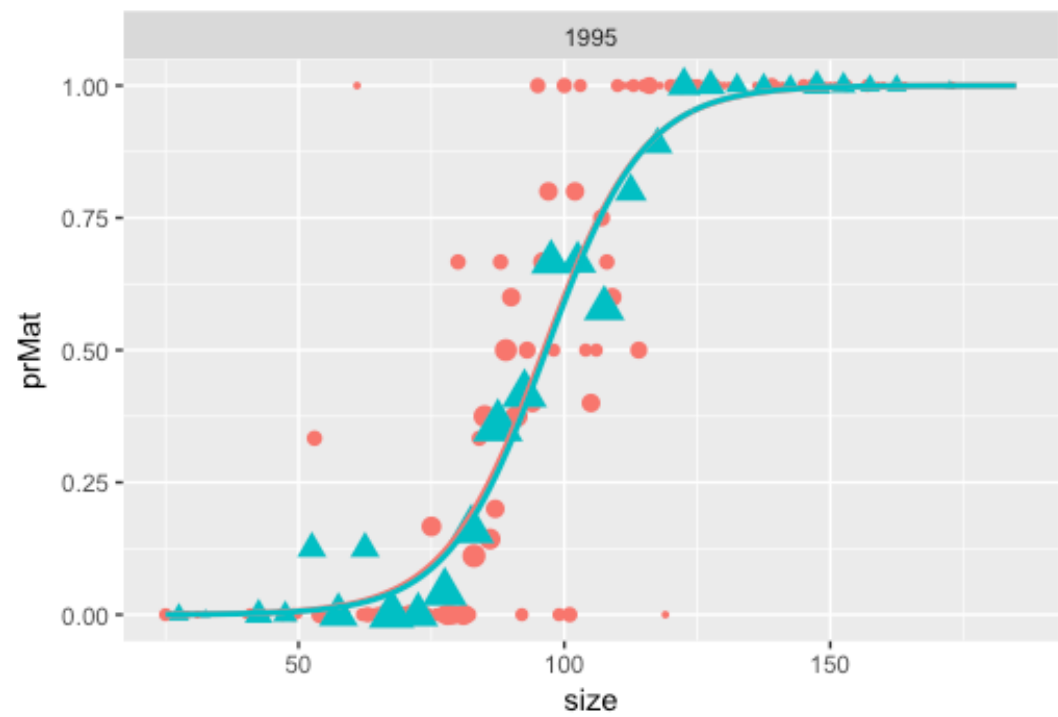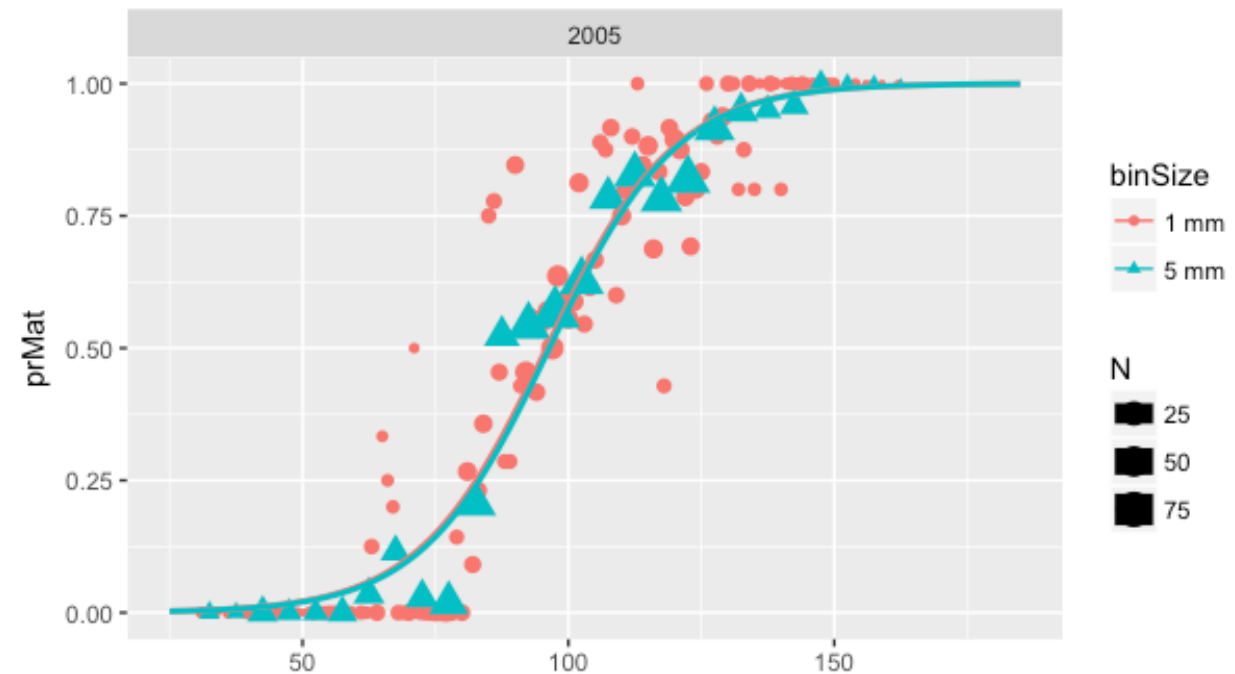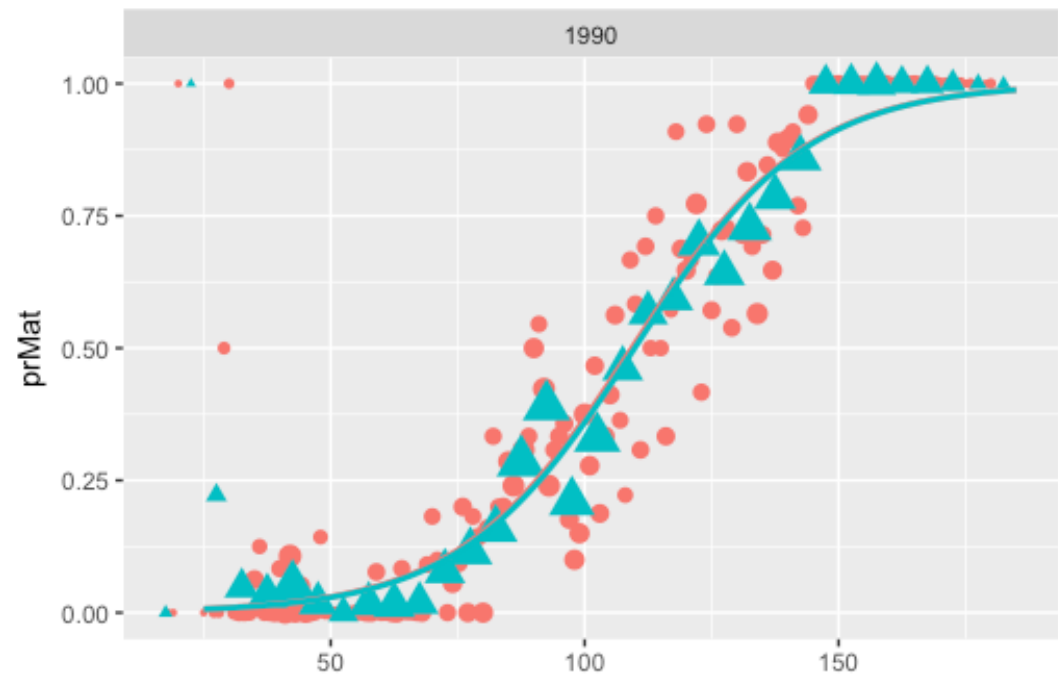# Incorporating male chela height data into the Tanner crab stock assessment

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Incorporating male chela height data into the Tanner crab stock assessment

- Use male chela heights from NMFS trawl survey to determine immature/mature status for measured new shell male crab

- Add likelihood component to fit observed ratios of mature new shell males to total new shell males by size bin and year

Changes to assessment model with incorporation of male chela height data

- Do not estimate male maturity status outside assessment model
  - Currently, NMFS survey abundance-at-size for males is converted to immature/mature abundance-at-size using a maturity ogive estimated outside the model (based on Rugolo and Turnock, 2012)

- Fit to NMFS survey total male biomass, total male size compositions by shell condition
  - Currently, the assessment model fits to
    - NMFS survey mature male biomass (summed over shell condition)
    - male size compositions by immature/mature categories (summed over shell condition)

- Fit observed ratios of mature male new shell-to-immature crab using NMFS chela height data using model-predicted ratios in the NMFS survey for the numbers of new shell mature males to immature males

$$p_{y,z} = \frac{M_{y,z}}{I_{y,z} + M_{y,z}} \sim B\left(\hat{p}_{y,z} = \frac{\widehat{M}_{y,z}}{\hat{I}_{y,z} + \widehat{M}_{y,z}} \middle| n_{y,z} = I_{y,z} + M_{y,z}\right)$$

- $M_{y,z}$ = observed number of mature, new shell males
- $I_{y,z}$ = observed number of immature (new shell) males
- $\widehat{M}_{y,z}$ = predicted number of mature, new shell males
- $\hat{I}_{y,z}$ = predicted number of immature (new shell) males

$$-\ln(L) = \sum_{y,z} n_{y,z} \cdot \left\{ p_{y,z} \cdot \left[\ln(\hat{p}_{y,z}) - \ln(p_{y,z})\right] + (1 - p_{y,z}) \cdot \left[\ln(1 - \hat{p}_{y,z}) - \ln(1 - p_{y,z})\right] \right\}$$

- Not currently done in assessment