Nicholi Brown Final Project Tutorial: Visualization of Leopard Seal Observations in Tierra del Fuego

The purpose of this code is to visualize how leopard seals utilize their habitat. Behaviors such as hauling out on the ice are part of the life history patterns of leopard seals. As predominantly solitary animals, how individuals within a population share space aids our understanding of resource use and partitioning. The data used for this visualization was recorded during a recent field expedition to Tierra del Fuego in December of 2023. Over five days, six leopard seals were observed, and the GPS coordinates of each seal were recorded at each instance of observation. For the purposes of this tutorial, the recorded GPS locations for each seal were swapped for randomized coordinates in an alternate location, a step taken to maintain the integrity of the study side in which the seals were directly observed. Observations were collected in an Excel table and served as the basis for the following tutorial. First, three packages were loaded into R studio. These include ‘ggmap’ and ‘ggplot2’. These packages were essential to visualize a terrain map of our study site. Furthermore, the package “readxl’ was installed to read the ‘raw’ data into R from Excel. To select the region of interest, I submitted the GPS coordinates of our study site to Open Street Maps. This online resource allows the user to submit coordinates of an area, and then upload these selected areas into R to create visualizations. After using the Open Street Maps to locate our study site, I exported the map via border ‘guides’ that can utilized in R code to create bounds (left, right, lower, upper) for my terrain map. To gain access to the Stadia Maps program in R, an API key needed to be registered. After the map is loaded, one can select the ‘guides’ provided via Stamen Maps to create the border and determine the resolution via zoom. Importing the data relied on the use of the ‘readxl’ package. After loading the data into R, I selected columns from the data set that were of interest for the visualization, specifically the name of the seal, date, and GPS coordinates. The data in the GPS coordinates column were in latitude and longitude; however, these need to be separated. To do so, a separate function was used, and values from either side of the ‘,’ in the original column were placed in a Latitude and Longitude column. This new data set was assigned a new name. Originally, when attempting to use this data set to create the visualization, an error message was displayed. The issue is that R was reading the latitude and longitude measurements as character data, yet ‘ggmap’ requires numeric data to plot visualizations. To remedy this, the ‘as.numeric’ function was utilized to coerce R into considering the latitude and longitude data as numeric values. Now, the data was ready to be layered atop the terrain map. The ‘geom\_point function of the ‘ggmap’ package was implemented to create a visualization that featured the locations of each seal observation. Plotting longitude on the X-axis, and latitude on the Y-axis, the locations of the observed seals are layered atop the terrain map. To enhance graph interpretation, each seal was assigned a unique shape and color. Furthermore, data labels and a title were added and scaled to make the final graph more aesthetically pleasing. For the chart to be made accessible to a wider audience, the ‘viridis’ color scheme was applied.

References

1. Hiruki LM, Schwartz MK, Boveng PL. Hunting and social behaviour of leopard seals (hydrurga leptonyx) at seal island, south shetland islands, antarctica. Journal of Zoology. 1999;249(1):97-109. doi:10.1111/j.1469-7998.1999.tb01063.x
2. Lemenkova, Polina, Using R Packages 'tmap', 'raster' and 'ggmap' for Dartographic Visualization: An Example of Dem-Based Terrain Modelling of Italy, Apennine Peninsula (December 22, 2020). Zbornik radova - Geografski fakultet Univerziteta u Beogradu, 68, 99-116. DOI: 10.5937/zrgfub2068099L
3. Moraga P, Baker L. Rspatialdata: a collection of data sources and tutorials on downloading and visualising spatial data using r. F1000Res. 2022;11:770. doi:10.12688/f1000research.122764.1
4. Kahle D, Wickham H. Ggmap: spatial visualization with ggplot2. *The R Journal*. 2013;5(1):144. doi:10.32614/RJ-2013-014
5. Kienle, Sarah S., et al. "Plasticity in the Morphometrics and Movements of an Antarctic Apex Predator, the Leopard Seal." *Frontiers in Marine Science*, vol. 9, 2022, p. 976019, [https://doi.org/10.3389/fmars.2022.976019. Accessed 26 Mar. 2024](https://doi.org/10.3389/fmars.2022.976019.%20Accessed%2026%20Mar.%202024).
6. Staniland IJ, Ratcliffe N, Trathan PN, Forcada J. Long term movements and activity patterns of an Antarctic marine apex predator: The leopard seal. *PLoS One*. 2018;13(6):e0197767. Published 2018 Jun 5. doi:10.1371/journal.pone.0197767