**ESM 206 – ASSIGNMENT 4**

***Spiny lobster abundance, community size structure, and fishing pressure along the Santa Barbara coast (2012 - 2018)***

**Due Monday 2019-11-18 at 8:00am PST. Submit one report per group via GauchoSpace.**

Read through the entire assignment before starting. **Follow instructions carefully.**

**Submit exactly and only what is requested.**

**For Assignment 4, you may work alone or in groups of two.**

**If you work in a group of two:**

* You will submit a single report with both members listed as coauthors
* You will be graded based on the same rubric as individual submissions
* Both members of the group will receive the same score
* We will not manage interpersonal conflicts that arise

For Assignment 4, you will prepare a cohesive, well-written and professionally presented “mini-report” **created entirely in R Markdown** to describe spiny lobster size and abundance collected for lobsters observed at five locations along the Santa Barbara coastline by researchers from the [Santa Barbara Coastal Long Term Ecological Research](http://sbc.lternet.edu/) program (SBC LTER).

To get started:

* Download the file ***lobster\_abundance\_sbc\_lter.csv***,which contains lobster size and abundance data you’ll need for this assignment
* Click here to familiarize yourself with the [data and metadata](https://portal.edirepository.org/nis/mapbrowse?scope=knb-lter-sbc&identifier=77&revision=newest)
* **Citation:** Reed D. 2019. SBC LTER: Reef: Abundance, size and fishing effort for California Spiny Lobster (*Panulirus interruptus*), ongoing since 2012. Environmental Data Initiative.<https://doi.org/10.6073/pasta/a593a675d644fdefb736750b291579a0>. Dataset accessed 10/30/2019.

**NOTE 1:** Read through the entire assignment prompt before starting. You probably want to hold off on writing the *Introduction* and *Data and Methods* sections until after you’ve completed your data analyses and visualizations.

**NOTE 2:** You will do everything for this report in R Markdown. We will look at your .Rmd to see your code, but you should **update code chunk settings so that only your final outputs show up in the knitted HTML**. In other words, don’t have your code or any warnings/messages show up in the knitted document.

**NOTE 3:** [Download and look at the example report](https://drive.google.com/file/d/1obY76hnrcNTBjWZnTp_mV7TDRsrtcINE/view?usp=sharing)

## What you are expected to include in your report:

1. **INTRODUCTION:** A short (7 - 8 sentence) introduction that helps the reader understand the purpose/motivation of the research, and previews the content of the report.
2. **DATA AND METHODS:** A brief ‘Data and Methods’ section (5 - 6 sentences) summarizing the data and how it was analyzed. Briefly describe the variables being studied in this report. Include the types of statistical tests performed, significance level used, and software (with version) for analysis.
3. **RESULTS**: Prepare finalized data visualizations and perform statistical analyses (as indicated) to do the following. You are expected to also add useful text that weaves the pieces together into a cohesive Results section (i.e., this should not just be a series of figures and without useful description & text flow between them).

**Results A: Visually explore changes in annual lobster abundance (counts) by site.** After grouping observations to find lobster counts for each **year**, create a **finalized** data visualization (no modeling/stats needed) showing changes in annual lobster abundance at the five sites over time. You should decide how to best present the data. Make your data visualization correct, clear, responsible, and professional. Details matter (e.g. is it easier to read a legend or label lines directly? How can I designate between MPA and non-MPA sites? And many more decisions!). **Add a figure caption below the graph.**

In text (above or below the graph for Results A), describe general / interesting trends that you observe for lobster abundance at the 5 sites.

**Results B. Visually explore lobster size distribution shifts by comparing lobster sizes in 2012 and 2018.** Visually explore the size distributions for lobsters observed at the 5 different sites in 2012, and in 2018 (i.e. you will have a total of 10 size distributions shown: for each of the 5 sites, one for 2012 and one for 2018). Make a finalized graph that clearly and professionally shows community size distributions at each site in the 2 years, allowing the reader to easily interpret distribution shifts. **Add a figure caption below the graph.**

In text, describe general / interesting trends that you see in community **size** structure at different sites (again, considering MPA vs. non-MPA status) for lobsters between 2012 and 2018.

**Results C. Compare mean lobster sizes at MPA vs. non-MPA sites in 2012 and 2018.** Here, for each year (2012 and 2018) consolidate the size observations into only two groups: MPA and non-MPA lobsters. Then answer the following four questions:

1. For 2012 observations, is there a significant difference in lobster size between MPA and non-MPA sites?
2. For 2018 observations, is there a significant difference in lobster size between MPA and non-MPA sites?
3. For MPA sites only, is there a significant difference in lobsters observed in 2012 vs. 2018?
4. For non-MPA sites only, is there a significant difference in lobsters observed in 2012 vs. 2018?

In your report for Results C, you should at least include:

* A finalized **table** (interactive or static) that includes **means**, **standard deviations**, and **sample sizes** for the two groups (MPA and non-MPA sites) in 2012 and 2018. **Add a caption (remember: table captions are above tables).**
* In text in your report, describe the outcome of the statistical hypothesis tests using **in-line** referencing (e.g. do not copy and paste values from the output). Remember: the *p*-value is not enough. You should also describe more meaningful metrics for comparison. Here are some things you might consider including in your description: the actual differences in mean size between groups, % changes, measure of uncertainty (e.g. confidence interval), etc.

1. **SUMMARY:** A brief summary of the major findings (pick 3 - 4) from your mini-report. A bullet-pointed list is fine, but the findings should be well-written, responsible (don’t overstate your findings), and refer to outcomes (e.g. figures, tables) in the Results section
2. **REFERENCES:** References (including for data sources & literature cited in your introduction) that were used to prepare the report. Reference formatting matters -

### WHAT YOU WILL SUBMIT FOR THIS ASSIGNMENT:

* Submit **ONE .Rmd** and **ONE final knitted HTML** for your completed report **per group** on GauchoSpace. No code or warnings / messages should appear in your knitted HTML. We will look at your code in the .Rmd.
* If you work in a group of two, **make sure both members are listed as authors** but only one of you should be submitting the .Rmd and HTML through GauchoSpace

### WHAT YOU WILL BE GRADED ON FOR THIS ASSIGNMENT:

* Does the introduction motivate the analyses and preview what is presented within it?
* Are the data and methods clearly and concisely described?
* Are data and statistics presented in graphs, tables, and text correct?
* Are graphs and tables responsible, clear, and professionally presented?
* Are figure captions descriptive, concise, and containing all necessary information to help the reader understand what’s shown (e.g. units, series descriptions, etc.)?
* Are statistical outcomes to compare means described appropriately in text (using in-line referencing), along with more important metrics for comparison?
* Is the report thoughtfully organized with clear subsections / headers?
* Does the report clearly communicate outcomes as part of a cohesive story?
* Does the summary correctly and clearly convey the major / interesting findings?
* Are references professionally formatted and presented?
* Is the code within your .Rmd organized, annotated and reproducible?
* Is text well-written, spell & grammar checked, and professional?

**Grading will be thorough and detail-oriented for all of the above criteria.**