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?

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

**benthic soft algae**

**benthic diatoms (unicellular, silicated algae)**

*can expand current southern California bioassessment scope*
Successful Application of PIBIs

- **Alaska**
  - Rinella & Bogan 2005
  - $r=0.636, p=0.011$

- **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

- Total Nitrogen
- Temperature
- BMI IBI
- CRAM
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 O₂ requirement

Soft algae

- taxa rich
- multiple divisions represented
Cluster B

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)

Soft algae
- taxa-poor
- dominated by cyanobacteria
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 $O_2$ (< 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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