Too much of a good thing? Exploring nutrient pollution in streams using bioindicators

Teaching Notes

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Course Information

Course: ENV 3009 - Conservation Biology and Sustainable Development

Department: Natural Sciences

Level: Upper Undergraduate

Course type: Both Lecture and Lab

Students: Majors

Number of Students: 20

Information

Original Module Name: Investigating human impacts on stream ecology: locally and nationally

Link to Original: <https://qubeshub.org/qubesresources/publications/1095/1>

Files associated:

* Student handout and assignment questions
* Faculty notes
* Data for students
	+ downloaded from original module
* Maps of landcover data, EPA regions, and sampling sites from original module
* Introductory lecture
* Blackboard rubric
* student materials accessible @
	+ <https://sites.google.com/view/env3009/labs/human-impacts-on-streams>

Modification Learning Goals:

Students will be able to:

* Define nutrient pollution and potential impacts
* Describe drivers of nutrient pollution in the United States
* Discuss the use of bioindicators to monitor environmental health
* Predict impacts of nutrient pollution on benthic macroinvertebrates
* Filter large datasets in Google Sheets
* Develop and interpret box plots and five-number summaries
* Plot and interpret relationships between two continuous variables, including explaining the strength of a relationship between two continuous variables using an R2 value

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(Think about what you would like to read about this activity if you came back to it in 2 years)

* What did you change and why?
	+ I revised the module to
		- include more background information in the introduction on
			* nutrient pollution
				+ Our class typically visits a wastewater treatment plant and discusses nitrogen pollution, so the emphasis on this was increased
			* bioindicators
				+ used module from the Knowledge Project as additional background
			* MMI (Multi Metric Index for benthic macroinvertebrates)
				+ Our class has an earlier lab where students “capture” Pokemon and calculate taxonomic and functional diversity metrics, so I added some information connecting the MMI to these components
		- have students focus on summarizing and graphing two focal regions
		- include more information on statistics and graphing due to lack of experience for some students
			* added information on five-number summary and boxplots
			* used a web-based tool to create boxplots
* How did the activity go?
	+ What went well and why?
		- Review of student submissions suggested the main topics were clearly addressed in the lab.
	+ What went wrong and why?
		- I have noted need to explain why streams near natural forests do not typically exhibit elevated levels of nutrients (common misconception)
* What was the prep like?
	+ How much time went into prep?
		- ~3 hours to review materials and make necessary edits/modifications for my course
		- Could be used in ~1 hour “as is”
	+ Did you have to do any prep (i.e. grow cultures, grow seeds, order supplies) ahead of implementation?
		- No prep needed ahead of implementation
* Would you do this activity again? – Yes!
* Is there anything else you would like to make note of?
	+ I reviewed the use of data filters in Google Sheets as part of the lab introduction. This helped students gather information from certain regions and easily calculate five-number summaries. Filtered data can also be easily pasted into the boxplot app
	+ Address common misconception that areas near forests should have high levels of nutrients due to local plant growth
* How does this activity fit in your overall course curriculum?
	+ We did this lab after discussing diversity metrics and visiting a wastewater treatment plant. This lab was accompanied by a lecture on habitat degradation as an example of pollution issues.