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Fishes of the Gauley River, West Virginia

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ABSTRACT.—The confluence of Gauley River and New River forms the Kanawha River a short distance above Kanawha Falls, West Virginia. A survey of fishes of Gauley River in 1976 yielded 50 species, 25 of which were not previously reported in the literature. Six species (*Lampetra aepyptera*, *Moxostoma erythrurum*, *Ictalurus natalis*, *Ictalurus nebulosus*, *Noturus flavus*, and *Percina caprodes*) established new distribution records above Kanawha Falls, which is generally recognized as a major barrier to fish dispersal. Additional verified records increased the total known ichthyofauna to 58 species. These data suggest that fishes which successfully negotiated Kanawha Falls may have found the Gauley River a less strenuous route than the New River for upstream dispersal. Gauley River fauna also may have been influenced by stream captures with Greenbrier and Elk rivers.

INTRODUCTION

Gauley River rises in Webster and Pocahontas counties, West Virginia, and flows west-southwest to Gauley Bridge where it joins New River to form Kanawha River (Fig. 1). The main-channel Gauley is 168 km long, occupies a drainage basin of 3497 km² and has an average gradient of 6.1 m/km (Reed 1974). Its headwaters are characterized by broad, meandering, low gradient streams draining the Plateau; the lower section is well known for long rapids, cataracts, large boulders and a deep, narrow V-shaped valley bordered by sandstone cliffs (Reger 1920).

Gauley River apparently retains the old channel it developed on a peneplain during the Cretaceous (Reger 1921), as evidenced by numerous ancient meanders representative of an old base-level bed (Hennen 1919). The length of the river, 168 km, as compared to the airline distance, 95 km (Reed 1974), is indicative of the amount of meandering.

Subsequent uplift of the area during the late Tertiary (Reger 1920) revived the parent stream and caused rapid cutting which resulted in formation of a great gorge, often incised 150 m or more into the Plateau. The presence of a V-shaped lower valley, rather than U-shaped, indicates that the river has not progressed far into its erosional cycle. Many tributaries approach base-level maturation in their heads as well, but have significantly increased gradients in their lower sections indicative of Plateau uplift and stream rejuvenation (Reger 1920). For instance, Meadow River, a major southern tributary, drops over 207 m in the last 18.5 km with an average gradient of 11.4 m/km (Reger 1921).

The only previous systematic survey of the fishes of the Gauley River was that of Addair (1944), who reported on 24 species. C.L. Hubbs, E.C. Raney, and F.J. Schwartz made occasional collections in the drainage, but did not publish their data. Reed's (1974) discussion of the fishery of a portion of the drainage was limited primarily to game species. Jenkins et al. (1972) reported some Gauley River records, but did not discuss the fauna in detail. Ross and Perkins (1959) and Ross (1959) discussed fishes of the New (upper Kanawha) River, but data presented by Jenkins et al. (1972) are more recent.

Zoogeographically, the Gauley River ichthyofauna is identified with the New River drainage (Jenkins et al. 1972), i.e., that portion of the Kanawha River drainage above the 7.3 m high Kanawha Falls (Denoncourt et al. 1975), which has been considered as a major barrier affecting upstream dispersal of fishes (Jenkins et al. 1972; Lachner and Jenkins 1971). Endemism is reportedly high in the upper Kanawha (New/Gauley) River drainage (Hocutt et al. 1978), with the following fishes occurring nowhere else: *Nocomis platyrhynchus*, *Notropis scabriceps*, *Phenacobius teretulus*, *Etheostoma kanawhae* and *E. osburni*. *Cottus carolinae* ssp. (Robins 1954), long thought to be a New River endemic, is also known from one spring in Jefferson County, Tennessee (Etnier, pers. comm.). *Exoglossum laurae* and *Percina oxyrhyncha*, species associated with the unique New River fauna, have wider distributions than once thought (Jenkins et al. 1972; Hocutt et al. 1978; Hocutt, in press). The form previously recognized as *Percina maculata* in the upper Kanawha drainage is another endemic species (E. Beckham, pers. comm.).

Various localities within the Gauley River system have been proposed by the Corps of Engineers, Huntington, W. Va., District, as potential sites for location of hydroelectric facilities. Among these sites is a location on the main-channel Gauley River at Swiss that would inundate much of the lower gorge. Collison Creek and Muddlety Creek are among the alternate sites. The U.S. Fish and Wildlife Service, aware of our efforts to survey the streams of West Virginia (Hambrick et al. 1973; Denoncourt et al.

1975; Stauffer et al. 1975; Denoncourt et al. 1977; Stauffer et al. 1977; Hocutt et al. 1978; Stauffer et al. 1977; and Hocutt et al. 1977), contracted this investigation to serve as a basis for their position regarding the proposed Corps' projects on Gauley River.

METHODS AND MATERIALS

Gauley River is rather isolated and offers several distinctive problems in sampling for fishes. Preliminary planning indicated a need to use a variety of collecting gear. Streams were sampled primarily with 1.5×3.0 m nylon seines with 3.2 mm mesh or with a pulsated DC electrofishing unit. In more open waters and pools a 1.5×7.6 m nylon seine with 3.2 mm mesh was often employed. The electrofishing unit was used exclusively in lower stream sections characterized by large rubble, boulders and high gradient. Four localities in the drainage were sampled with emulsified rotenone using techniques recommended by Hocutt et al. (1973). Trotlines and gill nets were fished overnight in some of the larger pools of Gauley River; these techniques were ineffective due to water clarity and depauperate fauna, so the data were combined with seine data for the particular localities.

A total of 52 stations was sampled in the system (Table 1, Fig. 1), with the expressed purpose of obtaining a representative qualitative sample (Hocutt et al. 1974) at each station. Stations were sampled a single time, except for Station 30 which was sampled by seine and by electrofishing; for the purposes of this report, data obtained in these two collections were combined. Table 2 lists each fish species collected by station. Data are organized for discussion by main-channel and its tributaries. Subsequently, an annotated list of species collected in this survey and by Addair (1944) and Reed (1974) is presented.

All specimens were preserved in a 10 percent formalin solution, unless collected by rotenone. Rotenone collections were preserved in 20 percent formalin (Hocutt et al. 1973). All collections were catalogued into the Fish Museum, Appalachian Environmental Laboratory (AEL 142-194, 226), and stored in 40 percent isopropanol.

Museum records of Gauley River specimens were verified where possible. Museums housing collections from the system include: Cornell University (CU); Ohio State University (OSU); University of North Carolina (UNC); U. S. National Museum (USNM); University of Michigan, Museum of Zoology (UMMZ), where Addair's (1944) collections are catalogued; and Virginia Polytechnic Institute and State University (VPISU).

Jenkins et al. (1972) defined drainages, systems, and basins, and their classification is followed here. Their suggestion that use of these terms be standardized has merit, but certain ambiguities remain. Critical comment is reserved for discussion elsewhere.

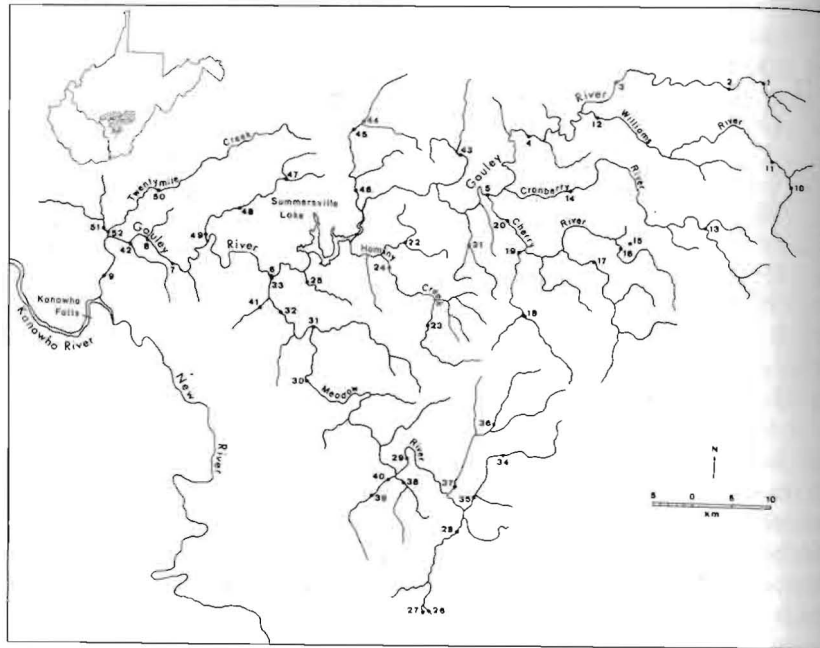


Fig. 1. Map of Gauley River drainage, West Virginia, with fish sampling localities noted.

Table 1. Fish sampling localities on the Gauley River, West Virginia. Appalachian Environmental Laboratory (AEL) catalogue number, date of collection and time of collection are in parentheses.

Station No.	Locality Description
1	Headwaters of Gauley River, mouth of Big Run, Webster Co. (AEL 165; 6/9/76; 1100).
2	Gauley River, old tipple at Jerrysville, Webster Co., WV (AEL 167; 6/9/76; 1245).
3	Gauley River, 3.2 km s on Route 20 from junction Co. Rd. 42, Bolair, Webster Co. (AEL 180; 6/9/76; 1445).
4	Gauley River at Gauley Mills, Webster Co. (AEL 179; 6/9/76; 1630).
5	Confluence of Gauley and Cherry rivers, Route 20 bridge, Nicholas Co. (AEL 181; 6/11/76; 1130).
6	Gauley River, at mouth of Meadow River, Carnifex Ferry, Fayette Co. (AEL 187; 7/6/76; 0900).
7	Gauley River, secondary road paralleling Peter's Creek, then downstream along Gauley for ca. 8.0 km, Nicholas Co. (AEL 188; 8/2/76; 1000).
8	Gauley River, mouth of Laurel Creek, Swiss, Nicholas Co. (AEL 185; 8/26/76; 1300).
9	Gauley River, first riffles above mouth, midway between Vanetta and Gamoca, Nicholas Co. (AEL 147; 8/9/76; 1430).
10	Williams River, Williams River Road, Williams River Campground, 4.8 km from Handley, Pocahontas Co. (AEL 186; 6/11/76; 0900).
11	Williams River, Scenic Route 150 bridge, Pocahontas Co. (AEL 182; 6/10/76; 0930).
12	Williams River bridge at Dyer, Webster Co. (AEL 165; 6/8/76; 1900).
13	Confluence North and South Forks of Cranberry River, Pocahontas Co. (AEL 163; 6/10/76; 1230).
14	Cranberry River at Little Bee Run, 0.96 km upstream of bridge at Big Rock Campgrounds, Nicholas Co. (AEL 166; 6/8/76; 1750).
15	Summit Lake, just off Route 39, Pocahontas Co. (AEL 161; 6/10/76; 2030).
16	North Fork of Cherry River, north bend of picnic area near road to Summit Lake, Greenbrier Co. (AEL 169; 6/8/76; 1030).
17	South Fork Cherry River, 5.3 km upstream of bridge across North Fork of Cherry, e of Richmond, Greenbrier Co. (AEL 183; 6/8/76; 1200).
18	Laurel Creek, at confluence McMillion Creek, Namu Chapel, Greenbrier Co. (AEL 175; 6/8/76; 1430).

Table 1. (Cont.)

Station No.	Locality Description
19	Laurel Creek, 0.48 km s of Route 39, Fenwick, Nicholas Co. (AEL 193; 6/8/76; 1345).
20	Cherry River, Route 20 bridge, Holcomb, Nicholas Co. (AEL 178; 6/10/76; 1530).
21	Panther Creek, Route 39/20 bridge, east of Nettie, Nicholas County (AEL 176; 6/11/76; 1400).
22	Deer Creek at Deepwell, Nicholas Co. (AEL 191; 6/11/76; 1220).
23	Hominy Creek at Hominy Falls, Nicholas Co. (AEL 184; 6/11/76; 1530).
24	Hominy Creek, ford 6.4 air km e of Mt. Nebo, Nicholas Co. (AEL 142; 7/7/76; 1515).
25	Collison Creek, Nicholas Co. (AEL 157; 7/7/76, 1100).
26	Meadow River, co. rd. bridge just w of Grassy Meadows, Greenbrier Co. (AEL 150; 7/8/76; 1400).
27	Meadow River, 0.27 km w of Station 26, w of Grassy Meadows, Greenbrier Co. (AEL 149; 7/8/76; 1330).
28	Meadow River, co. rd. bridge nw of Meadow Bluff, Greenbrier Co. (AEL 151; 7/8/76; 1400).
29	Meadow River, Route 60 bridge, n of McRoss, Greenbrier Co. (AEL 153; 7/8/76; 1630).
30	Meadow River, Russelville, WV (Babcock Railroad Junction), Fayette Co. (AEL 159; 7/10/76; 1545) (AEL 192; 8/25/76; 1300).
31	Meadow River at mouth on Anglins Creek, Nicholas Co. (AEL 155; 7/7/76; 1300).
32	Meadow River, below new Route 19 bridge, Fayette Co. (AEL 173; 7/6/76; 1000).
33	Mouth of Meadow River, Fayette Co. (AEL 152; 7/5/76; 1500).
34	Little Clear Creek, Raders Run Railway Crossing, on Co. Rd. 1, Greenbrier Co. (AEL 174; 6/11/76; 1800).
35	Little Clear Creek, Route 60 bridge, Shawyer's Crossing, Greenbrier Co. (AEL 156; 7/10/76; 1300).
36	Big Clear Creek at Anjean, Greenbrier Co. (AEL 177; 6/11/76; 1650).
37	Big Clear Creek, Route 60 bridge, Rupert, Greenbrier Co. (AEL 172; 7/10/76; 1215).
38	Little Sewell Creek, co. rd. bridge, just downstream of confluence Boggs Creek, Greenbrier Co. (AEL 170; 7/8/76; 1500).
39	Sewell Creek at Lilly Park, Greenbrier Co. (AEL 158; 7/8/76; 1030).

Table 1. (Cont.)

Station No.	Locality Description
40	Sewell Creek, Route 60 bridge, Rainelle, Greenbrier Co. (AEL 144; 7/8/76; 1115).
41	Dogwood Creek, Saturday Rd. Bridge, Fayette Co. (AEL 162; 7/10/76; 1010).
42	Mouth of Rich Creek at Jodie, Fayette Co. (AEL 160; 7/11/76; 1040).
43	Big Beaver Creek, Route 41 bridge, Craigsville, Nicholas Co. (AEL 189; 8/24/76; 1420).
44	Brushy Fork, Route 43 bridge, Muddlety, Nicholas Co. (AEL 168; 7/11/76; 1700).
45	Muddlety Creek below confluence Brushy Fork and McMillion Creek, s of Muddlety, Nicholas Co. (AEL 194; 7/11/76; 1745).
46	Lower Muddlety Creek at end of private drive off Route 39, Rev. Mycott property, Nicholas Co. (AEL 190; 8/25/76; 1100).
47	Confluence of Peter's Creek and Buck Garden Creek, Gilboa, Nicholas Co. (AEL 143; 7/11/76; 1500).
48	Peter's Creek, Summersville Dam rd. bridge, Drennen, W. Va. (AEL 171; 7/11/76; 1415).
49	Peter's Creek, along co. rd., 3.7 km s of Lockwood, above major water falls, Nicholas Co. (AEL 145; 7/11/76; 1310).
50	Twentymile Creek, at confluence Ash Fork, Nicholas Co. (AEL: 7/9/76; 1830).
51	Bell's Creek, first bridge (residential) above confluence Twentymile Creek, Fayette Co. (AEL 148; 7/9/76; 1700).
52	Confluence of Twentymile Creek and Bells Creek, Nicholas-Fayette Co. line (AEL 154; 7/9/76; 1930).

RESULTS

SUB-DRAINAGES

Main-channel

That portion of the Gauley River above the mouth of Cherry River is approximately 67 km in length and has an average gradient of 4.5 m/km; the major tributaries are Williams, Cranberry and Cherry rivers, in descending order (Fig. 1). From the confluence of Cherry River to the Route 39 bridge (near the head of Summersville Reservoir), Gauley River

drops 104 m in 24 km (gradient, 4.2 m/km), and begins the descent into its gorge. Summersville Dam is constructed across the gorge at or near the mouths of Battle Run and McKee Creek, and has a normal pool elevation of 503 m to above the Route 39 bridge approximately 22.5 km upstream. In the vicinity of the dam the gorge is cut nearly 152 m below the level of the Plateau. Hominy and Big Beaver creeks are the major tributaries between Summersville Dam and Cherry River.

Progressing downstream 9.7 km from the Summersville Dam to Carnifex Ferry at the mouth of Meadow River, Gauley River descends an additional 65 m at an average gradient of 6.7 m/km. Meadow River, the only significant tributary, has a large drainage basin, near 932 km², as compared to 1932 km² in the Gauley River basin above the confluence. Collison Creek also enters this section of the river with an average gradient of 28.4 m/km over its 10 km length. From Carnifex Ferry to Swiss the Gauley River continues its run through the gorge and is characterized by torrential water, boulder and bedrock substrate, and an average gradient over 3.8 m/km for the 30.5 km distance. The river then approaches base-level with an average gradient of 1.1 to 1.3 m/km, and with long riffle and pool habitats alternating over the last 14.5 km to its confluence with New River. These physical characteristics and associated stresses influence distribution of fishes throughout the drainage. In this survey, 31 species were collected in the main-channel Gauley River, Stations 1 through 9 (Table 2).

Williams River

Williams River heads against Dry Mountain, Pocahontas County, at an elevation of 1210 m and discharges into Gauley River near Cowen at an elevation of 689 m. Length of the stream is 54 km and average gradient is 11.5 m/km. The drainage basin of Williams River, 337 km², is larger than Gauley River above their confluence. A total of 23 species was collected in the Williams River subdrainage, Stations 10 through 12 (Tables 1 and 2; Fig. 1).

Cranberry River

Cranberry River rises in Pocahontas County at approximately 1402 m in elevation, flows north, then southwest to enter Gauley River at Cranberry Station at 585 m. Length of the river is 51.5 km and gradient is 15.9 m/km. The basin is 181 km² in size. Associated with the river is the Cranberry Back Country and Wilderness Study Area, a 14690 hectare tract that is regulated by the U.S. Forest Service and has been promoted for inclusion as a Wilderness Area. Nine species were collected from two stations (13, 14) on Cranberry River (Tables 1 and 2; Fig. 1). Generally,

Cranberry River has a depauperate fauna which probably resulted from a past history of intensive logging and mining, as well as naturally low pH waters draining Cranberry Glades.

Cherry River

Cherry River, a major southern tributary to Gauley River, rises at 1341 m in Greenbrier County and flows generally in a northeast direction for 43.4 km to its mouth at Curtin. The drainage basin is 445 km² in size and gradient averages 17.4 m/km. Cherry River is rather industrialized in its lower section and domestic sewage also adds to the degradation of water quality. Major tributaries to Cherry River are the North Fork, South Fork and Laurel Creek. A small impoundment, Summit Lake, is located off Route 39, and discharges into the North Fork. Six stations (15-20) were located in the Cherry River drainage (Tables 1 and 2; Fig. 1). Summit Lake (Station 15) is a well used recreation area stocked with *Lepomis macrochirus*, *Micropterus salmoides* and salmonids.

Panther Creek

Panther Creek is a small southern tributary to Gauley River east of Nettie. It is approximately 15.4 km long with an average gradient of 23.3 m/km. One collection was made on Panther Creek at Station 21 yielding only 4 species (Tables 1 and 2; Fig. 1).

Hominy Creek

Hominy Creek is a principal southern tributary to Gauley River, with its source near 1097 m in elevation at Grassy Knob, Greenbrier County. Its length is approximately 35.1 km with an average gradient of 18 m/km. The drainage basin is about 272 km². A vertical drop of 6.1 m occurs at Hominy Falls. A total of 15 species was collected from the system (Stations 22-24) (Tables 1 and 2; Fig. 1).

Collison Creek

This stream is a small tributary to Gauley River below Summersville Dam. It is being considered as a possible site for impoundment by the Corps. Total length is 9.5 km and gradient is 28.8 m/km. The drainage basin is 24.9 km². One collection (Station 25) on Collison Creek yielded 7 species (Tables 1 and 2; Fig. 1).

Meadow River

Meadow River, the major tributary to Gauley River, rises in eastern Summers County at approximately 1202 m and flows north to northwest along the Fayette-Greenbrier and Fayette-Nicholas county lines to its

mouth at Carnifex Ferry. Its total length is 80.5 km and the drainage basin is 932 km². Gradient averages 10.4 m/km and increases from head to mouth. Meadow River headwaters are along the broad Appalachian Plateau, but in the last 17.7 km it enters its own scenic gorge to Carnifex Ferry. Sixteen stations were located in the Meadow River system: main-channel (Stations 26-33), Little Clear Creek (34-35), Big Clear Creek (36-37), Sewell Creek (38-40), and Dogwood Creek (41). A total of 28 species was collected in the system (Tables 1 and 2; Fig. 1).

Rich Creek

This is a small tributary to Gauley River at Jodie, W. Va. Total length is near 12.2 km and average gradient is 45 m/km. The stream was surveyed at its mouth (Station 42), particularly in a pool area adjacent to but not a part of Gauley River. A total of 15 species was collected (Tables 1 and 2; Fig. 1).

Big Beaver Creek

This stream rises at 792 m in Webster County and is approximately 27.4 km in length. The gradient is 10.2 m/km and the drainage basin is 101 km². Seven species were collected at Station 43 (Tables 1 and 2; Fig. 1).

Muddlety Creek

Muddlety Creek, about 32 km in length, rises at an elevation of 731 m and enters Gauley River at Route 39 bridge. The drainage basin is 172 km² and gradient is 8.0 m/km. The stream had been rechanneled along much of the section below Muddlety, and road construction was present adjacent to the stream. Coal washings were abundant in the substrate. Thirteen species were collected from Stations 44-46 (Tables 1 and 2; Fig. 1). In general, the fauna was depauperate for the above reasons. This stream is presently being considered for impoundment by the Corps.

Peters Creek

Peters Creek originates north of Summersville and flows southwest for 28.1 km to its confluence with Gauley River. Gradient averages 10.8 m/km and the basin is approximately 135 km². A substantial waterfall of about 10-12 m exists 1.6 km above its mouth. Eleven species were collected from this subdrainage at Stations 47-49 (Tables 1 and 2; Fig. 1).

Twentymile Creek

Twentymile Creek is the largest northern tributary to Gauley River. It occupies a drainage basin of about 272 km², and has a total length of 43.1

km. Gradient averages 10.2 m/km. Its principal tributary is Bells Creek. Twentymile Creek was relatively productive with 21 species collected at three localities (Stations 50-52) (Tables 1 and 2; Fig. 1). This was probably due to a combination of factors, including its close relationship to Gauley River below the gorge.

ANNOTATED LIST OF SPECIES

The discussion of species collected in this survey is supplemented by other collections cited in the literature and verified museum records. Species are presented in phylogenetic order (Bailey et al. 1970). Considering the minimal information available on the Gauley River ichthyofauna, this discussion should prove beneficial for future comparisons.

Petromyzontidae

Lampetra aepyptera.— One specimen of the least brook lamprey (AEL 181), a non-parasitic species, was collected in Gauley River at the mouth of Cherry River. The specimen was an ammocoete taken over a detritus bank from an eddy at the lower tip of a mid-channel island. Continued seining and bank kicking did not produce additional specimens.

This record is the first report of *L. aepyptera* above Kanawha Falls. Its presence in other West Virginia drainages was documented by Addair (1944), Jenkins et al. (1972) and Stauffer, Denoncourt and Hocutt (ms.). The specimen was taken above Summersville Reservoir, which infers an established population prior to dam construction. Hocutt (1975) and Stauffer (1975) did not report it from the upper New River system, Virginia though they made extensive collections throughout the drainage.

Anguillidae

Anguilla rostrata.—Addair's (1944) collections of the American eel from Greenbrier River (one collection) and New River (two collections) were the only documented reports of this species in the upper Kanawha River drainage. A single specimen of *A. rostrata* (ca. 1 m TL), reported in this survey from Gauley River at the mouth of Meadow River below Summersville Dam (AEL 187), was found dead on the bank with an angler's hook and line attached.

Salmonidae

Salmo gairdneri.—Rainbow trout are routinely stocked by the W. Va. Department of Natural Resources.

Salmo trutta.—Brown trout are also commonly stocked in West Virginia.

Salvelinus fontinalis.—The Brook trout is indigenous to much of the Appalachian Plateau and natural populations are to be found in pristine habitats common to Gauley River headwaters.

Cyprinidae

Campostoma anomalum.—The Stoneroller is common throughout the upper Kanawha River drainage. Addair (1944) collected it from eight of 19 sampling localities on Gauley River. This survey reports it from 27 of 52 stations. Verified museum records are CU 32399; UMMZ 95280, 95293, 108166, 108176, 165698, 165705, 165754.

Clinostomus funduloides.—Addair (1944) reported the Rosyside dace from two Kanawha River localities, one of which was on Meadow River near Russelville (Station 30, Fig. 1). Hocutt et al. (1978) reported it from three localities in the Greenbrier drainage. It was found in this survey at five stations: Cherry River (Stations 17 and 20) and Meadow River (Stations 38, 39, 40). Its distribution appears limited to higher elevations and colder waters. Another record is from Cherry River (UNC 3315).

Ericymba buccata.—Addair (1944) collected the Silverjaw minnow in six of 87 collections above Kanawha Falls, including three localities in the Gauley drainage: Twentymile Creek, Peters Creek and Williams River. It was common at ten of the 20 localities where we collected it. Factors affecting its distribution (Wallace 1972; 1973) appear to be favorable under present conditions. Previous museum records are UMMZ 95294; USNM (RVM-260).

Exoglossum laurae.—The Tonguetied minnow was collected by Addair (1944) at three Williams River localities. It was not abundant in this survey, with only eight specimens collected from headwater stations of Williams River (Station 11, AEL 182), Cranberry River (13, AEL 163) and Cherry River (17, AEL 183; 18, AEL 175).

Nocomis platyrhynchus.—The Bigmouth chub is endemic to the upper Kanawha River drainage above Kanawha Falls (Lachner and Jenkins 1971). The sibling species, *N. micropogon*, occurs commonly in all other drainages of the greater Ohio River, including the lower Kanawha River, and Atlantic slope heading in West Virginia. Many diagnostic characteristics of the two species are similar, with overlap occurring between morphometric and meristic ranges; it is distinguished from *N. platyrhynchus* chiefly by tuberculation patterns. Despite six new distributional records for fishes above Kanawha Falls, it was necessary to consider all *micropogon*-group chubs collected in Gauley River as *N. platyrhynchus* for the reasons cited.

Addair (1944) collected *N. platyrhynchus* from five localities. This survey found it at 23 stations where it was often abundant. The use of elec-

trofishing gear and rotenone provided advantages of capture which Addair did not enjoy. Chubs were no doubt present throughout the drainage at the time of his survey, but they are difficult to collect by seine due to their habitat preference for rapid runs with large rubble and boulder substrate. Other records are UNC 6083, CU 28867; UMMZ 95281, 108168, 165699, 165706, 165755.

Notemigonus crysoleucas.—Collection of the Golden shiner from Gauley River at Carnifex Ferry (Station 6) represents the first record of this species from the Gauley drainage. It is widely used by fishermen, and its occurrence is attributed to bait bucket introduction.

Notropis albeolus.—Previous efforts by Addair (1944) and others did not yield representatives of the *Notropis* subgenus *Luxilus* from Gauley River. Hocutt et al. (1978) noted that Gilbert (1964) and R.D. Ross (VPISU 2429) took *N. albeolus* from Greenbrier River, and Hocutt (1974) and Stauffer (1975) found it in New River, Virginia. We collected the White shiner from nine localities where its presence was rare to abundant. The reason for its absence in previous collections is speculative.

Notropis chrysocephalus.—The Striped shiner is also a member of the subgenus *Luxilus* (Gilbert 1964). Gilbert (1964) considered *N. chrysocephalus* to be introduced to the upper Kanawha drainage, but common in other Ohio River drainages. We collected it at five localities, but it was abundant only at the mouth of Cherry River (Station 5). It was apparently collected by Schwartz from Gauley River east of Bolair (UNC 685) and Williams River (UNC 6087), but these records are not confirmed.

Notropis photogenis.—Addair (1944) reported the Silver shiner from one Peter's Creek locality and two Meadow River stations. We found it at ten stations, distributed from the headwaters to our most downstream station on Gauley River. The only other record of the Silver shiner from the Gauley system is UMMZ 95283.

Notropis rubellus.—The Rosyface shiner was one of the most abundant and widely distributed minnows collected in this survey, taken from 25 stations. Addair (1944) collected it from ten of 19 stations on Gauley River. Other records are UNC 6086, UMMZ 95285, 108170, 165700, 165707, 165756.

Notropis scabriceps.—The New River shiner is endemic to the upper Kanawha River drainage. We collected a single specimen from Williams River (Station 12; AEL 164). Although never abundant, Addair (1944) found it more widely distributed, collecting it from seven localities: Peters Creek (1 station), Muddlety Creek (1), Cherry River (2) and Williams River (3). This species deserves recognition by the W.Va. Department of Natural Resources as a threatened or endangered species. Its ecological requirements are not known, but its distribution appears to coincide with

high elevation, cold water streams. We found it at one of 52 localities in the Gauley River (Station 12, AEL 182) and Hocutt et al. (1978) found it at 5 of 32 localities on Greenbrier River. It was also previously collected from Peters Creek (UMMZ 95295), Muddlety Creek (UMMZ 108172), Panther Creek (UMMZ 1081178) and Williams River [USNM-(RVM-260)] in the Gauley system.

Notropis spilopterus.—The Spottfin shiner was the only species collected by Addair (1944) not found in this investigation. He collected it from Big Creek (a lower tributary to Gauley River) and two localities on Meadow River, and concluded it avoids high upland streams. It is also known from Gauley River, Route 41 bridge (CU 32391, 32391) and at the confluence of Gauley River and Twentymile Creek (UMMZ 95284).

Notropis stramineus.—Addair (1944) found the Sand shiner at Big Creek and two Meadow River localities. We collected it at six localities (Stations 9, 48-52) in the lower Gauley River system.

Notropis telescopus.—Collections of the Telescope shiner from Stations 8 (15 specimens; AEL 185) and 50 (1; AEL 146) represent the first records of this species from Gauley River. Gilbert (1969) considered *N. telescopus* as introduced to New River and Hambrick et al. (1973) first reported it from West Virginia. Hocutt et al. (1978) subsequently found it in Greenbrier River. Additionally, we have recent records from tributaries to Kanawha River below Kanawha Falls.

Notropis volucellus.—Addair (1944) found the Mimic shiner common in New and Kanawha rivers, but collected it at only two Gauley River localities. We collected it from six localities (Stations 4, 5, 6, 8, 9 and 52). Its distribution in the main-channel Gauley indicates an ability to tolerate, if not a preference for, large water. Evidence presented by Hocutt et al. (1978) supports this hypothesis. Other records from the Gauley system are CU 32532; UMMZ 95282, 108171.

Phenacobius teretulus.—The Kanawha minnow is endemic to the system above Kanawha Falls, but is rarely taken in West Virginia. Hocutt et al. (1978) reported three specimens from Greenbrier River. Hambrick et al. (1975) reviewed life history aspects of *P. teretulus*, noting only three collections of the species in West Virginia, all predating 1940. We collected only two specimens from upper Laurel Creek (Cherry River system; Station 18, AEL 175) during this study. Hocutt et al. (1978) recommended its consideration as an endangered species; these data support that conclusion.

Pimephales notatus.—Surprisingly, Addair (1944) collected the Bluntnose minnow from only one locality in the Gauley system, Twenty-mile Creek. We collected it at 32 stations, making it one of the more widely distributed species encountered. There is a distinct preference of this species

for sandy, silt-laden pool or eddy habitats. Other records include: CU 32531; UMMZ 95286; USNM (RVM-260).

Pimephales promelas.—This study yielded 14 specimens of the Fathead minnow from upper Williams River (Station 10, AEL 186). They were collected in a standing back water area clogged with filamentous algae, and represent the first records of the species from the system. Williams River is noted for its trout fishing and the occurrence of this minnow is attributed to bait bucket introduction.

Rhinichthys atratulus.—The Blacknose dace was a widely encountered species in this study, found at 23 stations. Addair (1944) collected it from 11 localities. It is known from other collections: UMMZ 95297, 108173, 108177, 108183, 131827, 165701; USNM 196458.

Rhinichthys cataractae.—The Longnose dace was not reported from Gauley River by Addair (1944). We found it at 18 localities where it was locally abundant. Other records are from: Williams River [OSU (LM-76-7), collected concurrent with this survey; UMMZ 165708]; Cranberry River (UMMZ 165702); Peters Creek (UMMZ 95296); and Gauley River (CU 32398).

Semotilus atromaculatus.—The Creek chub is a headwater species which Addair collected at nine localities; we sampled it from 37 stations. Other records are OSU (LM-76-7); UMMZ 95292, 108167, 165703, 165709, 165757; USNM (FJS 710).

Ictaluridae

Ictalurus natalis.—One specimen of Yellow bullhead (AEL 150) from upper Meadow River is the first record of this species from the Gauley, and also represents the first record of the species above Kanawha Falls (Jenkins et al. 1972). It was collected from a small pool in the headwaters, bordered by pasture. The specimen may be representative of an indigenous population, or introduced to the system. Addair (1944) collected two specimens from a tributary to lower Kanawha River.

Ictalurus nebulosus.—The collection of a Brown bullhead (AEL 174) from upper Little Clear Creek is the first confirmed record of the species above Kanawha Falls (Jenkins et al. 1972; Hocutt 1974; Stauffer 1975). It was collected with electroshocking gear in a pool averaging 1.4 m in depth, 9.1 m wide and 30 m long. Other bullheads were observed swimming at the surface, but not collected.

Noturus flavus.—Eight specimens (AEL 185) of the Stonecat collected by rotenone from the Gauley River at Swiss, West Virginia (Tables 1 and 2; Fig. 1), represent the first reported record of this species from the entire Kanawha River drainage above or below Kanawha Falls. Station 8 was characterized by a long riffle/run (90 m) habitat that opened into a pool

and was channelized on the right side of an island at the mouth of Laurel Creek. A collection (CU 32540) of the Stonecat from Gauley River, Route 41 bridge, in 1951 has been confirmed (E. Brothers, pers. comm.), which infers that *N. flavus* is native to the Gauley drainage.

Pylodictus olivaris.—Flathead catfish collected at the mouth of Meadow River (Station 33) by rotenone are the first specimens from the Gauley system reported in the literature. It was known from previous surveys above and below Kanawha Falls (Addair 1944; Jenkins et al. 1972; Hocutt 1974; Stauffer 1975), and is routinely taken by anglers (pers. comm.) from Gauley River. Specimens previously collected from Gauley River are housed at Cornell (CU 32397, 32535).

Centrarchidae

Ambloplites rupestris.—Addair (1944) did not collect the Rockbass from the Gauley system, but Reed (1974) reported it. We collected it from 22 stations and it was rarely abundant. Other records include: CU 32400, 32534; and UMMZ 9529, 165760.

Lepomis cyanellus.—Jenkins et al. (1972) considered the Green sunfish as probably introduced above Kanawha Falls. Our records of it from eight stations are the first reported from the Gauley. It was not abundant, although widely distributed, and was collected almost exclusively from small to moderate size streams with pool habitats.

Lepomis gibbosus.—We collected one adult specimen, a probable introduction, from lower Big Clear Creek (Station 37, AEL 172). The site was characterized by a long base-level pool, and banks which were strongly undercut. Another museum record from Gauley is CU 32539.

Lepomis macrochirus.—Addair (1944) collected the Bluegill from a lower Gauley tributary, Big Creek. We found it at four stations (6, 15, 28 and 43).

Micropterus dolomieu.—Smallmouth bass were collected by Addair (1944) from five stations and by Reed (1974) from various localities. It was widely distributed in this survey, being collected at 22 localities. Other records are CU 32392; and UMMZ 95289, 95291, 165713, 165761.

Micropterus punctulatus.—The species was not collected by Addair (1944) from Gauley River, although he found it at several localities in the Kanawha drainage where it is native (Jenkins et al. 1972). It was collected by Hocutt (1974), Stauffer (1975) and Hocutt et al. (1978) from the New system. We found it at five stations in this survey.

Micropterus salmoides.—We collected the Largemouth bass from three stations. It is regarded as introduced.

Percidae

Etheostoma blennioides.—Greenside darters were collected from upper Meadow River (2 stations), Cranberry River (1) and Williams River (1) by Addair (1944). Other collections are OSU (LM-76-7); CU 25393, 32396, 32536; UMMZ 95279, 165710, 165758. We collected it from 26 stations and it was locally abundant.

Etheostoma caeruleum.—The first record of the Rainbow darter above Kanawha Falls was reported in Hocutt et al. (1973) from New River just above the mouth of East River. Subsequently, it was collected from East River by Hambrick et al. (1973) and Stauffer et al. (1975), and from New River (Stauffer 1975). A total of 272 specimens was taken in this survey from six stations on the lower Gauley (AEL 146, 147, 148, 154, 160, 185). No other records are known from above the Falls. Two dams, several cataracts and the New River gorge separate this population from the small one described by Hocutt et al. (1973) in the vicinity of East River. Masnik, Hocutt, and Stauffer (ms) made over 200 collections in the upper New River system, West Virginia, Virginia and North Carolina, 1971-1975, and no other populations of *E. caeruleum* were located. Thus, the East River population appears to be a relict, virtually isolated from other populations.

Etheostoma flabellare.—Addair (1944) collected the Fantail darter from 14 of 19 localities sampled. We also found it widely distributed. Museum records are: OSU (LM-76-7); UMMZ 95278, 108174, 108181, 108182, 131826, 165704, 165711, 165759.

Etheostoma nigrum.—Addair (1944) was the first to report the Johnny darter above Kanawha Falls, collecting it at two localities: New River above the confluence with Gauley River; and Glade Creek, tributary to New River. He felt that its absence in Gauley River was related to rapid currents and lack of suitable substrate for food organisms. We found it at 13 localities distributed from the headwaters to the mouth. Its distribution and absence above Summersville Dam indicate that it is indigenous to the system. The only record located in addition to Addair (1944) was from Gauley River, Route 41 bridge south of Summersville, West Virginia (CU 32537).

Etheostoma osburni.—The Finescale saddled darter is endemic to the Kanawha River drainage above Kanawha Falls. Jenkins et al. (1972) reported it from Elk River below the Falls; however, the validity of these data is doubted (R.E. Jenkins, pers. comm.). Our recent efforts in Elk River have yielded only *E. variatum*, a sibling species. Addair (1944) found *E. osburni* in upper Gauley River (1 station), Williams River (1) and Cherry River (2). We found it at ten localities (Tables 1 and 2; Fig 1), being more predominant in the headwaters than the lower drainage. Other

collections are OSU (LM 76-7); CU 25394; UMMZ 165712. Collections catalogued from Gauley River as *E. kanawhae* (UNC 7006) and *E. variatum* (UNC 6704) are regarded as *E. osburni*; we are not aware of verified museum records of *E. kanawhae* from West Virginia.

Percina caprodes.—Specimens of the Logperch collected from Stations 8 (AEL 185) and 9 (AEL 147) represent the first reported records of this species above Kanawha Falls. Addair (1944) collected it below the Falls, and concluded that it was one of the darters unable to make it over that physical barrier into the upper Kanawha drainage. Our specimens were collected by rotenone (Station 8) and electrofishing (9) from extensive riffle/run habitats characterized by moderate to large rubble substrate. Our experience indicates that the Logperch is most often collected just below a "lip" or dropoff where the riffle becomes a run. Other specimens of *P. caprodes* are known from upper New River, Grayson County, Virginia (R.E. Jenkins, pers. comm.), but not reported in the literature.

Percina cf. *maculata*.—The endemic relative of the Blackside darter occurs above Kanawha Falls in the Kanawha River drainage (Jenkins et al. 1972; Hocutt 1974; Stauffer 1975; Hocutt et al. 1978) and is currently being described by E. Beckham. Addair (1944) collected it from one station on upper Williams River. We collected it from six localities chiefly in cold upland streams (Tables 1 and 2; Fig. 1). Past experience indicates that it is widely distributed throughout the New River system, but rarely abundant. The only other museum record from Gauley River is CU 28866.

Percina oxyrhyncha.—The Sharpnose darter has long been identified with the ichthyofauna of the upper Kanawha River drainage; however, its distribution is wider than once expected (Jenkins et al. 1972; Hocutt and Hambrick 1973; Denoncourt et al. 1977; Hocutt et al. 1978; Thompson 1977; Hocutt, in press). Further, it was once considered by the U.S. Department of Interior for posting as a threatened or endangered species. Recent collecting in the upper New River (Hocutt et al. 1973; Hocutt 1974; Stauffer 1975) has shown that it is locally abundant. Hocutt et al. (1973) collected 33 specimens from New River at Lurick, Virginia. Specimens from eight Gauley River stations are the first reported from the system (Table 1; Fig. 1). At the mouth of Meadow River (Station 33), 54 specimens were collected with rotenone. As suggested by Denoncourt et al. (1977), the preference of adult *P. oxyrhyncha* for habitats with a large rubble and boulder substrate probably accounts for the paucity of known specimens before our work in the 1970's. The only other records of it from the Gauley system are CU 28868 and 32538 from Route 41 bridge south of Summersville.

Stizostedion vitreum.—Reed (1974) first discussed Walleye in the Gauley River system. A rotenone sample from the mouth of Meadow River produced one specimen in this survey.

Cottidae

Cottus bairdi.—Prior to this survey, records of *Cottus* were not known from Gauley River. Three specimens of *C. bairdi* were collected from Williams River, Station 11 (AEL 182). They were distinguished by characters recommended by Robins (1954). One other collection exists (OSU-LM 76-7), made concurrently with this survey from Williams River.

Cottus carolinae ssp.—*C. carolinae* were collected from habitats with moderate to large rubble in Williams River (Stations 10, 11) and Peters Creek (47, 48).

Other Species

Other species are known to occur in the Gauley River system. *Perca flavescens*, *Lepomis auritus*, *Pomoxis annularis*, and *Pomoxis nigromaculatus*, occur in Summersville Reservoir (C. Clower, pers. comm.), where they presumably have been introduced. Reed (1974) reported stocking of *Esox masquinongy* in Meadow River. *Ictalurus punctatus* (CU 32393, 32533) was taken from Gauley River, Route 31 bridge, 4.8 km south of Summersville, prior to construction of Summersville Dam. Subsequent to our survey, the W. Va. Department of Natural Resources collected specimens of *Phoxinus oreas* 36 km upstream of the mouth of Williams River (R.L. Miles, pers. comm.).

Expected Species

Hocutt et al. (1978) treated the fishes of Greenbrier River and included information on species known from the main-channel New River between Claytor Lake, Virginia, and Kanawha Falls, West Virginia. It is possible that some of these species may potentially occur in Gauley River, e.g., *Hybopsis dissimilis* and *Labidesthes sicculus*. Claytor Lake, Bluestone Reservoir and the Union Carbide impoundment at Hawks Nest may be barriers for downstream dispersal of upper New River fishes (Ross 1959; Ross and Perkins 1959; Hambrick et al. 1973; Jenkins et al. 1972; Hocutt 1974; Hocutt et al. 1978; and Stauffer 1975). While the complete effectiveness of Kanawha Falls as a barrier to the upstream dispersal of fishes from the lower Kanawha River is debatable (Hocutt, in press), it no doubt is a limiting factor for many species.

Table 2. Number of each species collected from Gauley River, 1976, by station. (*new literature records to the Gauley River ichthyofauna; **first literature records for species above Kanawha Falls).

Species	Stations					
	1	2	3	4	5	6
** <i>Lampetra aepyptera</i>					1	
* <i>Anguilla rostrata</i>						1
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>						
<i>Campostoma anomalum</i>			3			
<i>Clinostomus funduloides</i>				1		4
<i>Ericymba buccata</i>						
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>		8	35	11	7	10
* <i>Notemigonus crysoleucas</i>						1
* <i>Notropis albeolus</i>			13			1
* <i>N. chrysocephalus</i>					106	
<i>N. photogenis</i>				2		
<i>N. rubellus</i>			57	333	383	4
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>				86	21	974
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>			22	195	40	494
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	21	24		2		
* <i>R. cataractae</i>		3			2	1
<i>Semotilus atromaculatus</i>	5	12				3
<i>Catostomus commersoni</i>					3	18
<i>Hypentelium nigricans</i>		3	5	10	1	18
** <i>Moxostoma erythrurum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictus olivaris</i>						
<i>Ambloplites rupestris</i>			2	7		3
* <i>Lepomis cyanellus</i>						
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>						1
<i>Micropterus dolomieu</i>				6	2	25
* <i>M. punctulatus</i>						
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>			30	11	1	3
* <i>E. caeruleum</i>						
<i>E. flabellare</i>	17	10	4		1	
* <i>E. nigrum</i>					3	162
<i>E. osburni</i>	1		15	2	3	
** <i>Percina caprodes</i>						
<i>P. maculata</i>			3			
* <i>P. oxyrhyncha</i>				2		1
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. caroliniae</i>						
Total Species	4	6	11	13	14	17
Total Specimens	44	60	189	668	574	1723

Table 2. (Cont.)

Species	Stations					
	7	8	9	10	11	12
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>				2	1	
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>						
<i>Campostoma anomalum</i>	2	9	10	2	2	1
<i>Clinostomus funduloides</i>						
<i>Ericymba buccata</i>			32			
<i>Exoglossum laurae</i>					5	
<i>Nocomis platyrhynchus</i>	39	67	18		7	11
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>		58	36			
* <i>N. chrysocephalus</i>					1	1
<i>N. photogenis</i>		25	50		1	
<i>N. rubellus</i>	1	108	243			12
<i>N. scabriceps</i>						1
<i>N. stramineus</i>			180			
* <i>N. telescopus</i>		15				
<i>N. volucellus</i>		5	93			
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>	2	10	16	1	31	
* <i>P. promelas</i>				14		
<i>Rhinichthys atratulus</i>				38	9	
* <i>R. cataractae</i>	27	91	4	1	1	
<i>Semotilus atromaculatus</i>				40	8	1
<i>Catostomus commersoni</i>			5	118	3	
<i>Hypentelium nigricans</i>	14	10	36	2	1	
** <i>Moxostoma erythrurum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>		8				
* <i>Pylodictus olivaris</i>						
<i>Ambloplites rupestris</i>		1	4		6	1
* <i>Lepomis cyanellus</i>						
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>						
<i>Micropterus dolomieu</i>	1	2	4		1	1
* <i>M. punctulatus</i>			2			
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>	24	12	17		33	16
* <i>E. caeruleum</i>		9	35			
<i>E. flabellare</i>		6	3	33	54	13
* <i>E. nigrum</i>	39	2	1			
<i>E. osburni</i>		9	3	25		
** <i>Percina caprodes</i>		4	10			
<i>P. maculata</i>					3	10
* <i>P. oxyrhyncha</i>	4	30	6			
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>					3	
* <i>C. caroliniae</i>				3	10	
Total Species	10	20	22	12	19	11
Total Specimens	153	481	808	279	180	68

Table 2. (Cont.)

Species	Stations					
	13	14	15	16	17	18
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>	1	1	1		4	
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>	2					3
<i>Camptostoma anomalum</i>					38	30
<i>Clinostomus funduloides</i>					6	
<i>Ericymba buccata</i>						
<i>Exoglossum laurae</i>	1				1	1
<i>Nocomis platyrhynchus</i>					22	10
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>						
* <i>N. chrysocephalus</i>						
<i>N. photogenis</i>					2	
<i>N. rubellus</i>						
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>					2	
<i>Pimephales notatus</i>						
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	19			20		89
* <i>R. cataractae</i>	4				9	2
<i>Semotilus atromaculatus</i>	1			1	1	21
<i>Catostomus commersoni</i>	1					9
<i>Hypentelium nigricans</i>					3	
** <i>Moxostoma erythrurum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictis olivaris</i>						
<i>Ambloplites rupestris</i>						
* <i>Lepomis cyanellus</i>						
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>				5		
<i>Micropterus dolomieu</i>					2	
* <i>M. punctulatus</i>						
* <i>M. salmoides</i>				2		
<i>Etheostoma blennioides</i>						
* <i>E. caeruleum</i>						
<i>E. flabellare</i>	15	2			6	11
* <i>E. nigrum</i>		2				
<i>E. osburni</i>					7	7
** <i>Percina caprodes</i>						
<i>P. maculata</i>						4
* <i>P. oxyrhyncha</i>						
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. caroliniae</i>						
Total Species	8	3	3	2	12	12
Total Specimens	44	4	8	21	101	189

Table 2. (Cont.)

Species	Stations					
	19	20	21	22	23	24 ¹
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>				3		
<i>Salvelinus fontinalis</i>			2			
<i>Camptostoma anomalum</i>	1	47		1		3
<i>Clinostomus funduloides</i>		1				
<i>Ericymba buccata</i>						
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>		14				41
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>						
* <i>N. chrysocephalus</i>		21				8
<i>N. photogenis</i>		1				
<i>N. rubellus</i>		81				10
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>		1				
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>			98	32		2
* <i>R. cataractae</i>		3				16
<i>Semotilus atromaculatus</i>			5	4	4	10
<i>Catostomus commersoni</i>				3	2	4
<i>Hypentelium nigricans</i>		16		3		9
** <i>Moxostoma erythrurum</i>						4 ¹
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictis olivaris</i>						
<i>Ambloplites rupestris</i>		5				4
* <i>Lepomis cyanellus</i>						
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>						
<i>Micropterus dolomieu</i>		4				
* <i>M. punctulatus</i>						
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>		8		4		2
* <i>E. caeruleum</i>						
<i>E. flabellare</i>		12	10	21	1	2
* <i>E. nigrum</i>		11		2		
<i>E. osburni</i>		5				
** <i>Percina caprodes</i>						
<i>P. maculata</i>				4		1
* <i>P. oxyrhyncha</i>						
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. caroliniae</i>						
Total Species	1	15	4	10	3	13
Total Specimens	1	230	115	77	7	112

¹***Moxostoma erythrurum* (AEL 226), four specimens collected in Summersville Reservoir at mouth of Hominy Creek by gill net in conjunction with this survey are not included in total number of species and specimens at Station 24.

Table 2. (Cont.)

Species	Stations					
	25	26	27	28	29	30
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>						
<i>Camptostoma anomalum</i>					5	20
<i>Clinostomus funduloides</i>						
<i>Ericymba buccata</i>	4					
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>						86
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>						
* <i>N. chrysocephalus</i>						
<i>N. photogenis</i>						
<i>N. rubellus</i>				21	14	146
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>	24	101	45	375	7	15
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	54	2				
* <i>R. cataractae</i>						1
<i>Semotilus atromaculatus</i>	7	2	50	6		
<i>Catostomus commersoni</i>	10	2	5	3	1	
<i>Hypentelium nigricans</i>						4
** <i>Moxostoma erythrum</i>						
** <i>Ictalurus natalis</i>		1				
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictus olivaris</i>						
<i>Ambloplites rupestris</i>		2		2	1	24
* <i>Lepomis cyanellus</i>	4	6		1		
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>				3		
<i>Micropterus dolomieu</i>						19
* <i>M. punctulatus</i>	1			5		
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>				1	7	3
* <i>E. caeruleum</i>						
<i>E. flabellare</i>		4	1			
* <i>E. nigrum</i>						15
<i>E. osburni</i>	5					
** <i>Percina caprodes</i>						
<i>P. maculata</i>						
* <i>P. oxyrhyncha</i>						8
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. caroliniae</i>						
Total Species	7	8	4	9	6	1
Total Specimens	104	120	101	417	35	341

Table 2. (Cont.)

Species	Stations					
	31	32	33	34	35	36
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>				15		10
* <i>S. trutta</i>						1
<i>Salvelinus fontinalis</i>	1					
<i>Camptostoma anomalum</i>	2	7	2	1		
<i>Clinostomus funduloides</i>						
<i>Ericymba buccata</i>	4	1		3	2	
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>	9	251	188	5	2	
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>					9	
* <i>N. chrysocephalus</i>						
<i>N. photogenis</i>						
<i>N. rubellus</i>	110	20	14	16	39	
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>	4	11	6	85	150	
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	1			8		24
* <i>R. cataractae</i>		54	99			
<i>Semotilus atromaculatus</i>	24	2	1	19	6	6
<i>Catostomus commersoni</i>	5		1		1	
<i>Hypentelium nigricans</i>	2	77	16	5	1	
** <i>Moxostoma erythrum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>				1		
** <i>Noturus flavus</i>						
* <i>Pylodictus olivaris</i>			5			
<i>Ambloplites rupestris</i>	1	8	28	3	1	
* <i>Lepomis cyanellus</i>				7	11	
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>						
<i>Micropterus dolomieu</i>	1	72	41			
* <i>M. punctulatus</i>						
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>	1	3	14			
* <i>E. caeruleum</i>						
<i>E. flabellare</i>	5			10	1	1
* <i>E. nigrum</i>	1		7			
<i>E. osburni</i>						
** <i>Percina caprodes</i>						
<i>P. maculata</i>						
* <i>P. oxyrhyncha</i>		24	54			
<i>Stizostedion vitreum</i>			1			
* <i>Cottus bairdi</i>						
* <i>C. caroliniae</i>						
Total Species	15	12	16	13	11	5
Total Specimens	171	530	478	178	223	42

Table 2. (Cont.)

Species	Stations					
	37	38	39	40	41	42
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>						
<i>Camptostoma anomalum</i>		17		7		225
<i>Clinostomus funduloides</i>		83	17	3		
<i>Ericymba buccata</i>	33	5	12	18		40
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>				1		15
* <i>Notemigonus crysoleucas</i>						
* <i>Notropis albeolus</i>						1
* <i>N. chrysocephalus</i>						
<i>N. photogenis</i>						7
<i>N. rubellus</i>	7					26
<i>N. scabriceps</i>						
<i>N. stramineus</i>						
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>	109	4		166		33
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	2	1	8	2	1	22
* <i>R. cataractae</i>						
<i>Semotilus atromaculatus</i>	15	11	23	32	29	211
<i>Catostomus commersoni</i>	7	5	9	9	3	526
<i>Hypentelium nigricans</i>	1	1				32
** <i>Moxostoma erythrurum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictus olivaris</i>						
<i>Ambloplites rupestris</i>	2			3		
* <i>Lepomis cyanellus</i>	1					
* <i>L. gibbosus</i>	1					
<i>L. macrochirus</i>						
<i>Micropterus dolomieu</i>		1		2		3
* <i>M. punctulatus</i>						
* <i>M. salmoides</i>						
<i>Etheostoma blennioides</i>		1		2		5
* <i>E. caeruleum</i>						124
<i>E. flabellare</i>		1	37			
* <i>E. nigrum</i>						21
<i>E. osburni</i>						
** <i>Percina caprodes</i>						
<i>P. maculata</i>						
* <i>P. oxyrhyncha</i>						
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. carolinæ</i>						
Total Species	10	11	6	11	3	15
Total Specimens	178	130	106	245	33	1291

Table 2. (Cont.)

Species	Stations					
	43	44	45	46	47	48
** <i>Lampetra aepyptera</i>						
* <i>Anguilla rostrata</i>						
* <i>Salmo gairdneri</i>						
* <i>S. trutta</i>						
<i>Salvelinus fontinalis</i>						
<i>Camptostoma anomalum</i>						2
<i>Clinostomus funduloides</i>						
<i>Ericymba buccata</i>		67	14			24
<i>Exoglossum laurae</i>						
<i>Nocomis platyrhynchus</i>						
* <i>Notemigonus crysoleucas</i>		2				
* <i>Notropis albeolus</i>						
* <i>N. chrysocephalus</i>						
<i>N. photogenis</i>					1	
<i>N. rubellus</i>						45
<i>N. scabriceps</i>						
<i>N. stramineus</i>						1
* <i>N. telescopus</i>						
<i>N. volucellus</i>						
<i>Phenacobius teretulus</i>						
<i>Pimephales notatus</i>		100	21			52
* <i>P. promelas</i>						
<i>Rhinichthys atratulus</i>	1					
* <i>R. cataractae</i>						
<i>Semotilus atromaculatus</i>	69	10			11	8
<i>Catostomus commersoni</i>	19	1			2	
<i>Hypentelium nigricans</i>		1				2
** <i>Moxostoma erythrurum</i>						
** <i>Ictalurus natalis</i>						
** <i>I. nebulosus</i>						
** <i>Noturus flavus</i>						
* <i>Pylodictus olivaris</i>						
<i>Ambloplites rupestris</i>				2		
* <i>Lepomis cyanellus</i>	1		2			
* <i>L. gibbosus</i>						
<i>L. macrochirus</i>	4					
<i>Micropterus dolomieu</i>					3	
* <i>M. punctulatus</i>			1			
* <i>M. salmoides</i>	1	1				
<i>Etheostoma blennioides</i>		1			2	
* <i>E. caeruleum</i>						
<i>E. flabellare</i>	1				3	
* <i>E. nigrum</i>						
<i>E. osburni</i>						
** <i>Percina caprodes</i>						
<i>P. maculata</i>						
* <i>P. oxyrhyncha</i>						
<i>Stizostedion vitreum</i>						
* <i>Cottus bairdi</i>						
* <i>C. carolinæ</i>					12	4
Total Species	7	8	4	4	4	8
Total Specimens	96	183	38	10	26	138

Table 2. (Cont.)

Species	Stations				Total
	49	50	51	52	
** <i>Lampetra aepyptera</i>					
* <i>Anguilla rostrata</i>					
* <i>Salmo gairdneri</i>					
* <i>S. trutta</i>					
<i>Salvelinus fontinalis</i>					
<i>Campostoma anomalum</i>	7	24	33	5	
<i>Clinostomus funduloides</i>					
<i>Ericymba buccata</i>	33	92	55	15	
<i>Exoglossum laurae</i>					
<i>Nocomis platyrhynchus</i>		4			
* <i>Notemigonus crysoleucas</i>					
* <i>N. albeolus</i>		107	5	13	
* <i>N. chrysocephalus</i>					
<i>N. photogenis</i>		15	4		
<i>N. rubellus</i>	102	42	92	7	
<i>N. scabriceps</i>					
<i>N. stramineus</i>	23	5	4	13	
* <i>N. telescopus</i>		1			
<i>N. volucellus</i>				1	
<i>Phenacobius teretulus</i>					
<i>Pimephales notatus</i>	75	43	9	9	
* <i>P. promelas</i>					
<i>Rhinichthys atratulus</i>					
* <i>R. cataractae</i>			1	1	
<i>Semotilus atromaculatus</i>	9	16	20		
<i>Catostomus commersoni</i>	18			1	
<i>Hypentelium nigricans</i>	89	14	1	7	
** <i>Moxostoma erythrurum</i>					
** <i>Ictalurus natalis</i>					
** <i>I. nebulosus</i>					
** <i>Noturus flavus</i>					
* <i>Pylodictus olivaris</i>					
<i>Ambloplites rupestris</i>			1		
* <i>Lepomis cyanellus</i>					
* <i>L. gibbosus</i>					
<i>L. macrochirus</i>					
<i>Micropterus dolomieu</i>	22	5	2	2	
* <i>M. punctulatus</i>				1	
* <i>M. salmoides</i>					
<i>Etheostoma blennioides</i>		2	3	1	
* <i>E. caeruleum</i>		8	91	5	
<i>E. flabellare</i>		2	4	1	
* <i>E. nigrum</i>				2	
<i>E. osburni</i>					
** <i>Percina caprodes</i>					
<i>P. maculata</i>					
* <i>P. oxyrhyncha</i>					
<i>Stizostedion vitreum</i>					
* <i>Cottus bairdi</i>					
* <i>C. caroliniae</i>					
Total Species	9	15	15	16	49
Total Specimens	378	380	325	84	12,518

ZOOGEOGRAPHY

This survey established many distributional records. The remoteness of the drainage and its inaccessibility, particularly in the lower two-thirds of the main-stem and its tributaries, has undoubtedly been a deterrent to sampling. The upper New River is generally more accessible. Perhaps for this reason, students of West Virginia fishes have tended to avoid the Gauley in their efforts.

The confluence of Gauley and New rivers forms Kanawha River above Kanawha Falls, long considered to be a barrier to upstream dispersal of fishes. All the endemic forms of the upper Kanawha (New) drainage occur in the Gauley, excluding *Etheostoma kanawhae* which is not known from West Virginia. However, the presence of six species found in Gauley River in this survey and not previously reported from the upper Kanawha drainage infers a relationship of the Gauley with the lower Kanawha drainage. The new distributional records indicate that either Kanawha Falls was not as effective a barrier as supposed, or conditions were once more favorable than at present for the dispersal of fishes above the Falls into Gauley River. In either case, it is assumed that other physical barriers were effective in limiting dispersal of fishes into the upper New River system. The zoogeographic relationships summarized below are discussed in detail by Hocutt (in press).

The wide distribution of *Etheostoma nigrum* in the Gauley drainage supports a hypothesis that more favorable conditions once existed for fishes to negotiate Kanawha Falls. It is more often found in slack water habitats over sand and detritus, and avoids strong currents. Thus, we reason that it is not a recent migrant over Kanawha Falls. Cole (1971) supports this, postulating that the present *E. nigrum* distribution resembles that of pre-Pleistocene times, and that populations east of the Appalachians are a consequence of relatively recent stream capture.

Subsequent to the Tertiary uplift of the Appalachians, the Teays River had a cutting advantage due to its volume and gradient. The evolving (New River) gorge with its multitude of rapids and cataracts probably served as an effective barrier. Kanawha, Wylie, Bull and Sandstone Falls are remnants of that rejuvenated period (Hocutt et al. 1978). Prior to recent impoundment, Kanawha Falls was the first of the series of natural barriers that served as a faunal filter (Hocutt in press).

The Pleistocene (Neff et al. 1970; Hocutt et al. 1978) impoundment of Teays River would have inundated Kanawha Falls if indeed the Falls existed at that time. Gauley River, smaller in drainage and volume of water, cut its gorge more slowly than the Teays and offered a route of dispersal for fishes (Hocutt, in press). Many species present today serve as relict populations to that time. The large numbers of *Etheostoma caeruleum*

support the contention that conditions once facilitated passage of fish upstream of the Falls area. *Lampetra aepyptera*, *Moxostoma erythrurum*, *Ictalurus natalis*, *I. nebulosus*, and *Noturus flavus* are native to the greater Ohio River drainage (Jenkins et al. 1972), thus their presence in the Gauley system may be explained by a Pleistocene impoundment. The capture of an immature *L. aepyptera* above Summersville Dam suggests a population predating construction; the presence of *N. flavus* in a 1951 collection (CU 32540) is similar evidence for an established population.

Gilbert (1969) regarded *Notropis telescopus* as introduced to the New River system, with all previously known records being very recent and from only a small part of the upper New River, Virginia (Jenkins et al. 1972). Subsequently, it was collected by Hocutt et al. (1978) from Greenbrier River, West Virginia, in this survey, and from Kanawha River below Kanawha Falls (Hocutt and Stauffer, ms). These data suggest three alternatives for its distributional status: (1) it is indeed an introduced species to the upper New system that has rapidly extended its range downstream by negotiating Bluestone Reservoir and the Union Carbide impoundment at Hawks Nest; (2) it is an introduced species to both the upper (New) and lower Kanawha drainages; or (3) it is a native species that is rarely encountered in the Kanawha drainage, its presence probably related to stream capture with the Tennessee drainage (Ross and Carico 1963).

Notropis scabriceps and *Phenacobius teretulus* are identified as part of the unique faunal assemblage of New River. Their almost exclusive distribution in the upper Gauley River system could be related to stream piracy with Greenbrier River (Wright 1934; Hocutt, in press), or to present-day ecological factors limiting their distribution. Wright (1934) felt there was evidence that the East Fork of Greenbrier River and Knapp Creek at one time continued a westerly flow beyond the present Greenbrier. The East Fork would have joined Shavers Fork in the vicinity of Cheat Bridge. Knapp Creek's westernly continuation is in approximate alignment with Stony Creek (reversed) into Laurel Creek of Williams River (Gauley system). Wright (1934) stated that little geological evidence existed to support this contention in light of the fact that erosion of the Greenbrier Valley limestone erased traces of stream diversion. Biological evidence (Hocutt et al. 1977, 1978; Hocutt, in press) supports Wright's (1934) hypothesis. Additionally, if his contention were correct, dispersal of upper New River fauna (e.g., *N. scabriceps*, *P. teretulus*, *Cottus* spp.) into the Gauley system via Greenbrier River would have been possible.

Once fauna entered Gauley River via Williams River from the Greenbrier, distribution would be related to downstream and lateral dispersal. Little Beaver Creek may once have flowed into Muddlety Creek via

Harris Fork of the latter (Reger 1921). Peters Creek apparently captured Muddlety Creek drainage via Arbuckle Branch, and could have once flowed through the present valleys of Otter and Little Elk creeks to a confluence with Gauley River at Swiss, 12.9 km downstream of its present mouth (Reger 1921). Back Fork of McMillion Creek may have once flowed into Persinger Creek. Similarly, fishes may have dispersed upstream through this series of captures.

Elk River of the lower Kanawha drainage has captured part of the Gauley system (Campbell 1896) and continues to encroach on Gauley River waters. Only 4.8 km separate their main-channels near Webster Springs, and capture by the Elk appears imminent (Reger 1920); the Elk valley is nearly 244 m lower than the Gauley valley at Webster Springs. Also, Anthony and Laurel creeks, tributaries to Birch River of the Elk system, are presently encroaching on Beaver and Muddlety creeks of Gauley River (Reger 1921). There may have been faunal interchange during the Elk River capture of Gauley River drainage (Campbell 1896). *Noturus miurus* (UNC 7629; identifications verified) is recorded from Williams River (Gauley system), but is suspected to represent a mistaken locality. No specimens were collected by us from Williams River after repeated sampling, but the species is known from nearby Elk River (Taylor 1969).

In summary, these data support a hypothesis that Kanawha Falls was once more navigable to fishes than at present (Hocutt, in press). Ichthyofauna once above the Falls area could migrate up either the New River gorge and its series of montane stresses, or up Gauley River, a rigorous but less stressful route. Biological evidence supports Wright's (1934) contention of piracy between the Greenbrier and Gauley rivers, with fauna having dispersed into each drainage from the other. Facts may be masked by introductions of various species (e.g., Hocutt and Hambrick 1973) into the Gauley system, and by extensive logging and mining operations in the basin during the past 80 years.

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Carolina, Morehead City, confirmed the identification of *Lampetra aepyptera*. Drs. David A. Etnier, University of Tennessee, and Robert E. Jenkins, Virginia Commonwealth University, offered critical comment for improvement of the manuscript.

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Historical Review of the Carolina Parakeet in the Carolinas

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ABSTRACT. — Parrots or parakeets appear in many lists of Carolina birds recorded by such early voyagers, explorers and promoters as Thomas Hariot (1588), William Hilton (1664), Thomas Ashe (1682), Samuel Wilson (1682), John Lawson (1709), Mark Catesby (1731) and others. These references, when authentic, can be safely assigned to the now extinct Carolina parakeet, *Conuropsis carolinensis*. The species was so named by Linnaeus (1758) from a drawing of a specimen taken in South Carolina by Catesby. Despite association of the region with the bird's name, a long history constitutes the bulk of evidence on the species in the Carolinas. There are no specimens, exceedingly few precise claims by ornithologists, and no specific references to eggs, migratory movements or young. Little can be found to validate North Carolina's claim to parakeets after about 1770 (William Bartram). For South Carolina, matters are more complex: widely spaced but fairly persistent records bring the bird's history there down to about the end of the Civil War, with a final, no doubt storm-tossed, bird accidentally occurring about 1885. There was a flurry of alleged sightings in the decade of the 1930s, but the birds either disappeared without documentation or were not there in the first place.

INTRODUCTION

In an account of the Carolina parakeet, *Conuropsis carolinensis* (Linnaeus), history and biology must mix, for the species is extinct. That notably handsome bird, so often remarked by early travelers, thus joins the passenger pigeon and other vanished species in a group about which we (as a civilization) know pretty much all that we shall know. Veteran ornithologists know about it, of course, and sometimes allege a good many things that a careful historian of the species learns are not true. But, ask a concerned American citizen to name ten exterminated species of animals and the Carolina parakeet will probably not be among them.

Except for its name, the parrot of Carolina was not uniquely associated with the Carolinas. It was widely, if somewhat erratically, distributed in the eastern United States, being found from Florida to Texas and well up the Arkansas, Missouri, Ohio and Mississippi river valleys. This report, emphasizing evidence on distribution in North and South