Phase II: Analysis and Summary of Periphyton Data Collection in Texas Streams

Introduction:
Algae has long been used as a translator for nutrient conditions in water quality monitoring. Often, chlorophyll *a* is sampled to account for sestonic algae in the water column. However, in rivers and streams, periphytic algae often dominate over sestonic forms, and are not adequately captured in sampling events. Studies have shown that monitoring periphyton can accurately characterize the nutrient conditions of a stream and indicate nutrient enrichment concerns.

Overall Goals:
- Evaluate the use of periphyton as an indicator of nutrient enrichment in Texas streams
- Increase quality and quantity of periphyton data and better understand how nutrients impact algal communities in Texas streams
- Develop standard field data collection methods for periphyton and nutrients
- Support the development of translator values to implement narrative criteria in streams

Phase II Objectives:
- Focus on periphyton collection while eliminating confounding factors that inhibited data analyses in Phase I of the study
    - Increased the number of periphyton coverage indices from Phase I
    - Confounding factors were eliminated by selecting sites that have similar substrate, canopy cover, and turbidity while representing varying nutrient concentrations
- Increase periphyton data collection
- Evaluate stressor-response relationships between nutrients and periphyton

Methods:
- 41 stations sampled once each between June and July, 2018
    - Guadalupe, Brazos, Colorado, San Antonio, and Nueces River basins
- Data collected: water chemistry, chlorophyll *a*, pheophytin-a, routine field water quality measurements, Secchi depth, 24-hour dissolved oxygen, periphyton coverage assessment, flow, physical habitat
- Periphyton collection: three diagonal transects established at each sample station. Each transect was divided into six sampling locations. The sampler would walk to each sampling location and pick up the piece of substrate nearest their big toe.
- Measured length of longest filament of algae
- Qualitative evaluation of periphyton coverage via three indices:

Transect Method A	Transect Method B	Phase I Study Methods
0-5 macroalgae and moss coverage score: • 0 = none • 1 = some, but <5% • 2 = 5-25% • 3 = >25-50% • 4 = >50-75% • 5= >75-100% 0-5 microalgae coverage score: • 0 = no growth • 0.5 = slimy, not visible • 1 = thin, visible layer • 2 = 0.5-1mm thickness • 3 = 1-5mm thickness • 4 = 5-20mm thickness • 5 = >20mm thickness	0-5 periphyton coverage score (moss, macroalgae, and microalgae evaluated together): • 0 = none • 1 = some, but <5% • 2 = 5-25% • 3 = >25-50% • 4 = >50-75% • 5= >75-100%	0-3 periphyton coverage score (moss, macroalgae, and microalgae evaluated together): • 0 = none • 1 = some, but <5% • 2 = 5-25% • 3 = >25%

- Quantitative evaluation of periphyton
    - Composite algae sample consisting of a 5.3 cm^2 periphyton scraping and 60 mL sestonic algae sample collected at nine of the eighteen sampling locations at each site.
        - Two 5 mL aliquots extracted for chlorophyll *a* and ash free dry mass analyses
        - Remaining sample preserved for algal community characterization. Soft algae identified to genus and diatoms were identified to species. All algae taxa were given guild designations (i.e. high profile, low profile, motile, planktonic).

Results/Discussion:

- Limiting the confounding factors among sampling locations helped to identify nutrient-driven trends in periphyton abundance.
- Periphyton was strongly associated with total phosphorus (TP) but weakly correlated with total nitrogen (TN).
- The macroalgae cover index, Phase I method index, and average filament length were positively associated with TP. Low-profile algal taxa were positive TP responders as well.
- The threshold of 0.04-0.05 mg/L surfaced as an important TP threshold in the Threshold Indicator Taxa Analysis (TITAN), as a change-point for positive responders at the species, guild, and guild+size class levels.
- Due to poor correlations among periphyton and TN, change-point thresholds could not be identified with confidence.