



Biological Indicators of Watershed Health

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Biological Response Signatures

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Biological indicators are both accurate and sensitive measures of the health of waterways and they can also be used to diagnose sources and causes of pollution. Definite patterns exist in the responses of biological communities to stress (pollution), and finding these patterns can show what types of pollution are present, and sometimes the source of those problems. When the response patterns of the various metrics and components of IBIs (Indices of Biotic Integrity) are identified, these unique combinations of biological community characteristics that aid in distinguishing one impact type over another are referred to as "Biological Response Signatures."

[Ohio Case Studies](#)

Metrics

When conducting biological assessments, measurements are taken in the field or lab. Metrics (or biological attributes) for each assemblage sample (e.g., benthic invertebrates, fish, periphyton, macrophytes) are calculated from these measurements. The following table presents an example of representative metrics for each type of assemblage.

Biological Assemblage	Metric	Response to Stress
Benthic Macroinvertebrates	No. of taxa	Reduced
	ETO taxa (ephemeroptera, trichoptera, odonates)	Reduced under enrichment, DO, stress
	% intolerant species	Reduced
	% suspension feeders	Reduced
Fish	No. of taxa	Reduced
	% piscivores	Reduced
	No. of intolerant species	Reduced
Macrophytes	No. of sunfish species	Reduced
	No. of taxa	Low
	% dominant species (by weight)	High
	No. of exotic species	High
Periphyton	Species richness	Not Determined
	Pollution Tolerance Index for Diatoms	Not Determined
	Achnanthes minutissima	Not Determined
	Shannon Diversity (for diatoms)	Not Determined

Each metric is then assigned a score which is related to its deviation from the reference (or expected) site values. In more complicated studies, multimetric indices can be calculated, which is the sum of all the metric scores within each biological assemblage. [<more on metrics>](#)

For more information on biological response signatures:

Please see the discussions on the diagnostic value of biological

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indicators in EPA's Stressor Identification Evaluation Manual and Ohio EPA's discussion on Biological Response Signatures (pdf file) and the Area of Degradation Value.

Reader to view some of the files on this page. See EPA's PDF page to learn more.

To learn more about metrics please visit the following sites:

- The Rapid Bioassessment Protocols For Use in Streams and Rivers: Periphyton, Benthic, Macroinvertebrates, and Fish Protocols Chapter has a nice section on Metrics
- The Lake and Reservoir Bioassessment and Biocriteria Technical Guidance Document