



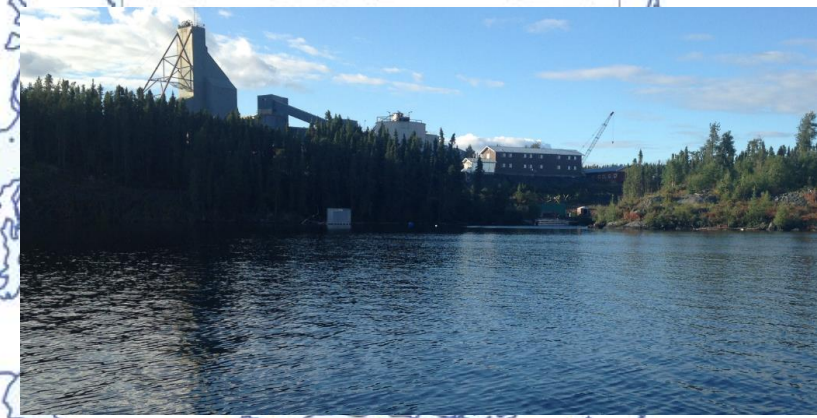
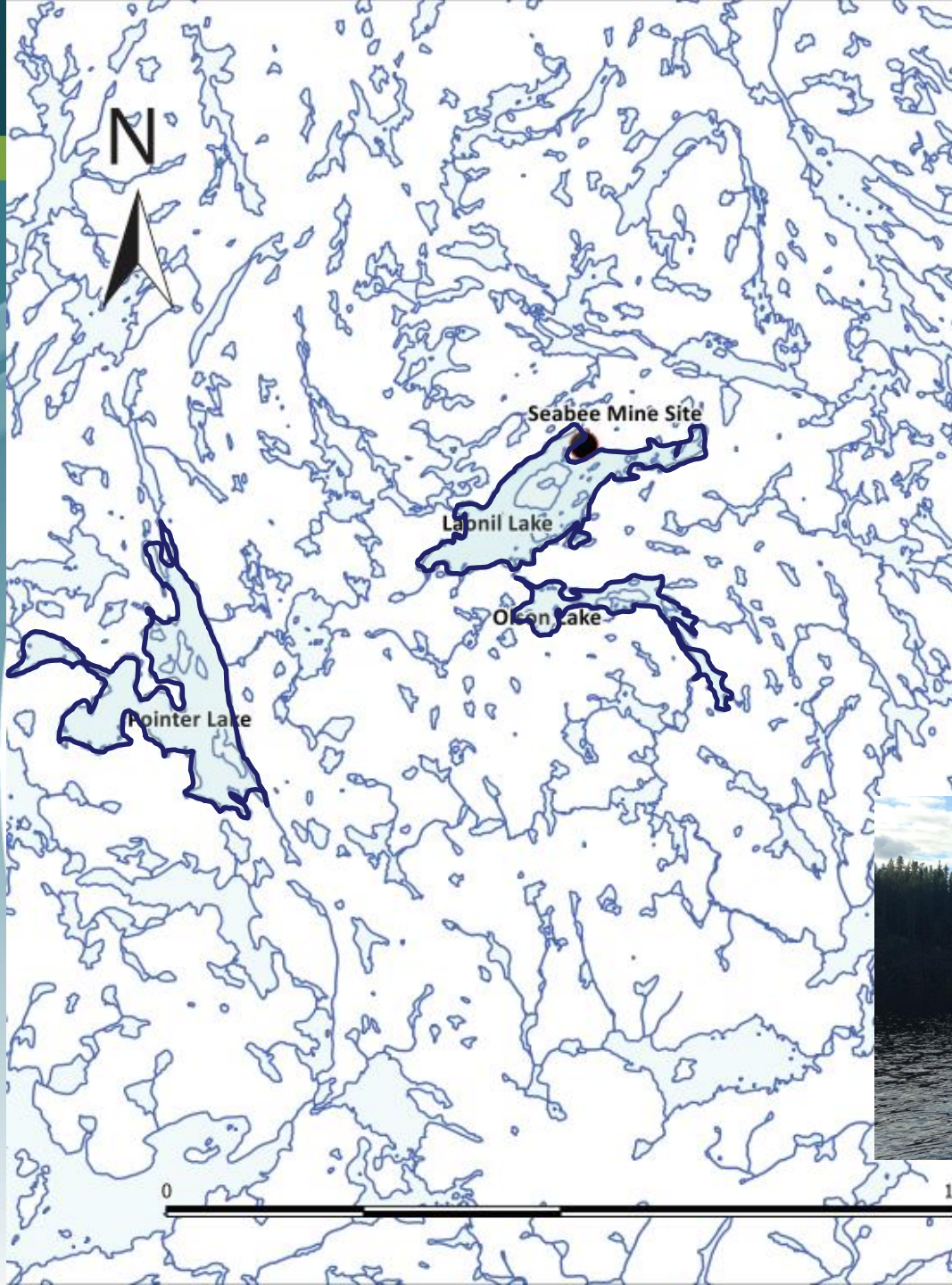
Benthos Unlikely Affected by Metals in Laonil Lake, SK, Near Seabee Gold Mine

Bruce Kilgour, [KAL](#)

Charles Hatry, [KAL](#)

Blair Gunter, [Seabee Gold Mine](#)

Sam Cormack, [Seabee Gold Mine](#)

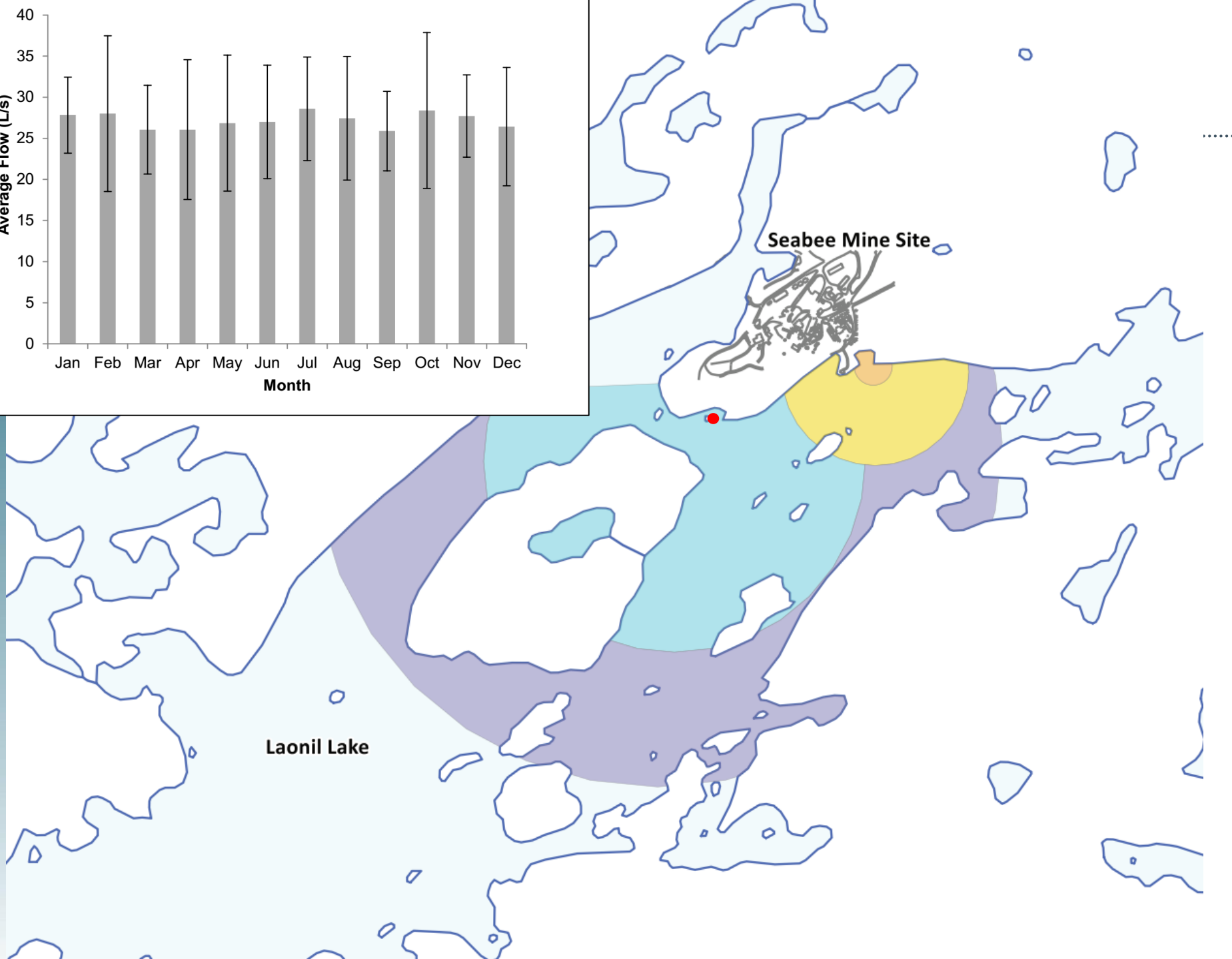
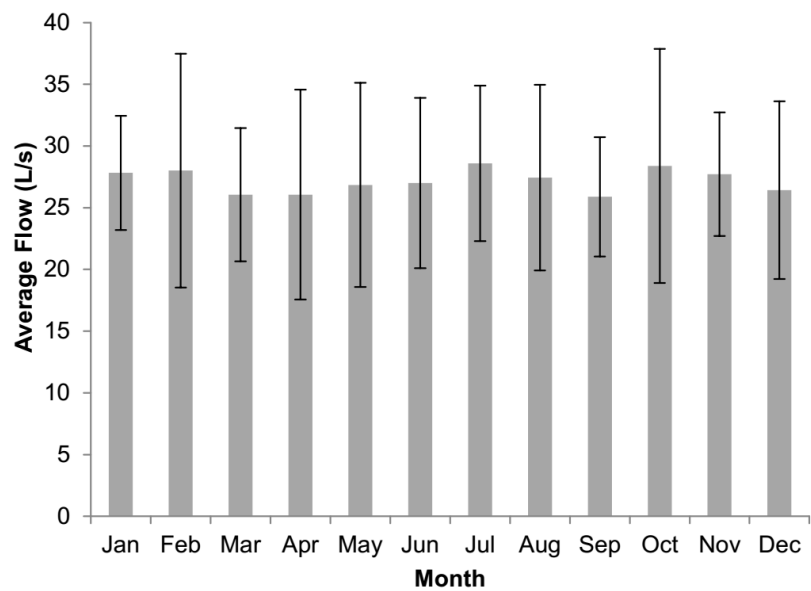




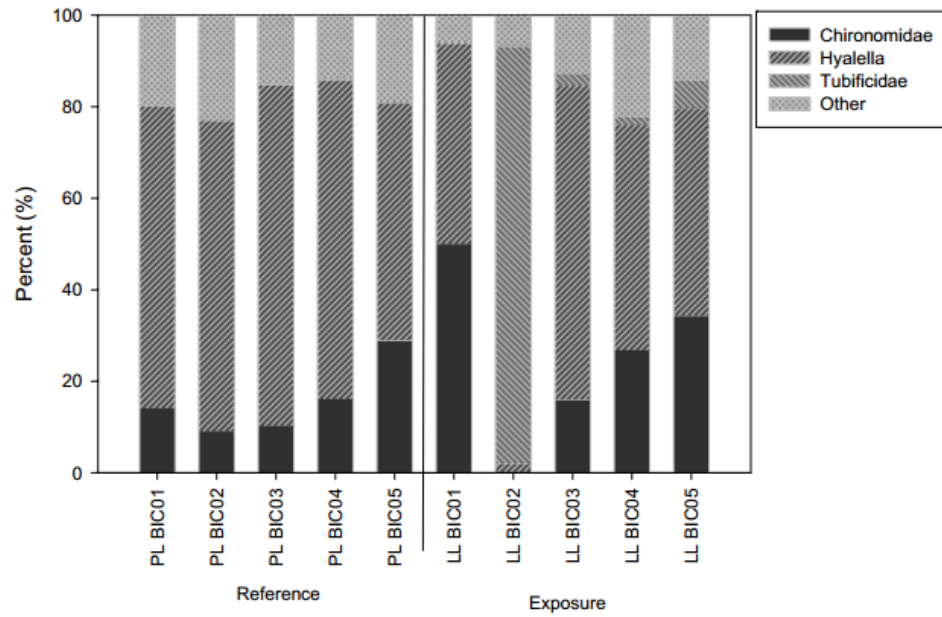
See Fig. 5-4



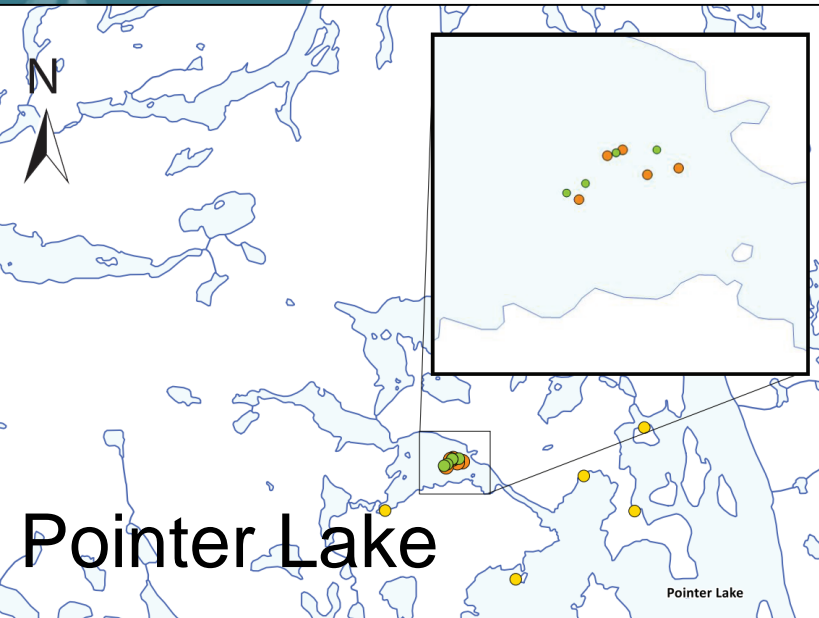




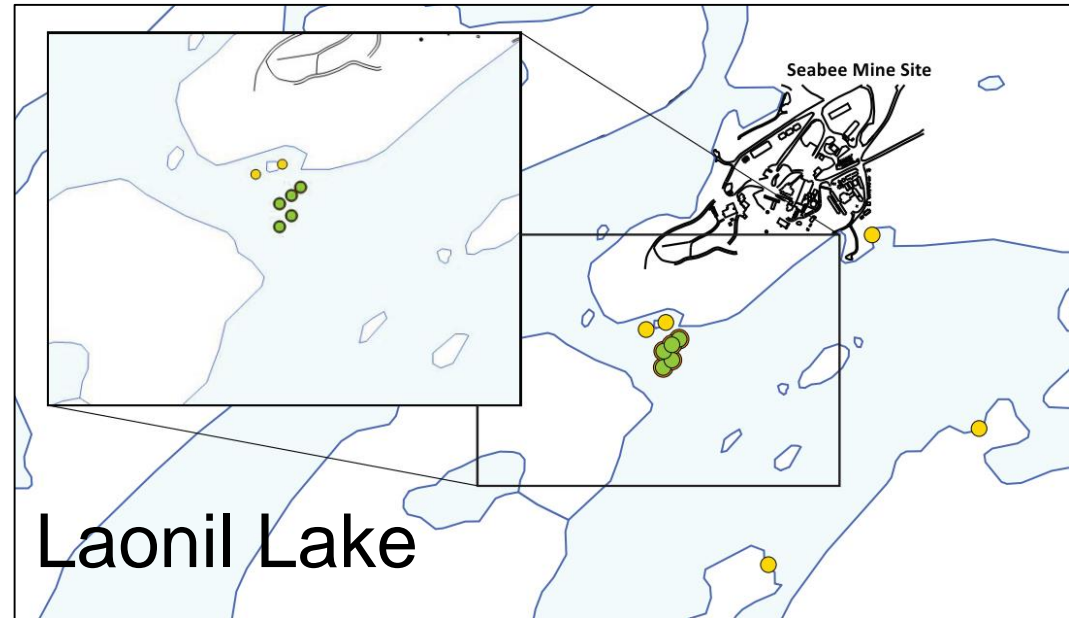
2004 field program



2007 Field Program



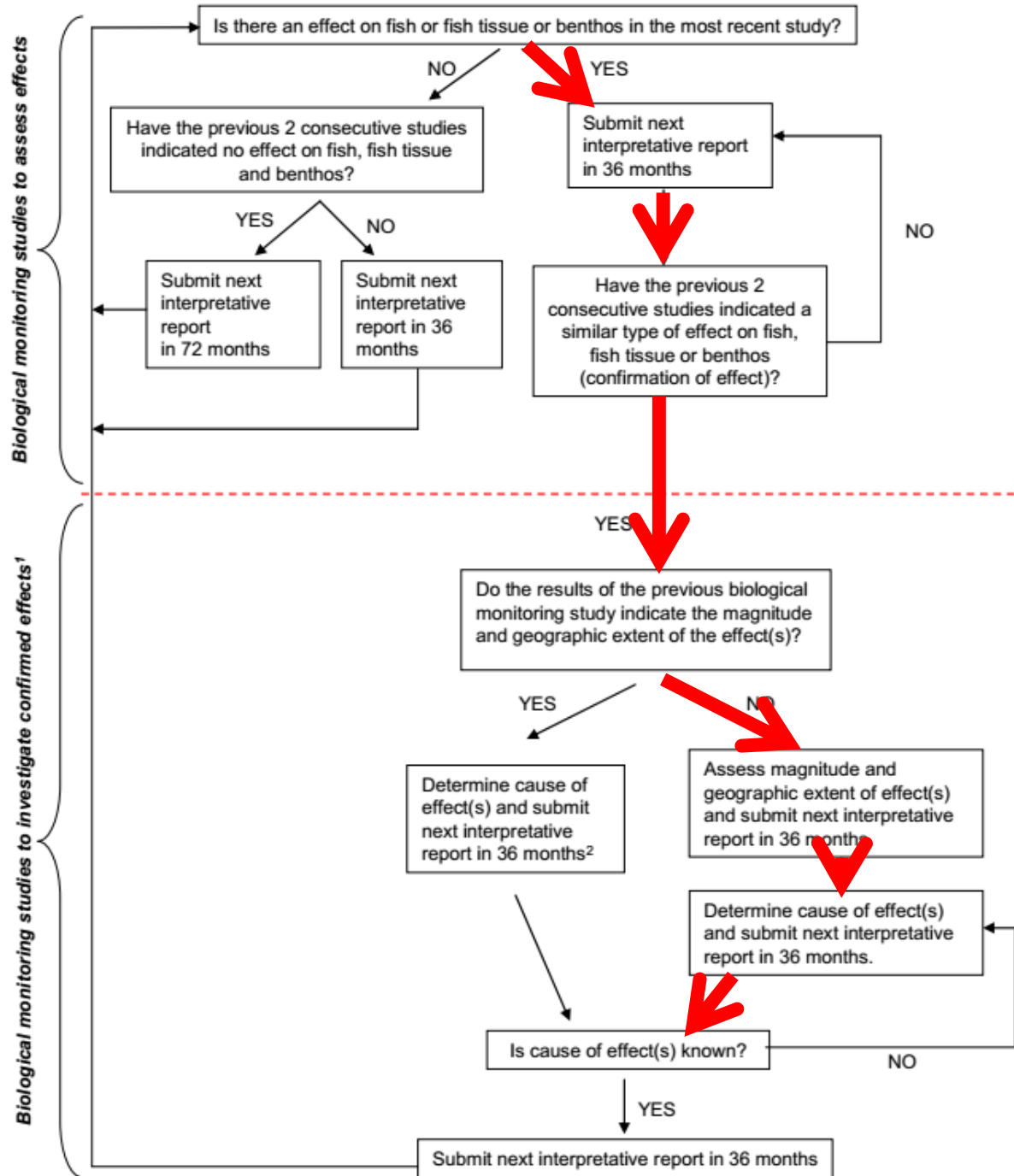
~ 250 m²
Chironomids 67%
-Chironomus
Sphaeriidae 14%
Ostracoda



~ 1500 m²
Sphaeriidae 59%
Amphipoda 35%
Mysids
Naidids
Valvatidae (snails)

Phase	Year	Benthos				
		Design	Abundance	Richness	Simpsons	Bray-Curtis
1	2004	Control-Impact, with stations well distributed in reference and exposure areas, and with sampling in < 2 m of water near shore.	0	0	0	0
2	2007	Control-Impact with stations in the exposure area nearer the point of discharge. Stations in Pointer Lake were relatively tightly arranged in a bay.	7.5 SD	0	0	5.6 SD
3	2009	Similar design for Laonil and Pointer Lakes as in 2007, except exposure station 2 was moved. Added Eisler Lake as an additional reference.	5.1 SD	0	0	9.2 SD

Table Note: Cells shaded in grey are 'confirmed' differences that support an Investigation of Cause Phase.



Phase 1: 2004

Phase 2: 2007

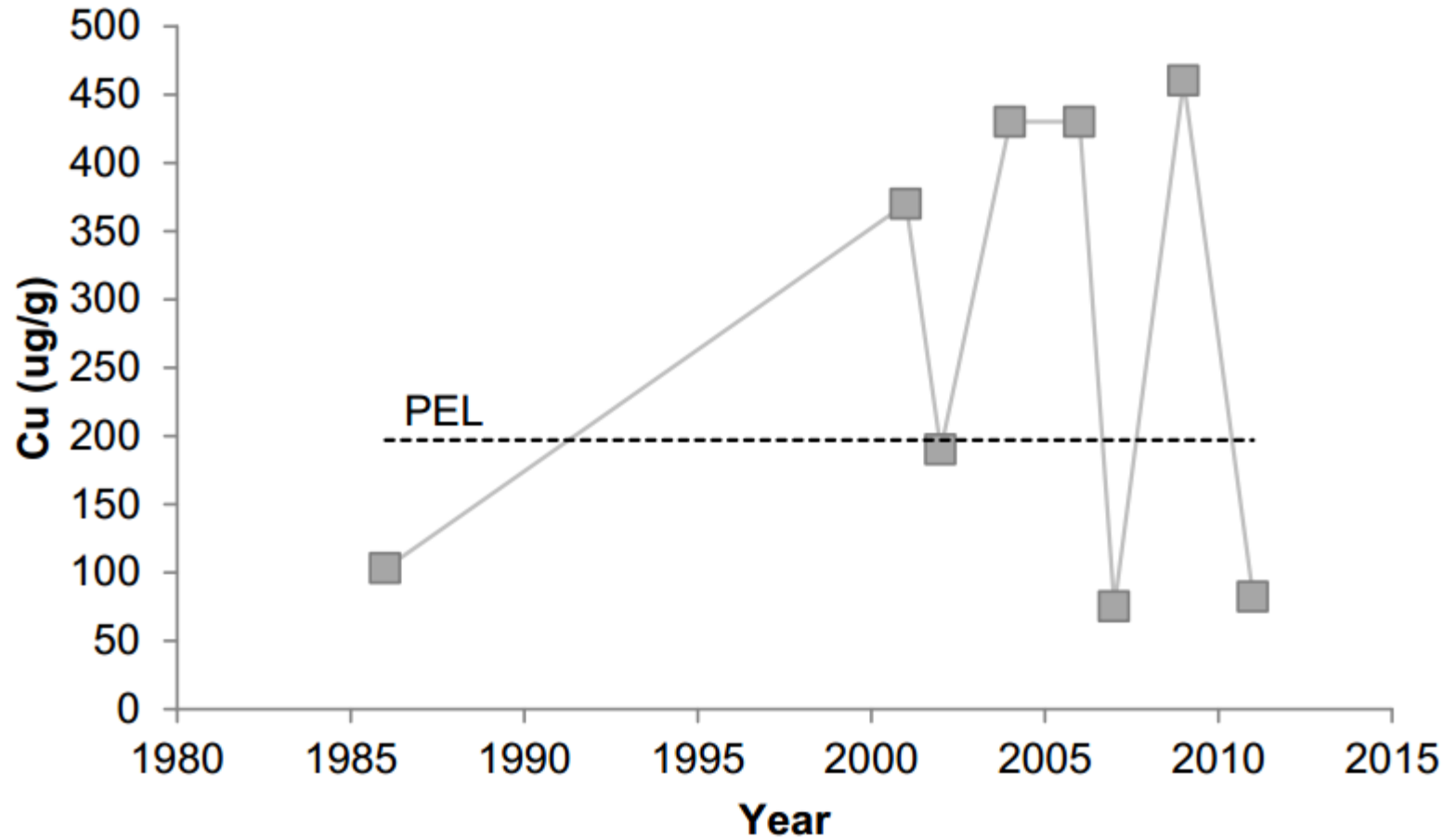
Phase 3: 2009

Phase 3: 2009

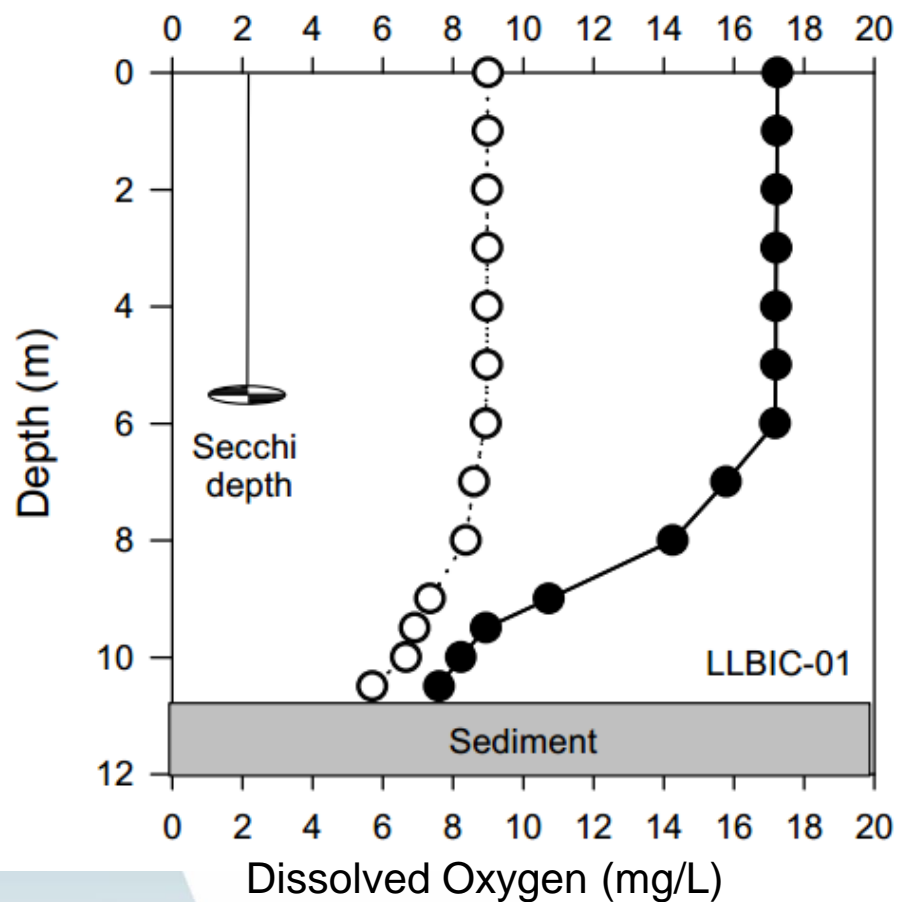
Phase 4: 2012

Phase 5: 2015

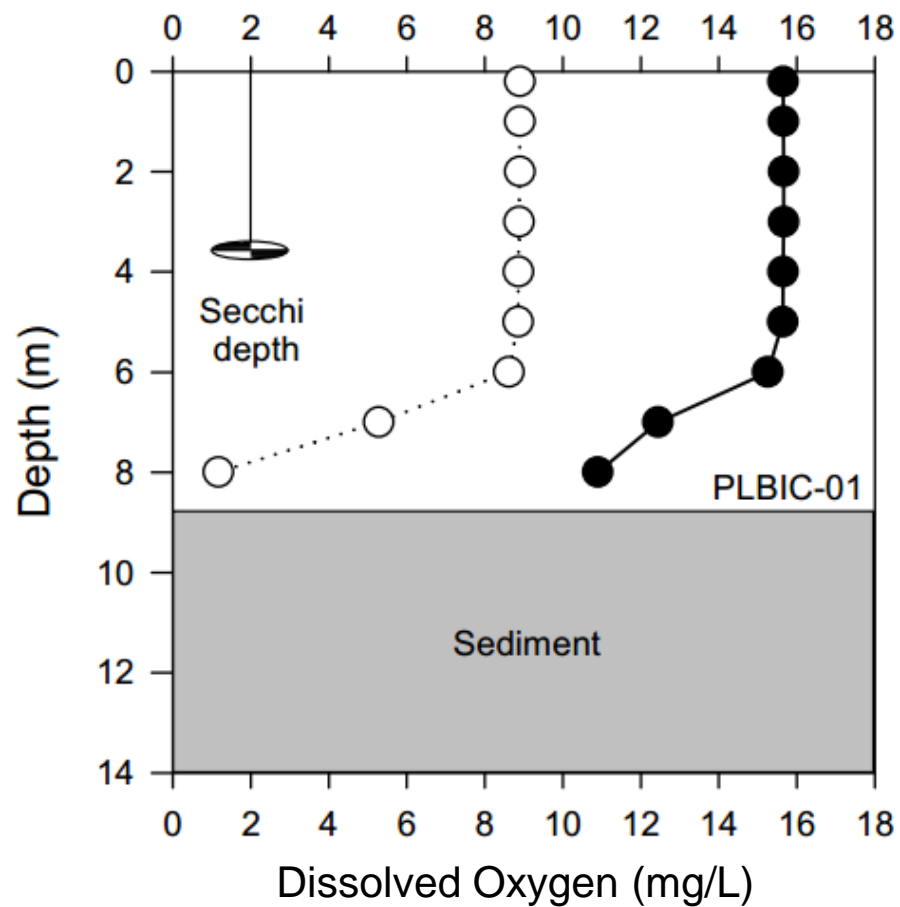
Historical Sediment Data



a) Laonil Lake



c) Pointer Lake



2015 Program

Key Hypotheses to Test:

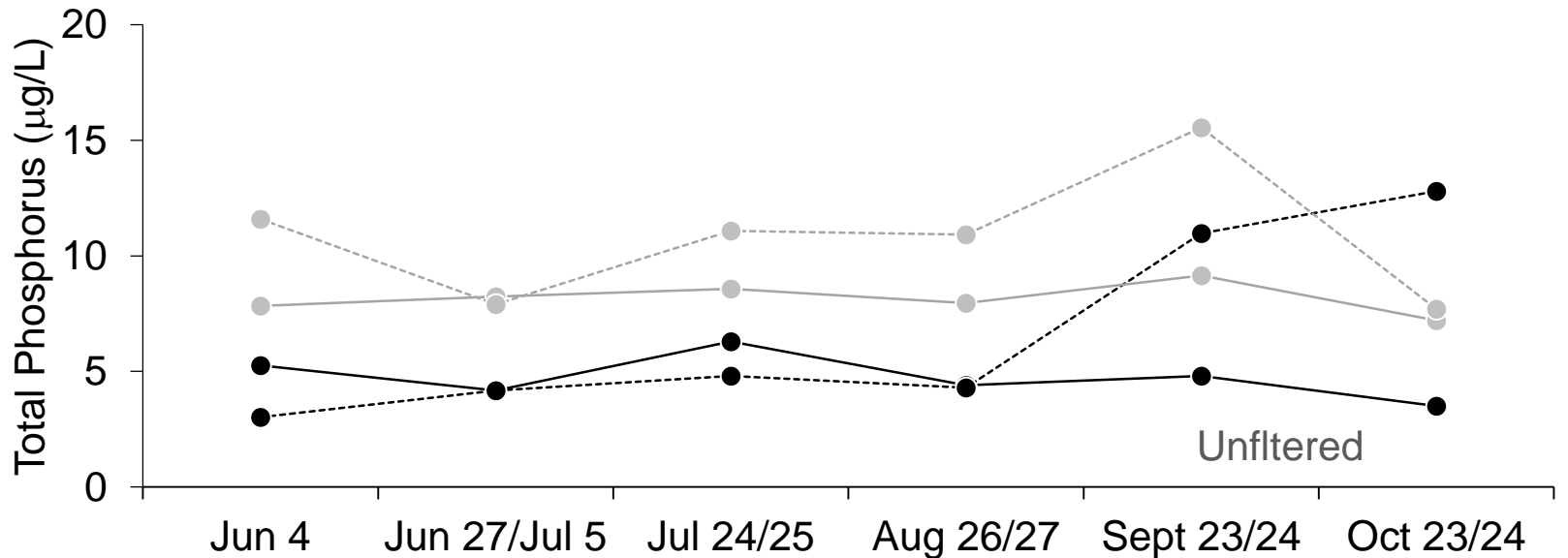
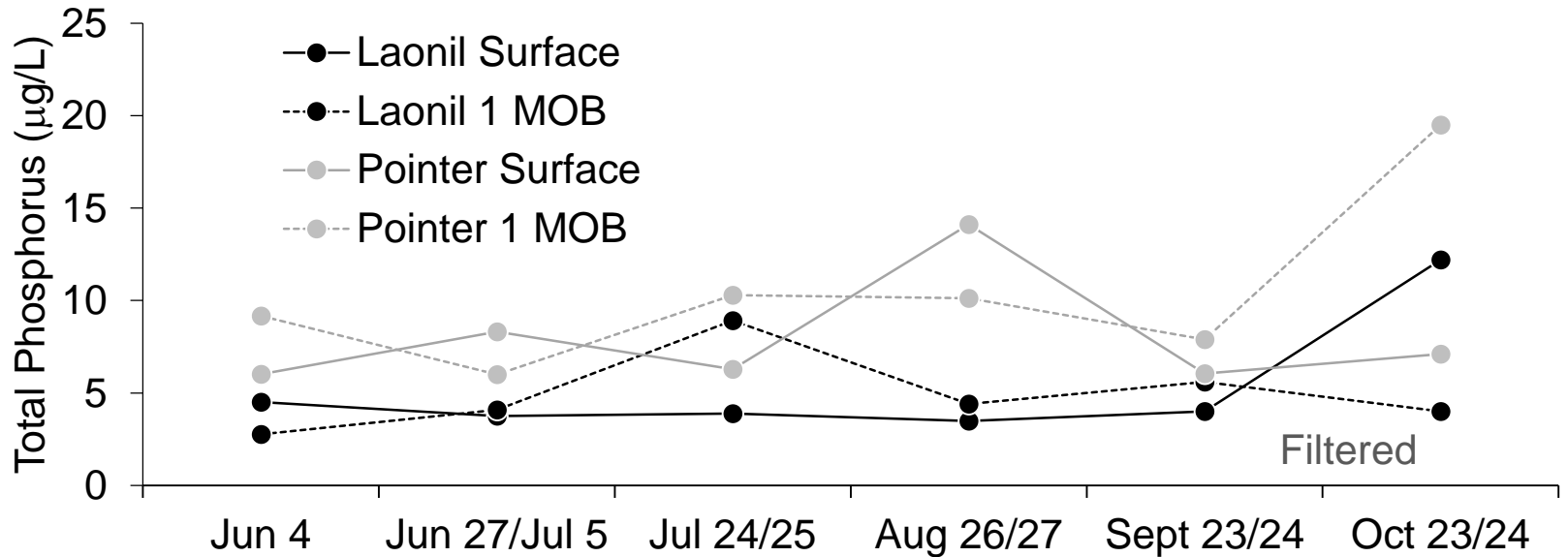
1. Higher concentrations of bioavailable metals in water and sediment in Laonil Lake related to mine effluent discharge; and,
2. Higher concentrations of phosphorus, related to effluent, and releases of sewage from toilets and kitchen in Laonil Lake.

Resulting in Analysis of:

- Water quality monthly, total and dissolved metal measured
- Ultra-low TP measured
- Sediment sampling of Phase 2 & 3 benthos locations
- Nutrients, metals, TOC
- Calculation of $\mu\text{mol M}^{2+}/\text{g OC}$ (USEPA 2005)
 - >3000 high risk
 - 130 to 1300 some risk
 - <130 negligible risk

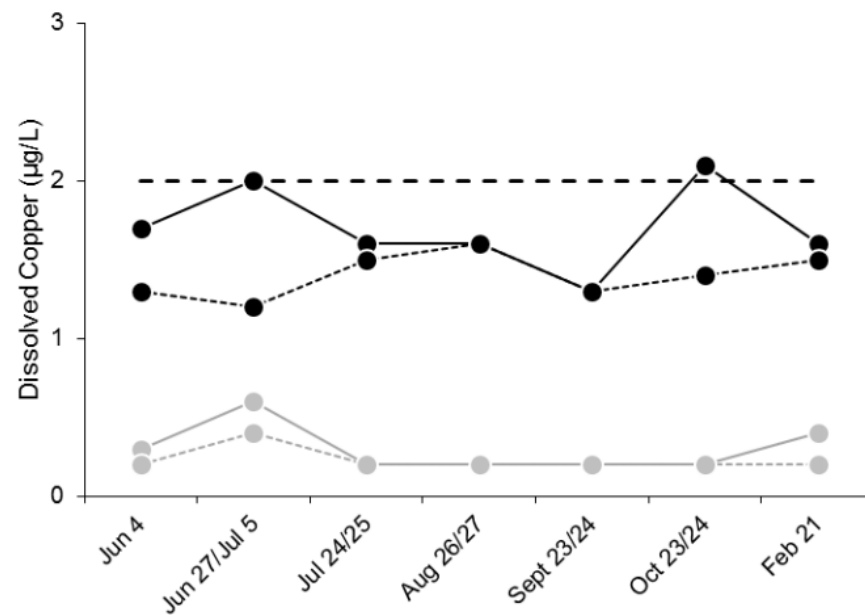
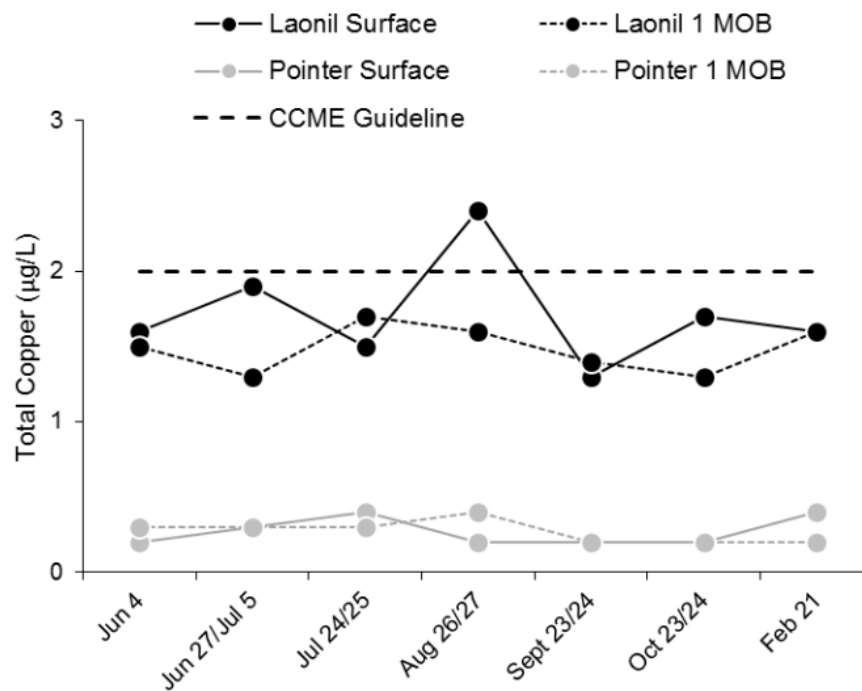
Water Chemistry

Ultra-low Phosphorus



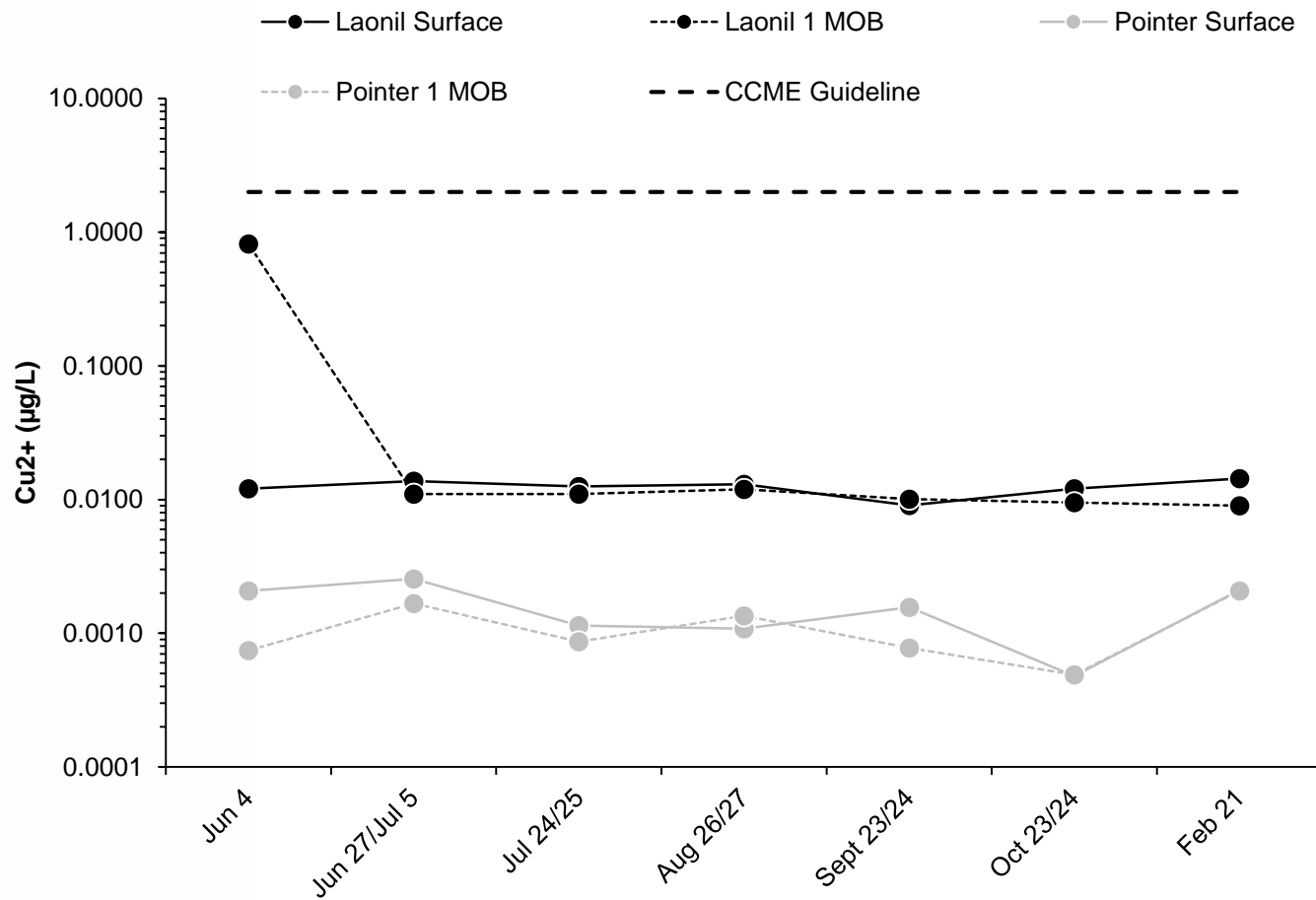
Water Chemistry

Copper – Total and Dissolved



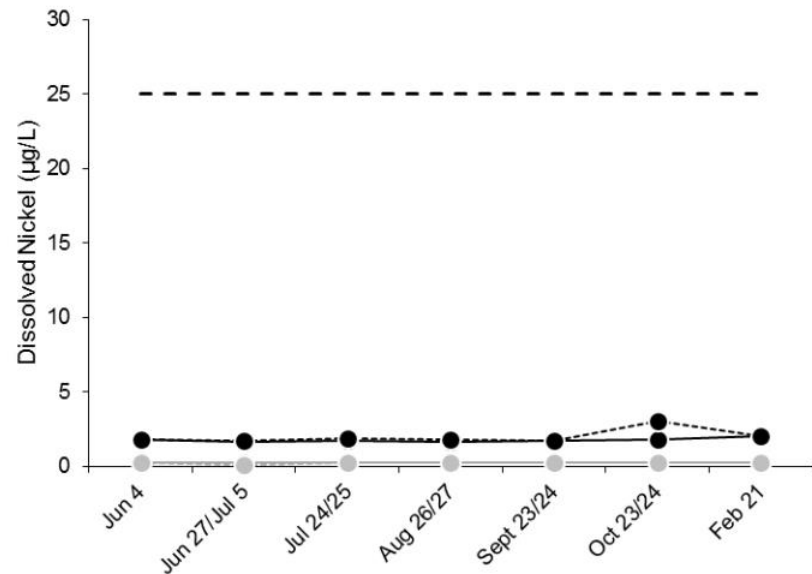
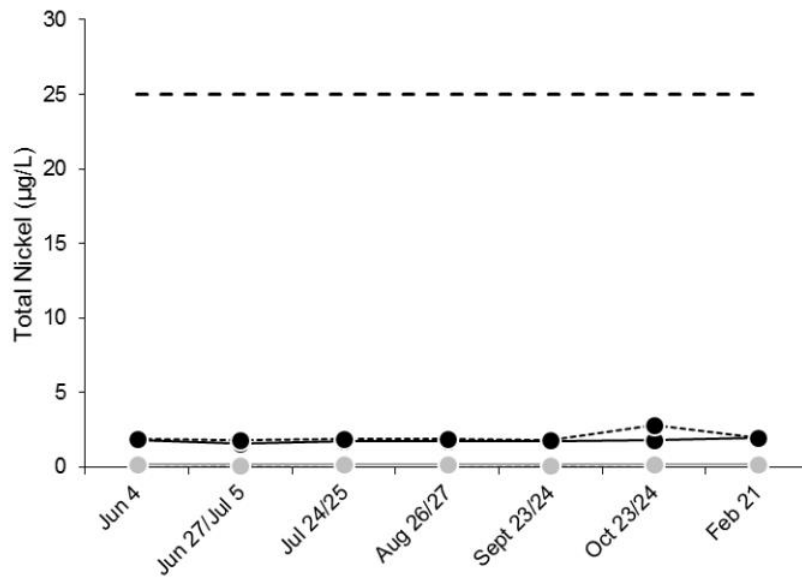
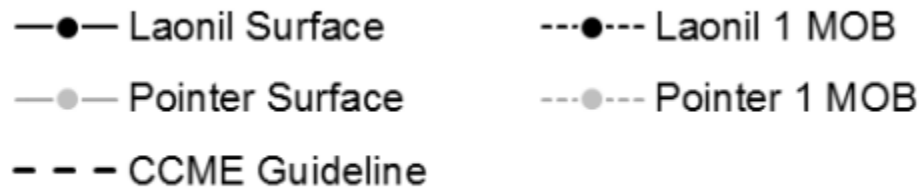
Water Chemistry

Cu²⁺



Water Chemistry

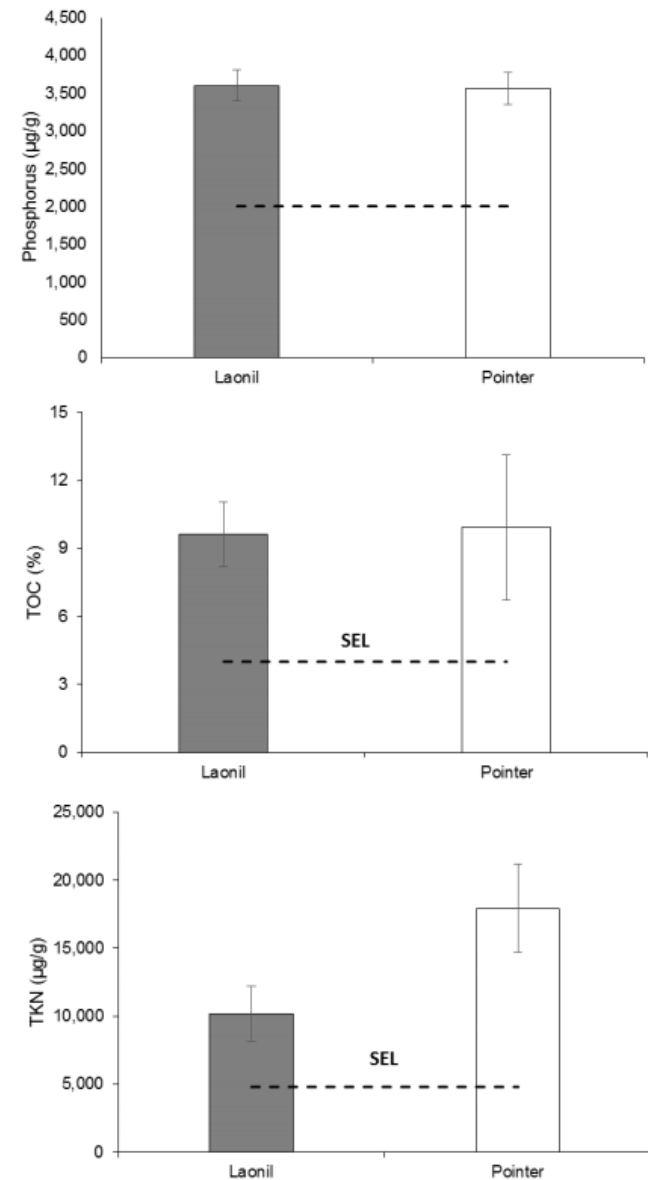
Nickel – Total and Dissolved



Sediment Chemistry

Phosphorus

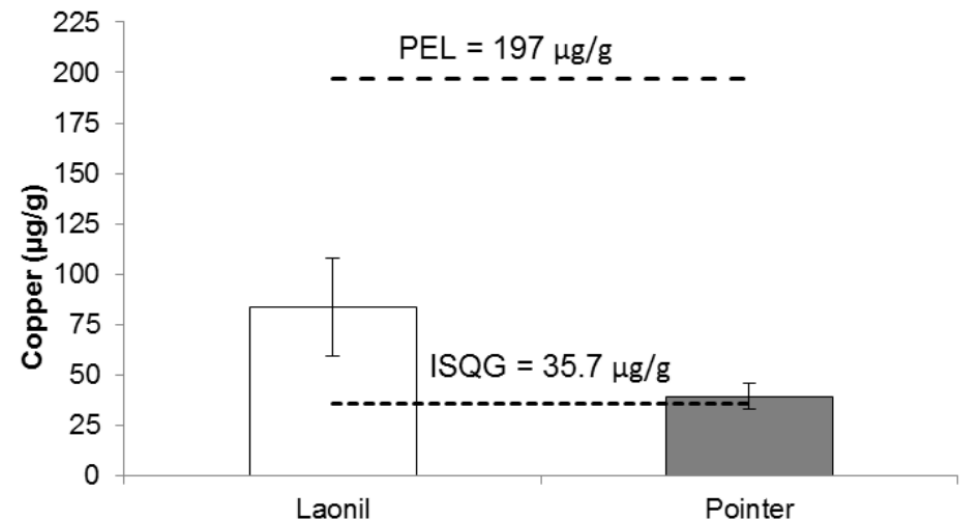
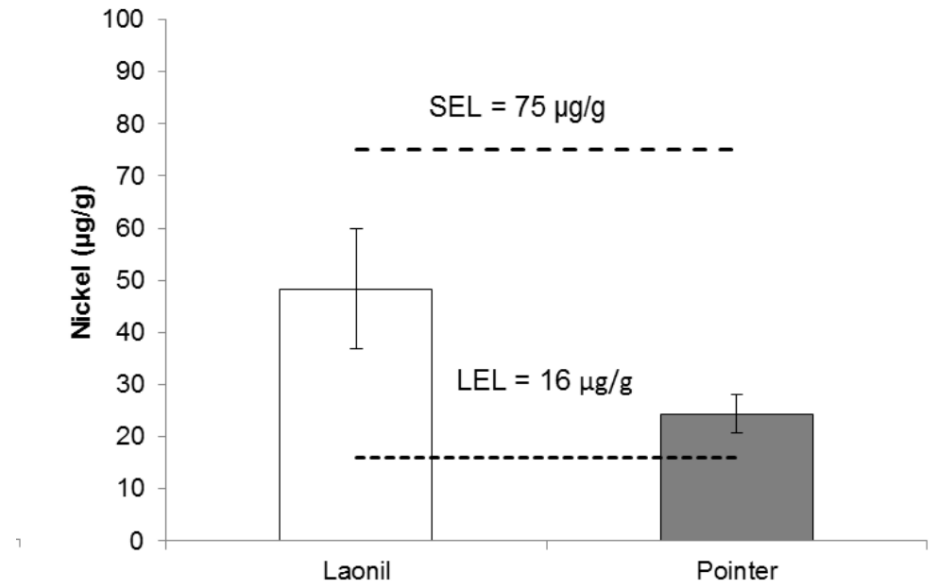
- Phosphorus TOC (%) and TKN in lake sediments
 - Phosphorus and TOC (%) are the same in both lakes with TKN elevated in Pointer
 - No evidence that Laonil Lake sediments are degraded relative to Pointer



Sediment Chemistry

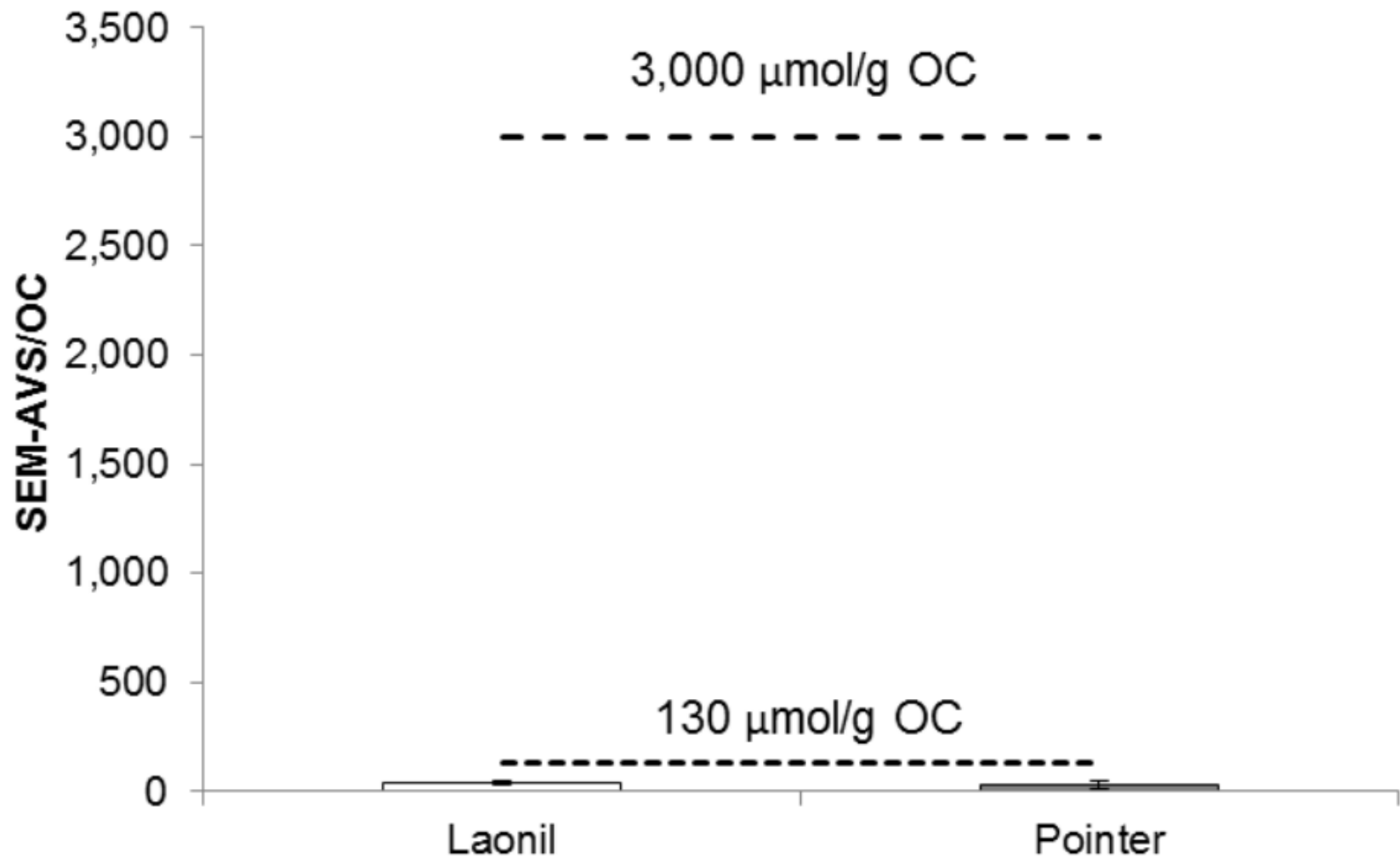
Copper and Nickel

- Sediment concentration data for copper and nickel
 - Elevated levels of Nickel and Copper in Laonil Lake Sediment compared to Pointer lake and compared to LEL limits in sediment



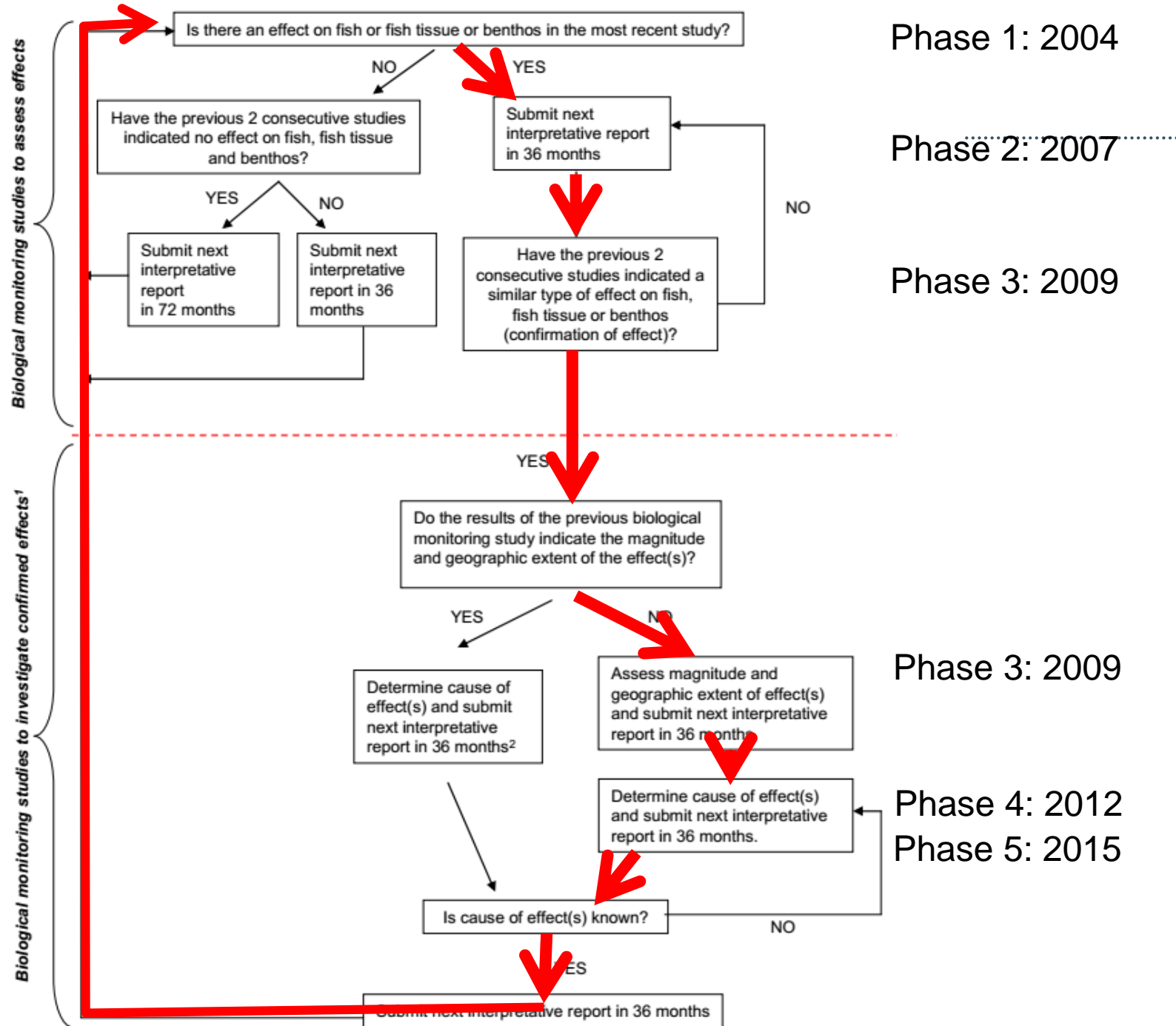
Sediment Chemistry

SEM-AVS/OC



Conclusions

1. Dissolved Cu^{2+} (aq) in water is low
2. Calculated free Cu^{2+} is very low
3. In sediments M^{2+}/OC is very low
4. DO depression in Pointer, but not Laonil Lake
5. Benthic community in Laonil not consistent with a conclusion of degraded water or sediment quality related to metals or nutrients



Questions?

