INCORPORATION OF UPDATED GROWTH INFORMATION WITHIN THE 2017 WCPO BIGEYE STOCK ASSESSMENT GRID, AND EXAMINATION OF THE SENSITIVITY OF ESTIMATES TO ALTERNATIVE MODEL STRUCTURES

SA-WP-03

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OCEANIC FISHERIES PROGRAMME

PACIFIC COMMUNITY

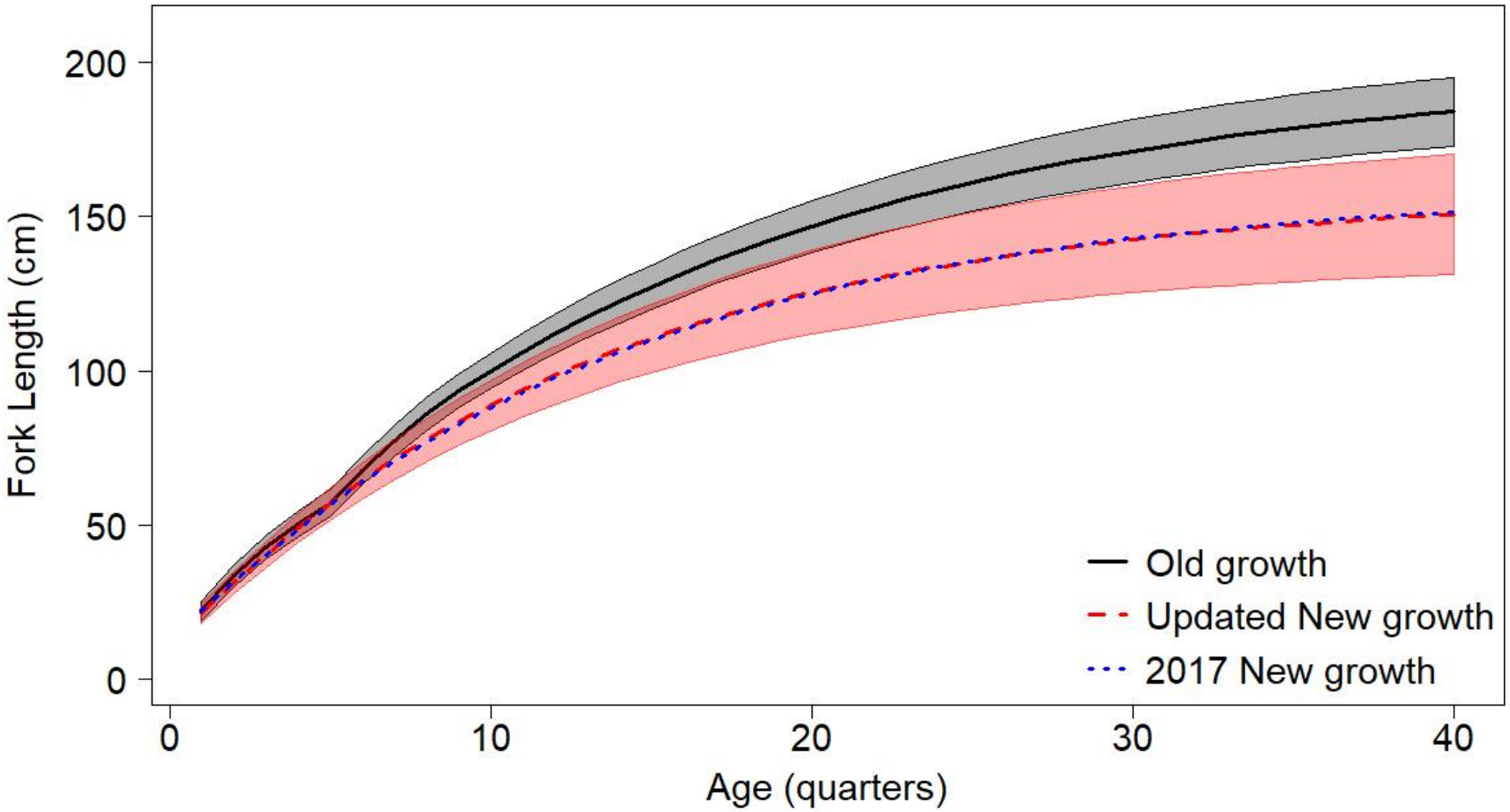
BACKGROUND

- Bigeye assessment conducted in 2017
  - Uncertainty from two axes larger than 2014 assessment
- SC13 suggested two areas to investigate:
  - Growth with newly sampled large fish
  - Sensitivity of model to alternative regional structure
- Not a full assessment: a re-evaluation
- Alternative minimization algorithm for 2017 models
  - Typically small differences in management quantities

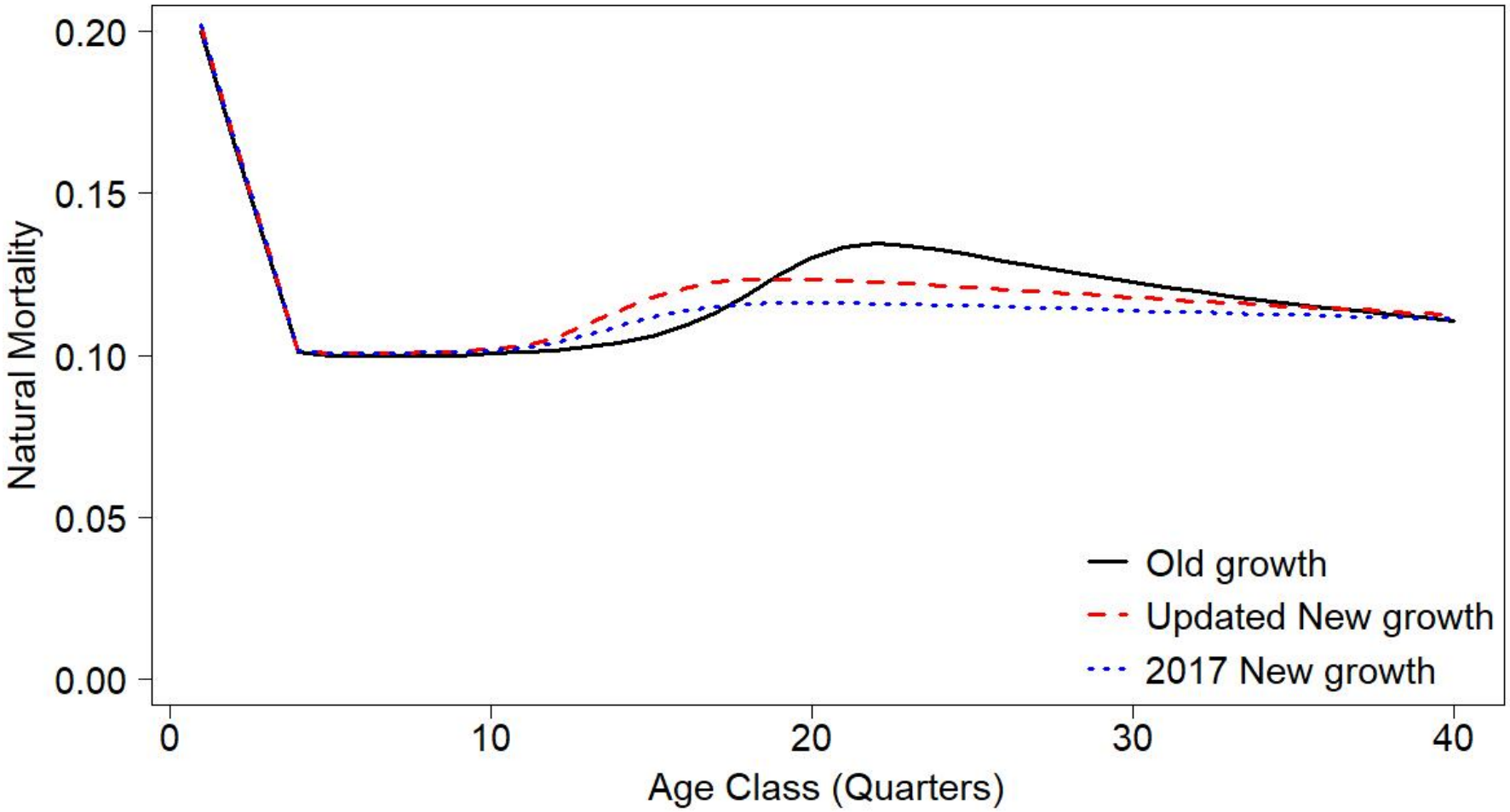
PROJECT 81

- Increase sample size of ages for very large bigeye
- An additional 237 otoliths read (188 were > 130 cm)
- Daily ages for 11 small fish (31-39 cm)
- New growth curve used in the updated assessment
  - "Updated New growth"

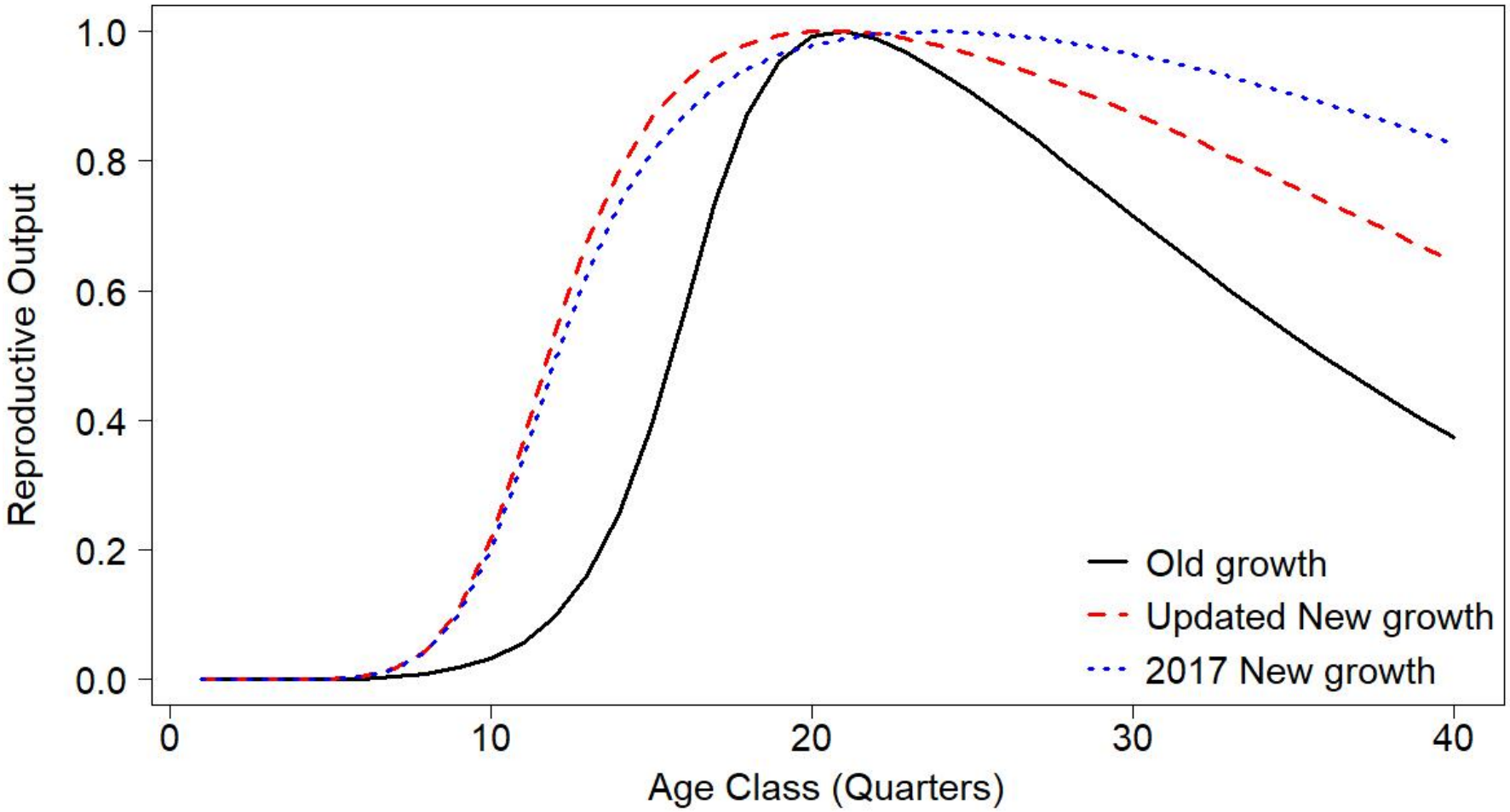
UPDATED NEW GROWTH



NATURAL MORTALITY



REPRODUCTIVE POTENTIAL-AT-AGE



REGIONAL STRUCTURES

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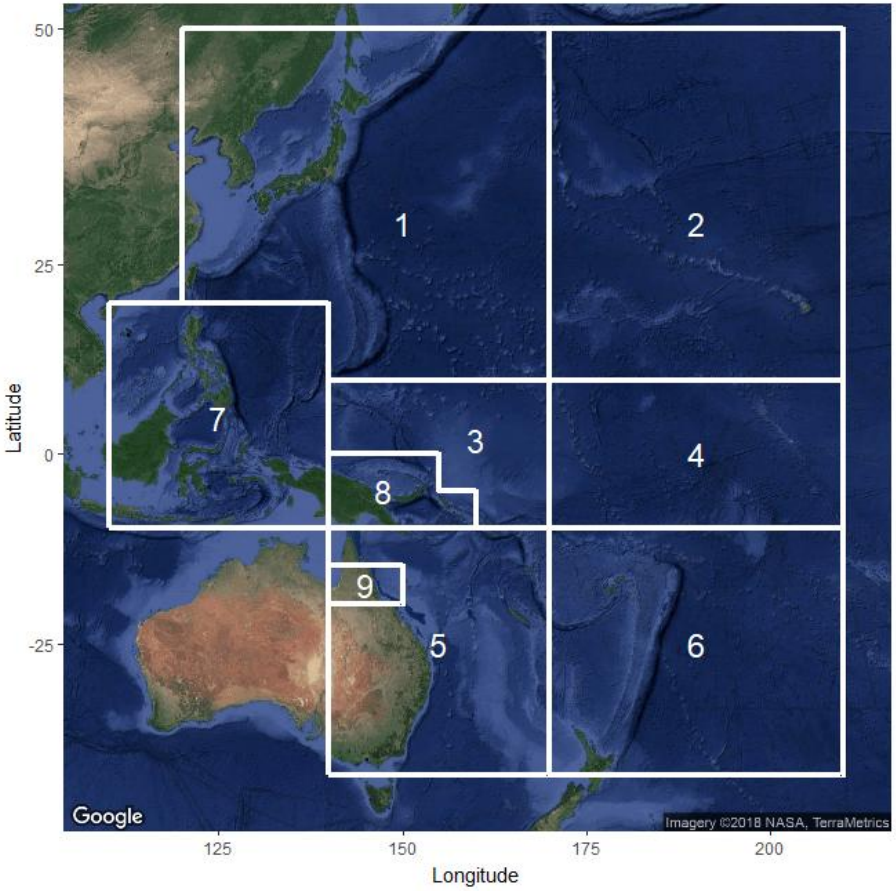
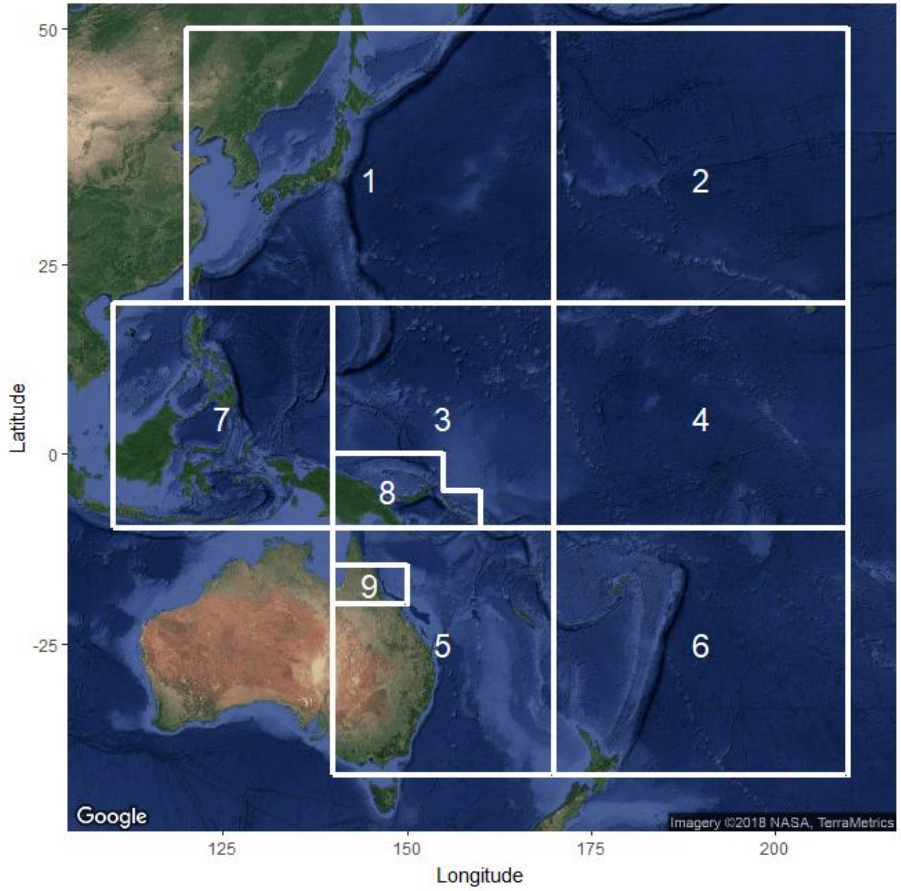
10˚N (2017 Regions)



20˚N (2014 Regions)



STRUCTURAL UNCERTAINTY AXES IN GRID

Axis	Level 1	Level 2	Level 3
Growth	Updated New	Old	
Spatial Structure	10˚N	20˚N	
Tag Over-dispersion	Default level	Fixed (moderate) level	
Size Data Scalar	10	20	50
Steepness	0.65	0.8	0.95

WEIGHTED GRID
3:1 UPDATED NEW : OLD

	Median 2018	Median 2017	80% CI 2018	80% CI 2017
F_{Recent}/F_{MSY}	0.81	0.83	0.68-1.25	0.61-1.32
$SB_{Recent}/SB_{F=0}$	0.33	0.32	0.16-0.40	0.15-0.41
$SB_{Latest}/SB_{F=0}$	0.39	0.37	0.16-0.47	0.15-0.46

	Risk 2018	Risk 2017		
$F_{Recent}/F_{MSY} > 1$	22%	23%		
$SB_{Recent}/SB_{F=0} < 20\%$	15%	16%		

SB_{RECENT} VS. SB_{LATEST}

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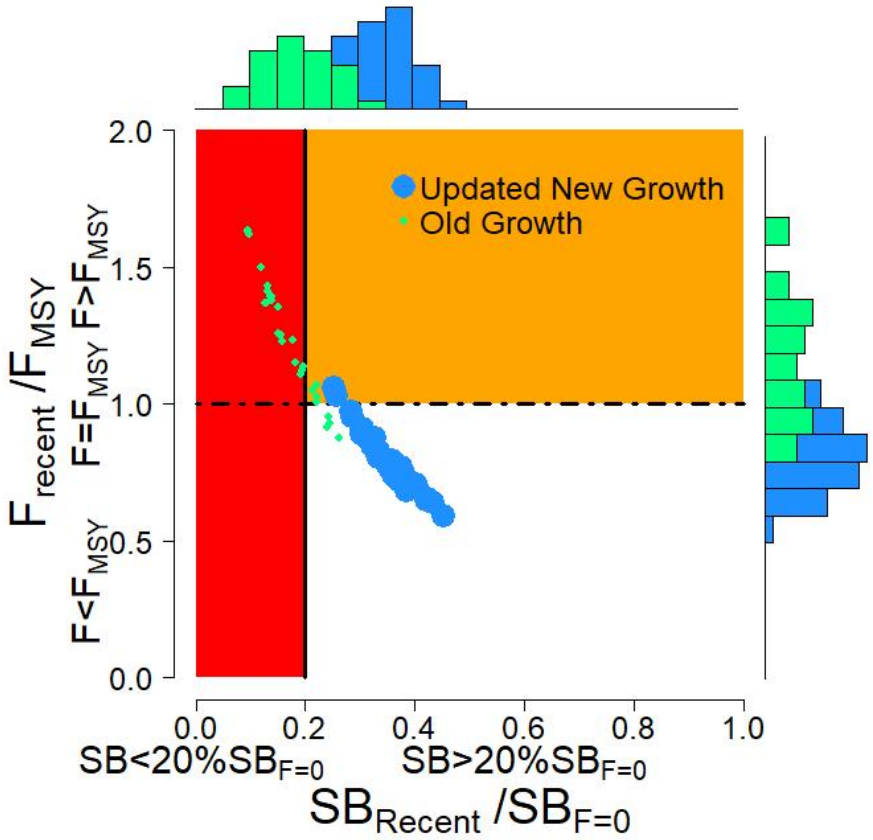
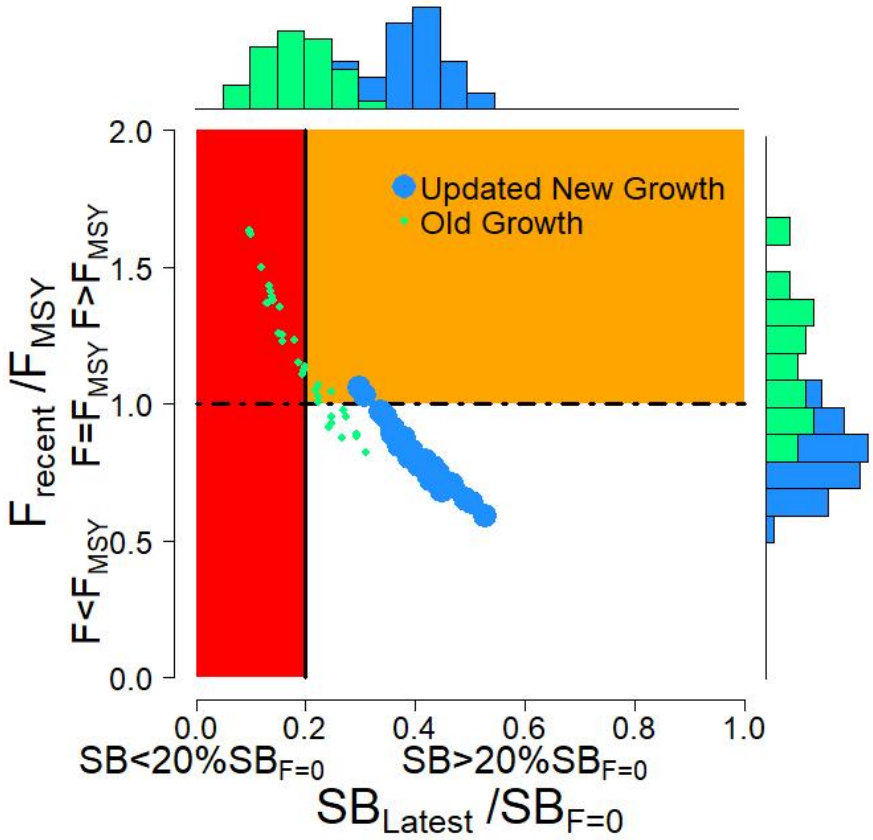
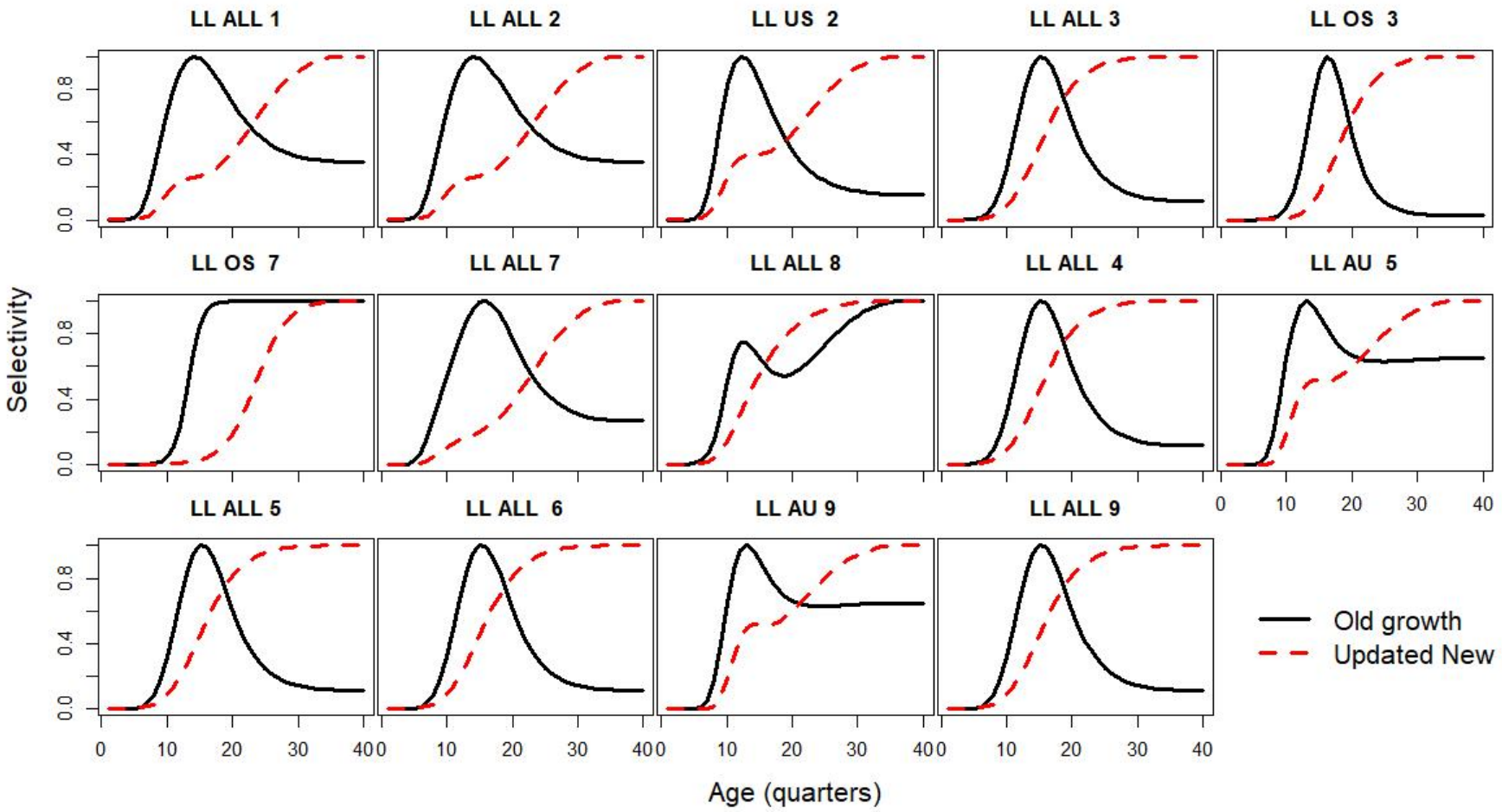
$SB_{Recent}/SB_{F=0}$



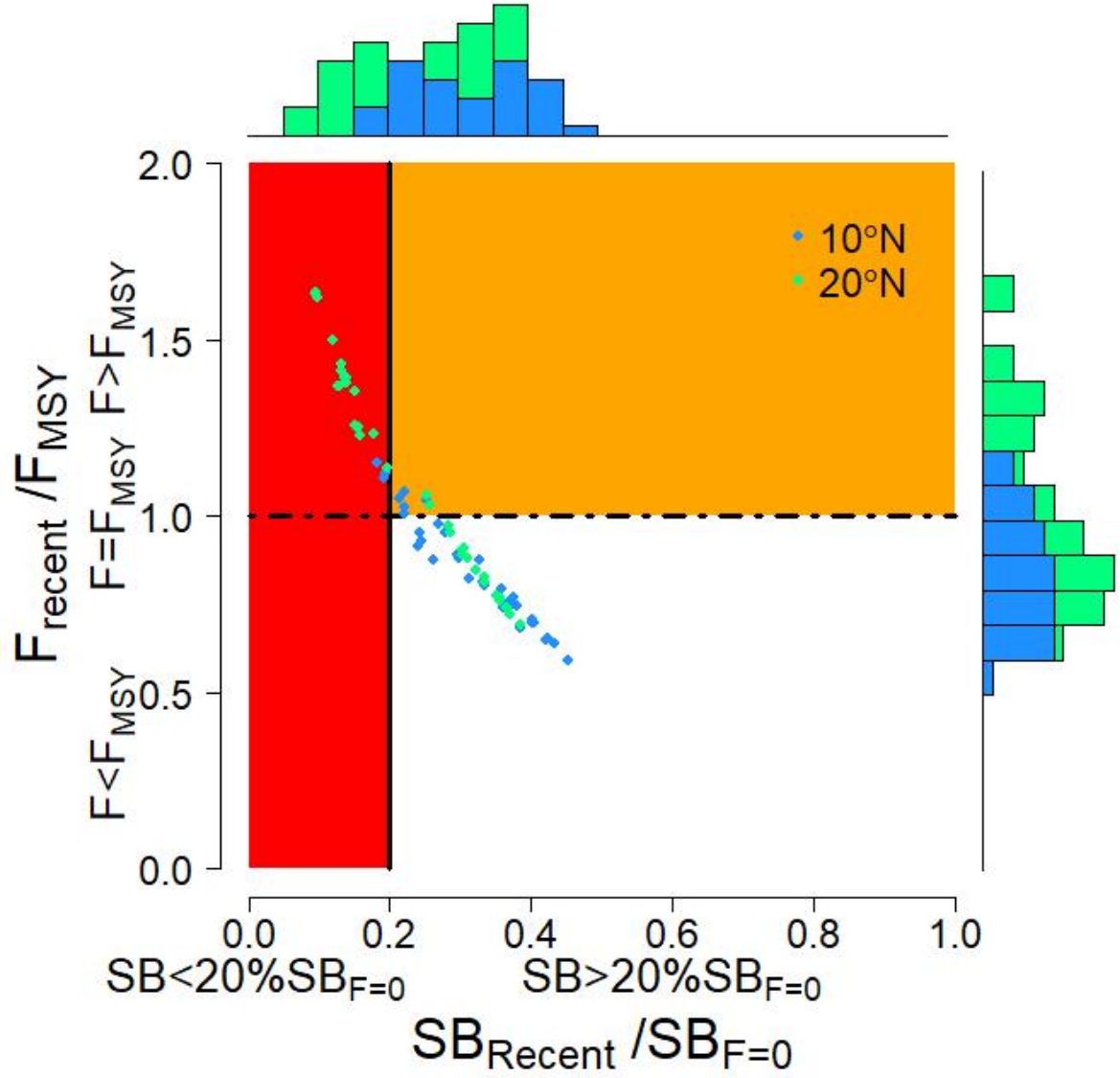
$SB_{Latest}/SB_{F=0}$



SELECTIVITY OLD VS NEW



SPATIAL STRUCTURE



RATIONALE FOR REGIONAL STRUCTURE IN ASSESSMENTS

- A stock is all fish of a species in an area at a given time
- Assessment area can be constrained by geographic, oceanic or political boundaries
  - Bigeye in WCPFC Convention area from 1952 to 2015
- Best practice is to create regional boundaries that are biologically meaningful to the species
  - Capture differences in genetic structure, growth, or mortality
- Usually there are insufficient data to discriminate stocks based on biological differences

RATIONALE FOR REGIONAL STRUCTURE IN ASSESSMENTS

- Current genetic evidence for bigeye inconclusive
- Some evidence growth may differ spatially for bigeye
- Age samples are inadequate for regional growth curves
- MULTIFAN-CL unable to account for spatially different growths
- Requires assumptions regarding growth of fish that move between regions

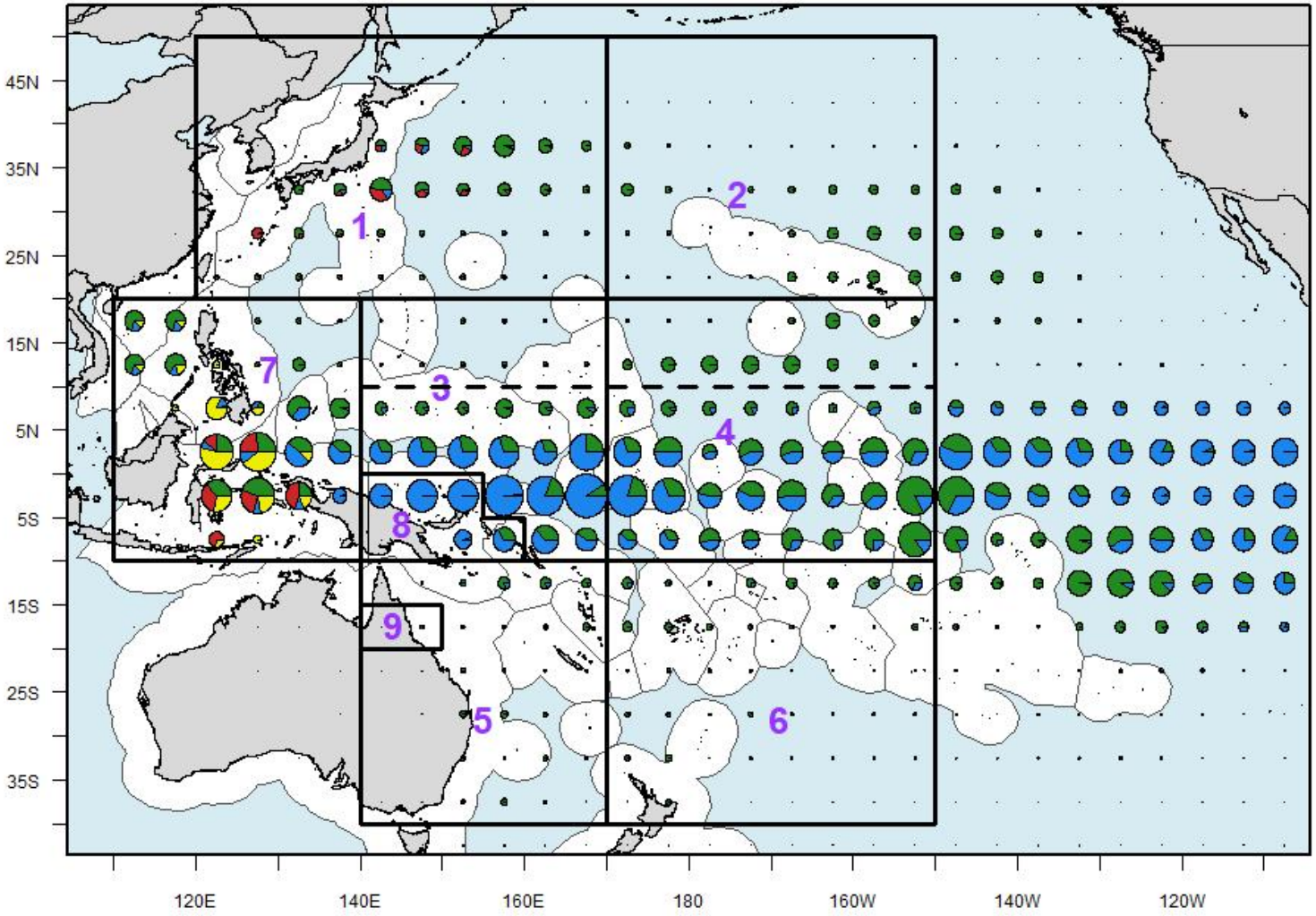
RATIONALE FOR REGIONAL STRUCTURE IN ASSESSMENTS

- Can create regions based on fishing mortality
  - Capture differences in scale of mortality or age distribution
- Regions allow for estimating unique levels of depletion
  - Regions 3, 4, 7, and 8 were most exploited in 2017 assessment
- Assessment spatial structure limited by the scale of data availability
  - Cannot have finer scale of stock structure than available data

AVAILABLE DATA SOURCES

- Raised catch data available only at 5˚x5˚ scale
- Majority (65.5%) of length frequency data 5˚x5˚ scale
- The remaining length frequency data are mostly at a 5˚x10˚ scale (16.6%) or 10˚x20˚ scale (13.4%)
- A 5˚x5˚ scale is the finest resolution available for alternative regional structures
  - Therefore we were only able to investigate a 15°N model

CATCH LOCATION



LL CPUE AND CATCH

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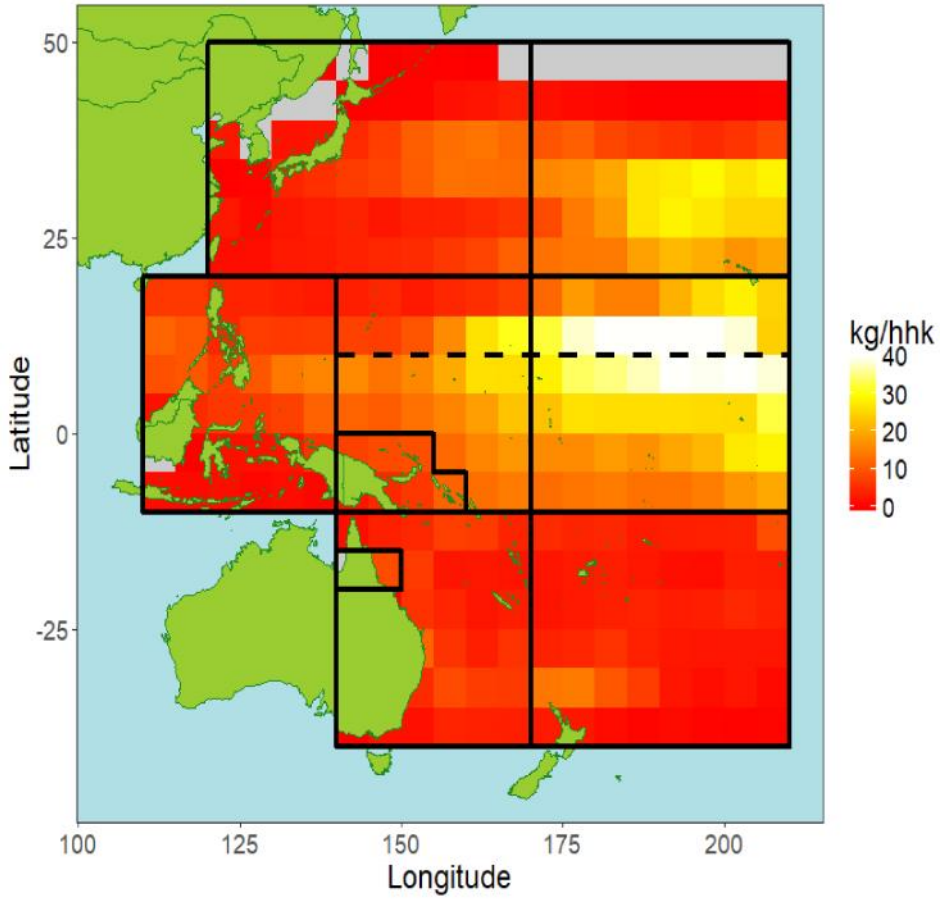
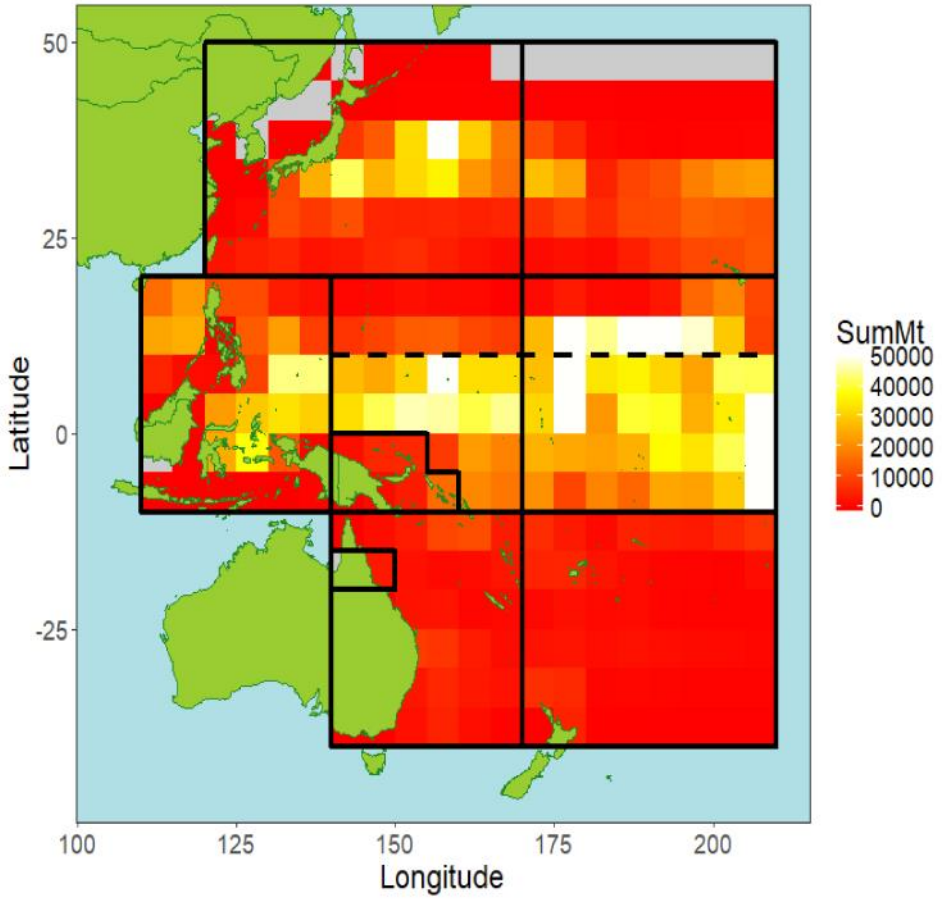
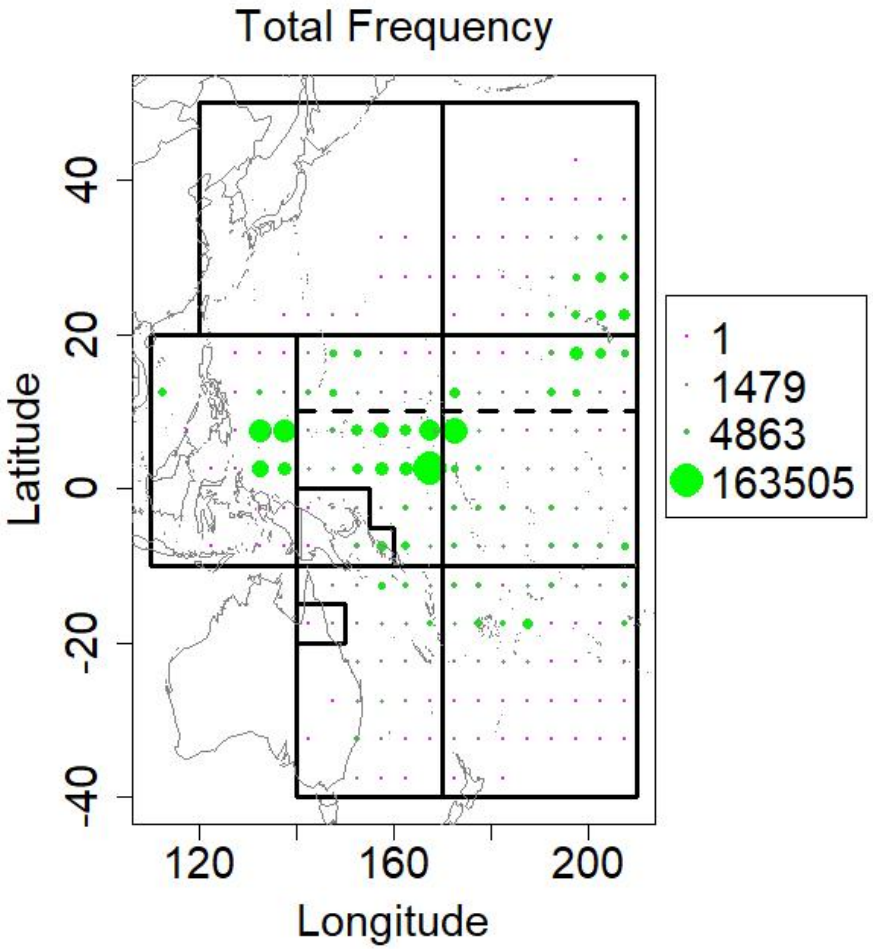
Kg per 100 hooks

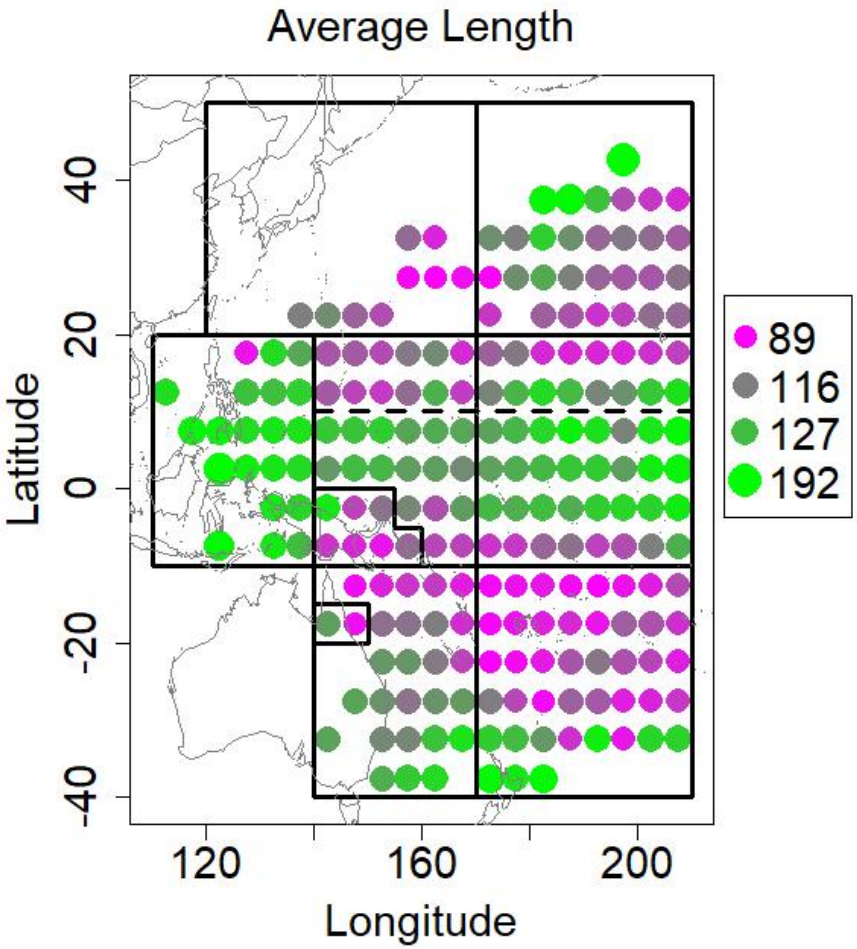


Total Catch Tonnes

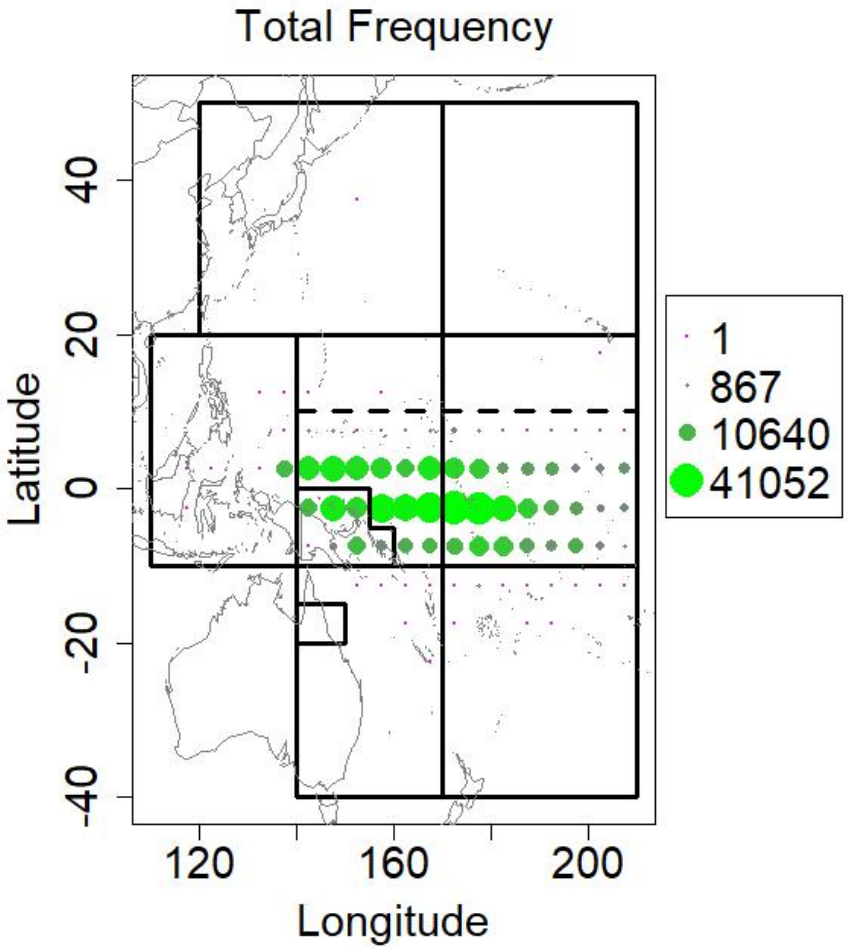


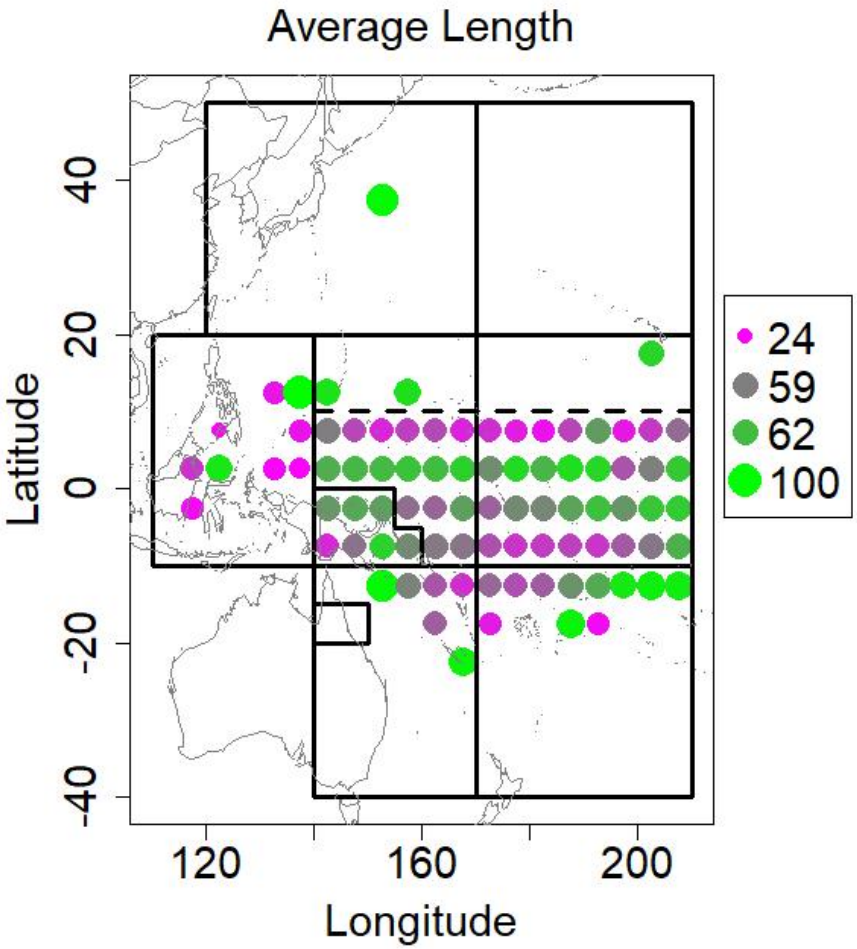
LL AVERAGE LENGTH





PS AVERAGE LENGTH





PS CPUE AND CATCH

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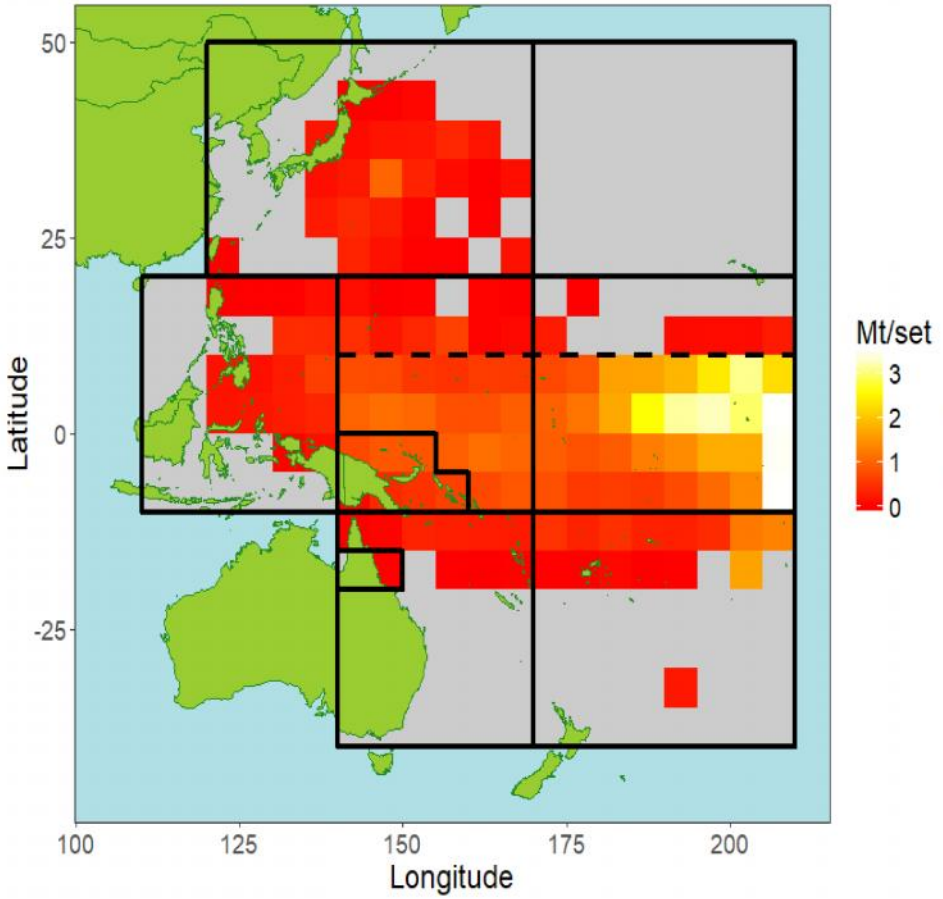
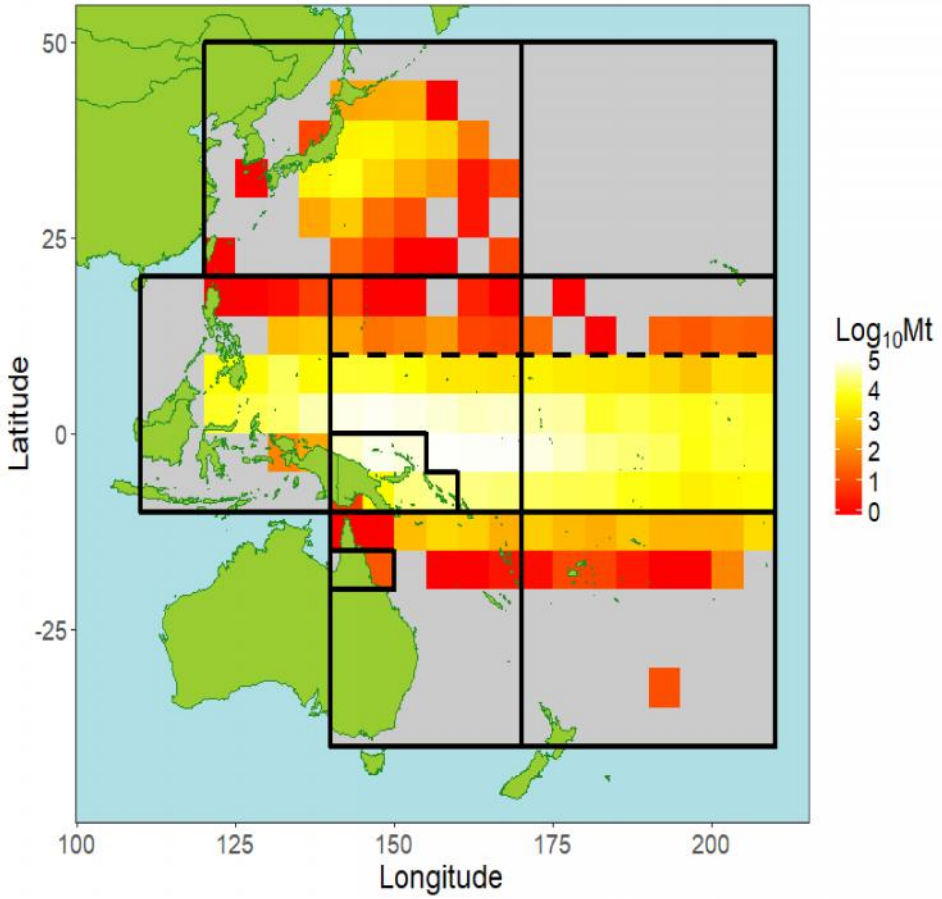
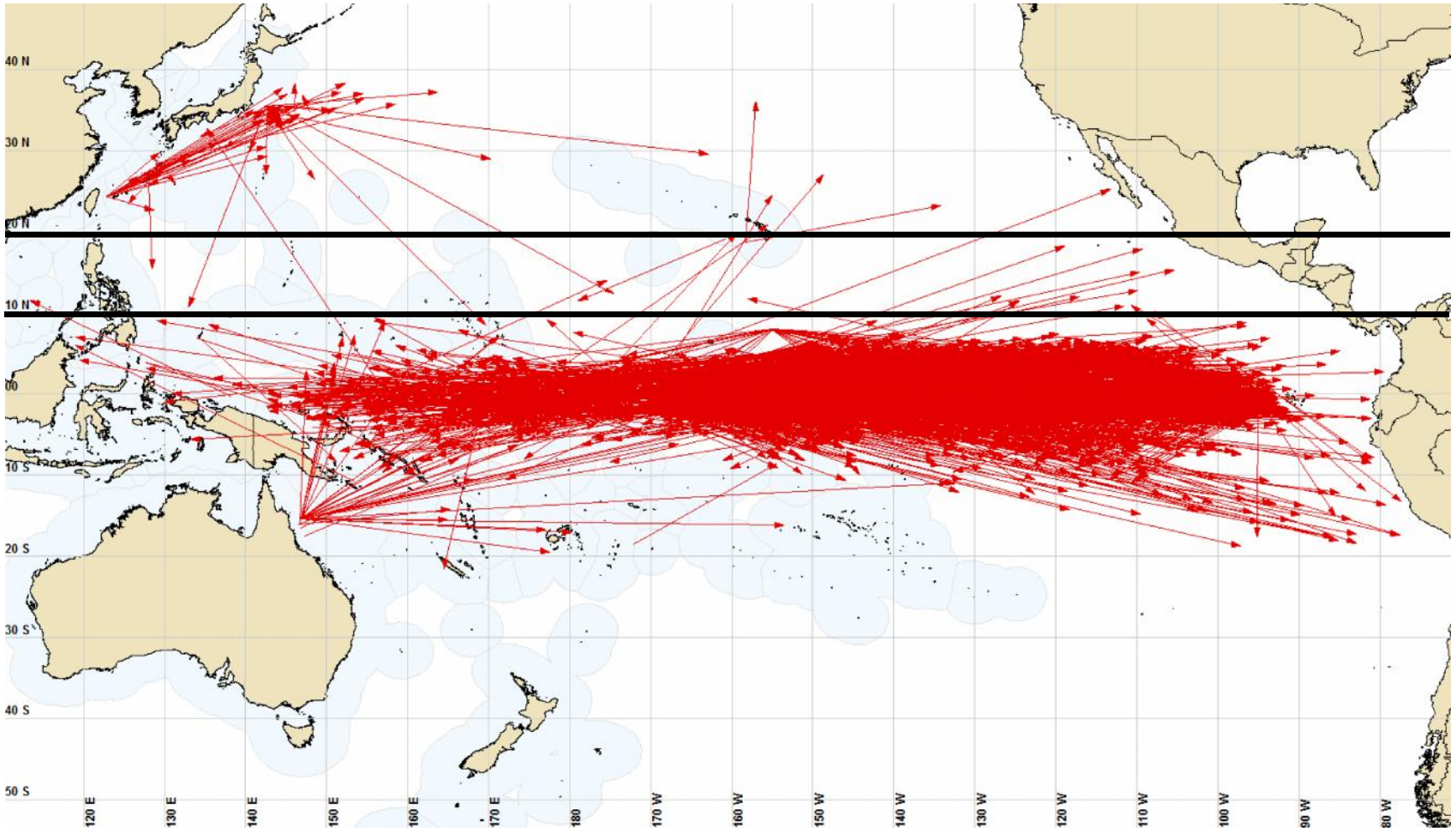
Metric Tonnes per set



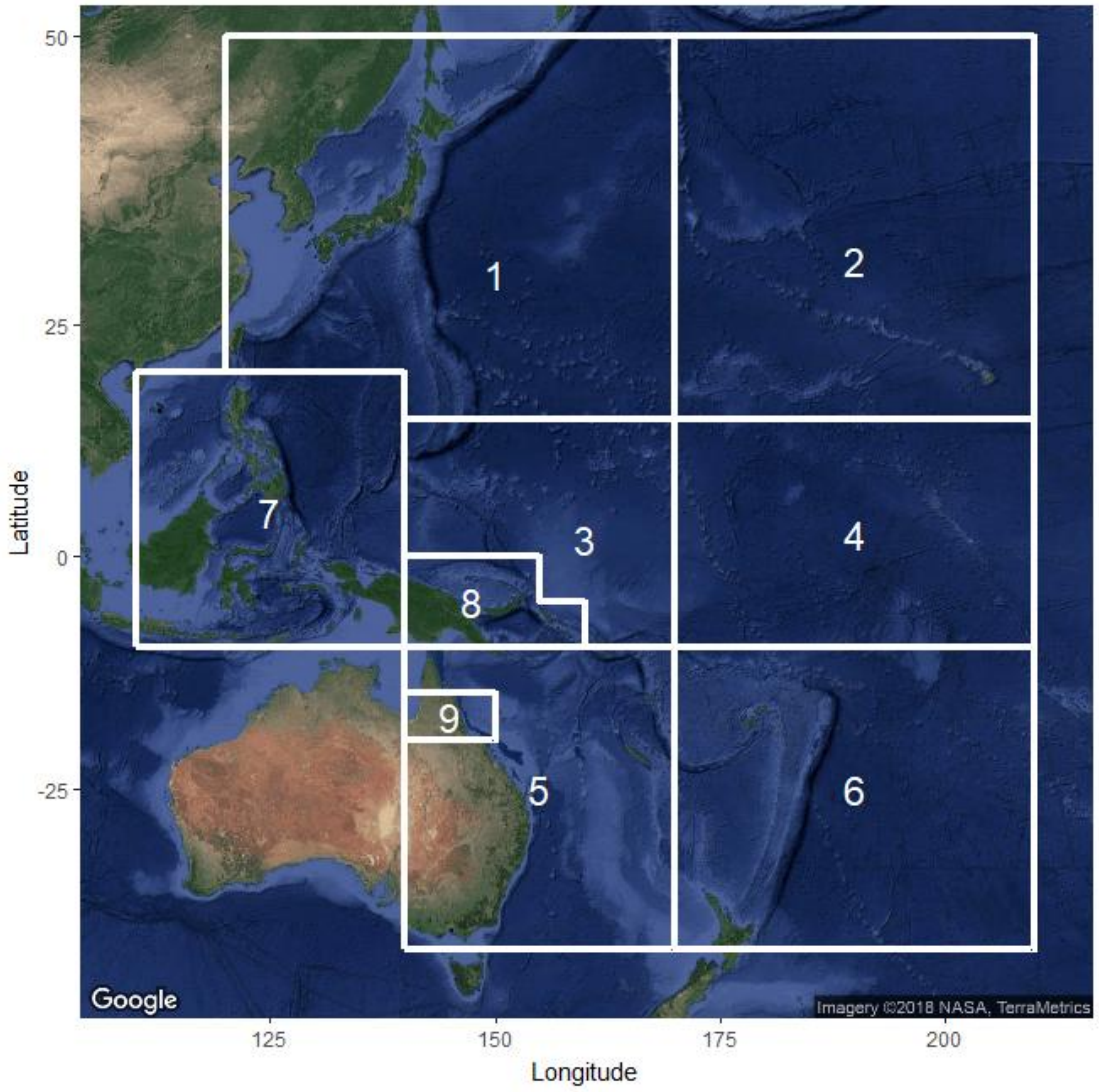
Log_{10} Total Catch Tonnes



TAG RECOVERIES



15˚N MODEL


50
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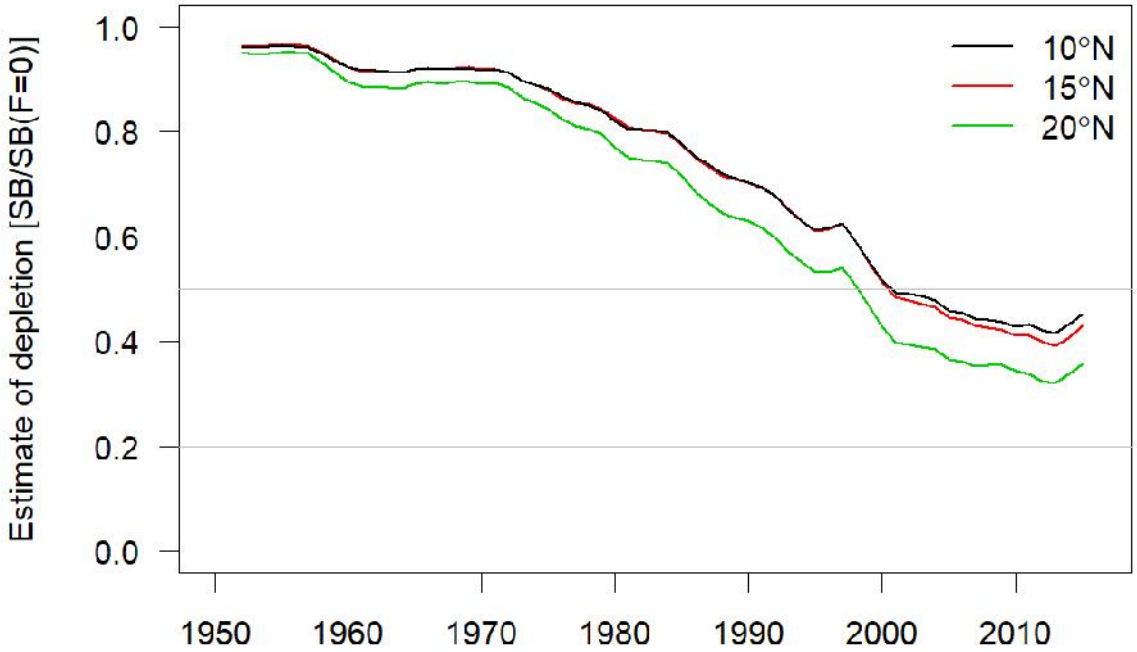
Google
Imagery ©2018 NASA, TerraMetrics



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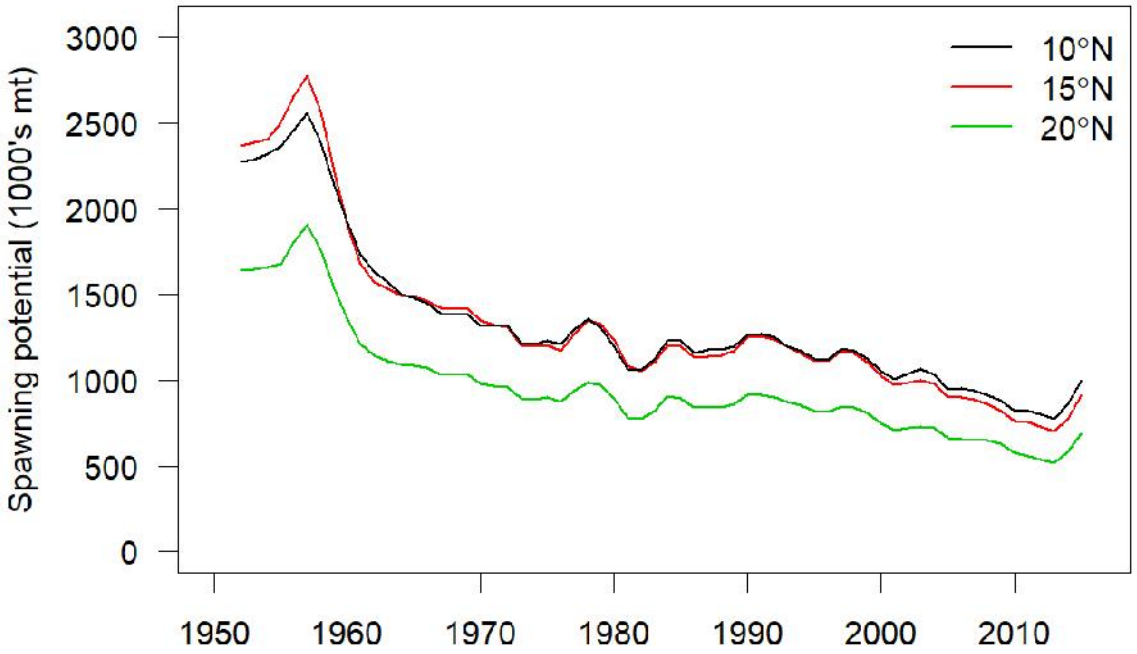

CONCLUSIONS - GROWTH

- Minimal change in the estimated growth function
- Some change to the resulting natural mortality and reproductive output at age
- Minimal changes to the estimated stock status resulted from the Updated New growth
- Old growth model ignores best currently available information regarding the growth of bigeye in WCPO

CONCLUSIONS – REGIONAL

- Data availability limits structures to a 5˚x5˚ scale
- Assumption in the preparation of size frequency data for the 15˚N model may be violated for 10˚x20˚ data
- Data for the longline fishery are ambiguous
- Average length, total catch, and average CPUE from purse seine fishery supports the 10˚N model
- Depletion, spawning potential, and yield estimates for the 15˚N model were similar to the 10˚N model

FURTHER WORK

- Collaboration with IATTC to build confidence in ageing estimates and estimate ageing error
  - Analyse same otoliths by different laboratories
- Continued development of tagging dataset for growth
  - Requires reliable measurement at release and recapture
- Collection and ageing of very small fish (L1 estimation)
  - Indonesian and Philippines domestic fisheries


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