



NOTES ON FRESH WATER FISHES OF THE PACIFIC  
SLOPE OF NORTH AMERICA.\*

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The present paper contains studies of fishes from certain regions of the Pacific Slope, and is based on material in the museums of Leland Stanford Jr. University and the California Academy of Sciences. In its preparation I have been under many obligations to my teachers in ichthyology, Professor Charles H. Gilbert and President David S. Jordan. The paper is divided into four parts, each independent of the others.

I.

ON THE STICKLEBACKS OF CALIFORNIA, WITH SPECIAL  
REFERENCE TO THEIR INDIVIDUAL VARIATIONS.

The Sticklebacks of the Pacific Slope have been described under ten specific names. Of these ten nominal species, four—*Gasterosteus obolarius* Cuvier & Valenciennes, *Gasterosteus insculptus* Richardson, *Gasterosteus serratus* Ayers, and *Gasterosteus intermedius* Girard—have been shown by Jordan and Gilbert to be synonyms of *Gasterosteus cataphractus* (Pallas). Three—*Gasterosteus plebeius* Girard, *Gasterosteus inopinatus* Girard, and *Gasterosteus pugetti* Girard—are likewise known to be synonyms of *Gasterosteus microcephalus* Girard. The other species has been described under the one name only—*Gasterosteus williamsoni* Girard.

The chief character used in distinguishing these three recognized species is the completeness of the lateral armor. This armature consists of a series of vertical

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imbricated plates, which cover the whole side of the body anteriorly, becoming smaller posteriorly and forming a keel on the tail. So far as is known, *Gasterosteus cataphractus* is invariably fully plated from head to caudal fin. This species does not enter the streams. The typical *microcephalus* has the sides partly plated, and *williamsoni* has been described as entirely without plates. Both of these forms are chiefly confined to fresh water. It is of the variations in these two nominal species—*Gasterosteus microcephalus* and *Gasterosteus williamsoni*—that the present paper treats.

It was first noticed that the number of lateral plates in specimens of *Gasterosteus microcephalus* from San Francisco Creek, which empties into San Francisco Bay at Palo Alto, was considerably less than that of specimens from San Gregorio Creek, which flows directly into the ocean on the opposite side of the peninsula. This led me to the inspection of specimens from other localities. In all, over twenty-two hundred specimens, representing thirty-nine localities, have been examined by me. Specimens from localities in the vicinity of Stanford University have been collected by various expeditions of the Department of Zoology. Mr. John M. Stowell collected in the San Miguel and San Luis Obispo creeks, Dr. Charles H. Gilbert and Dr. Wilbur W. Thoburn collected specimens in southern California. The Carmel River Expedition (N. B. Scofield, C. Rutter, A. Seale and C. J. Pierson) obtained specimens from the coastwise streams in the vicinity of Monterey Bay; specimens from Oregon and Washington have been secured by two expeditions of the U. S. Fish Commission; and Mr. E. C. Starks has furnished specimens from the vicinity of Seattle, Washington.

The chief variation is in the number of lateral plates.

When only a few plates are present, I have always found them to be those which join the post-pectoral plate below and the dorsal plates above. The post-pectoral plate, which is never wanting, is a wing of the pubic plate extending up the side behind the pectoral fin. The first plates to disappear are those in front of the caudal keel, the keel being next to go. Several specimens from brackish pools near Ballard, Washington, are an exception to this, the plates of the caudal keel being the only ones absent.

Below is given a table showing the variation in the number of lateral plates in specimens from different localities, the arrangement being in the order of the average number of plates. I here regard the whole series as forming one species, *Gasterosteus williamsoni*, with two varieties or subspecies, *williamsoni* and *microcephalus*, the latter being the prevalent form; the former, or typical form (because earliest known), originally described from near Saugus in Ventura county, Cal., being more local and confined to inland waters.

TABLE SHOWING THE VARIATION IN THE NUMBER OF PLATES  
IN *GASTEROSTEUS WILLIAMSONI*.

The number at the head of each column indicates the number of plates.

LOCALITY.	No. specimens examined	Number of plates																				Average Number			
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		20	Fully	
Santa Ana R., Colton, Cal....	44	43	1																						0
Santa Ana R., Riverside, Cal.	111	104	4	8																					0
Rio Salado, Mexico	3	1	1	1																					2
Santa Clara R., Ventura Co., Cal.	298	76	41	89	67	15																			2
Rio Pajaro, Santa Cruz Co., Cal..	4			1	1	2																			3
San Miguel Cr., San Miguel, Cal.	107	1	1	4		101																			4
La Laguna, Santa Maria R., Santa Barbara Co., Cal.	87	1	1	8	8	33	32	5																	4
Gassus Cr., San Mateo Co., Cal.	129	5		1	5	5																			4
Santa Ynez R., Santa Barbara Co., Cal.....	129				2	35	61	28	3																5
Salinas R., Soledad, Cal...	173				1		170		1		1														5
Adobe Cr., Santa Clara Co., Cal..	115						115																		5
San Luis Cr., San Luis Obispo Co., Cal.....	59			2			55		2																5
Unalaska	5						5																		5
Williamette R., Oregon City, Or.	1						1																		5
San Benito R., San Benito Co., Cal.....	103						100							1		1									5
The Lakes, Williamette R., Albany, Or.....	15				3	11	1																		6
San Francisquito Cr., Palo Alto, Cal.....	176						150		1	2	2	1	7		3	3	1								6
Lakes, vicinity of Seattle, Wash.	19					1	6	8	3	1															7
Carmel R., 25 mi. from mouth.	100					8	63	103	8	1		1				2	1		1						7
McKenzie R., Eugene, Or....	25					1	7	4	5	8															7
Deer Cr., Roseburg, Or..	3								1	2															8
Carmel R. (mouth) Monterey Co., Cal.....	14				1	1	3	6	2						1								2		8

TABLE SHOWING THE VARIATION IN THE NUMBER OF PLATES IN *GASTEROSTEUS WILLIAMSONI*—CONTINUED.

The number at the head of each column indicates the number of plates.

LOCALITY.	No. specimens examined.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Fully	Average Number.....
		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		
Soquel Cr., Santa Cruz Co., Cal.	84	...	...	...	1	1	...	4	2	7	6	3	2	5	...	1	...	1	...	1	...	1	10	
Pajaro R., Watsonville, Cal.	48	...	...	...	3	18	13	...	...	...	...	...	2	...	1	1	1	...	1	...	...	3	10	
Skookemchuck Cr., Chehalis, Wash.	39	...	...	...	...	...	1	11	6	1	...	2	3	1	2	1	...	1	...	1	...	1	9	13
Aptos Creek, Santa Cruz Co., Cal.	2	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1	15
Walla Walla R., Wallula, Wash.	46	...	...	...	1	3	1	3	5	1	...	2	2	2	3	1	3	2	3	4	2	3	15	15
Brackish Pools, Ballard, Wash.	57	...	...	...	...	1	2	2	...	1	...	2	1	2	3	2	1	3	...	...	...	37	20	20
San Gregorio Cr., San Mateo Co., Cal.	47	...	...	...	...	...	...	1	3	...	3	...	3	2	...	1	2	2	1	1	28	20	20	
Scott Creek, Santa Cruz Co., Cal.	11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	Fully	11	Fully
Liddel Cr., Santa Cruz Co., Cal.	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	"	"
San Vicente Cr., Santa Cruz Co., Cal.	41	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	40	"	"
Pescadero Cr., San Mateo Co., Cal.	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	"	"
Wadell Cr., Santa Cruz Co., Cal.	46	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45	"	"
Pillarcitos Cr., Spanishtown, Cal.	100	...	...	...	...	1	1	1	...	1	3	...	1	4	3	2	1	2	1	...	79	"	"	
Klaskanine R., Astoria, Or.	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	"	"
North Umpqua R., Roseburg, Or.	14	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	14	"	"

This table shows a complete gradation in the number of plates from specimens wholly naked to those fully plated. The specimens from the Santa Ana River are almost invariably without any plates. About one-fourth of those from the Santa Clara River in Ventura county are without plates, the others having from one to four. Into this stream flow the brooks of Williamson's Pass, which is the type locality of *Gasterosteus williamsoni*.

The specimens here noted agree with the original description of that species, except in the presence of plates as above noted. The original description was based on eight specimens. Our specimens from the San Miguel Creek have an average of four plates, only one having none. Adobe Creek furnishes 115 specimens, with from four to six plates. None of the 175 specimens from San Francisquito Creek have fewer than four plates, and four specimens are fully plated. The specimens from Walla Walla River range from four plates to a fully plated body, the average number of plates being fifteen. Seventy-nine per cent. of the specimens from Pilarcitos Creek, emptying into Half Moon Bay, are fully plated, but some have as few as six or seven. From several localities the specimens are all fully plated, but it is worthy of note that in such cases we have only a few specimens. Larger collections would doubtless show variation.

Dr. G. A. Boulenger has recorded similar variations in the English Stickleback, *Gasterosteus aculeatus*. The variations described by him were all found in one locality, in practically one haul of the seine. They correspond to those of our specimens from the Walla Walla River (see table).

From a number of measurements, made with as much accuracy as the small size of some of the parts measured would permit, I find that the dorsal and ventral spines become shorter, the prepectoral area becomes slightly smaller, and the pubic plate shorter as the number of lateral plates grows less. There is little variation in the size of the head, the width of the thoracic area or the depth of the body. The proportionate size of the eye varies inversely with the size of the specimen, as usual in fishes. These variations are all such that those found in one locality overlap those found in another, thus form-

ing a perfectly intergrading series from the plateless weak spined *williamsoni* to the fully plated, strongly armed form of *microcephalus*.

Other differences are as follows:

The tail of *microcephalus*, especially the more fully plated form, is somewhat depressed and rather slender. In the Colton and Riverside specimens (true *williamsoni*), the tail is heavy, and it is somewhat compressed, or rounded. However this character shows great individual variation, and the well plated form of *microcephalus* differs as much from the poorly plated form as the latter does from *williamsoni*.

In the well plated forms the tail is provided with a keel on each side. This keel consists of a fleshy basis covered by the lateral plates, which here become keel-shaped. In the poorly plated form and in *williamsoni* the keel is absent.

The sides of the thoracic area are decidedly convex in *williamsoni*, becoming almost straight in the fully plated form of *microcephalus*. The post pectoral plate is heavier and notched in the more completely plated specimens. The pubic plate is more sharply pointed and more firmly attached to the interclavicles when the lateral armor is more complete. The first dorsal plates, those in front of the first dorsal spine, are small or wanting in the naked specimens, becoming larger and more firmly attached as the lateral armature becomes more completely developed.

The specimens of *williamsoni* that I have seen are smaller than the average of *microcephalus*.

There are fully intergrading series in these variations also.

The following is a summary of the points in which variations exist and which may be used in distinguishing the two varieties. The average representative of the

parent form, called *microcephalus*, as compared with the average representative of the derived form, *williamsoni*, has:

1. The sides with more plates.
2. The pre-pectoral area larger.
3. The pubic plate longer and sharper.
4. The caudal peduncle or tail more slender.
5. The dorsal and ventral spines longer.
6. The pelvic girdle more firmly attached to the interclavicles.
7. The post-pectoral plate heavier.
8. The sides of the thoracic area less convex.
9. The first dorsal plates larger and more firmly attached.
10. A larger average size of the adult individual.

The fin rays are: *williamsoni*, dorsal 9 to 12, anal 7 or 8; *microcephalus*, dorsal 10 to 13, anal 7 to 9.

These numerous differences, together with the difference in distribution, necessitate the separation of *microcephalus* and *williamsoni*, but the fact that the differences all intergrade in intermediate territory, gives these forms only subspecific value. As the name *williamsoni* is the older, it must be used as the specific name, while the common or parent form must be recorded as *Gasterosteus williamsoni microcephalus*.

The true *williamsoni*, with the exception of the eight type specimens, is known only from the Santa Ana Basin at Colton, Riverside and San Bernardino. The form called *microcephalus* is known from many streams from Unalaska on the north to the Santa Clara River on the south, where it meets *williamsoni*, the types of *williamsoni* being from a tributary of the Santa Clara.

The variety *microcephalus* shows great variations, but I have been unable to coordinate them with any locality



or stream condition. The most that can be said is that the more fully plated specimens have been taken in small coastwise streams, while the less fully plated ones usually, though not always, have been found farther inland. In general, there is no doubt that the forms having the armature more fully developed are nearer the primitive type. These live near the sea. These facts point to the descent of the species from *Gasterosteus cataphractus*.

The marine species, *Gasterosteus cataphractus*, itself shows little variation. It differs from the well plated form of *microcephalus* in having a more slender and compressed body, longer spines, longer pectorals, larger prepectoral area, more depressed caudal peduncle, and narrower pubic plate and thoracic area. These, again, are all differences of degree, and they point to the recent origin of *microcephalus* and *williamsoni*, brackish and fresh water forms, derived from those strictly marine. In like manner, doubtless, the partly naked fresh water forms of Eastern America and Europe have sprung from the marine species of the same region.

TABLE OF MEASUREMENTS.  
(Specimens selected to show greatest variation.)

	Length of specimen in mm.	Head in length to base of U.	Sp. in length. 2d D.	V. Sp. in length.	Pre-pectoral area in length.	Pubic plate in length.	Pubic plate length + width.	Thoracic area, length + width.	Eye in length.	Depth in length.	Average number of plates from the locality.
Pilarcitos Creek.	45.0	3.00	11.0	7.4	9.4	6.0	2.4	3.0	11.0	3.7	Fully Plated.
	39.3	3.12	7.9	5.5	9.4	5.3	2.8	1.6	11.5	3.8	
	41.4	3.16	8.1	5.7	8.8	6.1	3.0	2.3	11.8	4.1	
	46.6	3.05	9.5	7.1	9.5	6.0	2.1	1.5	11.0	3.7	
	24.5	3.40	6.8	6.0	9.4	6.1	3.8	1.9	9.8	3.6	
San Francisquito Creek.	55.0	3.44	10.0	8.5	10.2	6.0	2.8	1.5	12.0	4.2	Six.
	52.8	3.24	10.6	7.7	8.9	5.8	2.4	1.5	12.0	4.1	
	53.9	3.31	11.7	7.8	8.7	5.7	2.5	1.7	12.5	4.1	
	56.2	3.45	10.0	7.6	9.9	5.8	2.7	1.5	12.3	4.0	
	55.3	3.35	10.4	7.8	9.1	5.8	2.7	1.6	12.0	4.0	
	54.0	3.21	10.6	7.7	8.7	5.7	2.5	1.3	11.5	3.7	
	61.5	3.59	9.6	7.4	9.8	5.3	2.5	1.6	13.4	3.4	
	37.0	3.22	10.6	7.4	9.5	6.9	3.2	2.2	11.6	4.1	
	35.7	3.29	7.3	5.7	9.4	5.9	3.8	2.0	11.5	4.0	
San Miguel Creek.	48.2	3.65	12.0	9.1	9.2	7.8	2.7	2.2	14.5	4.3	Four.
	35.3	3.22	11.4	7.5	8.8	6.8	2.5	2.2	11.0	3.9	
	61.0	3.40	12.7	10.2	9.3	6.9	2.0	1.8	13.4	3.9	
	54.0	3.40	12.0	9.6	10.0	6.4	2.7	1.7	12.3	3.9	
Riverside.	44.3	3.05	15.8	10.8	9.6	7.3	2.3	2.4	12.4	3.8	None.
	40.0	3.03	16.0	13.3	11.1	7.6	2.8	1.7	11.1	4.0	
	37.3	3.01	9.8	9.3	10.6	6.9	2.6	1.6	11.0	4.1	
	43.0	3.33	12.6	9.6	11.3	7.5	2.9	2.4	12.0	4.3	
	44.7	3.08	14.9	14.4	10.2	7.7	2.3	2.0	12.4	4.3	
23.6	3.28	8.7	7.8	9.1	9.1	2.6	1.8	10.7	3.8		
Colton.	36.0	3.00	14.4	10.0	10.7	7.5	3.0	1.5	10.7	3.6	None.
	34.1	3.37	13.6	10.0	11.0	9.7	2.2	2.6	11.8	4.2	
	32.0	3.33	12.8	10.0	10.7	8.8	2.6	1.9	10.7	3.9	
Maxima.	Pilarcitos .....	3.00	6.8	5.5	8.8	5.3	2.1	1.5	9.8	3.6	Fully Plated.
	San Francisquito .....	3.21	7.9	5.7	8.7	5.8	2.4	1.3	11.5	3.4	Six.
	San Miguel .....	3.22	9.2	7.5	8.8	6.4	2.0	1.7	11.0	3.9	Four.
	Riverside .....	3.01	8.7	7.8	9.1	6.9	2.3	1.6	10.7	3.8	None.
	Colton .....	3.00	12.8	10.0	10.7	7.5	2.2	1.5	10.7	3.6	None.

## II.

## THE FISHES OF RIO YAQUI, SONORA, WITH THE DESCRIPTION OF A NEW GENUS OF SILURIDÆ.

This report is based on two small collections of fishes, one of two species made by Dr. Gustav Eisen at Hermosillo, and the other of six species by Mr. William Wightman Price, in the headwaters of Rio Yaqui, in northern Sonora and southern Arizona. The only collections heretofore reported from Sonora were made in San Bernardino Creek by the Mexican Boundary Survey. No species other than those here reported were obtained at that time.

Dr. Eisen obtained his specimens from a tributary of the Rio Sonora, near Hermosillo, the capital of Sonora, while in charge of the exploring expedition sent out by the California Academy of Sciences in 1892. He gives the following notes on the stream in question:

The Sonora River at Hermosillo is a shallow stream, with so little water during the dry season that the stream becomes almost dry. Most of the water is taken out for irrigation above town, leaving the sandy bed dry below. In summer time after heavy rains, however, the water rises quickly and Rio Sonora may then become a torrent of several days' duration. East of Hermosillo the water increases rapidly, and even during the dry season may be several feet deep. The fishes collected were found in pools in the sandy bed, fed by a tiny streamlet in places simply percolating through the sand.

Mr. Price obtained specimens of fishes in 1894 while collecting birds and mammals in the mountains of southern Arizona and northern Sonora. His stations were (1) the Rio Yaqui, east of Oposura; (2) its tributary, San Bernardino Creek, at a point just south of the Arizona

line; (3) Morse Cañon, and (4) Rucker Cañon, small creeks in the Chiricahua Mountains, Arizona, which belong to the Yaqui Basin, although their waters disappear in the sand long before reaching any direct tributary of that stream. Mr. Price says that the region is much elevated, and, except in the mountains, nearly barren. The courses of the streams of Rucker and Morse cañons, and others similar in which he did not collect, can be traced for several miles into the desert, through which the water doubtless flows during freshets, but there is no evidence that it has reached the Yaqui in recent years.

Mr. Price's collection adds the family Siluridæ and the genus *Campostoma* to the list of types found in Pacific waters, this being the most northern record of a fresh water catfish on the Pacific slope, and the first record of *Campostoma* from the west slope. The species has been named *Campostoma pricei* by Jordan & Thoburn, but the species seems to be identical with *Campostoma ornatum* of the Rio Grande basin, an unexpected and curious fact, as the two basins are separated by the continental divide. The basin is more closely connected with that of the Gila, all of the species found in the former, excepting the new catfish and the *Campostoma* being found in the latter.

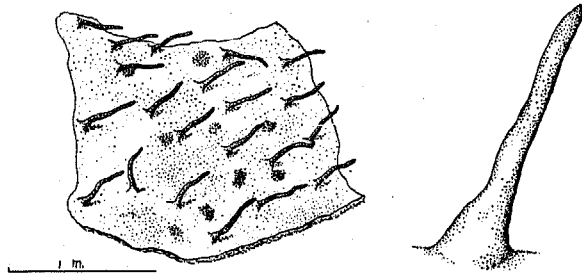
#### Family SILURIDÆ.

**Villarius** Rutter, new genus.

Allied to *Ameiurus*, differing in the presence of scattered cilia on the sides.

Backward process from occipital short, broad, emarginate, connected by ligament with the first interspinal buckler. In adults, the distance between this process and the buckler is equal to the length of the former; in young specimens the process overlaps the keel on the underside of the buckler. Head narrow, width of in-

termaxillary band of teeth  $\frac{1}{3}$  of head. Caudal deeply forked, the upper lobe the longer. Barbels long, those of the maxillary extending past the gill opening. *Sides with scattered hair-like cirri*. These are very noticeable under a lens, but not readily distinguished by the naked eye.



This genus differs from all others of the family in having hair-like cirri on the sides. It differs from *Ictalurus* in having the occipital process and the interspinal buckler widely separated and connected by ligament; from *Am-eiurus* in having a narrow head and a deeply forked caudal.

1. *Villarius pricei* Rutter, new species.

B. 8; D. I, 6; A. 22 to 23; C. 17; P. I, 9; V. 8.

Head  $3\frac{1}{3}$  to  $3\frac{3}{4}$  in body; eye 5 to 7, snout  $2\frac{2}{3}$ , maxillary  $5\frac{1}{2}$  to 6 in head. Maxillary barbel very long, reaching beyond the pectoral spine, in the adult specimen about to its tip when depressed, 3 to 4 times as long as the barbel at nostril. Origin of dorsal midway between snout and middle of base of adipose fin; pectorals inserted halfway between snout and ventrals. Longest dorsal ray six to seven times in length of body; spine of dorsal longer than its base, equal to base of adipose fin. Longest pectoral ray about half of head, pectoral spine  $2\frac{1}{2}$  to 3 in head, with about twelve distinct hooked serræ

behind, these fewer and somewhat smaller in a specimen 17 in. long. Base of anal three times in its distance from snout, its longest rays equal to those of the ventral. Caudal deeply forked. Lateral line present, but rather faint.

This species is closely related to the species described by Bean as *Ameiurus dugesii* (Proc. U. S. Nat. Mus., 1879, 304), differing in having very prominent serrations on the pectoral spines, the types of *dugesii* having the pectoral spines without serræ. I have examined a specimen of *dugesii*, 4 in. long, from Salamanca, Mex., which is in the type basin. It has the cirri minute and light in color, a row of papillæ along the lateral line, and the pectoral spines with four or five degenerate serræ. The process from the occipital is as described above, and Mr. Bean informs me that the types have the sides with hair-like cirri. It, therefore, belongs in the same genus with *pricei* and may stand as *Villarius dugesii*.

This description is based on seven specimens (No. 4826, L. S. Jr. Univ.), 7 to 17½ in. long, from San Bernardino Creek, near the northern border of Sonora, Mexico.

The species is named for the collector, Mr. William Wightman Price.

#### Family CATOSTOMIDÆ.

##### 2. *Catostomus bernardini* Girard.

Several specimens, in poor condition, 2¼ to 3½ in. long, from Rio Yaqui, Sonora.

Head 3½ to 3, depth about 4 to 4½ in length; eye 3⅔ to 4¼ in head, 1½ in snout. D. 11; A. 7. Scales 10 to 12-64 to 73-10 to 12, 26 to 30 before dorsal. Lips very large, about four rows of papillæ on upper, lower incised to base, the lobes rounded.

## Family CYPRINIDÆ.

3. *Campostoma ornatum* Girard. (*Campostoma pricei* Jordan & Thoburn.)

Five specimens,  $1\frac{1}{2}$  to 4 in. long, from Rucker Cañon, Chiricahua Mountains, Ariz.

Head  $3\frac{1}{2}$  to 4 in length; eye  $3\frac{2}{3}$  to  $4\frac{1}{2}$  in head,  $5\frac{1}{3}$  in an adult male; 31 to 35 scales before dorsal [31, 34, 35, 35]. Origin of dorsal midway between nostrils and rudimentary caudal rays. Maxillary extending to below anterior nostril; top of head  $1\frac{1}{2}$  in distance from occiput to dorsal ( $1\frac{1}{4}$  in one specimen).

These specimens are from the exact type locality of the specimen upon which Jordan and Thoburn based their description of *Campostoma pricei* (Fishes of North America, Jordan and Evermann, p. 205), and their type specimen is included in the notes here given. The receipt of more material and its comparison with specimens from Rio Conchas, Chihuahua, Mex., shows the species *pricei* not to be valid. The measurements for the Rio Conchas specimens are: Head  $3\frac{1}{2}$  to  $3\frac{1}{2}$ ; eye  $4\frac{1}{2}$  to 5; scales before dorsal 32 to 39; [32, 33, 36, 37, 37, 38, 39]; origin of dorsal and maxillary as given above; top of head  $1\frac{1}{2}$  in distance from occiput to dorsal,  $1\frac{1}{2}$  in one specimen.

The convolutions of the alimentary canal in these specimens are quite different from those of *Campostoma anomalum*. Instead of having the alimentary canal wound around the air-bladder a number of times, it is folded back and forth antero-posteriorly below and at the side and makes only one fold on top, not going entirely around it at all. The intestines were found to have the same arrangement in a specimen of *Campostoma ornatum* from Rio Conchas, Mexico. In one of our specimens, a female, the alimentary canal was entirely below the air-bladder. In a specimen of *Campostoma anomalum* from Ross Lake,

near Cincinnati, Ohio, the alimentary canal was wound around the air-bladder more than a dozen times, though the ovaries were not thus inclosed.

4. *Leuciscus purpureus* Girard.

One specimen  $1\frac{1}{4}$  inches long from Morse Cañon, and three of the same length from the Yaqui River, east of Oposura, are identified provisionally but very doubtfully with this species. The one from Morse Cañon has the head  $3\frac{1}{2}$ , depth  $3\frac{2}{3}$  in length, eye  $3\frac{1}{2}$  in head, longer than snout. Dorsal 9, anal 7, lat. l. 53. Teeth 1, 4-5, 1. The three from the Yaqui have the following description:

Head  $3\frac{3}{4}$  in length, eye  $3\frac{1}{2}$  in head, a little longer than snout. Dorsal 9, anal 7, lat. l. 70, complete. Teeth 4-4, hooked, with flat or slightly grooved grinding surface. Maxillary about to vertical from anterior margin of eye, slipping under the preorbital, without barbel. Mouth oblique, head pointed, lower jaw included. Dorsal inserted over ventrals; anal deep, pointed. Olive above, silvery below, sides and back finely dusted with black. Lateral band, caudal spot, and a median dorsal line, black.

5. *Agosia chrysogaster* Girard.

Numerous specimens from Rucker Cañon, the largest about three inches long, and one small specimen from Morse Cañon; also three specimens  $1\frac{1}{2}$  inches long from Hermosillo.

Dorsal 8, anal 7. Head  $3\frac{3}{8}$  to 4, depth  $3\frac{3}{4}$  to 4 in length; eye  $3\frac{1}{2}$  to 4 in head, longer than snout in the smaller specimens. Mouth low, terminal, scarcely oblique, the lower jaw included; premaxillaries protractile; maxillary to below nostril in the larger specimens, with barbel at extremity. Teeth 4-4, hooked, with deeply



grooved grinding surface. Scales very small, about 17-70 to 80-14, lateral line incomplete posteriorly. Alimentary canal  $1\frac{1}{4}$  times length of body; peritoneum black. Dorsal inserted behind ventrals, the latter reaching the vent. Anal deep, extending when depressed half way from its hinder margin to caudal.

Color of Hermosillo specimens, in alcohol, a dark median dorsal stripe, a dark lateral band, above which the sides are brown; under parts silvery; sides in and above the lateral band finely dusted with black; a distinct black spot at base of caudal; fins all pale. The specimens collected by Mr. Price have lost their color markings.

#### 6. *Poecilia occidentalis* (Baird & Girard).

Numerous specimens from the Yaqui, east of Oposura, collected by Mr. Price, and from Hermosillo, collected by Dr. Eisen. The following description is based on the latter, those collected by Mr. Price not differing materially. This species, as Mr. Garman has shown, is a true *Poecilia*, not a *Heterandria*:

Dorsal 7 or 8; anal 7; ventral 6. Scales 28-7. Head  $3\frac{2}{3}$  to 4 in length, depth  $3\frac{1}{2}$  to 4. Eye  $3\frac{1}{3}$  in head, equal to or slightly longer than snout, a little less than two times in interorbital width. Teeth in a double crescentric row in each jaw, with a series of minute teeth behind them, not readily appreciable. Origin of dorsal in middle of total length in females, more anterior in males; behind the anal in males, where it is nearer pectorals than caudal, above posterior rays of anal in females. Anal process  $1\frac{1}{2}$  to 2 times head, in some specimens extending to caudal, bent to one side at its extremity with minute serrulations. Adult males have the ventral fins very small and placed almost below the pectorals; the females have them larger and inserted below the tips of the pectorals.

Several specimens, which are doubtless immature males, resemble the females, except in having the anterior rays of the anal somewhat elongate, but not yet developed into a true anal process. Anal basis short, four times in lower side of caudal peduncle.

Color, in alcohol, a dark lateral band usually present on posterior half of body, with a distinct black line through its middle. A black line present on lower side of caudal peduncle. Scales edged with dark. Females otherwise very light, the fins unmarked. Adult males very dark, all fins with dark shadings; young males resembling the females in color.

Of the thirty-three specimens collected by Dr. Eisen, three are adult males and five or six others seem to be immature males. The largest male is 1 inch, the largest female  $1\frac{1}{4}$  inches. The largest collected by Mr. Price are, male  $1\frac{1}{4}$  inches, and female  $2\frac{1}{4}$  inches.

Mr. Price also fished Sabino Cañon, a tributary of the Santa Cruz, of the Gila Basin, obtaining *Leuciscus intermedius* and *Poecilia occidentalis*; and from the Rio San Pedro at Fairbank, Arizona, also in the Gila Basin, he obtained *Pantosteus clarki* and *Agosia chrysogaster*. I have the following note on

*Leuciscus intermedius* (Girard):

Head  $3\frac{1}{3}$  to  $3\frac{3}{4}$ , depth 4 in length; eye equal to snout, 1 to  $1\frac{1}{4}$  in interorbital,  $3\frac{3}{4}$  to 4 in head. Teeth normally 2, 5-4, 2, but 1, 5-4, 1 and 0, 5-4, 1 and 0, 4-4, 0 also found, the tips black in some specimens. Dorsal 8 or 9, anal 7 or 8; scales 17 to 20—64 to 73—7 to 9, lateral line much decurved. Anal fin deep, longest ray twice length of base.

## III.

NOTE ON A COLLECTION OF FISHES MADE IN STREAMS  
NEAR CAPE SAN LUCAS BY DR. GUSTAV EISEN.

A small collection of fishes, consisting of nine species, was obtained by Dr. Gustav Eisen in fresh water streams about Cape San Lucas, in Baja California. The species are all well known, but their occurrence in this region is worthy of record.

1. *Siphostoma starksi* Jordan & Culver.

Numerous specimens of this species from San José del Cabo. They differ somewhat from the types of *Siphostoma starksi* in having a longer body and shorter tail, though there is considerable variation in both lots of specimens.

Head  $10\frac{1}{2}$  to  $10\frac{2}{3}$ ; dorsal 37 to 39; pectoral 13. Head  $3\frac{3}{4}$  to 4 in distance from snout to vent; head and body  $1\frac{3}{4}$  to  $1\frac{1}{2}$  in tail; snout  $2\frac{1}{2}$  to  $2\frac{3}{8}$  in head. Two lateral keels on body, the upper ceasing and the lower curving upward under posterior part of dorsal, as in the types. Dorsal beginning over, or in some specimens, one segment behind vent. Color quite dark, a rather regular series of light-colored dots along sides; middle rays of caudal black, outer with irregular blotches.

2. *Agonostomus nasutus* (Günther).

One specimen,  $4\frac{1}{4}$  inches long, from San José del Cabo. It agrees in all essential characters with the original description, which was based on a specimen  $8\frac{1}{2}$  inches long from the Rio San Geronimo in Guatemala. The eye, however, is  $3\frac{1}{2}$  in head,  $4\frac{1}{8}$  in an 8-inch specimen from Mazatlan, instead of 5; the caudal is emarginate, the middle rays  $\frac{2}{3}$  length of outer. The soft dorsal is not so high as the spinous dorsal and is as high as the anal, in-

stead of being higher than the spinous dorsal and lower than the anal.

Head  $3\frac{4}{5}$ , depth  $3\frac{2}{5}$  in length; dorsal IV-I, 8; anal II, 10. Of specimens from Mazatlan, some have the anal II, 10, and some III, 9. The lateral line is faintly indicated; scales 6-44-6, 19 before dorsal, extending forward to anterior margin of pupil. Preorbital serrate on lower edge, the serræ not evident on larger specimens from Mazatlan. Pectoral  $1\frac{2}{5}$  in head, not quite equal to distance from nostril to margin of opercle. All fins, except the spinous dorsal, have scales on the basal part, and it has an elongate accessory scale on each side. The fourth spine of the dorsal is weak.

3. *Mugil albula* Linnæus. LA LIZA.

Two specimens, 9 in. long, from fresh water at San José del Cabo. Head 4 in length. Scales 38 and 39. Dorsal and anal scaled on anterior rays only.

4. *Mugil curema* Cuvier & Valenciennes. TRUCHA:  
LIZA.

Numerous specimens,  $1\frac{1}{2}$  to 8 in. long, from La Paz, and from Rio San José, San José del Cabo. This and the preceding are marine species, although frequently ascending rivers.

5. *Eucinostomus californiensis* (Gill). LA MAJARRA.

One specimen,  $4\frac{1}{2}$  in. long, from fresh water at San José del Cabo. It agrees with specimens from Panama.

Dorsal VIII, 9, its longest spine about  $1\frac{3}{4}$  in head; eye  $2\frac{4}{7}$  in head, longer than snout.

6. *Philypnus lateralis* Gill.

One specimen,  $3\frac{1}{2}$  in. long, from fresh water at San José del Cabo.

Dorsal VI-I, 9; anal I, 11.

7. *Dormitator maculatus* (Bloch.) PARGETA, LA PAJEQUE.

Nine specimens,  $2\frac{1}{4}$  to  $4\frac{1}{4}$  in. long, from Rio San José, San José del Cabo.

Head  $3\frac{1}{3}$ , depth  $3\frac{1}{2}$  in length. Dorsal VII-I, 8; anal I, 9. According to Dr. Eisen, the spot in front of the pectoral is blue in life.

8. *Eleotris pictus* (Kner & Steindachner). (*Eleotris æquidens* Jordan & Gilbert.)

Eight specimens, 3 to 14 in. long, from fresh water at San José del Cabo. They agree with the original description by Jordan & Gilbert, except in minor details.

Head 3 to  $3\frac{1}{3}$  in length; maxillary  $2\frac{1}{2}$  to  $2\frac{3}{4}$  in head; scales 61 to 68, 25 or 26 in an oblique series downward and backward from the origin of the dorsal. Eye 2 to  $2\frac{3}{4}$  in interorbital width, the latter in a specimen 14 in. long. No conspicuous knobs at upper anterior and posterior margins of orbit; if such were conspicuous in the types, they were probably due to shrivelling. Preopercular spine covered by the skin.

Dr. Gilbert informs me that *Eleotris æquidens*, of which species he has specimens from Panama, is identical with the form earlier known as *Eleotris pictus*.

9. *Awaous tajasica* (Lichtenstein). LA PUJEQUE, MUCHURA.

Six specimens,  $2\frac{1}{4}$  to  $3\frac{1}{2}$  in. long, from Rio San José, San José del Cabo.

Dorsal VI-I, 10, the first ray of the second dorsal being unsegmented; eye  $4\frac{1}{2}$  to 5 in head. The anterior profile of the head is much curved, as is the case with smaller specimens from Mazatlan.

10. *Spheroides annulatus* (Jenyns).

Five specimens, 3 to  $3\frac{1}{2}$  in. long, from La Paz. The bar at base of pectoral is indistinct, and there is a pale edging at tip of caudal.

## IV.

DESCRIPTION OF A NEW SPECIES OF CHARACODON FROM  
TEPIC, MEXICO.*Characodon eiseni* Rutter, new species.

Head  $3\frac{1}{2}$ ; depth  $3\frac{1}{4}$ ; eye 3. Dorsal 11 to 13; anal 13; scales 30 to 32, 12. Snout shorter than eye, lower jaw projecting. About nine teeth in upper jaw and about 14 in lower. Teeth strongly bicuspid, the villiform teeth not developed. Mouth almost vertical when closed, mandible about half length of eye. Interorbital space flat, the anterior part equal to orbit, wider posteriorly. Insertion of dorsal in middle of total length; anal inserted under 4th ray of dorsal. Pectoral reaching past insertion of ventral. Tips of depressed dorsal and anal in vertical through middle of caudal peduncle. Caudal broad, truncate, length of middle rays equal to length of top of caudal peduncle. Head about  $\frac{1}{4}$  of total; greatest depth of body above ventrals. Depth of caudal peduncle  $\frac{1}{2}$  its length. Color, in alcohol: Male with a broad indefinite lateral band; female with dark blotches on sides which in one of three specimens form distinct cross-bands.

This species is most closely related to *Characodon variatus* Bean, which is found in the headwaters of the same basin. It differs from that species in having fewer rays and scales, much fewer teeth, larger eye, much more posterior position of dorsal, and in color.

This description is based on four specimens (No. 4999,

L. S. Jr. Univ. Mus.), the largest  $1\frac{1}{4}$  inches long, from a branch of the Rio Grande de Santiago at Tepic, Mexico.

The species is named for Dr. Gustav Eisen, who collected it with the following species in 1894:

*Pæcilia occidentalis* (Baird & Girard).

Numerous specimens of this species were taken with the above. They do not differ from specimens from Hermosillo.