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Two New Catostomid Fishes (Cypriniformes) from the Northern Sierra Madre Occidental of Mexico

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ABSTRACT

Two new species of *Catostomus* (sensu stricto) are described from northwest Mexico. One inhabits northeastern headwater streams in the Río Yaqui drainage and the other is widely distributed in the southern and southeastern parts of the Río Yaqui and in the upper Río Mayo basin. These new taxa exhibit low pharyngeal tooth counts, possibly indicating a close relationship between them. They are hypothesized to be members of an old, regional ichthyofauna that stretches from central Mexico to northwest United States.

INTRODUCTION

Catostomid fishes of Mexico remain poorly known, especially those distributed in the mountain vastness of the northwestern portion of that country. Six described species are currently recognized from the region. Most are wide ranging, and some, on further study, may prove to constitute more than a single taxon (see, e.g., Ferris et al., 1982). Two new species of *Catostomus* not obviously related to other species in the region are described here. Their presence in streams of the northern Sierra Madre Occidental has been known for some time (Miller, 1959, 1976), but only recently have they been taken in numbers or of specimen quality adequate to define their characteristics, ecology, and distribution.

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Materials and Methods

Specimens were collected during ichthyological surveys of the Río Yaqui basin (Hendrickson et al. [1981]) and are deposited at the American Museum of Natural History (AMNH), Arizona State University (ASU), and the University of Michigan Museum of Zoology (UMMZ). Comparative materials are also housed at those institutions. Work in Mexico was under auspices of the Endangered Species Office, U.S. Fish and Wildlife Service (USFWS), Albuquerque, New Mexico. Collections were authorized by Permit No. 3618, issued by Departamento de Pesca, México, D.F., México.

Counts and body measurements follow Hubbs and Lagler (1970), with the following exceptions and additions: (1) interpectoral width, distance between pectoral fin insertions; (2) interpelvic width, distance between pelvic fin insertions; (3) pectoral fin to pelvic fin length, distance between fin insertions; (4) lip length, distance from anteriormost point of upper to posteriormost extent of lower lip; (5) lip width, widest measurement across lips; (6) upper lip length, distance at midpoint from outer to inner edge; and (7) lower lip length, distance from anterior to posterior edge. Counts of pharyngeal teeth include enumeration of gaps where teeth were obviously missing.

Osteological line drawings are from camera lucida tracings of individual bones. Measurements for calculation of proportions of tripus parts are also from such drawings; graph paper was overlaid so that a line designated as the y-axis passed through the anterior- and posteriormost points and this distance was measured to the nearest millimeter. Width was obtained by measurement of a perpendicular to length that passed through lines tangent to the widest parts of the bone that were parallel to the y-axis. Tripus arm lengths were measured as a distance between anterior- and posteriormost points of an arm and a line perpendicular to a y-axis that passed through the apex of the articulating process.

Acknowledgments

James E. Johnson, USFWS, arranged for research funding. Dean A. Hendrickson, ASU, was in charge of field operations, and was instrumental in their success. We thank Dean A. Hendrickson, Robert Rush Miller, and C. L. Smith, for reading and commenting on the manuscript.

SYSTEMATIC DESCRIPTIONS

Catostomus leopoldi, new species
Bavispe sucker

Figures 1A, B, 2A, 3A, C, E; tables 1–3

Catostomus sp., Miller, 1959, p. 215 ("headwaters of both the Yaqui and Casas Grandes"); Miller *in* Koehn, 1969, p. 28 ["undescribed species . . . subgenus *Catostomus* (of *Catostomus*)," possible hybridization with *Pantosteus plebeius* (Baird and Girard) in Río Casas Grandes basin]. Hendrickson et al. [1981], pp. 76–77 (distribution, habitat notes). Minckley and Brown, 1982, p. 223 (listed, Guzmán basin and Río Yaqui drainage). Minckley et al., 1986 (listed, "*Catostomus* sp. [Yaqui-Guzmán]; from the uppermost ríos Bavispe-Casas Grandes").

Diagnosis: A species of *Catostomus* (sensu stricto) with moderately small scales, usually 78 to 88 in the lateral line, and 9 or 10 dorsal fin rays. Lips large and elliptical. Lower lip completely cleft, with lobes widely separated at mandibular symphysis. Lips abundantly papillose, five or more rows of papillae crossing midline of upper and seven or more of papillae rows crossing longitudinal line across longest part of lower lobes. Pharyngeal teeth more than 32, but fewer than 40 per arch.

Types: Holotype: UMMZ 213391, a gravid female, 151.0 mm standard length (SL), from Río Gavilán (locally Arroyo Moctezuma), Chihuahua, Mexico (latitude 29°51′N, longitude 108°24′W, 2180 m), June 21, 1978, D. A. Hendrickson, J. E. Johnson, R. R. and F. H. Miller, W. L. and P. H. Minckley, and D. J. Siebert. Paratopotypes: UMMZ 213392, 12 females and 8 males, 80.0–137.5 mm SL, ASU 10559, 42 specimens, 83.0–29.0 mm SL, and AMNH 50708SD, dry skeleton. Additional paratypes: ASU 10560, mixed lot of 10 specimens, 22.0–137.0 mm SL, and AMNH 51302SD, dry skeleton, from Río Gavilán (locally Arroyo Moctezuma) between Rancho Puente de Agua and El Colorado, Chihuahua, Mexico (latitude 29°53′N, longitude 108°24′W, 2130 m), May 23, 1978; AMNH 50709, mixed lot of 44 specimens, 42.0–139.0 mm SL, from Río Negro, ca. 1.0

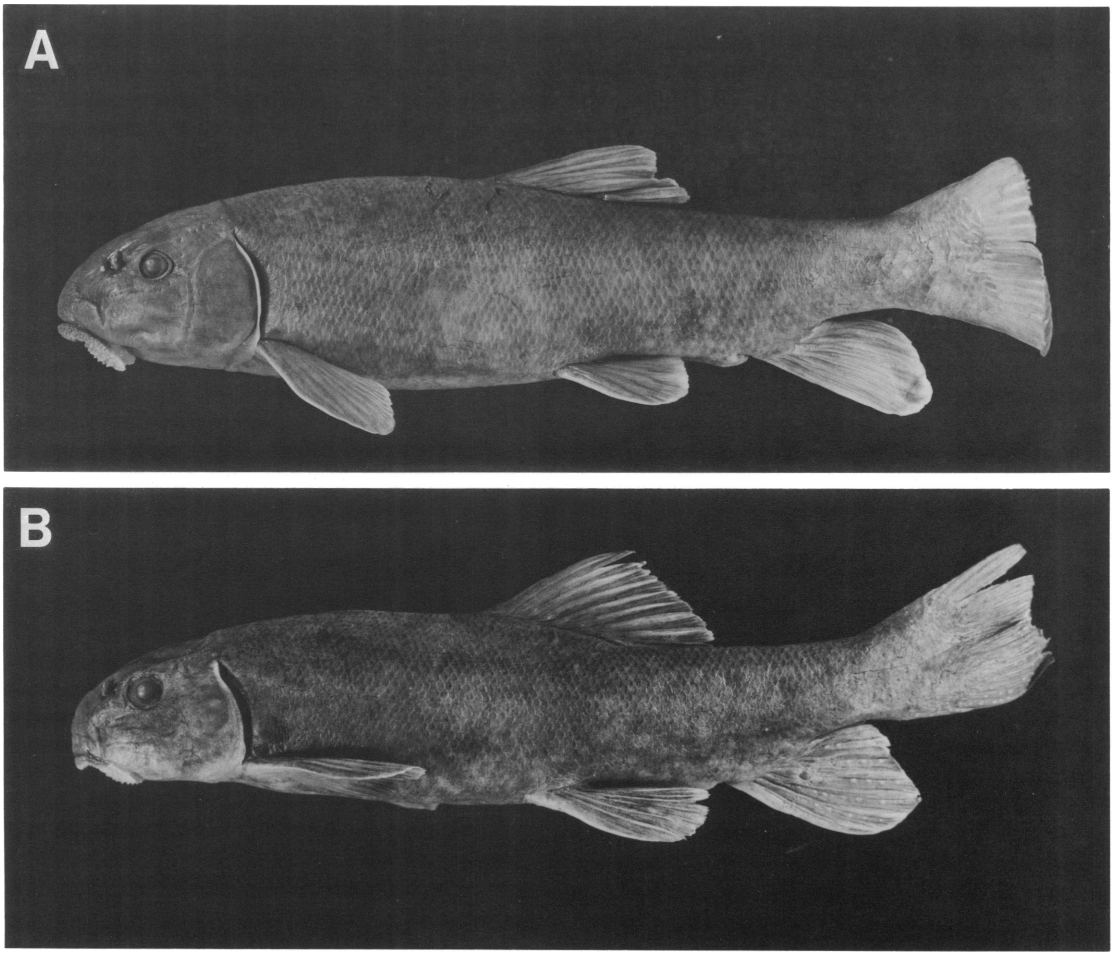

Fig. 1. Photographs of female holotype (A) and male paratype (B) of *Catostomus leopoldi,* new species. Note oblique orientation of mouth.

km upstream from bridge on road from Chuhuichupa to Molino de Aserrar Huaynopa, Chihuahua, Mexico (latitude 29°33′N, longitude 108°25′W, 1990 m), July 23, 1978; ASU 10561, mixed lot of 47 specimens, 43.0–164.3 mm SL, and AMNH 51301SD, dry skeleton, from Arroyo de la Norteña, ca. 3 km NW El Norte, Chihuahua, Mexico (latitude 29°39′N, longitude 108°24′W, 2100 m), July 22–23, 1978.

DESCRIPTION: Proportional measurements of *Catostomus leopoldi* are shown in table 1 and its body form and color pattern in alcohol are depicted in figure 1A, B. The body is well rounded, giving the species a plump appearance, especially about the head. The head is deep and broad, giving an impression of overall shortness, and typically has a fat or puffy aspect when compared to other *Catostomus,* especially in the suborbital (cheek) region.

The mouth is inferior and slightly oblique. The highly papillose lips are large (fig. 2A), their respective length and width 38 and 48 percent of head length. The lower lobes are divided by a median cleft, commonly slitlike in *Catostomus,* but broader in *C. leopoldi,* widely separating the lobes from one another at their points of attachment on either side of the mandibular symphysis.

The dorsal fin origin is about midway along SL, rarely slightly before the midpoint. Sexual dimorphism is pronounced (fig. 1A, B), with tuberculate males having longer and

TABLE 1

Proportional Measurements of *Catostomus leopoldi*, New Species (Above) and *C. cahita*, New Species (Below)

Expressed per mille SL; limits are followed by means ($\bar{x}$) and one standard deviation (s).

		Catostomus leopoldi							
Character	Holo-type	UMMZ 213392 (n = 12, ♀)		UMMZ 213392 (n = 7, ♂)		AMNH 50709 (n = 10)		ASU 10561 (n = 10)	
SL (mm)	151	83.6–137.5		80.0–135.0		91.2–139.0		101.3–164.3	
Predorsal L	507	506–538, 519.6	11.6	494–533, 519.3	12.6	515–545, 528.1	9.6	484–520, 506.6	12.6
Prepelvic L	564	548–587, 566.8	12.5	525–553, 543.8	10.3	555–592, 569.2	12.1	543–579, 555.2	13.4
Body W	190	167–188, 174.8	6.5	167–174, 171.0	2.6	176–197, 184.2	8.6	185–216, 197.9	10.2
Body D	238	214–235, 226.8	8.9	217–230, 225.0	9.3	206–242, 224.6	10.9	234–252, 244.3	7.1
Interpectoral W	171	162–183, 169.6	6.6	162–173, 167.4	4.1	152–180, 169.0	9.1	168–178, 172.1	4.5
Interpelvic W	107	100–116, 109.2	4.8	106–118, 114.1	5.2	98–122, 112.5	7.2	103–123, 114.9	6.1
Pect.–pelvic L	359	310–343, 325.2	11.6	308–323, 313.4	6.9	319–350, 335.9	10.1	316–360, 338.2	17.5
Head L	253	260–299, 278.8	12.2	260–284, 269.7	7.7	225–285, 275.4	8.7	250–261, 254.8	4.9
Head D	183	181–205, 191.3	7.7	173–200, 185.1	10.6	163–187, 178.1	7.4	161–183, 178.1	6.5
Head W	187	177–201, 189.9	6.6	181–206, 189.4	9.3	177–196, 185.5	6.1	182–192, 185.7	3.7
Nape–snout L	218	230–252, 241.1	7.2	223–254, 231.9	10.4	227–253, 240.8	9.2	212–228, 221.2	4.7
Snout L	126	81–133, 124.3	6.6	112–122, 118.6	3.2	114–133, 121.8	6.3	103–120, 111.9	6.4
Interorbital W	124	112–135, 125.2	6.4	111–138, 121.9	9.2	112–136, 124.1	8.7	118–126, 122.8	2.5
Postorbital W	109	111–132, 121.2	6.2	117–121, 118.1	1.5	111–120, 117.6	2.8	109–118, 113.6	4.2
Orbital L	38	44–57, 48.4	3.9	44–53, 46.7	3.5	44–61, 54.0	5.8	41–55, 46.7	4.3
Lip L	90	93–108, 101.4	4.9	94–104, 98.1	3.8	103–126, 116.6	6.3	85–96, 91.5	4.5
Lip W	113	96–144, 126.4	12.2	117–137, 126.4	7.3	137–160, 148.6	7.5	120–128, 124.0	2.8
Upper lip L	26	26–33, 29.6	2.8	26–31, 28.1	2.1	27–33, 29.5	2.4	19–26, 22.4	2.4
Lower lip L	64	63–74, 70.6	4.1	62–78, 69.6	6.6	66–82, 75.7	4.7	55–68, 60.0	3.7
Caudal peduncle L	162	141–173, 161.1	10.6	131–173, 155.4	13.2	142–170, 149.6	10.2	131–148, 141.0	6.6
Caudal peduncle D	95	98–107, 102.7	3.2	97–135, 107.1	12.9	95–109, 103.6	5.0	95–105, 101.6	3.4
L dep. dors. fin	235	223–251, 234.2	9.4	239–279, 260.7	13.7	211–276, 234.5	22.5	206–280, 274.0	9.1
L dorsal base	129	133–157, 146.6	8.0	139–177, 153.1	12.9	125–173, 147.9	13.5	134–174, 160.4	12.7
L dep. anal fin	209	187–228, 206.2	12.8	206–250, 233.1	15.4	207–244, 217.6	11.6	211–251, 242.2	9.6
L anal base	93	83–95, 88.9	4.9	87–115, 101.0	10.8	84–99, 88.9	4.4	92–123, 105.6	11.1
Pelvic L	150	148–183, 168.7	9.3	188–198, 192.0	3.6	173–205, 180.5	10.1	154–196, 186.4	7.1
Pectoral L	185	180–224, 206.2	13.4	203–224, 210.8	9.7	198–228, 214.1	9.9	176–225, 213.8	8.6

TABLE 1—(*Continued*).

Character	Holotype	UMMZ 213394 ($n = 5^a$, ♀)		UMMZ 213394 (n = 5, ♂)		AMNH 51305 (n = 10)		ASU 10563 (n = 10)	
	Catostomus cahita								
SL (mm)	148.1	129.0–148.1		101.1–128.0		112.5–143.0		81.2–101.3	
Predorsal L	504	492–512, 503.2	7.9	500–511, 505.6	4.2	494–524, 504.8	8.4	506–532, 521.6	8.3
Prepelvic L	527	517–543, 532.2	10.5	528–551, 536.0	10.3	519–538, 529.6	8.3	542–572, 555.2	12.3
Body W	155	155–174, 166.2	5.6	169–183, 176.2	6.8	157–178, 165.7	7.8	158–178, 170.3	6.6
Body D	194	194–220, 210.2	10.4	214–234, 225.5	8.4	204–231, 214.6	9.2	193–226, 213.9	9.6
Interpectoral W	149	149–164, 158.0	6.4	159–175, 167.3	6.7	150–177, 163.3	8.2	152–172, 166.1	7.9
Interpelvic W	112	112–123, 115.4	4.6	122–128, 125.2	2.8	110–120, 115.2	4.1	108–120, 114.8	4.5
Pect.–pelvic L	331	316–331, 324.8	5.9	307–328, 317.6	8.8	308–338, 320.3	10.9	322–360, 336.9	12.9
Head L	230	230–255, 238.0	10.1	239–258, 247.8	7.7	233–264, 245.6	9.7	254–276, 264.2	6.2
Head D	156	147–164, 156.2	6.1	161–170, 163.6	3.8	154–174, 164.4	5.4	165–185, 175.8	5.6
Head W	160	160–173, 166.2	5.6	168–176, 170.6	3.3	164–186, 173.1	6.3	177–201, 185.3	7.6
Nape–snout L	182	182–205, 190.8	9.7	197–209, 204.0	4.9	191–212, 198.2	6.2	209–233, 219.6	8.6
Snout L	93	86–100, 92.8	5.1	89–104, 98.8	6.1	103–116, 108.6	5.2	103–114, 108.7	3.4
Interorbital W	94	90–109, 98.0	8.9	98–106, 101.6	3.2	98–109, 104.2	3.3	108–122, 115.9	3.5
Postorbital W	108	108–117, 112.8	3.3	109–117, 113.4	4.0	112–128, 118.1	4.6	109–119, 114.0	3.5
Orbital L	47	45–50, 47.4	2.5	42–53, 48.4	5.9	33–55, 45.4	6.4	50–65, 56.8	5.6
Lip L	49	49–68, 57.6	7.7	50–69, 62.6	7.5	57–80, 66.8	6.5	74–91, 81.6	6.4
Lip W	70	70–91, 78.8	8.9	74–94, 85.0	7.4	81–101, 89.6	6.2	92–122, 103.8	10.6
Upper lip L	16	16–19, 17.2	1.3	17–20, 18.2	1.3	16–27, 22.3	3.3	20–26, 22.3	2.2
Lower lip L	34	34–46, 40.4	4.5	40–52, 45.0	4.7	41–51, 44.9	2.9	50–64, 54.7	5.3
Caudal peduncle L	157	147–159, 155.2	4.7	139–160, 151.0	9.4	151–175, 160.0	7.9	139–167, 158.5	9.3
Caudal peduncle D	95	95–100, 96.8	3.8	98–102, 99.0	1.4	90–103, 95.7	3.9	97–111, 103.7	4.6
L dep. dors. fin	217	217–245, 232.6	10.9	277–283, 279.0	3.2	197–284, 238.7	32.0	213–271, 238.1	18.9
L dorsal base	161	155–168, 161.2	4.6	161–211, 179.4	19.8	138–178, 155.9	12.6	127–160, 149.1	11.2
L dep. anal fin	182	167–202, 184.4	13.3	217–268, 239.2	22.8	186–258, 221.1	22.9	166–237, 187.5	29.7
L anal base	95	92–96, 93.8	1.6	98–119, 112.6	8.7	99–134, 111.7	12.4	72–98, 86.1	8.7
Pelvic L	146	140–166, 151.4	10.4	175–211, 195.6	14.2	141–198, 163.3	8.2	163–198, 175.1	10.9
Pectoral L	161	158–183, 172.4	12.1	183–190, 188.2	3.7	160–184, 171.0	7.8	188–233, 202.1	14.1

[a] Values for the holotype are included in this column.

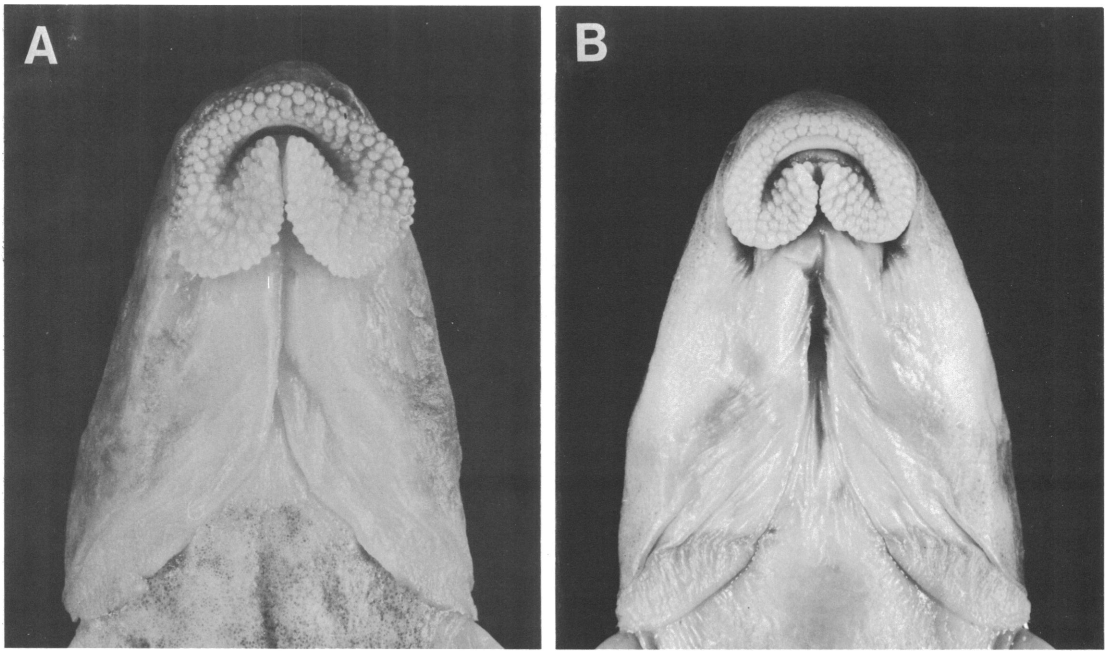

Fig. 2. Photographs of lips of male paratype of *Catostomus leopoldi,* new species (**A**) and a female paratype of *C. cahita,* new species (**B**). Note difference in lip size (relative to head length).

more expansive dorsal, pelvic, and anal fins (table 1).

The skull is slightly compressed dorsoventrally. The frontoparietal fontanelle is variously developed, ranging from moderate width to a narrow slit. The dorsal surface of the pterotic is broad, as in other *Catostomus.*

The mandible (fig. 3A) is characteristic of *Catostomus,* with a moderately long gnathic ramus that is not sharply deflected ventrally (as contrasted with *Pantosteus*; Smith, 1966). The body of the maxilla is slender, with a long, posteriorly directed dorsal process that articulates with the prepalatine cartilage (fig. 3C). The median dorsal process of the maxillary body is rather low. The ridge to which the maxillodentary ligament attaches on the mesial side of the ventral arm is robust as in other *Catostomus,* and in the genus *Pantosteus.*

The pharyngeal bones, modified fifth ceratobranchials characteristic of cyprinoid fishes, are heavy and deeply arched, with 34 to 39 teeth ($\bar{x} = 36.3$, $s = 2.5$, $n = 3$). The first few ventral teeth are large and show little dorsoventral compression (see Eastman, 1977, for terminology). Tooth size decreases and compression increases rapidly dorsad.

Struts bracing the anteriolateral expansions of the basioccipital process against the ventral side of the braincase are short and thick.

The neural complex of the specialized Weberian apparatus is rather low and pleural ribs of the fourth vertebral centrum unite to form an acute angle, as in other *Catostomus* (in part, Nelson, 1948). The tripus is subtriangular when the anterior and posterior arms are excluded, its width about 45 percent of total length of bone. The posterior arm is relatively long, about 60 percent of total length (fig. 3E). Width of the ascending process on a line connecting articular tips of the anterior and posterior arms is about equal to length of the thickened, distal portion of the anterior arm.

Scale and fin-ray counts of the holotype and paratypes are given in tables 2 and 3. No significant differences appear in these features among specimens from different localities.

ETYMOLOGY: The name *leopoldi* is patronymic, proposed to honor Aldo Leopold, whose

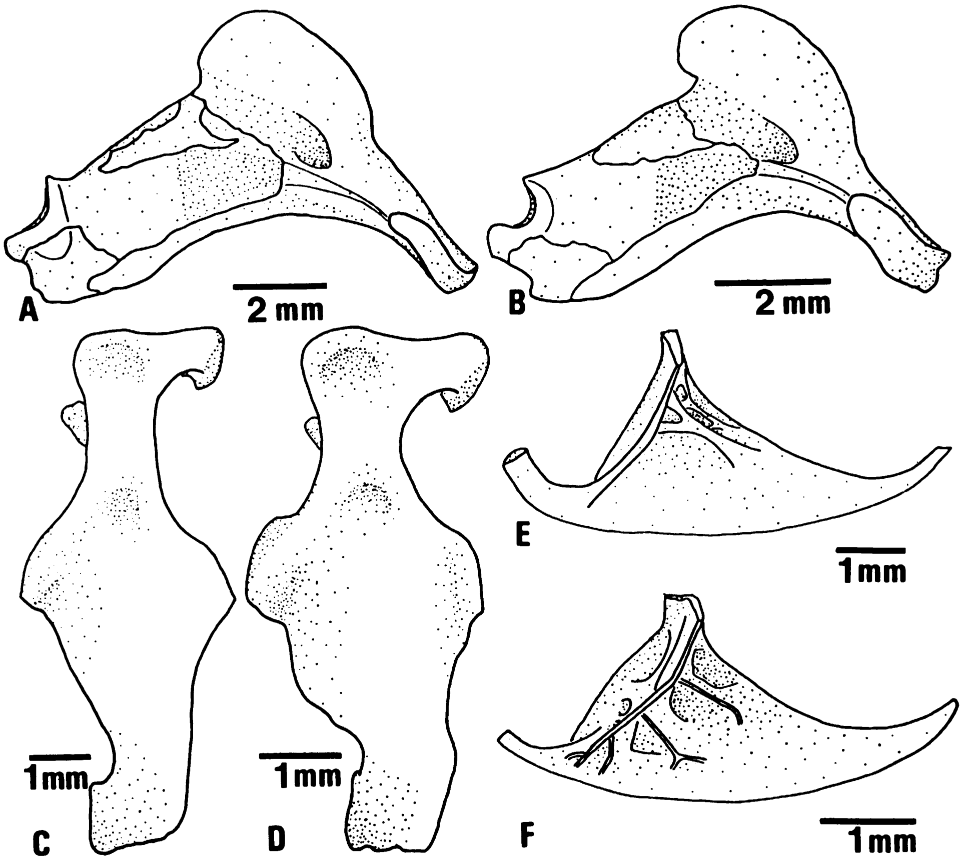

Fig. 3. Line drawings of left mandible (mesial view), maxilla, and tripus of paratype of *Catostomus leopoldi,* new species (AMNH 51301SD) (**A, C, E,** respectively) and paratype of *C. cahita,* new species (AMNH 51303SD) (**B, D, F,** respectively).

contributions to natural history of North America and to the science of ecology are immeasurable. Surprisingly, our cursory examination of the literature found no species named for Leopold. It seems especially appropriate to name this Mexican sucker for him since his "Song of the Gavilan" (Leopold, 1940) was based in part on experiences along the stream (locally Arroyo Moctezuma) that serves as type locality for the new species. The common name, Bavispe sucker, is for the subbasin of the Río Yaqui watershed in which the new species lives.

RANGE: *Catostomus leopoldi* is restricted to headwater streams of the Río de Bavispe drainage, the major northeastern tributary of the vast Río Yaqui watershed (fig. 4). Miller (1959) reported suckers, presumably of this species, in headwaters of the Río Casas Grandes, Chihuahua, immediately east of and adjacent to tributaries of the Río de Bavispe. We have not examined those specimens, nor have we been able to find catostomids other than *Pantosteus plebeius* Baird and Girard (Rio Grande Sucker) in that region.

HABITAT AND ASSOCIATED SPECIES: Habitats range from pools in high-gradient headwater streams flowing through Madrean Montane Forest to those in lower gradient creeks of Montane Meadow Grassland (Brown, 1982), mostly higher than 2000 m elevation. Streams ranged from about 1 m to 3 m in width. Depths of pools where the sucker was concentrated ranged to 2 m, but most were less than a meter. Bottoms were stony, with cobble and gravel on riffles and substantial deposits of fine gravels, sand, silt, and sometimes organic materials in pools. The

TABLE 2

Counts of Scales for Holotypes and Paratypic Series of *Catostomus leopoldi*, New Species (Above) and *C. cahita*, New Species (Below)

Number of specimens is given for each value. Values for holotypes are italicized; $\bar{x}$ = mean, and s = one standard deviation.

Catostomus leopoldi

Cat. no.	Lateral line scales: 75	76	77	78	*79*	80	81	82	83	84	85	86	87	88	89	90	91	92	$\bar{x}$	s
UMMZ 213392	3			2	1		2	4	1	2			1	1		1	1		81.5	9.5
AMNH 50709				1	3	1	1		1		1			1					81.3	3.4
ASU 10561							2	1			1	1	3			1		1	85.8	3.7
Totals	3			3	4	1	3	5	2	2	2	1	4	2		2	1	1		

Cat. no.	Around caudal peduncle: 24	25	26	27	*28*	$\bar{x}$	s	Above lateral line: 11	12	*13*	14	15	$\bar{x}$	s	Below lateral line: 9	*10*	11	12	$\bar{x}$	s
UMMZ 213392	9		2		6	25.4[a]	2.0		3	12	3	1	13.1	0.7	2	5	10	1	10.6	0.8
AMNH 50709	1		2		7	27.2	1.4		7	2	1		12.4	0.7	1	5	4		10.9	0.7
ASU 10561					10	28.0	0.0		1	5	4		13.3	0.7		1	9		10.9	0.3
Totals	10		4		23				11	19	8	1			3	11	23	1		

Catostomus cahita

Cat. no.	Lateral line scales: 78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	*98*	$\bar{x}$	s
UMMZ 213394										2			3		1	1		1	1		1	91.8	3.7
ASU 10563			1		2	1	1			1		2			1							84.2[b]	3.3
AMNH 51305	2			2	1	2	1			1	2											83.0	3.6
Totals	2		1	2	3	3	2			4	2	2	3		2	1		1	1		1		

Cat. no.	Around caudal peduncle: 26	27	28	29	*30*	$\bar{x}$	s	Above lateral line: 11	12	*13*	14	15	$\bar{x}$	s	Below lateral line: 9	10	*11*	12	$\bar{x}$	s
UMMZ 213394		1		1	8	29.6	0.9			5	5		13.5	0.5			5	5	11.9	0.5
ASU 10563	4	1	4			27.0	0.8		2	8			12.8	0.4		1	9		10.9	0.3
AMNH 51305	2	3	6			27.4	0.8		1	10			12.9	0.3		3	7		10.7	0.5
Totals	6	5	10	1	8				3	23	5					4	21	5		

[a] One specimen with 22 scales around the caudal peduncle was excluded to conserve space, but was included with the mean.
[b] One specimen with 72 lateral line scales was excluded to conserve space, but was included with the mean.

TABLE 3

Counts of Fin Rays for Holotypes and Paratypic Series of *Catostomus leopoldi*, New Species (Above) and *C. cahita*, New Species (Below)

Values for holotypes are italicized; $\bar{x}$ = mean, and s = one standard deviation.

	Catostomus leopoldi																		
	Dorsal					Anal	Both pectoral fins							Both pelvic fins					
Cat. no.	9	*10*	11	$\bar{x}$	s	7	26	27	28	*29*	30	$\bar{x}$	s	14	15	16	*17*	$\bar{x}$	s
UMMZ 213392	4	15		9.8	0.4	19	8	1	5	3		27.0[a]	1.4	3		16		15.7	0.7
AMNH 50709	1	9		9.9	0.3	10	1	1	5	2	1	28.1	1.1			10		16.0	0.0
ASU 10561	1	9		9.9	0.3	10	5	2	1			26.5	0.8		1	9		15.9	0.3
Totals	6	33				39	14	4	11	5	1			3	1	35			

	Catostomus cahita																		
	Dorsal					Anal	Both pectoral fins							Both pelvic fins					
Cat. no.	9	10	*11*	$\bar{x}$	s	7	26	27	*28*	29	30	$\bar{x}$	s	15	*16*	17	18	$\bar{x}$	s
UMMZ 213394		9	1	10.1	0.3	10	1	1	6	2		27.9	0.9	1	7		2	16.3	0.9
ASU 10563	3	6	1	9.8	0.6	10	3	1	6			27.3	0.9		10			16.0	0.0
AMNH 51305	9	2		9.2	0.4	11			10		1	28.2	0.6		10		1	16.2	0.6
Totals	12	17	2			31	4	2	22	2	1			1	27		3		

[a] One count of 24 pectoral fin rays was excluded to conserve space, but was included with the mean.

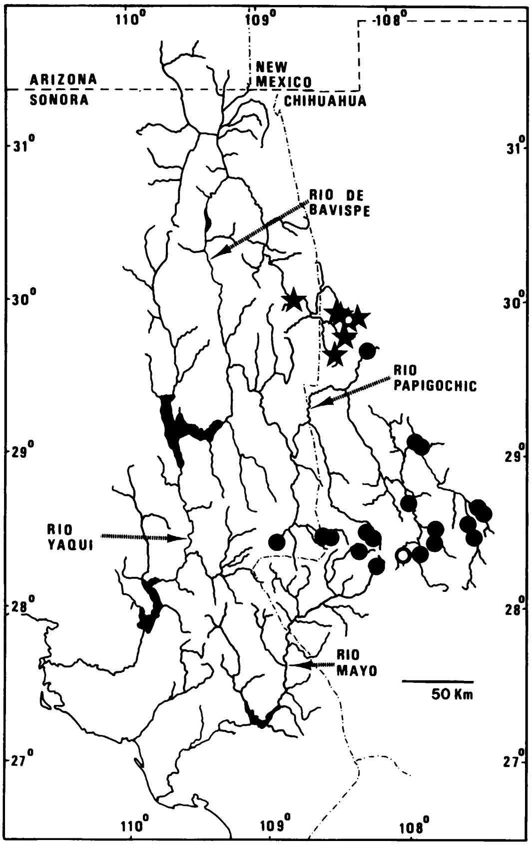

Fig. 4. Drainage map of ríos Yaqui and Mayo of northwestern Mexico showing distribution of *Catostomus leopoldi,* new species (stars) and *C. cahita,* new species (circles); open symbols indicate type localities.

fish was associated with cover in the form of boulders or undercut banks, typically over clean, gravel or sand bottoms (Hendrickson et al. [1981]).

The Bavispe sucker is syntopic with *Pantosteus plebeius* in Arroyo Moctezuma and occurred with *Catostomus bernardini* Girard (Yaqui sucker) in Río Negro, but was the only catostomid taken in arroyos de la Norteña and San Antonio. Native cyprinids occurred widely with the new species, as did the undescribed Yaqui trout, *Salmo* sp., at two localities (table 4). Introduced species, *Salmo gairdneri* Richardson and *Lepomis macrochirus* (Rafinesque), each co-occurred with *C. leopoldi* as a few individuals at separate localities.

***Catostomus cahita,* new species**
Cahita sucker

Figures 2B, 3B, D, F, 5A, B; tables 1–3

Pantosteus plebeius (Baird and Girard), Meek, 1902, p. 75 (misidentification, fide Miller, 1976); Meek, 1904, p. 30 ("Minaca," misidentification, fide Miller, 1976).

Catostomus sp., Miller, 1976, p. 5 ("an undescribed species of *Catostomus*"). Hendrickson et al. [1981], pp. 76–77 ("southern and southeastern headwaters of the Río Yaqui system"). Minckley and Brown, 1982, p. 233 (listed, ríos Yaqui and Mayo systems). Minckley et al., in press (listed "*Catostomus* sp. [Yaqui-Mayo]; from the ríos Papigóchic-Mayo headwaters").

DIAGNOSIS: A species of *Catostomus* (sensu stricto) with moderately fine scales, usually 78 to 92 in the lateral line, and 9 or 10 dorsal fin rays (rarely 11). Lips small, the lower lobes completely cleft, but closely appressed at the midline. Lips with four or fewer rows of papillae crossing the midline on upper lips and eight or fewer rows crossing a longitudinal line on longest part of lower lobes. Pharyngeal teeth more than 29, but fewer than 35 per arch.

TYPES: Holotype. UMMZ 213393, a female, 148.1 mm SL, from Arroyo Ahumado, a tributary of Río Tomóchic, Chihuahua, Mexico, 21.8 km from Tomóchic along road to Basaseáchic (latitude 28°21′N, longitude 107°58′W, ca. 2000 m), June 16, 1978, D. A. Hendrickson, J. E. Johnson, R. R. and F. H. Miller, W. L., P. H., and R. L. Minckley, and D. J. Siebert. Paratopotypes: UMMZ 213394, 4 females and 5 males, 101.1 to 140.5 mm SL, ASU 10561, 14 specimens, 46.0–105.0 mm SL, and AMNH 51303SD, dry skeleton. Additional paratypes: AMNH 51305, mixed lot of 47 specimens, 26.0 to 144.0 mm SL, and AMNH 51304SD, dry skeleton, from a tributary of Río Concheño, Chihuahua, Mexico, 16.5 km E Yepachic on road to Basaseáchic (latitude 28°22′N, longitude 108°17′W, ca. 1800 m), June 15, 1978; ASU 10563, mixed lot of 47 specimens, 37.0 to 101.3 mm SL, and AMNH 51306SD, dry skeleton, from tributary of Río Candameña above Salto de Basaseáchic, Chihuahua, Mexico, at highway bridge on road to La Junta, 8.5 km from the entrance of Basaseáchic Parque Nacional.

DESCRIPTION: Color pattern in alcohol and body form of *Catostomus cahita* are shown in figure 5A, B and proportional measurements are given in table 1. The general appearance of the Cahita sucker is much the same as other western American *Catostomus* species. The body is terete and head length enters SL about four times.

The mouth is horizontal and inferior, with papillose lips that resemble other *Catostomus* (fig. 2B). Lips are relatively small, their respective length and width 27 and 36 percent of head length.

The dorsal fin, with 9 or 10, rarely 11, fin rays, is located about midway along SL. Tuberculate males possess a longer dorsal fin than females (fig. 5A, B), with a larger base; males have longer and more expansive anal, pectoral, pelvic, and caudal fins as well (table 1).

The frontoparietal fontanelle is open, although the posterior extension of the parietal portion is closed in some specimens, parietals meeting at the dorsal midline. The pterotics are rooflike as in other *Catostomus*. Anteriorly directed spines of the lateral ethmoids extend as far forward as the anterior margins of the lateral expansions of the supraethmoid.

The ascending process of the dentary bone rises sharply from the mandibular body (fig. 3B). The gnathic ramus to mandibular body angle is obtuse, as in other *Catostomus*, and orientation of the mandibular symphysis is parallel to the plane of the gnathic ramus. The maxilla is robust, with a thick neck and heavy head (fig. 3D). Its ventral keel is well developed and the mesial bifurcation of the ventral arm where the maxillodentary ligament attaches is pronounced.

The pharyngeal arch is robust and strongly curved. Tooth number is low for the genus *Catostomus*, ranging from 29 to 32 ($\bar{x} = 30.3$, $s = 1.5$, $n = 3$), and the ventralmost teeth are large and little compressed. Tooth size decreases and dorsoventral compression increases rapidly along the row to result in relatively tiny teeth dorsally.

The pleural ribs of the fourth centrum of the Weberian apparatus unite to form an angle of less than 90° and are slightly retrorse, with broad blunt ends. The neural complex is low. The tripus is rather inflated, its width about 50 percent of its total length. Width of the ascending process on a line connecting articular tips of the anterior and posterior arms is about twice the length of the slender, distal portion of the anterior arm. Its posterior arm is short, less than 60 percent of total length (fig. 3F).

Scale and fin-ray counts for the holotype and paratypes from three localities are given in tables 2 and 3. Type material from the Río Yaqui basin shows a consistent trend for higher counts than in the other two populations, both of which are from the Río Mayo drainage. Further investigations may demonstrate uniqueness of suckers from these two independent Pacific drainages. However, specimens are similar and consistent in osteological characters and in their differences from both *Catostomus leopoldi* and the widespread *C. bernardini*.

TABLE 4

Species Associated with *Catostomus leopoldi*, New Species and *C. cahita*, New Species

Compiled from Hendrickson et al. (1981). Introduced species are indicated by an asterisk (*).

Associate	*C. leopoldi*	*C. cahita*
Salmonidae		
Salmo gairdneri Richardson*	X	X
Salmo sp.	X	–
Catostomidae		
Catostomus bernardini Girard	X	X
Pantosteus plebeius (Baird and Girard)	X	–
Cyprinidae		
Agosia chrysogaster Girard	X	X
Campostoma ornatum Girard	X	X
Codoma ornata Girard	–	X
Gila sp.[a]	–	X
G. robusta Baird and Girard	X	X
Notropis formosus (Girard)	X	X
Pimephales promelas Rafinesque*	–	X
Ictaluridae		
Ictalurus pricei (Rutter)	–	X
Crypinodontidae		
Cyprinodon sp.	–	X
Centrarchidae		
Micropterus salmoides (Lacépède)*	–	X
Lepomis macrochirus Rafinesque*	X	X

[a] Reported as *Gila pulchra* (Girard) by Hendrickson et al. (1981).

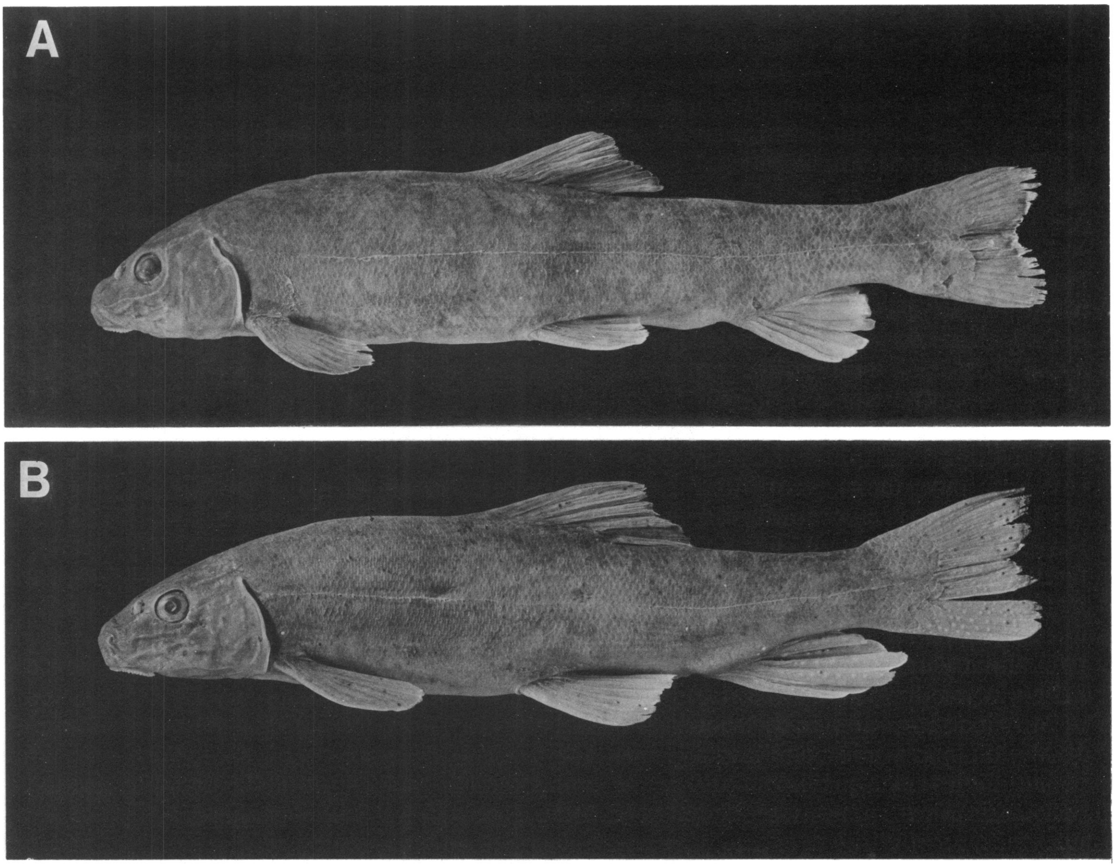

Fig. 5. Photographs of female holotype (A) and male paratype (B) of *Catostomus cahita,* new species.

ETYMOLOGY: The epithet, *cahita,* a noun in apposition, is after the name for the subfamily of Uto-Aztec language spoken by Amerinds inhabiting the region in which the new species lives (Crumrine, 1980). The suggested common name, Cahita sucker, follows from the trivial epithet.

RANGE: *Catostomus cahita* is widely distributed in a diversity of streams in the southern and southeastern parts of the Río Yaqui, principally in the Río Papigóchic drainage, and in the upper Río Mayo basin, Chihuahua, Mexico (fig. 4).

HABITAT AND ASSOCIATED SPECIES: The Cahita sucker inhabits streams of variable size and configuration. It often is syntopic with *Catostomus bernardini,* especially in larger systems, and ranges from high-elevation habitats in Madrean Montane Forest to lower elevations in Sinaloan Thornscrub (Brown, 1982). It was recorded in greatest abundance, however, in small streams at high and intermediate elevations. It avoids turbulence and characteristically lives in pools, but sometimes was taken from deeper runs. Associated fishes ranged from Yaqui trout.at high elevations, through most cyprinids known from the region, to an undescribed pupfish (*Cyprinodon* sp.) in the Río Papigóchic (table 4).

COMPARISONS

Catostomus leopoldi and *C. cahita* are readily distinguishable from each other and from other congeners. The large lips (fig. 2A) and slightly oblique mouth orientation of the Bavispe sucker, as opposed to smaller lips (fig. 2B) and a horizontal mouth in *C. cahita,* always serve to separate the two new species.

Osteologically, the ascending process of the mandible rises more abruptly in the Cahita sucker than in the Bavispe sucker, the anterior portion of its maxilla is more robust, and its tripus is inflated rather than subtriangular (excluding anterior and posterior arms) (fig. 3).

One of the striking features of both new taxa is their unusually low number of pharyngeal teeth. Other *Catostomus*, with the possible exception of *Catostomus wigginsi* Herre and Brock (Opata sucker), generally have more than 45 teeth on each arch (Eastman, 1977; Siebert, orig. data). As few specimens were skeletonized, numbers of individuals examined for this character are admittedly small (two specimens from Arroyo Moctezuma and one from Río de la Norteña for *C. leopoldi*; one specimen each from Arroyo Ahumado, Río Concheño, and Río Candameña for *C. cahita*). However, they came from widely separated localities in each species' range, which lends credence to observed counts not being seriously affected by local population influences or small sample sizes. Low tooth counts might also be attributed to subadult specimens since tooth numbers increase with age in suckers. However, there is no evidence that this character changes after sexual maturity (Eastman, 1977) and all specimens examined for numbers of teeth were adults.

Possession of few teeth on each pharyngeal arch may indicate that these two taxa are more closely related to one another than either is to other *Catostomus*. Tooth size relationships along the arch may be another indication of close relationship. Although most catostomids demonstrate considerable differences between ventral and dorsal tooth size, the disparity is exaggerated in these two taxa. So few teeth also raises the possibility that *C. leopoldi* and *C. cahita* are most closely related to the genus *Pantosteus*, which also tends to have fewer than 40 teeth per pharyngeal arch (Siebert, orig. data).

Six other catostomids, *Catostomus bernardini*, *Catostomus insignis* Baird and Girard (Sonoran sucker), *C. wigginsi*, *Pantosteus plebeius*, *P. clarki* (Baird and Girard) (desert mountainsucker), and *Moxostoma austrinum* (Bean) [west Mexican redhorse; including *M. mascotae* Regan (Buth, 1978)] occur naturally in Pacific drainages of northwestern Mexico. *Carpiodes carpio* (Rafinesque) has been introduced and is established in the Río Yaqui system (Hendrickson et al. [1981]). None of these is likely to be confused with either of the new taxa. *Catostomus insignis* and *P. clarki* inhabit the Gila River basin, lower Colorado River system (Minckley, 1980b, 1980c), and *M. austrinum* occupies drainages far south and east of the range of either of the two new species (Jenkins, 1980).

Catostomus leopoldi is syntopic with *C. bernardini* and *Pantosteus plebeius* in different parts of its range (Hendrickson et al. [1981]). So far as is known, it is not syntopic with both at any one locality. *Catostomus bernardini* has more dorsal (11–13) and pelvic (18–20, both fins) fin rays than *C. leopoldi* and has larger sales as well (lateral line scales 60–80, $\bar{x} = 72.8$, $s = 7.99$, $n = 39$, scales around caudal peduncle fewer than 25, $n = 39$; Siebert, orig. data). Lips of *C. bernardini* are smaller, its caudal peduncle more shallow ($\bar{x} = 8.8\%$ SL, $s = 3.81$, $n = 39$), and its dorsal fin base longer ($\bar{x} = 19.4\%$ SL, $s = 10.67$, $n = 10$) than that of *C. leopoldi.*

Catostomus wigginsi was reported from the Río Yaqui system based on a single specimen captured remote from localities inhabited by *C. leopoldi* (Hendrickson et al. [1981]). The record was considered invalid by Van Devender et al. (1985) who suspected it resulted from transposition of specimens or labels. The Opata sucker is nonetheless readily distinguished from the Bavispe sucker by its fewer lateral line scales ($\bar{x} = 72.3$, $s = 2.94$, $n = 10$; Siebert, orig. data), smaller lips, larger head ($\bar{x} = 29.2\%$ SL, $s = 14.52$, $n = 10$), and shallow median cleft of the lower lip (with up to four rows of papillae crossing the midline).

Pantosteus plebeius, unlike *Catostomus leopoldi*, possesses typical *Pantosteus* lip structure (shallow median cleft between lower lobes and well-developed lateral notches between upper and lower lips) and a closed frontoparietal fontanelle.

One skeletonized specimen from Arroyo Moctezuma (AMNH 56171SD) almost certainly represents a hybrid between *Catostomus leopoldi* and *Pantosteus plebeius*. The frontoparietal fontanelle is nearly closed, with only a small anterior slit, a condition intermediate between the two species at this locality. A probability of hybridization between *P. plebeius* and a *Catostomus* (presumably *C. leopoldi*) in the Río Casas Grande drainage, Chihuahua, Mexico, was detected in hemoglobins by Koehn (1969). Smith (1966) had earlier reported *P. plebeius* as the only *Pantosteus* not known to hybridize, although introgression between *P. plebeius* and *P. discobolus* was hypothesized and recently documented (Smith et al., 1983). Our specimen thus corroborates occurrence of natural hybridization between *P. plebeius* and a *Catostomus* (sensu stricto), adding information to biology of the sucker genus *Pantosteus*. Zuckerman et al. (1984) recently recorded *P. plebeius* hybridizing with nonnative *C. commersoni* (Lacépède) in the upper Rio Grande of Colorado.

Catostomus cahita is broadly syntopic with *C. bernardini*. Meristic characters and dorsal fin length that distinguish the Yaqui sucker from *C. leopoldi* also separate it from the Cahita sucker. *Pantosteus plebeius* and *C. wigginsi* are not known to be syntopic with *C. cahita*, but features that distinguish them from *C. leopoldi* also differentiate them from the Cahita sucker.

ZOOGEOGRAPHIC RELATIONS

The Sierra Madre Occidental was progressively formed by volcanic activity from 30 to 22 million years ago (mya) in the north and 10 to 8 mya in the south (McDowell and Clabaugh, 1979; Cameron et al., 1980). The mountains are surrounded on the east, north, and west by basin and range topography that developed from east to west between 27 and 7 mya (Chapin, 1979; Dokka and Merriam, 1982). Montane habitats in northwestern Mexico have thus been available to fishes for a long period of time.

Minckley et al. (1986) reviewed tectonism along coastal provinces of western North America and documented continuity of a southwestern North American ichthyofauna stretching north from Mexico into California. They considered it possible that transport northward on tectonically displaced coastal terranes, dispersal through formed and forming basin and range areas, or both, could have allowed formation of extensive, linear distributions of ancestral *Catostomus*. Such expanded ranges have precedence in modern suckers (viz., *Pantosteus plebeius* and the *C. bernardini* complex, see below). This hypothesized distribution pattern would have been established by early or middle Miocene.

Rates and magnitudes of displacements along what is now the San Andreas Transform since Eocene are well documented to fall within time constraints and relatively great distances required to transport modern fishes from basin to basin along the continental margin. What is now the Sierra Nevada of California-Nevada existed as an eroding highland in Miocene and Pliocene and was possibly interconnected with the northern Sierra Madre Occidental due to the intervening presence of what are now the Transverse Ranges of California. The latter represent microplate(s) that later migrated west-northwest and were rotated and uplifted in apparent response to Miocene extensional opening of basins to the west. Uplift, westerly tilting, and clockwise rotation of the Sierra Nevada proceeded from south to north beginning 18 mya, and has been mostly accomplished since 5 mya.

We cursorily examined possibilities for relationships among the two new Mexican *Catostomus* and species to the north and northwest. Striking mosaics of resemblances in scalation, body shape, pigmentation, and lip structure are evident among *Catostomus leopoldi, C. cahita, C. fumeiventris* Miller (Owens Valley sucker, occurring on the southeast end of the Sierra Nevada, California [Miller, 1973]), and further to the *C. microps* group of suckers (Moyle and Marciochi, 1975) of the northern Sacramento River and adjacent drainages (*C. microps* Rutter [Pitt River, California], *C. warnerensis* Snyder [Warner Valley, Oregon], *C. tahoensis* Gill and Jordan [Lahontan Basin, Nevada, California, Oregon], and *Catostomus* sp. [Surprise Valley, Nevada]). Disruption of distributions attained either by vicariance, dispersal, or a combination of the two, would have occurred through westward displacement and rotation of mountain masses, development of extension zones reflected in basin and range structure between the northern Sierra Madre Occidental and the southern

Colorado Plateau, and extension and horizontal displacement along the broad San Andreas Transform (Minckley et al., 1986).

Distributional relations paralleling those just described were suggested for species of the subgenus *Temeculina* of *Gila* (*G. pulchra* [Girard], *G. pupurea* [Girard], *Gila* sp., and *G. ditaenia* Miller of Mexico, and *G. orcutti* [Eigenmann and Eigenmann] and *G. crassicauda* [Baird and Girard] of California) adjacent to the Sierra Madre Occidental and west of the Sierra Nevada. *Pantosteus plebeius* of Mexico and *P. santaanae* (Snyder) of California may also show a comparable distribution (Minckley et al., 1986). Phylogenetic relationships of *Temeculina* to the south are with the central Mexican genus *Algansea* (Barbour and Miller, 1978). Another probable relative of *Algansea* (D. A. Hendrickson, personal commun.), *Agosia chrysogaster,* ranges from Sinaloa, Mexico, northward to the Bill Williams River, Arizona, east of the Sierra Nevada and the Mohave Desert (Minckley, 1980a). This pattern also appears both east and west of the Sierra Nevada among cyprinodontoids. Livebearers of the family Goodeidae occur in central Mexico, and then across a substantial hiatus marked by isolates and fossil occurrences to reappear in California and Nevada as primitive, egg-laying representatives (Parenti, 1981) (northern populations are referred to Empetrichthyidae by Miller and Smith, 1986). Pupfishes (genus *Cyprinodon*) arc from northern Mexico through Arizona to eastern California (Miller, 1981), and Minckley et al. (1986) further suggested examination of possible relationships of western North American *Fundulus* with those of southern and central Mexico (Miller, 1955).

We therefore propose that *Catostomus leopoldi* and *C. cahita* (and likely *C. wigginsi* of the Río Sonora basin) represent relicts or derivatives of an old regional fauna. *Pantosteus plebeius,* on the basis of its vast distribution from the uppermost Rio Grande basin, U.S.A., to the Río Mezquital of Mexico (Smith, 1966; Minckley, 1980c), may also be an old faunal component, and the complex of catostomids represented in the Río Yaqui by *C. bernardini* has a similarly wide distribution from the Bill Williams and Gila basins, U.S.A., to the Río San Lorenzo of Mexico (Miller, 1976; Hendrickson, 1984). Other southwestern freshwater fishes that may be of comparable age include those mentioned in the preceding paragraph, and perhaps some salmonids (*Salmo* spp.).

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