**ESS 474 Final Horsetooth Reservoir Lab Report Fall 2024**

On September 6th we visited Horsetooth Reservoir and undertook a two hour research cruise to conduct basic limnological sampling of Horsetooth Reservoir.

During the course of the semester, we have (or will have by a few weeks from now): 1) plotted depth profiles to describe thermophysical structure, 2) analyzed basic water chemistry, 3) evaluated the phytoplankton community, 4) evaluated the zooplankton community, 5) attempted to estimate zooplankton feeding rates, and 6) learned to plot and analyze data in R. For our final laboratory project, you will now compile the measurements and analyses from the samples we collected and write a final report on the limnology of Horsetooth Reservoir. All final reports will be composed in Rmarkdown and submitted (via Canvas) as a pdf. Please submit two versions of your final report: one where your R code is hidden, and one where it is not hidden. Reports are due on **Friday, November 22 at 11:59 pm**. This assignment is worth 100 points in the “Lab Assignments” category.

Total length of entire report, excluding R code, must not exceed **8 pages** including figures and references. Use RMarkdown’s default font size and font type. All R code should be properly commented, so that each line / block of code’s purpose is explained in plain English. Reports should be free of typos and other grammatical errors. The reports will be scanned by Turnitin for a plagiarism check, but a reasonable amount of similarity in R code among groups is expected and will not be penalized.

Lab attendance on Friday, November 13 for a work day on this report is required unless prior arrangements are made.

Final Reports should use the provided RMarkdown template and follow the below format.

1. **Introduction [5 points]**. For full credit you must include:
   1. A description and brief history of Horsetooth Reservoir, with in-text citations.
2. **Methods [5 points]**. For full credit you must include:
   1. A description of the sampling effort including an overview of which samples were taken and why.
   2. A map of Horsetooth Reservoir with our sampling location clearly identified. Image should include a caption. Map can either be inserted into your R Markdown as an image or created in R using a code block.
3. **Results (figures and calculations) [27 points]**. A presentation of the physical, chemical, and biological properties of the water column where we sampled.
   1. Each figure should have meaningful and axis labels (changed from the default label if appropriate, and with appropriate units), a legend, and a title.
   2. Profiles should have the y axis inverted.
   3. All figures should be indexed (i.e., Figure 1, Figure 2 etc.) and include a caption. In the remaining text of the report, when you want to refer to your figure to make a point, please use your figure numbers (like in a scientific journal article)
   4. For full credit you must include the following data. For items 1-3, use the data from whichever depth profile you uploaded to Canvas under the "Horsetooth Sampling Data Entry” assignment. For items 5-7, include class means and your group’s means, incorporated as you see fit into an appropriate figure.
      * 1. An oxygen profile, containing both the DO (percent) and DO (mg/L) series
        2. A temperature profile
        3. A pH profile
        4. The standard curve for TN from that prior assignment (but created in R). Add your group’s samples’ TN values on the curve in a conspicuous manner (e.g. different color or shape)
        5. A comparison of total nitrogen between the epilimnion and hypolimnion depths
        6. A figure illustrating the distribution of epilimnion chlorophyll a values taken by everyone, and the mean value.
        7. A comparison of dissolved organic carbon values between the epilimnion and hypolimnion depths
        8. An estimate of your group’s phytoplankton diversity (no figure required)
        9. A figure illustrating the distribution of Secchi depths taken by everyone, and the mean value.
   5. In some cases, not every group took samples for each water quality property, or they took them with the incorrect procedure, or their data is not realistic. Thus, before calculating class means, you should filter out missing data and data from groups who you think is not reliable (include an explanation of this filtering out in the Results (interpretation) section below). If you think your own group’s data is unreliable, still create a figure with the filtered class data and your group’s data if it exists, but also include a note in the Results (interpretation) section below explaining the circumstances; also, rely on the filtered pooled class data values to answer any subsequent questions.
4. **Results (interpretation) [18 points]**. For full credit please:
   1. Describe each of the figures you created. Comment on any trends or contrasts that are apparent within each figure.
   2. Comment on the phytoplankton diversity value you calculated.
5. **Discussion [32 points]**. Please answer the following questions in paragraph form and use in-text citations as necessary. For full credit, answer the following questions.
   1. Were there differences in dissolved organic carbon between depths? Why or why not? **[5 points]**
   2. Were there differences in total nitrogen between depths? Why? **[5 points]**
   3. How does Horsetooth compare to other reservoirs, in terms of each of the water quality parameters we measured? (this will require a citation or citations) **[10 points]**
   4. Building off of c., what limnological characteristics would explain similarities? Differences? **[7 points]**
   5. What study limitations and/or possible errors limit the insights you’ve gained about Horsetooth Reservoir and how so? How would you address these issues in a future Horsetooth Reservoir sampling campaign? **[5 points]**
6. **Conclusion [8 points]**. In 2 paragraphs, summarize what you learned about Horsetooth Reservoir. Focus on answering this question: “Based on our class’s collective data, what is the overall health and trophic state of Horsetooth Reservoir, and how do you arrive at this conclusion?”
7. **References [4 points]**. Can be any citation style as long as the style is consistent. Please only use peer reviewed literature, and so-called "[gray literature](information%20produced%20outside%20of%20traditional%20publishing%20and%20distribution%20channels,%20and%20can%20include%20reports,%20policy%20literature,%20working%20papers,%20newsletters,%20government%20documents,%20speeches,%20white%20papers,%20urban%20plans,%20and%20so%20on)" (“research and materials produced by organizations outside of the traditional publishing and distribution channels. It can include reports, working papers, government documents, white papers, and evaluations”). Overall total of 5-7 references would be reasonable.
8. **Contribution Roles [1 point]:** Using [this website](https://authorservices.wiley.com/author-resources/Journal-Authors/open-access/credit.html) as a guideline, please describe the contributions of each group member to the final product. Each group member should contribute an equal amount of time and effort. If during the report writing process this is not happening, please reach out to the instructor(s) with your concerns.