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## Description of *Laetacara fulvipinnis* sp. n. (Teleostei: Perciformes: Cichlidae) from the upper drainages of the rio Orinoco and rio Negro in Venezuela

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### > Abstract

*Laetacara fulvipinnis* sp. n. is described from the upper drainages of rio Orinoco and rio Negro in Venezuela. It can be distinguished from all the other described *Laetacara* species by the following combination of characters: dorsal fin usually XV.10, 23–25 scales in a lateral line, caudal fin without conspicuous pattern of light dots, and size (maximum SL 74 mm).

### > Resumen

Se describe una nueva especie de cíclido, *Laetacara fulvipinnis*, de la cuencas del alto río Orinoco y alto río Negro en Venezuela. La nueva especie se distingue de todas las demás especies del género *Laetacara* por la siguiente combinación de caracteres diagnósticos: rayos en la aleta dorsal XV.10, 23–25 escamas en la serie longitudinal, aleta caudal sin puntos claros y tamaño (máximo SL 74 mm).

### > Resumo

*Laetacara fulvipinnis*, espécie nova, descrita da drenagem do alto rio Orinoco e alto rio Negro em Venezuela. *Laetacara fulvipinnis* é distinta das demais espécies descritas do gênero *Laetacara* pela combinação das seguintes características: raios da nadadeira dorsal XV.10, 23–25 escamas na linha lateral, nadadeira caudal sem pontos claros, e tamanho (máximo SL 74 mm).

### > Kurzfassung

*Laetacara fulvipinnis* sp. n. wird aus dem oberen Einzugsgebieten des Orinoko und des rio Negro in Venezuela beschrieben. Die neue Art unterscheidet sich von allen anderen bisher beschriebenen *Laetacara*-Arten durch die Kombination folgender diagnostischer Merkmale: Rücken flosse meist XV.10, 23–25 Schuppen in der Längsreihe, Schwanzflosse ohne deutliches Muster heller Punkte und maximale SL 74 Millimeter.

### > Key words

Systematics, ichthyology, freshwater, ecology, reproductive behaviour, Cichlidae, new species, Venezuela.

## Introduction

The South American cichlid genus *Laetacara* KULLANDER (1986) was established with four species which for many years had been considered as members of the genus *Aequidens* EIGENMANN & BRAY. See KULLANDER (1986) for detailed description, distinguishing characters and comparison with similar groups. The genus, which comprises small cichlasomatine cichlids (max. SL approx. 110 mm) has a wide geographical range including large parts both of the

Amazon basin and the drainages of the río Orinoco, río Paraguay and río Paraná (KULLANDER, 1986; 2003; CASCIOTTA, 1998). At present it includes the following species: *L. dorsigera* (HECKEL, 1840) distributed both in the río Paraguay and the río Paraná basins and in the drainages of río Guaporé, río Mamoré and río Beni (HECKEL, 1840; HASEMAN, 1911; CASCIOTTA, 1998; pers. observ.), *L. flavilabris* (COPE, 1870) known from tributaries to the upper Amazon basin, e. g. río

Napo, r'õ Huallaga, r'õ Ucayali, r'õ Putumayo, r'õ Yavar', r'õ Juru (KULLANDER, 1986 and pers. observ.), *L. thayeri* (STEINDACHNER, 1875) distributed in the upper and middle Amazon River between some of its upper tributaries in Peru, e. g. r'õ Tigre, r'õ Nanay, r'õ Momon, r'õ Ucayali and r'õ Yavar', and the lower reaches of rio Negro and rio Trombetas (KULLANDER, 1986 and pers. observ.) and *L. curviceps* (AHL, 1923) distributed in the lower portions of tributaries of the Amazon River in Brazil (KULLANDER, 2003). In addition two or three more species remain to be described (KULLANDER, 1986).

The cichlid species described below from the upper drainages of the r'õ Orinoco and rio Negro has probably been known for almost 30 years in the aquarium hobby (PRICK, 1978). In the aquarium literature it was first provisionally referred to as *Laetacara* spec. Orangeflossen (KOSLOWSKI, 1985; STAECK, 2003) or Orange-finned *Laetacara* (LINKE & STAECK, 1994). The purpose of the present paper is to give a formal description of this species.

## Material and Methods

The three specimens from the type locality were fixed in 75 % ethanol, the other paratypes were fixed in formalin and later transferred into 75 % ethanol. The holotype and 4 paratypes are deposited in the fish collection of the Museum fTierkunde Dresden (MTD F), one paratype is in the collection of ZMB. Comparative material is in MTD F, ZMB or in the personal collections of the authors (CIS).

Comparisons were made with the following specimens:

*Laetacara dorsigera* (HECKEL, 1840): CIS, 5 ex., 29.4–38.1 mm SL, Bolivien, Laguna Mapava, approx. 30 km north of Magdalena, r'õ Itomanas drainage; CIS, 6 ex., 32.2–43.4 mm SL, Bolivien, Lago Mandiorõ r'õ Paraguay. *Laetacara flavilabris* (COPE, 1870): CIS, 5 ex., 53.4–69.8 mm SL, Brazil (Acre), drainage of the rio Moa at Cruzeiro do Sul. *Laetacara thayeri* (STEINDACHNER, 1875): ZMB 32312, 3 ex., 61.9–72.0 mm SL, Peru, r'õ Momon. *Laetacara curviceps* (AHL, 1923): ZMB 31324, 1 ex., (holotype), 46.8 mm SL, Amazonenstrom. ZMB 32398, 3 ex., (paratypes), 39.2–46.9 mm SL. ZMB 32399, 2 ex., (paratypes), 35.6–39.6 mm SL. ZMB 32400, 1 ex., (paratype), 40.4 mm SL.

Data from KULLANDER (1986) and from CASCIOTTA (1998) were also used for comparison.

The techniques for taking measurements and meristic data follow those described in KULLANDER (1986, 1990) and KULLANDER & NIJSSEN (1989). Measurements were made with an electronic digital caliper reading to the nearest 0.1 mm. Numbers in brackets after counts indicate the number of specimens exam-

ined with that condition. Nomenclature for colour pattern follows KULLANDER & SILFVERGRIP (1991) and for bones follows ROJO (1991).

The comparative material was used for the statistical evaluations. Principle component analyses (PCA) were used to investigate patterns of morphological variation between the species of *Laetacara*. PCA scores were calculated on the basis of the standardized metric or transformed meristic data, respectively, using the programme PAST (HAMMER *et al.*, 2004). PCA for the metric data is based on the covariance matrix and for the meristic data on the correlation matrix. As recommended by VAN VELZEN *et al.*, (1992) all measurements are standardized by expressing them as proportions of standard length in order to correct the differences in size before the data analysis. The formula  $\log(x) = \log(SL) - \log(x)$  is used for this purpose (BLACKITH & REYMANT, 1971). Meristic data were transformed by  $x = x^{0.5}$  as recommended by KULLANDER (1996).

**Abbreviations:** E1 = row of scales in the horizontal series directly above the longitudinal row including the lower lateral line; CIS = personal collection of the authors, MTD F = Staatliche Naturhistorische Sammlungen Dresden, Museum fTierkunde, Fischsammlung; SL = standard length; TL = total length; ZMB = Museum fNaturkunde, Berlin.

### *Laetacara fulvipinnis* sp. n.

(Figs. 1 & 3–7, Tables 1–2)

**Holotype.** MTD F 30607, male, 74.6 mm SL, lagoon at the village Arigua (15°03'N, 67°02'29"W), a few km south of San Carlos de r'õ Negro in Venezuela, leg. February 2006 by W. STAECK.

**Paratypes.** MTD F 30608–30609, 2 females, 55.1–59.4 mm SL, collecting data like holotype. MTD F 30610–30611, 2 specimens, 40.2–47.5 mm SL, rio Casiquiare close to the mouth of r'õ Pasimoni at the village El Ni-al in Venezuela, leg. February 2006 by W. STAECK. ZMB 32028, 1 ex., 66.3 mm SL, r'õ Orinoco, a few km south of Puerto Ayacucho, Venezuela, leg. July 1989 by I. SCHINDLER.

**Diagnosis.** *Laetacara fulvipinnis* differs from all the other described species in the genus in the combination of the following characters: (1) dorsal fin usually with 15 spines and 10 rays, (2) 23–25 scales in E1 row, (3) dorsal fin base only moderately scaly, (4) caudal fin without a conspicuous pattern of cross series of tiny light dots and (5) size (maximum SL 74 mm).

**Etymology.** The species epithet *fulvipinnis* is a compound derived from the Latin *fulvus* (= dark yellow,

**Tab. 1.** Body proportions of *Laetacara fulvipinnis*. Measurements of holotype (MTD F 30607) and paratypes (MTD F 30609, 30610–30611, ZMB 32028) in percent of SL (except SL in mm); min = lowest value, max = highest value, mean = arithmetic mean, sdm = standard error of mean.

Measurement	min – max	mean ± sdm
SL (mm)	40.2–44.6	53.7 ± 5.09
Total length	130.1–137.0	133.5 ± 1.33
Head length	26.4–31.8	29.4 ± 0.85
Snout length	5.0–6.9	5.9 ± 0.26
Body depth	41.3–47.8	44.6 ± 0.97
Orbital diameter	8.1–11.1	9.5 ± 0.46
Interorbital width	11.1–13.7	12.2 ± 0.38
Preorbital depth	4.6–7.5	5.4 ± 0.48
Caudal peduncle depth	18.8–21.9	20.1 ± 0.51
Caudal peduncle length	8.9–10.6	9.5 ± 0.29
Length of pectoral fin	22.2–28.2	25.6 ± 1.00
Length of pelvic fin	29.3–37.5	33.1 ± 1.25
Length of anal-fin base	20.0–22.9	21.4 ± 0.47
Length of dorsal-fin base	60.5–66.1	63.0 ± 0.78
Length of last D spine	10.1–13.9	12.1 ± 0.57



**Fig. 1.** *Laetacara fulvipinnis* sp. n., holotype, MTD F 30607.

orange) and *pinna* (= fin). It refers to the colouration of the caudal and anal fin, a distinguishing feature of this species.

**Description.** Based on the holotype, with notes on the paratypes. See Figs. 1 & 3 for general shape and colour patterns. Body proportions are summarized in Table 1.

Body moderately deep and laterally compressed. Head short, with bluntly rounded snout. Predorsal contour strongly curved in males; in females dorsal and

ventral contours of head more or less evenly arched, with slight concavity in front of orbit. Dorsal-fin base almost straight. Prepelvic contour less curved than dorsal profile; abdominal contour straight or slightly concave; anal-fin base contour slightly convex. Caudal peduncle short, with straight dorsal and ventral edge. In frontal aspect outline of body elliptic with rounded nape and chest.

Orbit in dorsal and chiefly in anterior half of head. Snout little produced. Mouth terminal, jaws equal anteriorly; maxilla reaching to vertical from anterior



**Fig. 2.** Collecting site of *Laetacara fulvipinnis* sp. n. at the r'ó Casiquiare close to the village El Ni-al and the mouth of R'ó Pasi-moni.

margin of orbit; lower jaw articulation not reaching to vertical from anterior margin of orbit. Lip folds interrupted and comparatively thick in larger males.

Scales on body and nape ctenoid. Prepelvic scales ctenoid with the exception of a few anterior ones. Triserial predorsal pattern with 4 median anterior scales. Cheek scales in 2 series. Anal fin, pelvic and pectoral fins naked. In larger males (SL > 45 mm) a few marginal smaller body scales extend over soft dorsal-fin base. One larger male with a single minute ctenoid interradiial scale. Caudal-fin base densely scaled; between one third and about half of the fin covered by scales; posterior margin of the scaled area about truncate. Scales in E1 row 23(4), 24(1), 25(1). Scales on upper lateral line 15(1), 16(3), 17(2), on lower lateral line 8(2), 9(4), including 2 on caudal fin base. No accessory lateral line on caudal fin.

Anal-fin origin opposite last or next to the last dorsal-fin spine. Soft portion of anal fin pointed, reaching slightly beyond middle of caudal fin in adult females and beyond posterior border of caudal fin in males. Soft dorsal fin pointed, reaching beyond posterior end of caudal fin in males. Caudal fin subtruncate or with rounded posterior margin; caudal fin length about one third of SL. Pelvic fins pointed, first ray extending to the anus. Pectoral fin rounded. Dorsal fin XIV.10(1), XV.9(1), XV.10(4). Anal fin III.8(6).

On first gill arch 0 or 1 minute gill raker on epi-branchial, 1 in the angle and 5–6 externally on cerato-branchial. Dorsal margin of anterohyal (Fig. 6) more or less straight (without deep notch), only with a shallow groove where the hyoid artery runs.

**Colouration in life.** Based on observations immediately after capture and on specimens kept in aquari-

um. Live colouration very variable, depending on age and mood. Adult specimens with beige to turquoise ground colour. Nape and dorsal region dark grey to brown. A dark brown blotch on nape in front of the dorsal fin. On snout and interorbital region alternating dark and light stripes: broad dark stripe from eye to eye across forehead and narrow dark stripe from eye to eye across upper lip. Both separated by contrasting broad light stripe from orbit to orbit across snout tip. Two additional alternating oblique dark and light stripes on cheek. Iris dusky golden or red.

Scales on the anterior body sides usually with thin black posterior edges. Posterior flanks with four vertical dark bars growing gradually narrower and separated by narrow light interspaces: one on caudal peduncle, one behind and two above anal fin. In front of anus an additional bar with midlateral spot, extending ventrally from lateral line scales 6–10 to scales of E1 row. Dark brown horizontal mid-lateral band about two scales wide, extending from distal margin of orbit over dorsal edge of operculum to midlateral spot. Vertical bar carrying midlateral spot margined anteriorly and posteriorly by contrasting narrow vertical orange zones approx. one scale wide.

Dorsal fin grey, with narrow light margin, maroon submarginal band and with several short cross series of minute light dots on last membranes of soft portion. Pectoral fins hyaline. Pelvic fins greyish, with thin dark anterior edges of first rays. Anal fin dark orange, with black margin and a few tiny light dots on last three membranes. Caudal fin translucent, with dark yellow to orange lower portion.

During courtship both sexes of *Laetacara fulvipinnis* develops a very dark, almost black colouration on cheek, preoperculum and operculum. After spawning



**Fig. 3.** Live subadult *Laetacara fulvipinnis* sp. n. from the r'õ Casiquiare, approx. 5 cm TL, immediately after capture in a photographic tank.

and during parental care it is replaced by a conspicuous ruby- to purple-red colouration, which spreads over cheek, gill cover and chest between upper lip and the pectorals.

**Colouration in alcohol.** Based on male holotype and paratypes. Dark markings well preserved, but general appearance of preserved specimens paler. Turquoise areas become white, red pigmentation becomes pale reddish brown. Cheek and opercle dark grey. Snout stripe reddish brown. Subadult specimens with dark dot both near the upper and lower edge of each scale in the midlateral portion of their body.

Posterior bars (bars 2–5) usually more distinct than anterior ones (bars 6–8). Bar 1 reduced to an indistinct narrow greyish midbasal caudal spot (only visible in larger specimens). Bar 2 distinct, ventral part connected with bar 3. Bar 3 between posterior rays of dorsal and anal fins, partly covering root of caudal peduncle. Bar 4 between soft dorsal and anal fin. Bar 5 very broad, between posterior part of spinous dorsal fin and spinous anal fin; vertically split into two parts; split indistinct in larger specimens. Bar 6 with midlateral spot, ventrally fused with bar 7; ventral third indistinct. Bar 7 ventrally indistinct, dorsally fused with bar 8 and horizontally interrupted by light interspace above lateral stripe. Bar 8 reduced to a blotch on nape and connected with bar 7. Lateral stripe from posterior orbit to bar 6 or 5 well defined; interrupted by a light zone in front and behind midlateral spot. Posterior part of lateral stripe indistinct, running to dorsal half of caudal peduncle.

Dorsal fin plain, posterior soft part with cross series of light dots. Anal fin plain with dark margin and cross series of light dots on posterior soft part. Caudal

fin plain, in large specimens with a few indistinct light dots in posterior part. Pectoral fin colourless. Pelvic fins hyaline, with dark margin.

**Geographical distribution.** *Laetacara fulvipinnis* is known from several localities in the drainage of the upper and middle r'õ Orinoco, the rio Casiquiare and the upper and middle rio Negro (SCHINDLER, 1991; REIMER, 1992; 1994). Confirmed collecting sites are situated between Pozo Azul, approx. 10 km north of Puerto Ayacucho, (pers. observ.) in the north and the rio Salgado near Barcelos de rio Negro (REIMER, 1992) in the south.

**Ecological notes.** Field observations indicate that *Laetacara fulvipinnis* prefers typical blackwater habitats with clear, acid and very soft tea-coloured water. The fish were usually collected along the banks of brooks and small rivulets in zones of extremely shallow water, i.e. in a water depth between approx. 10 and 50 cm, where they were found either in a layer of dead leaves covering the bottom of the bank side or among submerged terrestrial vegetation.

The following water data were collected in February in the rio Casiquiare at the village El Ni-al close to the mouth of rio Pasimoni: pH 4.4; electrical conductivity 10  $\mu$ S/cm; total and temporary hardness < 1  $\text{mg/l}$ ; water temperature 26.3  $^{\circ}$ Celsius. At this site the associated fish fauna included *Apistogramma uaupesi*, *Mesonauta insignis*, *Heros severus*, *Heros* sp. and several characid and silurid species.

**Reproductive behaviour.** Observations under aquarium conditions showed that *Laetacara fulvipinnis* is a monogamous substrate spawner and that both sexes



Fig. 4. Sexually active female of *Laetacara fulvipinnis* sp. n. (approx. 7 cm TL) from type locality in aquarium.

share in all the duties of brood care. The male, however, is usually the more active partner. A detailed description of the reproductive behaviour was published by RÖMÉR (1998). Like most other open brooders these cichlids deposit their eggs on a horizontal surface. The preferred spawning site is a stout leaf of a water plant. At 27 °Celsius hatching occurs about three days postspawning, and the fry attempt swimming six days thereafter.

## Discussion

Although all *Laetacara* species have the same general appearance and a similar colour pattern, *Laetacara fulvipinnis* is easily distinguished by a set of divergent characteristic features and the specific colouration of its translucent caudal fin, which in live specimens has a dark yellow or orange lower portion and, in contrast to all the congeners, lacks a conspicuous pattern of minute light dots. Subadult preserved specimens of *Laetacara fulvipinnis* can be distinguished from all the congeners by a dark dot both near the upper and lower edge of each scale in the midlateral portion of their body.

In addition *Laetacara fulvipinnis* differs from *L. dorsigera* and *L. curviceps* by its size (SL >70 mm versus SL <50 mm), potentially more scales in E1 row (23–25 versus <24) and the lack of a large dark blotch in the dorsal fin above bar 6 (present in both sexes in

*L. dorsigera* and at least in females of *L. curviceps*). Furthermore it can be distinguished from *L. dorsigera* by the shape of bar 4, which is vertically not split (versus split in *L. dorsigera*), and from *L. curviceps* by a higher number of dorsal-fin rays (9–10 versus < 9).

*Laetacara fulvipinnis* differs from the two larger species *L. flavilabris* (SL up to 110 mm) and *L. thayeri* (SL up to 65 mm) by the absence of a squamation of the dorsal-fin base in smaller specimens (SL <45 mm) or a weak squamation in larger specimens in contrast to a densely scaly dorsal-fin base in *L. thayeri* at all sizes and in larger specimens (SL >50 mm) of *L. flavilabris*.

Furthermore, *L. fulvipinnis* differs from *L. thayeri* by a naked anal-fin base (versus scaly in *L. thayeri*), more scales in E1 row (23–25 versus usually 22), modally 8 anal-fin rays (versus 7), modally 10 dorsal-fin rays (versus 9), the lack of an extension of the upper portion of the midlateral spot (versus midlateral spot dorso-caudally extended).

*Laetacara fulvipinnis* is distinguished from *L. flavilabris* by well-defined snout stripes (less intense in *L. flavilabris*), a dark blotch on the nape (versus absence of such blotch), the lack of an extension of the upper part of the midlateral spot (versus dorso-caudally extended midlateral spot at least in specimens up to 60 mm SL), less dorsal-fin spines (usually XV versus XVI), less scales in E1 row (modally 23 versus 24), no or only one minute gill raker on first epibranchial (versus 1 or 2 well developed ones) and the more steeply arched predorsal contour.



Fig. 5. Adult male of *Laetacara fulvipinnis* sp. n. (approx. 9 cm TL) from type locality during brood care in aquarium.

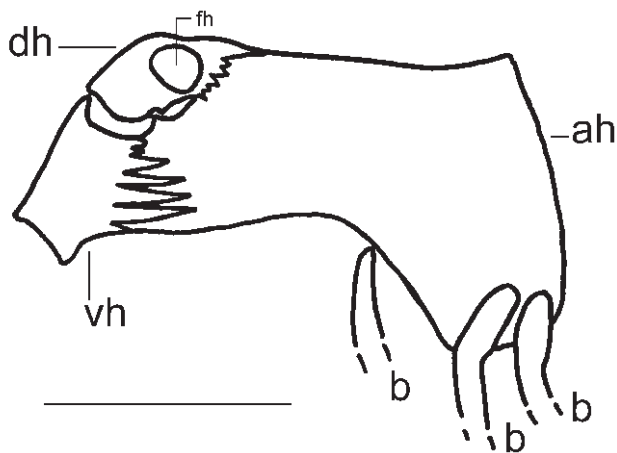


Fig. 6. Anterior part of left hyoid arch in *Laetacara fulvipinnis* sp. n.: ah = anterohyal, dh = dorsohyal, fh = hyoid foramen, vh = ventrohyal, b = branchiostegal rays. Scale bar ~ 2 mm.

Breeding males and females of *Laetacara fulvipinnis* develops a characteristic conspicuous red colouration on their cheeks, gill covers and chest. Sexually active pairs of *Laetacara dorsigera* have a similar colouration, which, however, spreads over the whole abdomen.

KULLANDER (1986) documented a deep notch in the dorsal margin of the anterohyal of *Laetacara flavilabris*. CASCIOTTA (1998), however, found only a shallow groove in *L. dorsigera*, an observation confirmed by our examination of the anterohyal of a *L. dorsigera*

specimen. In *Laetacara fulvipinnis* the dorsal margin of the anterohyal is also more or less straight, lacks a deep notch (fig. 6) and is slightly more elongated than in the remaining species. Thus, the shape of the anterohyal of *L. fulvipinnis* is a further sign of the specific differentiation.

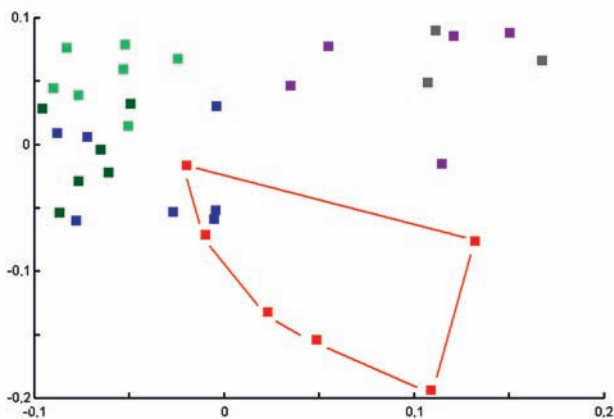
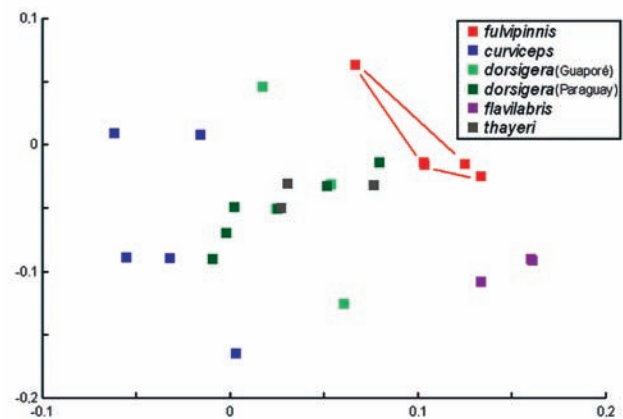
Principal component analyses (PCA) were based on the pooled samples of 34 specimens of all described species: *Laetacara fulvipinnis* (n=6), *L. dorsigera* (n=13), *L. flavilabris* (n=5), *L. thayeri* (n=3) and *L. curviceps* (n=7). In the PCA of 12 standardized measurements (Fig. 7a) the PC1 (35% of contribution) shows a high correlation with SL ( $r = 0.91$ ). This correlation is probably a reflection of the diagnostic difference in the size between the smaller and larger species. The PC1 is mainly influenced by the preorbital depth and caudal peduncle length (highest scores, see Table 2) and, therefore, indicates shape determinants which possibly get the strongest modification during ontogeny. PC2 accounts for 27 % of the variance (no significant correlation with SL,  $r = 0.21$ ). The loadings of this axis (Table 2) indicate that PC2 is mainly affected by snout length, orbital diameter and pectoral-fin length. The difference between larger specimens of *L. fulvipinnis* and the remaining species is most apparent in the PC2 axis and the plots of these specimens (*L. fulvipinnis* SL > 45 mm) are clearly separated in the PC1-PC2 diagram (Fig. 7a).

In the PCA of the meristic data (Table 2) *L. fulvipinnis* is well separated from the remaining species (Fig. 7b). The difference is mainly caused by the high-



**Tab. 2.** Character loadings on PC1 and PC2 for standardized morphometric and transformed meristic data.

Character	PC1	PC2
<b>Measurements</b>		
Total length	0.006	-0.072
Head length	0.114	-0.345
Snout length	-0.086	-0.594
Body depth	-0.002	-0.066
Orbital diameter	0.224	-0.515
Interorbital width	-0.003	-0.196
Preorbital depth	-0.800	-0.104
Caudal peduncle depth	0.062	-0.060
Caudal peduncle length	-0.491	-0.038
Length of pectoral fin	0.039	-0.420
Length of anal-fin base	0.193	0.139
Length of dorsal-fin base	-0.080	0.060
(Variance explained)	34.7%	26.9%
<b>Meristics</b>		
Dorsal-fin spines	0.542	-0.824
Dorsal-fin rays	0.864	0.415
Anal-fin rays	0.638	0.306
Scales in E1 row	0.829	-0.021
(Variance explained)	53.2%	27.0%

**Fig. 7a.** Scatter plot of scores of PC1 versus PC2 of 12 standardized measurements of *Laetacara fulvipinnis*, *L. dorsigera*, *L. flavilabris*, *L. thayeri* and *L. curviceps*. Refer to table 2 for character loadings.**Fig. 7b.** Scatter plot of PC1 versus PC2 scores of 4 meristic data of *Laetacara fulvipinnis*, *L. dorsigera*, *L. flavilabris*, *L. thayeri* and *L. curviceps*. Refer to table 2 for character loadings. One symbol may cover more than one specimen.

er number of dorsal-fin rays and scales in E1 row. The difference between *L. fulvipinnis* and *L. flavilabris* on PC2-axis is mainly based on the number of dorsal-fin spines. The remaining taxa are also significantly different and clearly separated from the cluster of the specimens of *L. fulvipinnis*.

Despite the comparatively limited number of samples the differences reflected in the multidimensional analysis are convincing evidence of the distinctness of *L. fulvipinnis*.

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