ACTA ZOOLOGICA BULGARICA
Acta zool. bulg., 60 (1), 2008: 77-88

The Ichthyofauna of the Shoreline Zone in the Longitudinal Profile of the Danube River, Bulgaria

Matej Polačik[1,2], Teodora Trichkova[3], Michal Janáč[1], Milen Vassilev[3], Pavel Jurajda[1]*

[1] Institute of Vertebrate Biology AS CR, 8, Květná St., 603 65 Brno, Czech Republic;
[2] Institute of Botany and Zoology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic;
E-mail: polacik@ivb.cz;
[3] Institute of Zoology, Bulgarian Academy of Sciences, 1, Tsar Osvoboditel Blvd., Sofia 1000, Bulgaria;
E-mail: trichkova@zoology.bas.bg

Abstract: The fish community in the shoreline zone of the Bulgarian section of the Danube River (r. km 376-840) was studied in different seasons of 2005-2006. Totally 38 sites were sampled using two methods-beach seining and electrofishing. In total, 44 fish species belonging to 12 families were recorded. Of them, 39 species are indigenous to the ichthyofauna of the Danube basin. First records of *Gasterosteus aculeatus* and nonindigenous *Gambusia holbrooki* are reported from the main channel of the Bulgarian Danube. In October 2005, *Neogobius fluviatilis* (91.18%) occurred most frequently followed by *Alburnus alburnus* and *N. kessleri* (88.24% each). Regarding the beach seine samples, *N. fluviatilis*, followed by *A. alburnus* and *N. melanostomus,* reached the highest abundance. Regarding the electrofishing, *A. alburnus* was most abundant followed by *N. kessleri* and *Leuciscus idus.* 19 of the species recorded are of high conservation concern in Bulgaria.

Key words: Lower Danube, shoreline zone, fish community, distribution, abundance, endangered species

Introduction

The Bulgarian part of the Danube River comprises the section of the Lower Danube located between river kilometres 845 and 375. The Lower Danube including the Danube Delta and its floodplains has been characterized by high species richness of the ichthyofauna (Busnita 1961, Banarescu 1964, Battes, Pricope 2006, Otel 2007). However, over the past decades, the fish community has undergone considerable changes as a result of human activities, such as river engineering, agriculture, waste water release, industry, overfishing, introduction of exotic species (Balon 1968, Cernisencu *et al.* 2002, Navodaru *et al.* 2002, Vassilev, Pehlivanov 2003, Schiemer *et al.* 2004).

First summary data on the ichthyofauna of the Bulgarian section of the Danube were presented in the works of Kovatcheff (1923), Morov (1931) and Drensky (1948, 1951). The number of the species and subspecies reported ranged from 33 to 54. The most intensive survey of the Danube ichthyofauna was made in the 1960s. Based on literature review and data from his survey, Marinov (1966, 1978) reported the occurrence of 61 fish species. Gheorghiev (1966) made a review of gobiid species in Bulgaria, including those occurring in the Danube River. Later, data on the fish species composition of the Danube River were summarized by Karapetkova, Zivkov 1995, Karapetkova *et al.* 1998 and Vassilev, Pehlivanov 2005.

* Corresponding author:

The recent studies in the Lower Danube have focused on the endangered fish species, such as sturgeons (Navodaru *et al.* 1999, Paraschiv, Suciu 2005, Vassilev 2003, Vassilev, Pehlivanov 2003) and lampreys (Stefanov, Holcik 2007). Some new fish species – native or introduced – not listed in the previous lists (see above) were reported for the main channel of the Lower Danube (Velkov *et al.* 2004, Jurajda *et al.* 2006, Simonovic *et al.* 2006, Vassilev, Trichkova 2007). Studies on the fish community were more intensive in the Romanian section and the Danube Delta, including its lentic side waters (Navodaru *et al.* 2002, Sindilariu, Freyhof 2003, Nastase, Navodaru 2004, Battes, Pricope 2006, Navodaru, Nastase 2006, Sindilariu *et al.* 2002, 2006), where the species composition is likely to differ somewhat from the main channel of the Bulgarian Danube. In the Bulgarian section, studies on fish communities relate exclusively to 0+ fishes (Vassilev 1994) or were performed in the adjacent lakes (Lake Srebarna, Pehlivanov 2000). The seasonal aspect of the potential change in fish community was not studied.

By sampling the whole Bulgarian section in different year seasons and using two sampling methods, the aim of our study was to provide a complex view on the fish community in the shoreline zone of the Danube River in Bulgaria.

Material and Methods

A total of 38 sites, more or less regularly distributed along the entire main channel of the Bulgarian Danube, were sampled (Table 1). The semiquantitative data are presented from the survey 5-12 October 2005. Within this period, a total of 34 sites were sampled by electrofishing and 28 sites by beach seining. Additionally, data on species composition of ichthyofauna of the Bulgarian Danube are qualitatively supplemented by the data from the surveys on 7-13 April 2005 (7 sites), 26-27 May 2005 (5 sites), 6-13 July 2005 (5 sites), 4-12 April 2006 (7 sites), 6-8 June 2006 (4 sites), 23-24 July 2006 (5 sites) and 11-19 October 2006 (11 sites) (Table 1). No young-of-the-year fishes were collected in April samplings, whereas samplings in other seasons allowed us to determine both adult and juvenile fishes to the species level right in the field. The only exception was *Cobitis* spp., which were determined only to the genus level. All samplings were undertaken during daylight.

Two sampling methods were employed in order to obtain a more complex view on the fish community. First, we used continuous, single pass electrofishing with a portable backpack unit LENA (output 300 V) equipped with elliptical anode of stainless-steel (40x20 cm, netting of 4 mm mesh size). The electrofishing samplings were made with the same sampling team to minimize between-operator bias (Bain, Finn 1990). A mean sampled stretch was 113 m. Second, a 7 m long beach seine with 4 mm mesh size was used for beach seining. The seine was operated by 2 persons who entered the river perpendicularly to the shoreline while holding the end bars. Then, the seine was moved downstream along the shoreline for about 20 m (mean netting length = 20.5 m) and closed by dragging it outspread to the shore. The length of the netted stretch was measured from the point of perpendicular entering to the middle of the outspread seine. Total percentage, catch-per-unit effort (CPUE = number of fish per 100 m of shoreline, Zalewski 1985) and frequency of occurrence of species caught in October 2005 were calculated.

The water temperature and the water level were recorded daily during the samplings and for one year period from 27 January 2006 to 26 January 2007, based on data from sites monitored by the Executive Agency for Exploration and Maintenance of the Danube River – Ruse, http://www.appd-bg.org.

Results

In both spring samplings (April 2005 and 2006) the Danube was flooded, reaching between 850 and 900 cm water level maximum (Fig. 1). In May 2005 and June 2006, the water level was still high ranging from 600 to 700 cm. In July samplings, the water level was in the range from around 200 to 350 cm, being higher during the first year. During October samplings, it attained levels up to about 400 cm in

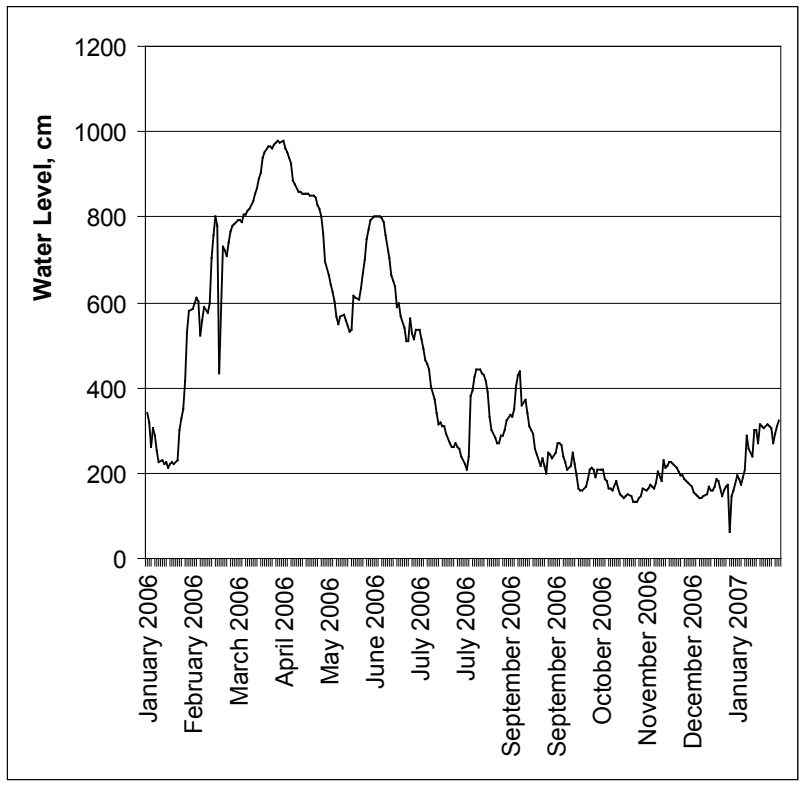

Fig. 1. Water level (cm) of the Danube River at Vidin (r. km 791) in the period 27.01.2006-26.01.2007, based on daily records of the Executive Agency for Exploration and Maintenance of the Danube River – Ruse.

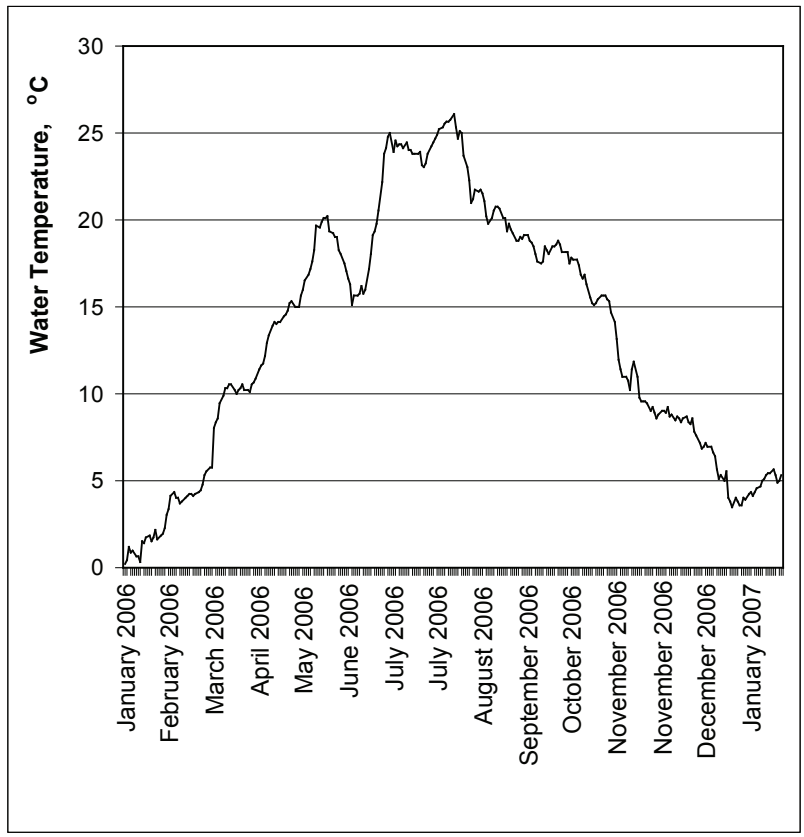

Fig. 2. Water temperature (°C) of the Danube River at Novo Selo (r. km 833) in the period 27.01.2006-26.01.2007, based on daily records of the Executive Agency for Exploration and Maintenance of the Danube River – Ruse.

2005 and up to 200 cm in 2006 (Fig. 1). The water temperature ranged from 8.5 to 11°C during April samplings; from 16.6 to 18.8°C in May and June samplings; from 23.0 to 24.5°C in July; and it was in the range from 15.0 to 19.0°C in October samplings 2005 and 2006 (Fig. 2). In October 2005, there were no substantial differences in water level and temperature between upstream and downstream sites.

The substrate type varied between different sites and within a single site depending on the season of sampling and the level of water. For instance, at Archar 2 in April (2005 and 2006), during the floods, the samplings took place on concrete ground and flooded vegetation, while in October, at normal levels, the substrate was mud and stones. In general, most frequently found were sites of mixed substrate, with mud and sand dominating among the downstream sites. In contrast, gravel and sand dominated in the upstream sites. Stones, boulders and concrete substrate were usually found at sites inside the bigger towns (Vidin, Ruse, Tutrakan). During the survey in October 2005, the total length of sampled stretch was 4.1 km (electrofishing) and 1.7 km (beach seining).

During all samplings in 2005 and 2006, 44 fish species belonging to 12 families were recorded (Table 2). A total of 4778 fishes of 36 species were caught in October 2005. Beach seine samples yielded higher species diversity (35 species) than electrofishing (26 species). Additionally, 8 species were collected during qualitative samplings: *Alosa pontica* (June 2006), *Leucaspius delineatus* (May, July 2005, April 2006), *Scardinius erythrophthalmus* (May 2005), *Misgurnus fossilis* (both April 2005 and 2006), *Gymnocephalus cernuus* (July 2005, June and July 2006), *Zingel streber* and *Z. zingel* (June 2006), as well as *Perccottus glenii* (both April 2005 and 2006) (Table 2).

In October 2005, the highest frequency of occurrence reached *Neogobius fluviatilis*, occurring at 91.18% of sites, followed by *Alburnus alburnus* and *Neogobius kessleri*, both occurring at 88.24% of sites (Table 2). *N. fluviatilis* was also the most abundant species contributing 41.38% to total catch. Regarding beach seine samples, *N. fluviatilis* reached the highest abundance, followed by *A. alburnus* and *Neogobius melanostomus*. However, electrofishing yielded *A. alburnus* being the most abundant, followed by *N. kessleri* and *Leuciscus idus* (Table 2).

Regarding the species origin, 39 recorded species are indigenous to the ichthyofauna of the Danube basin and *Sabanejewia bulgarica* is endemic to the Lower Danube. Five of the species are nonindigenous in Bulgaria: *Carassius gibelio*, *Pseudorasbora parva*, *Gambusia holbrooki, Lepomis gibbosus* and *P. glenii.* The presence of *G. holbrooki* seems to be restricted only to the lower part of the Bulgarian section (up to r. km 578). All nonindigenous species occurred in relatively low abundance (Table 2).

The species *A. alburnus*, *Rutilus rutilus*, *Cobitis* sp., *Syngnathus abaster* and all *Neogobius* species occurred in the catches during all sampling sessions. Some species were recorded only in one season – during April samplings (*Misgurnus fossilis* and *P. glenii*) or during autumn samplings (*Leuciscus cephalus* and *Benthophilus stellatus*). Some species were found only once at single sites – *Alosa pontica*, *Abramis ballerus, Gobio gobio, Scardinius erythrophthalmus, Z. streber* and *Z. zingel.*

Discussion

The only previous study on the Danube fish community, comparable with our survey in regard to the number of sampling sites and total length of sampled stretch, was that of Marinov (1966). The author sampled 25 sites in the whole Bulgarian section using common fishery equipment. During our survey electrofishing and small-mesh beach seine were applied for the first time to sample the Bulgarian Danube. These methods can be considered appropriate to obtain characteristic sample of the Danube`s shoreline fish community, since they enable collecting all sizes of fishes and provide covering of most of substrate types.

In this study we documented the presence of 44 species in the surveyed section, which is about 66% of the ichthyofauna occurring currently in the Bulgarian Danube and the adjacent lakes (unpublished data). This is the highest fish species diversity confirmed in the Bulgarian section compared to pre-

Table 1. Sampling sites, dates of sampling and sampled fish species along the longitudinal profile of the Bulgarian Danube. The fish species codes are given in Table 2.

River km	Site Name	Date of Sampling	Fish Species
840	Vrav 2	June, July, October 2006	Aa,Ab,Au,Cg,Cn,Li,Ra,Rr,El,Sa,Gb,Gc,Gs,Pf,Sl,Nf,Ng,Nk,Nm
836	Vrav 1	April, July, October 2005 April, June, July, October 2006	Ap,Aa,Ab,Au,Bb,Cg,Cn,Cc,Ld,Li,Pp,Ra,Rh,Rr,Vv,C,Mf,Sb,El,Sa,Lg,Gc,Gs,Pf,Sl,Pg,Nf,Ng,Nk,Nm,Pm
833	Novo Selo	April, May, July 2005 April, October 2006	Aa,Bb,Cg,Cn,Li,Pp,Ra,Rh,Rr,Vv,C,El,Ll,Sa,Lg,Gb,Pf,Sl,Pg,Nf,Ng,Nk,Nm,Pm
827	Florentin	October 2005	Aa,Ab,Bb,Cn,Gg,Li,Pp,Rr,Vv,El,Sa,Lg,Pf,N,Ng,Nm
825	Yasen	July, October 2005 April, June, October 2006	Aa,Ab,Bb,Cg,Cn,Li,Ra,Rh,Rr,Vv,C,Sb,El,Ll,Sa,Lg,Gc,Pf,Sl,Nf,Ng,Nk,Nm,Pm
818	Gomotartsi 2	October 2005	Aa,Bb,El,Sa,Pf,Nf,Nk,Nm,Pm
817	Gomotartsi 1	April, May, July, October 2005 July, October 2006	Aa,Ab,Au,Bb,Bj,Ld,Li,Rr,Vv,C,Sb,El,Sa,Pf,Pg,Nf,Ng,Nk,Nm,Pm
811	Koshava	April, May, July, October 2005 April, June, July, October 2006	Ap,Aa,Ab,As,Au,Bb,Bj,Cg,Cn,Ld,Li,Pp,Ra,Rh,Rr,Vv,C,Sb,El,Ll,Ga,Sa,Lg,Gc,Gs,Pf,Sl,Zs,Zz,Pg,Bs,Nf,Ng,Nk,Nm,Pm
796	Vidin 2	April, October 2006	Aa,Ab,Au,Cg,Cn,Lc,Li,Ra,C,Sa,Gs,Pf,Sl,Bs,Nf,Ng,Nk,Nm,Pm
791	Vidin 1	October 2005 October 2006	Aa,Ab,Bb,Bj,Cg,Li,Ra,Rr,C,Ll,Sa,Lg,Gb,Pf,Nf,Ng,Nk,Nm,Pm
776	Simeonovo	October 2005 April, July, October 2006	Aa,Ab,Au,Cg,Ld,Li,Rh,Rr,C,El,Ll,Sa,Lg,Gs,Pf,Sl,Nf,Ng,Nk,Nm,Pm
772	Archar 2	April, October 2005 April, October 2006	Aa,Cn,Ld,Pp,Rh,Rr,C,Mf,Sa,Lg,Pf,Sl,Pg,Nf,Ng,Nk,Nm,Pm
770	Archar 1	October 2005 October 2006	Al,Aa,Ab,Au,Cn,Li,Rr,C,El,Sa,Lg,Pf,Nf,Ng,Nm,Pm
765	Archar against Dovlek Island	April 2005	Rh,C,Nm,Pm
744	Lom	April, May, October 2005	Ab,Aa,Au,Bj,Li,Rh,Rr,C,El,Sa,Lg,Pf,Pg,Nf,Ng,Nk,Nm,Pm
735	Dolno Linevo	October 2005	As,Au,Cn,El,Sa,Pf,Sl,Nf,Nk,Pm
724	Stanevo	May, October 2005	Ab,As,Aa,Au,Cg,Ld,Li,Pp,Rh,Rr,Se,C,El,Sa,Lg,Gb,Pf,Sl,Nf,Ng,Nk,Nm,Pm
718	Dolni Tsibar	October 2005	As,Aa,Ra,Rr,Pf,Nf,Nk,Nm
701	Kozlodui	October 2005	Aa,Au,Bj,Li,Rh,Ra,Rr,C,Sa,Pf,Sl,Bs,Nf,Ng,Nk,Nm,Pm

Table 1. Continued.

River km	Site Name	Date of Sampling	Fish Species
678	Oryahovo	October 2005	Aa,Li,Ra,Rr,Gs,Pf,Sl,Nf,Ng,Nk,Nm
597	Nikopol	October 2005	Aa,Cg,Pp,Ra,Pf,Sl,Bs,Nf,Nk
578	Belene – Hisarlaka	October 2005	Aa,Cg,Vv,C,Gh,Gs,Pf,Sl,Nf,Nk,Nm,Pm
573	Belene	October 2005	Aa,Au,Cg,Ra,Vv,C,Gs,Pf,Sl,Nf,Nk,Nm
555	Svishtov	October 2005	As,Aa,Bb,Li,Ra,Vv,El,Sa,Gs,Sl,Nf,Nk,Nm
546	Vardim	October 2005	Ab,Aa,Ra,Vv,C,El,Pf,Sl,Nf,Ng,Nk,Nm
526	Batin	October 2005	Aa,Au,Li,Rh,Rr,C,Gh,Lg,Sl,Bs,Nf,Nk,Nm
516	Mechka Village, Stalpishte	October 2005	Ab,Aa,Au,Li,Pp,Ra,Vv,Ga,Sa,Gs,Sl,Nf,Nk
502	Ruse – Prista	October 2005	Aa,Nf,Nk,Pm
495	Ruse 2	October 2005	Aa,Cn,Li,Gh,Nk
493	Ruse 1	October 2005	Cg,Lc,Pp,El,Sl,Nf,Nk
482	Marten	October 2005	Aa,Bb,Ra,Gb,Nf,Nk,Nm
477	Sandrovo	October 2005	Aa,Cg,Cn,Cc,Li,Ra,C,Sb,Gb,Gs,Pf,Sl,Bs,Nf, Nk,Nm,Pm
466	Ryahovo	October 2005	Ab,Aa,As,Ra,El,Gh,Sa,Sl,Bs,Nf,Nk
433	Tutrakan	October 2005	Au,Li,Ll,Lg,Nk
423	Pozharevo – Dunavets	October 2005	Ab,Aa,Bj,Cn,Rr,C,El,Sa,Lg,Gs,Pf,Sl,Bs,Nf,N k,Pm
418	Dolno Ryahovo	October 2005	Aa,Au,Cg,Cn,C,El,Sa,Lg,Gs,Sl,Bs,Nf,Nk
395	Vetren	October 2005	Aa,Ra,C,Sa,Lg,Gs,Sl,Bs,Nf,Ng,Nk,Nm
376	Silistra	October 2005	Aa,Cn,C,Nf,Nk,Nm

vious studies (Marinov 1966 – 36 species, Vassilev 1994 – 29 species, Pehlivanov 2000 – 20 species). In the Romanian section of the Danube (r. km 530-504) Navodaru, Nastase (2006) reported the occurrence of 55 fish species, of which 30 species documented during their samplings and 25 species documented using direct observation of fishermen catches and processing filled questionnaires obtained from fishermen. Understandably, the number of species recorded during our study is much less than numbers reported for the Danube Delta (82 including the extinct species, Battes, Pricope 2006), or the Danube River as a whole (over 100 species, Schiemer *et al.* 2004, Sindilariu *et al.* 2006).

Marinov (1978) published a list of the Danube ichthyofauna in the Bulgarian section which included 61 species, based on the data from his survey (Marinov 1966) and the review of published works. Seven of the species found during our survey were not included in this list. Three of them did not occur in the surveyed section of the Danube before; however, they had occurred in some other lentic or lotic water bodies in Bulgaria. In the past, *L. delineatus* was rarely found only in the Black Sea coastal Lake Beloslav and the rivers Dyavolska, Provadiiska, Devnya and Kamchiya (Stefanov *et al.*, in press). First Vassilev (1994) recorded it in the ichthyoplankton of the Bulgarian Danube with relative abundance of about 4% of total catch. With sampling methods similar to ours, the species was recorded also in the Lower Danube and the Danube Delta and listed as sporadic and very rare (Sindilariu *et*

Table 2. List of fish species found in the shoreline zone of the Bulgarian stretch of the Danube River with species codes. Percentage, mean CPUE (number of fish per 100 m shoreline, beach seining and electrofishing, ± SE) and frequency of occurrence of fish species sampled in October 2005. (*) – Species collected during qualitative samplings in other seasons.

Species	Species Code	Percentage %	Mean CPUE (beach seine)	SE	Mean CPUE (electrofishing)	SE	Frequency of occurrence
Clupeidae							
Alosa pontica (Eichwald, 1838) *	Ap						
Cyprinidae							
Abramis ballerus (Linnaeus, 1758)	Al	0.02	0.04	0.04	-	-	2.94
Abramis brama (Linnaeus, 1758)	Ab	0.75	1.78	0.76	0.11	0.07	26.47
Abramis sapa (Pallas, 1814)	As	0.19	0.55	0.24	-	-	14.71
Alburnus alburnus (Linnaeus, 1758)	Aa	21.1	55.35	12.58	4.24	3.37	88.24
Aspius aspius (Linnaeus, 1758)	Au	0.71	1.44	0.53	0.19	0.08	32.35
Barbus barbus (Linnaeus, 1758)	Bb	0.10	0.12	0.09	0.08	0.05	14.71
Blicca bjoerkna (Linnaeus, 1758)	Bj	0.23	0.44	0.30	0.02	0.02	14.71
Carassius gibelio (Bloch, 1782)	Cg	0.19	0.05	0.05	0.24	0.14	17.65
Chondrostoma nasus (Linnaeus, 1758)	Cn	0.48	0.26	0.15	0.77	0.39	23.53
Cyprinus carpio Linnaeus, 1758	Cc	0.02	0.05	0.05	-	-	2.94
Gobio gobio (Linnaeus, 1758)	Gg	0.02	0.05	0.05	-	-	2.94
Leucaspius delineatus (Heckel, 1843) *	Ld						
Leuciscus cephalus (Linnaeus, 1758)	Lc	0.02	-	-	0.05	0.03	5.88
Leuciscus idus (Linnaeus, 1758)	Li	2.07	1.69	0.72	1.98	0.82	50.00
Pseudorasbora parva (Temminck & Schlegel, 1846)	Pp	0.17	0.18	0.10	0.11	0.06	14.71
Rhodeus amarus (Bloch, 1782)	Rh	0.86	0.21	0.21	0.87	0.57	8.82
Romanogobio albipinnatus (Lukasch, 1933)	Ra	0.86	2.46	0.73	0.01	0.01	38.24
Rutilus rutilus (Linnaeus, 1758)	Rr	3.58	8.53	5.06	0.32	0.22	35.29
Scardinius erythrophthalmus (Linnaeus, 1758) *	Se						
Vimba vimba (Linnaeus, 1758)	Vv	0.25	0.66	0.26	-	-	20.59
Cobitidae							
Cobitis sp.	C	2.45	5.81	4.52	0.22	0.10	41.18
Misgurnus fossilis (Linnaeus, 1758) *	Mf						
Sabanejewia bulgarica (Drensky, 1928)	Sb	0.02	0.05	0.05	-	-	2.94
Esocidae							
Esox lucius Linnaeus, 1758	El	0.65	1.49	0.58	0.13	0.06	43.18
Gadidae							
Lota lota (Linnaeus, 1758)	Ll	0.02	-	-	0.07	0.07	2.94
Poeciliidae							
Gambusia holbrooki Girard, 1859	Gh	0.08	0.13	0.09	0.19	0.16	11.76

Table 2. Continued.

Species	Species Code	Percentage %	Mean CPUE (beach seine)	SE	Mean CPUE (electrofishing)	SE	Frequency of occurrence
Gasterosteidae							
Gasterosteus aculeatus Linneaus, 1758	Ga	0.02	0.07	0.07	-	-	2.94
Syngnathidae							
Syngnathus abaster Risso, 1827	Sa	3.14	8.43	1.78	0.07	0.07	55.88
Centrarchidae							
Lepomis gibbosus (Linnaeus, 1758)	Lg	0.63	0.75	0.47	0.44	0.29	23.53
Percidae							
Gymnocephalus baloni Holcik & Hensel, 1974	Gb	0.15	0.10	0.10	0.13	0.09	8.82
Gymnocephalus cernuus (Linnaeus, 1758) *	Gc						
Gymnocephalus schraetser (Linnaeus, 1758)	Gs	0.40	1.05	0.39	-	-	26.47
Perca fluviatilis Linnaeus, 1758	Pf	3.43	6.82	1.90	1.00	0.41	64.71
Sander lucioperca (Linnaeus, 1758)	Sl	1.26	2.70	0.66	0.31	0.15	51.00
Zingel streber (Siebold, 1863) *	Zs						
Zingel zingel (Linnaeus, 1766) *	Zz						
Odontobutidae							
Perccottus glenii Dybowski, 1877 *	Pg						
Gobiidae							
Benthophilus stellatus (Sauvage, 1874)	Bs	0.63	1.75	0.70	-	-	23.53
Neogobius fluviatilis (Pallas, 1814)	Nf	41.38	109.13	15.05	1.38	0.36	91.18
Neogobius gymnotrachelus (Kessler, 1857)	Ng	2.51	5.22	2.07	0.49	0.31	38.24
Neogobius kessleri (Günther, 1861)	Nk	4.35	6.56	1.26	2.89	0.62	88.24
Neogobius melanostomus (Pallas, 1814)	Nm	6.44	13.37	3.86	1.49	0.66	58.82
Proterorhinus marmoratus (Pallas, 1814)	Pm	0.82	0.53	0.20	0.86	0.39	41.18

al. 2002). Navodaru, Nastase (2006) found it in the Danube River around Cama Dinu islets. In Bulgaria *Gasterosteus aculeatus* was known previously only from the marshes along the Danube (Kovatcheff 1923), as well as from the Black Sea coastal lakes and rivers (Drensky 1951, Trichkova *et al.* 2006). Our record is the first record of the species in the main Bulgarian Danube channel. In the Middle and Upper Danube, it was found as early as in the 1960s (Berinkey 1960, Balon 1967, Ahnelt 1986). In the Lower Danube, it was known from the Danube Delta (Banarescu 1964, Battes, Pricope 2006). The first finding from the Yugoslav Section of the Danube was from 1995 (Cakic *et al.* 2000). First data about the occurrence of *S. abaster* in the Bulgarian Danube was published by Karapetkova (1994). She reported finding of two specimens in the Danube near Silistra in 1982. Later, Karapetkova *et al.* (1998) reported it as rare in the Danube. In the period 1997-1998, the species was also for the first time recorded in the Yugoslav section of the Danube (r. km 956-862) (Sekulic *et al.* 1999). This was one of the species that reached high abundance and frequency of occurrence especially in our beach seine catches (Table 2). The species *Gymnocephalus baloni* was first recorded in the Bulgarian section only in the 1980s

(Sivkov 1985), however, this is likely to be due to the fact that it was described as lately as in 1974 (Holcik, Hensel 1974). This species is considered to be native for Bulgaria and most likely it had occurred in the surveyed section before, although not listed in Marinov`s list (1978).

The remaining 3 species are regarded as invasive and they are nonindigenous in Bulgaria. First records of *P. parva* in Bulgaria were reported from the Mechka fish ponds located along the Danube in 1975 (Marinov 1979), and from the Danube near Krivina and marshes between Tutrakan and Silistra (Manolov, Sivkov 1977). Despite its potential to establish dense populations in stagnant waters, especially aquaculture ponds (Banarescu 1999), according to our findings, this invasive species has not become neither abundant, nor occurs frequently within the decades of its presence in the Bulgarian Danube (Tables 1 and 2). For mosquito control, *G. holbrooki* was introduced intentionally to the Burgas Lakes (Black Sea coast) in 1924 (Karapetkova, Zivkov 1995). Our record of solitary specimens up to the r. km 578 (Table 1) seems to be the first record from the Lower Danube, since the species was not reported from the Romanian section (Navodaru, Nastase 2006) neither from the Danube Delta and adjacent lakes (Navodaru *et al.* 2002, Battes, Pricope 2006, Otel 2007). During our samplings in flood conditions (spring of 2005 and 2006) we repeatedly documented the presence of *P. glenii* in the Bulgarian Danube (Jurajda *et al.* 2006).

In the latest decades, a considerable increase in range and abundance of *Neogobius* species in the Middle and Upper Danube has been observed (e.g. Ahnelt *et al.* 1998, Simonovic *et al.* 2001, Eros *et al.* 2005, Jurajda *et al.* 2005, Wiesner 2005). In Bulgaria, not being important commercial fishes, the Danube gobies were given no particular scientific interest in the past except for the monography of Gheorghiev (1966). In the Lower Danube, *N. fluviatilis*, which occurred originally in the whole Bulgarian stretch and the main tributaries (Drensky 1948, 1951), reaching as far upstream as Orsova, Romania (954 r. km) (Banarescu 1964), was considered to be a common species (Drensky 1951). Recently, it was recorded as one of the most abundant species – about 30% of total catch of migrating ichthyoplankton (Vassilev 1994) and it reached also high densities in the juvenile fish community in the Danube Delta (Sindilariu *et al.* 2002, 2006). According to our results, it was the most frequent and abundant fish species in the shoreline zone of the Bulgarian Danube as well (Tables 1 and 2). *N. gymnotrachelus* was reported to occur only in the Danube near Ruse and rare in the Danube (Drensky 1948, 1951), and later, occurring in the Danube near Ruse, Svishtov and Vidin (Gheorghiev 1966). Marinov (1966) did not catch this species during his survey. Our results show *N. gymnotrachelus* as the rarest of the 4 *Neogobius* species currently inhabiting the Bulgarian Danube, but occurring quite regularly (Tables 1 and 2). *N. kessleri,* with the native range in the entire Bulgarian and Romanian stretches of the Danube (Drensky 1948, 1951, Banarescu 1964), was also reported as rare and later, it was listed in the Red Data Book of R. Bulgaria as endangered species (Botev, Peshev 1985). At present, *N. kessleri* occurs frequently and yet it has reached high proportion particularly in our electrofishing catches (Table 2). In the past, *N. melanostomus* occurred as far upstream as Vidin in the Danube (Drensky 1948, 1951). During subsequent years, the species was not reported from the Danube main channel (Banarescu 1964, Gheorghiev 1966, Marinov 1966). In the 1990s, the population density of *N. melanostomus* was high as can be deducted from Vassilev (1994). He found *N. melanostomus* as species ranked second in abundance (21% of total catch) in the migrating ichthyoplankton in the section from Vidin to Baikal (r. km 791-641). Our data yielded *N. melanostomus* as one of the most abundant species, especially in the beach seine catches (Table 2). The other two gobies (*Benthophilus stellatus* and *Proterorhinus marmoratus*) were of lower abundance and occurred less frequently than the *Neogobius* spp. (Table 2). *B. stellatus* was represented only by single individuals found mainly at downstream sites (Table 1). In the past, the species was considered rare (Drensky 1948, 1951) and listed in the Red Data Book of R. Bulgaria (Botev, Peshev 1985).

Besides gobies, the bleak *A. alburnus* was one of the most frequently found and abundant species in the Bulgarian stretch (Tables 1 and 2). It attained high proportion of the catch when using both sampling methods (Table 2). Moreover, being an agile, pelagic species, its presence on a site is not likely to be significantly influenced by the occurrence of a given substrate type. Contrary, *N. fluviatilis* and *N. kessleri* show distinct habitat preferences towards fine-substrate covered beaches or rocky areas (Erős *et al.* 2005, Jurajda *et al.* 2005), respectively. Therefore, since only rock-free beaches could have been sampled by the beach seine, the catch was dominated by *N. fluviatilis*. On the other hand, electrofishing technique enables also sampling of non-seinable rocky bottom substrates, which may explain higher proportion of *N. kessleri* compared to beach seining (Table 2), a pattern similar to the findings of Sindilariu *et al.* (2006), but with *N. melanostomus* being more abundant in the Danube Delta.

The Danube in the springs of both sampling years 2005 and 2006 reached extremely high water levels, in 2006 – the highest level for the Bulgarian-Romanian section since 1895 (Fig. 1, Schwarz *et al.* 2006). The records of some limnophilic species, such as *M. fossilis* and *P. glenii* (see also Jurajda *et al.* 2005) during both spring floods in 2005 and 2006 and their absence in autumns may suggest that the 2 species are more likely to be flooded out from some still waters adjacent to the Danube during flood events than constantly occupying the Danube main channel.

The relatively significant proportion of the fish species recorded is of high conservation concern at national level. Nine species are included in the recently adapted Biological Diversity Act (2002). *A. pontica, A. aspius, R. amarus, R. albipinnatus, M. fossilis, G. schraetser* and *Z. streber* are considered of high conservation priority and listed in Appendix 2. *A. pontica, B. barbus, G. schraetser* and *Z. zingel* are considered under a special regime of conservation and regulated use in nature and listed in Appendix 4. A total of 18 species are listed in the newly updated Red Data Book of Bulgaria based on the IUCN criteria (Stefanov *et al.,* in press). The populations of *M. fossilis, Z. streber* and *Z. zingel* are listed as endangered; the populations of *A. pontica, A. aspius, B. barbus, L. delineatus, R. albipinnatus, S. bulgarica, L. lota, G. aculeatus, G. baloni, G. schraetser* and *B. stellatus* – as vulnerable; and these of *A. ballerus* and *A. sapa* – as data deficient (Stefanov *et al.*, in press). Our results confirm that most of these species are found rarely and in very low abundance in the shoreline zone of the Bulgarian section of the Danube.

Acknowledgements: This study was possible thanks to the financial support from the Centre of Excellence (LC 522) of the Ministry of Education of the Czech Republic and National Science Fund, Bulgarian Ministry of Education and Science (Project B-1510/05). The authors would like to thank the Regional Departments of the Bulgarian Agency of Fisheries and Aquaculture in Vidin and Ruse and their Chiefs Mr Milen Metodiev and Mr Atanas Mindev for their co-operation and support during field work. We thank also our colleague Tihomir Stefanov and other friends of ours for field assistance.

References

Ahnelt H. 1986. Zum Vorkommen des Dreistachligen Stichlings (*Gasterosteus aculeatus,* Pisces: Gasterosteidae) im österreichischen Donauraum. – *Annalen des Naturhistorischen Museums in Wien*, **88/89B**: 309-314.

Ahnelt H., P. Banarescu, R. Spolwind, A. Harka and H. Waidbacher 1998. Occurrence and distribution of three gobiid species (Pisces, Gobiidae) in the middle and upper Danube Region: examples of different dispersal patterns? – *Biologia*, **53**: 665-678.

Bain M. B., J. T. Finn 1990. Analysis of microhabitat use by fish: investigator effect and investigator bias. – *Rivers* **2**: 57-65.

Balon E. K. 1967. Three-spined stickleback – *Gasterosteus aculeatus* Linnaeus, 1758 in the Danube near Bratislava. – *Acta Rerum Naturalium Museum Slovenici*, **13** (2): 127-134.

Balon E. K. 1968. Einfluß des Fischfangs auf die Fischgemeinschaften der Donau. – *Archiv für Hidrobiologie*, Suppl. **34** (3): 228-249.

Banarescu P. 1964. Fauna R.P.R. Pisces – Osteichthyes. Ed. Academiei R.P.R., Bucuresti, **13**: 959 p.

Banarescu P. 1999. *Pseudorasbora parva* (Temminck et Schlegel 1846). – In: Banarescu P. (ed.): The Freshwater Fishes of Europe. Vol. 5 / I. Cyprinidae 2 / I. AULA-Verlag, Wiesbaden, 207-224.

Battes K. W., F. Pricope 2006. The ichthyofauna of the Danube Delta. – In: Tudorancea C., M. M. Tudorancea (eds.): Danube Delta Genesis and Biodiversity. Leiden, Backhuys Publishers, 321-366.

Berinkey L. 1960. The stickleback (*Gasterosteus aculeatus* L.), a new fish species from Hungary. – *Vertebrata Hungarica*, *Musei Historico Naturalis Hungarici,* **2** (1): 1-10.

Botev B., T. Peshev (eds.) 1985. Red Data Book of the Republic of Bulgaria. Vol. 2. Animals. Sofia, BAS, 183 p. (In Bulgarian).

Busnita Th. 1961. Die Wandlungen der Fischfauna der unteren Donau während der letzten hundert Jahre. – *Verhandlungen Internationale Vereinigung für Theoretische und Angewandte Limnologie*, **14**: 114-126.

Cakic P., M. Lenhardt and Z. Petrovic 2000. The first record of *Gasterosteus aculeatus* L. 1758 (Pisces: Gasterosteidae) in the Yugoslav Section of the Danube. – *Ichthyologia*, **32** (1): 79-82.

Cernisencu I., M. Staras, I. Navodaru and E.V. Vasile 2002. Proposals for fisheries resources conservation strategy in the Danube Delta Biosphere Reserve. – *Scientific Annals of the Danube Delta National Institute for Research and Development* – Tulcea, Romania, **9**: 10-22.

Drensky P. 1948. Synopsis and distribution of fishes in Bulgaria. – *Annulaire de l'Universite de Sofia, Faculte de Sciences*, **44** (3): 11-71. (In Bulgarian, English summary).

Drensky P. 1951. Fishes of Bulgaria. Fauna of Bulgaria. II. Sofia, BAS, 270 p. (In Bulgarian).

Erős T., S. Sevcsik and B. Tóth 2005. Abundance and night-time habitat use patterns of Ponto-Caspian gobiid species (Pisces, Gobiidae) in the littoral zone of the River Danube, Hungary. – *Journal of Applied Ichthyology,* **21** (4): 350–357.

Gheorghiev J. 1966. Composition d'espece et caracteristique des Gobiides (Pisces) en Bulgarie. – *Proceedings of the Research Institute of Fisheries and Oceanography* – Varna, **7**: 159-228. (In Bulgarian, Russian and French summaries).

Holcik J., K. Hensel 1974. A new species of *Gymnocephalus* (Pisces: Percidae) from the Danube, with remarks on the genus. – *Copeia,* **1974**: 471-486.

Jurajda P., M. Vassilev, M. Polacik and T. Trichkova 2006. A first record of *Perccottus glenii* (Perciformes: Odobtobutidae) in the Danube River in Bulgaria. – *Acta zoologica bulgarica*, **58** (2): 279-282.

Jurajda P. J. Cerny, M. Polacik, Z. Valova, M. Janac, R. Blazek, R. and M.Ondrackova 2005. The recent distribution and abundance of non-native *Neogobius* fishes in the Slovak section of the River Danube. – *Journal of Applied Ichthyology*, **21**: 319-323.

Karapetkova M. 1994. Wirbellose Tiere. – In: Russev B. (ed.): Limnologie der Bulgarischen Donauzuflüsse. Sofia, MEW, BAS, 175-186. (In Bulgarian)

Karapetkova M., M. Zivkov 1995. Fishes of Bulgaria. Sofia, Gea-Libris Publ., 247 p. (In Bulgarian).

Karapetkova M., M. Zivkov and K. Alexandrova-Kolemanova 1998. The freshwater fishes of Bulgaria. – In: C. Meine (ed.): Bulgaria's Biological Diversity: Conservation Status and Needs Assessment. Vol. 1 and 2. Pensoft Publishers, 375-393.

Kovatcheff V. 1923. Faune des poissons d'eau douce en Bulgarie. – *Archives du Ministere de l'Agriculture et des Domaines du Royaume de Bulgarie*, **3**: 1-164. (In Bulgarian, French summary).

Manolov Z., Y. I. Sivkov 1977. Morphometrische Charakteristik lines für die Bulgarische Ichthyofaune neuen Fishes *Pseudorasbora parva* (Schlegel). – *Bulletin du Musee National de Varna*, **13** (28): 219-222. (In Bulgarian, German summary).

Marinov B. 1966. Über die fischfauna des Bulgarischen Donausectors. – *Bulletin de l'Institut de Zoologie et Musee, Academie Bulgare des Sciences*, **20**: 139-155. (In Bulgarian, Russian and German summaries).

Marinov B. 1978. Die Fischfauna im bulgarischen Donauabschnitt und ihre Bedeutung für die Wirtschaft. – In: Russev B., W. Naidenow (eds.): Limnologie des bulgarischen Donauabschnitts. Sofia, Bulgarische Akademie der Wissenschaften, 201-228. (In Bulgarian, Russian and German summaries).

Marinov B. 1979. *Pseudorasbora parva* (Schlegel, 1842) (Pisces, Cyprinidae) – a new representative of the ichthyofauna of Bulgaria. – *Hydrobiology*, Sofia, **8**: 75-78. (In Bulgarian, Russian and English summaries).

Morov T. 1931. The freshwater fishes of Bulgaria. Sofia, 93 p. (In Bulgarian).

Nastase A., I. Navodaru 2004. Ichthyofauna of the Somova-Parches Complex of lakes from the last natural flood plane of the Danube River in front of the Danube Delta. – *Studii si Cercetari, Biologie*, Universitatea din Bacau, **9**: 86-88.

Navodaru I., A. Nastase 2006. Qualitative inventory of fish fauna from Danube River around Cama Dinu islets. – *Scientific Annals of the Danube Delta National Institute for Research and Development* – Tulcea, Romania, **12**: 97-102.

Navodaru I., M. Staras and R. Banks 1999. Management of sturgeon stocks of the lower Danube River system. – In: The Deltas: State of Art, Protection and Management, Conference Proceedings, Tulcea, 26-31 July 1999, 229-237.

Navodaru I., A. D. Buijse and M. Staras 2002. Effects of hydrology and water quality on the fish community in Danube Delta Lakes. – *International Review of Hydrobiology*, **87** (2-3): 329-348.

Otel V. 2007 Atlasul pestilor din rezervatia biosferei Delta Dunarii. Institutul National de Cercetare-Dezvoltare Delta Dunarii Tulcea, 481 p.

Paraschiv M., R. Suciu 2005. First results of marking and recapturing young of the year beluga sturgeons (*Huso huso*) in the Lower Danube River. – *Scientific Annals of the Danube Delta National Institute for Research and Development* – Tulcea, Romania, **11**: 75-82.

Pehlivanov L. 2000. Ichthyofauna in the Srebarna Lake, the Danube Basin: state and significance of the management and conservation strategies of this wetland. – *International Association for Danube Research*, **33**: 317-322.

Schiemer F., G. Guti, H. Keckeis and M. Staras 2004. Ecological status and problems of the Danube River and its fish fauna: a review. – In: Welcomme R. L., T. Petr (eds.): Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries "Sustaining Livelihoods and Biodiversity in the New Millennium", 11-14 February 2003, Phnom Penh, Kingdom of Cambodia. Vol. **1**: 273-299. Available at: http://www.fao.org/docrep/007/ad525e/ad525e0i.htm

Schwarz U., C. Bratrich, O. Hulea, S. Moroz, N. Pumputyte, G. Rast, M. R. Bern and V. Siposs 2006. 2006 Floods in the Danube River Basin. Flood risk mitigation for people living along the Danube: The potential for floodplain protection and restoration. WWF For A Living Planet, Working Paper, Vienna/ Brussels. Available at: http://assets.panda.org/downloads/2006_floods_in_the_danube_river_basin_wwf_working_paper.pdf

Sekulic N., P. Cakic, M. Lenhardt, V. Dubravka, L. Budakov 1999. Short-snouted pipefish *Syngnathus abaster* (Acanthopterygii: Syngnathidae) in the Yugoslav section of the Danube. – *Ichthyologia*, **31** (1): 79-82.

Simonovic P., M. Paunovic and S. Popovic 2001. Morphology, feeding and reproduction of the Round Goby, *Neogobius*

melanostomus (Pallas), in the Danube River basin, Yugoslavia. – *Journal of Great Lakes Research*, **27**: 281-289.

Simonovic P., S. Maric and V. Nikolic 2006. Occurrence of paddlefish *Polyodon spathula* (Walbaum, 1792) in the Serbian part of the lower River Danube. – *Aquatic Invasions*, **1** (3): 183-185.

Sindilariu P.D., J. Freyhof 2003. Food overlap of benthic fishes in the Danube Delta, with special respect to two invasive gobiids (Teleostei: Gobiidae, Percidae, Cyprinidae). – *Lauterbornia*, **46**: 149-157.

Sindilariu P.D., N. Bacalbasa-Dobrovici, J. Freyhof and C. Wolter 2002. The juvenile fish community of the Lower Danube and the Danube Delta. IAD, Limnological Reports, **34**: 517-526.

Sindilariu P.D., J. Freyhof and C. Wolter 2006. Habitat use of juvenile fish in the lower Danube and the Danube Delta: implications for ecotone connectivity. – *Hydrobiologia*, **571**: 51-61.

Sivkov Y. 1985. Morphological characteristics of *Gymnocephalus baloni* Holcik et Hensel, 1974 (Pisces, Percidae) – a new species to the Bulgarian ichthyofauna. – *Acta zoologica bulgarica*, **27**: 10-20. (In Russian, English summary).

Stefanov T., J. Holcik 2007. The lampreys of Bulgaria. – *Folia Zoologica*, **56** (2): 213-224.

Stefanov T., Y. Sivkov and T. Trichkova 2008. Fishes. – In: Golemansky V. (ed.): Red Data Book of Bulgaria. Vol. 2. Animals. (In press).

Trichkova T., T. Stefanov, S. Mihov, M. Vassilev and M. Zivkov 2006. Species composition and conservation status of the ichthyofauna in the South Black Sea Rivers of Bulgaria. – In: Genov I. (ed.): The 15th International Symposium "Ecology 2006" 5-9 June, Bulgaria, Scientific Articles, Part **1**: 327-338.

Vassilev M. 1994. On the downstream migration of ichthyoplankton along the Bulgarian shore of the Danube River. – *Vie Milieu*, **44** (3/4): 273-280.

Vassilev M. 2003. Spawning sites of beluga sturgeon (*Huso huso* L.) located along the Bulgarian-Romanian Danube River stretch. – *Acta zoologica bulgarica*, **55** (2): 91-94.

Vassilev M., L. Pehlivanov 2003. Structural changes of sturgeon catches in the Bulgarian Danube section. – *Acta zoologica bulgarica*, **55** (3): 97-102.

Vassilev M., L. Pehlivanov 2005. Checklist of Bulgarian freshwater fishes. – *Acta zoologica bulgarica*, **57** (2): 161-190.

Vassilev M., T. Trichkova 2007. *Salmo labrax* Pallas, 1811 (Pisces: Salmonidae) – a new record for the Bulgarian sector of the Danube River. – *Acta zoologica bulgarica*, **59** (1): 97-99.

Velkov B., L. Pehlivanov and M. Vassilev 2004. *Umbra krameri* (Pisces, Umbridae): a reinstated species for the Bulgarian ichthyofauna. – *Acta zoologica bulgarica*, **56** (2): 233-235.

Wiesner C. 2005. New records of non-indigenous gobies (*Neogobius* sp.) in the Austrian Danube. – *Journal of Applied Ichthyology*, **21**: 324-327.

Zalewski M. 1985. The estimate of fish density and biomass in rivers on the basis of relationships between specimen size and efficiency of electrofishing. – *Fish. Res*. **3**: 147-155.

Received: 07.02.2008
Accepted: 13.02.2008

Крайбрежната ихтиофауна в Българския участък на р. Дунав

М. Полачик, Т. Тричкова, М. Янач, М. Василев, П. Юрайда

(Резюме)

Изследвана е крайбрежната ихтиофауна в българския участък на р. Дунав (р. км 376-840) през различни сезони в периода 2005-2006 г. Материалът е събран от 38 станции с помощта на два метода – мрежа гриб и електроулов. Установени са общо 44 вида риби от 12 семейства. 39 от тях са местни за дунавската ихтиофауна. За пръв път се съобщава намирането на *Gasterosteus aculeatus* и интродуцирания вид *Gambusia holbrooki* от българския участък на р. Дунав. През октомври 2005 г., най-често срещан е *Neogobius fluviatilis* (91.18%), следван от *Alburnus alburnus* и *N. kessleri* (88.24% всеки). По отношение на уловите с мрежа гриб, най-голяма численост достига *N. fluviatilis*, следван от *A. alburnus* и *N. melanostomus*. По отношение на електроулова, най-многочислен е *A. alburnus*, следван от *N. kessleri* и *Leuciscus idus*. 19 от установените видове имат висок природозащитен статус в България.