PROCEEDINGS

of the

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:

"Informed Decision Processes for Sustainable Development of Reservoirs"

and

SHORT TRAINING COURSES ON LAKE AND RESERVOIR WATER QUALITY MONITORING AND ECOLOGICAL MODELLING

March 9 to 17, 2001
City of Posadas, Province of Misiones, Argentina

June 2001

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
"Informed Decision Processes for Sustainable Development of Reservoirs"

March 9 to 17, 2001 - City of Posadas, Province of Misiones, Argentina

Organized by

United Nations Environment Programme-Division of Technology, Industry and Economics -International Environmental Technology Centre (UNEP-DTIE-IETC)

International Lake Environment Committee Foundation (ILEC)

Argentine Water Resources Institute (IARH)

La Plata River Basin Environmental Research and Management Network (RIGA)

Secretary of State General and Cabinet Coordination, Province of Misiones, Argentina

National Water Institute (INA), Argentina

Co-organized by

Japanese Ministry of Environment

Faculty of Exact, Chemical and Natural Sciences, National University of Misiones, Argentina.

Japan Fund for Global Environment/Japan Environment Cooperation

Undersecretary of Water Resources, Ministry of Infrastructure and Housing, Argentina.

Joint Argentinean Paraguayan Commission of the Paraná River

With the adhesion of

Centre of Applied Ecology for the Litoral (CECOAL), Argentina

Institute of Limnology "Dr. Raúl A. Ringuelet" (ILPLA-CONICET), Argentina

Argentine Association of Sanitary Engineering and Environment Sciences (AIDIS)

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FOREWORD

Last March 2001, along 9 days of very intense activity, over 140 representatives of many organizations from the various countries of the La Plata River Basin, and abroad, gathered in Posadas City, Province of Misiones, Argentina, to openly discuss about sustainable development and management of reservoirs. Understanding functions of lakes/reservoirs through monitoring, prediction of reservoir responses through modeling and institutional arrangements for participated decision processes, were subject to debate by the participants in the context of their own personal and country experiences and lessons learned in the region.

Short training activities on Water Quality Monitoring and Ecological Modeling of Lakes and Reservoirs, provided scientific and technological input for discussions. Thirty four (34) papers of general and specific interest, ten (10) lectures and keynote speeches by distinguished specialists and over twenty short background papers with recommendations on the Workshop topics, from various stakeholders sectors, were submitted to the meeting and most of them presented orally by their authors. All these materials were subject to critical analysis and evaluation by the participants in working group sessions, which yielded the Final Conclusions and Recommendations concerning scientific, technological and institutional aspects of sustainable reservoir development and management.

The III International Workshop also hosted the foundation of the La Plata River Basin Environmental Research and Management Network (RIGA), providing a remarkable framework for such a regional cooperative effort towards sustainable and integrated management of water resources.

Alberto T. Calcagno

On behalf of the Local Organizing Committee

ACKNOWLEDGEMENTS

The III International Workshop could be carried out thanks to the support of the International Environmental Technology Centre (UNEP-DTIE-IETC), the International Lake Environment Committee Foundation (ILEC) and the National Water Institute (INA). Also the Japanese Ministry of Environment and the Japan Fund for Global Environment/Japan Environment Cooperation contributed with their funding to the development of the pre Workshop training activities.

Organization of the Workshop was mainly driven by the Argentine Water Resources Institute (IARH), and succeeded thanks to the cooperation of the Faculty of Exact, Chemical and Natural Sciences of the National University of Misiones, the Secretary of State General and Cabinet Coordination of the Province of Misiones and the Joint Argentinean Paraguayan Commission of the Paraná River (COMIP).

Many persons within said organizations contributed to the success of the meeting. On the names of just a small number of them like Carlos Angelaccio, Carlos Brieva, José I. Enriquez, Cristina Foulon, Carlos Galian, Carolina Illañez, Ana Mugetti, Vicente Santiago Fandiño and Yosuke Yamashiki, let us express our deep gratitude and appreciation for the collaboration of them all.

Alberto T. Calcagno

On behalf of the Local Organizing Committee

LIST OF ACRONYMS

ACRONYM	DESCRIPTION[1]
AA	Aguas Argentinas S.A., Argentina
AAM	Asociación Misionera de Mediación, Argentina
AAPURE	Asociación Argentina para el Uso Racional de la Energia, Argentina
ABRH	AsSociaçao Brasileira de Recursos Hídricos, Brasil
APA-Chaco	Administración provincial del Agua, Provincia del Chaco, Argentina
APMA	Associação de Proteção do Meio Ambiente de Limeira, Brasil
BID	Banco Interamereicano de Desarrollo (IDB - Inter American Development Bank)
CAP	Comité Argentino de Presas, Argentina
CECOAL	Centro de Ecología Aplicada del Litoral, Corrientes, Argentina
CEHPAR	Centro de Estudios Hidráulicos "Professor Parigot de Souza", Paraná, Brasil
CESP	Companhia Electrica de São Paulo, São Paulo, Brasil
CICTT	Centro de Investigaciones Científicas y de Transferencia de Tecnología a la Producción, Entre Ríos, Argentina
CIRSA	Centro de Investigaciones de la Región Semiárida, INA, Argentina
CNPq	Conselho Nacional de Desenvolvimento Científico e Tecnológico, Brasil
COMIP	Comisión Mixta Argentino Paraguaya del Río Paraná, Argentina-Paraguay
COPEL	Companhia Paranaense de Energía, Paraná, Brasil
COREBE	Comisión Regional del Río Bermejo, Argentina
CPN	Centro Nacional Patagónico, Pto. Madryn, Chubut, Argentina
CTMSG	Comisión Mixta Técnica de Salto Grande, Argentina-Uruguay
DH-ER	Dirección de Hidráulica, Subsecretaría de Recursos Hídricos, Entre Ríos, Argentina

[1] Most names and geographical references are given in their native language

ACRONYM	DESCRIPTION[1]
DIPAS	Dirección Provincial de Agua y Saneamiento, Provincia de Córdoba, Argentina
DNH	Dirección Nacional de Hidrografia, Uruguay
DEE-GSE-KU	Department of Environmental Engineering, Graduate School of Engineering, Kyoto University, Japan
DSEES-GSES-KU	Department of Socio Environmental Energy Science, Graduate School of Energy Science, Kyoto University, Japan
DTIE	Division of Technology, Industry and Economics
EBY	Entidad Binacional Yacyretá, Argentina-Paraguay
EMSA	Electricidad de Misiones S.A., Misiones, Argentina
FCA-UN Comahue	Facultad de Ciencias Agrarias, Universidad Nacional de Comahue, Neuquén, Argentina
FCEFyN-UNC	Facultad de Ciencias Exactas, Físicas y Naturales, Univesidad Nacional de Córdoba, Argentina
FCEM	Federación de Cooperativas Eléctricas de Misiones, Misiones, Argentina
FCE-UNAM	Facultad de Ciencias Económicas, UNAM, Argentina
FHySC-UNAM	Facultad de Humanidades y Ciencias Sociales de la Universidad Nacional de Misiones, Argentina
FI – UNLP	Facultad de Ingeniería, Universidad Nacional de La Plata, Argentina
FI- URU	Facultad de Ingeniería, Universidad de la República del Uruguay, Uruguay
FICH-UNL	Facultad de Ciencias Hídricas, Universidad Nacional del Litoral, Santa Fe, Argentina.
FI-UNAM	Facultad de Ingeniería, UNAM, Misiones, Argentina
GEMS	Global Environment Monitoring System
GIEU	Grupo Interdisciplinario de Ecología Urbana, Entre Ríos, Argentina
HE	Hidroconsult Engenharia S/C Ltda.. Florianópolis, SC, Brasil
IB	Itaipú Binational Entity, Brazil-Paraguay
ICA	Instituto Correntino del Agua, Corrientes, Argentina
IC-NCST	Institute of Chemistry – National Council of Science and Technology (NCST), Vietnam

ACRONYM	DESCRIPTION[1]
IDTIQ	Instituto de Desarrollo Tecnológico para la Industria Química. Instituto Nacional de Tecnología, Santa Fe, Argentina
IETC	United Nations Environment Programme – Division of Technology, Industry and Economics - International Environmental Technology Centre (UNEP-DTIE-IETC)
IFAI	Instituto de Fomento Agropecuario e Industrial, Provincia de Misiones, Argentina
IHP V-UNESCO	International Hydrological Programme IHP V, Project 2.3/2.4 on EcoHydrology, UNESCO
IIE	Instituto Internacional de Ecología, São Carlos, SP, Brasil
ILINOA	Instituto de Limnología del Noroeste Argentino, Tucumán, Argentina
IMAS	Instituto Misionero de Agua y Saneamiento, Misiones, Argentina
IMFIA	Instituto de Mecánica de Fluidos e Ingeniería Ambiental, Universidad de la República del Uruguay, Uruguay
INA	Instituto Nacional del Agua, SSRH-MIV, Argentina
IPH	Instituto de Pesquisas Hidráulicas, Universidad Federal de Río Grande do Sul, Porto Alegre, Rio Grande Do Sul, Brasil
MEyRNR	Ministerio de Ecología y Recursos Naturales Renovables, Misiones, Argentina
MRECIC	Ministerio de Relaciones Exteriores, Comercio Internacional y Culto, Argentina
PAMOLARE	Planning and Management of Lakes and Reservoirs focusing on Eutrophication
RCEQC	Research Center for Environmental Quality Control, Graduate School of Engineering, Kyoto University, Japan
SABESP	Companhia de Saneamiento Básico do Estado de São Paulo, São Paulo, Brazil
SCyT-UBA	Secretaría de Ciencia y Técnica, Universidad de Buenos Aires, Argentina
SEMA-MS	Secretaría de Meio Ambiente, Estado de Matto Grosso do Sul, Brasil
SSRC	Subsecretaría de Relaciones con la Comunidad. Provincia de Misiones, Argentina

ACRONYM		DESCRIPTION[1]
SSRH- MIV		Subsecretaría de Recursos Hídricos de la Nación. Ministerio de Infraestructura, Argentina
SSRNyE		Subsecretaría de Recursos Naturales y Ecología, Formosa, Argentina
SUPCE – ER		Sub Unidad Provincial de Coordinación de Emergencias, Provincia de Entre Ríos, Argentina
UERJ		Universidade do Estado de Río de Janeiro, Brasil
UM		Universidad de Morón, Provincia de Buenos Aires, Argentina
UNAM		Universidad Nacional de Misiones, Argentina
UNCRD		United Nations Centre for Regional Development
UNEP		United Nations Environment Programme
UNESCO		United Nations Education and Science Organization
UNSJ		Universidad Nacional de San Juan, San Juan, Argentina.
USP		Universidade de São Paulo, São Paulo, Brasil
WCD		World Commission on Dams
WRRC-DPRI		Water Resources Research Center, Disaster Prevention Research Institute, Kyoto University (WRRC-DPRI-Kyoto University)

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

A. Introduction

The Third International Workshop on Regional Approaches to Reservoir Management and Development in La Plata River Basin, was held from March 9 to 17, 2001, in the city of Posadas, Province of Misiones, Argentina. Over 130 participants from the countries of the Basin and abroad, attended the various activities which included two short training courses on Water Quality Monitoring and Ecological Modeling of Lakes and Reservoirs, the III International Workshop and the Foundation Session of the La Plata River Basin Environmental Research and Management Network (RIGA)

The meeting was meant for experts from the five countries of the La Plata River Basin, willing to exchange country experiences, to analyze emerging policy issues in reservoir development and management and to identify and agree upon strategies and guidelines that should be incorporated to the planning, design, construction and operation stages to ensure that a participated and informed decision process leads to sustainable development and management of reservoirs.

These Proceedings present a summary of the background, objectives, focus, activities, conclusions and recommendations of the Workshop developed along nine days of intense dedication by the participants, lecturers and organizers. The list of participants, keynote speeches, papers and recommendations, as well the most relevant papers presented to the Workshop are included as Annexes.

B. Background and Objectives

This III International Workshop on Regional Approaches to Reservoir Development and Management in the La Plata River Basin is meant to (i) set the arena for an open and multisectorial debate on sustainable development of reservoirs; (ii) host foundation activities of the La Plata River Basin Environmental Research and Management Network (RIGA), which is one of the most relevant activities stemming from the recommendations of the previous I and II International Workshops, and in doing so, (iii) provide continuity and follow up to the previous regional meetings successfully held in 1991 and 1994.

The First Workshop-Training Course entitled "International Workshop on Regional Approaches to Reservoir Development and Management in the La Plata River Basin: Focus on Environmental aspects", was held at Sao Carlos (USP) and Itaipú (IB), Brazil, and Yacyretá (EBY - Ituzaingó), Argentina in August 1991. The Second, with focus on management aspects, was held at. Salto Grande (CTMSG - Concordia) and Buenos Aires (BID/INTAL), Argentina, in 1994[2]. A distinctive output of this last meeting was a strong recommendation towards the creation of a regional network to develop further the

[2] Both meetings were organized by the International Lake Environment Committee Foundation (ILEC), United Nations Environmental Programme (UNEP), United Nations Centre for Regional Development (UNCRD) together with regional and local organizations.

communication, interaction and cooperation among organizations within the basin devoted to water resources and environment management.

As a consequence, and with the support of national and international organizations like the National Council for Research and Technology Development (CNPq) of Brazil, the Argentine Water Resources Institute and the Inter American Development Bank, among many others, the grounds for the implementation of the **La Plata River Basin Environmental Research and Management Network (RIGA)**, integrated by organizations from all five countries of the basin, have been set.

La Plata River Basin, the second largest in South America spans its area of about 3,1 million sq.km and very dense and rich drainage network over the territory of five countries in the southern end of the continent. A large number of multipurpose reservoir systems have been built and many others are being planned, constituting a key feature for the development of the region. Reservoirs have been beneficial for the community in the region by satisfying energy demands, making water available for various uses and providing useful services. But they have also produced, due to their large scale interventions in land and water ecosystems, some unsuccessful experiences resulting in deleterious social and ecological effects.

As a consequence the region depicts a long history of successes and failures in reservoir development and management. Failures, mainly in the ecological and social fields, have casted environmental concerns in the recent times over reservoir construction and operation in the region. Of course this concern is not unique to the La Plata River Basin. The conflict between development and environment has found in reservoir development and management appropriate grounds to nourish the confronting opinions of many experts and organizations either in the governmental or non governmental sector, at local, national and international level, all over the world. Therefore, the concept of sustainable development faces, in the field of dams and reservoirs, a major challenge which calls for the joint efforts of all sectors to overcome it successfully.

Last November 2000, the World Commission on Dams (WCD) issued its Final Report on "Dams and Development: A new Framework for Decision Making" [3], which develops a global review of the performance of dams, and presents "an integrated assessment of when, how and why dams succeed or fail in meeting development objectives" as well as criteria and guidelines for good practice, strategic priorities and recommendations for the assessment of options, planning and the project cycle for the development of water resources and energy.

In the context of said report, but with focus on the rich experiences in the La Plata River Basin, it appears the need to review, with a constructive approach, the management and decision making processes involved in the development of existing reservoirs and the planning of future ones, in order to identify appropriate strategies for environmentally sound development and management of reservoirs in the region. Complementary, it appears the need to rebuild confidence in that the improvements achieved in the physical and social sciences and technologies, may contribute to successfully develop said strategies. This Workshop intended to stimulate actions concerning both issues.

[3] Dams and Development: A New Framework for Decision Making. Report of the World Commission on Dams An Overview. November 2000

At global level, involvement of all stakeholders, increased cooperation in international water basins and massive increase in water investments are some of the most relevant key actions identified by the World Water Vision (II World Water Forum, Le Hague, The Netherlands, 2000) to achieve the main objectives of integrated water resources management. La Plata River Basin faces the challenge of effectively implementing the recommendations from said Forum. Steps have already been taken in said direction. Some GEF funded projects, like the Upper Paraguay and the Bermejo River Binational Basin Strategic Action Programmes or the Guarani Regional Aquifer constitute good examples, among others. Development and management of multiple purpose reservoirs should be incorporated into the basin wide and participatory approach promoted by these initiatives. Said perception is reinforced by the existence of a legal framework in the countries of La Plata River Basin, both either national or international, which calls for participation and involvement of stakeholders in the use and protection of natural resources.

Therefore, La Plata River Basin displays a rich experience, past and recent, and, consequently, lessons learned by researchers, planning and funding agencies, including the major international banks, consultants, construction firms, NGOs and community based organizations should provide a valuable input to discussions and elaborations in the meeting.

In this context this III Workshop provided a forum for an open, high level, constructive debate among stakeholders to discuss and identify specific scientific, technological, institutional, economic, social and environmental criteria and guidelines, tailored to the region, that should be incorporated into project decision process leading to sustainable design, construction and management of reservoirs.

C. Focus

This III Workshop focuses on the implementation of truly informed decision processes to steer the identification, design, construction, management and dismantling of dams and reservoirs into the pathways of sustainable development. Said processes rely mainly (i) on data availability and systematic evaluation of lake-watershed environmental status and trends; (ii) a sound understanding, and appropriate conceptual and numerical modeling approaches to the simulation and prediction, of reservoirs response to watershed inputs and interrelationships in order to preserve biodiversity, water uses and human health and (iii) viable institutional and organizational arrangements to facilitate and encourage the participation of the community in project development and management activities, in the context of a basin wide approach.

To address these issues the meeting comprised two main components. The first was devoted to training activities and comprised a workshop on Water Quality Monitoring and a short training course on Ecological Modeling, both referred to lakes and reservoirs. Both activities provided input for discussions into the III International Workshop, which was the second main component. Workshop activities, were designed to enlighten the following points:

1. The extent to which the incorporation of new monitoring, data acquisition and processing techniques in the region have contributed to and may further improve information availability and the ability to assess ecosystems behavior and trends for planning and management purposes.

2. The availability of simple and friendly modeling techniques, based on a sufficient understanding of the dynamic linkages between reservoirs and their watersheds (upstream, on-site and downstream influences), tested in the region, capable of comprehending, simulating and predicting ecosystems behavior within reasonable uncertainty limits for sound decision making. Furthermore, the viability of promoting a generalized adoption of said modeling as a tool for the integrated planning and management process leading to decision making.

3. The institutional and organizational arrangements needed to further facilitate and implement truly informed decision processes for reservoir planning, construction and operation duly accounting for stakeholder information, participation and involvement.

D. Pre -Workshop Activities

A Workshop on Water Quality Monitoring and a Short Training Course on Ecological Modeling for Eutrophication Prediction in Lakes and Reservoirs, as effective and reliable design and management tools were offered to scientists, managers and specialists from various fields actively involved in research, technology development and management of water resources, particularly reservoir development and operation, in La Plata River Basin.

D.1. Water Quality Monitoring Workshop (ILEC) [4]

This workshop aimed at transferring monitoring technology and skills appropriate for reservoirs in the La Plata River Basin. Professor José G. Tundisi (IIE- ILEC Scientific Committee member) was the course leader, and together with Prof. Chris Magadza (ILEC Scientific Committee member), Prof. Le Quoc Hung (Institute of Chemistry- NCST Vietnam) and Dr. Yosuke Yamashiki (ILEC) lectured the course presenting modern monitoring and assessing techniques and concepts in the context of integrated water resources management. Field continuous and point sampling demonstration activities were carried out along the Paraná river, downstream Posadas City. Mr. Le Quoc Hung presented an on line continuous monitoring and digital recording equipment, capable of providing longitudinal and transect subsurface profiles of various water quality parameters while Prof. Tundisi and Dr. Yosuke Yamashiki (ILEC) demonstrated techniques for sampling point vertical profiles using multiparameter sampling devices.

The Faculty of Exact, Chemical and Natural Sciences of the National University of Misiones provided the facilities for the course. The *Prefectura Naval Argentina* (Fluvial GuardCoast Navy Corps) supplied the boat for the navigation. About **30 participants** from the four countries of La Plata River Basin as well as international experts attended the course and field activities.

[4] The organization of the Water Quality Monitoring Workshop was led by ILEC with the support of the Japan Fund for Global Environment

D.2. Short Training Course on Ecological Modeling (UNEP-DTIE-IETC and ILEC) [5]

The course, focusing on eutrophication in lakes and reservoirs, aimed at assisting decision makers, planners and managers in understanding the eutrophication processes and how to foreseen them, introduced the PAMOLARE 2L training package which included a number of models por PCs specifically designed for the purpose. Application examples of the model on lakes / reservoirs in different regions, were presented to illustrate about the usefulness of this kind of tools in the planning and management process. Prof. Sven E. Jorgensen (Chairman ILEC Scientific Committee) and Dr. Yosuke Yamashiki (Course leader, UNEP-DTIE-IETC) lectured theoretical and practical aspects involving the Two-layer Ecological Model for lakes/reservoirs entitled PAMOLARE2L, which is being developed by a joint effort of ILEC, UNEP-DTIE-IETC, RCEQC-Kyoto University (Japan) and the Danish Royal School of Pharmacy.

About **40 participants**, from four countries of La Plata River Basin, as well as international invited experts, attended the course and practiced the use of the model benefiting from the computer facilities kindly provided by the Faculty of Human Sciences of the University of Misiones. Dr. Fabián López (CIHRSA-INA, Arg.) and Dr. Angelo Saggio (UFSC, Br.) presented model applications case studies of San Roque Reservoir (Arg.) and Barra Bonita Reservoir (Br.), respectively.

D.3. Seminar Sessions

Over 30 papers, based on the activities and experiences achieved within their organizations and addressing the themes proposed by the Workshop, were submitted by the participants of the Training Courses and III Workshop. Complementing the training course activities, three Seminar Sessions were held, which provide an opportunity for the authors of 16 selected papers to present their findings and discussed them with the audience.

E. Third International Workshop Activities and Program

Workshop participation was open to researchers, senior staff and managers of governmental, non governmental and private sector organizations dealing with water resources, in particular reservoirs, and environment, in the La Plata River Basin region. Consequently relevant organizations, representative of the various stakeholders groups from each country and abroad, were invited to participate in the Workshop and to collaborate in the preparation and coordination of the Plenary Sessions. Annex I presents the programme of activities developed during the III Workshops while the participants who attended the Workshop and/or training activities are listed in Annex II. Annex III presents the list of papers, lectures, reports and recommendations submitted to the Workshop.

[5] The organization of the Ecological Modeling Training Course was led by UNEP-DTIE-IETC and ILEC with the support of Japanese Ministry of Environment

E.1 Opening Session

The opening ceremony was chaired by the Governor of the Province of Misiones, Argentina, who welcomed the participants and formally declared the Workshop inaugurated. Welcome speeches on behalf of the Local Organizing Committee and the International Organizations, were also offered by Mr. Alberto T. Calcagno and Mr. Vicente Santiago Fandiño respectively.

A representative of the World Commission on Dams (WCD), Mr. James Workman, offered the opening keynote speech presenting the Final Report of the WCD "Dams and Development: A New Framework for Decision-Making"

E.2 Plenary Sessions

Six **Plenary Sessions** addressed the focus topics described in section C above, on the basis of proposals with recommendations reflecting the opinion and experience of representative stakeholders sectors involved in reservoir development and management. A major part of the elaborations submitted by representatives of various stakeholder sectors, namely, science and technology, non governmental, private, international organizations, international funding agencies and governmental organizations, were presented by their authors during these sessions, giving room to enlightening discussions. Furthermore, keynote speeches by representatives of international organizations (UNESCO-IHP, UNEP-DTIE-IETC and ILEC) and international funding agencies (World Bank) were given in Plenary Sessions 4 and 5 dedicated to those sectors. Over 140 participants from the various countries of La Plata River Basin, representing a large number of organization devoted to water resources management in the Basin, as well as international invited experts, attended the III Workshop activities.

E.3 Working Group Sessions

The findings resulting from Plenary Sessions provided input to the discussions in the three Working Groups addressing each of the main themes of the meeting focus.

Working Group I: Data, information and understanding.
Working Group II: Tools for prediction and assessment of impacts.
Working Group III: Informed Decision Processes: Public participation.

The participants distributed among the various groups according to their preferences. The themes were discussed by each Group along a full day of intense activity and participation, moderated by a facilitator nominated by the Organization. The Conclusion and Recommendations of each Group, stemming from the discussions were edited by rapporteurs nominated by the participants.

E.4 Special sessions

Three **Special Sessions** were devoted to keynote speeches, special lectures and the presentation of papers selected among those submitted by the participants. Mr. Richard

Robarts (UNEP-WHO GEMS/WATER Programme, Canada) presented the GEMS/WATER Programme, in the context of the need to modernize water quality monitoring programmes in the region. Discussions following the presentations provided input for working group activities and contributed to the elaboration of the conclusions. See in Annex I the schedule of their presentation.

E.5 Final Plenary Session

The conclusions and recommendations elaborated by all three Working Groups were presented to the Plenary Final Session. They were adopted by the assembly together with the general conclusion of the Workshop. Said General Conclusion and Recommendations are presented below in Section 6 of this report.

E.6 RIGA Foundation Session

The III International Workshop also hosted the presentation and foundation of the **La Plata River Basin Environmental Research and Management Network (RIGA)**[6], a non governmental regional initiative which stems from the recommendations of the previous two International Workshops. RIGA is a cooperative effort by a number of organizations from Argentina, Brazil and Uruguay devoted to water resources and environmental research and management, to promote interaction, communication, technology transfer and coordination among governmental, non governmental and private organizations in the La Plata River Basin. Formal foundation of the RIGA was initiated during the **RIGA Session**, with the signature of the Statute and the minute of the session by founding organizations from the three countries attending the Session. The Declaration of Posadas, inviting other organizations in the Basin to join the initiative was issued at that time and is attached to this Proceedings as Annex IV.

F. Conclusions and Recommendations of the III Workshop

F.1 General Conclusion

The participants of the Third International Workshop on Regional Approaches to Reservoir Development and Management in the La Plata River Basin, as a result from the papers, recommendations and discussions held during the Plenary, Seminar and Special Sessions and in the Short Training Activities on Water Quality Monitoring and Ecological Modeling of Lakes and Reservoirs, agree on the need of renewing efforts towards the achievement of an integrated management and sustainable development of water resources at the watershed level, the present paradigms concerning water management.

They recognize the need to promote the sustainable development of the enormous potential offered by those resources all over the Basin, appropriately incorporating the technical, economical, social and environmental considerations which guarantee the acknowledgement of the economic, social and environmental value of water.

[6] **R**ed de **I**nvestigación y **G**estión **A**mbiental de la Cuenca del Río de la Plata (RIGA)

They agreed on that reservoirs, due to their capacity of addressing simultaneously various water uses, constitute a valid option[7], amongst other possible ones to be compared in equal conditions within the set of structural and non structural measures available to society, to achieve said sustainable development, in accordance with the legal arrangements existing in each jurisdiction. While recognizing that said projects, particularly those of larger dimensions, imply a significant intervention in the natural and socioeconomic system, comprising the whole basin.

Therefore, they consider a must to ensure that the decision making process of these kind of undertakings, should attend the criteria of participatory planning and adaptive management, in the context of an integrated management of water resources with an ecosystem approach at watershed level within each of the countries in the La Plata River Basin.

To this end the participants consider as appropriate to take in account the strategic priorities and guidelines recommended in the Final Report[8] of the World Commission on Dams, to which purpose said recommendations should be analyzed more in depth and be determined the best ways for their effective implementation in the reservoirs presently in operation or under planning.

Within said general framework, in order to make viable the implementation of informed and participated decision processes for reservoir development and management in the La Plata River basin, and in relation with the specific themes of this III Workshop, they recommend:

F.2 Specific Recommendations on the III International Workshop Focus Topics

a) Data, Information and Understanding

Sustainability of Monitoring Networks

Availability of data (hydro meteorological, physical-chemical and biological) in digital format, good quality and adequate quantity is essential for the realization of any study or project related to water resources use and management. This cannot be achieved without the commitment of the Governments of the countries to perform a continuous monitoring by means of the agencies involved in the collection, storage, processing and dissemination of information.

The functioning (implementation, operation and maintenance) of monitoring networks demand the availability of sufficient funding. Charging a price to water users (including discharge of effluents as a water use) has proved to be an effective tool. A recommended measure is to establish, through proper legal arrangements, that such economic resources should be allotted to the agencies in charge of water resources monitoring and management; part of it should be reinvested in the basin where they come from and the remainder be used

[7] The representatives of two NGOs, namely Ms Ana Petra Roge (Eco La Paz) and Mr Roberto A Ríos, (Asociación Ecologista "Yvy Marané'y") did not agree with this statement in what refers to dams as a valid option for development of water resources.

[8] Dams and Environment: A New Framework for Decision-Making, World Commission on Dams, November 2000.

in those regions where monitoring and management is needed but no funds are available for such purpose.

Given the leading role of biological communities in the metabolism of ecosystems, as descriptors which conspicuously reflect the environmental impacts of the interventions made, qualitative and quantitative aspects of biodiversity, community structure and bioindicators, among others, should be monitored.

Access to Information

Monitoring information of water and environmental variables collected and validated by public organizations should be accessible, free and of public domain (only reproduction costs should be charged); as regards organizations undergoing concession or privatization processes, necessary care should be taken to ensure that the information collected by organizations once said processes are completed, continues to be of public domain.

It is recommended that RIGA elaborates a Data Book of Reservoirs in the La Plata River Basin as a regional contribution to ILEC World Data Book

Network Auditing

It is a commendable practice to carry out audits of the existing networks, as a means to guarantee the quality of the data.

Standardization of sampling methodologies

It is fundamental to standardize methodologies for quantitative and qualitative monitoring. Elaboration or adaptation of common methodological guidelines at the regional level is an indispensable activity.

Monitoring networks and watershed management

Proper planning, implementation and operation of monitoring networks is imperative to achieve an adequate management of watersheds.

Small reservoirs

Extrapolation of data from monitoring networks of large extension to address problems in watershed of small dimensions less than 500 sq km, may lead to inadequate results. Establishment of monitoring plans (quantity and quality) in small watershed would contribute to cope with this situation. Users of said projects should collaborate according to their possibilities, as a means to minimize costs associated to monitoring activities.

Diffused loads

Due to the scarce monitoring of diffused loads contribution existing in the region, either urban or rural, it is recommended to increase the collection of this kind of information as a way to contribute to a representative evaluation and control of the various processes which take place

within the watershed. To this end, the study of bed sediments in reservoirs may provide relevant information.

Final Considerations

It is recommended that a Working Group be created in the framework of RIGA, to develop an Action Plan to carry out the recommendations issued in this meeting.
It is urged that these recommendations be formally communicated to the Governments of the country members of the La Plata River Basin asking them to devote their best efforts to secure their accomplishment.

b) Technologies for Prediction and Assessment of Impacts

It is recommended the use of technological tools for the systematic assessment of environmental consequences, during the planning, construction and operation of reservoirs, in the context of the watershed, as a task prior to decision making, accompanying the process of evaluation of alternatives leading to execution and definition of operating practices.

The results obtained through the application of said tools should be made available to the public with the endorsement of the scientific community in order to provide objective analysis tools as an approximation to reality within the corresponding limitations arising from the database and assumptions adopted.

As a step previous to the implementation of technological tools it should be paid attention to the aspects of cooperation, training, transference and adoption of technology, equipment, capacity of interpreting results and funding of the technical organizations of the region which are in charge of developing the utilization of said tools.

It is proposed that within the institutional framework of the La Plata River Basin, the technical component be integrated in a more effective way with a view to develop an effective interchange of information about problems, experiences and solutions.

There exists in the region an adequate technological level for the development and implementation of prediction and management tools for the problems related to reservoir development. It is envisaged as highly useful the conformation of regional centers for the adaptation and validation of said tools making use of the existing institutions.

As a further step in technology development, efforts should be devoted to the development of management tools (holistic models) for decision making incorporating social and economic variables that take in account the new paradigms on integrated watershed management.

It is recommended the integration of the use of these technological tools, to elaborate diagnosis of reservoirs in operation and its use in the environmental assessment of new projects.

It is considered a need the definition and complementation of water quality and sediment guideline criteria at watershed level, in the light of acquired experiences and on the basis of the technical requirements of the developed assessment tools. Diagnostic situations leading to

the planning of mitigation and/or remediation measures at the regional level in the medium term should be evaluated within said framework.

The integration at watershed level of basic information for the implementation and optimization of models addressing hidrosedimentological and contaminant transport aspects, is considered a must.

Mechanisms of international coordination to allow the development of contingency plans at watershed level available in the short term, should be established.

c) Informed Decision Processes – Public Participation

Organizations in charge of planning, building, managing and/or dismantling reservoirs should made available and disseminate the information to the public.

Organizations responsible for water resources management, in coordination with other competent sectors of the public administration, should implement participation processes including all involved stakeholders.

The countries of the region should adopt regulatory frameworks to promote and ensure the effective participation of all sectors.

The participation process should start with the initial project idea and accompany it along all its stages.

G. Final Considerations

This third edition of the International Workshop on Regional Approaches to Reservoir Development and Management in La Plata River Basin, succeeded in providing an arena for discussing conflictive issues concerning sustainable development of water resources, gathering together a large number of relevant specialists from the Basin and abroad, including representatives from different stakeholder sectors involved in water resources, environment and reservoir management. The objectives proposed were satisfactorily achieved and the topics submitted to debate provided a framework for the issuing of the General Conclusion and the Recommendations agreed by the participants.

The meeting also succeeded in hosting the foundation of the La Plata River Basin Environmental Research and Management Network (RIGA), which materializes the recommendations of the International Workshops I and II. Thus, this III Workshop, also meant as a follow up of the former meetings, highlights the importance of regional and international meetings and encourages their development as a way of effectively progressing in the pathway of sustainable development.

The Recommendations of the III Workshop call for further actions in the region and stronger cooperation among local, regional and international organizations. Some of these actions have been specifically endorsed to be incorporated into the Action Plan of RIGA, and, in fact, most of them fall within the objectives and programs of said regional initiative. Thus, not only the

framework for action but the means to carry them out had been set in this III Workshop. It is to be hoped that the next IV Meeting will encounter the region and RIGA actively engaged in their realization.

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
"Informed Decision Processes for Sustainable Development of Reservoirs"

March 9 to 17, 2001 - City of Posadas, Province of Misiones, Argentina

ANNEX I
PROGRAMME OF ACTIVITIES

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

"Informed Decision Processes for Sustainable Development of Reservoirs"

SHORT TRAINING COURSES ON WATER QUALITY MONITORING AND ECOLOGICAL MODELING OF RESERVOIRS

March 9 to 17, 2001 - Posadas City, Province of Misiones, Argentina

DETAILED PROGRAMME OF ACTIVITIES

TRAINING WORKSHOP ON WATER QUALITY MONITORING OF LAKES AND RESERVOIRS	
Time	**Activity**
	Friday March 9, 2001
8.30 – 9.30	**Registration of participants**
9.30 – 10.00	**Opening Ceremony of the Training Workshop on Water Quality Monitoring of Lakes and Reservoirs** Mr. Alberto T. Calcagno, on behalf of the Local Organizing Committee. Mr. Yosuke Yamashiki, on behalf of ILEC Mr. Horacio Schwieters, Dean of the Faculty of Exact, Chemical and Natural Sciences, National University of Misiones, Argentina.
10.00 - 12.30	**Workshop Session** Lecturer: Mr. José Galizia Tundisi (ILEC/IIE)
12.30 - 14.30	Lunch
14.30 - 18.00	**Workshop Session** Lecturers: Mr. José Galizia Tundisi (ILEC/IIE) Mr. Yosuke Yamashiki (UNEP-DTIE-IETC / ILEC) Mr. Le Quoc Hung (ICH-NCST)

TRAINING WORKSHOP ON WATER QUALITY MONITORING OF LAKES AND RESERVOIRS	
Time	**Activity**
	Saturday March 10, 2001
8.00 – 12.30	Field trip along the Paraná River . Demonstration and practice of point and continuous in situ sampling activities Lecturers: Mr. José Galizia Tundisi (ILEC/IIE) Mr. Yosuke Yamashiki (UNEP-DTIE-IETC / ILEC) Mr. Le Quoc Hung (ICH-NCST)
15.30 – 17.30	**Workshop Session** Lecturers: Mr. José Galizia Tundisi (ILEC/IIE) Mr. Yosuke Yamashiki (UNEP-DTIE-IETC / ILEC) Mr. Le Quoc Hung (ICH-NCST)
17.30 - 18.00	**Conclusions** Mr. José Galizia Tundisi (ILEC/IIE)

TRAINING COURSE ON ECOLOGICAL MODELING OF LAKES AND RESERVOIRS		
Time	**Activity**	**Moderator / Rapporteur**
	Sunday March 11, 2001	
8.30 – .30	**Registration of participants**	
9.30 – 10.00	**Opening Ceremony of the Short Training Course on Ecological Modeling of Lakes and Reservoirs** Mr. Alberto T. Calcagno, on behalf of the Local Organizing Committee. Mr. Yosuke Yamashiki, as Course Leader Mr. Vicente Santiago Fandiño, on behalf of UNEP-DTIE-IETC Mr. Carlos Galian, on behalf of the Faculty of Exact, Chemical and Natural Sciences, National University of Misiones, Argentina.	
10.00 - 12.30	**Training Course Session** Lecturer: Mr. Sven Jorgensen (ILEC)	
12.30 - 14.30	Lunch	
14.30 - 18.00 -	**Training Course Session** Lecturer: Mr. Yosuke Yamashiki (UNEP-DTIE-IETC /ILEC) Mr. Sven Jorgensen (ILEC)	
18.00 – 19.30	**Seminar Session 1** • Establishment of national environment water quality guidelines, Mr. Andres Carsen • Hydrological monitoring and reservoir operation management in the State of Paraná, Brazil, Ms. Arilde S. Gabriel de Camargo • Real time monitoring of water quality in water supply reservoirs in the Metropolitan Region of São Paulo (Brazil), Mr. Armando Pérez Flores • Water Quality and Sediment Monitoring in Los Molinos Reservoir, Córdoba, Argentina, Ms. Ana Cossavella	Mr. Carlos Galian (FCEQyN-UNAM) Mr. Alberto Calcagno (IARH/ILEC)

TRAINING COURSE ON ECOLOGICAL MODELING OF LAKES AND RESERVOIRS		
Time	**Activity**	**Moderator / Rapporteur**
	Monday March 12, 2001	
9.00 - 12.30	**Training Course Session** Lecturer: Mr. Sven Jorgensen (ILEC)	
12.30 - 14.30	Lunch	
14.30 - 18.00 -	**Training Course Session** Lecturer: Mr. Yosuke Yamashiki (UNEP-DTIE-IETC /ILEC) Mr. Sven Jorgensen (ILEC)	
18.00 – 19.30	**Seminar Session 2** • Application of statistical techniques applied to optimization of sampling campaigns in a reservoir, Ms Alice. E. González • CEHPAR and its experience in the conservation and management of water resources, Ms. Regina Tiemy Kishi • Model for growth prediction of populations in limited environments, without predators, Mr. Eduardo Zamanillo • Integrated Management Plan of the Wetlands of River Parelheiros, Ms. Rosalice Mincherian • Environmental Management Programme for Casa de Piedra Reservoir, Colorado River. First Stage: monitoring and modeling, Mr. Sergio Stangaferro	Mr. Sven E. Jorgensen (ILEC) Mr. Angelo Saggio (USP)

TRAINING COURSE ON ECOLOGICAL MODELING OF LAKES AND RESERVOIRS		
Time	**Activity**	**Moderator / Rapporteur**
	Tuesday March 13, 2001	
9.00 - 12.30	**Training Course Session** Lecturer: Mr. Sven Jorgensen (ILEC)	
12.30 - 14.30	Lunch	
14.30 - 18.00 -	**Training Course Session** Lecturers: Mr. Fabián López (CIHRSA-INA) – San Roque Reservopir Case Study Mr. Angelo Saggio (USP) – Barra Bonita Reservoir Case Study	
18.00 – 19.30	**Seminar Session 2** • Impact of environmental flows on drinking water supply in La Plata River Basin, Mr. Guillermo Nociari • Incidence of coastal raw sewage discharges in Setúbal shallow lake (Santa Fe), Mr. Alfredo Trento • Relocation of the City of Federación. Salto Grande Bi-national Hydropower Development (Argentina - Uruguay), Mr. Carlos Avogadro • Small hydropower plants in La Plata River Basin tributaries: A feasible alternatives for water power development, Ms. Nicole Ioanne Firta • Spatial and time variability of physical and chemical parameters in Ullum Reservoir, Ms. María Eugenia Paz	Mr. Yosuke Yamashiki (UNEP-DTIE-IETC / ILEC) Ms. Ana Mugetti (SSRH)

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

"Informed Decision Processes for Sustainable Development of Reservoirs"

SHORT TRAINING COURSES ON WATER QUALITY MONITORING AND ECOLOGICAL MODELING OF RESERVOIRS

March 9 to 17, 2001 - Posadas City, Province of Misiones, Argentina

DETAILED PROGRAMME OF ACTIVITIES

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Wednesday March 14, 2001	
8.30 – 12.30	**Registration of participants**	
9.30 – 10.30	**Opening Ceremony of the III International Workshop** Mr. Alberto T. Calcagno, on behalf of the Local Organizing Committee Mr. Vicente Santiago Fandiño on behalf of the International Organizations Mr. Carlos Rovira, Governor of the Province of Misiones	
10.30-11.30	**Presentation of the Final Report of the World Commission on Dams** Mr. James Workman. Senior Advisor, Media & Communications, WCD	
11.30-12.00	**Presentation of the Objectives, Activities and Expected Outputs from the Workshop** Mr. Alberto Calcagno, Organizing Committee	

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Wednesday March 14, 2001	
15.00 – 16.30	**Plenary Session 1: Science and Technology Sector** Presentation of recommendations that reflect the opinion and experience of Universities and Institutions devoted to research and technology development. • Considerations about Sustainable Development and Projects of Hydraulic Infrastructure. Mr. Fabián López e Mr. Carlos Angelaccio – CIRHSA-INA (Arg.) • Hydraulic and Hydrology Centre "Professor Parigot de Souza", Ms. Ingrid Müller CEHPAR (Br.) • Problem Identification and Recommendations on reservoir monitoring, simulation and management. Mr. Carlos Tucci, IPH (Br.) • Sediment-nutrient-bacteria rol and its importance in water quality changing proceses in lakes and reservoirs. Ms. Claudia Orona, UNC (Arg.) Discussion	Mr. Alejandro Arcelus (DNH) Mr. Claudio Laboranti (SSRH)
	Coffee break	
16.45 – 18.15	**Plenary Session 2: Non Governmental Sector** Presentation of recommendations that reflect the opinion and experience of non governmental, users and civil society organizations, involved in natural resources management, environment protection and social development. • Does true participation exist?. Ms. Anna Petra Roge Amigos de la Tierra, (Arg.) • ABRH Vision: Water Resources Systems Management. Mr. Carlos Tucci ABRH, (Br.) • Informed Decision Processes for the Sustainable Development of Water Resources. Mr. Alberto T. Calcagno IARH, (Arg.) • Compromise with Sustainable Reservoirs Development and Management, Mr..Ernesto Ortega, CAP, (Arg.) Discussion	Mr. Marcelo Gaviño Novillo (UNLP) Ms. Alicia Fernández Cirelli (UBA)
	Coffee Break	

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Wednesday March 14, 2001	
18.30 – 20.00	**Special Session 1** Key note lectures and presentations by the participants • The GEMS/WATER Programme and the Need to Modernize Water Quality Monitoring Programmes. Mr. Robart Richards, UNEP GEMS/Water Collaborating Centre, Environment Canada • Performance of fish facilities in Lower La Plata River Basin Reservoirs: Results and perspectives, Mr. Claudio Baigún (Arg.) • Quantification tools for the management of sedimentation in reservoirs, Mr. Pablo A. Tarela, INA, (Arg.) • Presentation of CYTED Programme – Ibero American Eutrophication Network. Ms. Alicia Fernández Cirelli, UBA (Arg.)	Mr. F. López (CIRHSA-INA) Mr. E. Nery Huerta (IB)

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

March 9 to 17, 2001 - Posadas City, Province of Misiones, Argentina

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III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Thursday March 15, 2001	
9.00 – 10.30	**Plenary Session 3: Private Sector** Presentation of recommendations that reflect the opinion and experience of consulting, building and operating private organizations dealing with planning, design, construction, and operation of dams. • Environmental Challenges of an Energy Enterprise – Environmental Vision of COPEL. Ms. Arilde. S.G. de Camargo, COPEL (Br.) Discussion	Mr. Alberto Calcagno (IARH/ILEC) Mr. Daniel Perczyk (COMIP)
	Coffee break	
11.00 – 12.30	**Plenary Session 4: International Organizations** Presentation of experiences from international organizations dealing with natural resources and environment management • UNESCO- IHP V Programme "Ecohydrology": the use of ecosystem properties as management tools for integrated river basin management. Dr. Maciej Zalewsky Science Academy of Varzovia • Informed Decisión Proceses for Sustainable Development of Reservoirs: Technology as a part of the process. Dr. Vicente Santiago Fandiño. UNEP-DTIE-IETC • Activities of ILEC: Monitoring, modeling and databases. Dr. Yosuke Yamashiki . ILEC Discussion	Mr. Carlos Angelaccio (INA) Ms. Beatriz Tracanna de Albornoz (ILINOA)

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Thursday March 15, 2001	
15.00 – 16.30	**Plenary Session 5: International Financing Organizations** Presentation of recommendations that reflect the opinion and experience of international funding organizations • Reservoir Sustainability, the RESCON project in the World Bank, Mr. Alessandro Palmieri, Senior Dam Specialist, World Bank Discussion	Mr. C. Tucci (ABRH, IPH) Ms. A. Mugetti (SSRH)
	Coffee break	
16.45 – 18.15	**Plenary Session 6: Governmental Sector** Presentation of recommendations that reflect the opinion and experience of governmental organizations dealing with natural resources and environmental management and, in particular, to dams and reservoir management • Considerations about Reservoir management by the National Board of Hydrography. Mr. Alejandro Arcelus, DNH (Ur.) • Environmental management of Itaipu Binational, Mr. Hélio Fontes, IB (Br.) • CESP experience in reservoir management. Mr. Uhlig, Alexandre (CESP) (Br.) • Operational Hydrologic System in Salto Grande Reservoir. Mr. Eduardo Zamanillo CTMSG (Arg.) • Water Institute of Corrientes. Mr. Mario Rujana (Arg.) • Warning on the Degradation of Water Quality and Lack of Integrated Water Resources Management in La Plata River Basin, Mr. Ramón Vargas APA (Arg.) Discussion	Mr. P. Bronstein Mr. I. Illich Müller (CEHPAR)
	Coffee break	

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Thursday March 15, 2001	
18.30 – 20.00	**Special Session 2** Key note lectures and presentations by the participants • IWRM: Formulation of Multi Objective Optimization of Water Quantity and Quality in Storage Reservoirs. Mr. Paulo Chaves (Br.) • Environmental Guidelines for the Operation and Maintenance Management of the Yacyretá Hydroelectric System. Mr.. Alfredo Fortuny (Arg.) • Ayui reservoir: A joint venture for water management. Pablo Bronstein et al. • Optimal Strategy to Reduce Pollutant Emission. Ms. Matsumoto, Miyuki (Jp.) • An overview vision of the institutional situation of the water resources sector in Rio de Janeiro State, Brazil. Ms. Thereza C. de Rosso (Br.) • Incorporation of New Monitoring Techniques in La Plata River Basin Region, Ms. Nora L. Andreani (Arg.)	Mr. Carlos Galián (FCEFyN-UNAM) Mr. Oscar Duarte (DH-ER)

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

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III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Friday March 16, 2001	
9.00 – 10.30	**Working Group Session I:**	
	Group I: Data, Information and Understanding	Mr. Carlos Tucci Mr. Alejandro Arcelus
	Group II: Technologies for prediction and assessment of impacts	Mr. Carlos Angelaccio Ms. Daniela García
	Group III: Informed decision processes: Public participation	Ms. Ana Mugetti, Ms. Ana Roge
	Coffee break	
11.00 – 12.30	**Working Group Session II:**	
	Group I: Data, Information and Understanding	Mr. Carlos Tucci Mr. Alejandro Arcelus
	Group II: Technologies for prediction and assessment of impacts	Mr. Carlos Angelaccio Ms. Daniela García
	Group III: Informed decision processes: Public participation	Ms. Ana Mugetti, Ms. Ana Roge
15.00 – 16.30	**Working Group Session: Conclusions**	

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator / Rapporteur**
	Friday March 16, 2001	
	Group I: Data, Information and Understanding	Mr. Carlos Tucci Mr. Alejandro Arcelus
	Group II: Technologies for prediction and assessment of impacts	Mr. Carlos Angelaccio Ms. Daniela García
	Group III: Informed decision processes: Public participation	Ms. Ana Mugetti, Ms. Ana Roge
17.00 – 18.15	**Final Plenary Session:** Consideration of Workshop Conclusions and Recommendations	Mr. Alberto Calcagno Mr. Alejandro Arcelus Ms. Daniela García Ms. Ana Roge
	Coffee break	
18.30 – 20.00	**Special Session 3** Key note lectures and presentations by the participants • Analysis of the Report of the World Commision on Dams. Mr. Andrés Ortiz • Methodological proposal to be adopted by RIGA Network to address emergency situations. Mr. José E. Lobos (INA) • Evolution of Environmental Management in Yacyreta Reservoir. Mr. Enrique Gandolla (EBY) • Information, participation and commitment of involved stakeholders. Ms. Silvina Nosiglia de Cella • Institute of Fluid Mechanics and Environmental Engineering (IMFIA) of the Faculty of Engineering of the University of the Republic of Uruguay, Ms. Alice. E. González (IMFIA) • Regional Approaches to the Restauration and Preservation of Water Quality of reservoirs in watersheds of Tucuman. Ms. Beatriz Tracanna de Albornoz (ILINOA) • Populations of shads in Paraná Medio River. Ms. Elly Cordiviola de Yuan (INALI)	Mr. Luis Jacobo Ms. María J. Fioriti

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

March 9 to 17, 2001 - Posadas City, Province of Misiones, Argentina

DETAILED PROGRAMME OF ACTIVITIES

III INTERNATIONAL WORKSHOP		
Time	**Activity**	**Moderator**
	Saturday March 17, 2001	
9.00-10.00	**Presentation of Conclusions and Recommendations**	Mr. Alberto Calcagno
10.00-11.30	**Session of the La Plata River Basin Environment Research and Management Network (RIGA)** Presentation of the initiative: background, objectives, organization, plan of action, financial programme, statute. Mr. Alberto Calcagno, RIGA Technical Committee Coordinator Reading of RIGA Foundation Act and the Declaration of Posadas, Ms. Ana Mugetti Signature of Foundation Act by representatives of member organizations	Mr. Alberto Calcagno Ms. Ana Mugetti
12.00 – 12.30	**Closing Ceremony** Mr. Vicente Santiago Fandiño, on behalf of UNEP-DTIE-IETC Mr. Yosuke Yamashiki, on behalf of ILEC Mr.. Horacio Schwieters, on behalf of the Faculty of Exact, Chemical and Natural Sciences, National University of Misiones, Argentina Mr. Alberto T. Calcagno, on behalf of the Local Organizing Committee Mr. Luis Jacobo, on behalf of the Government of the Province of Misiones.	

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
"Informed Decision Processes for Sustainable Development of Reservoirs"

March 9 to 17, 2001 - City of Posadas, Province of Misiones, Argentina

ANNEX II
LIST OF PARTICIPANTS

III INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN

"Informed Decision Processes for Sustainable Development of Reservoirs"

SHORT TRAINING COURSES ON WATER QUALITY MONITORING AND ECOLOGICAL MODELING OF RESERVOIRS

March 9 to 17, 2001 - Posadas City, Province of Misiones, Argentina

LIST OF PARTICIPANTS

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THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
"Informed Decision Processes for Sustainable Development of Reservoirs"

March 9 to 17, 2001 - City of Posadas, Province of Misiones, Argentina

ANNEX III

LIST OF PAPERS, LECTURES, KEYNOTE SPEECHES AND SHORT BACKGROUND PAPERS WITH RECOMMENDATIONS SUBMITTED TO THE WORKSHOP

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
"Informed Decision Processes for Sustainable Development of Reservoirs"
March 9 to 17, 2001 - City of Posadas, Province of Misiones, Argentina

LIST OF PAPERS, LECTURES, KEYNOTE SPEECHES AND SHORT BACKGROUND PAPERS WITH RECOMMENDATIONS SUBMITTED TO THE WORKSHOP BY CATEGORY AND TITLE

PAPERS	
TITLE	**AUTHOR/S**
Aplicación de técnicas estadísticas a la optimización de campañas de muestreo en un embalses / Statistical Techniques Applied to Optimisation of Sampling Campaigns in a Reservoir	González, Alice. E. (IMFIA)
Calidad del agua del Embalse de Itaipu. Programa de estudios de la ITAIPU / Water Quality in Itaipú Reservoir. Program of Studies of ITAIPU Binational	Hermosa A., José Luis (IB)
CEHPAR e sua experiência en la conservação e gestão dos recursos hídricos / CEHPAR and its experience in the conservation and management of water resources	Kishi, Regina Tiemy et al.
Conflicts and management perspectives of reservoirs in the São Francisco River (Brazil) / Perspectivas de conflicto y gestión de embalses en la Cuenca del Río san Francisco (Brasil)	Gaal Vadas, Rolando (Br.)
El Embalse de Río Hondo (Stgo. del Estero-Tucumán, Argentina): Un Humedal Conflictivo / Rio Hondo Reservoir (Stgo. del Estero-Tucumán, Argentina): A conflicting wetland	Villagra de Gamundi, Alcira ILINOA (Arg.)
Embalse Ayui: un emprendimiento coparticipativo de gestión conjunta. / Ayui reservoir: A joint venture for water management.	Bronstein, Pablo et al.
Establecimiento de niveles guía nacionales de calidad de agua ambiente / Establishment of national environment water quality guidelines	Carsen, Andrés y Jakomin, Luz M. (SSRH-MIV)
Evolución de la Gestión Ambiental en el Proyecto Yacyretá / Evolution of Environmental Management in Yacyreta Reservoir.	Gandolla, Enrique (EBY)

PAPERS	
TITLE	**AUTHOR/S**
Funcionamiento de los sistemas de transferencia para peces en represas de la baja Cuenca del Plata: Resultados y perspectivas. / Performance of fish facilities in Lower La Plata River Basin Reservoirs: Results and perspectives	Baigún, Claudio (CPN) & Oldani, Norberto (IDTIQ)
Gerenciamiento integrado de recursos hídricos- monitoramento e avaliação da qualidade da agua / Integrated water resources management- Water Quality Monitoring and Assessment.	Tundisi, José Galizia (IIE)
Herramientas de cuantificación para la gestión de la Sedimentación de Embalses / Quantification tools for the management of sedimentation in reservoirs	Tarela, Pablo A. (INA)
Hydrological monitoring and reservoir operation management in the State of Paraná, Brazil / Gestión del monitoreo hidrológico y de la operación de embalses en el Estado de Paraná, Brasil	Gabriel de Camargo, Arilde S. (COPEL)
Impacto de los flujos ambientales en la Cuenca del Plata sobre la producción de agua potable / Impact of environmental flows on drinking water supply in La Plata River Basin	Nociari, Guillermo y López, Walter. (AA)
Implementación del Procedimiento Cadena de Custodia de Muestras en Programas de Monitoreo Ambiental como Elemento de Aseguramiento de la Calidad / Implementation of Sampling Custody Chains Procedures in Environmental Monitoring Programs as a Quality Assurance Element.	Rodríguez Speroni, María A. (INA)
Incidencia de las descargas cloacales costeras en la Laguna Setúbal (Santa Fe) / Incidence of coastal raw sewage discharges in Setúbal shallow lake (Santa Fe)	Trento, Alfredo et al. (FICH-UNL)
IWRM: Formulation of Multi Objective Optimization of Water Quantity and Quality in Storage Reservoirs / GIRH: Formulación de una Optimización Multiobjetivo de Cantidad y Calidad del Agua en Embalses de Regulación	Chaves, Paulo (WRRC)
Limnoisperma Fortunei (Bivalvia: Mytilidae) en los circuitos de enfriamiento y otros sectores de la Central Hidoeléctrica de Yacyretá / *Limnoisperma Fortunei* (Bivalvia: Mytilidae) in the cooling systems and other sectors of Yacyretá Hydropower Plant	Di Persia, Danilo (GIEU) y D´Angelo, Raúl (CICTT)
Modelación matemática del transporte de sedimentos y la evolución del lecho de embalses / Mathematical modeling of sediment transport and reservoir bed evolution.	Tarela, Pablo & Menéndez, Angel (INA)

PAPERS	
TITLE	**AUTHOR/S**
Modelo de predicción de crecimiento de poblaciones en ambientes acotados, sin predadores / Model for growth prediction of populations in limited environments, without predators	Irigoyen, Manuel et al. (CTMSG)
Monitoreamento em tempo real da qualidade da água dos manaciais da Região metropolitana de São Paulo (Brasil) / Real time monitoring of water quality in water supply reservoirs in the Metropolitan Region of São Paulo (Brazil)	Pérez Flores, Armando (SABESP)
Monitoreo de Calidad de Agua y Sedimentos del Embalse Los Molinos I, Córdoba, Argentina / Water Quality and Sediment Monitoring in Los Molinos Reservoir, Córdoba, Argentina	Cossavella, Ana et al. (FCEFyN-UNC -CIRSA-DIPAS)
Monitoreo de Lagunas del Area Metropolitana del Gran Resistencia / Monitoring of shallow lakes in the Metropolitan Area of Great Resistencia	Otaño, Silvia H. y Vera, Delia S. (APA-Chaco)
PAMOLARE Training Package Version 1.0 / Módulo de Capacitación de PAMOLARE Versión 1.0	UNEP-DTIE-IETC / ILEC
Plano de Gerenciamiento Integrado da Várzea do Parelheiros / Integrated Management Plan of the Wetlands of River Parelheiros	Mincherian, R y Kertzman, F. (SABESP)
Prediction of Colonization of macrophytes in the Yacyretá reservoir of the Paraná River (Argentina and Paraguay) / Predicción de la Colonización de Macrófitas en el Embalse de Yacyreta en el Río Paraná.	Neiff, Juan J. et al. (CECOAL)
Programa de Gestión Ambiental del Embalse Casa de Piedra, Río Colorado (Argentina). Primera Etapa: monitoreo y modelado / Environmental Management Programme for Casa de Piedra Reservoir, Colorado River. First Stage: monitoring and modeling	Horne, Federico et al. (FCA-UNC)
Programa de Monitoreo del Embalse San Roque (Córdoba, Argentina), Período 1999-2000 / Monitoring Programme of San Roque Reservoir (Córdoba , Argentina), Period 1999-2000	Bustamante, María et al. (CIRSA)
Propuesta metodológica para ser adoptada por los integrantes de la red RIGA frente a situaciones de emergencia / Methodological proposal to be adopted by RIGA Network to address emergency situations	Lobos, José E. CTUA-INA (Arg.)
Relocalización de la Ciudad de Federación: Aprovechamiento Hidroeléctrico Binacional Salto Grande (Argentina-Uruguay) / Relocation of the City of Federación. Salto Grande Bi-national Hydropower Development (Argentina - Uruguay)	Avogadro, Carlos (UM.)

PAPERS	
TITLE	**AUTHOR/S**
Small hydropower plants in La Plata River Basin tributaries: A feasible alternatives for water power development / Pequeñas centrales hidroeléctricas en tributarios de la Cuenca del Río de la Plata: Alternativas factibles para el desarrollo de energía hidroeléctrica	Firta, Ioana N. et al. (HE)
Strategy to Reduce Pollutant Emission: Nitrogen Balance in Forest and Integrated Watershed Management. Case Study of Lake Biwa, Japan / Estrategia para Reducir la Emisión de Contaminantes: Balance de Nitrógeno en un Bosque y Manejo Integrado de los Recursos Hídricos.	Matsumoto, Miyuki (DSEES-GSES-KU)
Uma visão panorámica da situação institucional do sector de recursos hídricos no estado do Rio de Janeiro, Brasil / An overall vision of the institutional situation of the water resources sector in Rio de Janeiro State, Brazil	Almeida RossoT. C. de e Saldanha Machado, C. (UERJ)
Variabilidad espacial y temporal de los parámetros físicos-químicos en el embalse de Ullum / Spatial and time variability of physical and chemical parameters in Ullum Reservoir	Paz, María Eugenia et al. (UNSJ)

LECTURES / KEYNOTE SPEECHES	
TITLE	**SPEAKER**
Activities of ILEC: Monitoring, Modeling and Databases / Actividades de ILEC: Monitoreo, modelación y bases de datos.	Yamashiki, Yosuke. (ILEC)
Pautas Ambientales en la Gestión de la Operación y Mantenimiento del Complejo Hidroeléctrico Yacyreta. / Environmental Guidelines for the Operation and Maintenance Management of the Yacyretá Hydroelectric System.	Fortuny, Alfredo (EBY)
Presentación de los Objetivos, Actividades y Resultados Esperados del III Taller / Presentation of the Objectives, Activities and Expected Outputs from the III Workshop	Calcagno, Alberto T. IARH-ILEC
Presentación de RIGA: Red de Investigación y Gestión Ambiental de la Cuenca del Río de la Plata / Presentation of RIGA: La Plata River Basin Environmental Research and Management Network	Calcagno, Alberto T. (RIGA)

Presentación del Programa CYTED - Red Iberoamericana de Eutroficación / Presentation of CYTED Programme – Ibero American Eutrophication Network	Fernández Cirelli, Alicia (SCyT-UBA)
Presentation of the Final report of the World Comisión on Dams (WCD)/ Presentación del Informe de la Comisión Mundial de Represas	Workman, James. (WCD)
Procesos Informados de Decisión para el Desarrollo Sustentable de Embalses: La tecnología como parte del proceso / Informed Decisión Proceses for Sustainable Development of Reservoirs: Technology as a part of the process..	Santiago Fandiño, Vicente (UNEP-DTIE-IETC)
Reservoir Sustainability, the RESCON project in the World Bank / Sustentabilidad de Embalses, el Proyecto RESCON del Banco Mundial	Palmieri, Alessandro (World Bank)
The GEMS/WATER Programme and the Need to Modernize Water Quality Monitoring Programmes / El Programa GEMS/WATER y la Necesidad de Modernizar los Programas de Monitoreo de Calidad de Aguas	Robarts, Richard, (UNEP GEMS/Water)
UNESCO- IHP V Programme "Ecohydrology": The use of ecosystem properties as management tools for integrated river basin management / El Programa "Ecohidrología" UNESCO - PHI V: El uso de las propiedades del ecosistema como herramienta de manejo para la gestión integrada de cuencas.	Zalewsky, Maciej (UNESCO IHP V – Projects 2.3/2.4)

SHORT BACKGROUND PAPERS WITH RECOMMENDATIONS	
TITLE	**AUTHOR/S**
A experiencia da CESP na gestão dos seus reservatórios. / CESP experience in reservoir management	Uhlig, Alexandre et al. (CESP)
A visão da ABRH: Gerenciamiento dos Sistema Hídricos / ABRH Vision: Water Resources Systems Management	Tucci, Carlos (ABRH)
Acuífero Guaraní en la Provincia de Corrientes / Guarani Aquifer in the Province of Corrientes	Angeleri, José
Alerta sobre el Deterioro de la calidad del Agua y la falta de gestión Integral de los Recursos Hídricos de la Cuenca del Plata / Warning on the Degradation of Water Quality and Lack of Integrated Water Resources Management in La Plata River Basin	Vargas, Ramón (APA)

SHORT BACKGROUND PAPERS WITH RECOMMENDATIONS	
TITLE	**AUTHOR/S**
Algunas Acciones de la Subsecretaría de Recursos Hídricos de la república Argentina / Some Activities of the Argentine Undersecretariat of Water Resources	Fioriti, María J. (SSRH-MIV))
Calidad del Agua en el Embalse de Itaipú / Water Quality in Itaipú Reservoir	Hermosa, H. José L. (IB)
Centro de Hidráulica e Hidrología "Professor Parigot de Souza / Hydraulic and Hydrology Centre "Professor Parigot de Souza"	Müller, Ingrid Illich (CEHPAR)
Compromiso con el Desarrollo y Gestión de Embalses Sustentables / Compromise with Sustainable Reservoirs Development and Management	Ortega, Ernesto (CAP)
Consideraciones sobre el Desarrollo Sustentable y las Obras de Infraestructura Hidráulica / Considerations about Sustainable Development and Projects of Hydraulic Infrastructure.	López, Fabian (CIRSA) & Angelaccio, Carlos (INA)
Consideraciones sobre la gestión de embalses por parte de la Dirección Nacional de Hidrografía. / Considerations about Reservoir management by the National Board of Hydrography	Arcelus, Alejandro (DNH)
Desafíos Ambientais de uma Empresa de Energía- A Visão Ambiental da COPEL / Environmental Challenges of an Energy Enterprise – Environmental Vision of COPEL	Gabriel de Camargo, Arilde S. (COPEL)
El Conocimiento de los Recursos Hídricos / Water Resources Knowledge	Millón, Jorge E. et al. (FI-UNSJ)
El Sistema de Hidrología Operativo de la Represa de Salto Grande / Operational Hydrologic System in Salto Grande Reservoir	Irigoyen, M et al. (CTMSG)
Enfoques regionales de recuperación y preservación de la calidad de agua de embalses en cuencas de Tucumán / Regional Approaches to the Restauration and Preservation of Water Quality of Reservoirs in Watersheds of Tucuman.	Tracanna de Albornoz, Beatriz (ILINOA)
Eventual trasvase entre Lago Presa Yacyretá y Esteros del Iberá / Posible water transfer between Yacyretá Reservoir and Ibera Wetlands	Angeleri, José
Existe la verdadera participación? / Does true participation exist?.	Roge, Anna Petra (Eco La Paz)

SHORT BACKGROUND PAPERS WITH RECOMMENDATIONS	
TITLE	**AUTHOR/S**
Explotación futura de minerales pesados aguas debajo de la Presa de Yacyretá / Future exploitation of heavy minerals downstream Yacyreta Dam	Angeleri, José (Arg.)
Gestión Ambiental de Itaipú Binacional / Environmental management of Itaipu Binational	Ing. H. José L. Hermosa (IB)
Identificación de problemas y recomendaciones sobre monitoreo, simulación y gestión de embalses / Problem identification and recommendations on reservoir monitoring, simulation and management.	Tucci, Carlos (IPH)
Información, participación y compromiso de los actores sociales involucrados / Information, participation and commitment of involved stakeholders	Nosiglia de Cella, Silvina (AAM) & Tapia, Gachi (FCD)
Instituto Correntino del Agua / Water Institute of Corrientes	Rujana, Mario (ICA)
Instituto de Mecánica de los Fluidos e Ingeniería Ambiental (IMFIA) de la Facultad de Ingeniería de la URU / Institute of Fluid Mechanics and Environmental Engineering (IMFIA) of the Faculty of Engineering of the University of the Republic of Uruguay	González, Alice. E. (IMFIA)
La Incorporación de Nuevas Técnicas de Monitoreo en la región de la Cuenca del Plata / Incorporation of New Monitoring Techniques in La Plata River Basin Region	Andreani, Nora L.
Las poblaciones de sábalo en el río Paraná Medio / Populations of shads in Paraná Medio River	Cordiviola de Yuan, Elly (INALI)
Procesos Informados de Decisión para el Desarroollo Sustentable de los recursos Hídricos / Informed Decisión Processes for the Sustainable Development of Water Resources	Calcagno, Alberto T. (IARH)
Programa de Apoio de las Organizaciones No Gubernamentales para el Desarrollo en la Areas de Embalses y Cuencas / Program for the Support of Non Governmental Organizations for Development of Reservoir Areas and Watersheds	Pareja C., J. Marco A. (APMA)
Rol de sedimentos-nutrientes-bacterias y su importancia en los procesos de variación de calidad del agua en lagos y embalses / Sediment-nutrient-bacteria rol and its importance in water quality changing proceses in lakes and reservoirs	Orona, Claudia et al. (UNC-CIRSA-DIPAS)

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
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ANNEX IV
DECLARATION OF POSADAS

Red de Investigación y Gestión Ambiental de la Cuenca del Plata
Red de Investigaçao y Gestão Ambiental da Bacia do Prata

DECLARATION OF POSADAS

On March 17, 2001, in the city of Posadas, Province of Misiones, Argentina, the representatives of the institutions of Argentina, Brazil and Uruguay which integrate the Foundation Group of **La Plata River Basin Environmental Research and Management Network (RIGA)**, who undersign this Declaration, gathered themselves within the framework of the Third International Workshop on Regional Approaches to Reservoir Development and Management in the La Plata River Basin, to initiate the Foundation Act of the Network, which will remain open until forthcoming November 15, 2001.

RIGA is a regional non governmental non profit entity, which stems from the initiative of a representative group of qualified professionals belonging to organizations devoted to water and environment management, who have been meeting in said regional events since 1991. With the formal beginning of the Foundation Act, it comes to an end the pre-foundation process started in November 1999, in occasion of Buenos Aires Meeting when the participating founding organizations issued the Declaration of Buenos Aires, informing about the initiative and inviting to join it.

The involved institutions participating in said process thank the cooperation and financial support provided by ILEC, UNEP-DTIE-IETC, UNCRD, UNEP, IDB, CNPq (Brazil) and the Ministry of Foreign Affairs of Argentina

Fully aware of the importance of improving the conditions of sustainable use and development of the water resources as well as the integrated management of the environment in the La Plata River Basin and convinced that RIGA constitutes a communication, cooperation and interaction mechanism specifically created for such purpose, those undersigning this Declaration, **invite other governmental and non governmental organizations of Argentina, Bolivia, Brazil, Paraguay and Uruguay related with the management of water resources and the environment to integrate and actively participate in RIGA, expressing formally their adhesion to the initiative**[9].

[9] To this end, as well as to receive further information about RIGA, please address any of the representatives of the organizations that integrate the Transition Technical Committee: Coordinator: Ing. Alberto Calcagno (riga_iarh@iarh.org.ar; IARH (iarh@iarh.org.ar); SSRH-Arg (mfiori@miv.gov.ar); SSRH-ER (oduarte@dher@ciudad.com.ar); FICH-UNL (fich@fich.unl.edu.ar); COPEL (fred@copel.com); CESP (alexandre.uhlig@cec.cesp.com.br); CEHPAR (ingrid@lactec.org.br); IPH-UFRGS (tucci@if.ufrgs.br); DNH (dnh@uyweb.com.uy); IMFIA (lesy@fing.edu.uy).

RIGA

Red de Investigación y Gestión Ambiental de la Cuenca del Plata

Red de Investigaçao y Gestão Ambiental da Bacia do Prata

ORGANIZATIONS AND THEIR REPRESENTATIVES WHO SIGNED THE DECLARATION OF POSADAS

CECOAL - Centro de Ecología Aplicada del Litoral, Argentina	Prof. Juan José Neiff
CEHPAR – UFPR - Centro de Hidráulica e Hidrologia Prof. Parigot de Souza. Universidade Federal do Paraná, Brasil	Ingrid Illich Müller
CESP Companhia Electrica de São Paulo (Br.)	Dr. Daniel A. Salatti Marcondes
COPEL - Companhía Paranaense de Energía, Brasil	Eng. Frederico Reichmann Neto Eng. Arilde Gabriel de Camargo
DNH - Dirección Nacional de Hidrografía, Uruguay	Ing. Carlos Arcelus
FICH - Facultad de Ingeniería y Ciencias Hídricas- Universidad Nacional del Litoral, Argentina	Ing. Alfredo Trento
IARH - Instituto Argentino de Recursos Hídricos	Ing. Alberto Calcagno Ing. Ana Mugetti
IMFIA Instituto de Mecánica de Fluidos e Ingeniería Ambiental (Ur.)	Dra. Ing. Alice E. González
INA Instituto Nacional del Agua (Arg.)	Dra. Dora Goniadzki
INALI Instituto Nacional de Limnología CONICET (Arg.)	Dra. Elly Cordiviola de Yuan
IPH-UFRGS Instituto de Pesquisas Hidráulicas (Br.) **ABRH** Associação Brasileira de Recursos Hídricos (Br.)	Dr. Carlos Tucci
SEMA/MS Secretaria de Estado de Meio Ambiente- (Br.)	Dr. Valmir Gabriel Ortega
SSRH AR Subsecretaría de Recurs Hidricos de la Nación (Arg.)	Lic. María Josefa Fioriti
SSRH ER Subsecretaría de Recursos Hídricos de la Provincia de Entre Ríos (Arg.)	Ing. Oscar Duarte

THIRD INTERNATIONAL WORKSHOP ON REGIONAL APPROACHES TO RESERVOIR DEVELOPMENT AND MANAGEMENT IN THE LA PLATA RIVER BASIN:
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ANNEX V
PAPER ABSTRACTS

Aplicación de Técnicas Estadísticas a la Optimización de Campañas de Muestreo en un Embalse

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Resumen

El trabajo que se presenta se refiere a la aplicación de técnicas estadísticas para la optimización del diseño de campañas de muestreo de calidad de aguas en un embalse. Se parte de un conjunto de datos de distintos parámetros recabados a partir de análisis de laboratorio sobre muestras extraídas en una serie de puntos geográficos del lago a distintas profundidades y en distintas épocas del año. A partir de la aplicación de herramientas estadísticas se llega a determinar el mínimo número de muestras que pueden tomarse sin perder información relevante, con lo que se consigue reducir considerablemente el número de puntos de extracción de muestras, y por ende los costos y tiempos de las campañas de extracción y de los análisis de laboratorio. Se considera una herramienta de gran interés para el diseño de monitoreos de largo plazo, donde se requiere una asignación inteligente de costos para maximizar resultados con recursos acotados.

Palabras clave: Muestreos; Calidad de aguas; Estadística aplicada; Lagos

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Statistical Techniques Applied to Optimisation of Sampling Campaigns in a Reservoir

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Abstract

This paper refers to the application of statistical techniques for the optimisation of the design of water quality sampling programs in a reservoir. The starting point is a group of different parameters' data obtained from laboratory analysis on samples extracted in some geographical points of the lake at different depths and in different times of the year. From the application of statistical tools, the minimum number of samples that can be taken without losing important information is obtained. That makes possible a considerably reduction in the number of sampling points, and as a consequence the cost and time of sample extraction campaigns and laboratory analyses become also reduced. This tool is of great interest for the design of long term sampling programs, where a careful assignment of costs is required to maximize results with reduced resources.

Keywords: Sampling; Water quality; Applied statistics; Lakes

Calidad del agua del Embalse de Itaipu. Programa de estudios de la ITAIPU Binacional

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Resumen

La evaluación de los resultados físico-químicos e hidrobiológicos en un periodo de 10 años permite concluir que los mismos no han sufrido un cambio definido, y que la composición general del plancton es similar a la observada en el antiguo rio Paraná. El Embalse se estratifica en la época cálida y puede ser clasificado como mesotrófico.

Palabras clave: Calidad de agua; Embalse; Itaipú.

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Water Quality in Itaipú Reservoir. Program of Studies of ITAIPU Binational

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Abstract

The evaluation of the main physical, chemical and hydrobiological results in the period of 10 years leads to conclude that they have not suffered a definite change, and that the general plankton composition is similar to the observed in the ancient Paraná river. The lake shows a stratification pattern in the warm period of the year and it can be classified as mesotrophic.

Keywords: Water quality; Reservoir; Itaipú

CEHPAR e sua experiência na conservação e gestão dos recursos hídricos

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Resumo

Este trabalho descreve alguns estudos do CEHPAR/LACTEC (Brasil) em corpos d'água e bacias de drenagem, salientando aqueles relacionados com a qualidade da água. Atuando desde 1959 com pesquisas e projetos, esta instituição tem acumulado e difundido experiências e conhecimentos, nos campos de hidráulica e hidrologia, subsidiando a construção de reservatórios para fins hidroenergéticos nas etapas de projeto, construção e operação. Dando ênfase aos estudos ambientais, o CEHPAR/LACTEC realiza ensaios físicos e químicos em águas e materiais diversos, desenvolve e aplica modelos matemáticos, assim como elabora estudos de diagnóstico ambiental de bacias hidrográficas, identificando usos dos solos e das águas e fontes potenciais de poluição. Estas ações vão ao encontro do desenvolvimento sustentável, que enfatiza a importância do equilíbrio entre as atividades humanas, o desenvolvimento tecnológico e o meio ambiente, bem como assegura o bom funcionamento e durabilidade das obras feitas pelo homem. O estudo de processos que ocorrem no meio ambiente e a busca de soluções eficientes e adequadas que minimizem impactos ambientais constituem metas prioritárias a serem atingidas pela Área de Recursos Ambientais do CEHPAR/ LACTEC.

Palavras-chaves: CEHPAR; LACTEC; Reservatório; Qualidade da água.

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CEHPAR and its experience in the conservation and management of water resources

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Abstract

This work summarizes some experiences of CEHPAR/LACTEC (Brasil) in studies of reservoirs and of drainage basins in the hydraulics hydrology and environment fields. Acting since 1959 with researches and projects, this institution has been accumulating and spread experiences and knowledge that help in the several phases of the reservoir, from the project and construction to the operation. Giving emphasis to the environmental studies, CEHPAR/LACTEC participates from analysis of the behavior of the physical-chemical and biological characteristics of water body, even studies of environmental diagnosis of basins, where the potential pollution sources are located, and mathematical modeling application and development. For a sustainable development, it is important of the equilibrium between the human activities and the environment, as well as the good operation and durability of the building constructed by the man. This objective it is only reached through the knowledge about processes that happen in the environment and the research of new ways that allow choose efficient measurements and methods with smaller impact to the environment.

Keywords: CEHPAR; LACTEC; Reservoir; Water quality.

Conflicts and Management Perspectives of Reservoirs in the Sao Francisco River (Brazil)

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Abstract

The Sao Francisco River is one of the most important rivers in Brazil, being known as the "River of National Unity". The 640.000 km^2 basin, which drains across the North East Brazil to the South West Atlantic Ocean, is well endowed with a rich variety of natural resources, including minerals, fish, wildlife, and lands suitable for agricultural development. The 3200 km river and its watershed has been subjected to intense economic development pressures.

The river has been historically operated exclusively for energy production and for water supply for irrigation projects. Modifications of the natural hydrological regime of the river which – while contributing to the production of "clean" energy for use by the people and industries of the basin and throughout Brazil – have proven especially destructive to organisms that depend, for reproduction and survival, on the quantity, quality, timing and rate of water flows (especially in the estuarine and coastal marine endpoints of the basin), and to groundwater sources that depend for recharge upon surface water flows.

The geomorphology of the river has been significantly modified by regulation (e.g., erosion of riverbanks, sedimentation, formation of islands in the delta, and erosion of the southern extreme of the delta). These modifications not only affect the estuary by altering flooding cycles, but also impact the nearshore marine environment by modifying the nutrient and sediment content of the river water, affecting marine fauna, and the sediment and turbidity dynamics of the estuary with observed, although unquantified, changes in the aquatic fauna, flora and geomorphology of the river mouth.

Some of the actions required to reduce impacts include (i) sound design engineering; (ii) quantification of water use (quantity and quality) and integrated operational criteria; (iii) multisectoral and public participation in the process of basin management; (iii) creation of basin committees and water user associations, representing different users and interests; (iv) application of modern water resources management principles such as tradable water rights, financial mechanisms (including polluter pays principle, water pricing, fines and taxes), monitoring systems, ecohydrology, Information Systems, and Decision Support Systems; (v) formulation of a watershed management program (including information sharing) and; (vi) strengthening of Federal, State and local institutions.

Keywords: Reservoir management; Watershed: Integrated inland coastal water resources management

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Perspectivas de Conflicto y Gestión de Embalses en el Río San Francisco (Brasil)

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Resumen

El Río Sao Francisco es uno de los ríos mas importantes en Brasil, llamado también como el "Río de Unidad Nacional". La cuenca de 640.000 km^2 , que drena en dirección nordeste para el Océano Atlántico, tiene una rica variedad de recursos naturales, que incluyen minerales, pescados, vida silvestre, y manchas de excelentes áreas agrícolas. Toda la extensión de los 3200 km del río y vares partes de la cuenca fueron expuestos a presiones intensas de desarrollo económico.

El río fue históricamente operado únicamente para la producción de energía eléctrica y para abastecimiento de agua para los proyectos de riego. Modificaciones del régimen hidrológico natural del río, por un lado contribuyeron para la producción de energía "limpia" para personas y industrias en la cuenca y en todo Brasil, pero por el otro lado, fueron muy destructivos para organismos que dependen, para reproducción y para sobrevivir, de demandas de agua en cantidad, cualidad, época y duración (especialmente en el estuario y costa marina) y también para las fuentes subterráneas que dependen de la recarga da aguas superficiales.

La geomorfología del río fue modificada significativamente por la regulación (erosión, deposito de sedimentos, formación de islas en el delta, y erosión del delta). Estos cambios no solo afectan el estuarios cambiando ciclos de llena, pero también el medio ambiente marino, cambiando el contenido de nutrientes y sedimentos en el agua, la fauna marina, la dinámica y cantidad de sedimentos, fauna acuática, flora, y la geomorfología del estuario.

Algunas de las acciones necesarias para reducir impactos incluyen (i) buenos proyectos de ingeniería; (ii) identificar y medir los diferentes de usos de agua (cantidad y cualidad) y criterios de operación; (iii) participación multisectorial y publica en el proceso de manejo de la cuenca; (iii) formación de comités de cuenca y asociaciones de usuarios de agua, representando diversos usuarios y interesados; (iv) aplicación de modernos principios de manejo de agua como mercados de agua, mecanismos financieros (incluyendo el principio del pagador contaminador, tarifas, multas y impuestos de agua), redes de monitoreo, ecohidrología, sistemas de informaciones y sistema de apoyo a la toma de decisiones; (v) elaboración de un programa de manejo de agua y transferencia de informaciones y; (vi) fortalecimiento de las instituciones Federales, Estatales y locales.

Palabras claves: Gestión de embalses; Cuenca Hidrográfica: Manejo integrado de aguas interiores y costeras

El Embalse de Río Hondo (Stgo. del Estero – Tucumán , Argentina): Un Humedal Conflictivo

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Resumen

El embalse de Río Hondo es un humedal que cumple un rol de gran importancia en la cuenca endorreica Salí – Dulce ya que ocupa una situación estratégica de recepción y redistribución del agua. Desde hace tres décadas se produce regularmente alta contaminación generada por sedimentos, residuos urbanos e industriales que son vertidos coincidentemente con la período de "aguas bajas". Hasta el presente se encararon estudios sobre aspectos físico – químicos y biológicos que permiten diagnosticar el alto grado de deterioro.

Los parámetros descriptores de contaminación (nutrientes, OD, DBO, clorofila a, entre otros) y las comunidades biológicas reflejaron en sus magnitudes, composición específica y abundancias, su sensible impacto de este ambiente "en tensión". Se aprecian diferencias significativas entre la zona limnética y la desembocadura de los tributarios ya que en la primera el volumen "amortiguó" en cierto modo su efecto. Se produce eutrofización con floraciones algales de cianofitas (*Microcystis aeruginosa*, *Anabaena flos- aquae*), abundantes euglenofitas, abundantes bacterias, ciliados y rotíferos bacteriófagos, todos elementos indicadores de alta saprobiedad, con predominancia de microcrustáceos macrofiltradores ciclo-poideos, disminución de la riqueza específica en niveles tróficos superiores (peces y aves) como resultado de una falta de políticas de conservación. Además se analizan las acciones de gestión tendientes a revertir dicha compleja situación y se proponen sugerencias.

Palabras claves: Embalses; Contaminación; Impacto ambiental; Argentina

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Rio Hondo Dam (Santiago del Estero – Tucumán, Argentina): A conflictive wetland

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Abstract

The strategic geographic location of the Río Hondo reservoir in terms of water reception and redistribution makes this dam play a significant functional role as a wetland within the endohreic basin of the Sali-Dulce river. For the past 30 years, this dam has been affected by an annual increase in contamination levels produced by the input of sediments (urban and industrial byproducts) that occurs mostly during low-water periods. To the present, a series of studies have focused on physical, chemical and biological aspects aiming at a diagnosis of the degree of alteration. Pollution-descriptive parameters (nutrients, DO, DBO, chlorophyll a, among others) and biological communities reflected in their specific composition and abundance, a sensible impact affecting this stressed environment.

Water volume differences determined significant differences between the impact observed in the limnetic zone and the tributaries' mouth. Eutrophication is reflected by cianophyte algae blooms (*Microcystis aeruginosa*, *Anabaena flosaquae*), abundant euglenophytes, abundant bacteria, ciliates, and bacteriophagous rotifers, all of them being indicators of high saprobiety, with dominance of macrofilter microcrustaceans ciclopoids, and decrease in the species richness at superior trophic levels (fishes and birds) as a result of a lack of a conservation policy. Management actions towards a reversion of this complex situation are analyzed and recommendations are made.

Keywords: Dam; Contamination; Environmental impact; Argentina

Embalse de Ayui: un emprendimiento coparticipativo de gestión conjunta

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Resumen

Se presentan el proyecto y los estudios ambientales de la *Presa de Embalse Ayuí*, desarrollados de acuerdo a los términos de la Ley Provincial Nº 5067/96, y emprendidos en forma conjunta por un consorcio de establecimientos agropecuarios ribereños del arroyo Ayuí, en la zona de la ciudad de Mercedes, Corrientes, Argentina. Se lo compara con las alternativas implementadas hasta el momento en la región, consistentes en pequeños embalses en cabeceras de arroyos, manejados unilateralmente por los productores.

Se incluye una descripción del proyecto y una cuantificación de sus impactos ambientales negativos y positivos más significativos. También se describe la porción de ecosistema intervenida por el proyecto. Se efectúa un diagnóstico en cuanto a las tendencias de evolución observadas, tanto en el medio natural como en lo que hace a la intervención antrópica. También se describen las medidas de mitigación que fueron incorporadas desde el inicio del diseño de la obra, así como las recomendadas como complemento. Por último, se esboza el plan de gestión ambiental recomendado.

Palabras claves: Riego; Presa; Operación; Impacto; Gestión

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Ayui reservoir: A joint venture for water management

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Abstract

Design and environmental studies, in the framework of Provincial Law 5067/96, are carried out by a consortium of agricultural producers lying adjacent to Ayui River, close to the city of Mercedes, Corrientes Province, Argentina. The project is compared against the alternative operational mode presently used in the region, i.e., small dams in the upper zone of the tributaries managed by a single producer.
A description of the project and a quantification of the most significant negative and positive environmental impacts are included. The affected ecosystem is also described. A diagnosis about the evolutionary trends of environment, including the anthropic effects, is made. Mitigation measures taken into account from the very beginning of the design process and those recommended as a complement are described. Finally, the recommended environmental management plan is briefly introduced.

Keywords: Irrigation; Dam; Operation; Impact; Management

Establecimiento de niveles guía nacionales de calidad de agua Ambiente

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Resumen

Este trabajo expone los elementos metodológicos correspondientes a la elaboración de niveles guía nacionales para la Argentina, de parámetros prioritarios de calidad que tienen como objeto la salvaguarda de los componentes bióticos involucrados en los siguientes destinos del agua ambiente: a) fuente de provisión de agua para consumo humano, b) protección de la biota acuática, c) recreación humana, d) irrigación de cultivos y e) bebida de especies de producción animal. Esta elaboración está destinada a proveer el marco referencial primario para la especificación de objetivos y estándares de calidad específicos para los cuerpos de agua.

Palabras clave: Agua ambiente; Parámetros de calidad; Niveles guía

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Establishment of national environment water quality guidelines

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Abstract

This paper presents the methodological elements related to the development of Argentine national water quality guidelines for quality priority parameters concerning the protection of the biotic components involved in the following uses of ambient water: a) raw water for drinking supply, b) protection of aquatic biota, c) human recreation, d) irrigation, e) livestock watering are exposed. This development pursues the accomplishment of the basis for the derivation of ambient water quality objectives and standards.

Key words: Ambient water; Quality parameters; Guidelines

Evolución de la Gestión Ambiental en el Proyecto Yacyretá

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Resumen

El trabajo contiene una apretada síntesis de los antecedentes de la actual gestión ambiental en la Entidad Binacional Yacyretá. En el mismo se podrá evaluar cómo la EBY fue incorporando progresivamente las cuestiones ambientales a su propia gestión, ausentes en las demandas sociales de principios de la década de los años 70 y consecuentemente en el proyecto original gestado en aquellos años, pero de insoslayable y creciente importancia en los últimos años.

La Entidad Binacional Yacyretá cuenta hoy con un conjunto de decisiones que fueron construyendo paulatinamente un importante andamiaje que sirve de soporte para la gestión ambiental: un Plan de Manejo de Medio Ambiente que contiene los programas, proyectos y acciones definidos con el necesario rigor técnico-científico; actualizado mediante un valioso proceso de consulta y participación con la sociedad local; un equipo de profesionales propio, formado y capacitado en las especialidades requeridas; relaciones con instituciones académicas y científicas que garantizan alto nivel y calidad de los trabajos; un sistema de evaluación externo e independiente de la ejecución de los programas ambientales; y normas propias que garantizan el financiamiento de los programas ambientales por toda la vida útil de la misma, incorporándolos a los costos de operación y mantenimiento de la central.

Palabras Claves: Gestión ambiental; Embalses; Yacyretá

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Evolution of Environmental Management in Yacyreta Reservoir

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Abstract

The paper comprises a short briefing of the antecedents of current environmental management in the Yacyreta Binational Entity (EBY). It allows to assess how EBY has been progressively incorporating environmental issues into its own management, which were absent in the social demands of the early 70´s , and consequently, in the original design elaborated at that time, but which have become of unavoidable and increasing importance in the recent years.

The Yacyreta Binational Entity has available nowadays a set of decisions which progressively developed a very important framework to support the environmental management: an Environmental Management Plan comprising programs, projects and actions defined with proper technical and scientific rigorousness; updated by means of a valuable process of consultation and participation of local society; its own team of professionals, educated and trained in the necessary fields; relationships with academic and scientific institutions which guarantee a high level and quality of the undertakings; an external and independent system of evaluation in the execution of the environmental programs; and specific regulations which guarantee the financing of the environmental programmes along its lifetime, by including them into the operation and maintenance costs of the powerplant.

Keywords: Environmental management; Reservoirs; Yacyreta

Funcionamiento de los Sistemas de Transferencia para Peces en Represas de la Baja Cuenca del Plata: Resultados y Perspectivas

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Resumen

Las especies migradoras constituyen un rasgo característico de los grandes ríos de Sudamérica. Estas especies difieren en varios aspectos ecológicos importantes de las del hemisferio norte, para los cuales se han diseñado y construido la mayoría de los sistemas de transferencia de peces del mundo. En la baja cuenca del Plata, la represa de Salto Grande posee un sistema de esclusas Borland, mientras que en la represa de Yacyreta se ha construido dos elevadores para peces. Los resultados observados muestran que los sistemas de la baja cuenca, no han favorecido el pasaje de especies que migradoras importantes y que constituyen la base de las pesquerías regionales.

Por el contrario, han privilegiado la transferencia de especies de pequeño porte, distribución ubicua y escaso interés pesquero. La baja eficiencia para las especies migradoras obedece a problemas estructurales y funcionales de diseño. En Yacyreta, ello genera un elevado costo de transferencia para cada pez migrador. La piscicultura de repoblamiento para recuperar los stocks de peces migratorios en la alta cuenca (Brasil), no ha dado los resultados esperados por lo que resulta indispensable asegurar la construcción de sistemas mas eficientes. Los futuros pasos para peces en la cuenca, deberán diseñarse a partir de información bioecológica específica obtenida de manera apropiada, e integrada con criterios ingenieriles e información ambiental.

Palabras clave: Transferencia de Peces; Presas; Cuenca del Plata

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Performance of Fish Facilities in Lower La Plata River Basin Reservoirs: Results and Perspectives

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Abstract

Migratory fish species constitute a main feature in large rivers of South America. These species present different ecological characteristics from their counterparts in the North Hemisphere, for which most of the fishway systems in the world have been developed. In the lower De la Plata River basin, Salto Grande dam has two Borland locks and two fish elevators were installed in Yacyreta dam.

Results showed that such systems had limited success for transferring large amount of important migratory species, which are the basis of the regional fisheries. In turn, these systems primarily passed small non-migratory species, with ubiquitous distribution and without fishery importance. Low efficiency of fish passage facilities for migratory species can be attributed to functional and structural design limitations. In Yacyreta, low performance of fish elevators implies high costs for transferring migratory fishes. Stocking policies developed in the upper basin (Brazil) failed to restore migratory stocks, implying that sound fishway designs are required. Future fishways in the basin should be developed based on an integrated approach, that includes specific bioecological information obtained in an appropriate way, engineering criteria and suitable environmental information.

Key words: Fish facilities; Dams; La Plata River Basin

Integrated Water Resources Management- Water Quality Monitoring and Assessment

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Abstract

In this paper the author discusses some basic concepts in the organization of monitoring procedures. Monitoring is considered as an essential component of integrated water resources management. The number of variables, the choice of best methodology, the sampling statistics and accuracy are discussed. The new tendencies for adequate monitoring of a complex and variable system as a continental water body are presented, namely the authomatic sampling in real time, the biological monitoring and the need to develop early warning procedures and protocols to anticipate events.

Keywords: Water Quality; Monitoring; Assessment; Integrated water resources management

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Gerenciamento integrado de recursos hídricos – monitoramento e avaliação da qualidade da água.

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Resumo

Neste trabalho o autor discute alguns conceitos básicos do monitoramento. Este é considerado como um componente essencial do gerenciamento de recursos hídricos. O número de variáveis, a escolha de melhor metodologia, as estatísticas da amostragem e a acuracidade são discutidos. As novas tendências do monitoramento tais como o monitoramento em tempo real, o monitoramento biológico, e a necessidade de desenvolver sistemas de alerta para antecipar eventos são também discutidos.

Palavras-chaves: Qualidade da água; Monitoramento; Avaliação; Gerenciamento integrado de recursos hídricos

Herramientas de Cuantificación para la Gestión de la Sedimentación en Embalses

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Resumen

Se presenta una visión general del proceso de sedimentación en reservorios y sus efectos ambientales. El objetivo del trabajo es describir brevemente las herramientas de cálculo disponibles para determinar el impacto del proceso de sedimentación. Se presentan los métodos empíricos tradicionales y algunas experiencias de campo y laboratorio. Luego se describe un conjunto de modelos matemáticos 1D, 2D y 3D. Se explican sus ventajas y desventajas. Se concluye que el estado del conocimiento actual permite abordar esta problemática mediante la simulación numérica, preferentemente a través de modelos 1D o 2D. La aplicación de modelos 3D es todavía computacionalmente costosa, a la vez que requiere una gran base de datos. Los métodos empíricos deberían utilizarse para una evaluación preliminar.

Palabras clave: Sedimentación en embalses; Modelos matemáticos; Métodos empíricos; Estudios de campo.

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Quantification Tools for Reservoir Sedimentation Management

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Abstract

A general view of the reservoir sedimentation processes and their environmental effects is presented. The objective of the paper is to briefly describe the available calculation tools to assess the sedimentation impact. The traditional empirical methods and some laboratory and field experiences are presented. Then, a set of 1D, 2D and 3D mathematical models are described. Their advantages and disadvantages are explained. As a conclusion, the state of the art allows to approach the problem through numerical simulation, preferably using 1D or 2D models. The application of 3D models is still computationally expensive, and a large amount of data is required. The empirical methods should be used only as a preliminary evaluation.

Keywords**:** Reservoir sedimentation; Mathematical modeling; Empirical methods; Field studies.

Hydrological monitoring and reservoirs operation management in the State of Paraná, Brazil

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Abstract

In order to get a most efficient hydraulic and energetic operation in a Generation Company reservoir's system, it is important that the information and the necessary steps for a decision making are available at all the areas involved in a fast, secure and synchronized way. Regarding that COPEL (State of Paraná Energy Company) has been working on computer systems, models and tools since the 70'. Recently in 1997, the Hydrology of Operation Department proposed the development of a storage, processing, data consulting and decision support system – The HMS System –, integrating several data and software used in reservoirs monitoring.

The system development and installation were gradual, started with the Caxias' reservoir. In December of 1999 all the reservoirs operated by COPEL were already being monitored by the HMS System.

Among the benefits that the project brought to the company, stand out: a) convergence of information for an homogeneous database; b) automation of procedures: collecting of data, calculations and supporting process for decision making (automated operative rule); c) fast results; d) improvement of the quality of information; e) system integration; f) technological evolution.

Keywords: Hydrological monitoring, Reservoir operation; Decision suport system.

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Gestión del monitoreo hidrológico y de la operación de embalses en el Estado de Paraná, Brasil

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Resumen

Para alcanzar una operación hidráulica y energética más eficaz de un sistema de embalses de una Compañía de Generación, es importante que la información y los pasos necesarios en la toma de decisión estén absolutamente disponibles en las áreas implicadas de una manera rápida, segura y sincronizada. Con respecto a esto, COPEL (Brasil) ha estado trabajando en sistemas informáticos, modelos y herramientas desde los años 70. Recientemente en 1997, la Sección de Hidrología de la Operación propuso el desarrollo de un sistema (Sistema HMS) de consulta, procesamiento, almacenamiento y suporte a toma de decisión de datos integrando varios datos y software usados en la vigilancia de los embalses.

El desarrollo e instalación del sistema eran graduales, empezado con el embalse de Caxias. En diciembre de 1999 todos los embalses operados por COPEL eran supervisando ya por el Sistema HMS.

Entre las ventajas que el proyecto trajo a la compañía, destaque: a) convergencia de la información para un banco de datos homogéneo; b) automatización de procedimientos: el recoger de datos, cálculos y proceso de apoyo para la tomada de decisión (regla operativa automatizada); c) resultados rápidos; d) mejora de la calidad de información; e) integración del sistema; f) evolución tecnológica.

Palabras claves: Monitoreo hidrológico; Operación de Embalses; Sistemas Soporte de Decisión

Impacto de los flujos ambientales en la Cuenca del Plata sobre la producción de agua potable

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Resumen

En este trabajo se presenta el desarrollo de un procedimiento racional de gestión y control implementado en el año 2000 en Aguas argentinas S.A. Dos sistemas fueron analizados: el proceso de producción y la calidad del afluente. Del estudio del proceso de producción se obtuvieron los parámetros de agua cruda determinantes de la dosis de clarificación. El análisis del afluente permitió obtener la metodología de predicción de tendencias de dichas variables determinantes. Ambos estudios constituyen una herramienta fundamental para la elaboración del plan anual de gestión de insumos químicos en la producción de agua.

Palabras claves: Gestión racional; Red de información; Río Bermejo; Agua cruda; Presupuesto

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Impact of environmental flows on drinking water supply in La Plata River Basin

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Abstract

In this work it is shown the development of a rational procedure for management and control that was implemented in Aguas Argentinas, during year 2000.
Two systems were analyzed: the production process and influent´s quality. The first analysis let obtain the main variables to determine the dose of chemical reagents. The second one let obtain the procedure to predict trends in the mentioned variables. Both of the studies allowed to make the annual plan for the management of chemicals in water production.

Keywords: Rational management; Information network; Bermejo River; Raw water; Budget

Implementación del procedimiento cadena de custodia de muestras en programas de monitoreo ambiental como elemento de aseguramiento de la calidad

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Resumen

A partir de la intervención del Instituto Nacional del Agua en el derrame de hidrocarburos ocurrido en Enero de 1999, en las proximidades de la Costa de Magdalena, se incorpora a la metodología de trabajo habitual del Instituto una serie de controles tendientes al aseguramiento de la calidad en todas las etapas del proyecto. Dicho sistema incluye la utilización de planillas de registro de campo y de cadena de custodia a los efectos de garantizar el control de la muestra desde su colecta hasta el reporte de los resultados analíticos del laboratorio, así como la aplicación de un sistema de Control de Calidad en campo y laboratorio.

En el presente trabajo se desarrolla uno de los aspectos más importantes del programa de Control de Calidad vinculado a la obtención de la muestra, llamado *Cadena de Custodia*, cuya finalidad es la de asegurar la trazabilidad en el acarreo y posesión de todas las muestras.

Si bien el procedimiento de custodia de la muestra adquiere relevancia cuando la información obtenida debe ser presentada ante una instancia legal, se propone su implementación rutinaria debido a que la información generada es de mayor confiabilidad y permite además establecer una uniformidad de criterios en los diferentes programas de monitoreo de calidad ambiental.

Palabras Claves: Custodia de Muestras; Aseguramiento Calidad; Trazabilidad; Muestreo.

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Implementation of Sampling Custody Chains Procedures in Environmental Monitoring Programs as a Quality Assurance Element

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Abstract

Starting with the intervention of the National Institute of the Water in the oil spill happened in January of 1999, in the Magdalena coast- Bs. As. Province, it was incorporated to the routine methodology of sampling in the Institute, a series of quality controls applied in all the stages of the project. This system includes the use of field registration forms and custody chain, to guarantee the control of the sample from its collection until the report of the analytical results by the laboratory, as well as the application of a Control Quality system in field and laboratory.

This work shows one of the most important aspects of the Quality Control program related to the sampling program called "Chain of Custody", whose purpose is assure the tracking of Quality in the transport and possession of all the samples.

Although the custody procedure of the sample acquires relevance when the obtained information should be presented for legal purposes, its routine implementation during all the studies performed by the institutions will improve a better quality of date and an increase in the confidence of the monitoring environmental programs.

Key Words: Sample Custody; Quality Assurance; Tracking; Sampling

Incidencia de las descargas cloacales costeras en la Laguna Setubal (Provincia de Santa Fe, Argentina)

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Resumen

Se analizaron las concentraciones de *Escherichia coli*, coliformes termotolerantes y coliformes totales en muestras tomadas en aguas de la laguna Setúbal (Santa Fe, Argentina) y en conductos pluviales que descargan sobre sus playas en margen derecha. El objetivo del trabajo consistió en determinar la distribución espacial de bacterias hacia el interior del cuerpo de agua, receptor de las descargas. Se determinó que las aguas cuyas concentraciones superan los 200 NMP/100 ml de *Escherichia coli* y coliformes termotolerantes, ocupan una franja costera de 30 a 40 metros de ancho medidos desde la margen derecha. La toma de agua de la ciudad no es alcanzada por las descargas poluídas de los conductos, al menos para las condiciones hidrométricas de aguas medias en tiempo seco, para las cuales se realizaron los muestreos. La importancia del estudio se justifica en el aprovechamiento de sus aguas para recreación en la temporada estival, deportes náuticos y abastecimiento a la ciudad de Santa Fe.

Palabras claves: *Escherichia coli*; Coliformes; Aguas recreacionales; Toma de agua; Conductos pluviales; Distribución espacial

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Spatial distribution of coliform bacteria in the Setúbal lake (Santa Fe Province, Argentina)

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Abstract

Escherichia coli, thermotolerant coliform and total coliform concentrations were analysed in water samples collected from the Setúbal lake and pluvial drainages which discharge into its right bank. The aim of this work was to determine the bacteria spatial distribution towards the inner part of the water body where discharges take place. Waters with *Escherichia coli* and thermotolerant coliform concentrations higher than 200 NMP/ml were found to occupy a 30 - 40 m border edge, measured from the right bank. The city water intake is not affected by the polluted pluvial drainages, at least under the hydrometric conditions of mean level waters and dry weather when the sampling were carried out. The importance of this study lies in the use of the lake both for recreational purposes such as swimming and nautical sports, and as a source of water supply to Santa Fe town.

Keywords: *Escherichia coli*; Coliform; Recreational waters; Water intake; Pluvial drainages; Spatial distribution.

Integrated Water Resources Management: Formulation of Multi-objective Optimization on Water Quantity and Quality of Storage Reservoir

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Abstract

Short and long-term operation of a storage reservoir, focusing on quantity & quality assessment, is formulated in this paper. The objective is to improve benefits of a storage reservoir for all stakeholders involved with the water issues. Future scenarios under changing situations will be analyzed as this research progresses. Fuzzy dynamic programming (Fuzzy DP) is considered to be the most suitable tool to handle the posed problem. A case study is presented for the Barra Bonita Reservoir in the state of São Paulo, Brazil.

Keywords: Multi-objective Optimization; Dynamic Programming; Fuzzy Theory; Water Quality Model; Barra Bonita.

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Gestión Integrada de los Recursos Hídricos: Formulación de una Optimización Multiobjetivo de Cantidad y Calidad del Agua en Embalses de Regulación

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Resumen

En este trabajo se formula la operación de corto y largo plazo de un embalse de regulación, con énfasis en la evaluación de la cantidad y la calidad. El objetivo es incrementar los beneficios del embalse para todos los actores con intereses en los cuestiones de agua. Se analizarán escenarios futuros ba,o situaciones cambiantes a medida que la investigación progrese. Se considera que la Programación Dinámica Difusa (Fuzzy DP) es la herramienta mas apropiada para resolver el problema planteado. Se presenta un estudio de caso para el Embalse de Barra Bonita, Estado de San Pablo, Brasil.

Palabras clave: Optimización multiobjetivo; Programación dinámica; Teoría difusa; Modelo de Calidad de Agua; Barra Bonita

Limnoperna Fortunei (Bivalvia: Mytilidae) en los Circuitos de Enfriamiento y otros Sectores de la Central Hidroelectrica de Yacyretá

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Resumen

Limnoperna fortunei es un pequeño bivalvo de agua dulce que, introducido accidentalmente o por negligencia en el Río de la Plata, ha tenido una rápida dispersión en éste y en los ríos Paraná y Paraguay y sus tributarios. En el presente trabajo se hace referencia al desarrollo de densas poblaciones de este mitílido en distintos sectores de la central hidroeléctrica, donde se han encontrado larvas en los circuitos de conducción de agua para enfriamiento de las turbinas. Se hace referencia al potencial reproductivo de la especie y las posibles consecuencias de no mediar acciones eficientes de control.

Palabras Claves: *Limnoperna fortunei;* Especie invasora; Bivalbo asiático dulceacuícola; Embalse de Yacyretá: Colonización.

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Limnoisperma Fortunei (Bivalvia: Mytilidae) in the cooling systems and other sectors of Yacyretá Hydropower Plant

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Abstract

Limnoperna fortunei is a small bivalbe of fresh water; which was introduced accidentally or by negligence in the Río de la Plata river, it has got a quick dispersion in that river as well as in the Paraná and Paraguay rivers, and its tributaries. This present work deals about development of dense populations of this mytilid in different sections of the Yaciretá hydroelectric central; where it has been found larvae in the circuit of water conduction to cool the turbines. It does reference to the reproductive success of this species and the possible consequences if efficient actions of control are not taken place.

Keywords: *Limnoperna fortunei*; Invasive species; Freshwater asiatic bivalve; Yacyretá dam; Colonization.

Modelación matemática del transporte de sedimentos y la evolución del lecho de embalses

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Resumen

Se presenta un modelo matemático para predecir el proceso de sedimentación en un reservorio y simular el crecimiento del delta. El modelo está basado en una forma parabolizada y lateralmente integrada de las ecuaciones de movimiento. Para la resolución numérica se utiliza el método de los elementos finitos. La formulación del modelo y el esquema numérico de resolución se explican brevemente. El modelo es validado mediante comparaciones con datos de campo del lago Mead (EE.UU.). Se estudian la evolución longitudinal del perfil del lecho como así también la estratificación de la composición del suelo. Se explican tanto la formación como el crecimiento de las formas del fondo. Se muestra que la evolución del fondo del reservorio depende fuertemente de diversos parámetros: la geometría del reservorio, el ciclo hidrológico, el nivel de embalse, la carga de sedimentos y el tamaño de las partículas.

Palabras clave: Sedimentación en embalses; Modelación matemática; Simulación numérica; Crecimiento del delta; Evolución morfológica.

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Mathematical modeling of sediment transport and reservoir bed evolution

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Abstract

A mathematical model to predict the sedimentation process in a reservoir and to simulate the delta growth is presented. It is based on a parabolized and laterally integrated form of the governing equations. For the numerical resolution the finite element method is used. Model formulation and numerical scheme are both briefly explained. The model is validated through comparisons with field data from lake Mead (USA) surveys. The evolution of the longitudinal bottom profile as well as the resulting deposit stratification are studied. The formation and growth of bottom forms are explained. It is concluded that the reservoir bottom evolution depends strongly on several parameters: the geometry of the reservoir, the hydrological cycle, the lake level, the sediment load and the sediment size.

Keywords: Reservoir sedimentation; Mathematical modeling; Numerical simulation; Delta growth; Bottom evolution.

Modelo de predicción de crecimiento de poblaciones en ambientes acotados, sin predadores

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Resumen

En el presente trabajo se presenta un modelo determinístico de predicción de crecimiento de población en ambientes acotados y sin predadores, planteado en ecuaciones diferenciales para vincular los valores de población con sus variaciones. El modelo, además de proponer una curva de crecimiento en "S" como la logística, contempla el caso de oscilación amortiguada de crecimiento de poblaciones o de variaciones del medio o de población.

Palabras claves: Modelo; Crecimiento; Poblaciones; Ecuaciones diferenciales.

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Model for growth prediction of populations in limited environments, without predators

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Abstract

A deterministic model to predict the population growth in limited environments without predators is presented. The model, uses a differential equation to represent the relationships between the population size and its growth rates. The model proposes a "S" type growth curve, as the logistic, and can predicts a damped oscillation of population growing or changes of the environment or populations.

Keywords: Model; Growth; Populations; Differential equations

Monitoramento em tempo real da qualidade da água dos mananciais da Região Metropolitana de São Paulo (Brazil)

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Resumo

Este trabalho apresenta, o projeto implantado pela Companhia de Saneamento Básico do Estado de São Paulo – SABESP, para Monitoramento em Tempo Real da Qualidade da Água dos Mananciais da Região Metropolitana de São Paulo (Brazil).

Palavras-chaves: Monitoramento em Tempo Real; Reservatório; Qualidade da água; SABESP.

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Real time monitoring of water quality in water supply reservoirs in the Metropolitan Region of São Paulo (Brazil)

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Abstract

This work presents, the project implanted by São Paulo Basic Sanitation Company - SABESP, for in Real Time Monitoring of the Water Quality in the Water Source of São Paulo Metropolitan Area (Brasil).

Keywords: Real time monitoring; Reservoir; Water Quality; SABESP

Monitoreo de calidad de agua y sedimentos del embalse Los Molinos I, Córdoba, Argentina

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Resumen

El Embalse Los Molinos I está ubicado en la Provincia de Córdoba (Argentina), a 65 Km al sur de la Ciudad Capital. En la actualidad, a través de un sistema de canalización se utiliza para complementar el suministro de agua potable a la Ciudad de Córdoba, por lo que merece especial atención su preservación y adecuado manejo.

En los últimos años este reservorio ha presentado claros signos de problemas derivados del estado de eutrofia, tales como escasa transparencia, presencia de anoxia hipolimnética y frecuentes eventos de floraciones algales, con el consiguiente deterioro del recurso.

Con el objetivo de lograr un estudio integral y sistemático de la calidad del agua y los sedimentos abordado en forma interinstitucional e interdisciplinario y generar una base de datos para la aplicación futura de modelos de Eutrofización que contribuyan a la adecuada gestión, se iniciaron en el año 1.999 una serie de campañas de monitoreo de agua y sedimento del embalse y sus cuatro tributarios principales.

El objetivo del presente trabajo es presentar los avances y los resultados preliminares de los parámetros físico-químicos y biológicos de calidad correspondientes al embalse, conjuntamente con la utilización del programa PROFILE para el análisis y resumen de datos.

Palabras claves: Eutrofización; Embalse; Monitoreo; Nutrientes; *Ceratium sp.*

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Water Quality and Sediment Monitoring in Los Molinos Reservoir, Córdoba, Argentina

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Abstract

The reservoir Los Molinos I is located in the Province of Córdoba, Argentina, at 65 km at the south from the capital, Córdoba City. The preservation and appropriate use of this reservoir deserve special attention because it is connected to the city through a canal and is used to complement the drinking water supply.

In the last years, Los Molinos I has shown clear signs of problems related to eutrophication, such as low transparency, very low concentration of oxygen in the hypolimnion, and frequent algal blooms.

Since 1999, various field campaigns to monitor water, sediment and four main tributaries were started in order to achieve a comprehensive and systematic understanding of the status of water and sediment. This interdisciplinary and inter-institutional study also intends to generate data bases that allow to apply eutrophication models, aiming an appropriate management of the resource.

The aim of this work is to present the advances and preliminaries results obtained so far. Physicochemical and biologic parameters related to water and sediment quality are shown by using the program PROFILE to analyze and summarize the data.

Keywords: Eutrophication; Reservoir; Monitoring; Nutrients; *Ceratium Sp.*

Monitoreo de Lagunas del Area Metropolitana del Gran Resistencia

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Resumen

La conformación natural, social y tecnológica de los asentamientos humanos en el Área Metropolitana del Gran Resistencia (AMGR), dieron lugar a una dinámica de desarrollo urbano caracterizada por la expansión y apropiación de los ecosistemas lénticos que generaron procesos de contaminación y degradación. Entre las causas de estos procesos se encuentran la conexión clandestina de efluentes cloacales a la red plucvial, el establecimiento de personas en el borde de las lagunaas, la ocupación de áreas de riesgo hídrico, el relleno de lagunas, la proliferación de microbasurales espontáneos y la falta de conectividad de las lagunas con el río Negro.

El objetivo rector de estos monitoreos fue realizar una evaluación del estado de deterioro ambiental de las lagunas del AMGR e implementar medidas mitigadoras a corto plazo evaluando el comportamiento de los cuerpos de agua, así como realizar el seguimiento de las lagunas donde el Municipio emprendió tareas de recuperación. Este trabajo se circunscribe al monitoreo realizado en las lagunas del AMGR, especialmente aquellas que no sólo actúan como cuerpos receptores de lso drenajes urbanos sino que son utilizadas para el control de crecidas por medio de sistemas de bombeo hacia el Río Negro.

Del análisis de los datos de base relevados en los cuerpos de agua se concluyó que todos los ecosistemas estudiados presentan alto grado de eutrofización. Se propuso como medidas de mitigación el dragado en algunos casos y la recolección de macrófitas y limpieza de bordes en otros. Este trabajo se realizó en el marco del Plan de Monitoreo Ambiental de lagunas del AMGR., Programa de Protección contra Inundaciones (PPI), Programa Ambiental de Protección y Manejo de Humedales, Subunidad Central de Coordinación para la Emergencia (SUCCE), Sub Unidad provincial de Coordinación para la Emergencia (SUPCE).

Palabras clave: Eutrofización; Lagunas urbanas; Monitoreo; Calidad del Agua

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Monitoring of shallow lakes in the Metropolitan Area of Great Resistencia

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Abstract

The natural, social and technological conformation of the human settlements in the Metropolitan Area of the Great Resistencia (AMGR), gave place to a dynamics of the urban development characterized by the expansion and appropriation of the lentic ecosystems, which generated processes of contamination and degradation. The causes of these processess are the illegal sewage connections into the pluvial network, the settlement of people in lake shores, the occupation of water risk prone areas, the filling of the shallow lakes, the proliferation of spontaneous solid waste dumpings and the lack of connection of the lagoons with the Negro river.

The main objective of the monitoring was to carry out an evaluation of the state of environmental deterioration of the shallow lakes in the AMGR and to implement short term mitigation measures by assessing the behaviour of the water bodies, as well as to carry out the follow up of the lakes where the Municipality undertook recovery actions. This work refers to the monitoring carried out in the shallow lakes of the AMGR, especially those that not only act as receiving bodies of urban drainages but, rather, they are used for the control of floods by means of systems pumping into the Negro river.

From the analysis of the data collected in the water bodies, it is concluded that all the studied ecosystems present a high degree of eutrophycation. Dredging in some cases, and removal of vegetation and cleaning of the shorelines in others, have been proposed as mitigation measures. This work was carried out within the framework of the AMRG Shallow Lakes Environmental Monitoring Plan, Programme of Flooding Protection (PPI), Environmental Programme for Protection and Management of Wetlands, Central Coordination Sub Unit for the Emergency (SUCCE), Provincial Coordination Sub Unit for the Emergency (SUPCE).

Keywords: Eutrophication; Urban shallow lakes; Monitoring; Water quality

PAMOLARE Training Package Version 1.0

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Abstract

The PAMOLARE acronym is derived from Planning And Management Of Lakes And Reservoirs focusing on Eutrophication. Version 1.0 of the PAMOLARE training software package was developed for use by decision makers and all those professionals dealing with the planning and management of freshwater resources, engaged in lake and reservoir management in developing countries and countries with economies in transition. This package allows for a better understanding of eutrophication processes in lakes and reservoirs. The following three models are available in the PAMOLARE training package: 1) the Vollenweider plot, 2) 4st-model (a 1-layer lake model with 4 state variables plus several additional parameters, and 3) 2L-Model (a medium complex 2-layer model).

Users can select the most appropriate model on the basis of their purpose and the amount of data available. Target users of this package are decision makers and professionals who have a very limited background in lake modeling and wish to learn the basics of modeling; engineers and professionals with a background in lake modeling, and wish to better understand eutrophication processes in lake and decision makers and engineers engaged in lake and reservoir management who wish to predict the long-term status of lake and reservoir.

Keywords: Modeling; Eutrophication; Lakes; Reservoirs

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Conjunto para Capacitación PAMOLARE.Versión 1.0

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Resumen

El acrónimo PAMOLARE se deriva de "Planning And Management Of Lakes And Reservoirs focusing on Eutrophication" (Planeamiento y Gestión de Lagos y Embalses con foco en la Eutrofización). La Versión 1.0 del Conjunto de Programas Computacionales para Capacitación PAMOLARE ha sido desarrollado para ser usado por tomadores de decisión y todos aquellos profesionales dedicados al planeamiento y la gestión de recursos hídricos continentales, involucrados en la gestión de lagos y embalses en países en desarrollo y economías en transición. Este conjunto posibilita una mejor comprensión de los procesos de eutrofización en lagos y embalses. El conjunto de capacitación PAMOLARE tiene disponibles los tres modelos siguientes: 1) El diagrama de Vollenweider, 2) el 4st-model (modelo de lago de 1 capa con cuatro variables de estado mas varios parámetros adicionales), y 3) el 2L-Model (un modelo medianamente complejo de dos capas).

Los usuarios podrán seleccionar el modelo mas apropiado sobre la base de su objetivo y de la cantidad de información disponible. Los usuarios a los cuales está orientado este conjunto de programas son los tomadores de decisión y profesionales que tienen una experiencia limitada en modelación de lagos y desean aprender los fundamentos de la modelación, ingenieros e investigadores con experiencia en modelación de lagos que desean lograr una mejor comprensión de los procesos de eutrofización en lagos, y tomadores de decisión e ingenieros involucrados en la gestión de lagos y embalses que desean predecir su estado en el largo plazo

Palabras clave: Modelación; Eutrofización; Lagos; Embalses.

Plano de Gerenciamento Integrado da Várzea do Parelheiros

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Resumo

O presente trabalho trata do Plano de Gerenciamento Integrado para o Sistema Produtor Taquacetuba – Guarapiranga (Brazil), com ênfase no Plano de Manejo da Várzea do Parelheiros, contratado pela Sabesp e elaborado pela Empresa Geotec Geologia e Engenharia, contendo as alternativas e as intervenções propostas com o objetivo de possibilitar a transferência de água da Represa Billings para a Represa Guarapiranga, melhorando a qualidade das águas aduzidas de forma a garantir a qualidade do manancial representado pela Represa Guarapiranga.

Palavras chave**:** Gerenciamento; Várzea; Manejo; Wetlands

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Integrated Management Plan of the Wetlands of River Parelheiros

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Abstract

This paper is about the Integrated Management Plan of the Water Supply System Taquacetuba-Guarapiranga (Brazil), with focus on the proposed Plan for Management of the floodplain of the Parelheiros River. The study was commissioned by SABESP and completed by the"Geotec Geologia e Engenharia Co.". The Plan includes also the description of alternatives as well as of works proposed for the transfer of water from Billings Reservoir to Guarapiranga Reservoir. The purpose is to improve the quality of input water and thereby also ensure good water quality at the source, which is the Guarapiranga Reservoir.

Keywords: Management; Wetlands; Works

Prediction of colonization by macrophytes in the Yaciretá reservoir of the Paraná river (Argentina and Paraguay)

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Abstract

The potential colonization by anchored plants (PCAP) and the potential areas for initial colonization of free floating plants were estimated during the early filling phase for the Yaciretá reservoir (Argentina and Paraguay). In order to obtain the PCAP, the observed maximum depth of colonization of the anchored macrophytes before impoundment and the hypsographic curves were used. The species inhabiting the pre-impoundment area were classified according to the different bioforms before the inclusion in the analysis. The areal extent of PCAP (from depths between 0-4m) could reach 275 km^2 at 76m above sea level (current water level), whereas at 82 m above sea level (final filling level) the littoral zone will be increased by about 21.5%.

The potential area for geophytes was estimated to be 99 km^2; 131 km^2 for root-floating leaved plants and 120 km^2 for submerged plants, at 76 m above sea level. At 82 m above sea level, the geophytes could reach 271 km^2. The data for wind frequency, velocity and fetch, together with depth were used to calculate shallow and sheltered areas in which free floating plants could find favourable conditions to initial colonization. Physical and chemical features recorded at eight stations during the early filling phase are discussed in relation to potential plant development.

Keywords: Tropical rivers; Impounding reservoirs; South America; Potential macrophytes; Colonization; Reservoirs.

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Predicción de la Colonización de Macrófitas en el Embalse de Yacyreta en el Río Paraná.

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Resumen

Durante la primera fase temprana de llenado del embalse de Yacyretá (Argentina y Paraguay) se estimaron el potencial de colonización de plantas arraigadas (PCPA) y las áreas potenciales para la colonización de plantas flotantes libres. A los fines de obtener el PCPA, se usaron las máximas profundidades de colonización observadas de macrófitas arraigadas y las curvas hipsográficas. Las especies que habitaban el área antes de la inundación fueron clasificadas de acuerdo a sus diferentes bioformas antes de su inclusión en el análisis. La extensión areal del PCPA (profundidades entre 0 – 4m) podía llegar a 275 km^2 a 76 m sobre el nivel del mar (nivel actual del agua), mientras que a 82 m sobre el nivel del mar (nivel final de llenado) la zona litoral se incrementaría en casi 21,5%.

El área potencial para las geofitas se estimó en 99 km^2, 131 km^2 para plantas foliadas de raíces flotantes y 120 km^2 para plantas sumergidas, a 76 m s.n.m. A 82 m s.n.m., las geofitas pueden alcanzar 271 km^2. Se usaron los datos de frecuencia, velocidad y "fetch" de viento, junto con la profundidad para calcular las áreas someras y protegidas en donde las plantas flotantes libres pudieran encontrar condiciones favorables para una colonización inicial. Se analizan las características físicas y químicas registradas en ocho estaciones durante la fase temprana de llenado en relación con el potential de desarrollo de la vegetación.

Palabras Clave: Ríos Tropicales; Embalses; Sud America; Macrófitas potenciales; Colonización.

Programa de gestión ambiental del embalse Casa de Piedra, río Colorado. (Argentina) Primera etapa: monitoreo y modelado.

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Resumen

El presente trabajo es una síntesis de la propuesta realizada por la Universidad Nacional del Comahue para realizar el Programa de Gestión Ambiental del embalse Casa de Piedra ubicado sobre el Río Colorado (Argentina). La metodología consiste en recopilación de información existente referida a estudios de calidad física, química y biológica, relevamientos en terreno de parámetros y modelamiento matemático para poder planificar los usos de los recursos en el área del embalse. Se indican algunos avances realizados y los resultados que esperan obtenerse con la realización del estudio.

Palabras claves: Río Colorado; Monitoreo; Calidad de agua; Algas; Gestión

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Environmental management program for Casa de Piedra reservoir, Colorado river (Argentina). First stage: monitoring and modelling

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Abstract

This work is a synthesis of the proposal, made by Comahue National University, of an Environmental Management Program for Casa de Piedra Reservoir**,** which is located on Colorado river (Argentina). The methodology consists in the collection of existing information about studies of physical, chemical and biological properties, survey of land parameters and mathematical modeling in order to make planning of resources utilization in the reservoir area possible. Some advances already made are reported here together with the expected results of the study.

Keywords: Río Colorado; Monitoring; Water quality; Algae; Management

Programa de Monitoreo del Embalse San Roque (Córdoba, Argentina), periodo 1999-2000

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Resumen

Desde hace ya varios años el embalse San Roque muestra signos evidentes de eutrofización. Esto se manifiesta mediante altos contenidos de P en el agua y de elevadas concentraciones de clorofila-a como consecuencia del aumento de nutrientes, provenientes tanto de fuentes externas como internas. Surge la necesidad entonces de conocer y mejorar la calidad del recurso que abastece a la mayoría de la población de la Ciudad de Córdoba (70%). Para tales fines se desarrolló un programa de monitoreo sistemático sobre el embalse San Roque de parámetros de calidad de agua y ambientales con la finalidad de realizar el seguimiento de la evolución del fitoplancton. El presente trabajo tiene el objetivo no solo de mostrar el diseño y la metodología de trabajo de se llevó a cabo entre Septiembre de 1999 y Enero 2001 sino también los principales resultados obtenidos hasta el presente.

Palabras clave: Embalse San Roque; Monitoreo; Calidad del Agua; Fitoplancton

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Monitoring Programme of San Roque Reservoir (Córdoba , Argentina), Period 1999-2000

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Abstract

In the last years the San Roque Reservoir is showing evident signs of eutrophication. This is a consequence of high contents of phosphorous and chlorophyll “a” in water characterized by an increase of internal and external sources of nutrients. As a result of this, the need to know and evaluate the principal water resource which provides drinking water to 70% of the people of Cordoba City comes up. A systematic monitoring program was developed in order to achieve environmental and water quality information to evaluate the phytoplankton evolution. The program includes campaigns in the water body between September 1999 and January 2001. The objective of this paper is to show not only the work planning and methodology but also some results.

Keywords: San Roque Reservoir; Monitoring; Water Quality; Phytoplankton

Propuesta metodológica para ser adoptada por los integrantes de la red Riga frente a situaciones de emergencia

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Resumen

La ocurrencia de accidentes ambientales que ponen en peligro la calidad de las aguas de los grandes ríos de la Cuenca del Plata y los numerosos embalses en la misma, se vuelve cada día más evidente. La necesidad de proteger la salud de la población y el medio ambiente es una responsabilidad prioritaria. Se propone la adopción por parte de las instituciones integrantes de la RIGA, de una metodología común para accionar ante eventos de emergencia. Esta metodología sería distribuida y actualizada por RIGA.

Palabras claves: Metodología; Muestreo; Emergencia; Derrames; Red

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Methodological proposal to be adopted by RIGA Network to address emergency situations

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Abstract

The occurrance of environmental spills that may cause serious hazard to water quality of La Plata Basin rivers and its numerous dams, becomes more evident from day to day. The need to protect the health of the population and the environment is a priority. It is proposed that the institutions belonging to RIGA, adopt a common action methodology to be used in case of emergency events. RIGA would distribute and update this methodology

Keywords: Methodology; Monitoring; Emergency; Spills; Network

Relocalización de la Ciudad de Federación. Aprovechamiento Hidroeléctrico Binacional Salto Grande (Argentina - Uruguay)

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Resumen

El presente trabajo trata sobre la relocalización de la ciudad de Federación, ubicada en la Provincia de Entre Ríos (Argentina), motivada por la construcción del Aprovechamiento Hidroeléctrico de Salto grande (Binacional Argentina-Uruguay). La obra data de la década de 1970. El desarrollo del trabajo comprende una breve descripción del aprovechamiento hidroeléctrico y del marco de referencia que incluye: la ubicación geográfica de la ciudad, ilustrada con croquis de la antigua y nueva ciudad de Federación con su vinculación terrestre; características de la zona y crecimiento de la población obtenida de censos para diferentes años, comprendiendo el período 1970-1999, es decir, anterior y posterior a la relocalización, en el cual se observa un interesante incremento poblacional.

Posteriormente se incluye una breve reseña histórica de la ciudad y de las diferentes leyes nacionales de incumbencia con las expropiaciones. Con mayor amplitud se trata el tema de los impactos sociales y sus consecuencias, ocasionados por la relocalización, y las conclusiones y recomendaciones surgidas de un análisis que abarca la observación a 20 años de su fundación oficial (25 de marzo de 1979). Se observa a través de este ejemplo la necesidad de contar con una activa participación de los actores sociales involucrados, enmarcada en una destacada planificación regional.

Palabras clave: Embalse de Salto Grande; Relocalización: Impactos sociales; Participación social

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Relocation of the City of Federación. Salto Grande Bi-national. Hydropower Development (Argentina - Uruguay)

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Abstract

This paper is about the relocation of the City of Federación, located in the Province of Entre Ríos (Argentina), as a result of the construction of the Hydropower Development of Salto Grande (Binational Argentina-Uruguay). The development was made in the 1970 decade. The paper presents a short description of the Hydroelectric Development and a reference framework which includes the geographical location of the city illustrated with drawings of the old and new city of Federación with its terrestrial links, characteristics of the region and growing of the population obtained through census of different years, during the period 1970-1999, that is to say before and after the relocation, in which an interesting population growth took place..

Afterwards, a historical summary of the city and differente national laws referring to the expropriations, are presented. The social impacts, and its consequences, produced by the relocation as well as the conclusions and recommendations coming out from an analysis which encompasses a period of 20 years from its official foundation (May 25, 1979), is developed in detail. Through this example, it becomes evident the need of obtaining an active participation of the people within the framework of a regional planning.

Keywords: Salto Grande Reservoir; Resettlement; Social impacts; Social participation.

Small Hydropower Plants in La Plata River Basin Tributaries:
A Feasible Alternative for Water Power Development

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Abstract

The new regulatory scenario for small hydropower projects in Brazil resulted in a large number of new projects with this characteristic, after new rules were established by the Brazilian Electric Power Agency, redefining the required characteristics of a hydropower plant in order to be considered as a small hydropower plant, for which the concession for exploitation is granted by the Agency without bidding process. Many of the projects under study are in the tributaries of the main rivers in the La Plata River Basin. Some of these projects are already under construction.

Small hydropower plants differ from the large hydropower projects not only for their power production capacity: their impacts on the surrounding environment are deeply different, what makes them to be an attractive alternative to increase the electric power offer for the energy-hungry Brazilian market. As the number of projects increases, the knowledge on their environmental impacts is better developed. The current status of the development of small hydropower projects and their most frequent impacts are analyzed in this paper.

Keywords: Hydropower plant; reservoir; environment.

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Pequenas centrais hidrelétricas nos tributários da Bacia do Rio da Prata: Alternativas factibles para o desenvolvimento da energía hidrelétrica

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Resumo

As novas regras definidas para as pequenas centrais hidrelétricas no Brasil tem resultado num grande número de projetos com esta característica, após o estabelecimento de nova regulamentação pela Agência Nacional de Energia Elétrica, redefinindo as características necessárias para uma hidrelétrica ser classificada como pequena central hidrelétrica, com dispensa de processo licitatório para a concessão do direito de exploração. Vários dos projetos em estudo estão localizados nos tributários dos rios principais da Bacia Hidrográfica do Rio da Prata. Alguns destes projetos encontram-se já em construção.

As pequenas centrais hidrelétricas diferem dos projetos de grande porte não apenas pela sua capacidade instalada: seus impactos sobre o meio ambiente são profundamente diferentes, o que as torna atrativas para o aumento da oferta de energia para o mercado brasileiro. Com o aumento no número de projetos, o conhecimento sobre seus impactos ambientais também vem se desenvolvendo. O estágio atual do desenvolvimento de pequenas centrais hidrelétricas no Brasil e seus impactos mais freqüentes são analisados neste trabalho.

Palavras-chave: Centrais hidrelétricas; Reservatórios: Meio Ambiente

Strategy to Reduce Pollutant Emission: Nitrogen Balance in Forest and Integrated Watershed Management. Case Study of Lake Biwa, Japan

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Abstract

It is very important to estimate nutrient inflow from non-point sources, like forests, into lakes to prevent eutrophication. In this paper, the quantity of total nitrogen reduced by the forest around Lake Biwa, Japan is estimated. Nitrogen comes in the runoff after rainfall, and runs off through the soil. In this analysis, it was found that the amount of total nitrogen by forests around the lake was large. Artificial nitrogen removal is a very expensive process. Despite this, forests play an important role in water quality. Forests are gradually being devastated, and it is difficult to earn one's living from forestry around Lake Biwa. But it is time to reconsider forestry, not just as a wood producer, but also as a natural protector for the environment.

Key words: Lakes; Eutrophication; Nutrients; Nitrogen removal; Forests.

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Estrategia para Reducir la Emisión de Contaminantes: Balance de Nitrógeno en un Bosque y Manejo Integrado de los Recursos Hídricos

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Resumen

Es muy importante estimar el ingreso de los nutrientes provenientes de fuentes no puntuales, como bosques, en los lagos para evitar la eutrofización. En este trabajo se estima la cantidad total de nitrógeno reducido por los bosques que rodean el Lago Biwa, en Japón. El nitrógeno ingresa junto con la escorrentía luego de las lluvias y escurre a través del suelo. En este análisis se encontró que la cantidad de nitrógeno total removido por los bosques marginales es grande. La remoción artificial del nitrógeno es un proceso muy costoso. Sin embargo los bosques juegan un rol muy importante en la calidad del agua. Ellos están siendo gradualmente desvastados y resulta my difícil ganar el sustento a partir de ese recurso alrededor del Lago Biwa. Es tiempo de reconsiderar el recurso forestal, no sólo como un productor de madera, sino también como un protector natural del medio ambiente.

Palabras clave: Lagos; Eutrofización; Nutrientes; Remoción de nitrógeno; Bosques.

Uma visão panorâmica da situação institucional do setor de recursos hídricos no estado do Rio de Janeiro, Brasil

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Resumo

O objetivo deste trabalho é propiciar uma visão de conjunto da situação institucional do setor de recursos hídricos do Estado do Rio de Janeiro (Brazil) face à nova Lei federal 9.433/97. Para tanto, serão descritos a geografia, as unidades hidrográficas e o quadro atual da organização administrativa do território fluminense. Alguns aspectos relacionados ao saneamento ambiental e gerenciamento costeiros também serão considerados.

Palavras-chave: Gestão de Recursos Hídricos; Saneamento; Políticas Públicas; Rio de Janeiro; Brasil.

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An overall vision of the institutional situation of the water resources sector in Rio de Janeiro State, Brazil

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Abstract

The purpose of this paper is to furnish a vision of the State of Rio de Janeiro (Brazil) water resources under the institutional situation due to the new Federal Water Act 9.433/97. It shows the geography, hydrologic units and the State of Rio de Janeiro administrative organization. Some aspects related to environmental sanitary and coastal management are also considered.

Keywords: Water Resources Management; Basic Sanitation; Public Police; Brazil; Rio de Janeiro.

Variabilidad espacial y temporal de los parámetros físicos - químicos en el embalse de Ullum.

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Resumen

Se da cuenta de investigaciones efectuadas relativas al estudio de la evolución temporal y espacial de los parámetros físicos y químicos de calidad de agua que caracterizan el sistema lacustre Embalse de Ullum, Provincia de San Juan, proponiendo una metodología para medir las variables aconsejadas por organismos internacionales (EPA, ADEQ), aplicando las técnicas de monitoreo actualizadas desarrolladas por estos organismos y por otros centros de investigación, que norman estudios del medio ambiente con métodos de Laboratorio.

Palabras Clave: Embalses; Calidad de Agua; Parámetros Físicos; Parámetros Químicos

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Spatial and time variability of physical and chemical parameters in Ullum Reservoir

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Abstract

This paper deals with investigations carried out relative to the study of the temporary and spatial evolution of the physical and chemical parameters of water quality that characterize the lacustrine system in Ullum Reservoir, Province of San Juan. A methodology to measure the variables advised by International Organizations (EPA, ADEQ) is proposed and updated techniques of monitoring developed by said organizations and other research centers, which standardize environmental studies with laboratory methods, are applied.

Keywords: Reservoirs; Water Quality; Physical parameters; Chemical parameters