THE CONTRIBUTION TO OCCURRENCE OF BROOK LAMPREY (*LAMPETRA PLANERI*) IN THE ŠUMAVA MOUNTAINS

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ABSTRACT: During the ichthyological survey of small water courses in the territory of the Šumava Mountains National park and Protected Landscape Region which was carried out in the years 1995–1996, occurrence of critically endangered species of brook lamprey (*Lampetra planeri*) was confirmed in several localities. Population size of brook lamprey individuals (*Lampetra planeri*) in different localities ranged from 9–58 fish/100 m or 311–6 654 fish/ha.

brook lamprey; *Lampetra planeri*; small water courses; Šumava Mountains National Park

INTRODUCTION

Within the monitoring of brown trout populations (*Salmo trutta m. fario*) in ecosystems of flowing waters of the Šumava National Park and Protected Landscape Region in the years 1995–1996 (B u l a , 1997) an occurrence of critically endangered species of brook lamprey (*Lampetra planeri*) was confirmed in a few localities. Nowadays in the Czech Republic besides the above-mentioned species only the *Eudontomyzon mariae* species occurs, living only in several Moravian sites (H a n e l , 1994a).

Brook lamprey (*Lampetra planeri*) disappeared during the past 30 years due to continuing unsuitable arrangements of small water courses and systematic and single accidental contamination from many locations. Its present occurrence is of insular character, where different populations are isolated in space (B a r u š et al., 1989). It can be also presupposed that abundant fish stock (particular of salmonid stock) not corresponding to the character of the stream and food possibilities may be a certain danger to the lamprey population, especially in the course of spawning season when adults occur freely in the water course and are under strong predatory pressure (H a n e l , 1996;

Pivnička et al., 1995). Hanel (1996) remarks that larvae of lamprey fish occurred in flow sections in lower population size of salmonid stock (13 084 fish/ha and 234 kg/ha on average), while in others, more stocked stretches were missing.

For this species the sites of brooks and rivulets of trout and grayling zones with hard bottom and pure, rich-oxygenized water are typical. For their existence they need, especially larvae, fine loam sandy silts detritus-rich near banks which serve them as a shelter, as well as a food basis from which they filter microscopic organic material (Poulíčková, 1994; Baruš et al., 1995). Hanel (1995) reports that in the territory of the Czech Republic abundance of brook lamprey (*Lampetra planeri*) larvae was found, ranging from 666 to 7 067 individuals/ha. Larvae occurred particularly in streams with a width of bed over 2 m, with natural bed and well-preserved bank stands. In addition, Hanel (1994a) reports that in Southern Bohemia flows with the population size of 2–10 individuals/100 m of flow, sometimes even over 10 individuals/100 m of flow, are known. It is reported that the lamprey is a very sensible indicator of water purity, originality and integrity of water medium (Baruš et al., 1989).

This representative of the cyclostomatous family in the Czech Republic belongs to critically endangered species of animals (48, of Act No. 114/1992 of the Collection of Laws on Protection of Nature and Landscape and Amendment III, Decree No. 395/1992 of the Collection of Laws of the Ministry of Environment which serves for providing of some provisions of the law of the Czech National Council No. 114/1992 Collection of Laws on Protection of Nature and Landscape).

MATERIAL AND METHOD

Ichthyological survey of small water courses in which the brook lamprey (*Lampetra planeri*) occurred in several sites was carried out in the years 1995–1996 using electrical aggregate. Sites with occurrence of the above species are found in the territory of the Šumava Mountains National Park and Protected Landscape Region.

Captures were determined according to the species, then were weighed and measured. After finishing of fishings out of the lamprey (larvae and adults) they were discharged back to the locality.

The number of individuals of the brook lamprey (*Lampetra planeri*) was expressed by the number of fish per 100 m of the fished out flow (Hanel, 1994a) and per 1 hectare of water area (but not per area of suitable deposits).

To estimate the abundance, fish biomass and ecological demands, ordinary ichthyological instructions (Holčík, Hensel, 1972) were used. To estimate the population size of not-fished out fish species, the method after Robson-Regier for two fishings out (Cowx, 1983) was applied.

To determine the flow rate (Q), the float method and for estimation the following formula was used: $Q = F.V_{str}$, where F is area of cross-section filled with water and V_{str} means a medium velocity of water. Basic hydrochemical indicators were obtained using the device WATER TESTER (manufactured by Hanna Instruments) or by analysis in the central laboratory at the Research Institute of Fish Management (VÚRH Vodňany).

RESULTS

Of the total 24 investigated localities characteristic for the Šumava National Park and Landscape Protected Region the occurrence of brook lamprey (*Lampetra planeri*) has been confirmed in three locations (Fig. 1).

Polecký brook

The right-sided affluent of the Teplá Vltava river. The site is located above the inflow of Polecký brook into Dolnopolecká Dam. Average width of fished out stretch was 3 m, length of fished out stretch was 50 m. The brook here flows through meadows at the altitude 830 m above sea level, through the original bed with sand bottom without bank stand. The locality was fished out on May 9 and September 9, 1995. The defined stretch was on both dates fished out two times.

On this site on May 9, 1995 the total of 9 adult fish, which most probably started here to occupy the spawning nest, were fished out. Average length of fished out individuals was 150 mm. Average depth of water ranged around 60 cm, flow velocity was 0.27 m/s, flow rate of water Q = 396 l/s, water temperature 8 °C.

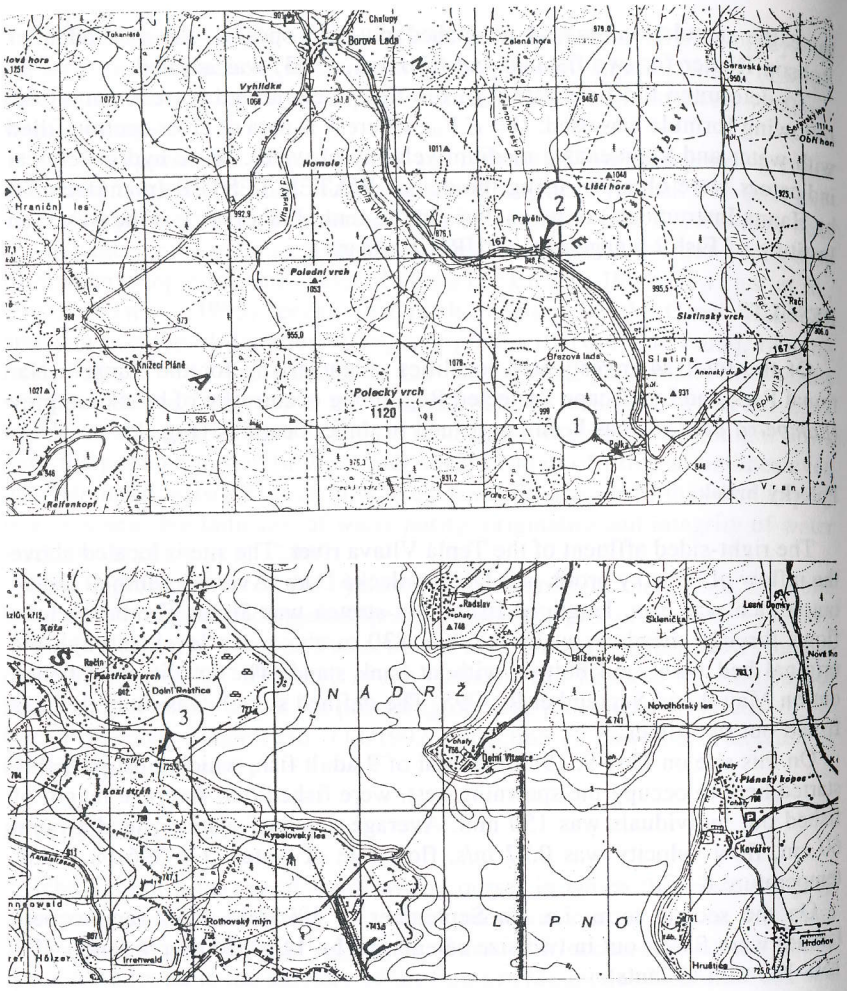
On the second term, i.e. on September 9, 1995, 11 lants (ammocoete larvae) were fished out in two size categories: I – 110–120 mm (6 lants); II – 150–180 mm (5 lants).

Average depth of water ranged about 30 cm, flow velocity was 0.17 m/s, flow rate Q = 121 l/s.

Of the representatives of ichthyofauna at the given site occurred the brown trout (*Salmo trutta n. fario*) and bullhead (*Cottus gobio*).

Zelenohorský brook

The left-sided affluent of the Teplá Vltava river. The site is located below the road Borová Lada – Horní Vltavice, approximately 1 km above the con-



1. Localities with occurrence of brook lamprey (*Lampetra planeri*): 1 – Polecký brook, 2 – Zelenohorský brook, 3 – Pestřice brook

fluent with Teplá Vltava. Average width of the fished out stretch was 2.0 m, its length was 130 m. The brook flows through meadows at the altitude 848 m above sea level, through the original bed with the gravel bottom and discontinuous bank stand. The site was fished out on May 10 and September 30, 1995. The defined stretch was in both terms fished out two times. 76 larvae in three size groups were fished out here on May 5, 1995: I – 40 mm (17); II – 110 mm (22); III – 150 mm (37 larvae).

Average depth of water ranged around 30 cm, flow velocity was 0.27 m/s, flow rate Q = 112 l/s.

On September 30, 1995 43 larvae in three size groups were again fished out: I – 65 mm (19 larvae); II – 95 mm (16 larvae); III – 130 mm (8 larvae).

Average depth of water ranged around 30 cm, flow velocity was 0.27 m/s, flow rate Q = 134 l/s.

Of the representatives of ichthyofauna the brown trout (*Salmo trutta m. fario*) and bullhead (*Cottus gobio*) were found in this site.

Pestřice brook

The right-sided affluent of the artificial dam Lipno. The site is situated 300 m from the mouth to the dam (725 m above sea level). Average width of the fished out stretch was 3 m, length of fished out stretch was 150 m. This stretch flows through the pastures at the altitude 728 m above sea level, through the original bed with gravel-sand bottom with discontinuous bank stand. The site was fished out on November 12, 1996. The defined stretch was fished two times.

Five adults and nine larvae were fished out in this stretch in two size categories: I – 130 mm (7 larvae); II – 170 mm (2 larvae).

Metamorphosed individuals reached average size of 150 mm. Average depth of water ranged around 35 cm, flow velocity was 0.5 m/s, flow rate Q = 598 l/s.

In this site of the representatives of ichthyofauna the following fish species can be found: brown trout (*Salmo trutta m. fario*), bullhead (*Cottus gobio*), perch (*Perca fluviatilis*), common gudgeon (*Gobio gobio*), and roach (*Rutilus rutilus*).

DISCUSSION

The population size of brook lamprey (*Lampetra planeri*) individuals in different sites ranged from 9 to 58 fish/100 m or from 311 to 3 654 individuals/ha (Tab. I). These values correlate more or less with the literary data (Hanel, 1994a, 1995).

In the site Polecký brook where population size of 18 to 22 fish/100 m (600–733 fish/ha) (Tab. I) will be obviously affected by the predatory pressure of the brown trout (*Salmo trutta m. fario*). This site is situated above the mouth to the dam Polka which is a part of sport angling ground and which

is to be restocked according to the stocking duty. Higher concentration of the trout stock follows probably from it. This increased predatory pressure may have adverse effect in the period of reproduction and intensive fishing of adults in spawning nests, what is verified by the fact that on the same place where adults were fished out on May 9, 1995, also brown trouts (*Salmo trutta m. fario*) of such a size at which they could not apply the above-mentioned predatory pressure, were fished out. On the other hand, it is necessary to add that Polka is strongly flowing dam by its character with abundance of sediments and silts in the bank zone in which strong population of lampreys will most probably be kept. The occurrence of brook lamprey in the Polka dam was confirmed in 1992 (Hanel, 1994b).

Zelenohorský brook represents a site where population with highest abundance, i.e. 33–58 individuals/100 m (2 067–3 654 individuals/ha) (Tab. I) is kept. The brown trout formed here relatively lower percentage of the total number than in other studied Šumava Mountains sites, i.e. 57.9–74.0% (Tab. II).

Relatively least population size of brook lamprey was found in the Pestřice site – 9 individuals/100 m (311 individuals/ha) (Tab. I). Most probably predatory pressure will be negatively present here not only on the side of the brown trout (*Salmo trutta m. fario*), because it forms here solely 16.7% population size of the total ichthyofauna (fished out individuals were predominantly of older age category) (Tab. II) but from the side of other predatory fish species, e.g. perch (*Perca fluviatilis*) and the pike (*Esox lucius*) whose presence has been confirmed here by Hartvich (1994). These undemanding predatory fish species which migrate upstream from the artificial dam have adverse effect by their predacious action not only on the abundance of the brook lamprey (*Lampetra planeri*), particularly in the period of reproduction, but also on the population of other fish species typical for trout zone (Bula, 1997).

Such low values of the total population size of fish species 600–9 134 fish/ha and total ichthyomass 30.6–121.9 kg/ha (Tab. III) in fished stretches speak in the favour of settlement of these localities by lampreys, as it was reported by Hanel (1966). Basic physical and chemical parameters of water from studied brooks (Tab. IV) illustrate the medium in which the local population of brook lamprey (*Lampetra planeri*) lives long time.

CONCLUSIONS

Three brook sites in the Šumava Mountains National Park, SW Bohemia, with occurrence of critically endangered species brook lamprey (*Lampetra planeri*) were observed. Abundance of this species on the tested sites ranged between 9 and 58 individuals per 100 m (311–3 654 individuals per 1 ha). Some of this population can be influenced by a high salmonid stock, especially of brown trout (*Salmo trutta m. fario*), or by migration of predatory fish from nearly dam – lake Lipno, for example perch (*Perca fluviatilis*) and pike (*Esox lucius*). The occurrence of brook lamprey (*Lampetra planeri*) emphasizes the high ecological level and stability of tested sites.

I. Brook lamprey abundance (per 100 m and 1 ha)

Locality	Date	Abundance (ind.100 m^{-1})	Abundance (inds.ha^{-1})
Polecký brook	9. 5. 1995	18	600
Polecký brook	9. 9. 1995	22	733
Zelenohorský brook	10. 5. 1995	58	3 654
Zelenohorský brook	30. 9. 1995	33	2 067
Pestřice brook	12. 11. 1996	9	311

II. Fish abundance (per ha) and fish biomass (kg per ha)

Locality	Date	Abundance (ind.ha^{-1})	Ichthyomass (ind.ha^{-1})
Polecký brook	9. 5. 1995	600	54.534
Polecký brook	9. 9. 1995	3 000	121.933
Zelenohorský brook	10. 5. 1995	2 644	61.298
Zelenohorský brook	30. 9. 1995	9 134	96.202
Pestřice brook	12. 11. 1996	2 100	30.635

III. Mean percentual occurrence and variation of brown trout within the tested sites

Locality	Abundance (%)	Ichtyomass (%)
Polecký brook	94.1 (88.1–100.0)	98.9 (97.8–100.0)
Zelenohorský brook	66.0 (57.9–74.0)	85.3 (77.5–93.0)
Pestřice brook	16.7	59.7

IV. Selected physicochemical parameters of water from brooks with the occurence of *Lampetra planeri*

Locality	Date	°C	pH	Conductivity µS.cm^{-1}	Alcalinity mval.l^{-1}	Acidity mval.l^{-1}	B.O.D.5 mg.l^{-1}	T.O.C. mg.l^{-1}	NO_2^- mg.l^{-1}	PO_4^{3-} mg.l^{-1}
Polecký brook	9. 9. 1995	10.2	5.6	24	–	–	–	–	–	–
Zelenohorský brook	30. 9. 1995	7.0	7.0	30	–	–	–	–	–	–
Pestřice brook	12. 11. 1996	6.5	5.62	36	0.6	0.2	0.4	6.9	0.81	0.037

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Příspěvek k výskytu mihule potoční (*Lampetra planeri*) na Šumavě.

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V rámci ichtyologického průzkumu malých vodních toků na území NP a CHKO Šumava, který se uskutečnil v letech 1995–1996, byl na několika lokalitách potvrzen výskyt kriticky ohroženého druhu mihule potoční (*Lampetra planeri*).

Odlovy byly provedeny elektrickým agregátem. K výpočtu abundance, biomasy ryb a ekologických nároků bylo použito běžných ichtyologických návodů (H o l č í k ,

Hensel, 1972). Počet jedinců mihule potoční (*Lampetra planeri*) byl vyjádřen počtem kusů na 100 m prochytávaného toku (Hanel, 1994a) a na 1 ha vodní plochy (nikoliv na plochu vhodných náplavů).

Početnost jedinců mihule potoční (*Lampetra planeri*) na jednotlivých lokalitách se pohybovala v rozmezí 9–58 ks/100 m, popř. 311–3 654 ks/ha.

Některé z populací tohoto druhu mohou být omezovány vysokou koncentrací lososovitých ryb, zvláště pak pstruha obecného f. potoční (*Salmo trutta m. fario*), která se projeví zvýšeným predačním tlakem, zejména v období rozmnožování, kdy může docházet k intenzivnímu lovení dospělců na trdlištích. Stejně negativně se může projevit přítomnost i ostatních druhů dravých ryb, např. okouna říčního (*Perca fluviatilis*) a štiky obecné (*Esox lucius*). Tyto nežádoucí druhy dravých ryb, které migrují proti proudu z blízké ÚN Lipno, tak predací negativně ovlivňují nejen početnost populace mihule potoční (*Lampetra planeri*) v období rozmnožování, ale i populace ostatních rybích druhů typických pro pstruhové pásmo. Přítomnost mihule potoční (*Lampetra planeri*) podtrhuje vysokou ekologickou hodnotu a stabilitu zkoumaných lokalit.

mihule potoční; *Lampetra planeri*; malé vodní toky; Národní park Šumava

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