

Distribution of *Gobio* species in the Czech Republic

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Abstract. Three species of the genus *Gobio* occur in the hydrographical network of the Czech Republic, belonging to the basins of three seas (the North, Black, and Baltic seas). *G. gobio* is distributed over streams belonging to all three sea basins. It is most common in their middle reaches, which are inhabited by fish communities of the *Barbus-Chondrostoma* type. Compared to that past, the population numbers of this species have not undergone any marked changes. *G. kesslerii* occurs only in the Bečva River (a tributary to the Morava River) and in the Morava River upstream of the mouth of the Bečva River (Danube basin, Black Sea). *G. albipinnatus* is distributed over the Morava and Dyje rivers and their tributaries (Danube basin, Black Sea). Compared to a century ago, the extent of distribution of *G. albipinnatus* has dropped to about 50%, which is due chiefly to stream canalisation and water pollution. At present, *G. albipinnatus* has been ascertained in the lower part of the River Labe, yet there are some doubts as to the originality of this occurrence. The localities of *G. albipinnatus* and/or *G. kesslerii* are shared with *G. gobio*, with which they hybridise. No evidence is available of the occurrence of *G. uranoscopus* (Agassiz, 1828) in the Czech Republic, although it does occur in neighbouring Slovakia and Austria. The most important devastation factors, which limited the distribution of the gudgeon in the past, include the construction and operation of dams and weirs, stream canalisation and water pollution. National laws protect *G. kesslerii* as critically endangered and *G. albipinnatus* as endangered. Both species are listed in European conservation laws (Council Directive no. 92/43/EEC) and, therefore, special areas of conservation have been delimited for them within the NATURA 2000 system.

Key words: *Gobio gobio*, *G. albipinnatus*, *G. kesslerii*, *G. uranoscopus*, dispersal, conservation, devastation factors

Introduction

Due to their small size, the species of the genus *Gobio* are of no direct economic importance, and thus they have received insufficient attention. Their correct identification may have proven difficult not only for common fishermen but even for expert ichthyologists. Some of the species have become objects of protection on the basis of European laws. In recent years, therefore, the distribution of the different gudgeon species in central Europe has been elaborated and their occurrence recorded in new localities, which pertains especially to *Gobio albipinnatus*, *Gobio kesslerii*, and *Gobio uranoscopus* (Balon et al. 1988, Wanz enböck et al. 1989, Blachuta et al. 1994, Honsig – Erlenburg & Povž 1999). The occurrence of some of the *Gobio* species, reported outside their previously known ranges, may be due to the streams being connected through artificial channels and/or to the activity of fishermen (Freyhof et al. 2000, Scholten 2000), and probably even to the presence of a species having been overlooked or misidentified, particularly in the past (Wanz enböck et al. 1989).

In the waters of the Czech Republic, *Gobio gobio* had been considered to be the only species of overall distribution (Frič 1859, Jettles 1863, Kitt 1905, Schönfeld &

P y t l í k 1926). J e i t t e l e s (1863) pointed out two different gudgeon species inhabiting the River Morava. M a h e n (1930) identified, besides *G. gobio*, also *G. uranoscopus* in the River Jihlava, but the gudgeon in question was in fact *G. albipinnatus*, a species not described until 1933. Only as late as the mid-20th century were *G. albipinnatus* and *G. kesslerii* correctly identified and their occurrence recorded in the drainage area of the River Morava (O l i v a 1950, 1952). It is namely these two species of local occurrence that have experienced marked changes in distribution (L u s k et al. 2000b, M e r t a & L u s k 2004, B o h l e n et al. 2004). The knowledge of the present distribution of the particular species, above all, *G. albipinnatus* and *G. kesslerii*, is also essential in regard of their protection under both national and European legislation. Data on the present status of the particular gudgeon species, collected in the course of recent years, have been evaluated and are presented in this paper.

Methods

The hydrological system of the Czech Republic belongs to three different sea basins (the Black, Baltic, and North seas), which fact has also affected the occurrence of certain gudgeon species. At present, the river systems of the three sea basins are not connected in any way (Fig. 2). Data on the occurrence of the particular gudgeon species were collected during investigations on the fish communities inhabiting individual rivers, carried out by means of electro-fishing. The knowledge of the present status of distribution of *G. kesslerii* and *G. albipinnatus* is almost exclusively the result of our own investigations implemented in 1990 through 2003. Concerning the distribution of the species mentioned, we also gathered up all published data required to define their respective ranges. In view of the fact that the identification of the *Gobio* species is not invariably unambiguous, we considered the published data with regard to our own pieces of knowledge. We have retained the generic name *Gobio* for all gudgeon species under study even though some recent authors have evaluated the subgenus *Romanogobio* (B ě n ě r e s c u 1961), containing the species *G. albipinnatus* and *G. kesslerii*, as an independent genus *Romanogobio* (N a s e k a 1996, N a s e k a 2001).

The degree of danger imminent to each species as well as their conservation status have been defined according to the national legislation (law no. 114/1992 Gazette and intimation no. 395/1992 Gazette) and according to the European legislation (Council Directive No. 92/43/EEC). The degree was classified in the national Red List (L u s k et al. 2002, L u s k et al. 2004).

Results and Discussion

So far, three species of the genus *Gobio* have been found in the waters of the Czech Republic, viz., the common gudgeon (*Gobio gobio* (Linnaeus, 1758)), the sand gudgeon (*Gobio kesslerii* Dybowski, 1862), and the whitefin gudgeon (*Gobio albipinnatus* Lukasch, 1933). The stone gudgeon (*Gobio uranoscopus* Agassiz, 1828) is the only species that occurs in the waters of the neighbouring countries (Slovakia, Austria) but does not occur in those of the Czech Republic.

Gobio gobio (Linnaeus, 1758)

The common gudgeon is distributed over the whole hydrographical system of the Czech Republic and has always been considered a species of overall distribution (F r i ě 1859, 1908,

Jeitteles 1863, Kitt 1905, Hykeš 1921). In his comprehensive characteristics of *G. gobio*, Libosvářský (1995) states that “it lives in almost all waters except in cold mountain ones”. Earlier data on the occurrence of *G. gobio* include those on *G. albipinnatus* and *G. kesslerii*, as these species were not identified in the waters of the Czech Republic until after 1950 (Oliva 1950, 1952, Kux 1957). *G. gobio* is a species showing wide ecological tolerance, being considerably resistant to water pollution and eutrophication. It can find optimum conditions in streams inhabited by fish communities of the *Barbus-Chondrostoma* type. During our long-term monitoring of fishes inhabiting 22 sections of five streams in the River Dyje drainage area and populated by the typical *Barbus-Chondrostoma* community, *G. gobio* was the species in which we did not record, after an interval of over 30 years, any change in population numbers (Fig. 1) although the numbers of the key species of this fish community (*Barbus barbus*, *Leuciscus cephalus*, *Alburnoides bipunctatus*, *Chondrostoma nasus*) showed a considerable drop. In the conditions of the Czech Republic the occurrence of *G. gobio* was limited, above all, by the construction of dams in the middle reaches of rivers. Parts of the streams disappeared in reservoir lakes and, also, the change in water temperature regime in sections lying below the dams prevented the occurrence of *G. gobio*. Thus, in the River Dyje drainage area, 18 dams were erected after 1930, as a result of which the previous extent of the *Barbus-Chondrostoma* community type with the numerous occurrence of *G. gobio* decreased, in the streams affected, from 600 to 214 km of stream length (Lusk 1995). Even though *G. gobio* is capable of adapting to lenitic or stagnant waters, nevertheless the loss of lotic character of streams upstream of dams and weirs will also lead to an appreciable drop in the numbers of this species. For example, in a section of the River Morava, 165 km in length

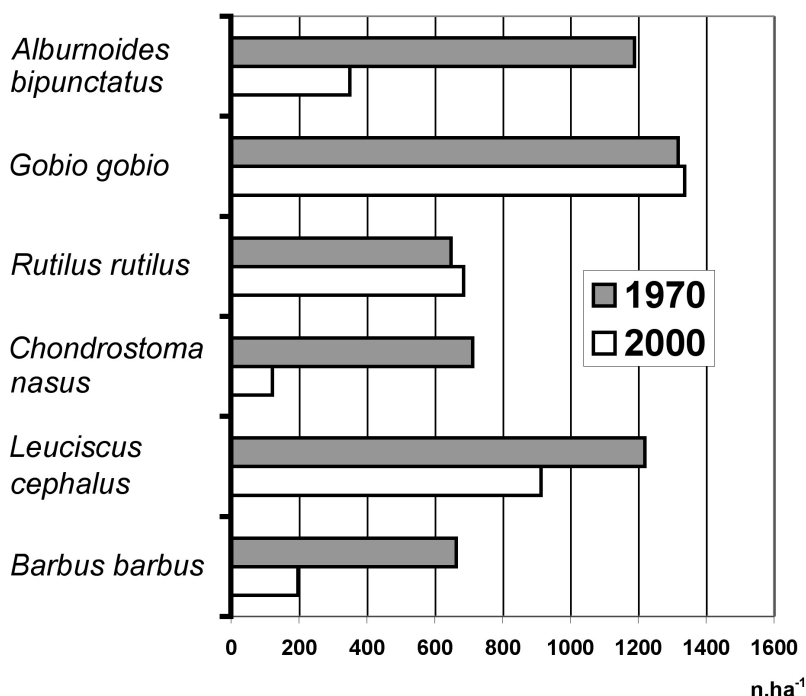


Fig. 1. Variation in numbers of *Gobio gobio* and some other species in 25 stream sections in the River Dyje drainage area after an interval of 30 years (1970 and 2000).

(r. km 70–235), 17 weirs have been constructed, impounding water in a total length of 95 km. Thus, the character of the river has been markedly altered from lotic towards lentic environments in 57.6 %. A similar situation can be found in most streams in the Czech Republic. *G. gobio* occurs together with *G. albipinnatus* and *G. kesslerii*, but in the past these species were not differentiated. *G. gobio* produces hybrids with the remaining two gudgeon species. Often the hybrids are difficult to identify by their phenotype. They can be reliably separated only by allozyme analysis (Š l e c h t o v á et al. 2005).

Status: The species is not protected either by national or by European legislation. In the national Red List it is evaluated as “Least Concern” (L u s k et al. 2004).

Major devastation factors: dams and their reservoirs, weirs and retained water, stream canalisation, strong water pollution.

Gobio kesslerii Dybowski, 1862

In the Czech Republic the sand gudgeon previously occurred only in the River Bečva, in which it was first identified in 1950 (O l i v a 1950). In 1950 a single specimen was collected near Lipník nad Bečvou (r. km 25); in the subsequent year, two specimens in the same locality; and another specimen was collected in a locality in r. km 56 (B a n a r e s c u & O l i v a 1966). Further finds did not follow until 45 years later when a single individual was captured near Přerov (r. km 10) (J u r a j d a et al. 1996). Our detailed ichthyological investigations on the River Bečva, implemented in 1997–1998, revealed the presence of *G. kesslerii* in the River Bečva from its mouth into the River Morava (r. km 0.1) up to Hustopeče n.B. (r. km 50.5). The species was most numerous in the river section near the village of Rybáře (r. km 35.5), up to 650 fish.ha⁻¹.

In 2003 the species was found to have spread even to the River Morava, in the section from the mouth of the River Bečva in r. km 210.7 up to the weir at Bolelouc (r. km 221.04), see M e r t a & L u s k (2004). The weir in r. km 221.04 is an insurmountable barrier for

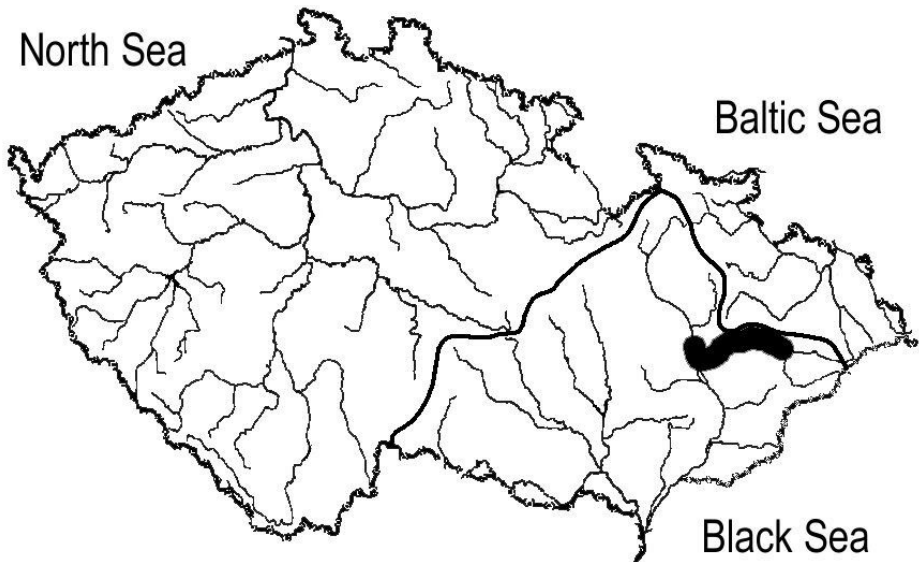


Fig. 2. Present distribution of *Gobio kesslerii* in the waters of the Czech Republic.

migrating fish so that incidental further upriver dispersal of *G. kesslerii* is out of question for the time being. The species may be expected to occur in the River Morava even downstream of the mouth of the Bečva. We consider the dispersal of *G. kesslerii* into the River Morava to be connected with the catastrophic flood that occurred in July 1997 (L u s k et al. 1998), during which the bottom quality of streams was markedly improved and individual *G. kesslerii* drifted down from the stream of the Bečva. According to earlier investigations, *G. kesslerii* had never occurred in the River Morava (P e ň á z & J u r a j d a 1993).

Status: According to the national legislation, *G. kesslerii* is evaluated as critically endangered so that it enjoys absolute protection including its habitats. The species has been proposed to be included among the species listed in Annex II of the Council Directive 92/43/EEC. For that reason, special areas of conservation have been defined for this species within the so-called NATURA 2000 system. This species is listed also in appendix 3 (Protected fauna species) of Bern Convention. In the national Red List (L u s k et al. 2004), *G. kesslerii* is classified as critically endangered (III-1, CE).

Major devastation factors: water pollution, stream modification, removal of gravel banks that form rapids in streams.

Gobio albipinnatus Lukasch, 1933

All original observations of the occurrence of *G. albipinnatus* come from streams in the River Morava drainage area (Black Sea basin). For the first time, the whitefin gudgeon was identified in the River Morava near Hodonín (O l i v a 1952). M a h e n (1930) reported the occurrence of *G. uranoscopus* in the River Jihlava, but this was no doubt a mistake for *G. albipinnatus*, the occurrence of which in that river was confirmed later (L u s k 1977). Mahen's misidentification was caused by the fact that *G. albipinnatus* was not recognised and described until

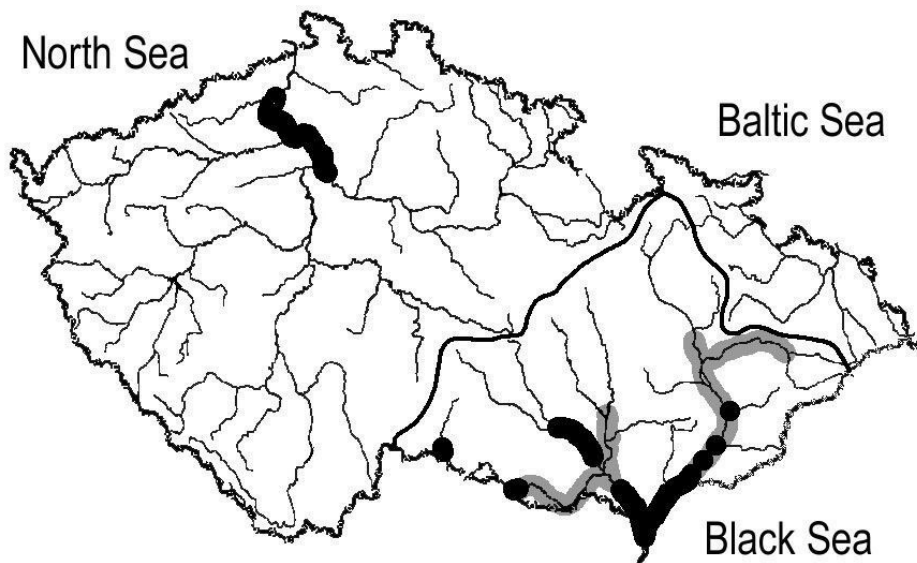


Fig. 3. Previous (grey) and present (black) distribution of *Gobio albipinnatus* in the waters of the Czech Republic.

four years later. According to K u x (1957), *G. albipinnatus* distinctly predominated over *G. gobio* in the lower reaches of the Morava and Dyje rivers. Recent data on the occurrence of *G. albipinnatus* are already available from the River Morava (P e ň á z & J u r a j d a 1993, J u r a j d a & P e ň á z 1994, J u r a j d a et al. 1998). We also found the species in the mouth of the stream Velička into the Morava upstream of Strážnice (r. km 128.8) (L u s k et al. 2000a). In 2003, *G. albipinnatus* was recorded in the River Morava near the mouth of the rivulet Olšava (r. km 154.7), also near Kroměříž (r. km 195.3) and in its tributaries Moštěnka, Dřevnice and Břežnice. One cannot exclude the possible local occurrence of this species in additional upstream sections of the River Morava.

L e l e k & L i b o s v á r s k ý (1960) reported the species as occurring in the lower section of the River Dyje in Břeclav. According to our recent observations, the whitefin gudgeon is very numerous in the lower reaches of the Morava and Dyje as well as in the lower section of the rivulet Kyjovka (a tributary to the Dyje). B a n a r e s c u & O l i v a (1966) also reported the species from the River Bečva near Kamenec where they had collected it in 1951. During our detailed investigations on the River Bečva in 1997–2000, we did not ascertain the occurrence of this species in that river.

According to recent data, the whitefin gudgeon occurs in the River Morava from its confluence with the Dyje in r. km 70 up to r. km 195.3. It is also abundant in the lower section of the Dyje down to the Novomlýnská reservoir (r. km 46.0). We recorded occasional whitefin gudgeon in the lower section of the River Jihlava up to Ivančice and in the lower and middle parts of the River Rokytná, a tributary to the Jihlava (r. km 15.7) (L u s k 1973). We have also confirmed the occurrence of *G. albipinnatus* in a short section of the Dyje upstream of the Vranov Reservoir (r. km 206–208). *G. albipinnatus* was also recorded in the River Dyje, r. km 253, near the Austrian border (the so-called Moravian Dyje). In contrast to the past, the distribution of *G. albipinnatus* has decreased by approximately 30% (Fig. 2) in the Morava and Dyje drainage areas.

In 2003 gudgeon were recorded in the River Labe in the area of its confluence with the River Vltava (the North Sea basin). They were identified as *Gobio albipinnatus*. After some hesitation, the authors of this find changed their earlier diagnosis of *G. albipinnatus* to *Romanogobio belingi* (B o h l e n et al. 2004). We ourselves found this “species” in 2004 in the River Labe near the weir at Sřtekov, 69 km downstream of the confluence of the Labe with the River Vltava, and furthermore near the weir at Neratovice, 13.1 km upstream of that confluence. In the German section of the Labe (r. km 419–454), where this gudgeon “species” was first ascertained in 1998, it was determined as *Gobio albipinnatus* (S c h o l t e n 2000). The author suggest three possible explanations for the presence of this species in the River Labe: (1) it resulted from fishermen releasing stocking material from other drainage areas; (2) it penetrated via channels from the drainage areas of other rivers (Odra); and (3) its origin is within the drainage area of the Labe but it had not been ascertained in the past. Similar explanations may also be acceptable for the presence of *G. albipinnatus* in the section of the Labe in the Czech Republic. The identification of the individuals that occur in the Labe in the Czech Republic is open to discussion.

The so-called *Romanogobio belingi* was originally described as *Gobio Belingi* (Slastenko, 1934) from the River Dnieper. B e r g (1949) was the first to synonymise *G. belingi* with *Gobio albipinnatus*. K o t t e l a t (1997) and N a s e k a et al. (1999) shared that opinion. At present, after the subgenus *Romanogobio* had been elevated to the species level, some authors (N a s e k a 2001, N a s e k a & F r e y h o f 2004) have evaluated the previous subspecies or synonyms within the species *Gobio albipinnatus* as species (*R. belingi*, *R. vladkovi*). Our

preliminary analyses of the DNA of specimens from the Labe and the Dnieper do not indicate their close relationship, necessary to accept their belonging to one species (*R. belingi*). For this reason, we tentatively evaluate the present finds in the River Labe in the Czech Republic as *Gobio albipinnatus*.

Interspecific hybrids often occur in places of joint occurrence of *G. albipinnatus* and *G. gobio*. Basing on morphometric analysis, K u x (1957) pointed out their occurrence in the lower reaches of the River Morava. L u s k (1973) reported the occurrence of such hybrids in the stream Rokytná. The occurrence of hybrids between *G. albipinnatus* and *G. gobio* was confirmed by examinations of allozyme diversity in the area of confluence of the rivers Morava and Dyje as well as in the lower section of the Rokytná.

Status: According to the national legislation, *G. albipinnatus* is evaluated as strongly endangered. The species is listed in Annex II of the Council Directive 92/43/EEC and therefore a special area of conservation has been delimited for this species within the so-called NATURA 2000 system. It is listed also in Appendix 3 (Protected fauna species) of Bern Convention. In the national Red List (L u s k et al. 2004) the species is classified as vulnerable (III-3, VU).

Major devastation factors: stream canalisation, water pollution, dams.

Factors affecting the distribution of gudgeons

The vital devastation factor, leading to the extinction of populations of all gudgeon species, is the change of the natural hydrological character of riverine habitats. Dams exert the most significant and most extensive impact in this point. Dam reservoirs will flood long river sections. Below the dams, the water temperature regime will change to a degree preventing the occurrence of gudgeon (L u s k 1995). To a smaller extent, weirs can exert a similar impact. They will decrease the longitudinal slope of streams and affect the movements of bed-load. In sections above the weirs the streaming water is retained, often for several kilometres long, so that lotic habitats will disappear. This circumstance limits or even prevents the occurrence of gudgeon. Besides, weirs are insurmountable migration barriers for the gudgeon, which is another factor that negatively affects the occurrence of the particular gudgeon species. In this way considerable parts of most streams have been devastated in the Czech Republic. In canalised sections the diversity of their hydrological as well as morphological characteristics is considerably limited. Another heavily devastating factor is the removal of gravel and sand beds from rapids, which offer stream microhabitats to gudgeon populations. At present, this activity is the most serious menace to microhabitats that are optimum for the occurrence of gudgeon. In the Czech Republic the exploitation of gravel and sand beds is not continuous, as is the case in some other regions (Slovakia), which is another heavily devastating factor (K o š č o et al. 2005). In the past, gudgeon populations were heavily devastated by water pollution of largely organic character. At present, however, such water pollution occurs quite exceptionally and to a limited extent.

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