

Practice Exercise: Regression & Correlation

Question 1:

A study was conducted to examine the association between adult immunity and juvenile mortality in southern fur seals. Therefore, researchers determined the percentage of adult southern fur seals on different island populations that contained a certain antibody in their blood (this antibody is associated with immunity against a known bacterial pathogen) and they also determined the mortality rate for seal pups on those same islands. Is there a significant relationship between adult southern seal immunity and seal pup mortality on these islands?

Question 2:

A study was conducted to examine the possible effect of habitat size on the diversity of organisms living within that habitat – a typical species-area relationship type of study. In this case, the size (cm²) of 25 clumps of bromeliads (an epiphytic plant) were measured and the number of insect species dwelling within each bromeliad clump were counted. Does a species-area relationship exist for bromeliad size and insect species? If so, how good is the relationship? If so, provide a mathematical description of the relationship. What is the predicted number of insect species for a bromeliad that is 150 cm²?

Question 1 Data:

(note: the order of the antibody values corresponds with that of the mortality values)

| Antibody Presence (% of population tested positive for antibody) | Pup mortality (mortality rate per 1000 live births) |
|---|---|
| 35, 58, 69, 43, 94, 26, 7, 9, 12, 45, 11, 66, 51, 18, 29, 90, 10, 12, 35, 27 | 115, 98, 109, 63, 24, 226, 357, 339, 112, 145, 111, 36, 51, 48, 129, 30, 110, 212, 65, 127 |

Question 2 Data:

(note: the order of the bromeliad size values corresponds with that of the insect species values)

| Bromeliad size (cm ²) | Number of Insect Species |
|---|---|
| 10, 11, 10, 15, 17, 27, 27, 28, 33, 35, 41, 42, 46, 54, 58, 87, 92, 100, 101, 105, 125, 202, 246, 267, 288 | 3, 6, 7, 7, 9, 10, 10, 11, 9, 11, 12, 13, 16, 20, 15, 22, 19, 20, 21, 16, 22, 23, 22, 23, 19 |

Answer Question 1: Correlation

Assumption check: assumption of normality not met; either use Spearman Rank correlation or transform data (log best) and use Pearson correlation.

Spearman results: $r = -0.691$, $n = 20$, $P = 0.001$

Pearson results on log transformed data: $r = -0.736$, $n = 20$, $P < 0.0005$

Answer Question 2: Regression

Normality? OK

Homogeneity of variances? OK

Outliers? None

Linearity? Problem; log transformed data provide more linear relationship

Is there a species area relationship? Yes, use ANOVA result: $F = 181.009$; $df = 1, 22$; $P < 0.0005$

How good is the relationship? Quite good; 88.7% of variance in insect species number is explained by variation in bromeliad size (adjusted $r^2 = 0.887$)

Predicted number of insects for a bromeliad of 150 cm² = 21