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Joint management of Latvian – Lithuanian trans-boundary river and lake water bodies (TRANSWAT) LLI-533

HARMONIZED
LATVIAN – LITHUANIAN LAKES
PROGRAMME OF MEASURES

2022

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I. GENERAL PRINCIPLES

As it is stated in the Water Framework Directive 2000/60/EC (WFD), Member States should aim to achieve the objective of at least good water status by defining and implementing the necessary measures within integrated programmes of measures. Where good water status already exists, it should be maintained.

Each programme of measures shall include the basic measures and, where necessary, supplementary measures.

Basic measures are those measures, whose implementation is ensured by regulatory requirements for specific sectors and applies for all water bodies.

For water bodies which are failing to achieve good ecological quality through implementation of basic measures, supplementary measures are needed. Supplementary measures in river basin management plans are those measures which are defined for certain water bodies to improve the quality of the particular water bodies (supplementary measures at WB scale) or apply to all water bodies (national supplementary measures) but are not included in the legislation.

In Figure 1.1, the scheme according to which supplementary measures at waterbody scale are set is shown.

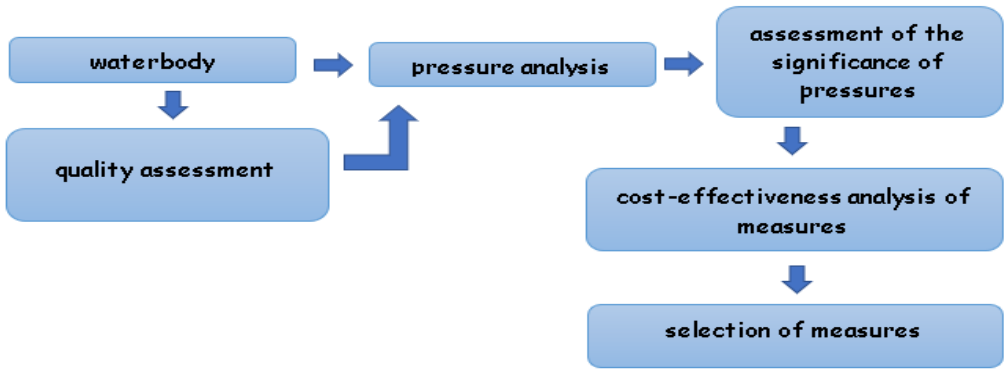

Figure 1.1. Scheme of defining measures

The present document summarizes information about the measures included in the programmes of measures of the Latvian and Lithuanian river basin management plans for 2022-2027 (Lielupe and Daugava River basin district management plans 2022-2027) as well as the measures that, based on the results of the project, are recommended to include in 4th cycle RBMPs.

II. CHARACTERISTICS OF THE TRANSBOUNDARY LAKES

One of the main steps in setting up measures is the quality assessment and analysis of pressures affecting water bodies.

In the course of the project, the quality of the lakes and the significant pressures affecting the lakes included in the project was assessed and coordinated between Latvia and Lithuania. More detailed information on the quality of the lakes is available in the “Report of the ecological status of transboundary lakes (2022)”.

During the development of Latvian river basin management plans 2022-2027, nitrogen (N) and phosphorus (P) loads were modelled using *FyrisNP* for the purposes of load assessment. Modelling with *FyrisNP* was repeated within the project based on the newest available data and the results of modelling are available in the report “Source apportionment of nutrient loads in transboundary lakes” (2022).

N and P loads significance, as well as significance of other pressures for Latvian River basin management plans 2022-2027 purposes were assessed according to methodologies of significance assessment of pressures (see Latvian River basin management plans Annex 4.A.a (LVĢMC 2022).

During the development of Lithuanian river basin management plans, N and P loads were modelled using SWAT for the purposes of load assessment. Of the transboundary lakes, N and P loads have only been assessed for Lake Laucesas/Laukesas, as the remaining transboundary lakes have not previously been identified as water bodies in Lithuania.

During the project, the importance of historical pollution/internal load for the quality of the lakes included in the project was brought up to date through the exchange of knowledge between the experts of the two countries.

2.1. Lake Ilzu(Garais)/Ilge

Quality status

Latvia

Although Lake Garais (Ilzu)/Ilge has been periodically monitored since 2006, in 2021 all biological samples were collected for the first time, including fish. Results confirm that phosphorus concentrations have been decreasing since year ~2014,

nitrogen concentrations and transparency have not significantly changed since previous monitoring. Total ecological quality is poor (Table 2.1.1.) which is confirmed by two biological quality elements (fish and macrophytes).

Table 2.1.1. Total ecological status assessment of Lake Ilzu (Garais)/Ilge, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Poor	Poor	Good	Poor	1.14	0.033	1.1	Moderate	Poor

Lithuania

According to Lithuanian system of classification of ecological status, the ecological quality of the lake is classified as moderate with high confidence (biological and physico-chemical elements indicate the same status class, Table 2.1.2.).

Table 2.1.2. Total ecological status assessment of Lake Garais (Ilzu)/Ilge, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Moderate	Moderate	Moderate	Moderate	1.14	0.033	1.1	Moderate	Moderate

Although the results obtained by the two countries are slightly different, they confirm that the lake is not in good ecological status and supplementary measures must be implemented to improve the quality of the transboundary lake.

N and P source apportionment

The modelling results show that the greatest share of nitrogen loads within the catchment originate from arable lands and forests – 54 % and 34 % respectively. Most important sources of phosphorus load are arable lands and forests as well, runoff from arable lands accounts for 56 % of P loads and runoff from forests for 33 % of the total load in the catchment.

There is a potential source of pollution (from the Ilzenbergas Manor in Lithuania), but there is no available data on pollution loads and outlets – as the sewage treatment plants are small and do not meet a certain threshold for the amount of water discharged, they are not requested to provide the data on the quality of wastewater.

The graphs below (Fig. 2.1.1. and Fig. 2.1.2.) show N and phosphorus P load distributions by sectors in Ilzu (Garais)/Ilge Lake catchment for the year 2021.

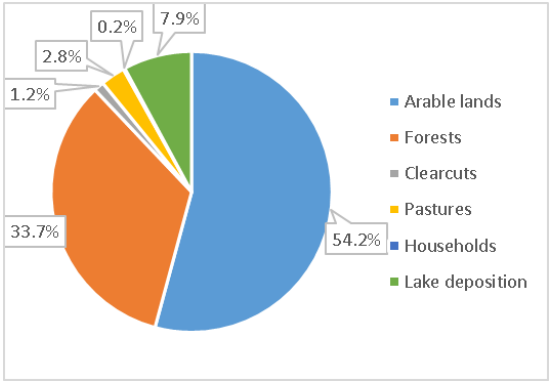

Figure 2.1.1. N source apportionment in Lake Ilzu (Garais)/Ilge catchment

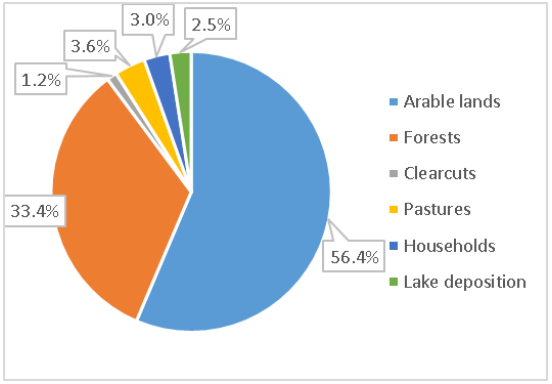

Figure 2.1.2. P source apportionment in Lake Ilzu (Garais)/Ilge catchment

The amounts (kg) of N and P loads from different sources in 2021 are shown in Table 2.1.3.

Table 2.1.3. N and P loads from different sources in Lake Ilzu (Garais)/Ilge catchment.

Nutrient	Arable lands	Forests	Clearcuts	Pastures	Households	Lake deposition
N, kg	3835,8	2386,7	83,6	198,7	14,1	558,0
P, kg	46,4	27,5	1	2,9	2,5	2

Other pressures/impacts

Lake Ilzu (Garais)/Ilge is a natural lake without significant water level alterations caused by unnatural factors. Hydromorphological pressure is insignificant in Latvian side and drainage (amelioration) systems occupy only about 0.5 % of the total lake catchment. No hydrological structures (e.g. dams, weirs) can be found on inflowing and outflowing rivers and ditches.

Based on observations, cattle are being grazed on the shore of the lake and livestock are being watered in the lake. This could be an additional source of direct nutrient pollution.

In Lithuania the lake shore is subject to quite intensive economic activity, but there are no known point sources of pollution (no wastewater treatment plants that exceed the volume of wastewater discharged, which triggers the obligation to register the treatment plants and to monitor the quality of the wastewater).

Significant pressures and objectives in the 3rd cycle RBMPs

Latvia

In Lielupe RBMP, significant pressure to Lake Ilzu (Garais)/Ilge is considered a transboundary impact. No objectives are set (see Latvian River basin management plans Annex 7.A.1.a (LVĢMC 2022).

Lithuania

The lake is identified as being at risk due to unknown anthropogenic pressure.

Assessment of the significance of loads and setting objectives according to the results of investigation made within the TRANSWAT project

Since there are no specific currently existing loads that can be evaluated using accurate data that would significantly affect the quality of the lake, attention should be paid to the importance of the historical pollution/internal load of the lake and the watering and grazing of livestock on the shore of the lake, and there is a need to implement supplementary measures to improve the quality of the lake.

2.2. Lake Lielais Kumpinišku/Kampiniskiai

Quality status

Latvia

Lake Lielais Kumpinišku/Kampiniskiai is a new water body that was delineated in year 2019 and first surface water monitoring was done in 2021 within the Transwat project (Table 2.2.1.). According to the 3rd cycle River basin management plans, ecological status of the lake was classified as moderate, but it was done using expert judgement, not real monitoring data. The mismatch is most likely due to

the fact that the lake basically consists of two parts and monitoring was carried out in only one of them (southern part).

Table 2.2.1. Total ecological status assessment of Lake Lielais Kumpinišku/Kampiniskiai, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Good	High	Good	Good	0.64	0.013	3.3	Good	Good

Lithuania

According to Lithuanian system of classification of ecological status, the ecological quality of the lake is classified as good with high confidence (biological and physico-chemical elements indicate the same status class, Table 2.2.2.). According to 3rd cycle River basin management plans, ecological status of the lake was classified as moderate, but classification was based on expert judgement. The lake was not previously delineated as a water body in Lithuania and monitoring has never been carried out.

Table 2.2.2. Total ecological status assessment of Lake Lielais Kumpinišku/Kampiniskiai, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Good	Good	High	Good	0.64	0.013	3.3	Good	Good

Ecological status assessment in both countries confirms that the lake is in good ecological status.

N and P source apportionment

The modelling results show that the greatest share of nitrogen loads within the catchment originate from arable lands and forests –60 % and 23 % respectively.

Most important sources of phosphorus load are households (47 %) and forests (26 %).

The graphs below (Fig. 2.2.1. and Fig. 2.2.2.) show N and P load distributions by sectors in Lake Lielais Kumpinisku/Kampiniskiai catchment for the year 2021.

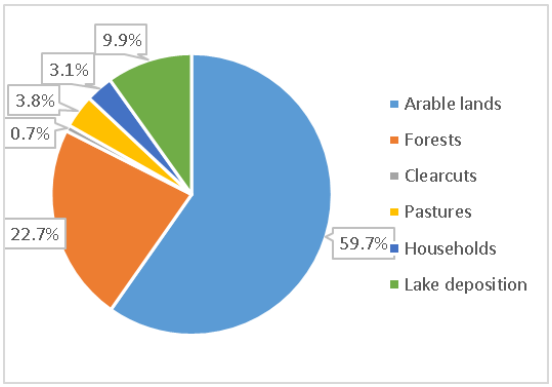

Figure 2.2.1. N source apportionment in Lake Lielais Kumpinisku/Kampiniskiai catchment

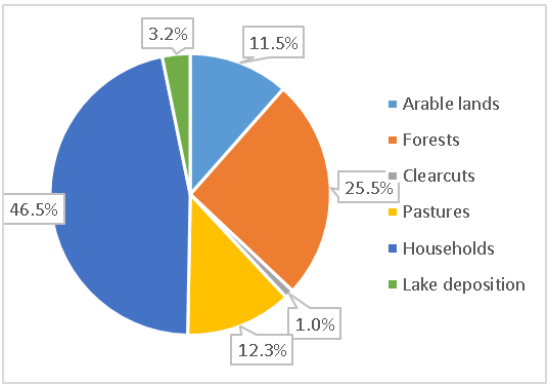

Figure 2.2.2. P source apportionment in Lake LielaisKumpinisku/Kampiniskiai catchment

The amounts (kg) of N and P loads from different sources in 2021 are shown in Table 2.2.3.

Table 2.2.3. N and P loads from different sources in Lake Lielais Kumpinisku/Kampiniskiai catchment.

Nutrient	Arable lands	Forests	Clearcuts	Pastures	Households	Lake deposition
N, kg	3248,1	1233,8	39,0	207,7	171,0	536,9
P, kg	7,4	16,4	0,7	7,9	29,9	2,1

Other pressures/impacts

Lake Lielais Kumpinišku/Kampiniskiai is a natural lake without water level and flow regulations. There are no drainage or hydrological structures (e.g. dams, weirs) within the lake catchment.

Significant pressures and objectives in the 3rd cycle RBMPs

Latvia

In Daugava RBMP, significant pressures to Lake Lielais Kumpinisku/Kumpiniskiai are considered pressures caused by agriculture and forestry.

By implementing planned measures to reduce nutrient load form arable lands and lands used for forestry (see Chapter IV), it is expected to decrease N and P loads:

- 16 kg N per year from arable lands (LV);
- 3 kg N per year from lands used for forestry (LV);
- 0,1 kg P per year from lands used for forestry (LV) (see Economical analysis of supplementary measures for waterbodies at risk Annex 7 and 9 (LVĢMC 2021)).

It is expected that good ecological status will be achieved by the year 2027 by implementing the proposed measures in the intended scope (no exemption applies under the WFD).

Lithuania

The lake is identified as being at risk due to unknown anthropogenic pressure.

Assessment of the significance of loads and setting objectives according to the results of investigation made within the TRANSWAT project

During the project, monitoring was carried out, which, contrary to the previous assessment based on expert judgement, showed that the lake has a good quality, so it cannot be considered that any of the loads significantly affect it. Therefore, it is not necessary to define supplementary measures as well as harmonisation of the programmes of measures is not needed.

2.3. Lake Galiņu/Salna

Quality status

Latvia

The results obtained in this project confirm that the lake is in good ecological status. Nutrients concentrations and transparency are similar to previous results, but biological quality (macroinvertebrates) have significantly improved within a two year period (from poor quality in 2019 to good in 2021). Also other monitored biological quality elements confirm that biological quality of the lake is at least good (Table 2.3.1.).

Table 2.3.1. Total ecological status assessment of Lake Galiņu/Salna, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Good	Moderate	High	Good	0.9	0.016	3.1	Good	Good

Lithuania

According to the Lithuanian ecological status classification system, the ecological quality of the lake is classified as good with medium confidence (at least two biological elements indicate the same ecological status that is one status class lower than that according to the physico-chemical elements, Table 2.3.2.).

Table 2.3.2. Total ecological status assessment of Lake Galiņu/Salna, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Good	Good	High	Good	0.9	0.016	3.1	High	Good

According to the results obtained by both countries, the lake is in good ecological status.

N and P source apportionment

The modelling results show that the greatest share of nitrogen loads within the catchment originate from forests and arable lands – 57 % and 33 % respectively. Most important sources of phosphorus load are forests and arable lands as well, runoff from forests accounts for 53 % of P loads and runoff from arable lands for 32 % of the total load in the catchment.

The graphs below (Fig. 2.3.1. and Fig. 2.3.2.) show N and P load distributions by sectors in Galiņu/Salna Lake catchment for 2021.

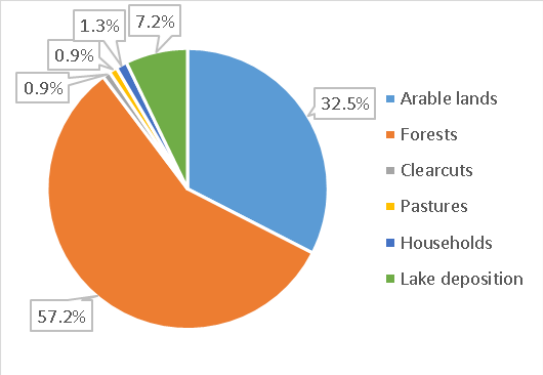

Figure 2.3.1. N source apportionment in Lake Galiņu/Salna catchment

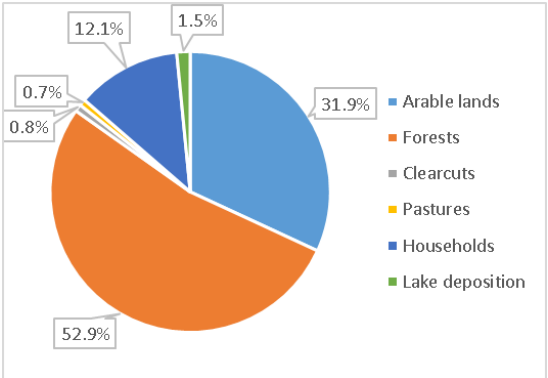

Figure 2.3.2. P source apportionment in Lake Galiņu/Salna catchment

The amounts (kg) of N and P loads from different sources in 2021 are shown in Table 2.3.3.

Table 2.3.3. N and P loads from different sources in Lake Galiņu/Salna catchment

Nutrient	Arable lands	Forests	Clearcuts	Pastures	Households	Lake deposition
N, kg	1427,2	2508,5	38,6	40,9	56,1	314,7
P, kg	25,9	43,0	0,7	0,6	9,8	1,3

Other pressures / impacts

Lake Galiņu/Salna is a natural lake without water level and flow regulations.

Significant pressures and objectives in the 3rd cycle RBMPs

Latvia

Considering that the lake is in good quality, there are no pressures considered significant.

Lithuania

According to the expert assessment, the ecological status of the lake is good so no pressures are considered as significant.

Assessment of the significance of loads and setting objectives according to the results of investigation made within the TRANSWAT project

The monitoring carried out during the project confirmed that the lake is of good quality, therefore there are no loads that can be considered significant, and it is

not necessary to propose supplementary measures as well as harmonisation of the programmes of measures is not needed.

2.4. Lake Skirnas

Quality status

Latvia

The monitoring results obtained in this project coincide with the monitoring results of previous years (based on monitoring results in 2018 quality was assessed as good) and confirm that Lake Skirnas is still in good ecological status. Nutrient concentrations continue to decrease. Monitoring of all biological elements shows that this lake possibly can be chosen as one of lake type L5 reference lakes (Table 2.4.1).

Table 2.4.1. Total ecological status assessment of Lake Skirnas, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	High	High	High	Good	0.55	0.011	5	Good	Good

Lithuania

According to the Lithuanian ecological status classification system, the ecological quality of the lake is classified as good with medium confidence (at least two biological elements indicate the same ecological status that is one status class lower than that according to the physico-chemical elements, Table 2.4.2.).

Table 2.4.2. Total ecological status assessment of Lake Skirnas, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Good	High	High	Good	0.55	0.011	5	High	Good

Ecological status assessment shows that Lake Skirnas is in good ecological status in both countries.

N and P source apportionment

Modelling results show that the greatest share of N loads within the catchment originates from lake deposition, forests, arable lands and pastures – 29 %, 24 %, 21,2 % and 20,8 % respectively. Most important sources of P load are households, forests and arable lands, pressure from households accounts for 40 % of P loads, runoff from forests for 20 % and runoff from arable lands for 19 % of the total load in the catchment.

The graphs below (Fig. 2.4.1. and Fig. 2.4.2.) show N and P load distribution by sectors in Lake Skirnas catchment for 2021.

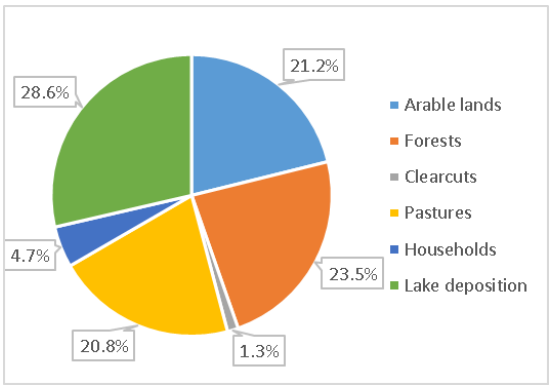

Figure 2.4.1. N source apportionment in Lake Skirnas catchment

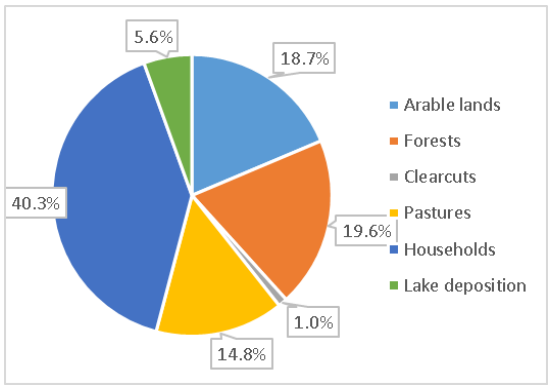

Figure 2.4.2. P source apportionment in Lake Skirnas catchment

The amounts (kg) of N and P loads from different sources in 2021 are shown in Table 2.4.3.

Table 4.4.3. N and P loads from different sources in Lake Skirnas catchment.

Nutrient	Arable lands	Forests	Clearcuts	Pastures	Households	Lake deposition
N, kg	461,6	512,3	27,3	453,5	103,4	624,4
P, kg	8,4	8,8	0,5	6,7	18,1	2,5

Other pressures/impacts

Lake Skirnas is a natural lake without water level and flow regulations.

Significant pressures and objectives in the 3rd cycle RBMPs

Latvia

Considering that the lake is in good quality, there are no loads considered significant.

Lithuania

According to the expert assessment, the ecological status of both lakes is good so no pressures are considered as significant.

Assessment of the significance of loads and setting objectives according to the results of investigation made within the TRANSWAT project

The monitoring carried out during the project confirmed that the lake is of good quality, therefore there are no loads that can be considered significant, and it is not necessary to propose supplementary measures as well as harmonisation of the programmes of measures is not needed.

2.5. Lake Laucesas/Laukesas

Quality status

Latvia

The results of this project confirm that the lake is still in moderate ecological status (Table 2.5.1.) and no changes have occurred in the 6 year period since last monitoring. Quality of the lake is not good because of moderate quality of macrophytes and water transparency.

Table 2.5.1. Total ecological status assessment of Lake Laucesas/Laukesas, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Moderate	Good	Good	Moderate	0.94	0.029	1.3	Moderate	Moderate

Lithuania

According to the Lithuanian ecological status classification system, the ecological quality of the lake is classified as poor with low confidence (according to one biological element the ecological status is more than one status class lower than that according to the physico-chemical elements, Table 2.5.2.).

Table 2.5.2. Total ecological status assessment of Lake Laucesas/Laukesas, 2021.

Macroinvertebrates	Macrophytes	Fish	Phytoplankton	Biology, total	Ntot, mg/L	Ptot, mg/L	Secchi, m	Physico-chemical, total	Total status
Good	Poor	Moderate	Moderate	Poor	0.94	0.029	2.10	Good	Poor

Ecological status assessment in both countries shows that Lake Laucesas/Laukesas is not in good status and supplementary measures must be implemented to improve the ecological quality of this lake.

N and P source apportionment

Modelling results show that the greatest share of N loads within the catchment originates from arable lands and forests – 46 % and 35 % respectively. Most important sources of P load are arable lands and forests as well, runoff from arable lands accounts for 46 % of P loads and runoff from forests for 33 % of the total load in the catchment.

The Lake Laucesas/Laukesas previously was polluted by poorly treated wastewaters coming from Zarasai WWTP, but after renovation of facilities in 2009-2010, the pollution load was significantly reduced and no longer considered a significant pressure.

The graphs below (Fig. 2.5.1 and Fig. 2.5.2) show N and P load distribution by sectors in Lake Laucesas/Laukesas catchment for 2021.

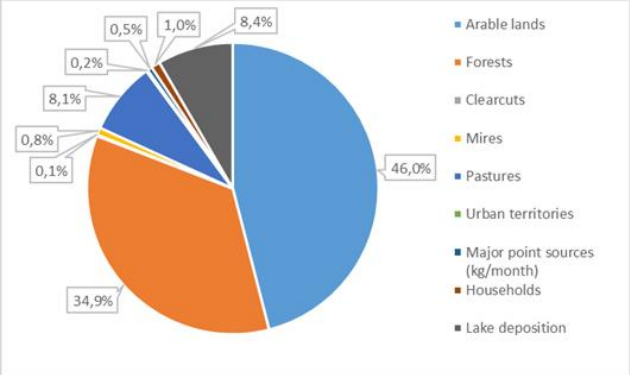

Figure 2.5.1. N source apportionment in lake Laucesas/Laukesas catchment

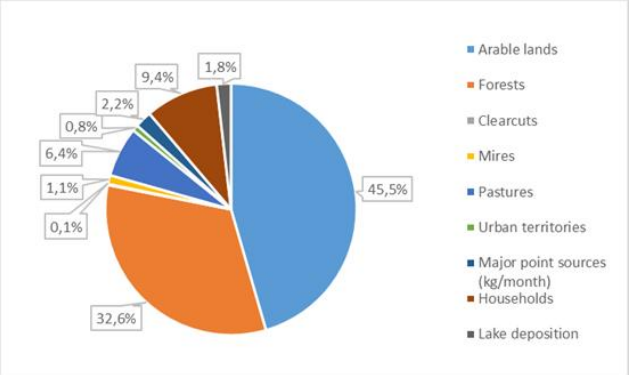

Figure 2.5.2. P source apportionment in Lake Laucesas/Laukesas catchment

The amounts (kg) of N and P loads from different sources in 2021 are shown in Table 2.5.3.

Table 4.5.3. N and P loads from different sources in Lake Laucesas/Laukesas catchment.

Nutrient	Arable lands	Forests	Clearcuts	Mires	Pastures	Urban territories	Households	Lake deposition	Other land use type	WWTP
N, kg	85288,0	64725,9	240,1	1509,9	14965,4	335,5	1830,8	15550,9	69,2	1009,1
P, kg	1548,7	1109,5	4,1	39,0	218,8	26,8	320,4	62,2	1	73,7

Other pressures/impacts

Lake Laucesas/Laukesas can be characterized as a natural lake without significant water level alterations. Drainage (amelioration systems) occupy about 1.5 % of the whole lake catchment. There are no hydropower plants, dams or other obstacles on inflowing and outflowing rivers and ditches.

Significant pressures and objectives in the 3rd cycle RBMPs

Latvia

In Daugava RBMP, significant pressures to Lake Laucesas/Laukesas are considered a pressure caused by agriculture and transboundary impact.

By implementing planned measures to reduce nutrient load from arable lands (see Chapter IV) it is expected to decrease N and P loads:

- 34 kg N per year from arable lands (LV);
- 1 kg P per year from arable lands (LV) (LVĢMC 2021).

It is expected that good ecological status will be achieved by the year 2027 by implementing the proposed measures in the intended scope (no exemption applies under the WFD).

Lithuania

The status of the lake Laucesas/Laukesas was assessed as good in the 3rd cycle of the Lithuanian River basin management plans, based on the results of monitoring, which was conducted in 2017 in Lithuanian part of the lake. However, fish and macrophytes were not monitored among biological elements.

Assessment of the significance of loads and setting objectives according to the results of investigation made within the TRANSWAT project

The most likely reason for the less than good ecological quality status of Lake Lauceses/Laukesas is the still lasting impact of the former pollution and there is a need to implement supplementary measures to improve the quality of the lake. However, current monitoring data of both Latvia and Lithuania show a trend in reduction of nutrient concentrations and an increase in water transparency.

2.6. Summary

Monitoring results and pressure assessment show that for only two of the five transboundary lakes surveyed in the frame of the TRANSWAT project there is a need to harmonize supplementary measures between Latvia and Lithuania – Lake Laucesas/Laukesas and Lake Garais (Ilzu)/Ilge.

In Table 2.6.1. pressures considered significantly impacting ecological quality of lakes according to Latvian and Lithuanian RBMPs 2022-2027 are shown, as well as pressures assessed as significant based on project results and exchanged knowledge between project experts.

Table 2.6.1. Pressures considered significantly impacting ecological quality of lakes

WB name	Latvian RBMPs 2022-2027				Lithuanian RBMPs 2022-2027		Based on TRANSWAT project results	
	Ecological quality	**Agriculture**	**Forestry**	**Other pressures/impacts**	**Ecological quality**	**Unknown atrophogenic pressure**	**Ecological quality**	**Significant pressures**
Lake Laucesas/Laukesas	3	x		x (transboundary)	2		3 (LV) 4 (LT)	historical pollution/internal load
Lake Garais (Ilzu)/Ilge	3			x (transboundary)	3	x	3 (LT) 4 (LV)	historical pollution/internal load; agriculture (potentially) – watering and grazing of livestock on LV side
Lake Lielais Kumpinišku/Kampiniskiai	3	x	x	x (transboundary)	3	x	2 (LV, LT)	no significant pressures
Lake GaliŅu/Salna	2				2		2 (LV, LT)	no significant pressures
Lake Skirnas	2				2		2 (LV, LT)	no significant pressures

III. Basic measures in the 3rd cycle RBMPs

In both countries the implementation of basic measures (Measures necessary for the implementation of European Community legislation on water protection, as well as measures required by Article 10 of the WFD and the legislation referred to in Annex VI, Part A) is ensured by regulatory requirements for specific sectors and they are applied on a national scale.

The implementation of basic measures is ensured by regulatory requirements for specific sectors and they apply for all water bodies equally (applied on a national scale). In the Latvian river basin district management plans, they are divided into action directions (see Latvian river basin management plans Annex 8.A.a (LVĢMC 2022) and in Lithuanian river basin management plans the same action directions are covered:

- ensure the quality of bathing waters, increasing the quality of life of the population and ensuring the sustainable use of natural resources;
- ensure the supply of high-quality drinking water, increasing the quality of life of the population and ensuring the sustainable use of natural resources;
- ensure the use of sewage sludge in accordance with the requirements of regulatory acts;
- ensure wastewater treatment, reducing the pollution load entering the waters;
- ensure environmental impact assessment is carried out in accordance with the requirements of regulatory acts;
- ensure the reduction or prevention of nitrate pollution caused by agricultural activity;
- ensure the protection of surface and underground waters against pollution/damage caused by plant protection products;
- ensure the preservation of biological diversity by protecting and managing natural habitats, wild flora and fauna;
- ensure the protection, knowledge and supervision of wild birds;
- ensure the protection of sea waters;
- ensure the prevention and control of the risk of pollution and major accidents related to dangerous substances;

- ensure water protection, increasing the quality of life of the population and ensuring sustainable use of natural resources;
- maintain the transboundary transfer of persistent organic pollutants and heavy metals in the atmosphere at the level of year 1990;
- reduce the use of priority and dangerous substances in production;
- take actions to mitigate the impact of climate change, including limiting the spread of alien invasive species, pests and pathogenic organisms.

Although basic measures cover the entire territories of countries there are measures that do not apply to the project lakes, for example, the basic measures that apply to swimming areas, because there are no official swimming areas in any of them, etc. In addition, these activities are performed continuously, thus there are no measurable categories as “implemented” or “not implemented” available.

IV. Supplementary measures in the 3rd cycle RBMPs

According to the assessment of ecological status and of the significance of pressures, which was carried out during the preparation of the 3rd cycle RBMPs, supplementary measures for the lakes included in the project are already foreseen in the programmes of measures that are part of the plans.

Supplementary measures are foreseen for those lakes that based on monitoring results and expert judgement are considered at lower than good ecological quality – Lake Laucesas/Laukesas, Lake Garais (Ilzu)/Ilge, Lake Lielais Kumpinišķu/Kampiniskiai. Supplementary measures are not foreseen in the 3rd cycle RBMPs for Lake Skirnas and Lake Galiņu/Salna because these lakes are considered to be in good status already.

Supplementary measures proposed in Latvian and Lithuanian RBMPs 2022-2027 for Lake Laucesas/Laukesas are shown in Table 4.1.

Table 4.1. Supplementary measures for Lake Laucesas/Laukesas

Lake Laucesas/Laukesas	
LV	LT
● establishment of perennial plantations ● introduction of conservative (minimum) tillage ● reduced use of nitrogen fertilizer (by 20% of the norm) ● creation of sedimentation ponds (pools)	No measures for the improvement of the lake status are planned in Lithuania's 3rd cycle RBMPs*. *The quality of the lake during the development of Lithuanian RBMPs was assessed as good, and no pressures were considered as significant (see Table 2.6.1. on p. 19)

Supplementary measures proposed in Latvian and Lithuanian RBMPs 2022-2027 for Lake Garais (Ilzu)/Ilge are shown in Table 4.2.

Table 4.2. Supplementary measures for Lake Garais (Ilzu)/Ilge

Lake Garais (Ilzu)/Ilge	
LV	LT
● Development of a coordinated management and ecological quality improvement measures programme for transboundary lakes	● Inventory outfalls to the water body and its tributaries, as well as in the vicinity of the water body, looking for unauthorised or illegally connected sewage discharges and the discharges from

	WWTPs which are not obliged to be registered in the databases of the Environmental Protection Agency, and to ensure that sewage is no longer discharged into the lake. ● Implement municipal monitoring of tributaries and outlets of the water body to determine the amount and balance of nutrients entering the lake. ● Investigative monitoring is planned, which allows to detect signs of internal pollution as well

Supplementary measures proposed in Latvian and Lithuanian RBMPs 2022-2027 for Lake Lielais Kumpinišķu/Kampiniskiai are shown in Table 4.3.

Table 4.3. Supplementary measures for Lake Lielais Kumpinišķu/Kampiniskiai

Lake Lielais Kumpinišķu/Kampiniskiai	
LV	LT
● Installation of forest coastal protective strips (buffer strips) 15 m wide. ● Establishment of perennial plantations. ● Introduction of conservative (minimum) tillage. ● Reduced use of nitrogen fertilizer (by 20% of the norm). ● Creation of sedimentation ponds (pools).	● Inventory outfalls to the water body and its tributaries, as well as in the vicinity of the water body, looking for unauthorised or illegally connected sewage discharges and the discharges from WWTPs which are not obliged to be registered in the databases of the Environmental Protection Agency, and to ensure that sewage is no longer discharged into the lake. ● Conduct extended monitoring to determine the nature and causes of problems in the water body.

Note: Although the latest quality assessment indicates that no supplementary measures are needed to improve the quality of Lake Lielais Kumpinišķu/Kampiniskiai, the implementation of the supplementary measures currently included in the programme of measures of the 3rd cycle RBMP could contribute to the improvement of the quality of hydrologically related water bodies, and could also ensure that the quality of the lake does not deteriorate.

V. Harmonized programme of measures for the LV-LT lakes

5.1. Possible measures to deal with historical pollution/internal load on lakes failing good ecological status

As it is mentioned in previous chapters, the pressure significantly impacting the quality of Lake Laucesas/Laukesas and Lake Ilzu (Garais)/Ilge is historical pollution/internal load. There are several ways to deal with the accumulated nutrient pollution load which have been analysed before, for example during the WBWB project (including the economic analysis of different types of measures). The results of this economic analysis (WBWB 2020) of the measures for lakes with accumulated nutrient pollution in sediments were taken into account in the development of programmes of measures for Latvian RBMPs 2022-2027, however, measures to prevent the historical pollution/internal load are not planned for the Lake Laucesas/Laukesas and Lake Ilzu (Garais)/Ilge, because during the development of the plans it was not fixed that the significant load in these lakes is historical pollution. For this reason, in the course of the project, by exchanging knowledge between Lithuanian and Latvian experts, it was evaluated what measures should be included in the River basin management plans of the next cycle (2028-2033).

In the Table 5.1.1. measures that can be implemented to deal with accumulated pollution in sediments are shown.

Table 5.1.1. Possible measures to deal with accumulated pollution in sediments

Sediment dredging – removal of sediments from lake bed.	This measure includes mechanical removal of sediments from the lake bed. Near the coast it is possible to remove the sediments using dredger (excavator), but for most of the lake area cutter and suction dredger would need to be used – appliances designed to dislodge sediments by cutting them, remove by suction through pipes and dispose in collection containers. A ship/boat could be needed to carry out the work. Correct disposal of removed sediments needs to be arranged.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • high implementation costs – public financing is required (large area of sediments to be removed); • may cause temporary negative effects; • coordination with the owner or manager of the lake is needed; • it is necessary to predict how to use or dispose the collected sludge.

Biomanipulation* – the deliberate transformation of an ecosystem by adding or removing species. **Information about Latvia's experience in implementing biomanipulation/fish restocking can be found in the Annex 1.*	This measure aims to decrease amount of cyprinid fish species, e.g. roach (rauda – latv., kuoja - liet., *Rutilus rutilus*), bream (plaudis – latv., karšis- lietuv., *Abramis brama*) etc., and increase species of predatory fish (pike (līdaka – latv., lydeka – liet. *Esox Lucius*), pike-perch (zandarts – latv.,starkis-liet., *Stizostedion lucioperca,* etc.) or European wels (catfish) (sams - lat., šamas - liet. *Silurus glanis*). Cyprinid fish that eat zoobenthos loosen up sediments in the process, causing phosphorus to leach from sediments into the water column. Also population of large zooplankton (e.g. Daphnia) can be enhanced by eliminating planktivorous fish (fish that feed on planktonic food, including zooplankton or phytoplankton) through physical removal (fishing) or increased piscivory (introduction of fish eating species). Increase in zooplankton subsequently leads to decrease in phytoplankton due to increased grazing. Measure can include both increased targeted fishing of cyprinid fish (through the increase of cyprinid fish landing) and increase of piscivory fish populations (through the restocking of pike, pike -perch and catfish). In order to increase predatory fish populations, restrictions on predatory species fishing can be set, also - predatory fish populations can be increased artificially.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • harmonization of angling rules/practices of both countries is needed to ensure the efficiency of the measure; • coordination with the owner or manager of the lake is needed.

Removal of macrophytes – harvesting and removing macrophytes from the lake, especially common reed (Phragmites australis) with the aim to remove nutrients with the plant biomass.	Measure includes cutting and removing macrophytes from the lake. It can be done by using aquatic mowers and collection containers attached to boats, or by using specially designed aquatic weed harvesters. Macrophytes use available nutrients to grow, therefore cutting them and removing them from the lake removes secondary usable nutrients (nutrients remaining in the lake from decomposing plant matter).
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • the effectiveness of the measure is considered low; • it is expected that the measure would need to be repeated regularly; • may cause temporary negative effects; • coordination with the owner or manager of the lake is needed.

Immobilization of P using chemical treatments – application of various aluminium and calcium based chemical compounds to immobilise sediment P by turning P in the upper layer of sediments into insoluble, non-bioavailable forms.	Technical measure that includes addition of certain chemical compounds to the lake water, to facilitate sorption of phosphorus, leading to reduction of biologically available phosphorus. Aims to create non-soluble phosphorus compounds on the ground of lake bed. Various chemicals possess the capacity to reduce bioavailability of phosphorus, such as iron, aluminium, calcium and specially developed composite materials, such as *Phoslock*. Measure also includes scientific case-studies, careful evaluation and ongoing monitoring to avoid adverse effects. Addition of aluminium as alum - concentrated liquid alum is added to lake water from boats. Addition of calcium - calcite or lime dispersed over the lake in powdered form, can be dispersed from air (from a plane or helicopter). Addition of *Phoslock* - *PhoslockTM* is a brand of phosphorus binding chemicals, made of lanthanum modified bentonite clay powder. Dispersed in water from boats.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • high implementation costs – public financing is required; • may cause temporary negative effects; • coordination with the owner or manager of the lake is needed; • legal obstacles, environmental impact assessment needed; • no experience in Latvia and Lithuania of implementing this kind of measure.

Hypolimnetic withdrawal – suctioning and removing nutrient rich hypolimnetic water from the lake.	Lakes tend to stratify or form layers based on temperature, density and other characteristics. The lowest layer that comes into contact with the sediment, or the hypolimnion, often contains higher phosphorus concentrations when the lake is stratified. This remediation technique involves selectively removing the nutrient-enriched layers of water from the lake through syphoning, pumping or selective discharge. Hypolimnetic withdrawal shortens nutrient retention time, decreases the chance for anaerobic conditions to develop, accelerates phosphorus export, reduces surface phosphorus concentration, and improves hypolimnetic oxygen content.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • high implementation costs – public financing is required; • coordination with the owner or manager of the lake is needed.

Artificial aeration and mixing – oxygenation of the lake by either injecting oxygen/air into the hypolimnion, or mixing lake water column to bring hypoxic bottom waters to the surface.	Artificial aeration is a technical measure to increase oxygen concentration in hypolimnion, to prevent deep water anoxia and the consequent accelerated internal loading of phosphorus during stratification. Artificial aeration could also lead to improvements in redox potential and immobilisation of phosphorus by sorption on iron, as well as enhance the distribution of fish and invertebrates. Carried out as either injection of oxygen or atmospheric air into the hypolimnion or with use of full-lift aerators, bringing oxygenated water from surface to hypolimnion. Measure would require monitoring of oxygen consumption and possibly gradual increase in aeration.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • high implementation costs – public financing is required; • the measure is suitable only if the lake is stratified; • coordination with the owner or manager of the lake is needed.

Floating treatment wetlands – artificial wetland islands with nutrient demanding plant species planted on them. Nutrients are removed from the lake during plant growth, plants are harvested after.	Wetlands rely on natural processes to biologically filter water as it passes through areas of dense aquatic vegetation and permeable bottom soils. Floating treatment wetlands are composed of an artificial platform that serves as a growing base for macrophytes. The primary mechanisms for nutrient removal are microbial transformation and uptake, macrophyte nutrient assimilation, absorption into organic and inorganic substrate materials and volatilization. Additional effect can be achieved if macrophytes are removed (cut) once or twice per vegetation season.
	Problems: • a feasibility study is required to predict the scope of work and the effect to be achieved; • the effectiveness of the measure is considered low; • it is expected that the measure would need to be repeated regularly; • coordination with the owner or manager of the lake is needed.

When evaluating the measures to be recommended for inclusion in the River basin management plans 2028-2033, facts related to the respective lakes were taken into account.

Lake Laucesas/Laukesas

- The lake previously has suffered from poorly treated wastewaters, coming from Zarasai (Lithuania) WWTP via Laukesa River. The reconstruction of the Zarasai wastewater treatment plant was carried out in 2009.
- The reason of the less than good status of Lake Lauceses/Laukesas is still lasting impact of the former wastewater pollution. Only internal pollution and time lag are recognized as the main reasons of not achieving good ecological status.
- Current monitoring data of both Latvia and Lithuania show a trend in reduction of nutrient concentration and an increase in water transparency.
- Lithuanian part of the lake is leased to a local association of anglers, and this causes additional problems (termination of lease contract or implementation of additional regulations for anglers association may be needed).

Lake Ilzu (Garais)/Ilge

- Investigative monitoring is planned, which allows to detect signs of internal pollution.
- Lithuanian part of the lake is leased to a local association of anglers, and this causes additional problems (termination of lease contract or implementation of additional regulations for anglers association may be needed).

Considering all the aspects mentioned in Table 5.1.1. and the individual conditions of the respective lakes it is evaluated that the only realistic measure to deal with historical pollution/internal load in these lakes is **biomanipulation**. Permanent releases of artificially bred predatory fish to increase their abundance in the lake can be applied by both countries; however, additional fishing regulations, harmonised between countries, must be applied in parallel, otherwise the effect of biomanipulation will be negligible. Detailed limnological studies are

needed with focus on in-lake distribution of nutrient pollution in sediments, sediment nutrient release and analysis of internal nutrient load. These lake studies would help to determine the most appropriate combination of measures for lake restoration. Since a positive trend in the change of problematic indicators is already being observed, no changes are planned in the programme of measures of the 3rd cycle. The final step to decide on the measures to be implemented to achieve good quality in the lakes should be taken after summarizing the progress of the implementation of the measures of the programme of measures of 3rd cycle.

The programmes of measures of Lake Laucesas/Laukesas and Lake Ilzu (Garais)/Ilge are shown in Tables 5.1.2. and 5.1.3.

Table 5.1.2. The programme of measures for Lake Laucesas/Laukesas

Year	2022-2027	2026-2027	2026-2027	2028-2033
Latvia	●Establishment of perennial plantations. ●Introduction of conservative (minimum) tillage. ●Reduced use of nitrogen fertilizer (by 20% of the norm). ●Creation of sedimentation ponds (pools).	The quality assessment and pressure analysis based on newest data and facts by exchanging knowledge with Lithuanian experts.	●Depending on the latest quality assessment and the results of pressure analysis results – development of joint project proposal (envisaging both tasks related to feasibility studies and practical implementation of biomanipulation) / development of joint biomanipulation programme in the future.	Implementation of biomanipulation in lake.
Lithuania		The quality assessment and pressure analysis based on newest data and facts by exchanging knowledge with Latvian experts.		

Table 5.1.3. The programme of measures for Lake Ilzu (Garais)/Ilge

Year	2022-2027	2026-2027	2026-2027	2028-2033
Latvia	●Development of a coordinated management and ecological quality improvement programme of measures for transboundary lakes	The quality assessment and pressure analysis based on newest data and facts by exchanging knowledge with Lithuanian experts	●Depending on the latest quality assessment and the results of pressure analysis results – development of joint project proposal (envisaging both tasks related to feasibility studies and practical implementation of biomanipulation) / development of joint biomanipulation programme in the future.	Implementation of biomanipulation in lake.
Lithuania	●Inventory outfalls to the water body and its tributaries, as well as in the vicinity of the water body, looking for unauthorised or illegally connected sewage discharges and the discharges from WWTPs which are not obliged to be registered in the databases of the Environmental Protection Agency, and to ensure that sewage is no longer discharged into the lake ●Implement municipal monitoring of tributaries and outlets of the water body to determine the amount and balance of nutrients entering the lake ●Investigative monitoring is planned, which allows to detect signs of internal pollution as well	The quality assessment and pressure analysis based on newest data and facts by exchanging knowledge with Latvian experts		

5.2. Possible sources of financing measures

In Latvia and Lithuania, a large part of the measures is implemented using the co-financing of European Union funds. In addition, it is possible to use state programs as well as private funding. The largest amount of funding is available in various European Union fund programs. Below are the possible sources of funding that could be taken into account when developing a project application for the introduction of biomanipulation in lakes in the future.

Possible sources of financing are:

- State funds:
- Latvian Environmental Protection Fund;
- Latvian Environmental Investment Fund;
- State Fish Fund (LV);
- Environmental Support Programme fund (LT);
- EU funds:
- Interreg Latvia - Lithuania programme;
- Interreg Central Baltic programme;
- Interreg Baltic Sea Region programme;
- Interreg Europe programme.

Since the planning cycle of all the mentioned EU programmes will end only in 2027, it is not yet predictable what the available financial amount will be on the next cycle, neither in the programmes in total, nor in the distribution by programmes' priorities.

Annexes

Annex 1. Fish restocking in Latvia

In order to ensure biologically diverse, preserved and long-term fishery-useable fish resources in Latvia, a programme for the artificial reproduction of fish resources 2021-2024 has been developed.

The following main problems to be solved are identified in the plan:

a) continuation of measures for the restocking of fish resources and reduction of anthropogenic impact, including, within the limits of possibilities, improving the natural habitats of fish, restoring spawning grounds, breaking down obstacles that hinder fish migration, or creating new migration routes to ensure the maintenance of fish resources in a biologically diverse and fishery-usable state;

b) monitoring of eel stocks in rivers and lakes where glass eels were introduced in previous policy planning periods, as well as development of recommendations for the future replenishment of eel stocks;

c) scientific monitoring and evaluation of the restocking of fish resources in order to provide the necessary scientific recommendations for the restocking of fish resources, their habitats and spawning grounds or restoring migration opportunities, as well as to evaluate the effectiveness of the measures implemented and provide recommendations for their improvement.

In order to promote the solution of the aforementioned problems, actions are planned in the following six directions:

1st direction of action - restocking of migrating fish resources in the public water bodies of the Gauja and Venta basins;

2nd direction of action - restocking of fish resources to compensate for losses caused by the HPP cascade in Daugava;

3rd direction of action – restocking of fish resources in publicly accessible water bodies;

4th direction of action - eel stock monitoring measures, evaluation of further replenishment and development of recommendations;

5th direction of action - restoration of natural habitats and migration opportunities of fish in rivers;

6th direction of action - scientific assessment of restocking of fish resources.

The plan is implemented using the funds from the annual state budget sub-programs "Regulation of fish use, reproduction and research" and "Fish fund", as

well as LATVENERGO's annual compensation payments for the damages caused to fish resources.

Regulation of the Cabinet of Ministers of December 19, 1995 No. 388 "Regulations of the Fish Fund" provides for the creation and use of the fund's state budget grant in order to obtain additional financial resources and implement relevant projects for the development of fisheries. For the purpose of restocking and multiplying of fish resources in publicly accessible water bodies, the fund is mainly used for financing various fish restocking and protection projects of local importance, as well as for the execution of certain scientific research works proposed by state institutions, municipalities or other derived public entities.

Following BIOR's recommendations, in the 3rd direction of action for ensuring the sustainability of fish resources, it is expected that municipalities and (or) managers of water bodies with relevant project applications to the Fish Fund (in accordance with MK Regulation No. 215 of March 2, 2010 "Regulations on granting state support for fisheries development from the Fish Fund's financial resources" requirements) replenishes fish stocks in a competitive manner by releasing juveniles, smolts and larvae of fish species used for fisheries into publicly accessible water bodies, where reproduction measures of the relevant fish species are not implemented in connection with direction lines 1 and 2 of the plan.

The following requirements and conditions are observed in the performance of works:

1. in this direction of action, such fish species as ide, pike, pike-perch, bream, vimba, brook trout, and sea trout are recommended for supplementing fish stocks. Catfish restocking is not supported.

2. fish resources are replenished annually in at least 50 publicly accessible water bodies;

3. in accordance with the projects supported by local governments and (or) water bodies managers in the Fish Fund tender procedure, specific release places, fish species, their age and development stage, as well as the volume of release are planned for supplementing fish resources. In this course of action, fish breeding is mainly provided by acknowledged private and state fish farms, if they have access to such juveniles that cannot be offered by private fish farms or the cost of offered fish juveniles is too expensive to be financed from the state budget.

4. if there is freshwater fish breeder fishing, during the implementation of the breeder fishing program, mandatory release of larvae, juveniles or smolts into the rivers and lakes from which the breeders were obtained is foreseen;
5. In the production of pike resources, the regional principle should be observed and restocking should be ensured in water bodies where pike resources are intensively used. The fish are sorted before release and pike of similar size are released at one time, sorted into groups of 1-10 g, 11-20 g and 21-30 g;
6. the amount of pike-perch release can be increased in those water bodies which, according to BIOR's opinion, are suitable for their release and where the pike-perch resource is intensively used.
Normative regulations do not require the water manager to perform any biomanipulation on fish.

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