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# **Ecological state of lakes in Central and Eastern Europe**

## **IWAC-SHMI, BRATISLAVA, SLOVAKIA**

# Second Assessment of transboundary rivers, lakes and groundwaters

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- the most comprehensive, up-to-date overview of the status of transboundary waters in the European and Asian parts of the UNECE region.
- request by the Sixth “Environment for Europe” Ministerial Conference as an input for the Seventh Ministerial Conference in Astana in September 2011.
- data and information provided by national Governments and river commissions,
- assessment presents a broad analysis of transboundary water resources, pressure factors, quantity and quality status, transboundary impacts, as well as responses and future trends.
- subregional focus - characteristics and specificities of five UNECE subregions: Western and Central Europe; South-Eastern Europe; Eastern and Northern Europe; the Caucasus; and Central Asia.

# Lake Neusiedl

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Lake Neusiedl is located on the Austrian and Hungarian border. It belongs to the Danube River Basin District.

Lake Neusiedl is a natural lake of tectonic and erosion origin, “soda lakes” in Europe.

The age of the lake is 10-15 thousand years. The basin has a lowland character. Lake Neusiedl is visited by around 1.4 million tourists per year.

- two major inflows: the Wulka River in Austria (mean discharge  $0.53 \text{ m}^3/\text{s}$ ; average for the years 1966–2008), the Rakos-creek in Hungary (mean discharge  $0.049 \text{ m}^3/\text{s}$ ; average for the years 1994–2006).
- no natural outflow, the artificial, regulated, Hansag-Channel, the overflow through the outlet gate in Fertőszel was  $1.44 \text{ m}^3/\text{s}$  (about  $45.5 \times 10^6 \text{ m}^3/\text{year}$ ) in 2009.

Catchment area: 1120 km<sup>2</sup>

Lake surface 315 km<sup>2</sup>

Austria: 240 km<sup>2</sup> , Hungary: 75 km<sup>2</sup>

Reed surface: 180 km<sup>2</sup> , Austria: 117 km<sup>2</sup> , Hungary: 63 km<sup>2</sup> ,  
Hungary's lake surface covered 85% by reed





# Lake Neusiedl - Pressures

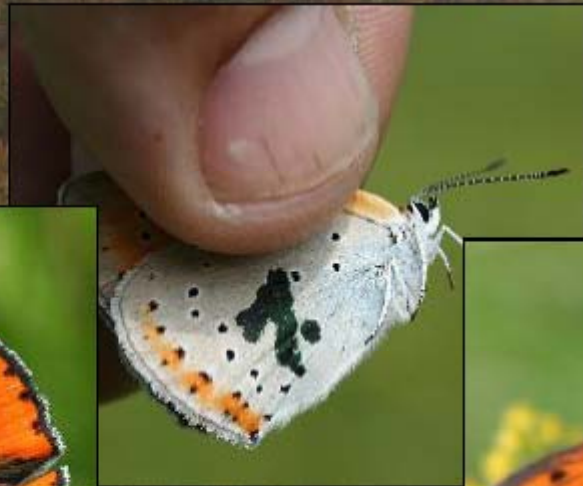
- urban wastewater is collected – need is advanced treatment (nutrient removal), no significant pressures in place in the catchment.
- agriculture, moderate, as considerable parts of the catchment are either Natura 2000 areas or national park.
- three harbours in the Hungarian part of the lake, and some recreational use thereof.





# Ecological studies:

- Species survival, population studies (Orsin's Viper, dogfish)
- Migratory bird ringing, population estimation
- Estimation of special invertebrate populations
- Studies supporting management
- Monitoring studies



# Lake Neusiedl - Status and transboundary impacts

- high salt concentration, alkaline pH, a high content of dissolved organic matter. The shallow lake (maximum depth is less than 2 metres), is mesoeutrophic. The lake is turbid and opaque, with a low degree of transmission.

Lake Neusiedl had a good ecological and chemical status in 2009, according to the requirements of the WFD. Since the 1990s and the early 2000s, the diffuse nutrient load (e.g., nitrate-nitrogen) has markedly decreased.

The most serious water-quality problems affecting the status of the lake are the following:

- nutrient pollution, water quality problems occurring especially in the reed belt (low oxygen in the summer);
- occasional low water levels;
- spread of the reed-belt that causes a decrease of the water surface, and reed over-growth in channels;
- the accumulation of sediments, which is characteristic of the southern part of the lake, due to the dominant wind-direction.

# Lake Cahul/Kagul

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Kagul, shared by Ukraine and the Republic of Moldova.

605 km<sup>2</sup> of the basin area is Moldovan territory.

Ukrainian territory is mainly downstream from the lake.

- In the period from 2005 to 2009, water in Lake Cahul/Kagul fell in to water quality class III, “moderately polluted water” accordingly to the Moldovan national Water Pollution Index.

Other lakes: Lake Yalpuh, Lake Sasyk

- Pressure factors: pollution from urban wastewaters, from agriculture (irrigation); both classified as local but severe by the Republic of Moldova. The importance of industrial wastewater discharges and eutrophication is ranked as local and moderate.



# Lake Geneva

- one of the largest lakes in Western Europe, 580 km<sup>2</sup>, and has a volume of 89 km<sup>3</sup>, 60% Switzerland, the rest to France.
- the lake forms part of the course of the river Rhone glacial origin, with an average depth of 153 m, maximum depth of 310 m.
- important as a source of drinking water, second most important wintering area for water birds in France.
- **Lake Emosson is located in the Swiss part of the Rhone basin and it is formed by a dam, which is jointly operated by France and Switzerland for hydropower generation.**
- **Po river basin: Lake Lugano - on the border between Italy and Switzerland, Lake Maggiore sub-basin of the Ticino River, a large pre-Alpine lake situated west of Lake Lugano, on the border between Italy and Switzerland. recreation and tourism activities only have a moderate impact.**

# Lake Constance

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- belongs to the Rhine Basin, is the second largest pre-Alpine European lake, an important drinking water supply for 4 million people, shared by Switzerland, Liechtenstein and Austria.
- It is an intensively monitored hard-water lake with low phosphorus content. The Upper Lake is almost oligotrophic: phosphorus levels (<10 µg/l since 2005), eutrophication started to threaten the lake in the late 1950s, and remarkably affected the species composition of the biota. Phosphorus concentrations strongly declined during 1980s, and overall water quality improved.

# Lakes in Basin Krka and Drin

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Major lakes in Krka basin are Lake Brijun (man-made), Lake Golubić (man-made), Lake Visovac (natural), and Lake Prokljan (natural). The river basin is shared by Croatia and Bosnia and Herzegovina.

- pressure from agriculture is insignificant as agricultural production of fruits, vegetables and olives is still low, as is animal husbandry. Sustainable agriculture and technological development are necessary.
- River basin Drin include Ohrid and Skadar/Shkoder Lakes. Ohrid - largest lake in volume in South-Eastern Europe, and one of the oldest in the world; it was formed 2 to 3 million years ago. The lake is shared by the former Yugoslav Republic of Macedonia and Albania.



# Lake Ohrid and Prespa

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- Lake Ohrid has been isolated by surrounding mountains, has unique collection of plants and animals have evolved; some of these are now considered relics or “living fossils”. UNESCO World Natural Heritage Site since 1980. The lakeshore reedbeds and wetlands provide a critical habitat for a high number of wintering water birds.
- Prespa comprises two Lakes separated by a natural narrow strip of land: Micro (Small) Prespa and Macro (Big) Prespa. MicroPrespa sits 8 m higher than Macro Prespa. A natural canal with sluice gates (reconstructed in 2004) connects the two lakes. Micro Prespa is shared by Albania and Greece, while Macro Prespa is shared by Albania, Greece and the former Yugoslav Republic of Macedonia.

# Lake Skadar/Shkoder

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Lake Skadar/Shkoder is the largest lake by surface in the Balkan Peninsula.

In general, the quality of the lake's water is considered to be reasonably good. Total biodiversity is high, and the region is considered to be a biogenetic reserve of European importance.

Lake Skadar/Shkoder and the Buna/Bojana basin still need attention and measures to protect the state of this unique ecosystem.

## **Pressures**

Agricultural, industrial pollution and pollution from municipal wastewater. Due to the nutrient loading, the lake has eutrophied slightly.

Inadequate solid waste management and illegal disposal of wastes directly to the water bodies has exerted pressure on the lake's system.

Heavy metal pollution, especially in lake sediments, and moderate pathogen loads have been observed locally in the aquifer.

# Lake Dojran/Doirani

Lake Dojran/Doirani is a small (total area 43.1 km<sup>2</sup>) tectonic lake, with a basin of 272 km<sup>2</sup>. The lake is shared by the former Yugoslav Republic of Macedonia (27.4 km<sup>2</sup>) and Greece (15.7 km<sup>2</sup>). The lake is rich with fish – 16 species. In general, the quality of the lake's water is considered to be reasonably.

## Pressures

- Water abstraction, resulting in the decline of groundwater levels. Over the last 20 years, the lake's level has also dropped continuously due to increasing Greek abstraction
- Pollution is caused by municipal wastewater, municipal solid wastes, sewage from tourist facilities, and agricultural point source and non-point source pollution; its impacts - in both countries.
- Water quality is characterized by high alkalinity and elevated carbonate and magnesium hardness, concentrations of certain toxic substances are near or even toxic levels.
- In Greece are high values of phosphates; low concentrations of heavy metals in the aquifer.



# Narva Reservoir, Lake Peipsi

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- Lake Peipsi/Chudskoei is the fourth largest lake in Europe in terms of surface area, it is largest transboundary lake in Europe.
- Lake Peipsi/Chudskoe is "very polluted,, (Russian national water-quality classification), by Estonia it is as moderate and Lake Pihkva as bad. Lake is vulnerable to pollution because of its relatively shallow depth (on average some 7 metres). It is becoming more eutrophic, a particularly rapid process in its southern basin. The construction of several new sewage treatment facilities improved water quality
- Estonia and the Russian Federation, which share Lake Peipsi/Chudskoe, have designated Ramsar Sites on the western and south-eastern shores of the lake.

# Lake Drisvyata/Druksiai

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Lake Drisvyata/Druksiai is a transboundary lake shared between Belarus and Lithuania. The area of the lake is 44.5 km<sup>2</sup>.

- catchment area is 604/621 km<sup>2</sup>.
- very susceptible to anthropogenic impact
- thermal pollution from the Ignalina nuclear power plant in Lithuania, which was closed at the end of 2009 (the lake was used as a cooling reservoir).

# Lake Galadus/Galandusys

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Lake Galadus/Galandusys (total surface area 7.37 km<sup>2</sup>, 5.6 km<sup>2</sup> is in Poland and 1.7 km<sup>2</sup> in Lithuania, lies in the Podlasie region in Poland, and in the western part of the Lithuanian Lake District.

- 60% of the lake basin is agricultural land, and agriculture is causing eutrophication of the lake.
- Its current status can be considered as “mesotrophic”, which corresponds to water-quality class 2 of the Polish classification.
- About 1,800 people live in the area, making the population density about 20 people/km<sup>2</sup>.
- The lake is used for recreational fishing and there are also recreation residential plots around the lake.



**Thank you for your attention**

