

# Status assessment of lampreys in Natura 2000 network in Lithuania

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The two lamprey species, European river lamprey *Lampetra fluviatilis* L. and European brook lamprey *L. planeri* Bloch, which inhabit Lithuanian rivers are of conservation concern. They are considered either Vulnerable, Critically Endangered, or even Extinct in different regions of Europe. Migration obstacles and consequent habitat loss and population fragmentation are probably the most widespread and significant factors contributing to the current status. Therefore, all member states are obliged to designate Special Areas of Conservation (SACs). This study assessed the conservation status of *L. fluviatilis* and *L. planeri* in 16 Proposed Sites of Community Interest (pSCIs) for lamprey conservation in Lithuania. Lamprey ammocoete surveys were conducted at 41 sites following the established national protocol. In particular, we compare historical and recent data of lampreys in Lithuanian rivers, discuss the factors that contributed most to their decline and recommend conservation measures that may contribute to their recovery.

**Key words:** river lamprey, brook lamprey, *lampetra*, pSCI, NATURA 2000

## INTRODUCTION

The Baltic Sea basin is represented by one lamprey family *Petromyzontidae*, which is dominant in all Northern Hemisphere and include three genus *Petromyzon*, *Lampetra* and *Eudontomyzon* (Renaud, 2011). In Lithuanian watersheds there are recorded *Lampetra* genus representatives ac-

counting for two closely related species of river lamprey *Lampetra fluviatilis* and brook lamprey *Lampetra planeri* as well as *Petromyzon* genus represented by sea lamprey *Petromyzon marinus* (Red Data Book of Lithuania, 2007). *Lampetra* genus lampreys are common in Lithuanian territorial waters contrariwise to very rare sea lampreys. There are confirmed reports about sea lampreys captured in the Curonian Lagoon, latest dated from 1961 (Gaigalas, 2001). How-

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ever, sea lamprey did not appear in commercial catch reports available since 1887 (Thiel et al., 2009) and is considered occasional migrant in national waters. *Lampetra fluviatilis* is restricted to Lithuanian watersheds with accessible rivers (Kesminas and Švagždys, 2010). Due to larger body size *L. fluviatilis* is the only species that has economic value in the Baltic Sea region and is on various scale exploited around the Baltic Sea. In Lithuania river lamprey fishery is managed by quota system with an annual quota of 7 tonnes in two localities.

Both lampreys present in Lithuanian water bodies are of conservation concern in Europe and are listed on Annex II of the European Union (EU) Habitats Directive (92/43/EEC). In different regions of Europe they are considered Vulnerable or Critically Endangered or even Extinct. The deterioration of lamprey status is mostly associated with loss of habitat and population fragmentation. The directive obliges all member states to designate Special Areas of Conservation (SACs) for the protection of Annex II species and ensure their favourable conservation status.

The decline of lamprey populations in Lithuanian rivers is caused by migration obstacles (dams and weirs) that make a significant impact on anadromous lampreys causing an estimated loss of approx. 70% of accessible rivers and even bigger number of habitats (Gailiušis et al., 2001). However, globally these 3 species are considered of Least Concern according to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Freyhof and Kottelat, 2011 a, b, c). On the scale of the Baltic Sea basin, *L. fluviatilis* is considered Near Threatened (A2bd) and *P. marinus* is considered Vulnerable (C2a(i)) (HELCOM, 2013).

NATURA 2000 network covers an area of 826 868 hectares, which is about 13% of the country of which Proposed Sites of Community Interest (406) occupy a total area of 651 625 ha. For a complex of protected species, including river and brook lampreys, 25 SCIs with a total area of 67 763 ha are proposed. Ten on them are proposed for the conservation of *L. planeri*

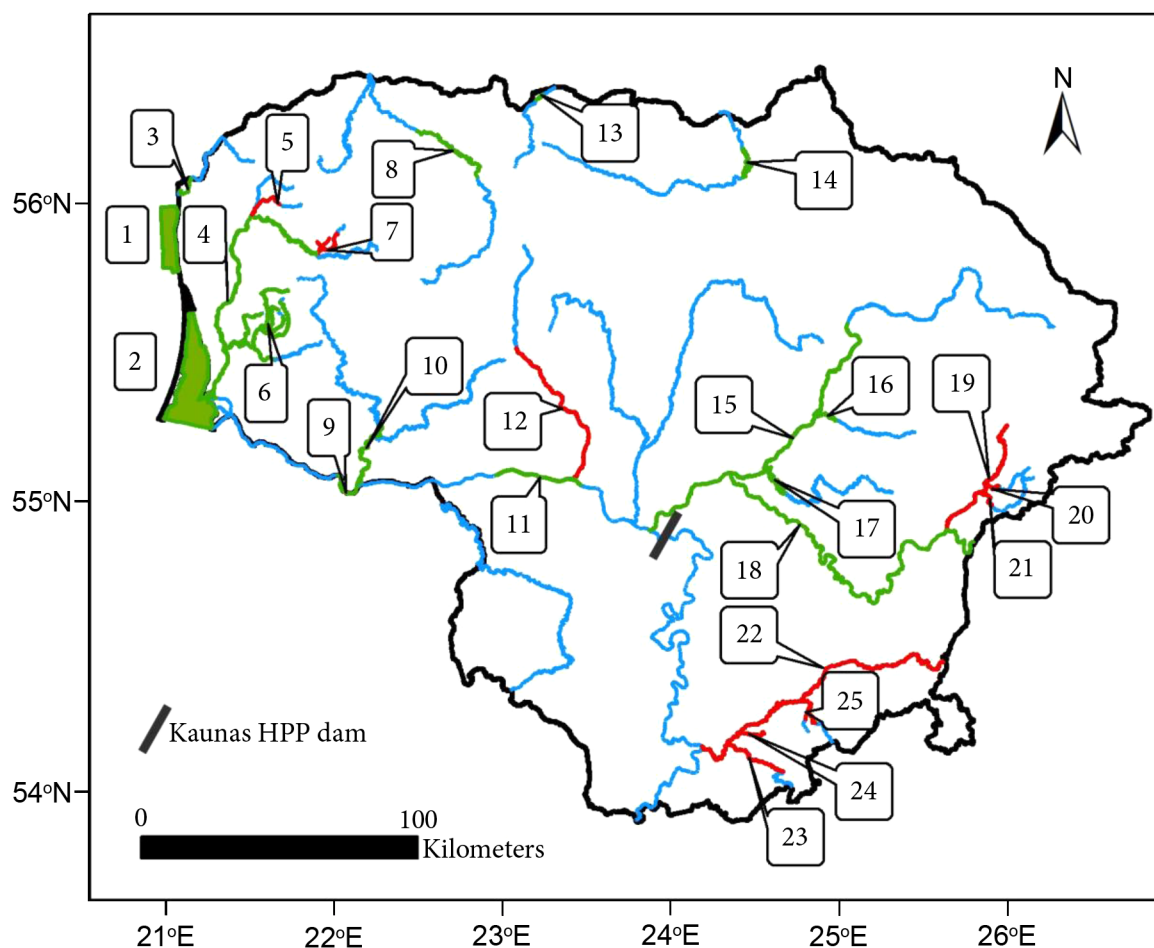
and the rest for *L. fluviatilis*. The selected SACs have to include the geographical range of the species and include a range of high-quality river types in which lampreys reside. Under ideal conditions, these sites should hold healthy populations of *L. fluviatilis* and *L. planeri* with clear water and suitable areas of gravel, silt or sand for spawning. The proposed sites generally include river sections but not whole catchments providing a limited range of habitat features required by the species.

In this paper we highlight lamprey conservation status, the distribution in Proposed Sites of Community Interest in Lithuania and also discuss the factors that contributed most to their decline and recommend conservation measures that may contribute to their recovery.

## MATERIALS AND METHODS

The survey took place during the period April–August 2008 and May–October 2012 and focused on juvenile lampreys known as ammocoetes. Ammocoetes sampling procedure followed the guidelines of the Lithuanian Ministry of Environment; ammocoetes were collected by shovelling a 1 m<sup>2</sup> netted area (Kesminas et al., 2009a). The sampling was carried out in optimal ammocoetes habitats at a bank-side of the river or backflow sections, with prevailing fine sediment and visible aggregation of detritus (Harvey and Cowx, 2003; Torgersen and Close, 2004). All ammocoetes were anaesthetised with 2-diphenylethanol 0.3 ml/l, the total length measured (TL, mm), and released after recovery.

As Kaunas Hydroelectric Power Plant is an impassable obstacle for fish migration, we assume upper reaches of the Nemunas basin to be entirely inhabited by stationary *Lampetra planeri*. All other freely accessible rivers and river sections are inhabited entirely by *L. fluviatilis* or by co-occurring both *L. planeri* and *L. fluviatilis* populations. In such areas due to the lack of morphological differences ammocoetes were classified as *Lampetra* sp. (Gardiner, 2003).



**Figure.** Proposed Sites of Community Interest for lamprey protection in the Lithuanian territory. Green colour indicates river sections and areas established for river lamprey protection and red colour indicates river sections of brook lamprey protection. Numbers indicate distinct areas: 1. Baltic Sea coastal waters; 2. Curonian Lagoon; 3. River Šventoji; 4. River Minija; 5. Rivers Salantas and Blendžiava; 6. Rivers Veiviržas and Šalpė; 7. River Sausdravas; 8. River Venta; 9. River Nemunas; 10. River Jūra; 11. River Nemunas; 12. River Dubysa; 13. River Švėtė; 14. River Mūša; 15. River Šventoji; 16. River Siesartis; 17. River Širvinta; 18. River Neris; 19. River Žeimena; 20. River Saria; 21. River Mera; 22. River Merkys; 23. River Ūla; 24. River Derežna; 25. Rivers Verseka and Pasgrinda

## RESULTS AND DISCUSSION

A total of 41 sampling sites were examined covering 16 pSCIs (Figure). The mean population densities of *L. fluviatilis* and *L. planeri* ammocoetes in sites varied from 0 per/m<sup>2</sup> to 46 per/m<sup>2</sup>. As the majority of pSCIs cover river sections rather than whole catchments, they were evaluated at an optimal habitat perspective. The national targets set for com-

pliance with favourable conservation status under the Habitats Directive are >10 per/m<sup>2</sup> for *L. planeri* ammocoetes and correspond to the targets outlined by Harvey and Cowx (2003). On the other hand, the national targets set for *L. fluviatilis* ammocoetes are >60 per/m<sup>2</sup> (Minister of Environment..., 2008). *L. fluviatilis* target is several times higher than that proposed by Harvey and Cowx (2003) and that is generally applied across Europe. This target is

in line with historical data. Although such data on the distribution and densities of *L. fluviatilis* ammocoetes in Lithuania is scarce and limited to an individual study of Mackevičius (1969) it is obvious that over last 40 years lamprey population in the Lithuanian watersheds has faced a decline. In his study Mackevičius (1969) collected data from 11 rivers and estimated

average density of ammocoetes that was  $66.5 \pm 14.9$  ( $\pm$ CI).

The conservation status was rated as 'Favourable' only in one of pSCIs – the Salantas and Blendžiava Rivers (Table). This pSCI is established for *L. planeri* protection, although the communal spawning of both *L. fluviatilis* and *L. planeri* is annually observed in redds there.

**Table.** Assessment of Conservation Status of lampreys (*Lampetra* sp.) and summary statistics for surveyed pSCIs

Proposed Site of Community Interest code (Figure, ref. No.)	River name	Number of sampling sites	% negative sites	Mean ammocoete density per/m <sup>2</sup> $\pm$ 95% CI	Ammocoete length range, mm	Conservation status
LTKRE0006 (3)	Šventoji**	1	0	46	26–79	Unfavourable-inadequate
LTKLA0007 (4)	Minija*	1	0	1	87–89	Unfavourable-inadequate
LTKRE0005 (5)	Salantas and Blendžiava**	2	0	31.5 $\pm$ 12.5	22–142	Favourable
LTPLU0011(7)	Sausdravas**	1	0	9	25–132	Unfavourable-inadequate
LTPAS0002 (14)	Mūša**	1	100	0	–	Unfavourable-bad
LTUKM0002 (15)	Šventoji**	3	33	4 $\pm$ 6.8	30–134	Unfavourable-inadequate
LTUKM0005 (16)	Siesartis**	1	0	8	43–145	Unfavourable-inadequate
LTJOA0002 (17)	Širvinta**	1	0	41	32–50	Unfavourable-inadequate
LTVIN0009 (18)	Neris**	3	66	0.33 $\pm$ 0.7	61	Unfavourable-inadequate
LTSVE0020 (19)	Žeimena*	5	40	2.8 $\pm$ 2.9	41–134	Unfavourable-inadequate
LTSVE0024 (20)	Saria**	2	50	8.5 $\pm$ 16.6	12–107	Unfavourable-inadequate
LTSVE0008 (21)	Mera**	2	50	4 $\pm$ 7.8	17–52	Unfavourable-inadequate
LTVAR0011 (22)	Merkys*	9	22	5.6 $\pm$ 2.6	16–140	Unfavourable-inadequate
LTVAR0012 (23)	Ūla*	5	20	3.8 $\pm$ 2.7	67–103	Unfavourable-inadequate
LTVAR0015 (24)	Derežna**	2	0	4	72–109	Unfavourable-inadequate
LTVAR0016 (25)	Verseka and Pasgrinda*	2	50	2.5	45–85	Unfavourable-inadequate

\* data collected in 2008 study period

\*\* data collected in 2012 study period

Due to impossible discrimination between ammocoetes of *L. planeri* and *L. fluviatilis* they were grouped together (Gardiner, 2003), thus, giving higher density values and 'Favourable' status of *L. planeri*. The pSCI in the Mūša River was the only rated to have 'Unfavourable–bad' condition. Watershed of the Mūša River is characterized by intense anthropogenic pollution, channelization and natural habitat destruction, as well as other factors (Paukštys et al., 2011) and it is highly probable not to support healthy and abundant lamprey population. All the remaining pSCIs have been rated as complying with 'Unfavourable–inadequate' conservation status.

Marine sites and lagoons are considered important migration routes or feeding grounds, this way they are also assigned as pSCIs for *L. fluviatilis* and (Figure, ref. No. 1, 2), however, they cannot be assessed by widespread study methods and they are not evaluated in the current study. Large rivers usually do not hold spawning ground and considering the limited range of ammocoete dispersion during the larval stage (Staponkus et al., unpublished) are designated for conservation of migration routes rather than lamprey habitats (Figure, ref. No. 4, 9, 11, 18). Our results also suggest this assumption to be correct as the larger rivers really showed the smallest population densities: the Minija River 1 per/m<sup>2</sup>, the Neris River 0.33 per/m<sup>2</sup>, the Žeimena River 2.8 per/m<sup>2</sup> and the Šventoji River 4 per/m<sup>2</sup>. However, the population density identified by Mackevičius (1969) in 1967–1968 study periods was much above the current values: in the Minija River 98 per/m<sup>2</sup>, the Neris River 19 per/m<sup>2</sup> and the Šventoji River 42 per/m<sup>2</sup>. Such population density in the listed rivers could be sustained only by very good conditions in tributaries which obviously have changed over the last 40 years and lamprey population has faced a drastic decline.

The means for improvement of population status are usually inferred by construction of technical fishways on dams and weirs and reconnecting lost spawning grounds and habitats. The conventional fishways are

primarily designed to effectively pass salmonids and other migratory fishes, but have little consideration of lamprey passage. The extreme inefficiency of most common fishways for *L. fluviatilis* migration (Foulds and Lucas, 2013) with minimal contribution to lamprey protection and conservation has been recently demonstrated. Hopefully, this can be solved by applying technical modifications to new already existing fishways.

## CONCLUSIONS

At present due to dams and weirs there are isolated populations of *L. planeri* and open populations with co-occurring of both nominal species of *L. planeri* and *L. fluviatilis*.

Lamprey, especially *L. fluviatilis*, population in Lithuania has faced a dramatic decline in the last 40 years. Recent status for both species is mostly rated as 'Unfavourable–inadequate'. The proposed pSCIs for the protection of lamprey also incorporate other aquatic species of Community Interest or riparian habitats. From a practical point of view, this reduces expenditures for monitoring and management of such areas. However, such approach can overlook areas that are suitable for maintenance of sustaining source populations and thus contribute to actual conservation of lampreys. Therefore, we consider the need for additional conservation areas designated entirely for protection of important spawning grounds and ammocoete beds.

Conservation status in larger rivers directly depends on free access to tributaries where typically major spawning grounds are located. To reach favourable status, especially for anadromous lampreys, free access to these grounds is essential. However, there should also be taken into account specific requirements for conventional fishways as they have been shown to be completely inefficient and lacking actual conservation value.

The following measures can be insufficient to reach favourable status as natural rivers, especially small tributaries, have been altered for agricultural purposes. Changes in hydrological

and thermal conditions also supposedly contribute to current conservation status and elimination of such effects usually is prolonged and costly with unguaranteed improvement. We consider that in order to achieve favourable conservation status the set targets could be reduced to the highest values estimated in this study and accounting for 20–30 per/m<sup>2</sup>.

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### **NĖGIŲ BŪKLĖS ĮVERTINIMAS LIETUVOS UPĖSE NATURA 2000 SAUGOMOSE TERITORIJOSE**

#### *Santrauka*

Straipsnyje apžvelgiama dviejų Lietuvoje aptinkamų nėgių rūšių – upinės nėgės *Lampetra fluviatilis* L. ir mažosios nėgės *Lampetra planeri* Bloch apsaugos būklė. Abi rūšys daugelyje Europos valstybių yra

laikomos pažeidžiamomis, esančiomis prie išnykimo ribos ar jau išnykusiomis. Migracijos kliūtys, buveinių degradacija ir populiacijų fragmentacija yra įvardijamos kaip pagrindinės priežastys, lemiančios nėgių dabartinę ekologinę būklę. Atsižvelgiant į esamą padėtį, visos Europos Sąjungos valstybės narės šių rūšių apsaugai privalo išskirti specialias saugomas teritorijas (SST). Šiame tyrime mes įvertinome upinių ir mažųjų nėgių paplitimą ir ekologinę būklę Lietuvos upėse, šių rūšių apsaugai skirtose teritorijose (BAST). Nėgių būklė nustatyta pagal Aplinkos ministerijos patvirtintą metodiką 16 teritorijų (41-oje tyrimų vietoje) pagal sėslių nėgių lervų (vingilių) gausumą ir pasiskirstymą. Tyrimų rezultatai palyginti su turimais istoriniais duomenimis, nustatyti veiksniai, turintys didžiausią įtaką nėgių ekologiškai būklei ir paplitimui. Pateiktos rekomendacijos dėl nėgių būklės gerinimo.

**Raktažodžiai:** upinė nėgė, mažoji nėgė, *Lampetra*, BAST, NATURA 2000

