INTERIM REPORT

of

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«Environmental value, Landscape and Biological Diversity of the Lori Plateau Lakes and Watershed (Lori region, Republic of Armenia)»

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INTRODUCTION

Lakes of Lori plateau are listed in the State Program on Conservation and Management of Protected Areas of Armenia (2014-2020) as requiring special status of protection. Moreover, the lakes have been included into the Emerald Network List (Bern Convention) as an Area of Specific Conservation Interest (ASCI).

Thus, apart from general inventory and species distribution research, our field work pursued the objective to gather and highlight material on the Lori lakes environmental value at the Ministry of Environment of Armenia in order to launch the process of establishment of a new protected area.

Lori lakes system historically has been a remarkable natural complex. The lakes render highly favorable conditions for the biota, due to their location at average height level (1400-1550 meters above sea level – a.s.l.), geomorphological and hydrological configuration. So, Emerald Network special edition for the ASCI of Armenia designates at least 28 bird species, 4 mammals, 3 invertebrates and 1 plant species which require special habitat conservation measures (according to Resolution No. 6, Bern Convention), and at least 9 plant species, 1 amphibian, 1 reptile and 1 bird species of national importance, which are widespread at the site.

The steppe landscapes of the Lori plateau are as well attractive for the local population: from the Soviet times up to nowadays peat and sapropel have been extracted from some of the lakes, vast flatlands have been intensely used as pastures. Nonetheless, considerable part of the Lori lake system is not subjected to any sort of human exploitation (but for recreational fishing by the locals and as a traditional hunting site for bird hunters).

Autumn 2020 expedition was dedicated to the comprehensive evaluation of the Lori plateau ecosystems conditions. Also primary lists of the rare and endangered flora and fauna species were compiled and the data are being processed to describe the wholesome biodiversity of the site in order to justify its conservation value.

PRIMARY RESULTS

Comprehensive field session was performed jointly by the Russian and the Armenian associates in the period from September 10th to 21st, 2020. The area between towns of Stepanavan, Urasar and villages Saratovka, Novoseltsevo was covered during the expeditions (Fig. 1). Stepanavan lakes (1, 2), lake Peatbog, Novoseltsevo lakes (1, 2), lake Clear Liman, lake Long Liman and lake Horse Liman were studied in the flat low part of the plateau (heights 1450-1475 meters a.s.l.); lake Urasar was investigated at the hillside in the Lori plateau southern part

(1559 meters a.s.l.). Lakes Cellular, Stepanavan 3, 4 and Katnaghbyur were studied briefly, with only one-day prompt visit (see Fig. 2-12).

Apart from the studied lakes there can be found 17 basins where water remains only until early summer (Figures 13-14). Some of these lakes lose water because of the channel drainage system connected with the Novoseltsevo small hydroelectric power station (NSHPS). Other lakes in the past served as a source of peat and sapropel for the locals, and were drained for that reason. At present such 'dry' lakes during the summer turn into wet grassland grown by sedge, sitnik, reed, cattail etc. Still, not all basins remain drained after the peat extraction - lakes Cellular and Peatbog are gross reservoirs which had been exploited intensely. The former has distinctive surface linear-cellular 'texture' of plant cover resembling map of peat seizure (Fig. 15). The latter is known to be used for as peat source for the locals in present time, with unnatural linear-hollow bathymetry map.

Several lakes remain subjected to severe artificial water volume regulation designed to supply the NSHPS. For instance, at lake Novoseltsevo-2 maximal registered water level drops made up to 46 cm, compared to all other lakes (maximum 1 cm per day), which are not transformed by the channel infrastructure.

Air survey and photographing via drone was conducted for landscape and hydrology research purposes; digital elevation models were calculated automatically for the lakes and their basins. The footage is being processed in order to achieve whole images for each lake with geographical reference for the subsequent habitats deciphering. Key features for all investigated lakes were calculated in accordance to the drone footage and field measurements, and presented in Table 1.

Bathymetry was measured only at 5 lakes (due to time restrictions) (Fig. 45), considered to be most promising for potential protection; see maximum depth values in Table 1. Water level oscillations were measured at 6 lakes during most of the work period (see Final report with data analysis).

Table 1. General geographical information about the studied Lori lakes

Lake Name	**Center coordinates, °**		**Area / clear water area, hectares**	**Max. depth, m**	**Human impact at the site**
	N	**E**			
Stepanavan-1	41,03287813	44,36199515	2,66/0,85	Not measured	Road, fishing, pasture
Stepanavan-2	41,03390595	44,35939341	3,64/1,39	Not measured	
Stepanavan-3	41,03566210	44,36244040	2,21/2,21	Not measured	Fenced, fished
Cellular	41,07638827	44,28992622	29,11/0,8 (seasonally)	Not measured	Peat extraction, pasture
Peatbog	41,06412861	44,30375202	34,98/6,22	3.6	Peat extraction,

					fenced, fishing
Novoseltsevo-1	41,05675078	44,28341015	13,59/11,76	Not measured	Water level regulation, pasture, fishing
Novoseltsevo-2	41,06814076	44,28032024	14,81/6,02	2.5	
Clear Liman	41,05231721	44,31048973	10,66/2,76	5.4	Fishing, designated for protection
Long Liman	41,05297318	44,32322680	12,22/0,5 (seasonally)	0.7	Pasture
Horse Liman	41,04127307	44,32691752	2,41/0,92	4.7	Fishing, pasture, littering
Urasar	41,02329001	44,30447280	7,94/1,62	Not measured	Fishing, pasture, chemical contamination*
Katnaghbyur	41,03459159	44,24198978	2,66/0,41	Not measured	Pasture

Phytoplankton species diversity, abundance and biomass was assessed due to its function as a primary autotropihic unit of water ecosystems, which quantitative and qualitative parameters are perceived as proxies for the ecological status of water systems investigation.

Samples were taken at depth 0.5-1.0 m from the surface of lakes Horse Liman, Long Liman and Clear Liman. Sampling, conservation and processing of the algae were performed with the standard hydrobiological technique (Methodic recommendations…, 1981; Barinova, Medvedeva, 1996; Barinova et al., 2006; Shannon, Weaver, 1949).

It was shown that major algae groups from the lakes' phytoplankton communities are: diatoms (Bacillariophyta) (15 species, 31% from all recorded species), green algae (Chlorophyta) (17 species, 35%), blue-green algae (Cyanophyta) (12 species, 24%) and euglenoids (Euglenophyta) 5 species, 10%) (Table 2).

Table 2. List of algae discovered at some of the Lori Lakes, saprobity and Shannon diversity index, abundance and biomass parameters.

N	**Taxon**	**Horse Liman**	**Long Liman**	**Clear Liman**	**Abundance, cells/l**	**Biomass, g/m^3**
	Cyanophyta					
1	*Aphanizomenonflos-aquae*		+			
2	*Aphanothececlathrata*	+	+	+	20000 - 444000	0.04 – 1.45
3	*Chroococcusturgidus*	+				
4	*Coelosphaeriumkuetzingianum*		+	+		
5	*Microcystisaeruginosa*	+				

6	*M. wessenbergii*	+				
7	*Merismopediaelegans*	+				
8	*Phormidiumfoveolarum*	+	+			
9	*P. retzii*		+			
10	*Spirulinaabbreviata*	+				
11	*Oscillatorialacustris*			+		
12	*O. teniius*		+			
	Bacillariophyta					
1	*Cyclotellacomta*	+	+			
2	*Naviculapupula*	+				
3	*N.cryptocephala*		+			
4	*N.radiosa*		+			
5	*Nitzschialinearis*		+			
6	*N.palea*		+			
7	*Eunotiaargus*	+			16000 - 88000	0.071 – 0.370
8	*Synedraacus*	+				
9	*Melosiragranulata*	+				
10	*Surirellaovata*		+			
11	*Cymbella lanceolata*		+			
12	*C. ventricosa*		+			
13	*Stephanodiscusastrae*	+				
14	*Diatomahiemale*	+				
15	*D. vulgare*	+				
	Chlorophyta					
1	*A.contorta*	+				
2	*Ankistrodesmusangustus*		+			
3	*Ankistrodesmusspiriliformis*			+		
4	*Botryococcusbraunii*	+	+			
5	*Chlorococcummultinucleatum*	+				
6	*Closteriumacutum*	+				
7	*Cosmariumreniforme*	+				
8	*Dictyosphaeriumpulchellum*		+		772000 - 820000	3.367 – 6.00
9	*Elakototrix sp.*	+				
10	*Kirchneriellacontorta*	+	+			
11	*Oocystislacustris*	+				
12	*Scenedesmusacutus*	+				
13	*S.obliquus*	+	+			
14	*S.obtutus*	+				
15	*S .quadricauda*	+	+	+		
16	*Sphaerocystissphroeterii*	+				
17	*Staurastrumcuspidatum*		+			
	Euglenophyta					
1	*E. pisciliformis*	+	+			
2	*Euglenaacus*	+			8000 - 132000	0.104 – 2.012
3	*Phacusoscillans*	+				
4	*T. volvocina*	+				
5	*Trachelomonasoblonga*	+	+	+		

Saprobity	1.65	1.72	2.00		
Shannon diversity index	2.90	2.06	1.26		

Average values of Shannon diversity index and saprobity of phytoplankton equal 2.07 and 1.78 respectively. This indicates an average level of algae community adaptedness and apparent persistent organic pollution. The lakes can generally be characterized as **mesotrophic** by the studied phytoplankton biomass values. Still algae seasonal and spatial dynamics need to be monitored in order to draw final assessment of the Lori Lakes ecosystems.

Landscape and habitats structure of the terrain is yet to be carefully drawn. Nevertheless it is possible to outline some outstanding habitats and communities which are either included into Resolution 4 (Bern Convention) or deserve protection as key sites for rare species temporal or permanent concentration. Some of the habitats registered at the site (with EUNIS classification indices) are listed below:

- C1.224 - Floating *Utricularia* colonies
- C1.32 – Free-floating vegetation of eutrophic waterbodies
- D2.3 – Transition mires and quaking bogs
- D5.2 – Beds of large sedges normally without free-standing water (Fig. 17)
- E3.4 – Moist or wet eutrophic and mesotrophic grassland
- E3.5 – Moist or wet oligotrophic grassland
- Semi-submerged *Nymphaea alba* colonies (Red Book of Armenia, EN B 1 ab(iii) + 2 ab(iii))

Lakes Urasar, Katnaghbyur and surroundings need to be discussed separately, due to (1) their geographical position higher on the Bazum ridge slopes (150 meters higher than all other lakes), and (2) proximity of the Armanis mining plant, which can likely cause somewhat elevated level of pollution of water and substrates of the area, with lake Urasar is the nearest assimilating reservoir for the air transported contaminants. Lake Urasar landscape structure is organized in the similar way to that of the flatland lakes', meaning existence of the *Nymphea alba* belt along the shore, and dense thickets of semi-submerged plants communities in the western part (Fig. 16).

As part of the primary survey river Dzoraget canyon was traced by 1 km downstream (Fig. 20) with brief description of natural complexes and plant species (Fig. 21). The canyon ecosystems render habitats for many more species than

surrounding steppe landscape, and in some places represent highly productive communities such as:

- C3.55 – Sparsely vegetated river gravel banks
- C3.62 – Unvegetated river gravel banks
- F9.1 – Riverine scrub

Water flow rate was measured at the spot 250 m upstream from the NSHPS. At the profile maximum water depth reached 65 cm, river width was 14.2 meters. Water flow rate was estimated 1.16 m^3 per second. Another measurements need to be accomplished in spring, in order to compare autumn and spring values, and also to estimate impact of the NSHPS on the flow volume.

BIODIVERSITY INVENTORY

Comprehensive ecological inventory was carried out at the sites named above. Birds, fish, amphibia, reptiles, mollusks, some group of insects and vascular plants diversity were observed.

Apart from the general observations on the habitats (plant communities) listed above, specific study of the lakes flora was conducted. At least two plant species included into the national Red list was found by the lakeshores: *Carex bohemica* Schreb. (Fig. 22) and *Nymphaea alba* L. (European white water lily) (Fig. 23). *Acorus calamus* L. (sweet flag) (Fig. 24) discovery is notable as it is considered to be the first finding for the Lori floristic region (previously it was described in Armenia only for Ararat floristic region).

Lake Clear Liman is notable for the measures implemented by the local supervisory authority addressed at protecting the white water lily communities at the lake (Figure 19).

These findings correspond to the published data (Tumanyan, 2014) where 6 more nationally protected plant species are expected to inhabit the lakes. These have not yet been discovered during our field work (and 3 of the species referred haven’t been noticed in the region for more than 50 years).

List of the flora species discovered at Lori lakes during autumn expedition is included into the Table 1 of the Appendix 1. It should be mentioned that the information is not absolutely exhaustive so far, and requires another survey to be performed in spring.

Avifauna of the area was studied previously as part of general countrywide or regional faunistic surveys (Lyaister & Sosnin 1942, Dahl 1954, Adamian & Klem 1999). However, dedicated studies of breeding birds of Lori Plateau and peculiarities of spring and autumn migration over the area, and use of the Lori ponds and their environs by birds in various seasons were not carried out. Future studies should also be aimed at assessing the conservational value of the area for a

number of threatened bird species occurring here, as well as at the conservational measures needed in view of the current threats to local birds, including fluctuation of natural water regime of some ponds and hunting pressure during the hunting season in spring and autumn.

Bird species recorded during September field work are listed below in Table 3. Pictures of some bird specimen are included in Appendix 2 (Fig. 25-28).

Table 3. Preliminary results of the ornithological inventory at the Lori lakes. Occurrence status legend: r – resident, sb – summer visitor – breeder, s – oversummer without breeding, w – winter visitor, pm – passage migrant, ? – relevant status uncertain.

Scientific Name	**English Name**	**Red Book of Armenia (2010)**	**IUCN Red List (as of September 2020)**	**Lakes / Sites**	**Occurrence status in the study area**
Anas crecca	Common Teal		LC	Cellular, Stepanavan	pm, w
Anas platyrhynchos	Mallard		LC	Cellular, Stepanavan	sb, pm, w
Aythya ferina	Common Pochard		VU	Stepanavan	sb?, pm, w
Tachybaptus ruficollis	Little Grebe		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	r
Phalacrocorax carbo	Great Cormorant	VU B1ab(iii)	LC	Cellular	pm, w
Podiceps cristatus	Great Crested Grebe		LC	Cellular, Novoseltsevo-2	r,w
Egretta garzetta	Little Egret		LC	Novoseltsevo-2	sb?, pm
Ardea cinerea	Grey Heron		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar, Clear Liman	s, pm, w
Ardea purpurea	Purple Heron		LC	Stepanavan	sb?, pm
Ciconia ciconia	White Stork		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Peatbog, Clear Liman, Long Liman	sb
Plegadis falcinellus	Glossy Ibis	VU D1	LC	Novoseltsevo-2	pm
Clanga pomarina	Lesser Spotted Eagle	VU D1	LC	Stepanavan, Cellular, Novoseltsevo-1, -	pm

				2, Peatbog, Urasar	
Milvus migrans	Black Kite		LC	Katnaghbyur*	pm
Circaetus gallicus	Short-toed Eagle	VU D1	LC	Stepanavan, Cellular, Novoseltsevo-2, Clear Liman, Peatbog	pm
Circus aeruginosus	Western Marsh Harrier		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	sb, pm, w
Circus macrourus	Pallid Harrier	EN B1ab(iii)+2ab (iii); D	NT	Stepanavan, Cellular, Novoseltsevo-2, Urasar, Clear Liman, Horse Liman	pm
Circus pygargus	Montagu's Harrier	VU D1	LC	Cellular	sb?, pm
Buteo buteo	Common Buzzard		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	pm
Buteo rufinus	Long-legged Buzzard		LC	Stepanavan, Cellular, Novoseltsevo -2, Urasar, Peatbog	pm
Falco tinnunculus	Common Kestrel		LC	Novoseltsevo-2	r, pm, w?
Gallinula chloropus	Common Moorhen		LC	Stepanavan, Cellular, Novoseltsevo-1, Urasar, Clear Liman	sb, pm, w
Fulica atra	Eurasian Coot		LC	Stepanavan, Cellular, Novoseltsevo-2, Peatbog	sb, pm, w
Vanellus vanellus	Northern Lapwing		LC	Novoseltsevo-1, Long Liman	sb, pm
Philomachus pugnax	Ruff		LC	Cellular	pm
Tringa glareola	Wood Sandpiper		LC	Novoseltsevo-2 (calls)	s, pm
Tringa ochropus	Green Sandpiper		LC	Novoseltsevo-2 (calls)	s, pm
Gallinago sp.				Novoseltsevo-1	
Larus armenicus	Armenian Gull	VU B1ab(iii)+2ab (iii)	NT	Stepanavan, Cellular, Novoseltsevo-1, -2	s, pm
Sterna	Common		LC	Novoseltsevo-1	sb? pm

hirundo	Tern				
Chlidonias hybrida	Whiskered Tern	VU D1	LC	Novoseltsevo-1	sb? pm
Columba livia	Rock Dove		LC	Stepanavan	r
Streptopelia decaocto	Eurasian Collared Dove		LC	Stepanavan town*	r
Apus apus	Common Swift		LC	Novoseltsevo-2	sb, pm
Upupa epops	Eurasian Hoopoe		LC	Stepanavan	sb, pm
Merops apiaster	European Bee-eater		LC	Stepanavan (calls), Cellular, Novoseltsevo-1, -2 (calls), Urasar (calls)	sb, pm
Coracias garrulus	European Roller	VU B1ab(iii)	LC	Urasar	sb, pm
Alauda arvensis	Eurasian Skylark		LC	Novoseltsevo-2 (calls)	sb, pm, w?
Riparia riparia	Sand Martin		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	sb, pm
Hirundo rustica	Barn Swallow		LC	Omnipresent	sb, pm
Anthus trivialis	Tree Pipit		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar, Clear Liman	sb, pm
Anthus spinoletta	Water Pipit		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	pm, w
Motacilla flava	Yellow Wagtail		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	sb, pm
Motacilla citreola	Citrine Wagtail	VU D1	LC	Stepanavan	sb?, pm
Motacilla alba	White Wagtail		LC	Omnipresent	sb, pm, w
Phoenicurus phoenicurus	Common Redstart		LC	Stepanavan and Novoseltsevo towns*	pm
Saxicola rubetra	Whinchat		LC	Stepanavan, Cellular	sb, pm
Saxicola rubicola	Common Stonechat		LC	Stepanavan	sb, pm
Oenanthe oenanthe	Northern Wheatear		LC	Stepanavan, Urasar	sb, pm

Acrocephalus schoenobaenus	Sedge Warbler		LC	Novoseltsevo-2	sb, pm
Phylloscopus lorenzii	Mountain Chiffchaff		LC	Stepanavan town*	pm
Parus caeruleus	Blue Tit		LC	Stepanavan town*	r
Parus major	Great Tit		LC	Stepanavan town*	r
Sitta neumayer	Western Rock Nuthatch		LC	Dzoraget river gorges*	r
Lanius collurio	Red-backed Shrike		LC	Stepanavan, Cellular, Novoseltsevo-1, -2, Urasar	sb, pm
Pica pica	Common Magpie		LC	Stepanavan, Novoseltsevo-1	r
Corvus monedula	Western Jackdaw		LC	Stepanavan	r
Corvus corone	Hooded Crow		LC	Novoseltsevo-2	R
Passer domesticus	House Sparrow		LC	Stepanavan town*	r
Fringilla coelebs	Common Chaffinch		LC	Stepanavan	pm
Carduelis chloris	European Greenfinch		LC	Stepanavan town*	sb, pm
Carduelis carduelis	European Goldfinch		LC	Stepanavan	sb, pm

Amphibian species were studied considering their spatial distribution and morphometric features (body length, head length, head width, nose length, rostrum – nostril distance, palbebral fissure maximum length, eyelid maximum width, nose width distance between nostrils, maximum length of tympanic membrane, femur length, tibia length, tarsus length, length of the first finger of a hind leg, inner nuptial pad length, limbs length asymmetry, fingers length asymmetry, color morph, color patterns, assymetry). 168 frogs (*Rana macrocnemis (*Boulenger, 1885) and *Pelophylax ridibundus* (Pallas, 1771)) were comprehensively characterized by the parameters listed above in order to determine diversity between populations and to conduct mutual correlation analysis of the features. Frogs were caught manually and with nets, and placed back to lakes after the measurements. Maximum observed length (SVL) for *Pelophylax ridibundus* was 86 mm, for *Rana macrocnemis* - 56,5 mm.

Lizards and snakes were rarely found at on the shores of the surveyed several lakes only, preferring stony lake slopes. Snake tongs were used to fix snakes, and lizards species were identified from the photos.

Discovered species of amphibia and reptiles are listed in Table 4. Pictures of specimen diversity are included in Appendix 2 (Fig. 29-33).

Table 4. Preliminary results of the herpetological inventory at the Lori lakes.

Latin name	**English name**	**Red Book of Armenia (2010)**	**IUCN Red List (as of September 2020)**	**Lakes / Sites**
Rana macrocnemis	Long-legged wood frog		LC	Clear Liman, Novoseltsevo-2
Pelophylax ridibundus	Marsh frog		LC	omnipresent
Hyla orientalis	European tree frog		LC	Long Lilman, Clear Liman, Peatbog
Lacerta agilis	Sand lizard		LC	Clear Liman, Horse Liman, Novoseltsevo-1
Darevskia dahli	Dahl's lizard	EN B1a+2a	NT	Clear Liman
Darevskia armeniaca	Armenian lizard		LC	Clear Liman, Horse Liman
Natrix tessellata	Dice snake		LC	Horse Liman
Natrix natrix	Grass snake		LC	Clear Liman, Horse Liman
Coronella austriaca	Smooth snake		LC	Clear Liman

Frogs with diseases or injuries were observed from time to time: a frog suffering from an eye injury (lake Horse Liman, Fig. 34), two frogs with their legs torn off (lake Peatbog, Fig. 35). Second reproduction cycle was observed at the Long Liman (see tadpole at Fig. 36) and at the Urasar (spawn). *Hyla orientalis* calls were detected at lakes Peatbog, Long Liman and Clear Liman, and at the Dzoraget River bank in 2017 (reported by Samvel Pipoyan, Fig. 37).

Ommatotriton ophryticus (Berthold, 1846) was not found during the survey, but there are several reports that it inhabits sites in the vicinity of Stepanavan (Herpetofauna of Armenia and Nagorno-Karabakh, 2011). The best way to investigate population status of *Ommatotriton ophryticus* is to study it during breeding period, so it is planned to conduct this work in April 2021.

Ichthyological survey was performed using crayfish traps (8 holes, diameter 80 cm, mesh 3 mm, with smelly bait inside). The traps were set at 0.5-1.5 meter depth, distanced by 1-5 meters from lakeshore (Fig. 38). Round traps (diameter 70 cm, mesh 5 mm), fishing net (diameter 50 cm, mesh 8 mm, 1.5 m long) and fishing rod were used in some cases.

In most of the studied lakes *Pseudorasbora parva* (invasive species) and *Alburnus hohenackeri* dominate in fish population. *Alburnus hohenackeri* presence in the isolated Lori lakes is considered to be a result of unintentional introduction by fishermen and farmers. It is worth mentioning that *Alburnus hohenackeri* has been reportedly noticed to inhabit upstream and middle course of Tashir river, where it replaces *Alburnoides eichwaldii* (De Filippi, 1863), which is quite widespread in rivers of Armenia, due to similar biological and ecological features of these two species.

Results of the ichthyological research in September 2020 are briefly provided in Table 5 and in Appendix 2 (Fig. 39-42).

Table 5. Preliminary results of the ichthyological inventory at the Lori lakes

Lake / Site	**Species (latin name)**	**Species (English name)**	**Notes**
Stepanavan lakes	*Carassius gibelio*	Prussian carp	Oral report from locals
Novoseltsevo-2	*Pseudorasbora parva, Alburnus hohenackeri, Carassius gibelio*	Stone moroko, North Caucasian bleak, Prussian carp	*Pseudorasbora parva* - 93 %, *Alburnus hohenackeri* -6.7 % of fish population. One specimen of *Pontastacus leptodactylus* was found
Novoseltsevo-1	*Carassius gibelio, Gobio* cf. *artvinicus, Alburnus hohenackeri, Pseudorasbora parva*	Prussian carp, Gudgeon, North Caucasian bleak, Stone moroko	Abundance of *Alburnus hohenackeri* amounts 96% of fish population
Katnaghbyur	*Carassius gibelio*	Prussian carp	Monoculture
Urasar	*Pseudorasbora parva, Carassius gibelio*	Stone moroko, Prussian carp	*Pseudorasbora parva* - 99% of fish population
Clear Liman	*Pseudorasbora parva, Alburnus hohenackeri, Carassius gibelio*	Stone moroko, North Caucasian bleak, Prussian carp	*Pseudorasbora parva* - 60%, *Alburnus hohenackeri* – 40% of fish population. *Ligula intestinalis* metacercariae were found in 5% of both fish species. *Carassius gibelio* is known to inhabit the lake from oral report of locals, and has more dark color
Horse Liman	*Carassius gibelio, Pseudorasbora parva*	Prussian carp, Stone moroko	Carp and grass carp are reported by local

			fishermen to have been introduced into the lake in the past
Long Liman	*Carassius gibelio, Pseudorasbora parva*	Prussian carp, Stone moroko	Many fish were found dead because of water level decrease
Peatbog	*Carassius gibelio*	Prussian carp	No special ichthyological study was performed. *Pseudorasbora parva* is likely to be found

Local fishermen and farmers often implant juvenile *Cyprinus carpio* L., 1758, *Ctenopharyngodon idella* (Valenciennes in Cuvier & Valenciennes, 1844), *Hypophthalmichthys molitrix* (Valenciennes, 1844) and *Carassius gibelio* (Bloch, 1782) following their personal interest.

Several specimen of *Hydrophilidae* (Insecta, Coleoptera) were found at lake Novoseltsevo-1, and determined as:

- *Helochares obscures* (O. F. Muller, 1776)
- *Noterus clavicornis* (De Geer, 1774)
- *Noterus crassicornis* (De Geer, 1774)

Mollusk fauna was briefly studied at lakes Novoseltsevo-1 and -2 with the following species discovered:

- *Physella acuta* (Draparnaud,1805) (European physa) – Novoseltsevo-1
- *Planorbis sieversi* Mousson, 1873 – Novoseltsevo-1
- *Radix auricularia* (Linnaeus,1758) (big-ear radix) – Novoseltsevo-2

Lori Lakes additionally can be subdivided into several groups ranging by the degree of human impact (mainly the intensity of current drainage exploitation, damage and consequences of peat extraction, pasture intensity and hunting / fishing pressure on the biota). In spite of high level of human impact on some of the lakes (e.g. Peatbog, Novoseltsevo-2, Long Liman), they remain extremely significant as birds resting / breeding locations, plants and amphibia biodiversity hot spots.

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APPENDIX 1

Table 1. Preliminary results of flora species inventory at Lori lakes, discovered during autumn expedition (September 2020)

TAXA (Scientific name)	Red book of Armenia	Long Liman	Horse Liman	Clear liman	Cellular	Urasar	Katnaghbyur	Novoseltsevo-2	Novoseltsevo-1	Stepanavan-1	Stepanavan-2	Stepanavan-4
BRYOPHYTA **Ricciaceae -**												
Riccia sp.											+	
PTEROPHYTA **Dryopteridaceae**												
Dryopteris filix-mas (L.) Shott.							+					
Woodsiaceae												
Cystopteris fragilis (L.) Bernh.				+								
GYMNOSPERMAE **Pinaceae**												
Pinus sylvestris L.										+	+	
ANGIOSPERMAE **Acoraceae**												
Acorus calamus L.	**EN B**				+			+	+		+	
Alismataceae												
Alisma plantago-aquatica L.		+		+				+			+	
Apiaceae												
Daucus carota L.						+						
Asclepiadaceae												
Vincetoxicum amplifolium K. Koch						+						
Asteraceae												
Achillea millefolium L.				+							+	
Artemisia absinthium L.											+	
Artemisia vulgaris L.										+	+	
Bidens tripartita L.		+	+						+	+		
Carduus nutans L.				+								
Centaurea salicifolia Bieb.								+				

Cichorium intybus L.											+	
Conyza canadensis (L.) Cronq. (ERE=Erigeron canadensis L.)				+								
Hieracium piloselloides Vill.									+			
Lactuca serriola L.											+	
Psephellus manakyanii (Gabr.) Gabr	**endemic**			+								
Betulaceae												
Betula pubescens Ehrh.							+					
Brassicaceae												
Rorippa islandica (Oeder) Borbas		+										
Caprifoliaceae												
Lonicera caucasica Pall.							+					
Viburnum lantana L.							+					
Ceratophyllaceae												
Ceratophyllum demersum L.		+	+					+	+	+		
Crassulaceae												
Sedum album L.									+			
Sedum caucasicum (Grossh.) A. Bor.				+								
Sedum oppositifolium Sims.				+			+		+			
Cyperaceae												
Carex bohemica Schreb.	**EN* B**	+		+	+							
Eleocharis acicularis (L.) Roem. & Schult.								+				
Eleocharis palustris (L.) Roem. et Schult.										+	+	
Schoenoplectus tabernaemontani (C. C. Gmel.) Palla		+		+		+						
Dipsacaceae												
Scabiosa argentea L.				+								
Fabaceae												
Trifolium campestre Schreb.			+									
Trifolium pratense L. var geniculatum R. et F.			+									
Trifolium repens L.			+						+			

Hypericaceae												
Hypericum perforatum L.				+								
Juncaceae												
Juncus articulatus L.			+		+							
Juncus bufonius L.								+				
Juncus effusus L.						+	+		+		+	
Juncus inflexus L.											+	
Lamiaceae												
Lycopus europaeus L.		+	+			+			+	+	+	
Mentha longifolia (L.) Huds.			+	+		+	+		+			
Nepeta mussinii Spreng.												+
Teucrium orientale L.				+								
Thymus rariflorus K. Koch				+			+		+		+	
Lemnaceae												
Lemna minor L.				+					+		+	
Lemna trisulca L.											+	
Lentibulariaceae												
Utricularia minor L.				+		+	+					
Utricularia vulgaris L.						+						
Lythraceae												
Lythrum salicaria L.		+	+			+			+		+	
Malvaceae												
Alcea rugosa Alef.											+	
Hibiscus trionum L.												+
Menyanthaceae												
Nymphoides peltatum (S. G. Gmel.) O. Kuntze					+					+		
Myriophyllaceae												
Myriophyllum spicatum L.					+		+		+	+		
Myriophyllum verticillatum L.					+							
Nymphaeaceae												
Nymphaea alba L.	**EN B**	+	+	+		+		+	+			
Oleaceae												

Fraxinus excelsior L.						+						
Onagraceae												
Epilobium hirsutum L.		+	+			+			+			
Papaveraceae												
Papaver fugax Poir.											+	
Plantaginaceae												
Plantago major L.									+		+	
Poaceae												
Alopecurus aequalis Sobol.									+			
Catabrosa aquatica (L.) P. Beauv.									+		+	
Phalaroides arundinacea (L.) Rauschert						+						
Phleum pratense L.						+						
Phragmites australis (Cav.) Trin. ex Steud.		+		+					+			
Puccinellia sevangensis Grossh.						+						
Polygonaceae												
Polygonum aviculare L.			+			+			+			
Polygonum hydropiper L.		+	+			+				+	+	
Rumex crispus L.		+							+		+	
Potamogetonaceae												
Potamogeton alpinus Balb.					+							
Potamogeton crispus L.									+			
Potamogeton lucens L.				+						+		
Potamogeton natans L.		+		+	+		+		+	+	+	
Primulaceae												
Lysimachia verticillaris Spreng.						+						
Ranunculaceae												
Batrachium trichophyllum (Chaix) Bosch (ERE=Ranunculus divaricatus Schrank)					+							
Ranunculus sceleratus L.			+		+	+			+			
Rhamnaceae												

Rhamnus cathartica L.							+					
Rosaceae												
Agrimonia eupatoria L.						+						
Aruncus vulgaris Raf.							+					
Cerasus avium (L.) Moench							+					
Filipendula ulmaria (L.) Maxim.							+					
Malus domestica Borkh.				+								+
Malus orientalis Uglitzk.					+							
Padus racemosa (Lam.) Gilib.							+					
Prunus divaricata Ldb.				+		+						
Pyrus caucasica Fed.				+		+	+					
Rosa spinosissima L.				+		+						
Rubus idaeus L.				+		+	+		+			
Sorbus aucuparia L.							+					
Salicaceae												
Populus alba L.												+
Populus balsamifera L.				+								
Populus nigra L.		+										
*Populus simonii Carr.												+
Salix armeno-rossica A.K.Skvortsov.			+									
Salix caprea L.		+		+		+	+					
Salix elbursensis Boiss.				+	+	+						
Salix excelsa S. G. Gmel.				+								
Salix pseudomedemii E. Wolf				+		+						
Salix triandra L.		+		+	+	+		+	+			
Scrophulariaceae												
Limosella aquatica L.								+				
Sparganiaceae												
Sparganium erectum L.										+	+	
Sparganium neglectum Beeby											+	
Thymelaeaceae												
Daphne mezereum L.							+					

Typhaceae												
Typha angustifolia L.		+										
Typha latifolia L.		+		+		+			+	+	+	
Typha laxmanii Lepech.		+				+		+				
Urticaceae												
Urtica dioica L.						+			+		+	
Violaceae												
Viola arvensis Murr.				+								

APPENDIX 2. Illustrations

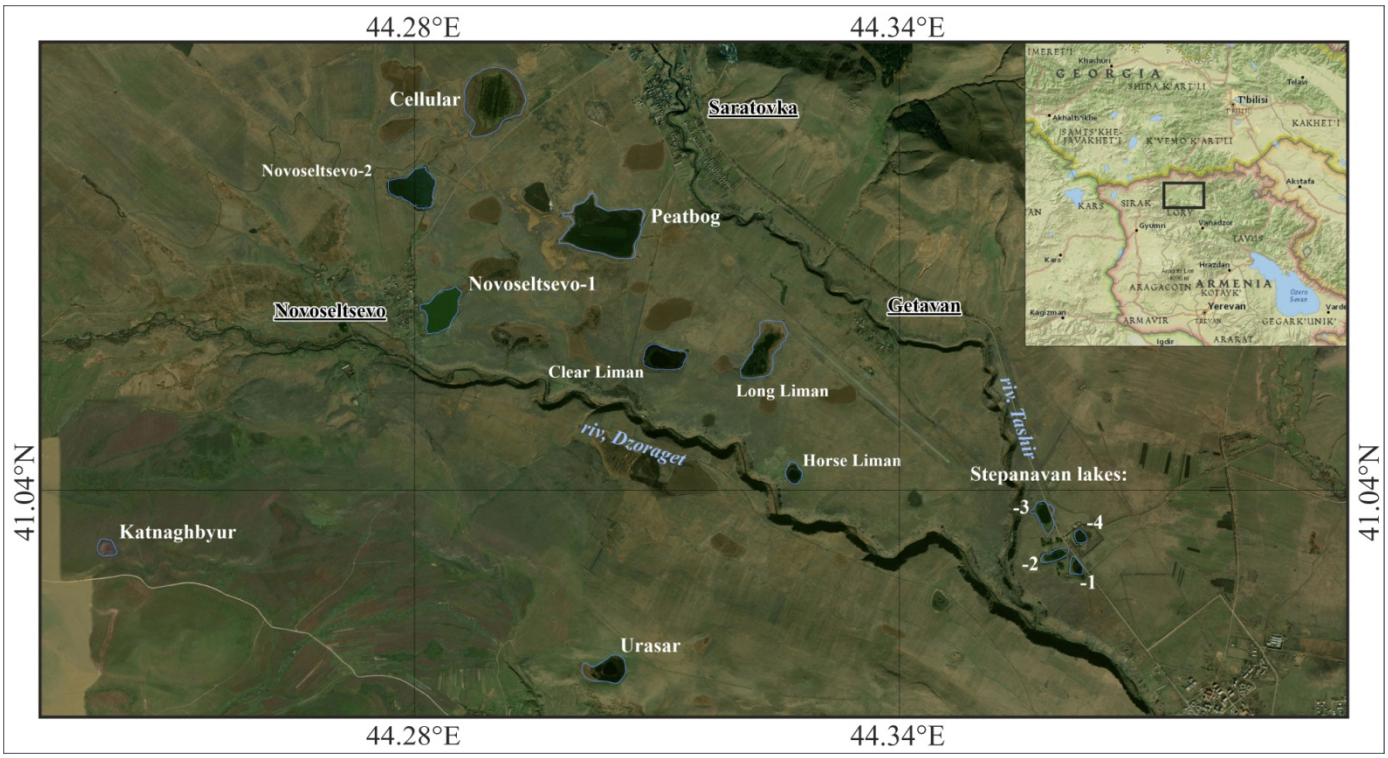

Figure 1. Geographical position and scheme of the studied lakes during September 2020 expedition

Figure 2. Lake Stepanavan-1 (Photo by Dmitrii Sadokov, 12.09.2020)

Figure 3. Lake Stepanavan-2 (Photo by Dmitrii Sadokov, 12.09.2020)

Figure 4. Lake Cellular (Photo by Dmitrii Sadokov, 12.09.2020)

Figure 5. Lake Urasar (Drone footage by Andrei Ostashov, 13.09.2020)

Figure 6. Lake Katnaghbyur (Photo by Samvel Pipoyan, 13.09.2020)

Figure 7. Lake Novoseltsevo-1 (Drone footage by Dmitrii Sadokov, 12.09.2020)

Figure 8. Lake Novoseltsevo-2 (Drone footage by Andrei Ostashov, 18.09.2020)

Figure 9. Lake Clear Liman (Photo by Dmitrii Sadokov, 19.09.2020)

Figure 10. Lake Horse Liman (Drone footage by Andrei Ostashov, 17.09.2020)

Figure 11. Lake Long Liman (Drone footage by Andrei Ostashov, 20.09.2020)

Figure 12. Lake Peatbog (Photo by Samvel Pipoyan, 19.09.2020)

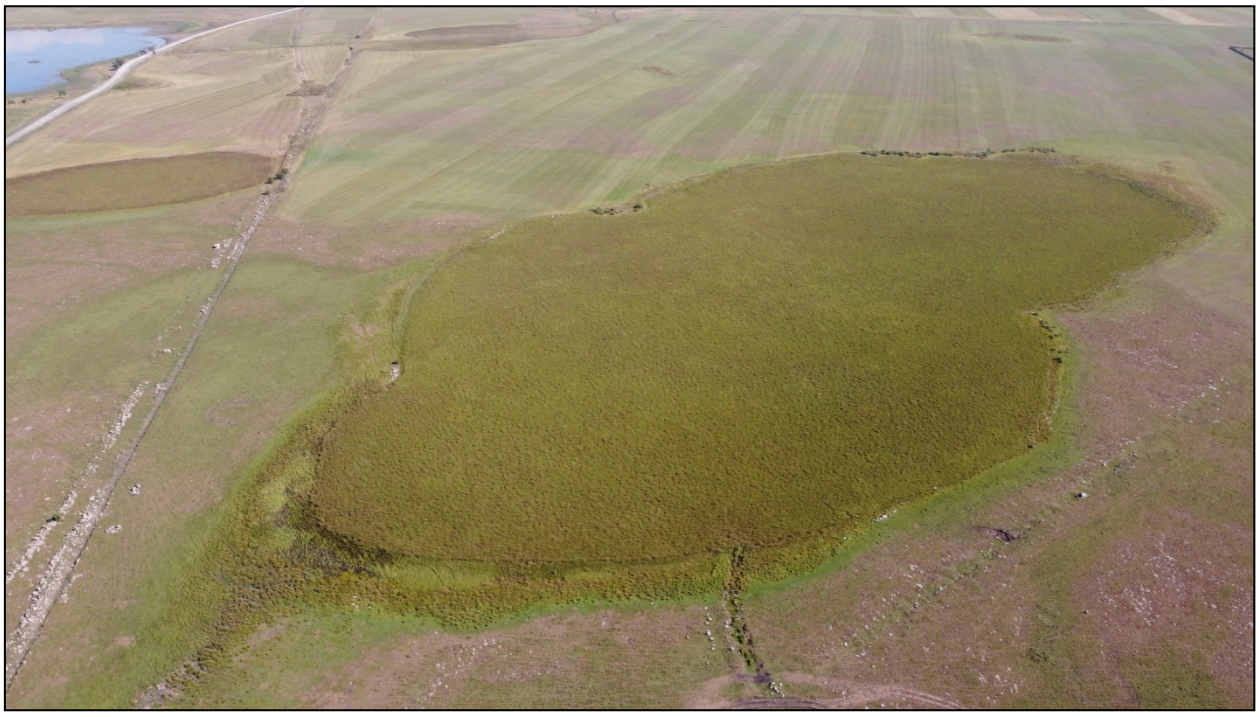

Figure 13. Artificially drained lake basin turned into moist grassland (Drone footage by Andrei Ostashov, 15.09.2020)

Figure 14. Grassland at one of the drained lake basins (Photo by Dmitrii Sadokov, 14.09.2020)

Figure 15. Linear-cellular surface ‘texture’ of plant cover at lake Cellular (Drone footage by Andrei Ostashov, 18.09.2020)

Figure 16. Tall helophytes, reedbeds and sedges fringing lake Urasar (Drone footage by Andrei Ostashov, 13.09.2020)

Figure 17. Beds of large sedges at one of the lakes where intensive peat extraction occurred in the past (Photo by Dmitrii Sadokov, 14.09.2020)

Figure 18. Amphibious vegetation of the periodically inundated shores at lake Clear Liman (Photo by Dmitrii Sadokov, 15.09.2020)

Figure 19. Placard at the shore of lake Clear Liman (Photo by Samvel Pipoyan, 20.09.2020): «White water lilies of lake Clear Liman of the village of Saratovka have the status ″endangered species″ and are listed in the Red Book. Any activity that contributes to the destruction of water lilies is subject to administrative punishment. /Article 93 of the RA Codex VIV/»

Figure 20. Middle course of the river Dzoraget crossing Lori plateau (Drone footage by Andrei Ostashov, 17.09.2020)

Figure 21. Riverine scrub and vegetated banks of the river Dzoraget in its middle course (Photo by Dmitrii Sadokov, 19.09.2020)

Figure 22. *Carex bohemica* Schreb. found at the shore of lake Clear Liman (Photo by Dmitrii Sadokov, 19.09.2020; identified by Ivan Gabrielyan)

Figure 23. *Nymphaea alba* L. in bloom at lake Urasar (Photo by Vasil Ananian, 13.09.2020)

Figure 24. *Acorus calamus* L. found at lake Stepanavan-2 (Photo by Vasil Ananian, 12.09.2020; identified by Ivan Gabrielyan)

Figure 25. *Chlidonias hybrida* (Photo by Vasil Ananian, 12.09.2020)

Figure 26. *Ciconia ciconia* (Photo by Vasil Ananian, 12.09.2020)

Figure 27. *Circaetus gallicus* (near lake Novoseltsevo-2) (Photo by Vasil Ananian, 12.09.2020)

Figure 28. *Ardea cinerea* resting at lake Novoseltsevo-2 (Photo by Vasil Ananian, 12.09.2020)

Figure 29. *Pelophylax ridibundus* found at lake Stepanavan-2 (Photo by Dmitrii Sadokov, 12.09.2020)

Figure 30. *Rana macrocnemis* found at lake Novoseltsevo-2 (Photo by Vasil Ananian, 12.09.2020; identified by Ilona Stepanyan)

Figure 31. *Darevskia dahli* at the shore of lake Clear Liman (Photo by Dmitrii Sadokov, 15.09.2020; identified by Ilona Stepanyan)

Figure 32. *Darevskia armeniaca* found at the shore of lake Horse Liman (Photo by Dmitrii Sadokov, 17.09.2020; identified by Ilona Stepanyan)

Figure 33. *Natrix tessellata* found at the shore of lake Horse Liman (Photo by Valentina Digalova, 17.09.2020; identified by Ilona Stepanyan)

Figure 34. A frog (*Pelophylax ridibundus*) with an eye injury found at the shore of lake Horse Liman (Photo by Valentina Digalova, 17.09.2020)

Figure 35. A frog (*Pelophylax ridibundus*) with a leg torn off found at the shore of lake Peatbog (Photo by Valentina Digalova, 19.09.2020)

Figure 36. A tadbole of *Pelophylax ridibundus* found in lake Long Liman (Photo by Valentina Digalova, 20.09.2020)

Figure 37. *Hyla orientalis* found at the bank of the river Dzoraget near village Novoseltsevo (Photo by Samvel Pipoyan, 27.05.2017; identified by Samvel Pipoyan)

Figure 38. One of the crayfish traps used for ichthyological survey (Photo by Samvel Pipoyan, 12.09.2020)

Figure 39. *Carassius gibelio* found in lake Peatbog (Photo and identification by Samvel Pipoyan, 19.09.2020)

Figure 40. *Pseudorasbora parva* found in lake Novoseltsevo-1 (Photo and identification by Samvel Pipoyan, 12.09.2020)

Figure 41. *Alburnus hohenackeri* found in lake Novoseltsevo-1 (Photo and identification by Samvel Pipoyan, 12.09.2020)

Figure 42. *Gobio cf. artvinicus* found in lake Novoseltsevo-1 (Photo and identification by Samvel Pipoyan, 12.09.2020)

Figure 43. Expedition team at lake Urasar (13.09.2020). Left to right: Vasil Ananian, Andrei Ostashov, Knarik Hambardzumyan, Samvel Pipoyan, Ilona Stepanyan, Valentina Digalova, Ivan Gabrielyan, Anush Arakelyan, Dmitrii Sadokov

Figure 44. Water level scale at lake Novoseltsevo-2 (Photo by Andrei Ostashov, 13.09.2020)

Figure 45. Bathymetric measurements at lake Novoseltsevo-2 (Photo by Valentina Digalova, 18.09.2020)

Figure 46. Russian expedition participants. Left to right: Andrei Ostashov, Valentina Digalova, Dmitrii Sadokov (Photo by Ilona Stepanyan, 21.09.2020)