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Yellowtail rockfish pre-assessment workshop

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January 30, 2025

Outline

- Overview
- Fishery dependent data
  - Landings
  - Fishery length and age composition data
  - Fishery-dependent indices
- Fishery-independent data
  - Indices: retained from previous assessment
  - Indices: new
  - Length and age composition
- Biological information

Important dates

- **Data deadline:** Monday, February 24
- **Pre-STAR distribution:** Monday, May 5
- **STAR Panel:** May 19-23 (Seattle, WA and online)
- **SSC Post-STAR report:** June 6
- **Revised draft assessment:** June 13
- **SSC GFSC review:** August TBD
- **SSC & Council review:** Sept 18-24 (Spokane, WA)

Basic biology overview

- Range from Baja to Aleutian islands, core of distribution from Oregon to B.C.
- Sexually dimorphic: females grow to larger sizes
- Sex ratio becomes male-dominated at older ages
- Managed as two stocks split at 40°10’ (~Cape Mendocino) based on genetic and oceanographic evidence
- Population density increases north along the U.S. west coast

Assessment history

- Integrated age-structured model updated six times from 1993-2005
- Data-moderate assessment with only catch and index data conducted in 2013
- North and South stocks last assessed in 2017
  - Only the northern model was approved for management
  - Southern stock is currently managed as category 3

2025 assessment

- Only the northern stock is being assessed
- Assessment will be based in Stock Synthesis
- Data-rich, extensive age data available from the fishery
  - Allows for estimation of recruitment deviations, selectivity, natural mortality
- Data used: catch; length, age, age-at-length compositions; indices of abundance; recruitment indices (?); biological data

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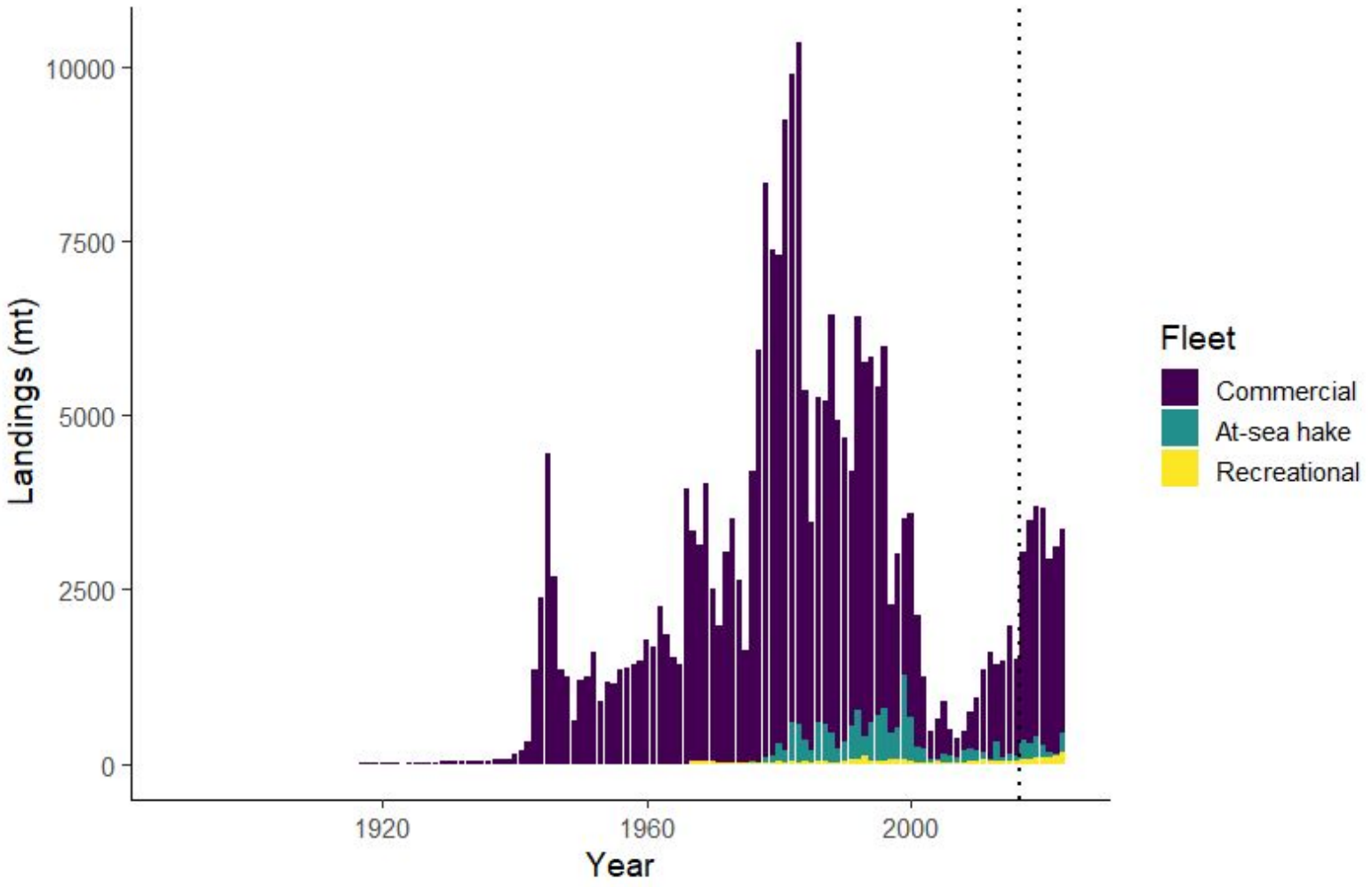
Total landings by fleet through 2023

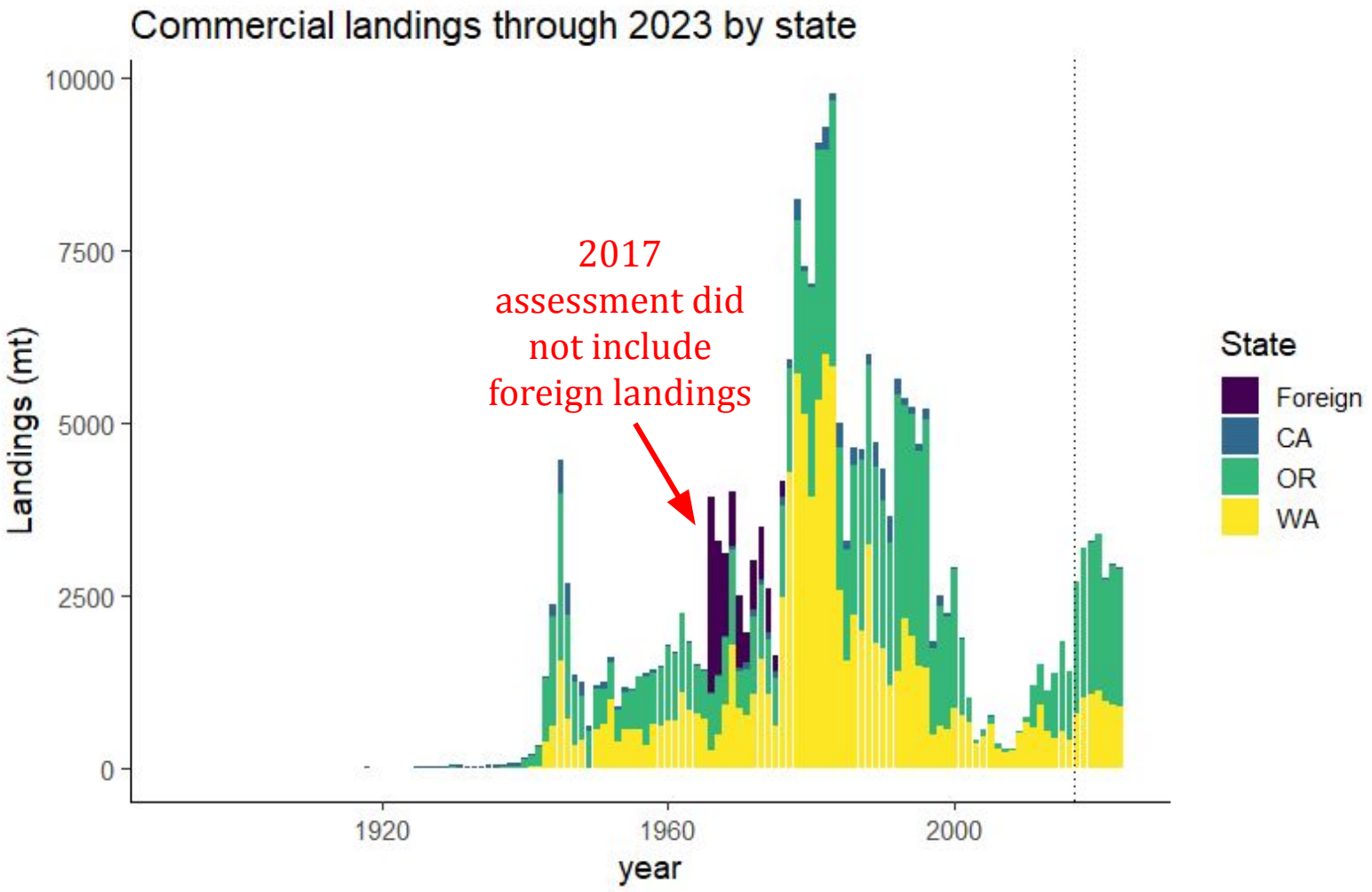


Landings are dominated by commercial fishery

>97% of commercial catches are trawl

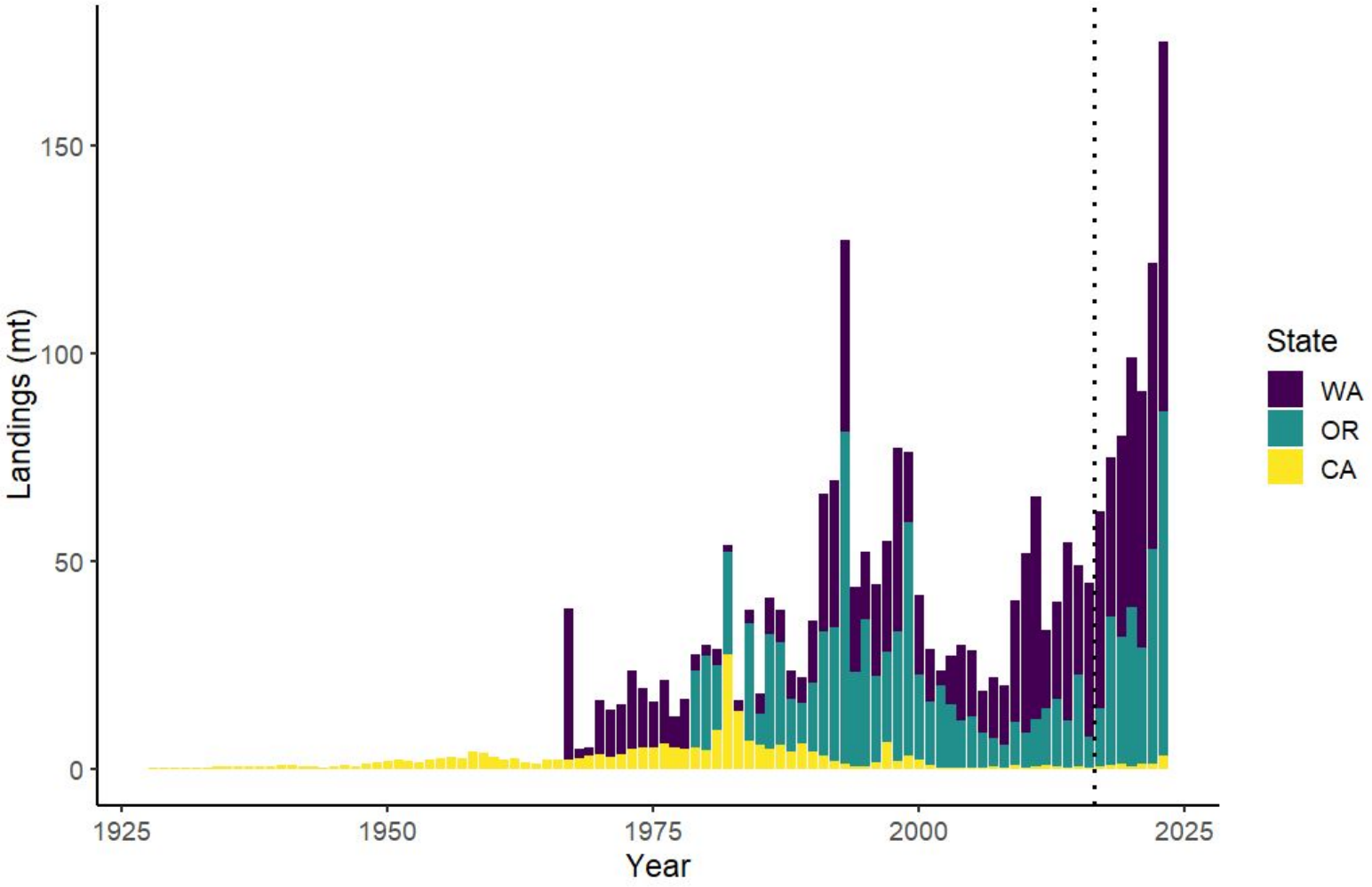
Catches have increased substantially since last assessment

Commercial landings by state



- Added foreign landings
- CA pre-CALCOM landings somewhat higher
- PacFIN-era data similar to 2017
- Time series extended

Recreational landings by state



New OR recreational reconstruction

WA landings input as weight not numbers, one single rec fleet

Some departures from 2017 assessment, but overall magnitude of recreational fishery is low

Discards

- 2017 assessment estimated a retention curve and fit to observed sizes of discards and discard rates.
- Discard rates are low except for 2002-2010 when trip limits were restrictive
- The GEMM (Groundfish Expanded Mortality Multi-year) report shows less discarding in 2000s than what was estimated in the 2017 assessment
- Discard rate was applied to the total landings, but majority of landings during 2000s were from the tribal fishery with full retention
- For 2025 we plan to simplify the model by adding external estimates of discards (e.g. from GEMM) to the landed catch

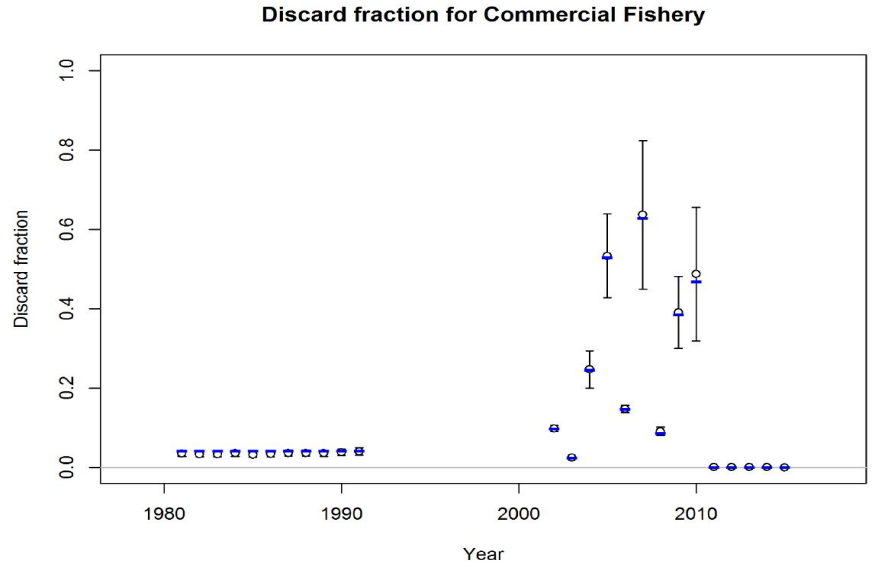
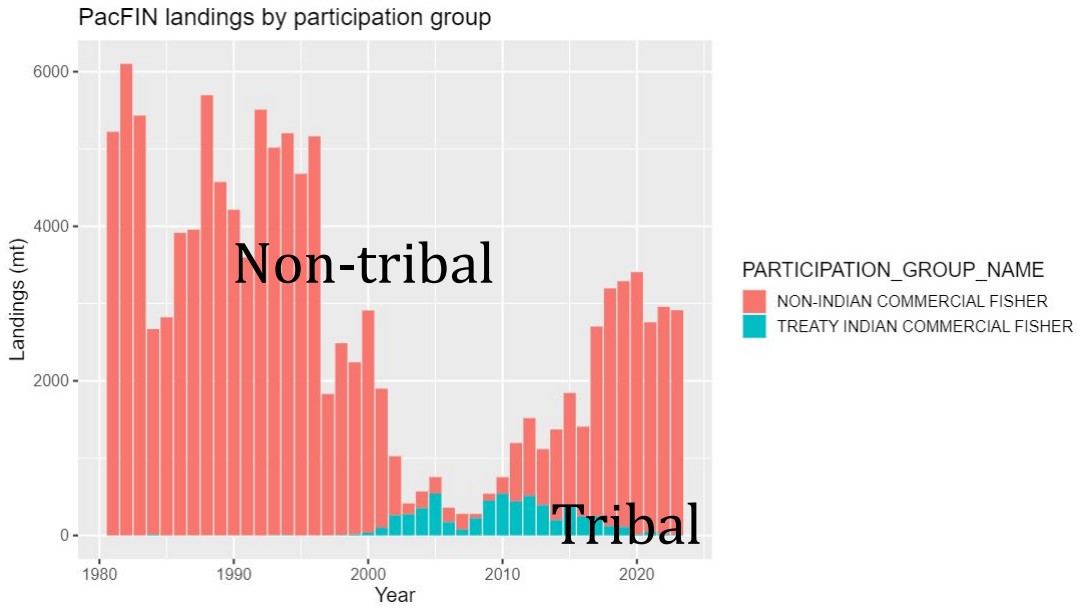


Figure 11: Fit to discard fractions for the commercial fishery in the Northern model.



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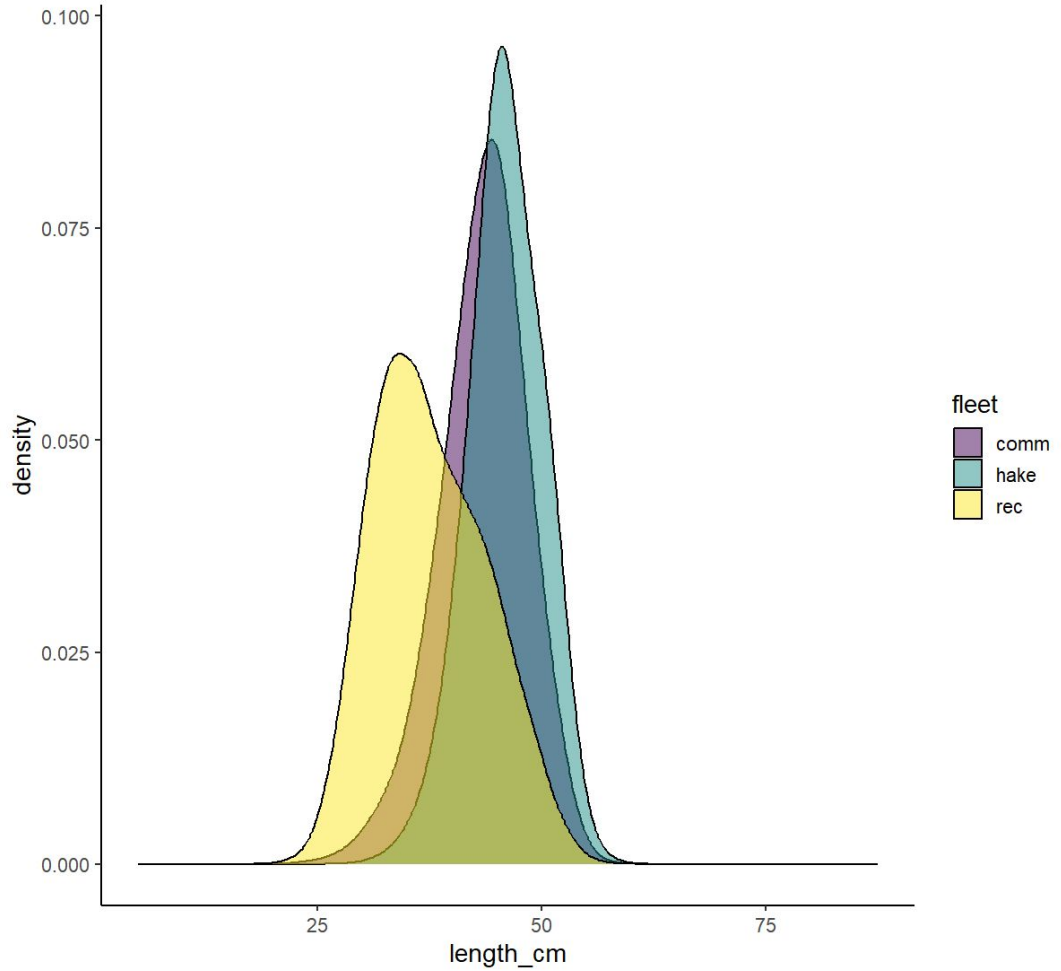
Composition data by fleet

Recreational fleet catches smaller fish

At-sea hake and commercial fleet are more similar



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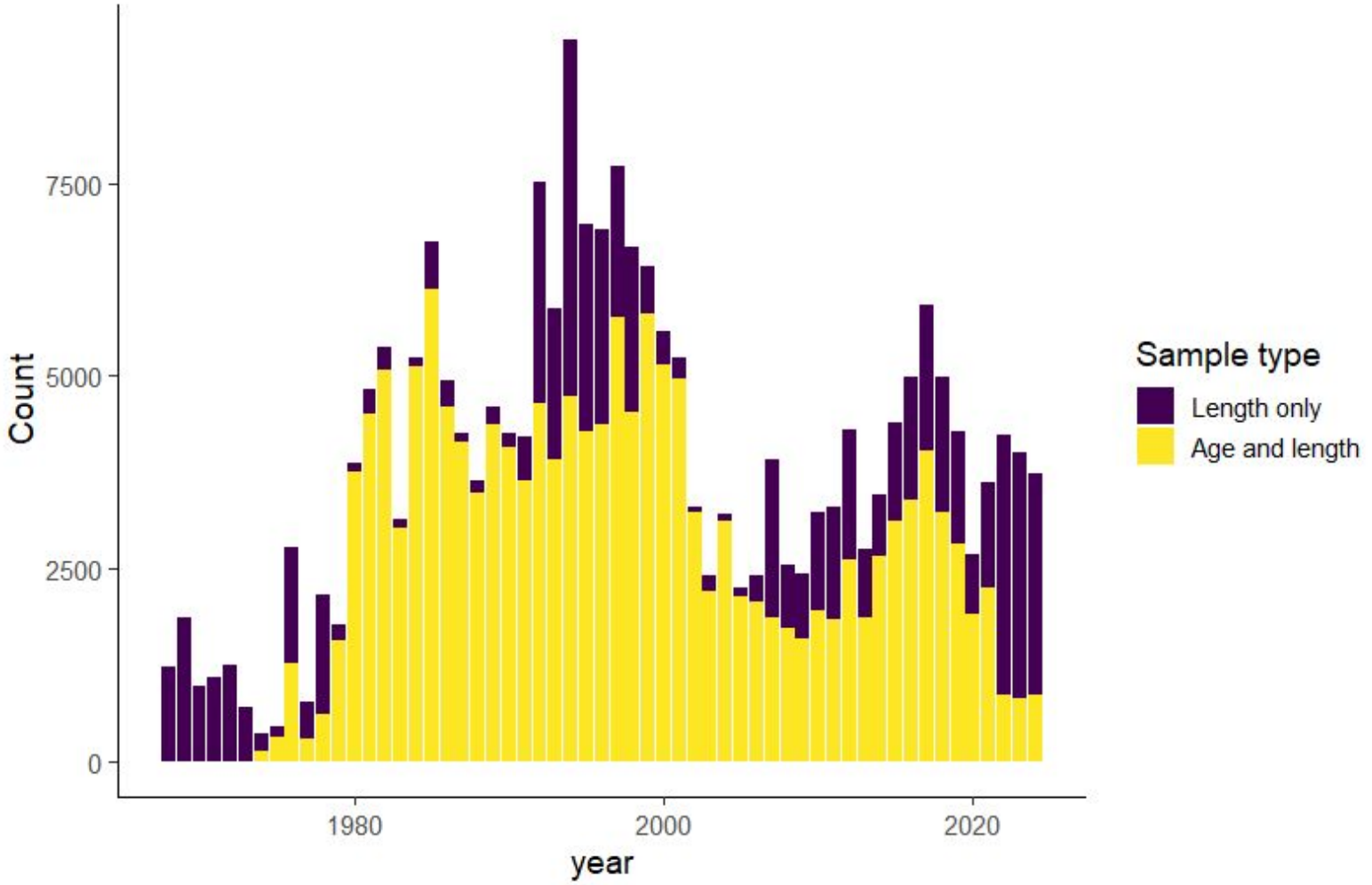
Commercial composition data: sample sizes

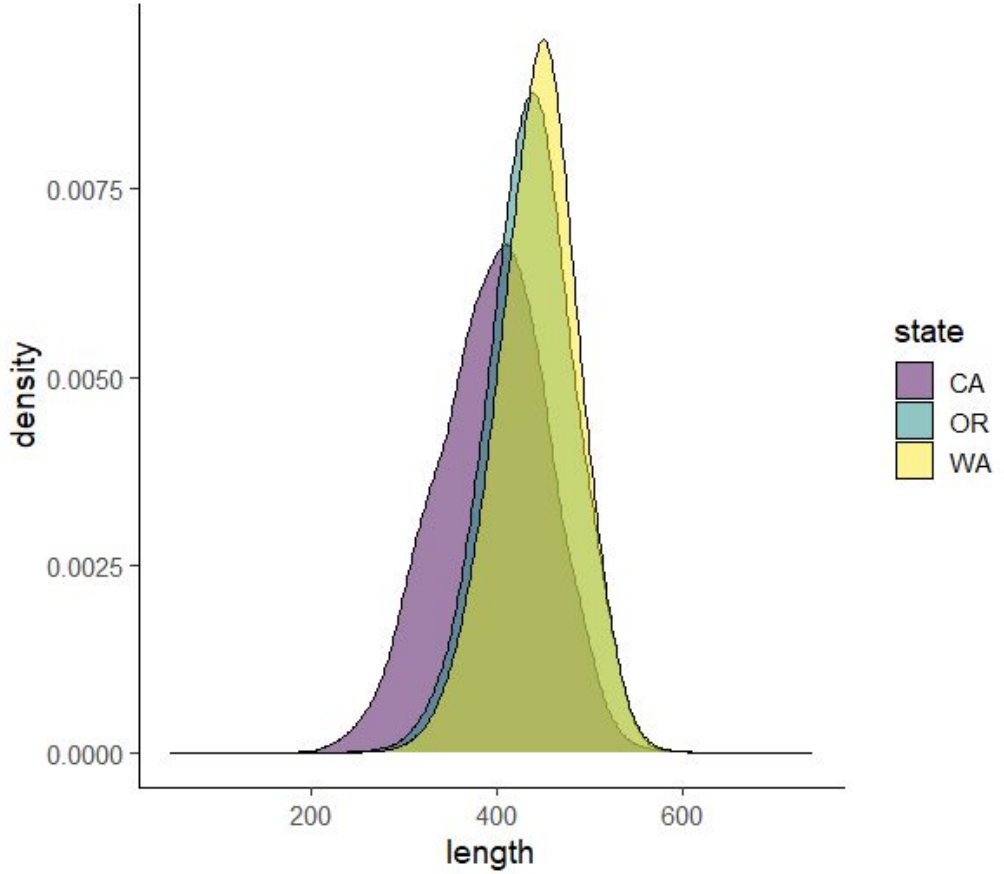


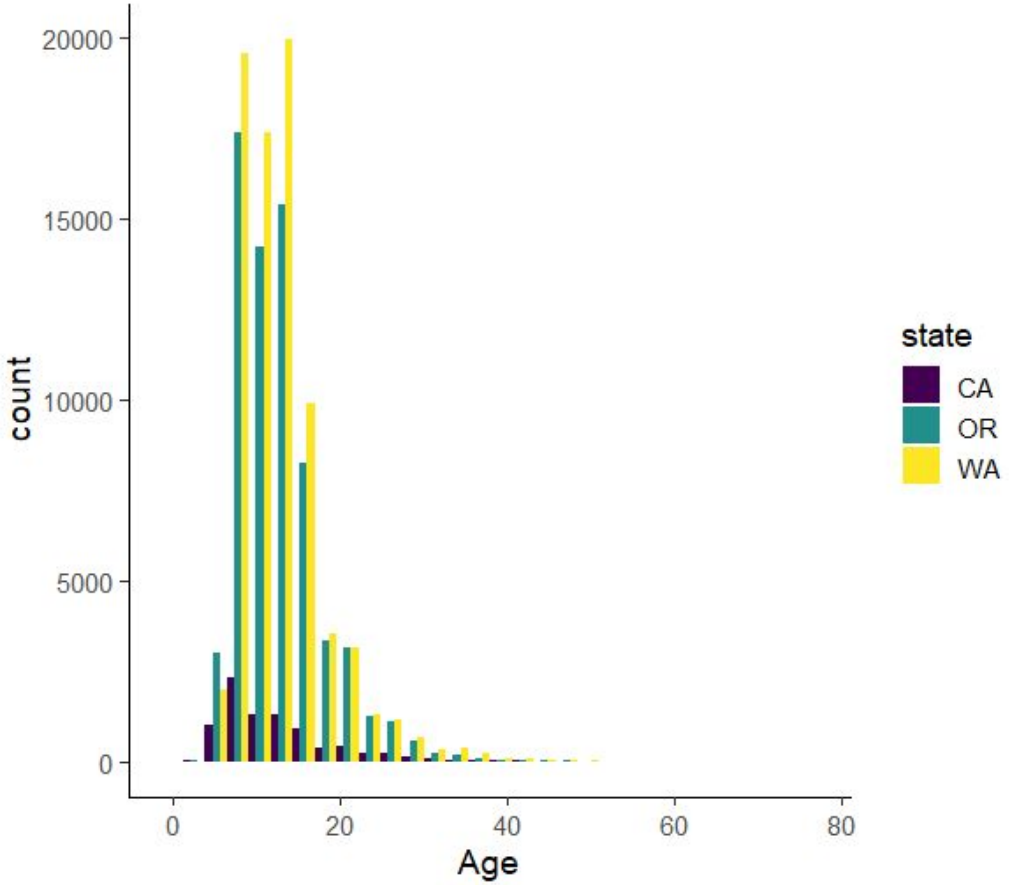
Expect additional ages to arrive for recent years

Most composition data is sexed

Large quantity of age data back to the 1980s

CA catches are slightly smaller and younger





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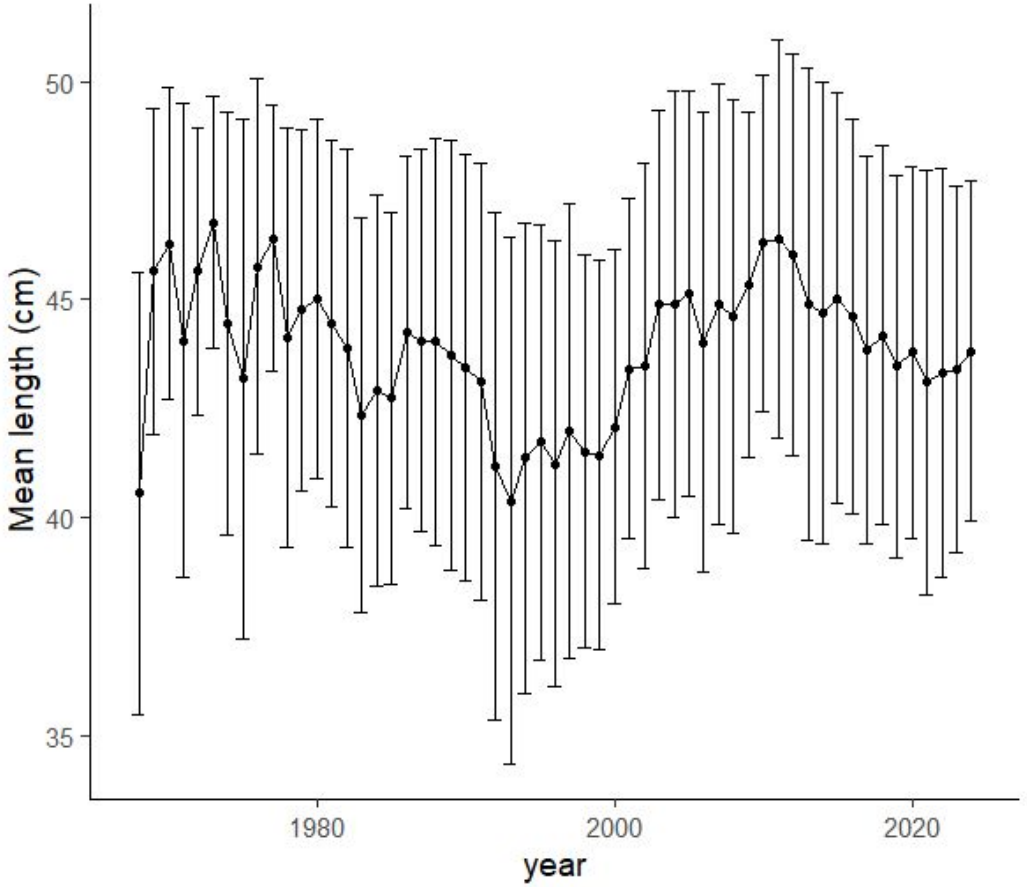
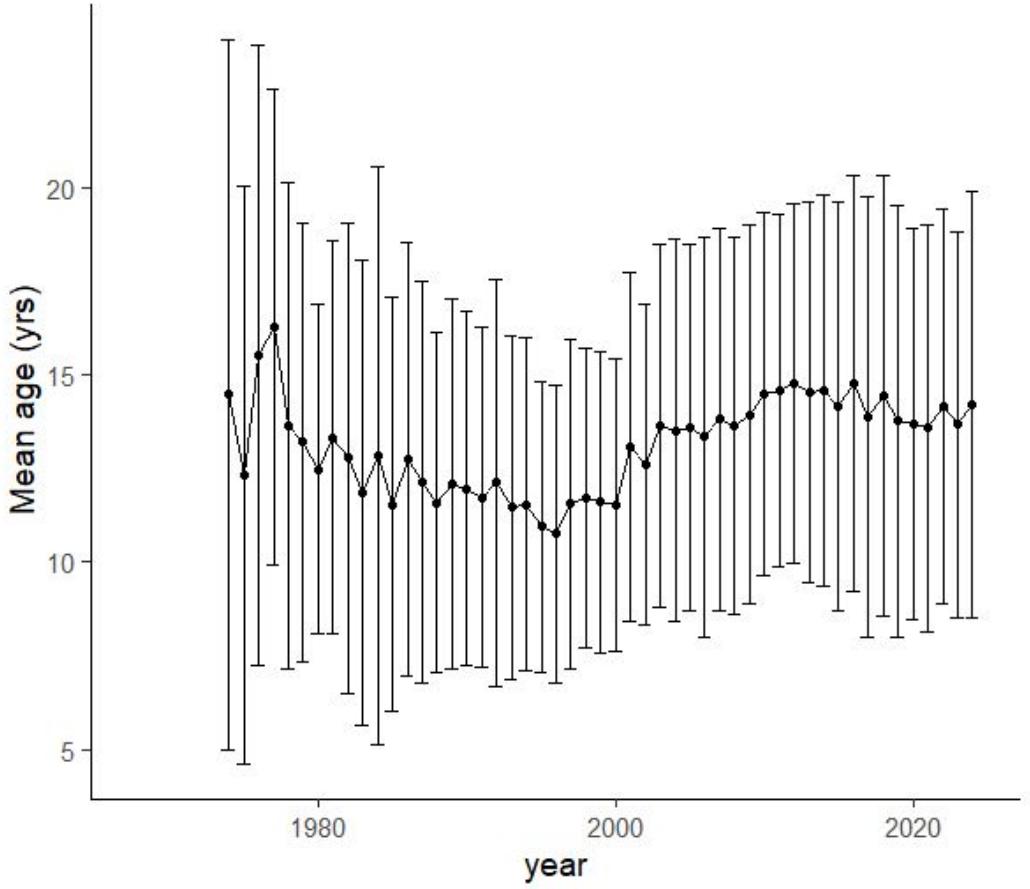
Mean lengths and ages consistent with fishing down and subsequent recovery





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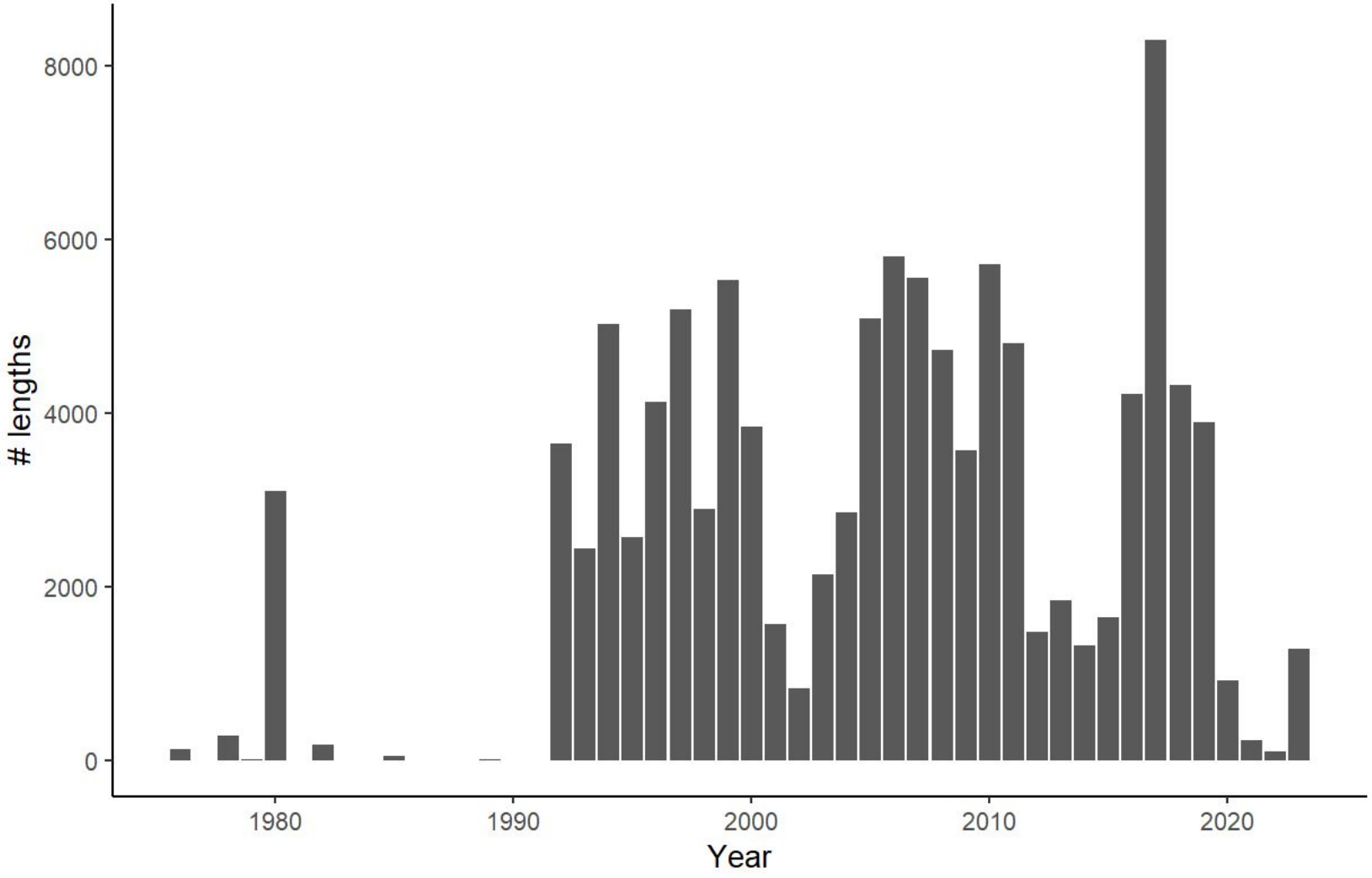
At-sea hake composition data: sample sizes

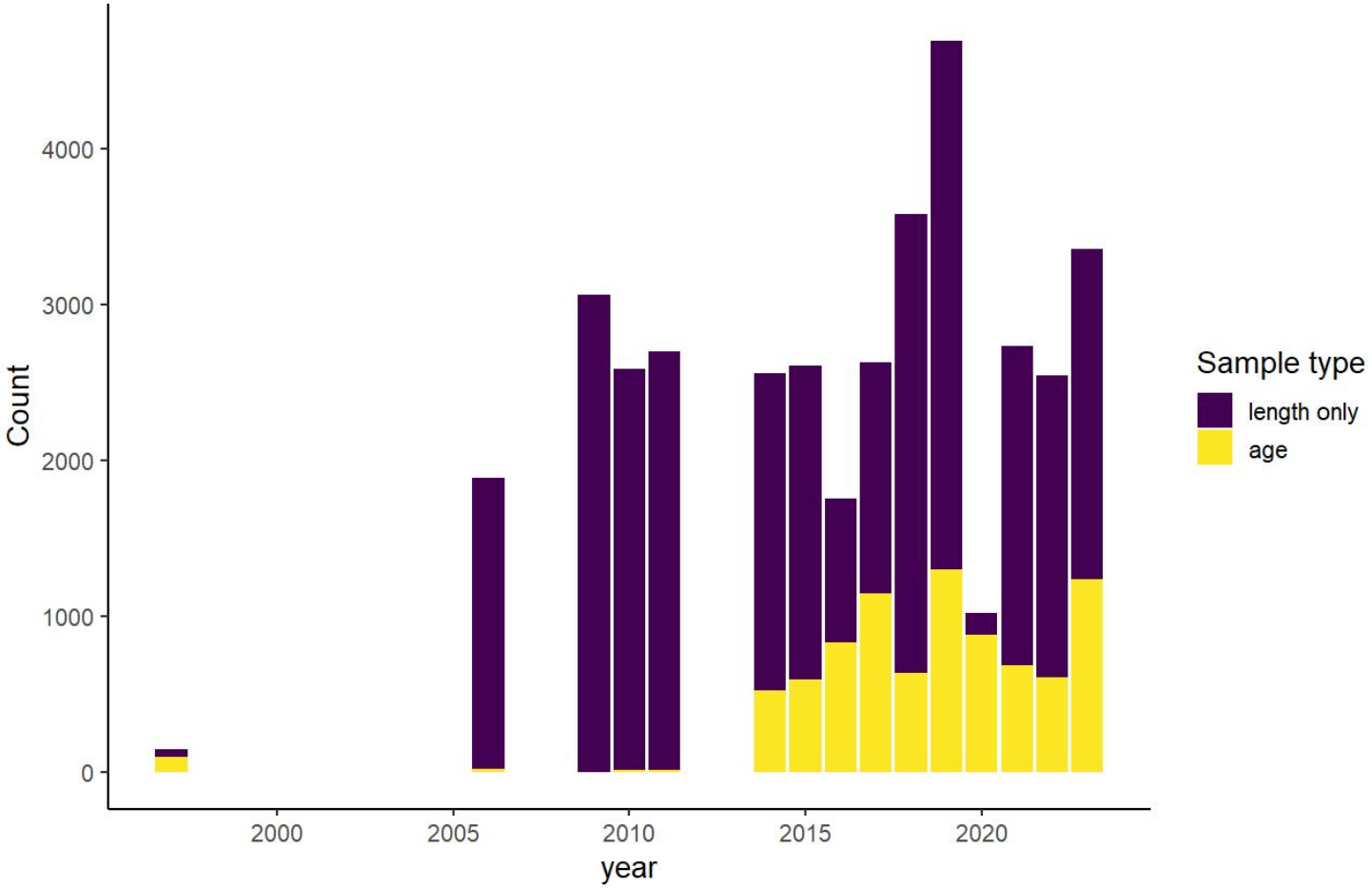


Lengths only for now

Expect ages for subset of recent years with high catch

Generally more samples in years with higher catches

Recreational composition data post-MRFSS: sample sizes



Also will use data from historical sampling programs

All age data is from WA

Lengths from all three states

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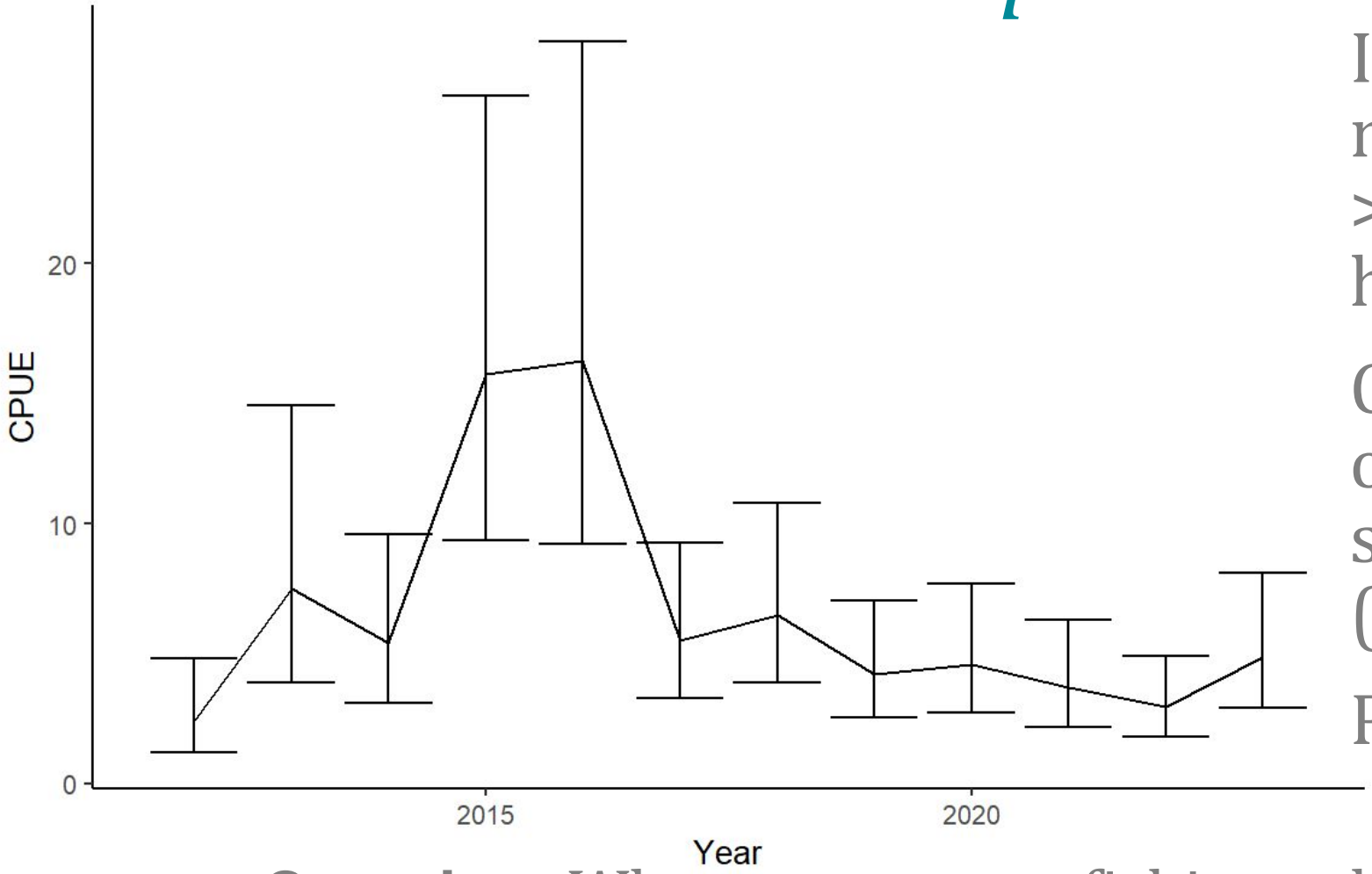
Observer and EM data index

- 2017 assessment explored ASHOP index, commercial logbook index (prior to fishery constraints)
  - Both were excluded from the final model at the STAR panel
  - Recommended exploring observer data as an alternative fishery-dependent index
- Observer CPUE index
  - **Benefit:** uses midwater gear that more effectively targets yellowtail than a bottom trawl
  - **Downside:** Difficult to control for changes in fishing effort, efficiency, targeting practices, regulations, etc., especially given a multispecies fishery

Observer and EM data *preliminary* index



Includes trips using midwater gear catching >50% rockfish. 70% of hauls contain yellowtail.

CPUE ~ year + observer/EM + s(depth) + s(month) + (1|vessel ID) + (1|port)

Peak around 2015-2016

Question: When you are out fishing, what impacts the amount of yellowtail caught in a given amount of time trawling?

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Fishery-Dependent Data: Recreational Index

- Previous assessment - combined MRFSS and RecFIN (ORBS) trips for OR/NCA evaluated but rejected
- Current approach (OR only):
  - Ocean Recreational Boat Survey (ORBS) - dockside sport boat sampling (2001 - 2024)
  - Ocean Recreational Fishing Survey (ORFS) - state observers onboard charter vessels (2003 - 2024)
  - ORBS - high sample size, opportunity to focus index on longleader fishery
  - ORFS - total encounters of fish (includes discarded fish); lower sample size
  - Model-based index in sdmTMB after standard filtering approach

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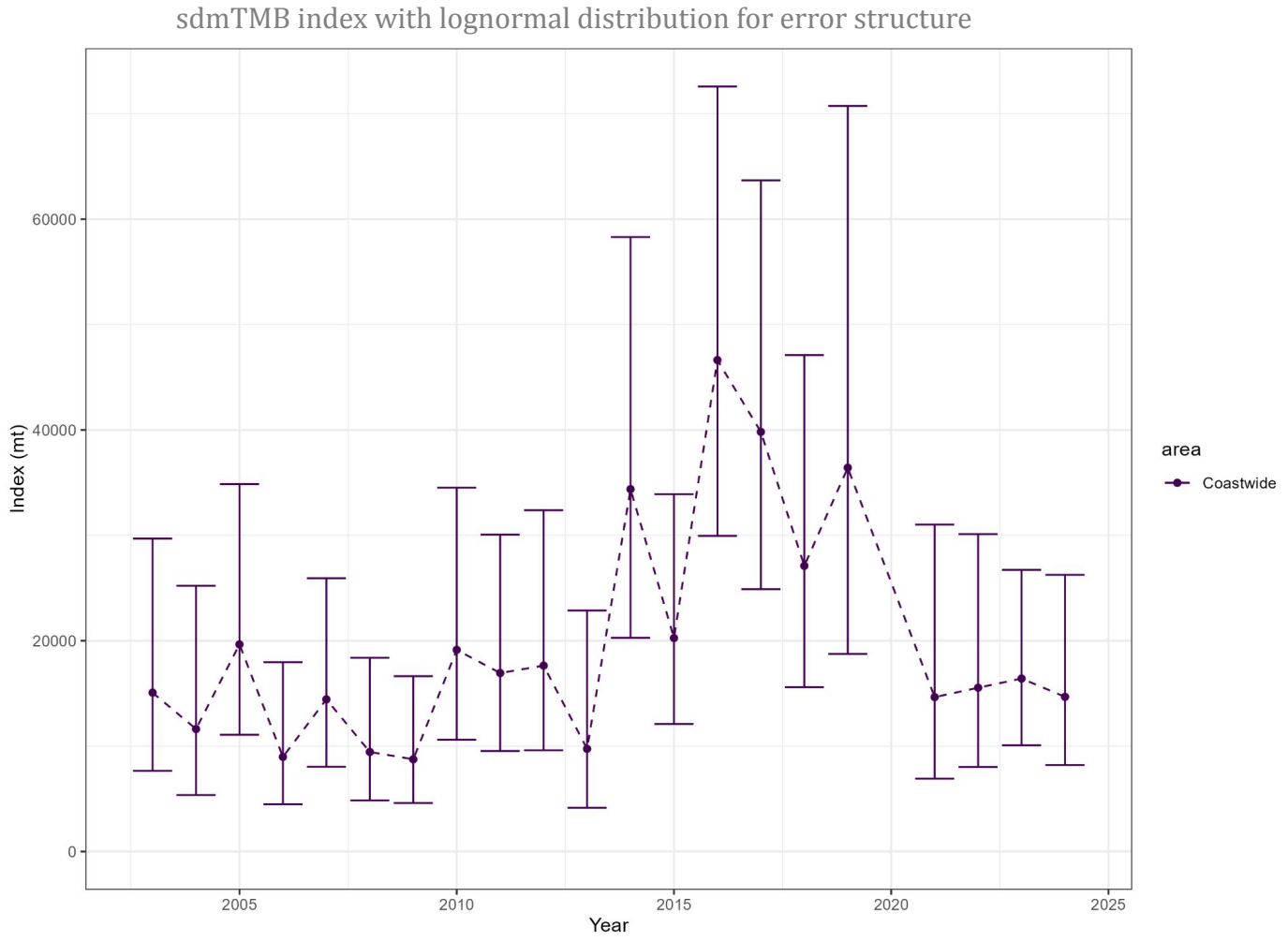
West Coast Groundfish Bottom Trawl Survey (WCGBTS) index

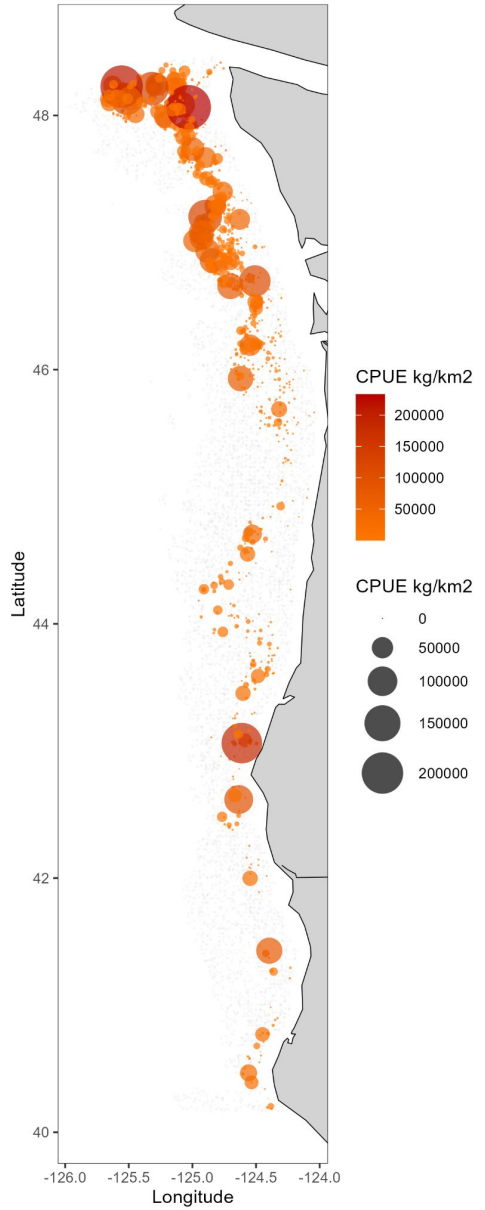
- Additional years of data added (2017-2024)
- Standardization software updated (sdmTMB instead of VAST)
- Shows population peak around 2016



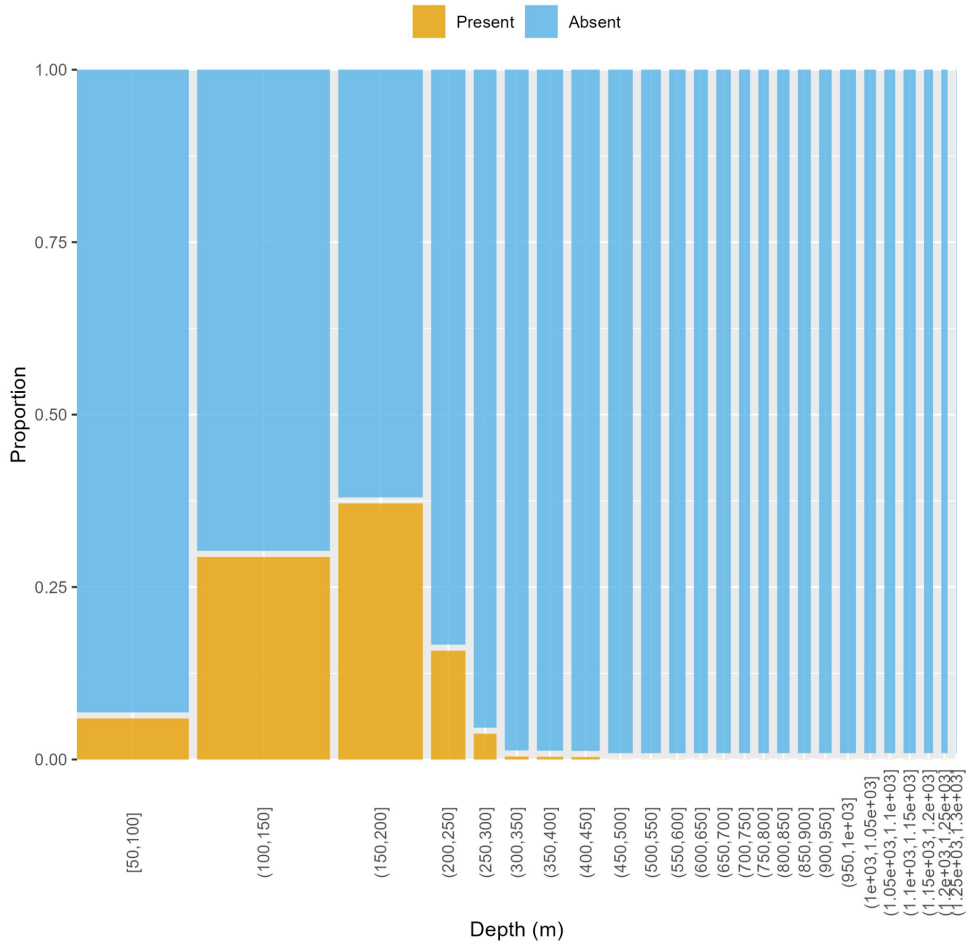
West Coast Groundfish Bottom Trawl Survey (WCGBTS) index

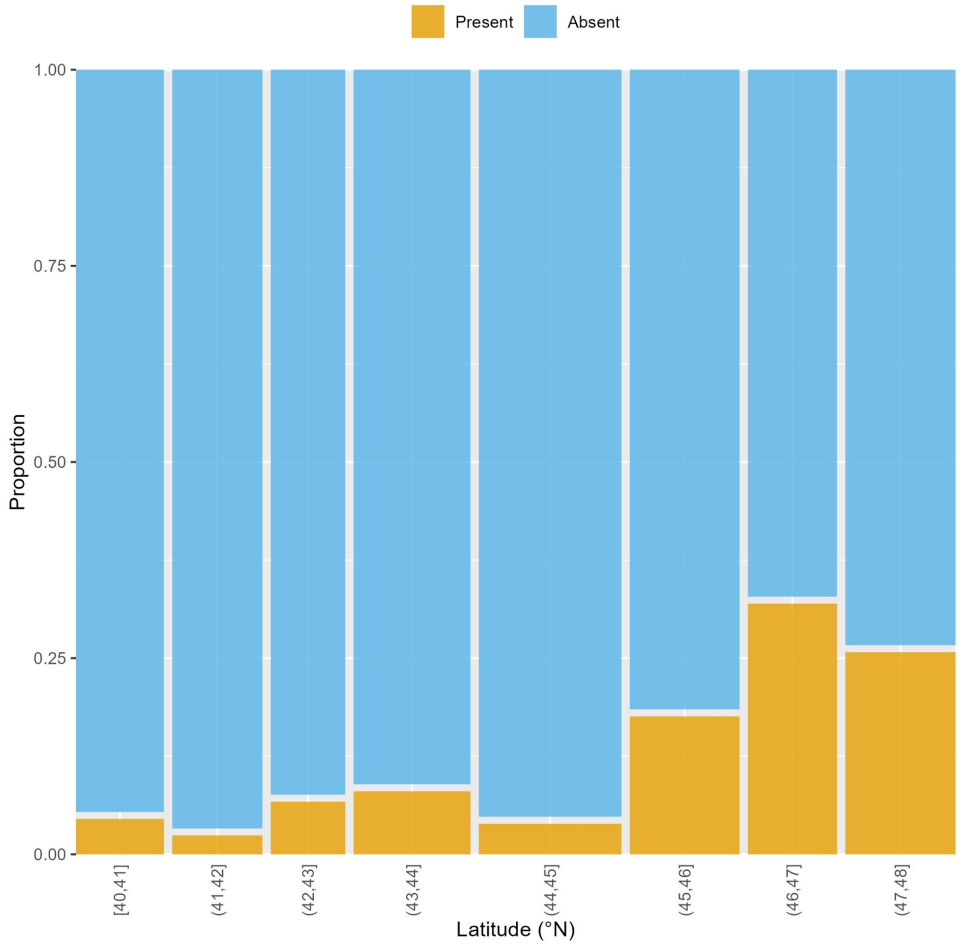
- Additional years of data added (2017-2024)
- Standardization software updated (sdmTMB instead of VAST)
- Shows population peak around 2016
- Catches increase north along coast

distribution of yellowtail catch in WCGBTS across all years



West Coast Groundfish Bottom Trawl Survey (WCGBTS) presence/absence by depth & lat.





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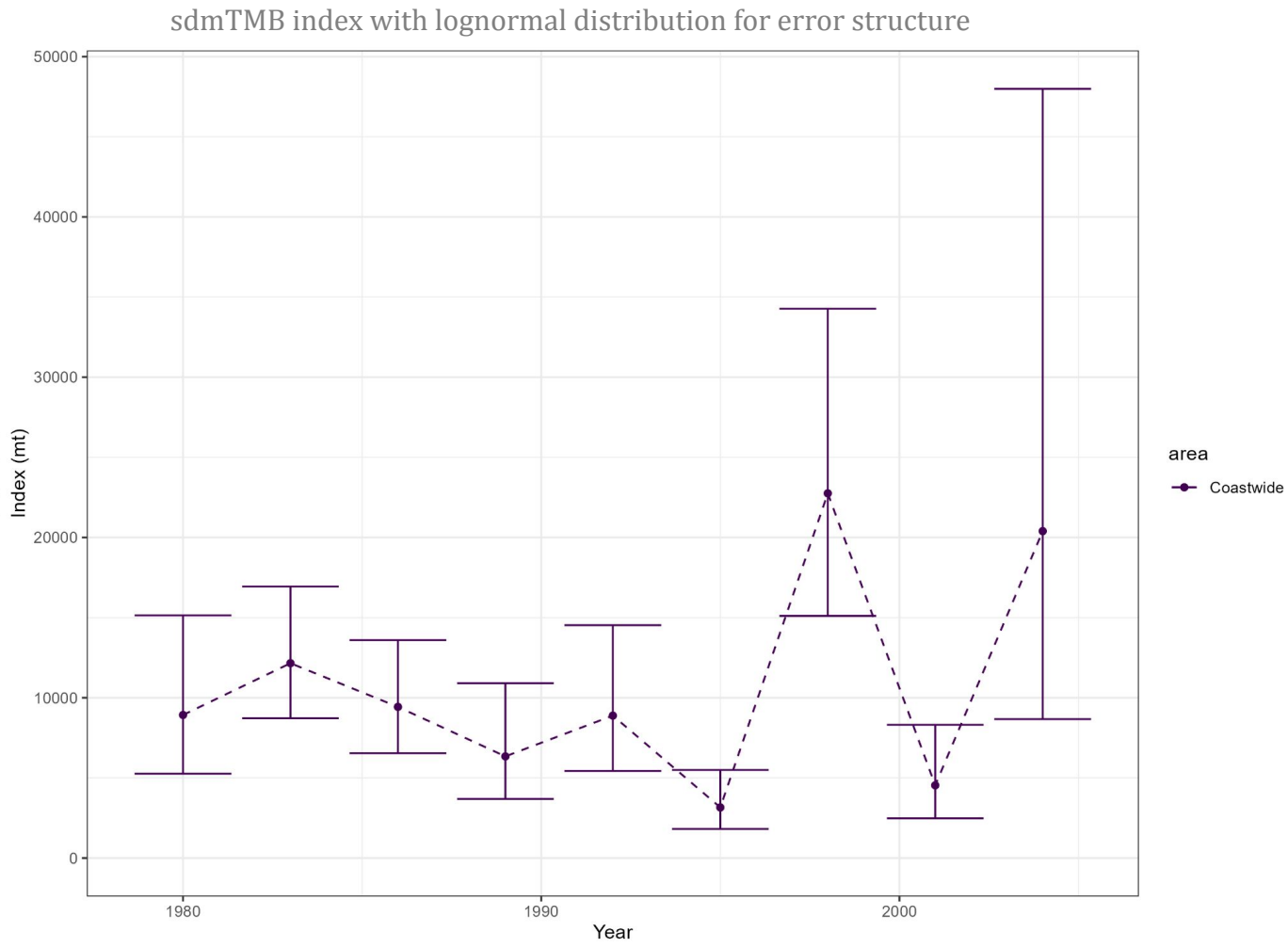
Triennial Trawl Survey index

- Survey ended in 2004
- Standardization software updated (sdmTMB instead of VAST)
- Noisier index is less informative of yellowtail trends



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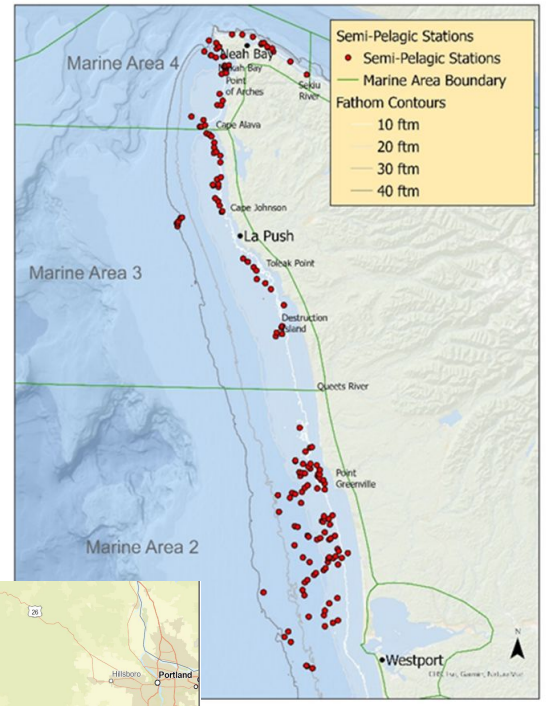
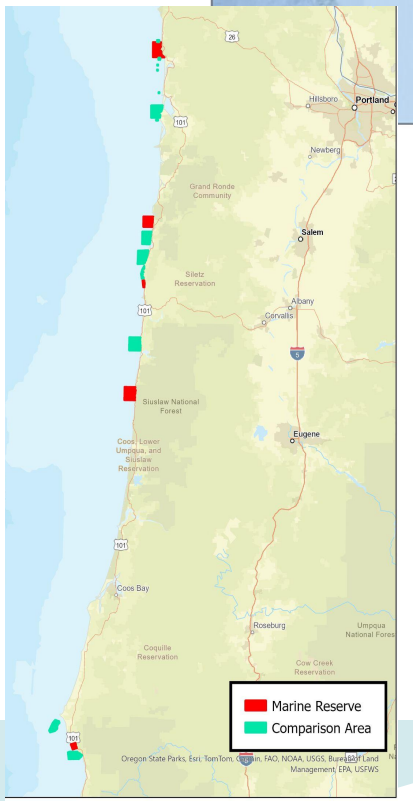
Fishery-Independent Indices: Combined Hook and Line (OR/WA)

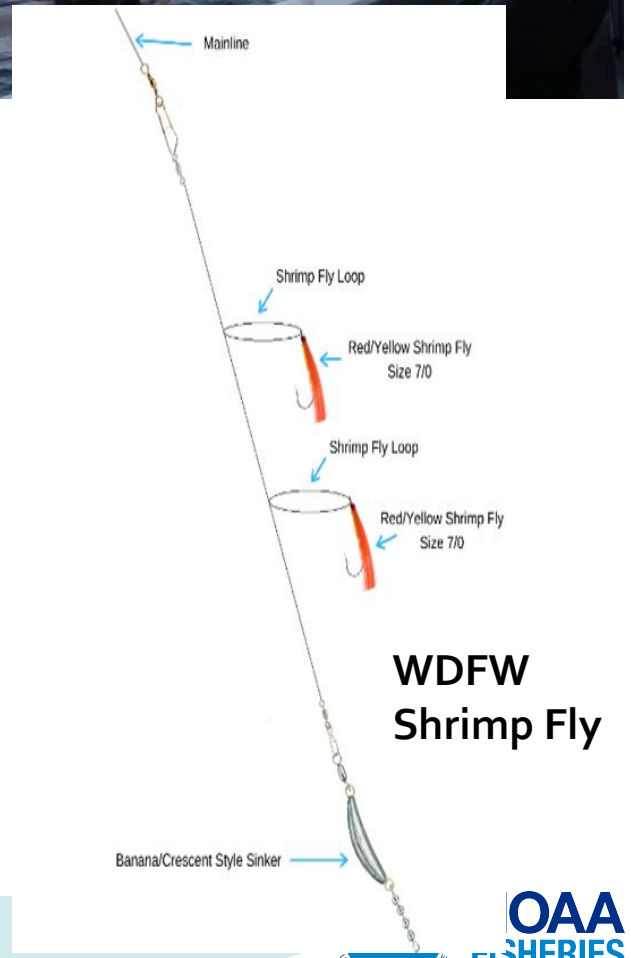
- WDFW “rod and reel” survey (2009 - 2024)
  - Replicate drifts at randomly selected stations on outer WA coast, primarily in marine area 2
  - Focus on rocky reef habitat
- ODFW Marine Reserves “hook and line” survey (2013 - 2024)
  - Replicate drifts at randomly selected cells within reserves/comparison areas (coastwide coverage)
  - Culled over time to focus on rocky reef habitat
- Drift characteristics, gear types, oceanography data available for both surveys





Fishery-Independent Indices: Combined Hook and Line (OR/WA)

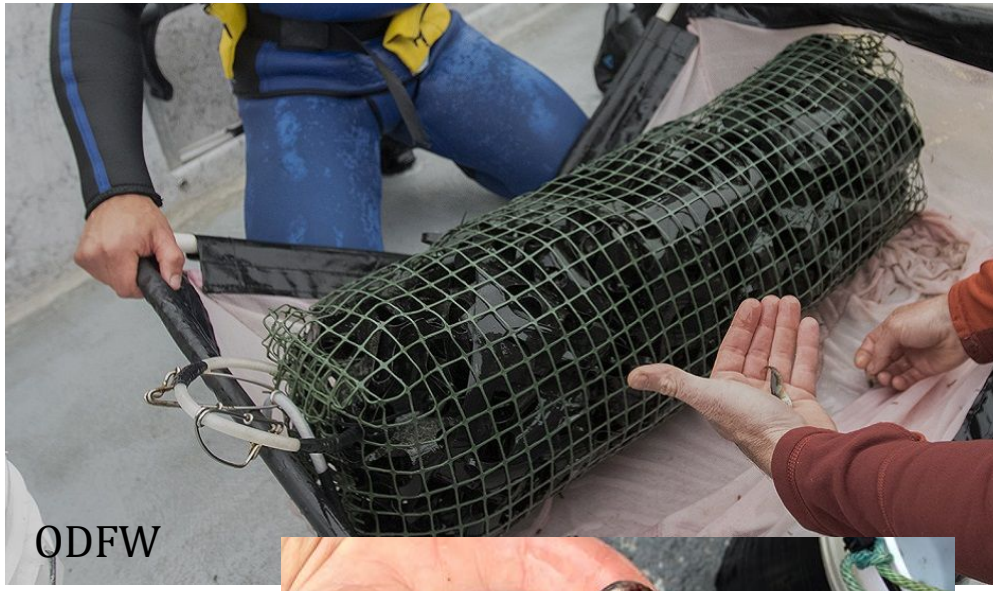
- ~2900 station/cell days combined with a 17.8% positive encounter rate for yellowtail
- Model-based index in sdmTMB (spatially explicit?)
- Factors considering:
  - Regional (WA vs OR) - more in WA
  - Season - spring and fall sampling (more in spring)
  - Temperature/dissolved oxygen
  - Drift speed and depth - CPUE seems to increase with depth (most samples <40fm)
  - Gear type - need to reconcile some minor configuration differences, plan to categorize to evaluate in model



WDFW Shrimp Fly

Fishery-Independent Indices: SMURFS

- Standard Monitoring Unit for the Recruitment of Fishes
  - Oregon State University/ODFW Marine Reserves
  - Otter Rock (central) and Redfish Rocks (south)
  - Monitored every two weeks April - Sept
  - 2011 - 2024
  - Settlement rates (YOY fish per day)
  - Paired with oceanographic data from ODFW moorings (temp/DO)



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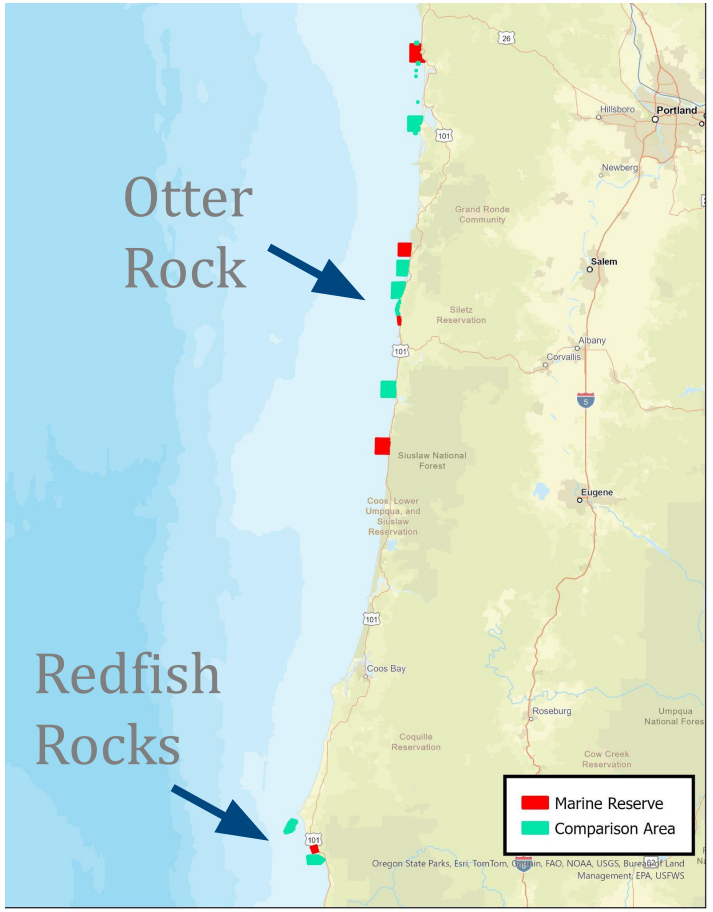
Fishery-Independent Indices: SMURFS

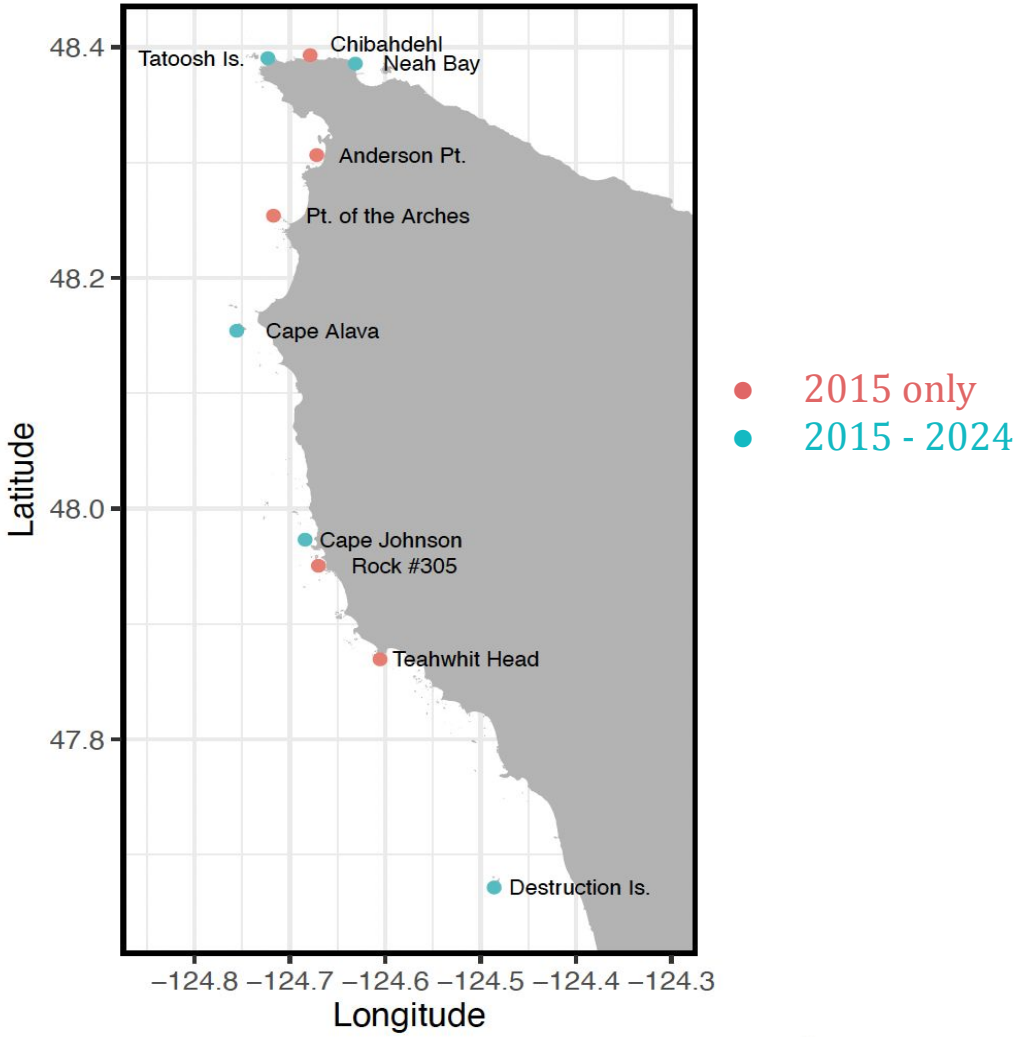
- Preliminary results/modeling approach
  - Fill in oceanographic data holes
  - Model-based index using sdmTMB (spatially-explicit?)
  - Factors exploring:
    - south vs central OR - more in the south (but more sampling in the north)
    - early vs late season - more yellowtail earlier in the year
    - treatment effect (sampling locations inside/outside marine reserves)
    - temperature - settlement rates peaking 8 - 10℃



ODFW Marine Reserves Program

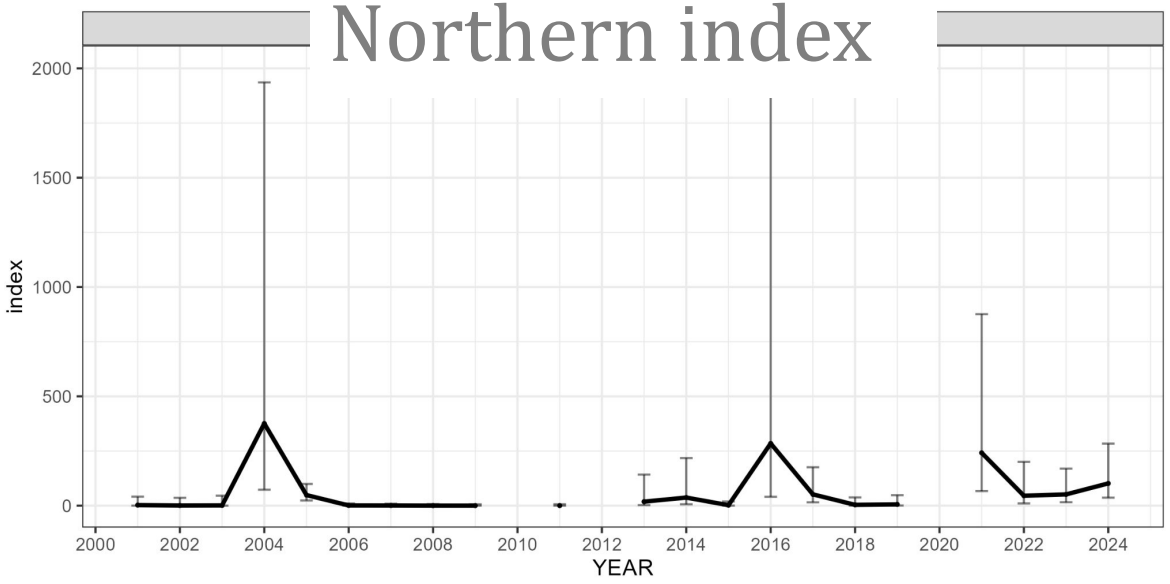
Fishery-Independent Indices: OCNMS Dive Survey

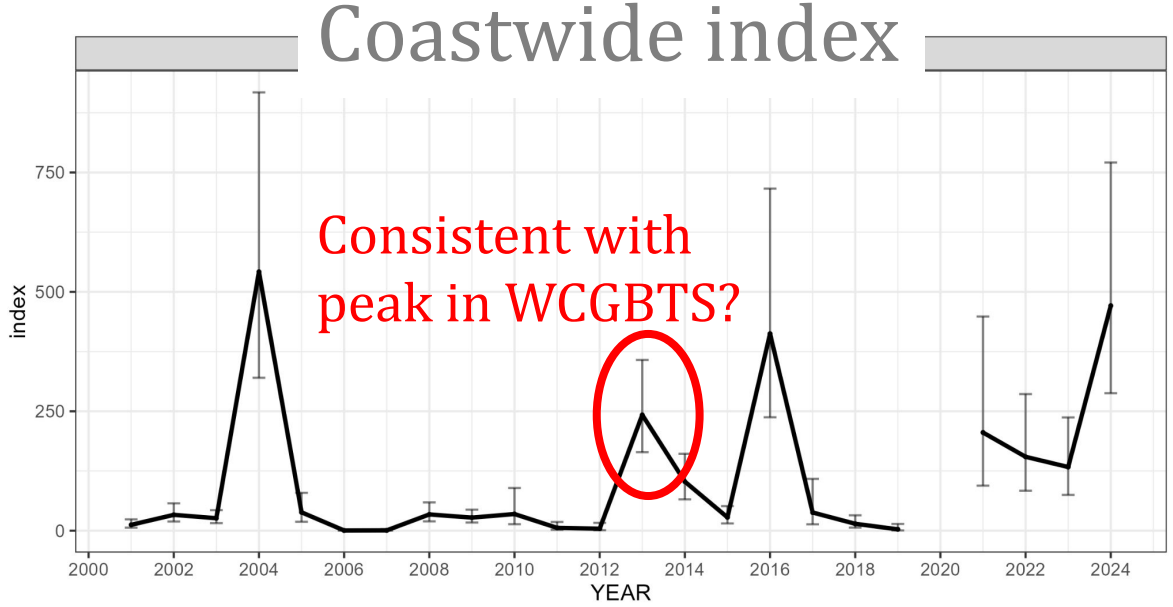
- BYT Young of Year Complex
  - Difficult to visually distinguish small Black vs. Yellowtail = single complex (BYT)
    - YOY fish <10 cm
  - Estimated young-of-year rockfish (BYT) density on the Washington coast.
  - 6 replicate transects at each year-site-depth combination
    - 5 sites -> 2 locations within sites -> 2 depths per location
    - Sites are kelp forest adjacent
  - 2015 - 2024
  - Density (YOY fish per 120 m^3)
  - Sampled late July - early August



Rockfish recruitment survey (RREAS)

- Used in many west coast rockfish assessments
- Coastwide and northern indices have both been developed
- Coastwide index would be more informative, seems more consistent with other data





Figures courtesy of Tanya Rogers, SWFSC

Oceanographic Indices of Recruitment

- Research has linked oceanographic conditions to recruitment
  - *Melissa Haltuch, Nick Tolimieri*
- This work has been tested as oceanographic indices in assessments
  - Sablefish
  - Petrale sole

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DOI: 10.1111/fog.12266

ORIGINAL ARTICLE

WILEY FISHERIES OCEANOGRAPHY

Oceanographic drivers of sablefish recruitment in the California Current

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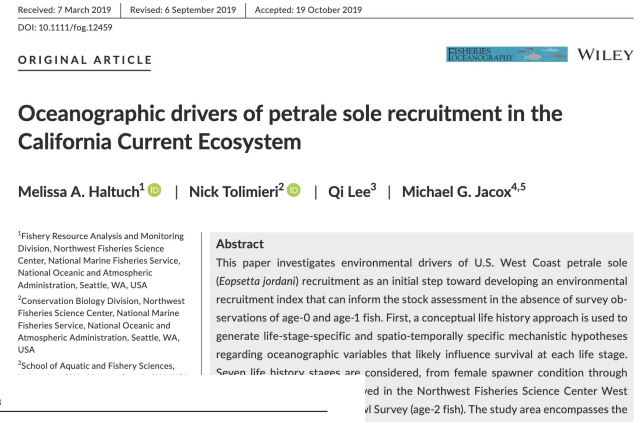
Abstract

Oceanographic processes and ecological interactions can strongly influence recruitment success in marine fishes. Here, we develop an environmental index of sablefish recruitment with the goal of elucidating recruitment-environment relationships and informing stock assessment. We start with a conceptual life-history model for sablefish *Anoplopoma fimbria* on the US west coast to generate stage- and spatio-temporally-specific hypotheses regarding the oceanographic and biological variables likely influe



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DOI: 10.1111/fog.12459

ORIGINAL ARTICLE

FISHERIES OCEANOGRAPHY WILEY

Oceanographic drivers of petrale sole recruitment in the California Current Ecosystem

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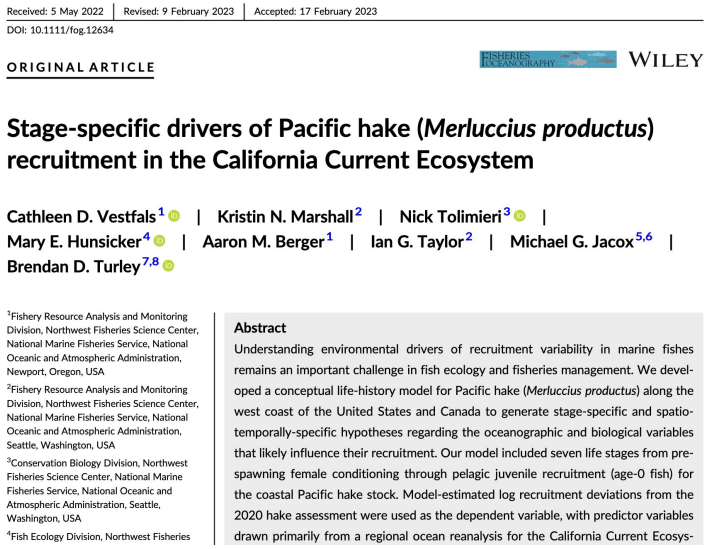
[2]Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, WA, USA
[3]School of Aquatic and Fishery Sciences,

Abstract

This paper investigates environmental drivers of U.S. West Coast petrale sole (*Eopsetta jordani*) recruitment as an initial step toward developing an environmental recruitment index that can inform the stock assessment in the absence of survey observations of age-0 and age-1 fish. First, a conceptual life history approach is used to generate life-stage-specific and spatio-temporally specific mechanistic hypotheses regarding oceanographic variables that likely influence survival at each life stage. Seven life history stages are considered, from female spawner condition through ed in the Northwest Fisheries Science Center West l Survey (age-2 fish). The study area encompasses the



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ORIGINAL ARTICLE

FISHERIES OCEANOGRAPHY WILEY

Stage-specific drivers of Pacific hake (*Merluccius productus*) recruitment in the California Current Ecosystem

Cathleen D. Vestfals[1] | Kristin N. Marshall[2] | Nick Tolimieri[3] | Mary E. Hunsicker[4] | Aaron M. Berger[1] | Ian G. Taylor[2] | Michael G. Jacox[5,6] | Brendan D. Turley[7,8]

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[3]Conservation Biology Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Seattle, Washington, USA
[4]Fish Ecology Division, Northwest Fisheries

Abstract

Understanding environmental drivers of recruitment variability in marine fishes remains an important challenge in fish ecology and fisheries management. We developed a conceptual life-history model for Pacific hake (*Merluccius productus*) along the west coast of the United States and Canada to generate stage-specific and spatio-temporally-specific hypotheses regarding the oceanographic and biological variables that likely influence their recruitment. Our model included seven life stages from pre-spawning female conditioning through pelagic juvenile recruitment (age-0 fish) for the coastal Pacific hake stock. Model-estimated log recruitment deviations from the 2020 hake assessment were used as the dependent variable, with predictor variables drawn primarily from a regional ocean reanalysis for the California Current Ecosys-

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Previously established process for linking stage-specific oceanographic conditions to recruitment

Comprehensive literature review linking oceanographic conditions to groundfish lifestages ✓

Oceanographic Profile

Female preconditioning (50–1,200 m)

(–) DD_{pre}

Cold water is associated with higher system productivity and lower metabolic costs making more energy available for reproduction

Eggs (300–825 m)

(+) CST_{egg}

Onshore transport maintains larvae near settlement habitat

(+) DD_{egg}

Faster development in warm water

Yolk-sack (1000–1200 m)

(+) LST_{yolk}

Transport to the north results in better feeding later on northern zooplankton

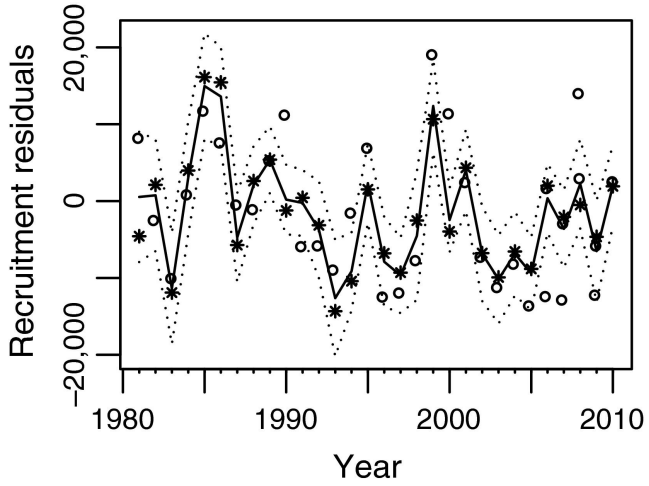
Pelagic larvae (surface waters) ✓

(–)DD_{larv}

Cold water is associated with higher system productivity and lower chance of starvation

Evaluate identified oceanographic conditions for fit to recruitment

Model Fit ✓



Evaluation complete from the 2017 assessment; will be updated with 2025 data

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Oceanographic data: Global Ocean Physics Reanalysis (GLORYs)

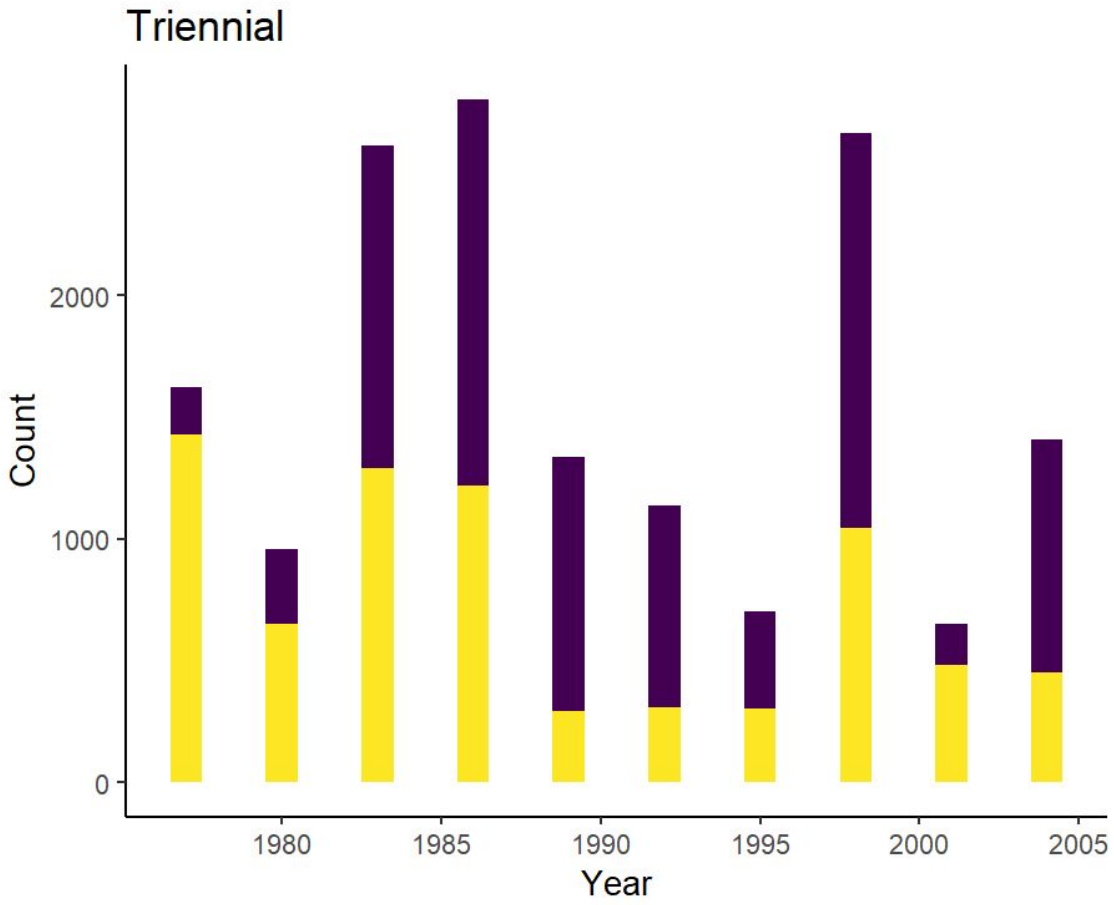
- Resolution
  - 1/12° resolution
  - 50 vertical levels
  - Depth domain and temporal domain are lifestage dependent
- Variables
  - Upwelling *(not GLORYs, ROMs)*
  - Transport
  - Temperature
  - Mixed Layer Depth

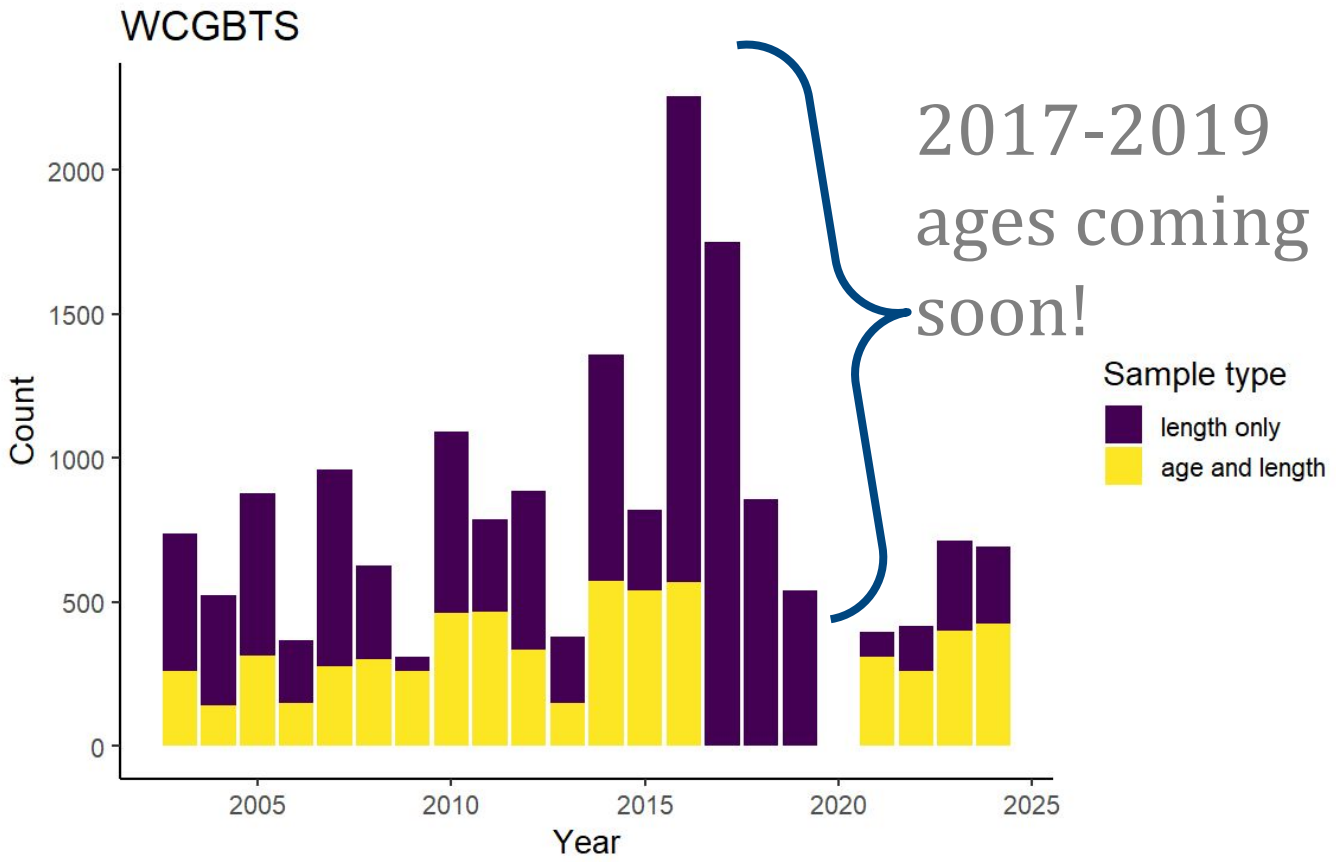
} Combinations* of these four categories oceanographic variables explained 50 - 65% of the variation in recruitment from 1993 - 2014

Outline

- Overview
- Fishery dependent data
  - Landings
  - Fishery length and age composition data
  - Fishery-dependent indices
- **Fishery-independent data**
  - Indices: retained from previous assessment
  - Indices: new
  - **Length and age composition**
- Biological information

Available survey composition data





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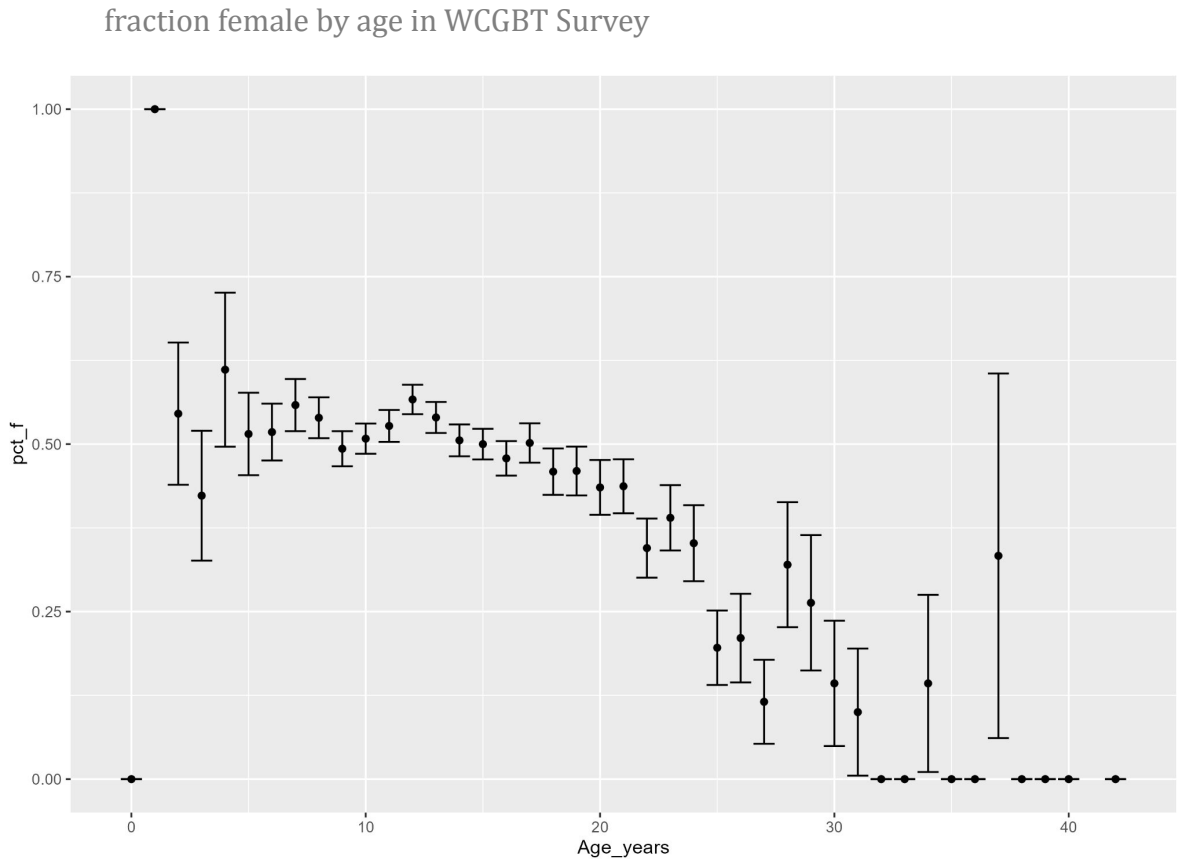
Maturity

- 635 maturity samples are now available
  - 2017 assessment included 141 samples
  - Some subset of new samples will be added
- Hope to utilize new approach NWFSC has developed to account for spatial variation in maturity
- Ages not yet available for most new samples yet, updated relationship is TBD.

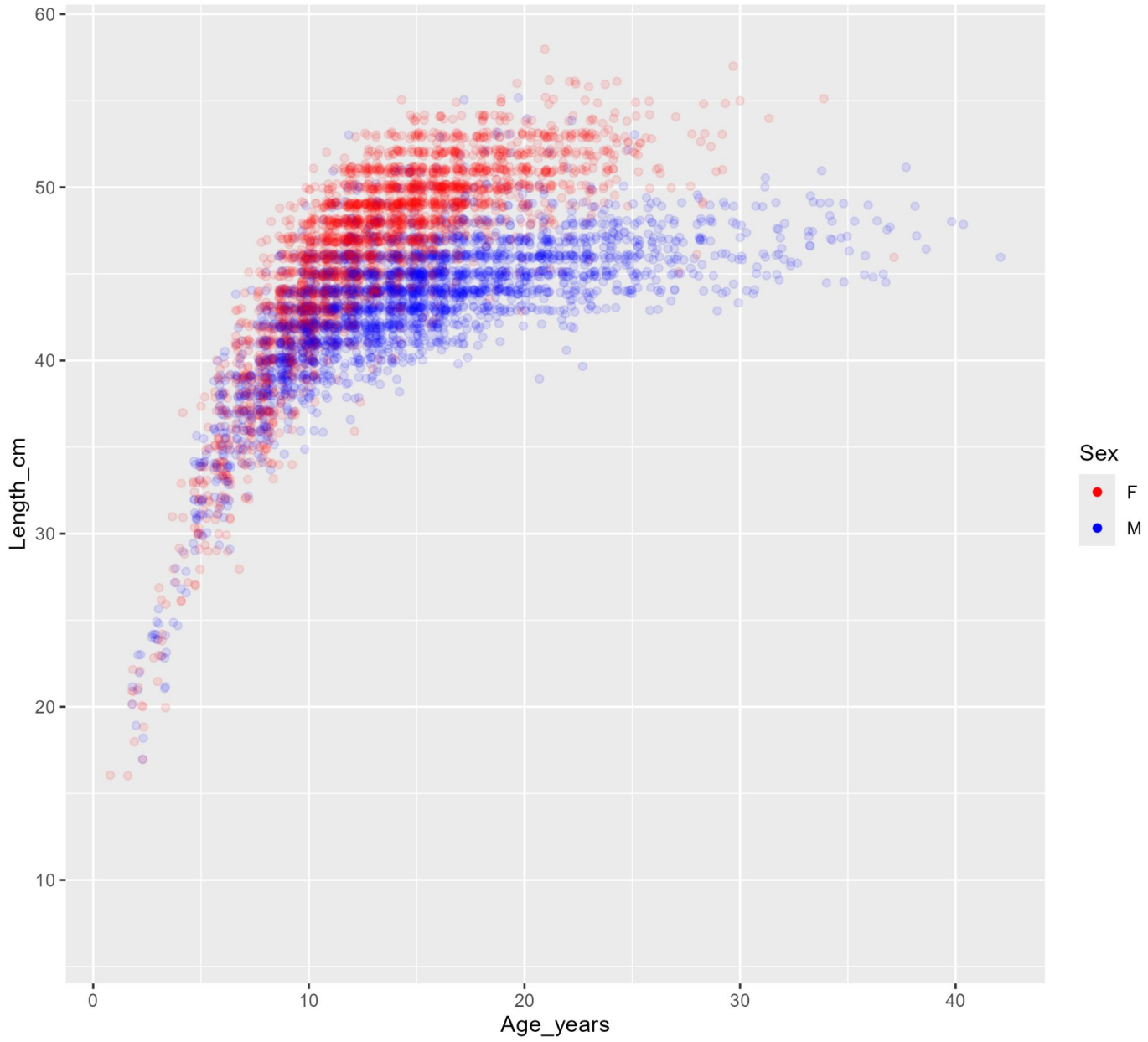
Natural mortality

- Sex ratio in all data sources becomes male-dominated at older ages. Cause is unknown
- Plan for some form of sex-specific natural mortality
- Max age for M prior is difficult to determine
  - Literature: 64 years
  - Max survey age: 37/42 years
  - Max commercial age: 53/60 years
  - 2017 assessment: 35/45 years
  - Data overwhelmed prior in 2017



Length-at-age

Distribution of points shows larger maximum size for females and small number of old females



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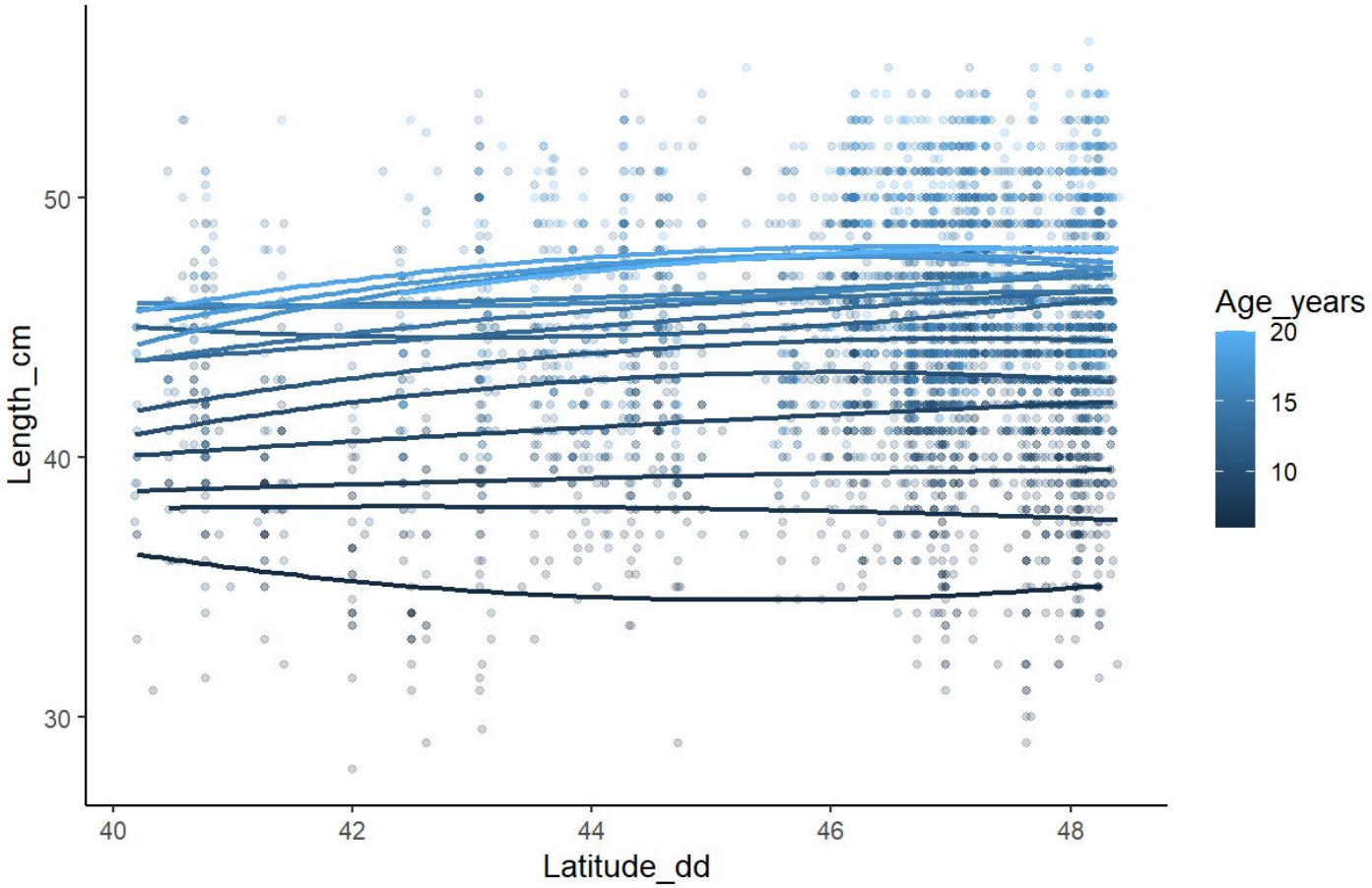
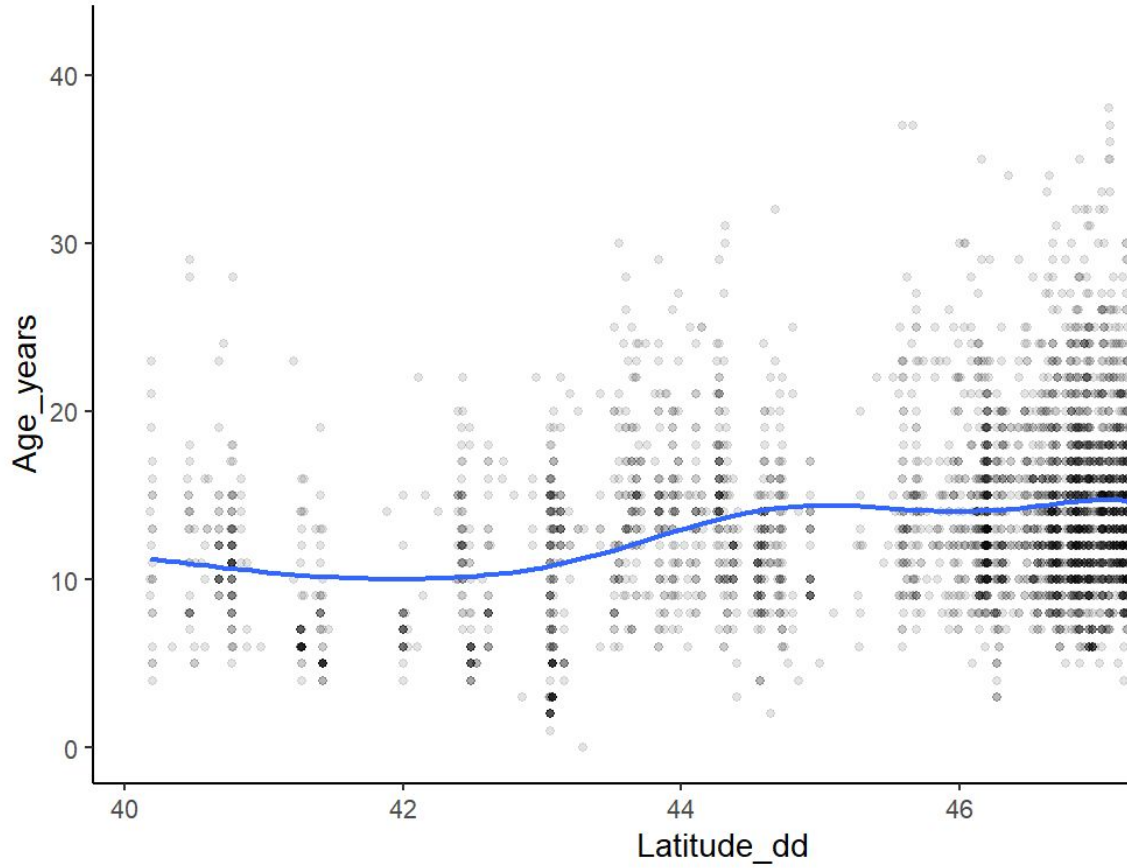
Subtle trends in age and size by latitude

Larger maximum size farther north



Older fish farther north



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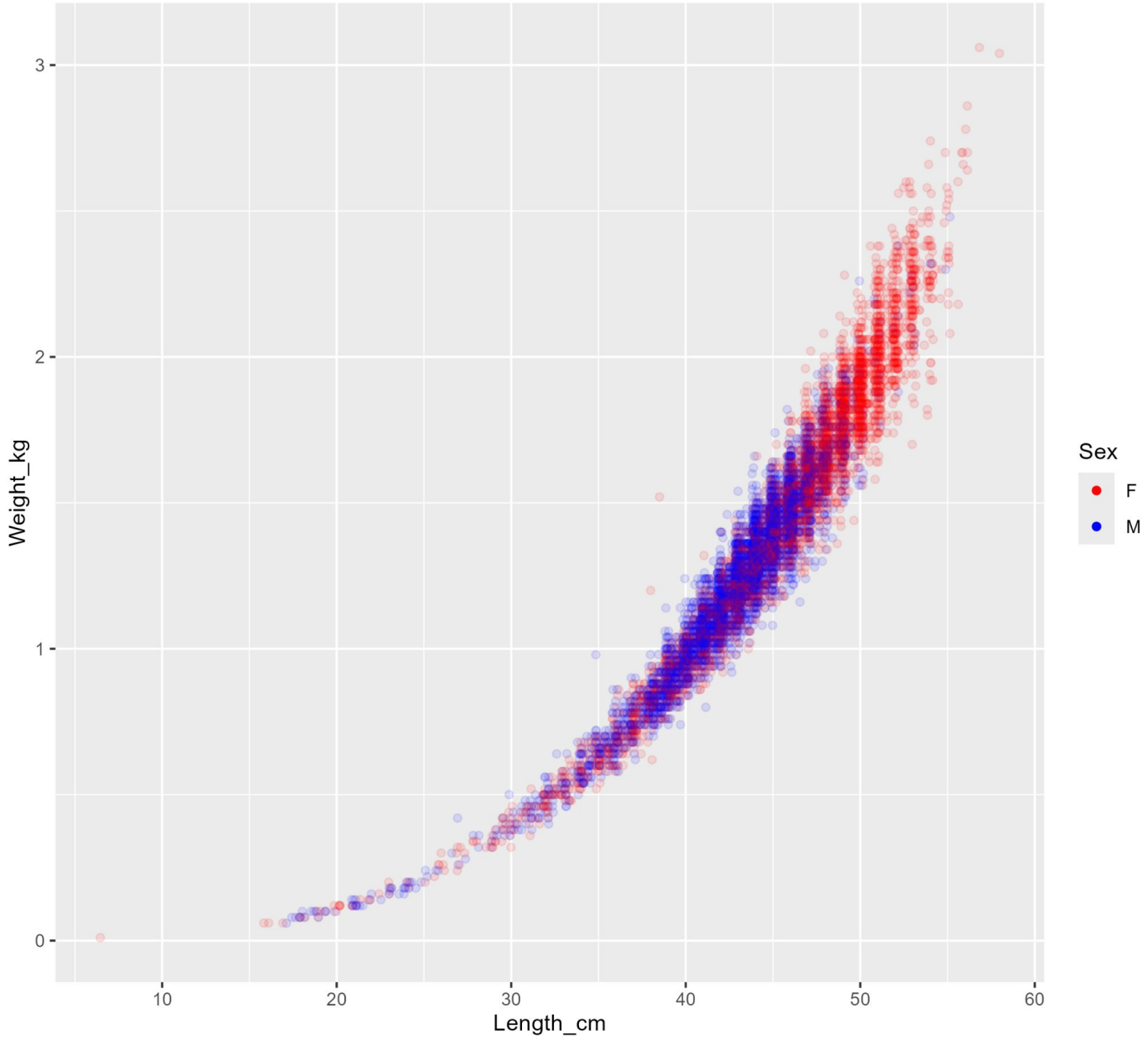
Weight-at-length

2017 assessment had one relationship for both sexes. Appears supported by data.

May explore time-varying weight-at-length as a sensitivity model.



Discussion questions for folks with knowledge of the fishery

- How does the midwater rockfish fishery differ from bottom trawl fishery in terms of gear and fishing practices?
- How much does the catch of other species impact targeting yellowtail (are you limited by quotas for canary, widow or anything else)?
- Were there regulatory changes which impacted the sizes of fish caught in the commercial or recreational fisheries?
- The trawl survey had higher catch rates in 2015-2019 than before or after. Does that match the experience of the fishery?

Thank you!

Questions? Comments?
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Landings and summary of composition data available at:
https://pfmc-assessments.github.io/yellowtail_2025/

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