

BMAP Monitoring Options: An Ecological Perspective for Florida Springs

Mary Szafraniec, PhD, PWS

Senior Scientist, AMEC E&I, Water Resources



Ecological Link between TMDLs and BMAPs

- **TMDL:** “Nitrate nitrogen determined to contribute to the ecological imbalance of flora and fauna”
 - Ecological shift from SAV to filamentous benthic macroalgae
- **BMAP:** Identify monitoring strategies to evaluate the effectiveness of BMAP efforts
 - Ecological indicators



Aquatic Floral Communities

- Submerged aquatic vegetation (SAV)
- Epiphytic (attached) algae
- Filamentous benthic macroalgae





Significance of Aquatic Flora

SAV

- Habitat for fish and wildlife
- Substrate for epiphytic complex
- Stabilize sediments

SAV/Epiphyte Complex

- Enhance water quality/clarity
- Primary productivity
- Uptake and fuel for nutrient removal



Stressors on Aquatic Flora

- Water column nutrients
- Light attenuation
- Sediment quality and nutrients
- Hydrology / Residence times
- Grazing
- Disturbance / Recreation



Routine Ambient Water Quality and Biological Parameters (SWFWMD)



Nutrients

- Ammonia N
- Nitrate+nitrite N
- TN
- TKN
- Orthophosphate
- TP

Metals

- Cobalt
- Copper
- Iron
- Magnesium
- Manganese
- Zinc

Minerals

- Potassium
- Sodium
- Calcium

Field

- Dissolved oxygen
 - Specific conductance
 - Temperature
 - pH
- Horizontal secchi

Biological / Detrital

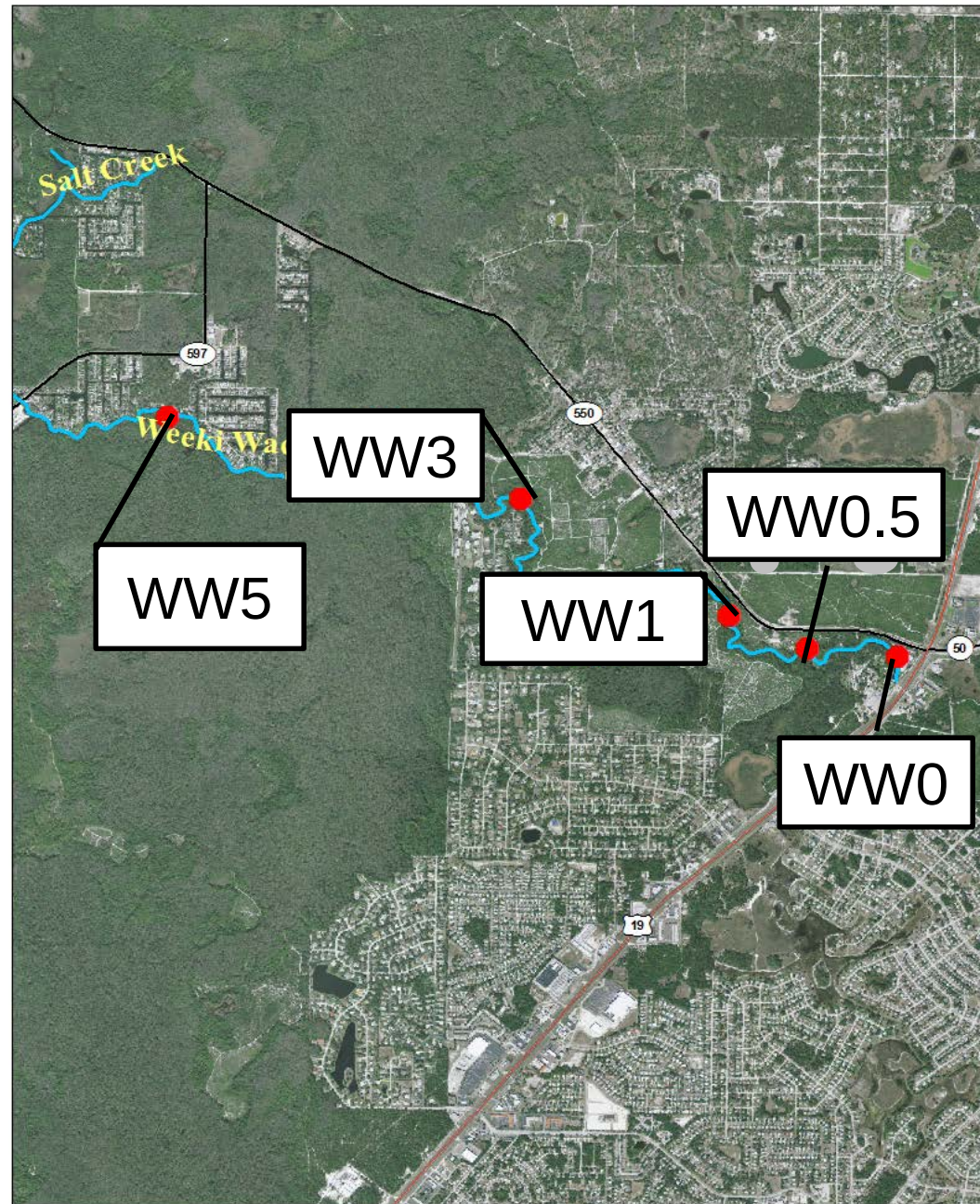
- Chlorophyll a
- Dissolved organic carbon
- Total organic carbon
- Color
- Turbidity
- Total suspended solids

Ecological

- SAV/algal braun
blanquet



Weeki Wachee SWFWMD Ambient Sampling Sites



BMAP Monitoring Options

Ecological



Benthic Zone

- SAV, benthic filamentous algae, epiphytes
 - River mapping
 - Relative coverage
 - Transects
 - Biomass
 - Coverage
 - Biovolume
- Macroinvertebrates

Rapid Surveys

- Rapid Periphyton Survey
- Linear Vegetation Survey
- Stream Condition Index

BMAP Monitoring Options

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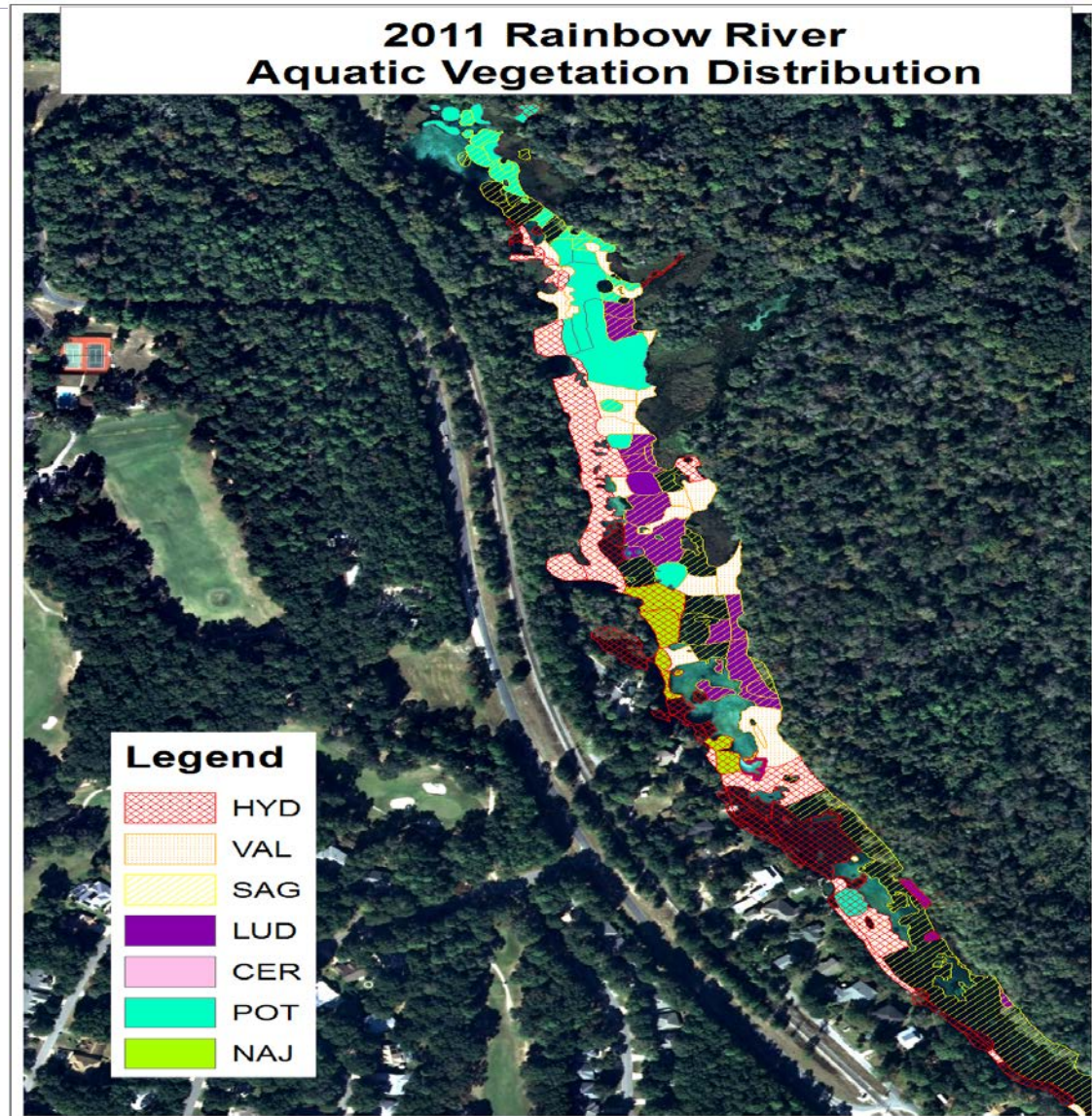
- FDEP NNC rapid monitoring methods to assess floristic and faunal conditions
- Weight of evidence approach
- LVS & RPS: Qualitative
 - Presence, dominance, coverage, thickness
 - Weighted by scoring of ecological tolerance to pre-settlement condition
- SCI: macroinvertebrates
 - 10 Tolerance/fidelity metrics

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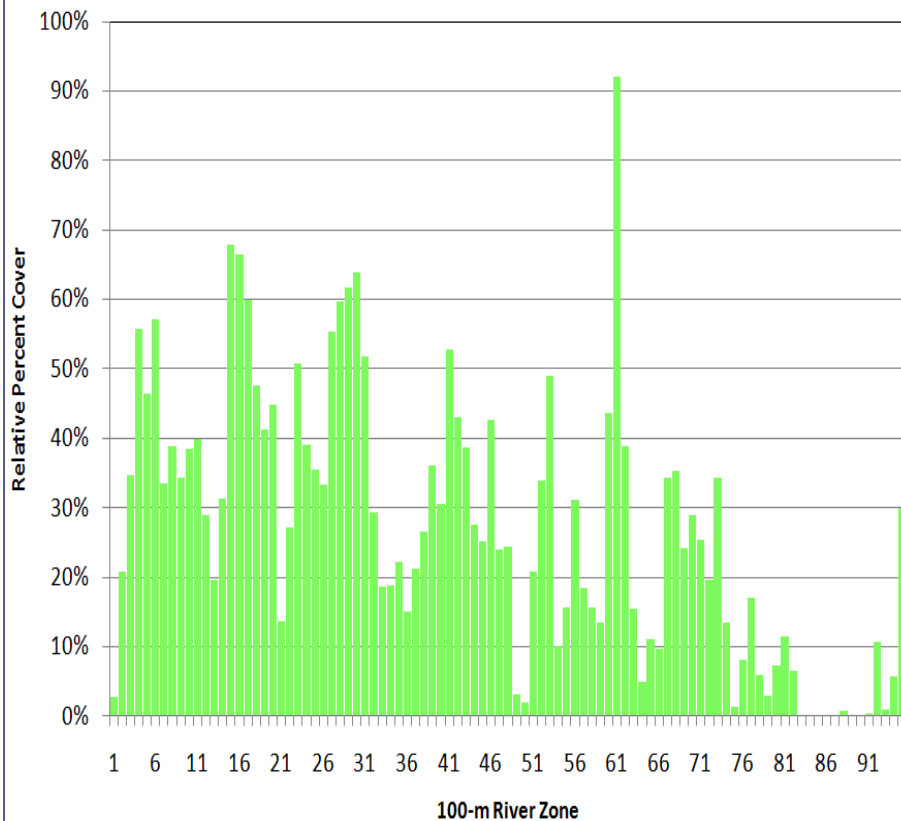
Source: Atkins 2012



Benthic Zone Mapping (Areal Coverage) *amec*

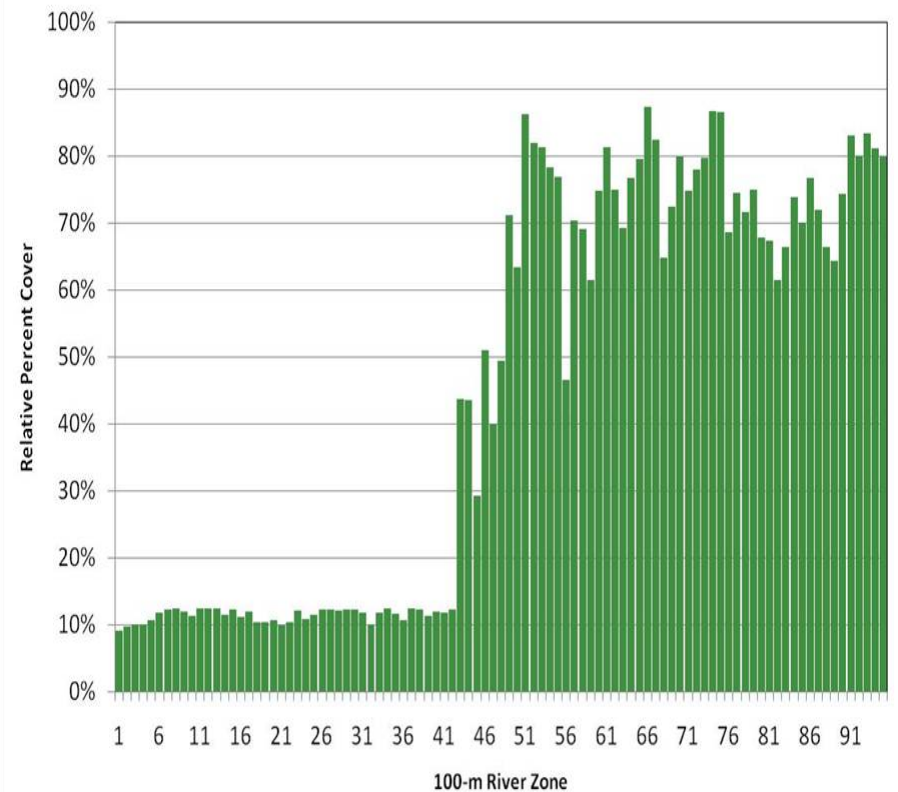
Epiphytic algae

2011 Epiphytic Algae Percent Cover



Benthic algae

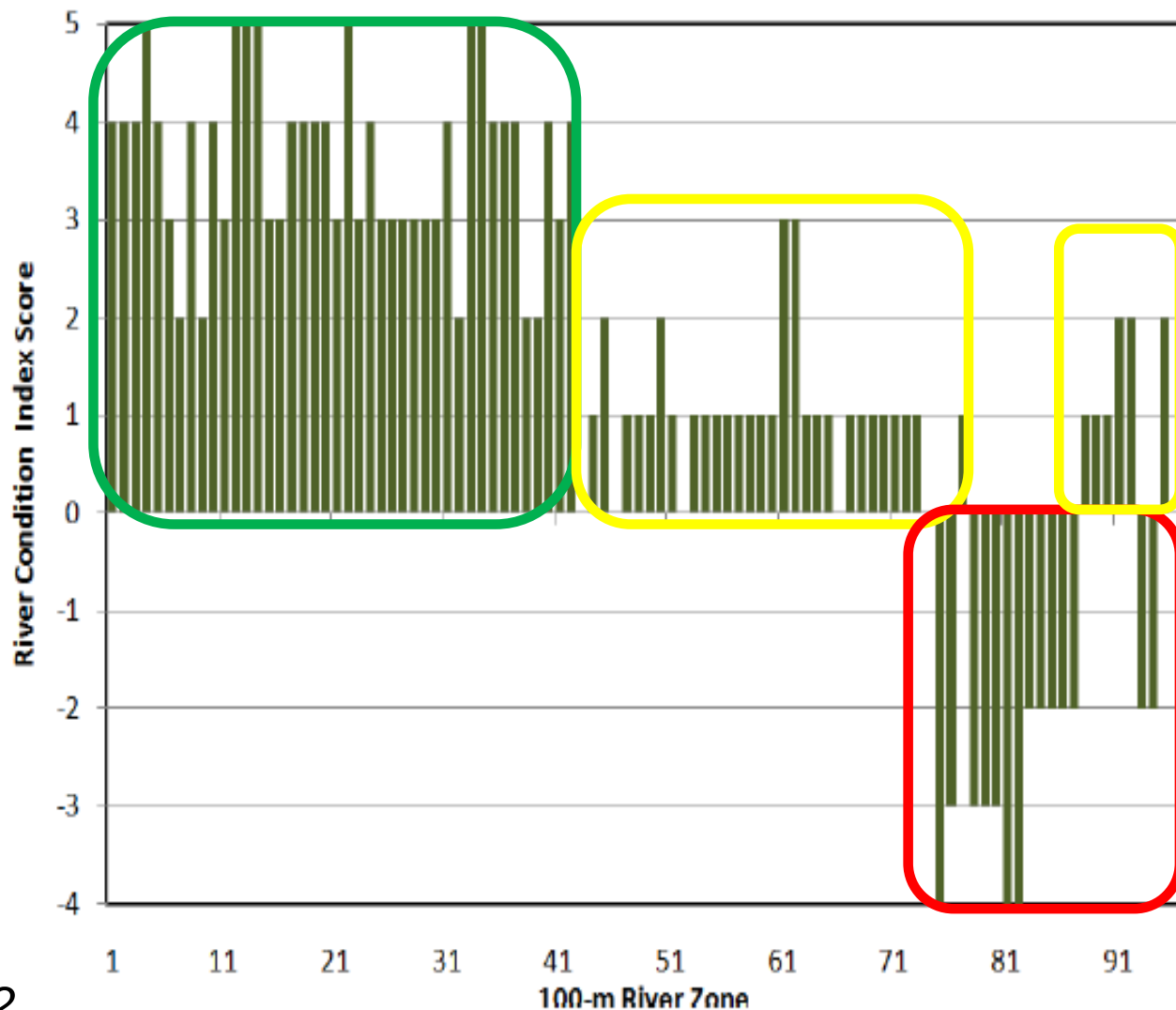
2011 Benthic Algal Matt Percent Cover



Source: Atkins 2012

River Condition Index

- SAV
 - Native
 - Exotic
- Filamentous and epiphytic algae



Source: Atkins 2012

BMAP Monitoring Options

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- Relative coverage

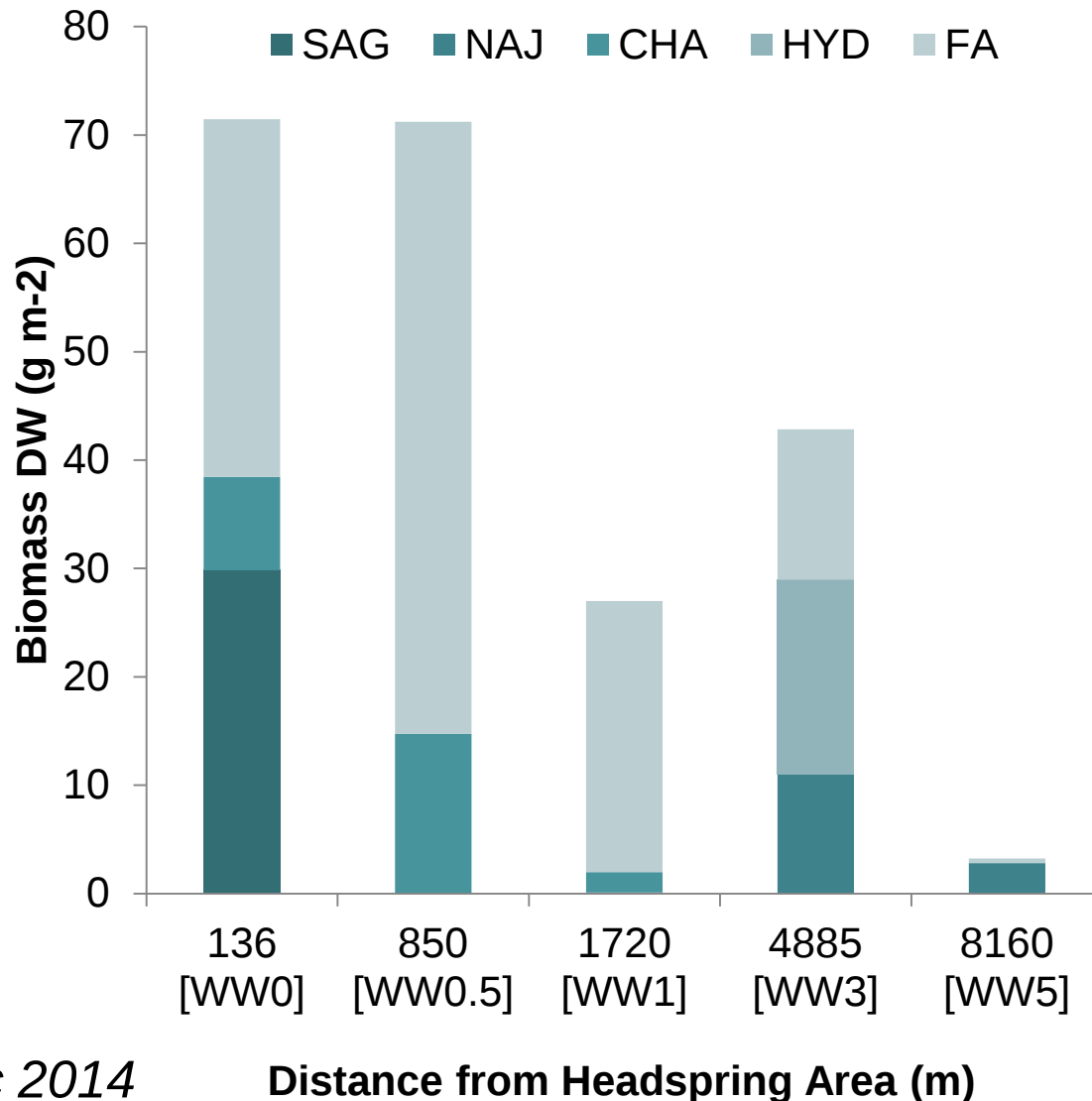
- **Transects**

- **Biomass**

- Coverage

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Source: Szafraniec 2014

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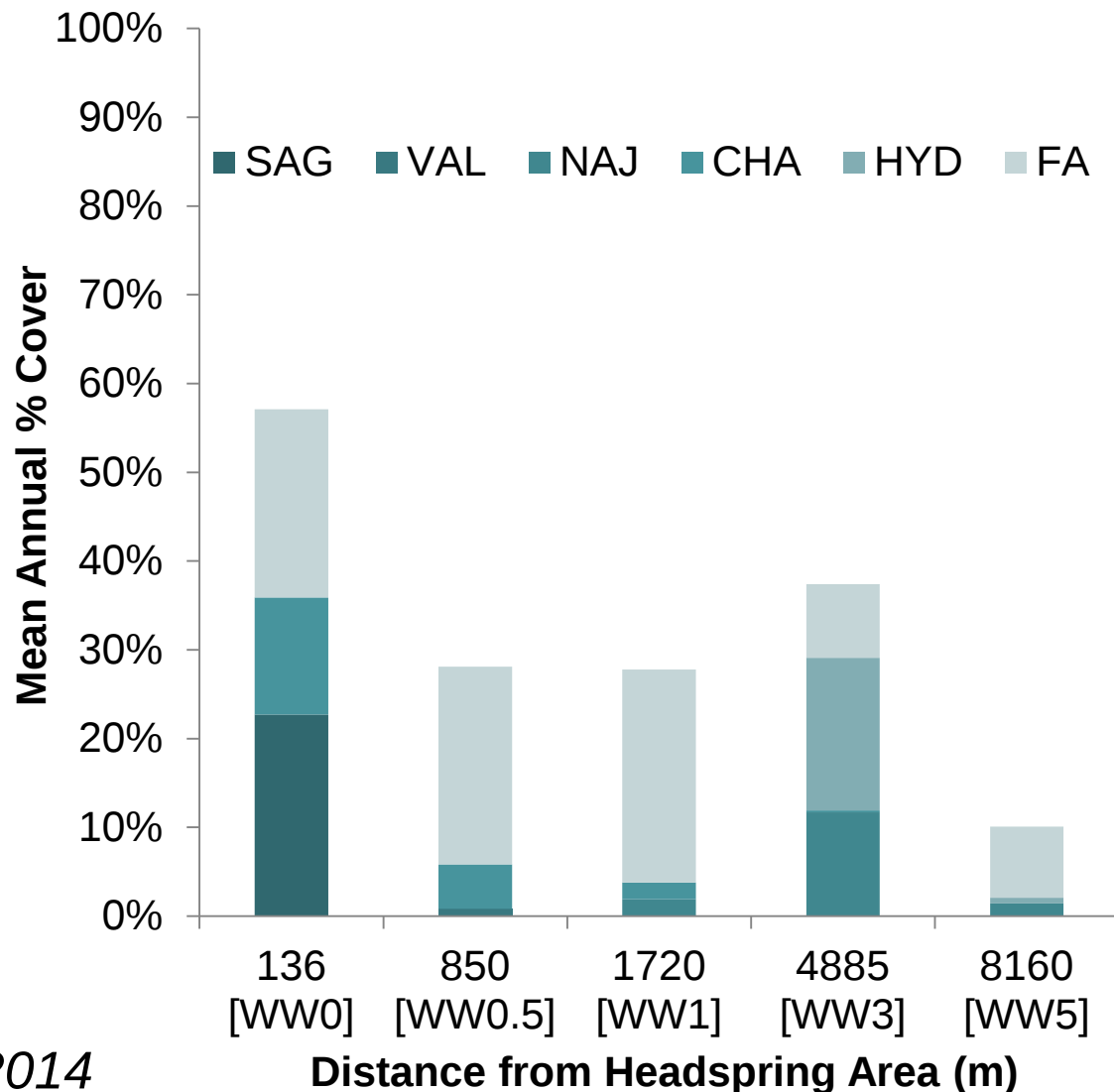
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Paired Epiphyte/Plankton Study

- Epiphytes
 - Blue-green (cyanophyta) algae dominant with minimal green (chlorophyta) algae taxa
 - Diatoms (bacillariophyta) absent
- Plankton
 - Cyano/chlorophyte mix
 - Cyanophytes decrease longitudinally

Source: Szafraniec, unpublished data

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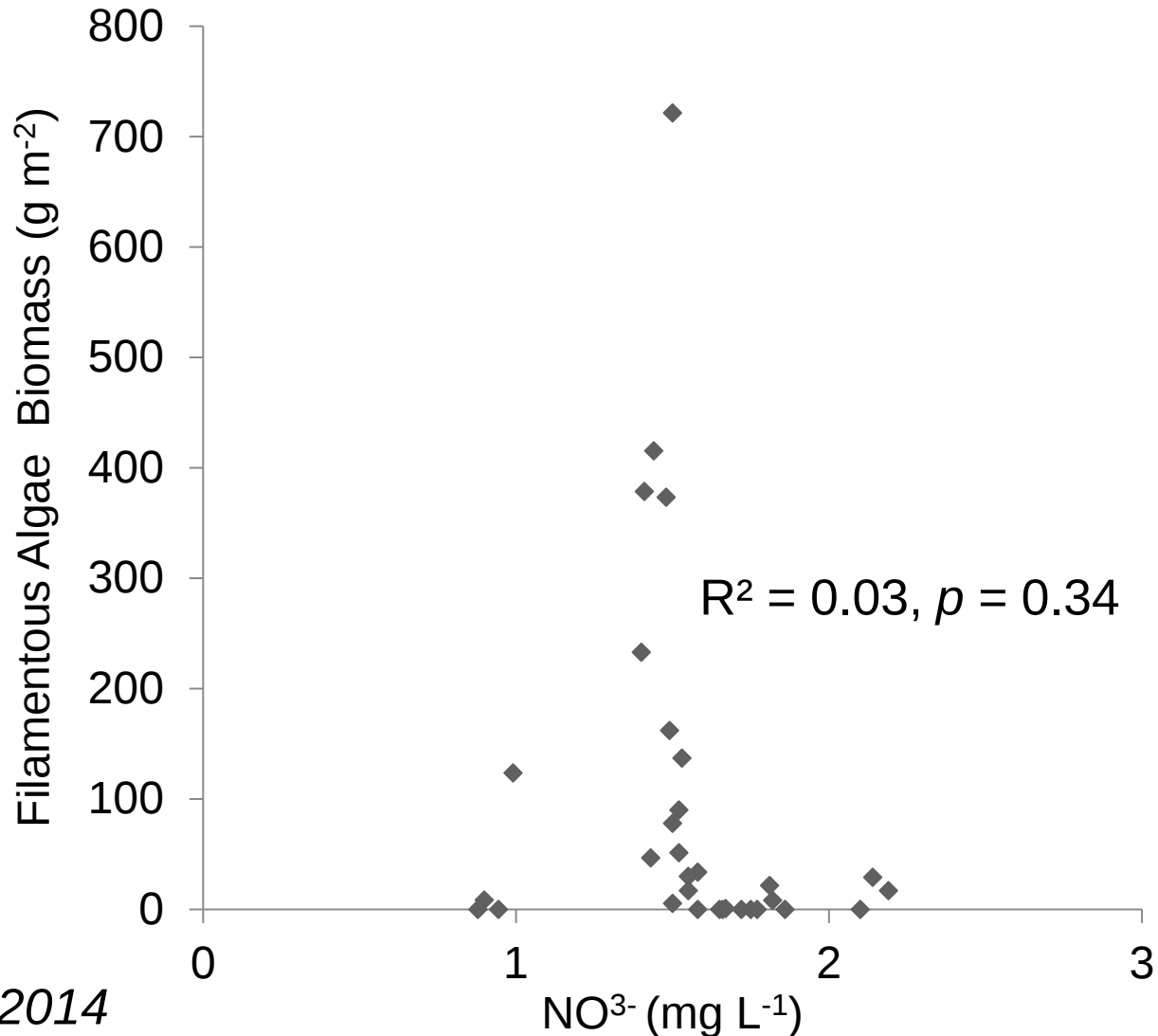
Physico-chemical

- Surface water quality
- Velocity
- Sediment nutrient content
- Light quantity and quality

BMAP Monitoring Options

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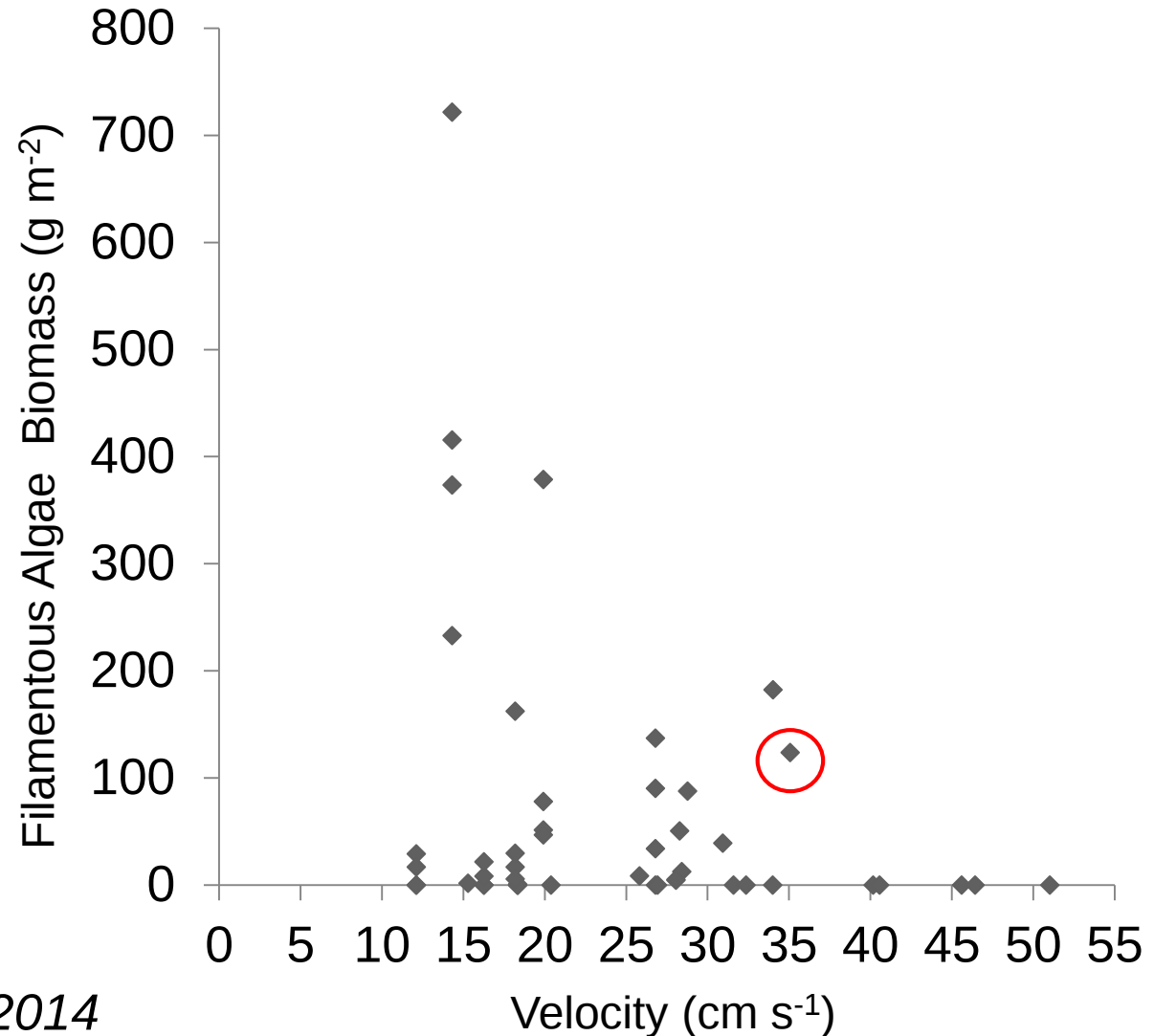


Source: Szafraniec 2014

BMAP Monitoring Options

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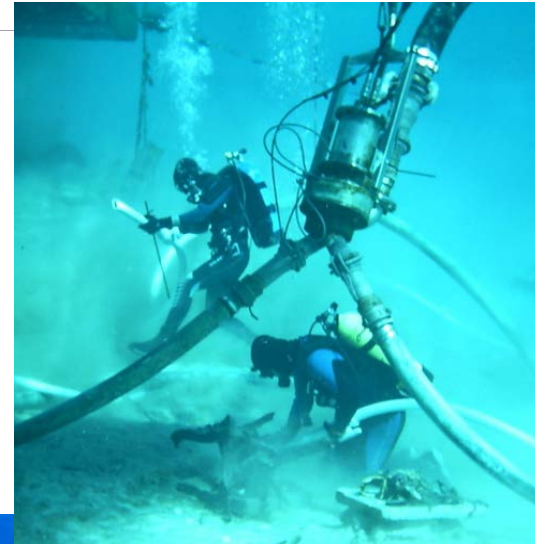


Source: Szafraniec 2014

BMAP Monitoring Options

Physico-chemical

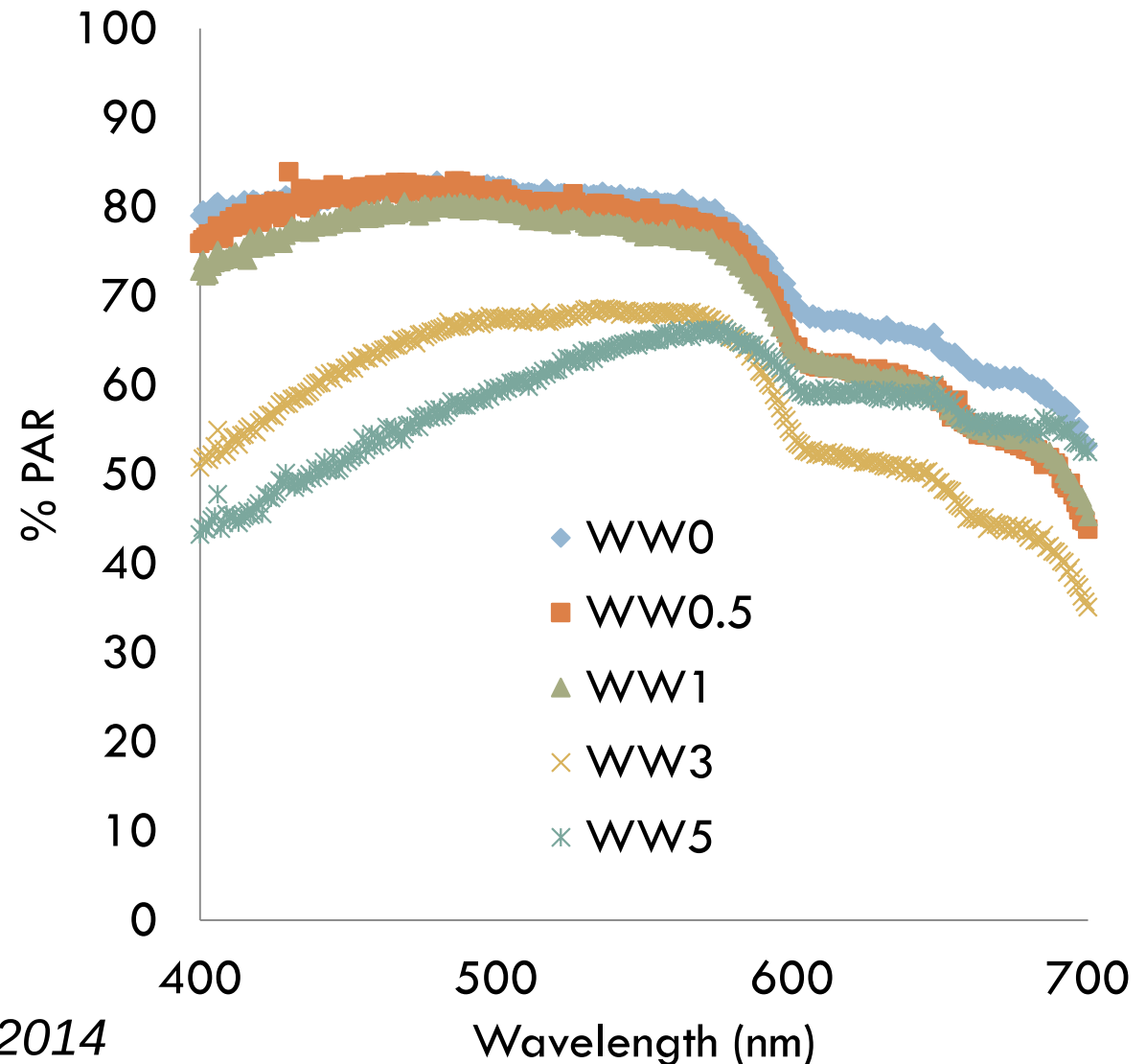
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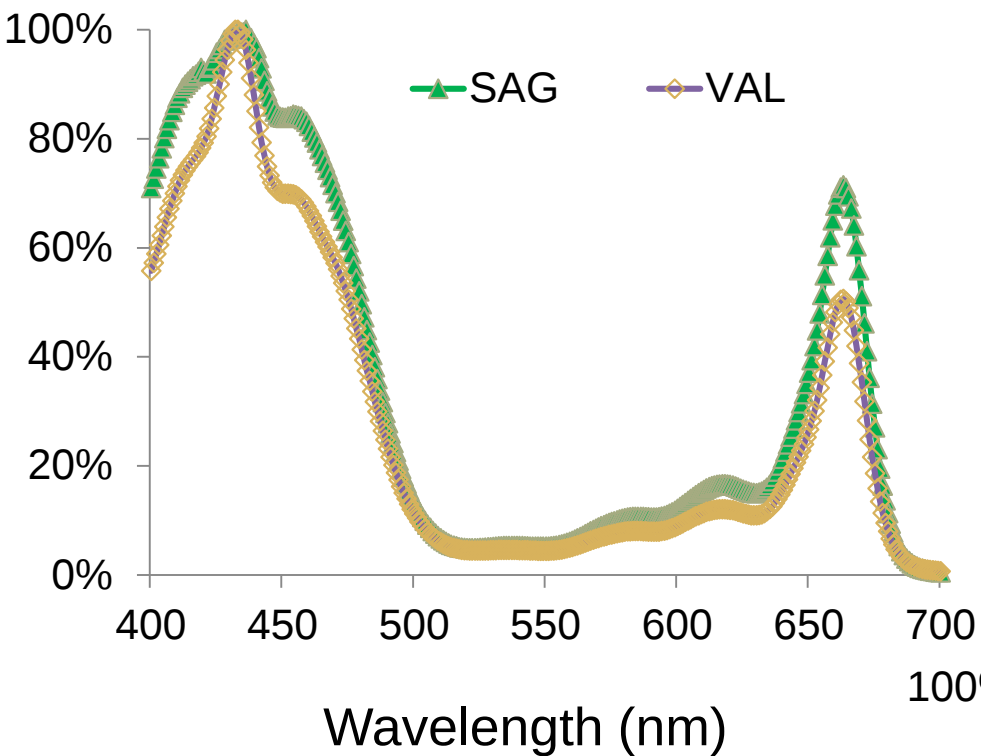
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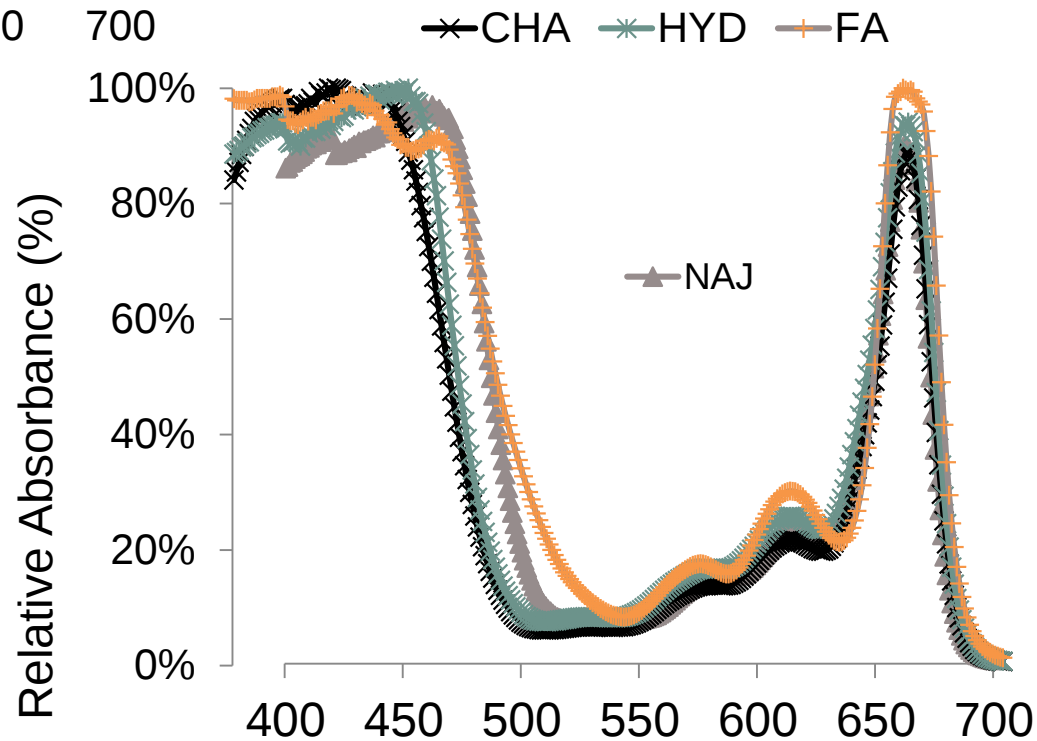
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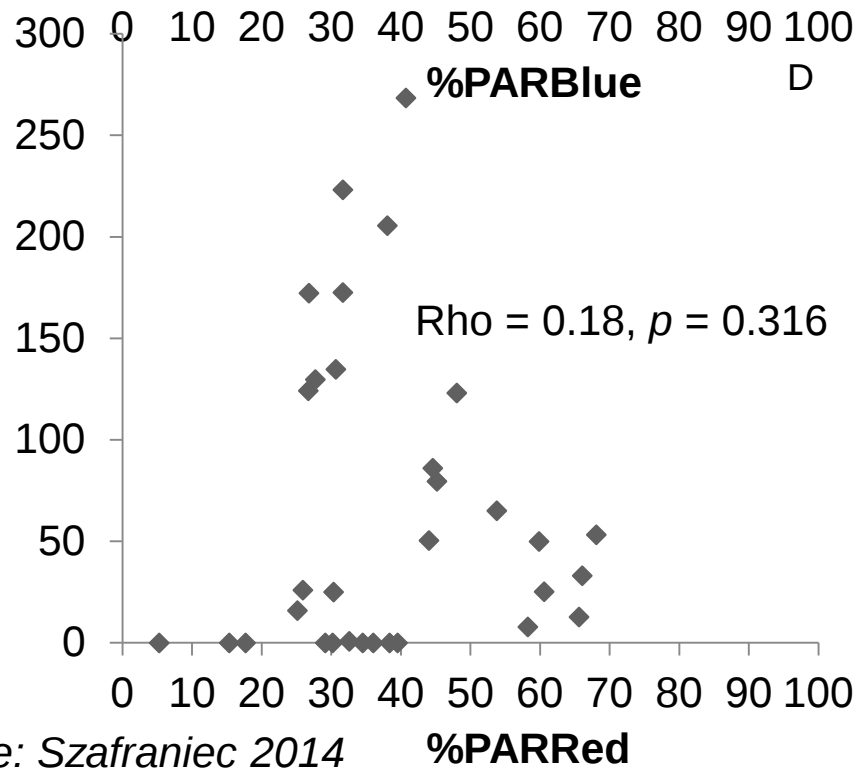
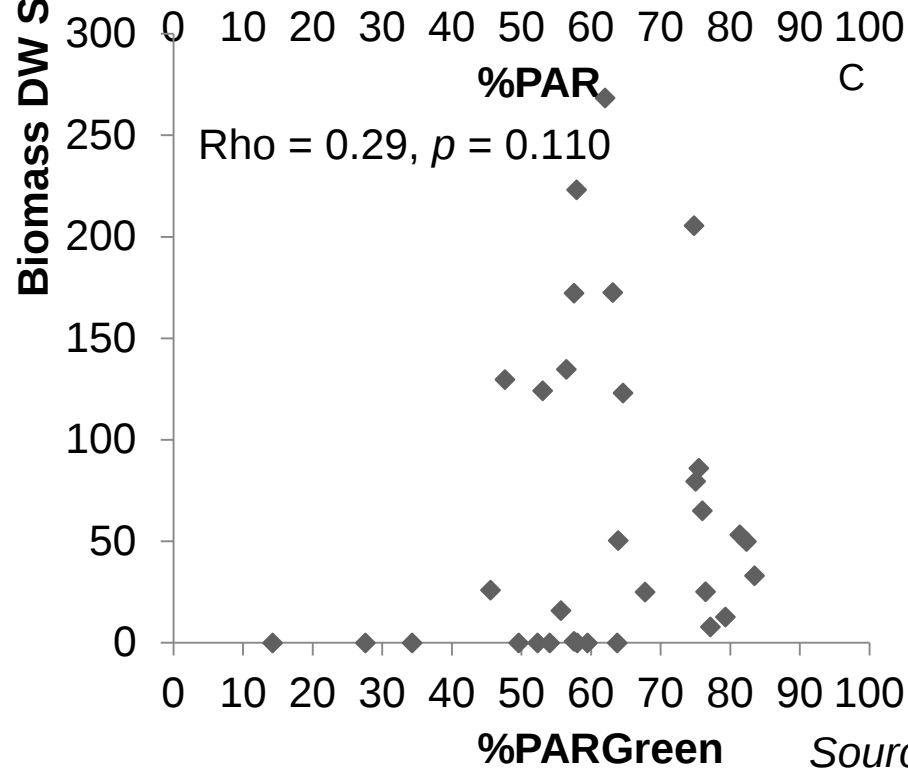
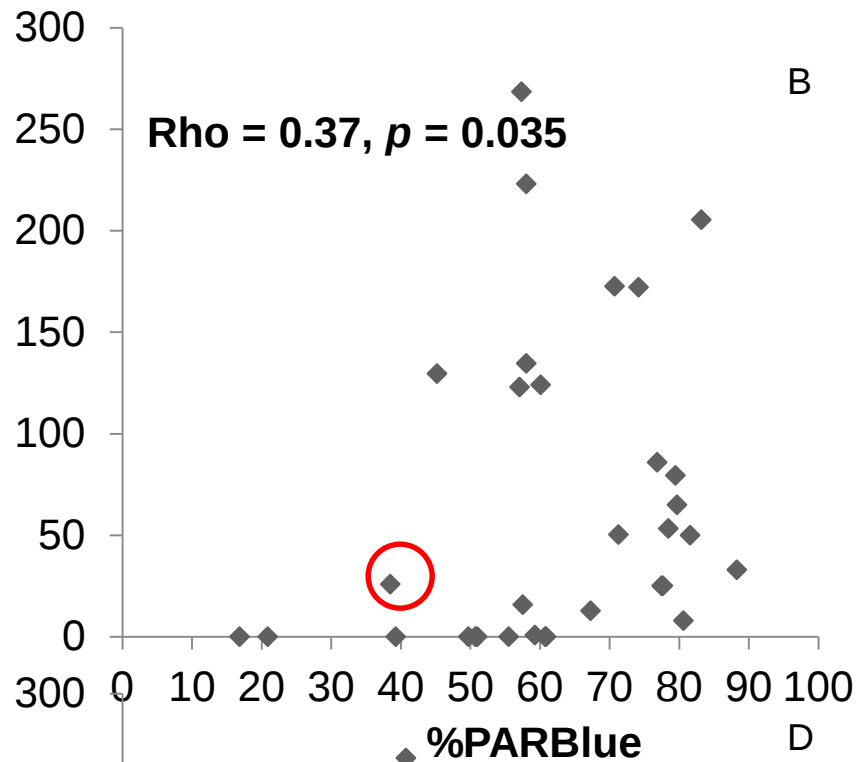
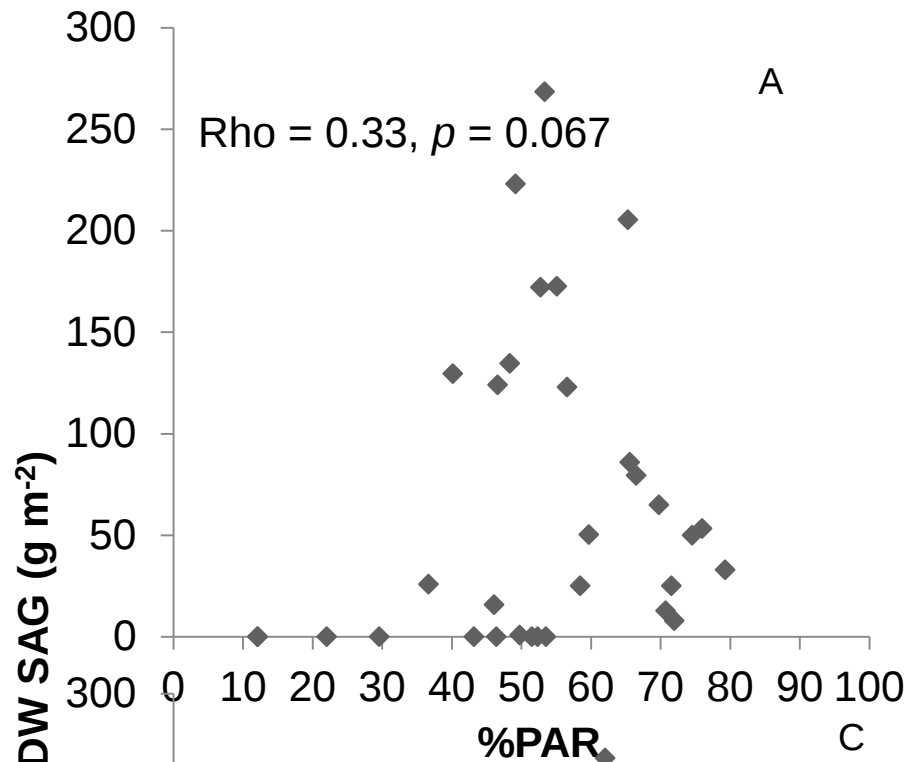
Source: Szafraniec 2014



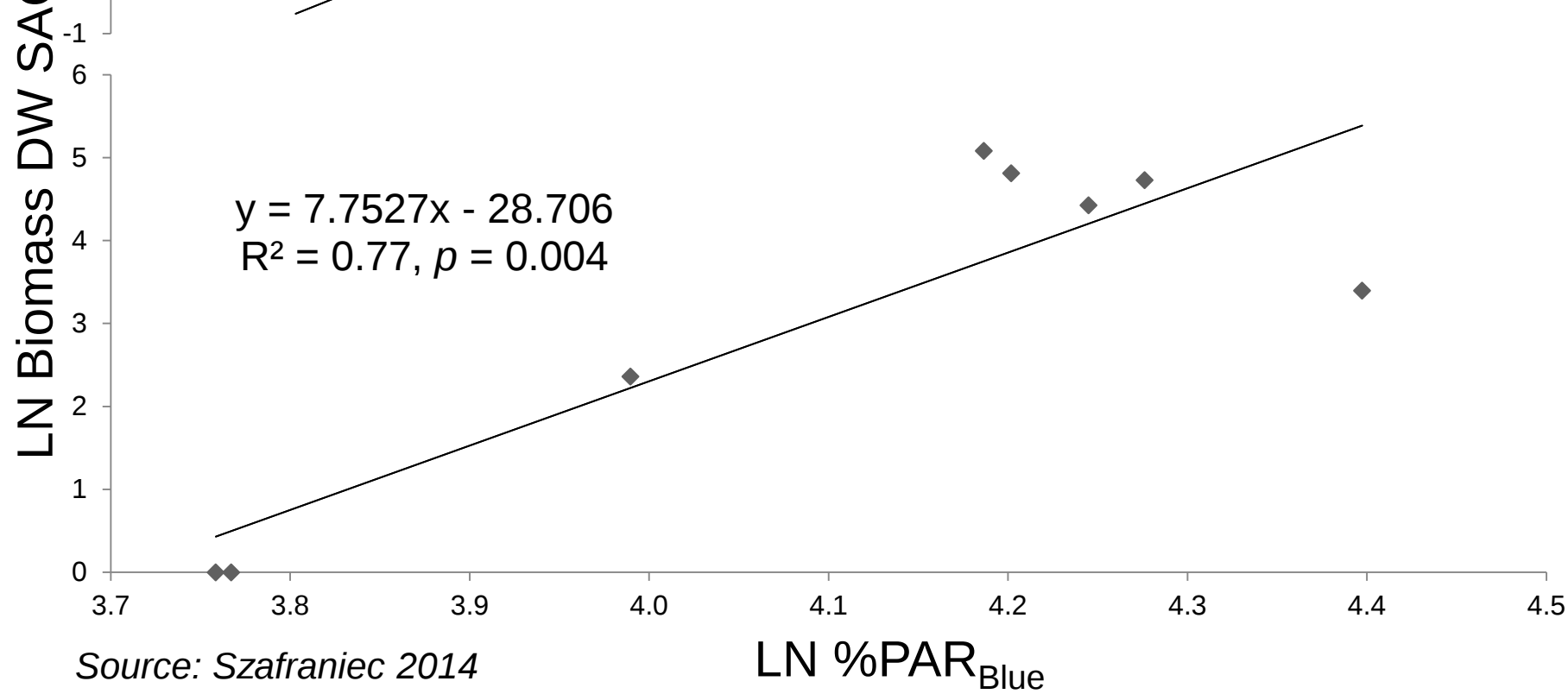
Preferential Light Absorption by SAV and Algae



Source: Szafraniec 2014



Source: Szafraniec 2014



LN %PAR_{Blue}

BMAP Monitoring Plan

- Selection of ecological indicators and goals
 - Reduce algal over abundance
 - Restore native/beneficial SAV and algal communities
- Monitoring options to track change
 - Spatial and temporal scale and resolution
 - Rapid surveys
 - River wide assessments
 - Transects



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Senior Scientist, AMEC, Water Resources
mary.szafraniec@amec.com

