

US EPA ARCHIVE DOCUMENT

# EMAP-West Communications

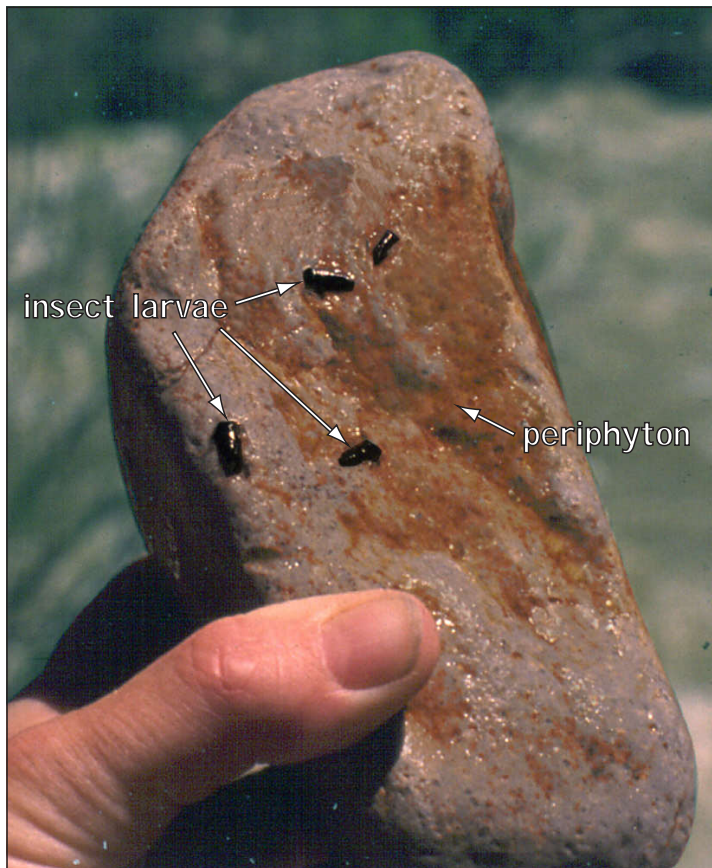
## Indices of Biotic Integrity

The Clean Water Act calls for the “restoration and maintenance of biological integrity of Nation’s waters.” To fulfill this requirement, environmental managers must be able to measure the biological condition of their aquatic resources. EMAP-West is helping to meet this need by developing tools for assessing condition known as Indices of Biotic Integrity (IBI’s), extending the work of James Karr who first developed IBI’s to measure the condition of fish assemblages in the early 1980s. The IBI concept has since been extended to other types of stream organisms (including periphyton – algae that are attached to the stream bottom, and invertebrates – insects, both of which serve as valuable indicators of the biotic condition). EMAP-West scientists and cooperators are developing this concept further for streams across the 12-state region of the Program.

The IBI concept has developed around the assumption that similar groups or categories of organisms respond similarly to human-induced changes in their environment. Based on this assumption IBI development requires that a set of metrics of the integrity of the assemblage of interest (e.g., fish) be identified and calibrated. Examples of candidate metrics for EMAP-West are:

- species richness (e.g., total number of species, or percent alien species),
- habitat preferences (e.g., percent of the species that live on the stream bottom),
- mode of reproduction (e.g., percent of individuals that spawn on clean gravel),
- tolerance categories (e.g., number of species which are intolerant to chemical disturbance).

Evaluating the statistical quality of the candidate metrics, their redundancy with other candidate metrics, and responsiveness to disturbance initially screens candidate metrics. Remaining candidate metrics that are responsive to natural factors, such as stream size, are adjusted to account for these natural factors. The result is that changes in the candidate metrics reflect human-induced changes, rather than natural variability.



Scores are then assigned to the screened and adjusted metrics for each sampled location. Higher scores (usually a maximum of 10) are assigned for locations where the metric value more closely matches the value of the metric at reference sites. The scores for the metrics are added together resulting in an IBI score for each site, based on multiple metrics. The index is then validated by testing the response of the IBI scores for a set of locations with known human-induced stressors. The probability sampling design that determines how the sample sites are selected allows us to describe the biotic integrity of a population of streams in a region of interest.

Wherever sufficient data are available, EMAP-West scientists and cooperators will develop IBI’s for fish, invertebrates, and algae. Each cooperating state and tribe will then be able to assess the biological condition of their aquatic resources and, through appropriate management actions, move closer to meeting the requirements of the Clean Water Act.

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