J. R. Stauffer, Jr.[1], C. H. Hocutt[1], and M. T. Masnik[2]

Biology Department, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061
and

J. E. Reed, Jr.

Department of Natural Resources, Wildlife Resources Division, MacArthur, West Virginia 25873

Manuscript received May 12, 1975
Revised manuscript received July 29, 1975

The Longitudinal Distribution of the Fishes of the East River, West Virginia-Virginia

Abstract—Collections at 13 stations in the East River system, over a two-year period, produced 49 species representing 7 families. *Notropis stramineus* was added to the ichthyofauna of Virginia. Range extensions were established for *Clinostomus funduloides* Girard; *Etheostoma buccata* Cope; *Nocomis leptocephalus* (Girard); *Notropis chrysocephalus* (Rafinesque); *Notropis procne* (Cope); *Notropis telescopus* (Cope); *Notemigonus crysoleucas* (Mitchill); *Pimephales promelas* Rafinesque; *Phoxinus oreas* (Cope); *Noturus insignis* (Richardson); and *Etheostoma caeruleum* (Storer).

Introduction

Two localities on the Virginia portion of the East River were sampled from February-October 1973 (Stauffer et al. 1974) in relation to Appalachian Power Company's Glen Lyn, Virginia, fossil fuel plant. These collections added the sand shiner, *Notropis stramineus* (Cope), to the fauna of Virginia (Jenkins, pers. comm.). Hambrick et al. (1973) discussed two collections from the East River which added the whitetail shiner, *Notropis galacturus* (Cope), and the telescope shiner, *Notropis telescopus* (Cope), to the known West Virginia ichthyofauna. Hambrick et al. (1973) also established distributional records in the East River for the cutlips minnow, *Exoglossum maxillingua* (Lesueur); bluehead chub, *Nocomis leptocephalus* (Girard); striped shiner, *Notropis chrysocephalus* (Rafinesque); spottail shiner, *Notropis hudsonius* (Clinton); rainbow darter, *Etheostoma caeruleum* (Storer); and the Roanoke darter, *Percina crassa roanoka* (Jordon and Brayton). The establishment of these records at downstream localities prompted an ichthyofaunal study of the upper East River.

The East River is a 5th order stream which arises in Bluefield, Mercer County, West Virginia, and discharges into the New River 23 miles (37 km) downstream at Glen Lyn, Giles County, Virginia. The East River drains 77.31 square miles (200 km²) and has an average gradient of 45.22 ft./mi. (8.56 m/km) (Reger 1925). The valley is bounded by Stony Ridge on the north and East River Mountain on the south.

The geology of the area was determined by Reger (1925) and Chauvin (1957). The immediate valley comprises an outcrop of limestone, while sandstone and sandy shales are present on the south slope and red shales on the north. Reed (1974) attributes the relatively high pH (8.0-8.9) and total alkalinity (139-300 ppm) to the presence of a series of limestone springs in the headwaters.

The state of West Virginia stocks the East River each spring with rainbow trout, *Salmo gairdneri* (Richardson); brown trout, *Salmo trutta* Linnaeus; and brook trout, *Salvelinus fontinalis* (Mitchill). The West Virginia Department of Natural Resources classifies the East River as a high quality stream. However, our observations and a literature review identify five major water quality problems associated with the East River: 1) insufficiently treated and untreated domestic wastes; 2) the discharge of oil, grease and detergents from commercial and industrial establishments; 3) silt loads washed into the stream from road construction; 4) the deposition of rubbish along

Present addresses:
[1] J. R. Stauffer, Jr. and Charles H. Hocutt, Appalachian Environmental Laboratory, Center for Environmental and Estuarine Studies, University of Maryland, Frostburg, Maryland 21532
[2] M. T. Masnik, Environmental Specialists Branch
Directorette of Licensing, USNRC
Washington, D. C. 20545

the stream banks (Anonymous 1967) and 5) discharge of heated water.

The communities of the East River Valley, and their respective 1970 populations, are as follows: Bluefield, West Virginia (15,921); Kellysville, West Virginia (180); Oakvale, West Virginia (292), Ada, West Virginia (250); Glen Lyn, Virginia (191); Ingleside, West Virginia (75), Bluefield, West Virginia, has the only existing sewage treatment facilities. Kellysville and Glen Lyn discharge untreated sewage directly into the stream (Anonymous 1967). Domestic discharges of raw sewage occur throughout the stream's length.

Run-off from the Norfolk and Western Railway Company's installation in Bluefield, and from the tracks which traverse the entire length of the valley, carry oil, grease and detergents into the river. Run-off from the present construction of U.S. Rt. 460 has increased the sediment load.

Other industrial effluents include treatment waste from the Crowgey Sausage Company, Kellysville; run-off from a quarrying operation upstream from Ingleside; and a heated discharge from Appalachian Power Company's stream electric facility located at Glen Lyn. See Reed (1974) for a more comprehensive discussion of the water quality.

Methods

Thirteen stations, including the two downstream stations outlined by Stauffer et al. (1974), were established throughout the East River and in its major tributaries (Figure 1). Stations were selected for accessibility but were spaced as evenly as possible throughout the river's length. Rotenone in conjunction with a block net (Hocutt et al. 1973) was used to sample fishes at stations 6, 10, 11, 12, and 13. All other stations were sampled with a 1.2 m × 3.6 m × .64 cm seine. Each locality was sampled until it was felt that more effort would not produce any additional species. Both riffle and pool habitats were sampled extensively. All specimens were preserved in 10 percent formalin, identified to species and stored in 40 percent isopropyl alcohol in the Virginia Polytechnic Institute and State University Fish Museum (VPISU).

The U.S. Geological Survey 15-minute maps (1:62,500 scale) of Bluefield, West Virginia-Virginia and Narrows, West Virginia-Virginia were used to determine stream order, gradient, altitude and river mile. Horton's (1945) method as discussed by Kuehne (1962) was used to calculate stream order. A map tracer was used to determine gradient and river mile.

Stations and Collections

1. **Km 33.8. East River below Bluefield's water treatment plant, Mercer Co., West Virginia, 25 July 1974. Gradient 11.9 m/km; altitude 716.3 m.**
2. **Dam Hollow Creek in Bluefield water reservoir (old Ada Dam) due south of Ada, Mercer Co., West Virginia, 18 Sept 1973. Altitude 701 m.**
3. **Km 30.6. East River at mouth of spring from Ada Reservoir, Mercer Co., West Virginia, 25 July 1974. Gradient 11.2 m/km; altitude 670.6 m.**
4. **Km 27.4. East River, 2.4 km due west of Box Spring Branch (tributary of East River), Mercer Co., West Virginia, 18 September 1973. Gradient 9.0 m/km; altitude 655.3 m.**
5. **Km 25.7. East River at Jug Neck Curve 4 km upstream from Ingleside, Mercer Co., West Virginia, 25 July 1974. Gradient 5.9 m/km; altitude 624.8 m.**
6. **Km 20.9. East River below mouth of 12 Mile Creek, Ingleside, Mercer Co., West Virginia, 18 September 1973; 25 July 1974. Gradient 5.9 m/km; altitude 597.1 m.**
7. **Km 18.5. East River below Mill Dam, Rt. 12, McKenzie, Mercer Co., West Virginia, 17 September 1973. Gradient 9.0 m/km; altitude 569.4 m.**
8. **Km 12. East River at mouth of Five Mile Creek, downstream**

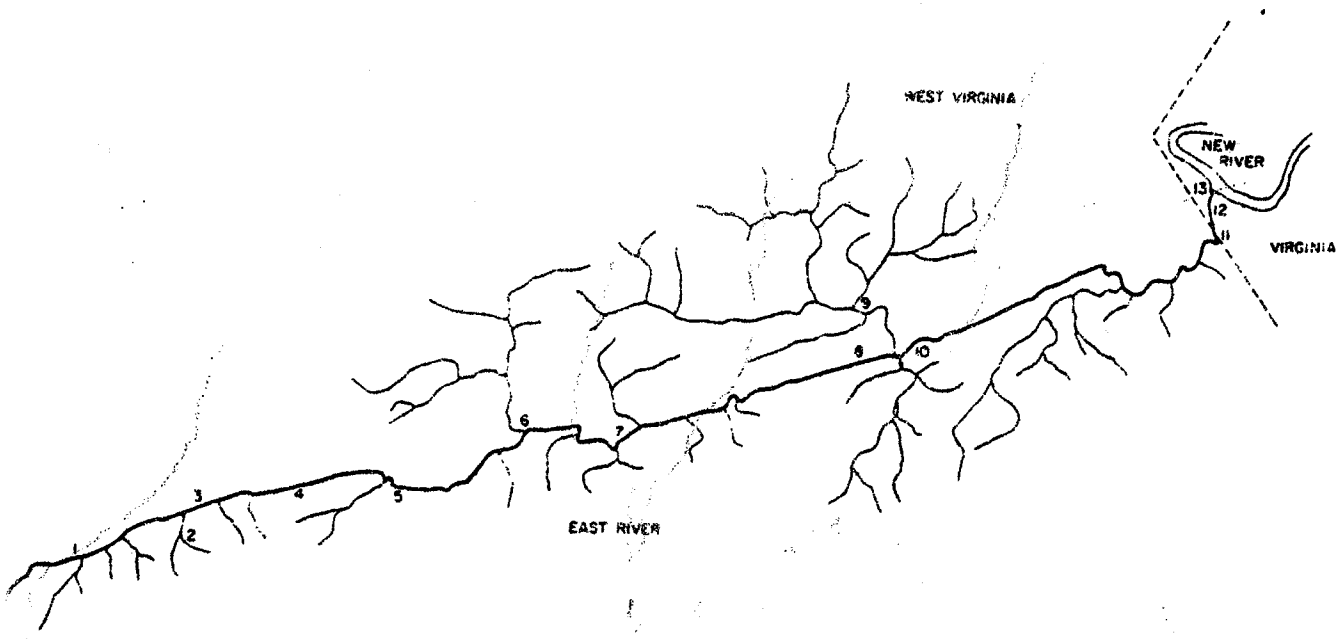

FIG. 1. Map of the East River drainage, West Virginia-Virginia.

from Oakvale, Mercer Co., West Virginia, 17 September 1973. Gradient 3.0 m/km; altitude 533.4 m.

9. Five Mile Creek at mouth of Hales Branch, Goodwin Chapel, Mercer Co., West Virginia, 17 September 1973. Gradient 9.9 m/km; altitude 558.7 m.
10. Km 10.4. East River at mouth of Pigeon Creek, Pigeon Creek Road (219-6), Mercer Co., West Virginia, 17 September 1973. Gradient 4.5/km; altitude 518.2 m.
11. Km 1.2. East River at West Virginia-Virginia State Line. Sampled bimonthly, February 1973—December 1974. Gradient 7.5 m/km; altitude 487.7 m.
12. Km 0.4. East River below outfall of APCO's heated discharge, Glen Lyn, Giles Co., Virginia. Sampled bimonthly, February 1973—December 1974. Gradient 3.8 m/km; altitude 475.5 m.
13. Km 0. East River at confluence of New River, Giles Co., Virginia. Sampled bimonthly, February 1973—December 1974. Gradient 1.9 m/km; altitude 457.2 m.

Results and Discussion

This survey resulted in the collection of 49 fish species in 7 families (Table 1). All species except the rainbow trout, *Salmo gairdneri* Richardson, and brook trout, *Salvelinus fontinalis* (Mitchill) were present in the Virginia portion of the East River. The West Virginia fauna comprised 24 species. Range extensions were established for 12 species.

Rosyside dace, *Clinostomus funduloides* Girard. The Range of the rosyside dace was extended to include the West Virginia portion of the East River. An examination of fishermen's bait buckets revealed that this species was abundant. Records of the VPISU Fish Museum show that the rosyside dace was present in many of the streams in the area. Jenkins and Freeman (1972) reported it as a headwater pool inhabitant in the Roanoke drainage. Burton and Odum (1945) recorded it in Sinking Creek and Spruce Run, New River drainage, Giles County, Virginia. A downstream distributional record in the main channel, New River, was reported in Hocutt et al. (1973).

Silverjaw minnow, *Ericymba buccata* Cope. One specimen, collected at station 12, represents a new distributional record for the New River drainage, Giles County, and adds this species to the ichthyofauna of the East River. The silverjaw minnow did occur in fishermen's bait buckets, although it was not common.

Bluehead chub, *Nocomis leptocephalus* (Girard). Hambrick et al. (1973) collected it at Willowton, West Virginia (km 4.0). The collection at station 6 (km 20.9) represented an upstream distributional record for the bluehead chub in the East River.

Striped shiner, *Notropis chrysocephalus* (Rafinesque). Hambrick et al. (1973) established a new distributional record for this species at Willowton, West Virginia. The presence of the striped shiner at station 8 extends this record upstream to km 12.

Golden shiner, *Notemigonus crysoleucas* (Mitchill). The presence of the golden shiner at stations 11 and 12 added this species to the fauna of the East River. As this is a common bait fish, the specimens may represent bait bucket introductions.

Swallowtail shiner, *Notropis procne* (Cope). One specimen of the swallowtail shiner, collected at station 11, added this species to the fauna of the East River. Jenkins et al. (1971) did not list the swallowtail shiner in the Kanawha River; however, Hocutt (1974) added this species to the New River fauna. Interviews with fishermen indicated that several of them came from Salem, Virginia. The swallowtail shiner is generally common in some small streams (Roanoke River drainage) of the Salem area (Jenkins and Freeman, 1972); however, no specimens of the swallowtail shiner were observed in bait buckets.

Sand shiner, *Notropis stramineus* (Cope). The collection of one specimen of the sand shiner at station 12 adds this species to the ichthyofauna of Virginia (Jenkins, per. comm.). Jenkins et al. (1971) list it as being native to the Kanawha River above the falls. It is possible that this specimen was attracted by either the warm water or the artificially created sand bottom, which are both created by APCO's fossil fuel plant located at station 12.

Telescope shiner, *Notropis telescopus* (Cope). Hambrick et al. (1973) added the telescope shiner to the ichthyofauna of West Virginia with their collection at Willowton, West Virginia. Our collection of this species at station 8 extended its distribution to km 12. The absence of the telescope shiner at the upstream stations supports the theory of Hambrick et al. (1973) of the upstream dispersal from the New River.

Mountain redbelly dace, *Phoxinus oreas* (Cope). The occurrence of this species at station 11 is the first record for the East River drainage, Virginia.

Fathead minnow, *Pimephales notatus* Rafinesque. Collections at stations 11 and 12 are the first records of the East River. Jenkins et al. (1971) did not find the fathead minnow in the Kanawha River above the falls. Hocutt et al. (1973) established a distributional record for this species in the main channel, New River. Again, these distributional records probably represent bait bucket introductions. This species was present in several fishermen's minnow buckets along the banks of the New River and mouth of the East River.

Margined madtom, *Noturus insignis* ssp. (Richardson). One specimen collected at station 12 was the first record for the East River drainage. Records at the VPISU Fish Museum show that this species is abundant in many of the tributaries of the New River. This record may represent downstream dispersal via the main channel New River.

Rainbow darter, *Etheostoma caeruleum* (Storer). Hocutt et al. (1973) added the rainbow darter to the ichthyofauna of the upper New River, Virginia. The first record in the East River was reported by Hambrick et al. (1973). The presence of this species at station 10 extends the distribution to include the New River drainage, West Virginia.

Other species not collected in this study, but which may be present in the East River, include the tonguetied minnow, *Exoglossum laurae* (Hubbs); longear sunfish, *Lepomis megalotis* (Rafinesque); finescaled saddle darter, *Etheostroma osburni* (Hubbs and Trautman); and the mottled sculpin, *Cottus bairdi* Girard. The tonguetied minnow was reported in a collection of Addair (University of Michigan Museum of Zoology: 119174-119183) in the East River, 19.3 kilometers from Princeton, West Virginia. Two specimens of the longear sunfish were collected by

Hubbs and Hubbs (UMMZ:2 specimens 95249) in the East River, Glen Lyn, Virginia. This material was subsequently confirmed by R. E. Jenkins (pers. comm.). Both the finescaled saddle darter and the mottled sculpin have been collected by the authors in the main channel New River.

In addition to the above, Goldsborough and Clark (1908) reported 21 specimens of the emerald shiner, *Notropis atherinoides* Rafinesque, in the East River near Ingleside, West Virginia. Jenkins (1971), however, does not list this species as being present above the falls in the Kanawha River. We feel certain that the records of Goldsborough and Clark represent a misidentification of either the rosyface shiner or the silver shiner.

Station 12, located in APCO's heated discharge,

TABLE 1

List of species captured in the East River February 1973—December 1974.

	Stations												
	13	12	11	10	9	8	7	6	5	4	3	2	1
	River Kilometer												
Species	0	4	1.2	10.4	*	12	18.5	20.9	25.7	27.4	30.6	*	33.5
Salmo gairdneri					X								
Salvelinus fontinalis					X								
Campostoma anomalum	X	X	X	X	X	X	X	X	X				
Clinostomus funduloides		X	X										
Cyprinus carpio			X										
Exoglossum maxillingua	X	X	X										
Ericymba buccata		X											
Nocomis platyrhynchus	X	X	X				X						
N. leptocephalus	X	X	X	X		X		X					
Notemigonus crysoleucas		X	X										
Notropis albeolus	X	X	X	X		X							
N. ardens	X	X	X			X							
N. chrysocephalus			X			X							
N. galacturus	X	X	X										
N. hudsonius	X	X	X			X							
N. photogenis	X	X	X										
N. procne		X											
N. rubellus	X	X	X	X		X							
N. spilopterus	X	X	X	X	X	X	X						
N. stramineus		X											
N. telescopus	X	X	X		X	X							
N. v. volucellus	X	X	X										
Phoxinus oreas			X										
Pimephales notatus	X	X	X		X	X	X						
P. promelas		X	X										
Rhinichthys atratulus obtusus	X	X	X	X	X	X	X	X	X		X		
R. cataractae			X										
Semotilus atromaculatus	X	X	X	X	X		X			X			
Catostomus commersoni	X	X	X	X	X		X			X			
Hypentelium nigricans	X	X	X	X	X								
Ictalurus punctatus	X	X	X										
Noturus insignis		X											
Pylodictus olivaris	X	X											
Ambloplites r. rupestris	X	X	X	X									
Lepomis auritus		X	X										
L. cyanellus		X	X					X					
L. gibbosus			X					X	X	X		X	
L. macrochirus		X	X										
Micropterus dolomieui	X	X	X										
M. punctulatus	X	X											
M. salmoides				X									
Pomoxis nigromaculatus		X											
Etheostoma blennioides	X	X	X	X									
E. flabellare	X	X	X	X	X	X	X	X	X				
E. caeruleum		X	X	X									
Percina crassa roanoka	X	X	X										
P. oxyrhyncha	X	X											
P. maculata					X								
Cottus carolinae ssp	X	X	X	X									

* Station not located on the main channel.

supported the most diverse fauna. It is probable that when the heated discharge provides the preferred temperature of a particular species in the effluent, that species moves into the area (Stauffer 1975; Stauffer et al. 1974)

Excluding the stations located in the heated discharge, the number of species decreased from 37 at station 11 (river km 1.2) to 0 at station 1 (river km 33.8). A natural decrease in the number of species in headwater areas was to be expected (Jenkins and Freeman 1972; Hocutt and Stauffer 1975); however, the decline in the number of species in East River was probably influenced by the presence of organic pollution. This hypothesis was further supported by the complete absence of fish at station 1, which was located immediately downstream of Bluefield's sewage treatment facility.

It should be noted that rotenone was used to samples stations 6, 10, 11, 12 and 13 in 1974. The rotenone collection at station 6 (river km 20.9) did not produce any more species than a seine collection at the same locality had in 1973. It was therefore assumed that the continued use of rotenone upstream of this point would not result in the collection of more species than would careful seining.

In general, we support the conclusions of Hambrick et al. (1973) that the populations of the whitetail shiner and telescope shiner have dispersed upstream from the New River. However, the rainbow darter's presence may reflect a relict population which can no longer inhabit the upper reaches of the East River because of pollution. The margined madtom probably dispersed down the New River from other tributaries to the mouth of the East River. Other distributional records probably resulted from bait bucket introductions.

Acknowledgments—Robert E. Jenkins confirmed the records of many of the specimens, identified the one specimen of the sand shiner and provided encouragement throughout the course of the study. D. Bailey, J. Belcher and J. Wilson aided in the collection of specimens. Without the cooperation of E. J. Griffith (conservation officer) and Lt. Col. P. Patton of the Law Enforcement Division, and I. S. Latimer, Director (West Virginia Department of Natural Resources), this study would not have been possible.

Literature Cited

Anonymous. 1967. East River Watershed Mercer County, West Virginia, and Giles County, Virginia. Federal Water Pollution Control Administration, Ohio Basin Region. Work Document No. 3. 11 pp.

Burton, G. W. and E. P. Odum. 1945. The distribution of stream fish in the vicinity of Mountain Lake, Virginia. Ecology 26(2):182–194.

Chauvin, E. N. 1957. The Geology of the East River Mountain area, Giles County, Virginia. M.S. Thesis. Va. Poly. Inst., Blacksburg, Va.

Goldsborough, E. L. and H. W. Clark. 1908. Fishes of West Virginia. Bull. Bur. Fish., Wash. 27(1907):29–39.

Hambrick, P. S., C. H. Hocutt, M. T. Masnik and J. H. Wilson. 1973. Additions to the West Virginia ichthyofauna, with comments on the distribution of other species. Proc. W. Va. Acad. of Sci. 45(1):58–60.

Hocutt, C. H. 1974. Methodology developed for the assessment of fish and macroinvertebrate communities in the New River, Virginia. Ph.D Dissertation. Va. Poly. Inst. and State Univ., Blacksburg, Va.

Hocutt, C. H., P. S. Hambrick and M. T. Masnik. 1973. Rotenone methods in a large river system. Arch. Hydrobiol. 72(2): 245–252.

Hocutt, C. H. and J. R. Stauffer. 1975. The influence of gradient on the distribution of fishes in Conowingo Creek, Maryland and Pennsylvania. Chesapeake Sci. 16(1):143–147.

Horton, R. E. 1945. Erosional development of streams and their drainage basins; hydrophysical approach to quantitative morphology. Bull. Geol. Soc. Amer. 56:225–370.

Jenkins, R. E. and C. A. Freeman. 1972. Longitudinal distribution and habitat of the fishes of Mason Creek, an upper Roanoke River Drainage tributary, Virginia. Va. J. Sci. 23(4):194–202.

Jenkins, R. E., E. A. Lachner and F. J. Schwartz. 1971. Fishes of the central Appalachian drainages. Their distribution and dispersal. Pages 43–117 *in* P. C. Holt, ed. Va. Poly. Inst. and State Univ., Res. Div. Monog. 4. The Distributional History of the Biota of the Southern Appalachians. Part III: Vertebrates.

Kuehne, R. A. 1962. A classification of streams, illustrated by distribution in an eastern Kentucky creek. Ecology. 43(4):608–614.

Reed, J. E., Jr. 1974. Stream survey of District IV (Southeastern) West Virginia. Department of Natural Resources, Wildlife Resources Division. 96 pp.

Reger, D. R. 1925. Mercer, Monroe, and Summers Counties. W. Va. Geol. Survey. 963 pp.

Stauffer, J. R., Jr. 1975. The influence of temperature on the distribution, community structure and condition of fish on the New River, Glen Lyn, Virginia. Ph.D Dissertation. Va. Poly. Inst. and State Univ., Blacksburg, Virginia.

Stauffer, J. R., Jr., K. L. Dickson and J. Cairns, Jr. 1974. A field evaluation of the effects of heated discharges on fish distribution. Water Resour. Bull. 10(5):860–876