Evaluation of a commercial fluorometer probe for rapid assessment of water quality trends using benthic chlorophyll

Brad Rogers, PhD student, Environmental Science

Dan Storm, Professor, Biosystems Engineering

Derek West, Undergraduate Student, Biosystems Engineering

Andy Dzialowski, Associate Professor, Zoology

Bill Henley, Professor, Botany

Oklahoma State University

Stillwater, Oklahoma

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Background

- Environmental monitoring
  - EMAP (environmental monitoring and assessment program)
    - EPA wanted more comprehensive monitoring
      - Statistical comparisons
      - Long term trends
      - Prediction
      - Data storage

- Nonpoint source management program (Sec 319)
  - Water quality
  - Stream habitat
  - Aquatic communities

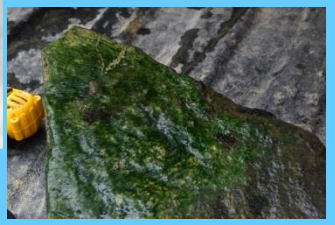
Biologic Monitoring

- Assess ecologic conditions
  - Stream Habitat and aquatic communities
  - Includes adjacent land use/land cover

Tar Creek (Miami OK)

Assess Ecologic Condition

- **Aquatic communities**
  - **Fish**
  - **Macroinvertbrates**
  - **Periphyton**



Glover River (near Broken Bow)

Periphyton Sampling
Traditional Method

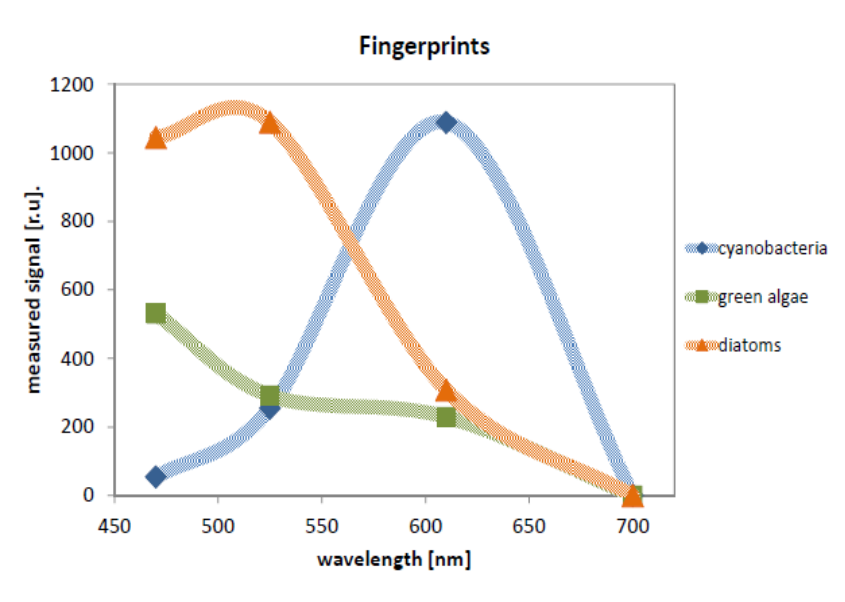
Periphyton Sampling
BenthoTorch®

- **Commercial Fluorometer**
  - ***In situ* and *in vivo***
  - **Provides results in 20 seconds**
    - **Stores files for later upload**
  - **Measure total biomass (by chlorophyll fluorescence)**
  - **Internal proprietary algorithm for relative abundance for three periphyton divisions**
  - **Used in monitoring and research across the world**
  - **Only one published comparison with traditional method**

BenthoTorch®

Based on Principal of Fluorescence

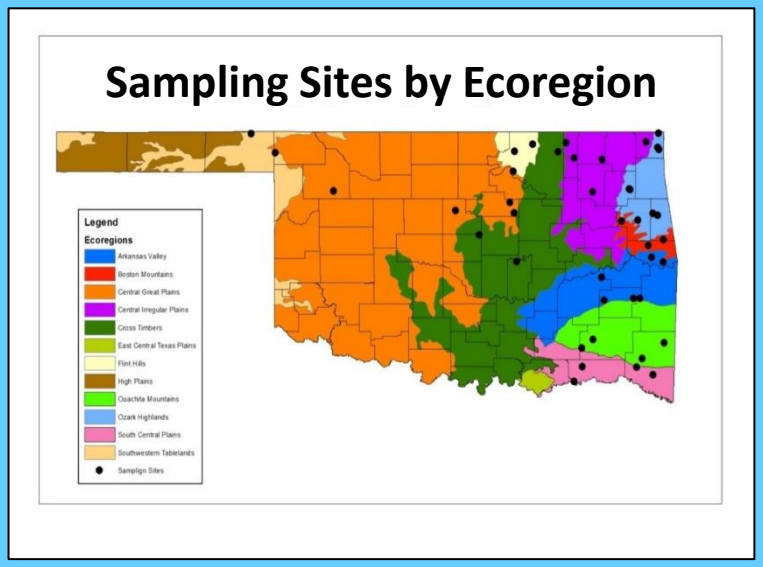
- LED wave lengths (nm): 470, 525, 610, 700
- Light directed at algae in pulses (PAM)
- Chlorophyll emits light at longer wavelength (Stokes Shift)
- 700 nm used to compensate for background reflection



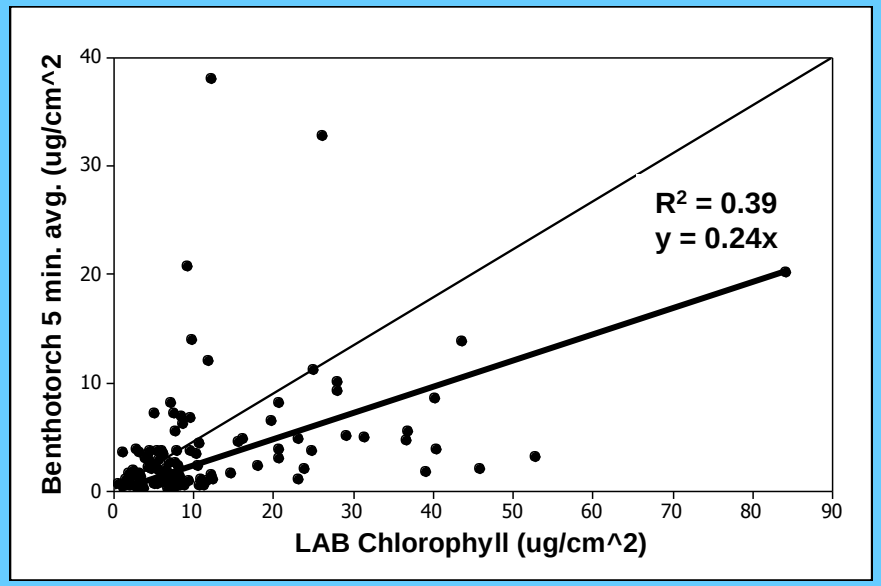
BenthoTorch®®
Algal Class Fingerprint

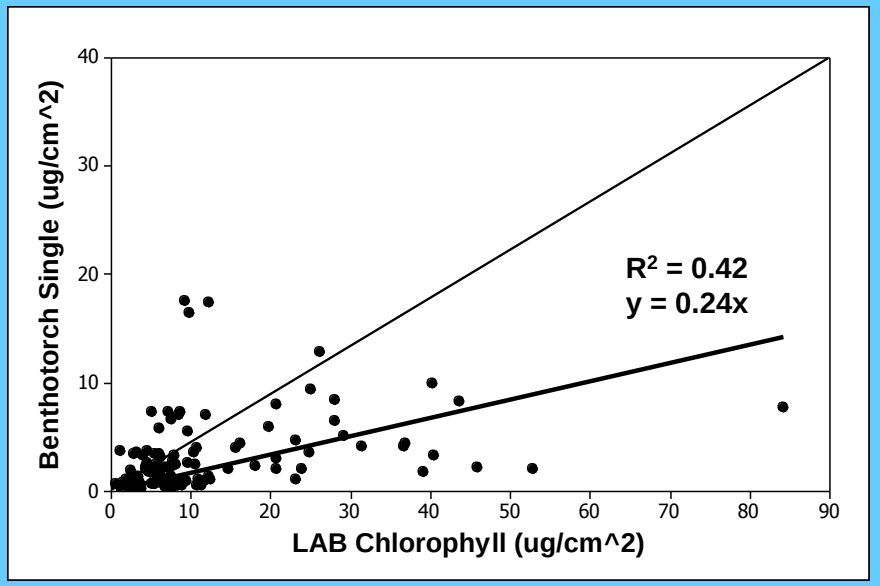
Objective

- **Assess the Accuracy of the Benthotorch® in Estimating Total Benthic Algal Biomass Across Major Stream Types and Conditions Throughout Oklahoma**



Results: Field 2014



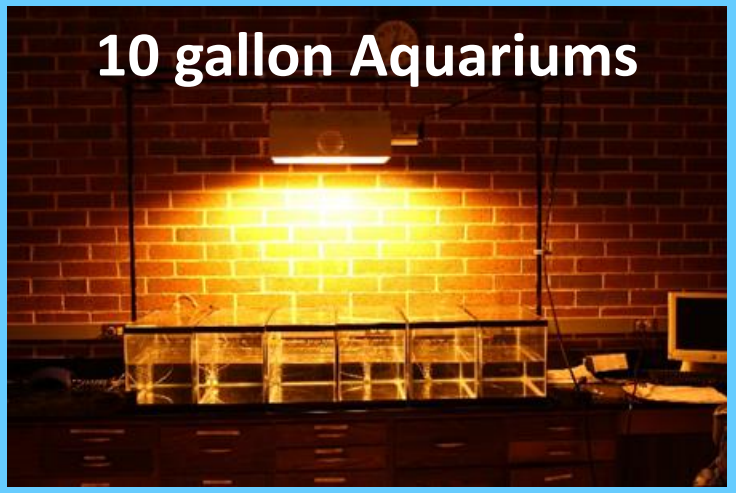


- **BenthoTorch®: no significant relationship with Taxonomist**
- **Using light adjustment & continuous measurements correlated better with laboratory results**
- **Variance within BenthoTorch® readings increased with increasing chlorophyll a**
- **Improved accuracy with non-filamentous**

Conclusions: Field 2014

- **BenthoTorch® may not provide useful information**
- **BenthoTorch® data not directly comparable to traditional methods**
- **Hypothesized reasons for variance in methods**
  - **Irregular substrates**
  - **3-D structure of periphyton**
  - **Spatial variability of periphyton**
  - **Environmental conditions**

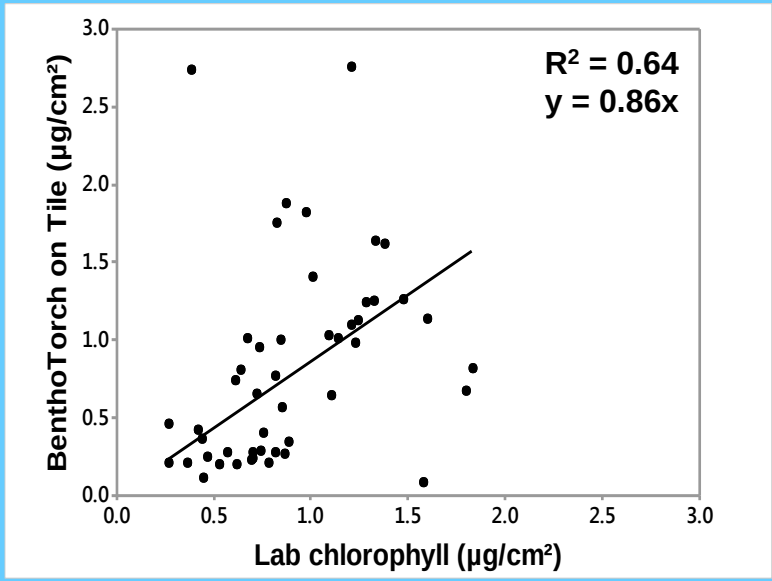
Laboratory Methods



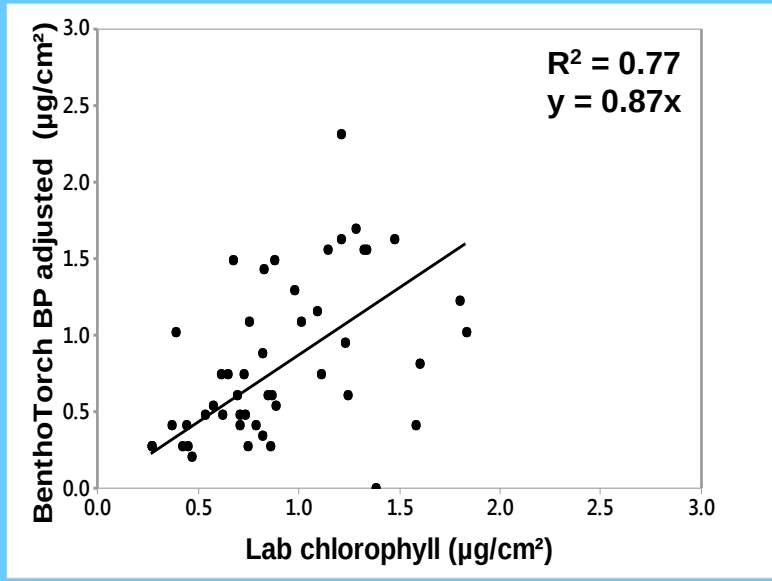
Results: Laboratory 2015-2016

BenthoTorch® Comparison with Lab Extracted Chlorophyll

In Situ Tile



Black Calibration Plate



- Significant (α=0.05) and reasonable regression equations
- Mean BenthoTorch® vs lab chlorophyll *a* not significantly different (paired t-test, α=0.05)

Conclusions

1. BenthoTorch® *In Situ* Laboratory Tiles
   - Compares favorably in controlled environment with low chlorophyll *a* concentrations
2. Modified Black Calibration Plate method looks promising for field conditions
   - Needs additional testing at sites with higher periphyton density
3. BenthoTorch® likely a good tool to detect trends in periphyton density
   - Based on lab results, minimum 2 readings for each spot sampled
   - Stream reach characterization methods must be developed

Questions?