WCPO YELLOWFIN TUNA ASSESSMENT PEER REVIEW NOUMEA, 7-13 SEPT, 2022

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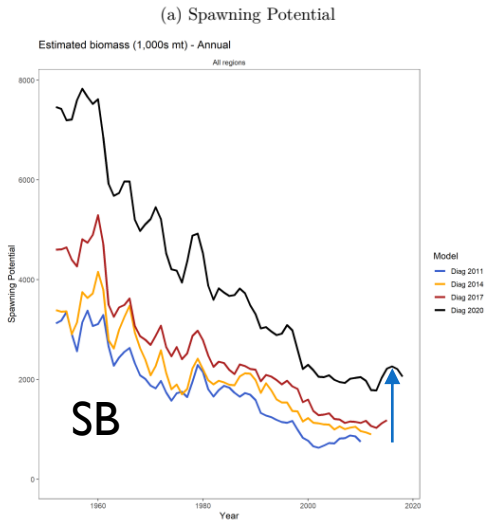
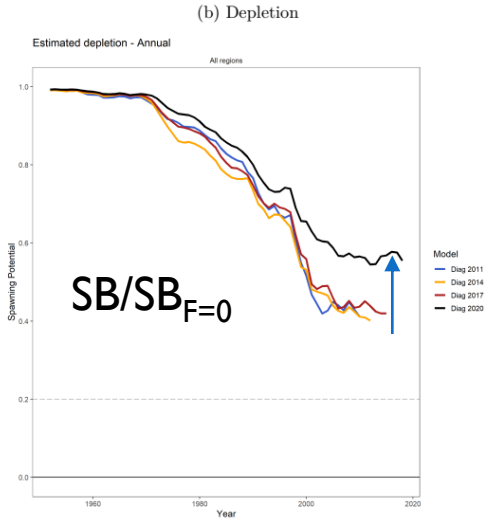
Background

- Peer review recommended by SC16 noting various concerns around the 2020 yellowfin assessment models and the notable changes in management quantities.
- Peer review panel selected based on WCPFC TOR for peer review panels.
- CCMs nominate 2 (individuals or organisations), 8 shortlisted, CCMs ranks these 1- 8, top 3 get approached. Top three accepted. **Thank you!!**
- Peer review workshop – in person 5 days, typically 2 days reviewing the assessment, 3 days running analyses/models etc.
- Peer review panel provides written report to SPC for comment, then to WCPFC Exec. Director, presentation at next Science Committee (also Pre-assessment Workshop)
- Andre is the panel chair.
- Assessments every 3 years, next is 2023, assessment models provide basis for OMs in MSE frameworks





Terms of Reference

Objectives

1. Undertake, in consultation with the stock assessment team (SPC), following the guidelines described in Process for the Independent Review of stock assessments (Attachment K), a peer review of the 2020 YFT stock assessment in the Western and Central Pacific Ocean (WCPO).

2. Based on the review work **provide recommendations for improving the assessment, including data inputs, modelling approaches and treatment of uncertainty.**

3. In conjunction with the SPC assessment scientists, **identify improvement options that are feasible for application to the 2023 YFT assessment.**

- Growth (several options available)
- Size composition (initial re-weighting, effective sample size estimation)
- Selectivity (improving fits to catch compositions)
- Tagging data (reporting rates, mixing period assumption etc….)
- Natural mortality at age (external, internal, uncertainty)
- CPUE (standardisation method, regional scaling etc.)
- Model complexity (can we simplify, where to focus simplifications etc.)
- New MFCL features to apply (catch conditioned model)
- Model diagnostics
- Uncertainty characterisation (factorial grids, ensembles, structural and estimation uncertainty)

This assessment was fraught with strife due to conflict among data inputs – M Vincent July 2020

Untangling a fur ball takes time, but I have the patience

- And we mustn't forget bigeye

Activity	Output	Timeframe	Progress
Model development/analyses	Technical milestones and other information posted to GitHub review site.	December 2021 – early 2023	MFCL training, backtracking and replicating the previous assessment models, set-up catch condition model, 4-region model
Pre-workshop planning meetings	Planning and preparation for the workshop developed.	At least one month prior to the 2022 review workshop	Met with Andre, flurry of emails and documentation, developed questions list and workshop planning, reviewed previous assessments, presentations and Shiny app.
Review workshop at SPC, Noumea	Completion of 5 day + travel in-person modelling workshop in Noumea	Second half of 2022 (Sept)	
Draft report outcomes of peer review workshop	SPC runs additional analyses post workshop?? Panel provides draft report to SPC for review and response.	**Mid November 2022**	
Finalise peer review report	Final report with SPC responses returned to panel Chair. Panel chair send report to WCPFC for posting to Online Discussion Forum (ODF, post for 2-3 weeks)	**Late November 2022**	
Report finalised	Pending ODF, SPC to add appendix of ODF comments, submission to SC19.	**July 2023**	
Presentations	Pre-assessment workshop (hybrid), SPC or panel member. SC19 (panel member if possible)	**Late March - Early April 2023** **August 2023**	

GENERAL DAILY PLAN

- 8 am start
- 8 – 8.30 recap and any overnight ‘light bulb’ moments, new model results
- 8.30 - 8.45 revise goals/focus for today
- 8.45 - 10.00 tackling issues/reviewing new analyses
- **10 - 10.30 morning tea**
- 10.30 – 12.30 tackling issues/reviewing new analyses
- **12.30 – 1.30 lunch**
- 1.30 -3 .00 pm tackling issues/reviewing new analyses
- 3 - 3.30 pm plan for tomorrow/summarise any overnight work to do, model runs etc.
- 3.30 - 5.30 – OFP staff set-up models, prepare other information requested by panel for next day

Other: dinner/weekend activities ……..

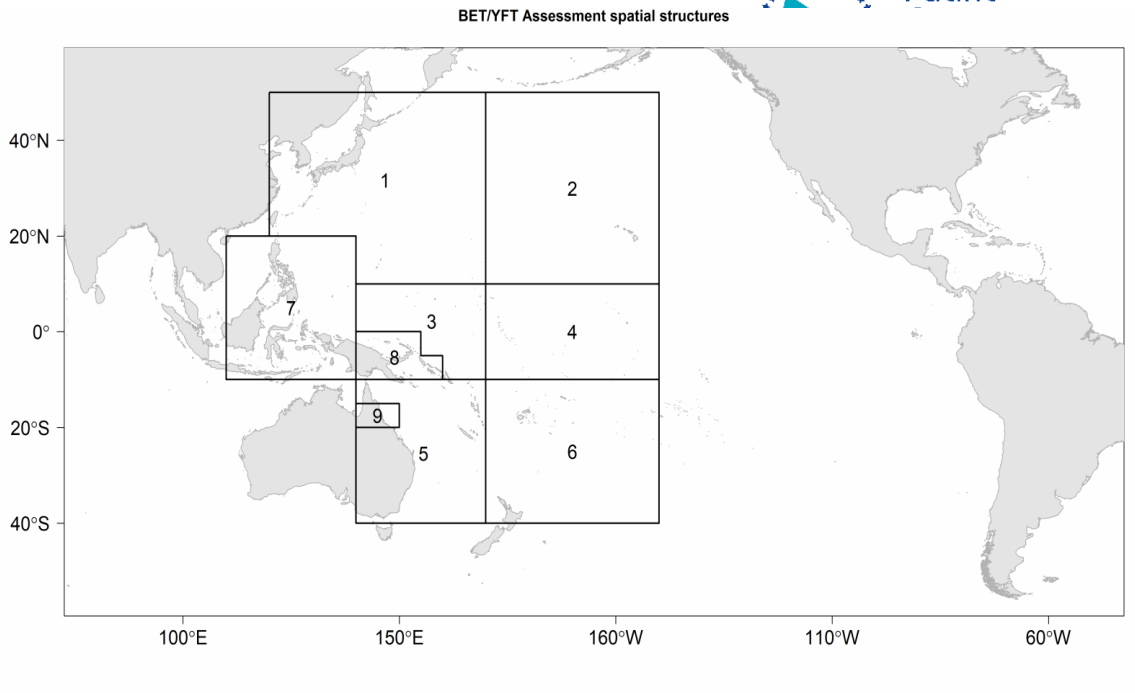
DISCUSSION

ARNI: ASSESSMENT OVERVIEW

PEER REVIEW OF 2020 WCPO YELLOWFIN TUNA ASSESSMENT – DATA INPUTS

BACKGROUND

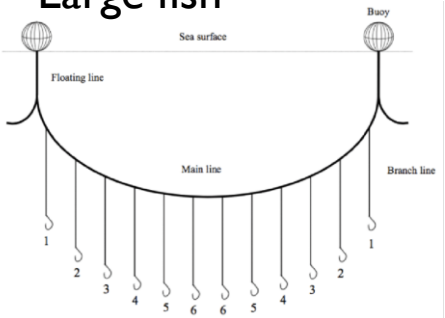
- Quarterly 1952-2018
- Catch (32 extraction fisheries)
- Standardized CPUE (9 index fisheries, VAST spatiotemporal GLMM)
- Maturity-at-length (previous input as maturity at age)
- Natural mortality-at-age (external multiple depending on growth curves)
- Tagging data, sporadic various programmes since late 1980s. Included Japanese tag data.
- Length (PS, PL , Misc) and weight (LL, HL) composition data
- New otolith growth curve



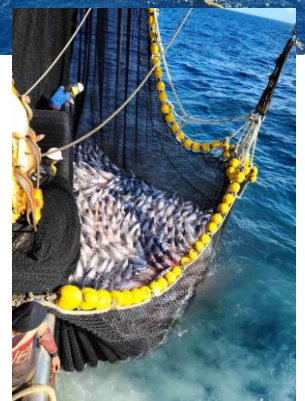
FISHERIES

- Same spatial and fishery structure as 2017 diagnostic
- 32 ‘extraction’ fisheries (no effort): 14 longline, 4 pole and line, 10 purse seine, 1 handline, 3 misc. gear
- 1 x longline ‘index’ fishery (standardised effort, 1 fish catch) in each region assumed same catchability

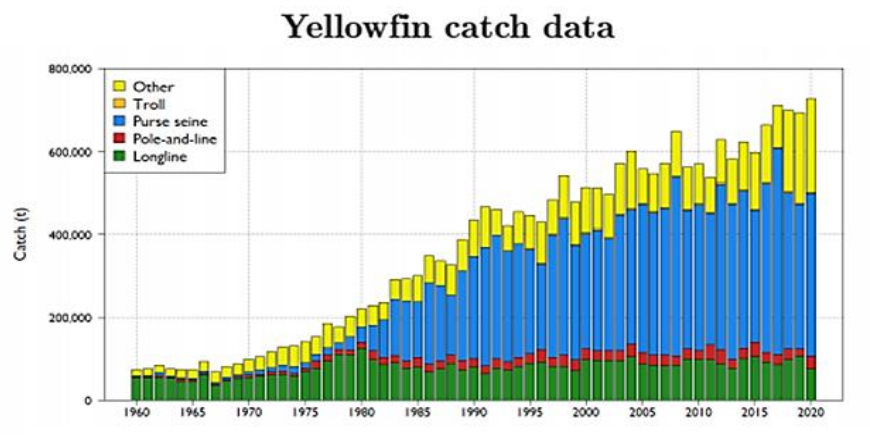
Large fish

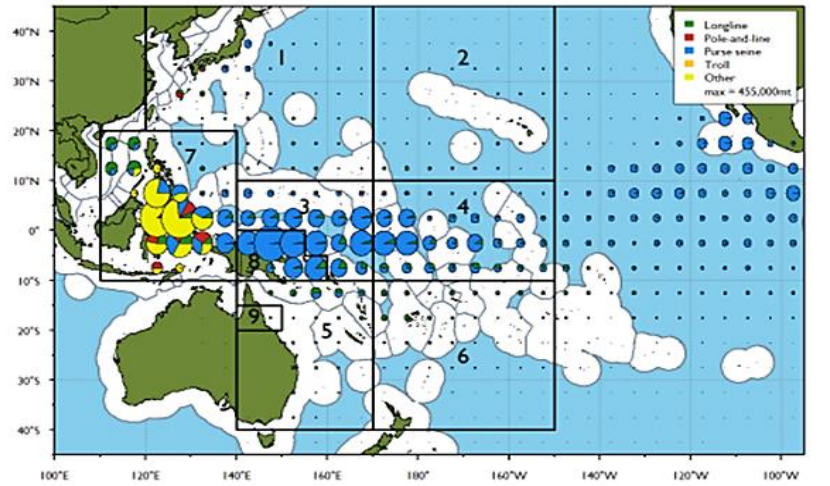


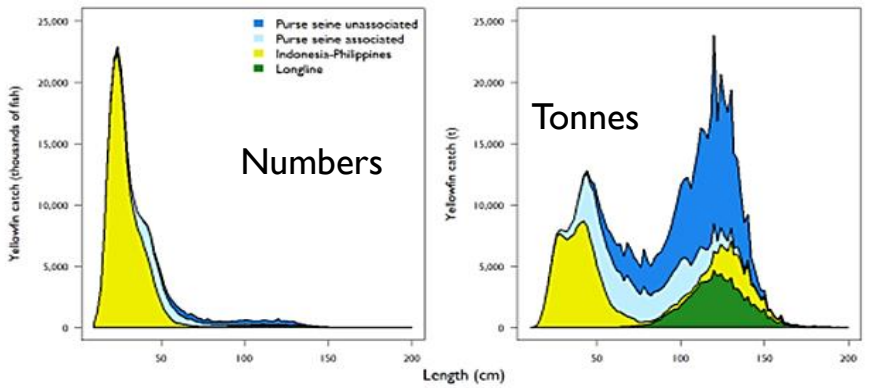
Large and small fish



Small fish







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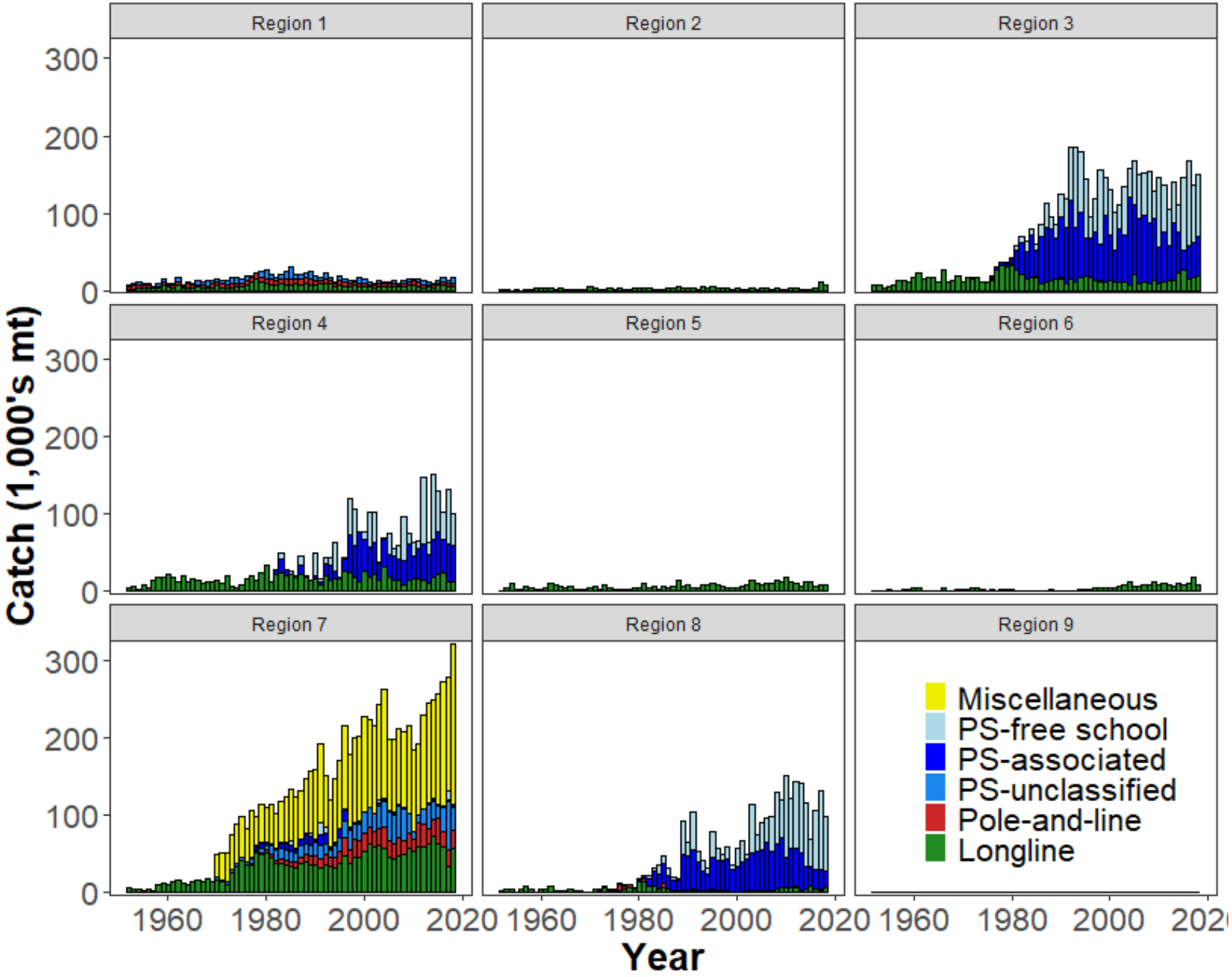
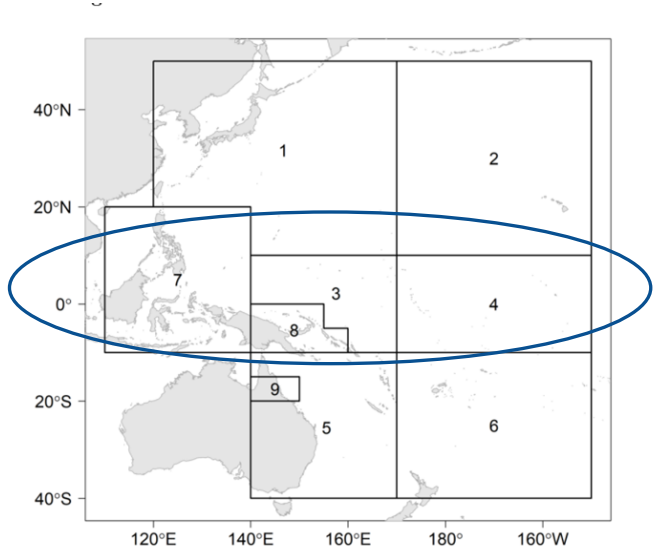
Catches by region

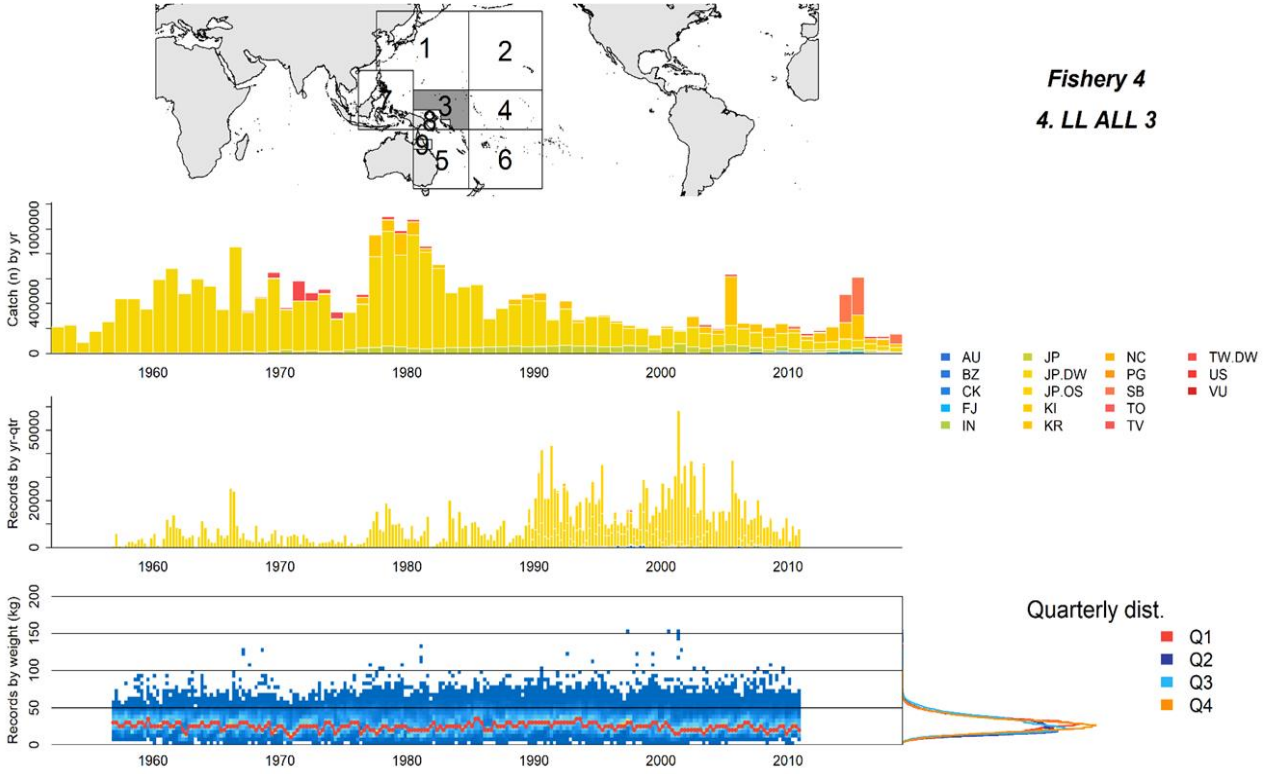




SIZE DATA

- Generally similar between 2017 and 2020 assessments
- Data from various port sampling and observer programmes
- Purse seine (length) and longline (weight), other fisheries (mostly length)
- 95 x 2 cm bins, 200 x 1 kg bins
- Conversion factors for GillGut (GG) to WetWeight (WW) and WW to length (latter updated in 2020)
- Length and weight samples are collected unevenly in space and time - re-weighting procedure applied to improve representativeness – ‘extraction’ fisheries re-weighted by catch, ‘index’ fisheries re-weighted by CPUE (Peatman et al. 2020)

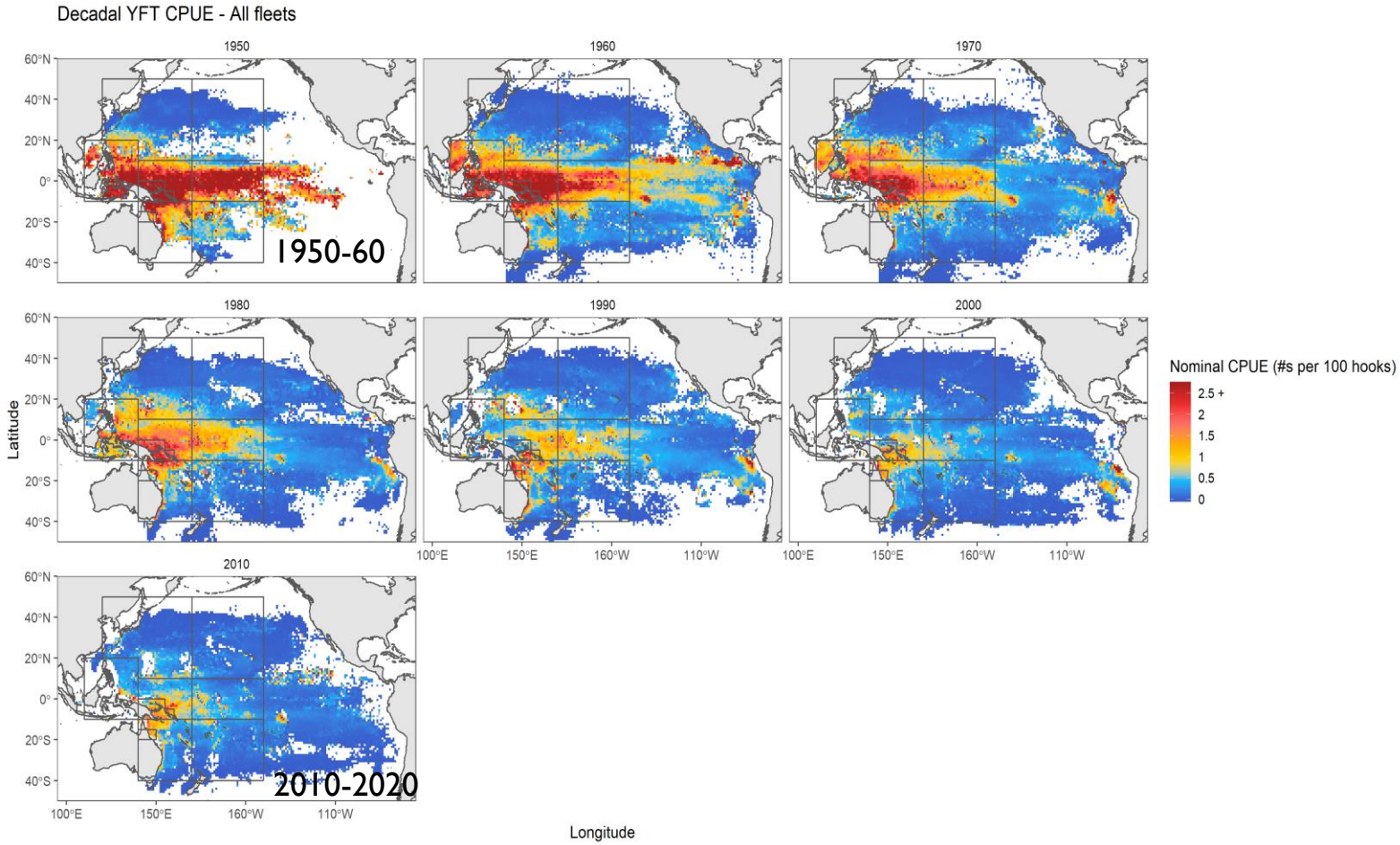
Example: Summary plots for all fisheries



CPUE

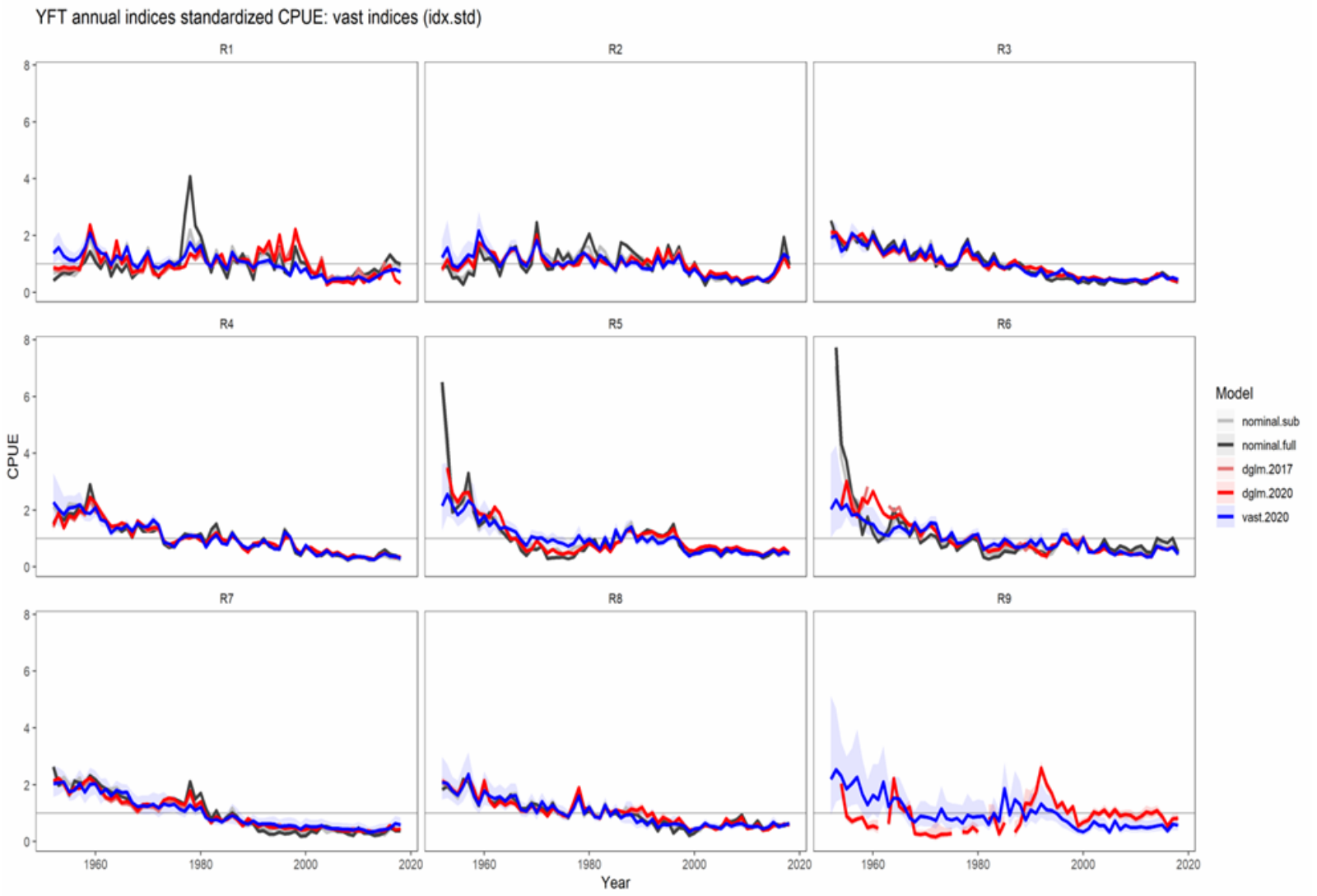
- Operational (logbook) data, Pacific wide data set
- **2017**: GLM combined data across fleets for each region, assume shared/constant catchability, region 9 used nominal with weak penalty (earlier assessments identified specific fleets for CPUE analysis)
- **2020:** used the combined fleets data (as 2017), but applied spatio-temporal delta-GLMM (VAST), catchability covariates of Flag-group and Hooks between Floats (HBF) (minor effects for yellowfin, more so bigeye)

Nominal CPUE spatio-temporal changes



CPUE

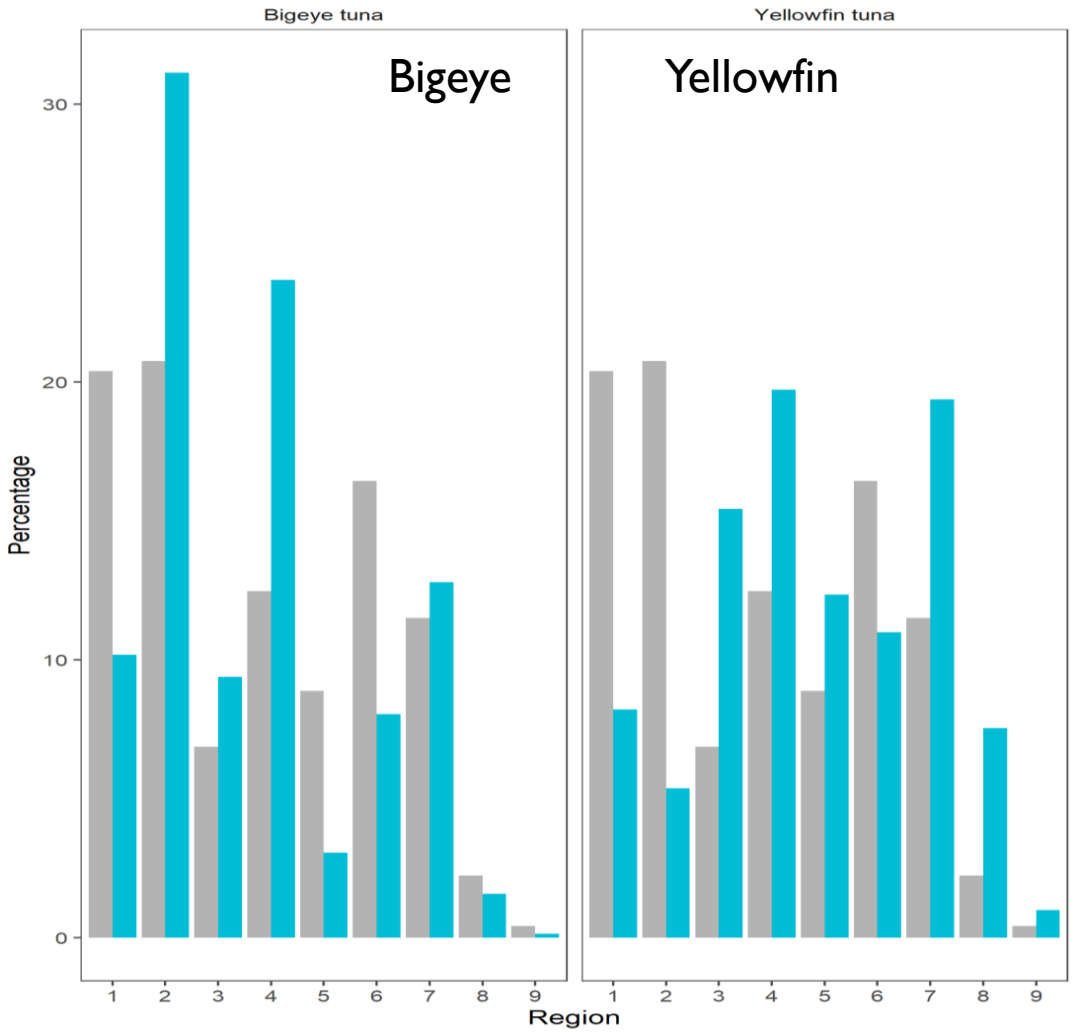
- CPUE trends - pretty similar across assessments, covariates had limited effects, VAST uses areas for regional scaling of relative abundance – question for review
- Suggested to explore other covariates, split time series to use more recently available covariate data, some covariate effects likely confounding by persistent temporal changes in fleet composition - question for review
- Extrapolating VAST indices to areas with low data/low effort, outside temperature tolerances etc. - question for review
- Effort creep scenarios – question for review

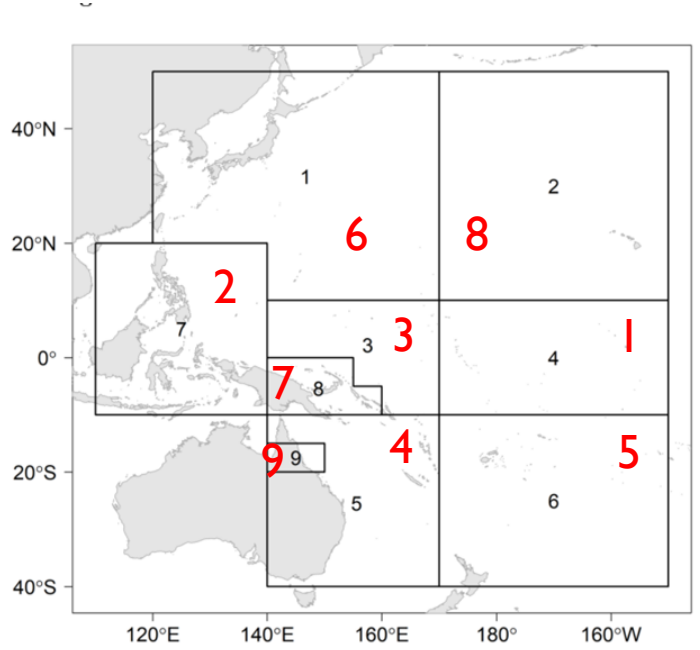


VAST 2020

dGLM 2020

REGIONAL SCALING – DISTRIBUTION OF LL VULNERABLE BIOMASS





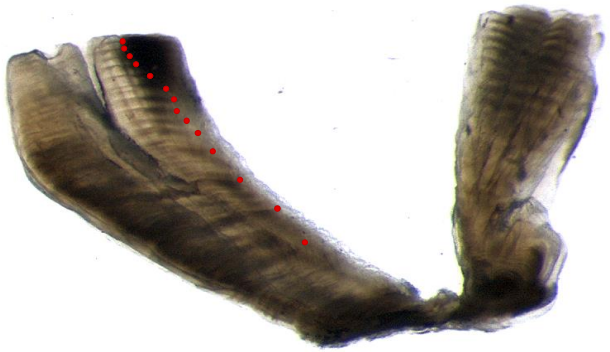
YFT Rank by VAST

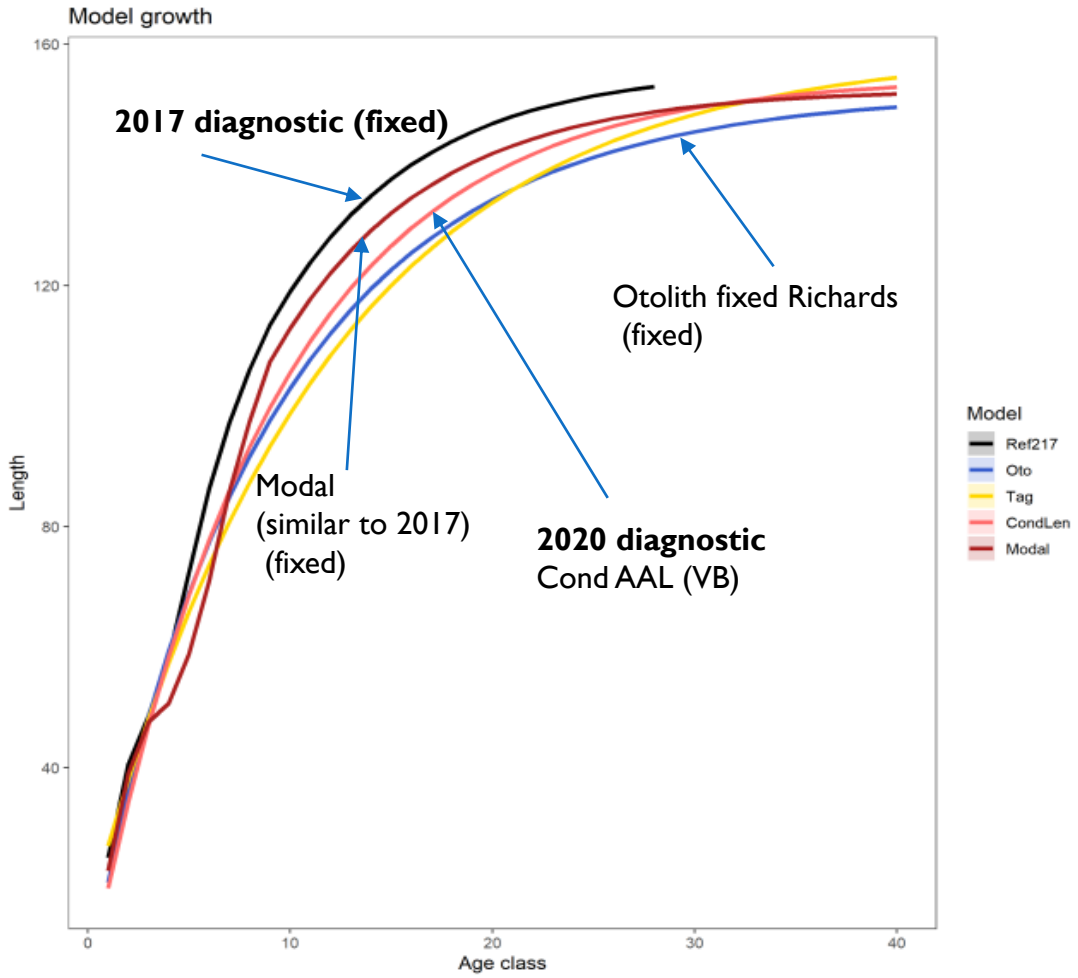
Geographic area of regions

VAST indices scaled by area of regions

GROWTH

- 2017 used modal progression, VB but first 2-8 quarters ind. parameters (offsets), single growth curve used
- 2020: growth became a key axis of uncertainty, **new otolith and tag based growth information available**, extended to 40 quarters
- Tag growth not used as conflicted with otolith growth

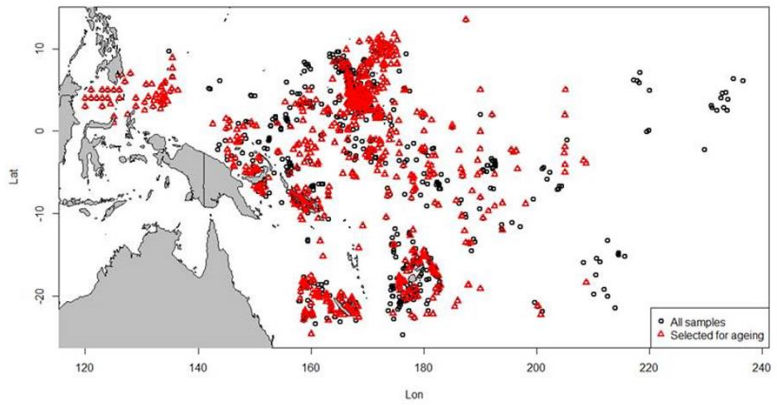


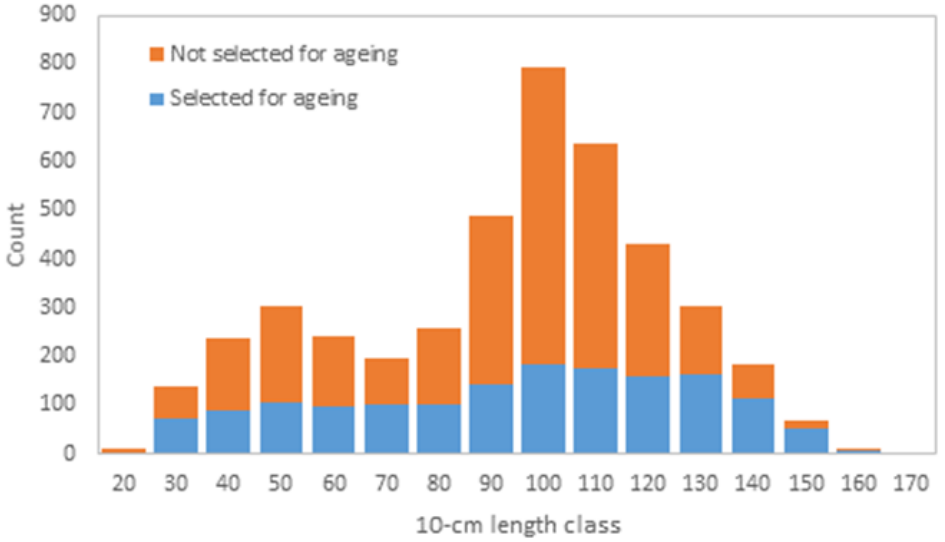


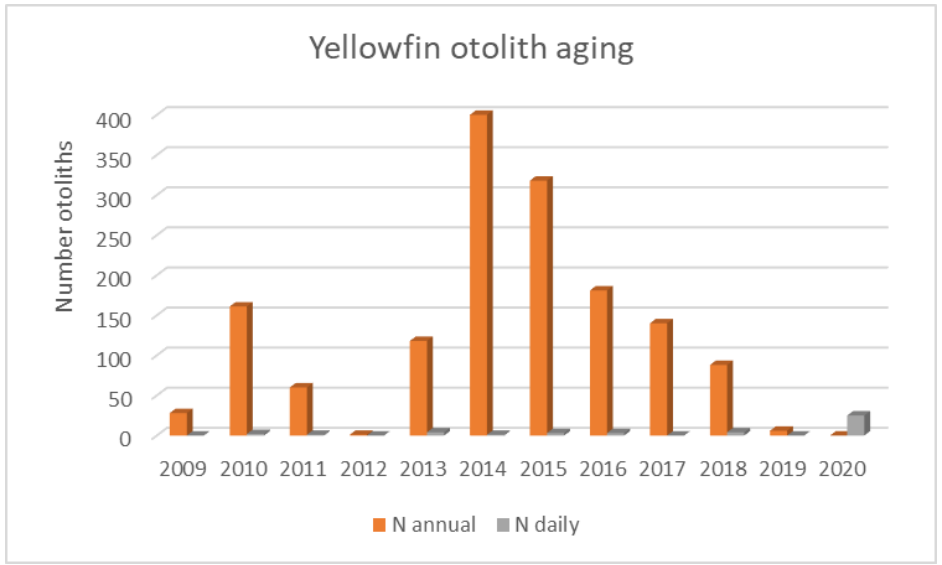
OTOLITHS SELECTED

(2009-2019)

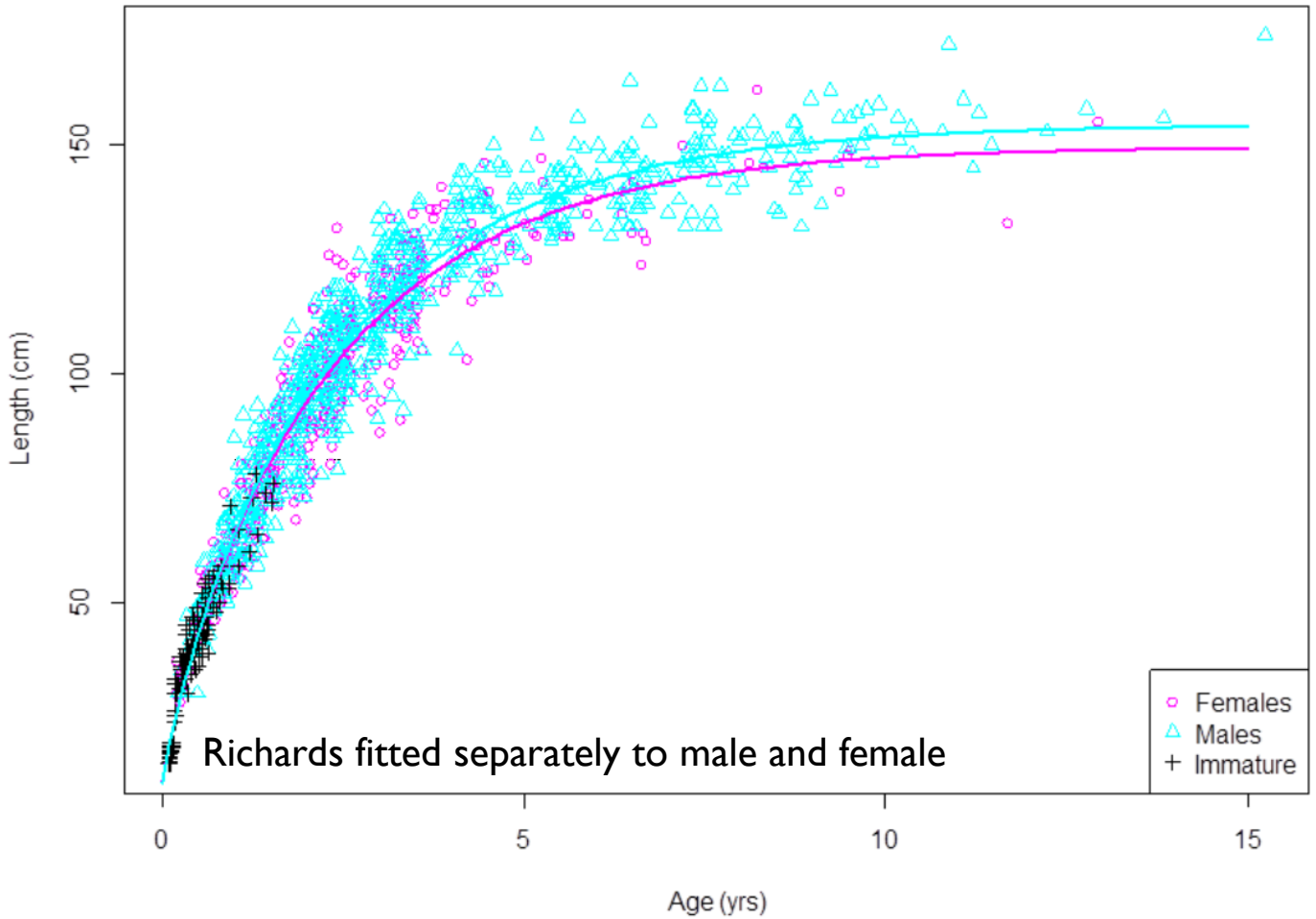
Assessment region	% of catch	No. otolith required	No. otoliths selected
1	18.9	283	2
2	4.7	71	68
3	15.5	233	351
4	11.2	168	271
5	10.4	155	231
6	5.2	78	121
7	24.6	370	269
8	8.5	128	256
9	0.9	14	0
Total	100	1500	1569

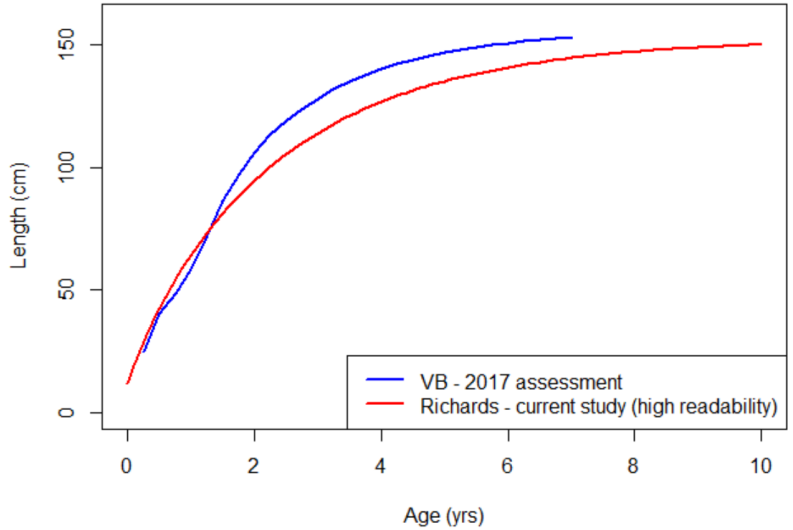




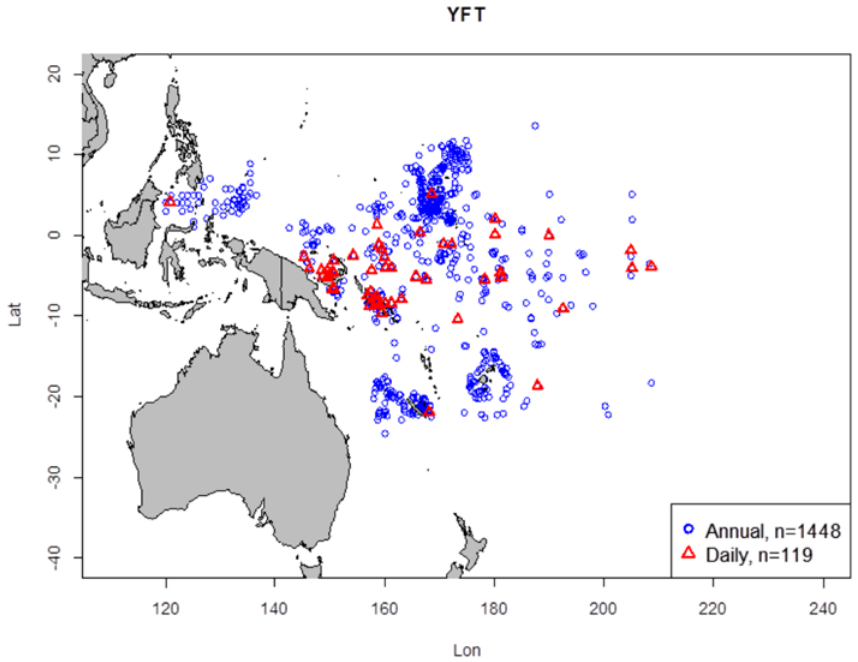


Decimal age method algorithm based on counts of opaque zones and otolith measurements





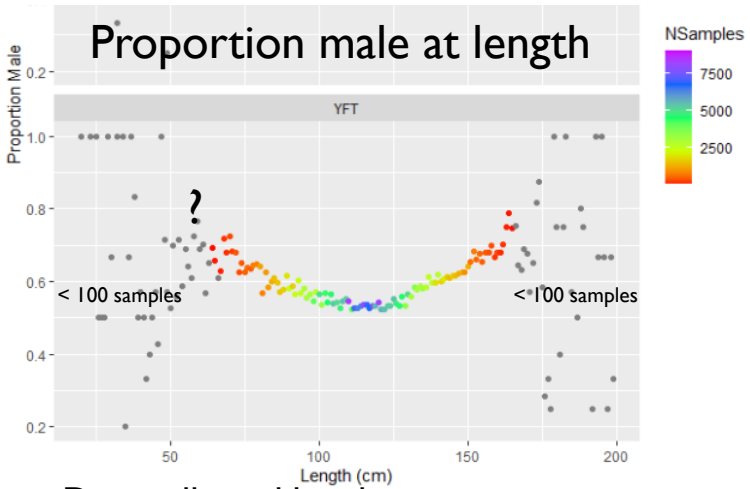
Otoliths samples for growth – collected since 2009



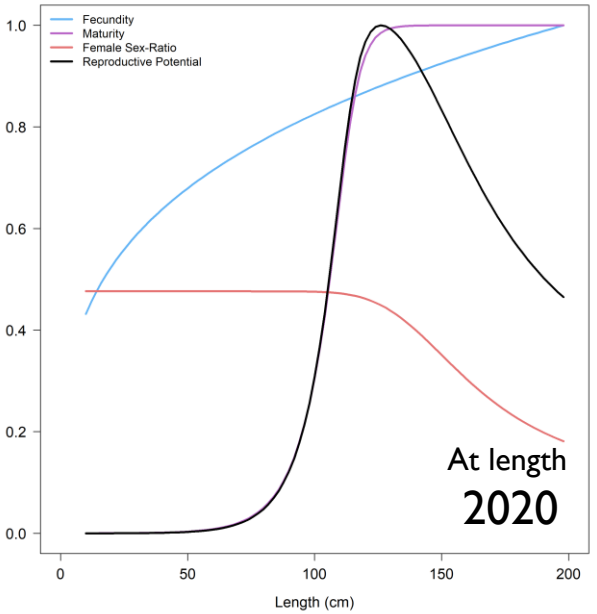
- The longevity of yellowfin tuna was found to be at least 15 years, although 89% of fish were <6 years old.
- 6.3% of females (n=458) were aged ≥5 years.
- 23.5% of males (n=766) were aged ≥5 years.
- Previous assessments assume single growth curve, less females at older ages

MATURITY AND SPAWNING POTENTIAL

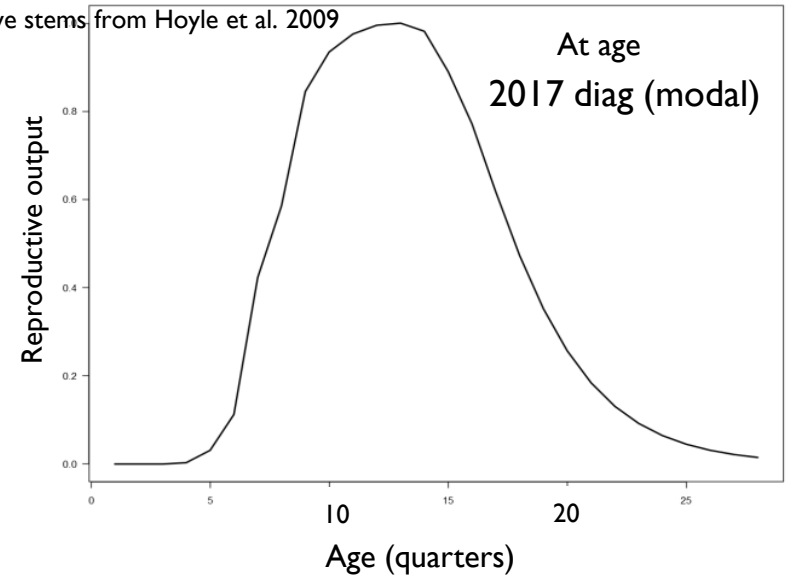
- 2020 changed to reproductive output at-length as inputs with conversion to at-age in MFCL using growth curves
- Reproductive output is a product of: fecundity at length, proportion mature at length, female sex ratio at length, spawning fraction at length data considered unreliable and not used in 2020.

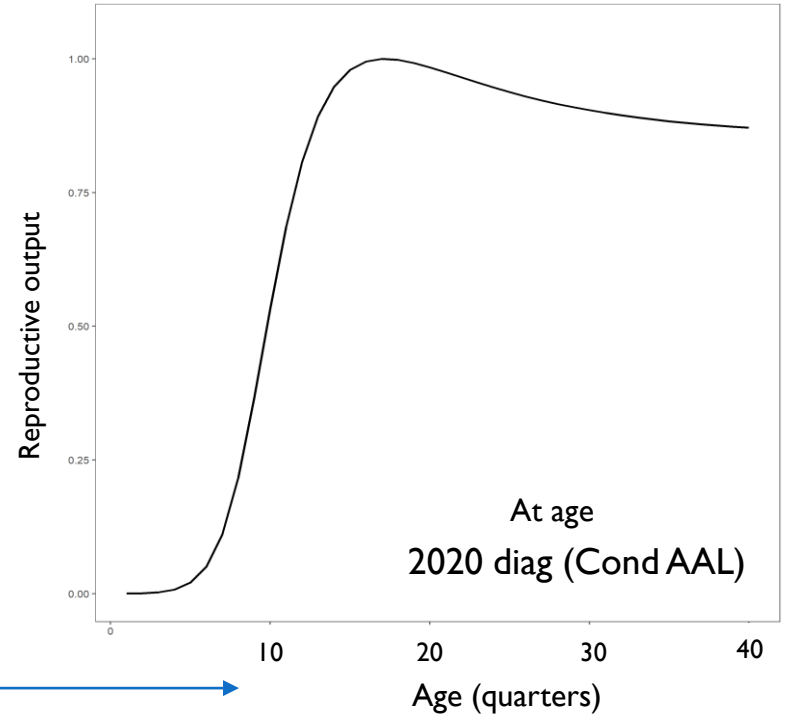


Data collected by observers



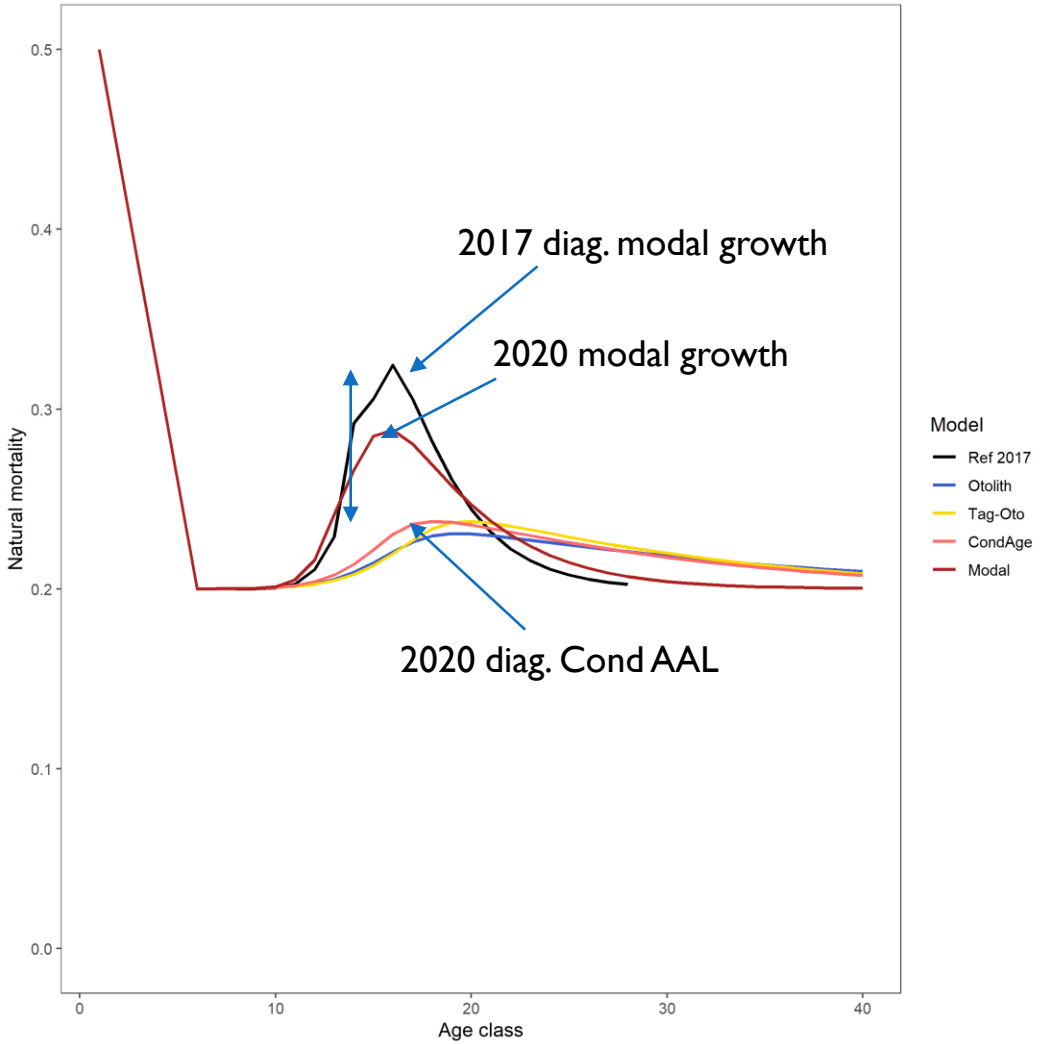
2017 referred to 2014 assessment – Davies et al.
This curve stems from Hoyle et al. 2009

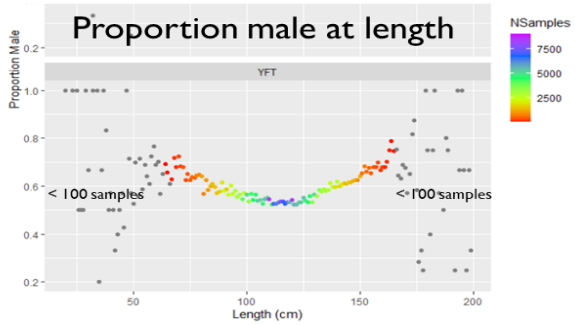




NATURAL MORTALITY AT AGE

- 2017 replicated the 2014 assessment, (Harley and Maunder 2003 method), natural mortality at age between the sexes modelled by estimating the natural mortality parameters that gave the best fit to the sex ratio at length data.
- 3 phase M-at-age curve method to account for higher M at older ages for females that is **assumed from decline in the proportions of females at larger sizes/older ages** (assume same growth)
- 2020 used same method, updated data on sex ratios, new growth estimation etc…base male M=0.2 or was it 0.23??
- Also meta-analysis on M: 0.11-0.15, produced implausible biomass levels – more yellowfin than skipjack!!
- M not included in uncertainty as a specific grid axis but each growth used a different M-at-age relationship.

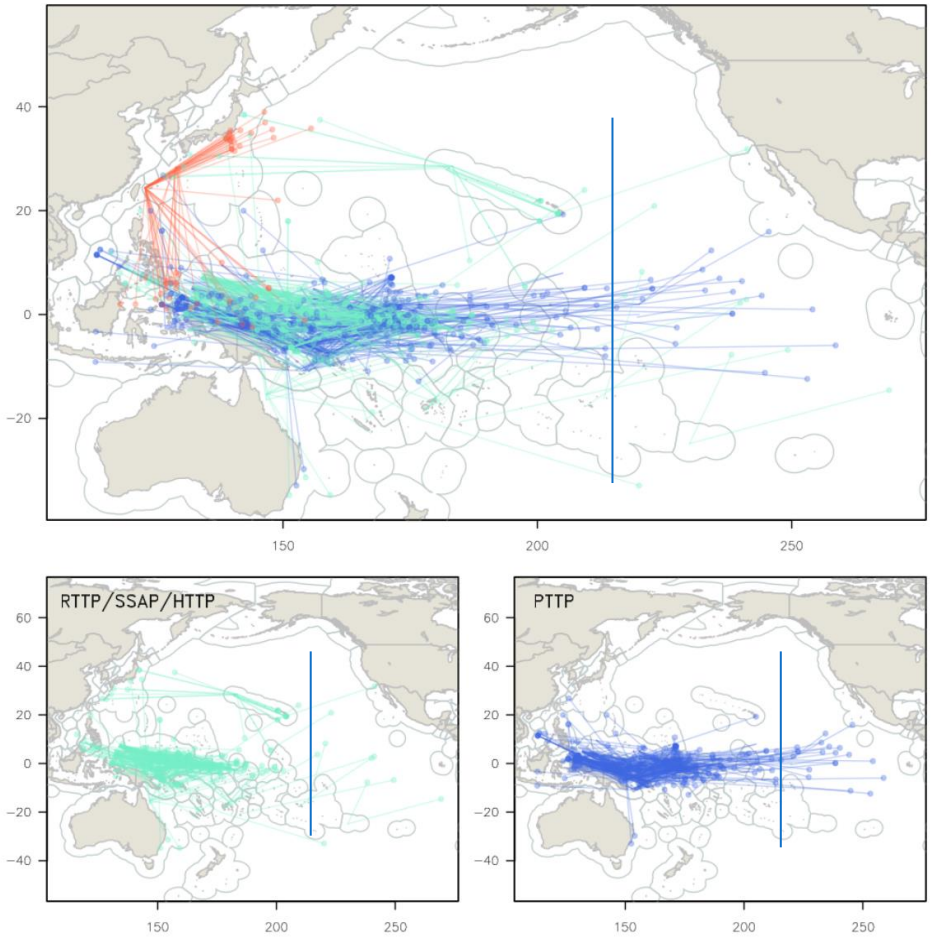




TAGGING DATA

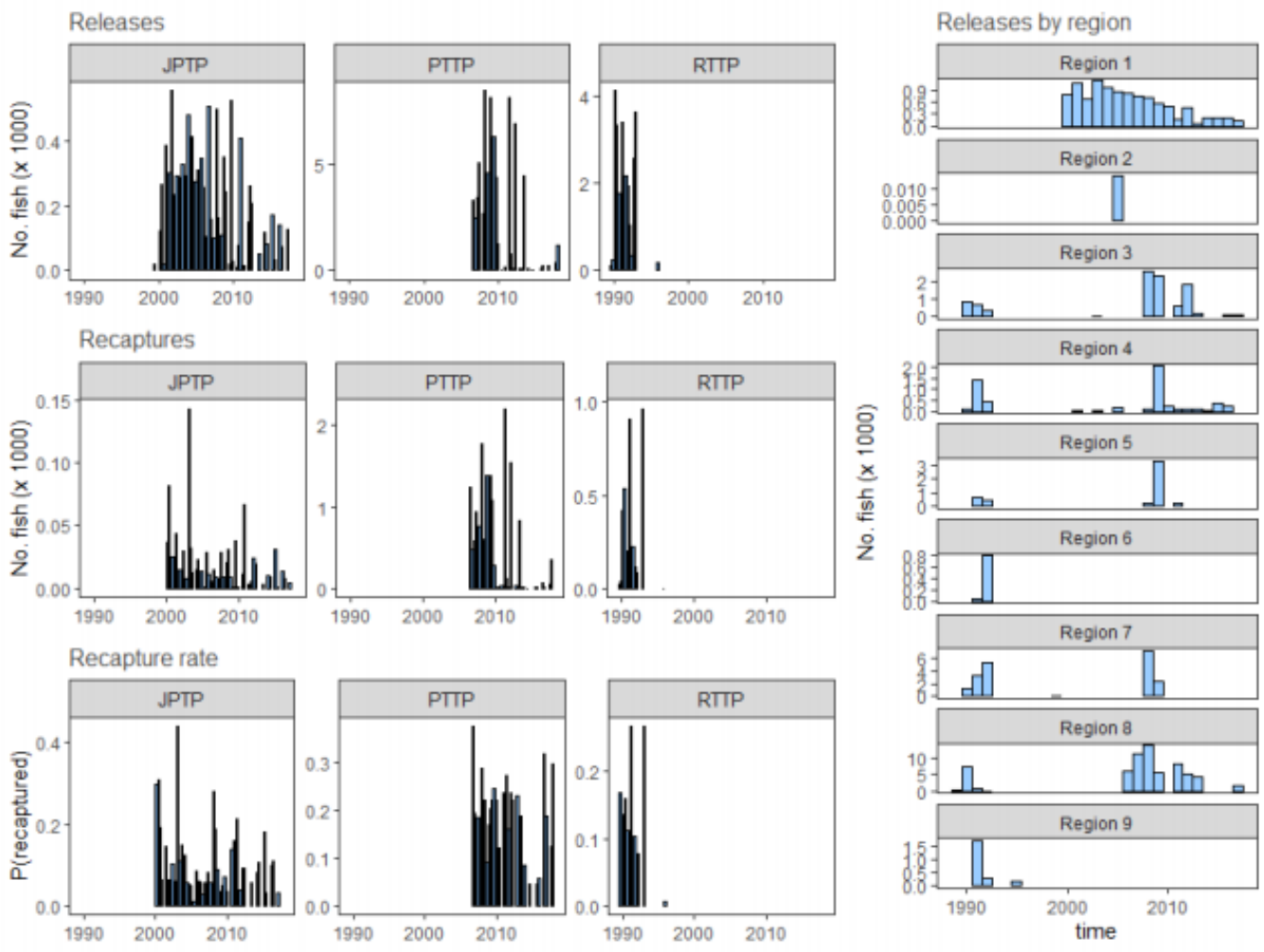
- 2020 tag data preparation generally consistent with 2014 and 2017 assessments, data added for releases until end 2017 (previous assessment until mid 2015)
- Japan tagging data added - region 1 (1999-2017)
- Tag mortality and shedding rates assumed same as 2017, changes to tagger effects models increased useable tag releases, also additional recaptures added from data previous data, both had minor effects for YFT
- Despite changes, effective recapture rates similar between assessments

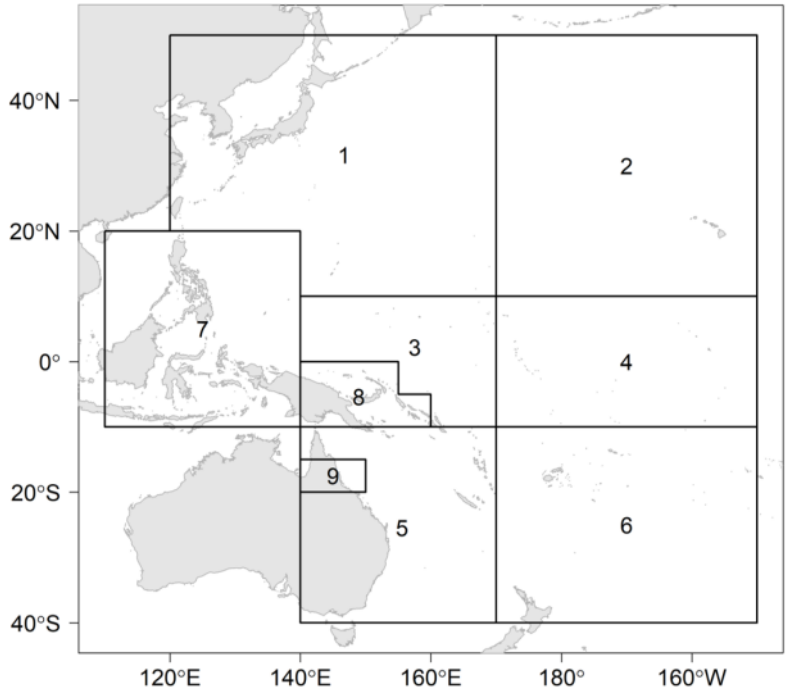
Species	Prog	2017 Eff	2017 Rec	2017 Rate	Raw	Eff	Rec	Raw Rate	Eff Rate
YFT	RTTP	20,574	4,151	0.20	35,225	24,014	4,303	0.12	0.18
	CSTP	2,343	70	0.03	2,999	2,221	77	0.03	0.03
	PTTP	55,888	14,883	0.27	108,453	79,339	17,002	0.16	0.21
	JPTP			na	15,437	10,551	1,024	0.07	0.10



- **Tag mixing**: ensured actual times at liberty considered in relation to assumed mixing periods (i.e. 1 or 2 quarters).

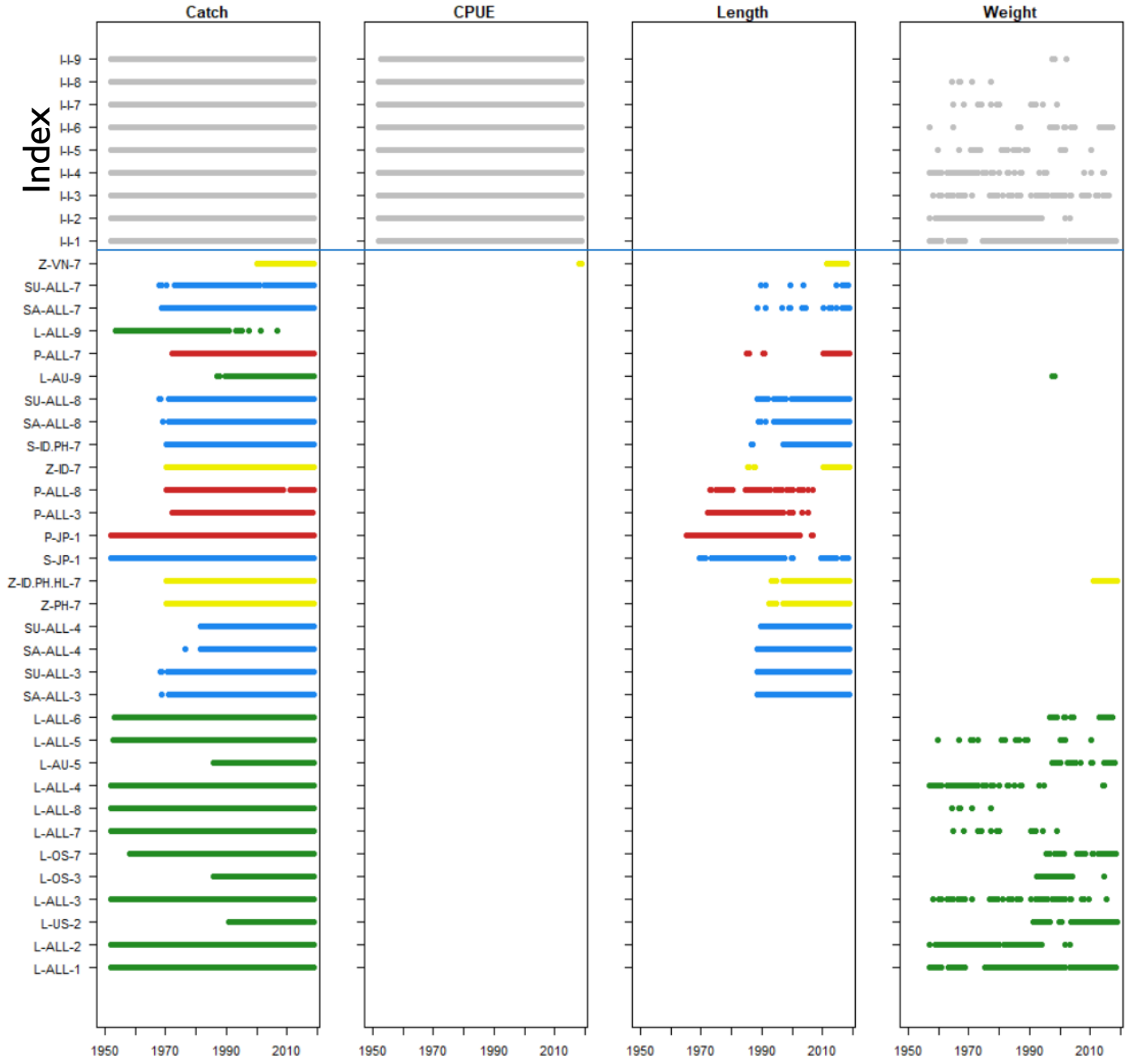
Tag data summary

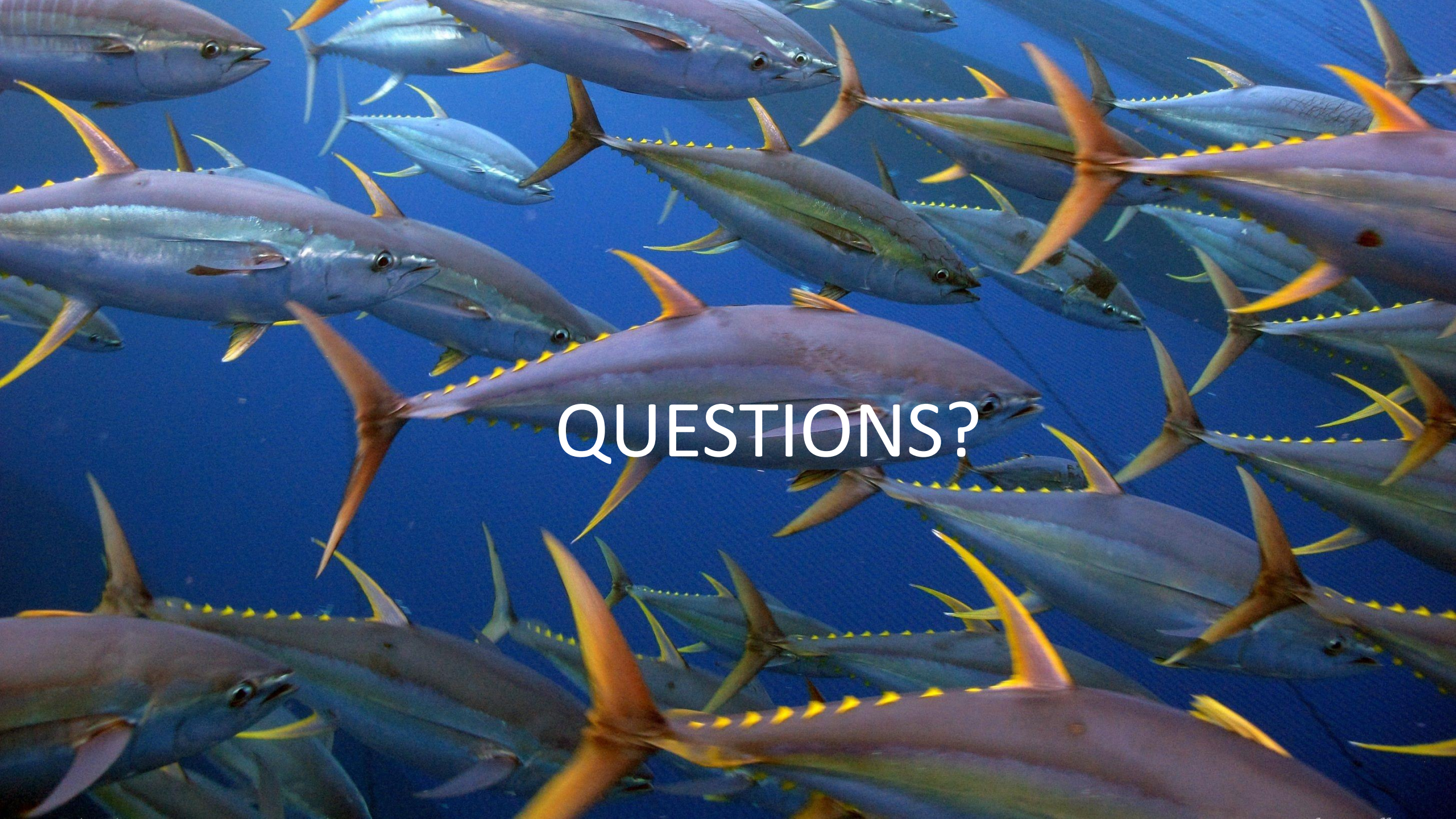




Prog	JPTP			PTTP			RTTP		
Years	1999–2017			2006–2017			1989–1995		
Region	Grps	Rel	Rec	Grps	Rel	Rec	Grps	Rel	Rec
1	52	10295	1013	0	0	0	0	0	0
2	1	14	0	0	0	0	0	0	0
3	1	11	0	15	7800	1343	6	1837	235
4	3	211	11	13	3236	568	4	1951	188
5	0	0	0	5	3870	479	2	1112	209
6	0	0	0	0	0	0	3	830	41
7	1	20	0	3	9563	1558	7	9653	2361
8	0	0	0	17	54871	13054	9	8631	1269
9	0	0	0	0	0	0	3	2221	77
Total	58	10551	1024	53	79339	17002	34	26235	4380

DATA COVERAGE SUMMARY




QUESTIONS?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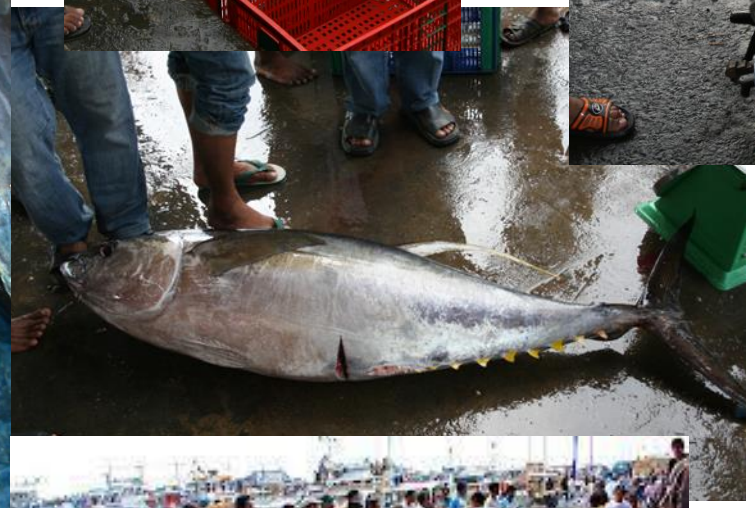
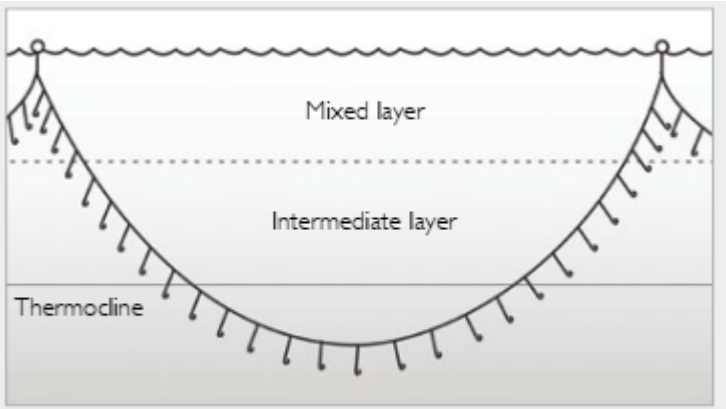
NATHANNARFACH





Normal longline set