



2025 Yellowtail Rockfish North of 40° 10' N. STAR presentation 1: Biology, Fisheries, Data Kiva L. Oken¹, Ian G. Taylor¹, Megan L. Feddern¹, Alison D. Whitman², Fabio P. Caltabellotta³

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Outline

- 1. Background
- 2. Model summary
- 3. Biology
- 4. Fishery-dependent data
- 5. Fishery-independent data



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Background

• Range along U.S. west coast primarily north of Point Conception to Alaska



- Caught in commercial and recreational fisheries with commercial being majority
- Semi-pelagic shelf species with young fish shallower than older fish.
- Relatively short-lived for a rockfish, few observations >40 yrs
- Genetic break near Cape Mendocino, assessment is only for Northern stock



Outline

1. Background

- 2. Model summary
 - a. Stock size and status
 - b. Key uncertainty
 - c. Changes for 2025
- 3. Biology
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- 5. Fishery-independent data



Model summary



- Catch + length + age + index integrated model (using SS3)
- Model fits composition data reasonably well, index fits are more of a mixed bag



Sensitivities

Most sensitive to:

- Composition data weighting
- WCGBTS weight
- Natural mortality treatment





Changes for 2025

- Reanalysis of all data sources
- Discards added to catch rather than modeled using retention
- Added foreign landings from 1960s and 1970s
- New Oregon recreational reconstruction
- Single recreational fleet
- New recruitment and hook & line survey indices
- Sex-specific recreational selectivity, new selectivity blocks
- Change from length-based to age-based maturity



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Maturity

- Estimated from additional data
- Age-based rather than length-based
- Length-based model fit to new data is nearly identical





Weight-at-length similar by sex





Females grow to larger maximum sizes





Male-skewed sex ratio for fish >20 years

Females more prevalent in recreational fleet (Untrawlable habitat?)





Natural mortality (M)

- Female and male *M* estimated separately (male as offset from female)
- *M* is constant across ages and years within each sex
- Lognormal prior included (Hamel and Cope 2022) based on max age of 43 years (99.9th percentile of the 161,828 available ages)
- Information about *M* in the data is much more informative than prior (judging from likelihood profiles)



Fecundity and Steepness

- Fecundity and steepness unchanged from the 2017 assessment
- Fecundity relationship from Dick et al. (2017): spawning output (in trillions of eggs) for an individual is
 1.1185 × 10⁻¹¹ *length^{4.59}
- Steepness fixed at 0.718 based on a 2017 meta-analysis



Appear to migrate north through ontogeny





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Fleet structure

- Commercial shoreside
- At-sea hake
- Recreational

All fleets have catch, age, and length data



Year



Catches dominated by commercial trawl fleet

Catches for each fleet include landings and discards





Availability of commercial comp data by year



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Availability of at-sea hake comp data by year





Availability of recreational comp data by year





Fishery ages





Fishery lengths





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Fishery independent indices in model

• NWFSC WCGBTS

- 2003-2024 (no 2020)
- $\circ~~40^\circ10^\prime$ N. Canada
- \circ 55m CUTOFF
- Index, length, age-at-length

• Triennial

- 1980-2004 (every 3rd year)
- 40°10' N. Canada
- DEPTH
- Index, length, age
- \circ Single time series

- OR/WA Hook and Line
 - 2010-2024 (no 2020)
 - Combines similar surveys from ODFW, WDFW
 - Index, unsexed lengths
- SMURF
 - 2014-2024 (no 2020)
 - Oregon marine reserve sites
 - Samples YOY fish settling to the bottom, IDs to species level



WCGBTS

- Model-based index in sdmTMB (via the indexwc package)
- Delta-lognormal model
- Encountered frequently
 - 13% of the hauls north of 40°10',
 - $\circ~~55\%$ of the hauls north of 46° within 100–200m depths
- Bottom trawl isn't ideal method for sampling midwater schools





Triennial

- Similar standardization to WCGBTS
- Fewer hauls, typically less informative than WCGBTS despite spanning range of years with large changes in abundance





OR/WA Combined Hook & Line Survey



- Combined WDFW rod and reel survey (2009 -2024) with ODFW Marine Reserves hook and line survey (2013 - 2024)
- Filters years with limited observations, spring surveys only (March June)
 - Final dataset ~2k observations with overall 17.8% positive encounter rate
 - 2010 2024
- Model-based index in sdmTMB
 - A negative binomial model fit to catch in numbers with a log offset for angler hours
 - Final model covariates include: year, survey (ODFW/WDFW), drift depth (binned) and month
- Treatment (reserve vs non-reserve) not a significant factor
- Length compositions were also included



SMURF YOY Index

- Standard Monitoring Unit for the Recruitment of Fishes (SMURF)
 - Oregon State University/ODFW Marine Reserves
 - Otter Rock/Redfish Rocks
 - Monitored regularly throughout settlement season (April - Sept)
- Paired with ODFW oceanography data
 - Temp highly correlated across depth and between sites within region
 - 16 day rolling mean temp and 16 cumulative degree day (cdd)
 - (Mean SMURF deployment = 15.5 days)
- Filters peak settlement for yellowtail (May July), years with limited observations (2014 2024)
- Negative binomial model using sdmTMB
 - YOY fish/day ~ year + region + 16-day cdd







Other recruitment indicators considered



Rockfish Recruitment and Ecosystem Assessment Survey YOY Index

- Annual survey of pelagic juvenile rockfish (*Sebastes* spp.) May - June
 - Samples YOY ~100 days old
- US/Mexico border to Cape Mendocino
 - 2004 survey was expanded
- 2001 2009
 - Pacific Whiting Conservation Cooperative and NWFSC survey
- 2011 present
 - NWFSC "Pre-recruit" survey
- Spatial GLM with sdmTMB
 - tweedie error structure (delta-lognormal, delta-gamma)
 - Catch per tow ~ year + s(Julian Day)









Oceanographic Index of Recruitment

_1

-2 -

2000

- Oceanographic Index of Recruitment
 - Following methods developed for:
 - 2023 petrale sole; 2023 sablefish; and 2025 Pacific hake assessments
 - Developed models based on conceptual life history
 - Considers depth, location, and temporal domain of juvenile life stages
 - Included flexible nonlinear relationships (GAMs)
 - Evaluated predictive capacity in addition to⁰ model fit
 - Used Copernicus Ocean Model Products (GLORYs)
- Models were fit to 1993 2019
- RecDev ~s(DDegg)+s(CutiSTI)+s(ONIpjuv) +s(LSTpjuv)



2020

2010



Other YOY/Recruitment Indices

- Northern RREAS Yellowtail Index
 - RREAS data north of 40°10'
 - 2010 and 2012 insufficient data, excluded
 - 2002, 2003, 2008, 2009, 2011 no positive yellowtail
 - convergence issues for non-tweedie model exploration
- Northern RREAS Rockfish Index
 - RREAS data north of 40°10'
 - 2010 and 2012 insufficient data, excluded
- OCNMS Nearshore Rockfish Survey
 - black-yellowtail complex
 - SCUBA/belt transects
 - 2 locations at 2 depths for each of 5 sites
 - 2 5 cm length bins





Availability of WCGBTS composition data by year





Availability of triennial composition data by year



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Availability of H&L length data by year





Survey lengths





Survey age-at-lengths

WCGBTS ages entered as conditional age-at-length

(unsexed samples entered as separate distributions)







Triennial



WCGBTS (excluded from likelihood)





Age (yr)

Thank you!



1-10

Design-based index indicates different temporal patterns North and South of Columbia River





Strong evidence for large 2008 year class



