UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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Reply To: OEA-095

MEMORANDUM

SUBJECT: Macroinvertebrate Data Related to the Delisting of Nutrients on the Lower Boise River

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An increase in algal growth resulting from increased nutrient loadings can affect the food webs of aquatic ecosystems, including the macroinvertebrates. Increasing nutrient levels in rivers and streams can increase in primary producer biomass or production. Primary producers include periphyton, macrophytes, and phytoplankton. This increase in plant material can influence other organisms via several routes. First, plant photosynthesis and respiration both may increase. Enhanced photosynthesis can lead to supersaturated dissolved oxygen concentrations, which adversely affect biota. In addition, increased respiration by plants will consume oxygen, and may drive dissolved oxygen concentrations below critical levels, especially at times when photosynthesis is limited (e.g, at night or on cloudy days). Finally, increased plant material can lead to increased suspended organic matter and turbidity, which decreases visibility, which impacts visual predators.

Increases in primary producers can directly affect both food quantity and food quality. In response to nutrient enrichment certain plant taxa may increase while others decrease, leading to changes in plant assemblage structure. Thus, increases in plant production do not necessarily translate to increases in food availability. Also, changes in plant assemblage structure also can affect habitat structure, for example by changing the availability of refugia, smothering coarse substrates and/or the trapping of fine organic matter particles.

More sensitive taxa such as Plecoptera (stonefly) often decrease with increases in many types of stress, including nutrient enrichment (Klemm et al., 2003). This decease in sensitive taxa (such as stoneflies) is due to changes in dissolved oxygen, decreasing

visibility, increasing habitat simplification and among other factors. In the lower Boise, Plecoptera decrease in the downstream direction and are completely absent from the lower sites.

Tolerant species increase as result of nutrient enrichment (Miltner and Rankin, 1998). More tolerant taxa can take advantage of more simplified, less varied habitat structure and poorer water quality conditions. In the lower Boise, tolerant species increase in the downstream direction. Specifically, Molluscs and Crustaceans are tolerant of nutrient enrichment (Griffith et al., 2005). In the lower Boise, the taxa richness of Molluscs and Crustaceans increase in the downstream direction.

Excess fine sediment can have similar effects on macroinvertebrates as nutrients. Excess sediments also change habitat structure, for example by changing the availability of refugia, and smothering coarse substrates. Excess sediment also decreases visibility. These changes can also result in decreases in sensitive taxa and increases in more tolerant taxa. The biological effects due to sediment stress are not sufficiently specific to be considered symptomatic of sediment impairment alone.

The lower Boise river macroinvertebrate assemblages are impaired, and this impairment increases in the downstream direction. There is evidence that sediment and nutrients are both likely sources of impairment. However there is not sufficient information to show that one stressor is causing this impairment exclusively of the other.

References

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Miltner, RJ; Rankin ET. (1998) Primary nutrients and the biotic integrity of rivers and streams. Freshwater Biol 40:145-158.