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Percina gymnocephala, a new percid fish of the subgenus *Alvordius*, from the new river in North Carolina, Virginia, and West Virginia

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PERCINA GYMNOCEPHALA, A NEW PERCID FISH OF THE SUBGENUS *ALVORDIUS*, FROM THE NEW RIVER IN NORTH CAROLINA, VIRGINIA, AND WEST VIRGINIA[1]

By EUGENE C. BECKHAM, III[2]

According to Hubbs and Raney (1939:4) *Percina maculata* is "probably a complex of subspecies." Examination of specimens throughout the range of *P. maculata* has revealed the presence of an undescribed species of darter endemic to the New River in North Carolina, Virginia, and West Virginia. The description of the new form is based on 311 specimens. Counts and measurements were according to the methods in Hubbs and Lagler (1958). Transverse scale counts, from the second dorsal fin origin downward and backward to the base of the anal fin, were as outlined by Raney and Suttkus (1964).

Percina gymnocephala, new species
Appalachia Darter
Figure 1, Figure 2

Hadropterus aspro—Fowler, 1906: 521 (species list)

Hadropterus maculatus—Hubbs and Raney, 1939: 2; Raney, 1941: 3 (Table 1, species associates and distribution); Raney and Hubbs, 1948: plate I, fig. 4, plate II, fig. 4 (comparative material)

Percina maculata — Ross and Perkins, 1959: 16, 20 (species list); Ross, 1959: 18 (key), 26 (Table 1, species list and distribution); Jenkins, Lachner, and Schwartz, 1972: 55 (species list and distribution); Menhinick, Burton, and Bailey, 1974: 42 (state checklist); Denoncourt, Raney, Hocutt, and Stauffer, 1975: 119 (state checklist); Stauffer, Hocutt, Masnik, and Reed, 1975: 124

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(Table 1, species list and distribution); Stauffer, Dickson, Cairns, and Cherry, 1976: 14 (Table 1, species list and distribution), 16 (Table 2, species list and distribution), 33 (annotated list); Bailey, J. R. *in* Cooper, Robinson, and Funderburg, 1977: 280 (species list); Hocutt, Denoncourt, and Stauffer, 1978: 63 (Table 1, species list and distribution), 65; Hocutt, Denoncourt, and Stauffer, 1979: 48, 66-74 (Table 2, species list and distribution)

Percina cf. *maculata*—Hocutt, Denoncourt, and Stauffer, 1979: 64 (annotated list)

Holotype.—TU 106911, an adult female, 63.8 mm SL (Figure 1), South Fork of New River at eastern crossing of co. rd. 1181, 7.0 airmi. SE of West Jefferson, Ashe Co., North Carolina, 22 September 1977, Eugene C. Beckham and Esther B. Beckham.

Paratypes.—USNM 194774 (2), Big Fox Cr., Grayson Co., Virginia, May, 1964; TU 70102 (12), UMMZ 203834 (4), UAIC 4421.01 (4), and UT 91.1860 (4), all from Fox Cr. at US Hwy 58, Grayson Co., Virginia, 12 June, 1971; TU 70059 (3), Fox Cr. along co. hwy 711, 1.4 mi. above Fox, Grayson Co., Virginia, 13 June, 1971; TU 71144 (3), Fox Cr. along co. hwy 711, 1.2 mi. NW of Fox, Grayson Co., Virginia, 13 June, 1971; TU 105084 (2), Fox Cr. at US Hwy 58, Grayson Co., Virginia, 20 September, 1977; TU 105124 (1), South Fork of New River at hwy 163, Ashe Co., North Carolina, 22 September, 1977; TU 105137 (3), collected with the holotype; TU 106912 (2), and INHS 27291 (2), all from South Fork of New River at co. rd. 1105, Ashe Co., North Carolina, 24 March, 1978.

Additional material. Numbers in parentheses represent numbers of specimens examined. Complete locality data may be obtained from the author on request.—NORTH CAROLINA: Watauga Co., CU 21872 (1); Ashe Co., CU 7659 (2), CU 7670 (3), CU 7709 (7), CU 7694 (5), NCSM 2928 (4), NCSM 4187 (1), NCSM 3562 (3), NCSM 4009 (2), UNCC 72-17 (1), UNCC 72-18 (1), UNCC 72-20 (1), NCSM 6328 (2), NCSM 6294 (2), NCSM 6297 (1), UNCC 76-102 (4), UNCC 76-103 (5), UNCC 76-104 (4), TU 105038 (1); Allegheny Co., UMMZ 147671 (3), NCSM 5135 (1), NCSM 4355 (1), NCSM 4363 (1), NCSM 5565 (2); VIRGINIA: Grayson Co., CU 9470 (1), UF 1397 (1), UMMZ 169193 (1), UNCC, uncat. (3), CU 52226 (11), TU 70480 (3), VPI 2995 (10), VPI 3217 (15), AEL 31 (20); Carroll Co., UMMZ 95372 (4), CU 9458 (1), CU 9481 (1), CU 50450 (1), TU 19577 (1), VPI 2508 (1), VPI 2994 (7); Floyd Co., CU 44074 (2), UNC 6644 (1); Wythe Co., UMMZ 95367 (7), UMMZ 118487 (1), UMMZ 112416 (1), CU 8040 (3), CU 9503 (2), VPI 2864 (16), VPI 2991 (4), VPI 3220 (21); Montgomery Co., CU 24838 (11), TU 25599 (2), VPI 1677 (3); Giles Co., CU 24955 (5), VPI 2186 (16); WEST VIRGINIA: Pocohontas Co., CU 5805 (1), CU 20675 (1), OSU 18464 (2), AEL 88 (6); Greenbrier Co., UNC 6712 (1); Webster Co., UMMZ 118941 (1), UNC 7009 (3), UNC 7633 (1), AEL 164 (9), AEL 180 (3); Nicholas Co., CU 20867 (3), AEL 191 (3).

Comparative material. Numbers in parentheses represent numbers of specimens of *Percina maculata* examined. Complete locality data may be obtained from the author on request.—Ohio River drainage, ILLINOIS: Clay Co., INHS 7972 (2); Coles Co., INHS 18856 (2); Crawford Co., INHS 11571 (1); Cumberland Co., INHS 26902 (3); Effingham Co., INHS 7662 (1); Jasper Co., INHS 9613 (1), INHS 9638 (10); Johnson Co., INHS 2181 (2); Pope Co., INHS 1350 (6), INHS 1468 (4); Vermilion Co., INHS 12198 (2); White Co., INHS 9359 (1); INDIANA: Warrick Co., INHS 75542 (2); KENTUCKY: Carlisle Co., FSU 9002 (3); Livingston Co., INHS 75545 (1), INHS 75546 (4); Montgomery Co., INHS 75544 (1); Washington Co., INHS 75543 (1); TENNESSEE: Fentress Co., CU 30762 (2); Montgomery Co., CU 23188 (2); Stewart Co., CU 23222 (2), CU 47857 (3); Sumner Co., UF 22319 (1); WEST VIRGINIA: Cabell Co., UNC 6921 (3); Kanawha Co., CU 4979 (1), CU 4991 (1); Tyler Co., UNC 6951 (1); Upper Mississippi River drainage, ILLINOIS: Bureau Co., INHS 12689 (1); Clark Co., INHS 2837 (17); Coles Co., INHS 19058 (8); Douglas Co., INHS 8282 (4); Edwards Co., INHS 7154 (8); Iroquois Co., INHS 7208 (1); Jackson Co., INHS 22592 (7), INHS 22660 (1); Kankakee Co., INHS 5356 (4), INHS 5614 (4), INHS 5630 (6); Lawrence Co., INHS 9336 (3); Livingston Co., INHS 6827 (1); Logan Co., INHS 18645 (1); Marshall Co., INHS 10482 (6); Mason Co., INHS 14528 (2); INHS 25700 (1); McDonough Co., INHS 14730 (5); McLean Co., INHS 21148 (6), INHS 21247 (1); Morgan Co., INHS 16278 (3); Moultrie Co., INHS 8861 (7); Piatt Co., INHS 8541 (10); Scott Co., INHS 10259 (1); Tazewell Co., INHS 14942 (9), INHS 14965 (9); Will Co., INHS 4872 (11), INHS 5101 (10); Woodford Co., INHS 10930 (14).

Diagnosis.—A species of the genus *Percina*, subgenus *Alvordius* (diagnosed by Page, 1974), distinguished from other known species of the subgenus by the following combination of characteristics. Reduced head and nape squamation; cheeks usually naked; opercles usually naked or with 1 to 5 wholly or partly embedded scales along dorsal margin; nape usually naked or with embedded scales posteriorly. Basicaudal black blotch diffuse, submedial, and confluent with last lateral blotch. Gular region with moderate concentration of melanophores from area centrally located between subocular bars to near tip of chin. First dorsal fin with black basal band formed of interradial, oval concentrations of melanophores; a dusky distal band; and a medial clear band formed by an absence or near absence of melanophores anteriorly on most interradial membranes. Females with row of modified scales on midbelly.

Percina gymnocephala is contrasted with *P. maculata*, in Tables 1-3. Counts for *P. peltata* are given by Mayden and Page (1979). In addition to having fewer vertebrae (Table 2), modally fewer pectoral rays, and modally more dorsal rays, lateral-line scales and caudal peduncle scales (Tables 2 and 3), *P. maculata* is distinguished from *P. gymnocephala* by having a distinct, round, medial, black basicaudal spot,

Table 1. Proportional measurements of **Percina gymnocephala** and **Percina maculata** expressed as thousandths of standard length.

Measurement	Holotype	P. gymnocephala (10)		P. maculata (20)	
		range	$\bar{X}$	range	$\bar{X}$
Standard length (mm)	63.8	47.3-66.1	57.4	47.4-73.9	57.3
Head length	241	230-272	256	262-288	275
Orbit diameter	55	53-66	60	60-82	68
Snout length	57	56-65	60	57-81	66
Snout-D_1 origin	332	298-357	327	329-360	341
Snout-D_2 origin	658	596-658	638	625-676	650
Snout-A origin	641	590-678	639	625-674	646
Snout-P_2 insertion	233	207-239	226	215-242	231
Snout-jct. gill membrane	134	116-163	129	97-146	128
Body depth	188	143-196	167	137-200	174
Body width	146	116-163	136	123-156	140
Caudal peduncle length	230	211-247	234	215-247	227
Caudal peduncle depth	90	82-99	91	81-96	88
D_1 base	312	294-319	309	263-333	299
D_2 base	147	142-180	153	141-202	176
A base	133	127-156	141	118-183	151
Longest D spine	104	92-106	100	85-139	113
Longest D ray	117	108-134	123	101-135	123
Longest A ray	138	129-154	148	130-155	145
P_1 length	229	211-258	234	207-239	220
P_2 length	203	188-214	203	181-213	194
Upper jaw length	63	62-71	65	71-91	78
Upper jaw width	16	11-16	13	8-14	11

Table 2. Frequency distributions of fin-ray and vertebral counts in **Percina gymnocephala** and **Percina maculata**.

Dorsal spines

	12	13	14	15	16	$\bar{X}$
P. gymnocephala	3	40	87	47	5	14.06
P. maculata	6	41	54	12		13.64

Dorsal rays

	10	11	12	13	14	$\bar{X}$
P. gymnocephala	19	125	35	3		11.12
P. maculata	1	7	66	36	3	12.29

Anal rays

	7	8	9	10	$\bar{X}$
P. gymnocephala	4	85	88	6	8.52
P. maculata		21	75	17	8.96

Left pectoral rays

	12	13	14	15	$\bar{X}$
P. gymnocephala		22	110	50	14.15
P. maculata	2	62	48	4	13.47

Right pectoral rays

	12	13	14	15	16	$\bar{X}$
P. gymnocephala		13	112	55	2	14.25
P. maculata	5	55	51	5		13.48

Vertebrae

	40	41	42	43	44	45	46	$\bar{X}$
P. gymnocephala				3	29	49	6	44.67
P. maculata	2	16	63	52	8			42.34

Table 3. Frequency distributions of scale counts in **Percina gymnocephala** and **Percina maculata**.

Lateral line scales

	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	$\bar{X}$
P. gymnocephala	1	-	5	3	5	10	12	30	26	30	22	10	10	7	6	-	3					64.46
P. maculata			1	-	2	6	6	10	7	16	11	9	11	8	13	5	5	4	1	1	1	66.71

Transverse scales

	14	15	16	17	18	19	$\bar{X}$
P. gymnocephala	6	58	65	45	8		15.95
P. maculata	4	21	38	37	13	4	16.39

Caudal peduncle scales

	19	20	21	22	23	24	25	26	27	$\bar{X}$
P. gymnocephala	1	17	43	46	45	26	4			22.16
P. maculata		3	9	18	32	28	19	7	1	23.39

fully scaled opercles, and fully or partly scaled cheeks. In *P. maculata* melanophores are typically scattered throughout the first dorsal fin with no clear medial band or dark basal band but with an anterior black basal blotch. In contrast to *P. gymnocephala*, *P. peltata* has modally fewer lateral-line scales and caudal peduncle scales, more dorsal-fin rays (Tables 1, 3 and 4 in Mayden and Page, 1979), a first dorsal fin with a wide clear medial band bordered basally by a row of large black crescents and distally by a dusky band, and a black chin bar (Mayden and Page, 1979). Other species of *Alvordius* are readily distinguishable from *P. gymnocephala* in general appearance.

Description.—*Percina gymnocephala* is a relatively robust species of the subgenus *Alvordius* (Fig. 1) of moderate size (maximum length examined, 79.5 mm SL). Proportional measurements and frequency distributions of scale, fin-ray, and vertebral counts are given in Tables 1 through 3.

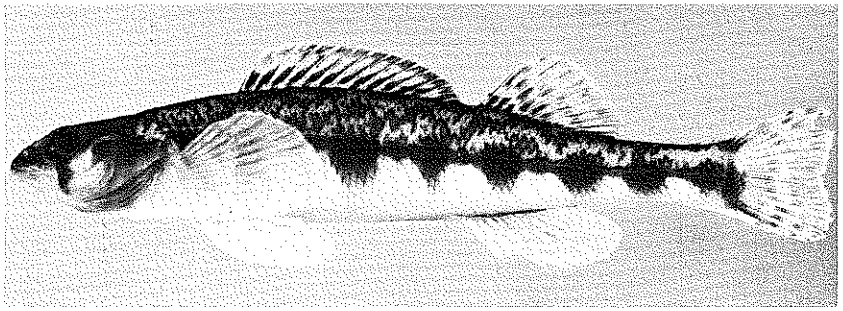

FIGURE 1. *Percina gymnocephala*, n. sp., holotype, TU 106911, an adult female, 63.8 mm SL, from South Fork New River, Ashe Co., North Carolina, 22 September, 1977.

Branchiostegal membranes separate; premaxillary frenum well developed; cephalic sensory canal system without interruptions: a single coronal pore, supratemporal canal with three pores, supraorbital canal with four pores, infraorbital canal with 7 or 8 pores, typically 8, preoperculomandibular canal with 10 pores.

Dorsal spines 12 to 16 (usually 13 to 15); dorsal rays 10 to 13 (modally 11), anal spines 2, rarely 1; anal rays 7 to 10 (usually 8 or 9), pectoral fin rays 13 to 16 (modally 14). Total vertebrae 43 to 46 (modally 45). Breeding tubercles absent.

Nape naked or with few embedded scales posteriorly. Cheeks usually naked, rarely with a few embedded scales. Opercles usually naked; scales, when present, number 1 to 5, and are wholly or partly embedded and in a single row across the dorsal margin. Breast usually naked. Midventral row of modified scales well developed and present in both males and females. Lateral line straight, complete (rarely 1 unpored scale) with 56 to 72, usually 61 to 68, scales. Transverse scales 14 to 18 (usually 15 to 17). Caudal peduncle scales 19 to 25 (usually 21 to 23).

Color.—No sexual dichromism is exhibited by *Percina gymnocephala*. Dark-brown lateral blotches number 6 to 8, usually 7, are elongate, and tend to be square or rectangular rather than rounded as in *P. maculata* and *P. macrocephala*. There are typically 7 dark-brown, square, dorsal saddles with light-brown or tan interspaces approximately equal in size to the saddles. Narrow, dark bands extend from each corner of the 5 center saddles and form a V-shape on the dorsolateral surface between and below the saddles. One predorsal saddle is usually present. The spinous dorsal fin originates in the light interspace between the first and second saddle and extends to the fourth saddle. The second dorsal fin begins at the posterior edge of the fourth saddle and extends to the sixth. The seventh saddle is on the caudal peduncle. No distinct round basicaudal spot is present as in *P. maculata*, but at the base of the caudal fin is a diffuse blotch that is typically the same color as the lateral blotches and tends to be confluent with the last lateral blotch. The basicaudal blotch is usually located entirely below the plane of the lateral line with its upper margin at the level of the lateral line. The ventral and ventro-lateral body is typically white or light tan and occasionally has scattered melanophores creating a dusky appearance. Scattered melanophores are present on the area immediately anterior to the pectoral fin base. The head is dark above the ventral margin of the eye and has a heavy concentration of dark pigment immediately anterior to the eye that extends to the frenum and along one fourth to one half of the upper margin of the upper jaw. Other heavy concentrations of dark pigment are in a bar above the eye, in a subocular bar, in an oval to crescent blotch on the upper cheek and on the upper half of the operculum. Scattered melanophores form a dusky band around the ventral margin of the orbit and along the posterior portion of the upper jaw. The lower cheek and operculum are dusky. Patches of melanophores are present on the gular region, chin, lower lip, and the medial area of each branchiostegal ray. The breast typically has scattered melanophores with concentrations along the mid-ventral line immediately posterior to the isthmus and between the pelvic fin bases.

The first dorsal fin typically has a proximal dark band formed by an oval concentration of black pigment on each interradial membrane, a clear band, and a distal dusky band. The proximal band may be up to one half of the fin height and is more intense than the distal band. The intensity of the proximal band decreases posteriorly whereas the intensity of the distal band increases posteriorly. Scattered melanophores occur along the anterior edge of each spine and interrupt the clear band. The second dorsal fin has a concentration of melanophores on the proximal portion of anterior three to five interradial membranes. Scattered melanophores form two to three dusky bands on the interradial membranes on a diagonal across the central portion of the fin and a distal band. The fin rays are outlined by melanophores at each band. The anal fin has a few scattered melanophores along the proximal portion. On the rays are melanophores that form a dusky band in the central area of the fin. The caudal fin has three to four bands formed by

melanophores on the rays for the proximal and central bands and the rays and the interradial membranes for the distal band. The pectoral fins typically have five pale bands formed by melanophores along the edges of the rays. A patch of scattered melanophores is present on the upper one half of the pectoral fin base. The pelvic fins occasionally have a few scattered melanophores not arranged in bands.

Distribution and habitat.—*Percina gymnocephala* is endemic to the New River drainage above Kanawha Falls in North Carolina, Virginia, and West Virginia (Fig. 2). It is distributed predominantly within the Blue Ridge province in North

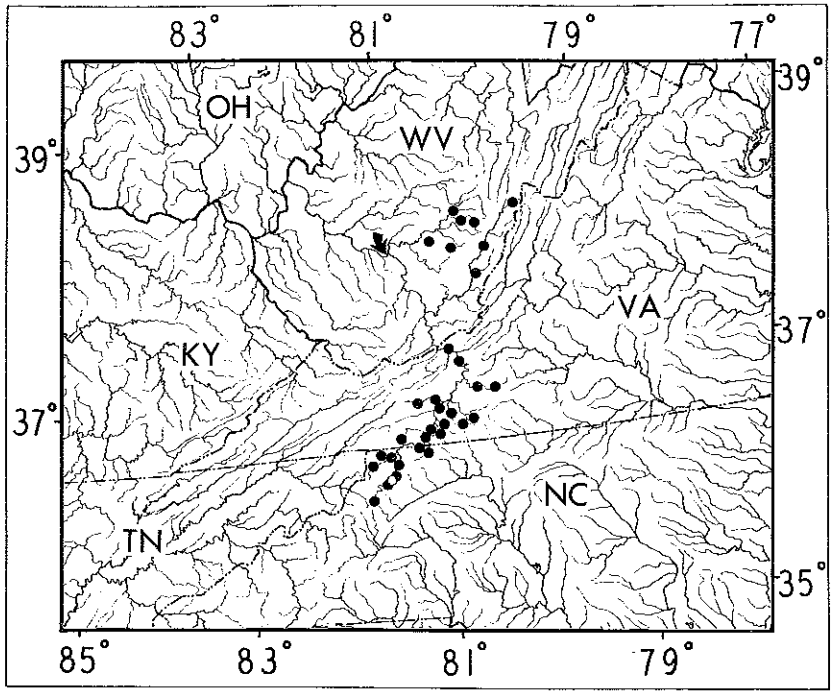

FIGURE 2. Distribution of *Percina gymnocephala*. Open circle indicates type locality. Arrow shows position of Kanawha Falls.

Carolina and southern Virginia. Fewer collection records are from the Ridge and Valley province which includes the northern part of Virginia and most of the upper Greenbrier River in West Virginia. The Appalachian Plateau province contains a few records from the Gauley River in West Virginia.

The distribution of *P. gymnocephala* is similar to that of *Phenacobius teretulus*

(Hambrick *et al.*, 1975), another new drainage endemic; however, *P. gymnocephala* is more widespread today in the Ridge and Valley and Appalachian Plateau provinces than the Kanawha minnow. One other species endemic to the New River, *Etheostoma kanawhae*, is less widespread in the drainage and is essentially restricted to the Blue Ridge province in North Carolina and Virginia (Raney, 1941). The distributions of *E. kanawhae* and *P. teretulus* have been attributed to preference for those streams in the Blue Ridge province that have relatively soft water (Ross and Perkins, 1959). The preference for soft water may also account for the abundance of *P. gymnocephala* in the Blue Ridge region. The greater occurrence of the Appalachia darter in the remaining provinces may be due to a greater tolerance than the other two species for the harder water streams; however, the gap in distribution in southern West Virginia may be due to affinities for moderate-sized river and main tributary channels with limited dispersal through, or avoidance of, the larger, high gradient portions of the lower New River.

Seasonal variation in habitat preference is exhibited by *P. gymnocephala*. Late spring and early summer collections reveal its occurrence in riffle and riffle-run habitats whereas in the fall it inhabits slower, deeper water above and below riffles.

Species associates.—Species collected with the holotype include *Hypentelium nigricans*, *Campostoma anomalum*, *Exoglossum laurae*, *Nocomis platyrhynchus*, *Notropis coccogenis*, *N. photogenis*, *N. rubellus*, *N. scabriceps*, *N. volucellus*, *Phenacobius teretulus*, *Pimephales notatus*, and *Ambloplites rupestris*. Additional species collected with paratypic material include *Nocomis leptocephalus*, *Notropis albeolus*, *N. rubricroceus*, *Micropterus dolomieui*, *M. salmoides*, *Etheostoma blennioides*, *E. flabellare*, *E. kanawhae*, *Percina oxyrhyncha*, and *Cottus bairdi*.

Three species, *Phenacobius teretulus*, *Etheostoma kanawhae*, and *Percina oxyrhyncha*, are often associated with *P. gymnocephala* in riffle and riffle-run habitats in the upper reaches of the New River in Virginia and North Carolina.

Relationships.—Meristic data (e.g., scale counts) indicates *P. gymnocephala* is intermediate between *P. peltata* and *P. maculata*. Color pattern (e.g., lateral and dorsal blotches, chin pigmentation, and first dorsal fin) shows a closer relationship between *P. peltata* and *P. gymnocephala*. *P. gymnocephala* has long been referred to as *P. maculata*; however, its relationships appear to be aligned with *P. peltata* of the Atlantic Coast drainages based on meristics and coloration.

Etymology.—The name *gymnocephala*, a noun in apposition, is from the Greek *gymnos* meaning naked or lightly clad and *cephalos* meaning head, referring to the typically naked head.

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