

Geneseo



Microbiology of Streams Draining Conesus Lake Watershed: Challenges



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Challenges Facing a Study of this Magnitude

- Technical
- Ecological

Technical Problems Measuring Microbial Quality in Streams

- What to measure?
- How to deal with the scale of the project?
- Are there problems with the samples themselves?

Microbial Quality is Monitored by Measuring Surrogates

- Coliforms
- Fecal Coliforms
- *Escherichia coli*

- Fecal *Streptococci*
- *Enterococci*

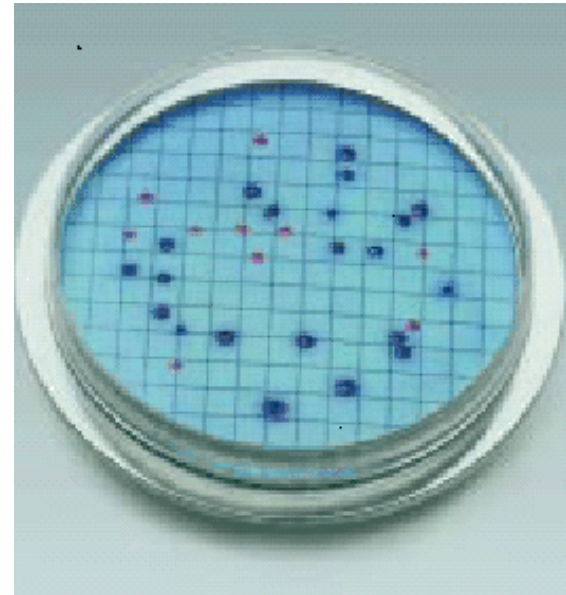
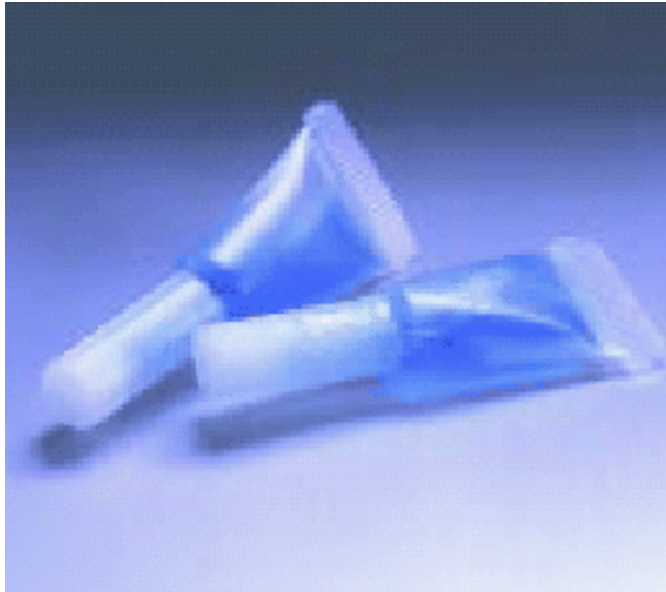
- Total Heterotrophic Bacteria

EPA's Recommended 1986 Water Quality Criteria for Bacteria in Recreational Fresh Water

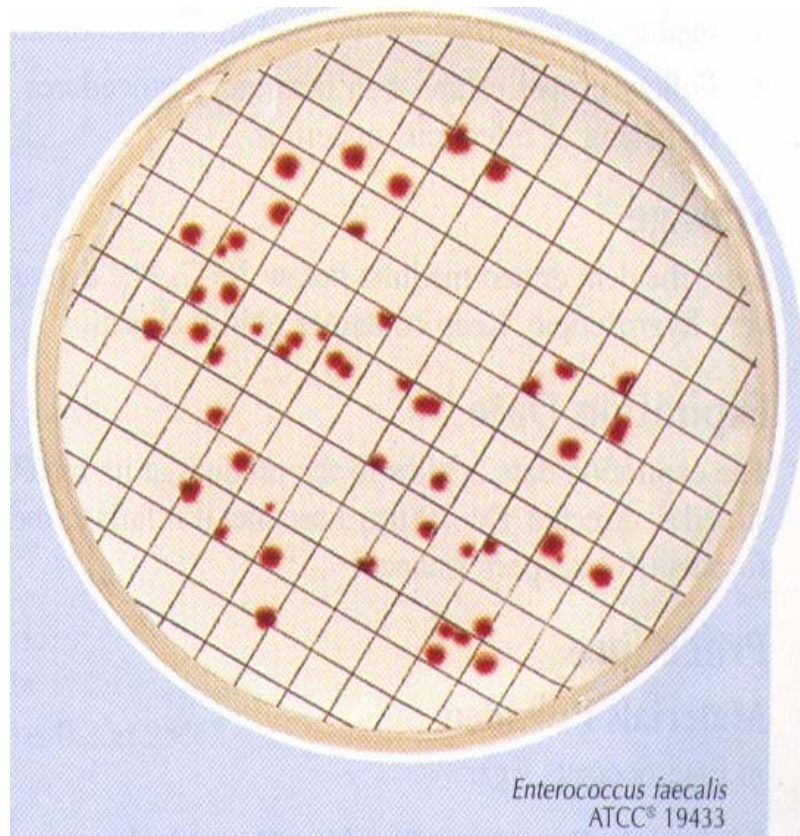


Indicator Bacteria	Illness Rate (per 1000)	Geometric Mean Density	Designated Beach Area	Infrequently Used Full Body Contact
enterococci	8	33	62	151
<i>E. coli</i>	8	126	235	576

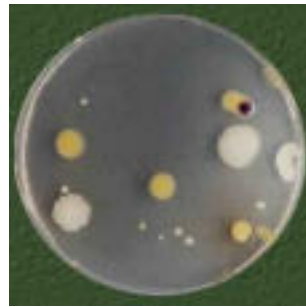
Millipore - mColiBlue24



Enterococcus



Heterotrophic Bacteria Spot Plating on Bacto R2A Agar



Conesus Outlet - Average cfu/ml for growth
on Different Media - 8/06/02

	R2A	TSB	EMB
Up	4,000	1,125	2,170
Down	100,000	66,250	67,000

Spot Plating

Advantages of Spot Plating

Disadvantages of Spot Plating

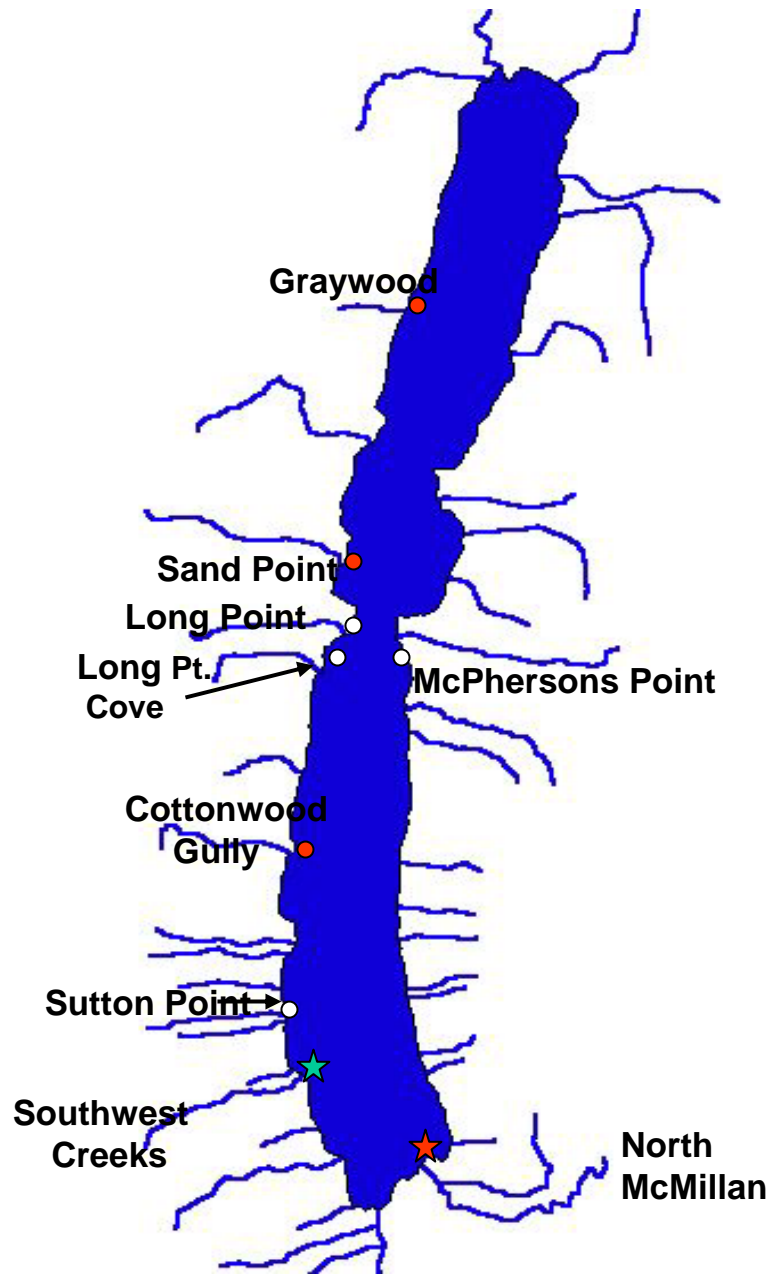
Effects of Storage Temperature on Microbial Counts

	Total Coliforms	<i>E. coli</i>
0 Time	20,881 ± 10,900	2,340 ± 165
24 hr at 25 °C	307,300 ± 81,100	1,925 ± 700
24 hr at 4 °C	30,700 ± 13,800	2,520 ± 490

Results

Two Types of Stream Flow

- Regular Flow (Grab Samples)
- Events



- Experimental sites with weed beds
- Control sites with weed beds
- ★ Experimental site without weed beds
- ★ Control sites without weed beds

Escherichia coli - cfu/100ml

							North
		Sand	Long		Sutton		McMillan
Month - Year	Graywood	Point	Point	Cottonwood	Point	Southwest	Creek
August-02							99
September-02	7,035	4,214	18,400	24	4,350		40
October-02		740		70	196		2
November-02	316	40	40	29	3	57	3
December-02	157	19	61	6	4	18	4
January-03	114	8	15	0	3	0	3
February-03	340	20	34	3	3	14	24
March-03	43	1	1	1	1	1	6
April-03	5	3	2	2	1	2	2
May-03	213	157	259	5	10	44	49
June-03	627	215	320	7	27	28	136
July-03	2,806	1,387	120	121	306	661	214
August-03	862	379	1,200	663	30	249	157
September-03	2,229	873	983	273	135	215	31
October-03	638	11	80	128	6	4	9
November-03	53	40	10	14	3	28	35
December-03	15	8	6	2	2	5	2
Average 2003	662	259	252	102	44	104	56
Median 2003	276	30	57	6	5	21	27

Heterotrophic Bacteria - cfu/ml

							North
		Sand	Long		Sutton		McMillan
Month - Year	Graywood	Point	Point	Cottonwood	Point	Southwest	Creek
August-02							13,334
September-02	109,573	56,524	161,667	30,842	29,808		15,603
October-02		39,158		25,371	5,624		7,936
November-02	45,526	52,233	68,333	75,390	19,770	50,847	16,884
December-02	41,654	66,893	73,351	20,026	5,655	42,098	19,370
January-03	19,389	33,897	38,763	20,259	3,822	9,356	14,414
February-03	181,165	30,729	29,326	19,122	9,544	24,022	36,320
March-03	57,471	73,065	46,025	99,504	21,148	25,690	67,404
April-03	20,257	12,065	27,937	17,883	8,033	17,545	10,962
May-03	18,712	9,238	34,435	3,709	6,108	12,383	6,749
June-03	20,370	17,593	23,800	5,961	5,986	14,429	14,099
July-03	14,818	14,292	5,250	8,225	7,886	7,037	18,111
August-03	37,937	18,447	359,166 (1)	18,043	43,555	18,478	21,451
September-03	79,431	28,492	45,111	13,902	12,998	14,261	15,650
October-03	55,310	24,470	19,927	14,771	4,670	9,128	3,550
November-03	25,941	24,116	19,313	16,348	6,304	12,309	10,489
December-03	23,131	24,915	39,923	15,070	9,655	12,662	10,621
Average 2003	46,161	25,943	29,983	21,066	11,642	14,775	19,152
Median 2003	24,536	24,293	29,326	15,709	7,959	13,461	14,257

Problems in Interpreting the Routine Grab Sample Data

Seasonal Variability

We do not understand in
enough detail the normal
processes that take place in
these streams

Enterococcus - cfu/100ml

							North
		Sand	Long		Sutton		McMillan
Month - Year	Graywood	Point	Point	Cottonwood	Point	Southwest	Creek
August-02							183
September-02	23,751	9,202	9,880	1,037	1,116		974
October-02		4,893		704	80		401
November-02	230	404	80	512	1	80	53
December-02	28	47	174	19	2	151	18
January-03	57	24	6	0	0	3	11
February-03	1,355	47	159	18	4	222	41
March-03	7	9	6	41	1	57	13
April-03	11	12	5	3	1	5	4
May-03	79	71	27	6	44	23	27
June-03	384	199	405	22	21	135	147
July-03	2,968	2,474	640	197	775	1,278	426
August-03	1,919	1,157	400	997	345	789	1,048
September-03	4,059	1,260	3,592	217	225	717	502
October-03	1,773	339	230	92	127	330	132
November-03	86	177	132	38	30	95	55
December-03	84	21	25	6	25	31	4
Average 2003	1065	483	469	136	133	307	201
Median 2003	235	124	145	30	27	115	48

Experimental Sites Marked in red

Events

There are different types of events!

Some events are well understood, others are not.

Manure Spread on Snow Above Graywood - February 2003

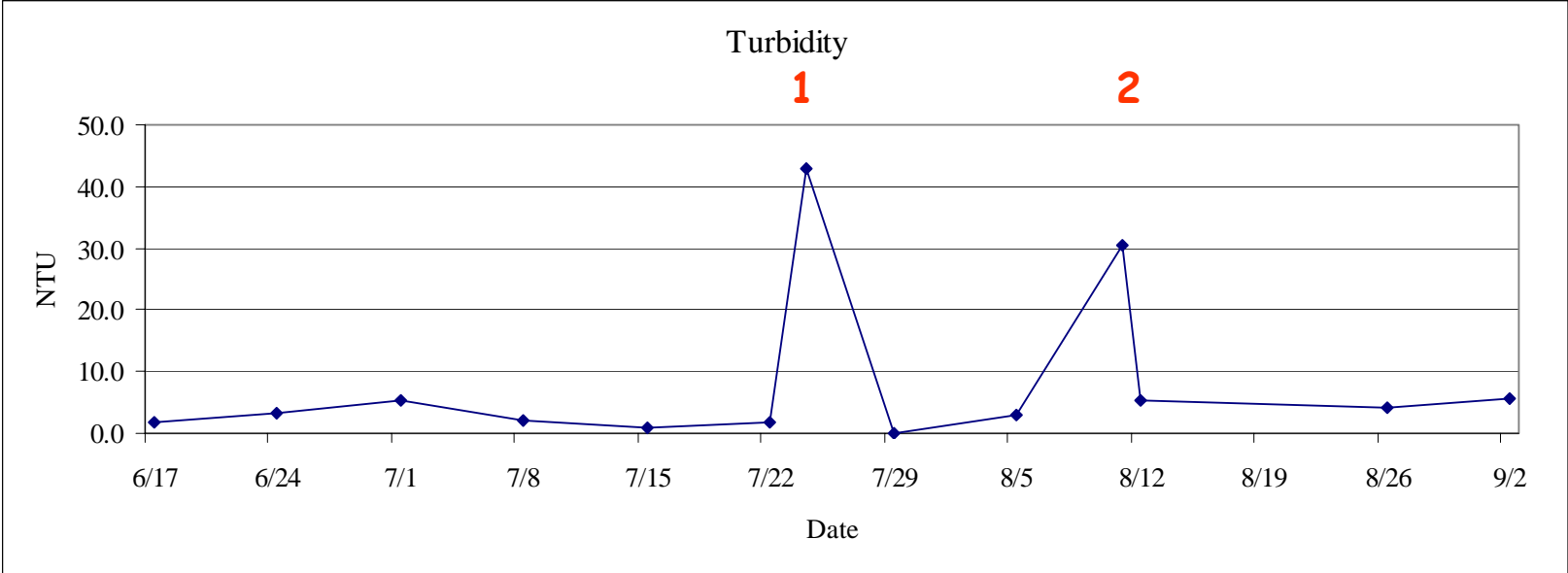


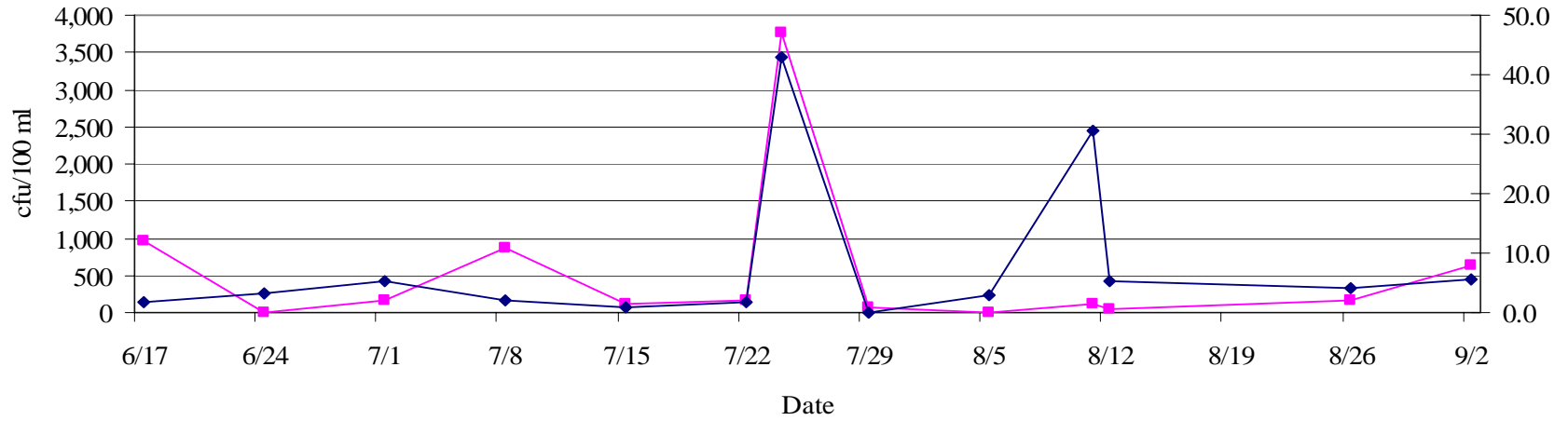
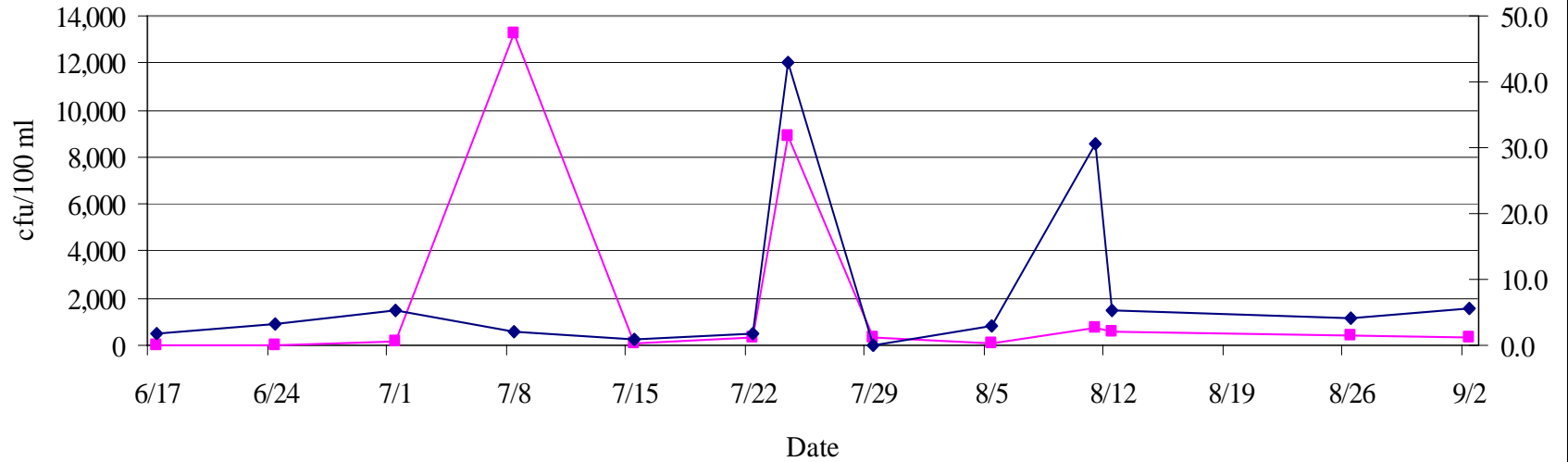
Graywood Gully

Enterococcus
cfu/100 ml

Date	Grab	Event	Event Stage
11/5/02	120		
11/5/02		3,653	Rise
11/5/02		20	Fall
11/5/02		2,133	Grab
11/19/02	420		
11/25/02	240		
12/3/02	0		
12/10/02	0		
12/17/02	440		
12/22/02	520		
12/30/02	80		
12/31/02		11,640	Composite
1/7/03	40		
1/14/03	160		
1/21/03	40		
1/28/07	40		
2/4/03		41,200	Grab
2/5/03		28,400	Fall
2/11/03	80		

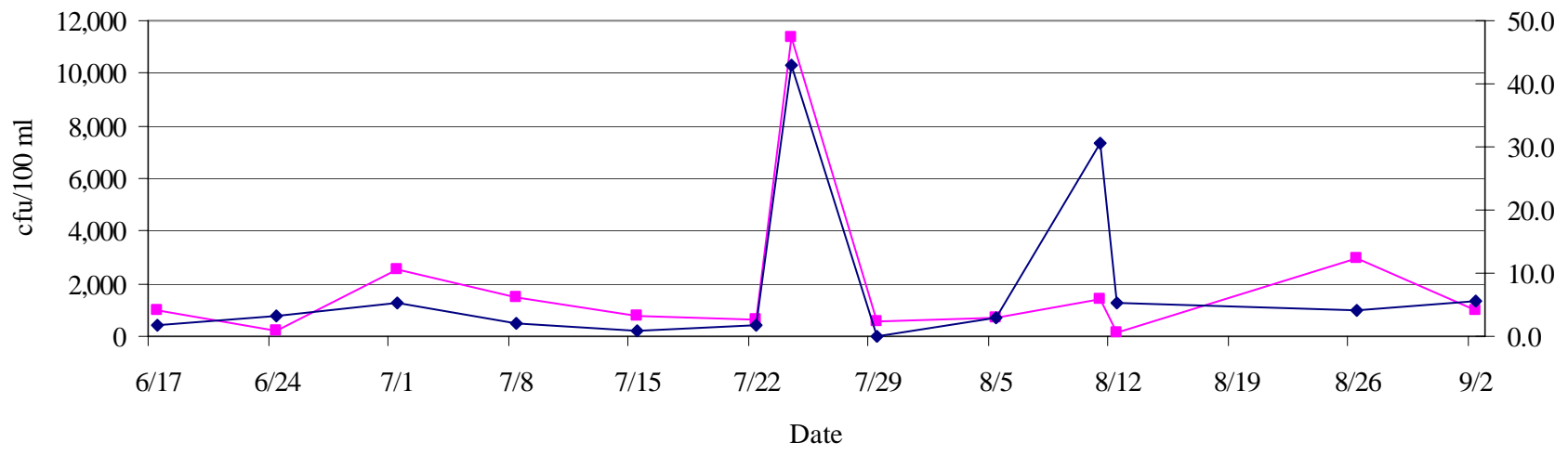
Sutton Point - Two Recorded Events from 6/17/03 - 9/2/03



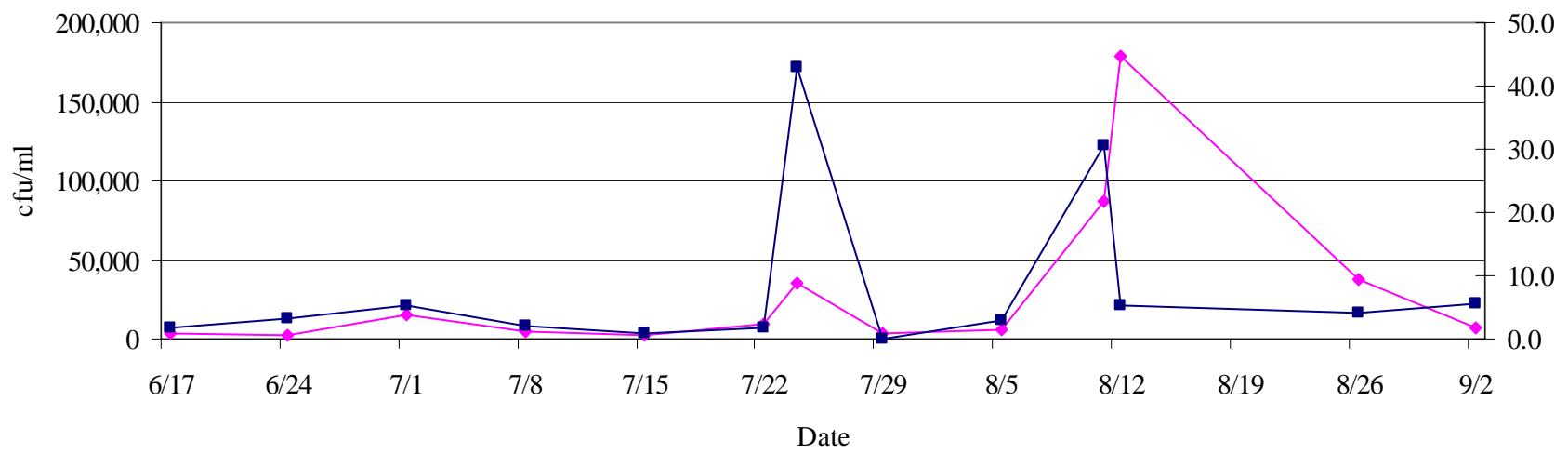
1**2***E. coli**Enterococcus*

1**2**

Total Coliforms



Heterotrophic Bacteria



Conclusions