BIOASSESSMENT PRIMER

"The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters." -Clean Water Act section 101a.

Biological monitoring is the first step in protecting biological integrity in waters (Karr and Chu 1999). Biological Integrity can be defined as "a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region." (Karr and Dudley 1981).

A biota's condition as revealed through biological monitoring offers the most comprehensive indication of ecological risks in a particular place.

Bioassessment is a cost-effective biological monitoring tool that utilizes measures of the stream's benthic macroinvertebrate (BMI) community and its physical/habitat structure. Because they are ubiquitous and sensitive in varying degrees to anthropogenic pollutants and other stressors, BMIs can provide considerable information regarding the biological condition of water bodies. (Resh and Jackson 1993, Karr and Chu 1999, Davis and Simon 1995).

Together, biological and physical assessments integrate the effects of water quality (and any changes) over time, are sensitive to multiple aspects of water and habitat quality, and provide the public with more familiar expressions of ecological health (Gibson 1996). The additive or synergistic affects of multiple stressors, including the cumulative effects of sub-lethal doses of toxins, are reflected in changes in the community composition and structure in the stream benthos.

Metrics are measures of changes in biological attributes that respond predictably to disturbance, pollutants, or other stressors. Metrics are chosen on the basis of whether they reflect specific and consistent biological responses to human activities. Ideal metrics are also relatively easy to measure and interpret, are sensitive to a range of biological stresses, and can discriminate between human caused changes and the background "noise" of natural variation.

In a multimetric approach to biological assessment, the metrics that exhibit the strongest response to human caused changes in the stream are combined into a single score, the Index of Biotic Integrity (IBI).

Karr (1981) first published the IBI as a consistent means of measuring the societal goal of biological integrity. Based on a combination of tested biological attributes of an aquatic community, the IBI provides a cumulative site assessment as a single score value (Davis and Simon 1995, Karr et al. 1986). The IBI is the end point of a multimetric approach recommended by the US EPA for the development of biocriteria (Barbour et al. 1999).

The data collection methods of the California Stream Bioassessment Procedure (Harrington 1999) represents a regional adaptation of the US EPA Rapid Bioassessment Protocols (Barbour et al. 1999) and is recognized by the US EPA as California's standardized bioassessment procedure (Davis et al. 1996, Harrington 1999b).

Finally, because it focuses on the living organisms whose very existence represents the integration of conditions around them, biological evaluations expressed as an IBI can diagnose chemical, physical and biological impacts as well as their cumulative effects on beneficial uses. Bioassessment can serve many kinds of environmental and regulatory programs. Because it focuses on what is at risk, bioassessment analysis is a powerful diagnostic tool and an essential measurement of beneficial use attainment and protection. As such, it is less likely to underprotect aquatic systems or to waste resources (Karr and Chu 1999, Davis and Simon 1995)

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