

OCCURRENCE AND CONSERVATION OF THE ENDANGERED CYPRINID FISH SPECIES LAKE MINNOW *Eupallasella percnurus* (PALLAS, 1814) IN THE MAZOWIECKIE VOIVODESHIP IN POLAND

Jacek Wolnicki, Justyna Sikorska, Rafał Kamiński

Pond Fishery Department in Żabieniec, The Stanisław Sakowicz Inland Fisheries Institute in Olsztyn
Żabieniec, 05–500 Piaseczno, jawol@infish.com.pl

Summary. As a result of extensive field studies, carried out in the Mazowieckie Voivodeship in Poland in 2001–2008, formerly unknown to knowledge 7 stations of critically endangered cyprinid fish species, lake minnow *Eupallasella percnurus*, were found. Next 4 stations of this species exist at present due to the repeated introductions of juvenile individuals, which originate from the captive breeding of wild fish and rearing of their offspring under controlled conditions. After being introduced, *E. percnurus* proved to attain sexual maturity and successfully spawn in all stocked water bodies. High effectiveness of this method of conservation of the endangered fish species makes it possible to use it on a larger scale, in other voivodeships in Poland, falling into the natural range of the occurrence of this fish.

Key words: lake minnow, stations, stocking, Mazowieckie Voivodeship (Poland)

INTRODUCTION

Lake minnow *Eupallasella percnurus* (Pallas, 1814) is a tiny fish belonging to the Cyprinidae family. For a long time it has been regarded as one of the most endangered with extinction freshwater fish species in Poland [Witkowski 1992]. It became strictly protected by law in 1983, and later it was also included in the Polish Red Data Book of Animals as a species critically endangered with extinction [Kusznierz 2001]. Not long ago this fish has gained also the status of the priority vertebrate species in the European Ecological Natura 2000 Network [Kusznierz *et al.* 2005].

In Poland *E. percnurus* populations inhabit small and very shallow water bodies, overgrown with submerged and emerged vegetation, in our times mainly of anthropogenic origin. Most often they are remnants of former peat excavations or – rarely – pits left after clay exploitation. Such water bodies are always

highly vulnerable to extinction resulting from both drying off and other reasons [Wolnicki 2005].

The Mazowieckie Voivodeship is one of only five today's voivodeships in Poland, where *E. percnurus* stations used to occur and also occur at present [Wolnicki *et al.* 2006a, 2007b]. Due to a lack of consistent field studies in the XXth century, however, our knowledge of the historical occurrence of *E. percnurus* populations in this part of the Polish territory (geographically the Mazovian Lowland) will always remain only fragmentary. Nevertheless, considerably more is known as concerns the current state of the occurrence of this species there. It is a result of the most extensive ever field studies that have been conducted in the Mazowieckie Voivodeship since the beginning of this century [Ligęza and Wolnicki 2003a, b, Kuszniierz *et al.* 2005, Wolnicki *et al.* 2006a, 2007b].

The main purpose of this paper was to give a concise account of the past as well as present state of the occurrence in the Mazowieckie Voivodeship of *E. percnurus*, including a rough assessment of the risk to existence of its stations. As to present state, many information were collected while carrying out the long-term project of conservation of this fish species in the Mazowieckie Voivodeship, planned to be terminated at the earliest in 2013. It was also intended to briefly characterize one of the most important goals of this project which was to increase the number of *E. percnurus* existing stations. It was to be attained by means of the repeating stockings of carefully selected water bodies, using juvenile individuals originating from the controlled conditions.

STUDY AREA, MATERIAL AND METHODS

Extensive field studies in the Mazowieckie Voivodeship, all encompassing areas where *E. percnurus* populations were likely to occur, have been conducted every year since 2001. The choice of the individual sites to be searched through was based mostly on the scientific data concerning location of the historical stations of this species [Lorec and Wolski 1910, Gąsowska and Rembiszewski 1967, Kuszniierz 1995 and unpubl. data]. Reliable suggestions, delivered by the local anglers, were also checked in the field. Additionally, topographic maps at a scale of 1 : 25,000, showing location of old peat and clay excavations, served as an important source of helpful information. A total of about 60 sites, mainly single isolated water bodies, were surveyed.

The presence of fish in the particular water bodies was checked once only when successful. Otherwise, within the same year 2–3 consecutive attempts were undertaken. To catch fish, specialized Chinese small traps, equipped with bait (a piece of bread put inside) were used [Wolnicki *et al.* 2006a, b, 2007b]. Mainly 2–4 traps were exposed throughout the period of 0.5 to 24 hours. The number of *E. percnurus* individuals caught in the particular water bodies

varied between 10 and more than 100. All fish caught in the traps were freed immediately thereafter. The only exception were selected mature females and males, captured in the spring to be maintained under culture conditions as broodstock for the captive breeding.

Used for the stocking purposes *E. percnurus* juveniles at the age of 0+ and 1+ (0.5–1.0 and 1.5–2.5 g BW, respectively) were pooled offspring of the broodstock fish (30–40 females and 15–20 males), kept in captivity after being trapped in the wild just before the natural spawning. Standard fish propagation techniques were applied [Kamiński *et al.* 2004], likewise the methods used for the egg incubation [Kamiński *et al.* 2006] and larval and juvenile rearing under controlled conditions [Wolnicki *et al.* 2004].

The geographical situation of all the water bodies either already inhabited by *E. percnurus* or those considered to be useful for the future introductions was determined. To this purpose, a GPS hand receiver (Garmin GPSmap 60C) with a practical accuracy of 3–9 m was applied. Approximate water surface area of all these water bodies was determined with help of a laser telemeter (Bushnell YD Pro; 1 m accuracy). Measurements were also carried out in the field of the water pH (Knick Portamess pH-meter) and its electrolytic conductivity (Slandi SC300 conductivity detector). Either existing *E. percnurus* stations or those being made up by means of fish stocking were monitored several times a year from early spring to late autumn. Fish presence and some water quality parameters (pH, electrolytic conductivity) were controlled. Special attention was paid to the identification of the factor crucial for their existence in the near future. To evaluate levels of threat to existence of the particular *E. percnurus* stations, water conditions were chosen arbitrarily as the major criterion for this purpose.

RESULTS

Among around 60 sites surveyed in the field between spring of 2001 and fall of 2008, altogether 7 *E. percnurus* stations – earlier unknown to knowledge – were found to exist in the Mazowieckie Voivodeship, nearly all in its central part (Fig. 1). All these stations were single water bodies with the individual water surface of 0.07–0.40 ha; however, in some cases highly variable throughout the year (Tab. 1). Only Krogulec was of the natural origin (formerly large mid-forest lake). The remaining water bodies were dug years ago to exploit resources of clay (Glinianka) or peat (Bagno Jacka Nature Reserve, Gostynin, Nowiny, Wołomin) or to serve as a fire reservoir (Zielonka). All of the newly found stations were characterized by at least periodically acidic waters (in the spring often below 6.00 pH value), then of very low electrolytic conductivity of merely 46–75 $\mu\text{S cm}^{-1}$. Besides *E. percnurus*, the major inhabitants of these water bodies were gibel carp, *Carassius gibelio* or crucian carp, *C. carassius*, or both.

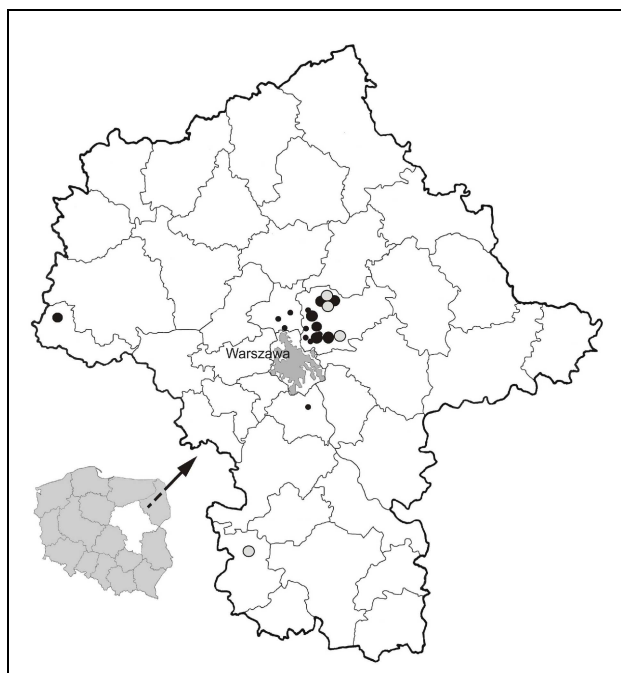


Fig. 1. Distribution of *E. percunurus* stations in the Mazowieckie Voivodeship in Poland. Small black circles – extinct stations; big black circles – existing stations; grey circles – stations under formation

Most of the stations, considerably shallow and often with highly fluctuating water level, were considered to be of medium (Bagno Jacka, Glinianka, Nowiny) or high (Krogulec, Wołomin, Zielonka) level of threat to their existence (Tab. 1). As to Gostynin, this water body of the maximum water depth of 1.0–1.5 m had the status of low threat to existence.

From the view-point of their general characteristic, all water bodies chosen for the introduction of juvenile *E. percunurus* individuals did not differ much from those existing independently (Tab. 1). Three of them (Kowalicha, Łojków, Okuniew) were counted into those of medium threat to existence; considerably shallower Działy Czarnowskie gained the status of a high threat.

Juvenile fish, used for the stocking purposes, were progeny of broodstock originating from one station, Krogulec (Tab. 1), where large population of this species was found to occur in the period of 2002–2004. The first to be stocked were two water bodies, Działy Czarnowskie and Kowalicha (Tab. 1 and 2), both situated at a close distance from Krogulec: 2.2. and 2.0 km, respectively. Shortly after being stocked, juvenile *E. percunurus* proved to reach sexual maturity, so they successfully spawned every year beginning from 2005. In Kowalicha, this fish became abundant and predominant over, present here in a large number, *C. gibelio*. As a consequence, Kowalicha ceased to be stocked in 2006, after three consecutive years of the repeated introductions with the use of 1530 juvenile

Table 1. List and general characteristics of *E. percunurus* stations presently existing in the Mazowieckie Voivodeship (all data for 2006–2008)

No.	Station/year of discovery	Geographical situation	Water surface (ha)	pH	Electrolytic conductivity ($\mu\text{S cm}^{-1}$)	Status*
Stations existing without stocking						
1	Bagno Jacka Nature Reserve/2008	N 52° 15' 33'' E 21° 13' 21''	0.40	5.75–6.47	63–131	M
2	Dąbrówka (Glinianka)/2002	N 52° 29' 33'' E 21° 15' 25''	0.30	5.99–8.94	46–120	M
3	Dąbrówka (Krogulec)/2002	N 52° 29' 34'' E 21° 16' 20''	0.15–0.40	5.10–6.91	68–108	H
4	Gostynin/2005	N 52° 26' 07'' E 19° 27' 14''	0.25	7.45–9.13	540–642	L
5	Nowiny/2007	N 52° 22' 37'' E 21° 13' 00''	0.12	6.52–7.90	323–356	M
6	Wołomin (Białe Błota)/2005	N 52° 21' 31'' E 21° 13' 45''	0.20–0.30	5.48–6.67	75–136	H
7	Zielonka/2006	N 52° 17' 46'' E 21° 08' 29''	0.07–0.12	6.25–7.10	298–600	H
Stations existing due to stocking						
8	Działy Czarnowskie	N 52° 28' 48'' E 21° 14' 52''	0.05–0.60	5.30–6.60	92–227	H
9	Kowalicha	N 52° 30' 29'' E 21° 15' 26''	0.08–0.15	5.78–6.84	58–94	M
10	Łojków	N 51° 30' 02'' E 20° 40' 50''	0.50–0.70	8.20–8.35	116–124	M
11	Okuniew	N 52° 16' 04'' E 21° 17' 43''	0.10	8.00–8.01	321–370	M

* Level of threat to existence: H – high; M – medium; L – low

Table 2. Stocking with juvenile *E. percunurus* (individ.) of selected water bodies in the Mazowieckie Voivodeship in 2004–2008

Year	Działy Czarnowskie	Kowalicha	Łojków	Okuniew
2004	1500	280	-	-
2005	1000	750	-	-
2006	2900	500	-	-
2007	1000	-	1800	200
2008	1000	-	1500	200
Sum total	7400	1530	3300	400

individuals. In May 2008, *E. percnurus* constituted about 87% of the number of the ichthyofauna there, whereas the share of *C. gibelio* was 13% ($n = 239$). In contrast to Kowalicha, in Działy Czarnowskie almost total extinction of its ichthyofauna in exceptionally severe winter from 2005 to 2006 was noted. This fact was the reason for the continuation of fish introductions so far. In July 2008, presence of both adult and larval *E. percnurus* was recorded in this water body.

In 2007, the stocking material was introduced first into another two water bodies, Łojków and Okuniew, both relatively deep, so of medium level of threat to their existence (Tab. 1).

DISCUSSION

Fish occurrence

The first published information about *E. percnurus* occurrence on the territory of Poland was given by Benecke (1881). He found this species in a water body in the neighbourhood of Gdańsk (today's Pomorskie Voivodeship). By the end of the last century, a total of about 80 Polish stations were mentioned in the literature [Wolnicki 2005]. Among them, only 9 stations were situated within the present boundaries of the Mazowieckie Voivodeship.

As concerns *E. percnurus* historical occurrence in the area of present Mazowieckie Voivodeship, the first published record was done by Lorec and Wolski [1910]. These authors found 2 stations at a close distance from Warsaw: Choszczówka to the north and Siedliska to the south. Considerably later, next 6 stations (Legionowo, Kielpin, Pustelnik, Radzymin, Struga, Zielonka), all discovered in 1964–1965, were mentioned by Gąsowska and Rembiszewski [1967]. The 9th station, situated right next to the Grabicz Nature Reserve near Wołomin, was discovered by Kuszniierz [1995]. However, all these stations were found not existent before the end of the 20th century.

Undoubtedly the actual number of *E. percnurus* stations existing in the last century in many parts of today's Mazowieckie Voivodeship had to be much higher than that mentioned above. Especially the north-east region of Warsaw abounded in remnants of clay and peat excavations which were often inhabited by populations of this species. For example, barely 30–35 years ago, quite a lot of stations existed only in the immediate vicinity of Marki [Wojtatowicz pers. comm.], but most likely none of them survived till today. One of those worth to be mentioned is Horowe Bagno Nature Reserve, given mistakenly by Rąkowski *et al.* [2006] as still existing. In fact, though some water bodies exist there at least periodically, all recent attempts to find *E. percnurus* have proven to be entirely unsuccessful [Wolnicki *et al.* unpubl. data].

At the turn of the 20th and 21st centuries, it was believed that all the Mazovian populations of *E. percnurus* were entirely extinct [Kuszniierz *et al.* 2002,

Wolnicki *et al.* 2006a]. In 2002, however, two unexpected discoveries took place when Ligęza and Wolnicki [2003a, b] found 2 stations, Glinianka and Krogulec, near Dąbrówka village not far away from Radzymin. The next four finds were done between 2005 and 2007 [Wolnicki *et al.* 2006a, 2007b], whereas the last one in 2008. Most of the newly found stations turned out to exist within the historical range of the occurrence of this species, covering the neighbourhood of Zielonka, Wołomin and Radzymin [Gąsowska and Rembiszewski 1967].

Present today, in the Mazowieckie Voivodeship, 11 *E. percunurus* stations contribute considerably to their total number of around 100 currently existing in Poland [Wolnicki *et al.* 2007b and unpubl. data].

Fish conservation

The results of consistent monitoring of all *E. percunurus* stations, existing in the country, give evidence to the fact that the most important threat to their existence is permanent water deficit, in vast majority of them combined with very low maximum water depth [Radtke *et al.* 2006, Wolnicki *et al.* 2006b, 2007a, Sikorska *et al.* 2007]. It seems then that the most effective way to protect from extinction most of populations of this species would be to protect their habitat from destruction caused by total drying off [Kusznierz *et al.* 2005]. In such case, however, at least partial deepening would be necessary of the water bodies inhabited by *E. percunurus*, what seems to be both costly and – sometimes – technically complicated.

The long-term conservation project of *E. percunurus* populations in the Mazowieckie Voivodeship is the only one undertaking of this kind carried out in Poland ever [Wolnicki *et al.* 2006a, Wolnicki 2007]. Its basis is the assumption that exclusively biological methods of species conservation can be successfully applied. Hence, performed repeatedly introductions of juvenile fish to carefully selected water bodies seem to be both easy and safe solution for their biocoenosis and biotope.

Obtained so far preliminary results of the project should be considered promising. *E. percunurus* presence in two water bodies (Działy Czarnowskie and Kowalicha) stocked since 2004 and their undoubtedly successful spawning there prove good biological quality of the stocking material, originating from the controlled conditions, as well as appropriateness of selection of these water bodies to the stocking purposes.

CONCLUSION

The project of *E. percunurus* conservation, carried out in the Mazowieckie Voivodeship, helped so far to discover 7 stations of this species, all unknown to

knowledge, whereas the next 4 stations remain under formation by means of fish introductions. All this means that the Mazowieckie Voivodeship contributes approximately 11% to the total number of *E. percnurus* stations known to presently exist in the territory of Poland.

This study was supported by the Voivodeship Fund for Protection of the Environment and Water Management in Warsaw, the voivodeship Nature Conservator, and S-001 Project of the Inland Fisheries Institute in Olsztyn.

REFERENCES

- Benecke B., 1881. Fische, Fischerei und Fischzucht in Ost- und Westpreussen. Königsberg, 514 pp.
- Gąsowska M., Rembiszewski J.M., 1967. The revision of the subspecies of the swamp-minnow *Phoxinus percnurus* (Pallas) in Poland. Ann. Zool., 24, 305–341.
- Kamiński R., Kuszniierz J., Myszkowski L., Wolnicki J., 2004. The first attempt to artificially reproduce the endangered cyprinid lake minnow *Eupallasella perenurus* (Pallas). Aquacult. Int., 12, 3–10.
- Kamiński R., Kamler E., Korwin-Kossakowski M., Myszkowski L., Wolnicki J., 2006. Effects of different incubation temperatures on the development of yolk-feeding *Eupallasella percnurus* (Pallas). J. Fish Biol., 68, 1077–1090.
- Kuszniierz J., 1995. A preliminary estimate of the present state of the Polish populations of the swamp minnow *Moroco* (= *Phoxinus*) *percnurus* (Pallas, 1811), Cyprinidae, Osteichthyes (in Polish). Acta Univ. Wratislav., 1744, Prace Zool., 29, 59–69.
- Kuszniierz J., 2001. *Eupallasella percnurus* (Pallas, 1811). Lake (swamp) minnow (in Polish) [in:] Z. Głowaciński (ed.) Polish Red Data Book of Animals. Vertebrates. PWRiL, Warszawa, pp. 301–303.
- Kuszniierz J., Wolnicki J., Kamiński R., Myszkowski L., 2002. Lake minnow *Eupallasella perenurus* (Pallas, 1814) in Poland – history, threats and prospects of protection (in Polish). Komun. Ryb., 2, 11–13.
- Kuszniierz J., Wolnicki J., Radtke G., 2005. Swamp-minnow *Eupallasella perenurus* (Pallas) – status and perspectives of protection (in Polish). Chrońmy Przyrodę Ojczystą, 61, 70–78.
- Ligieża J., Wolnicki J., 2003a. New stations of the lake minnow *Eupallasella perenurus* (Pallas) in Mazowsze (in Polish). Chrońmy Przyrodę Ojczystą, 59, 103–105.
- Ligieża J., Wolnicki J. 2003b. Presently existing lake minnow *Eupallasella perenurus* (Pallas) stations in the Mazovian Lowland (in Polish). Komun. Ryb., 2, 18–19.
- Lorec Z., Wolski T., 1910. New species from genus *Phoxinus* Agas. Lake minnow (*Phoxinus Dybowskii* spec. nov.?) (in Polish). Sprawozdania TNW, Wydz. Mat.-Przyr., Warszawa, 3, 114–120.
- Radtke G., Wolnicki J., Kamiński R., 2006. Occurrence and major threats to the habitats of lake minnow *Eupallasella perenurus* (Pallas) in Pomorze (in Polish). Komun. Ryb., 6, 31–33.
- Rąkowski G., Walczak M., Smogorzewska M., 2006. Horowe Bagno (in Polish) [in:] G. Rąkowski (ed.) Nature reserves in the Central Poland. Inst. Env. Protect., Warszawa, 297.
- Sikorska J., Wolnicki J., Kamiński R., Kolejko M., 2007. Occurrence of lake minnow *Eupallasella perenurus* in aquatic ecosystems of the Lubelskie Voivodeship (in Polish). Komun. Ryb., 1, 30–33.
- Witkowski A., 1992. Threats and protection of freshwater fishes in Poland. Neth. J. Zool., 2–3, 243–259.
- Wolnicki J., 2005. The lake minnow *Eupallasella perenurus* (Pallas, 1814) (in Polish) [in:] Adamski P., Bartel R., Bereszyński A., Kepel A., Witkowski Z. (eds) Animals species (except for birds). Guide of habitats and species protection. Nature 2000. Warszawa, 6, 229–233.

- Wolnicki J., 2007. Occurrence and protection of lake minnow in the Mazowieckie Voivodeship (in Polish). *Przyroda Polska*, 10, 29–30.
- Wolnicki J., Kamiński R., Korwin-Kossakowski M., Kuszniarz J., Myszkowski L., 2004. The influence of water temperature on laboratory-reared lake minnow *Eupallasella percnurus* (Pallas) larvae and juveniles. *Arch. Pol. Fish.*, 12, 61–69.
- Wolnicki J., Kamiński R., Sikorska J., 2006a. Actual state of the occurrence of lake minnow in the Mazowieckie Voivodeship (in Polish). *Komun. Ryb.*, 4, 25–28.
- Wolnicki J., Kolejko M., Sikorska J., 2006b. Present state of the occurrence of lake minnow *Eupallasella percnurus* (Pallas, 1814) in the Lubelskie Voivodeship. *Teka Kom. Ochr. Kszt. Środ. Przyr.*, 3, 250–256.
- Wolnicki J., Kamiński R., Kuszniarz J., 2007a. Occurrence of lake minnow *Eupallasella percnurus* (Pallas) in the Wielkopolskie and Kujawsko-Pomorskie Voivodeship (in Polish). *Komun. Ryb.*, 6, 24–26.
- Wolnicki J., Sikorska J., Kolejko M., Kamiński R., Radtke G., 2007b. Newest discoveries of lake minnow *Eupallasella percnurus* (Pallas, 1814) stations in Poland. *Teka Kom. Ochr. Kszt. Środ. Przyr.*, 4, 314–321.

WYSTĘPOWANIE I OCHRONA ZAGROŻONEGO GATUNKU RYBY KARPIOWATEJ
STRZEBLI BŁOTNEJ *Eupallasella percnurus* (Pallas, 1814)
W WOJEWÓDZTWIE MAZOWIECKIM W POLSCE

Streszczenie. Województwo mazowieckie jest jednym z pięciu krajowych województw, w których występowała w przeszłości i występuje obecnie krytycznie zagrożona wyginięciem ryba karpionowa – strzebla błotna *Eupallasella percnurus*. Pierwsze opublikowane doniesienie naukowe na temat jej obecności na Nizinie Mazowieckiej w bezpośrednim sąsiedztwie Warszawy (stanowiska w Choszczówce i Siedliskach) pochodzi z lat 1907–1909. Od tamtej pory w literaturze wzmiankowano o zaledwie 9 stanowiskach łącznie, z których jednak wszystkie uległy całkowitemu zanikowi przed końcem ubiegłego wieku. W początkach bieżącego stulecia (2001 r.) rozpoczęto systematyczne poszukiwania stanowisk strzebli błotnej w granicach województwa, w ramach przygotowań do realizacji długofalowego projektu ochrony mazowieckich populacji tej ryby. Do jesieni 2008 r. zbadano około 60 małych zbiorników wodnych. Wynikiem tych badań było odkrycie 7 stanowisk strzebli błotnej, do tej pory zupełnie nieznanymi nauce. Sześć z nich znaleziono w pobliżu Warszawy, na obszarze historycznego występowania gatunku w rejonie Radzymina, Wołomina i Zielonki, a jedno w Gostyninie. Tylko byt ostatniego z wymienionych można uważać za stosunkowo mało zagrożony. Dla wszystkich innych realnym niebezpieczeństwem jest zupełne wyschnięcie wskutek permanentnego niedoboru wody i małej głębokości samych zbiorników. Cztery inne stanowiska są od kilku lat tworzone metodą zarybień. Do tego celu stosuje się młodociane ryby, pochodzące z warunków hodowlanych. Są one potomstwem dzikich osobników, łowionych co roku w zbiorniku wodnym Krogulec (N 52° 29' 34''; E 21° 16' 20''). W wyniku stałego monitoringu stwierdzono, że introdukowane osobniki strzebli błotnej w zarybianych zbiornikach wodnych w krótkim czasie osiągają dojrzałość płciową i pomyślnie odbywają tarło. Obiecujące wyniki tych działań wskazują na możliwość ich rozszerzenia na inne województwa w kraju, leżące w granicach naturalnego arealu występowania strzebli błotnej.

Słowa kluczowe: strzebla błotna, stanowiska, zarybienia, województwo mazowieckie (Polska)