

2010 Benthic Macroinvertebrate Data Analysis,
for the Animas River Stakeholders's Group, 12/7/10
Chester Anderson, B.U.G.S. Consulting

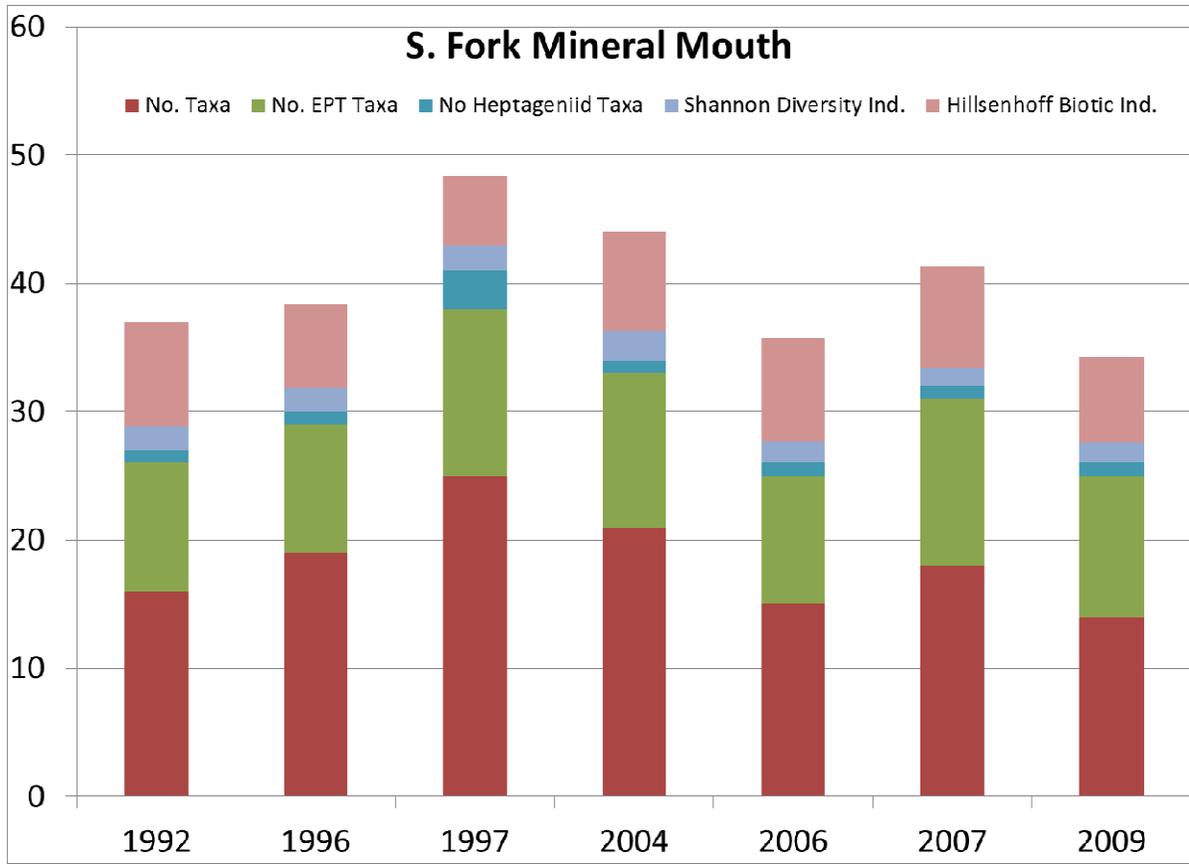
Methods:

I looked at several indices that are relatively independent of each other:

1. Total number of taxa along with the Shannon-Wiener diversity index. The Shannon Wiener index incorporates the relative number of each taxa (evenness) along with the total number of taxa into 1 metric. Typically the value of the Shannon-Wiener diversity index ranges from 1.5 (low species richness and evenness) to 3.5 (high species evenness and richness).
2. Total number of EPT (Ephemeroptera (mayflies) Plecoptera (stoneflies) and Trichoptera (caddisflies)) taxa along with the proportion of EPT taxa to the total number of taxa. These taxa tend to be more sensitive to pollution than other taxa.
3. Total number of Heptageniid (flat-headed mayflies) taxa along with the proportion of Heptageniid taxa to the total number of taxa. Heptageniid are known to be very sensitive to metal pollution.
4. Hilsenhoff biotic index. The HBI ranges from 0 to 10, higher values indicating taxa with greater tolerances to pollution and thus poorer conditions in the river. The HBI formula takes accounts for the relative number of each taxa with particular tolerance values into the final metric. For graphical consistency with the other metrics, I subtracted the HBI from 10. Therefore, with my modified HBI, an increasing value indicates improving conditions on the graphs shown below. Although originally created for sensitivity to organic pollution, tolerance values work okay as indications of overall sensitivity to pollution.

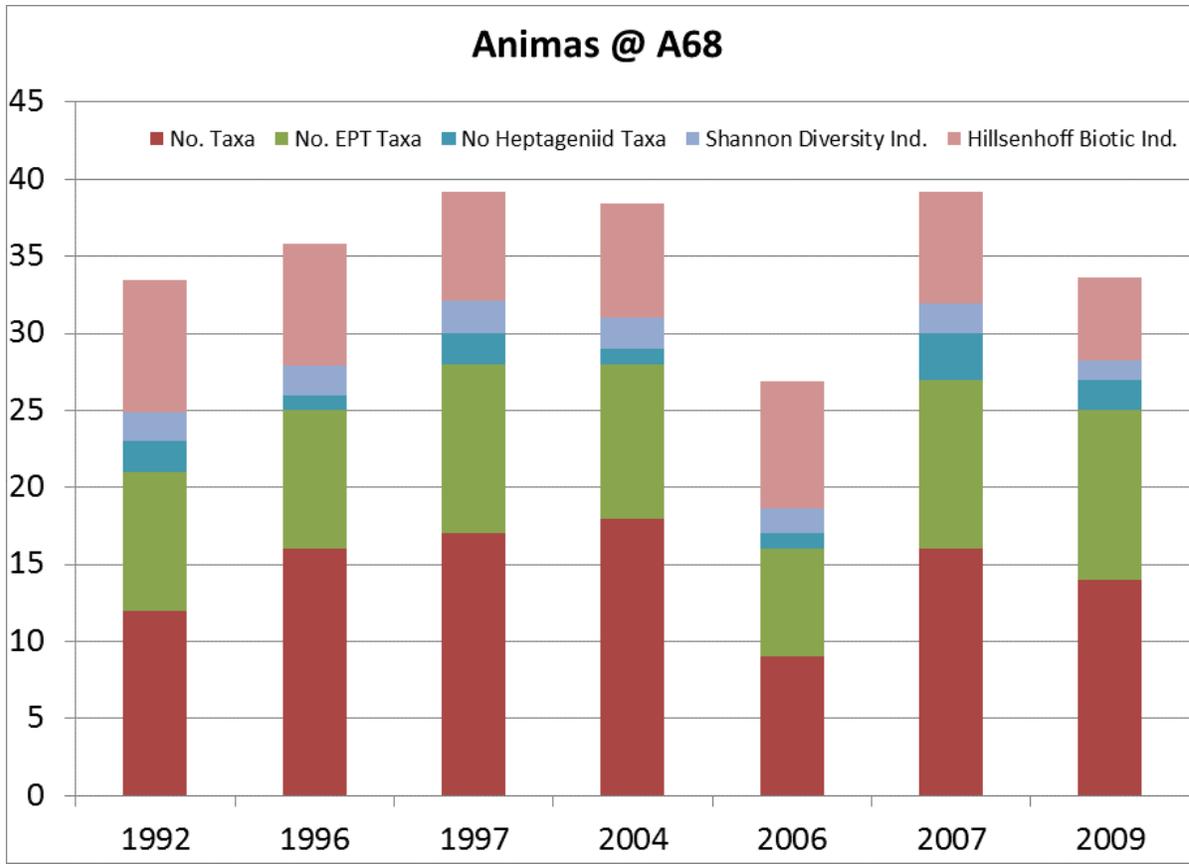
Below I discuss each sample site, comparing data collected after 2004 to the 2004 data itself and to the 96, 97 baseline data and to the CDPH&E's 1992 data. Although not reflected in the overall metric, in my analysis and discussions I give more weight to metrics in the following order: total number of Heptageniid taxa, total number of EPT taxa, Shannon-Wiener Diversity Index, total number of taxa, the HBI, and the proportions of total number.

The data collected at the Animas River at KOA campground includes the 96, 97 ARSG baseline data and post baseline data collected by the Animas Nutrient Workgroup and the Animas Watershed Partnership.



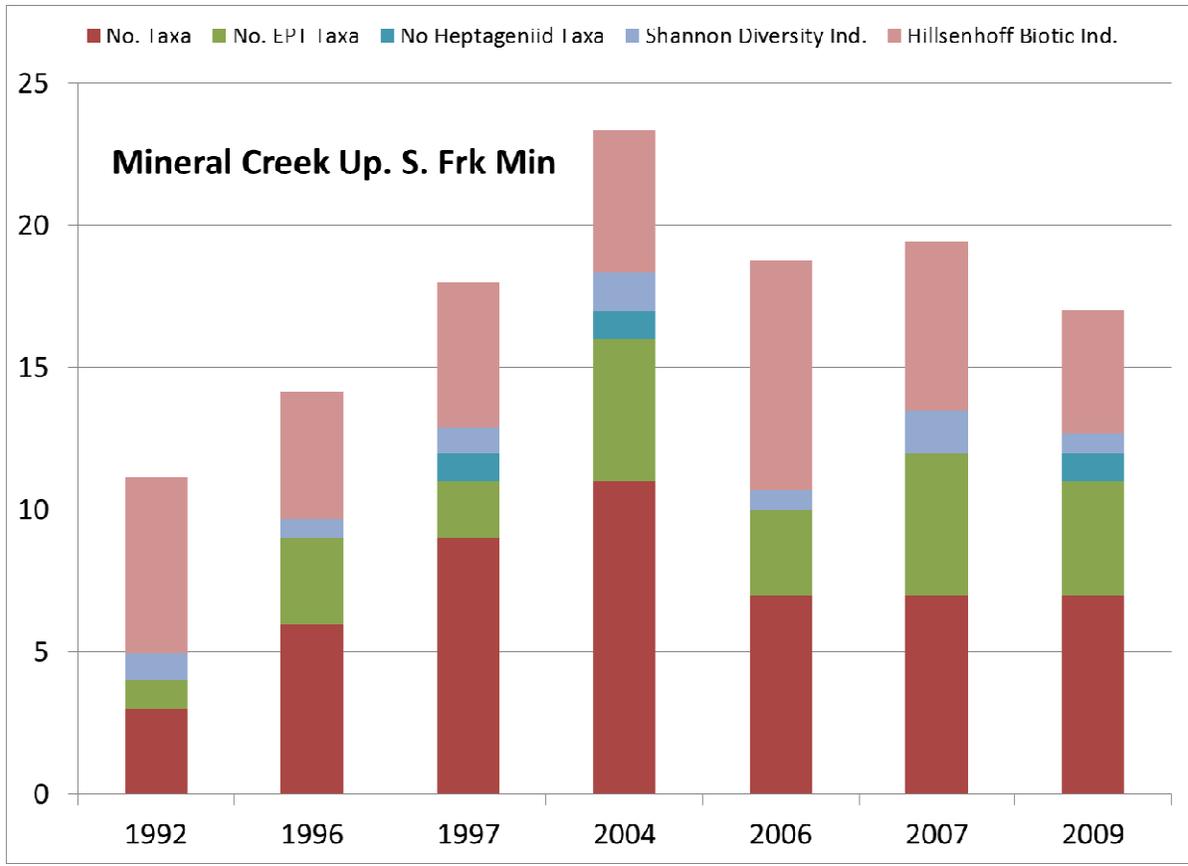
South Fork Mineral just upstream of confluence with Mineral (M28)

At this site there was a large decrease in the total number of taxa from 2004 (21) to 2009 (14) although the number of EPT taxa remained relatively constant, ranging from 12 in 2004 to 11 in 2009 and an average of 11.5 in the 96, 97 baseline data. The diversity index decreased significantly compared to the 2004 samples and decreased slightly when compared to the baseline data. The taxa in the 2009 samples had somewhat higher tolerance values resulting in the HBI increasing from 2.29 in 2004 to 3.30 in 2009 both showing improving conditions when compared to an average HBI of 3.97 for the 96, 97 baseline data. *Overall, the indices show slightly decreasing conditions at this site compared to the baseline and the 2004 data but relatively consistent compared to other sample sites.*



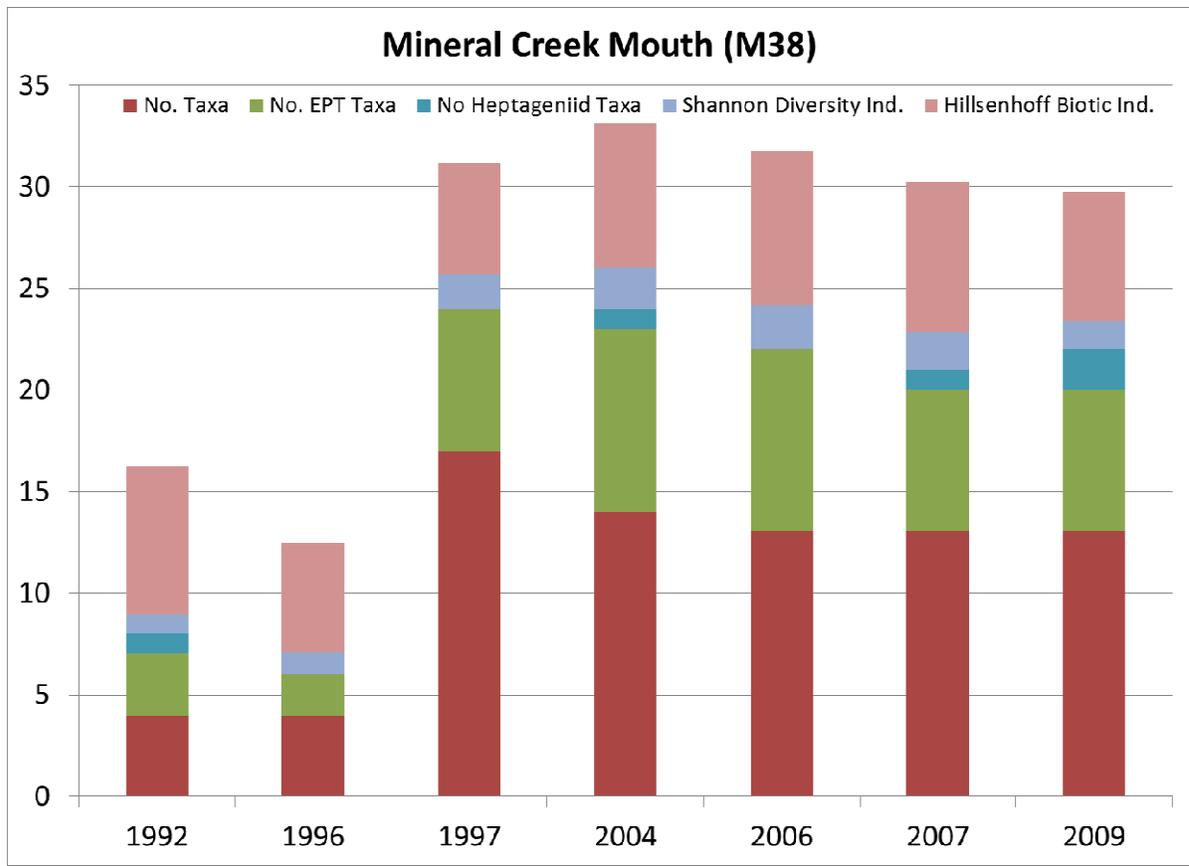
Animas River upstream of Cement Creek (A68).

At this sample site there was a decrease in the total number of taxa in the 2009 (=14) samples when compared to the 2004 (=18) although the number of EPT taxa remained the same (11 in 2009 and 10 in 2004 with an average of 10 total taxa found in the 96, 97 baseline data). Of significance indicating improving conditions at this sample site, were the 3 Heptageniid taxa found in 2007 and the 2 Heptageniid taxa found in 2009 as well as increasing numbers of EPT taxa. Both the diversity index and the HBI showed declining conditions compared to both 2004 data and baseline data. *Overall, the indices show slightly improving conditions at this site compared to the baseline data and similar conditions when compared to the 2004 data.*



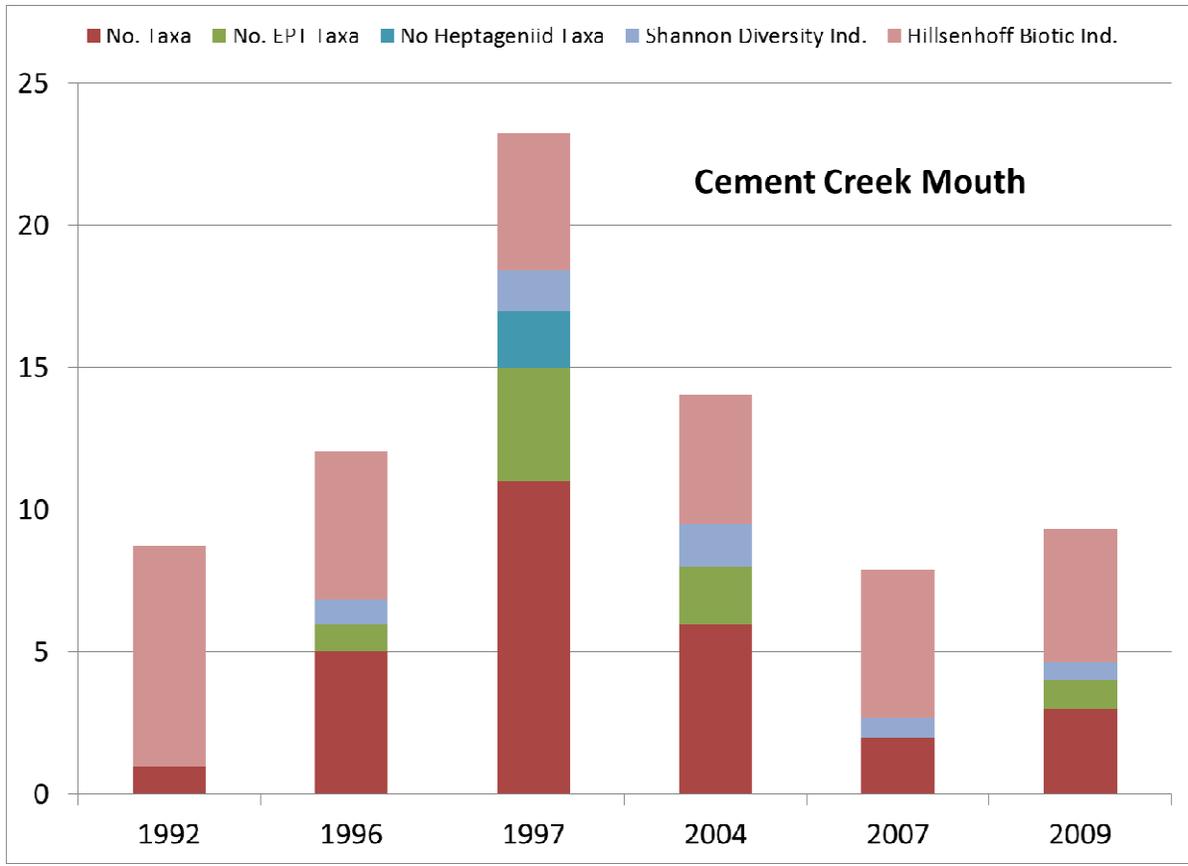
Mineral Creek upstream of confluence with S. Fork of Mineral Creek (M27)

The number of taxa found in 2009 (=7) was less than the number of taxa found in 2004 (=11), although similar to the number of taxa found in 96, 97 baseline data (average = 7.5). The number of EPT taxa in 2009 was the same as found in 2004 and greater than the number of EPT taxa found in the baseline data. The diversity index and the HBI showed similar trends to trends in the number of EPT taxa at this sample site. *Overall, the indices show slight improvement at this site compared to the baseline data and similar conditions compared to the 2004 data.*



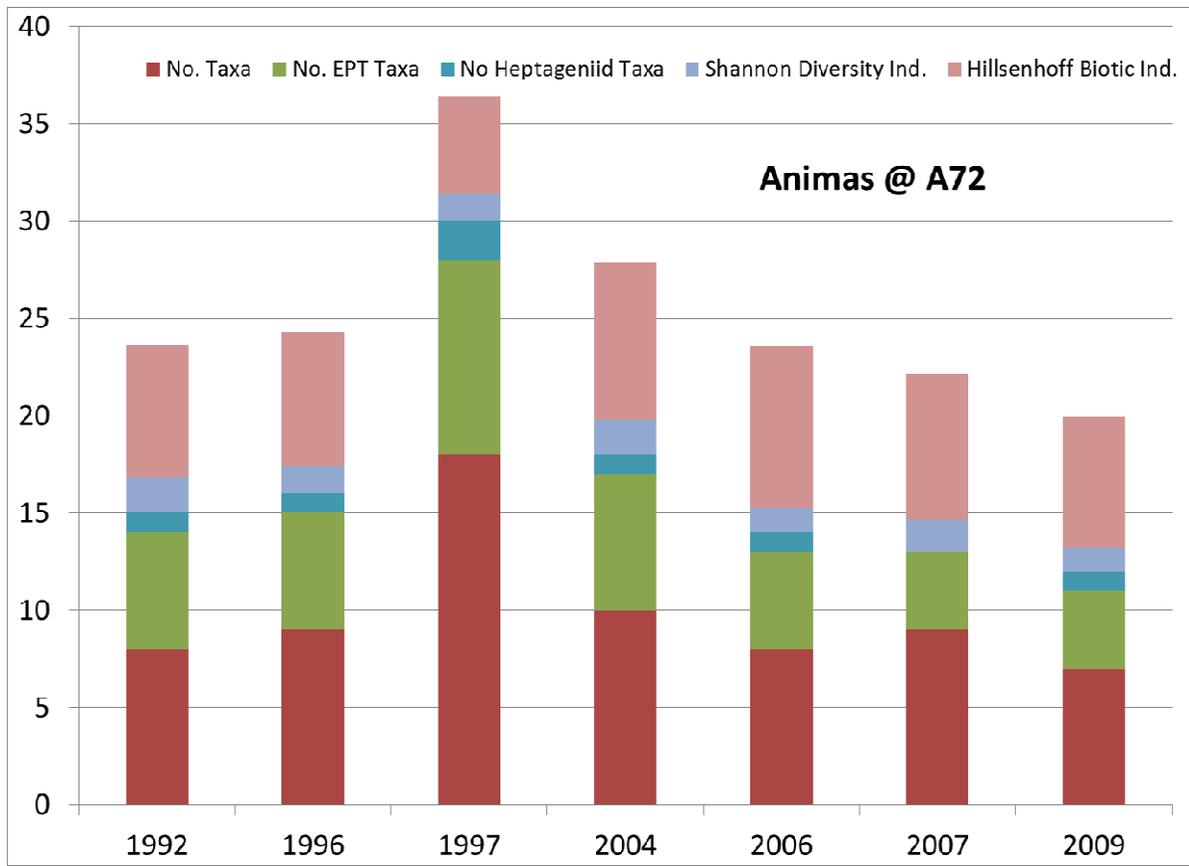
Mineral Creek Mouth (M38)

The total number of taxa in 2009 (=13) was as high as the total number of taxa found in 2004 (=14) and slightly greater than average, total number of taxa found in the 96, 97 baseline data (=10.5). Since 2004 this site has more or less sustained the number of EPT taxa. (7 in 2009, 9 in 2004) with an increase in the number of taxa when compared to the 96, 97 baseline data (= 4.5 total number of taxa) although the Shannon-Wiener diversity index has declined since 2004 and the HBI has increased. Both the diversity index and the HBI show similar or improved conditions when compared to the 96, 97 baseline data. Of significance to this sample site were the 2 Heptageniid taxa found in 2009 and the 1 Heptageniid taxa found in 2007. *Overall, the indices show improving conditions at this site compared to the baseline data and similar conditions compared to the 2004 data.*



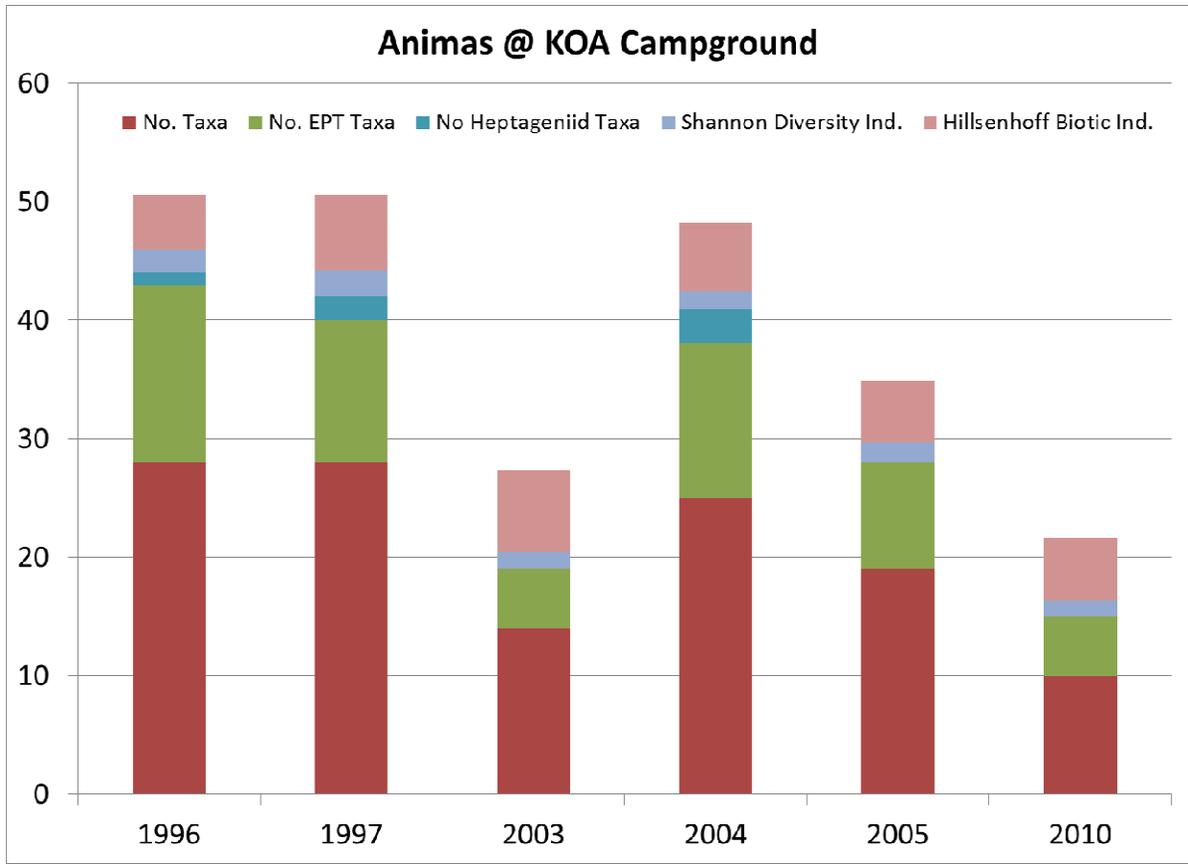
Cement Creek Mouth (CC01)

The total number of taxa (=3) and the number of EPT taxa (=1) in the 2009 samples were less than what was found in 2004 when there were 6 total number of taxa and 2 EPT taxa. The 2009 data was also less than the total number of taxa (average = 8) and the number of EPT taxa (average = 2.5) that were found in the 96, 97 baseline samples. Similar downward trends at this site were found in the diversity index and the HBI. *All indices at this site show declining conditions compared to the baseline data and compared to the 2004 data.*



Animas River @ A72

Only 7 total number of taxa were found in the 2009 samples at A72, 3 less than what were found in the 2004 samples when the total number of taxa was 10 and 6 less than the average, total number of taxa found in the 96, 97 baseline samples where the average was 13. The number of EPT taxa declined as well, from 10 in 2004 to 7 in 2009 which was slightly less than the number of EPT taxa found in the baseline data with an average of 8. The diversity index in 2009 at A72 was 1.23 compared to 1.8 in 2004. There was also an increase in the HBI from 1.89 in 2004 to 3.31 in 2009 which was less than the average HBI found in the 96, 97 baseline data of 4.04 which also indicates decreasing conditions at A72. The loss of individual EPT taxa at this site since 2004 included the complete loss of all Perlodid stoneflies and Taeniopterygidae caddisflies along with the predatory *Ryacophila* caddisfly. *All indices at this site show declining conditions compared to the baseline data and to the the 2004 data.*



Animas River @ KOA Campground

In 2010 the number of taxa was 10 whereas 27 were found in 2004 and 20 in 2005 along with a large decrease in the number of EPT taxa - from 13 in 2004 to 9 in 2005 and 5 in 2010. There were 3 Heptageniid taxa in the samples in 2004 but all Heptageniids were absent in the 2005 and the 2010 samples and all stoneflies were absent in the 2010 samples, The HBI increased to a high of 4.97 in 2010 compared to 2004 when it was 4.23 and increased when compared to the average of the 96, 97 baseline HBI which was 4.44. *All indices at this site show declining conditions compared to the baseline data and to the 2004 data.*

Overall Observations:

Given the declining conditions found at the mouth of Cement Creek, the Animas at A72 and the Animas at KOA Campground along compared to the relatively stable conditions of the Animas upstream of Cement Creek (A68) and improving conditions at the mouth of Mineral Creek (MC38) it is clear that water quality in Cement Creek has declined and had a deleterious effect on the Animas at A27 and possibly as far down as the Animas at KOA Campground.