



2004

Water Quality Results from Togus Pond

Colby College

Problems in Environmental Science course (Biology 493), Colby College

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Water Quality Results from Togus Pond

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Historical Water Quality

- Monitoring since 1976-(VLMP)
- Water quality is below average
- Potential for algal blooms high
- Severe algal bloom in 1999
- Secchi disk transparency is lowest since 1978
- Water quality fluctuates (some years above state average, some below)

Past Data

- Color = average 16 SPU (27 from '77-'03)
- SDT = 4.7 meters
- TP = 11-22 ppb (average 16 ppb)
- Chlorophyll-a = 1.8-34.5 ppb (average 7 ppb)
- DO = depletion at depth
- Internal P loading possibility = high

Lake profile: Temperature

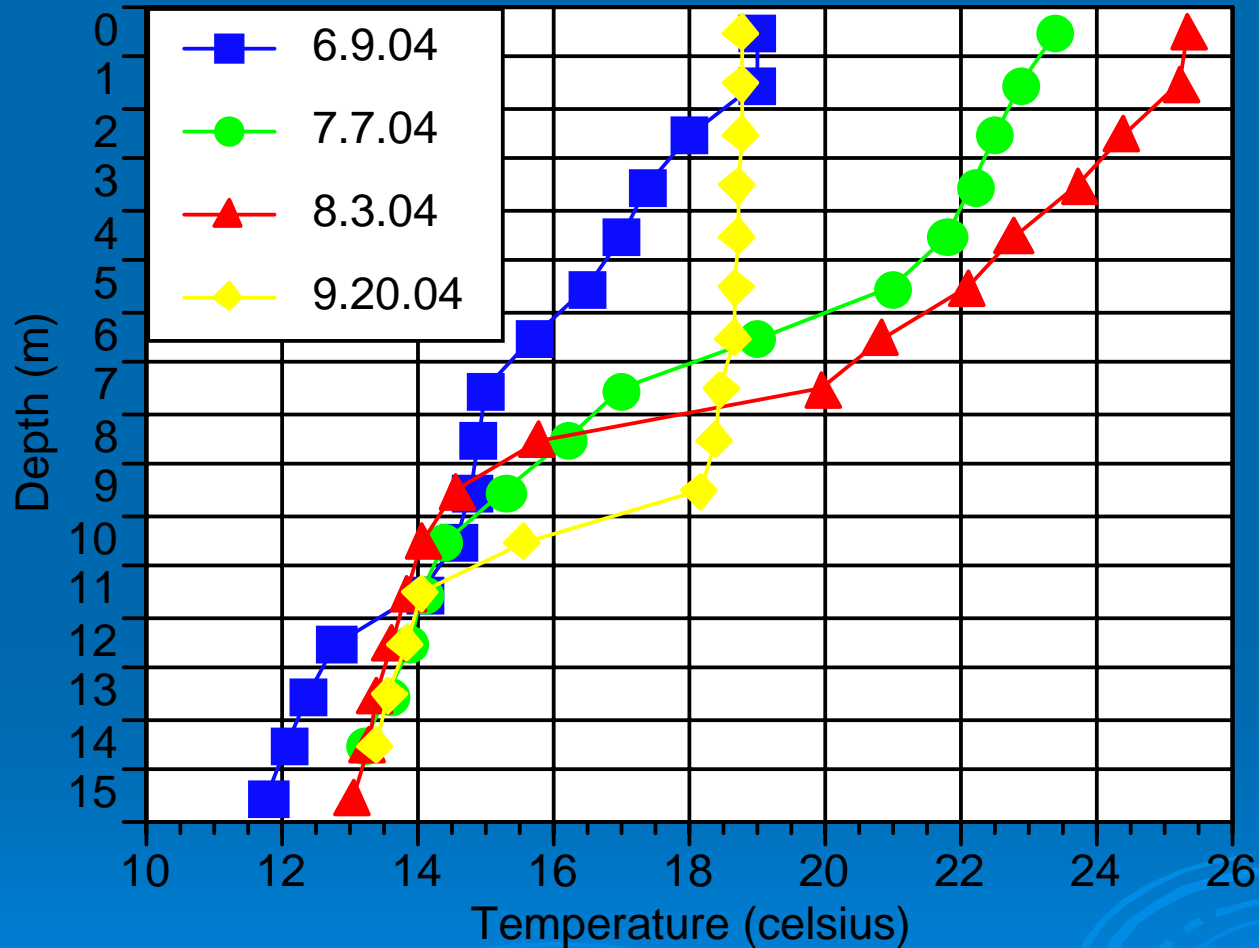


Figure A. Summer temperature vs. depth

Dissolved Oxygen

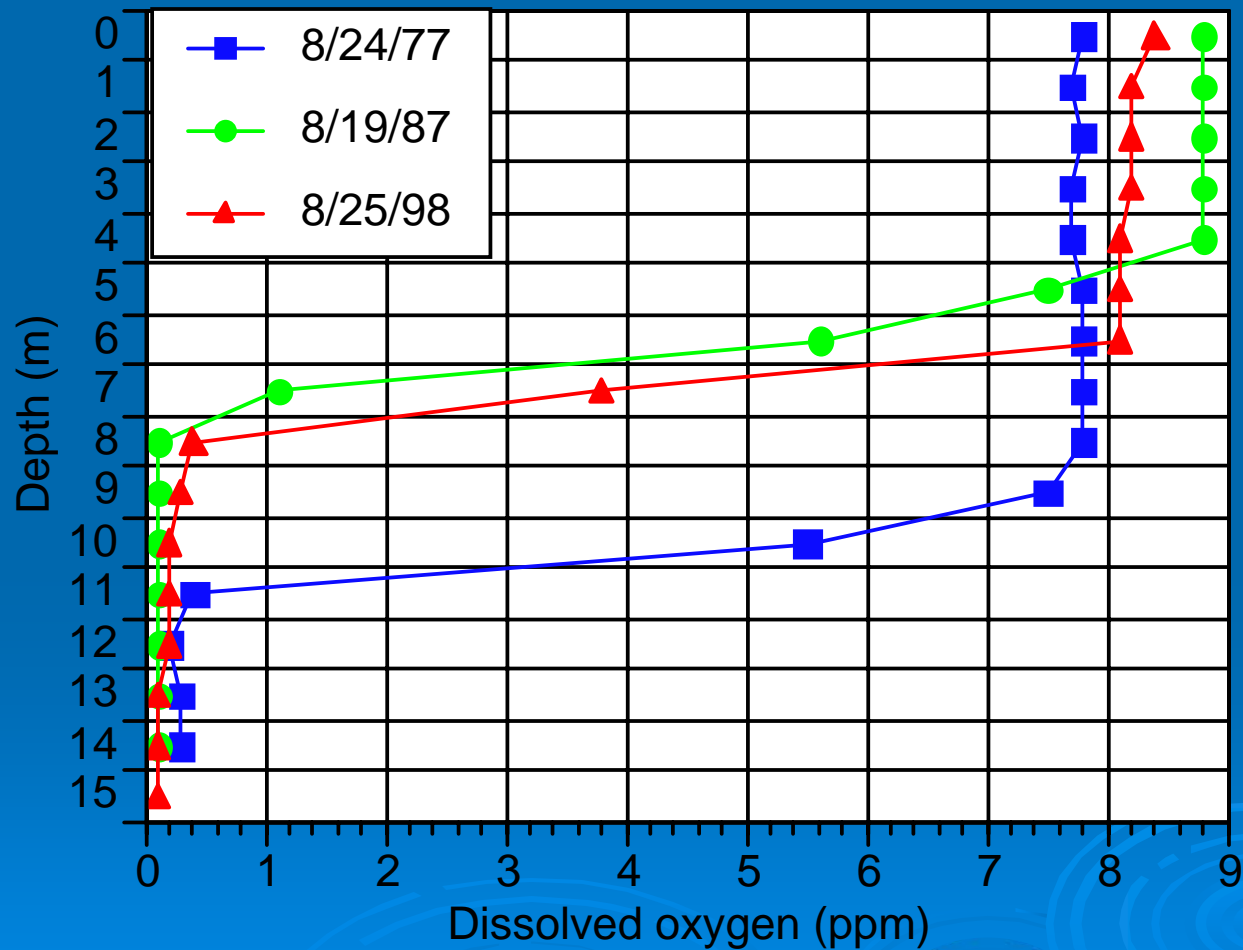


Figure B. Historical DO vs. Depth

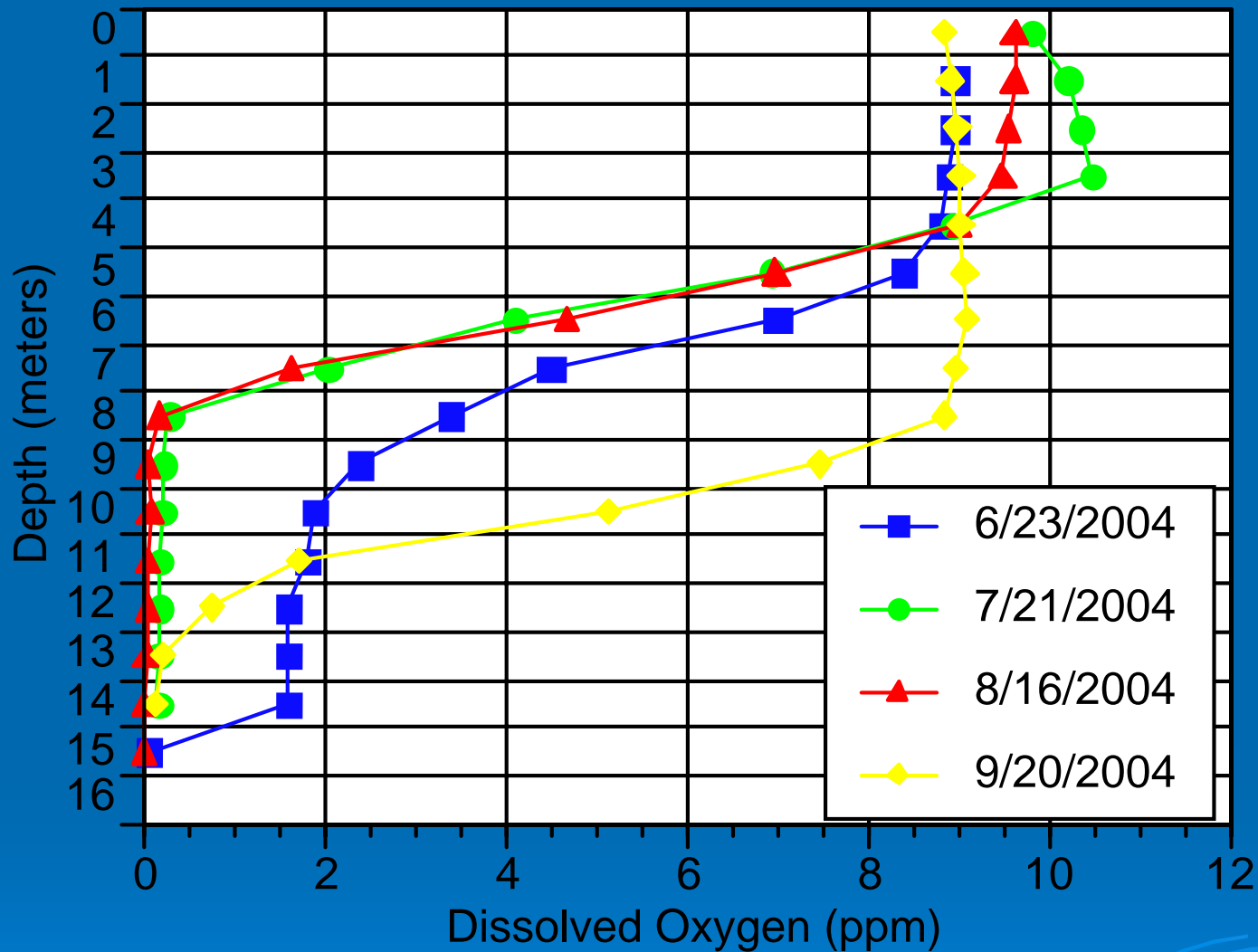


Figure C. Mean Summer DO vs. Depth

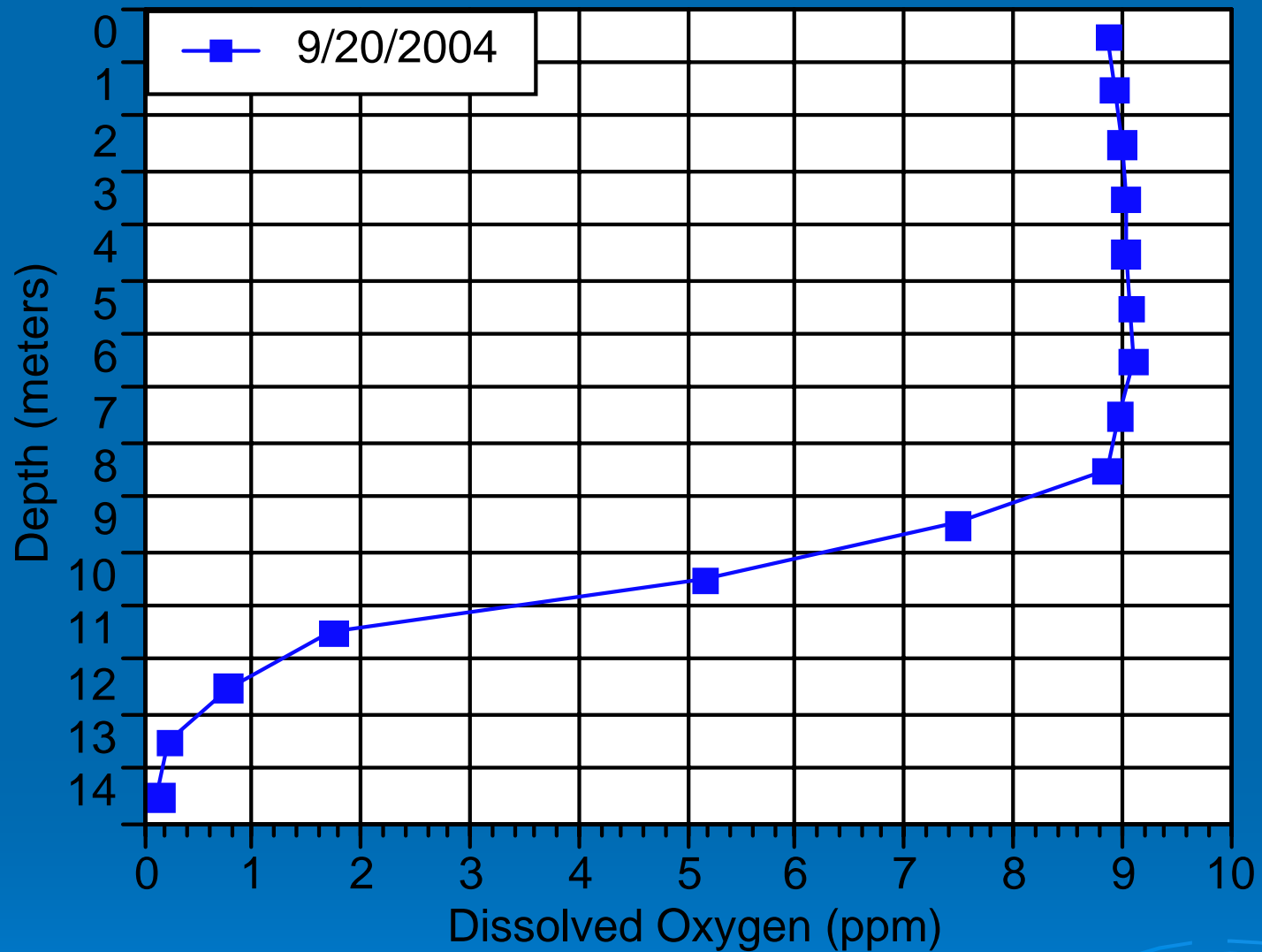


Figure D. Dissolved Oxygen vs. Depth in September 20, 2004

Historical Transparency

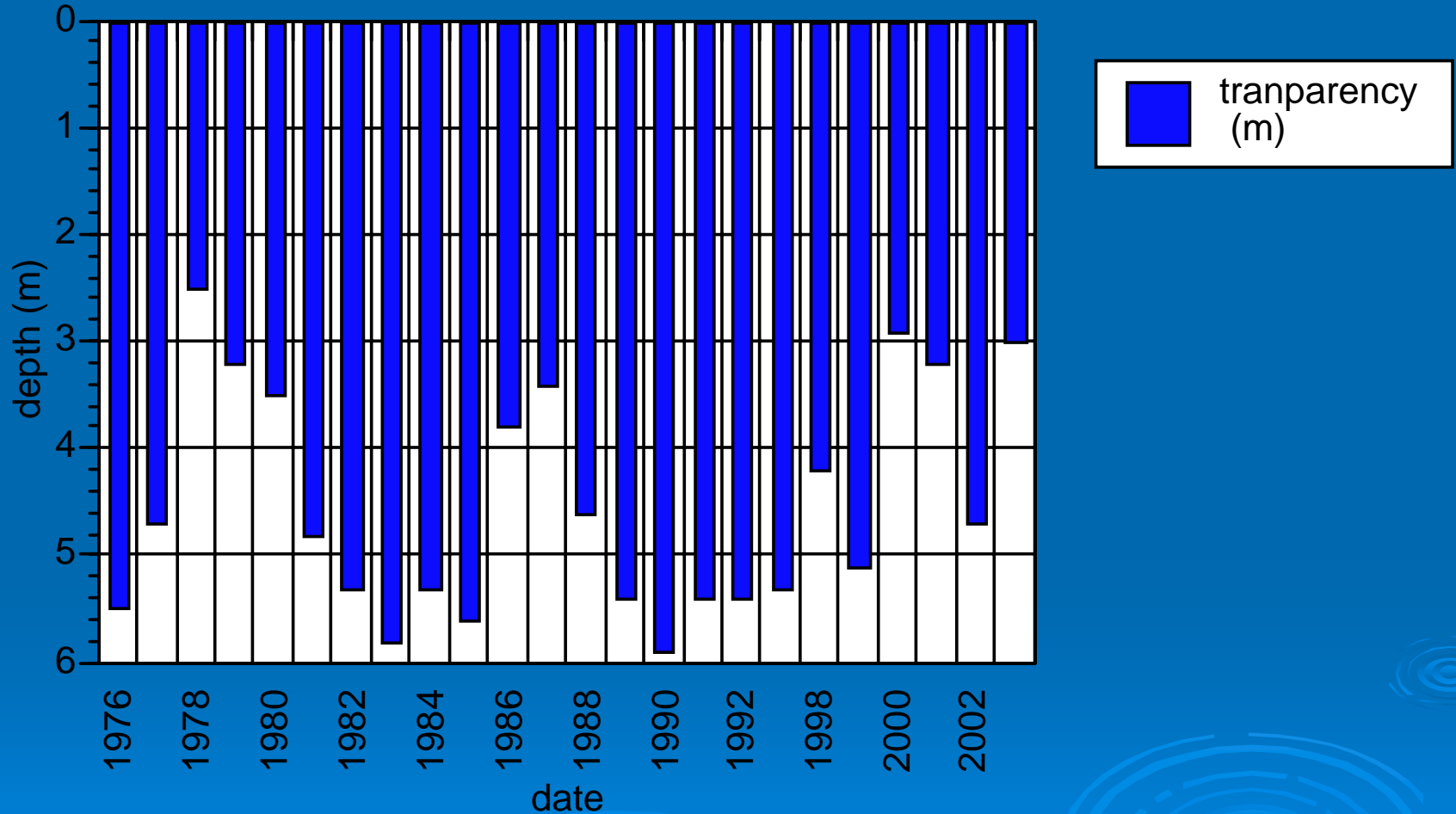


Figure E. Historical Togus Transparency over Time

Transparency continued

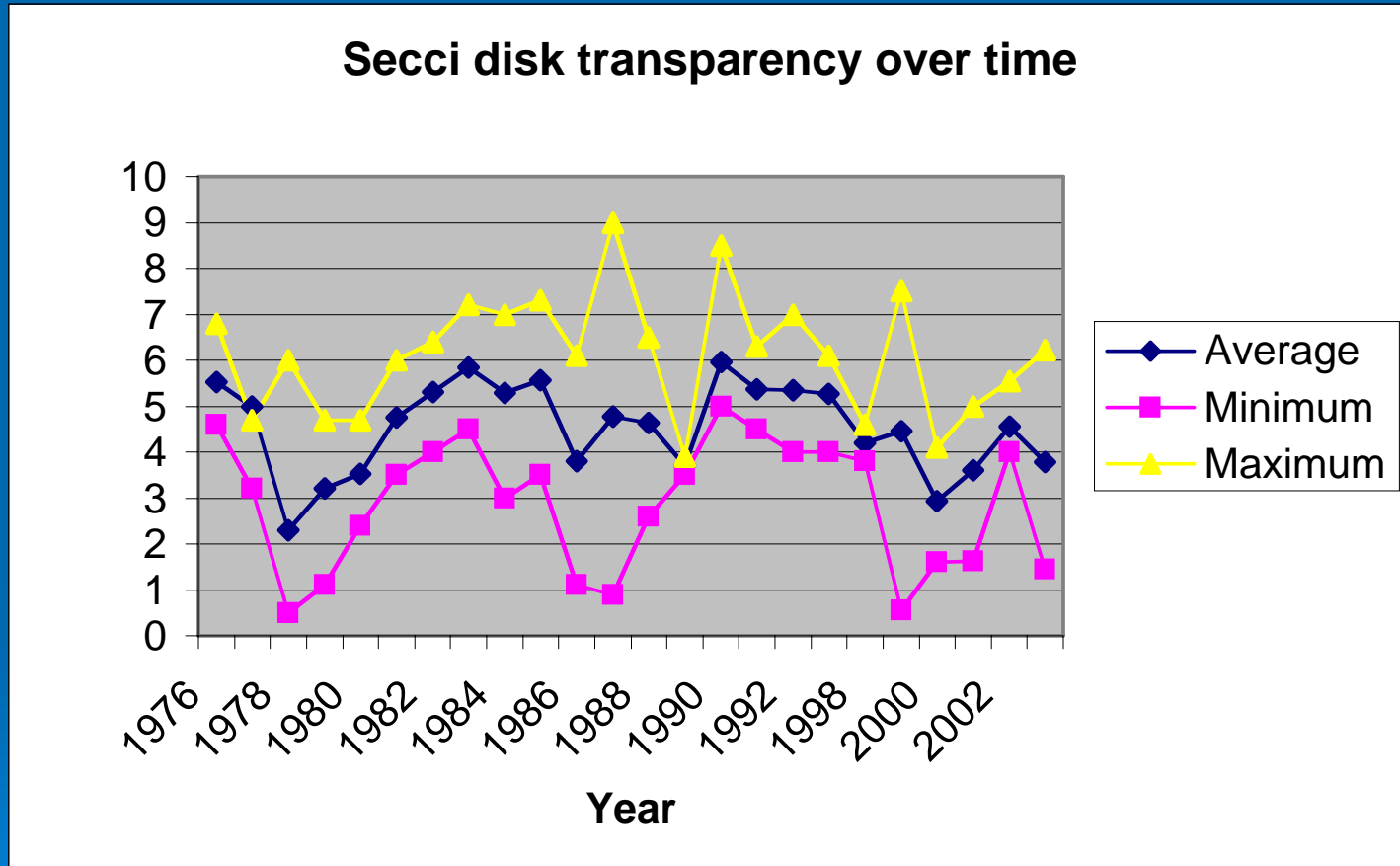


Figure F. Secchi Disk Transparency over time

Current Transparency

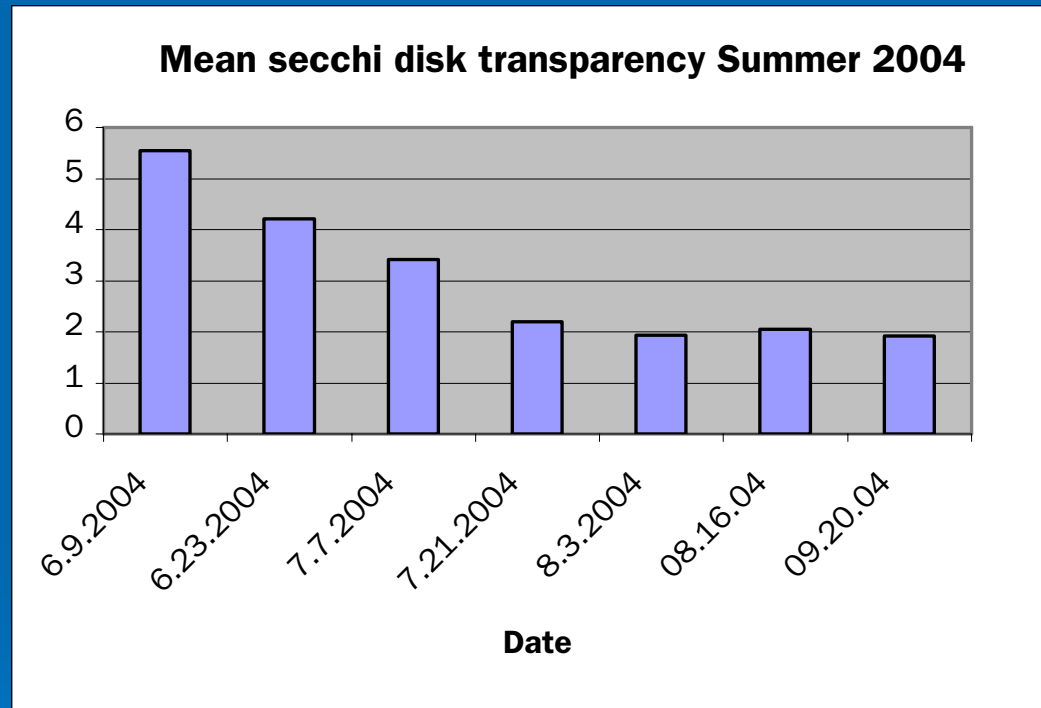


Figure G. Mean Secchi Disk Transparency Summer 2004

Physical test results

➤ Mean value of physical parameters for June-September, 2004

- Transparency (m): 3.04, (past data: 4.7m)
- Turbidity (NTU): 3.68
- Color (SPU): 44.63, (past data: avg 16 SPU)
- Conductivity ($\mu\text{MHOs/cm}$): 58.03

Chemical test results

➤ Mean value of chemical parameters for June-September, 2004

- pH: 7.62
 - Max=9.39, minimum=6.44 range=2.95
- Hardness (mgCaCO₃/L): 22.23
- Nitrates (ppm): 0.94
- Alkalinity (ppm): 18.25
- Chlorophyll-a (ppb): range 0.8-7.7 avg 3.2, (past data: range 1.8-34.5 avg 7 ppb)

pH

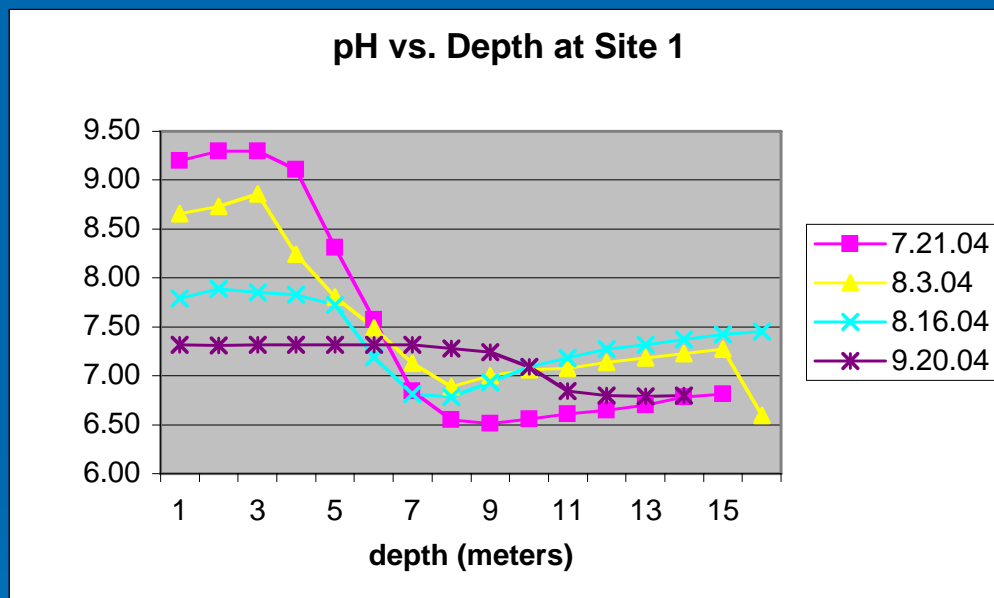


Figure H. Summer pH at Site 1

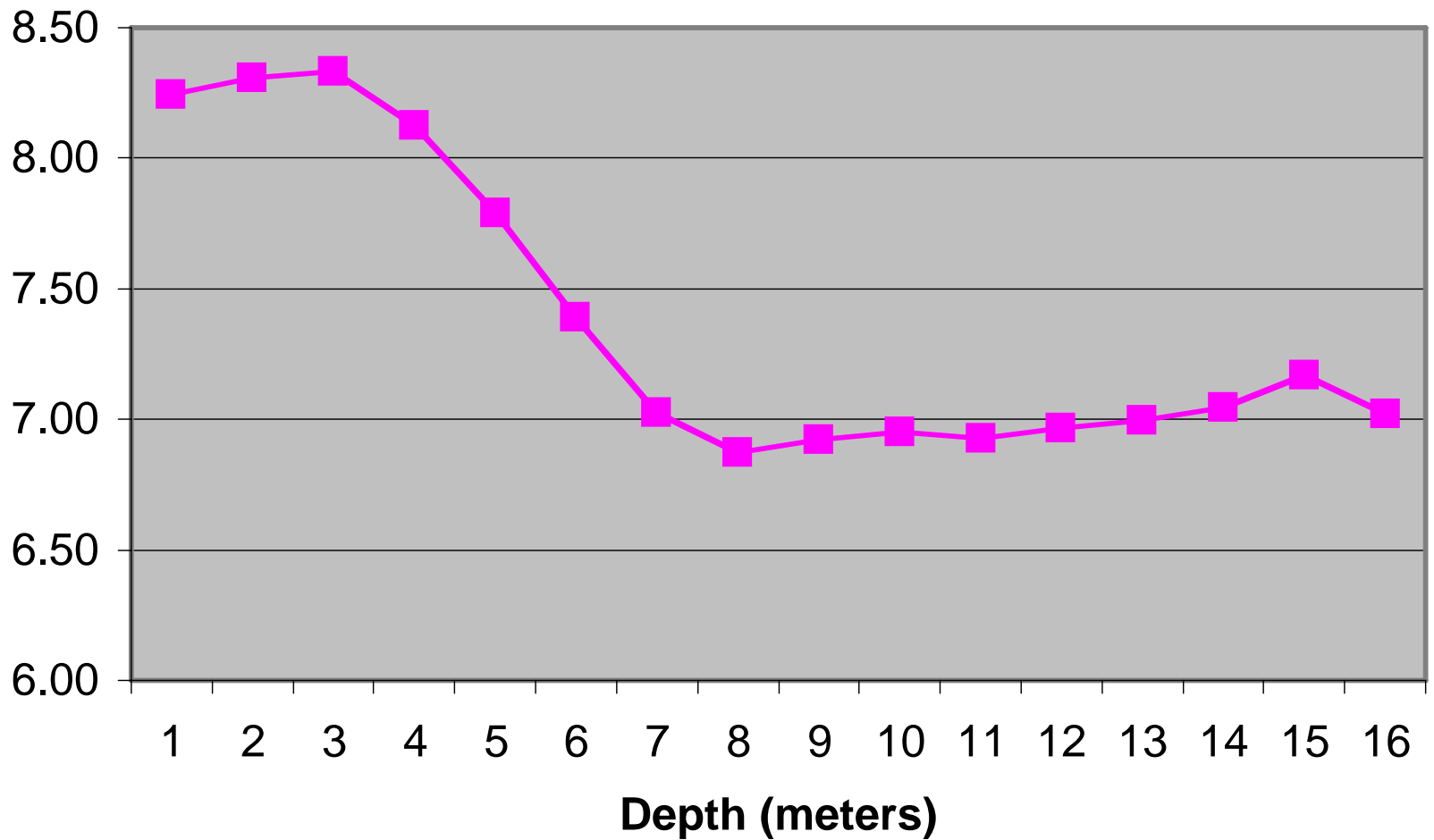


Figure I. Average Summer pH at Site 1 vs. Depth

Nitrates

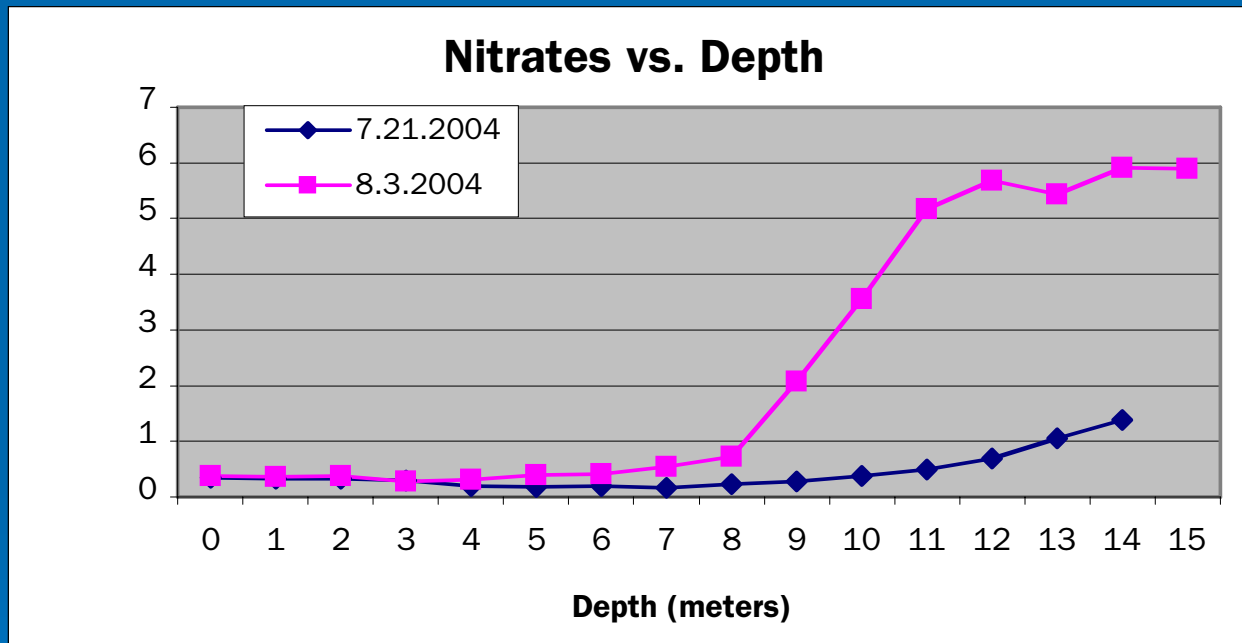


Figure K. Nitrates vs. Depth

Ammonium

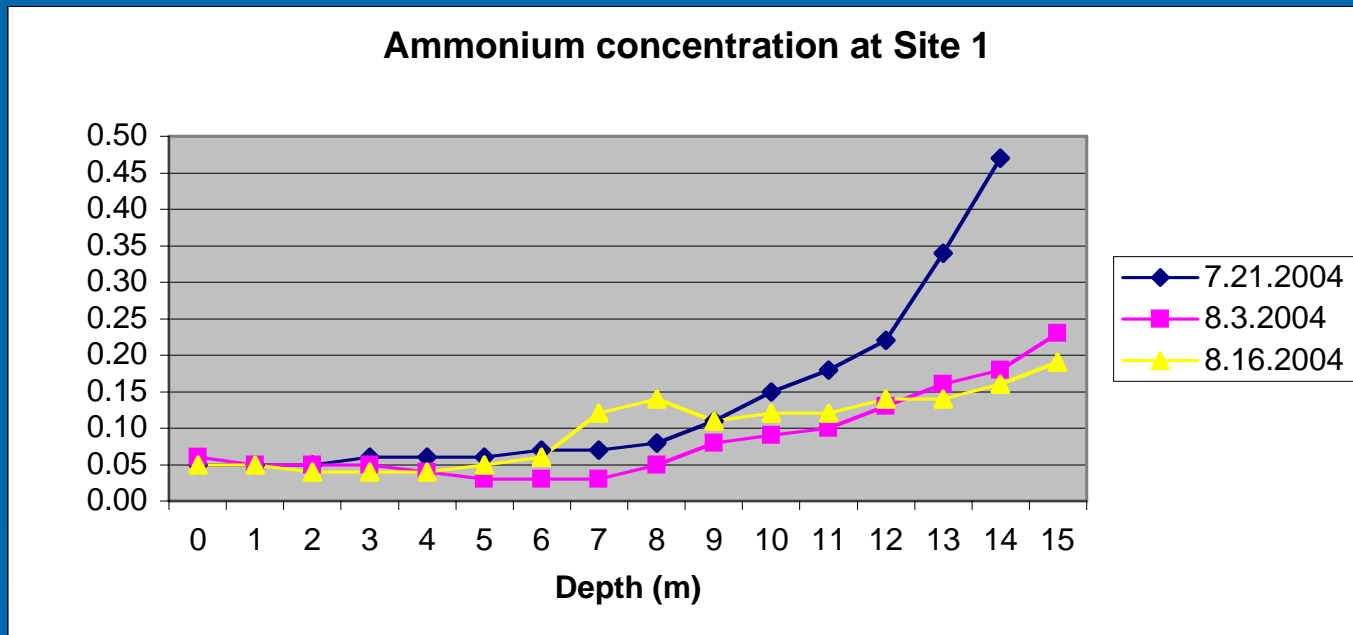


Figure L. Ammonium Concentration at Site 1

Trophic state of the lake

- Eutrophic- Maine Trophic State Index: ~70
- DO/temperature- lake stratification
- Severe algal blooms and chlorophyll-a, poor transparency
- Hardness
- PHOSPHORUS

Hardness

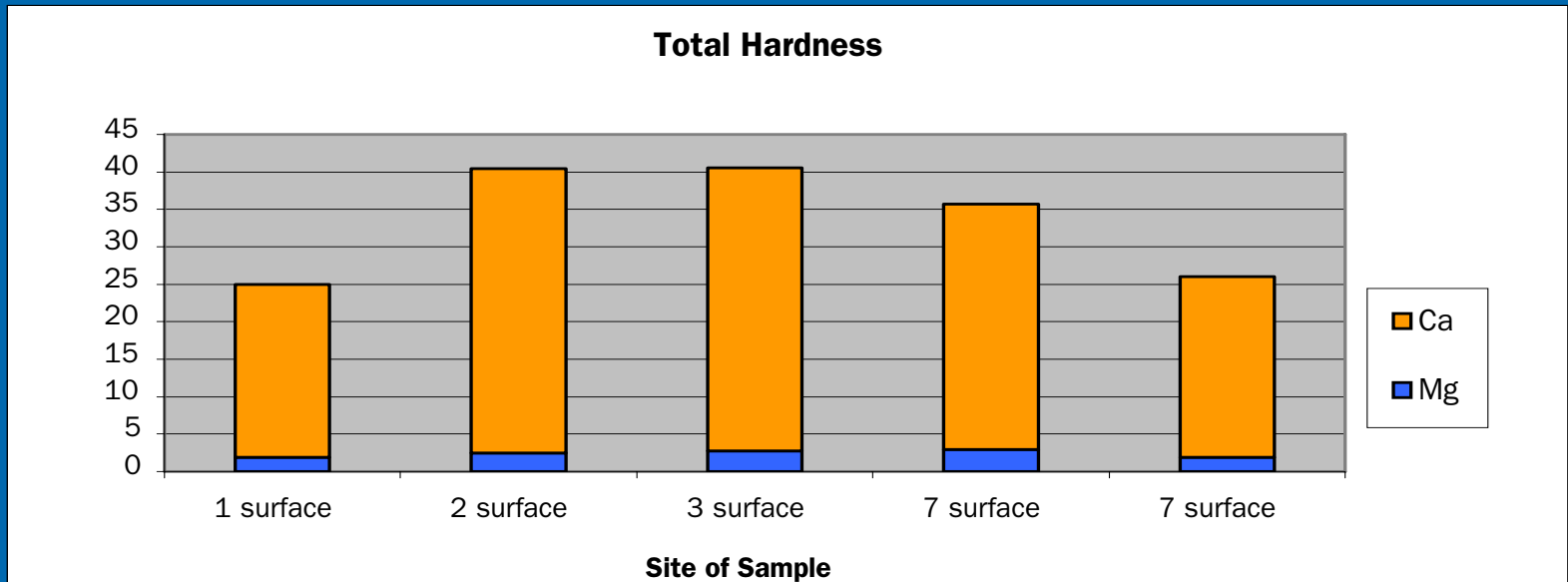
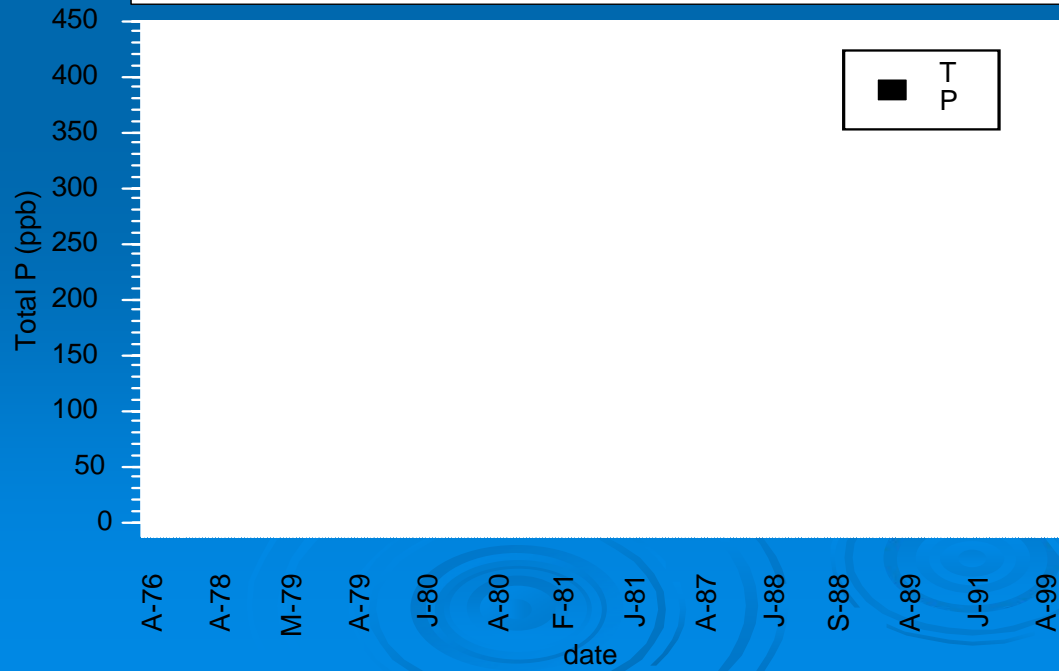
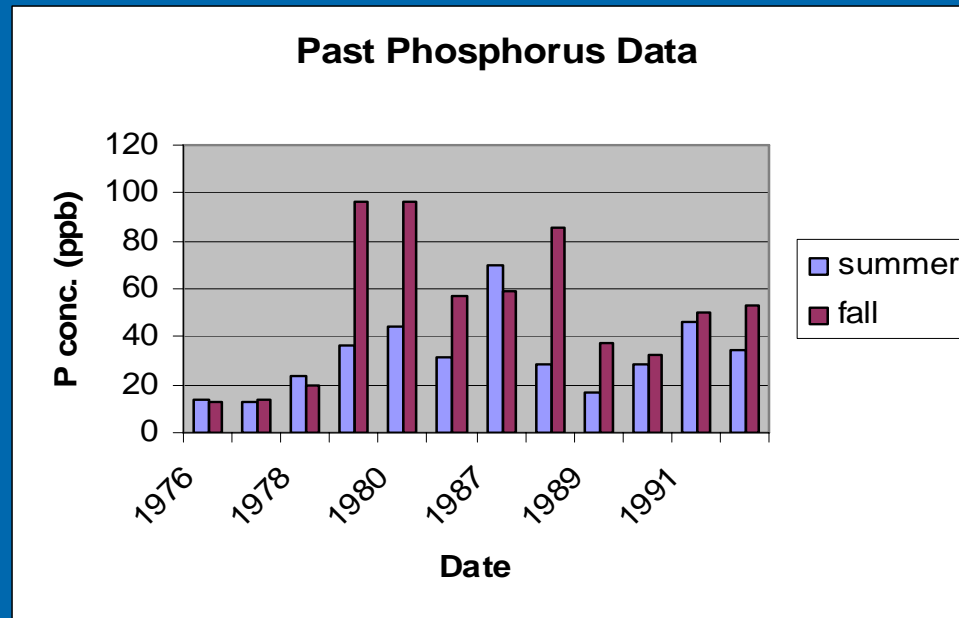


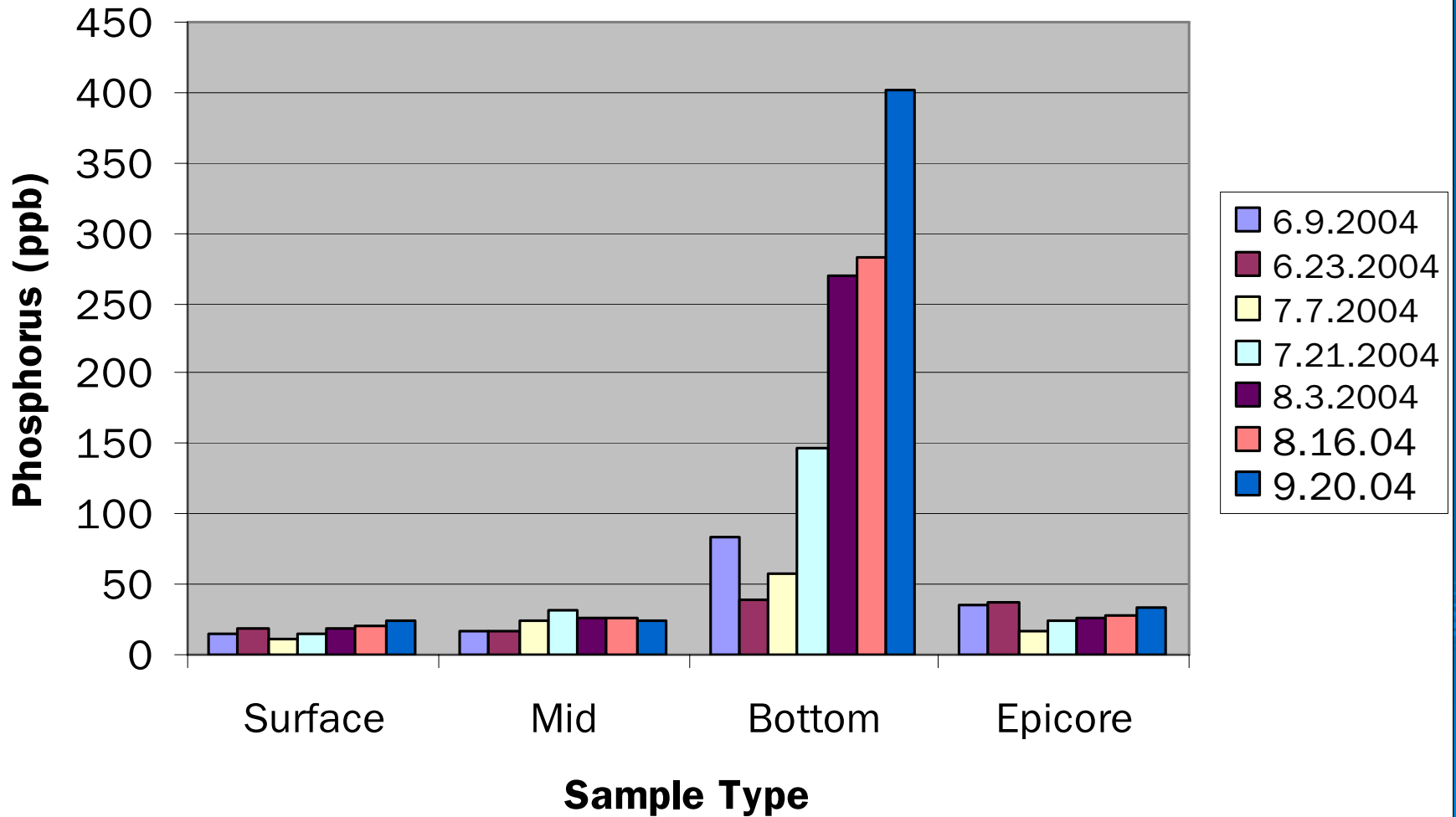
Figure J. Total Hardness

More results are being performed at NEL currently

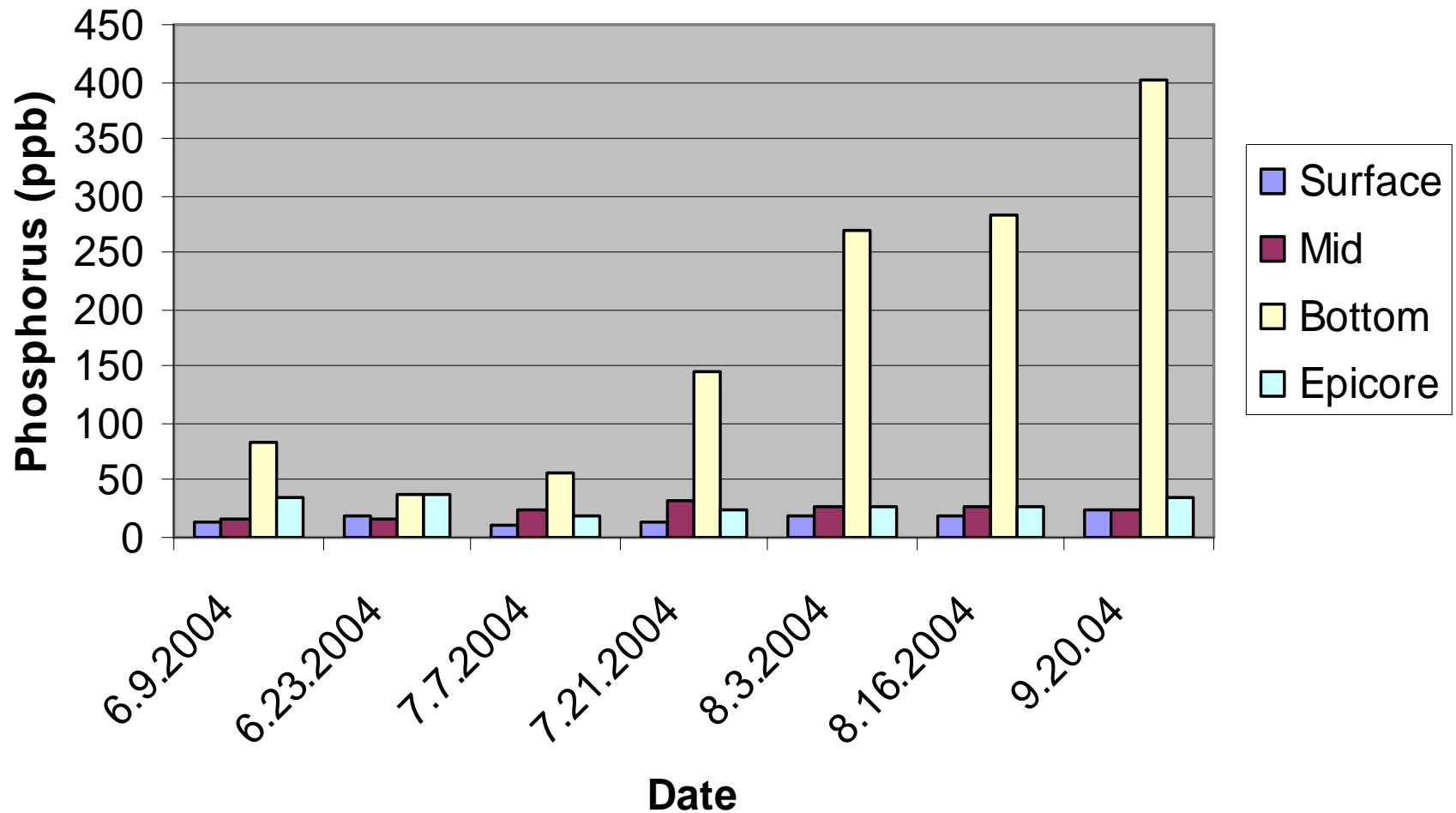
Historical phosphorus levels



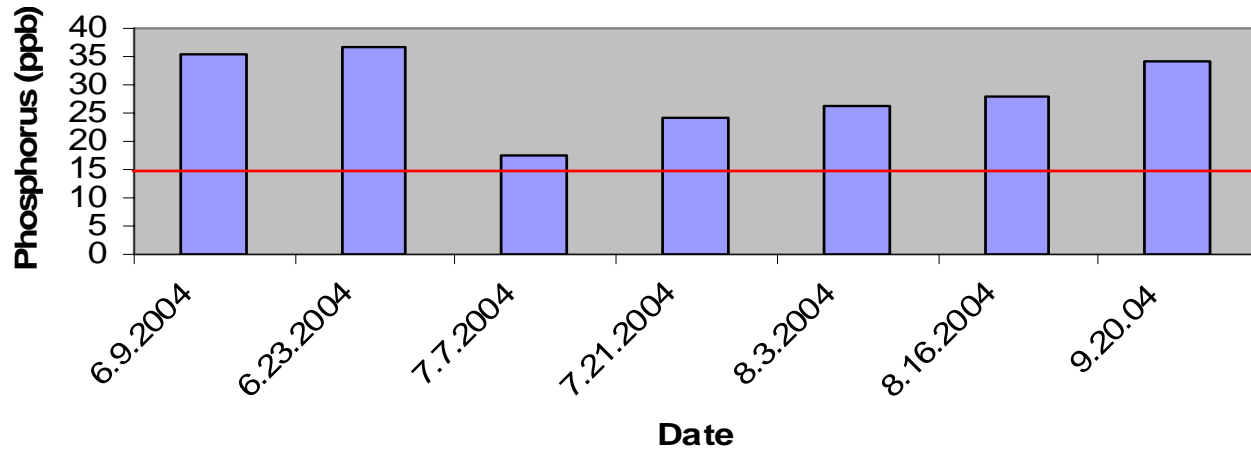
Site 1 Phosphorus



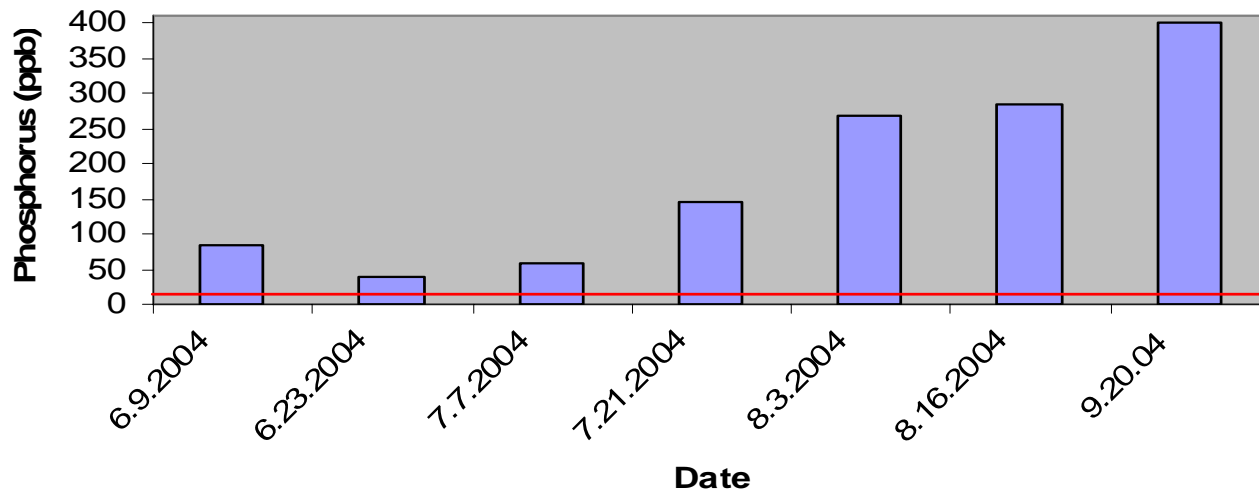
Site 1 Phosphorus (June- Sept.)



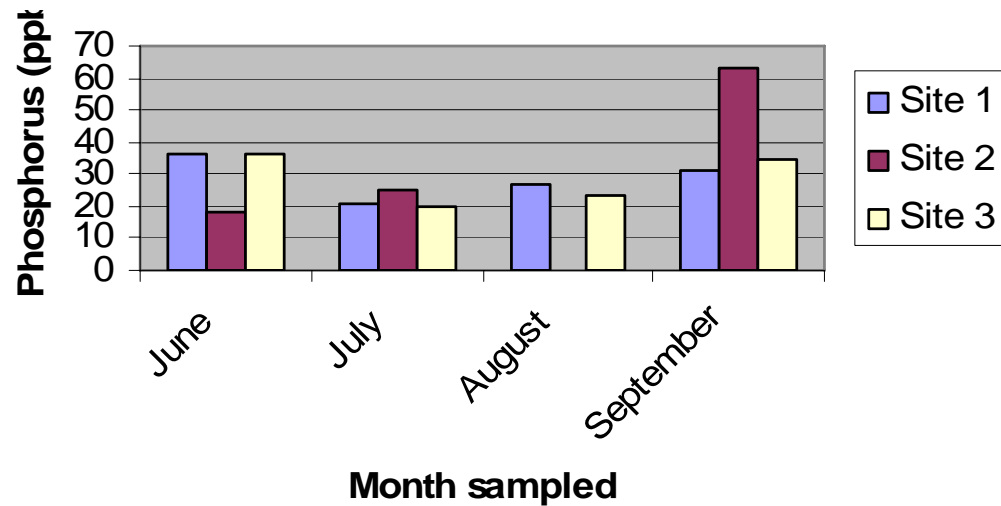
Concentration of phosphorus in epicore samples from Site 1



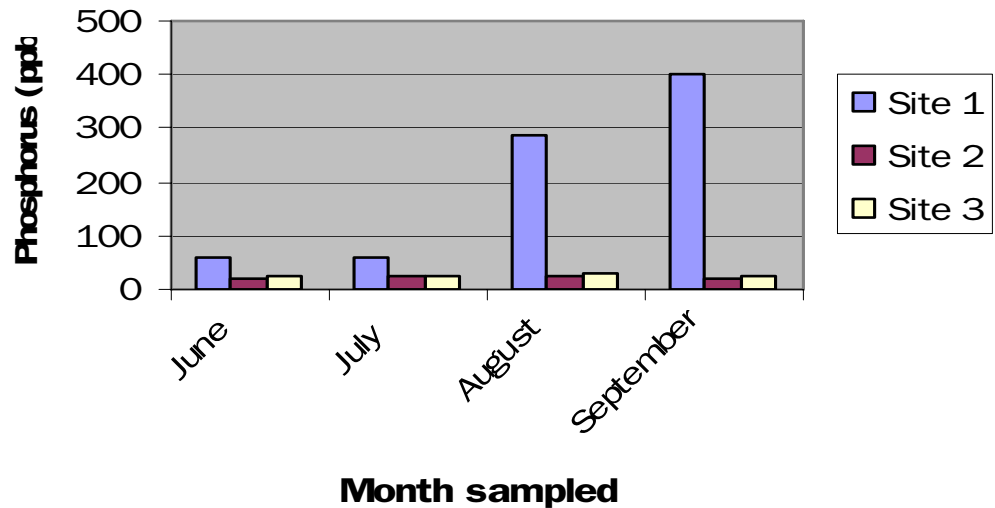
Concentration of phosphorus from bottom samples at Site 1



Average phosphorus from epicore samples

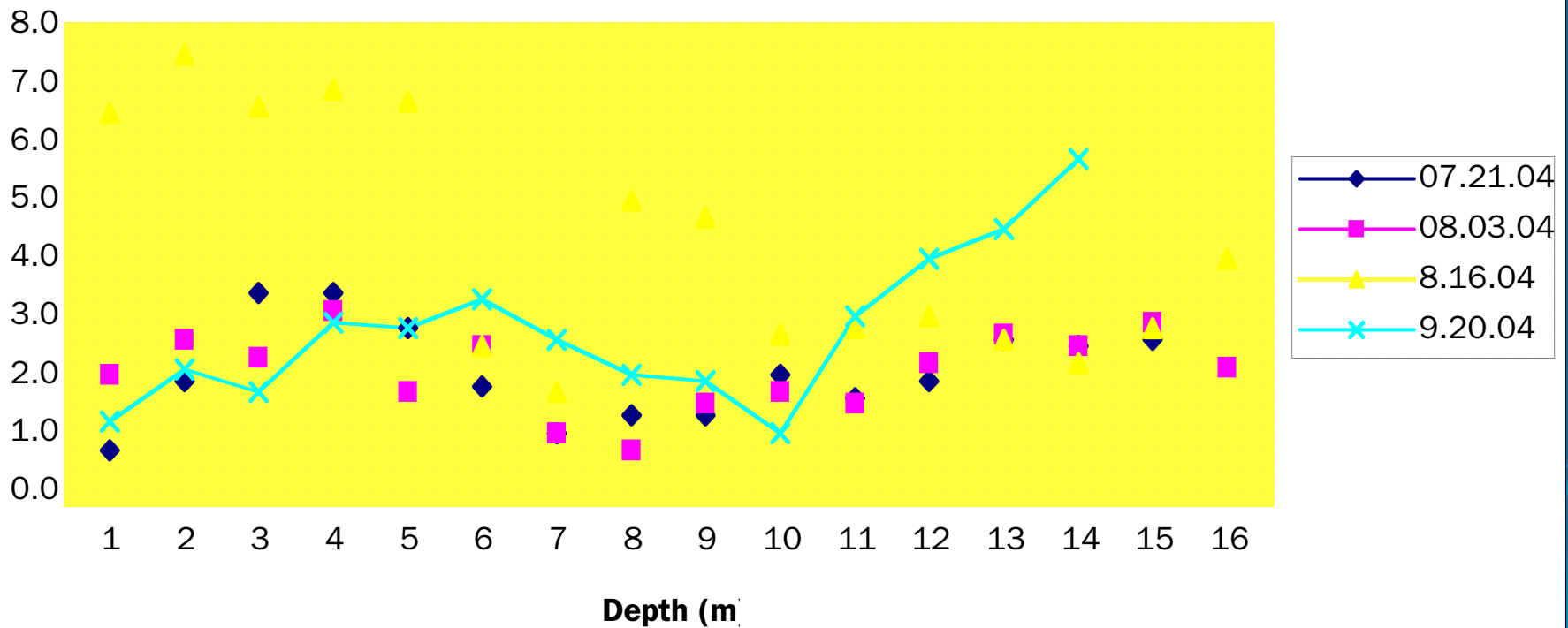


Average phosphorus from bottom samples

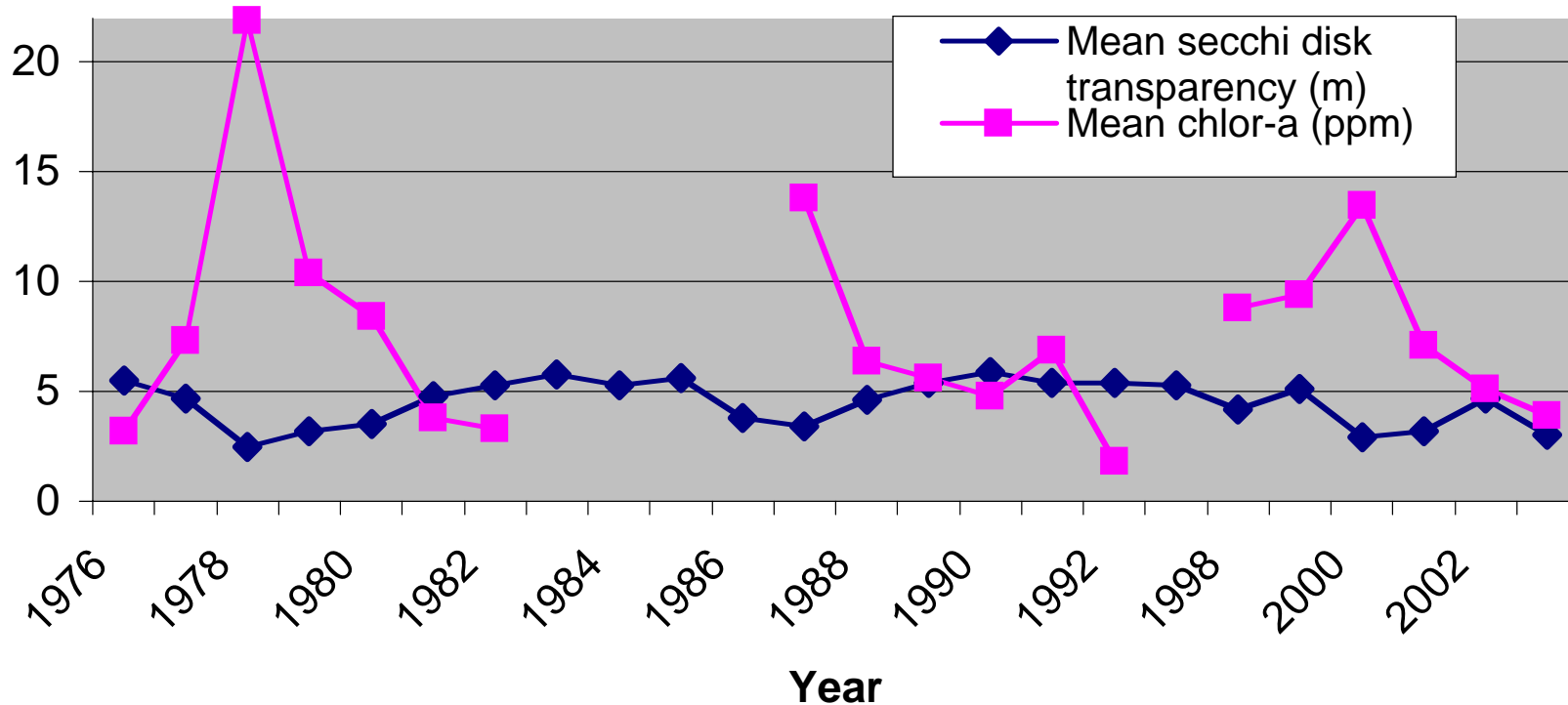


Chlorophyll-a

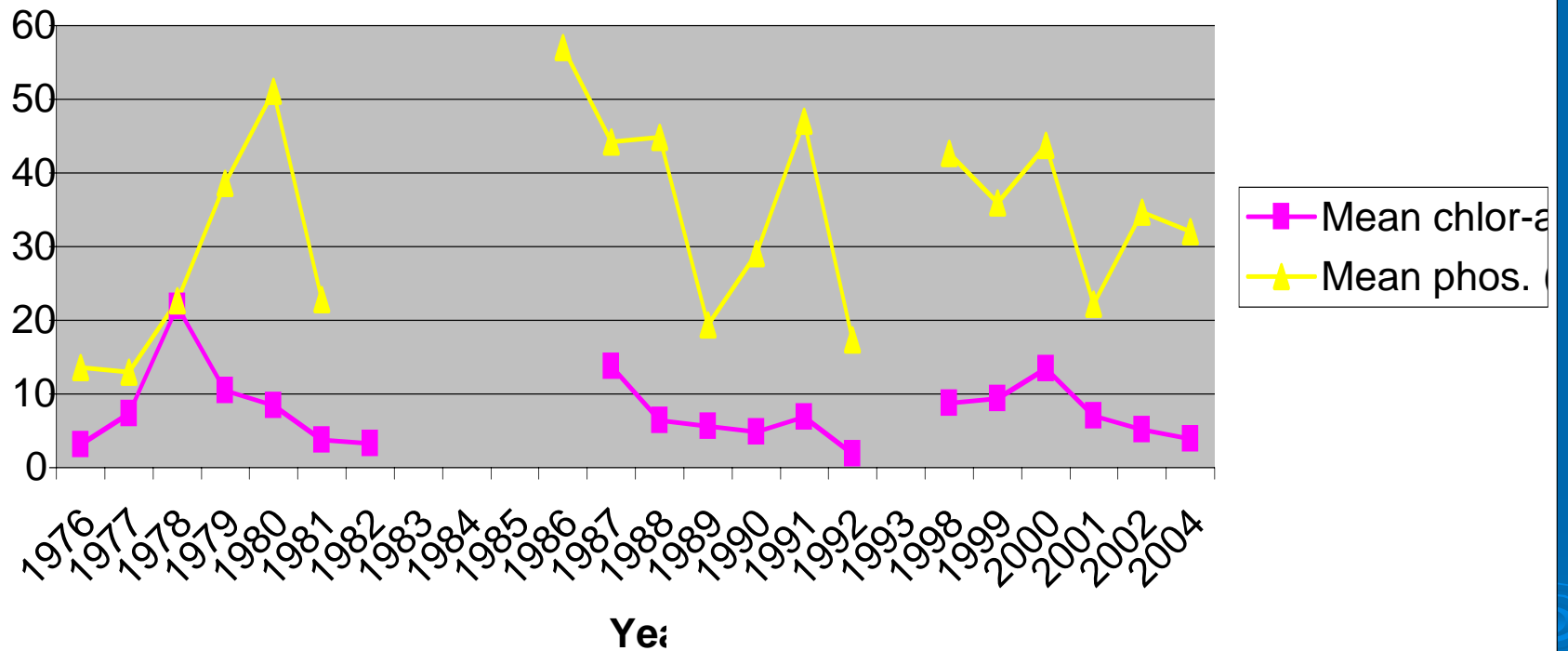
Site 1 Chlorophyll



Relationship between chlor-a and transparency



Relationship between chlorophyll



Coliform

- Fecal Coliform was found to be 1 per 100mL, which is unacceptable for drinking and prohibitive to swimming
 - Subsequent tests found levels to be 0/100mL, suggesting this was an isolated incident
- *Togus Pond water is not used for consumption

Summary: Current water quality

	Togus	Webber	East Pond	Threemile
Dissolved Oxygen (ppm)	0-9 Internal P loading	0.05 at 13m 7.4 at surface	2.2 at 8m No internal P loading	0.2 -9.5 Internal P loading
Color (SPU)	44.63	18.5	16.9	14.2
Conductivity (µMHO/cm)	58.03	39.3	27.5	48.2
Turbidity (NTU)	3.68	5.89	8	1.6
Transparency (m)	3.04	1.3	3.3	2.9
pH	7.62	7.13	7	7.07
Nitrates (ppm)	0.94	0.07	0.04	0.057
Alkalinity (mg/L)	18.25	37.0	11.2	42.3
Hardness (mg/L)	22.23	2.91	3.9	4.04
Phosphorus (ppb)	28	28	15-20	40

Sources of error

- Phosphorus levels quite high in comparison to nearby lakes
- Gaps in historical data
- Difficulty with hardness and color laboratory tests

Future monitoring

- Continue data collection by volunteers/DEP (transparency, etc)
- Phosphorus- monitoring and study regarding internal trends/recycling (natural factors?)
- Continue to monitor fecal coliform periodically for safety purposes
- Appropriate remediation techniques

Questions?

Comments?

