Dungeness Crab Molting

The data for this project were collected as part of a study of the adult female Dungeness crab. Two sets of data are provided. The first consists of premolt and postmolt widths of the carapaces (shells) of 472 female Dungeness crabs. These data are a mixture of some laboratory data and some capture–recapture data. They were obtained by scientists and commercial fisheries over three fishing seasons. The first two seasons were in 1981 and 1982. The third season was in 1992.

Variable	Description
Premolt	Size of the carapace before molting.
Postmolt	Size of the carapace after molting.
Increment	postmolt–premolt.
Year	Collection year (not provided for recaptured crabs).
Source	1=molted in laboratory; 0=capture–recapture.

- Predict the premolt size of a crab given only its postmolt size using linear regression. Examine a subset of the data collected, say those crabs with postmolt carapace width between 147.5 and 152.5 mm. Compare the prediction estimates of premolt size for this subset with the actual premolt size distribution of the subset.

- Use your procedure to describe the premolt size distribution of the molted crabs collected immediately following the 1983 molting season.

- One simple biological model for growth that is derived from the notion of cell duplication is the multiplicative growth model. It says that the relative growth of a crab should be constant, A crab's molt increment is an approximation to its growth rate, and relative growth can be approximated by normalizing the molt increment by the premolt size:

$$\frac{(\text{post} - \text{pre})}{\text{pre}},$$

  For our case, constant relative growth can be expressed as

$$\text{molt increment/premolt} = c.$$

  Plot the molt increment against the premolt size to see if this is an appropriate model.

- Another model is *constant growth increment* is simply expressed as

$$\text{molt increment } = c.$$

  Use a plot to determine if this is appropriate model for the data.

- A third model is the allometric relationship between crab weight and width gives

$$\log(\text{molt increment/premolt}) = a - c \times \log(\text{premolt}),$$

  where c is the exponent in the allometric relationship. Fit the data to this model; what value of c does it give? Does it make sense? Does the model fit well?

- Use cross-validation to compare the predictive ability of these three models.