# Agate Fossil Beds National Monument

Aquatic Invertebrates
Resource Brief

Trends from 1989 – 2010

Aquatic invertebrates have been collected along the Niobrara River at Agate Fossil Beds NM since 1989 using Hester-Dendy samplers. These samplers consist of 9 plates that are colonized by invertebrates while they are suspended in the water for 30 days. Aquatic invertebrates are typically identified to genus and
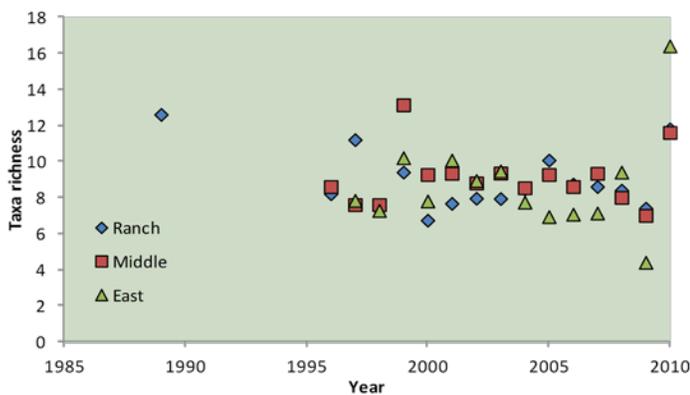
*Taxa richness, or the number of different taxa collected in each sample, has remained similar through time.*

counted. Bioassessment metrics are calculated based on invertebrate data to estimate ecosystem health. One bioassessment metric is Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness, which counts the number of taxa that are mayflies, stoneflies, and caddisflies. Insects in these orders tend to be sensitive to ecosystem health, thus more EPT means better ecosystem health. Another bioassessment metric is Hilsenhoff's Biotic Index (HBI) that uses values (0 to 10) to describe how tolerant invertebrates are to pollution. A value of 0 indicates that the invertebrate is extremely sensitive to pollution and a value of 10 indicates that the invertebrate

Questions
• **How has the aquatic invertebrate assemblage changed over time?**

• **According to the invertebrates, how has ecosystem health changed over time?**

is very tolerant of pollution. Tolerant invertebrates will live in all types of streams, but sensitive species will be absent in streams with poor ecosystem health.

The Niobrara River is home to trueflies, mayflies, dragonflies, damselflies, beetles, crustaceans (scuds and
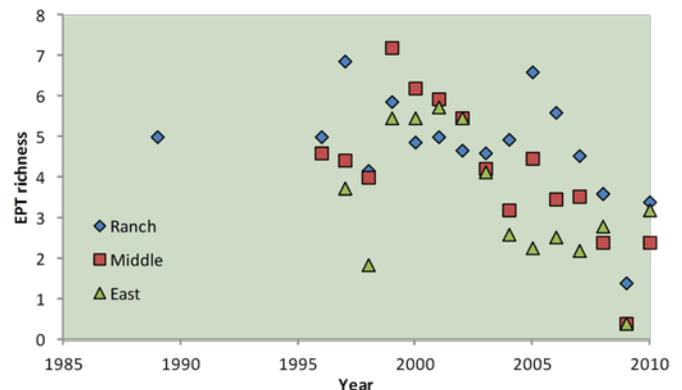
The number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies; EPT) taxa collected in each sample decreased over time.

crayfish), snails, and mussels. Eight taxa were collected per sample in the Niobrara River in 1996. Since that time, the number of genera has remained similar through time. Therefore, the data suggest that the diversity of invertebrates has remained constant through time. On

Why use Aquatic Invertebrates?

Aquatic invertebrates are excellent indicators of ecosystem health because they are ubiquitous, abundant, relatively long-lived, diverse, and typically sedentary. These animals have been used to monitor ecosystems since the 1870s. Growth, survival, and reproduction of aquatic invertebrates are sensitive to declines in environmental health allowing analysis of assemblage structure to monitor lakes, streams, and wetlands. Aquatic invertebrates integrate ecosystem health throughout their lives, and much research has focused on how pollution alters assemblages (e.g., Rosenberg and Resh 1993).

the other hand, ecosystem health appears to have decreased over time. The number of EPT taxa decreased at all three sites (ranch, middle, and east) between 1989 and 2010. On average, 6 EPT taxa were collected in the late 1990's, but only 3 were collected on average in 2010. Therefore, the number of sensitive mayfly, stonefly and caddisfly taxa has decreased over time. In 2010, we did not collect any stoneflies in the Niobrara River. Similarly, the HBI values have increased at all sites. In the late 1990's the index averaged a tolerance value of 3, but the average tolerance value has increased

to nearly 8 in 2010. The HBI index indicates that the mean tolerance value of invertebrates in the river has increased indicating a decline in ecosystem health. Ecosystem health of the Niobrara River has decreased over time according to the invertebrates living there.

Many variables impact the river from large-scale (e.g., climate change) to small-scale processes (e.g., agricultural runoff). Invasive yellow flag iris may be impacting the ecosystem of the Niobrara River. The iris dominates the riparian vegetation along some parts of the river, likely decreasing channel width. The iris probably adds more organic matter to the river increasing decomposition and creating large swings in daily dissolved oxygen. Low concentrations of oxygen in the water at night (when no photosynthesis is occurring) likely decreases sensitive invertebrates living there. Alternatively, the invasion of pike in the Niobrara River at Agate Fossil Beds NM has probably changed the invertebrate assemblage. When predaceous fish, such as pike, are added to a river, invertebrate biomass increases. Biomass of invertebrates was not recorded during this time; however, biomass has likely increased given that insect-eating fish have drastically decreased. The decline of ecosystem health in the Niobrara River is likely a combination of these factors.
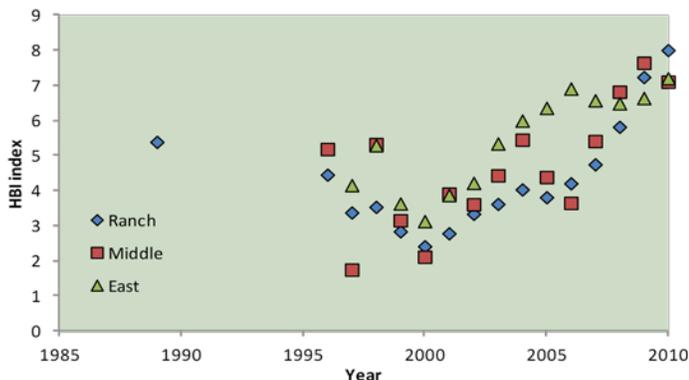
Hilsenhoff's Biotic Index (HBI) calculates the average pollution tolerance of invertebrates at each site.

References:

Rosenberg, D. M. and V. H. Resh.1993. Freshwater biomonitoring and benthic macroinvertebrates. Chapman and Hall, New York.

Stasiak, R. H., G. R. Cunningham, S. Flash, A. Wagner, and A. Barela. In prep. Fishes of the Niobrara River at Agate Fossils Beds National Monument: 2011 survey. University of Nebraska at Omaha, Omaha, NE

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