UNITED
NATIONS

E

Economic and Social Council

Distr.
GENERAL

ECE/MP.WAT/WG.2/2007/17
20 June 2007

ENGLISH ONLY

ECONOMIC COMMISSION FOR EUROPE

MEETING OF THE PARTIES TO THE CONVENTION ON
THE PROTECTION AND USE OF TRANSBOUNDARY
WATERCOURSES AND INTERNATIONAL LAKES

Working Group on Monitoring and Assessment

Eighth meeting
Helsinki, Finland, 25–27 June 2007
Item 4 of the provisional agenda

ASSESSMENT OF THE STATUS OF TRANSBOUNDARY WATERS IN THE UNECE REGION[1]

ASSESSMENTS ON TRANSBOUNDARY LAKES IN WESTERN EUROPE AS WELL AS CENTRAL AND EASTERN EUROPE[2]

Submitted by the Chairperson of the Working Group on Monitoring and Assessment[*]

[1] At their fourth meeting (Bonn, Germany, 20–22 November 2006), the Parties to the Convention mandated its Working Group on Monitoring and Assessment with the assessment of transboundary rivers, lakes and groundwaters in the UNECE region. For details, please refer to documents ECE/MP.WAT/WG.2/2007/1 and ECE/MP.WAT/WG.2/2007/3.
[2] Assessments of other lakes in the region were published in document ECE/MP.WAT/2006/16/Add.1, and the updates of these assessments in document ECE/MP.WAT/WG.2/2007/16.

[*] The present document was submitted late due to resources constraints in the secretariat and late submission by some countries.

I. TRANSBOUNDARY PORTUGUESE-SPANISH LAKES

A. Alto Lindoso Reservoir[3]

1. The Alto Lindoso Reservoir is an artificial water body in the Lima River basin on the border between Spain (upstream country) and Portugal. The reservoir was reconstructed in the 1980s for hydropower purposes. Alto Lindoso is one of the most important hydropower plants for Portugal's energy sector. The reservoir has also significance for recreational uses.

2. The total surface area of the Alto Lindoso Reservoir is 10.72 km^2. The reservoir is relatively deep (maximum depth 109 m, mean depth 73 m) and its water storage capacity is relatively high (0.379 km^3). The maximum and average inflows are 1.39 km^3/a and 0.65 km^3/a, respectively. The total basin area of the reservoir is 1,525 km^2, from which 1,300 km^2 are in upstream Spain.

3. The status of this important hydropower reservoir is "mesotrophic". The main sources of nutrient loading are in the Spanish part of the basin.

B. Cedillo Reservoir[4]

4. The Cedillo (also known as Cedilho) Reservoir in the Tagus River basin on the border between Spain and Portugal was constructed for hydroelectric power production. With a depth of 117 m, the reservoir is a "deep water body". It has a total surface area of 14 km^2. The total volume of the reservoir is 0.260 km^3; the mean inflow equals 10.265 km^3 and the minimum outflow should not be lower than 2.7 km^3. The total basin area of the reservoir is relatively large (59,000 km^2), from which 55,800 km^2 are located in upstream Spain.

5. The reservoir has steep banks and occasional cliffs. It is also known as an important bird area and a potential site under the Ramsar Convention on Wetlands. The surrounding vegetation mainly comprises Mediterranean scrub, *Quercus* woodland, and some olive groves. The main human activities in the vicinity of the reservoir are livestock farming and hunting.

6. The reservoir has a high, but very varying mean concentration of phosphorus (varying between 97–325 µg/l in 2001–2006). For the same period of time, the BOD_5 concentrations varied between 1.2 and 3.0 mg/l; and NO_3 was between 2.3 and 4 mg/l.

7. The management of the reservoir is mainly based on the Convention on cooperation for the protection and sustainable use of the waters of the Spanish-Portuguese catchment areas that was signed in 1998 and entered into force in 1999.

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[3] Based on information from the Government of Spain and the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes (see http://www.unece.org/env/water/publications/documents/inventorylakes.pdf)

[4] Based on information from the Government of Spain and the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.

C. Frieira Reservoir[5]

8. The Frieira Reservoir is an artificial lake constructed for hydroelectric power production. The reservoir is situated in Spain in the Mino River basin in the border area between Spain and Portugal, but both countries jointly manage it.

9. Constructed for hydropower production purposes, the Frieira Reservoir is shallow (mean depth 20 m, maximum depth 27 m) and has a surface area of 4.66 km^2. Due to its shallowness, the water storage capacity of the reservoir is relatively small (0.044 km^3). The mean inflow is 9.524 km^3/year and the minimum outflow 3.7 km^3/year.

10. The status of the reservoir is “mesotrophic” (mean total phosphorus concentration 29 µg/l); its water quality and quantity is regularly monitored.

11. The management of the reservoir is mainly based on the Convention on cooperation for the protection and sustainable use of the waters of the Spanish-Portuguese catchment areas that was signed in 1998 and entered into force in 1999.

D. Miranda Reservoir[6]

12. The Miranda Reservoir is a man-made lake situated in the Douro River basin on the border between Spain (upstream country) and Portugal. The reservoir was constructed for hydropower purposes. It is also used as a source for water supply and for recreation, especially bathing.

13. The total surface area of Miranda Reservoir is small, only 1.22 km^2. The maximum depth is 68 m and mean depth 45 m. Due to its small surface area, the reservoir’s water storage capacity is also small (0.0281 km^3). The mean water inflow and outflow is relatively high and equals 284 m^3/s.

14. Eutrophication is a particular issue in this hypertrophic reservoir.

II. TRANSBOUNDARY LAKES IN THE RHINE BASIN

A. Lake Constance[7]

15. Lake Constance, which belongs to the Rhine basin, is the second largest pre-Alpine European lake and serves as an important drinking water supply for 4 million people.

16. The lake basin is situated in the Molasse basin of the northern Alpine foreland and was mainly formed by water and ice activity during the last Quaternary glaciation period more than

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[5] Based on information from the Government of Spain and the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.

[6] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.

[7] Based on information provided by the Governments of Austria, Germany and Switzerland.

15,000 years ago. The lake basin area of about 11,000 km² (~20 times the lake surface) covers the territories of the four European countries: Germany (28%), Switzerland and Liechtenstein (48%) and Austria (24%). With an area of 572 km2 and a total volume of 48.5 km^3, Lake Constance lies 395 m above sea level. Its two major parts are the Upper Lake Constance (472 km^2, 47.6 km^3, max. depth 253 m, mean depth 101 m) and Lower Lake Constance (62 km^2, 0.8 km^3, max. depth 40 m, mean depth 13 m). More than 75% of the water inflow originates from the Alps, mainly through the tributaries Alpine Rhine (Alpenrhein) and Bregenzerach (theoretical water renewal time 4.3 years).

17. The phytoplankton succession typically shows a spring bloom followed by the “clear water” phase with very low phytoplankton abundance due to zooplankton grazing. Diatoms contribute up to 90% of the phytoplankton bio-volume in spring. Phytoplankton, bacteria and crustaceans are the most important contributors of biomass. During summer, zooplankton is the main food source for most fish in Lake Constance. About 30 species of fish contribute to the fauna of Lake Constance. The dominant species are whitefish (*Coregonus lavaretus L.*) and perch (*Perca fluviatlis L.)* – contributing to 90% of total commercial fishing yield (1032 tons, annual mean for the period 1995–2004).

18. Lake Constance is certified by the Ramsar Convention as a habitat of international importance especially for water and wading birds. It is an intensively monitored hard-water lake with low-phosphorus content - overall mesotrophic (the Upper Lake is almost oligotrophic: Phosphorus levels < 10 µg/l since 2005). Originally an oligotrophic water body, eutrophication started to threaten the lake in the late 1950s and remarkably affected the species composition of the biota. Starting in the early 1980s, phosphorus concentrations strongly declined, and overall water quality improved. This was due to reduced nutrient loads (more than €4 billion have been invested to improve sewage treatment).

19. In recent times, the pressures by rising population figures and industrial and agricultural activities may deserve concern. Today, some 60% of shore and shallow-water zones are characterized as deviating from the natural state, and therefore a main focus is on ecological improvement by shoreline restoration. For this purpose, the International Commission for Protection of Lake Constance has initiated an action programme “Shore-water and Shallow-water Zone”.

20. The biological quality of tributaries discharging into the lake varies from unpolluted headwater rivers to slightly polluted lower reaches. Hydromorphological changes have been severe in these areas, as canalization and artificial riverbeds and banks are common. Recently, revitalization has been undertaken in the floodplains of the Alpine Rhine, the main tributary discharging into the lake.

21. Lake Constance is also facing climate change with increasing winter temperatures and higher precipitation in the form of rain. The summers will be dryer and hotter resulting in lower water levels and changes in the littoral zone. This climatic change might be accompanied by an increasing number of exotic species in the future, which may threaten indigenous biota.

III. TRANSBOUNDARY LAKES IN THE PO BASIN

A. Lake Lugano[8]

22. Lake Lugano, a transboundary lake shared by Italy and Switzerland, belongs to the Po River basin. The lake is a popular place for recreation activities.

23. The lake has a surface of 48.9 km^2 and basin area of 565 km^2. Lake Lugano is divided into two main parts, the northern part being deep and the southern part relatively shallow. The volume of the lake is 6.5 km^3 and its theoretical retention time is approximately 8.2 years (11.9 years in the northern part and 2.3 years in the southern part).

24. In the 1960s, the lake was heavily polluted by anthropogenic sources and became eutrophic. The period was characterized by high phosphorus concentration and oxygen deficiency in the bottom water layers. Since the 1970s, the lake has recovered substantially, mainly due to eight wastewater treatment plants that gradually came into operation and use mechanical, chemical and biological treatments. In 1986, Italy and Switzerland began to eliminate the phosphorus in detergents and cleaning products. Since 1995, the main sewage treatment plants have improved their efficiency by introducing phosphorus post-precipitation, denitrification and filtration treatments. During the last 20 years, recovery measures have reduced the external phosphorus load from about 250 to 70-80 tons/year. The improved water status is also visible in the n Secchi-disk transparency, which has increased from 3.5 to 5.5 m. Currently, the external nutrient load derives from anthropogenic (85%), industrial (10%) and agricultural (5%) sources.

B. Lake Maggiore [9]

25. Lake Maggiore (Lago Maggiore) is a large pre-Alpine lake situated west of Lake Lugano on the border between Italy and Switzerland. It offers good possibilities for fisheries, navigation, tourism and recreation (swimming, sportfishing, yachting). The lake belongs to the sub-basin of the Ticino River, a tributary of the Po River.

26. Lake Maggiore has a relatively large drainage basin (6,600 km^2) covered, inter alia, by woody vegetation (20 %), rocky outcrops and depris (20 %), permanent snow, and glaciers and lakes. The lake is 65 km long and 2–4.5 km wide and has a surface area of 213 km^2. The total volume of this deep lake (mean depth 177 m, maximum depth 372 m) is 37.5 km^3, and its theoretical retention time is 4 years.

27. Lake Maggiore underwent a process of eutrophication in the course of the 1960s and 1970s due to phosphorus inputs from municipal sewage, changing its status from oligotrophic to meso-eutrophic. Starting from the late 1970s, the phosphorus load has been gradually reduced; the total phosphorus in-lake concentration is currently below 10 µg/l (at winter mixing), compared to a maximum value of 30 µg/l in 1978.

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[8] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.
[9] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.

IV. TRANSBOUNDARY LAKES IN THE DANUBE BASIN

A. Lake Iron Gate I[10]

28. Iron Gate is a gorge between the Carpathian and Balkan mountains on the Danube River on the border between Romania and Serbia. Earlier, it was an obstacle for shipping.

29. Iron Gate I (upstream of Turnu Severin.) has one of Europe's largest hydroelectric power dams. The dam was built by Romania and the former Yugoslavia between 1970 and 1972.

30. The total area of the lake is 260 km^2 and the total volume 2.4 km^3. The lake is relatively shallow, the mean depth being 25 m and the deepest point being 40 m. The lake has been monitored for a number of physical, chemical, biological, microbiological and radiological determinands. The riparian countries consider that there are no major water-quality problems in Iron Gate I.

B. Lake Iron Gate II[11]

31. Iron Gate II downstream of Turnu Severin is smaller (78 km^2) than Iron Gate I; the total volume of the lake (0.8 km^3) is one third of that of Iron Gate I. The lake is even shallower than Iron Gate I, the mean depth being 10 m and the deepest point being 25 m. The lake is also monitored similarly to Iron Gate I. The riparian countries consider that Iron Gate II has no serious water-quality or water-quantity problems.

C. Lake Neusiedl/Fertő-tó

32. Document ECE/MP.WAT/WG.2/2007/16 contains an update to the assessment made earlier (ECE/MP.WAT/2006/16/Add.1).

D. Lake Stanca-Costesti[12]

33. The Stanca-Costesti Reservoir is a transboundary lake shared by Moldova and Romania. It is part of the sub-basin of the Prut, a transboundary tributary to the Danube**.** The reservoir was built for hydropower purposes during 1973 - 1978.

34. Constructed on the Prut approximately 580 km upstream of its confluence with the Danube, the dam (47 m high and 3,000 m long) retains a volume of 735 million m^3 at the normal water level. The discharge is 82.9 m^3/s (2.6 km^3 per annum). The area of the river basin upstream of the reservoir is 12,000 km^2. The surface area of the reservoir is 59 km^2, the mean depth 24 m and the deepest site 41.5 m. Water level changes are about 8 m between the normal and lowest levels. The theoretical retention time is 30 days during the spring floods and about 180 days

[10] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.
[11] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.
[12] Based on information provided by the Ministry of Environment and Water Management, Romania.

during the rest of the year. The area in the vicinity of the reservoir is covered by arable lands (70%), perennial crops (17 %), forests and urban areas.

35. The Stanca-Costesti Reservoir has been monitored since 1984. Sampling sites are located near the dam (at surface and 10 m depth), in the middle of the reservoir (at surface and 5 m depth) and the end of the backwater. The sampling frequency is four times a year. Besides chemical and biological sampling of the water, the sediment is also sampled for a variety of determinands, especially hazardous substances.

36. Due to the high volume of water in the reservoir, the aquatic ecosystem has a substantial self-purification capacity and the reservoir can annihilate loadings of certain pollutants.

37. The main hydromorphological pressure due to the dam is discontinuity of flow and flow regulation.

38. Diffuse pollution by nutrients and accumulation of heavy metals are the most serious pressure factors. However, the overall water quality (for the majority of indicators) of the reservoir is classified as “1st category” under the Romanian water-quality classification system.

V. TRANSBOUNDARY LAKES IN THE BARENTS SEA BASIN

Lake Inari[13]

39. Lake Inari is a large (1,043 km^2), almost pristine clear-water lake situated in northern Finland, some 300 km north of the Arctic Circle. The lake belongs to the Paatsjoki basin.

40. The lake is relatively deep (maximum depth 92 m, mean depth 14.3 m) and has a total volume of 15.9 km^3 with a retention time of a bit over 3 years. The shoreline is very broken and there are over 3,000 islands in the lake. The lake drains through the Paatsjoki River to the Barents Sea. The lake is regulated by the Kaitakoski power plant located in the Russian Federation. The annual water level fluctuation is normally 1.45 m. The freezing period starts in November and lasts until June.

41. The drainage basin is very sparsely populated (0.47 persons/km^2), and consists mainly of mires, low-productive land and pine forests on moraine soil, and is mainly used for forestry and reindeer herding. Due to lack of substantial human impact in the lake basin, a lot of relatively small nutrient loading, especially nitrogen loading, comes as atmospheric deposition. Ivalo village (4,000 inhabitants) discharges its purified wastewaters through the Ivalojoki River to the south-western corner of the lake. The lake retains nutrients effectively and thus the transboundary impact to the Russian Federation is very low.

42. The lake has been monitored intensively for decades for physico-chemical determinands by the Finnish Environmental Authorities. Furthermore, biological monitoring (phytoplankton,

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[13] Based on information provided by the Finnish Environment Institute (SYKE) and the Lapland Regional Environment Centre.

macrophytes, fish) is getting more important, as the Water Framework Directive requires it. The discharge has been monitored daily since 1949 in the Kaitakoski power plant.

43. The water quality of Lake Inari is excellent. Nutrient levels and colour values are low and oxygen concentrations of the deep areas remain good throughout the year. The western parts of the lake are naturally more nutritious and coloured than the eastern and northern parts due to inflow from several large rivers. Although the regulation has some undesirable effects on Lake Inari's biota, the overall status is good. Fish stocks and community structure are in good status, bearing in mind that the natural state of fish fauna has been altered by former introduction of new species and present compensatory fish stockings. The water quality and ecological status have remained quite stable for several decades.

44. There is no finalized classification of Lake Inari's ecological status according to the classification requirements set by the Water Framework Directive. However, it is probable that no major changes compared to the general national classification of water quality are to be expected in the near future. Lake Inari will most likely maintain its reputation as one of the most pristine and beautiful lakes in Finland. However, it is likely that water level regulation will likely have adverse effects on the lake (bank erosion and impaired circumstances for fish spawning and bird breeding).

VI. TRANSBOUNDARY LAKES IN THE BALTIC SEA BASIN

A. Lake Nuijamaanjärvi

45. The lake is part of the Juustilanjoki basin. Its assessment is contained in document ECE/MP.WAT/WG.2/2007/6.

B. Lake Pyhäjärvi

46. The lake is part of the Vuoksi River basin. Its assessment is contained in document ECE/MP.WAT/WG.2/2007/6.

C. Lake Saimaa

47. The lake is part of the Vuoksi River basin. Its assessment is contained in document ECE/MP.WAT/WG.2/2007/6.

D. Lake Drisvyaty/Druksiai

48. The lake belongs to the Daugava River Basin District. Its assessment is part of documents ECE/MP.WAT/2006/16/Add.1 as well as ECE/MP.WAT/WG.2/2007/16.

E. Lake Galadus

49. Lake Galadus belongs to the Neman River Basin district. Its assessment is part of documents ECE/MP.WAT/2006/16/Add.1 as well as ECE/MP.WAT/WG.2/2007/16.

F. Lake Peipsi

50. Lake Peipsi belongs to the Narva River basin. Its assessment is part of documents ECE/MP.WAT/2006/16/Add.1 as well as ECE/MP.WAT/WG.2/2007/16.

G. Narva reservoir

51. The Narva reservoir belongs to the Narva River basin. Its assessment is part of documents ECE/MP.WAT/WG.2/2007/7.

VII. TRANSBOUNDARY LAKES IN THE MEDITERRANEAN SEA BASIN

A. Lake Dojran

52. Lake Dojran belongs to the Vardar River basin. Its assessment is part of documents ECE/MP.WAT/2006/16/Add.1 as well as ECE/MP.WAT/WG.2/2007/16.

B. Lake Ohrid

53 Lake Ohrid belongs to the Drin River basin. Its assessment is part of document ECE/MP.WAT/2006/16/Add.1.

C. Lake Prespa

54. Lake Prespa belongs to the Drin River basin. Its e assessment is part of documents ECE/MP.WAT/2006/16/Add.1.

D. Lake Shkoder[14]

55. Lake Shkoder (also known as Skadar), one of the largest lakes on the Balkan Peninsula, is shared by Albania and Montenegro. It belongs to the Drin River basin. Lake Skoder discharges through the transboundary Bojana/Buna River (44 km; average flow 320 m^3/s) into the Adriatic Sea.

56. The total size of the lake varies considerably due to varying water inflow and use, from 369.7 km^2 at low water to up to 530 km^2 at high water. The lake has a transboundary catchment area of 5,180 km^2, with a medium elevation of 770 m above sea level.

57. Lake Shkoder receives its waters mainly by the 99-km-long Moraca River, which has its source in the central Montenegrin mountains and is altered by four hydropower plants. The lake

[14] Based on the Background document for the Guidelines on Monitoring and Assessment of Transboundary and International Lakes.

is famous for a wide range of endemic and rare, or even endangered, plant and animal species. About half of the 250 recorded bird species breed on the lake, including the westernmost breeding site for the Dalmatian Pelicans in Europe and the second largest colony of the Pygmy Cormorant world-wide. Especially due to the bird fauna, the lake has a highly significant international importance. The lake is also home for some endemic reptiles. Its northern shores are flat with extensive reed beds around the Montenegrin tributaries. The Montenegrin side is protected as a national park (40,000 ha) and a Ramsar site.

58. Human activities have a considerable impact on the Lake Shkoder ecosystem, either directly or indirectly. Major direct factors are irrigation, drainage, poaching and overfishing, and major indirect factors are poor wastewater management and illegal landfills. The only substantial industrial area is the Lake Shkoder region.

59. Approximately 40% of the lake basin is agricultural land and 10% pastures. Due to the high nutrient loading, the lake has eutrophied slightly. One of the basic problems is insufficiently treated sewage water. For example, the Podgorica wastewater treatment plant is designed for 55,000 people, but is currently servicing 150,000. Besides eutrophication, intensive fishing has led to a decline of food for fish-eating birds. Especially due to its international importance for many bird species, Lake Shkoder still needs special attention and protection measures to guarantee the proper state of this unique lake ecosystem.
