



No.32 July 1998

NEWSLETTER

INTERNATIONAL LAKE ENVIRONMENT COMMITTEE FOUNDATION

— For Better Lake Management —

This Newsletter is also available in Japanese.



What's good for her is good for us

Please forgive the grammar in our headline, but we think you will agree that the media have a tendency to accentuate the negative. Bad news seems to sell newspapers and even free-of-charge newsletters like this one, more often than not, highlight problems, but have little in the way of good news.

Here at ILEC we believe that, like most things in life, a good balance is absolutely necessary for a healthy environment and thereby a healthy life. That balance stretches, we hope you will agree, to our newsletter. To counter some of the not so good news that we have brought to you in the past, we are kicking off a series of articles on lakes that have faced environmental degradation and made a comeback of some

sort. The first article is written by the Chairman of ILEC's Scientific Committee, Professor Jørgensen.

He emphasises that the old adage about prevention being better than a cure applies just as much to environmental problems in lakes as to any other field of science. The problems encountered by Fure, the lake in question, could have been reduced considerably if preventative measures were taken in the past.

There are lessons to be learned here for everyone, and we hope to bring to light more good news about recovering lakes in future editions. To that effect, we should like to make this front page another call for

articles. To continue this series we need your help by way of news on the successes you have had with your lake. We very much look forward to hearing from you.

Finally, continuing on the theme of good news, this issue contains another two papers from the Lácar '97 conference. Our opinion, as we have expressed in our last edition, was that the 7th International Conference on the Conservation and Management of Lakes was a great success. That success was largely due to the high-level of the content in the papers given at the conference. It is beyond the scope of this newsletter to bring you all the papers or even papers in full, but where we can we intend to accentuate the positive and Lácar '97 was just that.

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Lácar '97 - Two (abbreviated) papers from the International Conference on the Conservation and Management of Lakes

The Laguna de Bay Zoning and Management Plan for Fisheries

Adelina C. Santos-Borja

Laguna de Bay, the largest lake in the Philippines with a surface area of 900 km² and an average depth of 2.8 meters, occupies almost half of the total surface area of Philippines lakes. Its watershed area of 3820 km² includes the highly urbanized area of Metro Manila and the rich agricultural areas of the provinces of Rizal and Laguna.

The lake is one of the most vital and economically significant water resources of the country. It is a multi-use resource, but at present the dominant use is for fishery. In the late sixties, the culture of *Chanos chanos* (milkfish) in fishpens was introduced in Laguna de Bay, after a study done in 1968 showed that its aquatic biota could support a more extensive fishery production.

On July 1970, the Laguna Lake Development Authority (LLDA) constructed a 38-hectare fishpen in a cove northeast of the Central Bay of the lake. The pilot project demonstrated an annual potential milkfish yield of 1500 kg/ha or more than 3.5 times the annual open water fish catch. Aside from fishpens, fishcage culture of *Tilapia* species was also introduced into

the lake in the mid-seventies. However, due to the pressing problems associated with fishpens, this type of aquaculture method was given more attention by the government insofar as regulation and management was concerned.

In 1973, the area occupied by fishpens was 5,000 hectares with a yield of 3.88 tons/ha/yr or ten times the open water yield in 1968. The initial success of this kind of business encouraged other investors from areas outside the Laguna de Bay watershed which caused an alarming increase in fishpen area to 31,000 hectares in 1982. The increase in the number of fishpens and the corresponding increase in fish stocks created intense competition for the natural food supply in the lake, such that the unit yield in 1982 was reduced to 2 tons/ha/yr. A semi-intensive culture method is now practiced.

The operation of fishpens utilizes a state-owned resource. Thus, it became inevitable that conflicts between two socio-economic strata i.e., the rich fishpen operators and the marginal fishermen arose. It stemmed from the assertion of rights of small fisher-folk who lost much of their traditional open lake fishing grounds, and consequently, their income was also affected.

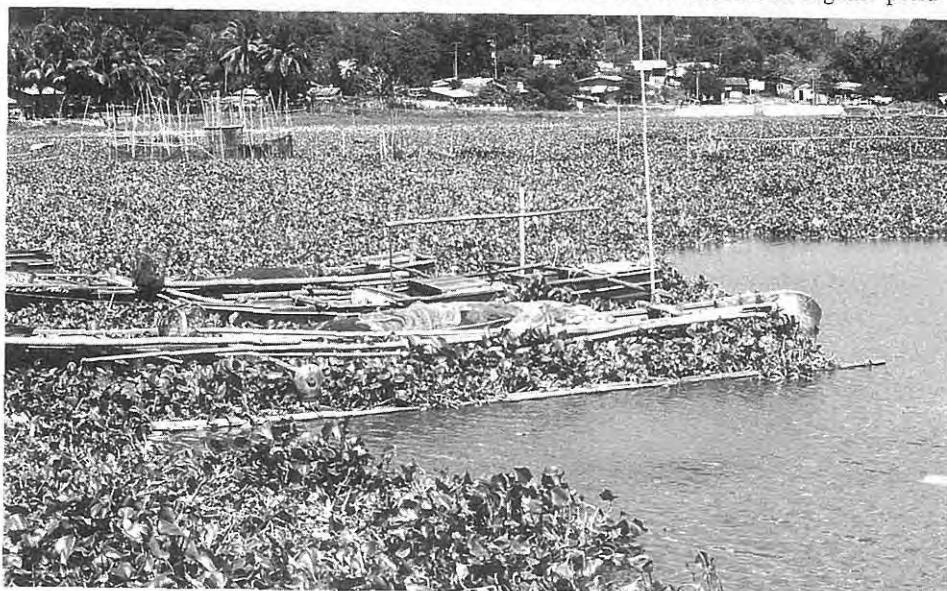
Aside from socio-economic problems, there have also been environmental problems such as the increase in organic pollu-

tion and enhancement of lake eutrophication, impediment of water movement that contributes to the siltation and accumulation of water hyacinth.

As a result of the problems the LLDA developed a management system, part of which included the Laguna Lake Zoning and Management Plan (ZOMAP) in 1983. The area for aquaculture was set at 21,000 hectares. Fishpen and fishcage belts were delineated, with access lanes and navigational lanes marked to facilitate the movement of people, goods, and services within the lake.

Changes in the leadership of the LLDA meant that the initial ZOMAP was never seriously implemented. Nevertheless, productivity in the lake improved greatly in 1991 leading to a proliferation of new fishpens. After a legal battle with Local Government Units concerning the regulation of the lake, the LLDA was given exclusive jurisdiction to issue permits for the use of all surface waters for any project in the Laguna de Bay Region.

The implementation of rules and regulations regarding the operation of aquaculture structures in Laguna de Bay has always been a struggle between the implementing agency and the fishpen operators. The high risk and cost of investment make it hard for some fishpen operators to transfer their structure to the revised fishpen belt at the designated time. Those that did not comply with the rules and regulations were given notice to self-demolish their structures within a specified time frame. Non-compliance compels the LLDA to do the demolition and the fishpen materials are confiscated in favour of the government. To date the LLDA has demolished more than 2,000 hectares of illegal fishpen. Other fishpen operators have even resorted to filing cases against the LLDA. However, the strong political will of the current LLDA administration coupled with the support from the Department of Environment and Natural Resources and the President of the Philippines have paved the way for the implementation of the revised ZOMAP.



Water hyacinths and fishing boats - Laguna de Bay

Factors Controlling the Trophic State of Reservoirs at the Basins of Limay, Neuquén and Negro Rivers (Argentina)

Héctor A. Labollita and Fernando L. Pedrozo

Reservoirs at the Río Negro basin are grouped in accordance with two mechanisms which regulate their trophic state (TS), namely: 1) those determined by the availability of light and nutrients (Los Barreales); 2) those regulated only by the availability of nutrients (Limay reservoir plus Mari Menuco). Regulation by nutrients is related to the fact that the maximum concentration of chlorophyll *a* is registered in the mixture period (winter). The global TS control pattern (in terms of mean chlorophyll *a*) for both basins is well outlined.

The Río Negro basin is located in the north of Argentine Patagonia, from the Andes mountain range to the Atlantic ocean. Its main rivers are the Limay and the Neuquén, which meet to make the Negro river. Precipitation is concentrated in the mountain areas, and the hydrological regime of the Limay and Neuquén rivers shows a double flowing wave (rain and thaw). In spite of such similarity, geology, topography and vegetation determine that the drainage have special characteristics for each river; while the Limay river has natural regulation given by the presence of woods, headwater lakes and lower slopes, the Neuquén river lacks all these, which gives it a torrential and irregular nature with more violent swellings. The latter determines that the solid load carried by both rivers be different as regards quantity and the type of suspended sediments.

This is an analysis of the chain reservoirs located on the Limay river, namely: Alicura (ALI), Piedra del Aguila (PDA), Exequiel Ramos Mexía (ERM) and Arroyito (ARR), as well as those located on the Neuquén river, formed by means of channeling works towards land lowerings adjacent to the river bed, namely: Los Barreales (LB), and Mari Menuco (MM). These reservoirs are located on a gradient

of geographic and weather distribution which is revealed both as regards morphometric characteristics as well as trophic state.

Two control mechanisms have been determined for the algae biomass as those of higher significance operating individually within the reservoirs, namely:

1) **Reservoirs controlled by light and the bio-availability of nutrients.** In the case of reservoirs receiving high concentrations of suspended solids, a substantial fraction of the TP load is not made use of immediately. Such process is registered in LB, mainly in the tailwater areas and the following chain of events occur: the high load of suspended solids conditions a very low transparency which limits photosynthesis.

2) **Reservoirs controlled only by the availability of nutrients.** The concentration of suspended solids is quite low. In the case of Alicura and PDA, the particulate contribution is mainly igneous, silicic and the bio-available P would be scarce. Phytoplankton develops scarcely at the expense of the low dissolved fraction and transparency is determined by the algae development itself. At PDA, TP concentration is not correlated to TP load, since the particulate fraction sediments at the rear of the reservoir, and there is no re-dissolution of labile P fractions to the water column.

A global analysis shows that the maximum algae biomass (such as chlorophyll *a*) is presented during the mixture period (winter) for ALI, PDA, LB and MM. ERM and ARR (usually without thermal stratification) may show a second maximum during spring - summer due to water blooms of cyanobacteria. Deviations found between the observed chlorophyll *a* and that expected from the application of the equations proposed for the region are explained by the fact that the latter consider summer chlorophyll *a* values. On the other hand, all reservoirs as a whole show a maximum of chlorophyll regulated by the mean depth, which coincides with the trend indicated for the Andean-Patagonian lakes. Such a relation is used to forecast the trophic state of future reservoirs on these basins.

Professor Kira honoured

ILEC's Professor Kira has been awarded the Duke of Edinburgh Prize of the Japan Academy. Typical of his self-effacing character, Professor Kira's first response to news of his being awarded this prize, was that happy as he was to receive the prize, he would rather that prizes were awarded to active scientists.

However, this prize is awarded every other year to someone with a significant track record in subjects such as environmental preservation.

Professor Kira's specialist field is plant ecology and regular readers will be familiar with his many achievements in the analysis of data concerning the production of organic matter in forests and carbon circulation. He has worked extensively in southeast Asia and in many countries around the world. This prize, from a most prestigious Japanese institution, is, we believe, both well deserved and highly appropriate.

Call for Papers

The Editors of the ILEC Journal - Lakes & Reservoirs: Research and Management - write: "The well-trodden path for those concerned with the resolution of research and management problems in lakes and reservoirs is clearly signposted: define the problem; find out what others have done to resolve it; decide on the best and most practical method to address the problem; implement the method; analyse the results; draw conclusions. There is a further step in this path that all responsible researchers and investigators take: they make their findings available to others: **they publish them**. Without acceptance of this responsibility, enormous duplication and wastage of economic and scientific resources is an inevitable result. We urge you to accept your responsibilities. You have the appropriate journal, sympathetic editors and are assured of rapid and wide international exposure. See the back page of this issue for contact details for the Journal. We look forward to your paper."

FURE LAKE - A MODEL CASE

ILEC Scientific Committee Chairman, Professor Jørgensen, starts off a series of articles on lakes that are making a successful comeback from perilous situations.

Fure Lake is situated close to Copenhagen (15-20 km from the centre of town). It is surrounded on three sides by forest and wetlands used as recreational areas by the citizens of Copenhagen. The lake is used almost entirely for recreational purposes: for sailing, rowing, angling and swimming

ing waste water for Lake Fure decided to construct a pipeline to the sea (about 10 km) to discharge the mechanical-biological waste water in Øresund, the water between Sweden and Denmark. The third community decided to introduce more advanced waste water treatment, in the first hand

dard. It has also been considered to remove phosphorus from the storm water overflow to reduce the phosphorus input to the lake further, but a final decision has not been taken, yet.

It has furthermore been considered to use ecological engineering to reach a quicker reduction in eutrophication. Measurement of the phosphorus release from the sediment has shown that while the external loading of phosphorus today is about 2.5-3 t the internal loading coming from the sediment is as much as 15 t. Therefore it could be beneficial for the recovery of the lake to remove more phosphorus from the lake by siphoning the hypolimnic water, treating this water by use of an activated aluminium oxide column and discharging the treated water (phosphorus concentration \approx 0.05 mg/l) downstream of the lake. This project has been estimated to cost 3.5-4 million dollars, while the treatment of all the storm water would cost in the order of 1.5 million dollars. In the first case about 10-12 t of phosphorus will be removed annually, while in the second case only about 1500



Residents Relax

(mainly for children, as the distance to the sea is only 12 km). The lake has an area of 19 km² and the depth is up to 39 m. The total water volume is 100 million m³.

During the fifties and sixties, Copenhagen was expanded in this direction, because many people found it attractive to live close to nature, and the districts north of Copenhagen, where Fure Lake is situated, is characterized by many lakes and forests. Many one-family houses were built north of Copenhagen during the period 1950-1975. This of course implies also that more waste water was discharged and in the sixties, Lake Fure was used to discharge the mechanical-biological treated waste water from more than 100,000 inhabitants in the three communities adjacent to the lake. This caused an increased eutrophication and the transparency of this beautiful lake was during the sixties decreased from about 3-4 m to about 1 meter at spring and summer bloom.

Waste Water Treatment

In 1972 two of the communities discharg-

chemical precipitation with pH-adjustment to ensure a high efficiency. By use of chemical precipitation as the so-called direct and at the same time also as post precipitation, it was possible to ensure a phosphorus concentration of 0.25 mg/l. In the sixties 33 t of phosphorus was discharged into the lake per year. Now after the described measures have been taken, the phosphorus discharge directly to lake was reduced to about 3 t, half of which would come by the storm water overflows.

The eutrophication was reduced as a consequence of the measures taken, but very slowly because the retention time of the water in the lake is about 20 years. Today, more than 25 years after the measures were taken, the transparency at spring and summer bloom is about 2 m.

Environmental Management Considerations Today

Today, nitrogen removal has also been introduced. In accordance with Danish law, all waste water treatment plants above 15,000 inhabitants have to introduce nitrogen removal. 8 mg N/l is the required stan-



Fishing Fure

Model computations have shown that if no additional measures are taken, it will take another 25 years before the lake has recovered in accordance with the present input of 2.5 - 3 t phosphorus. This would imply an increased transparency to about 3 m. It would, however, be possible to achieve a better result faster, it means within 10-15 years, if either the proposed ecological engineering methods would be used or the storm water would be treated. The realization of both proposals would imply a gradual improvement of the transparency to 4-5 m in 15-20 years.

It has also been considered to convey the waste water from the third community to the sea, but model results indicate that it is a waste of money, as the siphoning of hypolimnic water and/or treatment of storm water give much better results for the approximately same amount of money.

What can we learn from this case study?

The environmental management story of Lake Fure shows us clearly that prevention of pollution is very important. If the measures taken in 1972 were taken in 1962, ten years earlier, the amount of phosphorus in the sediment would have been considerably lower, and the recovery of the lake much faster.

It is also shown that an environmental management plan has to consider all sources, and that it would always be beneficial to reduce all sources as early as possible. It is evident from a phosphorus balance of the lake that the treatment (phosphorus removal) of the storm water is crucial. A treatment of the storm water as early as 1972 would have implied that the sediment today would have contained 30-40 t less phosphorus which would imply a correspondingly faster recovery.

The study has finally shown that it is beneficial to use ecological models to get a good overview and comparison of the various environmental management plans. Modelling is an excellent management tool, provided that it is not oversold and for instance used outside its range of applicability.

Lake 99 Copenhagen

The 8th International Conference on the Conservation and Management of Lakes (17-21 May, 1999) will take place when it is springtime and pre summer in Denmark, making a magnificent setting for the conference.

The basic point of any conference is always the subject and the papers to be presented. The number of parallel sessions will be kept within certain limits in order to avoid too much confusion and frustration among the participants at the conference.

When organising the Lake 99 Conference it has been considered very important to have all activities gathered at a single geographical location. Hence the Radisson SAS Falconer Center, which is very near to the centre of Copenhagen, has been selected as venue for the 8th International Conference on the Conservation and Management of Lakes.

The theme of the Lake 99 Conference will be all aspects related to sustainable lake management. Hence it will be part of the programme not only to encourage discussions among researchers but also to involve administrative staff and decision makers in a way that the huge knowledge to be presented can be absorbed and put into practice.

In Denmark, lake management has for many years been put very high on a list of priority. Technical excursions to lakes in North Zealand (1 day) and Jutland (2 days) will be arranged in relation to the conference. This will give the participants an excellent opportunity to see some of the problems and achieved results within lake management with regard to conservation, restoration, handling of wastewater and creation of wetlands.

With less than a year to go to the conference, constant updates are given on the Lake 99 home page: <http://www.lake99.dk/>

Finally, authors are asked to submit papers before 1 November 1998. More details can be found on the home page.

Mini-

Symposium

ILEC and UNEP-IETC organised a mini-symposium in commemoration of World Environment Day with the working title "Thinking of global environment problems through the protection of water for life", on 5 June 1998, at the Lake Biwa Museum in Kusatsu, Japan. The main objective of the symposium was to raise public awareness towards environmental protection.

Some 100 participants, including local residents, gathered for the symposium. ILEC's Secretary General Mr. Kiyoshi Imai gave the opening speech and was followed by presentations given by two local environmentalists who spoke about environmental education and recovering water quality in a local bay.

A lively panel discussion followed the presentation. The panel consisted of water specialists, a journalist, the two local environmentalists and representatives from the World Health Organization and the Director of IETC.

The discussion was followed by participation by the audience, and some of the conclusions drawn from the symposium were that individuals need to take more responsibility for their actions regarding consumption and waste, and that behavioural change is further needed for us to get back in touch with nature.



Symposium Panelists

Profile on Professor Jin Xiangcan ILEC Scientific Committee Member

Professor Jin Xiangcan is an outstanding scientist in the field of lake environment and lake pollution control in China. He has conducted long and thorough studies on more than 40 lakes in China. Currently he is the Technical Director of the Chinese government project "Pollution Control Projects of Three Lakes (Lake Dianchi, Lake Taihu and Lake Chaohu).

Professor Jin Xiangcan was born in 1945 in Zhejiang Province of China. He obtained a degree in paleo-biology from Beijing University in 1970. He gained a further degree from the same university in environmental geochemistry in 1982, and studied abroad during 1987 and 1988.

In 1982 he became a member of the staff of the Chinese Research Academy of Environmental Science (CRAES) and took over as Director of the Research Institute of Water Environmental Science (RIWES), CRAES in 1988. RIWES is one of the major institutes on limnology in China and its pre-eminent activity is directed to the study of lakes functioning in natural, polluted and recovering situations, and to management information systems of lake environment. The institute cooperates with several Chinese universities and institutes in many lake treatment projects. Such international activities as academic exchanges are also carried out in the institute to keep in close touch with experts abroad as well as to learn and make use of advanced technology and achievements in the world.



Professor Jin Xiangcan

The studies performed by Professor Jin Xiangcan in his early research centered on the transference and transformation of pollutants in both solid and liquid phases and partition coefficient research of toxic chemicals in China. Later he turned to the study of technology and methodology of lake eutrophication. In this field, he was among the pioneers who began researching non-point source control technology in lake eutrophication control and developed systematic research of lake eutrophication in China. He also contributed to the establishment of applicable methods for lake eutrophication investigation and evaluation in China.

Professor Jin's present activities are mainly directed towards ecological treatment engineering for lake pollution which consists of comprehensive treatment technology, lake shore ecological recovery technology, in-lake submerged macrophyte rehabilitation technology, lake water source conservation forest restoration technology, and lake environmental expert systems. He has contributed to more than 80 scientific research activities, including important government work in the 6th, 7th and 8th Five-year Plan of the Chinese government. His publications cover a variety of studies in the field of lake environment protection. He has published 15 compositions (including translations), and issued more than 100 scientific papers and research reports in national and international Journals.

Professor Jin is a member of the scientific committee of the international ILEC Journal, *Lake and Reservoirs: Research and Management*. He is an expert member of the United Nation's Global Terrestrial Observing System (GTOS). He is also a member of a great number of national and international committees including the Chinese Research & Engineering Center of Lake Environments (Director), Chinese Water Environmental Society (General Secretary), the International Water Pollution Research and Control Association Committee, Chinese Environmental Monitoring Committee, and the Chinese Environmental Geographical Society.

ILEC/JICA Training Course

Anadi Shrivastava, a trainee on the course from India, writes:

Water, one of the most important constituents of the environment, is also facing a big threat in the form of quality deterioration. Out of the total water available on our planet, only 0.01% is available as fresh water in different lakes and rivers of the world. Looking at the severity of water contamination problem these fresh water resources should be preserved from pollution. Anthropogenic activities, lack of education, inadequate funds and improper waste water treatment technologies are responsible for fresh water contamination in developing countries. Most of the developing countries still find themselves incompetent to cater for basic needs such as food, shelter, clean water, medical, health and sanitation facilities and education to their citizens.

In identifying with the above fact and related problems, ILEC has done a great job in organizing the Lake Water Quality Management training program and providing opportunities to candidates of developing countries to learn about the causes of pollution in the process of development and their control technologies. It is a great effort being done by ILEC, through JICA and the Shiga Prefectural Government to transfer technology to the developing countries for their capacity building in preservation of the environment.

This training program is a good platform for the participants of developing countries to meet, interact and share their ideas and knowledge and discuss the problems being faced by the water bodies in their respective countries. We were given exposure to different problems related to water contamination, through observations, lectures and practicals which may add new dimensions to approach problems and solutions. It is safe to say that the knowledge acquired by the participants through this course shall be useful in tackling and solving the environmental problems faced in their respective countries.

LAKES OF THE WORLD

RANGLA WETLAND COMPLEX - PAKISTAN

KASHIF SHEIKH

Pakistani wetlands are one of the significant faunal and floral habitats, which provide a stream of biological, economic and social benefits to mankind in a variety of ways.

Rangla Wetland Complex (RWC) 30°C 40' N, 71° 11' E is situated in the Punjab (South) province of Pakistan. It constitutes 11 small to large wetlands in an area of 40 km². These wetlands constitute an area of approximately 35 hectares to 60 hectares. The small wetlands are covered by sand dunes and a scattered population of *Phragmites* on the sides.

These water bodies have a vegetation cover of 30-50%. The main vegetation dominance is comprised of *Phragmites*, *Tamarix*, *Salvadora* and *Typha* communities. The depth of water is from 3 to 15 feet at different sites of the wetlands. The temperatures in the summer go up to 49°C. The wetlands also support a small fish population, mainly local carps, which were introduced to the wetlands. Very remote but friendly, rural poor communities of Punjabi and Saraiki language speakers have lived here for centuries and have their centuries old traditions for hunt-

ing and to keep birds and wildlife as pets.

These wetland are very important due to the fact that they are used by the migratory species of water birds for breeding, who go further to Iran and Afghanistan in their migratory routes. The most important of these are the Marbled Teal *Marmarornetta angustirostris* and Ferruginous Duck *Aythya nyroca*, which breeds in the area. The Marbled Teal has been declared globally threatened and the population of Ferruginous Duck is vulnerable. There is a variety of other bird species which come for breeding and their nests can be found along the sides of the road, floating on the water, on isolated islands in the wetlands and on the ground along the shore of the water.

These wetlands are natural depressions in the earth, which are filled by the gradual seepage of the water and some inflow of small contributing streams originating from the canals. A lot of waterlogged land is also found in the area which were formed due to the construction of a canal system where sometimes the water level rises up causing water logging and inundation in the area.

WC is a very crucial wetland for the bird populations visiting and breeding in the area. The River Indus flows close and provides refuge to a variety of migratory species including a good number of Lesser Whistling Teal. Due to disturbances these species often move to these nearby wetlands for feeding and refuge both in the summer and wintering season.

The situation of these wetlands is deteriorating due to many factors. The wetlands are both overused, including by wildlife, and they are also decreasing in area as well. The locals use the wetland vegetation for making mats, chairs, rooftops, walls, boundaries of homes and for various indigenous purposes. The intrusions are going inside the water bodies through expanding agriculture. The education level is very low in the area and the local communities are living in conditions of extreme poverty. Threats to the wetland also include extensive reed cutting, uprooting, wood cutting, livestock trampling, overgrazing which reduce the amount of habitat available for nesting, and hunting pressures by the local officials and the local elite.



Rangla Wetland Complex

he habitats can only be maintained/sustained/restored through the use of a well worked wetland management and research plan, which should cover all the actors of the community and the evaluation of the wild resources in the area for sound management in the field. Environmental education is a must and the training of hunters and the wildlife staff is another pre-requisite for positive results. The Ornithological Society of Pakistan, with the financial help of UNDP, is conducting a study at the site. Nevertheless, a more refined and multi-disciplinary approach is required for the conservation of these unique habitats, which are a hope for the migratory waterfowl moving in and across Pakistan. Rangla needs a declaration to have a much better status by law.

New Publications

Guidelines of Lake Management - The World's Lakes in Crisis, Edited by S.E. Jørgensen and S. Matsui.
(International Lake Environment Committee and United Nations Environment Programme)
ISBN: 4-906356-23-0

In this eighth book in the Guideline series of books, the authors describe issues of impact of global warming on lakes and reservoirs, acidification of the Scandinavian lakes, main problems in Chinese lakes and their restoration, environmental problems of Lake Nasser-Nubia, water quantity and quality relationship for human uses of reservoirs, and the results of survey of the state of world lakes.

Available from ILEC in August 1998

Lakes & Reservoirs, Research and Management

Volume 3, Issue 1, March 1998
Volume 3, Issue 2, June 1998

These two issues of ILEC's Journal feature articles as diverse as "The current problems of Lake Baikal ecosystem conservation", "Status of global reservoirs: The position in the late twentieth century", "Volga-Kama cascade reservoirs and their optimal use", "Exergy content in the pelagic food chain of Lago Maggiore", and "An improved parameter estimation procedure in lake modelling".

Both issues and details about subscribing to the Journal are available by contacting Kate Aspinall at Blackwell Science Asia, 54 University Street, P.O. Box 378, Carlton South, Victoria 3053, Australia.

Tel: 61-3-9347-0300
Fax: 61-3-9347-5001
Email: Kate.Aspinall@blacksci-asia.com.au

Forthcoming Events

BICER, BDP and DIWPA Joint International Symposium on Lake Baikal

Pacifico Yokohama, Japan 6-8 November 1998
Contact: Koji Minoura (Secretary General)
Institute of Geology and Paleontology, Faculty of Science,
Tohoku University, Sendai 980-8579, Japan
Fax: 81-22- 217-6634
Email: minoura@dges.tohoku.ac.jp

18th International Symposium of the North American Lake Management Society (NALMS)

Theme: Cooperative Lake and Watershed Management:
Linking Communities, Industry and Government

Banff Springs Hotel, Banff, Alberta, Canada
11-13 November 1998
Contact: Brian G. Kotak
Alberta-Pacific Forest Industries Inc.
Tel: 1-403-525-8431
Email: kotak@compusmart.ab.ca
<http://www.biology.ualberta.ca/alms/1998.htm>

International Water Supply Symposium in Tokyo '98

Theme: Water Supply Systems in the Urban Environment:
Perspectives on the Future

Tokyo International Exhibition Center, Tokyo, Japan
19-20 November 1998
Contact: International Water Supply Symposium in Tokyo '98, c/o Management and Planning Division, Bureau of Waterworks, Tokyo Metropolitan Government
Tel: 81-3-5320-6356
Fax: 81-3-5388-1678
<http://www.tokyo-teleport.co.jp/tokyo-suido/>



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