Stat 104 – Lecture 10

Least Squares Estimates

$$b_1 = 0.9807 \frac{109.760}{8.016} = 13.428$$

$$b_0 = 154.029 - 13.428(9.207) = 30.397$$

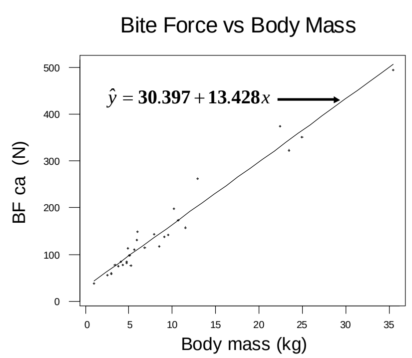
$$\hat{y} = 30.397 + 13.428x$$

1

Interpretation

- Slope – for every 1 kg increase in body mass, the bite force increases, on average, 13.428 N.
- Intercept – there is not a reasonable interpretation of the intercept in this context because one wouldn't see a *Canidae* with a body mass of 0 kg.

2



Prediction

- Least squares line

$\hat{y} = \mathbf{30.397} + \mathbf{13.428}\,x$

$x = \mathbf{25}$

$\hat{y} = \mathbf{30.397} + \mathbf{13.428}(\mathbf{25}) = \mathbf{366.1}$ N

4

Residual

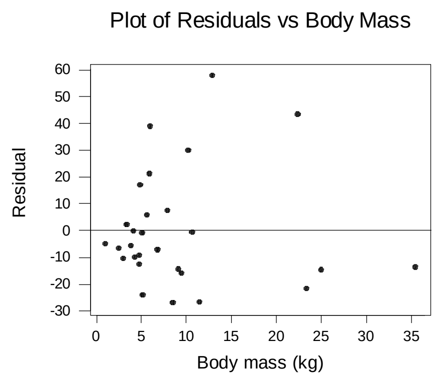
- Body mass, x = 25 kg
- Bite force, y = 351.5 N
- Predicted, $\hat{y}$ = 366.1 N
- Residual, $y - \hat{y}$ = 351.5 – 366.1 = – 14.6 N

5

Residuals

- Residuals help us see if the linear model makes sense.
- Plot residuals versus the explanatory variable.
  - If the plot is a random scatter of points, then the linear model is the best we can do.

6



Interpretation of the Plot

- The residuals are scattered randomly. This indicates that the linear model is an appropriate model for the relationship between body mass and bite force for *Canidae*.

8

$(r)^2$ or R^2

- The square of the correlation coefficient gives the amount of variation in *y*, that is accounted for or explained by the linear relationship with *x*.

9

Body mass and Bite force

- r = 0.9807
- $(r)^2 = (0.9807)^2 = 0.962$ or 96.2%
- 96.2% of the variation in bite force can be explained by the linear relationship with body mass.

10

Regression Conditions

- Quantitative variables – both variables should be quantitative.
- Linear model – does the scatter diagram show a reasonably straight line?
- Outliers – watch out for outliers as they can be very influential.

11

Regression Cautions

- Beware of extraordinary points.
- Don't extrapolate beyond the data.
- Don't infer x causes y just because there is a good linear model relating the two variables.
- Don't choose a model based on R^2 alone.

12