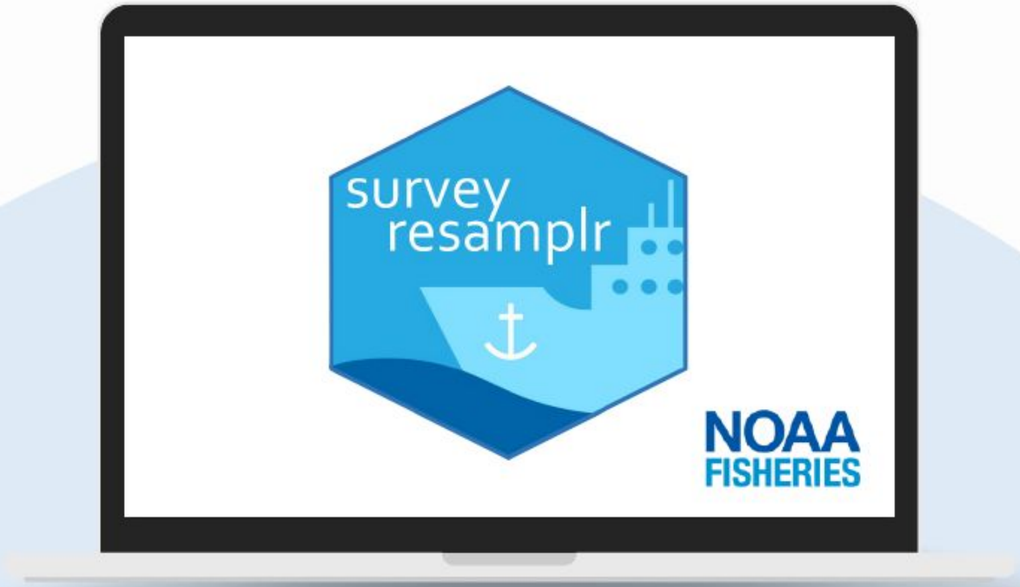
Effort in, assessment confidence out

Does survey effort matter to stock assessment outcomes?



Elizabeth Perl

Derek Bolser, Emily Markowitz, Ian Taylor

ECS contracted to NOAA Fisheries Office of Science and Technology

PICES 2025

A Multifaceted Team

Derek D. Bolser - Project lead; National Fishery-Independent Survey Science Coordinator

Elizabeth Perl - SS3 Scientific Software Support; stock assessments and outputs, R package development

Ian Taylor - Stock Assessor at NWFSC; leading development of stock assessment outputs

Emily Markowitz - Survey scientist; R package development, survey data sourcing, and case studies

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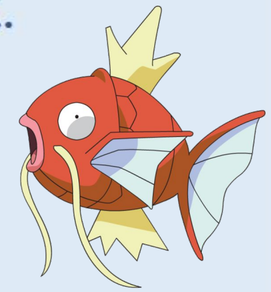
Disclaimer

This project, findings, and R package are still in the early stages of development.



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Inspiration

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Case study of NWFSC survey data and stock assessments

Develop standardized R package and broader case studies for this process using an open science approach

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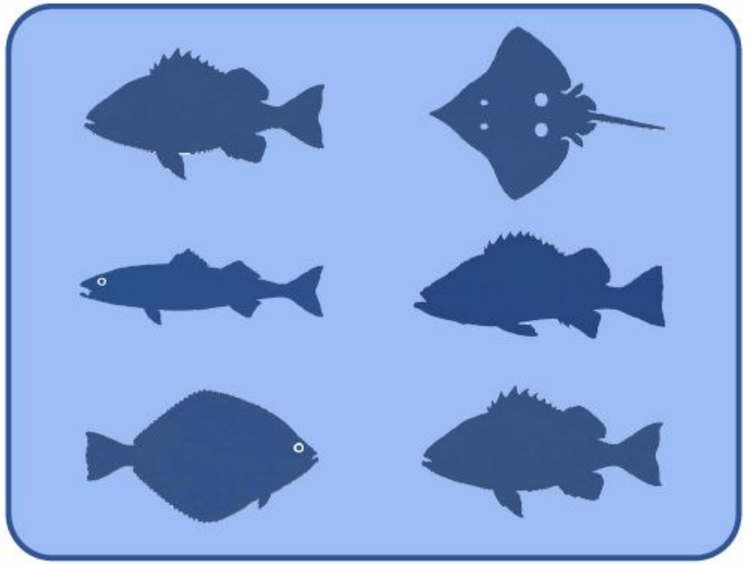
Develop standardized R package and broader case studies for this process using an open science approach

NWFSC Survey → Randomly remove historical tows → Effort-reduced model-based indices → Mock stock assessments

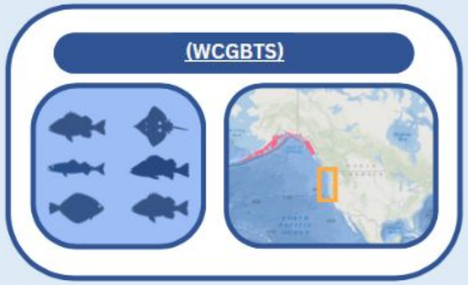
West Coast Groundfish Bottom Trawl Survey (WCGBTS)



Chose stocks sampled reasonably well by the survey AND had a stock assessment conducted in the past 8 years

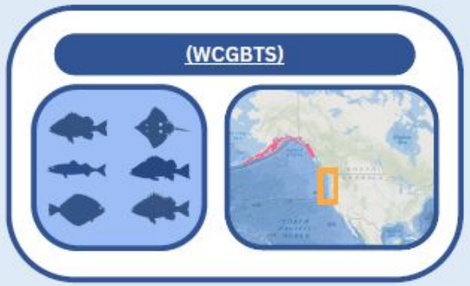
- Pacific ocean perch - 2017
- Sablefish - 2023
- Petrale sole - 2023
- Longnose skate - 2019
- Yellowtail rockfish - 2017
- Shortspine thornyhead - 2023

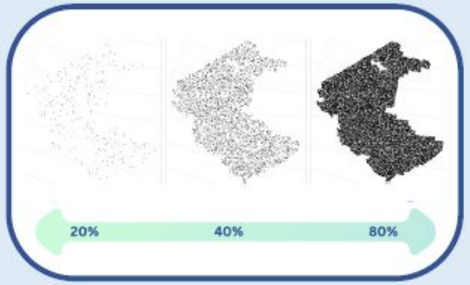
NWFSC Survey | Randomly remove historical tows | Effort-reduced model-based indices | Mock stock assessments

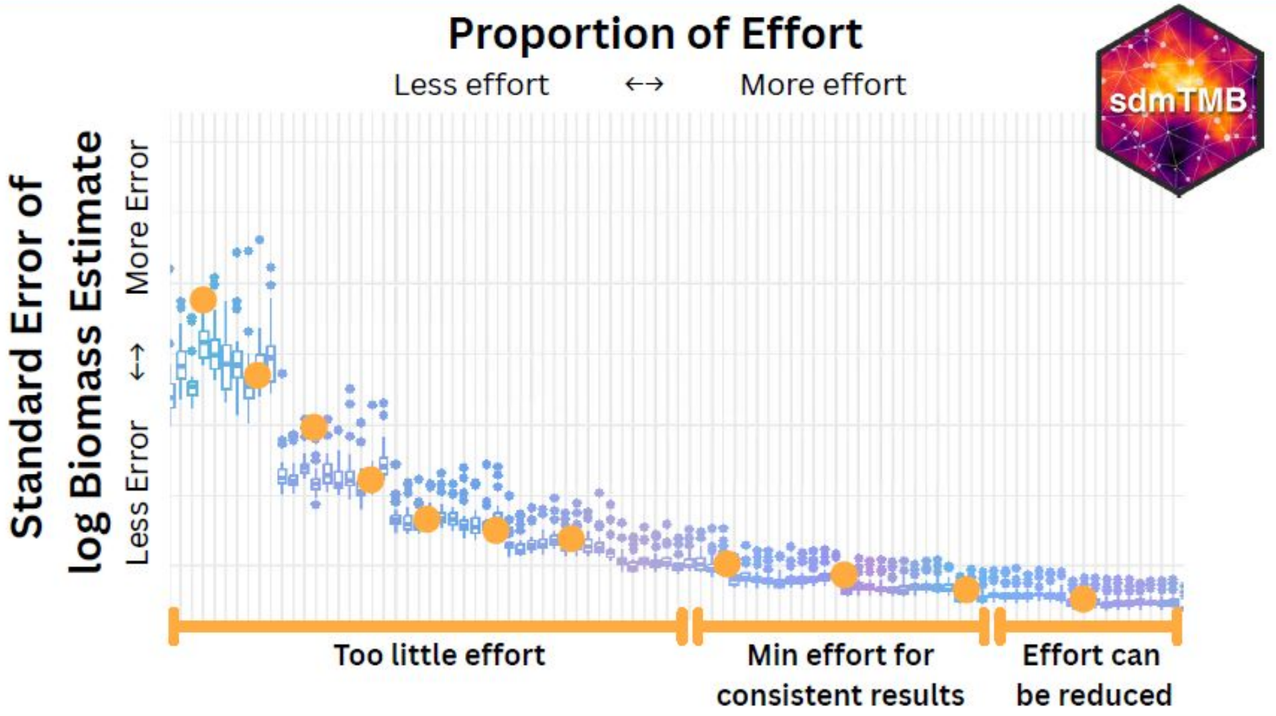


- 100%, 80%, 40% or 20% of historical tows included in model runs to simulate a reduction in effort
- Random removal of samples (catch) across tows, not proportional to strata (distribution among strata should be similar)

NWFSC Survey | Randomly remove historical tows | **Effort-reduced model-based indices** | Mock stock assessments

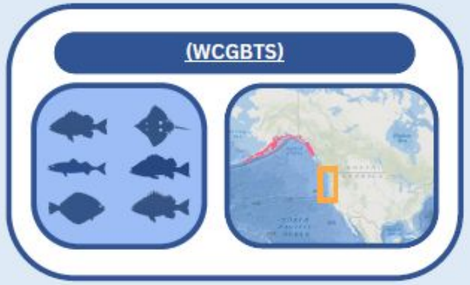


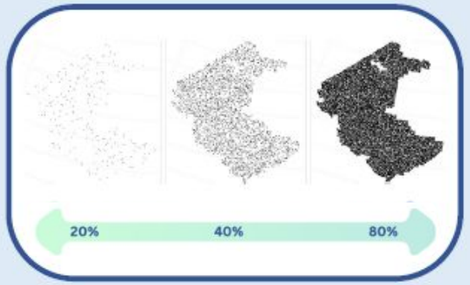


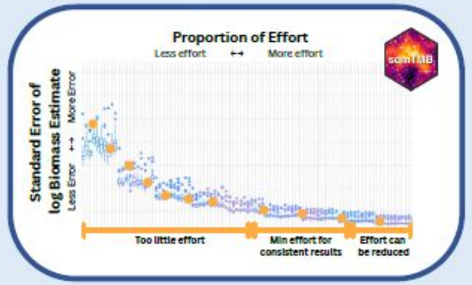


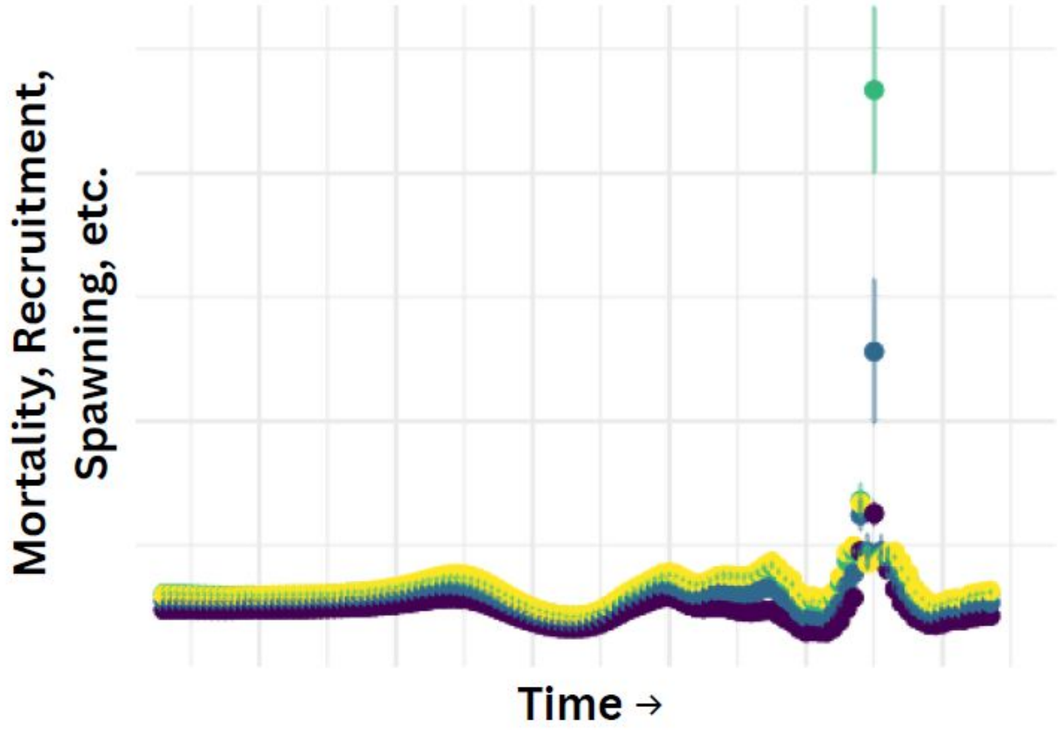
- Single species models
- Uses sdmTM to calculate a model-based index of biomass for each effort level of each stock
- 3 replicates per effort level (and 1 replicate at 100%)

Mock stock assessments









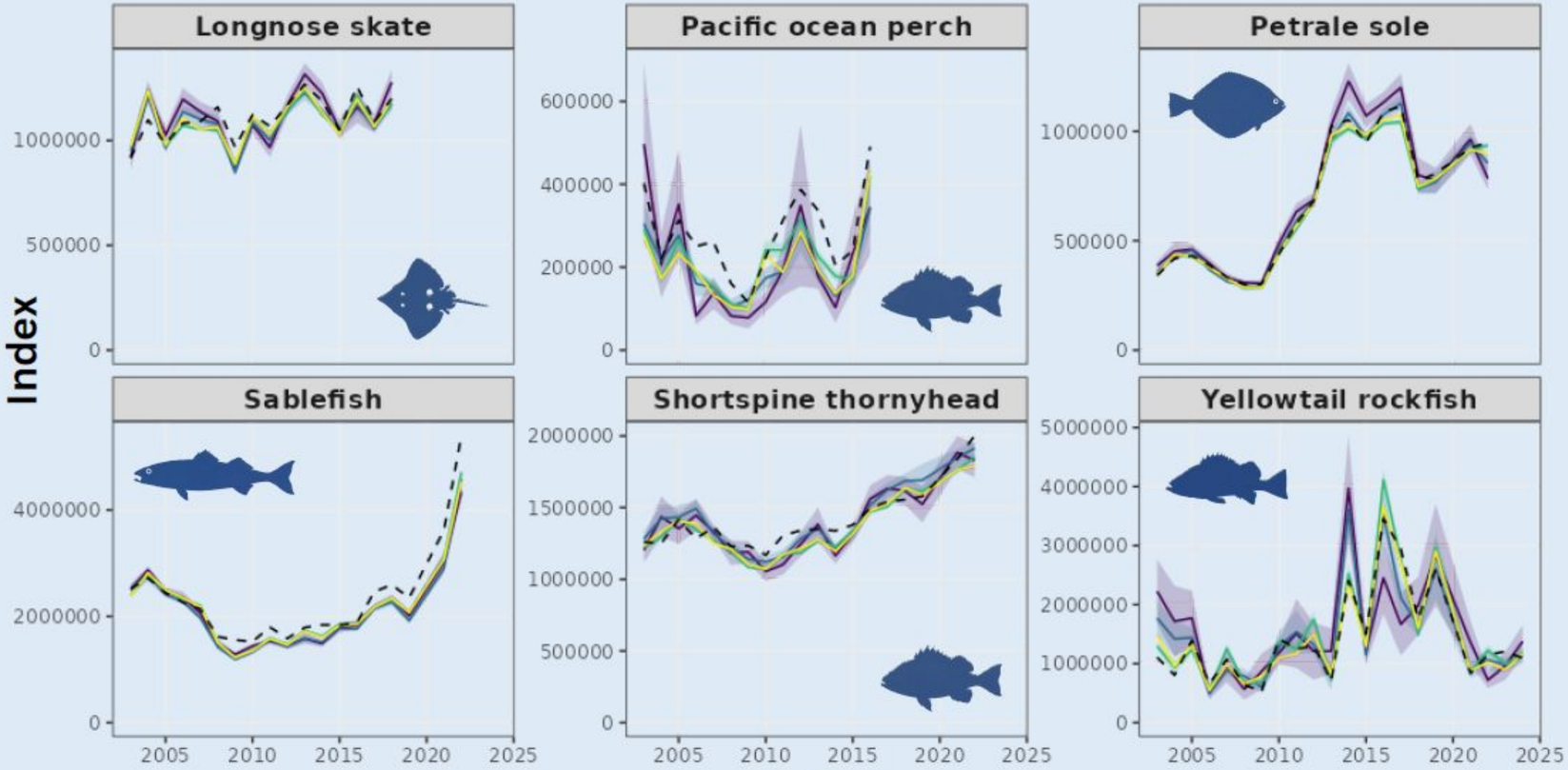
- Resampled age & length data - same subset of tows as resampled indices
- Fit assessment models using resampled indices & biological data with SS3
- Compare results & uncertainty among effort levels to 100% model with {r4ss}

Resampled Data

Biomass indices time series

Model/Effort

- 0.2
- 0.4
- 0.8
- 1.0
- Base Model



Index coefficient of variation

Resampled Data

Biomass indices time series

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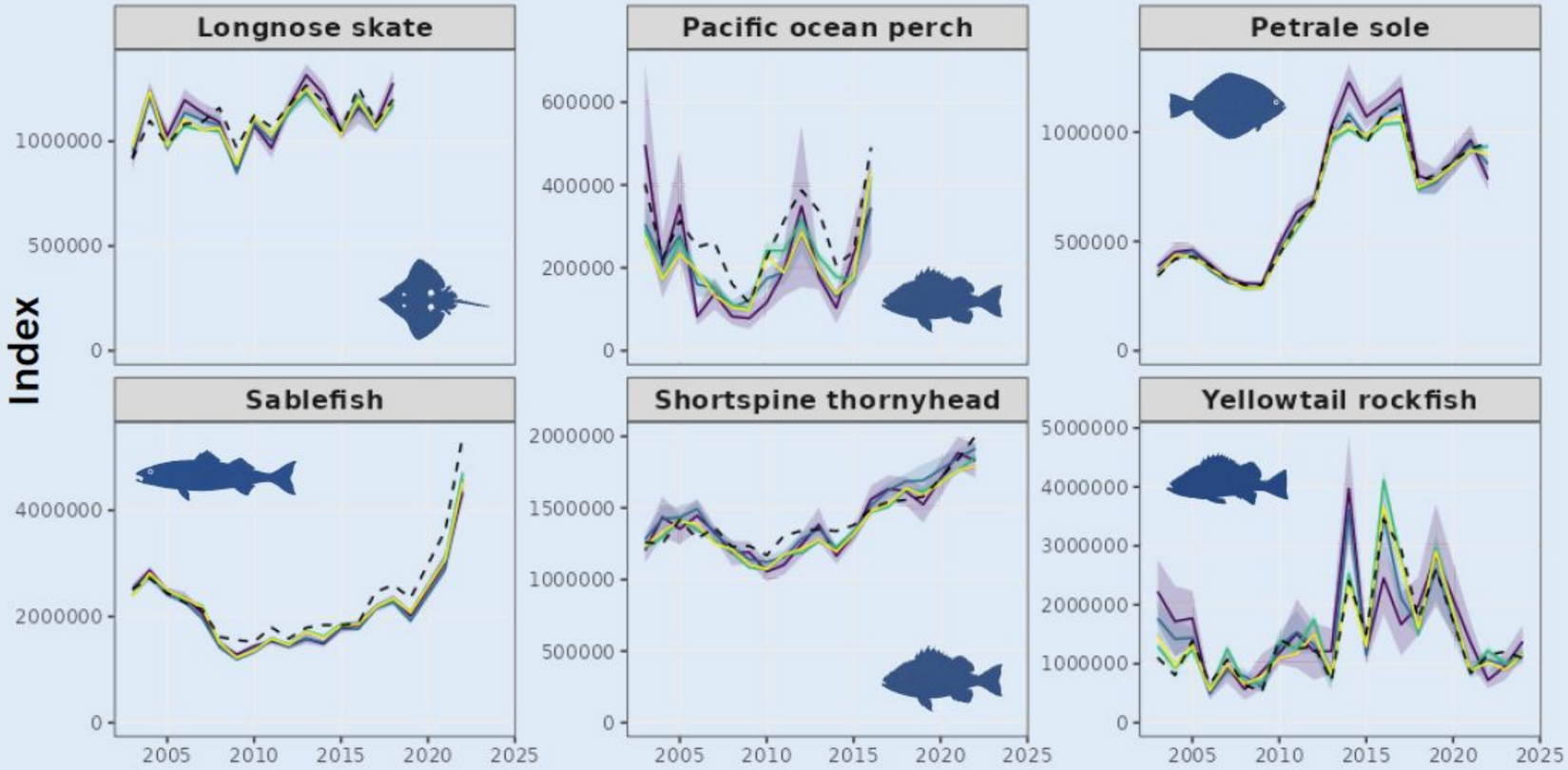
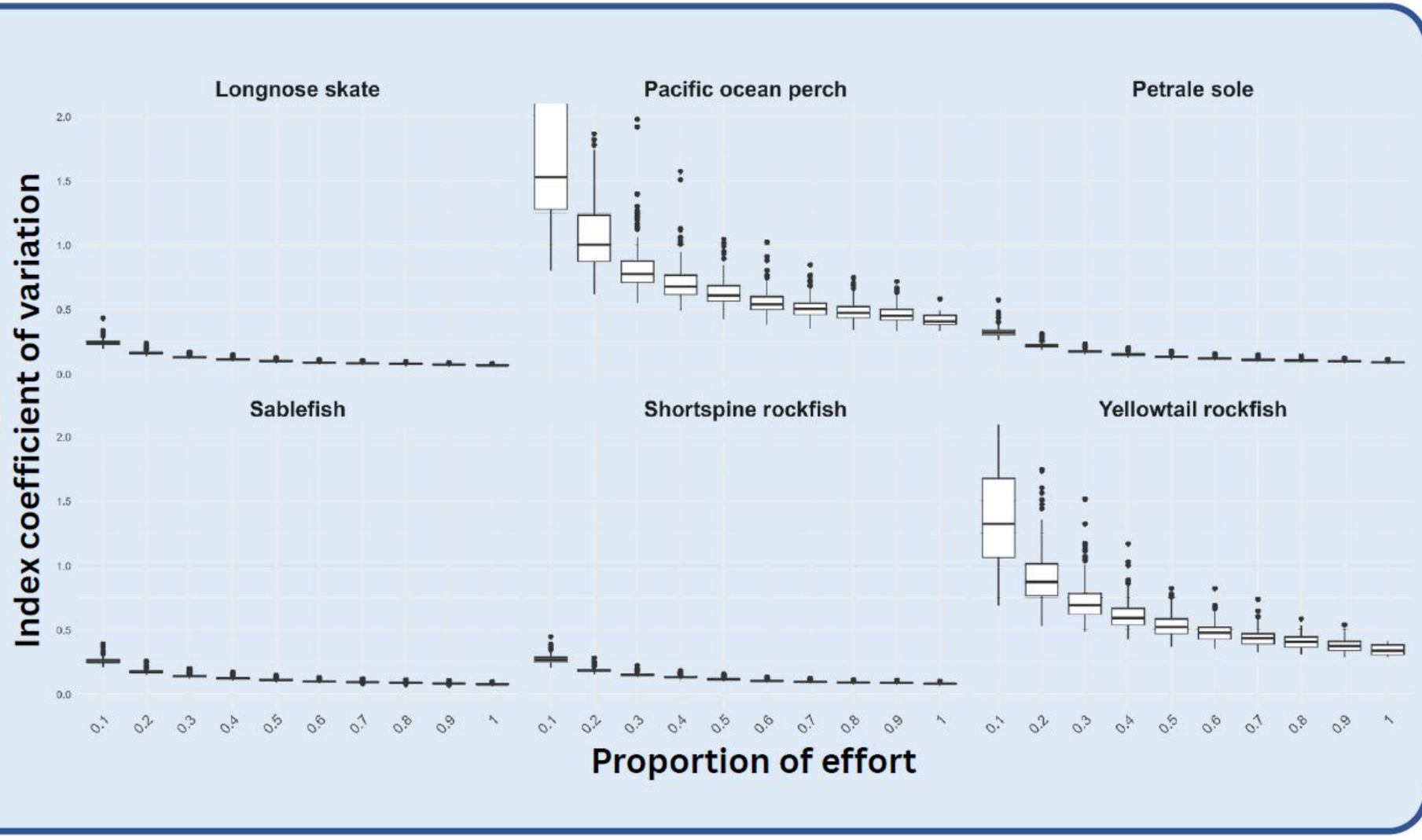
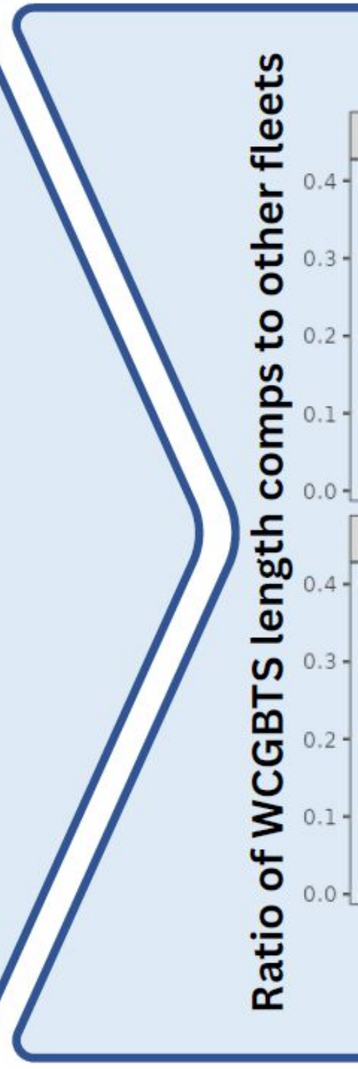
Had to adjust scale for the base model and need to sort out why the scales are different



Index coefficient of variation

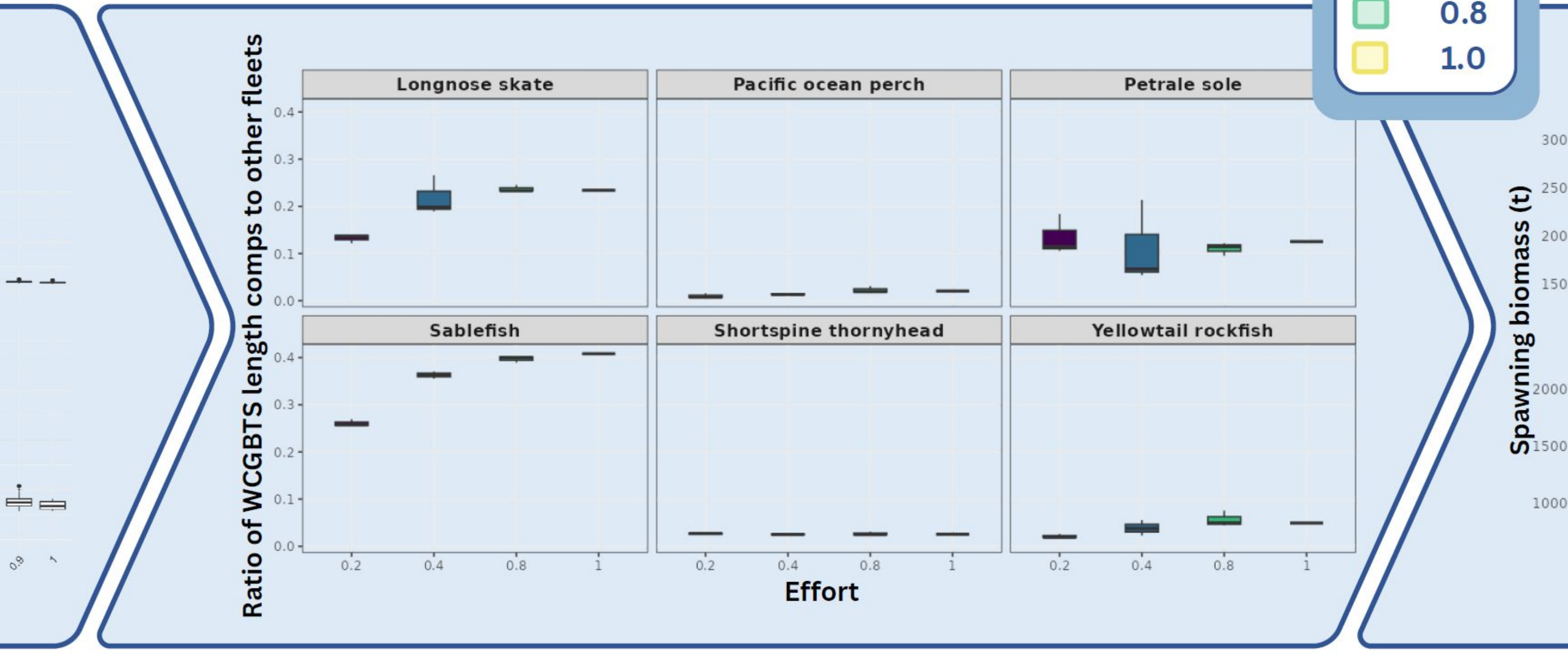
Resampled Data
Index CVs





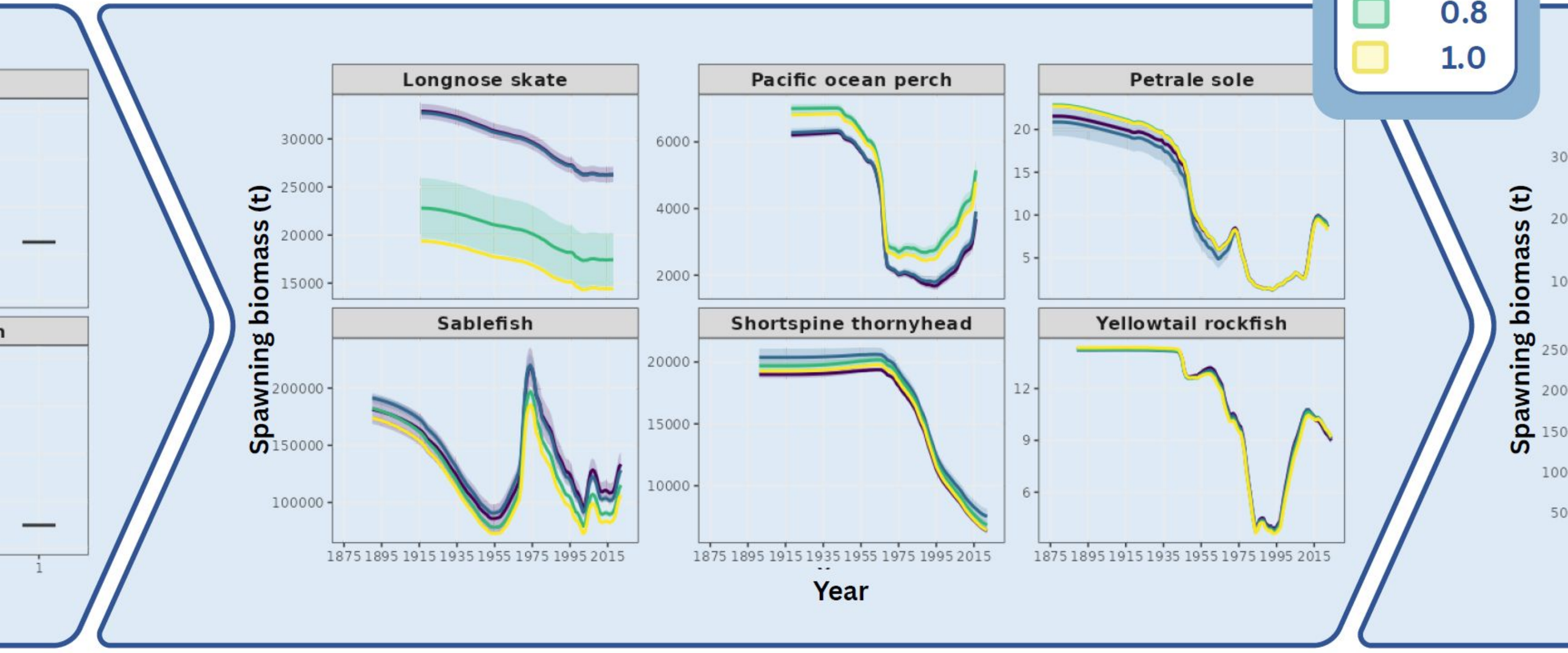
Stock Assessment Model Results

Length Composition Ratio



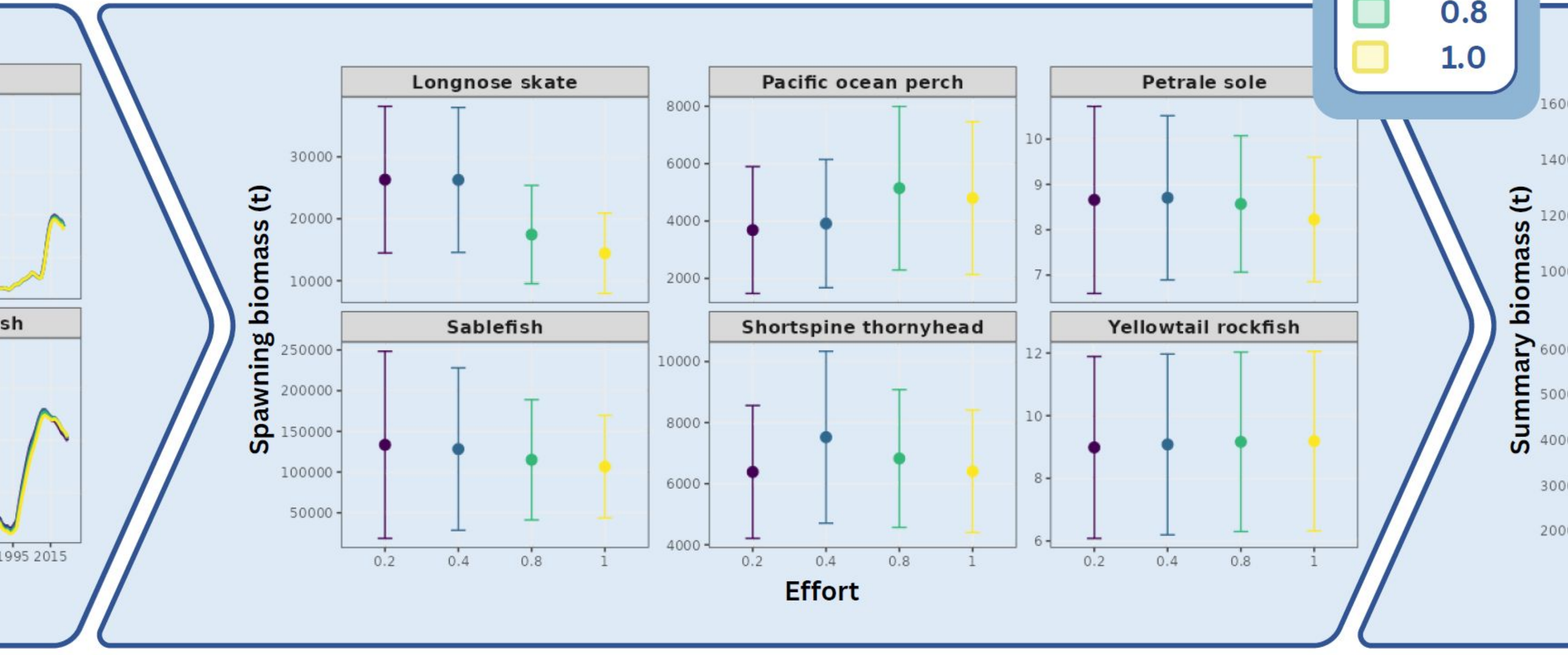
Stock Assessment Model Results

Spawning Biomass



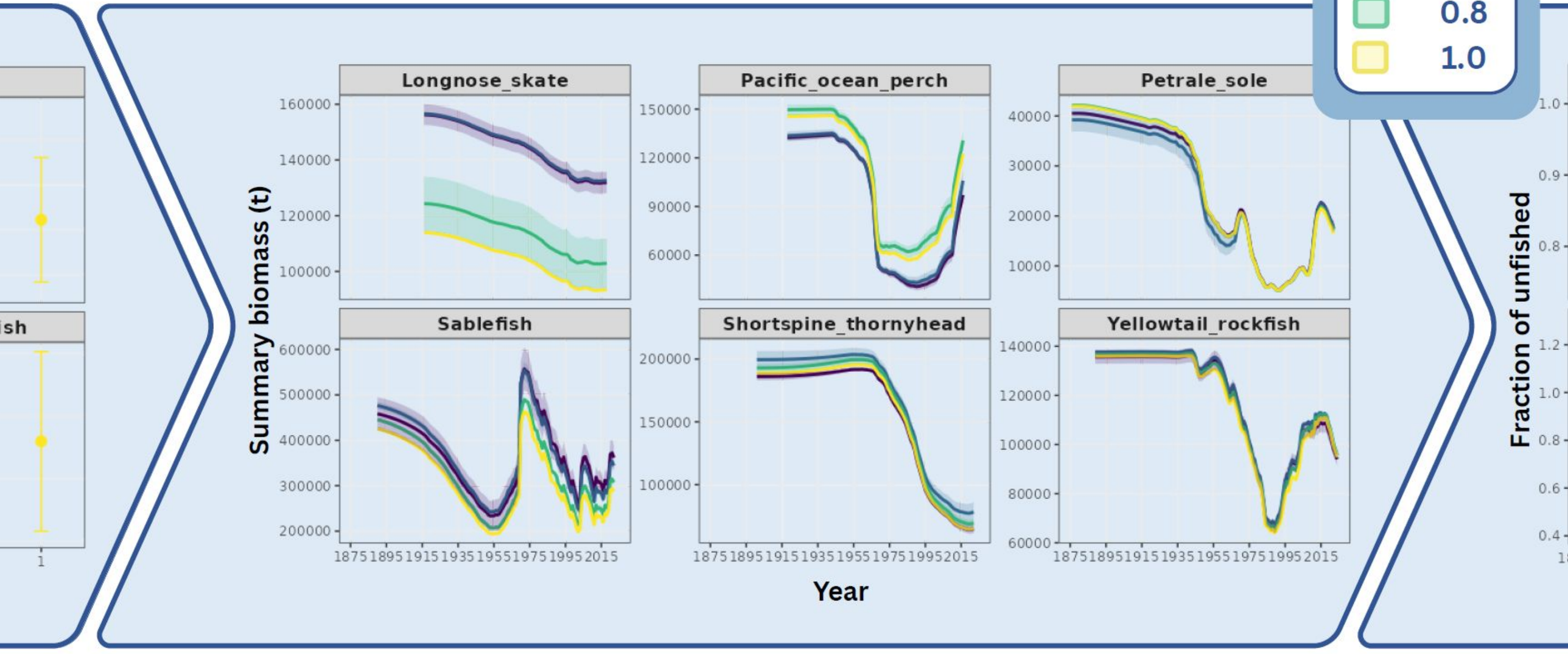
Stock Assessment Model Results

Uncertainty in End Year Spawning Biomass



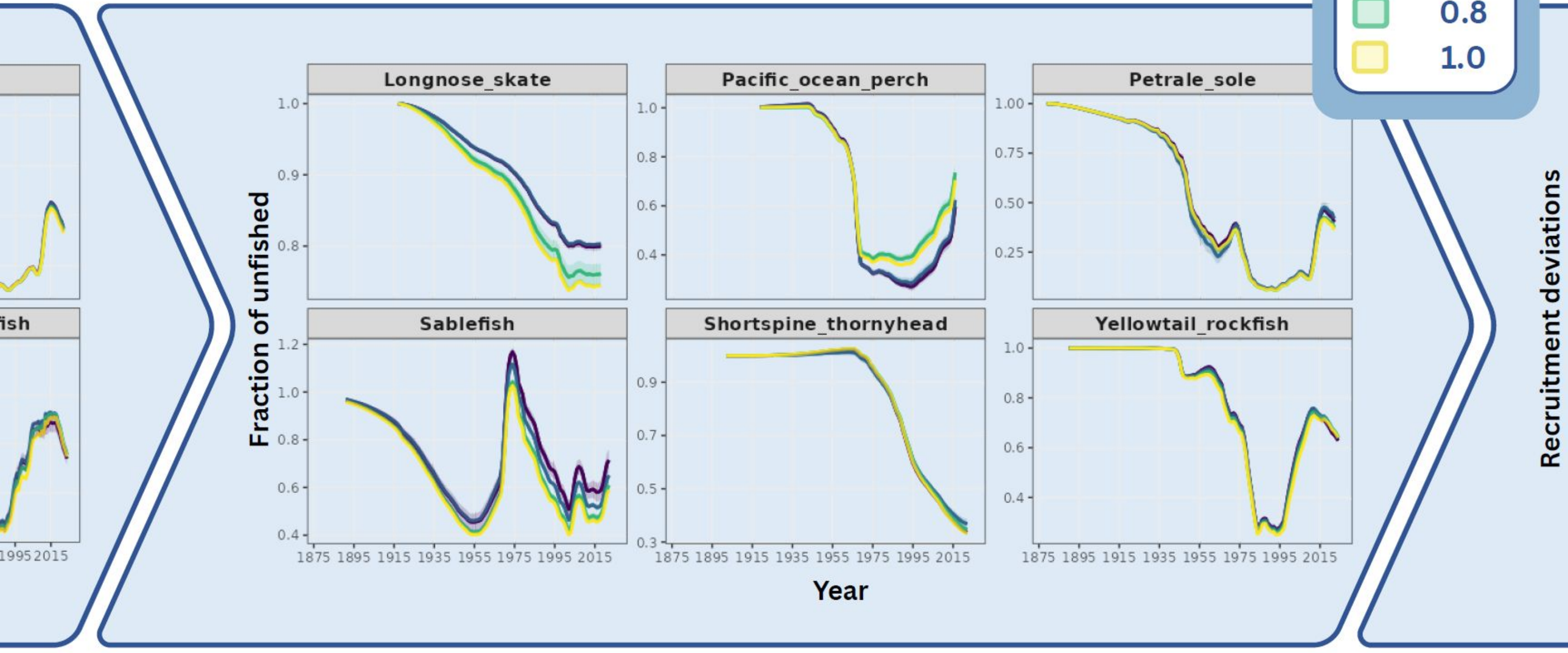
Stock Assessment Model Results

Summary Biomass



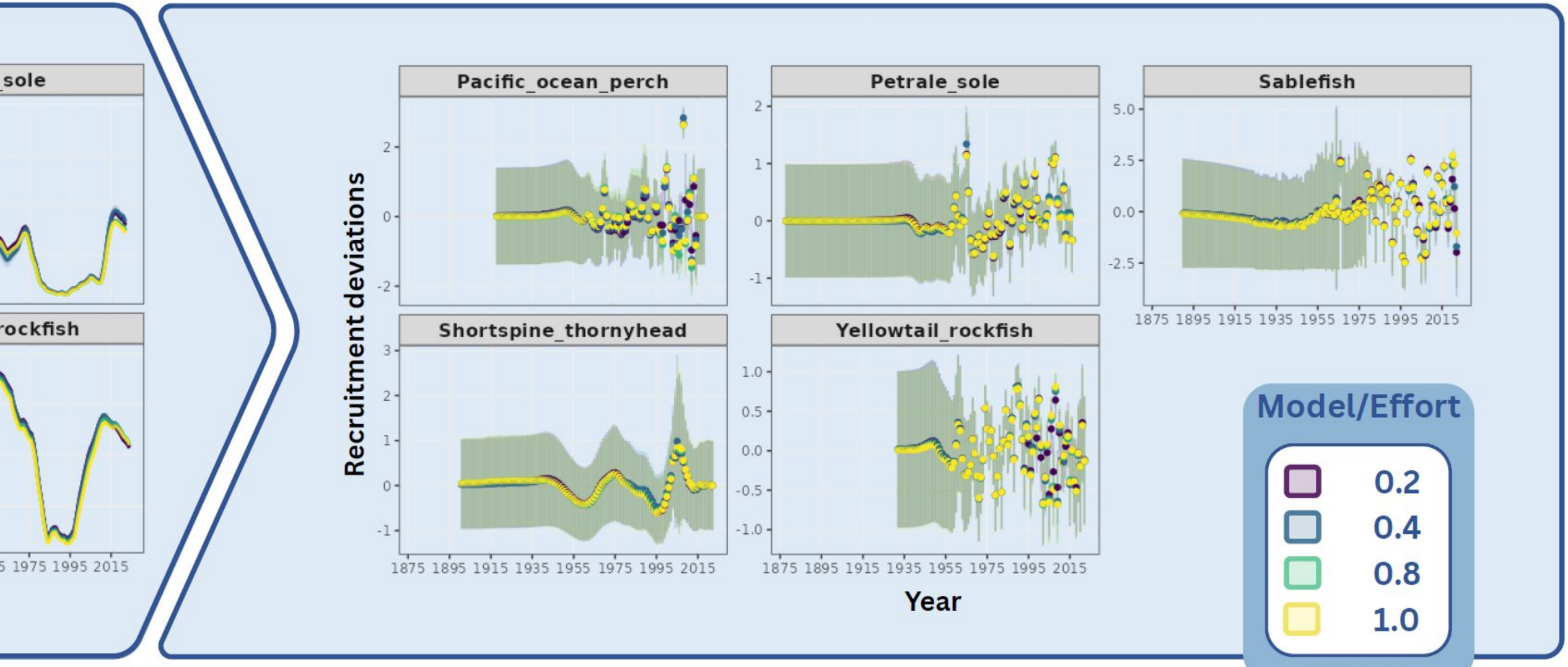
Stock Assessment Model Results

Fraction Unfished



Stock Assessment Model Results

Recruitment Deviations



Challenges to re-running stock assessments

- There remain numerous species-specific details that need to be accounted for:

Longnose skate	Shortspine thornyhead
Assessment had an informative prior distribution applied to survey catchability which led to incorrect results when new scale of new indices didn't match old results – we will work to resolve difference in index scale. 	Model fit catch data (descending trend) fit more closely at low survey effort levels (ascending trend). No significant bias at the index level; just effects on precision. 

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- Valuable to have expertise in both the assessment platform and in the individual assessment models (harder to scale up to more regions and species)

Main takeaways

Index

- Index uncertainty is strongly influenced by effort level (as expected).
- Indices at low effort levels (especially 20%) are noisier, but there does not appear to be significant bias associated with reducing effort at the index level.

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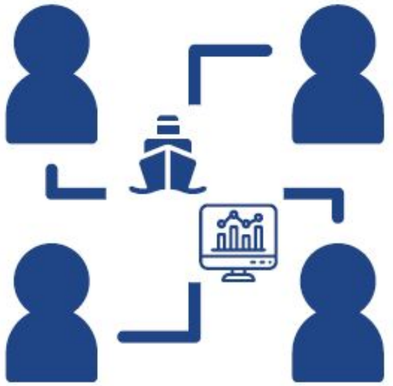
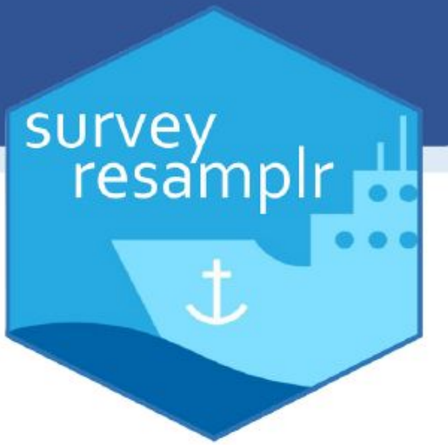
Assessments

- The impact on assessments are species-specific depending on things like frequency of occurrence and influence of WCGBT Survey on assessment relative to other data sources.
- Model structure and configuration matters a lot!

Future directions for {surveyresamplr}





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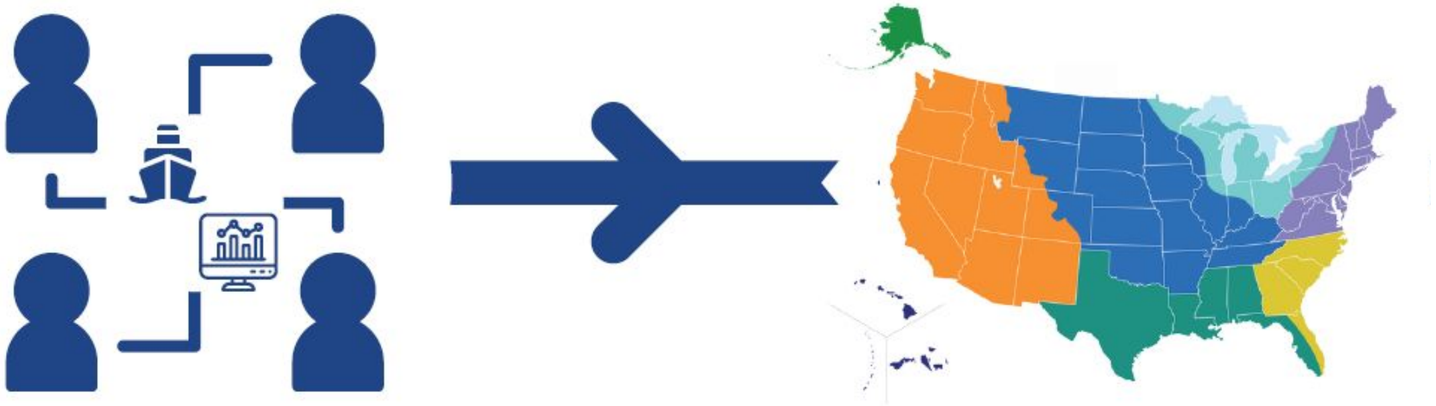

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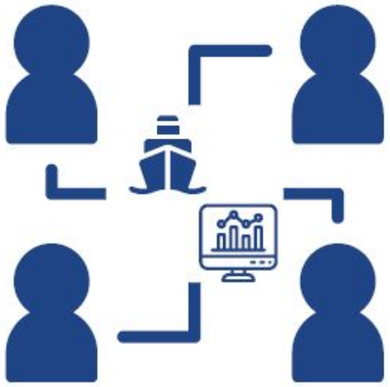

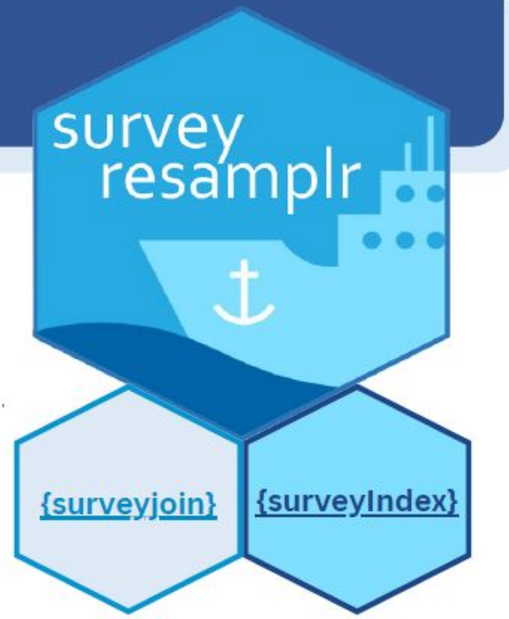

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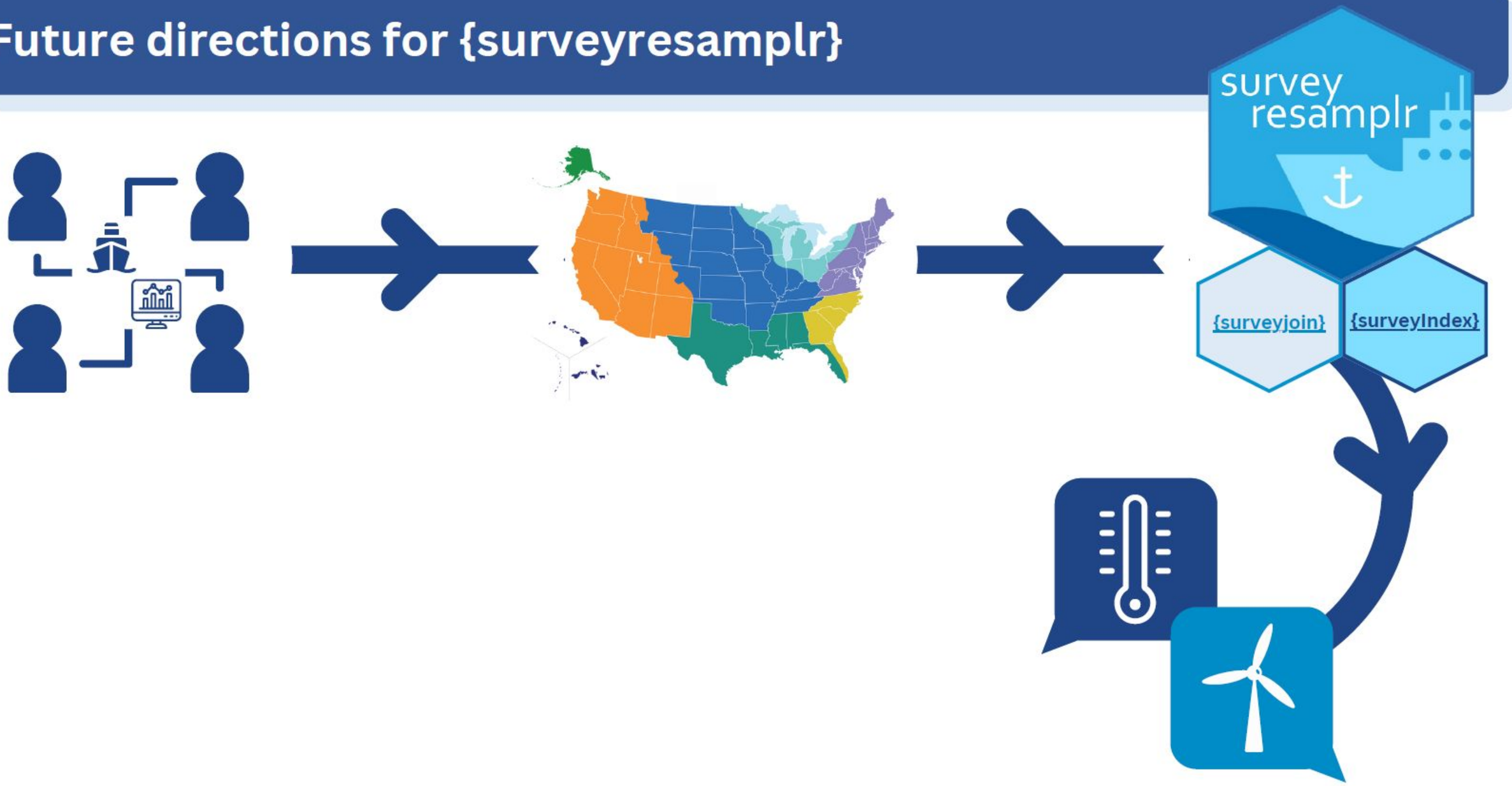

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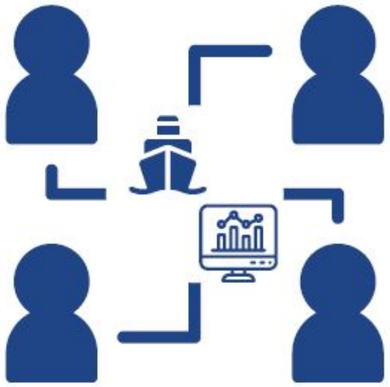
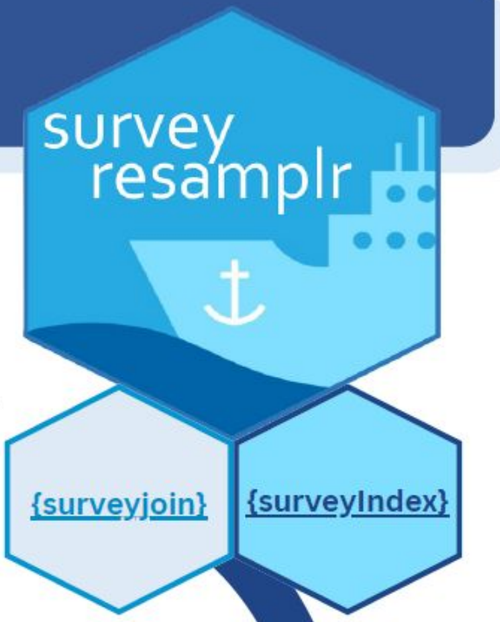
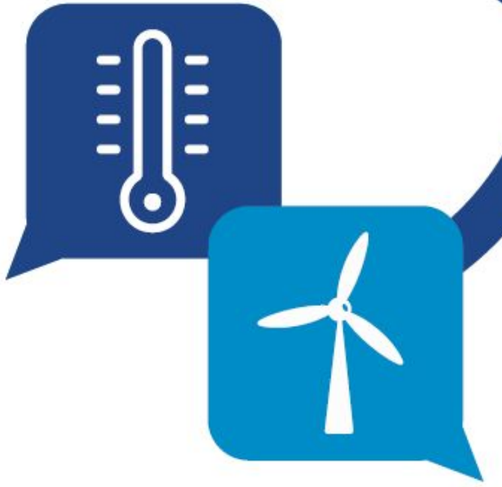




FUNCTIONS

```
noaa_nwfsc_catch()              clean_and_resample()
noaa_nwfsc_bio()                plot_results()
noaa_nwfsc_pred_grid_depth()    wrapper_sdmTMB()
```

WORKFLOW



QUESTIONS?

survey resamplr

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