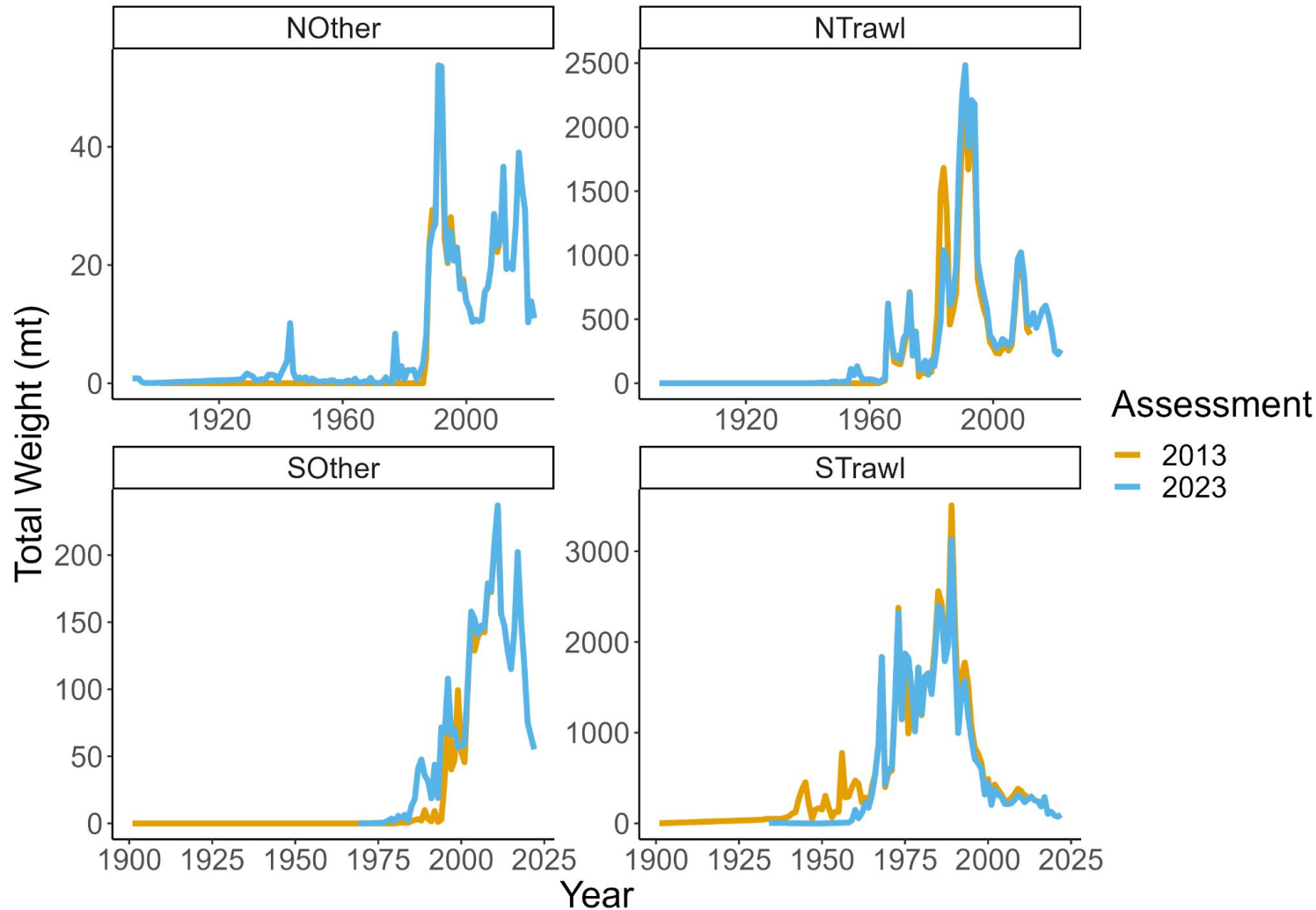
- Historical data from California, Oregon, and Washington (1900 - 1981)
- Recent data from PacFIN (1981 - 2023)

2013 assessment fleet structure:

1. **'NTrawl'** = OR/WA trawl
2. **'NOther'** = OR/WA non-trawl
3. **'STrawl'** = CA trawl
4. **'SOther'** = CA non-trawl



Catch comparison with 2013 assessment

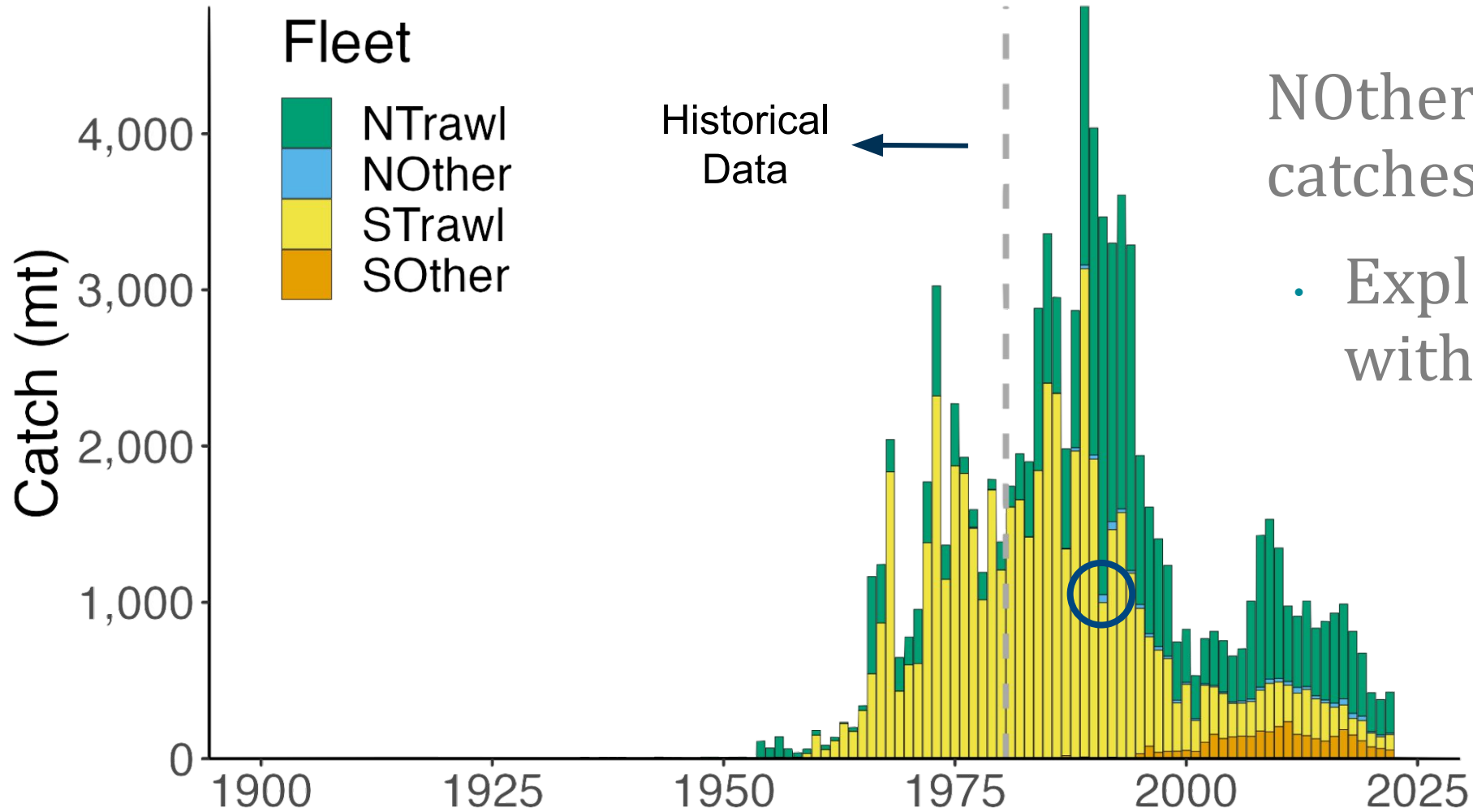


Large agreement between 2013 and 2023 catch estimates *except:*

- Additional early catches in North
- Reduced early catches in South



Full catch time series

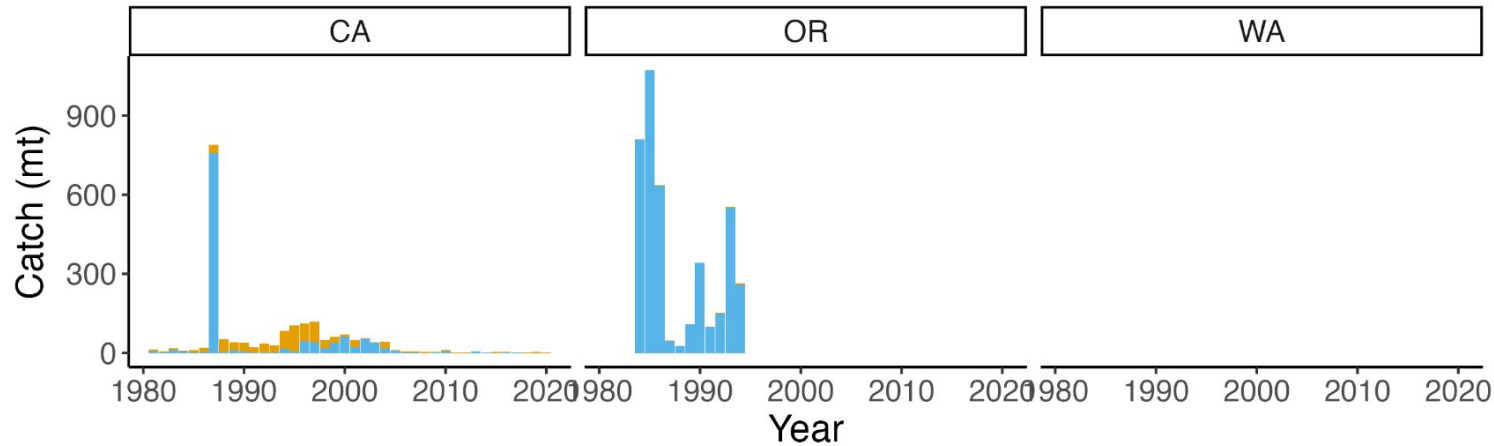


NOther (non-trawl) catches very small

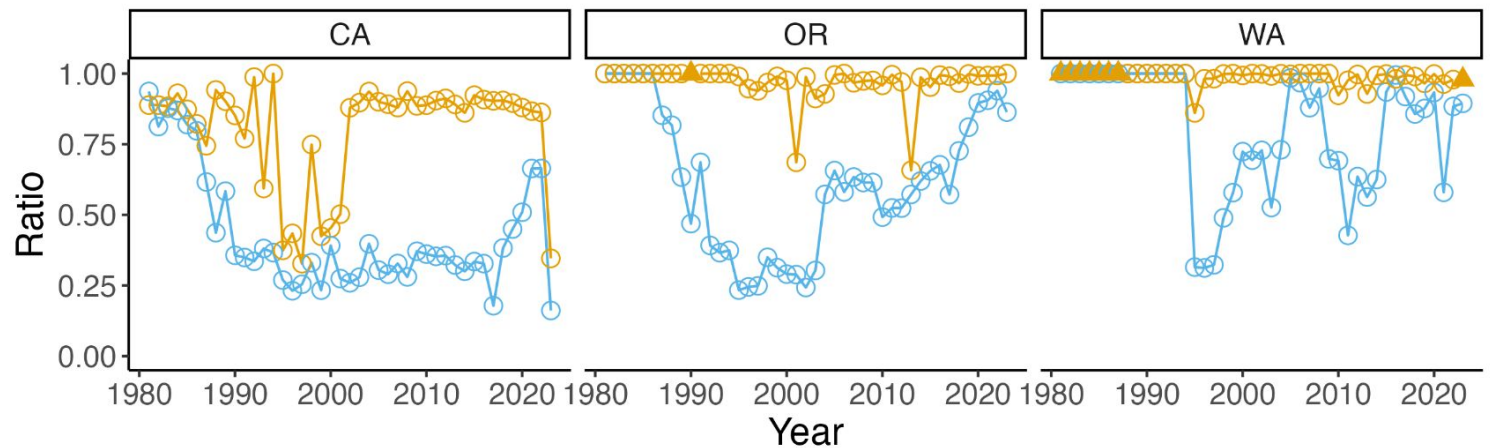
- Explore combining with SOther fleet

Estimating unidentified thornyhead catch

Unidentified Thornyheads Catch (mt)



Proportion Shortspine in Identified Thornyhead Catch



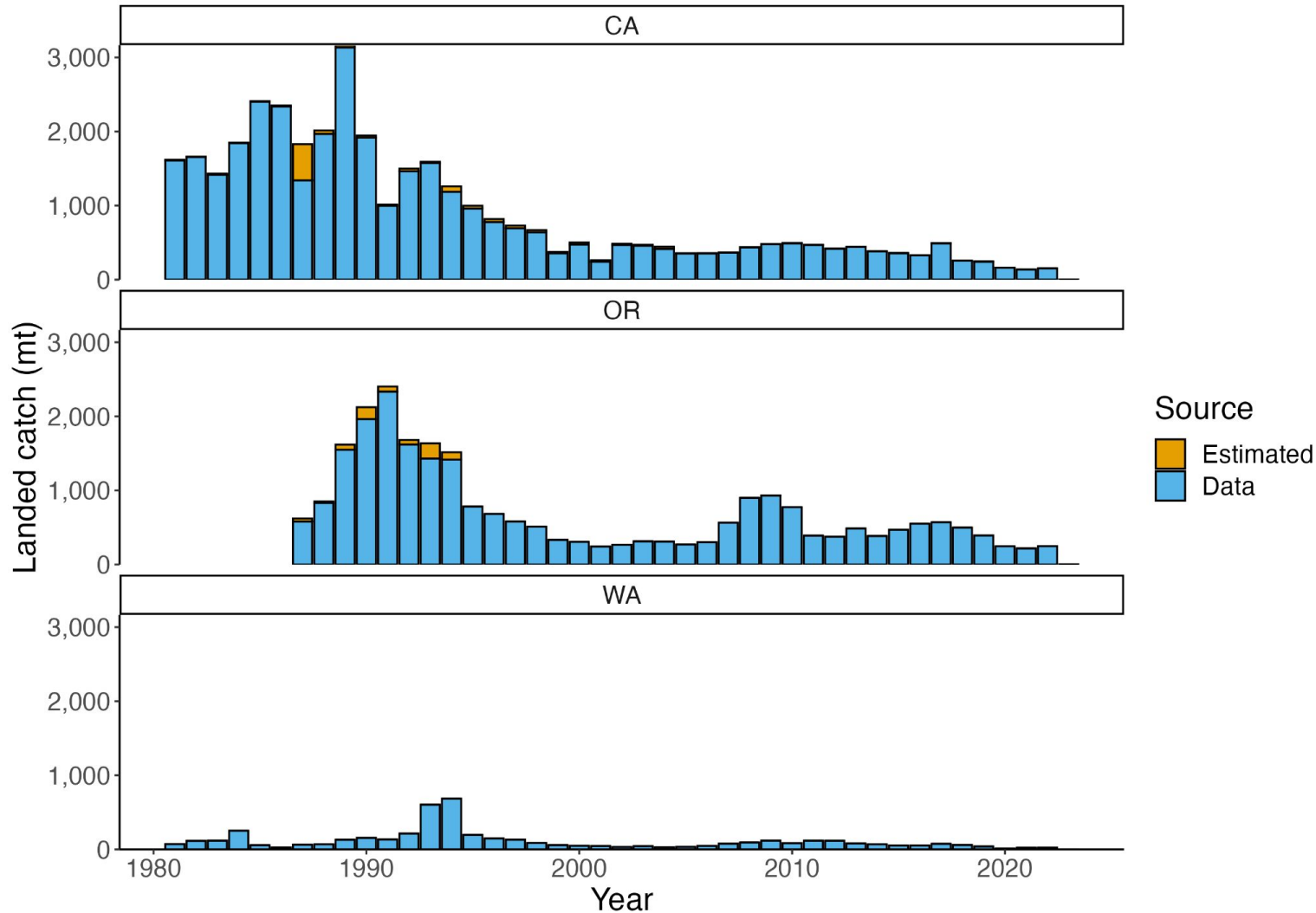
$$\text{Proportion_Shortspine} = \frac{\text{Shortspine}}{\text{Shortspine} + \text{Longspine}}$$

2013 assessment used coastwide proportion

We recommend using state and gear-specific proportions



Estimating unidentified thornyhead catch



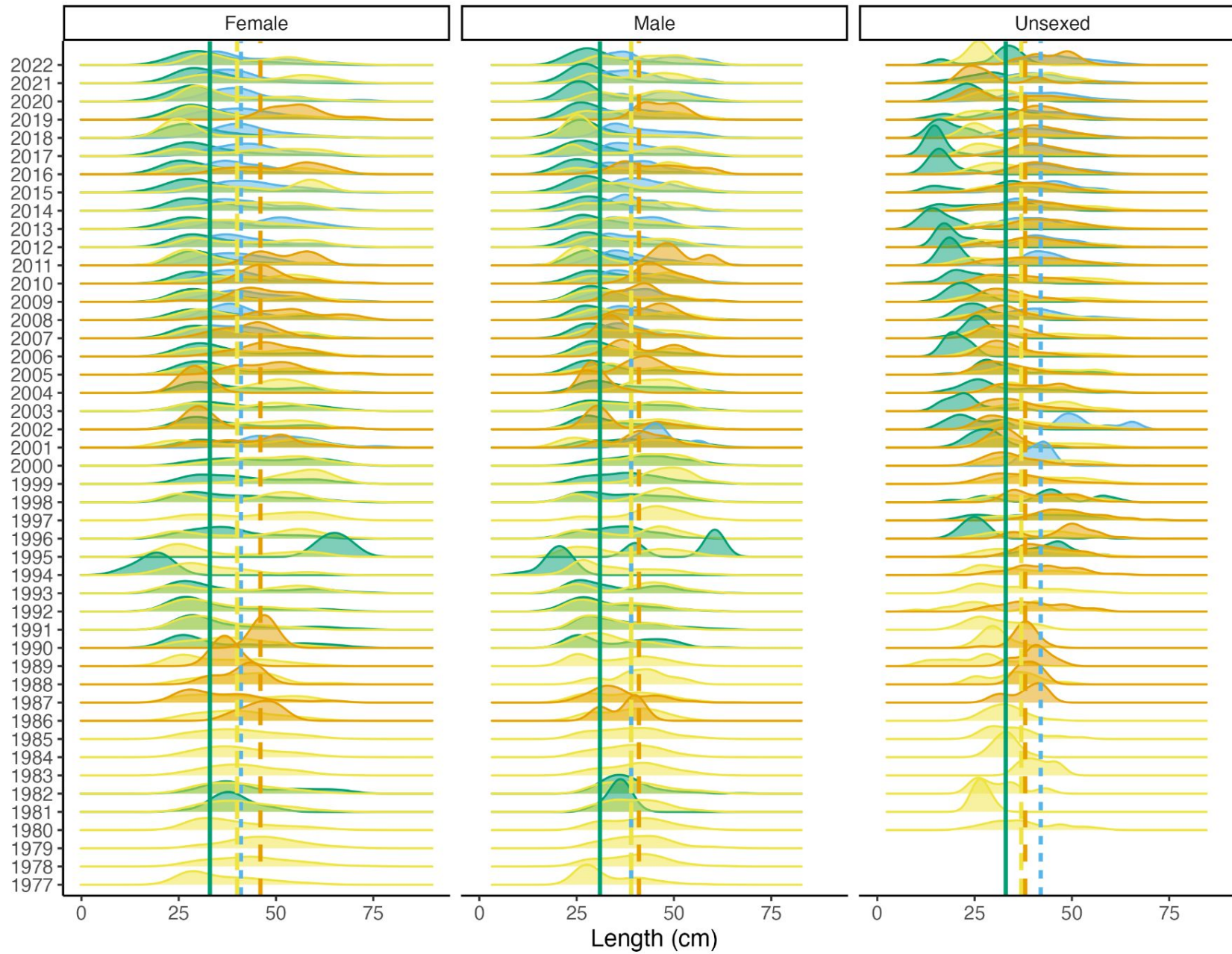
Estimated_Shortspine =
Proportion_Shortspine *
Unidentified_thornyhead

Very little catch is
unidentified

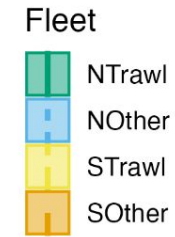
Transitioning from
coastwide to state/
gear-specific proportion
is a minor change



Fishery Length Compositions



Vertical lines represent the median length for each fleet across all years



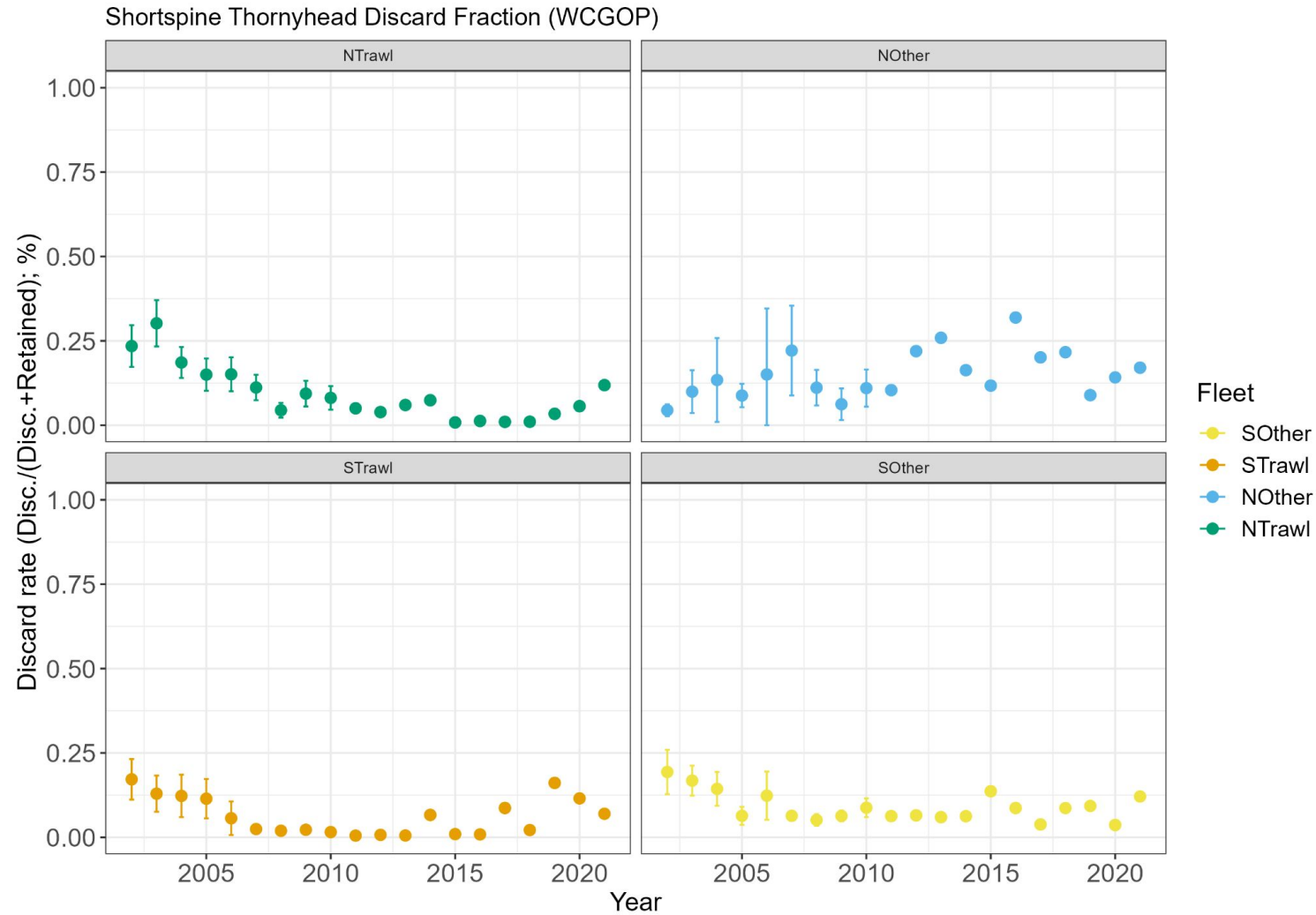
Discards

Discard rates (%) + Length distributions (L)

	2005	2013	2023
Pikitch (N)	1980s-1990s %	1985-1987 % + L	New estimates (J. Wallace) % + L
EDCP (N)	1995-1999 %	1995-1999 %	New estimates %
WCGOP (N + S)	2002-2003 %	2002-2011 % + L	2002-2021 % + L



Discards Rates



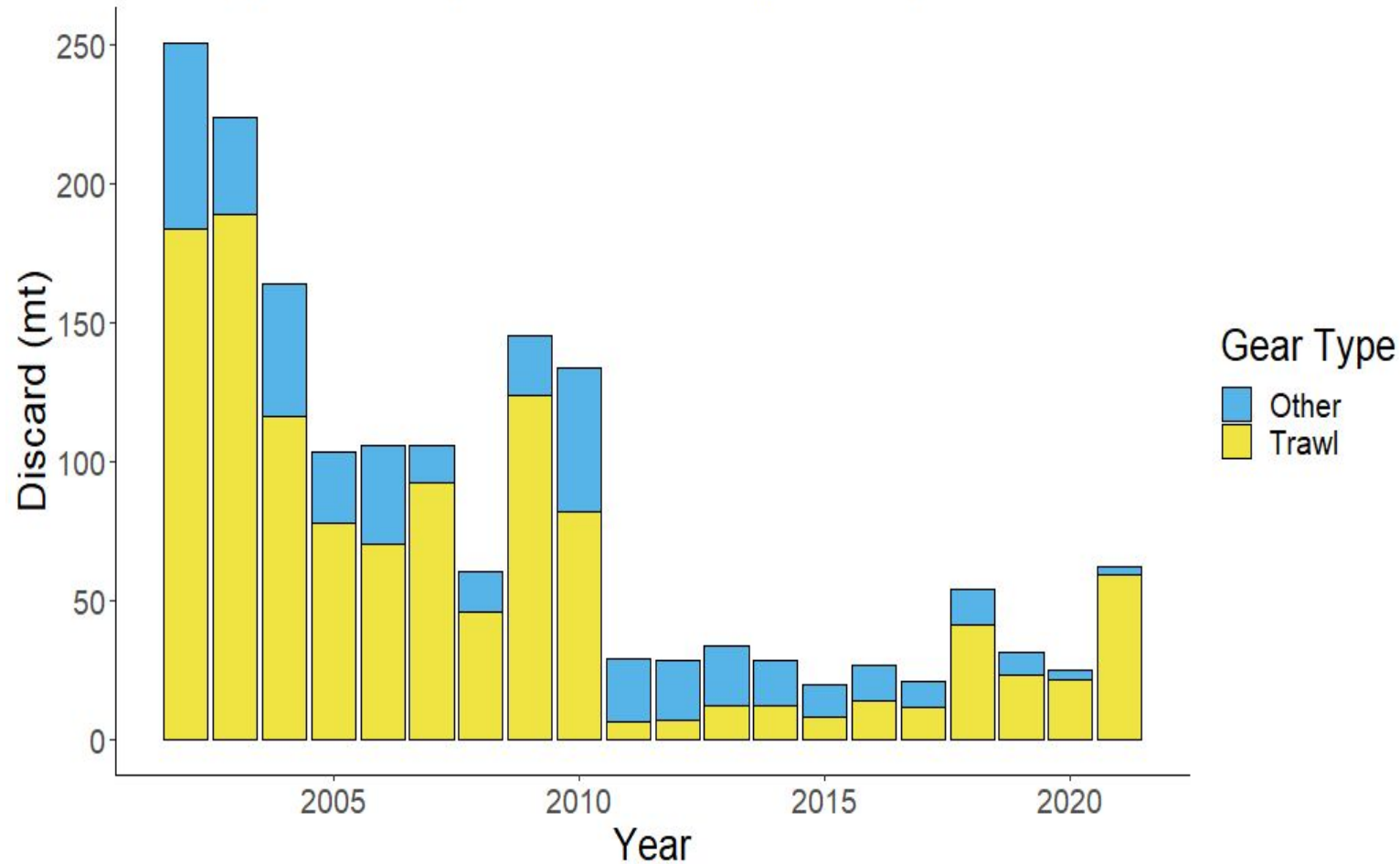
Discard Weights and Lengths



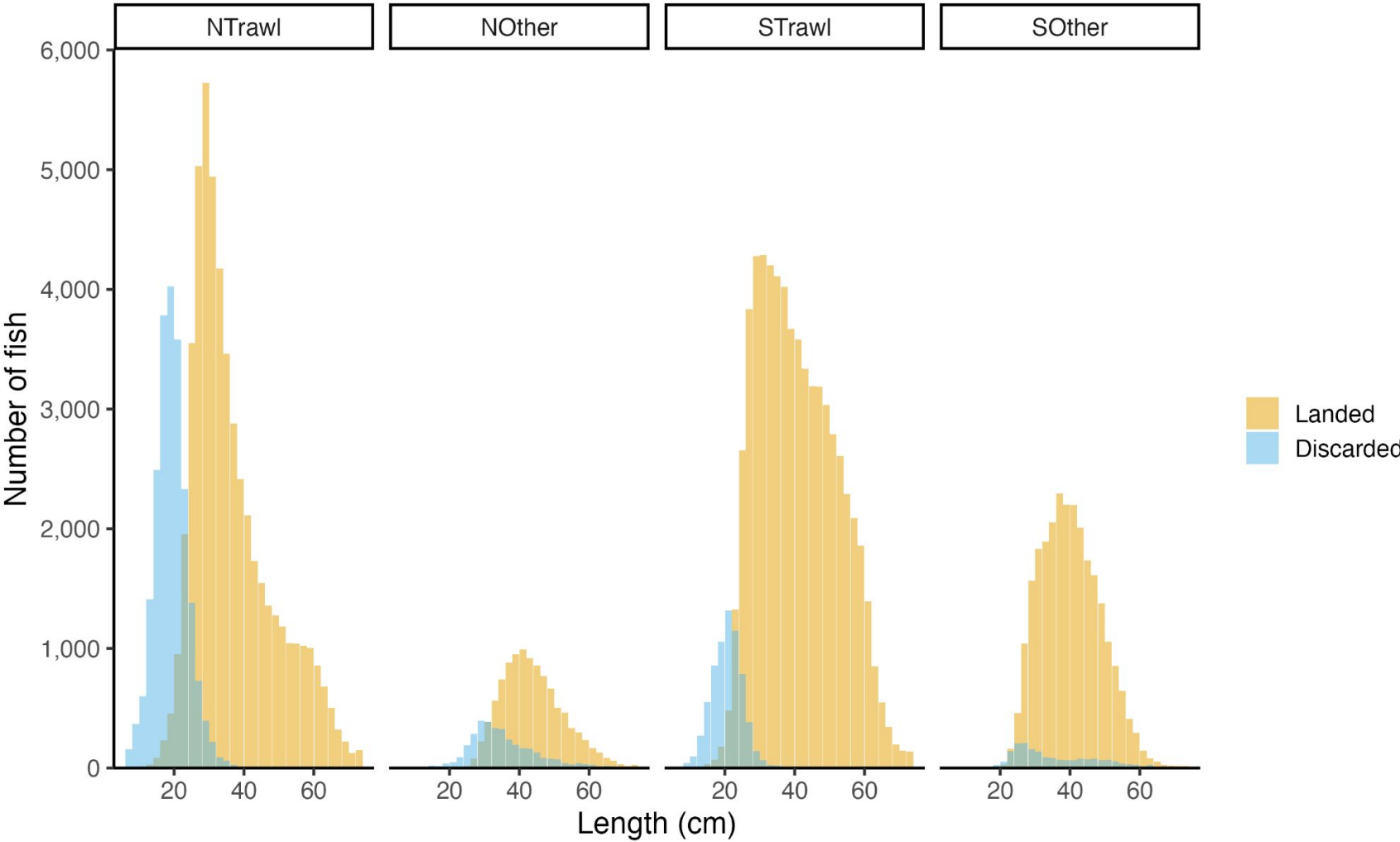
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Total Discards

Shortspine Thornyhead Discards (GEMM)



Aggregated Landing and Discard Lengths



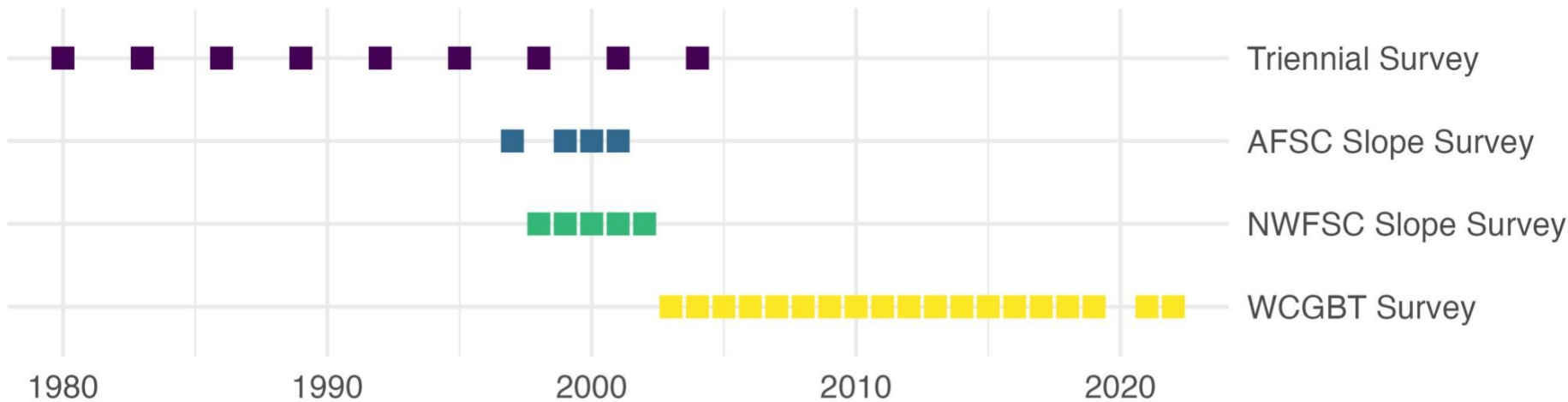
Fisheries Independent Data



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Fisheries Independent Surveys

- AFSC Triennial Shelf Survey (1980-2004, 1977 removed)
- AFSC Slope Survey (1997-2001)
- NWFSC Slope Survey (1998-2002)
- NWFSC Combo Survey (2003-2022, no 2020)



Survey Strata

Survey	Strata Definitions
AFSC Slope	2 strata: 32.0-49.0°N: 150-500 m, 500-1280 m
NWFSC Combo <i>(West Coast Groundfish Bottom Trawl Survey)</i>	7 strata 32.0-34.5°N: 183-550 m, 550-1280 m 34.5-40.5°N: 183-550 m, 550-1280 m 40.5-49.0°N: 100-183 m, 183-550 m, 550-1280 m The depth breaks at 183 m and 550 m are associated with changes in sampling intensity of the survey and are recommended to be used.
NWFSC Slope	6 strata 32.0-40.5°N: 55-500m, 550-1280m 40.5-43.0°N: 55-550m, 550-1280m 43.0-49.0°N: 55-550m, 550-1280m
AFSC Triennial 1	1 stratum: <=366 m
AFSC Triennial 2	1 stratum: 366-500 m

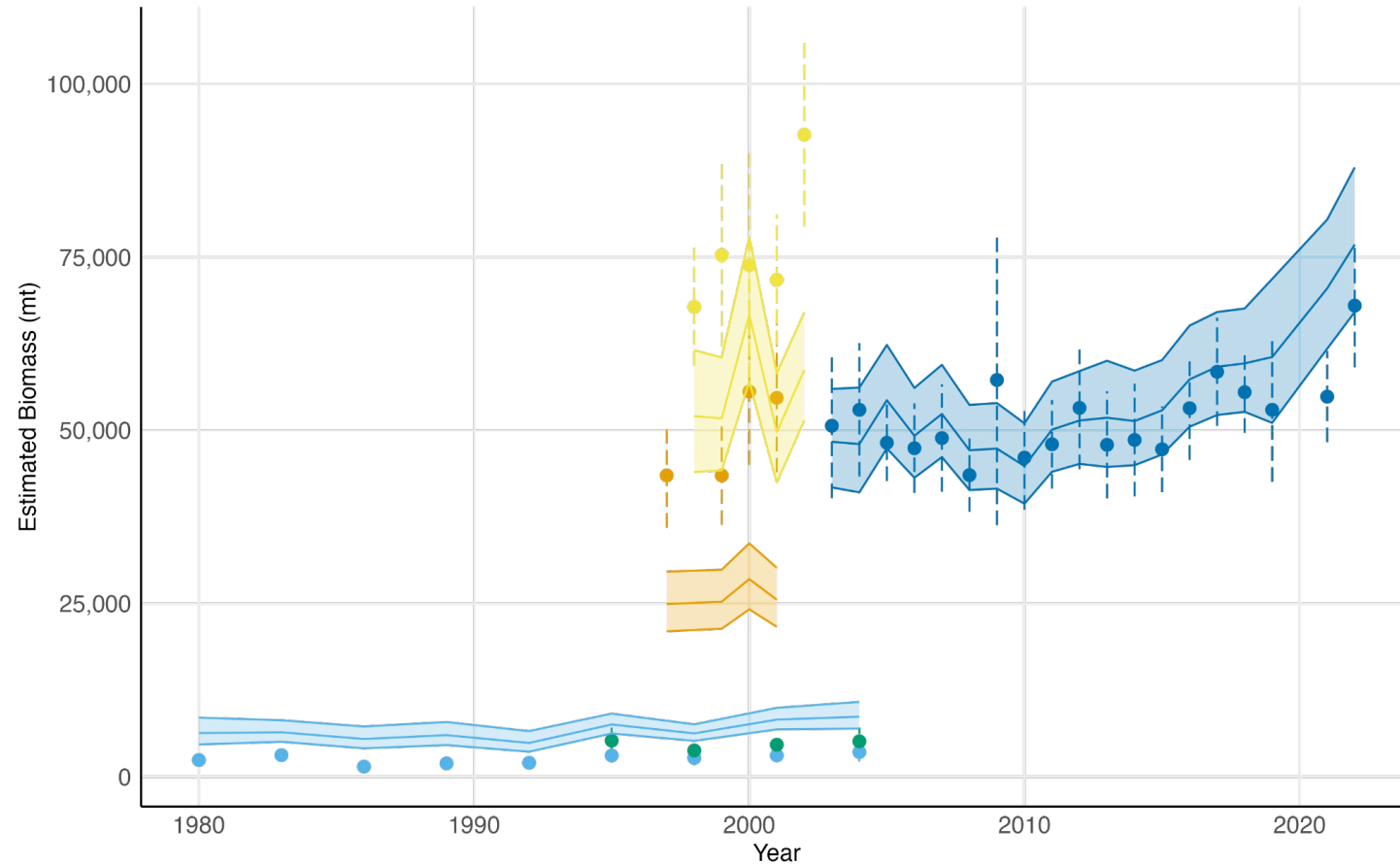
2013 and 2023 strata definitions are identical

Investigate strata definitions for the AFSC Triennial survey:

- Single index
- Removed all together



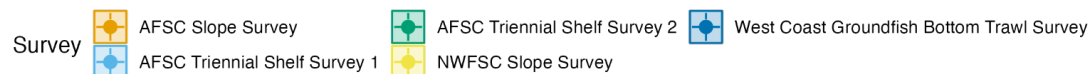
Survey Indices



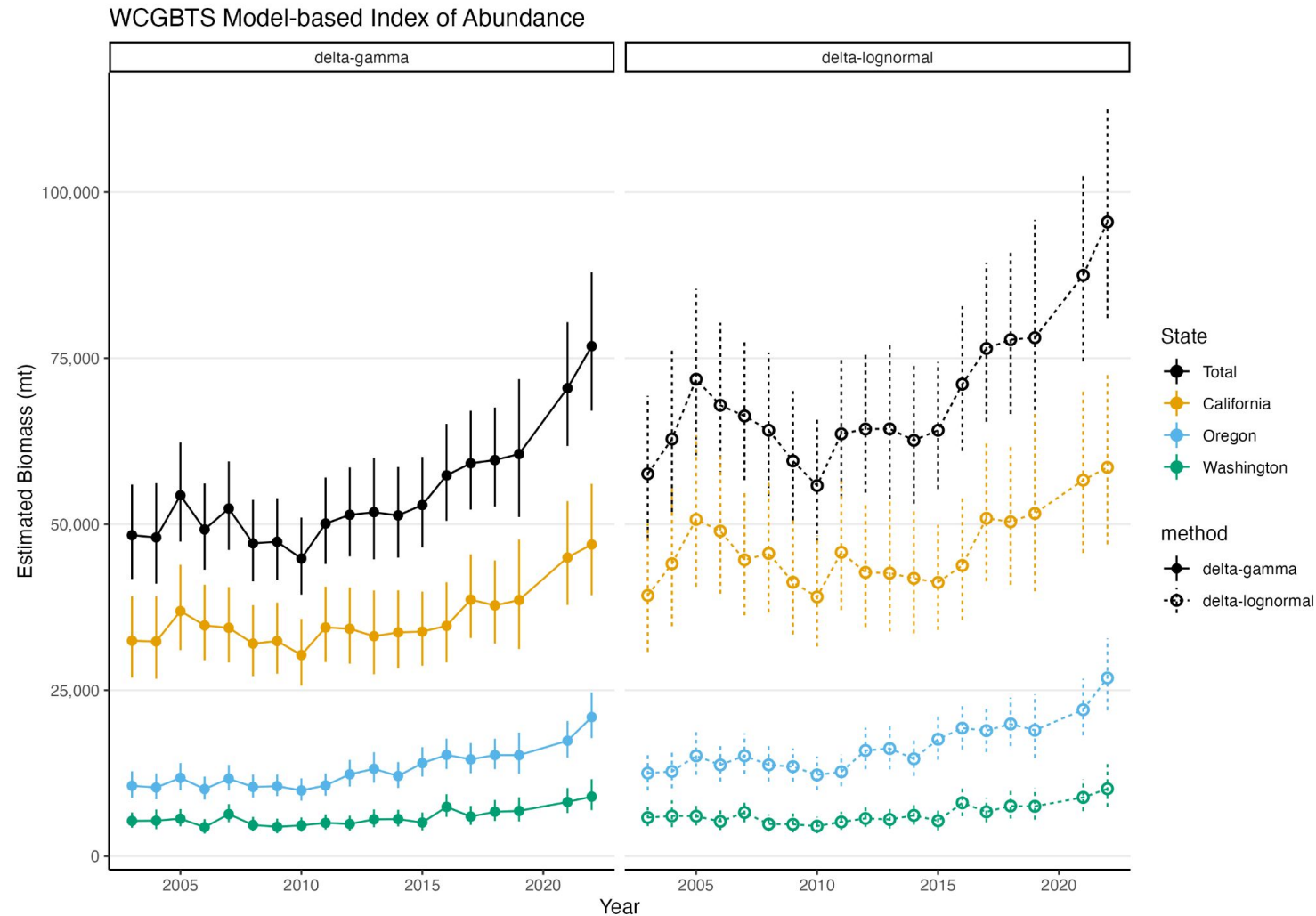
Point + error bars =
design-based index

Line + ribbon =
sdmTMB model index

Combine Triennial 1/2
surveys for model-based
indices



Geostatistical Survey Indices

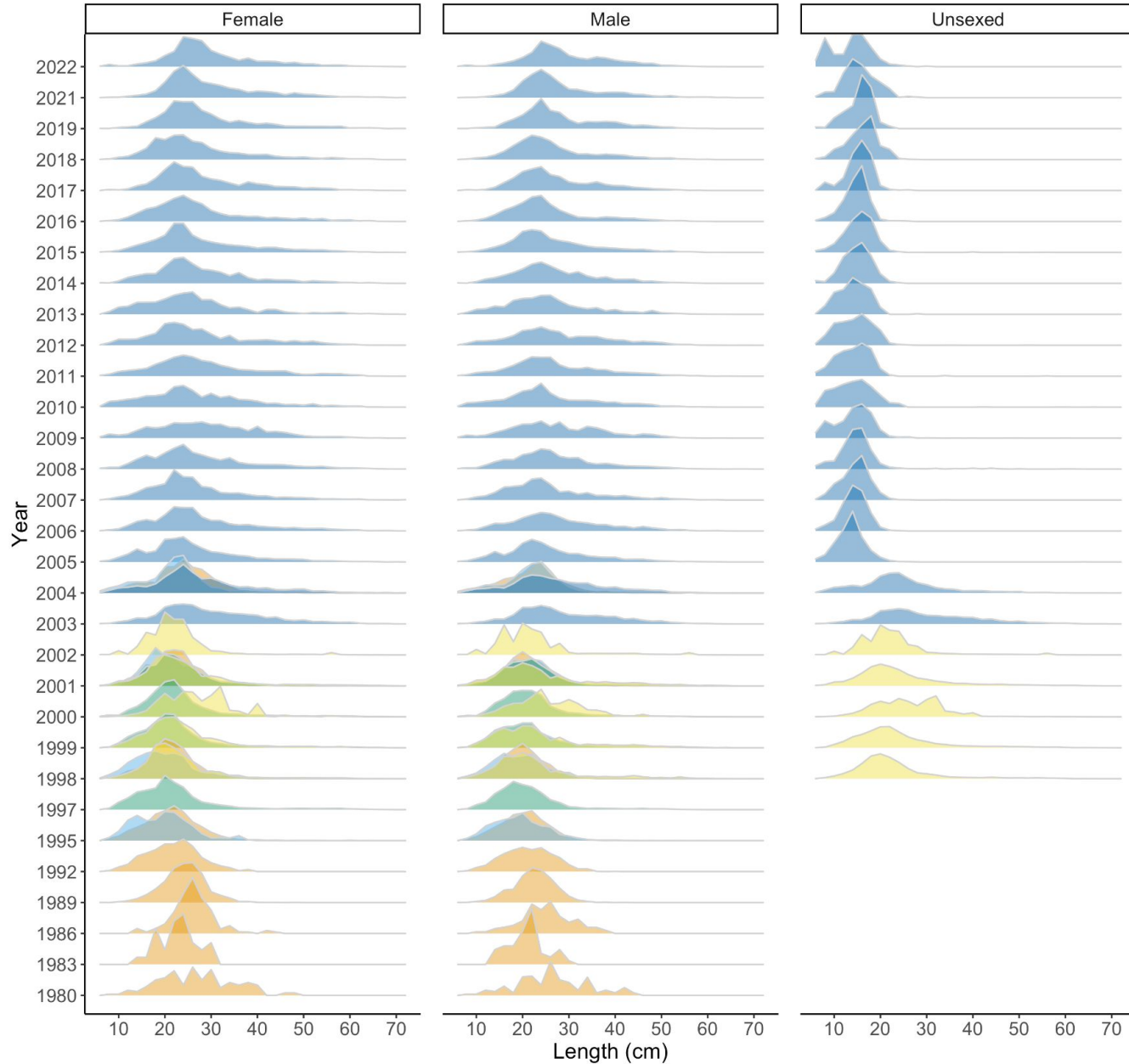


Two possible error structures

Explore as a sensitivity analysis alongside design-based indices

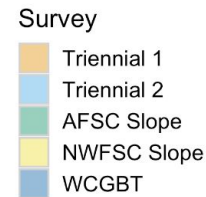


Shortspine Thornyhead Survey Length Compositions



Unsexed fish <16cm in length assumed to be immature?
Apply a 50:50 sex ratio?

All surveys have roughly the same length compositions, and similar to fishery comps



Biological Information



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Growth uncertainty

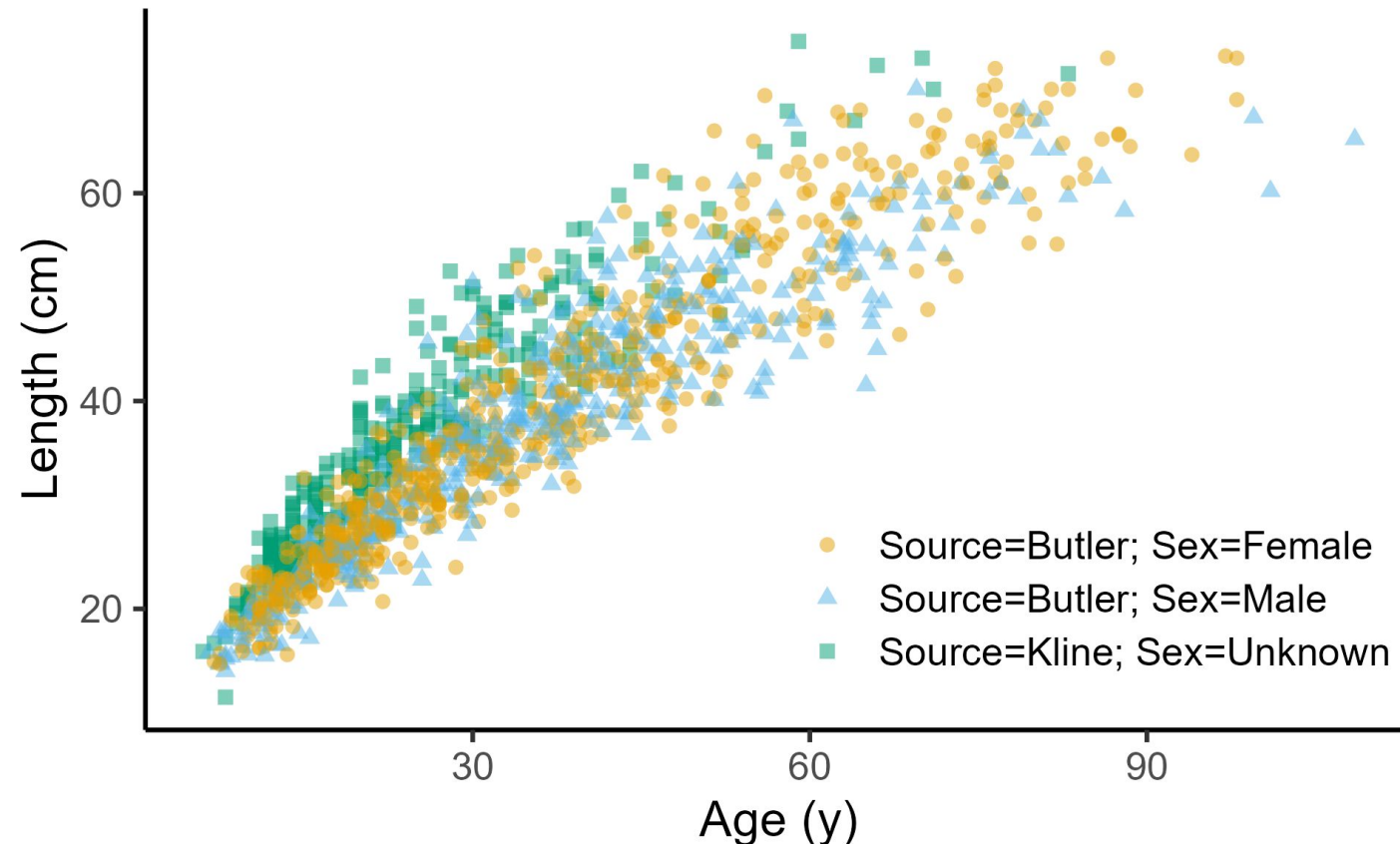
No validated ageing method for thornyheads

Relying on research data sets from the 1990s

Kline fish appear to grow faster and to larger sizes:

- Growing faster in central CA?
- Ageing error/bias?

Source	Region	Years	Details
Butler et al. 1995	OR and northern CA	1978-87, 1988, 1990	N=1,023; Sexed; Fork length; Two age readers
Kline 1996	Central CA	1991	N=319; Unsexed; Total length; One age reader



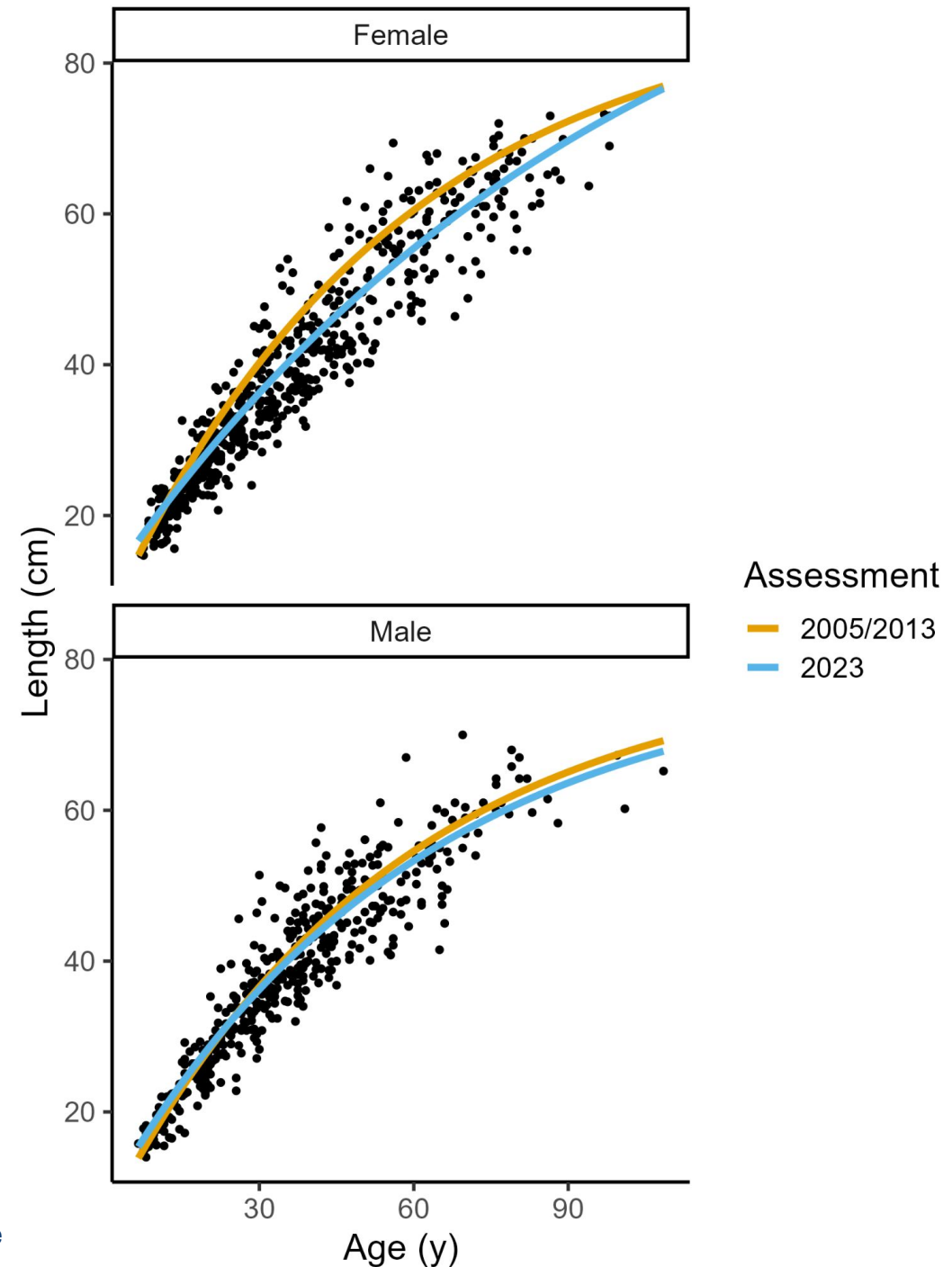
New growth curves for 2023 assessment

Unable to reproduce 2005/2013 assessment growth curves (based on Kline 1996)

Propose using Butler data for 2023

- Sex-specific data, higher N, two age readers

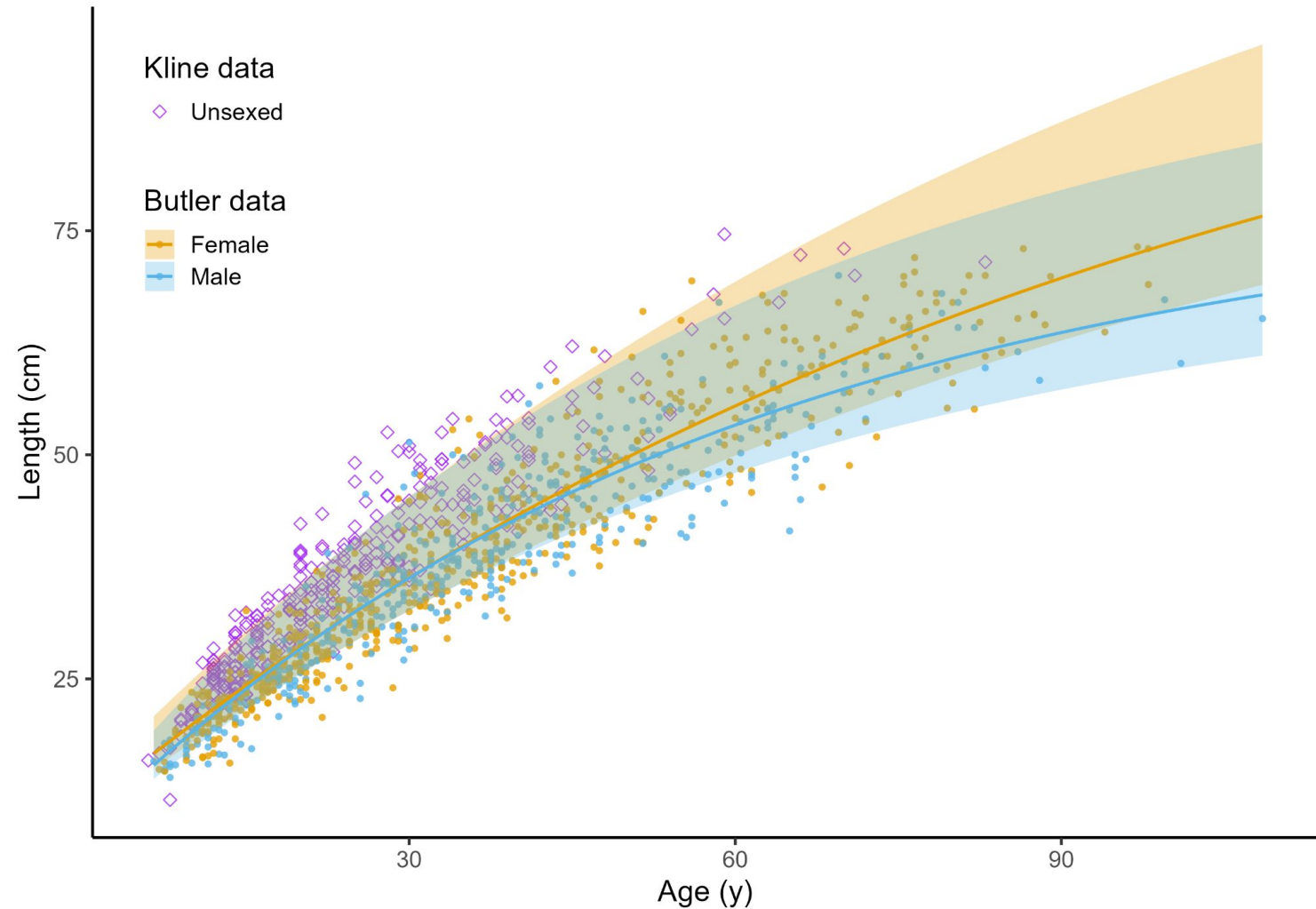
2023 analysis: Sex-specific Schnute growth curves with lognormal error distribution fit to Butler data



Growth sensitivities

Sensitivity analysis (shaded areas):

- +25% and -10% on lengths at age-2 and age-100
- Upper bound of sensitivity accounts for Kline data
- 2005 and 2013 assessments used +/-10% on length-at-age 100



Maturity

2005/2013 assessment used Pearson and Gunderson (2003)

2013 sensitivity based on observed proportions mature (samples collected during 2011/2012 surveys)

New maturity data may be available later in March (M. Head, NOAA)

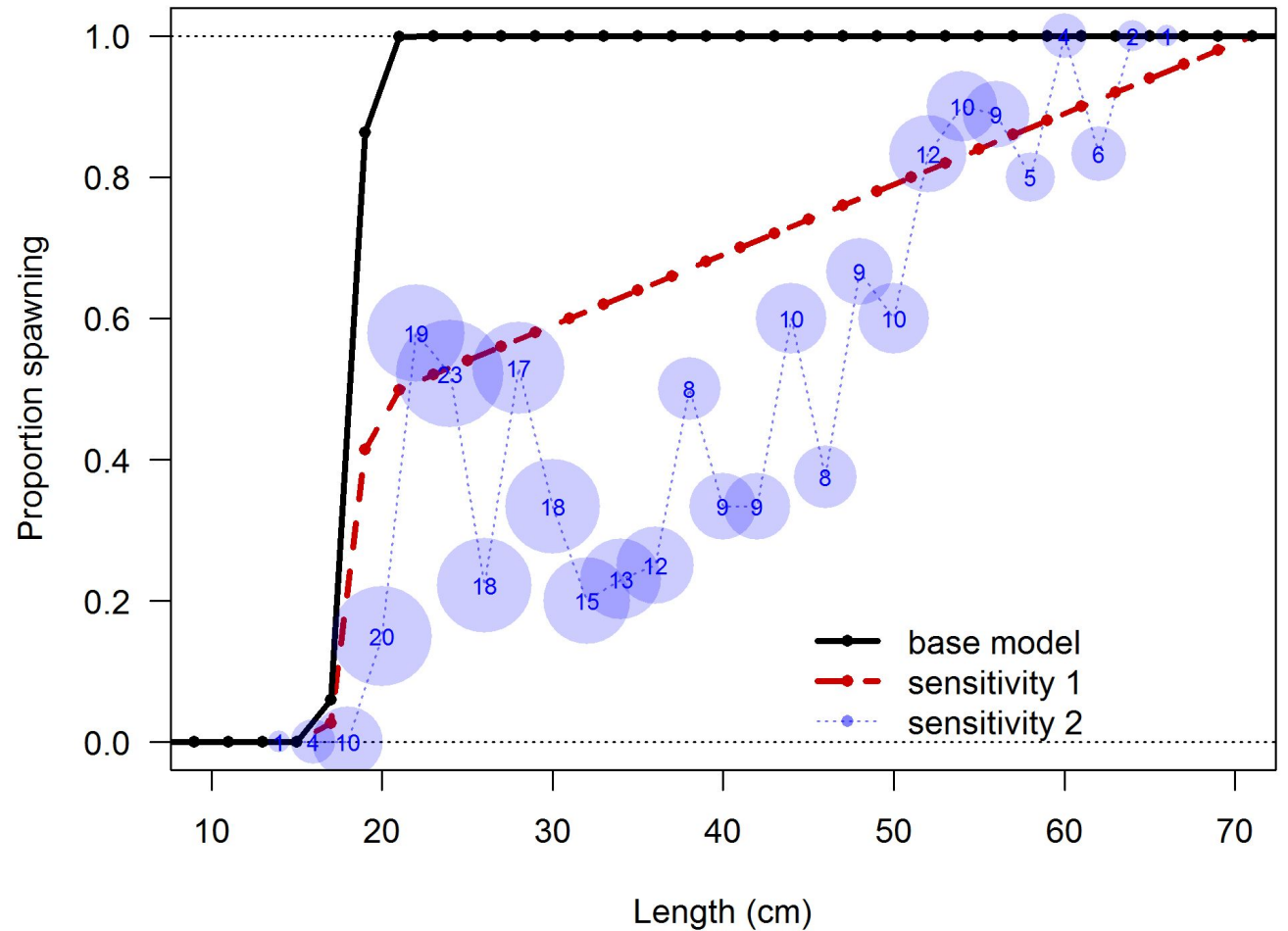
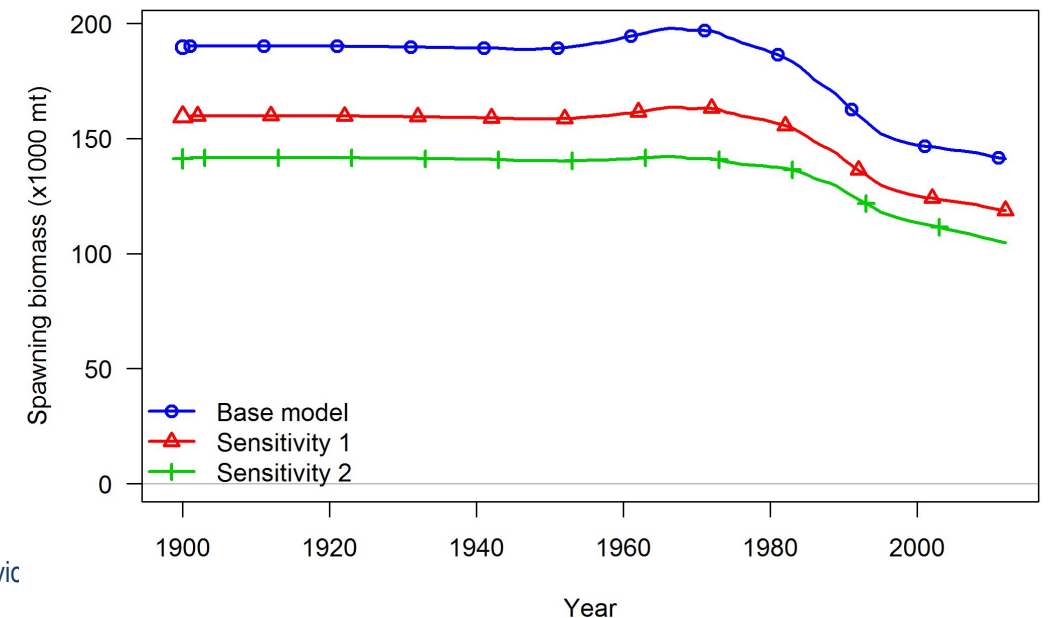
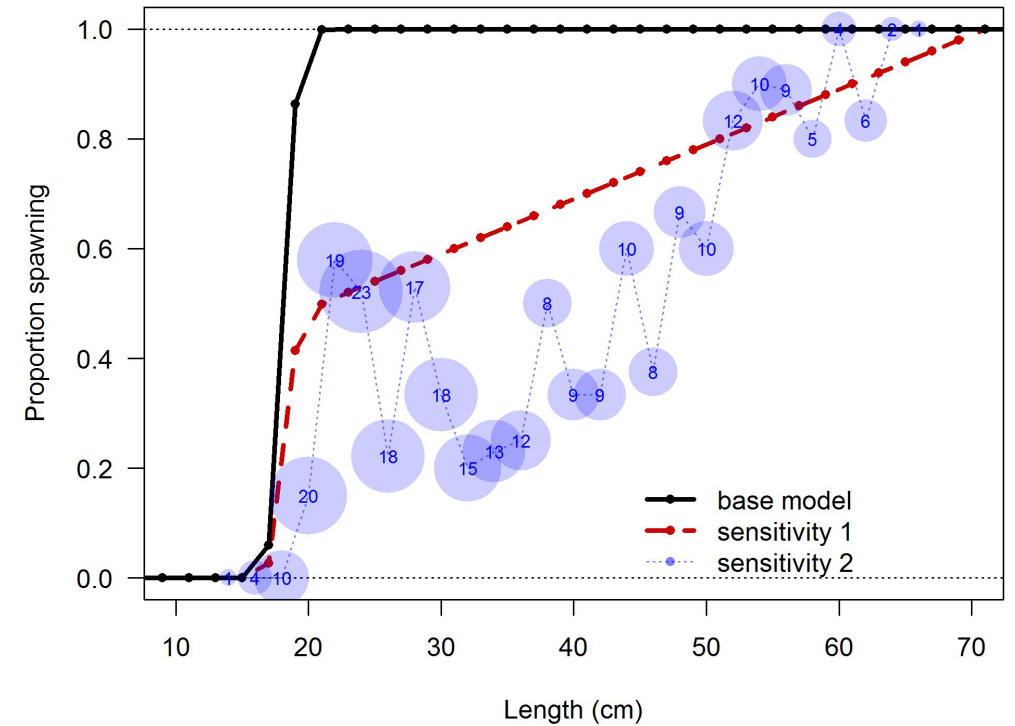


Figure from 2013 assessment, sample sizes reported in the blue circles

Maturity

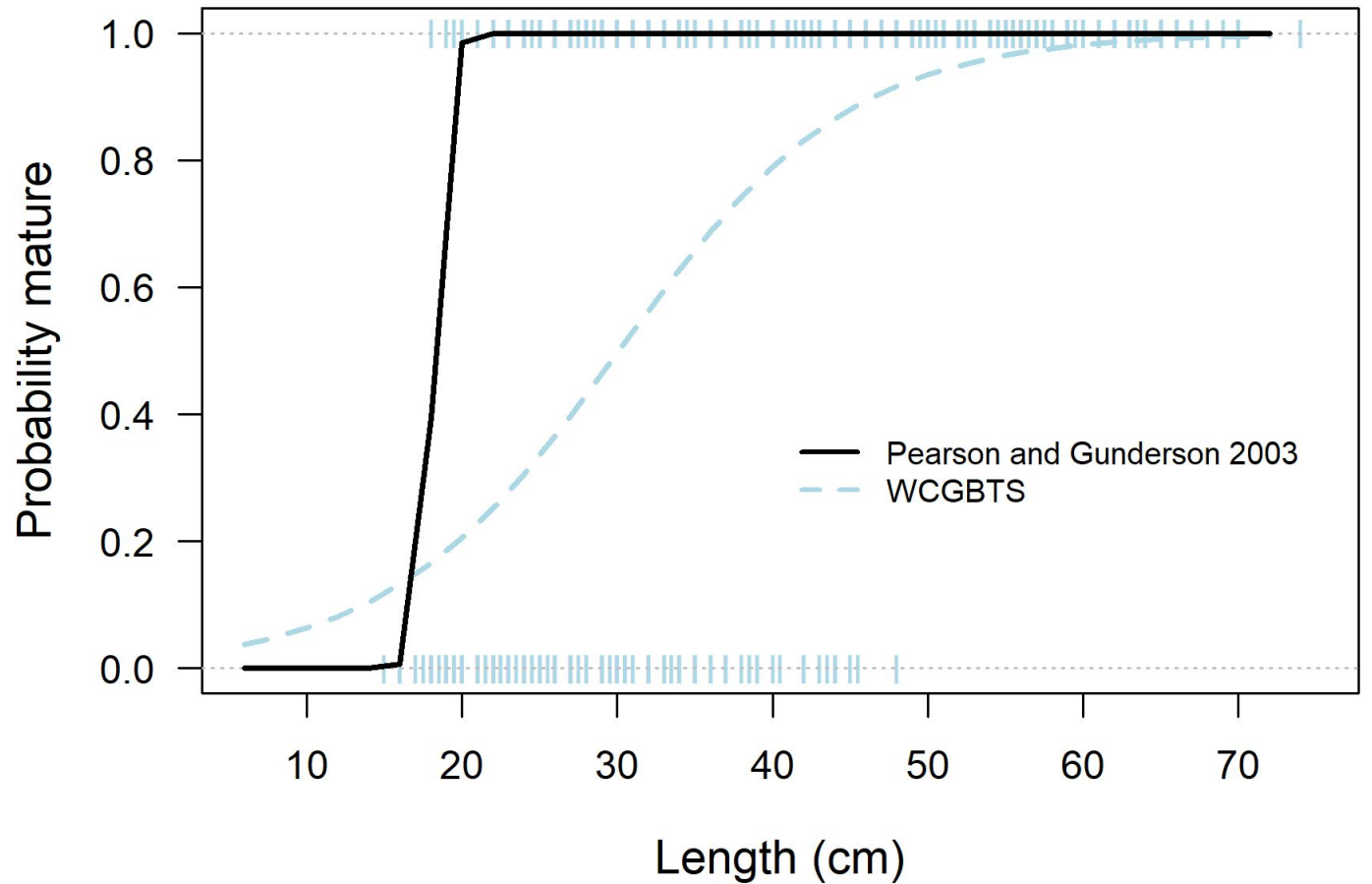
- Base model in 2005/2013 assessments used Pearson and Gunderson (2003)
- 2013 sensitivity based on observed proportions mature (samples collected during 2011/2012 surveys)

Figures from 2013 assessment:



Maturity

- New histological maturity data from WCGBTS (M. Head, NOAA) to be analyzed for 2023 assessment



Fecundity

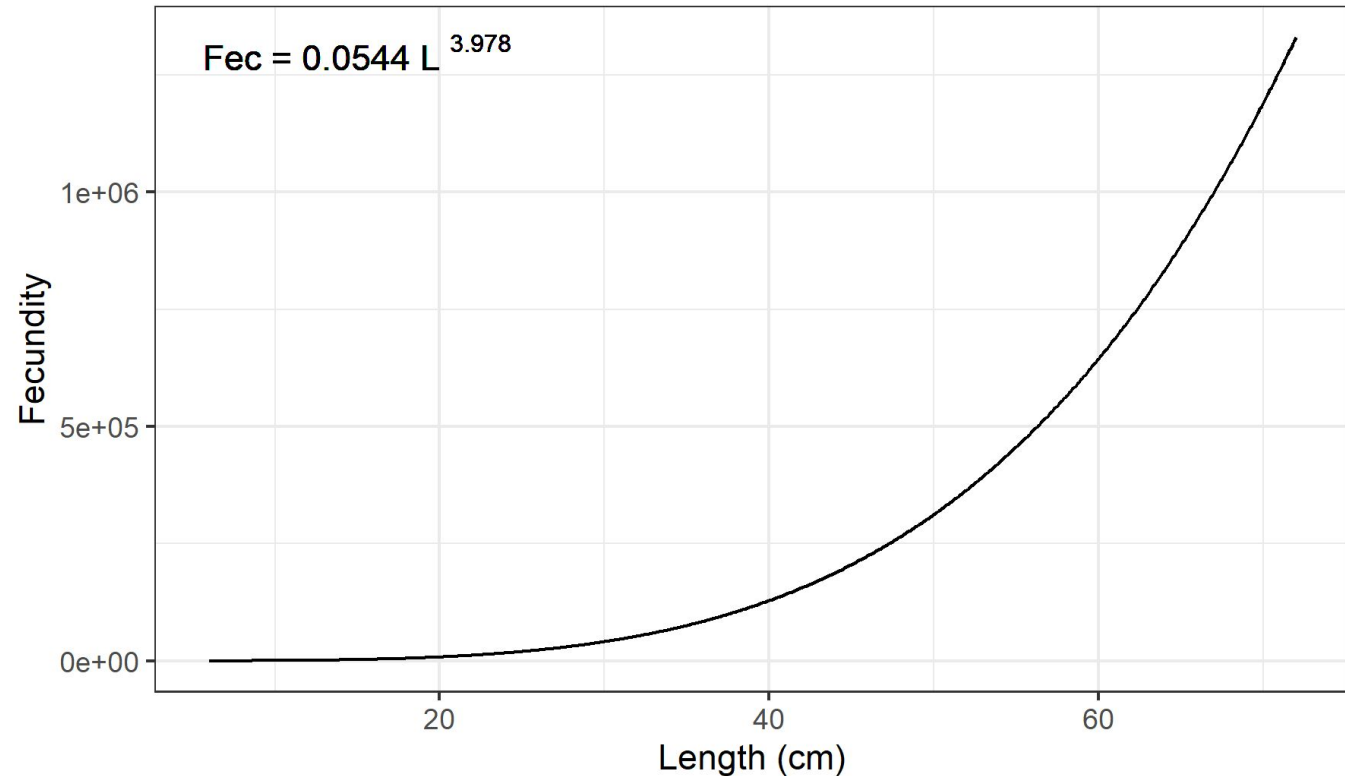
2013 assessment assumed spawning biomass equivalent to spawning output (i.e., spawning output proportional to body weight)

2023: Use fecundity-at-length information

- Cooper et al. 2005
- Alaska and West Coast (no regional difference)
- 56 samples
- accounts for greater relative fecundity of large females

Shortspine thornyhead fecundity-at-length

Source: Cooper et al. 2005



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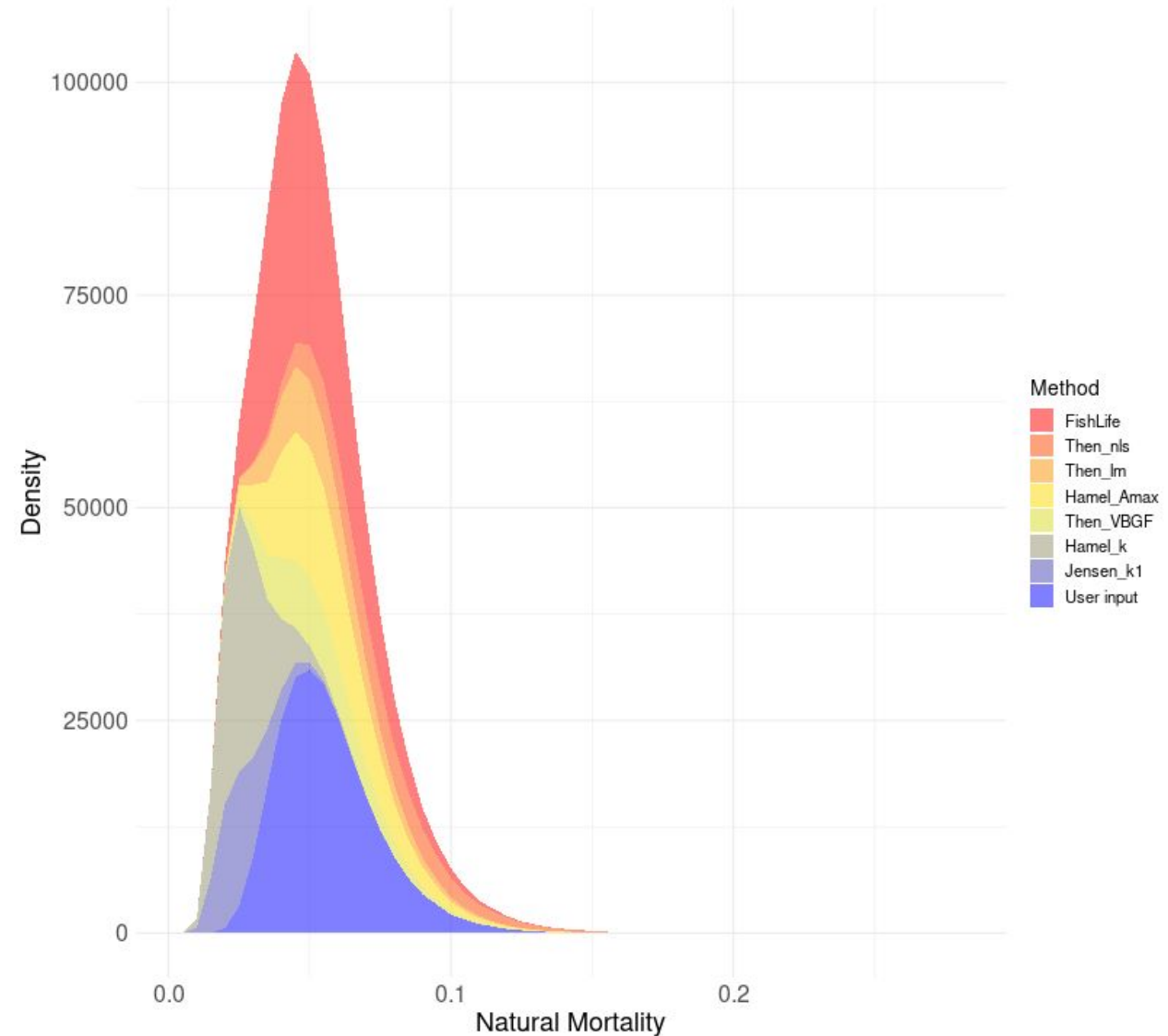
Natural Mortality

2005: M fixed at 0.05

2013: M fixed at 0.0505

2023: M fixed at 0.054
(Hamel and Cope 2022)

- $Age_{max} = 100$
- $M = 0.054 = 5.40 / Age_{max}$
- Explore estimating M in the model



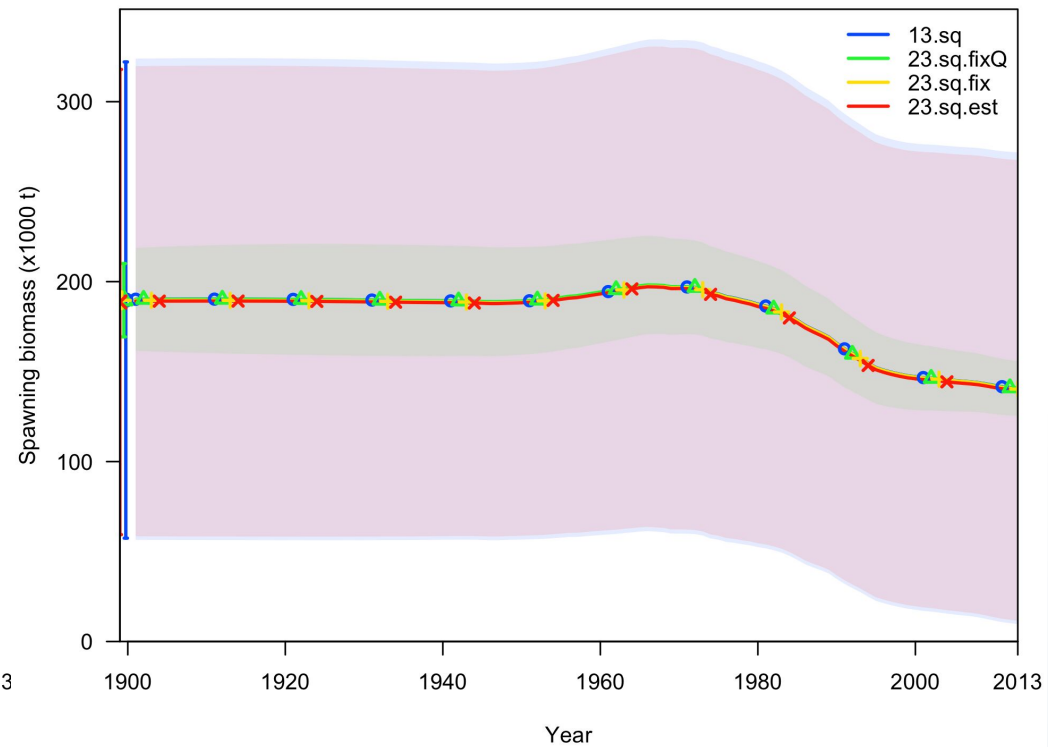
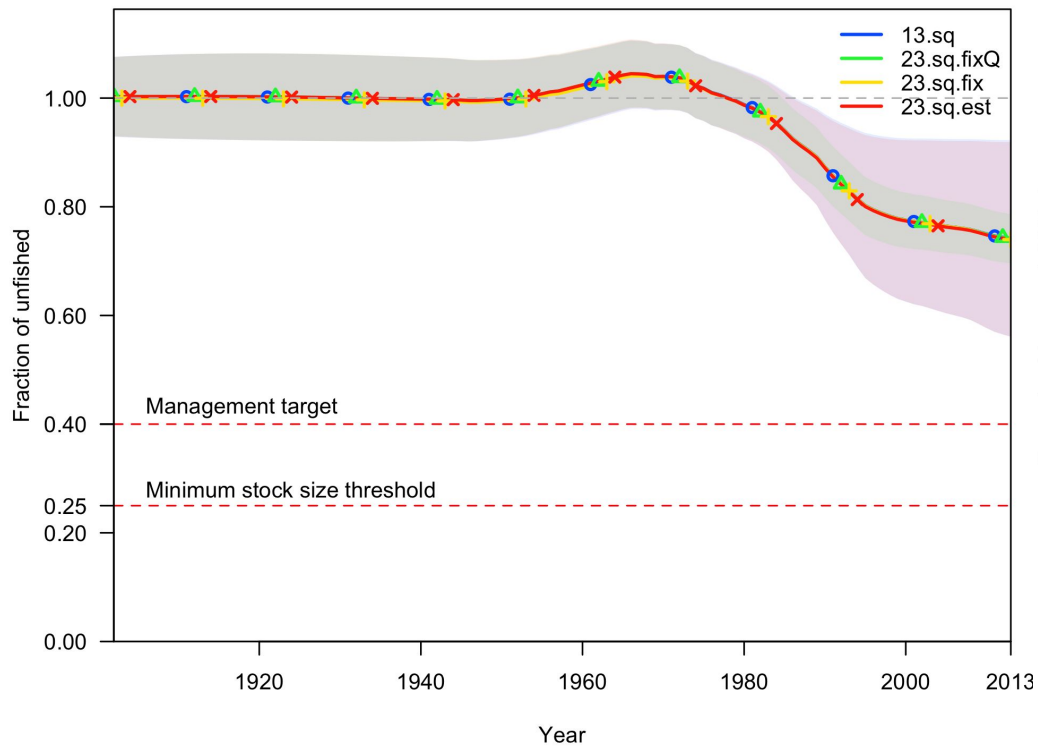
Model Information



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Model Information

2013: SS v3.24.0 → 2023: SS v3.30.21



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Summary of 2023 Data Changes

- Historical state-level catch reconstructions
- Gear/state specific SST:LST proportions
- Geostatistical model-based abundance indices
 - Single Triennial Survey index
- New growth and maturity curves



2013 Research and Data Needs

- Additional research into ageing and maturity
 - **New maturity data, update growth**
- A comprehensive catch reconstruction pre-1981
 - **Historical state data rather than based on sablefish catch**
- Exploration of simpler assessment methods
 - **Explore simplified fleet structure**
 - **Explore removal of older survey data**
 - **Explore utility of design-based indices**



Thank you

- Julia Coates
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- Andi Stephens
- Ian Taylor
- Theresa Tsou
- John Wallace
- Chantel Wetzel
- Ali Whitman

Instructors

- Vladlena Gertseva
- Melissa Haltuch
- Owen Hamel
- Kiva Oken



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Matthieu Veron



Joshua Zahner



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