



## On the expansion and occurrence of an invasive species - *Pseudorasbora parva* (Temminck et Schlegel, 1846) (Teleostei: Cyprinidae: Gobioninae) in Poland

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**Abstract:** The topmouth gudgeon, *Pseudorasbora parva*, originating from eastern Asia, was accidentally introduced in European waters (1961) with stocking material of imported herbivorous fishes. In Poland it was first recorded in 1990 in the Barycz R. system – Fish Farm Stawno (SW, Poland); it probably came from Hungary with imported fry of *Aristichthys nobilis*. It was presumably from that region of Poland that it spread to other fish farms and then rapidly penetrated into rivers and other water bodies. At present 51 localities are known, mainly in the lowlands of Poland. The species still shows an expansion tendency which is favoured by stocking open waters with material containing an admixture of the topmouth gudgeon, using it as a bait-fish and by some aspects of its biology and ecology.

**Key words:** Cyprinidae, *Pseudorasbora parva*, accidental introduction, expansion, Poland

### INTRODUCTION

More than 30 fish species were introduced deliberately or accidentally in Poland within the last 800 years (Witkowski 1989, 2002). The most numerous new arrivals appeared within the last 50 years, constituting over 50% of all these fish introductions (Witkowski 1996).

During the post-war period *Ameiurus nebulosus* (Le Sueur, 1819) and *Carassius auratus gibelio* (Bloch, 1783) were regarded as rapidly expanding species (Witkowski 2002). At present fast-spreading species are members of the genus *Neogobius* Iljin, 1927: *N. fluviatilis* (Pallas, 1811), *N. gymnotrachelus* (Kessler, 1857), *N. melanostomus* (Pallas, 1811) and *Proterorhinus marmoratus* (Pallas, 1814), which spontaneously migrate through canals connecting the Ponto-Caspian river systems with the Vistula basin (Kostrzewa & Grabowski 2001, 2002, Kostrzewa et al. 2004, Sapota 2004, Sapota & Skóra 2005, Grabowska 2008a,b, Grabowska et al 2008, Skóra 2008). Besides, *Perccottus glenii* Dybowski, 1877 (Nowak et al. 2008, Witkowski 2008a) and *Pseudorasbora parva* (Witkowski 2008b) increase their distribution ranges every year as a result of accidental introductions.

*P. parva* originates from east Asian (Manchurian) subregion which includes the basins of the Amur, Yang-tse and Huang-ho rivers, the Japanese islands, the western and southern parts of the Korean Peninsula, and Taiwan (Berg 1949, Bănărescu 1999).

The topmouth gudgeon was introduced in Europe with stocking material of herbivorous fishes - *Ctenopharyngodon idella* (Valenciennes, 1844), *Aristichthys nobilis* Richardson, 1836, *Hypophthalmichthys molitrix* (Valenciennes, 1844). In Europe it was first recorded in 1961 from southern Romania and Albania (Bănărescu 1964, Bănărescu & Nalbant 1965, Knezevič et al. 1978, Witkowski 2006). From these regions within about 40 years, mainly with the help of man, it invaded almost the whole continent and started its further expansion to Asia Minor, Near East and northern Africa (Witkowski 2006, 2008b).

In Poland within about 20 years it invaded most lowland river systems and is still expanding its range, constituting a threat for native ichthyofauna. The aim of this paper is to present the origin and expansion of *P. parva* in Poland.

#### MATERIAL AND METHODS

Up-dating of the distribution and estimate of the rate of expansion of *P. parva* in Poland were based on own field studies and data of other authors published within the last 20 years (Witkowski & Kotusz 2008). Enquiry data from fish farms keeping lowland fishes, mainly carp, and from persons involved in fishery management, were also used. For each locality of the topmouth gudgeon lat-long coordinates were converted using the programme *MapInfo Profesional*. Which allowed preparing the distribution map of the species in Poland.

#### RESULTS AND DISCUSSION

In Poland *P. parva* was found for the first time during emptying of ponds (October 1990) in the Fish Farm Stawno near Milicz (Witkowski 1991a,b). It had probably occurred there for a few years (since 1987?) as indicated by the age structure of the population including a few generations (2–3). The species was introduced with stocking material of herbivorous fishes, mainly *Aristichthys nobilis* and *Hypophthalmichthys molitrix* (M.Tomala – pers. com.), imported at that time by the PGRyb [State Fish Farms] Poznań from Hungary. Next year the topmouth gudgeon was recorded from the neighboring fish farm – Ruda Sulowska, and from the Barycz R. and its tributaries (Witkowski 1991a, Błachuta et al. 1993).

It is likely that it was from these fish farms that the topmouth gudgeon started a rapid expansion, mainly with stocking material of other fish species, to invade nearly the whole territory of Poland (Fig. 1). It is not excluded however that it could arrive in other regions also directly, with fishes imported then from the former Czechoslovakia and Hungary; this is supported by simultaneous records (1990–1992) from other areas – Wielkopolska and Małopolska.

The appearance of the species in consecutive regions was not a result of spontaneous successive expansion along a river or within the same catchment area, as was the case with invasive species of *Neogobius* (Kostrzewa et al. 2004) and *Perccottus glenii* (Nowak et al. 2008). Table 1 shows that often consecutive new records were very remote from earlier localities. They were most often consecutive fish farms or rivers draining them. This demonstrates that careless fishery management (Witkowski & Paszkowski 2000) is mainly responsible for the expansion of the topmouth gudgeon in Poland. In spite of prohibition (rozporządzenie Ministra Rolnictwa i Rozwoju Wsi [decree of the Minister of Agriculture and Village Development] of 12 November 2001 – Dz. U. 2001, Nr 138, poz. 1559, § 8, and Regulamin Amatorskiego Połowu Ryb PZW [Angling Regulations, Polish Angling Union]), also anglers contributed to the dispersal of *P. parva* by using it as a bait-fish, and transporting and releasing unused individuals into other water bodies.

Cumulative numbers of records of *P. parva* in Poland during three-year periods are the following: till 1993 – 10; till 1996 – 14; till 1999 – 27; till 2002 – 38; till 2005 – 43; till 2008 – 51 (Table 1). The number of localities of the species is probably greater. Its occurrence noted to date should be regarded as centres associated with fish ponds, from which the topmouth gudgeon constantly penetrates into open waters.

The species occurs in masses in many fish farms. During emptying of one of the ponds in the Fish Farm Ruda Sulowska (1993) ca. 300 kg of *P. parva* were caught and released into the Barycz R. system (Witkowski 2008b). During autumn catches in fish ponds, periodically (?) in open waters the density of the species may be equally high. In the Sumina R. (tributary to Ruda

R., Upper Silesia) in 2005 it was a few thousand individuals per 100 m<sup>2</sup> river, many times exceeding the abundance of the remaining fish species (Dr J. Kotusz – pers. com.). Considerable numbers of the topmouth gudgeon were also observed in other regions: up to 250 indiv./500 m shore line (Obra R.) or 25.4 indiv./100 m<sup>2</sup> (Stradunia R.), and in Konin lakes the species constituted 80-90% of phytolittoral fishes (Kusznierz et al. 2005, Penczak et al. 2006, Kapusta et al. 2008).

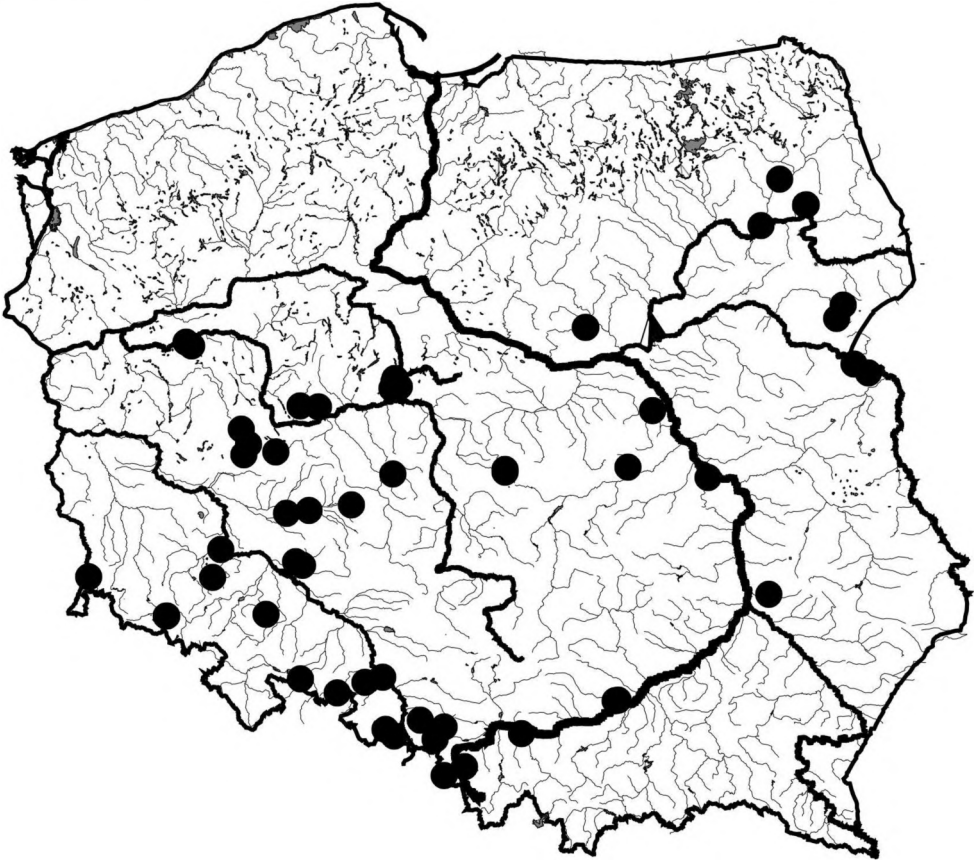


Fig. 1. Distribution of topmouth gudgeon (*Pseudorasbora parva*) in Poland.

The data show that in many regions of Poland *P. parva* occurs in masses. Its dispersal is also favoured by some of its biological features, such as ability to reproduce on various substrata, multiple reproduction, comparatively high fecundity, parental care, wide food spectrum and tolerance to various habitat factors including ability to invade canalised and polluted rivers (Mukhacheva 1950, Kozlov 1974, Movchan & Kozlov 1978, Baruš et al. 1984, Šebela & Wohlegmuth 1984, Witkowski 2000, Kruk et al. 2003). Because the species reaches a small size (max. 10–12 cm *TL*) and stays mainly in densely vegetated parts of water bodies, it is not easily accessible to native predators. Consequently, its eradication or limiting its abundance, either in Poland or in other countries, are practically impossible (Witkowski 2008b).

Table 1. Localities of topmouth gudgeon (*Pseudorasbora parva*) in Poland (1990–2008)

Site	Location	Year of discovery	References
1	2	3	4
„Polny” pond, Stawno Fish Farm - Stawno n. Milicz, Barycz R. basin, SW Poland	N 51:31:32,5 E 17:21:00,3	1990 (1987?)	Witkowski 1991a,b
Ruda Sułowska Fish Farm – Ruda Sułowska n. Milicz, Barycz R. basin	N 51:30:42,4 E 17:06:41,8	1990	Kotusz, & Witkowski 1998
Plawowice Fish Farm – n. Nowe Brzesko, Szreniawa R. basin	N 50:10:16 E 20:24:39	1990 (1988?)	M.Tomala per. com.
Szreniawa R., Szreniawa R. basin	N 50:10:27,2 E 20:26:18,3	1990	M. Tomala per. com.
Olszówka R. – n. Dębica, Barycz R. basin	N 51:33:07,5 E 17:47:56,9	1992	Blachuta et al. 1993
Osieczna Fish Farm – n. Leszno, Warta R. basin	N 51:54:11,5 E 16:40:34,5	1992 (1989?)	A. Łakomy per. com.
Tarf pits – n. Środa Wlkp., Warta R. basin	N 52:12:52 E 17:17:29,6	1993	A. Łakomy per. com.
Miłosław Fish Farm, Miłosław, Warta R. basin	N 52:12:16,8 E 17:29:15	1993	A. Łakomy per. com.
Warta R. – n. Sieraków Wlkp., Warta R. basin	N 52:39:03,9 E 16:04:49,9	1993	A. Łakomy per. com.
Jeziorna Fish Farm – n. Lutom, Warta R. basin	N 52:37:34,1 E 16:08:27,1	1993	A. Łakomy per. com.
Knyszyn Fish Farm – n. Knyszyn, Jaskranka R. basin	N 53:17:53,3 E 22:53:23	1994	B. Czeczuga per. com.
Karpnicki stream – n. Karpniki, Bóbr R. basin	N 50:51:05,2 E 15:50:14,2	1995	Z. Czarny per. com.
Wierzbiak R., Kaczawa R. basin	N 51:06:03,2 E 16:19: 15,7	1995	T. Domżański per. com.
Zgliniec Fish Farm – n. Zgliniec, Warta R. basin	N 51:58:13,8 E 16:43:47,3	1995	A. Łakomy per. com.
Biebrza R. – n. Osowiec, Narew R. basin	N 53:29:01,8 E 22:38:19,9	1997	Witkowski & Wiśniewolski 2005
Narew R. – n. Wizna, Narew R. basin	N 53:11:38,7 E 22:22:54,9	1997	Wiśniewolski et al. 1999
Żabieniec Fish Farm, – Żabieniec n. Warsaw, Jeziorka R. basin	N 52:03:06,1 E 21:01: 53	1998	A. Krüger per. com.
Olza R. – n. Cieszyn, upper Oder R. basin	N 49:44:55,8 E 18:37:44,6	1999	Kusznierz et al. 2005
Szotkówka R. – n. Połomia, upper Oder R. basin	N 49:59:23,9 E 18:33:19,1	1999	Kusznierz et al. 2005
Kłokocinka R. – n. Rowień, Ruda R. basin	N 50:04:03,3 E 18:39:10,1	1999	Kusznierz et al. 2005
Stradunia R. – n. Stradunia., upper Oder R. basin	N 50:24:44,5 E 18:02:49,4	1999	Kusznierz et al. 2005
Troja R. – n. Nowa Cerekwia, upper Oder R. basin	N 50:04:06,7 E 18:03:15,4	1999	Kusznierz et al. 2005
Biała Woda R. – n. Krzanowice, upper Oder R. basin	N 50:01:22,2 E 18:08:20,1	1999	Kusznierz et al. 2005
Osobłoga R. – n. Rzepcze, upper Oder R. basin	N 50:22:57,5 E 17:52:09,9	1999	Kusznierz et al. 2005
Złoty Potok R. – n. Prudnik, upper Oder R. basin	N 50:19:11,6 E 17:34:45,5	1999	Kusznierz et al. 2005
Pogórze Fish Farm – n. Skoczów, Iłownica R. basin	N 49:48:00,6 E 18:50:25,9	1999	M. Tomala per. com.
Zator Fish Farm – n. Zator, Skawa R. basin	N 49:59:47,4 E 19:26:16,7	1999	A. Kapusta per. com.
Bug R. – n. Janów Podlaski, Bug R. basin	N 52:13:35,2 E 23:12:38	2000	Czeczuga et al. 2002

1	2	3	4
Cieleśnica R. - n. Cieleśnica, Bug R. basin	N 52:09:26,9 E 23:21:05,9	2000	Czeczuga et al. 2002
Widna R. – n. Buków, Nysa Kłodzka R. basin	N 50:25:11 E 17:12:22	2000-2001	Kotusz et al. 2009
Zagożdżonka R. – Kozenice, mid Vistula R. basin	N 51:34:55,9 E 21:33:18,8	2001	J. Kotusz per. com.
Jasień stream – Łódź, Warta R. basin	N 51:44:08 E 19:25:56,5	2001	Kruk et al. 2003
Olechówka R.– Łódź, Warta R. basin	N 51:43:02,7 E 19:25:47,5	2001	Kruk et al. 2003
Lake Licheń – n. Licheń, Warta R. basin	N 52:18:53,1 E 18:21:14,9	2002	Kapusta et al. 2008
Lake Mikoszyńskie – n. Mikoszyn, Warta R. basin	N 52:20:58,6 E 18:17:55	2002	Kapusta et al. 2008
Lake Pątnów – n. Pątnów, Warta R. basin	N 52:18:21,3 E 18:16:27,6	2002	Kapusta et al. 2008
Lake Ślesin – n. Ślesin Warta R. basin	N 52:22:16,3 E 18:18:40,6	2002	Kapusta et al. 2008
Płonka R. – n. Płońsk, Wkra R. basin	N 52:37:50,9 E 20:23:26,6	2002	Marszał et al. 2005
Cienia R. – n. Kalisz, Proсна R. basin	N 51:44:39,8 E 18:14:36,3	2003	Penczak et al. 2004
Mogielanka R. – n. Mogielnica, mid course, Pilica R. basin	N 51:41:38,4 E 20:43:22,3	2005	Penczak et al. 2007
Obra R. – n. Jarczewo, Warta R. basin	N 52:04:21,7 E 16:39:19,7	2005	Penczak et al. 2006
Kania R. – n. Ostrowo, Obra R. basin	N 51:55:01,5 E 17:01:01,5	2005	Penczak et al. 2006
Sumina R. – n. Sumina, upper Oder basin	N 50:07:09 E 18:24:46	2005	J. Kotusz per. com.
Szczodre Fish Farm – n. Wrocław, Widawa R. basin	N 51:11:30,2 E 17:11:30,5	2006	M. Kleszcz per. com.
Jordanów reservoir – n. Jordanów Śl., Ślęża R. basin	N 50:51:03 E 16:52:08	2006	M. Kleszcz per. com.
Karasiówka R. – n. Zdziechowice, Sanna R. basin	N 50:46:57,7 E 22:04:27,1	2006	Pietraszewski et al. 2008
Oleśniczanka R. – n. Raków, Widawa R. basin	N 51:09:58 E 17:15:46	2007	M. Kleszcz & M. Popiołek per. com.
Nurzec R., Bug R. basin	N 52:37:06,2 E 23:10:08	2007	Zięba et al. 2008
Nurczyk R. – n. Pokaniewo, Bug R. basin	N 52:32:07,4 E 23:04:53,2	2007	Zięba et al. 2008
Czerwona Woda R. – n. Tylice, Nysa Łużycka R. basin	N 51:06:47 E 15:01:59	2008	J. Błachuta per. com.
Kaczawa R. – n. Kwiatkowice, Kaczawa R. basin	N 51:01:59 E 16:24:45	2008	J. Błachuta per. com.

In Poland there were no studies on the effect of the topmouth gudgeon on the native ichthyofauna and aquatic habitats. Only transmission of about a dozen of species of zoosporic fungi was observed (Czeczuga et al. 2002). According to literature this „international pest species” may transmit an infectious disease rosette-like agent (RLA) caused by *Sphaerothecum destruans* to native fish species (Gozlan et al. 2005, Pinder et al. 2005). In ponds, especially during mass occurrence, it competes for food with cultured species (Kozlov 1974, Movchan & Kozlov 1978). Besides, consuming larger species of planktonic crustaceans, the topmouth gudgeon contributes to the increase in eutrophication rates of the water bodies (Adamek & Sukop 2000). In open waters of southern Europe it contributed to the decrease in abundance or even disappearance of some autochthonous species – *Scardinius erythrophthalmus* (Linnaeus,

1758), *Carassius carassius* (Linnaeus, 1758), *Rhodeus amarus* (Pallas, 1778), *Gobio gobio* (Linnaeus, 1758), *Leucaspis delineatus* (Heckel, 1843) (Giurca & Angelescu 1971, Žitnan & Holčík 1976, Jankovič 1985, Bănărescu 1999, Pollux & Karosi M 2006, Tomala – pers. com.). At higher density it may constitute a threat to native fish species also in Poland (Witkowski et al. 2009).

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## STRESZCZENIE

**[Ekspancja i występowanie inwazyjnego gatunku *Pseudorasbora parva* (Temminck et Schlegel, 1846) (Teleostei: Cyprinidae: Gobioninae) w polskich wodach]**

Czebaczek amurski - *Pseudorasbora parva*, pochodzący ze wschodniej Azji, został przypadkowo introdukowany do Polski w materiale zarybieniowym importowanych ryb roślinożernych z Węgier. Po raz pierwszy stwierdzony został w 1990 r. w systemie Baryczy – Gospodarstwo Rybackie Stawno k./Milicza (SW Polska). Prawdopodobnie z tego regionu został dalej rozprzestrzeniony od innych gospodarstw rybackich, skąd szybko przeniknął do rzek i innych akwenów. Aktualnie, znanych jest 51 stanowisk, na nizinnych obszarach Polski, głównie w obrębie kompleksów stawowych lub ich sąsiedztwie. Gatunek ten nadal wykazuje tendencje do szybkiego rozprzestrzeniania się. Sprzyja temu zarybianie stawów hodowlanych i wód otwartych materiałem zawierającym domieszkę czebaczka, używanie go przez wędkarzy jako „żywca” do połowu drapieżnych ryb oraz niektóre aspekty jego biologii i ekologii.

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