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SUBSPECIES OF *NOTROPIS ALTIPINNIS*, A CYPRINID
FISH OF THE EASTERN UNITED STATES

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IN a recent study of the status of *Notropis altipinnis* it was shown (Hubbs, 1941) that this minnow exhibits considerable local variation. Specimens from the extremes of the range, from the Chowan River system in southern Virginia and from the Santee River system in northern South Carolina, were indicated as particularly aberrant. At that time, however, adequate material was at hand only from the Cape Fear River system. On the basis of the available data it seemed unwise to distinguish, even as subspecies, the populations of the several independent coastal stream systems of North Carolina and adjacent states.

New material, collected by the junior author in 1940, 1941, and 1946 (on field trips supported by grants from the Trustee-Faculty Research Fund of Cornell University), by Dr. Elmer E. Brown, Davidson College, North Carolina, by Dr. Reeve M. Bailey, University of Michigan, and by Dr. Joseph R. Bailey, Duke University, sheds a brighter light on the problem. An obviously distinct form, which might justify full specific standing, was taken on the Coastal Plain, in the Neuse River system (all other subspecies are characteristic of the Piedmont). Additional material from the Yadkin River of the Peedee

system shows that the low anal ray count of 9 on 2 cotypes of *Alburnellus altipinnis* was not fortuitous, for in this river system alone the anal ray count is usually 9, rather than mostly 10. It is obvious, therefore, that we need to recognize: a typical subspecies, *Notropis altipinnis altipinnis*; the Neuse River form, here called *N. a. neusensis*; and another subspecies (*N. a. whitei*) for the form with 10 anal rays, of the Cape Fear River system. Since these 3 kinds warrant nomenclatorial recognition, we deem it wise to separate also the geographically terminal forms already indicated as aberrant, namely *N. a. chowanus* of the Chowan River system in Virginia, and *N. a. wrighti* from the Santee River system in South Carolina. Specimens from the Tar system also have some slight peculiarities and are taken to represent another local race, which we name *N. a. tarensis*. This action is prompted in part by the circumstance that the Tar River system is separated from the range of *N. a. whitei*, the subspecies most similar to *tarensis*, by the habitat of a well-marked kind, *N. a. neusensis*. A list of the subspecies follows:

Notropis altipinnis neusensis, new subspecies, Neuse River system, North Carolina.

Notropis altipinnis chowanus, new subspecies, Chowan River system, Virginia.

Notropis altipinnis wrighti, new subspecies, Santee River system, South Carolina.

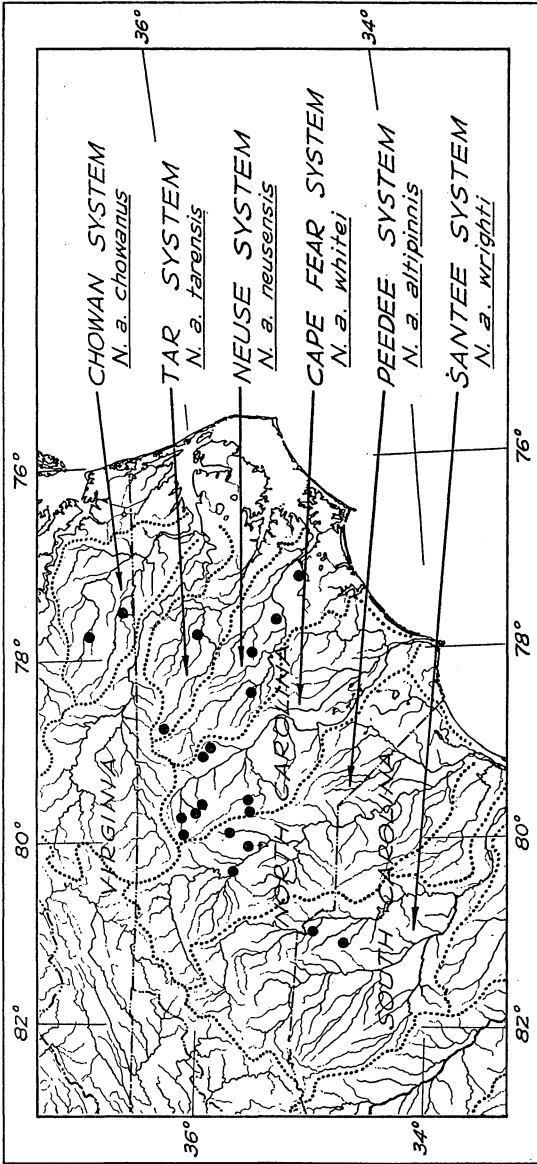
Notropis altipinnis tarensis, new subspecies, Tar River system, North Carolina.

Notropis altipinnis whitei, new subspecies, Cape Fear River system, North Carolina.

Notropis altipinnis altipinnis (Cope), Peedee River system, North Carolina.

The record stations for each subspecies as well as the stream systems inhabited are shown on Map 1.

The differentiation by stream systems of the fishes of the coastal streams of the Atlantic and Gulf drainages has already impressed ichthyologists. It was discussed by Jordan



Map 1. Distribution of the subspecies of *Notropis altipinnis*.
Three localities for *N. a. wrighti* were not plotted (see p. 13).

TABLE I
 NUMBER OF ANAL RAYS IN SUBSPECIES OF *Notropis altipinnis*
 Including counts given by Hubbs (1941: 172).

	Number of Anal Rays							Mean
	8	9	10	11	12	No.		
<i>N. a. chowanus</i> (Chowan River system)								
Waqua Cr., Va.	.....	2	12	.....	.....	14	9.86
Trib. of Meherrin River, Va.	.....	7	47	11	.....	65	10.06
Total	.....	9	59	11	.....	79	10.03
<i>N. a. taransis</i> (Tar River system, N. C.)								
Stream near Surf, N. C.	1	1	6	.....	.....	6	10.00
Trib. of Tar River, N. C.	1	1	20	3	.....	25	10.00
Total	.....	3	26	3	.....	31	10.00
<i>N. a. neuseusis</i> (Neuse River system, N. C.)								
<i>N. a. whittei</i> (Cape Fear River system)								
Near Greensboro, N. C.	.....	3	20	7	.....	30	10.13
Morgan Creek, N. C.	1	15	47	7	.....	70	9.86
Haw River, N. C.	.....	4	20	8	.....	32	10.12
Trib. of Haw R., N. C.	.....	1	33	12	1	47	10.28
New Hope Cr., N. C.	.....	2	7	1	.....	10	9.90
Trib. of Deep River, N. C.	.....	18	98	14	.....	130	9.97
South Buffalo Cr., N. C.	.....	9	9	.....	.....	9	10.00
Total	1	43	234	49	1	328	10.02	
<i>N. a. altipinnis</i> (Peedee River system, N. C.)								
Yadkin River and tributaries*	.....	17	3	.....	.....	20	9.15
<i>N. a. wrighti</i> (Santee River system, S. C.)	.....	3	28	6	.....	37	10.08
Grand total for species	2	76	400	86	1	565	10.01	

* Including 2 counts of 9 rays made on cotypes.

TABLE II

MEASUREMENTS IN THOUSANDTHS OF STANDARD LENGTH OF THE SIX SUBSPECIES OF *Notropis altipinnis*

Under each subspecies there is given, for each character: the range of variation; the value for the holotype, in italics; and, in parenthesis, the average. For methods of measuring see Hubbs and Lagler (1941 or 1947). The measurements given for the species by Hubbs (1941) are included.

Subspecies	<i>neusensis</i>	<i>chowanus</i>	<i>wrighti</i>	<i>tarensis</i>	<i>whitei</i>	<i>altipinnis</i>
Stream system	Neuse	Chowan	Santee	Tar	Cape Fear	Peedee
Number of specimens	10	9	8	8	8	8
Standard length, mm.	36-50 <i>43.7</i> (41.0)	31-45 <i>35.7</i> (38.7)	28-39 <i>30.2</i> (34.4)	38-42 <i>42.2</i> (40.2)	34-40 <i>37.1</i> (36.2)	33-38 <i>(35.9)</i>
Predorsal length	499-556 <i>539</i> (531)	502-548 <i>548</i> (532)	520-547 <i>526</i> (532)	520-545 <i>536</i> (531)	522-550 <i>541</i> (534)	520-556 <i>(537)</i>
Dorsal to occiput	324-374 <i>351</i> (346)	323-345 <i>341</i> (333)	317-332 <i>317</i> (325)	321-342 <i>340</i> (333)	311-355 <i>346</i> (333)	318-362 <i>(345)</i>
Prepelvic length	463-506 <i>475</i> (480)	451-488 <i>477</i> (471)	458-503 <i>466</i> (476)	463-503 <i>493</i> (484)	463-502 <i>476</i> (484)	463-507 <i>(483)</i>
Body depth	177-233 <i>203</i> (200)	196-234 <i>213</i> (218)	196-240 <i>200</i> (217)	203-249 <i>219</i> (220)	210-266 <i>249</i> (243)	229-266 <i>(250)</i>
Body width	111-143 <i>142</i> (125)	126-134 <i>132</i> (131)	118-137 <i>135</i> (130)	117-145 <i>127</i> (128)	119-144 <i>144</i> (133)	121-146 <i>(135)</i>
Caudal peduncle, depth	85-100 <i>93</i> (94)	90-103 <i>92</i> (97)	93-107 <i>100</i> (96)	88-96 <i>91</i> (91)	94-105 <i>101</i> (100)	94-117 <i>(104)</i>
Caudal peduncle, length	198-247 <i>216</i> (220)	211-230 <i>230</i> (221)	215-256 <i>249</i> (232)	218-243 <i>226</i> (229)	204-238 <i>208</i> (218)	226-260 <i>(240)</i>
Head length	236-254 <i>241</i> (246)	248-269 <i>259</i> (257)	237-265 <i>252</i> (252)	254-268 <i>263</i> (258)	240-272 <i>260</i> (255)	259-278 <i>(265)</i>
Head depth	148-169 <i>169</i> (160)	157-167 <i>167</i> (163)	158-179 <i>163</i> (167)	164-182 <i>174</i> (172)	167-182 <i>182</i> (175)	179-197 <i>(189)</i>

TABLE II—(Cont.)

Subspecies	<i>neusensis</i>	<i>chowanus</i>	<i>wrightii</i>	<i>tarensis</i>	<i>whitei</i>	<i>altipinnis</i>
Snout length	73 (71) 67-74	67-77 76 (72)	66-76 71 (71)	64-78 78 (71)	66-73 73 (69)	65-74 (69)
Eye length	80-86 83 (83)	84-97 94 (89)	79-96 89 (88)	89-98 98 (93)	82-90 85 (75)	87-94 (92)
Interorbital, least fleshy width	80-89 87 (84)	83-94 94 (88)	77-90 87 (83)	81-95 81 (86)	80-88 85 (85)	71-94 (84)
Upper jaw, length	74-87 75 (80)	75-82 80 (80)	73-90 78 (84)	84-94 85 (87)	74-82 77 (79)	74-88 (81)
Dorsal origin to lateral line	122-160 144 (139)	132-156 149 (146)	136-156 136 (145)	139-154 147 (148)	140-170 165 (157)	160-186 (173)
Pelvic insertion to lateral line	53-75 71 (65)	69-79 73 (74)	58-101 73 (81)	54-92 66 (68)	73-101 101 (91)	60-96 (81)
Dorsal height	227-249 227 (240)	237-270 262 (251)	244-279 244 (262)	249-268 249 (259)	238-260 260 (250)	254-283 (265)
Anal height	180-233 180 (203)	192-211 196 (202)	194-223 195 (209)	210-256 231 (231)	187-215 206 (201)	205-241 (227)
Anal base, length	144-168 151 (154)	134-166 134 (151)	131-156 134 (138)	140-154 141 (147)	140-169 141 (149)	120-155 (135)
Caudal, longest ray*	263-301 ₁₀ 263 (281)	290-310 ₆ 295 (299)	281-311 ₇ 306 (297)	275-307 ₆ 297 (297)	264-298 ₆ 278 (278)	273-337 ₆ (294)
Pectoral length	172-202 186 (194)	179-211 186 (197)	188-218 193 (198)	194-216 204 (201)	188-211 197 (199)	199-226 (212)
Pelvic length	168-187 170 (177)	164-192 176 (179)	172-202 172 (184)	177-199 191 (190)	166-187 173 (175)	179-204 (192)

* Subscripts indicate the number of caudal fins measured for each subspecies.

and Brayton (1878: 21) and by Jordan (1905: 312-13). Similar speciation by river systems has been demonstrated for crayfishes of western Florida by Hobbs (1942). We are finding an abundance of cumulative evidence that such speciation has been very extensive, particularly among the Piedmont and

TABLE III

ANGLE BETWEEN PREMAXILLARY AND TOP OF HEAD IN *Notropis cummingsi* AND IN SUBSPECIES OF *Notropis altipinnis*

The frequencies are given for the angle measurements, made with an arm protractor (Hubbs, 1946).

Angle	<i>Notropis cummingsi</i>	<i>Notropis altipinnis</i>					
		<i>neusensis</i>	<i>chomanus</i>	<i>wrighti</i>	<i>tarensis</i>	<i>whitiei</i>	<i>altipinnis</i>
45-47°	1	1	.....	.....	.....	.....	.....
48-50°	3	2	.....	.....	.....	.....	.....
51-53°	7	4	.....	6	4	.....	.....
54-56°	5	8	.....	1	5	.....	.....
57-59°	11	14	2	5	8	1	.....
60-62°	8	19	9	6	10	5	1
63-65°	.....	3	18	9	4	42	3
66-68°	.....	.....	11	5	.....	57	9
69-71°	.....	.....	5	.....	.....	19	2
72-74°	.....	.....	.....	.....	.....	2	2
75-77°	.....	.....	.....	.....	.....	1	.....
78-80°	.....	.....	.....	.....	.....	1	.....
Number	35	51	45	32	31	128	17
Range	45-62	45-65	57-71	51-68	51-65	57-79	62-73
Average*	56	58	64	60	58	66	67

* Averages taken from uncombined data.

montane species, which have been more effectively isolated than have the Coastal Plain forms. Here lies a fruitful field for study.

Since *Notropis altipinnis* as a species has been treated recently in some detail (Hubbs, 1941) we do not give here lengthy descriptions of each of the 6 subspecies that we now recognize. Salient features are brought out in the diagnoses. The anal ray counts for each form are detailed in Table I, measurements in Table II, and determinations of the obliquity of the mouth

in Table III. The slope of the mouth was measured as an angle by an arm protractor (Hubbs, 1946), and the determinations were tabulated by frequencies and were averaged. This was done not only to illustrate the differences between the forms of *altipinnis* but also to test the constancy and value of the character and of the new method.

NEUSE HIGHFIN SHINER

Notropis altipinnis neusensis, new subspecies

(Pl. I, Map 1)

In many respects this subspecies closely approaches *N. cummingsi*, with which it occurs on the Coastal Plain in the Neuse River system. At first the separation of the species proved difficult, but characters were finally found that rendered the distinction rather obvious. These characters are outlined in another paper, on the status of *N. cummingsi* (Hubbs and Raney, in press).

Identification of *neusensis* with *altipinnis* (as a species) is based on the tooth formula 2, 4—4, 2 (not 1, 4—4, 1 as in *cummingsi*), and on a variety of other characters. It is so distinct from *N. a. altipinnis* and from *N. a. whitei* that full specific status would be accorded, were it not for the tendency toward intergradation through *chowanus*, *tarensis*, and *wrighti*.

DIAGNOSIS.—When it is compared with typical *N. a. altipinnis* and similar subspecies, *N. a. neusensis* is seen to be a more slender fish, with the head decidedly slenderer and narrower and somewhat shorter, the eye smaller, and the dorsal and pectoral fins shorter and more rounded (Table II). The depth of the head enters the length of the head 1.5 to 1.7, usually about 1.6 times. The width of the head enters the head length 1.9 to 2.1 times and equals the distance from the tip of the snout to the middle of the pupil (about to the posterior rim of the pupil in other subspecies). The pigmentation is more evenly distributed than in other subspecies of *altipinnis*; there are fewer areas devoid of melanophores. On the average

there is more pigment on the top of the head. The stippled area on the front of the snout is extended sideward in front of the nostrils. The lateral band is nearly solid down to the lowest part of the lateral line. There is considerable pigment, instead of almost none, about the anus and the front of the anal fin, and there is usually a double file of melanophores on the lower border of the caudal peduncle (in these respects *N. a. neusensis* approaches, but does not equal *N. cummingsi* and *N. chalybaeus*). *N. a. neusensis* has the mouth less oblique than in the other subspecies, *tarensis* and perhaps *wrighti* excepted; scarcely more oblique than in *N. cummingsi* (Table III). The anal rays are usually 10 (Table I).

MATERIAL EXAMINED (all collected by E. C. Raney, E. A. Lachner, R. A. Pfeiffer, and R. D. Ross in North Carolina, in 1941 and 1946).—The holotype, an adult 43.7 mm. in standard length, was seined on March 30 in a tributary of Trent River, 7 miles west-southwest of New Bern, Craven County; U.M.M.Z. No. 136152. Four paratypes, 36 to 51 mm. long, were collected with the holotype. Two others, 38 and 39 mm. long, were seined on April 1 in Swift Creek, a tributary of Neuse River, 6.5 miles northwest of Smithfield, Johnson County. Six other paratypes, 35 to 49 mm. in length, were taken on March 31 in Falling Creek, tributary to Neuse River, 6 miles west of Kinston, Lenoir County. Fifty-eight paratypes, 34 to 51 mm. long, were captured in Nahunta Swamp, 1 mile north of Pikeville, Wayne County. These localities are spotted on Map 1.

RANGE AND HABITAT.—This subspecies occupies the Coastal Plain of North Carolina, in the drainage basin of the Neuse River, including its lower tributary, Trent River (Map 1).

The habitat varied. Two of the four rather small streams in which the species was seined were "white-water"; the others were brown stained. The bottom in each place was sand, with some silt in the pools. The current was moderate to sluggish. Two of the stations were free of aquatic plants; one stream contained some *Vallisneria*; at the other locality vegetation was noted as sparse.

This subspecies is named *neusensis* because it is supposedly confined to the Neuse River system.

CHOWAN HIGHFIN SHINER

Notropis altipinnis chowanus, new subspecies

(Map 1)

Notropis altipinnis.—Hubbs, 1941: 169–73, Fig. 1 (characters; aberrant specimens from Waqua Creek, Chowan River system, Virginia).

It was noted by Hubbs (1941: 173) that the Chowan River form differs somewhat from the North Carolina types. It is now thought worthy of subspecific separation.

DIAGNOSIS.—The characters by which *chowanus* differs from *neusensis* are indicated above. In some ways it shows an approach toward that form. The head averages only slightly deeper than in the Neuse River kind; it is much slenderer than in *N. a. altipinnis*, but the local forms of the Tar and Cape Fear systems provide a transition (Table II). The mandibular region of *chowanus* is rather massive, and in this subspecies only, the lower jaw projects slightly. In consequence, a narrow rim of the mandible is visible from directly above in *chowanus*, but is hidden from dorsal view in the other subspecies. The snout is more sharply pointed and the gape is less curved than in *tarensis*, *whitei*, or *altipinnis*. The width of the head enters the head length 1.7 to 1.9 times and equals the distance from the tip of the snout to the hind margin of the pupil. The pigment pattern on the top of the head is more evident than in *neusensis*, but is hardly as sharply developed as in *tarensis*, *whitei*, or *altipinnis*. The stippled area on the front of the snout, unlike that of *neusensis*, is scarcely extended sideward in front of the nostrils. As in *neusensis* and *tarensis*, but not as in *whitei* and *altipinnis*, the lateral band is solid down to the lowest part of the lateral line. There is almost no pigment about the anus; along the anal base there are some small scattered melanophores; behind the anal fin the black specks are very few or entirely lacking. The anal rays usually number 10, as in most of the subspecies.

MATERIAL EXAMINED.—The holotype, U.M.M.Z. No. 94515, an adult 38.2 mm. in standard length, was seined with 5 paratypes by Donald Ameel on November 10, 1931, in Waqua Creek, a tributary of Nottoway River, near Rawlings, Brunswick County, Virginia. A series of paratypes in the United States National Museum (No. 101338) was collected by George S. Myers and Stuart Abraham at approximately the same place, on September 14, 1935. Seventy-five paratypes, 29 to 48 mm. long, were collected by Edward C. Raney, E. A. Lachner, and R. D. Ross, in a tributary of Meherrin River, 1 mile south of Emporia, Greensville County, Virginia, on June 28, 1946.

RANGE AND HABITAT.—This is the northernmost of the subspecies of *Notropis altipinnis* (Map 1). The Chowan River forms the northern arm of Albemarle Bay. Roanoke River also discharges into this bay but as yet no specimens of *altipinnis* are known from that river; perhaps populations will be discovered in the lower tributaries, the fish fauna of which is little known. The next stream southward, the Tar, is the home of *Notropis altipinnis tarensis*.

Ameel described Waqua Creek, where the types were obtained, as being a clear, sandy stream, 20 to 30 feet wide, with a moderate current. Myers also indicated this creek as clear and sandy. He gave the current as strong and the depth as 1 to 3 feet. The tributary of Meherrin River averaged 10 feet wide. Its extreme depth was 3 feet. The bottom was sand and gravel and the water slightly brown and clear. This stream yielded only this species of cyprinid, which was observed to travel in rather large schools.

The name *chowanus* is derived from that of the Chowan River.

SANTEE HIGHFIN SHINER

Notropis altipinnis wrighti, new subspecies

(Map 1)

Notropis altipinnis.—Hubbs, 1941: 169-73 (characters; aberrant specimens from Steele Creek, Rock Hill, South Carolina).

It was noted by Hubbs that a distinctive race of *Notropis altipinnis* seems to be represented by specimens from the Santee River system in South Carolina. In view of the differentiation that the highfin shiner has undergone in the several river systems of the middle Atlantic Coast, the Santee form is here accorded the status of a subspecies.

DIAGNOSIS.—*N. a. wrighti*, like *N. a. neusensis*, is a slender form. As a rule the dorsal, anal, and pelvic fins are more anteriorly inserted than in the 5 other subspecies; as a consequence the predorsal, dorsal to occiput, and prepelvic measurements give low values, whereas the caudal peduncle value is high (Table II). The depth of the head is contained about 1.5 times in the head length. The mouth is rather straight and the snout is more sharply pointed than in *tarensis*, *whitei*, or *altipinnis*. The pigmentation on the top of the head, although characteristic of the species, is apparently neither so intense nor so sharply defined as it is in the subspecies just named. The area in front of the nostrils is clear of pigment. The lateral band is almost solid down to the lateral line. Contrasting with that of *neusensis*, the other slender subspecies, the pigment is very weakly developed near the mid-ventral line: there is none about the anus, only a little, deeply hidden, along the anal base, and extremely little, usually none, along the lower edge of the caudal peduncle. The anal fin, unlike that of the adjacent subspecies *altipinnis*, has 10 rays.

MATERIAL EXAMINED.—The holotype (U.M.M.Z. No. 94551) is a small fish, probably half-grown, 30.2 mm. in standard length. It was collected with 3 paratypes, 28 to 33 mm. long, in Steele Creek, of the Catawba River drainage, at Rock Hill, York County, South Carolina. These specimens were seined by Donald Ameel on November 11, 1931. Twenty-three paratypes, 25 to 42 mm. long; were taken by Elmer E. Brown in South Fork Creek between Rock Hill and Chester, Chester County, South Carolina, on August 13, 1946. Ten other paratypes were taken by Harry W. Freeman in late June, 1947, in Richland County, South Carolina, from the following locali-

ties: 5, 31 to 45 mm. long, from Hopes Creek; 1, 36 mm. long, from Harmon Creek; 3, 33 to 37 mm. long, from Nicholas Creek; and 1, 32 mm. long, from Slatestone Creek.

RANGE AND HABITAT.—It is presumed that this subspecies is characteristic of the Santee River system. At present it is known from the Catawba and Broad divisions of that system, and only from South Carolina. The 3 records for the Broad River system, all in Richland County, were obtained too late to be entered on May 1. The localities lie near the tip of the arrow south of the other dots for the subspecies.

According to Ameal the semiclear water at the type locality, 6 inches to 2 feet deep, was flowing slowly over a bottom of sand, with some sediment. The stream was 15 to 20 feet wide.

Noting that Albert Hazen Wright has not been commemorated in the name of a fish, we both take pleasure in dedicating the Santee highfin shiner to this outstanding leader in the study of cold-blooded vertebrates.

TAR HIGHFIN SHINER

Notropis altipinnis tarensis, new subspecies

(Map 1)

Like the populations of the other stream systems of the middle Atlantic Coast, that of the Tar has recognizably distinct features.

DIAGNOSIS.—This subspecies contrasts sharply with the form of the Neuse River system, next to the southward (as is indicated in the diagnosis of *N. a. neusensis*), but it closely approaches that form in the obliquity of the mouth (Table III). It is very similar to *N. a. chowanus*, the only form known from farther to the north, but differs in having the lower jaw less prominent, not visible from directly above; the mouth less oblique (Table III) and a little more curved; the head as a proportion of the standard length averaging deeper, almost as deep as in *whitei*, intermediate between *chowanus* and *altipinnis* (Table II). The lateral line runs lower than in *chowanus* (Table II). The head averages a little deeper in

reference to its own length than in *chowanus*, but is definitely slenderer than in *whitei* and *altipinnis*, the subspecies that *tarensis* most closely resembles in general appearance; in *tarensis* the head depth enters the head length 1.5 to 1.6, usually 1.6 times. The pigmentation on the top of the head is similar to that of *whitei* and *altipinnis*; the anterior median blotch on the top of the snout is scarcely extended in front of the nostrils. As in *chowanus* the lateral band is almost solid to the lower part of the lateral line, not leaving the narrow clear stripe evident in *whitei* and *altipinnis*. There is very little pigment about the anus, along the anal base, or behind the anal fin. This fin has 10 rays.

MATERIAL EXAMINED.—The holotype (U.M.M.Z. No. 136148) is a 42.2 mm. adult (standard length), collected by E. C. Raney, E. A. Lachner, and R. A. Pfeiffer, on April 2, 1941, in a small southward-flowing stream in the Tar River drainage, on Highway 158, 4.5 miles east of Surl, Person County, North Carolina. Five adult paratypes, all taken in the same collection, are deposited in the fish collections of Cornell University and of the University of Michigan. Twenty-five additional paratypes, 30 to 46 mm. long, were collected June 27, 1946, by E. C. Raney, E. A. Lachner, and R. D. Ross, in a tributary of Tar River, 2.5 miles north of Rocky Mount, North Carolina.

RANGE AND HABITAT.—This species is apparently confined to the Tar River system and is probably characteristic of the Piedmont belt (Map 1). The collections were made in small streams, 10 to 20 feet wide and with a flow, when fished, of 1 to 10 cubic feet per second. In the smaller stream near Surl the turbid, unstained water flowed over sand, gravel, and small rubble; the riffles were moderately short, and 1 pool, below the road, was 3 feet deep. There was no aquatic vegetation. The stream north of Rocky Mount had a sand bottom and slightly brown though clear water.

The name *tarensis* comes from the name of the Tar River system, to which the subspecies seems to be confined.

CAPE FEAR HIGHFIN SHINER

Notropis altipinnis whitei, new subspecies

(Map 1)

Notropis altipinnis.—Jordan, 1890: 132, 134 (comparisons; possibly identical with *N. chalybaeus*; Reedy Fork of Haw River at Fulk's Mill, 11 miles north-northeast of Greensboro; South Buffalo Creek about 5 miles southeast of Greensboro, Little Allemance Creek about 9 miles southeast of Greensboro, Cape Fear system, North Carolina). Jordan and Evermann, 1896a: 257, 287 (synonymy, descriptions, comparisons, and range, in part); 1896b: 257 (range, in part). Smith, 1907: 90, 96-97 (compiled; in part). Pratt, 1923: 82 (compiled; in part).

Hydrophlox altipinnis.—Jordan, 1929: 83-84 (characters, comparisons, and range, in part). Jordan, Evermann, and Clark, 1930: 127 (range, in part). Pratt, 1935: 77-78 (compiled, in part).

The current concept of *Notropis altipinnis* (Hubbs, 1941) is based largely on this subspecies, for it is the one that has been collected most frequently.

DIAGNOSIS.—This subspecies is very close to *N. a. altipinnis*. The most tangible difference lies in the number of anal rays: the average is 10 for *whitei*, but 85 per cent of the specimens of subspecies *altipinnis* have 9 rays (Table I). There are several average differences in proportions. For instance, the body and particularly the head are less deep in *whitei* than in *altipinnis*, the eye averages smaller, the lateral line is lower, and the fins are smaller (Table II). By stepping the measurement over the curve of the head, the head depth enters the head length 1.4 to 1.5 times, rather than 1.3 to 1.4 times. The head width enters the head length 1.7 to 1.9 times. The pattern on the top of the head is similar in the 2 subspecies. Only rarely does the median anterior blotch on the snout extend laterally in front of the nostrils. In *whitei* as in *altipinnis* there is a narrow clear stripe between the lateral band and the lower part of the lateral line. The region around the front of the anus is usually devoid of pigment, but has a little in some fish. There is little melanin along the anal base. Along the lower edge of the caudal peduncle there is virtually no pigment in adults, except in some small ones.

MATERIAL EXAMINED.—The holotype (U.M.M.Z. No. 128914), an adult female 37.1 mm. in standard length, was seined by A. McLaren White on June 3, 1933, in Morgan Creek, of the Cape Fear River system, near Chapel Hill, North Carolina, 1 mile upstream from the bridge on the road to Pittsboro. Forty-nine paratypes were obtained in the same collection, and others were seined by White on April 28, 1933, in Morgan Creek, 2 miles below the Pittsboro road, and on March 18, 1932, in a tributary of the same stream, also near Chapel Hill. Still other paratypes, 178 in all, were taken by E. C. Raney and E. A. Lachner on April 6, 1940, at 2 other places in the Cape Fear River System: (1) Brush Creek, a branch of Deep River, 5 miles west of Siler City, Randolph County; (2) a tributary of Haw River, 13 miles east of Siler City, in Chatham County. Thirty-two other paratypes, 28 to 51 mm. long, were collected on June 24, 1946, by E. C. Raney, E. A. Lachner, and R. D. Ross, in Haw River, 3.5 miles south of Stokesdale, Guilford County, North Carolina. Nine paratypes, 26 to 41 mm. long, were taken by Elmer E. Brown in a tributary of South Buffalo Creek, 5 miles southwest of Greensboro, Guilford County, North Carolina, on December 25, 1934. Ten paratypes, 17 to 45 mm. in length, were secured by Joseph R. Bailey in New Hope Creek below Piney Mount, Duke Forest, Orange County, North Carolina. These types are deposited in the fish collections of University of Michigan and Cornell University. Some of the material recorded by Jordan has been examined in the United States National Museum and in the Museum of Comparative Zoology and is also designated as paratypes. The known localities are all plotted on Map 1.

RANGE AND HABITAT.—*N. a. whitei* inhabits the Piedmont part of the Cape Fear River system (Map 1). The habitat of the subspecies is indicated by the ecological data accompanying all the recent collections. It inhabits small streams, 3 to 25, occasionally 30 to 60 feet wide, and usually 3 or 4 feet deep in the pools. The water is clear to turbid, but is not brown stained. Vegetation is lacking or at most is little developed

(a small amount of filamentous algae was noted at one place). The bottom varies from sand to rubble. The current varies from slow in pools to swift in rapids. Specimens in apparently spawning condition were seined from March 18 to June 3.

This subspecies is named for A. McLaren White, collector of many of the types. White developed in his youth an intense interest in natural history that was never lost, even as he rose rapidly in the field of engineering education. His untimely death cut short a career of great promise.

PEEDEE HIGHFIN SHINER

Notropis altipinnis altipinnis (Cope)

(Map 1)

- Alburnellus altipinnis*.—Cope, 1870: 464-65 (original description; comparisons; Yadkin River, Roane [Rowan] County, North Carolina).
- Minnilus altipinnis*.—Jordan and Copeland, 1876: 154 (Yadkin River). Jordan and Gilbert, 1883: 195 (after Cope).
- Notropis altipinnis*.—Jordan and Brayton, 1878: 85 (Peedee system). Jordan, 1878: 422 (Yadkin River); 1885: 814. Jordan and Evermann, 1896a: 257, 287 (synonymy, description, comparisons, and range, in part); 1896b: 257 (synonymy; range in part). Smith, 1907: 90, 96-97 (compiled; in part). Fowler, 1910: 286-87, Pl. 19, Fig. 37 (characters and figure of cotype); 1923: 16 (types listed). Pratt, 1923: 82 (compiled; in part). Fowler, 1945: 30 (Peedee system).
- Hydrophlox altipinnis*.—Jordan, 1929: 83-84 (characters, comparisons, and range, in part). Jordan, Evermann, and Clark, 1930: 127 (range, in part). Pratt, 1935: 77-78 (compiled, in part). Schrenkeisen, 1938: 126 (characters; Rowan County, North Carolina). Driver, 1942: 224 (characters; North Carolina).
- Erogala formosa*.—Fowler, 1935: 16 (misidentification; references to types of *A. altipinnis*). Davis, 1948: 35-36 (after Fowler).

DIAGNOSIS.—New series confirm previous indications that the local form of *Notropis altipinnis* inhabiting the Peedee River system—the "typical" subspecies—usually has only 9 anal rays. On the basis of this character it may be separated from the subspecies of all other stream systems. It is definitely extreme, also, in the depth of the head, and in some other characters stands at the end of a chain of variants.

The preceding comparisons with the other subspecies indicate how each differs from *N. a. altipinnis*.

NOMENCLATURE.—Since the types of *Alburnellus altipinnis* were examined by one of us, we can state with assurance that Fowler (1935: 16) erred in identifying Cope's species with "*Erogala formosa*." *Alburnus formosus* Putnam is a synonym of *Notropis hypselopterus* (Günther). *Notropis stonei* Fowler also appears to be valid. It is one of the several species of the *hypselopterus* group.

MATERIAL EXAMINED.—In addition to two of the types, seen in the Philadelphia Academy of Natural Sciences, we have examined 17 half-grown to adult specimens, 26 to 37 mm. long to caudal, collected by E. C. Raney, E. A. Lachner, and L. J. Kezer, on April 5, 1940, in a tributary of Yadkin River, 11 miles southeast of Lexington, Davidson County, North Carolina, on Highway 64, and 1 adult, 37 mm. long, secured by R. M. and J. R. Bailey on August 31, 1946, in Uharie River, Randolph County, North Carolina.

RANGE AND HABITAT.—The Piedmont belt of the Peedee River system in North Carolina is the home of the typical subspecies of *Notropis altipinnis*.

The woodland stream from which the 1940 collection was seined was 10 to 25 feet wide and 2 feet deep, with an estimated flow of 10 cubic feet per second. Its water, turbid after a heavy rain but not brown stained, contained no vegetation. The current was slow between short riffles, and the bottom consisted of rubble, sand, and gravel, with occasional outcrops of bedrock.

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Carl L. Hubbs and Edward C. Raney

PLATE I

Notropis altipinnis neusensis, new subspecies

A paratype, 45 mm. in standard length, collected by E. C. Raney, E. A. Lachner, and R. A. Pfeiffer, in a tributary of Trent River, 7 miles west-southwest of New Bern, Craven County, North Carolina.

Photographed by Art Smith.

