

Occurrence, threats and active protection of the lake minnow, *Eupallasella percnurus* (Pall.), in Mazowieckie Voivodeship in Poland

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Abstract. From March 2002 to May 2011 about a hundred water bodies in the Mazowieckie Voivodeship (Poland) were investigated with the goal of discovering new sites inhabited by the endangered cyprinid lake minnow, *Eupallasella percnurus* (Pall.). Ten sites were discovered that had been previously unknown. During the same period, six new sites were created by translocation of cultured juvenile individuals into suitable water bodies not inhabited by this species. These measures were undertaken as part of a long-term (2002-2015), voivodeship-wide program for the active protection of this species, which is the only one of its kind in Poland. Of the sixteen sites currently in existence, ten are suffering from advanced water basin shallowing and/or vegetation overgrowth. However, good water conditions throughout 2010 and in the first half of 2011 have meant that only six sites are presently considered as critically threatened, whereas seven appear to be of least vulnerability. At present, five sites (31.3% of all sites in the voivodeship) are protected within the European Ecological Natura 2000 Network.

Keywords: lake minnow, distribution, threats, conservation, Mazowieckie Voivodeship (Poland)

Introduction

Mazowieckie Voivodeship is one of the five current voivodeships in Poland where populations of the critically endangered lake minnow, *Eupallasella percnurus* (Pall.), occur (Wolnicki and Radtke 2009). In this part of the Polish territory, this rare cyprinid species of exceptionally high ecological status (Wieser 1992, Witkowski 1992, Witkowski et al. 1999, 2009, Kuszniarz 2001, Wolnicki 2004) seemed to become totally extinct by the end of the previous century (Wolnicki and Sikorska 2009). This is why the first national long-term (2002-2015) program of *E. percnurus* protection began to be implemented in Mazowieckie Voivodeship. To date, this program is the only one of its kind in Poland, and likely the only one worldwide. The program, known as the “Conservation of populations of lake minnow, *Eupallasella percnurus* (Pallas, 1814), in Mazowsze region” has two major goals that are being pursued simultaneously: (1) conducting extensive field investigations to discover sites where this species might have survived and (2) creating new populations using translocations (Wolnicki et al. 2006, 2008b). The first of these two goals has led to the discovery of several new sites of *E. percnurus* occurrence (Ligęza and Wolnicki 2003, Wolnicki et al. 2006, 2007, 2008b).

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The aim of the present work is to summarize all published and unpublished scientific data on the past and present occurrence of *E. percnurus* in Mazowieckie Voivodeship. Threats to its habitats, populations, and sites are also evaluated. Additionally, the results of the unique program for the active protection of *E. percnurus* in the voivodeship are described.

Study area

Field studies were carried out every year from March 2002 to May 2011. The study area comprised about 100 water bodies located in areas of Mazowieckie Voivodeship where *E. percnurus* populations are likely to occur. Special attention was focused on the central part of the voivodeship including the vicinity of Warsaw (Radzymin, Marki, Wołomin, Zielonka) and peripheral areas near Gostynin, Płock, and Sierpc. The selection of the water bodies to be investigated was based on published scientific data (e.g., Lorec and Wolski 1910, Gąsowska and Rembiszewski 1967, Kuszniierz 1995). Unpublished data, including those from the local communities and especially anglers, were also used. Topographic maps (scale 1:25,000) showing the locations of former peat or clay excavation sites were another important source of information.

Material and methods

E. percnurus occurrence was determined by angling, lift nets (2002-2004), or, beginning in 2005, with baited specialized folding traps with two openings (25 x 25 x 40 cm; mesh 5 mm; opening diameter 60 mm) (Wolnicki et al. 2006, 2008a, 2008b). Fishing was conducted primarily from May to August. The routine time of trap exposition was 0.5-1 h, and 2-4 traps were usually deployed depending on the water body size. When no fish were caught, more attempts were made to catch them at least in the same year. The number of *E. percnurus* individuals caught in

a single sampling event in the water bodies investigated where populations occurred ranged from 2 to about 150. All of the fish caught were immediately released alive, except for mature individuals caught in spring in one of the water bodies investigated (Krogulec; Wolnicki et al. 2006, 2008b). These were used as a broodstock, and were released into their native water body the following year.

The material used for translocation was obtained with standard methods for *E. percnurus* propagation, egg incubation, and larval and juvenile rearing (Kamiński et al. 2004, 2005, 2006, Wolnicki et al. 2004). The material released during the translocations comprised juveniles aged 0+ or 1+ which were the pooled progeny of 20-30 females and 15-20 males.

The geographical situation of all water bodies inhabited by *E. percnurus* and those regarded as suitable for future translocations was determined with a handheld GPS receiver (GPSMap 60C, Garmin; 3-5 m accuracy). When possible, the origin of these water bodies was determined usually based on information from local communities. At each *E. percnurus* site that was discovered or initiated, the factors crucial for the continued existence of the fish populations or habitats or both were determined. The degree of threat to the continued existence of all sites was evaluated according to the classification system developed by Wolnicki and Radtke (2009, 2010).

Results

A total of 10 previously unknown *E. percnurus* sites were confirmed in Mazowieckie Voivodeship between 2002 and 2010. Nearly all of them were located in the Wołomińska Plain mesoregion in the vicinity of Warsaw (Fig. 1). Most of these sites were single water bodies (Table 1) with surface areas of 0.1-0.5 ha and maximum depths of about 1 m. All but one was formed as a result of human activity, e.g., peat or clay excavations. The site that appeared to be of natural origin, Krogulec, was the small remnant of a former shallow, mid-forest lake.

Table 1List and general characteristics of *Eupallasella percunurus* sites in Mazowieckie Voivodeship in May 2011 (alphabetical order)

No.	Site/year of discovery or initiation	Geographical coordinates	Origin ¹	Number of water bodies	Protection status ²	Threats identified ³	Level of threat ⁴
1	"Bagno Jacka" Nature Reserve/2008	52°15'33"N; 21°13'21"E	MM	3	N20 ⁶	WAT	H
2	Białe Błota (Wołomin)/2005	52°21'31"N; 21°13'45"E	MM	>3	N20 ⁷	SHA, OVE	L
3	Bledzewo/2010	52°49'40"N; 19°34'55"E	MM	>1	NOP	SHA, OVE	M
4	Dobczyn/2009	52°22'33"N; 21°19'09"E	MM ⁵	1	NOP	OVE	L
5	Dręszew/2009	52°30'11"N; 21°19'03"E	MM	1	NOP	INT	H
6	Działy Czarnowskie/2004	52°28'48"N; 21°14'52"E	NA ⁵	1	NOP	SHA, OVE, WAT	H
7	Glinianka/2002	52°29'33"N; 21°15'25"E	MM	1	N20 ⁸	SHA, OVE	L
8	Gostynin/2005	52°26'07"N; 19°27'14"E	MM	1	NOP	OVE, WAT	L
9	Kowalicha/2004	52°30'29"N; 21°15'26"E	MM ⁵	4	NOP	SHA	L
10	Krogulec/2002	52°24'08"N; 21°16'20"E	NA	1	N20 ⁷	SHA, WAT	H
11	Lasków/2009	52°29'39"N; 21°19'52"E	MM ⁵	3	NOP	OVE	L
12	Łojków/2007	51°30'02"N; 20°40'50"E	MM ⁵	1	NOP	SHA, OVE	M
13	Nadma/2009	52°21'19"N; 21°10'03"E	MM	4	NOP	OVE, WAT	L
14	Nowiny/2007	52°22'37"N; 21°13'00"E	MM	1	NOP	FIL	H
15	Okuniew/2007	52°16'04"N; 21°17'43"E	MM ⁵	1	NOP	INT	M
16	Zielonka/2006	52°17'46"N; 21°08'29"E	MM	1	N20 ⁹	SHA, OVE	H

¹MM – man-made; NA – natural²N20 – protected within Natura 2000 Network; NOP – non-protected³SHA – permanent shallowing of water body basin; OVE – overgrowing with water plants; WAT – unfavorable water properties; FIL – intentional filling in;

INT – fish introductions or presence of invasive fish species or both

⁴L – low; M – medium; H – high⁵Population initiated by translocation⁶PLH140034 "Poligon Rembertów"; ⁷PLH140038 "Białe Błota"; ⁸PLH140008 "Krogulec"; ⁹PLH140040 "Strzebla Błotna w Zielonce"

The first attempts to initiate new *E. percunurus* populations date from 2004, when water bodies in Działy Czarnowskie and Kowalicha were stocked with 1500 and 280 juvenile fish, respectively (Table 2). From then to 2010, a total of six new *E. percunurus* populations were established using both man-made and natural water bodies. At the Lasków and

Dobczyn sites, single fish translocations were performed intentionally.

Among all existing *E. percunurus* sites in the voivodeship, habitats are endangered by three types of threats (SHA, OVE, FIL), while populations are directly endangered by two (WAT, INT; see Table 1 for explanation of threat types), with the first two types of

Table 2Translocations of cultivated *Eupallasella percunurus* juveniles (indiv.) into water bodies in Mazowieckie Voivodeship from 2004 to May 2011

Year	Działy					
	Czarnowskie	Kowalicha	Łojków	Okuniew	Lasków	Dobczyn
2004	1500	280	-	-	-	-
2005	1000	750	-	-	-	-
2006	2900 ¹	500	-	-	-	-
2007	1000	-	1800	200	-	-
2008	1000	-	1500	200	-	-
2009	-	-	-	330	400	400
2010	-	-	-	500	-	-
2011	-	-	-	450	-	-
Total	7400	1530	3300	1680	400	400

¹beginning of the second series of translocations after the fish died out in winter 2005/2006

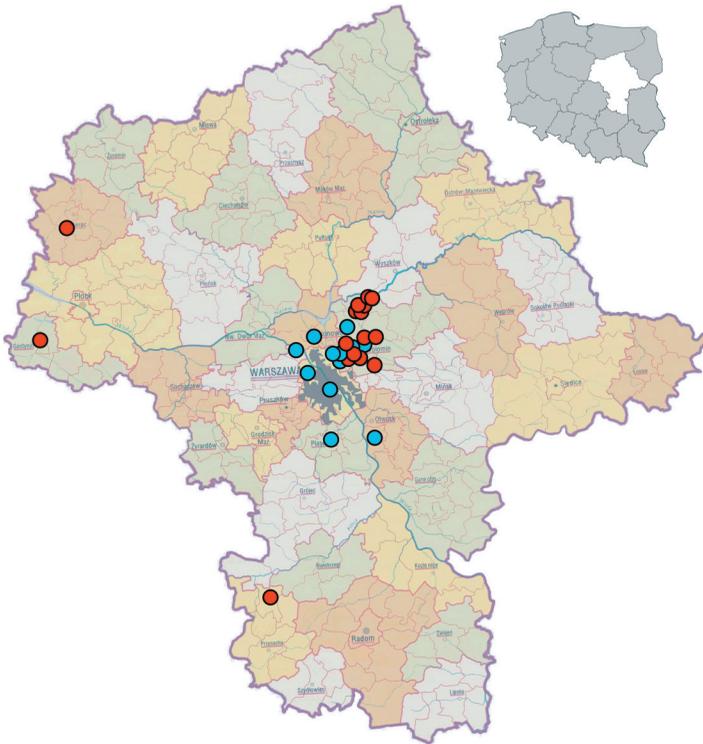


Figure 1. Past (blue circles) and present (red circles) distribution of *Eupallasella percunurus* sites in Mazowieckie Voivodeship in Poland.

threats as the most common. The existence of six sites is highly threatened, whereas seven are threatened to low degree. Of sixteen current sites of occurrence in the Mazowieckie Voivodeship, five are under protection within the European Ecological Natura 2000 Network (Table 1).

Discussion

Historical state of occurrence

Published and unpublished scientific sources together confirm that at the end of the twentieth century there were eleven *E. percunurus* sites in today's Mazowieckie Voivodeship (Fig. 1). Chronologically, Dybowski (1916) made a highly probable, although ultimately unconfirmed, report of the occurrence of this fish species in a ditch in Łazienki in Warsaw as early as in 1878. The next report by Lorec and

Wolski (1910) indicated its occurrence in Choszczówka (1906) and Siedliska (1909), both of which are near Warsaw. In 1964-1965, Gąsowska and Rembiszewski (1967) found an existing *E. percunurus* site in Struga (which had been discovered in 1929 by Feliksiak, unpubl. data) and five other previously unknown sites located in Pustelnik, Zielonka, Radzymin, Kiełpin, and Legionowo. In a book by Rolik and Rembiszewski (1987), a caption under a picture of an *E. percunurus* specimen indicates its origin as a clay pit in Karczew near Otwock. Although the authors are now unable to provide any details on this sighting, it is likely that the local population originated from one of old peat excavations in nearby "Bagno Całowanie". In 1992, a previously unknown site in Wołomin on the border of the "Grabcicz" Nature Reserve was discovered by Kuszniierz (unpubl. data).

Most of the sites mentioned above had disappeared by the mid 1990s (Kuszniierz 1995), while the remaining sites did not survive into the current decade (Wolnicki and Sikorska 2009). The major causes for the disappearance of these sites were gradual shallowing, then complete drying up, or destruction from filling in.

Although the actual number of historic *E. percunurus* sites in today's Mazowieckie Voivodeship must have been considerably higher than that mentioned in scientific sources, this number will never be established because no systematic field inventories were ever conducted (Wolnicki et al. 2008b). It is noteworthy that the vicinity of Warsaw is rich in deposits of clay and peat, and excavations of the former continue at an intense level today, especially near Marki, Radzymin, and Wołomin. The small water bodies created after the excavation of both of these natural resources are currently the most common habitats of *E. percunurus* in all regions of Poland, excluding only Pomorskie Voivodeship (Wolnicki and Radtke 2009, Radtke et al. 2011). For example, according to reliable personal communications from Wojtatowicz, 30-35 years ago there were many small water bodies inhabited by *E. percunurus* only in the

immediate vicinity of Marki. Wojtatowicz also reports that this species inhabited man-made water bodies in "Horowe Bagno" Nature Reserve. It is noteworthy that some sources erroneously report this site of *E. percunurus* occurrence as extant (e.g., Rąkowski et al. 2006).

Present state of occurrence

Although it was widely believed that all *E. percunurus* sites in Mazowieckie Voivodeship had become extinct by the late 1990s (Kusznierz et al. 2002), Ligieża and Wolnicki (2003) confirmed the occurrence of this species in two water bodies near Radzymin as early as in 2002 (Table 1). Subsequent finds were made in 2005-2007 (Wolnicki et al. 2006, 2007) and 2008 (Wolnicki et al. 2008b), which brought the total number of sites discovered in the voivodeship to seven. With three more finds made in 2009-2010, their number grew to ten. With six new populations created through translocations, the total number of *E. percunurus* sites currently existing in Mazowieckie Voivodeship is sixteen, which means that this voivodeship is in third place in Poland following Pomorskie (102 sites) and Lubelskie (44 sites) voivodeships (Radtke et al. 2011, Wolnicki et al. 2011b). It is noteworthy that all recent discoveries of *E. percunurus* sites are within the historical range of this species in Poland (Wolnicki and Sikorska 2009). Among the new finds, the sites in Gostynin and Bledzewo near Sierpc are especially valuable as they are distinctly isolated from all other sites in Poland (Fig. 1, Table 1).

Threats

The first attempts to identify the primary threats faced by *E. percunurus* habitats and/or populations were done by Wolnicki and Kolejko (2008) for Lubelskie Voivodeship and Wolnicki et al. (2008b) for Mazowieckie Voivodeship; these investigations also allowed to assess to what degree the continued existence of these fish was under threat. Of the eleven extant Mazowieckie sites in 2008, four, or

36.4%, were classified as threatened to high degree, while the site in Gostynin was classified as threatened to low degree. The most common threats to these sites were the permanent shallowing of water basins and vegetation overgrowth.

The newest data (Table 1) provide a slightly more optimistic picture of the current state of the sixteen extant sites. Although six, or 37.5%, of them are classified as highly threatened, seven, or 43.8%, of the sites are classified as threatened to low degree. This improvement in status is thanks to heavy atmospheric precipitation noted in Poland since late fall 2009 throughout 2010 and 2011. Consequently, the water levels in many of the basins increased as did ground water levels in the vicinities of these sites, all of which renders the continued existence of *E. percunurus* sites considerably safer.

Protection

Only five, or 31.3%, of the *E. percunurus* sites in Mazowieckie Voivodeship are protected under the auspices of the Natura 2000 Network (Table 1), which is considerably fewer than in Pomorskie and Lubelskie voivodeships. Although these regions have many more sites of *E. percunurus* occurrence, the share of protected sites exceeds 40% (Radtke et al. 2011, Wolnicki et al. 2011b).

According to many recent field observations most *E. percunurus* sites in Poland suffer from low water depth (Radtke et al. 2006, 2011, Sikorska et al. 2007, Wolnicki and Radtke 2009, 2010, Wolnicki et al. 2011a, 2011b). Consequently, the best active protection measure to take in many instances is to deepen, at least partially, water bodies inhabited by this species. This measure provides habitat preservation rather than population protection, which relies exclusively on biological methods and which is decidedly less expensive and less technically complicated than habitat preservation. Thus, it is not surprising that, to date, only two attempts to deepen water bodies that are inhabited by *E. percunurus* populations have been undertaken in Poland. One of

these attempts was begun in Okuniew, Mazowieckie Voivodeship in December 2009.

Attempts are being made to establish a new *E. percnurus* population in a water body in Okuniew (Table 1), but the results thus far are unsatisfactory. Although, two or three years of lake minnow translocations have proved elsewhere to be sufficient for establishing new, more or less stable, populations, the site in Okuniew remains unstable and requires further translocations every year, including in 2011 (Table 2). All of the translocations performed to date have not resulted in a viable population capable of surviving independently without further large-scale translocations. One of the reasons behind this apparent failure, could be the abundant population of the invasive cyprinid fish species topmouth gudgeon, *Pseudorasbora parva* (Temminck & Schlegel), which is a dangerous competitor with young stages of native fish species (Hliwa 2010).

With the remaining five newly-established *E. percnurus* populations, the first signs of their developmental progress were usually noted in the year subsequent to the first translocation, and manifested in the abundance of the youngest offspring, which signaled that spawning had occurred successfully among the translocated individuals. In consecutive years, increases in the total number of *E. percnurus* individuals and the occurrence of several generations in populations accompanied sometimes by decreased numbers of cohabiting crucian carp, *Carassius carassius* (L.), and Prussian carp, *Carassius gibelio* (Bloch) were recorded. The occurrence of all these indexes was taken as a signal to discontinue translocation.

The first studies on the size and structure of a newly-established *E. percnurus* population were performed in Kowalicha in 2010, which was approximately four years following the final translocation (Sikorska et al. 2011). The total size of the population was estimated at approximately 600 individuals aged 1+ and older. This value was considerably lower compared to the only other data available on size and structure of an *E. percnurus* population, existing in Zielonka, which had not been subjected to such

measures and was estimated to number approximately 2000 adult fish (Wolnicki et al. 2008a).

The active protection measures applied to *E. percnurus* thus far in Mazowieckie Voivodeship appear to be promising enough to be implemented in other voivodeships. It is especially desirable to implement them in Wielkopolskie Voivodeship where probably there is only one extant *E. percnurus* site (Sikorska and Wolnicki 2011).

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Streszczenie

Występowanie, zagrożenia i czynna ochrona strzebli błotnej *Eupallasella percnurus* (Pall.) w województwie mazowieckim w Polsce

Celem pracy było podsumowanie informacji na temat dawnego i obecnego występowania oraz ochrony zagrożonego wyginieciem gatunku ryby karpiowatej, strzebli błotnej *Eupallasella percnurus* (Pall.), w województwie mazowieckim. Do końca ubiegłego wieku w opublikowanych i niepublikowanych źródłach naukowych wzmiankowano o 12 mazowieckich stanowiskach tej ryby, z których do dzisiaj nie przetrwało jednak żadne. Dane na temat obecnego występowania strzebli błotnej uzyskano w ramach realizacji – jedyne go w kraju – projektu czynnej ochrony tej ryby, zapoczątkowanego wiosną 2002 roku. W wyniku przeprowadzonych badań terenowych, do listopada 2010 roku odkryto w województwie 10 nieznanych nauce jej stanowisk. Większość z nich jest skupiona w okolicach Warszawy, w pobliżu miast Radzymin i Wołomin, w miejscach dawnej lub trwającej nadal eksploatacji gliny i torfu. Od 2004 roku zainicjowano 6 nowych populacji strzebli błotnej za pomocą jednorazowych lub ponawianych translokacji hodowlanego materiału

zarybieniowego do specjalnie wytypowanych do tego celu zbiorników wodnych. W pięciu z nich, po dwóch lub trzech latach zarybień stwierdzono wyraźne oznaki stabilizacji nowych populacji, w związku z czym dalszych translokacji zaniechano. Obecnie na Mazowszu ochronie podlega 5 stanowisk, wszystkie w ramach europejskiej sieci ekologicznej Natura 2000. Analiza zagrożeń dla istnienia poszczególnych mazowieckich stanowisk strzebli błotnej wykazała, że w odniesieniu do 10 z nich można mówić o trwałym wypłyceniu misy zamieszkałych przez populacje tej ryby zbiorników wodnych i/lub o silnym zarośnięciu ich roślinnością wodną. Utrzymujący się od późnej jesieni 2009 roku wysoki poziom wód, zarówno w samych zbiornikach wodnych, jak i wód gruntowych w ich otoczeniu, spowodował obniżenie statusu zagrożenia stanowisk w województwie. Obecnie za zagrożone w stopniu wysokim uważa się istnienie 6 stanowisk, podczas gdy 7 innych jest zagrożone w stopniu niskim.