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A Pre-impoundment Investigation of the Limnology of East Fork of Twelvepole Creek, Lincoln, Mingo, and Wayne Counties, West Virginia

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Abstract

The fish populations at 10 collecting stations in Twelvepole Creek were sampled by rotenone, in order to determine the species composition prior to impoundment. Seven families represented by 38 species of fish were collected during the study. A total of 1,474 fish which weighed about 64 pounds were collected above the dam site. Game fishes comprised 25.4 per cent of the total number of fishes and 33.6 per cent of the total weight; rough fishes, 14.1 per cent by number and 36.1 per cent by weight; and forage fishes 60.5 per cent by number and 30.3 per cent by weight. Maximum and minimum standing crops were 221.3 and 16.6 pounds per acre, respectively; the average was 87.97 pounds per acre.

The benthic invertebrates at the 10 collecting stations were sampled with a bottom dredge. A total of 707 organisms were collected which represented 9 orders, 24 families, and about 36 species. The following benthic taxa were ranked according to percentage frequency by number; Ephemeroptera (42.7), Diptera (13.8), Decapoda (13.8), Trichoptera (10.6), Odonata (7.4), Coleoptera (6.7), Plecoptera (2.3), Mollusca (1.6), and Megaloptera (1.1).

The following physical and chemical parameters were determined: dissolved oxygen, $\bar{x}$ = 8.8 (7.1-11.0) mg/l; pH, $\bar{x}$ = 6.6 (6.3-7.0); total hardness, $\bar{x}$ = 32.0 (20.0-75.0) mg/l $CaCO_3$; total alkalinity, $\bar{x}$ = 32.0 (15.0-60.0) mg/l $CaCO_3$: iron, $\bar{x}$ = 0.9 (0.2-2.0) mg/l; sulfate, $\bar{x}$ = 12.0 (7.0-16.0) mg/l; and temperature, $\bar{x}$ = 21.6 (17.0-28.0) C.

East Fork of Twelvepole Creek has its source at the base of Guyan Mountain in the northern part of Mingo County, West Virginia, and flows in a northwest direction through Mingo and Lincoln counties to its junction with the West Fork of Twelvepole Creek about 1 mile south of Wayne, West Virginia, in Wayne County. The length of the East Fork is approximately 50.0 miles and the average gradient is 13.5 feet per mile.

The U. S. Army Corps of Engineers, Huntington District, is constructing a dam on the East Fork of Twelvepole Creek in Wayne County, 1.6 miles south of East Lynn, West Virginia. Initial impoundment is tentatively scheduled for the spring 1972. The dam will control a drainage area of 133 square miles. The proposed reservoir will have a surface area of 823 acres during the winter months, and a surface area of 1,005 acres will be maintained from May through September for recreation and fish and wildlife purposes (USACE, 1969). Flood control storage capacity will vary from 65,300 acre-feet during the summer to 70,800 acre-feet during the winter-spring flood season.

The primary objectives of this investigation were to survey the populations of fishes and benthos and to delineate the primary chemical and physical parameters of the East Fork of Twelvepole Creek and its tributaries, providing a baseline for impoundment and post-impoundment studies in the future.

Materials and Methods

Fishes were sampled at 10 collecting stations (Figure 1) with rotenone. The collecting station was blocked off with seines, and the toxicant was applied to the upper end of the area at a concentration of 0.5 to 1.0 ppm. Potassium permanganate was added in the lower end of the collecting station to detoxify the rotenone. Specimens were fixed immediately in 10 per cent formalin, and later washed and preserved in 50 per cent isopropyl alcohol. Collections are presently stored in the Department of Biological Sciences, Marshall University.

Benthic invertebrates were sampled at the 10 collecting stations (Figure 1) with a bottom dredge. The bottom net, with an opening of 18 x 8 inches, was held immediately downstream while the substrate was agitated causing the organisms to be dislodged. The specimens were fixed in 10 per cent formalin, and later preserved in 70 per cent ethanol.

The following chemical parameters were measured in the field at each collecting site using a Hach "Direct Reading" Portable Water Engineer's Laboratory, Model DR-EL: dissolved oxygen, pH, total hardness, total alkalinity, iron, and sulfate. Water temperature was determined by placing a Celsius thermometer in the water for several minutes.

Results

A total of 1,474 fish which weighed about 64 pounds were collected from the study area; 38 species, comprising 7 families, were represented in the collections (Tables 1, 2, and 3). Nomenclature follows that of the American Fisheries Society (1970). All fishes were generally grouped into the following 3 categories (Tables 1 and 2): game, forage, and rough fishes. Game fishes, based on the above categories, represented the family Centrarchidae; the forage fishes included the families Atherinidae, Cyprinidae, Percidae, and Petromyzontidae; and the rough fishes contained the Catostomidae and Ictaluridae. Game, forage, and rough fishes comprised 25.4, 60.5, and 14.1 per cent, respectively, of the total number of fishes, and 33.6, 30.3, and 36.1 per cent, respectively, of the total weight (Table 3). The most abundant 7 species in the study are in order of

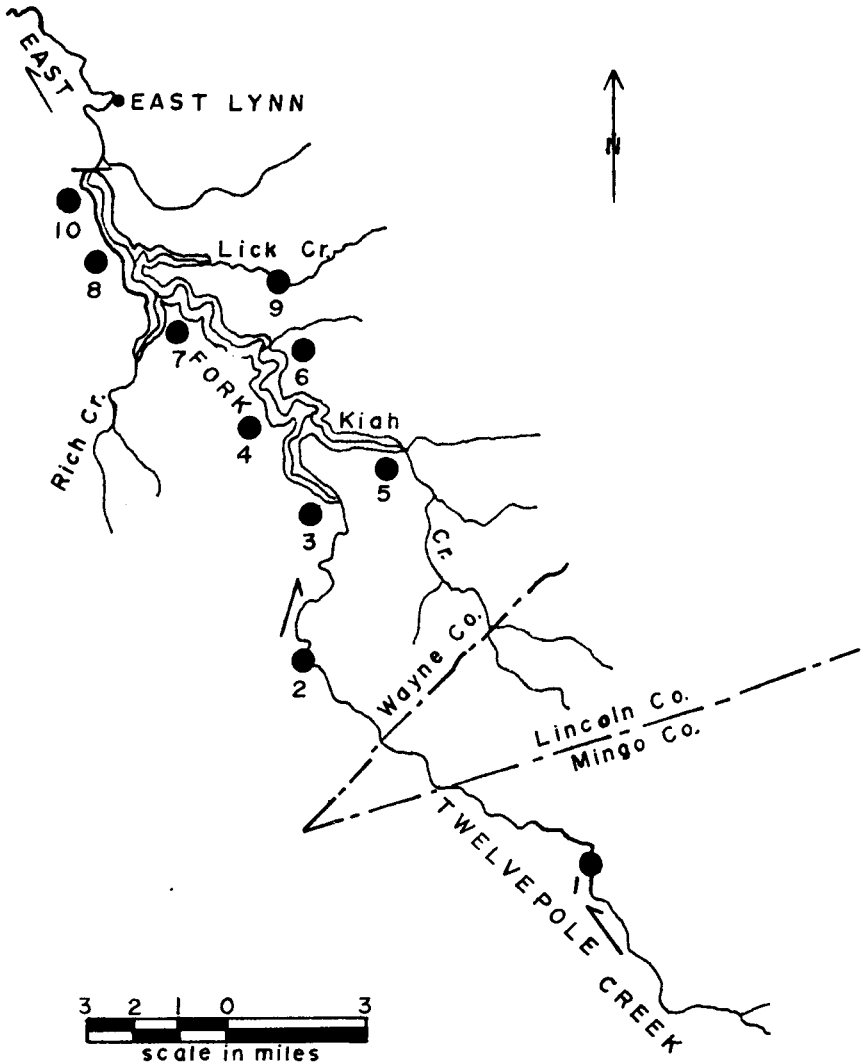

FIGURE 1. Map of East Fork of Twelvepole Creek, Lincoln, Mingo, and Wayne counties, West Virginia, showing locations of collecting stations, and extent of East Lynn Lake. The line through East Lynn Lake shows the course of the East Fork prior to impoundment (U. S. Army Corps of Engineers, Huntington, West Virginia).

Table 1. List of fishes collected from East Fork of Twelvepole Creek, 1970.

GAME FISHES	
Family Centrarchidae—Basses and Sunfishes	
Ambloplites rupestris (Rafinesque)	Rock bass
Lepomis cyanellus Rafinesque	Green sunfish
L. macrochirus Rafinesque	Bluegill
L. megalotis (Rafinesque)	Longear sunfish
Micropterus dolomieui Lacepede	Smallmouth bass
M. punctulatus (Rafinesque)	Spotted bass
M. salmoides (Lacepede)	Largemouth bass
FORAGE FISHES	
Family Atherinidae—Silversides	
Labidesthes sicculus (Cope)	Brook silverside
Family Cyprinidae—Minnows	
Campostoma anomalum (Rafinesque)	Stoneroller
Ericymba buccata Cope	Silverjaw minnow
Hybopsis amblops (Rafinesque)	Bigeye chub
H. micropogon (Cope)	River chub
Notropis cornutus (Mitchill)	Common shiner
N. photogenis (Cope)	Silver shiner
N. rubellus (Agassiz)	Rosyface shiner
N. spilopterus (Cope)	Spotfin shiner
N. stramineus (Cope)	Sand shiner
Pimephales notatus (Rafinesque)	Bluntnose minnow
Rhinichthys atratulus (Hermann)	Blacknose dace
Semotilus atromaculatus (Mitchill)	Creek chub
Family Percidae—Perches	
Etheostoma blennioides Rafinesque	Greenside darter
E. caeruleum Storer	Rainbow darter
E. flabellare Rafinesque	Fantail darter
E. nigrum Rafinesque	Johnny darter
E. variatum Kirtland	Variegate darter
E. zonale (Cope)	Banded darter
Percina caprodes (Rafinesque)	logperch
P. maculata (Girard)	Blackside darter
P. sciera (Swain)	Dusky darter
Family Petromyzontidae—Lampreys	
Lampetra aepyptera (Abbott)	Least brook lamprey
ROUGH FISHES	
Family Catostomidae—Suckers	
Catostomus commersoni (Lacepede)	White sucker
Hypentelium nigricans (LeSueur)	Northern Hog sucker
Minytrema melanops (Rafinesque)	Spotted sucker
Moxostoma anisurum (Rafinesque)	Silver redhorse
M. erythrurum (Rafinesque)	Golden redhorse
Family Ictaluridae—Freshwater catfishes	
Ictalurus melas (Rafinesque)	Black bullhead
I. natalis (LeSueur)	Yellow bullhead
Noturus miurus Jordan	Brindled madtom

Table 2. Composition, number (parentheses), and collecting stations of fishes in East Fork of Twelvepole Creek, 1970.

GAME FISHES—298

Basses

Rock bass (89) 1,2,3,4,5,6,7,8,10.
Smallmouth bass (9) 2,4,5,6,8.
Spotted bass (29) 1,2,3,4,5,6,7,8,10.
Largemouth bass (1) 5.

Sunfishes

Green sunfish (20) 3,6,10.
Bluegill (13) 5,9,10.
Longear sunfish (137) 1,2,3,4,5,6,9,10.

FORAGE FISHES—884

Silversides

Brook silverside (14) 1,2,3,7,8,10.

Minnows

Stoneroller (27) 3,4,5,6,9.
Bigeye chub (49) 2,3,4,6.
River chub (14) 3,4,6.
Silverjaw minnow (29) 1,2,3,4,5,6,9.
Common shiner (205) 1,2,3,4,5,6,7,8,9,10.
Silver shiner (32) 1,2,3,4,5,8.
Rosyface shiner (25) 3,4,6.
Spotfin shiner (11) 6.
Sand shiner (26) 1,3,4,5,6,7.
Bluntnose minnow (121) 1,2,3,4,5,6,7,8,9.
Blacknose dace (2) 4.
Creek chub (134) 1,3,4,5,6,7,8,9.

Perches

Greenside darter (13) 2,3,4,5.
Rainbow darter (17) 1,3,4,5.
Fantail darter (26) 1,2,3,4,5,8.
Johnny darter (13) 3,4,5,6.
Variegate darter (2) 5.
Banded darter (5) 4.
Logperch (36) 1,2,3,4,5,6,7,8,9.
Blackside darter (53) 2,3,4,5,6,7,8,10.
Dusky darter (1) 7.

Lampreys

Least brook lamprey (29) 2,3,4,5,7,10.

ROUGH FISHES—292

Suckers

White sucker (71) 1,3,4,5,6,7,8,9,10.
Northern hog sucker (37) 1,2,3,4,5,6,7,8,9.
Spotted sucker (15) 2,3,4,7,8.
Silver redhorse (4) 1,7,8.
Golden redhorse (42) 3,5,6,7,8.

Freshwater catfishes

Black bullhead (3) 6,8.
Yellow bullhead (16) 2,3,5,7,8,9.
Brindled madtom (104) 1,2,3,4,5,6,7,8.

Table 3. Percentage Frequency of Total Numbers and Weight of Game, Forage, and Rough Fishes in East Fork of Twelvepole Creek, 1970. N = Total Numbers and Weight.

Station	*Percentage Frequency (Numbers)*			*Percentage Frequency (Weight-lbs.)*		
	Game	*Forage*	*Rough*	*Game*	*Forage*	*Rough*
1	28.1	37.4	24.5	35.4	13.7	50.9
2	31.5	64.8	3.7	59.5	21.4	19.1
3	21.1	69.5	9.4	28.5	25.6	45.9
4	7.0	86.5	6.5	12.6	58.6	28.8
5	16.0	76.7	8.3	33.0	38.1	28.9
6	18.3	69.9	11.8	21.4	34.9	43.7
7	11.6	62.8	25.6	28.4	18.3	53.3
8	10.8	52.3	36.9	31.8	21.8	46.4
9	8.5	78.2	13.3	11.5	65.6	22.9
10	91.2	8.3	1.5	74.3	5.0	20.7
Total (1-10)	25.4	60.5	14.1	33.6	30.3	36.1
N		1474			64	

Table 4. Estimated Total Pounds of Fishes Per Acre Collected From East Fork of Twelvepole Creek, 1970.

Station	*Weight (Pounds)*	*Area (Acres)*	*Pounds/Acre*
1	9.31	0.042	221.3
2	3.06	0.058	52.8
3	9.37	0.104	90.0
4	6.57	0.046	142.9
5	11.15	0.065	171.6
6	4.49	0.077	58.3
7	6.96	0.366	19.3
8	9.40	0.140	67.1
9	0.91	0.055	16.6
10	2.79	0.070	39.9
		Average	87.97

decreasing abundance were *Notropis cornutus, Lepomis megalotis, Semotilus atromaculatus, Pimephales notatus, Noturus miurus, Ambloplites rupestris,* and *Catostomus commersoni* (Table 2). The maximum and minimum standing crops for these 10 stations were 221.3 and 16.6 pounds per acre, respectively; the average was 87.97 pounds per acre (Table 4).

A total of 707 benthic invertebrates were collected which represented 9 orders, 24 families, and about 36 species (Tables 5 and 6). The following benthic taxa were ranked according to their numerical percentage frequency (Table 5): Ephemeroptera (42.7), Diptera (13.8), Decapoda (13.8), Trichoptera (10.6),

Table 5. Numerical Percentage Frequency of the Total Number of Benthic Taxa Collected From All Stations in East Fork of Twelvepole Creek, 1970.

Taxon	*Number*	*Percentage Frequency*
Ephemeroptera	302	42.7
Diptera	98	13.8
Decapoda	98	13.8
Trichoptera	75	10.6
Odonata	52	7.4
Coleoptera	47	6.7
Plecoptera	16	2.3
Mollusca	11	1.6
Megaloptera	8	1.1
Total	707	

Odonata (7.4), Coleoptera (6.7), Plecoptera (2.3), Mollusca (1.6), and Megaloptera (1.1). The most abundant 5 species in order of abundance were *Stenonema vicarium, Cambarus* sp., *Chironomus* spp., *Orconectes* sp., and *Cheumatopsyche* sp. (Table 6).

The following physical and chemical parameters were characteristic of good water quality (USDI, 1968): dissolved oxygen, $\bar{x}$ = 8.8 (7.1-11.0) mg/l, 86-118 per cent saturation; pH, $\bar{x}$ = 6.6 (6.3-7.0); total hardness, $\bar{x}$ = 32.0 (20.0-75.0) mg/l $CaCO_3$; total alkalinity, $\bar{x}$ = 32.0 (15.0-60.0) mg/l $CaCO_3$; iron, $\bar{x}$ = 0.9 (0.2-2.0) mg/l; sulfate, $\bar{x}$ = 12.0 (7.0-16.0) mg/l; and temperature, $\bar{x}$ = 21.6 (17.0-28.0) C (Table 7).

Discussion

Game fishes comprised about 25 per cent of the total number of fishes collected from the pre-impoundment area. Hoyt et al. (1970) reported that game fishes represented about 22 per cent of the collections sampled in the pre-impoundment area of the upper Salt River in Kentucky. Game fishes were rather rare in the nearby pre-impoundment area of Beech Fork of Twelvepole Creek, representing about 5 per cent of the total collected (Olson, 1970). Forage fishes represented the highest percentage (60.5) of fishes collected during the study period. Olson (1970) and Hoyt et al. (1970) reported that forage fishes composed 85 and 50 percent, respectively, of the fishes in their pre-impoundment studies. Forage species also made up the greatest percentage of total numbers in pre-impoundment surveys of 6 Kentucky streams (Turner, 1959). Rough fishes constituted the highest percentage (36.1) of total weight of the East Fork collections. The average standing crop (87.97 pounds per acre) in the study area was similar to the average standing crop (90 pounds per acre) in the upper Salt River in Kentucky (Hoyt et al., 1970). Electroshocking and seining were used to sample the fishes in the upper Salt River. In Kentucky, the average standing crops were 108,47, 30, and 40 pounds per acre in the Barren, Middle Fork of the Kentucky, Nolin, and Rough rivers, respectively (Carter, 1968). Olson (1970) reported the average standing crop to be 17 pounds per acre in the nearby pre-impoundment area of Beech Fork. Probably the deficiencies of electrofishing were partly responsible for the low standing crop in Beech Fork.

Table 6. Composition, number (parentheses), and collecting station of the benthic fauna in East Fork of Twelvepole Creek, 1970.

EPHEMEROPTERA (302)
Ameletus lineatus Traver (1) 9.
Caenis sp. (14) 1,4,5,6,9.
Ephemera guttulata Pictet (1) 4.
Hexagenia limbata (Serville) (7) 2,6,8.
Isonychia sp. (38) 1,3,4,5,7,8,9.
Pseudocloeon punctiventris (McDunnough) (2) 7.
Stenonema heterotarsale (McDunnough) (2) 1,8.
S. tripunctatum (Banks) (13) 1,6,7.
S. vicarium (Walker) (224) 1,2,3,4,5,6,7,9,10.
DIPTERA (98)
Chironomus spp. (96) 1,2,4,5,6,8,9,10.
Tipula sp. (2) 4,9.
DECAPODA (98)
Cambarus sp. (98)
Orconectes sp. (93) 1,2,4,5,6,7,8,9,10.
TRICHOPTERA (75)
Cheumatopsyche sp. (67) 1,3,4,5,9.
Chimarra sp. (8) 3,4.
ODONATA (52)
Zygoptera (damselflies)
Agrion maculatum Beauvois (1) 9.
Argia violacea (Hagen) (1) 9.
Enallagma civile (Hagen) (3) 6,8.
Anisoptera (dragonflies)
Aeschna umbrosa Walker (1) 7.
Basiaeschna janata Say (1) 8.
Boyeria vinosa Say (6) 6,9.
Cordulegaster maculatus Selys (2) 9,10.
Dromogomphus spoliatus Hagen (3) 2,6,7,8.
Gomphus scudderi Selys (5) 7.
Hagenius brevistylus Selys (4) 7,8.
Macromia illinoiensis Walsh (24) 2,6,7,8.
Progomphus obscurus Rambur (1) 7.
COLEOPTERA (47)
Helichus sp. (35) 1,3,4,7,9.
Psephenus herricki DeKay (1) 5.
Stenelmis sp. (11) 1.
PLECOPTERA (16)
Perlesta placida (Hagen) (6) 7.
Unidentified (10) 7,9.
MOLLUSCA (11)
Helisoma sp. (6) 2,6,8.
Sphaerium sp. (5) 7.
MEGALOPTERA (8)
Chauliodes sp. (1) 3.
Corydalus cornutus (Linnaeus) (2) 3,4.
Sialis sp. (5) 7,8.

Table 7. Water Analyses, East Fork of Twelvepole Creek, 1970.

Sta.	Temp. °C	pH	Dissolved Oxygen mg/l	Dissolved Oxygen % sat.	Alkalinity mg/l ($CaCO_3$)	Hardness mg/l ($CaCO_3$)	Fe mg/l	SO_4 mg/l
1	17.0	7.0	11.0	118.0	40.0	35.0	1.1	14.0
2	22.0	6.7	9.3	110.0	30.0	30.0	0.3	7.0
3	18.0	6.5	8.3	90.0	25.0	20.0	0.6	12.0
4	20.0	6.7	9.5	108.5	25.0	25.0	0.5	12.0
5	27.0	6.9	8.2	105.0	15.0	20.0	0.2	7.0
6	28.0	6.4	8.0	104.0	35.0	35.0	1.5	8.0
7	17.0	6.5	8.3	88.0	30.0	25.0	0.8	15.0
8	20.0	6.5	9.6	108.5	60.0	75.0	2.0	14.0
9	24.0	6.6	7.1	85.6	30.0	20.0	0.6	15.0
10	23.0	6.3	9.1	109.0	30.0	35.0	1.8	16.0
Av. (1-10)	21.6	6.6	8.8	102.8	32.0	32.0	0.9	12.0

Immatures of dipterans, ephemeropterans, and trichopterans constituted about 17, 34, and 22 per cent, respectively, of the total number in a pre-impoundment shallow-water benthic investigation of Watts Bar Reservoir area in Tennessee (Lyman, 1943). In East Fork of Twelvepole Creek, immatures of dipterans, ephemeropterans, and trichopterans composed about 14, 43, and 11 per cent, respectively, of the total number of benthic organisms. Pierce (1969) reported that ephemeropterans composed 30 per cent of a pre-impoundment survey on the Elk River in West Virginia. Olson (1970), in a pre-impoundment study of Beech Fork of Twelvepole Creek in West Virginia, collected 2,106 benthic invertebrates which represented 14 orders, 40 families, and about 60 species. He noted that immatures of ephemeropterans, trichopterans, and plecopterans comprised the highest percentage frequencies, 29, 29, and 18, respectively, of the total number of benthic organisms.

The fish and benthic fauna and certain environmental parameters have been delineated prior to impoundment in the East Fork of Twelvepole Creek in West Virginia. Eutrophication, siltation, and water quality in the proposed reservoir will greatly change the extant lotic fish and benthic fauna, and gradually many of these species will diminish or disappear and be replaced by different lentic populations.

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