



Water Indicators: Paddling Upstream

2008 Environmental Information Symposium:
Transforming Information into Solutions

December 10, 2008

Phoenix, Arizona



Overview

- U.S.-Mexico Border Water Indicators
- Bioindicators and Water Quality
- Indicators for Decision-Making
 - Bioindicators in Arizona
 - Santa Cruz River Bioindicators

U.S.-Mexico Border Environmental Cooperation



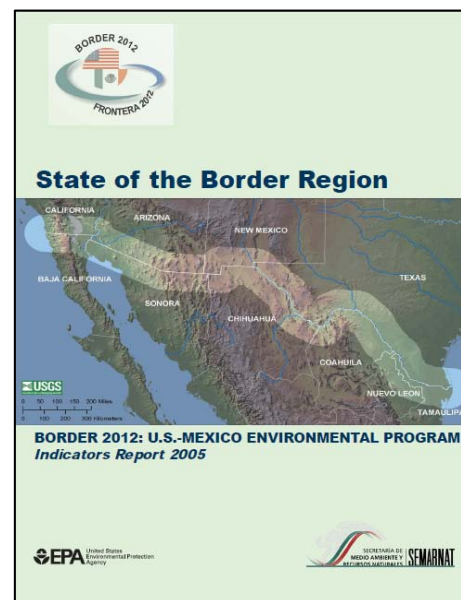
To protect the environment and public health in the U.S.-Mexico border region, consistent with the principles of sustainable development

*Air Water Land Environmental Health
Emergency Response Enforcement & Compliance*

Border Indicators Task Force Objective and Products



“Identify and develop a set of performance-based indicators that best contribute to measure...the progressive accomplishments of the goals and objectives of the Program”



Planning for Border Water Indicators: Opportunity Tables



Goal 1: Improve Water Quality Border 2012 Objective	Need <i>Need for program response</i>	Input <i>Resources invested in response</i>	Output <i>Activities, products, or services</i>	Flow Outcome <i>Emissions changes</i>	State Outcome <i>Ambient conditions</i>	Effect/ Impact Outcome <i>Human or ecosystem effects</i>
<i>1: Increase water and wastewater connections</i>	Population Projections				Water/WW Access	
<i>2: Improve water quality</i>					Gap in Environmental Knowledge	
<i>3: Strengthen beach and coastal monitoring</i>						
<i>4: Assess water system conditions</i>						

Measures  Indicators

Theme



“The true health of our aquatic environments is reflected by the biological communities that reside within them”

Prof. J. Karr
University of Washington

Biological Indicators for Water



Clean Water Act Objective

Section 101



To Restore & Maintain the Chemical, Physical, & Biological Integrity of the Nation's Waters

Section 303(c) - WQS that serve the purposes of the Act

Section 303(c)2(B): ...where numeric criteria are not available, States shall adopt criteria based on biological assessment methods...

Section 304(a)8: EPA shall...develop and publish information on methods for establishing and measuring water quality criteria for toxic pollutants on other bases than pollutant-by-pollutant, including biological monitoring and assessment methods.

Value of Biological Indicators



Ohio Comparison of Biosurvey With Chemical Evaluation

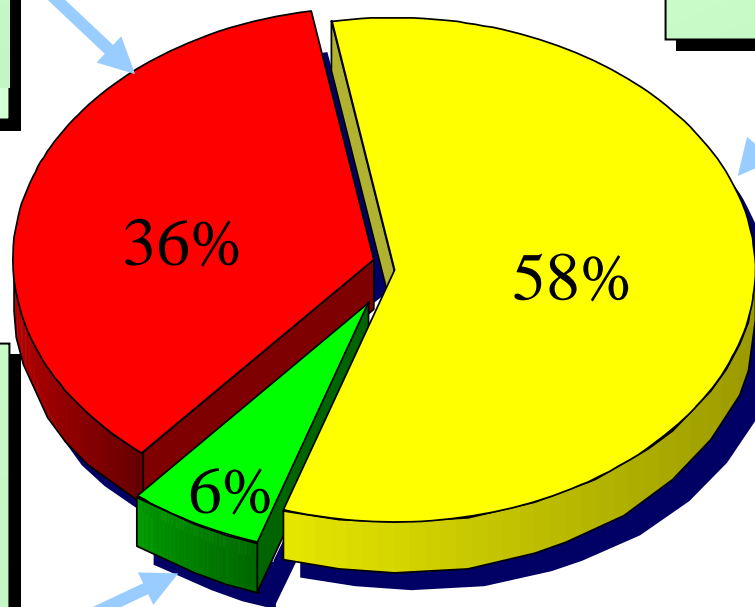
**Chemical Evaluation
Indicates No Impairment**

**Biosurvey Shows
Impairment**

**Chemical Prediction &
Biosurvey Agree**

**Biosurvey Shows
No Impairment**

**Chemical Evaluation
Indicates Impairment**



The Biological Condition Gradient

Biological Response to Increasing Levels of Stress



Levels of Biological Condition

Natural structural, functional, and taxonomic integrity is preserved.

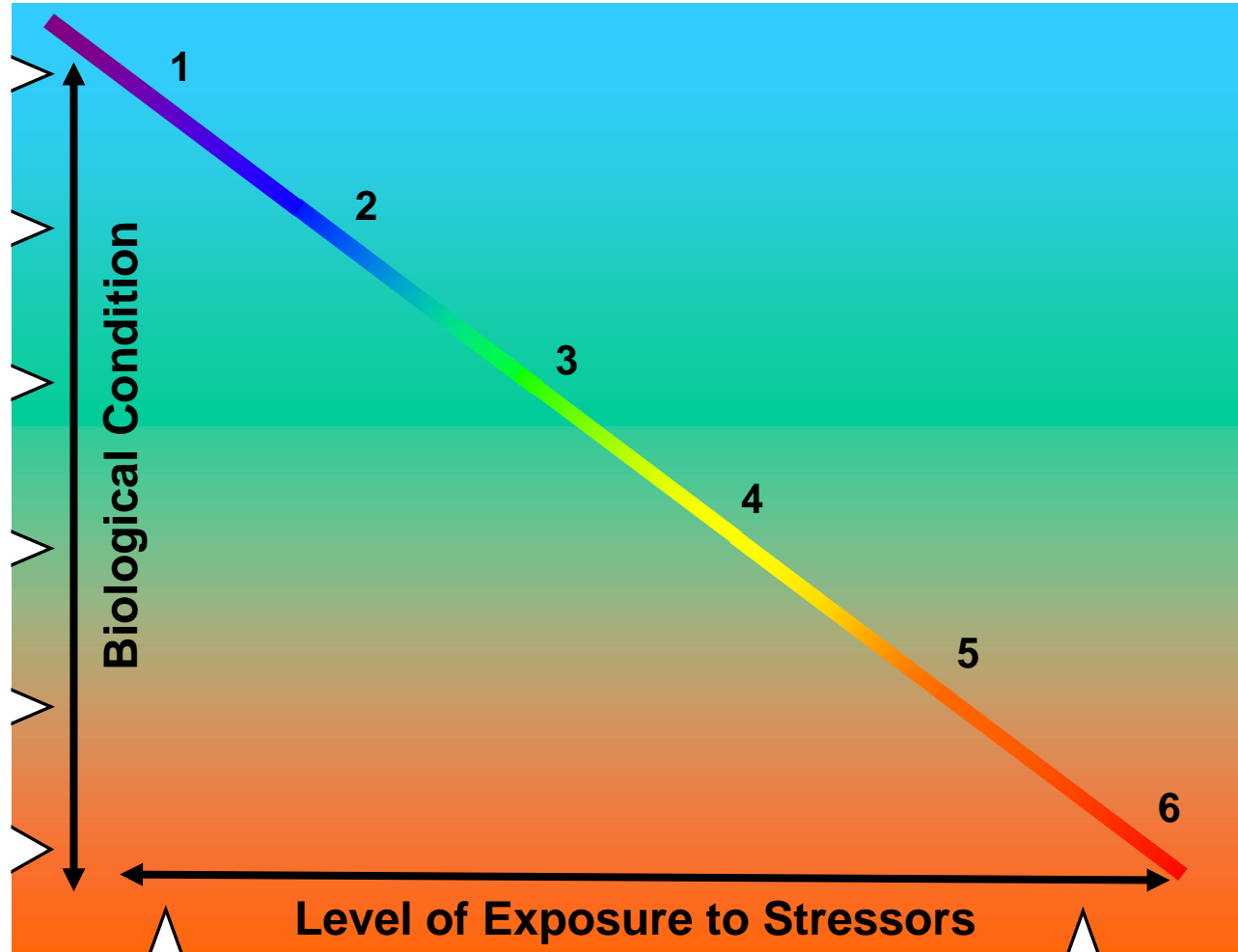
Structure & function **similar to natural** community with some additional taxa & biomass

Evident changes in structure due to loss of some rare native taxa; shifts in relative abundance

Moderate changes in structure due to replacement of sensitive taxa by more tolerant taxa

Sensitive taxa markedly diminished; conspicuously unbalanced distribution of major taxonomic groups

Extreme changes in structure and ecosystem function.



Watershed, habitat, flow regime and water chemistry as naturally occurs.

Chemistry, habitat, and/or flow regime severely altered from natural conditions.

Undisturbed/Minimally Disturbed Stream



Stoneflies



Mayflies



**Dragonflies,
Damselflies**



Beetles



Midges



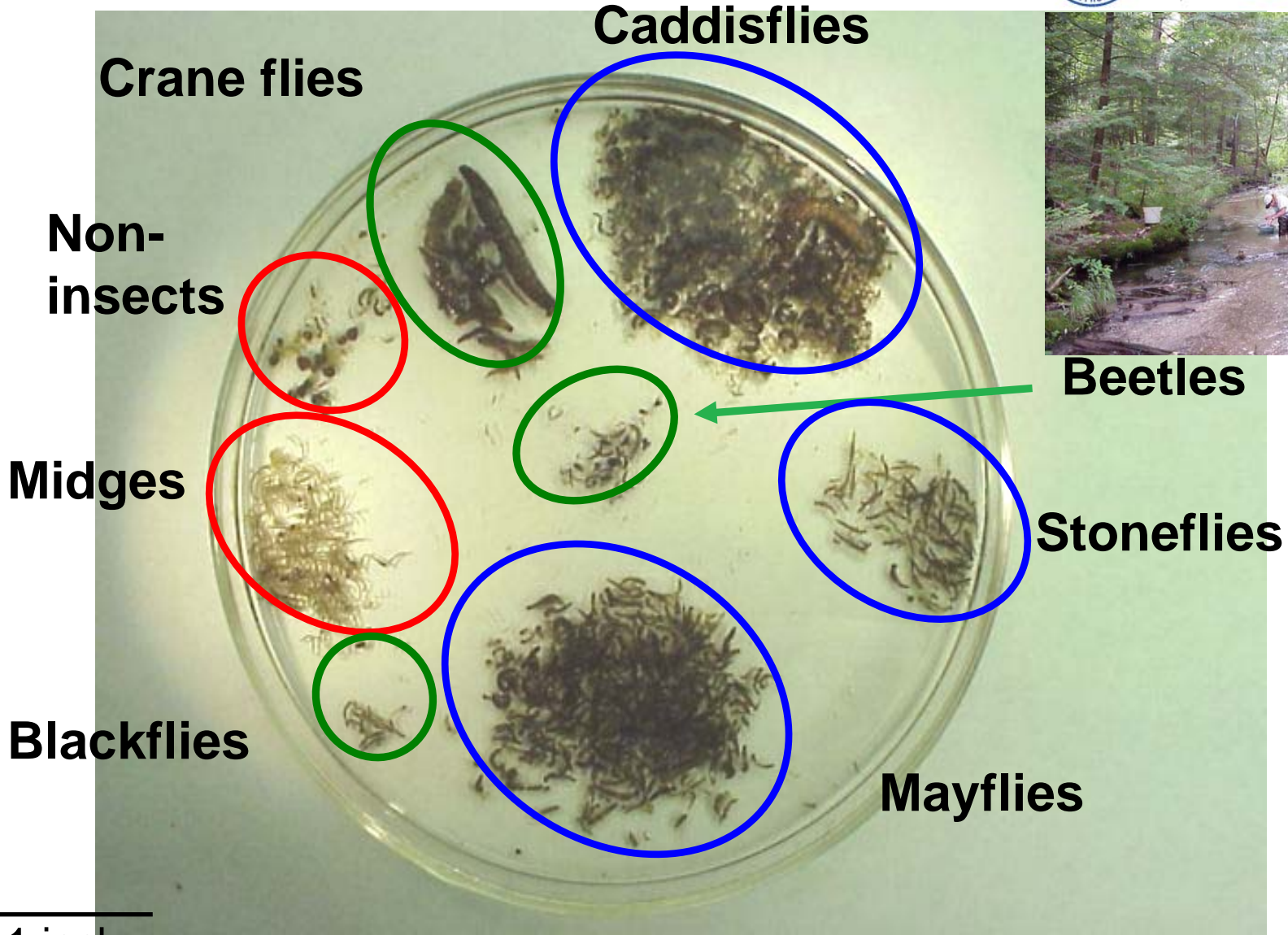
Caddisflies



1 inch

Courtesy of Susan Davies, ME DEP

Nutrient Enriched Stream



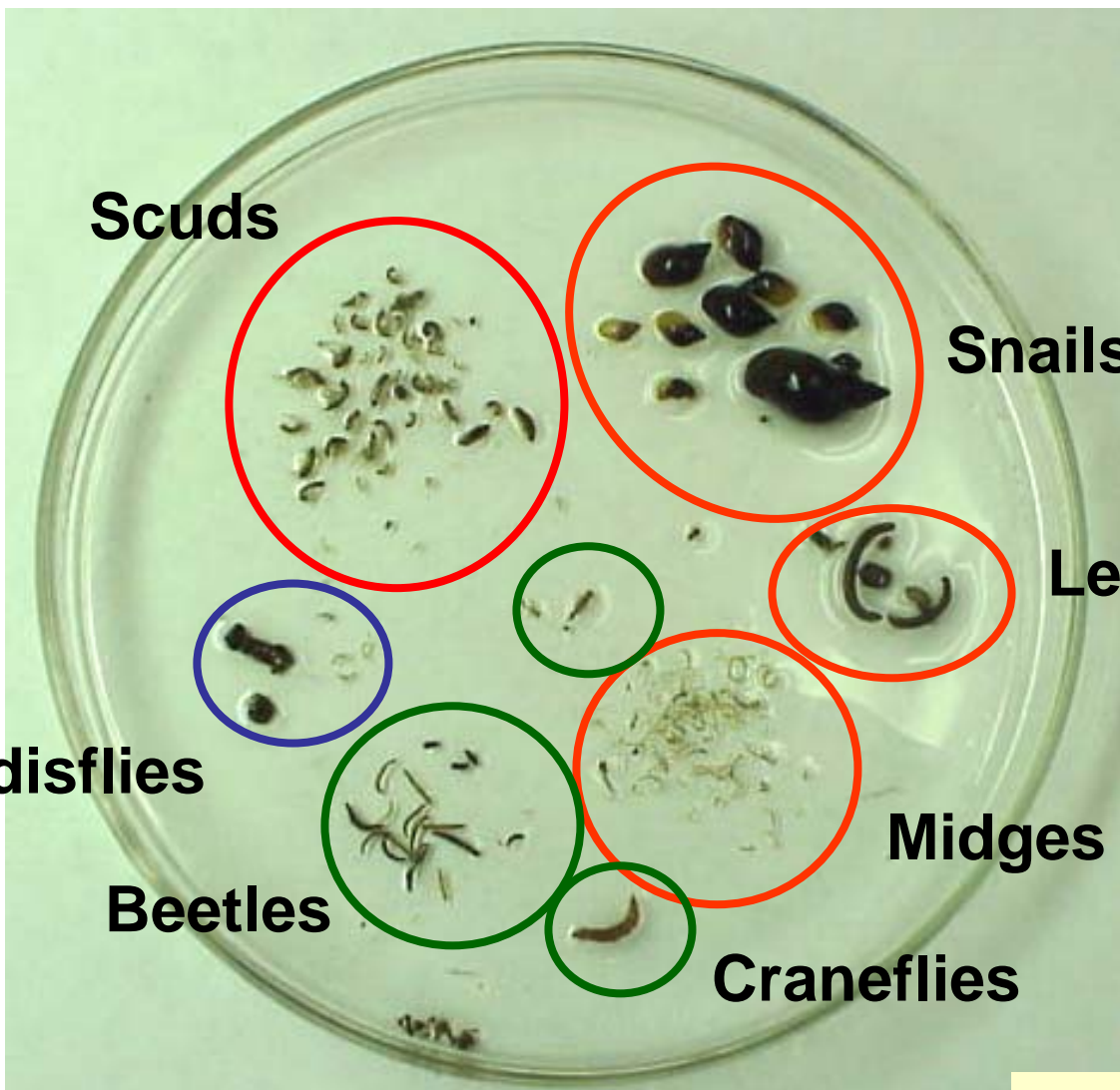
Beetles

Stoneflies

Mayflies

1 inch

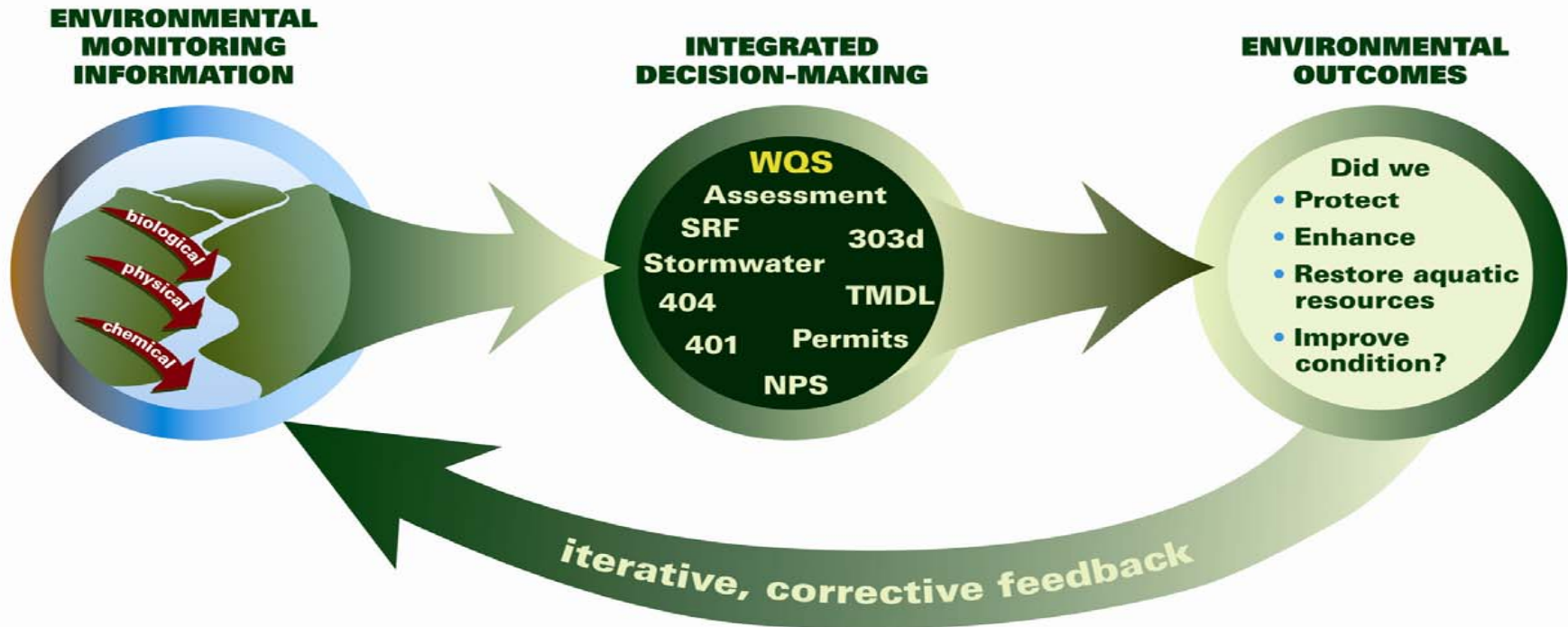
Drainage from a Shopping Mall Parking Lot



1 inch

Courtesy of Susan Davies, ME DEP

Measure Environmental Results



Data on biological condition, level and categories of stress, and biological impacts can be used to more precisely define designated aquatic life uses and help support data sharing among water quality program managers.

Working collaboratively, programs can relate the results of individual program actions to a common measure of success - the condition of the aquatic biota as expressed in WQS.

Program integration optimizes our ability to meet the goals of the Clean Water Act and achieve real **environmental results**. We can measure these results and communicate our progress to the public.

Theme



Lee Dunbar

Assistant Director, Planning and Standards Division,
Bureau of Water Management and Land Reuse, CT DEP

“Trying to run a water quality management program without biological monitoring information is like trying to drive a car at night without the headlights on.

And if you do monitor but you don't look at the data, it's like driving the car with the headlights on but with your eyes closed!”