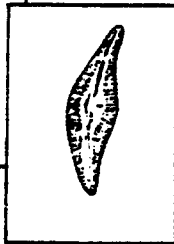
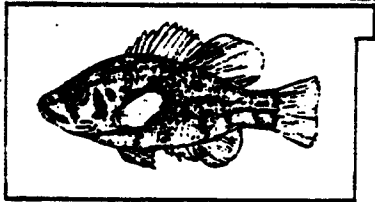


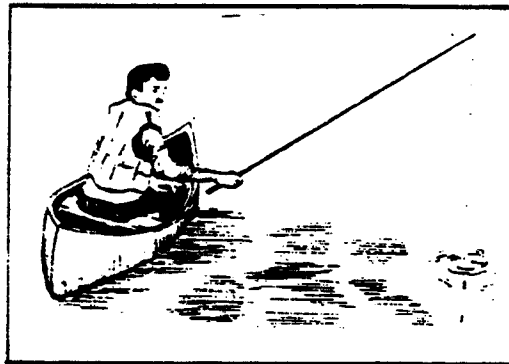
A Biological Assessment of The Upper Tradewater River



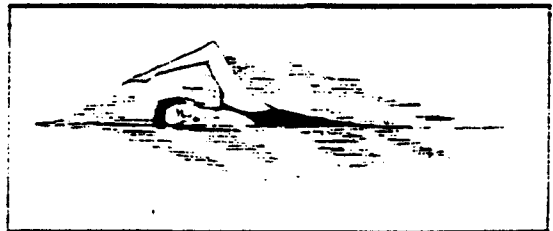
Outstanding
Resource
Waters



Aquatic
Life

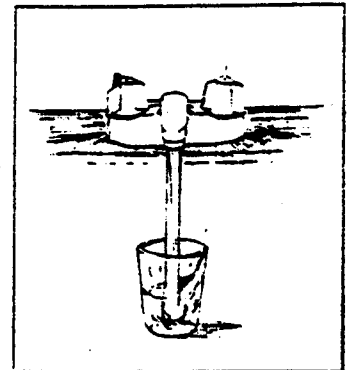


Recreation



Natural Resources and
Environmental Protection Cabinet

Kentucky Division of Water
Ecological Support Section
Technical Report No. 51



Domestic
Use

**A BIOLOGICAL ASSESSMENT OF THE
UPPER TRADEWATER RIVER**

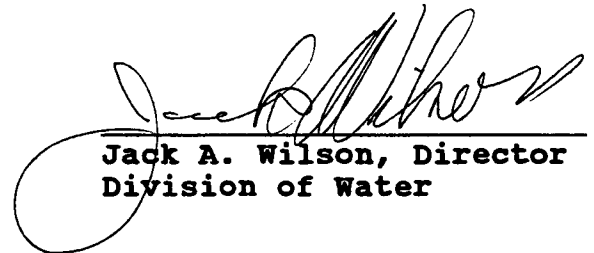
**Division of Water
Water Quality Branch**

**A BIOLOGICAL ASSESSMENT OF THE
UPPER TRADEWATER RIVER**

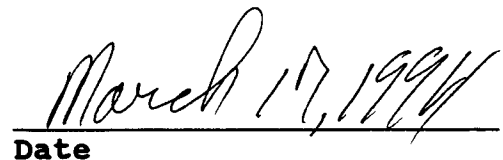
**Kentucky Department for Environmental Protection
Division of Water
Water Quality Branch
Ecological Support Section
Frankfort, Kentucky**

March, 1994

This report has been approved for release:



**Jack A. Wilson, Director
Division of Water**



Date

ACKNOWLEDGEMENTS

Michael R. Mills
Project Leader

Ron Houp
Aquatic Invertebrate Zoologist

John Brumley
Phycologist

Karen Smathers
Ichthyologist

EXECUTIVE SUMMARY

A biological inventory of the aquatic community existing in the upper reaches of the Tradewater River was conducted in the spring of 1993. Algae, macroinvertebrates, and fish communities were sampled from one site utilizing the methods outlined in KDOW (1993a). The intent of this inventory was to evaluate the aquatic communities, available instream habitats, and desirable physical properties for possible inclusion into the Division of Water's Reference Reach Program.

Algae community data was evaluated using the Periphyton Bioassessment Index (PBI) (KDOW 1993a). An excellent rating for the algae community at this site was obtained when all metrics of the PBI were calculated.

The macroinvertebrate collection was analyzed using various metrics including the Reference Community Index (RCI), Taxa Richness, and the Ephemeroptera, Plecoptera, Trichoptera Index (EPT).

Fish data were analyzed using the Index of Biotic Integrity (IBI) (Karr et al 1986) which was modified for use in the Interior Plateau ecoregion (KDOW 1993b). A "good" rating was obtained when all metric scores were totaled, indicating a good fish community was found at this site.

Physicochemical data analyses (both field and laboratory) revealed acceptable water quality for a productive aquatic community.

Therefore, an overall assessment of the biological and

physicochemical data of the upper Tradewater River would indicate good to excellent quality which can serve as a benchmark to describe the biological and physiochemical integrity of an unimpaired stream in this ecoregion.

INTRODUCTION

A biological inventory of the aquatic community existing in the upper reaches of the Tradewater River was conducted in the spring of 1993. Algae, macroinvertebrate, and fish communities were sampled utilizing methods described in KDOW (1993a). Algae data were analyzed using the Periphyton Bioassessment Index (PBI). Macroinvertebrate data were evaluated using various metrics including the Reference Community Index (RCI), Taxa Richness, and the Ephemeroptera, Plecoptera, Trichoptera Index (EPT). The Index of Biotic Integrity (IBI) was used to assess the fish community structure for site IPREFTRR. All data analysis methods are outlined in KDOW (1993a).

Water samples were collected for analysis of standard physicochemical parameters. Field measurements were also conducted using the YSI 3800 water quality logger to determine water temperature, dissolved oxygen, conductivity, turbidity, and pH.

The intent of this inventory was to evaluate the aquatic communities, available instream habitats and desirable physical properties for possible inclusion into the Division of Water's Reference Reach Program. A site description is in the Appendix (page 12).

PHYSICOCHEMICAL

Physical properties including habitat were comparable to those recorded by Bryan and MacGregor (1993). The riparian zone was well developed with mostly forested stream banks. Pools were of various sizes and depths, while riffles were small and shallow. Stream substrate was composed mostly of bedrock and gravel beds. Instream habitat included overhanging banks, logs, debris piles, root mats, sand bars, and Justicia beds.

Chemical properties that indicate organic enrichment (i.e. nitrogen complex) were found to be low. Parameters which would indicate toxicity (i.e. metals & chloride) were also low.

Overall, physicochemical analyses showed acceptable requirements for a productive aquatic community. Laboratory chemical data is in the Appendix (pages 13-14), field parameter measurements are in Table 1.

Table 1. Field Parameters Measured for Site IPREFTRR

Water Temperature	17.7°C
Dissolved Oxygen (DO)	9.46 mg/L
Saturation	100.6%
Conductivity	234 umho/cm
Salinity	0.1%
pH	7.67 S.U.
Turbidity	3 NTU

PHYTOBENTHOS (PERIPHYTON)

Eighty algal taxa, representing five algal divisions, were collected from the Upper Tradewater River on May 13, 1993. Twenty-two chlorophyte; seven cyanophyte; two euglenophyte; one cryptophyte; and forty-eight chrysophyte taxa were identified by staff biologists. Of the 32 non-diatom taxa, 78% were periphytic (growing attached to a substrate) or tycho planktonic (entangled among other filaments), while 22% were euplanktonic (suspended within the water column). The high percentage of euplanktonic taxa was attributed to the occurrence of an upstream impoundment (Buntin Lake), as well as transport of some taxa from neighboring farm ponds.

The periphyton bioassessment index (PBI) was used to determine impairment of biological integrity. The metrics used in the PBI were as follows: total number of diatom taxa (TNDT), diatom diversity (D), diatom taxonomic index (DTI), and relative abundance of sensitive species (RAS). The ranges of metric values used to assign scores for the PBI were summarized in Kentucky Division of Water (1993a).

Total number of diatom taxa at the Upper Tradewater River station was 38 which scored a high 3 for that metric. Diatom diversity was calculated at 2.97 which again scored a 3. The diatom taxonomic index was 3.26 which scored a 5. The final metric, relative abundance of sensitive species, was determined to be 39%, scoring a 5 for that metric. In final

analysis of these metrics, a PBI score of 4 was obtained. Therefore, this station was rated as excellent, fully supporting warmwater aquatic habitat uses. Soft algae and diatom taxonomic lists are found in the Appendix (pages 15-18).

MACROINVERTEBRATES

The macroinvertebrate component of the biotic community was evaluated using several metrics designed to illustrate a reference condition. One of those, the Reference Community Index (RCI), contained sufficient species to indicate that point and/or non-point impacts such as sediments were not affecting or limiting the instream habitats or organisms at that location. Other metrics such as Taxa Richness and the Ephemeroptera, Plecoptera, Trichoptera Index (EPT) also contained acceptable numbers and kinds of intolerant species to meet reference reach standards for that ecoregion.

A comparison between the data submitted by Bryan and MacGregor (1993) and Division of Water are largely confined to the differences between species and numbers of organisms collected in spring (DOW), from those collected in summer. In most instances, species compositions and community structures are different for most organisms occurring in summer and do not have as stringent habitat or water quality requirements as do spring or winter communities. Consequently, summer collections are of limited value in water quality assessments. However, they do help define the total community and certainly

contribute in that respect.

From the initial investigations conducted at this location on the Tradewater, the instream habitats appear to be unaltered or minimally affected by agricultural activities, as reflected by the amount of habitat partitioning expressed amongst the same functional feeding groups. From the cursory evaluation of this site in relation to downstream areas and other streams in the area, this portion of the Tradewater River could eventually serve as a reference stream for the ecoregion. A species list is included in the Appendix (page 19).

FISH COMMUNITY STRUCTURE

The Appendix (page 20) contains the species collected from the Upper Tradewater River site IPREFTRR. Nineteen species were collected with six families represented. Individuals generally were appropriately distributed among all trophic levels except for top carnivores (Micropterus sp.) which were observed but not collected. Four fish species were collected that are intolerant to silt, low DO, etc. Most other species collected are typically found in lowland streams and are tolerant of silt.

An Index of Biotic Integrity (IBI) was calculated for IPREFTRR (Table 2) using expectation criteria developed for the Interior Plateau ecoregion (KDOW 1993b; Karr et al 1986). A rating of 52 was obtained out of a possible score of 60. This value falls into the "good" (Karr et al. 1986) class

meaning that the fish community structure at this site is of good quality.

Recent collections from the Tradewater River made by Bryan and MacGregor (1993) show data that are comparable with KDOW collections. Bryan and MacGregor have collections from several sites on the Tradewater River including one from the KDOW Reference Reach site (IPREFTRR). Seventeen species representing eight families were collected by Bryan and MacGregor (1993) at the T. Sparkman Rd. site. Thirteen species were common to both the KDOW sample and Bryan & MacGregor (1993) samples.

Previous collections reported by KDOW (1985), and Miller and Mills (1986), show species composition for the Tradewater River to be similar to KDOW collections.

Table 2: Index of Biotic Integrity for Site IPREFTRR		
Metric	#Obtained	Score
Total Species	19	5
Total Individuals	144	5
Darter Species	4	5
Sunfish Species	4	5
Sucker Species	2	5
Intolerant Species	4	3
Omnivores	18.1%	5
Insectivorous Cyprinids	23.8%	3
Green Sunfish	1.4%	5
Top Carnivores	0.7%	1
Hybrids	0%	5
Diseased, etc.	0%	5
Total Score:		52
Class - Good		

LITERATURE CITED

- Bryan, H. D. and J. R. MacGregor. 1993. Ecological Assessment for the Upper Tradewater River, Christian Co., Kentucky. Eco Tech, Inc. Frankfort, KY.
- Karr, J. R., K.D. Fausch, P. L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. Assessing Biological Integrity in Running Waters: A Method and Its Rationale. Illinois Natural History Survey, Champaign, IL, Special Publication 5.
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- Kentucky Division of Water (KDOW). 1993b. Reference Reach Program Data Analysis for Fish Community Structure (in Draft). Kentucky Dept. Env. Prot. Division of Water, Frankfort, KY.
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- Miller, L. G. and M. R. Mills. 1986. Fishes of the Tradewater River System, Kentucky. Trans. KY. Acad. Sci. 47: 106-117.

Appendix

SITE DESCRIPTION

INTERIOR PLATEAU ECOREGION

Upper Tradewater River

County: IPREFTRR

Waterbody Number: KY5140205-017

County: Christian

Stream Order: IV

USGS Topo Quad: Pleasant Green Hill (4-20)

Latitude:

Longitude:

Location: T. J. Sparkman Rd. Bridge approximately 122.0 river miles (196.3 km) upstream from the confluence with the Ohio River

Sampling Dates: 13 May 1993

Stream Length: 132.3 mi (212.9 km)

Direction of Flow: NW

Elevation: Headwaters - 700 ft (213.4 m)

Site - 490 ft. (149.4 m)

Gradient: 3.9 m/km

Watershed: 65% Forested

35% Agricultural and Residential

Riparian Zone: Good to Excellent; 75% Canopy Cover

Observed Riparian and Aquatic Vegetation: Platanus occidentalis, Betula nigra, Acer negundo, and Cyperus sp.

Stream Character: Good pools and riffles varying in size and depths

Pool Substrate: Bedrock, Cobble, and Fines

Riffle Substrate: Cobble, Pebble, and Bedrock

PHILLIP J. SHEPHERD
SECRETARY



BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
18 REILLY ROAD
FRANKFORT, KENTUCKY 40601

June 17, 1993

Division of Environmental Services
Report Number: A25-00079
Sample Number: 9302610

TO: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

RE: Tradewater River

ATTN: Karen Smathers

County: N/A

Facility:

Collected by: Smathers, Houp & Brumley

Date: 05/13/93 Time: 1430

Delivered by: Ron Houp

Date: 05/17/93 Time: 1505

Received by: Polly Ellis

Date: 05/17/93 Time: 1505

Sample Matrix: Water

Collection Method: Grab

Sample Identification: Tradewater River

REPORT OF ANALYSIS

<u>TOTAL CONSTITUENTS</u>	<u>CONCENTRATION</u>
Acidity	1.9 mg/L
Alkalinity	101 mg/L
Chloride	4.9 mg/L
Conductivity	277 μ mho/cm
Fluoride	ND @ 0.1 mg/L
Hardness, total	119 mg/L
pH	8.0 S.U.
Total Suspended Solids	ND @ 1 mg/L
Total Dissolved Solids	134 mg/L
Sulfate	27.4 mg/L
Organic Carbon	1.6 mg/L
Turbidity	1.9 NTU
Ammonia-Nitrogen	ND @ 0.05 mg/L
Total Kjeldhal Nitrogen	ND @ 0.05 mg/L
Nitrate	0.419 mg/L
Phosphorus, total	ND @ 0.005 mg/L
Calcium	42.1 mg/L
Magnesium	5.71 mg/L
Potassium	2.02 mg/L
Sodium	5.49 mg/L
Aluminum	0.095 mg/L
Arsenic	ND @ 0.002 mg/L
Barium	0.039 mg/L



June 17, 1993

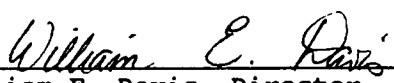
Report Number: A25-00079

Page 2 of 2

<u>TOTAL CONSTITUENTS</u>	<u>CONCENTRATION</u>
Chromium	0.016 mg/L
Copper	ND @ 0.001 mg/L
Iron	0.246 mg/L
Lead	ND @ 0.001 mg/L
Manganese	0.046 mg/L
Mercury	ND @ 0.0001 mg/L
Zinc	ND @ 0.003 mg/L

ND = Not Detected

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.



William E. Davis, Director
Division of Environmental Services

SOFT ALGAE SPECIES LIST 1993

WATERBODY: Upper Tradewater River
DATE COLLECTED: 930513.11
LOCATION: T.J. Sparkman Rd. Br.-Christian
COLLECTORS: Brumley, Houp, Smathers

CHLOROPHYTA

Ankistrodesmus convolutus
Ankistrodesmus falcatus
Chlamydomonas sp.
Cladophora glomerata
Closterium lunula
Closterium peracerosum
Coelastrum sphaericum
Cosmarium subgranatum
Gloeocystis vesiculosa
Mougeotia sp.
Oedogonium sp.
Pediastrum boryanum
Protococcus viridis
Scenedesmus acutus
Scenedesmus bijuga
Scenedesmus brasiliensis
Scenedesmus dimorphus
Scenedesmus obliquus
Scenedesmus quadricauda
Spirogyra sp.
Stigeoclonium sp.
Ulothrix variabilis

CYANOPHYTA

Anacystis sp.
Lyngbya major
Merismopedia elegans
Microcoleus sp.
Oscillatoria angustissima
Oscillatoria limosa
Oscillatoria tenuis

CRYPTOPHYTA

Cryptomonas ovata

EUGLENOPHYTA

Euglena sp.

Trachelomonas hispida

TOTAL # OF TAXA: 32

U. TRADEWATER RIVER DIATOM DATA (5/13/93)

Achnanthes lanceolata
Achnanthes lanceolata var. *dubia*
Achnanthes minutissima
Amphipleura pellucida
Amphora perpusilla
Cocconeis pediculus
Cocconeis placentula var. *lineata*
Cyclotella stelligera
Cyclotella striata var. *ambigua*
Cymatopleura solea
Cymbella affinis
Cymbella naviculiformis
Cymbella prostrata
Cymbella prostrata var. *auerswaldii*
Cymbella silesiaca
Cymbella tumida
Diploneis elliptica
Fragilaria vaucheriae
Frustulia rhomboides var. *saxonica*
Gomphonema parvulum
Gomphonema sphaerophorum
Gomphonema tergestinum
Gyrosigma scalproides
Hantzschia amphioxys
Melosira granulata
Melosira varians
Meridion circulare
Navicula cryptocephala
Navicula cryptocephala var. *veneta*
Navicula cuspidata
Navicula pupula
Navicula radiosa
Navicula salinarum var. *intermedia*
Navicula tripunctata
Neidium binode
Nitzschia acicularis
Nitzschia amphibia
Nitzschia clausii
Nitzschia dissipata
Nitzschia linearis
Nitzschia sinuata var. *tabellaria*
Pinnularia subcapitata var. *paucistriata*
Rhoicosphenia curvata
Surirella angustata
Surirella ovata

Synedra acus

Synedra rumpens var. *familiaris*

Synedra ulna

**MACROINVERTEBRATES FROM IPREFTRR
KENTUCKY DIVISION OF WATER**

Site ID: IPREFTRR	Receiving Stream: U. TRADEWATER RIVER
Mile Point: 128.85	Drainage Area: 0 square miles
Order: 3	Ecoregion: INTERIOR PLATEAU
County: CHRISTIAN	Basin: TRADEWATER
Location Description: J. T. SPARKMAN RD.; 0.7 MI FROM MT. ZOAR RD. JC	
Map Number: 04-20	

Date Collected: 05/13/93

Acentrella ampla	4
Acroneuria sp	4
Allocapnia sp	4
Baetis sp	6
Boyeria vinosa	3
Cheumatopsyche sp	6
Chimarra aterrima	4
Chimarra feria	40
Corydalus cornutus	2
Dytiscus sp	2
Elimia sp	4
Gammarus lacustris	5
Helichus lithophilus	3
Heptagenia sp	5
Hydroptila sp	6
Isoperla sp	6
Leptophebia sp	5
Lithasia obovata	2
Ochrotrichia sp	3
Optioservus ovalis	3
Orconectes sp	1
Physella sp	6
Rhyacophila lobifera	5
Stenacron interpunctatum	5
Stenelmis crenata	4
Stenonema femoratum	4
Stenonema pulchellum	4
Stylogomphus albistylus	2
Tabanus sp	4
Wormaldia sp	9

Total # of Individuals:	161
Total # of Species:	30
EPT Index:	17

**FISH FROM SITE IPREFTRR
KENTUCKY DIVISION OF WATER
FISH COLLECTION DATA**

Site ID: IPREFTRR	Receiving Stream: U. TRADEWATER RIVER
Mile Point: 128.85	Drainage Area: 0 square miles
Order: 3	Ecoregion: INTERIOR PLATEAU
County: CHRISTIAN	Basin: TRADEWATER
Location Description: J. T. SPARKMAN RD.; 0.7 MI FROM MT. ZOAR RD. JC	
Map Number: 04-20	

Date Collected: 05/13/93 Collection Method: SEINE (1,1,1)

Collected By: SMATHERS, BRUMLEY, HOUP	ID Date: 10/20/93
ID By: SMATHERS	
Verified By:	

Campostoma oligolepis	27
Luxilus chrysocephalus	13
Lythrurus fumeus	1
Lythrurus umbratilis	33
Pimephales notatus	10
Semotilus atromaculatus	11
Catostomus commersoni	1
Erimyzon oblongus	2
Ameiurus melas	1
Fundulus olivaceus	1
Lepomis cyanellus	2
Lepomis gulosus	3
Lepomis macrochirus	10
Lepomis megalotis	2 *
Micropterus	1
Etheostoma kennicotti	16 *
Etheostoma nigrum	1
Etheostoma squamiceps	8 *
Percina maculata	1 *

SPECIES:	Total	Native	Darter	Sunfish	Sucker	*Intolerant
	19	19	4	4	2	4

INDIVIDUALS:	Total	Native	Omnivores	Insectivore	Green	Top
	Ind.			Cyprinids	Sunfish	Carnivores
Number:	144	144	26	34	2	1
Percent:		100	18.1	23.6	1.4	0.7