Likelihood functions for including CPUE based indices of abundance in stock assessment models

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Outline

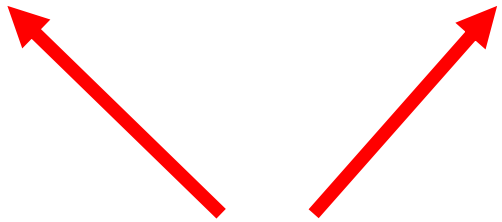
- Current approach
- Indices from spatio-temporal models
  - Age/length
- Practicalities
- Catch composition

Current approach

- Total Catch
  - Know without error
  - Fit to catch using a lognormal likelihood with small sd
- Catch composition data
  - Independent of index
  - Multinomial (or similar) likelihood
  - Sample size semi-arbitrarily fixed or estimated
- Index of abundance
  - Aggregated across ages/size
  - Fit using a lognormal likelihood
  - sd semi-arbitrarily fixed or estimated

Current approach

$\mathcal{L}(parameter|data)$ =Multi(composition, parameters) x ln$\mathcal{N}$ (CPUE, parameters) x ln$\mathcal{N}$(catch, parameters) x …….



Independent

Indices from spatio-temporal models

- Joint time and age/size index
- Estimated variance-covariance matrix
- Fit using a multivariate distribution (e.g. normal or lognormal)
- Use Estimated variance-covariance matrix in likelihood
- How to deal with unmodeled process variation and model misspecification

Practicalities

- General models don’t have multivariate likelihood
- Independent age/size specific indices
  - May be too many lengths
- Aggregated index and composition likelihoods

Catch composition

- Calculated in spatio-temporal model using same data
  - Index composition weighted by CPUE
  - Catch composition weighted by catch
- Joint time, age/size, index, and catch
- Estimated variance-covariance matrix
- Fit using a multivariate distribution (e.g. normal or lognormal)
- Use Estimated variance-covariance matrix in likelihood
- How to deal with unmodeled process variation and model misspecification
  - Are data weighting issues enough to treat it independently?