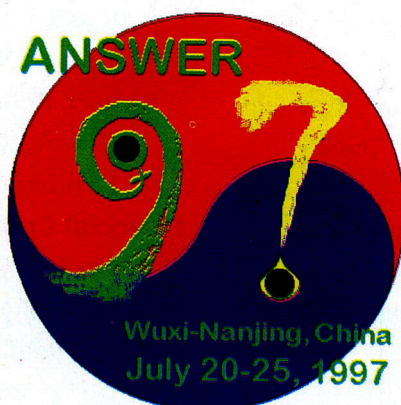


*International Symposium on  
A New Strategy for Water Environmental  
Research, 1997*

**ANSWER'97**

“How can we save lakes and rivers from  
progressive environmental deterioration?”



*10<sup>th</sup> Anniversary of KROHEN and  
Improving the Water Quality of Taihu Lake,  
Wuxi-Nanjing, China  
July 20-25, 1997*

## **Organized by**

Nanjing Institute of Geography & Limnology,  
Chinese Academy of Sciences (NIGLAS),  
China

Kansai Research Organization for  
Hydrosphere Environments (KROHEN),  
Japan

## **Supported by**

Academy of Natural Sciences, U.S.A.

Chinese Society for Oceanology and Limnology, China

Ecological Society of Japan, Japan

Environmental Agency, Japan

Environmental Protection Bureau, Jiangsu  
Province, China

Hohai University, Nanjing, China

Institute of Environmental Research, National  
Environment Protection Bureau of China,  
China

Institute of Estuarine & Coastal Research,  
East China Normal University, China

International Ecological Society

International Ecological Modelling Society

International Lake Environmental Committee

Japanese Society of Limnology, Japan

Jiangnan University, Wuxi, China

Lake Biwa Research Institute, Japan

National Hydrology Research Institute,  
Environment Canada, Canada

National Natural Science Foundation of China,  
China

National Water Research Institute, CCIW,  
Environment Canada, Canada

Science and Technology Agency, Japan

Taihu Basin Authority, Ministry of Water  
Resources, China

Institute of Hydrology, Chinese Academy of  
Sciences, China

## **Chairperson and Vice-Chairperson of Organizing Committee**

**SHI Yafeng**, Prof., Nanjing Institute of  
Goeography & Limnology, Chinese  
Academy of Sciences (CAS);  
Academician of the CAS, China

**Setsuo OKUDA**, Prof., Okayama  
University of Science, Japan; President,  
KROHEN, Japan

## **Steering Committee**

**PU Peimin**, Prof., Nanjing Institute of  
Goeography & Limnology, CAS

**NAKANISHI Hideaki**, Prof., Kyoto  
University, Japan

## **Scientific Committee**

**Yasushiko TEZUKA**, Prof., Emeritus,  
Kyoto University; Ex.-President, The  
Japanese Society of Limnology, Japan

**Richard ROBARTS**, Dr., National  
Hydrology Research Institute,  
Environment Canada, Canada

## **Financial Committee**

**Yasumasa ITAKURA**, Prof., Shiga  
University, Japan

**FAN Yunqi**, Prof. Nanjing Institute of  
Goeography & Limnology, CAS, China

## **Exhibition Committee**

**Hiroshi HASHITANI**, Director, Meteoro-  
logy & Limnology Laboratory, Japan

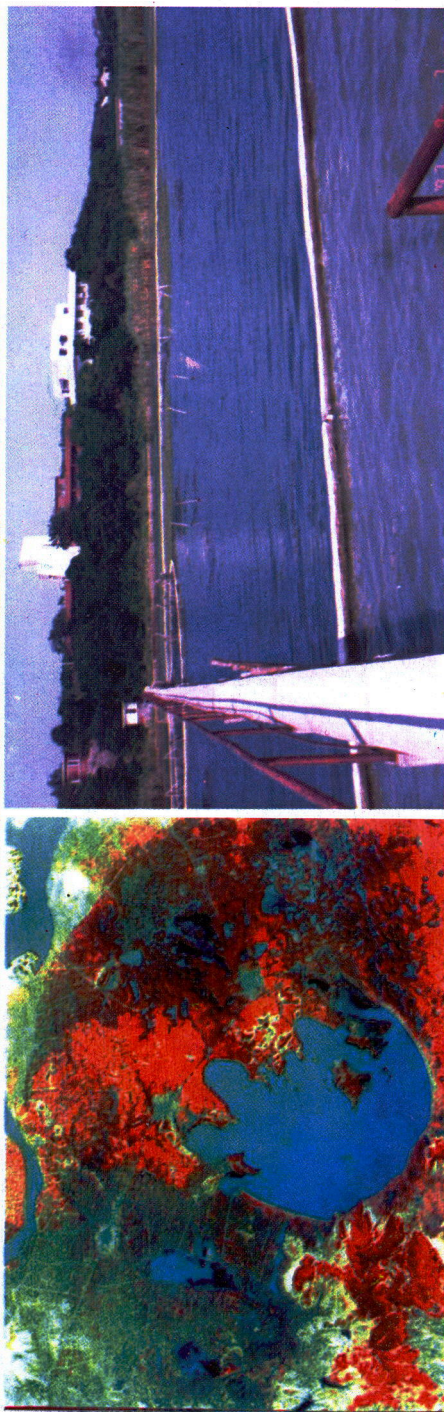
**WU Ruijin**, Prof., Nanjing Institute of  
Goeography & Limnology, CAS, China

## **Secretariat**

**Michio KUMAGAI**, Dr., Lake Biwa  
Research Institute, Japan

**CHEN Weimin**, Prof., Nanjing Institute of  
Goeography & Limnology, CAS, China





Participants at  
ANSWER '97  
Taihu Lake in  
the Changjiang  
R. Delta, China  
Taihu Lab for  
Lake Ecosystem  
Research, CAS





**ANSWE' 97 venue in Jiangnan University, Wuxi (Lower) and in Dongnan University, Nanjing (Upper) during July 20-25, 1997**



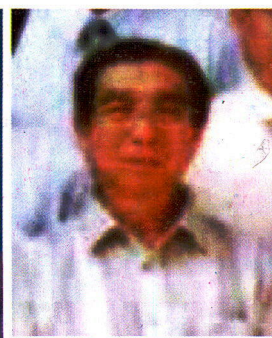


Participants at ANSWER '97 investigating the experiment field of Taihu Lab for Lake Ecosystem Research (TaiLLER), The Chinese Academy of Sciences (upper); Introduction of Prof. PU Peimin on experiments of TaiLLER at the platform (lower).





**Introduction and discussion on Taihu Lake issue at TaiLLER**



**From left: Prof. SHI Yafeng, President of Organizing Committee; Prof. Setsuo OKUDA, Vice-President of Organizing Committee; Prof. PU Peimin, President of Steering Committee; Prof. Yasushiko TEZUKA, President of Scientific Committee of ANSWER'97**



## Preface

The natural resources, environments and development are the worldwide unprecedented challenge of the human society. How we can make progress in economical aspects without destroying the environments we live on becomes a difficult problem, which all countries now confront with. The Shanghai and Suzhou-Wuxi-Changzhou district centered in the catchment of Taihu Lake have got fast development in the recent decade, whereas the water quality of Taihu Lake, an indication of the environments and the most important sources of water supplying in this area, has a progressive deterioration. The choice of Wuxi and Nanjing as the sites of the International Symposium on A New Strategy for Water Environmental Research (ANSWER'97), therefore, is both timely and meaningful. Considering the visibility and seriousness of the deterioration of water environments in this area, this symposium had the main topic of "How can we save lakes and rivers from progressive environmental deterioration?"

Water is a valuable resource, absolutely necessary for our daily life. Because of the inadequate utility, the water quality has been deteriorated, which threatens not only drinking water supplies and human health but also causes serious economic loss of beneficial use of agriculture and industry. The fact that development of economy is at the expense of the destruction of environment in many countries and regions in the world arises the necessity of national and international cooperation in science, technology and policies of the management. It is not therefore by chance that we very appreciate all the contributions, including the final document of TAIHU Declaration - ANSWER'97, from all attendants of four continents

This book, as a supplement issue of the *Journal of Lake Sciences*, contains the proceedings of the symposium and covers a wide area of aquatic environmental and ecological problems encompassing both the mechanism and practice in field of lake sciences. The various specialties have been involved and so many problems have been addressed, indicated the complication of problems we have. Undoubtedly, the achievements of this symposium reflected in this book mark a step of our effort toward the final aim.

Finally, we gratefully acknowledge the sponsorship of Kansai Research Organization for Hydrosphere Environments (KROHEN), the Chinese Academy of Sciences, the National Natural Science Foundation of China and other sponsors for their generous financial support. We also wish to express our appreciate to the organizers of Nanjing Institute of Geography & Limnology, Academia Sinica, Lake Biwa Research Institute and KROHEN, Japan for their efficient and devoted assistance during the meeting and the preparation of this publication.

施肇凤

Prof. SHI Yafeng, Chairperson, Organizing Committee, ANSWER'97

Professor, Nanjing Institute of Geography & Limnology, Academia Sinica

Honorary Director of Cold and Arid Regions Environmental & Engineering Research Institute

Academician of the Chinese Academia of Sciences;



## Greetings

I would like to extend my sincere gratitude for your participation in ANSWER'97, in spite of the unusually hot weather.

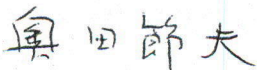
Furthermore, I thank you for the cooperation of the staff of Nanjing Institute of Geography and Limnology, Academia Sinica (NIGLAS) who were involved in this symposium.

Almost ten years has passed since my initial involvement in implementing the scientific joint project on lake science, filed between NIGLAS and Kyoto University, which I had belonged to. It is my great pleasure that we could work together and develop a warm relationship, implement joint research projects like those concerning Lake Taihu and Lake Biwa, and help young Chinese scientists who came to Japan.

Visiting Lake Taihu again after a twelve years absence, I recalled the hot days of our original visit when we installed some experiment equipment made of bamboo at offshore of Dapu in Lake Taihu with Prof. Pu of NIGLAS. Since then, I have visited China several times, however, I was really surprised to see the rapid growth of industrial activity, and was worried about detrimental effects to the water environments. It reminded me of the status of Japan thirty years ago, during the so-called "economic rapid growth ages". It may not be polite for outsiders to comment on the rapid economic development in neighbouring countries. However, I think it is our duty to give advise and cooperation which would be useful for the development of industries and conservation of the environment, based on our experience over the last three decades.

It is very important to have rational discussions focusing on the natural and social aspects of each country, in order to plan a scheme, which will be consistent with industrial development and environmental enhancement. I think it is necessary for many international and interdisciplinary experts to cooperate for the conservation and improvement of water circumstances under various natural and social pressures. From this viewpoint, ANSWER'97 was the most suitable international and interdisciplinary symposium to discuss and seek new strategies for the management of Chinese lakes such as Lake Taihu, and the inland waters of other east Asian countries.

I hope we have achieved the above-mentioned goals in cooperation with all participants of ANSWER'97. Thank you very much.



Prof. Setsuo Okuda

Okayama University of Science

Vice-Chairperson, Organizing Committee, ANSWER'97

President, Kansai Research Organization for Hydrosphere Environments

Former Director of the Disaster Prevention Institute of Kyoto University



## For the Healthy Water Systems

Water is the foundation of life. Without adequate protection, the deterioration of water quality threatens not only drinking water supplies but causes serious economic loss through loss of beneficial use for industry, agriculture and fisheries, and loss of recreational, touristic and aesthetic value in many regions of the world. The lakes and rivers are in danger. The serious problem of progressive environmental deterioration in Taihu Lake Basin we are faced with. ANSWER'97 was a very nice opportunity for Chinese limnologists to shear the research results and experiences from the worldwide academic circle. We sincerely thank the Kansai Research *Organization* for Hydrosphere Environments (KROHEN), the Chinese Academy of Sciences (CAS), National Natural Science Foundation of China (NSFC) and other organizations for their supporting the symposium. I would like to express my especial thank to Prof. Setsuo Okuda for his continual efforts to promote the academic relationship between Chinese and Japanese scientists since the beginning of 1980s.

This supplement of Journal of Lake Sciences was designed to publish the proceedings of ANSWER'97. We hope this would be a present for the **10<sup>th</sup> Anniversary C  remony of the JLS**. There are 60 papers were included in this volume. They are dealing with wide fields of limnology, such as: conservancy and management of lakes, assessment of lake eco-environment, water-sediment environments, phytoplankton dynamics, modeling of lake eco-environment, experiments *for* purifying water quality, and monitoring methods and technology. I hope the papers in this issue presented by the scientists from four continents would be benefit for deeper understanding the problems we met and the developed/proposed new strategies for overcoming the problems, and this book would contribute to realizing our aim-**for the health water systems**.

I greatly appreciate the Scientific Committee chaired by Prof. Yasuhiko Tezuka, and the Co-Editors of this issue-Dr. Michio Kumagai, and Dr. Richard Robarts for their review and editing. I extend my sincere thank to Mr. Koji Yokoyama and Ms. Michiko Nakagawa for their supporting the publication. I thank all the editors of this special issue: Associate Prof. LI Wanchun, Dr. JIAO Chunmeng, Dr. WANG Guoxiang, Dr. HU Weiping, Mr. HUANG Chunpu, Mr. LI Zhengkui, Mr. LI Bo, Mr. CHEN Baojun and Ms. CHENG Xiaoying for their suffering work on editing.



Prof. PU Peimin

Deputy President, Committee for Degree Award, Nanjing Institute of Geography & Limnology  
President, Society for Oceanology & Limnology, Jiangsu Province  
Former Deputy Director of Nanjing Institute of Geography & Limnology, Academia Sinica  
First Director, Taihu Lab for Lake Ecosystem Research, Academia Sinica  
President, Steering Committee, ANSWER'97  
Editor-in-Chief of this Issue



## Participating in ANSWER'97

It was my great pleasure to have participated in ANSWER'97 (A New Strategy for Water Environmental Research), which was held from July 20 to 25, 1997 at Nanjing, China, and sponsored by NIGLAS (Nanjing Institute of Geology and Limnology, Academia Sinica) and KROHEN (Kansai Research Organization for Hydrosphere Environments). The reason is that, although I had previously had communication with some Chinese scientists, this was my first experience to talk and exchange opinions with them in China.

The main tasks for the Scientific Committee were to coordinate the technical program, and to screen all papers for suitability of presentation. I would like to express my sincere appreciation to the members involved for the successful conclusion of this symposium. It was a regrettable matter that some of the expected Russian researchers could not attend due to financial shortage.

The fields and gardens that I saw while travelling from Shanghai to Nanjing are very important because they produce vegetables for a billion Chinese. When we realize that these paddy fields, which play such an important role in food production, are dependent on the aquasphere, it reminds us all that water is a truly precious resource.

It was my great pleasure to visit Lake Taihu and compare the circumstance with those of Lake Biwa in Japan. I found that the management of shallow lakes which suffer from blue green algae, such as Lake Kasumigaura and Lake Suwa of Japan, is very difficult. However, it was a little disappointing that I could not obtain the data of pollutant loading from the basins, organic production rate, and circulation of nutrient (nitrogen and phosphorus), etc., because of language obstacles between Japanese and Chinese communicating in English.

After ANSWER'97, it was a wonderful experience for me to enjoy the Three Gorge Cruise Tour with other overseas participants. During the cruise, I worried that the beautiful scenery and quality of the water of this river would deteriorate drastically after its damming. Deterioration and destruction of water environments has been a problem all over the world. In order to research water environments, and to understand the process of their enhancement, I would like to strongly encourage the continuance of this kind of symposium.



Yasuhiko Tezuka

Professor Emeritus, Kyoto University

President, Scientific Committee, ANSWER'97



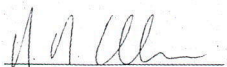
## ANSWER'97

ANSWER'97 provided the opportunity for aquatic scientists from several overseas countries and from China to get together and discuss mutual problems related to water quality issues and research approaches. For me this was a most valuable opportunity as I had no real idea of the level and type of aquatic science research being done in China today. I was impressed by the enthusiasm and interest of Chinese scientists and by the fact that they were now coming into possession of state-of-the-art equipment, in some cases to the point where I was envious!

The papers presented at ANSWER'97 covered a wide-range of topics and demonstrated the extent of the active aquatic science research community in China. In doing this it, of course, also highlighted the extent of environmental problems in China. These seem to be basically eutrophication, industrial pollution and the consequences of reservoir development. The field trip to Lake Tai was particularly noteworthy in giving ANSWER'97 participants an overview of a major water quality issue and the approaches adopted by Chinese researchers to provide the scientific information required to develop sound ecosystem management plans for the lake and its basin. My presentation, on preserving the quality of Canada's inland waters, highlighted how Canada had adopted and developed the ecosystem approach to resolving water issues for large ecosystems such as the Great Lakes, the Fraser River system and the northern river basins (the Athabasca, Peace, and Slave rivers). The fundamentals of this ecosystem approach should be applicable to Chinese aquatic ecosystems.

Papers from ANSWER'97 are to be published in the Journal of Lake Sciences, a publication of the Academia Sinica. This will further bring to the attention of the international aquatic science community the water quality problems in China and the active research programs that are currently in place to help provide the information needed to satisfactorily address these.

I returned from China with the feeling that ANSWER'97 was a very worthwhile conference experience for both overseas and Chinese participants - it allowed for the exchange of a great deal of information and I am confident that many worthwhile collaborative projects will be developed from the initial contacts made between scientists at ANSWER'97. In addition, it was truly an eye-opening experience for me to visit China, to experience the warm reception we received from Chinese scientists and to see the remarkable developments occurring in China. I am looking forward to the opportunity to return to China and to nurture the potential scientific collaborations I discussed with several scientists.



Dr. Richard Robarts

Director, NWRI, Canada

Vice Chairperson

Scientific Committee, ANSWER'97



## Message from ANSWER'97

The international symposium on "A New Strategy for Water Environmental Research (ANSWER'97)" was held at Wuxi and Nanjing in China from July 20 to 25 in 1997, and closed successively. We are very grateful for your cooperation and support to this special occasion. More than 200 scientists and students from 11 countries and districts joined the symposium to solve the deterioration problems of water environment with international collaboration for the coming century. We could have the fruitful presentations and exciting discussions, and then make Taihu Declaration at the end of the symposium. This is the result enough to evaluate the purpose of ANSWER'97. The proceeding of the symposium is now edited in China, and it will be published by the summer in 1998.

One of the symposium organizers, Nanjing institute of Geography and Limnology, Academia Sinica (NIGLAS), is a governmental research institute for geography and limnology, and it is the biggest organization to investigate all lakes and rivers in China. Another organizer is Kansai research Organization for Hydrosphere Environments (KROHEN), Japan, consists of limnologists, oceanographers and companies related to water environments, and it is promoting some activities on water environments protection as the non-profitable organization. This symposium was also designed to celebrate the 10th anniversary of KROHEN.

I have got the impression through ANSWER'97 that the scientists from China and Russia express the serious risks on the deteriorating fresh water environments. Especially, Taihu Lake needs quick reaction against water pollution. These desires can be seen in the Taihu Declaration which appeal the promotion of joint research program on Taihu Lake, and the establishment of Asian Society for Aquatic Sciences (ASAS).

In Asia, there is the clear relationship between the latitude and the annual precipitation that can not be seen in the other areas: the annual precipitation decreases as the latitude increases. This may produce the diversity of water use and ecosystem in the different districts of Asia. All people from the research organizations, the governments and the companies are obliged to use their wisdom to leave the blessing of fresh water to the next generation.

Now most of Asian countries face on the serious economic crisis. However, I believe that the Asian people are enough active to overcome this difficulty. In Asia where the old history is mixed with the rapid developments, let us create the new paradigm based on our own eyes, hands and brains. Please support our progressive efforts on water environment protection.



Michio Kumagai  
Lake Biwa Research Institute  
Secretary General, ANSWER'97



# 1997 水环境研究新对策国际学术会议

## 太湖宣言

1997 年 7 月 20—25 日，正值日本关西水圈研究机构成立十周年之际，水环境研究新对策国际学术会议在中国太湖—长江之滨召开。来自四大州的各国学者兹宣言：

水是生命之本。若缺乏合理的保护，水质恶化不仅会影响正常生活供水，威胁人体健康，而且会损害水对渔业、农业和工业的支持功能，水体的娱乐、旅游、美学价值也会日渐丧失，从而导致严重的经济损失。

全球淡水资源状况的恶化，已引起各国和国际上的关注。近年来，这已成为许多地区性组织，如联合国亚太经社组织（ESCAPO）和联合国持续发展委员会所关心和讨论的焦点。

太湖生态环境的恢复需要加强国内和国际之间的科技合作，同时扩大流域综合管理实践经验的交流，以便实施一些低投入高效益的解决方法。应该考虑到中国水体的具体水文物理条件和生态现状，采用一些非常规的方法。

为了给亚洲水科学及有关管理方面的国际合作提供一个框架，提供一个亚洲水科学中心，促进水科学技术及相关管理方面的教育、培训和专业事业的发展，与会专家强烈呼吁，建议成立一个区域性协作机构—**亚洲水科学学会（Asia Society for Aquatic Sciences; ASAS; 暂定名）**，由中国科学院南京地理与湖泊研究所和日本关西水圈环境研究机构共同筹备。

山青水秀      人杰地灵  
为了美好的未来！

ANSWER'97

1997 年 7 月 25 日



## TAIHU Declaration-ANSWER'97

This declaration arises from the International Symposium on A New Strategy for Water Environmental Research (ANSWER'97), and the 10<sup>th</sup> anniversary of KROHEN, held in the Taihu Lake and Changjiang River region of China, July 20-25, 1997 with participants from four continents.

Water is the foundation of life. Without adequate protection, the deterioration of water quality threatens not only drinking water supplies and human health but also causes serious economic loss through loss of beneficial use for fisheries, agriculture and industry, and loss of recreational, tourism and aesthetic value.

The deterioration of world freshwater is cause for national and international concern and has been the recent focus of discussion within regional organizations such as United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), and by the Commission on Sustainable Development of the United Nations.

Restoration of Taihu Lake will require ongoing national and international cooperation in science and related technology, and in the practice of integrated basin management that can lead to cost-effective solutions for the lake. This cooperation must recognize that unique hydro-physical and ecological conditions exist in China that will require non-conventional solutions.

To provide a framework for international collaboration on aquatic issues and related management concerns, to provide a focus for aquatic sciences in Asia, and to promote education, training and professional development in aquatic sciences, technology and related management issues, it is strongly recommended that a regional association, identified tentatively here as the **Asia Society for Aquatic Sciences (ASAS)** be formed with the participation of NIGLAS and KROHEN.

*For a beautiful and bright future with  
Green mountains and clean waters,  
High level civilization and abundant resources!*

山青水秀      人杰地灵  
为了美好的未来！

ANSWER'97  
July 25, 1997