An Ecological Evaluation of the Effects from Fidelity's MPDES Discharges to Aquatic Life in the Tongue River

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BACKGROUND

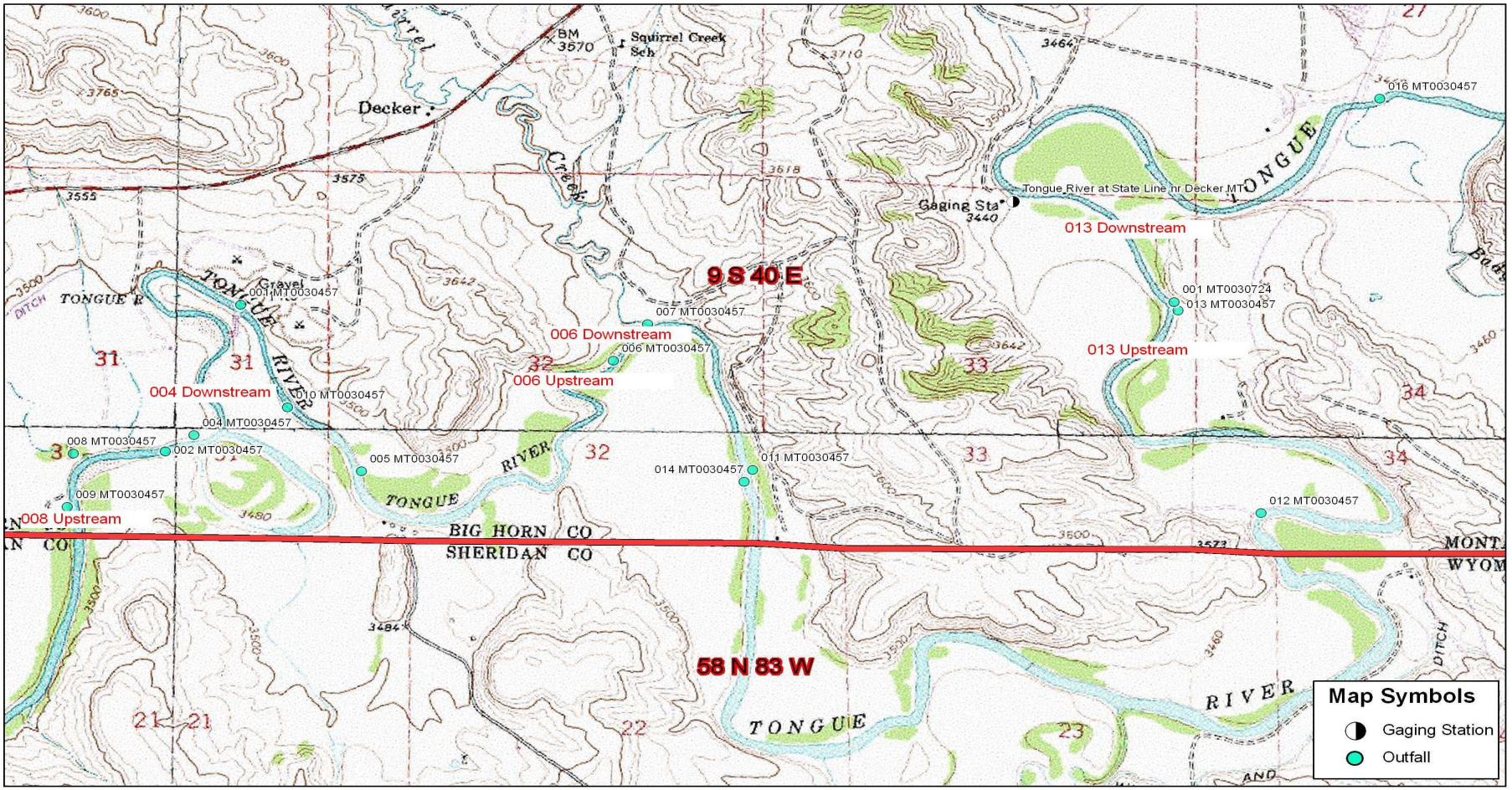
- Fidelity Exploration & Production Company Discharges Untreated CBNG Water to the Tongue River.
- Fathead Minnows Pass Acute Whole Effluent Toxicity (WET) Limits (LC_{50} >100%), in MPDES Permits.
- *Ceriodaphnia dubia* (Water Fleas) Often Fail WET Limits.
- When There Is Significant Mortality to *C. Dubia*, 48-h LC_{50}s Are Typically $\geq$85% Produced Water And Often $\geq$95% PW.
- Do these Discharges Cause Significant Adverse Effects to Aquatic Life in the Tongue River?

WE EVALUATED 5 LINES OF EVIDENCE

- CBNG Water Toxicity to *C. dubia*, *Daphnia magna a*nd Fathead Minnows,
- Zone of Initial Dilution (ZID) Toxicity to *C. dubia* and *D. magna*,
- Benthic Macroinvertebrate Community Composition,
- Periphyton Community Composition, and
- River Water Quality.

UPSTREAM VS. DOWNSTREAM APPROACH

- Sampled Six Sites Upstream And Downstream Of Three Fidelity Discharges.
- August and September, 2008.


Decker
Squirrel Creek Sch
BM 3570
Gaging Sta
Tongue River at State Line nr Decker MT
016 MT0030457
013 Downstream
001 MT0030724
013 MT0030457
013 Upstream
9 S 40 E
007 MT0030457
006 Downstream
006 MT0030457
006 Upstream
001 MT0030457
Gravel
004 Downstream
010 MT0030457
004 MT0030457
008 MT0030457
002 MT0030457
005 MT0030457
014 MT0030457
011 MT0030457
009 MT0030457
008 Upstream
012 MT0030457
BIG HORN CO
SHERIDAN CO
58 N 83 W
TONGUE RIVER
TONGUE
DITCH
Map Symbols
Gaging Station
Outfall

METHODS

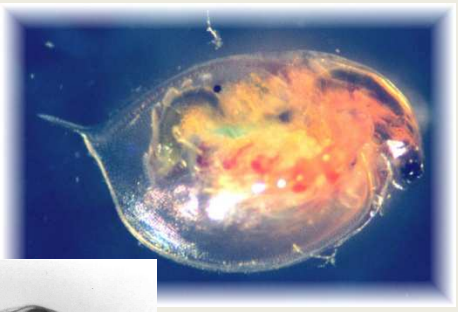
- Acute, 48-hr WET tests
  - *C. dubia*, *Daphnia magna a*nd Fathead Minnows
- Acute, 48-hr ZID Toxicity Tests
  - Sampled ZID as Close as Possible to Outfall
  - *C. dubia* and *D. magna*
  - All toxicity tests followed EPA test methods (EPA-821-R-02-012)
- Benthic Macroinvertebrates
  - MDEQ (2006)
  - Hess Sampler: 0.5 m^2 Riffle Substrate
  - Calculated Species Composition, Density (#/m^2), Plains Multi-Metric Index (MMI)

METHODS

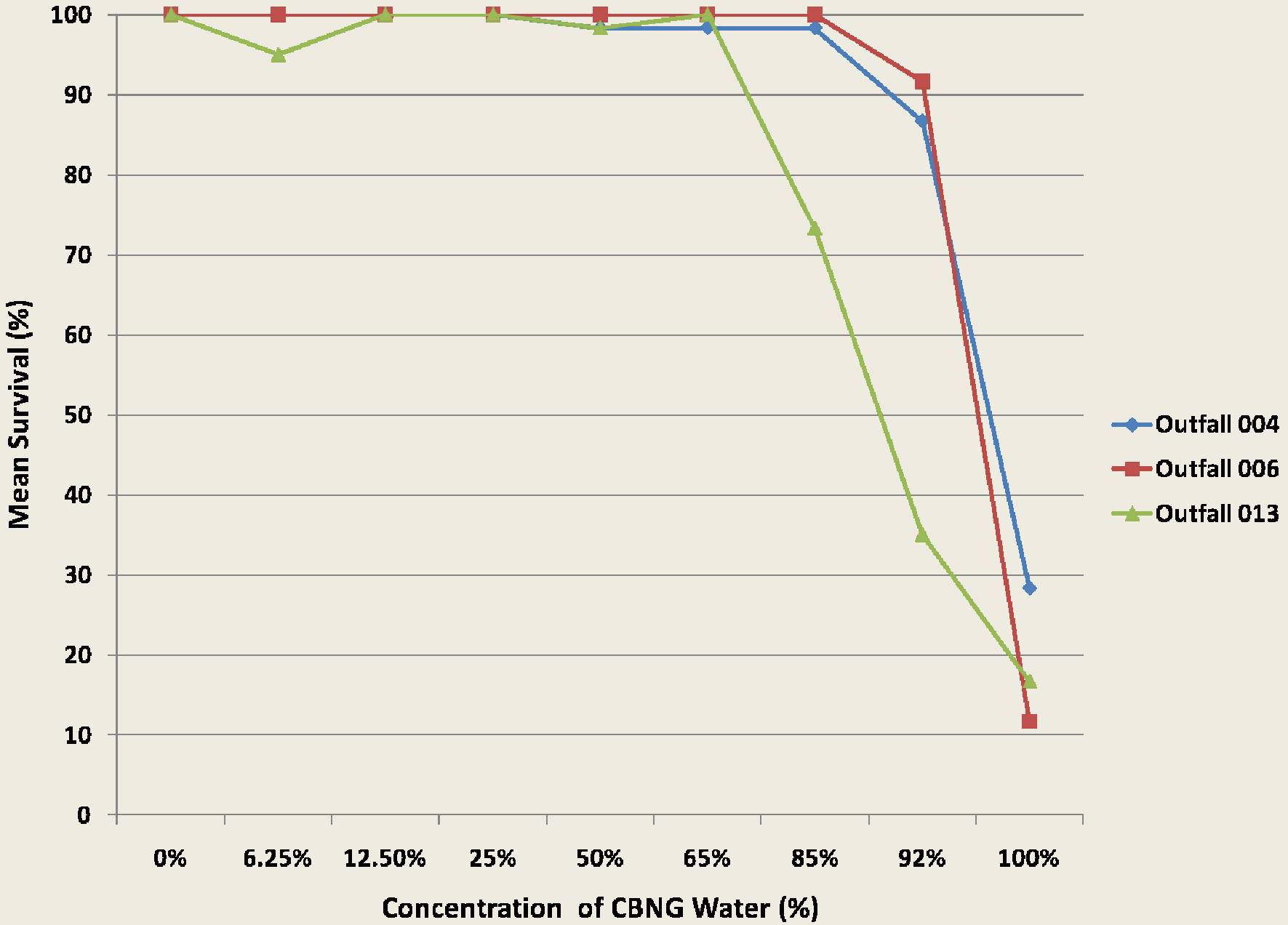
- Periphyton (Benthic Algae)
  - MDEQ (1999), Section 12.1.2
  - Species Composition, Chlorophyll *a* and Biomass (Ash Free Dry Weight)
- Water Quality
  - Conductivity, Temperature, pH, Dissolved Oxygen, Turbidity, Anions, Cations
- Aquatic Habitat
  - Depth, Velocity, Riffle Embeddedness, Riffle Pebble Count, Riffle Habitat Score, Canopy Density

RESULTS AND DISCUSSION: TOXICITY TESTS

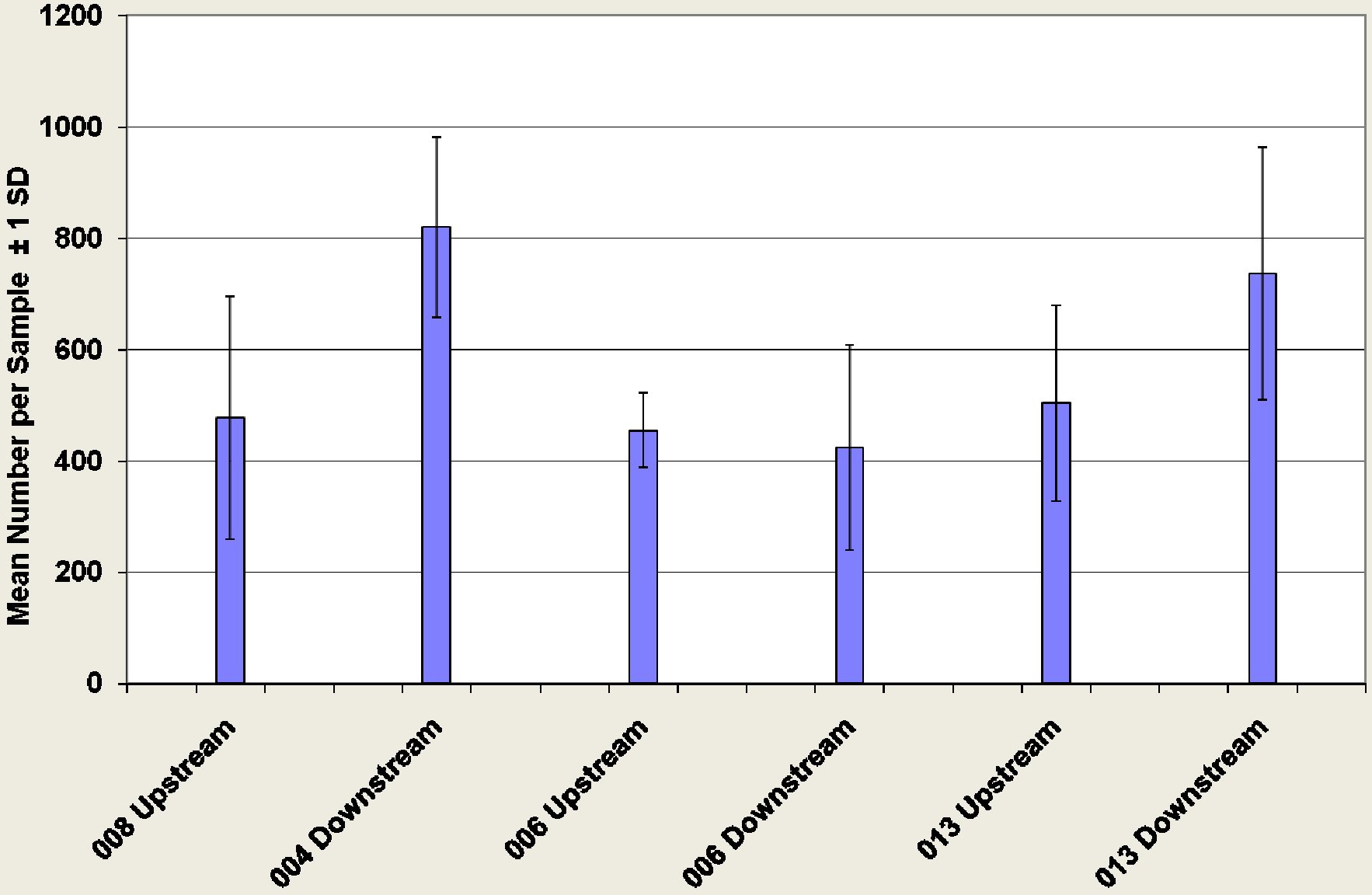
- Survival in 100% CBNG Water
  - *D. magna*: 90-100%
  - Fathead minnows: 100%
  - *C. dubia*: 0-20%
- Survival in 100% ZID Water
  - *D. magna*: 95-100%
  - *C. dubia*: 95-100%

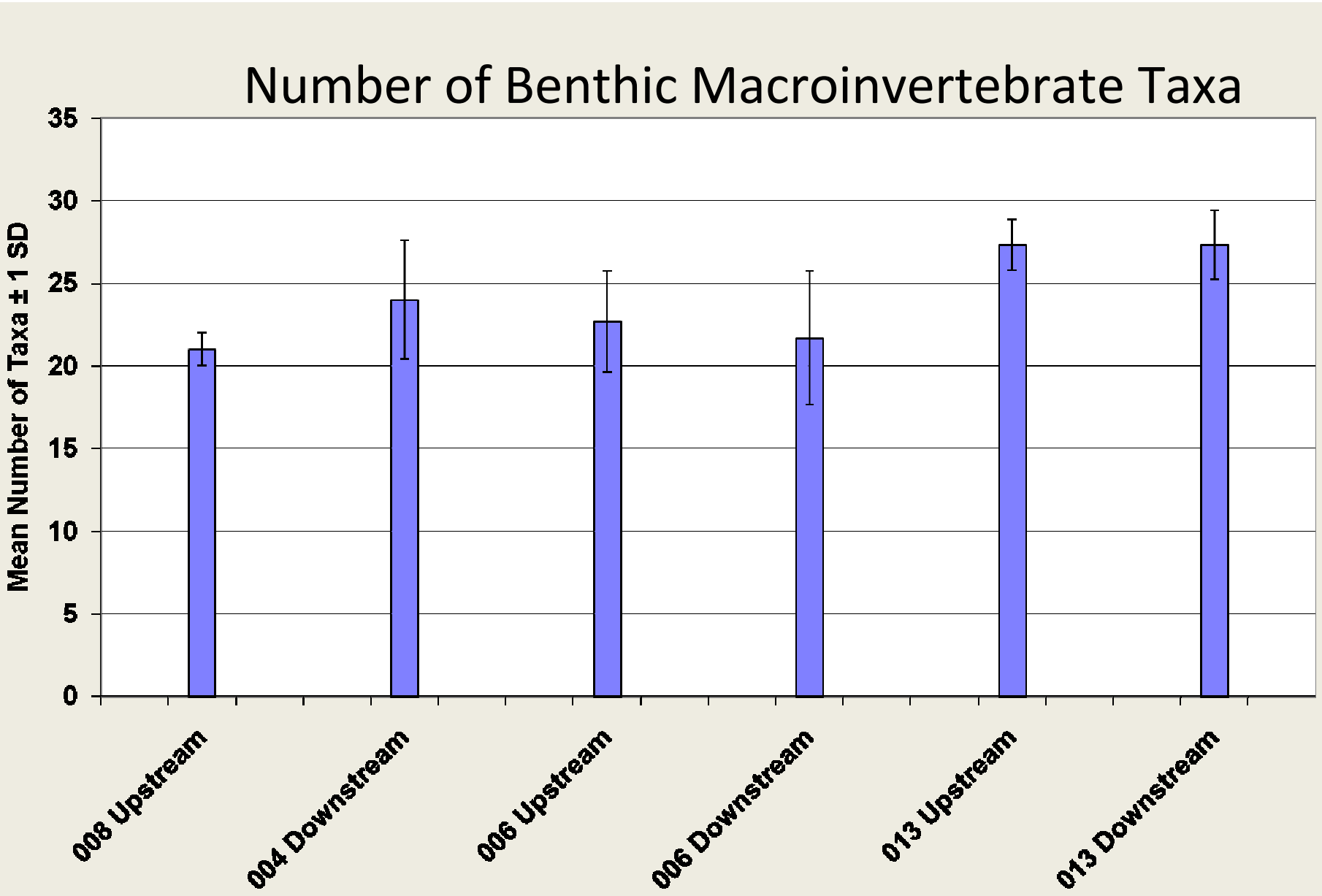


C. dubia Survival in CBNG Water

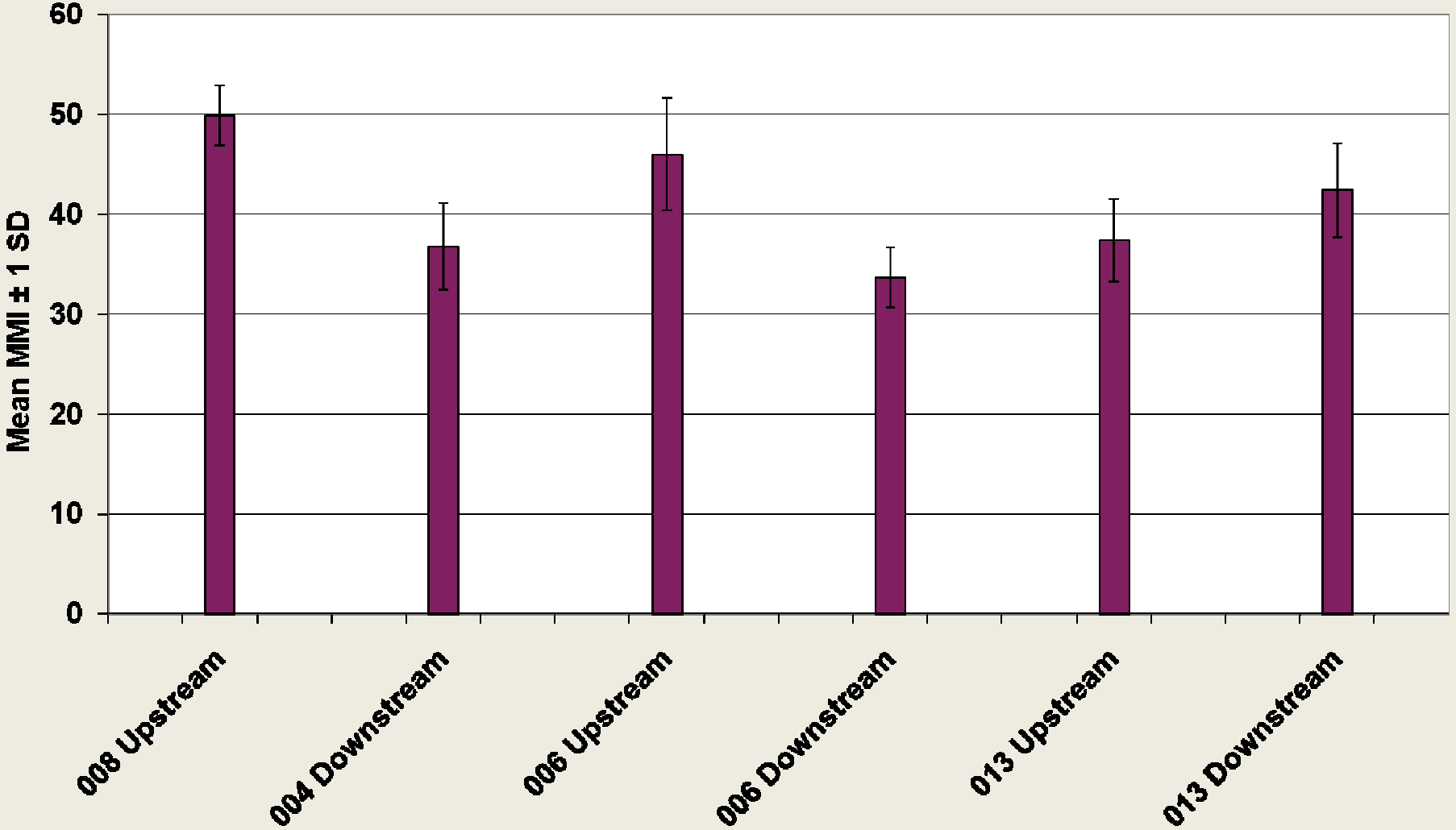


Benthic Macroinvertebrate Density

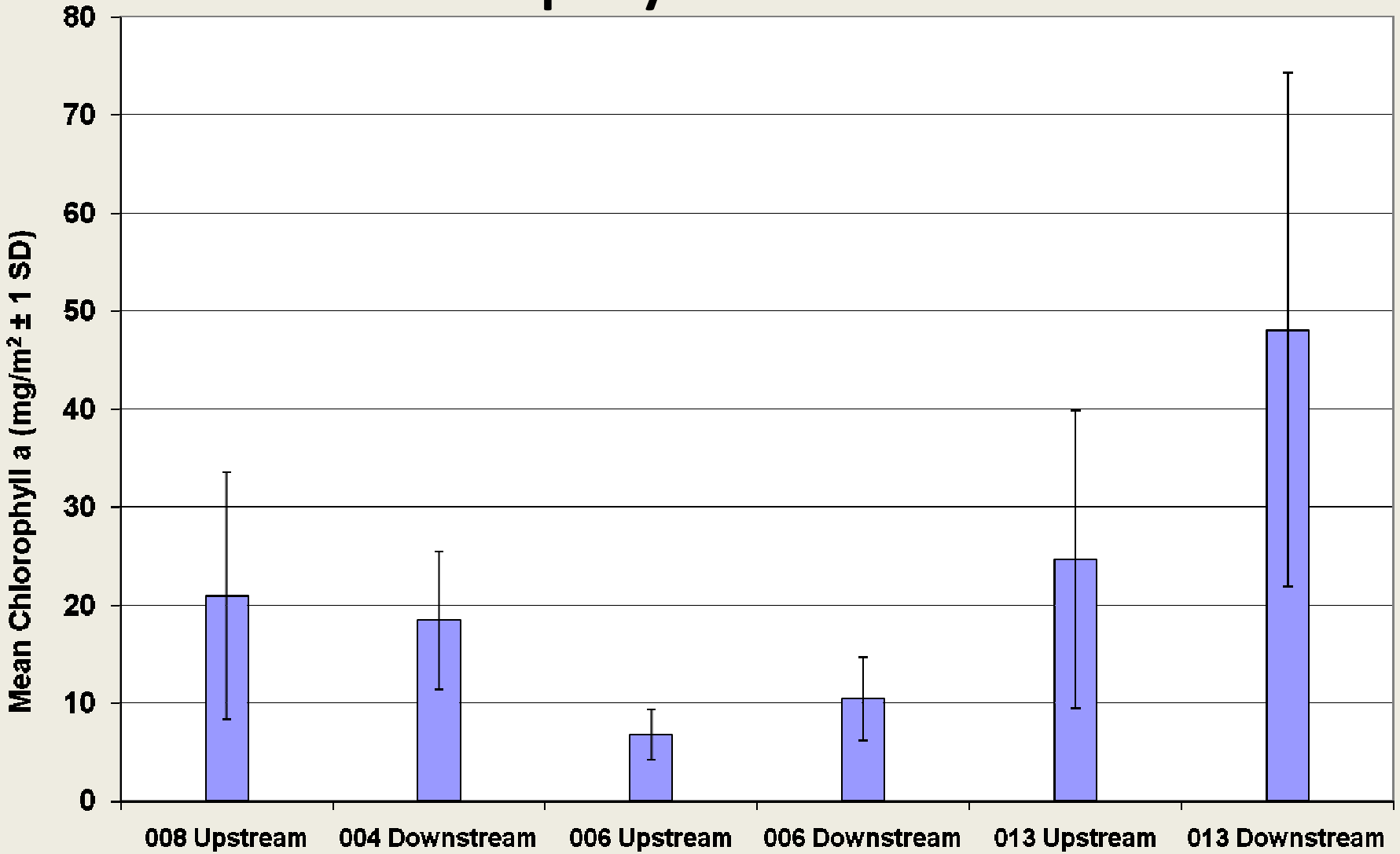



Number of Benthic Macroinvertebrate Taxa
Mean Number of Taxa ± 1 SD
35
30
25
20
15
10
5
0
008 Upstream
004 Downstream
006 Upstream
006 Downstream
013 Upstream
013 Downstream

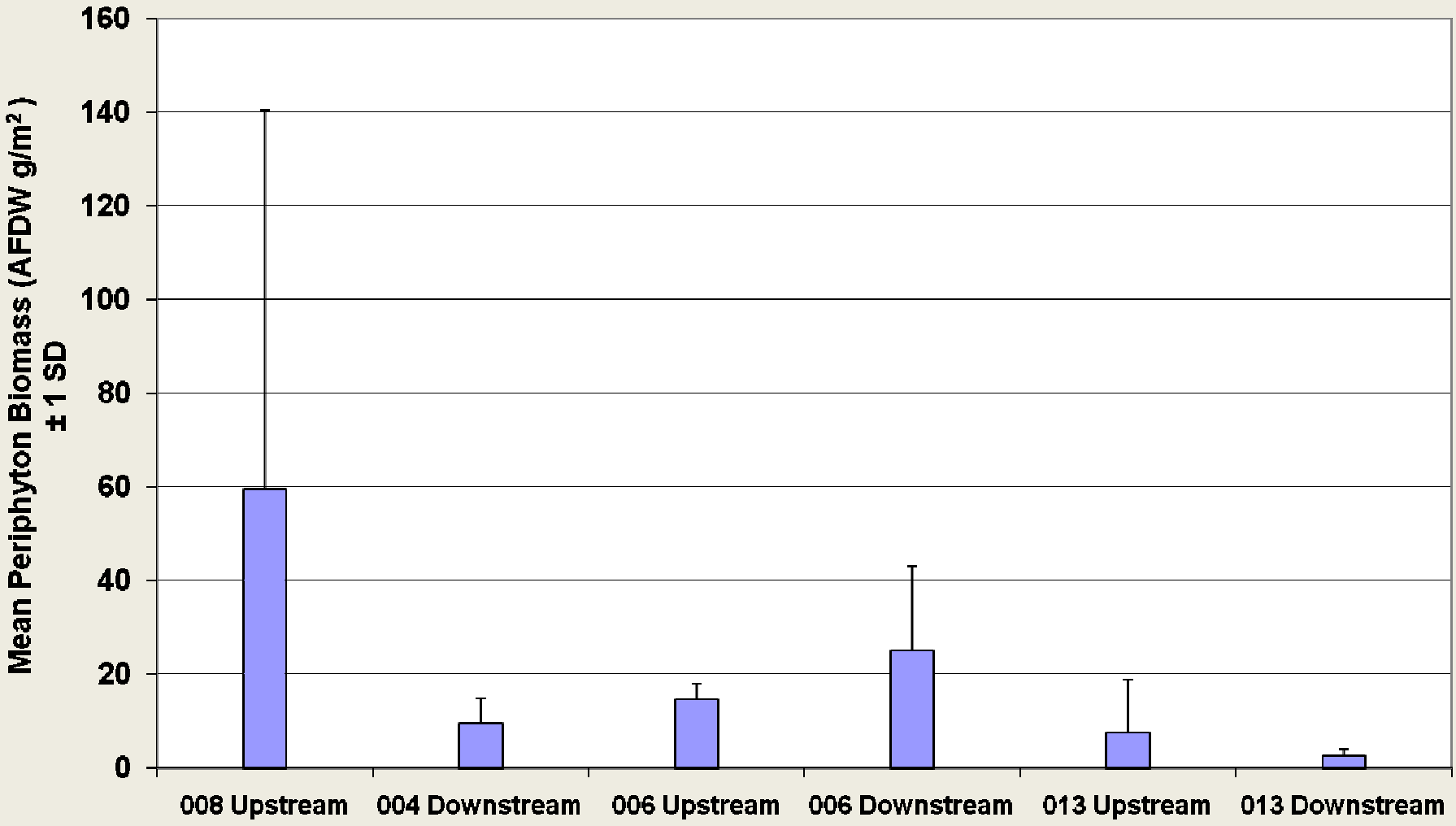
Benthic Macroinvertebrate MMI



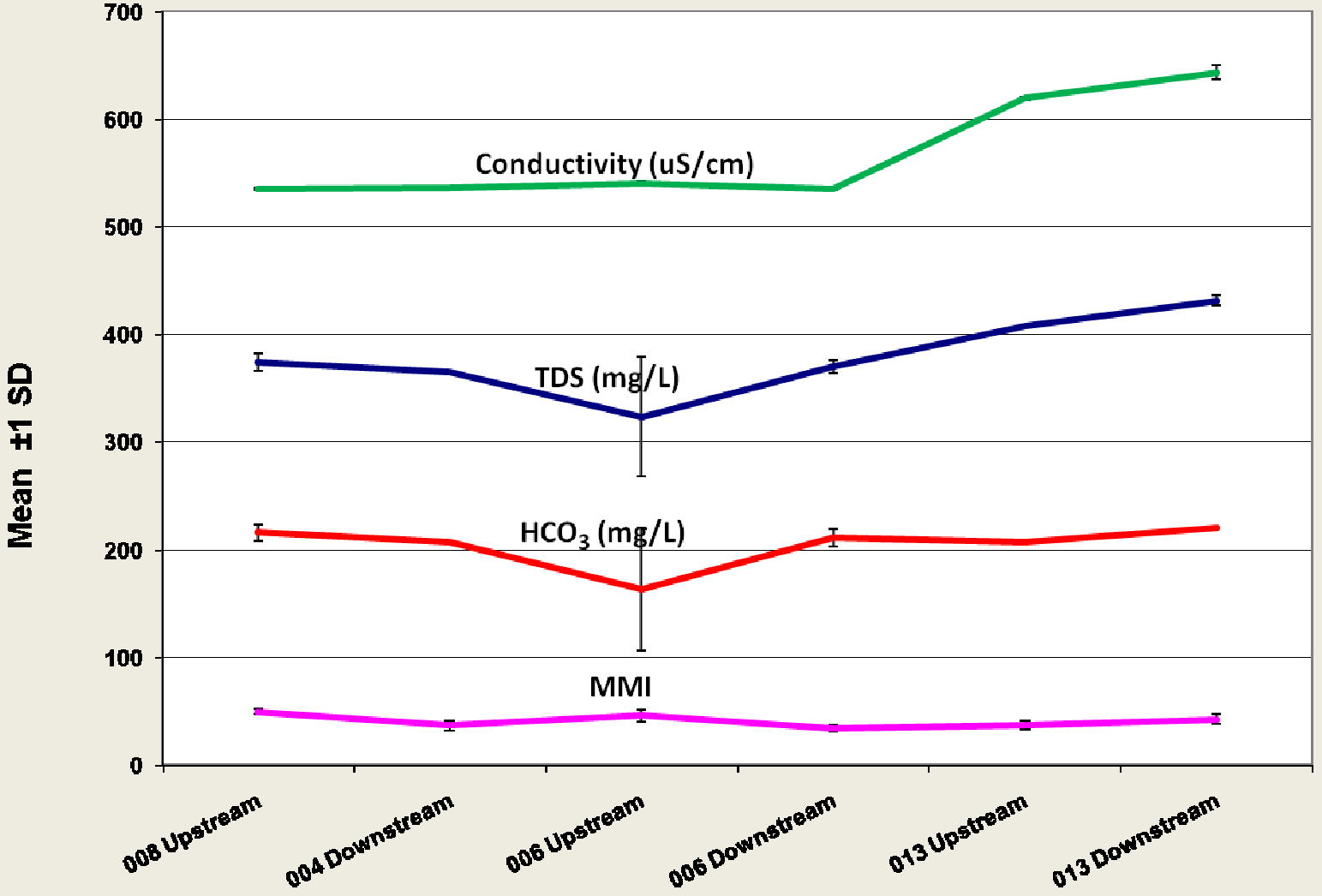
Periphyton Chl *a*

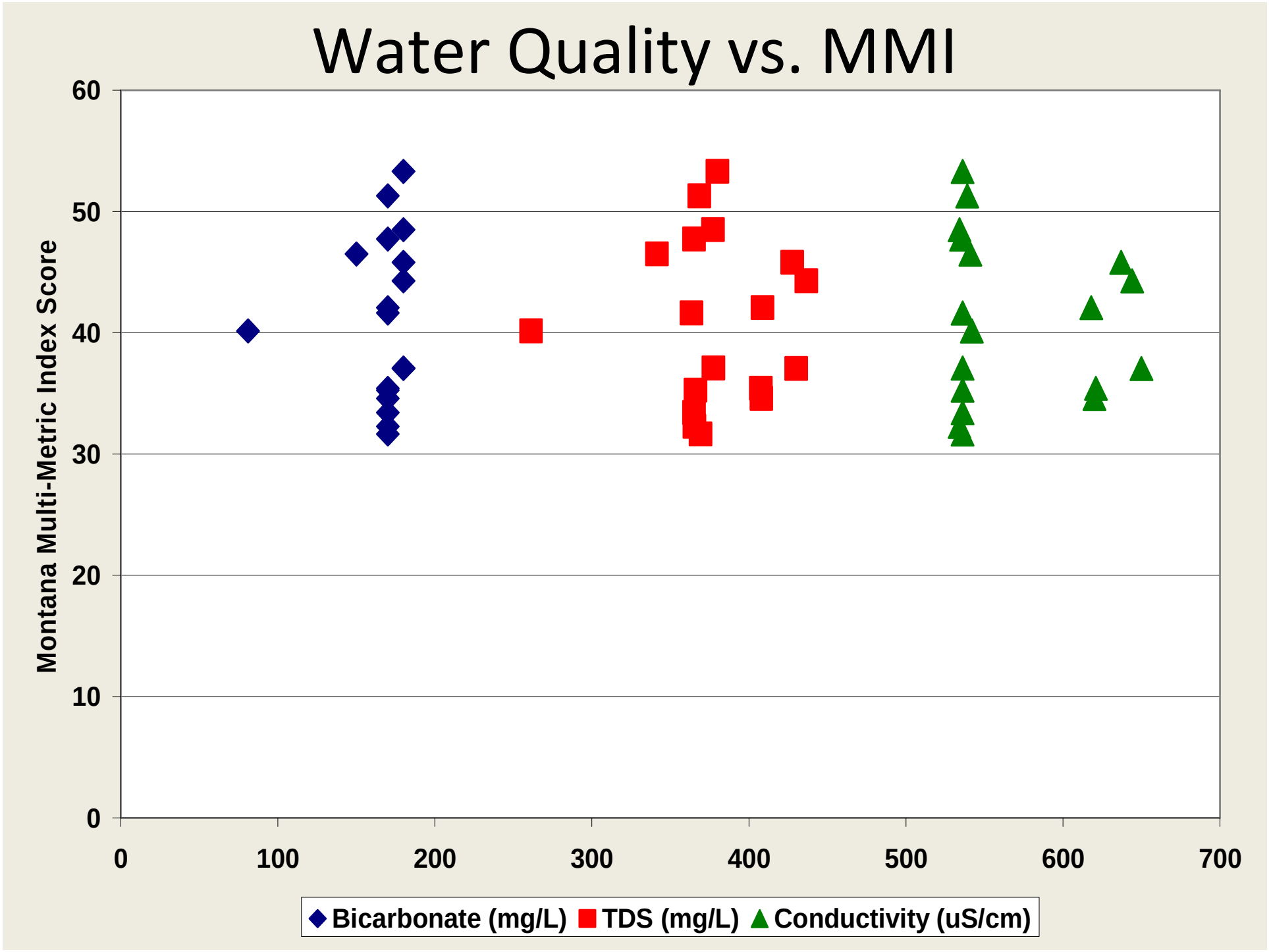


Periphyton Biomass



Water Quality vs. MMI




Water Quality vs. MMI
Montana Multi-Metric Index Score
60
50
40
30
20
10
0
0
100
200
300
400
500
600
700
Bicarbonate (mg/L)
TDS (mg/L)
Conductivity (uS/cm)

CONCLUSIONS

- Toxicity of CBNG Water:
    - Only Acutely Toxic to *C. dubia*.
    - Only Toxic at ≥85% Effluent.
- ZID Toxicity: None.
- Benthic Macroinvertebrates: No effects Observed.
- Periphyton: No Effects Observed.
- River Water Quality: No Negative Relationships Between MMI & HCO_3, TDS or Conductivity.

CONCLUSIONS

- No Adverse Effects to the Benthic Macroinvertebrate and Periphyton Communities in the Tongue River.
- Acute *C. dubia* WET Test Is Not a Good Indicator of Potential Risk to Aquatic Life in the Tongue River.
- *D. magna* Would Be a Better Invertebrate WET Test Species for CBNG Waters, Since It Is Less Sensitive to TDS Than *C. Dubia,* But Would Still Indicate Toxicity from Other Potential Chemical Stressors.