Setting a Mini-trapnet in Adelmann Pond, Bloomington, Minnesota

Fish Surveys of Ten Stormwater Ponds in Bloomington, Minnesota in 2010

Fish Surveys Conducted:
July and October, 2010

Minnesota DNR Permit Number: 16638

Prepared for:
City of Bloomington, MN
and
Minnesota DNR

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Fish Surveys of Ten Stormwater Ponds in Bloomington, Minnesota, 2010

Summary

Fish surveys for ten Bloomington stormwater ponds (Figure S-1) were conducted in July and October 2010. The objectives of the surveys were two-fold: to characterize the pond fish communities and to evaluate the potential impact of fish on pond water quality.

Fish surveys used mini-trapnets (2x3 foot frames with four hoops and one mouth) with two to four nets were set per pond which were then sampled for the following two days. A summary of pond characteristics and the number of nets set per pond is shown in Table S-1.

Table S-1. Characteristics of ponds that had fish surveys in 2010.

	Minnesota Protected Water ID	Size (ac)	Circular 39 Classification	Number of Mini-Trapnets per Night	Number of Nights	Total Lifts
Bloomington Ponds, Hennepin County						
1. Adelmann	27-1050W	6.6	Type 5	4	2	8
2. Bogen	27-1015W	5.0	Type 5	3	2	6
3. Canterbury Oaks	none	0.8	Type 5	2	2	4
4. Marce Woods, N	none	0.9	Type 4	2	2	4
5. Marce Woods, S	none	1.1	Type 4	2	2	4
6. Nesbitt	none	1.1	Type 5	2	2	4
7. Oxmore	none	2.3	Type 5	3	2	6
8. Round	none	2.5	Type 5	3	2	6
9. Tierney's Woods	none	0.3	Type 5	2	2	4
10. Wanda Miller	27-7W	14	Type 5	4	2	8

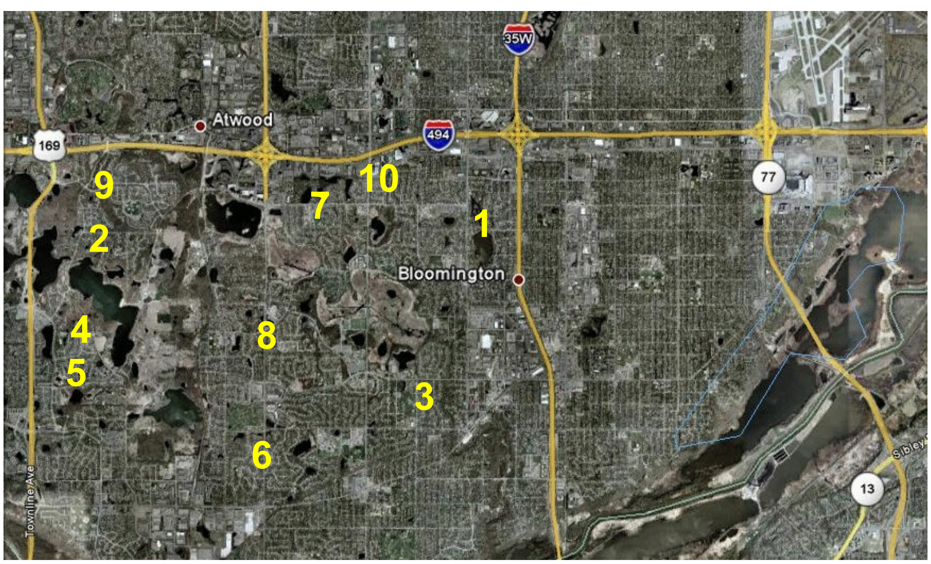


Figure S-1. Stormwater pond locations.

A summary of the number of fish and pounds of fish per net are shown in Table S-2. Up to 4 species of fish were observed in the ponds with Adelmann Pond having the highest diversity. Oxmore Pond had the greatest number of fish per net and Bogen Pond had the highest amount of pounds of fish per net. Fathead minnows dominated the fish community in ponds where they were present. Three ponds (Marce North, Marce South, and Nesbitt) had no fish and one pond (Round) had 1 minnow per net. It appears fish had a water quality impact on Canterbury Oaks and Tierney's Woods Ponds and possibly in Adelmann Pond. Although high numbers of minnows were found in Bogen and Oxmore Ponds, there was also abundant vegetation which may have supported aquatic invertebrates as a food source, keeping minnows from feeding in the sediments and maintaining good water quality.

Table S-2. Summary of mini-trapnet catch rates from ten stormwater ponds in Bloomington, Minnesota. Numbers represent an average of mini-trapnet lifts for that pond.

	Black Bullhead				**Carp**		**Fathead Minnows**		**Green Sunfish**				**Total Fish/Net**		**Total Phos 2010 Summer Average (ug/l)**	**Total Phos Predicted by Modeling (ug/l)**
	0-year		***Adults***						***0-year***		***Adults***					
	#/net	***lbs/ net***	***#/net***	***lbs/ net***	***#/net***	***lbs/ net***	***#/net***	***lbs/ net***	***#/net***	***lbs/ net***	***#/net***	***lbs/ net***	***#/net***	***lbs/ net***		
Adelmann			3	0.6	1	0.6	256	0.7	11	2.1	0.3	T	270	4.0	162	123
Bogen							1,671	12.1					1,671	12.1	51	109
Canterbury Oaks							1,430	6.8			1.0	T	1,430	6.8	302	134
Marce N													0	0	239	156
Marce S													0	0	572	146
Nesbitt													0	0	163	134
Oxmore							1,810	7.0					1,810	7.0	53	77
Round							5.5	0.03					5.5	0.03	126	86
Tierney's							1,028	4.1					1,028	4.1	278	121
Wanda Miller	0.5	T	13.5	1.5			65	0.3			38.1	4.0	117	5.8	41	103

Figure S-1. Fathead minnows, *Pimephales spp*, were the dominant fish found in the Bloomington ponds where fish were present.

Introduction

Fish surveys for ten stormwater ponds located within the City of Bloomington were conducted in July and October, 2010. The objectives were two-fold. The first objective was to characterize the fish communities in the ponds and the second objective was to evaluate the potential impact of fish on pond water quality.

Pond characteristics are summarized in Table 1 and pond locations are shown in Figure 1.

Table 1. Stormwater pond characteristics.

Map Number in Figure 1	Name of Pond	MnDNR Protected Wetland Number	Size (ac)	Average Depth (ft)
1	Adelmann	27-1050W	6.6	2.6
2	Bogen	27-1015W	5.0	2.5
3	Canterbury Oaks	none	0.8	1.8
4	Marce Woods N	none	0.9	1.5
5	Marce Woods S	none	1.1	2.0
6	Nesbitt	none	1.1	3.5
7	Oxmore	none	2.3	3.0
8	Round	none	2.5	4.5
9	Tierney's Woods	none	0.3	3.0
10	Wanda Miller	27-7W	14	3.0

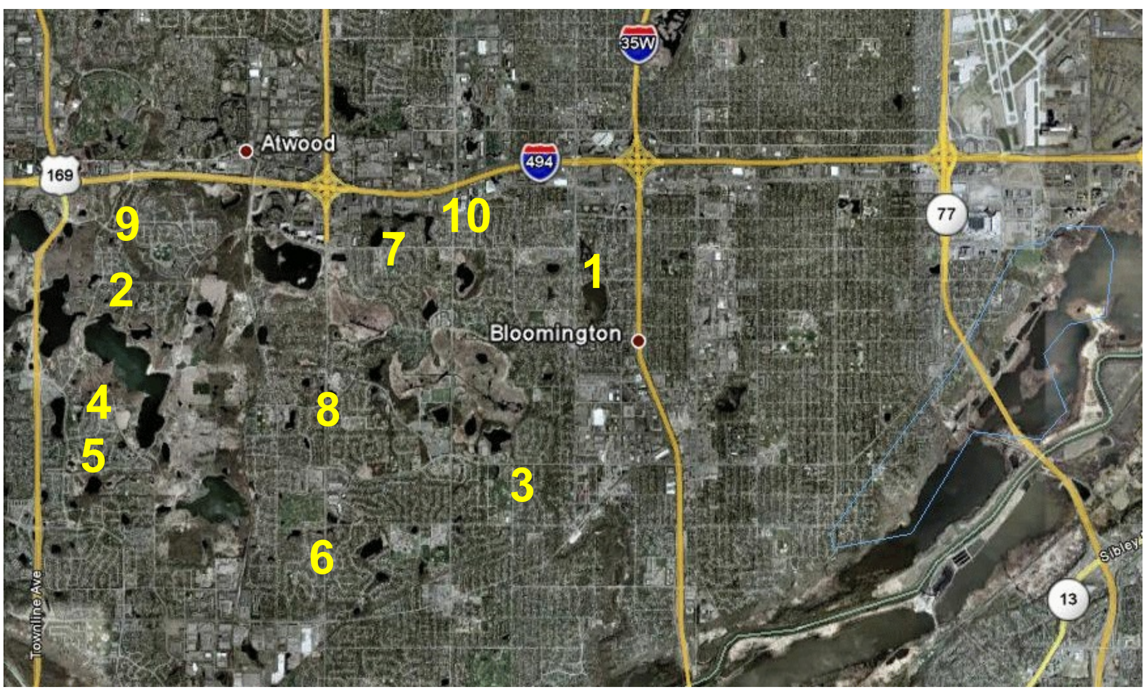


Figure 1. Stormwater pond locations all within the City of Bloomington, Minnesota.

Methods

Fish were surveyed using mini-trapnets that consisted of 2x3 foot frames with four hoops and one mouth with a 25-foot lead (Figure 2). The mesh size was 3/16 inches. Depending on the size of the pond, either 2, 3, or 4 nets were set in mid-day and then sampled the following two days (Table 2).

Adult fish were measured and weighed in the field and released. Minnows and young of the year fish were weighed in bulk in the field and a subsample of up to 50 fish was preserved and in the lab, individual fish were weighed and measured.

Table 2. Number of mini-trapnets set for each pond.

	Minnesota Protected Water ID	Size (ac)	Circular 39 Classification	Number of Mini-Trapnets per Night	Number of Nights	Total Lifts	Survey Dates (2010)
Bloomington Ponds, Hennepin County							
1. Adelmann	27-1050W	6.6	Type 5	4	2	8	Sept 30, Oct 1, 2
2. Bogen	27-1015W	5.0	Type 5	3	2	6	Oct 13 - 15
3. Canterbury Oaks	none	0.8	Type 4	2	2	4	Oct 13 - 15
4. Marce Woods, N	none	0.9	Type 4	2	2	4	July 12 - 14
5. Marce Woods, S	none	1.1	Type 4	2	2	4	July 12 - 14
6. Nesbitt	none	1.1	Type 4	2	2	4	July 12 -14
7. Oxmore	none	2.3	Type 4	3	2	6	Oct 6 - 8
8. Round	none	2.5	Type 4	3	2	6	Oct 6 - 8
9. Tierney's Woods	none	0.3	Type 4	2	2	4	Oct 13 - 15
10. Wanda Miller	27-7W	14	Type 5	4	2	8	Sept 30, Oct 1, 2

Figure 2. A mini-trapnet set in Adelmann Pond in 2010.

Fish Survey Results for 2010

Ten Bloomington stormwater ponds, ranging in size from 0.3 acres to 6.6 acres, had fish surveys conducted in July and October, 2010. A summary of the number of fish and pounds of fish per net are shown in Table 3. Up to 4 species of fish were observed in the ponds with Adelmann Pond having the most species. Oxmore Pond had the highest number of fish and Bogen Pond had the highest amount of pounds of fish per net. Fathead minnows dominated the fish community in ponds where they were present. Three ponds (Marce North, Marce South, and Nesbitt) had no fish and one pond (Round) had 1 minnow per net. The average weights and lengths of individual young-of-the -year bullheads and carp and for minnows are shown in Table 4.

Table 3. Summary of trapnet catch rates from ten stormwater ponds. Numbers represent an average of trapnet lifts.

	Black Bullhead				Carp		Fathead Minnows		Green Sunfish				Total Fish/Net		Total Phos (Jun, Jul, Aug) ug/l
	0-year		*Adults*						*0-year*		*Adults*				
	#/net	*lbs/ net*	*#/net*	*lbs/ net*	*#/net*	*lbs/ net*	*#/net*	*lbs/ net*	*#/net*	*lbs/ net*	*#/net*	*lbs/ net*	*#/net*	*lbs/ net*	
Adelmann			3	0.6	1	0.6	256	0.7	11	2.1	0.3	T	270	4.0	162
Bogen							1,671	12.1					1,671	12.1	51
Canterbury Oaks							1,430	6.8			1.0	T	1,430	6.8	302
Marce N													0	0	239
Marce S													0	0	572
Nesbitt													0	0	163
Oxmore							1,810	7.0					1,810	7.0	53
Round							5.5	0.03					5.5	0.03	126
Tierney's Woods							1,028	4.1					1,028	4.1	278
Wanda Miller	0.5	T	13.5	1.5			65	0.3			38.1	4.0	117	5.8	41

Table 4. Average weight of individual fish (in grams) for 2010.

	Black Bullhead (g)	Carp (g)	Fathead Minnows (g)
Adelmann	90 (n=10)	270 (n=8)	1.37 (n=45)
Bogen			3.29 (n=46)
Canterbury Oaks			2.14 (n=50)
Oxmore			1.75 (n=51)
Round			
Tierney's Woods			1.82 (n=50)
Wanda Miller	45 (n=20)		

Individual Net Results: Ten ponds were sampled in 2010 but only seven ponds had fish. The dominant fish were fathead minnows (Table 5). Bogen, Oxmore, and Tierney's Woods Ponds only had a single species which was fathead minnows. Wanda Miller Pond averaged 38 green sunfish per net which is fairly high.

Table 5. Fish numbers and fish biomass for individual trapnets for six Bloomington Ponds.

	Adelmann												Bogen										Canterbury Oaks							
	Net 1		Net 2		Net 3		Net 4		Totals		Fish/net		Net 1		Net 2		Net 3		Total		Fish/net		Net 1		Net 2		Total		Fish/net	
	n	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*
Day 1																														
Black Bullhead																														
Carp					4	3.3			4	3.3	1	0.83																		
Fathead	150	0.5	330	1.0	265	0.8	132	0.4	897	2.5	224	0.63	1310	9.5	2,620	19	758	5.5	4,688	34	1,563	11.3	1,905	9.0	1,695	8	3,600	17	1,800	8.5
Green Sunfish			5	0.5					5	0.5	1.3	0.13											3	T					1.5	0.2
Young-of-year sunfish	30		15		24		8		77	4.3	11	2.1																		
Crayfish			1		6				7		1.8																			
Painted turtle															1		1		2		0.7									
Day 2																														
Black Bullhead			18	3.0	5	1.5	1	0.3	24	4.8	6	1.2																		
Carp			4	1.5					4	1.5	1	0.38																		
Fathead	100	0.2	660	2.0	330	1.0	60	0.1	1,150	3.3	287	0.83	3,030	22	2,340	17	3,310	24	8,680	63	2,893	21	1,165	5.5	955	4.5	2,120	10	1,060	5.0
Green Sunfish					2	0.2			2	0.2	0.5	0.05													1	T			0.5	T
Young-of-year sunfish					18	1.5			18	1.5	4.5	0.38																		
Crayfish	1								1		0.3																			
Painted turtle													1						1		0.3									

	Oxmore										Tierney's Wood								Wanda Miller											
	Net 1		Net 2		Net 3		Total		Fish/net		Net 1		Net 2		Total		Fish/net		Net 1		Net 2		Net 3		Net 4		Totals		Fish/net	
	n	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*	*n*	*lbs*
Day 1																														
Black Bullhead																					54	2.0	7	2.5	4	1.0	65	5.5	16.3	1.4
Carp																														
Fathead	1,035	4.0	2,850	11.0	78	0.3	3,963	15.3	1,321	5.10	875	3.5	500	2.0	1,375	5.5	688	2.8	4	T	7	T	68	0.3	50	0.22	119	0.6	30	0.2
Green Sunfish																					30	6.0	118	7.0			148	13	37	3.3
Young-of-year sunfish																					105		12				117			
Crayfish	1						1		0.3																					
Painted turtle	1						1		0.3																					
Day 2																														
Black Bullhead																					12	3.5	16	2.0	5	1.2	43	6.7		
Carp																														
Fathead	2,075	8.0	160	0.6	4,665	18	6,900	26.6	2,300	8.87	1,990	8.0	750	3.0	2,740	11.0	1,370	5.5	4	T	12	0.05	204	0.9	180	0.8	400	1.8	100	0.5
Green Sunfish																					87	7.0	108	8.0	62	4.0	157	19	39	4.8
Young-of-year sunfish																														
Muskrats																							2		2		4		1	

Marce-North: no fish;
Marce - South: no fish;
Nesbitt: no fish;
Round: 6 minnows/net

Table 6. Length frequencies for bullheads, green sunfish, and carp.

Total Length (inches)	Adelmann			Wanda Miller		
	Black Bullhead	Green Sunfish	Carp	Black Bullhead	Green Sunfish	Carp
2						
2.5						
3				1	1	
3.5						
4	1			9		
4.5	1			2	1	
5	4		2	3	19	
5.5	2	1		3	28	
6	4	3		13	29	
6.5	6	2		3	4	
7	3	1		1		
7.5	1			2		
8	1			5		
8.5			1			
9	2		1	2		
9.5			1			
10						
11			1			
12				1		
13						
14			2			
Total	25	7	8	45	82	0

Table 7. Representative minnow lengths and weights from a subsample of the net catch.

	Sample Size	Length (in)	Standard Deviation	Weight (g)	Standard Deviation
Adelmann	45	1.82	0.32	1.37	0.71
Bogen	46	2.47	0.27	3.29	1.12
Canterbury Oaks	50	2.09	0.44	2.14	1.16
Oxmore	51	2.09	0.31	1.75	0.94
Tierney's Woods	50	2.02	0.39	182	0.94

Representative Fish Conditions in Surveyed Ponds

Adelmann (bullheads, carp, minnows, green sunfish)

Bogen (fathead minnows only species)

Canterbury Oaks (fathead minnows and green sunfish)

Oxmore (fathead minnows only species)

Tierney's Woods (fathead minnows only species)

Wanda Miller (green sunfish dominated)

Representative Fish Conditions in Surveyed Ponds

Marce Woods N (no fish)

Marce Woods S (no fish)

Nesbitt (no fish)

Round (fish were scarce)

Aquatic Plant Status in Surveyed Ponds

Prior to fish surveys, the hypothesis was that fish may be inhibiting submerged plant growth in some ponds. In Canterbury Oaks and in Tierney's Woods submerged plants were sparse and aquatic plants are likely limited by fish activities. However four ponds that had few or no aquatic plants also had few or no fish (Marce Woods N and S, Nesbitt and Round). For three of the ponds, Marce Woods North and South, and Nesbitt, the water surface was covered with nearly 100% duckweed and watermeal which probably has shaded out and inhibited submerged plant growth. In Round Pond, surface duckweed coverage was not extensive and few fish were found, still there was no submerged plant growth. Something else is likely inhibiting plant growth in Round Pond.

Table 8. Aquatic plant treatment methods, aquatic plant coverage, and dominant plants observed in the Bloomington ponds for 2010. Green shading indicates 90-100% coverage with duckweed or watermeal. Red shading indicates no submerged aquatic plants observed.

Pond Name	Pond Surface Area (ac)	Average Depth (ft)	Max Depth (ft)	Treatment Notes	% Surface Coverage			Dominant Submerged Plants		
					June 22-24, 2010	July 26, 2010	August 23, 2010	June 22-24, 2010	July 26, 2010	August 23, 2010
1. Adelmann	6.6	2.6	3.7	--	85%	15% DW	0%	sago (10%)	stringy pondweed (15%)	coontail, elodea (15%)
4. Bogen	5	2.5	4.2	--	30% FA 30% DW 5%	50% - 1st basin 5% - 2nd basin	1% DW	coontail, nitella (80%)	coontail -1, stringy -3 (80% overall)	stringy pondweed
6. Canterbury Oaks	0.84	1.8	4.5	Barley straw	--	0%	0%	No plants	No plants	No plants
10. Marce Woods, N	0.85	1.5	3.5	Barley straw	80% WM	90% DW	95% DW	No plants	No plants	No plants
11. Marce Woods, S	1.12	2	6	Sonar, Galleon	100% DW	100% DW, WM	50% WM	No plants	No plants	No plants
13. Nesbitt	1.13	3.5	5.5	Barley straw, skimming	75% DW	95% DW	100% DW	No plants	No plants	No plants
14. Oxmore	2.29	3	6.2	Symmetry (July 7)	2% FA	0%	0%	chara; coontail; sago (50%)	naiads-stringy (60%overall)	stringy pondweed (60%)
18. Round	2.49	4.49	5.83	Barley straw	15-20% DW, WM	40% DW	25% WM	No plants	No plants	No plants
23. Tierney's Woods, NW	0.28	3	4.2	Barley straw	0%	0%	0%	coontail	chara (20%)	naiads, stringy (20%)
26. Wanda Miller	14	3	5	Avocet, cutting	65% WL, DW	20% - FA 50% - WL	50% WL	cabbage; coontail; floatingleaf; stringy	coontail; elodea; stringy	cabbage, coontail, milfoil (80%)

* CLP = curlyleaf; DW = duckweed; FA = filamentous algae; pw = pondweed; WL = white lilies; WM = watermeal

Figure 3. Eurasian watermilfoil was observed in Bogen Pond in October 2010.

What Are the Fathead Minnows Eating?

The dominant fish in all ponds with fish were fathead minnows. It appears there is a correlation between what the minnows eat and the coverage of aquatic plants and total phosphorus. In two ponds with extensive submerged plant coverage (Bogen and Oxmore) minnows were feeding in the water column and phosphorus was low (Table 9). In the two ponds with little or no submerged plants, minnows were feeding in the sediments and phosphorus concentrations were higher (Table 9).

Table 9. Stomach contents of fathead minnows that were collected from four Bloomington ponds.

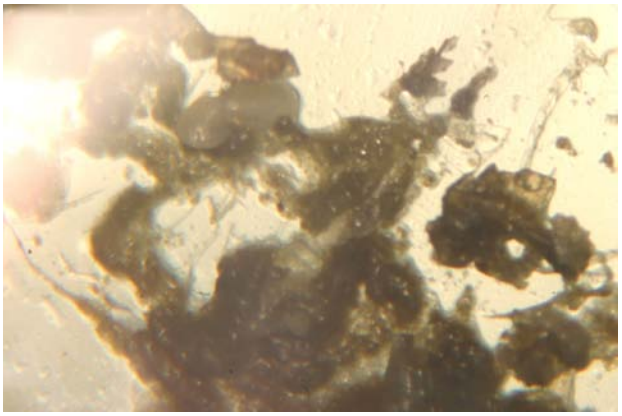
Length (in)	BOGEN (TP = 51 ppb, macrophyte coverage = 80%)				
	Plants	Detritus	Zooplankton	Insects	Nothing
3	decaying plants	small granules and OM			
2.6					
2.5	min. amt. of plant				
2.8	stringy plant parts		body parts		
2.5			daphnia body parts		
2.6					empty
2.6	stringy plant parts		body part signs (5)		
3				bug w/ segmented body parts	
2.25	plant filament	decomposed matter			
2.6	stringy filament	decomposed matter			
2.6					empty
1.9					empty
2.3	clear sign of plants decaying				
2.4			possible but too decomposed	winged insect	
2.2					empty

Length (in)	OXMORE (TP = 53 ppb, macrophyte coverage = 60%)				
	Plants	Detritus	Zooplankton	Insects	Nothing
2.0		small amt. sand grains			
2.1			zooplankton remains		
2.2				insect parts (80%)	
2.2		sand like grains and dark matter	some zooplankton remains		
1.9			zooplankton remains		
2.1		black/grainy material	possible zoop remains		
2.1	Stringy plant parts	black grainy material			

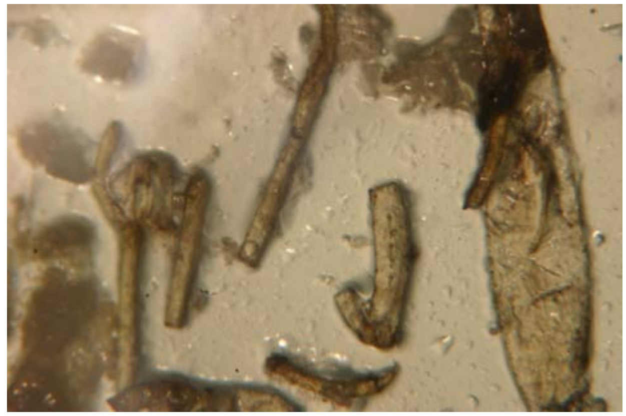
Length (in)	CANTERBURY (TP = 302 ppb, macrophyte coverage = 0%)				
	Plants	Detritus	Zooplankton	Insects	Nothing
2.7		dark OM small grain size			
1.5					empty
1.4		95% full dark OM no zoop signs			
2.5					empty
2.2		small black granules			
2.4		black material no organisms			
1.4					empty
2.25	stringy plant parts	small amt of decomposed material			
2.2		gut 50% full dark small grain			
2	stringy plant w/ leaf	dark small grained material			
2.1					empty
2.2		detritus OM nothing else			

Length (in)	TIERNEY'S WOODS (TP = 278 ppb, macrophyte coverage = 20%)				
	Plants	Detritus	Zooplankton	Insects	Nothing
2.4	Stringy plant material		mucus membrane remains		
2.5	Plant filaments	decomposed matter			
2.5	Plant/algae material				
2.2		small grained dark matter			
2.3			zoop remains		
2.1					nothing
2.3	Plant stems, stringy and bleached				

Fathead Minnow Stomach Contents: Photographs of minnow stomach contents show that in Bogen and Oxmore Ponds, fish were feeding on insects and zooplankton, indicating they were feeding in the water column. In Tierney's Woods, contents were composed of mostly detritus material indicating minnows were feeding in the sediments (Figure 4).



Bogen



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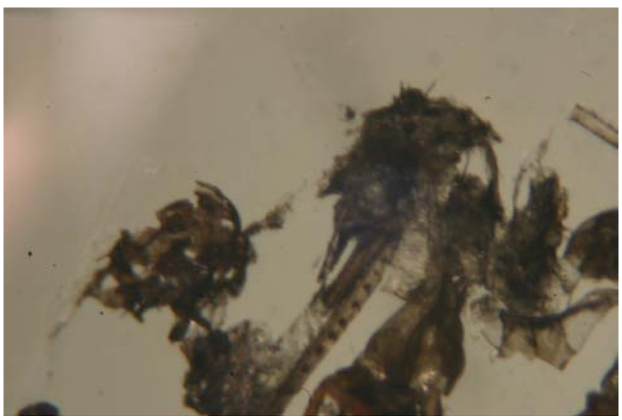
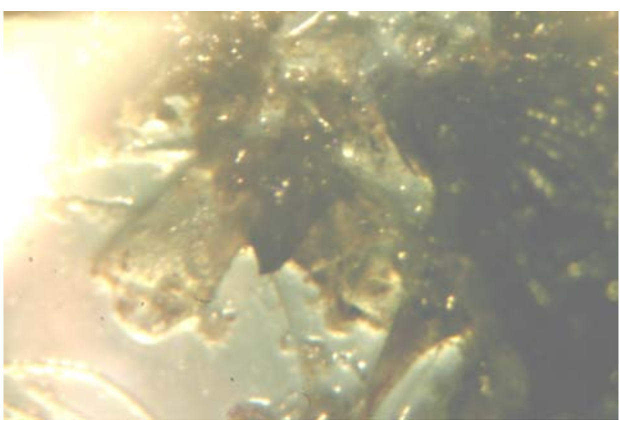
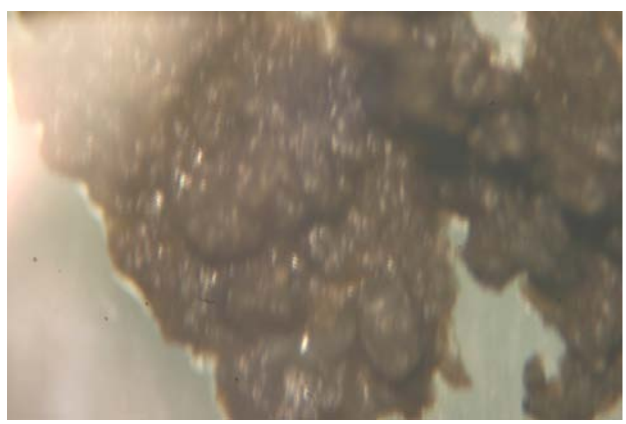


Oxmore

Oxmore



Tierney's Woods



Tierney's Woods

Figure 4. Photographs of minnow stomach contents.

Interpreting Water Quality Results for 2010 Based on Fish And Forage Availability

Along with fish surveys and plant surveys, water quality was sampled in the ten ponds in 2010 (Table 10). Total phosphorus concentrations in the ponds ranged from 41 ppb (Wanda Miller) to 572 (Marce S). A variety of factors influence phosphorus concentrations in ponds and fish can be a significant force (Williams et al 2002, Vanni 2002, Zimmer et al 2001).

Ponds can accommodate high fish densities if fish are feeding in the water column and merely recycling nutrients compared to feeding in the sediments where nutrients in the detritus are translocated into the water column. Fish in three ponds in this study probably were feeding in the water column. The three ponds were Bogen, Oxmore, and Wanda Miller (Table 10). Fish in two ponds, Canterbury Oaks and Tierney's Woods, were likely feeding in the sediments and water quality was poor as would be predicted by Zimmer et al 2001. Adelmann Pond may have had some bottom-feeding fish influence on water quality. In two ponds without fish, Marce Woods North and South, elevated nutrients may have originated from watershed inputs or phosphorus release from pond sediments.

Table 10. Stormwater pond phosphorus, plants, and fish characteristics.

	Size (ac)	2010 Total Phosphorus (ppb)	Predicted Total Phosphorus (ppb)	Number of fish/net	Pounds of fish/net	Submerged Aquatic Plant Coverage	Duckweed	Dominant Food Found in Fish Stomach	Potential Fish Impacts
Adelmann	6.6	162	123	270	3.4	15%	15%	ND	Moderate
Bogen	5.0	51	109	1,671	12.1	80%	5%	Plants and zooplankton	Low
Canterbury Oaks	0.8	302	134	1,430	6.8	0%	0%	Detritus	High
Marce N	0.9	239	156	0	0	0%	90%	--	No
Marce S	1.1	572	146	0	0	0%	100%	--	No
Nesbitt	1.1	163	134	0	0	0%	80%	--	No
Oxmore	2.3	53	77	1,800	7.0	60%	0%	Zooplankton	Low
Round	2.5	126	86	5.5	0.03	25%	0%	--	Low
Tierney's Woods	0.3	278	121	1,028	4.1	20%	0%	Plants, detritus, zooplankton	High
Wanda Miller	14.0	41	103	117	5.8	5%	80%	ND	Low

Mechanisms of How Fish Impact Aquatic Plants: Fathead minnow can affect aquatic plants in a number of ways and a list is shown below (from Williams et al 2002 and Vanni 2002). It is likely several of these mechanisms are occurring in Bloomington ponds where high densities of fish are present.

1. Fish feeding in root crowns of aquatic plants looking for invertebrate prey, uproot plants.

2. Resuspended sediments release nutrients into the water column causing algae blooms.

3. Shading from suspended sediments inhibits plant growth.

4. Resettled sediment can smother young plants.

5. Fish reduce large bodied zooplankton, reducing grazing pressure on algae and allowing algae to increase in density. Shading from algae inhibits plant growth.

6. Fish excrete nitrogen which favors epiphyte growth, which smothers plants (creates O_2 and pH regimes not favorable to plants).

7. Fish reduce macroinvertebrates, thus reducing their grazing effects on epiphytes allowing epiphytes to increase on aquatic plants.

8. Fish translocate phosphorus from the sediments into the water column by excretion, producing algae growth which creates turbid conditions.

9. Fish may eat plants.

10. As plants decline, zooplankton lose a hiding refuge and are more easily preyed upon.

11. Once plants are gone, fish activities keep plants from returning. Fish predation on zooplankton reduces grazing on algae, fish feeding in the sediments translocates phosphorus to the water column, and fish feeding in newly sprouted aquatic plant root crowns which uproots plants in the process are three activities that will continue to limit aquatic plant reestablishment.

Minnow Influences: In small lakes and ponds in the prairie pothole region (PPR) minnows play an important role in the food web. Fathead minnows and brook stickleback, two common types of minnows provide predators (piscivores) with great forage, as even juvenile predators are able to feed on adult minnows. In systems with predators, the prey are usually scarce and can often limit growth of maturing predators.

But if minnow colonization occurs without predators due to winterkill or without any predator introduction, what limits minnows' growth? It is probably food. Minnows typically feed on plants, zooplankton, and invertebrates but when the population gets high enough the immediate food sources can be eliminated and minnows will feed in pond sediments looking for macroinvertebrates, and ingesting detritus as well. In extreme numbers minnows have great potential to influence phosphorus cycling in wetlands (Zimmer et al. 2001). In a lake without a piscivore population, minnows and other non-predator fish are able to reproduce without pressure. Multiple spawns throughout the summer coupled with high recruitment and growth rates make a very productive minnow community. This high production can speed the turnover of phosphorus through the minnows and lead to and increase of available phosphorus and chlorophyl a.

Winterkill Influences: In ponds that are connected with storm sewer pipes, some fish are able to survive over the winter even though the shallow nature of the ponds would seem to dictate against it. There must be some refuges with oxygen that the fish find. However, refuges are not foolproof, and not all fish make it.

It appears bullheads and minnows are able to survive the low oxygen and low water conditions. Sunfish and gamefish predators do not overwinter as well as bullheads and minnows.

Based on shallow lake ecology, most of the ten ponds in this survey are 2 to 4 feet deep and are not deep enough to overwinter fish. In fact, they should freeze from top to bottom. Any fish that survive must be finding a refuge to make it through the winter. It appears stormwater culverts may be a winter refuge. Some culverts that go under roads are probably below the frost line. Water would not freeze and the open water could become somewhat re-aerated to support some fish life. Another possibility is that ponds with emergent vegetation such as cattails may get aeration from the transfer of atmospheric oxygen down a stalk to pond water. Neither of these possibilities have been tested and should be investigated.

Water Quality Responses: A range of water quality conditions were found in the ten ponds in 2010. With two of the ponds, Canterbury Oaks and Tierney's Woods, there was a correlation of fish biomass, total phosphorus, and no submerged plants. In ponds without plants, it appears as fish biomass increases total phosphorus increases and if fish biomass decreases, total phosphorus decreases. In ponds with significant aquatic plants, like Bogen and Oxmore, ponds can accommodate high fish densities and still maintain good water quality. Of course, ponds also have a variety of other factors influencing total phosphorus concentrations in the water column.

References

Vanni, M. J. 2002. Nutrient cycling by animals in freshwater ecosystems. Annual Review of Ecology and Systematics. 33: 341-370.

Williams, A. E., Moss, B., and J. Eaton. 2002. Fish induced macrophyte loss in shallow lakes: top-down and bottom-up processes in mesocosm experiments. Freshwater Biology 47: 2216-2232.

Zimmer, K. D., Hanson, M. A., and M. Butler. 2001. Effects of fathead minnow colonization and removal on a prairie wetland ecosystem. Ecosystems 346-357.

APPENDIX

Appendix A: MnDNR Notification of fish survey activities in five ponds (sent by email)

Appendix B: Apple Valley Stormwater Pond Fish Survey Results for 2007 and 2008

Appendix A

From: Steve McComas [mailto:mccomas@pclink.com]
Sent: Monday, October 11, 2010 2:09 PM

To: Daryl Ellison; Scott Carlson
Cc: Bryan Gruidl
Subject: Bloomington Pond fish surveys starting October 13

Hello All,

Steve McComas of Blue Water Science will be conducting fish surveys in three Bloomington ponds (Hennepin Co): Bogen Pond - 27-1015W (5 acres), Canterbury Oaks Pond (0.8 acres), and Tierney's Wood Pond (0.3 acres) starting on Wednesday, October 13, 2010 and finishing on Friday, October 15. We will set between 2 to 4 mini-fyke nets in each pond. All fish will be weighed and measured and returned to the pond. The fish surveys are sponsored by the City of Bloomington. These surveys are conducted under MnDNR permit number 16638.

Thank you,

Steve McComas
BLUE WATER SCIENCE
550 South Snelling Avenue
St. Paul, MN 55116
651 690 9602
mccomas@pclink.com

From: Steve McComas [mailto:mccomas@pclink.com]
Sent: Monday, October 04, 2010 11:24 AM

To: Daryl Ellison; Scott Carlson
Cc: Bryan Gruidl; Daryl Jacobson; Jeff Kehrer
Subject: Fish surveys on Alimagnet Lake and Bloomington Ponds

Hello All,

Steve McComas of Blue Water Science will be conducting fish surveys in Alimagnet Lake (Dakota County) and two Bloomington ponds (Round Pond and Oxmore Pond, Hennepin County) during the week of Oct 5-8. The Alimagnet Lake fish survey starts on Tuesday, October 5, 2010 and finishes on Friday, October 8. We will set 6 fyke nets. All fish will be weighed and measured and returned to the lake. The fish surveys are sponsored by the Cities of Apple Valley and Burnsville. This survey is conducted under MnDNR permit number 16638.

Bloomington pond fish surveys in Round and Oxmore Ponds will start on Wednesday October 6 and finish on Friday October 8. We will set 3 to 4 mini-fyke nets in each pond. All fish will be weighed and measured and returned to the ponds. The fish surveys are sponsored by the City of Bloomington. This survey is conducted under MnDNR permit number 16638.

Thank you,

Steve McComas
BLUE WATER SCIENCE
550 South Snelling Avenue
St. Paul, MN 55116
651 690 9602
mccomas@pclink.com

From: Steve McComas [mailto:mccomas@pclink.com]
Sent: Tuesday, September 28, 2010 1:30 PM

To: 'daryl.ellison@dnr.site.mn.us'; 'scott.carlson@state.mn.us'
Cc: Bryan Gruidl
Subject: Bloomington Ponds fish surveys staring September 30

Hello All,

Steve McComas of Blue Water Science will be conducting fish surveys in two Bloomington ponds (Hennepin County), starting on Thursday, September 30, 2010 and finishing on Saturday, Oct 2. We will set between 2 to 4 mini-fyke nets in each pond. All fish will be weighed and measured and returned to the pond. The fish surveys are sponsored by the City of Bloomington. This survey is conducted under MnDNR permit number 16638.

Thank you,

Steve McComas
BLUE WATER SCIENCE
550 South Snelling Avenue
St. Paul, MN 55116
651 690 9602
mccomas@pclink.com

Steve McComas

From: "Steve McComas" <mccomas@pclink.com>
To: "Daryl Ellison" <Daryl.Ellison@dnr.state.mn.us>; "Scott Carlson" <scott.carlson@state.mn.us>
Cc: "Bryan Gruidl" <bgruidl@ci.bloomington.mn.us>
Sent: Friday, July 09, 2010 2:00 PM
Subject: Fish surveys in three Bloomington ponds

Hello All,

Blue Water Science will be conducting fish surveys in Marce Woods North, Marce Woods South, and Nesbitt Ponds (City of Bloomington), Hennepin County, starting on Monday, July 12. We will set between 2 to 4 minifyke nets in each pond on Monday. The nets will be monitored daily and all fish will be weighed and measured and returned to the pond on Tuesday and Wednesday. All nets will be removed on Wednesday. The fish surveys are sponsored by the City of Bloomington with the objective to examine possible winterkill effects from last winter on the fish community structure and determine if fish may be impacting water quality.

This survey is conducted under permit number 16638

Thank you,

Steve McComas
Blue Water Science
550 South Snelling Avenue
St. Paul, MN 55116
651.690.9602

Appendix B

Apple Valley Stormwater Pond Fish Survey Results for 2007 and 2008

2007 **2008**

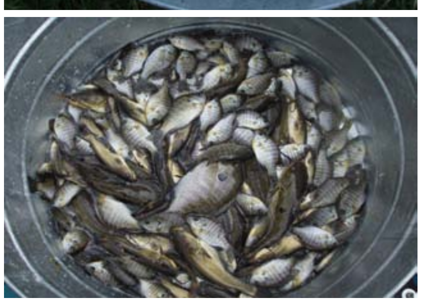
Pond 2


Pond 12


Pond 14


Pond 21


Pond 170




Fish biomass was less in 2008 than 2007 for four ponds, but higher in one, Pond 170. Bluegill sunfish were found in Ponds 12, 21, and 170 in 2007 but were not found in those ponds in 2008. A partial winterkill over the 2007-2008 winter is the likely explanation. A similar thing could occur in Bloomington ponds over the 2010-2011 winter.