

Conservation status of the genus *Cobitis* and related genera in Croatia

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A b s t r a c t. Nine species of the family Cobitidae live in Croatia. Seven species belong to the genus *Cobitis* and one each to the genera *Sabanejewia* and *Misgurnus*. Species such as the *C. jadovaensis* Mustafić et Mrakovčić, 2008, *C. bilineata* Canestrini, 1866, *C. dalmatina* Karaman, 1928, *C. illyrica* Freyhof et Stelbrink, 2007 and *C. narentana* Karaman, 1928 live in the Adriatic River Basin (the northern Mediterranean), while the *C. elongatoides* Bacescu et Maier, 1969, *C. elongata* Heckel et Kner, 1858, *S. balcanica* Karaman, 1922 and *M. fossilis* Linnaeus, 1758 inhabit watercourses of the Danube River Basin. Although most Adriatic taxa appear to be endemic to this area, some researchers have revealed new phylogenetic relationships, suggesting the possibility of more recent taxa exchange with Danube freshwater fish fauna. All members of these genera inhabit either running and/or standing waters. According to IUCN methodology, *S. balcanica*, *C. elongata* and *M. fossilis* in the Danube watershed and *C. dalmatina* and *C. narentana* in the Adriatic watershed have been classified as vulnerable. *C. elongatoides* is in the lower risk category. The newly determined species *C. bilineata*, *C. illyrica* and *C. jadovaensis* will be in the endangered category. Here we present the majority of a total of 20 areas and water bodies included in the proposal of Natura 2000 and which have been selected for the conservation of the species from the family of the Cobitidae.

Key words: *Cobitis* diversity, distribution, Natura 2000, endangered species, conservation

Introduction

New findings and knowledge on the cobitid species has been uncovered in Croatia over the last eight years as a consequence of encouragement from research in the Czech Republic and three International Conferences on Loaches held in different European countries. The present study summarizes the current knowledge on the distribution and IUCN conservation status of family spined loaches Cobitidae in Croatia and presents a national list of sites for Croatian Ecological Network, which are of international importance and will be part of the proposal of the ecological network known as Natura 2000.

In recent years, the distribution and systematics of spined loaches in Croatia (Mrakovčić et al. 2000) have undergone numerous taxonomic changes and intensive investigations (Freyhof et al. 2000, Vasićeva 2000, Mustafić & Mrakovčić 2008). New data however suggests that the spined loaches still require much attention (Buj et al. 2008). The genus *Cobitis* consists of approximately 46 species of freshwater fish and has a wide geographic distribution throughout Europe and Asia, representing one of the most widespread genera of European freshwater fish (Kottelat & Freyhof 2007). The taxonomic status of genera *Sabanejewia* and *Misgurnus* is not yet resolved and numbers of species are not definite (Kottelat & Freyhof 2007). Croatian geological history, different habitats and different aquatic systems have resulted in a very rich freshwater fish fauna. Croatian rivers and streams are populated with nearly 129 freshwater fish species,

among them three autochthonous genera of spined loaches occur. Members of the spined loaches inhabiting Croatian freshwaters account for over 19 % of the total European spined loaches. Of the 26 species of the genus *Cobitis* in Europe (Bohlen 2001), 35 % are found in Croatia. The distribution and taxonomic data on the spined loaches in Croatia are properly described. Three cobitid taxa inhabit the streams draining into the Black Sea (*Cobitis*, *Sabanejewia* and *Misgurnus*) and two (*Cobitis* and *Misgurnus*) live in the streams draining into the Adriatic river basin.

Material and Methods

In recent years, new data on the cobitid species, legal regulations to adopt the IUCN red list of fish and the obligation to designate Natura 2000 sites has presented a number of questions in Croatia. The potential Natura 2000 sites for spined loaches from Annex II and the EC Habitats Directives were chosen on the basis of a long term survey carried out for more than 25 years and on the analysis of existing data from the tertiary publications. Once adopted, Natura 2000 sites will be designated by the Republic of Croatia as Special Areas of Conservation (SACs). Unfortunately, in European practice, there is no unique method for the determination of important areas for freshwater fish. However, there are a number of models for determining important areas in terrestrial and coastal ecosystems according to defined criteria. The methods specified for terrestrial ecosystems are not directly applicable in the ecosystems of continental waters (Abell et al. 2002). In selecting important areas for the recommendation of potential Natura 2000 sites, the principle of “best expert judgement“ was applied. Observed were: the importance of the areas for reproduction, nutrition, migration and the long term species stability. During the selection process, the quality and preserved condition of the habitats were taken into consideration and, where necessary, the possibility of restoration, all with the aim of preserving the favorable status of the investigated species.

Recommendations (Bohlen 2001) were also applied to protect and save the natural patterns of cobitid diversity. In order to emphasize the immense richness of these species, we included all the cobitid species in the Croatian legislation, and with less success their hybrid forms.

The presence and status of spined loaches were surveyed by electrofishing at more than 100 sites in the majority of Croatian rivers in the Danube and Adriatic river catchments. Data on the distribution of the genera *Cobitis*, *Sabanejewia* and *Misgurnus* were compiled for the catchments areas of the major rivers with the help of the Fisheries Registers of various angler societies, annual reports on fish kills, etc. Unpublished reports from many angler societies were reviewed specifically in rivers where the cobitid species were not found (Leiner et al. 1995). It was not possible to assess the necessary quantitative data of the population structure in relation to the total population number in specified areas. The estimates for some of the species will be possible only after some additional investigations, which will then be documented in percentages in relation to the entire population.

The threat of all the species was assessed according to the 2001 IUCN Red List Categories and Criteria, version 3.1. All species belonging to this family are recorded in Annex II of the Council Directive on the conservation of natural habitats and wild fauna and flora.

Results and Discussion

Zoographically, Croatia is divided into two separated watersheds, the Danube and the Adriatic river catchments. The contact zones between those areas are very interesting for *Cobitis*

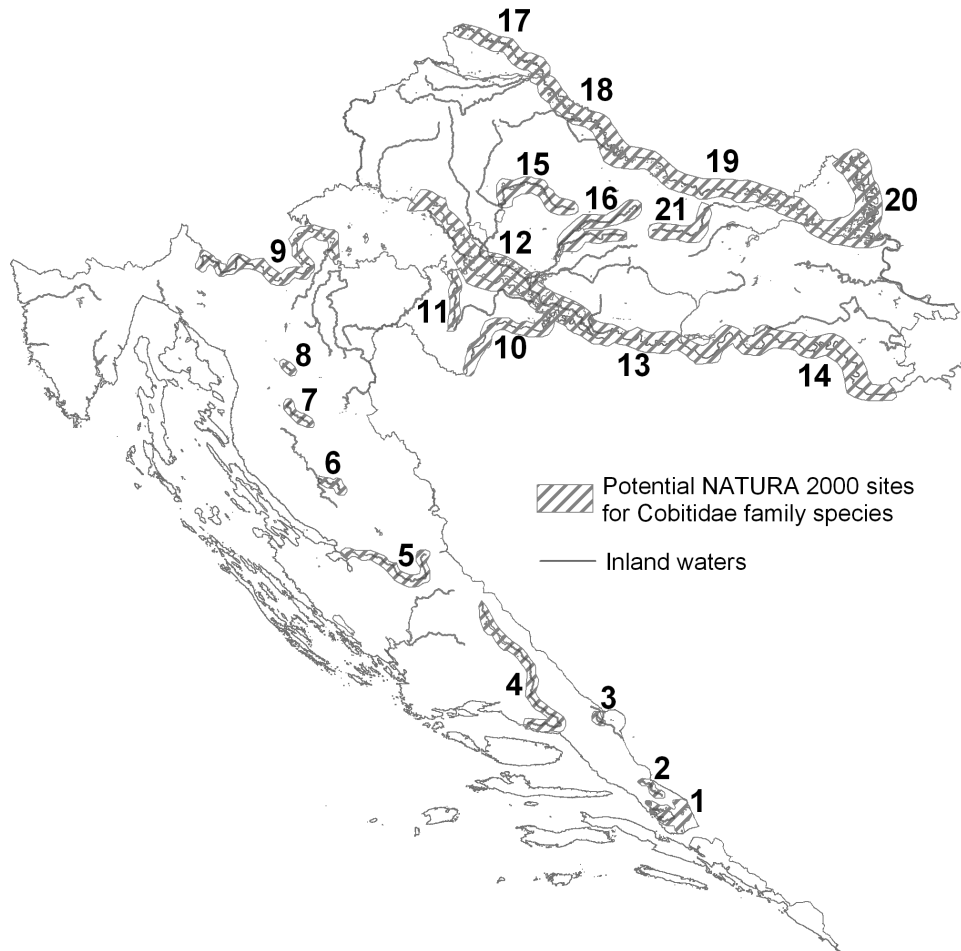


Fig. 1. Cobitidae species and their assigned habitats in Croatia, potential Natura 2000 sites in Croatia for species from the Cobitidae family: Delta Neretva with Bacina lakes (1), River Matica (2), Prolosko Blato (3), River Cetina (4), River Zrmanja (5), River Jadova (6), River Gacka (7), River Stajnicka jaruga (8), River Kupa from its source to the town of Ozalj (9), Una (10), Petrinjica (11), River Sava from Ivanja Reka downstream and Lonjsko polje (12,13,14), River Česma (15), Ilova and Toplica rivers(16), River Mura (17), River Drava from the Dubrava reservoir downstream (18,19), Podunavlje and lower Podravlje (20), and River Vocinska (21).

and *Misgurnus* species. The new results support differentiation of the Adriatic basin *Cobitis* and their independent evolution from the Central European group (B u j et al. 2008). Four species of spined loaches live in the Croatian part of the Danube watershed: *C. elongatoides*, *C. elongata*, *M. fossilis* and *S. balcanica*. Currently, six species are known to inhabit the Adriatic watershed: *C. jadovaensis*, *C. bilineata*, *C. dalmatina*, *C. narentana*, *C. illyrica* and *M. fossilis*. Although most Adriatic taxa appear to be endemic to this area, new phylogenetic relationships suggest the possibility of more recent taxa exchange with Danube freshwater fish fauna than previously anticipated (P e r d i c e s et al. 2008).

C. elongata is endemic for the Danube River basin. It is more frequent in the upper parts of the watershed and streams. The species inhabits the River Sava and its tributaries. It occurs only on habitats with fast running waters.

C. elongatoides is distributed in the watershed of the Danube basin, and its populations are quite stable. This species inhabits the Rivers Sava, Drava and its tributaries, and occurs in different types of waters from minor stagnant waters to major brooks and minor and major rivers.

S. balcanica is a rare species; the localities of inhabitation are fragmentary. In Croatia it is found in the River Kupa, the mid flow of the River Sava, the River Una and the lower flow of the River Drava and its tributaries.

M. fossilis inhabits watercourses of the Danube River Basin and Lika and Gacka, rivers of the karst fields, an isolated area in the Adriatic Basin. It is frequent in lowland floodplains of the Sava River and its tributaries, Drava, Mura and Danube rivers and prefers calm and stagnant waters. On the other hand, *M. fossilis* inhabits relatively cold and constant waters (11°C) of the River Gacka and is common in the River Lika. While a mixed fish fauna occurs in the River Lika, only two salmonid fish species co-exist in the River Gacka. For this region, it is not known neither if the species has been introduced nor the time of introduction in these waters (Mrakovčić et al. 2000).

All of the loaches from the Adriatic Basin are limited on small areas. Every species occurs only in a single river basin; *C. jadonaensis* in the Jadova River basin, *C. dalmatina* in the Cetina River basin, *C. illyrica* in the Imotski Polje, *C. narentana* in the Neretva River basin and *C. bilineata* in the Zrmanja River basin.

The cobitid species distribution has been hardly affected by human activities (Bohlen & Ráb 2001), therefore they are extremely important for fish conservation and zoogeographic boundaries. Some of the newly discovered species live only in a single river, stream or small watershed. According to IUCN methodology, *S. balcanica*, *C. elongata* and *M. fossilis* belong to the vulnerable category. *C. elongatoides* from the Danube watershed is in a lower risk category, *C. dalmatina* and *C. narentana* in the Adriatic rivers are considered vulnerable. The newly described species, *C. bilineata*, *C. jadonaensis* and *C. illyrica* are proposed to be in the endangered category. The present level of international evaluation for these species is presented in Table 1.

A few emphasized factors of threat exist for these species, primarily the alteration of habitat, pollution, sand and gravel extraction, water flow and level regulations, and the introduction of nonnative species. Sand and gravel extraction are especially emphasized as a cause of threat in the large rivers of the Danube River basin in the Kupa, Sava, Drava and Danube rivers and in the in the Neretva River Delta in the Adriatic River basin. The

Table 1. Species of family Cobitidae in Croatia (CE – critically endangered, EN – endangered, VU – vulnerable, LR – low risk, LC – least concern, NT – near threatened).

Species	Regional threat status	Global threat status
* <i>Cobitis jadonaensis</i>	EN	None
<i>Cobitis bilineata</i>	EN	LC
<i>Cobitis elongata</i>	VU	LC
<i>Cobitis elongatoides</i>		LC
<i>Sabanejewia balcanica</i>	VU	LC
<i>Misgurnus fossilis</i>	VU	LC
<i>Cobitis dalmatina</i>	VU	VU
<i>Cobitis narentana</i>	VU	VU
<i>Cobitis illyrica</i>	EN	CR

*Newly described species

Table 2. Species of family Cobitidae and their assigned habitats in Croatia.

Species	Potential Natura 2000 sites
<i>Cobitis narentana</i>	Delta of River Neretva and Bacina lake
<i>Cobitis illyrica</i>	Prolosko Blato
<i>Cobitis dalmatina</i>	River Cetina
<i>Cobitis bilineata</i>	River Zrmanja
* <i>Cobitis jadovaensis</i>	River Jadova
<i>Cobitis elongatoides</i>	River Mura River Sava from Ivanje Reke, Lonjsko polje River Cerna River Drava, from Dubrava reservoir down Podunavlje and lower Podravlje
<i>Cobitis elongata</i>	Rijeka Sava, Ivanja Reka, Lonjsko polje River Petrinjica River Kupa from the source to the town of Ozalj
<i>Sabanejewia balcanica</i>	River Kupa from the source to the town of Ozalj Rivers Ilova and Toplica River Una River Petrinjica River Vocinska
<i>Misgurnus fossilis</i>	River Stajnicka jaruga River Gacka River Mura River Drava from Dubrava basin down Podunavlje and lower Podravlje

* Newly described species

species of the Adriatic watershed have a limited area of distribution and are under great anthropogenic pressure.

Nine representatives of the spined loaches are included in Annex II of the Habitat Directive. Twenty areas were chosen in which the species from the spined loaches exist (Table 2). A total of 1674,5 km of rivers and a surface of 17489 ha were designated for the spined loaches (Table 2, Fig. 1).

As can be seen from the above (Table 2), 1 area each was isolated for *C. narentana*, *C. illyrica*, *C. dalmatina*, *C. bilineata*, *C. jadovaensis*, 3 areas for *C. elongata*, and 5 areas each for *C. elongatoides*, *S. balcanica* and *M. fossilis*. For six species in the Adriatic River basin the total area of 1138 ha was designated, and around 16351 ha were designated for four species in the Danube River basin (Table 3). The *M. fossilis* is the only species for which there is an isolated area in the Adriatic and Danube River basin.

It should be mentioned that *C. dalmatina*, *C. narentana*, *C. jadovaensis* and *C. illyrica* are distributed in a small area, and these fish are endemic to either Croatia alone or to Croatia and Bosnia & Herzegovina. As such, up to 100% of the area of occurrence was assigned for these species. The areas of occurrence of these species represent the „hot spots“ for a large number of other endemic species and, indirectly, through habitat conservation, will contribute to their protection. This is extremely important because protection through Natura 2000 will not depend on the acceptance of the eventual administrative demand for additional species in Annex II in Habitat Directive, which is a very slow process.

Of the designated localities, some are found within the protected areas. Part of the Sava River is within the bounds of the Lonjsko Polje Nature Park, and the mouth of the Drava

Table 3. Potential Natura 2000 sites, lengths (km) of rivers and surfaces (ha).

Potential Natura 2000 sites	Length	Surface
Delta of River Neretva and Bacina lake	42	699
River Matica	24	24
Prolosko Blato	8	34
River Cetina	104	208
River Zrmanja	69	104
River Jadova	23	23
River Gacka	25,5	46
Stajnicka jaruga	7,5	3
Kupa from source to the town of Ozalj	151	378
River Una	120	192
River Petrinjcica	33,5	17
River Sava from Ivanja Rijeka to Lonjsko polje	468	4680
River Cesma	52	78
Rivers Ilova and Toplica	86	52
River Mura	83	415
River Drava from Dubrava reservoir down	192	500
Podunavlje and lower Podravlje	143	10010
River Vocinska	43	26
Total	1674,5	17489

River is within the bounds of the Kopacki Rit Nature Park. Also, a large portion of the River Zrmanja is within the Velebit Nature Park. Some other areas are protected in the lower, landscape categories.

Detailed maps of occurrence, community structures and distribution suggest that spatial abundance of the Adriatic watershed populations is much denser. Temporal and other parameters of past distributions of the investigated genera were difficult to assess, as many investigations in the past were performed without a quantitative evaluation of those populations.

In the future, a two-year investigation is planned to obtain precise and quantitative data, and only then will a final assessment be possible. There is a lack of data for certain waters, which are particularly ecologically valuable. At this time, they have been assessed only partially or they were excluded, despite representing potential Natura 2000 sites. This particularly refers to the smaller rivers of the Adriatic River basin.

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