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HARMONIZED
LATVIAN – LITHUANIAN LAKES
MONITORING PROGRAMME

2022

Contents

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1. General principles for the monitoring of ecological status of surface waters

The Water Framework Directive (2000/60/EC) requires EU Member States to establish monitoring programmes for the assessment of status of water bodies. This also includes monitoring of Protected areas - as far as the quality of waters is concerned. Results of monitoring play a key role in determining what measures are needed to reach good status of water bodies. This means that reliable monitoring results are of key importance for sound planning of investments in the Programmes of measures.

Monitoring planning principles are specified in the Article 8 and Annex V of the WFD. These principles are binding for both Latvia and Lithuania as EU Member States, but real practices in monitoring planning and carrying out on the national level may differ. In case of transboundary water bodies, a requirement posed by the WFD is *harmonisation of monitoring* which is an important prerequisite for the subsequent *harmonised status assessment*.

Quality elements (QEs) and parameters to be monitored in different water categories are listed in the WFD and shown in a graphic format in the Guidance Document No.7 "Monitoring under the Water Framework Directive" (see Fig. 1). Monitored parameters should enable the detection of all significant pressures on water bodies.

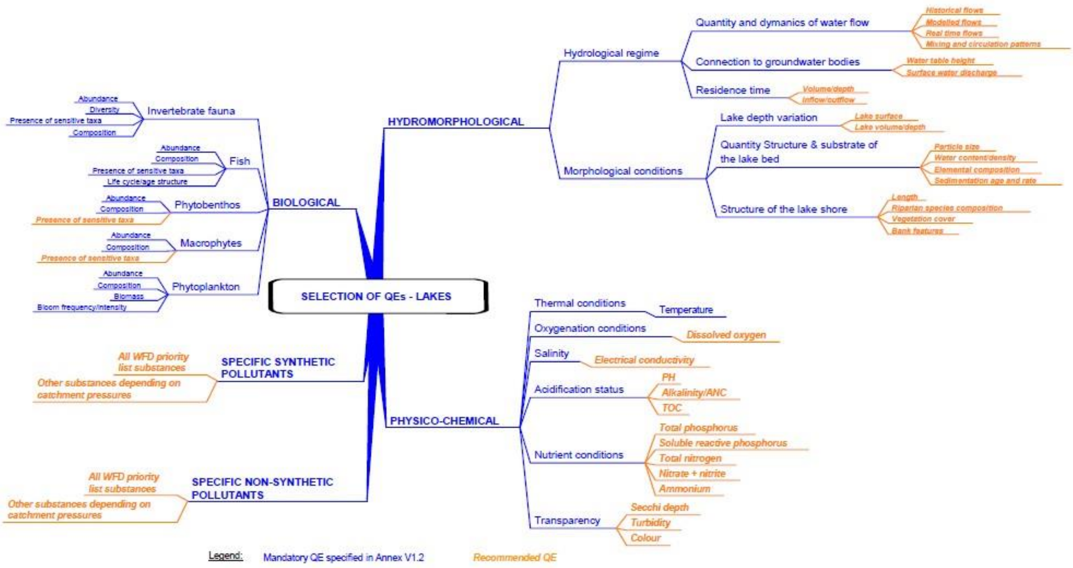

Figure 1. Selection of Quality Elements for Lakes. Cited from: WFD Guidance Document No.7 "Monitoring under the Water Framework Directive"

According to the requirements of the WFD, there are **three types** of monitoring of water bodies, namely: surveillance, operational, and investigative monitoring.

Surveillance monitoring is carried out to provide information for: 1) supplementing and validating the impact assessment procedure; 2) effective design of future monitoring programmes; 3) assessment of long term changes in natural conditions; 4) assessment of long term changes resulting from widespread anthropogenic activity.

Surveillance monitoring has to be undertaken for at least a period of one year during the 6-yrs RBMP planning period. It should include a sufficient number of water bodies to provide an assessment of the overall surface water status within each catchment and sub-catchment of the river basin district. For this type of monitoring, Member States must monitor at least for a period of a year parameters indicative of all biological, hydromorphological and general physico-chemical quality elements. The results of surveillance monitoring should ensure that the potential impacts of all pressures on WBs are detected.

The objectives of **operational monitoring** are to: 1) assess the status of WBs identified as being at risk of failing to meet their environmental objectives; and 2) assess any changes in the status of such WBs resulting from the programmes of measures.

Operational monitoring is used to assess or confirm the status of WBs thought to be at risk. It is focused on parameters indicative of the QEs most sensitive to the pressures to which the water body or bodies are subject. Monitoring in *all* relevant WBs is not necessarily required as the WFD allows similar water bodies to be grouped and representatively monitored.

Investigative monitoring may be necessary in certain cases: 1) where the reason for any exceedances of environmental objectives is unknown; 2) where surveillance monitoring indicates that the objectives for a WB are not likely to be achieved and operational monitoring has not yet been established; and 3) to assess the magnitude and impacts of accidental pollution.

Monitoring results are then used to establish a programme of measures for the achievement of the environmental objectives and to select specific measures necessary to remedy the effects of accidental pollution.

Investigative monitoring is usually designed for the specific case or problem. Therefore, it can be more intensive in terms of monitoring frequencies and focused on particular water bodies or parts of WBs, and on relevant QEs.

Intensity of monitoring in a given water body is usually characterised by monitoring frequency and periodicity. **Frequency** is the number of sampling events in a year when monitoring is undertaken - for example, “12” usually means 12 sampling events, i.e. every month; while **periodicity** indicates how many times (years) in a 6-year cycle monitoring is carried out.

Some QEs (e.g. river flow) or parameters (e.g. groundwater level) can be measured continuously.

A general requirement for the design of **monitoring network** is that the monitoring points have to be located so as to enable collection of information representative of a water body.

Sampling time has to be chosen with respect to natural temporal variability in measured quality elements. In the case of harmonised monitoring of the transboundary WBs, sampling time has to be coordinated between the states, to ensure that 1) monitoring data are usable for both the states, e.g. water organisms are sampled in appropriate time of the year, and 2) there are no inconsistencies in status assessment resulting from the effect of temporal variability. For instance, phytoplankton sampling in July and August may show quite different results depending on whether algal bloom is present or not.

Another important aspect to be taken into account is **sampling techniques**, as well as **taxa identification level** (in the case of biological QEs).

Monitoring of ecological status of water bodies shares a number of physico-chemical parameters with the monitoring of certain types of **protected areas**, namely priority fish waters (salmonid / cyprinid), and nitrate vulnerable zones. Project lakes are mostly located outside of protected areas of these types, except for the Lake Laucesas / Laukesas which is a priority fish lake (salmonid) in Latvia. Therefore, several additional chemical parameters have to be monitored in this lake.

2. Monitoring programme (year 2021 - 2026) and monitoring principles in Latvia

2.1. General information about monitoring in Latvia

All five transboundary lakes described in the present Report are designated as lake water bodies in Latvia and are included in the actual Surface water Monitoring programme 2021-2026.

Currently, surface water monitoring is implemented in accordance with the Environmental Monitoring Programme 2021 - 2026, Surface water monitoring sub-programme. According to the Programme, there are three types of monitoring:

- surveillance;
- operational;
- investigative.

Surveillance (S) monitoring stations are designed to:

- include the number of surface water bodies so that the resulting data characterise the status of surface water in each RBD;
- provide information on the amount of transboundary pollution;
- monitoring stations for information exchange of surface fresh water quality in the EU.

Operational (O) monitoring stations are selected to obtain information for assessing:

- the status of their surface water bodies, in which monitoring risks or anthropogenic loads have identified a risk of not being reached the environmental quality objectives;
- changes in the status of the surface water body at risk following the implementation of the programme of measures.

Sensitive quality elements should be selected based on a type of pressure. Operational monitoring programme may be adjusted on the basis of results of annual monitoring, as well as river basin district management plans. During this monitoring cycle every water body is monitored once for a six year period to assess ecological quality.

Investigative (I) monitoring stations according to programme is planned to assess:

- the reasons for exceeding the environmental quality standards;
- the causes that prevent the achievement of the environmental quality objectives, if it has been established in the course of surveillance monitoring and operational monitoring has not yet been started;
- the impact of accidental pollution on surface water and to obtain relevant data to enable the development of recommendations for emergency response measures.

Two of the Transwat project lakes have surveillance monitoring stations (Lake Lielais Kumpinišku/Kampiniskiai and Lake Skirnas) and three lakes have hybrid combination of surveillance and operational monitoring stations (Lakes Ilzu (Garais)/Ilge, Laucesas/Laukesas and Galiņu/Salna). In this monitoring cycle, there are no investigative monitoring stations in project lakes.

2.2. Monitored quality elements in Latvia

Quality elements for the ecological status assessment are: biological, physico-chemical (including river basin specific pollutants zinc and copper), and hydromorphological.

Biology. Only biological quality elements requested by WFD are included in monitoring (Table 1). Zooplankton is not monitored within the national monitoring programme. If resources (including funding) are very limited, only the most sensitive quality elements to the dominant pressure source are monitored. Phytoplankton is never excluded from lake monitoring and macroinvertebrates are never excluded from river monitoring programme. Physico-chemical quality indicators are monitored in all seasons, including winter. Only winter months with unstable ice cover are avoided. Secchi transparency is monitored in all seasons except ice-cover time, but only summer values are taken into account in the status assessment. Except for macroinvertebrates and phytoplankton, biological monitoring usually starts in second half of June.

Table 1. Monitoring frequency and field work time in Latvia

Quality element	**Monitoring frequency**
Phytoplankton	2 times/ year (May to first half of September)
Macroinvertebrates	2 times (May and/or October)
Macrophytes	Once a year (late June to early September)
Phytobenthos	Once a year (middle of June to the end of August)
Fish	Once a year (July - middle of September)
Physico-chemical quality indicators	4 or 12 times/ year in all seasons
Hydromorphology	May - October, depending on hydrological regime

Table 2 shows the biological quality element sensitivity to different pressures in Latvian lakes. It is important to use and monitor quality elements which are sensitive to the most significant pressures within a water body. Latvian lake phytobenthos method is not intercalibrated and therefore not tested against different pressures. All biological quality elements are sensitive to eutrophication which is the most common pressure in Latvian lakes.

__Table 2. Biological quality element sensitivity to different pressures in Latvian lakes__

Pressure	Macrophytes	Macroinvertebrates	Fish	Phytoplankton	Phytobenthos
Eutrophication	yes	yes	yes	yes	yes
Organic pollution	n.a.	no	yes	yes	n.a.
General degradation	n.a.	yes	yes	yes	n.a.
Hydromorphological degradation	n.a.	yes	yes	no	n.a.
Acidification	n.a.	yes	no	no	n.a.

*yes - sensitive, no - not sensitive, n.a. - no information

List of biological indices used for ecological classification:

- Indices used for lake ***macroinvertebrates*** (type specific, pH > 6): T (number of taxa), ASPT (Average Score Per Taxon), EPTCBO (number of Ephemeroptera, Plecoptera, Trichoptera, Coleoptera, Bivalvia, Odonata), H' (Shannon – Wiener diversity index), Acid index.
- Indices used for lake ***macrophytes*** (type-specific): typical taxa; total number of taxa; presence of type-specific indicator species (*Chara* sp., *Isoetes* sp., *Lobelia dortmanna*...); occurrence (scale from 1 to 7) of different plant groups: charophytes, free-floating, emergent, submerged, filamentous green algae; maximum depth to which taxa are present.
- Indices used for lake ***phytoplankton*** (type-specific): chlorophyll-a, Pielou evenness J, Nygaard modified compound quotient (PCQ), description of a community (PCD).
- Index used for lake ***phytobenthos***: IPS (Index of Pollution Sensitivity).
- Indices used for lake ***fish*** (type-specific): WPUE– weight per unit of effort; RoachWavg – roach average weight (g) in a catch using nets with a mesh size of 20-35 mm; Bream/RoachW%– roach and bream percentage by weight in a gill net with a mesh size 20-35 mm;

PerchW%– percentage of perch by weight in gill nets with a mesh size of 20-35 mm.

List of physico-chemical quality elements monitored in Latvian Lakes:

Parameters included in ecological quality assessment: transparency (Secchi depth), N_{tot}, P_{tot}.

Parameters included in priority fish water quality monitoring: ammonium ions NH_4^-, BOD_5, Zn, Cu, phenol index, dissolved O_2, petroleum hydrocarbons, non-ionized ammonia NH_3, NO_2^-, suspended solids, pH, temperature.

Other parameters which are monitored but don't have quality standards: O_2 saturation (%), conductivity, Ca, Mg, Na, K, HCO_3, SO_4, Cl, Si, TOC, DOC, P/PO_4, N/NO_3, water colour.

For **hydromorphological** assessment Latvia uses a slightly adapted version of the *Lake Habitat Survey* protocol which was developed in Great Britain. This field based method consists of 7 indicators: shore zone modification, shore zone intensive land use, hydrological regime, sediment regime, in-lake use, index Site condition (oxygen and temperature conditions in deepest part), catchment pressures. Final score is calculated as sum of these sub-indexes and assessment is given in a 5 point system, depending on deviations from reference conditions. Longitudinal connectivity is not taken into account. Water temperature and oxygen are measured every 1 meter throughout the entire depth of the lake to determine **stratification**, which is part of hydromorphological assessment method but results are also used in ecological assessment. Hydromorphological monitoring, including measurements of stratification, is the most time consuming of all quality parameters and therefore only limited amount of lakes can be assessed within each 6 year monitoring cycle.

Latvian part of all five transboundary lakes was monitored within the Transwat project in 2021 and next monitoring is planned in the next monitoring cycle after 2027. According to latest monitoring results in 2021, three lakes are in good ecological status (Table 3) on two lakes are in moderate status. Two of these good status lakes (Lakes Galiņu and Skirnas) even are close to reference status lakes and therefore there is no need to monitor these lakes more than once in one monitoring cycle. Lake Laucesas/Laukesas belongs to priority fish waters (salmonid type) and some additional parameters (phenol index and petroleum hydrocarbons) which are not included in the regular monitored parameter list must be monitored in this lake.

Table 3. Monitoring type, quality elements monitored, periodicity of sampling per 6 year monitoring circle (P), and frequency of sampling per year (F) (Monitoring programme in Latvia)

Lake		**Ilzu (Garais)/Ilge**	**Laucesas/Laukesas**	**Lielais Kumpinišku/ Kampiniskiai**	**Skirnas**	**Galiņu/Salna**
Monitoring type		S/O*	S/O	S	S	S/O
Priority fish waters		No	Yes, salmonid	No	No	No
Hydromorphology	P	0	1	0	0	0
	F	1	1	1	1	1
Physico-chemical	P	1	1	1	1	1
	F	12	12	12	12	12
Phytoplankton	P	1	1	1	1	1
	F	2	2	2	2	2
Phytobenthos	P	1	1	1	1	1
	F	1	1	1	1	1
Macrophytes	P	1	1	1	1	1
	F	1	1	1	1	1
Macroinvertebrates	P	1	1	1	1	1
	F	2	2	2	2	2
Fish	P	1	1	1	1	1
	F	1	1	1	1	1
Ecological status		Moderate	Moderate	Good	Good	Good

*Surveillance (S), Operational (O)

3. Monitoring programme (year 2022 - 2027) in Lithuania

All five transboundary lakes described in the present Report are currently designated as lake water bodies in Lithuania. Surface water monitoring is implemented in accordance with the Environmental Monitoring Programme 2022 – 2027. As in Latvia, three types of monitoring are implemented according to the Surface Water Monitoring Programme of Lithuania: surveillance, operational and investigative.

Surveillance monitoring stations are designated in three of the Transwat project lakes (Lakes Skirnas, Laucesas/Laukesas and Galiņu/Salna). Investigative monitoring is foreseen in the rest two lakes (Lakes Ilzu (Garais)/Ilge and Lielais Kumpinišku/Kampiniskiai). In this monitoring cycle, there are no operational monitoring stations in project lakes.

Quality elements for the ecological status assessment are: biological, physico-chemical, and hydromorphological. The periodicity of sampling per 6 year monitoring cycle and frequency of sampling per year are described in Table 4.

Table 4. Monitoring type, quality elements monitored, periodicity of sampling per 6 year monitoring circle (P), and frequency of sampling per year (F).

Lake		**Ilzu (Garais)/Ilge**	**Laucesas/Laukesas**	**Lielais Kumpinišku/ Kampiniskiai**	**Skirnas**	**Galiņu/Salna**
Monitoring type		I	S	I	S	S
Hydro-morphology	P	1	1	1	1	1
	F	1	1	1	1	1
Physico-chemical	P	2	2	2	2	2
	F	7	4	7	4	4
Phytoplankton	P	2	2	2	2	2
	F	6	4	6	4	4
Phytobenthos	P	2	2	2	2	2
	F	1	1	1	1	1
Macrophytes	P	1	1	1	1	1
	F	1	1	1	1	1
Macroinvertebrates	P	2	2	2	2	2
	F	1	1	1	1	1
Fish	P	1	1	1	1	1
	F	1	1	1	1	1

*Investigative (I), Surveillance (S)

Samples of **phytoplankton** and chlorophyll "a" are taken in the warm season: 6 times a year - in the second half of April, in June, in the second half of July, in August, in mid-September, in mid-October; 4 times a year - in the second half of April - May, in the second half of July, in the second half of August, in the second half of September - in the first half of October.

Samples of **phytobenthos** are taken in July – August.

Samples of **macrozoobenthos** are taken in the second half of April – May.

Physico-chemical elements are monitored: 7 times a year - in February, April, and monthly from June to October (if the ice cover is unstable in February, sampling is carried out at a later date (March) after the ice has melted); 4 times a year – in the second half of April - May, in July, in August and, in the second half of September - in the first half of October. Monitoring is carried out at the same time as phytoplankton sampling.

Macrophytes are monitored in late June – September.

Fish are monitored in late June – October.

List of physical and chemical quality elements:

- Transparency, temperature*, acidity (pH)*, suspended substances, dissolved oxygen*, alkalinity, conductivity*, total nitrogen (Nb), ammonium nitrogen (NH_4-N), nitrate nitrogen (NO_3-N), nitrite nitrogen (NO_2-N), total phosphorus (Pb)*, phosphate phosphorus (PO_4-P), organic matter (7-days biochemical oxygen demand (BOD_7)).

In lakes of type 1 (polymictic lakes), all indicators of physical and chemical quality elements are measured in the upper layer of the water. In lakes of types 2 and 3 (stratified and deep stratified lakes), all indicators of physical and chemical quality elements are measured in the surface layer, but water temperature and dissolved oxygen twice a year (in the second half of July and in the second half of August) are additionally measured every 1 metre throughout the entire depth of the reservoir to determine stratification. In cases where stratification is determined, measurements of indicators marked with an asterisk (*) are carried out not only in the surface layer of water, but also below the beginning of the temperature jump, above the end of the temperature jump and at the bottom.

List of biological indices used for ecological classification:

- Indices used for lake ***macroinvertebrates***: H_i (first Hill's effective taxa number), ASPT (Average Score Per Taxon), CEP (number of Coleoptera, Ephemeroptera and Plecoptera taxa), COP (percentage of Coleoptera Odonata and Plecoptera individuals in respect of a total number of individuals).
- Indices used for lake ***macrophytes***: abundance of type-specific indicator species (A – sensitive, C – insensitive and B – indifferent taxa); maximum depth to which taxa are present.
- Indices used for lake ***phytoplankton*** *(type-specific)*: total biovolume, chlorophyll-a, algal class metric (biovolume or its percentage of total biovolume of cyanophytes, dinophytes, chlorophytes and chrysophytes), PTSI (species composition based on lake-type specific lists of indicator species)
- Index used for lake ***phytobenthos***: TI (Trophic index).
- Indices used for lake ***fish***: S_bream_W% (relative biomass of silver bream), Benth_Sp_W% (relative biomass of silver bream, bream, and ruff), Roach_W_av (mean weigth of roach individuals), Perch_N% (relative abundance of perch), Perch_Steno_W% (relative biomass of perch, burbot, smelt, vendace and whitefish), Nb_Oblig_Sp (number of obligatory species), Non-nat_W% (relative biomass of non-native and translocated species).

4. Does LV-LT lake status correspond to the existing monitoring design?

Ecological status assessment for all 5 lakes was done in Report of the ecological status of transboundary lakes (Deliverable T2.4.1). Although both countries use different biological indices and physico-chemical quality class boundaries, results of final ecological status are comparable (Table 5). Two of lakes (Lakes Ilzu (Garais)/Ilge and Laucesas/Laukesas) are in less than good ecological status and must be monitored with greater frequency than other lakes.

Table 5. Ecological status assessment in transboundary lakes

		Ilzu (Garais)/Ilge		Lielais Kumpinišku/ Kampiniskiai		Galiņu/Salna		Skirnas		Laucesas/Laukesas	
		LV	LT	LV	LT	LV	LT	LV	LT	LV	LT
Macroinvertebrates		Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Macrophytes		Poor	Moderate	Good	Good	Good	Good	High	Good	Moderate	Poor
Fish		Poor	Moderate	High	Good	Moderate	Good	High	High	Good	Moderate
Phytoplankton		Good	Moderate	Good	High	High	High	High	High	Good	Moderate
Biology, total		Poor	Moderate	Good	Good	Good	Good	Good	Good	Moderate	Poor
Ntot, mg/L		1.14	1.14	0.64	0.64	0.9	0.9	0.55	0.55	0.94	0.94
Ptot, mg/L		0.033	0.033	0.013	0.013	0.016	0.016	0.011	0.011	0.029	0.029
Secchi, m		1.1	1.1	3.3	3.3	3.1	3.1	5	5	1.3	2.1
Physico-chemical, total		Moderate	Moderate	Good	Good	Good	High	Good	High	Moderate	Good

HYMO	Moderate	Less than good	Good	Good	Good	Good	Good	Good	Moderate	Less than good
Total status	Poor	Moderate	Good	Good	Good	Good	Good	Good	Moderate	Poor

During preparation of 3rd cycle River basin management plans, Latvia made pressure-impact analysis for all water bodies, including newly delineated ones. Lithuania has not made such analysis for new water bodies which makes it difficult to estimate total pressures within transboundary lakes. Both countries agree that there are no significant pressures which affect Lakes Skirnas and Galiņu/Salna (Table 6). According to Latvian pressure-impact analysis, transboundary pollution affects three lakes, but there is no significant pressure in Lithuanian site.

Table 6. Significant pressures in transboundary lakes

Lake/country		**Point source**	**Diffuse**	**Hydromorphological**	**Transboundary**	**Other**
Ilzu (Garais)/Ilge	LV				x	
	LT					x
Lielais Kumpinišku/Kampiniskiai	LV		x		x	
	LT					x
Galiņu/Salna	LV					
	LT					
Skirnas	LV					
	LT					
Laucesas/Laukesas	LV		x		x	
	LT					historical

5. Recommendations for harmonised monitoring programme and principles for the LV-LT lakes

The size of transboundary lakes is relatively small (but surface water area larger than 50 ha), so it is not always rational for each country to survey the same elements on its side. However, the countries use different methods to assess the status of lakes in terms of biological and hydromorphological indicators, and the composition of the physico-chemical indicators measured in the monitoring frameworks of Latvia and Lithuania differs slightly (although most of the indicators are identical). There are also differences in the planned sampling periodicy and frequency of sampling (depending on the type of monitoring planned, physico-chemical indicators are planned to be sampled 4 times in one country and 7 times per year in the other, 1 or 2 times in a 6-year monitoring cycle, and the specific years in which the countries have planned to carry out the surveys may also differ).

During the course of the project, it became clear that only the macroinvertebrate index of Lithuanian lakes can currently be calculated on the basis of Latvian monitoring data in a truly representative way.

The frequency of monitoring in Latvia is insufficient to calculate a sufficiently representative phytoplankton index, which is used in Lithuania for assessment of ecological status of lakes (only 2 samples are taken per year, whereas 4 samples are needed to calculate a representative index in Lithuania). The Lithuanian phytoplankton index can be calculated using the Latvian data, but with a higher probability of erroneous status assessment.

The sampling and measurement of the main physico-chemical elements in Lithuania and Latvia follow the same methodology, but some specific, insignificant indicators are not measured in either country (see Table 7). Monitoring of Priority and Hazardous substances was not discussed within this project, because all lakes are located in remote areas and are not expected to be subject to this kind of pressure.

Table 7. Comparison of monitored physico-chemical quality elements in both countries

Parameter	LV	LT	Parameter	LV	LT
Secchi depth	+	+	BOD_5 / BOD_7	+	+
Temperature	+	+*	TOC; DOC	+	-
Dissolved O_2; O_2 saturation	+	+*	Ptot; P/PO_4	+	+**
Conductivity	+	+**	Ntot; N/NH_4	+	+
Ca, Mg, Na, K, HCO_3, SO_4, Cl, Si	+	-	N/NO_2; N/NO_3	+	+
Hardness	-	-	Color	+	-
Alkalinity	-	+	RBSP: Cu; Zn	+	-
pH	+	+**	Sampling periodicity (x times / 6 yrs)	1	2
Suspended solids	-	+	Sampling frequency (x times / year)	12	7 / 4

*temperature and dissolved O2 are measured additionally at 1 m depth interval in the second half of VII and VIII (in stratified lakes)
** = pH, conductivity, P-tot are measured additionally above and below the thermocline and at the bottom layer (in stratified lakes)

However, all the methodological differences mentioned above are not substantial and the countries can certainly harmonise with each other, which quality elements can be investigated in one country while ensuring sufficient representativeness of the data for the calculation of the biological indices used in the other country and for the determination of the ecological status based on the criteria of the physico-chemical indicators of quality elements.

The frequency and periodicity of the surveys and the specific years in which they should be carried out can also be agreed.

Such harmonisation might be slightly more complicated if different countries were to carry out studies on different indicators in the same lake.

A much simpler solution for harmonising monitoring and sharing the work and financial burden would be to distribute transboundary water bodies between countries, where one country would collect information on a method and indicators that would be suitable for the assessment of the ecological status of the lakes according to the methodology used in the other country.

The only elements that should still be investigated by each country are fish and hydromorphological conditions. Due to fundamental methodological differences, the results of the assessment of fish and hydromorphological conditions carried out in one country cannot be used to calculate the corresponding index used in another country. Comparison of hydromorphological quality elements monitored in both countries can be seen in table 8. Although hydromorphological quality methods, used in both countries, has significant methodological differences, monitored parameters are mostly the same. Latvia has one lake (Lake Laucesas/Laukesas) which is designated as protected water body (priority fish waters) and additional monitoring needs must be taken into account.

Table 8. Comparison of hydromorphological quality elements monitored in both countries

Parameter	LV	LT	Parameter	LV	LT
Hydrology:			Littoral zone structure:		
Water level	+	+	Substrate	+	+
Water temperature	+	+	Sediments over natural substrate	+	+
Water discharge	+	+	In-lake pressures & uses	+	
Morphology:			***Index Site condition:***		
Shore zone structure:			Lake depth	+	
Shoreline land-cover & land-use	+	+	Secchi depth	+	
Shore modification	+	+	Dissolved oxygen profile	+	
Shore erosion	+	+	Temperature profile	+	

Experts of both countries agreed to start joint monitoring of 5 transboundary lakes in next monitoring cycle which starts in 2027 in Latvia and 2028 in Lithuania.

6. Conclusions and recommendations for next monitoring cycle

- Several national monitoring expert meetings were held during Transwat project, but another meeting must be held prior to planning for the next monitoring cycle. Experts from Lithuanian Environmental Protection Agency must be included.
- Latvia must increase phytoplankton sampling frequency from 2 times per vegetation season to at least 4 times per vegetation season. Actual frequency is not in line with WFD guidelines and makes interpretation of cross-border results difficult.
- There are no qualified macrophyte experts in Lithuania, and macrophyte monitoring has been carried out by Latvian experts in recent monitoring cycles. In order to save time and money, Latvian experts could create transects throughout the lake, not only in one side of border. It must be decided which country will cover expenses for such extra work.
- Lake Lielais Kumpinišku/Kampiniskiai consists of two ecologically and hydromorphologically different parts: shallower northern part and deeper southern part. Investigative monitoring, which includes all biological quality elements, must be done in both parts within one year to see possible differences in ecological quality.
- Both countries must revise pressure-impact analysis for transboundary lakes. Currently there are large inconsistencies and it is not possible to carry out a qualitative analysis of loads at the scale of the catchment area.

7. Location of monitoring stations for the LV-LT lakes

During this project also locations of sampling stations were discussed (Fig. 5.-5.5). It was concluded that location of almost all physico-chemical monitoring stations are representative enough and obtained results can be used on both sides of the border. Exception is Lake Lielais Kumpinišku/Kampiniskiai which consists of two parts and actual monitoring design is not fully representative in both countries.

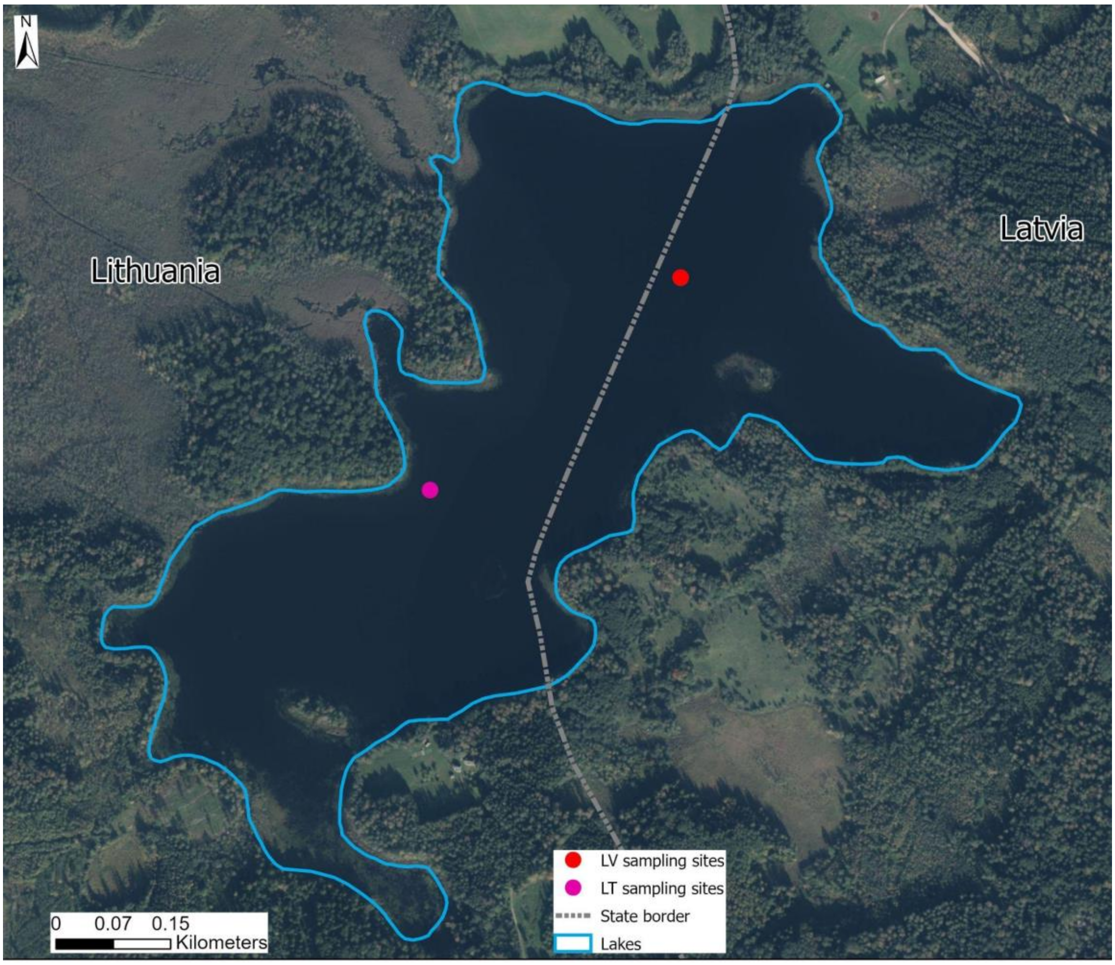

Figure 5.1. Locations of surface water monitoring stations within lake Galiņu/Salna

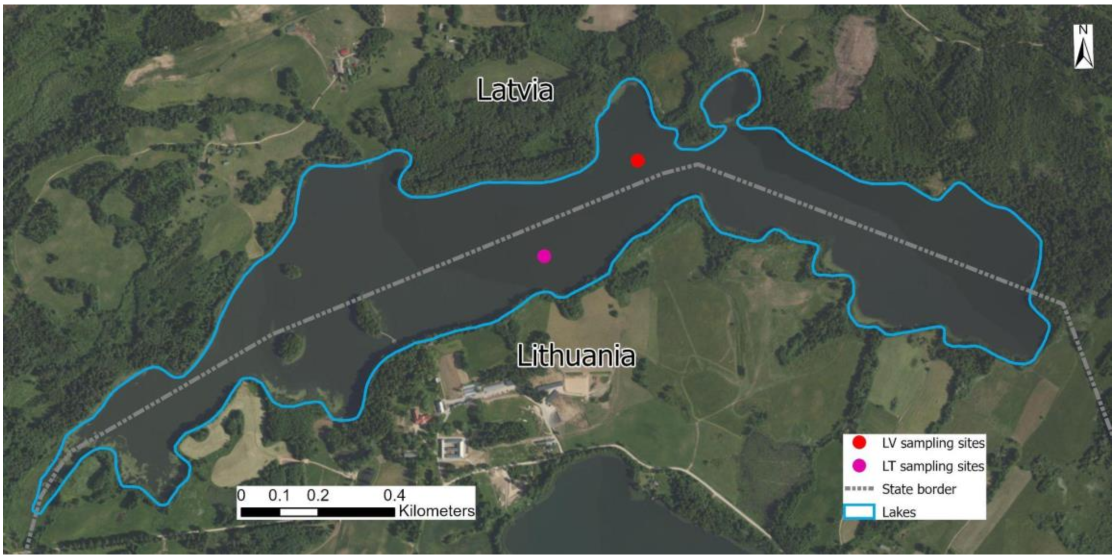

Figure 5.2. Locations of surface water monitoring stations within lake Ilzu (Garais)/Ilge

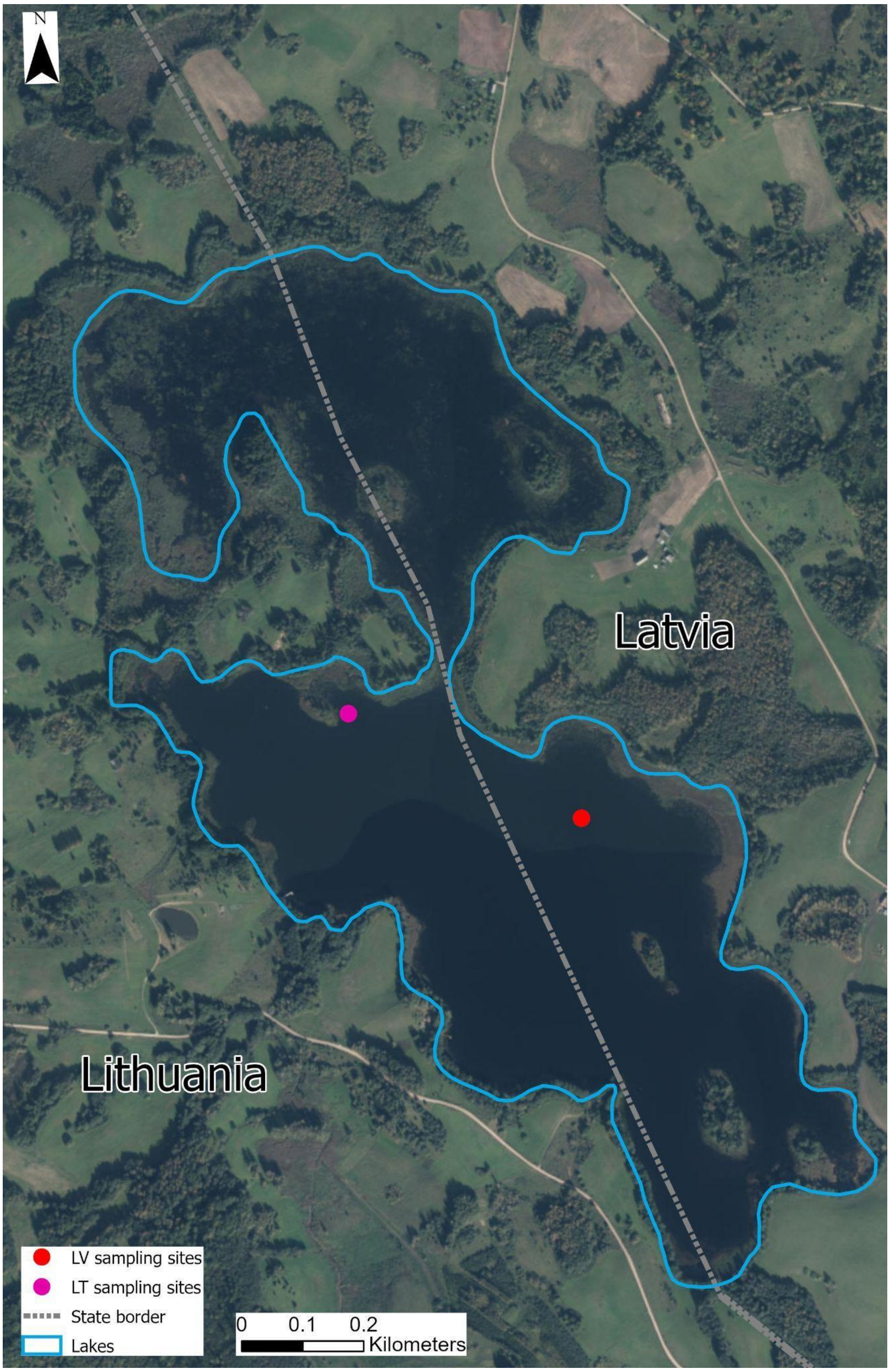

Figure 5.3. Locations of surface water monitoring stations within lake Lielais Kumpinišku/Kampiniskiai

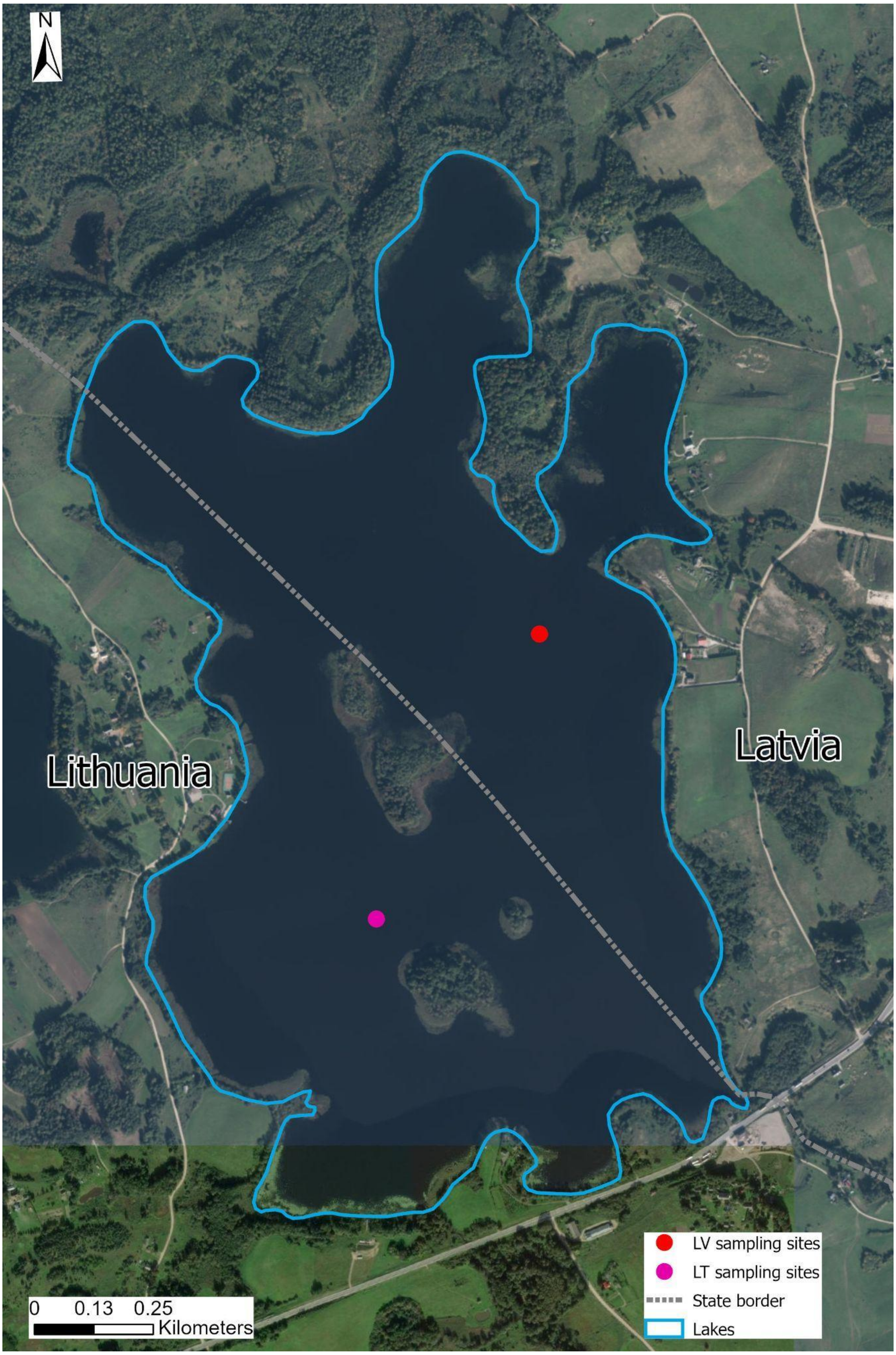

Figure 5.4. Locations of surface water monitoring stations within lake Laucesas/Laukesas

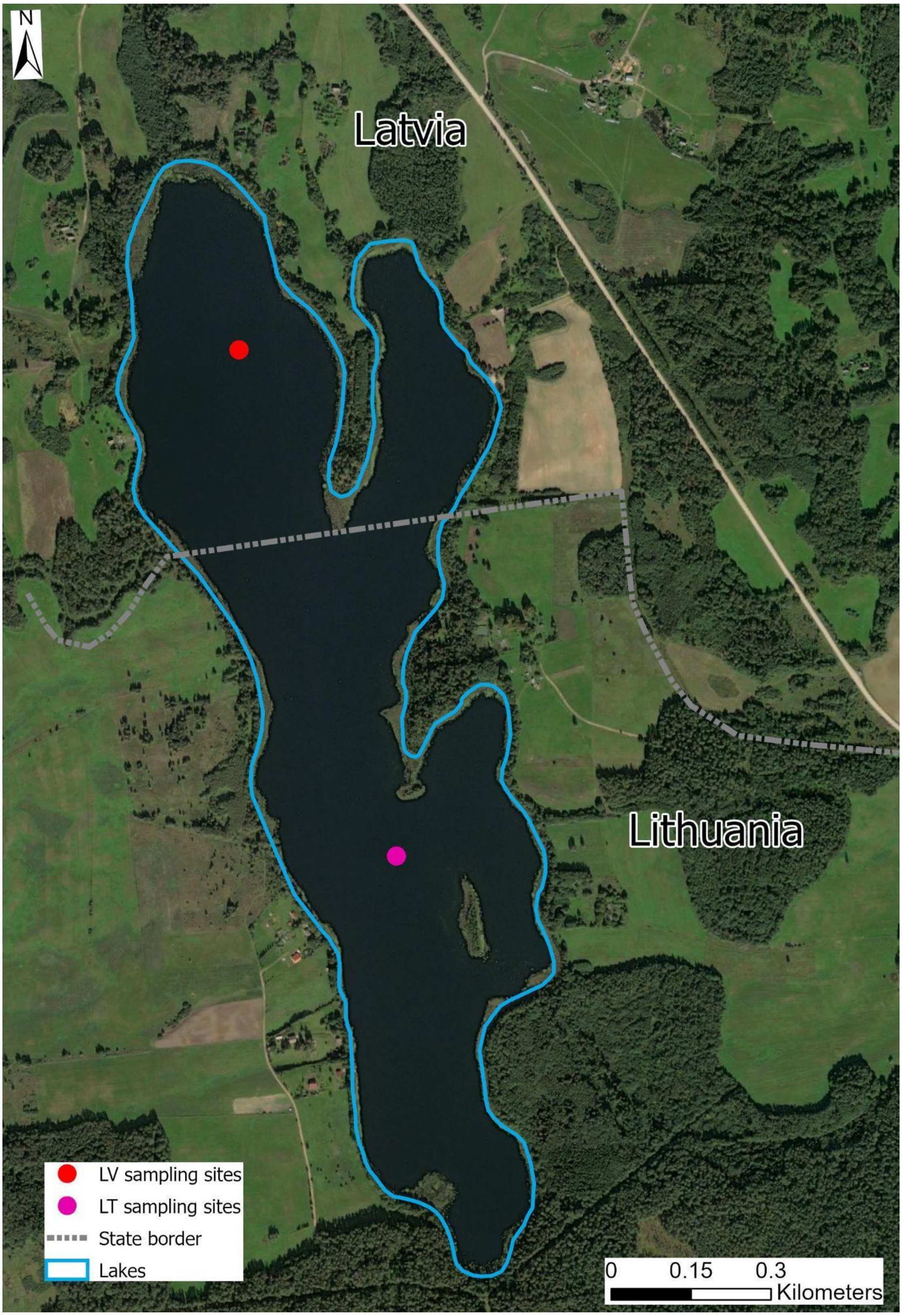

Figure 5.5. Locations of surface water monitoring stations within lake Skirnas