

## A REVISION OF THE RAINBOWFISH GENUS *CHILATHERINA* (MELANOTAENIIDAE)

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### ABSTRACT

The six species of *Chilatherina*, family Melanotaeniidae, are reviewed. The genus inhabits freshwater streams of northern New Guinea between the Markham and Mamberamo Rivers and also the central highlands of Papua New Guinea. The habitat consists mainly of exposed, sunlit sections of tributary streams, although two species have lacustrine populations. A brief diagnosis, illustrations, and tables of counts are presented for each of the following species (approximate distributions indicated in parentheses): *C. axelrodi* (Pual River system); *C. campsi* (Markham River system and head-water streams of Sepik and Purari River systems); *C. crassispinosa* (widespread northern New Guinea); *C. fasciata* (widespread northern New Guinea); *C. lorentzi* (Tawarin River, Irian Jaya); *C. sentaniensis* (Lake Sentani, Irian Jaya). A generic diagnosis and key to the species are also provided.

### INTRODUCTION

The freshwater rainbowfishes (Melanotaeniidae) of Australia and New Guinea have received relatively little attention since the major works of Weber (1908), Regan (1914), and Weber and De Beaufort (1922). Aside from brief reviews of the Australian and New Guinea species by Munro (1958 and 1964, respectively) nothing of great significance has been published in the last several decades. The main reason for the lack of recent activity is the remote nature of the rainbowfish habitat. Most of the species inhabit the New Guinea interior, much of which remains unexplored even today, particularly the western half now known as Irian Jaya. The present author initiated a study of melanotaeniid taxonomy in 1974 and since that time has conducted six major fieldtrips to northern Australia and Papua New Guinea. This work has resulted in the discovery of 13 new species and a far better understanding of the biology and taxonomy of rainbowfishes. Seven genera were recognized in my recent review of taxonomic relationships within the family (see Allen 1980a).

The genus *Chilatherina* Regan is revised in the present paper. The only previous reviews of this genus are those of Regan (1914) and Weber and De Beaufort (1922). Two species were recognized in both of these works, *C. fasciata* (Weber) and *C. sentaniensis* (Weber). Munro (1964) gave a brief synopsis of generic characters and showed that *Anisocentrus campsi* Whitley

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also belonged to *Chilatherina*. He placed *C. fasciata* in the synonymy of *C. lorentzi* (Weber) a species originally described as a *Rhombatractus* Weber (= *Melanotaenia*). The present study reveals that *C. fasciata* and *C. lorentzi* are distinct. Allen (1980a) expanded the genus to encompass *C. crassispinosa* (Weber), a species previously assigned to the monotypic *Centratharina* Regan. The sixth member of the genus, *C. axelrodi* was described by Allen (1980b).

The genus is restricted primarily to northern New Guinea (see map) between the Markham and Mamberamo Rivers. The only exception is *C. campsi* which occurs in mountainous terrain on both sides of the central dividing range. *Chilatherina* are relatively small fishes, seldom exceeding 100 mm SL. They generally inhabit streams and small creeks although at least two species, *C. fasciata* and *C. sentaniensis*, have lacustrine populations. In stream habitats they frequent shallow pools usually where the flow is relatively gentle, although *C. crassispinosa* is sometimes found in steep gradient situations. Typically these fishes prefer sections of the stream which afford maximum exposure to sunlight. The substratum generally consists of gravel or sand, frequently littered with leaves or log debris. Food items include filamentous algae, small crustacea, terrestrial insects such as ants and beetles, and various aquatic insect larvae. Sexual maturation occurs in most species at a relatively small size, usually about 35-40 mm SL in females and 45-55 mm SL in males. Gravid females deposit several eggs each day which adhere to aquatic vegetation by means of a thread-like filament. Hatching occurs in about 15 days at 22°-24°C. The fry grow rapidly and may attain sexual maturity by the end of their first year.

During the present study *Chilatherina* were observed and collected in the field at Papua New Guinea in tributary streams of the Markham, Ramu, Sepik, and Pual Rivers. In addition, *Chilatherina campsi* was taken from the Upper Purari system of the Central Highlands. Specimens were also examined from the following institutions (abbreviations in parentheses are used in the subsequent text): American Museum of Natural History, New York (AMNH); Australian Museum, Sydney (AMS); Museum National d'Histoire Naturelle, Paris (MNHN); Kanudi Fisheries Research Laboratory, Port Moresby, Papua New Guinea (PNG); Rijksmuseum van Natuurlijke Historie (RMNH); U.S. National Museum of Natural History, Washington, D.C. (USNM); Western Australian Museum, Perth (WAM); and Zoologisch Museum, Amsterdam (ZMA). Lectotypes deposited at ZMA which are listed under the material examined sections were designated by Hoedeman (1960).

Proportions appearing in the text are expressed as percentage of the standard length unless stated otherwise. Selected fin-ray and scale counts are summarized in Tables 1-4.

Standard length (SL) is taken from the most anterior point of the upper lip to the midbase of the caudal fin (end of hypural plate). Head length is measured from the front of the upper lip to the end of the opercular membrane. The depth of the body is the maximum depth from the base of the

first dorsal fin. The diameter of the eye is the horizontal fleshy diameter. The interorbital width is the bony width. The depth of the caudal peduncle is the least depth. The length of the caudal peduncle is the horizontal measurement connecting two vertical lines, one passing through the base of the last dorsal ray and the other through the base of the middle caudal rays.

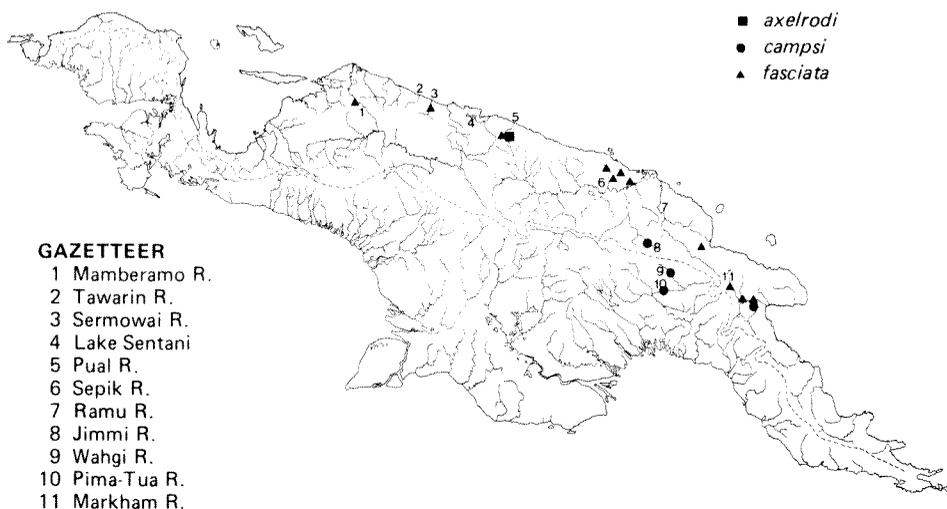


Fig. 1: Distribution of *Chilatherina axelrodi*, *C. campsi*, and *C. fasciata*. The gazetteer includes major river systems and lakes mentioned in the text.

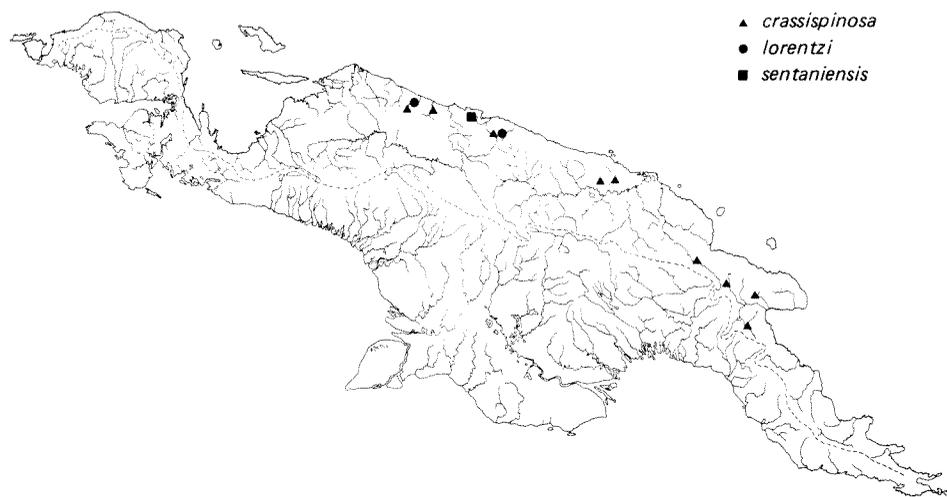


Fig. 2: Distribution of *Chilatherina crassispinosa*, *C. lorentzi*, and *C. sentaniensis*.

REVISION OF *CHILATHERINA*

Predorsal, preanal, and prepelvic distances are measured from the snout tip to the base of the spine at the origins of the first dorsal, anal, and pelvic fins respectively. Horizontal scale rows are counted from the anus to the base of the first dorsal fin. Vertical scale rows are counted along the side from the scale immediately above the upper edge of the gill opening to the middle of the caudal fin base. Predorsal scales are counted on the dorsal mid-line between the origin of the first dorsal fin and the interorbital. Preopercle scale counts refer to the total number of scales overlying the preopercle bone. Pectoral ray counts include the tiny, rudimentary lowermost rays. Gill-raker counts include rudiments; the raker at the angle was incorporated into the lower-limb count.

TABLE 1  
Dorsal fin-ray counts for species of *Chilatherina*.

	First dorsal spines					Second dorsal soft rays									
	IV	V	VI	VII	VIII	8	9	10	11	12	13	14	15	16	
<i>axelrodi</i>		3	30	3					15	18	3				
<i>campsi</i>		8	18	3	2					1	13	9	6	1	
<i>crassispinosa</i>	4	13	3			2	5	6	6	1					
<i>fasciata</i>	6	44	17	1					2	16	30	13	4	1	
<i>lorentzi</i>	4	18	8							2	17	8	4		
<i>sentaniensis</i>	14	25	1				3	21	4	1					

TABLE 2  
Anal and pectoral fin-ray counts for species of *Chilatherina*.

	Anal soft rays										Pectoral rays						
	19	20	21	22	23	24	25	26	27	28	29	30	12	13	14	15	16
<i>axelrodi</i>	2	1	12	13	6	2							4	28	4		
<i>campsi</i>			6	7	10	4	1	2					5	20	5		
<i>crassispinosa</i>	1	3	3	5	7	1								4	15	1	
<i>fasciata</i>			1	5	8	22	12	7	2	2				13	32	3	
<i>lorentzi</i>							1	5	10	8	4	2		16	15		
<i>sentaniensis</i>			3	10	16	7	3	1						7	31	2	

TABLE 3  
Predorsal scale counts for species of *Chilatherina*.

	No. of predorsal scales										
	16	17	18	19	20	21	22	23	24	25	
<i>axelrodi</i>		5	10	2	1						
<i>campsi</i>			3	6	4	6	4	2	2		
<i>crassispinosa</i>						6	7	7			
<i>fasciata</i>				6	18	11	11	8	1		
<i>lorentzi</i>			10	14	4	2					
<i>sentaniensis</i>					1	4	10	14	6	3	1

TABLE 4  
Preopercle-suborbital scale counts for species of *Chilatherina*.

	No. of preopercle-suborbital scales															
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
<i>axelrodi</i>				2	1	1	3	6	2	1	2	3				
<i>campsi</i>	1		1	3	3	4	3	8	2	1						
<i>crassispinosa</i>						1	3	5	1	5	4	1				
<i>fasciata</i>			2		4	1	5	14	14	13	4	3	1			
<i>lorentzi</i>							1	3	2	3	7	4	2	1	2	1
<i>sentaniensis</i>				6	14	5	4	4	3							

## SYSTEMATICS

### Genus *Chilatherina*

*Chilatherina* Regan, 1914: 282 (type-species, *Rhombatractus fasciatus* Weber, 1913, by subsequent designation of Jordan and Hubbs, 1919: 22).

*Centratherina* Regan, 1914: 283 (type-species, *Rhombatractus crassispinosus* Weber, 1913, by original designation).

### Diagnosis

Oblong, laterally compressed body; body depth generally increasing with age, particularly in males; greatest body depth 2.3 to 5.4 in standard length; premaxillaries more or less straight, without abrupt bend between the anterior horizontal portion and lateral part; jaw teeth conical to caniniform, several rows extending outside of mouth; vomerine and palatine teeth present or absent; inter-dorsal pterygiophores 2 or 3; first dorsal fin with 4 to 7 spines, usually first spine rigid and others more slender and flexible, except all rays relatively stout in *C. crassispinosa*; second dorsal fin with a stout rigid spine and 8 to 16 segmented rays; anal fin with a stout rigid spine and 18 to 30 segmented rays; anal fin originates on anterior half of body; all soft segmented fin rays usually branched except first soft ray of anal and second dorsal fin; branched caudal rays usually 15; parahypural fused to lower hypural plate; pelvic girdle with well-developed finger-like projections anteriorly at ventral mid-line; lateral 'wing' of pelvic girdle anchored to third pleural rib; dorsal head of cleithrum with well-developed posteriorly directed projection; scales cycloid to slightly crenulate with well-developed radii; horizontal rows on body at level of anal fin origin 10 to 13, vertical rows from upper corner of gill opening to caudal fin base 34 to 44; gill rakers on lower limb of first gill arch usually 13 or 14; vertebrae usually 37 or 38; sexual dimorphism characterized mainly by deeper body and taller first dorsal fin of males, but in some species males have the second dorsal and anal fin outline more pointed posteriorly and the posteriormost rays of the second dorsal fin are more elongate.

### Remarks

*Chilatherina crassispinosa* (Weber) was previously placed in the genus *Centratherina* (Regan, 1914; Weber and De Beaufort, 1922; and Munro, 1967). The traditional character used to separate these genera is the constitution of the first dorsal fin rays: they are supposedly segmented in *Chilatherina* and unsegmented in *Centratherina*. However, examination of numerous specimens of *Chilatherina* by Allen (1980a) failed to reveal segmentation (see Fig. 22 in Allen 1980a), although there is a pronounced difference in the rigidity of the dorsal rays. In *C. crassispinosa* all the rays of the first dorsal fin are relatively stout and pungent whereas this condition is restricted to the first ray in other members of the genus. The remaining rays are slender and flexible. In view of the overall morphological similarities between *crassispinosa* and other *Chilatherina* this difference appears significant only at the specific level.

Allen (1980a) indicated that *Chilatherina* possessed teeth on the vomer and palatine bones. This observation was based on limited material. A more detailed study of this feature during the present study reveals that three species lack vomerine teeth and palatine teeth are also absent in two of these.

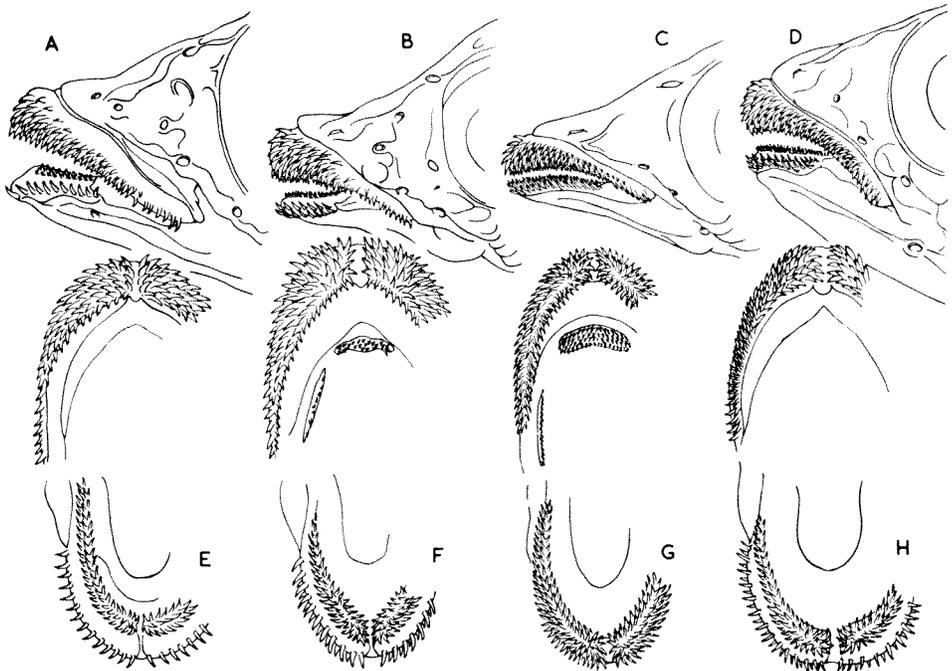


Fig. 3: Dentition of *Chilatherina*: (A and E) *C. campsi*; (B and F) *C. fasciata*; (C and G) *C. sentaniensis*; (D and H) *C. crassispinosa*. Drawings adapted from Munro 1964.

*Chilatherina* is closely related to *Melanotaenia*, the largest genus in the family. They differ chiefly with regard to jaw structure. In *Chilatherina* the lateral portion of the premaxillary is either straight or curved gently in a postero-ventral direction. The lower jaw is generally inferior to the upper jaw and the medial portion of the upper lip is swollen and profusely covered with teeth (Fig. 3). In addition, the head tends to be more slender and the snout relatively pointed compared with *Melanotaenia*. The latter genus by contrast, has a more or less abrupt downward bend in the lateral portion of the premaxillary with less swelling of the medial upper lip and fewer teeth on its surface. Moreover, the jaws are usually about even or the upper jaw is slightly inferior (i.e. lower jaw protruding). The external jaw features of *Chilatherina* and *Melanotaenia* were illustrated by Allen (1980a).

#### Key to the Species of *Chilatherina*

- 1a Vomerine teeth absent . . . . . 2
- 1b Vomerine teeth present . . . . . 4
- 2a All rays of first dorsal fin stiff and pungent (sometimes not evident in small specimens); soft rays in second dorsal fin usually 8 to 11, rarely 12; caudal fin with thin black margin on basal half (widespread northern New Guinea between Markham and Mamberamo Rivers) . . . . . *C. crassispinosa*
- 2b Only first ray of first dorsal fin stiff and pungent, remaining rays relatively weak and flexible; soft rays in second dorsal fin 11 to 16; caudal fin without thin black margin on basal half . . . . . 3
- 3a Palatine teeth well developed; soft rays in second dorsal fin usually 11 or 12, occasionally 13; mid-lateral dark stripe interrupted, forming series of blotches on anterior half of body; males deep-bodied, greatest depth frequently greater than 40% of SL in specimens exceeding 70 mm SL and averaging 37% of SL between 50-69 mm SL (Pual River system near Vanimo) . . . . . *C. axelrodi*
- 3b Palatine teeth absent; soft rays in second dorsal fin usually 13 to 15, rarely 12 or 16; mid-lateral dark stripe, if present, not forming series of blotches; males relatively slender, greatest depth not exceeding 33% of SL and averaging 30% of SL in specimens over 50 mm SL (foothill streams of Markham River system and headwater streams of Sepik and Purari Rivers in Central Highlands) . . . . . *C. campsi*
- 4a Rear edge of maxillary reaching to level of anterior edge of eye or beyond; dorsal fin origin noticeably

- behind level of anal fin origin, about level with base of fourth or fifth soft anal ray; soft rays in anal fin 25 to 30, usually 27 or 28 (Tawarin River, Irian Jaya) ..... *C. lorentzi*
- 4b Rear edge of maxillary not reaching level of eye; dorsal fin origin either equal to or only slightly behind level of anal fin origin, about level with base of first or third soft anal ray if behind; soft rays in anal fin usually 25 or less except sometimes 26 to 28 in *C. fasciata* ..... 5
- 5a Snout elongate, usually 2.5 to 2.9 in head length; soft rays in second dorsal fin usually 9 to 11, rarely 12 (Lake Sentani, Irian Jaya) ..... *C. sentaniensis*
- 5b Snout shorter, usually 3.0 to 3.5 in head length; soft rays in second dorsal fin usually 12 to 15, rarely 11 or 16 (widespread northern New Guinea between Markham and Mamberamo Rivers) ..... *C. fasciata*

*Chilatherina axelrodi* Allen

Fig. 4

*Chilatherina axelrodi* Allen, 1980b: 48 (type locality: Yungkiri Stream, Papua New Guinea).

Diagnosis

Dorsal rays V to VII-I, 11 to 13; anal rays I, 19 to 24; pectoral rays 13 to 15; horizontal scale rows 10; vertical scale rows 37 to 40; predorsal scales 16 to 19; preopercle-suborbital scales 15 to 22. Greatest body depth by sex and size class as follows: *males* — (a) 40-49 mm SL, 30.0-34.7 ( $\bar{x}$  = 32.8, N = 5), (b) 50-69 mm SL, 34.0-39.1 mm SL ( $\bar{x}$  = 37.2, N = 18), (c) 70+ mm SL, 36.1-41.3 ( $\bar{x}$  = 39.3, N = 11); *females* — (a) under 50 mm SL, 32.6 (N = 1), (b) 50-63 mm SL, 31.1-36.1 ( $\bar{x}$  = 33.4, N = 15); head length 23.9-25.8; snout length 6.7-8.8; eye diameter 7.5-9.3; interorbital width 7.2-8.2; caudal peduncle depth 10.1-11.7; caudal peduncle length 14.1-17.7; predorsal distance 45.1-48.9; preanal distance 46.8-52.4.

*Colour in alcohol*: generally brownish on back and whitish on lower two-thirds of body with dark markings similar to those shown in Fig. 4; dorsal and caudal fins dusky; anal fin whitish at base and dusky on distal half; pelvic and pectoral fins mainly translucent. Some specimens light brown or tan on back with darkly pigmented scale outlines; dark midbody stripe faint or absent on several specimens.

*Colour in life*: generally greenish-brown on upper half and whitish on lower half; a series of about 10 short bars along middle of side (approximately every two scales) these finally merging with more or less solid blackish

stripe along middle of caudal peduncle; about 6-10 faint dusky bars on lower side, those on side of abdomen particularly evident; upper half with series of bluish stripes and lower half with series of faint yellow stripes, bordering each longitudinal scale row; dorsal fin dusky with yellow suffusion; caudal, anal, and pelvic fins yellow; pectoral fins translucent. The live coloration of a male specimen was illustrated by Allen (1980b).

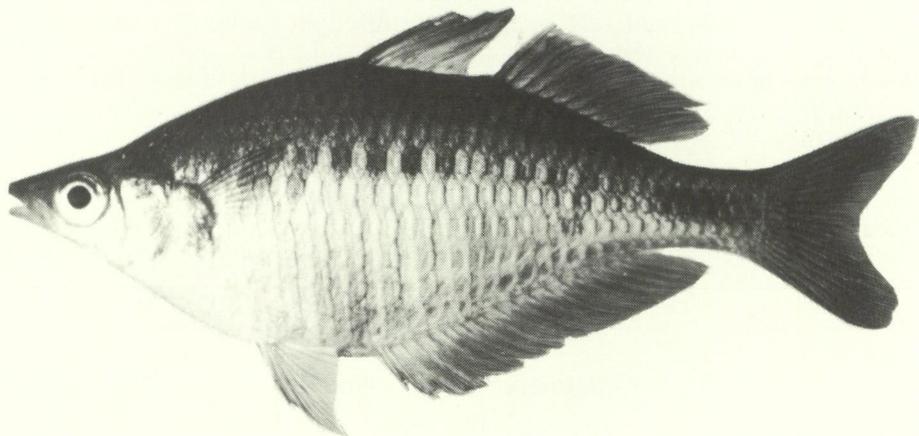


Fig. 4: *Chilatherina axelrodi*, male holotype, 81 mm SL, Pual River system, Papua New Guinea (WAM P26739-001).

### Comparisons

*Chilatherina axelrodi* is most closely related to *C. fasciata* and *C. sentaniensis*. These species share a similar body shape, jaw dentition, and general coloration. However, they are separable on the basis of head and snout length, modal dorsal ray counts (Table 1) and to a certain extent on the basis of colour pattern. *Chilatherina axelrodi* has a consistently shorter head and snout length; its head fits about 4 times in the standard length compared with about 3.2-3.8 for the others. The snout length of *C. axelrodi* is generally about equal to the horizontal eye diameter whereas it is slightly to considerably greater than the eye diameter in the other two species (at least in specimens in excess of about 55 mm SL). Furthermore, *C. axelrodi* differs significantly in lacking teeth on the vomer. The general coloration consisting of a brownish back with white on the lower sides is present in all three species, but *C. axelrodi* differs by usually having a series of 6-10 pronounced bars on the lower side. Similar bars are sometimes evident on the other species, but they are generally very faint and fewer in number.

### Distribution

*Chilatherina axelrodi* is known only from the type locality, Yungkiri Stream which is a tributary of the Pual River (Nemayer River on some maps).

This site is situated near the Irian Jaya border approximately 37 km southwest of Vanimo.

### Habitat

The only known specimens were collected from a small flowing stream in rainforest habitat. Most were taken from two large pools measuring about 3 x 10 m with a maximum depth of 1.5 m. Although situated in rainforest the stream-bed was relatively open and exposed to sunlight. The water was slightly turbid and a temperature of 28.5°C and pH of 7.8 were recorded. *Chilatherina axelrodi* was by far the most common fish in the stream which was also inhabited by two other rainbowfishes, *C. crassispinosa* and *Melanotaenia affinis*.

**Material Examined** (51 specimens, 35-81 mm SL, all types)

AMS I.21299-001 (7: 46-76 mm SL); MNHN 1979-671 (3: 61-66 mm SL); PNG F.4466-01 (5: 53-68 mm SL); RMNH 28152 (5: 57-72 mm SL); USNM 220909 (3: 43-75 mm SL); WAM P26739-001 (holotype, 81 mm SL); WAM P26739-002 (22: 35-85 mm SL); ZMA 115.400 (5: 41-62 mm SL).

### *Chilatherina campsi* (Whitley)

#### Fig. 5

*Anisocentrus campsi* Whitley, 1956: 26 (type locality: small creek flowing into the middle Jimmi River, 53 km, 6°E of NE of Mount Hagen airstrip).

*Centratherina tenuis* Nichols, 1956: 1 (type locality: Kondiu, Wahgi Valley).

### Diagnosis

Dorsal rays V to VII-I, 12 to 16; anal rays I, 21 to 26; pectoral rays 13 to 15; horizontal scale rows 11 or 12; vertical scale rows 39 to 42; predorsal scales 17 to 23; preopercle-suborbital scales 12 to 21. Greatest body depth by sex and size class as follows: *males* — (a) 30-49 mm SL, 26.5-29.7 ( $\bar{x}$  = 27.6, N = 6), (b) 50-65 mm SL, 28.0-32.3 ( $\bar{x}$  = 29.6, N = 15); *females* — (a) 30-49 mm SL, 23.7-27.9 ( $\bar{x}$  = 26.0, N = 13), (b) 50-69 mm SL, 25.9-28.3 ( $\bar{x}$  = 27.0, N = 7), (c) 70+ mm SL, 26.8 (N = 1); head length 23.2-25.8; snout length 6.3-8.0; eye diameter 7.0-8.5; interorbital width 7.1-8.0; caudal peduncle depth 9.1-10.4; caudal peduncle length 14.8-17.0; predorsal distance 43.4-47.1; preanal distance 45.4-51.3.

*Colour in alcohol*: brown or tan on upper half and whitish to pale yellow on lower half; a black mid-lateral stripe from rear edge of gill cover to base of caudal fin, this marking sometimes faint in females; a series of 6-8 faint dusky bars on lower sides from below pectoral fin to level of anterior anal rays, this marking apparently not evident in specimens from the Central Highlands; fins translucent to slightly dusky.

*Color in life*: generally pale bluish-white with silvery sheen; top of head and nape yellowish-brown; mid-lateral stripe blue, most prominent on

posterior part of body; pale yellow to whitish longitudinal stripes frequently bordering scale rows; fins frost-white, soft dorsal and anal fins sometimes with yellow suffusion; pectoral fins translucent. Female colours are similar, but less intense, particularly the mid-lateral stripe. In addition, the fins of females are mainly translucent. Male specimens from the Markham River system exhibit faint dusky bars on the middle of the lower side. The live coloration of a male specimen from the Wahgi River was illustrated by Allen (1980b).

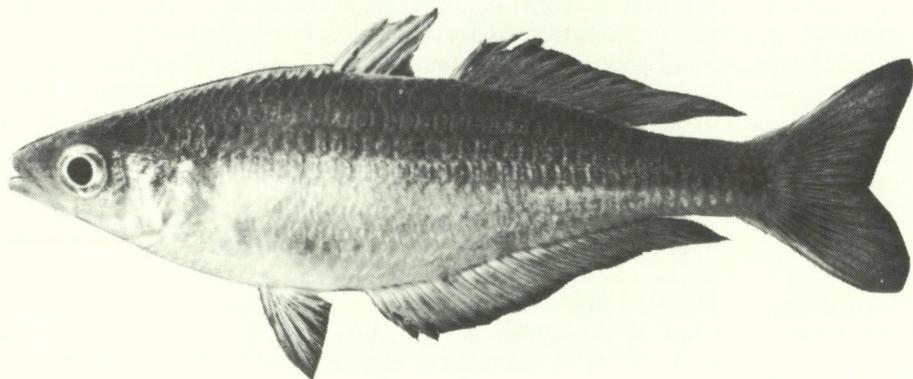


Fig. 5: *Chilatherina campsi*, male, 54 mm SL, Wahgi River, Papua New Guinea (WAM P26745-001).

### Comparisons

*Chilatherina campsi* is most closely allied to *C. fasciata*. These species exhibit similar fin-ray and scale counts (Table 1), and small specimens of *C. fasciata* are easily confused with *C. campsi*. However, they possess vomerine teeth, a feature which is lacking in *C. campsi*. In addition, the premaxillary has a slight downward curve in *C. fasciata* compared with the straight premaxillary of *C. campsi*. The former species attains a much greater length, about 105 mm SL compared with 75 (usually under 65) mm SL for *C. campsi*. There is also a difference in the position of the first dorsal fin origin in relation to the anal fin origin; in *C. campsi* the dorsal origin is about even or slightly ahead of the anal origin, whereas the dorsal origin is noticeably behind the anal origin in *C. fasciata*. These species appear to have mainly allopatric distributions except they co-occur in some tributaries of the Markham River.

### Distribution

*Chilatherina campsi* was formerly known only from the Central Highlands of Papua New Guinea in the Jimmi River (Sepik system) and Wahgi River (Purari system) at an elevation of approximately 1,525 m. It is the only melanotaeniid known to occur on both sides of the central dividing range.

Recent collections by the author have expanded the range considerably. It is now known from the Pima River at the junction of the Tua River, approximately 190 km downstream from the previous collection sites on the Wahgi River, and from two sites in the Markham River drainage near Lae, some 240 km east of the Highland collection sites.

### Habitat

*Chilatherina campsi* inhabits foothill and mountain streams ranging in altitude from about 200 m to 1600 m. It appears to be most abundant in the smaller tributaries characterized by reduced flow and clear to moderately turbid water. Small schools are often seen over sand, mud or rock bottom in areas exposed to sunlight. Temperatures and pH values at several collection sites ranged from 21.0°-25.5°C and 7.6-7.8 respectively. In the Wahgi Valley *C. campsi* is the only rainbowfish present, but at the Pima River it co-occurs with *Melanotaenia pimaensis* and is sympatric with *M. affinis* and *Glossolepis maculosus* at the Omsis River near Lae.

### Remarks

Two probable female hybrid crosses between *C. campsi* and *Melanotaenia affinis* were collected at the Omsis River. These specimens, 68 and 84 mm SL display a blend of features from the presumed parental species. They are deposited at WAM (P26976-005).

The smallest ripe female examined was 34.5 mm SL although immature eggs were detected in a specimen of 33.0 mm SL. Males begin to develop secondary sexual features (i.e. elongate fins and increased body depth) between 35-40 mm SL.

### Material Examined (91 specimens, 18-71 mm SL)

AMNH 20211 (holotype of *Centratherina tenius*, 65 mm SL), Wahgi Valley; AMS IB.3337 (holotype, 56 mm SL) and AMS IB.3342 (paratype, 50 mm SL), both from tributary of middle Jimmi River; USNM 224787 (23: 34-59 mm SL), small tributary of Markham River about 105 km NW of Lae; WAM P26745-001 (43: 18-54 mm SL), Wahgi Valley near Minj; WAM P26971-003 (5: 27-49 mm SL), Pima River, upper Purari system, 78 km SW of Goroka; WAM P26976-001 (7: 29-71 mm SL), Omsis River, 22 km W of Lae; WAM P26977-002 (10: 29-65 mm SL), small tributary of Omsis River.

### *Chilatherina crassispinosa* (Weber)

#### Fig. 6

*Rhombatractus crassispinosus* Weber, 1913: 567 (type locality: Tawarin and Upper Sermowai Rivers, northern New Guinea).

### Diagnosis

Dorsal rays IV to VI-I, 8 to 12; anal rays I, 19 to 24; pectoral rays 14 to 16; horizontal scale rows 11 to 13; vertical scale rows 37 to 43; predorsal scales 20 to 22; preopercle-suborbital scales 17 to 23. Greatest body depth

by sex and size class as follows: *males* — (a) 30-49 mm SL, 25.4-28.7 ( $\bar{x}$  = 27.3, N = 6), (b) 50-69 mm SL, 27.0-36.5 ( $\bar{x}$  = 31.4, N = 8), (c) 70+ mm SL, 29.7-34.3 ( $\bar{x}$  = 32.1, N = 5); *females* — (a) 30-49 mm SL, 24.0-29.7 ( $\bar{x}$  = 27.1, N = 6), (b) 50-69 mm SL, 27.0-32.3 ( $\bar{x}$  = 29.6, N = 8), (c) 70+ mm SL, 27.2-32.5 ( $\bar{x}$  = 28.9, N = 6); head length 24.2-27.7; snout length 6.9-9.3; eye diameter 7.0-9.6; interorbital width 6.8-8.8; caudal peduncle depth 8.2-11.4; caudal peduncle length 15.5-21.2; predorsal distance 46.9-53.4; pre-anal distance 48.1-53.5.

*Colour in alcohol*: brown on upper half with dense pattern of pepper-like pigmentation, lower half yellow-white; most specimens with thin black longitudinal stripe from upper edge of opercle to middle of caudal fin base; some specimens with faint series of 'herring-bone' markings along middle of sides; opercle silvery; dorsal fins dusky with translucent membrane; caudal, anal, pelvic, and pectoral fins translucent to pale yellow; dorsal and ventral edges of caudal fin and sometimes outer edge of anal fin with narrow black margin.

*Colour in life*: overall silvery, shading to brown or greenish on dorsal portion of side and white in breast region; fins mainly translucent with some

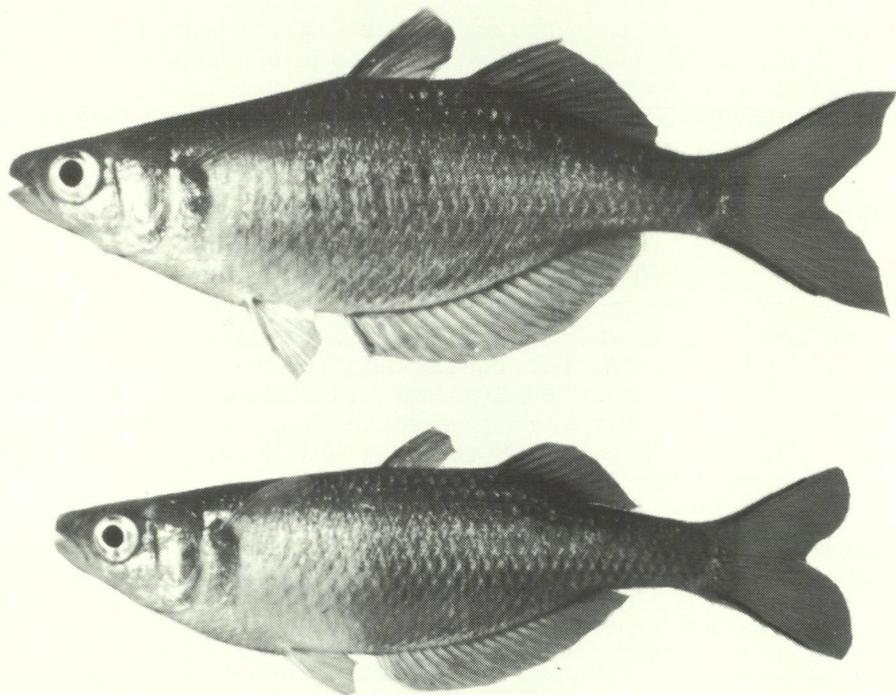


Fig. 6: *Chilatherina crassispinosa*, male (upper), 60 mm SL, and female, 51 mm SL, Markham River system, Papua New Guinea (WAM P26425-001).

duskiness, except anal and pelvic fins of adults, particularly males, often whitish or yellow-white and second dorsal fin sometimes yellow along base; dorsal and ventral edges of caudal fin with narrow black margin. The live coloration of a male specimen was illustrated by Allen (1980b).

### Comparisons

*Chilatherina crassispinosa* differs from all other members of the genus in having the spines of the first dorsal fin, particularly the first three or four, stiff and pungent. There is a relatively gradual reduction posteriorly in the thickness of each spine. Other *Chilatherina*, to the contrary, have a greatly thickened first spine with the other spines much more slender in comparison. Only the first spine is stiff and pungent; the remainder are relatively flexible. In addition, *C. crassispinosa* lacks teeth on the vomer, a character shared only by *C. campsi* and *C. axelrodi*. The latter species are easily separable on the basis of soft dorsal ray counts and predorsal scalation respectively (see Tables 1 and 3).

### Distribution

*Chilatherina crassispinosa* and *C. fasciata* are the most widely distributed members of the genus. The range for both species extends from the vicinity of Lae in Papua New Guinea westward to the Mamberamo River of Irian Jaya. Major river systems encompassed by the distribution include the Markham, Ramu, Sepik, and Mamberamo. In addition, it occurs in many of the smaller systems along the north coast.

### Habitat

*Chilatherina crassispinosa* exhibits a broader tolerance to habitat conditions than other members of the genus. It is often found in the sunlit, relatively slow flowing pools favoured by other *Chilatherina*. In addition, it has been taken from rapid flowing, steep gradient streams in pools adjacent to waterfalls and cascades. Temperature and pH values recorded at various collection sites ranged from 26°-29°C and 7.7-8.5 respectively. This species is usually found in relatively hilly or mountainous terrain at elevations between 100-600 m. It sometimes co-occurs with *C. fasciata*, *C. axelrodi*, and *Melanotaenia affinis*.

### Material Examined (163 specimens, 32-104 mm SL)

USNM 224785 (50: 34-86 mm SL), tributary of Ramu River; WAM P26425-001 (14: 34-64 mm SL), Erap River, 45 km NW of Lae; WAM P26427-001 (47: 17-50 mm SL), tributary of Ramu River, 5 km E of Usino on Madang Road; WAM P26428-001 (14: 32-75 mm SL), tributary of Ramu River, 13 km NE of Usino on Madang Road; WAM P26734-002 (4: 67-72 mm SL), tributary of Sepik River, 5 km beyond Maprik on Dreikikir Road; WAM P26736-003 (16: 36-84 mm SL), Trubum Stream on Maprik Road 79 km W of Wewak; WAM P26739-003 (17: 37-67 mm SL), Yungkiri Stream, 37 km inland from Vanimo on Bewani Road; ZMA 103.104 (lectotype, 104 mm SL), Mamberamo River, northern New Guinea.

*Chilatherina fasciata* (Weber)

Fig. 7

*Rhombatractus fasciata* Weber, 1913: 565 (type locality: Boearin River, tributary of Upper Sermowai River, Irian Jaya).

**Diagnosis**

Dorsal rays IV to VII-I, 11 to 16; anal rays I, 21 to 28; pectoral rays 14 to 16; horizontal scale rows 10 to 12; vertical scale rows 39 to 44; predorsal scales 18 to 23; preopercle-suborbital scales 14 to 24. Greatest body depth by sex and size class as follows: *males* — (a) 30-49 mm SL, 26.3-30.9 ( $\bar{x}$  = 27.7, N = 16), (b) 50-69 mm SL, 26.1-33.1 ( $\bar{x}$  = 29.3, N = 23), (c) 70+ mm SL, 30.3-38.8 ( $\bar{x}$  = 33.6, N = 10); *females* — (a) 30-49 mm SL, 27.0-32.3 ( $\bar{x}$  = 28.5, N = 6), (b) 50-69 mm SL, 26.5-30.6 ( $\bar{x}$  = 29.4, N = 5), (c) 70+ mm SL, 29.9-33.4 ( $\bar{x}$  = 31.1, N = 12); head length 23.2-27.5; snout length 6.3-8.6; eye diameter 7.2-8.8; interorbital width 7.4-9.6; caudal peduncle depth 7.8-11.3; caudal peduncle length 12.7-19.5; predorsal distance 44.6-55.0; preanal distance 46.5-53.0.

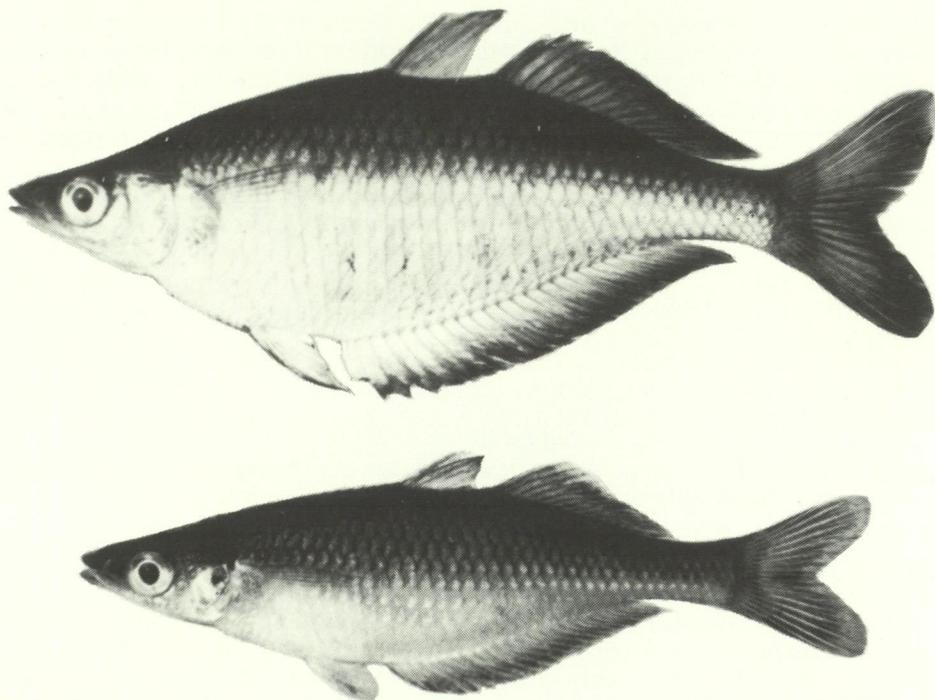


Fig. 7: *Chilatherina fasciata*, male (upper), 78 mm SL, and female, 65 mm SL, Lake Wanam, Papua New Guinea (WAM P26420-003).

*Colour in alcohol:* brownish on upper half and white or yellowish on lower half, frequently with a dusky or black mid-lateral stripe; 6-8 faint dusky bars sometimes present on middle of lower sides in male specimens; operculum silvery; fins translucent or dusky. Old specimens tend to be tan or pale brown, slightly darker on the dorsal half.

*Colour in life:* brown to bluish-green on upper half; white on lower half frequently with scales bordered with pale yellow; opercle silvery; dorsal fins and caudal fin dusky, particularly outer edge; pelvic fins and basal two-thirds of anal fin yellow-white in males, more or less translucent in females, outer edge of anal fin and anterior edge of pelvics dusky; pectoral fins with translucent membranes and dusky rays. The live coloration of a male specimen was illustrated by Allen (1980b, as *C. lorentzi*).

### Comparisons

*Chilatherina fasciata* is closely allied to *C. campsi*, and also shares similarities with *C. axelrodi* and *C. sentaniensis*. The reader is referred to the comparisons section for *C. fasciata* and *C. axelrodi* for a discussion of the differences between these species. Munro (1964) considered *C. fasciata* to be a junior synonym of *C. lorentzi*, but comparison of the respective types at ZMA during the present study revealed important differences between these species. *Chilatherina fasciata* is a much more slender fish, males seldom exceed a maximum depth of 35% of the SL compared with frequent values exceeding this figure and sometimes over 40% in *C. lorentzi*. The caudal peduncle depth also reflects this difference with most specimens of *C. fasciata* under 11.3% whereas the values in *C. lorentzi* ranged from 11.3-13.6% SL. Counts for the anal rays and preopercle-suborbital scales are also useful for separating these species, although there is some overlap in the ranges (see Table 1). Additionally, the upper jaw of *lorentzi* is longer and reaches the level of the anterior edge of the eye, whereas that of *fasciata* fails to reach eye level.

### Distribution

The known range of *C. fasciata* extends from the vicinity of Lae westward to the Mamberamo River. Major river systems encompassed by the distribution include the Markham, Ramu, Sepik, and Mamberamo. It possibly occurs farther westward, but this region of Irian Jaya remains uncollected.

### Habitat

*Chilatherina fasciata* is generally found in clear rainforest streams, but in open clearings exposed to maximal sunlight. Flow conditions range from moderate to slow. I have also taken specimens from Lake Wanam near Lae. These were caught along the shore in an area of clean white sand with isolated clumps of aquatic vegetation. Temperature and pH measurements taken at various field localities ranged from 28°-32°C and 7.7-8.1 respectively. The species occurs both in the lowland tributaries of major rivers and in

hilly terrain to an elevation of about 400-500 m. It often co-occurs with *C. crassispinosa* and *Melanotaenia affinis*, particularly the latter species.

### Remarks

This is the only known species of melanotaeniid in which hermaphroditism occurs (at least in some individuals). Both male and female gonads were found in 12 specimens, 44-82 mm SL. The smallest female examined with ripe eggs was 35 mm SL.

### Material Examined (175 specimens, 23-105 mm SL)

USNM 224786 (11: 39-97 mm SL), small tributary of Markham River about 25 km W of Lae; WAM P26420-003 (4: 65-89 mm SL), Lake Wanam, 25 km W of Lae; WAM P26421-001 (4: 64-92 mm SL), small stream 15 km W of Lae; WAM P26424-002 (6: 47-83 mm SL), Cleanwater Creek, 65 km W of Lae; WAM P26727-001 (78: 23-99 mm SL), small stream on Angoram Road, 73 km E of Wewak; WAM P26734-001 (10: 32-105 mm SL), small stream 5 km beyond Maprik on Dreikikir Road; WAM P26733-001 (42: 44-90 mm SL), Bagi Stream about 10 km W of Angoram; WAM P26735-001 (1: 81 mm SL), small stream on Maprik Road 113 km W of Wewak; WAM P26736-002 (7: 66-89 mm SL), Trubum Stream on Maprik Road 79 km W of Wewak; ZMA 103.104 (paratype, 104 mm SL), Boearin River, tributary of Upper Sermowai River, Irian Jaya; ZMA 103.047 (11: 51-57 mm SL), Mamberamo River at Pioniersbivak, Irian Jaya.

### *Chilatherina lorentzi* (Weber)

#### Fig. 8

*Rhombatractus lorentzi* Weber, 1908: 236 (type locality: Tawarin River, northern New Guinea).

### Diagnosis

Dorsal rays IV to VI-I, 12 to 15; anal rays I, 25 to 30; pectoral rays 14 or 15; horizontal scale rows 11 to 13; vertical scale rows 35 to 38; predorsal scales 17 to 20; preopercle-suborbital scales 18 to 27. Greatest body depth by sex and size class as follows: *males* — (a) 30-49 mm SL, 31.7-32.5 ( $\bar{x}$  = 32.1, N = 2), (b) 50-69 mm SL, 32.4-37.3 ( $\bar{x}$  = 34.9, N = 3), (c) 70+ mm SL, 34.0-40.8 ( $\bar{x}$  = 38.3, N = 3); *females* — (a) 30-49 mm SL, 30.6-32.4 ( $\bar{x}$  = 31.8, N = 4), (b) 50-69 mm SL, 32.7-33.8 ( $\bar{x}$  = 33.8, N = 4), (c) 70+ mm SL, 33.7-36.7 ( $\bar{x}$  = 35.3, N = 5); head length 26.5-28.7; snout length 7.9-9.8; eye diameter 6.3-9.7; interorbital width 8.5-10.1; caudal peduncle depth 11.3-13.6; caudal peduncle length 12.2-16.4; predorsal distance 50.4-55.6; preanal distance 48.0-53.9.

*Colour in alcohol*: overall yellowish-tan, scales on upper half with dusky outlines and a faint, dark mid-lateral band from eye to middle of caudal fin base; fins dusky grey except pelvics and pectorals mainly translucent. Several specimens from near Vanimo have 1-5 small intensely blackish spots on the anterior portion of the mid-lateral scale row. The type series show very little colour after 77 years in preservative. The body and fins are a bleached yellow-tan.

## REVISION OF *CHILATHERINA*

*Colour in life:* females brownish-green on back and silvery-white on lower half; a diffuse bluish mid-lateral band from eye to middle of caudal fin base (fades rapidly after death); dorsal, caudal, and anal fins dusky, anal fin with slight suffusion of yellow; pelvic fins white; pectoral fins translucent. The live coloration of males is unknown, but Weber (1908) stated that freshly preserved examples have a longitudinal blackish band, about two scales wide, extending from the upper edge of the opercle to the middle of the caudal fin base.

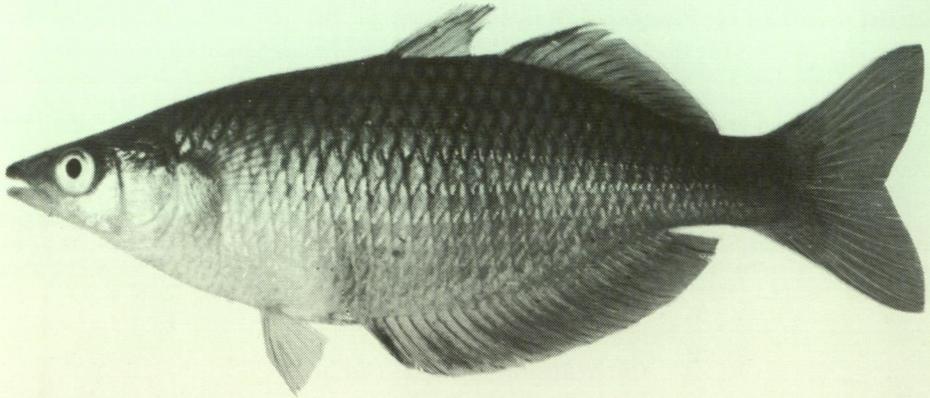


Fig. 8: *Chilatherina lorentzi*, female, 95 mm SL, Pual River system, Papua New Guinea (WAM P26741-001).

### Comparisons

See comparison section for *C. fasciata*.

### Distribution

*Chilatherina lorentzi* is thus far known from only two localities on the central north coast of New Guinea. The types were collected in the Tawarin River, Irian Jaya which is situated approximately 100 km west of Jayapura. A recent collection of 13 female specimens was made by the author at Puive Creek, a tributary of the Nemayer or Pual River system, in mountainous terrain near Vanimo, Papua New Guinea. This site is situated about 160 km east of the type locality and the species can be expected to occur in the intermediate area. The male and female *C. lorentzi* illustrated by Allen (1980a and b) from Lake Wanam near Lae represents a misidentification of *C. fasciata*.

### Habitat

Specimens were collected by the author in 1979 from a relatively small (5-10 m width) clear, moderately flowing stream. The stream was enveloped by dense rainforest canopy with little direct sunlight reaching the surface.

The fishes were concentrated in the deeper (1-2 m) sections in the vicinity of aquatic plants and log debris. The elevation at this site is approximately 300 m above sea level.

**Material Examined** (37 specimens, 21-96 mm SL)

WAM P26741-001 (13: 39-95 mm SL), Puive Creek, Papua New Guinea; ZMA 103.146 (lectotype, 96 mm SL), Tawarin River, Irian Jaya; ZMA 110.157 (paralectotypes, 23: 21-86 mm SL), Tawarin River.

*Chilatherina sentaniensis* (Weber)

Fig. 9

*Rhombatractus sentaniensis* Weber, 1908: 235 (type locality: Lake Sentani, Irian Jaya).

**Diagnosis**

Dorsal rays IV to VI-I, 9 to 12; anal rays I, 21 to 26; pectoral rays 14 to 16; horizontal scale rows 11 to 13; vertical scale rows 38 to 41; predorsal scales 19 to 25; preopercle-suborbital scales 16 to 20. Greatest body depth by sex and size class as follows: *males* — (a) 50-69 mm SL, 32.3-34.8 ( $\bar{x}$  = 33.6, N = 2), (b) 70+ mm SL, 35.2-39.5 ( $\bar{x}$  = 36.9, N = 5); *females* — (a) 50-69 mm SL, 29.4-30.9 ( $\bar{x}$  = 30.2, N = 3), (b) 70+ mm SL, 29.0-38.4 ( $\bar{x}$  = 32.5, N = 10); head length 27.3-30.3; snout length 9.6-11.2; eye diameter 7.5-9.0; interorbital width 8.3-9.6; caudal peduncle depth 9.3-11.2; caudal peduncle length 13.8-17.4; predorsal distance 56.4-61.0; preanal distance 46.8-52.4.

*Colour in alcohol*: dark brown on upper half, whitish to tan on lower half; males with series of 6-8 faint bars in middle of lower half of body; opercle silvery and silvery sheen sometimes present on lower sides; dorsal fins and

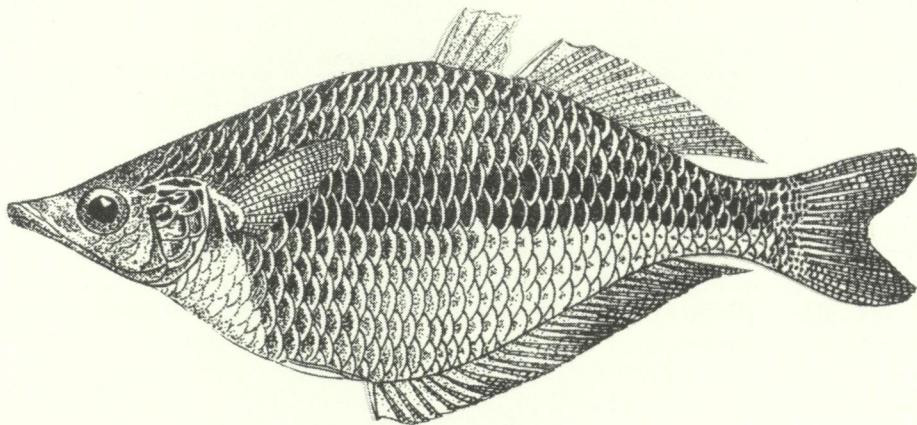


Fig. 9: *Chilatherina sentaniensis*, drawing of adult male, Lake Sentani, Irian Jaya (from Weber and De Beaufort, 1922).

caudal fin dusky; anal fin translucent or yellowish, dusky on outer edge; pectoral and pelvic fins translucent.

*Colour in life:* blue-grey on upper half; white with slight pink suffusion on lower half; males with 6-8 reddish-brown bars on lower sides between pectoral fin base and level of middle anal rays; dorsal fins and anal fin bluish-grey; anal and pelvic fins mainly whitish, blue-grey along distal margin; pectoral fins translucent. The live coloration of a male specimen was illustrated by Clasen (1976).

### Comparisons

*Chilatherina sentaniensis* is a lacustrine species apparently derived from the ancestral stock of *C. fasciata*. It is similar in appearance to *C. fasciata*, but differs significantly in having a lower number of soft rays in the second dorsal fin (see Table 1). In addition, the snout of *C. sentaniensis* is longer, usually 2.5 to 2.9 in the head length compared with 3.0 to 3.6 for *C. fasciata*.

### Distribution

*Chilatherina sentaniensis* is known only from Lake Sentani which lies about 12 km to the south-west of Jayapura, Irian Jaya.

### Habitat

According to Boeseman (1963) Sentani Lake is situated in a hilly region at an altitude of 75 m. It has an approximate length of 30 km and widths varying between 2 and 5 km. The shores are generally steep, but low and swampy in a few places, generally covered with grasses, shrubs, and some forest. The water is clear and the bottom along shore consists of mud or sand covered with some aquatic vegetation which may be dense. The lake receives an annual average rainfall of 185 cm.

### Material Examined (57 specimens, 48-96 mm SL)

RMNH unregistered (51: 48-81 mm SL), Lake Sentani; WAM P26789-001 (5: 69-76 mm SL), Lake Sentani; ZMA 103.093 (lectotype, 96 mm SL), Lake Sentani.

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