5-6-2005

Second Herring Brook: An Analysis of Our Watershed

Second Herring Brook

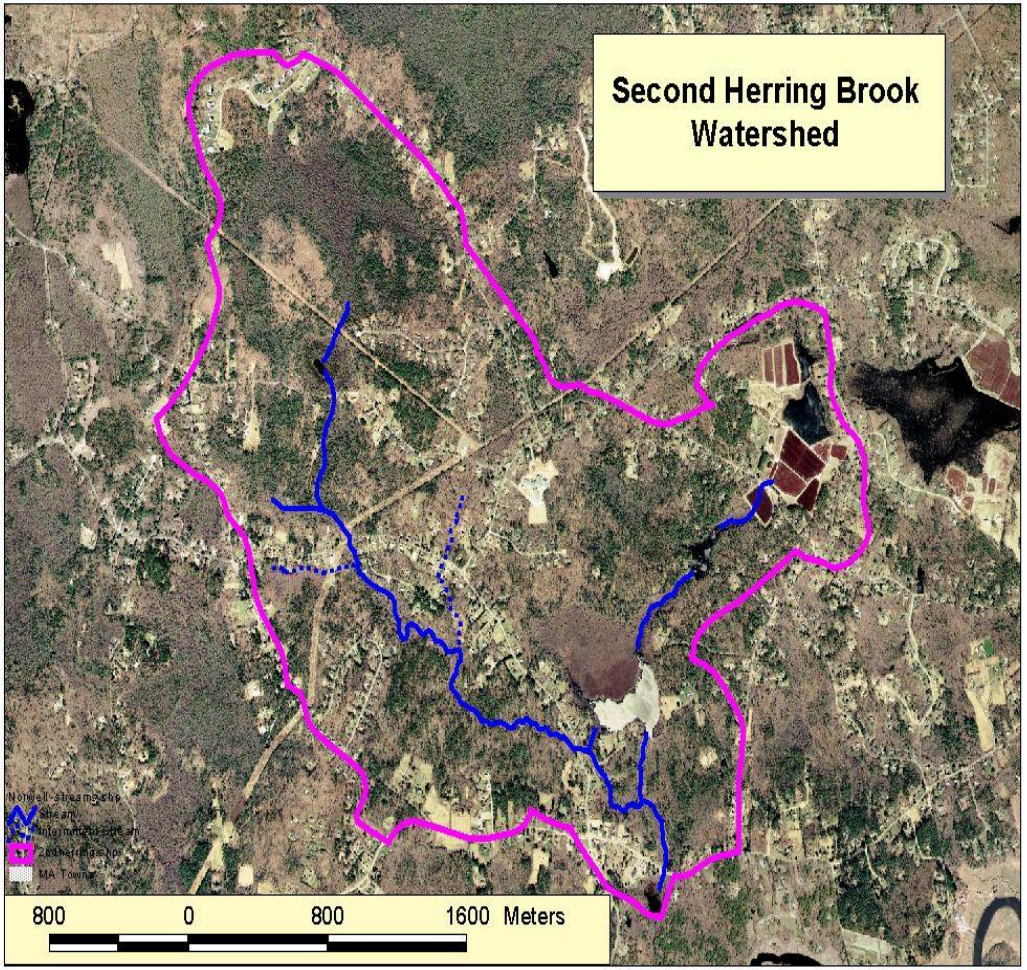
An Analysis of Our Watershed

Our Mission

- To observe and analyze Second Herring Brook in Norris Reservation
- Seek a better understanding of our surroundings and environment
- We investigated the
  - condition of the water
  - macroinvertebrates living in the area
  - different elements of the reservation that may affect the condition of the watershed

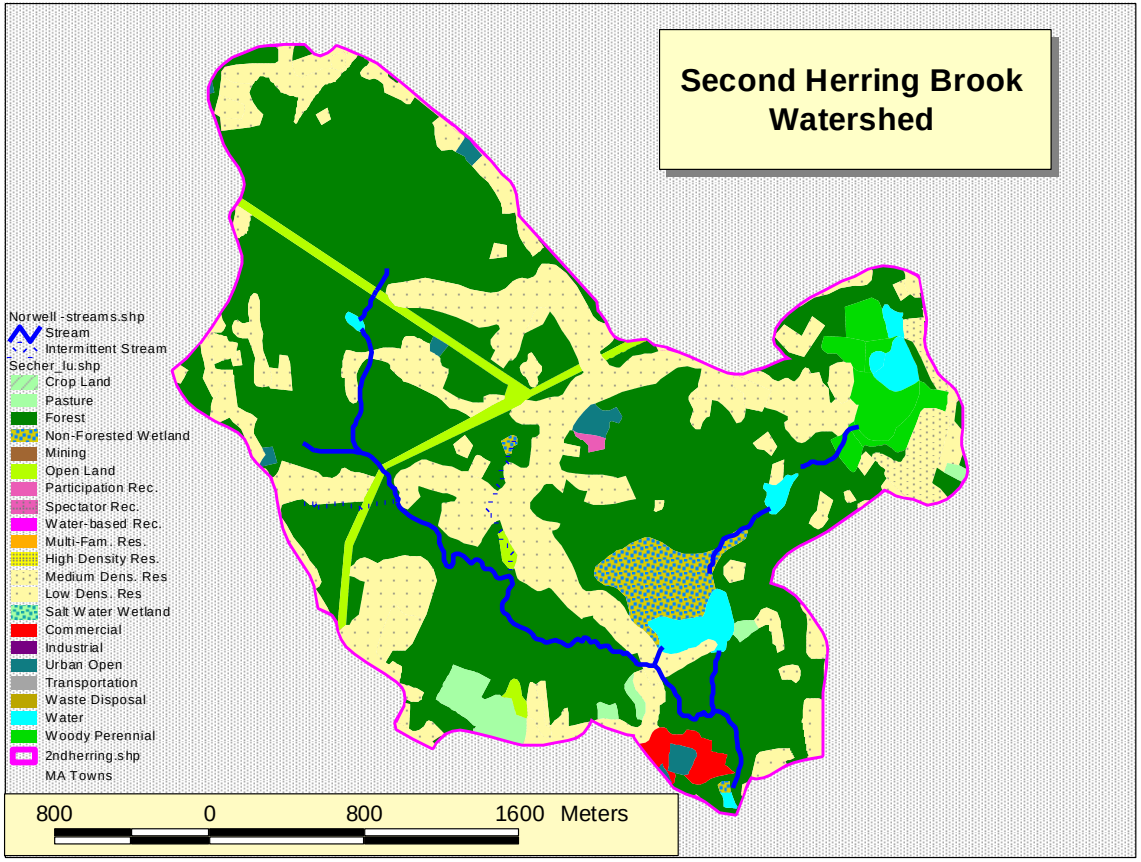
Watershed Location

- Our watershed is in Norwell, Massachusetts in Norris Reservation.
- The reservation is secluded from houses, roads, and industrial areas.



Our Watershed Area

Dark green = Forestry.
Lime green = Open land.
Light Green = Pasture
Light Yellow = Residential areas.
Green Spots = Non-Forested wetlands.
Magenta = Recreation
Teal = Urban open area
Turquoise = Water body
Blue = Stream
Red = Commercial Area




SOUTH SECTIONAL
'03
CHAMPS

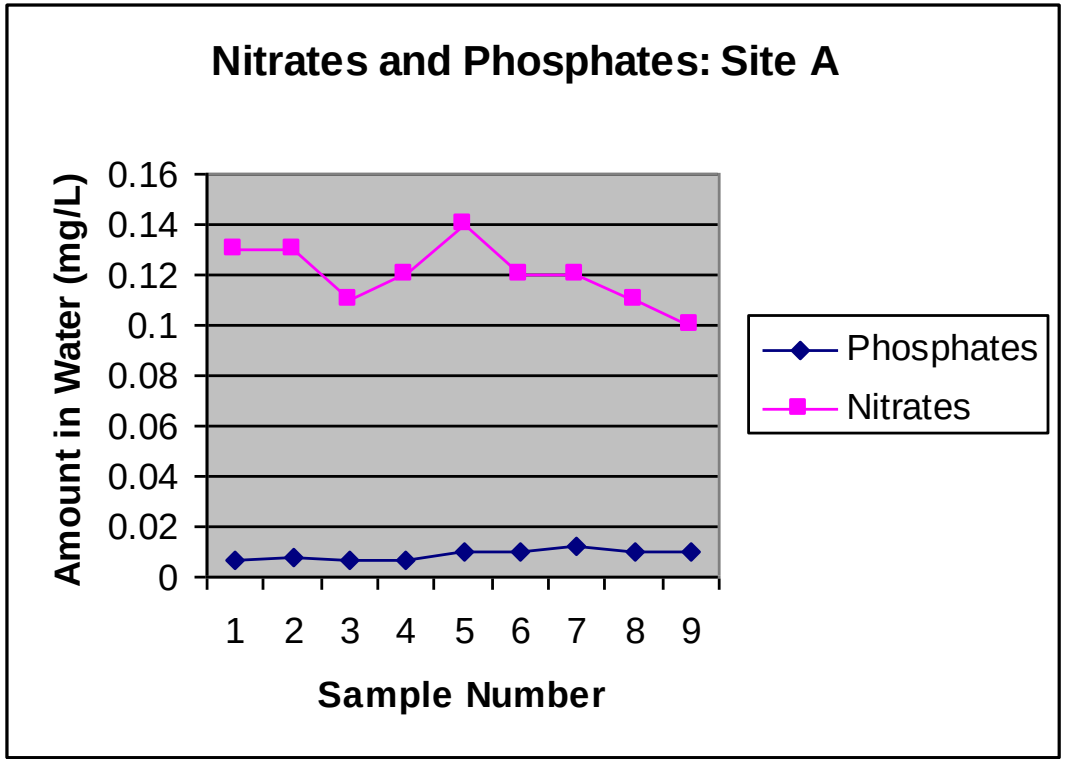
Experiments, Observations, and Collections

- Nitrates
- Phosphates
- Dissolved Oxygen Levels
- pH Levels
- Temperature
  - Water
  - Air
- Water Flow
- Fecal Coliform Bacteria
- Macroinvertebrates

Nitrates and Phosphates

- **Nitrates**
  - bi-products of animal waste and fertilizers
  - An excess could be harmful to life in the area.
    - *Standard amount of nitrates in clean water is <1.0ppm.*
  - EPA has set a drinking water Maximum Contaminant Level (MCL) of 10 mg/l for nitrates.
- **Phosphates**:
  - plant nutrients, present in low levels in nature
    - Sources: detergents, sewage, and cattle feedlot runoff
  - A presence of this may disturb plant life levels.
  - Phosphate levels greater than 1.0 mg/l may interfere with coagulation in drinking water treatment plants.

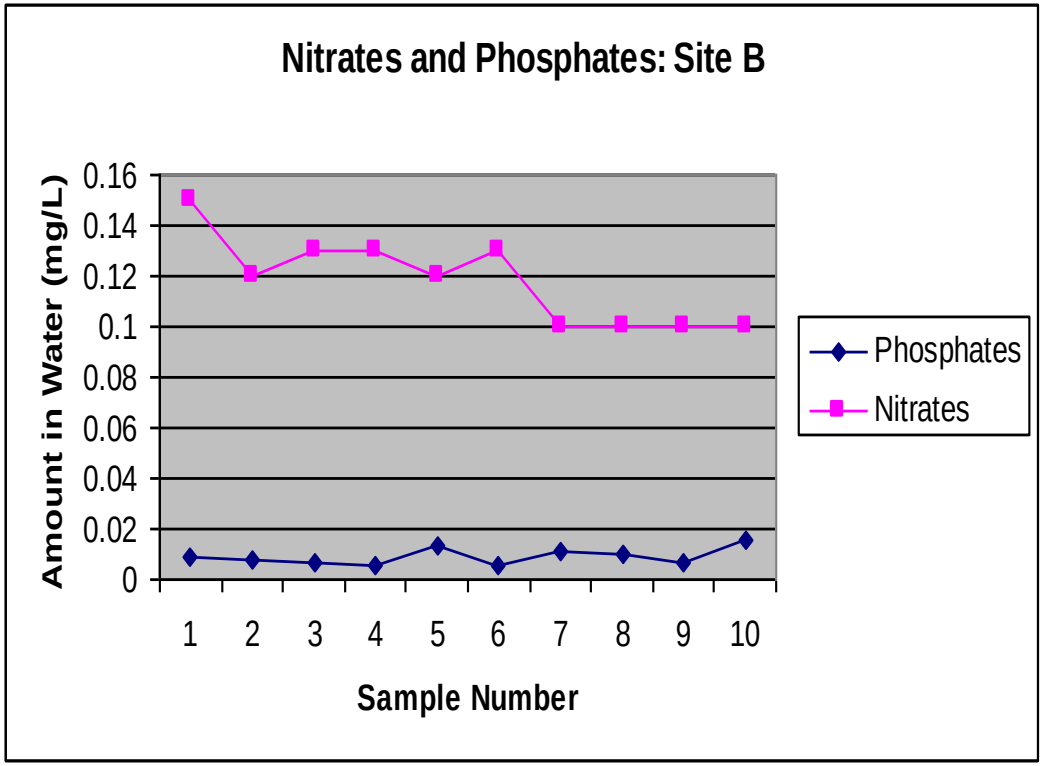
Nitrates and Phosphates: Site A



Hour	Phosphates	Nitrates
1	0.007	0.13
3	0.008	0.13
5	0.007	0.11
7	0.007	0.12
9	0.01	0.14
11	0.01	0.12
13	0.012	0.12
15	0.01	0.11
17	0.01	0.1

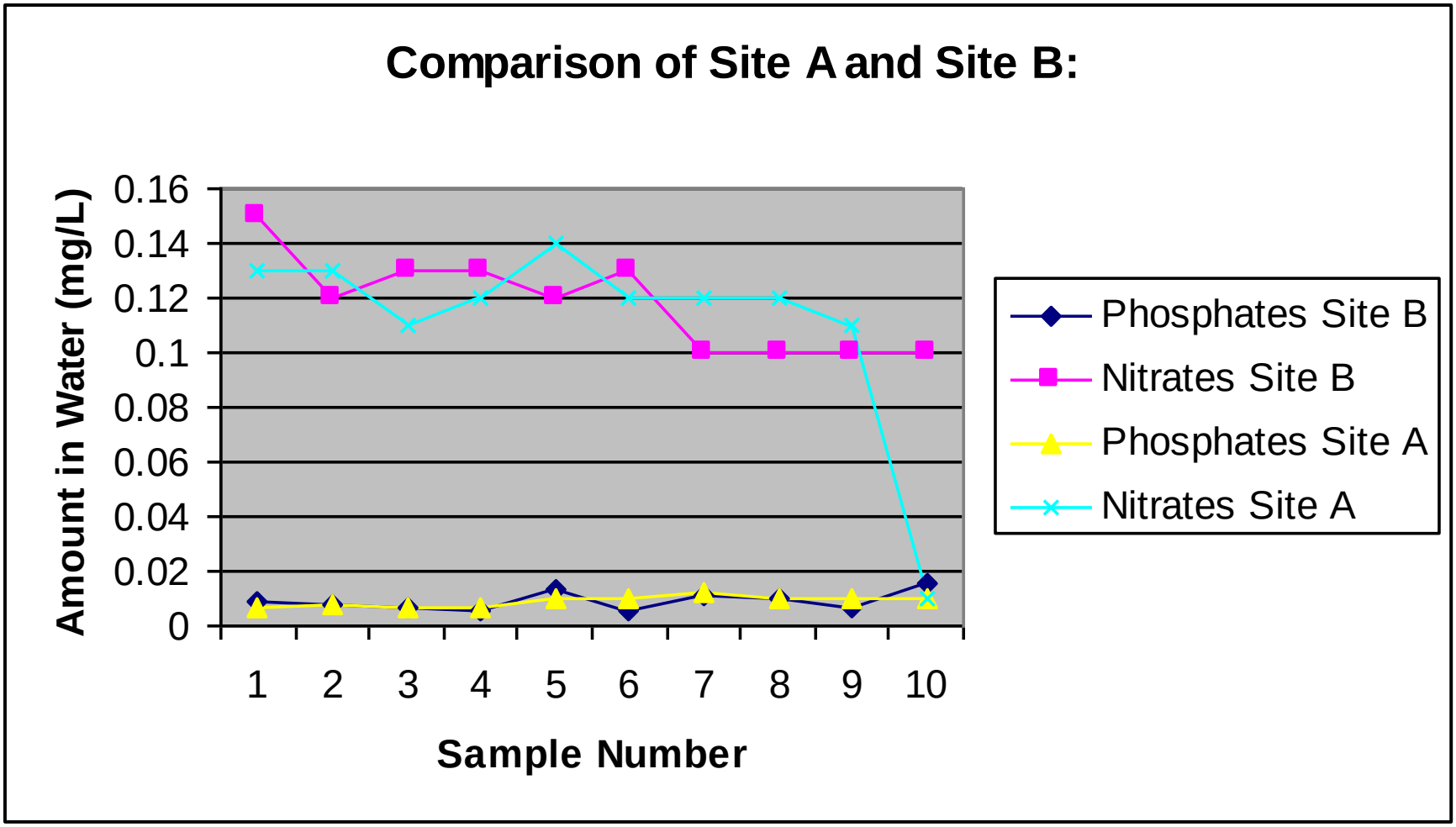
Our watershed does not have excess amounts of nitrates or phosphates. This indicates our water is clean. *Calculations on following slide*

Nitrates and Phosphates: Site B



Time	Phosphates	Nitrates
1	0.009	0.15
3	0.008	0.12
5	0.007	0.13
7	0.006	0.13
9	0.013	0.12
11	0.006	0.13
13	0.011	0.1
15	0.01	0.1
15	0.007	0.1
17	0.016	0.1

Nitrates and Phosphates: A Comparison



Nitrates and Phosphates Calculations

N/L: 0.118mg/L discharge 43.6 L/sec

Load= .118 (43.6)= 5.1 mg/sec

(5.1 mg/sec)(86.4)=**441 g/day**

P/L: 0.01mg/L discharge 43.6 L/sec

Load= 0.01 (43.6)= 0.436 mg/sec

(0.436mg/sec)(86.4)= **37.7 g/day**

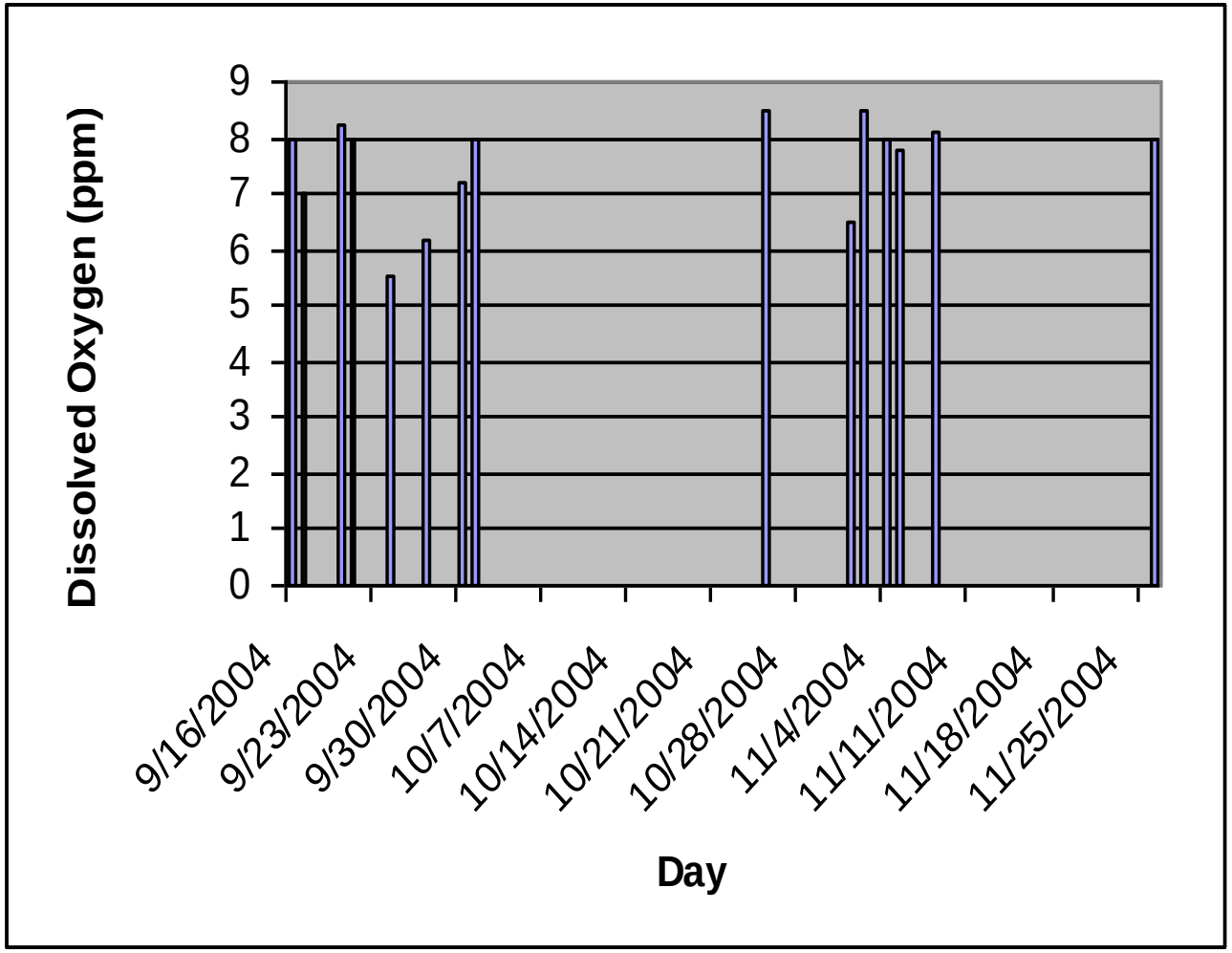
Dissolved Oxygen

- Tested dissolved oxygen levels with Lamotte kits and a Hydrolab Multiprobe
  - Expected about 5-6 ppm
    - Amount necessary to support a diverse ecosystem
- Our testing area has a number of riffles
  - Brook is constantly infused with oxygen
    - More water is coming into contact with the air
- Temperature affects the dissolved oxygen levels.
  - Colder temps = higher levels of dissolved oxygen in the water

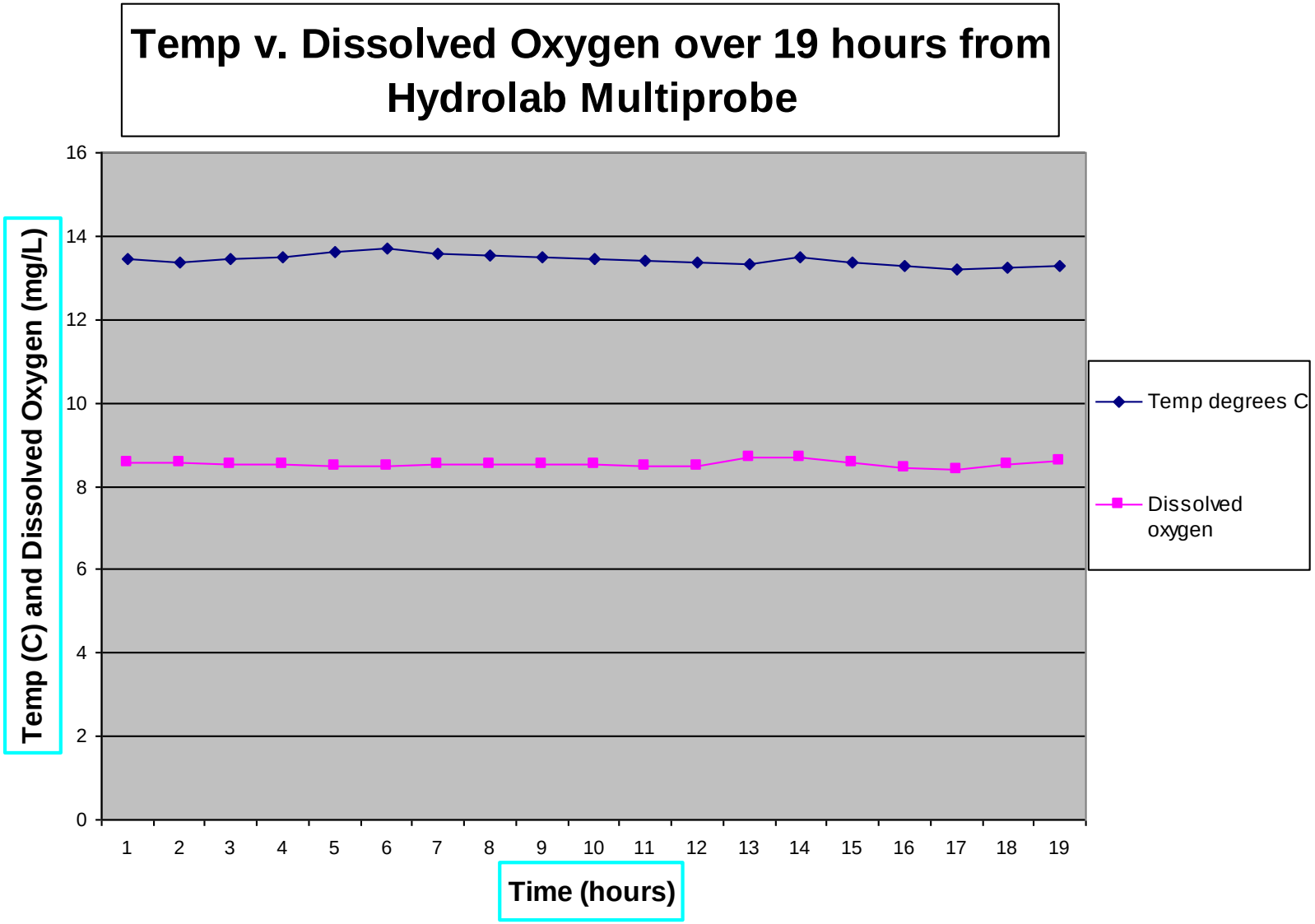
Dissolved Oxygen (Continued)

- Measured temperature during trips to stream
- Sought correlations between temperature and dissolved oxygen

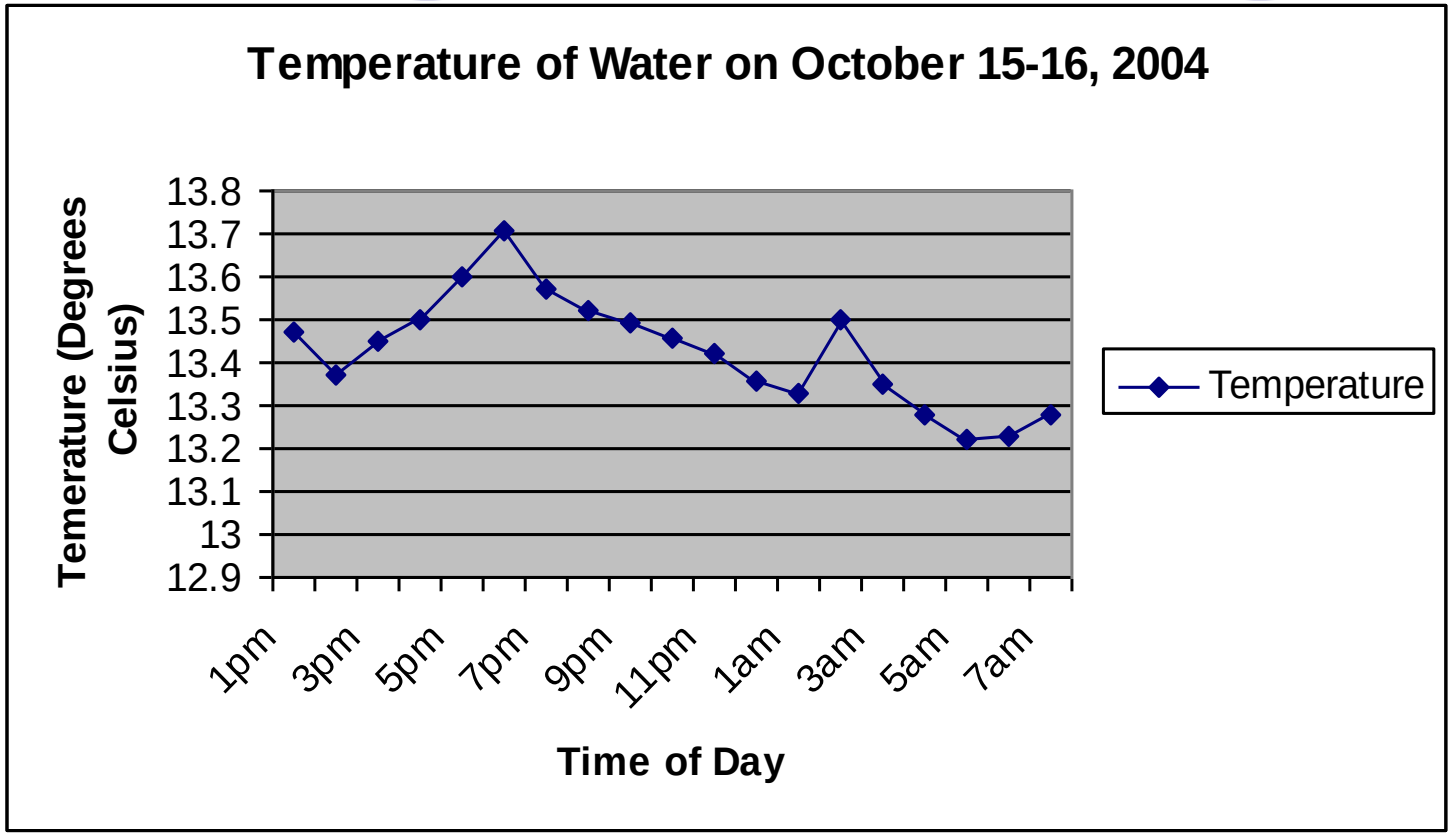
*No bar = data not collected on day



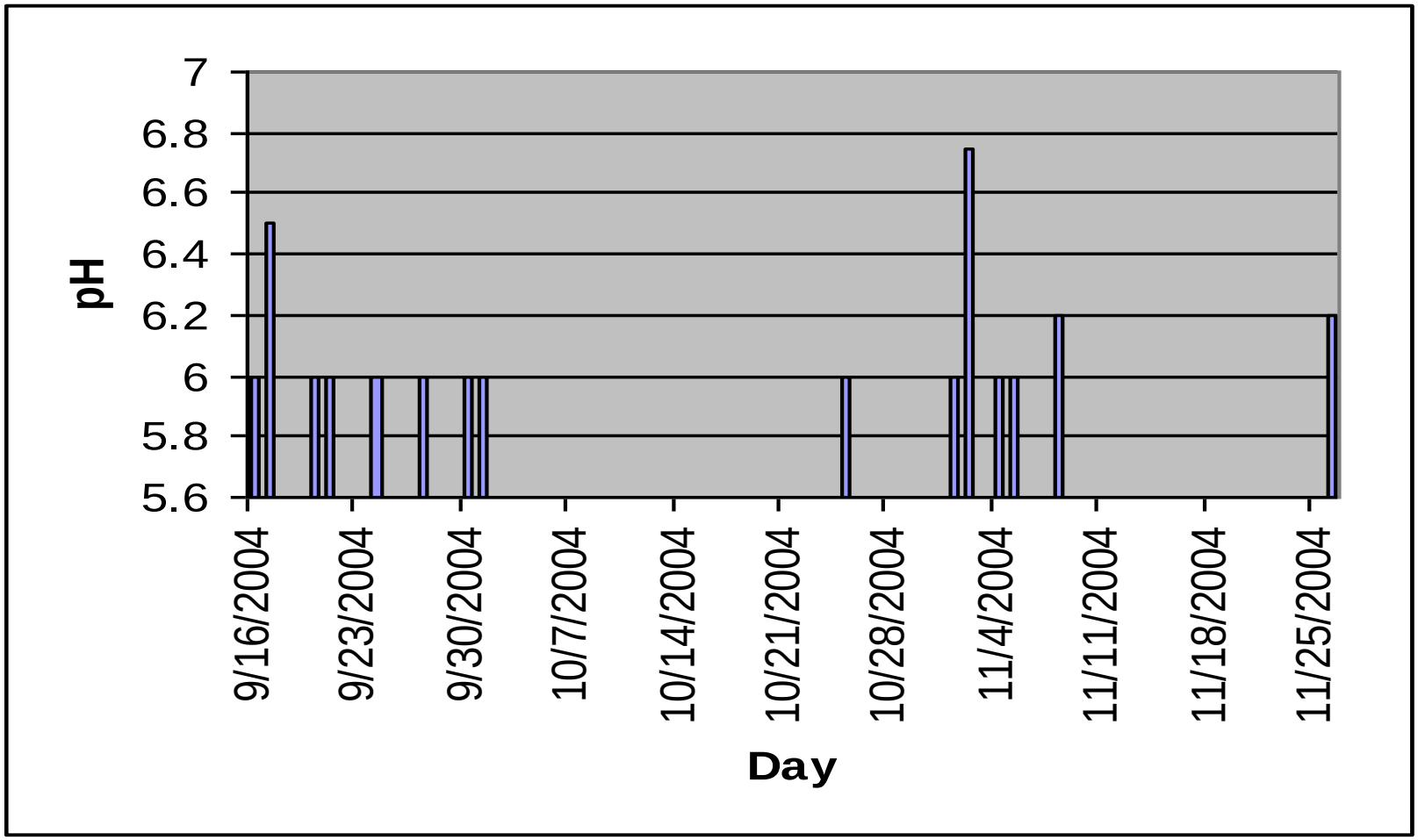
Dissolved Oxygen (Continued)



Temperature of Stream



pH Levels


7
6.8
6.6
6.4
6.2
6
5.8
5.6
pH
9/16/2004
9/23/2004
9/30/2004
10/7/2004
10/14/2004
10/21/2004
10/28/2004
11/4/2004
11/11/2004
11/18/2004
11/25/2004
Day

Go with the Flow

- Next we set out to find how many liters of water travel downstream over time.
- The flow indicates how many nitrates and phosphates travel down the stream over time

Segment	Avg. flow at 6 in. from surface	Segment Discharge
1	0	0
2	0.65	0.163
3	1.05	0.368
4	0.92	0.367
5	1.28	0.64

Total Discharge: **1.54 cubic feet/sec**

(1.54)(28.32)= **43.6 L/sec**

Fecal Coliform Bacteria

- A presence of FCB indicates that the water has been contaminated by animal waste products.
- An excessive amount of FCB poses a health risk for animals and people in the presence of it
- Standards Today:
  - Recreation: Must be fewer than 200 colonies per 100mL
  - Fishing & Boating: 1000 colonies per 100mL
  - Domestic Water Supply: 2000 per 100mL
  - Drinking Standard: fewer than 1 colony per 100mL

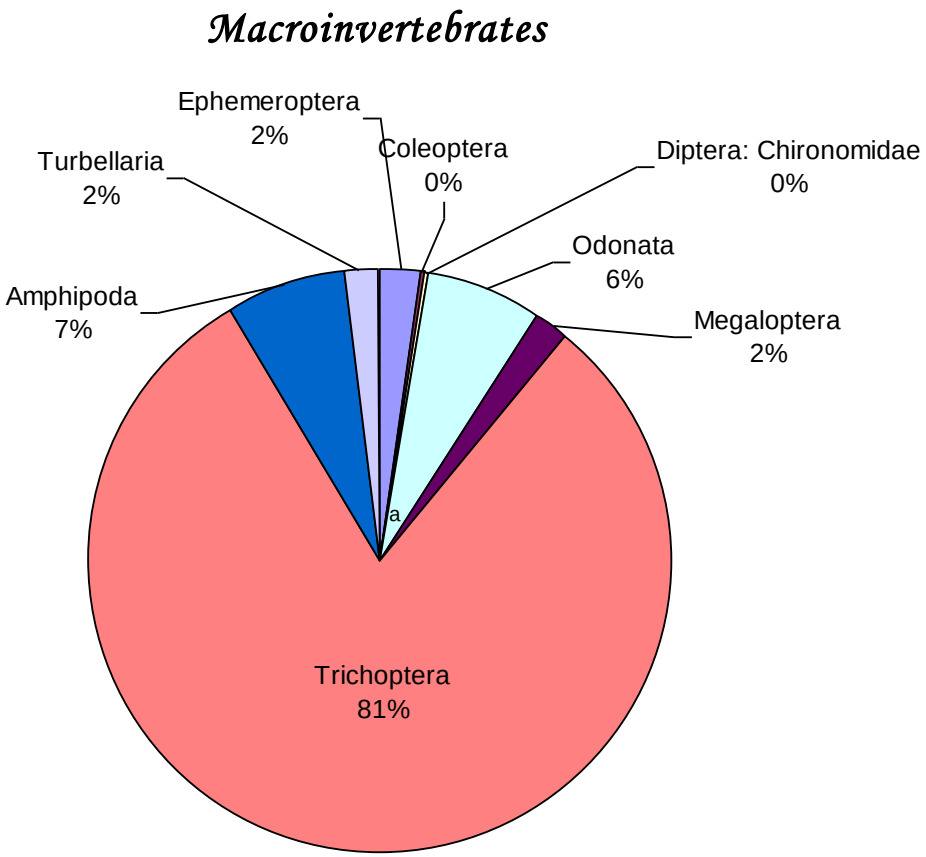
Fecal Coliform Bacteria Test Results

- To see how many colonies exist per 100.0 mL of Second Herring Brook water, we put the water over a medium where they'd grow in a petri dish after incubation
- Sample One: 17 colonies per 100.0mL
- Sample Two: 28 colonies per 100.0mL
- The average number of colonies per 100.0mL (22.5 colonies) shows us that it isn't quite safe to drink from the brook, but it's fine for recreational use.

Macroinvertebrates

- Collected insects twice using the kick method
- Counted and categorized in lab
  - Classified up to Order level
- Most abundant populations:
  - Trichoptera
  - Amphipoda

Macroinvertebrate Population



Data Summary

Depth	Temp *Degrees celsius*	pH Units	Dissolved Oxygen (ppm)	Phosphate Discharge	Nitrate Discharge	MGBI
.2 ft.(avg.) Range: 0-.4 ft.	13.43 (avg.) Range: 13.22-13.71	6.28 (avg.) Range: 6.13-6.59	8.4 ppm (avg.)	37.7 g/day	441 g/day	5.15 *Moderately Impaired*

Class B Waters Suitable For:

- Fish and wildlife habitat
- Primary and secondary contact
- Recreation
- Public water supply w/treatment
- Irrigation/agriculture
- Industrial cooling and process uses
- Aesthetic value

Reasons for Results

- Stream is a safe distance from roads, businesses, and homes.
- No definitive source of pollution in the area other than septic tanks and run-off from roads
- Large population of animals
  - Proof that the ecosystem is healthy and able to sustain life

Limitations

- Human error
- Substantial amount of data originates from LaMotte kits which are not always accurate
- Tests with advanced equipment not sufficiently repeated
- From October 2nd until October 25th our class collected and sorted data on macroinvertebrates and was unable to collect other data
- Sigma 900 failed to collect data hourly at times
  - Repeated some hours, skipped some