

Rapid Communication

First record of Asian weather loach *Misgurnus anguillicaudatus* (Cantor, 1842) in the River Meuse basin

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Abstract

The presence of Asian weather loach, *Misgurnus anguillicaudatus*, was confirmed for the first time in the River Meuse basin in September 2012. Initially, four specimens were caught in the Tungalroyse brook near the Belgium border. Based on settlement patterns in other parts of the world the species may become invasive. Potential ecological impacts should therefore be studied.

Key words: invasive species, Cobitidae, Aziatische modderkruiper, alien species, Europe

Introduction

During a 2012 fish survey in the Tungalroyse brook in the southeastern part of The Netherlands, 10 individuals (four in September, six in November) of Asian weather loach *Misgurnus anguillicaudatus* (Cantor, 1842) were observed. These are the first records of the species in both the Netherlands and the Meuse River basin. The Dutch name ‘Aziatische modderkruiper’ was given to the species by the authors.

M. anguillicaudatus is a species that belongs to the family Cobitidae. Species of this family of relatively small benthic fish can be found throughout Europe, Asia and Northern Africa. The species was introduced throughout the world as an ornamental fish for the aquarium trade (Strecker et al. 2011; Chang et al. 2009; Franch et al. 2008; Tabor et al. 2001), a food source (Park et al. 2006) and live bait (Franch et al. 2008).

Materials and methods

In September 2012, a fish survey for a legal ecological status assessment in pursuance with the European Water Framework Directive (WFD) (Bijkerk 2010) was conducted. For lowland streams, the WFD methodology dictates that permanent transects, representative of the occurring habitats, of approximately 250 m length have to be monitored every 3–6 years. This monitoring was conducted in the Tungalroyse brook using electrofishing (power generator and hand held equipment). Additionally, shallow swamp zones along the stream bank that were characterized by dense vegetation and a thick sediment layer, were sampled using a combination of hand held electrofishing gear and landing nets. Seven transects with a total length of 1985 m were monitored (Figure 1). Each individual fish was identified and measured to the nearest cm (total length).

Figure 1. Distribution of *Misgurnus anguillicaudatus* in the Tungalroyse brook (indicated with black line), a tributary of the River Meuse. Red open circles indicate record locations, numbers correspond to the Site Numbers in the Appendix (data: Water Board Peel and Maasvallei; S. Hunink). Small red dots indicate fish survey sites of the present study in the (vicinity of the) Tungalroyse brook. Some fish survey sites are outside the range of the map. See Appendix for record data.



Results

On September 24th, 2012, the first three specimens of *M. anguillicaudatus* were caught in the Tungalroyse brook in the vicinity of the village of Ell (Figure 1; Appendix 1). The fourth specimen was caught on September 25th in the Tungalroyse brook near the village of Altweertterheide (Figure 1; Appendix 1). On November 7th and November 28th 2012, additional specimens (n=6) were caught at the same location as the first specimens. The total length range of all specimens was 7 - 14 cm.

Identification

Relevant morphological characteristics of the collected specimens are indicated in Figures 2 and 3. *M. anguillicaudatus* was distinguished from the other species of *Misgurnus* and *Paramisgurnus* in Europe by three morphological characteristics according to Kottelat and Freyhof (2007): (1) dark irregular spots on the body, the absence of a broad midlateral stripe from eye to caudal base and the absence of a narrow stripe from the opercle (part of the operculum) at least to the pelvic origin (Figure 2); (2) caudal peduncle with low adipose crests (Figure 3); (3) presence of a dark spot at the upper caudal base (Figure 3).

Based on our findings, it appeared that one additional specimen of approximately 6 cm was

observed in the same stream at the village of Swartbroek (Figure 1; Appendix 1) on May 7th, 2012 by S. Hunink. Photographs of this specimen confirmed the presence of dark irregular spots on body, the absence of broad midlateral stripe, a caudal peduncle with low adipose crests and the presence of a dark spot at the upper caudal base.

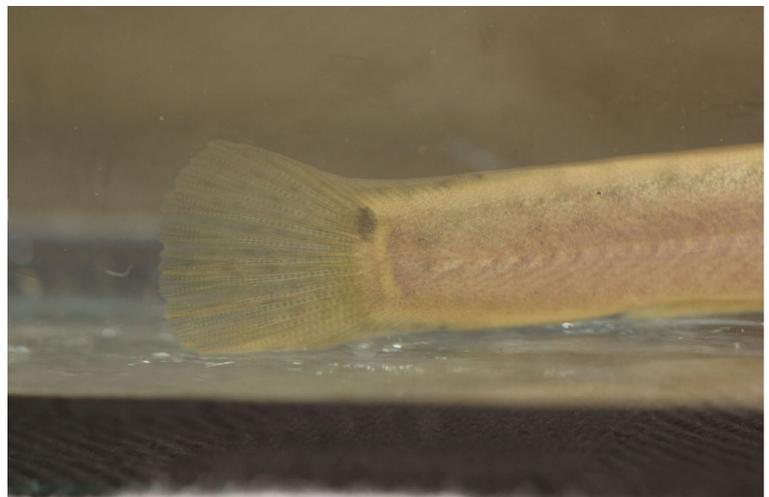
Discussion

A total of 11 specimens of *M. anguillicaudatus* have been caught in the Tungalroyse brook. The total length range of the observed specimens was 6 - 14 cm. The maximum length is 28 cm (Kottelat and Freyhof 2007) and the common length is about 15 cm (Froese and Pauly 2012). The age at first maturity in *M. anguillicaudatus* is 1-2 years for females and 1 year for males and in intensive culture *M. anguillicaudatus* reaches a length of over 11 cm at two years of age (Fengyu and Bingxian 1990). Based on these data, the caught individuals probably belong to the first, second or third year class. Because this species has been recorded at three different sites over four sampling periods, it is likely that the species has been reproducing in this or a nearby stream, rather than that the observations are the result of a single introduction. This is a strong indication that a viable population of *M. anguillicaudatus* has been established in the Meuse River basin.

Figure 2. Lateral view of *Misgurnus anguillicaudatus* from the Tungalroyse brook. Dark irregular spots present on body. Midlateral stripe from eye to caudal base and narrow stripe from opercle (part of the operculum) at least to pelvic origin are absent. Photograph by Martijn Dorenbosch.



Figure 3. Lateral view of caudal base of *Misgurnus anguillicaudatus* from the Tungalroyse brook. Dark spot at upper caudal base is present and caudal peduncle with low adipose crests. Photograph by Martijn Dorenbosch.



The native distribution of *M. anguillicaudatus* includes the Tugur and Amur River catchments in Siberia, Korea, Japan, China, Cambodia, India, Taiwan, Thailand, Laos and Vietnam (Froese and Pauly 2012; Kottelat and Freyhof 2007; Tabor et al. 2001). The species has been introduced into the wild in Australia (Allen 1984), Hawaii (Maciolek 1984), mainland USA (Amant and Hoover 1969), Mexico and Palau (Welcomme 1988), the Philippines (Juliano et al. 1989), Turkmenistan (Sal'nikov 1998), Germany (Freyhof and Korte 2005), Italy (Razzetti et al. 2001) and Spain (Franch et al. 2008). Subsequently, the species was first recorded in The Netherlands in May 2012.

The species is known to hybridize with other species of *Misgurnus* and *Paramisgurnus* (You et al. 2009; Fujimoto et al. 2008). Therefore, the

presence of this species in The Netherlands may form a potential threat to the rare native and protected *Misgurnus fossilis* (Linnaeus, 1758). This may also be applicable to *Cobitis taenia* (Linnaeus, 1758), a native species that occurs in the same locations in the Tungalroyse brook as *M. anguillicaudatus*.

Additionally, *M. anguillicaudatus* is a benthic feeder and its prey consists of a variety of macroinvertebrates. High population densities of *M. anguillicaudatus* may be altering macroinvertebrate communities and may cause elevated water column ammonia-N and NO_x-N and turbidity levels (Keller and Lake 2007), thus showing a similar effect on water quality as carp *Cyprinus carpio* (Linnaeus, 1758) (King et al. 1997; Robertson et al. 1997; Breukelaar et al. 1994).

The species has a broad tolerance for physiological variables, a flexible diet and a high reproductive potential (Koetsier and Urquhart 2012; Logan et al. 1996) and based on settlement patterns of the species in other parts of the world, there is a chance the species will become invasive in the Netherlands. Although negative impacts of *M. anguillicaudatus* in natural systems have not yet been quantified, ecological impacts should be studied and eradication strategies should be considered.

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Appendix 1. Records of *Misgurnus anguillicaudatus* in the Tungalroyse brook. References: S. Hunink (Site No. 1) and Water Board Peel and Maasvallei (Site No. 2-11).

Site number (Map ref.)	Record date	Record coordinates		Number collected	Length (cm)
		Latitude, N	Longitude, E		
1	7 May 2012	51°14'09.94"	5°47'33.22"	1	6
2	24 September 2012	51°13'00.03"	5°46'36.00"	1	14
3	24 September 2012	51°13'00.03"	5°46'36.00"	1	10
4	24 September 2012	51°13'00.03"	5°46'36.00"	1	8
5	25 September 2012	51°13'13.38"	5°39'27.35"	1	8
6	7 November 2012	51°13'00.03"	5°46'36.00"	1	11
7	7 November 2012	51°13'00.03"	5°46'36.00"	1	10
8	7 November 2012	51°13'00.03"	5°46'36.00"	1	9
9	28 November 2012	51°13'00.03"	5°46'36.00"	1	8
10	28 November 2012	51°13'00.03"	5°46'36.00"	1	7
11	28 November 2012	51°13'00.03"	5°46'36.00"	1	9