Types of data, and input for assessment models

FISH 576, Winter 2025, Week 1

Looking ahead

- This week, you will read the assessment reports for widow and yelloweye rockfish.
- Next week, you will divide into two stock assessment teams
- As a team, you will decide who does what tasks
- During this lecture and as you read, consider what you would like to help with

One goal of stock assessment

- Assimilate all information to understand the system and provide management advice

- Use the data to outline hypotheses to be tested during modeling
  – Data will inform model structure(s)

General sources of information

- Scientific understanding
  - Fundamentals of population dynamics
  - Literature
- Data
  - Fishery monitoring and survey data
  - Fit model to data or use as forcing functions
- Similarities with other species
  - E.g. borrow natural mortality from a similar species
  - Used to fix or provide information on model parameters or structure
- Expert opinion
  - A historian considers catch to be substantial for many years before historical records were kept
  - Used to refine assumptions and model structure
- Anecdotes
  - A fisherman notes that after a vessel buyback CPUE increased for the vessels left in the fishery.
  - Used to develop conceptual model, refine assumptions, and structure assessment model.

Quantitative data sources

- Removals
- Size and age-composition of removals
- Relative or absolute estimate of abundance
    - Fishery independent or dependent
- Size and age-composition from surveys
- Other biological information
   - Maturity, fecundity, weight-length relationship, etc.
- Ecosystem data

Main west coast data sources

- **PacFIN:** Pacific fisheries information network, commercial data since 1981
- **RecFIN:** Recreational fisheries information network, recreational data since ~1981 (spans multiple sampling programs)
- **ASHOP:** At-sea hake observer program, data for Pacific hake catcher-processors and motherships. (Shoreside hake fishery is in PacFIN.)
- **WCGOP:** West coast groundfish observer program, observes commercial fisheries since 2002
- **GEMM:** Groundfish Expanded Mortality Multiyear, estimate of dead catch (landings and discards) by sector and species
- **WCGBTS:** West coast groundfish bottom trawl survey, most common current source of fishery-independent data for west coast groundfish
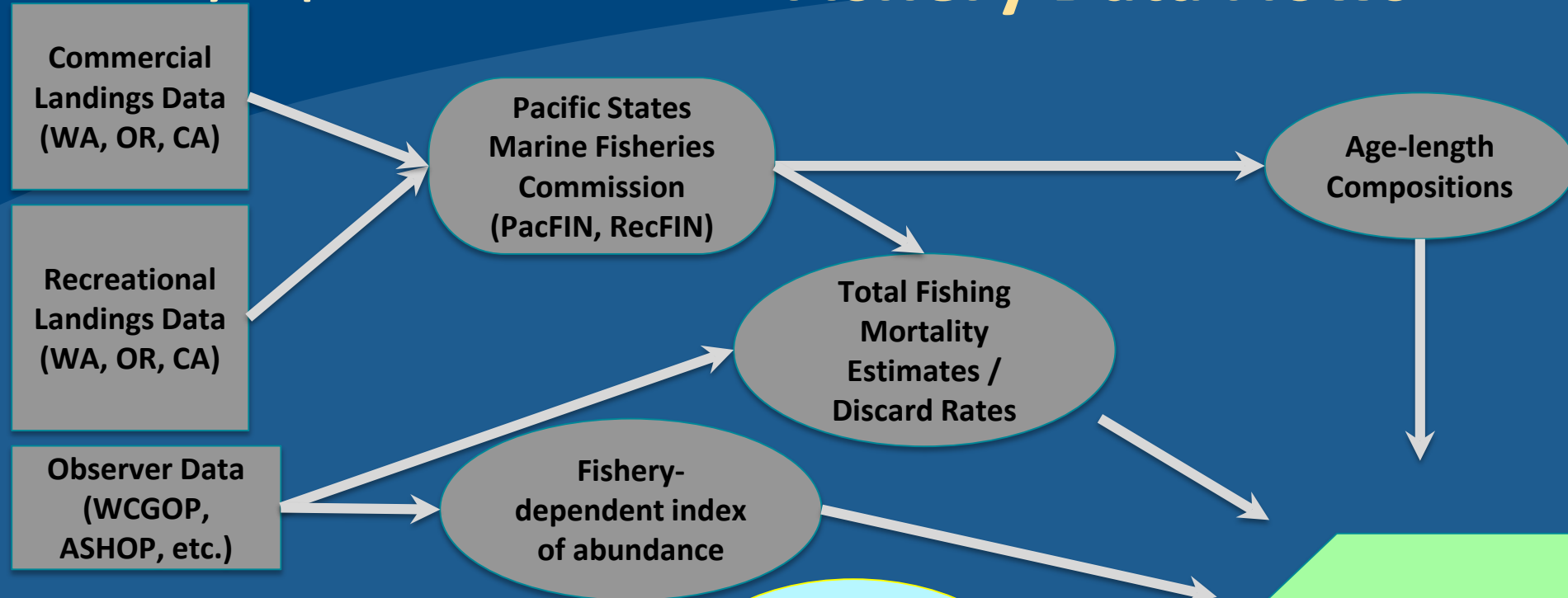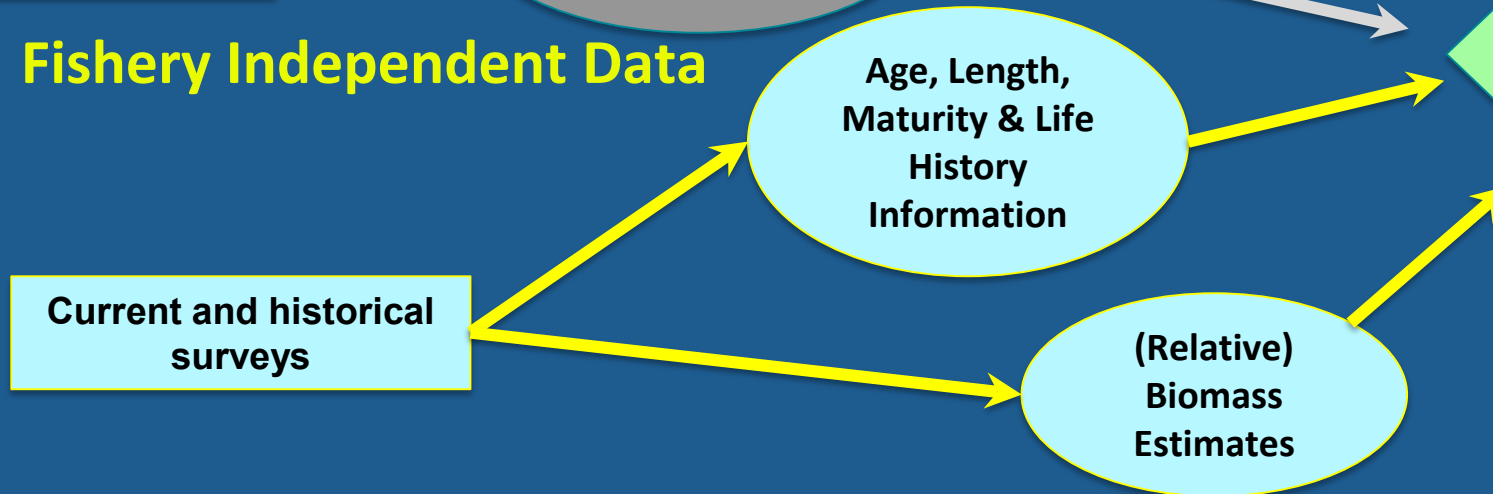
Fishery Data Flows

Landings

- History of removals
  - We usually go back to the start of the fishery
  - Other assessments may estimate a fished initial condition
- Stratified, where appropriate, by area, fishing gear, etc.
  - Model assumes ages/sizes within a fleet are homogenous
- **Data sources:** PacFIN, RecFIN, ASHOP, historical state reconstructions
- **Tools:** R data manipulation

Discards

- Many ways to account for this, depends on fishery dynamics and available data
- Three main options
  1. Add estimates of dead discards to landings.
  2. Include separate discard fleet with a selectivity curve.
  3. Estimate retention curve and fit discard fractions/amounts.
- Yelloweye model uses option (1) and widow model option (3)
- **Data sources:** WCGOP, GEMM, RecFIN
- **Tools:** R data manipulation, WCGOP data is pre-processed

Indices of abundance

- Fishery-independent
  - Methods to standardize each survey's data are established, will run data for your species or receive the index time series
  - **Data Source:** WCGBTS, historical surveys, recruitment survey, others
  - **Tools:** {indexwc}, {sdmTMB}
- Fishery-dependent
  - Requires more species-specific analysis
  - **Data Source:** Rec observer programs, WCGOP, others
  - **Tools:** {sdmTMB}, other regression functions/packages

Age and length composition data

Can be useful for estimating:

- Recruitment
- Growth/size at age
- Natural and fishing mortality rates
  - Truncation/expansion of age structure over time
- Fishery and Survey selectivity

Importance of Age Data

Age-length relationship for sablefish
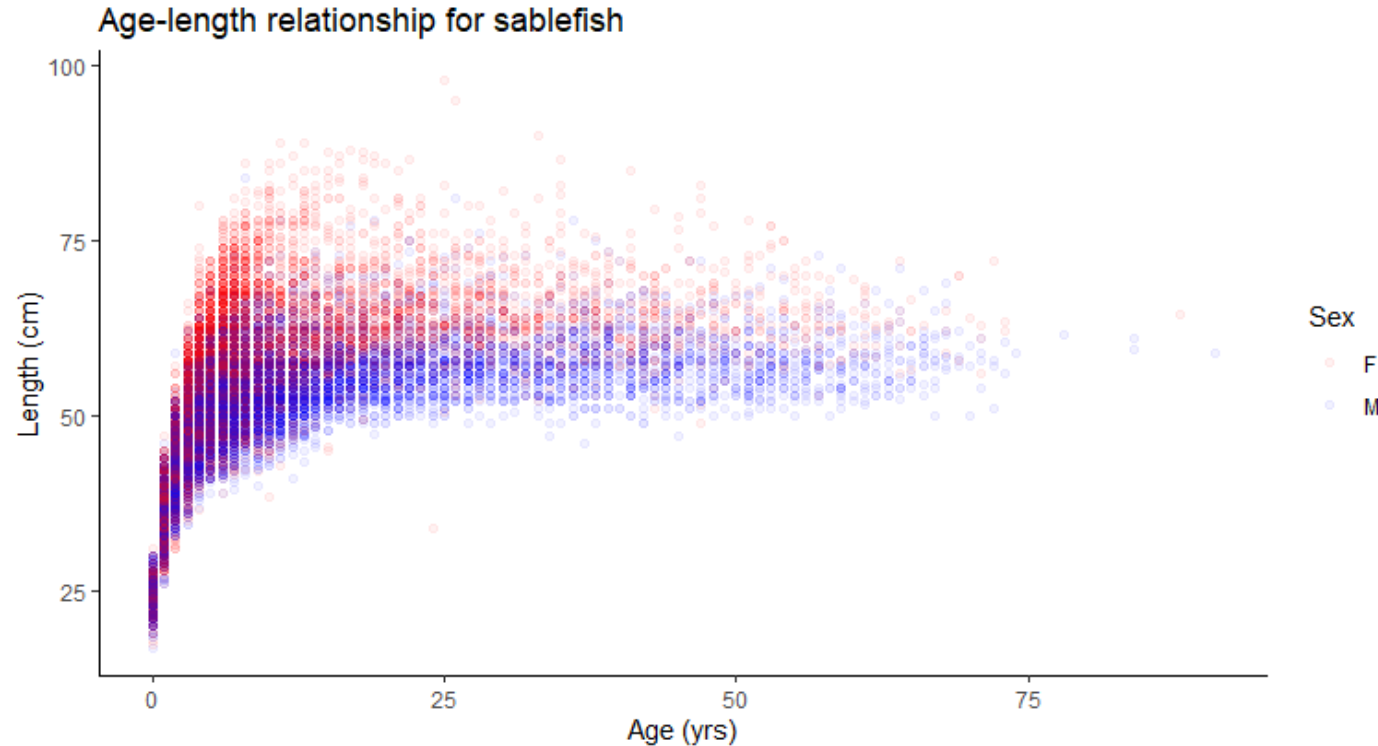
- Asymptotic length reached decades before maximum age
- Age determination is vital to understanding population structure

Example: sablefish
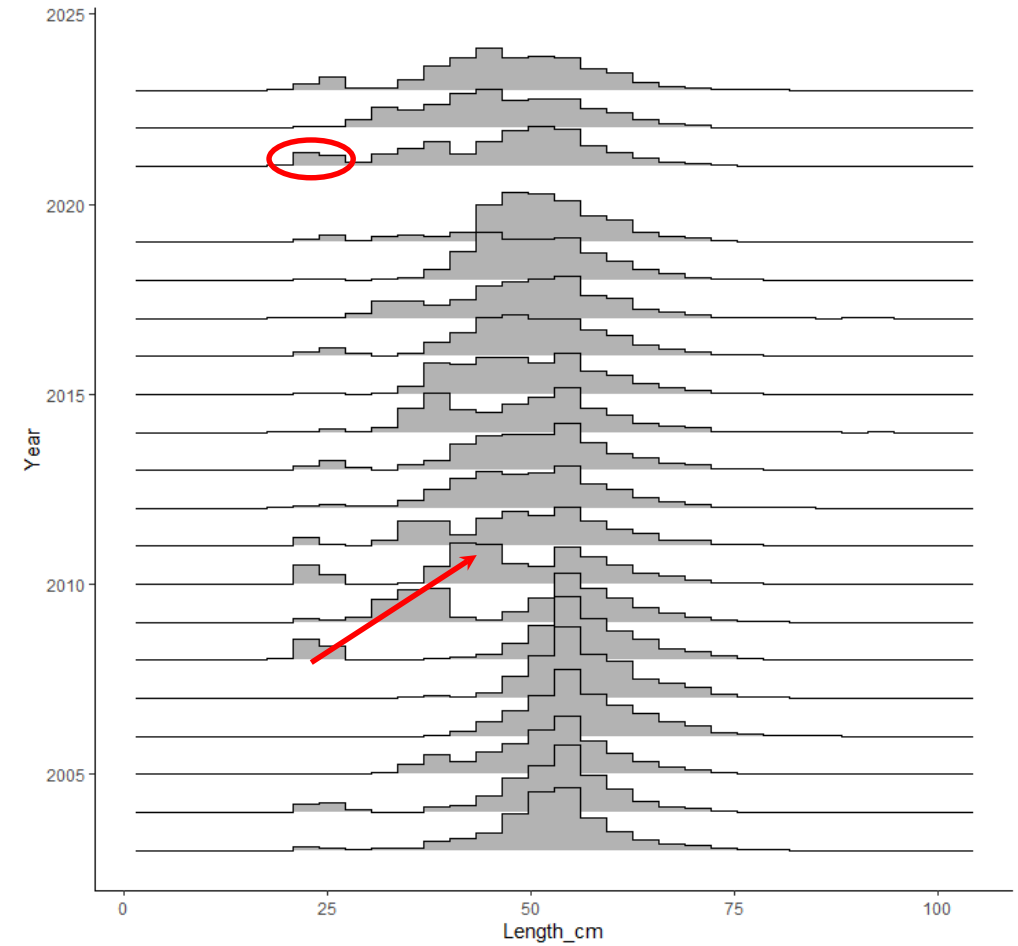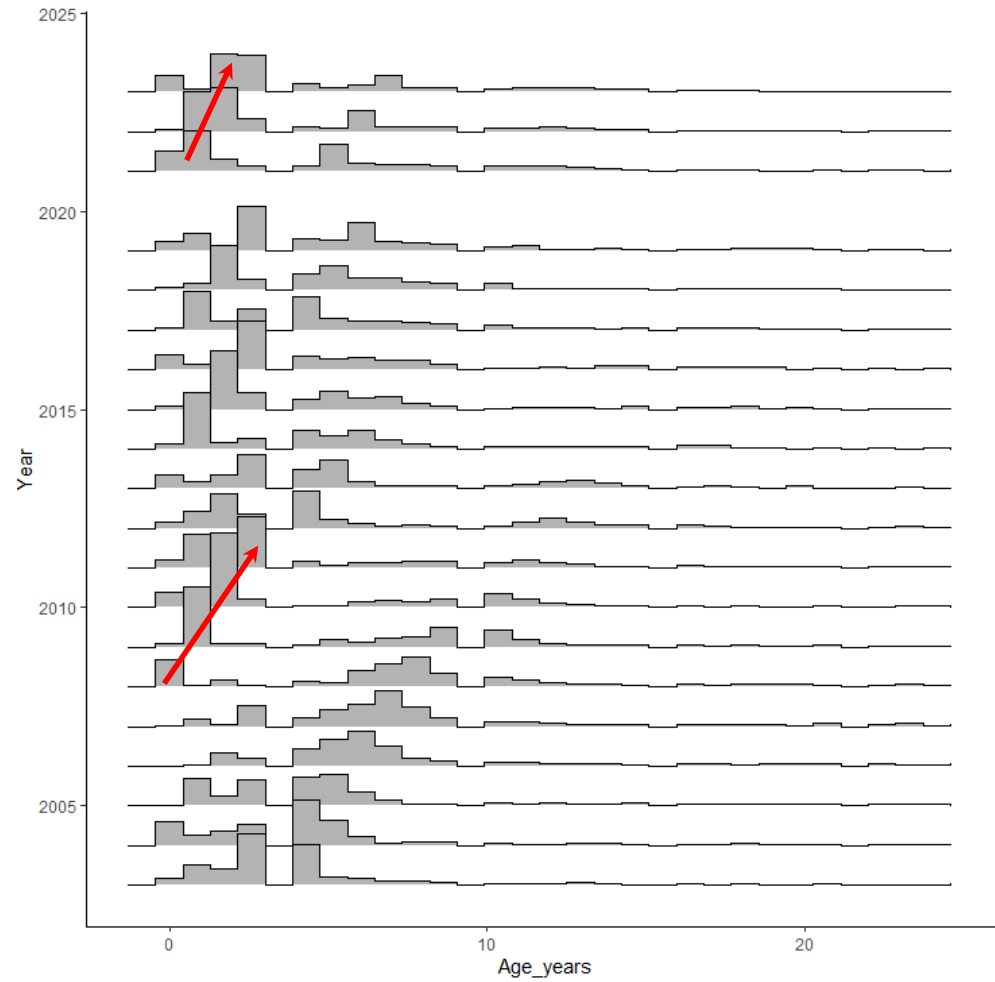
Investigating Length and Age Data

- N trips, N fish -> Input N for assessment
- How will samples from different areas be combined?
  - Weighted by trip or market category within trip and then state landings
- Sexed and unsexed data, changes over time?
  - Often have sexed age comps
  - May have unsexed length comps

Age and length data sources

- Fishery
  - **Data Sources:** PacFIN, RecFIN, ASHOP
  - **Tools:** {PacFIN.Utilities}, R data manipulation
- Survey
  - **Data Sources:** WCGBTS, historical surveys
  - **Tools:** {nwfscSurvey}

Other biological data

- Maturity at length/age
- Fecundity at length/age
- Weight at length
- Natural mortality and stock-recruit steepness
    - Either estimated in the model (can be hard) or based on a meta-analysis
- Update if new data/priors are available, otherwise retain from previous assessment

Concluding thoughts

- ~80% of your time will be spent on data issues
- Data will arrive late
- Keep asking questions until you are satisfied
- Do not be satisfied easily
- When your model does not fit the data ask more questions about how the data were collected or prepared.
- Try to use the data at it is collected (e.g. lengths) rather than derived data products (e.g. lengths converted to ages)
- Identify data needs to be collected for future assessments