Improving the lives of released sea turtles

Analyzing data from the Cooperative Marine Turtle Tagging Program

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1. Introduction

Sea turtles are often the focus of conservation. Some of these conservation efforts focus on rehabilitating and releasing injured or otherwise unwell turtles. While the intentions are well, the treatment and handling of these turtles could have a negative impact on survival rate.

Sea turtles are important to conserve for multiple reasons. All of which eventually affect us. Turtle nests on beaches help prevent eroding; migration helps spread “aquatic hitchhikers” like barnacles and other small crustaceans, remoras, algae, and diatoms (SEE Turtles, n.d.); and trimming of seaweed and corals help with the breeding of marine animals that are higher in demand, for example: shrimps and tuna. Without healthy seagrass beds, reproduction of these animals will not take place successfully and the entire food chain will be affected, eventually causing the supply of food sources for humans to decline (Siew, n.d.).

The data used in this research originates from the Cooperative Marine Turtle Tagging Program. It contains sea turtle tagging records on rehabilitated and released sea turtles from NOAA Galveston. The database is a summary of records and is derived from paper data sheets submitted to the Cooperative Marine Turtle Tagging Program CMTTP at the Archie Carr Center for Sea Turtle Research ACCSTR, University of Florida, Gainesville (Higgins, 2015). The turtles get tagged so their progress can be evaluated when these turtles get recaptured.

This investigation will analyze whether certain handling- and capture conditions result in a higher mortality rate among released sea turtles.

2. Research Question & Hypothesis

The dataset contains various data including if the turtle was later found deceased. It's interesting to see if certain handling or conditions have a correlation with the mortality rate.

2.1. Hypothesis 1

Hypothesis 1: The project type does not effect if the turtle was later found deceased.

The database uses the statistic "project type" to indicate: Means by which the turtle was made available for examination.

Project type might have an effect on the turtle survival rate. Capture in certain extreme conditions might mean the turtle has permanent damage that decreases the survival chances. It might also indicate the tendency for 'risky' behavior of the specific turtle.

2.2. Hypothesis 2

Hypothesis 2: Tag scars do not effect if the turtle was later found deceased.

Tag scars are left when a flipper tag tears out. It usually forms a highly visible V notch in the flipper.

Tag scars might also be related to increased deaths, but there would be more variables to consider. Perhaps older types of tags are more prone to leave scars and thus we're dealing with older turtles. Therefore, the increased death rate might simply be due to the higher average age.

3. Experimental Design

Both hypothesizes consists of nominal variables and are comparing 2 variables with each other. Therefore, a chi-square test for independence for both hypotheses is the right choice. Cramer's V will be used to measure effect size.

4. Results

This section will cover the results of both hypotheses.

4.1. Hypothesis 1

This sub-section covers the results of the hypothesis: The project type does not effect if the turtle was later found deceased.

Chi-square test

Table 1: Observed cases of project type vs found deceased

Observed	Later found deceased	Not found deceased	Total
Stranding	4	297	301
Stranding-line entanglement	0	3	3
Hook and Line	4	204	208
Nesting	0	37	37
Cast/Tangle Net	0	2	2
Offshore Capture	0	1	1
Dredge Take	0	2	2
Found in crab trap	0	1	1
Platform Blast Site	0	1	1
Netted out of surf by fisherman	0	1	1
Boat Strike	0	1	1
Incidental Capture	0	2	2
Hand Catch	0	1	1
Total	8	553	**561**

Table 2 Expected cases of project type vs found deceased

Expected	Later found deceased	Not found deceased	Total
Stranding	4.292	296.707	301
Stranding-line entanglement	0.043	2.957	3
Hook and Line	2.966	205.034	208
Nesting	0.527	36.472	37
Cast/Tangle Net	0.029	1.971	2
Offshore Capture	0.014	0.986	1
Dredge Take	0.029	1.971	2
Found in crab trap	0.014	0.986	1
Platform Blast Site	0.014	0.986	1
Netted out of surf by fisherman	0.014	0.986	1
Boat Strike	0.014	0.986	1
Incidental Capture	0.029	1.971	2
Hand Catch	0.014	0.986	1
Total	8	553	**561**

$\chi 2$: 1.1376 DF: 12

The two-tailed P value equals 1.0000. By conventional criteria, this difference is considered to be not statistically significant. If a=0.05 then the χ2-statistic needed to be 21.026 or bigger.

Note: rule of thumb is that each expected cell should contain at least 5 participants. This is not the case with all but 3 of the project type variables.

Effect size measure

Cramer's V: 0.045030831

A score of 0.1 would indicate a small effect. Our score is less than half of that, so It's safe to say It's a very small effect size.

Chi-square test 2

Because a lot of cells contained 0, 1 or 2 samples, an analysis of the 3 options with more samples is performed separately. This increases the chance of finding a correlation.

Table 3: Observed cases of top 3 options for project type vs found deceased

Observed	Later found deceased	Not found deceased	**Total**
Stranding	4	297	301
Hook and Line	4	204	208
Nesting	0	37	37
Total	8	538	**546**

Table 4: Expected cases of top 3 options for project type vs found deceased

Expected	Later found deceased	Not found deceased	**Total**
Stranding	4,410	296,590	301
Hook and Line	3,048	204,952	208
Nesting	0,542	36,458	37
Total	8	538	**546**

χ2: 0.8905 DF: 2

The two-tailed P value equals 0.6407. By conventional criteria, this difference is considered to be not statistically significant. If a=0.05 then the χ2-statistic needed to be 5.991 or bigger.

Effect size measure 2

Cramer's V: 0.040385236

A score of 0.1 would indicate a small effect. Our score is less than half of that, so It's safe to say It's a very small effect size.

4.2. Hypothesis 2

This sub-section covers the results of the hypothesis: Tag scars do not effect if the turtle was later found deceased.

Chi-square test

Table 5: Observed cases of tag scars vs found deceased

Observed	Tag scar	No tag scar	**Total**
Later found deceased	0	8	8
Not found deceased	24	529	553
Total	24	537	**561**

Table 6: Expected cases of tag scars vs found deceased

Expected	Tag scar	No tag scar	**Total**
Later found deceased	0.34	7.66	8
Not found deceased	23.66	529.34	553
Total	24	537	**561**

χ2: 0.3602 DF: 1

The two-tailed P value equals 0.5484. By conventional criteria, this difference is considered to be not statistically significant. If a=0.05 then the χ2-statistic needed to be 3.841 or bigger.

Note: rule of thumb is that each expected cell should contain at least 5 participants. This is not the case with the variables used in this comparison.

Effect size measure

Cramer's V: 0.025

A score of 0.1 would indicate a small effect. Our score is a quarter of that, so It's safe to say It's a very small effect size.

5. Conclusion

This section provides the conclusion of this research for both hypotheses.

5.1. Hypothesis 1

The sample size contains 561 specimen, but a lot of variables only contained 0, 1 or 2 turtles. Therefore the results are inconclusive for these variables. Further analysis of more datasets is advised.

For the 3 variables with more samples, this research suggests that project type does not affect mortality rate in sea turtles. Based on this, it is suggested to focus efforts elsewhere instead of preventing certain project types from happing. But, because the remaining 3 variables also lack a big enough sample size for each variable, this analysis is still inconclusive. Further analysis of more datasets is suggested.

Even though project type does not appear to effect mortality rate specifically for released turtles, it could still have an impact on mortality rate. For instance: dredge takes, nets and crab traps could result in turtles drowning; while beaching gives turtles the possibility of easily being spotted by humans. Research into this subject is suggested.

5.2. Hypothesis 2

With a dataset containing 561 turtles, there are 0 dead turtles with tag scars. While this suggests no correlation exists, a rule of thumb is to base conclusions on datasets with at least 5 samples for each variable combinations. Because this isn't the case with this dataset, the results are inconclusive.

Even if the hypothesis is not supported by this data, tag scars can still have a negative impact on the turtle's wellbeing and length of life. Research into why these scars exist is advised. If It's due to a specific type of tag then a solution can be very straight forward.

6. Source reference

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