Shell Height Measurement Conversion

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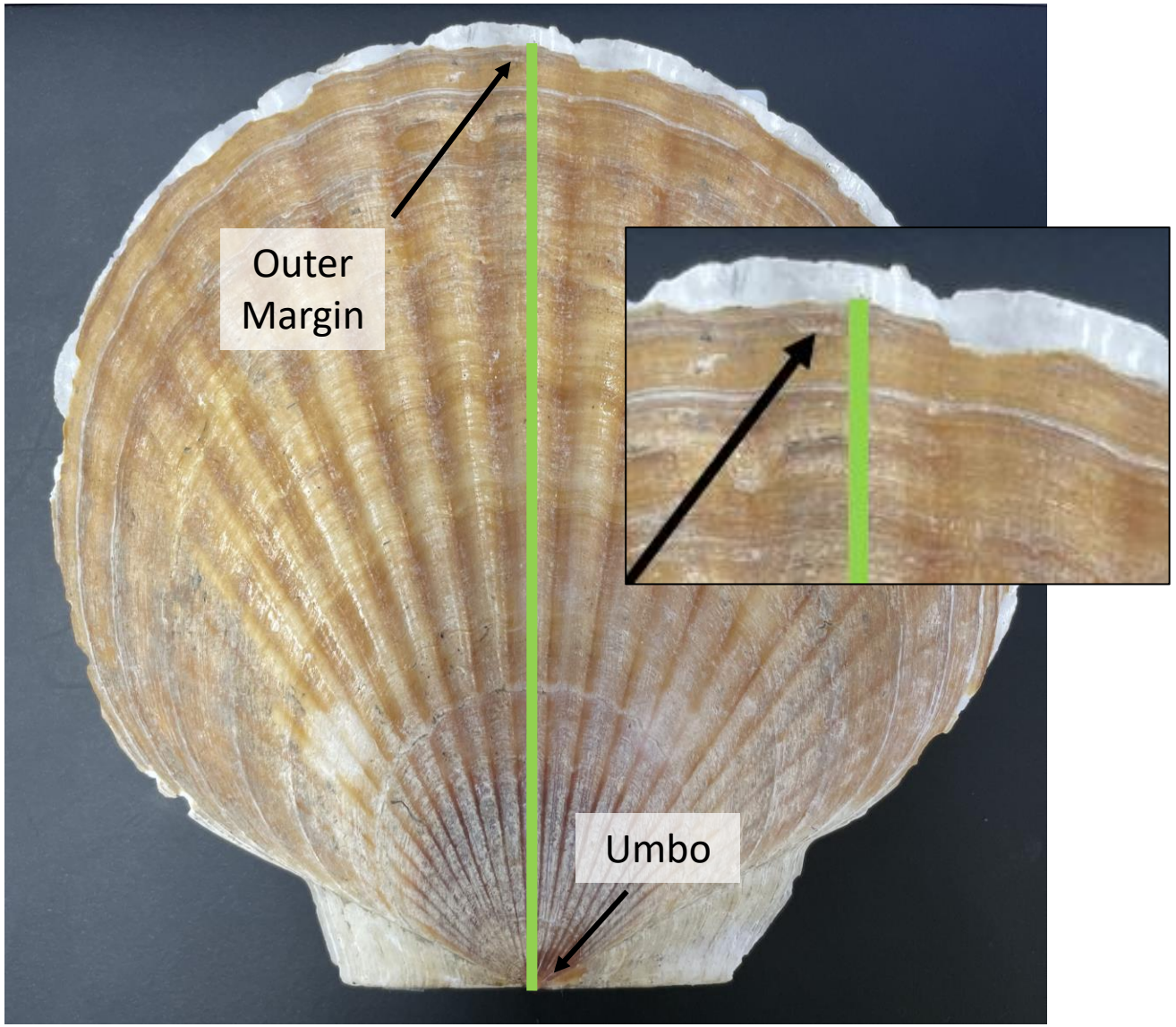
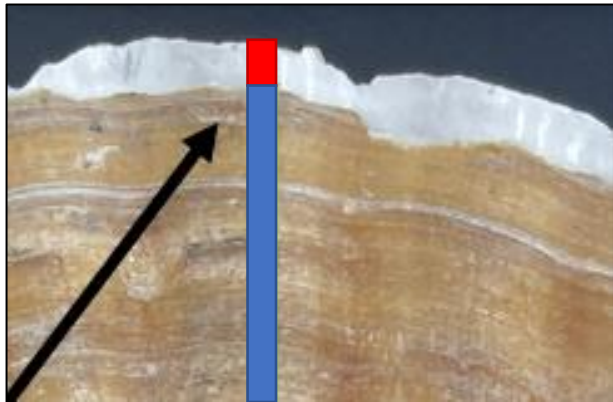


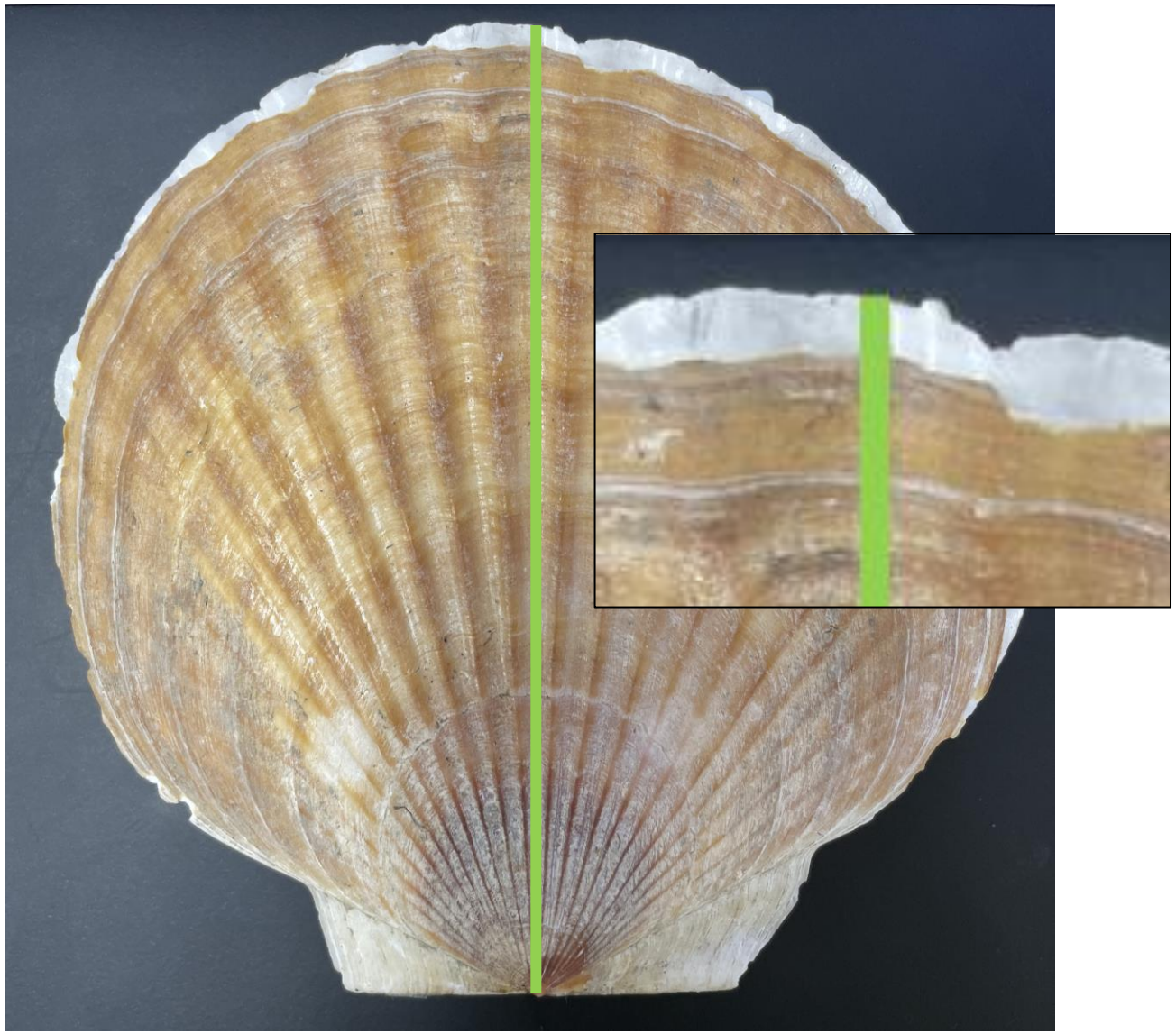
Current Shell Height Definition:

"The scallop biological measurement is shell height (in mm). This is defined as the straight-line distance from the umbo to the outer shell margin, perpendicular to the hinge. The top valve of the animal is measured when determining shell height. ***The bottom valve is typically larger than the top valve*** *and it protrudes beyond the top shell's margin. Care should be given when measuring shell height so not to include the bottom valve."*

Defining Shell Height

- Measurement of top valve initially driven by age structure analyses
- The outer shell margin (OSM) better represents biological size and gear selectivity
- Shift to OSM represents a concurrent improvement in measurement technology, increasing data collection efficiency
- Increasing the volume of shell height measurements is necessary to improve size frequency distributions
- OSM is the standard in east coast scallop programs (NOAA/NMFS, VIMS, WHOI, SMAST, etc.)



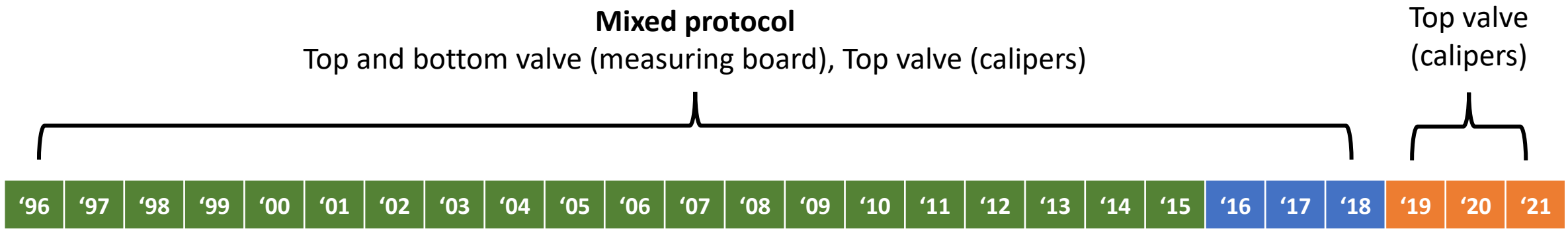


Proposed Shell Height Definition:

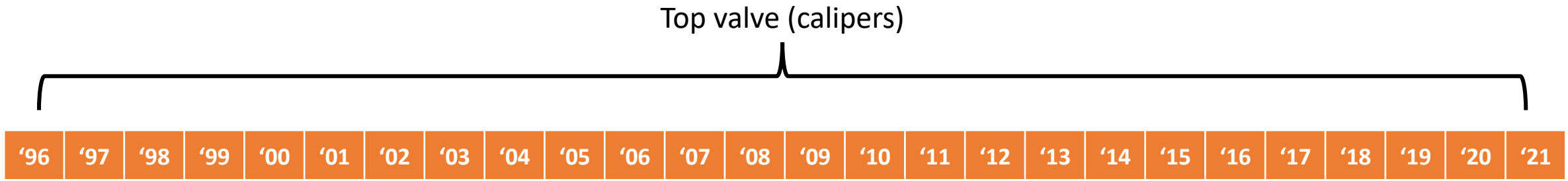
"The scallop biological measurement is shell height (in mm). This is defined as the straight-line distance from the umbo to the outer shell margin, perpendicular to the hinge."

Atlantic Sea Scallop: *". . . Shell height is a straight-line measurement from the hinge to the part of the shell that is farthest away from the hinge*" (50 CFR § 648.50)

Shell Height Data Collection History



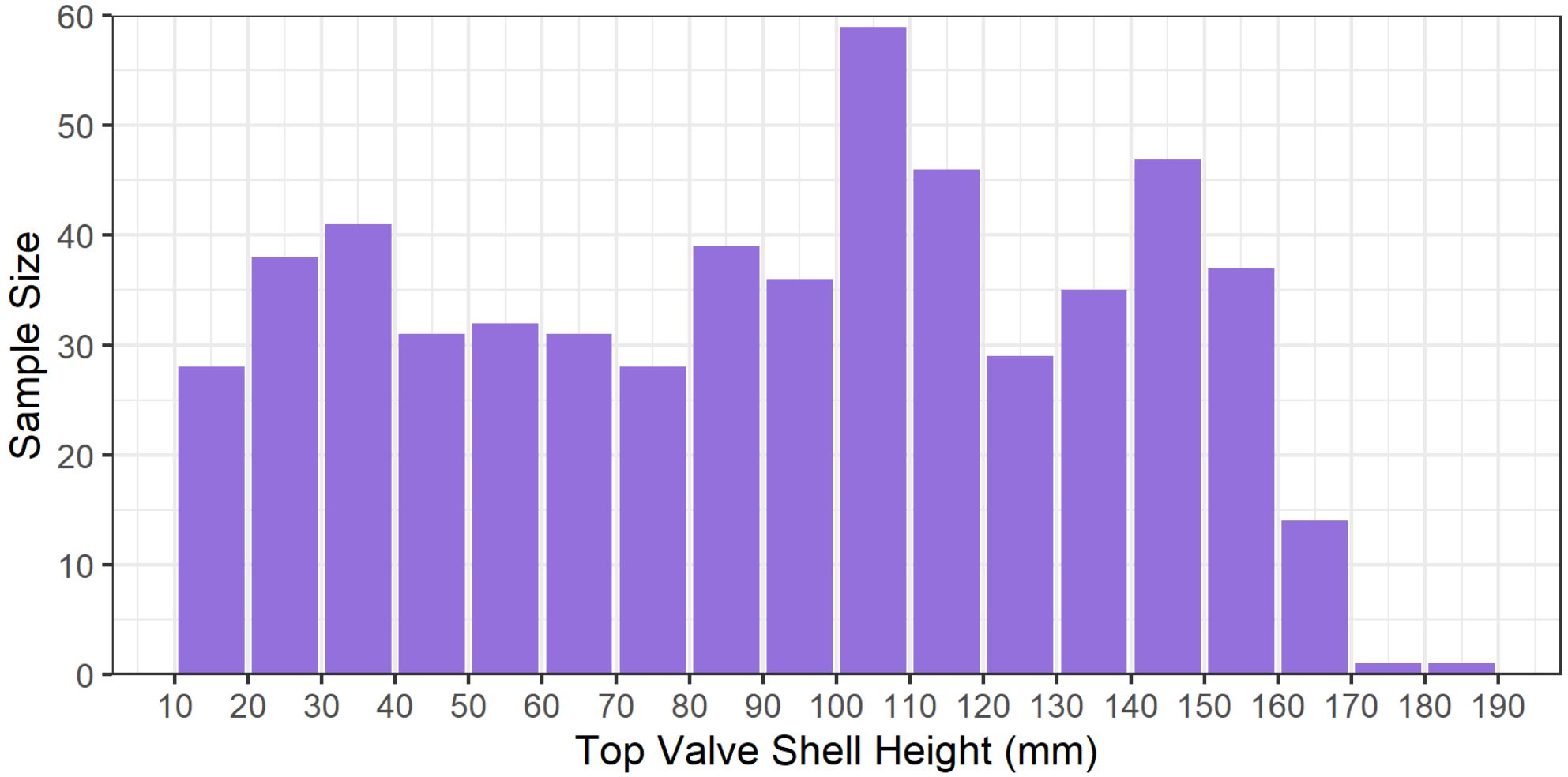
Dredge Surveys



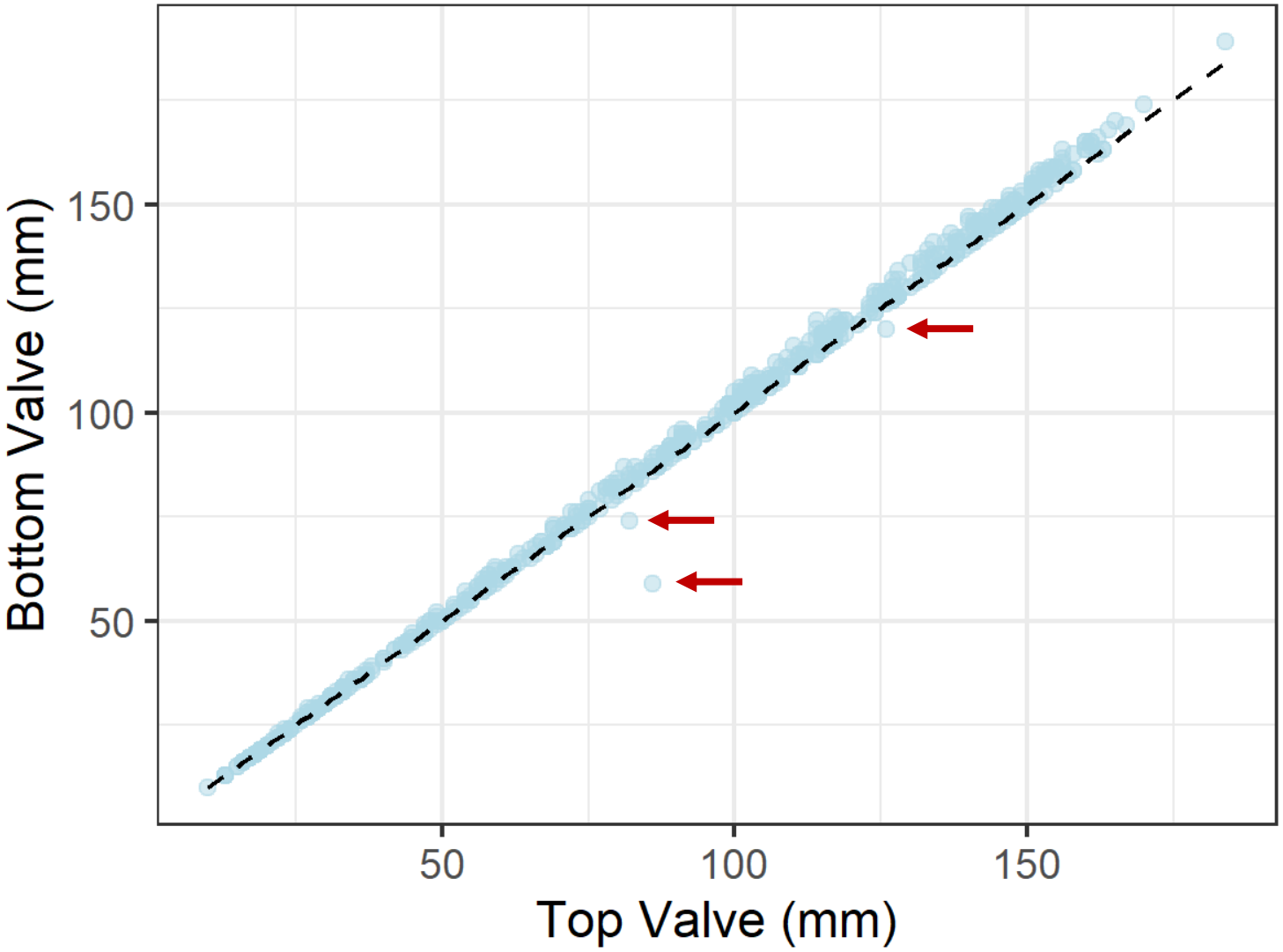
Fishery (Observer)

Shell Height Study Design

- Collected paired, top and bottom shell measurements during 2021 dredge survey in Yakutat Area
  - Goal – at least 30 samples for each 10 mm size bin across the survey area



Results



- Three outliers, removed from analysis
- All bottom valve measurements ≥ top valve measurements
- Variance in bottom valve measurement increases with shell height
  - More variable top valve damage
  - Lack of precision at small sizes (measured to nearest 1mm)

Results

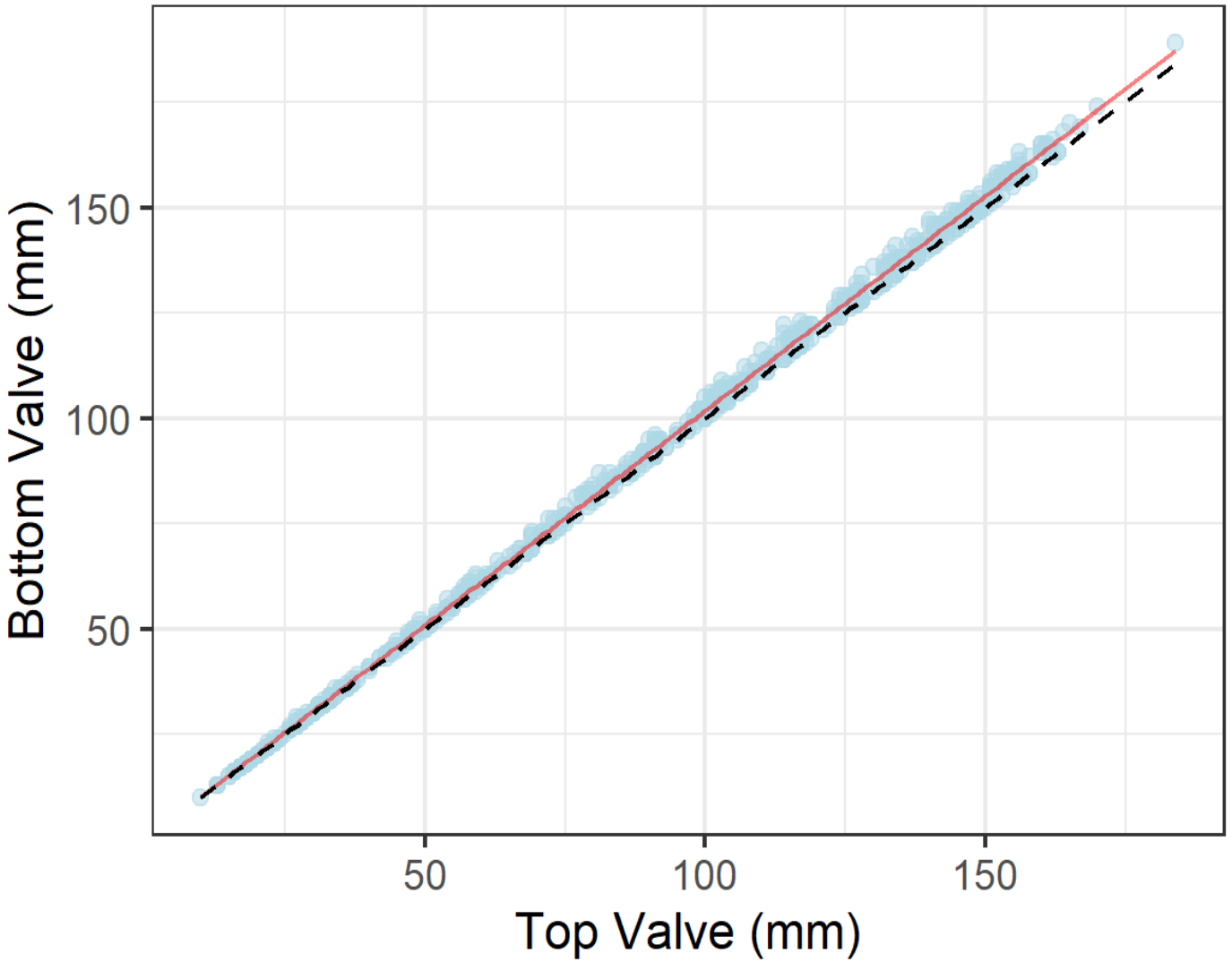
OLS Length Conversion

$$L_{bottom} = \beta_0 + \beta_1 L_{top} + \varepsilon$$

	df	RSS	*F*	*P*-value
w/ β_0	571	1,346.2	0.09	0.76
w/o β_0	572	1,346.4		

$$\beta_1 = 1.02,\ \sigma_{\beta_1} < 0.001$$

$$L_{bottom} = 1.02 L_{top}$$



Conclusions & Recommendations

- Results suggest redefining shell height from “top valve” to “outer shell margin” (usually bottom valve) is appropriate, without conversion
  - Systematic differences between top and bottom valve measurements are minor
  - Linear conversion seems appropriate (consistent with fish length types)
  - Historical data collection inconsistent – too difficult to know if or when to apply a correction
- *Measurement differences can be accounted for in assessment development – e.g. size bin design, error in size at age, etc.*
- *Evaluate this conversion in fishery data as well*