Investigative lab project

For the next three weeks of lab, you will be working on an independent investigative project. Similarly to our other labs in this course, you will be analyzing a pre-existing dataset to answer a question of interest.

Timeline:

4-2 Find a dataset and decide on a question of interest (maybe in the other order)
4-9 Working on analyses in lab
4-16 Working on analyses in lab
4-23 Presenting your project during lab
4-30 Written report due

Finding a question and dataset

Deciding on a question and finding a problem set to answer it is the first step. Finding datasets can be more challenging than you might expect; you won't want to decide on a highly specific question until you know you can find some data to address it.

First, discuss possible questions with your partner. Start with something fairly broad—for example, maybe you want to look at evolutionary constraints affecting local adaptation. You can use the analyses that we've done previously in lab for some ideas, or get more creative if you want to do something else. This question needs to be of broad evolutionary interest; at the end of your project, you want to be able to explain why this question was worth putting in the effort of answering, and what it tells you about broader questions in evolutionary biology.

As you're developing a question, start looking for datasets. An increasing number of journals are requiring researchers to archive their full datasets; these can be a valuable resource. There are several ways to try finding datasets to work with. You can try a literature search for papers related to the question you want to investigate, and see if they've archived their data; it's not yet a universal requirement, however, and many of them probably won't have. You can also try looking specifically in journals that require data to be archived (any of the PLoS journals or Evolution). You can also search a database specifically. One database that is often used for evolutionary papers is Dryad; you can use their search function to search for a term like Fst and find datasets from papers that used that as a keyword.

Once you have a possible dataset, start thinking more specifically about the question you want to ask and the analyses that you would need to run to answer it. You will have three lab sessions to find your dataset and analyze it; an appropriate question will need approximately that much time to address.

Analyzing your dataset

You'll complete your analyses using R and/or any other appropriate programs. You should be sure to include tests for statistical significance if appropriate. The details will vary based on your question; I'll be available during lab to help with any questions that come up.

Written report

As a group, you will turn in a written report for your project. This will follow the typical lab report, and should follow the guidelines in the department style manual.

The introduction should clearly describe your question, and give the background necessary to put that question into context. This background should help you show why your question is interesting and important to answer, as well as giving the information needed to understand what you're doing. It can also include information about the system, and any previous studies in it.

The methods will be slightly different from what you've done in other classes, as you will be using someone else's dataset. Begin the section by briefly describing the relevant pieces of the experimental design. Most of the methods should be a description of your analyses. Some of the pieces that you should be sure to include are:

- Any cleaning steps that you did on the data, and if you excluded any samples why and how many
- The program(s) that you used, and any packages in R
- Any calculations, such as Fst
- What statistical tests you used, and the models if you used lmer
- The sample sizes for all analyses

The results section will be fairly straightforward. Start by making the appropriate tables and figures to represent your data. I'll be happy to look over them if you want. Describe your results in the text (before the figures/tables appear).

In the discussion, you will discuss your results in the context of your question. What answer can you now give? How does this result make sense (or not) given the biology of your organism? You should also talk about the broader evolutionary context; compare your results to the literature and what is already known about this question.

Throughout all of this, **remember the biology**. The point isn't to do an F_{ST} comparison; it's to learn something about the biology of your organism and contribute to answering a broader evolutionary question.

Presentation

In our last week of lab, your group will give a 20-30 minute presentation about your project. This presentation should include the same pieces as your written report, but with slightly different organization and emphasis. Typically, a talk doesn't have distinct methods, results and discussion sections. Usually, you can talk about how you did one thing and what you found, and then move on to the next analysis and results. Wrap up with a review of the big-picture piece of the discussion. When you talk about the methods, don't include every detail of how you did the calculations, but do discuss what you did well enough that the audience has some understanding of it.

Talks are also less formal that written reports. If you have questions about what your data mean, bring that up. See if any of your classmates have ideas. It's great if it turns into something of a discussion. People asking a lot of questions means that they're really interested.

This will be the rubric for the presentation (20 points total):

1. Question and background (4)

    Do you:

    - Clearly state what question(s) you were trying to answer?
    - Give enough background for the class to understand your experiment?
    - Discuss why that question is interesting?

2. Design and Methods (4)

    Do you:

    - Describe enough of the experimental design that the class can understand your analyses?
    - Describe your analyses and why they were appropriate?

2. Results (5)

    Do you:

    - Present your results clearly in appropriate figures? (try not to use tables in a talk)
    - Verbally describe the important trends in your results?
    -

3. Interpretation (5)

    Do you:

    - Discuss how your results answer your question?
    - Include potential explanations for your results that include biological explanations?
    - Put into context of broader evolutionary questions?

4. Presentation (2)

    - Are slides easy to read (minimal text, clear figures, etc)?
    - Equal participation?
    - Able to answer questions?