2008 Biomonitoring

Hecla
GREENS CREEK

Aquatic Biomonitoring at Greens Creek 2001-2008

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- Biomonitoring program initiated in 2001 at Sites 48, 6, & 54 in Greens Creek and Site 9 in Tributary Creek

- Methods include assessments of:
  - Periphyton biomass
  - Benthic macroinvertebrates abundance and classification
  - Juvenile fish population estimates
  - Metals concentrations in whole body juvenile fish

- Annual Sampling and Reports by Alaska Department of Fish and Game, Division of Habitat
  - 2008 Results reported in: Technical Report No. 09-02, Aquatic Biomonitoring at Greens Creek Mine, May 2009

Biomonitoring Sampling Sites

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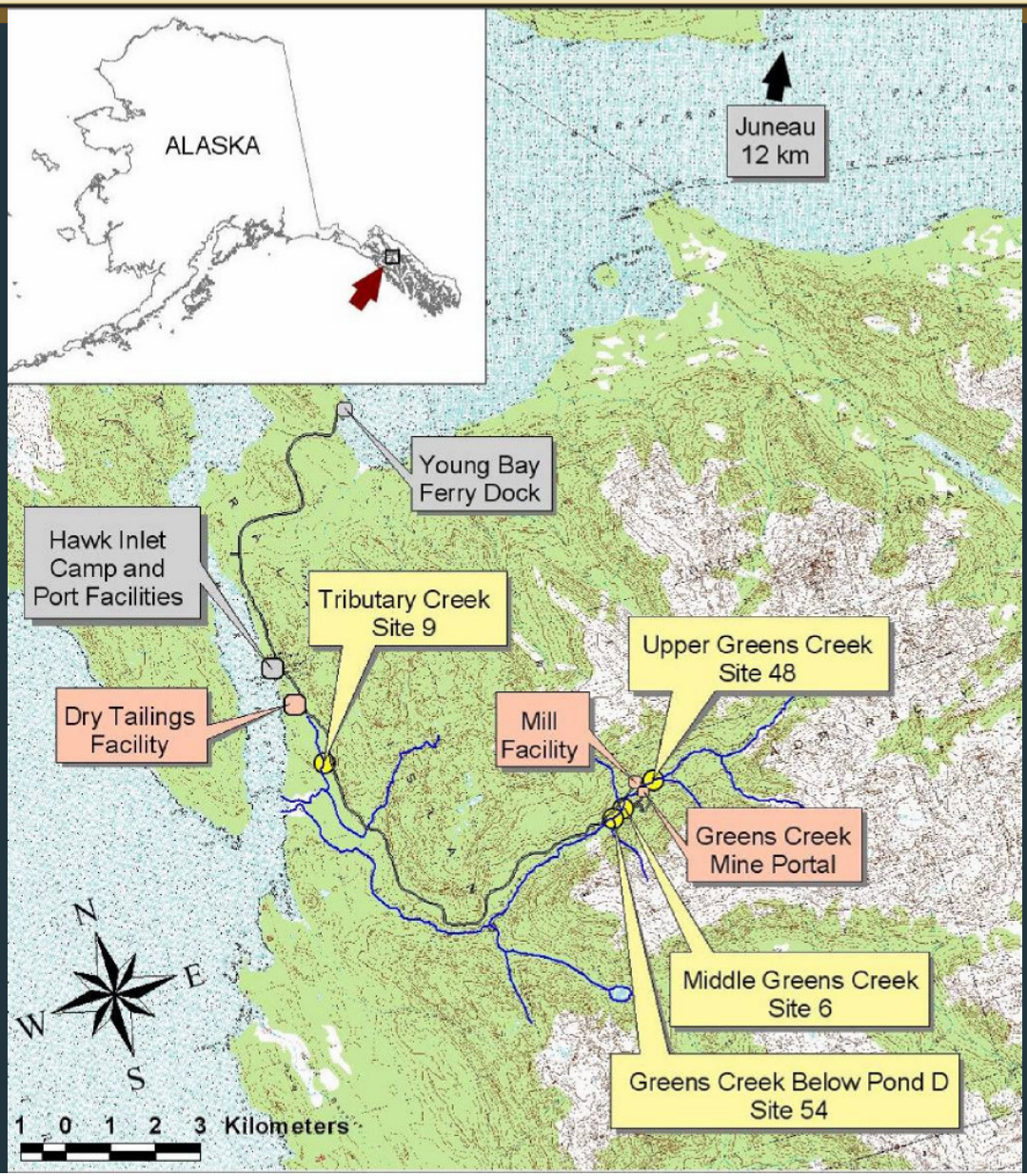

Site 48

Site 54

Site 9

Greens Creek and Tributary Creek Flows during Biomonitoring 2001-2008

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- "Water levels and stream discharges at the two Greens Creek sampling sites in 2008 were high and similar to those present during the 2001 sampling, while those at the Tributary Creek site were low " (ADNR, Technical Report No. 08-03)
- *It is difficult to field measure low discharges in Tributary Creek because of the stream's relatively shallow channel and largely rectangular cross-section.

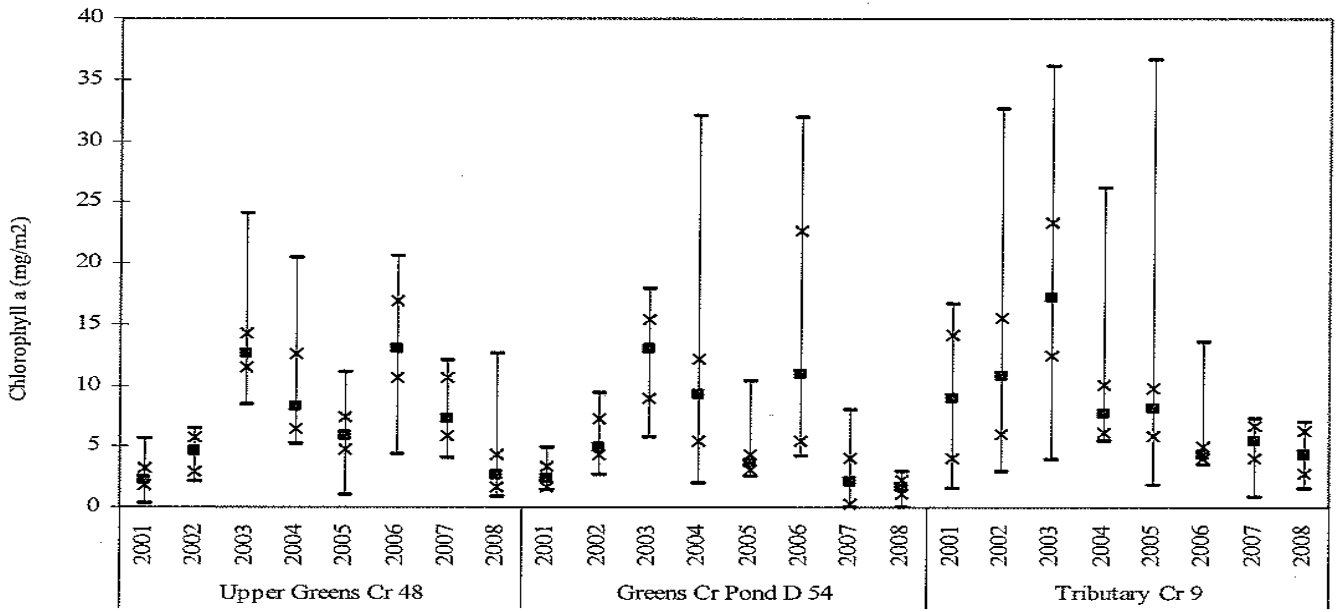
Year	Sampling Dates	Greens Cr. USGS Gage		Tributary Cr. Field Data*	
		feet^3/sec	meter-Vsec	feet^3/sec	mete/sec
2001	July 23	72	2.04		
	July 24	73	2.07	- - -	- - -
2002	July 23	51	1.44	- - -	- - -
	July 24	57	1.61	- - -	- - -
2003	July 22	16	0.45	- - -	- - -
	July 23	15	0.42	- - -	- - -
2004	July 21	25	0.70	0.1	<0.01
	July 22	22	0.62	- - -	- - -
2005	July 22	33	0.93		
	July 23	29	0.82	2.7	0.08
2006	July 20	35	0.99		
	July 21	59	1.67	3.4	0.10
2007	July 20	100	2.83	5.4	0.15
	July 21	98	2.78		
2008	July 22	81	2.29		
	July 23	73	2.07	0.35	0.01

Mean daily discharge during biomonitoring sampling periods.

(ADNR Technical Report No. 09-02, Table 1)

Periphyton Biomass Results

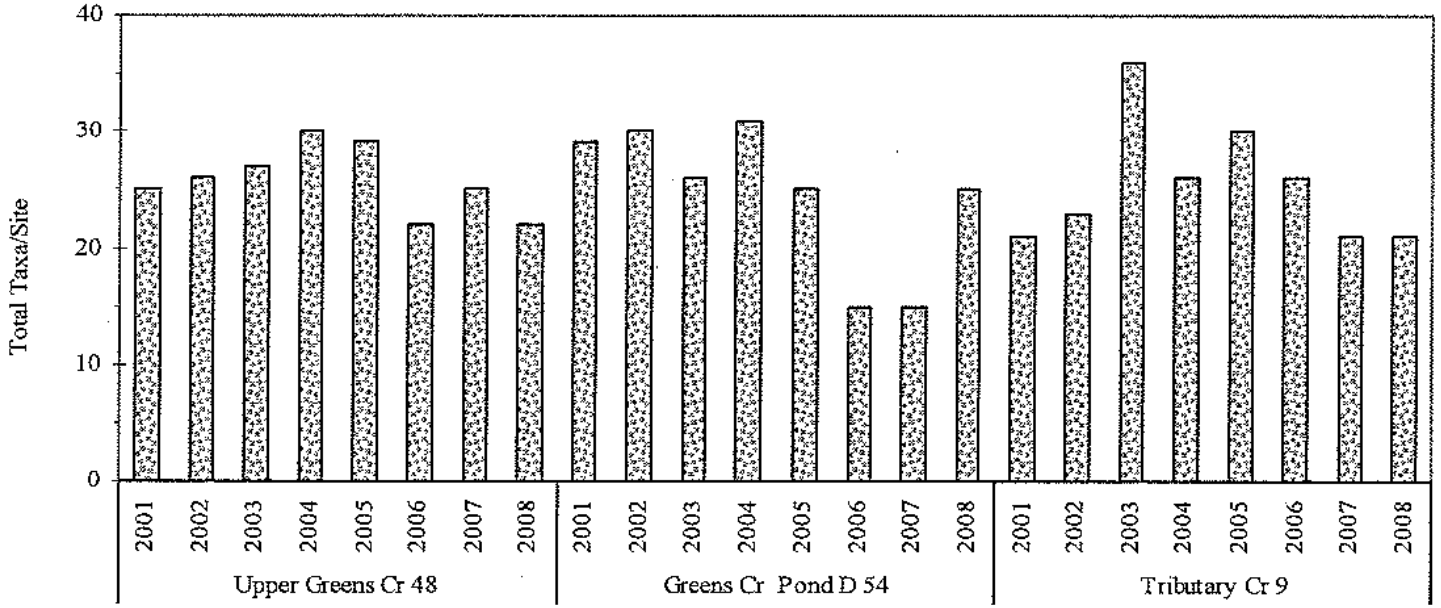
"Periphyton biomass at the Greens Creek sites has shown a similar pattern over the eight years sampled, with lower values in 2001 and 2002 followed by a peak in 2003, decreases in 2004 and 2005, increase again in 2006, and down from that in 2007 and 2008" (ADNR Technical Report No. 09-02)



Comparison of estimated periphyton biomass (medians and ranges) among biomonitoring sites, 2001-2008
(ADNR Technical Report No. 09-02, Figure 29)

Benthic Macroinvertebrates Results

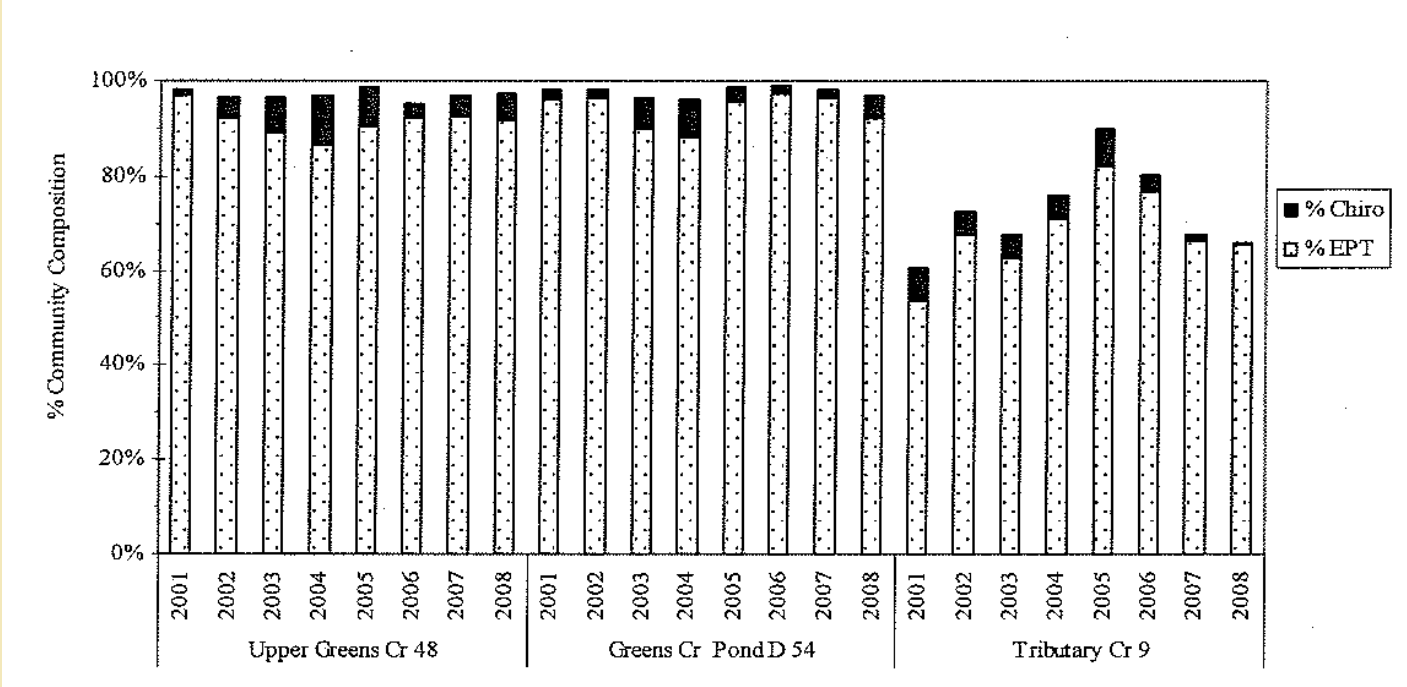
- "Each of the three biomonitoring sites continued to have diverse invertebrate communities with abundant numbers of taxa (taxonomic richness) per sample" (ADNR Technical Report No. 09-02)
- "The number of taxa per site (richness) was among the lowest encountered in this biomonitoring project at the two Greens Creek sites and at Tributary Creek Site 9. Richness was not statistically different between sites in 2008." (ADNR Technical Report No. 09-02)



Comparison of benthic macroinvertebrate taxonomic richness among biomonitoring sites, 2001-2008
(ADNR Technical Report No. 09-02, Figure 32)

Benthic Macroinvertebrates Results (cont)

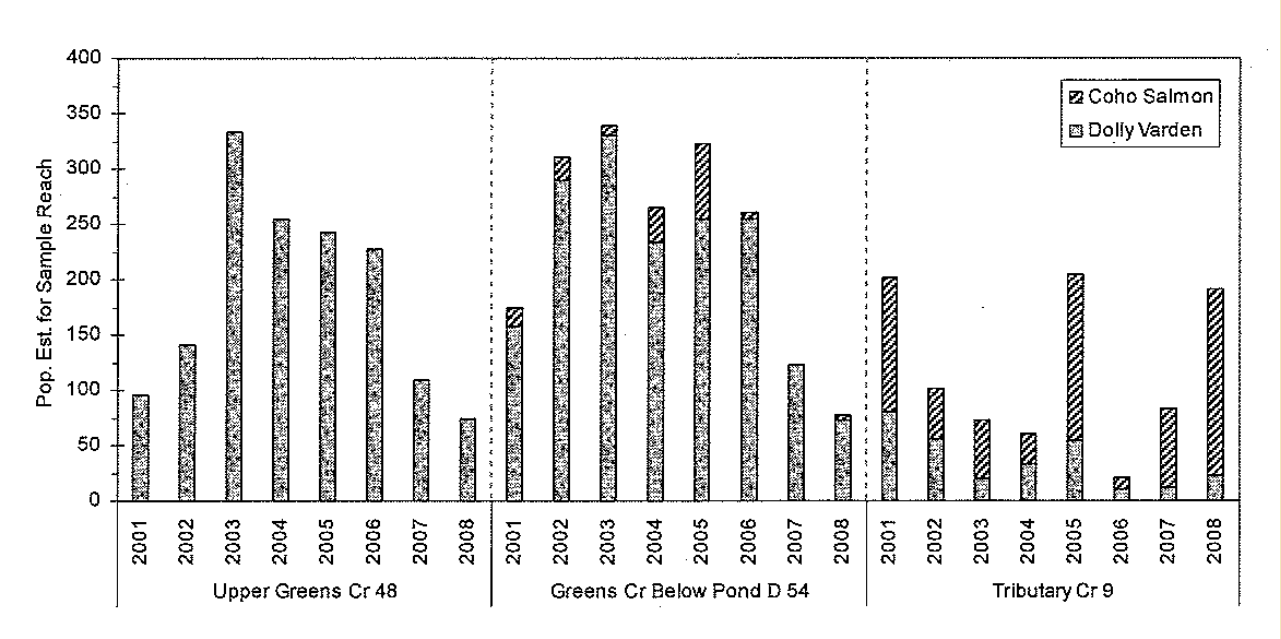
"The percent EPT metric, based on the concept that many taxa within Ephemeroptera, Plecoptera, and Trichoptera taxa are sensitive to pollutants (Merritt and Cummins 1996), was high in all of the biomonitoring sites in each of the years sampled (Figure 33). The percent of Chironomidae has been relatively constant at the Tributary Creek site but variable in the three Greens Creek sites." (ADNR, Technical Report No. 09-02)



Comparison of proportions of EPT taxa and Chironomidae among sites, 2001-2008.
(ADNR Technical Report No. 09-02, Figure 33)

Juvenile Fish Community

- "Dolly Varden population estimates for Upper Greens Creek Site 48 and Greens Creek Below Pond D Site 54 continued to follow very similar patterns although the density estimates for Site 54 are less than those for Site 48 because of different sample reach lengths and channel configurations" (ADNR, Technical Report No. 09-02)
- A few coho salmon were captured at Greens Creek Below Pond D Site 54 in 2008 following no captures the previous year, although the coho salmon density was one-ninth the regional average
- Coho salmon populations and densities at Tributary Creek Site 9 have ranged over one and one-half orders of magnitude during the eight years of biomonitoring sampling

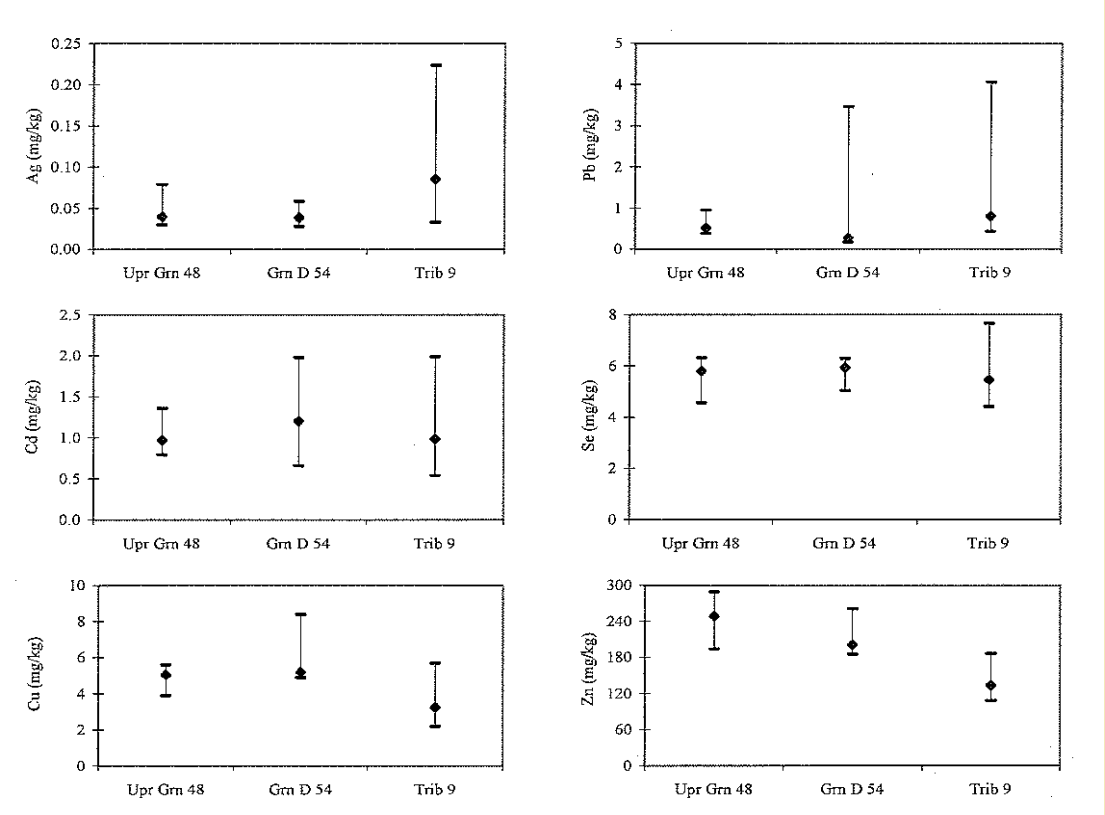


Estimated fish densities in the biomonitoring sites

(ADNR Technical Report No. 09-02, Figure 35)

Metals in Juvenile Fish 2008

- None of the metal concentration rank means were statistically different between the two Greens Creek sites in 2008. As such, the tissue metals concentrations from the two sites were pooled for comparison to Tributary Creek
  - Tributary Creek fish tissue contained significantly more Ag and Pb than Greens Creek fish
  - Greens Creek fish tissue contained significantly more Cu and Zn than Tributary Creek fish
  - No statistical difference between streams in 2008 for fish tissue concentrations of Cd or Se



Comparison of metals concentrations in 6 Dolly Varden from each site in 2008

(ADNR Technical Report No. 09-02, Figure 36)

Conclusions

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- In general, the aquatic communities at the three sites have remained fairly diverse, robust, and moderately abundant during the 8 years of monitoring
- Differences noted between years, and between Greens Creek and Tributary Creek have typically been of larger amplitude than have differences between the control site and the below-mining site within Greens Creek, or over time at Tributary Creek