

# Teratogenic processes in an embryo without gills and low yolk absorption of *Zapteryx brevirostris* (Elasmobranchii: Rhinobatidae)

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## ABSTRACT

This is the first report of morphological anomaly in embryos of *Zapteryx brevirostris* (Lesser guitarfish), a very common species in Brazil. The gills were absent, and the pectoral fins were not fully formed nor were they completely fused to the head. They were asymmetrical, with the larger left pectoral fin projecting more toward the head (almost at the height of the eyes). The pelvic fin was absent, making sexing impossible. The cause of the morphological deformity is uncertain, although a nutritional problem of the embryo is evoked.

**Descriptors:** Abnormality, Anomalies, Chondrichthyes, Malformation, Ray.

## RESUMO

Este é o primeiro relato de anomalias morfológicas em embriões de *Zapteryx brevirostris*, espécie comum no Brasil. As brânquias estiveram ausentes, e as nadadeiras peitorais mostraram-se assimétricas e não totalmente formadas e fundidas à cabeça. A nadadeira esquerda, a maior, se projetou distintamente em direção à cabeça, quase alcançando a altura dos olhos. A nadadeira pélvica esteve ausente, não foi possível a determinação do sexo do animal. A causa da deformidade morfológica é incerta, mas sugere-se que possa estar relacionada a problema nutricional durante o desenvolvimento do embrião.

**Descritores:** Anomalias, Chondrichthyes, Anormalidade, Malformação, Raia.

The record of the existence of anomalies and diseases in fish is very old, the first to document a ray with malformed pectoral fins (from a report, since the original has not been found) being GESNER, before 1613 (RADCLIFFE, 1928). The occurrence of anomalies is more frequently recorded in osteichthyan species than in chondrichthyan (MNASRI et al., 2010), and despite several reports of morphological alterations in Chondrichthyes (i.e. SAÏDI et al., 2006; RIBEIRO-PRADO et al., 2008; NUNES; PIORSKI, 2009; MNASRI et al., 2010; GALVÁN MAGAÑA et al., 2011; HEVIA-HORMAZÁBAL et al., 2011), no records of anomalies in the species *Zapteryx brevirostris* (MÜLLER; HENLE, 1841) (Rhinobatidae) exist.

The collections of the specimens (artisanal fishery using gill nets: mesh 16) occurred on the coast of the state of Paraná in November 2011. The anomalous embryo was

found in a female collected in February 2012. It measured 45.4 cm TL and weighed 644 g, being one of a total of five embryos. The right uterus contained two males and one female, and the left uterus contained one male and the anomalous embryo (Figure 1).

With the exception of the anomalous embryo, the embryos were well developed, with total length (TL) varying from 9.1 to 9.9 cm, and weights varying from 4.06 to 4.54 g (Table 1). The anomalous embryo (Figures 2 and 3) was the smallest (0.15 g, approximately 2 cm). Since it was folded (arc-shaped), it was not possible to measure its TL. The pectoral fins were asymmetrical, with the larger left pectoral fin projecting more toward the head (almost at the height of the eyes). The pectoral fins were present but were not fused to the head (Figures 2 and 3). The pelvic fin was absent, making sexing impossible. The anomalous embryo had no spiracles or gill slits (Figure 4).

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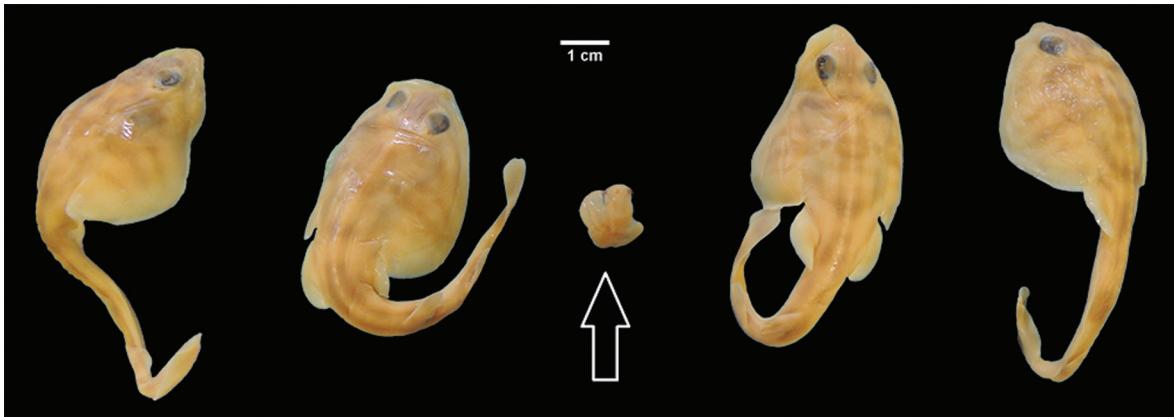


Figure 1. Dorsal view of the normal embryos and anomalous embryo (arrow).

Table 1. Morphometric measurements of the embryos.

	RIGHT UTERUS			LEFT UTERUS	
	1	2	3	1	2
Embryos	1	2	3	1	2
Total length (cm)	9.1	9.6	9.9	9.7	± 2
Total weight (g)	4.06	4.44	4.54	4.35	0.15
Sex	M	F	M	M	Unidentified
Full yolk sac weight (g)	7.6	9.26	9.82	9.8	10.86

M: Male; F: Female.

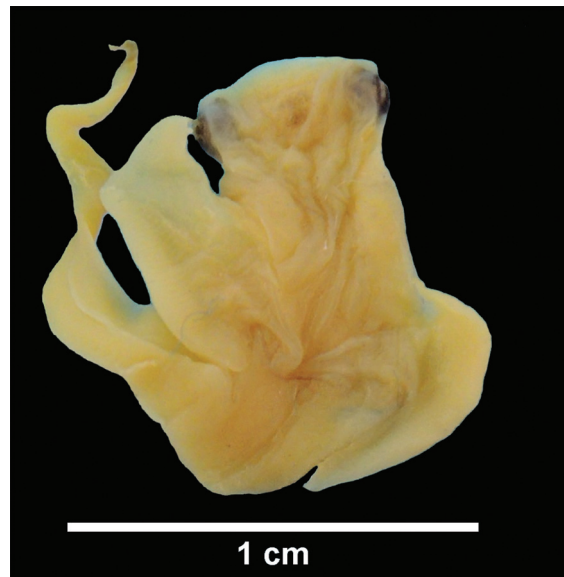


Figure 3. Dorsal view of the anomalous embryo.

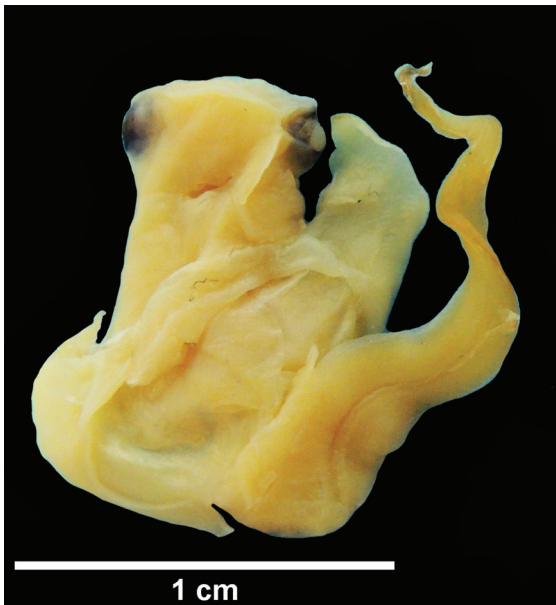


Figure 2. Ventral view of the anomalous embryo.

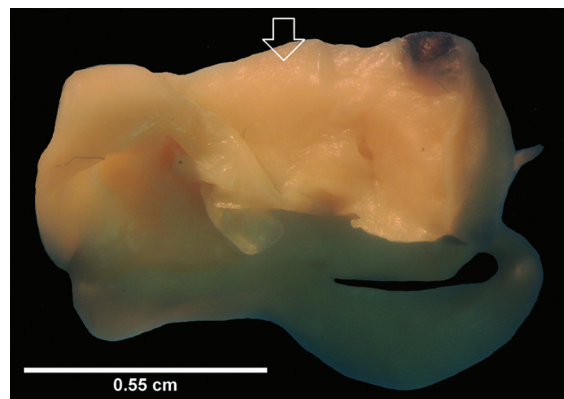


Figure 4. Anomalous embryo detail. Right sides of the head, between the mouth level and the origin of the pectoral fin, showing the absence of gill slits (arrow indicate where the gill slits should be).

The full yolk sacs of the four healthy embryos weighed between 7.60g and 9.82 g, while that of the anomalous embryo weighed 10.86 g. Despite the small difference between the full yolk sac weights, the difference in development between the normal embryos and the anomalous one was clear (Figure 1).

Most of the abnormalities found in rays are cases where the pectoral fins are not fused to the head (MEJÍA-FALLA et al., 2011). This type of abnormality has been described by different authors for diverse species of the ray families (ESCOBAR-SÁNCHEZ et al., 2009; MEJÍA-FALLA et al., 2011). The non-junction of the head with the pectoral fins in rays is possibly determined in the initial stages of embryonic development, when the rays present the snout free and the pectoral fins projected forward on each side (ROSA et al., 1996; MEJÍA-FALLA et al., 2011). With the development of the embryo, the fins grow more rapidly than the lateral fusion to the head, but the fusion is constant, and finally the pectoral fin becomes confluent with the head (as in adult rays), however, development is not always uniform and anomalies do, occasionally, occur (RADCLIFFE, 1928). The above statements thus suggest that the anomalous embryo was in the initial stages of development, corroborating the results of NUNES and PIORSKI (2009) and MEJÍA-FALLA et al. (2011) also attributed the malformations to problems during the initial stages of organogenesis.

The absence of gill slits and spiracles is another fact that confirms that the embryo in question was in the initial stages of development. In ray embryos, during the phase before the pectoral fins merge into the head, the gill slits are on the sides of the head, between the mouth level and the origin of the pectoral fin. In the anomalous embryo, between the mouth and the origin of the pectoral fin, this face was completely smooth without any gap or fissure (Figure 4). Based on the approximate size of the specimen and on the embryology of other elasmobranchs (due to the inexistence of studies about the embryology of the family Rhinobatidae), this embryo should have possessed gill slits and spiracles, since the rudimentary spiracle is present in embryos of about 0.50 to 0.90 cm TL, and the gill slits become visible in embryos of between 0.11 and 0.50 cm TL (SEDGWICK, 1892; DIDIER et al., 1998). Deeper explanations from an embryological point of view as regards the factors involved in the abnormal development are, unfortunately, impossible, since nothing about this has been found in the literature.

The fact that four healthy embryos and one malformed embryo were found in the same mother suggests that the main cause of the anomaly was a problem related to the absorption of the full yolk sac by the embryo, since the weight of the full yolk sac of the four normal embryos and the malformed embryo were similar, but the degree of development of the anomalous embryo was very different from that of the normal individuals.

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