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NOTES ON MORPHOLOGICAL CHARACTERS IN EARLY-DEVELOPED AMAZONIAN LEAFFISH, *MONOCIRRHUS POLYACANTHUS* (POLYCENTRIDAE, PERCIFORMES)

NOTAS ACERCA DE LOS CARACTERES MORFOLÓGICOS EN ESTADIOS TEMPRANOS DE *MONOCIRRHUS POLYACANTHUS* (POLYCENTRIDAE, PERCIFORMES)

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The Amazonian leaffish *Monocirrhus polyacanthus* Heckel 1840 is one of the two representatives of the family Polycentridae in South America (Britz & Kullander 2002, Cardona & Osinaga 2006). Adults of the species inhabit shallow waters, near to fallen leaves in the surface, taking advantage of the leaf shape to feed onto fish preys, which eventually occur in the surroundings. Liem (1970) provided a detailed study on the morphology of both *M. polyacanthus* and *Polycentrus schomburkgkii*, focusing on the feeding mechanisms adopted by each species, specifically those related to jaw protrusion.

Though *Monocirrhus polyacanthus* can be artificially bred with some ease, descriptive studies on early development of polycentrid fishes focusing on their early developmental stages had also hardly been conducted. The present study deals with the description early-developed of *M. polyacanthus*, regarding the leaf-mimic characteristics.

Artificially reared samples of *Monocirrhus polyacanthus* were obtained from the Public Aquarium of the Goeldi Museum (Belém, Pará, Brazil), which fries were fed daily with live *Artemia salina*. Individuals who died naturally were removed every day and not used for morphological analyses in the present study. Specimens were randomly sampled at the 3rd (n = 10), 7th (n = 10), 53rd (n = 4) and 180th days (n = 1) after the egg hatch (DAH). Each specimen was immediately fixed using ethanol 40%.

At the 3rd DAH, head shape of specimens (3.9 ± 0.2 mm in standard length: SL) was round, with a slightly protruding mouth, the edge of which still near to center of eye. Large eyes compared to head size, occupying 41% of head volume. Dorsal, pelvic and caudal fins absent, replaced by the larval fin fold. Pectoral fins noticeable though still underdeveloped. Body divided in three parts: head, pre-anal and post-anal regions. Pre-anal myomeres 24; post-anal myomeres 18, slenderer than the anteriormost portion of body. Pigmentation only on head and posteriormost 1/3 of post-anal myomeres. Caudal peduncle is evidenced by the presence of urostyle.

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Figure 1. Early developed *Monocirrhus polyacanthus*. A. 3rd day after egg-hatching (DAH), B. 7th DAH. C. 53rd DAH, D. 180th DAH, resembling the adult form. 1) mouth and jaws, 2) fin fold (A and B) and unpaired fins (C and D), 3) Pectoral fin, 4) caudal fin. White bars indicate 1 mm.

Figura 1. Estadios tempranos de *Monocirrhus polyacanthus*. A. Al 3er día después de la eclosión (DAH). B. a los 7 días después de la eclosión. C. A los 53 días después de la eclosión. D. A los 180 días después de la eclosión. Forma con rasgos de adulto. 1) boca y mandíbulas, 2) pliegue (A y B) y aletas impares (C y D), 3) aleta pectoral, 4) aleta caudal. La barra blanca equivale a 1 mm.

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At the 7th DAH, head of specimens (4.5 ± 0.1 mm SL) became slightly trigonal as compared to former stage, with jaws considerably more protruding and with their edge slightly farther from center of eye. Dorsal and ventral fins still absent, with larval fin fold in their place; pelvic fins in early developmental stage, but caudal fin becoming more evident; soft rays in pectoral fin visible. Anus evident. Body division and pigmentation following the same pattern as in 3rd DAH samples.

At the 53rd DAH, specimens (8.0 ± 0.1 mm SL) showed triangular-shaped head resembling adult form, with well-protruding jaws, their edge far from center of eye. All paired and unpaired fins observed, but pelvic fins not fully developed, replacing larval fin fold. Body homogeneous in size, its pigmentation more diffuse than in former stages, although still following the same pattern as before.

At the 180th DAH, specimens (30.0 mm SL) seemed identical to adults, with characteristic barbel at edge of subterminal mouth. Body homogeneously pigmented, differing from former stages with pigmentation restricted to certain portions of the body.

Like adult fish of the species, fry and juveniles were observed to inhabit a near-water surface environment during all stages of development sampled. All measured characters for all groups were compared through Kruskal-Wallis (H=19.74; $p < 0.005$) test and Mann-Whitney *U* test, (3-7 DAH: $U = 3.77$, $p < 0.05$; 7-53 DAH: $U = 2.82$, $p < 0.05$; 53-180 DAH: $U = 3.72$, $p < 0.05$; 3-53 DAH: $U = 2.82$, $p < 0.05$; 3-180 DAH: $U = 3.77$, $p < 0.05$; 7-180 DAH: $U = 2.82$, $p < 0.05$) confirming the validity of the different size classes.

Most of the drastic morphological changes in *Monocirrhus polyacanthus* were observed to take place in early developed fishes (3rd DAH and 7th DAH), but fins showed slower development regardless of other body parts (Fig. 1, Table 1). Only pectoral and caudal fins were observed to develop earlier, in 3-7th DAH fish.

Observations on leaffish fries in the breeding tank revealed that their trophic strategies varied from ramming and alternately ram- and suction-feeding (data not shown). At the 3rd DAH stage, larvae were seen ramming onto living prey by propelling their body with tail movements for short distances, a technique classified as “S-starts movement” (Diana, 1995; Walker, 2004). From around the 5-7th DAH, larvae were observed to alternate both ram- and suction-feeding combined with active hunting of prey, culminating in the complex suction feeding behavior and mimic tactics displayed by adults.

Until the present, virtually no efforts on describing the early morphology of *Monocirrhus polyachanthus* has been found in the literature, except for one paper presented in the occasion of the 32nd annual meeting of the Ichthyological Society of Japan (Doi *et al.*, 1999). The faster development of pectoral and caudal fins rather than others might be associated with standard maneuvering and “start movements”, as usually observed in fishes in this stage. According to Walker (2004), maneuvering and “start movements” are commonly associated to predation strikes, which involve both caudal fin movements to generate the impulse as pectoral fins for maneuvering. As early-developed fish were observed to feed around 5-7 DAH, it is predictable that those fins should develop faster regarding others. As well, probably due to the need to

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feed on its preys in such an early stage of development, the rapid development of the body portions employed in the feeding mechanisms might be necessary.

Table 1. Average values (mm) are shown with standard deviation (SD) in parenthesis, except for 180 DAH, as only one sample was available. Values described with* refers for the calculation of the distance between the jaws to the begging of the "caudal membrane" described in the text, which is gradually replaced by the unpaired fins within development.

Tabla 1. Valores promedio (mm) van acompañados con la desviación estándar (SD) entre paréntesis, excepto para 180 DAH, dado que solo se contó con un espécimen. Valores remarcados con* se refieren al cálculo de la distancia entre las mandíbulas y el inicio de la "membrana caudal" descrita en el texto, que durante el desarrollo es gradualmente reemplazada por aletas impares.

	3 DAH	7 DAH	53 DAH	180 DAH
	n = 10	*n* = 10	*n* = 4	*n* = 1
Total length	5.0 (0.1)	5.5 (0.0)	9.9 (0.0)	35.0
Standard length	3.9 (0.2)	4.5 (0.1)	8.0 (0.1)	30.0
Jaw length	0.02 (0.0)	0.3 (0.0)	1.4 (0.0)	5.6
Head length	1.07 (0.9)	1.6 (0.0)	4.1 (0.0)	13.1
Head depth	1.3 (0.1)	1.7 (0.0)	3.0 (0.0)	8.9
Body depth	1.4 (0.9)	1.6 (0.0)	4.1 (0.0)	11.6
Jaw – Pectoral fin	1.2 (0.7)	1.8 (0.0)	4.2 (0.0)	13.2
Jaw – Pelvic fin	No data	2.0 (0.0)	3.7 (0.0)	11.4
Jaw - Dorsal fin	1.5 (0.1)*	1.9 (0.0)*	4.6 (0.0)	14.6
Presence of fins				
Pectoral fins	Yes	Yes	Yes	Yes
Pelvic fins	No	Yes	Yes	Yes
Dorsal fin	No	No	Yes	Yes
Caudal fin	No	Yes	Yes	Yes
Anal fin	No	No	Yes	Yes

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