Why do we do bioassessments

How do we do bioassessment

How do we interpret bug data

How do we conduct bioassessments in California

Some examples and proposal for industrial timber lands
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Some examples and proposal for industrial timber lands
California Department of Fish and Wildlife

Hot Creek Hatchery
NPDES Permit

1993 in permit
Waited for response
1999-2004
2005 SI process
Continue monitoring
1993-95 Pilot Monitoring Study

BIOLOGICAL CONDITION OF STUDY REACHES
BASED ON MACRO-INVERTEBRATE FAUNAS

Score | Reach
--- | ---
45 | Upper Pudding Creek (Novo Watershed)
39.6 | Sweetwater Creek (Mokolomne Watershed)
37 | Tiger Creek (Mokolomne Watershed)
35.5 | Noyo River (Novo Watershed)
35.5 | Mil Creek (Mokolomne Watershed)
21.5 | Dony Creek (Guadela Watershed)
29 | Solarsky Crossing (Mokolomne Watershed)
21 | North Fork Guadela River (Guadela Watershed)
17.5 | Lower Pudding Creek (Noyo Watershed)
13.5 | Cottonwood Creek (Bbklyon Watershed)
12.5 | Log Cabin Creek (Guadela Watershed)

Obviously, this ranking should be taken with a degree of caution. Without comparison to differences in habitat parameters, the biological significance of the groupings is not clear.

Subsampling 100 macro-invertebrates from a sample is recommended in the national RBPs (Poffk et al 1989). The total number of macro-invertebrates in 11 samples examined ranged from 130 to 3950 with an average of 1140. Subsampling affected the metric values from 0 to 300% and the degree of difference was related to the difference in abundance (Appendix N, Table 7). In spring 1994, sub-sampling was increased to 300 to improve metric reliability. Metric values increased substantially (Appendix N, Table 2 and 3), but there was no difference in the coefficients of variance (Table 5 and 6). For 12 of the 1994 samples, there were less than 300 organisms. The lowest number was 134 but there was no noticeable effect on the metric value or variability.

A strong correlation could not be detected between bioassessment metrics values and physical/habitat scores. This may be because the generalized visual evaluation was not quantitative or there was inconsistency in implementing the field procedures. The macro-invertebrate community appears to be more responsive to upstream influences than those in the immediate area. There were also inconsistencies between information indices generated for the streams visited in fall 1993 and spring 1994.

The bioassessment metrics taxa richness, diversity index and EPT index seem to be reliable indicators of biological conditions. The biotic index had low variability which is indicative of a useful metric, but may not be a relevant metric for forested streams since it was developed for an indicator of organic pollution. Dominant taxa had the highest variability and its usefulness may be questionable.

The effectiveness of the physical/habitat evaluation procedure originally recommended by the EPA (Poffen et al. 1989) was not determined in this study. Low-level indicator physical assessment.

PILOT MONITORING PROGRAM
DFG-IN STREAM COMPONENT

STREAM BIOASSESSMENT

<table>
<thead>
<tr>
<th>STREAM REACH</th>
<th>WATERSHED</th>
<th>SAMPLE ID</th>
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<tbody>
<tr>
<td>RIFFLE #</td>
<td>DATE</td>
<td>TIME</td>
</tr>
<tr>
<td>WATER TEMP (C)</td>
<td>RIFFLE LENGTH (W)</td>
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<table>
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<th>TRANSECT INTERSECT</th>
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<tbody>
<tr>
<td>#1 (W.e.w)</td>
<td>#2 (W.e.w)</td>
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</table>

<table>
<thead>
<tr>
<th>CREW MEMBERS</th>
</tr>
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</table>

1. BOTTOM SUBSTRATE
2. INSTREAM COVER
3. EMBEDDEDNESS
4. VELOCITY / DEPTH
5. CHANNEL SHAPE
6. POOL / RIFFLE RATIO
7. WIDTH / DEPTH RATIO
8. BANK VEGETATION
9. LOWER BANK STABILITY
10. DISRUPTIVE PRESSURES
11. ZONE OF INFLUENCE

COMMENTS

CHAIN OF CUSTODY | RELEASED BY | RECEIVED BY | DATE |
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>COLLECTOR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSPORTER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRANSPORTER</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sampled 11 sites in 3 watersheds
Purchased field and lab equipment
Tested field and lab methods
Modified US EPA methods for Cal needs
Was standard protocol until 2007
Statutory Authority

- Clean Water Act Section 101(a) Purpose:
  - “To restore and maintain the chemical, physical and biological integrity of the Nation’s waters”
Biological integrity - the capability of the waterbody to support and maintain a balanced, integrated, adaptive community of organisms having a composition and diversity comparable to that of natural habitats of the region.
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FRESHWATER BIOASSESSMENT - THE USE OF AQUATIC ORGANISM TO MEASURE AQUATIC HEALTH -

US EPA Recommendation:

Multiple Assemblages
Fish, Invertebrates and Algae
Benthic Macroinvertebrates

Ubiquitous

Relatively stationary

Their large species diversity provides a spectrum of responses to environmental stresses
Collect BMIs
Measure Phab
Measure Basic Chemistry
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End Product - 600 subsampled BMIs from the sample reach
Sensitive Organisms in Streams

- **Dragonflies and Damselflies**
- **Mayflies**
- **Stoneflies**
- **Caddisflies**

**Expected Response to Stress:** abundance & proportion
Tolerant Organisms in Streams

- Scuds
- Snails
- Leeches
- Midge

Expected Response to Stress: abundance & proportion
Types of BMI Metrics

Richness Measures
- EPT Taxa

Composition Measures
- Percent EPT Individuals

Tolerance/Intolerance Measures
- Percent Sensitive EPT Taxa

Functional Feeding Groups
- Percent Shredder Taxa

Total of 134

SAFIT Standard Taxonomic Effort I & II
California’s “Algae Plan”
March 2008

Algae Bioassessment: Supporting Documents

Incorporating Bioassessment Using Freshwater Algae into California’s Surface Water Ambient Monitoring Program (SWAMP)

Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California

July 2009
A. Elizabeth Felter
Southern California Coastal Water Research Project
330 5th Street
Santa Monica, CA 90403

Lillian Basae
San Diego Regional Water Quality Control Board
State Water Resources Control Board
9174 Sky Park Court
San Diego, CA 92123

Pete Oda
Aquatic Bioassessment Laboratory/Water Pollution Control Laboratory
Department of Fish and Game
2015 Venue Road
Rancho Cordova, CA 95670

SWAMP Algae Field SOP
June 2009 (updated May 2010)

http://www.waterboards.ca.gov/water_issues/programs/swamp
Why do we do bioassessments
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Some examples and proposal for industrial timber lands
Targeted Sampling Site from Various Special Studies as of 2000
Western Pilot EMAP and CMAP

2000 through 2007

CDFW
U.S. EPA
SWRCB
RWQCB
EMAP West Example of Proposed Sample scheme.

Reg 9 and 10 = 50 per state and 160 in each shaded area
Reg 8 = 50 in UT and CO, ~20-25 outside shaded areas of MT, WY, and ND, and ~280 within shaded area.
Blue shade is Region’s Special Interest Areas
Red shade is REMAP area
Biological condition of our nation’s streams (USEPA 2006)
2007 CDFW Partnership with SWAMP
Surface Water Ambient Monitoring Program
Perennial Stream Assessment
SWAMP Program

PSA Regions
More than 2000 Random Sample Site through Combined Programs

2000 - 2003 US EPA

2004 - 2006 SWRCB Non-point Source Program

2007 - 2015 SWAMP
## Reference Sites

<table>
<thead>
<tr>
<th>REGION</th>
<th>n</th>
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<td>North Coast</td>
<td>75</td>
</tr>
<tr>
<td>Central Valley</td>
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<tr>
<td>Coastal Chaparral</td>
<td>57</td>
</tr>
<tr>
<td>Interior Chaparral</td>
<td>33</td>
</tr>
<tr>
<td>South Coast Mountains</td>
<td>85</td>
</tr>
<tr>
<td>South Coast Xeric</td>
<td>34</td>
</tr>
<tr>
<td>Western Sierra</td>
<td>131</td>
</tr>
<tr>
<td>Central Lahontan</td>
<td>114</td>
</tr>
<tr>
<td>Deserts + Modoc</td>
<td>27</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>586</td>
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</table>
California Stream Condition Index (CSCI)

A bioassessment tool for perennial wadeable streams based on benthic macroinvertebrates

Raphael Mazor - SCCWRP
Andy Rehn - ABL
Pete Ode - ABL

www.sccwrp.org
raphaelm@sccwrp.org
Trout Creek
Tahoe Basin
<table>
<thead>
<tr>
<th>Component</th>
<th>Obs</th>
<th>Expect</th>
</tr>
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<tbody>
<tr>
<td>CSCI</td>
<td>0.65</td>
<td>1</td>
</tr>
<tr>
<td>O/E</td>
<td>0.49</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>7</td>
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<tr>
<td>MMI</td>
<td>0.81</td>
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<table>
<thead>
<tr>
<th>Metric</th>
<th>Obs</th>
<th>Expect</th>
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</thead>
<tbody>
<tr>
<td>% Coleoptera taxa</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Diptera taxa</td>
<td>5</td>
<td>5.3</td>
</tr>
<tr>
<td>% EPT taxa</td>
<td>24</td>
<td>63</td>
</tr>
<tr>
<td>% Intolerant</td>
<td>5</td>
<td>36</td>
</tr>
<tr>
<td>% Non-insect</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>% Predator taxa</td>
<td>65</td>
<td>26</td>
</tr>
<tr>
<td>% Scraper taxa</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>% Shredders</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Simpson’s diversity</td>
<td>0.90</td>
<td>0.84</td>
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<tr>
<td>Tolerant taxa</td>
<td>6</td>
<td>5</td>
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</table>

<table>
<thead>
<tr>
<th>Observed taxa</th>
<th>Missing taxa</th>
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<tbody>
<tr>
<td>Micrasema</td>
<td>Hydropsyche</td>
</tr>
<tr>
<td>Sweltsa</td>
<td>Diamesinae</td>
</tr>
<tr>
<td>Paraleptophlebia</td>
<td>Fallceon</td>
</tr>
<tr>
<td>Oligochaeta</td>
<td>Epeorus</td>
</tr>
<tr>
<td>Baetis</td>
<td>Rithrogena</td>
</tr>
<tr>
<td>Chironominae</td>
<td>Ameletus</td>
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<tr>
<td>Acari</td>
<td>Cinygmula</td>
</tr>
<tr>
<td>Orthocladiinae</td>
<td>Zapada</td>
</tr>
<tr>
<td>Oligochaetinae</td>
<td>Serratella</td>
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<tr>
<td>Chironominae</td>
<td>Tanypodinae</td>
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<tr>
<td>Acari</td>
<td>Rhyacophila</td>
</tr>
<tr>
<td>Orthocladiinae</td>
<td>Simulium</td>
</tr>
<tr>
<td>Oligochaetinae</td>
<td>Drunella</td>
</tr>
</tbody>
</table>
State's SWAMP Perennial Stream Assessment 2000-2014

- 83% of perennial stream miles are in reference condition.
- 66% of perennial stream miles are in reference condition.

From Andy Rehn, CDFW, April 2014
305(b) assessments
303(d), TMDL
ambient screening
NPDES/stormwater
BMP effectiveness
NPS monitoring

Numeric Endpoints for Interpretation
401 Water Quality Cert
305(b) assessments
303(d), TMDL
NPDES/stormwater
BMP effectiveness
ambient screening
NPS monitoring

Regulatory Applications

SWAMP Standards Regulatory Programs
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USFS Aquatic Management Indicator Species

Lawsuit on EIS saying MIS not effective, No Data

Decided to Change from Trout to BMIs

2009 - first probabilistic sampling event (contractor issues)

2010 - second probabilistic sampling event (contractor issues)

2011 and 2012 regroup contract with ABL

2013 ABL sampled 21 stream sites incorporated into PSA
Based on CSCI Scores
USFS & CDFW combined indicate that 78 ± 6% of perennial stream miles on Sierra Nevada National Forests are in reference condition.
Achieving regulatory biological objectives in California

October 2014
4 Locations Bio-Assessment Protocol
Harrington (Field Staff) & SPI
Greater Battle Creek Working Group (Tussing)
King Fire Sampling Locations – Above, Within - Pilot Creek
Ponderosa Fire Sampling Locations-Above, Within, Below
Objective

The intent of this project is to establish a collaborative monitoring framework for applying California’s SWAMP ecological performance measures to evaluate water and habitat quality in streams on private forest lands. Direct collaborators include the State Water Resources Control Board, Department of Fish and Wildlife, Department of Forestry and Fire Protection, California Forestry Association, and private industrial forest owners.

Background

Over the past decade California has adopted ecological performance measures to evaluate resource management practices and support effective regulatory policies. Recently, wadeable streams have been the focus of a large multi-agency effort to develop standardized technical and regulatory tools for measuring and assessing biological integrity as ecological performance measures. The State Water Board is currently developing guidance for the application of these tools that will become part of its Inland Surface Waters and Enclosed Bays and Estuaries Plan.
Ponderosa Fire – August 2012

Northeast pattern
27,680-acres Total
17,664-acres SPI
So Appreciate Your Mayflies
And your Beetles