Preface

There are a numerous number of lakes in the world. As a critical water resource for the local people, the quantity and quality of the water of each lake can either provide great benefits to them or threaten their lives. At the same time, the people themselves affect the quality of the water. The development and conservation upstream also have impacts on the water. Therefore the conservation and sustainable use of the water require comprehensive measures to cope with various factors. Japan's cooperation with developing countries for such measures is important in achieving the objective of sustainable development as provided for in the Basic Law on the Environment as well as the Official Development Assistance Charter.

However, a critical problems which we often encounter when we consider such cooperation is unavailability of basic information about the state of the lakes and their conservation in the subject country. In view of this, the Environment Agency of the Japanese Government requested ILEC to prepare on their behalf reports on the state of the lakes and their conservation in specific developing countries. This is one of such reports.

This study on Argentina was conducted through (a) interviews with government officials and researchers, (b) a small workshop convened on 24 and 25 October 1997 in San Martin de los Andes, and (c) measurements of the water quality at Lake Setubal, San Roque Reservoir and Lake Lacar respectively representing a contaminated lake in a warm and wet climate, a contaminated lake in a semi-arid climate, and a scarcely contaminated glacier lake in a scenic tourism area. Because the participants in the workshop submitted excellent papers, we decided to use their papers as they are to form many of the chapters of this report. The rest were prepared by the ILEC secretariat.

The ILEC is very grateful to the officials and researchers who met with the ILEC missions and provided them invaluable information and advice, the participants in the workshop who introduced and discussed specific issues, and the officials and researchers of the National Institute of Water and the Environment, its Water Research Center of Semi-Arid Region, Litoral University and the Government of the Municipality of San Martin de los Andes who provided substantial assistance to the ILEC missions to facilitate their visits to the lakes by arranging meetings, boats and many others. The ILEC is grateful also to Ing. Alberto Calcagno who provided substantive and logistical support to it.

I sincerely hope that this report will not only contribute to Japanese authorities' action but also encourage Argentine people to further effectively conserve and sustainably use the lakes.

Kei Yamazaki President International Lake Environment Committee Foundation (ILEC)

Contents

Chapter 1. An outline of Argentina	page
1. Land and Nature of Argentina	1
(1) An outline of the land	1
(2) Climate	2
(3) Vegetation	5
(4) Hydrology	5
2. Political, governmental and socio-economic conditions	8
3. Environmental conservation in Argentina	14
(1) An outline	14
(2) Environmental Problems in Argentina	15
(3) Law	18
(4) Environmental impact assessment	20
(5) Government Agencies	22
(6) Research	23
(7) NGOs	24
References	27
Chapter 2. Lakes in Argentina	
Section 1. Classification and State of the Environment	
of the Argentine Lakes (Rolando Quirós)	
1. Introduction	30
2. Methods	30
Regional features	31
3. Results	35
(1) Classification of lakes	35
Water chemistry	35
Environmental classification	36
(2)State of the environment of the Argentine lakes	38
4. Discussion	40
Issues and constraints for Argentine lake management	40

References	41
Section 2. The water quality of three lakes in Argentina	
1. Locations	51
2. The measurement method and equipment used	52
3. Results of the water quality analysis	5 3
3.1. Lake Setubal	53
3.2. San Roque Reservoir	55
3.3. Lake Lacar	57
4. Discussion	60
5. Water analysis technologies	61
6. Recommendations	61
References	62
Chapter 3. Lake environment conservation in Argentina	
Section 1. Rules Governing the Lakes in the Argentine Republic (Corina l	Fernandez)
1. Geographical aspects	73
2. Water resources	73
3. Lakes	74
4. Rules governing lakes	74
5. Legal and political aspect	74
6. Environmental question	75
7. Natural resources	76
8. Lakes question	77
Section 2. Issues in the Use of Argentine Lakes (María Josefa Fior	riti)
Introduction	83
Main productive activities	85
Environmental questions and uses of some lakes and reservoirs	89
Nrothwest region	89
Region of Chaco	91
Pamepean Region	93

References

Mesopotamia Rgion	97
Sierras Pameanas	99
Cuyo Region	101
Patagonia Region	103
References	109
Section 3. Monitoring of Argentine Reservoirs Water Quality and	
Environmental Impact Assessment: Current State and Issues (Oscar Nat	ചിച്ച
Environmental Impact Assessment. Ourrent State and Issues (Oscar Ivat	aie)
Introduction	114
Reservoir water quality monitoring and survey programs	115
Water quality evaluation methodology	116
Water quality issues in Argentine Reservoirs	120
Conclusions	122
Chapter 4. Case Studies	
Section 1. San Roque Reservoir (Ana Laura Ruibal Conti)	
1. Introduction	141
2. Basic characteristics	141
Location and main features	141
Dam usage	142
3. Dynamics of the San Roque Reservoir	143
4. Environmental situation	144
5. Administrative situation of the basin	145
6. Financial discussion and suggestions from the workshop	147
References	148
Section 2. Efforts and issues in the conservation and management	
of Lake Nahuel (Fernando Pedrozo)	
Summary of the principal efforts made for the diagnosis, monitoring	
and survey of the quality of waters	170
Description of the lake	170
GEMS and water monitoring station	171

Chemistry composition	171
Heavy metals	172
Phytoplankton Limiting nutrient Periphyton	173
	173 174 174 174
Trophic state	
Water currents, water residence time and lake trophism	
Treatment of the waste waters	176
Fish fauna: Evaluation and conservation	176
Institutions which participated in the different stages of the study	
of Nahuel Huapi Lake	177
References	178
Section 3. The Environment and Hydroelectric Dams:	
The Experience of the Salto Grande (Aljandro V. Otaegui)	
Abstract	199
1. The Salto Grande Reservoir	199
2. Salto Grande Experience	200
3. Purposes	201
4. Actions: Water quality	202
Fish species	202
The fauna affecting human health	203
Wild flora and fauna	203
5. Results : Water quality	204
Fish species	204
The fauna affecting human health	205
Flora and fauna	205
Chapter 5. International Cooperation	
1. International cooperation in which Argentina has been involved	209
2. International cooperation at the global level	209
3. Regional and subregional cooperation	210
4. Bilateral cooperation with neighbor countries	212
5. Development cooperation	213
6 Development cooperation from Japan	215

References 216

Chapter 6. Conclusions

217

Annex 1. An outline of the Workshop on Sustainable Management of Argentine Lakes

Annex 2. An outline of the ILEC missions

Annex 3. List of the Members of the study team