|  |
| --- |
| CLIMATE CHANGE IMPACTS ON POLAR BEAR PHYSIOLOGY |
| krYSTIN CIPRIANO, NICK NATH, PAOLO ARCIAGA |
| A polar bear with a black background  Description automatically generated |
|  |

I. **PROJECT IDEA**

* Examine changes in body mass of Polar Bears to assess the physiological impact of climate change.
* Leverage the data collected from polar bears from the Southern Beaufort Sea during the years 1981-2017.
* Data include individual identification, demographic characteristics, year, concentrations of mass over time and sparse reproductive data.
* Use the above metrics to explore the relationship between the response of polar bear population and rapidly diminishing sea ice environment/climate change.

II. **DATA EXPLORATION**

1. Use Pandas to clean and format datasets!

* Data Import
  + Import the Dataset: Use pd.read\_csv() to load the dataset into a pandas DataFrame.
  + Initial Exploration: Use .head(), .info(), and .describe() to get an overview of the data types, number of non-null values, and statistical summaries of numerical columns.
  + Create a Pandas dictionary from the list.
* Data Cleaning
  + Manage Missing Values: Use .isnull() to identify missing values and .fillna() or .dropna() to manage them.
  + Data Type Conversion: Ensure correct data types using metric or Imperial.
  + Renaming Columns: Use. rename() to give columns clear, descriptive names.
* Filtering Data
  + Use float indexing to filter relevant data for the years concerned with climate change impact.
* Formatting Data
  + Convert columns with overlapping categories into single objects if needed.
  + Convert categorical variables such as Age, Sex, etc. into other categorical variables with .astype(‘category’)
  + Where possible, sort data values into BINS. This will help us categorize variables.

1. Jupyter Notebook Script for Data Exploration and Cleanup!

* Structured Documentation
  + Use Markdown cells to document the steps and rationale of the data exploration and cleanup process as shown in class.
* Code Organization
  + Organize the code into separate cells for each step of the data cleaning process.
  + Interactive Outputs:
  + Display DataFrames and statistics directly in the notebook after each significant step.
* Version Control
  + Use a version control system like GitHub and branching methodology to track changes in the Jupyter Notebook.

IV. DATA ANALYSIS

* Create a Jupyter notebook illustrating the final data analysis.
* Create a structured notebook with an introduction, methodology, data cleaning, analysis, visualizations, and conclusions.
* Perform statistical analyses, such as correlations between hormone levels and climate data.
* Use data to estimate the impact of climate variables on polar bear physiology.

V. DATA VISUALIZATION

Create 6-8 visualizations using Matplotlib (2 visualizations per question)

Time Series Analysis using a linear regression.

a. Plot mass levels over time to see trends.

* Boxplots:

b. Visualize the distribution of mass markers across different age groups.

* Scatter Plots:

c. Correlate environmental data (temperature) with physiological metrics.

* Histograms:

d. Show the frequency distribution of BMI across the population.

* Scatterplots:

e. Display correlations between different physiological parameters.

* Bar Charts:

f. Compare average hormone levels between bears with and without dependent young.

* Line Plots:

g. Track changes in oxidative stress markers over the years.

* Pie Charts:

h. Illustrate the proportion of bears in different health status categories.

VI. CONCLUSIONS: NUMERICAL SUMMARY AND VISUALIZATION

Numerical Summary:

o Present statistical summaries such as mean, median, mode mass levels by year and their changes. Also incorporate Standard Deviation and P value.

Visualization Summary:

o Use graphs to highlight key findings, e.g., a line graph showing a trend in reduced BMI correlating with rising temperatures. Leverage Quantiles, Quartiles and Outliers to determine defined regions of dataset and their skewness.

VII. IMPLICATIONS OF FINDINGS

Conservation Strategies:

o If physiological stress increases with temperature rise, suggest targeted conservation efforts.

Policy Recommendations:

o Findings could inform policy on greenhouse gas emissions and Arctic industrial activity.

Public Awareness:

o Use the data to raise awareness about the impact of climate change on Polar Bears.