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**Project EDDIE: Project EDDIE: Exploring the relationship between periphyton, nutrients, and other environmental variables in karstic wetlands Student Handout**

This module was developed by Gabriel Kamener and Katie Johnson. Feb 2022. Project EDDIE: Exploring the relationship between periphyton, nutrients, and other environmental variables in karstic wetlands. Project EDDIE Module 2, Version 1.

Learning objectives:

* Know how to perform diagnostics on regression model to check for meeting assumptions of linearity and normality
* Perform regression analyses of transformed data
* Interpret results from regression analyses to answer over-arching question: What are the relationships between periphyton and variables associated with water quality in the Everglades and Caribbean?
* Determine diatom indicator species (part of periphyton matrix) and their autecology by applying research from literature and online resources to answer over-arching question: What can regional diatom species indicate about water quality and their environment?

Why this matters: Physicochemical properties and nutrients drive aquatic processes that sustain biota. Therefore, aquatic assessments usually investigate these variables as well as biological indicators to gain a better understanding of water quality. In this module, you will use regression analysis and online resources to investigate the relationship between periphyton and variables associated with water quality (including nutrients). You will also examine the role of diatom indicator species. As you explore the concepts in this module, you will be introduced to and practice biostatistical skills needed to answer the over-arching question: What are the relationships between periphyton and variables associated with water quality in the Everglades and Caribbean? What can regional diatom species (part of periphyton community) indicate about water quality and their environment?

Outline of Class Today

1. Work through pre-module questions
2. Class discussion of optional papers and PowerPoint presentation
3. Work through Activity A as a class
4. Class discussion of graphics and PowerPoint
5. Work through Activity B as a class
6. Class discussion of graphics and PowerPoint introduction to following activity
7. Work through Activity C in small groups
8. Class introduction to online resources about diatom species
9. Research a diatom species' autecology for information about water quality indication in groups
10. Work through post*-*module questions

Required pre-class reading

* Online resources about diatom species:
  + [*https://diatoms.org/*](https://diatoms.org/%20%20)

***U****se this site to access information on bioindicator autecology, taxonomy, and other species information. For pre-class reading, explore site to get familiar.*

Optional pre-class reading:

* La Hée, J. M., & Gaiser, E. E. (2012). Benthic diatom assemblages as indicators of water quality in the Everglades and three tropical karstic wetlands. *Freshwater Science*, *31*(1), 205-221.

**Activity A:** linear regression model and diagnostics of assumptions

1. **Using the provided LTER dataset, and R statistical software:** Model a linear regression for water pH and percent periphyton organic content for the Everglades.
2. Is the assumption that there is a linear relationship met?
3. Is the assumption of normality met?
4. What can you do with this model if the assumptions are not met? Can you still use it?
5. How can you tell if the assumptions are met?

**Activity B**: Transformations and diagnostics of assumptions

1. Model a linear regression for periphyton ash free dry mass per meter squared and periphyton total phosphorus for the Everglades. Are assumptions of linearity and normality met?
2. Transform the data for this model and perform diagnostics on the model’s residuals. Are the assumptions of normality and linearity better met?
3. What are the P-values (Shapiro-Wilks normality test), R-squared values, and fitted line equations before and after conducting transformations? What do they “tell” you about the response and predictor variables?

**Activity C**: exploring variables in karstic wetland sites and investigating bioindicators

1. In groups, choose the data for the Caribbean or the Everglades and explore a relationship between predictor variables (pH, water depth, or periphyton TP) and response variables (periphyton percent organic content or periphyton ash free dry mass).
2. Are assumptions of linearity and normality met?
3. Transform the data for this model (if needed) and perform diagnostics on the model’s residuals. Are the assumptions of linearity and normality better met?
4. Is there a correlation between the variables you chose? Is it strong? How so? What does this mean about the region you chose?
5. Given the regression we conducted in class and your results in this activity, are you surprised by these findings? How do your findings relate to the following overarching question: what are the relationships between periphyton and variables associated with water quality in the Everglades and Caribbean?
6. In groups, choose one of the following diatom species that are commonly found in the Everglades periphyton and are known to indicate something about their environment: *Encyonema evergladianum*, *Fragilaria synegrotesca*, *Epithemia gibba, Kobayasiella subtilissima, Nitzschia serpentiraphe, Eunotia incisa*. Using online resources ([diatoms.org](https://diatoms.org/)), research its autecology, and specify what it indicates. Describe the morphology of the species you chose or provide a picture. How do your findings relate to the following overarching question: what can regional diatom species (part of periphyton community) indicate about water quality and their environment? HINT: use autecology/natural history information from website to answer this question. For example, if the species you chose is found in oligotrophic environments, you can state that and explain what an oligotrophic environment is.

Note: To access species information on diatoms.org, go to “species” tab at the top. Select species. Scroll down to read available information.