

Deformity in the spine column of *Hoplerythrinus unitaeniatus*, an erythrinid fish from the Amazon basin in Brazil

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ABSTRACT

Skeletal deformity in fish such as lordosis, scoliosis and kyphosis are reported worldwide. These deformities occur especially in fish under farming conditions, being an utmost concern for aquaculture producers. However, cases in wild fish populations are poorly documented. Our study is the first record of scoliosis and kyphosis in *Hoplerythrinus unitaeniatus*, an erythrinid fish from the Amazon River system (Brazil).

Keywords: Amapá State; Vila Nova River; Jeju; Freshwater fish; Scoliosis, Kyphosis.

Deformidade na coluna vertebral de *Hoplerythrinus unitaeniatus*, um peixe eritrínideo da bacia Amazônica no Brasil

RESUMO

Deformidades esqueléticas em peixes como lordose, escoliose e cifose são relatadas no mundo todo. Essas deformidades ocorrem principalmente em peixes de cultivo, sendo uma grande preocupação para os produtores aquícola. Porém, os casos em populações de peixes selvagens, são pouco documentados. Nosso estudo é o primeiro registro de escoliose e cifose em *Hoplerythrinus unitaeniatus*, um peixe eritrínideo do sistema Rio Amazonas (Brasil).

Palavras-chave: Estado do Amapá, Rio Vila Nova, Jeju, Peixe de água doce, Escoliose, Cifose.

Jeju or aimara *Hoplerythrinus unitaeniatus* (Spix & Agassiz, 1829) is an Erythrinidae (Characiformes) with wide distribution in South America (MATTOX et al., 2006). This fish is distributed in several watersheds in Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Paraguay, Uruguay, Suriname, Trinidad and Tobago, and Venezuela (FRICKE et al., 2019). It is a carnivorous fish highly tolerant to hypoxic water (KRAMER, 1978; MATTOX et al., 2006). The species is important for subsistence fishing, with a few destined for aquarium trade, and for food consumption of the Amazonian traditional populations (FROESE; PAULY, 2019).

Skeletal deformity in fish such as lordosis, scoliosis and kyphosis are reported worldwide. These deformities occur especially in fish under farming conditions, being an utmost concern for aquaculture producers. However, skeletal deformities in natural fish populations are rare (ADHAM et al., 2000; ARBUATTI et al., 2013; COBCROFT; BATTAGLENE, 2013; FJELLDAL et al., 2012; KELLY et al., 2010; PORTA; SNOW, 2019; SANCHESAS et al., 2015; TOFTEN; JOBLING, 1996). Since the spinal deformities in wild fish from the Amazon has been not addressed, the aim of this study was to report for the first time the spinal deformity in *H. unitaeniatus* from the Amazon system, in eastern Amazon, northern Brazil.

During surveys (November 2017) biological with *H. unitaeniatus* from the Vila Nova River basin, municipality of Mazagão, Amapá state, Northern Brazil (Figure 1), thirty specimens were collected. Fish were collected using long gillnets and transferred to water tanks of 250 L with continuous water flow and constant aeration, in Laboratory of Aquaculture and Fishery from Embrapa Amapá for analysis. Thereafter, fish were euthanized with Eugenol (10 mg/L) and necropsied, when we observed the spinal deformity in *H. unitaeniatus*. This study developed in accordance with the principles adopted by the Brazilian

College of animal Experimentation (COBEA), and authorization from Ethics Committee in the Use of Animal of the Embrapa Amapá (Protocol N° 014/2018) was carried out.

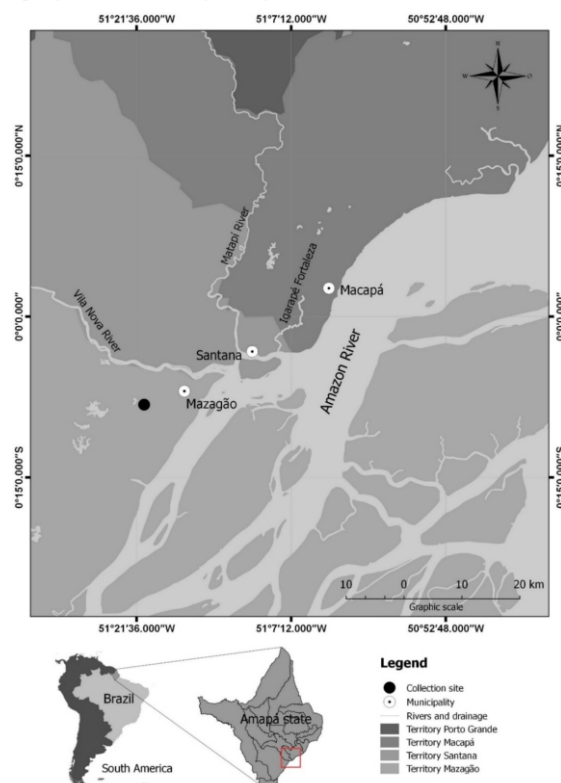


Figure 1. Study site in the Vila Nova River basin, a tributary of the Amazon River, Amapá State, Northern Brazil.

Among the 30 specimens of *H. unitaeniatus* (21.2 ± 3.1 cm and 240.1 ± 59.1 g) 3.3% had kyphosis (excessive convex curvature of the spine) (Figure 2A) and scoliosis (sideways spinal curvature) (Figures 2B-C).



Figure 2. Specimen of *Hoplerythrinus unitaeniatus* with spinal deformity in side view (A), dorsal (B) and ventral (C).

Skeletal deformity such as lordosis, scoliosis and kyphosis can occur specially in farmed fish due to nutritional deficiency. However, in wild fish populations such skeletal deformities have been rarely reported (ADHAM et al., 2000; ARBUATTI et al., 2013; COBCROFT; BATTAGLENE, 2013; FJELLDAL et al., 2012; KELLY et al., 2010; PORTA; SNOW, 2019; SANCHESAS et al., 2015; TOFTEN; JOBLING, 1996). For instance, in Brazil, lordosis has been reported in *Centropomus undecimalis* (Bloch, 1972) from a fish farm in the Santa Catarina state (SANCHES et al., 2013), as well as in farmed *Piaractus mesopotamicus* (Holmberg, 1887) in the São Paulo state (LOPES et al., 2014). In wild fish populations, lordosis has been reported in *Epinephelus itajara* (Lichtenstein, 1822) in the coast of the Pernambuco state (SANCHESAS et al., 2015) and in *Rhizoprionodon lalandii* (Valenciennes, 1839) in the coast of the São Paulo state (SANTOS; GADIG, 2014). However, no records on spinal deformities have been performed for wild fish from the Amazon region. Therefore, this is the first record of scoliosis and kyphosis in fish from the Amazon and were observed in *H. unitaeniatus* from the Amazon River system.

As *H. unitaeniatus* is a carnivorous fish, high levels of metal concentrations such as methylmercury commonly used in gold mining areas in the Amazon river systems during decades (BELTRAN-PEDREROS et al., 2011; GONÇALVES et al., 1999), should be a factor causing the skeletal deformity found here. In wild fish, it has been reported that skeletal deformities can be caused by several factors such as nutritional deficiency, pollution caused by heavy metals, variation in water temperature, stream water velocity, epigenetic factors and parasite infections (BENGTSSON et al., 1985; BERILLIS, 2015).

Although the trophic ecology of this species indicates a higher chance of accumulation of methylmercury, it is not possible to assign this skeletal abnormality in *H. unitaeniatus* based on a single specimen found. Hence, further studies should be performed to elucidate which factors are associated with such skeletal abnormality and whether this is in fact a problem in fish populations of the basin studied.

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