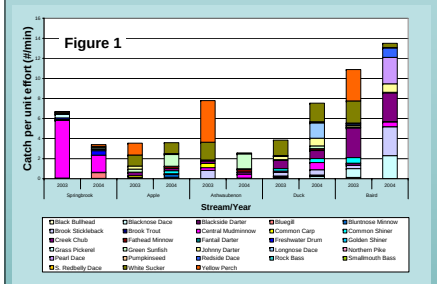
Biological Monitoring of the Lower Fox River Watershed

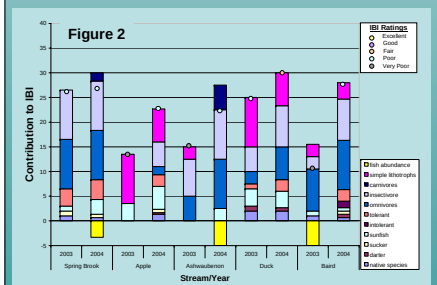
2004 Update: *UW-Milwaukee, UW-Green Bay, USGS*

THE LOWER FOX RIVER watershed monitoring program

Fish Data

In order to evaluate the biological integrity of the five study streams in the Lower Fox River, fish were sampled in July 2003 and 2004 during summer low flow conditions using a stream or backpack electrofisher. At least two stations were sampled in each watershed. Station lengths were 35 times the mean stream width. Fish were identified, counted, weighed and measured, and then returned to the stream unharmed. An Index of Biological Integrity (IBI) was calculated using standardized protocols developed by the Wisconsin DNR.





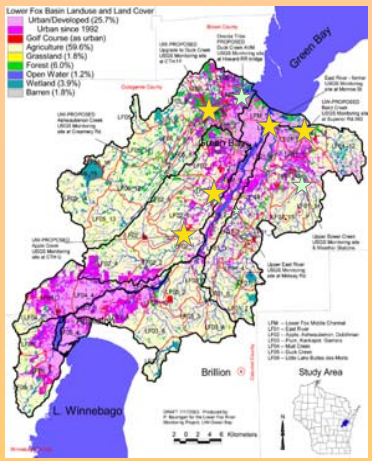
Results:

Fish abundance and diversity differed among streams and between years (Figure 1). Twenty eight different species were found in total (Table 1). Baird Creek had the highest average fish abundance during both years.

The fish assemblage of a stream can serve as an indicator of the stress exerted on the stream by land use in a watershed. For example, as water quality degrades the number of intolerant species (such as darters) declines and the number of tolerant species (like green sunfish) increases. When considered together these different parameters provide an "Index of Biotic Integrity" or "IBI" on a scale from 0 to 60 which corresponds to ratings from very poor to excellent. Figure 2 shows that IBI scores ranged from 10 (very poor) to 30 (fair), with most streams rated "poor". These numbers indicate that these streams are facing significant stress from their watersheds.

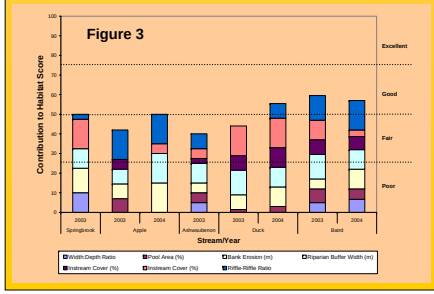
Stream	Spring Brook				Apple				Ashwaubenon			Duck						Baird				
Station ID	SB1		SB2	SB3	AP1		AP2	AP3	AS1		AS2	DM1	DM1.5	DM2		BC1	BC2	BM6		BN1	BS1	
Year	2003	2004	2003	2004	2004	2003	2004	2004	2003	2004	2003	2004	2004	2003	2004	2003	2003	2003	2004	2004	2003	2004
Brook Trout																			1			
Grass Pickerel	3		2	3	1		2	1	2		1		1				3	2	21	5	6	5
Northern Pike						1										3	6	3				
White Sucker	1	10	5		86	33	123	47	34	19	3	37	183	6	202	52	14	75	49	77	18	19	1	4
Central Mudminnow	19	7	272	95	2			9		8	10	1	1	16	7	50	4	27		3	2	21	5	6	5
Black Bullhead			3	3		2	1		2		2			5	3	1	1		3	6	3				
Blacknose Dace							3	1						3	7	4	6	12			80	130	75	1	4
Bluntnose Minnow						4	25		9						1	8	4	9	2	3					
Common Carp						9		7		2	2		11		1			5	5						
Common Shiner			3				3		32					2	11	35	18		8	40	7	3			
Creek Chub			3			13	1	20	21	3	6	7	2	67	36	49	31	19	41	47	158	124	87	20	23
Fathead Minnow							13			6	1	8		1		19		1	2	5					
Golden Shiner				8																	11	11	74	2	
Longnose Dace														6	272										2
Pearl Dace																	3				6	10	225	1	1
Redside Dace																					11	11	74	2	
Southern Redbelly Dace																									
Bluegill		2		5	6	1				9															
Green Sunfish		4	6			12	69	16	44	14		43	1	4	12	7	4	15	1	2	1	4			
Pumpkinseed																1									
Rock Bass															9	1			3						
Smallmouth Bass														5											
Freshwater Drum		35	11	2			2		1																
Blackside Darter														17	15										
Fantail Darter																					1				
Johnny Darter						16	4	10	3	2				13	10	60	19	21			13	37	42		
Yellow Perch		2	6	8						110		26							145	138					
Brook Stickleback	1	1	2			1			1	10		15		46	10	44	5			3	13	48	79	8	56
Total Fish identified	22	32	318	128	9	141	153	181	158	74	158	73	92	3	325	389	490	145	126	282	299	372	408	600	39	96

Biological Indicators are useful tools for assessing the impact of human activity on the ecological health of aquatic ecosystems. Land use practices such as agriculture and residential development can have profound impacts on how water moves in the ecosystem and the amount of pollution carried into the lakes and streams. As a result, the types of fish and invertebrates that live in a stream can tell us a great deal about what is going on in the watershed that feeds the stream.



Stream Habitat Data

Habitat data for the study streams were collected in 2003 and 2004 and scores were calculated according to the Wisconsin DNR "Guidelines for Evaluating Fish Habitat in Wisconsin Streams. This method incorporates eight parameters (see legend to Figure 3) including hydrology, substrate, fish cover, and riparian vegetation. Scores are assigned to each parameter and then summed up for a total score. Scores are then rated, ranging from poor to excellent.



Results:

In general, habitat scores rated from fair to good for all streams in both 2003 and 2004. This suggests that the low fish IBI scores are likely the result of poor water quality rather than the result of poor habitat conditions alone.

Stream	Station	Year	Total Score	Rating
Spring Brook	SB1	2003	50	Good
	SB2	2003	50	Good
Apple	AP1	2003	42	Fair
	AP2	2003	42	Fair
	AP3	2004	50	Good
Ashwaubenon	AS1	2003	50	Good
	AS2	2003	30	Fair
Duck	DC1	2003	60	Good
	DM1.5	2004	48	Fair
	DC2	2003	43	Fair
Baird	BM6	2003	62	Good
		2004	53	Good
	BS1	2003	57	Good
		2004	60	Good
	BN1	2004	58	Good

Invertebrate Data

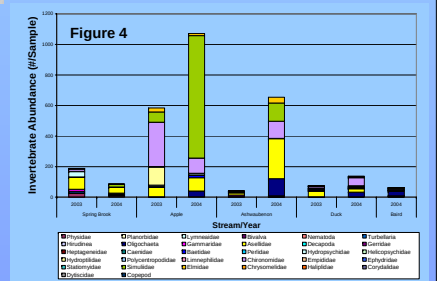
Invertebrate sampling is important because, on a local scale, presence or absence of certain invertebrate families can be a strong indicator of water quality. The Family Biotic Index (FBI) is a standard method used to calculate a water quality rating. A low FBI value indicates that the invertebrates have a low tolerance to organic pollution and oxygen stress (a healthy stream), whereas a high FBI indicates that the invertebrate community is tolerant and can endure higher levels of pollution-related stress (a polluted stream).

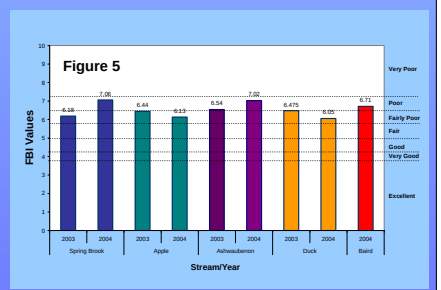
Results:

Replicate samples were collected from riffles in each stream using Hess samplers. The number of invertebrates collected in a sample varied greatly among sites and between years (Figure 4). This is not unusual, because invertebrate abundance changes naturally as individuals progress through the different stages of their lives and move from aquatic to terrestrial stages (e.g. midge larvae become pupae and then emerge as adult flies and leave the stream to reproduce).

What is important to notice in the samples is that most of the species found were tolerant to organic pollution (i.e. high FBI values) and as a result the study streams were rated as either fairly poor or poor in both years.

This indicates that there are significant stresses in the ecosystem that are affecting the aquatic invertebrates. These data also suggest that water quality factors, like low oxygen levels, may be responsible for the low integrity of the biological community.





Stream	Spring Brook		Apple		Ashwaubenon		Duck				Baird		
Site ID	SB1		AP1		AS1		DM1		DM2		BC1	BM6	BS1
Year	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2004	2004	2004
Physidae	26	9	2	2	1	2	0	0	2	0	6	0	0
Planorbidae	0	6		1		1					9	0	0
Lymnaeidae	1	2				1					6	0	0
Bivalva		1	1		4	3	0	4	0	1	3	0	0
Nematoda											0	0	0
Turbellaria	10		0								0	0	0
Hirudinea	1	1				3					0	0	0
Oligochaeta		2		37	2	112	0	49	0	8	57	19	10
Gammaridae	14	5		1	8	2	0	2	0	2	0	0	0
Asellidae	80	38	60	87	14	262	15	38	62	6	2	11	6
Decapoda							2	0	0	0	0	0	0
Gerridae			0				1	0		0	0	0	0
Heptageneidae			0				7	3	6	1	1	2	1
Caenidae							1	0	5	1	0	0	0
Baetidae	1		7	15		1	8	0	5	4	0	2	1
Peridae							0	11		2	1	7	0
Hydropsychidae	34	0	8	10	7	1	1	2	1	2	0	0	0
Helicopsychidae				4							0	0	0
Hydroptilidae	3		118				0	2	0	0	0	0	0
Polycentropodidae			4	1			0	0	0	0	0	0	0
Limnephilidae							0	0	10	0	0	0	0
Chironomidae	16	2	289	99	6	112	5	52	20	53	12	5	8
Empididae			1					1			0	0	0
Ephydridae				0			0	0	0	1	0	0	0
Stratomyidae			0								0	0	0
Simuliidae	1	19	68	801		119	0	10	0	1	3	0	3
Elmidae	1		26	13	3	38	0	8	1	4	2	7	1
Chrysomelidae							0	0	0	0	0	0	0
Tipulidae	1										0	0	0
Corydalidae							0	0	0	0	0	0	0
Dytiscidae											0	0	1
Copepod		1									0	0	0
Average per sample	188	86	584	1071	43	654	44	179	104	97	102	55	33