Development of a Periphyton IBI for Southern California Streams

Augmenting Southern California's Bioassessment Toolkit

Need for:

- bioassessment tools expanding beyond perennial systems
- more integrative indicators of nutrient impairment

What is periphyton? Why use it?

benthic soft algae

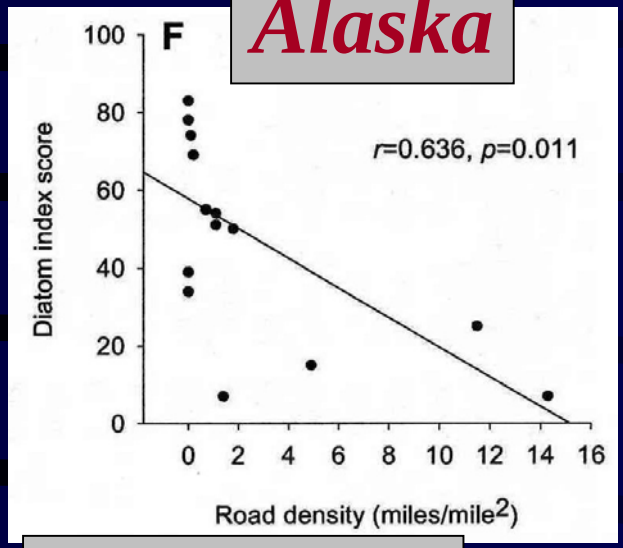
benthic diatoms (unicellular, silicated algae)

- communities stabilize rapidly
- responsive to many perturbations (incl. nutrients)
- periphyton IBIs have been developed elsewhere

can expand current southern California bioassessment scope

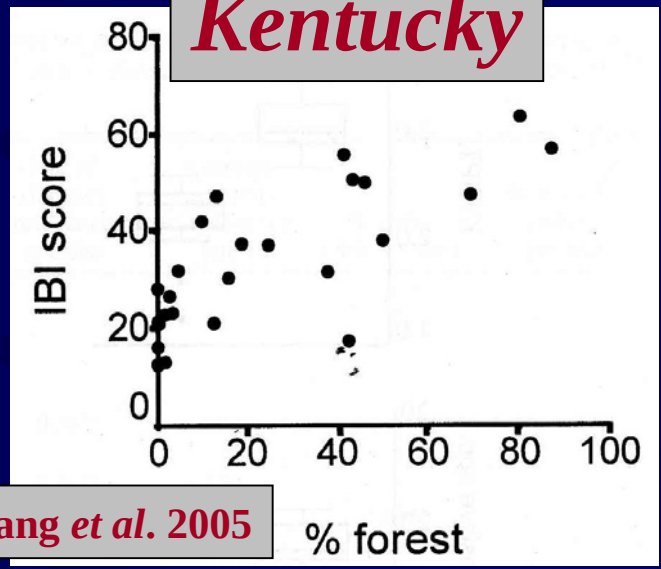
Successful Application of PIBIs

Alaska



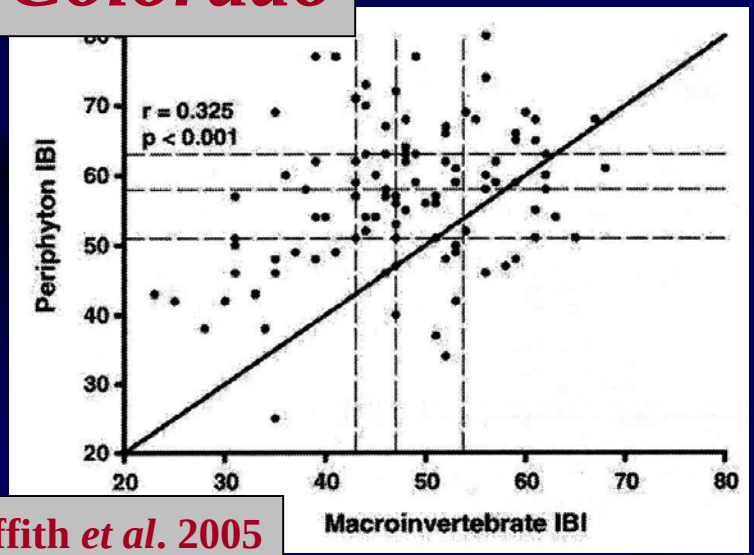
Rinella & Bogan 2005

Kentucky



Wang *et al.* 2005

Colorado



Griffith *et al.* 2005

Others:

- *Idaho*
- *Eastern U.S.*
- *middle Appalachia*
- *Australia*

Use of Periphyton in California

- NAWQA
- EMAP Western Pilot
- Lahontan Basin
- CMAP / SWAMP

Phased Approach to Developing Periphyton Bioassessment Tools

Goal: Develop periphyton as an indicator of stream condition

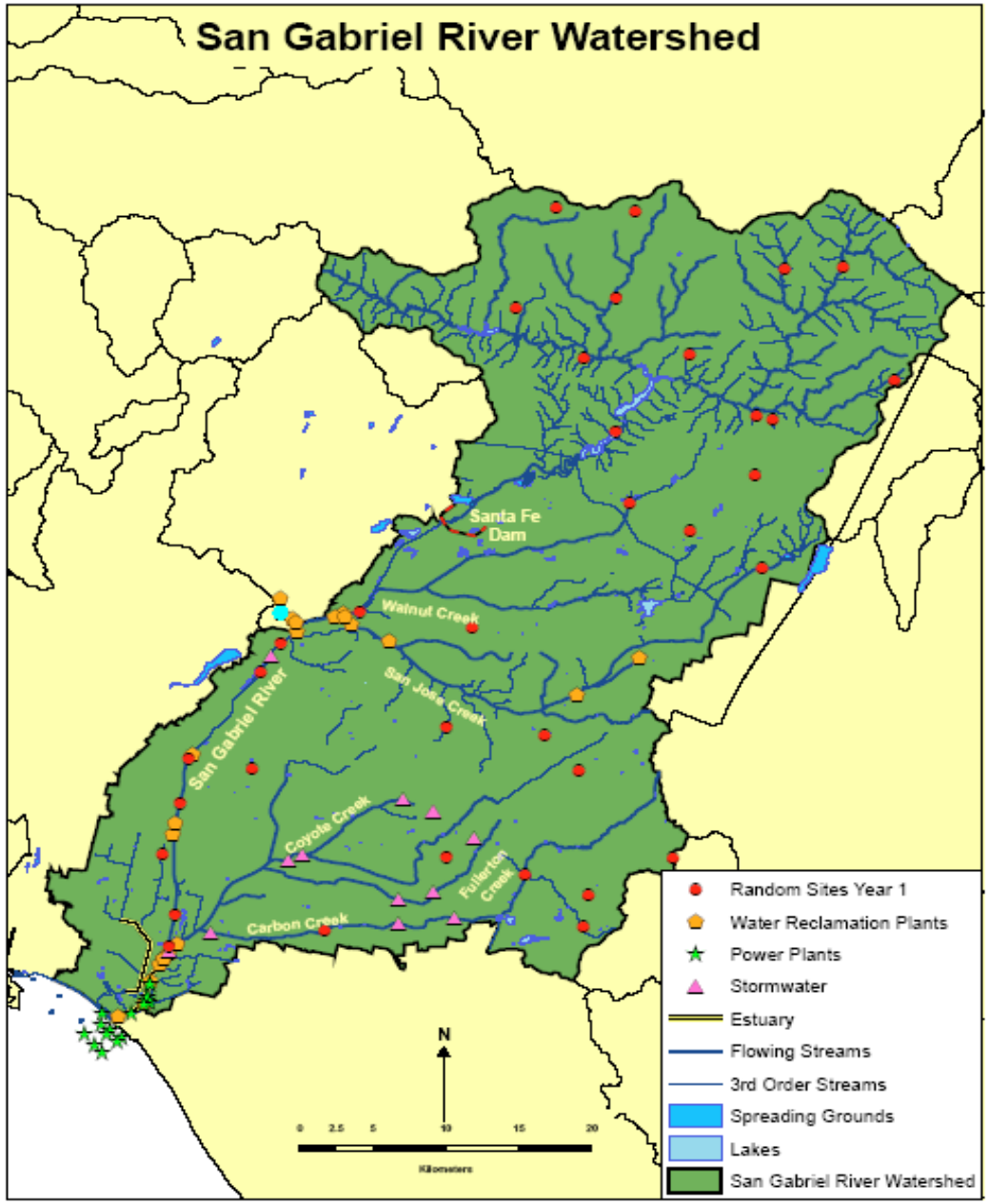
Phase I – Pilot study

Phase II – Tool development:

- reference dataset
- periphyton IBI

Phase I – Pilot Study:

Is it feasible to develop a periphyton bioindicator for So Cal streams?



Pilot Study – Data Collection

- ambient assessment: spring – summer 2005
- 30 random & 6 targeted sites
- periphyton substrata:
  - rock / concrete scrapings
  - sediment / gravel
  - wood
- additional indicators:
  - water chemistry / toxicity
  - BMIs
  - instream habitat

San Gabriel Watershed Diatom Flora

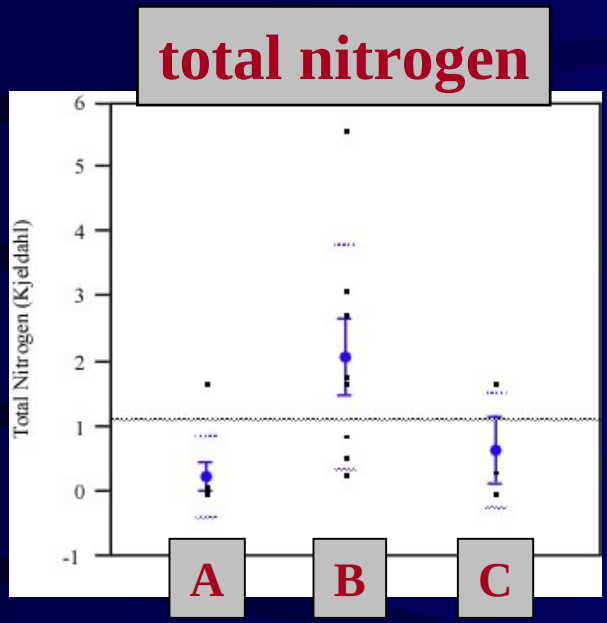
99 species in 42 genera…
and counting

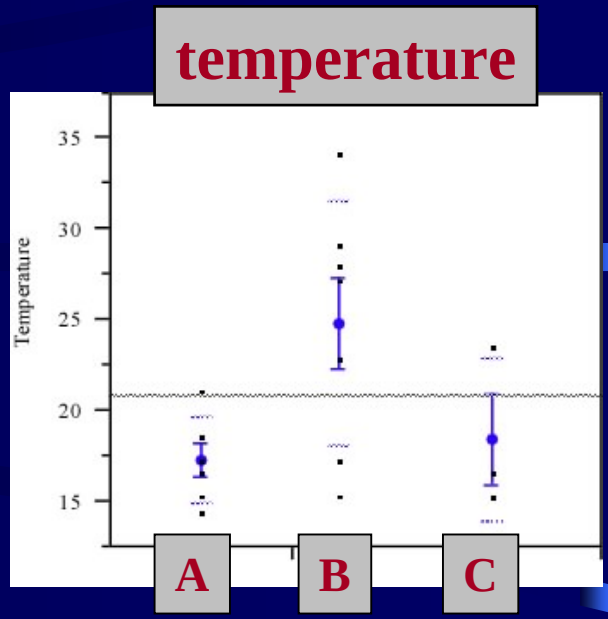
Classification of Sites Based on Periphyton Data

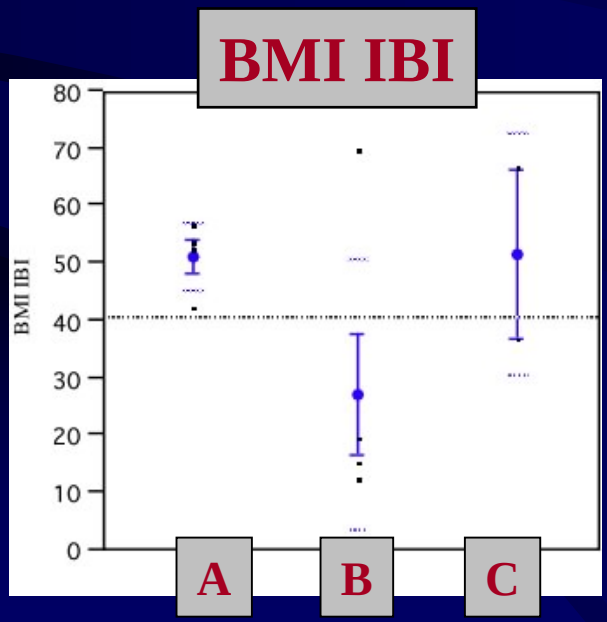
3 clusters:

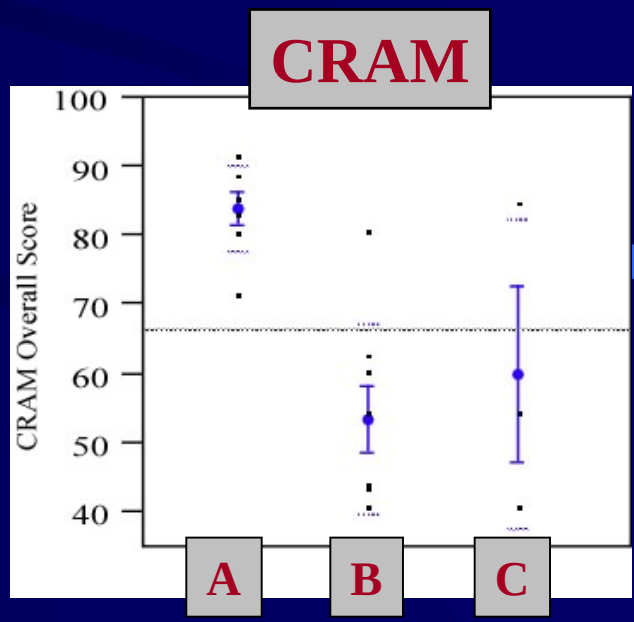
- based on dominant diatoms
- corroborated by soft algae

Cluster Relationships to Other Indicators





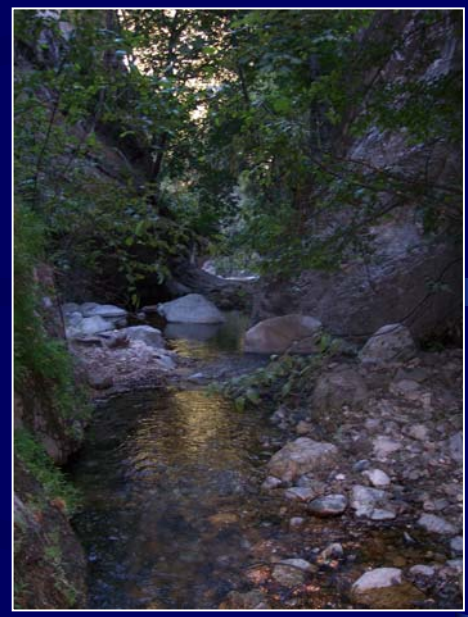




Cluster A

Sites

- N = 7
- upper watershed; mostly high-gradient
- low N
- high CRAM, channel alteration, and BMI IBI scores



Diatoms

- moderate diversity
- several taxa intolerant of organic-bound N (oligo-/mesotrophic)
- low salinity (< 0.9 ppt)
- high 0_2 requirement

Soft algae

- taxa rich
- multiple divisions represented

Cluster B

Soft algae

- taxa-poor
- dominated by cyanobacteria

Sites

- N = 8
- mostly lower watershed, low-gradient, channelized
- highest N and temperature
- low CRAM, and lowest mean BMI IBI and channel alteration scores

Diatoms

- relatively taxa-poor
- high “Pollution Tolerance” (Lange-Bertalot)
- eutrophic species
- fresh/brackish water (0.9 – 1.8 ppt)

Cluster C

Sites

- N = 3
- position in watershed highly varied
- diffuse, intermediate scores for most indicators examined, but lowest pH

Soft algae

- taxa-rich
- indicators of large river

Diatoms

- taxa-rich
- moderately tolerant of nutrient enrichment (Bahls)
- fresh/brackish water
- many taxa tolerant of lower 0_2 (< 75 % DO saturation)
- 2 “large-river” taxa

Conclusions from Phase I (Pilot)

- Diversity of periphyton taxa in southern California appears sufficient to support the production of a periphyton IBI
- Diatom and soft algae data are telling consistent “stories” about physical habitat & water quality
- Taxa in southern California are exhibiting ecological indicator / tolerance trends identified in other regions

Phase II:
Development of Multimetric Tools for Setting Numeric Nutrient Targets Including a Periphyton IBI

- Prop. 50 CNPS funded
- 3 years (2007); southern California
- Project team:
  - Southern California Coastal Water Research Project (SCCWRP)
  - California Academy of Sciences
  - CSU San Marcos
- Central Coast partners:
  - CSU Monterey Bay
  - UC Santa Cruz

Major Goals / Products of Phase II

understand relationship between nutrients and stream periphyton

- reference dataset
- periphyton IBI (So Cal & CC)
- protocols / training materials
- flora / online photodatabase for southern California algal taxa
- taxonomic key
- voucher specimens

Immediate Issues for California

- sampling:
  - time of year / inter-year variation
  - substrata
  - compositing
- analysis:
  - level of intensity
    - counting in lab
    - taxonomic identification
- ephemeral systems: suitability / thresholds

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