Estimating Observation Errors from Tag Data

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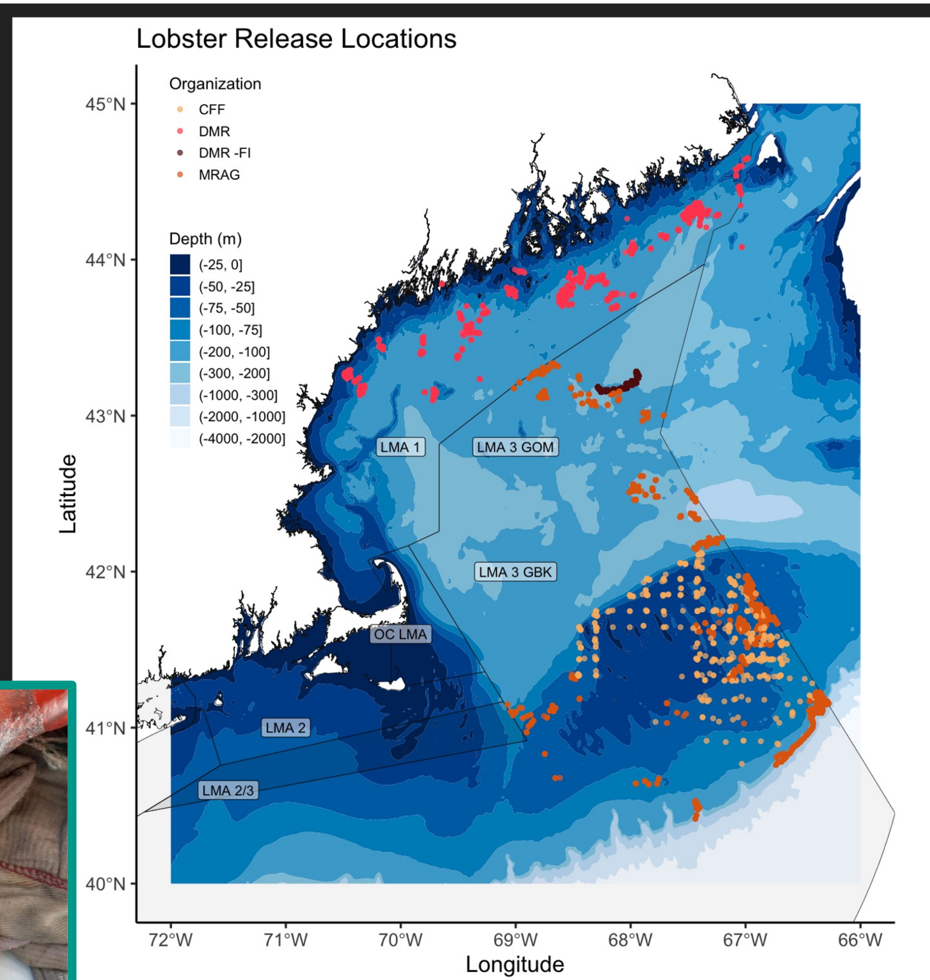
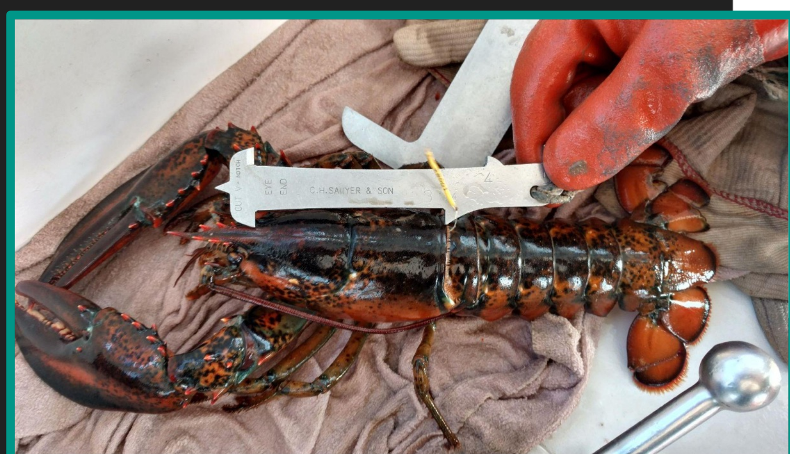
AOLA data collection

Project addressed 2015 ASMFC Stock Assessment research priorities.

1. "Examine stock connectivity between GOM and GBK"
2. "Update information on growth and maturity"



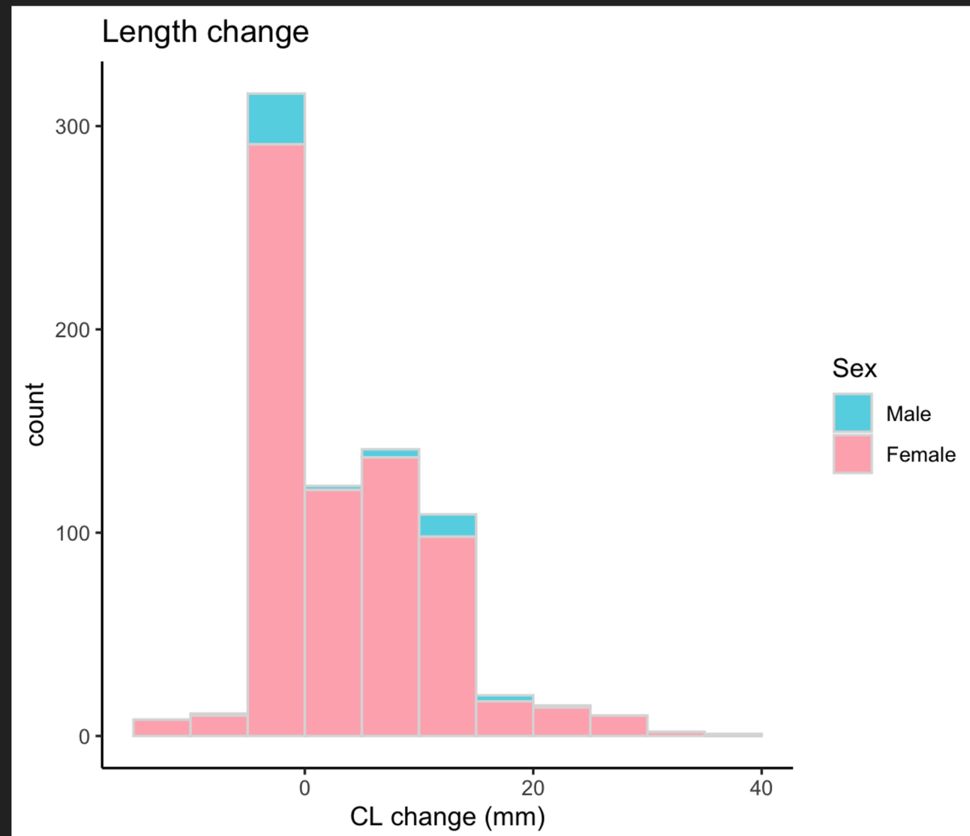


Above: Lobster release locations by different organizations; Right: Example image used in industry outreach to fishermen.

Recapture data

- 1800+ recaptures
  - 488 caliper only measurement
  - 270 caliper + ImageJ measurement
  - 251 ImageJ measurement

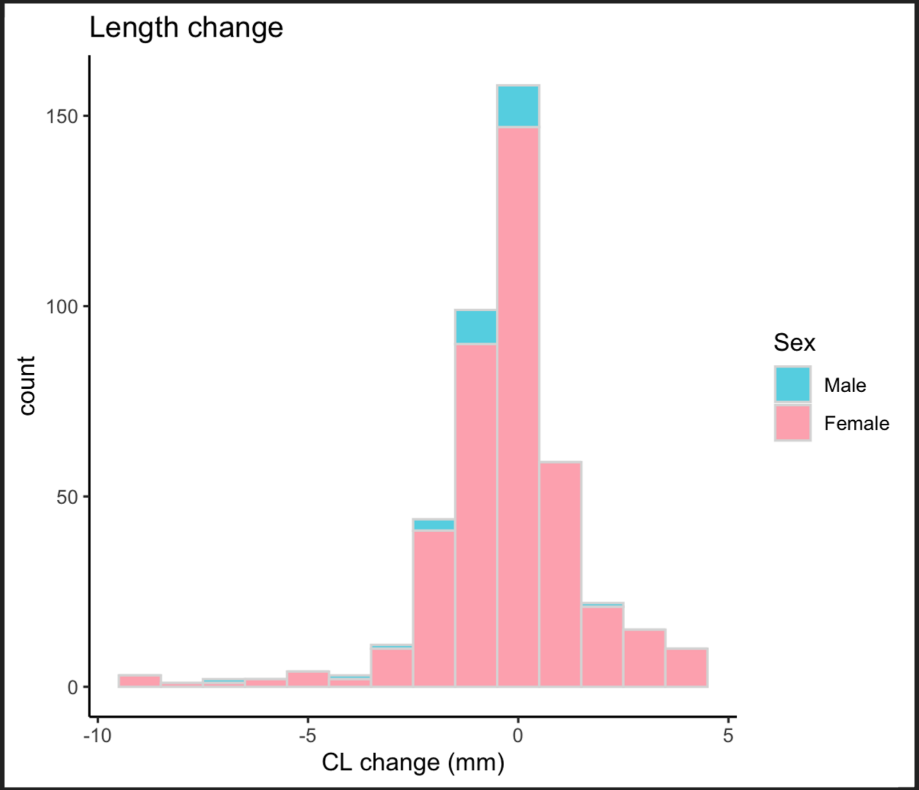
- Note: a large proportion of measurements are negative



Calculated length change from caliper measurements (758 total)

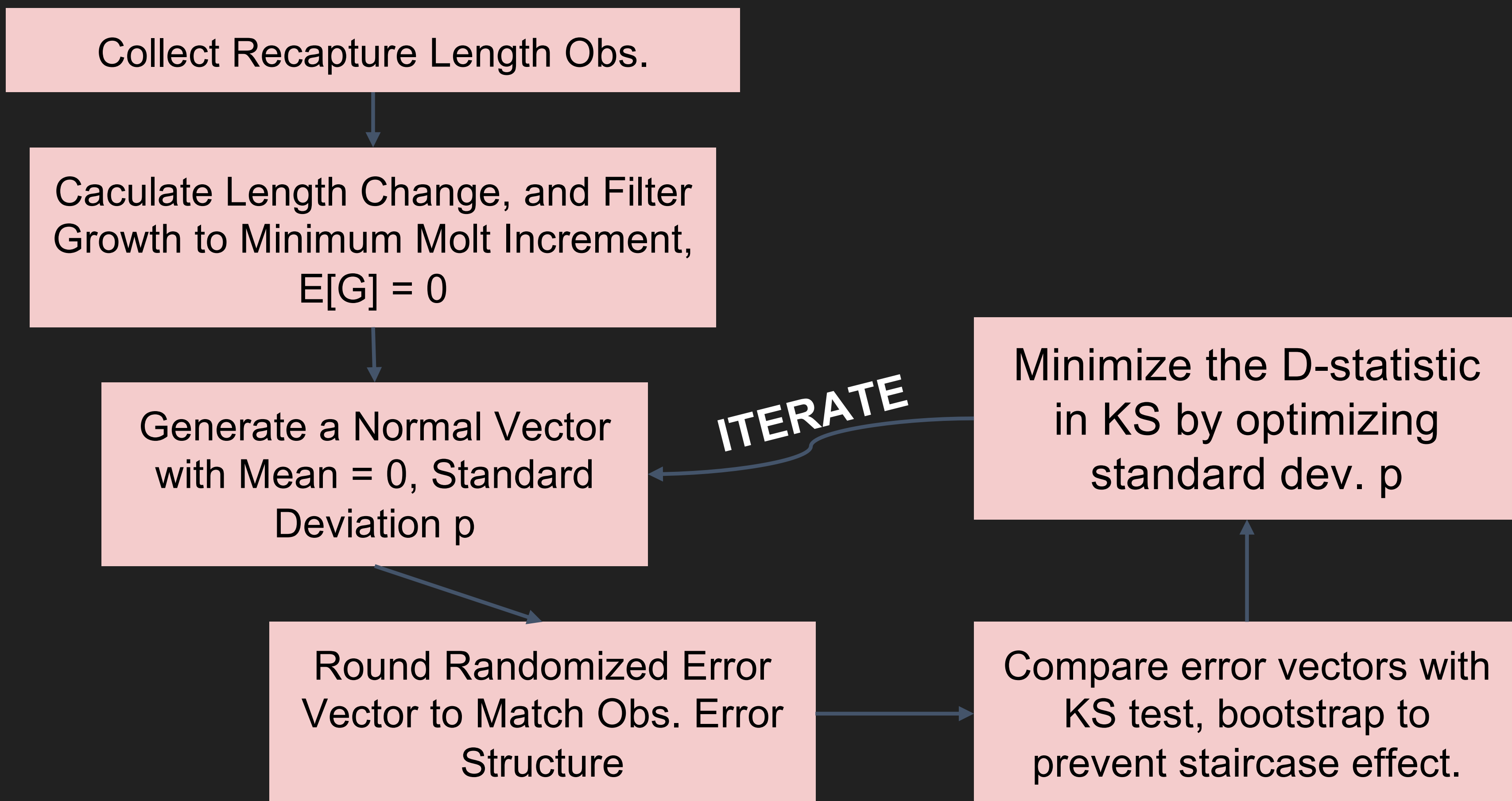
Low growth observations

- How can we use poor datapoints i.e. low, negative, zero length change?



Distribution of low length changes.

Estimating error from obs. with E[Growth = 0]



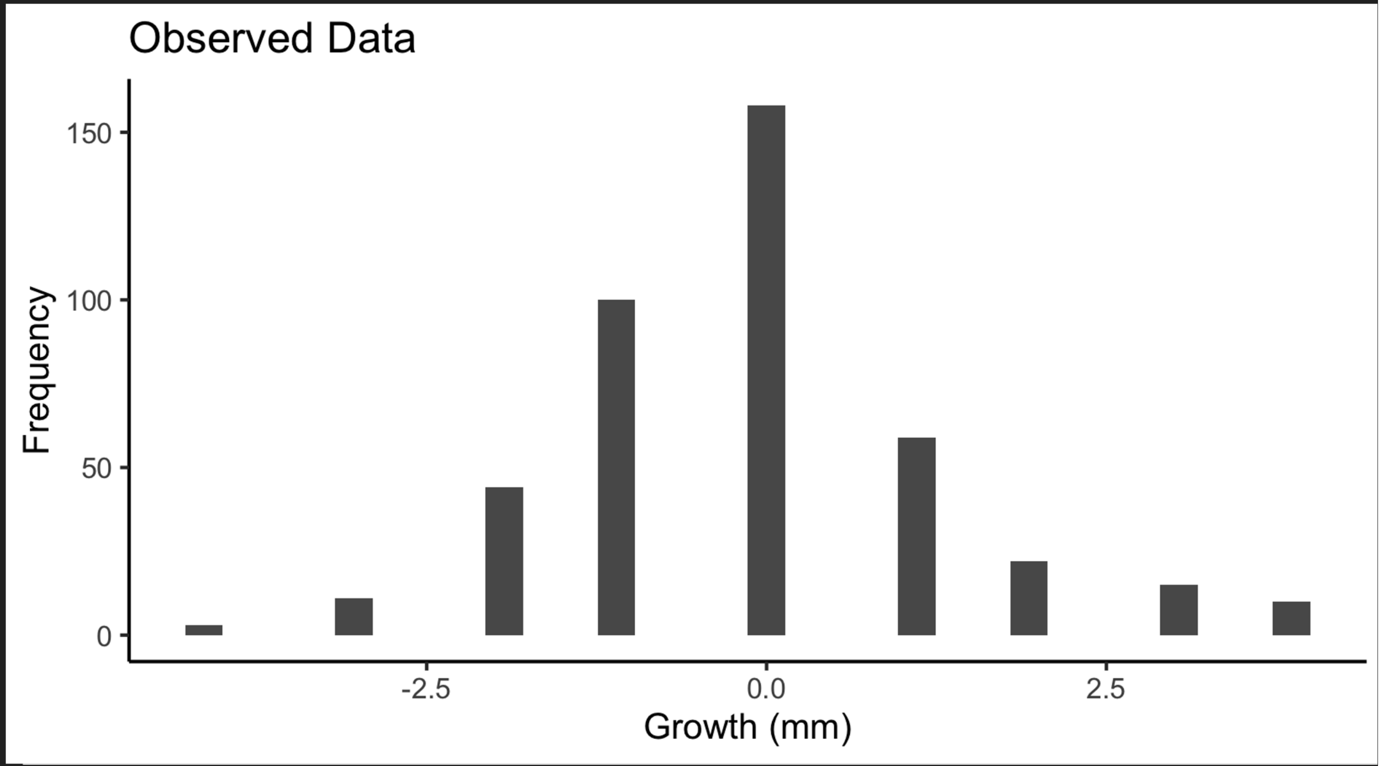
Why estimate error in this way?

- Each length measurement has the potential to introduce error
- Combining length estimates may cancel or compound this error → error distribution
- If we can estimate a stable stochastic term for this error, we can add noise to GTM growth increment parameter
- Running the assessment model with and without this additional noise can inform as to the level of compound measurement bias and its impact on results

Distribution of low growth measurements

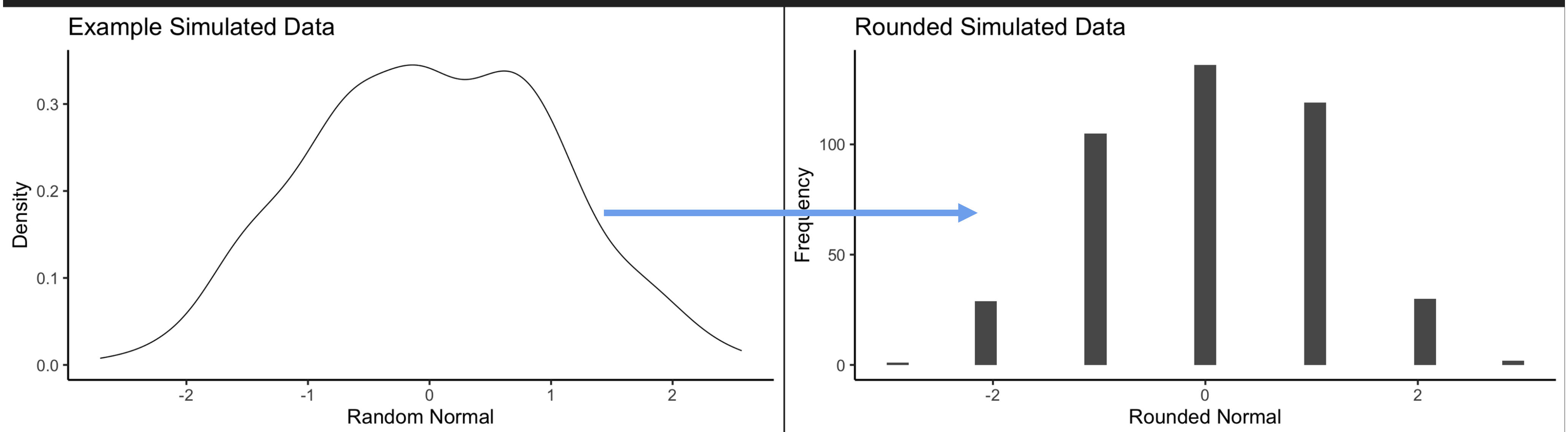
Low growth measurements are not normally distributed due to the discrete structure of observer measurements.

Confirmed with Shapiro-Wilk.



The normal vector, discretization and the D-statistic

Generate random normal, discretize to match growth data, compare distributions via KS D-statistic



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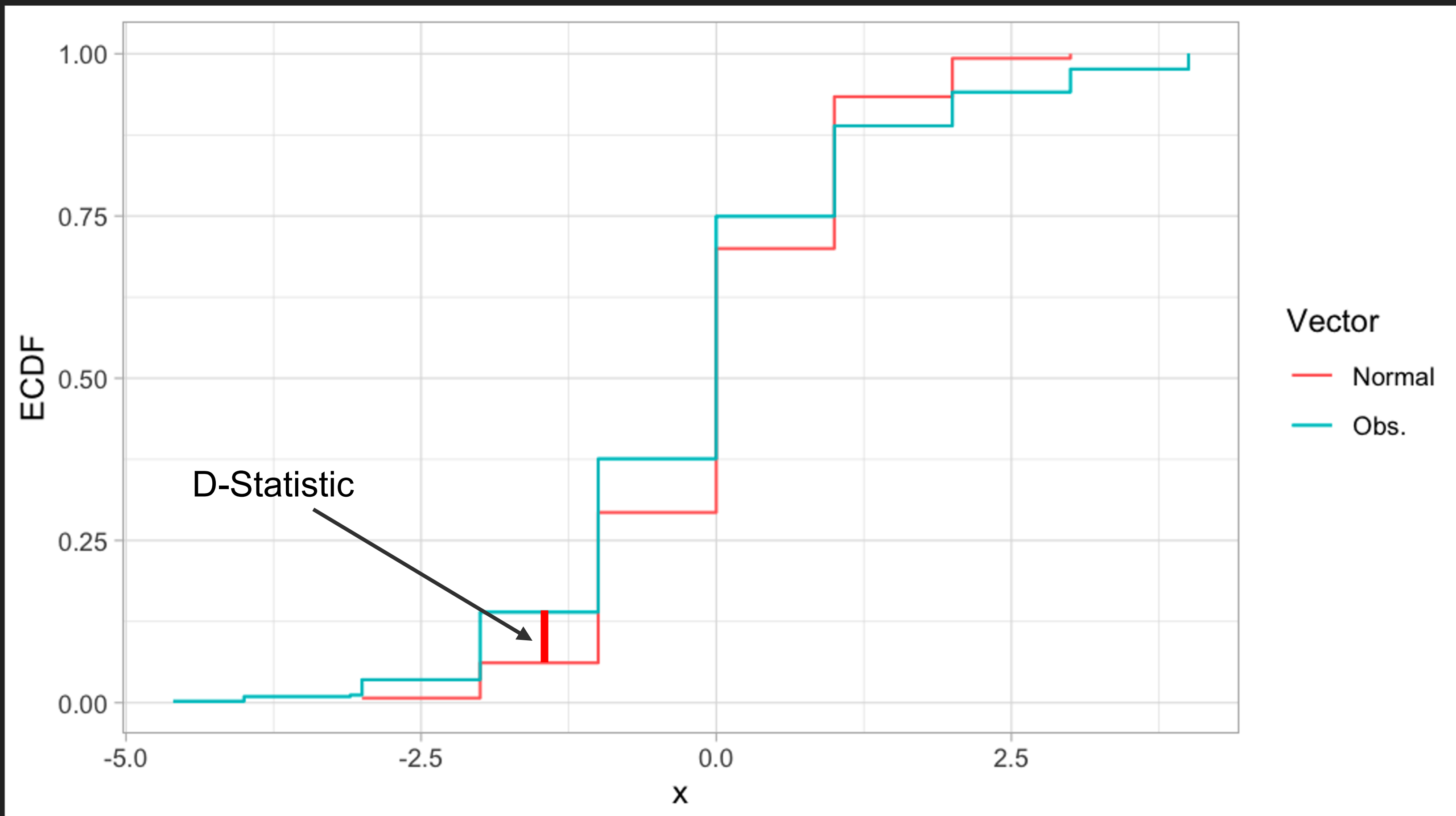
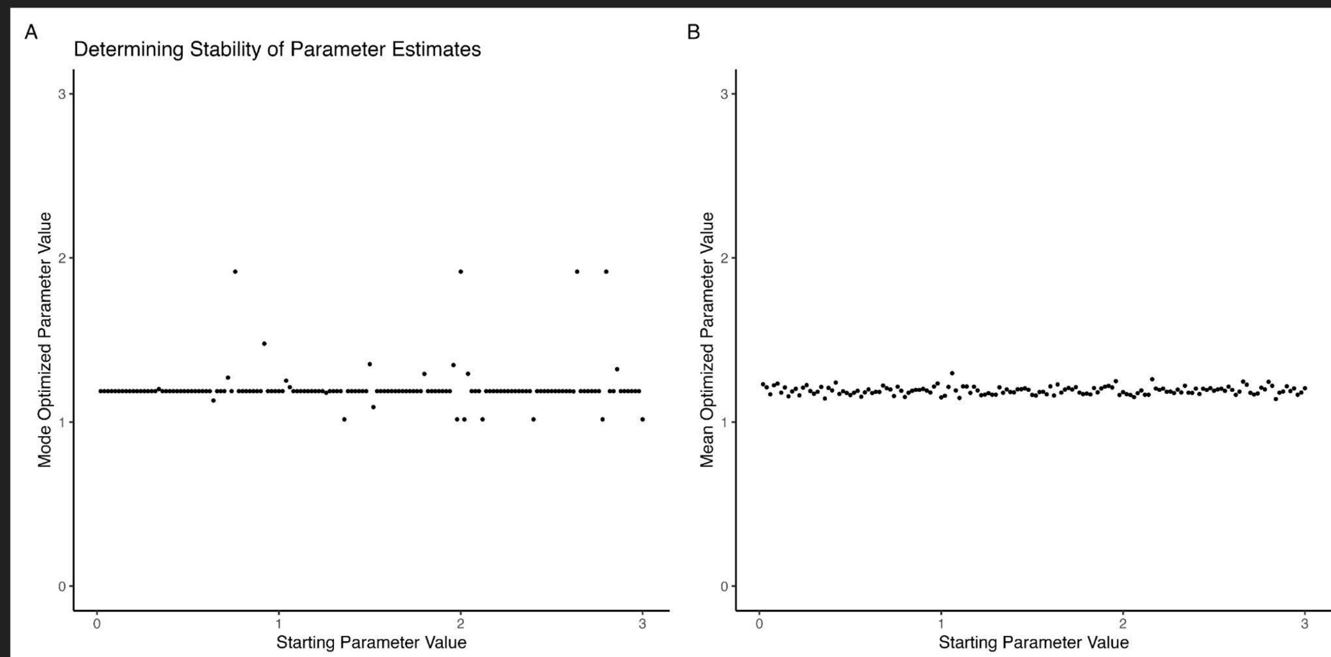


Testing Across Starting Parameters

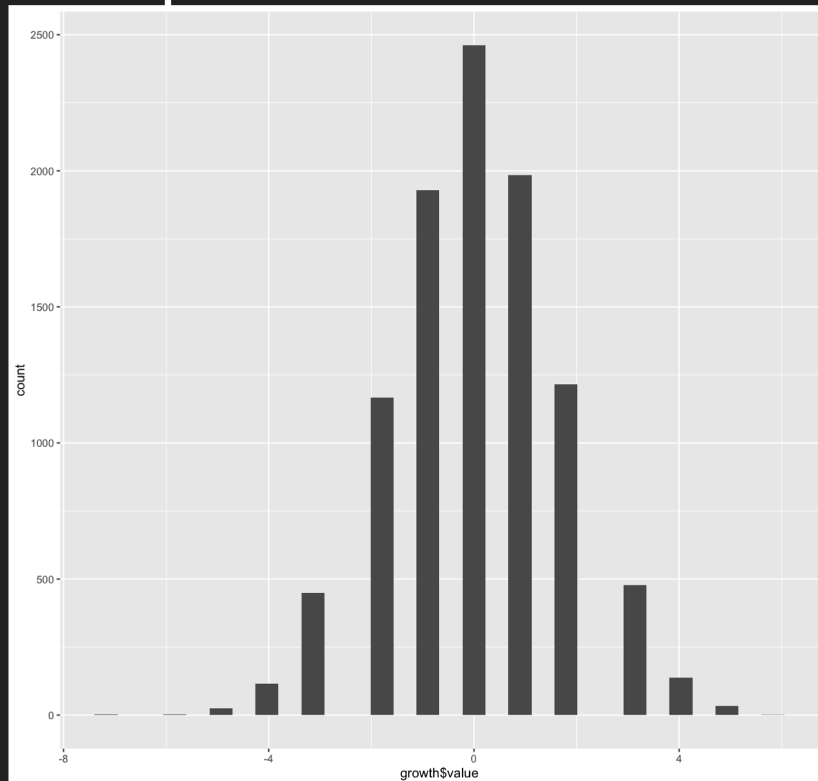
- 150 starting standard deviation values from 0.02 to 3.00
- Standard deviation is optimized over 100 iterations, mode and mean are reported to determine stability
- *N(0, 1.19)* is identified as the stochastic term.

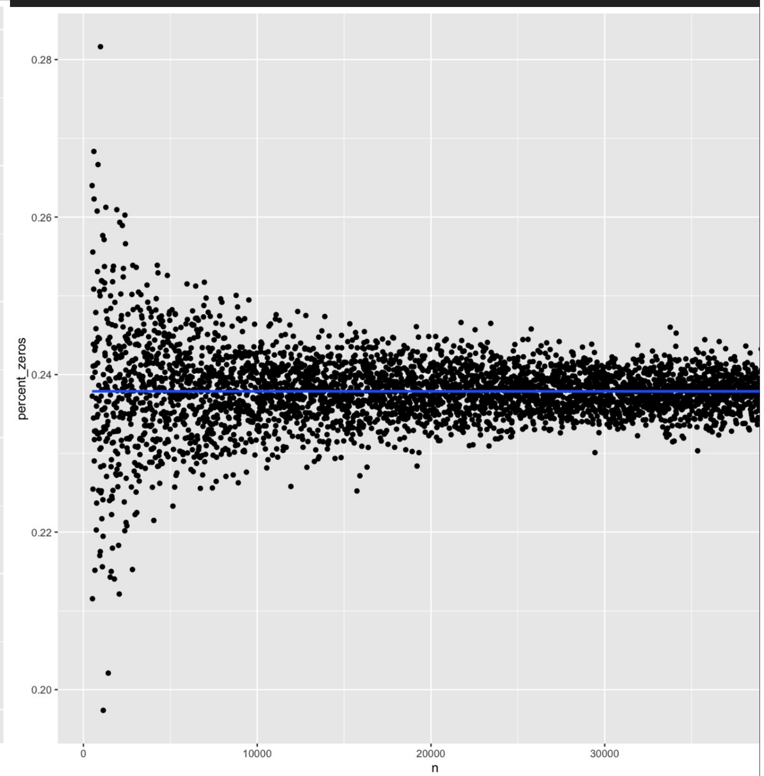


Adding error components

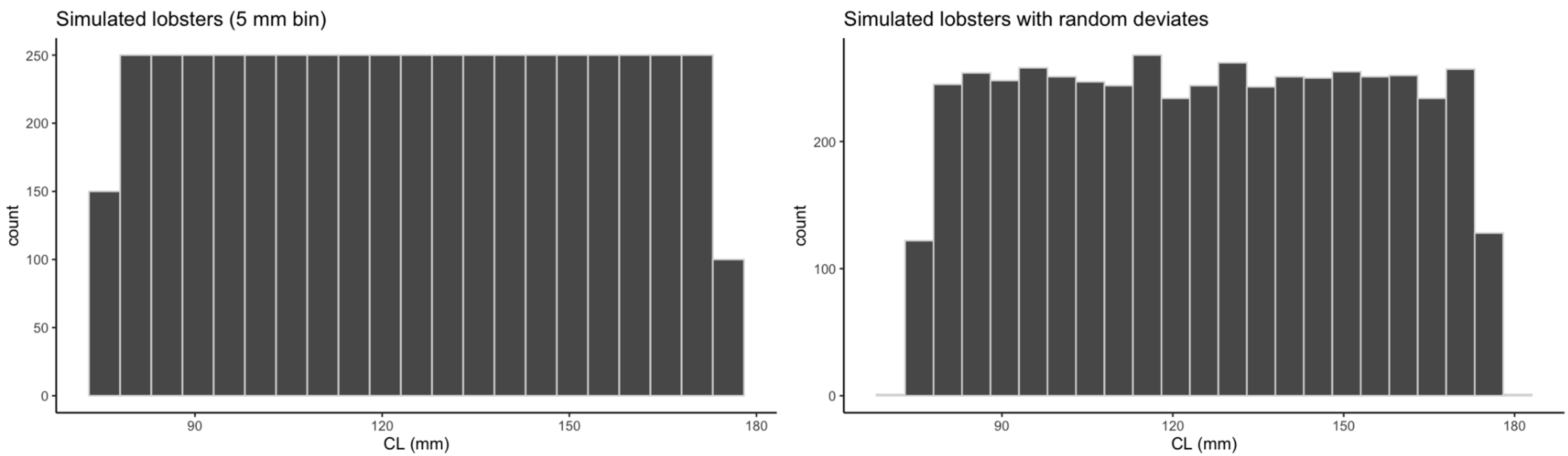
If we assume both observer obs. have the same error structure,

Error cancels itself 23.8 % of the time.





Simulation bin change, n = 5000 “lobsters”



In simulation where lobsters are equally distributed across 5 mm bins, adding the stochastic term changes lobster size 19% of the time.

Take Home Points

1. When we expect Growth = 0 we can use observations to calibrate an error term for growth.
2. Optimization of this term across parameter values finds *N(0, 1.19)* to be an appropriate stochastic term to model introduced observation error.
3. This stochastic term changes a lobsters size bin 19 % of the time in simulation.

This could be used to add noise to GTM growth increments and determine if observer error impacts our understanding of stocks by changing growth.

Next step: Fit as max likelihood through TMB

Questions!