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NEWSLETTER

INTERNATIONAL LAKE ENVIRONMENT COMMITTEE FOUNDATION

— For Better Lake Management —

This Newsletter is also available in Japanese.

Environmental Education and Problems in Today's Thailand

ILEC has been running a "Promotion of Environmental Education in Developing Countries" project in Thailand, Brazil, Ghana, Argentina, Denmark and Japan since 1991, for the purposes of building a network for environmental education. As one of its activities, five Japanese Working Group Members were sent to Thailand from March 22 to 27, 1992, as an ILEC Eovironmental Education Mission.

The state of environmental education in Thailand reported by the ILEC Mission is as follows.

1. Strategies for environmental education in today's Thailand

In the six years of compulsory education (primary school), environmental education is involved in subjects such as "living and experiences." In the next three years (junior high school), environmental education is divided into compulsory subjects and optional courses. Natural resources and environmental preservation, major subject of concerns in Thailand, are included in compulsory subjects. The environment in Southeast Asia, global environment problems, nature preservation, outline of geography, demography, the study of technology and home environment are subjects included in optional courses. During the high school period (three years), environmental problems in Thailand are studied as a compulsory subject. Optional courses include subjects such as humans and the environment and Buddhist art. Through education from primary school to high school, the environment is included in various subjects, but these are still problems such as insufficient materials, and teachers who lack experience and basic knowledge

on the subject.

Many universities have lectures on environmental science. For example, a lecture entitled "environmental management" is part of a Master's course at Songkla University.

Furthermore, ONEB (Office of the National Environment Board) facilities environmental activities by monks, provides training for school teachers, seminars/ workshops for civil servants and training for students for the purposes of furthering interest in environmental problems. In 1990, a project on nature and environment preservation started in the southern part of Thailand aimed mainly at children. This project was extended to the northern part of the country in 1991. Concerts on the environment and a folk song campaign have also been held and posters, booklets and journals on the environment are published on a frequent basis.

TECDA (Thai Environment and Community Development Association), which is well known for its "magic eyes" campaign, promotes environmental activities through "cleaning and planting." The magic eyes campaign posters can be found in many places in city areas, and its activities play an active role in environmental preservation. For example, although many Thai people eat at street stalls, streets were well cleaned and the garbage is a rare sight. It is helped by the fact that the budget for cleaning is both big and fixed as a matter of policy of the Mayor of Bangkok.

Schools also promote cleaning of their premises and nearby streets. However, the acclaim for these positive activities must be tempered by the fact that school attendance rate of compulsory education (primary school) is about 80% and that of junior high school only about 40%. There are a lot of students who work instead of attend school and many educational problems remain.

2. Promotion of the Thai Case in "Promotion of Environmental Education in Developing Countries" Project

This project has been implemented by ILEC since 1991, to promote environmental education in developing countries. For the promotion of the Thai case, the Mission met Professor Sanga Sabhasri, the representative of Thai Case, to discuss the plan for 1992. Prof. Sanga chose Songkla and Chiang Mai Universities as the base for the study to research into methodologies used in the countryside where nature is still in abundance. The developed methodologies will then be applied in the city area (Bangkok).

At Songkla University, an environmental education committee, which includes the Vice President and Dean, was established. Dr. Prayoonsak (Associate Professor) was chosen as the representative of the Committee. The Songkla case intends to develop materials and research into water quality of the Pattani River and Pattani Bay basin and the preservation of mangrove forests. Furthermore, an international exchange program among pilot countries is planned. The Songkla case will be implemented in early May 1992 at the Pilot schools.

In the Songkla region, deforestation of mangrove forests has become a serious problem. Deforestation is due to the cultivation of shrimps (black tiger), and these shrimps are mainly exported to Japan. Moreover, in this region, people cultivate rice twice a year, but have a poor harvest because of the "red clay." Large quantities of fertilizers and agricultural chemicals are used and have also become a serious environmental problem.

At Chiang Mai University, the Mission met Professor Prasit (Dean of Educational Department) and Professor Sirmsree (Associate Professor), and discussed future plans. The Environmental Education Committee consists of members of the university and the board of education. Prof. Sirmsee, who researches the curriculum and teaching methods in primary and junior high school education, was chosen as the representative of the committee. In the Chiang Mai case, the committee plays a leading part in the project. The committee examined the original plans and it will be implemented in the pilot schools from May 1992. This method of promotion of the study is different from that of "Shiga Project" in Japan. The Japanese case lays emphasis on planning by the pilot schools with positive support from the committee.

Near Chiang Mai University, the Mission inspected the "Huay Hong Krai Royal Project" (Project for the development of water resources). In this project, a reservoir and ditches were constructed to moisten the entire forest and prevent natural forests fire. More than one hundred organizations, including the Chiang Mai University, participate in the project regarding effective use of reservoirs, water quality, forests and living things.

Prof. Sanga and the environmental education committees of Songkla and Chiang Mai are eager to promote and study environmental education, However, because of the big difference in environment between Thailand and Japan, Japanese cases are not always suitable for directly transfer to the Thai case.

From now on, further Japanese cases will be introduced through the exchange program between Thailand and Japan. In addition, exchange programs of children (correpondence, etc.) are expected to be started.

April, 1992

ILEC Environmental Education Mission

Working Group Members of Lake Environmental Education, "Shiga Project" Prof. Munetsugu KAWASHIMA, Shiga University (representative), Department of Education

Mr. Hajime IWATA, Head Teacher, Notogawa Town, Notogawa Kita Primary School

Mr. Shingo HOSOE, Teacher, Kohoku Town Kohoku Junior High Shool

Mr. Shin-ichi NISHIKAWA, Teacher, Ritto Town Daiho Primary School

Mr. Itaru NAKAI, Teacher, Ritto Town Ritto Nishi Junior High School

Training Course in Lake Water Quality Management (ILEC/JICA)

—Technology transfer to developing countries—

The "Training Course in Lake Water Quality Management" for developing countries was held mainly in Otsu, Japan from January 24 to March 26, 1992, jointly convened by ILEC and JICA (Japan International Cooperation Agency). This was the second time and this training course has been holding since its inauguration as an ODA project in 1991.

The course included lectures on laws and regulations on water pollution control in Japan, basic knowledge of lake water quality management, measures of water quality analysis such as sampling, sediment analysis and waste water treatment through practical training and inspections. Also included in the course is the Lake Biwa Case Studies Discussion. The scientific know-how and technologies of universities, institutes and companies are necessary and useful for the progress of lake environment management and ILEC intends to transfer this information to developing countries through this training course.

A list of participants, a total 11 from 10 countries, follows:

Carlos Alberto Basaldua (Argentina)
Gerald Guiherme Jose Eysink (Brazil)
Binghui Zheng (China)
Zhou Su (China)
Syafifah Sofiah Dwikorawati (Indonesia)
Akech Maurice Omondi (Kenya)
Fernando Angel Martinez Martinez (Nicaragua)
Helen B. Caddauan (the Philippines)
Karn Ekabut (Thailand)
Luisa Julia Damia Torres (Venezuera)
Elizabeth Khaka (Zimbabwe)

The following are some of the comments made by participants.

"I learned about the technologies on pollution control such as waste water treatment, sewage treatment, waste disposal and laws/regulations on environmental management in developed countries. This course classifies the directions of my field of study clear. Also, it seems to be very useful for environmental management planning in my country."
(Zheng Binghui, China)

"This training course made me consider the present state of development from the view point of environment management"
(Helen B. Caddauan, the Philippines)

"It is difficult to maintain lake water quality without total package of planning and measures with the cooperations and efforts of government and institutes. I think the knowledges that I gained from this course is very useful. I think 'The Act for Special Measure for the Lake Biwa Comprehensive Development' by the Japanese Government is an appropriate measure."
(Syarifa Sophia Dwikorawati, Indonesia)

"I think that some of the knowledge gained from the course could be transferred to the improvement of monitoring and analysis methods in Lake Victoria basin, data collection and decision making in administration."
(Aketch Maurice Omondi, Kenya)

"I learned to know that administration, citizens and companies can cooperate together to preserve the environment. I also learned about the ILEC Environmental Education Project which has been promoted in primary and junior high schools."
(Luisa Julia Damia Torres, Venezuera)

ILEC intends to hold this training course on an annual basis for about 10 trainees and hopes to make a global network of administrators/researchers in water environment.

SUPERVISORS OF THE COURSE

Takeshi Goda — Vice Director General of ILEC Foundation,
Professor at Faculty of Engineering, Setsunan University

Saburo Matsui — Secretary of ILEC Scientific Committee
Professor at Faculty of Engineering, Kyoto University

LECTURERS OF THE COURSE

Tatuo Kira — Chairperson of ILEC Scientific Committee
Director of Lake Biwa Research Institute, Shiga Prefectural Government

C.E. Bauer — Vice Chairperson of ILEC Scientific Committee
Honorary President of World Federation of Engineering Organization (Argentina)

S.E. Joergensen — ILEC Scientific Committee Member
Professor at the Royal Danish School of Pharmacy (Denmark)

Hiroshi Tsuno — Associate Professor at Kyoto University

Munetsugu Kawashima — Professor at Shiga University

Akira Kurata — Head of Research Section of Lake Biwa Research Institute, Shiga Prefectural Government

Masahisa Nakamura — Head of Research Section of Lake Biwa Research Institute, Shiga Prefectural Government

Hiroto Maeda — Senior Researcher of Lake Biwa Research Institute, Shiga Prefectural Government

Fumitsugu Kusano — Assistant Executive Director of Department of Health and Welfare, Shiga Prefectural Government

Takehiko Hobo — Professor of Shimane University

Toshiaki Kagatsume — Assistant Section Chief of Hikone Public Health Center, Shiga Pre-

fectural Government

Hiroshi Ishiguro — Senior Administrator of Waste Disposal Control Division, Department of Consumer Affairs, Traffic and Environment, Shiga Prefectural Government

Shinji Ide — Programme Coordinator, Shiga Office for UNEP/IETC, Shiga Prefectural Government

GEMS WATER

RAISON/GEMS Experts Meeting

Background

The Raison/Gems Experts Meeting was held at the National Water Research Institute, Canada Centre for Inland Waters in Burlington, Ontario between May 11-15, 1992.

The RAISON system (Regional Analysis by Intelligent System ON a microcomputer) originated some six years ago in response to a need for an integrated software for Canada's acid rain programme. In Phase II, GEMS/WATER has expanded its objectives beyond monitoring, to place a greater emphasis upon the provision of assessments. Furthermore, a need for information handling technology has been increasing among its participating countries and particularly developing countries. Under these circumstances, the RAISON system is about to be adapted and promoted for its use under the GEMS/WATER programme. Raison itself has many spin-offs. A version to be adapted by GEMS/WATER has been developed for its purposes by CCIW and referred to as RAISON/GEMS. The aim of this Experts Meeting was to discuss technical and political issues in the course of using this RAISON/GEMS in the GEMS/WATER programme, and further discuss some long-term strategies of GEMS/WATER for its data collection.

RAISON/GEMS

RAISON/GEMS employs micro-computer technology, requiring an IBM compatible 386/486 machine (minimum 386/20 MHz with math co-processor), DOS 3.1 or higher and a minimum hard disk capacity of 10Mb, 1.44 Mb 3.5" disk drive and VGA graphics (640 x 480, 16 colour). The main features of RAISON/GEMS are its database, analysis, spreadsheet and mapping functions. For example by clicking an icon showing the location of a monitoring station on a map displayed on the computer screen, we can immediately access the data collected at the station, process the data on a spreadsheet, make graphs and put the graphs any place on the map.

Conclusion of the Meeting

After the demonstration, all the participants expressed extremely favourable comments on RAISON/GEMS. Although it may not, as yet, be an ideal system, it holds considerable promise and it was agreed that such a common system was indeed necessary for the GEMS/WATER programme. Fortunately, Canada has shown willingness to give strong support towards the development, maintenance and distribution of RAISON/GEMS. It was determined at this meeting that GEMS/WATER would adapt RAISON/GEMS as an information handling system and promote its use and dissemination to developing nations.

PUBLICATIONS

PROCEEDINGS OF THE 4TH INTERNATIONAL CONFERENCE ON THE CONSERVATION AND MANAGEMENT OF LAKES "HANGZHOU '90"

eds. Liu Hongliang, Zhang Yutian and Li Haisheng, 654 pp.

Proceedings of the 4th World Lake Conference (Hangzhou, China, September 1990) is available from:

Chinese Research Academy of Environmental Sciences (CRAES), Anwai, Beijing 100012

CHINA

phone:4232542 cable:1064

telex:210364 CRAES CN fax:4231308

$74.00.

DATA BOOK OF WORLD LAKE ENVIRONMENTS

—A Survey of the State of World Lakes— Vol.4

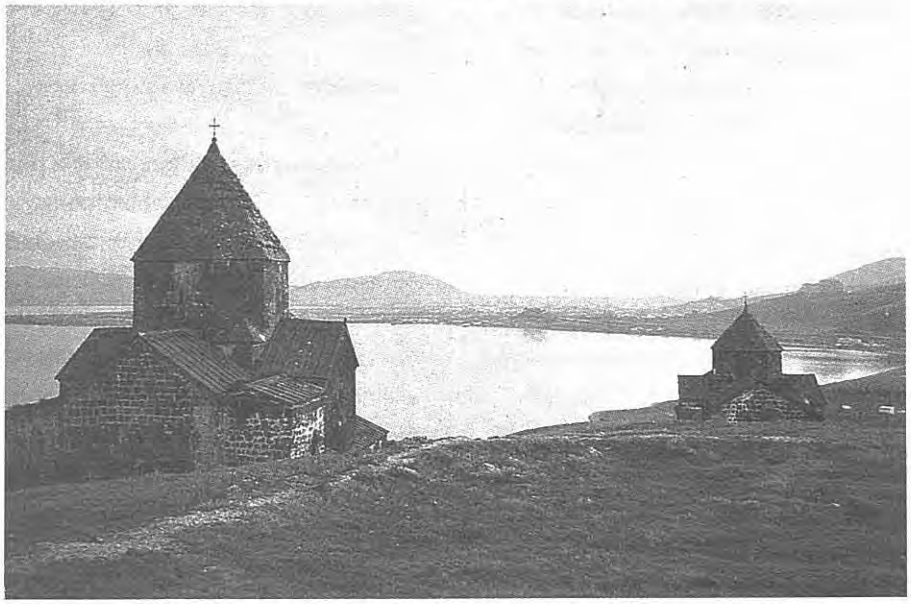
ed. Lake Biwa Research Institute and ILEC

Latest volume of Data Book series. Contains the data of 38 lakes/reservoirs. 2 Asian, 9 European, 3 African, 22 North American and 2 South American lakes/reservoirs are covered.

$70.00.

Data Book of World Lake Environments Vols. 1, 2 and 3 are also available from ILEC.

LAKES OF THE WORLD



LAKE SEVAN

By Vadim Melnichuk (Institute of Limnology, St. Petersburg, Russia)

Sevan proper has two coupled parts: Major-Sevan and Minor-Sevan. It is situated high in the mountains and is very big for such altitude. All available information may be taken from Table 1.

Minor-Sevan has the same characteristics instead of morphometric one (its surface area, volume, maximum and average depth were 384, 19.5, 98.8 and 50.9 before the reduction of the water level and 328, 12.8, 80.3 and 37.8 at the present time). Dimensions of this parameters are the same as in Table 1.

Phosphorus and nitrogen budget assessment mas taken from Oganesian and Parparov (1989) paper. For example, tributary Pinflow (agriculture and sewage) is about 190 and flux from sediments is about 960 tons y^{-1}. For nitrogen similar value is 4200 while diffusive nitrogen flux from sediments is 9700 tons y^{-1}.

Some years ago we have faced the problem: What is to be done with Lake Sevan water level for better water quality. The key element for this problem was found by chance and unexpected answer was obtained. Unfortunately till now neither local people nor politicians aren't aware of possible solution of the problem.

This lake was oligotrophic before the artificially water level lowering since 1939. Water column was exceptionally oversaturated with respect to calcite ($CaCO_3$) and concentration of dissolved orthophosphate was very high for an oligotrophic lake. When the rate of water level reduction was the highest eutrophication of lake had started (in the 1974-1978). Concentration of phosphorus decreased significantly during this period in contrast to other eutrophic lakes. In 1980-1988 Lake Sevan water quality has improved. Primary production dropped (Oganesian & Parparov, 1989) and the blue-green algae were substituted by green ones. Phosphorus budget of Lake Sevan suggests that output of P significantly exceeded it's input. The importance of sediment-water interaction for Lake Sevan eutrophication was concluded. Water level lowering has assumed to be the mechanism of eutrophication (Oganesian & Parparov, 1989).

But there is the need to answer another question. Why eutrophication has stopped? What is the reason for phosphorus retention in the sediments? Are there any reservoirs which are able to control phosphorus redistribution between sediments and water column? Fortunately, such information is available. It allows to reveal natural phosphorus control mechanisms in Lake Sevan. It's also possible to provide a certain generalization of such natural phenomena.

It was noted that increased external loading and almost constant total phosphorus concentration in lake Biwa (Japan) for the past several years are in contradiction with well known eutrophical relation by R. A. Vollenweider. In spite of the large external loading, phosphorus content in the Baltic Sea does not increase in corresponding rate.

Lake Sevan presents more strange occurrence from the standpoint of R. A. Vollenweider's relation. There is paradoxical discrepancy in this case. Really, external phosphorus loading into this lake has increased about two times during past 20 years, but total phosphorus concentration by evidence of several studies has been

decreased more than 10 times. The decrease in orthophosphate concentration was more efficient (Table 2). This altering was followed by phosphorus increase in upper sediment layer (Table 3).

It was suggested that all phosphorus entering Lake Sevan and Lake Biwa was transported to the sediments, and fixed there without been recycled. No doubt, the regulation of the mineralization processes in different sediments types is quite complex and our understanding of their importance for phosphate cycle is still very incomplete. But secondary reaction of phosphorus with previously precipitated $CaCO_3$ in sediments and co-precipitation of orthophosphates with carbonates in water column has been well documented. The observation of calcite precipitation in the deep mesotrophic lake Breiter Lucin (Germany) indicated that calcite precipitation is connected with a decrease in dissolved and total phosphorus, phytoplankton biomass and light transmission.

We have applied this hypothesis to assess the efficacy of phosphorus displacement from Lake Sevan water to the sediments during calcite precipitation (Melnichuk et. al., 1989). Oversaturation of Lake Sevan pore waters with respect to carbonate fluorapatite was established. This phase formation on $CaCO_3$ crystals was documented for fine-grained Lake Sevan carbonate sediments. By using data from Table 2 a sharp growth in the rate in $CaCO_3$ rate of precipitation (300-500 times) was estimated (Melnichuk et al., 1989) for 1976-1986 when compared with 1928-1948. Such shift is enough to remove almost all phosphorus from the water column.

We believe that phosphorus water limitation since 1976-1983 is responsible for oxygen regime improvement and the production of biomass decrease. The key mechanisms for Lake Sevan action against eutrophication are phosphorus-calcite co-precipitation in water and carbonate fluorapatite formation on $CACO_3$ crystals within pore water.

We may conclude that it hardly possible to improve present water quality by water level increasing, because almost all phosphorus is binding now in the upper sediment layer. It means that now the only problem is how to prevent sharp increase in phosphorus internal loading.

References

Melnichuk, V. I., S. A. Reznikov & D. S. Uljanova. 1989. Influence of the Rate of Carbonate Sedimentation on the Decrease of the Dissolved Phosphorus Content in the Water of Lake Sevan (in Russian). Dokl. Akad. Nauk USSR 308: 967-970.

Oganesian, R. O. & A. S. Parparov. 1989. The Problems of Lake Sevan and Ways of Solution. In Conservation and Management of Lakes. J. Salanki & S. Herodek (eds), Budapest, 367-378.

Table 1

Some morphometric and limnological characteristics of Major-Sevan. Compilation by Oganesian & Parparov (1989). 1-before the reduction of the water level, 2-at present time.

Parameters	1	2
Altitude (m)	1916.2	1897.7
Surface area (km^2)	1032	916
Volume (km^3)	39	29
Maximum depth (m)	58.8	40.3
Average depth (m)	39.5	22.8
Hypolimnetic O_2 conc. (mg ℓ^{-1})	4.0	0.0
Inorganic phosphorus (mg ℓ^{-1})	0.32	0.04
Inorganic nitrogen (mg ℓ^{-1})	0.00	0.10
Secchi depth (m)	14.0	3.0
Primary prod. (g C m^{-2} y^{-1}) *	50	250

* Algal production increased considerably (during high eutrophication in the period 1974-1978) to 400-600 mg C y^{-1} and blue-green algal blooms were observed.

Table 2

Trends in components of carbonate system and inorganic phosphorus concentration in Lake Sevan surface water. The compilation of Melnichuk et. al. (1989).

Year	pH	Alk_{carb}	Ca^{2+} mg/l	HPO_4^{2-} —P	Ovesatur. $CaCO_3$ coeff
1928	9.3	338-440	33-34	0.32	25-30
1948	9.0	393-449	34-42	0.12	15-19
1968	8.7	416-452	36-38	0.23	11-12
1976	8.8	421-460	23-35	0.07	9-11
1983	8.7	385-410	19-22	0.008	6-10
1985	8.5	404-413	18-22	0.008	4
1986	8.6	399-404	13-17	0.008	3

Table 3

Trends in phosphate content in Lake Sevan sediments, (P_2O_5, mass%). The compilation of Melnichuk et. al. (1989).

Year	1948, 1956	1981	1986
Phosphate content	0.08-0.12	0.10-0.33	0.21-0.30
Mean value	0.09	0.16	0.27

Forthcoming Meeting

The 2nd International Conference on Environmental Management of Enclosed Coastal Seas 1993-EMECS '93

Date : July 19-21, 1993

Venue : Baltimore Convention Center
Baltimore, Maryland, U. S. A.

Organizers : Office of the Governer, State of Maryland
University of Maryland System, U. S. A.:
Center for Environmental and Estuarine Studies
Coastal and Environmental Programme

Co-sponsors : U. S. Environmental Protection Agency
National Oceanic and Atmospheric Administration, U. S. A.
National Academy of Sciences, U. S. A.
United Nations Environment Programme (UNEP)
Organization for Economic Cooperation and Development (OECD)
Intergovernmental Oceanographic Commission, France
The Marine Forum for Environmental Issues, U. K.
Hyogo Prefectural Government, Japan

Theme : Toward effective coastal seas governance : using sciences, policy and management to sustain our coastal environments

Sub-themes : Perspectives on integrated policymaking and implementation in multi - use, multi - jurisdictional seas
Advancements in marine and estuarine science and interactions between science and management
Examinations of citizen involvement in the stewardship of enclosed coastal seas

For Further Information :
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Cambridge, Maryland 21613 U. S. A.
Tel : +1 410-228-9250
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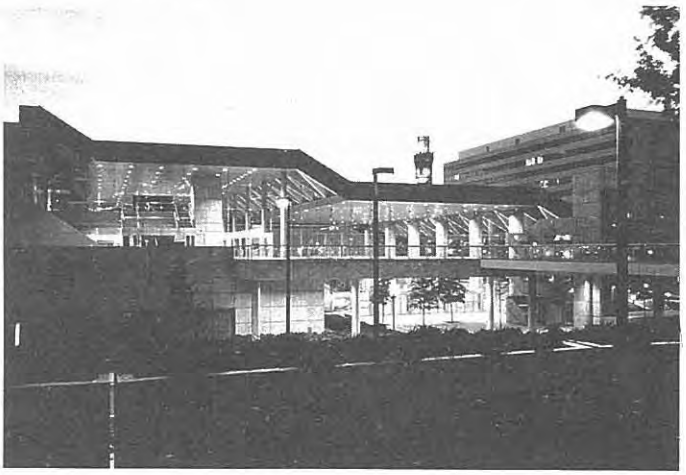
CALL FOR ARTICLES

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



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