Stock Assessment of Yellowfin Tuna in the WCPO

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WCPFC-SC22-2026/SA-WP-05
15 August 2026, Apia

Objectives in the stock assessment

- Deliver report on time
- Develop a model with good convergence properties
- Simplify the model as much as possible
- Incorporate innovations recommended by experts, including the SC
- Check for and remove errors

PAW 2026 discussion points

Pacific Community
Communauté du Pacifique

Spatial structure

1. Consider single-region or equatorial model

Fisheries

2. Convert weight comps to length comps
3. Combine fisheries
4. Dirichlet-multinomial sample sizes

Recruitment

5. Orthogonal polynomial recruitment

Natural mortality

6. Fix M at different levels

Movement

7. SEAPODYM movement coefficients

Growth

8. Reweight otoliths based on location
9. Richards growth curve

Selectivity

10. Length-based selectivity

CPUE

11. Regional CPUE analysis w/thermal limits
12. Regional scaling with a prior
13. Time-varying CV
14. Effort creep

Tags

15. Mixing period for each release group

New features in the assessment

- ✔ Consider single-region or equatorial model
- ✔ Convert weight comps to length comps
- ✔ Combine fisheries
- \- Dirichlet-multinomial sample sizes
- ✔ Orthogonal polynomial recruitment
- ✔ Fix M at different levels
- \- SEAPODYM movement coefficients
- ✔ Reweight otoliths based on location
- \- Richards growth curve
- \- Length-based selectivity
- ✔ Regional CPUE analysis w/thermal limits
- ✔ Regional scaling with a prior
- ✔ Time-varying CV
- ✔ Effort creep
- \- Mixing period for each release group
- \+ Tag rep. rates excl. during mixing period
- \+ Tag variance with overdispersion $\tau = 2$

Model overview

MULTIFAN-CL version 2.2.7.9

5 regions

1952–2024, quarterly time steps

31 fisheries + 5 CPUE indices

Fixed M at terminal age, Lorenzen shape

Internally estimated growth, von Bertalanffy

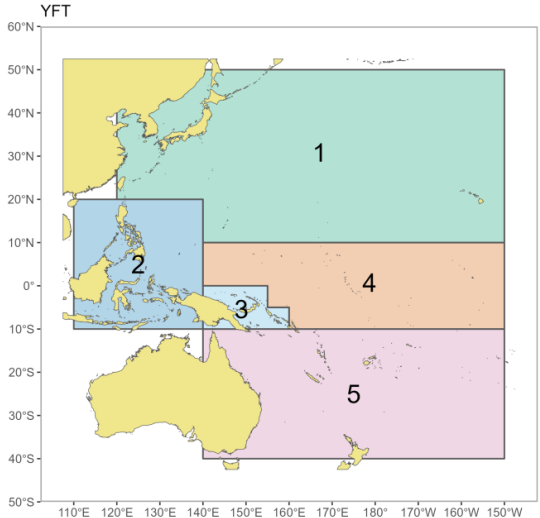
Major reduction in parameters 1901 $\rightarrow$ 454 (was 11,688 in 2020 assessment)

Regional scaling with multivariate normal prior

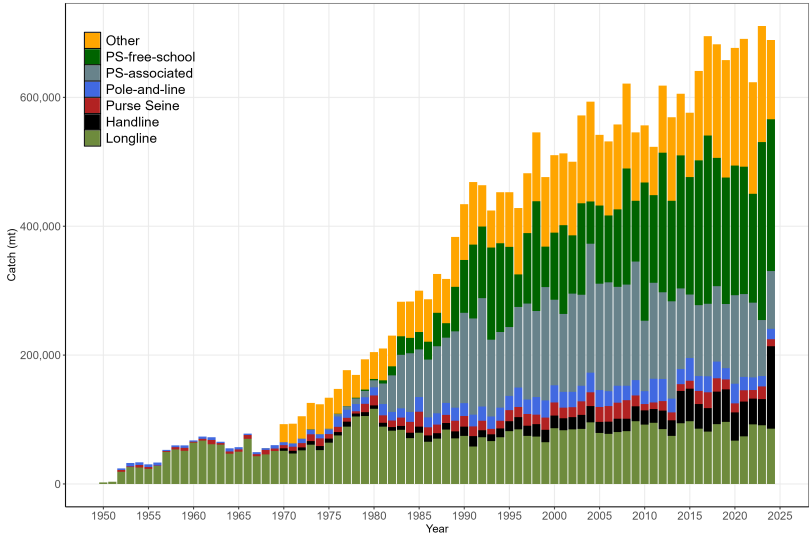
Likelihoods based on model fits to data

- Length comps
- CPUE
- CAAL (otoliths)
- Tags

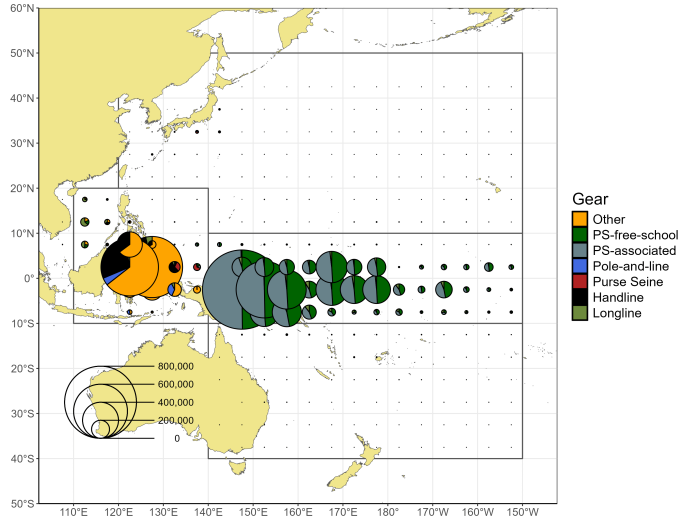
Regions


YFT
60°N
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°
170°W
160°W
150°W
1
2
3
4
5

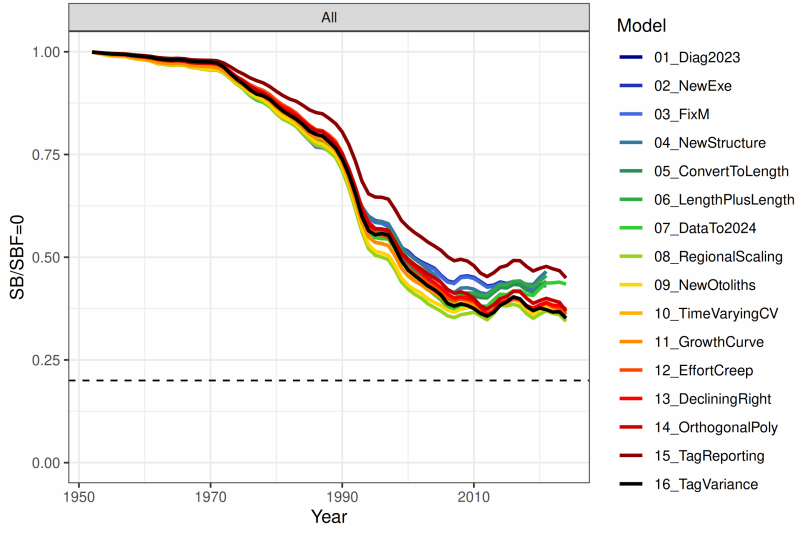
Catches


Other
PS-free-school
PS-associated
Pole-and-line
Purse Seine
Handline
Longline
Catch (mt)
600,000
400,000
200,000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year

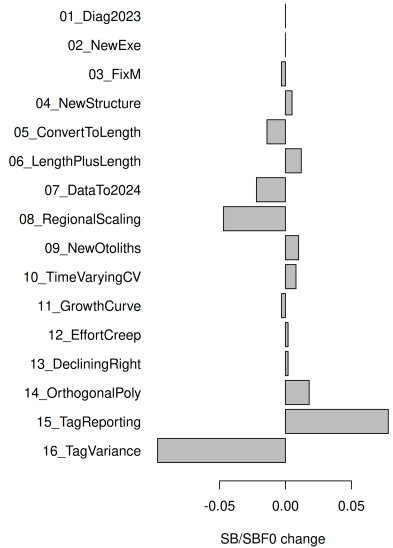
Catches


60°N
50°N
40°N
30°N
20°N
10°N
0°
10°S
20°S
30°S
40°S
50°S
110°E
120°E
130°E
140°E
150°E
160°E
170°E
180°
170°W
160°W
150°W
800,000
600,000
400,000
200,000
0
Gear
Other
PS-free-school
PS-associated
Pole-and-line
Purse Seine
Handline
Longline

Stepwise


All
1.00
0.75
0.50
0.25
0.00
SB/SBF=0
1950
1970
1990
2010
Year
Model
01_Diag2023
02_NewExe
03_FixM
04_NewStructure
05_ConvertToLength
06_LengthPlusLength
07_DataTo2024
08_RegionalScaling
09_NewOtoliths
10_TimeVaryingCV
11_GrowthCurve
12_EffortCreep
13_DecliningRight
14_OrthogonalPoly
15_TagReporting
16_TagVariance

Stepwise


01_Diag2023
02_NewExe
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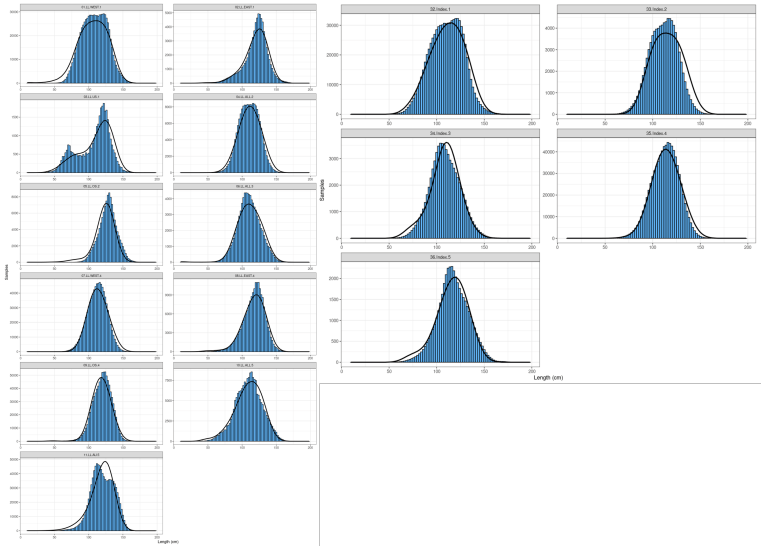
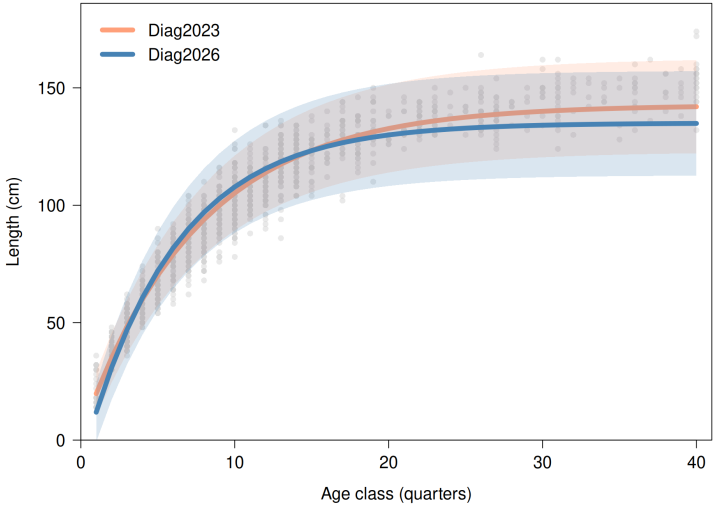
09_NewOtoliths
10_TimeVaryingCV
11_GrowthCurve
12_EffortCreep
13_DecliningRight
14_OrthogonalPoly
15_TagReporting
16_TagVariance
-0.05
0.00
0.05
SB/SBF0 change

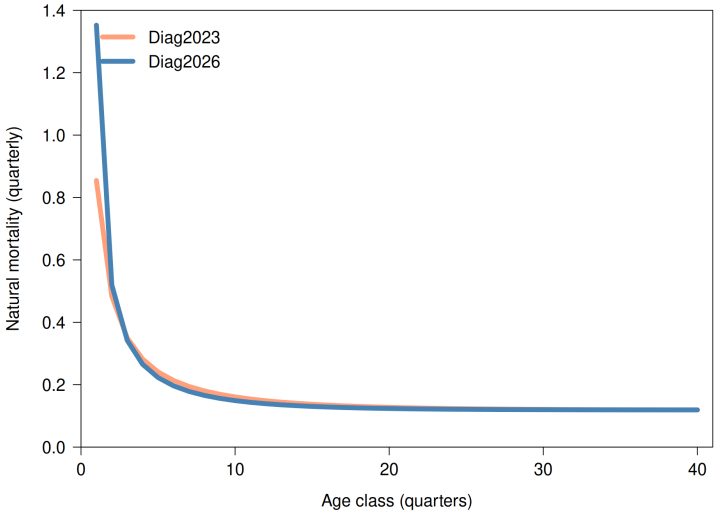
Fit to longline and index fisheries



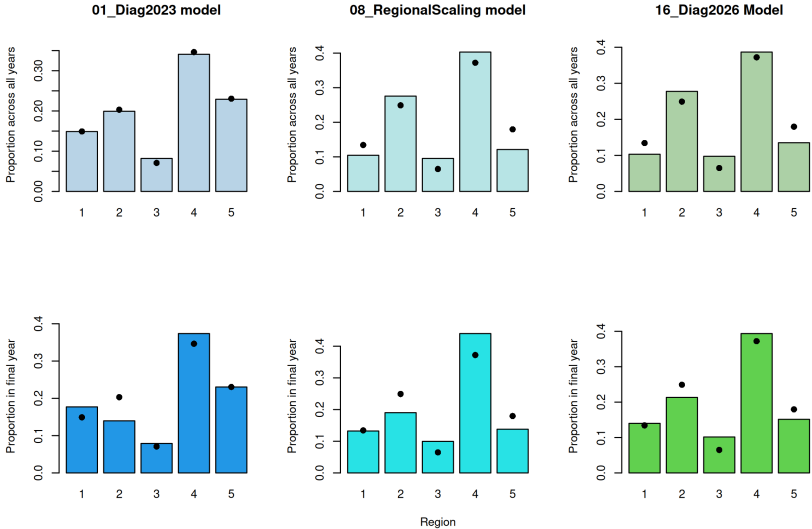
Growth


Diag2023
Diag2026
Length (cm)
0
50
100
150
0
10
20
30
40
Age class (quarters)

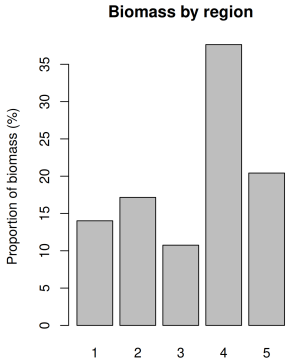
Natural mortality

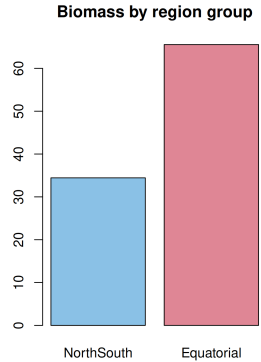


Regional scaling

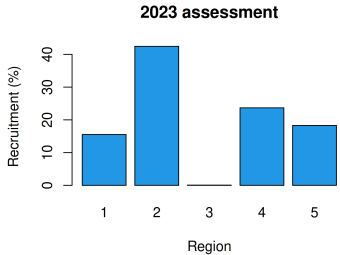


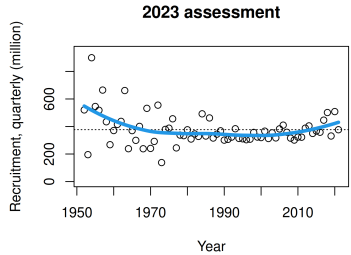
Biomass distribution between regions

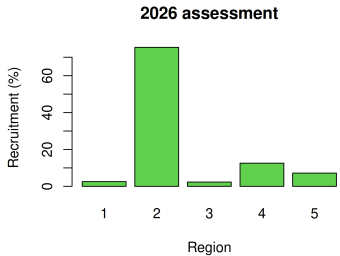


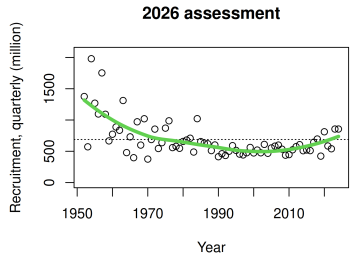


Recruitment

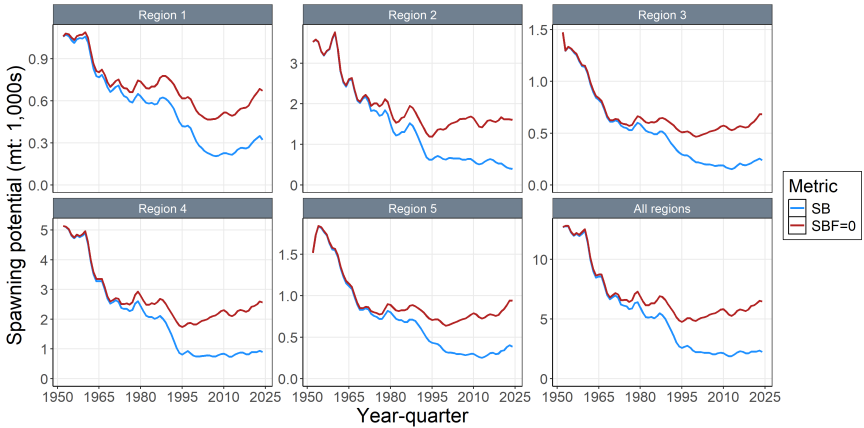




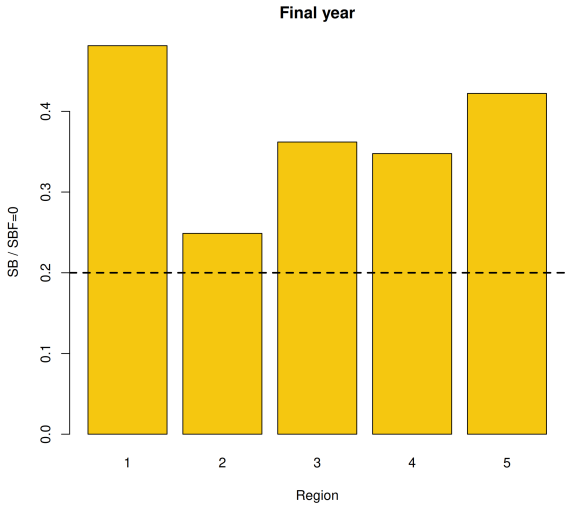




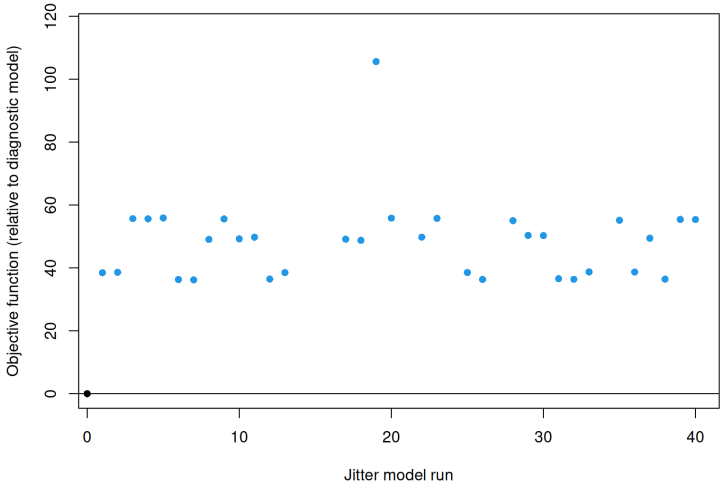
Fished and unfished biomass by region



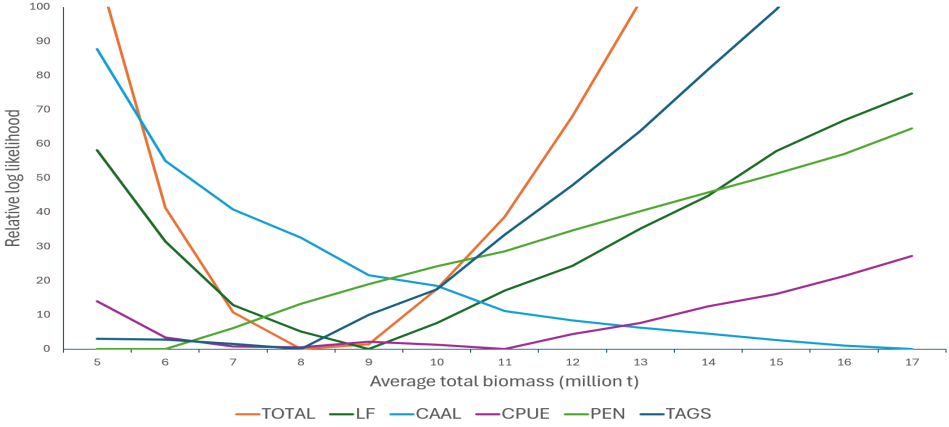
Depletion



Jitter analysis



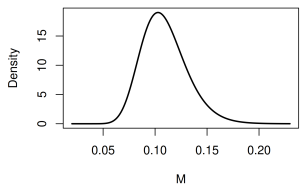
Likelihood profile

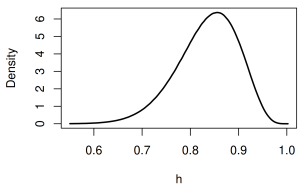


Ensemble analysis

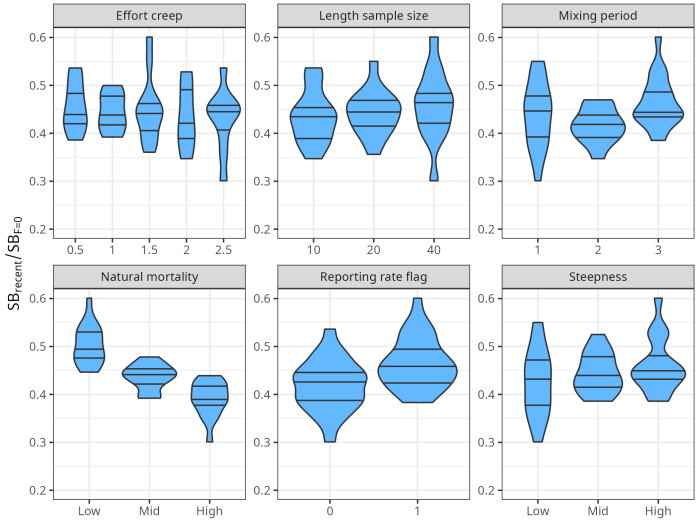
Structural uncertainty

- Effort creep: 0.5, 1.0, 1.5, 2.0, 2.5% for the first years, half of that in later years
- Length sample size: divided by 10, 20, 40
- Tag mixing period: 1, 2, 3
- Tag reporting rate during mixing period: 0=included, 1=excluded
- Natural mortality: continuous prior
- Steepness: continuous prior

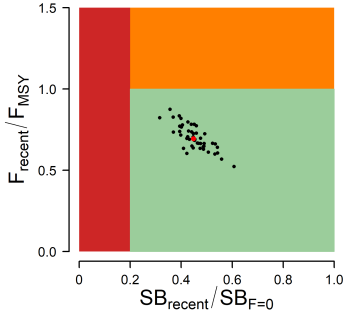


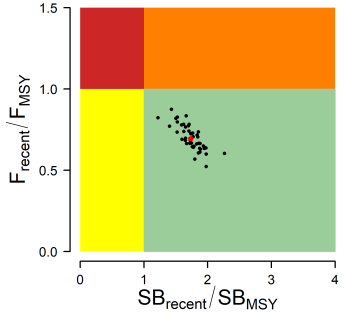


Ensemble analysis

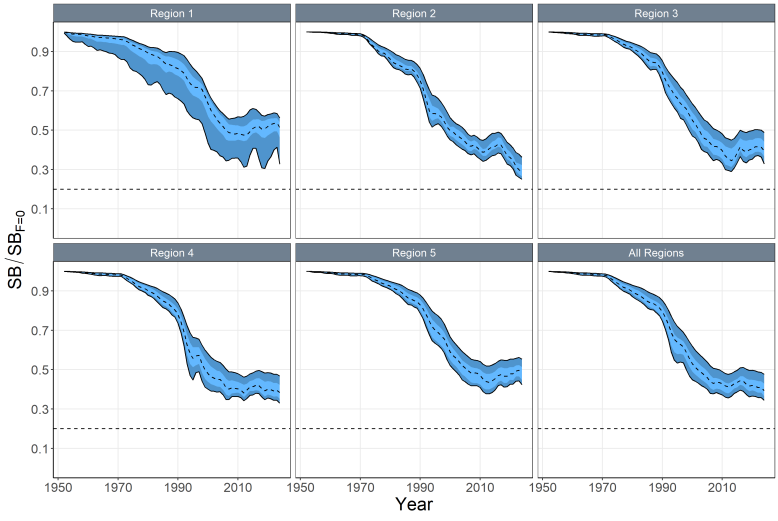


Stock status





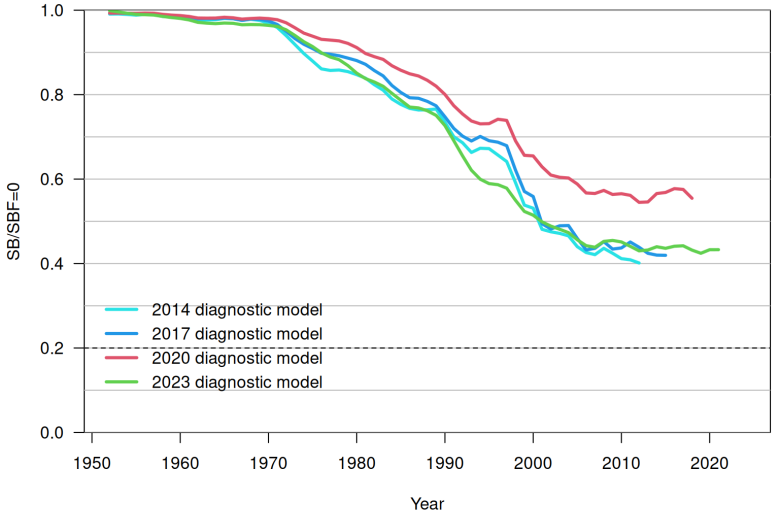
Stock status



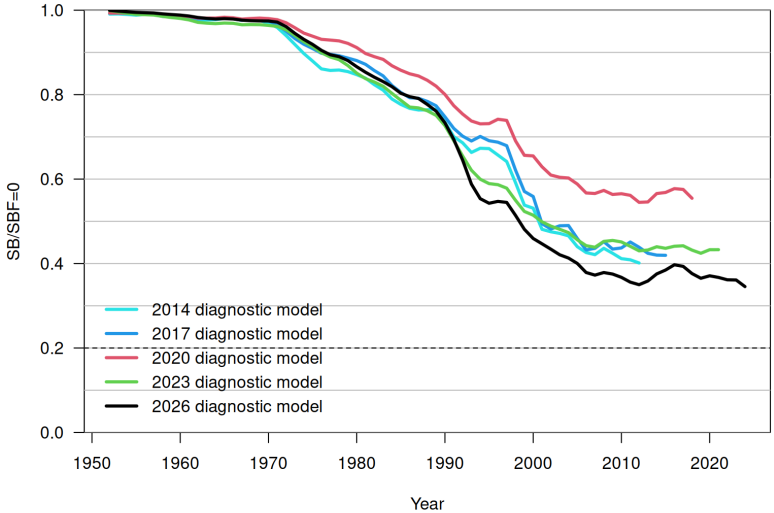
Stock status

Quantity	Mean	Median	Min	10%	90%	Max
F_{MSY}	0.05	0.05	0.03	0.03	0.07	0.09
f_{mult}	1.44	1.44	1.14	1.24	1.64	1.91
$F_{\text{recent}}/F_{\text{MSY}}$	0.70	0.69	0.52	0.61	0.80	0.87
MSY	709,492	712,800	610,000	657,080	758,040	838,800
SB_{latest}	4,225,501	3,601,588	1,449,490	1,781,367	7,185,084	12,284,825
SB_{recent}	4,239,072	3,595,731	1,546,934	1,845,127	7,163,028	12,139,288
$SB_{F=0}$	9,116,300	8,293,368	4,138,987	5,214,403	13,617,615	20,203,280
$SB_{\text{latest}}/SB_{F=0}$	0.44	0.44	0.28	0.37	0.53	0.61
$SB_{\text{latest}}/SB_{\text{MSY}}$	1.72	1.73	1.11	1.49	1.89	2.10
SB_{MSY}	2,409,656	2,076,000	758,100	1,246,700	3,799,600	6,074,000
$SB_{\text{MSY}}/SB_{F=0}$	0.26	0.25	0.18	0.23	0.29	0.30
$SB_{\text{recent}}/SB_{F=0}$	0.44	0.44	0.30	0.38	0.53	0.60
$SB_{\text{recent}}/SB_{\text{MSY}}$	1.74	1.75	1.18	1.51	1.91	2.22
$Y_{F_{\text{current}}}$	167,600	166,700	150,500	158,050	178,030	192,400

Comparison with previous assessments



Comparison with previous assessments



Main conclusions

- Spawning depletion has been relatively stable since around 2005 to the present, between 0.35 and 0.50
- All the ensemble models were above the $SB_{\text{current}}/SB_{F=0} = 0.20$ limit reference point and $F_{\text{current}} < F_{\text{MSY}}$
- Using a prior for M in the ensemble analysis improved the incorporation of uncertainty about this key parameter in the assessment
- Convergence problems remain in the model, likelihood conflict between the data sources
- Slightly lower estimated relative stock size compared to previous assessment, primarily because of model settings related to tags
- Orthogonal polynomial recruitment reduced the number of estimated parameters and improved model convergence
- Effort creep incorporated in the assessment for the first time

Recommendations for further work

1. Examine and descibe data conflict in greater detail
2. Consider alternative regional structure
3. Explore how growth curve is affected by the tagging data likelihood
4. Workshop that focuses on how best to analyze the tagging data for the assessment

Browse results online

Shiny app with stepwise results:

https://ofp-sam.shinyapps.io/yft-2026-stepwise

After SC:

https://github.com/PacificCommunity/ofp-sam-yft-2026-diagnostic

https://github.com/PacificCommunity/ofp-sam-yft-2026-ensemble