Transboundary Waters Management Symposium

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Lake Ohrid
Environmental State and Trends

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1. Transboundary lakes

- In the world there are over than 5,000,000 lakes
- 60 of the these lakes are transboundary
- Albania and Macedonia shear with neighbours 3 lakes each
- Other trounsboundary lakes besides Lake Ohrid:

  Albania: Lake Shkodra/Skadar with Montenegro, Prespa' Lakes with Macedonia and Greece

  Macedonia: Lake Dojran with Greece, Lake Macro Prespa with Albania and Greece

2. Lake Ohrid

Location: 41° 05' , 20 ° 45'
Altitude: 659 m a.s.l.
Area: 358 km² form which:
1/3 belongs to Albania, 2/3 to Macedonia

Shoreline: 88 km: 31.5 km 56.5 km
Maximal length: 30 km

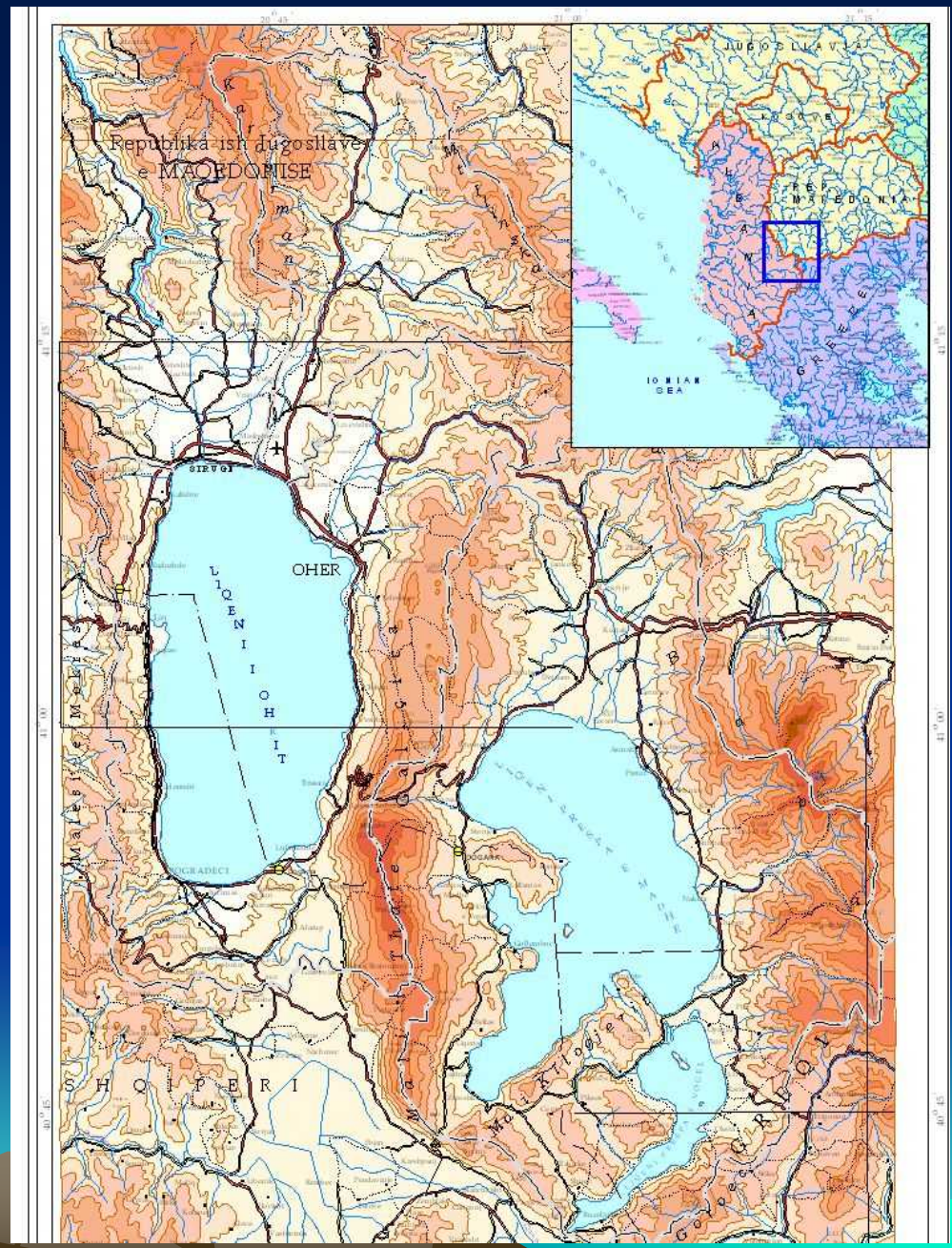
Maximal width: 14.5 km
Maximal depth: 289 m
Mean depth: 164 m

Volume 58 km3
Catchments area: over 2000 km² (including catchments area of river Sateska and Lake Prespa)

Retention time: over 80 years
Origine: tectonic

The age: 4-10 mio year old
Inflows: about 40 rivers (Sateska, Koselska, Cerava) and streams and springs from Lake Prespa
Outflows: River Black Drin/Drim 22 ³/sek (78%), evaporation (22%)

Trophic state: oligotrophic



3. Natural and historical values

- The oldest lake in the Europe
- Geographical position, age and oligotrophice state; main factors for conserving world uncial collection of flora and fauna
- 220 endemic species from flora
- Infusore: 80%
- Gastropode: 90%
- Ostracode: 66%
- Fish: 60%
- 17 native fish species from which 10 endemic
- Over 400 algal species
- More than 60,000 birds reiterated during the census of 2003
- For its age and rich endemism Lake Ohrid is considered: *Museum of Living Fossils*

3. Natural and historical values (cont.)

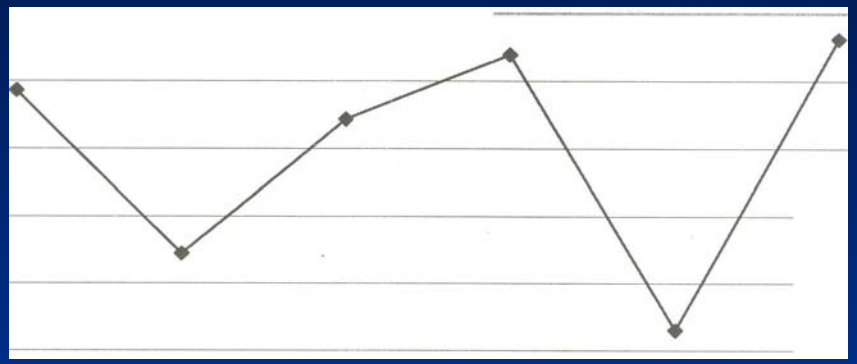
- The flora and fauna of the watershed is also rich in the diversity of plans and animals (more than 40 species of medicinal plants)
- Lake Ohrid watershed is also rich in historical, cultural, educational and archaeological values (lake's shore has been populated since 6,000 years BC)
- Landscape with a variety of lake, rivers, mountains, meadows and hills covered by forests makes LO and its surroundings a very attractive place as tourists destination.
- Both countries has given statues of Protected Areas most of the pars of LO watershed (National Park/Monument, Protected Landscape)
- UNESCO has declared since 1980 part of the Macedonian side of Lake Ohrid including the town with the same name *World Natural and Cultural and Heritage Site*

4. Environmental issues

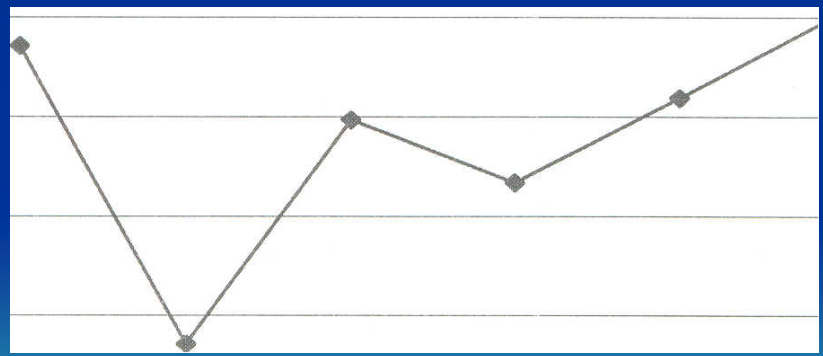
- Pressure from human activities
- 200,000 inhabitants are living in the area around the LO and its watershed (5 times more than half century ago)
- Phosphorous
- Bacterial pollution
- Industrial activities
- Urban solid waste
- Agriculture pollution
- Destruction of lakeshore lines and habitats
- Decline of fish catch s and animals (more than 40 species of medicinal plants)

Phosphorous sources:

- Untreated sewage wastewater from town of Pogradec and communes
- Rivers Sateska, Koselsla, Velgoska, Cerava
- Diffused sources of phosphorous from agriculture land, forestry pasture and livestock
- Inflows from Lake Prespa (actually in meso-eutrophic state)
- Actual situation of the content of P as was identified in SOER
- There is a continuous increase of P in the littoral waters
- The species of phyto and zooplankton, typically for mesotrophic state are more present in LO particularly in the littoral of urban zones.



Mean total phosphorus concentration (Ilg/L) in the water column at Station 1 in Lake Ohrid, April 2000 _ May 2001'.



Mean total nitrogen concentration (Ilg/L) in the water column at Station 1 in Lake Ohrid, April 2000 - May 2001.

Phosphorous sources: (cont.)

Table 4.1. Total Phosphorus Concentration in Lake Ohrid Station 6, 2000-2001 (µg/l).

	Month.year				
Depth (m)	**2.00**	**4.00**	**7.00**	**9.00**	**12.00**
Surface	3	3	10	3	3
10	3	3	8	3	3
20	3	3	8	3	3
30	3	3	10	3	3
40	3	6	10	3	3
50	3	6	12	3	3
75	3	3	10	3	3
100	3	3	12	3	3

	Month.year						
Depth (m)	**3.01**	**4.01**	**5.01**	**7.01**	**8.01**	**9.01**	**11.01**
Surface	8	4	8	3	10	3	3
10	4	4	8	3	8	3	3
20	5	3	4	5	8	3	3
30	4.5	3	10	7	10	3	3
40	4.5	3	8	4	10	3	3
50	4	3.5	10	3	12	3	3
75	9	3.5	8	4	10	3	3
100	4	3.5	4	5	12	3	3

Table 4.2. Total Phosphorus Concentration in Lake Prespa Station 9, 2000-2001 (µg/l).

	Month.year			
Depth (m)	**4.00**	**8.00**	**9.00**	**12.00**
Surface	5	20	30	30
10	10	19	30	40
17	10	10	13	30

	Month.year						
Depth (m)	**3.01**	**5.01**	**7.01**	**8.01**	**9.01**	**10.01**	**11.01**
Surface	21	16	25	20	5	30	26
10	24	18	20	50	7	25	29
15	30	18	30	110	25	25	

Bacterial pollution

The sources of this kind of pollution are sewages from urban centres, mainly from town of Pogradec but also communes around the shoreline of the lake

Results of monitoring of E.Coli (1999-2000) for Macedonian side of LO (tab 4.7) and for Albanian side in the tab. 4.20

UNEP/WHO standard for bathing water is 100-1000 E.Coli/100 ml water

Bacterial pollution is a serious problem in some areas of Albanian littoral waters. 58% of samples analysed compiled with standards

Table 4.7. Presence and level of contamination with the bacterium *E. coli*.

Locality	Min. no./100ml	Max. no./100ml	Average no./100ml	% above 1000/100 ml	Level of contamination
River Velgoska	0	680,000 (II-2001)	79,713 ± 139,136	84%	Highly polluted
Velgoska -littoral	0	68,000 (XI-2001)	7,826 ± 14.892	56%	Highly polluted
River Cerava	0	56,000 (VI-1999)	6,545 ± 13,150	36%	Highly polluted
Cerava-littoral	0	2,000 (IX-2001)		21%	Polluted
Village Pestani	0	3,000 (VIII-2001)	316 ± 820	15.8%	Polluted
Hotel Metropol	0	2,000 (VI-2000)	100 ± 447	5.3%	Polluted
Ohrid Bay	0	16,000 (VII-2001)	1,526 ± 4,599	10.5%	Very polluted
Village Kalista	0	0	0 ± 0	-	Unpolluted
Camp Radozda	0	0	0 ± 0	-	Unpolluted

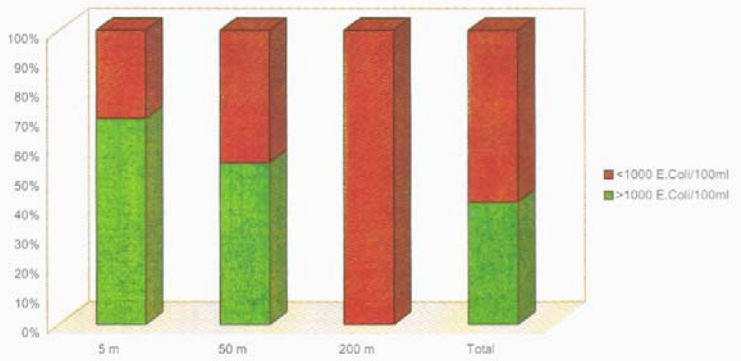


Figure 4.20. Percentage of water samples that are within or surpass the WHO/UNEP standard for protection of human health.

Industrial activities

-- In Albanian side there are;

6 mines + 1 enrichment factory for Fe-Ni, within 2.5 km distance from the shoreline and 6 mine within 10 km from the shoreline

All mines and the factory are closed down since 1991, except one in Pojska with capacity 8,500 t/y chromium ore.

There are about 550,000 m^3 of mineral residues at the six mines closest to the lake

Industrial activities

The content of some chemical elements in these residues is presented in tab. 5.2

Chemical analysis of a sample of water in the LO water close to the ex factory of enrichments shows that levels of some heavy metals are to be considered (tab. 5.4)

There are no data on the content of these chemical elements in the sediments

- So far survey of Macedonian scientist has found high level of Cu in the liver of the fish

Table 5.2. Percentage of the fine and course residue material that is metal or quartz.

Chemical elements	Fine Inert (< 0.5 mm)	Coarse Inert (>0.5 mm)
Fe	14.92 %	30.03 %
Ni	0.27 %	0.95 %
Co	0.01 %	0.075 %
Cr	0.72 %	0.24 %
SiO_2	18.1 %	11.74 %

Table 5.4. Chemical analyses of water samples collected in the lake at two distances from the shore of Lake Ohrid (mg/L).

Chemical	5 –10 m from shore	30–40 m from shore
Fe	12	10
Ni	5.26	0.5
Co	0.07	0.04
Cu	0.022	0.0
Cr	0.01	0.0

Urban solid waste

There are not sanitary landfill in the LO watershed

The spontaneous burning of the waste cause the air pollution (PM10, NOx, Dioxine, Furans)

The dumpsites are not lined; there is the risk for contamination of ground water

The most of the villages has not organized the collection and transport of the waste

Contamination of soil, surface and ground waters by leaches

Agriculture pollution

The use of nutrients, pesticides and insecticides

In Albania cultivated land is 2,500 ha
Amount of nutrients 248 kg/ha from which 100 kg/ha fertilizers with P (mainly to two- ammonium phosphate)

Amount of pesticides and insecticides used in the district of Pogradec is 3,56 kg/ha (10% of which are organophosphates)

In Macedonia cultivated land 53,000 ha
There are no specific data for the use of chemicals in Macedonian side of LO region. Banned chemicals are used illegally

There are no figures about pollution from non point sources in the lake Ohrid watershed including livestock

Deforestation in Albanian side has intensified soil erosion which may increase the level of pollution ended in the lake

Destruction of shoreline habitats

Constructions in the lake shore caused:
- destruction of the biological processes in the interface land-water,
- loses in the reed belt,
- alteration of the natural landscape

The importance of reed zones:
- spawning ground for fish
- biotopes for various aquatic birds
- mechanical and biological filters reducing the concentration of various - organic/inorganic pollutants
- barrier for lake shore erosion

Reed zones has been heavily modified in both shore line in Albania and Macedonia caused:
- construction in the lake shore
- excavation and removal the send along the lake shore
- cutting of the reeds and using for a variety of production
- pollution of the lake water which alterated the species composition

Alterated flow of the River Sateska

In 1962 River Sateska was diverted to LO (before flowed into the River Black Drin)

The eroded materials drained to LO are estimated to be 44-110,000 m3 including considerable amount of organic matter causing:

- organic pollution,
- reduction of dissolved oxygen,
-modification of flora and fauna in this area of lake

River is one of main actual contributors of P from point sources

Decline of fish sock

Over fishing (uncontrolled fishing, inappropriate tools for fishing)

Destruction of spawning grounds

Lack of law and regulations enforcement

Lack of harmonization of legal acts between two countries

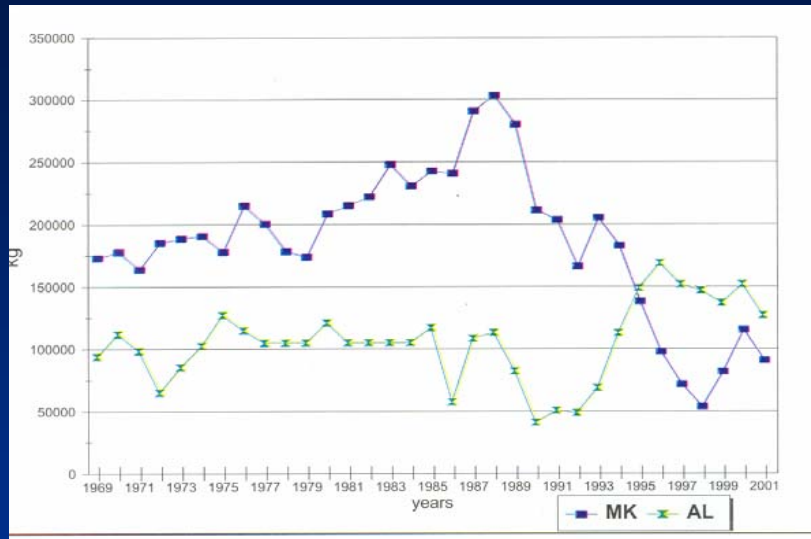


Figure 4.36. Total annual commercial fish catch taken from Lake Ohrid, by country.

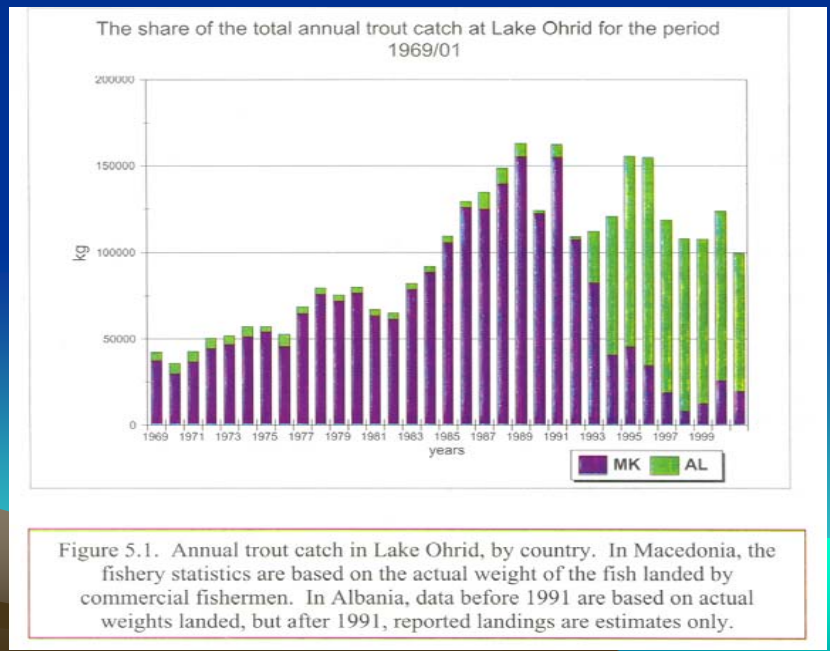


Figure 5.1. Annual trout catch in Lake Ohrid, by country. In Macedonia, the fishery statistics are based on the actual weight of the fish landed by commercial fishermen. In Albania, data before 1991 are based on actual weights landed, but after 1991, reported landings are estimates only.

5. Trends

Achievement under LOCP

-Establishment of joint institutions for the project management (LOMB, ISTF, MTF, VMC)
- Unification of procedures for water monitoring in Lake Ohrid and Lake Prespa and its tributaries (Joint Protocols for sampling analyzing and quality assurance)

-Improvement environmental legislation, regulations, standards with EU Directives (New law on protection of Tran boundary lakes, draft Agreement for Protection and Sustainable Development of LO and its watershed)

-New Monitoring Laboratory in Pogradec

-First Joint State of Environment Report on LO and its watershed Scientific and layman version, contribution of 50 scientists and experts of both countries.

-Joint Tran boundary action plan draft

-Many Joint NGO-s projects for public awareness and participation

-Establishment of 21 June as “Lake Ohrid Day”

- The twining of Pogradec with Ohrid and Struga towns

5. Trends (cont.)

Projects under way:
- Design and construction of collector and sewage treatment plant for Pogradeci town
- The extension of sewerage system and collector in Macedonian side of Lake Ohrid
- Construction of landfill for Korca Region which include Pogradec, Bucimas, and Cerrava Communes
- Remove within the year 2004 of the residues of Fe-Ni ore from dumpsite of ex enrichment factory in Guri Kuq Pogradec

- The new urban plan for the town of Pogradec is under the preparation
-LOCP has identified other projects to be implemented as land use plan for the watershed area of LO
-Implementation of GIS in different economic sectors
- The fish stock assessment