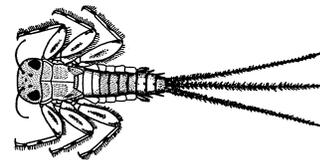
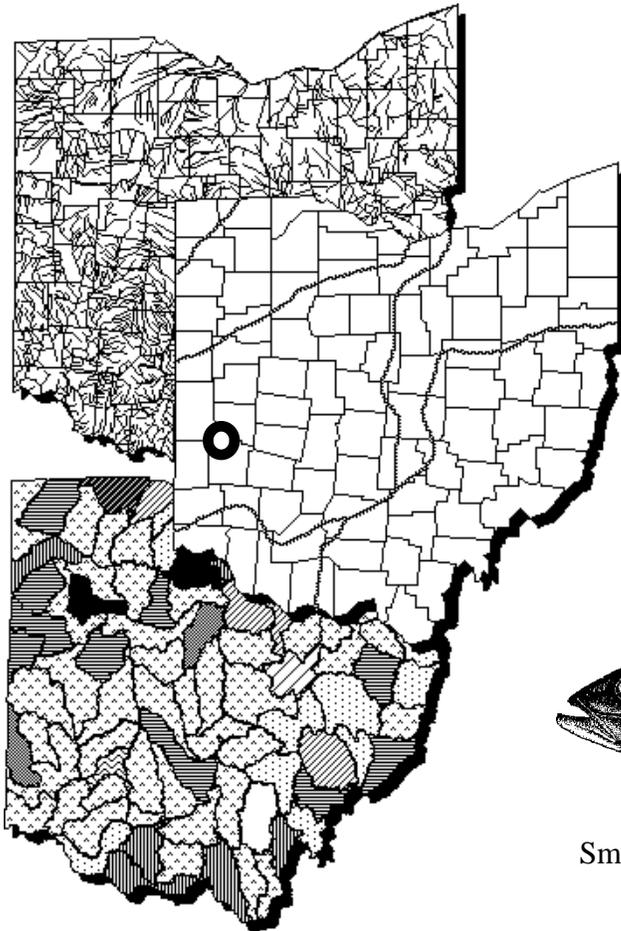
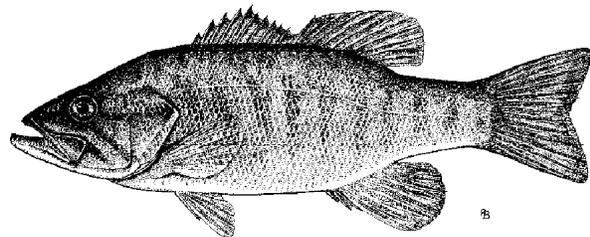


Biological and Sediment Quality Study of the Stillwater River

Garland Road Landfill Miami and Montgomery Counties, Ohio



Mayfly (*Stenacron sp.*)



Smallmouth Bass (*Micropterus dolomieu*)

August 1, 1995

Errata Sheet (dated 2/5/96)

Biological and Sediment Quality Study of the Stillwater River, August 1, 1995

The revised fish tissue PCB data presented below are based on revised results provided by the Ohio EPA Division of Emergency and Remedial Response contract lab. The initial results presented in the original report were determined to be improperly produced by the lab and therefore are unacceptable data.

Appendix Table 6. Pesticides, PCBs, lead, mercury, and lipid analyses of fish tissue collected from the Stillwater River study area, 1994 by Ohio EPA.

Parameter	Sampling Location - by River Mile						
	<u>15.4</u> Channel catfish SFF	<u>15.4</u> Small- mouth bass SOF	<u>15.4</u> Common carp WBC	<u>14.7</u> Channel catfish SFFC	<u>14.7</u> Small- mouth bass SOFC	<u>14.7</u> Common carp WBC	<u>12.1</u> Small- mouth bass SOFC
<i>PCB's (ug/kg)</i>							
PCB-1016					*		
PCB-1221					*	<99	
PCB-1232					*		
PCB-1242					*		
PCB-1248					*		
PCB-1254					*		
PCB-1260					*		

* - Data rejected

Biological and Sediment Quality Study of the Stillwater River

Garland Road Landfill 1994

Miami and Montgomery Counties, Ohio

August 1, 1995

OEPA Technical Report MAS/1995-8-8

prepared for

State of Ohio Environmental Protection Agency
Division of Emergency and Remedial Response

prepared by

State of Ohio Environmental Protection Agency
Division of Surface Water
Ecological Assessment Unit
1685 Westbelt Dr.
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Sediment, Pollutant Loadings, Macroinvertebrate Data Analysis - Bernie Counts

Reviewers - Chris Yoder, Jeff DeShon, and Marc Smith

Support during field collections was provided by Mike Pettegrew, Bret Henninger, and Erica Burnett (college interns).

**Biological and Sediment Quality Study of the Stillwater River
(Miami and Montgomery Counties, Ohio)**

Ohio Environmental Protection Agency
Division of Surface Water
Monitoring and Assessment Section
Ecological Assessment Unit
1685 Westbelt Drive
Columbus, Ohio 43228

INTRODUCTION

The Stillwater River study area included the mainstem river from upstream from Garland Road (RM 15.7) to near the Englewood dam (RM 9.2). In addition, fish tissue samples were collected upstream at Fenner Rd. (RM 23.4) and State Route 571 (RM 17.4).

Specific objectives of this evaluation were to:

- 1) determine and measure adverse impacts on biological condition and sediment quality in the Stillwater River in the vicinity of the Garland Road landfill,
- 2) determine the potential accumulation of contaminants in river sediments and fish tissue in the vicinity of the Garland Road landfill,
- 3) determine the attainment status of the current EWH aquatic life use designation for the Stillwater River within the study area, and
- 4) follow-up on conditions documented in the 1982 and 1990 Ohio EPA surveys.

The findings of this evaluation may factor into regulatory actions taken by Ohio EPA (e.g. NPDES permits, Director's Orders, the Ohio Water Quality Standards - OAC 3745-1), and may eventually be incorporated into the State Water Quality Management Plans, the Ohio Nonpoint Source Assessment, and the biennial Ohio Water Resource Inventory (305[b] report).

Fish and macroinvertebrate communities were sampled during the summer and fall of 1994 at three locations on the Stillwater River from river mile (RM) 15.7 to 12.1 (Table 1, Figure 1). Sampling was conducted to assess fish and macroinvertebrate communities in the vicinity of the Garland Road landfill. Fish collections were made at each site from August to October using pulsed DC electrofishing gear, with a sampling distance of 500 meters. Macroinvertebrate collections were made at each site using modified Hester-Dendy multiple-plate artificial substrate samplers colonized for a six-week period from August 4 - September 15. At the time of sampler retrieval, a qualitative sample of the macroinvertebrate community was collected from all available natural habitats in the near vicinity of the sampling site.

The Stillwater River is located in the Eastern Corn Belt Plains (ECBP) ecoregion and is currently designated Exceptional Warmwater Habitat (EWH) aquatic life use.

SUMMARY / CONCLUSIONS

From August to November, 1994 Ohio EPA Division of Surface Water staff, at the request of the Division of Emergency and Remedial Response, conducted biological community, fish tissue, fish biomarker, and sediment sampling on the Stillwater River in the vicinity of the Garland Road landfill. The results of these sampling events are summarized below.

- PARTIAL attainment of the EWH use designation (Table 2) was observed at RM 15.2/15.7 due to impoundment like conditions affecting the macroinvertebrate community. Full attainment of the EWH use designation was observed at RM 14.7 with the macroinvertebrate community assessment based on the qualitative sample; RM 12.1 demonstrated FULL attainment of the EWH use designation.
- Fish tissue results showed only mercury as being a concern with one of the seventeen samples analyzed exceeding the FDA action level of 1.0 mg/kg. The sample was from RM 23.4, well upstream from the Garland Road landfill.
- Sediment samples were collected at six locations in the Stillwater River by the Ohio EPA during November 1994. All semivolatile parameters measured in the sediment samples were below the estimated quantitation limits (EQL). Nearly all the pesticides, PCBs, and mercury results were below the EQLs. There was one detection of the pesticide aldrin and one mercury sample equaled the EQL. All results were below the Lowest Effect Level (Persaud *et al.* 1994), a level of sediment contamination that can be tolerated by the majority of benthic organisms.
- The West Milton WWTP was the only point source discharge to the Stillwater River within the 1994 study area. The plant had a significant decrease in the loadings of both ammonia-N and carbonaceous biochemical oxygen demand (CBOD₅) during 1993 and 1994 resulting in an improved fish community during 1994.

RECOMMENDATIONS

It is recommended that the drums in the southern end of the landfill, which according to the land owner is flooded yearly (U.S. EPA 1993), be removed first to minimize the chance of flushing into the river. Every attempt should be made at the Garland Road landfill to preserve the mature trees lining the river bank to stabilize the stream bank and provide riparian habitat. It would take decades for newly planted trees to provide the same functions that the trees currently provide the aquatic community. Erosion controls and bank stabilization need to be of primary concern in all actions taken during remediation activities.

Table 1. Sampling locations (sediment - S, macroinvertebrate - M, fish - F, fish tissue - T, and biomarkers - B) in the Stillwater River, 1994.

<i>Stream/</i> River Mile	Type of Sampling	Latitude	Longitude	Landmark	County	USGS 7.5 min. Quad. Map
<i>Stillwater River</i>						
23.4	T	40°01'21"	84°20'26"	Fenner Rd.	Miami	Pleasant Hill, OH
17.4	T	39°57'52"	84°19'26"	State Route 571	Miami	West Milton, OH
15.7	F	39°56'34"	84°18'40"	Upst. Garland Rd.	Miami	West Milton, OH
15.4	T,B	39°56'22"	84°18'17"	Upst. Garland Rd.	Miami	West Milton, OH
15.39	S	39°56'20"	84°18'14"	Upst. Garland Rd.	Miami	West Milton, OH
15.2	M	39°56'18"	84°18'10"	Upst. Garland Rd.	Miami	West Milton, OH
14.7	F,T,M,B	39°55'57"	84°17'52"	Adj. Garland Rd. Landfill	Miami	West Milton, OH
14.35	S	39°55'50"	84°17'42"	Adj. Garland Rd. Landfill	Miami	West Milton, OH
13.95	S	39°55'30"	84°17'47"	Near canoe access	Miami	West Milton, OH
12.75	S	39°55'02"	84°17'46"	Adj. gravel co.	Montgomery	West Milton, OH
12.3	M	39°54'38"	84°17'52"	Ust. Old Springfield	Montgomery	West Milton, OH
12.1	F,T,B	39°54'26"	84°17'52"	Old Springfield Rd.	Montgomery	West Milton, OH
12.10	S	39°54'30"	84°17'52"	Old Springfield Rd.	Montgomery	West Milton, OH
9.17	S	39°52'16"	84°17'17"	Englewood Park	Montgomery	Trotwood,OH

Table 2. Aquatic life use attainment status for the Stillwater River based upon sampling conducted between August and October, 1994. The results for 1982 and 1990 surveys are also included. Attainment status is based on EWH biocriteria for the Eastern Corn Belt Plains ecoregion of Ohio (OAC Chapter 3745-1-07, Table 7-17).

RIVER MILE Fish/ Invert.	IBI	MIwb	ICI	QHEI	Attainment Status^a	Comment
Stillwater River 1994						
<i>Eastern Corn Belt Plain ecoregion - EWH use Designation (Existing)</i>						
15.7/ 15.2	53	9.7	G ^b	82.0	PARTIAL	Impounded like conditions affected macroinvertebrates
14.7/ 14.7	55	9.9	VG ^b	80.5	FULL	Adj. Garland Rd. landfill
12.1/ 12.3	57	9.9	44 ^{ns}	81.5	FULL	Dst. Garland Rd.
1990						
16.0/ 16.4	51	9.2 ^{ns}	46	85.0	FULL	Dst. W. Milton WWTP
-/ 12.2	-	-	46	-	(FULL)	
11.5/ 11.4	48	8.3*	48	82.0	PARTIAL	Dst. Union WWTP
1982						
16.0/ 14.9	49	9.1 ^{ns}	46	-	PARTIAL	
14.4/-	37*	8.4*	-	-	(NON)	
12.1/-	49	8.5*	-	-	(PARTIAL)	Ust. Union WWTP
-/ 11.4	-	-	42 ^{ns}	-	(FULL)	Dst. Union WWTP

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)

INDEX	WWH	EWH	MWH^c
IBI - Boat	42	48	24
MIwb - Boat	8.5	9.6	5.8
ICI	36	46	22

^{ns} Nonsignificant departure from EWH ecoregional biocriterion (≤ 4 IBI or ICI units or ≤ 0.5 MIwb units).

* Significant departure from ecoregion biocriterion (>4 IBI units); poor and very poor results are underlined.

^a Attainment status based on one organism group is parenthetically expressed.

^b The narrative evaluation using the qualitative sample (VG = very good, G = good) is based on best professional judgment utilizing sample attributes such as taxa richness, EPT taxa richness, and community composition and is used in lieu of the ICI when artificial substrates are lost or deemed not useable.

^c Modified Warmwater Habitat for channel modified areas.

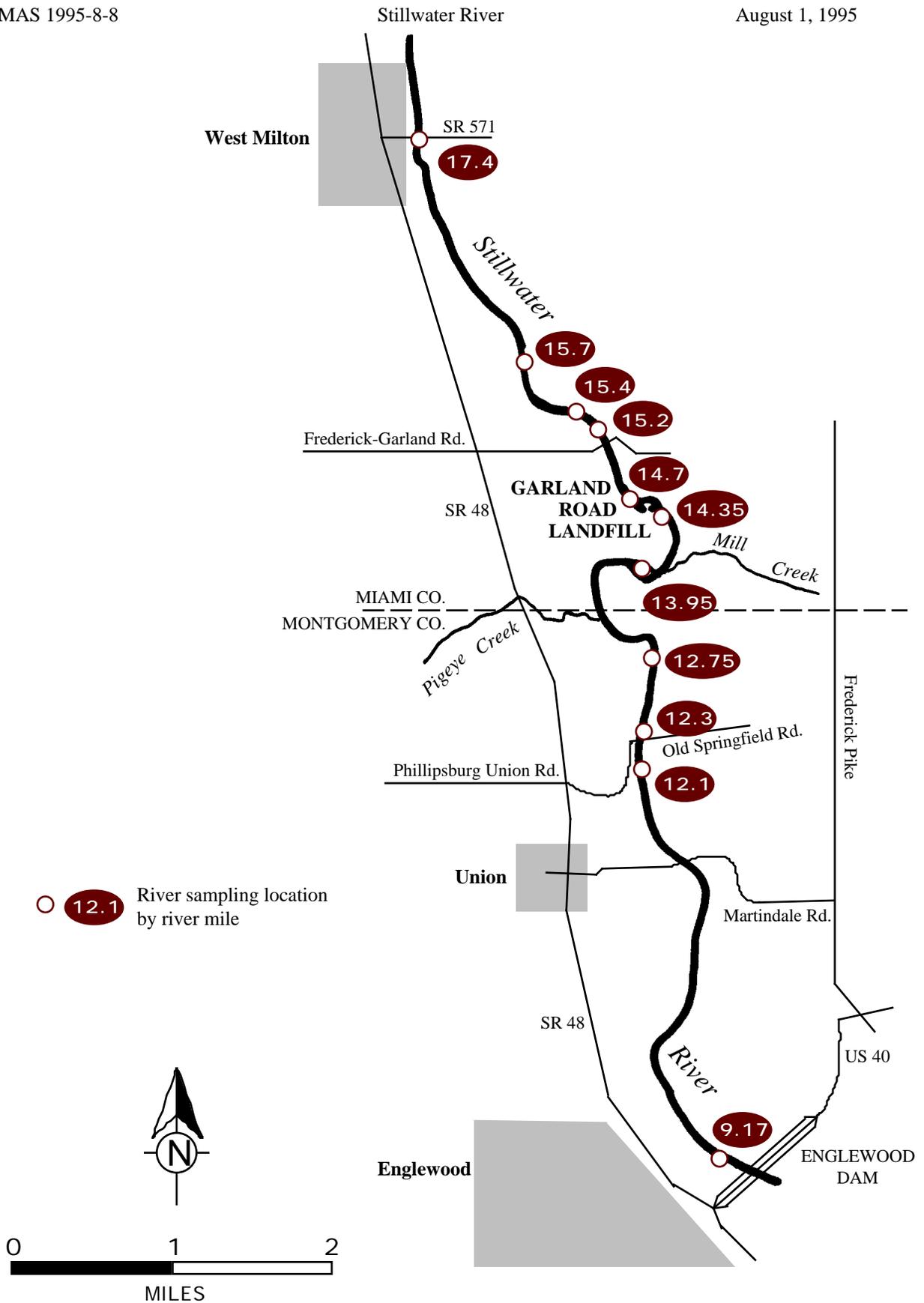


Figure 1. Map of the Stillwater River study area showing principal streams, landmarks, the Garland Rd. landfill, and Ohio EPA biological sampling locations, 1994.

METHODS

All chemical, physical, and biological field, laboratory, data processing, and data analysis methodologies and procedures adhere to those specified in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio Environmental Protection Agency 1989a) and Biological Criteria for the Protection of Aquatic Life, Volumes I-III (Ohio Environmental Protection Agency 1987a, 1987b, 1989b, 1989c), and The Qualitative Habitat Evaluation Index (QHEI): Rationale, Methods, and Application (Rankin 1989) for aquatic habitat assessment.

Determining Use Attainment Status

The attainment status of aquatic life uses (*i.e.*, FULL, PARTIAL, and NON) is determined by using the biological criteria codified in the Ohio Water Quality Standards (WQS; Ohio Administrative Code [OAC] 3745-1-07, Table 7-17). The biological community performance measures which are used include the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), based on fish community characteristics, and the Invertebrate Community Index (ICI) which is based on macroinvertebrate community characteristics. The IBI and ICI are multimetric indices patterned after an original IBI described by Karr (1981) and Fausch *et al.* (1984). The ICI was developed by Ohio EPA (1987b) and further described by DeShon (1995). The MIwb is a measure of fish community abundance and diversity using numbers and weight information and is a modification of the original Index of Well-Being originally applied to fish community information from the Wabash River (Gammon 1976; Gammon *et al.* 1981).

Performance expectations for the principal aquatic life uses in the Ohio WQS (Warmwater Habitat [WWH], Exceptional Warmwater Habitat [EWH], and Modified Warmwater Habitat [MWH]) were developed using the regional reference site approach (Hughes *et al.* 1986; Omernik 1988). This fits the practical definition of biological integrity as the biological performance of the natural habitats within a region (Karr and Dudley 1981). Attainment of the aquatic life use is FULL if all three indices (or those available) meet the applicable biocriteria, PARTIAL if at least one of the indices does not attain and performance at least fair, and NON-attainment if all indices fail to attain or any index indicates poor or very poor performance. Partial and non-attainment indicate that the receiving water is impaired and does not meet the designated use criteria specified by the Ohio WQS.

Habitat Assessment

Physical habitat was evaluated using the Qualitative Habitat Evaluation Index (QHEI) developed by the Ohio EPA for streams and rivers in Ohio (Rankin 1989, 1995). Various attributes of the habitat are scored based on the overall importance of each to the maintenance of viable, diverse, and functional aquatic faunas. The type(s) and quality of substrates, amount and quality of instream cover, channel morphology, extent and quality of riparian vegetation, pool, run, and riffle development and quality, and gradient are some of the metrics used to determine the QHEI score which generally ranges from 20 to 100. The QHEI is used to evaluate the characteristics of a stream segment, as opposed to the characteristics of a single sampling site. As such, individual sites may have poorer physical habitat due to a localized disturbance yet still support aquatic communities closely resembling those sampled at adjacent sites with better habitat, provided water quality conditions are similar. QHEI scores from hundreds of segments around the state have indicated that values greater than 60 are *generally* conducive to the existence of warmwater faunas. Scores greater than 75 frequently typify habitat conditions which have the ability to support exceptional warmwater faunas.

Macroinvertebrate Community Assessment

Macroinvertebrates were sampled quantitatively in the Stillwater River using multiple-plate, artificial substrate samplers (modified Hester/Dendy) in conjunction with a qualitative assessment of the available natural substrates. During the present study, macroinvertebrates collected from the natural substrates were also evaluated using an assessment tool currently in the developmental phase. This method relies on tolerance values derived for each taxon, based upon the abundance data for that taxon from artificial substrate (quantitative) samples collected throughout Ohio. To determine the tolerance value of a given taxon, ICI scores at all locations where the taxon has been collected are weighted by its abundance on the artificial substrates. The mean of the weighted ICI scores for the taxon results in a value which represents its relative level of tolerance on the ICI's 0 to 60 scale. For the qualitative collections in the Stillwater River study area, the median tolerance value of all organisms from a site resulted in a score termed the Qualitative Community Tolerance Value (QCTV). The QCTV shows potential as a method to supplement existing assessment methods using the natural substrate collections. Use of the QCTV in evaluating sites in the Stillwater River study area was restricted to relative comparisons between sites with no direct attempt to interpret quality of the sites or aquatic life use attainment status.

Fish Community Assessment

Fish were sampled using the boat method pulsed DC electrofishing gear, used at a frequency of two to three samples at each site.

Causal Associations

Using the results, conclusions, and recommendations of this report requires an understanding of the methodology used to determine the use attainment status and assigning probable causes and sources of impairment. The identification of impairment in rivers and streams is straightforward - the numerical biological criteria are the principal arbiter of aquatic life use attainment and impairment (partial and non-attainment). The rationale for using the biological criteria in the role of principal arbiter within a weight of evidence framework has been extensively discussed elsewhere (Karr *et al.* 1986; Karr 1991; Ohio EPA 1987a,b; Yoder 1989; Miner and Borton 1991; Yoder 1991; Yoder 1995). Describing the causes and sources associated with observed impairments relies on an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and the biological response signatures (Yoder and Rankin 1995) within the biological data itself. Thus the assignment of principal causes and sources of impairment in this report do not represent a true "cause and effect" analysis, but rather represent the association of impairments (based on response indicators) with stressor and exposure indicators whose links with the biosurvey data are based on previous research or experience with analogous situations and impacts. The reliability of the identification of probable causes and sources is increased where many such prior associations have been identified. The process is similar to making a medical diagnosis in which a doctor relies on multiple lines of evidence concerning patient health. Such diagnoses are based on previous research which experimentally or statistically linked symptoms and test results to specific diseases or pathologies. Thus a doctor relies on previous experience in interpreting symptoms (*i.e.*, multiple lines from test results) to establish a diagnosis, potential causes and/or sources of the malady, a prognosis, and a strategy for alleviating the symptoms of the disease or condition. As in medical science, where the ultimate arbiter of success is the eventual recovery and the well-being of the patient, the ultimate measure of success in water resource management is restoration of lost or damaged ecosystem attributes including aquatic community structure and function. While there have been criticisms of misapplying the metaphor of ecosystem "health" compared to human patient "health" (Suter 1993) here we are referring to the process for

identifying biological integrity and causes/sources associated with observed impairment, not whether human health and ecosystem health are analogous concepts.

Fish were sampled for biomarkers and tissue analysis using pulsed DC electrofishing gear using boat methods. Fish whole body and fillet samples were collected in September, 1994 for tissue analysis. Fish tissue sampling procedures are detailed in the Manual of Ohio EPA Surveillance Methods and Quality Assurance Practices (Ohio EPA 1989a). Fine grained sediment samples were collected in the upper six inches of bottom material at each location using decontaminated stainless steel scoop samplers (decontamination followed the procedures outlined in FSOP 10.01, DERR Sampling Guidance, Vol. III, Ohio EPA 1992). Collected sediment was placed into decontaminated clear glass jars with teflon lined lids, placed on ice (to maintain 4°C) and shipped to an Ohio EPA contract lab. Common carp were collected for biomarker processing during normal community assessment sampling. Fish blood, liver, spleen, and bile samples were collected in the field and transported to the Environmental Monitoring Systems Laboratory, U.S.EPA in Cincinnati for specific biomarker analyses. An analysis of the biomarker results was provided by U.S. EPA. All sediment, fish tissue, biomarker, and biological sampling locations are listed in Table 1.

RESULTS AND DISCUSSION

Sediment Chemistry

Sediment samples were collected at six locations in the Stillwater River by the Ohio EPA during November 1994. All sampling locations are indicated by river mile in Figure 1. Samples were analyzed for semivolatiles organic compounds, pesticides, PCBs, lead, mercury, total organic carbon, and grain size. Specific chemical parameters tested and results are listed in Appendix Table A-1.

- Historically, sediment chemistry results (from 1986 and 1990) from the Stillwater River are remarkably low compared to other rivers and streams throughout Ohio.
- All semivolatile parameters measured in the Stillwater 1994 sediment samples were below the EQLs.
- Nearly all the pesticides, PCBs, and mercury results were below the EQLs. There was one detection of the pesticide Aldrin (1.8 ug/kg) and one mercury sample equaled the EQL (0.08 mg/kg). Lead values ranged from 2.2 to 8.9 mg/kg. All results are below the Lowest Effect Level (Persaud *et al.* 1994).

Physical Habitat for Aquatic Life

Physical habitat was evaluated in the Stillwater River at each 1994 biological sampling location. Qualitative Habitat Evaluation Index (QHEI) scores are detailed in Table 3.

- Stream morphology in the Stillwater River within the study area is free-flowing and consists largely of long pools interspersed with short, well developed riffle and run habitats. Bottom substrates are predominated by cobble, gravel, and sand. Qualitative Habitat Evaluation Index (QHEI) scores for the Stillwater River (80.8 - 82.0) were indicative of excellent stream and riparian habitat and reflective of conditions capable of supporting EWH stream fish communities. The total number of warmwater habitat attributes were considerably higher than the total of modified warmwater habitat attributes at all three locations sampled.

Table 3. Qualitative Habitat Evaluation Index (QHEI) matrix showing modified and warmwater habitat characteristics for the Stillwater River, 1994.

River Mile	Gradient QHEI (ft/mile)	WVH Attributes										MWH Attributes																	
												High Influence			Moderate Influence														
		No Channelization or Recovered Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low/Natural Overall Embeddedness	Max. Depth > 40 cm	Low/No Riffle Embeddedness	Total WVH Attributes	Channelized or No Recovery Silt/Muck Substrates	Low Sinuosity	Sparse/No Cover	Max. Depth < 40 cm (WD/HW)	Total H/L MWH Attributes	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low/No Sinuosity	Only 1-2 Cover Types	Intermittent & Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffe	Total M/L MWH Attributes
(14-200) Stillwater River																													
Year: 94																													
15.7	82.0 DJA	3.66	■	■	■	■	■	■	■	■	7	■	■	■	0	■	▲	▲	2	0.13	0.38								
14.7	80.5 DJA	3.66	■	■	■	■	■	■	■	■	7	■	■	■	0	■	▲	▲	2	0.13	0.38								
12.1	81.5 DJA	2.44	■	■	■	■	■	■	■	■	8	■	■	■	0	■	▲	▲	2	0.11	0.33								

Macroinvertebrate Community

Macroinvertebrate communities were sampled during the summer of 1994 at three locations in the Stillwater River from upstream from Frederick-Garland Rd (RM 15.2) to Old Springfield Rd. (RM 12.3) (Table 1). Summarized results from the 1994 macroinvertebrate sampling are compiled in Table 4. ICI metrics, scores, and raw data tables sampled by river mile are attached as Appendix Tables 2 and 3. Also included in Table 4 are data collected in prior years by the Ohio EPA. This includes three sites from 1982 and four sites from 1990; a detailed discussion of this data is provided in Ohio EPA (1986) and Ohio EPA (1991), respectively.

- The 1994 data indicated the presence of good to very good macroinvertebrate communities throughout the study area. ICI scores ranged from 20 (good compared with other background impounded sites) at Frederick-Garland Road. (RM 15.2) to 44 (very good) at Old Springfield Road (RM 12.3).
- The site upstream from Frederick-Garland Rd (RM15.2) consisted of an extended pool with very slow current velocity and marginal habitat quality. The lack of current velocity and habitat heterogeneity appeared to be the primary influence at this site; however, there was a good assortment of pollution sensitive mayflies and the percentage of tolerant organisms was very low (1%). The predominant taxon was the midge genus *Glyptotendipes* (67% of the total number of organisms collected in the quantitative sample), a filter feeding midge preferring slow currents and an indicator of enrichment. This site was evaluated based on the qualitative sample and compared with other background, impounded sites reflected good conditions.
- The site just downstream from the landfill (RM 14.7), although set at the base of a large riffle, appeared to have not had sufficient flow over the artificial substrates for the duration of the six week colonization period. This is based on the numeric predominance of taxa preferring slow current (e.g. the caddisfly *Cyrmellus fraternus* and the midge *Glyptotendipes*) and the presence of current dependent taxa in the qualitative sample. Based on the qualitative sample the site shows very good conditions. The qualitative sample included 45 taxa and an EPT taxa richness of 13. Macroinvertebrates were represented by a total of eight mayfly taxa, seven caddisfly taxa, and the hellgrammite *Corydalus cornutus*, all relatively intolerant of pollution. The percentage of tolerant organisms in the quantitative sample was low (2.8%). The predominant taxa in the riffle were caddisflies and mayflies in high numbers. In the quantitative sample the one predominant influence was the presence of 11,413 individuals of the midge *Glyptotendipes* (73% of the total sample) which dominated four of the proportional ICI metrics.
- The downstream site at Old Springfield Rd. (RM 12.3) was in the very good range with an ICI score of 44 meeting the EWH biocriterion. The quantitative sample consisted of 43 taxa including eleven mayfly taxa, five caddisfly taxa, and nineteen dipteran taxa. Mayflies and caddisflies comprised over 50% of the sample while tolerant organisms were rare (0.6%).
- Based upon the 1994 sampling results, the Garland Road landfill was not impacting the macroinvertebrate communities of the Stillwater River.

Table 4. Summary of macroinvertebrate data collected on artificial substrates (quantitative sampling) and from natural substrates (qualitative sampling) in the Stillwater River in 1982, 1990, and 1994. The Stillwater River has an EWH aquatic life use designation in the Ohio Water Quality Standards.

Stream/ River Mile	Relative Density	Total Taxa	Quant Taxa	Qual Taxa	Qual EPT ^a	ICI	Evaluation
<i>Stillwater River - 1994</i>							
15.2	634	45	19	38	7	20*	Good ^b
14.7	3139	54	25	45	13	24	Very Good ^b
12.3	1323	54	43	33	11	44 ^{ns}	Very Good
<i>Stillwater River- 1990</i>							
18.3	2414	54	33	42	14	48	Exceptional
16.4	5246	58	31	49	17	46	Exceptional
12.2	977	62	32	50	20	46	Exceptional
11.4	1774	51	27	38	13	48	Exceptional
<i>Stillwater River- 1982</i>							
18.3	4418	48	27	33	9	40*	Very Good
14.9	3813	51	36	23	9	46	Exceptional
11.4	2926	46	28	34	8	42 ^{ns}	Very Good

Ecoregional Biocriteria: Eastern Corn Belt Plains (ECBP)
(from OAC 3745-1-07, Table 7-17)

<u>INDEX</u>	<u>WWH</u>	<u>EWH</u>	<u>MWH^c</u>
ICI	36	46	22

^a EPT= total Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) taxa richness.

^b The narrative evaluation using the qualitative sample (VG = very good, G = good) is based on best professional judgment utilizing sample attributes such as taxa richness, EPT taxa richness, and community composition and is used in lieu of the ICI when artificial substrates are lost or deemed not useable.

^c Modified Warmwater Habitat for channel modified areas.

* Significant departure from ecoregional biocriterion (>4 ICI units); poor and very poor results are underlined.

^{ns} Nonsignificant departure from ecoregional biocriterion (≤4 ICI units).

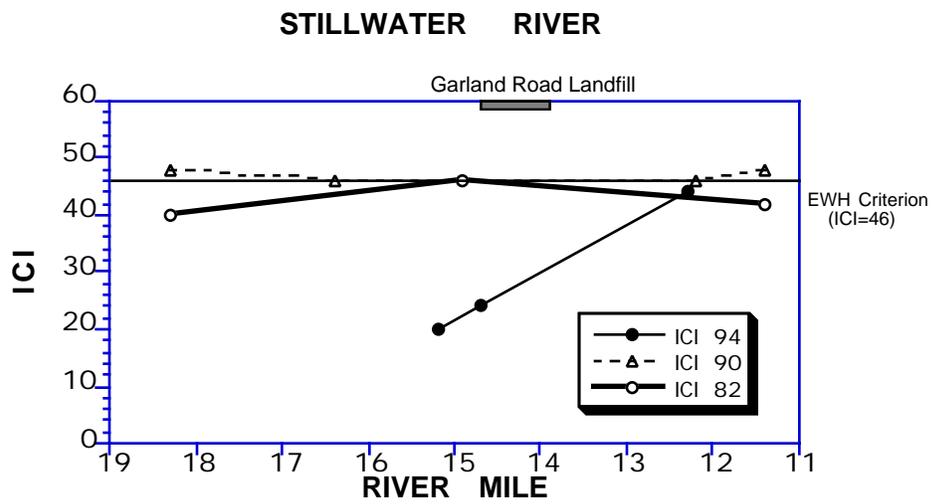


Figure 2. Longitudinal performance of the Invertebrate Community Index (ICI) in the Stillwater River for 1982, 1990, and 1994.

Fish Community

A total of 3,739 fish representing 39 species and two hybrids were collected from the Stillwater River between August and October, 1994. The sampling effort included a cumulative distance electrofished of 4.52 km at three locations. (Table 5, Figure 1). Relative numbers and species collected per location are presented in Appendix Table 4. Sampling locations were evaluated using Exceptional Warmwater Habitat biocriteria.

- The fish communities in the Stillwater River at all three sampling locations were reflective of exceptional quality. The IBI (53 - 57) and MIwb (9.7 - 9.9) scores exceeded the EWH biocriteria. A high number of species were collected at each location, including significant numbers of pollution sensitive golden redbreast, black redbreast, shorthead redbreast, northern hog sucker, and smallmouth bass. River redbreast, a species listed by the Ohio Department of Natural Resources as Special Interest, was collected at all three sampling locations.
- Pollution intolerant fish species collected in the study area included black redbreast, river redbreast, river chub, silver shiner, rosyface shiner, stonecat madtom, and banded darter. These species combined represented 10.5% of the catch, numerically.
- The Garland Road landfill was not impacting the fish communities of the Stillwater River, based upon 1994 sampling results.

Table 5. Fish community indices from the Stillwater River, 1982, 1990, and 1994 based on pulsed D.C. electrofishing at sites sampled by Ohio EPA. Sites were sampled using boat methods. Relative number and weight are per 1.0 km.

Stream/ River Mile	Mean Number of Species	Cumulative Species	Mean Relative Number	Mean Relative Weight	QHEI	Mean Modified Index of Well-Being	Mean Index of Biotic Integrity	Narrative Evaluation ^a
<i>Stillwater River - 1994</i>								
15.7	28.7	34	798	127.8	82.0	9.7	53	Exceptional
14.7	26.0	34	619	119.5	80.5	9.9	55	Exceptional
12.1	27.0	32	1069	200.1	81.5	9.9	57	Exceptional
<i>Stillwater River - 1990</i>								
16.0	18.3	25	389	58.3	85.0	9.2 ^{ns}	51	Very Good/ Exceptional
11.5	17.3	24	395	131.5	82.0	8.3*	48	Marginally Good/ Exceptional
<i>Stillwater River - 1982</i>								
16.0	21.7	27	532	56.0	71.5	9.1 ^{ns}	49	Very Good/ Exceptional
14.4	17.5	23	448	78.7	80.5	8.4*	37*	Marginally Good/ Fair
12.1	18.0	23	386	118.9	63.0	8.5*	49	Marginally Good/ Exceptional

Ecoregion Biocriteria: Eastern Corn Belt Plains (ECBP)
(from Ohio Administrative Code 3745-1-07, Table 7-17)

<u>INDEX</u>	<u>WWH</u>	<u>EWB</u>	<u>MWH^b</u>
IBI - Boat	42	48	24
MIwb - Boat	8.5	9.6	5.8

* Significant departure from ecoregional biocriteria (>4 IBI units, >0.5 MIwb units); poor and very poor results are underlined.

^{ns} Nonsignificant departure from EWB biocriteria (≤4 IBI units, 0.5 MIwb units).

^a Narrative evaluation is based on MIwb and IBI scores, when available.

^b Modified Warmwater Habitat for channel modified areas.

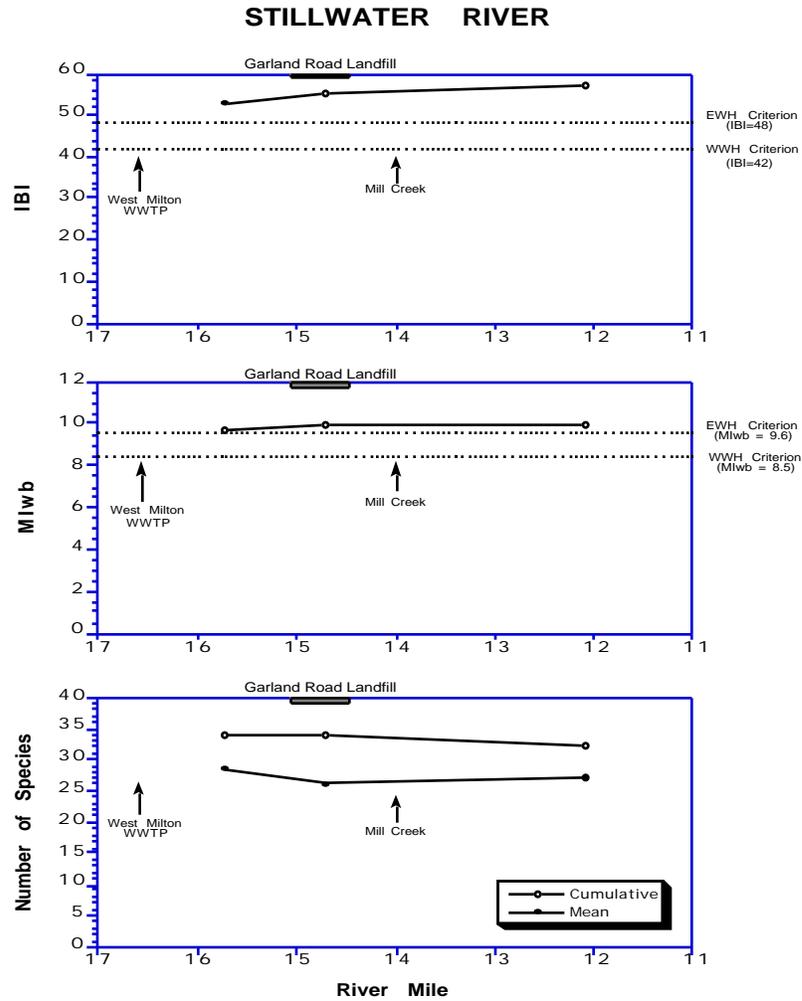


Figure 3. Longitudinal performance of the Index of Biotic Integrity (IBI), Modified Index of Well-being (MIwb) and number of species in the Stillwater River, 1994.

Fish Tissue

Fish tissue samples were collected in September, 1994 from three locations on the Stillwater River from RMs 15.4 to 12.1 and analyzed for pesticides, PCBs, lead, mercury, and percent lipids. Due to the presence of mercury in the ten samples analyzed, seven more samples were collected in December from two additional upstream sites (RMs 23.4 and 17.4) and analyzed for mercury and percent lipids. Four species were collected for analysis in all. Specific chemical parameters tested and results are listed in Appendix Table 5.

- Most of the analyzed pesticides were at concentrations below the EQL values. Heptachlor epoxide, dieldrin, endosulfan sulfate, and 4,4'-DDT and metabolites, however, were detected at low levels.
- All PCBs and lead results were below EQL values.
- Mercury was detected in all but one of the seventeen samples and concentrations ranged from <0.08 mg/kg to 1.04 mg/kg. A channel catfish skin off fillet composite sample from RM 23.4 (Fenner Rd.) had a mercury level of 1.04 mg/kg (lipids 5.27%), which exceeded the Food and Drug Administration (FDA) Consumption Action Level of 1.0 mg/kg.

Biomarkers

Biomarker analyses were done on blood, bile, and liver samples collected from common carp from three sites on the Stillwater River collected on September 15 and 19, 1994. Analyses that were run included: measurement of bile metabolites, ethoxyresorufin-O-deethylase (EROD) activity, total hepatic glutathione (GSH), plasma levels of blood urea nitrogen, pseudo-cholinesterase, cholesterol, triglycerides, aspartate transaminase, albumin, and total protein.

- At the time of report preparation four key measurement endpoints had been analyzed (S. Cormier, US EPA, personal communication). The Stillwater River samples had some of the lowest scores for EROD, GSH, and two bile metabolites of all the Ohio samples collected in 1993 and 1994. All median values for the four key endpoints were below their respective reference values indicating low exposure to xenobiotic stressors.

Pollutant Loadings

The West Milton WWTP (Ohio permit number 1PC00011001) is located in Miami County, Ohio on the Stillwater River at RM 16.57. A plant upgrade was completed in November 1992 and the interim limits expired April 30, 1993. The sewage collection system has separate sewers and storm sewers and no bypasses of raw sewage.

- Loadings data shows a marked decrease in ammonia and CBOD₅ following completion of the plant upgrade. Fiftieth (50th) percentile effluent loadings of ammonia-N from 1982 to 1992 ranged between 11.2 and 37.1 kg/day; during 1993 and 1994, these decreased to 1.1 and 2.2 kg/day, respectively. The fiftieth (50th) percentile effluent loadings of CBOD₅ from 1986 to 1992 ranged between 15.0 and 84.2 kg/day; during 1993 and 1994, loadings were 12.6 and 6.5 kg/day, respectively. Loading trends from the third quarter for CBOD₅, total nonfilterable residue, and ammonia-N, from the West Milton WWTP 001 effluent between 1982 and 1994 are shown in Figure 4.

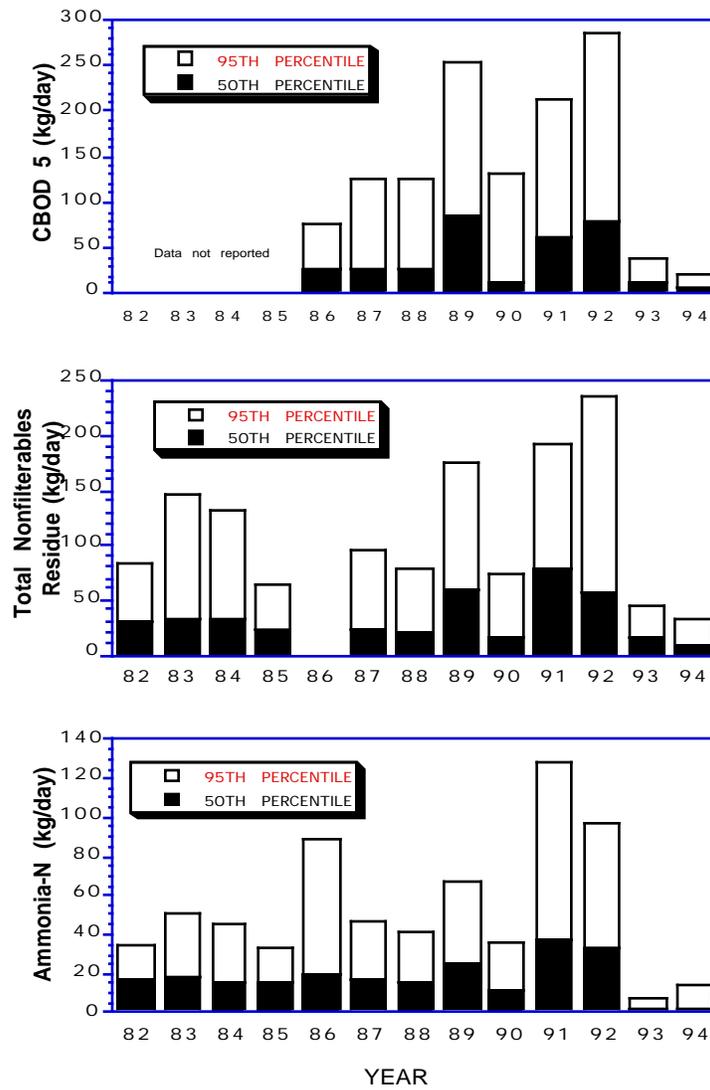


Figure 4. Loadings (kg/day) of carbonaceous biochemical oxygen demand (CBOD₅), total nonfilterable residue, and ammonia-N from the West Milton WWTP 001 effluent to the Stillwater River for the third quarter from 1982 through 1994 (CBOD₅ from 1986).

Trend Assessment

Changes in Macroinvertebrate Performance: 1982 - 1994

- Macroinvertebrate communities in the Stillwater River in the vicinity of the Garland Road Landfill have historically demonstrated very good to exceptional conditions (Figure 2). The site at Old Springfield Rd. (RM 12.3) in 1990 met the EWH biocriterion with an ICI of 46. The site showed similar results in 1994 with a very good (ICI = 44) macroinvertebrate community. The site at RM 14.9 in 1982 also met the EWH biocriterion with an ICI of 46. In 1994, based on the qualitative sample from RM 14.7, the area demonstrated a very good macroinvertebrate community. The site at RM 15.2 had not been previously sampled.

Changes in Fish Community Performance: 1982 - 1994

- The fish communities between RMs 16.0 and 11.5 were sampled during 1982 and 1990 as part of a larger survey of the Stillwater River basin. Historical results have indicated fish communities in the fair to exceptional range, with IBI values ranging from 37 to 51 and MIwb scores ranging between 8.3 and 9.2. A significant improvement in the fish communities occurred during 1994, as documented in the higher IBI (53 - 57) and MIwb (9.7 - 9.9) scores.
- The improvement in the fish communities during 1994 appears associated with reduced effluent loadings of ammonia-N and oxygen demanding material from the West Milton WWTP. The reduced loadings are a result of a treatment plant upgrade at the West Milton WWTP which was completed during 1992. Fiftieth (50th) percentile effluent loadings of ammonia-N from 1982 to 1992 ranged between 11.2 and 37.1 kg/day; a substantial decline in ammonia-N loadings occurred during 1993 and 1994 (1.1 and 2.2 kg/day).

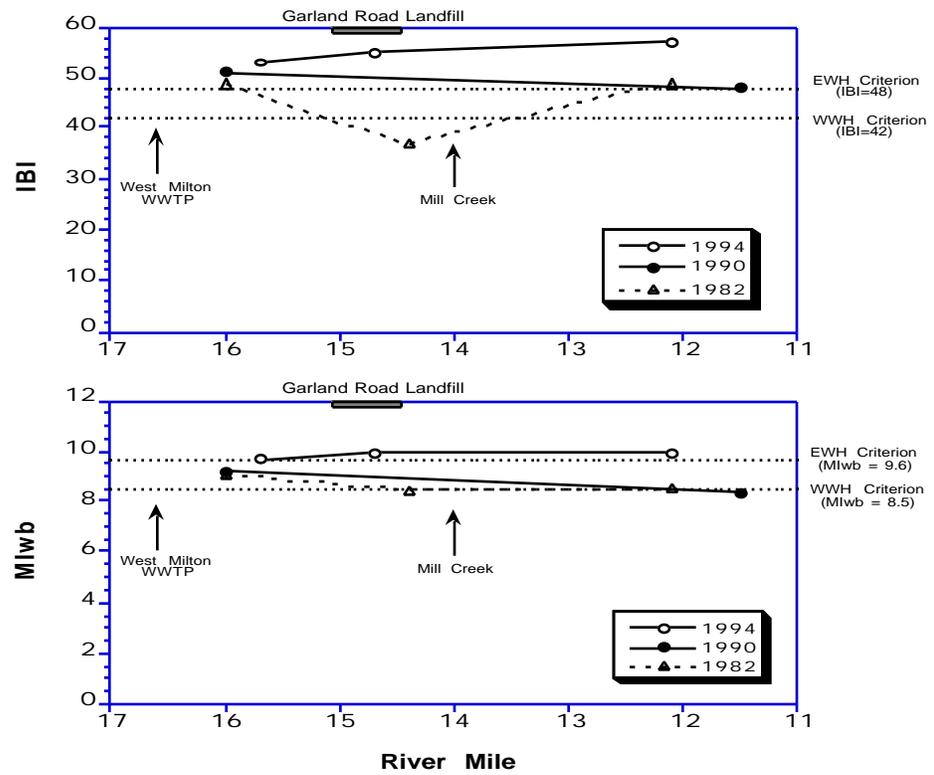


Figure 5. Longitudinal trend of the Index of Biotic Integrity (IBI) and Modified Index of Well-being (MIwb) from the Stillwater River, 1982 - 1994.

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Appendix Table 1. Sediment Chemistry.

Appendix Table 1. Continued.

Sampling Location - by River Mile							
Parameter	15.39 (0-6'')	14.35 (0-6'')	14.35D (0-6'')	13.95 (0-6'')	12.75 (0-6'')	12.10 (0-6'')	9.17 (0-6'')
4-Nitroaniline (ug/kg)	<330	<330	<330	<330	<330	<330	<330
4,6-Dinitro-2-methylphenol (ug/kg)	<1700	<1700	<1600	<1700	<1600	<1600	<1600
N-Nitrosodiphenylamine * (ug/kg)	<330	<330	<330	<330	<330	<330	<330
4-Bromophenyl phenyl ether (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Hexachlorobenzene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Pentachlorophenol (ug/kg)	<1700	<1700	<1600	<1700	<1600	<1600	<1600
Phenanthrene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Anthracene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Di-n-butylphthalate (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Fluoranthene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Pyrene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Butyl benzyl phthalate (ug/kg)	<330	<330	<330	<300	<330	<330	<330
3,3'-Dichlorobenzidine (ug/kg)	<670	<660	<660	<670	<660	<660	<660
Benzo(a)anthracene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Bis(2-Ethylhexyl) phthalate (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Chrysene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Di-n-octyl phthalate (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Benzo(b)fluoranthene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Benzo(k)fluoranthene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Benzo(a)pyrene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Indeno(1,2,3-cd)pyrene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Dibenz(a,h)anthracene (ug/kg)	<330	<330	<330	<330	<330	<330	<330
Benzo(g,h,i)perylene (ug/kg)	<330	<330	<330	<330	<330	<330	<330

* - Cannot be distinguished from diphenylamine.

Appendix Table 1. Continued. Pesticides, PCBs, lead, mercury, total organic carbon, and grain size parameters measured in sediment collected from the Stillwater River study area, 1994 by Ohio EPA. Depth of sediment sample is noted in parentheses.

Parameter	Sampling Location - by River Mile						
	15.39 (0-6")	14.35 (0-6")	14.35D (0-6")	13.95 (0-6")	12.75 (0-6")	12.10 (0-6")	9.17 (0-6")
<i>Pesticides (ug/kg)</i>							
alpha-BHC	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
gamma-BHC (Lindane)	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
beta-BHC	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
Heptachlor	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
delta-BHC	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
Aldrin	1.8	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
Heptachlor epoxide	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
Endosulfan I	<1.6	<1.6	<1.7	<1.6	<1.7	<1.6	<1.7
4,4'-DDE	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Dieldrin	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Endrin	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
4,4'-DDD	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Endosulfan II	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
4,4'-DDT	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Endrin aldehyde	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Endosulfan sulfate	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3	<3.3
Methoxychlor	<16	<16	<17	<16	<17	<16	<17
Chlordane (technical)	<82	<82	<83	<82	<83	<82	<83
Toxaphene	<82	<82	<83	<82	<83	<82	<83
<i>PCBs (ug/kg)</i>							
PCB-1016	<33	<33	<33	<33	<33	<33	<33
PCB-1221	<66	<66	<66	<66	<66	<66	<66
PCB-1232	<33	<33	<33	<33	<33	<33	<33
PCB-1242	<33	<33	<33	<33	<33	<33	<33
PCB-1248	<33	<33	<33	<33	<33	<33	<33
PCB-1254	<33	<33	<33	<33	<33	<33	<33
PCB-1260	<33	<33	<33	<33	<33	<33	<33
<i>Metals (mg/kg)</i>							
Lead	3.98	3.23	3.39	4.09	3.88	2.20	8.90
Mercury	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	0.08
<i>Total Organic Carbon (mg/kg)</i>							
TOC	43,400	18,400	18,000	22,200	30,700	14,800	18,300
<i>Grain Size (Percent)</i>							
Gravel	6.9	0.0	0.0	8.6	11.0	0.4	0.3
Sand	56.1	61.4	61.2	33.6	63.0	86.0	6.0
Silt	28.4	28.5	29.1	45.9	18.3	9.4	66.0
Clay	8.6	10.1	9.7	11.9	7.7	4.2	27.7

Appendix Table 2. Raw macroinvertebrate data by river mile for the Stillwater River, 1994.

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/94 River Code: 14-200 River: Stillwater River

RM: 15.20

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	0 +
03360	<i>Plumatella sp</i>	0 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
03600	<i>Oligochaeta</i>	33 +	84750	<i>Stictochironomus sp</i>	0 +
06800	<i>Gammarus sp</i>	0 +	85625	<i>Rheotanytarsus exiguus group</i>	25 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	0 +	85814	<i>Tanytarsus glabrescens group</i>	25 +
12200	<i>Isonychia sp</i>	0 +	95100	<i>Physella sp</i>	0 +
13400	<i>Stenacron sp</i>	36 +	97601	<i>Corbicula fluminea</i>	0 +
13521	<i>Stenonema femoratum</i>	15			
16700	<i>Tricorythodes sp</i>	0 +	No. Quantitative Taxa: 19		Total Taxa: 45
17200	<i>Caenis sp</i>	177 +	No. Qualitative Taxa: 38		ICI: 20
18100	<i>Anthopotamus sp</i>	24 +	Number of Organisms: 3170		Qual EPT: 7
18700	<i>Hexagenia sp</i>	1			
22001	<i>Coenagrionidae</i>	0 +			
22300	<i>Argia sp</i>	4 +			
44501	<i>Corixidae</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
51206	<i>Cyrnellus fraternus</i>	121			
52200	<i>Cheumatopsyche sp</i>	0 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
60900	<i>Peltodytes sp</i>	0 +			
68901	<i>Macronychus glabratus</i>	1 +			
69400	<i>Stenelmis sp</i>	0 +			
77130	<i>Ablabesmyia rhamphe group</i>	50			
77500	<i>Conchapelopia sp</i>	0 +			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	0 +			
78650	<i>Procladius sp</i>	0 +			
80360	<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	8			
80410	<i>Cricotopus (C.) sp</i>	0 +			
80430	<i>Cricotopus (C.) tremulus group</i>	0 +			
81250	<i>Nanocladius (N.) minimus</i>	50 +			
83040	<i>Dicrotendipes neomodestus</i>	250 +			
83050	<i>Dicrotendipes lucifer</i>	175			
83158	<i>Endochironomus nigricans</i>	0 +			
83300	<i>Glyptotendipes (Phytotendipes) sp</i>	2125 +			
83820	<i>Microtendipes "caelum" (sensu Simpson & Bode, 1980)</i>	25 +			
84020	<i>Parachironomus carinatus</i>	25			
84040	<i>Parachironomus frequens</i>	0 +			
84300	<i>Phaenopsectra obediens group</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/94 River Code: 14-200 River: Stillwater River

RM: 14.70

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01801	<i>Turbellaria</i>	32 +	78650	<i>Procladius sp</i>	0 +
03121	<i>Paludicella articulata</i>	0 +	80410	<i>Cricotopus (C.) sp</i>	0 +
03360	<i>Plumatella sp</i>	4 +	80430	<i>Cricotopus (C.) tremulus group</i>	0 +
03600	<i>Oligochaeta</i>	244	81231	<i>Nanocladius (N.) crassicornus or N. (N.) rectinervus</i>	202
04685	<i>Placobdella ornata</i>	0 +	81240	<i>Nanocladius (N.) distinctus</i>	202
04964	<i>Mooreobdella microstoma</i>	0 +	83040	<i>Dicrotendipes neomodestus</i>	0 +
06201	<i>Hyalella azteca</i>	0 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	11413 +
08250	<i>Orconectes (Procericambarus) rusticus</i>	0 +	84010	<i>Parachironomus abortivus</i>	101 +
11130	<i>Baetis intercalaris</i>	0 +	84040	<i>Parachironomus frequens</i>	202 +
12200	<i>Isonychia sp</i>	0 +	84450	<i>Polypedilum (P.) convictum</i>	808 +
13400	<i>Stenacron sp</i>	41 +	84470	<i>Polypedilum (P.) illinoense</i>	0 +
13561	<i>Stenonema pulchellum</i>	156	85625	<i>Rheotanytarsus exiguus group</i>	1111 +
13570	<i>Stenonema terminatum</i>	65 +	95100	<i>Physella sp</i>	1 +
16700	<i>Tricorythodes sp</i>	80 +	98200	<i>Pisidium sp</i>	4 +
17200	<i>Caenis sp</i>	116 +			
18100	<i>Anthopotamus sp</i>	0 +	No. Quantitative Taxa: 25 Total Taxa: 54		
21200	<i>Calopteryx sp</i>	0 +	No. Qualitative Taxa: 45 ICI: 24		
22001	<i>Coenagrionidae</i>	0 +	Number of Organisms: 15695 Qual EPT: 13		
22300	<i>Argia sp</i>	17 +			
45100	<i>Palmacorixa sp</i>	0 +			
45300	<i>Sigara sp</i>	0 +			
47600	<i>Sialis sp</i>	0 +			
48410	<i>Corydalis cornutus</i>	0 +			
51206	<i>Cyrnellus fraternus</i>	293			
52200	<i>Cheumatopsyche sp</i>	288 +			
52430	<i>Ceratopsyche morosa group</i>	0 +			
52520	<i>Hydropsyche bidens</i>	0 +			
52530	<i>Hydropsyche depravata group</i>	0 +			
53800	<i>Hydroptila sp</i>	0 +			
59530	<i>Oecetis eddlestoni</i>	0 +			
60300	<i>Dineutus sp</i>	0 +			
65800	<i>Berosus sp</i>	4 +			
68901	<i>Macronychus glabratus</i>	8			
69400	<i>Stenelmis sp</i>	0 +			
71100	<i>Hexatoma sp</i>	0 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	101			
77500	<i>Conchapelopia sp</i>	101			
77750	<i>Hayesomyia senata or Thienemannimyia norena</i>	101			
77800	<i>Helopelopia sp</i>	0 +			

**Ohio EPA Water Quality Monitoring and Assessment Section
Macroinvertebrate Collection**

Collection Date: 09/15/94 River Code: 14-200 River: Stillwater River

RM: 12.30

Taxa Code	Taxa	Quan/Qual	Taxa Code	Taxa	Quan/Qual
01320	<i>Hydra sp</i>	12	80410	<i>Cricotopus (C.) sp</i>	56
01801	<i>Turbellaria</i>	0 +	81229	<i>Nanocladius (N.) crassicornus</i>	364 +
03360	<i>Plumatella sp</i>	1 +	81250	<i>Nanocladius (N.) minimus</i>	196
03600	<i>Oligochaeta</i>	40 +	82141	<i>Thienemanniella xena</i>	140
08250	<i>Orconectes (Procericambarus) rusticus</i>	0 +	82820	<i>Cryptochironomus sp</i>	28
11130	<i>Baetis intercalaris</i>	124 +	83300	<i>Glyptotendipes (Phytotendipes) sp</i>	168 +
11650	<i>Procloeon sp (w/ hindwing pads)</i>	1	84450	<i>Polypedilum (P.) convictum</i>	504 +
12200	<i>Isonychia sp</i>	13 +	84540	<i>Polypedilum (Tripodura) scalaenum group</i>	84 +
13000	<i>Leucrocuta sp</i>	42	84750	<i>Stictochironomus sp</i>	0 +
13400	<i>Stenacron sp</i>	86	85625	<i>Rheotanytarsus exiguus group</i>	392 +
13510	<i>Stenonema exiguum</i>	17	85800	<i>Tanytarsus sp</i>	168
13561	<i>Stenonema pulchellum</i>	853 +	85814	<i>Tanytarsus glabrescens group</i>	140
13570	<i>Stenonema terminatum</i>	415 +	93900	<i>Elimia sp</i>	0 +
16700	<i>Tricorythodes sp</i>	315 +	98200	<i>Pisidium sp</i>	4 +
17200	<i>Caenis sp</i>	313 +			
18100	<i>Anthopotamus sp</i>	23 +	No. Quantitative Taxa:	43	Total Taxa: 54
21300	<i>Hetaerina sp</i>	0 +	No. Qualitative Taxa:	33	ICI: 44
22001	<i>Coenagrionidae</i>	0 +	Number of Organisms:	6613	Qual EPT: 11
22300	<i>Argia sp</i>	2 +			
26700	<i>Macromia sp</i>	0 +			
50315	<i>Chimarra obscura</i>	1 +			
51206	<i>Cyrnellus fraternus</i>	4			
52200	<i>Cheumatopsyche sp</i>	925 +			
52430	<i>Ceratopsyche morosa group</i>	302 +			
52520	<i>Hydropsyche bidens</i>	106			
57900	<i>Pycnopsyche sp</i>	0 +			
59970	<i>Petrophila sp</i>	4			
68700	<i>Dubiraphia sp</i>	0 +			
68901	<i>Macronychus glabratus</i>	26			
69400	<i>Stenelmis sp</i>	4 +			
74100	<i>Simulium sp</i>	0 +			
77120	<i>Ablabesmyia mallochi</i>	28			
77800	<i>Helopelopia sp</i>	56 +			
78140	<i>Labrundinia pilosella</i>	28			
78450	<i>Nilotanypus fimbriatus</i>	392			
78750	<i>Rheopelopia paramaculipennis</i>	28 +			
79085	<i>Telopelopia okoboji</i>	168			
80310	<i>Cardiocladius obscurus</i>	0 +			
80360	<i>Corynoneura "celeripes" (sensu Simpson & Bode, 1980)</i>	24			
80370	<i>Corynoneura lobata</i>	16			

Appendix Table 3. Invertebrate Community Index (ICI) metrics and scores for the Stillwater River study area, 1994.

River Mile	Drainage Area (sq mi)	Number of				Percent:					Qual. EPT	Eco- region	ICI
		Total Taxa	Mayfly Taxa	Caddisfly Taxa	Dipteran Taxa	Mayflies	Caddis- flies	Tany- tarsini	Other Dipt/NI	Tolerant Taxa			
STILLWATER RIVER — 14-200													
Year: 94													
15.20	609.0	19(2)	5(2)	1(0)	10(4)	8.0(2)	3.8(0)	1.6(2)	86.5(0)	1.0(6)	7(2)	5	20
14.70	609.0	25(4)	5(2)	2(2)	10(4)	2.9(2)	3.7(0)	7.1(2)	86.1(0)	2.8(4)	13(4)	5	24
12.30	630.0	43(6)	11(6)	5(4)	19(6)	33.3(6)	20.2(4)	10.6(2)	35.3(2)	0.6(6)	11(2)	5	44

Appendix Table 4. Summary of relative numbers of fish and species collected at each location by river mile sampled in the Stillwater River area, 1994. Relative numbers are per 1.0 km.

Species List

River Code: 14-200	Stream: Stillwater River	Sample Date: 1994
River Mile: 15.70	Basin: Great Miami River	Date Range: 08/08/94
Data Source: 01	Time Fished: 5442 sec Drain Area: 608.0 sq mi	Thru: 10/07/94
Purpose:	Dist Fished: 1.50 km No of Passes: 3	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GIZZARD SHAD		O	M	34	22.67	2.85	3.91	3.06	172.50
QUILLBACK CARPSUCKER	C	O	M	19	12.67	1.59	3.70	2.89	291.79
BLACK REDHORSE	R	I	S I	82	54.67	6.87	5.74	4.49	105.00
GOLDEN REDHORSE	R	I	S M	133	88.67	11.15	7.06	5.53	79.67
SHORHEAD REDHORSE	R	I	S M	46	30.67	3.86	3.06	2.39	99.78
RIVER REDHORSE [S]	R	I	S I	7	4.67	0.59	9.37	7.33	2,007.71
NORTHERN HOG SUCKER	R	I	S M	38	25.33	3.19	2.06	1.61	81.39
WHITE SUCKER	W	O	S T	10	6.67	0.84	0.05	0.04	8.20
SPOTTED SUCKER	R	I	S	6	4.00	0.50	0.43	0.34	107.83
COMMON CARP	G	O	M T	82	54.67	6.87	72.05	56.38	1,317.97
GOLDEN SHINER	N	I	M T	1	0.67	0.08	0.04	0.03	60.00
RIVER CHUB	N	I	N I	7	4.67	0.59	0.25	0.19	53.00
CREEK CHUB	N	G	N T	2	1.33	0.17	0.01	0.01	11.00
SILVER SHINER	N	I	S I	12	8.00	1.01	0.09	0.07	11.33
ROSYFACE SHINER	N	I	S I	10	6.67	0.84	0.01	0.01	1.30
STRIPED SHINER	N	I	S	80	53.33	6.71	0.20	0.15	3.68
SPOTFIN SHINER	N	I	M	195	130.00	16.35	0.41	0.32	3.16
SAND SHINER	N	I	M M	91	60.67	7.63	0.13	0.10	2.13
BLUNTNOSE MINNOW	N	O	C T	52	34.67	4.36	0.15	0.12	4.31
CENTRAL STONEROLLER	N	H	N	1	0.67	0.08	0.00	0.00	6.00
CHANNEL CATFISH	F		C	2	1.33	0.17	3.22	2.52	2,412.50
WHITE CRAPPIE	S	I	C	1	0.67	0.08	0.14	0.11	212.00
ROCK BASS	S	C	C	13	8.67	1.09	1.15	0.90	132.15
SMALLMOUTH BASS	F	C	C M	94	62.67	7.88	7.28	5.70	116.15
LARGEMOUTH BASS	F	C	C	36	24.00	3.02	5.47	4.28	227.83
GREEN SUNFISH	S	I	C T	22	14.67	1.84	0.72	0.56	49.05
BLUEGILL SUNFISH	S	I	C P	12	8.00	1.01	0.33	0.26	41.33
OR'GESPOTTED SUNFISH	S	I	C	9	6.00	0.75	0.06	0.04	9.56
LONGEAR SUNFISH	S	I	C M	78	52.00	6.54	0.54	0.42	10.30
GREEN SF X BLUEGILL				2	1.33	0.17	0.03	0.02	22.50
LONGEAR SF X B'GILL				1	0.67	0.08	0.11	0.09	163.00
BLACKSIDE DARTER	D	I	S	1	0.67	0.08	0.00	0.00	5.00
LOGPERCH	D	I	S M	5	3.33	0.42	0.02	0.01	5.60
JOHNNY DARTER	D	I	C	2	1.33	0.17	0.00	0.00	2.00
GREENSIDE DARTER	D	I	S M	6	4.00	0.50	0.01	0.01	3.50
BANDED DARTER	D	I	S I	1	0.67	0.08	0.00	0.00	2.00
<i>Mile Total</i>				1,193	795.33		127.80		
<i>Number of Species</i>				34					
<i>Number of Hybrids</i>				2					

Species List

River Code: 14-200	Stream: Stillwater River	Sample Date: 1994
River Mile: 14.70	Basin: Great Miami River	Date Range: 08/08/94
Data Source: 01	Time Fished: 5513 sec Drain Area: 609.0 sq mi	Thru: 10/07/94
Purpose:	Dist Fished: 1.52 km No of Passes: 3	Sampler Type: A

Species Name / ODNR Status	IBI Grp	Feed Guild	Breed Guild Tol	# of Fish	Relative Number	% by Number	Relative Weight	% by Weight	Ave(gm) Weight
GIZZARD SHAD		O	M	22	14.55	2.35	2.79	2.34	191.91
QUILLBACK CARPSUCKER	C	O	M	9	5.88	0.95	4.89	4.09	830.56
BLACK REDHORSE	R	I	S I	51	33.61	5.43	5.90	4.93	175.62
GOLDEN REDHORSE	R	I	S M	143	93.91	15.18	16.09	13.46	171.43
SHORHEAD REDHORSE	R	I	S M	51	33.57	5.43	3.69	3.09	109.46
RIVER REDHORSE [S]	R	I	S I	10	6.61	1.07	12.07	10.09	1,825.00
NORTHERN HOG SUCKER	R	I	S M	68	44.85	7.25	7.77	6.50	173.21
WHITE SUCKER	W	O	S T	1	0.65	0.11	0.01	0.01	9.00
SPOTTED SUCKER	R	I	S	1	0.65	0.11	0.15	0.12	222.00
COMMON CARP	G	O	M T	54	35.54	5.74	49.23	41.18	1,382.13
GOLDEN SHINER	N	I	M T	1	0.65	0.11	0.03	0.02	38.00
RIVER CHUB	N	I	N I	24	15.78	2.55	0.20	0.17	12.54
SILVER SHINER	N	I	S I	8	5.23	0.85	0.05	0.04	9.38
ROSYFACE SHINER	N	I	S I	7	4.64	0.75	0.01	0.01	3.00
STRIPED SHINER	N	I	S	54	35.61	5.75	0.23	0.20	6.60
SPOTFIN SHINER	N	I	M	108	71.15	11.50	0.27	0.22	3.78
SAND SHINER	N	I	M M	4	2.64	0.43	0.01	0.01	2.25
BLUNTNOSE MINNOW	N	O	C T	48	31.74	5.13	0.14	0.12	4.56
CENTRAL STONEROLLER	N	H	N	10	6.59	1.06	0.06	0.05	8.70
CHANNEL CATFISH	F		C	3	2.00	0.32	2.16	1.81	1,081.00
YELLOW BULLHEAD		I	C T	1	0.67	0.11	0.10	0.08	152.00
STONECAT MADTOM		I	C I	1	0.65	0.11	0.02	0.02	28.00
ROCK BASS	S	C	C	6	3.95	0.64	0.28	0.24	71.67
SMALLMOUTH BASS	F	C	C M	76	50.16	8.11	8.74	7.31	174.71
LARGEMOUTH BASS	F	C	C	29	19.07	3.08	2.84	2.38	149.52
GREEN SUNFISH	S	I	C T	25	16.55	2.67	0.45	0.38	27.39
BLUEGILL SUNFISH	S	I	C P	20	13.22	2.14	0.79	0.66	59.80
OR'GESPOTTED SUNFISH	S	I	C	9	5.92	0.96	0.06	0.05	10.52
LONGEAR SUNFISH	S	I	C M	50	33.10	5.35	0.38	0.31	11.36
GREEN SF X BLUEGILL				2	1.32	0.21	0.03	0.02	19.00
BLACKSIDE DARTER	D	I	S	1	0.65	0.11	0.00	0.00	2.00
LOGPERCH	D	I	S M	7	4.63	0.75	0.04	0.03	8.00
GREENSIDE DARTER	D	I	S M	26	17.11	2.77	0.07	0.06	4.13
BANDED DARTER	D	I	S I	7	4.58	0.74	0.02	0.02	4.00
RAINBOW DARTER	D	I	S M	2	1.32	0.21	0.00	0.00	3.50
<i>Mile Total</i>				939	618.75		119.55		
<i>Number of Species</i>				34					
<i>Number of Hybrids</i>				1					

Species List

River Code: 14-200	Stream: Stillwater River	Sample Date: 1994
River Mile: 12.10	Basin: Great Miami River	Date Range: 08/09/94
Data Source: 01	Time Fished: 3927 sec Drain Area: 630.0 sq mi	Thru: 10/07/94
Purpose:	Dist Fished: 1.50 km No of Passes: 3	Sampler Type: A

Species Name / ODNR Status	IBI	Feed	Breed		# of	Relative	% by	Relative	% by	Ave(gm)
	Grp	Guild	Guild	Tol	Fish	Number	Number	Weight	Weight	Weight
GIZZARD SHAD		O	M		292	194.67	18.22	25.28	12.63	129.88
QUILLBACK CARPSUCKER	C	O	M		3	2.00	0.19	1.56	0.78	780.67
BLACK REDHORSE	R	I	S	I	112	74.67	6.99	10.43	5.21	139.74
GOLDEN REDHORSE	R	I	S	M	463	308.67	28.88	69.60	34.78	225.49
SHORHEAD REDHORSE	R	I	S	M	85	56.67	5.30	15.55	7.77	274.44
RIVER REDHORSE [S]	R	I	S	I	4	2.67	0.25	1.02	0.51	382.50
NORTHERN HOG SUCKER	R	I	S	M	132	88.00	8.23	14.70	7.34	167.03
SPOTTED SUCKER	R	I	S		1	0.67	0.06	0.14	0.07	209.00
COMMON CARP	G	O	M	T	64	42.67	3.99	40.56	20.27	950.65
RIVER CHUB	N	I	N	I	17	11.33	1.06	0.21	0.11	18.88
SILVER SHINER	N	I	S	I	6	4.00	0.37	0.01	0.01	2.83
ROSYFACE SHINER	N	I	S	I	25	16.67	1.56	0.05	0.03	3.04
STRIPED SHINER	N	I	S		21	14.00	1.31	0.29	0.15	21.02
SPOTFIN SHINER	N	I	M		92	61.33	5.74	0.22	0.11	3.58
SAND SHINER	N	I	M	M	31	20.67	1.93	0.06	0.03	2.94
BLUNTNOSE MINNOW	N	O	C	T	10	6.67	0.62	0.04	0.02	6.20
CENTRAL STONEROLLER	N	H	N		4	2.67	0.25	0.05	0.02	17.50
CHANNEL CATFISH	F		C		3	2.00	0.19	1.36	0.68	678.67
BROWN BULLHEAD		I	C	T	2	1.33	0.12	0.22	0.11	168.00
BLACK BULLHEAD		I	C	P	1	0.67	0.06	0.12	0.06	178.00
WHITE CRAPPIE	S	I	C		4	2.67	0.25	0.47	0.24	176.75
ROCK BASS	S	C	C		15	10.00	0.94	1.73	0.86	172.91
SMALLMOUTH BASS	F	C	C	M	94	62.67	5.86	13.98	6.99	223.09
LARGEMOUTH BASS	F	C	C		10	6.67	0.62	0.93	0.46	138.80
GREEN SUNFISH	S	I	C	T	33	22.00	2.06	0.72	0.36	32.85
BLUEGILL SUNFISH	S	I	C	P	4	2.67	0.25	0.04	0.02	15.25
OR'GESPOTTED SUNFISH	S	I	C		3	2.00	0.19	0.02	0.01	11.00
LONGEAR SUNFISH	S	I	C	M	46	30.67	2.87	0.67	0.34	22.00
GREEN SF X BLUEGILL					2	1.33	0.12	0.03	0.02	23.50
BLACKSIDE DARTER	D	I	S		1	0.67	0.06	0.00	0.00	3.00
LOGPERCH	D	I	S	M	8	5.33	0.50	0.03	0.02	6.00
GREENSIDE DARTER	D	I	S	M	9	6.00	0.56	0.02	0.01	2.78
RAINBOW DARTER	D	I	S	M	6	4.00	0.37	0.01	0.00	1.33
<i>Mile Total</i>					1,603	1,068.67		200.14		
<i>Number of Species</i>					32					
<i>Number of Hybrids</i>					1					

Appendix Table 5. Index of Biotic Integrity (IBI) metrics and scores by river mile for locations sampled in the Stillwater River study area, 1994.

River Mile	Type	Date	Drainage area (sq mi)	Number of				Percent of Individuals							Rel.No. minus tolerants /(1.0 km)	IBI	Modified lwb
				Total species	Sunfish species	Sucker species	Intolerant species	Rnd-bodied suckers	Simple Lithophils	Tolerant fishes	Omni- vores	Top carnivores	Insect- ivores	DELT anomalies			
Stillwater River - (14-200)																	
Year: 94																	
15.70	A	08/08/94	608	25(5)	5(5)	8(5)	5(5)	37(3)	44(3)	18(3)	21(3)	13(5)	65(5)	1.5(3)	558(5)	50	9.5
15.70	A	09/07/94	608	32(5)	5(5)	8(5)	6(5)	28(3)	36(3)	13(5)	14(5)	11(5)	73(5)	0.0(5)	794(5)	56	9.6
15.70	A	10/07/94	608	26(5)	5(5)	8(5)	5(5)	15(1)	32(3)	13(5)	15(5)	12(5)	73(5)	0.3(5)	700(5)	54	10.1
14.70	A	08/08/94	609	25(5)	5(5)	7(5)	6(5)	46(5)	51(5)	17(3)	16(3)	12(5)	71(5)	0.0(5)	473(5)	56	9.6
14.70	A	09/07/94	609	25(5)	5(5)	5(3)	4(5)	29(3)	40(3)	17(3)	16(5)	13(5)	70(5)	0.3(5)	640(5)	52	10.2
14.70	A	10/07/94	609	25(5)	4(5)	6(5)	6(5)	30(3)	51(5)	6(5)	10(5)	10(5)	78(5)	0.8(3)	486(5)	56	10.0
12.10	A	08/09/94	630	25(5)	4(5)	5(3)	4(5)	57(5)	60(5)	12(5)	13(5)	6(3)	79(5)	0.5(3)	708(5)	54	9.7
12.10	A	09/07/94	630	26(5)	6(5)	7(5)	4(5)	64(5)	70(5)	6(5)	5(5)	8(3)	86(5)	0.3(5)	842(5)	58	10.1
12.10	A	10/07/94	630	25(5)	6(5)	5(3)	5(5)	59(5)	66(5)	6(5)	4(5)	12(5)	84(5)	0.0(5)	892(5)	58	10.0

Appendix Table 6. Fish tissue chemical parameters and results by river mile for locations sampled in the Stillwater River study area, 1994.

Appendix Table 6. Pesticides, PCBs, lead, mercury, and lipid analyses of fish tissue collected from the Stillwater River study area, 1994 by Ohio EPA.

Parameter	Sampling Location - by River Mile						
	<u>23.4</u> Channel catfish SFFC	<u>23.4</u> Large- mouth bass SOF	<u>23.4</u> Common carp SOFC	<u>17.4</u> Common carp WBC	<u>17.4</u> Common carp SOFC	<u>17.4</u> Small- mouth bass SOFC	<u>17.4</u> Channel catfish SFF
<u>Pesticides (ug/kg)</u>							
alpha-BHC	-	-	-	-	-	-	-
gamma-BHC (Lindane)	-	-	-	-	-	-	-
beta-BHC	-	-	-	-	-	-	-
Heptachlor	-	-	-	-	-	-	-
delta-BHC	-	-	-	-	-	-	-
Aldrin	-	-	-	-	-	-	-
Heptachlor epoxide	-	-	-	-	-	-	-
Endosulfan I	-	-	-	-	-	-	-
4,4'-DDE	-	-	-	-	-	-	-
Dieldrin	-	-	-	-	-	-	-
Endrin	-	-	-	-	-	-	-
4,4'-DDD	-	-	-	-	-	-	-
Endosulfan II	-	-	-	-	-	-	-
4,4'-DDT	-	-	-	-	-	-	-
Endrin aldehyde	-	-	-	-	-	-	-
Endosulfan sulfate	-	-	-	-	-	-	-
Methoxychlor	-	-	-	-	-	-	-
Chlordane (technical)	-	-	-	-	-	-	-
Toxaphene	-	-	-	-	-	-	-
<u>PCB's (ug/kg)</u>							
PCB-1016	-	-	-	-	-	-	-
PCB-1221	-	-	-	-	-	-	-
PCB-1232	-	-	-	-	-	-	-
PCB-1242	-	-	-	-	-	-	-
PCB-1248	-	-	-	-	-	-	-
PCB-1254	-	-	-	-	-	-	-
PCB-1260	-	-	-	-	-	-	-
<u>Metals (mg/kg)</u>							
Lead	-	-	-	-	-	-	-
Mercury	1.04	0.20	0.22	<0.08	0.19	0.23	0.18
<u>Lipids (Percent)</u>							
	5.27	0.41	1.05	3.41	0.64	1.96	0.48

Appendix Table 6. Continued.

Parameter	Sampling Location - by River Mile						
	15.4 Channel catfish SFF	15.4 Small- mouth bass SOF	15.4 Common carp WBC	14.7 Channel catfish SFFC	14.7 Small- mouth bass SOFC	14.7 Common carp WBC	12.1 Small- mouth bass SOFC
<i>Pesticides (ug/kg)</i>							
alpha-BHC	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
gamma-BHC (Lindane)	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
beta-BHC	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
Heptachlor	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
delta-BHC	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
Aldrin	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
Heptachlor epoxide	3.1	<1.6	3.4	2.6	<1.7	3.9	<1.6
Endosulfan I	<1.7	<1.6	<1.6	<1.6	<1.7	<1.6	<1.6
4,4'-DDE	22	<3.3	27	18	<3.3	32	3.8
Dieldrin	24	7.5	25	25	<3.3	27	7.1
Endrin	<3.3	<3.3	<3.2	<3.3	<3.3	<3.3	<3.3
4,4'-DDD	4.3	<3.3	7.5	18	<3.3	8.8	<3.3
Endosulfan II	<3.3	<3.3	<3.2	<3.3	<3.3	<3.3	<3.3
4,4'-DDT	3.6	<3.3	<3.2	12	<3.3	7.5	<3.3
Endrin aldehyde	<3.3	<3.3	<3.2	<3.3	<3.3	<3.3	<3.3
Endosulfan sulfate	5.6	<3.3	11	<3.3	<3.3	<3.3	<3.3
Methoxychlor	<17	<16	<16	<16	<17	<16	<16
Chlordane (technical)	<83	<82	<81	<82	<83	<82	<82
Toxaphene	<83	<82	<81	<82	<83	<82	<82
<i>PCB's (ug/kg)</i>							
PCB-1016	<50	<48	<50	<49	<49	<49	<49
PCB-1221	<99	<96	<99	<97	<99	<98	<99
PCB-1232	<50	<48	<50	<49	<49	<49	<49
PCB-1242	<50	<48	<50	<49	<49	<49	<49
PCB-1248	<50	<48	<50	<49	<49	<49	<49
PCB-1254	<50	<48	<50	<49	<49	<49	<49
PCB-1260	<50	<48	<50	<49	<49	<49	<49
<i>Metals (mg/kg)</i>							
Lead	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Mercury	0.21	0.55	0.10	0.28	0.32	0.16	0.21
<i>Lipids (Percent)</i>							
	3.13	0.44	3.33	2.41	0.12	2.38	1.17

Appendix Table 6. Continued.

Sampling Location - by River Mile			
Parameter	<u>12.1</u> Small- mouth bass SOF	<u>12.1</u> Common carp WBC	<u>15.4D</u> Common carp WBC
<i>Pesticides (ug/kg)</i>			
alpha-BHC	<1.7	<1.6	<1.7
gamma-BHC (Lindane)	<1.7	<1.6	<1.7
beta-BHC	<1.7	<1.6	<1.7
Heptachlor	<1.7	<1.6	<1.7
delta-BHC	<1.7	<1.6	<1.7
Aldrin	<1.7	<1.6	<1.7
Heptachlor epoxide	<1.7	2.8	4.6
Endosulfan I	<1.7	<1.6	<1.7
4,4'-DDE	<3.3	25	32
Dieldrin	4.9	12	29
Endrin	<3.3	<3.3	<3.3
4,4'-DDD	<3.3	4.3	9.9
Endosulfan II	<3.3	<3.3	<3.3
4,4'-DDT	<3.3	<3.3	<3.3
Endrin aldehyde	<3.3	<3.3	5.2
Endosulfan sulfate	<3.3	<3.3	11
Methoxychlor	<17	<16	21
Chlordane (technical)	<83	<82	<83
Toxaphene	<83	<82	<83
<i>PCB's (ug/kg)</i>			
PCB-1016	<50	<49	<50
PCB-1221	<100	<98	<100
PCB-1232	<50	<49	<50
PCB-1242	<50	<49	<50
PCB-1248	<50	<49	<50
PCB-1254	<50	<49	<50
PCB-1260	<50	<49	<50
<i>Metals (mg/kg)</i>			
Lead	<0.10	<0.10	<0.10
Mercury	0.44	0.11	0.13
<i>Lipids (Percent)</i>			
	0.89	0.89	3.16