Analysis on the pre-molt and post-molt carapace size of Dungeness crabs

Issue :

The Dungeness crab is a large crustacean that can be commonly found along the Pacific coast. This crab species is known for being one of the largest and most abundant types of crabs. In order to analyze adult female Dungeness crabs, a database was created that contains information on pre-molt and post-molt carapace sizes. The crabs in the database underwent molting in either a laboratory or an ocean environment.Our objective is to investigate the relationship between the carapace size of Dungeness crabs before and after molting, and then provide a summary of our findings.

Findings:

Our analysis of pre-molt and post-molt carapace sizes in Dungeness crabs revealed a remarkable correlation between the two variables. We found a strong linear relationship between pre-molt size and post-molt size, which was indicated by a correlation coefficient of 0.99 and a very low p-value of less than 0.001. These significant statistical results provide strong evidence against the null hypothesis and demonstrate the high level of statistical significance between pre-molt size and post-molt size in Dungeness crabs.This new finding sheds new light on the growth patterns and biology of this fascinating species. It suggests that the pre-molt size of a Dungeness crab can be used to predict its post-molt size, providing valuable insights for crab fisheries and management.

Discussion :

Based on our collected data, we conducted a straightforward linear regression analysis with post-molt size as the predictor variable and pre-molt size as the predicted variable. Our analysis yielded impressive results with Pearson's r2 coefficient indicating a strong correlation between the two variables with a value of 0.9915901. This strong correlation highlights the close relationship between pre-molt and post-molt size in Dungeness crabs. To validate our findings, we performed a Shapiro-Wilk test and obtained a value of 0.94589 for w and a p-value of less than 0.001. This further supports our initial finding of the strong relationship between pre-molt size and post-molt size in Dungeness crabs. Overall, our findings contribute to our understanding of this fascinating species and its growth patterns.

Appendix A : Method

The first step in our analysis of the relationship between pre-molt and post-molt carapace sizes in Dungeness crabs was to import the data, which was in the form of a .csv file, into R-Studio. We then used pre-molt size as the predictor variable and post-molt size as the response variable to examine the relationship between the two variables.To explore this relationship, we utilized a variety of statistical tools, including histograms, scatter plots, and quantile plots. Furthermore, we calculated the correlation coefficient using Pearson's method and performed a Shapiro-Wilk test to determine the p-value.These statistical techniques provided us with valuable insights into the correlation between pre-molt and post-molt size in Dungeness crabs, furthering our understanding of the growth patterns of this fascinating species.

Appendix B : Results

We imported a database of 487 data points into R-Studio to study the distribution of pre-molt and post-molt carapace sizes in Dungeness crabs. By constructing histograms and smooth histograms, we gained valuable insights into the growth patterns of this species. Surprisingly, we observed a significant shift to the right in the green-colored histogram representing post-molt size compared to the red-colored histogram representing pre-molt size. This indicates that Dungeness crabs tend to have larger carapace sizes after molting, indicating their growth and development over time. These findings have significant implications for the conservation and management of this fascinating species.

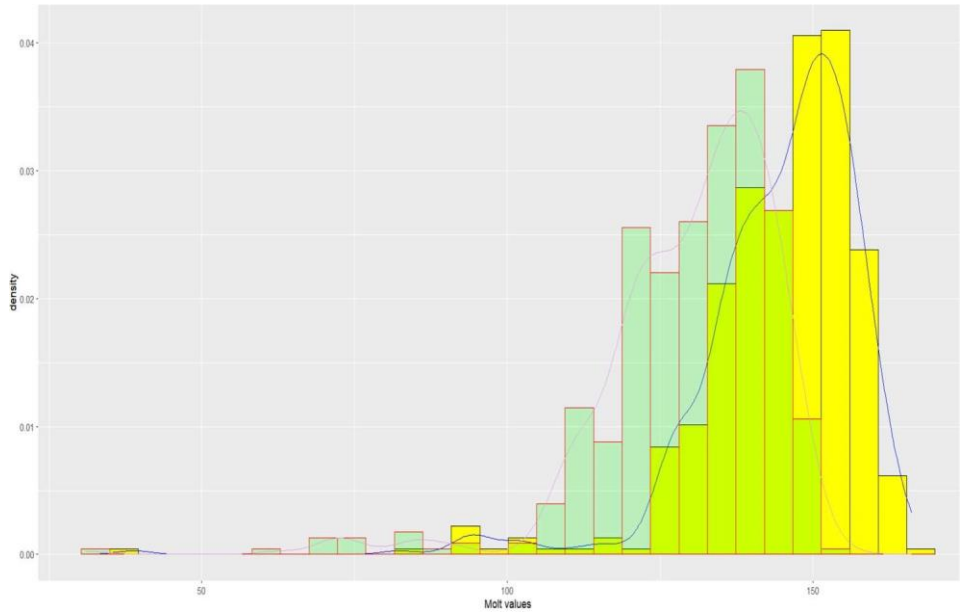

Figure 1: Distribution of post-molt size and pre-molt size

To explore the relationship between pre-molt and post-molt carapace sizes in Dungeness crabs, we created several informative figures. Figure 2 presented a clear and intuitive representation of the relationship between pre-molt and post-molt sizes by plotting premolt size as a function of post-molt size. To deepen our understanding of this relationship, we conducted a simple linear regression analysis using post-molt size as the

predictor variable and pre-molt size as the predicted variable. The results, shown in Figure 3, highlighted a strong association between these variables and provided valuable insights into the growth patterns of Dungeness crabs. By combining our statistical analysis with these figures, we gained a better understanding of the complex relationship between pre-molt and post-molt carapace sizes, which has significant implications for the management and conservation of this species.

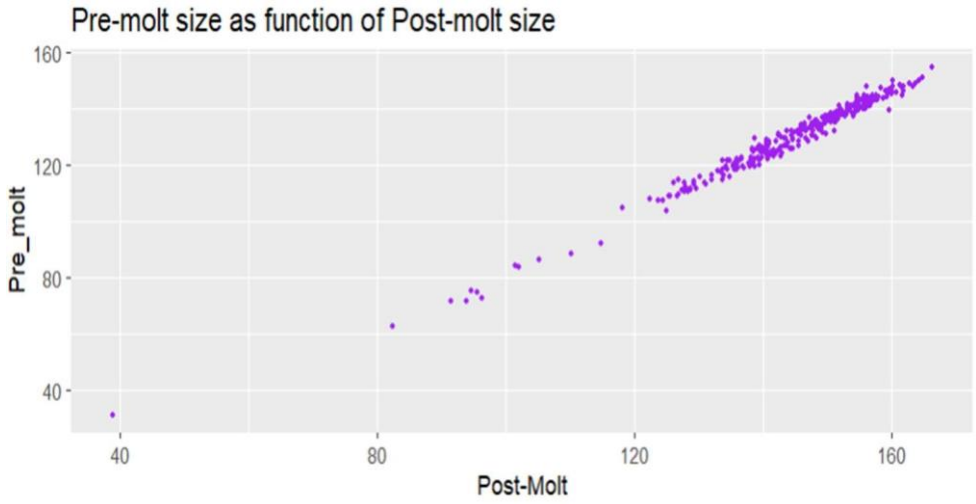

Figure 2: Scatter plot between pre-molt size and post-molt size

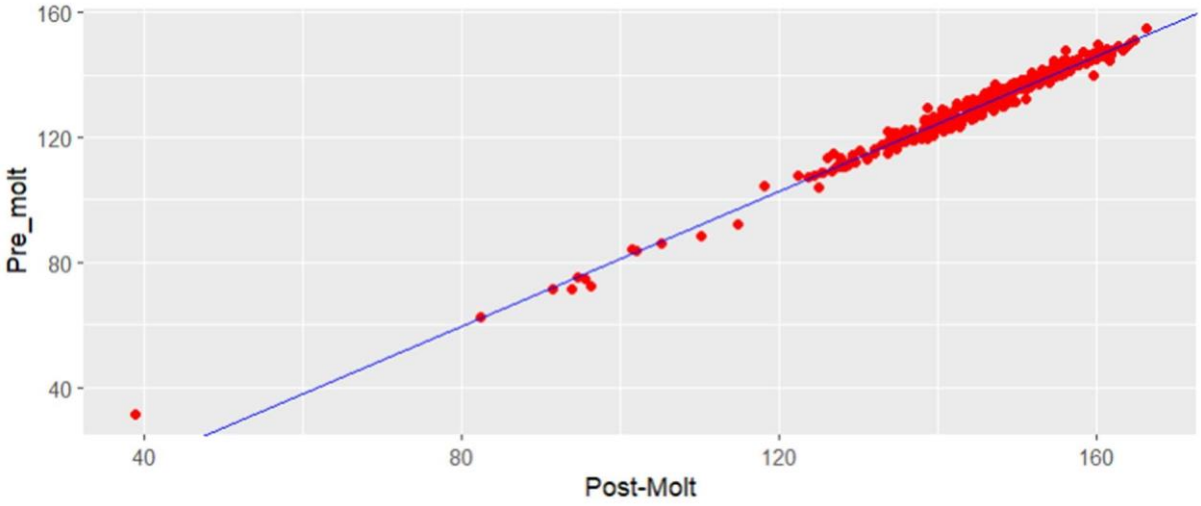

Figure 3:Linear regression relation between post-molt size and pre-molt size

Figure 3 provides a fascinating insight into the relationship between pre-molt and post-molt carapace sizes in

Dungeness crabs. The scatter plot in the figure represents individual observations in our data, while the striking red line passing through the scattered points is the result of a simple linear regression analysis. The analysis demonstrates that the relationship between pre-molt size and post-molt size is linear, indicating that Dungeness crabs exhibit consistent growth patterns over time, which may be influenced by various environmental factors. By gaining a better understanding of the factors that influence these growth patterns, we may be better equipped to manage and conserve this species in the future.

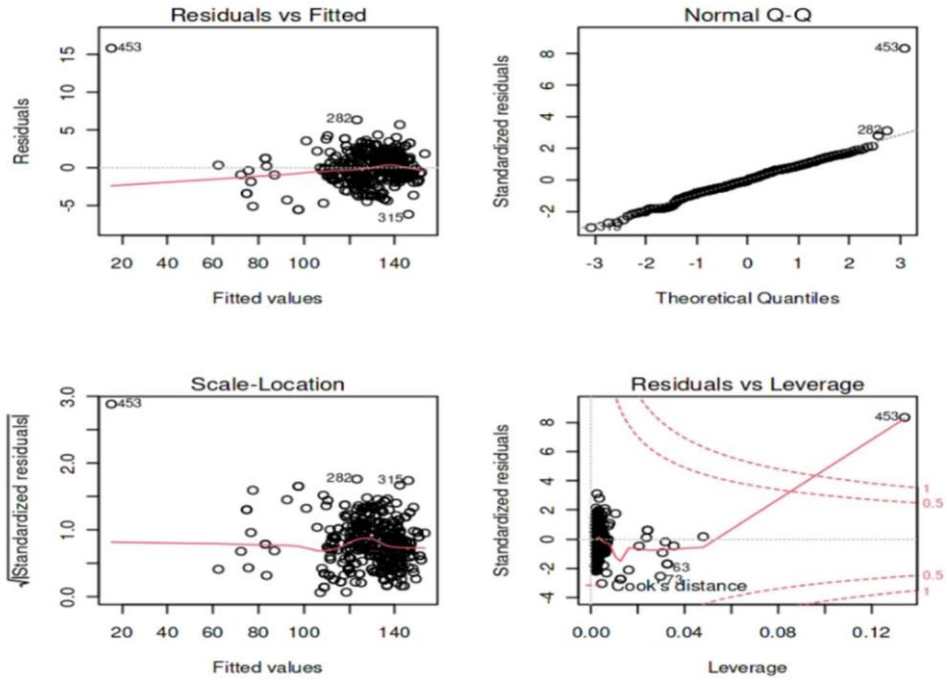

Figure 4: Heteroscedasticity with the help of Plots

Appendix C : summary(data1)

sd(data1$`Post-Molt`)

sd(data1$Pre_molt)

install.packages("moments")

library(moments)

```
skewness(data1$`Post-Molt`)
skewness(data1$Pre_molt)

kurtosis(data1$`Post-Molt`)
kurtosis(data1$Pre_molt)

install.packages('ggplot2')
library(ggplot2)

install.packages('dplyr')
library(dplyr)

data1 %>%
  ggplot(aes(x=Post_Molt)) +
  geom_histogram(aes(y=..density..), alpha=0.5, col='blue') +
  geom_density(aes(y=..density..), col='red', lwd=1) +
  ggtitle("Post-molt histogram")

data1 %>%
  ggplot(aes(x=Pre_molt)) +
  geom_histogram(aes(y=..density..), alpha=0.5, col='blue') +
  geom_density(aes(y=..density..), col='red', lwd=1) +
  ggtitle("Pre-molt histogram")
```

```
data1 %>%
  ggplot(aes(x=Post_Molt)) +
  geom_histogram(aes(y=..density..), color='black', fill='yellow') +
  geom_density(aes(y=..density..), color='blue', lwd=0.5) +
  geom_histogram(aes(x=Pre_molt, y=..density..), color='red', fill='green', alpha=0.2) +
  geom_density(aes(x=Pre_molt, y=..density..), color='plum', lty=1, lwd=0.5) +
  labs(x="Molt values") +
  ggtitle("Overlaying of Smooth Histograms for Each Variable")

data1 %>%
  ggplot(aes(x=Post_Molt, y=Pre_molt)) +
  geom_point(col='purple', pch=20) +
  ggtitle("Pre-molt size as function of Post-molt size")

linear_regression <- lm(data1$Pre_molt ~ data1$Post_Molt)
summary(linear_regression)

data1 %>%
  ggplot(aes(x=Post_Molt, y=Pre_molt)) +
  geom_point(col='red') +
  geom_abline(intercept=-26.785511, slope=1.083216, col='blue')

pearson_cor <- cor(data1$Post_Molt, data1$Pre_molt, method="pearson")
print(pearson_cor)
```

```
residuals <- resid(linear_regression)

summary(residuals)


qqnorm(residuals)

qqline(residuals)


shapiro.test(residuals)


plot(data1$Pre_molt, residuals, xlab="Pre-molt values", ylab="residuals", main="Residual
analysis")

abline(0,0)


par(mfrow=c(2,2))

plot(linear_regression)
```