

NEW CYPRINID FISHES OF THE GENUS *NOTROPIS* FROM TEXAS *

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During the past three decades the known freshwater fish fauna of eastern North America, one of the richest in the world, has been further augmented by the discovery of many new species. Unfortunately, pressure of other duties has prevented the formal naming of a considerable proportion of these discoveries. The three new species of *Notropis* from Texas here treated—*oxyrhynchus*, *brazosensis* and *potteri*—are among the fishes for which the initial published descriptions have been unduly withheld. Since further delay would interfere with the researches and publications of other ichthyologists and fishery biologists, these species are now diagnosed.

The three species are apparently confined to eastern Texas, for they have never been collected in the extensive surveys of surrounding regions, namely northeastern Mexico (Hubbs and Gordon, MS), New Mexico (survey in progress by William J. Koster), Oklahoma (work begun by Ortenburger and Hubbs, 1926, and Hubbs and Ortenburger, 1929 a-b, and now being continued by George A. Moore), and Louisiana (more cursory collecting).

These shiners, especially *oxyrhynchus* and *brazosensis*, abound in the very silty water of the Brazos River and its main tributaries, which are thus shown to have a somewhat distinctive fauna. As native species, *N. oxyrhynchus* and *N. potteri* seem to be confined to the Brazos River system (the population of *N. potteri* currently existing in and about artificial Lake Texoma in the Red River system, between Texas and Oklahoma, is interpreted as the result of the establishment of escaped bait minnows). The range of *brazosensis* extends into adjacent coastwise waters.

The discovery of these new species in Texas occasioned no great surprise, for the varied fish fauna of this large state has been little studied and very seldom reported upon since the compilation by Evermann and Kendall (1894).

Following the recognition by the senior author of these species as new, counts and measurements were made by the junior author in 1940, in accordance with the specifications proposed by Hubbs and Lagler (1941: 12-20, figs. 2-3; 1947: 8-15, figs. 2-6). Angles were measured as recommended by Hubbs (1946). The calculations were also made by Bonham and the photographs were taken by him. The final draft was prepared in 1950 with the much appreciated cooperation of Dr. Reeve M. Bailey of the University of Michigan Museum of Zoology. Prof. Frank T. Knapp of the Agricultural and Mechanical College of Texas kindly dropped in our favor his plan to describe the three species, which he also has collected. He has contributed specimens and ideas helpful in determining the status and relationships of

N. potteri. Dr. George A. Moore of Oklahoma Agricultural and Mechanical College has provided critical material from the Red River and from within Oklahoma, and has contributed useful suggestions.

All specimens herein reported for the three new species are deposited in the University of Michigan Museum of Zoology and in the Agricultural and Mechanical College of Texas.

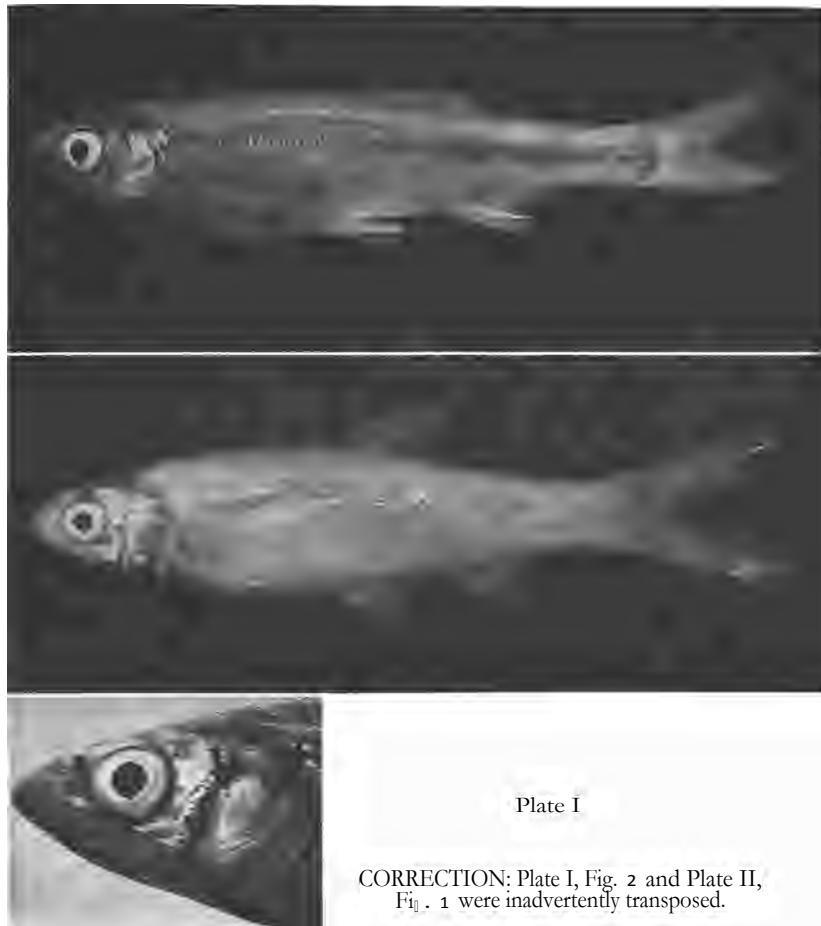


Plate I

CORRECTION: Plate I, Fig. 2 and Plate II,
Fig. 1 were inadvertently transposed.

Fig. 1. *Notropis percobromus*: adult specimen (University of Michigan Museum of Zoology, No. 127636), collected in Arkansas River near Oxford, Kansas, by C. E. Burt, on June 15, 1939. All photographs were taken by Kelshaw Bonham.

Fig. 2. *Notropis oxyrhynchus*: topotypic paratype, an adult, 54 mm. in standard length, collected in Brazos River at Wellborn Crossing, Texas, by Kelshaw Bonham and class, on October 25, 1940.

Fig. 3. *Notropis oxyrhynchus*: head of the holotype, an adult 50.8 mm. long, collected in Brazos River at Wellborn Crossing, Texas, by Kelshaw Bonham and class, on October 21, 1938.

SHARPNOSE SHINER
Notropis oxyrhynchus, new species
 Pl. I, Figs. 2-3

In both ecological and taxonomic view this striking species appears to be the southern representative of *N. percobromus* Cope (Pl. I, Fig. 1). Since that species has seldom been mentioned and has usually been confused with other forms, its history and status call for clarification. It was described, as *Alburnellus percobromus*, by Cope (1871: 440) from specimens collected at St. Joseph, Missouri, presumably in the Missouri River or some adjacent water (Jordan and Evermann gave the type locality definitely as the Missouri River at St. Joseph). Under the name *Minnilus percobromus* the species was accepted as valid by Jordan and Gilbert (1883: 202), but it was synonymized with *N. rubrifrons* (=*N. rubella*) by Jordan and Evermann (1896: 295). Accepting this synonymy, Fowler (1910: 290) based his description of *rubrifrons* in part on the types *A. percobromus*, one of which he figured (pl. 21, fig. 50). Swayed by these actions, Hubbs and Ortenburger (1929b: 83-85) wrongly resurrected Cope's name for the southwestern representatives, still unnamed, of *N. rubella*. They had the true *percobromus* as well, however, but treated it as "*Notropis*, species?" (1929a: 34; 1929b: 86). Only recently (Hubbs, 1945: 16-17) has the true distinctive status of *percobromus* been pointed out, along with the indication that it inhabits the silty waters of the Great Plains from the Missouri River system in the Dakotas to the Red River (of the South), with tongues extending down the main rivers into Arkansas and presumably into Missouri, even to the Mississippi River in Tennessee (Reeve M. Bailey, in personal communication, has indicated his belief that the records from the upper Mississippi River system were based on misidentified specimens of *N. a. atherinoides*). This statement of range is based on the identification by the senior author of many series in the Museum of Zoology of the University of Michigan.

Although it resembles *rubella* in certain respects, such as the anteriorly deep body, the sharp nose and the large mouth, *oxyrhynchus* seems to belong, with *percobromus*, to the *atherinoides* rather than to the *rubella* series of the subgenus *Notropis*, as these series were distinguished by Hubbs and Ortenburger (1929b: 83-84).

N. oxyrhynchus agrees rather well with *percobromus* and contrasts with *atherinoides atherinoides* in several of the characters by which those forms were distinguished in tabular form by Hubbs (1945: 17): the head is relatively large, more than one-fourth the standard length; the eye is submedian,

TABLE I
 ANAL RAY COUNTS IN FIVE SPECIES OF *Notropis*

Species	Anal rays (frequencies)										
	6	7	8	9	10	11	12	13	No.	Av.	S.E.
<i>N. percobromus</i>					40	40	8	2	90	10.69	.08
<i>N. oxyrhynchus</i>				7	61	14			82	10.69	.06
<i>N. brasiliensis</i>		4	94	8		...	.		106	8.04	.04
<i>N. illecebrosa</i>			12	31	4	1	.	....	48	8.87	.09
<i>N. potteri</i>	1	81	3	....				....	85	7.02	.02

dorsoventrally; and the lips are not conspicuously blackened anteriorly. In other characters *oxyrhynchus* resembles *A. atherinoides* more closely than *percobromus*. The predorsal scale pockets are generally, though not always, clearly marked by rather definite marginal files of melanophores, and the body is usually rather slender, though some examples are deeper than the more attenuate specimens of *percobromus*. In the slope of its mouth *oxyrhynchus* further resembles *atherinoides* more closely than *percobromus*, the mouth of which is more strongly oblique than it is in most related species. The angle seen in lateral view between the closed mouth and the long axis of the body ranges from 32° to 38° in *oxyrhynchus*, to about 35° in *atherinoides*, and is typically 48° to 50° in *percobromus*. The head is much slenderer than in *percobromus*, averaging even slenderer than in *A. atherinoides*. The head depth is usually contained about 1.7 times in the head length. The height of the dorsal fin is contained 1.5 to 1.9 times in the

TABLE III

**MEASUREMENTS (IN THOUSANDTHS OF STANDARD LENGTH) AND COUNTS OF
Notofris oxyrhynchus FROM TEXAS AND *N. percobromus* FROM
KANSAS AND OKLAHOMA**

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distance forward to the occiput (in this respect *oxyrhynchus* is intermediate). The measurements of *oxyrhynchus* and *percobromus* are compared in detail in Table H.

The outstandingly distinctive feature of *oxyrhynchus*, as contrasted with either *percobromus* or *atberinoides*, or, in fact, with almost any other species of the genus, is the form of the muzzle, which is very sharp in either dorsal or lateral view. The front angle of the top of the head is only 15° to 17°, as contrasted with 19° to 23° in *N. percobromus*. The angle formed by the dorsal and ventral contours of the muzzle, 56° to 70°, is usually much narrower than in *percobromus* (72° to 85°), particularly in the smaller fish. The angle of the head proper in lateral view is only 43° to 50°. The conical appearance of the head (Pl. I, Fig. 3) is enhanced by the continuous and almost straight, rather than distinctly angulated line formed by the margins of the ~~interopercle~~ and the mandibular ramus. The dorsal contour of the snout also tends to be straighter than in *percobromus*, and less decurved. The margins of the rami as seen from below are almost straight and converge forward evenly throughout their length, rather than generally being divergent forward to beyond the middle of the length of the rami. In further correlation with the more conical form of the head, the muzzle in *oxyrhynchus* is longer than in *percobromus*: in adults the snout is consistently much longer than the eye, on the average 29 rather than 15 percent longer, and the upper jaw is 1.2 to 1.6 times as long as the eye, instead of being only a little longer.

The anal rays average 10.09, slightly fewer than in *percobromus* (Table I). The scales in the lateral line average fewer, those around the caudal peduncle more numerous (Table II). The lateral line is more decurved, as is indicated by the lesser proportional distance between the lateral line and the insertion of the pelvic fin. *N. oxyrhynchus* seems to be a more silvery fish than *percobromus*. The distribution of melanophores is shown on Plate I, Figures 2-3.

The general form is rather distinctive. The ventral outline (Pl. I, Fig. 2) is more curved than the dorsal. Though it bisects the eye, a straight line from the anterior tip of the upper lip to the middle of the caudal base lies distinctly above the middle of the head. The dorsal contour rises in a gentle arch from the acuminate muzzle to the origin of the dorsal fin, which is well behind the middle of the body. From the vertical through the dorsal origin the upper and lower contours converge backward in slightly concave lines. Forward from the anal fin the slope continues downward to about the middle of the belly and then curves upward to the isthmus.

Fundamentally, *oxyrhynchus* agrees with the other members of the subgenus *Notropis*. The hooked teeth number 2, 4-4, 2. The slightly falcate anal fin typically has more than 9 rays (Table I). The dorsal fin begins well behind the insertion of the pelvic. The silvery color, slender form, strongly curved ventral contour, oblique mouth and sharp snout stamp it, like the other species of the subgenus, as a midwater to near-surface swimmer.

TYPES.—The holotype (University of Michigan Museum of Zoology, No. 129829), an adult 50.8 mm. in standard length, was seined from Brazos River at Wellborn Crossing, Brazos County, Texas, on October 21, 1938, by Kelshaw Bonham and party from the Agricultural and Mechanical College of Texas. Many paratypes were collected in Brazos River at four places: at the holotype locality, on October 21, 1938, and on October 25, 1940; at

Government Dam, near Navasota, on November 24, 1939, and December 3, 1939; west of College Station, on October 12, 1939; and at Kappes Bridge, southwest of College Station, on September 29, 1941. Smaller series were obtained in Navasota River, 16 miles southeast of College Station, on October 6, 1939; in Little Brazos River, at State Highway 21, on June 13 and July 13, 1940 (breeding adults included); and in the lower end of Toweash Creek, another tributary of the Brazos. The last-named series was collected by Marion Toole, the one from Kappes Bridge by G. H. Soulent, the others by Kelshaw Bonham and students.



Plate II

Fig. 1. *Notropis brazosensis*: topotypic paratype, an adult 46 mm. long, collected by Kelshaw Bonham and class, on October 25, 1940.

Fig. 2. *Notropis brazosensis*: head of holotype, an adult 49.2 mm. long, collected in Brazos River at Wellborn Crossing, Texas, by Kelshaw Bonham and class, on October 21, 1938.

CORRECTION: Plate I, Fig. 2 and Plate II, Fig. 1 were inadvertently transposed.

The name *oxyrhynchus* is derived from Greek words transliterated into Latin as oxys (sharp) and rhynchos (snout). Though the gender of *Notropis* is feminine and though the species name is regarded as a compound adjective, it is given the -us ending because that is the Latin transliteration of the normal feminine ending for Greek compound adjectives.

BRAZOS SHINER
Notropis brasiliensis, new species
Pl. II

In the maze of species that constitute the genus *Notropis*, in the broad sense to which we have adhered, this new one appears to be most closely related to *N. illecebrosa* (Girard). In fact, *N. brasiliensis* seems to be the southwestern representative of *illecebrosa*, which ranges through the silty waters of the large rivers in the Mississippi Valley from Illinois to Louisiana. The status of the true *illecebrosa*, which had been confused with other species, was clarified by Ortenburger and Hubbs (1926: 126) and by Hubbs and Ortenburger (1929a: 29).

From *illecebrosa* this species differs in usually having 8 instead of 9 anal rays (Table I). Jordan and Evermann (1896: 268) reported the anal rays as 8 in the types of *Alburnops illecebrosus* Girard, perhaps as a miscount or misprint, or perhaps because the count was made on a variant specimen or on one of the specimens of *N. boops* that were mixed in the same series.

The difference in number of anal rays would suffice for no more than subspecific separation, but other distinctions (Table III) warrant treatment of the forms in full species. Especially significant are the differences in the structure of the mouth, the pharyngeal arch, and the teeth.

The rays in the fins other than the anal are alike in number (Table IV). The number of pelvic rays is rather characteristic, for most species of *Notropis* have 8 pelvic rays.

OTHER CHARACTERS.—The body contours are symmetrically curved on either side of the horizontal line extending from the front of the rather strongly oblique mouth through the center of the eye to the middle of the caudal base. The muzzle is bluntly conical in side view. The lips are relatively thin and the upper lip is scarcely expanded at the midline.

The fins are moderately pointed and rather expansive. The dorsal and anal are distinctly falcate; the pectoral and pelvic, somewhat blunt at the tip. The dorsal origin is near or a little behind the middle of the standard length, about over or a little behind the pelvic insertion. The dorsal height often nearly equals the length of the head and occasionally exceeds that dimension. The caudal fin is usually longer than the head.

The complete lateral line is rather strongly downcurved anteriorly. Its scales are scarcely modified in outline. Scale counts are detailed in Table V.

The general color is pale and silvery, with rather sparse punctulation above the midsides and virtually none below. Large melanophores are scattered deep beneath the broad and rather diffuse silvery band. The band broadens anteriorly and covers the side of the head behind the eye. Above this silvery band and along its upper part is a narrow dusky streak comprising small superficial melanophores. The dark streak is arched upward to nearly parallel the dorsal contour, but on the caudal peduncle it becomes submedian. Between the dorsal origin and the pelvic insertion this streak and the lateral line divide the body approximately into thirds. The dusky

TABLE III

COMPARISON OF *Notropis brazosensis* WITH *N. illecebrosa*

Based chiefly on a series of paratypes of **N. brazosensis** (U.M.M.Z., 159368, from Little Brazos River at Highway 21, Brazos County, Texas) and on a collection of **N. illecebrosa** (U.M.M.Z., 153072, from Mississippi River at Brasher or Cottonwood Point, Pemiscot County, Missouri).

CHARACTER	N. brazosensis	N. illecebrosa
Anal rays (Table I)	Typically 8	Typically 9
Fins	Usually less elevated and less pointed; pelvic not or barely reaching anus	Usually much elevated and pointed; pelvic reaching about to, or beyond, anus
Size and texture	Larger and coarser	Thinner, more delicate
Fin rays	Thicker and stronger	Usually projecting beyond snout tip; profile of tip sloping downward and more or less forward; little or not at all visible from directly below
Upper lip	About even with snout tip; profile of tip about vertical or sloping downward and more or less backward; mostly visible from directly below	Approximately even with upper lip
Lower lip	Definitely included within upper lip	About two-fifths as broad (at base) as long; outer edge rather evenly curved; upper limb longer than lower
Upper limb of pharyngeal arch	About one-half as broad (at base) as long; outer edge rather evenly curved; upper limb longer than lower	More or less strongly cultrate and jagged
Lower (anterior) edge of grinding surface of main pharyngeal teeth	Scarcely cultrate and jagged	Remaining strong in half-grown; obsolescent in adult
Row of melanophores along anal base and on lower edge of peduncle	Becoming obsolescent in half-grown	

TABLE IV

FIN RAY NUMBERS IN *Notropis brazosensis* AND *N. illecebrosa*

The anal ray counts are given in Table I. The counts for **N. illecebrosa** were all taken from the series noted in Table III.

Dorsal Rays					
	8	9	N	M	
N. brazosensis	1	85	1	87	8.00
N. illecebrosa		45	4	49	8.08
Caudal Rays					
	18	19	20	N	M
N. brazosensis	3	70	1	74	18.97
N. illecebrosa	2	35	1	38	18.97
Pectoral Rays					
	13	14	15	16	M
N. brazosensis	3	73	85	12	14.61
N. illecebrosa	2	33	31	4	14.58
Pelvic Rays					
	8	9	10	N	M
N. brazosensis	54	117	3	174	8.71
N. illecebrosa	20	77	1	98	8.81

streak is separated by a narrow almost unpigmented light band from the dorsal area, where melanophores in single file line the scale pockets. Near the dorsal midline other melanophores lie inside the marginal file. There is a narrow dusky streak before, along and behind the dorsal base. Before the dorsal the more prominent melanophores are arranged in one series; behind the dorsal, in two or three series. There is a weak dusky triangle just before the dorsal base but none at the caudal base or at the nape. The basicaudal spot is barely suggested. Fine melanophores line the dorsal and caudal rays and occur on the outer edge of the pectoral. The top of the head is dark on the parietal region and is dusky between the eyes and between the nostrils. The melanophores extend over the snout onto the upper lip and occasionally onto the lower lip and the tip of the chin. Fine dots are sprinkled between the nostrils and the mouth and a narrow streak follows the lower margin of the orbit. Very few melanophores occur about the upper part of the opercles. Except as noted the lateral and ventral surfaces of the head are unpigmented.

Minute nuptial tubercles, sharp and recurved, follow the second to the ninth pectoral rays, in a single file branching once, with about 4 to 6 tubercles (or pairs) on each ray segment. Elsewhere the nuptial organs are almost completely obsolete.

Proportional measurements are analyzed in Table V.

TABLE V
MEASUREMENTS (IN THOUSANDTHS OF STANDARD LENGTH)
AND SCALE COUNTS OF TYPES OF *Notropis* *brazosensis*

	Holo-type	24 Paratypes (Range)	Mean
Standard length, mm	49.2	33.5-61.5	44.1
Predorsal length	500	498-537	613
Prepelvic length	504	478-528	504
Body depth	252	217-289	243
Dorsal origin to lateral line	165	134-184	160
Pelvic insertion to lateral line	98	74-119	91
Body width	153	125-184	147
Caudal peduncle length	206	193-226	205
Caudal peduncle depth	123	108-124	116
Head length	250	249-282	262
Head depth	183	167-198	179
Snout length	72	71-87	77
Eye length	55	51-60	59
Fleshy interorbital	99	91-102	97
Upper jaw length	78	73-90	80
Mouth width ¹	63	51-69	58
Dorsal height	240	217-270	248
Anal height	172	158-204	178
Anal base	116	102-128	110
Longest caudal ray	272	256-313	288
Pectoral length	197	177-222	201
Pelvic length	161	144-184	168
Scales			
Above lateral line	6	5-7	6.04
Along lateral line	34	33-35	34.1
Below lateral line	4	3-4	3.76
Lateral line to pelvic	3	3-4	3.20
Predorsal scales	14	13-20	14.8
Predorsal rows	14	12-17	14.0
Around body: Above	13	12-14	12.6
Below	11	9-11	10.8
Total	26	23-27	24.8
Around caudal peduncle: Above	6	4-7	5.28
Below	5	4-6	5.00
Total	13	11-14	12.3

Between ends of gape.

HABITAT AND RANGE.—Like *oxyrhynchus*, this species is characteristic of the ~~silt~~ waters of Brazos River and its main tributaries, in eastern Texas. The form of the body, the position of the mouth and eye, the color and other features suggest a mid-water habitat. It is often, perhaps usually, associated with *oxyrhynchus* and the two commonly dominate the fauna. Outside the Brazos system *brazosensis* is known to us only from adjacent waters near the coast, including San Bernard and Colorado rivers, to the southward, and, doubtfully, from one locality in Harris County, to the northward (see below). Recent collecting by Clark Hubbs in the Neches River system has failed to disclose this species there.

TYPES.—The holotype (University of Michigan Museum of Zoology, No. 129827), an adult 49.2 mm. in standard length, was seined with the type series of *oxyrhynchus* from Brazos River at Wellborn Crossing, Brazos County, Texas, on October 21, 1938, by Kelshaw Bonham and party from the Agricultural and Mechanical College of Texas. Several series of paratypes were collected at other points in the Brazos River system, by Bonham and others. The 24 paratypes measured for Table V were obtained at 5 places: at the holotype locality; in Brazos River west of College Station, on October 21, 1938; in Little Brazos River at State Highway 21, on June 13 and July 13, 1940 (including breeding adults); in borrow pit 5.3 miles west of Bryan on highway 21, on July 13, 1940; and in San Bernard River at State Highway 60, on May 12, 1939.

Additional paratypes of this species were collected by Bonham and party at 3 localities in Brazos County: in Brazos River west of College Station, on October 12, 1939; in Little Brazos River near Bryan, on March 31, 1939; and in Navasota River at Ferguson Crossing, on October 6, 1939. Still others were taken by R. T. Richey in Little Brazos River, Brazos County, on March 23, 1936, and by A. H. Wright in Colorado River, on the road between Houston and Victoria, on June 24, 1917.

A single large specimen collected by J. L. Baughman at Old River Terrace, on Market Street Road, Harris County, on May 18, 1941, is referred doubtfully to *brazosensis*. It agrees with that species in most respects, but has only 7 anal rays. More material is urgently needed from this region north of the mouth of Brazos River—not only of this species but also of the fish fauna in general.

CHUB SHINER

Notropis potteri, new species

Pl. III

Notropis potteri.—Potter, 1938: Pl. 4, Figure 1, facing p. 422 (probably a recognizable figure; species attributed on legend to Hubbs; no text reference; "recently located in McLellan County, Texas"). Baughman, 1950: 130 (name attributed to Hobbs; no description whatever; "common in Brazos River and tributaries"; entry taken from manuscript list by Bonham and Reid).

This species is described as new, despite the fact that Potter published, over the name *Notropis potteri*: Hubbs, a figure that is probably recognizable, when the assigned locality is considered. Potter's action failed to satisfy the requirements for availability stipulated by Article 25, Item C of the International Rules of Zoological Nomenclature, however, because the date of publication was subsequent to 1930 and because neither a diagnosis nor a definite bibliographic citation was furnished.

DIAGNOSIS.—The hooked pharyngeal teeth number 2, 4-4, 2. Fin rays: dorsal, consistently 8; anal, usually 7, rarely 6 or 8 (Table I); pectoral, 14 to 18, averaging 15.7; pelvic, typically 8, rarely 9, averaging 8.07.

The fins are moderately large and rather bluntly pointed: the dorsal height is always less than the head length, often only two-thirds as great;

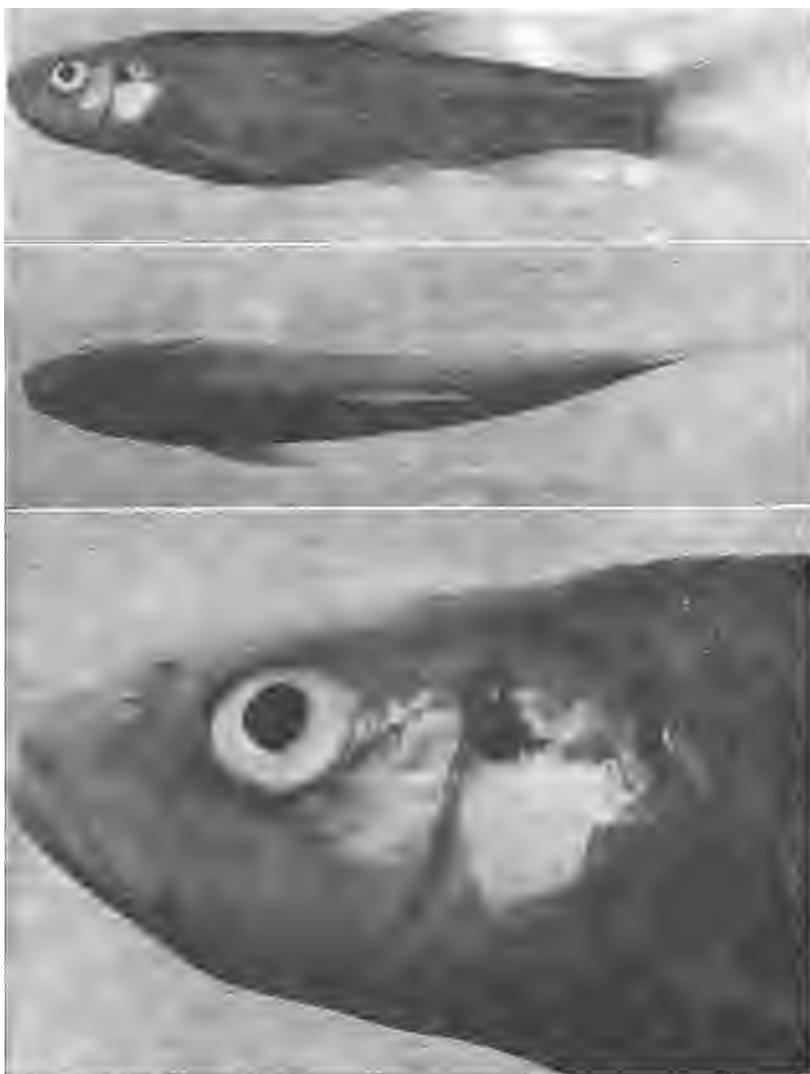


Plate III

Fig. 1. *Notropis potteri*: lateral view of an adult paratype 66 mm. long, collected in Brazos River at Government Dam, Texas, by Kelshaw Bonham, on December 3, 1939.

Fig. 2. *Notropis potteri*: dorsal view of a 62 mm. paratype from the same collection.

Fig. 3. *Notropis potteri*: enlarged view of the head of specimen shown in Fig. 1.

the caudal is usually a little shorter than the head; the pectoral length about equals the dorsal height; the pectoral does not reach the pelvic insertion. The dorsal origin is near or a little behind the middle of the standard length, approximately over the pelvic insertion.

The body contours are symmetrically curved, with most of the small eye above the axis. The muzzle is very thick and blunt in side view, with the heavy jaws about equal in forward projection. The snout in top view is extremely massive, almost semicircular. The mouth is moderately oblique: the upper lip rises to the level through the lower margin or the lower part of the pupil (*Pl. III*, Fig. 3). The middle part of the lower lip and the posterior part of the upper lip are much swollen.

The complete lateral line is nearly straight, horizontal, and median behind the short downward anterior curve. Its scales are scarcely modified in outline.

The body is moderately dusky above and silvery below, with little pigment below the region of the lateral line. The melanophores on the upper parts of the head and body are rather evenly scattered. Large melanophores are dispersed about the lateral line anteriorly. The lateral dark band is moderately developed on the caudal peduncle and ends just in advance of the very weak and diffuse basicaudal spot.

COMPARISONS.—*Notropis potteri* is one of the more distinctive of the many species that constitute the genus. The broad head, heavy muzzle and big mouth, well shown in the figures (*Pl. III*), accord it an aspect surprisingly like that of the creek chub, *Semotilus atromaculatus*. In some respects it shares characters with the Gulf-coastal species *N. sabinae* Jordan and Gilbert, but it is a much larger and coarser fish, with a somewhat smaller and much less inferior and less horizontal mouth. It also shows some resemblance to *N. bairdi* and *N. girardi* Hubbs and Ortenburger (1929a: 29-33), which seem to represent *N. sabinae* in the Red and Arkansas river systems, respectively. Since it differs from *sabinae*, *bairdi* and *girardi* in the dental formula, its resemblance to those species is probably not indicative of very close relationship.

Except for the consistent development of a second row of two pharyngeal teeth and for the complete squamation of the nape and breast, the specimens of *N. potteri* scarcely differ from the original account of *N. bairdi* and agree strikingly in some respects, for example in the superficial resemblance to *Semotilus atromaculatus*. On comparing *potteri* with the types of *bairdi*, however, close attention to detail discloses numerous other trenchant differences. The pharyngeal arch is less heavy (items 3 and 4 in the accompanying comparison); the scales are larger, are shield-shaped instead of suboval, and have fewer radii (items 6-8). The skin is thinner and less papillose (9). The body is slenderer, especially in adult females (10). The head is notably slenderer and thinner and the margins are straightish rather than notably turgid (12-14). The mouth and lip structures are very different (15-21). The opercle is much smaller (22). There are also sharp differences in pigmentation (24-29).

The relationship is probably more intimate with *Notropis blennius* (Girard), the status of which was clarified by Fowler (1910: 274-276, figs. 4, 6, 10) and by Hubbs (1926: 42-44). When compared with either of the subspecies into which *N. blennius* now seems divisible, *N. potteri* stands out so sharply as to call for full specific separation.

The subspecies of *blennius* may be called *Notropis blennius blennius* (Girard) and *N. b. jejunes* (Forbes). Specimens from the Arkansas River in Oklahoma are topotypic of *Alburnops blennius* Girard (1856: 194; 1858: 261, pl. 57, figs. 13-16 referred to but not bound in same volume; 1859: 55, pl. 57, figs. 13-16). They agree with Girard's description and figure in some important respects, such as the deep and abruptly decurved snout and low mouth. Adequate material from the Cimarron River and from various smaller tributaries also represents the nominate subspecies. The same form occurs in the Arkansas and Missouri rivers in Kansas. A specimen collected by George A. Moore and J. M. Paden in the Red River system, in Bricken Spring, 24 miles south of Ada, Oklahoma, on April 5, 1947, is typical of *N. b. blennius*, but is thought by Dr. Moore to represent a bait introduction, as it was taken on the premises of Thomas Bricken, a bait dealer, who gets his material from the Arkansas River system as well as the Red. As determined by reexamination of the collections in the University of Michigan Museum of Zoology, *N. b. jejunes* ranges from the Plains streams of Alberta and Manitoba in Canada through the Red River and Mississippi River of Minnesota and through the Mississippi River drainage basin of Iowa, Illinois, Indiana, Ohio, Kentucky, Tennessee and Missouri to the Mississippi River in Arkansas. It also occurs in the Tombigbee River in Alabama. The Neosho and ~~Illinois~~ rivers in Oklahoma, which are clearer and cooler than other streams in the same region, are inhabited by the northern subspecies. Since the differential characters of the two forms, outlined below, show moderate overlap and some degree of both local and individual inconsistency, and especially since the abundant material from Nebraska exhibits varying degrees of intermediacy and of mixture of characters, only ~~subspecific~~ separation is justified, and until the material is more critically analyzed and until the differences can be demonstrated to be genetic, even the subspecific separation must be regarded as tentative.

Since this paper was written the pertinence of the name *blennius* to the form here called *N. b. blennius* was confirmed at the National Museum by an examination of the type series (No. 67). The 6 largest specimens, 51 to 65 mm. long, including one of 56 mm. labelled "Type" in Jordan's handwriting, agree with the type figure, and are *N. b. blennius*. They have the deep head, decurved snout, ~~low~~ mouth, small eye, and most other characters here attributed to the typical subspecies, but not the small scale size (the total length of the key scale enters the postorbital length 2.7 to 3.0 times). The 5 smaller types, 38 to 44 mm. long, represent the unnamed creek subspecies of *Notropis volucella* Cope which inhabits the Neochero River system and other waters in the contiguous parts of Oklahoma, Arkansas, Missouri, and Kansas and which is characterized by the only moderate elevation of the lateral-line scales, the smallish size, the large eye, the high dorsal fin and the chunky body. These 5 specimens have been recataloged as U.S.N.M. 152780. Their characters were apparently not considered in the preparation of the type figure and description of *Alburnops blennius*.

N. b. blennius differs from *N. b. jejunes* in the usually less flattened and less expansive upper limb of the pharyngeal arch (item 3 in accompanying comparison of forms); the somewhat smaller rather less shield-shaped scales, the length of the median scales entering the postorbital more instead of less than 3.0 times (items 6-7), with slight overlap in some series; the somewhat thicker and more papillose skin (9); the deeper body,

with more arched anterodorsal profile (10); the usually deeper and wider head (12-13); the usually more nearly horizontal mouth and the blunter and more decurved snout (15-16); on the average probably in the somewhat thicker lips (17-19), and shorter mouth (21); usually in the longer opercle (22) and smaller eye (23); and somewhat in the pigmentation (26-29).

The differences between potteri and both forms of blennius, as here recognized, are also outlined in the accompanying comparison. The teeth of the second row are stronger, less deciduous, and more constantly developed (items 1-2). The pharyngeal arches are relatively larger than in either form (4) and the upper limb is more rodlike, less flangelike, particularly in comparison with jejonus (3). The ratio between scale length and ~~post-~~
~~orbital~~ contrasts with that of blennius (6) and the scale is usually more shield-shaped, less suboval, than in that subspecies (7). The radii average more (item 8). The skin seems smoother and less coarsely papillose than in N. b. blennius (9). The body averages slenderer than in that subspecies (10). The head averages slightly longer (11) and definitely slenderer (12). Its margins are less curved than in N. b. blennius (14). The mouth averages more oblique and higher anteriorly than in that subspecies (15-16). The local thickening of the lips and the resulting sigmoid gape give the mouth of potteri a strikingly different physiognomy, although N. b. blennius sometimes slightly approaches potteri in these respects (17-20). The opercle is usually smaller, especially in comparison with N. b. blennius (22). The eye averages smaller than in that subspecies and at comparable sizes is definitely smaller than in jejonus (23).

COMPARISON OF *Notropis potteri* WITH SIMILAR FORMS

1. Pharyngeal tooth formula:
 N. *potteri*: 2, 4—4, 2.
 N. *bairdi*: 4—4 (5—4 in 1 specimen, with the 5 on the left side normal in appearance).
 N. *blennius*, both subspecies: 1 or 2, 4—4, 1 or 2.
2. Teeth of lesser row:
 N. *potteri*: large, strong, firmly fixed; both constantly present.
 N. *bairdi*: consistently absent; the arch rather swollen in their place, not flattened as in the 3 other forms.
 N. *blennius blennius*: small and very weak, not very firmly fixed, one frequently lost and occasionally never developed.
 N. *blennius jejonus*: as in *blennius blennius*, but perhaps not quite so weak.
3. Pharyngeal arch:
 N. *potteri*: only moderately heavy; upper limb usually more or less rodlike, approaching lower limb in form.
 N. *bairdi*: much heavier than in the 3 other forms.
 N. *blennius blennius*: weakest; in form of arch about intermediate between *potteri* and *jejonus*.
 N. *blennius jejonus*: averaging weaker than in *potteri*; upper limb usually a thin, broad flange.
4. Width across both arches, laid with ends together on a flat surface, stepped into head length:
 N. *potteri*: 2.3 to 2.5, rarely 2.6.

- N. bairdi: 1.9 **to** 2.2.
N. blennius blennius: 2.5 (rarely) **to** 2.7.
N. blennius jejonus: 2.4 **to** 2.7.
5. Squamation on *nape* and on breast:
N. potteri, N. blennius blennius and N. blennius jejonus: complete.
N. bairdi: usually incomplete, with scaleless area small to large.
6. Median horizontal length of entire scale from first row above lateral line, below dorsal fin, measured into postorbital.
N. potteri: more than 3.0 but less than 4.0 times.
N. bairdi: more than 4.0 times (reflecting the long opercle and the small eye as well as the small scales).
N. blennius blennius: usually between 3.0 and 4.0 times, occasionally slightly less than 3.0 times.
N. blennius jejonus: typically less than 3.0 times, sometimes slightly more than 3.0 times (reflecting larger scale and larger eye).
7. Shape of scales from near middle of sides:
N. potteri: strongly shield-shaped, with prominent anterior angles in outline and in course of circuli; posterior margin somewhat produced.
N. bairdi: suboval, with very weak anterior angles and scarcely produced posterior margin.
N. blennius blennius: somewhat shield-shaped (intermediate between bairdi and 2 other forms).
N. blennius jejonus: about as in *potteri*.
8. Radii:
N. potteri: rather few.
N. bairdi: rather numerous.
N. *blennius*, both subspecies: very few.
9. Skin texture:
N. potteri: rather thin and smooth, with microscopic papillae.
N. bairdi: thick and tough with coarse papillae.
N. blennius blennius: intermediate between bairdi and the 2 other forms.
N. blennius jejonus: about as in *potteri*.
10. Greatest depth of body in standard length (these differences are accentuated when specimens of the same sex and of similar size are compared):
N. potteri: 3.7 **to** 4.8 (average of 40, 4.26).
N. bairdi: 3.6 **to** 4.5 (average of 37, 4.00).
N. blennius blennius: 3.7 **to** 4.3 (average of 17, 3.92); as a result of the deep body and the low mouth, the anterior dorsal profile is typically more arched than in N. b. jejonus.
N. blennius jejonus: 4.0 **to** 4.8 (average of 43, 4.39).
11. Head length stepped into standard length (these differences are accentuated when specimens of like size are compared):
N. potteri: 3.3 **to** 3.8 (average of 61, 3.56).
N. bairdi: 3.3 **to** 3.8 (average of 30, 3.63).
N. blennius blennius: 3.4 **to** 4.1 (average of 17, 3.69).
N. blennius jejonus: 3.7 **to** 4.0 (average of 32, 3.77).
12. Head depth stepped into head length:
N. *potteri*: 1.65 **to** 1.8.

- N. bairdi: 1.5 to 1.65.
- N. blennius blennius: 1.4 to 1.6, usually 1.5.
- N. blennius jejunus: 1.5 to 1.75, usually 1.6 to 1.7.
- 13. Head width stepped into head length.
 - N. potteri: 1.7 to 2.0.
 - N. bairdi: 1.5 to 1.7.
 - N. blennius blennius: 1.6 to 1.9, usually 1.7 to 1.8.
 - N. blennius jejunus: 1.7 to 2.0, usually 1.8 to 1.9.
- 14. Head margins.
 - N. potteri: straightish, even in large adults.
 - N. bairdi: more strongly curved, becoming extremely turgid in large adults.
 - N. blennius blennius: somewhat approaching bairdi.
 - N. blennius jejunus: almost as straight as in *potteri*.
- 15. Mouth.
 - N. *potteri*, N. bairdi (usually) and N. blennius jejunus: moderately oblique.
 - N. blennius blennius: subhorizontal to moderately oblique.
- 16. Horizontal from front of rostral fold crossing orbit at:
 - N. potteri: lower margin or lower part of pupil.
 - N. bairdi: variable, from lower margin of orbit to lower part of pupil.
 - N. blennius blennius: lower margin of orbit or a little higher (in correlation, the snout is blunter and more decurved than in the 3 other forms).
 - N. blennius jejunus: usually about midway between lower margin of orbit and lower edge of pupil.
- 17. Upper lip:
 - N. potteri: markedly dilated and swollen posteriorly.
 - N. bairdi: scarcely dilated, thin throughout.
 - N. blennius blennius: thin throughout to slightly thickened posteriorly.
 - N. blennius jejunus: scarcely dilated.
- 18. Lower lip:
 - N. potteri: markedly dilated medially.
 - N. bairdi: scarcely dilated, thin throughout.
 - N. blennius blennius: thin throughout to slightly thickened medially.
 - N. blennius jejunus: scarcely dilated.
- 19. Shape of gape (resulting from degree of thickening of lips):
 - N. *potteri*: rather strongly sigmoid.
 - N. bairdi and N. blennius jejunus: scarcely sigmoid.
 - N. blennius blennius: straight to slightly sigmoid.
- 20. Length of conjoined *lip* behind end of gape, compared with length of pupil:
 - N. *potteri*: nearly or quite as long.
 - N. bairdi and both subspecies of N. blennius: about one-half as long.
- 21. End of gaPe approximately under:
 - N. potteri: posterior nostril.
 - N. bairdi and N. blennius jejunus: front of orbit.
 - N. blennius blennius: intermediate.
- 22. Length of opercle (from extreme *tip* of membrane to nearest point on preopercular margin) stepped into greatest distance from tip of snout

- to preopercular margin.
- N. potteri: 2.2 to 2.7, usually 2.3 to 2.5.
- N. bairdi: 1.7 to 2.0.
- N. blennius blennius: 1.85 to 2.45, usually 2.0 to 2.3.
- N. blennius jejunus: 2.1 to 2.6, usually 2.2 to 2.4.
23. Length of eye (cornea) stepped into length of head (these differences are accentuated when specimens of like size are compared; toward the far north the eye in *jejunus* becomes reduced):
- N. potteri: 4.2 to 5.5 (average of 61, 4.72).
- N. bairdi: 4.4 to 5.6 (average of 30, 5.02).
- N. blennius blennius: 4.2 to 5.4 (average of 17, 4.57).
- N. blennius jejunus: 3.6 to 4.4 (average of 32, 3.97).
24. Pigment along base of dorsal fin.
- N. potteri and both subspecies of N. blennius: fin base rather evenly bordered by mid-dorsal dark streak.
- N. bairdi: middle of base blackened; front and end of base more or less completely depigmented.
25. Narrow dark streak above main lateral dark band.
- N. potteri and both subspecies of N. blennius: scarcely differentiated from main band.
- N. bairdi: sharply set off from main band, with an intervening scarcely pigmented area, especially in half-grown (in young pigment may be poorly developed; in adult pigment may be more uniformly distributed).
26. Pigment on scale row below lateral line on anterior part of trunk.
- N. *potteri*: undeveloped.
- N. bairdi: well developed in adult.
- N. blennius blennius: undeveloped to moderately developed.
- N. blennius jejunus: moderately to well developed.
27. Pigment on cheek below horizontal from just below orbit.
- N. potteri: scarcely developed onto cheek, ending below front nostril.
- N. bairdi: developed down to or nearly to rostral rim and back to behind vertical from front of eye.
- N. blennius, both subspecies: developed down to or nearly to rostral rim and back to below vertical from posterior nostril.
28. Pigment on upper lip.
- N. *potteri*: usually moderately well developed, at least anteriorly.
- N. bairdi: lacking to weakly developed, anteriorly.
- N. blennius blennius: moderately to well developed.
- N. blennius jejunus: well developed.
29. Pigment on lower lip.
- N. potteri: usually weakly developed, at front.
- N. bairdi: lacking or barely developed.
- N. blennius blennius: usually weakly developed.
- N. blennius jejunus: weakly to moderately developed.

RANGE AND HABITAT.—*Notropis* potteri occurs not only in the silty Brazos River and its main tributaries, along with *oxyrhynchus* and *brazensis*, but also in some of the smaller and less turbid waters of this river system. As a native fish it seems to be confined to the Brazos system. It has recently been taken in the Red River system, but we think it probable that the population there has become established from escaped bait minnows,

originally from the Brazos River system. No specimens were recognized among the myriads of fish from the Red River and tributaries collected in 1925, 1926 and 1927 (reported by Ortenburger and Hubbs, 1927, and by Hubbs and Ortenburger, 1929a-b), nor in other, unreported collections from those waters made prior to 1948. The material in the University of Michigan Museum of Zoology, comprising more than 1,800 specimens collected in 1926 and smaller numbers taken in 1925, 1929, and 1932, was all carefully reexamined in this connection. The specimens taken in 1948 and 1949 were from Lake Texoma, a heavily fished artificial lake, and the Red River, mostly near the lake. Those from the lake were collected by Frank T. Knapp on June 25, 1949, at Burns Run Resort, Bryan County, Oklahoma, near highway 75A. Series from the river below the lake were seined north of Paris, Lamar County, Texas, by George A. Moore and party on March 28, 1948, and by Knapp and party on July 8, 1949, and south of Yuba, Bryan County, Oklahoma, on Highway 299, by Moore and class on March 15, 1949. Four were seined by Knapp and party on June 23, 1949, in the Red River far above the lake, at Davidson, Tillman County, Oklahoma. No specimens have been identified in collections from the Trinity or other river systems between the *Brazos* and the Red. Comparison of specimens shows no notable difference. The tabulated proportional measurements (Table VI) are very similar, considering the difference in habitat, the difference in average size of specimens, and the fact that the Brazos and Red specimens were measured by different men. The biggest indicated difference in proportions, in head length, was not verified in measuring larger series of specimens for the preceding species comparison.

TYPES.-The holotype (University of Michigan Museum of Zoology, No. 120228), an adult 45.3 mm. in standard length, was seined by the Hubbs family and Leo T. Murray in Waco Creek, McLennan County, Texas, on June 21, 1938. The paratypes were taken with the holotype and at several other places in the Brazos River system. The 22 paratypes measured for Table VI were collected with the holotype; and in Brazos River at Government Dam, near Navasota, on November 24, 1939, by Bonham and party; in Little Brazos River at State Highway 21, on June 13 and July 13, 1940, by Bonham and party; at the Texas state fish hatchery at Cisco (received August 24, 1936, from George E. Potter); and in the lower end of Toweash Creek, a Brazos River tributary, by Marion Toole. Other paratypes were collected by G. E. Potter in Waco Creek, Baylor University Campus, Waco, on March 3, 1931, in Baylor Creek, at Waco, on January 22, 1931, and in unspecified waters at Waco; by R. T. Richey in Little *Brazos* River, Brazos County, on March 23, 1936, and at an unspecified locality and date in the Brazos River system; and by Bonham and students in Brazos River at Government Dam, on December 3, 1939. Specimens not designated as paratypes were taken by Bonham and students in Brazos River at Wellborn Crossing, *Brazos* County, on October 31, 1931, and in Little Brazos River, Brazos County, on March 31, 1939.

Subsequent to the preparation of the diagnosis other specimens, not designated as paratypes, have been collected by Frank T. Knapp of the Agricultural and Mechanical College of Texas and by Clark Hubbs of the University of Texas.

This species is dedicated to an enthusiastic naturalist, Dr. George E. Potter, formerly of Baylor University and now at the Agricultural and

Mechanical College of Texas. He collected the first specimens of the species and submitted them to the senior author for study.

SUMMARY

Among the many new fishes added during the past three decades to the known freshwater fish fauna of eastern North America are the three now belatedly described from eastern Texas—*Notropis oxyrhynchus*, *N. brazosensis*, and *N. potteri*. These species characterize the larger silty streams of the Brazos River system, which are thus shown to have a somewhat distinctive fauna. *N. oxyrhynchus* and *N. potteri* appear to be confined to this system (a population of *potteri* in the Red River system is thought to be the result of bait-minnow introduction); *N. brazosensis* occurs also in the lower parts of adjacent river systems. *N. potteri* also inhabits smaller and clearer streams.

TABLE VI

MEASUREMENTS (IN THOUSANDTHS OF STANDARD LENGTH)
AND COUNTS OF TYPES OF *Notropis potteri*

The types were measured by Keishaw Bonham, the Red River specimens by Frank T. Knapp.

	Holo-type	22 Paratypes (Range and Mean)	19 from Red River (Range and Mean)
Standard length, mm.....	45.3	38.7-80.0 (48.7)	34.2-64.3 (44.2)
Predorsal length	523	497-567 (527)	500-548 (521)
Prepelvic length	505	511-552 (528)	491-548 (517)
Body depth	245	211-263 (233)	210-265 (228)
Dorsal origin to lateral line....	153	128-165 (141)	119-159 (131)
Pelvic insertion to lateral line	120	80-123 (97)	83-127 (100)
Body width	181	152-191 (170)	125-195 (153)
Caudal peduncle length	221	183-231 (203)	183-240 (221)
Caudal peduncle depth	117	100-144 (113)	106-125 (114)
Head length	297	267-318 (301)	252-294 (278)
Head depth	180	161-195 (177)	114-181 (167)
Snout length	83	85-104 (95)	73-93 (86)
Eye length	66	49-66 (58)	50-69 (60)
Fleshy interorbital	100	93-128 (105)	87-107 (95)
Upper jaw length	86	86-110 (98)	94-112 (101)
Mouth width	72	71-109 (86)	74-93 (82)
Dorsal height	240	209-243 (229)	199-244 (225)
Anal height	172	150-188 (171)	159-190 (172)
Anal base	81	82-104 (91)	78-108 (91)
Longest caudal ray	300	255-314 (281)	251-326 (272)
Pectoral length	253	195-253 (221)	188-244 (211)
Pelvic length	158	143-169 (155)	137-168 (149)
Scales			
Above lateral line	6	5-6 (5.72)	6-7 (6.16)
Along lateral line	85	34-57 (35.0)	34-36 (34.6)
Below lateral line	4	4-5 (4.52)	4-5 (4.32)
Lateral line to pelvic	4	3-5 (4.52)	4-4 (4.00)
Predorsal scales	19	15-24 (19.1)	16-20 (18.1)
Predorsal rows	15	13-18 (15.3)	14-17 (15.8)
Around body: Above	13	11-14 (12.6)	11-13 (11.9)
Below	13	12-16 (13.9)	11-14 (12.5)
Total	28	25-31 (28.4)	24-28 (25.8)
Around caudal peduncle: Above	6	5-7 (5.91)	5-6 (5.53)
Below	5	5-8 (5.52)	5-6 (5.11)
Total	13	12-16 (13.4)	12-13 (12.6)
Fin Rays			
Dorsal	8	8-9 (8.00)	7-8 (7.95)
Anal (Table I)	7	7-8 (7.04)	7-8 (7.00)
Pectoral	16-16	14-18 (15.7)	13-16 (14.9)
Pelvic	8-8	8-9 (8.07) ^g	7-8 (7.97) ^g

¹ Between ends of gape.² 18 specimens.³ Both sides counted.

Notropis oxyrhynchus appears to be the southwestern representative of *N. percobromus*, the status of which is further elucidated. *N. brasiliensis* seems to represent *N. illecebrosa*. *N. potteri* resembles *N. Sabinae*, *N. bairdi*, and *N. girardi*, but is probably more closely related to *N. blennius*, which is held to comprise two subspecies, *N. b. blennius* of the generally silty Southwestern streams, especially of the Arkansas River system, and *N. b. jejunus* of more northern and more eastern waters. Detailed comparisons are made between *oxyrhynchus* and *percobromus*, between *brasiliensis* and *illecebrosa*, and between *potteri*, *bairdi*, and the two subspecies of *blennius*.

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