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PRELIMINARY ASSESSMENT OF THE STATUS OF TRANSBOUNDARY LAKES IN THE UNECE REGION*

Submitted by the Chairperson of the Working Group on Monitoring and Assessment

Addendum

1. This document is based on information gathered from various sources, such as previous UNECE publications prepared by the Working Group on Monitoring and Assessment (WGMA), in particular the *Guidelines on Monitoring and Assessment of Transboundary and International Lakes. Background Paper – General Properties and Monitoring Practices of Selected Transboundary/International Lakes* (2002).[1] Additional material has been gathered from the members of the WGMA, from publications by other international organizations and from the Internet.

2. Monitoring activities differ greatly in UNECE. While in some areas reliable data and reports are available, in others monitoring is not carried out, or the available information is not

* This document was submitted on the above date because of processing delays.

[1] http://www.unece.org/env/water/publications/documents/inventorylakes.pdf

adequate for reliable assessments. Therefore, expert judgment has been used in most of these cases.

3. This document is an intermediate product which only presents information on selected lakes, mostly in countries in Eastern Europe, Caucasus and Central Asia (EECCA). It also includes some transboundary lakes shared by EU and EECCA countries, as well as some lakes in South-Eastern and Western Europe. The other lakes will be included in the updated version to be submitted to the sixth Ministerial Conference “Environment in Europe” (Belgrade, October 2007) as is explained in document ECE/MP.WAT/2006/16. At this stage, only very general conclusions can be drawn.

I. ASSESSMENT OF THE STATUS OF TRANSBOUNDARY LAKES IN EECCA COUNTRIES

A. Aral Sea[2]

4. The Aral Sea is an inland sea in Central Asia; it lies between Kazakhstan in the north and Uzbekistan in the south. Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan share the lake basin (with respectively 344,400 km^2, 124,900 km^2, 143,100 km^2, 488,100 km^2 and 448,840 km^2).

5. The region is characterized by large variations in precipitation. Annual precipitation ranges from 1,500 to 2,500 mm in the glacier belts of the West Tien Shan and West Pamir ranges and 500–600 mm in the foothills to 150 mm at the latitude of the Aral Sea.

6. Historically, the Aral Sea has risen and fallen considerably. During the Quaternary period, the sea’s level showed variations of as much as 36 metres. In the first half of the twentieth century, the variance did not exceed one metre, and the ecological situation was quite stable until the late 1950s. However, since then substantial variations have occurred: since the end of the 1950s, the level of the sea has fallen by more than 22 m (figure 1).

7. Since the 1960s, the Aral Sea has been shrinking as the rivers that feed it (Amu Darya and Syr Darya) has been diverted for irrigation. This has created a number of ecological problems both for the sea and for the surrounding area. The sea is badly polluted, largely as a result of weapons testing, industrial projects and fertilizer runoff before the break-up of the Soviet Union.

8. Irrigation for agriculture is very common in the lake basin. Of the basin’s 154,934,000 ha, 59,474,100 ha are potential arable land. Some 10,140,900 ha are at present in agricultural use, and of these 7,895,600 ha are irrigated.

[2] http://www.giwa.net/areas/reports/r24/giwa_regional_assessment_24.pdf

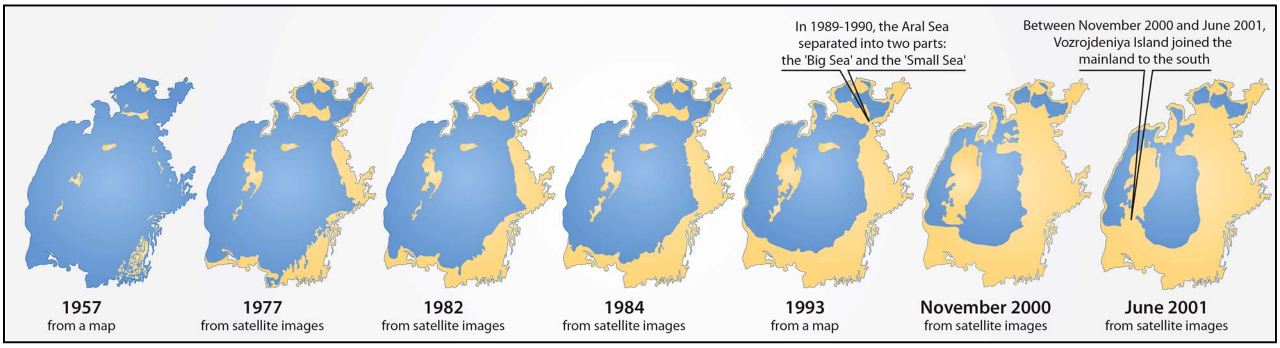

Figure 1. Aral Sea from 1957 to 2001 (*Source:* FAO 1997)

9. A major environmental problem facing the Aral Sea basin is the increasing salinization of irrigated areas, which is reducing their productivity. A significant proportion (about 33,000 km^2) of the sea has dried up, and water mineralization has increased. The ecosystem of the Aral Sea has been nearly destroyed, not least because of the salinization. The land around the Aral Sea is also heavily polluted, and the people living in the area are suffering from a lack of fresh water, as well as from a number of other health problems: the receding sea has left huge plains covered with salt and toxic chemicals, which are picked up and carried away by the wind as toxic dust, and thereby spread to the surrounding area. The population around the Aral Sea shows high rates of certain forms of cancer and lung disease.

10. Crops in the region are also being destroyed by salt deposits. Fish spawning sites have disappeared, and forage reserves are depleted, which has led to a decline in fish resources. The most acute problems in the Aral Sea region are the unsustainable use of water resources and persistent organic pollutants (POPs). In short, the Aral Sea is heavily polluted, and the situation is getting worse.

B. Lake Balqash

11. Lake Balqash, the largest moderately saline lake of Central Asia, is located in south-eastern Kazakhstan. The total area of the lake is 18,210 km^2. The total area of the lake basin is 413,000 km^2, shared between Kazakhstan (353,000 km^2 or 85%) and China (60,000 km^2 or 15%).[3] The western half of the lake consists of fresh water, while the eastern half is salt water. The average depth of the lake is only six metres. The lake is fed principally by the Ili River but has no outlet.[4]

12. Water pollution of the Balqash is growing as urbanization and industrialization in the area increase. Pollution occurs both in China and in Kazakhstan. The main pollutants are copper, zinc and oil products. The lake is also shrinking because of over-utilization of water. The extinction of species in the lake due to over-fishing is occurring at an alarming rate.

13. The most acute problem in Lake Balqash is the irrational use of surface water resources and the use of POPs in the river basin, with its serious consequences for biota. The Balqash system is heavily polluted by non-ferrous metallurgy and agriculture. The main water polluters

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[3] http://www.grid.unep.ch/activities/sustainable/balkhash/index.php

[4] For an assessment of the Ili River, see document ECE/MP.WAT/2006/16/Add.6.

are industrial, mining and refinery enterprises, animal farms and irrigated farming. Consequently, Lake Balqash is heavily polluted, and the overall trend is not positive.

14. In addition, there is the potential threat of growing pressure on water resources due to increasing economic activities in China. Of the available 18.1 km^3/year water resources (long-term mean average inflow into the Kapshagan reservoir), almost two thirds (i.e. 12.3 km^3/year) originate in China. With the expected decrease to 8.0 km^3/year due to increasing water use in China, Lake Balqash may eventually share the fate of the Aral Sea.

C. Lake Har Us Nuur[5]

15. Lake Har Us Nuur is the second largest freshwater lake in Mongolia. The lake basin is shared by China, Mongolia and the Russian Federation.

16. The area of the lake is 1,760 km^2, while the mean depth is only four metres. The area is sparsely populated: density is less than 1.2 inhabitants/km^2. Non-point loading from livestock breeding, which is the main economic activity of the agrarian Mongolian society, is the major pressure factor. It accounts for 70% to 75% of total agricultural production. Traditionally, livestock breeding includes sheep, horse, camel, cattle and goat breeding.

17. Precipitation is low throughout the year (the annual average in Hovd City is 122 mm). Lake Har Us Nuur receives water from four rivers with a total catchment area of 74,500 km^2 and a mean annual water volume of 3.5 billion m^3. The Khovd Gol and Bujant Gol originate in the Mongolian Altai and terminate in the extensive Khovd Gol delta. The twin Dund Tsenker Gol and Khovd Tsenkher Gol rivers flow to the southern marshland of Lake Khar Us Nuur, contributing a much smaller amount of water. Lake Har Us Nuur has an outflow at its north-eastern end into Lake Har Nuur. From here on the water feeds the saline Dorgon Nuur, while Lake Har Us Nuur and Lake Har Nuur are freshwater lakes.

18. Lake Khar Us Nuur is a perfect habitat for wild ducks, geese, wood grouse, partridges and seagulls, including the rare relict gull and herring gull. Lake Har Us Nuur is in good status, and its outlook is also good.

D. Lake Jandari

19. Lake Jandari covers an area of 12.5 km^2, and the lake basin's area is 102 km^2. Some 67% of the basin is located on Georgian territory and 33% in Azerbaijan. Water comes mainly through the Gardaban water canal from the Kura River. The maximum capacity of the canal is 15 m^3/s.

20. Pollution originates from various anthropogenic sources. Wastes from industry, residential areas and agriculture pollute water coming into the reservoir from the Kura River. The total population in the lake basin is 14,000–15,000 (some 140–150 inhabitants/km^2). The lake is used for fishing.

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[5] http://www.worldlakes.org/lakedetails.asp?lakeid=8661

21. In the nineteenth century, the shallow and salty lake often dried out during the summer. Later, in order to provide water for irrigation, an additional water supply canal (the Gardaban canal) was constructed. As a result, the lake was filled and turned into a water reservoir. Another canal, which starts from the Tbilisi (Samgori) water reservoir, also feeds Lake Jandari.

22. Lake Jandari does not currently have a good ecological or chemical status. Increased pollution from the Kura River and from reservoirs is increasing levels of pollution in the lake. Moreover, expansion of irrigated land in both countries and uncoordinated use of water by various users are decreasing the water level.

E. Lake Ubsa-Nur/Uvs Nuur

23. Lake Uvs Nuur is large (3,350 km^2) but shallow (mean depth six metres). The lake basin is 10,688 km^2. The main feeder to Lake Uvs Nuur is the Tes-Khem River, which has its source in the freshwater Lake Sangyn Dalai Nuur in the alpine meadows and larch forests of the Sangilen uplands at the eastern extremity of the basin (in Mongolia). The Tes-Khem flows 500 km westward, through steppe and desert, into southern Tuva, and then back into Mongolia before emptying into Lake Uvs Nuur. For its last 100 km, the river meanders through an extensive wetland complex, a green swathe in another wide semi-desert landscape; its delta is nearly 40 km wide and is an important wildlife habitat.

24. Lake Uvs Nuur is the largest lake in Mongolia. It is saline (18 g salts/l) and is thought to be all that remains of a huge saline sea that once covered much of the basin. The lake has no outlet, so the shoreline is mostly swampy, making it difficult to reach.

25. The Uvs Nuur basin has in recent years been declared a natural World Heritage Site. The Uvs Nuur basin is one of the best-preserved natural steppe landscapes in Europe and Asia. The lake is of vital importance for migrating species of waterfowl as they make their way north every year.

26. Except for the potential for over-grazing, there are currently no serious threats to the natural environment of the Lake Uvs Nuur. The level of urban population is low and industry is completely lacking in both the Tuvan and Mongolian sectors. Moreover, the lake’s geographic isolation, climatic extremes and lack of surface water flow make it an unattractive location for agricultural industries.

F. Lake Xingkai/Khanka

27. Lake Xingkai/Khanka is located on the border of China and the Russian Federation. It is the largest freshwater lake in Northeast Asia. The area of the lake is 4,190 km^2 (1,160 km^2 in China and 3,030 km^2 in the Russian Federation). The lake basin is 16,890 km^2 (507 km^2 in China and 16,383 km^2 in the Russian Federation). The River Song’acha is the lake’s outlet and is connected with the Ussuri River and the Amur River system.

28. Lake Xingkai/Khanka is shallow – its mean depth is only 4.5 metres. The total population in the lake basin is 345,000, with a density of more than 20 inhabitants/km^2. The area around the lake is an important wetland habitat and forms a National Nature Reserve on the Chinese side

and the Khanka Lake Nature Reserve on the Russian side. It is a remarkable site for nature protection, eco-tourism and scientific research. The Russian Federation has designated the lake as a Ramsar Convention wetland site.

29. The waters of Lake Xingkai/Khanka are of the carbonate-calcium type. The majority of water input from the Chinese part of the lake basin is from the Muling River floodwater. The overall water quality of the inflow river meets fishery requirements. The Muling River water-quality parameters indicate, however, that the river is suffering from serious organic pollution originating from Mishan City.

30. In the Russian part, DDT and other groups of pesticides have been found. The data indicate that only the COD value seriously exceeds the accepted standard. The overall water quality is suitable for agricultural purposes, tourism and fishing.

31. During 1985–1992, the overall quality of Lake Xingkai/Khanka’s water, based on hydrochemical parameters, was evaluated as being “very dirty”, “dirty” or “polluted”. By 1996–1997, the quality of the lake waters was “moderately polluted” at the Astrakhanka and Sivakovka observation stations (Russian Federation) and “clean” at the Troiskoe and Novoselskoe settlements (Russian Federation).

32. The average annual concentration of main nutrients indicates that, although nitrogen and phosphorus concentrations decreased during the 1990s, the lake is still eutrophic. But a decreased anthropogenic load and rising lake water levels have slowed the eutrophication process.

33. Although the basin does not have a wide range of natural resources, it does have considerable deposits of coal, fluorspar and raw materials for producing cement. There is comparatively little industry on the lake-basin scale, and most of the existing industry is concentrated on the Russian side of the basin.

34. The Lake Xingkai/Khanka basin currently receives a high anthropogenic pollution load. From the Russian part of the basin, it receives approximately 100 times the allowable limit. In the Chinese part, industrial, agricultural and domestic sewage from the cities of Muling, Jixi, Jidong and Mishan are discharged into the Muling River, which is also the major Chinese source of pollution affecting Lake Xingkai/Khanka.

35. By the mid-1980s, rice irrigation systems surrounded the lake for about 160 km. Because of the large volumes of irrigation water subsequently draining back into the lake, agrochemicals and fertilizer compounds have become a major environmental threat to the lake ecosystem.

36. The Lake Xingkai/Khanka basin has undergone significant economic development over the past 130 years. This development, which includes agricultural activities throughout the basin, has resulted in negative ecological impacts, including (a) contamination of surface waters and (to some extent) groundwater; (b) soil cover erosion; and (c) reduced communities of rushes in wetlands and related degradation of biodiversity.

37. Overall, the primary reasons for biodiversity degradation in the Lake Xingkai/Khanka basin include (a) draining of swamps; (b) lowering of the lake's water level; (c) agricultural development (which particularly affects bird nesting areas); (d) stress due to the noise and other impacts of technical facilities; (e) large-scale environmental contamination; (f) cutting of forests; and (g) reduction and/or elimination of ecological corridors.

38. Part of the water body has been seriously polluted by increasing human activity around the lake. Based on evaluation of various environmental components, the overall pollution status of Lake Xingkai/Khanka does not exceed "weak". At the same time, however, specific regions of the lake basin exhibit elevated levels of pollution.

II. ASSESSMENT OF THE STATUS OF TRANSBOUNDARY LAKES IN SOUTH-EASTERN EUROPE

A. Lake Dojran

39. Lake Dojran is a small (total area 43.10 km^2) tectonic lake with a basin of 271.8 km^2. The lake is shared between The former Yugoslav Republic of Macedonia (27.4 km^2) and Greece (15.7 km^2). The lake is rich with fish – 16 species. The "Aquatic Forest of Mouria" has been listed as a "Natural Monument" and also proposed, together with a small part (200 ha) of Lake Doiran, for inclusion in the EU NATURA 2000 network.

40. Over the last 20 years, the lake's level has dropped continuously due to reduced precipitation and increasing Greek abstraction, mainly for irrigation purposes. The most extreme water level and water volume decrease have occurred since 1988. From 262 million m^3 in 1988, the volume decreased to 80 million m^3 in 2000.

41. Water quality is characterized by high alkalinity and elevated carbonate and magnesium hardness. Additionally, concentrations of certain toxic substances are near or even beyond toxic levels. In Greece, there are high values of phosphates.

42. Pollution is caused by municipal wastewater, municipal solid wastes, sewage from tourist facilities, and agricultural point source and non–point source pollution, including transboundary pollution.

43. In recent years, the lake has been struggling for survival. Since 1988, because of the decrease in water level and volume, over 140 species of flora and fauna have disappeared, according to biologists. The water level has dropped 1.5 metres below its permitted hydro-biological minimum. Therefore, the lake is in danger of a real ecological disaster because of the uncontrolled use of water for farming in Greece.

B. Lake Ohrid (including Lake Prespa)

44. Lake Ohrid (358 km^2) is located at an altitude of 695 m and encircled by mountains exceeding 2,000 m in height. The lake is deep (mean depth 163.7 m, maximum depth 288.7 m). Some 249 km^2 (67%) of the lake belongs to The former Yugoslav Republic of Macedonia and

109 km^2 (33%) to Albania. Some 650 km^2 (62%) of the lake basin is in The former Yugoslav Republic of Macedonia and 392 km^2 (38%) in Albania.

45. Lake Prespa (274 km^2) is a transboundary lake shared by The former Yugoslav Republic of Macedonia (178 km^2), Albania (49 km^2) and Greece (47 km^2). The lake basin is some 2,800 km^2, and the mean depth is 16 m (the maximum is 47 m). The lake is characterized by eutrophication, industrial pollution, toxic substances and other relevant pollution factors.

46. Lake Prespa is situated at an altitude of 845 m, i.e. above Lake Ohrid, and its waters drain into Lake Ohrid through very porous karst mountains. The water system of Lake Ohrid is rather complex because of the underground links with Lake Prespa. The mean theoretical retention time is 83.6 years.

47. Lake Ohrid is one of the oldest lakes in the world. It was formed 2 to 3 million years ago. Because the lake has been isolated by surrounding mountains, a unique collection of plants and animals have evolved. Some of these plants and animals were common species millions of years ago but are now considered relics or “living fossils” because they can be found only in Lake Ohrid. The Lake Ohrid area has been a World Natural Heritage Site since 1980.

48. The water quality monitoring shows significant organic loading to Lake Ohrid from municipal waste, agricultural and urban runoff. Although the phosphorus concentrations and water transparency still suggest an oligotrophic condition, the living organisms tell a different story.

49. The commercially important fish species in Lake Ohrid, including the famous Lake Ohrid trout, have been over-harvested in recent years and are in immediate danger of collapse. Human activities along the shoreline also threaten the spawning and wintering grounds of these fish. Because the fish in the lake are a single, linked population, they must be managed collectively, with similar requirements in both The former Yugoslav Republic of Macedonia and Albania.

50. Both the phytoplankton and zooplankton communities are shifting to a species composition more characteristic of a mesotrophic, or more polluted, condition. The macrophytic plants and benthic fauna have also responded to the nutrient loading and contamination present in the shallow-water zone. These bioindicators are sending a clear message that the unique biodiversity of the lake may be permanently altered unless more stringent management actions are taken to reduce the amount of pollution loaded into the lake.

51. The industrial activities in the town of Pogradec (Albania) include alimentary, textile, metal and wood processing and other light industries. As wastewaters from these plants are discharged without treatment, they may be a significant source of pollution.

52. The major industries in The former Yugoslav Republic of Macedonia region include the production of automobile spare parts, metal and ceramic processing, plastics, textiles, shoes, electrical parts (including transformers, transmission equipment, circuit boards, fuses, and other parts), and food processing.

53. In the 1980s, the construction of a sewage collection system for towns in The former Yugoslav Republic of Macedonia along the shores of Lake Ohrid reduced the levels of faecal pathogens. This was a very positive step for the health of the people using the lake for drinking water and recreation. Unfortunately, there are still sections of the coast in both countries where pathogens from human waste pose a significant risk. The problem is most acute in the region around Pogradec, where faecal contamination is extremely high. The planned wastewater treatment plant will help solve this problem as well as reduce the amount of phosphorus and organic material entering the lake.

54. The sewerage from the town of Pogradec is a major contributor of phosphorus, and the planned wastewater treatment plant will significantly reduce the phosphorus load. Other sources of phosphorus are present throughout the lake basin. Because phosphorus detergents may be one of the largest contributors of phosphorus to wastewater, efforts to reduce their use should be strongly encouraged. Other management actions might include additional wastewater treatment, storm water management, stream bank stabilization measures, and other agricultural best management practices.

55. In the surrounding villages, the sewage is discharged directly into streams or onto the soil. Thus, the wastewater produced by over 60,000 inhabitants is discharged directly or indirectly into Lake Ohrid.

III. ASSESSMENT OF THE STATUS OF TRANSBOUNDARY LAKES SHARED BETWEEN EU AND EECCA COUNTRIES

A. Lake Drisvyaty/Drukshiai

56. Lake Drisvyaty (49 km^2) is one of the largest lakes in Belarus (6.7 km^2 in Belarus) and the largest in Lithuania (42.3 km^2). The deepest site of the lake is 33.6 m. The lake is of glacial origin and was formed during the Baltic stage of the Neman complex. The lake basin has an area of 613 km^2.

57. The water resources of the lake are of great value. The lake enables the functioning of the Ignalina nuclear power station and the Drisvyata hydroelectric station. On the Lithuanian side, the lake is used as a water-cooling reservoir for the Ignalina station. On the Belarusian side, the lake is used for commercial and recreational fishing.

58. Adjacent forests are exploited by the Braslav state timber industry enterprise. A tree belt approximately 1 km wide surrounding the lake plays an important role in water protection. The trees are cut down seldom and very selectively.

59. Scientific investigation of Lake Drisvyaty and its wetlands began in the early twentieth century. Regular monitoring of the wetlands was initiated before the construction of the nuclear plant in 1980. Studies focused on hydrochemistry and hydrobiology, and the results were published in numerous scientific papers.

60. The lake is deep and is characterized by a large surface area and thermal stratification of water masses, oxygen-saturated bottom layers of water, low concentration of phosphorus compounds, low eutrophication and the presence of a complex of glacial relict species. Altogether 95 species of aquatic and semi-aquatic plants are found in the lake. Blue-green algae dominate the phytoplankton community. The micro- and macrozooplankton are composed of 250 taxons. The communities of macrozoobenthos number 143 species. The most noteworthy is a complex of relict species of the quaternary period, among them *Limnocalanus macrurus, Mysis relicta, Pallasea quadrispinosa* and *Pontoporea affinis* (all entered into the Red Data Book of Belarus).

61. The ichtyofauna of the lake is rich and diverse. The 26 species of fish include some especially valuable glacial relicts such as *Coregonus albula typica*, the white fish *Coregonus lavaretus maraenoides,* and the lake smelt *Osmerus eperlanus relicta*. The raccoon dog, the American mink, beavers, weasels, ermine and polecats are common in the areas surrounding the lake, though the otter is rare. Almost all mammals economically valuable for hunting purposes are found in the adjacent forests.

62. The discharge of industrial thermal waters from the Ignalina power plant and non-purified sewage from the Lithuanian town of Sneckus are a problem. Accumulation of polluted sediments has been registered in deeper parts of the lake, 3.9% of the bottom is polluted with oil products, and 27.5% of the lake bottom sediments are moderately or heavily polluted with heavy metals (Pb, Cd, Cr, Zn, Cu) and petroleum hydrocarbons. As a result, the lake is turning into a moderately polluted water body.

63. Thermal pollution affects the lake extremely negatively the lake, resulting in eutrophication and subsequent degradation of the most valuable relict component of a zoo- and phytocenosis complex.

64. After the construction of a hydroelectric power station along the Prorva River, the water level of the lake rose up to one metre. This has resulted in the submerging of the lowered floodplain part of the wetland. The annual fluctuation of the lake water level is up to 0.9 metre, depending on the changes of filling. The Ignalina power station is connected to the lake by two channels. The amount of water discharged from the station is nine times the volume of the lake and 27 times the natural annual influx of water to the lake.

B. Lake Nuijamaanjärvi

65. Lake Nuijamaanjärvi (7.65 km^2) is shared by Finland (4.92 km^2) and the Russian Federation (2.73 km^2). It is a natural, shallow (mean depth 3.7 m) lake. The lake is situated south of the Salpausselkä ridge at the border of Finland and the Russian Federation in the Juustilanjoki river basin (112 km^2). The Saimaa canal, an intensively used shipping route from Finland to the Russian Federation, runs from Lake Saimaa to the Gulf of Finland in the Baltic Sea through Lake Nuijamaanjärvi. The theoretical retention time is only about 100 days. Some 28.2% of the catchment consists of agricultural land. The population density is 24 persons/km^2.

66. Transboundary monitoring has been carried out regularly since the 1960s. The sampling activity in stationary monitoring takes place twice a year (February/March and August), and

there are two sampling stations. National transboundary monitoring is carried out once a month at one sampling station. Physical and chemical analyses, including of phenols and mineral oils have been determined.

67. Pollution by the pulp and paper industry originates from Lake Saimaa via the Saimaa Canal. Canal traffic and harbour activity are the most important pressure factors. Eutrophication is the most significant threat.

68. The amounts of suspended solids and of organic matter have decreased slightly. The total nitrogen content has varied, while the total phosphorus content has decreased slightly. The electrical conductivity values have increased slightly. The basic levels of total nitrogen and total phosphorus concentrations suggest that Lake Nuijamaanjärvi is mesotrophic. However, the lake's ecological status is good and the situation is stable.

C. Lake Peipsi/Chudskoe Ozero

69. Lake Peipsi/Chudskoe is the fourth largest and the biggest transboundary lake in Europe (3,555 km^2, area of the lake basin 47,800 km^2). It is situated on the border between Estonia and the Russian Federation. Lake Peipsi belongs to the watershed of the Narva River, which connects Lake Peipsi with the Gulf of Finland of the Baltic Sea. The lake consists of three unequal parts: the biggest is northern Lake Peipsi/Chudskoe proper; the second biggest is Lake Pihvka/Pskovskoe, south of Lake Peipsi; and the narrow, strait-like Lake Lämmijärv/Teploe connects Lake Peipsi proper and Lake Pskovskoe. Lake Peipsi is relatively shallow (mean depth 7.1 m, max 15.3 m).

70. The annual inflow of freshwater to Lake Peipsi, calculated as a mean value for 1995–1998, was estimated to be 398 m^3/s, or approximately 12.6 km^3/a. Population density is approximately 23 persons/km^2.

71. The pollution load into Lake Peipsi originates mainly from three different sources:

(a) Point pollution sources, such as big towns (Pskov in the Russian Federation and Tartu in Estonia);

(b) Agriculture from point sources and diffuse sources (nutrient leakage from soils); and

(c) Atmospheric deposition.

72. Agriculture is responsible for 60% of the total nitrogen load (estimated values are 55% in Estonia and 80% in the Russian Federation) and 40% of the phosphorus load in Estonia, and for 75% of phosphorus load in the Russian Federation.

73. The total annual load of nutrients N and P to Lake Peipsi depends greatly on fluctuations in discharges during long time periods, and is estimated as 21,000–24,000 tons of nitrogen and 900–1,400 tons of phosphorus. Diffuse pollution has increased in recent years, partially because

of drastic changes in economy; sharply reduced industrial production means less pollution. Another factor influencing non-point pollution is forest cutting.

74. Lake Peipsi is particularly vulnerable to pollution because it is relatively shallow. Water quality is considered to be the major problem due to eutrophication. The first priority for the management of the lake is to slow the pace of eutrophication, mostly by building new wastewater treatment facilities. The expected future economic growth in the region, which is likely to increase the nutrient load into the lake, must be taken into account. Eutrophication also poses a threat to the fish stock of the lake, as economically less valuable fish endure eutrophication better. The pollution load from point sources, the poor quality of drinking water and ground water quality are other important issues to be addressed in the basin.

D. Lake Pyhäjärvi

75. Lake Pyhäjärvi (248 km^2) in Karelia is a transboundary lake between Finland (207 km^2) and the Russian Federation (41 km^2). The lake basin is divided between Finland (804 km^2) and the Russian Federation (215 km^2). The mean depth is 7.9 m on the Finnish side and 7.0 m on the Russian side. The maximum depth of the lake is 26 m (on the Finnish side). The theoretical retention time is 7.5 years. The lake basin on the Finnish side is mainly forested (almost 83%). About 13.5% of the basin is covered by arable land. Population density in the basin is approximately 9 inhabitants/km^2.

76. Lake Pyhäjärvi is a clear water lake valuable for fishing, recreation, research and nature protection. The anthropogenic impact is evident on the Finnish side, whereas the Russian side is considered almost pristine. The lake has been monitored since the 1970s.

77. The estimated nutrient load into Lake Pyhäjärvi has decreased since 1990. The phosphorus load has decreased by 55% and nitrogen by 12%. In particular, the phosphorus load from point sources has diminished. Some loading sources have closed or are closing.

78. The lake is very vulnerable to changes. Because of the low nutrient status and low humus concentration, an increase in nutrients causes an immediate increase in production, and the long retention time extends the effect of the nutrient load.

79. The main problem is incipient eutrophication because of non-point and point source loading, especially during the 1990s. The overall quality of the lake’s water is classified as excellent, although some small areas subject to more human interference receive lower ratings.

IV. ASSESSMENT OF THE STATUS OF TRANSBOUNDARY LAKES IN WESTERN EUROPE

A. Lake Galadus/Galadusys

80. Lake Galadus (7.37 km^2) lies in the Podlasie region in north-eastern Poland and in the western part of the Lithuanian Lake District. The mean depth of the lake is 12.7 m (the maximum is 54.8 m). The theoretical retention time is 5.7 years.

81. The border between Poland (5.6 km^2) and Lithuania (1.7 km^2) runs through the lake. Some 60% of the lake basin is agricultural land. About 1,800 people live in over a dozen villages in the area (about 20 people/km^2). The lake is used for recreational fishing, and there are also recreation residential plots around the lake.

82. In the 1990s there was well-organized monitoring activity by the Polish and Lithuanian environment protection services. The monitoring was first carried out throughout 1991–1995, and the research is to be repeated regularly every couple of years. Samples were collected at three locations on the lake and at three locations on the tributaries. Originally the samples were collected four times a year, but finally, according to the Polish methodology, the samples were collected twice a year (spring circulation and summer stagnation).

83. A normal set of physical and chemical analyses, as well as some biological analyses (e.g. for chlorophyll *a*, macrozoobenthos and phytoplankton) have been carried out. Also, some microbiological and radiological analyses were conducted in the monitoring programme.

84. The main problem of the lake is eutrophication connected with agricultural activities. The lake can be considered part of a mesotrophic group. It is characterized by an oxygen-saturated bottom layer of water and a low productivity level. According to the Polish classification, it belongs to class 2.

B. Neusiedler See/Lake Fertő-tó

85. Lake Fertő-tó is located in the east of Austria and shared with Hungary. It has a total surface area of 315 km^2, of which 240 km^2 is located in Austria and 75 km^2 in Hungary. More than half of its total area consists of reed beds; in certain parts the reed belt is 3 to 5 km wide. In the past the lake had no outflow, and therefore extremely large fluctuations of its surface area were recorded.

86. The lake has an average depth of 1.1 m; the maximum water depth is 1.8 m. In its history, it has dried out completely several times. Later, the Hanság Main Canal was built as the lake outlet. Since 1965, the water level has been stabilized by the outlet sluice based on an agreement of the Hungarian-Austrian Water Commission concluded in 1965. The main surface water input is through precipitation on the lake surface, with other inputs by the Wulka River, the Rákos Creek and other smaller tributaries. The groundwater inflow is negligible. Due to its low depth, the lake is quickly mixed by wind and therefore naturally turbid. The lake water is characterized by a high salt concentration.

87. The lake is characterized as the last and westernmost member of the so-called steppe-type lakes in Europe. In the assessment made in 2004 according to the Water Framework Directive, the Neusiedler See/Lake Fertő-tó is “not at risk” of failing to reach the environmental objectives of the Directive.

C. Lake Geneva/Lac Leman

88. Lake Geneva is a transboundary lake (580 km^2) in the alpine region shared between Switzerland (345.3 km^2) and France (234.8 km^2). It is the largest lake of Western Europe and a vast drinking-water reservoir. Lake Geneva is a deep lake; the mean depth is 152.7 m and the maximum depth 309.7 m. It represents a privileged habitat and recreation area. The anthropogenic impact is strong on both sides of the lake. Only 3% of the lakeshores are still natural.

89. As 20% of the lake basin (total area 7,975 km^2) consists of cultivated land, agriculture is clearly one of the pressure factors. The others are industries and urbanization.

90. In 1957, concerned by the growing pollution in Lake Geneva, a group of scientists introduced systematic monitoring of the water quality. Subsequently, the Governments of France and Switzerland founded the International Commission for the Protection of Lake Geneva (CIPEL), following an agreement signed in 1962. Today, CIPEL’s efforts include not only the protection of the lake water but also the renaturation of the rivers in the lake basin, whose biodiversity is threatened.

91. Eutrophication and industrial pesticides are the most serious water-quality problems. The lake has a good ecological status. Due to the long retention time (11.4 years), the restoration of the lake is slow, making it vulnerable to alteration.