

## NEW DATA ON THE DISTRIBUTION OF *Cottus gobio* (SCORPENIFORMES; COTTIDAE) IN CROATIA WITH SPECIAL OVERVIEW OF THE ADRIATIC BASIN

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### *Summary*

In this paper, the data already known on the distribution of *C. gobio* in Croatia and is enriched and plotted together with several new localities. In the Butižnica River, right tributary of the Krka River, and the Babića Lake, one new population of *Cottus gobio* Linnaeus, 1758 was recorded during August 2009. This population belongs to the Adriatic lineage of *C. gobio*, which was until recently considered a separate species - *C. ferrugineus* Heckel and Kner, 1895. This lineage also includes the population from the River Zrmanja, and supports the theory that the Krka and the Zrmanja were connected in the past. So, the distribution area of *Cottus gobio* has been considerably extended by this study to the North, South and East of Croatia.

**Key words:** ichthyology, Krka, sculpin, distribution, Croatia

### *INTRODUCTION*

Only three species of *Cottus* are widespread in Eurasia (*Cottus poecilopus* Heckel, 1837, *C. gobio* Linnaeus, 1758 and *C. sibiricus* Kessler, 1889) and they are all cold-adapted species that inhabit upper parts of streams and rivers. Several additional species in Europe have lately been described by different authors (Kottelat and Freyhof, 2007). The sculpin, *C. gobio* is, except for the Iberian and Apennine peninsula, distributed throughout most of Europe.

In Croatia, the sculpin inhabits upper parts of the streams and rivers of north-western and central Croatia. In the Danube drainage system it is usually found in cold, clear waters together with *Salmo labrax* Pallas, 1814 and *S. trutta* (Linnaeus, 1758), as well as the in Adriatic drainage system (Zrmanja) with *S. farioides* (Karaman, 1938). Heckel and

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Kner (1858) first reported on the findings of sculpin in Croatian River Zrmanja („Zrmanja, Žegar“) in their book „Die Süßwasserfische der Österreichischen Monarchie“. They compared these individuals with specimens from the Lake Garda (Italy) and described them as a new endemic species *Cottus ferrugineus* (Heckel and Kner, 1858). According to their data this new species is endemic to the rivers drainage of the north Adriatic Sea basin. Afterwards reports were also made by Brusina (1874, 1907) and Kolombatović (1907) on the River Krupa (tributary of Zrmanja). Nominal species, *C. gobio*, was first reported by Jurinac (1887) from the rivers Dobra (near Ogulin), Korana, Vitunjčica and Zagorska Mrežnica. Except from that, according to Langhoffer (1905) and RHZZM (1908) in the fish collection of Croatian Natural History Museum there are *C. gobio* specimens from the rivers Una at Doljani, Sutla at Klanjec, Čabranka, Dobra, Sava (near Zagreb and Zaprešić), and *C. ferrugineus* from the Zrmanja.

Despite the expectation that sculpin could inhabit the Krka river, since the river was in the past connected to Zrmanja (Fritz, 1972; Bonacci, 1999), there had been no published findings of this kind. The authors Mrakovčić and Mišetić (1990) only mention previously reported *Cottus* sp. from an earlier unpublished study. However, no accurate data on these findings are given, and the authors present the suspicion that this species occurs in the Krka River basin.

Based on the examination of two specimens caught in the Zrmanja river at Žegar (locus typicus), Karaman (1928) was the first to express the doubts about the validity of the species *C. ferrugineus*. His measurements, proved that, apart from the colour, all the characteristics correspond to the nominal species. Later, Bianco (1990, 1993) also suggested that *Cottus* is a recent trans-Alpine „invader“ from the Danubian drainage area and agrees with Koli (1969) in that the populations of the Adriatic freshwater drainage belong to the widespread species *C. gobio*. In their hypothesis they assume that the Alps had not have acted as an efficient barrier for the dispersal of this fish and suggest where had been active transfers of haplotypes across this geographic barrier from the glacial cycles up to recent times (Šlechtova et al., 2004).

Finally, recent genetic research (Nolte et al., 2000; Šlechtova et al., 2004; Freyhof et al., 2005) reject *Cottus ferrugineus* as a valid species and populations of the Adriatic basin in Italy and Croatia are added to the nominal type *Cottus gobio* but considered as separate Adriatic lineage.

## MATERIALS AND METHODS

In this paper all of data from the former literature were analysed together with recent data gathered by the author and his colleagues from 2006 till 2011. All of the data was further analysed in ESRI ArcInfo GIS v. 9,3 software to plot distribution map of *C. gobio* in Croatia. Literature data was collected from the following references: Brusina, 1874, 1907; Jurinac, 1887; Langhoffer, 1905; Kolombatović, 1907; RHZZM (Ravnateljstvo Hrvatskog Zemaljskog Zoologičkog muzeja, 1908); Karaman, 1928; Šlechtova et al., 2004; Jelić et al., 2009. The author had preformed the electrofishing on two occasions during August 2009 on the Babića lake (Northern Dalmazia, Croatia; 44°16'26"N, 16°10'48"E; 646 m a.s.l.) where there is one of the main springs of the Butižnica River (belonging to



Fig. 1. *C. gobio* (Adriatic lineage) from the Babića Lake

Slika 1. *C. gobio* (jadranska linija) iz Babića jezera

upper Krka River drainage). On these occasions new, unknown population of *C. gobio* was recorded and sampled (Fig 1). SAMUS 725M (max 1000 V, 600 W) electrofishing device was used for all the sampling.

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## RESULTS AND DISSCUSION

During the six years investigation of fish fauna of the Adriatic and the Croatian part of Danube basin, several new populations of *Cottus gobio* were found. *C. gobio* was recorded on the total of 29 sites in Croatia (Table 1), out of which 8 sites belonged to the Adriatic basin (the rivers Krka and Zrmanja, and their tributaries), while 21 site belonged to the Danube River Basin (the upper part of the Sava River Basin to be exact) (Fig 2).

Altogether, 20 localities were already known from literature, but were mainly concentrated on localities in the upper Sava River basin, with only one record from middle Sava River basin (Jelić et al., 2009).

The author recorded the existence of *C. gobio*, for the first time, in August 2009 when investigating the fish fauna of the upper parts of the Krka River and its tributaries (Butižnica). For a long time the River Zrmanja was considered to be the only habitat of the Adriatic lineage of *C. gobio* (formerly *C. ferrugineus*) in Croatia. Newly discovered population inhabits the remote Babića lake and the upper parts of the River Butižnica on

Table 1. Data on the distribution of *C. gobio* in Croatia (X and Y coordinates in Gauss Kruger, zone 5)

Tablica 1. Podaci o distribuciji vrste *C.gobio* u Hrvatskoj (X i Y coordinate u Gauss Kruger, peta zona)

Locality	Basin (A - Adriatic, D - Danube)	Reference	X	Y
Babića jezero, Butižnica spring, Krka basin	A	this study	5594570	4904043
Bistrica brook	D	this study	5522819	5015693
Curak brook, tributary of Kupica (Kupa)	D	this study	5490525	5033647
Dobra	D	RHZZM, 1908	5535385	5036388
Dobra (Puškarići)	D	this study	5515202	5014408
Dobra near Ogulin	D	Jurinac, 1886	5517981	5013387
Gerovčica brook by Zamost	D	this study	5475314	5042621
Glina, middle part, village Topusko	D	this study	5574232	5012039
Glina, upper part, Bandino village	D	this study	5546812	5007994
Spring of Kupica, pritoka Kupe	D	this study	5488826	5032713
Klanjec area (probably from the Sutla river)	D	RHZZM, 1908	5556785	5100461
Kolpa, Kuzelj	D	Šlechtova, 2004	5485379	5036911
Korana	D	Jurinac, 1886	5538226	5023030
Križ lake (Lokvarsko lake)	D	this study	5477858	5025454
Krnjeza	A	this study	5568529	4895007
Krnjeza, spring area	A	this study	5568474	4895085
Krupa	A	Kolombatović 1907	5571277	4894428
Krupa, Monastery on the Krupa river	A	this study	5571277	4894428
Krupa, spring area, village Ljubičići	A	this study	5573030	4895126
Krupa, tributary of Zrmanja	A	Brusina, 1874; 1907	5571277	4894428
Maceljčica, Smiljanova graba	D	this study	5564616	5121460
Mrzlica, Lokvarsko lake	D	this study	5473208	5025922
Plešci, Čabranka	D	RHZZM, 1908	5475985	5044651
Savišće near Zaprešić	D	Langhoffer, 1905	5564348	5079510
Slunječica	D	Langhoffer, 1905	5546739	4992945
Slunječica by Slunj	D	this study	5546739	4992945
Stupnica brook (Gornja Stupnica)	D	this study	5600445	5002616
Šaševa brook (village Hajtić)	D	this study	5583918	5014769
Toplica, Dobra kuća	D	Jelić et al., 2009	5679565	5053723
Tounčica, Tounj	D	Šlechtova, 2004	5526654	5011692
Una, Doljani	D	Langhoffer, 1905	5588965	4932680

Una, estuary of Srebrenica	D	this study	5588981	4918194
Una, main spring	D	this study	5588586	4918115
Una, tributary Srebrenica	D	this study	5589852	4915606
Una, upper part	D	this study	5588772	4918133
Vidak brook, Medvednica mountain	D	this study	5571851	5090768
Vitunjčica (Turkovići)	D	this study	5514017	5015398
Vitunjčica (Vitunja brook)	D	Jurinac, 1886	5511423	5016329
Zagorska Mrežnica by Oštarije	D	Jurinac, 1886	5521959	5008975
Zagorska Mrežnica near Zagorje	D	Jurinac, 1886; Langhoffer, 1905	5518071	5007737
Zagreb ( the Sava)	D	RHZZM, 1908	5569115	5071666
Zrmanja	A	RHZZM, 1908	5569002	4891167
Zrmanja	A	Šlechtova, 2004	5569002	4891167
Zrmanja by Žegar	A	Karaman, 1928	5569002	4891167
Zrmanja, hidrological station Nadvode	A	this study	5571186	4890251
Zrmanja, Kaštel Žegarski, bridge	A	this study	5568931	4891189
Zrmanja, spring part	A	this study	5585871	4895881
Zrmanja, Dobarnica well	A	this study	5562205	4895861
Zrmanja, in Žegar	A	this study	5570788	4890751

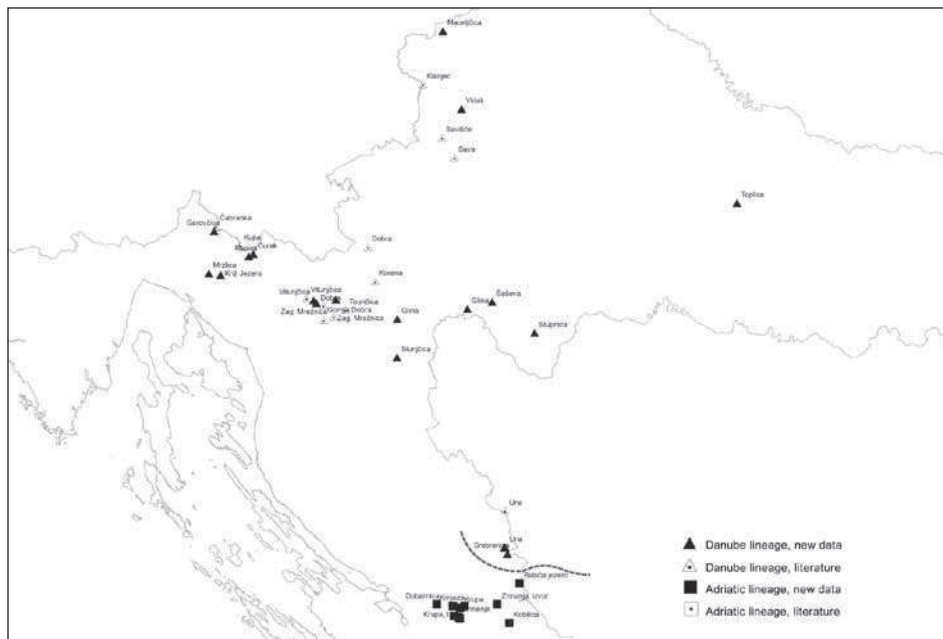


Fig. 2. Distribution of *C.gobio* in Croatia: ▲ Danube lineage, ■ Adriatic lineage, dashed line represents the border between the lineages

Slika 2. Distribucija vrste *C.gobio* u Hrvatskoj: ▲ dunavska linija, ■ jadranska linija, isprekidana linija predstavlja granicu između linija

the border between Croatia and Bosnia-Herzegovina (Tiskovac, Šibenik-Knin County). The Babića Lake is a 22 m deep limnophytic spring draining into the river Butižnica.

44 individuals of *C. gobio* were caught among the large stones and vegetation in the shallow parts of the lake, while only 4 individuals were caught in the Butižnica River below the lake. *Salmo farioides* Karaman, 1938 was the only other fish species caught in the lake and Butižnica River. In the lower part of the Butižnica River, near Knin, no fish species were recorded because the river, channelled by concrete walls, is completely destroyed. The Adriatic lineage of *C. gobio* was also recorded in several localities belonging to the Zrmanja River basin (Dobarnica, Krnjeza, Krupa, Zrmanja). The Danube lineage was newly recorded in northernmost parts of the Sava River basin in Croatia (Maceljčica brook), the river Glina and lower parts of the river Una (brooks Šaševa and Stupnica). All of the data gathered from the literature and our own field survey show that the Danube lineage is only found in the Sava River basin. Only literature record on the Drava River basin is brought by Mrakovčić et al. (1996) in their review on the ichthyofauna of the Drava River. But the authors just mention the presence of *C. gobio* as present without giving any literature reference or exact locality.

With this work the distribution area of *C. gobio* in Croatia is considerably extended to the North (Maceljčica brook), South (Butižnica, Krka River basin) and East (Toplica, Ilova River basin). Author believes that further morphological and genetic studies are needed to resolve the status of the Adriatic lineage of *Cottus* in Croatia and Southern Europe in general.

#### Sažetak

### NOVI PODACI O DISTRIBUCIJI *Cottus gobio* (SCORPENIFORMES; COTTIDAE) U HRVATSKOJ S POSEBNIM OSVRTOM NA JADRANSKI SLIV

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U radu se raspravlja o ukupnoj distribuciji *C. gobio* u Hrvatskoj i iznosi više novih lokaliteta. U rijeci Butižnici, desnoj pritoci rijeke Krke, i Babića jezeru, zabilježena je tijekom kolovoza 2009. nova populacija vrste *C. gobio* Linnaeus, 1758. Ova populacija pripada jadranskoj liniji peša koja je do nedavno smatrana zasebnom vrstom *C. ferrugineus* Heckel and Kner, 1895. Ovoj liniji pripadaju i populacije iz rijeke Zrmanje, što podupire i teorije o nadzemnom spoju tijekom geološke povijesti. Ovim radom, poznati areal vrste *C. gobio* u Hrvatskoj značajno je proširen na sjever, jug i istok.

**Ključne riječi:** ihtiofauna, peš, ribe, rasprostranjenje, Krka, Hrvatska

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