

# First adult record of *Misgurnus anguillicaudatus*, Cantor 1842 from Ribeira de Iguape River Basin, Brazil

Primeiro registro de um indivíduo adulto de *Misgurnus anguillicaudatus*,  
Cantor 1842 do rio Ribeira de Iguape, Brasil

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**Abstract: Aim:** This work aimed to describe a first record of *Misgurnus anguillicaudatus*, Cantor 1842 in São Paulo state, as well as your potential impacts on native populations. **Methods:** The specimen was caught by eletro-fishing device, in Itaguapeva river, Ribeira do Iguape river basin, Ibiuna (SP), Brazil. Later, it was fixed in 10% formalin and taken to laboratory for species identification, morphometric data evaluation, diet analysis and stage of gonadal maturity. **Results:** The individual was an adult female, without parasites and with gonads in maturity stage B, which indicates vascularized ovaries and presence of oocytes in vitellogenesis process. The dietary analysis showed that 95.3% of the stomach was occupied by insect larvae. **Conclusions:** The diet analysis may suggest food overlap and consequent competition for food with native species of the genera *Trichomycterus* e *Characidium*, which consume essentially the same items. Still, the great morphological similarity with native species, especially Siluriformes, could generate competition for shelters. Additionally, the stage of gonadal maturity and a recorded ability of the species on establish invasive populations in different environments raise concerns about the possibility of *Misgurnus anguillicaudatus* reproduction on the studied site.

**Keywords:** oriental weatherfish, exotic species, sexual maturity, diet overlap, São Paulo State.

**Resumo: Objetivo:** Este trabalho objetivou descrever o primeiro registro de *Misgurnus anguillicaudatus*, Cantor 1842 no estado de São Paulo, bem como seus potenciais impactos em populações nativas. **Métodos:** O exemplar foi capturado com equipamento de pesca elétrica, no Rio Itaguapeva, bacia hidrográfica do Rio Ribeira de Iguape, no Município de Ibiuna (SP), Brasil. Posteriormente, foi fixado em formalina 10% e levado ao laboratório, para identificação da espécie, coleta de dados morfométricos, avaliação do estágio de maturidade gonadal (Vazzoler, 1996) e análise do conteúdo estomacal. **Resultados:** O indivíduo capturado era uma fêmea adulta, sem parasitas e com gônadas em estágio de maturidade B, que indica ovários já vascularizados e presença de ovócitos em processo de vitelogênese. A análise da dieta revelou que 95,3% do estômago era ocupado por larvas de insetos. **Conclusões:** A composição da dieta pode sugerir sobreposição alimentar e consequente competição por alimento com espécies nativas dos gêneros *Trichomycterus* e *Characidium*, que consomem essencialmente os mesmo itens. Ainda, a grande semelhança morfológica com espécies nativas, principalmente Siluriformes, poderia gerar disputa por abrigos. Adicionalmente, o estágio de maturidade gonadal e a já registrada capacidade da espécie de estabelecer populações invasoras em diversos ambientes geram preocupações quanto à possibilidade de reprodução da espécie no local.

**Palavras-chave:** Dojo, espécies exóticas, maturidade sexual, sobreposição de dieta, Estado de São Paulo.

## 1. Introduction

The oriental weatherfish, *Misgurnus anguillicaudatus* Cantor, 1842, known in Brazil as Dojo, is a member of the Cobitid family, which is very popular among aquarists including species such as the clown loach *Chromobotia macracanthus* (Bleeker, 1852), yoyo loach *Botia lohachata* Chaudhuri, 1912 and the kuhli loach *Pangio kuhlii* (Valenciennes, 1846). The dojo diet consists in worms, crustaceans, insect larvae and adult insects; it can reach 28 cm length, and support temperatures from 2 to 28 °C (Allen et al., 2002). In addition, the species has the ability to breathe atmospheric air for short periods due to adaptations of the respiratory system (Gonçalves et al., 2007). These characteristics allow its incidence in a wide range of environments such as streams, ponds, lakes, estuaries and swamps, giving preference to lentic environments (Freyhof and Korte, 2005; Franch et al., 2008). The spawning period occurs between May and August (Fujimoto et al., 2008).

Information on the ecological and socio-economical impact of fish introductions are scarce, and even in documented cases it is not given enough emphasis (Casal, 2006). Currently, there are reports of consolidated populations of *M. anguillicaudatus* introduced in the United States, Germany, Italy, Spain, Palau, Indonesia, Australia and the Philippines (Freyhof and Korte, 2005). In the USA, the first invasive populations were recorded in the decade of the 1930s (Freyhof and Korte, 2005), and they already demonstrate an established association with native macrophytes as hideouts (Tabor et al., 2001). In Europe the first record of a population was made in Italy in 1990 and in Germany this occurred 14 years after the first record of an individual specimen made in 1990 (Freyhof and Korte, 2005). A study demonstrating the establishment of the species in the Ebro Delta River, in Spain, reports the capture of more than 1000 individuals, adults and juveniles, in less than 7 years (Franch et al., 2008). In Brazil four individuals were caught in a stream in the Paraná River Basin between 2000 and 2001 (Ingenito et al., 2004) and several individuals were reported to the middle and high part of the Iguaçú River (Vitule, 2009). According to Oyakawa and Menezes (2011), there are no records of this species in the state of São Paulo. Nowadays, *M. anguillicaudatus* is imported for ornamental use in aquariums. However, the species was introduced as food source and living baits in the United States, Australia and Turkmenistan (Freyhof and Korte, 2005).

## 2. Material and Methods

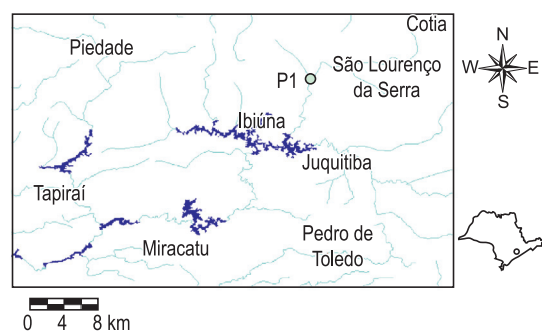
The specimen was captured in 2010 in the Itaguapeva River, a tributary of the Ribeira de Iguape River Basin, São Paulo (47° 14' 36" S and 23° 51' 46" W) (Figure 1). The stream is located on a well preserved mountain area, where a rich vegetation coverage occurs. There is no underwater vegetation but the presence of rocks and logs provides a great amount of shelters.

## 3. Results

The specimen captured (Figure 2) was fixed in a 10% formaldehyde solution, identified (Kottelat et al., 1998) and included in the fish collection of the laboratory of ecology of stream fish of the UFSCar-Sorocaba. It was a female measuring 15.3 cm (ST) and weighting 12.84 g. Since the individual was more than 8 cm in standard length, it was classified as an adult (Fujimoto et al., 2008). The body proportions of the specimen captured was in agreement with morphometrics traits of *M. anguillicaudatus* (Park et al., 2006) (Table 1).

## 4. Discussion

The large size of the specimen can be associated to introduction by aquarists. Fish release by aquarists can be aggravated when the animals are close to the sexual maturity, facilitating a successful establishment of a new population (Duggan et al., 2006). This is consistent with our observations because the female presented gonads in the B state



**Figure 1.** The study area with the sampling site (P1) in the Itaguapeva River (SINBIOTA, 2011).



**Figure 2.** The specimen captured.

**Table 1.** Comparisons between body proportions of *M. anguillicaudatus* obtained by us and by Park et al. (2006). All measures were made in mm. DSA = distance between snout and origin of anal fin; DSP = distance between snout and origin of pelvic fin; DPA = distance between origin of pelvic fin and origin of anal fin; HL = head length; DPP = distance between origin of pectoral fin and origin of pelvic fin; CPL = caudal peduncle length; CPD = caudal peduncle depth; BD = body depth; DED = distance between snout and origin of dorsal fin; LD = length of dorsal fin base; LB = length of third barbell; ED = eye diameter; SNL = snout length; SL = standard length.

Ratio (%)	Specimen captured	Park et al. (2006) (Mean $\pm$ SD)
DSA to SL	73.28	73.7 $\pm$ 1.9
DSP to SL	60.03	60.2 $\pm$ 2.2
DPA to SL	15.08	14.3 $\pm$ 1.0
HL to SL	17.02	16.9 $\pm$ 1.1
DPP to SL	42.08	42.4 $\pm$ 1.4
CPL to SL	15.45	14.3 $\pm$ 1.3
CPD to SL	9.3	9.4 $\pm$ 0.7
BD to SL	12.2	11.8 $\pm$ 0.6
DED to SL	59.11	57.2 $\pm$ 2.9
LD to SL	9.09	10.3 $\pm$ 1.2
CPD to CPL	60.36	58.0 $\pm$ 1.6
LB to HL	33.21	37.4 $\pm$ 2.2
ED to HL	15.48	15.8 $\pm$ 1.5
SNL to HL	38.58	42.3 $\pm$ 3.1

of maturity (Vazzoler, 1996). This means there were various oocytes in the first stages of vitellogenesis and the gonads were vascularized, suggesting the possibility of sexual maturity and spawning.

The diet overlap is another possible impact of the establishment of this species in the environment. About 96% of the stomach content of the specimen was composed by insect larvae and the remaining items were fragments of adult insects. Species of the genera *Characidium* and *Trichomycterus*, which are native taxa of the Itaguapeva river, feed on the same items found in the stomach of *M. anguillicaudatus* (Rondineli et al., 2009). Thus, the invasive species can be a potential competitor with the native ones.

We found a morphological similarity between the *M. anguillicaudatus* and the *Trichomycterus* species. Both fish have elongated and thin bodies, equipped with well developed barbells, indicating a putative competition by natural shelter.

Although no parasite has been found on the specimen collected, records about the presence of this ecological relation in introduced populations and the known cases in which parasites coming

from exotic species spread to local ones suggests precaution on this aspect (Dove and Ernst, 1998, Leal et al., 2010).

The wide range of possible impacts here demonstrated emphasizes the importance of creating awareness in the population about the environmental and socioeconomic impacts derived from the introduction of exotic species into the environment, coming to the conclusion that euthanasia is a better option than the release into the wild.

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