

AN EVALUATION OF SIX BIOLOGICAL MODELS USED TO ASSESS THE CONDITION OF LARGE STREAMS FROM A STATEWIDE MONITORING NETWORK IN MONTANA

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ABSTRACT

The Montana Department of Environmental Quality (DEQ) established a statewide water quality monitoring (SWM) network with sites located on mainstems and major tributaries within the Missouri, Yellowstone, and Columbia River Basins. We collected periphyton and macroinvertebrate samples and physical-chemical data from 1999-2005 at over 50 fixed station sites that were located on the major tributaries. We used two periphyton and four macroinvertebrate models to assess the biological condition of these streams. Our preliminary analysis showed poor agreement between the six biological models that were used, which made it difficult for us to assess the biological condition of these streams with a reasonable level of confidence. For this reason, we developed a multi-stressor gradient to evaluate the models and determine what was affecting their performance.

I compared the results of the bioassessment models to a multi-stressor gradient that was developed by:

1. Evaluating habitat, physical, and chemical data collected by the SWM network.
2. Evaluating data and reviewing assessments provided in Montana's 2006 303(d) list.
3. Comparing the chemical and physical data to water quality standards and criteria.
4. Comparing the physical and chemical data to draft aquatic life use tiers that describe expected physical and chemical conditions that occur along a human disturbance gradient.

An algae and macroinvertebrate index of biological integrity were found to agree with each other and the multi-stressor gradient at approximately 70% of the sites that were located in the mountains and valley ecoregions. When this occurred, it was estimated that the level of confidence in the result was high. The level of confidence in the result was slightly improved when a third biological model (diatom general increaser taxa) also agreed. This occurred at nearly 60% of the sites. The level of confidence in the results was determined to be low for the remaining three bioassessment models; and was low for all of the bioassessment models when they were used to assess the condition of streams located in the plains ecoregion.

KEYWORDS

Bioassessment models, biological condition, macroinvertebrate, periphyton, multi-stressor gradient, human disturbance gradient, aquatic life use tiers, level of confidence.