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NEWSLETTER

INTERNATIONAL LAKE ENVIRONMENT COMMITTEE FOUNDATION

— For Better Lake Management —

This Newsletter is also available in Japanese.

ILEC "International Environmental Education Exhibition"

The ILEC "International Environmental Education Exhibition" was held at Lake Biwa Research Institute (Otsu, Shiga) on 18-20 November, 1991, under the joint auspices of the Environment Agency of Japan, ILEC, Shiga Prefectural Government and the Shiga Board of Education.

At this exhibition, "Environmental Education", nowadays a common and global subject, was introduced through the pilot projects and documentation of 1) "Pilot Project on Lake Environmental Education" which was promoted by ILEC from 1989 to 1991 and 2) "Promotion of Environmental Education in Developing Countries" which ILEC is currently promoting.

The "Promotion of Environmental Education in Developing Countries" was entrusted to ILEC by the Environment Agency of Japan as an ODA Project, and is promoted in line with the "Pilot Project on Lake Environmental Education" for Denmark, Brazil and Japan. These three countries are also included in ILEC's latest project in which Denmark and Japan play a role of showing case studies from developed countries to the other countries chosen to participate in this project-Brazil, Argentina, Thailand and Ghana. ILEC hopes to make a school network on Environmental Education in these countries.

Pilot projects of six countries were shown as follows:

Japan

The Japanese project lays emphasis on "eutrophication" and "acid rain", because eutrophication is one of the major problems of water quality in Shiga Prefecture, and "acid rain" is a common and global environmental issue.

The lessons held at the pilot schools were shown on panels.

Also, apparatus (timple filtrator) developed by students with the assistance of their teachers and software for personel computers used as material for the lesson on "eutrophication" and "acid vain" were exhibited.

Denmark

The aim of the Danish project was to look at the ecosystem of lakes with the Fure Lake (Copenhagen) selected as a pilot lake.

Pictures and posters of the environment of the lake, workbooks, essays and graphs of water quality at Fure Lake were shown.

These materials were prepared by students of the pilot school Syvstjernskolen (Seven-stars Primary School in English). Materials and posters by the "Forum for Environmental Education, Denmark" were also introduced.

Brazil

Since 1989 the Brazilian project has been organizing courses and practical and theoretical training for school teachers and one-day excursions for students at the Lobo (Broa) Reservoir basin.

Pictures of these activities were shown on panels.

Thailand

Environmental education in Thailand is currently receiving a great deal of attention. An E. E. campaign by the National Environment Board and the "Magic Eyes Campaign" (the concept of this campaign is that "nature is alive and if you do something bad to the environment, it is watching you") by the Thai Creation Association were introduced through such things as posters, stickers, video software and booklets.

Argentina

In Argentina, Chascomus Reservoir and Salto Grande Reservoir (Buenos Aires) were selected as pilot lakes. Students went on a field trip to the lakes and made posters on their observations of the environment. Besides notebooks of mathematics (data on water quality was calculated in maths lessons) and biology, wall newspapers and pictures by the students were shown.

Ghana

The Ghanaian project collected information on Environmental Education.

Weija Reservoir (Densu), the pilot lake, and four pilot schools were introduced through pictures and posters.

Big Thanks To All Contributors
— Biwako Lake Aid Concert —

The 9th "Biwako Lake Aid Concert" was held on August 2nd, 1991, on an artificial island on Lake Biwa. Appearing at the concert were world famous jazz musicians who gave exciting performances and appealed for protection and conservation of the environment. An audience of more than ten thousand gathered on that midsummer night and NHK (Nippon Broadcasting Corporation) aired the concert all over Japan.

The outdoor music festival was started in 1983 by the Government of Shiga Prefecture and NHK to highlight the plight of lake environments. Since then, the festival has been held on a yearly basis every summer and been named the "Biwako Lake Aid Concert".

In 1989, a promoter of the festival requested ILEC to participate in the concert to give a global view of lake environments. In response to this request, the ILEC Secretariat provided posters showing the condition of many lakes around the world. At the same time, the Secretariat provided collecting boxes for fund-raising for the Capital Fund of the ILEC Foundation. Donations have been made by over 20,000 people.

Other than the money collected at the concerts, there have also been contributions to the Capital Fund from approximately 200 enterprises and 100 persons. We would like to take this opportunity to thank every single person and enterprise for the generosity they have shown in making contributions to ILEC.

HIROYA KOTANI
ILEC Head of General Affairs Division

IWRA 7th World Congress

An ILEC Special Session on Lake Management was convened on 16 May 1991 during the IWRA 7th World Congress on Water Resources—Water for Sustainable Development in the 21st Century—at Rabat, Morocco.

ILEC participants included the session chairperson Professor S. Matsui, Prof. C. H. D. Magadza, Prof. M. Nakayama and Dr. J. G. Tundisi who spoke on the "Problems of water quality and management and multiple uses in Amazon Reservoirs". Other topics dealt with by ILEC members were the "Current situation and countermeasures for China's lake environment" by Prof. Liu Hongliang and Prof. Duan Ning, "The state and perspectives of the Aral Sea problem" by Prof. G. N. Golubev, and the "Impact of global warming on lakes and reservoirs" by Dr. J. P. Bruce.

Of the 630 people attending the IWRA conference, some 100 were at the ILEC Special Session. Many questions were taken from the floor and the session was declared a great success.

The 16th Meeting of Governing Council of UNEP

—A Statement Given by Prof. Tatuo Kira—

The 16th meeting of the Governing Council of UNEP was held between 20-31 May 1991. The following extract is the speech given by Professor Tatuo Kira—Chairperson of the ILEC Scientific Committee—at this meeting.

We have organized or supported training courses and expert workshops in several countries and are publishing a series of guideline books on lake and reservoir management. A joint project by several countries on environmental education for school children, with a focus on water resource and watershed conservation, is also currently in progress. Another function of ILEC is its role of coordinator for the World Lake Conference, which has been held at 2-3 year intervals since 1984 in Japan, the United States, Hungary and China. The next (5th) conference will be held in northern Italy in the Spring of 1993.

We have also accumulated information on the environmental states of a few hundred lakes of the world, both natural and manmade, to be further compiled into a database. Thanks to the financial aid received from UNEP, detailed data on the limnological, environmental and socio-economic aspects of some 120 important lakes have already been published in a series of the Data Book of World Lake Environments.

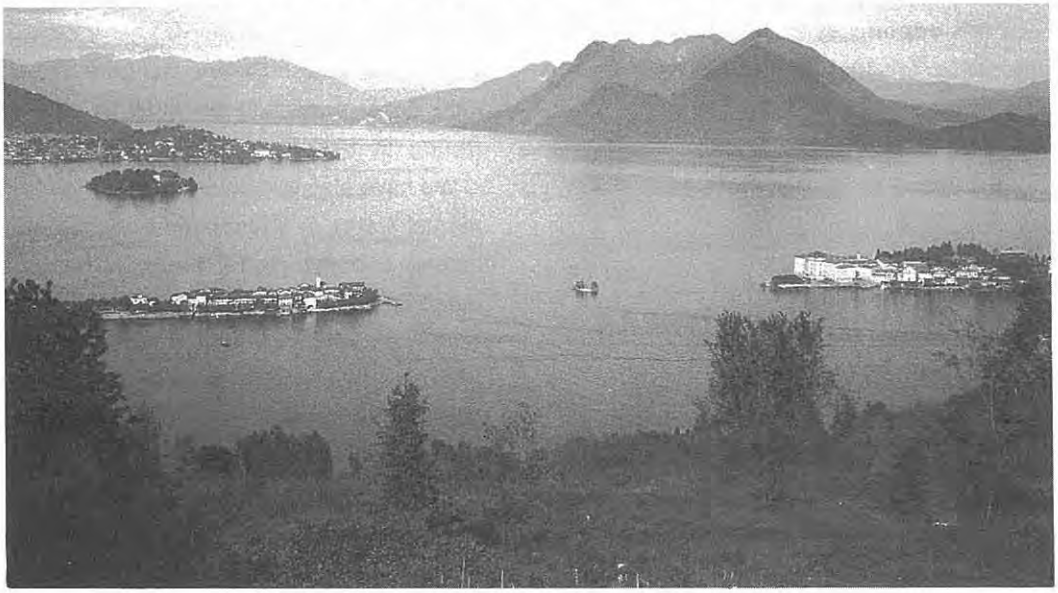
I would like to emphasize that the information ILEC has accumulated clearly shows the critical deterioration of inland water environments and freshwater resources. This is taking place on a global scale, not only in developing regions of the world, but also in many industrialized countries.

Overuse of land and freshwater resources in watersheds is progressively impoverishing the amount of water storage in lakes and reservoirs by the sedimentation of eroded soil on the one hand and through the lowering of the water level on the other. A good illustration of this problem is the crisis of the Aral Sea and some other arid-zone lakes. Lake water quality and ecosystems are being seriously damaged or even totally upset at an increasing rate due to eutrophication, acidification and toxic contamination resulting from accelerated concentration of human population and industrial activity in their watersheds. However, only a very limited number of lakes have hitherto been successfully recovered from such environmental degradation by appropriate countermeasures.

So I would like to request UNEP, the Dublin Conference and the upcoming United Nations Conference on Environment and Development to pay proper attention to the inland water crisis, as it is an urgent global environmental problem, and to take effective action against it.

Tatuo Kira
Chairperson of the ILEC Scientific Commitee

LAKES OF THE WORLD



LAGO MAGGIORE (ITALY)

Lago Maggiore, which is the second largest among the Italian lakes (212.5km²), lies at an altitude of 193.5m above sea level, just to the south of the Alps (latitude 45°57′N; longitude 8°33′E). The lake was formed over a period of about 100,000 years through excavation by two Würmian glaciers which moved down from the Alps and along the valleys of the rivers Ticino and Toce, remodelling pre-existing river valleys of the Messinian period (about 20 million years ago). The erosive power of these glaciers (approximately 1200-1500m thick, moving at a speed of 5-10m/day) is well shown by the depth of the lake (mean value 177.4m; maximum value 370m, corresponding to a cryptodepression of 177m).

The lake is approximately 15,000 years old and is a typical, very elongate, piedmont lake, with an U-shaped transverse profile (maximum breadth 10km; length along the thalweg 66km).

The drainage basin of the lake covers 6,599km². As much as 50% of this area lies 1,283m above sea level and 1.1% of it is composed of glaciers. Politically, the drainage basin belongs both to Italy (3,229km²) and to Switzerland (3,370km²), but 80% of the lake surface is in Italy. The basin contains several lakes and reservoirs, of which nine have an area exceeding 0.5km².

Reservoirs and naturally dammed lakes number 32, and account for a total volume of more than half a million cubic meters. The largest of these lakes (Lago di Lugano, Lago d'Orta and Lago di Varese) are heavily polluted. Lago di Lugano and Lago di Varese are extremely eutrophic; whilst Lago d'Orta has been subject, for several decades, to severe industrial pollution with copper and ammonia.

The geological features of the drainage basin are quite complex and have been deeply influenced by the alpine orogenesis.

The basin is divided into two parts by the so called "Insubric line", the most important tectonic line crossing the southwestern portion of the Alpine system. At the north of this line, in the massif of St. Gotthard, orthogneiss dominates; at the south of this mountain range are a band of schistis and calcareous rocks.

The total resident population in the drainage area is about 670,000. However, as Lago Maggiore is a renowned touristic resort, recreation represents one of the most important uses of the lake, the tourist industry can account for more than 12 million "tourist days"; nearly half of them concentrated along the shore region.

Other important uses of the lake are sport, commercial fisheries and boating. Agricultural water requirements, such as irrigation for rice fields and dairy pastures, still represent the greatest use of the water discharged from Lago Maggiore.

The Insubric region, to which the Lago Maggiore area belongs, is characterised by high humidity and rather mild winters because of the presence of both the lake itself and the Alps, which offer protection from northerly winds. The lowest temperatures are attained in January, with an average of 2.6°C. Maximum temperatures at Pallanza station occur in July, with an average of 22.1°C. Prevailing winds are northwesterly and southwesterly.

Rainfall in the area is high (mean value about 1,800mm/yr), with rather strong variations (1,191-3,352mm/yr).

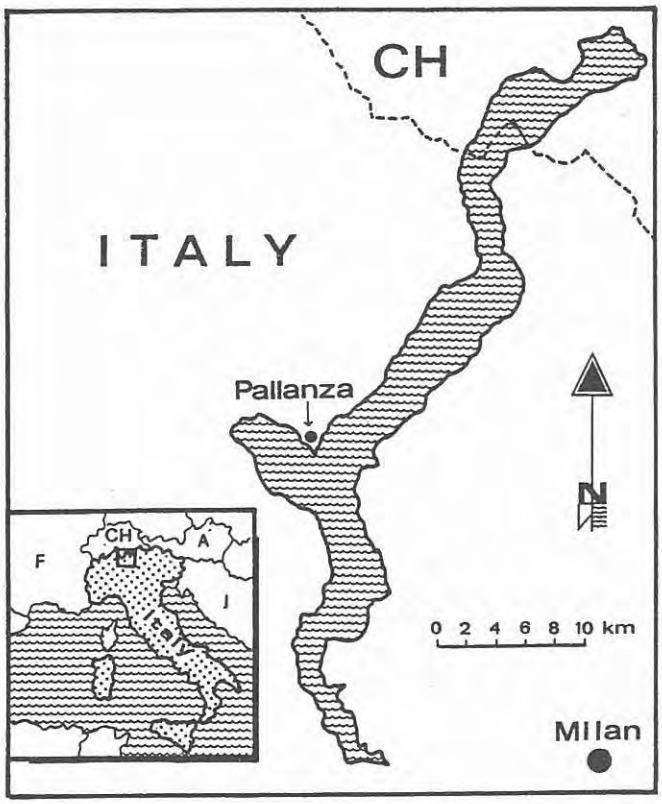
From late spring to autumn, a marked stratification is present, with a maximum deepening of the thermocline to 30m.

Due to the high maximum and mean depth of the lake, as well as to the peculiar climatic conditions of the area, a complete overturn of the waters of Lake Maggiore does not occur every year.

The layer overturned in winter is about 100 to 150m deep, whereas a complete mixing occurs only in wind and in cold years.

The marked increase of human population in the drainage basin during the last few decades, together with the progressive industrialization of the area, is clearly reflected in the rapid worsening of the water quality of Lago Maggiore from the 1960s to the 1970s.

The ionic composition of Lago Maggiore waters presents a prevalence of calcium and magnesium among cations and bicarbonate and sulphates among anions (90% of total ionic concentration equal to 3.06 meq/l). The conductivity range is between 135 and 137 μS/cm at 18°C; pH from 7.4 and 7.5 in hypolimnetic waters and 8.0-8.5 in epilimnion; oxygen can reach 130-150% of saturation during algal blooms whilst in hypolimnetic waters the minimum value of concentration, observed during 1977 after 8 years of permanent stratification, was 5mg/l (usually 7.8mg/l).



Phosphorus and Nitrogen concentration are very important in order to understand the trophic evolution of the lake.

Nitrates constitute the most important fraction of inorganic nitrogen and concentration has shown a marked increase from 1960 to 1977 passing from 500 to 800 μg N/l; since then the nitrate concentration has stayed at much the same value.

A marked increase in the levels of phosphorus was observed during the same years, passing from values below 10 μg P/l to 37 μg P/l at the end of the 1970s; at the present time total phosphorus concentration has dropped to values of 15 μg P/l.

The trends in nutrients dynamics in the past reflect a trend in phytoplankton productivity and community composition towards eutrophication until the end of the 1970s and oligotrophication in the following years.

From the 1960s and 1970s the algal productivity increased almost 3 times and blooms of the cyanobacteria *Oscillatoria rubescens* took place.

At the present time Lago Maggiore is recovering and it can be classified as an oligo-mesotrophic lake.

With regard to zooplankton, copepods dominate with four species (1 diaptomid and 3 cyclopoids), but cladocera with *Daphnia hyalina* and the predaceus *Leptodora kindtii* and *Bythotrephes longimanus* represent the key factor in the trophic chain as they are the preferred food item for planktivorous fish.

The fish population is dominated by pelagic planktivorous species. The average annual yield for the most common species of fish is: coregonus 400-500tons, bleak 15-20tons, perch 10tons, trout 2-3tons.

The improvement observed in lake water quality in the last decade can be attributed to the construction of sewage treatment plants for about 50% of the total equivalent population of the drainage area. The phosphorus load passed from 760tons P/yr in 1980 to 260tons P/yr in 1989.

An International Commission for Water Protection was established in 1978 by the Italian and Swiss Governments, supporting limnological research and studies for lake recovery as well providing support for positive actions.

The environmental protection plan aims to reduce phosphorus load to a level below 200tons P/yr and the phosphorus concentration in lake water to below 10 μg P/l.

As the realization of the treatment plants for sewage in the drainage area planned for the next 5 years aims to handle the waste from more than 80% of the total equivalent population, we expect future amelioration close to natural conditions.

Dr. Riccardo de Bernardi
Director
Instituto Italiano di Idrobilogia
Pallanza-Italy

The Volga

—A region of ecological disaster

N.N. Smirnov and L.A. Smirnova

The Volga is the largest river of Europe. Its length after damming is 3,530km with a drainage area of 1,360,000km^2. About half the population of Russia lives in the basin of the Volga, and 1/4 of its agricultural and industrial output is produced in this region. The water supply of Moscow, with its resident population of about 9,000,000 people, and of many other big cities, is derived from the Volga and its tributaries.

At present the Volga is transformed into a chain of artificial lakes with slowed down flow which are also constructed on its largest tributary—the Kama. (See Table)

The construction of artificial lakes mainly for industrial purposes, the development of energetics, as well as for water supply and navigation, has radically modified the flora and fauna of the river and the conditions of their existence.

The life of the Volga had been actively studied both before damming and after it with reviews, including lists of animals and plants recorded, having been published for some artificial lakes constructed on the Volga and its tributaries. Based on detailed field data, investigations were made for the first time on the formation of fauna and flora of artificial lakes in 1978.

Changes related to damming, theoretically predicted, were on the whole either unrealised or unpredictable. It appears that artificial lakes modify interactions between the environment and the intra-water medium in climatic, underflooding and abrasion aspects. Damming entailed submergence of fertile floodplain lands. Altogether in the USSR some 10,000,000ha of agricultural land has been inundated.

Substances extracted from inundated soil and numerous pollutants accumulated due to slowed down water exchange essentially modified the chemical composition of water, deteriorating its quality. The inflow of biogenous compounds from inundated soil and vegetation as well as anthropogenic eutrophication contributed to restructuring of the flora and fauna, accompanied by blooms of blue-greens. Fertilizers and pesticides are washed into artificial lakes from fields. Non-functioning, inadequate or the total absence of purification plants on the Volga and the insufficient control of pollution has led to a general deterioration of the quality of water and of the intra-water medium in the absence of "any particular offender".

(Table Artificial Lakes of Volga)

Artificial Lakes (downstream)	Year of Damming	Area at Normal Water Level (km^2)
Ivancovo	1937	327
Uglich	1940	249
Rybinsk	1941	4550
Gorkiy	1955	1591
Cheboksary	1981	2189
Kuybyshev	1956	6448
Saratov	1968	1831
Volgograd	1958	3117
Perm (on the Kama)	1954	1915
Nizhnkamskoe (on the Kama)	1979	2570
Votkinskoe (on the Kama)	1962	1120

The Volga basin receives 25km^3 of waste water annually, including 0.7km^3 which is not purified. This includes, inter alia, a daily discharge of 4,000,000m^3 into the Kama artificial lake and an annual discharge into the Volga delta of 1,136,000,000m^3. Some 185,000,000m^3 of water is used annually for industrial and domestic purposes by the city of Cherepovets.

In the Rybinsk artificial lake 30% of the phosphorus and 20% of the nitrogen is of anthropogenic origin. Eutrophication due to land development in the drainage area and to industrial and domestic waste water is on the increase.

A number of catastrophic discharges of waste water have been recorded for example in 1964 in the Kama

and in 1987 several hundred thousand cubic meters was discharged into the Rybinsk artificial lake in the region of the city of Cherepovets causing extensive fish kill and the loss of commercial quality fish across many other regions. As a result, the content of heavy metals in the Lower Volga reached (μg/l); Cu 7; Zn 22.5; Cd 0.5.

Ichthyological investigations of the Volga revealed that the total annual fish catch in artificial lakes is several times higher than that in the river before damming. In the artificial lakes of the Volga-Kama system the annual fish catch (an average for 1976—1980) was 20,400t. However, the species composition of the fish fauna changed significantly affecting commercially valuable fish species.

Dams interrupted migration routes of sturgeons, herrings and Stenodus. Some 85% of natural spawning grounds have been lost due to hydraulic construction. The natural spawning rhythm has also been disturbed and fish fry destroyed in great quantities in water intakes. During the 29 years of the dammed Volga, the loss of commercially valuable fish catches totaled 5,500,000t.

Between 1964—1965 there were 15 mass kills of sturgeons and in 1987 a further 17 mass fish kills in the Lower Volga and the Volga delta. It was not until there was a further mass kill of sturgeons in 1988 (5,800t perished) that these facts aroused any attention.

In many species of sturgeons, pike, catfish, wild carp, and Stenodus from the dam of the Volgograd artificial lake downstream to the North Caspian, myopathy is diagnosed due to chemical "multiple-factor" intoxication; in tissues and organs of the Russian sturgeon pesticides and heavy metals are detected.

Histologically, irreversible pathological changes in the tissues of sturgeons in the Lower Volga under the influence of the increased general pollution level are evident.

If no immediate effective measures are taken, the Caspian basin will lose its importance in fisheries. Most sturgeons are Red data book species. Their existence is limited to the basins of the southern seas of the USSR, a zone undergoing considerable destruction of its natural environment. Thus they may disappear completely. Measures to rescue these species may include their acclimatization in various countries.

Along with fish cultural problems, damming has caused various other problems, including demographical ones. Construction of artificial lakes entailed moving the residents of settlements to be inundated. A total of 1,250,000 people in the USSR have been moved from areas of future artificial lakes.

Much attention has always been paid to the scientific and applied problems of the Volga and the Volga basin. At the beginning of this century numerous biological stations in the Volga basin carried out research and published their proceedings. Later most of them disappeared, though some were transformed into research centers. The following institutions are at the forefront of research in this region: The Institute of Biology of Inland Waters of the USSR Ac. Sci. (in Borok, on the Rybinsk artificial lake), the Institute of Ecology of the Volga basin of the USSR Ac. Sci. (in Togliatti, on the Kuybyshev artificial lake), the Saratov branch of the State Research Institute for Lake and River Fish Management (GosNIORKh) (in Saratov, on the Saratov artificial lake), the Volgograd branch of the GosNIORKh (in Volgograd, on the Volgograd artificial lake), the Astrakhan reserve (in the Volga delta). The public committee for the salvation of the Volga is extremely active. Research carried out in the state of the existing artificial lakes is aimed at the improvement of hydrological, hydrochemical, biological and other conditions related to the impact of hydraulic construction and of industries.

The catastrophic situation of biological productivity of aquatic and near-aquatic ecosystems led to the idea of the advisability of the emptying of artificial lakes. Some publications formulate the idea of emptying the artificial lakes as a new scientific problem requiring a thorough analysis. Some authors defend hydraulic construction and artificial lakes with evident talent, but it is obvious that the requirements to investigate the situation exceeds the requirements realized in making the artificial lakes.

Forthcoming Meeting

Global Wetlands Old World and New IV International Wetlands Conference

Date : September 13—22, 1992
Place : Ohio State University, Columbus, Ohio, U.S.A
Sponsor : The International Association of Ecology

The conference will emphasize the global role of wetlands, their global extent, new and traditional approaches to wetland restoration monitoring, and coupling of wetlands with their landscape. ILEC is going to sponsor a session entitled "Wetland for Protection of Lakes"

Contact : Dr. W.J.Mitsch, Organizing Committee Chair, School of Natural Resources, The Ohio State University, 2021 Coffey Road, Columbus, Ohio 43210 USA

Asian Wetland Symposium

Date : October 15—20, 1992
Place : Lake Biwa Research Institute
(Otsu, Shiga, Japan)
Kushiro-city
(Hokkaido, Japan)
Organizers : ILEC, Environment Agency of Japan, IUCN/ELC, and Ramsar Center

This symposium generally aims for better understanding on wetlands in Asia and the Ramsar Convention towards the 5th Meeting of the Conference of the Contracting Parties in Kushiro in 1993.

Contact : ILEC Secretariat

2nd International Conference on Reservoir Limnology and Water Quality

Date : August 9—14, 1992
Place : Ceske Budejovice, Czechoslovakia
Organizer : the Hydrobiological Institute of the Czechoslovak Academy of Sciences at Ceske Budejovice
Sponsors : the International Association for Water Pollution Research and Control, Societas Internationalis Limnologorum, Czechoslovak Limnological Society, and ILEC

The scope of this conference is to document the progress in understanding reservoir limnology and water quality management over the last few years.

CALL FOR ARTICLES

Those who wish to contribute to the ILEC Newsletter are invited to send manuscripts to the secretariat.

ILEC
INTERNATIONAL LAKE ENVIRONMENT COMMITTEE FOUNDATION
Secretariat
3-4-22 Kyomachi, Otsu, Shiga 520, Japan
Tel : 775-25-1076 Tlx : 5464850 ILEC J Fax : 775-23-1581
Cable : ILEC OTSU

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