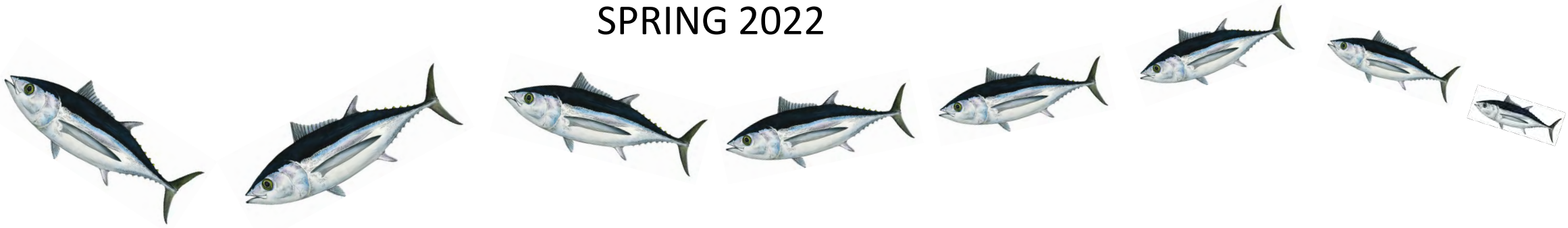
SOUTH PACIFIC ALBACORE STOCK ASSESSMENT

IATTC SAC-13

SPRING 2022



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(a) Oceanic Fisheries Program, Pacific Community (SPC),
(b) Inter-American Tropical Tuna Commission (IATTC/CIAT)
(c) NOAA fisheries
(d) SPRFMO

2021 SOUTH PACIFIC ALBACORE - HIGHLIGHT

2021 stock assessment is a collaboration with the IATTC/CIAT

- Main collaborator at the IATTC **Dr. Haikun Xu**
- Support from Dr. Cleridy Lennert-Cody and IATTC team

Main new changes

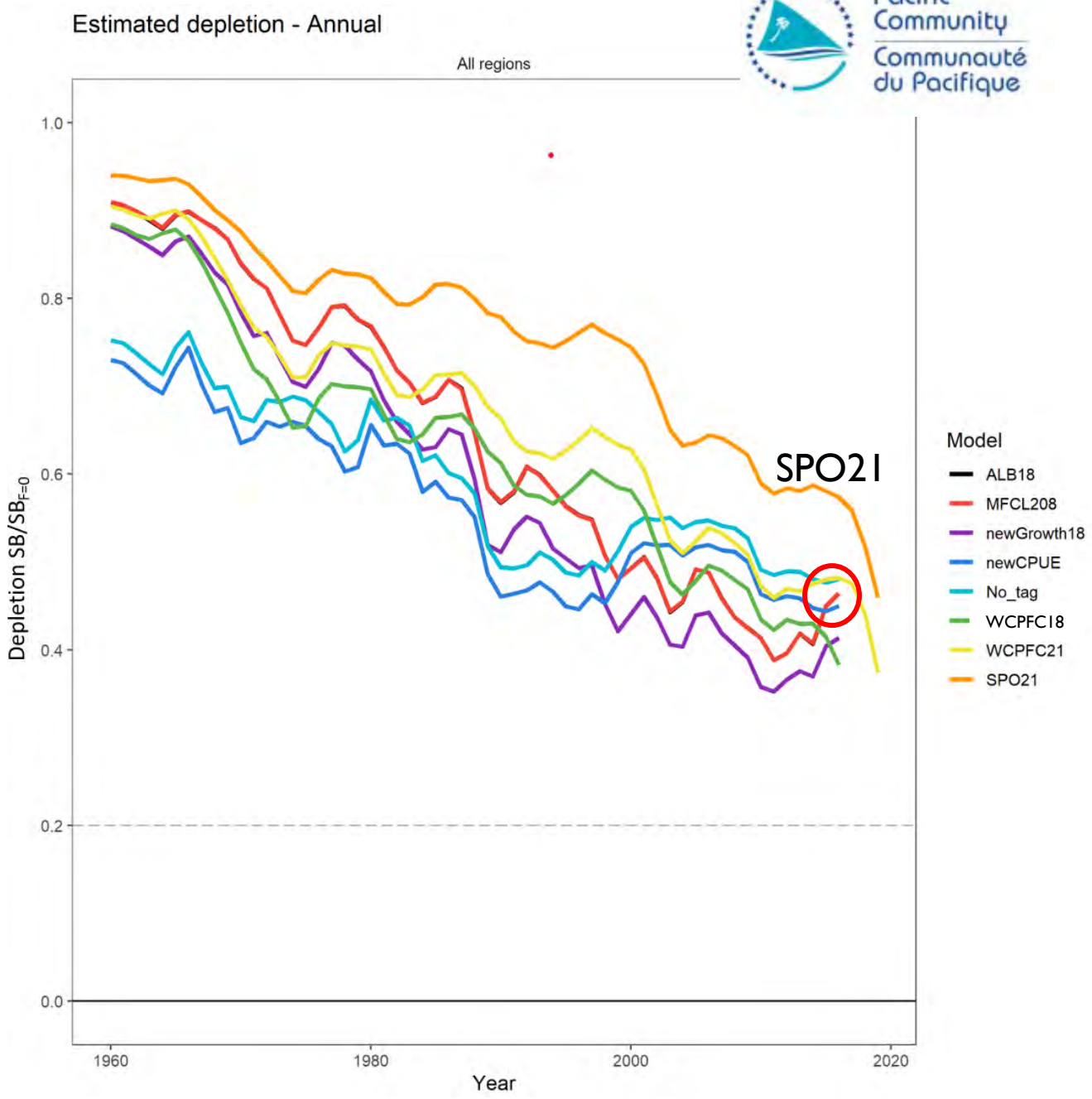
- New regions definition (South Pacific-wide)
- New growth parameters
- Growth and Natural mortality approach
- New MFCL 2.08 version

SUMMARY

- Previous assessment was in 2018, WCPFC-CA only (Tremblay-Boyer et al. 2018).
- Model spatial and fishery structures for ‘south Pacific wide’ albacore assessment 2021 (IATTC)
- Fisheries and data inputs, including length composition until 2019 (IATTC region 4)
- CPUE index fisheries 1960-2019 (IATTC consultation)
- New growth parameters (Farley et al 2021)
- Biological assumptions similar to 2018 assessment (single sex model)
- Stepwise diagnostic model development from 2018 to 2021 model
- Uncertainty grid include: steepness (3 options), movement (2 options), data weighting (3 options), recruitment (2 options) and growth-natural mortality (2 options) (72 models in total)
- Sensitivities tag or no-tag

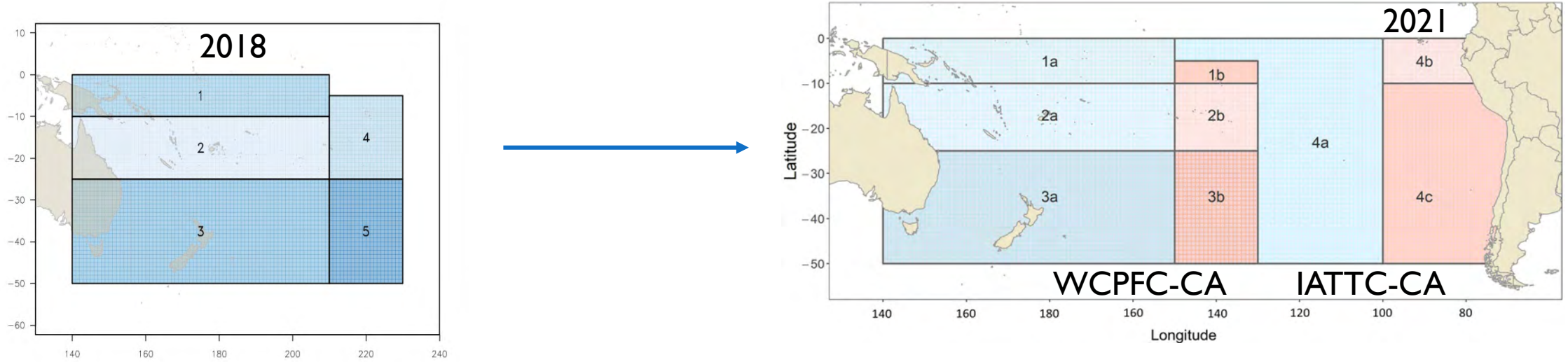
MODEL DEVELOPMENT

- ALB18 identical to MFCL208
- New growth decreased depletion
- New CPUE different early period
- No tag does not affect the results
- New data WCPFC18
- WCPFC21
- SPO21 (IATTC data)



2021 ASSESSMENT

- MFCL (V2.08.02), single sex, spatial structured
- “Simplified” spatial structure compared with 2018 (5 to 4 regions) South Pacific ocean (3 x WCPFC, 1 x IATTC)
- 25 fisheries (17 LL, 2 DN, 2 TR, 4 Index fisheries (1 per region)
- Similar approach to 2018, CPUE standardisation (spatio-temp delta GLMM, VAST, Thorson et al. 2015)
- New otolith based growth parameter estimations (L_{max}=107.23 cm; k= 0.268/yr; L_{min}= 41.07 cm), and an alternative growth LF estimation fixing just L_{max} (L_{max}=107.23 cm; k= 0.210/yr, L_{min}= 46.06 cm)
- **Movement hypotheses: MFCL (internal estimated)** and **SEAPODYM** movement (fix param., external).



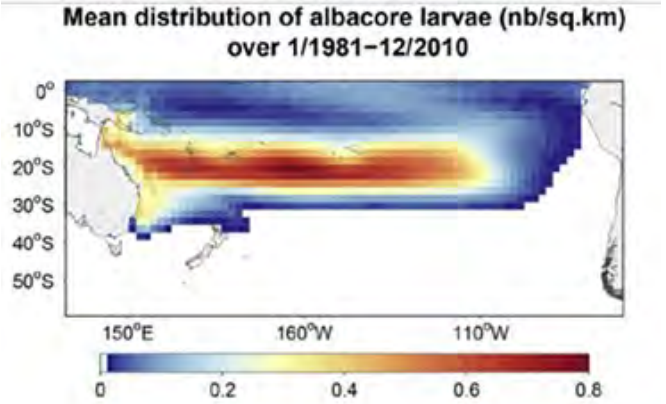
Other sources of information to inform movement rates: Spatial Ecosystem And Population Dynamics Model; SEAPODYM (Senina et al. 2020)

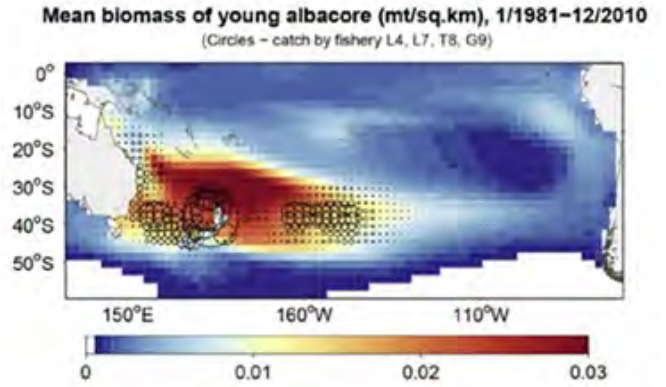
- SEAPODYM provides predictions on spatio-temporal exchange of biomass by age class (in numbers and months), forced by environmental/habitat variables
- Convert this to an "average" matrix of probabilities for movement between regions by 'quarter' and age
- Apply this matrix of quarterly/age movement probabilities to MFCL (fixed)

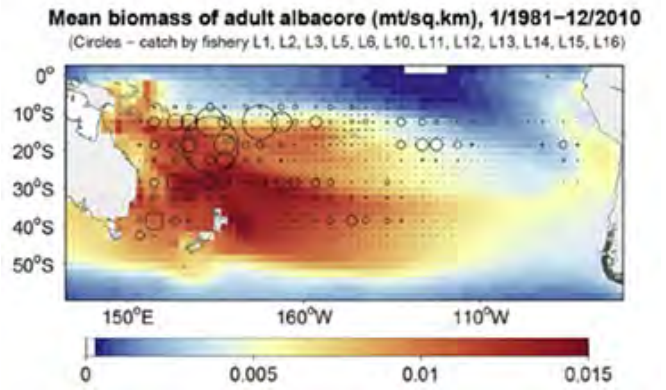
Quantitative modelling of the spatial dynamics of South Pacific and Atlantic albacore tuna populations

Inna N. Senina [a,*], Patrick Lehodey [a], John Hampton [b], John Sibert [c]

Deep–Sea Research II 175 (2020) 104667





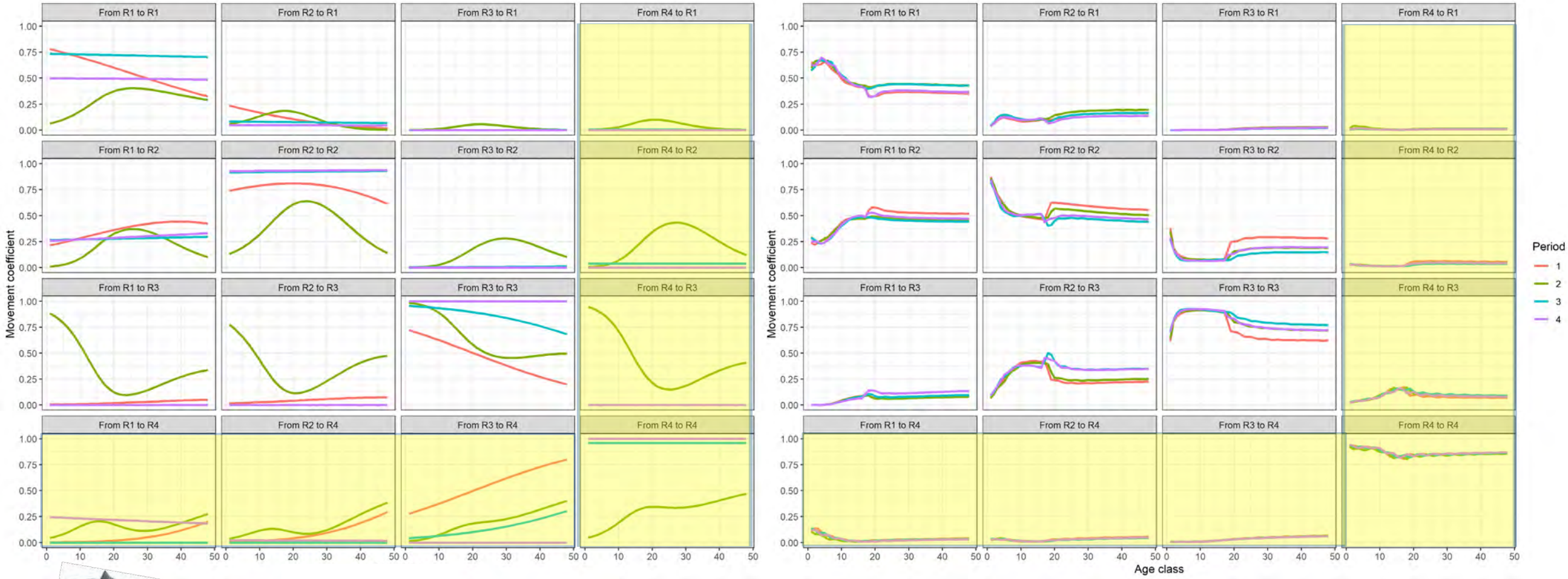


MOVEMENT

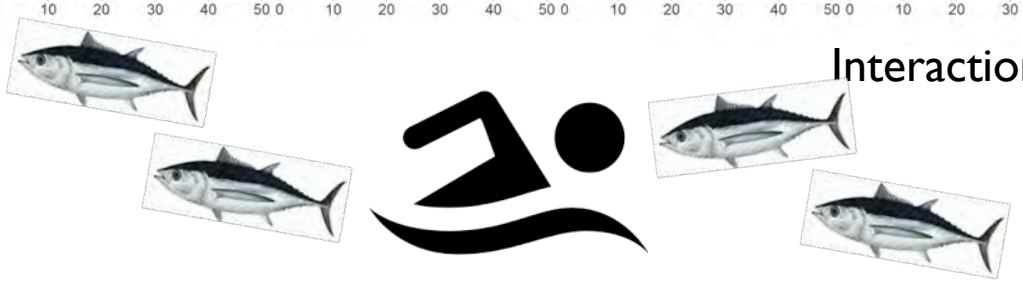
Pacific Community
Communauté du Pacifique

MFCL estimated internally (M1)

SEAPODYM (M2)



Interaction Region1,2,3 / Region 4

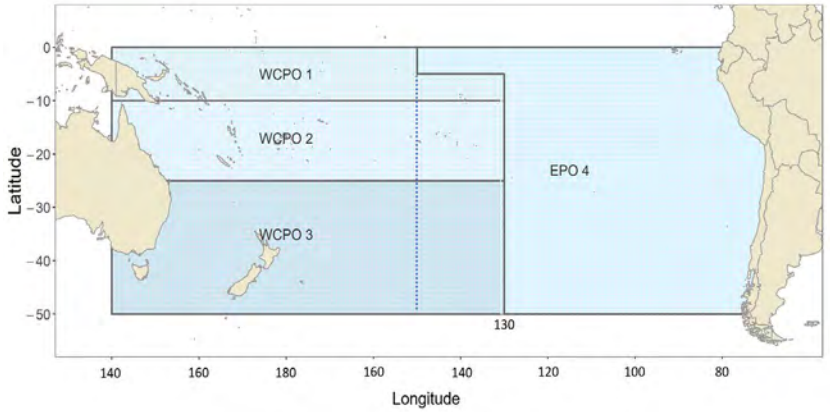


Bilyana Stoyanovska | Dreamstime.com

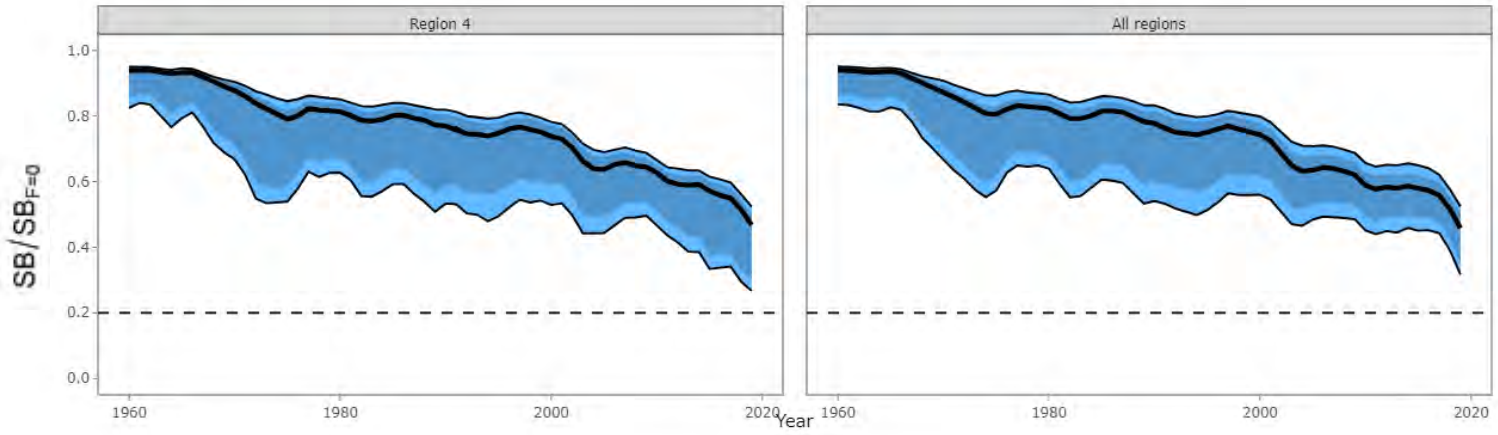
STRUCTURAL UNCERTAINTY GRID

Axis	Value
Steepness	0.65 **0.80** 0.95
Movement	**Model estimated**, SEAPODYM
Data weighting	50 (low) **25 (medium)** 10 (high)
Recruitment distribution	**SEAPODYM**, Regions 3 - 4
Growth/M-at-age	**Otolith growth/associated M-at-age**, LF/associated M-at-age

OUTCOMES 2021

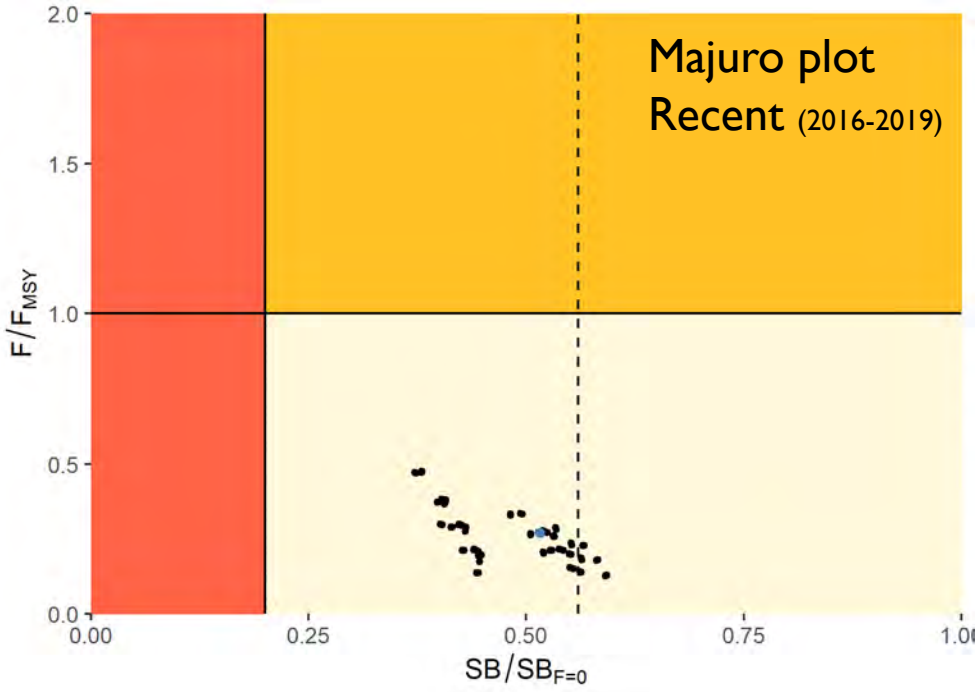


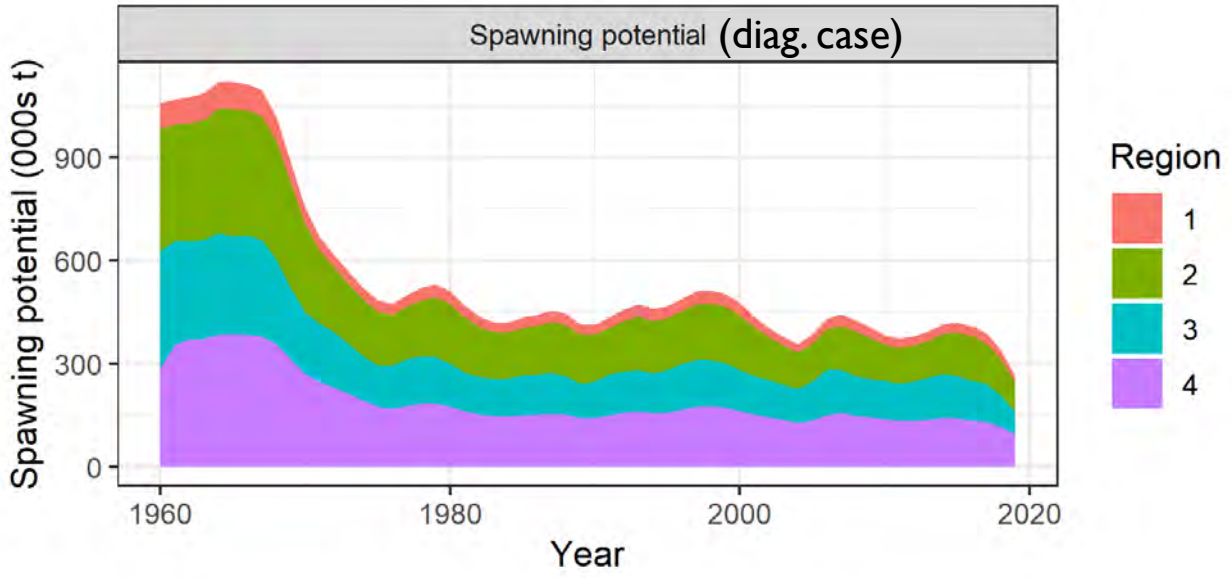
Dynamic depletion



EPO-CA

South Pacific wide





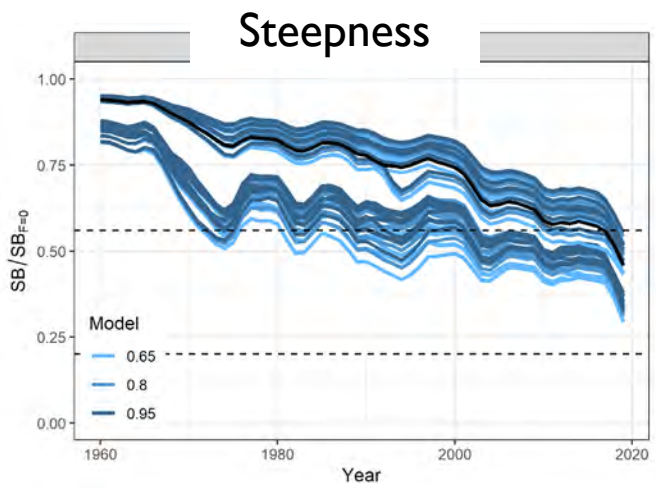
KEY UNCERTAINTIES

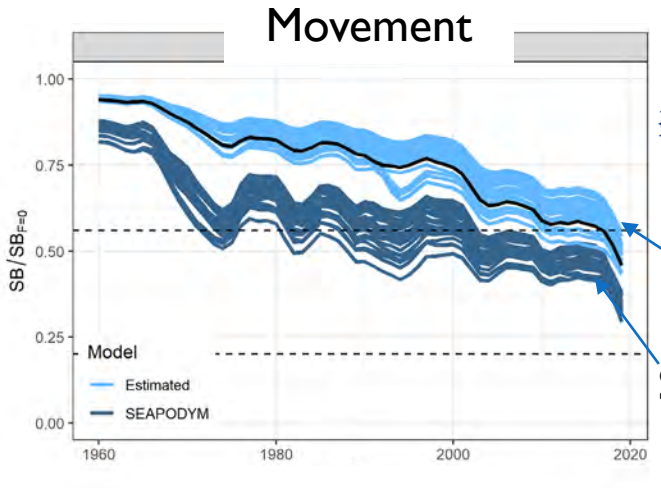
All regions
South Pacific wide

Overlap for some analysis

Main uncertainties:

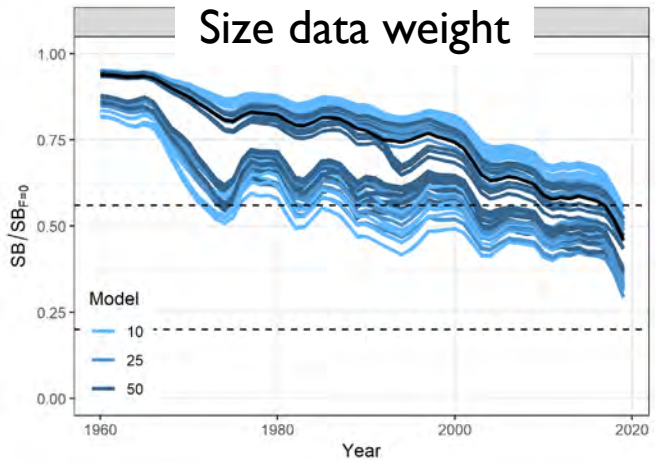
- Movement
- Size data weighting

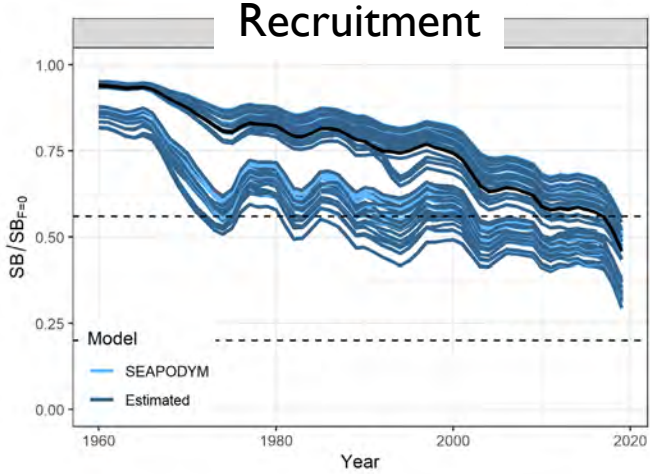


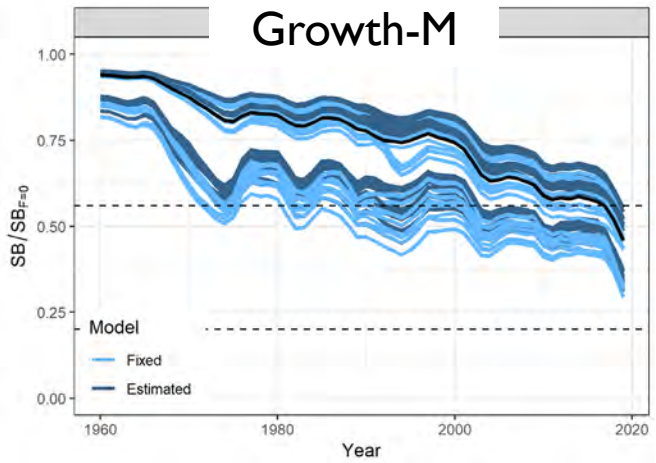


Internal estimation

SEAPODYM

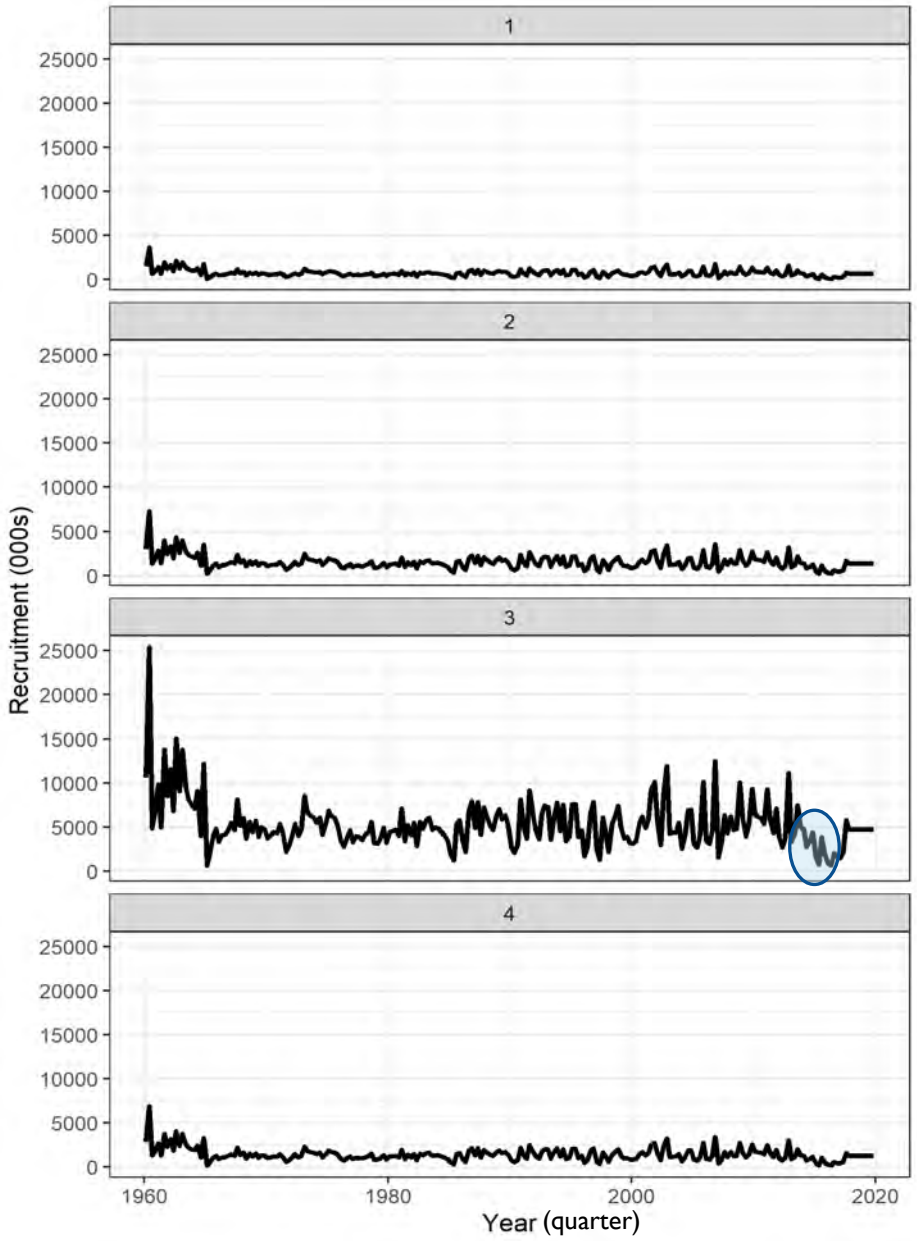






Depletion ($SB/SB_{F=0}$)

RECRUITMENT

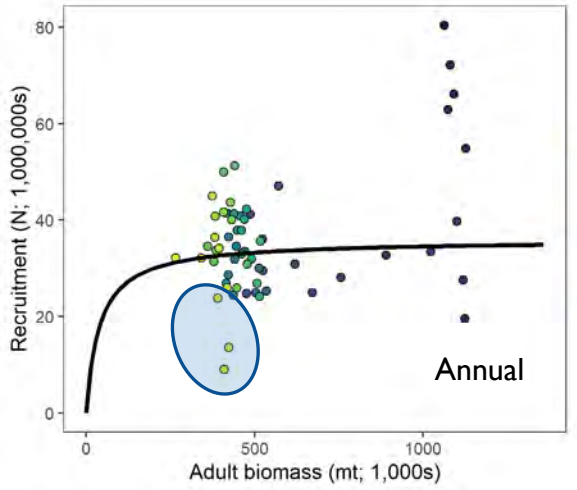


- Last 9 quarters = average recruitment

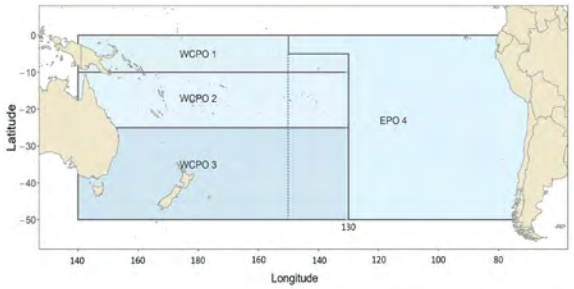
- Low recruitment estimated for years 2015-2017

- Investigation of influences on low recruitment estimates:
  - not related to region 4
  - mostly related to region 3 data
  - not influenced by the alternative movements
  - not driven by the recent CPUE in region 3
  - exploration of LF data suggests related to multiple data set (LLs, Index fisheries, and more so NZ troll)

- Low recruitment could be related to El Niño 2015-16



OFP-SPC, SC17-EB-IP-09



MAIN CONCLUSIONS

- Spawning potential has generally declined across the model period, with that decline increasing in the most recent years. Consistent general trends by regions
- SPO “latest” (2019) and “recent” (2016-2019) (Table 5)

	Mean	Median	Min	10%	90%	Max
$SB_{latest}/SB_{F=0}$	0.35	0.36	0.25	0.27	0.44	0.46
$SB_{recent}/SB_{F=0}$	0.48	0.47	0.37	0.40	0.56	0.59

- Uncertainty in movement and the size frequency data weighting are the major contributors to the overall assessment uncertainty.
- CPUE indices lacked contrast to inform population scale, which was more influenced by the size composition data.
- Poor recruitment estimated in 2015-2017 period

BY RFMO

WCPFC-CA

	Mean	Median	Min	10%	90%	Max
C_{latest}	78946	78434	75673	76740	79163	118706
$SB_{F=0}$	457559	452323	415746	432039	483703	501602
$SB_{latest}/SB_{F=0}$	0.35	0.36	0.26	0.28	0.43	0.44
$SB_{recent}/SB_{F=0}$	0.49	0.47	0.39	0.42	0.58	0.61

IATTC-CA

	Mean	Median	Min	10%	90%	Max
C_{latest}	8351	8166	7845	7903	8773	12229
$SB_{F=0}$	187230	157583	92190	95879	336838	379718
$SB_{latest}/SB_{F=0}$	0.35	0.36	0.22	0.24	0.46	0.48
$SB_{recent}/SB_{F=0}$	0.43	0.43	0.28	0.31	0.56	0.57

KEY CHALLENGES AND RESEARCH SUGGESTIONS

- **Movement:** Biological research to improve understanding of population structure and movement, genetics, otolith chemistry, spatial growth etc. – multimethod approaches
- **Recruitment dynamics:** Environmental/oceanography influences on South Pacific albacore recruitment
- **Implications poorly specified spatial models:** MSE or simulation-estimation approaches to investigate implications of spatial/movement uncertainties
- **Early life growth, growth variation**: Spatio-temporal analysis of growth (i.e. last major otolith sampling/ageing were in 2009-2010), daily age of even smaller fish, alt. growth models
- **General model complexity:** parameter reductions (1000s effort deviates – move to catch conditioned), spatial complexity.
- **Independent estimates of population scale** (lack of CPUE contrast): Close-kin mark-recapture - CKMR (point estimates to scale future assessments, Bravington et al. 2021 (SC17-SA-IP-14)

TO BE CONTINUE...

https://ofp-sam.shinyapps.io/SALSA/

South Pacific ALbacore Stock Assessment

Version 0.0.1 The Filthy Fraco