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STATS 515

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Linear Regression

**Introduction**

The study done today is to show what could possibly be affecting sea turtle sex determination and the two factors involved. The objective is to determine how temperature varies with depth in a sea turtle nest. Hypothesis is temperature will go down with depth. This produces a null hypothesis that temperature will have no effect on depth. The data was collected from an experiment performed in a marine science course. The experiment had multiple variables including differing sand color, temperature, depth, and time. For this data set the emphasis was on temperature and depth. This is the dataset for black sand. Temperature is very important to figure out the ratio of male to female sea turtles. Sea turtle sex is determined by temperature. Warmer temperatures produce females and cooler temperatures produce more male sea turtles. Unfortunately, only black sand was used for the experiment not getting the full range of the experiment. The prediction is that temperature should rise as depth decreases.

**Methods**

The study performed is broadly over sea turtles, not any specific species. Two different beach sands were given, one black and the other white. The sands were set into two marked containers. The depths were 20 cm, 15 cm, 10 cm, 5 cm, and surface level. Five “eggs” were set into each mark. The sands were then set under lights to act as the sun. They sat under the lights for 60 minutes in fifteen-minute intervals. At the beginning and after every fifteen-minute mark the sands temperature was taken at every depth to see how temperature affects the two different types of sands at varying depths. For the hypothesis, a spreadsheet was created to put all of the data into to show a linear relationship. Everything was then sent into r coding to determine the significant values. A scatterplot was created for the black sand data on temperature throughout the experiment. A linear regression is then created to test hypothesis one producing a p-value and slope value. An anova is also performed.

Results

The study shows the individual nests tested in the lab, but the results could affect how sea turtle conservation is approached going forward. The results show a p-value of 0.001431. The residual standard error is 14.99 with 22 degrees of freedom. Hypothesis one is accepted, and the null is rejected showing that temperature will have an effect on depth. The R-squared value is 0.3764 and the adjusted R-squared value is 0.348. The mean standard error is 4945.6. The equation for slope is y=47.0545+-1.6140x.

**Conclusion**

The code run shows that temperature does have an effect on depth in black sand. Figure one shows the results of the hypothesis mean showing the relationship between temperature and depth. Errors are possible to occur in how the temperature is taken and at what depths. Human error can also occur skewing certain results. This shows that sand temperature can affect nesting and sex determination.

**The Code Used**

> x=c(5,10,15,20,0,5,10,15,20,0,5,10,15,20,0,5,10,15,20,0,5,10,15,20)

> y=c(22,22,22,22,30.9,22.6,22.6,22.6,22.6,69.5,24,22.8,22.8,22.7,78.6,26.1,23,23,23,85,26.7, 23.3,23,23)

> result=lm(y~x)

> > summary(result)

Error: unexpected '>' in ">"

> summary(result)

Call:

lm(formula = y ~ x)

Residuals:

Min 1Q Median 3Q Max

-16.984 -9.757 -0.544 7.851 37.945

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 47.0545 5.5367 8.499 2.13e-08 \*\*\*

x -1.6140 0.4429 -3.644 0.00143 \*\*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 14.99 on 22 degrees of freedom

Multiple R-squared: 0.3764, Adjusted R-squared: 0.348

F-statistic: 13.28 on 1 and 22 DF, p-value: 0.001431

> anova(result)

Analysis of Variance Table

Response: y

Df Sum Sq Mean Sq F value Pr(>F)

x 1 2985.0 2985.0 13.279 0.001431 \*\*

Residuals 22 4945.6 224.8

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> plot(x,y) abline(result)

Error: unexpected symbol in "plot(x,y) abline"

> plot(x,y)

> abline(result)



Figure 1. The graph for temperature vs. depth. The y-axis is the temperature in Celsius and the x-axis depth of the sand.