Fibropapilloma Virus in Hawaiian Green Sea Turtles

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Original Datasets Obtained

1. **The study conducted by George Balaz analyzed the strandings of green sea turtles in Hawaii in relation to fishing practices, disease, and vessel traffic in regards to proximity and space.**

2. **The water quality data we are using was collected by the University of Hawaii Sea Grant Program to assess nearshore water quality in Hawaiian waters over a 15 year time period.**

- What is turtle fibropapillomatosis (FP) ?
- Scientists Balaz, Aguirre, Haines, Herbst, and Klein

Research Questions

- ➔ Is there a difference in the frequency of fibropapillomatosis in Hawaiian green sea turtles with changes in the water quality parameters: temperature, pH, and salinity.
- ➔ Is there a difference in mortality rates in Hawaiian green sea turtles with changes in the water quality parameters: temperature, pH, and salinity.
- ➔ Is there an association in the frequency of fibropapillomatosis and mortality in Hawaiian green sea turtles?

The Data

To increase usability we combined the datasets from the two studies. In our first dataset concerning fibropapillomatosis in Hawaiian green sea turtles we use 3 variables: year, fibropapillomatosis (fp), and life status. In our next dataset of water quality records in Hawaii we use an additional 3 variables: pH, temperature, and salinity.

Observations: 2,031

Type of variables:

Year: discrete integer

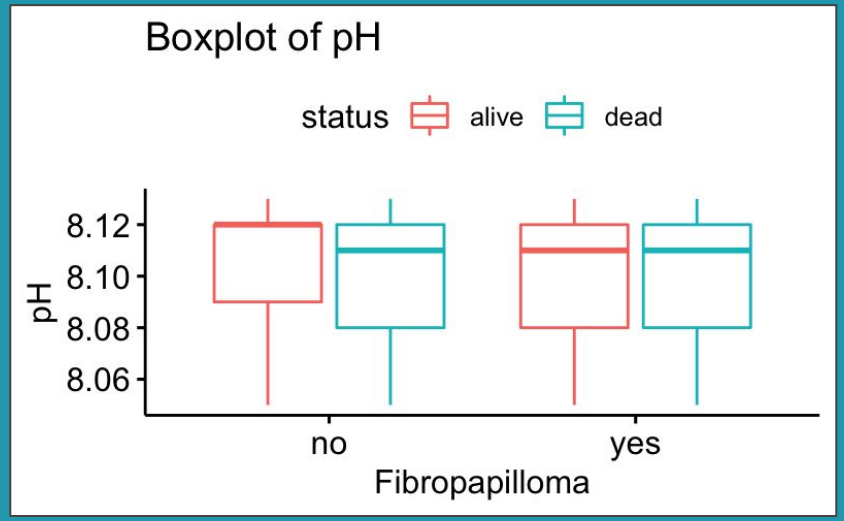
Fp: factor

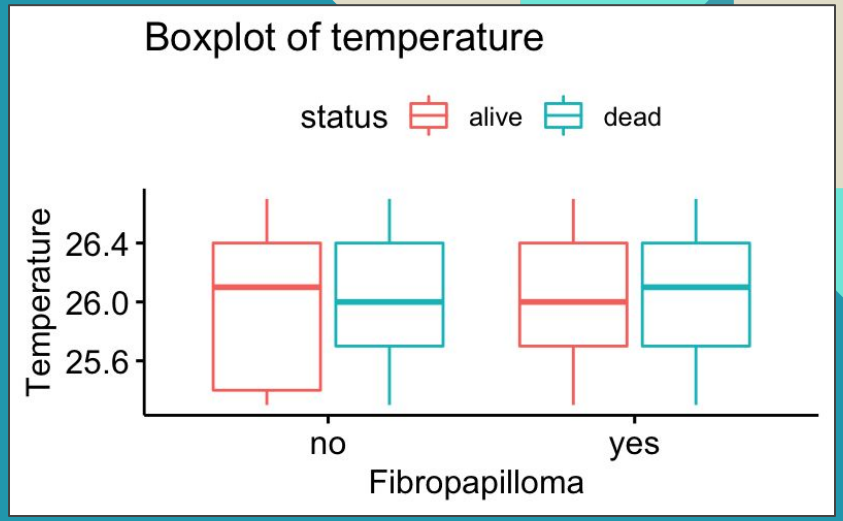
Life status: factor

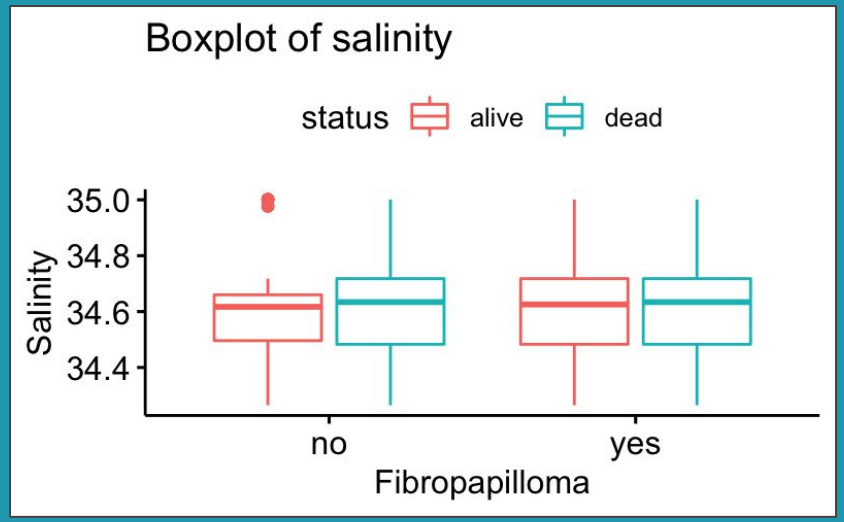
pH: continuous numeric

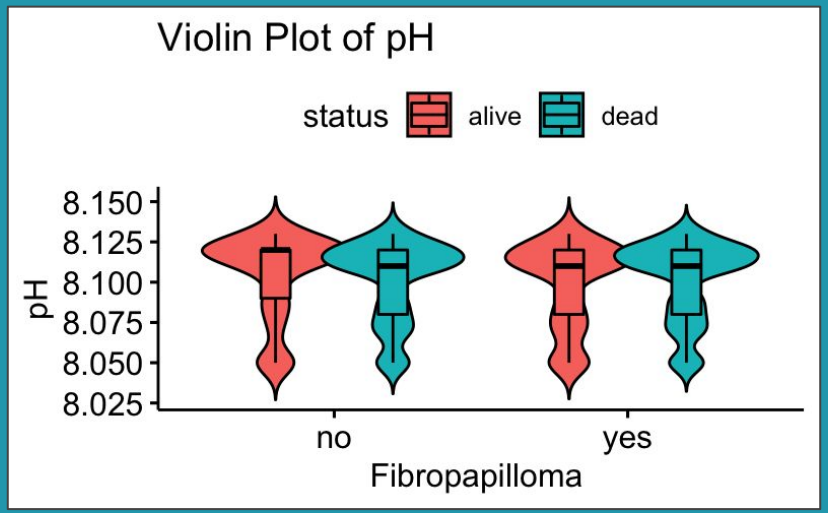
Temperature: continuous numeric

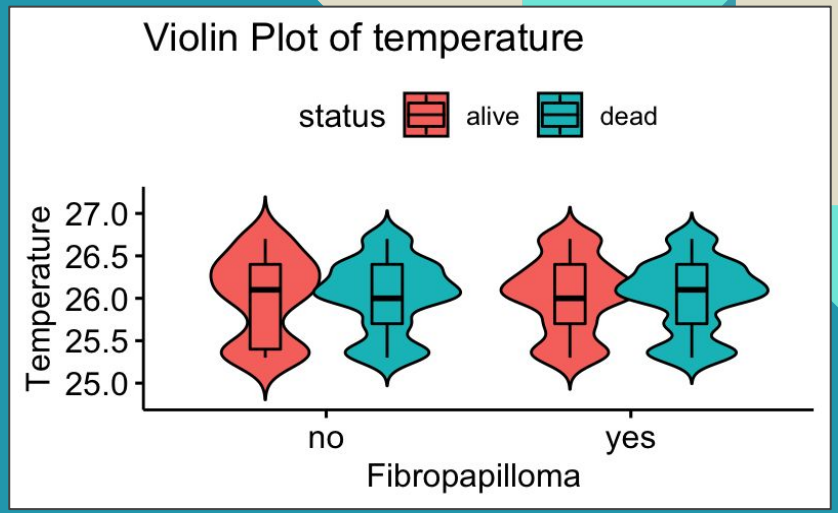
Salinity: continuous numeric

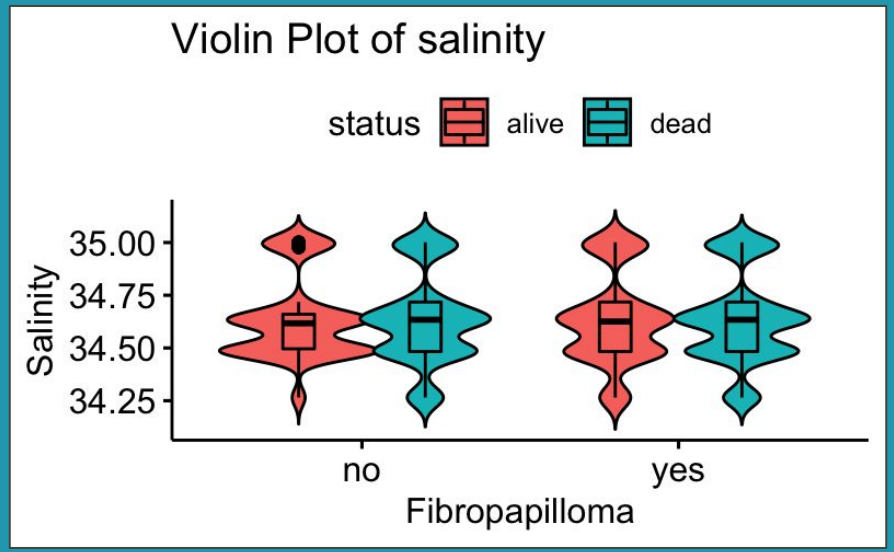

Boxplot of pH
status
alive
dead
pH
8.12
8.10
8.08
8.06
no
yes
Fibropapilloma

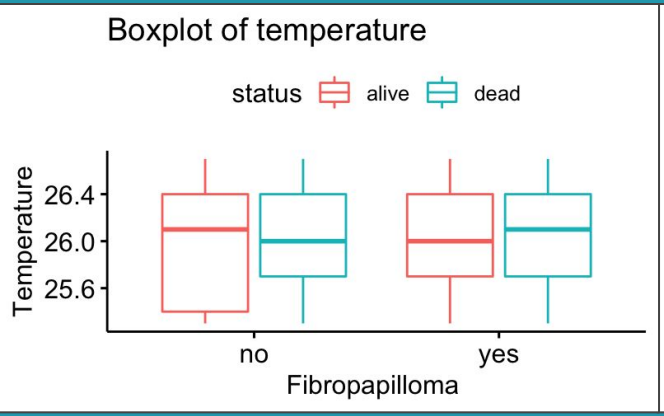

Boxplot of temperature
status
alive
dead
Temperature
26.4
26.0
25.6
no
yes
Fibropapilloma

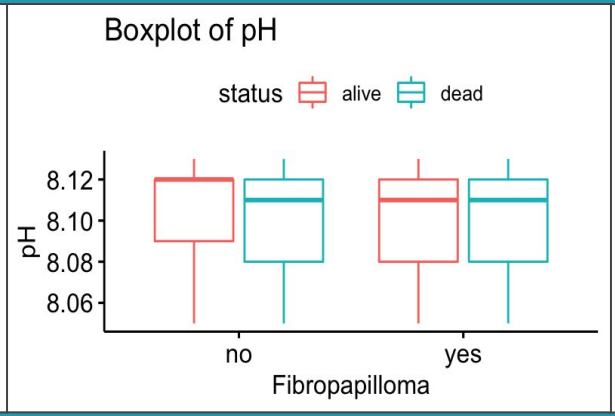

Boxplot of salinity
status
alive
dead
Salinity
35.0
34.8
34.6
34.4
no
yes
Fibropapilloma

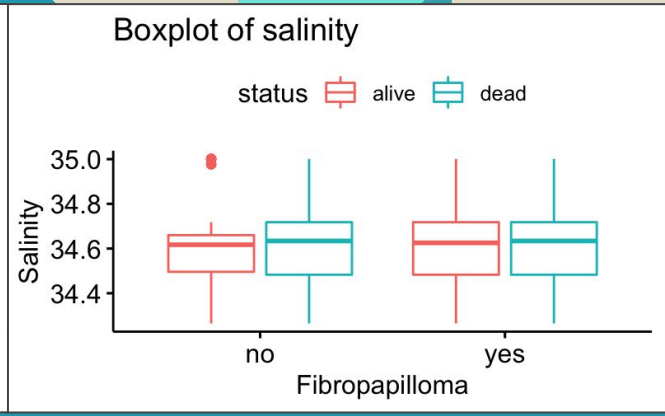

Violin Plot of pH
status
alive
dead
pH
8.150
8.125
8.100
8.075
8.050
8.025
no
yes
Fibropapilloma

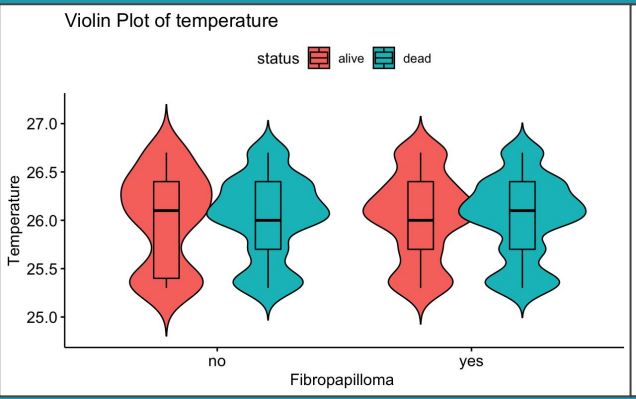

Violin Plot of temperature
status
alive
dead
Temperature
27.0
26.5
26.0
25.5
25.0
no
yes
Fibropapilloma

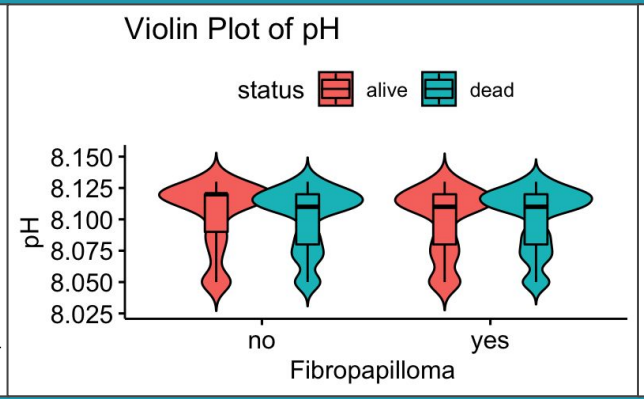

Violin Plot of salinity
status
alive
dead
Salinity
35.00
34.75
34.50
34.25
no
yes
Fibropapilloma

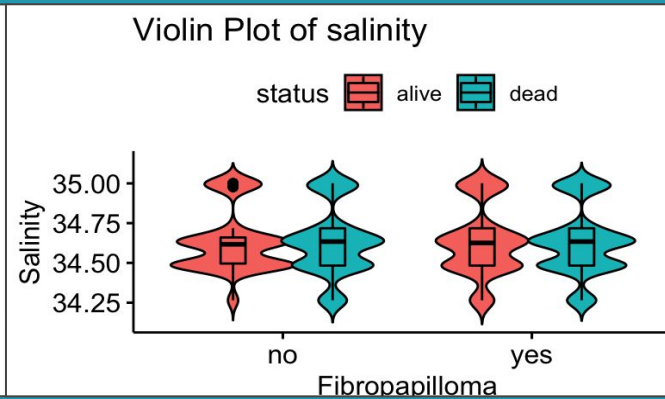

Boxplot of temperature
status alive dead
Temperature
26.4
26.0
25.6
no
yes
Fibropapilloma

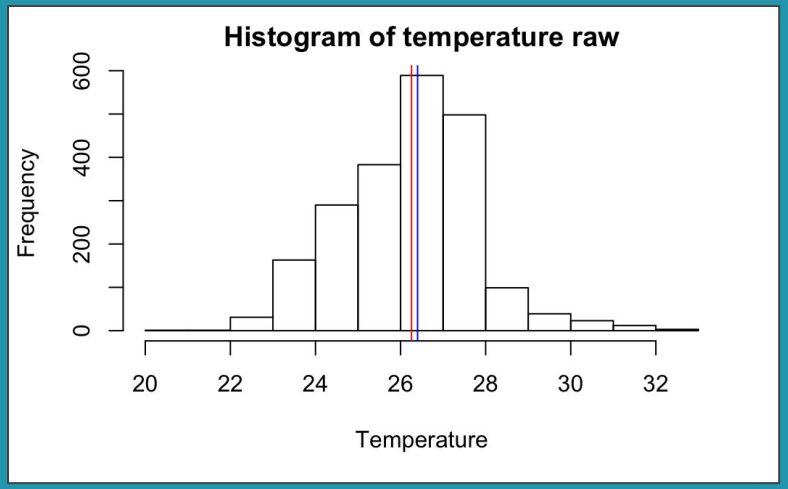

Boxplot of pH
status alive dead
pH
8.12
8.10
8.08
8.06
no
yes
Fibropapilloma

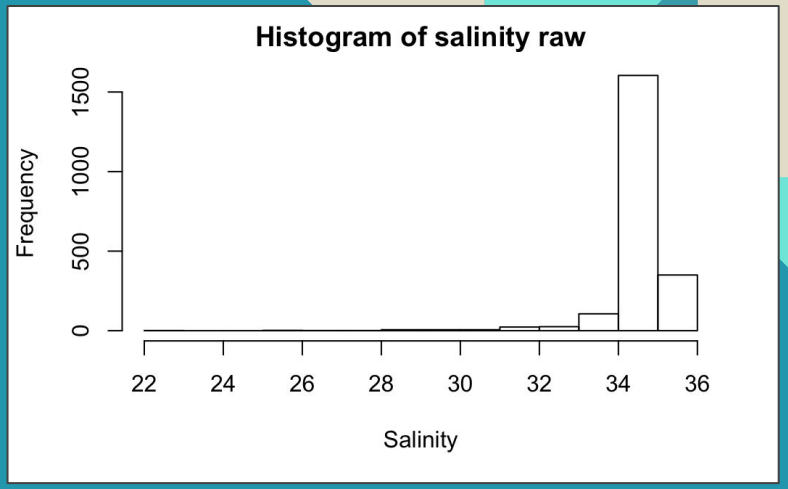

Boxplot of salinity
status alive dead
Salinity
35.0
34.8
34.6
34.4
no
yes
Fibropapilloma

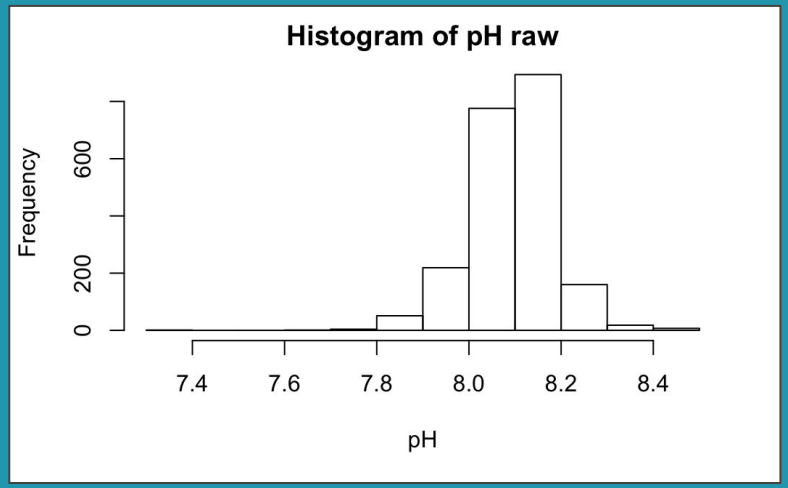

Violin Plot of temperature
status alive dead
Temperature
27.0
26.5
26.0
25.5
25.0
no
yes
Fibropapilloma

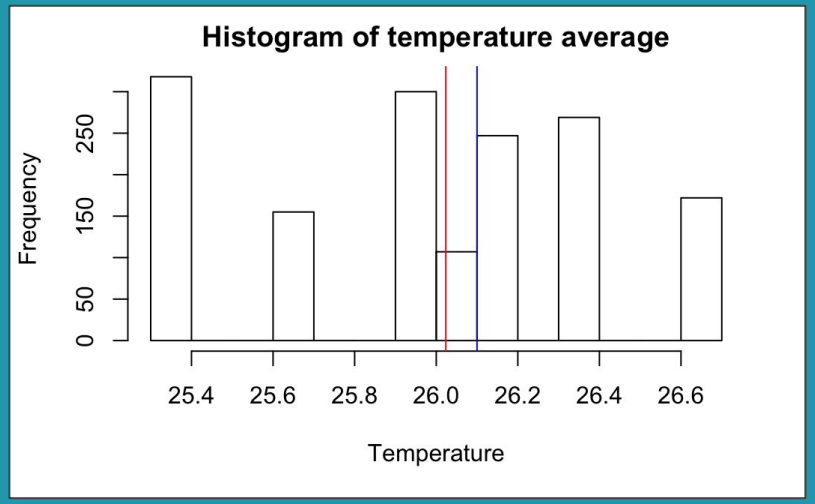

Violin Plot of pH
status alive dead
pH
8.150
8.125
8.100
8.075
8.050
8.025
no
yes
Fibropapilloma

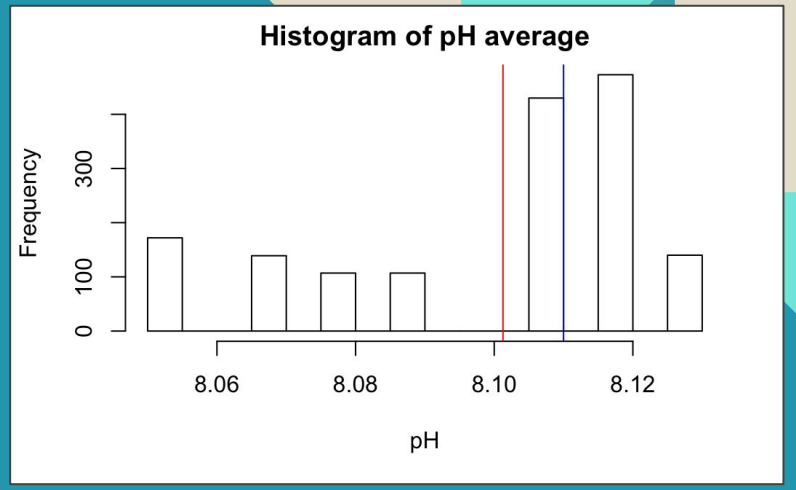

Violin Plot of salinity
status alive dead
Salinity
35.00
34.75
34.50
34.25
no
yes
Fibropapilloma

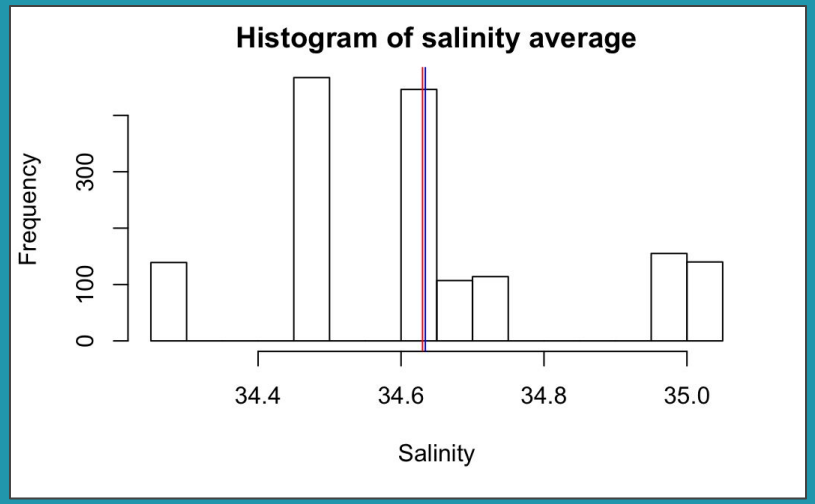

Histogram of temperature raw
Frequency
0
200
400
600
20
22
24
26
28
30
32
Temperature

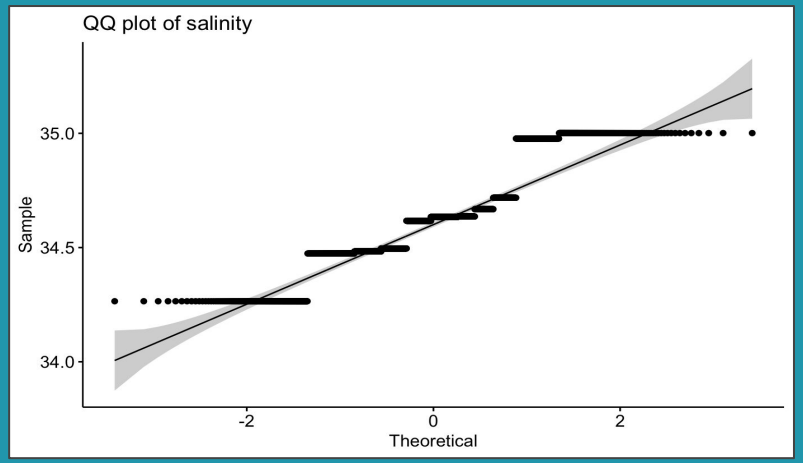

Histogram of salinity raw
Frequency
0
500
1000
1500
22
24
26
28
30
32
34
36
Salinity

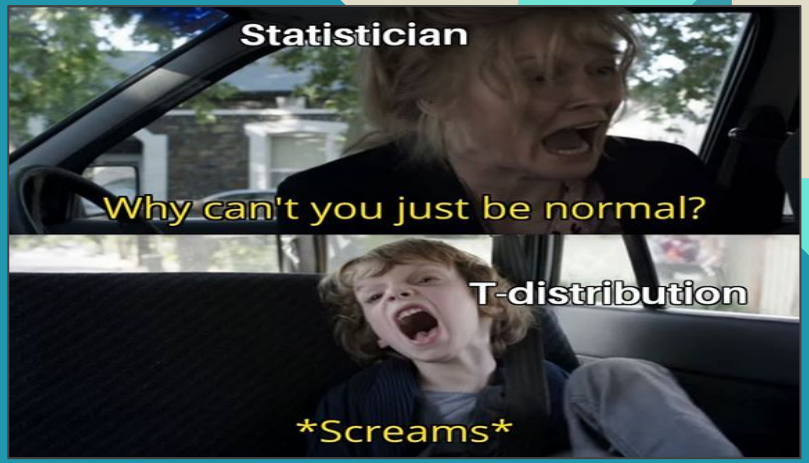

Histogram of pH raw
Frequency
0
200
600
7.4
7.6
7.8
8.0
8.2
8.4
pH

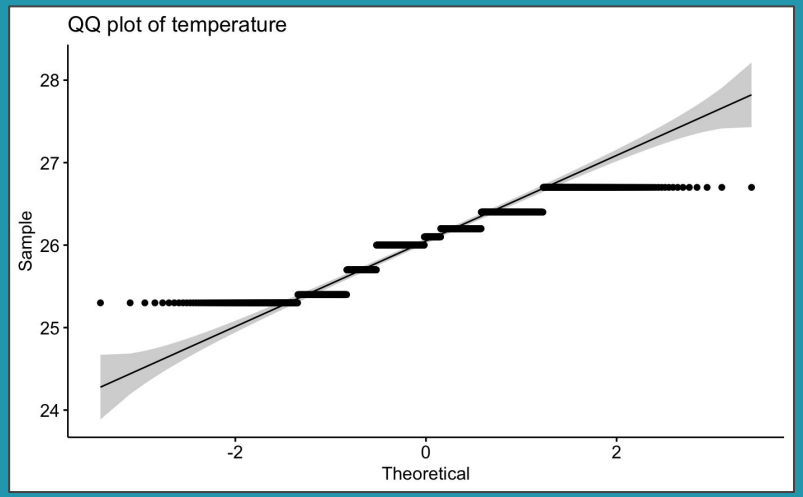

Histogram of temperature average
Frequency
0
50
150
250
25.4
25.6
25.8
26.0
26.2
26.4
26.6
Temperature

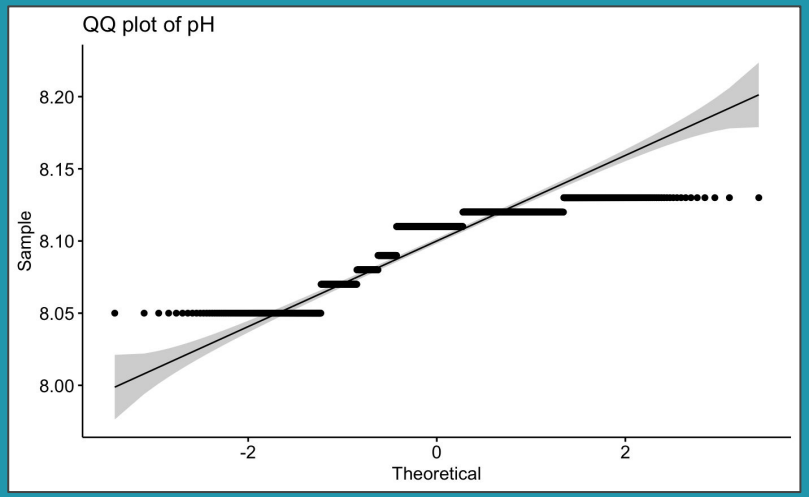

Histogram of pH average
Frequency
0
100
300
8.06
8.08
8.10
8.12
pH


Histogram of salinity average
Frequency
0
100
300
34.4
34.6
34.8
35.0
Salinity


QQ plot of salinity
Sample
35.0
34.5
34.0
-2
0
2
Theoretical


Statistician
Why can't you just be normal?
T-distribution
Screams


QQ plot of temperature
Sample
28
27
26
25
24
-2
0
2
Theoretical


QQ plot of pH
Sample
8.20
8.15
8.10
8.05
8.00
-2
0
2
Theoretical

Tests Conducted

Two Mann- Whitney Tests

- Status- compares median values of “dead” or “alive” turtles for each parameter
- Fibropapillomatosis-compares median values of turtles with and without fp for each water quality parameter

Chi- Square Analysis

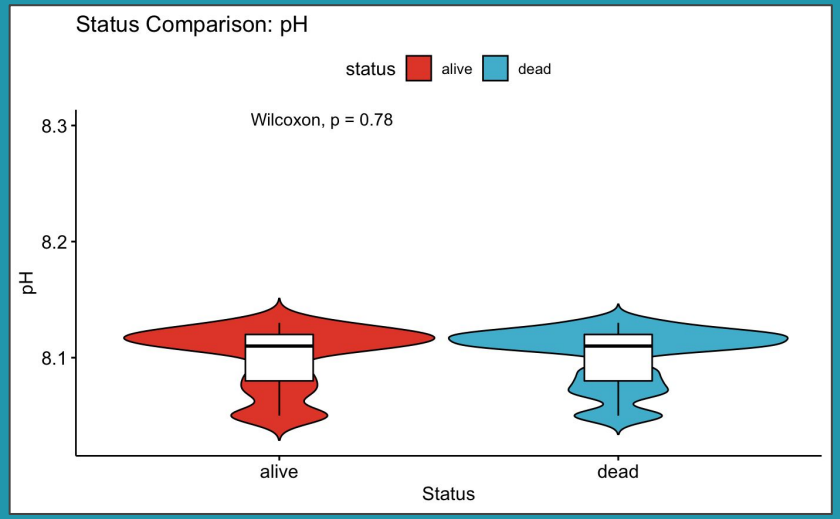
Mann-Whitney Test for Status

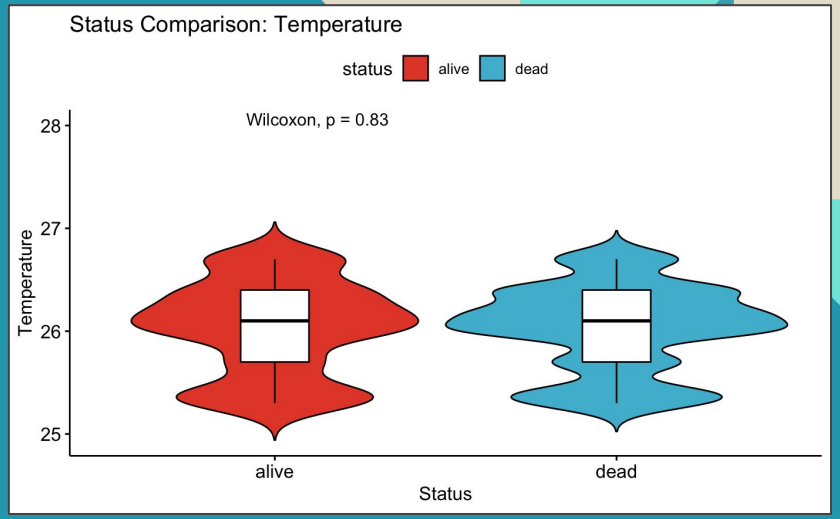
Two- Way Test

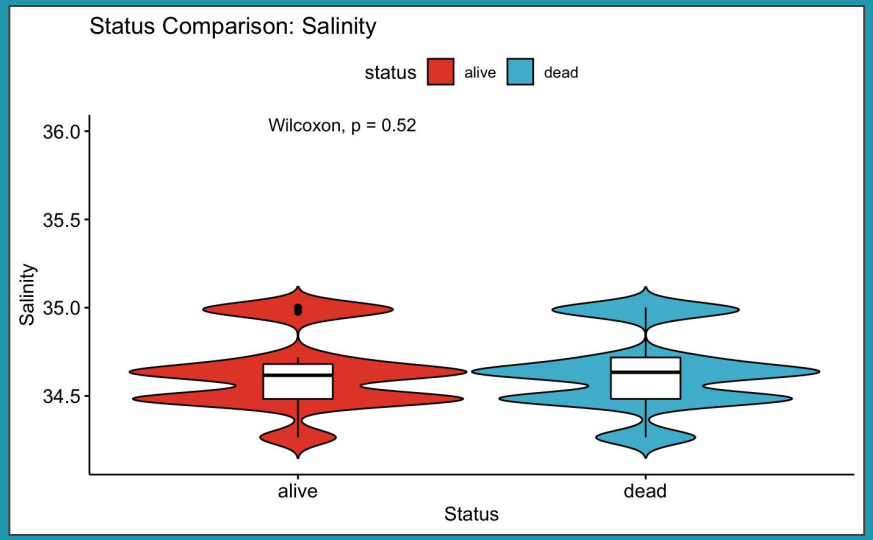
```
Temperature
W = 248487, p-value = 0.8296

pH
W = 248931, p-value = 0.783

Salinity
W = 241574, p-value = 0.5154
```

One- Way Test

```
Temperature
W = 248487, p-value = 0.4148

pH
W = 248931, p-value = 0.3915

Salinity
W = 241574, p-value = 0.7423
```


Status Comparison: pH
status
alive
dead
Wilcoxon, p = 0.78
8.3
8.2
8.1
pH
alive
dead
Status


Status Comparison: Temperature
status
alive
dead
Wilcoxon, p = 0.83
28
27
26
25
Temperature
alive
dead
Status


Status Comparison: Salinity
status
alive
dead
Wilcoxon, p = 0.52
36.0
35.5
35.0
34.5
Salinity
alive
dead
Status

Mann-Whitney Test for Fibropapillomatosis

Two - Way Test

Temperature
W = 289537, p-value = 0.851

pH
W = 298980, p-value = 0.1908

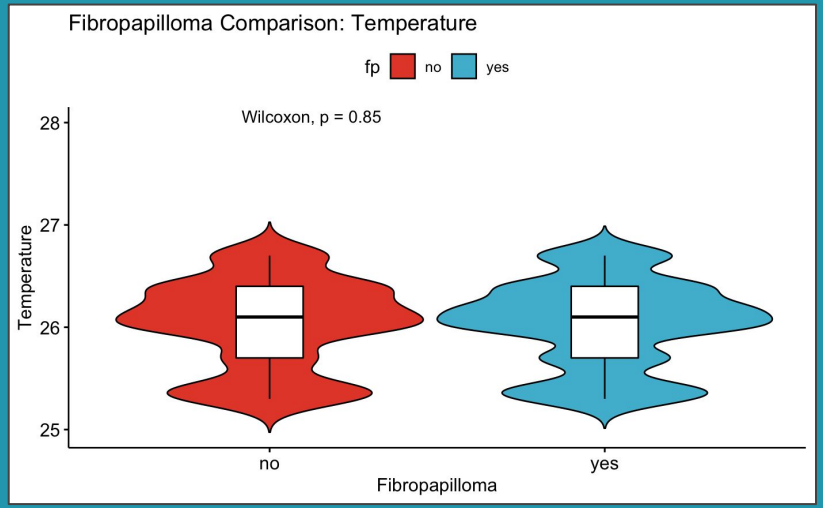
Salinity
W = 286679, p-value = 0.8855

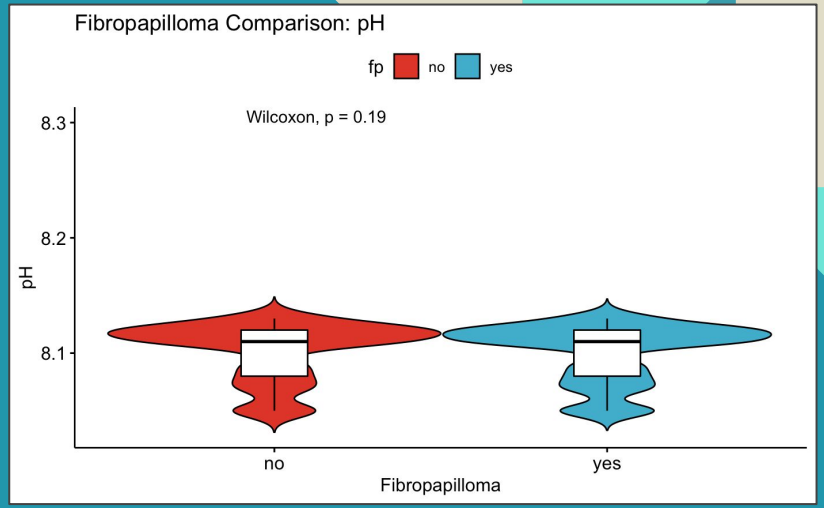
One- Way Test

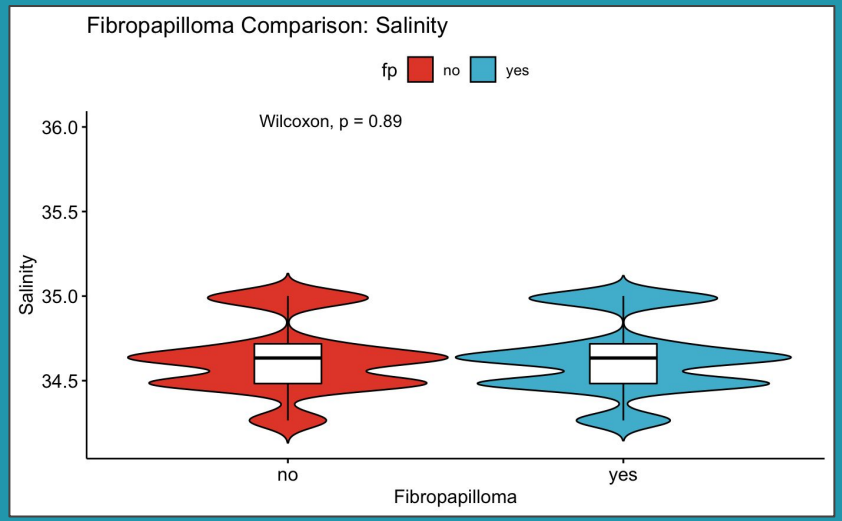
Temperature
W = 289537, p-value = 0.4255

pH
W = 298980, p-value = 0.09538

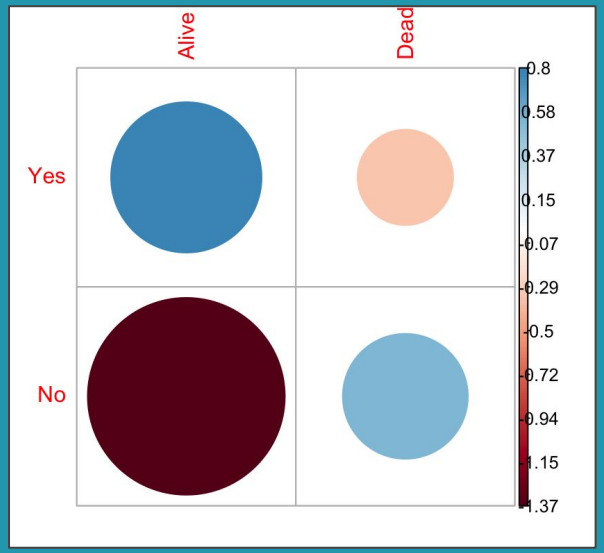
Salinity
W = 286679, p-value = 0.5573

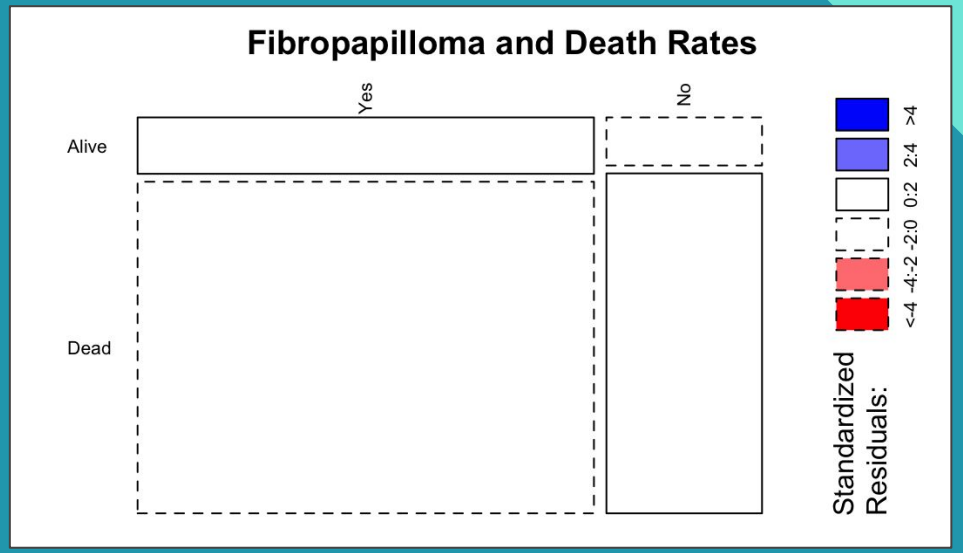

Fibropapilloma Comparison: Temperature
fp
no
yes
Wilcoxon, p = 0.85
28
27
26
25
Temperature
no
yes
Fibropapilloma


Fibropapilloma Comparison: pH
fp
no
yes
Wilcoxon, p = 0.19
8.3
8.2
8.1
pH
no
yes
Fibropapilloma


Fibropapilloma Comparison: Salinity
fp
no
yes
Wilcoxon, p = 0.89
36.0
35.5
35.0
34.5
Salinity
no
yes
Fibropapilloma

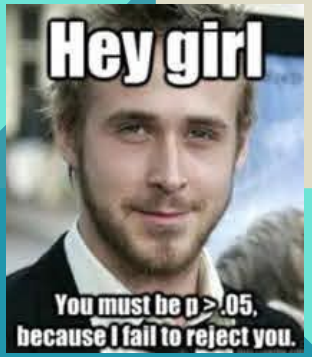
Chi Square Analysis





Ho: There is not an association between death rates and the presence of fibropapilloma virus.

X-squared = 2.7531, df = 1, p-value = 0.09706



Conclusion

We found no significant difference in FP, nor mortality rates, for the Hawaiian green sea turtles in regards to salinity, temperature, or pH found within the analysis of our data. Our studies have shown that these three variables have no affect over whether or not the Hawaiian green sea turtles develop FP in their lifetime, though other studies have said otherwise. There hasn't been enough research conducted to confidently say whether or not these variables actually cause FP or not.