Aquatic Effects

Monitoring Program

Ekati's Environmental Monitoring and Management Programs
Workshop - November 14th, 2007

Independent Environmental

Monitoring Agency

Presentation Outline

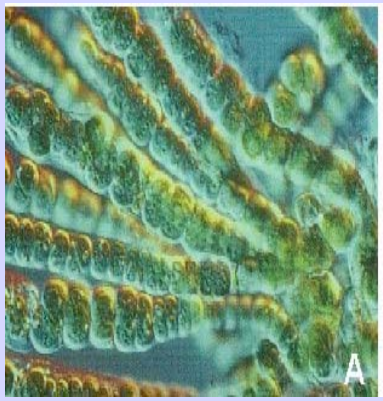
- Background on the Aquatic Effects Monitoring Program (AEMP)
- Findings of the AEMP 2006 field season
- IEMA comments on the findings and monitoring program

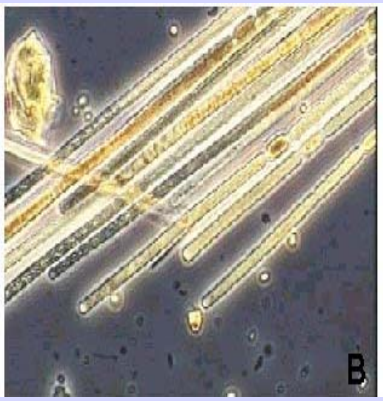
What is the AEMP?

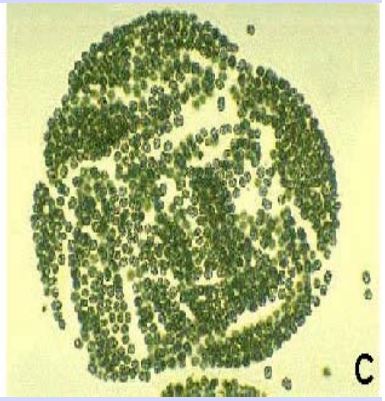
- Monitors water, fish and small plants and bugs to see if they are being affected by the mine
- Annual program
- Information used to determine changes
- 2006 is 9th year of monitoring since mining started
- Focused on downstream effects, not on discharge limits

Outline of Studies

- **Water quality and aquatic life sampled annually**
- **Sediment quality sampled (every 3 years) and fish sampled (every 5 years)**
- **Animal plankton and plant plankton are monitored in August**







- **Winter sampling under ice in lakes in April**
- **more than 16,000 data points**

Where Does BHPB Sample?

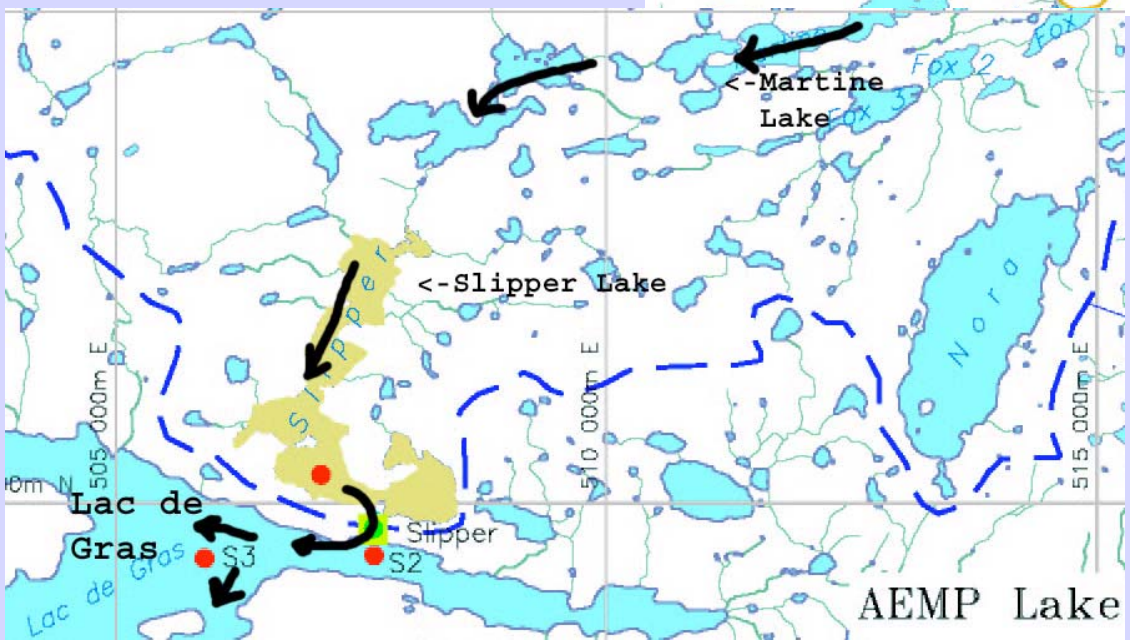
- **Downstream of the main mine and into Lac de Gras**
- **Downstream of the Misery pit and into Lac du Sauvage**
- **At lakes far enough away that they are not affected by the mine (control lakes)**

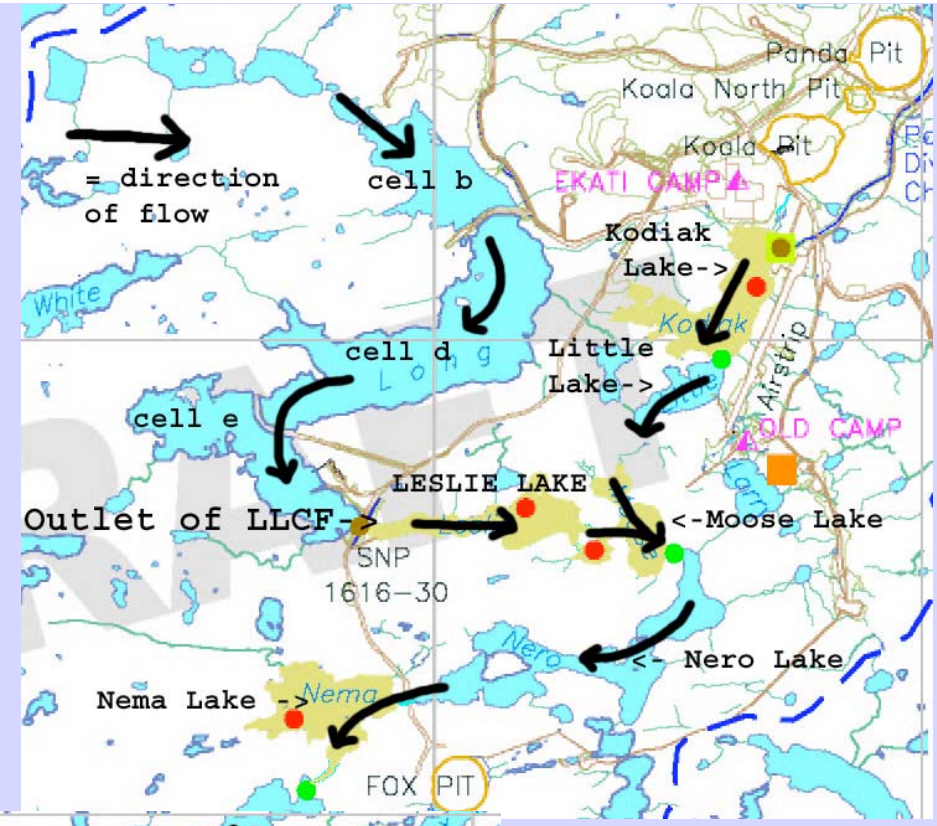
What Watersheds are Monitored by the AEMP?

- Two watersheds are currently monitored
  - The Koala Watershed (the main mine)
  - The King-Cujo Watershed (the Misery mine)
- Baseline studies are done on another watershed - the Horseshoe Watershed (prior to Sable pit mining)

What lakes are immediately downstream of Ekati in the Koala Watershed?

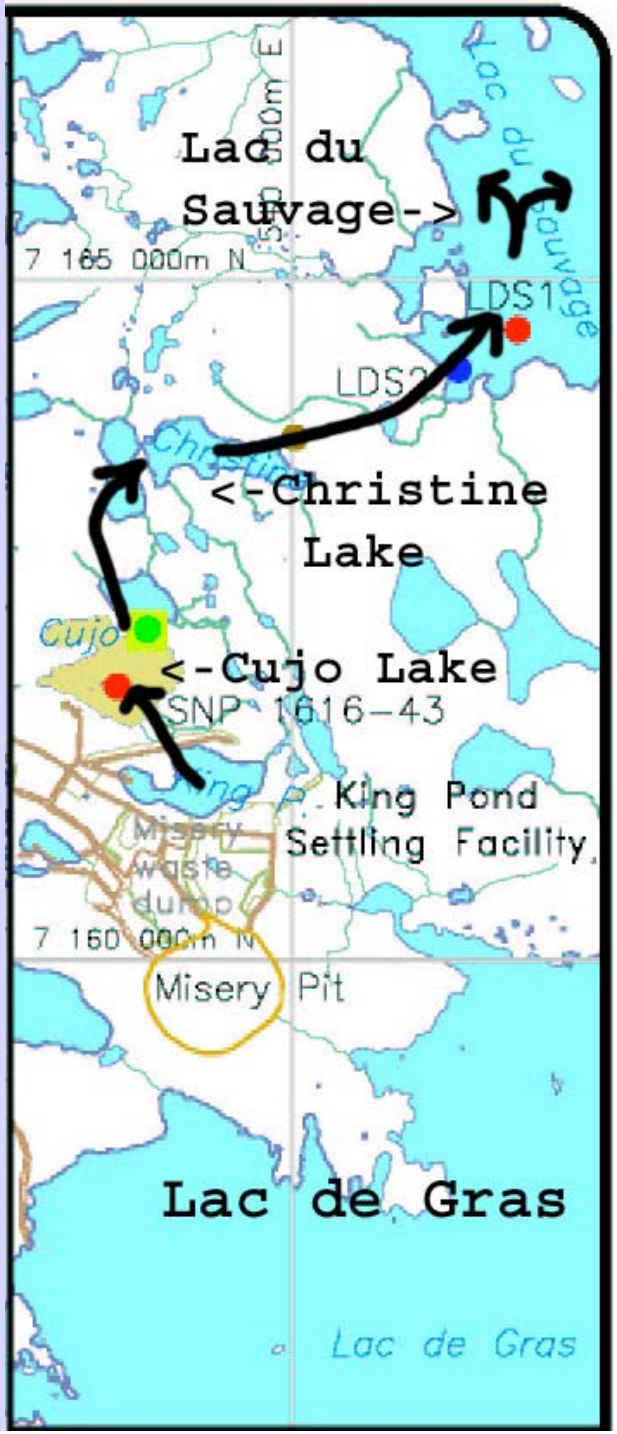
Leslie, Moose, Kodiak, Little, Nero, Nema, Martine, Slipper, Lac de Gras





What lakes are immediately downstream of Misery Pit in the King Cujo Watershed?

King, Cujo, Christine, Lac du Sauvage, Lac de Gras



How clean does water have to be when it leaves Long Lake Containment Facility (LLCF)?

- Water discharged must
  - meet levels outlined in the water licences and
  - not harm aquatic life

Are Those Goals Being Met?

- Contaminant levels are
  - within license limits
  - within CCME guidelines for the protection of aquatic life, except -copper (Kodiak Lake)

    -nitrates (Leslie Lake in winter)

- Molybdenum: at historic rate of increase, expect it will exceed CCME in 2007 (Moose Lake)

How Is Water Quality Changing Downstream of LLCF?

- A variety of nutrients, metals and salt ions in lake water downstream of Ekati increased significantly above pre-mining levels

- Main components of water quality changes

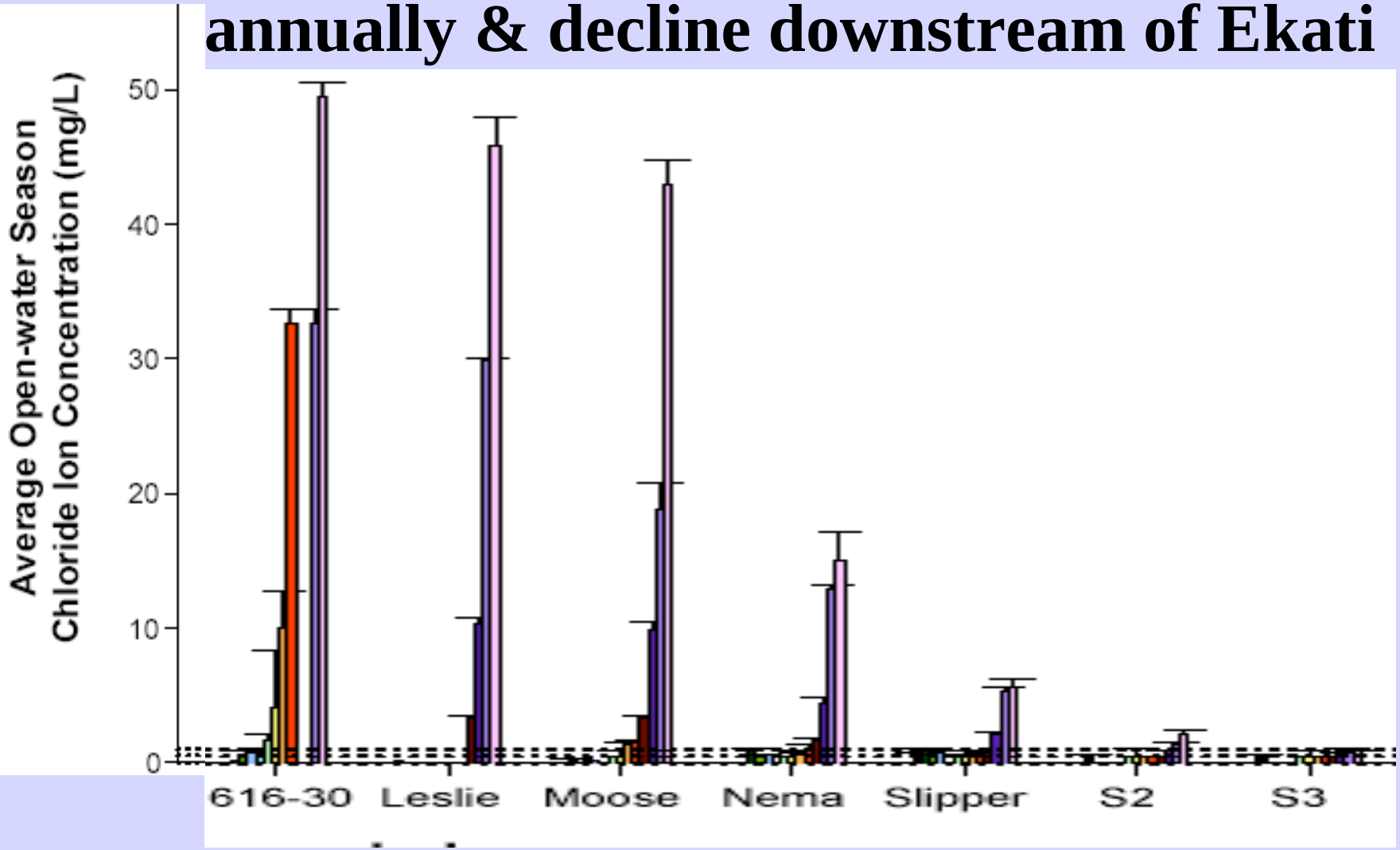
TDS **alkalinity** **barium**

hardness **antimony**

conductivity **nickel**

chloride

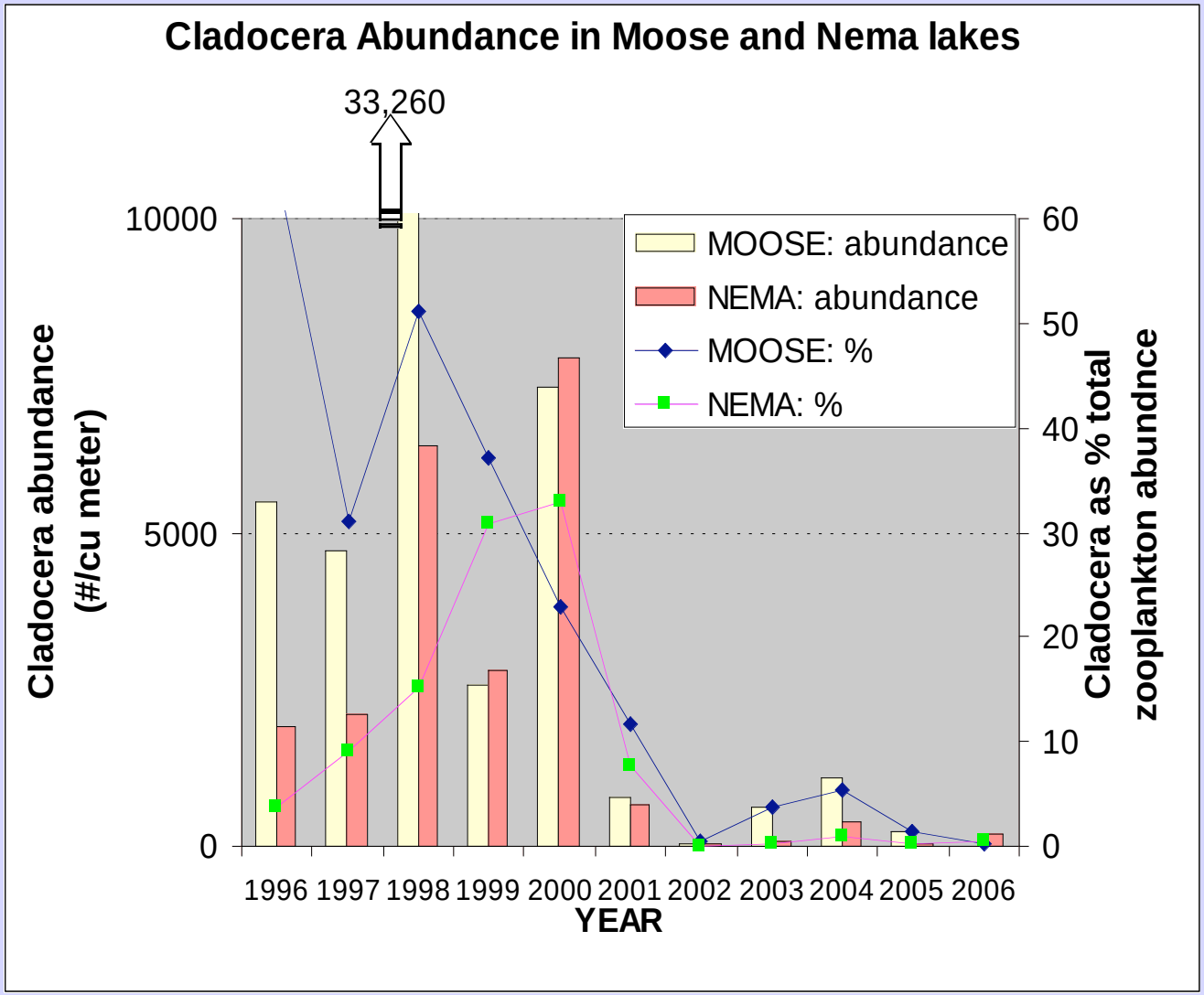
How the levels of a contaminant increase annually & decline downstream of Ekati



Downstream Direction Away from the LLCF →

Zooplankton numbers in Moose & Nema Lake are changing

Cladocera
(*Daphnia)*



Has Lac de Gras been affected by Ekati up to 2006?

- Small water quality changes have been measured in NW arm of Lac de Gras :
  - **pH**
  - **Sulphate**
  - **Potassium**
  - **Total Dissolved Solids**
  - **Chloride**
  - **Arsenic**
  - **Molybdenum**

BHPB Commitments for 2007

- Replicates or Subsamples?: determine within-lake variability of water quality variables by sampling from >1 location

  Is water from one location representative of water in the whole lake?

- Statistical Effect Size: determine the amount of change in impacted lake water that all parties will accept.

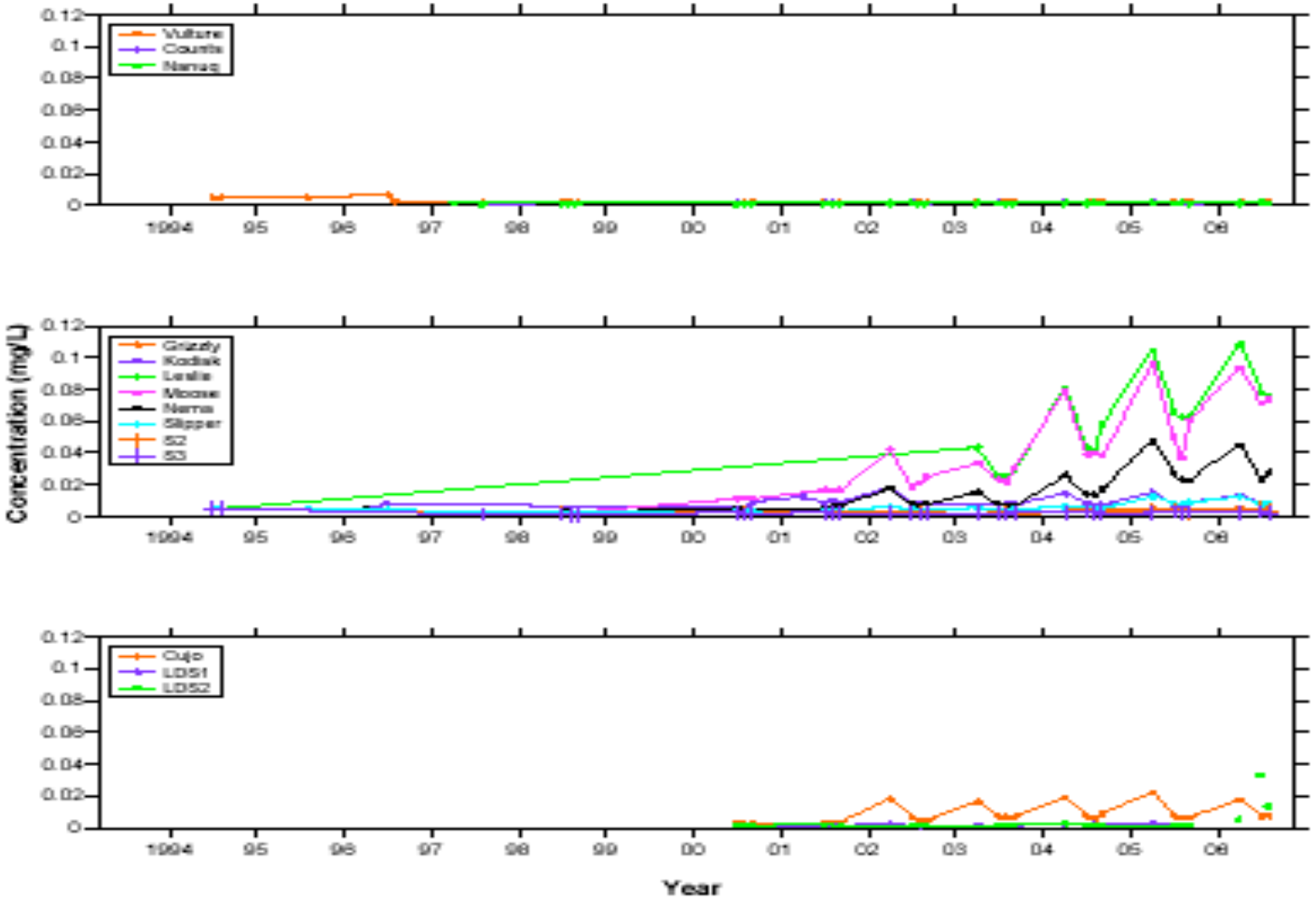
BHPB Commitments for 2007

- Fish Studies: - overall health

  Using: Condition Factors
  DELT
  Toxicology

  - diet

  Using: Stomach contents



Historical Barium Concentrations at AEMP Lake Sites, 1994-2006

FIGURE 6

Agency Assessment

- Concerns:
  - Increasing trends in TDS, chloride, nitrates, copper & molybdenum
  - long-term health of zooplankton community in lakes downstream of LLCF
- Welcome addition to analysis:
  - Multivariate analysis investigating links between water quality changes and biological changes
- Welcome addition to reporting:
  - Graphs of historical trends in every one of 48 measured water quality variables