

*A new species of killifish
(Pisces, Cyprinodontidae)
from the Chilean Altiplano*

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ABSTRACT

A new species of Cyprinodontidae, *Orestias chungarensis* n. sp. is described from Lake Chungará in the Chilean altiplanic region. It is a slender fish with greyish flanks fading to white on the belly and with dark brown vertical bands. It shows big eyes and a small protractile mouth with upturned lower jaws. The pectoral fins are small. All fins have a reduced number of rays. It lives closely associated with the plant *Myriophyllum elatinoides* in the littoral shallow areas of the western part of the lake where it mainly predaes on *Amphipoda* and *Chironomidae*. Morphologically *O. chungarensis* is closely related to *O. gracilis*.

KEY WORDS : Cyprinodontidae — *Orestias* — Lake Chungará — Altiplanic region.

RÉSUMÉ

DESCRIPTION D'UNE NOUVELLE ESPÈCE DE POISSON DE L'ALTIPLANO CHILIEN (PISCES, CYPRINODONTINAE)

Ce travail décrit *Orestia chungarensis* n. sp., un poisson Cyprinodontidae du lac Chungará (Altiplano chilien). *O. chungarensis* n. sp. est élancé à flancs gris et ventre blanc avec des bandes verticales marron sombre. Il est caractérisé par ses grands yeux, sa bouche petite et protractile, ses mandibules dirigées vers le haut et ses nageoires pectorales petites comportant peu de rayons. Il vit dans les herbiers de *Myriophyllum elatinoides* des zones littorales peu profondes de la partie ouest du lac. Il se nourrit principalement d'*Amphipodes* et de *Chironomidae*. Par ses caractéristiques morphologiques, *O. chungarensis* ressemble à *O. gracilis*.

MOTS-CLÉS : Cyprinodontidae — *Orestias* — Lac Chungará — Altiplano chilien.

RESUMEN

UNA NUEVA ESPECIE DE PEZ DEL ALTIPLANO CHILENO (PISCES, CYPRINODONTINAE)

Se describe *Orestias chungarensis* n. sp. un pez Cyprinodontidae del lago Chungará en la región altiplánica chilena. *O. chungarensis* n. sp. es esbelto de color gris en los flancos y blanco en el vientre, con bandas verticales café oscuro. Se distingue por sus grandes ojos, boca pequeña y protractil, mandíbulas inferiores dirigidas hacia arriba y aletas pectorales pequeñas, todas con un número bajo de rayos. Vive asociada con la planta *Myriophyllum elatinoides*, en áreas litorales de poca profundidad en la zona oeste del lago, donde depreda principalmente *Amphipoda* y *Chironomidae*. Por sus características morfológicas, *O. chungarensis* se asemeja a *O. gracilis*.

PALABRAS CLAVES : Cyprinodontidae — *Orestias* — Lago Chungará — Altiplano chileno.

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INTRODUCTION

The high Andean plateau, known as the altiplano or puna, situated between the eastern and western slopes of the Andes extends from the Ancash province in northern Perú to the Antofagasta province in northern Chile. In spite of the diverse tropical fish fauna, the endemic fish genera of the high Andes hydrographic basins exhibit low diversification. Presently, three genera of fishes have been described for the peruvian and bolivian altiplano: *Orestias*, *Trichomycterus* and *Astroblepus*. Only *Orestias* and *Trichomycterus* have been found in the chilean altiplano (EIGENMANN, 1927; MANN, 1954; DE BUEN, 1958; ARRATIA, 1976, 1981, 1982, 1983 and PARENTI, 1984).

Orestias has been thoroughly studied in the Titicaca basin and the available evidence indicates that it has undergone a process of high speciation. Forty species of *Orestias* have been so far described from that region (TCHERNAVIN, 1944; LAUZANNE, 1981 and 1982; PARENTI, 1984).

The available information indicates that *Orestias agassii* Valenciennes is present in some of the swampy grounds "bofedales" and streams of the chilean altiplanic region (EIGENMANN, 1927; EIGENMANN and ALLEN, 1942; MANN, 1954). Two other *Orestias* species, *O. parinacotensis* from Parinacota ponds and *O. laucaensis* from the Lauca river, have been described by ARRATIA (1982).

In this paper a new species of *Orestias* from the littoral area of Lake Chungará is described. Interestingly it is the first fish described from this lake. Lake Chungará ($18^{\circ}13' S-69^{\circ}18' W$) situated at 4518 m of altitude in the chilean altiplano, with a surface 2 700 km² (KLÖHN, 1972) is considered to be the largest lentic ecosystem of the Lauca hydrographic basin. In the absence of commercial fisheries, its fish fauna has not yet been studied. Considering the high speciation undergone by *Orestias* of the Titicaca basin (PARENTI, *op. cit.*) it may be expected that such process might also has happened with *Orestias* from the chilean altiplanic waters.

MATERIAL AND METHODS

The metric and meristic characteristics of 40 specimens, were examined using the methodology described by LAUZANNE 1981 (Fig. 1).

The gill-rakers of the left gill-arches I to V were studied in 15 specimens stained with alizarine, and the total number of vertebrae were also counted.

Orestias chungarensis n. sp.

Holotype: A female specimen of 67 mm of standard length originating from the western littoral region

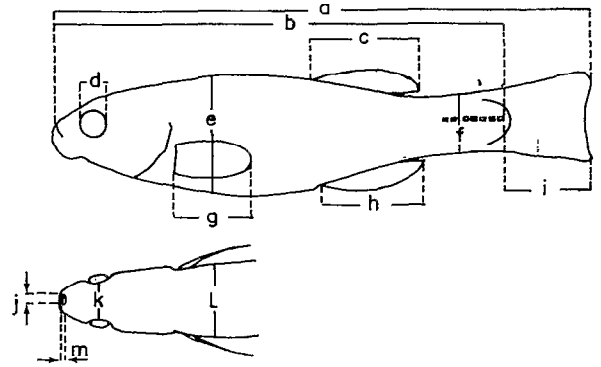


FIG. 1. — Measurements done in all the specimens (after LAUZANNE 1982).

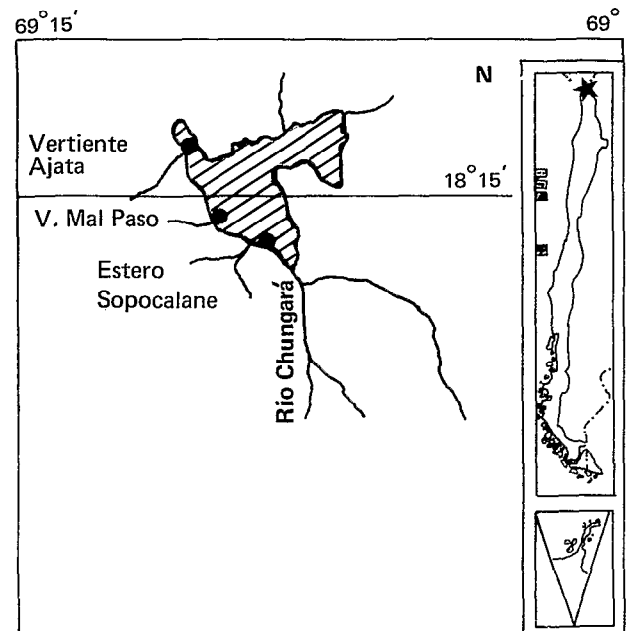


FIG. 2. — Lake Chungará, Chile (Circles indicate the area where *O. chungarensis* was captured).

of Lake Chungará, Chile, collected during May 1986 (Fig. 2) and deposited at the National Museum of Natural History, Santiago, Chile.

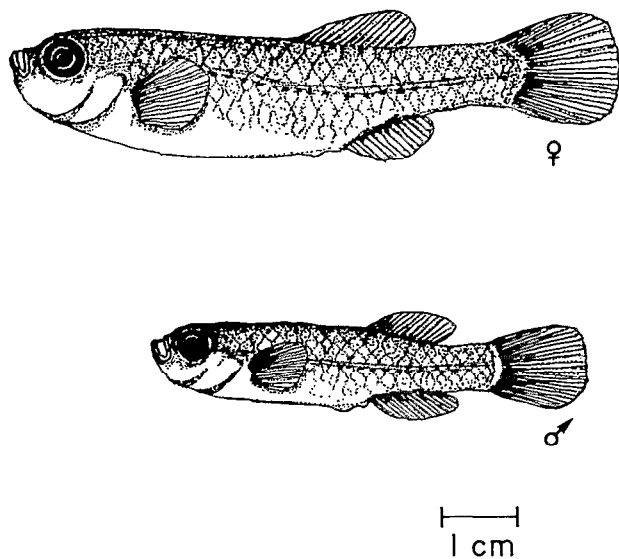
Number: 11 210 (Fig. 3).

Paratypes: 10 males (28 to 40 mm SL) and 10 females (25 to 60 mm SL).

Number: 11 211. Same data as the holotype.

DIAGNOSIS

Dorsally the body is slightly curved in females and straight in males. Pale greyish flanks turning

FIG. 3. — *Orestias chungarensis* n. sp.

white ventrally. Bands of dark brown melanophores at both sides and at base of dorsal and caudal fins. Orbits project above the dorsal profile of the head. Small protractile mouth with upturning lower jaws. The vertical cleft reaches the inferior border of the orbit. Incisiform jaw teeth in one irregular line.

Thin cycloid scales with circular striae cover the entire dorsal and lateral surfaces and the base of dorsal and anal fins. Belly, chest and isthmus scaleless. One regular row of big scales on the dorsal ridge and large thick, smooth scales on the anterior part of the head. The number of midlateral scales is 35. Males with midlateral scales having two anterior ctenii and with ventral and dorsal fins bearing a spined tubercle. Females with a large anal pouch. Branchial arches I to V with 128 simple and short gill-rakers. 13 dorsal fin rays. Small and rounded pectoral fins with 14 rays. Caudal fin truncated with 26 rays.

DESCRIPTION

Orestias chungarensis is a slender and elongated fish. Females have a dorsal profile that gently raises from the tip of the snout to the anterior base of the dorsal fin. Males have a straight dorsal profile. Head moderately long, reaching from 22,4 % to 29,6 % of the standard length. Small and slightly protractile mouth with an irregular row of unicuspid teeth barely protruding out of the upper and lower jaw epithelium. In the smaller specimens orbits project above the primary dorsal profile of the head.

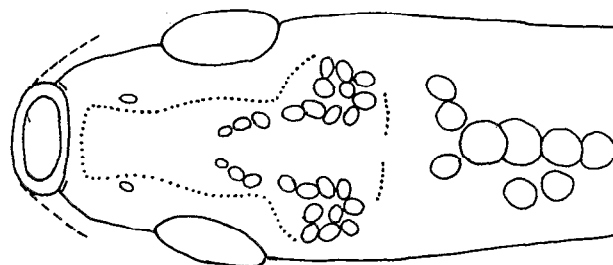


FIG. 4. — Dorsal view of neuromast pattern and squamation.

The head pores or neuromasts, show the typical lyre pattern described for the genus (Fig. 4). *O. chungarensis* exhibits limited changes of color patterns during ontogeny. No sexual dimorphism in color has been observed. All specimens exhibit prominent bands of dark melanophores laterally and at the base of the caudal fin. The grey color of the dorsal and lateral body sides fades out to a whitish tint on the belly and chest. Dorsal, pectoral and anal fins are relatively small, with a reduced number of rays. The most peculiar feature of *O. chungarensis* is the small size of the pectoral fin and the low number of pectoral fin rays. The truncated caudal fin represents about 25 % of the standard length.

The distribution of scales is bilaterally symmetrical and the lateral ones begin at the posttemporal region arranged in 10 rows increasing to 15-16 on the caudal peduncle. The largest scales are seen on the midlateral zone and their size progressively diminishes towards the posterior dorsal and ventral regions. Striae and sclerites are easily visualized in all the scales. The middorsal line scales are larger and thicker and form a ridge. Scales are present at both sides of the dorsal ridge. The dorsal surface of the head is irregularly covered with small scales having a few concentric striae (Fig. 4). The ventral body surface and the operculum lack scales. The average number of lateral scales is 35. In the males they bear two oblique ctenii that project outwards (Fig. 5). Males also have breeding spiny tubercles distributed along the rays of the dorsal and anal fins.

The branchial apparatus is short and triangular with smaller number of teeth in the anterior dorsal gill arches. The third and fourth pharyngobranchial tooth plates and the fifth ceratobranchials have molariform teeth. The latter show curved tips. The number of gill-rakers in the branchial arches I to V increases with the standard length (Table III) and range from 81 to 128 (Fig. 6). *Orestias chungarensis* has a deep caudal peduncle that reaches 12,8-17,8 of the standard length. The number of vertebrae, counted on ten specimens stained with alizarine, was 32.

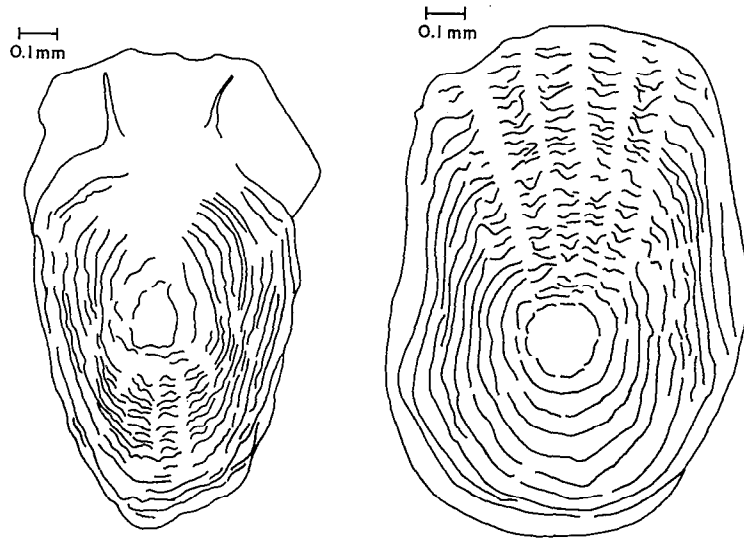


FIG. 5. — Female (right) and male (left) scales of *O. chungarensis* n. sp.



FIG. 6. — Left side branchial apparatus of *O. chungarensis* (X 15).

The paired testes are fused and in mature specimens the length may be twice the body length.

O. chungarensis has been collected along the shallow western littoral of Lake Cungará, in close association with *Myriophyllum elatinoides*. The fish is a micropredator that mainly feeds on crustaceans of the genus *Hyalella* and Chironomidae larvae. Although *O. parinacolensis*, Arratia and *O. laucaensis*, Arratia inhabit nearby swamps and streams they markedly differ from *O. chungarensis*. Thus, the latter two species have an irregular pattern of squamation, two to three conic jaw teeth rows and a rounded caudal fin. The number of caudal fin rays of *O. parinacolensis* and *O. laucaensis* is higher, ranging from 35 to 41. The number of gill rakers is also different for the last two species, and it varies from 103 to 118 in the branchial arches I to IV. The size and position of the eyes, the complete and regular pattern of squamation and the general morphological characteristics of *O. chungarensis* place it close to *O. gracilis*.

Details on the morphometric and meristic characteristics are summarized in tables I and II.

Metric characteristics

The first number represents the holotype and number in parenthesis indicates the range of the measured specimens.

Standard length percentage (a)	
Head length (b)	27,7 (22,4-29,6)
Body height (f)	23,4 (20,4-25,4)
Body width (g)	17,0 (15,2-21,7)

TABLE I

Frequencies of metric references calculated for 40 *O. chungarensis* measured.

	%	b/a	f/a	g/a	h/a	i/a	j/a	$\frac{al-a}{a}$	o/b	p/b	q/b	e/d
15-15,9				1		10						
16				4		14		1				
17				11	1	8	3	3				
18				11	2	1	1	5	1			
19				7	3		1	3				
20			2	4	3		1	3			1	
21			2	1	7		7	5				
22	1		9	1	8		7	7				
23	2		10		2		1	5			2	
24	2		14		9		12	3				
25	1		3		1			2			3	
26	10				3		3	1			6	
27	12				1		3					
28	3						1		1	1	5	
29	9											
30											8	
31									1	2		
33									5	7	6	
34												1
35									6	4		
36									3	4	5	
37									2	2		
38									6	4	1	
39												
40									3	4	3	2
41									2	4		1
42									2	1		
43									1			2
44									2	2		1
45									2	2		7
46										2	6	
47												2
48												3
49												
50									3	1		8
51												2
52												2
53												1
54									3			1
55												
56.9												1

Ventral caudal peduncle length (h) 19,1 (17,7-27,3)
 Small height of the caudal peduncle (i) 12,8 (12,8-17,8)
 Dorsal caudal peduncle length (j) 21,2 (17,7-28,1)
 Caudal length (l) $\frac{(al-a)}{a}$ 25,2 (13,0-26,2)
 Head length percentage (b)
 Head width (n) 61,5 (52,9-81,8)
 Interorbital space (o) 38,5 (28,6-54,5)
 Mouth length (p) 38,5 (28,6-53,8)
 Mouth height (r) 53,8 (40,0-63,6)
 Eye diameter (q) 30,8 (20,8-40,0)

Anal length (l) 100,0 (85,7-107,2)
 Pectoral length (m) 80,7 (60,1-90,5)

Meristic characteristics

Number of fin rays
 Caudal rays 30 (29-32)
 Anal rays 13 (11-14)
 Dorsal rays 13 (11-14)
 Pectoral rays 16 (16-18)

Number of gill rakers (exterior (ext) and interior (int) gill rakers of branchial arches I to V)

		exterior	interior
Distance percentage: mouth tip to the anterior anal base (d)		I 9- 15	10-17
Mouth tip — pectoral superior base (e)	54,2 (34,3-56,8)	II 10- 16	10-16
Mouth tip — dorsal anterior base (c)	90,0 (80,6-97,4)	III 10- 15	9-15
Dorsal length percentage (k)		IV 8- 14	8-14
		V 7- 12	
		Total 81-128	

TABLE II
Frequencies of metric references calculated for 40 *O. chungarensis* measured.

%	n/b	r/b	c/d	e/k	m/k	%	n/b	r/b	c/d	e/k	m/k
40.9		2				81.9	1		3		1
41		3				82			1		
42		2				83			2		3
43		2				84					
44						85		4		1	
45						86		2		2	
46		5				87		3		1	
47		1				88		4			
48						89		1			
49						90		7		2	1
50		10				91		4		4	
51						92		1		5	
52	1	1				93		2		2	
53		4				94					1
54		3				95		2			
55	1	2				96		2			
56	1					97		1			
57	2					98					
58	4					99					
59						100				10	
60	4	2				..					
61	2	1			1	107.9				2	
62	2										
63	1	2									
64	3				1						
65					1						
66	7				7						
67											
68	4										
69	3				3						
70	2				2						
71	1				2						
72	2				2						
73					1						
74											
75					4						
76	1				5						
77											
78					3						
79	1										
80.9			1		4						

TABLE III
Exterior and interior gill-rakers of branchial arches I to IV of *Orestias chungarensis*.

S.L. (mm)	I		II		III		IV		V		Total
	E	I	E	I	E	I	E	I	E	I	
28	9	10	10	10	10	9	8	8	7		81
33	14	13	12	12	13	13	12	10	8		107
33	13	12	13	12	13	13	12	10	8		106
35	14	13	13	12	11	10	8	9	8		98
35	13	14	13	14	12	12	10	11	9		108
35	13	14	16	14	12	13	10	10	9		111
35	13	13	14	13	13	13	13	11	10		112
42	13	13	12	12	13	13	13	12	12		113
44	15	15	14	13	14	13	13	11	9		118
44	15	14	16	15	15	15	13	13	12		127
45	13	13	14	13	11	11	11	11	9		105
46	13	15	14	14	13	12	11	12	12		116
47	14	15	15	16	15	14	14	14	10		127
56	15	17	15	15	15	13	14	12	12		128
58	14	15	15	16	15	15	13	13	12		128

DISCUSSION

RINGUELET (1975) classified the South American Continent in two subregions named Brazilian and Austral. The high-altitude plateau between the eastern and western slopes of the central and south Andes forms the altiplanic region and has been included by this author in the biogeographic Province Titicacence of the Austral subregion.

The hydrographic basins of the altiplanic region are mostly endorheic and their waters have a notorious high salinity. They also have remarkable ecologically different biotopes ranging from extensive swampy areas, fast and low running streams to deep lakes as is the case of Chungará Lake in the Chilean altiplano. They have remained isolated since the last Andean elevation during the Miocene.

The geographic isolation concomitantly with the habitat diversity have influenced the high speciation process undergone by the genus *Orestias* described for Bolivia and Perú.

Since the establishment of this genus by VALENCIENNES in 1846 when he described ten species, 43 species have been recognized (PARENTI, 1984) for

the Titicaca basin. The largest number of *Orestias* species have been found in Titicaca Lake.

The Chilean altiplanic region has 33 hydrographic basins (MONTTI and HENRIQUEZ, 1979) and their fish fauna have been studied only partially and only three species of *Orestias* have been described recently.

PARENTI (1984) affirms that *Orestias* have no resemblance to other South American fishes. Considering the isolation of the southern altiplano it is of a high zoogeographic importance to study speciation in these ecosystems, and it is also of ecological importance to study the adaptations of fish to high irradiance, lower atmospheric pressure and drastic daily difference in temperature.

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