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Northwest
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Processing survey length/age composition data

FISH576, Week 2

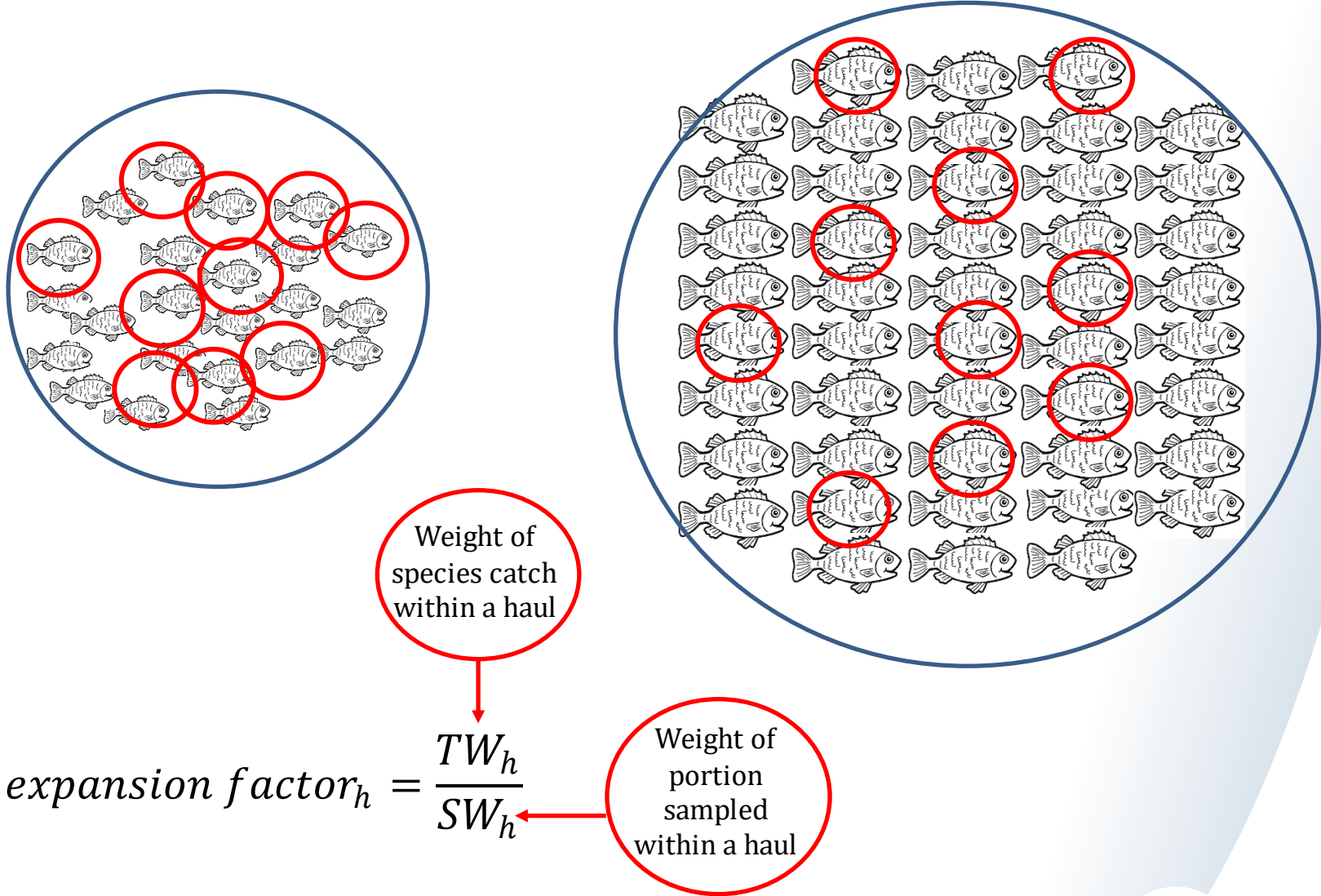
What's length and age composition data used for in the model?

- To estimate growth parameters
- To estimate natural mortality
- To estimate recruitment and recruitment deviations
- To describe survey selectivity curves
- To describe fishery selectivity and retention curves

Length composition data

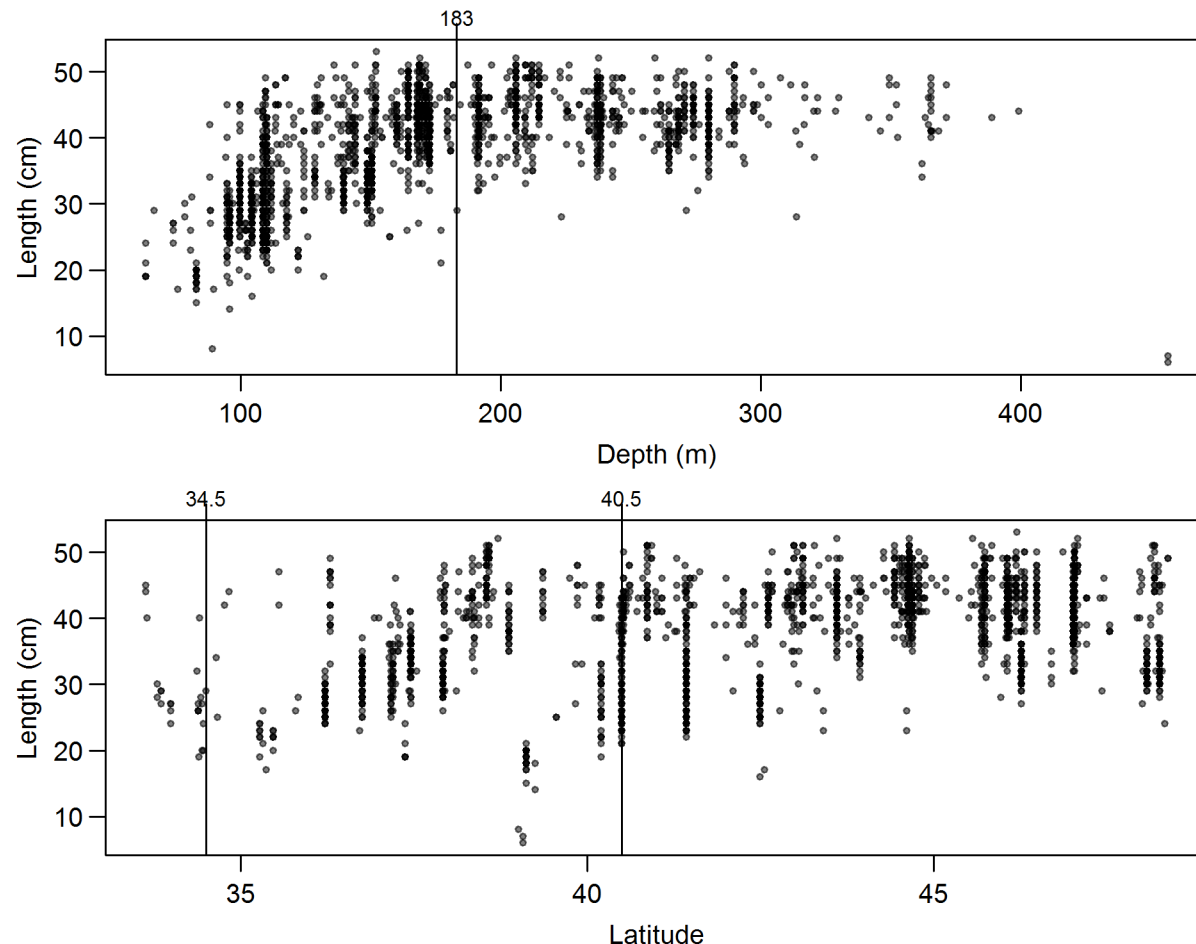
- Set # lengths for each species randomly sampled each haul, no matter of the amount of catch.
- The numbers (and weight) of fish sampled each survey haul are not proportional to amount caught.
- Therefore, we need to account for differences in catch among hauls.

Length composition expansion: stage one



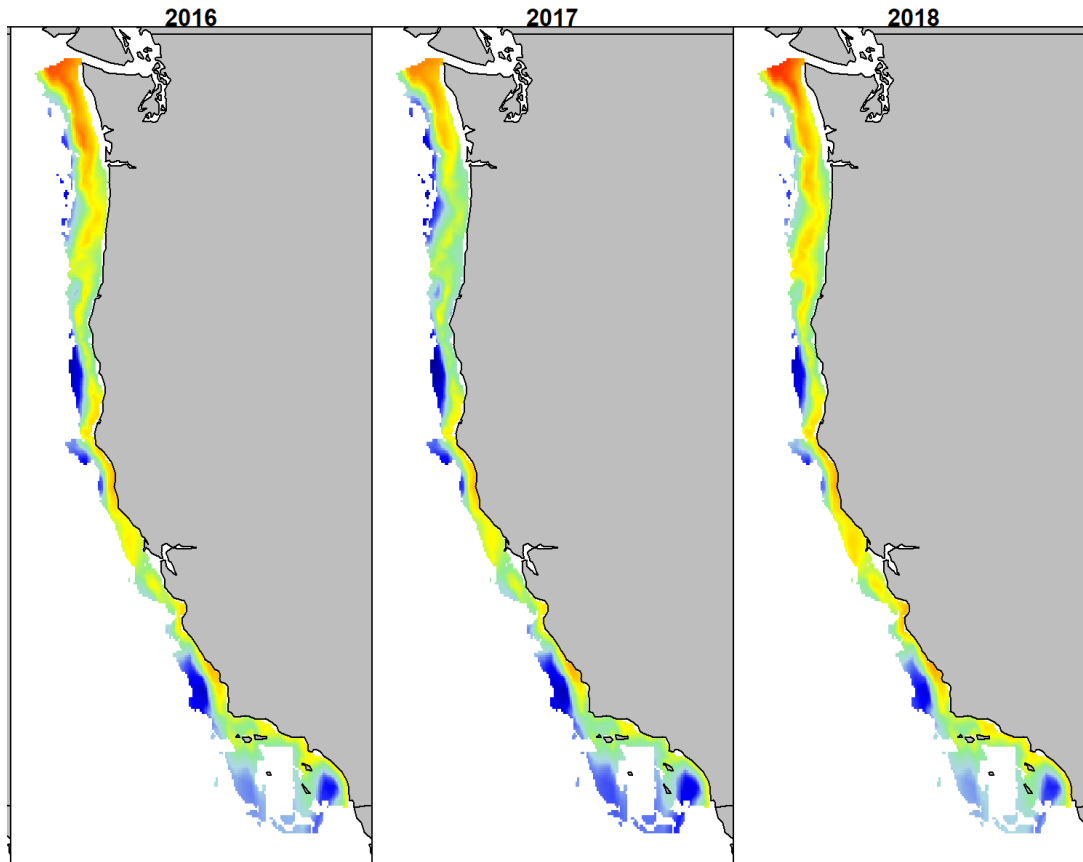
Why composition data expansion matter

- Fish tend to aggregate by size.
- In groundfish we often observe ontogenetic movements.



Widow rockfish example:
smaller fish are found in
shallower waters and
more often in southern
areas

Length composition expansion: stage two



Spiny dogfish shark example:
fish are more abundant in the
north, around U.S.-Canada
border

Stock
biomass
within
stratum

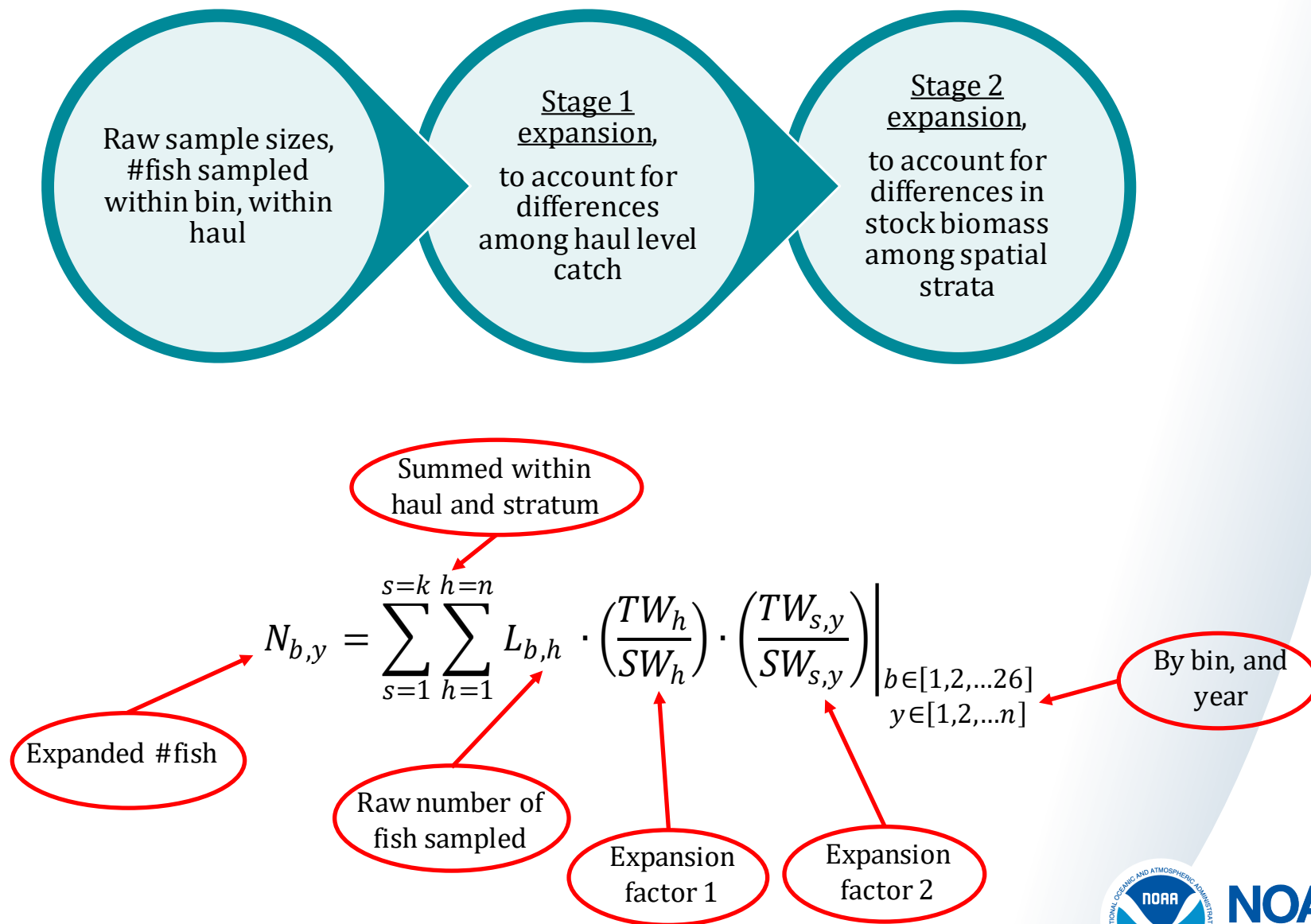
$$\text{expansion factor}_y = \frac{TW_s}{SW_s}$$

Weight of
sampled fish
within a
stratum



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Putting everything together:



Luckily!

- We have a generalized R code, to expand the data and put it in the format needed for ss3 input file.
- It is publicly available on GitHub at:
<https://github.com/pfmc-assessments/nwfscSurvey>
- It is important to explore the data, there are a lot of details, specific to individual species that are not be accounted for in the generalized code.
- Generalized code require species specific inputs, that include length and age bins, spatial strata you want to use in your analysis.

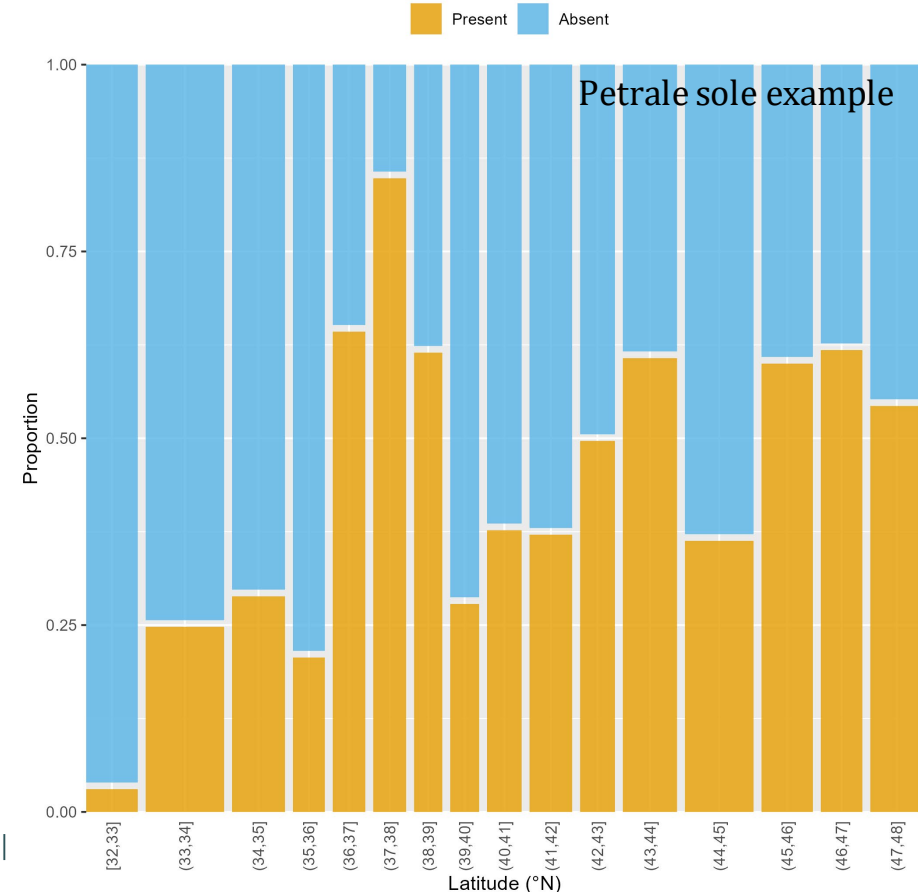
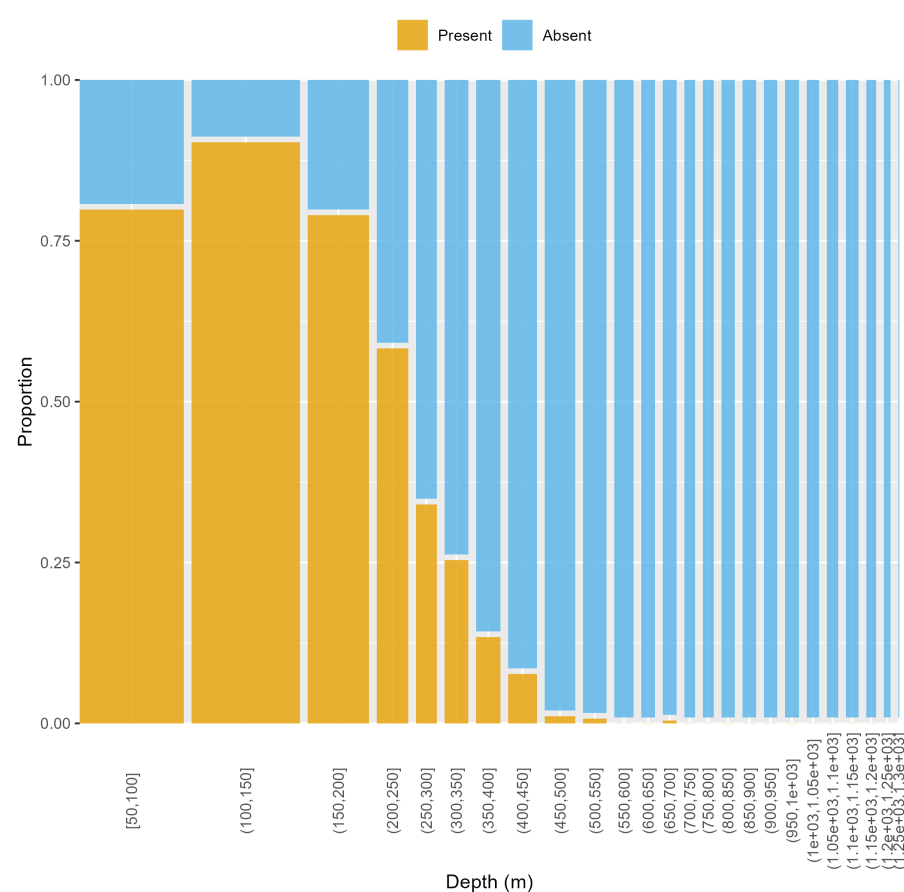
Length and age bins

- Length data are usually split by 2 cm bins (for large organisms can be 5cm).
- Rule of thumb – the number of length bins in many assessment is about 30
- Lowest bin includes all fish in that bin and smaller.
- Highest bin includes all fish in that bin and larger
- Rule of thumb –highest bin should not have more than 5% of data.
- Ages are usually split by 1 year bins, with highest bin accumulating fish older than that bin.

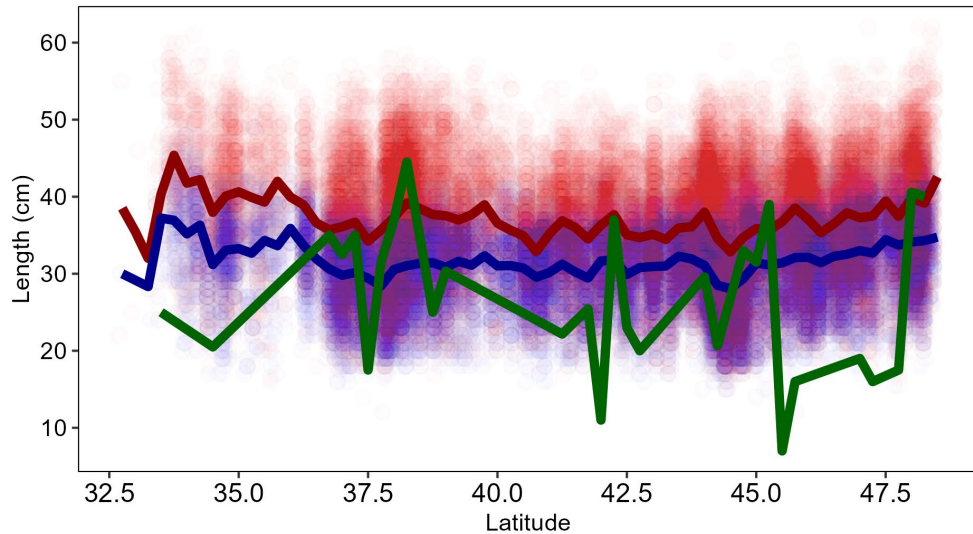


Spatial strata

- Needed to calculate design-based indices
- Also used in length composition data expansion.
- Defined based on species depth range and spatial distribution.

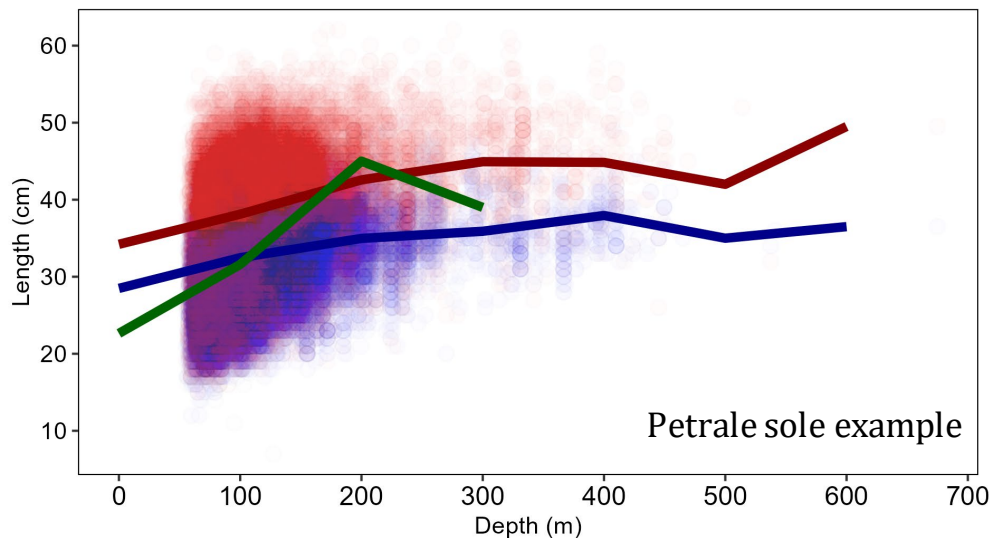


Spatial strata



Sex
F
M
U

- Latitudinal bins are often aligned with state borders,
- Depth bins more species specific.
- Need to locate strata used in the last full assessment.



Sex
F
M
U

Petrale sole example

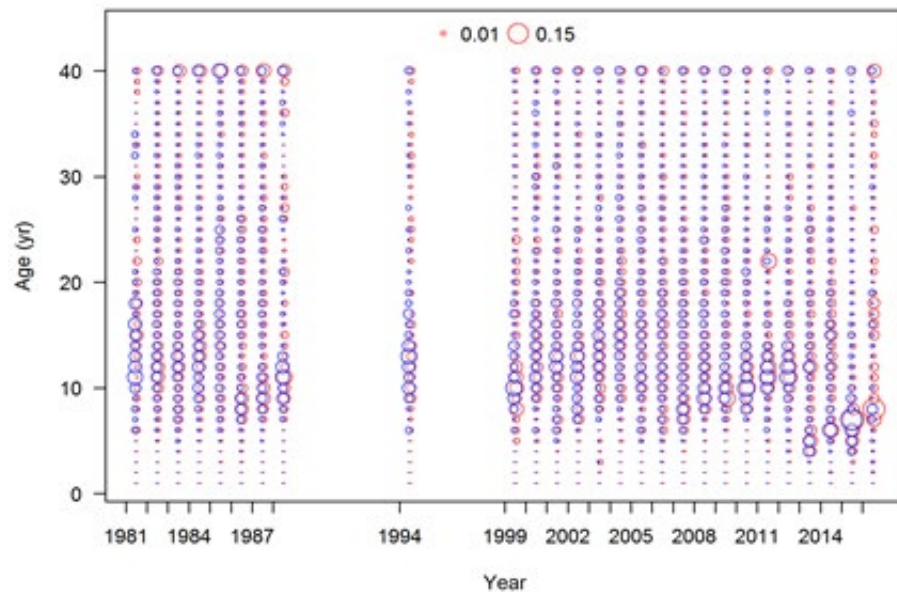
Age composition data

- From systematic sampling of survey catch
- Set # ages for each species randomly sampled each haul
- Age samples are usually is a set subset of fish sampled for length
- Otoliths are used for ageing of rockfish

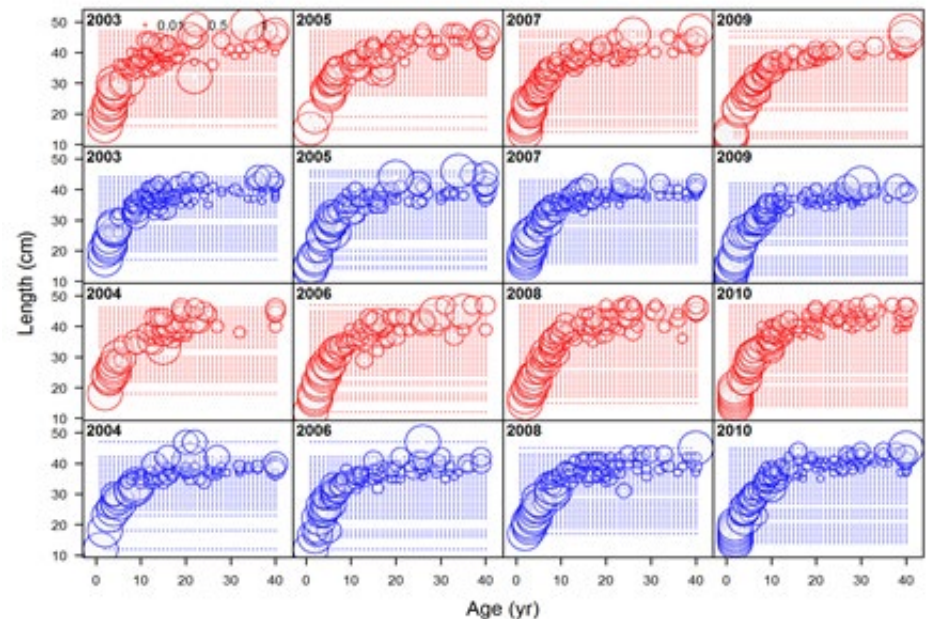
Age composition data

- Multiple ways to enter age data – marginal length compositions and conditional ages-at-length compositions (CAAL).
- Survey age data are inputted as CAAL in most ss3 models.
- Facilitates the estimation of growth within the model.
- Goes around the issue of double counting the same fish (since age samples are usually a subset of length samples).
- But, model estimation slows considerably using CAAL data.

Age comp data, retained, Fishery



Conditional age-at-length data, whole catch, NWFSC shelf-slope survey



Lets switch to nwfscSurvey

- <https://github.com/pfmc-assessments/nwfscSurvey>



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nwfscSurvey

```
length_comps <- get_expanded_comps(  
  bio_data = bio,  
  catch_data = catch,  
  comp_bins = seq(10, 80, 2),  
  strata = strata,  
  dir = getwd(),  
  comp_column_name = "length_cm",  
  output = "full_expansion_ss3_format",  
  two_sex_comps = TRUE,  
  month = "7",  
  fleet = "7",  
  input_n_method = "stewart_hamel")
```

Stewart & Hamel (2014),
Input N is a function of both
#fish and #haul



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Lets look at nwfscSurvey outputs

Exercise

- Extract the catch and bio data
- Develop length compositions for WCGBTS
- Create plots to evaluate data by depth and latitude.