

Aquatic Biomonitoring at Greens Creek Mine, 2012

presented by Kate Kanouse (ADF&G)



A mayfly captured at Greens Creek Site 48 in 2012.





Aquatic Biomonitoring Program

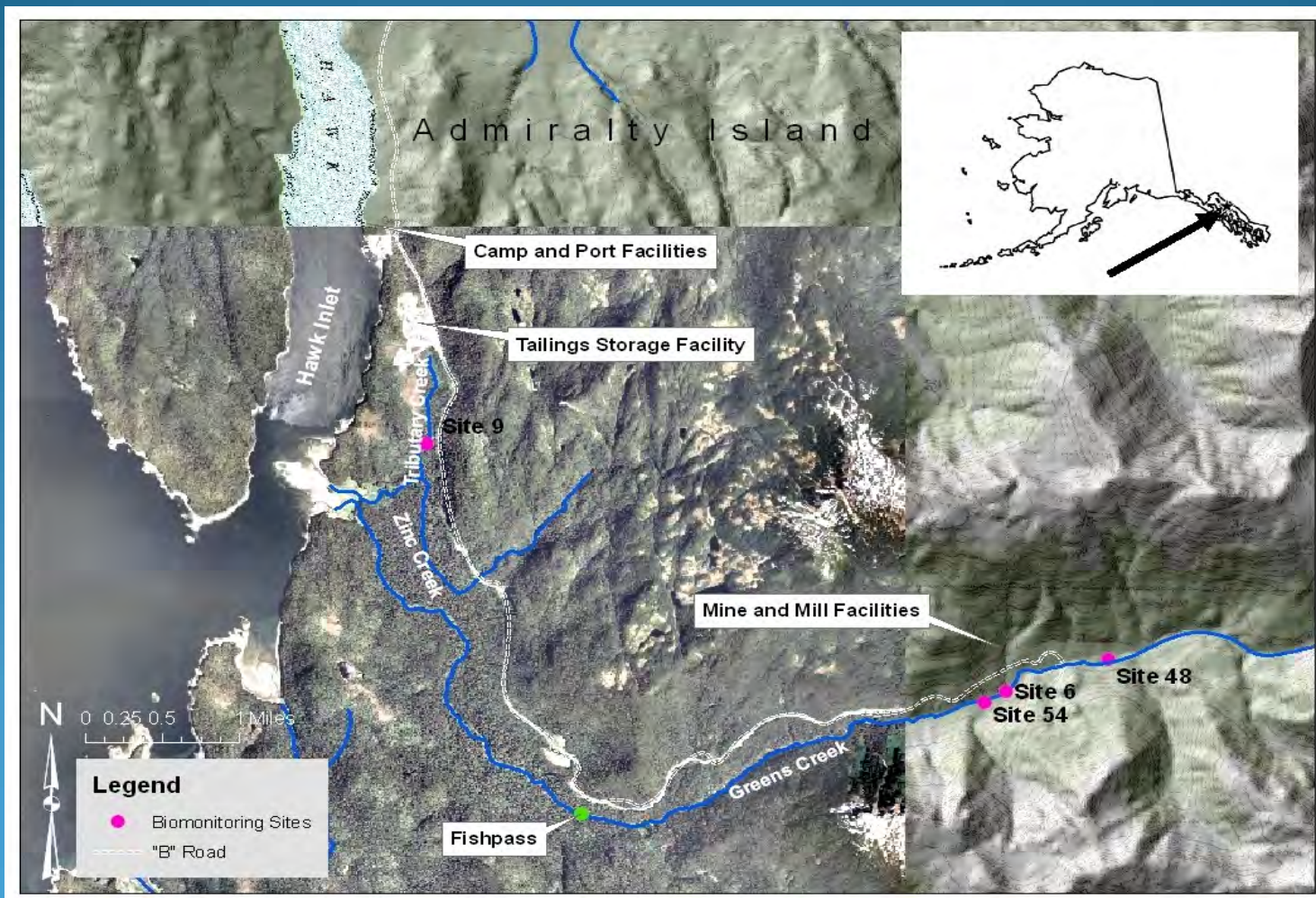
- Purpose
- Location and monitoring schedule
- Program components
- 2012 results
- Comparisons among sites
- Trends in the data
- Recommendations

Purpose of the program

To document the condition of aquatic biological communities in Greens Creek and Tributary Creek near mine development and operations.



Location and Schedule



Program Components



- Juvenile fish whole body metals concentrations
- Juvenile fish populations
- Aquatic insect density and community composition
- Periphyton biomass and chlorophyll-type

Program components

- Periphyton biomass and chlorophyll-type



Program components

- Aquatic insect density and community composition



Rick Hoffman (ADF&G Habitat Intern)
sampling aquatic insects



Ephemeroptera (mayflies)



Plecoptera (stoneflies)



Trichoptera (caddisflies)

EPT taxa

Program components

- Juvenile fish populations
- Juvenile fish whole body metals:
 - Ag
 - Cd
 - Cu
 - Hg
 - Pb
 - Se
 - Zn



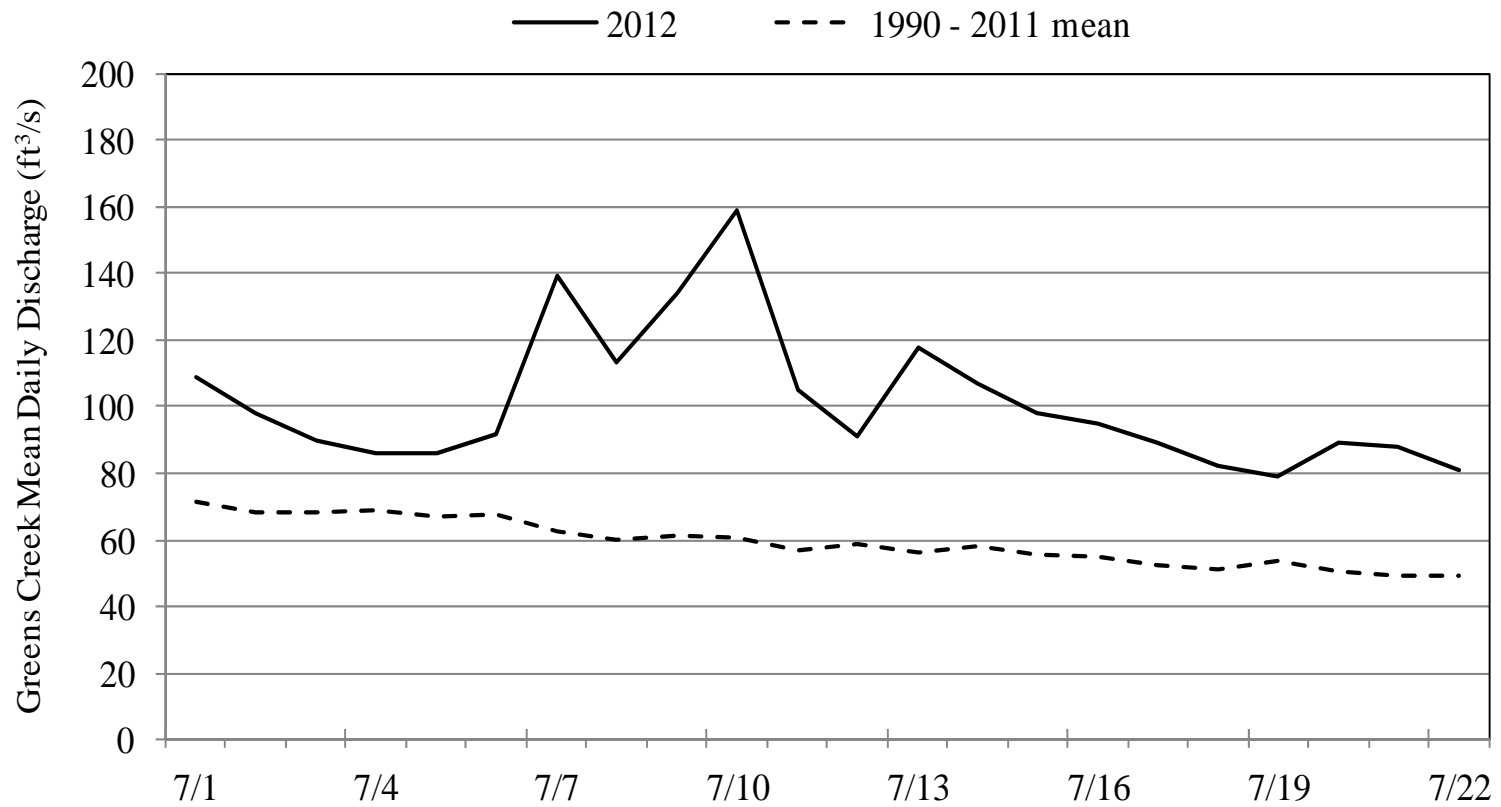
2012 sample sites



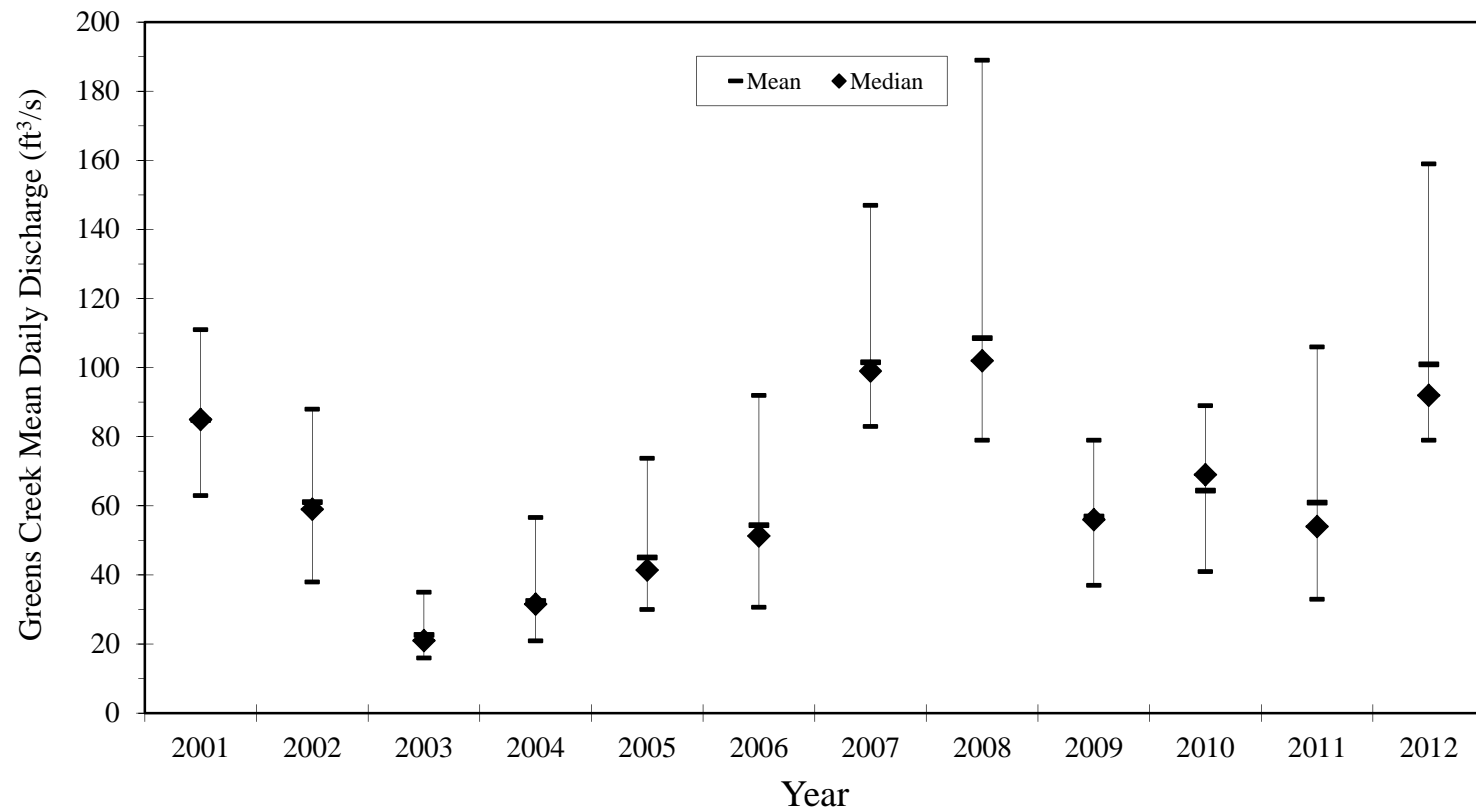
2012 Results



2012 Stream Flow

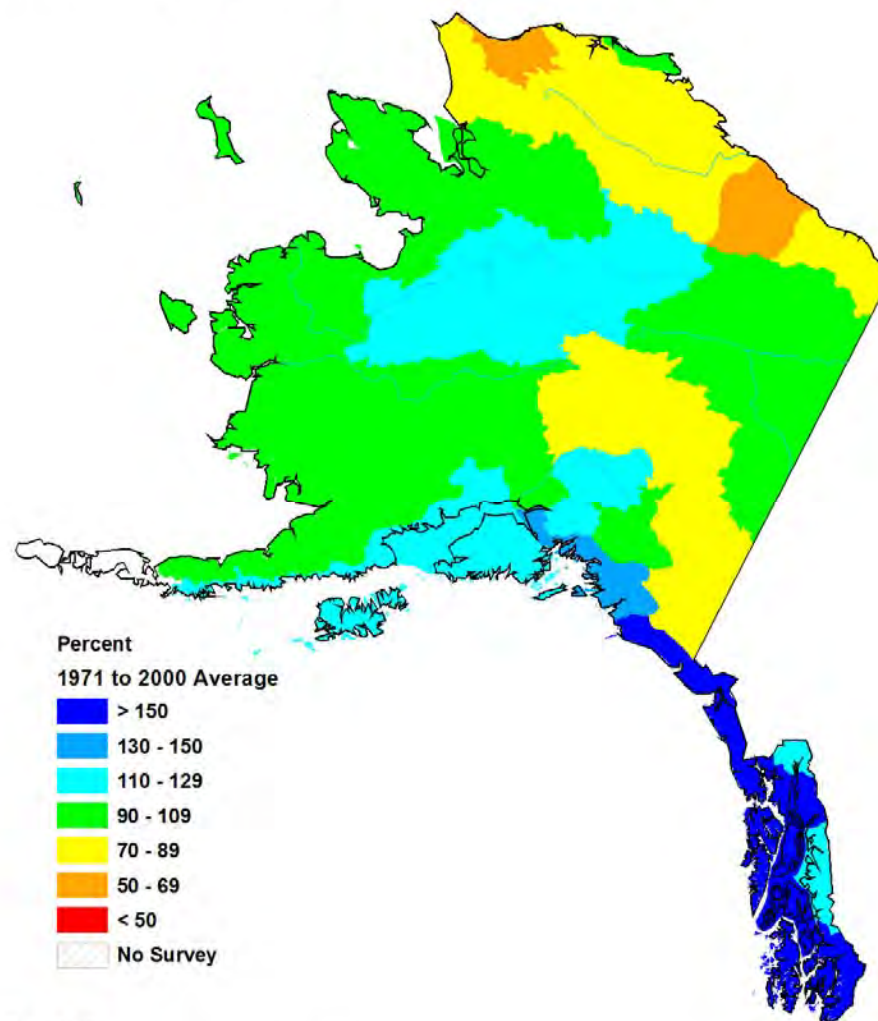


2001-2012 Stream flow



NRCS Alaska Snowpack Map

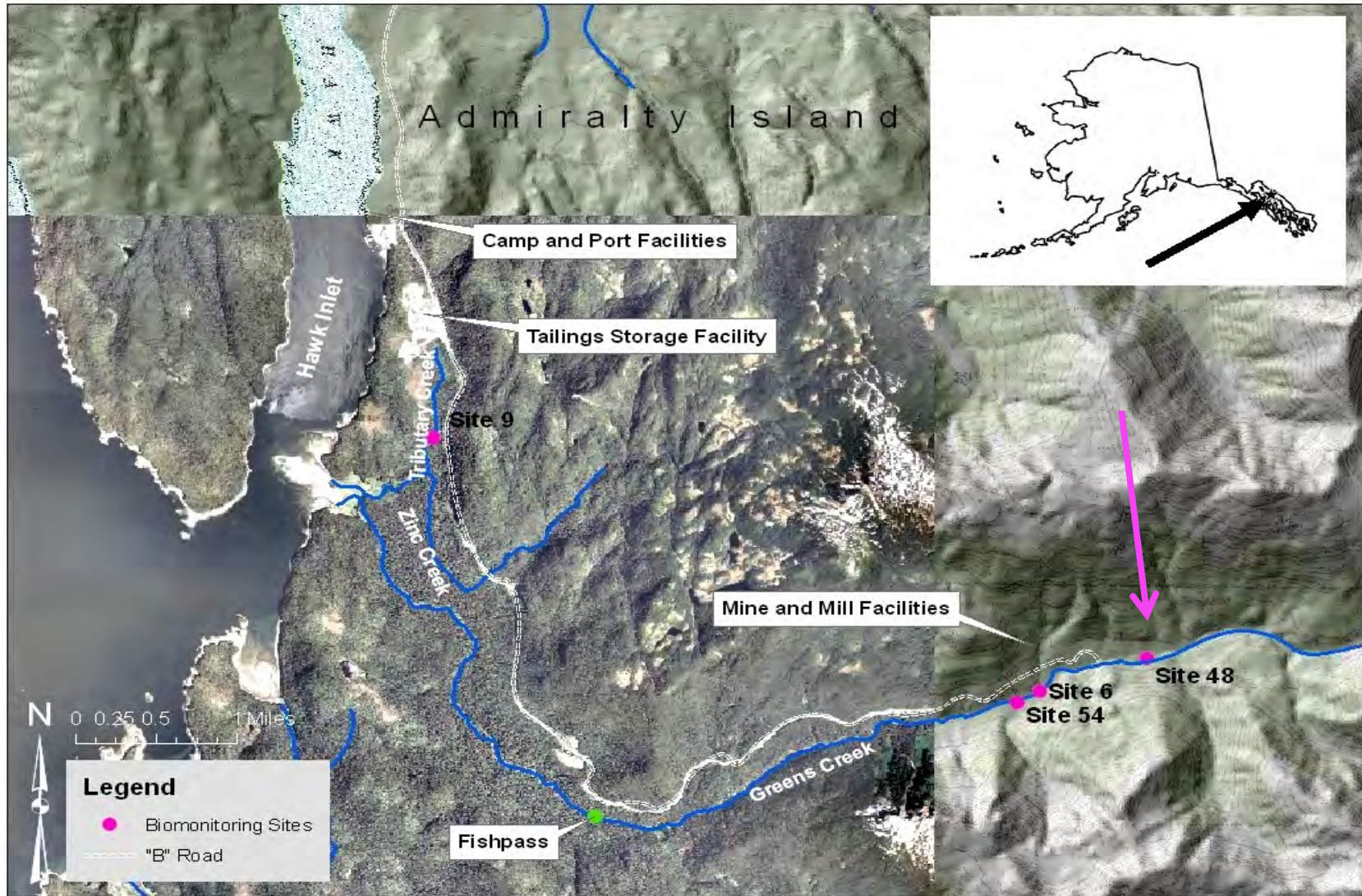
Alaska Snowpack
as of May 1, 2012



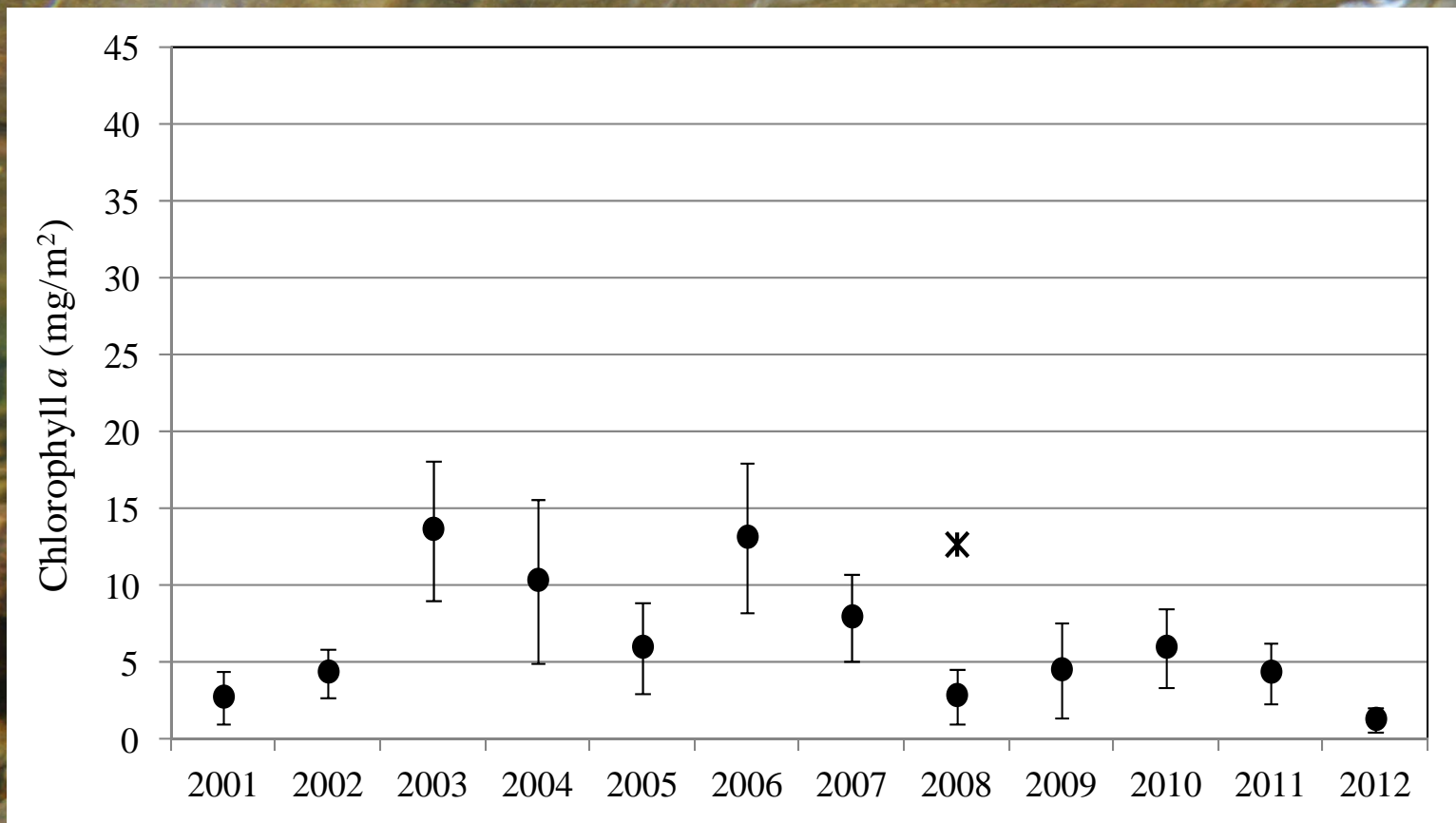
Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>

Greens Creek Site 48

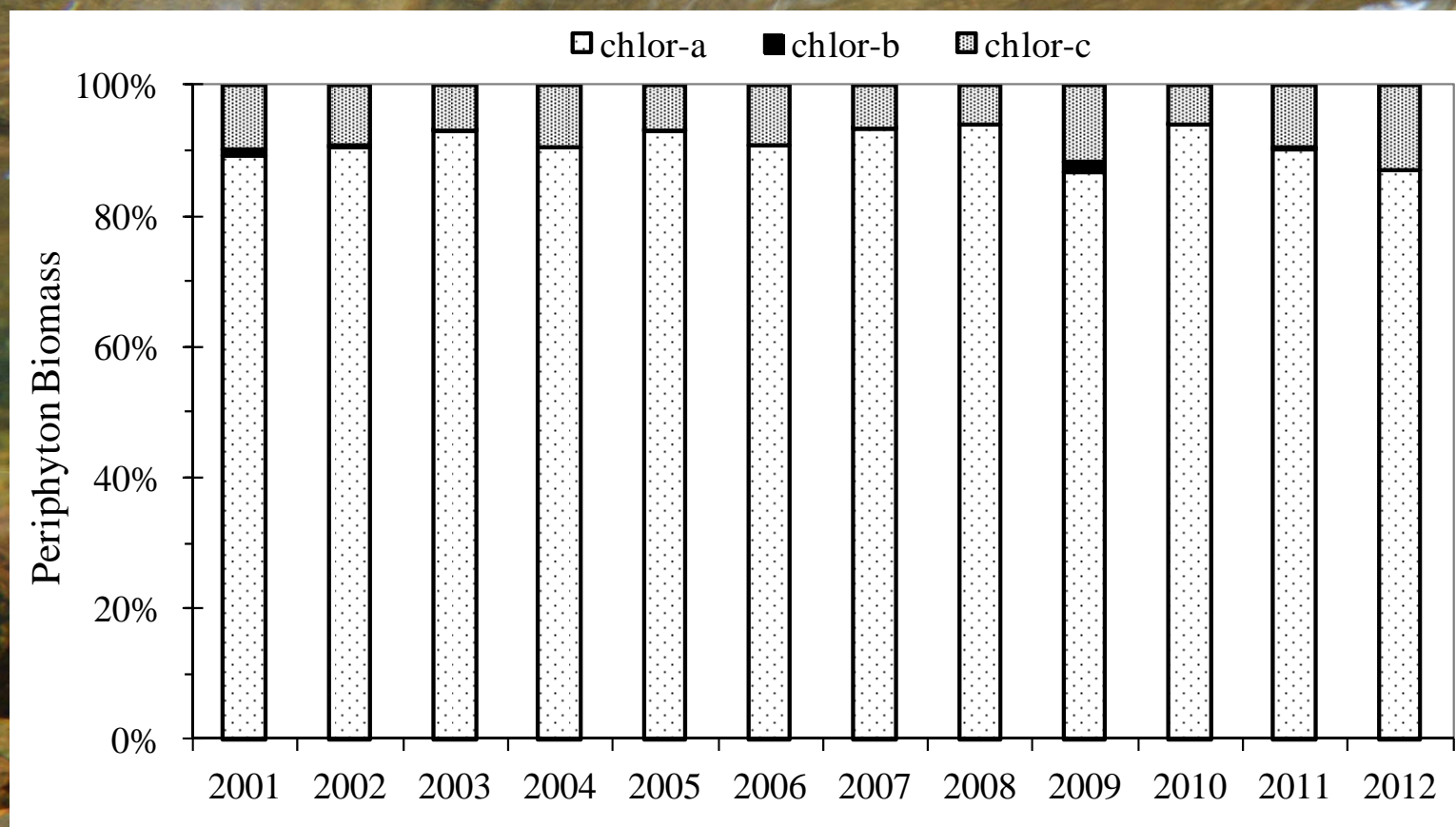




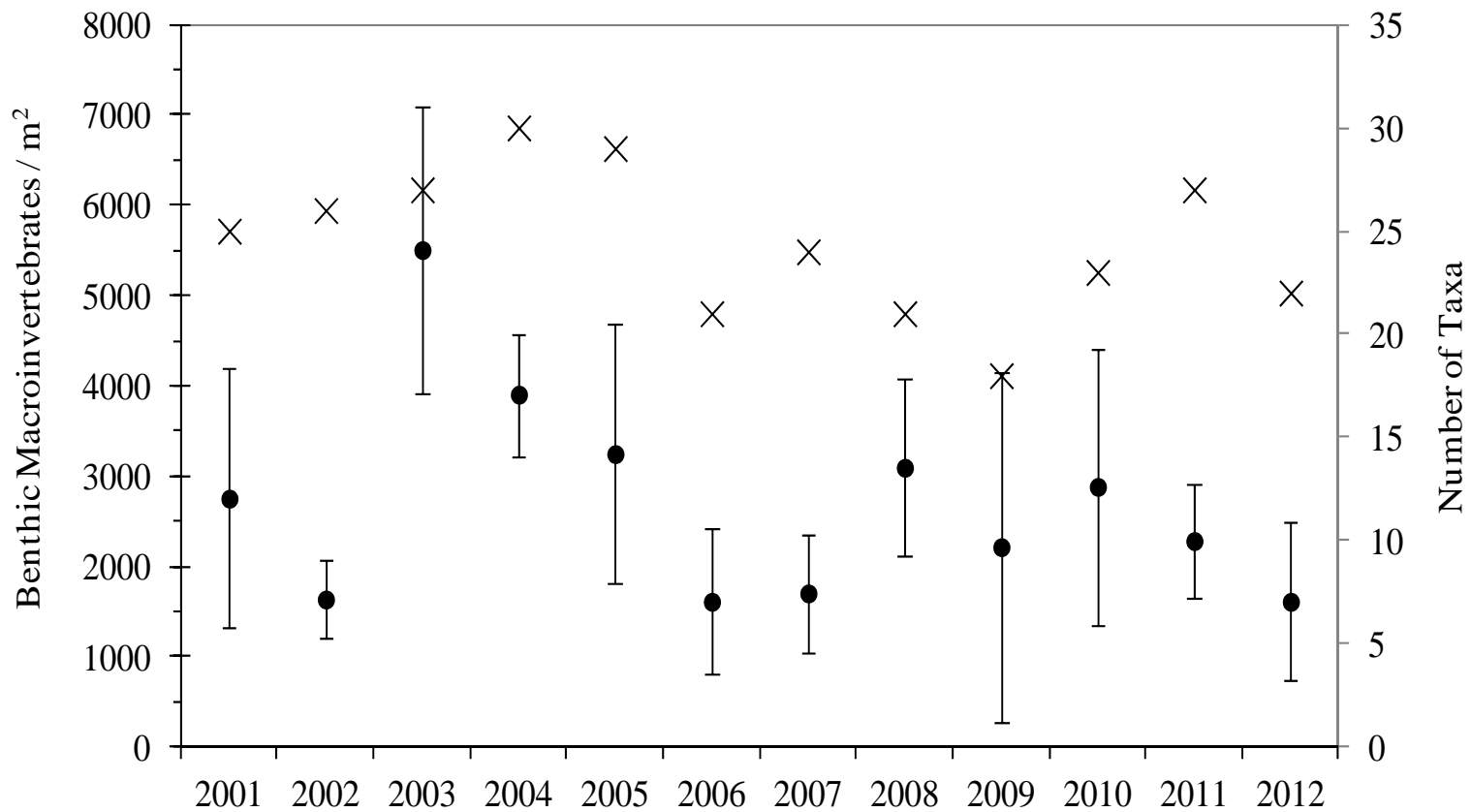
GC Site 48 – Periphyton biomass



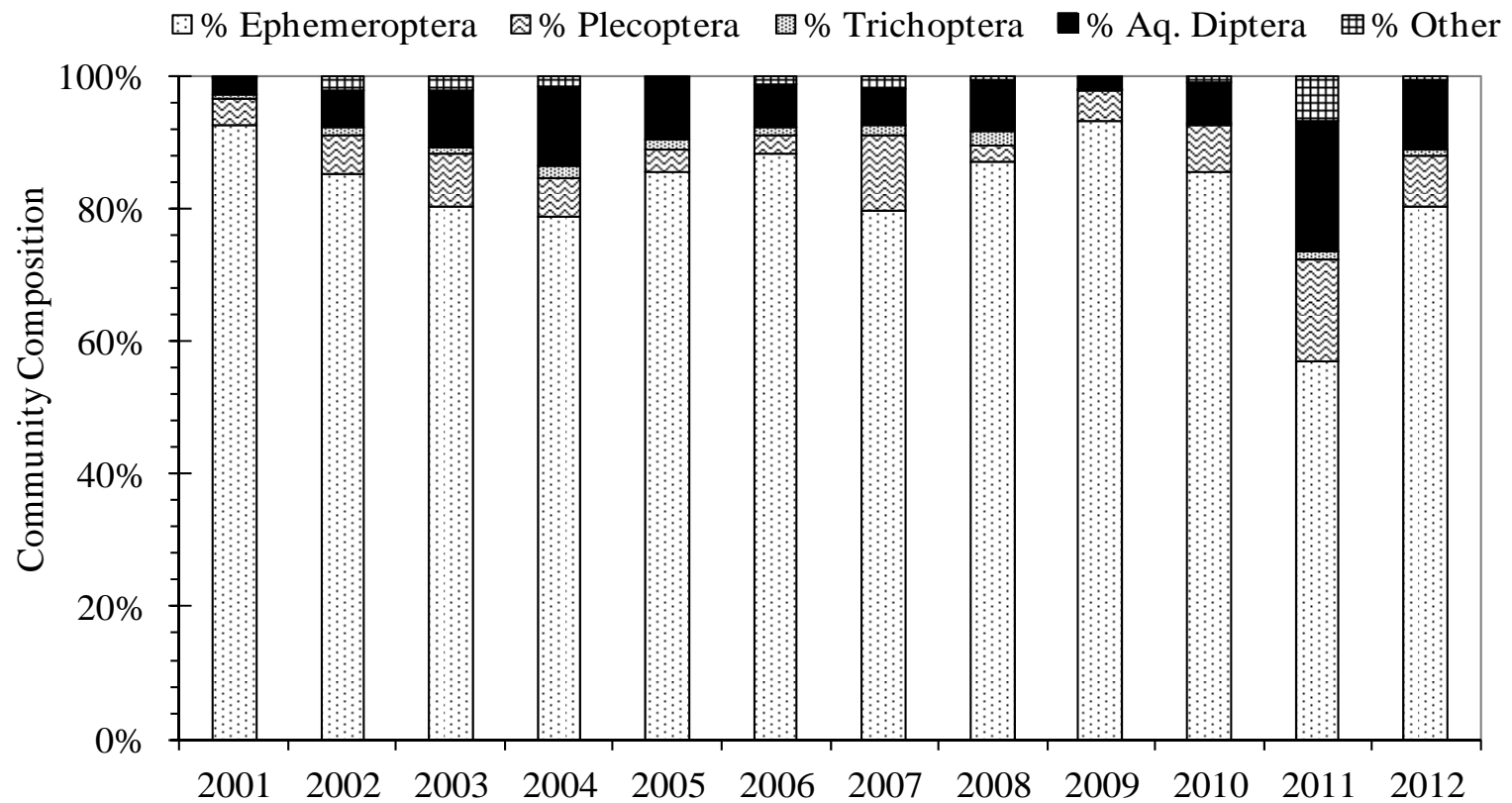
GC Site 48 – Periphyton chlorophylls



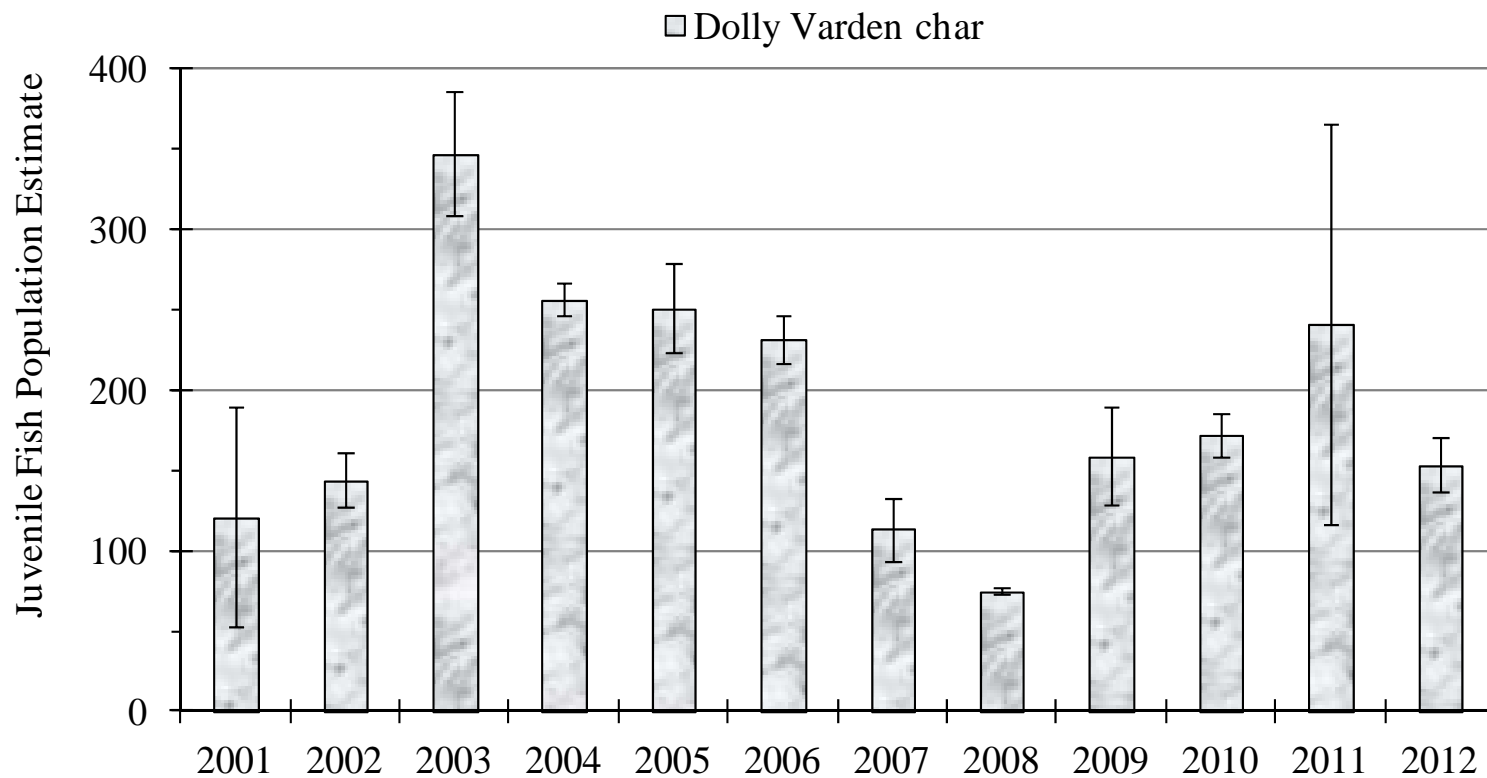
GC Site 48 – Aquatic insect density and number of taxa



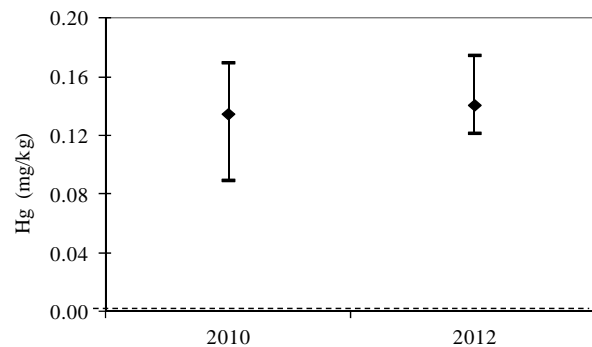
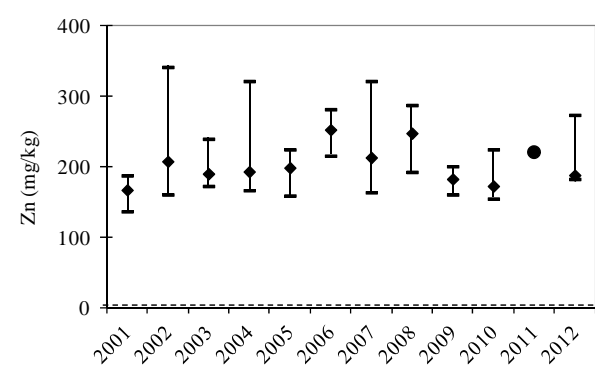
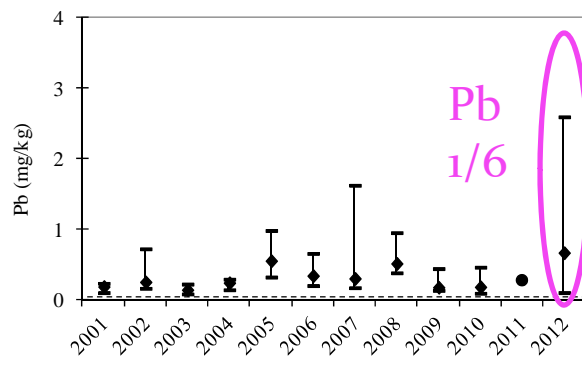
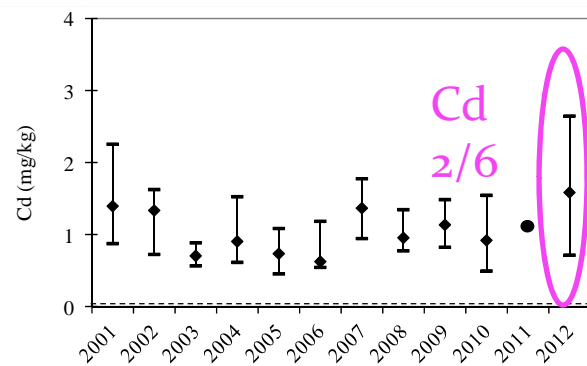
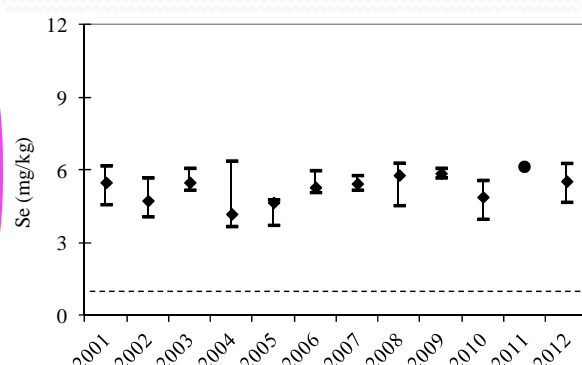
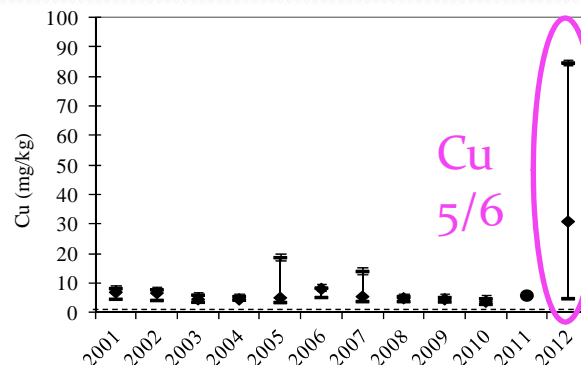
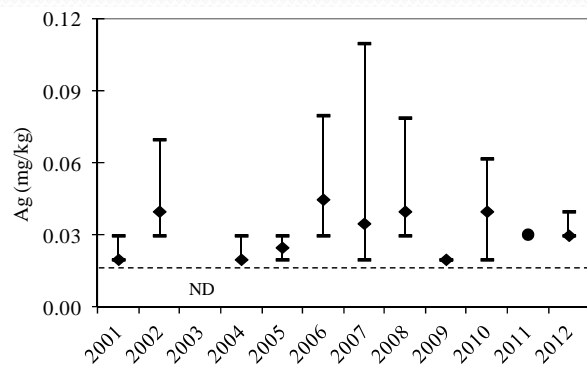
GC Site 48 – Aquatic insect community



GC Site 48 – Juvenile fish populations



GC Site 48 – Juvenile fish metals concentrations



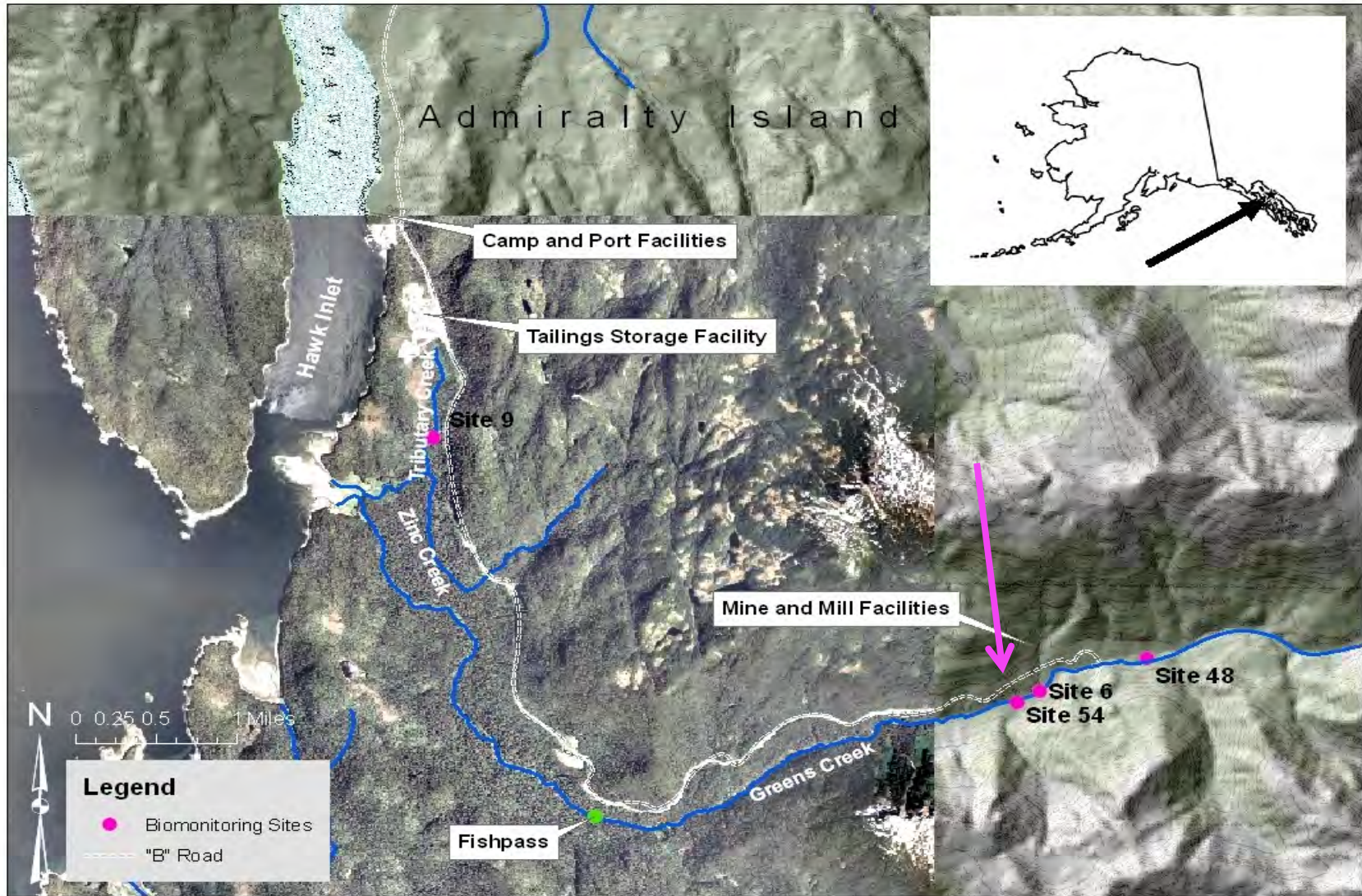


GC Site 48 – 2012 Summary

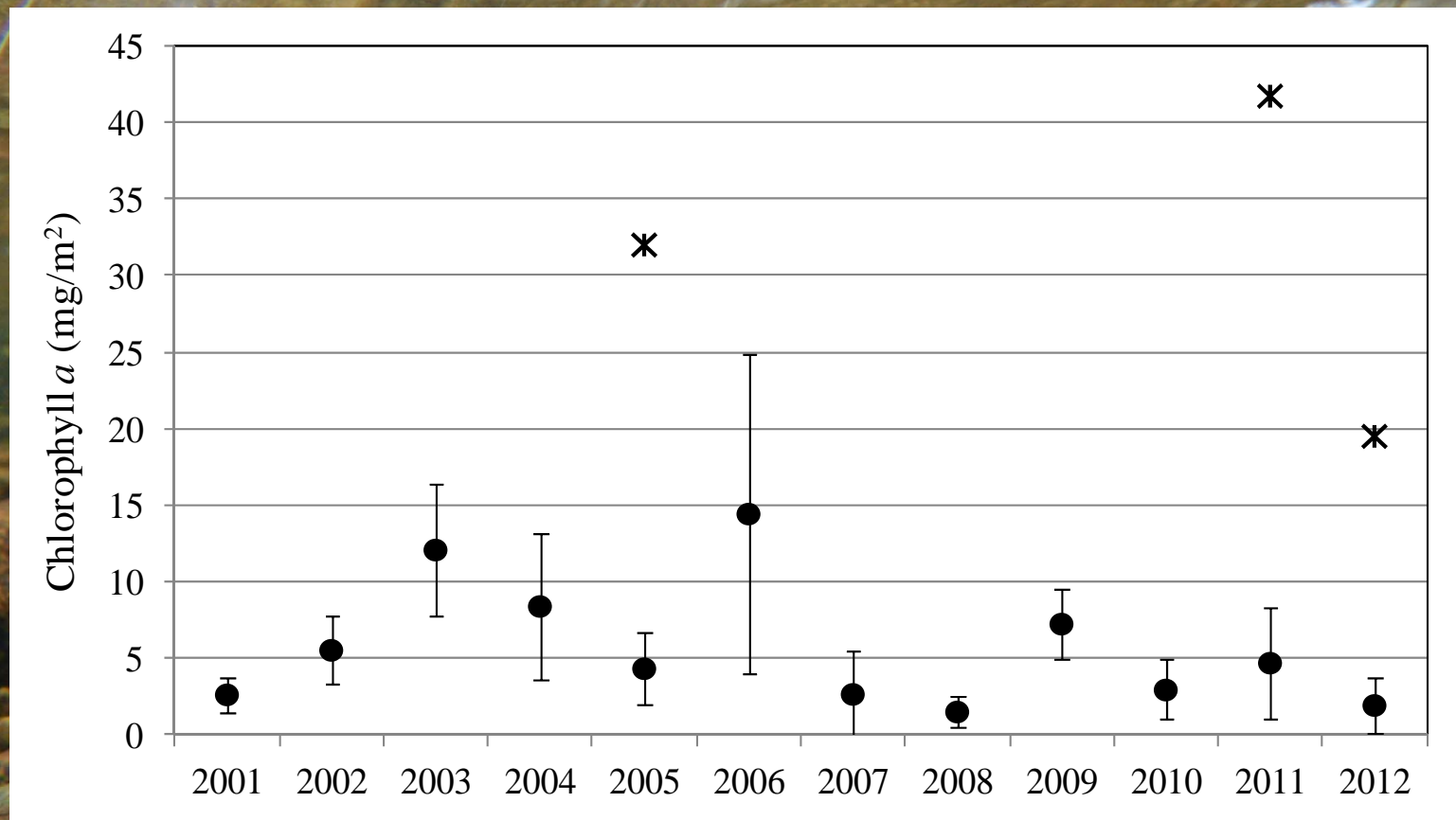
- Upstream of mine development and operations
- 2012 periphyton mean density lowest observed since 2001
- Aquatic insect density and richness within range observed since 2001
- EPT remains ~90%
- Fish population within range observed since 2001
- High values of Cd, Cu, and Pb in whole body juvenile DV suggest contamination

Greens Creek Site 54

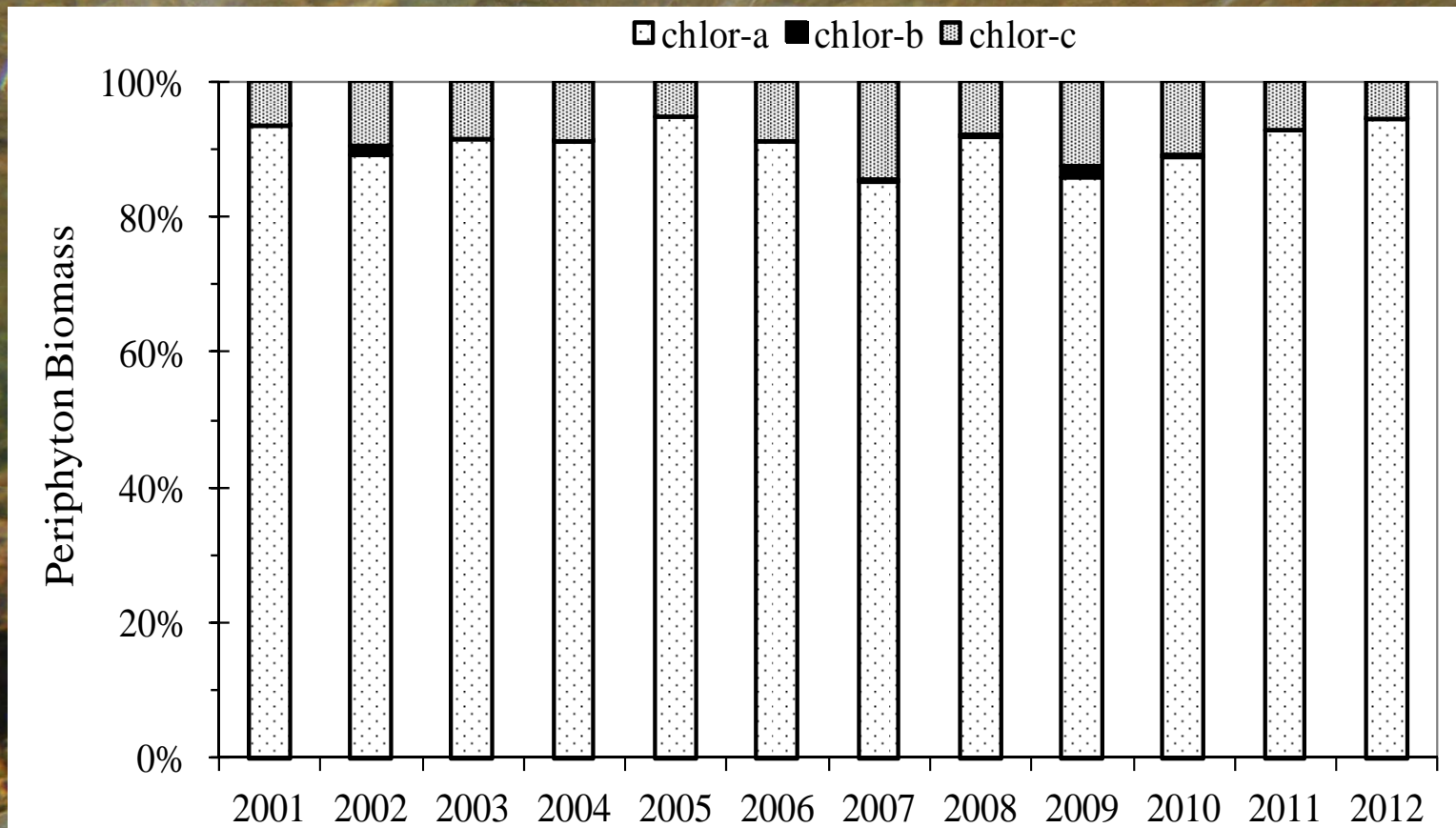




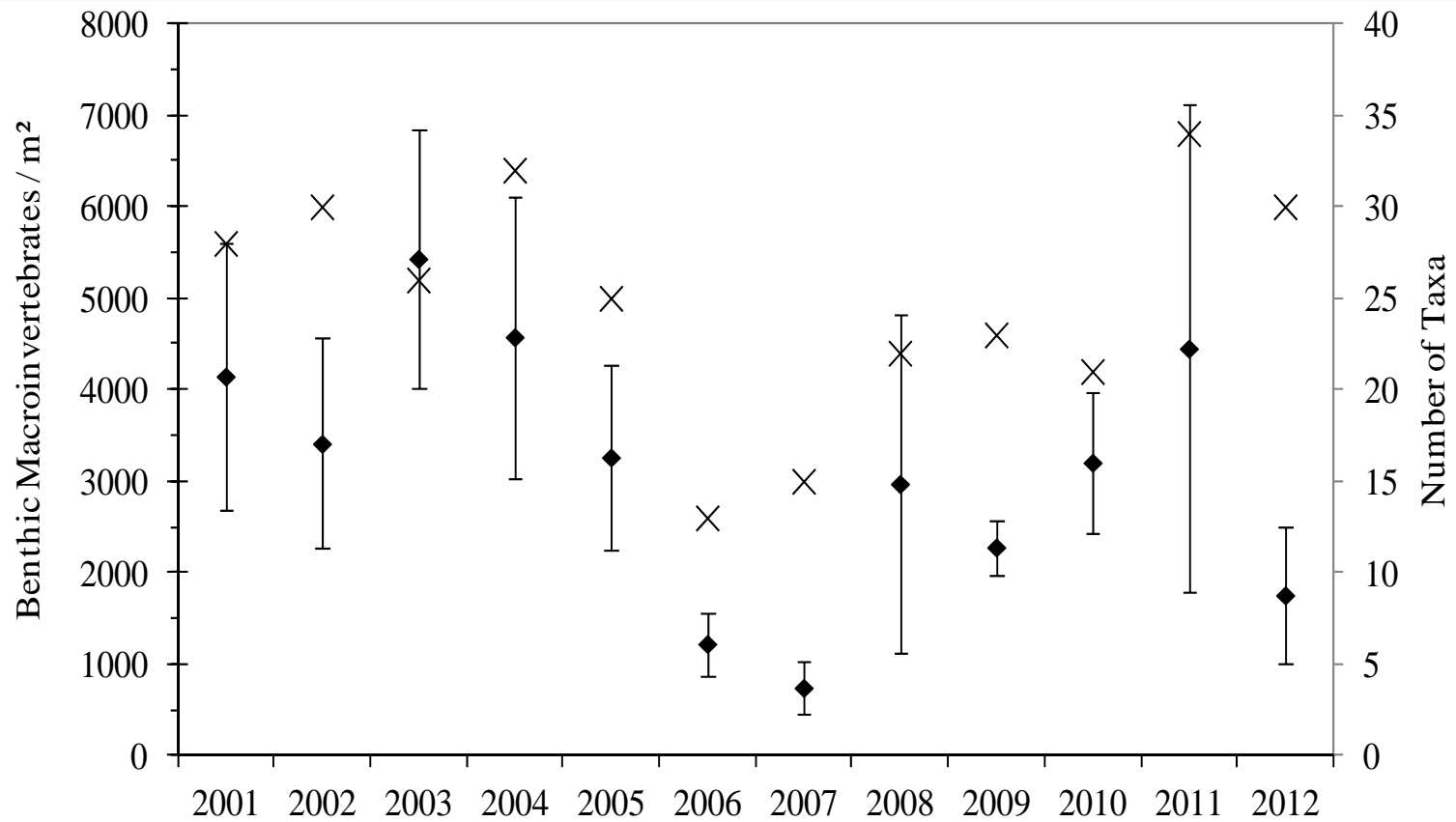
GC Site 54 – Periphyton biomass



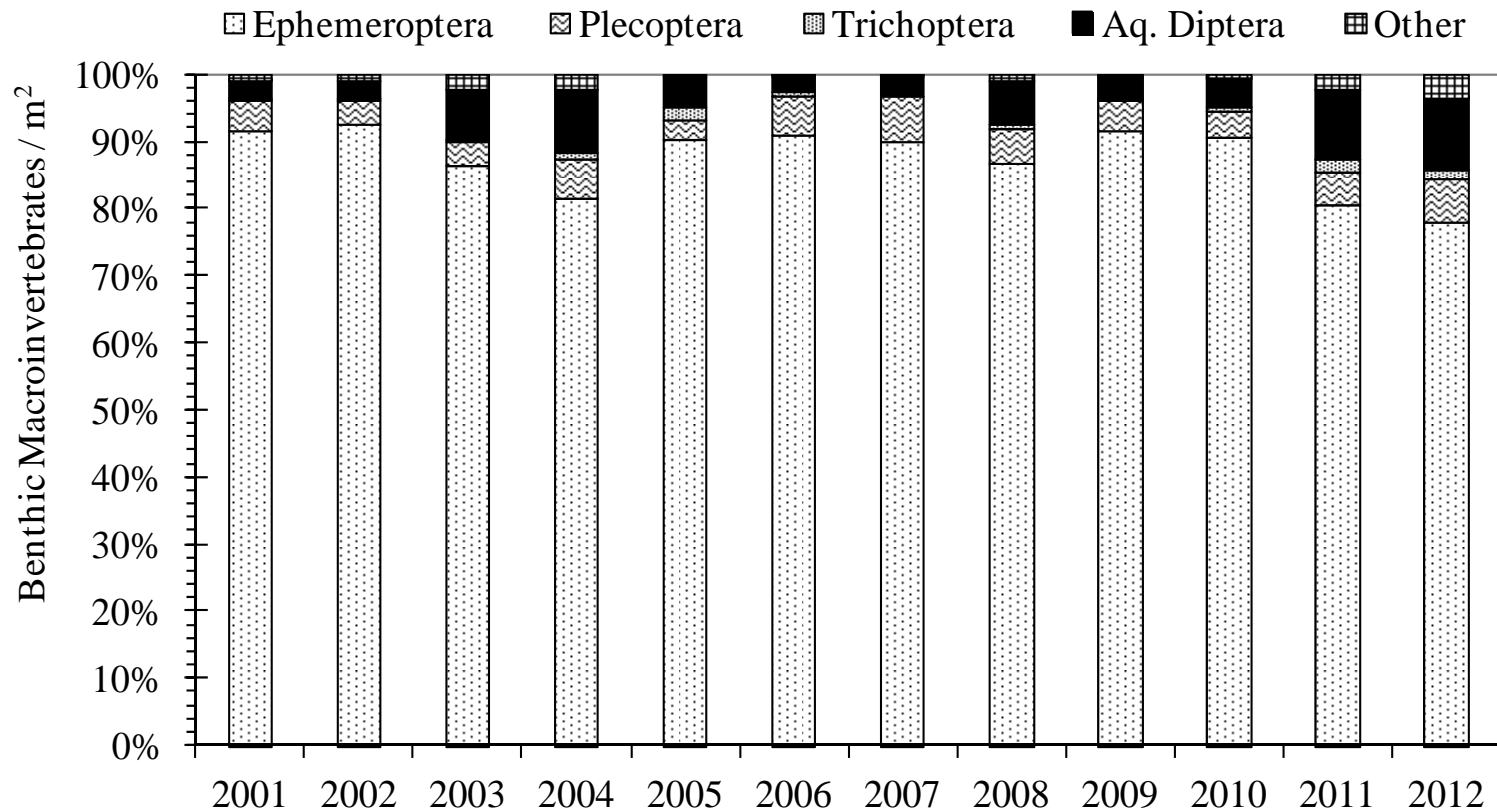
GC Site 54 – Periphyton chlorophylls



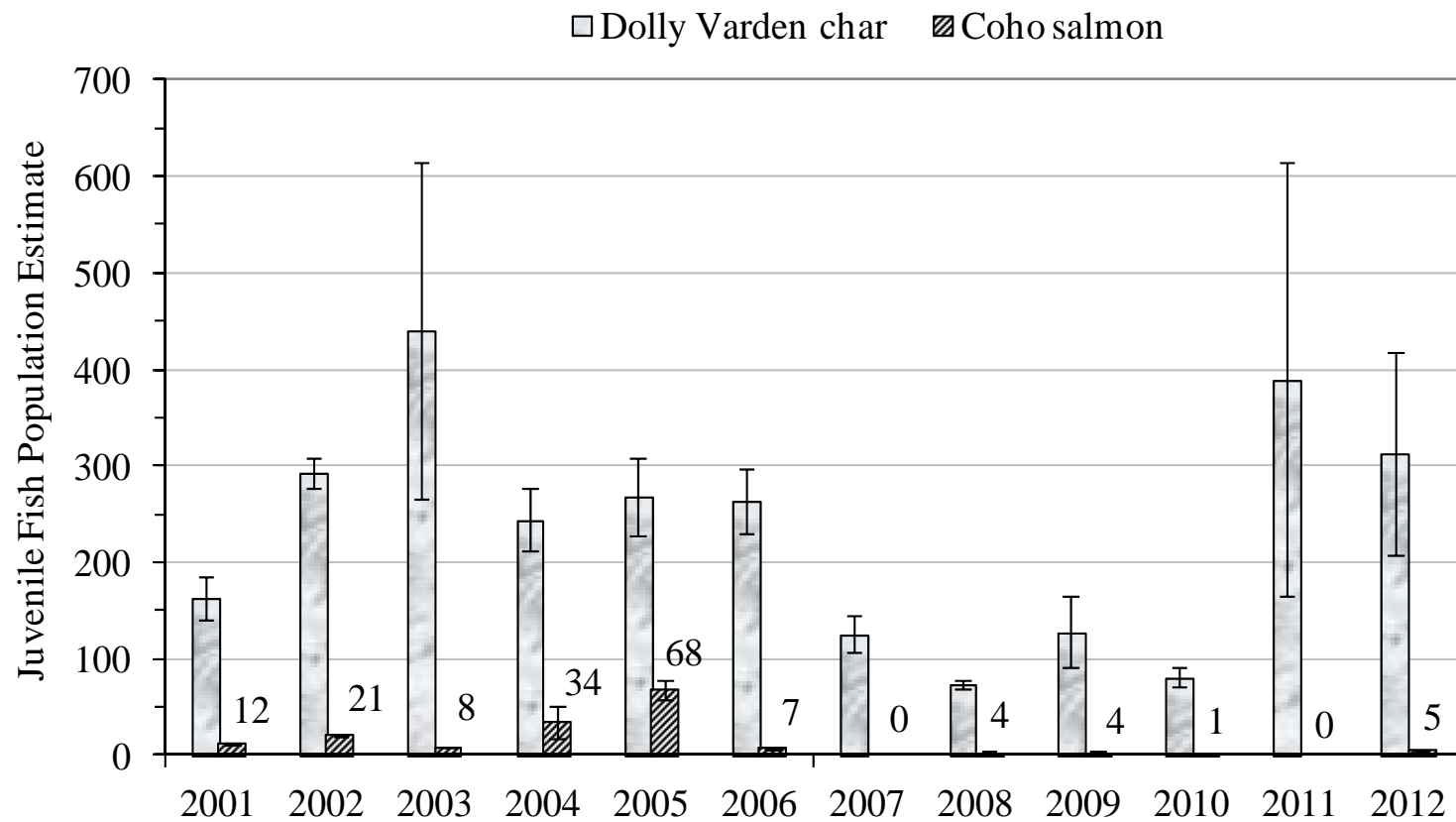
GC Site 54 – Aquatic insect density and number of taxa



GC Site 54 – Aquatic insect community



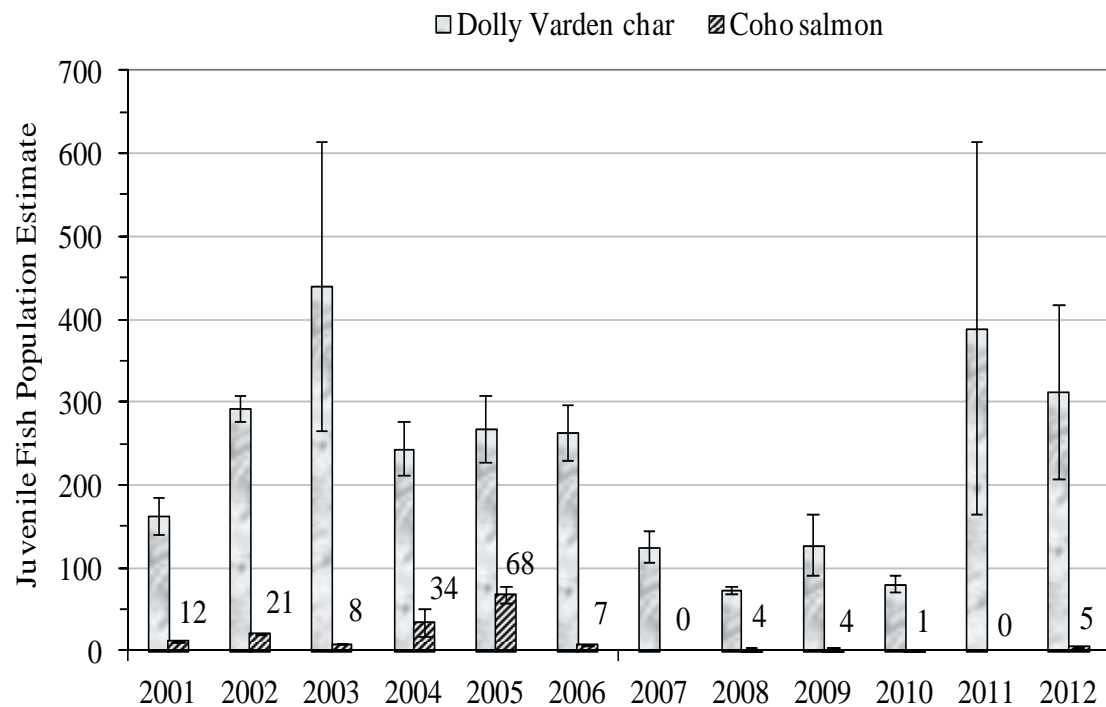
GC Site 54 – Juvenile fish populations



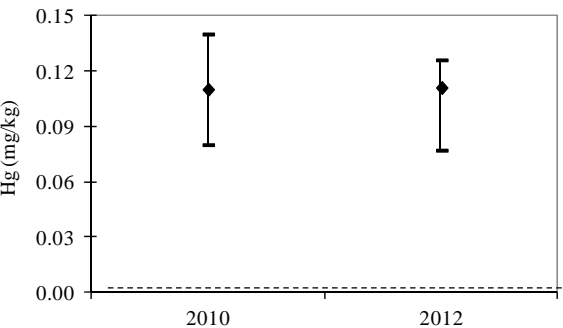
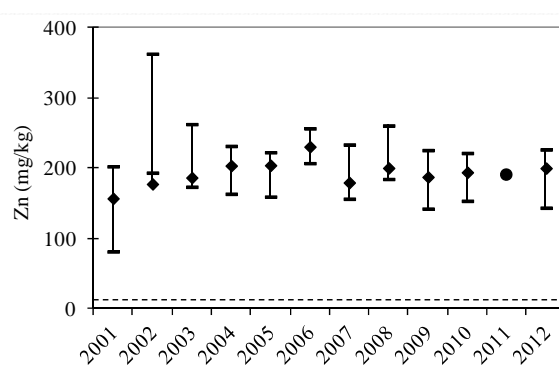
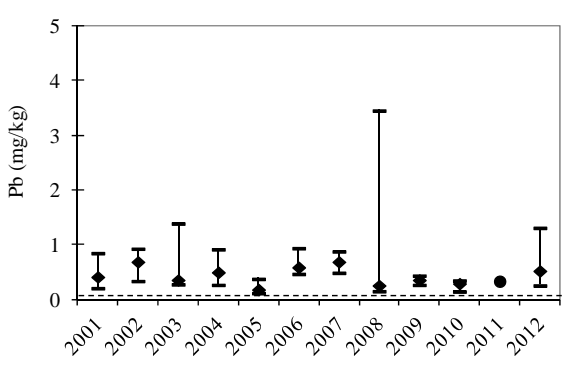
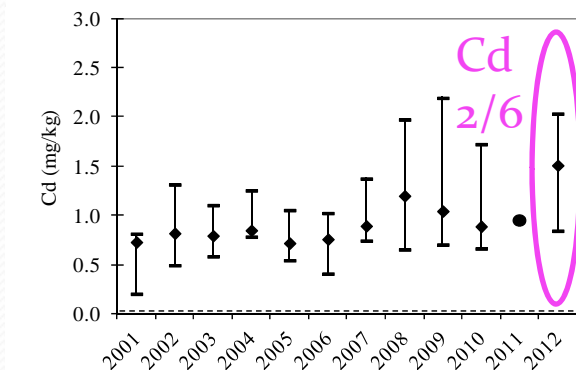
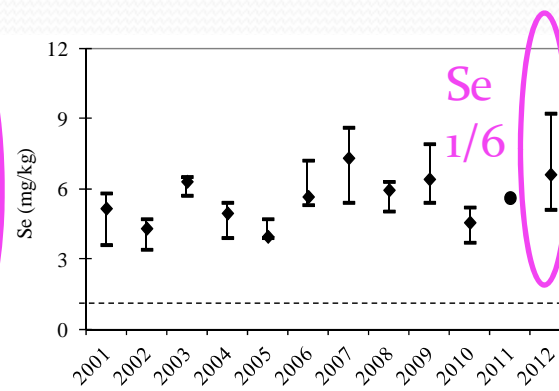
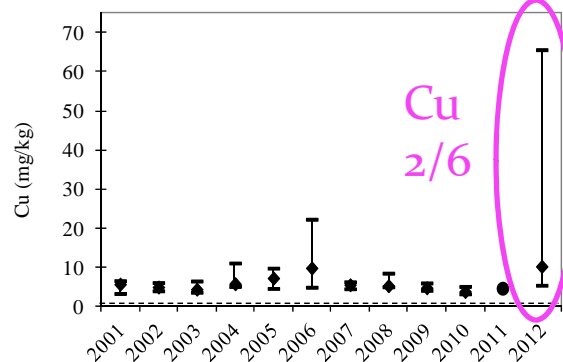
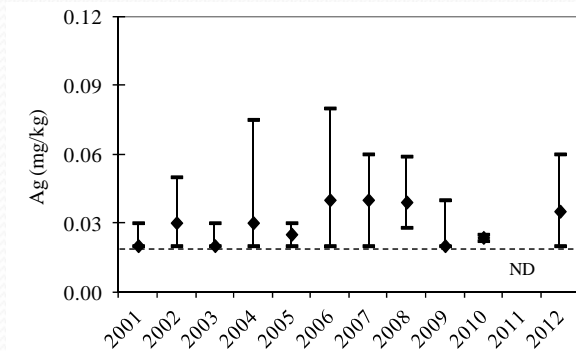
GC Site 54 – Juvenile fish populations



- In 2010, a brown bear destroyed 8/29 (28%) minnow traps during third pass.
- In 2011, we extended the 28m reach to 50m.
- In 2012, we sampled the same reach as 2011



GC Site 54 – Juvenile fish metals concentrations

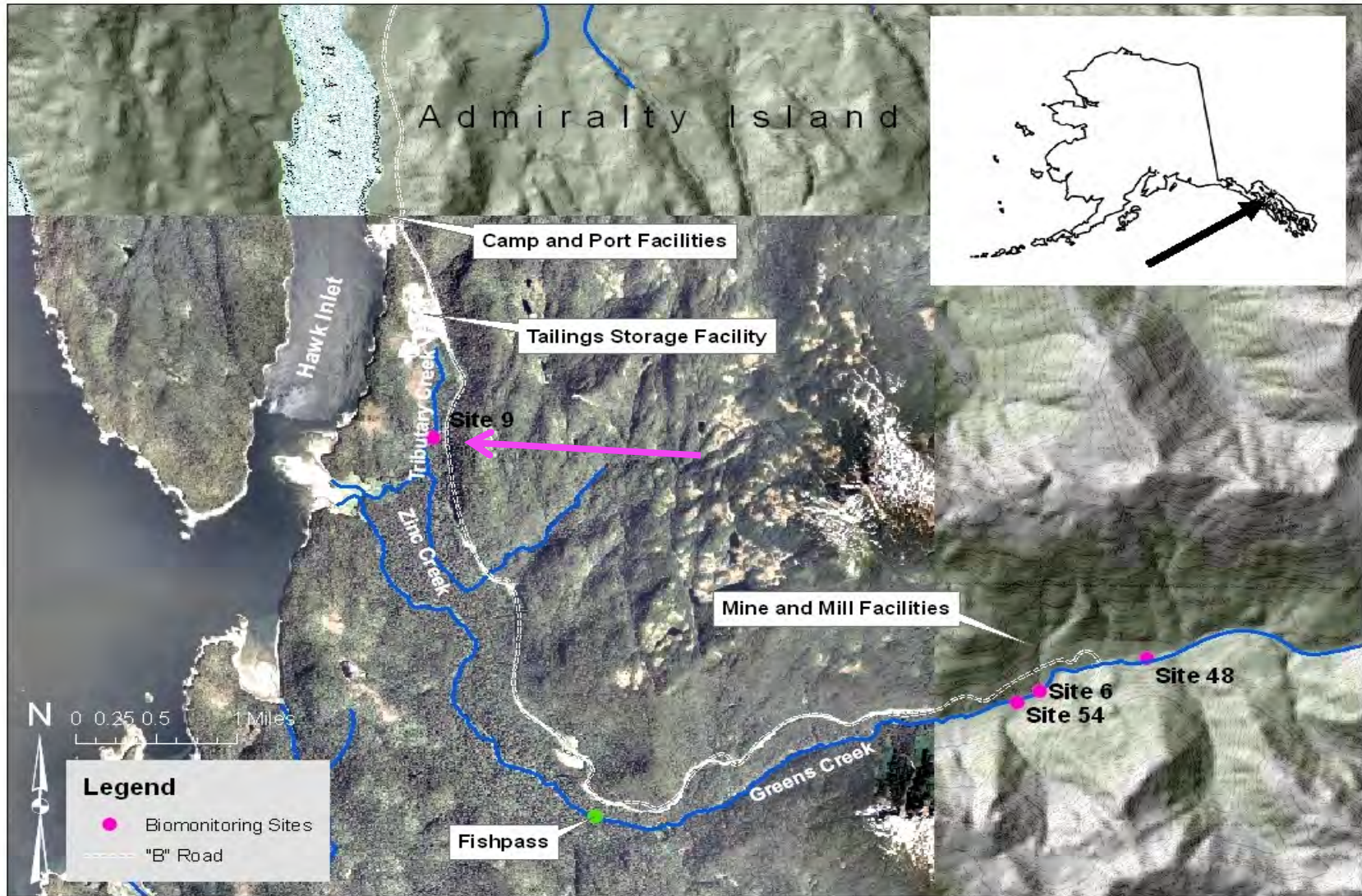


GC Site 54 – 2012 Summary

- Downstream of portal development and operations
- 2012 periphyton mean density low, within range
- Aquatic insect density low, richness high
- EPT remains ~90%
- DV populations greater in 2011 and 2012*
- High values of Cd, Cu, and Se in whole body juvenile DV suggest contamination

Tributary Creek Site 9

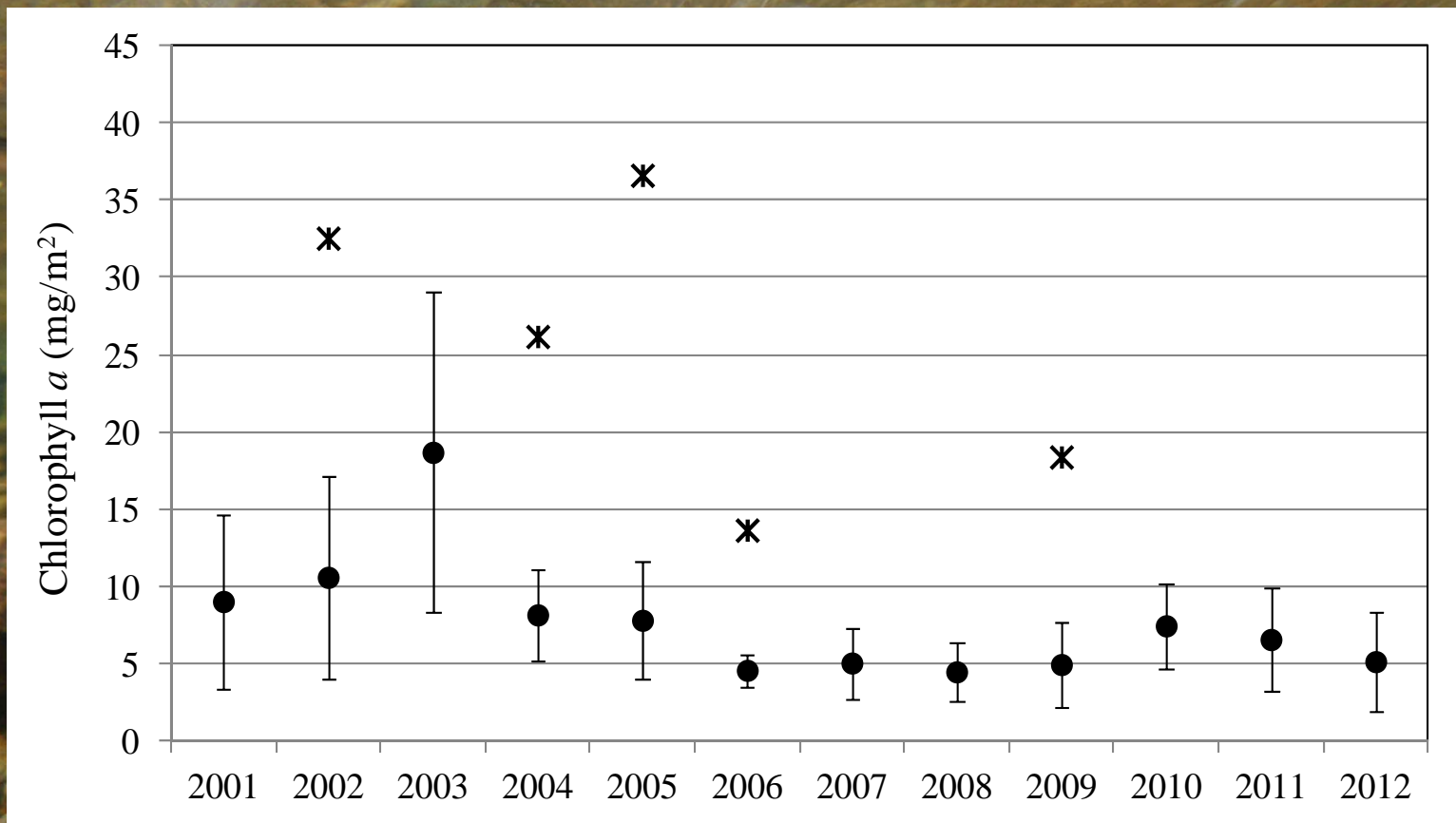




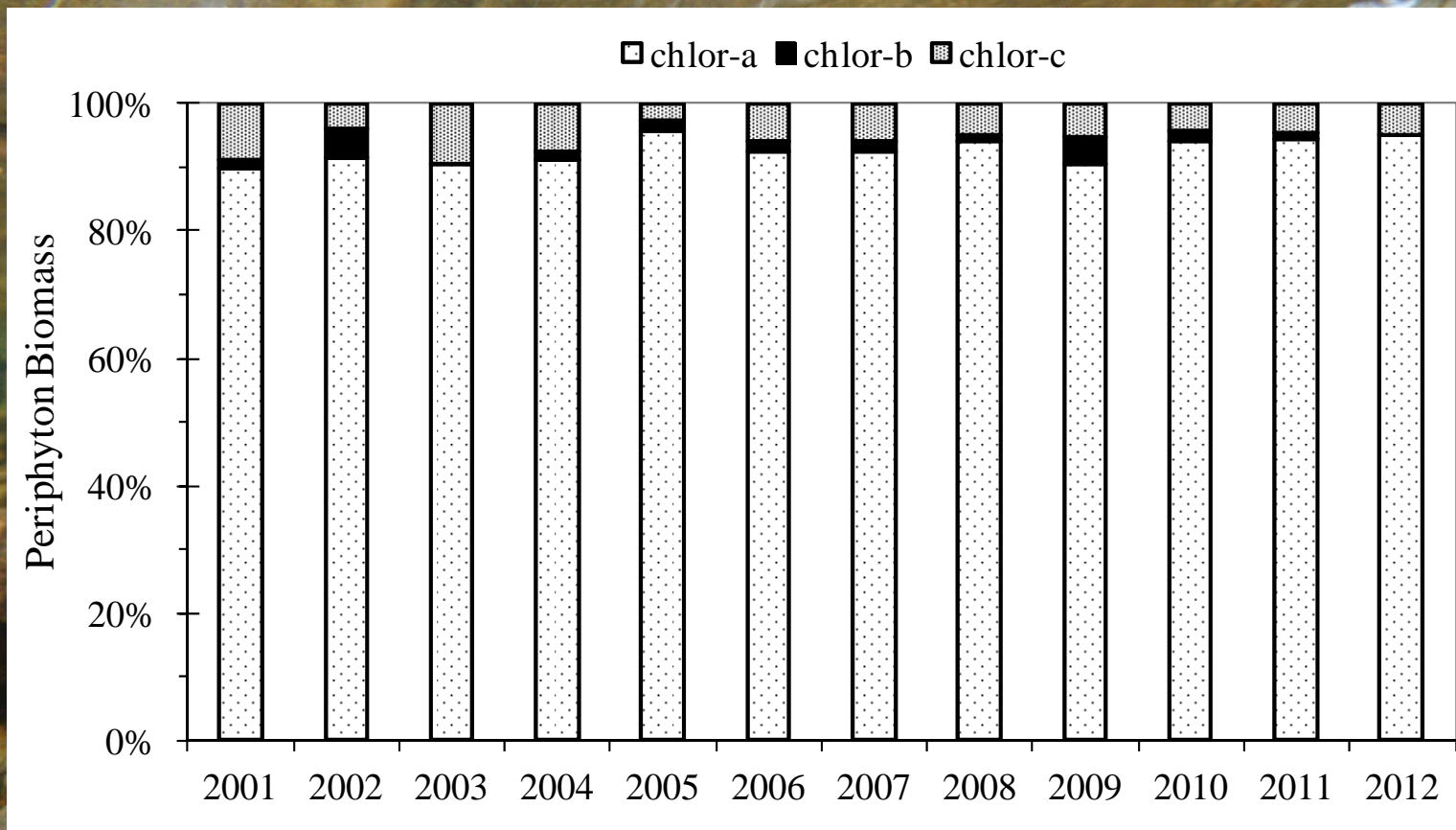


New beaver activity upstream of Site 9

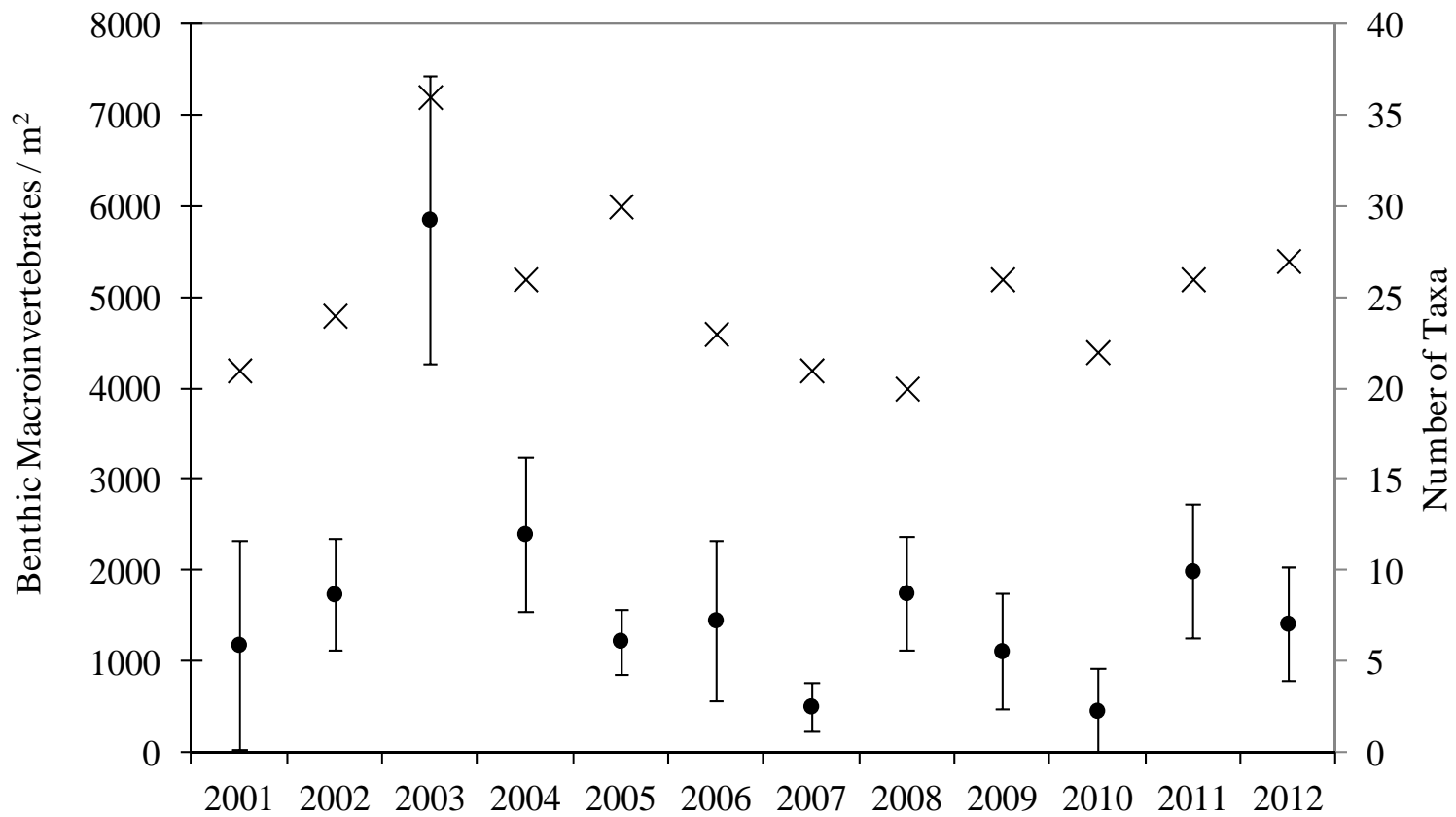
TC Site 9 – Periphyton biomass



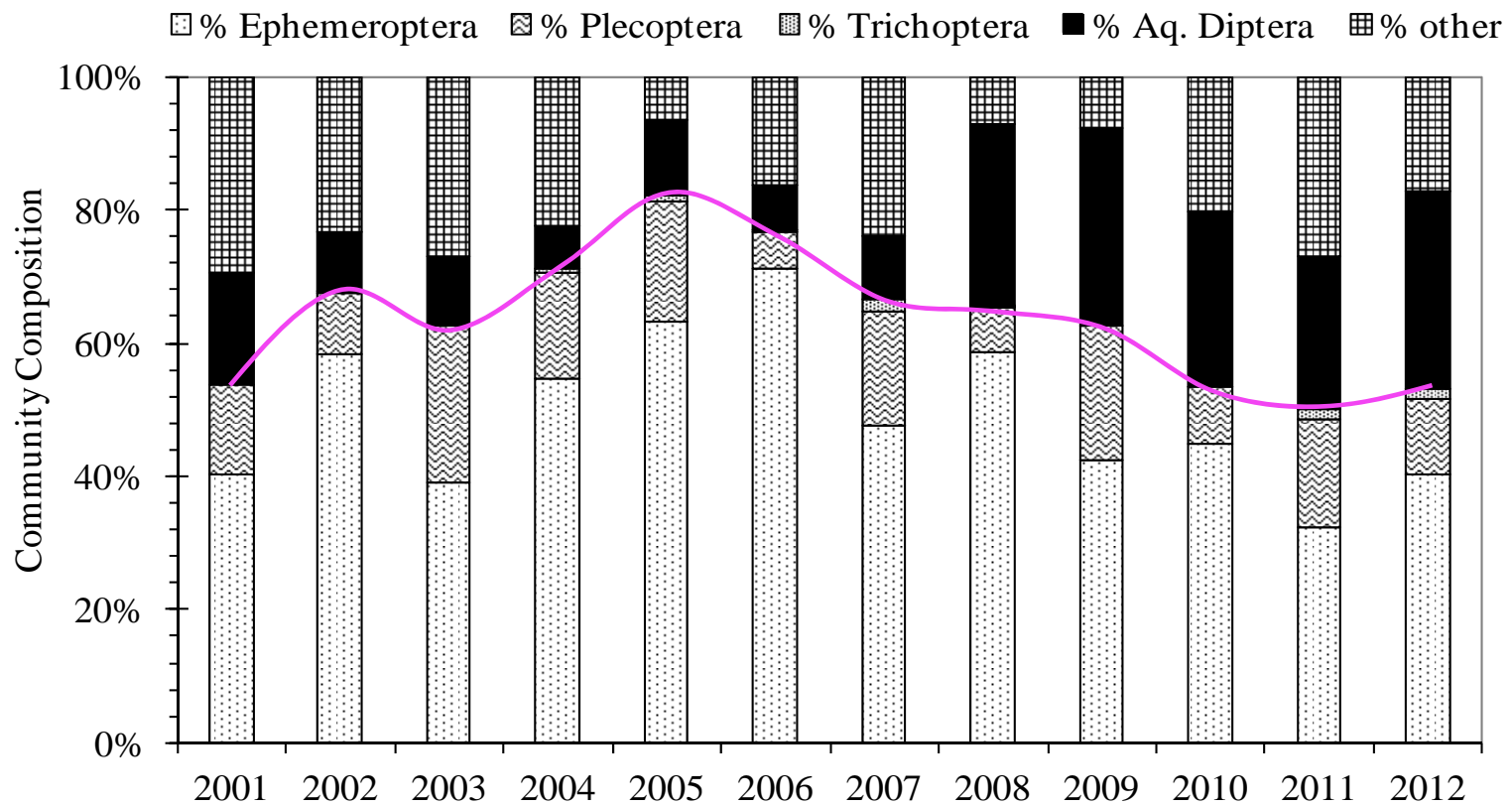
TC Site 9 – Periphyton chlorophylls



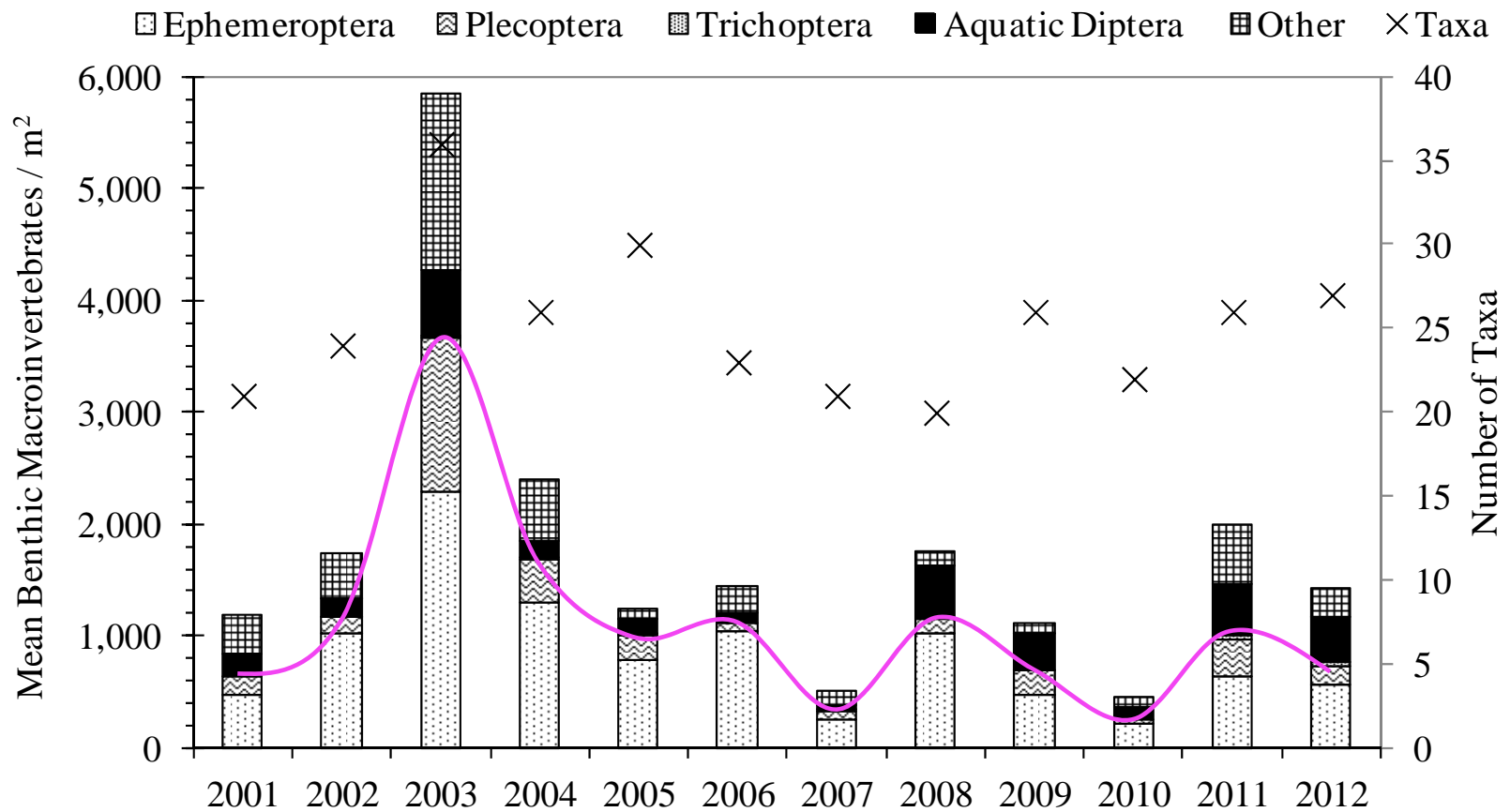
TC Site 9 – Aquatic insect density and number of taxa



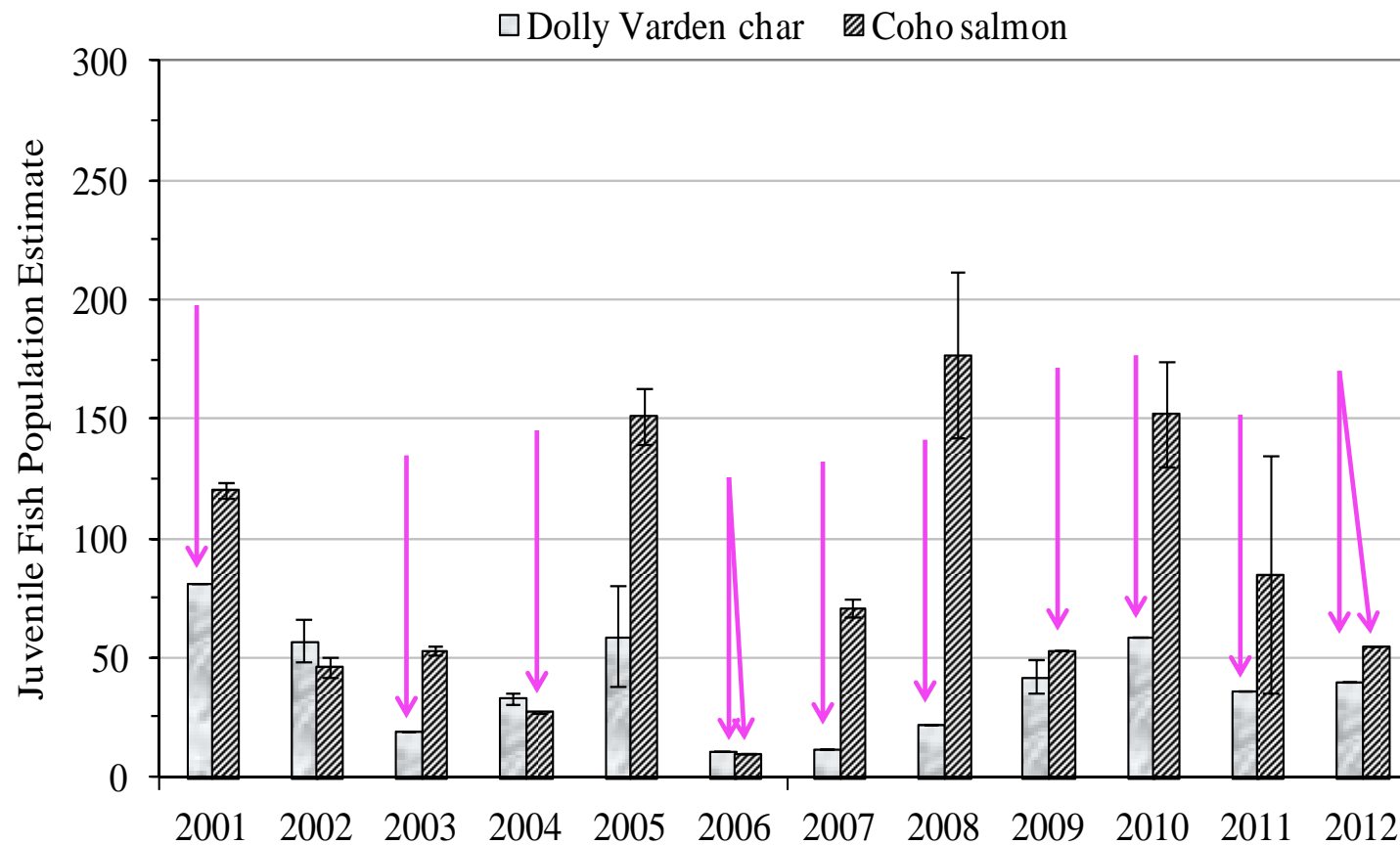
TC Site 9 – Aquatic insect community



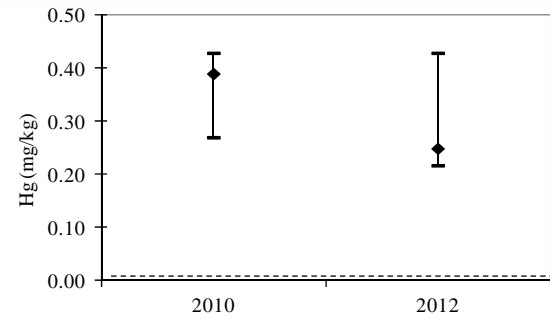
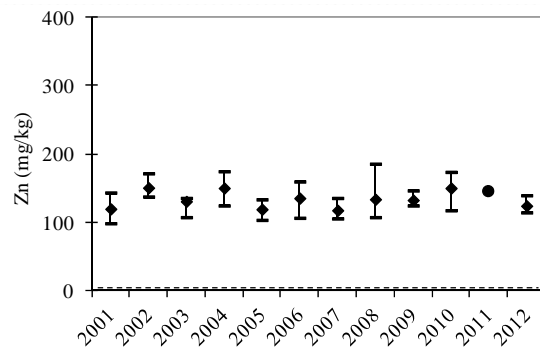
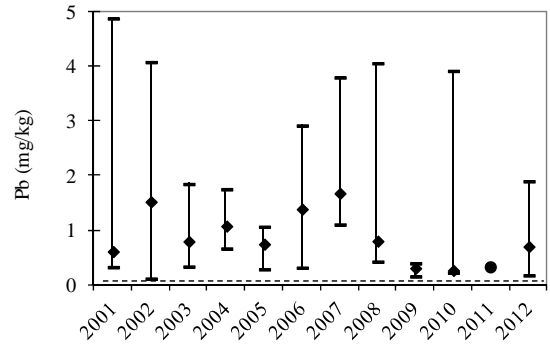
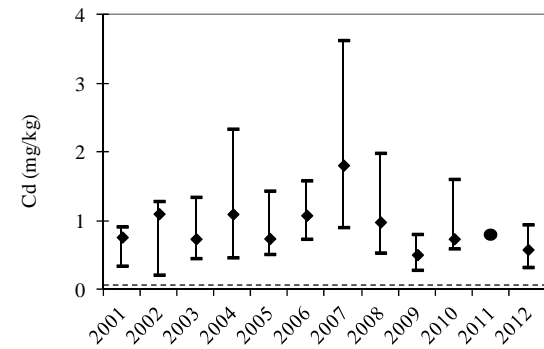
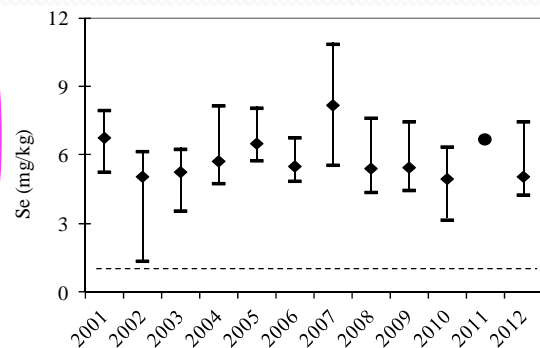
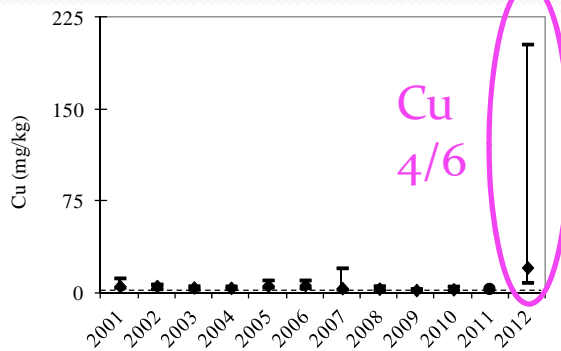
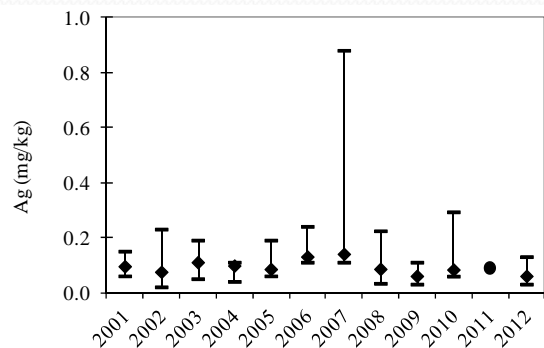
TC Site 9 – Aquatic insect community



TC Site 9 – Juvenile fish populations



TC Site 9 – Juvenile fish metals concentrations





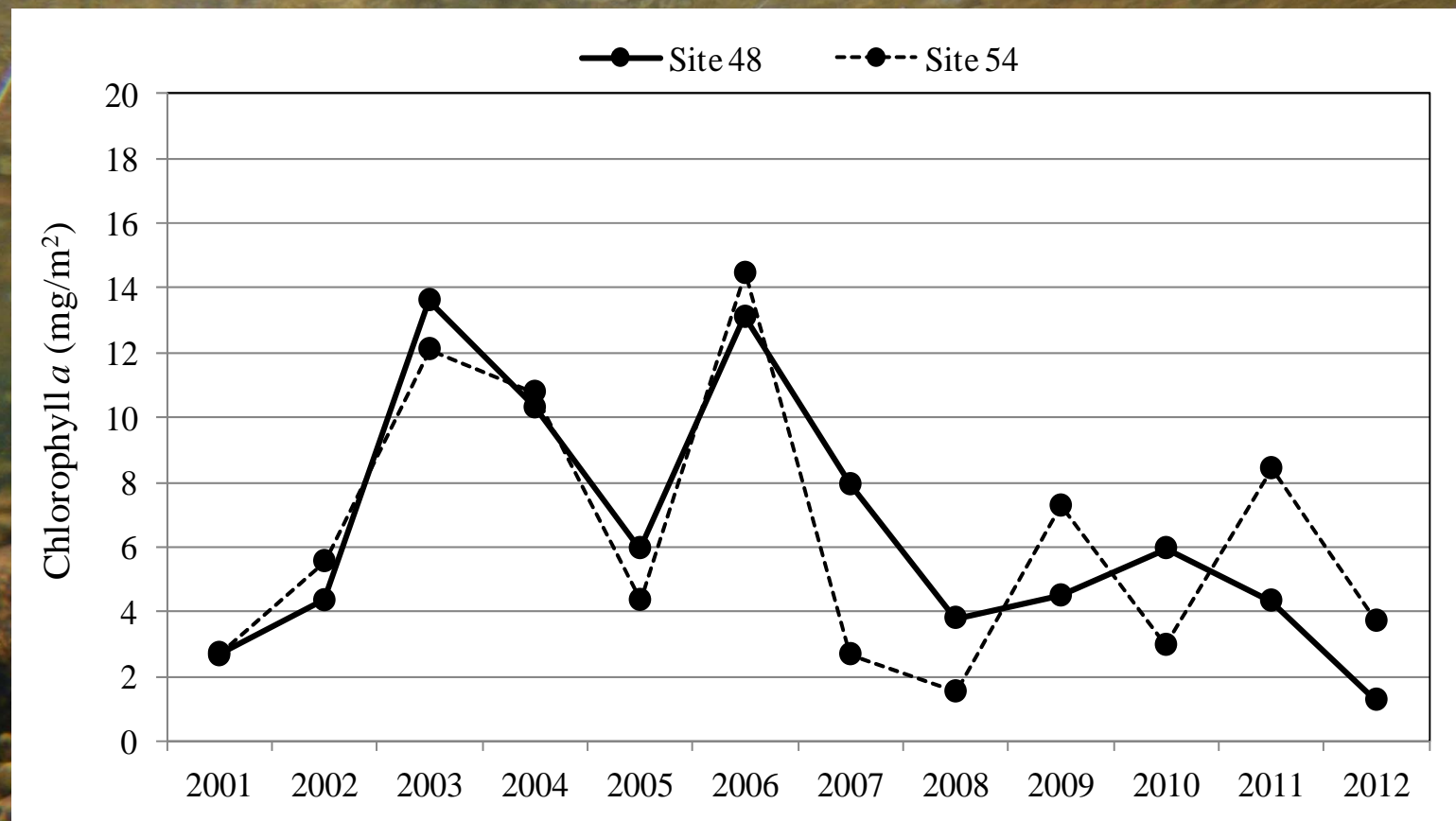
TC Site 9 – 2012 Summary

- Downstream of tailing storage facility
- 2012 periphyton mean density similar to values observed since 2006
- Aquatic insect density and richness similar to values observed in all years, except 2003
- EPT ~53% (ranged 50-80% 2001-2011)
- Fish populations similar to previous years
- High values of Cu in whole body juvenile DV suggest contamination

Comparisons among Greens Creek sites

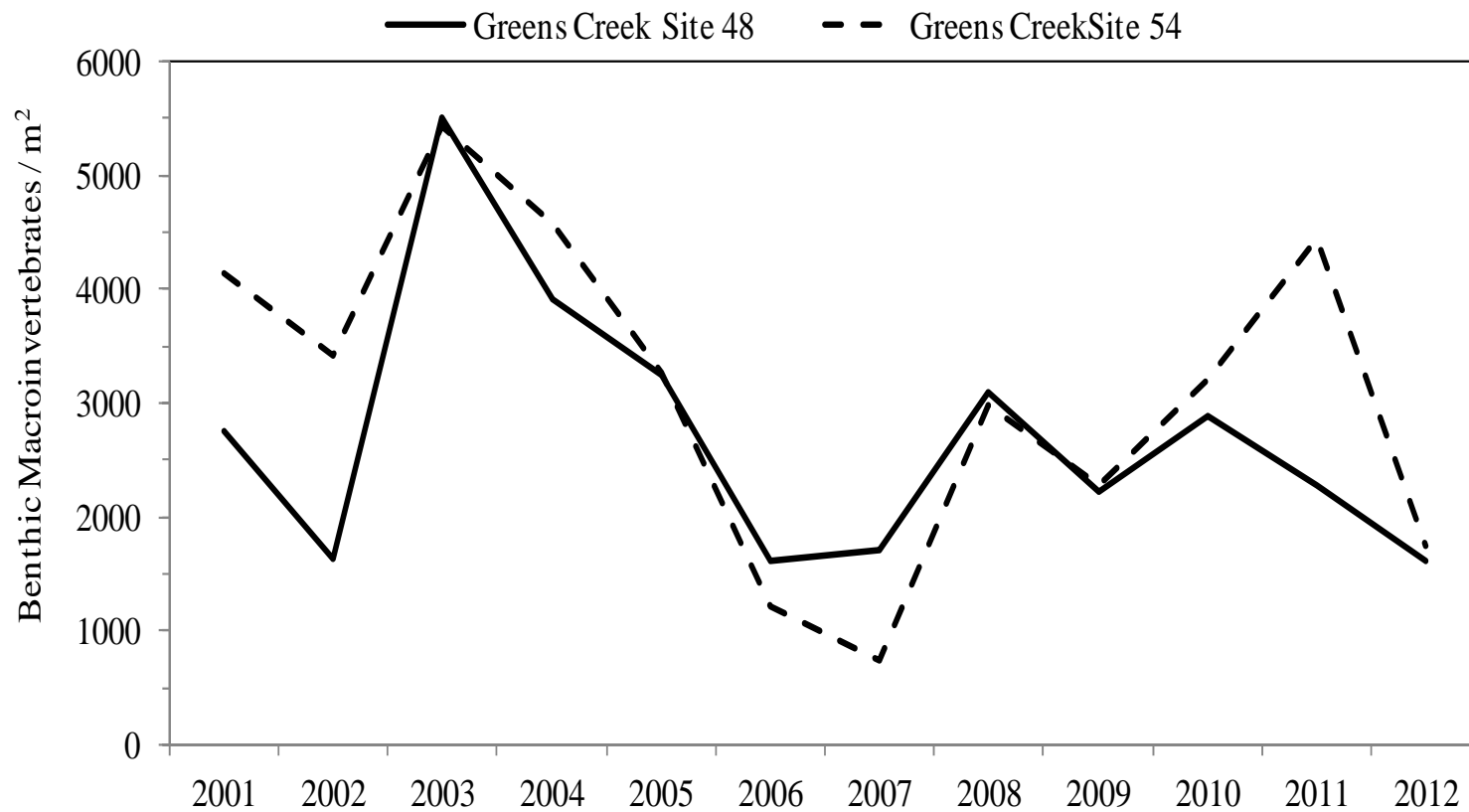


Greens Creek periphyton biomass

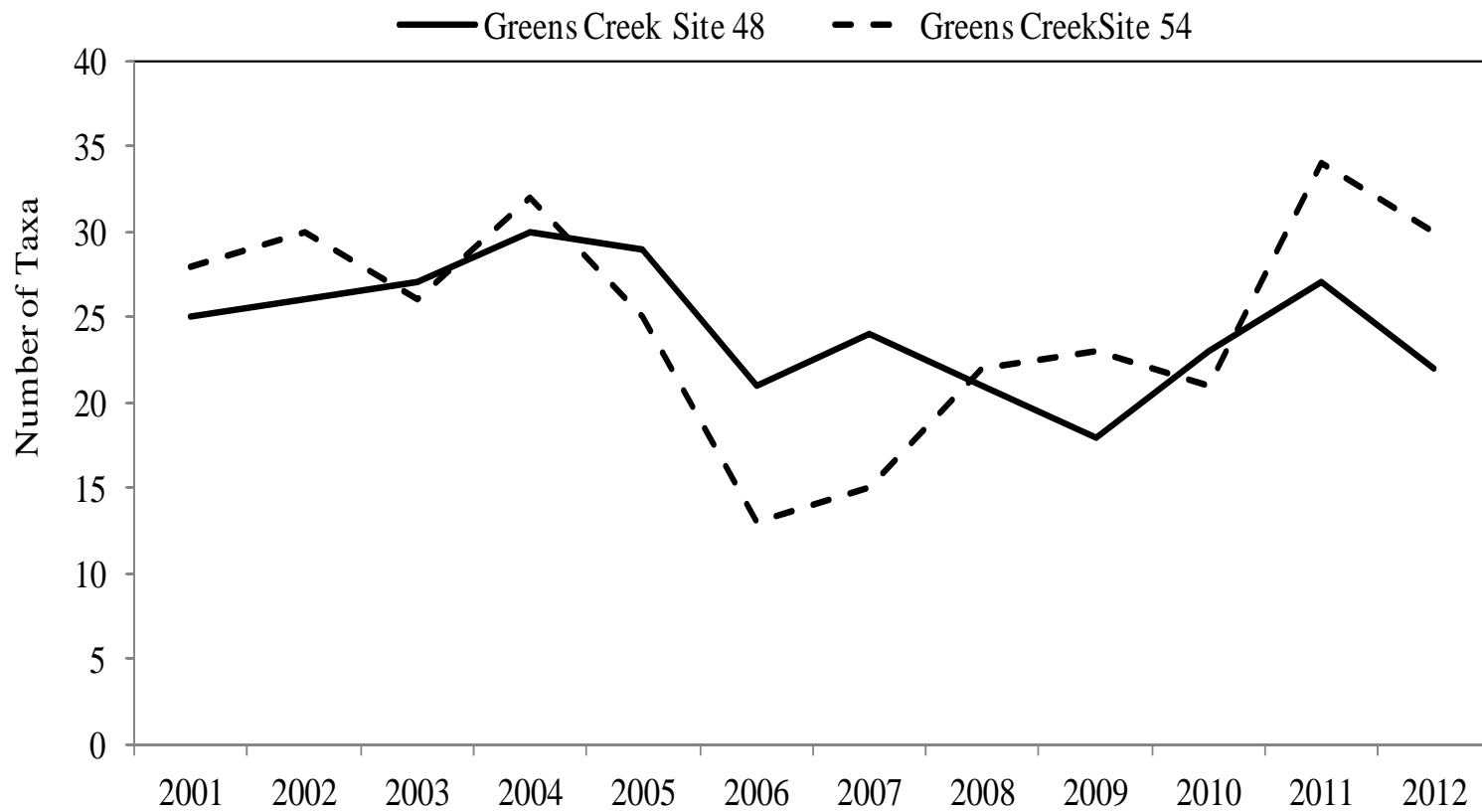


Samples from both sites contained about 90% chlor-a, nearly 0% chlor-b, and about 10% chlor-c.

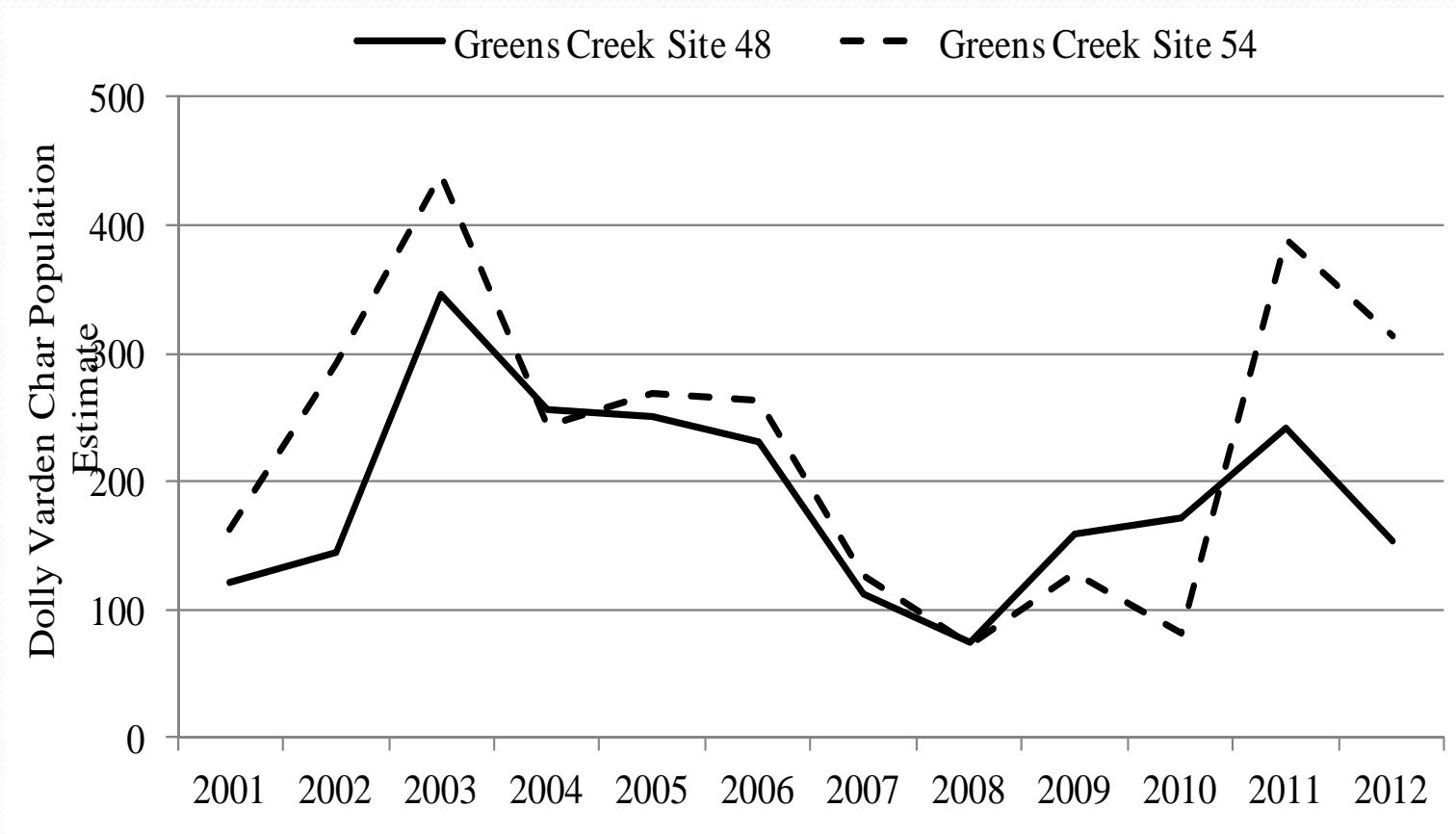
Greens Creek aquatic insect densities



Greens Creek aquatic insect taxa



Greens Creek DV populations



NEW IN 2012

Juvenile fish condition, ALL SITES



Several factors influence fish health:

- Age
- Sex
- Season
- Diet
- Fat reserve, etc...

Site 48 DV = 1.03 g/mm³

Site 54 DV = 1.08 g/mm³

Site 9 DV = 1.00 g/mm³

Site 9 CO = 1.14 g/mm³

Three trophic (productivity) levels



Periphyton



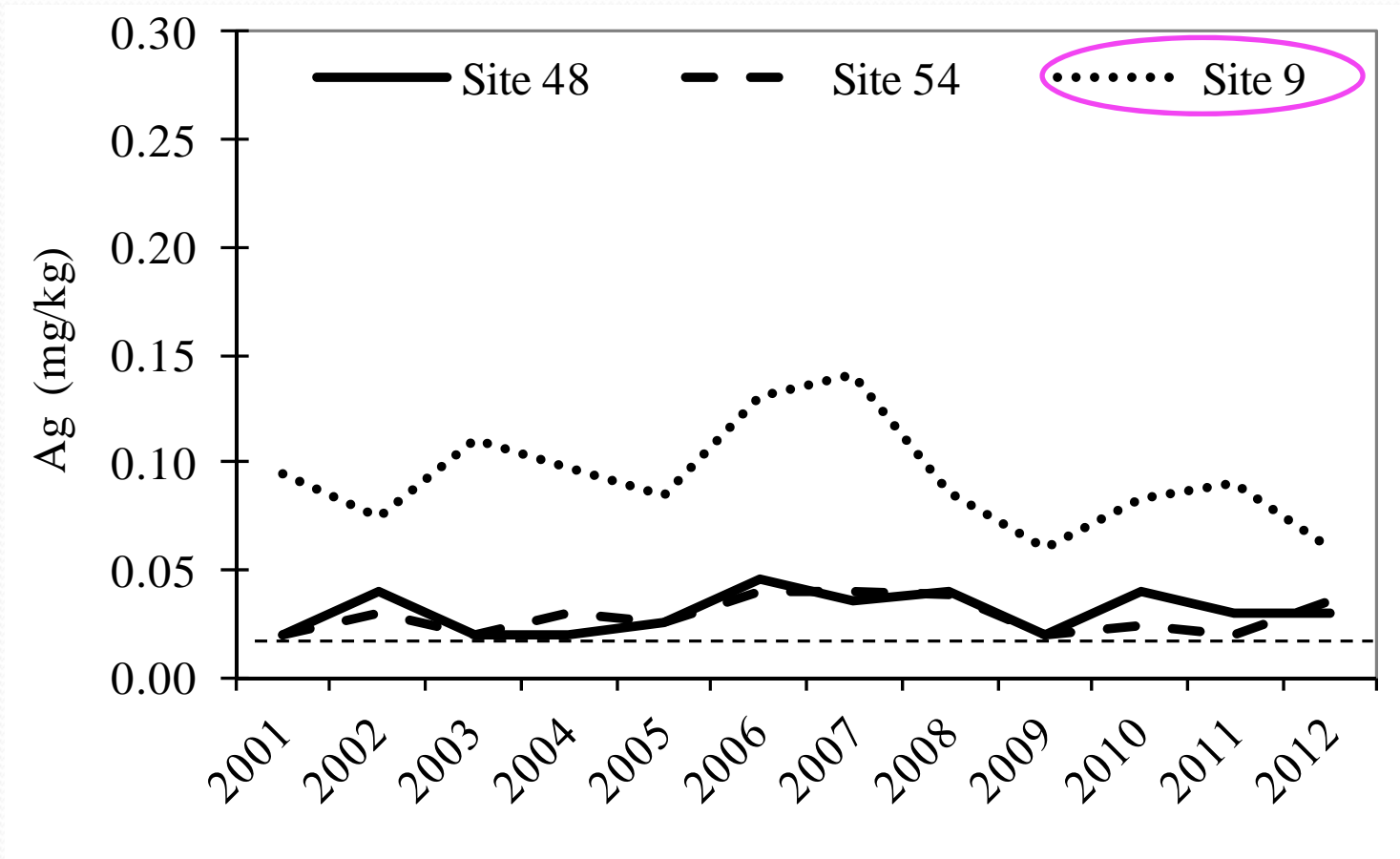
Aquatic insects



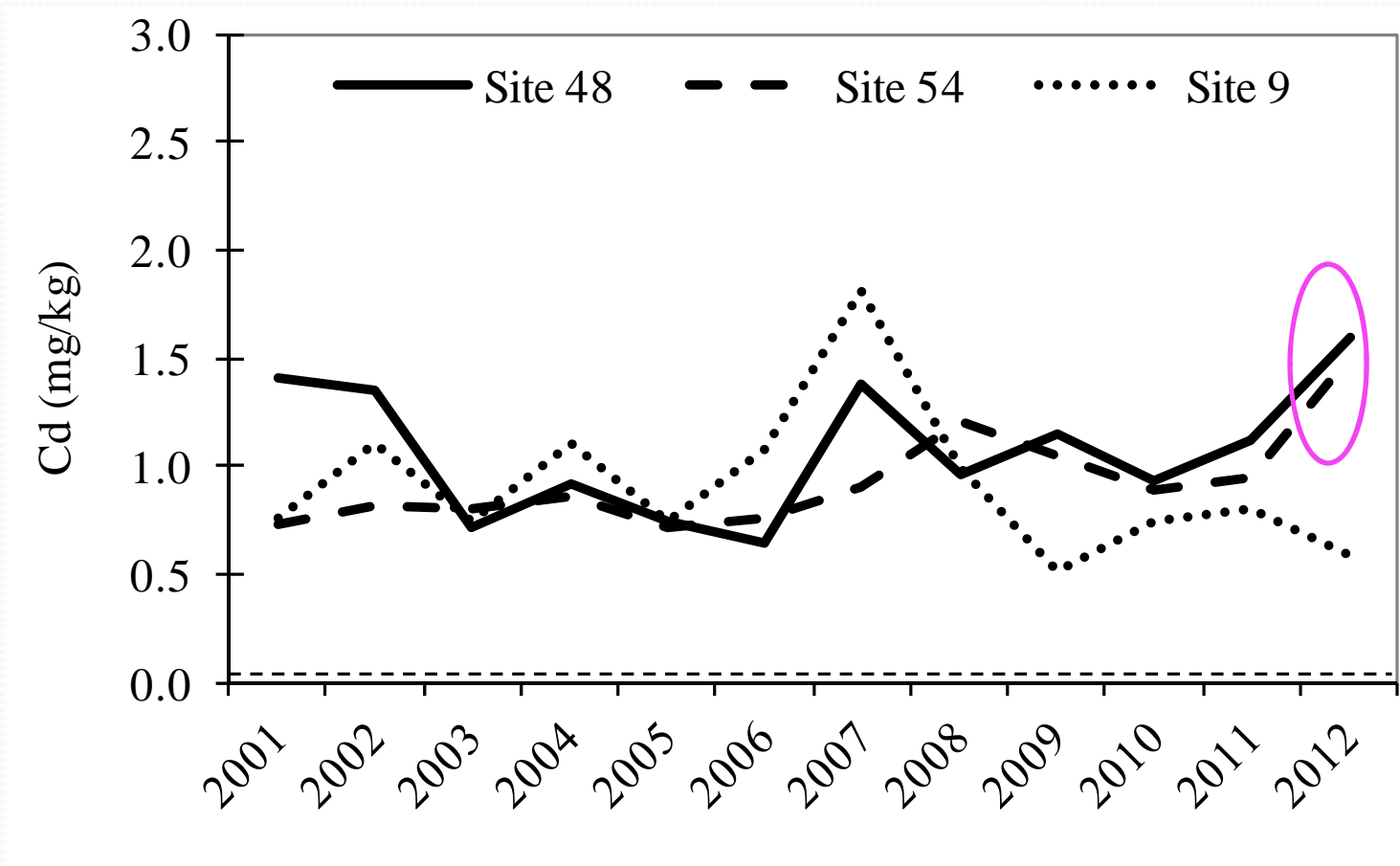
Juvenile fish

Finally, juvenile fish metals concentrations

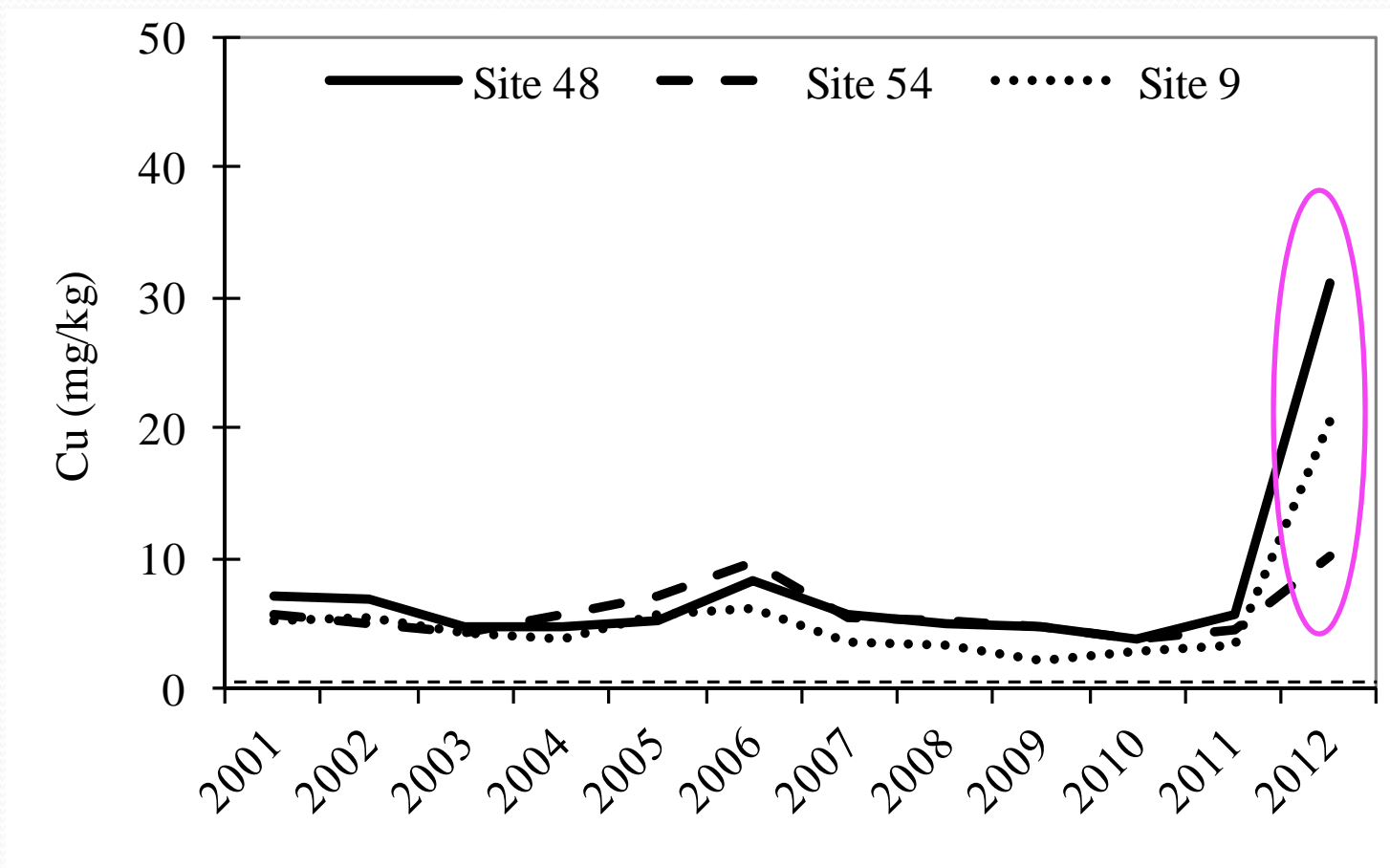
Juvenile fish median whole body [Ag]



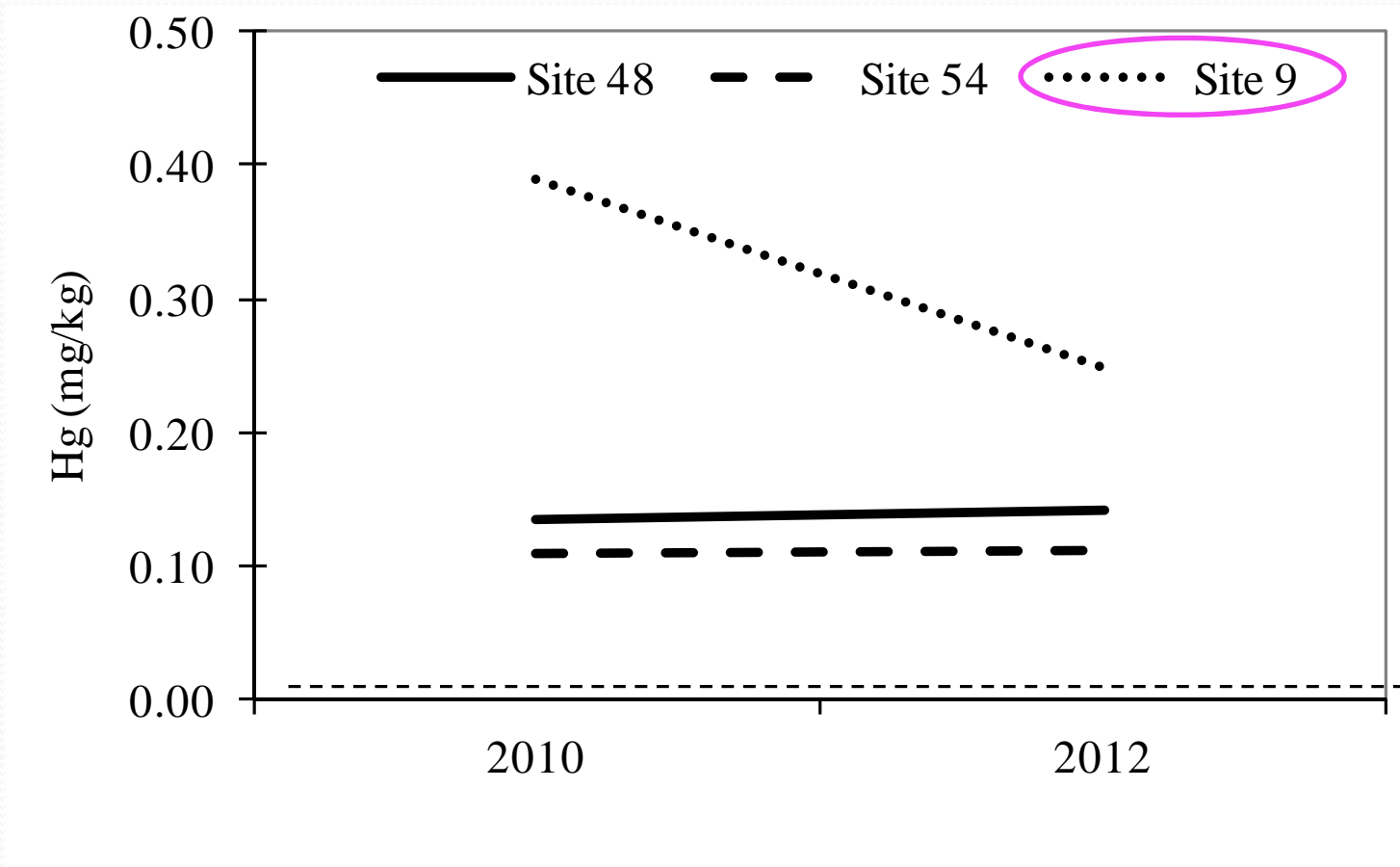
Juvenile fish median whole body [Cd]



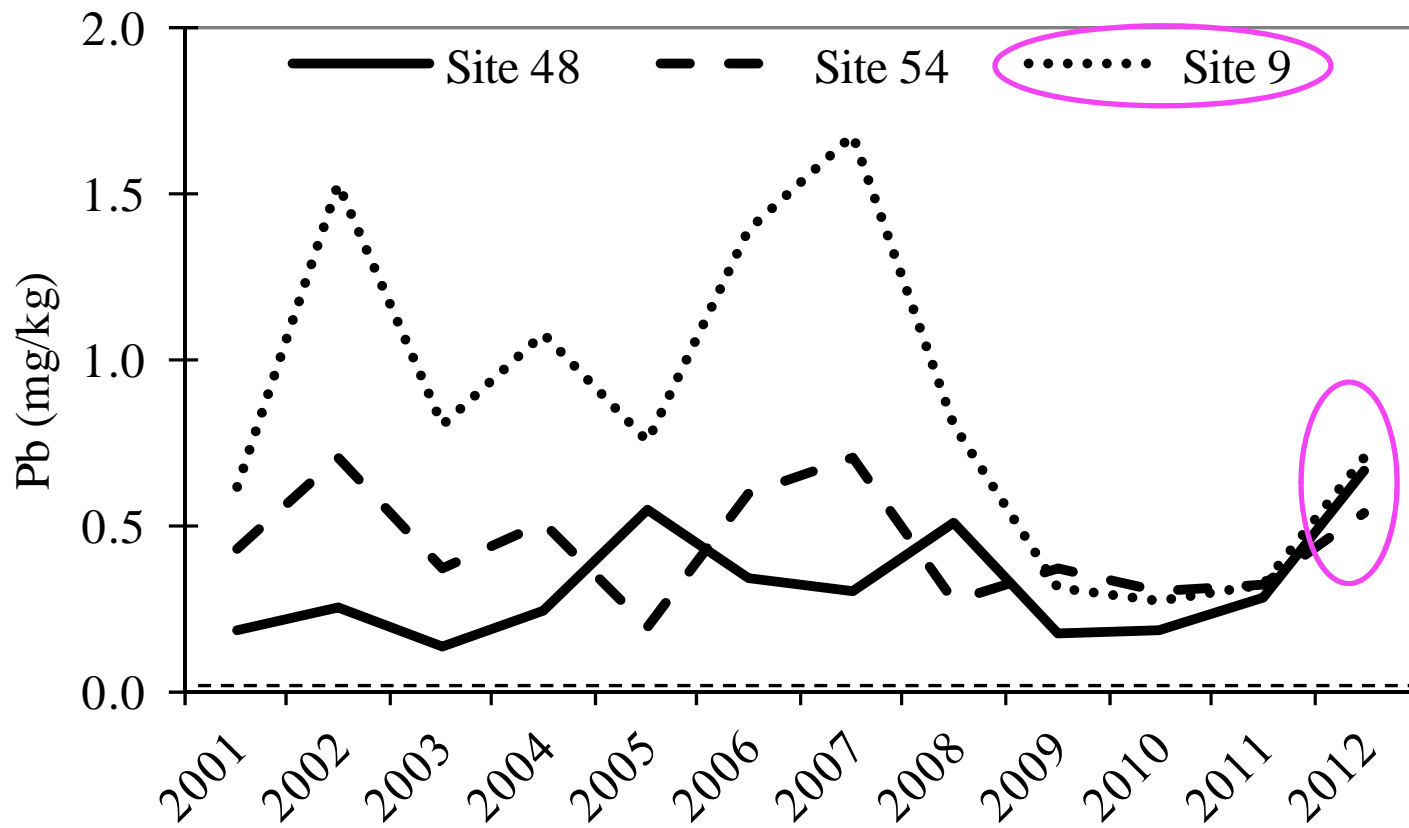
Juvenile fish median whole body [Cu]



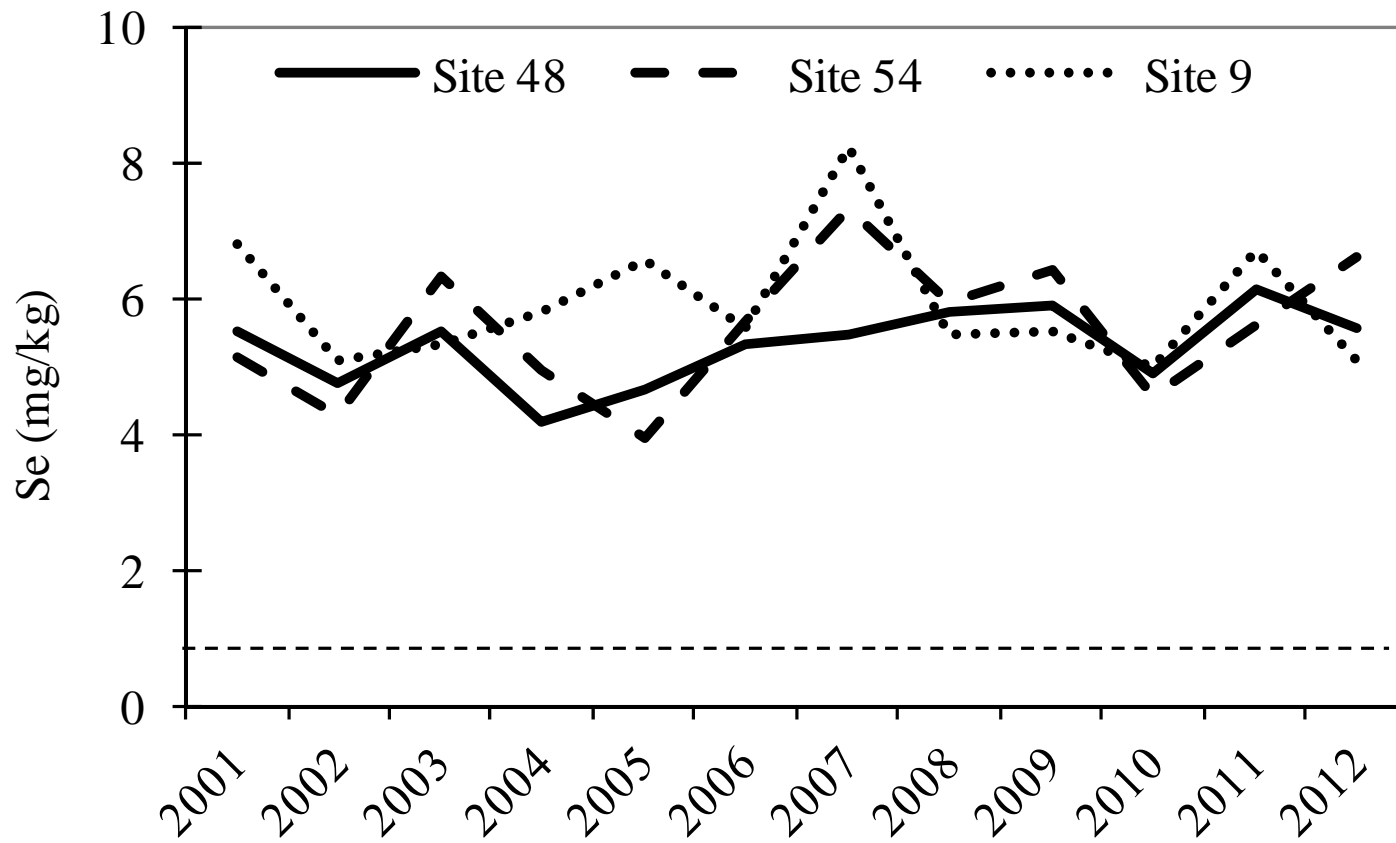
Juvenile fish median whole body [Hg]



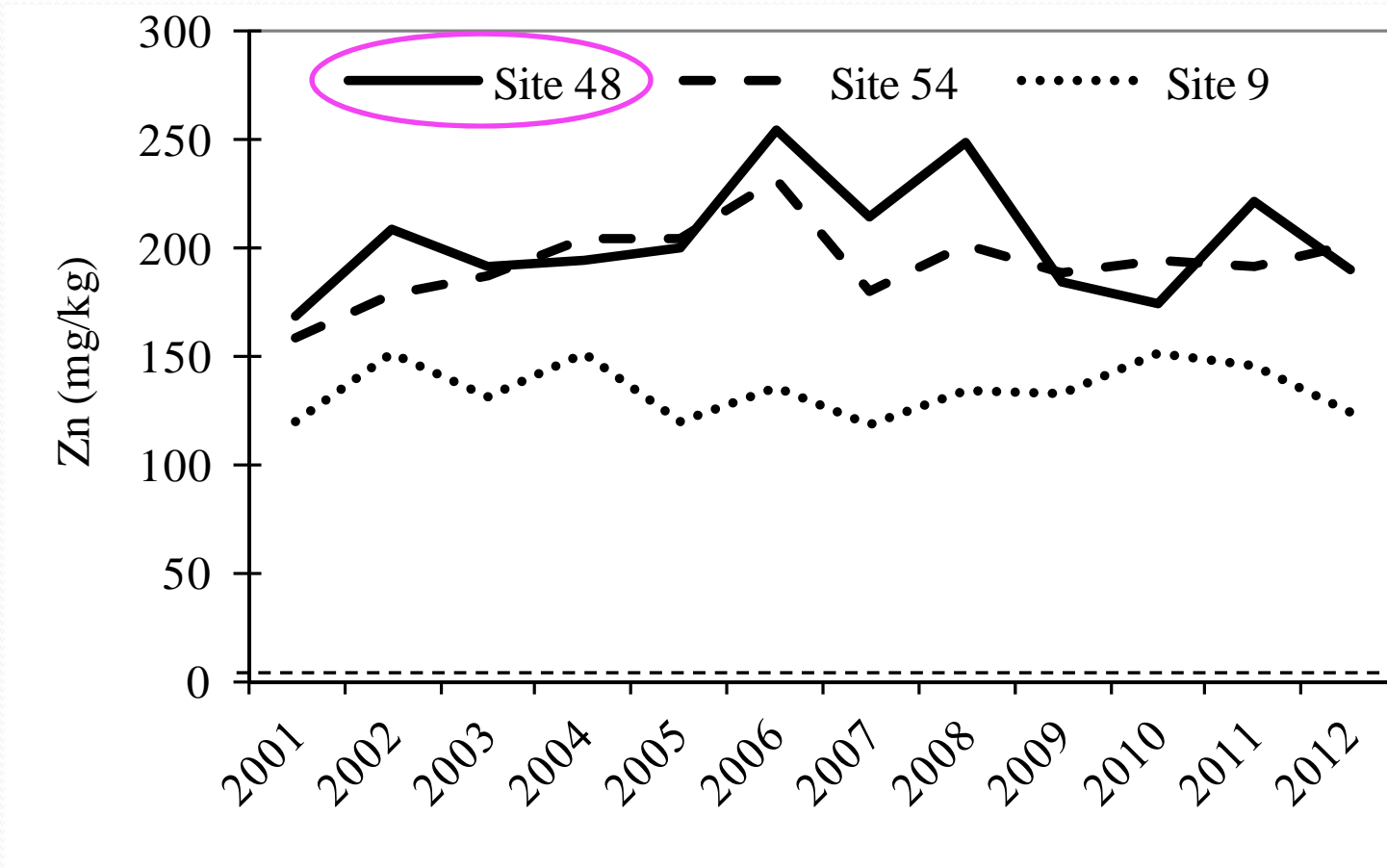
Juvenile fish median whole body [Pb]



Juvenile fish median whole body [Se]



Juvenile fish median whole body [Zn]





Trends among the data

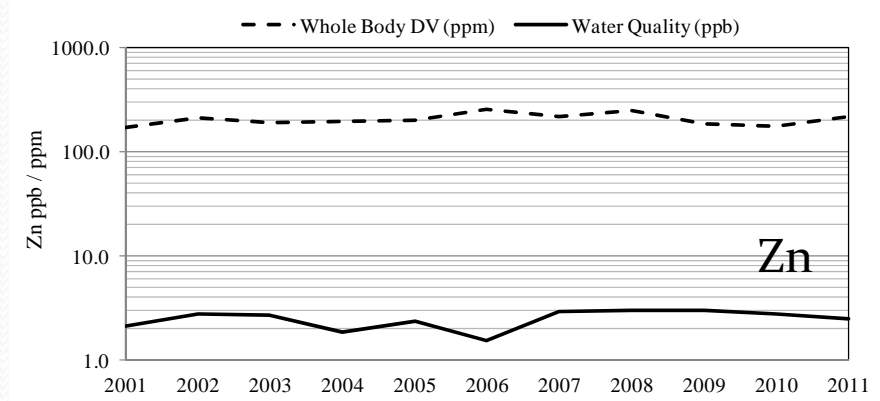
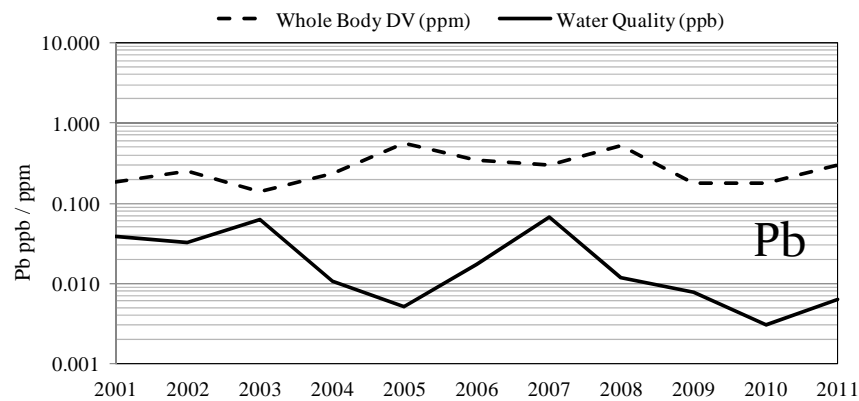
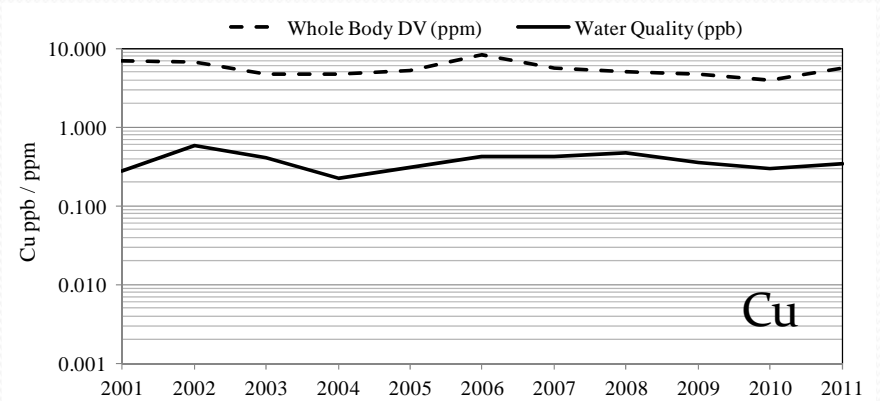
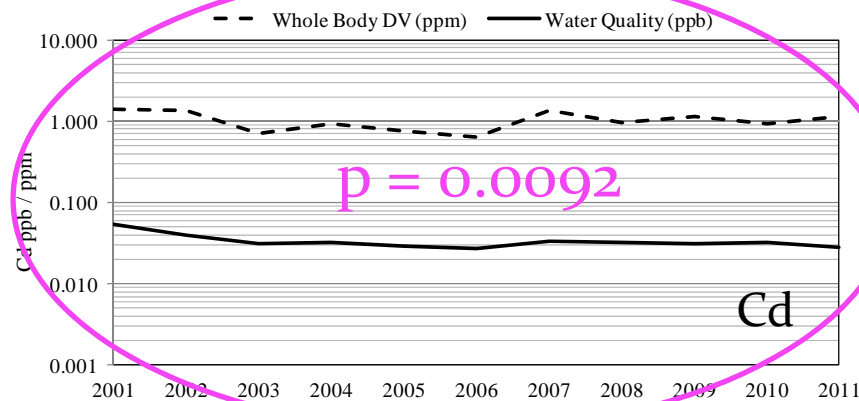
- In Greens Creek, differences between years are generally greater than between sites.
- High flows prior to sampling appear to affect periphyton densities more than aquatic insect densities.
- Some adult coho transit the fishpass.
- Tributary Creek fish populations more variable than periphyton density, or aquatic insect density and richness.



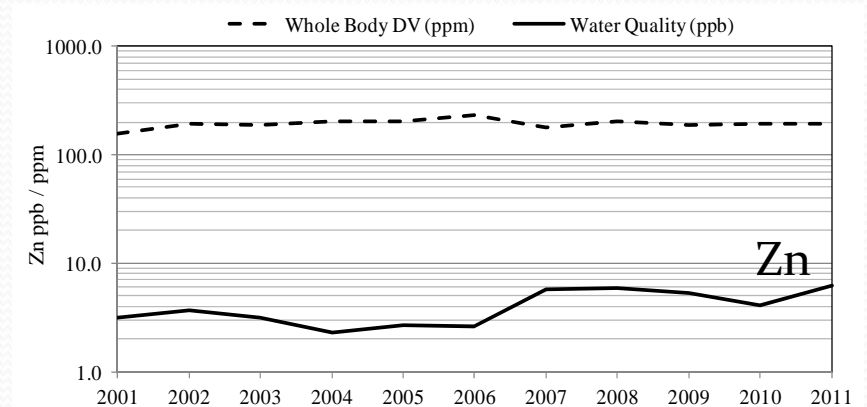
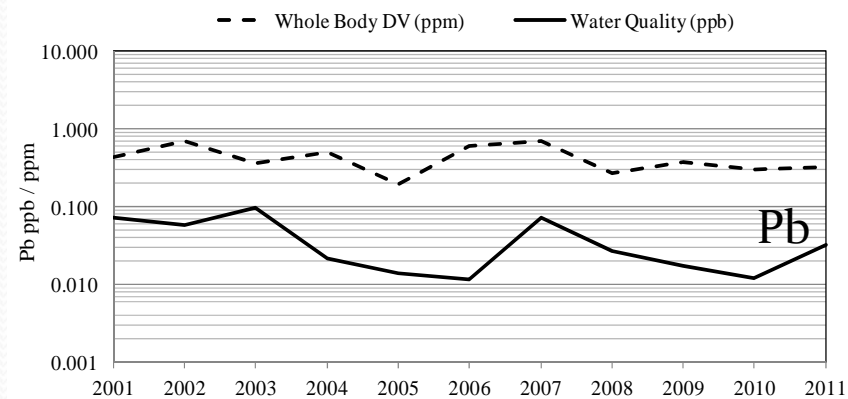
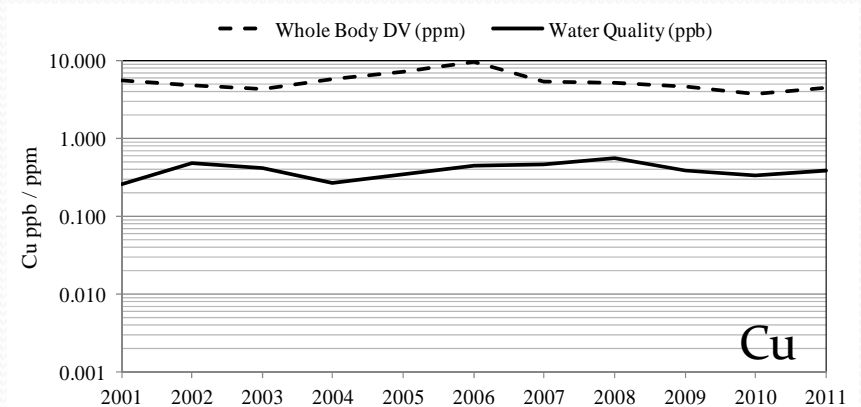
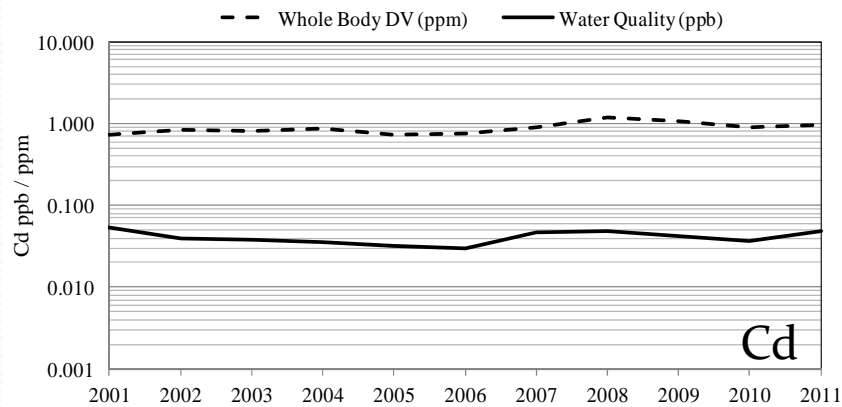
2011 Recommendations

- ~~Compare water quality data with biological abundance and composition data, and~~
- Compare water quality data with whole body fish metals concentrations data.

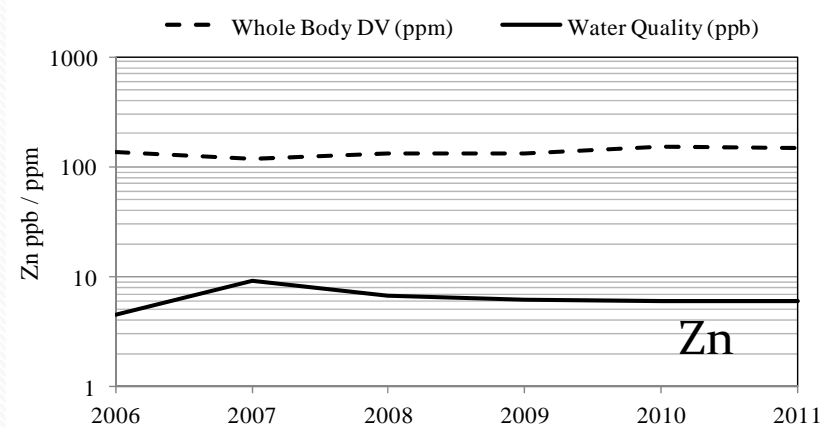
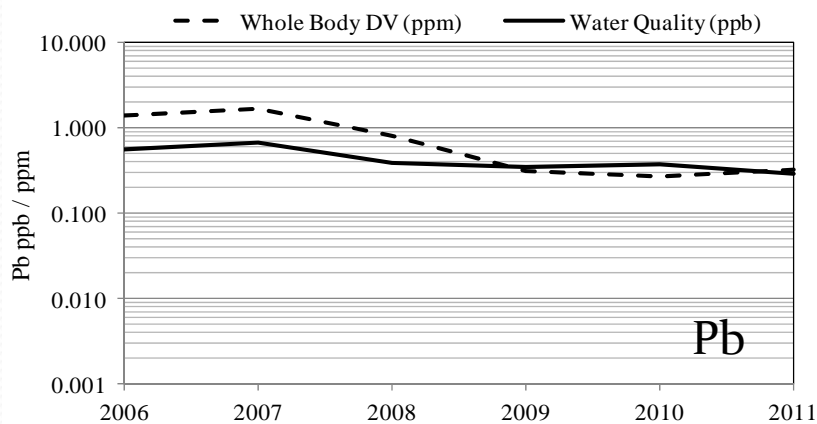
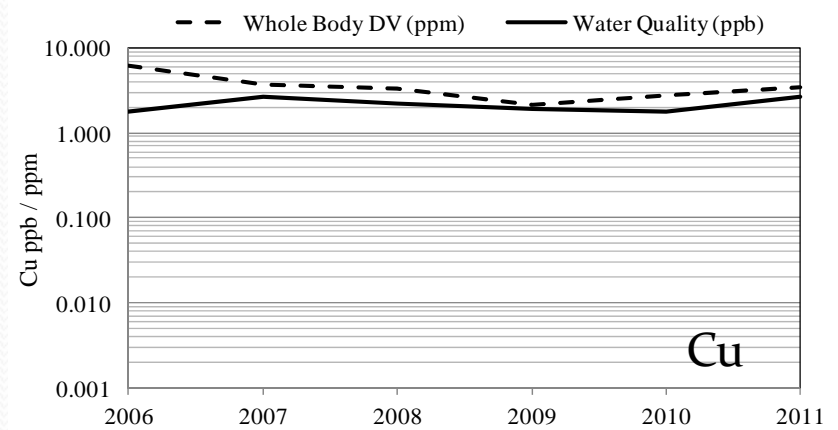
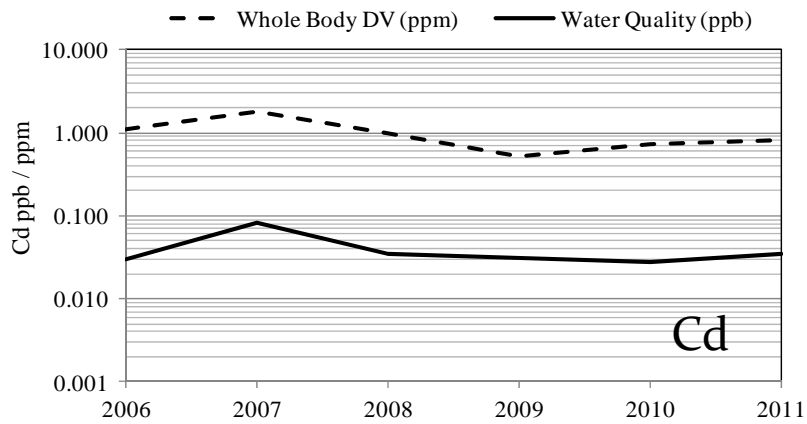
Greens Creek Site 48 WQ and fish [metals]



Greens Creek Site 54 WQ and fish [metals]



Tributary Creek Site 9 WQ and fish [metals]





2012 Recommendations

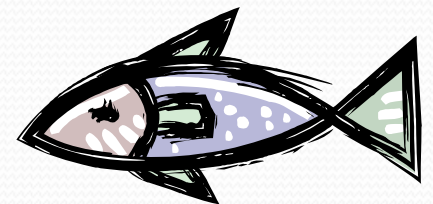
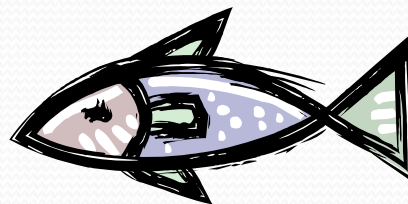
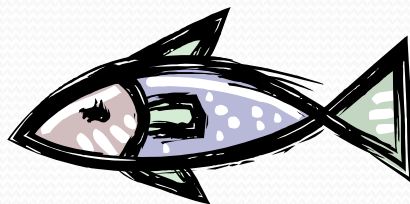
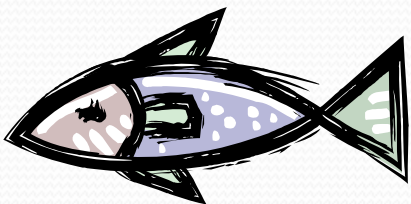
- Compare water quality data with periphyton density data and with aquatic insect density & composition data
- Measure sediment metals concentrations
- Test for significant positive correlations between juvenile fish metals concentrations and years

Thank you

Hecla Greens Creek Mining Company for funding, the opportunity, and logistical and field assistance,

ADF&G Habitat Biologists for data collection, sample analyses and technical review, and

ADF&G Dan Reed for biometric review.



Questions?

