

BIODIVERSITY OF THE ENDORHEIC UVS NUUR BASIN IN CENTRAL ASIA, MONGOLIA

Dulmaa A.

The presentation gives information about the ecology and biodiversity of the Uvs Nuur hollow. From 1996 up to 1999, 10 groups of Mongolian and German biologists and geographers are working together with their colleagues about problems of limnology, palaeolimnology, botany, geomorphology, soil science, climatology, remote sensing. In the following some results of the lakes investigated during September 1996, August 1997, 1998 and 1999 are demonstrated [2, 3].

INTRODUCTION

In the Uvs Nuur catchment area numerous water bodies exist – rivers, lakes and spring. They are different in respect of altitude, climatic conditions, catchment area, hydrology, morphometry, chemistry and biology. For their protection and use as water resources a description of the waters including the main influencing parameters and a characterization of the actual water quality are necessary. Whereas for Mongolian lakes a classification according to trophic types, in five groups exists [1].

Table 1

Important parameters of lakes on the Uvs Nuur basin

Parameters		Uvs	Doroo	Bayan	Baga	Shavart
Morphometrical characteristics	Altude (m)	761	1148	932	762	982
	Area (km ²)	3650	19 (W) 53 (E)	35	1.35	0.45
	Volume (km ³)	49.3	0.7	0.33	0.001	0.0005
	Mean depth (m)	13.5	7 (W)	9.4	0.7	1
	Max. depth (m)	~23	20	29.2	1	0.2
	Drainage area DA (km ²)	71100	900	730	211	42
	DA/lake area	19.5	12.4	20.9	156	94
Chemistry	Water type, pH Conductivity/ Transperensy	hyposaline pH 9,1900 µS/cm high 6.0 §	-	fresh,hard pH 8.9 430 µS/cm high 6.0 §	fresh,soft, pH 8.25 88 µS/cm	-
	Nutrients: TN total Phosph./SPR	0.3-2.1 mg/l 0.021-0.0.84 mg/l	-	0.1 mg/l 0.008 mg/l 0.01 mg/l	-	-
Trophic conditions/ biota	Im.OrgMat. Autotr. Prod. Rel.O ₂ (%)	Oligotrophic 100 70	Mezotroph.	Oligomezotroph 100 20	eu	eu
	Fish/ Macrozoobentos Microphytobent.	Oreoleuciscus A.salinus Plantolyngbya	Oreol.+Esox Eudiaptomus Kellicotia longispina M. granulate G.lacustris	Oreoleuciscus Keratella quad. Ceratium hirun	Oreoleucis. Diaphanos. Brachyurum D.similis Cypris	
Some properties of lake water	Transparency (m)	6 (NW) 0.3 (E)	2	4.8 - 6	0.35	0.2
	O ₂ , % Saturat.epilimn.	~100	~100	~100	to 145	to 125
	O ₂ , % saturat.hypolim.	70 - 80		20 - 30	-	-
	pH epolimnion	~9	~9.5	~8.9	~10.2	~9.5
	pH hypolimnion	9	-	~7.8	-	-
	Total P [µg/L]	18 (NW) 84 (E)	12	8	79	318
	NO ₃ -N [g/L]	<2	5	80	5	<<40
	Chloroph.a [g/L]	0.5 – 0.8	3	2 – 2.5	~23	~13
Phytoplank.[g/L]	0.6	3.6	2.3	27.1	15.0	

Mezotrophic lake Uvs-Nuur located in the northwestern part of Mongolia, has an area of 3350 km², with a length of 84 km, a width of 79 km. The waterlevel is at 759 m MSL and the watershed reaches altitudes up to 4037 m MSL. The lake is separated from the Valley of Great Lakes by the Khan-Khukhii

ridge. It has no outlet and has a very large catchment area, receiving water from the east in the Baruunturuun, Nariin and Tes rivers. In west, the Harchirai, Turgen, Sagil and Borschoo rivers flow into the lake from the Altai Mountains. There is also an extensive area of marsh to the west of the lake. The lake is situated in a basin with large areas of sand dunes at the northernmost limit of the semi-arid zone.

The most important quality parameters for human use are salinity and ionic composition (see Table 1.) In the eastern bay of Uvs Nuur the salinity was only 9.2 g/L, compared with 12.6 g/L in the main part and showed a distinct. In August on the shallow SW shore a change of conductivity from 15.2 to 21.5 $\mu\text{S}/\text{cm}$. The fresh water lake Bayan is differing from the normal CA-HCO_3 -type. Magnesium and sodium are the major cations, which is result of strong, mostly biogenic (dense *Chara tomentosa* stands) calcite precipitation in the zones of inflowing groundwater. The calcium depletion can be observed even clearer in the slightly subsaline Doroo Nuur, where almost no calcium is left and magnesium is the dominating cation.

The Uvs-Nuur correspondents with its total salinity of about 1.1% to the western part of the Baltic Sea. The hyposaline Uvs Nuur represents the relatively seldom NaCl-MgSO_4 -type and shows, that there seems to be not enough calcium in all flowing waters to almost completely precipitate magnesium as dolomite. Sulphate, Sodium and Chloride ions being the most important constituents. Having a maximum depth of 24 m and an average depth of 5 m, the medium Secchi depth is about 5 m. In the shore area numerous marginal lagoons are spread, that are very shallow and greatly isolated from the actual Uvs-Nuur according water exchange. In the afternoon there was an oversaturation of oxygen, however during the night the oxygen concentration not only decreased to zero, but hydrogen sulfide is formed (also smells nearby). In summer, the water temperature exhibits a gradient from 25 $^{\circ}\text{C}$ at the surface to 19 $^{\circ}\text{C}$ at the bottom.

The literature and own data on biodiversity of the biota of the lake Uvs and its tributaries are summarized. Recently there are 49 species of phytoplankton and 128 species of phytobenthos (83 species of algae and 45 species of high aquatic plants), 66 species of zooplankton and 118 species of zoobenthos. In the basin Uvs-Nuur are inhabited mainly by palearctic species. The list of algae belonging to 6 divisions: Cyanophyta, Chlorophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Euglenophyta. The greatest amount of species was marked for diatom (64 species). The second place on species diversity was occupied by green algae of 5 species. On the third place were blue-green algae - 22 species. The composition of phytoplankton in samples had a casual and reflected the floristic compound of stony substratum algaeocenoses of the upper rivers sites and in the Nariin-gol river source - that of lake Uvs. Characteristics of plankton phytocenose in the Nariin-gol source reflect the diversity and abundance of lake phytoplankton. At the pelagic phytoplankton *Ceratium hirundinella* are dominant. Among subdominants diatom *Cyclotella meneghiniana*, *Achnanthes brevipes*, *Stephanodiscus* sp., green algae *Oocystis borgei*, bluegreen algae - *Spirulina laxissima*, *Phormodium frigidum* prevailed.

Table 2

Composition of the phytoplankton biomass (%), species numbers of euplanktic zooplankton & SHANNON diversity indices

Lake	Uvs	Doroo	Bayan	Baga	Shavart
Phytoplankton					
Cyanobacteria	67	81	10	65	74
Diatomeae	1	3	33	0	0
Chrysophyceae	0	0	20	0	3
Cryptophyceae	0	1	3	0	0
Dinophyceae	0	5	32	31	0
Chlorophyceae	32	8	2	4	22
Diversity Index	1.45	0.50	1.40	0.47	0.82
Zooplankton					
N Copepoda	3	4	3	1	2
N Cladocera	2	4	4	3	2
N Rotifera	6	6	4	11	15
Diversity Index	0.8 – 1.1	1.78	1.14	1.66	2.13

The highest indices of floristic riches of higher water plants are marked at shallow well warmed up eutrophic water bodies connected with lake Uvs-Nuur. Here, high plants species diversity with predomination of *Myriophyllum verticellatum*, *Potamogeton panormitanus*, *Polygonum laphathifolium*, *Callitriche hermafroditica* and subdominant *P.berchtoldii*, *P.perfoliatus* prevail at the depth up to 1.5 m. The specific morphometric conditions of river Nariin-gol, characterized by the presence of large open

sandy shoals that promoted the development of the fine half-shipped macrophyte forms, such as *Subularia aquatica*, *Batrachium mongolicum*, *Ranunculus reptans*, *Limosella aquatica*. Among plunged species at Tes-gol settlement *Batrachium divaricatum* dominated and the deeper places - *Potamogeton gramineus*. Near the river mouth, where the current is, *Potamogeton perfoliatus* and *P. tenuifolius* developed.

In the zooplankton 5 representative of Copepoda, 19 - of Cladocera, 19 - of Rotatoria were found. In the pelagial of the lake four species of Copepoda dominate in numbers and biomass throughout the year: - the *Arctodiaptomus salinus*, *Eudiaptomus graciloides*, *Cyclops vicinus* and *Acanthocyclops viridis*. The Cladocera - *Bosmina longirostris longirostris*, *Daphnia longispina longispina*, and the Rotatoria - *Asplanchna brightwellii*, *Keratella cochlearis*, *K. quadrata*, *Polyarthra major*, *Conochilus hippocrepis*, *Filinia longiseta* are subdominant. Copepoda in the open pelagial account for 45-85% of total numbers and more than 85% of zooplankton biomass; Rotatoria make up to 9-38%, and Cladocera not more than 5%. Occurring in the plankton throughout the year, Rotatoria mass develop from July to October. Cladocera occur from the end July to August. During the whole ice-cover period, their number remains constant.

The composition of the bottom fauna is now standing at 183 species and forms of stenothermic invertebrates, including Planarians, Nematodes, Oligocheta, Hirundinea, Ostracoda, Gammaridae, Mollusca, Hydrocarina, Chironimidae, Trichoptera, Plecoptera, Ephemeroptera, Tabanidae, Tipulidae, Hemiptera, Odonata, Coleoptera. As seen, the most diverse are Chironomidae, Plecoptera, Ephemeroptera, Trichoptera.

In the fish fauna of the Uvs-Nuur two endemic species (Altai osman - *Oreoleuciscus Warpachowskii* and *Barbatulus strauchi*) have been recorded. Altai osman appears in three types: *Oreoleuciscus humilis*, *Oreoleuciscus potanini* and *Oreoleuciscus pewzowi*. Dominating species are *Oreoleuciscus potanini*. Altai osman types are interesting examples of non-competitive evolution of a relatively young immigrant. Altai osman is highly adaptable to a variety of conditions. Osman is a lake fish, but it also inhabits rivers with slow current, avoiding the fast current of mountain rivers. It can live in rivers with a wide range of dissolved oxygen concentrations and conductivity. For spawning, osman migrates from saline lakes into freshwater rivers.

References

1. *Dulmaa A.* Hydrobiological Outline of the Mongolian Lakes // Internationale Revue der Gesamten Hydrobiologie. 1979. ol. 64. No.6. 709-736.
2. *Dulmaa A.* Investigations on the biodiversity of the Uvs-Nuur Basin in Central Asia, Mongolia // Biodiversity of the Mongolian Plateau and Adjacent territory. Ulaanbaatar-Hohhot. 2001. p.58.
3. *Paul, M., Horn, W., Dulmaa, A., Davaa, G., & Tseveendorg, N.* Der Uvs Huur, ein Grober Salzsee in der nordwestlichen Mongolei, und sein endorheisches Einzugsgebiet. Deutsche Gesellschaft für Limnologie: Tagungsbericht 1998 (Klagenfurt). Eigenverlag der DGL. Tutzing // 115-119.