mer months and early fall, when the water temperature has had time to rise to 24–26 C or more. In fact, sharks have been reported in the Mississippi-Atchafalaya River system at Simmesport, Louisiana, at least 300 km by water from the Gulf of Mexico and near Jonesport, Lousiana, 440 km from the Gulf (Gunter, 1938). These were reported as *C. platyodon* (Poey), which Bigelow and Schroeder (1948) treated as a synonym of *C. leucas*. They undoubtedly occur more commonly in the lower Mississippi than the scientific record discloses, and the wonder is that they have not been reported much farther up the river than they have.

In 1937, the distance from the point of capture at Alton to the Gulf of Mexico was approximately 2800 river km, much less than the distances cited in the Amazon. The Alton Lock and Dam was the first obstruction to free transit of the Mississippi River, but it did not go into operation until approximately a year after the capture of the shark.

The factor that would most effectively limit the movement of sharks up the Mississippi River is water temperature. The maximum distance they could penetrate would be the distance they could wander upstream between the times the water temperature reached around 24 C at the rivermouth and the time it had dropped back down to 24 C at the level they had reached by that time. Water temperatures at the St. Louis city water plant at Chain-of-Rocks, about 23 km downstream from the point of capture, were high enough to allow transit of a bull shark to that point. For August, 1937, the figures were: Maximum 29 C, Average 27.2 C, Minimum 26.7 C. For September 1 through 7, 1937, single daily temperatures ran 27.7, 27.7, 27.7, 26.7, 25.6, 23.3, 24.4 C respectively.

The occurrence of a shark at Alton is almost as far upriver as such an occurrence could reasonably be expected, even if the dam were not there. However, *C. leucas* can reasonably be looked for occasionally at points farther down the river.

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NOTES ON THE HABITAT, DESCRIPTION AND DISTRIBUTION OF THE SHARPNOSE DARTER, *PERCINA OXYRHYNCHA*.—The holotype of the sharpnose darter, *Percina oxyrhyncha* (Hubbs and Raney, 1939), was captured in Cheat River, Monongahela drainage, at the Cheat R. bridge, West Virginia. This species has been reported from the Monongahela, Little Kanawha and above and below the falls of the New-Kanawha rivers (Addair, 1944; Jenkins, et al. 1972), North Carolina, Virginia and West Virginia. Ross and Perkins (1959) reported it from the main channel New R., Radford, Virginia, and in several tributaries. Stauffer et al. (1974) collected it in East River, another New R. tributary. Six specimens were taken in Big Sandy Creek, Monongahela drainage, Preston County, Virginia (Page, 1974). Additional New River specimens were taken recently by Hocutt et al. (1973, 1974) and by

Stauffer (1975). Specimens at Cornell University and the United States National Museum were taken from Elk River, Gauley River, and Birch Creek (tributary of Elk R.) in the Kanawha system in West Virginia and in Red Bird Creek (tributary of Kentucky River).

Hubbs and Raney (1939) hypothesized that the sharpnose darter was transferred from the New R. drainage to the upper Cheat basin via stream piracy between Second Fork of the Cheat and the Greenbrier. A comprehensive literature review revealed no record of the sharpnose darter from the Greenbrier River, but F. J. Schwartz (pers. comm.) stated that he had collected it in Greenbrier R. near Bartow, West Virginia, in 1957.

Morphometric and meristic characteristics and general ecology of the sharpnose darter were discussed by Hocutt and Hambrick (1973). The species was reported as rare by Schwartz (1967). However, Hocutt, et al. (1973) reported a single rotenone collection of 33 specimens, which may indicate local abundance in preferred habitats.

The purpose of this paper is to present additional data on the habitat, description and distribution of the sharpnose darter.

Methods and Materials

Fishes were collected at 32 locations in the Greenbrier R. and its tributaries in 1972 and 1974 (Denoncourt, et al., 1975). *P. oxyrhyncha* was taken at four localities: 1) river km 9.7, two specimens; 2) 14.5, three; 3) 45.1, ten; and 4) 123.9, one. Specimens will be deposited in the Appalachian Environmental Laboratory Fish Museum, University of Maryland at Frostburg, Maryland. Additional specimens of the sharpnose darter at Cornell University (CU 20839, 20855, 20863, 32280, 32498) and United States National Museum (USNM 56690, 181914, 194749, 208594, 211272, 211273) were examined.

Meristic and morphometric data taken from these specimens were compared with those in Hubbs and Raney (1939) and Page (1974). Meristic and morphometric data were taken as described by Hubbs and Lagler (1958) and diagonal scale counts as by Raney and Suttkus (1964, 1966). Measurements were taken from the left side of the specimen with dial calipers and recorded to the nearest 0.1 mm. Fin base length for this paper was expressed in thousandths of the standard length. A one-way analysis of variance was used to test the differences between fin base lengths of males and females. Examination of squamation followed that in Hocutt and Hambrick (1973). Habitat

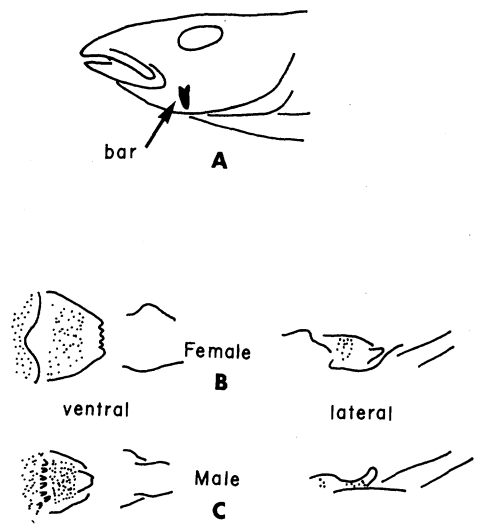

Fig. 1. Diagrammatic sketches of the sharpnose darter, *Percina oxyrhyncha*, from the Greenbrier R. West Virginia. (a. subocular bar, b. female genital papilla, c. male genital papilla).

descriptions were synthesized from Hubbs and Raney (1939), Addair (1944), Hocutt and Hambrick (1973), Hocutt (1974), Stauffer et al. (1974), Stauffer (1975) and our own observations.

Results and Discussion

Sixteen sharpnose darters were collected in August, 1974: one juvenile (35.5 mm SL), seven female and eight male adults (71.0–93.2 mm SL). Creek, nape and abdominal squamation were incomplete in the juvenile. All adults had embedded cycloid scales on the cheek, partially to completely scaled opercle, one caducous scale and usually a few embedded scales on the breast. Contrary to Page (1974) the midventral scales possessed elongated ctenii as described in Hubbs and Raney (1939). All specimens possessed a faint, diagonal bar on the lower cheek, similar to that shown for *Percina macrocephala* by Trautman (1957). This extended to the gular region in most specimens (Fig. 1a).

Sexual dimorphism for our specimens was similar to that described by Hubbs and Raney (1939). In addition, the genital papillae (Fig. 1, b, c), second dorsal and anal fins and midventral scales differ. The female genital papilla is broad and flattened, while that of the male has a narrow and usually raised, unpigmented tip. Melanophores on the female papilla are more scattered than on the male. The base of the second dorsal (males: .227–.261, $\bar{x}$ = .240 SL;

TABLE 1. COMPARISON OF MORPHOMETRIC AND MERISTIC CHARACTERISTICS OF *Percina oxyrhyncha* FROM THE GREENBRIER R., WEST VIRGINIA WITH THOSE OF THE CHEAT AND NEW RIVERS REPORTED BY PAGE (1974) AND HUBBS AND RANEY (1939).

	Greenbrier (N = 16)		Page (N = 6) Cheat	Hubbs and Raney			
				Cheat (N = 2)		New (N = 7)	
Characteristic	Range	$\bar{x}$	$\bar{x}$	Range	$\bar{x}$	Range	$\bar{x}$
Standard length	35.5–93.2	79.7	–	63.0–80.0	71.5	29.5–54.0	40.5
Lateral line scales	69–79	74.4	72.8	74–77	75.5	73–80	75.9
Scales above lateral line	10–13	10.6	10.8	9	9.0	10	10.0
Scales below lateral line	15–16	15.2	14.2	14	14.0	14–16	14.9
Least caudal peduncle scales	27–30	28.7	28.7	–	–	–	–
First dorsal hard rays	13–14	13.5	13.1	14	14.0	12–14	13.0
Second dorsal soft rays	12–13	12.6	12.5	14	14.0	13–14	13.1
Anal soft rays	8–9	8.3	8.3	8–9	8.5	9	9.0

females: .206–.235, $\bar{x}$ = .223) and the base of the anal (males: .229–.255, $\bar{x}$ = .239; females: .215–.233, $\bar{x}$ = .221) fins are significantly ($P \leqslant .05$) longer in males. Both males and females have a row of enlarged, midventral scales. Those of females are twice the diameter of adjacent scales, while those on males are usually three times the diameter of adjacent scales and have enlongated ctenii.

Meristic data were compared (Table 1) with those in Page (1974) and Hubbs and Raney (1939). Greenbrier specimens showed slight or no differences in scale and ray counts. Additional specimens will be required for a more comprehensive analysis.

Coloration of a large, freshly preserved specimen collected in New R. on 29 June 1971 was recorded by R. D. Ross and Hocutt. The following is adapted from their notes: Brown and yellowish ventrally with vertical dark bars on body. Paired fins and anal fin slate colored. First dorsal dusky at base, red above with narrow dark margin. Second dorsal slate. Caudal brown or rufous at base, yellowish on middle part of all membranes, with dusky margin. Cheek dull yellow. A dark line from snout through eye to upper end of gill cleft. Ten dark, dorsal saddles present. Top of head slate. Enlarged midventral scales prominent and somewhat lighter than the yellow of rest of body. Anal papilla dusky.

Specimens collected by us in the Greenbrier and upper New R. were similar in pattern to the above, but not as brightly colored. All had the typical submarginal band in the first dorsal fin.

Hubbs and Raney (1939) described the habitat of the sharpnose darter as being large stones and boulders embedded in sandy riffles. They stated that specimens could be collected in the swift waters flowing around rooted macrophytes. Brief habitat descriptions were also given by Addair (1944) and Hocutt and Hambrick (1973). Addair (1944) noted that the sharpnose darter tolerated a "muddy silty habitat" and indicated that it was euryecious. He stated that Hubbs collected it from under boulders and around pond weeds in yellow silty water. Data collected by two of us (Stauffer and Hocutt) suggested a distribution related to stream flow.

Adult specimens were taken by us in clear, moderately flowing runs 45 to 65 cm deep, from among boulders. Individuals were drawn out by the DC electroshocker. Few or no specimens would have been captured by seine alone due to the subshale type of bottom. Adult specimens at localities 1 and 2 were found under large (to 5 m) flat boulders. More rounded and smaller (1–2 m) boulders and some weed beds characterized the substrate at locality 3. The one juvenile was collected among small (3–10 cm) rubble.

Hocutt has taken the sharpnose darter from virtually every type of habitat. There seemed to be a definite correlation of specimen size with substrate and gradient. Small specimens (under 30 mm) were taken with 3 and 7.5 m seines over sandy, cove/beach areas with slight surface current. Other small specimens have been taken in areas of slight to moderate current over gravel and small rubble. Adult specimens have been collected almost exclusively from fast, turbulent riffles and runs to a meter in depth. Substrate in the latter areas was strewn with large rubble and small boulders, interspersed with

sandstone bedrock, extremely difficult places to collect.

Stauffer, et al. (1974) reported this species from a heated discharge in the New River at 34.4 C. The Greenbrier specimens were collected at water temperatures between 23.3 and 26.7 C.

Species associated with the sharpnose darter in New R. were given by Hocutt and Hambrick (1973) and in the Cheat R. by Hubbs and Raney (1939). The following Percidae were taken with the sharpnose darter in Greenbrier R.: *Etheostoma blennioides, E. flabellare* and *E. osburni.*

Several authors have referred to stream capture between the Greenbrier and the Cheat (Campbell, 1896; Fridley, 1933; Wright, 1934; Addair, 1944; Schwartz, 1967). The presence of *P. oxyrhyncha* in the Greenbrier R. lends credence to the hypothesis that stream capture(s) occurred between the New and Monongahela systems as suggested by geological and hydrographical evidence.

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