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Re-occurrence of *Zingel streber* (Teleostei: Pisces) in the Czech Republic

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A b s t r a c t . Almost after a century, the occurrence of *Zingel streber* (Siebold, 1863) was recorded again in the area of confluence of the rivers Morava and Dyje. The population consisted of fish 0+ to 5+, with 0+ group predominating in the sample, indicating that the species had successfully reproduced in 2003. Analysis was made of their karyotype (n=5) and meristic characters (n=10). The following was the result of a study of growth of standard lengths (n=16): SL_1 – 81 mm, SL_2 – 114 mm, SL_3 – 130 mm, SL_4 – 146 mm, SL_5 – 166 mm. The biggest individual was a female 5+ of age, TL 200 mm, SL 180 mm. The habitat types preferred by individuals 0+ were the rapidly flowing sections with gravel bottom, in which the stream velocity was 0.2–0.6 $m.s^{-1}$. Re-occurrence of this species was facilitated by the marked improvement of water quality after 1990 as well as by the barrier-free connection of sections of the rivers Morava and Dyje with the Danube via the Slovakian-Austrian part of the River Morava. Further dispersal of this species is limited by the weir in r.km 26.7 on the Dyje, and six weirs between r.km 74.1 and r.km 101.8 on the Morava. *Z. streber* is protected by national law and the area mentioned above has been proposed as a pSCI for the NATURA 2000 system.

Key words: streber, occurrence, karyotype, meristic characters, length growth, conservation

Introduction

In the past, members of the genus *Zingel* rarely occurred in the Morava River and its tributaries in the Czech Republic (J e i t t e l e s 1863). In the mid-18th century, there were no migration barriers on the Morava River, and zingel *Z. zingel* and streber *Z. streber* could freely migrate upstream to considerable distances, such as to Olomouc (river km 233) and also tributaries, such as the Bečva River about 60 km of its mouth into the Morava in r.km 210.7 (P r i n c 1882). According to H e i n r i c h (1856), *Z. streber* migrated from the Danube upstream into the rivers Morava, Dyje, and Svratka. The occurrence of this species in the lower part of the Jihlava River was also reported by C a n o n (1927). The last record of the Danube streber in the Morava River near Hodonín (r.km 100) in 1911–1915 was mentioned by Z b o ř i l & A b s o l o n (1916). Subsequent reports of the occurrence of *Z. streber* in the Morava River drainage area in the Czech Republic were apparently derived from the information mentioned above (Š i m e k 1954, D y k 1956).

In the second half of the 19th and the first half of the 20th centuries, permanent, high weirs were successively built in the Morava River, and became migration barriers for fish (L u s k et al. 1996, L u s k & H o l č í k 1998). A similar situation occurred on the Dyje River. Degradation of water quality was another factor that caused the most sensitive fish species to vanish. In the course of the 20th century, water pollution successively increased in the Morava and Dyje rivers in the Czech Republic, causing extensive cases of fish

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mortality. At the same time, modifications to the two rivers, above all, the straightening and canalisation of their beds, occant noted other impacts on fishes (K u x 1956). For instance, in 1982 and 1985, a fish kill due to organic water pollution (from sugar refineries) was experienced during periods of low water discharge in the Morava River between Uherské Hradiště down to its confluence with the Dyje River (L u s k & H o l č í k 1998). A turn for the better came after 1990, when the water quality gradually improved both in the Morava River (when most of the sugar refineries were closed, sewage treatment plants were built near all major towns) and in the Dyje River, which was positively influenced by the presence of the Novomlýnské Reservoirs.

As a result, in the course of the last decade of the 20th century, renewed occurrence was successively demonstrated, in the Dyje and Morava rivers, of *Pelecus cultratus, Z. zingel,* the wild form of *Cyprinus carpio,* and *Gymnocephalus schraetser* (J u r a j d a et al. 1992, 1994, L u s k & J u r a j d a 1995, L u s k et al. 1996, 2000). Some new species also occurred, such as *Sander volgense, Proterorhinus marmoratus,* or *Gymnocephalus baloni* (J u r a j d a & P a v l o v 1993, L u s k et al. 2000). The reasons for these positive changes were improved water quality and the barrier-free connection between the confluence of the two rivers and the Danube (L u s k & H o l č í k 1998). However, the occurrence of the streber was not recorded until 2003. For this reason, the species had been included in the Red List as extinct from the waters of the Czech Republic (L u s k & H a n e l 2000, L u s k et al. 2002). In record of *Z. streber* in the lower reaches of the Morava and Dyje rivers in the Czech Republic for almost a century.

Study Area, Material and Methods

In the area of their confluence, the lower section of the Dyje River and that of the Morava River are connected with the Danube. In that part of the Morava River there are no migration barriers (weirs etc.). In the course of its regulation, various types of weirs were constructed on the lower section of the Morava River above its confluence with the Dyje. The first one is found in r.km 74.1 and another five up to Hodonín (r.km 101.8). Most of the weirs are impassable for migrating zingel species and other small fish species. The section of the Dyje River, from r.km 0.0 up to the weir at Břeclav (r.km 26.7) is also free from migration barriers (Fig. 1). During our investigations in the summer and autumn of 2003, there was a period of very low water discharge: Dyje 12 $m^3.s^{-1}$, Morava 9.8 – 15.1 $m^3.s^{-1}$.

The occurrence of *Z. streber* was recorded by means of an electro-fishing survey (pulsed DC, 160–200 V, 2.0 – 3.1 A). In the course of five excursions to the Morava River we captured and measured a total of 167 specimens. During three excursions to the Dyje River we captured 12 specimens. Besides, we recorded also occasional bags of this species by anglers. In all specimens, we measured their total length (TL) and standard length (SL). Meristic characters were determined in 10 specimens. The chromosome number was determined in 5 specimens. Standard procedures for chromosome preparation followed B o r o ń & K o t u s z (2000). The chromosomes were classified according to the system of L e v a n et al. (1964). Scales were taken from 16 specimens in order to determine their age and back-calculate their growth. Growth was determined from the lateral-ventral scale radius by using graphic variant of the Lee method, usage a correction of 26 mm (M a k a r a & S t r á ň a i 1980). After having been examined and recorded, most of the fish were released.

Results and Discussion

Dyje River

The first recent occurrence of *Z. streber* (n = 1, SL 102 mm) was recorded on 7 August 2003 in r. km 0.4 (48.37.162 N, 15.56.143 E). In the course of subsequent investigations, we recorded the occurrence of *Z. streber* in r. km 13.5 (n = 3), 20.3 (n = 6) and 25.7 (n = 2). Further possible dispersal of the species is prevented by the absolute migration barrier, the weir in r. km 26.7, as already stated in the case of other species *(Z. zingel, G. schraetser, G. baloni, Pelecus cultratus)* (L u s k et al. 1996, 2000).

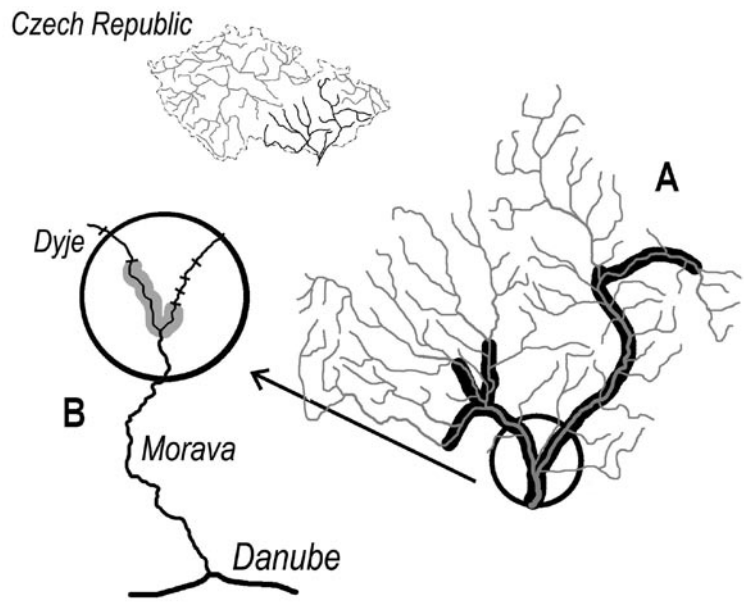

Fig.1. Historical (A) and present (B) occurrence of *Zingel streber* in the Morava River drainage area.

Morava River

The first occurrence of *Z. streber* (n = 3) was recorded on 17 July 2003 in r. km 71.8 (48.37.795 N, 16.57.550 E). Later (13 Aug., 17 Aug., 16 Sept., 28 Nov.), we observed numerous *Z. streber* in the section of the Morava River from its confluence with the Dyje River (r. km 70.0) up to the weir in r. km 74.1. Considering the motility of this species, the weir is an important barrier for its upstream dispersal.

Some biological characteristics

Data on biological characteristics of the *Z. streber* are rather scarce, therefore we present here our concrete observations obtained from the sample evaluated.

Meristic characters (n = 10, SL 59–179 mm): D_1 VIII–IX (mean, 8.4), D_2 II–III (mean, 2.2) 10–12 (mean, 10.9), A I–II (mean, 1.9), 8–10 (mean, 9.4), number of scales in l.l. 73–78 (mean, 75.6), scales above l.l. 4–7 (mean, 5.4), scales below l.l. 10–12 (mean, 10.6), number of spots 5–6 (mean, 5.5) not including the spot on anterior part of head. The above values fit

within the variation ranges and means reported by Weisz & Kux (1962) and Holčík (1979) in very numerous samples taken from rivers in eastern Slovakia.

The diploid chromosome number 2n = 48 was found in five specimens. Their karyotype consists of 3 pairs of metacentric, 4 pairs of submetacentric, 5 pairs of subtelocentric, and 12 pairs of acrocentric chromosomes. Similar results have been reported by Ráb et al. (1987), 2n = 48 (4 mtc + 20 smc + 22 stc-ac). Certain differences in chromosome classification are rather frequent in fishes. They are caused by the small size of the chromosomes, different degrees of their spiralization, and even by the different subjective evaluation by different authors.

Table 1. Growth in standard length (SL in mm) of *Zingel streber.*

River	Authors	n	SL_1	SL_2	SL_3	SL_4	SL_5
Morava	Our results	16	81	119	130	146	163
Topľa	Our results	4	78	110	132		
Nitra	Makara & Stráňai (1980)	12	76	106	131	148	166
Ondava	Krupka (1973)	15	71	104			
Dunaj	Krupka (1973)	14	64	95	119	139	
Hron	Stráňai & Makara (1976)	3	73	117			

Two females 5+ years of age showed the following dimensions. TL 199 mm, SL 179 mm, W 34.2 g, and TL 200 mm, SL 180 mm, W 35.1 g respectively. Berg (1949) and Banarescu (1964) give 175 mm as the maximum length for this species. The biggest female examined by Makara & Stráňai (1980) was 171 mm in SL and 47 g in W. Muus & Dahlström (1968) give the length of 12–18 cm, maximum about 22 cm, without stating the source of information. The SL of 16 specimens were back-calculated from their scales, with the following results: SL_1 = 81 (54–86) mm, SL_2 = 114 (109–117) mm, SL_3 = 130 (126–133) mm, SL_4 = 146 (143–148) mm, SL_5 = 163 (160–165) mm. Compared with data on the growth of the *Z. streber* in Slovakian rivers, our length growth data are very similar (Table 1). The length structure of the sample (n = 95), obtained in the Morava River on 13 and 17 August, indicates the highest representation of young-pf-the-year (0+), see Fig. 2. This suggests

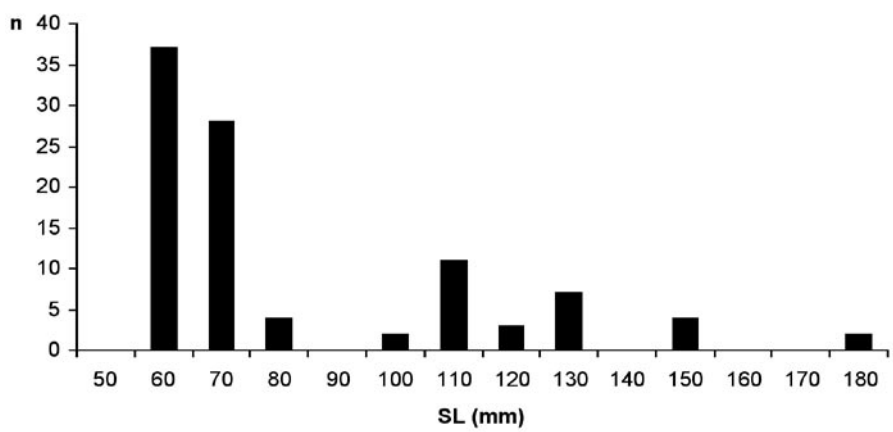

Fig.2. Size structure (SL) of a sample of *Zingel streber* (n=95) taken from the Morava River in August 2003.

that the species reproduced successfully in the Morava River in 2003. The low representation of bigger individuals is partly due to the character of the sections examined, i.e. rapids on gravel banks, with low water column, occupied primarily by the 0+ specimens. The data on both the numbers and observed size (age) structure of the *Z. streber* population in the area of confluence of the Morava and Dyje rivers indicate that this is with a population permanent, not an accidental occurrence.

The young-of-the -year (50–70 mm SL) stayed in the rapid sections of the stream on gravel-sandy bottom material. The water depth was 15–40 cm, the stream velocity 0.15–0.35 $m.s^{-1}$. Usually the fish occurred singly in the shadow of water flow behind a protruding gravel-stone. Since there are few such sections in that part of the River Morava (r.km 70.0–74.1), the occurrence of yearlings was very numerous in those habitats (5–18 fish per 10 m^2). Bigger single individuals stayed in deeper water at the bottom in the shadow of water flow behind bigger stones or lumps of wood lying on the bottom. A similar affinity of *Z. streber* to rapids with gravel bottom and water column about 30 cm high was found by Weisz & Kux (1962) in the Ondava River, Slovakia.

Conservation status and action

Although the occurrence of *Z. streber* had never been evidenced in the waters of the Czech Republic since the beginning of the past century, it is protected by national Intimation No. 395/1992 Sb. as a "critically endangered species". The species is also listed in Annex II. to the Council Direction no. 92/43/EEC. For this reason, the Czech Republic has proposed, for *Z. streber,* a pSCI area for the system of specially protected areas NATURA 2000. The proposed pSCI lies at the confluence of the lower sections of the Morava and Dyje rivers. In the national Red List of Lampreys and Fishes (Lusk et al. 2004), *Z. streber* has been classified as "critically endangered". The hitherto distribution of the streber is limited by weirs in lower parts of Dyje and Morava rivers. Preparations are under way for making these weirs passable for migrating fishes, and thus one may expect that by 2015 this will be done up to r.km 40 (Nové Mlýny) in the Dyje River, and at least up to r. km 110 (Hodonín) in the Morava River. Gravel and sandy banks with rapids are important microhabitats, above all, for spawning and subsequent growth of yearling *Z. streber.* Such sections must be uncompromisingly protected against gravel exploitation. Likewise, objects that create the shadow of water flow in the stream are important microhabitats for bigger individuals. In canalised river beds, therefore, rocks or groups of rocks scattered in the streamline can create such preferred microhabitats.

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LITERATURE

BANARESCU P. 1964: Pisces – Osteichthyes. Fauna Republicii Populare Romine, Vol. 13. *EARPR, Bucuresti, 959 pp. (in Romanian).*

BERG L.C. 1949: [Fishes in the freshwaters of U.S.S.R. and adjacent countries]. Vol.3. *Moskva-Leningrad: 927–1382 (in Russian).*

BOROŃ A. & KOTUSZ J. 2000: The preliminary data on diploid-polyploid complexes of the genus *Cobitis* in the Odra River basin, Poland (Pisces, Cobitidae). *Folia Zool. 49 (Suppl. 1): 79–84.*

CANON H. 1927: Tiere der Heimat, ein Beitrag zur Tiergeographie des böhmischmährischen Höhenzuges. *Jihlava*.
DYK V. 1956: Naše ryby [Our fishes]. *SZN Praha, 339 pp. (in Czech)*.
HEINRICH A. 1856: Mährens und k.k. Schlesiens Fische, Reptilien und Vögel. *In: Commision bei Nitsch und Grosse, Brünn, 1856, 200 pp*.
HOLČÍK J. 1979: Supplements to the description of *Zingel streber* (Osteichthyes, Percidae) with regard to its geographical variability. *Folia Zool. 28: 73–84*.
JEITTELES L.H. 1863: Die Fische der March bei Olmütz. I. *Abth. Jahres-Bericht über das kaislerl.-königl. Gymnasium in Olmütz während des Schuljahres 1863: 3–33*.
JURAJDA P., GELNAR M. & KOUBKOVÁ B. 1992: Occurrence of ziege (*Pelecus cultratus*) in the River Morava with notes on its parasites. *Folia Zool. 41: 187–189*.
JURAJDA P., GELNAR M. & KOUBKOVÁ B. 1994: Occurrence on Zingel (*Zingel zingel*) in the River Morava with notes on its parasites. *Folia Zool. 43: 93–96*.
JURAJDA P. & PAVLOV I**.** 1993: The first report of the Volga pikeperch (*Stizostedion volgense*) in the Dyje River. *Folia Zool. 42: 383–384*.
KRUPKA I. 1973: Ďalšie poznatky o veku a raste rýb [Additional findings about age and growth of fish]. *Pol'ovníctvo a rybárstvo 25 (5): 28 (in Slovak)*.
KUX Z. 1956: Příspěvek k ichthyofauně dolní Moravy a Dunaje (Contribution to the ichthyofauna of the lower Morava River and the Danube River). *Acta musei Moraviae 41: 93–112 (in Czech with German summary)*.
LEVAN A., FREDGA K. & SANDBERG A.A. 1964: Nomenclature for centromeric position on chromosomes. *Hereditas 52: 201–220*.
LUSK S. & HANEL L. 2000: Červený seznam mihulí a ryb České republiky – verze 2000 (The Red List of lampreys and fishes in the Czech Republic – Version 2000). *Biodiverzita ichtyofauny ČR (III): 5–13 (in Czech with English summary)*.
LUSK S., HANEL L. & LUSKOVÁ V. 2004: Red List of the ichthyofauna of the Czech Republic. *Folia Zool. 53: 215–226*.
LUSK S. & HOLČÍK J. 1998: Význam bezbariérového spojení říčního systému Moravy a Dyje na území České republiky s Dunajem (The importance of an unhindered connection of the Morava and Dyje river systems in the territory of the Czech Republic with the Danube. *Biodiverzita ichtyofauny ČR (II): 69–83 (in Czech with English summary)*.
LUSK S. & JURAJDA P. 1995: Record of ziege (*Pelecus cultratus*) in the Dyje River. *Folia Zool. 44: 284–287*.
LUSK S., LUSKOVÁ V. & HALAČKA K**.** 1996: Distribution of species of the family Percidae in the waters of the Czech Republic. *Acta Universitatis – Carolinae Biologica 40: 139–145*.
LUSK S., LUSKOVÁ V., HALAČKA K. & LOJKÁSEK B. 2000: Změny v druhové skladbě ichtyofauny na území České republiky po roce 1990 (Changes in the species composition of the ichthyofauna in the territory of the Czech Republic after 1999). *Biodiverzita ichtyofauny ČR (III): 21–28 (in Czech with English summary)*.
LUSK S., LUSKOVÁ V., HALAČKA K., ŠLECHTA V. & ŠLECHTOVÁ V. 2002: Status and protection of species and intraspecific diversity of the ichthyofauna in the Czech Republic. In: Collares-Pereira M.J., Coelho M.M. & Cowx I.G. (eds), Conservation of Freshwater Fishes: Options for the Future. *Fishing New Books, Blackwell Science Ltd. Oxford: 23–33*.
MAKARA A. & STRÁŇAI I. 1980: K poznaniu rastu kolka malého (*Zingel streber*, Siebold, 1863) a kolka vel´kého (*Zingel zingel*, Linnaeus, 1766) (Notes on growth of the *Zingel streber* (Siebold, 1863) and of the *Zingel zingel* (Linnaeus)). *Biológia, Bratislava 35: 595–599 (in Slovak with English summary)*.
MUUS B.J. & DAHLSTRÖM P. 1968: Süßwasserfische Europas. *BLV GmbH, München, 224 pp*.
PRINC V. 1882: Ryby v Bečvě u Val. Meziříčí [Fishes in the River Bečva near Val. Meziříčí]. *Vesmír 11: 164–165 (in Czech)*.
RÁB P., ROTH P. & MAYER B. 1987: Karyotype study of eight species of European percid fishes (Pisces, Percidae). *Caryologia 40: 307–318*.
STRÁŇAI I. & MAKARA A. 1976: K veku a rastu kolka väčšieho (*Zingel zingel*, Linnaeus, 1758) a kolka menšieho (*Zingel streber* Siebold, 1863) v dolnom Hrone (Notes on age and growth of *Zingel zingel* Linnaeus, 1758 and *Zingel streber* Siebold, 1863 in the lower Hron.) *Biológia, Bratislava 31: 883–884 (in Slovak with English summary)*.
ŠIMEK Z. 1954: Rybářství na tekoucích vodách [Fisheries on running waters]. *SZN Praha, 442 pp. (in Czech)*.
WEISZ T. & KUX Z. 1962**:** Ichtyofauna Ondavy a Hornádu (The ichthyofauna of Ondava and Hornad rivers). *Acta musei Moraviae 47: 181–200 (in Czech with German summary)*.
ZBOŘIL J. & ABSOLON K. 1916: Zoologická pozorování z okolí hodonínského [Zoological investigation from the Hodonín surroundings]. *Čas. mor. zem. mus. 15:171–183 (in Czech)*.